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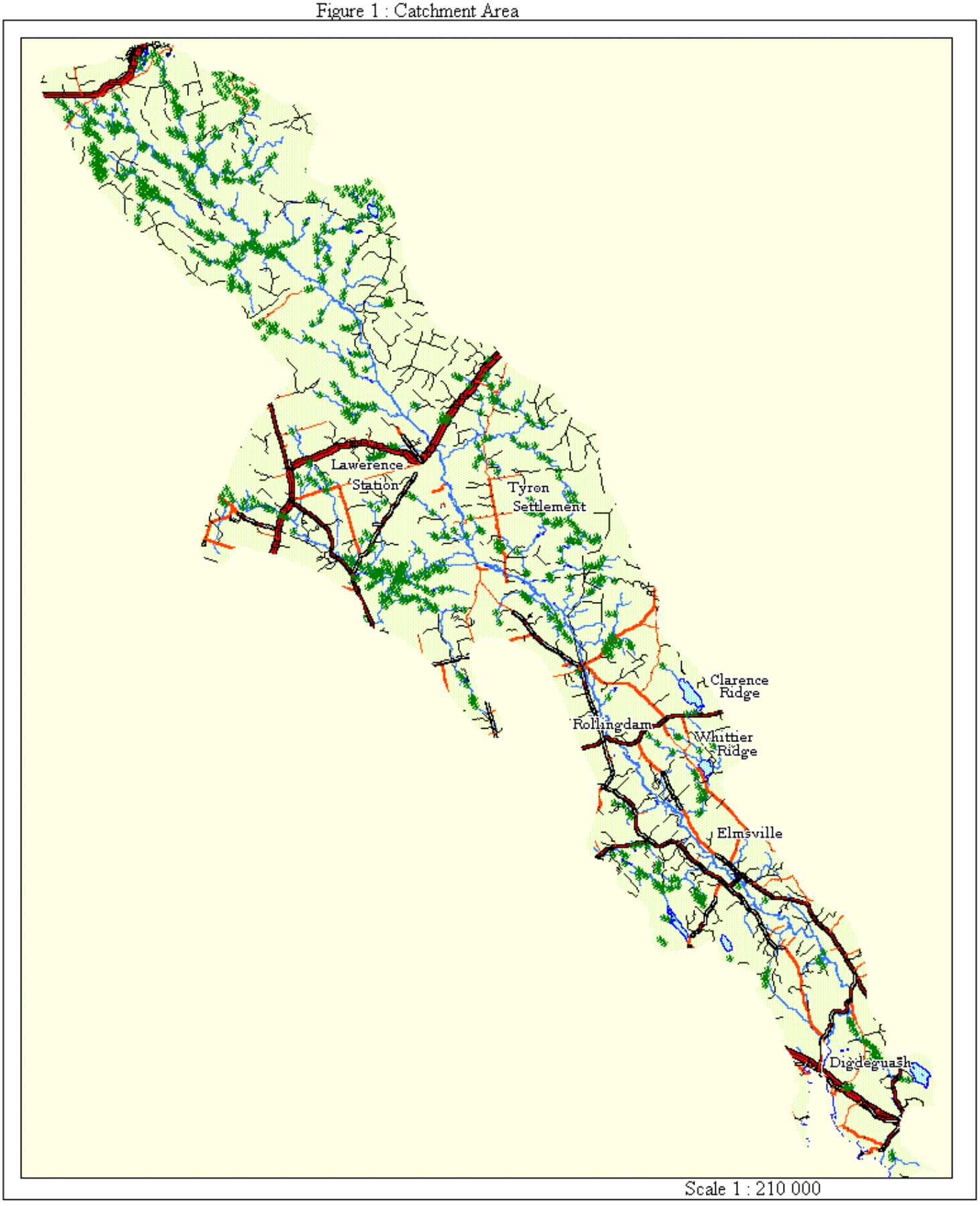
1 INTRODUCTION

Eastern Charlotte Waterways Inc. has participated in community partnership with the New Brunswick Department of Environment and Local Government (DELG) to conduct studies on watershed related issues for the past four years. Activities included in this partnership are: water quality monitoring, benthic macroinvertebrate collections, watershed mapping and volunteer training. The goal of this partnership is to initiate community based management of the water resources in the Digdeguash, Magaguadavic, Pocologan, New and Lepreau watersheds. The following report is an overview of the Digdeguash watershed with a focus on water quality monitoring.

The Digdeguash River is a fifth order stream which originates from a series of springs near McAdam, New Brunswick and flows southeasterly approximately 63km before emptying into Passamaquoddy Bay (Carr 2001). The total watershed area is 457.9 km^2 (Figure 1).

Figure 1 : Catchment Area

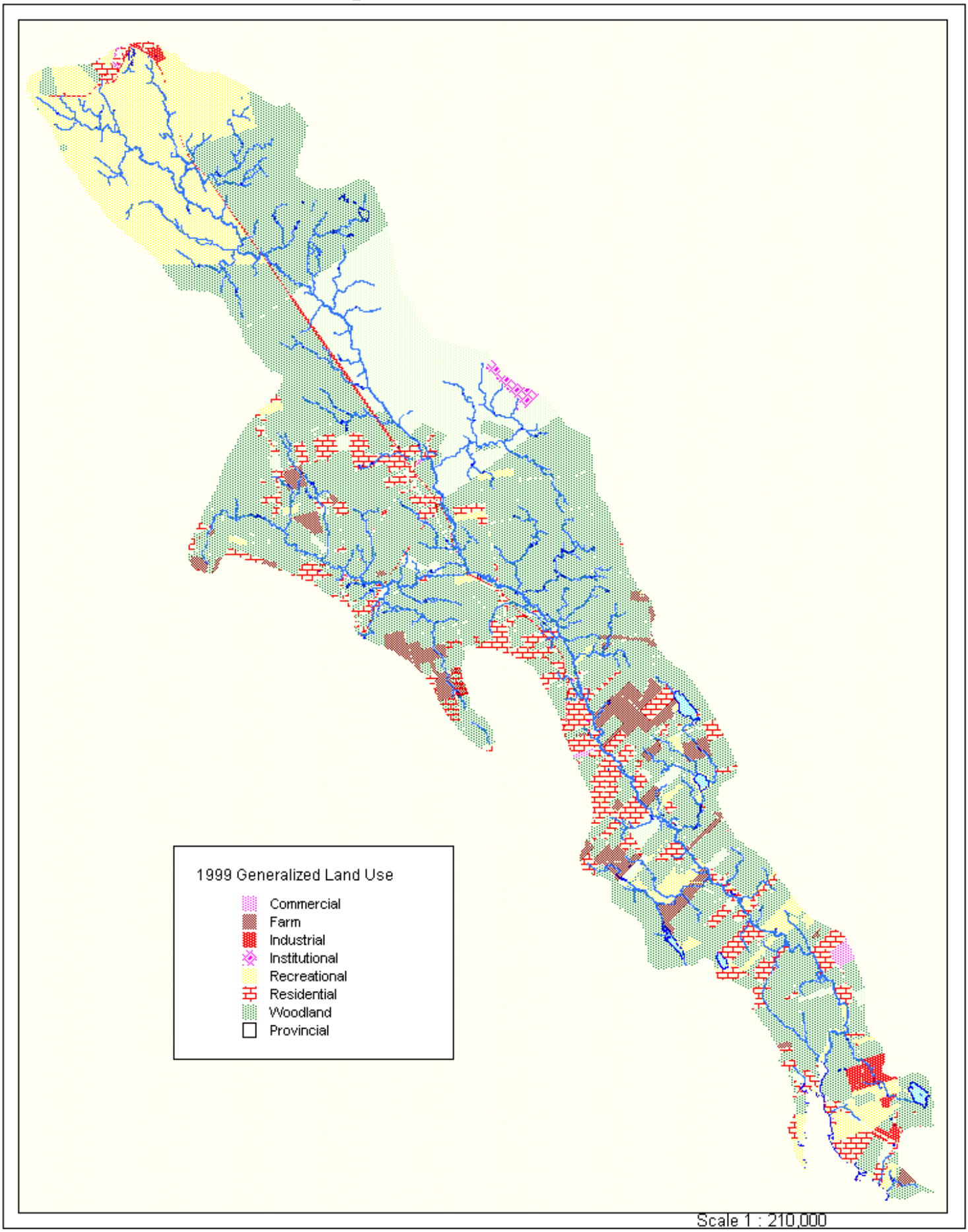


2 ENVIRONMENTAL CONDITIONS

2.1 LAND AND WATER USE

The study area is predominantly rural with a number of small settlements along major roads. The major economic forces in the watershed consist of agriculture, forestry and aquaculture. The land and water uses within the Digdeguash Watershed include recreation as the river and watershed area provides activities such as hiking, camping, boating, fishing, bird watching and wildlife photography. The land uses also includes agriculture and timber harvest. Some non point sources of pollution within the Digdeguash Watershed include, agricultural activities i.e. the farming of livestock and the growing of crops, predominantly blueberries. Timber harvest is a non point source of sediment within the watershed. A number of seasonal and non-seasonal residences rely on individual sewage treatment methods. Dysfunctional or overloaded septic systems could allow fecal coliforms and nutrients to seep out and negatively impact water quality. A salmon hatchery and a fish processing plant are the only two point source discharges in the watershed area (Figure 2).

Figure 2 : Generalized Land Use



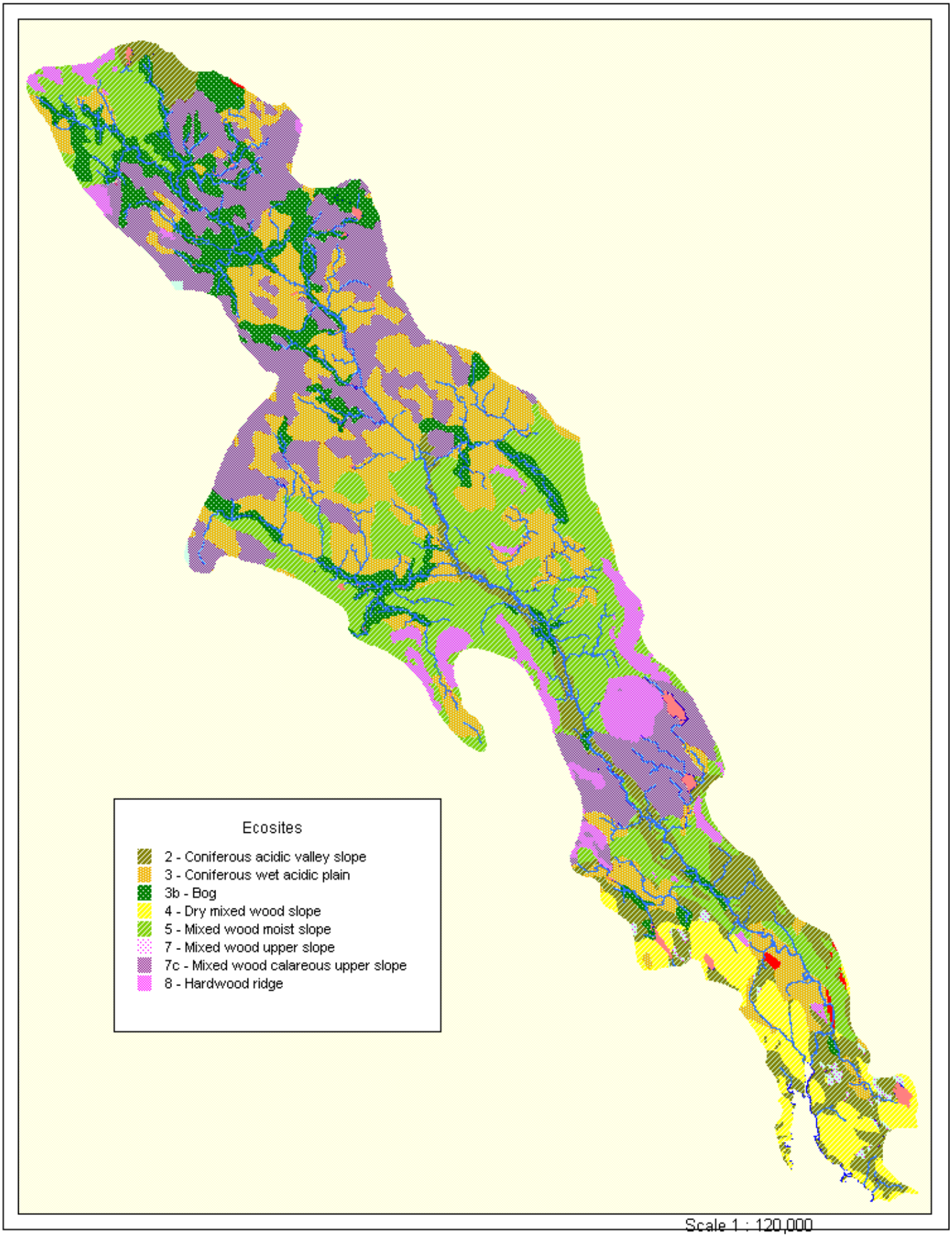
2.2 Ecological land Classification

The New Brunswick Department of Natural Resources and Energy, Forest Management branch, in 1997, compiled climate, moisture, soil fertility, drainage, slope, and slope position data to define ecosites within the province of New Brunswick, based on the Canadian Ecological Land Classification System (DNRE 1997). The ecosites, which represent the Digdeguash Watershed, are illustrated in Figure 3 and described in Appendix A. The headwaters of the Digdeguash watershed are predominantly bog areas which are peat accumulating and usually covered in sphagnum moss. The slopes in this area are mixed wood underlain by calcareous soils. These headwater areas give way to areas dominated by wet acidic till plain, comprised of strongly acidic soils and heavily carpeted in mosses (most commonly sphagnum). The southwestern areas of the watershed are predominantly dry mixed wood slopes.

2.3 Fish Species

Eight fish species have been reported in the Digdeguash River, these are Atlantic Salmon, Brook Trout, Brown Trout, White Sucker, Yellow Perch, Pumpkinseed, Common shiner and American Eel. There are likely other species present in this river, but they have not been reported to the Department of Natural Resources and Energy (Seymour 2001).

Figure 3 : Ecosites



3 WATER QUALITY CONCERNS IN THE WATERSHED

Faulty septic systems belonging to permanent and non-permanent residences can contribute to excess nutrients and high bacteria levels in waterways. Agricultural land situated throughout the watershed can negatively affect water quality. Bacteria levels can be increased due to run-off from livestock and the use of pesticides on crops can elevate nutrient levels. The harvesting of woodlands may add sediment, nutrients and contaminants to the waterway that may increase the turbidity and speed up eutrophication.

The Digdeguash watershed contains two point source discharges, which are listed below with their associated concerns. Point source discharges are easier to identify than non-point sources and therefore may be monitored and controlled more effectively.

- The Salmon Hatchery located at **Elmsville** (UTM Easting 656 854m, Northing 5 013 099m) consists of two covered grow-out tank fields and a wastewater treatment system using a peat bed and settling pond. The facility uses re-circulation technology and has an annual production of 400,000 Atlantic Salmon smolts. The New Brunswick DELG, under the water quality regulation of the Clean Environment Act has issued an Approval to Operate to Silver Hatchery for the operation of the fish hatchery valid from January 01, 2000 to December 31, 2004. The terms and conditions within this approval require the hatchery to keep total phosphorous levels of their effluent below .03 mg/L. The wastewater from the facility is treated for the removal of solids and phosphorous to maintain water quality and protect fish habitat in the receiving stream. The water for the facility is supplied by drilled wells. The major concern for fish hatcheries is nutrient loading of the receiving waters (especially phosphorous).

- The fish processing plant located in Oven Head (UTM Easting 663 030m, Northing 5 001 660m) discharges effluent into Passamaquody Bay.

4 METHEDOLOGY, SAMPLING HISTORY AND SAMPLING FREQUENCY

ECW staff and volunteers collected water samples during July, August and September from 1997 until 2000 using standard DELG methods. The DELG laboratory in Marysville provided the bottles used for collection. They were pre-washed and pre-sealed before shipment. All bottles were labeled according to laboratory procedures to ensure proper identification and data warehousing. Water samples were analyzed for *E. coli* and *B suit of analysis. The parameters of this analysis including the method used for analysis are outlined in Table 1. Volunteers were used extensively to collect water samples for this project and received training in 1998. This training is outlined in the *Preliminary Classification of Composite Drainage 08* report and is included in Appendix B (Moore and Kennedy, 1999).

The volunteers collected the samples for *B analysis and stored them in a fridge or a cooler bag on ice until pick-up. The samples were transported to the lab and arrived within a 48-hour timeframe where they were either analyzed immediately or preserved for future analysis. Water samples to be analyzed for *E. coli* were collected by ECW staff and transported to the lab for analysis within 24 hours. The results from the water quality laboratory analysis were statistically analyzed using a Microsoft Excel© software package.

Benthic macro-invertebrate data was collected at many of the sites throughout the watersheds by DELG staff during 1997 - 2000. The model for the use of this data in relation to water classification was not refined during the drafting of this report. Full nutrient analyses and rapid benthic assessments were performed above and below the Elmsville Hatchery during the fall of 2000.

4.1 Rapid Benthic Assessment Methodology

The methods used were based on *Streamkeepers Field Guide: Watershed Inventory and Stream Monitoring Methods* and involved the collection of two replicate samples of invertebrates as well as

water collection for nutrient analysis. Sample sites were chosen in similar riffle area habitats at 75m above and at 75m, 300m, and 800m below the hatchery. For each riffle chosen, the sample was collected at the upstream end of the riffle or the 'head' of the riffle where possible. These collection sites were documented in a MapInfo version 6.0 of a GIS. Sampling at these sites was performed in August, September and October in order to reflect seasonal fluctuations in the benthic community and to establish best sampling times for future sampling events.

A 250mm mesh D-frame kick-net was used to collect all samples. The stream bottom area sampled at each site was approximately one square meter. The riffle was approached from the downstream edge of the area to be sampled, placing the net perpendicular to the flow and planted firmly on the bottom. Large rocks within the sample area were picked up and gently rubbed to release any invertebrates into the net, the rocks were then set aside. Next, the sampler stepped inside the sample area to disturb the streambed by kicking and shuffling to loosen any other invertebrates within the sample site. The net was then removed with a forward scooping motion and the sample placed into a labeled container for future analysis.

Each sample was spread evenly into a shallow white tray with a grid of 12 squares of equal size marked on the bottom. Squares were randomly selected as subsamples and the BMI's extracted and identified until approximately 100 individuals were collected or all 12 squares sampled. The individual BMI's were then sorted into families and identified using the benthic macroinvertebrate identification keys provided in the Streamkeepers Manual. These individuals were then sorted counted and recorded in the Macroinvertebrate Survey data sheets. The results from the data analysis are summarized in the Macroinvertebrate data Sheets provided in Appendix D.

Table 1: Parameters Measured

Parameter Code	Analyte		Instrument/ Method Reference	Detection Limits
ALK-G	Alkalinity	mg/L	Auto-Gran's Titration (Radiometer LIST)	
Al-X	Aluminum	mg/L	Inductively Coupled Plasma Ultrasonic Nebulizer EPA 200.9	0.001
Sb-XGF	Antimony	ug/L	Atomic Absorption Spectrophotometry Graphite Furnace - EPA 200.9	
As-XGF	Arsenic	ug/L	Atomic Absorption Spectrophotometry Graphite Furnace - EPA 200.9	1
Cd-XGF	Cadmium	ug/L	Atomic Absorption Spectrophotometry Graphite Furnace - EPA 200.9	1
Ca-D	Calcium	mg/L	Inductively Coupled Plasma Ultrasonic Nebulizer EPA 200.9	0.1
Cl-IC	Chloride	mg/L	Ion Chromatography/Dionex DX-300 EPA 300.0	0.05
Cr-X	Chromium	mg/L	Inductively Coupled Plasma Ultrasonic Nebulizer EPA 200.9	0.0005
CLRA	Color(apparent)		Visual Comparison Method Method $td Method 17th ed	0
COND	Conductivity	uS/cm	Conductivity Meter - Radiometer CDM 83 (Std. Methods) 17th ed - #25103	
Cu-X	Copper	mg/L	Inductively Coupled Plasma Ultrasonic Nebulizer EPA 200.9	0.0005
F	Fluoride	mg/L	F - ion Selective Electrode Radiometer-Automated Std Methods 17th ed, 4500-F-C	0.1
Fe-X	Iron	mg/L	Inductively Coupled Plasma Ultrasonic Nebulizer EPA 200.9	0.01
Pb-XGF	Lead	ug/L	Atomic Absorption Spectrophotometry Graphite Furnace - EPA 200.9	1
Mg-D	Magnesium	mg/L	Inductively Coupled Plasma Ultrasonic Nebulizer EPA 200.9	0.1
Mn-X	Manganese	mg/L	Inductively Coupled Plasma Ultrasonic Nebulizer EPA 200.9	0.005
Ni-X	Nickel	mg/L	Inductively Coupled Plasma Ultrasonic Nebulizer EPA 200.9	0.005
NO3	Nitrate	mg/L		0.05
NO-X	Nitrate & Nitrite	mg/L	Technicon Auto Analyzer II Automated Cadmium Reduction Method Std Methods 17th ed 4500-NO3-F	0.05
NO2D	Nitrite	mg/L	Technicon Auto Analyzer II Same as NO-X without Cadmium Reduction	0.05
pH			Hydrogen Ion Specific Electode Radiometer Automated, See Alkalnity	
K	Potassium	mg/L	Atomic Absorption Spectrophotometry Absorption Mode Std Methods 17th ed, 3111B	0.05
Na	Sodium	mg/L	Inductively Coupled Plasma Ultrasonic Nebulizer EPA 200.9	0.1
SO4-IC	Sulfate	mg/L	Ion Chromatography/Dionex DX-300 EPA 300.0	0.05
SS	Suspended Solids	mg/L	Gravimetric - 934-AH Filter Paper, Microwave Dried	15
NH3T	Ammonia	mg/L	Auto Analyzer	0.01
HARD	Total Hardness	mg/L		0.65
TKN	Total Kjeldahl Nitrogen	mg/L	Technicon Auto Analyzer II Technicon Method No 329-74 W/B	0.2
TOC	Total Organic Carbon	mg/L		1
TP-L	Total Phosphorus	mg/L	Technicon Auto Analyzer II-Auto UV Digestion	0.005
TURB	Turbidity	NTU	Nephelometic Method Std Methods 21303 17th ed	0
Zn-X	Zinc	mg/L	Inductively Coupled Plasma Ultrasonic Nebulizer EPA 200.9	0.005
TEMP	Temperature	ºC	thermometer	
DO	Dissolved Oxygen	mg/L	Dissolved Oxygen Meter	
E.coli	Escherichia Coli	MPN/100m		1
CHL"A"	Chlorophyll A	ug/L		0.5
Secchi		meters	Secchi	

5 SAMPLING SITES

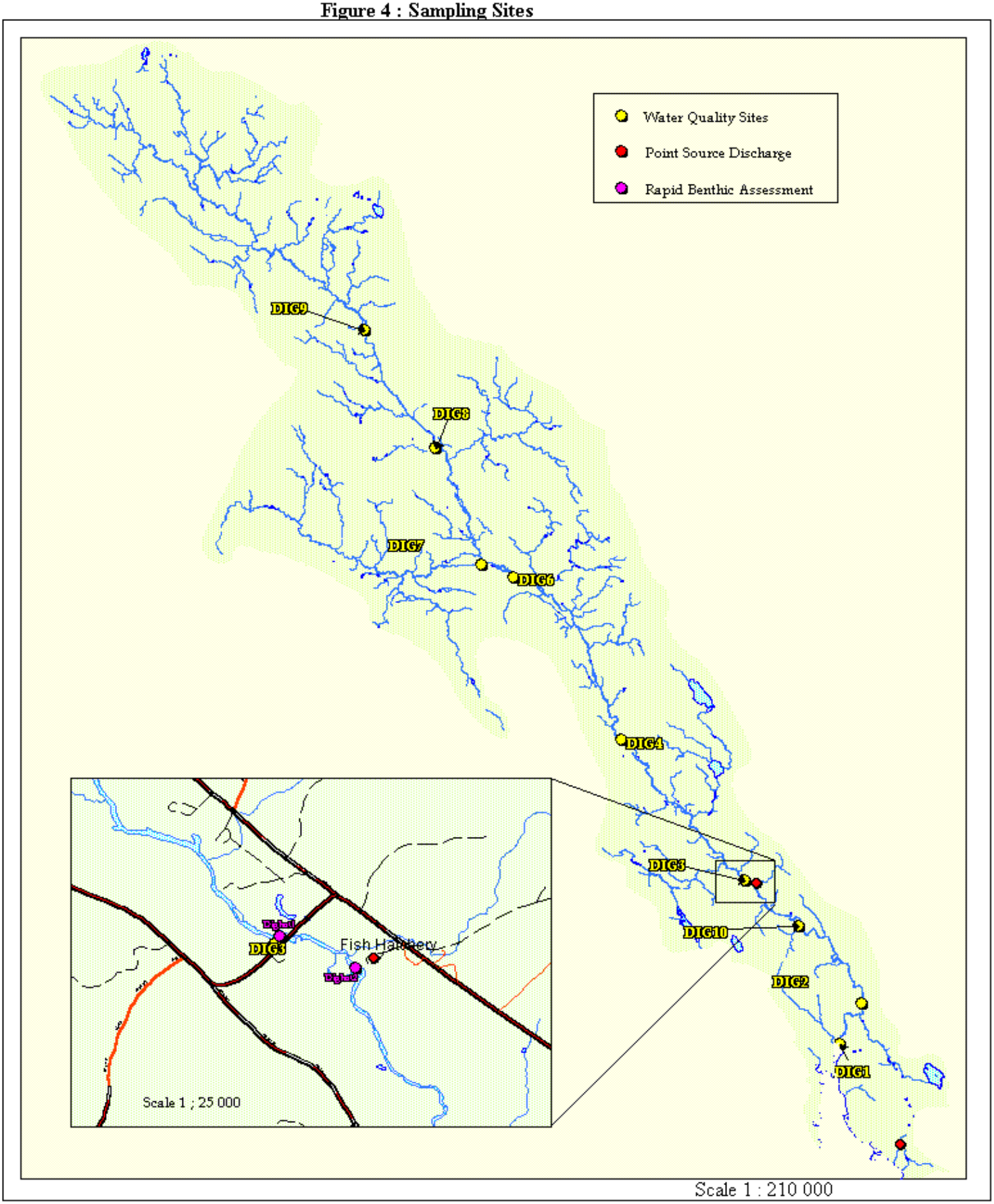
Eight water quality stations were determined for the Digdeguash watershed in 1997. These stations (Dig 1 to Dig 4 and Dig 6 to Dig 9) were chosen with the following goal in mind; to evaluate the overall water quality of the Digdeguash River. There was an attempt to select stations previously used by the New Brunswick Department of Environment and Local Government. Stations also needed to be sufficiently accessible to accommodate sampling protocol and integrate volunteer sampling into the program.

The water quality station Dig 10, was established 3 km, below the hatchery at Elmsville in 1999. The goal of monitoring in this point in the river was to determine if there was a difference in the water quality here and the Water Quality at the station Dig3 located approximately 300m above the hatchery. A complete nutrient analysis and rapid benthic assessment was performed at Dig3/DigHat1 and DigHat2 in the fall of 2000. Dig3 and Dig4 were the only previously established river sample sites on the Digdeguash River sampled in the summer of 2000. Monitoring of the lakes, and the initiation of action items, such as Rapid Benthic Assessments were a priority. A description of these sample sites is provided in Table 2 and illustrated in Figure 4.

Table 2: Station Descriptions

ECW Station	DELG Station	Station Description	UTM Zone 19 Easting	Northing
DIG1	00BR01AR002	Digdeguash River above Basin Falls	5006050	660425
DIG2	00BR01AR0022	Digdeguash River above bridge upstream of Burns Brook	5007825	661400
DIG3/DIGHAT1	00BR01AR023	Digdeguash River above bridge @ Elmsville	5013175	656350
DIG4	00BR01AR024	Digdeguash River above bridge @ Rollingdam	5019350	651000
DIG6	00BR01AR026	Digdeguash River above bridge @ Dumbarton	5027050	644925
DIG7	00BR01AR027	North West Digdeguash above Route 750 bridge	5027050	644925
DIG8	00BR01AR028	Digdeguash River above bridge @ Lawrence Station	5032125	642950
DIG9	00BR01AR029	Digdeguash River below Barber Dam	5037300	639900
DIG10		Digdeguash River below hatchery @ Elmsville		
DIGHAT2	00BR01AQ0076	Digdeguash River 100m below hatchery effluent	5013260	656840

Figure 4 : Sampling Sites



6 RESULTS OF SAMPLING

6.1 Statistical Summary of Parameters

A statistical summary including minimum, 5th, 25th, median, 75th, 95th and maximum level for this time period, of parameters, is provided in Table 3. The geometric mean of *E. Coli* counts from samples taken in the Digdeguash watershed during the study period are provided in Table 4a and 4b. Complete results from 1997 to 2000, at each site are provided in Appendix C along with rainfall norms for this area.

6.2 Trends

Bacteria levels were all below the standard for secondary contact with the exception of Dig 1 in August 1999 in which a count of 210 was recorded. Counts were generally lower in September than in July and August. There were no geographical trends in bacteria counts (Table 4). However, trends in both Iron and Aluminum found in the water samples from the 1997 -2000 study period are seasonal; levels are higher in spring and autumn, corresponding with increased rainfall (Figure 5 and Figure 6). Large rainfall events cause a washing effect of the soil producing, in the case of the Digdeguash River, an increase in aluminum and iron concentrations. Alkalinity is also influenced by rain events and shows consistent decreases in the Digdeguash River in the fall.

There was a significant rainfall of 92 mm over a period of 4 days prior to sampling on September 27, 1999 (C. Tatton, personal communication). Aluminum at all stations on the Digdeguash during this sampling period were above the CWQG for aquatic life. It was also noted that pH from all stations during the September 1999 sampling period except Dig 7 were below the CWQG for the protection of aquatic life. It is suspected that this large flushing of rainfall over a short period of time washed material from the large numbers of marshes in the watershed (Moore, 1999). Marshes typically have a lower pH produced from the rotting detritus material (Wetzel, 1983).

6.3 Fish Hatchery at Elmsville

There were no significant differences in the levels of chemicals measured in the *B suit above and below the hatchery at Elmsville (Dig3 and Dig10) for the sample events during 1999. The Rapid Benthic Assessments and the nutrient analysis performed above and below the Elmsville Hatchery, in the fall of 2000, are consistent with the results from the chemical analysis as there is no significant difference between the aquatic life at these two sites (Table 5). The phosphorous levels at these two sites are consistent with the background levels of the sampling sites in the Digdeguash River (Figure 7). The results from the Rapid Benthic Assessments are provided in Appendix D.

Table 5: Comparison of Rapid Benthic Assessments

Family Biotic Index		
	Sept	Oct
Above Hatchery at Elmsville	3.5	4.2
Below Hatchery at Elmsville	3.9	3.7
Average Density for the Site		
	Sept	Oct
Above Hatchery at Elmsville	100.5	46.5
Below Hatchery at Elmsville	75.5	46

Table 3: Statistical Summary of Parameters

	ALK-G mg/L	Al-XGF ug/L	Al-X mg/L	Sb-XGF ug/L	As-XGF ug/L	Cd-XGF ug/L	Ca-D mg/L	Cl-IC mg/L
CWQG		**100**	**0.1**		**5**	**0.017**		
Min	5.47	18.6	0.0079	< 1.0	1.00	< 0.1	5.7	0.948
5th	6.90	37.3	0.0112	< 1.0	1.00	< 0.1	5.8	1.330
25th	14.35	47.5	0.0193	< 1.0	1.00	< 0.1	6.9	4.365
med	17.40	56.9	0.0325	< 1.0	1.15	< 0.1	7.8	5.080
75th	23.60	74.2	**0.1323**	< 1.0	1.50	< 0.1	9.1	6.510
95th	29.17	93.4	**0.2500**	< 1.0	1.92	< 0.1	10.7	8.426
max	38.20	**125.0**	**0.2940**	< 1.0	**13.00**	**0.2**	13.1	10.400
	Cr-XGF ug/L	**Cr-X mg/L**	**CLRA TCU**	**COND uSIE/CM**	**Cu-XGF ug/L**	**Cu-X mg/L**	**F mg/L**	**Fe-X mg/L**
CWQG	**8.9**	**0.0089**			**2**	**0.002**		**0.3**
Min	< 0.5	0.0006	15	39.8	< 0.5	< 0.00050	< 0.10	0.034
5th	< 0.5	0.0007	18	49.0	< 0.5	< 0.00050	< 0.10	0.066
25th	< 0.5	0.0009	30	57.3	< 0.5	< 0.00050	< 0.10	0.110
med	0.8	0.0013	60	63.4	< 0.5	< 0.00050	< 0.10	0.172
75th	1.1	0.0016	75	80.7	0.50	0.0008	< 0.10	0.286
95th	1.5	0.0021	150	101.4	1.82	0.0016	< 0.10	**0.397**
max	2.3	0.0027	200	110.0	**2.40**	**0.0050**	0.356	**0.552**
	Pb-XGF ug/L	**Mg-D mg/L**	**Mn-X mg/L**	**Hg ug/L**	**Ni-X mg/L**	**NO3 mg/L**	**NO-X mg/L**	**NO2D mg/L**
CWQG	**1**				**0.025**			**0.06**
Min	< 1.00	0.9	0.009	< 0.05	< 0.005	0	< 0.05	< 0.05
5th	< 1.00	1	0.0105	< 0.05	< 0.005	0	< 0.05	< 0.05
25th	< 1.00	1.2	0.0155	< 0.05	< 0.005	0	< 0.05	< 0.05
med	< 1.00	1.3	0.029	< 0.05	< 0.010	0.020	< 0.05	< 0.05
75th	< 1.00	1.5	0.0415	< 0.05	< 0.010	< 0.050	< 0.05	< 0.05
95th	< 1.00	1.91	0.072	< 0.05	< 0.010	0.065	0.070	< 0.05
max	< 1.00	2.65	0.101	< 0.05	< 0.010	0.190	0.110	< 0.05
	pH pH	**K mg/L**	**Na mg/L**	**SO4-IC mg/L**	**SS mg/L**	**NH3T mg/L**	**HARD mg/L**	**TKN mg/L**
CWQG						**2.2**		
Min	5.9	0.075	1.50	0.986	T 0.0	< 0.010	17.9	0.200
5th	6.5	0.132	1.63	1.290	T 0.0	< 0.010	18.8	0.214
25th	7.2	0.205	3.00	2.300	T 0.0	< 0.010	22.2	0.330
Med	7.4	0.257	3.40	3.220	T1.0	< 0.010	24.6	0.445
75th	7.6	0.331	4.10	4.510	< 15	0.013	28.8	0.600
95th	7.7	0.443	6.74	9.058	< 15	0.018	34.7	0.867
Max	7.8	0.513	9.10	11.000	< 15	0.021	42.6	0.990
	TOC mg/L	**TP-L mg/L**	**TURB NTU**	**Zn-X mg/L**	**TEMP oC**	**DO mg/L**		
CWQG				**0.03**				
Min	4.00	<0.0050	0	< 0.005	10.3	7.3		
5th	5.35	<0.0050	0	< 0.005	10.6	7.5		
	7.95	<0.0050	0.2	0.0078	12.1	8.4		
Med	11.80	0.005	0.3	< 0.010	18.9	9.2		
75th	18.75	0.009	0.5	< 0.010	22.0	10.1		
95th	29.15	0.015	1	0.0160	24.5	11.2		
Max	35.20	0.017	1.4	**0.0840**	27.0	12.2		

Table 4a: Geometric Mean of E. Coli

ECW Station Number	Date	E.coli a mpn/100ml	E. coli b mpn/100ml	Ave E.coli mpn/100ml
Dig4	17/06/1997	11	20	16
	23/07/1997	6	5	6
	01/11/1997	5	6	6
	07/07/1998	25	14	20
	17/08/1998	29	47	38
	14/09/1998	12		12
	14/09/1998	16		16
	19/10/1998	15		15
	26/07/1999	<10		10
	30/08/1999	80		80
	27/09/1999	80		80
Geometric Mean				**18**

ECW Station Number	Date	E.coli a mpn/100ml	E. coli b mpn/100ml	Ave E.coli mpn/100ml
Dig6	17/06/1997	23	18	21
	23/07/1997	45	14	30
	07/07/1998	30	34	32
	17/08/1998	12	16	14
	14/09/1998	37		37
	19/10/1998	18		18
	26/07/1999	20		20
	30/08/1999	110		110
	27/09/1999	30		30
Geometric Mean				**28**

Dig5	17/06/1997	28	34	31
	23/07/1997	15	29	22
	01/11/1997	9	7	8
Geometric Mean				**18**

ECW Station	Date	E.coli a mpn/100ml	E. coli b mpn/100ml	Ave E.coli mpn/100ml
Dig2	17/06/1997	51	56	54
	23/07/1997	37	38	38
	01/11/1997	10	15	13
	07/07/1998		53	53
	17/08/1998	4	9	7
	14/09/1998	26		26
	19/10/1998	16		16
	26/7//1999	<10		10
	30/08/1999	<10		10
	27/09/1999	90		90
Geometric Mean				**22**

ECW Station	Date	E.coli a mpn/100ml	E. coli b mpn/100ml	Ave E.coli mpn/100ml
Dig3	17/06/1997	15	12	14
	23/07/1997	10	3	7
	01/11/1997	2	1	2
	07/07/1998	16	10	13
	17/08/1998	68	71	70
	14/09/1998	64		64
	19/10/1998	11		11
	7/261999	<10		10
	8/30/1999	90		90
	9/27/1999	40		40
Geometric Mean				**18**

Table 4b: Geometric Mean of E.Coli in Digdeguash River

ECW Station	Date	E.coli a mpn/100ml	E. coli b mpn/100ml	Ave E.coli mpn/100ml
Dig1	23/07/1997	2	2	2
	01/11/1997	11	6	9
	07/07/1998	32	38	35
	17/08/1998	1		1
	14/09/1998	10		10
	19/10/1998	18		18
	26/07/1999	210		210
	30/08/1999	<10		10
	27/09/1999	20		20
Geometric Mean				**12**

ECW Station Number	Date	E.coli a mpn/100ml	E. coli b mpn/100ml	Ave E.coli mpn/100ml
Dig7	17/06/1997	29	33	31
	23/07/1997	11	5	8
	07/07/1998	50	43	47
	17/08/1998	6	11	9
	14/09/1998	31		31
	19/10/1998	11		11
	26/07/1999	10		10
	30/08/1999	90		90
	27/09/1999	40		40
Geometric Mean				**22**

ECW Station Number	Date	E.coli a mpn/100ml	E. coli b mpn/100ml	Ave E.coli mpn/100ml
Dig9	17/06/1997	16	10	13
	23/07/1997	50	88	69
	07/07/1998	29	32	31
	17/08/1998	15	21	18
	14/09/1998	27		27
	19/10/1998	19		19
	26/07/1999	10		10
	30/08/1999	30		30
	27/09/1999	10		10
Geometric Mean				**21**

ECW Station Number	Date	E.coli a mpn/100ml	E. coli b mpn/100ml	Ave E.coli mpn/100ml
Dig8	17/06/1997	24	17	21
	23/07/1997	16	20	18
	07/07/1998	22	25	24
	17/08/1998	17	26	22
	14/09/1998	38		38
	19/10/1998	44		44
	26/07/1999	10		10
	30/08/1999	80		80
	27/09/1999	30		30
Geometric Mean				**27**

Figure 5: Seasonal Geographic Trends in Aluminum

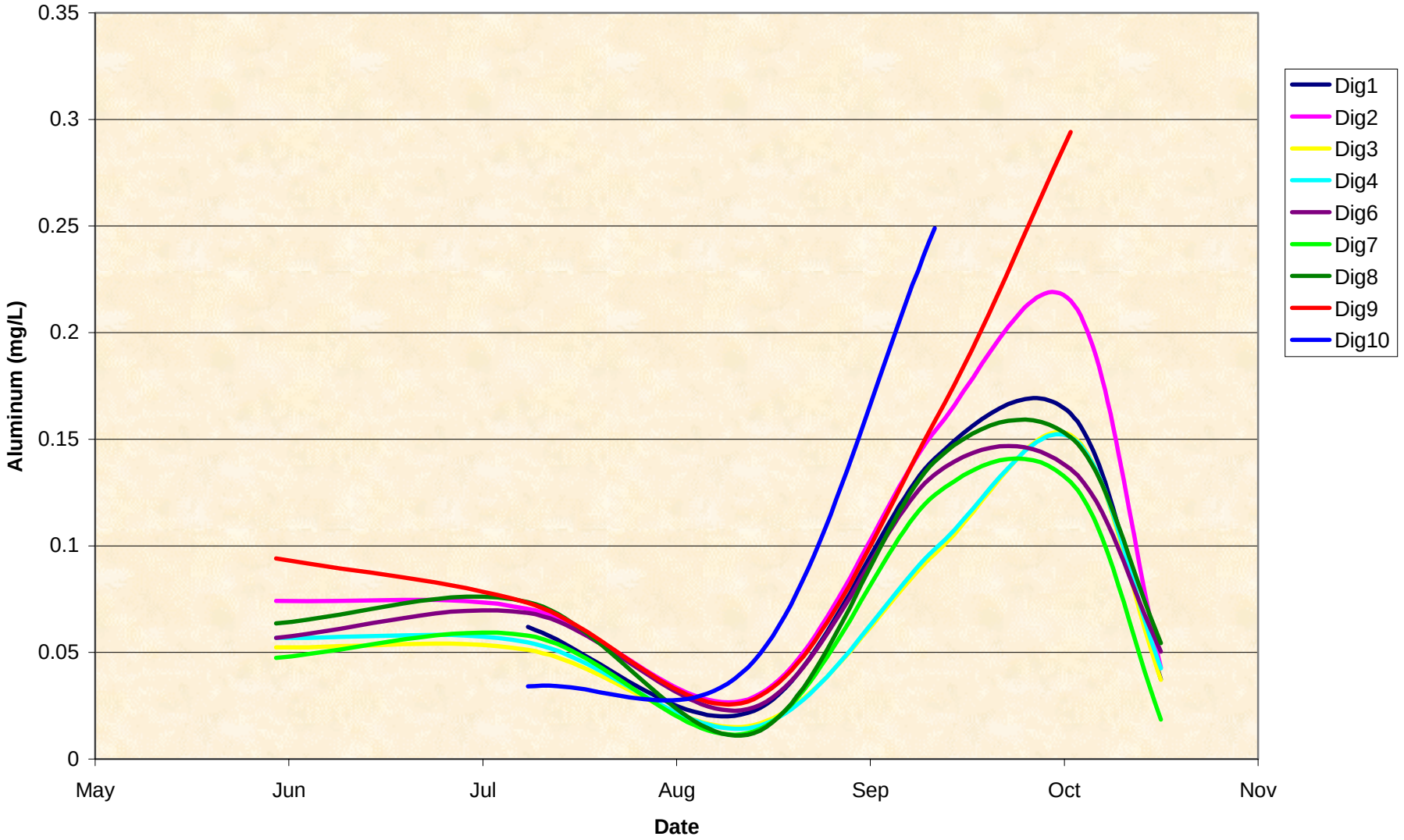


Figure 6: Seasonal Iron Trends in Digdeguash River

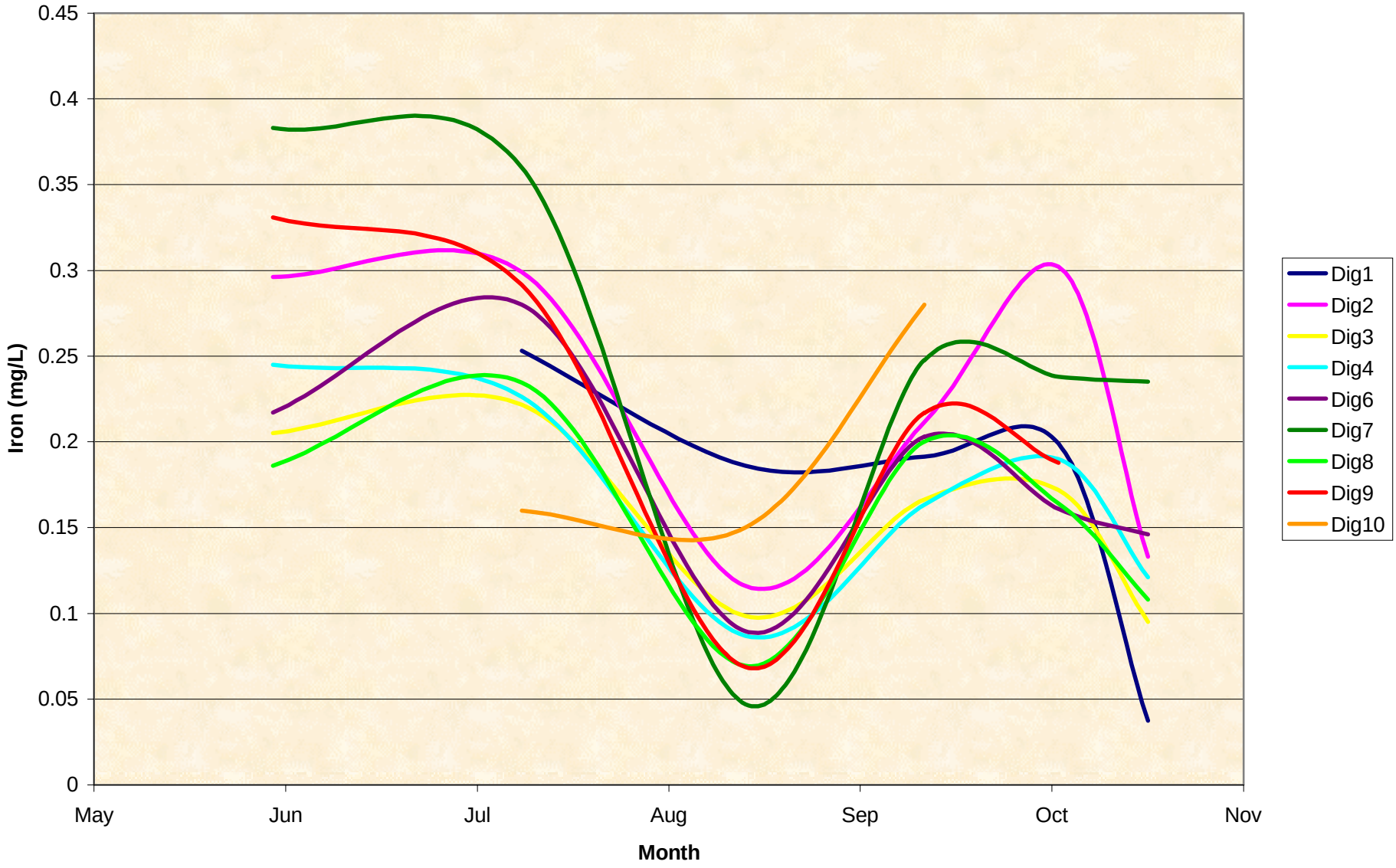
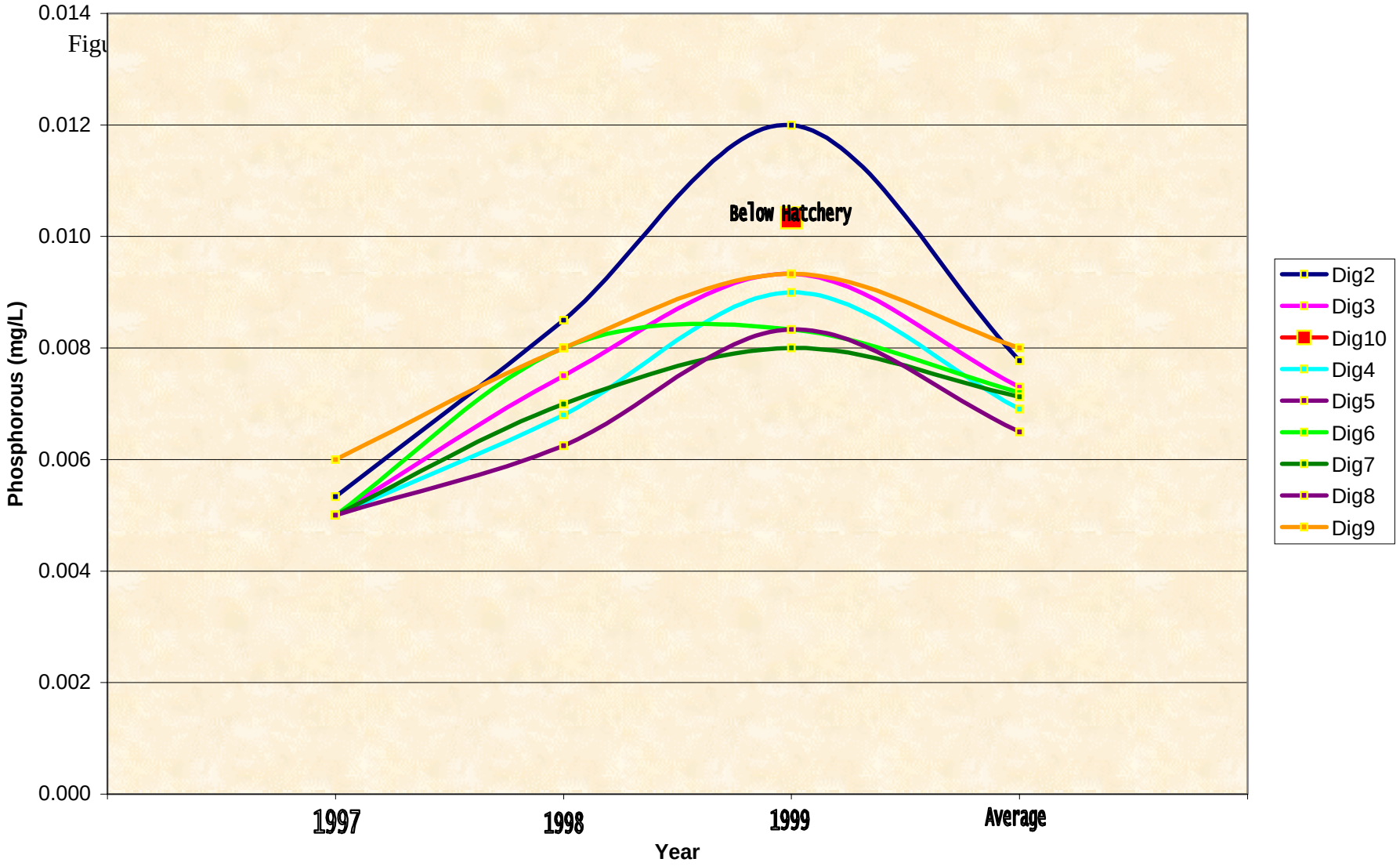


Figure 7: Yearly Total Phosphorous



7 MAJOR ISSUES AND FINDINGS

The majority of the parameters, tested in the Digdeguash River during the 1997– 2000 study period were found at levels below the CWQG for aquatic life and may be considered background levels for this river system. Aluminum and Iron levels, although occasionally above CWQG for aquatic life, may also be considered as background levels since they are consistent throughout the watershed, follow seasonal rainfall levels and can be attributed to their natural abundance in the soil. The stations above and below the hatchery at Elmsville show no significant difference between water chemistry (including nutrients) or benthic macroinvertebrate life, during this study period.

8 CONCLUSIONS AND RECOMMENDATIONS

1) The utilization and expansion of ECW's existing volunteer base, to determine a baseline characterization of benthic macroinvertebrates in the Digdeguash River system would be beneficial for future rapid benthic assessments of water quality, as well as providing an excellent forum for promoting water quality at the watershed level to community and industry.

2) Rapid benthic assessments, with the cooperation of industry, government and academics, should continue above and below the Elmsville hatchery and at the sites of the New Brunswick Department of the Environment and Local Government's rock baskets to analyze and interpret the relationship of these two methods. If the chemical and benthic comparisons above and below the hatchery continue to prove little or no impact on the receiving waters and instream life, this hatchery and its recirculation system, which include biofilters, should be viewed as a best management practice for this type of fish hatchery.

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Appendix A: Ecosites of the Digdeguash Watershed

Appendix A: Ecosite Descriptions

1 Coniferous dry acidic outcrop or coarse-textured deposit

Comprised of the poorest, most rapidly drained soils in the province, this ecosite is almost exclusively inhabited by conifers, especially pines and black spruce. Soils are commonly glacial-fluvial in origin and are coarse textured (gravelly and sandy) and often follow stream courses. Gravel pits and eskers are good indicators of this ecosite.

1s Coniferous steep acidic valley slope

Found only in the Miramichi highlands and the Northwest Miramichi ecodistricts, this ecosite is similar to ecosite 1, however the topography is steep and is only found along steeply dissected river valeys such as the Nepisiguit, Sevogle and Northwest Miramichi. Therefore, the soils are the driest, and support the highest cover of pine. This ecosite is highly susceptible to fire.

2 Coniferous acidic valley slope or coarse-textured deposit

Although this ecosite is of the same poor fertility as ecosite 1, it contains sufficient moisture to be designated as moist and is frequently found along narrow river valleys in upland conditions or better drained flats in the lowlands.

2c Transitional coniferous calcareous steep slope

This ecosite occurs mostly in the Northern Uplands ecoregion on the steeply incised river valleys that are underlain by highly weatherable calcareous rocks. Due to the narrowness of these valleys and the accompanying cool climate, they are mostly covered in coniferous vegetation.

2h Sub-boreal coniferous acidic high hills

This ecosite is similar to ecosite 2, however is found at high elevations. They often form exposed peaks underlain by volcanic rocks that rise above the surrounding topography.

2s Sub-boreal coniferous steep valley slope

Only found along the Fundy Coast, this ecosite consists of the steep river gorges that drain in a southeasterly direction from the Fundy Plateau.]

3 CONIFEROUS WET ACIDIC TILL PLAIN

This is the wettest of the upland ecosites. Comprised of strongly acidic soils, it mainly consists of black spruce and tamarack and is heavily carpeted in mosses, most commonly sphagnum. Large expanses of this ecosite are found in the Eastern Lowlands.

3b Bog

This ecosite is completely consistent with organic soils. The tree species most often associated with it are black spruce, cedar and tamarack, however, they are often treeless. These bogs are peat accumulating and are therefore usually covered in sphagnum moss.

4 DRY MIXEDWOOD SLOPE

Due to the dryness of the soils, this mixedwood ecosite is usually dominant to hardwood and is found on steeper slopes than found on ecosites 5 or 7.

4c Mixedwood steep calcareous slope

Similar to ecosite 4, however found on calcareous soils. These ecosites are often found on steeply incised valley slopes, due to the rapid weatherability of the underlying bedrock. This ecosite is only found on a few rivers that drain into the Saint John River.

5 CONIFEROUS OR MIXEDWOOD MOIST SLOPE

This middle of the road ecosite is found in the center of the edatopic grid, thus having moderate to well drained soils and of moderate fertility. It contains a mix of tolerant hardwoods and softwoods.

5c Mixedwood calcareous slope

Similar to ecosite 5 but found on calcareous soils. It does however, contain more rolling topography relative to ecosite 4c.

5h Boreal or costal coniferous high plateau

This ecosite is only found in the two ecodistrics of the highlands ecoregion where the highest elevations of the province are found, and in the Fundy Costal ecodistrict. The ecosite consists of high plateaus dominated by balsam fir in the highlands and almost entirely red spruce with yellow birch on the coast.

6 Coniferous wet highly calcareous till plain

Found only in the Saint John river valley and the Sisson Branch Reservoir ecodistrict, this ecosite is found on wet limestone soils and contains high proportions of cedar.

6t Coastal marsh

This ecosite is subjected to tidal influences of the bay of fundy and is found in the Petitcodiac and Fundy coastal ecodistricts.

7 Mixedwood upper slope

These moist upperslopes and low hills often support mixedwoods with a strong sugar maple component.

7b Acadian moist bottomland

This ecosite consists entirely of soils that are undergoing or have undergone, annual flooding. In the Saint John ecodistrict, the tree cover is mostly silver maple, butternut and bur oak. In the Tobique River ecodistrict, the tree cover changes to black ash and balsam poplar.

7c Mixedwood calcareous upper slope

This ecosite is similar to ecosite 7, however is underlain by calcareous soils.

7l Mixedwood highly calcareous upper slope

This Ecosite is similar to 8, however is underlain by soils derived from limestone.

8 Hardwood ridge

This ecosite, occurring on well drained, rich sites is most synonymous of what is commonly thought of as a hardwood ridge. Depending on the ecodistrict, the tree cover ranges from sugar maple - beech - yellow birch to sugar maple - beech to yellow birch sugar maple and other combinations.

8c Hardwood calcareous ridge

This ecosite is similar to 8, however as it occurs on calcareous soils, it is more productive.

8l Hardwood highly calcareous ridge

This is the richest in fertility of the hardwood ridge ecosites.

9 Hardwood dry ridge or steep slope

This ecosite also occurs on ridges, but due to the dryness and coarseness of the soils, often contains hardwood of poor quality.

Appendix B: Volunteer Training

Appendix B: Volunteer Training

Eastern Charlotte Waterways recruited volunteers during the summer of 1998 to help monitor water quality throughout the five watersheds. 19 of the 29 water quality sites were monitored by volunteers. There was tremendous support from the community reflected in the willingness of people to cooperate on this initiative.

Volunteer training session on the banks of the Magaguadavic River

Quality control is an important aspect of volunteer monitoring. ECW and DELG took the following steps to help ensure volunteers collected samples promptly and properly. All volunteers were given training through a training session with DELG on how to collect water samples. If volunteers were not able to attend the training session, they were given one on one instruction by ECW staff trained in water quality sampling. All volunteers were supplied with an insulated cooler bag and a gel pack that could be frozen and used to keep the water samples cool. The bottles used for collection were pre-cleaned and labeled by DELG prior to being distributed to volunteers.

Volunteers collected samples for chemical analysis and ECW employees collected the water samples to be tested for bacteria. Sampling protocol for bacterial monitoring by DELG dictates that water samples must be delivered to the laboratory within 30 hours of field collection. These time constraints, associated with the bacteria samples do not fit with the flexible schedule required for volunteer sampling. Therefore, in order to avoid placing too rigid time constraints on the volunteers, ECW employees collected the water samples for bacteria analysis.

Summary of Quality Controls for Volunteer Sampling

- Training sessions
- Detailed sample protocol
- Standardized equipment
- Pre-cleaned bottles
- Pre-labeled bottles
- Scheduled sampling
- Designated sampling site
- Sample pick-up
- Duplicate QC samples

Volunteers were responsible for sampling the water quality one weekend during the months of August, September and October which was designated by ECW staff. To allow some flexibility in scheduling, the sample was collected some time during the designated weekend. The bottles were immediately placed in the cooler bag with the frozen gel pack for transport back to the volunteer's home or cottage. The samples were then stored in a refrigerator. On either the Sunday evening or the Monday morning following the designated weekend, the samples were stored in the cooler bag with the frozen gel pack and placed outside at a predetermined location (i.e.- doorstep or woodshed). On Monday, an ECW employee would travel to each volunteer's house during the course of collecting water samples for bacteria testing. The ECW employee would collect the water samples and replace them with empty, cleaned, labeled bottles for the samples to be collected the next month. On occasion, a few of the volunteers would drop their samples at the ECW office in St. George. These samples were refrigerated immediately for later transport.

A DELG technician collected duplicate samples on two occasions at some selected sites during the course of the program. Table 9a illustrates the dates and places of sampling. A ***two-tailed students t-test*** was used to compare the data from the volunteers with the samples collected by DELG. The results are included in table 9. The measured chemical parameters from the samples collected by volunteers were compared to the corresponding parameters for the water collected from the same sites by the DELG technician. Using a 95% confidence interval, there was only 1 parameter with a significant difference between the two groups, MG-D (table 9c), were significantly different higher in the samples collected by the DELG technician.

Magnesium is a component of the hardness parameter which did not show a statistical difference between the two groups (Table 9a, Appendix F). There was a lag of at least 24 hours between collection of samples by the volunteer and the DELG technician which may account for the variability here. Twenty-four of the Twenty –five parameters tested showed no significant difference between volunteer and DELG technician sample collection.

These results indicate that volunteer sampling, with proper quality controls, can be used as an accurate way to evaluate water chemistry in the watershed. Volunteer sampling can help accomplish

some of the goals of the Water Classification Program. Trained volunteers are valuable in helping with the initial evaluation of a watershed. They may also be helpful in maintaining a level of monitoring after classification has been implemented in a watershed. The involvement of the general public will help in recruiting stakeholders and getting a first hand “feel” for the concerns of people who use the waterways.

Appendix C: Water Quality Results

Monthly Precipitation Averages 1961-1990

PENNFIELD, New Brunswick
45º06-N 66º44-W/O
23m
1961 to/à 1990

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precpitation													
Rainfall (mm)	63.3	56.5	70.7	91.7	118.3	96.8	92	103.7	114.4	117.3	133.3	99.9	1158.2
Snowfall (cm)	48.6	50.4	37	11.3	0.6	0	0	0	0	1	10.1	43.6	202.7
Precipitation (mm)	112.2	106.9	107.7	103.1	118.9	96.8	92	103.7	114.4	118.3	143.5	145.2	1362.7
Extreme Daily Rainfall (mm)	82.6	83.3	65.5	86.4	60	62.8	65	111	82	75.9	84.3	103.8	
Date	978/25	970/03	985/12	973/28	990/13	984/26	980/30	981/15	969/09	977/01	975/13	981/02	
Extreme Daily Snowfall (cm)	29.4	33	34	31	8.1	0	0	0	0	12.2	22.9	30	
Date	981/13	962/18	976/16	975/03	966/01	990/30+	990/31+	990/31+	990/30+	974/20	964/30	962/30	
Extreme Daily Pcpn. (mm)	82.6	83.3	65	86.4	60	62.8	65	111	82	75.9	84.3	103.8	
Date	978/25	970/03	985/12	973/28	990/13	984/26	980/30	981/15	969/09	977/01	975/13	981/02	
Month-end Snow Cover (cm)	39	N	20	0	0	0	0	0	0	0	2	16	
Days With													
Measurable Rainfall	6	5	9	11	15	15	13	14	12	13	13	8	134
Measurable Snowfall	7	7	5	2	*	0	0	0	0	*	2	7	29
Measurable Percipitation	11	10	12	13	15	15	13	14	12	13	14	13	156

http://www.cmc.ec.ca/climate/normals/NBP001.HTM

	Date	ALK-G mg/L	Al-XGF ug/L	Al-X mg/L	Sb-XGF ug/L	As-XGF ug/L	Cd-XGF ug/L	Ca-D mg/L
DIG5	17-Jun-97	14.0	68.7		< 1.0	1.30	< 0.1	5.80
DIG5	23-Jul-97	20.4	75.9		< 1.0	1.40	< 0.1	8.00
DIG5	01-Nov-97	15.6	44.8		< 1.0	< 1.00	< 0.1	7.30
DIG6	17-Jun-97	17.4	56.9		< 1.0	1.10	< 0.1	6.90
DIG6	23-Jul-97	16.1	78.1		< 1.0	1.50	< 0.1	6.50
DIG6	01-Nov-97	16.9	50.4		< 1.0	< 1.00	< 0.1	8.00
DIG6	07-Jul-98	19.1		0.0954	< 1.0	1.60	< 0.1	7.20
DIG6	17-Aug-98	27.2		0.0245	< 1.0	1.10	< 0.1	10.30
DIG6	14-Sep-98	24.3		0.0181	< 1.0	< 1.00	< 0.1	8.50
DIG6	18-Oct-98	10.3		0.1360	< 1.0	< 1.00	< 0.1	8.00
DIG6	26-Jul-99	23.3		0.0320	< 1.0	1.39	< 0.1	9.27
DIG6	30-Aug-99	28.0		0.0240	< 1.0	1.35		9.63
DIG6	27-Sep-99	6.8		0.2490	< 1.0	1.01	< 0.1	8.10
DIG7	17-Jun-97	20.6	47.5		< 1.0	1.20	< 0.1	7.90
DIG7	23-Jul-97	23.2	65.3		< 1.0	1.70	< 0.1	9.00
DIG7	01-Nov-97	26.0	18.6		< 1.0	< 1.00	< 0.1	9.20
DIG7	07-Jul-98	20.3		0.0991	< 1.0	1.80	< 0.1	7.50
DIG7	17-Aug-98	29.0		0.0181	< 1.0	1.00	< 0.1	9.60
DIG7	14-Sep-98	25.4		0.0117	< 1.0	< 1.00	< 0.1	7.70
DIG7	18-Oct-98	13.4		0.1300	< 1.0	< 1.00	< 0.1	9.30
DIG7	26-Jul-99	29.8		0.0094	< 1.0	< 1.00	< 0.1	10.60
DIG7	30-Aug-99	29.5		0.0079	< 1.0	< 1.00		9.93
DIG7	27-Sep-99	8.9		0.2360	< 1.0	1.12	< 0.1	7.77
DIG8	17-Jun-97	19.5	63.6		< 1.0	< 1.00	< 0.1	7.70
DIG8	23-Jul-97	21.0	90.7		< 1.0	< 1.00	< 0.1	8.60
DIG8	01-Nov-97	17.5	54.4		< 1.0	< 1.00	< 0.1	9.20
DIG8	07-Jul-98	18.2		0.0984	< 1.0	1.10	< 0.1	7.20
DIG8	17-Aug-98	39.1		0.0126	< 1.0	< 1.00	< 0.1	13.10
DIG8	14-Sep-98	39.9		0.0092	< 1.0	< 1.00	< 0.1	12.90
DIG8	18-Oct-98	9.21		0.1510	< 1.0	< 1.00	< 0.1	8.30
DIG8	26-Jul-99	27.6		0.0320	< 1.0	1.08	< 0.1	10.70
DIG8	30-Aug-99	38.2		0.0120	< 1.0	1.16		12.70
DIG8	27-Sep-99	7.1		0.2700	< 1.0	< 1.00	< 0.1	8.39
DIG9	17-Jun-97	13.9	94.1		< 1.0	< 1.00	< 0.1	5.70
DIG9	23-Jul-97	12.6	125.0		< 1.0	1.20	< 0.1	6.30
DIG9	07-Jul-98	14.0		0.1330	< 1.0	1.20	< 0.1	6.30
DIG9	17-Aug-98	17.2		0.0304	< 1.0	< 1.00	< 0.1	7.50
DIG9	14-Sep-98	16.9		0.0228	< 1.0	< 1.00	< 0.1	6.90
DIG9	18-Oct-98	8.03		0.1660	< 1.0	< 1.00	< 0.1	8.00
DIG9	26-Jul-99	13.0		0.0740	< 1.0	13.00	< 0.1	7.04
DIG9	30-Aug-99	15.3		0.0260	< 1.0	< 1.00		6.84
DIG9	27-Sep-99	5.6		0.2940	< 1.0	< 1.00	< 0.1	7.94
DIG10	26-Jul-99	25.2		0.0340	< 1.0	2.01	< 0.1	10.70
DIG10	30-Aug-99	31.4		0.0460	< 1.0	2.35		11.10
DIG10	27-Sep-99	6.3		0.2490	< 1.0	1.11	< 0.1	7.52

ECW Station	Date	ALK-G mg/L	Al-XGF ug/L	Al-X mg/L	Sb-XGF ug/L	As-XGF ug/L	Cd-XGF ug/L	Ca-D mg/L
DIG1	23-Jul-97	17.4	71.6		< 1.0	1.90	< 0.1	7.00
DIG1	01-Nov-97	18.4	37.5		< 1.0	< 1.00	< 0.1	8.30
DIG1	07-Jul-98	14.9		0.0933	< 1.0	1.80	< 0.1	6.00
DIG1	17-Aug-98	28.4		0.0121	< 1.0	1.14	< 0.1	9.80
DIG1	14-Sep-98	25.4		0.0209	< 1.0	1.30	< 0.1	9.70
DIG1	18-Oct-98	8.1		0.1620	< 1.0	1.10	< 0.1	6.80
DIG1	26-Jul-99	25.3		0.0210	< 1.0	1.78	< 0.1	10.10
DIG1	30-Aug-99	21.8		0.0330	< 1.0	1.63		9.94
DIG1	27-Sep-99	7.3		0.2610	< 1.0	1.23	< 0.1	7.71
DIG2	17-Jun-97	15.2	74.2		< 1.0	1.50	< 0.1	6.50
DIG2	23-Jul-97	18.4	78.4		< 1.0	1.70	< 0.1	7.10
DIG2	01-Nov-97	17.9	43.0		< 1.0	< 1.00	< 0.1	8.00
DIG2	07-Jul-98	14.6		0.0948	< 1.0	1.70	< 0.1	5.80
DIG2	17-Aug-98	26.1		0.0282	< 1.0	1.50	0.1	10.00
DIG2	14-Sep-98	24.6		0.0576	< 1.0	1.60	0.2	9.00
DIG2	18-Oct-98	7.2		0.2150	< 1.0	1.20	< 0.1	5.80
DIG2	26-Jul-99	24.8		0.0380	< 1.0	2.30	< 0.1	9.73
DIG2	30-Aug-99	25.7		0.0300	< 1.0	1.91		9.08
DIG2	27-Sep-99	7.1		0.2500	< 1.0	1.14	< 0.1	7.56
DIG3	17-Jun-97	14.8	52.3		< 1.0	1.20	< 0.1	6.50
DIG3	23-Jul-97	17.7	54.7		< 1.0	1.50	< 0.1	6.80
DIG3	01-Nov-97	16.3	37.2		< 1.0	< 1.00	< 0.1	7.50
DIG3	07-Jul-98	14.6		0.0910	< 1.0	1.50	< 0.1	5.90
DIG3	17-Aug-98	23.1		0.0130	< 1.0	1.20	< 0.1	8.80
DIG3	14-Sep-98	16.9		0.0298	< 1.0	1.30	< 0.1	6.70
DIG3	18-Oct-98	7.3		0.1520	< 1.0	1.00	< 0.1	6.70
DIG3	26-Jul-99	23.9		0.0160	< 1.0	1.80	0.1	9.15
DIG3	30-Aug-99	25.1		0.0150	< 1.0	1.93		9.25
DIG3	27-Sep-99	7.1		0.2450	< 1.0	1.15	< 0.1	7.65
DIG3	30-Jul-00	15.9		0.0430	< 1.0	1.27	< 0.1	6.85
DIG3	27-Aug-00	18.0		0.0200	< 1.0	1.45	< 0.1	8.30
DIG 3	24-Sep-00	20.9		0.0140	< 1.0	1.32	< 0.1	8.15
DIG4	17-Jun-97	14.1	56.9		< 1.0	1.10	< 0.1	5.80
DIG4	23-Jul-97	16.8	63.7		< 1.0	1.30	< 0.1	6.70
DIG4	01-Nov-97	15.4	42.6		< 1.0	< 1.00	< 0.1	7.30
DIG4	07-Jul-98	15.3		0.0950	< 1.0	1.50	< 0.1	6.00
DIG4	17-Aug-98	20.5		0.0137	< 1.0	< 1.00	< 0.1	7.80
DIG4	14-Sep-98	13.7		0.0291	< 1.0	< 1.00	< 0.1	7.00
DIG4	15-Sep-98	15.5		0.0190	< 1.0	< 1.00	< 0.1	5.70
DIG4	18-Oct-98	8.91		0.1510	< 1.0	< 1.00	< 0.1	7.40
DIG4	26-Jul-99	23.1		0.0210	< 1.0	1.32	< 0.1	7.97
DIG4	30-Aug-99	21.0		0.0110	< 1.0	1.43		7.74
DIG4	27-Sep-99	5.5		0.2500	< 1.0	1.08	< 0.1	7.94
DIG4	30-Jul-00	16.8		0.0390	< 1.0	1.65	< 0.1	7.34
DIG4	27-Aug-00	17.4		0.0200	< 1.0	1.24	< 0.1	6.86
DIG 4	24-Sep-00	16.7		0.0160	< 1.0	1.00	< 0.1	6.89

ECW Station	Date	Cl-IC mg/L	Cr-XGF ug/L	Cr-X mg/L	CLRA TCU	COND uSIE/CM	Cu-XGF ug/L	Cu-X mg/L
DIG1	23-Jul-97	6.11	0.9		80.0	62.2	< 0.5	
DIG1	01-Nov-97	7.37	< 0.5		40.0	74.7	0.6	
DIG1	07-Jul-98	4.87	< 0.5		80.0	53.7	< 0.5	
DIG1	17-Aug-98	11.9	0.8		20.0	105.0	< 0.5	
DIG1	14-Sep-98	14.1	1.3		20.0	110.0	< 0.5	
DIG1	18-Oct-98	4.52	0.8		75.0	58.2	< 0.5	
DIG1	26-Jul-99	8.48		0.0013	30.0	88.8		< 0.00050
DIG1	30-Aug-99	10.40		0.0013	40.0	97.4		< 0.00050
DIG1	27-Sep-99	5.03		0.0009	150.0	61.1		0.00170
DIG2	17-Jun-97	4.38	0.8		70.0	53.0	< 0.5	
DIG2	23-Jul-97	4.92	0.7		70.0	62.9	< 0.5	
DIG2	01-Nov-97	6.80	< 0.5		40.0	71.2	1.6	
DIG2	07-Jul-98	4.45	< 0.5		60.0	51.7	1.9	
DIG2	17-Aug-98	11.8	0.9		20.0	106.0	1.3	
DIG2	14-Sep-98	15.1	1.4		20.0	110.0	< 0.5	
DIG2	18-Oct-98	4.63	1.0		70.0	55.8	< 0.5	
DIG2	26-Jul-99	6.92		0.0015	30.0	84.1		0.00050
DIG2	30-Aug-99	6.76		0.0017	20.0	84.9		0.00060
DIG2	27-Sep-99	5.12		0.0009	150.0	61.1		0.00110
DIG3	17-Jun-97	5.53	0.7		70.0	55.9	0.5	
DIG3	23-Jul-97	4.45	< 0.5		60.0	58.9	1.8	
DIG3	01-Nov-97	7.07	< 0.5		50.0	67.1	0.5	
DIG3	07-Jul-98	4.70	< 0.5		70.0	51.6	0.8	
DIG3	17-Aug-98	7.04	0.9		15.0	82.6	< 0.5	
DIG3	14-Sep-98	4.87	1.1		30.0	65.4	< 0.5	
DIG3	18-Oct-98	4.41	0.8		75.0	57.5	< 0.5	
DIG3	26-Jul-99	4.29		0.0015	20.0	73.7		0.00050
DIG3	30-Aug-99	5.51		0.0016	15.0	80.4		< 0.00050
DIG3	27-Sep-99	5.08		0.0009	150.0	60.3		0.00100
DIG3	30-Jul-00	5.29		0.0007	60.0	59.6		< 0.0005
DIG3	27-Aug-00	5.30		0.0006	15.0	69.5		< 0.0005
DIG 3	24-Sep-00	5.34		0.0007	20.0	72.1		< 0.0005
DIG4	17-Jun-97	4.62	0.6		70.0	50.8	< 0.5	
DIG4	23-Jul-97	5.98	< 0.5		70.0	59.4	< 0.5	
DIG4	01-Nov-97	6.99	< 0.5		60.0	66.5	< 0.5	
DIG4	07-Jul-98	4.71	< 0.5		100.0	51.7	< 0.5	
DIG4	17-Aug-98	9.94	0.6		20.0	85.6	< 0.5	
DIG4	14-Sep-98	5.34	1.0		30.0	58.2	2.4	
DIG4	15-Sep-98	6.33	1.5		30.0	63.4	< 0.5	
DIG4	18-Oct-98	4.78	0.8		75.0	61.7	< 0.5	
DIG4	26-Jul-99	5.48		0.0013	40.0	70.3		< 0.00050
DIG4	30-Aug-99	7.28		0.0014	15.0	80.9		< 0.00050
DIG4	27-Sep-99	4.81		0.0010	100.0	61.7		0.00110
DIG4	30-Jul-00	4.61		0.0007	40.0	61.9		< 0.00050
DIG4	27-Aug-00	6.06		0.0009	20.0	68.3		< 0.00050
DIG 4	24-Sep-00	6.42		0.0006	20.0	66.0		< 0.00050

ECW Station	Date	Cl-IC mg/L	Cr-XGF ug/L	Cr-X mg/L	CLRA TCU	COND uSIE/CM	Cu-XGF ug/L	Cu-X mg/L
DIG5	17-Jun-97	3.98	0.6		70.0	47.7	< 0.5	
DIG5	23-Jul-97	4.67	< 0.5		70.0	64.8	< 0.5	
DIG5	01-Nov-97	6.60	< 0.5		50.0	63.0	< 0.5	
DIG6	17-Jun-97	4.78	0.8		70.0	57.1	< 0.5	
DIG6	23-Jul-97	3.86	< 0.5		80.0	53.3	< 0.5	
DIG6	01-Nov-97	4.64	< 0.5		60.0	65.8	0.9	
DIG6	07-Jul-98	4.88	0.6		100.0	58.6	< 0.5	
DIG6	17-Aug-98	7.71	1.3		30.0	88.0	< 0.5	
DIG6	14-Sep-98	7.68	1.3		20.0	83.7	< 0.5	
DIG6	18-Oct-98	5.83	1.1		70.0	71.1	< 0.5	
DIG6	26-Jul-99	4.81		0.0014	50.0	72.5		< 0.00050
DIG6	30-Aug-99	6.82		0.0018	30.0	86.0		0.00500
DIG6	27-Sep-99	5.45		0.0010	150.0	63.4		0.00090
DIG7	17-Jun-97	5.04	1.0		70.0	63.3	0.8	
DIG7	23-Jul-97	6.75	0.6		70.0	71.6	1.5	
DIG7	01-Nov-97	6.28	< 0.5		50.0	77.5	1.8	
DIG7	07-Jul-98	5.61	< 0.5		100.0	62.8	< 0.5	
DIG7	17-Aug-98	6.71	1.2		40.0	83.2	< 0.5	
DIG7	14-Sep-98	5.16	1.5		20.0	74.7	< 0.5	
DIG7	18-Oct-98	8.24	1.3		75.0	83.4	< 0.5	
DIG7	26-Jul-99	9.37		0.0017	20.0	95.8		< 0.00050
DIG7	30-Aug-99	4.35		0.0021	30.0	82.1		< 0.00050
DIG7	27-Sep-99	7.65		0.0013	200.0	69.2		0.00110
DIG8	17-Jun-97	2.31	0.9		70.0	52.7	0.5	
DIG8	23-Jul-97	1.91	1.0		100.0	56.4	1.6	
DIG8	01-Nov-97	4.03	0.5		70.0	66.3	< 0.5	
DIG8	07-Jul-98	1.50	< 0.5		100.0	47.8	< 0.5	
DIG8	17-Aug-98	3.18	1.6		30.0	98.5	< 0.5	
DIG8	14-Sep-98	3.25	2.3		20.0	98.8	< 0.5	
DIG8	18-Oct-98	2.31	1.1		75.0	60.9	< 0.5	
DIG8	26-Jul-99	1.84		0.0018	60.0	72.2		< 0.00050
DIG8	30-Aug-99	2.66		0.0027	30.0	94.6		< 0.00050
DIG8	27-Sep-99	2.64		0.0010	200.0	56.2		0.00070
DIG9	17-Jun-97	1.35	0.8		150.0	39.8	< 0.5	
DIG9	23-Jul-97	1.02	0.9		120.0	45.0	2.3	
DIG9	07-Jul-98	1.21	0.5		120.0	41.0	< 0.5	
DIG9	17-Aug-98	1.92	0.7		70.0	55.9	< 0.5	
DIG9	14-Sep-98	1.84	1.2		50.0	54.9	< 0.5	
DIG9	18-Oct-98	2.13	1.1		100.0	60.4	< 0.5	
DIG9	26-Jul-99	1.15		0.0011	100.0	54.4		0.00060
DIG9	30-Aug-99	0.95		0.0013	60.0	50.2		< 0.00050
DIG9	27-Sep-99	2.52		0.0015	200.0	55.4		0.00080
DIG10	26-Jul-99	6.01		0.0016	20.0	88.0		< 0.00050
DIG10	30-Aug-99	8.42		0.0021	15.0	104.0		0.00050
DIG10	27-Sep-99	5.05		0.0010	150.0	61.2		0.00160

ECW Station	Date	F mg/L	Fe-X mg/L	Pb-XGF ug/L	Mg-D mg/L	Mn-X mg/L	Hg ug/L	Ni-X mg/L
DIG1	23-Jul-97	< 0.100	0.304	< 1.00	1.20	0.023		< 0.010
DIG1	01-Nov-97	< 0.100	0.114	< 1.00	1.40	0.014		< 0.010
DIG1	07-Jul-98	< 0.100	0.325	< 1.00	1.00	0.029	< 0.05	< 0.010
DIG1	17-Aug-98	0.146	0.062	< 1.00	1.50	0.011		< 0.010
DIG1	14-Sep-98	0.108	0.103	< 1.00	1.40	< 0.010		< 0.010
DIG1	18-Oct-98	< 0.100	0.199	< 1.00	1.10	0.013		< 0.010
DIG1	26-Jul-99	< 0.100	0.130	< 1.00	1.58	0.021		< 0.005
DIG1	30-Aug-99	0.356	0.310	< 1.00	1.23	0.024		< 0.005
DIG1	27-Sep-99	< 0.100	0.280	< 1.00	1.25	0.035		< 0.005
DIG2	17-Jun-97	< 0.100	0.296	< 1.00	1.00	0.042		< 0.010
DIG2	23-Jul-97	< 0.100	0.375	< 1.00	1.20	0.049		< 0.010
DIG2	01-Nov-97	< 0.100	0.133	< 1.00	1.40	0.020		< 0.010
DIG2	07-Jul-98	< 0.100	0.332	< 1.00	1.00	0.036	< 0.05	< 0.010
DIG2	17-Aug-98	< 0.100	0.122	< 1.00	1.50	0.015		< 0.010
DIG2	14-Sep-98	< 0.100	0.143	< 1.00	1.30	0.017		< 0.010
DIG2	18-Oct-98	< 0.100	0.302	< 1.00	1.00	0.030		< 0.010
DIG2	26-Jul-99	< 0.100	0.190	< 1.00	1.55	0.038		< 0.005
DIG2	30-Aug-99	< 0.100	0.110	< 1.00	1.51	0.026		< 0.005
DIG2	27-Sep-99	< 0.100	0.280	< 1.00	1.23	0.039		< 0.005
DIG3	17-Jun-97	< 0.100	0.205	< 1.00	1.00	0.024		< 0.010
DIG3	23-Jul-97	< 0.100	0.243	< 1.00	1.20	0.031		< 0.010
DIG3	01-Nov-97	< 0.100	0.095	< 1.00	1.40	0.015		< 0.010
DIG3	07-Jul-98	< 0.100	0.303	< 1.00	1.00	0.030	< 0.05	< 0.010
DIG3	17-Aug-98	< 0.100	0.083	< 1.00	1.30	0.034		< 0.010
DIG3	14-Sep-98	< 0.100	0.134	< 1.00	1.00	0.034		< 0.010
DIG3	18-Oct-98	< 0.100	0.172	< 1.00	1.10	0.013		< 0.010
DIG3	26-Jul-99	< 0.100	0.110	< 1.00	1.41	0.045		< 0.005
DIG3	30-Aug-99	< 0.100	0.120	< 1.00	1.41	0.040		< 0.005
DIG3	27-Sep-99	< 0.100	0.270	< 1.00	1.23	0.024		< 0.005
DIG3	30-Jul-00	< 0.100	0.231	< 1.00	1.19	0.018		< 0.005
DIG3	27-Aug-00	< 0.100	0.092	< 1.00	1.21	0.014		< 0.005
DIG 3	24-Sep-00	< 0.100	0.095	< 1.00	1.31	0.013		< 0.005
DIG4	17-Jun-97	< 0.100	0.245	< 1.00	1.10	0.018		< 0.010
DIG4	23-Jul-97	< 0.100	0.278	< 1.00	1.20	0.026		< 0.010
DIG4	01-Nov-97	< 0.100	0.121	< 1.00	1.40	0.010		< 0.010
DIG4	07-Jul-98	< 0.100	0.322	< 1.00	1.00	0.027	< 0.05	< 0.010
DIG4	17-Aug-98	< 0.100	0.091	< 1.00	1.20	0.014		< 0.010
DIG4	14-Sep-98	< 0.100	0.150	< 1.00	1.00	0.015		< 0.010
DIG4	15-Sep-98	< 0.100	0.119	< 1.00	1.10	0.010		< 0.010
DIG4	18-Oct-98	< 0.100	0.190	< 1.00	1.30	0.011		< 0.010
DIG4	26-Jul-99	< 0.100	0.120	< 1.00	1.36	0.030		< 0.005
DIG4	30-Aug-99	< 0.100	0.070	< 1.00	1.33	0.025		< 0.005
DIG4	27-Sep-99	< 0.100	0.280	< 1.00	1.27	0.028		< 0.005
DIG4	30-Jul-00	< 0.100	0.185	< 1.00	1.16	0.017		< 0.005
DIG4	27-Aug-00	< 0.100	0.100	< 1.00	1.22	0.013		< 0.005
DIG 4	24-Sep-00	< 0.100	0.075	< 1.00	1.25	0.0092		< 0.005

ECW Station	Date	F	Fe-X	Pb-XGF	Mg-D	Mn-X	Hg	Ni-X
		mg/L	mg/L	ug/L	mg/L	mg/L	ug/L	mg/L
DIG5	17-Jun-97	< 0.100	0.292	< 1.00	1.00	0.035		< 0.010
DIG5	23-Jul-97	< 0.100	0.272	< 1.00	1.40	0.053		< 0.010
DIG5	01-Nov-97	< 0.100	0.127	< 1.00	1.40	0.010		< 0.010
DIG6	17-Jun-97	< 0.100	0.217	< 1.00	1.20	0.030		< 0.010
DIG6	23-Jul-97	< 0.100	0.358	< 1.00	1.20	0.025		< 0.010
DIG6	01-Nov-97	< 0.100	0.146	< 1.00	1.50	0.013		< 0.010
DIG6	07-Jul-98	< 0.100	0.352	< 1.00	1.20	0.044	< 0.05	< 0.010
DIG6	17-Aug-98	< 0.100	0.099	< 1.00	1.70	0.053		< 0.010
DIG6	14-Sep-98	< 0.100	0.086	< 1.00	1.50	0.029		< 0.010
DIG6	18-Oct-98	< 0.100	0.161	< 1.00	1.30	0.011		< 0.010
DIG6	26-Jul-99	< 0.100	0.130	< 1.00	1.65	0.073		< 0.005
DIG6	30-Aug-99	< 0.100	0.080	< 1.00	1.74	0.058		< 0.005
DIG6	27-Sep-99	< 0.100	0.320	< 1.00	1.29	0.035		< 0.005
DIG7	17-Jun-97	< 0.100	0.383	< 1.00	1.40	0.027		< 0.010
DIG7	23-Jul-97	< 0.100	0.458	< 1.00	1.60	0.058		< 0.010
DIG7	01-Nov-97	< 0.100	0.235	< 1.00	1.70	0.012		< 0.010
DIG7	07-Jul-98	< 0.100	0.552	< 1.00	1.40	0.060	< 0.05	< 0.010
DIG7	17-Aug-98	< 0.100	0.034	< 1.00	1.70	0.035		< 0.010
DIG7	14-Sep-98	< 0.100	0.115	< 1.00	1.40	0.023		< 0.010
DIG7	18-Oct-98	< 0.100	0.238	< 1.00	1.70	0.012		< 0.010
DIG7	26-Jul-99	< 0.100	0.070	< 1.00	2.03	0.040		< 0.005
DIG7	30-Aug-99	< 0.100	0.060	< 1.00	1.84	0.035		< 0.005
DIG7	27-Sep-99	< 0.100	0.380	< 1.00	1.40	0.030		< 0.005
DIG8	17-Jun-97	< 0.100	0.186	< 1.00	1.30	0.029		< 0.010
DIG8	23-Jul-97	< 0.100	0.282	< 1.00	1.50	0.044		< 0.010
DIG8	01-Nov-97	< 0.100	0.108	< 1.00	1.80	0.016		< 0.010
DIG8	07-Jul-98	< 0.100	0.282	< 1.00	1.20	0.035	< 0.05	< 0.010
DIG8	17-Aug-98	< 0.100	0.059	< 1.00	2.40	0.055		< 0.010
DIG8	14-Sep-98	< 0.100	0.060	< 1.00	2.50	0.047		< 0.010
DIG8	18-Oct-98	< 0.100	0.164	< 1.00	1.30	0.013		< 0.010
DIG8	26-Jul-99	< 0.100	0.140	< 1.00	1.98	0.071		< 0.005
DIG8	30-Aug-99	< 0.100	0.080	< 1.00	2.65	0.101		< 0.005
DIG8	27-Sep-99	< 0.100	0.340	< 1.00	1.27	0.050		< 0.005
DIG9	17-Jun-97	< 0.100	0.331	< 1.00	0.90	0.080		< 0.010
DIG9	23-Jul-97	< 0.100	0.510	< 1.00	1.00	0.053		< 0.010
DIG9	07-Jul-98	< 0.100	0.423	< 1.00	1.00	0.078	< 0.05	< 0.010
DIG9	17-Aug-98	< 0.100	0.161	< 1.00	1.20	0.026		< 0.010
DIG9	14-Sep-98	< 0.100	0.090	< 1.00	1.20	0.030		< 0.010
DIG9	18-Oct-98	< 0.100	0.206	< 1.00	1.30	0.012		< 0.010
DIG9	26-Jul-99	< 0.100	0.290	< 1.00	1.19	0.047		< 0.005
DIG9	30-Aug-99	< 0.100	0.080	< 1.00	1.29	0.041		< 0.005
DIG9	27-Sep-99	< 0.100	0.410	< 1.00	1.16	0.090		< 0.005
DIG10	26-Jul-99	< 0.100	0.160	< 1.00	1.56	0.045		< 0.005
DIG10	30-Aug-99	< 0.100	0.150	< 1.00	1.67	0.062		< 0.005
DIG10	27-Sep-99	< 0.100	0.280	< 1.00	1.22	0.036		< 0.005

ECW Station	Date	NO3 mg/L	NO-X mg/L	NO2D mg/L	pH pH	K mg/L	Na mg/L	SO4-IC mg/L
DIG1	23-Jul-97	0.000	< 0.05	< 0.05	7.53	0.232	3.80	2.73
DIG1	01-Nov-97	0.000	0.05	< 0.05	7.45	0.441	4.00	7.08
DIG1	07-Jul-98	0.000	< 0.05	< 0.05	7.49	0.201	3.50	1.82
DIG1	17-Aug-98	0.000	< 0.05	< 0.05	7.81	0.257	7.20	4.12
DIG1	14-Sep-98	0.000	< 0.05	< 0.05	7.64	0.371	8.00	4.53
DIG1	18-Oct-98	0.040	0.09	< 0.05	7.01	0.246	3.00	7.40
DIG1	26-Jul-99	< 0.050	< 0.05	< 0.05	7.71	0.503	6.68	3.42
DIG1	30-Aug-99	< 0.050	< 0.05	< 0.05	7.29	0.427	6.69	5.32
DIG1	27-Sep-99	0.050	0.05	< 0.05	6.49	0.310	3.08	8.62
DIG2	17-Jun-97	0.000	< 0.05	< 0.05	7.21	0.268	3.20	2.60
DIG2	23-Jul-97	0.000	< 0.05	< 0.05	7.36	0.188	3.80	2.70
DIG2	01-Nov-97	0.010	0.06	< 0.05	7.36	0.448	3.70	6.99
DIG2	07-Jul-98	0.000	< 0.05	< 0.05	7.28	0.208	3.40	1.71
DIG2	17-Aug-98	0.000	< 0.05	< 0.05	7.72	0.311	7.90	3.95
DIG2	14-Sep-98	0.000	< 0.05	< 0.05	7.56	0.402	9.10	4.43
DIG2	18-Oct-98	0.040	0.09	< 0.05	6.75	0.352	3.00	6.45
DIG2	26-Jul-99	< 0.050	< 0.05	< 0.05	7.51	0.422	5.88	3.43
DIG2	30-Aug-99	< 0.050	< 0.05	< 0.05	7.26	0.417	5.62	4.40
DIG2	27-Sep-99	0.060	0.06	< 0.05	6.46	0.311	3.13	8.59
DIG3	17-Jun-97	0.000	< 0.05	< 0.05	7.30	0.274	5.40	2.50
DIG3	23-Jul-97	0.000	< 0.05	< 0.05	7.41	0.197	3.30	2.59
DIG3	01-Nov-97	0.020	0.07	< 0.05	7.33	0.389	3.40	4.15
DIG3	07-Jul-98	0.000	< 0.05	< 0.05	7.40	0.160	3.30	1.40
DIG3	17-Aug-98	0.000	< 0.05	< 0.05	7.50	0.259	4.70	3.72
DIG3	14-Sep-98	0.000	< 0.05	< 0.05	7.48	0.294	3.30	2.82
DIG3	18-Oct-98	0.050	0.10	< 0.05	6.98	0.231	2.90	7.54
DIG3	26-Jul-99	< 0.050	< 0.05	< 0.05	7.57	0.439	3.98	3.53
DIG3	30-Aug-99	< 0.050	< 0.05	< 0.05	7.39	0.444	4.33	4.51
DIG3	27-Sep-99	0.070	0.07	< 0.05	6.45	0.299	3.12	8.74
DIG3	30-Jul-00	< 0.050	< 0.05	< 0.05	7.48	0.166	3.77	3.58
DIG3	27-Aug-00	< 0.050	< 0.05	< 0.05	7.66	0.335	3.50	3.29
DIG 3	24-Sep-00	< 0.050	< 0.05	< 0.05	7.67	0.334	3.75	3.69
DIG4	17-Jun-97	0.000	< 0.05	< 0.05	7.35	0.243	3.30	2.21
DIG4	23-Jul-97	0.000	< 0.05	< 0.05	7.48	0.155	3.80	2.27
DIG4	01-Nov-97	0.050	0.10	< 0.05	7.32	0.420	3.40	4.09
DIG4	07-Jul-98	0.000	< 0.05	< 0.05	7.37	0.143	3.40	1.24
DIG4	17-Aug-98	0.000	< 0.05	< 0.05	7.43	0.237	6.10	3.76
DIG4	14-Sep-98	0.000	< 0.05	< 0.05	7.43	0.279	3.60	3.31
DIG4	15-Sep-98	0.000	< 0.05	< 0.05	7.60	0.297	3.80	3.19
DIG4	18-Oct-98	0.070	0.12	< 0.05	6.97	0.223	3.00	8.17
DIG4	26-Jul-99	< 0.050	< 0.05	< 0.05	7.56	0.399	4.74	2.99
DIG4	30-Aug-99	< 0.050	< 0.05	< 0.05	7.40	0.456	5.54	3.71
DIG4	27-Sep-99	0.060	0.06	< 0.05	6.41	0.300	3.17	8.38
DIG4	30-Jul-00	< 0.050	< 0.05	< 0.05	7.54	0.156	3.42	3.84
DIG4	27-Aug-00	< 0.050	< 0.05	< 0.05	7.66	0.221	3.83	2.71
DIG 4	24-Sep-00	< 0.050	< 0.05	< 0.05	7.59	0.316	4.30	3.09

ECW Station	Date	NO3	NO-X	NO2D	pH	K	Na	SO4-IC
		mg/L	mg/L	mg/L	pH	mg/L	mg/L	mg/L
DIG5	17-Jun-97	0.000	< 0.05	< 0.05	7.31	0.233	2.90	2.02
DIG5	23-Jul-97	0.000	< 0.05	< 0.05	7.48	0.210	3.40	1.88
DIG5	01-Nov-97	0.050	0.10	< 0.05	7.30	0.355	3.10	4.07
DIG6	17-Jun-97	0.000	< 0.05	< 0.05	7.39	0.258	3.20	1.90
DIG6	23-Jul-97	0.000	< 0.05	< 0.05	7.43	0.127	3.00	1.89
DIG6	01-Nov-97	0.060	0.11	< 0.05	7.30	0.292	3.00	4.12
DIG6	07-Jul-98	0.000	< 0.05	< 0.05	7.46	0.156	3.50	1.00
DIG6	17-Aug-98	0.000	< 0.05	< 0.05	7.66	0.208	4.10	3.01
DIG6	14-Sep-98	0.000	< 0.05	< 0.05	7.55	0.285	4.00	2.98
DIG6	18-Oct-98	0.070	0.12	< 0.05	7.02	0.233	3.70	9.17
DIG6	26-Jul-99	< 0.050	< 0.05	< 0.05	7.46	0.328	4.10	2.36
DIG6	30-Aug-99	< 0.050	< 0.05	< 0.05	7.32	0.310	4.49	2.91
DIG6	27-Sep-99	< 0.050	< 0.05	< 0.05	6.45	0.231	3.27	8.69
DIG7	17-Jun-97	0.000	< 0.05	< 0.05	7.55	0.275	3.40	1.83
DIG7	23-Jul-97	0.000	< 0.05	< 0.05	7.62	0.172	4.50	1.11
DIG7	01-Nov-97	0.010	0.06	< 0.05	7.56	0.219	3.20	2.13
DIG7	07-Jul-98	0.000	< 0.05	< 0.05	7.54	0.119	3.90	0.99
DIG7	17-Aug-98	0.000	< 0.05	< 0.05	7.77	0.101	4.00	0.845
DIG7	14-Sep-98	0.000	< 0.05	< 0.05	7.70	0.182	3.40	0.687
DIG7	18-Oct-98	0.190	0.24	< 0.05	7.14	0.280	5.00	8.89
DIG7	26-Jul-99	< 0.050	< 0.05	< 0.05	7.72	0.224	6.31	1.29
DIG7	30-Aug-99	< 0.050	< 0.05	< 0.05	7.57	0.181	3.86	2.30
DIG7	27-Sep-99	< 0.050	< 0.05	< 0.05	6.57	0.231	4.69	7.19
DIG8	17-Jun-97	0.000	0.05	< 0.05	7.45	0.270	2.00	1.89
DIG8	23-Jul-97	0.000	< 0.05	< 0.05	7.35	0.217	2.00	2.12
DIG8	01-Nov-97	0.030	0.08	< 0.05	7.34	0.344	3.30	4.32
DIG8	07-Jul-98	0.000	< 0.05	< 0.05	7.53	0.171	1.70	1.29
DIG8	17-Aug-98	0.000	< 0.05	< 0.05	7.78	0.200	2.50	3.06
DIG8	14-Sep-98	0.000	< 0.05	< 0.05	7.80	0.355	2.40	2.86
DIG8	18-Oct-98	0.060	0.11	< 0.05	6.98	0.226	1.60	10.60
DIG8	26-Jul-99	< 0.050	< 0.05	< 0.05	7.60	0.328	2.00	2.48
DIG8	30-Aug-99	< 0.050	< 0.05	< 0.05	7.47	0.334	2.83	2.87
DIG8	27-Sep-99	< 0.050	< 0.05	< 0.05	6.26	0.231	2.24	9.59
DIG9	17-Jun-97	0.000	< 0.05	< 0.05	7.01	0.225	1.60	1.78
DIG9	23-Jul-97	0.000	< 0.05	< 0.05	6.95	0.106	1.60	1.96
DIG9	07-Jul-98	0.000	< 0.05	< 0.05	7.22	0.151	1.60	1.41
DIG9	17-Aug-98	0.000	< 0.05	< 0.05	7.54	0.075	1.90	2.87
DIG9	14-Sep-98	0.000	< 0.05	< 0.05	7.46	0.167	1.80	2.66
DIG9	18-Oct-98	0.070	0.12	< 0.05	6.65	0.245	1.50	11.00
DIG9	26-Jul-99	< 0.050	< 0.05	< 0.05	7.16	0.175	1.65	3.22
DIG9	30-Aug-99	< 0.050	< 0.05	< 0.05	7.15	0.136	1.71	2.90
DIG9	27-Sep-99	< 0.050	< 0.05	< 0.05	5.90	0.244	1.73	9.72
DIG10	26-Jul-99	0.060	0.06	< 0.05	7.56	0.513	4.97	4.15
DIG10	30-Aug-99	< 0.050	< 0.05	< 0.05	7.60	0.398	6.79	5.36
DIG10	27-Sep-99	0.050	0.05	< 0.05	6.48	0.281	3.12	8.67

ECW Station	Date	SS mg/L	NH3T mg/L	HARD mg/L	TKN mg/L	TOC mg/L	TP-L mg/L	TURB NTU
DIG1	23-Jul-97	T 1	< 0.010	22.4	0.400	13.40	< 0.0050	0.6
DIG1	01-Nov-97	T 0.2	< 0.010	26.5	0.270	7.00	0.0050	0.8
DIG1	07-Jul-98	T 1	< 0.010	19.1	0.420	13.00	0.0150	1.0
DIG1	17-Aug-98	T 0	< 0.010	30.6	0.210	5.50	< 0.0050	0.2
DIG1	14-Sep-98	T 0	< 0.010	30.0	< 0.200	4.00	< 0.0050	0.3
DIG1	18-Oct-98	T 1.45	0.018	21.5	0.510	19.40	0.0120	0.4
DIG1	26-Jul-99	< 15	0.013	31.7	0.430	9.96	0.0070	0.5
DIG1	30-Aug-99	< 15	0.014	29.9	0.420	8.74	0.0170	0.6
DIG1	27-Sep-99	< 15	0.011	24.4	0.770	28.60	0.0150	1.0
DIG2	17-Jun-97	T 2	< 0.010	20.3	0.600	9.30	0.0060	0.9
DIG2	23-Jul-97	T 1	< 0.010	22.7	0.390	13.40	< 0.0050	0.7
DIG2	01-Nov-97	T 0.5	< 0.010	25.7	0.280	7.90	< 0.0050	0.8
DIG2	07-Jul-98	T 1	0.012	18.6	0.480	13.70	0.0120	0.7
DIG2	17-Aug-98	T 1	< 0.010	31.1	0.320	6.50	< 0.0050	0.6
DIG2	14-Sep-98	T 5.6	< 0.010	27.8	< 0.200	4.60	0.0050	0.7
DIG2	18-Oct-98	T 2.30	0.015	18.6	0.510	18.50	0.0120	0.9
DIG2	26-Jul-99	< 15	< 0.010	30.7	0.460	11.00	0.0100	1.3
DIG2	30-Aug-99	< 15	< 0.010	28.9	0.330	6.66	0.0100	1.4
DIG2	27-Sep-99	< 15	0.012	23.9	0.820	27.90	0.0160	1.2
DIG3	17-Jun-97	T 0	< 0.010	20.3	0.300	9.00	< 0.0050	0.2
DIG3	23-Jul-97	T 1	< 0.010	21.9	0.380	12.70	< 0.0050	0.3
DIG3	01-Nov-97	T 0.2	< 0.010	24.5	0.370	9.30	< 0.0050	0.3
DIG3	07-Jul-98	T 0	< 0.010	18.8	< 0.200	14.40	0.0080	0.3
DIG3	17-Aug-98	T 0	< 0.010	27.3	0.200	5.80	< 0.0050	0.2
DIG3	14-Sep-98	T 0	< 0.010	20.8	0.220	5.20	< 0.0050	0.3
DIG3	18-Oct-98	T 3.23	0.011	21.3	0.530	20.20	0.0070	0.3
DIG3	26-Jul-99	< 15	< 0.010	28.7	0.330	7.14	0.0050	0.3
DIG3	30-Aug-99	< 15	< 0.010	28.9	0.210	4.47	0.0070	0.2
DIG3	27-Sep-99	< 15	0.012	24.2	0.800	28.90	0.0160	0.5
DIG3	30-Jul-00	< 15	0.020	22.0	0.450	11.60	0.0060	0.1
DIG3	27-Aug-00	< 15	< 0.010	25.7	0.270	5.67	0.0050	0.0
DIG 3	24-Sep-00	< 15	< 0.010	25.7	0.230	5.96	0.0050	0.0
DIG4	17-Jun-97	T 0	< 0.010	19.0	0.320	10.10	< 0.0050	0.3
DIG4	23-Jul-97	T 1	< 0.010	21.7	0.460	15.10	< 0.0050	0.3
DIG4	01-Nov-97	T 1	< 0.010	24.0	0.380	10.80	< 0.0050	0.3
DIG4	07-Jul-98	T 0	< 0.010	19.1	0.500	15.80	0.0090	0.2
DIG4	17-Aug-98	T 0	< 0.010	24.4	0.280	7.30	< 0.0050	0.1
DIG4	14-Sep-98	T 0	< 0.010	21.6	0.210	6.90	0.0050	0.2
DIG4	15-Sep-98	T 0	< 0.010	18.8	0.260	6.70	0.0050	0.1
DIG4	18-Oct-98	T 2.46	0.012	23.8	0.600	22.00	0.0100	0.3
DIG4	26-Jul-99	< 15	< 0.010	25.5	0.470	10.60	0.0060	0.6
DIG4	30-Aug-99	< 15	< 0.010	24.8	0.300	6.10	0.0060	0.2
DIG4	27-Sep-99	< 15	0.012	25.1	0.860	29.70	0.0150	0.4
DIG4	30-Jul-00	< 15	0.016	23.1	0.370	9.15	0.0050	0.0
DIG4	27-Aug-00	< 15	< 0.01	22.2	0.300	7.03	0.0050	0.0
DIG 4	24-Sep-00	< 15	0.010	22.4	0.250	7.60	< 0.005	0.0

ECW Station	Date	SS	NH3T	HARD	TKN	TOC	TP-L	TURB
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU
DIG5	17-Jun-97	T 0	< 0.010	18.6	0.490	11.10	< 0.0050	0.4
DIG5	23-Jul-97	T 1	< 0.010	25.7	0.530	17.60	< 0.0050	0.3
DIG5	01-Nov-97	T 0.2	< 0.010	24.0	0.400	11.80	0.0050	0.5
DIG6	17-Jun-97	T 1	< 0.010	22.2	0.340	12.00	< 0.0050	0.3
DIG6	23-Jul-97	T 0	< 0.010	21.2	0.500	17.00	< 0.0050	0.5
DIG6	01-Nov-97	T 1	0.013	26.2	0.480	13.60	0.0050	0.4
DIG6	07-Jul-98	T 0	0.013	22.9	0.560	18.00	0.0090	0.3
DIG6	17-Aug-98	T 1	< 0.010	22.7	0.380	10.70	< 0.0050	0.2
DIG6	14-Sep-98	T 0.1	< 0.010	27.4	0.260	6.90	0.0110	0.2
DIG6	18-Oct-98	T 1.97	0.012	25.3	0.620	22.60	0.0070	0.2
DIG6	26-Jul-99	< 15	0.018	29.9	0.620	13.10	0.0060	0.4
DIG6	30-Aug-99	< 15	0.013	31.2	0.430	9.92	0.0060	0.5
DIG6	27-Sep-99	< 15	0.012	25.5	0.930	30.50	0.0130	0.4
DIG7	17-Jun-97	T 1	0.013	25.5	0.360	10.20	< 0.0050	0.3
DIG7	23-Jul-97	T 0	< 0.010	29.1	0.540	16.20	< 0.0050	0.4
DIG7	01-Nov-97	T 0.4	< 0.010	30.0	0.360	8.00	< 0.0050	0.4
DIG7	07-Jul-98	T 0	0.016	24.5	0.580	18.10	0.0100	0.4
DIG7	17-Aug-98	T 0	< 0.010	31.0	0.440	11.70	< 0.0050	0.2
DIG7	14-Sep-98	T 0	< 0.010	25.0	0.410	10.10	< 0.0050	0.2
DIG7	18-Oct-98	T 0.00	0.016	30.2	0.630	20.80	0.0080	0.3
DIG7	26-Jul-99	< 15	0.010	34.8	0.440	8.96	< 0.0050	0.3
DIG7	30-Aug-99	< 15	< 0.010	32.4	0.370	9.33	< 0.0050	0.1
DIG7	27-Sep-99	< 15	0.014	25.2	0.910	29.40	0.0140	1.2
DIG8	17-Jun-97	T 1	< 0.010	24.6	0.390	13.30	< 0.0050	0.2
DIG8	23-Jul-97	T 1	< 0.010	27.6	0.620	20.10	< 0.0050	0.3
DIG8	01-Nov-97	T 0.3	< 0.010	30.4	0.520	15.90	< 0.0050	0.4
DIG8	07-Jul-98	T 0	0.014	22.9	0.610	19.10	0.0090	0.2
DIG8	17-Aug-98	T 2	0.017	42.6	0.420	11.10	< 0.0050	0.1
DIG8	14-Sep-98	T 0	< 0.010	42.5	0.210	6.70	< 0.0050	0.0
DIG8	18-Oct-98	T 0.21	0.013	26.1	0.510	24.20	0.0060	0.3
DIG8	26-Jul-99	< 15	0.015	34.9	0.590	15.30	0.0060	0.3
DIG8	30-Aug-99	< 15	0.010	42.6	0.460	10.70	0.0060	0.3
DIG8	27-Sep-99	< 15	0.013	26.2	0.950	32.60	0.0130	0.4
DIG9	17-Jun-97	T 1	0.019	17.9	0.600	17.70	0.0070	0.4
DIG9	23-Jul-97	T 0	< 0.010	19.8	0.670	25.10	< 0.0050	0.5
DIG9	07-Jul-98	T 0	0.021	19.8	0.770	22.50	0.0130	0.4
DIG9	17-Aug-98	T 0	0.012	23.7	0.670	19.10	< 0.0050	0.3
DIG9	14-Sep-98	T 0	< 0.010	22.2	0.600	17.10	0.0070	0.2
DIG9	18-Oct-98	T 0.21	0.016	25.3	0.580	26.40	0.0070	0.2
DIG9	26-Jul-99	< 15	0.017	22.5	0.870	23.00	0.0100	0.8
DIG9	30-Aug-99	< 15	0.013	22.4	0.670	19.00	0.0050	0.2
DIG9	27-Sep-99	< 15	0.017	24.6	0.990	35.20	0.0130	0.3
DIG10	26-Jul-99	< 15	< 0.010	33.1	0.330	7.01	0.0100	0.9
DIG10	30-Aug-99	< 15	< 0.010	34.6	0.240	4.43	0.0080	0.9
DIG10	27-Sep-99	< 15	0.012	23.8	0.820	28.50	0.0130	0.5

ECW Station	Date	Zn-X mg/L	TEMP °C	DO mg/L
DIG1	23-Jul-97	< 0.010	23.0	9.8
DIG1	01-Nov-97	< 0.010		
DIG1	07-Jul-98	< 0.010	21.1	9.2
DIG1	17-Aug-98	< 0.010	17.6	9.8
DIG1	14-Sep-98	< 0.010	12.3	11.2
DIG1	18-Oct-98	< 0.010	11.1	10.8
DIG1	26-Jul-99	< 0.005	20.9	9.0
DIG1	30-Aug-99	0.005	16.7	9.7
DIG1	27-Sep-99	0.029	12.2	11.2
DIG2	17-Jun-97	< 0.010		
DIG2	23-Jul-97	< 0.010	21.5	9.8
DIG2	01-Nov-97	< 0.010		
DIG2	07-Jul-98	< 0.010	22.3	7.9
DIG2	17-Aug-98	< 0.010	20.8	9.1
DIG2	14-Sep-98	< 0.010	14.1	10.1
DIG2	18-Oct-98	< 0.010	10.8	10.8
DIG2	26-Jul-99	< 0.005	22.4	7.5
DIG2	30-Aug-99	< 0.005	20.4	8.2
DIG2	27-Sep-99	0.009	12.0	9.9
DIG3	17-Jun-97	< 0.010		
DIG3	23-Jul-97	< 0.010	23.0	9.7
DIG3	01-Nov-97	< 0.010		
DIG3	07-Jul-98	0.014	20.3	9.0
DIG3	17-Aug-98	0.016	24.0	8.8
DIG3	14-Sep-98	< 0.010	11.6	9.9
DIG3	18-Oct-98	< 0.010	10.3	11.1
DIG3	26-Jul-99	< 0.005	21.1	8.2
DIG3	30-Aug-99	< 0.005	17.8	8.0
DIG3	27-Sep-99	0.023	12.1	10.3
DIG3	30-Jul-00	< 0.005	26.5-31/7	7.5
DIG3	27-Aug-00	< 0.005	21.0	8.3-28/08
DIG 3	24-Sep-00	0.0061	12.0	
DIG4	17-Jun-97	< 0.010		
DIG4	23-Jul-97	< 0.010	24.5	9.7
DIG4	01-Nov-97	< 0.010		
DIG4	07-Jul-98	< 0.010	22.1	9.0
DIG4	17-Aug-98	< 0.010	23.0	9.8
DIG4	14-Sep-98	< 0.010	11.9	10.1
DIG4	15-Sep-98	< 0.010	15.2	10.4
DIG4	18-Oct-98	0.014	10.5	12.2
DIG4	26-Jul-99	< 0.005	21.3	8.9
DIG4	30-Aug-99	0.015	18.1	10.1
DIG4	27-Sep-99	0.084	11.9	10.6
DIG4	30-Jul-00	< 0.005	27.0	8.3
DIG4	27-Aug-00	0.009	21.0	8.3-28/09
DIG 4	24-Sep-00	< 0.005	12.0	

ECW Station	Date	Zn-X mg/L	TEMP °C	DO mg/L
DIG5	17-Jun-97	0.016		
DIG5	23-Jul-97	< 0.010	24.5	9.0
DIG5	01-Nov-97	0.012		
DIG6	17-Jun-97	< 0.010		
DIG6	23-Jul-97	< 0.010	24.0	9.2
DIG6	01-Nov-97	< 0.010		
DIG6	07-Jul-98	< 0.010	22.7	9.0
DIG6	17-Aug-98	< 0.010	20.0	8.5
DIG6	14-Sep-98	< 0.010	12.5	10.3
DIG6	18-Oct-98	< 0.010	10.4	11.3
DIG6	26-Jul-99	< 0.005	21.8	7.5
DIG6	30-Aug-99	< 0.005	12.0	7.3
DIG6	27-Sep-99	0.006	12.1	10.3
DIG7	17-Jun-97	< 0.010		
DIG7	23-Jul-97	0.026	26.5	8.4
DIG7	01-Nov-97	< 0.010		
DIG7	07-Jul-98	< 0.010	24.2	8.3
DIG7	17-Aug-98	< 0.010	19.1	9.6
DIG7	14-Sep-98	< 0.010	12.0	10.2
DIG7	18-Oct-98	< 0.010	10.4	10.6
DIG7	26-Jul-99	0.009	21.8	8.6
DIG7	30-Aug-99	< 0.005	18.5	9.7
DIG7	27-Sep-99	0.015	12.5	10.1
DIG8	17-Jun-97	< 0.010		
DIG8	23-Jul-97	< 0.010	26.0	8.7
DIG8	01-Nov-97	0.012		
DIG8	07-Jul-98	< 0.010	24.4	8.7
DIG8	17-Aug-98	0.015	18.5	8.7
DIG8	14-Sep-98	< 0.010	11.6	9.6
DIG8	18-Oct-98	< 0.010	10.6	10.6
DIG8	26-Jul-99	< 0.005	21.8	7.7
DIG8	30-Aug-99	< 0.005	16.9	8.0
DIG8	27-Sep-99	< 0.005	12.7	10.1
DIG9	17-Jun-97	< 0.010		
DIG9	23-Jul-97	< 0.010	24.0	8.4
DIG9	07-Jul-98	< 0.010	22.7	8.1
DIG9	17-Aug-98	< 0.010	20.5	9.1
DIG9	14-Sep-98	< 0.010	12.9	9.5
DIG9	18-Oct-98	< 0.010	10.7	10.3
DIG9	26-Jul-99	0.009	22.8	7.8
DIG9	30-Aug-99	< 0.005	18.7	8.9
DIG9	27-Sep-99	0.007	12.8	7.7
DIG10	26-Jul-99	< 0.005	21.1	7.3
DIG10	30-Aug-99	< 0.005	20.0	8.4
DIG10	27-Sep-99	0.016	11.9	10.6