WATER CLASSIFICATION 1st YEAR REPORT:

REPORT ON PROGRESS TOWARDS WATER CLASSIFICATION, 2001/2002 NASHWAAK WATERSHED DRAINAGE

Prepared for: The New Brunswick Department of the Environment and Local Government

Prepared by: Nashwaak Watershed Association Inc.

March, 2002

NASHWAAK WATERSHED ASSOCIATION INC. established 1995

New Nouveau Brunswick

Your Environmental Trust Fund at Work!
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EXECUTIVE SUMMARY

Water quality monitoring was conducted at 17 sites for inorganic and bacteriological analytical data and nine sites for benthic invertebrates throughout the watershed during the months of July, August, September, and October 2001. The New Brunswick Department of Environment and Local Government (DELG) conducted analytical testing for chemical and biological parameters. Analytical data was tabulated adjacent to guidelines for fresh water aquatic as published by the Canadian Council of the Ministers of the Environment (CCME). Water quality parameters for water classification (NB Regulation) as published by DELG were also used. Benthic Macro Invertebrate data was not available at the time of production of this report. Temperature and dissolved oxygen (DO) was also collected and tabulated.

Water quality data assessed in accordance with DELG guidelines for water classification indicates that the vast majority of the Nashwaak River system meets Class A assessment or better. Information regarding the Watershed Classification exercise being implemented for the Nashwaak River was communicated to the general population by production of regular information newsletters, organization of regular public meetings, and involvement of volunteers for water quality sampling and benthic extraction. Eighteen new members joined the Nashwaak Watershed Association Inc. (NWAI) during 2001; bringing total membership to 67. Significant gains were achieved with respect to partnership arrangements and stakeholder participation within the Nashwaak Watershed.

Geographic Information System (GIS) database assembly was completed for Land Usage, Geology, Soils, and Ecological Land Classification and preliminary maps were generated. These maps have assisted with public information dissemination regarding classification of the Nashwaak River system.

ACKNOWLEDGEMENTS

The Nashwaak Watershed Association Inc. (NWAI) would like to thank the many organizations and individuals who contributed to the activities of the 2001/2002 season of this project. Without their assistance this project would not have been possible.

Appreciation is also extended to the New Brunswick Environmental Trust Fund and the Outreach and Partnering staff of DELG for provision of funding and assistance with completion of the activities described in this report. These actions have advanced the water classification process within the Nashwaak Watershed.

The NWAI would like to extend our gratification to the many volunteers who gave their valuable time by administering the NWAI, conducting partnering and outreach, water quality sampling, benthic extraction and many other activities.

Finally, the NWAI would like to thank all members of various communities within the Nashwaak Watershed for their support through attendance at General Meetings.

MISSION STATEMENT

To manage the Nashwaak River Watershed as a healthy ecosystem that balances a variety of economic, recreational, social and landowner interests. All stakeholders on the Nashwaak are committed to sustaining the scenic and serene nature of the area in a manner consistent with the pursuits of all user groups. The Nashwaak River should be a watershed that serves the community while maintaining a healthy resource for generations to come.

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1.0 INTRODUCTION

1.1 Terms of Reference

The NWAI was granted $89,000.00 from the Environmental Trust Fund following submission of a proposal to perform water classification and public awareness for waters draining to the Nashwaak River. The project was preformed in conjunction with the New Brunswick Department of the Environment and Local Government (DELG) between July/01 and March/02 in accordance with our written correspondence dated July 10, 2001. This report contains information pertaining to public outreach and awareness in the Nashwaak Watershed and project deliverables associated with Environmental Trust Fund Project # 010006. It is understood that the purpose of the report is to present factual information regarding progress towards watershed classification on the Nashwaak River.

1.2 Methodology

The Classification Progress Report generally consisted of the following tasks associated with the deliverance of progress towards watershed classification and outreach during 2001/2002:

(i) Tabulation of water quality data with a list of volunteers involved in water sample collection;
(ii) Development of newsletters or other means of regular communication with the membership and the general public;
(iii) Production of Digital Land Use maps for lands draining to the Nashwaak. These maps will incorporate land ownership, forest cover, soils, geology, and Ecological Land Classification;
(iv) Production of monthly progress reports to DELG;
(v) Provision of an expanded stakeholder list; and
(vi) Production of a final report summarizing activities performed and progress made toward water classification.

This work was carried out between July 1, 2001 and March 31, 2002.

2.0 BACKGROUND INFORMATION

2.1 Classification Area

With a drainage area of 1,700 km^2, the Nashwaak River flows approximately 110 km in an easterly and southerly direction from Upper Nashwaak Lake (on the York/Carlton county line) to its confluence with the St. John River at Fredericton (Appendix I). The river is the largest salmon-producing tributary of the St. John River below the influence of the Mactaquac hydroelectric dam.

The majority of the Nashwaak Watershed is located in the Continental Lowlands Eco-Region (73.9%) with a considerable portion in the Southern Uplands Eco-Region (22.8%) and a minor portion in the Grand Lake Eco-Region (3.3%)(Appendix I).

The headwaters of the Nashwaak River begin in the Southern Uplands, which has elevations around 180m above sea level. The topography is rolling with small mountains to the west of Gorby Gulch (Appendix I). The average summer precipitation (May – September) ranges from 500mm to greater than 1200mm in high elevation areas. There is also a tendency toward cooler temperatures resulting in 1400-1600 growing degree-days, (5°C basis) in the Southern Uplands.

The Continental Lowlands, which encompasses drainage from the mouth of Napadogan Stream to near Nashwaak Village, has a climate that is warmer and drier than the Southern Uplands. The average growing season precipitation is 400-500mm, while the total number of growing degree-days is 1500-1700 (5°C basis).

As the Nashwaak River drains to the East and eventually to the south, it gives way to the Grand Lake Eco-Region near Nashwaak Village to its confluence with the St. John River near Barkers Point. The elevations of this eco-region tend to be relatively low, ranging from slightly above sea level to 150m. The presence of Grand Lake in this eco-region has moderating effects on the surrounding climate. By storing heat in the summer and giving it off in the fall, the amount of frost-free days is extended. This eco-region is the warmest in the province of New Brunswick with an average of 1800 growing degree days (5°C basis) along the St. John River. The area also receives 425-450mm of summer precipitation (May-September) (Zelanzy et al, 1996).

The Eco-Regions within the Nashwaak Watershed describe distinct differences in climate. Climate patterns are affected by altitude, wind circulation in the relation to topography and proximity to large inland or coastal water bodies. The patterns of vegetation in the Nashwaak Watershed are strongly influenced by changes in climatic influence.

The Nashwaak Watershed provides a significant amount of habitat for many mammals, amphibians and birds. The river and its tributaries also provide a wide array of habitat conditions for a diverse aquatic community. Historically (until approximately 1993), the

Nashwaak River provided some of the best Atlantic salmon angling opportunities in the world.

The predominant land cover type of the Nashwaak Watershed is forest (92.3%). Other land cover types are agriculture (2.8%), wetlands (1.99%), linear features (1.15%), urban/residential (1.01%), water (0.44%) and other (0.13%) (see Appendix I). This data is summarized in the following table.

Table 2.1 Portion of Specific Land Use Categories in the Nashwaak River Watershed

Specific Land Use	Area (ha)	Percent (%)
Airstrip	34.9	0.0
Cultivated Shrubs/Trees	308.7	0.2
Cultivated/Pastures	4498.4	2.6
Gravel Pits	192.6	0.1
Hardwood	47248.8	27.6
Lakes	231.2	0.1
Mixedwood	52713.4	30.8
Occupied	1731.8	1.0
Other Forested Land	4182.5	2.4
Ponds	36.8	0.0
Railway	19.9	0.0
Nashwaak River & Main Tributaries	707.7	0.4
Roads	1316.1	0.8
Exposed Bedrock	2.6	0.0
Softwood	54132.1	31.6
Sentier NBTrail	124.2	0.1
Transmission Lines	518.9	0.3
Open Water	9.0	0.0
Wetland	3409.1	2.0
Total	**171418.7**	**100.0**

Water quality and quantity in the Nashwaak River Watershed is affected by a number of direct and indirect influences from various activities or uses. Road construction has the potential to affect river discharge patterns by directing precipitation directly to streams via roadway ditches. Snowmelt timing may be altered from historical timing by clear cutting operations. Water quality may be affected by agriculture, residential and forest-harvesting operations due to sediment loading from poor land use practices, equipment crossing waterways and inadequate buffer zone management. Agricultural, rural residential and other occupied areas can have a effect on water quality due to cattle grazing, top soil mining, municipal run-off, riparian zone removal, failed septic systems, fertilizer run-off and other water management issues. Residential and agricultural areas, which collectively occupy 3.8 percent of the total land area, are found in the lower 2/3 of the Nashwaak River Watershed plus the headwaters of Cross Creek, Tay River and Penniac Stream. Even though these activities represent small amounts of land area, they

have the potential to produce significant effects on water quality. Recreational activity in the form of a golf course is found on the main stream of the Nashwaak below Durham Bridge. Urbanization of the watershed has occurred at Marysville and Barkers Point near the confluence of the Nashwaak River and the Saint John River.

2.2 Classification Process

Water classification, developed by DELG and enforceable under the Clean Water Act (NB Regulation# , encourages community groups to set goals for surface water quality. Once goals are set, community groups may work towards maintenance and improvement of these goals by formulating action plans for long-term watershed management. The water classification process utilized in New Brunswick by watershed groups involves the following steps: (i) identification of stakeholders and involving them in the process; (ii) gathering water quality information; (iii) assembly of land use information; (iv) setting goals for water quality and (v) preparation of action plans for remedial work within the watershed.

Since 1996, the NWAI has developed long-standing relationships with numerous partners, thereby forging relationships with some of the stakeholders in the watershed (Appendix V). The water classification process allows for stakeholder involvement through the use of newsletters, public meetings, mail outs, and other techniques. In year two of the project, the watershed will be divided into sub watersheds to focus on localized water quality status, address local concerns and obtain feedback regarding desired water quality. (Appendix I).

Staff and volunteers of the NWAI collected water samples at 17 locations throughout the watershed during the months of July through October 2001 inclusive (Appendix V). These samples were analyzed to help identify water quality deficiencies and help determine the overall health of the watershed. This data will be compared to historical data collected on the system, expanding the baseline dataset. Also, this data will be used in making decisions about the water quality goals within the Nashwaak River Watershed.

Land use/cover information was collected in the form of digital Geographic Information System (GIS) data (Appendix II). These spatial data will be used to aid in the understanding of how topography, soils, geology, vegetative cover and human interaction affects water quality. Several layers of spatial information such as roads, water, streams, and land use in combination with precipitation and flow discharge data will be utilized to help gain an understanding of variations in water quality data (Appendix III).

Initial contact has been made with stakeholders in the watershed to assist their understanding of roles they might play in the classification process. Through continued public outreach, stakeholders will work together to build a consensus on what the water quality should be for the Nashwaak Watershed. Once the waters of the Nashwaak are classified, the NWAI may work together with stakeholders to formulate an action plan for restoration. This action plan could prioritize activities, which will maintain existing water quality in some areas and undergo restoration activities to improve water quality in

other areas. All of these actions would be performed in accordance with the framework set out for water classification.

While the overall objective of the water classification process is to ensure adequate water quality for its intended use, the NWAI considers water quantity to be equally important to this process. Water usage ranges from recreation to supporting healthy aquatic life populations. Collected water samples were analyzed for various chemical, physical and biological parameters. The results of these analyses were compared to the CCME guidelines for fresh water aquatic life, which outlines the acceptable limits for the various parameters in question as they pertain to the protection of aquatic life (Appendix IV). If some parameters are of a concentration that is outside the suggested limits, negative effects to fishes may occur. The DELG has published guidelines for Dissolved Oxygen (DO) and E-coli, which are shown in the table below.

Table 2.2 Summary of Water Quality Guidelines Utilized in the New Brunswick Water Classification Process

PARAMETER (Table abbreviation)	DESCRIPTION	CANADA GUIDELINE	PROPOSED NB STANDARD	WATER-RELATED BACKGROUND
Bacteria, *E- coli* (EC)	One of the fecal coliform bacteria most commonly used as an indicator of sewage pollution. Listed as the most probable number (MPN) in 100ml water. N.B. standard is a geometric mean of a minimum of 5 samples in a 30-day period.	For swimming waters, a mean of <200 MPN for 5 samples in a 3 day period and <400 MPN for any one sample; no guideline is set for aquatic life	Class AP: no *e.coli*. Class 0, AL & A: as naturally occurs. Class B: <200. Class C: <400. Class B & C (tidal shellfish areas): < 14.	
Oxygen, dissolved (DO)	Oxygen is one of earth's most versatile and abundant elements. Dissolved in water, it is used for respiration by most aquatic life. Dissolved oxygen levels are affected by temperature and aeration: cold or standing water generally has lower levels. Often measured in parts per million (ppm): 1ppm = 1 mg/l.	5.5-6mg/l for warm-water species; 6.5-9 mg/l for coldwater species: higher values for early life stages	***For cold-water species:*** 9.5ppm (early stages), 6.5ppm (other stages) ***For warm-water species:*** 6.0ppm (early stages), 5.0ppm (other stages), ***In estuarine waters:*** 80% saturation	Generally 4-10ppm in surface waters
Macro-invertebrates, benthic	Bottom-dwelling aquatic insects and other invertebrate animals large enough to be visible. The types and numbers of these are a good indicator of water characteristics over time.		As naturally occur in New Brunswick waters	Profiles are being developed which relate the macro-invertebrates found to various water quality types.

3.0 PUBLIC OUTREACH

3.1 Public Outreach Initiatives

Volunteers were utilized (1996 to present) to collect water samples for analytical testing at the DELG laboratory on McGloin Street, Fredericton. The volunteer network was successful in increasing NWAI membership and improving public awareness in water quality stewardship. A list of volunteers is presented in Appendix V.

In conjunction with water quality sampling, a benthic macro invertebrate sample program was conducted during 2001with the help of one volunteer from our membership. The sampling of the benthic invertebrate community will assist in the provision of assessing the current status of the Nashwaak River Watershed.

Regular newsletters were published and distributed to the membership and the general public through bulk mail outs and distribution through local retail outlets. The Fall 2001 Newsletter was mailed and/or hand delivered to approximately 2000 households throughout the watershed. The feature article of this newsletter was the water classification process.

Digital land use maps of the subject area were complied and presented at the January 19, 2002 Annual General Meeting at Nashwaak Valley School in Durham Bridge.

3.2 Non-Project Related Outreach Initiatives

Significant public awareness was generated through the introduction of a Fish Friends program at Stanley Elementary School (funded separately) and continuation of the Atlantic salmon satellite rearing operations at Taymouth, NB. Additional volunteer based activities included Nashwaak River discharge data evaluation, adult salmon seining, salmon smolt production evaluation, salmon fry releases and other related activities.

4.0 PROJECT DELIVERABLES

4.1 Tabulated Water Quality Data With a List of Volunteers

Water quality sampling events were conducted during July, August, September and October of 2001 with six volunteers participating in the process. Participants are listed in Appendix V.

Water samples were collected by adherence to the procedures outlined in the "Volunteers Guide to Water Quality Monitoring" produced by DELG (Appendix VI). This manual is intended to educate community groups and volunteers of all aspects of water quality monitoring. Water samples were collected from 17 of the sites already established in the watershed by DELG.

Laboratory analysis was performed under contract by the DELG laboratory located at 20 McGloin Street, Fredericton. Results from the chemical and biological analysis were tabulated and are presented in Appendix VII. Generally the water quality testing indicated compliance with the CCME guidelines for the protection of aquatic life. Nitrogen input appears to be minimal and bacteriological parameters are superior to many rivers found in New Brunswick. Generally, water quality displayed Class A quality or better throughout the entire watershed. The classification guidelines used by DELG are shown in Table 2.2 and the CCME guidelines are shown in Appendix IV.

4.2 Development of Regular Newsletter for Circulation to the General Public

Newsletters were published twice during the eight-month project duration. Newsletters covered topics of water classification, salmon enhancement, funding raising and, research initiatives.

Newsletters were an effective means of public outreach assisting in the generation of 15 new members. The newsletters have also been made available at the Legislative Library. The published newsletters are presented in Appendix VIII.

4.3 Production of Digital Maps

Production of digital maps allowed the NWAI to examine specific datasets, which may be useful in providing public awareness initiatives. Samples of generated maps are presented in Appendix I.

In watershed classification projects, knowledge the spatial extent of the watershed you are working in is important. A Geographic Information System (GIS) is a tool that describes these features within the watershed. Several layers of spatial information such as Land Use / Cover Assessment, Soils, Geology, Ecological Land Classification, and Digital Property mapping (Appendix II) will be used in conjunction with Nashwaak River water quality, discharge and precipitation data to help attempt explanation of the variation in the water quality results.

4.4 Production of Quarterly Progress Reports

Monthly Progress reports, prepared on pre-printed forms, were submitted to DELG staff for the months of September 2001 through March 2002 inclusive. Copies of these reports are presented in Appendix IX.

4.5 Provision of an Expanded Stakeholder List

A stakeholder list was generated utilizing land ownership data included in the Service New Brunswick (SNB) Digital Property Mapping data provided by the Department of Natural Resources & Energy (DNRE). Businesses and community group names were also catalogued from the Stanley exchange of the phonebook. Many of these stakeholders were contacted at least once by the NWAI during this project. Membership increased by 18 during the course of this project to a total of 67 members. A current membership list is presented in Appendix X

4.6 Workshops and Meetings Attended Regarding Water Classification

The staff and executive of the NWAI attended numerous meetings and workshops during the course of this project. The following list is an outline of the workshops and meetings:

(i) Water quality monitoring session hosted by the DELG – July 13, 2001
(ii) NWAI meeting with outreach and partnering group of DELG – September 4, 2001
(iii) NWAI Fall General Meeting - Talk on water classification given by staff of DELG – September 19, 2001
(iv) NWAI meeting with Hammond River Angler's Association (HRAA) (mentor group) – October 14, 2001
(v) Social marketing workshop hosted by HRAA – November 7-9, 2001
(vi) New Brunswick Council Atlantic Salmon Federation – December 1, 2001
(vii) NWAI Annual General Meeting - Talk on Declines of the Atlantic salmon in the Bay of Fundy with reference to the Nashwaak River. – January 19, 2002
(viii) Benthic Macro-Invertebrate workshop hosted by the Eastern Charlotte Waterways (ECW) (mentor group) – March 15, 2002
(ix) Public stakeholder meetings with Forestry Companies (i.e. J.D. Irving Limited & St Anne Nackawic) – Various Dates
(x) St. John River Advisory meetings hosted by DFO – Various Dates

5.0 FINDINGS AND DISCUSSION

Throughout this water classification project, the public was found to be genuinely interested in the water quality of the Nashwaak River. Approximately 2000 households in the watershed were informed of some of the issues related to water quality. Newsletters were also distributed to local merchants throughout the watershed.

Land use mapping proved useful in understanding the composition of the watershed. This information was compiled near the end of this project and as such has not been conveyed to the public in any meaningful way. The mapping exercise will provide a wealth of information to inform stakeholders and evaluate water quality in the coming years.

Benthic invertebrate sampling was not successful in advancing public involvement in the process due to scheduling difficulties. Laboratory analysis of benthic samples was not available at the time of report production.

Water quality sampling continues to assist in public involvement as well as providing valuable scientific information regarding water quality. A cursory review of analytical testing of water samples indicates good water quality throughout the entire Nashwaak Watershed. This result is not surprising for a watershed comprising 1700 km^2 with 94.9 percent of its landmass undeveloped.

Broad based mail-outs of our newsletters continue to be the most effective means of generating interest in the water quality of the Nashwaak River. Public meetings have been moderately successful in this regard as well. Continuation of both of these activities is recommended for the 2002/2003 year. The overwhelming consensus of the public, as expressed in the public meetings, was that the Nashwaak River and its Tributaries should be classified at the highest possible standard (O or A wherever possible). Not a single individual expressed a desire for lower classifications. However, J.D. Irving Ltd. did express some concern with the water classification process.

NWAI staff and executive members attended several meetings and workshops during the course of this project. These initiatives were provided, for the most part by mentor groups who are further along in the classification process. These sessions were reasonably effective in providing the NWAI with a better understanding of the classification process and the importance of the public outreach. More importantly, these workshops allowed interaction with other watershed groups to discuss mutual difficulties and findings. One significant mutual finding resultant from these interactions is that the majority of evaluated sites on all provincial watercourses currently under study achieve a Class A designation. If this is true, it suggests the classification standards may be set to low to allow an "A" designation to be meaningful. Additionally, it only became known to the NWAI in late March, 2002 that mixing zones from point source discharges must be classified as B or lower and there is no avenue to delineate mixing zones, making it impossible to properly map final classification distributions.

Data defined as deliverable under this classification progress report is appended to this report. This and additional data is presented to allow public discussion of water quality issues and eventual classification throughout the Nashwaak Watershed.

6.0 RECOMMENDATIONS

It is recommended at this time that water classification for the Nashwaak Watershed be continued in the 2002/2003 fiscal year. Application for funding from the Environmental Trust Fund has been performed to facilitate this effort. Generally, the efforts for the 2002/2003-year should target sub-watersheds of the Nashwaak River and public meetings should focus on documenting public desires regarding water classification.

Given that production of a preliminary classification report for the Nashwaak was outside of the scope for this project, one should be produced next year and presented to the general public prior to finalizing recommendations for water classification. As the data generated in 2002/2003 will not be available until near the end of next year's effort, it will not be possible to distribute that data until 2003/2004. As previously stated, meaningful stakeholder decision-making cannot be performed until this information is made available for public consideration. Benthic analytical data has not been made available to date and means of evaluating this data will be required prior to presenting it publicly.

The DELG should clarify and reconsider the criteria for class A, B, & C waters which is currently vague (benthic communities "as naturally occurs") and difficult to explain to the general public. If it is a fact that a high percentage of water bodies in the province meet class A, consideration should be given to raising the criteria for this class.

Having gained better insight to the current state of the Nashwaak River Watershed, it is recommended that next years project identify segments of water that meet an O classification.

7.0 LITERATURE CITED

Canadian Council of Ministers of the Environment. 1999. Canadian Environmental Quality Guidelines.Canadian Council of Ministers of the Environment, Winnipeg, Man.

R.N. McNeely, V.P. Neimanis and L. Dwyer. 1979. Water Quality Sourcebook: A Guide to Water Quality Parameters. Environment Canada, Ottawa, Ont.

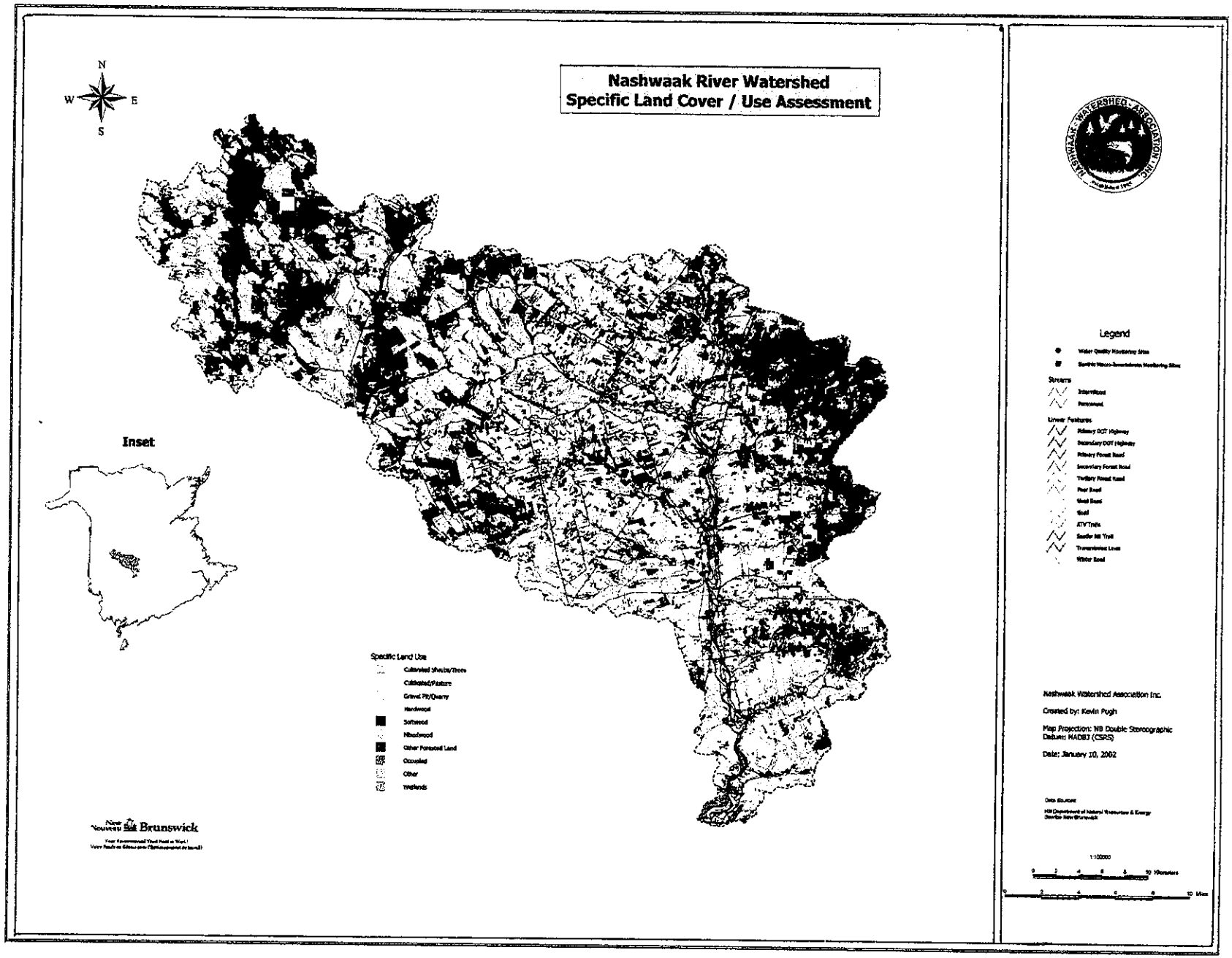
Zelazny et al, 1996. An Ecological Land Classification System for New Brunswick.

Environment Canada, 2001. Precipitation Data from Fredericton Airport.

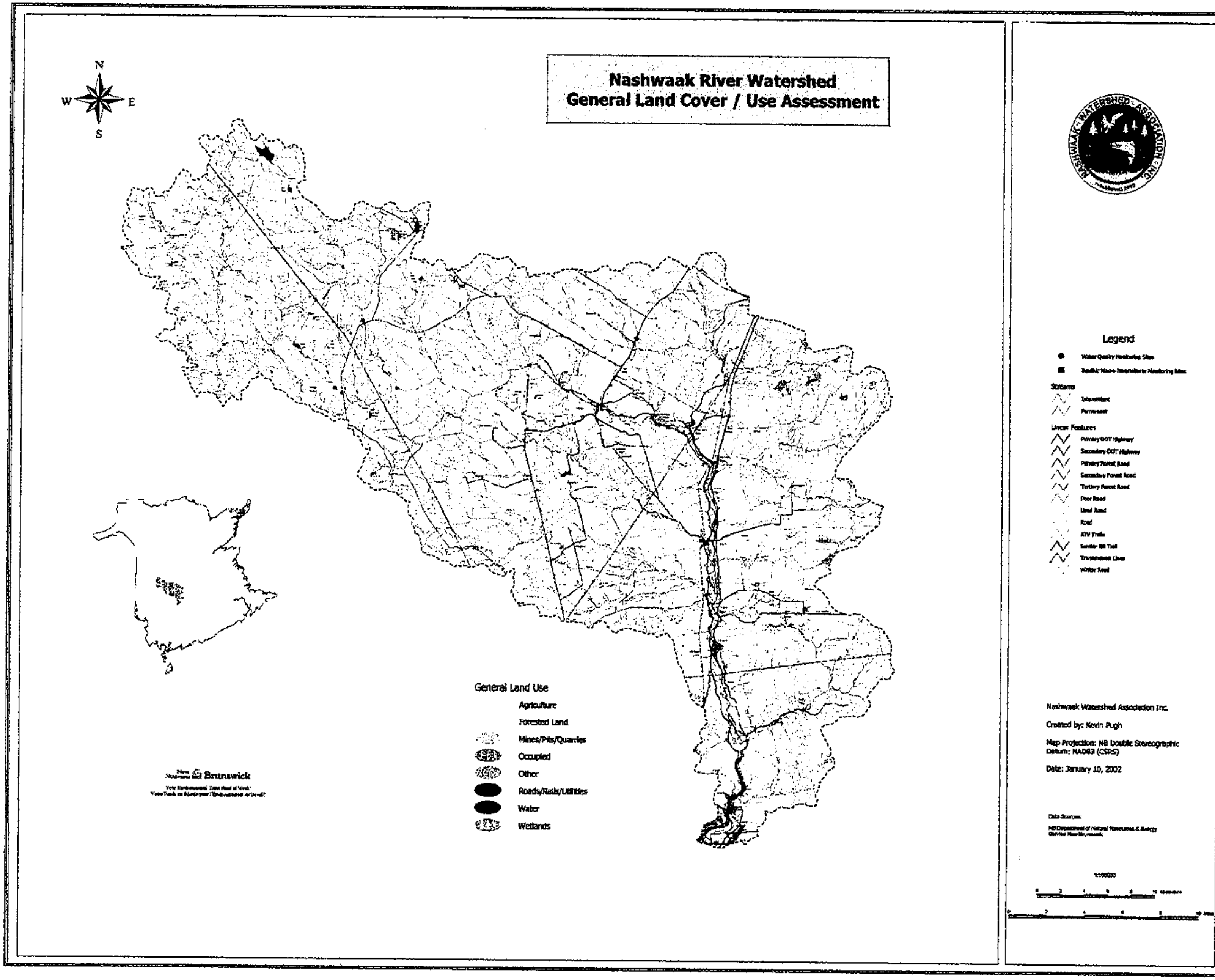
Environment Canada, 2001 Discharge Data for the Nashwaak River at Durham Bridge.

Appendix I

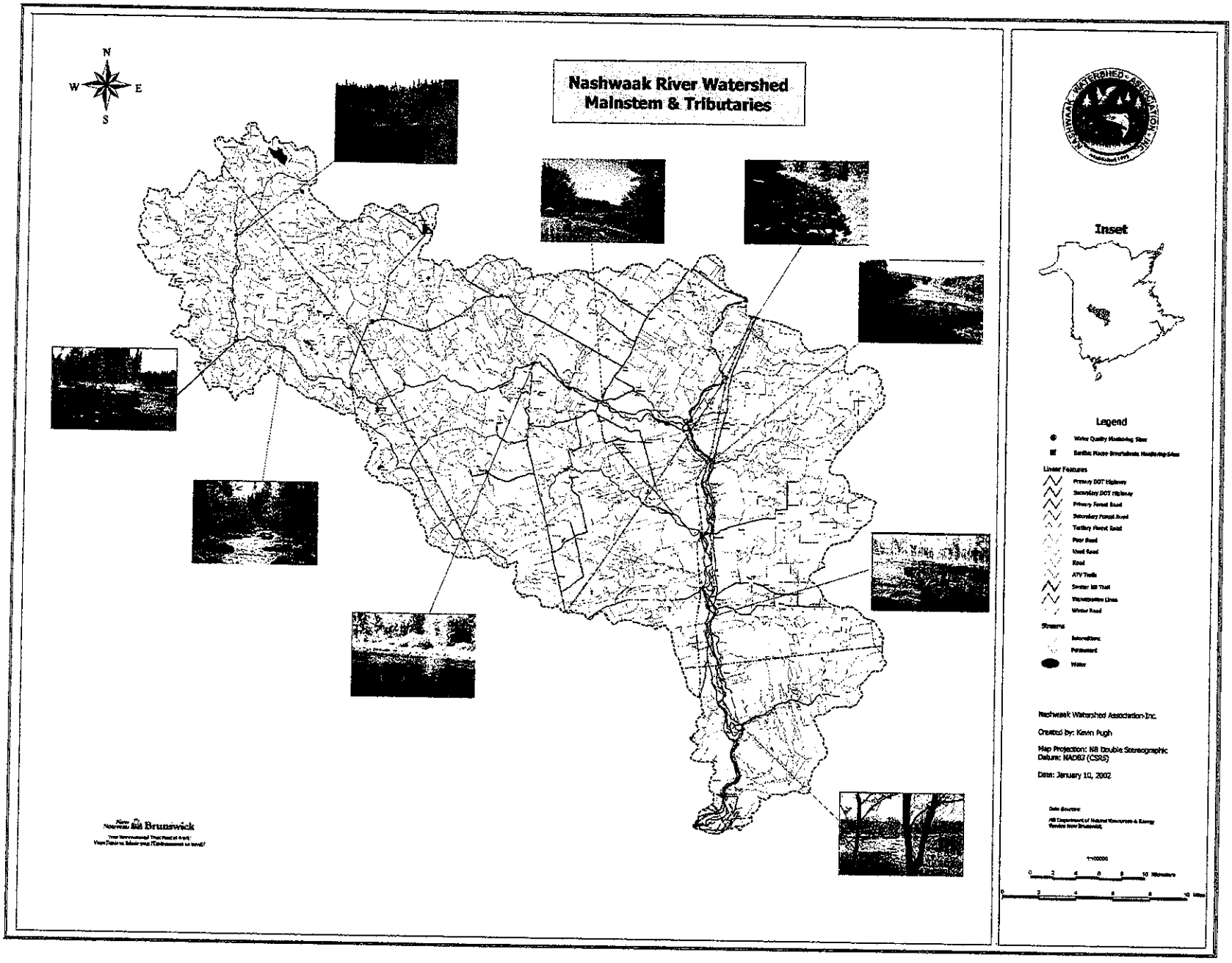
Map Products used for the Water Classification Process



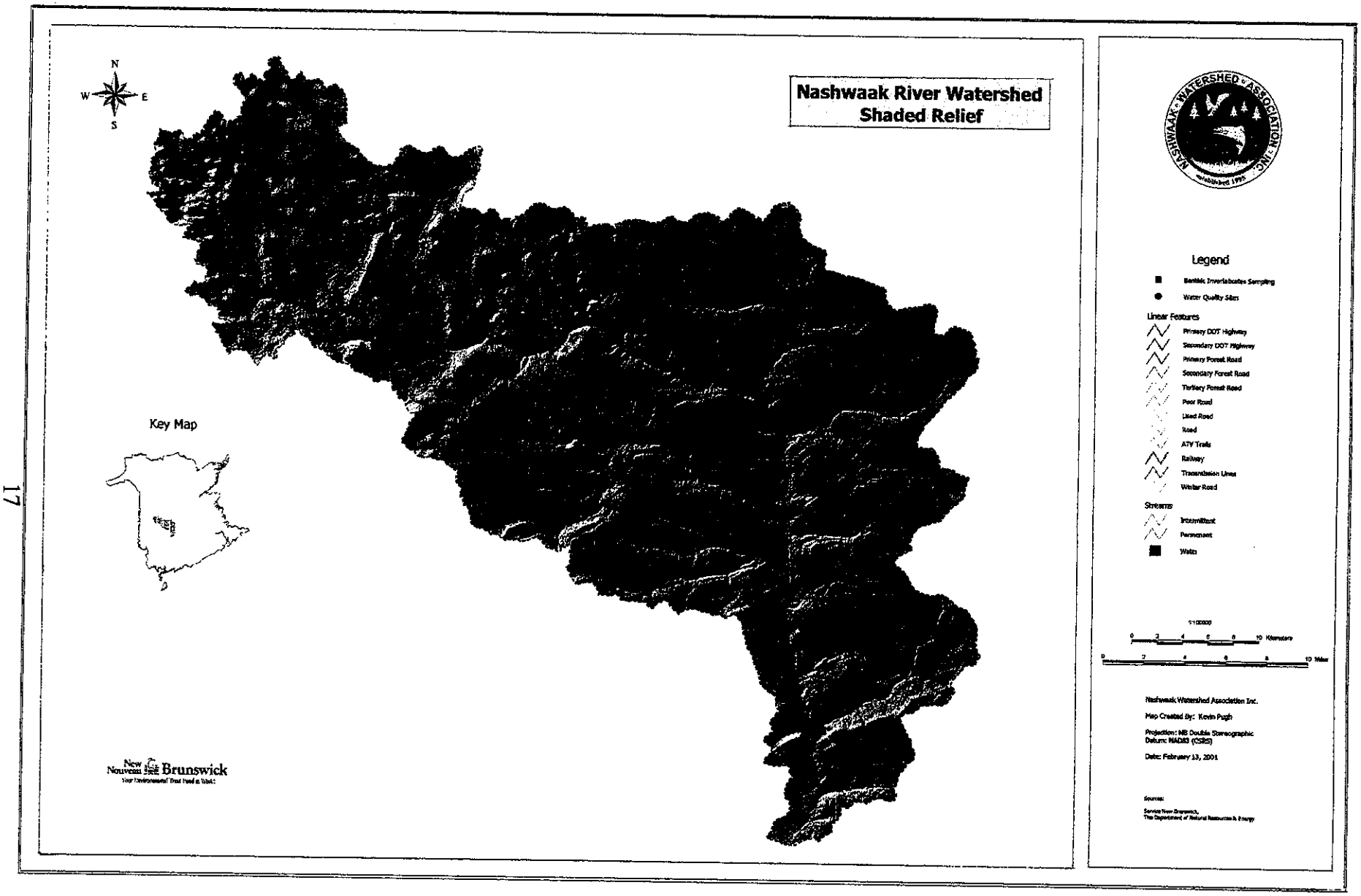
Specific Land Use / Land Cover assessment of the Nashwaak River Watershed



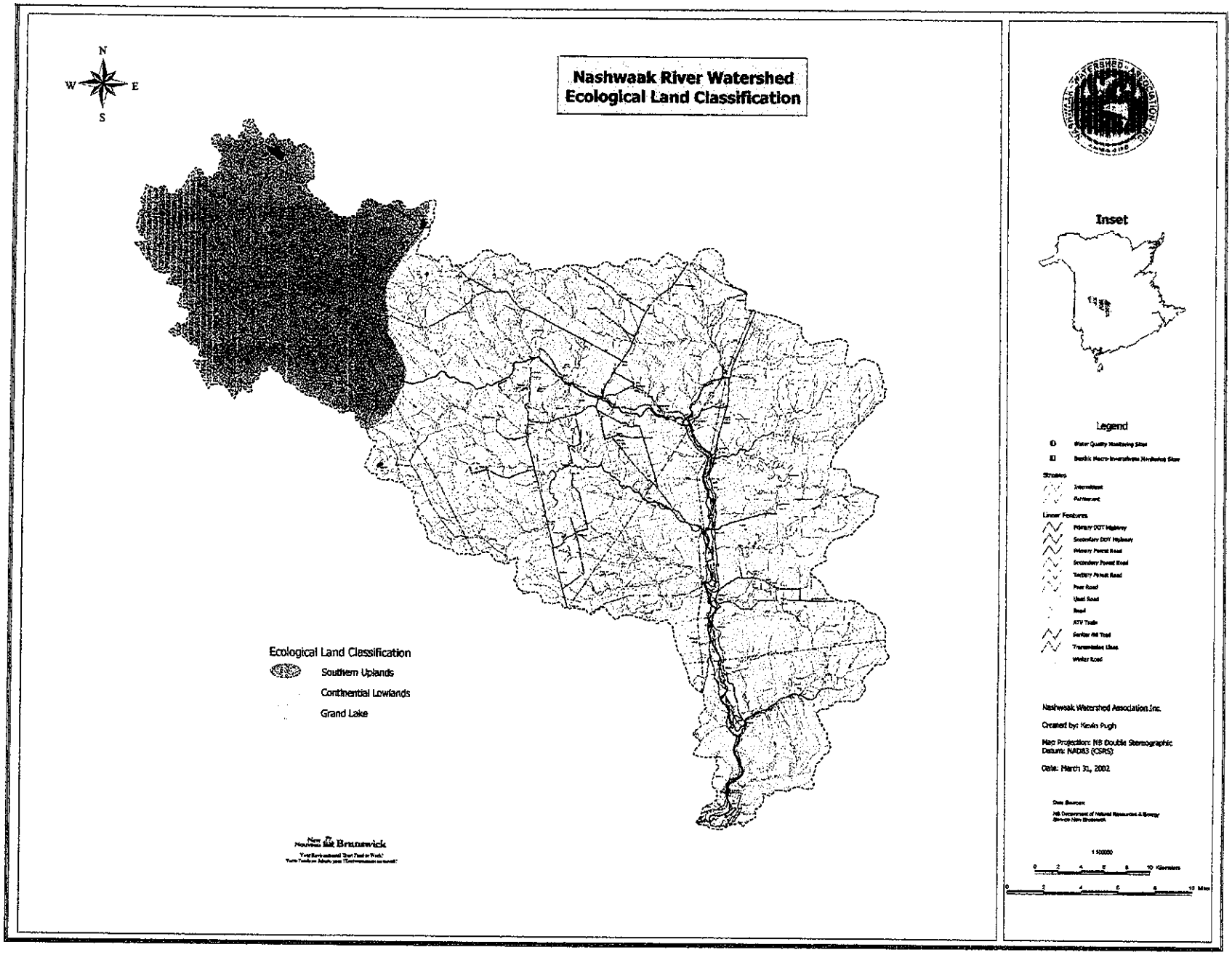
General Land Use / Land Cover assessment of the Nashwaak River Watershed



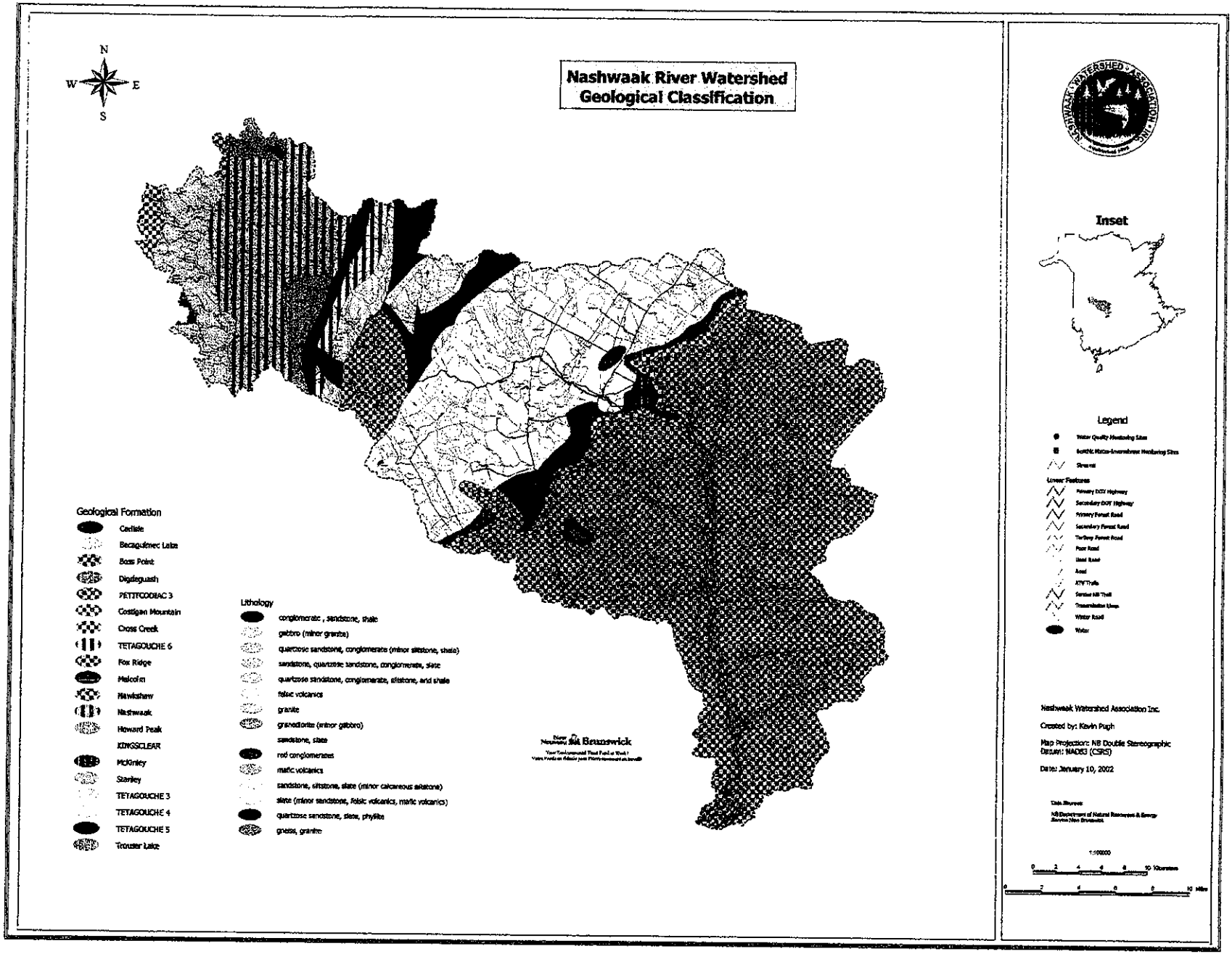
Nashwaak River Watershed and its tributaries



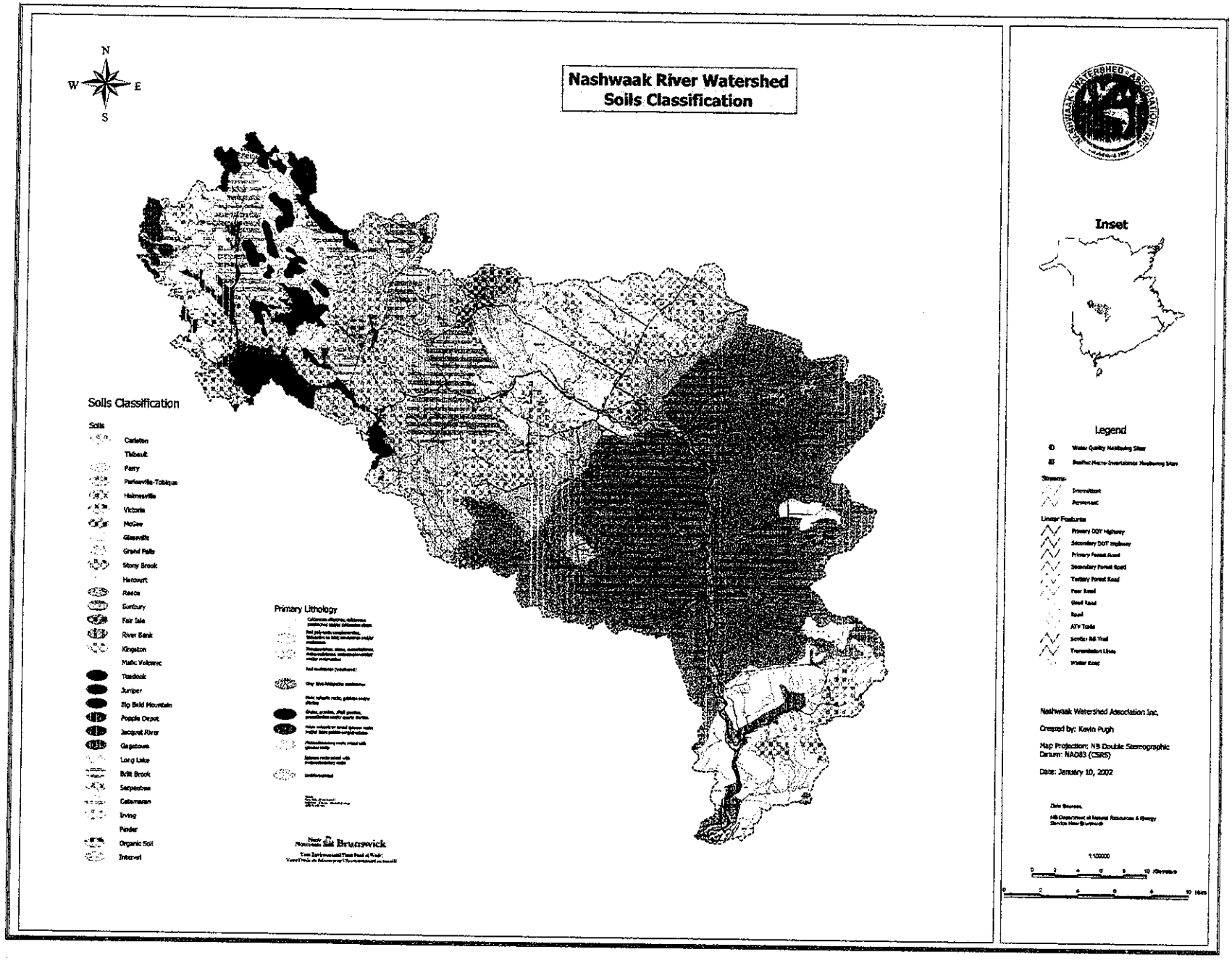
Map showing the shaded relief and topography of the Nashwaak Watershed.



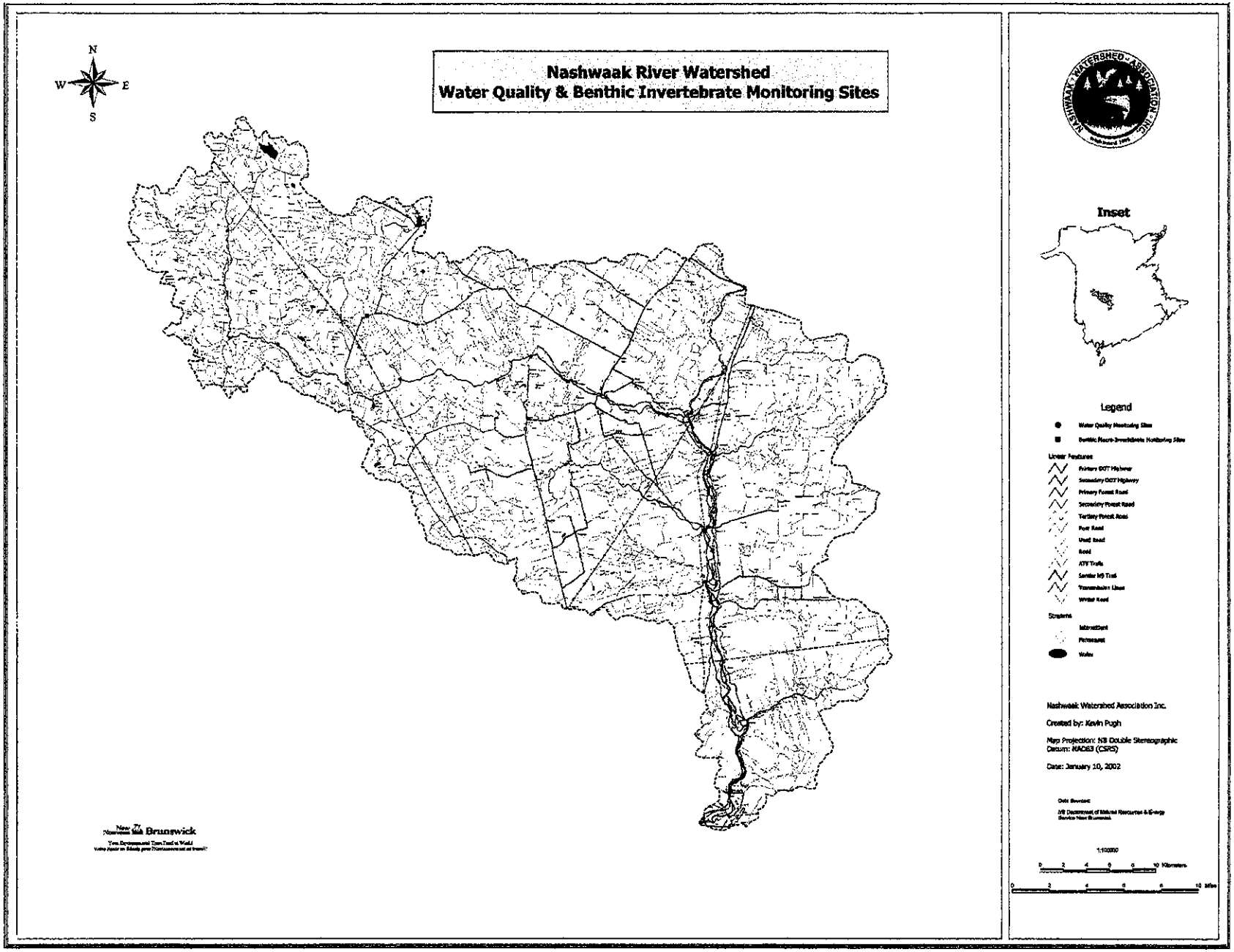
Map of the Eco-Regions of the Nashwaak River Watershed



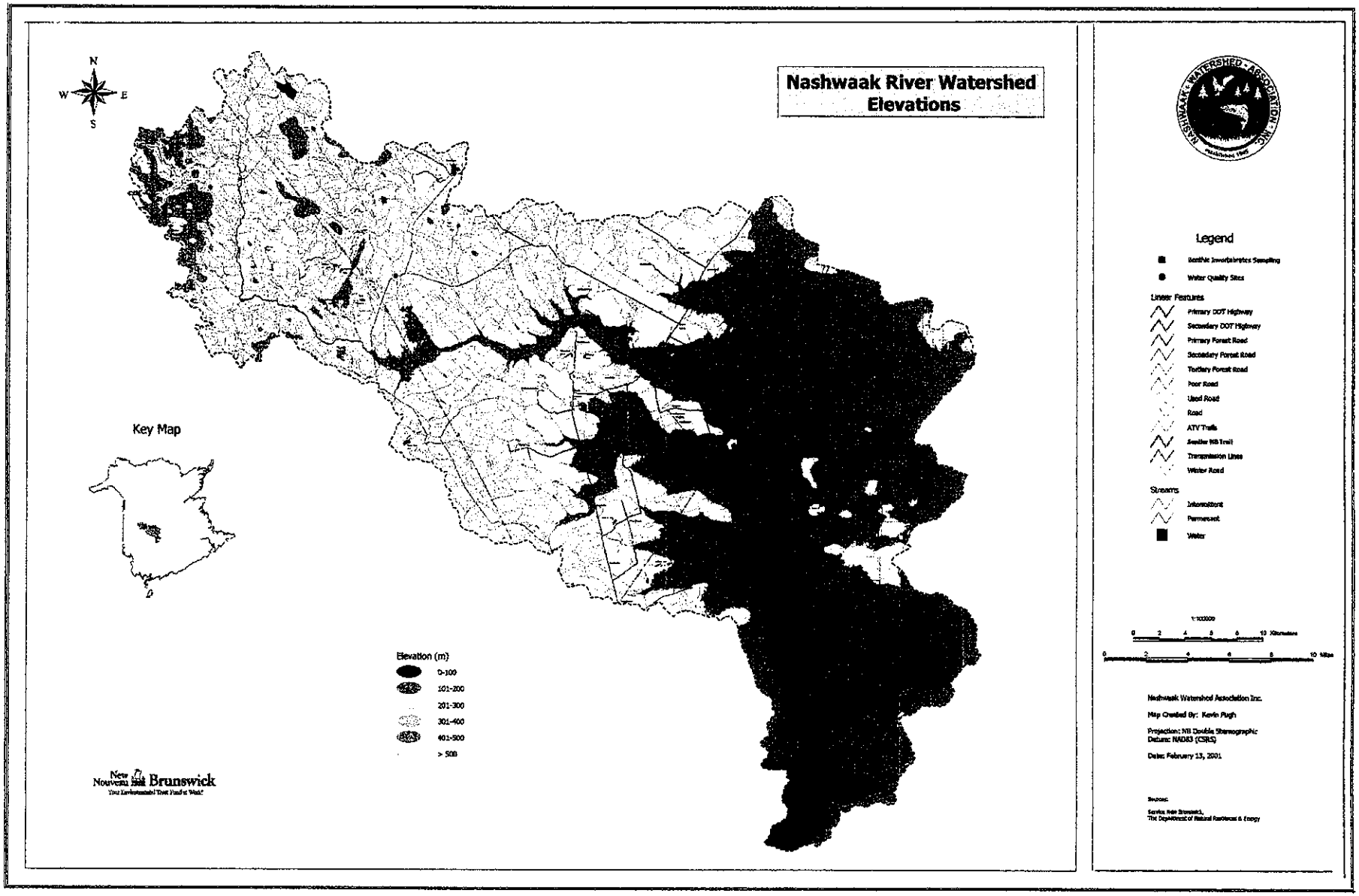
Geological Classification of the Nashwaak River Watershed



Soils Classification of the Nashwaak River Watershed



Water Quality and Benthic Invertebrate Monitoring Sites in the Nashwaak River Watershed



Elevation Map of the Nashwaak River watershed

Appendix II

GIS and Mapping Summary

GIS Layers Obtained	By March 31st, 2002
1. Base Map Layers	
Digital Property Map	✓
2. Watershed Boundary Delineation's:	
Nashwaak Watershed	✓
Sub Watersheds	✓
3. Land/Use Cover	
Land Use – Agricultural	✓
Forest Inventory	✓
4. Other Recommended Data Layers	
Ecological Land Classification	✓
Soils and Geology	✓
Wetlands	✓
Environmentally Significant Areas	
Water Quality Monitoring Sites (2001)	✓
5. Additional Layers	
Provincial Boundary	✓
Contours	✓
Digital Elevation Model (Mass Point Data)	✓
Watercourse Buffers	✓
Hydro graphic and Place Name Annotation (1:125000)	✓
Inoperable Areas	✓
Photo Centre Points	✓
Miscellaneous Point Data	✓

GIS Maps Created		By March 31st, 2002
Standard Map Products		
1. Provincial and Watershed Overview		
		✓
2. Watercourses, stream order, and water quality monitoring sites		
Watercourses	Entire Nashwaak Watershed	✓
	Each Sub-watershed	
Water Quality Monitoring Sites	Entire Nashwaak Watershed	✓
	Each Sub-watershed	
3. Land Use/Cover		
	Entire Nashwaak Watershed	✓
	Each Sub-watershed	
4. Eco-regions		
	Entire Nashwaak Watershed	✓
	Each Sub-watershed	
5. Land Ownership		
	Entire Nashwaak Watershed	✓
	Each Sub-watershed	
6. Provisional Classification		
	Entire Nashwaak Watershed	
	Each Sub-watershed	
7. Soils		
	Entire Nashwaak Watershed	✓
	Each Sub-watershed	
8. Geology		
	Entire Nashwaak Watershed	✓
	Each Sub-watershed	
9. Others		
Shaded Relief Map	Entire Nashwaak Watershed	✓
	Other Sub-watersheds	
Contour Map	Entire Nashwaak Watershed	✓
	Other Sub-watersheds	
Elevation Map	Entire Nashwaak Watershed	✓
	Other Sub-watersheds	

Proposed Layers, Maps and Analysis for Year Two of the Water Classification Project.

GIS Component	Information
Land Use/Cover	Maps will be created displaying the land use/cover and a summarized statistics table for each sub-watershed.
Land Ownership	Maps will be created displaying the property mapping for each sub-watershed.
Provisional Classification	Maps will be created for the entire Nashwaak Watershed displaying a color code representation of the different classes of streams within the Nashwaak Watershed. This information can later be manipulated to conform with any changes that might be made to the provisional classification.
Soils	Maps will be created displaying the soil characteristics for each sub-watershed.
Geology	Maps will be created displaying the geological characteristics for each sub-watershed.
DTM Layer	DTM data (Mass point data for the Nashwaak Watershed) can be used to: - Derive slope data. These layers could be used in conjunction with other existing layers to perform analysis and determine problem areas to be included within the Action items. - Delineate watersheds for tributaries within the sub-watersheds.
Others	Other maps will be created, as they are required.

J. D. IRVING, LIMITED
Woodlands Division

P. O. Box 5777, 300 Union Street, Saint John, New Brunswick, Canada E2L 4M3
Tel: (506) 632-7777 **Fax**: (506) 632-4421 **E-Mail**: brunsdon.blake@jdirving.com

October 9, 2001

Mr. Kevin Pugh
Nashwaak Watershed Association
45 Ward Settlement Road
Stanley, New Brunswick
E6B 1Y9

Dear Mr. Pugh,

We received your letter dated September 20 offering us the invitation to participate on your Association and requesting our permission to access forest covertype information for our freehold land within the Nashwaak Watershed.

I have asked our Manager of Fish and Wildlife, John Gilbert, to consider representing us on your Association. He will contact you to discuss this and we will then make a formal decision in this regard.

We are willing to give NBDNRE permission to provide you with the present FUNA cover (only) for our freehold land on mapsheets within the Nashwaak watershed (only). This information is provided with a clear understanding that it will be used only for the purposes described in your letter of September 20 and that our data will not be published or further distributed without out prior expressed permission. Please signify your agreement with these conditions by signing the agreement below and returning a copy to us. We also need to know who you are working with at NBDNRE to get the data; and we request a list of the specific mapsheets for which you require data. You must not access or utilize our data if you are not in full agreement with our conditions.

Feel free to contact us directly if you have any specific questions or concerns.

Sincerely yours,

J. D. IRVING, LIMITED

Blake Brunsdon
Chief Forester

BB:sm
Copy: John Gilbert

*I, **KEVIN PUGH**, and the Nashwaak Watershed Association Inc. agree to fully abide by the conditions outlined in this letter to access and utilize J. D. Irving, Limited GIS data coverages.*

Signature

Fri Oct 19, 2001
Date

IRVING **J. D. IRVING, LIMITED**
Woodlands Division

P. O. Box 5777, 300 Union Street, Saint John, New Brunswick, Canada E2L 4M3
Tel: (506) 632-7777 **Fax**: (506) 632-4421 **E-Mail**: brunsdon.blake@jdirving.com

Via Fax

October 29, 2001

Mr. Danny Crain
Forest Management Branch
Department of Natural Resources and Energy
P.O. Box 6000
Fredericton, NB E3B 5H1

Dear Mr. Crain

As per the conditions outlined in the attached letter to Kevin Pugh with the Naskwaak Watershed Association, we are willing to allow NBDNRE to release the requested information (only) to Mr. Pugh.

Specifically you may provide Mr. Pugh with the present FUNA cover (only) for our freehold lands on map sheets within the Nashwaak Watershed (only). This includes only the following map sheets:

3940	4040	4140	4245	4346	4445	4549	4647	4750
3941	4044	4144	4246	4347	4446	4550	4648	
3942		4145			4447		4649	
3943							4650	

Please note that any future requests from this group (or any other group) for access to our data must be specifically and prior-approved by J. D. Irving, Limited.

Thank you for respecting the privacy of our data.

Sincerely yours,

J. D. IRVING, LIMITED

Blake Brunsdon
Chief Forester

Attachment:
BB:sm
cc Kevin Pugh
Joe Pelham

ST. ANNE-NACKAWIC PULP COMPANY LTD.
WOODLANDS DIVISION

October 29, 2001

Mr. Kevin B. Pugh
Coordinator/GIS Analyst
Nashwaak Watershed Association Inc.
45 Ward Settlement Road
Stanley, N.B.
E6B 1Y9

Dear Mr. Pugh:

I have been asked by Mr. Rex Brown, Vice President of St. Anne Woodlands, to respond to your letter of September 20, 2001.

St. Anne-Nackawic Pulp Company Ltd. gives the Nashwaak Watershed Association Inc. permission to use the Dept. of Natural Resources & Energy GIS forest inventory data for both our Crown and Freehold lands for your water classification study of the Nashwaak River and its tributaries. St. Anne would appreciate being informed of the progress and results of your quality surveys. Also, St. Anne would definitely like to be involved in the eventual goal setting for water quality of the Nashwaak and its tributaries.

I will be contacting you to further discuss the project.

Regards.

Yours truly,

ST. ANNE-NACKAWIC PULP COMPANY LTD.
WOODLANDS DIVISION

Fred Somerville
Manager Forestry

FS/saj
Cc: Rex Brown

ESTABLISHED IN 1946

MLB Fed. Incorporated 1978

CRABBE

H.J. Crabbe & Sons Ltd.
Quality Lumber Producers

6 Lockharts Mill Rd.
Bristol, NB E7L 2R2
Phone: (506) 392-5563
Fax: (506) 392-6242

December 14, 2001

Nashwaak Watershed Association Inc.
45 Ward Settlement Road
Stanley, NB
E5B 1Y9

Dear Kevin:

This letter is to allow you access to forestry information about H.J. Crabbe & Sons Ltd. freehold GIS information within the area of the Nashwaak Watershed.

Trusting this is satisfactory, I remain.

Sincerely yours,

Donald Crabbe

Crain, Danny (DNRE/MRNE)

From: Pat McCarthy [patmcc@nb.aibn.com]
Sent: Friday, December 14, 2001 10:47 AM
To: Danny Crain
Cc: Stephen Mason
Subject: Bowater Miramichi Freehold

Danny,

We had a request from the Nashwaak Watershed Association inc. for the use of our forest cover type maps of our Boiestown freehold that are part of the Nashwaak watershed. This request was from Mr. Kevin B. Pugh.

We have looked at the request and the maps that would be of use to them are: 4241, 4341, 4441, 4442, 4541 and 4542.

Could you please forward them the necessary information.

Thank you

Pat McCarthy
Operations Superintendent - Miramichi
Bowater Pulp and Paper Canada inc.
Boiestown, NB
Tel 506 369 8889
Fax 506 369 2468
www.bowater.com

New Brunswick Department of Natural Resources and Energy

Digital Map Files

Distribution Agreement

1. General

1.1 The User of the digital files is:

Name: Nashwaak Watershed Assoc.
Address: 45 Ward Settlement Road
Stanley, New Brunswick
E6B 1Y9

1.2 Description of the digital map files:

Format: ArcView Shapefiles
Extent: See attached lists.
forest, cadastral property & provincial geology
Media: CD Rom
Date delivered: Dec 21, 2001

1.3 Description of the use of the digital map files:

Nashwaak Watershed studies.
NOT TO BE REDISTRIBUTED.

2. Ownership

2.1 The New Brunswick Department of Natural Resources and Energy will retain sole ownership and copyright to the digital map files.

2.2 The User shall have the perpetual, non-exclusive right to use the digital map files for the purpose described above in section 1.3, subject however to the restrictions and conditions herein set forth, and in the case of a corporation, this right shall not extend to affiliates of the User as defined in the Business Corporations Act, R.S.N.B. 1973, Chapter B-9.1.

2.3 The User shall have the perpetual, non-exclusive right to create value added products from the digital map files.

2.4 The User may not give, loan, lease, sell, copy, publish, distribute or otherwise make the digital map files available to any other party without negotiating a licensing agreement with the New Brunswick Department of Natural Resources and Energy.

2.5 The User may not give, loan, lease, sell, copy, publish, distribute or otherwise make the digital map files available as part of a value added product to any other party without first negotiating a licensing agreement with the New Brunswick Department of Natural Resources and Energy.

2.6 The User shall not use the digital map files for purposes other than those stated in section 1.3, without first having obtained the written approval of the New Brunswick Department of Natural Resources and Energy.

3. Limited Warranty

3.1 The digital map files are licensed as is, subject to no warranties or representations, either express or implied, and if the media is defective the User may return it within 30 days of the date of delivery and the New Brunswick Department of Natural Resources and Energy shall replace it

at no charge.

3.2 While the digital map files may not be free from error or omission, care has been taken to ensure the best possible quality. The digital map files are a graphical representation of land related features which approximates the size, configuration and location of features. It is not a survey and is not intended to be used for legal descriptions or to calculate exact dimensions or area.

3.3 The New Brunswick Department of Natural Resources and Energy shall not be liable for any loss or damage of any kind including personal injury or death, or economic loss arising from the use of the digital map files or accompanying written materials or from errors, deficiencies or faults therein, whether such damage is caused by negligence or otherwise.

4. Assignment

4.1 This agreement or any rights arising hereunder shall not be assigned by the User either in whole or in part, without the prior written consent of the New Brunswick Department of Natural Resources and Energy.

4.2 If the User undergoes a change in either ownership or organization, this agreement will automatically become null and void, and the license conferred on the User hereunder shall terminate.

5. Entire Agreement

5.1 This Agreement is the entire agreement between the parties and supersedes all previous agreements, arrangements, or understandings between the Parties hereto whether written or oral, in connection with or incidental to the digital map files.

6. Time is of the essence

6.1 Time shall be of the essence of this Agreement.

7. Interpretation

7.1 It is hereby agreed that where the context requires, words in the singular include the plural, and words in the plural include the singular, and words imparting the masculine gender include the feminine and neuter genders.

8. Law of the Contract

8.1 This Agreement shall be governed by and construed in accordance with the laws of the Province of New Brunswick and the laws of Canada applicable in the Province of New Brunswick.

Within 10 business days of receiving this agreement, a signed copy is to be returned and addressed to:

Manager GIS
Information Services and Systems Branch
Department of Natural Resources and Energy
PO Box 6000
Fredericton, NB
E3B 5H1

The above conditions are agreed to:

_____ _____
Signature (user) Date

_____ _____
Signature (user) Date

Appendix III

Precipitation and Discharge Data

CLIMATE DATA

Fredericton

	DATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	Monthly Ave Temps																															
	Total Precip																															
August 1999	MAX *25.0*	28.7	25.1	24.4	25.0	26.5	26.7	23.7	17.5	17.9	22.5	24.3	17.7	26.1	23.1	19.2	26.1	28.5	25.4	24.3	25.6	21.2	23.3	27.5	30.7	31.8	31.2	30.9	27.6	23.8	22.1	26.4
	MIN *12.9*	19.4	10.9	7.2	9.0	15.5	14.8	15.0	11.7	13.8	6.5	6.0	10.2	14.7	19.0	16.2	14.1	13.4	16.2	14.5	7.8	11.6	12.2	13.7	12.4	14.6	15.2	15.6	18.6	18.2	6.1	4.7
	PCPN *45.6*	0.8	0.0	0.0	0.0	1.3	0.8	0.8	22.9	1.8	0.0	0.5	10.0	0.4	0.2 t		0.3	0.0	4.8	0.0	0.0 t		0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
September 1999	MAX *23.7*	29.1	32.0	33.2	29.9	30.4	28.6	27.7	25.7	26.1	25.9	25.1	23.9	26.3	24.6	24.0	16.9	20.0	19.2	21.1	21.4	23.6	15.9	16.7	25.2	15.6	19.5	21.2	22.9	18.4	21.1	
	MIN *11.6*	5.3	7.6	14.5	16.6	15.1	16.9	19.2	20.0	19.5	19.2	21.3	8.2	6.3	5.8	16.5	15.9	14.2	11.7	2.4	4.4	10.0	14.4	13.6	8.6	12.1	3.4	2.9	4.4	9.2	9.1	
	PCPN *271.2*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.3	1.0	0.0	0.0 t		3.4	70.5	10.1	0.0	0.0	0.0	42.9	104.9	17.6 t		10.1	0.0	0.0	0.0	0.0	6.4	
October 1999	MAX *12.3*	18.6	16.8	16.4	6.2	10.3	11.5	8.4	9.7	16.6	16.7	15.2	11.2	15.5	15.9	9.9	14.9	20.4	10.0	6.0	9.0	10.9	10.6	15.5	11.5	5.3	13.2	9.2	6.3	11.9	10.4	16.9
	MIN *1.6*	4.1	3.6	6.4	1.3	1.6	4.2	2.1	-2.8	4.7	1.9	9.8	2.5	-2.6	11.8	0.1	-2.3	12.2	6.3	-1.6	-4.6	4.8	-1.4	6.2		-2.3	-4.8	-0.4	-7.7	-2.8	-5.0	1.3
	PCPN *57.7*	0.0 t		0.5	11.3 t		t		0.0	0.2	2.0	5.7	0.0	0.0	0.3	9.5	0.0	0.0	13.0	6.2	0.0	3.6	0.0 t		5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
November 1999	MAX *8.7*	13.3	17.5	20.8	9.2	10.8	12.5	4.7	2.9	1.9	5.4	-1.1	0.6	5.0	8.2	8.0	2.4	1.2	1.9	8.9	17.0	12.7	13.8	15.9	14.3	14.4	11.6	15.6	7.2	3.0	0.2	
	MIN *-0.2*	3.7	-2.9	12.5	3.8	0.7	4.2	-3.8	-2.1	-9.3	0.1	-6.1	-10.8	-4.1	2.8	5.3	-1.3	-1.3	-7.7	-9.2	0.6	10.1	6.1	8.2	-2.6	6.5	-2.8	3.8	-1.4	-3.4	-6.0	
	PCPN *115.2*	0.0	0.0	29.8	0.0	1.0 t		0.0	0.0	0.3	1.7	0.0	2.3	15.6	20.4	1.0	0.4 t		t	0.0	5.9	1.2	0.5	0.0	1.2	0.0	4.7	29.2	0.0 t		0.0	
October 2000	MAX *13.4*	21.9	20.6	21.4	18.2	13.8	8.7	9.6	12.4	6.2	6.2	9.2	16.7	20.8	17.0	15.9	9.1	8.6	11.2	9.8	14.6	21.0	10.6	10.3	17.3	15.6	20.6	16.9	10.3	5.0	8.1	6.6
	MIN *2.2*	4.4	4.4	6.6	5.2	2.2	5.7	7.4	5.7	-2.0	3.6	1.2	-1.2	2.6	0.1	9.2	-6.9	-7.5	-2.1	8.6	4.0	4.2	4.0	-7.1	-1.8	1.5	0.1	3.1	5.7	0.4	1.9	3.6
	PCPN *89.8*	0.0	0.0	0.0	0.0 t		7.4	0.5	8.6	29.6	3.2 t		0.0	0.0	0.0	0.0	0.0	0.0	13.0	11.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	7.4	0.7	5.4	1.8
July 2001	MAX *25.0*	28.4	19.4	23.7	24.2	23.2	24.0	24.4	22.2	18.0	18.8	23.4	24.5	24.6	23.0	25.1	22.4	21.7	24.1	26.0	29.6	31.3	31.9	31.9	33.4	27.1	21.2	21.6	23.4	25.7	28.4	28.0
	MIN *12.8*	16.7	12.9	5.0	11.3	15.3	15.9	8.3	13.9	15.0	14.0	14.9	14.6	12.0	9.5	10.6	13.2	15.2	14.4	10.5	8.9	13.3	16.5	17.7	18.8	18.2	12.6	6.1	7.6	7.6	12.2	13.0
	PCPN *63.5*	3.3	0.0	0.0	4.4	1.5	2.2	0.0	2.0 T		T	0.0	1.0	0.0	6.6	0.0	7.7	10.6	0.0	0.0	0.0	0.0	7.2	0.0	17.0	0.0	0.0	0.0 t		0.0	0.0	0.0
August 2001	MAX *27.3*	31.1	33.7	29.7	27.8	31.2	34.8	32.9	28.6	32.5	33.0	26.5	29.2	28.3	23.8	28.0	30.1	21.9	22.6	28.9	23.9	21.4	28.6	30.5	23.4	22.7	25.8	18.0	25.4	23.1	23.9	26.4
	MIN *13.5*	12.1	14.1	21.6	15.5	10.9	16.2	19.7	13.1	14.7	19.7	11.8	9.1	14.4	13.6	9.1	9.4	14.7	14.9	13.6	17.3	15.8	17.3	14.7	16.5	2.8	8.1	10.9	16.4	15.9	4.8	8.8
	PCPN *24.1*	0.0	0.0	0.0	0.0	0.0	2.9 T		0.7	0.0	0.0	0.0	0.0 t		0.0	0.0	0.0	2.2 t		0.0	0.5	0.3	0.0	0.7	0.0	0.0	0.0	9.0	6.6	0.0	0.0	1.2
September 2001	MAX *22.1*	20.1	19.8	22.8	22.4	18.9	20.8	28.7	32.2	33.9	29.0	25.2	20.9	24.2	17.3	18.0	22.8	25.7	23.9	20.1	20.8	19.7	21.9	24.7	24.1	20.2	21.2	17.1	15.1	14.1	18.0	
	MIN *8.9*	17.9	8.0	2.9	11.2	14.6	6.3	11.1	13.1	18.0	12.8	18.0	5.4	1.3	4.5	-1.2	4.9	4.9	5.3	1.9	3.9	12.2	16.9	15.5	10.4	8.6	17.1	11.2	8.3	4.0	-0.6	
	PCPN *40.5*	4.4	0.0	0.0	10.4	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 t		16.2	0.3	0.0	0.0	7.6	1.0 T		0.0	0.0	0.0	
October 2001	MAX *15.8*	21.1	22.3	21.3	26.3	18.5	20.4	11.5	11.4	12.6	18.6	24.2	21.4	18.6	19.5	17.6	18.4	17.2	9.5	11.9	15.4	18.5	13.6	12.7	18.1	17.2	11.2	9.4	8.1	10.4	6.2	6.0
	MIN *2.7*	-1.5	1.4	2.9	7.8	8.3	10.4	-0.2	-3.8	-2.7	4.4	2.3	5.9	5.4	8.3	13.4	3.2	5.4	5.7	-2.6	0.9	-0.6	7.6	-4.1	5.5	12.0	2.8	-1.5	-1.9	-6.2	1.0	-5.2
	PCPN *47.2*	0.0	0.0	0.0	0.0	0.0	3.2	0.9 t		t	t	0.0	0.0	0.0	2.0	7.0	23.8	1.8	0.0	0.0	0.0	1.7	0.0	2.3 t		1.0	3.3	0.2	0.0	0.0	0.0 t	

(Modified from Environment Canada)

DISCHARGE DATA (cm/s)

Nashwaak River at Durham Bridge

Month	Date / Ave Monthly Flow	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total
January 1999	*35.0*	16.2	14.5	13	17	23.2	19.8	16	14	16	28	21.5	18	16	13.6	18	40	29	25.5	34	64	47	37	32	38	122	94	74	60	50.2	40	33.5	1120.0
February 1999	*20.3*	28.5	24	27	46	36.2	29	24	20	17.3	14.4	12.3	11.1	20	35	26.5	22	19	16	20.2	17.5	15.5	14.8	12.6	11.8	11.2	11.7	12.7	10.8				587.4
March 1999	*42.2*	14	18	25	22.6	33.6	25.4	20	15.8	12.5	14.7	22	60	43	33	27.8	32	25.9	27.6	22	19	16.3	20	34	63	80.8	76	61.7	68	101	142	132	1350.9
April 1999	*106.2*	102	83.9	75.3	71.3	61.1	63.3	75.7	91.1	132	133	124	125	119	95.3	90.7	92.7	113	154	157	152	146	135	134	119	102	94.8	92.9	90.4	84.9	76.8		3293.4
May 1999	*31.9*	70.4	67.6	62.4	57.1	51.2	45.5	40.7	36.6	33.6	32.9	29.9	26.3	24.1	22.9	21.1	19.6	18.2	16.9	16	21.2	34.5	24.3	18.9	16.6	33.7	41.6	30.1	24	20	17	14.8	1021.6
June 1999	*8.7*	13.8	12.8	12.7	13.1	12.1	11	10.4	10.1	11.2	11	9.5	8.53	7.91	7.41	7.24	7.15	6.78	6.54	6.5	6.36	5.92	5.66	5.75	6.77	8.44	7.21	6.82	6.41	8.16	8.68		270.7
July 1999	*5.9*	7.07	6.28	7.19	6.83	5.83	5.36	5	4.88	5.15	5.46	8.81	10.2	7.7	6.08	5.14	4.45	4	4.11	6.12	5.98	4.93	4.18	3.99	4.32	5.68	9.05	7.84	6.32	5.19	4.39	3.83	187.2
August 1999	*7.0*	3.66	3.54	3.37	3.2	3.3	3.46	3.33	3.83	12.5	9.51	6.35	5.43	5.42	8.75	38.2	20.5	11.8	8.9	8.73	7.58	6.1	5.37	4.94	4.56	4.23	3.82	3.54	3.36	3.3	3.16	2.98	223.7
September 1999	*28.8*	2.81	2.67	2.55	2.44	2.37	2.33	2.35	2.51	3.32	3.48	5.15	15.6	9.48	6.18	4.95	4.62	54.3	103	47	24.7	17.4	30.7	175	132	63.1	41.2	31.5	26.2	23	21.2		891.9
October 1999	*35.6*	20.3	19	17.2	16.9	20	24.2	21.8	18.5	17.5	23.6	25.6	28	21.8	48.3	150	78.3	54.2	49.8	48.5	39.6	36.1	33.9	36	53.2	40.5	32.9	29.6	26.9	25.3	23.7	22.7	1139.5
November 1999	*50.3*	22	20.7	26.2	134	79.4	53.7	43.5	37.4	32.8	31.2	28.9	24.3	25.5	30.4	136	113	70.8	51.7	41.3	41	48.3	52.1	43.3	38	36	33.4	40.7	75	55.2	42.5		1558.6
December 1999	*51.6*	35	33.2	31.3	29	28.2	28.1	45.1	265	150	93.1	114	122	93.1	76	62.6	53.6	51.7	38	29	26	34.9	33.6	24	18	16	14.3	13	11.9	10.9	10	9.4	1651.6
																																Total	**13296.5**
																																Days	**366**
																																Ave	**36.3293**
January 2000	*16.5*	8.5	8	9.5	12	19	34	28	24	21	19.5	23	27	22.3	20.5	19	17.5	15.9	14.9	13.5	12.5	11.9	11.5	10.5	10	12	14	16	15	14.3	13.9	13.4	512.1
February 2000	*11.3*	12.8	12.2	11.9	11.6	11	10.5	10.2	9.8	9.5	9.3	8.86	8.5	8.2	9.5	11.5	10.5	10	9.3	8.7	8.3	7.9	7.3	7.6	8.3	9.3	10.1	13	21	42			328.66
March 2000	*63.5*	90	100	75	65	54	47	39	34	30	38	44	52	56	52	46	42	39	35	32.5	30	28	26	30	33	40	51.4	64.7	83.2	207	219	185	1967.8
April 2000	*141.9*	158	139	188	238	342	253	183	145	202	404	198	137	110	90.6	88.4	88.2	76.4	63.2	56.4	52.9	51.2	51	157	205	156	108	89.9	83.6	72.5	68.8		4256.1
May 2000	*45.3*	64.6	55.7	49.1	43.8	40.4	37.7	37.5	47.1	42.3	43.8	48.4	89.3	61.1	48.3	44	37.9	33.8	33.6	90.1	63.7	44.9	37.9	34	32.1	40.8	48.6	39.2	33.2	29.3	26.9	24.6	1403.7
June 2000	*15.0*	22.6	20.9	21.9	21.2	18.6	17	18.1	21.7	20.9	21.5	18.1	16.6	14.8	13.5	12.5	12.1	11.4	10.5	9.7	9.1	8.84	10.7	13.3	13.1	10.4	11.8	12.2	9.92	8.65	10.1	24.6	466.31
July 2000	*12.4*	15.3	12.5	9.64	8.97	30.5	23.9	15.1	15.8	15.9	12.8	11.1	10.1	9.21	8.32	7.78	7.59	9.59	13.9	13.6	12.2	9.38	9.13	21.7	20.1	13.1	10	8.5	7.73	7.32	6.89	6.44	384.09
August 2000	*7.3*	6.01	5.77	5.85	6.62	9.21	6.87	6.01	6.24	6.87	10.1	10.4	8.3	6.72	5.88	5.58	5.61	5.86	6.03	5.68	5.49	10.5	9.49	7.29	8.62	15	10.5	7.93	6.69	5.8	5.2	5.35	227.47
September 2000	*6.6*	6.46	5.78	5.61	5.46	5.36	5.2	4.67	4.29	4.03	3.81	3.67	3.6	3.79	4.18	4.24	6.24	12.2	8.24	6.26	5.31	4.9	4.83	4.68	6.13	22.3	14.4	9.75	8.24	7.54	6.64		197.81
October 2000	*9.2*	6.03	5.59	5.3	5.12	4.84	4.76	5.13	5.77	9.37	13.3	19.5	16.8	13.3	10.5	8.97	7.97	7.23	6.92	8.5	16.8	14.7	11.2	9.3	8.3	7.79	7.4	7.07	6.92	7.58	8.72	13.5	284.18
November 2000	*15.6*	18.1	16.5	14.2	12.2	10.8	11.5	15	13.5	11.7	10.6	9.93	9.61	9.21	9.18	14.3	43.8	29.3	21.1	17.2	14.4	14.1	13.4	11.5	10.7	10.4	10.1	15.8	18	28.5	23.5		468.13
December 2000	*26.3*	20.3	16.6	11	9.9	9	8.2	7.6	7	6.6	6.1	5.8	10	16.4	14.4	12.3	10.4	16	26	85	74	64	55	50	45	41	37	34	32	29.5	28	26	814.1
																																Total	**11310.5**
																																Days	**367**
																																Ave	**30.8187**
January 2001																																	
February 2001																																	
March 2001																																	
April 2001																																	
May 2001																																	
June 2001																																	
July 2001	*7.3*		11.0	8.4	7.3	7.3	8.3	8.3	7.6	7.1	7.1	7.3	7.7	8.1	7.4	6.9	6.8	8.2	13.3	11.8	8.3	6.6	5.9	6.7	6.9	6.2	5.6	4.9	4.5	4.6	4.5	4.1	218.6
August 2001	*3.0*	3.8	3.5	3.3	3.1	3.3	3.3	2.9	2.7	2.5	2.5	2.8	2.5	2.4	2.3	2.3	2.2	2.1	2.6	2.6	2.6	2.9	3.6	3.6	3.2	2.8	2.6	3.1	3.8	4.4	4.5	3.8	89.7
September 2001	*5.7*	9.4	17.8	9.7	6.3	5.9	7.3	6.0	4.6	3.9	3.4	3.4	3.2	2.8	2.6	2.4	2.3	2.3	2.2	2.1	2.0	2.2	3.9	4.5	4.0	3.4	9.0	18.8	11.3	7.8	5.9		161.0
October 2001	*6.8*	4.8	4.3	3.9	3.7	3.4	3.4	3.8	4.0	3.9	3.7	3.5	3.4	3.2	3.1	3.5	3.9	8.0	15.1	10.7	8.1	6.8	6.2	6.4	7.4	11.6	15.9	17.5	12.9	10.0	8.4		199.7
November 2001																																	
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APPENDIX IV

Table of Parameters – CCME Guidelines

Summary of parameters included in New Brunswick Water Classification water quality assessments. Unless otherwise noted, the Canada Guidelines cited are the Canadian Environmental Quality Guidelines for the Protection of Aquatic Life.

PARAMETER (table abbreviation)	DESCRIPTION	CANADA GUIDELINE	PROPOSED NB STANDARD	WATER-RELATED BACKGROUND
Alkalinity, Grans (Alk-G)	Indicates water's ability to neutralize acid. Stated as an equivalent value of calcium carbonate in mg/l.			30-500 mg/l is generally acceptable. 2-10 mg/l shows sensitivity to acidification.
Aluminium (Al)	The most abundant metal in the earth's crust. An essential trace element for life processes, toxic to fish at higher levels.	5 g/l at pH 6.5 100 g/l at pH>6.5		
Ammonia (NH_3)	A nitrogen/hydrogen form generated by plant and animal excretions; manufactured in inorganic form for use in fertilizers and cleaners. It affects oxygen transport in blood and is toxic to fish at low levels.	Varies with temperature and pH, generally 1370 - 2200 g/l		Generally <100 g/l in surface waters
Antimony (Sb)	A brittle, inert metal often found with lead, silver and copper deposits. Used in compounds ranging from metal alloys to medicines.			
Arsenic (As)	A semi-metallic element found naturally in the common mineral arsenopyrite. A by-product of smelting; used in industrial processes. Accumulates in the body. Some forms are quite toxic.	50 g/l		Typically 0-10 g/l in surface waters
Bacteria, *E. coli* (EC)	One of the fecal coliform bacteria most commonly used as an indicator of sewage pollution. Listed as the most probable number (MPN) in 100ml water. N.B. standard is a geometric mean of a minimum of 5 samples in a 30 day period.	For swimming waters, a mean of <200 MPN for 5 samples in a 3 day period and <400 MPN for any one sample; no guideline is set for aquatic life	Class AP: no *e.coli*. Class 0, AL & A: as naturally occurs. Class B: <200. Class C: <400. Class B & C (tidal shellfish areas): < 14.	

PARAMETER (table abbreviation)	DESCRIPTION	CANADA GUIDELINE	PROPOSED NB STANDARD	WATER-RELATED BACKGROUND
Cadmium (Cd)	A soft metal found in association with metallic ores. Used in batteries, electroplating and solder. Toxic above trace levels; accumulates in the body.	0.017 g/l		Typically 0.1-10 g/l in natural surface waters
Calcium, dissolved (Ca-D)	An alkaline-earth metal vital for bone development and muscle function. It and magnesium primarily determine water hardness.			< 15 mg/l is common in this region's surface waters. Can be up to 100 mg/l, even higher in tidal waters.
Carbon, total organic (TOC)	Organic carbon is required for most biological processes. This indicates the amount of organic (plant and animal) matter in the water: it will deplete waterborne oxygen as it decays.			General range is 1-30 mg/l but < 10 mg/l is typical in higher quality waters
Chloride (Cl)	Major inorganic ion; with sodium forms common salt. Essential for life in trace amounts. As chlorine or chloride, used commonly in road salting, water and sewage disinfection and bleaches.			Generally <10mg/l in freshwaters
Chlorophyll A (ChlA)	Green pigment found in plants; can be used to estimate the amount of plant life in the water.			Generally < 4 mg/l in unproductive, nutrient-poor waters; 10-100 ug/l in very productive or enriched lakes
Chromium (Cr)	A metal used extensively to harden and plate other metals. Used by the body in its trivalent form to metabolize fats and carbohydrates; toxic in other forms	8.9 g/l for trivalent chromium, 1 g/l for other forms		Generally ranges 0-17 g/l in surface waters

PARAMETER (table abbreviation)	DESCRIPTION	CANADA GUIDELINE	PROPOSED NB STANDARD	WATER-RELATED BACKGROUND
Clarity (Secchi)	An index of how far light penetrates into the water; measured as the maximum depth at which a 25cm diameter 'secchi' disk with black and white quadrants can be seen in the water.	For recreation, >1.2m viewing depth when measured without a viewing scope; no guideline for aquatic life		Decrease in secchi reading may indicate increased suspended matter; this often occurs at lake turnover in spring and fall and during algae blooms
Color, Apparent (Clra)	Color given to water by dissolved matter, suspended particles and light, measured on a color band scale.	Mean value not significantly less than that to be expected for those waters on a seasonal basis		Varies significantly. Decaying vegetation, tree bark and other organic matter color water naturally
Conductivity (Cond)	Ability to carry an electrical current, helpful in determining the amount of dissolved matter in water.			Normal range 10-50 usie/cm in NB waters . Groundwater often higher than surface water.
Copper (Cu)	A metal essential, in trace amounts, to blood cell formation, nerves and the immune system; toxic above trace levels. Used in manufacturing metals and in fungicides and pesticides.	From 2 g/l at a water hardness of 0-120mg/l to 4 g/l at a hardness of > 180mg/l		Generally less than 50 g/l in surface waters
Fluoride (F)	A compound of the gas fluorine and oxygen. In trace amounts it aids bone and tooth formation; toxic in higher amounts. Often added to drinking water to prevent dental cavities.			Usually found in surface waters in a range of 0-2 mg/l
Hardness (Hard)	A measure of the calcium, magnesium and other divalent ions in water, expressed in calcium carbonate equivalent in mg/l. Increased hardness can decrease metal toxicities and acidity but increase mineral deposits.			Varies from 0-30 mg/l in very soft water to >180 mg/l in very hard water

PARAMETER (table abbreviation)	DESCRIPTION	CANADA GUIDELINE	PROPOSED NB STANDARD	WATER-RELATED BACKGROUND
Iron (Fe)	A metal, the fourth most common element on earth. Essential in forming haemoglobin (the oxygen-carrying blood pigment), also present in enzymes and proteins. Interferes with insect and fish reproduction and respiration.	300 g/l		Usually less than 500 g/l in surface waters
Lead (Pb)	A metal; its resistance to corrosion led to its extensive use in plumbing, paint and batteries until it was found to have a cumulative toxic effect on humans.	1 g/l - 7 g/l, depending on water hardness		Typically 0-40 g/l in natural surface waters
Macro-invertebrates, benthic	Bottom-dwelling aquatic insects and other invertebrate animals large enough to be visible. The types and numbers of these are a good indicator of water characteristics over time.		As naturally occur in New Brunswick waters	Profiles are being developed which relate the macro-invertebrates found to various water quality types.
Magnesium (Mg)	A metal involved in bone growth and nerve and muscle function. Forms the core of the plant photosynthesis compound, chlorophyll. With calcium, primarily determines water hardness.			Normal range is 1-100 mg/l in surface waters
Manganese (Mn)	A metal involved in bone growth and energy production. May be essential to vitamin B1 utilization.			Usually >0.2mg/l in surface waters
Nickel (Ni)	A metal used extensively in alloys, it occurs naturally in trace amounts in foods and may be needed for human health. However it accumulates in the food chains of aquatic species, with some toxic effects.	Ranges from 25 g/l at a water hardness of 1-60 mg/l to 150 g/l at a hardness of >180 mg/l		Generally 15-20 g/l in surface waters

PARAMETER (table abbreviation)	DESCRIPTION	CANADA GUIDELINE	PROPOSED NB STANDARD	WATER-RELATED BACKGROUND
Nitrite (NO_2)	A transitory form of oxidized nitrogen produced by bacteria in nature, also found in industrial and sewage effluents. Toxic to humans and others above low levels.	60 g/l		Usually < 1 g/l in surface waters
Nitrate (NO_3)	The most common, stable form of nitrogen in surface waters. A product of natural nitrogen-fixing cycles and rock leaching, also found in sewage, industrial discharges and fertilizer runoff.			0.1-5 mg/l common in surface water; may be 100 mg/l or more in water affected by groundwater, sewage or fertilizers.
Nitrate + Nitrite (NO_x)	The combined inorganic forms of oxidized nitrogen. A major nutrient source for aquatic plants but can be toxic to fish at higher levels.			0.1-5 mg/l common in surface water; higher in water influenced by groundwater, sewage or fertilizer runoff.
Nitrogen, total Kjeldahl (TKN)	Nitrogen is the earth's most common gas and a key building block of many compounds. It is measured here as the sum of the organic forms of nitrogen and ammonia.			Commonly 0.1-0.5 mg/l in surface waters
Oxygen, dissolved (DO)	Oxygen is one of earth's most versatile and abundant elements. Dissolved in water, it is used for respiration by most aquatic life. Dissolved oxygen levels are affected by temperature and aeration: cold or standing water generally have lower levels. Often measured in parts per million (ppm): 1ppm = 1 mg/l.	5.5-6mg/l for warm-water species; 6.5-9 mg/l for coldwater species: higher values for early life stages	*for cold-water species*: 9.5ppm (early stages), 6.5ppm (other stages) *for warm-water species:* 6.0ppm (early stages), 5.0ppm (other stages), *in estuarine waters:* 80% saturation	Generally 4-10ppm in surface waters
pH (pH)	A measure of acidity/alkalinity based upon hydrogen ion concentration. A value of 7 is neutral; lower is acidic and higher is alkaline	6.5 - 9.0 for aquatic life, 6.5-8.5 for contact recreation		Natural freshwaters range pH4-9. A pH of 6.0-7.5 is most common in this region

PARAMETER (table abbreviation)	DESCRIPTION	CANADA GUIDELINE	PROPOSED NB STANDARD	WATER-RELATED BACKGROUND
Phosphorus, total (TP-L)	A non-metallic element common in in-organic and organic forms. An essential plant nutrient and key biological building block; stimulates plant growth. Used commonly in fertilizers, cleaners and water conditioners.			Should be 25 g/l in lakes and reservoirs to prevent excess algae growth, generally 10 g/l in rivers
Potassium (K)	An alkali metal essential for function of nerves, muscles and vital organs.			Generally < 10mg/l, rarely as high as 20mg/l
Sodium (Na)	A major alkali metal and important inorganic ion. With other elements, it forms salts widely used in households, industry and road maintenance. Helps regulate body fluid balance and blood pressure.			1 mg/l -100,000 mg/l is common in surface waters
Solids, total suspended (TSS) or (SS)	Measure of the solid particles, organic and inorganic, that can be filtered from the water.	For clear waters 25mg/l above background for short term, 5mg/l for long-term. 10% change if background is >100mg/l		
Sulphate (SO_4)	An oxidized form of sulphur; comes naturally from rock leaching and biological processes. Used in some industrial processes.			5-5000 mg/l is found in surface waters
Temperature (Temp)	A measure of heat energy. Affects water's ability to hold dissolved oxygen and the respiration rate of most aquatic organisms	Varies, to keep changes within the tolerance range of the aquatic species present		Summer range of 18-25°C is common for lake surface waters; annual range of 0-25 °C is typical for all waters

PARAMETER (table abbreviation)	DESCRIPTION	CANADA GUIDELINE	PROPOSED NB STANDARD	WATER-RELATED BACKGROUND
Turbidity (Turb)	A measure of water clarity resulting from particles in the water (silt, algae, etc). Measured in nephelometric turbidity units (NTU).	For clear waters 8 NTU above background for short term, 2NTU for longer term. For turbid waters 10% change.		Can range 0.1-1000 NTU in natural waters, but is typically 0.1-5 NTU
Zinc (Zn)	A natural metal used in many alloys (ex: brass, bronze, galvanized steel). Essential to immune system and cell development in trace amounts; toxic to aquatic life at higher levels.	<30 g/l		Typically <50 g/l in natural surface waters.

Units of measure:
mg/l: milligrams per liter. g/l: micrograms per liter (1000 micrograms = 1 milligram). ppm: parts per million.

Primary references:
Canadian Council of Ministers of the Environment. 1999. Canadian Environmental Quality Guidelines. Canadian Council of Ministers of the Environment, Winnipeg, Man.
R.N. McNeely, V.P. Neimanis and L. Dwyer. 1979. Water Quality Sourcebook: A Guide to Water Quality Parameters. Environment Canada, Ottawa, Ont.

Appendix V

List of Water Quality Monitoring Volunteers

Water Quality Monitoring:

Gary Spencer
Bill Gammon
Peter DeMarsh
Andre Boutot
Kim Hargrove
June Allen
Greg Dodds
Jim Fraser
Don Clark
Susan Merritt

Appendix VI

Volunteers Guide to Water Quality Monitoring

Province of New Brunswick
Department of the Environment and Local Government

Volunteer's Guide to Water Quality Monitoring

Version T2000-1

July 2000

New Nouveau Brunswick

"Your Environmental Trust Fund at Work"

ACKNOWLEDGEMENTS

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The Environmental Planning and Sciences Division gratefully acknowledges the diligent efforts of the many volunteers with whom they have worked over the years whose experiences and contributions provided the framework for this manual.

The efforts put forth by the Analytical Services Laboratory and the Environment Integrated System (ENVI) team to accommodate the extra analyses and data are recognized as being an invaluable contribution to all volunteer monitoring projects.

PREFACE

This manual was written as a guide for volunteer monitors for surface water projects such as a baseline watershed assessment. The use of this document along with training provided by the New Brunswick Department of the Environment and Local Government (NBDELG) will ensure that all samples collected result in accurate, reliable data.

The Volunteer's Guide to Water Quality Monitoring will be continually updated to accommodate new chapters to cover additional topics. Upcoming chapters include lake sampling methodologies and benthic invertebrate sampling. Comments and suggestions are invited.

TABLE OF CONTENTS

INTRODUCTION

Traditionally, government agencies, researchers, environmental consultants, or corporate personnel have carried out water quality monitoring in New Brunswick. Limited government resources combined with an increase in awareness and concern for environmental issues by the general public has resulted in the development of community-based watershed groups, along with other interest groups, and their participation in programs such as water quality monitoring.

Watershed management is an on-going process of planning and implementation of practices and goals to protect and manage the various uses of land and water within a drainage basin.

Programs such as watershed management that engage the community and promote cooperation among stakeholders are often more successful than those carried out wholly by government. Volunteers and other interested stakeholders participate in all aspects of the programs from planning sessions to collection of land use information and water sample collection.

Outreach and Partnering, a new initiative, has been developed by NBDELG (New Brunswick Department of the Environment and Local Government), with the goal of working cooperatively with community and other stakeholder groups. The purpose of the initiative is to assist these groups with baseline assessments of watersheds leading to long-term management strategies.

Filling a bottle with water from a river may seem like an easy task, but the need for high quality data in a baseline assessment program cannot be overstated. Preparation and training are required to collect samples in a variety of different conditions to accurately reflect the water quality at a particular site and to preserve the sample during handling and transportation to the laboratory. Subtle deviations may influence results that will be used in decision making at the watershed level. An accepted procedure must be followed with care each time.

The Volunteer's Guide to Water Quality Monitoring includes sections that describe important considerations for planning and preparation for a water quality survey, and procedures to carry out the sample collection, preservation, handling, and submission for analysis.

The procedures described in this manual refer to grab samples, which are single water samples taken at a specified location, depth, and time. Data from grab samples represents a picture of the conditions at a point in the watercourse at the

WATER QUALITY

How is Water Quality Measured?

Water quality is quantified by measuring the levels of various chemical, biological, and physical parameters of a sample or series of samples and comparing them to established standards and guidelines. Many factors, both natural and human induced, will influence the level of these parameters in a water body.

The interpretation of water quality data depends upon the use (drinking water, recreation, aquatic life, etc.) of the watercourse in question. There are water quality objectives to protect and sustain water for each use. The objectives are expressed as limits or levels of parameters. The parameter levels for the protection of aquatic life may be different than those for drinking water or other uses, and management strategies should reflect this.

If a substance is present at a concentration outside the suggested guideline, effects may begin to occur. Effects can reach a point where the water is no longer suitable for a particular use.

NBDELG compares water quality data with the limits that are found in the Canadian Environmental Quality Guidelines (CEQG). These guidelines were revised in 1999 by the Canadian Council of Ministers of the Environment (CCME). The CEQG includes guidelines for water, air, sediment, soil, and tissue.

The guidelines for the various uses of water are referred to as Canadian Water Quality Guidelines (CWQG).

Canadian Water Quality Guidelines exist for the following uses of water:

- For the Protection of Aquatic Life
- For the Protection of Agricultural Water Uses
- Community Water Supplies - for Drinking Water
- Recreational Water Quality and Aesthetics

The guidelines are nationally derived, generally stringent, and designed to protect the quality of the water for these uses. Conditions that vary from location to location can often naturally modify levels of parameters. This should be taken into consideration when using the guidelines. For example, in New Brunswick, because of the abundance of aluminum in the bedrock and soils, the levels of aluminum in water samples often exceed the guideline limit.

WATER QUALITY SAMPLING

Things to Think about Beforehand

When to survey

The climate in New Brunswick is responsible for dramatic seasonal changes in the quality and quantity of the surface water. To obtain a complete picture of water quality, the seasonal fluctuations should be reflected in the monitoring schedule. In general, a maximum of 5 or 6 sampling events between early spring and late fall should be scheduled depending on available resources.

Site Selection

Selection of sampling sites must be carried out cooperatively with a representative of the watershed group and NBDELG staff. The site selection process considers the various conditions found in each watershed.

Visual Assessment

Before the field season begins every year, it is a good idea to do a visual assessment of the watershed. Changes or new activities in the land within the watershed boundaries should be noted. The location of the sample sites should be visited and verified with a representative from NBDELG.

Volunteer Support

Volunteer groups are key resources in watershed assessments and other programs throughout government. Recruiting volunteers and establishing a watershed group is a time-consuming process but the end result is very rewarding. Recruiting can be accomplished by advertising in stores, churches, and community newspapers. Door-to-door canvassing is a good way to meet community members and discuss their individual concerns.

Activities that volunteers participate in for a baseline assessment project usually consist of collecting water samples, taking field measurements, making field and general observations, and gathering land use and other environmental information from the sample station.

There are many benefits to involving volunteers in these activities including the following:

preservation and sample handling techniques. Part of the session requires that they collect a sample from the river. Trained volunteers are then certified to collect water samples for the NBDELG for a period of one year. Their names will be recorded in a database of certified sample collectors. Re-training volunteers every year plays an important role in ensuring that the proper techniques are practiced, resulting in high quality samples and data.

Laboratory Loading

Most sampling programs take place in the spring, summer, and fall. Many laboratories can only accept a limited number of samples in order to maintain proper storage and analysis protocols. Scheduling of sampling events must be done with NBDELG representatives to ensure the laboratory can accommodate the proposed sampling dates.

Sample Quality

The NBDELG Quality Assurance Plan will ensure that the data and information resulting from water sampling activities are credible and accurate. The plan contains strategies for field sampling techniques, sampling audits and data management.

Taking time to use this manual and completing a training session will help to ensure that the samples collected are representative of the water quality at the sampling location.

- Make sure that you are visible in the woods, especially during hunting season.

Some safety equipment that you may want to include on your sampling trip is listed below:

First aid kit
Lifejackets
Hunter orange vest
Latex or rubber gloves
Cellular phone
Change of clothing

Preparation

The following points should be considered well before the sampling event:

Sample Shipment Considerations

Samples must be delivered to the lab in time to avoid sample degradation. Make arrangements to ensure that a NBDELG representative will be able to meet someone from your group at the lab if they will be arriving after normal business hours. If the samples are shipped from the watershed to the NBDELG lab, make arrangements ahead of time for a member of your group to meet all volunteer sampling teams, pick up the samples, and deliver them to the drop off location for shipment. Ensure that they will be picked up at the other end and delivered to the lab before sample degradation can occur.

Site locations and contacts

All volunteers must be well aware of the exact station locations and possible accessibility problems. They should also be advised of any property owners that must be contacted in advance of the sampling event.

Travel plans

Consult station location maps and design travel plans to accommodate remote locations. Ensure that there will be sufficient time or other means to transport samples to a designated place in order to pool all samples collected and transport them to the lab in sufficient time to avoid degradation.

Tidal Influences

If the sampling locations are influenced by tides, plan the time for sample collection to be in advance of low tide so that the water is flowing towards the mouth at the time of sampling. This will ensure that the sample collected will reflect the freshwater of the watercourse rather than salt water being carried in by tidal action.

Equipment

The following is a suggested list of the equipment for surface water sampling projects:

- field book or field observation data sheet
- a road map and a station location map
- a list and description of the proposed sample sites and travel plan
- sampling procedure
- pens, and permanent markers
- the appropriate number of clean, suitably sized sample bottles with lids (provided by NBDELG)
- storage to transport the samples (coolers)
- ice - crushed or cubed
- properly calibrated instruments for field measurements
- a wristwatch
- extra clothing
- tap water for washing hands
- drinking water
- a backpack for carrying sample bottles

- Date and time of sample collection, and the parameters for analysis.
- NBDELG field number and the station name. For example 87-00-675 - Nepisiguit River at Highway 430. This may be written on the field data sheets ahead of time. Be sure that the field number and station name on the data sheet corresponds to the field number on the sample bottles.

- Results of field measurements and on-site analysis.

- Information about QC samples, if taken.

2. Field observations that must be recorded include any condition either natural or man-made that may influence the sample. Examples of relevant observations include:

- Significant changes in water level.

- Any changes in the condition of the banks or riparian zone. Examples include vegetation removal, or bank slumping.

- The appearance of surface runoff or seeps.

- Any new land developments adjacent to the watercourse in the vicinity of the site.

- Observations about weather conditions during sampling. Include any events that may influence the water quality such as a recent heavy rain or a prolonged dry spell along with general observations including cloud cover and temperature.

3. Sample observations should include anything unusual about the water itself. Examples are:

- Occurrences of dead fish, foam, odours, unusual colours, debris, turbulence, or barriers, natural or man-made.

- Presence of a pollutant, new or routine for the site.

- Presence of suspended sediment or surface matter.

deep to wade in safely at all times of the year. In larger rivers, wade into the river only as far as safety permits.

- Take the sample from moving water. This will ensure that the water represents the water from upstream in the channel and that it is mixed. Do not collect water from still areas, back waters, eddies or waters immediately downstream from any natural or man-made obstruction.

Take time to familiarize yourself with the following steps while preparing for and carrying out water sampling:

1. **Label the appropriate field number and analysis required on dry sample bottles with a permanent marker. This can be done before arriving at the sample collection site. Be sure that the field number on the sample bottles matches the field number on the data sheets that have been assigned to the site for that day.**

2. **Do not enter the watercourse at a point downstream from any instream activity such as swimming, fishing or boating. Enter the watercourse carefully to minimize bottom disturbance and move in an upstream direction. Carry the bottles, with lids on, in a knapsack or some other carrying bag that enables you to have two free hands during sampling.**

3. **Always stand with the water flowing towards you so that any bottom disturbance resulting from your movements will be carried away from you and not into the sample bottle.**

4. **Carefully remove the cap from one sample bottle. Do not rinse the bottles. Inorganic sample bottles are pre-cleaned and the bacteria bottles have been sterilized. To avoid sampling surface debris, immerse the bottle so that the opening is approximately 6 inches below the surface whenever possible. Do not disturb the bottom sediments. The opening of the bottle should always be facing upstream. Fill the bacteria bottles first. They should be filled only to the line indicated on the bottle. Other sample bottles should be filled completely. Once the bottle is full, remove it and tightly cap it.**

Sample Submission

The watershed group coordinator will be responsible for making certain that the sample submission sheets are filled out with the proper documentation. The coordinator must also arrange sample shipment to the lab, and make sure that a NBDELG representative will be able to receive the samples and submit them to the lab for analysis.

DATA MANAGEMENT

When the samples have been analysed and quality assured the information will be downloaded from the Laboratory Information System to ENVI, the Environment Integrated System. ENVI is a computer-based data management system that stores all the environmental monitoring results for NBDELG.

A Quality Assurance technician at NBDELG is responsible for making sure that all sample information has been properly entered and that a complete set of results arrives from the lab for each sample. During the field season, from the time the samples are submitted until this process is complete, can take one to two months.

The technician tabulates the data and forwards a report to the coordinator of each watershed group as soon as the results have been checked for errors, verified, and quality assured.

GLOSSARY OF TERMS

absorb - to take in another substance completely

adsorb - to take up and hold another substance on the surface

anthropogenic - caused or influenced by the activities of humans

aquatic life - plant or animal species that live all or part of their lives in the aquatic environment , such as fish, amphibians, and aquatic invertebrates

baseline assessment - of a watershed is a characterization of background water quality supplemented by land use information including point and non-point source information

benthic - pertaining to the bottom (bed) of rivers or streams

bioaccumulate - increase in concentration of chemicals or metals within living things such as fish due to the absorption and retention of chemical. Substances can bioaccumulate in one organism over time if intake is greater than excretion. In addition, bioaccumulation increases in the food chain. For example, toxins will be higher in fish than in the surrounding water, and will be highest in the top predators such as gulls

bioavailable - the portion of a substance that is readily absorbed or ingested by living organisms

bog - a wet, spongy swamp made of decaying peat moss and other vegetation

calibrate - to ensure the correct reading of an instrument by: measuring a known quantity or concentration of a substance, and adjusting the reading of the instrument to reflect this quantity or concentration

contaminant - any substance added to natural water that changes its composition but is not necessarily harmful to living organisms

humic - organic material formed from the decomposition of plant and animal matter

invertebrates - animals lacking a backbone including insects. Macroinvertebrates are those that can be seen with the naked eye

All activities that occur on the land and in the water within the boundaries have potential to impact the entire watershed including the downstream waters

watershed management - includes plans and objectives for activities occurring within the watershed boundaries. Activities may be forestry, agricultural, residential, industrial, water usage, or recreational

Tidal action causes an influx of water upstream past the head of tide leading to dramatic increases in water levels. This phenomena is prevalent in many rivers that drain into the Bay of Fundy, where the tides are the highest recorded in the world. Increased erosive action impacts on riparian habitat and subsequent influences on the water quality will result as an effect of the repeated fluctuation of water in the river channels.

Many of the air masses that move across the province are marine air masses, enriched in chemicals associated with salt water such as chlorides, sodium, sulfates, and magnesium. These chemicals will affect the chemistry of the rainfall and may subsequently influence the surface water. Elevated levels of sulphate, for example, have been observed at varying distances from the ocean.

2. Water Flow - Water flow, often referred to as discharge, is the volume of water moving past a fixed point in a watercourse over a definite period of time. It is expressed in units of m^3/sec (cubic metres per second). Flow is a function of both water volume and velocity, and affected by climate, topography (slope), and human activities. Watercourse alterations such as water withdrawal for irrigation or industrial processes, or operation of a dam, can alter water flow.

   If the volume of water in a river channel increases for any reason, the velocity will increase, and the resulting flow will have more energy. This increased energy may result in increased erosion and transport of sediment that may stay suspended for longer periods of time.

   Both high and low water flows can significantly affect water quality.

3. Wetland Areas - Many areas in New Brunswick contain a significant number of wetlands, bogs or marshes. Drainage from these areas is very slow and the water often contains high levels of dissolved organic matter that may naturally be acidic with a pH of less than 7, and brownish in colour. When bacteria decomposes organic material, the water is depleted of dissolved oxygen and organic acids are produced. As a result of these natural processes, samples collected from water that drains from or through a bog will have low pH and DO (dissolved oxygen) values.

   Wetlands can improve water quality by acting as natural filters for sediment, removing it from flowing water. The unique chemical environment in bogs and wetlands may remove contaminants from industrial effluents. Wetlands may also buffer the effects of high and low flows by holding water during high flows and releasing it during low flows.

in the summer and warmer in the winter, have higher conductivity values, and may contain higher levels of dissolved ions than surface water.

8. Point Sources of Pollution - Point sources are effluents that discharge directly from a pipe or other localized origin often resulting from industrial, commercial or domestic activities. Levels of contaminants are specified in approvals issued under the Water Quality Regulation with conditions designed not to negatively impact the water quality for a particular use (usually aquatic life and recreation). The levels of some parameters will be still be influenced to a certain degree either by direct addition or from reactions resulting from the effluent.

9. Non-point Sources of Pollution - Non-point sources of pollution are a result of broad based, activities such as forestry, agriculture, or land clearing. Pollutants from these sources are generally carried to the watercourse by surface runoff and can include sediment, pesticides, herbicides, hydrocarbons, bacteria, metals, and salts.

10. Barriers or Impoundments - When the natural flow of a watercourse is impeded with a barrier and a pond is formed, the chemical and physical characteristics of the impounded water changes. The normal downstream movement of the water is interrupted allowing substances entering the impounded area more time to accumulate.

11. Riparian Zone Habitat - The riparian zone is the area of land immediately adjacent to a watercourse. Vegetation growing in the riparian zone provides shade, preventing the sunlight from shining directly into the water. This effect reduces the temperature of the water, allowing more oxygen to dissolve and remain in the water to be used by aquatic life. Vegetation growing on the banks of a watercourse stabilizes the soil with its root system reducing erosion and deposition of sediment into the watercourse. Riparian zones provide corridors for wildlife movement and contribute food in the form of leaf litter for aquatic animals. More importantly, they can act as buffers for the watercourse and inputs from the land outside the riparian zone. If significant portions of the riparian habitat are removed as a result of clear cutting, road building, or lawn creation, infiltration of rainfall will be reduced, increasing runoff and eroded particles entering the watercourse.

12. Soils - As water flows through soils on the banks, channel bottom, floodplain or as runoff on the land within the watershed, it will dissolve some constituents and erode and transport others into the watercourse. The watercourse may be

FIELD DATA FOR _____

Station Name: _____

NBDELG Field Number: _____

Date: _____ Time: _____

Sample Collected by: _____

Weather Observations: _____

_____

_____

Sample Observations: _____

_____

_____

_____

_____

Field Observations: _____

_____

_____

_____

_____

_____

Other Observations: _____

_____

_____

_____

_____

Temperature: _____ DO: _____

PARAMETER	SOURCES	GUIDELINES	ENVIRONMENTAL SIGNIFICANCE
Turbidity Turbidity – is a measure of water cloudiness. It is determined by measuring the amount of light scattered by tiny suspended particles with a meter. The reading indicates how much the particles decrease the passage of light through water. Units for turbidity are NTU's (nephelometric turbidity units) if a nephelometer is used.	Sources include particles in the size range of .004mm (clay) to 1.0 mm (sand) that are suspended in the water. Increases in turbidity may be the result of soil erosion, waste discharge, algae growth, runoff from logging, agricultural, or construction activities. Periods of heavy rain will increase the runoff and erosion processes.	CWQG limits for Aquatic Life – when background levels are 8 to 80 NTU's, short term (~24 hours) increases of less than 8 NTU's are acceptable. If background levels are > 80 NTU's the increase should be <10% of background. Long term (~30 days) changes of < 2 NTU's are acceptable. CWQG limits for Recreational Water – Increases of < 5 are acceptable where background levels are <50 NTU.	Suspended particles can clog fish gills or blanket the stream bottom, smothering eggs or benthic macroinvertebrates. Higher concentrations of particles will lead to a decreased concentration of dissolved oxygen in the water by causing an increase in the temperature of the water, and blocking the sunlight that penetrates the water thereby decreasing the photosynthesis process normally carried out by aquatic plants.
Suspended Solids (SS) Suspended Solids (SS) – refers to the solid particles that are retained on a piece of filter paper after filtering a water sample. Units for SS are mg/l.	Suspended solids may be soil particles, organic or inorganic materials, plankton or other organisms. High values may result from erosion of bedrock, banks or channel bottoms, runoff from forestry or construction activities. High water and increased flow rates will accelerate these processes.	CWQG limits for Aquatic Life – During periods of clear flow, anthropogenic activities should not increase the concentration of SS over background by more than 25 mg/l for short-term exposure period and 5 mg/l for long term exposure. During high flow periods, when background levels of SS are between 25 mg/l and 250 mg/l, the increase should be <25 mg/l. If background levels of SS are > 250 mg/l, increases should be < 10% of background.	Sediment in rivers can be detrimental to fish, fish eggs, and aquatic invertebrates. Fine sediments can blanket the stream bottom, reducing the amount of natural spawning substrate. Phosphate often enters the water by attaching to eroded particles. Increased levels can lead to algal blooms and decreased DO. Toxins, such as pesticides and some metals, may cling to suspended particles increasing their levels in areas of high suspended sediments. Some of these toxins can bioaccumulate in the food chain.

PARAMETER	SOURCES	GUIDELINES	ENVIRONMENTAL SIGNIFICANCE
E.Coli (Escherichia coli) *E. coli* (*Escherichia coli*) is the most predominant fecal coliform. It is specific to humans and other warm-blooded animals. It is used as an indicator of fecal contamination. *E. coli* in water samples is usually measured in MPN (most probable number) per 100 ml.	*E. coli* may enter a watercourse directly via sewage discharge or be carried in by surface runoff from a manure pile adjacent to a river. Heavy or continuous rain will increase the amount of surface runoff and may temporarily increase the levels of *E. coli* in a river.	Water used as drinking water must have no detectable *E. coli* organisms. There is no guideline limit for *E. coli* for the protection of aquatic life. The CWQG limit for recreational water is stated as follows: The geometric mean of at least 5 samples taken over a period not to exceed 30 days should not exceed 200 MPN/ 100ml.	In recreational waters, the presence of *E. coli* does not always represent a significant health hazard. *E. coli* is regarded as an indicator of the possible presence of disease-causing microorganisms that originate in the digestive tracts of humans and animals. High levels indicate a possible health risk. In baseline watershed assessments, measurements of *E. coli* are used as general indicators of water quality. The presence of E. coli indicates a recent fecal contamination and therefore poses a possible health risk. A decline in water quality may also result in the form of unpleasant odours, turbid water and depleted dissolved oxygen. Note: Interpretation of results of *E. coli* testing is difficult as they are living organisms. Within a sample, there will be bacteria in various stages of survival ranging from healthy, injured or stressed, to near dead or dead. Survival of the bacteria is temperature and time dependent. Cooling the samples, keeping them cool until they reach the lab, and ensuring that the analysis is carried out within the 30-hour limit is extremely important to obtain accurate results.

PARAMETER	SOURCES	GUIDELINES	ENVIRONMENTAL SIGNIFICANCE
As (Arsenic)			
As (Arsenic) is a grey metal found in surface waters in low (2 µg/l) concentrations. As is expressed in µg/l.	As goes through chemical changes in the water occurring as different oxides, or it may be adsorbed by suspended sediments or attach itself to humic material and clays.	The CWQG limit for the protection of aquatic life is 5 µg/l (.005 mg/l).	As can accumulate in tissue to a certain extent and can be toxic to fish, other aquatic life, and mammals.
Cd (Cadmium)			
Cd (Cadmium) occurs in surface water in trace amounts as chlorides, nitrates, sulfates, carbonates, hydroxides, organic or inorganic complexes, or sorbed onto suspended particles. It is expressed in units of µg/l.	Cd results from the combustion of fossil fuels. As a result, atmospheric fallout can be a source for surface water. A large source is effluent from smelting operations. Other sources include refinery effluents, electroplating operations, Ni-Cd batteries, paint, fungicides and herbicides.	The interim proposed guideline (CWQG) is 0.017 µg/l. Higher concentrations might be tolerated in harder water.	Cd can accumulate and is highly toxic to mammals. Toxicity effects on aquatic species vary with species and time of exposure.
Cu (Copper)			
Cu (Copper) occurs in surface waters associated with suspended sediments or as phosphates, carbonates, sulfates, or hydroxides. It is expressed as µg/l.	Industrial inputs result from the corrosion of Cu pipes, use of aquatic algaecides, fungicides and pesticides, and industrial effluents including coal burning, mining, smelting, and refining. Natural sources only constitute a small percentage of the surface water's source, but they include the weathering of Cu minerals or native Cu	The toxicity of Cu varies with water hardness. The CWQG limits for aquatic life are as follows: Hardness (mg/l) Limit 0 to 120 2 µg/l Cu 120 to 180 3 µg/l Cu >180 4 µg/l Cu	Cu is a micronutrient and essential to plants and animals. In relatively small quantities, it can be toxic to aquatic life. Cu can easily attach onto carbonate and clay minerals, and organic matter.

Cr (level has been lowered)

trivalent
for Cr_3 8.9 µg/L
ppb

Cr_6 1.0 ug/L
ppb

PARAMETER	SOURCES	GUIDELINES	ENVIRONMENTAL SIGNIFICANCE
Ca (Calcium) Mg (Magnesium), Na(Sodium), K (Potassium) Ca (Calcium) Mg (Magnesium)are alkali earth metals, and Na(Sodium), K (Potassium) are alkali metals. They are expressed in mg/l.	These metals are abundant in the earth's crust and their presence in surface waters results primarily from natural sources. K is found in surface waters in lower concentrations (<20 mg/l), because it doesn't stay dissolved in water after leaching but forms new compounds. Fresh water concentrations of the other metals are usually: Ca <15 mg/l (but can be up to 100 mg/l if the water is in contact with carbonate bedrock); Mg - 1 to 100 mg/l, Na - 1 to 200 mg/l.	There are no guideline limits for these metals.	Ca appears to be virtually harmless to all organisms and may even reduce the toxicity of some chemical compounds to fish. The hardness of water is influenced to a large degree by the sum of Ca^{2+} and $Mg.^{2+}$ The other ions that contribute to hardness are usually not present in significant quantities in natural surface waters. Higher concentrations of these metals may indicate a higher percentage of groundwater in the flow. Na and K are usually higher in seawater.
Cond (conductivity) Conductance is the ability of water to conduct an electrical current. Conductivity is the conductance for a unit length of solution, usually expressed as µsie/cm. Cond is controlled by the amount of dissolved ions such as Cl- (chloride), NO_3- (nitrate), SO_4= (sulfate), PO_4^{3}-(phosphate), Na+ (sodium), Ca^{2}+ (calcium) among others. Sometimes dissolved gases will contribute to the Cond. Cond and TDS are related and can be correlated if the solutions being compared contain the same ions.	The ions in watercourses originate from minerals and constituents in bedrock and soils that are dissolved in water. The high concentration of ions in salt water that mixes with fresh water as a result of tidal action will result in higher conductivities. Some discharges such as sewage, industrial, mining or acid runoff will increase conductivity. Increases in temperature will result in an increase in Cond. Generally, a increase of 2% will result from an increase of 1 degree C.	There are no guideline limits for conductivity. Watercourses that are not subject to influences by tidal waters will have fairly constant values for conductivity, therefore, fluctuations in readings may indicate that the watercourse has been impacted in some way.	Inputs of dissolved ions such as metals or Cl^{-}, NO_3^{2-}, PO_4^{3-} into water from sewage would increase cond, whereas additions of hydrocarbons or alcohol would decrease the conductivity because of their low conductivities. Groundwater usually has a higher conductivity than surface water and, in winter and dry summer periods when the proportion of groundwater contributing to the surface flow is high, a sample collected from the surface water may have a higher conductivity.

PARAMETER	SOURCES	GUIDELINES	ENVIRONMENTAL SIGNIFICANCE
TOC (total organic carbon)			
TOC (total organic carbon) is generally made up from humic substances, and partly degraded plant and animal materials. TOC is expressed as a concentration, mg/l.	Sources include plant and animal material, runoff from agricultural land, and municipal and industrial waste.	There is no guideline limit. The range for natural surface water is from 1 to 30 mg/l. High quality water would have values of < 10 mg/l.	Excessive levels can deplete the water of dissolved oxygen through the decomposition process.
Alk (Alkalinity)			
Alk (Alkalinity) measures the ability of water to neutralize an acid. Compounds responsible for increasing the alkalinity in water are chiefly carbonates, bicarbonates, and hydroxides; and to a lesser degree: borates, silicates, phosphates, and some organic compounds. Alkalinity is expressed in units of mg/l of $CaCO_3$. $CaCO_3$ is quoted for standard reference purposes despite the fact that other constituents are present in the sample contributing to the alkalinity. It is determined by measuring the amount of acid added to a volume of sample to reach a specified pH.	Compounds contributing to the alkalinity in water originate from the natural erosion of bedrock and soils.	No guidelines exist for alkalinity but ideally, levels should remain close to background levels to avoid impacts on aquatic life.	The alkalinity of a water body is important to know because it quantifies the ability of water to resist changes in pH that may result from acidic pollution. If the water has a higher alkalinity, addition of acidic solution will not cause a change in pH. With no alkalinity, the addition of acid would cause a drop in pH. Aquatic life is very sensitive to acidic pH values and to fluctuations in pH values. Alkalinity can be used to determine lake acidification status. Lakes with zero alkalinity are considered acidified. Lakes with 0 to 10 mg/l alkalinity may be considered to be in transition.

PARAMETER

DO (dissolved oxygen)

DO (dissolved oxygen) is the gas, O_2, dissolved in water. Expressed as ppm or mg/l. The amount of O_2 dissolved in water depends upon:
temperature - oxygen dissolves more readily in colder water,
flow - more O_2 will enter faster flowing water from the atmosphere than in slower, stagnant waters.
the amount of dissolved or suspended solids - it will dissolve more readily in water with low levels of dissolved solids, therefore, salty water will have lower DO values than fresh water.
ice cover - ice cover inhibits aeration of the water, and reduced sunlight penetration causes plants to die or become dormant reducing the amount of oxygen produced by photosynthesis.
altitude - oxygen will dissolve more readily at low altitudes.
aquatic plants - plants produce oxygen as a by-product of photosynthesis and this process occurs during the day with the sun. The amount of DO may reach a maximum in the late afternoon and a minimum in the early morning as a result of fluctuations in sunlight. If there is an abundance of aquatic plants, the DO may reach

PARAMETER (cont'd)

levels of supersaturation in the late afternoon on sunny days.

biological processes -respiration
Plants and other aquatic life take oxygen from the water for the process of respiration.

turbulence - turbulence caused by rocks, wind and/or water flowing over a rough bottom mixes more oxygen into the water resulting in higher levels of DO.

SOURCES

The major sources of dissolved oxygen are the atmosphere (20.9 % O_2), and photosynthesis by aquatic plants.

GUIDELINES

The CWQG guidelines for aquatic life are as follows:
For warm water biota: early life stages - 6.0 ppm; other life stages - 5.5 ppm
For cold water biota: early life stages - 9.5 ppm; other life stages - 6.5 ppm

ENVIRONMENTAL SIGNIFICANCE

Some fish and aquatic organisms can live in water with low DO, and other species may recover from a short period of low DO conditions but for many aquatic species, prolonged exposure to low DO conditions will result in suffocation.

ENVIRONMENTAL SIGNIFICANCE

Sufficient DO is one of the fundamental requirements for a healthy aquatic system. Almost all aquatic life and plants need dissolved oxygen to live and flourish. Adult fish and fish eggs and larvae can suffocate if subjected to low DO conditions. Respiration by aquatic plants and animals use DO from the water. DO levels in a watercourse will vary naturally but human activity may lead to depletion and threaten aquatic life. The major cause for severe depletion of DO from a watercourse is the microbial decomposition of excess organic matter. Sources of organic substances that lead to DO depletion include: industrial effluents, deforestation practices, agricultural drainage, and sewage discharges. Nutrient loading that produces excessive plant growth followed by decomposition can also lead to depletion of DO.
Any activity or natural process that leads to a decreased water flow may increase the water temperature enough to drive the DO out of the water. Some industrial effluents or cooling waters may also increase the temperature of the water.

Hardness

Water hardness is influenced by the presence of Ca, Mg, Fe, Al, and Mn, but is generally determined by the sum of Ca and Mg. It is expressed as an equivalent of $CaCO_3$ in mg/l.

The hardness of water will influence its ability to produce lather from soap. Softer water produces lather more easily than harder water.

Hardness may also influence the toxicity of certain metals in fresh water. The metals can be present in higher concentrations in harder water without having toxic effects on aquatic life. (see Pb, Ni, Cu)

The degree of hardness may be expressed numerically.

Hardness as $CaCO_3$ in mg/l.	Degree of Hardness
0 to 30	very soft
31 to 60	soft
61 to 120	moderately soft
121 to 180	hard
>180	very hard

1064.18 $81.05

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Appendix VII

Tabulation of Water Quality Data

August 1999

Station	Barkers Point	Marysville	Penniac	Penniac Str	Durham Br	Dunbar	Tay River	Taymouth	Above Youngs	Cross Creek-Above Rd Br	McGlaggon	Currieburg
FromDate	1999/08/25	1999/08/25	1999/08/25	1999/08/25	1999/08/25	1999/08/25	1999/08/25	1999/08/25	1999/08/25	1999/08/25	1999/08/25	1999/08/25
Al (mg/L)	0.05	0.047	0.044	0.084	0.034	0.024	0.016	0.033	0.029	0.047	0.052	0.05
ALK_T (mg/L)	20.7	20.5	21.1	18	21.9	17	36	17.6	17.5	16.1	15.2	12.7
As (µg/L)	1	1	1	1	1	1	1	1	1	1	1	1.06
Ca (mg/L)	7.83	7.78	7.13	5.68	6.97	5	12.4	6.66	7.1	5.57	6.24	4.44
Cd (µg/L)	0.1	0.147	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cl (mg/L)	4.93	4.44	4.59	4	3.36	1.77	2.86	3.94	2.49	2.18	2.11	0.832
CLRA (TCU)	40	30	30	40	30	15	10	30	30	40	40	40
COND (µSIE/cm)	68	67.7	67.4	60.5	67.7	54	94.5	60.8	55.8	50.7	49.8	40
Cr (µg/L)	2	1.9	2	1.8	1.9	1.7	3.2	1.9	1.7	1.4	1.4	1
Cu (µg/L)	0.6	1.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5
DO (mg/L) Client-fld												
E_coli-MPN (MPN/100ml)	10	190	120	290	30	10	120	20	10	20	20	10
F (mg/L)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Fe (mg/L)	0.3	0.15	0.14	0.35	0.07	0.07	0.05	0.08	0.07	0.06	0.08	0.08
HARD (mg/L)	24.4	24.2	22.2	17.6	21.9	17.4	36.2	21	22.2	17.4	19.6	14.1
K (mg/L)	0.479	0.525	0.472	0.449	0.426	0.418	0.559	0.426	0.4	0.404	0.387	0.384
Mg (mg/L)	1.18	1.16	1.07	0.82	1.09	1.19	1.28	1.07	1.09	0.85	0.98	0.74
Mn (mg/L)	0.083	0.024	0.036	0.028	0.014	0.0063	0.013	0.02	0.011	0.01	0.0097	0.0074
Na (mg/L)	4.43	4.49	4.12	5.26	3.68	2.92	3.55	3.69	3.14	2.62	2.89	1.93
NH3T (mg/L)	0.012	0.01	0.024	0.015	0.011	0.01	0.016	0.017	0.022	0.019	0.01	0.012
Ni (µg/L)	5	5	5	5	5	5	5	5	5	5	5	5
NO2 (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
NO3 (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.09	0.05	0.05	0.05	0.05	0.05
NOX (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.09	0.05	0.05	0.05	0.05	0.05
Pb (µg/L)	1	1	1	1	1	1	1	1	1	1	1	1
PH (pH) Client-fld												
PH (pH)	7.08	7.18	7.11	7.17	7.26	7.22	7.34	7.14	7.22	7.34	7.32	7.22
Sb (µg/L)	1	1	1	1	1	1	1	1	1	1	1	1
SO4 (mg/L)	4.15	4.18	4.58	4.12	3.74	3.9	6.33	4.2	4.03	3.67	3.45	3.23
SS (mg/L)	15	15	15	15	15	15	15	15	15	15	15	15
TDS (mg/L)	36.18	35.425	35.17	31.919	32.852	25.826	49.163	31.007	29.188	25.399	25.674	19.641
TEMP (Celsius) Client-fld												
TKN (mg/L)	0.28	0.23	0.23	0.26	0.24	0.2	0.2	0.2	0.2	0.22	0.25	0.22
TOC (mg/L)	6.58	6.06	5.86	5.29	5.02	2.74	2.3	5.34	5.38	6.02	5.93	6.07
TP-L (mg/L)	0.014	0.019	0.01	0.02	0.012	0.009	0.007	0.008	0.01	0.009	0.008	0.008
TURB (NTU)	1.2	0.4	0.5	1.2	0.3	0.2	0.2	0.3	0.1	0.1	0.2	0.1
Zn (µg/L)	5	5	5	5	5	5	5	5	5.3	5	32	5

September 1999

Station	Barkers Point	Marysville	Penniac	Penniac Str	Durham Br	Dunbar	Tay River	Taymouth	Above Youngs	Cross Cr - Nash R above Mouth - temp	McGlaggon	Currieburg	Napadogan-Mouth	Narrows	South Sisters	Gorby Gulch	Arnold Br - DISC	McBean - Nash R below Mouth - DISC
FromDate	1999/10/03	1999/10/03	1999/10/03	1999/10/03	1999/10/03	999/10/03	1999/10/03	1999/10/03	1999/10/03	1999/10/03	1999/10/03	1999/10/03	1999/09/29	1999/09/29	1999/09/29	1999/09/29	1999/09/29	1999/09/29
Al (mg/L)	0.077	0.072	0.074	0.133	0.062	0.071	0.035	0.069	0.065	0.07	0.078	0.093	0.108	0.137	0.122	0.138	0.072	0.193
ALK T (mg/L)	12.9	12.7	13.2	3.09	14.2	3.02	24.2	9.82	15.2	13.6	13.9	9.27	5.57	6.86	7.92	5.1	13	5.88
As (µg/L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.04	1	1
Ca (mg/L)	5.58	5.75	5.69	3.43	6.5	3.15	9.29	5.92	5.95	6.02	5.51	4.26	3.31	3.34	4.06	3.03	6	3.43
Cd (µg/L)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cl (mg/L)	3.27	2.96	2.79	2.78	2.66	1.85	2.26	2.86	2.32	2.22	1.71	0.883	1.78	0.92	1.49	1.09	1.95	1.18
CLRA (TCU)	40	40	40	40	40	20	15	40	40	40	40	50	50	60	60	70	40	75
COND (µSIE/cm)	53.1	51.2	49.8	39.6	52.9	33.5	67.7	49.6	50.5	47.8	42.8	33.4	30.7	28.3	32.6	25.5	48.1	27.9
Cr (µg/L)	0.7	0.6	0.5	0.5	0.5	0.5	0.8	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.5	0.8	0.5
		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<		<
Cu (µg/L)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5
DO (mg/L) Client-fld												11.4						
E. coli-MPN (MPN/100ml)	380	80	90	50	10	10	20	10	20	30	10	30	30	20	10	50	40	10
F (mg/L)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Fe (mg/L)	0.16	0.13	0.14	0.25	0.11	0.12	0.08	0.12	0.11	0.11	0.12	0.13	0.18	0.16	0.16	0.23	0.15	0.2
HARD (mg/L)	17.5	17.8	17.6	10.8	19.9	10.9	27	18.4	18.5	18.3	17.1	13.4	10.4	10.9	13.3	9.87	19.5	11
K (mg/L)	0.381	0.353	0.317	0.286	0.321	0.305	0.367	0.275	0.289	0.333	0.267	0.269	0.302	0.311	0.258	0.196	0.24	0.33
Mg (mg/L)	0.86	0.85	0.83	0.55	0.9	0.73	0.92	0.88	0.88	0.8	0.81	0.65	0.51	0.62	0.78	0.56	1.1	0.58
Mn (mg/L)	0.034	0.013	0.018	0.022	0.0081	0.012	0.005	0.0079	0.0055	0.005	0.005	0.005	0.011	0.0078	0.0065	0.012	0.032	0.0053
Na (mg/L)	3.03	2.76	2.73	3.06	2.64	2.17	2.38	2.56	2.27	2.26	2	1.51	1.94	1.47	1.52	1.33	1.4	1.57
NH3T (mg/L)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Ni (µg/L)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
NO2 (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
NO3 (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.08	0.13	0.06	0.05	0.05
NOX (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.08	0.13	0.06	0.05	0.05
Pb (µg/L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
PH (pH) Client-fld												7.35						
PH (pH)	7.1	7.19	7.15	6.97	7.24	7.06	7.47	7.21	7.29	7.28	7.2	7.04	6.79	6.85	6.85	6.6	7.21	6.63
Sb (µg/L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
SO4 (mg/L)	3.75	3.52	3.64	3.37	3.67	3.13	4.08	3.42	3.84	3.47	3.42	3.18	3.2	2.66	2.66	2.01	2.58	2.86
SS (mg/L)	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
TDS (mg/L)	25.21	24.356	24.477	16.063	25.719	13.678	34.225	22.332	25.177	23.776	22.588	16.88	15.011	14.114	16.491	12.028	21.652	14.204
TEMP (Celsius) Client-fld	10	10										10.7	10	11	9	9	11	12
TKN (mg/L)	0.24	0.21	0.22	0.27	0.23	0.2	0.2	0.23	0.26	0.22	0.23	0.25	0.26	0.27	0.27	0.27	0.22	0.34
TOC (mg/L)	6.72	6.31	6.55	6.69	6.86	3.82	3.85	7.84	7.52	8.05	8.58	9.62	10.9	11.4	11.8	12.4	9.41	17.3
TP-L (mg/L)	0.01	0.007	0.01	0.015	0.007	0.011	0.008	0.008	0.008	0.009	0.006	0.012	0.01	0.009	0.011	0.011	0.005	0.012
TURB (NTU)	0.5	0.4	0.5	1.3	0.3	0.5	0.3	0.2	0.2	0.3	0.3	0.3	0.5	0.5	0.4	0.5	0.6	0.5
Zn (µg/L)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

October 1999

Station	Barkers Point	Marysville	Penniac	Penniac Str	Durham Br	Dunbar	Tay River	Taymouth	Above Younge	Cross Cr - above Rd Br - temp	McGlaggon	Currieburg	Napadogan-Mouth	Narrowe	South Sisters	Gosby Gulch	McBean - Nash R below Mouth - DISC	Arnold Br - DISC
FromDate	1999/10/31	1999/11/01	1999/10/31	1999/10/31	1999/10/31	999/10/31	1999/10/31	1999/10/31	1999/10/31	1999/10/31	1999/10/31	1999/10/31	1999/11/02	1999/11/02	1999/11/02	1999/11/02	1999/11/02	1999/11/01
Al (mg/L)	0.096	0.067	0.069	0.066	0.056	0.048	0.046	0.068	0.064	0.056	0.069	0.082	0.084	0.078	0.074	0.089	0.11	0.06
ALK_T (mg/L)	16.6	13.7	12.3	11.4	13.7	7.73	25.4	12.4	12.1	16.3	11.5	7.56	7.26	8.06	8.36	5.56	7.23	14.3
As (µg/L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ca (mg/L)	6.32	5.91	5.73	3.71	6.03	2.64	9.08	5.25	5.41	6.69	4.6	3.6	3.52	3.39	4.11	2.95	3.39	6.01
Cd (µg/L)	0.1	0.148	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cl (mg/L)	3.43	2.9	2.72	2.77	2.56	1.95	2.52	2.4	2.01	2.41	1.53	0.826	1.09	0.707	0.88	0.614	0.753	1.77
CLRA (TCU)	20	20	20	20	20	10	5	20	30	20	30	30	40	30	30	40	50	20
COND (µSIE/cm)	57	50.3	50.9	44.1	52.7	34.5	88.8	48.3	48.4	66.2	42.5	34.5	31.9	30.4	35.5	26.6	31.2	46.4
Cr (µg/L)	1.5	0.7	0.6	0.5	0.7	0.5	1	0.6	0.5	0.9	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.6
Cu (µg/L)	1.2	2	0.5	0.5	0.5	0.5	0.9	0.5	0.5	0.6	0.8	0.5	0.5	0.5	0.5	0.5	0.5	0.6
DO (mg/L) Client-fld												11.3						
E. coli-MPN (MPN/100ml)	50	590	10	90	10	10	10	10	10	10	10	10	10	30	10	20	10	10
	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
F (mg/L)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Fe (mg/L)	0.51	0.13	0.11	0.17	0.08	0.08	0.08	0.08	0.08	0.09	0.08	0.09	0.1	0.09	0.07	0.12	0.09	0.11
HARD (mg/L)	19.5	18.3	17.8	11.7	18.6	9.35	26	16.5	16.9	20.9	14.5	11.5	11	11	13.4	9.63	10.9	19.5
K (mg/L)	0.433	0.574	0.455	0.362	0.298	0.358	0.362	0.369	0.309	0.354	0.369	0.393	0.411	0.313	0.362	0.335	0.518	0.248
Mg (mg/L)	0.91	0.87	0.84	0.59	0.85	0.67	0.82	0.83	0.82	1.03	0.73	0.61	0.55	0.61	0.77	0.55	0.59	1.09
Mn (mg/L)	0.152	0.0082	0.013	0.019	0.0058	0.0089	0.005	0.0065	0.005	0.013	0.005	0.005	0.0081	0.005	0.005	0.0053	0.005	0.028
Na (mg/L)	3.14	2.54	2.49	3.21	2.31	2.06	1.96	2.18	1.89	1.92	1.73	1.37	1.9	1.51	1.44	1.37	1.62	1.42
NH3T (mg/L)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.023	0.021	0.01	0.013	0.015	0.011
Ni (µg/L)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
NO2 (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
NO3 (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.05	0.08	0.08	0.07	0.12	0.25	0.08	0.09	0.05
NOX (mg/L)	0.05	0.06	0.06	0.05	0.06	0.05	0.05	0.07	0.07	0.06	0.09	0.09	0.08	0.13	0.26	0.09	0.1	0.05
Pb (µg/L)	1	1	1	1	1	1	1	1	1	*	1	1	1	1	1	1	1	1
PH (pH) Client-fld																		
PH (pH)	7.08	7.25	7.26	7.15	7.33	7.06	7.58	7.29	7.32	7.42	7.24	7.08	6.91	6.98	6.96	6.81	6.92	7.16
Sb (µg/L)	1	1	1	1	1	1	1	1	1	*	1	1	1	1	1	1	1	1
SO4 (mg/L)	3.47	3.88	3.87	3.44	4.03	3.35	4.16	4.01	3.72	3.18	3.77	3.34	3.54	2.92	3.7	2.7	3.16	3.16
SS (mg/L)	15	15	15	15	15	15	15	15	15	15	15	15	16	15	15	15	15	15
TDS (mg/L)	28.15	25.573	24.049	21.505	24.812	16.121	34.581	23.048	21.985	25.885	20.303	15.251	16.02	15.135	17.686	12.569	15.123	22.804
TEMP (Celsius) Client-fld	0	4										7.4	3	4	4.5	4.5	4	2
TKN (mg/L)	0.26	0.21	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.21	0.2	0.2
TOC (mg/L)	5.96	5.06	5.1	4.86	5.38	3.4	4.15	5.7	5.82	5.31	5.95	6.34	6.52	6.6	6.56	7.44	8.64	6.3
TP-L (mg/L)	0.011	0.008	0.008	0.013	0.008	0.012	0.008	0.009	0.01	0.007	0.01	0.01	0.013	0.012	0.013	0.014	0.013	0.006
TURB (NTU)	0.9	0.5	0.5	0.8	0.2	0.3	0.4	0.3	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.2	0.1	0.6
Zn (µg/L)	5	5.4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

October 2000

Station	DISC - NASH S	Barkers Pt	Marysville	Penniac	Penniac Str	Penniac Str	Durham Bridge	Dunbar	Tay River	Taymouth	Above Youngs Bk	MacGlaggon Br	Currieburg	Nepadogan Mouth	Nepadogan Mouth	Valley Rd	McBean Br	South Sisters	Gorby Gulch	Cross Creek (Nash Riv above mouth)
FromDate	2000/10/22	2000/10/22	2000/10/22	2000/10/21	2000/10/21	2000/10/21	2000/10/21	2000/10/21	2000/10/22	2000/10/22	2000/10/22	2000/10/22	2000/10/21	2000/10/22	2000/10/22	2000/10/22	2000/10/22	2000/10/22	2000/10/22	2000/10/22
Field Number	54-00-920	54-00-920	54-00-921	54-00-922	54-00-923	54-00-924	54-00-925	54-00-926	54-00-927	54-00-928	54-00-929	54-00-931	54-00-932	54-00-933	54-00-934	54-00-935	54-00-936	54-00-937	54-00-938	54-00-930
Al (mg/L)	0.168	0.112	0.109	0.103	0.144	0.142	0.113	0.028	0.05	0.127	0.117	0.137	0.106	0.114	0.114	0.15	0.177	0.16	0.171	0.05
ALK_T (mg/L)	8.6	13.7	14.4	14.8	15.2	13.4	12.8	13.6	27.8	11.5	12.9	9.29	16.3	7.48	7.02	8.27	8.72	7.63	7.21	24.7
As (µg/L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ca (mg/L)	4.41	6.58	6.48	6.44	5.66	5.65	6.45	5.72	11.4	5.79	5.85	5.14	7.2	4.18	4.16	4.19	4.5	3.88	3.66	9.99
Cd (µg/L)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cl (mg/L)	0.958	2.83	2.45	2.26	3.21	3.15	2.1	2.87	2.75	2.21	1.75	1.43	2.28	1.3	1.23	1.02	0.979	0.941	1.16	2.69
CLRA (TCU)	75	50	50	40	40	40	60	10	15	50	60	60	60	60	70	70	75	70	60	30
COND (µSIE/cm	31.6	51.9	49.5	49.6	54.5	54.4	46.9	54.3	73.4	43.4	42.1	36.6	52.9	32	32.1	32.6	32.2	28.9	28.3	68.6
Cr (µg/L)	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6
Cu (µg/L)	0.6	0.6	1	0.7	0.6	0.5	0.6	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	1	1	0.7	2	0.5
F (mg/L)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Fe (mg/L)	0.198	0.219	0.176	0.173	0.368	0.362	0.167	0.081	0.105	0.168	0.149	0.164	0.165	0.192	0.192	0.184	0.198	0.221	0.251	0.116
HARD (mg/L)	14.1	20.8	20.4	20.3	17.8	17.7	20.3	20	32.9	18.6	18.6	16.5	24.5	13	13	13.6	14.3	12.7	12.1	31.4
K (mg/L)	0.377	0.618	0.598	0.472	0.642	0.622	0.42	0.538	0.474	0.379	0.349	0.373	0.366	0.379	0.38	0.344	0.401	0.32	0.407	0.429
Mg (mg/L)	0.754	1.05	1.02	1.03	0.891	0.877	1.02	1.38	1.1	0.994	0.97	0.892	1.59	0.635	0.627	0.771	0.752	0.731	0.709	1.58
Mn (mg/L)	0.006	0.021	0.0073	0.0078	0.017	0.017	0.0063	0.0068	0.0058	0.0055	0.005	0.005	0.005	0.0053	0.0082	0.005	0.005	0.0063	0.0079	0.0055
Na (mg/L)	1.7	2.77	2.54	2.35	4.55	4.52	2.16	3.32	2.62	2.3	2.01	1.84	2.12	1.92	1.92	1.52	1.74	1.46	1.68	2.51
NH3T (mg/L)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.015	0.01	0.01	0.01	0.032	0.01
Ni (µg/L)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
NO2 (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
NO3 (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
NOX (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Pb (µg/L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
PH (pH)	6.98	7.29	7.29	7.31	7.26	7.28	7.31	7.48	7.66	7.27	7.3	7.22	7.36	7.1	7.06	7.07	6.98	6.89	6.77	7.6
Sb (µg/L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
SO4 (mg/L)	2.84	3.84	3.45	3.45	3.96	3.87	3.43	4.72	4.42	3.41	3.34	3.04	4.72	3.08	3.01	2.94	2.82	2.45	2.53	4.13
SS (mg/L)	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
TDS (mg/L)	16.915	26.603	25.816	25.506	28.907	27.599	23.881	28.352	39.934	22.655	22.63	18.95	28.688	16.637	16.217	16.421	17.162	15.112	15.248	36.671
TKN (mg/L)	0.33	0.29	0.26	0.24	0.31	0.27	0.26	0.2	0.21	0.24	0.3	0.31	0.28	0.26	0.28	0.31	0.32	0.29	0.62	0.2
TOC (mg/L)	14.6	9.45	10.2	9.07	8.89	8.89	10.5	3.71	6.43	11.9	11.3	12.1	11	10.8	10.9	12.4	14.9	12.8	14.4	8.75
TP-L (mg/L)	0.012	0.012	0.012	0.017	0.021	0.019	0.017	0.011	0.008	0.009	0.009	0.015	0.011	0.011	0.012	0.011	0.01	0.011	0.011	0.008
TURB (NTU)	0	0.8	0.3	0.5	1.3	1.4	0.3	0	0.2	0	0	0.1	0	0	0	0	0	0	0.1	0
Zn (µg/L)	22	20	23	17	22	26	12	5	5.8	48	27	32	33	18	41	12	34	42	22	27

									July 2001									
Station	Barkers Point	Marysville	Penniac	Penniac Str	Durham Br	Dunbar Str	Tay River	Taymouth	Above Youngs	McGlaggon	Currieburg	Currieburg	Narrows	McBean	McBean	South Sisters	Gorby Gulch
FromDate	2001/07/29	2001/07/29	2001/07/29	2001/07/29	2001/07/29	2001/07/29	2001/07/29	2001/07/29	2001/07/29	2001/07/29	2001/07/29	2001/07/29	2001/07/31	2001/07/31	2001/07/31	2001/07/31	2001/07/31
Field Number	54-01-831	54-01-832	54-01-833	54-01-834	54-01-835	54-01-836	54-01-837	54-01-838	54-01-839	54-01-841	54-01-842	54-01-843	54-01-802	54-01-803	54-01-804	54-01-805	54-01-806
Al (mg/L)	0.032	0.027	0.023	0.055	0.018	0.024	0.015	0.018	0.024	0.019	0.021	0.022	0.029	0.032	0.033	0.032	0.034
ALK_T (mg/L)	23.9	24.8	24.3	21	24.4	15.6	38.3	22.4	21.4	17.7	16.1	16	15.4	14.9	15.1	15.5	15.3
As (µg/L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.29
Ca (mg/L)	7.52	7.81	7.17	4.93	7.95	4.72	13.6	7.12	7	6.38	5.1	5.37	4.42	5.24	5.11	5.21	4.88
Cd (µg/L)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cl (mg/L)	5.25	7.2	4.65	3.86	3.87	1.99	2.88	3.7	2.2	1.5	0.582	0.69	0.859	0.739	0.734	0.666	0.7
CLRA (TCU)	30	20	20	30	10	10	5	15	10	20	20	30	30	30	30	30	30
COND (µSIE/cm)	75.2	82.8	71.1	61.9	67.2	48.1	92.8	62.4	56.5	50.8	42.4	42.5	41.5	42.6	42.2	39.7	40.8
COND (µSIE/cm) Field-ELG													15	23		33	40
Cr (µg/L)	1.3	1.1	0.8	0.6	0.9	0.6	1.7	0.9	0.7	0.6	0.5	0.5	1	0.8	0.9	0.9	1
Cu (µg/L)	1.8	1.5	0.9	0.7	0.6	0.5	0.5	0.5	0.8	0.5	0.5	0.5	0.5	0.7	2.5	1	0.6
DO (mg/L) Client-fld																	
DO (mg/L) Field-ELG										9.2	9.8						
E_coli-MPN (MPN	30	310	20	30	10	40	20	10	10	10	10	10	10	10	20	10	60
F (mg/L)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Fe (mg/L)	0.184	0.142	0.089	0.365	0.049	0.086	0.025	0.047	0.038	0.043	0.062	0.065	0.074	0.09	0.09	0.141	0.163
HARD (mg/L)	23.3	24.2	22.3	15.3	24.6	16.3	39.3	22.4	21.7	19.9	16.2	17.1	14.1	16.7	16.2	16.6	15.6
K (mg/L)	0.452	0.546	0.404	0.387	0.394	0.305	0.424	0.353	0.456	0.304	0.24	0.272	0.252	0.32	0.327	0.234	0.21
Mg (mg/L)	1.1	1.15	1.07	0.732	1.15	1.1	1.29	1.12	1.03	0.976	0.848	0.888	0.754	0.867	0.838	0.869	0.839
Mn (mg/L)	0.035	0.025	0.015	0.029	0.01	0.007	0.008	0.011	0.01	0.006	0.005	0.005	0.005	0.005	0.005	0.012	0.012
Na (mg/L)	4.48	4.83	3.55	4.49	3.39	2.72	3	3.22	2.55	2.22	1.75	1.82	1.75	2.13	2.12	1.96	1.78
NH3T (mg/L)	0.041	0.013	0.055	0.021	0.065	0.033	0.034	0.015	0.05	0.01	0.043	0.012	0.012	0.01	0.01	0.028	0.01
Ni (µg/L)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
NO2 (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
NO3 (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
NOX (mg/L)	0.05	0.056	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.055	0.056	0.05	0.05
Pb (µg/L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
PH (pH) Client-fld																	
PH (pH)	7.57	7.5	7.68	7.7	7.76	7.62	7.86	7.67	7.78	7.7	7.63	7.66	7.51	7.5	7.48	7.46	7.33
Sb (µg/L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
SO4 (mg/L)	3.75	4.28	3.66	3.3	3.73	3.74	4.62	3.79	3.24	3.05	3.1	3.04	2.61	3.02	3.06	2.12	2.05
SS (mg/L)	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
TDS (mg/L)	37.472	41.246	35.539	31.076	35.529	24.38	49.17	33.147	29.716	25.446	21.696	22.1	20.321	21.733	21.734	20.873	20.176
TEMP (Celsius) Client-fld																	
TEMP (Celsius) Field-ELG										21.2	18.1		22.5	17.8		17.5	16.3
TN (mg/L)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
TOC (mg/L)	4.41	4.14	3.7	4.74	3.96	3.3	2.68	3.92	3.9	4.32	4.7	4.4	4.54	5.17	4.77	4.64	5.32
TP-L (mg/L)	0.012	0.012	0.008	0.022	0.007	0.011	0.009	0.007	0.008	0.007	0.008	0.011	0.012	0.013	0.011	0.013	0.016
TURB (NTU)	1	0.5	0.3	1.3	0.1	0.1	0.2	0	0	0	0	0	0	0.1	0.1	0.2	0.3
Zn (µg/L)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

August 2001

Station	Barkers Point	Marysville	Penniac	Penniac Str	Durham Bridge	Dunbar	Tay River	Taymouth	Youngs Bk	Cross Creek-Train Br	McGlaggon	Currieburg	Napadogan Mouth	Narrows	McBean	South Sisters	Gorby Gulch	Napadogan-Valley Rd
FromDate	2001/09/05	2001/09/06	2001/09/06	2001/09/06	2001/09/06	2001/09/06	2001/09/06	2001/09/06	2001/09/06	2001/09/05	2001/09/05	2001/09/05	2001/09/05	2001/09/05	2001/09/05	2001/09/05	2001/09/05	2001/09/05
Field Number	54-01-2100	54-01-2101	54-01-2102	54-01-2103	54-01-2104	54-01-2105	54-01-2106	54-01-2107	54-01-2108	54-01-2109	54-01-2110	54-01-2111	54-01-2112	54-01-2113	54-01-2114	54-01-2115	54-01-2116	54-01-2117
Al (mg/L)	0.053	0.037	0.031	0.031	0.026	0.016	0.014	0.027	0.026	0.031	0.049	0.055	0.07	0.072	0.12	0.077	0.171	0.055
ALK_T (mg/L)	20.5	21.5	21.4	25.1	23.4	17.9	39.4	20.7	16.5	28.4	20.5	12	12.9	11.9	9.87	12	8.98	10.3
As (µg/L)	1	1	1	1	1	1	1	1	1	1	1	1	1.04	1	1	1	1.25	1.16
Ca (mg/L)	8.33	8.7	8.45	6.66	8.43	5.69	13.8	7.58	5.62	10.1	6.92	5.63	5.42	5.31	5.08	4.8	4.75	4.47
Cd (µg/L)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cl (mg/L)	3.28	3.48	3.24	3.72	2.74	2.01	3.35	2.2	1.25	2.76	1.86	0.947	0.964	0.814	0.7	0.665	0.81	0.895
CLRA (TCU)	40	40	30	20	30	15	15	30	40	20	40	50	50	60	75	70	75	50
COND (µSIE/cm)	65.8	65.8	68.1	68.7	66.7	54.9	96.7	60.3	50.1	80.8	55	45.2	44.3	41.3	39.4	40.8	36.2	39.4
COND (µSIE/cm) Field-ELG																		
Cr (µg/L)	0.5	0.6	0.6	0.7	0.6	0.5	1.1	0.5	0.5	1.2	0.8	0.8	0.5	0.5	0.5	0.5	0.5	0.5
Cu (µg/L)	0.9	0.5	0.5	3.3	0.5	0.5	0.5	0.5	0.5	4	0.5	0.5	0.5	0.5	0.5	0.5	1.7	2.1
DO (mg/L) Client-fld			11.5	10.6	10.4	10.3	11.1	10.8	11.2				9.8	9.3	9.6	9.1	9.8	
DO (mg/L) Field-ELG										9.8	9.7	9.8						10.6
E. coli-MPN (MPN	60	100	80	20	20	10	10	20	10	10	20	10	10	10	10	80	500	10
F (mg/L)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Fe (mg/L)	0.174	0.1	0.091	0.276	0.054	0.059	0.033	0.061	0.125	0.067	0.08	0.094	0.184	0.145	0.179	0.196	0.321	0.156
HARD (mg/L)	25.8	27	26.2	20.5	26	19.5	39.7	24	18.8	31.2	21.7	17.8	16.9	17	16.2	15.6	15.4	13.8
K (mg/L)	0.443	0.438	0.384	0.399	0.323	0.347	0.348	0.303	0.309	0.332	0.342	0.322	0.346	0.343	0.33	0.265	0.254	0.775
Mg (mg/L)	1.22	1.27	1.24	0.941	1.2	1.3	1.24	1.22	1.15	1.48	1.06	0.906	0.824	0.92	0.85	0.869	0.866	0.637
Mn (mg/L)	0.027	0.017	0.015	0.02	0.0074	0.0056	0.0057	0.0074	0.011	0.0089	0.0074	0.0062	0.0098	0.0088	0.0058	0.011	0.017	0.014
Na (mg/L)	3.61	3.74	4.13	6.33	2.93	3.03	2.99	2.55	2.37	2.63	2.38	1.8	1.97	1.64	1.73	1.36	1.28	1.9
NH3T (mg/L)	0.01	0.018	0.01	0.01	0.015	0.01	0.01	0.01	0.01	0.01	0.02	0.011	0.01	0.01	0.01	0.01	0.01	0.011
Ni (µg/L)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
NO2 (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
NO3 (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
NOX (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.062	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.075	0.05
Pb (µg/L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
PH (pH) Client-fld													7.1	7.3	7.3	7.2	7.1	
PH (pH)	7.55	7.63	7.68	7.81	7.74	7.72	7.95	7.82	7.58	7.86	7.55	7.45	7.35	7.31	7.12	7.28	6.94	7.32
Sb (µg/L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
SO4 (mg/L)	5.31	5.34	5.26	3.31	5.34	4.54	5.15	5.14	4.57	5.61	5.25	5.11	4.46	4.38	4.62	3.82	4.64	4.31
SS (mg/L)	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
TDS (mg/L)	35.075	36.36	36.009	37.078	35.418	28.066	50.952	31.836	25.659	40.39	30.576	22.398	22.316	21.102	19.865	19.591	18.937	19.726
TEMP (Celsius) Client-fld			19	18.6	18.2	17	17.2	16.1	14				15.4	17.5	16.1	17.1	16	
TEMP (Celsius) Field-ELG										19.5	20	18.3						15.4
TN (mg/L)	0.3	0.31	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.319	0.3	0.333	0.3
TOC (mg/L)	7.98	7.87	7.28	3.58	6.82	3.03	4.25	7.51	7.02	5.94	9.48	9.78	8.96	11.4	16.4	12.4	17.4	8.36
TP-L (mg/L)	0.012	0.012	0.015	0.014	0.009	0.015	0.009	0.011	0.013	0.008	0.01	0.012	0.017	0.014	0.016	0.016	0.019	0.018
TURB (NTU)	1	0.4	0.5	1	0.3	0.2	0.3	0.2	0.4	0.2	0.3	0.3	1	0.6	0.6	0.8	1.5	0.6
Zn (µg/L)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	9.6

September 2001

Station	Barkers Point	Marysville	Penniac	Penniac Str	Durham Br	Dunbar Str	Tay River	Taymouth	Above Youngs	Cross Creek- Train Br	McGlaggon	Curriebura	Narrows	McBean	South Sisters	Gorby Gulch	Napadogan-Valley Rd	Napadogan-Valley Rd
FromDate	2001/09/30	2001/09/30	2001/09/30	2001/09/30	2001/09/30	2001/09/30	2001/09/30	2001/09/30	2001/10/01	2001/10/01	2001/10/01	2001/10/01	2001/10/01	2001/10/01	2001/10/01	2001/10/01	2001/10/01	2001/10/01
Field Number	54-01-845	54-01-846	54-01-847	54-01-848	54-01-849	54-01-850	54-01-851	54-01-852	54-01-853	54-01-854	54-01-855	54-01-856	54-01-808	54-01-809	54-01-810	54-01-811	54-01-812	54-01-813
Al (mg/L)	0.049	0.052	0.049	0.047	0.043	0.02	0.028	0.05	0.049	0.031	0.059	0.073	0.098	0.108	0.1	0.116	0.068	0.063
ALK_T (mg/L)	18.5	21.4	21.5	25	21.7	17.8	32.9	16.1	20.2	27	15	13	11.9	12	12.4	11.3	11.4	11.9
As (µg/L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.06	1	1
Ca (mg/L)	8.83	8.52	8.28	6.43	6.17	5.97	11.9	7.8	8.11	10.9	7.23	6.26	5.19	5	5.01	4.65	4.98	4.92
Cd (µg/L)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cl (mg/L)	3.63	3.71	3.58	4.38	3.37	2.94	3.02	3.39	2.62	3.45	2.23	1.13	0.965	0.958	0.927	0.907	1.18	1.15
CLRA (TCU)	40	40	40	40	40	15	20	40	40	20	50	60	60	75	70	75	50	50
COND (µSIE/cm)	69.5	71.1	71.2	74	66.8	59.3	88.2	65.5	64.1	83	57.5	46.8	41	41.8	40.3	38.3	40.6	40.7
COND (µSIE/cm) Field-ELG																		
Cr (µg/L)	0.5	0.5	1.5	1.4	1	0.9	1.5	0.9	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
				<													<	<
Cu (µg/L)	0.7	0.8	0.7	0.5	0.5	0.5	0.9	0.6	0.5	0.5	0.5	0.8	0.6	0.6	0.6	0.5	0.5	0.5
DO (mg/L) Client-fld		10.7	10.1	11.9	11.2	11.1	11.3	11.9	11.1	11.1	10.9	11.2	12	12.4	12.4	12.2	11.9	
DO (mg/L) Field-ELG																		
E. coli-MPN (MPN/	10	120	50	80	20	10	30	20	10	10	10	10	10	10	20	10	10	10
F (mg/L)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Fe (mg/L)	0.192	0.124	0.123	0.575	0.078	0.062	0.066	0.087	0.082	0.07	0.09	0.121	0.147	0.158	0.2	0.275	0.169	0.164
HARD (mg/L)	27.3	26.3	25.6	20.1	25.4	20.6	34.4	24.1	25.9	34.2	22.9	20	16.8	16.1	16.4	15.3	15.5	15.3
K (mg/L)	0.512	0.49	0.496	0.842	0.427	0.532	0.423	0.456	0.432	0.397	0.424	0.421	0.441	0.464	0.382	0.342	0.446	0.401
Mg (mg/L)	1.27	1.22	1.2	0.99	1.21	1.37	1.14	1.24	1.27	1.88	1.18	1.06	0.948	0.878	0.941	0.891	0.748	0.74
Mn (mg/L)	0.029	0.018	0.017	0.048	0.0092	0.0094	0.0071	0.0094	0.0086	0.0087	0.0062	0.0066	0.0065	0.0061	0.008	0.012	0.017	0.015
Na (mg/L)	3.34	3.33	3.69	8.32	3	3.18	2.59	2.94	2.81	2.84	2.59	2.28	1.87	1.99	1.77	1.75	2.33	2.25
NH3T (mg/L)	0.01	0.01	0.012	0.017	0.01	0.01	0.01	0.018	0.01	0.01	0.01	0.01	0.011	0.01	0.01	0.01	0.01	0.01
Ni (µg/L)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
NO2 (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
NO3 (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
NOX (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Pb (µg/L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
PH (pH) Client-fld																		
PH (pH)	7.56	7.62	7.53	7.75	7.63	7.67	7.62	7.61	7.68	7.85	7.61	7.49	7.41	7.34	7.38	7.22	7.41	7.4
Sb (µg/L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
SO4 (mg/L)	5.88	6.06	5.84	4.08	5.92	5.33	6	6.32	5.8	5.87	5.63	5.33	4.1	4.34	3.8	3.54	4.32	4.22
SS (mg/L)	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
TDS (mg/L)	35.16	36.692	36.513	36.84	35.575	30.421	45.243	32.081	33.63	41.755	28.767	24.83	21.234	21.428	20.708	19.591	21.426	21.391
TEMP (Celsius) Client-fld		15.6	14.5	14	13.9	13.4	14.8	15.2	16.3	13.9	16.3	14.8	11	8.7	9.5	8	11.7	
TEMP (Celsius) Field-ELG																		
TN (mg/L)	0.413	0.3	0.3	0.3	0.3	0.3	0.326	0.342	0.3	0.3	0.3	0.3	0.3	0.335	0.3	0.333	0.3	0.366
TOC (mg/L)	9.03	8.94	8.95	4.85	8.91	3.86	8.67	9.53	9.08	8.45	10	10.8	11.8	13.4	12.5	13.6	8.93	9.04
TP-L (mg/L)	0.009	0.008	0.007	0.017	0.007	0.006	0.005	0.008	0.008	0.005	0.007	0.008	0.009	0.008	0.01	0.011	0.011	0.01
TURB (NTU)	1.2	0.7	0.6	1.8	1.8	0.3	0.4	0.3	0.2	0.3	0.2	0.3	0.6	0.6	0.7	0.9	0.5	0.7
Zn (µg/L)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

October 2001

Station	Barkers Point	Marysville	Penniac	Penniac Str	Penniac Str	Durham Br	Dunbar	Tay River	Taymouth	Above Youngs	Cross Creek-Train Br	McGlaggon	Currieburg	Narrows	McBean	South Sisters	South Sisters	Gorby Gutch	Napadogan-Valley Rd
FromDate	2001/10/29	2001/10/29	2001/10/28	2001/10/28	2001/10/28	2001/10/28	2001/10/28	2001/10/29	2001/10/28	2001/10/29	2001/10/29	2001/10/29	2001/10/29	2001/10/29	2001/10/29	2001/10/29	2001/10/29	2001/10/29	2001/10/29
Al (mg/L)	0.131	0.077	0.091	0.088	0.084	0.088	0.04	0.033	0.104	0.107	0.07	0.114	0.126	0.158	0.178	0.138	0.13	0.177	0.113
ALK_T (mg/L)	15	14.8	14.7	21.5	21.5	14.3	12.8	26.5	13.5	13.2	18.5	11.6	9.96	8.7	8.33	9.13	9.4	7.37	8.76
As (ug/L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ca (mg/L)	8.09	7.87	7.3	5.87	5.79	7.12	4.89	10.6	6.72	6.84	8.13	8.21	5.55	4.96	5.1	5.2	5.37	4.22	4.83
Cd (ug/L)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cl (mg/L)	3.47	3.69	3.22	4.17	4.14	3	3.88	3.42	3.13	2.78	3.8	2.32	1.37	1.1	1.05	1.11	1.16	1.08	1.32
CLRA (TCU)	60	60	60	40	30	60	30	30	70	70	40	60	70	75	100	75	75	100	75
COND (µSIE/cm)	65	64	61.1	69.4	69.1	61.7	55	78.1	58.5	58.1	67.8	52.3	44.4	39	39.3	37.6	37.7	33.8	41
COND (µSIE/cm) Field-ELG																			
Cr (ug/L)	0.7	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.6	0.5	0.8	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Cu (ug/L)	0.9	0.8	1	1.7	0.5	0.8	0.5	0.8	0.5	0.7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
DO (mg/L) Client-fl	11.1	13.1	13.1	13.7		13.9	13.9	14	14.2	14.3	14.2	14.8	14.8	12.33	11.85	12.25		12.1	11.54
DO (mg/L) Field-ELG																			
E. coli-MPN (MPN	110	30	60	80	30	30	10	10	10	10	30	10	10	10	10	20	10	40	10
F (mg/L)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Fe (mg/L)	0.326	0.149	0.184	0.408	0.411	0.141	0.119	0.079	0.136	0.138	0.109	0.147	0.174	0.194	0.197	0.207	0.208	0.268	0.198
HARD (mg/L)	25.8	24.1	23	17.8	18.2	22.4	17.3	30.8	21.8	22	25.9	20	17.9	16.2	16.4	17.3	17.8	14	15.1
K (mg/L)	0.442	0.313	0.344	0.428	0.418	0.288	0.332	0.262	0.312	0.319	0.269	0.309	0.284	0.348	0.391	0.327	0.313	0.284	0.334
Mg (mg/L)	1.3	1.21	1.17	0.869	0.906	1.13	1.24	1.08	1.18	1.18	1.35	1.08	0.983	0.924	0.891	1.05	1.08	0.838	0.741
Mn (mg/L)	0.029	0.0078	0.0082	0.021	0.021	0.0055	0.0059	0.005	0.0053	0.0053	0.006	0.005	0.005	0.005	0.005	0.0059	0.0057	0.01	0.0092
Na (mg/L)	3.14	2.92	2.73	5.63	5.73	2.4	3.07	2.4	2.43	2.18	2.14	2.05	1.69	1.75	1.74	1.41	1.47	1.37	1.71
NH3T (mg/L)	0.01	0.019	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Ni (ug/L)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
NO2 (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
NO3 (mg/L)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
NOX (mg/L)	0.084	0.071	0.087	0.068	0.067	0.077	0.05	0.058	0.075	0.08	0.079	0.078	0.08	0.054	0.059	0.053	0.057	0.051	0.05
Pb (ug/L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
PH (pH) Client-fld																			
PH (pH)	7.21	7.33	7.3	7.5	7.48	7.32	7.44	7.62	7.27	7.29	7.46	7.19	7.09	7	6.92	6.92	6.98	6.73	7.04
Sb (ug/L)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
SO4 (mg/L)	7.12	6.74	6.85	5.49	5.84	7	5.39	6.39	7.09	6.59	6.12	6.7	6.17	4.6	4.5	4.28	4.42	4.02	5.27
SS (mg/L)	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
TDS (mg/L)	33.528	32.078	31.19	36.072	36.423	30.198	26.855	40.513	29.646	26.516	33.332	26.357	22.789	19.803	19.416	19.545	20.156	17.039	20.109
TEMP (Celsius) C	4.5	6.8	7.1	6.7		6.2	5.8	6.2	5.8	5.5	4.2	4.4	3.8	4.1	3.4	3.2		4.3	4.7
TEMP (Celsius) Field-ELG																			
TN (mg/L)	0.433	0.359	0.399	0.3	0.312	0.42	0.3	0.304	0.368	0.43	0.394	0.464	0.491	0.426	0.478	0.468	0.491	0.489	0.415
TOC (mg/L)	11.6	11.3	11.5	5.67	5.44	12.5	5.27	6.79	12.8	12.8	9.45	14.4	14.8	15.3	17.9	13.8	15	14.7	12.3
TP-L (mg/L)	0.014	0.011	0.011	0.016	0.016	0.01	0.01	0.007	0.011	0.011	0.008	0.011	0.012	0.009	0.008	0.009	0.009	0.01	0.01
TURB (NTU)	2.9	1	1	2.2	2	0.7	0.8	0.8	0.8	0.6	0.5	0.5	0.8	0.5	0.4	0.5	0.8	0.8	0.7
Zn (ug/L)	6.2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

Appendix VII

Newsletter

NASHWAAK WATERSHED ASSOCIATION INC. NEWSLETTER – FALL 2001

What's Inside?

ETF FUNDING AWARDED

The Nashwaak Watershed Association Inc. (NWAI) has applied for and obtained funds from the Environmental Trust Fund (ETF) for water classification of the Nashwaak River and its tributaries. This process, which was developed by the Department of Environment and Local Government (DELG), involves community groups and stakeholders who set the goals for water quality on the Nashwaak. Stakeholders in the watershed are encouraged to volunteer and become a member of the NWAI. Stakeholder involvement is key to making the right decisions regarding water quality management issues. The established goals will be achieved by compiling a proposal that will form an action plan. When the proposal is completed, it will be sent to the Minister of the Environment and Local Government for eventual legislation of classification.

Initially, the state (i.e. class) of the water quality will be assessed for various river segments. Once water quality is known, NWAI members, residents, community groups and other stakeholders will reach a consensus on what the goals for water quality of the Nashwaak should be. The process may suggest the water quality to improve, stay the same, or to accept degradation.

Volunteer collecting water samples

A Provisional classification over the next two years will assess the water quality of the Nashwaak by collecting water quality and benthic invertebrate samples, as well as digital land use mapping. These tools will be used to assist in the understanding of the present water quality in the Nashwaak River.

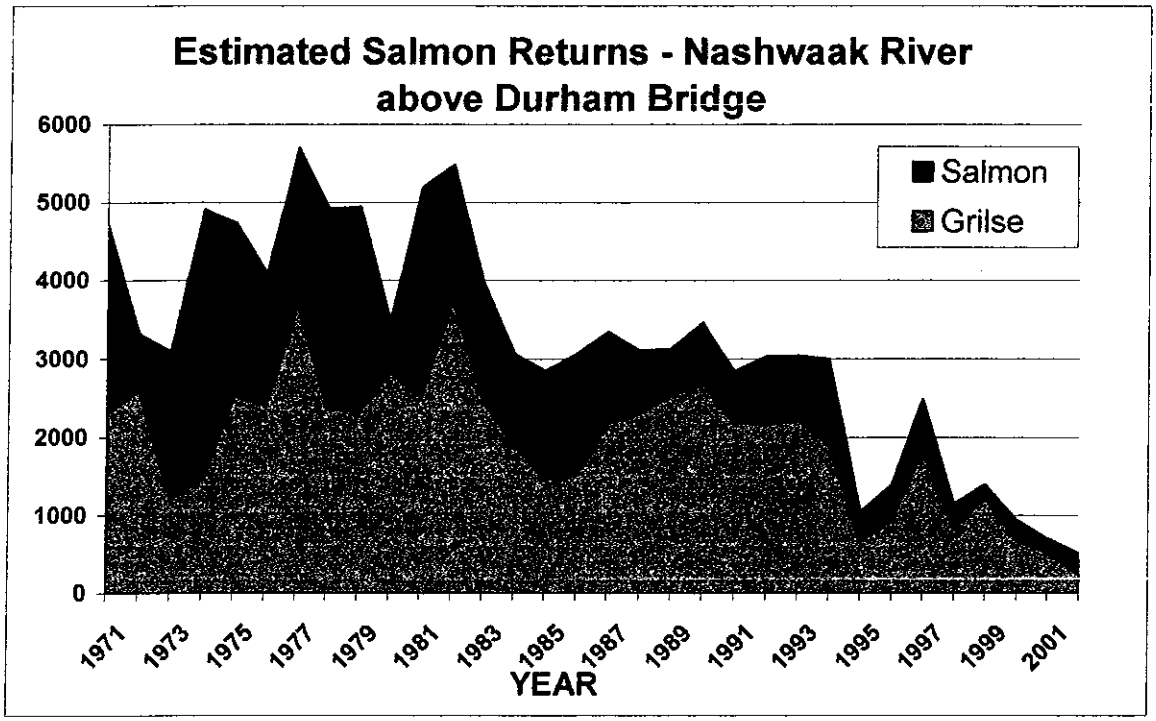
To help coordinate these activities, **Kevin Pugh** has been hired as our new coordinator; financed by the Environmental Trust Fund grant. Mr. Pugh has a BScF from UNB and will (amongst other activities) be responsible for surveys preliminary to Water Classification on the Nashwaak

FALL GENERAL MEETING HELD

A general Meeting of the Nashwaak Watershed Association Inc was held at **7:00PM on September 19, 2001 at the Durham Recreational Center.** The following points were highlights of the Fall General meeting:

Nelda Craig, Water Classification Officer, supported by **Colette Lemieux**, Outreach and Partnering Coordinator from the NB Department of the Environment and Local Government were on hand to explain the water classification process currently being embarked on by the NWAI.

There will be a watershed group mentoring session hosted by the Hammond River Anglers Association in November at Pond=s Resort, Ludlow



Gary Spencer explained that the graph presented above shows the seriousness of the salmon return situation on the Nashwaak River. Since the early 90=s returning salmon and grilse have been on a steady decline. The Nashwaak is currently in life support mode with approximately 25000 salmon being hatched at Mactaquac and released to the Nashwaak annually. The NWAI would encourage the participation of anyone who is interested in the conservation and enhancement of salmon populations on the Nashwaak River. Low water and high temperatures, fatalities at sea, poaching, sedimentation, and influence of Mactaquac dam are a few of the problems that give reason for the decline. Eighteen salmon from the early run are now safely at the Mactaquac Hatchery where they will serve as broodstock for the 2002 streamside rearing projects on the Tay River and as a source of eggs for the stocking of unfed fry in headwater of streams in the spring.

Bonnie Deveau reported that there is grading work to be completed on 22 km of trail from Peniac to Nashwaak Bridge

Our next general meeting will be held on Saturday January 19, 2002 at 10:00am at the Nashwaak Valley School located at 747 Route 628 Highway, Durham Bridge, NB. Dr. Fred Whorisky form the Atlantic Salmon Federation will be on hand to speak on salmon declines in the Bay of Fundy. Dr. Whorsky is a well-known scientist and salmon conservationist and he will shed some light on salmon declines internationally, within the Bay of Fundy and in the Nashwaak specifically. Mark your calendars!

VOLUNTEERS AT WORK

Greg Dodds, Gary Spencer, Peter Salonius, Jim Fraser, Ken Salter, and Bill Gammon helped clip the adipose fins on 7000 fall fingerling to be released into the Nashwaak. Numerous volunteers will also be on hand for netting surveys of salmon upriver from Durham. **Rod Currie** was also on hand for collecting benthic invertebrate rock bags. Many thanks to all participants.

Volunteers and DFO staff conducting netting surveys at the Cross Creek Pool

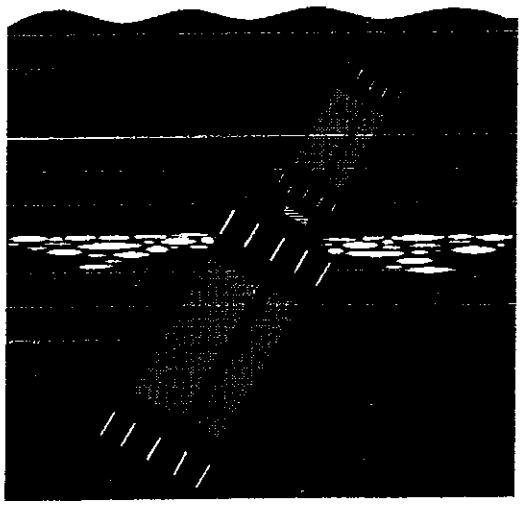
Leroy Anderson (DFO) and Jim Fraser (NWAI) releasing a grilse

EGG SURVIVAL STUDY

Dr. Rick Cunjak (UNB), with assistance from the NWAI, has been conducting an egg survival study on some of the tributaries of the Nashwaak River. The Cross Creek stream and the Tay River has been the subject of the study.

Five emergence baskets were placed at upper and lower reaches for each tributary amounting to a total of 20 baskets. Gravel is sifted to determine particle size and to simulate the particle size of the substrate where salmon eggs are typically laid. One hundred eggs were placed in each basket.

Survival to the egg stage was found to be 24% at both sites on the Tay River and ranged from 26%-



Egg basket

Dr. Rick Cunjak (UNB) and students preparing egg baskets

32% at the lower and upper stations respectively on Cross Creek stream. In similar studies on Catamaran Brook, which is a tributary to the Little Southwest Miramichi, survival rates of 75-80% have been achieved. Dr. Cunjak stated, Awe know it=s not a problem of eggs because there is 95% survival of the 300 control eggs at the hatchery. Survival to emergence was much worse. The results on the Tay River show 2-5% survival while Cross Creek showed 6-13%. Dr. Cunjak is currently conducting a sediment analysis to determine the impact siltation may have had in the poor results.

The NWAI is planning to repeat this experiment in 2001/2002. It is speculated that sediment deposition may be the cause of such poor results. If this is the case, this may be one of the major bottlenecks with respect to Salmon production in the Nashwaak. This years experiment will also include Young=s (McKenzie) Brook.

LOTTERY DRAW WINNERS

The NWAI would like to extend many thanks to citizens concerned about the Nashwaak River for donating prizes to our recent lottery draws.

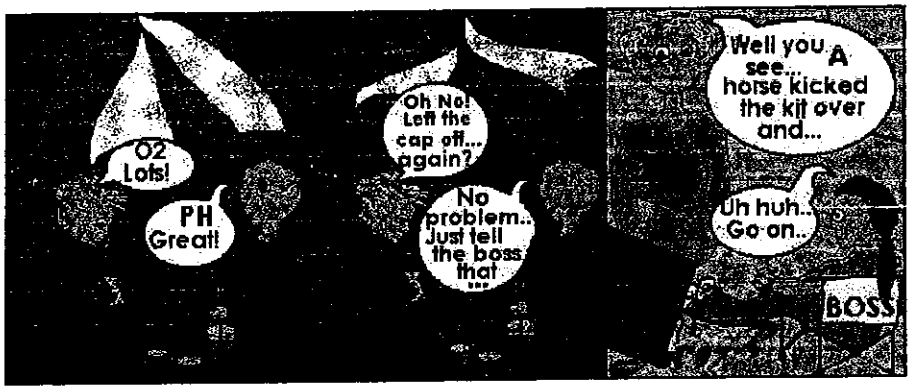
The following recipients were successful winners in our recent draws.

1st draw on July 9, 2001:

Don MacNeil *B 18 holes of golf at the Riverbend Golf and Fishing Club*
Jack Bolton *B Atlantic Salmon Federation B Salmon Fishing Print*

2nd draw on August 13, 2001

Karen Bennett *B Katherine Karnes Munn print*
Jocelyn Fraser *B NB Provincial mementos & clothing*
Jack Bolton *B (2) $10.00 certificates for Rivers Edge Restaurant*



WHO IS THE NASHWAAK WATERSHED ASSOCIATION?

The Nashwaak Watershed Association Inc. is a non-profit organization committed to the improvement of the Nashwaak Watershed. We are actively pursing the betterment of the Nashwaak Watershed by:

Assessing water quality;
Building stakeholder groups and volunteer involvement;
Conducting river specific stocking programs;
Promotion of education and awareness;
Assessing fish stocks;
Working to improve the trail system;
Promoting utilization of the Watershed, and
Working with government and industry to promote sustainable practices.

Our Mission Statement is:

A Healthy River

The river should be managed as a healthy ecosystem that balances a variety of economic, recreational, social and landowner interests. All stakeholders on the Nashwaak are committed to sustaining the scenic and serene nature of the area in a manner consistent with the pursuits of all user groups. The Nashwaak River should be a watershed that serves the community while still maintaining a healthy resource for generations to come.

We need you as a member! Please fill out the application form below and mail it with your $10.00 membership fee to:

Nashwaak Watershed Association Inc.
45 Ward Settlement Rd, Stanley, NB E6B 1Y9
E-Mail gmspence@nbnet.nb.ca

The NWA is an affiliate of the New Brunswick Salmon Council and the Atlantic Salmon Federation and discounted membership fees are available to NWAI members. **All monies** will go to preservation and enhancement of the Nashwaak Watershed.

Name:
Address: Please enclose your $10.00 dues.

Phone #

I want to be advised of your next meeting ___ YES ___ NO
I want to volunteer to: ___ Feed fish, __ collect water samples, __ administer the Assoc., other.
__

NASHWAAK WATERSHED ASSOCIATION INC.
NEWSLETTER - SPRING, 2001

NBCASF FORMS SAINT JOHN RIVER SUB-COMMITTEE

The New Brunswick Council of the Atlantic Salmon Council (NBSC) is very, very concerned about Atlantic Salmon returns to the Saint John River. Despite the efforts of Government and conservation groups, salmon returns to the Saint John River are at all time lows and there appears to be no improvement on the horizon. Last year only 587 salmon and 2981 grilse returned to the fishway at Mactaquac and fully 49% of these fish were of hatchery origin. The Saint John River traditionally experienced salmon returns in excess of40-60,000 with the majority of these fish being salmon . Furthermore, the Saint John system produced a longer angling season with angling opportunities from May to October each season. It was common to have Mirimichi anglers flocking to the Saint John system to try the angle before opportunities opened up on their own system each spring.

With this once great resource in peril the New Brunswick Council of the Atlantic Salmon Federation has struck a subcommittee with representation from it's affiliates on the Tobique, Nashwaak, Saint John and Meduxnakeg Rivers. The NBSC and ASF are also represented within the committee. The sole goal of this committee is Salmon **enhancement** on the Saint John system.

GENERAL MEETING TO BE HELD MARCH 31, 2001

A general Meeting of the Nashwaak Watershed Association Inc will be held at 10:00 AM on March 31, 2001 at the Durham Recreational Center in Durham Bridge. All persons interested in the preservation of the Nashwaak River Watershed are invited to attend. Guest Speaker will be Mike Boyd presenting J. D. Irvings proposed Green certification for woodlot management.

LOTTERY DRAW FOR NWA EFFORTS

Please help to sell tickets on a variety of prizes kindly donated to the NWA by citizens concerned with the Nashwaak River. All proceeds will be applied to current planned programs for youth education, salmon enhancement and habitat improvement. Tickets are $2 each, 3 for $5 with a maxium of 500 tickets to be sold. Five prizes are available to be won including a limited edition salmon angling print (Swan, Pool 424), your choice of a large size print (Katherine Karnes Munn), New Brunswick pottery and souvineres, golf passes and dining certificates.

"HONESTLY! IT'S GETTING SO THE WATER'S NOT FIT TO BREATHE ANYMORE!!"

ETF FUNDING SOUGHT.

The NWA has applied for funding from the Environmental Trust Fund for watershed classification. Under the proposed arrangement, funding would be provided for water quality analysis, digital land use mapping and classification under pending legislation. Stakeholder involvement in the classification process is key to making appropriate decisions regarding the Nashwaak River system and public participation will be encouraged.

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I want to be advised of your next meeting ___ YES ___ NO

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Appendix IX

Progress Reports

Watershed Group Progress Report/Compte-Rendu - September 2001

Deliverables/Produits livrables	Status (list of activities)/État d'activitées
Organization	Stakeholder Involvement/Participation des intervenants: • Invitation to identified Industrial Freehold owners to become members and participate in the water classification process. • Made a list of stakeholders in the watershed. Will be more complete when Digital Property Database is received. • Coordinating water quality sampling events with staff at Fraser Nexfor. • Personal contact with Forest Planner at St. Anne Nackawic • Personal visit to Cooke Aquaculture (Tay Falls Salmon Hatchery) for discussions with Fred DeSaulnier. • Setting up a Fish Friends program at Stanley Elementary School in cooperation with DFO, ASF and Stanley Elem School. • Special email invitation to JDI – as they conduct forest management on 1/3 of the watershed • Other interested stakeholders (i.e. Northside Ready Mix, Riverbend Golf and Fishing Club etc.). Some stakeholders are expressing interest in setting up satellite rearing stations. Volunteer Recruitment/Recrutement des bénévoles: • Calling on volunteers throughout the watershed to conduct the water quality sampling events. • Volunteers for clipping fish, releasing fish and netting fish etc
Monitoring	• Coordinated two water quality monitoring events (August and September). • Setting in place rock bags for benthic invertebrate samplers with DELG staff. • Requested locations/data for DFO electro-fishing locations.
Education and Communication/Éducation et Communication	• 1st draft of the Fall 2001 newsletter was circulated to the Executive for review. Subsequent delivery to all current and past members. Considering mass mail out. • Made contact with ASF representative for Fish Friends project at Stanley Elementary School in January 2002 • Education in the Community About salmon enhancement • Northside Newsletter (September Submission) • General Meeting – Sept 19, 2001 – Reporting on water classification, St. John River Advisory Council, Trail Development, Salmon Enhancement.
Database/Base de données	Itemize data collected/Détailler les données collectées: • Made a request to Sheila Goucher for historical water quality data for the Nashwaak. • Assembled discharge data from Environment Canada for 1962-1996. Requested data from 1997-Present • Marked water quality monitoring stations on paper maps for digital mapping. Will use UTM or Lat/Long Coordinates also. • Collected photo database of the water quality monitoring sites.
Mapping/Cartographie	Itemize completed steps from the mapping protocol/Détailler les étapes □ompletes:

	• Prepared, revised, and resubmitted GIS request letters to DELG for permission from industrial freehold owners for use of forest cover GIS data. Letters have been sent. • Request to DELG/DNRE for lines, soils, and ELC data (received) • Requested contours, DTM, photo centerpoints (received) • Request for outline of the Nashwaak watershed (received) • Request for NB provincial outline (not received) • Request for Digital Property Mapping (DPM) & ETB98 (not received) • All GIS data assembled into layers from component pieces (maptiles). • Some preliminary mapping has been started on the soils map.
Reporting/Rapportage	• Prepared progress report outlining activities for the month of September 2001
Action Plan/Plan d'action	• Have already identified some potential problem areas

Watershed Group Progress Report/Compte-Rendu - October 2001

Deliverables/Produits livrables	Status (list of activities)/État d'activitées
Organization	Stakeholder Involvement/Participation des intervenants: • Collaboration with Andre' Boutot from Fraser/Nexfor for Water Quality sampling on the upper part of the Nashwaak. • Compiled an expanded stakeholders list. Received membership renewals from 5-6 people plus a few new members. • Coordinated water quality sampling events with member volunteers. Volunteer Recruitment/Recrutement des bénévoles: • Continued involvement of volunteers for collection of the October water quality sampling event. • Solicited volunteer assistance from Rod Currie for benthic extraction. • Volunteers came out to help NWAI and DFO net salmon for adjusting total counts at the adult counting fence. • Volunteers were involved in releasing fall fingerlings into the Nashwaak River. • Volunteers clipped 6000 reared salmon for release
Monitoring	• Collected water quality samples from 17 locations along the Nashwaak River and its tributaries • Extracted Benthic invertebrate rock bag samplers in late October • Collected DO and temperature at each site and at the sites of benthic extraction. • Made Inquires about ph-meters and thermo-loggers
Education and Communication/Éducation et Communication	• Information exchange with Jerry Munn and Mike Power of Hammond River Anglers Assoc. Discussions over the growth, operation and the ETF deliverables of a watershed group. Sent newsletter to Rick Cunjak for review of an article regarding one of his projects. • Requested reprint authority for material from the Atlantic Salmon Journal. The story outlines the effects of agriculture on trout and salmon populations. • Procured some office furniture • ASF fish friends confirmed for after Christmas 2001
Database/Base de données	Itemize data collected/Détailler les données collectées: • Requested water quality data from DELG • requested Nashwaak Flow data for 1997-2001 from DELG
Mapping/Cartographie	Itemize completed steps from the mapping protocol/Détailler les étapes □ompletes: • Completed the database construction phase for lines (roads and streams), soils, and Ecological Land Classification (ELC). 2/5 of the deliverables for mapping • Completed the data base construction phase for DTM, contours, inoperable areas, buffers and place name and hydrographic annotation. • Some preliminary mapping completed • Resubmitted letter to H.J. Crabbe &Sons for GIS information on their freehold lands in the Nashwaak Watershed
Reporting/Rapportage	• Reviewed a preliminary and provisional classification from other watershed groups. Prepared progress report outlining activities for the month of October 2001
Action Plan/Plan d'action	• Have already identified more potential problem areas.

	• Have identified areas of cattle in streams in the lower part of the Nashwaak River • Identified some Top Soil mining problems between Taymouth and Marysville. • Implemented preliminary discussion amongst Executive regarding Bank stabilization problems along the Tay River. • Conducted discussion with Sheila Goucher over parameters used for the water classification exercise and relationship to the data that NWAI has collected to date. Discussions over the limits on other parameters, ALK-T, DO, and e-coli. Discussion about the number of sites in comparison to the size of the watershed

Watershed Group Progress Report/Compte-Rendu – November 2001

Deliverables/Produits livrables	Status (list of activities)/État d'activitées
Organization	Stakeholder Involvement/Participation des intervenants: • Made personnel contact with Fred Sommerville of St. Anne Nackawic. • Attended St. Anne Nackawic stakeholder meeting. • Representative from the association executive has attended J.D. Irving Ltd stakeholder meeting • Continual liaison and discussion with Bowater Maritime staff about NWAI activities. Inquires into getting clerical/field assistance for 2002/2003 under Provincial Government Program. Volunteer Recruitment/Recrutement des bénévoles: • Volunteers from the Executive coordinating the salmon enhancement program (ie. Satellite rearing), trail development (NB Trails), NWAI operations, advisory boards, liaison with other watershed groups, and the overall NWAI promotion. • Gary Spencer's liaison with Eastern Charlotte Waterways, St. Croix, HRAA, Madawaska and Pokemouche groups
Monitoring	
Education and Communication/Éducation et Communication	• Attended a Social Marketing workshop hosted by HRAA • Established a new office in Durham Bridge Secured a Guest Speaker from ASF for the Annual General Meeting on January 19, 2001. Topic of discussion will be declines in the Salmon stocks in the Nashwaak and other rivers • Submission of WTF proposal with a considerable communications effort • Preliminary efforts towards placement of signs along watercourse roadway crossing of the Nashwaak river • Provided a variety logos for the NWAI for executive selection/modification.
Database/Base de données	Itemize data collected/Détailler les données

	collectées: • All water quality databases pertaining to the Nashwaak Watershed were sent by Matthew Dickson (inclusive of the 1998 benthic work at Rocky Brook, August-Sept-Oct 1999, Oct 2000, July-August, Sept-Oct 2001 and 2001 benthic extraction) • Request made for the actual benthic data from Rocky Brook • Nashwaak River Discharge data from 2000-2001 was sent by Sheila Goucher • Jim DeVenney sent Nashwaak River discharge data from 1997-1999. • Water Quality data for each month of the years sampled have been tabulated by station for each parameter. • Obtained climate data for the period of water quality sampling.
Mapping/Cartographie	Itemize completed steps from the mapping protocol/Détailler les étapes complétés: • Obtained sub-watershed boundaries shapefile from Nelda Craig. • More database construction for mapping streams and water • Created water quality monitoring sites shapefile • Created benthic invertebrate sampling sites shapefile • Created mapping products for Social Marketing workshop conducted by HRAA. • Created Map Index layer for outline of map sheets • Obtained parishes shapefile from Nelda Craig • Mapping products for inclusion into the WTF proposal for 2002/2003.
Reporting/Rapportage	• Discussions with Roy Parker at Environment Canada (member of NWAI) to help with water quality analysis. Discussion with Roy Parker and HRAA about Cattle fencing and eco-Action 2000 funding. • Prepared progress report outlining activities for the month of November 2001.
Action Plan/Plan d'action	• Very preliminary analysis of year 2001 water quality data may indicate point source pollution due to elevated E.coli. Of 30-300 MPN/100ml). All other stations low • Consideration of habitat survey, remediation work along the last 5km of the Tay River. • Consideration of Bank stabilization work above Penniac • Consideration of a funding proposal through ACAP to do remediation work.

Watershed Group Progress Report/Compte-Rendu - December 2001

Deliverables/Produits livrables	Status (list of activities)/État d'activitées
Organization	Stakeholder Involvement/Participation des intervenants: • Conversations with John Gilbert (biologist of J.D. Irving Ltd.) over NWAI activities. John has been invited to the Annual General meeting on January 2002 • Inquiry to obtain digital phone listing to expand stakeholder list down the Nashwaak. • Conversations with Steve Young (biologist) Fraser/Nexfor about water classification on the Nashwaak Volunteer Recruitment/Recrutement des bénévoles:
Monitoring	
Education and Communication/Éducation et Communication	• Held December Executive meeting at our new office. • Inquires made to local MLA about clerical/field assistance • Mass mail out of Fall 2001Newsletter to DELG staff, Bowater, JDI staff, NWAI Membership and other watershed groups, and MLA's and MP's
Database/Base de données	Itemize data collected/Détailler les données collectées:
Mapping/Cartographie	Itemize completed steps from the mapping protocol/Détailler les étapes complétés: •Produced mapping products for Annual General Meeting
Reporting/Rapportage	• Prepared progress report outlining activities for the month of December 2001. • Tabulated water quality data. • Revisited and upgraded report shell
Action Plan/Plan d'action	• Identified and implemented long term funding application plan

Watershed Group Progress Report/Compte-Rendu – January 2002

Deliverables/Produits livrables	Status (list of activities)/État d'activitées
Organization	Stakeholder Involvement/Participation des intervenants: • Received support from DFO, St. Anne Nackawic for year two water classification work on the Nashwaak • Receieved support from JDI for watershed management work on the Nashwaak • Held Annual General Meeting (AGM) at Nashwaak Valley School – 10 new members • Conducted Newsletter Mailout – 8 new members • MLA for Tobique/Mactaquac – Kirk MacDonald was present at AGM and showed concern about the Nashwaak • Gary Spencer had numerous coorespondance with MP for Tobique/Mactaquac – Andy Savoie • Had numerous discussions at AGM with organization representatives and the public: JDI, City of Fredericton, MLA, and public at large Volunteer Recruitment/Recrutement des bénévoles: • Continued to recruit volunteers for water sampling, clipping fish, netting fish, and association administration
Monitoring	• Placed order for 10 thermo-loggers to placed into the Nashwaak River during the 2002 sampling season.
Education and Communication/Éducation et Communication	• Mailed out Fall 2001 Newletter to all residents in the watershed from Penniac to Stanley. • Distributed Fall 2001 Newsletter in the lower portion of the watershed (Penniac to Barker's Point) in local stores. • Installed fish friends project in Stanley Elementary School • Received mock-ups of salmon habitat signage produced by DOT sign department. • Had public service announcements at local radio stations for the AGM • Had a notice placed in the community news section of the Daily Gleaner for the AGM • Had an ad placed in the January 16, 2002 issue of the Daily Gleaner to advertise the AGM • AGM meeting was held January 19, 2002 at the Nashwaak Valley School • Had the Nashwaak Watershed Association Inc. Logo created • Inquired into getting decals of NWAI logo made
Database/Base de données	Itemize data collected/Détailler les données collectées: • Continued tabualation of water quality data from 1999, 2000, & 2001

	• Collected temperature data from Rick Cunjak's (UNB) experimental work plus data from Danny Bird (ASF) • Continued work on water quality graphs • Obtained discharge data
Mapping/Cartographie	Itemize completed steps from the mapping protocol/Détailler les étapes complétés: • Requested received for Digital Property Mapping data (shapefiles and attribute information) • Build the GIS database for the Digital Property Mapping information • Conducted further work on maps for Ecological Land Classification, Soils, Geology, and Land Use • Obtained Hydrographic and Placename annotation for placement on maps
Reporting/Rapportage	• Began 1st draft of the first year water classification report outlining the progress toward water classification on the Nashwaak • Continued construction of water quality graphs to analyze the data • 1999 water quality graphs completed • Prepared progress report for activities during the month of January 2002
Action Plan/Plan d'action	• Identified and implemented a long term funding application plan

Watershed Group Progress Report/Compte-Rendu – February 2002

Deliverables/Produits livrables	Status (list of activities)/État d'activitées
Organization	Stakeholder Involvement/Participation des intervenants: • Tabulated all landowners inclusive of owner, address, and postal code from the attribute information derived from the Digital Property Mapping data • Had discussions among the NWAI executive about fund raising ideas for 2002-03-07 • All new members recieved membership cards Volunteer Recruitment/Recrutement des bénévoles: • Continued volunteer recruitment through membership forms filled out by new members. Activities involve water quality sampling, fish clipping, fish netting, and association administration
Monitoring	
Education and Communication/Éducation et Communication	• Sent letters to new members and existing members who renewed membership explaining who the NWAI is and what we are doing (i.e. water classification, salmon restoration). An overall thank you for joining or renewing membership was included • Sent a letter to the New Brunswick Council of the Atlantic Salmon Federation (NBCASF) thanking them for the Fish Friends grant • Fish Friends was and continues to ba a huge success at Stanley School. Other classrooms talking aboout salmon and the health of the river
Database/Base de données	Itemize data collected/Détailler les données collectées: • Completed tabulation of the 1999, 2000 & 2001 water quality data • Tabulated and/or graphed precipatation and discharge data for the sampling periods
Mapping/Cartographie	Itemize completed steps from the mapping protocol/Détailler les étapes complétés: • Completed mapping for land use/cover assessment, Ecological Land Classification, Soils, Geology, Water Quality monitoring sites and Digital Property mapping. • Completed other map products such as: (i) Shaded Relief and (ii) Contour Mapping

Reporting/Rapportage	• Completed the 1999, 2000 & 2001 water quality graphs which will be used in the analysis of the data • Completed the 1st draft of a progress report toward water classification on the Nashwaak • Completed graphs a had a preliminary look at trends in the data from a spatial and temperal context • Completed the monthly progress report outlining activities conducted by NWAI during the month February 2002
Action Plan/Plan d'action	

Watershed Group Progress Report/Compte-Rendu - March 2002

Deliverables/Produits livrables	Status (list of activities)/État d'activitées
Organization	Stakeholder Involvement/Participation des intervenants: • Continued to recruit new members. Volunteer Recruitment/Recrutement des bénévoles: •
Monitoring	• Attended Benthic Macro Invertebrate workshop hosted by Eastern Charlottle Waterways.
Education and Communication/Éducation et Communication	• Received continued reports from the fish friends initiative. • Purchased habitat signage from DOT sign shop. • Purchased Vehicle window decals of NWAI logo. •
Database/Base de données	Itemize data collected/Détailler les données collectées: • Received all flow data inclusive of 1962-2001 from Environment Canada • Received all temperature and DO data for the Nashwaak from DFO (orginally collected by the NWAI). • Received climate data for Juniper and Fredericton Airport, inclusive of 1962-2001 ; from Environment Canada. • Complete payment made for Water Quality Analysis and Benthic Macro Invertabrate identification.
Mapping/Cartographie	Itemize completed steps from the mapping protocol/Détailler les étapes complétés: • Completed all mapping deliverables.
Reporting/Rapportage	• Completed progress report on water classification on the Nashwaak River watershed. • Completed monthly progress report for March 2002.
Action Plan/Plan d'action	

Appendix X

Membership

Rec #	Member#	Name	Address	City/Town	Prov	Postal Code	Home Ph#	Work Ph#	Cell#	Fax	Home Email	Work Email	Status	Dues 2001	Renewal
1	91	Gary and Anne Marie Spencer	45 Ward Settlement Rd	Stanley	NB	E6B 1Y9	367-2476	452-6623	461-2674	367-2656	gmspence@nbnet.nb.ca	gms@adi.ca	Exec	Apr-01	**Apr-02**
2	90	Bill Gammon	24 Abernathy Rd	Durham Bridge	NB	E6C 1S4	459-8560	458-8265	461-3715		WGAMMON@nb.sympatico.ca		Exec	Apr-01	**Jan-03**
3	89	Peter Salonius	522 Route #8 Hwy	Durham Bridge	NB	E6C 1K5	459-6663	452-3548			psalonius@nrcan.gc.ca		Exec	Apr-01	**Apr-02**
4	88	James Fraser	1130 Route #8	Nashwaak Bridge	NB	E6C 2C4	367-3023	367-7675			MRJIMFRASER@HOTMAIL.COM		Exec	Apr-01	**Apr-02**
5	87	June Wade	889 English Sett Rd.	Taymouth	NB	E6C 2B2	367-2584	458-8670			dodds@nbnet.nb.ca		Exec	Apr-00	Apr-01
6		Peter Thompson	371 Rte 628	Penniac	NB	E3A 8Y1	472-1458	357-3132			ddeveau@nb.sympetico.ca		Exec	Apr-01	**Apr-02**
7		Thurston Gallager	694 Route #8	Taymouth	NB	E6C 2E7	472-2383						Exec	Nov-00	Nov-01
8		Ron Jenkins	12 Zionville Road	Taymouth	NB	E6C 1Y3	367-2503	459-2990			grandpic@nbnet.nb.ca		Mem	Apr-00	Apr-01
9		Greg Dodds	91 Red Rock Road	Stanley	NB	E3B 2B8	367-2584						Mem	Apr-01	**Apr-02**
10		Peter DeMarsh	152 Nashwaak Road	Taymouth	NB	E6C 2A2	367-9010	453-2440			Dan.Beaudette@gnb.ca		Mem	Oct-01	**Oct-02**
11		Earle MacNaughton	733 Route 628	Durham Bridge	NB	E6C 1N6	457-0147	363-3028					Mem	Apr-00	
12		Dan Beaudette	1162 Route 845	Clifton Royal	NB	E5S 1N1	763-3719						Mem		
13		Bonnie and Danny Deveau	21 Jenkins Drive	Fredericton	NB	E3A 9E6	452-1020						Mem	Jun-00	Jun-01
14		Mark Bell	490 Route #8 Hwy	Nashwaak Village	NB	E6C 1L2	459-7494						Mem	Jul-01	**Jul-02**
15		Joe Kowalski	490 Route #8 Hwy	Nashwaak Village	NB	E6C 1L2	459-7494						Mem	Jul-01	**Jul-02**
16		Donald Colford	451 Route 8 Hwy	Nashwaak Village	NB	E6C 1L3	451-6469	450-7896					Mem	Jun-01	**Jun-02**
17		Judy Colford	451 Route 8 Hwy	Nashwaak Village	NB	E6C 1L3	451-6469						Mem	Apr-00	Apr-01
18		Terry Esty	24 Fearn Lane	Taymouth	NB	E6C 2E4	450-2964						Mem	Apr-00	Apr-01
19		Deb Esty	105 Camp Road	Durham Bridge	NB	E6C 1N8	459-4680		447-2604				Mem		
20		Terry Banks	23 Johnston Lane	Durham Bridge	NB	E6C 1E2	458-5326	452-7300			sqbliss@nbnet.nb.ca		Mem	Sep-00	Sep-01
21		Ed Haines	24 Penniac Rd	Penniac	NB	E3A 8Y7	472-2839						Mem	Apr-00	Apr-01
22		Stephen Bliss	61 London Court	Fredericton	NB	E3B 4B5	451-8694	452-6204			cunjak@unb.c		Mem	Nov-00	Nov-01
23		Donald Clark	694 Route # 8 Highway	Taymouth	NB	E3B 4B5	472-2383	369-2646			dhashey@coxhanson.ca		Mem	Nov-00	Nov-01
24		Dr.Rick Cunjak	807 Mitchell Street	Fredericton	NB	E3B 6E8	455-0711	529-1057			schase@nb.cerbn.ca		Mem	Nov-00	Nov-01
25		David T. Hashey	45 Alexandra Cres.	St. Andrews	NB	E5B 2S1	529-9896	529-1072			dbird@nbnet.nb.ca		Mem	Nov-00	Nov-01
26		Stephen Chase	101-158 Hanwell Road	Fredericton	NB	E3B 9K7	454-7807	452-3234			roy.parker@ec.gc.ca		Mem	Oct-01	**Oct-02**
27		Danny Bird	J.D. Irving	Deersdale	NB		392-8110		273-0651		boyd.mike@jdirving.com		Mem	May-01	**May-02**
28		Roy Parker	11 Hillcourt Dr.	Fredericton	NB	E3A 1S2	458-5643	458-5643					Mem	Nov-00	**Jan-03**
29		Mike Boyd	5 Mannor Court	Fredericton	NB	E3B 2M9	450-6130	458-7362			billc@math.unb.ca		Mem	Nov-00	Nov-01
30		Rod Currie	425 Fulton Ave	Fredericton	NB		458-8491						Mem	Nov-00	Nov-01
31		William Chernoff		Durham Bridge	NB								Mem		
32		Norm Bowen	114 Fish Hatchery Lane	French Village	NB	E3E 2C6	363-3126				AndersonLA@mar.dfo-mpo.gc.ca	Rudi@nbnet.nb.ca	Mem	Jun-00	Jun-01
33		Stephen Scott	114 Fish Hatchery Lane	French Village	NB	E3E 2C6	363-3126				GoffT@mar.dfo-mpo.gc.ca		Mem	Jun-00	Jun-01
34		Leroy Anderson	114 Fish Hatchery Lane	French Village	NB	E3E 2C6	363-3126						Mem	Jun-00	Jun-01
35		Trevor Geoff	562 Route 8	Durham Bridge	NB		472-1048						Mem		
36		John Mallory	436 Kingsclear Ave	Kingsclear 1st Nation	NB	E3E 1J8	363-2457						Mem		
37		Larry Jackson	P.O.Box 3473 Stn B	Fredericton	NB	E3A 5H2	459-3797						Mem	May-01	**May-02**
38		Peter Solomon	417 Manzer Road Rte 628	Durham Bridge	NB	E6C 1R4	474-0623						Mem	May-01	**May-02**
39		Micheal Esty									canoeguy@nbnet.nb.ca		Mem	Jun-01	**Jun-02**
40		Don E. Bell					450-2571				redcanoe@nb.sympatico.ca		Mem	May-01	**May-02**
41		Kim Hargrove					246-5528				ketterling.jim@jdirving.com		Mem		
42		Don McNeil	General Delivery 553 Hwy 628	Durham Bridge	NB	E6C 1R4	450-3068				lunatic@nbnet.nb.ca		Mem	Jan-01	**Jan-03**
44		Jim Ketterling	General Delivery 553 Hwy 628	Durham Bridge	NB	E6C 1R4	450-3096						Mem	Jan-01	**Jan-02**
45		John B. Canney	526 Route 8 Hwy	Durham Bridge	NB	E1C 1K5	450-3068						Mem		
46		Jack Bolton	2288 Route 640	Hanwell	NB	E3E 2EB	367-2069	457-1530			sqdogs@nb.sympatico.ca		Mem	Sep-01	**Sep-02**
47		Barry Labillois	916 Route 628 Hwy	Durham Bridge	NB	E6C 1P4	451-8581						Mem	Sep-01	**Sep-02**
48		Ken Salter	628 Rte #8 Hwy	Durham Bridge	NB	E6C 2C9	457-2300		444-1646	474-1071	MCNEILF@nbnet.nb.ca		Mem	Sep-01	**Sep-02**
49		Edmund Beaulieu							447-2604						
50		Fred McNeil	Route #8 Hwy	Durham Bridge	NB	E6C 2B5	367-2664						Mem	Apr-00	Apr-01
51		Ed Haines	1679 Waasis Route 655	Rusagonis	NB	E3B 8G3	459-3524	459-3524	461-6895	454-4342	woodrivr@nbnet.nb.ca	woodrivr@nbnet.nb.ca	Mem	Apr-00	Apr-01
52		Bob Gillespie	895 Rte 628 Hwy	Durham Bridge	NB	E3C 1A4	450-2566								**Jan-03**
53		Frances Gillespie	897 Rte 628 Hwy	Durham Bridge	NB	E6C 1A4	459-4482								**Jan-03**
54		Scott Neilson	691 Rte 628 Hwy	Durham Bridge	NB	E6C 1S3	452-9713					scott.neilsen@emec.com			**Jan-03**
55		Gordon Dunphy			NB		367-3291					michiko@unb.ca			**Jan-03**
56		David Dunphy	160 Main Street	Fredericton	NB	E3A 1C8									**Jan-03**
57		Ted Colson	24 Rte 8	Penniac	NB	E3A 9C4	459-4304					colson@unb.ca			**Jan-03**
58		George F Wandless	68 McKay Drive		NB		474-1001								**Jan-03**
59		Shirley Lamey	1079 Route 620 Hwy	Estey's Bridge	NB	E3A 6M4	453-1494								**Jan-03**
60		Ingo Doestch	226 Centreville Rd	Cross Creek	NB	E6B 2J6	367-3065								**Jan-03**
61		David Steele	250 Rte 107 Hwy	Nashwaak Bridge	NB	E6C 2G4	367-2527								**Jan-03**
62		Paul/Barb Maher	17 Currieburg Road	Currieburg	NB	E6B 1G9	367-2787								**Jan-03**
63		William MacDonald	259 Nashwaak West Road	Nashwaak Bridge	NB	E6C 2A6									**Jan-03**
64		Brian Watson	53 Highland Heights	Taymouth	NB	E6C 1Y2	367-2210								**Jan-03**
65	93	Austin Watson	47 Gregory Ave	Fredericton	NB	E3A 4B6	472-9448								**Mar-02**
66	94	Hammond River Angling Assoc	10 Porter Road	Nauwigewauk	NB	E2N 6X1	832-1230								**Mar-03**
67	95	Thomas Moss	896 English Settlement Rd	Taymouth	NB	E6C 2B3	367-2476								**Mar-03**