A Preliminary Assessment of the Greater Vancouver Sewerage and Drainage District Annacis Island Sewage Treatment Plant Effluent Discharge Impact

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SUMMARY

On February 18, 1993, water and sediment in the expected zone of influence from the Annacis Island Sewage Treatment Plant (STP) was sampled. Water column samples were collected at the surface and at a depth of four metres. Significant findings of the work were:

- An outflowing tide was experienced for the entire sampling time. This would result in samples being taken at a time when there were not stagnant water conditions or flow reversals. Thus, multiple dosing of the river water would be at a minimum (i.e., the discharge scenario to show the least effect on water column variables from the sewage discharge).

- The most elevated ammonia concentrations were noted with the depth samples 25 and 100 metres downstream from the point of discharge.

- All the ammonia values were less than the MoE criteria to prevent chronic effects; however, the highest measured concentrations were about one-third of this criterion. Therefore, the criteria may be approached with the multiple-dosing scenario, although how close to the criteria is open to speculation.

- The MoE water quality criteria for bacteriological indicators were usually not achieved at sites either upstream or downstream from the effluent discharge.

- For all bacteriological variables and ammonia, the higher concentrations were associated with depth samples. This shows the importance both of using a technique such as the depth sounder to find the effluent plume, and not relying solely on surface samples to assess the impact of this discharge.

- Three PAHs (phenanthrene, anthracene, and chrysene) in sediments from a site 200 metres downstream from the outfall exceeded certain MoE water quality objectives. These objectives were established for Burrard Inlet on the basis of Puget Sound Apparent Effects Threshold values, and are used as a rough guideline. The presence of these PAHs in this preliminary assessment may indicate a need for improved effluent treatment at the Annacis Island Sewage Treatment Plant, although other potential sources must be eliminated before action based on these findings is taken.

- The solid phase microtox toxicity test showed the greatest toxicity to be associated with the sediments collected 200 metres downstream from the effluent discharge. The least toxicity was found to be associated with the sediments from the site 50 metres downstream. This pattern of toxicity is similar to the concentration distribution found for most PAHs and two (i.e., chromium and iron) of three metals concentrations discussed.

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1.0 INTRODUCTION TO HISTORICAL CONCENTRATIONS

Theoretical Dilution and Ammonia Concentrations at the Annacis Island Sewage Treatment Plant (STP)

Different theoretical scenarios for the discharge of secondary-treated sewage from the Annacis Island STP into the Main Arm of the Fraser River are examined in the following. We have concentrated on ammonia since it is one variable where we measured high concentrations in the water column during our survey. The purpose of this examination is to review whether actual concentrations measured in February 1993 approach the theoretical values.

It must be pointed out that we recognize that some of the theoretical estimates presented in this report are a simplistic approach for a discharge to a complicated hydrodynamic regime. However, we believe that a simplistic approach is justified for a preliminary assessment, since the survey was exploratory in nature.

Initially, a "worst-case" situation is not examined but simply a more normal low-flow case. There are two situations where we potentially can have a problem with respect to chronic effects, one being with multiple dosing of the river water with effluent due to flow reversals caused by tides, and the second with stagnant water in the river, once again caused by tides.

We must point out that since we are dealing with an estuary with movement of water back and forth past the discharge point, we do not have a "black and white" situation. For example, we want to protect the fish from chronic ammonia effects, and we have criteria to do this. The problem is that these criteria were developed by exposing fish to certain concentrations for long periods of times (20 to 40 days). In the estuary where the fish are exposed to different concentrations throughout the day due to water movement, the fish could probably tolerate higher concentrations for short periods of time (somewhere in between the chronic criteria and the acutely toxic criteria). The criteria were developed with a fairly small safety factor included and, by using the criteria to prevent chronic toxicity, an additional safety factor has been added compared to the case of acute toxicity.

We are aware that there are several theoretical models to predict effluent effects both close to and removed from the outfall. However, we are not aware of published findings for actual field work in the river related to dilution at the Annacis STP other than work performed by B.C. Research for the Greater Vancouver Sewerage and Drainage District (GVS&DD) and presented in the 1978 B.C. Research report. With respect to the stagnant water situation, that report indicates (p. 13) that at "high slack tide, the dye again pooled at the outfall forming a cloud approximately 15 m diameter, with an estimated minimum dilution of 4.8-fold." On page 12 of the same report, the period of slack water was up to 30 minutes between a flood and ebb tide and up to one hour following an ebb tide. The dilution values were for a simulated effluent of 0.11 m^3/s from one

port. It must be remembered that these data are fifteen years old, and may not be representative of the actual flows through the ports in 1993.

For the multiple dosing scenario, we have estimated that the same particle of water potentially could be exposed to effluent three times; initially at discharge immediately prior to flow reversal, a second time just as flow reversal occurs, and a third time when the flow reversal is overcome and normal flows return. This would only happen, we believe, with high tides and low flows (February and March). This can occur in surface waters and at depth according to the B.C. Research report (p. 11). The following are the data used or generated for this situation.

Average annual flow from STP	6.71 m^3/s
Fraser R. Flow: 85% of 1 100 m^3/s (median monthly)	935 m^3/s
Fraser R. Flow with 1/4 available for dilution	233.75 m^3/s
Resulting Dilution (3 exposures)	11.6:1
Fraser R. Flow with 1/2 available for dilution	467.5 m^3/s
Resulting Dilution (3 exposures)	23.2:1

B.C. Research (p. 13) did indicate that the dye did spread over about 50% of the river when it returned with flow reversal.

The question raised is how high can the ammonia concentration in the effluent be while still preventing chronic responses in aquatic organisms? The simplest situation that has to be dealt with is when there is a discharge into the river as it is flowing downstream with no reverse flow or stagnant water effects. The water quality criteria developed for the Ministry relate to two concentrations, a maximum concentration based on preventing acute toxicity and an average concentration, developed to prevent chronic toxicity. In the case of discharging to the river as it is flowing downstream, the criterion to prevent chronic effects at a temperature of 5 °C and a pH of 8.0 is 1.18 mg/L NH_3-N. (the temperature is meant to reflect typical March temperatures, while the pH is an approximate average of the maximum river pH (8.3) and effluent pH (maximum of about 7.5)). In this situation, the dilution available is 34.8:1 (233.75 m^3/s / 10.194 m^3/s).

Chronic toxicity will also be present when there are multiple dosing or stagnant conditions. For such short-term situations, excursions to concentrations greater than the chronic value can be tolerated for short periods of time. The table indicating the average criteria use a factor of 1.5 times the chronic level, which in our case results in a criterion of (1.18 mg/L x 1.5 =) 1.77 mg/L. This value is allowed by the criteria to exist for one in five samples, or put another way, once in every five hours. For the case of stagnant water which will occur for periods less than one-in-five hours, the effluent NH_3-N concentration based on the 5:1 dilution (B.C. Research) should not exceed (5 x 1.77 mg/L=) 8.85 mg/L.

This excursion factor is not considered to be valid for the case of multiple dosing because the upstream water movement can last for periods from 3.5 to 6 hours, greater than the one-in-five hour period. Since the diluted effluent returning to be dosed a second time occupies about 50% of

the river width, the applicable dilution rate probably varies somewhere between the 11.6:1 for one-quarter of the river flow and 23.2:1 for one-half the river flow. .

It should be remembered that in developing the water quality criteria, certain safety factors were applied to the data sets so that even should these concentrations be exceeded slightly, chronic effects will not necessarily occur. The safety factors used relate to the concentrations of ammonia by itself, and do not take into account additive effects of other compounds. However, this safety factor may be negated at flows in the river lower than used for these calculations. We should also attempt to keep the entire flow reversal/stagnant water situation in perspective. Stagnant water occurs for a maximum of about 2 hours per day, while flow reversal takes place for up to 10 hours per day. Therefore, there are 12 or more hours a day when the discharge will be to a conventional river setting.

Background River Ammonia Concentrations in the Fraser River Near Annacis STP

We reviewed ammonia concentrations in the lower Fraser River from two sources: the 1980 Fraser River Estuary Study Water Chemistry report, prepared by a Federal/Provincial task force, and a 1983 Ministry report on the water chemistry of the Fraser River at the Pattullo Bridge, prepared by the Lower Mainland Region.

From the former, we have extracted three figures (1, 21, and 22), which we have numbered as Figures 1, 2, and 3. Figure 1 is included so that information in Figure 2 can be interpreted. The interesting data are for reach 6, adjacent to the Annacis STP outfall, where the highest mean ammonia concentrations were measured. Presumably, this reflects at least some period of time prior to the sewage treatment plant beginning to operate. Also of interest is the fact that the median ammonia concentration is about the same as for the other reaches.

Figure 3 is also significant by showing that the peaks in ammonia concentration occur in the January/February period (i.e., low river flows) on a fairly consistent basis.

The 1983 report (Page 19) indicated that a "general trend toward higher concentrations of ammonia through the winter was observed. Ammonia concentrations varied from non-detectable to 0.08 mg/L with an average of 0.0175 mg/L. The November (1981) increase in Fraser River flow combined with the November-December (1981) increase in flow from the local tributaries, and the January-February (1982) flow increase of local tributaries both resulted in significant increases in ammonia levels. Concentrations which roughly plateau through February until mid-April fall off rapidly during freshet and remain at low levels for much of the summer. Little vertical stratification is observed but the data occasionally show a one-sidedness with higher concentrations again found at the north (0300124) sampling location." In addition, a number of combined sewer outfalls discharge in the New Westminster area, along the North shore. These discharges would take place during the winter, and would raise river concentrations at that time.

Ammonia data are given for three sites located on the Pattullo Bridge: Site 0300005 at the centre (Figure 4), Site 0300124 located about one-half way from the centre of the bridge to the

north shore (Figure 5), and Site 0300125 located about one-half way from the centre of the bridge to the south shore (Figure 6). The data for all the figures confirm that concentrations are usually less than 0.03 mg/L except in the January/February period, and that the highest concentrations at both depth and at surface are closer to the north shore, due probably to the effect of combined sewer overflows and stormwater discharges near this point.

We would conclude that ambient ammonia concentrations are usually 0.03 mg/L or less, and that values in excess of this are during low flow periods or when a discharge occurs to affect this concentration.

Measured Ammonia Concentrations in the Fraser River Near Annacis STP

Data for previously measured ammonia concentrations in the Fraser River near the Annacis STP are in Table 1.

The data which are presented have been collected well-removed from the actual Annacis outfall, and likely represent well-mixed conditions in the river. As such, we would not anticipate seeing toxic concentrations of ammonia, and this is certainly the case. However, there are a number of situations where we see that the concentrations of ammonia are increased considerably at one or both of the downstream sites. We have identified those cases in **bold** type face. It should be noted that these increases are seen in virtually every month of the year, and thus for many river flow situations. It should be noted that the Greater Vancouver Regional District (GVRD) does try and sample when the tide is going out.

As stated, the data were collected at sites well-removed from the Annacis STP mixing zone. Conditions 100 metres downstream from the mixing zone are of crucial importance in determining whether water quality objectives are achieved, and of course there are not to be acutely toxic conditions within the initial dilution zone.

2.0 FEBRUARY 1993 FIELD SAMPLING PROGRAM

Since signing off the Liquid Waste Management Plan - Phase 1 report, BC Environment has directed the Greater Vancouver Regional District to upgrade the level of treatment at the Annacis and Lulu sewage treatment plants to secondary. This is consistent with Provincial policy of "Best Available Control Technology" and also serves to recognize the permit non-compliance (poor effluent quality) characteristic of these discharges for many years.

What little is known of the environmental impact of these two discharges may be summarized in three points:

- Calculation of contaminant loadings from Waste Management Permit authorized discharges into the estuary show that these two sewage treatment plants account for the largest proportion of permitted loadings into the estuary (FREMP Waste Management Activity Program Report, 1990). It should also be noted that these two discharges are among the only toxic discharges into the Fraser estuary (permit monitoring data files).

- In 1985 the Ministry issued Provisional Water Quality Objectives for the Fraser River estuary downstream from Kanaka Creek. Review of the associated water quality monitoring program information (1986-91) has shown the two treatment plant discharges act to raise fecal coliform and ammonia concentrations, and decrease dissolved oxygen concentrations at distance from the plume (Rocchini 1987, MoE 1988, 1989, 1990, 1991, 1993).

- In 1986 BC Environment, in partnership with the Fraser River Harbour Commission, initiated the Fraser River estuary monitoring program to assess environmental conditions in the lower river. Although a large database has thereby been established for contaminant levels, and trends in effluent, sediment, sediment biota, and fish quality have or are being determined (Supervisory Coordinating Committee 1987, Swain and Walton 1988, 1989, 1990, 1991, 1992), a discrete receiving environment study of the two treatment plant discharges has not been undertaken. The database does allow for comparisons to be made with "expected contaminant levels" in the estuary.

Municipal and public reaction to the cost of upgrading has resulted in questions being raised regarding the demonstrated impacts of the Annacis and Lulu sewage treatment plant discharges.

In the late 1992-93 fiscal year residual monitoring funds were made available by Water Quality Branch, Water Management Division, B.C. Ministry of Environment, Lands, and Parks and we undertook a preliminary study of the environmental impact of the Annacis and Lulu treatment plant discharges. Sampling at Lulu was precluded, however, by construction activities to repair the outfall and apply sand preload to the treatment plant site. Samples therefore were only taken at the Annacis treatment plant location which is immediately downstream from the Alex Fraser bridge on the north side of the river. The diffuser extends approximately 150 m offshore and effluent is visible from the Ministry air quality monitoring station site on the adjacent bridge

tower (G. Veale, personal comm.). At times four boils corresponding to the diffuser ports are visible from this vantage point. Regional staff have also noted members of the public fishing from the river bank in the vicinity of the discharge.

On February 18, 1993, the Beak Consultants vessel was chartered and the Annacis discharge area was sampled. The video depth sounder on the vessel was sufficiently sensitive that it clearly showed the locations of the outfall pipe, diffuser port, and rising/surfacing plume dispersion. A concentration of seagulls was noted on the surface downstream from the plume. Also, a number of fish schools were observed in the plume (on the video screen), about 200 metres downstream from the discharge. The tide was falling at the time of sampling and a significant current was experienced while on location (See Appendix 1 for a description of the sampling locations and tidal cycle). Water and sediment samples were taken. It should also be noted that, while sampling for sediment, we did not find an accumulation of "sludge" directly associated with the discharge. In fact, in the area of the diffuser ports, coarse sands were encountered so that we adjusted our sampling locations slightly inshore. Here, sediment samples were observed to contain a reasonable proportion of silts/clays in which contaminants may be expected to preferentially accumulate.

3.0 DISCUSSION OF RESULTS

During the course of the field sampling program, the plume could be observed on the video depth sounder discharging from the outfall ports. The discharge was observed as a discrete plume spreading and rising to the surface. These observations were taken into account in selecting sample site location with both distance and depth, although there is still a possibility that the samples were not taken in the centre of the plume. This may account for data variability. While sampling, an outflowing tide was experienced for the entire time. This would result in our taking samples at a time when there were not stagnant water conditions, flow reversals, and thereby multiple dosing of the river water (i.e., we sampled at the discharge scenario where we would expect to show the least effect).

The water quality objectives for the Fraser River downstream from Kanaka Creek (Swain and Holms 1985) define the initial dilution zone as extending 100 metres upstream or downstream from a discharge. Therefore, sites 1, 4, and 5 are outside the initial dilution zone; however, within the initial dilution zone, no acutely toxic conditions are to occur.

Information on selected variables in water is included in Table 2. These variables were selected on the basis of being representative of human sewage and a preliminary review of the data to determine significant changes in concentrations. Variables selected included ammonia nitrogen, and the bacteriological indicators fecal coliform, E. coli, Enterococcus, and Pseudomonas aeruginosa. All data are included in Appendix 3. Effluent disinfection was not taking place in February 1993.

3.1 Monitoring of Water

3.1.1Ammonia

In Section 1.0, we determined from historical Ministry data (Lawson et. al. 1983) that the background river ammonia-N concentration would be 0.03 mg/L. In fact, the data in Table 2 reveal that the lowest ammonia concentration upstream or downstream from the discharge was about 0.08 mg/L, at a time when the river was approaching low slack water conditions. This implies that in fact we were seeing some residual multiple dosing of the river water.

The B.C. Ministry of Environment, Lands, and Parks (MoE) water quality criteria to protect fresh water aquatic life from chronic effects from ammonia depend upon temperature and pH. When we sampled, these were about 100C and pH of 7.5. For these conditions, a concentration of 1.85 mg/L should protect aquatic life (Nordin and Pommen 1986). All the values in Table 2 are less than this, with the highest measured concentration being about one-third of this criterion. If, as discussed in Section 1.0, multiple dosing could result in three exposures of a particle of water to the effluent, then the concentration would still be below the criterion of 1.85 mg/L, although the actual amount below would stil be open to speculation. (The most elevated ammonia concentrations were noted with the depth samples 25 and 100 metres downstream from the point of discharge.) Thus, we conclude that there may, as predicted, be times when ammonia concentrations are a concern in the river in the vicinity of the effluent plume.

The ammonia concentrations indicate a rising plume dispersion pattern for the effluent.

3.1.2Effluent Dilution

We estimated effluent dilution at the time of sampling by two methods. The first used estimated river and measured effluent flows (Appendix 2), and the second used measured ammonia concentrations and effluent ammonia concentrations measured in 1992. The dilution estimate using flows resulted in a 48:1 value, while the dilution estimate using ammonia resulted in values from 18:1 to 36:1. The lower dilutions with ammonia values likely reflect the fact that only a portion of the initial dilution zone is used for mixing, and not the entire zone as assumed using flow estimates (Figure 7). The lower dilutions with ammonia may also reflect to some degree, multiple dosing influences.

In Section 1.0, we determined that the minimum available dilution would be 34.8:1, assuming one-quarter of the river water available for dilution of effluent, and with avarage annual flows from the STP of 6.71 m^3/s. In fact, we do not know the pattern of discharge through the ports (i.e., the number of ports in use, the volume discharged per port, the actual location of the ports in use relative to our sample location).

3.1.3Bacteriological Indicators

Bacteriological indicators considered were fecal coliform, E. coli, Enterococcus, and Pseudomonas aeruginosa (Table 2). The MoE water quality criteria for bacteriological indicators are as follows to protect secondary-contact recreation and public access (for irrigation):

Fecal coliform	no criterion for these uses
E. coli	≤385 / 100 mL (geometric mean)
Pseudomonas aeruginosa	≤100 / 100 mL (75th percentile)
Enterococcus	≤100 / 100 mL (geometric mean)

The data in Table 2 show that if we assume these to be threshold concentrations, then only the Pseudomonas aeruginosa criteria are occasionally achieved. It is important to note that the criteria are often not achieved upstream from Annacis, and the best we can hope to achieve is that by controlling the discharge from Annacis, is that the gap of acceptability will be lessened.

It would appear from the data that the fecal coliform and the E. coli data show similar concentration patterns, as do the data for Pseudomonas aeruginosa and Enterococcus, although the two patterns differ from each other. It appears that the fecal coliform and E. coli data vary in a similar fashion to the ammonia data. For all variables, the higher concentrations were associated with depth samples. This shows the importance both of using a technique such as the depth sounder to find the effluent plume, and not relying solely on surface samples to assess the impact of this discharge.

3.2 Monitoring of Sediment

As the particle size distribution and the total volatile residue are essentially the same for all three sites where the samples were collected, the quality of the sediments can be directly compared (Table 3).

3.2.1Polycyclic Aromatic Hydrocarbons (PAHs)

Data for the PAHs are in Table 3. Generally, concentrations of the individual PAHs were highest at the site 200 metres downstream from the outfall, and lowest at 50 metres downstream from the outfall (including comparison to the upstream site).

In an attempt to relate these PAH concentrations to existing MoE water quality criteria or objectives for sediments, a comparison was made with the water quality objectives for Burrard Inlet (Nijman and Swain 1990). These objectives had been developed on the basis of Apparent Effects Threshold values for Puget Sound. PAHs with concentrations higher than the water quality objectives were found only at the site 200 metres downstream for phenanthrene, anthracene, and chrysene. The presence of these PAHs in this preliminary assessment may indicate a need for improved effluent treatment at the Annacis Island Sewage Treatment Plant, although other potential sources must be eliminated before action based on these findings is taken.

3.2.2Metals

Generally, for most metals measured in the sediments, there was no apparent pattern of concentration with location. The exceptions to this were for arsenic, chromium, and iron. The highest arsenic concentration was found at the site 50 metres downstream from the effluent discharge, while the highest chromium and iron concentrations were found at the site 200 metres downstream. This latter observation is similar to what we found for PAHs.

3.2.3Toxicity

The solid phase microtox toxicity test (5 minute test time) showed the greatest toxicity to be associated with the sediments collected 200 metres downstream from the effluent discharge. The least toxicity was found to be associated with the sediments from the site 50 metres downstream. This pattern of toxicity is similar to that found for most PAHs and two of three metals concentrations.

3.3 Characteristics Not Discussed

There were a number of variables measured in the water column which have not been discussed because no impact by the discharge was observed on the analytical results. All the individual data for both sediments and water column are included as Appendix 3. The rainbow trout toxicity test result is not considered to be significant since the sample was collected from the surface, and a subsequent review of the data shows that only very diluted effluent would be found at the surface. As well, the bioassay was conducted 24 hours after sample collection, in which time ammonia initially present in the sample may have oxidized to less toxic nitrogen forms.

Table 1

Ammonia Concentrations in the Fraser River Near the Annacis STP

Date	Ammonia Concentration (mg/L) - GVRD Data		
	U/S Annacis	D/S Annacis	U/S Lulu
90.02.27	0.12	0.10	0.09
90.04.25	**0.03**	**0.03**	**0.05**
90.06.05	<0.02	<0.02	<0.02
90.08.30	0.02	0.02	0.03
90.10.10	**0.03**	**0.04**	**0.10**
90.11.14	0.06	0.02	0.05
89.02.24	**0.08**	**0.11**	**0.12**
89.04.19	0.06	0.06	0.07
89.06.14	**0.03**	**0.04**	**0.05**
89.08.24	0.03	0.03	0.04
89.10.25	**0.03**	**0.06**	**0.06**
89.12.05	**0.02**	**0.03**	**0.06**
88.02.26	0.06	0.06	0.08
88.04.19	**0.04**	**0.04**	**0.08**
88.06.20	**0.05**	**0.09**	**0.06**
88.08.17	**<0.02**	**0.02**	**0.03**
88.10.05	<0.02	<0.02	0.03
88.12.20	**0.07**	**0.05**	**0.10**
87.04.29	**0.02**	**0.04**	**0.11**
87.06.08	0.02	0.02	<0.02
87.08.18	<0.02	0.02	<0.02
87.10.15	**<0.02**	**0.03**	**0.04**
87.11.26	**0.04**	**0.04**	**0.08**

Date	Ammonia Concentration (mg/L) - MoE Data		
	U/S Annacis	D/S Annacis	D/S Lulu
89.01.04	0.055	0.057	0.060
89.01.10	0.051	0.056	No Data
89.01.17	0.065	0.075	0.063
89.01.23	0.062	0.055	0.058
89.02.27	0.093	0.099	0.082

Source: MoE 1988, 1989, 1990, 1991

Bold values indicate significant increases from u/s to d/s.

Table 2

Measured Concentrations (February 1993) of Selected Variables at the Sampling Locations

AMMONIA (mg/L)

Site #	Description of Site	Surface	Depth
1	150 m upstream from discharge	0.102	0.084
2	at discharge location	0.077	0.177
3	25 m downstream from discharge	0.078	0.607
4	100 m downstream from discharge	0.290	0.544
5	200 m downstream from discharge	0.081	0.323

FECAL COLIFORM (CFU/100 mL)

Site #	Description of Site	Surface	Depth
1	150 m upstream from discharge	790	920
2	at discharge location	1900	3400
3	25 m downstream from discharge	2100	17000
4	100 m downstream from discharge	1400	500
5	200 m downstream from discharge	500	6100

E. COLI (CFU/100 mL)

Site #	Description of Site	Surface	Depth
1	150 m upstream from discharge	770	1000
2	at discharge location	990	7900
3	25 m downstream from discharge	1500	10000
4	100 m downstream from discharge	1200	4700
5	200 m downstream from discharge	570	7200

PSEUDOMONAS AERUGINOSA (CFU/100 mL)

Site #	Description of Site	Surface	Depth
1	150 m upstream from discharge	76	70
2	at discharge location	38	320
3	25 m downstream from discharge	34	180
4	100 m downstream from discharge	46	100
5	200 m downstream from discharge	52	120

ENTEROCOCCUS (CFU/100 mL)

Site #	Description of Site	Surface	Depth
1	150 m upstream from discharge	480	490
2	at discharge location	520	9800
3	25 m downstream from discharge	390	5100
4	100 m downstream from discharge	360	1000
5	200 m downstream from discharge	380	1100

Table 3

Measured Concentrations (February 1993) of Selected Variables (µg/g dry-weight except where noted) in Sediments Near the Annacis Island STP Discharge

Variable	150 m u/s	50 m d/s	200 m d/s	Objective*
% Silt & Clay	86	90	84	N/A
Total Volatile Residue	3.4%ww	3.0%ww	3.1%ww	N/A
(a) POLYCYCLIC AROMATIC HYDROCARBONS				
Naphthalene	0.010	0.009	0.019	0.200
Acenapthylene	0.002	0.001	0.003	0.060
Acenaphthene	0.013	0.006	0.010	0.050
Fluorene	0.016	0.008	0.046	0.050
Phenanthrene	0.074	0.054	**0.170**	0.150
Anthracene	0.008	0.004	**0.390**	0.100
Fluoranthene	0.086	0.065	0.140	0.170
Pyrene	0.067	0.046	0.120	0.260
Benzo(a)anthracene	0.027	0.010	0.081	0.130
Chrysene	0.040	0.017	**0.330**	0.140
Benzo(b+k)fluoranthene	0.034	0.020	0.085	0.320
Benzo(a)pyrene	0.011	0.005	0.035	0.160
Indeno(1,2,3-c,d)pyrene	0.004	0.002	0.014	0.060
Dibenzo(a,h)anthracene	0.001	<0.001	0.004	0.060
Benzo(g,h,i)perylene	0.005	0.003	0.013	0.070
CONCENTRATIONS GENERALLY - 200 m d/s >> 150 m u/s > 50 m d/s				
b) METALS				
Arsenic	16	24	13	
Chromium	38	39	55	
Iron	37200	35500	40100	
(c) TOXICITY - SOLID PHASE MICROTOX (5 minute test time)				
EC 50 (mean)	0.7793	1.6484	0.5344	
EC 50 (Range - 95% confidence)	0.5908-1.0279	1.4739-1.8436	0.4554-0.6287	
TOXICITY GENERALLY - 200 m d/s > 150 m u/s > 50 m d/s				

* Water Quality Objectives for sediments from Burrard Inlet (Nijman and Swain 1990)
Bold values indicate water quality objective not achieved.

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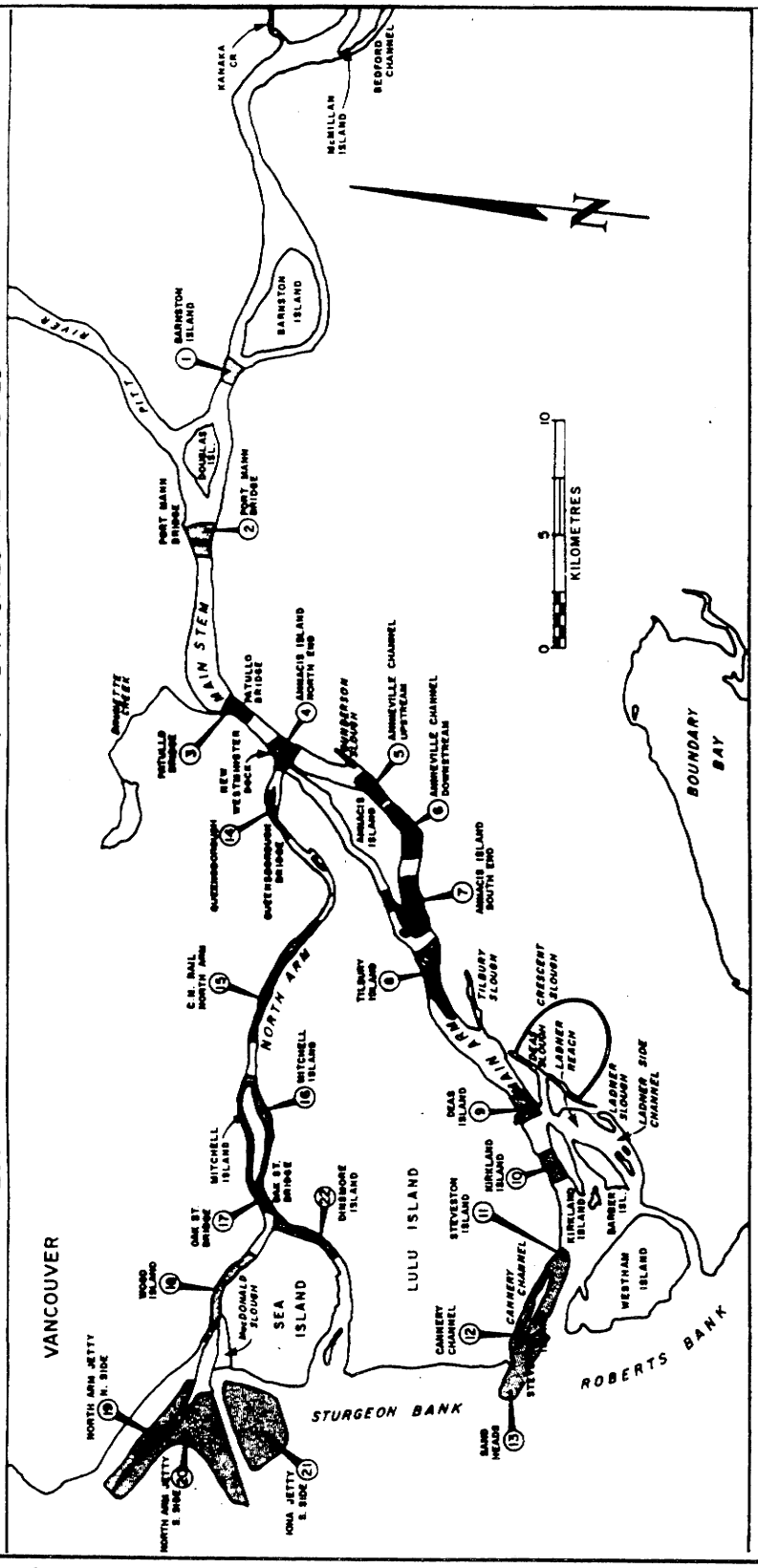
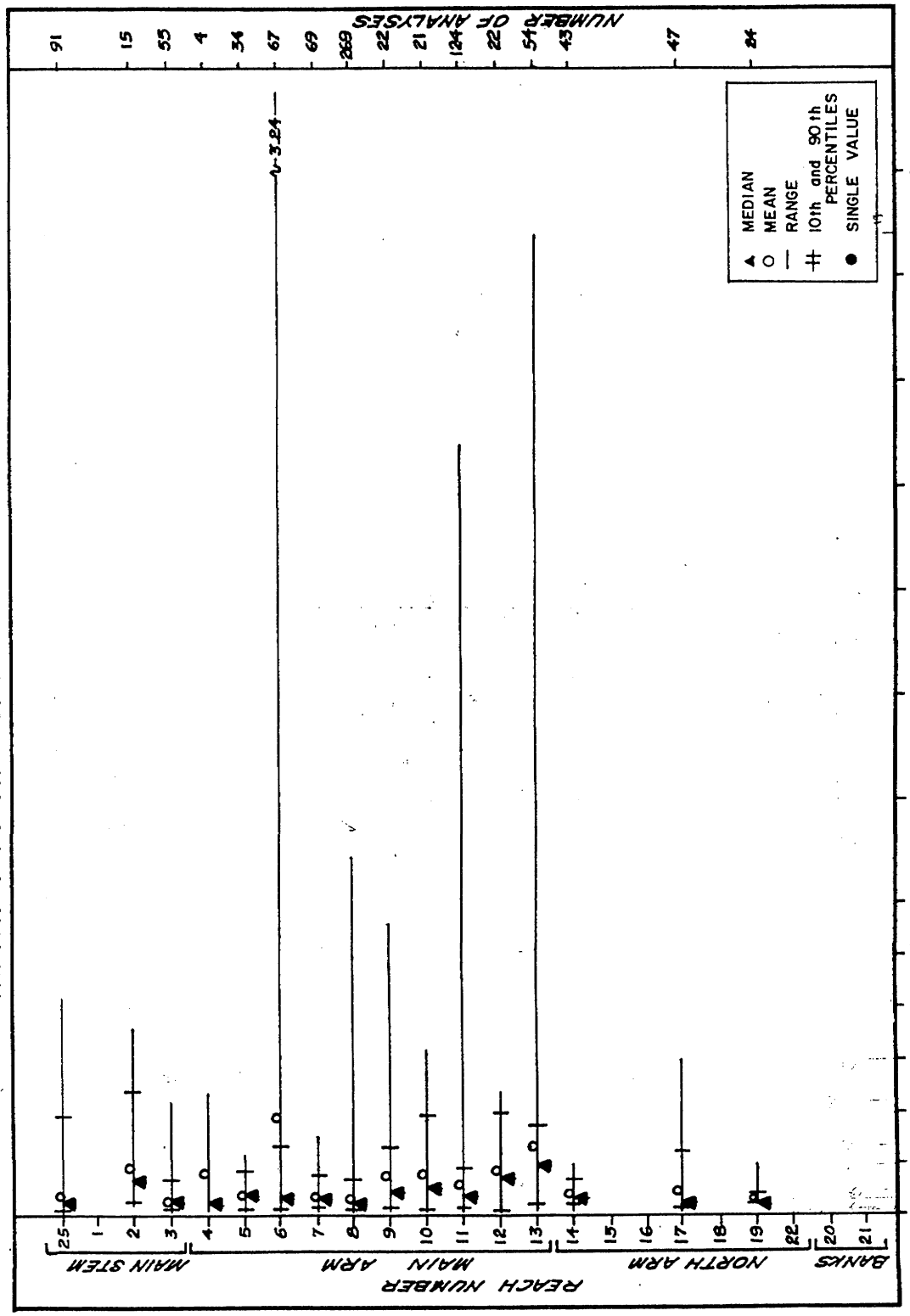


FIGURE 1
LOCATION OF REACHES INTO WHICH SAMPLING SITES ARE GROUPED

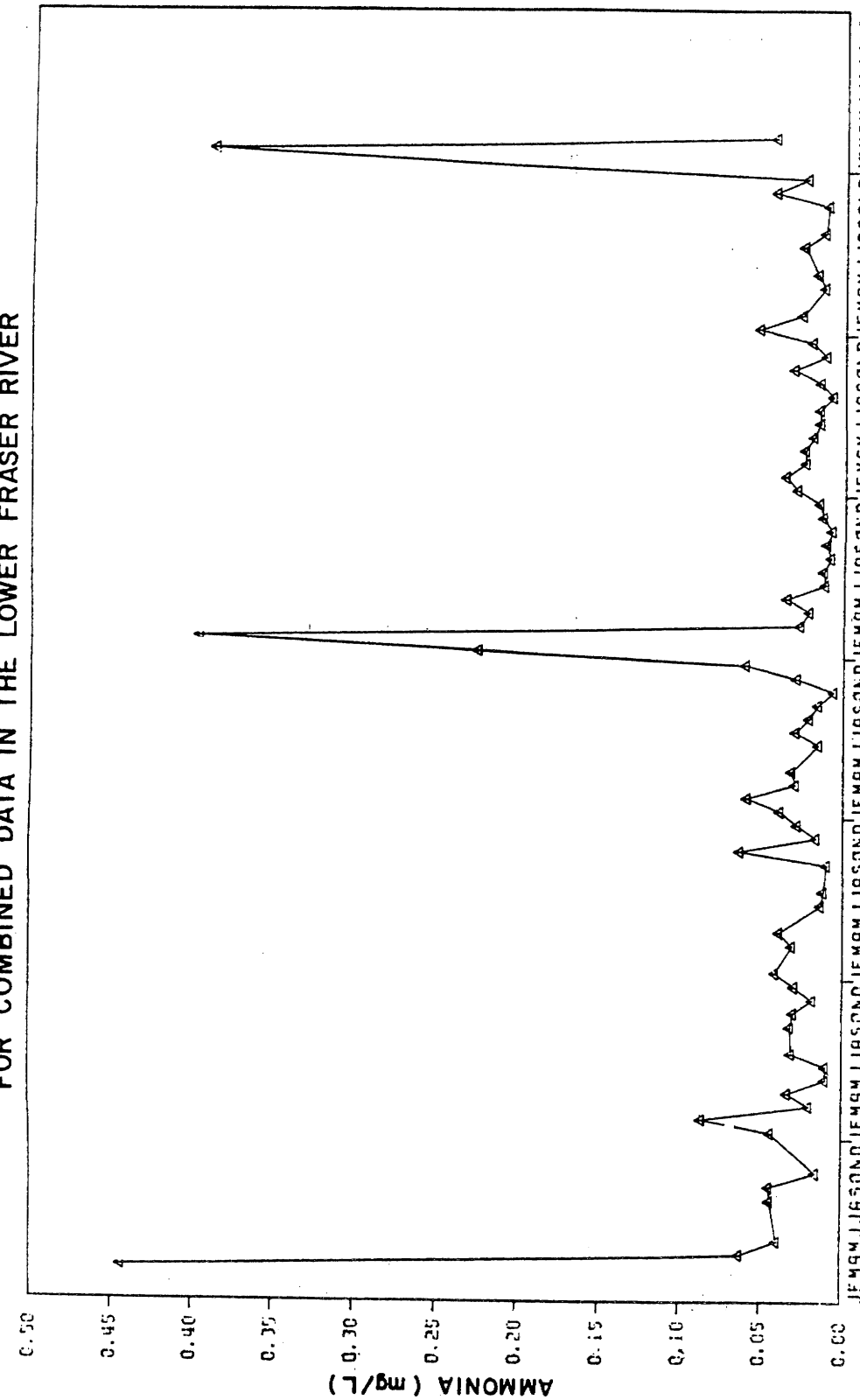
FROM: Fraser River Estuary Study (R. W. Drinnan and M. J. R. Clark). Water Quality. Water Chemistry, 1970-1978. December 1980.

FIGURE 2
SUMMARY OF AMMONIA DATA FOR THE INDIVIDUAL REACHES IN THE LOWER FRASER RIVER



FROM: Fraser River Estuary Study (R. W. Drinnan and M. J. R. Clark). Water Quality. Water Chemistry, 1970-1978. December 1980.

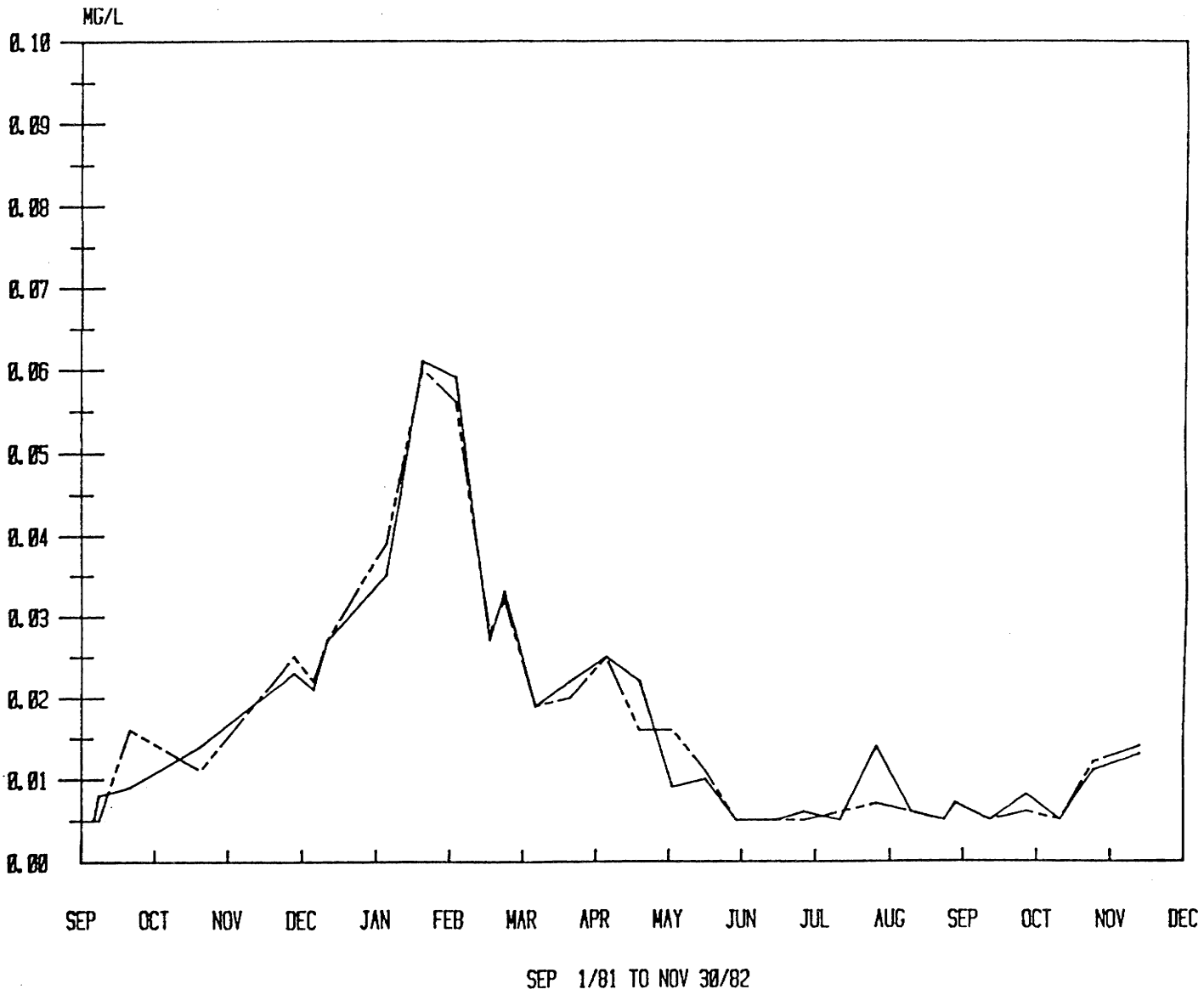
FIGURE 3
SEASONAL CHANGES (MONTHLY MEANS) IN AMMONIA
FOR COMBINED DATA IN THE LOWER FRASER RIVER



FROM: Lawson, E. M., G. B. Mitchell, and D. G. Walton. Fraser River Water Quality at the Pattullo Bridge. B. C. Ministry of Environment. December 1983.

Figure 4

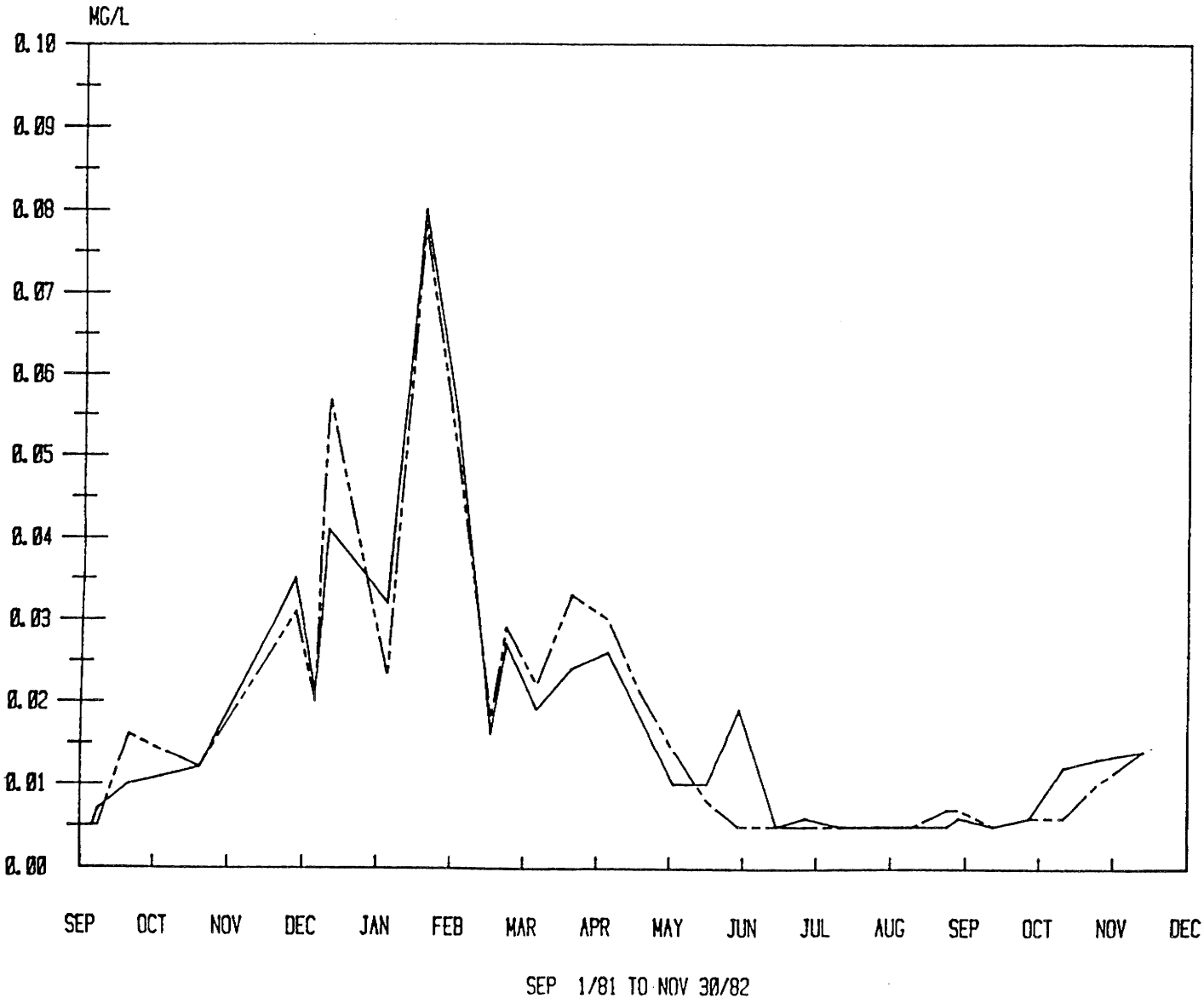
Surface and Depth Comparison of Fraser River Ammonia Concentrations at the Mid-river Sampling Location, September 1981 to December 1982 (0300005; 0.m ———, 7.m -- ——— --)



FROM: Lawson, E. M., G. B. Mitchell, and D. G. Walton. Fraser River Water Quality at the Pattullo Bridge. B. C. Ministry of Environment. December 1983.

Figure 5

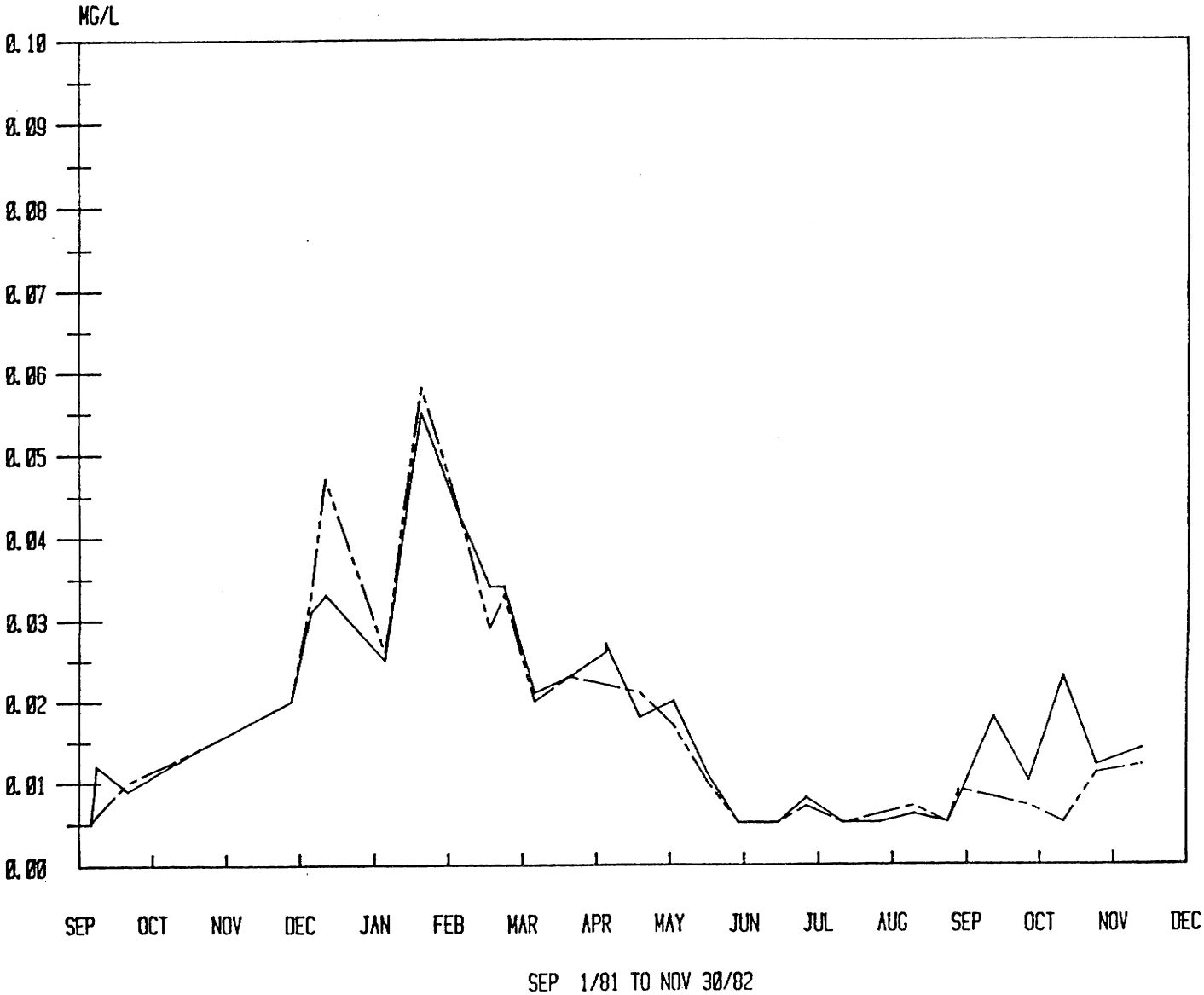
Surface and Depth Comparison of Fraser River Ammonia Concentrations at the North Sampling Location, September 1981 to December 1982 (0300124; 0.m ———, 9.m -- ——— --)



FROM: Lawson, E. M., G. B. Mitchell, and D. G. Walton. Fraser River Water Quality at the Pattullo Bridge. B. C. Ministry of Environment. December 1983.

Figure 6

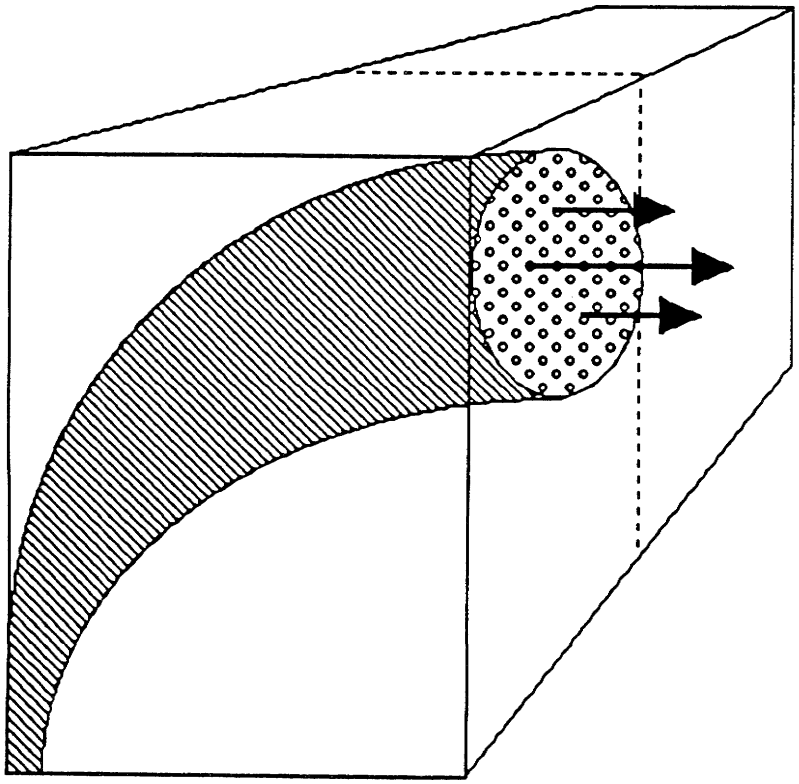
Surface and Depth Comparison of Fraser River Ammonia Concentrations at the South Sampling Location, September 1981 to December 1982 (0300125; 0.m ———, 7.m -- ——— --)



FROM: Lawson, E. M., G. B. Mitchell, and D. G. Walton. Fraser River Water Quality at the Pattullo Bridge. B. C. Ministry of Environment. December 1983.

FIGURE 7

SCHEMATIC SHOWING THE DISCHARGE OF SEWAGE FROM A DIFFUSER PORT AT THE ANNACIS ISLAND SEWAGE TREATMENT PLANT INTO THE FRASER RIVER



APPENDIX 1: SAMPLING LOCATIONS and TIDAL CYCLE INFORMATION

Water Samples (falling tide, van Dorn depth measured by gauge on cable, stainless steel grab)

a) site 1 - 1100h; approximately 150 m upstream of the plume, off the piling denoted by the letter "G", 3rd set of pilings downstream from the Alex Fraser bridge; sampled at 4m and 1m.

b) site 2 - 1125h; approximately 100 m offshore; judged by sounder to be right on top of the discharge; plume is very evident on the sounder, can follow it right down to the mouth of the diffuser; sampled at 4m and 1m, depth sample taken at mid-plume.

c) site 3 - 1140h; approximately 100 m offshore and 25 m downstream of the outfall sign; sampled at 4m and 1m, plume evident on the sounder.

d) site 4 - 1200h; approximately 100 m downstream from the outfall; sampled at 4m and 1m.

e) site 5* - 1210h; approximately 200 m downstream from the outfall; sampled at 4m and 1m.

* noted that at 200 m downstream there were many fish/fish schools showing on the sounder

Sediment Samples

a) site 1 - 1230h; backwater area close to Alex Fraser bridge, quite close to shore.

b) site 2** - 1300h; 50 m downstream from discharge; just downstream from the letter "H" denoted on a piling.

c) site 3 - at the furthest downstream water sampling location but inshore inside log boom stringers; at letter "I" denoted on a piling approximately 25 m offshore.
** area slightly offshore at the diffuser was found to be coarse sand, needed to go inshore to get fines.

Tidal Cycle Information for February 18, 1993

Time	Pt. Atkinson (metres)	Time- adjusted to New Westminster
0445	4.5	0450
1015	3.3	1025
1450	3.9	1455
2155	1.2	2215

APPENDIX 2: ESTIMATED RIVER FLOW AND EFFLUENT DILUTION OF THE ANNACIS STP DISCHARGE ON FEBRUARY 18, 1993

Estimated River Flow

Actual river flow at Hope: 642 m^3/s

Distribution of River flows at New Westminster:
North Arm: 15%
Main Arm: 79%
Annacis Channel: 6%

Mean February flow at Hope (1913 to 1990) : 866 m^3/s
Median estimated February flow at the Pattullo Bridge: 1200 m^3/s

Calculated flow at Pattullo Bridge on February 18, 1993 was

(1200 m^3/s/866 m^3/s) * 642 m^3/s = 890 m^3/s

If 79% flows past Annacis, flow was 0.79 * 890 m^3/s = 703.1 m^3/s

Therefore, we can say a flow of 700 m^3/s was experienced on February 18, 1993 when we sampled.

Estimated Effluent Dilution on February 18, 1993

Measured hourly flows for Annacis STP

1100	116 cfs
1200	124 cfs
1300	144 cfs

Average hourly flow was 128 cfs (3.6 m^3/s)

Estimated dilution:

- **Based on estimated river, and measured effluent flows**

1/4 flow/Single Exposure: (0.25 * 700 m^3/s) / 3.6 = 48.6:1

- **Based on measured ammonia concentrations**

Measured ammonia concentrations (1992) in effluent: 11 - 22 mg/L
(R. Jones, personal communication, 1993)

Measured ammonia concentration 25 m downstream: 0.607 mg/L
(Table 2)

Estimated dilutions: 22 mg/L / 0.607 mg/L = 36:1
11 mg/L / 0.607 mg/L = 18:1

APPENDIX 3

DATA SHEETS FOR SEDIMENTS AND THE WATER COLUMN

FRASER R U/S ANNACIS

Zenon ID : 93003377

Sparcode	Parameter	Media	Workroute	MDC	Unit	
WKSCWKS4	Weekend Surcharge	04/01	Surcharge 4		None	--- (1)
00041220	pH	02/01	Automated pH Meter	1.0	pH units	7.6
00111160	Specific Conductance	02/01	Cond.Meter Siebold	1	uS/cm	5660
0107CALC	Hardness Total	--/--	Calculated Result		mg/L	584
00030960	Oil & Grease	07/20	Dir.Ext.Hexane	1	mg/L	2
01151110	Biochem. Oxygen Dem.	02/01	Seeded Dil.Nit.Inh.5 Day	10	mg/L	< 10
11081351	Nitrogen Amm.Diss(N)	02/01	Automated Bertholot meth	0.005	mg/L	0.102
11111354	Nitrogen NO2 Diss(N)	02/01	Auto. Diazotization	0.005	mg/L	0.007
Ag-T0042	Silver	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Al-T0042	Aluminum	05/02	GI HNO3 Dig; ICAP 61E	0.06	mg/L	0.15
As-T0042	Arsenic	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.10
B--T0042	Boron	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.37
Ba-T0042	Barium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.015
Be-T0042	Beryllium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	< 0.001
Bi-T0042	Bismuth	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Ca-T0042	Calcium	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	49.3
Cd-T0042	Cadmium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Co-T0042	Cobalt	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Cr-T0042	Chromium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Cu-T0042	Copper	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.004
Fe-T0042	Iron	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	0.32
K__T0042	Potassium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	30.5
Mg-T0042	Magnesium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	112
Mn-T0042	Manganese	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.021
Mo-T0042	Molybdenum	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Na_T0042	Sodium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	876
Ni-T0042	Nickel	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
P--T139A	Phosphorus	02/01	Pres.Dig.Auto.Ascorbic A	0.003	mg/L	0.039
P__T0042	Phosphorus	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.08
Pb-T0042	Lead	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
S__T0042	Sulphur	05/02	GI HNO3 Dig; ICAP 61E	0.1	mg/L	75.8
Sb-T0042	Antimony	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	0.03
Se-T0042	Selenium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Si-T0042	Silicon	05/02	GI HNO3 Dig; ICAP 61E	0.8	mg/L	3.9
Sn-T0042	Tin	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	0.04
Sr-T0042	Strontium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.631
Te-T0042	Tellurium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Ti-T0042	Titanium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	0.019
Tl-T0042	Thallium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
V--T0042	Vanadium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003
Zn-T0042	Zinc	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
Zr-T0042	Zirconium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003

Sample State : Fresh Water
Sampled on : 93/02/18 11:00

Sample 93003377 comment : A1S

Zenon ID : 93003377

Sparcode	Parameter	Media	Workroute	MDC	Unit	
04502480	Coliform - Fecal	30/01	Membrane Filter Count-EL	0	CFU	790
01476013	E Coli	30/01	MF Method for E Coli	0	CFU	770
PSEU601A	Pseudomonas aerugin.	30/01	Membrane filtr. count	0	CFU	76
01486014	Enterococcus	30/01	MF Method for Enterococ.	0	CFU	480

Sample State : Fresh Water
Sampled on : 93/02/18 11:00

Sample 93003377 comment : A1S

Zenon ID : 93003378

Sparcode	Parameter	Media	Workroute	MDC	Unit	
WKSCWKS4	Weekend Surcharge	04/01	Surcharge 4		None	--- (1)
00041220	pH	02/01	Automated pH Meter	1.0	pH units	7.6
00111160	Specific Conductance	02/01	Cond.Meter Siebold	1	uS/cm	9230
0107CALC	Hardness Total	--/--	Calculated Result		mg/L	936
00030960	Oil & Grease	07/20	Dir.Ext.Hexane	1	mg/L	< 1
01151110	Biochem. Oxygen Dem.	02/01	Seeded Dil.Nit.Inh.5 Day	10	mg/L	< 10
11081351	Nitrogen Amm.Diss(N)	02/01	Automated Bertholot meth	0.005	mg/L	0.084
11111354	Nitrogen NO2 Diss(N)	02/01	Auto. Diazotization	0.005	mg/L	0.006
Ag-T0042	Silver	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Al-T0042	Aluminum	05/02	GI HNO3 Dig; ICAP 61E	0.06	mg/L	0.11
As-T0042	Arsenic	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.17
B--T0042	Boron	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.58
Ba-T0042	Barium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.015
Be-T0042	Beryllium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	< 0.001
Bi-T0042	Bismuth	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	0.02
Ca-T0042	Calcium	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	71.3
Cd-T0042	Cadmium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Co-T0042	Cobalt	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Cr-T0042	Chromium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Cu-T0042	Copper	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.004
Fe-T0042	Iron	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	0.31
K__T0042	Potassium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	50.9
Mg-T0042	Magnesium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	184
Mn-T0042	Manganese	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.019
Mo-T0042	Molybdenum	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Na_T0042	Sodium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	1480
Ni-T0042	Nickel	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
P--T139A	Phosphorus	02/01	Pres.Dig.Auto.Ascorbic A	0.003	mg/L	0.041
P__T0042	Phosphorus	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.11
Pb-T0042	Lead	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
S__T0042	Sulphur	05/02	GI HNO3 Dig; ICAP 61E	0.1	mg/L	124
Sb-T0042	Antimony	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Se-T0042	Selenium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Si-T0042	Silicon	05/02	GI HNO3 Dig; ICAP 61E	0.8	mg/L	2.9
Sn-T0042	Tin	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	0.08
Sr-T0042	Strontium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.983
Te-T0042	Tellurium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Ti-T0042	Titanium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	0.006
Tl-T0042	Thallium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
V--T0042	Vanadium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003
Zn-T0042	Zinc	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
Zr-T0042	Zirconium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003

Sample State : Fresh Water
Sampled on : 93/02/18 11:00

Sample 93003378 comment : A1D

Zenon ID : 93003378

Sparcode	Parameter	Media	Workroute	MDC	Unit	
04502480	Coliform - Fecal	30/01	Membrane Filter Count-EL	0	CFU	920
01476013	E Coli	30/01	MF Method for E Coli	0	CFU	1000
PSEU601A	Pseudomonas aerugin.	30/01	Membrane filtr. count	0	CFU	70
01486014	Enterococcus	30/01	MF Method for Enterococ.	0	CFU	490

Sample State : Fresh Water
Sampled on : 93/02/18 11:00

Sample 93003378 comment : A1D

Zenon ID : FRASER R D/S ANNACIS 93003369

Sparcode	Parameter	Media	Workroute	MDC	Unit	
WKSCWKS4	Weekend Surcharge	04/01	Surcharge 4		None	--- (1)
00041220	pH	02/01	Automated pH Meter	1.0	pH units	7.3
00111160	Specific Conductance	02/01	Cond.Meter Siebold	1	uS/cm	5730
0107CALC	Hardness Total	--/--	Calculated Result		mg/L	606
00030960	Oil & Grease	07/20	Dir.Ext.Hexane	1	mg/L	< 1
01151110	Biochem. Oxygen Dem.	02/01	Seeded Dil.Nit.Inh.5 Day	10	mg/L	< 10
11081351	Nitrogen Amm.Diss(N)	02/01	Automated Bertholot meth	0.005	mg/L	0.077
11111354	Nitrogen NO2 Diss(N)	02/01	Auto. Diazotization	0.005	mg/L	< 0.005
Ag-T0042	Silver	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Al-T0042	Aluminum	05/02	GI HNO3 Dig; ICAP 61E	0.06	mg/L	0.14
As-T0042	Arsenic	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.15
B--T0042	Boron	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.44
Ba-T0042	Barium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.015
Be-T0042	Beryllium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	< 0.001
Bi-T0042	Bismuth	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Ca-T0042	Calcium	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	51.3
Cd-T0042	Cadmium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Co-T0042	Cobalt	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Cr-T0042	Chromium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Cu-T0042	Copper	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.004
Fe-T0042	Iron	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	0.30
K__T0042	Potassium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	31.2
Mg-T0042	Magnesium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	116
Mn-T0042	Manganese	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.020
Mo-T0042	Molybdenum	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Na_T0042	Sodium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	883
Ni-T0042	Nickel	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
P--T139A	Phosphorus	02/01	Pres.Dig.Auto.Ascorbic A	0.003	mg/L	0.035
P__T0042	Phosphorus	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.07
Pb-T0042	Lead	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
S__T0042	Sulphur	05/02	GI HNO3 Dig; ICAP 61E	0.1	mg/L	78.5
Sb-T0042	Antimony	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Se-T0042	Selenium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Si-T0042	Silicon	05/02	GI HNO3 Dig; ICAP 61E	0.8	mg/L	3.4
Sn-T0042	Tin	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	0.05
Sr-T0042	Strontium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.640
Te-T0042	Tellurium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Ti-T0042	Titanium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	0.010
Tl-T0042	Thallium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
V--T0042	Vanadium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003
Zn-T0042	Zinc	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
Zr-T0042	Zirconium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003

Sample State : Fresh Water
Sampled on : 93/02/18 00:00

Sample 93003369 comment : A2S

Zenon ID : 93003369

Sparcode	Parameter	Media	Workroute	MDC	Unit	
04502480	Coliform - Fecal	30/01	Membrane Filter Count-EL	0	CFU	1900
01476013	E Coli	30/01	MF Method for E Coli	0	CFU	990
PSEU601A	Pseudomonas aerugin.	30/01	Membrane filtr. count	0	CFU	38
01486014	Enterococcus	30/01	MF Method for Enterococ.	0	CFU	520

Sample State : Fresh Water
Sampled on : 93/02/18 00:00

Sample 93003369 comment : A2S

Zenon ID : 93003370

Sparcode	Parameter	Media	Workroute	MDC	Unit	
WKSCWKS4	Weekend Surcharge	04/01	Surcharge 4		None	--- (1)
00041220	pH	02/01	Automated pH Meter	1.0	pH units	7.6
00111160	Specific Conductance	02/01	Cond.Meter Siebold	1	uS/cm	7770
0107CALC	Hardness Total	--/--	Calculated Result		mg/L	842
00030960	Oil & Grease	07/20	Dir.Ext.Hexane	1	mg/L	2
01151110	Biochem. Oxygen Dem.	02/01	Seeded Dil.Nit.Inh.5 Day	10	mg/L	< 10
11081351	Nitrogen Amm.Diss(N)	02/01	Automated Bertholot meth	0.005	mg/L	0.117
11111354	Nitrogen NO2 Diss(N)	02/01	Auto. Diazotization	0.005	mg/L	0.006
Ag-T0042	Silver	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Al-T0042	Aluminum	05/02	GI HNO3 Dig; ICAP 61E	0.06	mg/L	0.12
As-T0042	Arsenic	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.17
B--T0042	Boron	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.54
Ba-T0042	Barium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.014
Be-T0042	Beryllium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	< 0.001
Bi-T0042	Bismuth	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	0.02
Ca-T0042	Calcium	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	65.0
Cd-T0042	Cadmium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Co-T0042	Cobalt	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Cr-T0042	Chromium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Cu-T0042	Copper	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.009
Fe-T0042	Iron	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	0.34
K__T0042	Potassium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	45.6
Mg-T0042	Magnesium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	165
Mn-T0042	Manganese	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.022
Mo-T0042	Molybdenum	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Na_T0042	Sodium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	1340
Ni-T0042	Nickel	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
P--T139A	Phosphorus	02/01	Pres.Dig.Auto.Ascorbic A	0.003	mg/L	0.043
P__T0042	Phosphorus	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.26
Pb-T0042	Lead	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
S__T0042	Sulphur	05/02	GI HNO3 Dig; ICAP 61E	0.1	mg/L	113
Sb-T0042	Antimony	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Se-T0042	Selenium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Si-T0042	Silicon	05/02	GI HNO3 Dig; ICAP 61E	0.8	mg/L	2.8
Sn-T0042	Tin	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	0.05
Sr-T0042	Strontium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.889
Te-T0042	Tellurium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Ti-T0042	Titanium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	0.006
Tl-T0042	Thallium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
V--T0042	Vanadium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003
Zn-T0042	Zinc	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
Zr-T0042	Zirconium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003

Sample State : Fresh Water
Sampled on : 93/02/18 00:00

Sample 93003370 comment : A2D

Zenon ID : 93003370

Sparcode	Parameter	Media	Workroute	MDC	Unit	
04502480	Coliform - Fecal	30/01	Membrane Filter Count-EL	0	CFU	3400
01476013	E Coli	30/01	MF Method for E Coli	0	CFU	7900
PSEU601A	Pseudomonas aerugin.	30/01	Membrane filtr. count	0	CFU	320
01486014	Enterococcus	30/01	MF Method for Enterococ.	0	CFU	9800

Sample State : Fresh Water
Sampled on : 93/02/18 00:00

Sample 93003370 comment : A2D

Zenon ID : 93003371

Sparcode	Parameter	Media	Workroute	MDC	Unit	
WKSCWKS4	Weekend Surcharge	04/01	Surcharge 4		None	--- (1)
00041220	pH	02/01	Automated pH Meter	1.0	pH units	7.6
00111160	Specific Conductance	02/01	Cond.Meter Siebold	1	uS/cm	4490
0107CALC	Hardness Total	--/--	Calculated Result		mg/L	414
00030960	Oil & Grease	07/20	Dir.Ext.Hexane	1	mg/L	< 1
01151110	Biochem. Oxygen Dem.	02/01	Seeded Dil.Nit.Inh.5 Day	10	mg/L	< 10
11081351	Nitrogen Amm.Diss(N)	02/01	Automated Bertholot meth	0.005	mg/L	0.078
11111354	Nitrogen NO2 Diss(N)	02/01	Auto. Diazotization	0.005	mg/L	0.006
Ag-T0042	Silver	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Al-T0042	Aluminum	05/02	GI HNO3 Dig; ICAP 61E	0.06	mg/L	0.11
As-T0042	Arsenic	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.05
B--T0042	Boron	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.30
Ba-T0042	Barium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.015
Be-T0042	Beryllium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	< 0.001
Bi-T0042	Bismuth	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Ca-T0042	Calcium	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	40.4
Cd-T0042	Cadmium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Co-T0042	Cobalt	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Cr-T0042	Chromium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Cu-T0042	Copper	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.003
Fe-T0042	Iron	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	0.27
K__T0042	Potassium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	22.3
Mg-T0042	Magnesium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	76.1
Mn-T0042	Manganese	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.019
Mo-T0042	Molybdenum	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Na_T0042	Sodium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	658
Ni-T0042	Nickel	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
P--T139A	Phosphorus	02/01	Pres.Dig.Auto.Ascorbic A	0.003	mg/L	0.029
P__T0042	Phosphorus	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.09
Pb-T0042	Lead	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
S__T0042	Sulphur	05/02	GI HNO3 Dig; ICAP 61E	0.1	mg/L	57.1
Sb-T0042	Antimony	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Se-T0042	Selenium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Si-T0042	Silicon	05/02	GI HNO3 Dig; ICAP 61E	0.8	mg/L	3.0
Sn-T0042	Tin	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	0.05
Sr-T0042	Strontium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.484
Te-T0042	Tellurium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Ti-T0042	Titanium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	0.005
Tl-T0042	Thallium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
V--T0042	Vanadium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003
Zn-T0042	Zinc	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
Zr-T0042	Zirconium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003

Sample State : Fresh Water
Sampled on : 93/02/18 00:00

Sample 93003371 comment : A3S

Zenon ID : 93003371

Sparcode	Parameter	Media	Workroute	MDC	Unit	
04502480	Coliform - Fecal	30/01	Membrane Filter Count-EL	0	CFU	2100
01476013	E Coli	30/01	MF Method for E Coli	0	CFU	1500
PSEU601A	Pseudomonas aerugin.	30/01	Membrane filtr. count	0	CFU	34
01486014	Enterococcus	30/01	MF Method for Enterococ.	0	CFU	390

Sample State : Fresh Water
Sampled on : 93/02/18 00:00

Sample 93003371 comment : A3S

Zenon ID : 93003372

Sparcode	Parameter	Media	Workroute	MDC	Unit	
WKSCWKS4	Weekend Surcharge	04/01	Surcharge 4		None	--- (1)
00041220	pH	02/01	Automated pH Meter	1.0	pH units	7.5
00111160	Specific Conductance	02/01	Cond.Meter Siebold	1	uS/cm	6440
0107CALC	Hardness Total	--/--	Calculated Result		mg/L	696
00030960	Oil & Grease	07/20	Dir.Ext.Hexane	1	mg/L	< 1
01151110	Biochem. Oxygen Dem.	02/01	Seeded Dil.Nit.Inh.5 Day	10	mg/L	< 10
11081351	Nitrogen Amm.Diss(N)	02/01	Automated Bertholot meth	0.005	mg/L	0.607
11111354	Nitrogen NO2 Diss(N)	02/01	Auto. Diazotization	0.005	mg/L	< 0.005
Ag-T0042	Silver	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Al-T0042	Aluminum	05/02	GI HNO3 Dig; ICAP 61E	0.06	mg/L	0.11
As-T0042	Arsenic	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.14
B--T0042	Boron	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.44
Ba-T0042	Barium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.015
Be-T0042	Beryllium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	< 0.001
Bi-T0042	Bismuth	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Ca-T0042	Calcium	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	56.0
Cd-T0042	Cadmium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Co-T0042	Cobalt	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Cr-T0042	Chromium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Cu-T0042	Copper	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.004
Fe-T0042	Iron	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	0.29
K__T0042	Potassium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	37.1
Mg-T0042	Magnesium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	135
Mn-T0042	Manganese	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.019
Mo-T0042	Molybdenum	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Na_T0042	Sodium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	1040
Ni-T0042	Nickel	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
P--T139A	Phosphorus	02/01	Pres.Dig.Auto.Ascorbic A	0.003	mg/L	0.144
P__T0042	Phosphorus	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.14
Pb-T0042	Lead	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
S__T0042	Sulphur	05/02	GI HNO3 Dig; ICAP 61E	0.1	mg/L	91.3
Sb-T0042	Antimony	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Se-T0042	Selenium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Si-T0042	Silicon	05/02	GI HNO3 Dig; ICAP 61E	0.8	mg/L	3.2
Sn-T0042	Tin	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	0.08
Sr-T0042	Strontium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.738
Te-T0042	Tellurium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Ti-T0042	Titanium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	0.007
Tl-T0042	Thallium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
V--T0042	Vanadium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003
Zn-T0042	Zinc	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
Zr-T0042	Zirconium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003

Sample State : Fresh Water
Sampled on : 93/02/18 00:00

Sample 93003372 comment : A3D

Zenon ID : 93003372

Sparcode	Parameter	Media	Workroute	MDC	Unit	
04502480	Coliform - Fecal	30/01	Membrane Filter Count-EL	0	CFU	17000
01476013	E Coli	30/01	MF Method for E Coli	0	CFU	10000
PSEU601A	Pseudomonas aerugin.	30/01	Membrane filtr. count	0	CFU	180
01486014	Enterococcus	30/01	MF Method for Enterococ.	0	CFU	5100

Sample State : Fresh Water
Sampled on : 93/02/18 00:00

Sample 93003372 comment : A3D

Zenon ID : 93003373

Sparcode	Parameter	Media	Workroute	MDC	Unit	
WKSCWKS4	Weekend Surcharge	04/01	Surcharge 4		None	--- (1)
00041220	pH	02/01	Automated pH Meter	1.0	pH units	7.6
00111160	Specific Conductance	02/01	Cond.Meter Siebold	1	uS/cm	5350
0107CALC	Hardness Total	--/--	Calculated Result		mg/L	378
00030960	Oil & Grease	07/20	Dir.Ext.Hexane	1	mg/L	< 1
01151110	Biochem. Oxygen Dem.	02/01	Seeded Dil.Nit.Inh.5 Day	10	mg/L	< 10
11081351	Nitrogen Amm.Diss(N)	02/01	Automated Bertholot meth	0.005	mg/L	0.290
11111354	Nitrogen NO2 Diss(N)	02/01	Auto. Diazotization	0.005	mg/L	< 0.005
Ag-T0042	Silver	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Al-T0042	Aluminum	05/02	GI HNO3 Dig; ICAP 61E	0.06	mg/L	0.13
As-T0042	Arsenic	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.10
B--T0042	Boron	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.25
Ba-T0042	Barium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.015
Be-T0042	Beryllium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	< 0.001
Bi-T0042	Bismuth	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Ca-T0042	Calcium	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	38.2
Cd-T0042	Cadmium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Co-T0042	Cobalt	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Cr-T0042	Chromium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Cu-T0042	Copper	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.002
Fe-T0042	Iron	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	0.29
K__T0042	Potassium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	20.5
Mg-T0042	Magnesium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	68.6
Mn-T0042	Manganese	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.019
Mo-T0042	Molybdenum	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Na_T0042	Sodium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	593
Ni-T0042	Nickel	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
P--T139A	Phosphorus	02/01	Pres.Dig.Auto.Ascorbic A	0.003	mg/L	0.076
P__T0042	Phosphorus	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.06
Pb-T0042	Lead	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
S__T0042	Sulphur	05/02	GI HNO3 Dig; ICAP 61E	0.1	mg/L	51.3
Sb-T0042	Antimony	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Se-T0042	Selenium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Si-T0042	Silicon	05/02	GI HNO3 Dig; ICAP 61E	0.8	mg/L	3.0
Sn-T0042	Tin	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	0.03
Sr-T0042	Strontium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.447
Te-T0042	Tellurium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Ti-T0042	Titanium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	0.006
Tl-T0042	Thallium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
V--T0042	Vanadium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003
Zn-T0042	Zinc	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
Zr-T0042	Zirconium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003

Sample State : Fresh Water
Sampled on : 93/02/18 00:00

Sample 93003373 comment : A4S

Zenon ID : 93003373

Sparcode	Parameter	Media	Workroute	MDC	Unit	
04502480	Coliform - Fecal	30/01	Membrane Filter Count-EL	0	CFU	1400
01476013	E Coli	30/01	MF Method for E Coli	0	CFU	1200
PSEU601A	Pseudomonas aerugin.	30/01	Membrane filtr. count	0	CFU	46
01486014	Enterococcus	30/01	MF Method for Enterococ.	0	CFU	360

Sample State : Fresh Water
Sampled on : 93/02/18 00:00

Sample 93003373 comment : A4S

Zenon ID : 93003374

Sparcode	Parameter	Media	Workroute	MDC	Unit	
WKSCWKS4	Weekend Surcharge	04/01	Surcharge 4		None	--- (1)
00041220	pH	02/01	Automated pH Meter	1.0	pH units	7.5
00111160	Specific Conductance	02/01	Cond.Meter Siebold	1	uS/cm	6360
0107CALC	Hardness Total	--/--	Calculated Result		mg/L	688
00030960	Oil & Grease	07/20	Dir.Ext.Hexane	1	mg/L	< 1
01151110	Biochem. Oxygen Dem.	02/01	Seeded Dil.Nit.Inh.5 Day	10	mg/L	< 10
11081351	Nitrogen Amm.Diss(N)	02/01	Automated Bertholot meth	0.005	mg/L	0.544
11111354	Nitrogen NO2 Diss(N)	02/01	Auto. Diazotization	0.005	mg/L	< 0.005
Ag-T0042	Silver	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Al-T0042	Aluminum	05/02	GI HNO3 Dig; ICAP 61E	0.06	mg/L	0.11
As-T0042	Arsenic	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.12
B--T0042	Boron	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.43
Ba-T0042	Barium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.015
Be-T0042	Beryllium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	< 0.001
Bi-T0042	Bismuth	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	0.02
Ca-T0042	Calcium	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	56.0
Cd-T0042	Cadmium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Co-T0042	Cobalt	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Cr-T0042	Chromium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Cu-T0042	Copper	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.005
Fe-T0042	Iron	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	0.31
K__T0042	Potassium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	36.1
Mg-T0042	Magnesium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	133
Mn-T0042	Manganese	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.021
Mo-T0042	Molybdenum	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Na_T0042	Sodium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	1060
Ni-T0042	Nickel	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
P--T139A	Phosphorus	02/01	Pres.Dig.Auto.Ascorbic A	0.003	mg/L	0.123
P__T0042	Phosphorus	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.18
Pb-T0042	Lead	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
S__T0042	Sulphur	05/02	GI HNO3 Dig; ICAP 61E	0.1	mg/L	90.2
Sb-T0042	Antimony	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Se-T0042	Selenium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Si-T0042	Silicon	05/02	GI HNO3 Dig; ICAP 61E	0.8	mg/L	3.0
Sn-T0042	Tin	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	0.06
Sr-T0042	Strontium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.730
Te-T0042	Tellurium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Ti-T0042	Titanium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	0.005
Tl-T0042	Thallium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
V--T0042	Vanadium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003
Zn-T0042	Zinc	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
Zr-T0042	Zirconium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003

Sample State : Fresh Water
Sampled on : 93/02/18 00:00

Sample 93003374 comment : A4D

Zenon ID : 93003374

Sparcode	Parameter	Media	Workroute	MDC	Unit	
04502480	Coliform - Fecal	30/01	Membrane Filter Count-EL	0	CFU	500
01476013	E Coli	30/01	MF Method for E Coli	0	CFU	4700
PSEU601A	Pseudomonas aerugin.	30/01	Membrane filtr. count	0	CFU	100
01486014	Enterococcus	30/01	MF Method for Enterococ.	0	CFU	1000

Sample State : Fresh Water
Sampled on : 93/02/18 00:00

Sample 93003374 comment : A4D

Zenon ID : 93003375

Sparcode	Parameter	Media	Workroute	MDC	Unit	
WKSCWKS4	Weekend Surcharge	04/01	Surcharge 4		None	--- (1)
00041220	pH	02/01	Automated pH Meter	1.0	pH units	7.7
00111160	Specific Conductance	02/01	Cond.Meter Siebold	1	uS/cm	4000
0107CALC	Hardness Total	--/--	Calculated Result		mg/L	386
00030960	Oil & Grease	07/20	Dir.Ext.Hexane	1	mg/L	< 1
01151110	Biochem. Oxygen Dem.	02/01	Seeded Dil.Nit.Inh.5 Day	10	mg/L	< 10
11081351	Nitrogen Amm.Diss(N)	02/01	Automated Bertholot meth	0.005	mg/L	0.081
11111354	Nitrogen NO2 Diss(N)	02/01	Auto. Diazotization	0.005	mg/L	< 0.005
Ag-T0042	Silver	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Al-T0042	Aluminum	05/02	GI HNO3 Dig; ICAP 61E	0.06	mg/L	0.17
As-T0042	Arsenic	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.10
B--T0042	Boron	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.27
Ba-T0042	Barium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.015
Be-T0042	Beryllium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	< 0.001
Bi-T0042	Bismuth	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Ca-T0042	Calcium	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	38.7
Cd-T0042	Cadmium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Co-T0042	Cobalt	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Cr-T0042	Chromium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Cu-T0042	Copper	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.004
Fe-T0042	Iron	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	0.33
K__T0042	Potassium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	20.6
Mg-T0042	Magnesium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	70.3
Mn-T0042	Manganese	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.020
Mo-T0042	Molybdenum	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Na_T0042	Sodium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	606
Ni-T0042	Nickel	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
P--T139A	Phosphorus	02/01	Pres.Dig.Auto.Ascorbic A	0.003	mg/L	0.031
P__T0042	Phosphorus	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	< 0.04
Pb-T0042	Lead	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
S__T0042	Sulphur	05/02	GI HNO3 Dig; ICAP 61E	0.1	mg/L	52.5
Sb-T0042	Antimony	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Se-T0042	Selenium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Si-T0042	Silicon	05/02	GI HNO3 Dig; ICAP 61E	0.8	mg/L	3.3
Sn-T0042	Tin	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	0.03
Sr-T0042	Strontium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.455
Te-T0042	Tellurium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Ti-T0042	Titanium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	0.008
Tl-T0042	Thallium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
V--T0042	Vanadium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003
Zn-T0042	Zinc	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
Zr-T0042	Zirconium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003

Sample State : Fresh Water
Sampled on : 93/02/18 00:00

Sample 93003375 comment : A5S

Zenon ID : 93003375

Sparcode	Parameter	Media	Workroute	MDC	Unit	
04502480	Coliform - Fecal	30/01	Membrane Filter Count-EL	0	CFU	500
01476013	E Coli	30/01	MF Method for E Coli	0	CFU	570
PSEU601A	Pseudomonas aerugin.	30/01	Membrane filtr. count	0	CFU	52
01486014	Enterococcus	30/01	MF Method for Enterococ.	0	CFU	380

Sample State : Fresh Water
Sampled on : 93/02/18 00:00

Sample 93003375 comment : A5S

Zenon ID : 93003376

Sparcode	Parameter	Media	Workroute	MDC	Unit	
WKSCWKS4	Weekend Surcharge	04/01	Surcharge 4		None	--- (1)
00041220	pH	02/01	Automated pH Meter	1.0	pH units	7.5
00111160	Specific Conductance	02/01	Cond.Meter Siebold	1	uS/cm	5820
0107CALC	Hardness Total	---/--	Calculated Result		mg/L	584
00030960	Oil & Grease	07/20	Dir.Ext.Hexane	1	mg/L	2
01151110	Biochem. Oxygen Dem.	02/01	Seeded Dil.Nit.Inh.5 Day	10	mg/L	< 10
11081351	Nitrogen Amm.Diss(N)	02/01	Automated Bertholot meth	0.005	mg/L	0.323
11111354	Nitrogen NO2 Diss(N)	02/01	Auto. Diazotization	0.005	mg/L	0.005
Ag-T0042	Silver	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Al-T0042	Aluminum	05/02	GI HNO3 Dig; ICAP 61E	0.06	mg/L	0.11
As-T0042	Arsenic	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.12
B--T0042	Boron	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.38
Ba-T0042	Barium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.015
Be-T0042	Beryllium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	< 0.001
Bi-T0042	Bismuth	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Ca-T0042	Calcium	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	49.2
Cd-T0042	Cadmium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Co-T0042	Cobalt	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Cr-T0042	Chromium	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	< 0.002
Cu-T0042	Copper	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.004
Fe-T0042	Iron	05/02	GI HNO3 Dig; ICAP 61E	0.05	mg/L	0.27
K__T0042	Potassium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	30.7
Mg-T0042	Magnesium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	112
Mn-T0042	Manganese	05/02	GI HNO3 Dig; ICAP 61E	0.002	mg/L	0.019
Mo-T0042	Molybdenum	05/02	GI HNO3 Dig; ICAP 61E	0.004	mg/L	< 0.004
Na_T0042	Sodium	05/02	GI HNO3 Dig; ICAP 61E	0.4	mg/L	870
Ni-T0042	Nickel	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
P--T139A	Phosphorus	02/01	Pres.Dig.Auto.Ascorbic A	0.003	mg/L	0.090
P__T0042	Phosphorus	05/02	GI HNO3 Dig; ICAP 61E	0.04	mg/L	0.11
Pb-T0042	Lead	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
S__T0042	Sulphur	05/02	GI HNO3 Dig; ICAP 61E	0.1	mg/L	76.2
Sb-T0042	Antimony	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Se-T0042	Selenium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
Si-T0042	Silicon	05/02	GI HNO3 Dig; ICAP 61E	0.8	mg/L	3.1
Sn-T0042	Tin	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	0.05
Sr-T0042	Strontium	05/02	GI HNO3 Dig; ICAP 61E	0.001	mg/L	0.632
Te-T0042	Tellurium	05/02	GI HNO3 Dig; ICAP 61E	0.02	mg/L	< 0.02
Ti-T0042	Titanium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	0.006
Tl-T0042	Thallium	05/02	GI HNO3 Dig; ICAP 61E	0.03	mg/L	< 0.03
V--T0042	Vanadium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003
Zn-T0042	Zinc	05/02	GI HNO3 Dig; ICAP 61E	0.01	mg/L	< 0.01
Zr-T0042	Zirconium	05/02	GI HNO3 Dig; ICAP 61E	0.003	mg/L	< 0.003

Sample State : Fresh Water
Sampled on : 93/02/18 00:00

Sample 93003376 comment : A5D

Zenon ID : 93003376

Sparcode	Parameter	Media	Workroute	MDC	Unit	
04502480	Coliform - Fecal	30/01	Membrane Filter Count-EL	0	CFU	6100
01476013	E Coli	30/01	MF Method for E Coli	0	CFU	7200
PSEU601A	Pseudomonas aerugin.	30/01	Membrane filtr. count	0	CFU	120
01486014	Enterococcus	30/01	MF Method for Enterococ.	0	CFU	1100

Sample State : Fresh Water
Sampled on : 93/02/18 00:00

Sample 93003376 comment : A5D

FRASR R U/S ANNACIS-A-1

Zenon ID : 93003368

Sparcode	Parameter	Media	Workroute	MDC	Unit	
C--T0790	Carbon Total	14/00	D/G:Leco Carbon	1000	ug/g	9700
00320750	Residue Tot.Volatile	14/00	D/G:/Grav. 550C	0.1	%(W/W)	3.4
00250760	Moisture	14/00	Hom; Gravimetric 105C	0.1	%(W/W)	40.3
00330660	Part. Size 16 Mesh	14/00	16 Mesh: 1.19 mm (dry)	0.1	%(W/W)	< 0.1
003A0670	Part. Size 30 Mesh	14/00	30 Mesh: 0.59 mm (dry)	0.1	%(W/W)	< 0.1
003B0680	Part. Size 50 Mesh	14/00	50 Mesh: 0.297 mm (dry)	0.1	%(W/W)	1.0
003C0690	Part. Size 100 Mesh	14/00	100 Mesh: 0.149 mm (dry)	0.1	%(W/W)	7.1
003D0700	Part. Size 140 Mesh	14/00	140 Mesh: 0.105 mm (dry)	0.1	%(W/W)	4.6
003E0710	Part. Size 200 Mesh	14/00	200 Mesh: 0.074 mm (dry)	0.1	%(W/W)	22.4
003F0720	Part. Size 270 Mesh	14/00	270 Mesh: 0.053 mm (dry)	0.1	%(W/W)	15.8
003G0730	Part. Size 400 Mesh	14/00	400 Mesh: 0.037 mm (dry)	0.1	%(W/W)	14.3
003H0740	Part. Size >400 Mesh	14/00	Pan: <0.037 mm (dry)	0.1	%(W/W)	34.7
0103CAL2	Carbon Total Organic	--/--	Calculated Result		ug/g	8100
01240941	Carbon Tot Inorganic	14/00	Ash on Leco	500	ug/g	1600
Al-T0190	Aluminum	14/00	D&G:N/P Dig:ICP Anal.	10	ug/g	26700
As-T0190	Arsenic	14/00	D&G:N/P Dig:ICP Anal.	10	ug/g	16
Ba-T0190	Barium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	167
Ca-T0190	Calcium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	11100
Cd-T0190	Cadmium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	< 1
Co-T0190	Cobalt	14/00	D&G:N/P Dig:ICP Anal.	10	ug/g	12
Cr-T0190	Chromium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	38
Cu-T0190	Copper	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	31
Fe-T0190	Iron	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	37200
Mg-T0190	Magnesium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	12100
Mn-T0190	Manganese	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	471
Mo-T0190	Molybdenum	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	< 1
Ni-T0190	Nickel	14/00	D&G:N/P Dig:ICP Anal.	5	ug/g	41
P--T0190	Phosphorus	14/00	D&G:N/P Dig:ICP Anal.	5	ug/g	803
Pb-T0190	Lead	14/00	D&G:N/P Dig:ICP Anal.	10	ug/g	< 10
Se-T0190	Selenium	14/00	D&G:N/P Dig:ICP Anal.	10	ug/g	< 10
Sr-T0190	Strontium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	67
V--T0190	Vanadium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	62
Zn-T0190	Zinc	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	72
GSSPGSSP	Special Analysis	14/00	Special Analysis		None	--- (1)
PAHS-S02	Polyc.Arom.Hydroc	14/00	PAHS - Soil		None	--- (3)
ORSPORSP	Organics Special	14/00	Org. Special Analysis		None	--- (2)

Sample State : Soil
Sampled on : 93/02/18 00:00

NONYLPHENOL <0.05 ug/g

(3) Text results for sample 93003368 sparcode PAHS-S02 follow :

	ug/g
Naphthalene	0.010
Acenaphthylene	0.002
Acenaphthene	0.013
Fluorene	0.016
Phenanthrene	0.074
Anthracene	0.008
Fluoranthene	0.086
Pyrene	0.067
Benz(a)anthracene	0.027
Chrysene	0.040
Benzo(b+k)fluoranthene	0.034
Benzo(a)pyrene	0.011
Indeno(1,2,3-cd)pyrene	0.004
Dibenz(a,h)anthracene	0.001
Benzo(g,h,i)perylene	0.005

SURROGATE RECOVERIES (%)

Acenaphthene d10	69
Phenathrene d10	73
Chrysene d12	95
Perylene d12	85

0.8% TOC

FRASER R D/S ANNACIS

Zenon ID : 93003366

Sparcode	Parameter	Media	Workroute	MDC	Unit	
C--T0790	Carbon Total	14/00	D/G:Leco Carbon	1000	ug/g	9400
00320750	Residue Tot.Volatile	14/00	D/G:/Grav. 550C	0.1	%(W/W)	3.0
00250760	Moisture	14/00	Hom; Gravimetric 105C	0.1	%(W/W)	36.2
00330660	Part. Size 16 Mesh	14/00	16 Mesh: 1.19 mm (dry)	0.1	%(W/W)	< 0.1
003A0670	Part. Size 30 Mesh	14/00	30 Mesh: 0.59 mm (dry)	0.1	%(W/W)	< 0.1
003B0680	Part. Size 50 Mesh	14/00	50 Mesh: 0.297 mm (dry)	0.1	%(W/W)	0.4
003C0690	Part. Size 100 Mesh	14/00	100 Mesh: 0.149 mm (dry)	0.1	%(W/W)	5.7
003D0700	Part. Size 140 Mesh	14/00	140 Mesh: 0.105 mm (dry)	0.1	%(W/W)	3.9
003E0710	Part. Size 200 Mesh	14/00	200 Mesh: 0.074 mm (dry)	0.1	%(W/W)	23.1
003F0720	Part. Size 270 Mesh	14/00	270 Mesh: 0.053 mm (dry)	0.1	%(W/W)	18.8
003G0730	Part. Size 400 Mesh	14/00	400 Mesh: 0.037 mm (dry)	0.1	%(W/W)	14.0
003H0740	Part. Size >400 Mesh	14/00	Pan: <0.037 mm (dry)	0.1	%(W/W)	34.1
0103CAL2	Carbon Total Organic	--/--	Calculated Result		ug/g	6600
01240941	Carbon Tot Inorganic	14/00	Ash on Leco	500	ug/g	2800
Al-T0190	Aluminum	14/00	D&G:N/P Dig:ICP Anal.	10	ug/g	27200
As-T0190	Arsenic	14/00	D&G:N/P Dig:ICP Anal.	10	ug/g	24
Ba-T0190	Barium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	179
Ca-T0190	Calcium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	11500
Cd-T0190	Cadmium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	< 1
Co-T0190	Cobalt	14/00	D&G:N/P Dig:ICP Anal.	10	ug/g	12
Cr-T0190	Chromium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	39
Cu-T0190	Copper	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	30
Fe-T0190	Iron	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	35500
Mg-T0190	Magnesium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	11600
Mn-T0190	Manganese	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	482
Mo-T0190	Molybdenum	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	< 1
Ni-T0190	Nickel	14/00	D&G:N/P Dig:ICP Anal.	5	ug/g	38
P--T0190	Phosphorus	14/00	D&G:N/P Dig:ICP Anal.	5	ug/g	755
Pb-T0190	Lead	14/00	D&G:N/P Dig:ICP Anal.	10	ug/g	< 10
Se-T0190	Selenium	14/00	D&G:N/P Dig:ICP Anal.	10	ug/g	< 10
Sr-T0190	Strontium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	66
V--T0190	Vanadium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	63
Zn-T0190	Zinc	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	70
GSSPGSSP	Special Analysis	14/00	Special Analysis		None	--- (1)
PAHS-S02	Polyc.Arom.Hydroc	14/00	PAHS - Soil		None	--- (3)
ORSPORSP	Organics Special	14/00	Org. Special Analysis		None	--- (2)

Sample State : Soil
Sampled on : 93/02/18 00:00

Sample 93003366 comment : A-2

(1) Text results for sample 93003366 sparcode GSSPGSSP follow :

0.7% TOC

(2) Text results for sample 93003366 sparcode ORSPORSP follow :

NONYLPHENOL <0.05 ug/g

(3) Text results for sample 93003366 sparcode PAHS-S02 follow :

	ug/g
Naphthalene	0.009
Acenaphthylene	0.001
Acenaphthene	0.006
Fluorene	0.008
Phenanthrene	0.054
Anthracene	0.004
Fluoranthene	0.065
Pyrene	0.046
Benz(a)anthracene	0.010
Chrysene	0.017
Benzo(b+k)fluoranthene	0.020
Benzo(a)pyrene	0.005
Indeno(1,2,3-cd)pyrene	0.002
Dibenz(a,h)anthracene	< 0.001
Benzo(g,h,i)perylene	0.003
.	
SURROGATE RECOVERIES (%)	
.	
Acenaphthene d10	65
Phenathrene d10	67
Chrysene d12	90
Perylene d12	80

Zenon ID : 93003367

Sparcode	Parameter	Media	Workroute	MDC	Unit	
C--T0790	Carbon Total	14/00	D/G:Leco Carbon	1000	ug/g	9400
00320750	Residue Tot.Volatile	14/00	D/G:/Grav. 550C	0.1	%(W/W)	3.1
00250760	Moisture	14/00	Hom; Gravimetric 105C	0.1	%(W/W)	35.9
00330660	Part. Size 16 Mesh	14/00	16 Mesh: 1.19 mm (dry)	0.1	%(W/W)	< 0.1
003A0670	Part. Size 30 Mesh	14/00	30 Mesh: 0.59 mm (dry)	0.1	%(W/W)	< 0.1
003B0680	Part. Size 50 Mesh	14/00	50 Mesh: 0.297 mm (dry)	0.1	%(W/W)	1.9
003C0690	Part. Size 100 Mesh	14/00	100 Mesh: 0.149 mm (dry)	0.1	%(W/W)	17.0
003D0700	Part. Size 140 Mesh	14/00	140 Mesh: 0.105 mm (dry)	0.1	%(W/W)	6.8
003E0710	Part. Size 200 Mesh	14/00	200 Mesh: 0.074 mm (dry)	0.1	%(W/W)	24.5
003F0720	Part. Size 270 Mesh	14/00	270 Mesh: 0.053 mm (dry)	0.1	%(W/W)	14.2
003G0730	Part. Size 400 Mesh	14/00	400 Mesh: 0.037 mm (dry)	0.1	%(W/W)	10.8
003H0740	Part. Size >400 Mesh	14/00	Pan: <0.037 mm (dry)	0.1	%(W/W)	24.8
0103CAL2	Carbon Total Organic	--/--	Calculated Result		ug/g	8100
01240941	Carbon Tot Inorganic	14/00	Ash on Leco	500	ug/g	1300
Al-T0190	Aluminum	14/00	D&G:N/P Dig:ICP Anal.	10	ug/g	25200
As-T0190	Arsenic	14/00	D&G:N/P Dig:ICP Anal.	10	ug/g	13
Ba-T0190	Barium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	158
Ca-T0190	Calcium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	10900
Cd-T0190	Cadmium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	< 1
Co-T0190	Cobalt	14/00	D&G:N/P Dig:ICP Anal.	10	ug/g	13
Cr-T0190	Chromium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	55
Cu-T0190	Copper	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	31
Fe-T0190	Iron	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	40100
Mg-T0190	Magnesium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	12100
Mn-T0190	Manganese	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	425
Mo-T0190	Molybdenum	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	< 1
Ni-T0190	Nickel	14/00	D&G:N/P Dig:ICP Anal.	5	ug/g	44
P--T0190	Phosphorus	14/00	D&G:N/P Dig:ICP Anal.	5	ug/g	792
Pb-T0190	Lead	14/00	D&G:N/P Dig:ICP Anal.	10	ug/g	< 10
Se-T0190	Selenium	14/00	D&G:N/P Dig:ICP Anal.	10	ug/g	< 10
Sr-T0190	Strontium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	64
V--T0190	Vanadium	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	71
Zn-T0190	Zinc	14/00	D&G:N/P Dig:ICP Anal.	1	ug/g	70
GSSPGSSP	Special Analysis	14/00	Special Analysis		None	--- (1)
PAHS-S02	Polyc.Arom.Hydroc	14/00	PAHS - Soil		None	--- (3)
ORSPORSP	Organics Special	14/00	Org. Special Analysis		None	--- (2)

Sample State : Soil
Sampled on : 93/02/18 00:00

Sample 93003367 comment : A-3

(1) Text results for sample 93003367 sparcode GSSPGSSP follow :

0.8% TOC

(2) Text results for sample 93003367 sparcode ORSPORSP follow :

NONYLPHENOL <0.05 ug/g

(3) Text results for sample 93003367 sparcode PAHS-S02 follow :

	ug/g
Naphthalene	0.019
Acenaphthylene	0.003
Acenaphthene	0.010
Fluorene	0.046
Phenanthrene	0.17
Anthracene	0.39
Fluoranthene	0.14
Pyrene	0.12
Benz(a)anthracene	0.081
Chrysene	0.33
Benzo(b+k)fluoranthene	0.085
Benzo(a)pyrene	0.035
Indeno(1,2,3-cd)pyrene	0.014
Dibenz(a,h)anthracene	0.004
Benzo(g,h,i)perylene	0.013
.	
SURROGATE RECOVERIES (%)	
.	
Acenaphthene d10	68
Phenathrene d10	71
Chrysene d12	88
Perylene d12	78

COLLECTED BY	DATE	RECEIVED IN LABORATORY BY	DATE
DW	18 feb 93	RW	19 Feb 93
WITNESS	TIME 1300 Hrs.	WITNESS	TIME 9:00 Hrs.

ANALYSIS REQUIRED: ☐ 96 Hr LC50 ☒ 96 Hr LT50 ☐ Other — Specified Concentration (s) @ 100%

RECEIVED FROM: D. Walton

SAMPLE ☐ Legal ☐ Audit ☒ Routine

DILUTION WATER ☒ Fresh Water ☐ Salt Water

DILUTIONS MEASURED BY ☑ Weight ☑ Whole Sample Of ☐ Volume ☐ Active Ingredient

FISH SPECIES ☑ Rainbow Trout (*Oncorhynchus mykiss*) ☐ Other

ORIGINAL SAMPLE pH	Salinity	DILUTION WATER pH	Hardness	Salinity	BIOASSAY TEMPERATURE	FISH SIZE
7.3	— o/oo	6.4	9.1 mg/l. $CaCO_3$	— o/oo	13 ± 2 °C	☑ Weekly Average ☐ Actual

LOADING DENSITY	FORK LENGTH (Average)	RANGE	WEIGHT (Average)	RANGE
0.57 gm./l. Or ☐ See Below ☐ See Data Sheet	5.75 cm. ☐ See Data Sheet	4.6 cm. to 7.5 cm. ☐ See Data Sheet	1.71 gm. ☐ See Data Sheet	0.83 gm. to 3.88 gm. ☐ See Data Sheet

CONCENTRATION	TEST AMOUNT	START DATE	START pH	START D.O.	START Time	NO. FISH	CUMULATIVE MORTALITY AT TIME (HRS) 24	48	72	96	FINAL pH	FINAL D.O.	Test vessel
CONTROL	0	19Feb93	6.4	12.0	1130	10	0	0	0	0	6.8	10.1	41
100%	30L	19Feb93	7.3	12.0	1130	10	0	0	0	0	7.8	10.2	206

ANALYSIS RESULTS sample conductivity _____ µMOHS., control conductivity _____ µMOHS.

96 Hr. LC50 is _____ concentration. | 96 Hr. LT50 is NON-TOXIC at 100% concentration.

The sample was NON-TOXIC to R. trout exposed for 96 hrs at 100% concentration

C. Buday
Analyst

02 02 93
DAY MONTH YEAR
Date

290
Man. Min. Conc. 2

MICROTOX DATA REPORT

FILE NAME: 96.K5

TEST DATE: Feb 25/93
TEST TIME:

Sample Description:
ANNACIS STP

Procedure: BASIC
Initial Concentration : 50 %
Test Time: 5 minutes

Osmotic Adjustment: 2% NaCl
Dilution Factor : 2
Concentration Units: %

NUMBER	IO/IT	CONC.	GAMMA
1	87.89/ 72.28	6.2500	-0.08803*
2	89.57/ 73.77	12.5000	-0.08937*
3	92.50/ 77.96	25.0000	-0.11012*
4	89.83/ 78.26	50.0000	-0.13912*

CONTROL IT/IO = 69.72/ 92.96 CORRECTION FACTOR = 0.7500

EC50 IS GREATER THAN 100%

* Invalid gammas

MICROTOX DATA REPORT

FILE NAME: 96.K15

TEST DATE:
TEST TIME:

Sample Description:
ANNACIS STP

Procedure: BASIC
Initial Concentration : 50 %
Test Time: 15 minutes

Osmotic Adjustment: 2% NaCl
Dilution Factor : 2
Concentration Units: %

NUMBER	IO/IT	CONC.	GAMMA
1	87.89/ 70.77	6.2500	-0.09195*
2	89.57/ 71.96	12.5000	-0.08989*
3	92.50/ 77.17	25.0000	-0.12358*
4	89.83/ 78.25	50.0000	-0.16062*

CONTROL IT/IO = 67.97/ 92.96 CORRECTION FACTOR = 0.7312

EC50 IS GREATER THAN 100%

* Invalid gammas

DAPHNIA BIOASSAY RECORD

SUBMITTING AGENCY Surrey WMB
SITE NAME Annacis STP
DAPHNIA SAMPLE NUMBER 93094

DATE SAMPLED Feb 18/93
DATE ANALYZED Feb 24/93
SAMPLE TYPE Effluent
FISH SAMPLE NUMBER 930237

	CONTROL	100%	56%	32%				
24 HR Mortality	0/0	0/0	0/0	0/0				
48 HR Mortality	0/0	0/0	0/0	0/0				
Initial pH	7.8	7.6	7.7	7.7				
Initial D.O.	9.1	9.8	9.5	9.4				
Final pH	7.9	7.7	7.7	7.7				
Final D.O.	8.6	8.8	8.8	8.9				

COMMENTS The sample was NON-TOXIC to Daphnia exposed for 48 hrs

LC50 NON-TOXIC