Water Quality Trends in Selected Surface Water Bodies of Newfoundland & Labrador – Phase 2

Newfoundland Labrador

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EXECUTIVE SUMMARY

This is a follow up of the report entitled *Water Quality Trends in Selected Surface Water Bodies of Newfoundland & Labrador*, published in 2003. The report examined trends in 36 different water quality parameters from 65 different water quality monitoring stations using data from 1986-2001. This report continues to examine trends in 31 of the original water quality parameters and 34 of the original stations using data from 1986-2013. The current report aims to identify any difference in parameter trend results with an additional 10 years of data. The risk-based assessment (RBA) results, Canadian Environmental Sustainability Indicator (CESI) station classification based on land use, developmental pressures from Canada Newfoundland Aqua Link (CANAL) help determine likely causes contributing to the improving or deterioration of water quality trends. Reference from past trend report is drawn to explain parameter trend in the current report.

The parameter trend in this report was determined using time series plot, non-parametric Mann Kendall and Rank Spearman. All parameters that exhibited trends in the past report either continued to exhibit the same trend or exhibited no trend in the current report. Station location and land use within the watershed influenced the parameter trends. Local stressors generally influenced urban station parameters. Geological or global stressors such as climate change influenced non-urban station parameters. Urban influence were more visible in the eastern region of the island portion of the province.

Water quality parameters for trend analysis included major chemical and physical parameters, such as pH, turbidity, colour, conductivity, nutrients, major ions and metals. Throughout the province, copper, pH, zinc and lead were consistently displaying improving trends which is consistent with the past trend report. The river stewardship programs established in urban station locations led to improved water quality through increased public awareness of harmful activities which led to improvement of these parameters. Reductions in the rate of atmospheric deposition improved copper, zinc and lead. Natural geological factors such as limestone lead to improvements in pH and lead in non-urban or remote locations.

Turbidity, colour, dissolved organic carbon (DOC) and nitrogen generally displayed deteriorating trend which is consistent with the previous trend report. Turbidity and colour located in urban stations were influenced by urban development while DOC was influenced by a combination of lawn fertilizing and organic decay of soil. Increased precipitation from climate change along with global carbon emissions played a major role in influencing these parameters in non-urban or remote location. Arsenic, beryllium, cadmium, chromium, cobalt, lead, molybdenum, and selenium consistently measured below lab detection limit, which influenced the trend results for these parameters.

The overall results in this report is very consistent with the parameter trends in the previous report. The concluding section of this report outlines guidance to evaluate trends on all active Water Quality Monitoring Agreement (WQMA) stations using recent data.

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1. Introduction

Department of Environment, Climate Change and Municipalities (ECCM) in partnership with Environment and Climate Change Canada (ECCC) monitors the surface water quality at selected rivers across the province of Newfoundland and Labrador since 1986 under the Water Quality Monitoring Agreement (WQMA). The purpose of this Agreement is:

- Coordination and integration of federal and provincial water quality monitoring activities
- Assessment of the suitability of water for various beneficial water uses
- Development of pollution control regulations, water quality guidelines and objectives
- Use of the collected data for trend analysis, water quality modeling, environmental assessment studies, research undertakings, legislative formulations, and federal-provincial-international agreements and commitments

A 2003 report entitled *Water Quality Trends in Selected Water Bodies of Newfoundland & Labrador* examined trends in 36 different water quality parameters from 65 water quality monitoring stations located on waterbodies throughout the province of Newfoundland and Labrador (NL). The report identified parameters that improved, deteriorated or remained unchanged during 1986 to 2001. Some of the key findings of the report on changes in parameter trend throughout the province were:

- A decrease (or improving trend) in **conductivity** and by extension, major ion concentration, (**calcium, sodium, magnesium, potassium, sulphate, chloride**).
- An increase (or deteriorating trend) in **colour, turbidity, nitrate/nitrite and nitrogen**.
- A decrease (or improving trend) in **arsenic** throughout the province.
- A decrease (or improving trend) in **barium, copper, mercury and lead**.
- An increase (or deteriorating trend) in **beryllium, cadmium** and **molybdenum**. However, these three parameters had the highest occurrence of censored data that is believed to have had some influence on the trend analysis.
- A decrease (or improving trend) in **phosphorous** in rivers of the Central and Eastern regions.
- The occurrence of trend in **cobalt** and **manganese** (all showed a majority of improving trends) is most apparent in water quality stations from the Eastern region.
- An increase (or deteriorating trend) in **nickel** in rivers in non-urban areas of the Avalon and rivers on the eastern side of the Central region.
- An increase (or deteriorating trend) in **sulphate** in urban rivers of St. John's.
- Frequent improving trends in **zinc**, **strontium**, **lithium**, and **selenium**.

The report further identified the following universal sources of water quality trends:

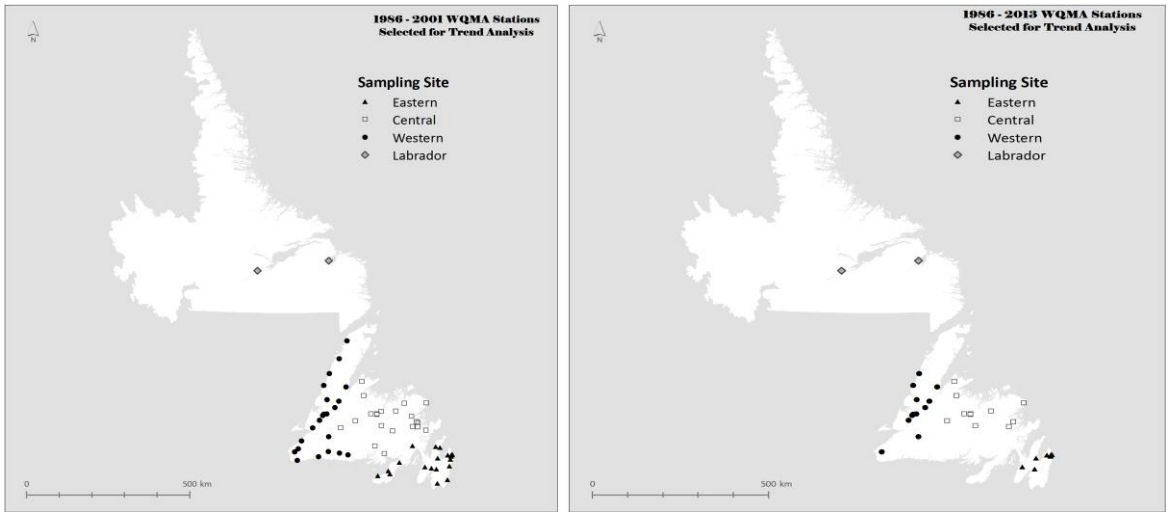
- In pristine watersheds where there was little development or activity, trends were frequently observed in major ions (and conductivity), turbidity, and colour. As these trends were observed in all regions of the province, their cause was linked to climate change using representative regional precipitation plots for the same period. Increased precipitation leads

to increased runoff, which in turn leads to decreased concentrations of major ions (and conductivity) and increased sediment loads, affecting turbidity and colour.

- Monitoring in pristine Arctic environments has revealed the presence of contaminants far from their source as a result of atmospheric deposition. Recent observations have shown reductions in lead levels, linked to reduced global emissions of lead into the atmosphere from leaded gasoline, since the 1970s. It has also revealed declining trends in zinc, declining trends in copper since 1991, and declining trends in mercury since 1990 (Indian & Northern Affairs Canada, 1997). These results were mirrored in many of the more pristine watersheds of Newfoundland and Labrador. Copper, mercury and lead (and to a lesser extent barium, zinc, selenium, and arsenic) frequently displayed improving trends in watersheds with little human activity or development. The cause of these trends is most likely linked to reductions in the levels of contaminants from atmospheric deposition, due to improved emissions from pollution sources- local, continental and global.
- Phosphorous Control Act were implemented in the mid 1970s and continued to reduce the amounts of phosphorous used in detergents throughout the 1980s. The results of this abatement are most evident in more populated urban areas (particularly St. John's).
- There are several river stewardship programs or societies, which try to promote, encourage, and maximize the ecological value of different rivers in the province. Such rivers include Virginia River, Rennies River, Waterford River, Corduroy Brook, and Corner Brook. These river societies plan river enhancement activities, including river restoration to facilitate fish spawning, alleviation of pollution, and the development of appropriate public access to the system. In many rivers, such programs have led to improved water quality through increased public awareness of harmful activities.

The map in Figure 1 shows the distribution of the WQMA stations used in previous (Phase I) and current (Phase II) trend report.

Figure 1: Station Comparison - Trend analysis Phase I (1986 – 2001) and Phase II (1986 – 2013)



The map on the left shows the 65 stations used in the Phase I report while the map on the right shows the 34 stations used in the Phase II report. The number of stations in Phase II report are fewer due to the discontinuation of sampling at many of the earlier stations resulting from lack of resources, inaccessibility of sampling site or identification of newer priority sampling locations.

This Phase II report identifies any differences in trend results for the same stations and parameters reported in Phase I. Phase II report uses information from the recently updated Risk Based Approach (RBA), Canada Newfoundland Aqua Link (CANAL), and Canadian Environmental Sustainability Indicator (CESI), for parameter trend interpretation and station land use classification. The station land use classification identifies station location and its relation to local, geological or global stressors. For example, parameter improvement or deterioration in an urban river would more likely be related to local stressors in comparison to the same parameter in a remotely located river, which would likely be related to geological or global stressors.

The current study does not include monthly Spearman trend analysis applied in Phase I report due to the lack of monthly data. This is resulting from reduction of sampling frequency to four times a year in the majority of the sampling sites in comparison to the increased sampling frequency that took place in the past. The report uses the detection limit value for censored data and leaves the outliers in the dataset as they indicate an important phenomenon, not necessarily erroneous data.

This report first discusses the objectives and scope followed by the methodology applied to obtain results. The methodology includes description of trend method, sources of water quality trends identified in the previous report, names of stations and parameters, data source and statistical analysis performed on data. A brief description of the RBA, CANAL and CESI reporting follows the methodology section. The trends results are then discussed which includes the causes of parameter trend in relation to Phase I trend results. The report concludes by discussing the regional and global parameter trend results and its correlation with the local and global stressors.

1.1 Objectives and Scope

The overall objective for this study is to identify whether parameters trend results in Phase I are the same or different with the parameter trend results in Phase II. The scope of the study is limited to data obtained for the parameters that were analyzed in the Phase I report. During the years 1998-2004, there was a reduction in sampling frequency and in some cases absence of years of sampling resulting from lack of human and financial resources. This resulted in discontinuity of data in many of the sampling locations. As a result, many of the parameter in this report consists of discontinuous data in those years.

Specific objectives of the current report include:

- Explaining causes for difference in parameter trend in Phase I report from Phase II report;
- Comparing trend results using graphs, Mann-Kendall and Rank Spearman;
- Recommendations to improve future trend reporting.

2. Methodology

2.1 Trend Methods Description

Phase I trend report used three methods for trend detection, namely the time series plot using moving average, non-parametric Spearman's rank correlation and monthly trends using Spearman's rank correlation. A summary of the trend matrix for each sampling location and the majority of indicators determined the overall trend for individual parameters.

Phase II trend report also used time series plot, Spearman's rank correlation and Mann Kendall test. This report compares Spearman's rank correlation results with Mann Kendall. Spearman's rank correlation coefficient measures the association between two variables (Sokal, 1995; Zar, 1999), in this case WQMA parameter date and data. The ranks of the data rather than the measured values was applied for trend identification and is particularly suitable to detect linear trend.

Non-parametric Mann Kendall was applied since most parameters in this study follow a non-normal distribution (right-skewed) observed by the high value of skewness (greater than 0.5) and kurtosis (greater than 4). Mann-Kendall measures the estimate of the magnitude of the trend obtained by using Theil-Sen estimator, also known as Sen's slope. The Theil-Sen estimator is a method for robust linear regression that chooses the median slope among all lines through pairs of two-dimensional data points (Theil, 1950). This method is robust enough to address outliers and it is the most popular non-parametric technique for estimating a linear trend.

The statistical power to identify trend for Spearman's rank and Mann-Kendall are identical (Sheng et al., 2002). Most studies performed in the past to explain the differences in results between these two trend methods, in terms of statistical power to detect trend, failed to observe any difference. As a result, Mann-Kendall is primarily used to report parameter trend results but if the results vary from Spearman's rank then further explanation on the differences are provided.

In both trend methods, significance testing identifies existence of trend using the following null (H0) and alternate (H1) hypothesis:

H0: Spearman's correlation coefficient (or Mann-Kendall's tau) = 0 (no evidence of a trend)
H1: Spearman's correlation coefficient (or Mann-Kendall's tau) $\neq$ 0 (evidence of a trend)

A test statistic checks the existence of trend in R statistical programming (version 3.42). In order to determine if there is enough evidence in the data to reject the null hypothesis of no trend, a p-value for the test is calculated. Whenever the p-value is less than the significance level (α), the null is rejected and there is enough evidence to conclude on the existence of a linear trend in data. This study applies a p-value of 0.05 for the significance level.

The p-values obtained for each of the parameters identifies whether trend exists. A trend exists if the obtained p-value is less than the significance level of 0.05. A positive value of Kendall's tau (or Spearman's rho) indicates a parameter showing deteriorating trend while a negative rho indicates an improving trend. Deteriorating trend is indicated by the keyword "Up" in the "Trend Result", improving trend by the keyword "Down", while no trend is indicated by the keyword "None".

2.2 Sources of Water Quality Trends

Table 1 lists some of the potential sources, the majority were identified in Phase I report of observed improving or deteriorating water quality trends in NL. The table details the causes, parameters affected and possible explanations of the underlying mechanism.

Table 1: Potential Factors Affecting Water Quality

Cause	Mechanism	Parameters Affected
Abatement	Through greater awareness, people are using less harmful household products and disposing of them safely, using phosphate-free soaps and detergents, reducing or eliminating use of fertilizers and pesticides on lawn and garden, checking and repairing fluid leaks from vehicles, not putting toxic chemicals down the drain, forming community stewardship groups to care for local waterbodies and provide stream enhancement, etc.; Phosphorous Control Act; move to unleaded gasoline; buffer zone regulations; using silt screens on construction sites.	Metals, Nutrients, Major Ions, Turbidity, pH, Conductivity
Atmospheric Deposition	Long range transport of Atmospheric pollutants and deposition on land and water surfaces; acid rain; also, reduction in Atmospheric pollutants through international initiatives such as the ban on leaded gasoline.	Nutrients, Metals, pH, and Major Ions
Farming	Runoff from farms treated with manure, fertilizer, lime, pesticides, and herbicides.; which is affected by land clearing, tillage, ploughing, irrigation, grazing, feedlots and animal corrals; aquaculture.	Nutrients, Metals, pH, Turbidity, Major Ions, and DO
Forestry	Increased water temperature and runoff from removal of vegetation, road construction and use, and timber harvesting	Nutrients, Turbidity and Colour
Global Carbon Emissions	The annual rate of increase in atmospheric carbon dioxide over the past 60 years is about 100 times faster than previous natural increases. This increase resulting from the burning of fossil fuel coal etc. causing rise in global carbon emissions. The effect of global carbon emission through air transportation is observed in waters with increased DOC contents. (Boden, et. al. 2017) (Edenhofer, et. al. 2014)	DOC
Industry	Wastes and sludge from industries such as pulp and paper mills, sawmills, smelting, metal production or plating, etc.	Metals, and Colour
Landfill	Seepage from landfills and hazardous waste facilities. Deposition from incinerators.	Nutrients, Metals and pH
Mining	Runoff from mines and mine wastes, quarries and test well sites; residuals from nitrogen-based explosives; acid mine drainage.	Turbidity, pH, Metals and Major Ions

Natural Sources	Local waterfowl populations; local geology; soil chemistry; forest fires; synergistic effects; flow conditions.	Major Ions,Nutrients, Metals, pH and Conductivity
Recreation	Large variety of recreational land uses including ski resorts, boating and marinas, campgrounds, parks, tourist chalets, golf courses, hunting, cabin development, ATV and snowmobile trails, etc.	Nutrients, Turbidity, and Metals
Rural Sewage System	Overloading and malfunction of septic systems from rural housing or cabin developments.	Nutrients
Sewage	Disposal of liquid wastes from municipal wastewater effluents, sewage sludge, industrial effluents and sludge, wastewater from home septic systems, cross-connections; legal and illegal dumping in water courses	Nutrients, Metals and Turbidity
Stream Modification	Stream alterations such as dams, weirs, bridges, culverts, armoring, fish ladders, dredging, channelization; nutrients settle with suspended sediments in reservoirs while scouring occurs downstream of dams, flowing streams slow to form slack water pools.	Metals, Nutrients and Turbidity
Transportation	Roads, pipelines, hydroelectric corridors, bridges, etc.; Chemicals from motor vehicles.	Nutrients, Turbidity and Metals
Unknown	Cannot attribute to any known cause.	All
Weather and Climate Change	Streamflow has an important effect on the level of many water quality indicators. Peak flows have increased levels of suspended solids and related indicators, while low flows are associated with increased levels of dissolved ions.	Turbidity, Major Ions, Conductivity

2.3 Stations Selected for Trend Analysis

Table 2 lists the 34 stations selected for Phase II, which were part of the stations in the original study. The previous study used station data from 1986 to 2001 while the current study uses data from 1986 to 2013. The 34 stations include 10 stations in Eastern, 10 stations in Central, 12 stations in Western, and 2 stations in Labrador. All stations consist of at least 22 years of data.

Table 2: Selected WQMA Trend Stations Ordered by Region

Station No	Station Name	Start Date	End Date	Years	Region
NF02ZM0020	Broad Cove Brook near St. Phillips	29-Oct-86	16-Jan-13	26	Eastern
NF02ZL0029	Goulds Brook near Makinsons	6-Jun-89	6-Dec-12	23	Eastern
NF02ZM0144	Kellys Brook at Portugal Cove Road	12-Oct-90	16-Jan-13	22	Eastern
NF02ZM0109	Mundy Pond at Outlet	12-Oct-90	11-Dec-12	22	Eastern
NF02ZK0005	Northeast River near Placentia	26-Nov-86	6-Dec-12	26	Eastern
NF02ZM0015	Quidi Vidi Lake at Outlet	29-Oct-86	11-Dec-12	26	Eastern
NF02ZM0016	Rennies River at Carnell Drive	29-Oct-86	11-Dec-12	26	Eastern
NF02ZN0004	Salmonier River at St. Catherines	27-Aug-87	6-Dec-12	25	Eastern
NF02ZM0014	Virginia River at The Boulevard	29-Oct-86	11-Dec-12	26	Eastern
NF02ZM0009	Waterford River at Kilbride	29-Oct-86	16-Jan-13	26	Eastern
NF02YO0107	Exploits River near Millertown	4-May-89	5-Dec-12	23	Central
NF02YO0001	Exploits River at Grand Falls	1-Aug-86	25-Jan-13	26	Central
NF02YO0020	Exploits River at Aspen Brook	5-Sep-86	24-Jan-13	26	Central
NF02YQ0030	Gander River at Appleton	7-Aug-89	19-Feb-13	23	Central
NF02YM0003	Indian Brook at Route 390	5-Sep-86	19-Feb-13	26	Central
NF02YQ0006	Northwest Gander River	5-Sep-86	5-Dec-12	26	Central
NF02YR0001	Pound Cove Brook at Route 330	5-Sep-86	4-Feb-13	26	Central
NF02YM0004	South West Brook at Baie Verte	5-Sep-86	19-Feb-13	26	Central
NF02YS0011	Terra Nova River at Spencer Bridge	8-Jan-86	25-Jan-13	27	Central
NF02YS0001	Terra Nova River at Terra Nova	8-Jan-86	25-Jan-13	27	Central
NF02YL0013	Corner Brook at Margaret Bowater Park	22-Aug-86	10-Jan-13	26	Western
NF02ZA0006	Grand Codroy River Below Overfall Brook	22-Aug-86	12-Dec-12	26	Western
NF02YK0022	Humber Canal at Main Dam Road	11-Apr-89	10-Jan-13	23	Western
NF02YL0012	Humber River at Humber Village Bridge	22-Aug-86	10-Jan-13	26	Western
NF02YL0011	Humber River at Little Falls Bridge	22-Aug-86	12-Dec-12	26	Western
NF02YN0001	Lloyds River at Bridge at Burgeo Road	8-Jun-86	12-Dec-12	26	Western
NF02YH0018	Lomond River at Route 431	22-Aug-86	22-Jan-13	26	Western
NF02YG0001	Main River at Route 420	22-Aug-86	22-Jan-13	26	Western
NF02YJ0004	Pinchgut Brook at TCH	22-Aug-86	31-Jan-13	26	Western
NF02YE0004	Portland Creek at Route 430	22-Aug-86	22-Jan-13	26	Western
NF02YE0005	Western Brook at Route 430	22-Aug-86	22-Jan-13	26	Western
NF02YL0029	Wild Cove Brook at Route 440	12-Jan-89	31-Jan-13	24	Western
NF03OE0001	Churchill River Above Upper Musk. Falls	2-Apr-89	30-Jan-13	23	Labrador
NF03QC0001	Eagle River Above Falls	3-Apr-89	23-Jan-13	23	Labrador

2.4 Parameters Selected for Trend Analysis

Table 3 lists the 31 parameters used in the current study. The previous study consisted 36 parameters. However, due to lack of sufficient data the current study excludes the following parameters: dissolved oxygen, fluoride, nitrate & nitrite, manganese, and mercury. The table also includes the parameter abbreviation, units and parameter group for each parameter. The parameters divided into four broad groups monitored under the WQMA Program: Physical and Chemical, Major Ions, Nutrients, and Trace Elements and Metals.

Table 3: Parameters Selected for Trend Analysis*

Parameter Name	Abbrev	Units	Parameter Group
Colour Apparent	COLOURA	pt-co units	Physical and Chemical Parameters
Conductivity	COND	µS/cm	Physical and Chemical Parameters
pH	PH	pH units	Physical and Chemical Parameters
Turbidity	TURB	NTU	Physical and Chemical Parameters
Calcium Dissolved	CAD	mg/L	Major Ions
Chloride Total	CLD	mg/L	Major Ions
Magnesium Dissolved	MGD	mg/L	Major Ions
Potassium Unfiltered	KU	mg/L	Major Ions
Sodium Unfiltered	NAU	mg/L	Major Ions
Sulphate Total	SOT	mg/L	Major Ions
Carbon Dissolved Organic	DOC	mg/L	Nutrients
Nitrogen Total	NT	mg/L	Nutrients
Phosphorous Total	PT	mg/L	Nutrients
Silica	SIO2	mg/L	Nutrients
Aluminum Total	ALT	mg/L	Trace Elements and Metals
Arsenic Total	AST	mg/L	Trace Elements and Metals
Barium Total	BAT	mg/L	Trace Elements and Metals
Beryllium Total	BET	mg/L	Trace Elements and Metals
Cadmium Total	CDT	mg/L	Trace Elements and Metals
Chromium Total	CRT	mg/L	Trace Elements and Metals
Cobalt Total	COT	mg/L	Trace Elements and Metals
Copper Total	CUT	mg/L	Trace Elements and Metals
Iron Total	FET	mg/L	Trace Elements and Metals
Lead Total	PBT	mg/L	Trace Elements and Metals
Lithium Total	LIT	mg/L	Trace Elements and Metals
Molybdenum Total	MOT	mg/L	Trace Elements and Metals
Nickel Total	NIT	mg/L	Trace Elements and Metals
Selenium Total	SET	mg/L	Trace Elements and Metals
Strontium Total	SRT	mg/L	Trace Elements and Metals
Vanadium Total	VT	mg/L	Trace Elements and Metals
Zinc Total	ZNT	mg/L	Trace Elements and Metals

**Revised May 18th, 2023*

2.5 Data Collection and QA/QC Analysis

Water quality samples collected by WRMD staff members are sent to accredited ECCC labs for analysis. The lab performs its own internal QA/QC check during the sample analysis to ensure the validity of the data. Once the analysis is complete, the sample parameter data is stored in an internal database. Every six months the updated data is loaded into an Access™ database and transferred to WRMD. The current study uses this transferred data to generate parameter trend for the stations identified in Table 2.

Some parameters such as arsenic, beryllium, cadmium, chromium, cobalt, lead, molybdenum, and selenium consistently showed censored values in at least 30% of the data. The preciseness of the newer analysis instruments allowed parameter measurement with a lowered censored value detection limit. As a result, many of the earlier censored parameters started showing an actual parameter value instead of a censored value. The change in the instrument detection limits resulted in improving trend for the above parameters as the newer true values are much lower than the instrument detection limit identified in the past. However, this kind if trend is not considered a true trend. In this report, parameters showing improving or deteriorating trend with 30% or more censored data is listed as "Censored" under the cause of parameter trend due to the influence of censored data in the trend result.

Appendix A lists the statistical measurements including count, minimum, maximum, mean, median, standard deviation, 5^{th} and 95^{th} percentile, for each station. In addition, kurtosis and skewness, which measures the sharpness of parameter distribution peak and direction of the distribution skew is also measured. The kurtosis and skewness identify parameter distribution to select an appropriate trend method, which in this case was Mann Kendall.

3. Risk Based Approach (RBA)

ECCC has developed a tool for the assessment of potential environmental risk to water quality and aquatic ecosystems across Canada, known as the Risk- Based Approach (RBA). The tool combines information on the potential risks to a specific water quality sampling site or watershed, including activities and sources of contamination (category A), impacts on water quality (category B), and potential impacts on the aquatic ecosystem (category C). The RBA tool combines the information within each category to produce a category score (0 to 100) and level of risk (low, medium, high). Finally, all the data from categories A, B and C, are combined to produce an overall RBA score (0 to 100) and overall categorization of the level of risk to water quality and aquatic ecosystems at the site being considered. The RBA level of risk and the corresponding score are:
Low: 0 – 30; Medium: 30.1 – 70; and High 70.1 – 100.

For example, if the overall score is 80, then the level of risk to water quality at that site is high. The current report accesses the individual category ranks along with the overall RBA ranking to identify the relationship between parameter trends and the rankings.

4. Canada-Newfoundland/Labrador AquaLink (CANAL)

The Canada-Newfoundland/Labrador AquaLink (CANAL) is a partnership project between ECCC and ECCM. This website allows public access to ambient water quality data as well as sample site descriptions and metadata for over 100 water quality monitoring stations throughout Newfoundland and Labrador. For each station, CANAL provides information on general site description, climate information (mean seasonal and annual precipitation), geology and soil information, development information in the basin, urban (population and infrastructure) and recreational activities. The current report uses information from CANAL, specifically the urban and development information to identify the effect of parameter trend results in each site.

5. Canadian Environmental Sustainability Indicators (CESI)

Canadian Environmental Sustainability Indicators (CESI) measures the progress of the Federal Sustainable Development Strategy. It reports to Canadians on the state of the environment, and describe Canada's progress on key environmental sustainability issues. The Freshwater Quality Indicator (WQI) provides an overall measure of the ability of freshwater bodies to support aquatic life at selected monitoring stations across Canada. It is a water quality guideline-driven tool used to analyze large quantities of water quality data at a monitoring station into a single index. Water quality at a monitoring station is considered excellent when ambient water quality does not exceed guidelines at any time for any of the selected parameters. When water quality is rated poor, water quality measurements usually exceed their guideline; exceedances at these stations may be large. For each CESI water quality monitoring sites, the CESI website lists the land use category along with the WQI index category. These land use categories are likely to influence the water quality for each CESI sites. Example of land use categories can be population, agriculture, remote etc. In this report, the land use categories identify relationship between land use and parameter improvement or degradation at a site.

6. Results and Discussions

The parameter trend results are categorized by each of the four regions across the province.

Parameters that displayed same trend outcomes in both reports are shaded as follows:

Parameters that displayed different trend outcomes in both reports are shaded as follows:

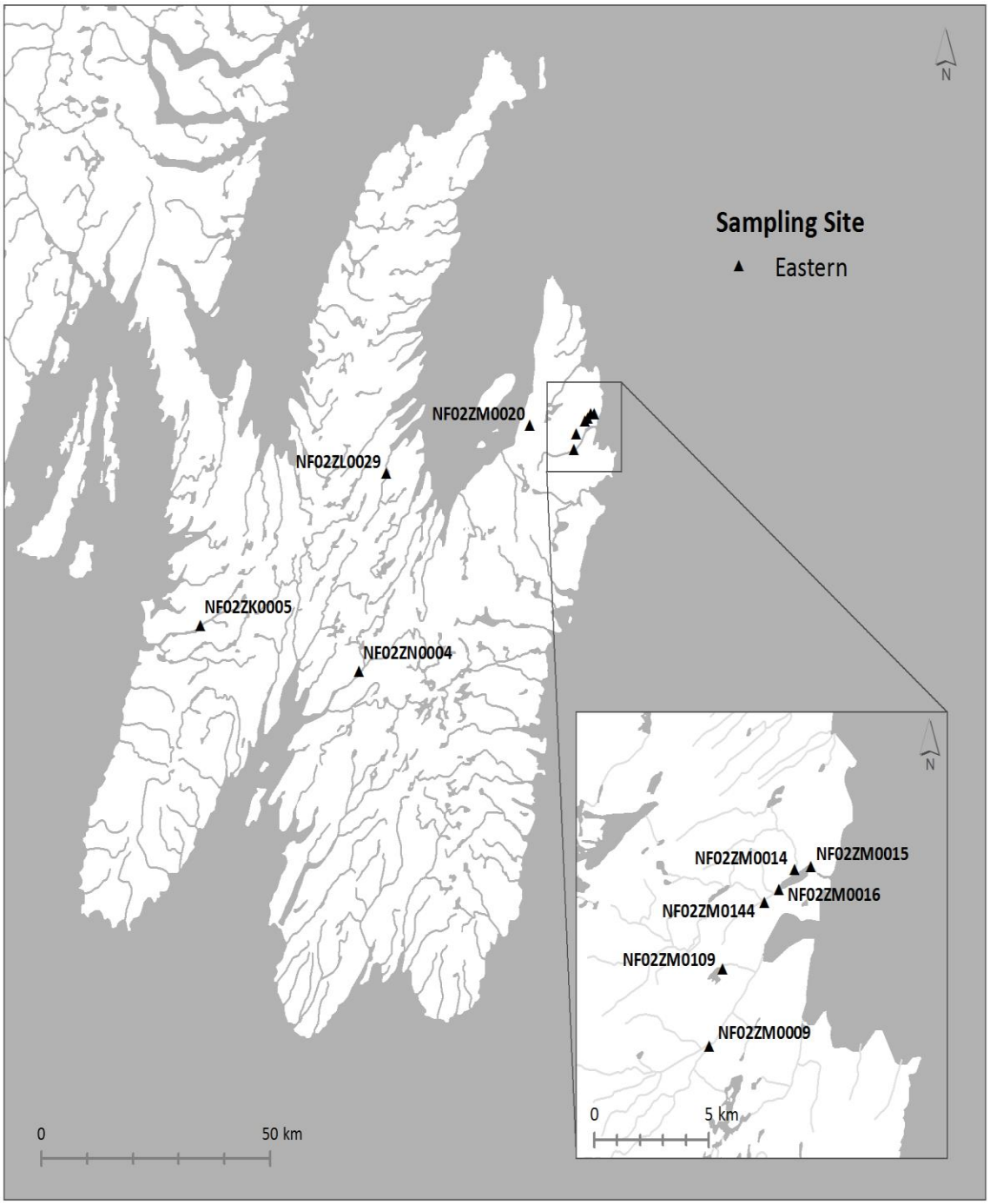
For each station within a region, the results show:

- Parameter time series plots (improving / deteriorating trend).
- Parameter summary of overall trend (improving / deteriorating trend).
- Comparison of current trend results (Phase II) with past trend results (Phase I).

6.1 Eastern Water Quality Station Trends

Figure 2 displays 10 Eastern stations included for trend analysis. Six stations are in the City of St. John's.

Figure 2: Selected Eastern WQMA Trend Stations



6.1.1 Broad Cove Brook near St. Phillips (NF02ZM0020)

Broad Cove Brook is located near the community of Portugal Cove-St Phillip's. The CESI land use category classifies the station as populated. The population of Portugal Cove-St Phillip's is approxiamtely 8000 which is smaller in comparison to the City of St. John's (100,000). CANAL lists the surrounding development pressure as medium. RBA ranks the level of overall risk to water quality as medium.

6.1.1.1 Parameter Time Series Graph

Figures 3 and 4 display the parameter time series graphs for improving and deteriorating trend parameters for Broad Cove Brook.

Figure 3: Broad Cove Brook near St. Phillips - Improving Trend Parameters

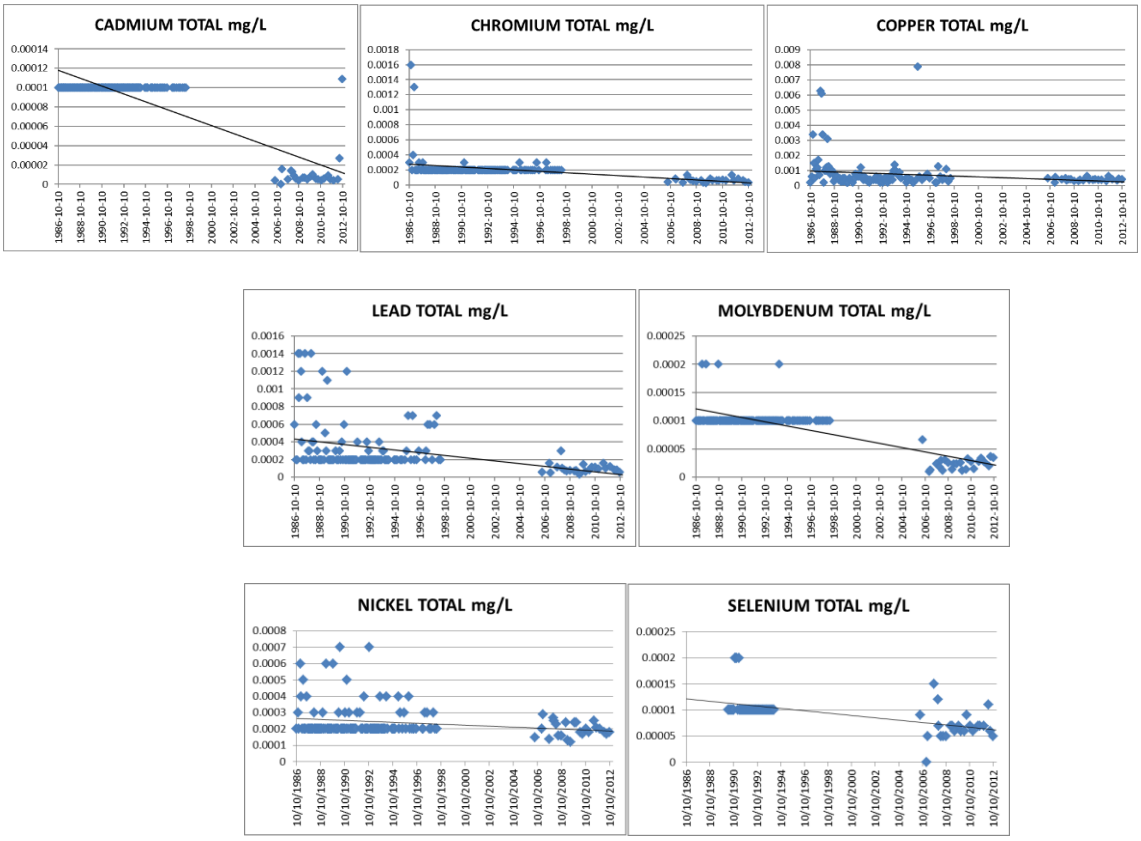
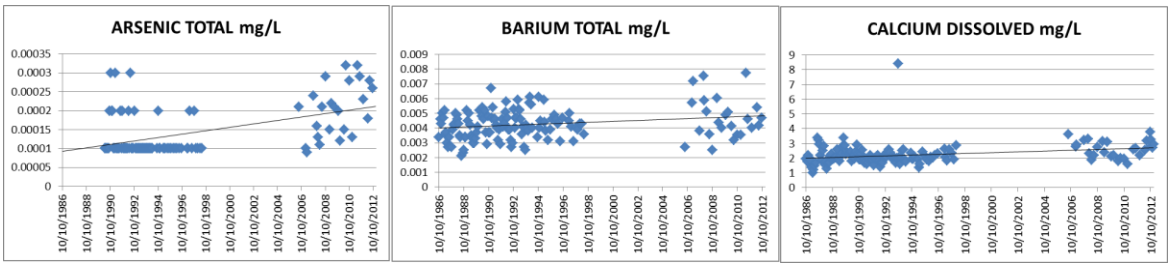
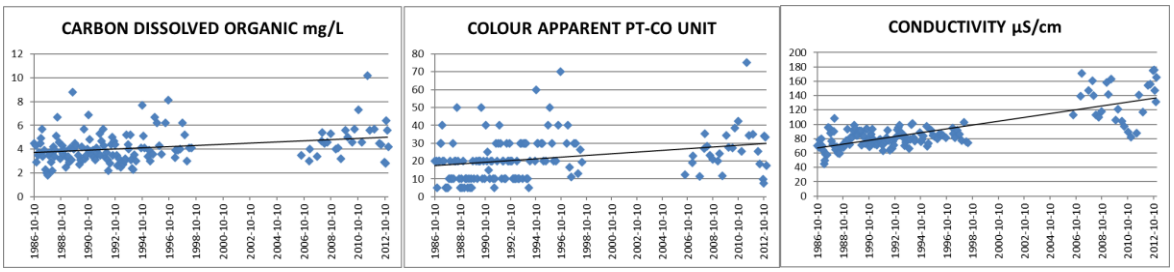
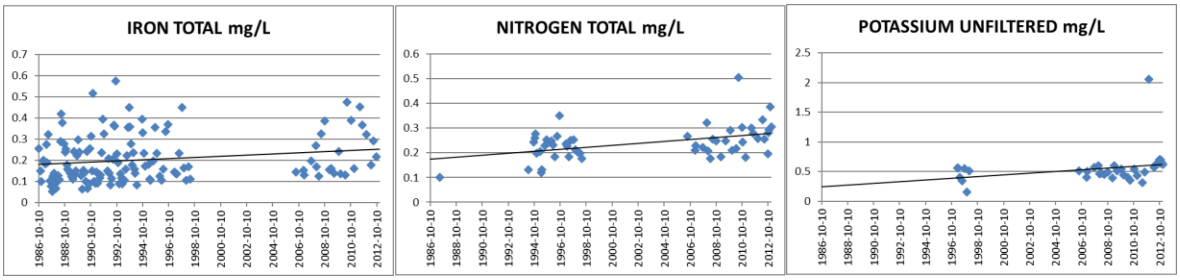
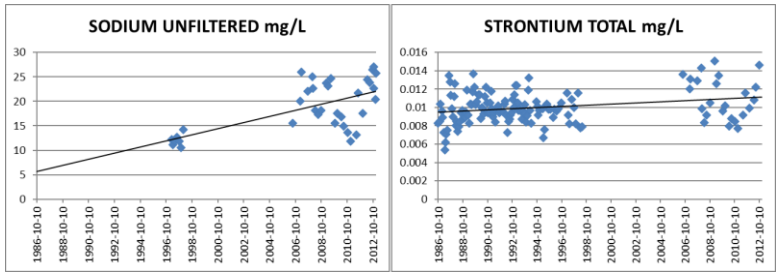


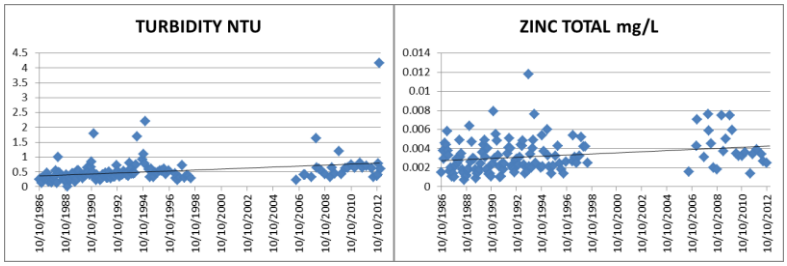
Figure 4: Broad Cove Brook near St. Phillips - Deteriorating Trend Parameters




CARBON DISSOLVED ORGANIC mg/L
COLOUR APPARENT PT-CO UNIT
CONDUCTIVITY µS/cm


IRON TOTAL mg/L
NITROGEN TOTAL mg/L
POTASSIUM UNFILTERED mg/L


SODIUM UNFILTERED mg/L
STRONTIUM TOTAL mg/L


TURBIDITY NTU
ZINC TOTAL mg/L

6.1.1.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 4 displays overall water quality parameters trend results for Broad Cove Brook.

Table 4: Broad Cove Brook near St. Phillips - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	138	0.05	0.65	0.04	No	0.65	0.03	No
AST	97	0.05	0	0.37	Up	0	0.29	Up
BAT	138	0.05	0.03	0.19	Up	0.03	0.13	Up
BET	138	0.05	0.05	-0.16	No	0.26	-0.07	No
CAD	140	0.05	0	0.31	Up	0	0.21	Up
DOC	141	0.05	0	0.26	Up	0	0.18	Up
CDT	138	0.05	0	-0.58	Down	0	-0.46	Down
CLT	28	0.05	0.59	0.11	No	0.74	0.05	No
COLOURA	142	0.05	0	0.37	Up	0	0.27	Up
COND	142	0.05	0	0.61	Up	0	0.45	Up
COT	136	0.05	0.43	0.07	No	0.45	0.05	No
CRT	136	0.05	0	-0.64	Down	0	-0.51	Down
CUT	136	0.05	0	-0.29	Down	0	-0.21	Down
FET	136	0.05	0.02	0.2	Up	0.03	0.13	Up
LIT	136	0.05	0.7	0.03	No	0.54	0.04	No
MGD	140	0.05	0.14	-0.13	No	0.12	-0.09	No
MOT	136	0.05	0	-0.65	Down	0	-0.5	Down
NIT	136	0.05	0.02	-0.2	Down	0.02	-0.15	Down
NT	54	0.05	0	0.43	Up	0	0.29	Up
PBT	136	0.05	0	-0.56	Down	0	-0.42	Down
PH	142	0.05	0.44	0.07	No	0.44	0.04	No
PT	141	0.05	0.81	0.02	No	0.81	0.01	No
SET	72	0.05	0	-0.65	Down	0	-0.5	Down
SIO2	61	0.05	0.51	0.08	No	0.43	0.07	No
SOT	28	0.05	0.41	0.16	No	0.66	0.06	No
SRT	136	0.05	0.04	0.18	Up	0.03	0.13	Up
TURB	142	0.05	0	0.48	Up	0	0.35	Up
VT	136	0.05	0.11	-0.14	No	0.11	-0.1	No
ZNT	136	0.05	0	0.27	Up	0	0.18	Up

6.1.1.3 Comparison and Causes of Change from Past

Table 5 compares trend for Broad Cove Brook near St. Phillip's between Phase I and Phase II. Copper displayed improving trend. Barium, calcium, colour, conductivity, DOC, iron, nitrogen, potassium, sodium, strontium, turbidity, and zinc displayed deteriorating trend. Cadmium, chromium, lead, molybdenum, nickel, and selenium displayed improving trend with censor majority data. Arsenic displayed deteriorating trend with censored majority data.

When comparing the trend results between Phase I and Phase II, copper continued to improve over time while barium, colour, conductivity, nitrogen, turbidity and zinc deteriorated over the years. Molybdenum continued to deteriorate with censor majority data. Nickel, which deteriorated in the past, improved with censor majority data. Chloride and lithium, which deteriorated in the past, showed no trend. Sodium and potassium, having only one year of common data period with Phase I report, was considered insufficient for comparative analysis.

Reduction due to atmospheric deposition likely contributed to improvement in copper.

Urban development affected colour, conductivity turbidity and increased metal levels such as barium, iron, strontium, and zinc. The application of road salt during the winter affected major ions such as calcium, potassium, and sodium. Farming activities in the basin was likely linked to increasing level of nitrogen. DOC levels may be increasing because of urban activities affecting natural organic decay. The degree of urbanization has increased heavily in this basin indicated by the increased number of deteriorating parameters.

Table 5: Broad Cove Brook near St. Phillips - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Copper	Atmospheric Deposition	Copper Total	Atmospheric Deposition
Mercury	Atmospheric Deposition		
Deteriorating Trend			
Barium	Urban Development	Barium Total	Urban Development
Chloride	Transportation	Calcium Dissolved	Transportation
Colour	Urban Development	DOC	Urban Development / Natural Sources
Conductivity	Urban Development	Colour	Urban Development
Lithium	Urban Development	Conductivity	Urban Development
Nickel	Urban Development	Iron Total	Urban Development
Nitrogen	Farming	Nitrogen Total	Farming
Sodium	Transportation	Strontium Total	Urban Development
Turbidity	Urban Development	Turbidity	Urban Development
Zinc	Urban Development	Zinc Total	Urban Development
Censored			
Beryllium	Censored	Arsenic Total	Censored
Cadmium	Censored	Cadmium Total	Censored
Molybdenum	Censored	Chromium Total	Censored
		Lead Total	Censored
		Molybdenum Total	Censored
		Nickel Total	Censored
		Selenium Total	Censored

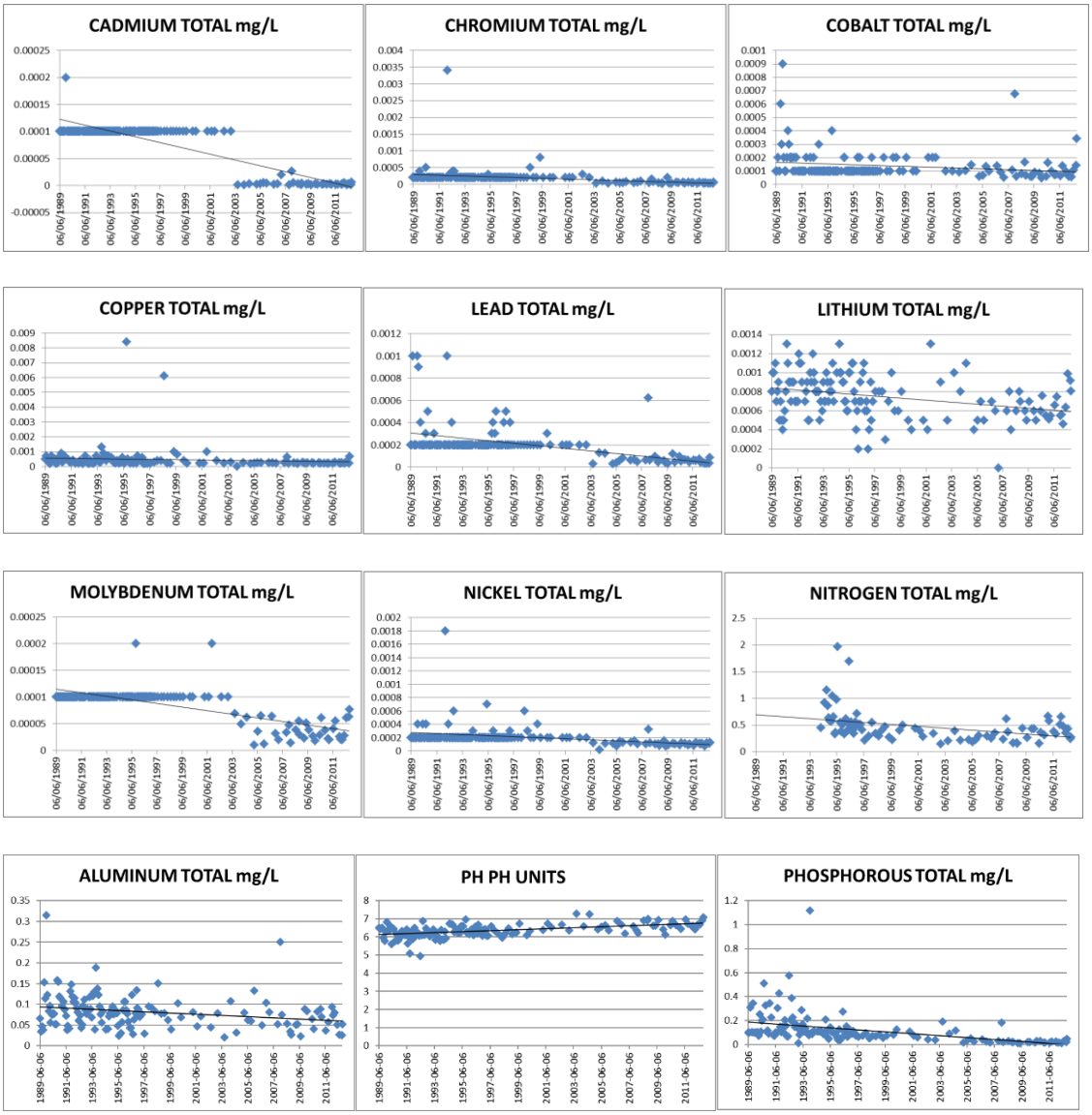
6.1.2 Goulds Brook near Makinsons (NF02ZL0029)

Goulds Brook is located near the community of Makinsons and several other nearby communities with a combined total population of approximately 1000. The CESI land use category classifies the station as low agriculture. CANAL lists the surrounding development pressure as low. RBA ranks the level of overall risk to water quality as medium.

6.1.2.1 Parameter Time Series Graph

Figures 5 and 6 display the parameter time series graphs for improving and deteriorating trend parameters for Goulds Brook.

Figure 5: Goulds Brook near Makinsons - Improving Trend Parameters



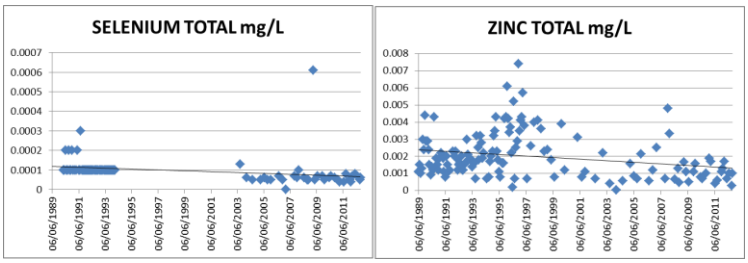
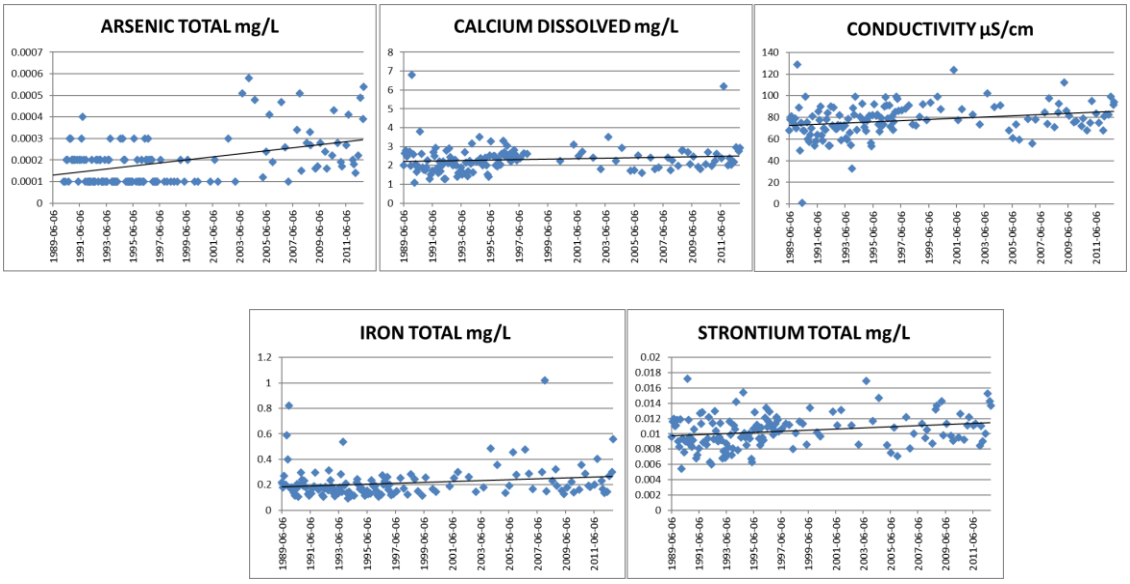


Figure 6: Goulds Brook near Makinsons - Deteriorating Trend Parameters



6.1.2.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 6 displays overall water quality parameters trend results for Goulds Brook.

Table 6: Goulds Brook near Makinsons - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	141	0.05	0	-0.29	Down	0	-0.2	Down
AST	131	0.05	0	0.29	Up	0	0.2	Up
BAT	141	0.05	0.4	-0.07	No	0.43	-0.05	No
BET	141	0.05	0	-0.26	Down	0.08	-0.11	No
CAD	134	0.05	0.02	0.21	Up	0.02	0.14	Up
DOC	140	0.05	0.06	0.16	No	0.08	0.1	No
CDT	141	0.05	0	-0.75	Down	0	-0.59	Down
CLT	33	0.05	0.11	0.28	No	0.12	0.19	No
COLOURA	140	0.05	0.44	0.07	No	0.53	0.04	No
COND	141	0.05	0	0.35	Up	0	0.24	Up
COT	139	0.05	0	-0.38	Down	0	-0.29	Down
CRT	139	0.05	0	-0.68	Down	0	-0.53	Down
CUT	139	0.05	0	-0.3	Down	0	-0.21	Down
FET	139	0.05	0.04	0.17	Up	0.04	0.12	Up
KU	46	0.05	0.1	-0.25	No	0.11	-0.16	No
LIT	139	0.05	0	-0.34	Down	0	-0.23	Down
MGD	134	0.05	0.29	0.09	No	0.29	0.06	No
MOT	139	0.05	0	-0.71	Down	0	-0.54	Down
NAU	46	0.05	0.73	0.05	No	0.77	0.03	No
NIT	139	0.05	0	-0.64	Down	0	-0.48	Down
NT	83	0.05	0	-0.48	Down	0	-0.34	Down
PBT	139	0.05	0	-0.66	Down	0	-0.5	Down
PH	141	0.05	0	0.51	Up	0	0.36	Up
PT	140	0.05	0	-0.69	Down	0	-0.51	Down
SET	82	0.05	0	-0.75	Down	0	-0.57	Down
SIO2	82	0.05	0.26	0.12	No	0.23	0.09	No
SOT	33	0.05	0.53	0.11	No	0.55	0.08	No
SRT	139	0.05	0	0.25	Up	0	0.18	Up
TURB	141	0.05	0.18	0.11	No	0.19	0.07	No
VT	139	0.05	0.3	-0.09	No	0.35	-0.06	No
ZNT	139	0.05	0.01	-0.23	Down	0.03	-0.12	Down

6.1.2.3 Comparison and Causes of Change from Past

Table 7 compares trend for Goulds Brook near Makinsons between Phase I and Phase II.

Aluminum, copper, lithium, nitrogen, pH, phosphorus, and zinc displayed improving trend. Calcium dissolved, DOC, iron, conductivity, strontium, and thallium displayed deteriorating trend. Cadmium, chromium, cobalt, lead, molybdenum, nickel, and selenium displayed improving trend with censor majority data. Arsenic displayed deteriorating trend with censored majority data.

When comparing the trend results between Phase I and Phase II, aluminum, nitrogen and phosphorus continued to improve over time while conductivity and strontium deteriorated over the years. Zinc, which deteriorated in the past, improved in the current report. Chromium and nickel, which deteriorated in the past, improved with censor majority data. Cobalt, which improved in the past, continued to improve with censor majority data.

Manganese, nitrate and nitrite, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Potassium, which improved in the past, showed no trend in the current report. Chloride, colour, sodium, sulphate, and zinc, which deteriorated in the past, showed no trend.

Reductions in atmospheric deposition have improved copper, lithium and zinc levels. The trend in phosphorous can be linked to phosphorous control measures started in the 1970s. The cause of improving trends in aluminum is most likely due to general abatement practices. The requirement for regular application of agricultural limestone likely lead to an improvement of pH. The cause of improvement in nitrogen is unknown.

The use of road salt on transportation routes in this basin may be affecting calcium and conductivity. Deteriorating trends in strontium likely linked to transportation corridors located in the basin. The increase of global carbon emissions likely linked to increased DOC levels. The natural geology in the surrounding area may have led to increased levels of iron observed by the high background colour and iron level in CANAL WQI summary.

Table 7: Goulds Brook near Makinsons - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Aluminum	Abatement	Aluminum Total	Abatement
Cobalt	Abatement	Copper Total	Atmospheric Deposition
Manganese	Abatement	Lithium Total	Atmospheric Deposition
Nitrate and Nitrite	Unknown	Nitrogen Total	Unknown
Nitrogen	Unknown	pH	Natural Sources
Potassium	Climate Change	Phosphorus Total	Abatement
Phosphorus	Abatement	Zinc Total	Atmospheric Deposition
Deteriorating Trend			
Chromium	Transportation / Urban Development	Calcium Dissolved	Transportation
Chloride	Transportation	DOC	Global Carbon Emissions
Colour	Climate Change	Conductivity	Transportation
Conductivity	Transportation	Iron Total	Natural Sources
Nickel	Transportation / Urban Development	Strontium Total	Transportation
Sodium	Transportation		
Sulphate	Unknown / Urban Development		
Strontium	Transportation / Urban Development		
Zinc	Transportation / Urban Development		
Censored			
Beryllium	Censored	Arsenic Total	Censored
Cadmium	Censored	Cadmium Total	Censored
Molybdenum	Censored	Chromium Total	Censored
		Cobalt Total	Censored
		Lead Total	Censored
		Molybdenum Total	Censored
		Nickel Total	Censored
		Selenium Total	Censored

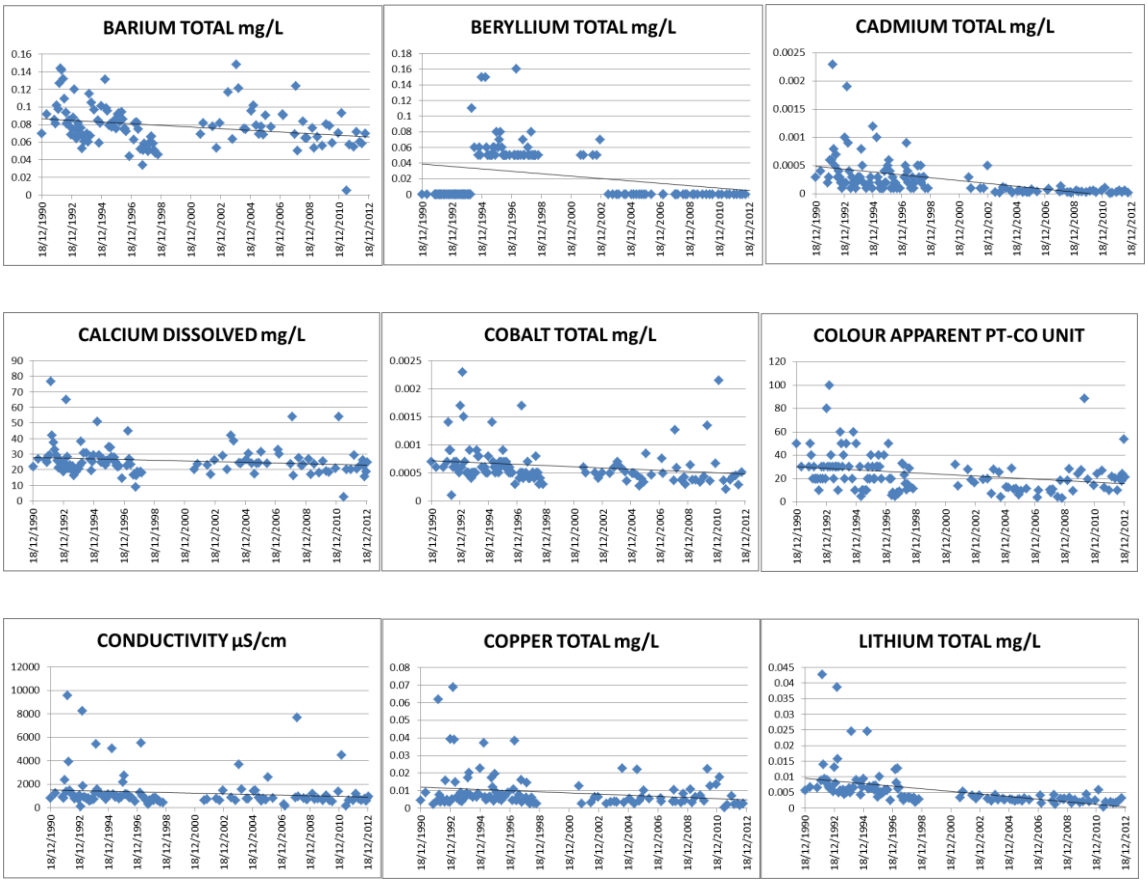
6.1.3 Kelly's Brook at Portugal Cove Road (NF02ZM0144)

Kelly's Brook is in the City of St. John's. The brook runs through an area of the City already fully developed and more than 75% of the brook is culverted. There is no CESI sampling at the site, but nearby Rennies River is classified as populated under the CESI land use category. CANAL lists the surrounding development pressure as low. RBA ranks the level of overall risk to water quality as medium and the risk related to activities and sources of contamination as high.

6.1.3.1 Parameter Time Series Graph

Figures 7 and 8 display the parameter time series graphs for improving and deteriorating trend parameters for Kelly's Brook at Portugal Cove Road.

Figure 7: Kelly's Brook at Portugal Cove Road - Improving Trend Parameters



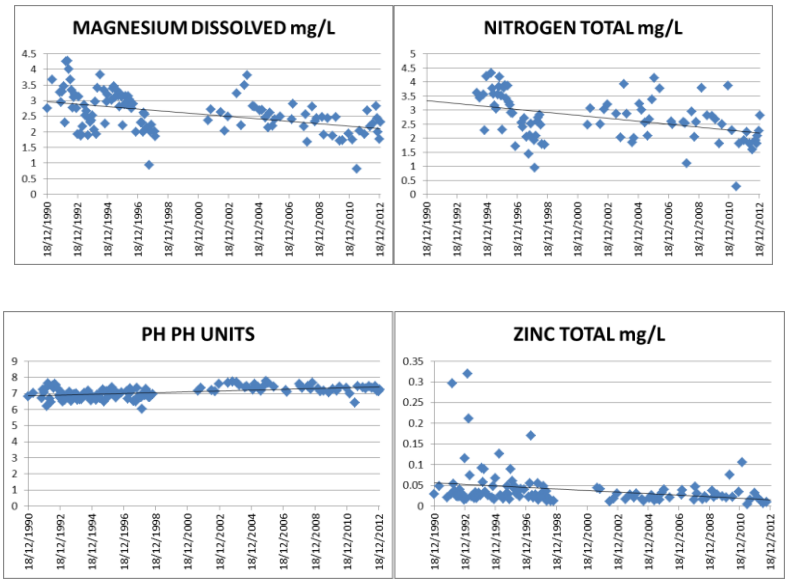
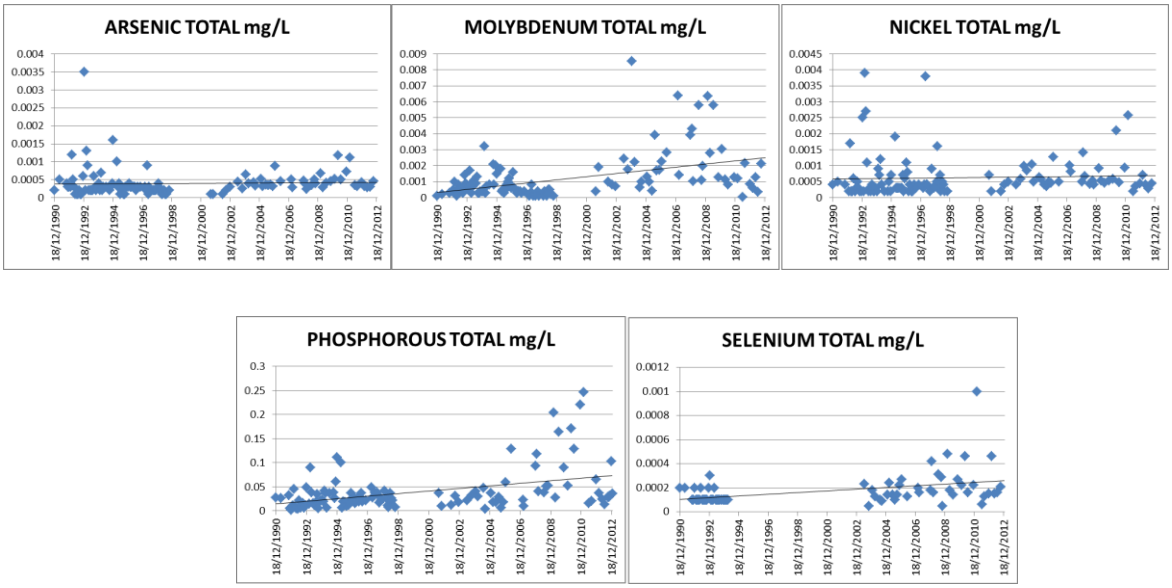


Figure 8: Kelly's Brook at Portugal Cove Road - Deteriorating Trend Parameters



6.1.3.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 8 displays overall water quality parameters trend results for Kelly's Brook at Portugal Cove Road.

Table 8: Kelly's Brook at Portugal Cove Road - Parameter Trend Results

Parameter	Count	Sig Level	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	118	0.05	0.69	0.04	No	0.59	0.03	No
AST	118	0.05	0.01	0.24	Up	0.01	0.17	Up
BAT	118	0.05	0	-0.36	Down	0	-0.25	Down
BET	118	0.05	0	-0.3	Down	0.01	-0.18	Down
CAD	115	0.05	0.01	-0.23	Down	0.01	-0.16	Down
DOC	113	0.05	0.88	-0.01	No	0.87	-0.01	No
CDT	118	0.05	0	-0.73	Down	0	-0.54	Down
CLT	38	0.05	0.06	-0.31	No	0.07	-0.21	No
COLOURA	122	0.05	0	-0.38	Down	0	-0.26	Down
COND	122	0.05	0	-0.32	Down	0	-0.22	Down
COT	116	0.05	0	-0.46	Down	0	-0.34	Down
CRT	116	0.05	0.09	-0.16	No	0.09	-0.11	No
CUT	116	0.05	0.01	-0.25	Down	0.01	-0.17	Down
FET	116	0.05	0.14	-0.14	No	0.14	-0.09	No
KU	57	0.05	0.41	0.11	No	0.46	0.07	No
LIT	116	0.05	0	-0.8	Down	0	-0.59	Down
MGD	115	0.05	0	-0.48	Down	0	-0.34	Down
MOT	116	0.05	0	0.39	Up	0	0.25	Up
NAU	57	0.05	0.63	-0.07	No	0.62	-0.05	No
NIT	116	0.05	0	0.27	Up	0	0.2	Up
NT	87	0.05	0	-0.48	Down	0	-0.34	Down
PBT	116	0.05	0.62	0.05	No	0.46	0.05	No
PH	122	0.05	0	0.47	Up	0	0.33	Up
PT	118	0.05	0	0.4	Up	0	0.29	Up
SET	70	0.05	0	0.43	Up	0	0.31	Up
SIO2	76	0.05	0.34	-0.11	No	0.33	-0.08	No
SOT	38	0.05	0.11	-0.26	No	0.12	-0.18	No
SRT	116	0.05	0.26	-0.1	No	0.22	-0.08	No
TURB	122	0.05	0.05	-0.17	No	0.06	-0.12	No
VT	116	0.05	0.17	0.13	No	0.14	0.1	No
ZNT	116	0.05	0	-0.33	Down	0	-0.23	Down

6.1.3.3 Comparison and Causes of Change from Past

Table 9 compares trend for Kelly's Brook between Phase I and Phase II.

Barium, beryllium, cadmium, calcium, cobalt, colour, copper, lithium, magnesium, nitrogen, pH, conductivity, and zinc displayed improving trend. Arsenic, molybdenum, nickel, and phosphorus displayed deteriorating trend. Selenium displayed improving trend with censored majority data.

When comparing the trend results between Phase I and Phase II, barium, beryllium, cadmium, calcium, cobalt, colour, conductivity, copper, lithium, magnesium, and nitrogen continued to improve over time while phosphorus deteriorated over the years.

Manganese and mercury, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Chloride, iron, potassium, strontium and sulphate, which improved in the past, showed no trend in the current report.

Kelly’s Brook is a highly polluted urban stream that has seen improvements in nearly all parameters because of the cleanup of some sewer cross-connections, various abatement measures practiced by the local population, and a reduction in leachate over time from the old town landfill located in its headwaters.

Phosphorus levels may increase because of the fertilizer application in the nearby recreational facilities. The cause for deteriorating trend for nickel and molybdenum is unknown. The stream is almost entirely culverted, which may affect these parameters.

Table 9: Kelly's Brook at Portugal Cove Road - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Barium	Stream Modification / Abatement	Barium Total	Stream Modification / Abatement
Beryllium	Stream Modification / Abatement	Beryllium	Stream Modification / Abatement
Cadmium	Stream Modification / Abatement	Cadmium Total	Stream Modification / Abatement
Calcium	Stream Modification	Calcium Dissolved	Stream Modification / Abatement
Chloride	Stream Modification	Cobalt Total	Stream Modification / Abatement
Cobalt	Stream Modification / Abatement	Conductivity	Stream Modification / Abatement
Colour	Stream Modification	Colour	Stream Modification / Abatement
Copper	Stream Modification / Abatement	Copper Total	Stream Modification / Abatement
Conductivity	Stream Modification	Lithium Total	Stream Modification / Abatement
Iron	Stream Modification / Abatement	Magnesium Dissolved	Stream Modification / Abatement
Lithium	Stream Modification / Abatement	Nitrogen Total	Stream Modification / Abatement
Magnesium	Stream Modification	pH	Stream Modification / Abatement
Manganese	Stream Modification / Abatement	Zinc Total	Stream Modification / Abatement
Mercury	Stream Modification / Abatement		
Nitrogen	Stream Modification / Abatement		
Potassium	Stream Modification		
Strontium	Stream Modification / Abatement		
Sulphate	Stream Modification		
Deteriorating Trend			
Phosphorus	Urban Development / Sewage	Molybdenum Total	Unknown
		Nickel Total	Unknown
		Phosphorus Total	Urban Development / Sewage
Censored			
		Selenium Total	Censored

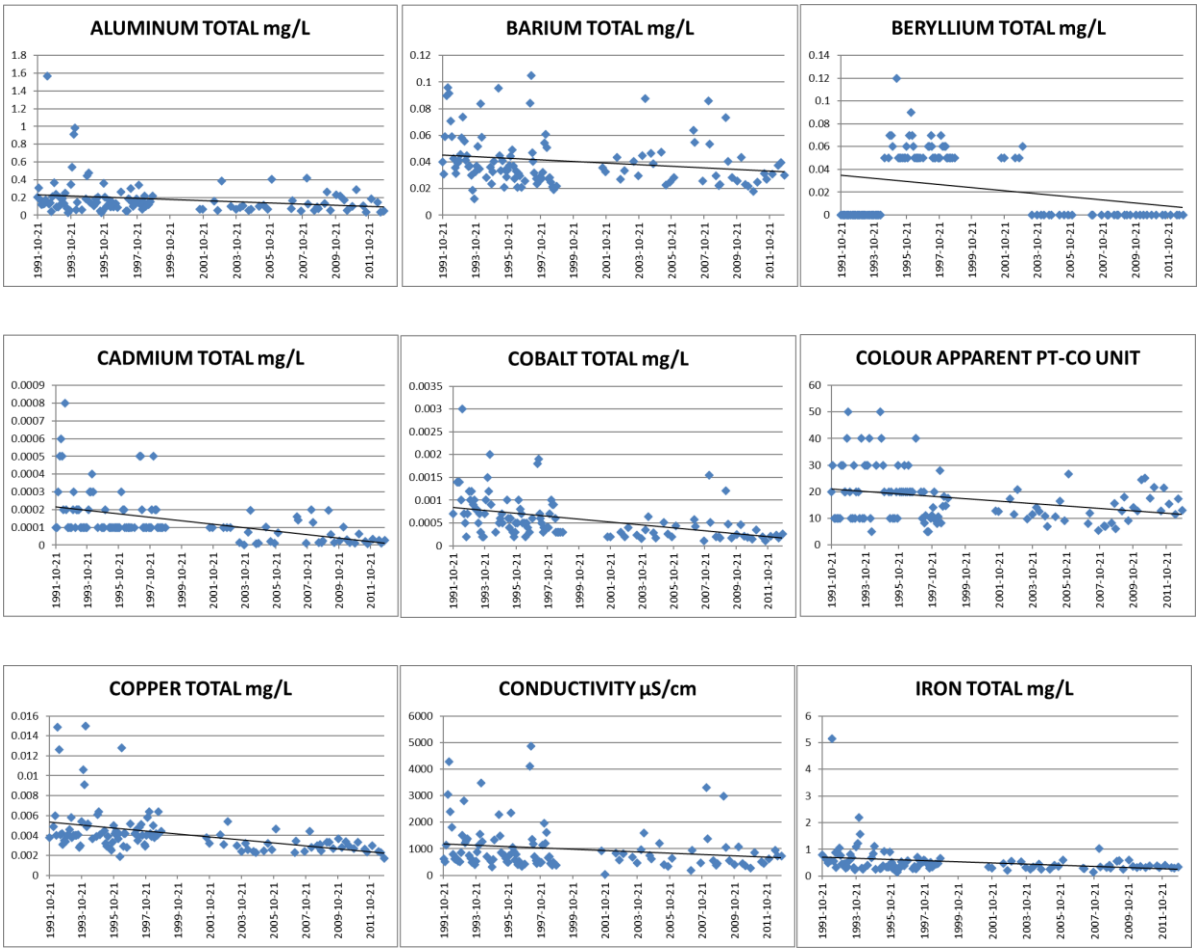
6.1.4 Mundy Pond at Outlet (NF02ZM0109)

Mundy Pond is in the City of St. John's. There is no CESI sampling at the site, but the nearby Waterford River is classified as populated under the CESI land use category. CANAL lists the surrounding development pressure as low. RBA ranks the level of risk to water quality as medium and the risk related to activities and sources of contamination as high.

6.1.4.1 Parameter Time Series Graph

Figures 9 and 10 display the parameter time series graphs for improving and deteriorating trend parameters for Mundy Pond at Outlet.

Figure 9: Mundy Pond at Outlet - Improving Trend Parameters



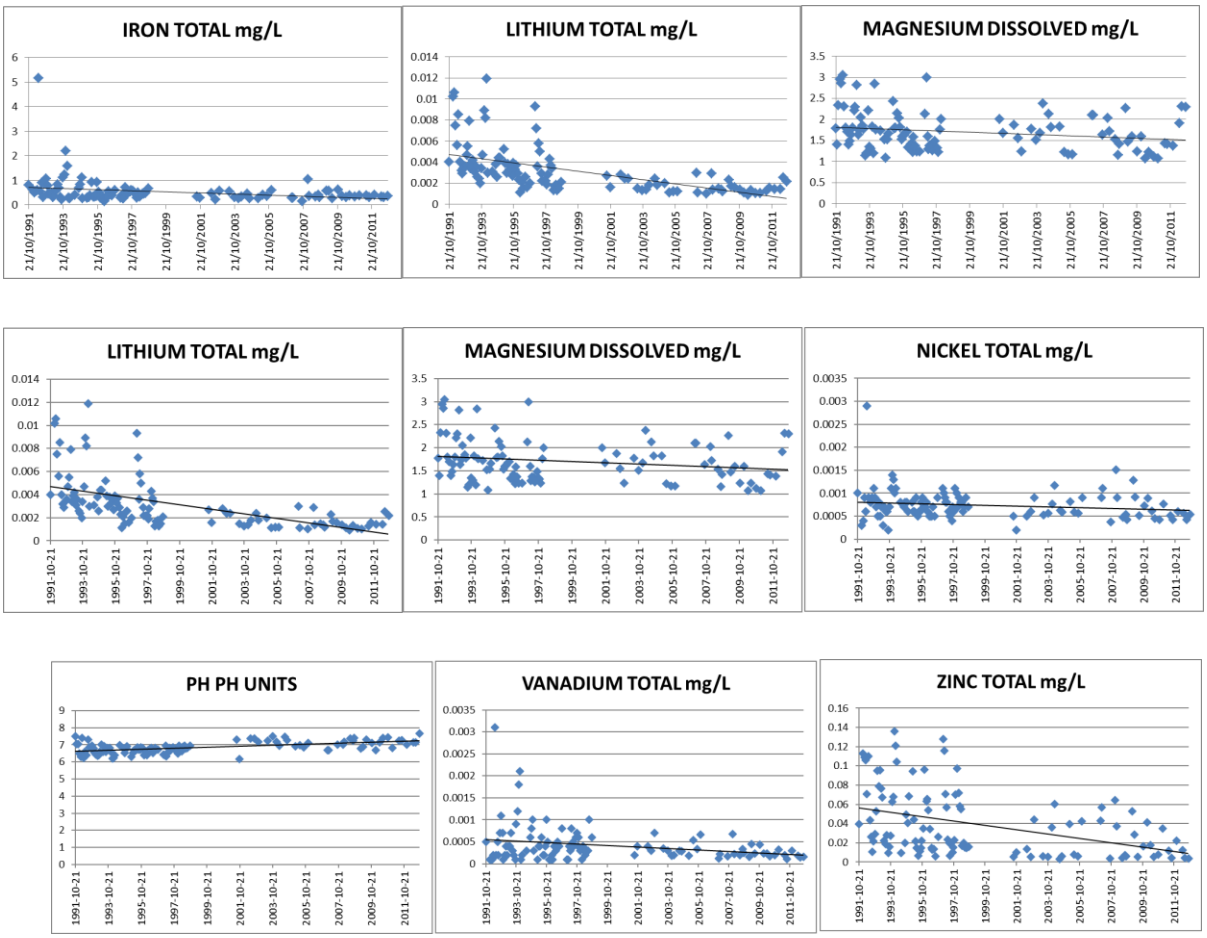
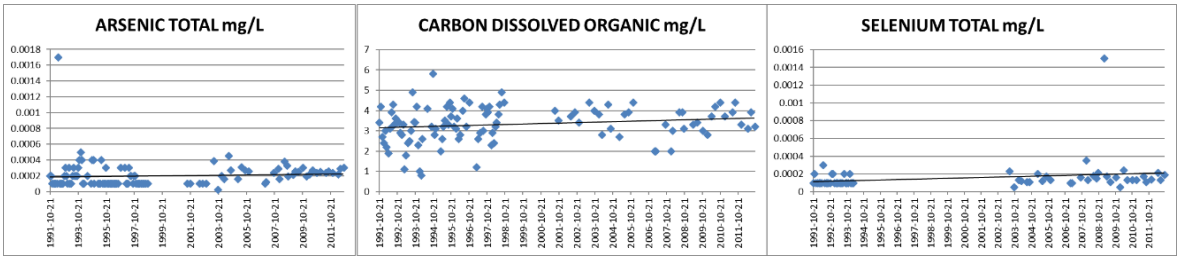


Figure 10: Mundy Pond at Outlet - Deteriorating Trend Parameters



6.1.4.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 10 displays overall water quality parameters trend results for Mundy Pond at Outlet.

Table 10: Mundy Pond at Outlet - Parameter Trend Results

Parameter	Count	Sig Level	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	112	0.05	0.02	-0.22	Down	0.02	-0.16	Down
AST	112	0.05	0.01	0.23	Up	0.01	0.17	Up
BAT	112	0.05	0	-0.31	Down	0	-0.22	Down
BET	112	0.05	0	-0.31	Down	0.01	-0.18	Down
CAD	105	0.05	0.19	-0.13	No	0.18	-0.09	No
DOC	108	0.05	0.02	0.23	Up	0.02	0.15	Up
CDT	112	0.05	0	-0.58	Down	0	-0.43	Down
CLT	29	0.05	0.46	-0.14	No	0.46	-0.1	No
COLOURA	112	0.05	0.01	-0.25	Down	0.01	-0.18	Down
COND	112	0.05	0.01	-0.25	Down	0.01	-0.18	Down
COT	110	0.05	0	-0.59	Down	0	-0.44	Down
CRT	110	0.05	0.45	0.07	No	0.38	0.06	No
CUT	110	0.05	0	-0.52	Down	0	-0.36	Down
FET	110	0.05	0	-0.34	Down	0	-0.23	Down
KU	50	0.05	0.1	0.23	No	0.14	0.15	No
LIT	110	0.05	0	-0.76	Down	0	-0.56	Down
MGD	105	0.05	0.01	-0.26	Down	0	-0.19	Down
MOT	110	0.05	0.47	0.07	No	0.48	0.05	No
NAU	50	0.05	0.09	-0.24	No	0.1	-0.16	No
NIT	110	0.05	0.06	-0.18	No	0.04	-0.14	Down
NT	79	0.05	0.7	0.04	No	0.73	0.03	No
PBT	110	0.05	0.14	-0.14	No	0.08	-0.12	No
PH	112	0.05	0	0.48	Up	0	0.34	Up
PT	110	0.05	0.75	0.03	No	0.83	0.01	No
SET	63	0.05	0	0.44	Up	0	0.33	Up
SIO2	75	0.05	0.19	-0.15	No	0.19	-0.10	No
SOT	29	0.05	0.11	-0.3	No	0.18	-0.18	No
SRT	110	0.05	0.19	-0.13	No	0.18	-0.09	No
TURB	112	0.05	0.49	-0.07	No	0.8	-0.02	No
VT	110	0.05	0.09	-0.16	No	0.04	-0.13	Down
ZNT	110	0.05	0	-0.48	Down	0	-0.34	Down

6.1.4.3 Comparison and Causes of Change from Past

Table 11 compares trend for Mundy Pond between Phase I and Phase II.

Aluminum, barium, cadmium, cobalt, colour, conductivity, copper, iron, lithium, magnesium, pH, nickel, vanadium and zinc displayed improving trend. DOC displayed deteriorating trend. Beryllium and cadmium displayed improving trend with censored majority data. Arsenic and selenium displayed deteriorating trend with censored majority data.

When comparing the trend results between Phase I and Phase II, barium, cobalt, colour, conductivity, iron, lithium, magnesium, and zinc continued to improve over time while DOC deteriorated over time. Beryllium and cadmium, which improved in the past, continued to improve with censor majority data.

Manganese, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Nitrogen, potassium, strontium and turbidity, which improved in the past, showed no trend in the current report.

The pond was a polluted water body but continued to show improvements in aluminum, barium, cobalt, colour, conductivity, copper, iron, lithium, magnesium, pH, nickel, vanadium and zinc because of various abatement measures by the population of the City of St. John's.

Dredging has occurred in Mundy Pond to remove gravel and debris, which may have resulted in increased dilution and mixing of parameters, and increased settling time. Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow and decreasing conductivity and concentration of major ions. DOC levels may be increasing because of urban activities affecting natural organic decay.

Table 11: Mundy Pond at Outlet - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Barium	Abatement / Stream Modification	Aluminum Total	Abatement / Stream Modification
Beryllium	Abatement / Stream Modification	Barium Total	Abatement / Stream Modification
Cadmium	Abatement / Stream Modification	Cobalt Total	Abatement / Stream Modification
Cobalt	Abatement / Stream Modification	Colour	Abatement / Stream Modification
Colour	Abatement / Stream Modification	Conductivity	Abatement / Stream Modification
Conductivity	Abatement / Stream Modification / Climate Change	Copper Total	Abatement / Stream Modification
Iron	Abatement / Stream Modification	Iron Total	Abatement / Stream Modification
Lithium	Abatement / Stream Modification	Lithium Total	Abatement / Stream Modification
Magnesium	Abatement / Stream Modification / Climate Change	Magnesium Dissolved	Abatement / Stream Modification / Climate Change
Manganese	Abatement / Stream Modification	Nickel Total	Abatement / Stream Modification
Nitrogen	Abatement / Stream Modification	pH	Abatement / Stream Modification
Potassium	Abatement / Stream Modification / Climate Change	Vanadium Total	Abatement / Stream Modification
Strontium	Abatement / Stream Modification	Zinc Total	Abatement / Stream Modification
Turbidity	Abatement / Stream Modification		
Zinc	Abatement / Stream Modification		
Deteriorating Trend			
DOC	Urban Development / Natural Sources	DOC	Urban Development / Natural Sources
Censored			
		Beryllium Total	Censored
		Cadmium Total	Censored
		Selenium Total	Censored

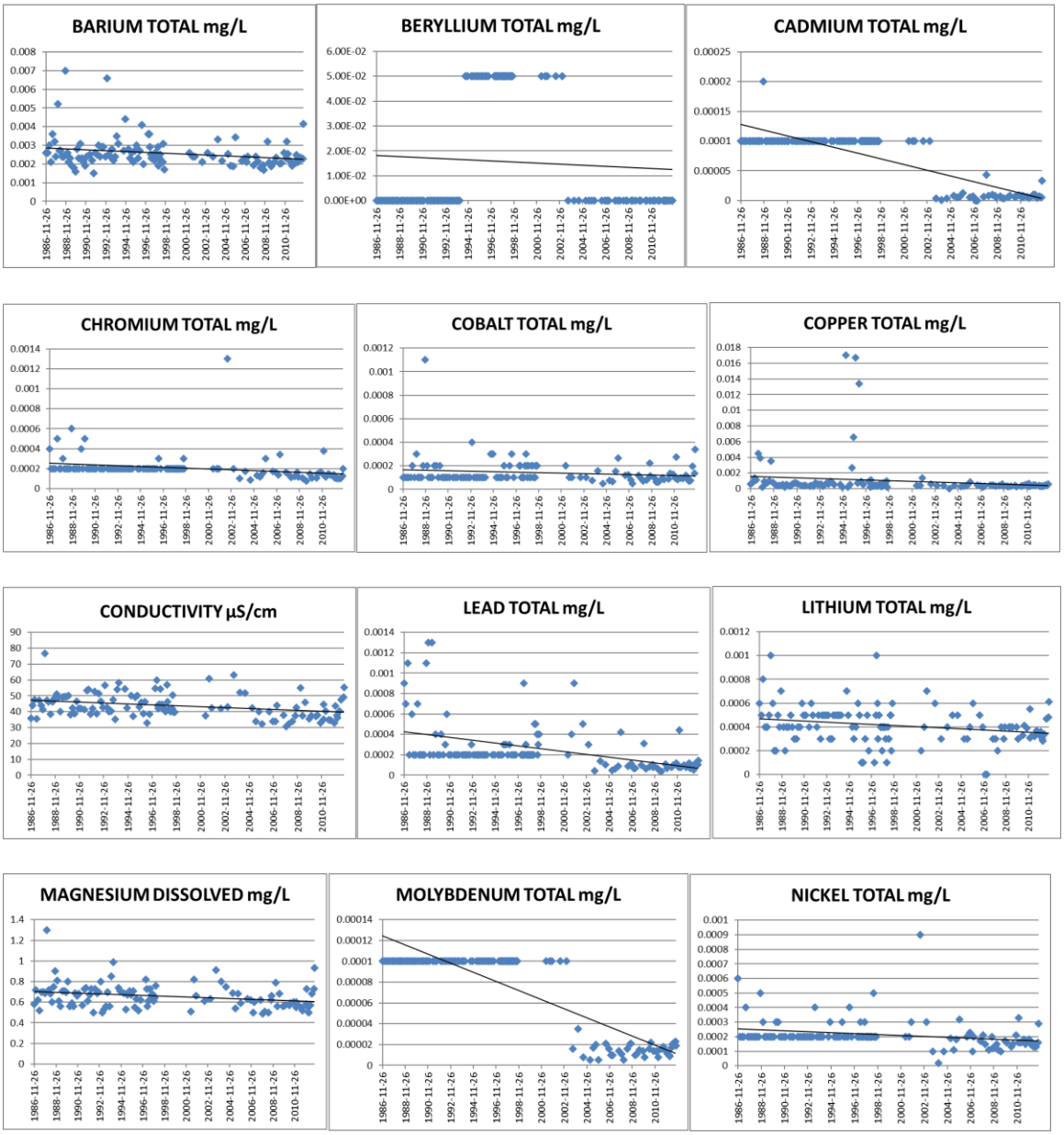
6.1.5 Northeast River near Placentia (NF02ZK0005)

Northeast River near Placentia is located near the community of Placentia (Dunville). The CESI land use category classifies the station as remote. CANAL lists the surrounding development pressure as low. RBA ranks the level of risk to water quality as medium.

6.1.5.1 Parameter Time Series Graph

Figures 11 and 12 display the parameter time series graphs for improving and deteriorating trend parameters for Northeast River near Placentia.

Figure 11: Northeast River near Placentia - Improving Trend Parameters



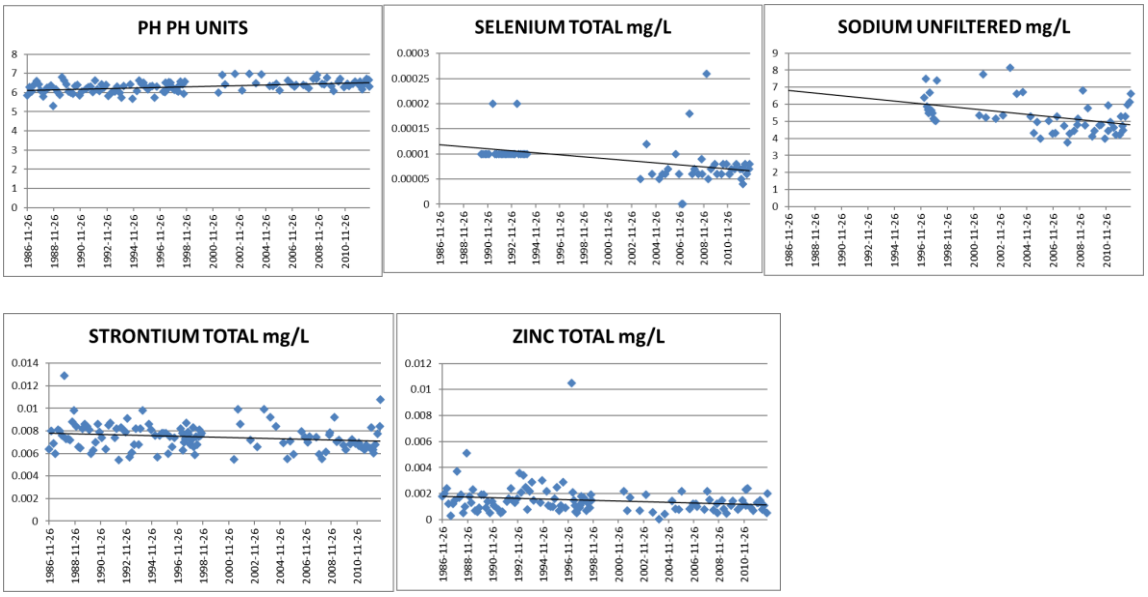
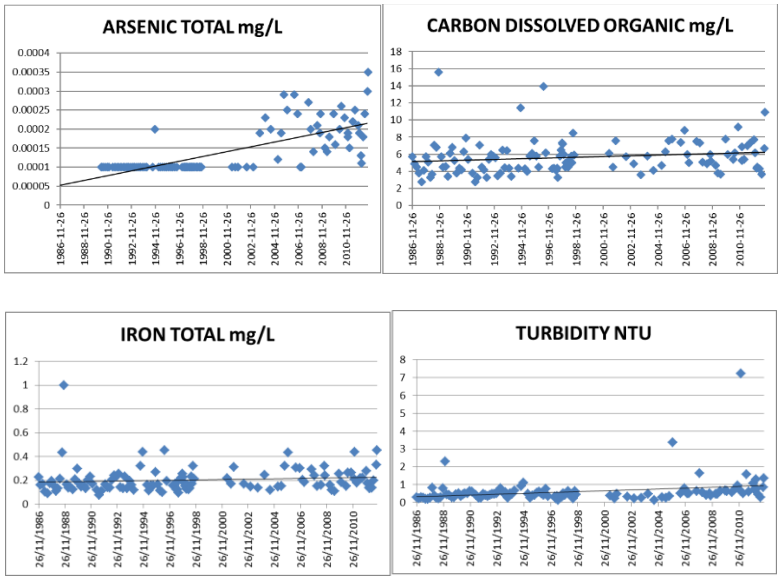


Figure 12: Northeast River near Placentia - Deteriorating Trend Parameters



6.1.5.2 Overall Trend for Parameters: Rank Spearman and Mann Kendall

Table 12 displays overall water quality parameters trend results for Northeast River near Placentia.

Table 12: Northeast River near Placentia - Parameter Trend Results

Parameter	Count	Sig Level	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	119	0.05	0.19	-0.12	No	0.19	-0.08	No
AST	98	0.05	0	0.77	Up	0	0.58	Up
BAT	119	0.05	0	-0.29	Down	0	-0.2	Down
BET	119	0.05	0	-0.42	Down	0	-0.21	Down
CAD	111	0.05	0.26	-0.11	No	0.22	-0.08	No
DOC	117	0.05	0	0.27	Up	0	0.19	Up
CDT	119	0.05	0	-0.78	Down	0	-0.58	Down
CLT	36	0.05	0.15	0.25	No	0.13	0.18	No
COLOURA	119	0.05	0.12	0.14	No	0.15	0.09	No
COND	119	0.05	0	-0.33	Down	0	-0.21	Down
COT	118	0.05	0.01	-0.23	Down	0.02	-0.16	Down
CRT	118	0.05	0	-0.66	Down	0	-0.51	Down
CUT	118	0.05	0	-0.36	Down	0	-0.25	Down
FET	118	0.05	0.01	0.24	Up	0.01	0.16	Up
KU	56	0.05	0.68	-0.06	No	0.66	-0.04	No
LIT	118	0.05	0	-0.26	Down	0.01	-0.18	Down
MGD	111	0.05	0	-0.27	Down	0	-0.19	Down
MOT	118	0.05	0	-0.78	Down	0	-0.59	Down
NIT	118	0.05	0	-0.47	Down	0	-0.34	Down
NT	73	0.05	0.09	0.2	No	0.07	0.15	No
PBT	118	0.05	0	-0.61	Down	0	-0.43	Down
PH	119	0.05	0	0.44	Up	0	0.29	Up
PT	118	0.05	0.64	0.04	No	0.42	0.05	No
SET	61	0.05	0	-0.6	Down	0	-0.39	Down
SIO2	53	0.05	0.78	-0.04	No	0.81	-0.02	No
SOT	36	0.05	0.37	-0.15	No	0.31	-0.12	No
SRT	118	0.05	0.03	-0.2	Down	0.02	-0.15	Down
TURB	119	0.05	0	0.37	Up	0	0.26	Up
VT	118	0.05	0.48	0.07	No	0.53	0.04	No
ZNT	118	0.05	0.03	-0.2	Down	0.03	-0.14	Down

6.1.5.3 Comparison and Causes of Change from Past

Table 13 compares trend for Northeast River between Phase I and Phase II.

Barium, copper, conductivity, lithium, magnesium, pH, sodium, strontium and zinc displayed improving trend. DOC, iron, and turbidity displayed deteriorating trend. Beryllium, cadmium, chromium, cobalt, lead, molybdenum, nickel, and selenium displayed improving trend with censor majority data. Arsenic displayed deteriorating trend with censor majority data.

When comparing the trend results between Phase I and Phase II, lithium, pH and strontium continued to improve over time. Lead, which improved in the past, continued to improve with censor majority data. Nickel, which deteriorated in the past, showed improving trend with censor majority data. Phosphorus, which improved in the past, showed no trend in the current report. Chloride and nitrogen, which deteriorated in the past, showed no trend in the current report. Sodium having only one year of common data period with Phase I report, was considered insufficient for comparative analysis.

Reduction in atmospheric deposition likely improved barium, copper, lithium, strontium and zinc levels. Natural limestone geology influenced pH levels leading to its improvement. Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow and decreasing conductivity and major ion concentration, while increasing turbidity.

The increase of global carbon emission across the north likely caused the deterioration of DOC. The natural geology in the surrounding area may lead to increased level of iron observed by the high background colour and iron level in CANAL WQI summary.

Table 13: Northeast River near Placentia - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Lead	Atmospheric Deposition / Abatement	Barium Total	Atmospheric Deposition
Lithium	Atmospheric Deposition	Copper Total	Atmospheric Deposition
pH	Natural Sources	Conductivity	Climate Change
Phosphorus	Abatement	Lithium Total	Atmospheric Deposition
Strontium	Atmospheric Deposition	Magnesium Dissolved	Climate Change
		pH	Natural Sources
		Strontium Total	Atmospheric Deposition
		Zinc Total	Atmospheric Deposition
Deteriorating Trend			
Chloride	Transportation	DOC	Global Carbon Emissions
Nickel	Transportation	Iron Total	Natural Sources
Nitrogen	Farming / Rural Sewage System	Turbidity	Climate Change
Censored			
Beryllium Total	Censored	Arsenic Total	Censored
Cadmium Total	Censored	Beryllium Total	Censored
Molybdenum	Censored	Cadmium Total	Censored
		Chromium Total	Censored
		Cobalt Total	Censored
		Lead Total	Censored
		Molybdenum	Censored
		Nickel Total	Censored
		Selenium Total	Censored

6.1.6 Quidi Vidi Lake at Outlet (NF02ZM0015)

Quidi Vidi Lake is in the City of St. John's. The station is not included in CESI WQI, but the nearby Virginia River is classified as populated under CESI land use category. CANAL lists the surrounding development pressure as medium. RBA ranks the level of overall risk to water quality as medium and the risk related to activities and sources of contamination and impact on water quality as high.

6.1.6.1 Parameter Time Series Graph

Figures 13 and 14 display the parameter time series graphs for improving and deteriorating trend parameters for Quidi Vidi Lake at Outlet.

Figure 13: Quidi Vidi Lake at Outlet - Improving Trend Parameters

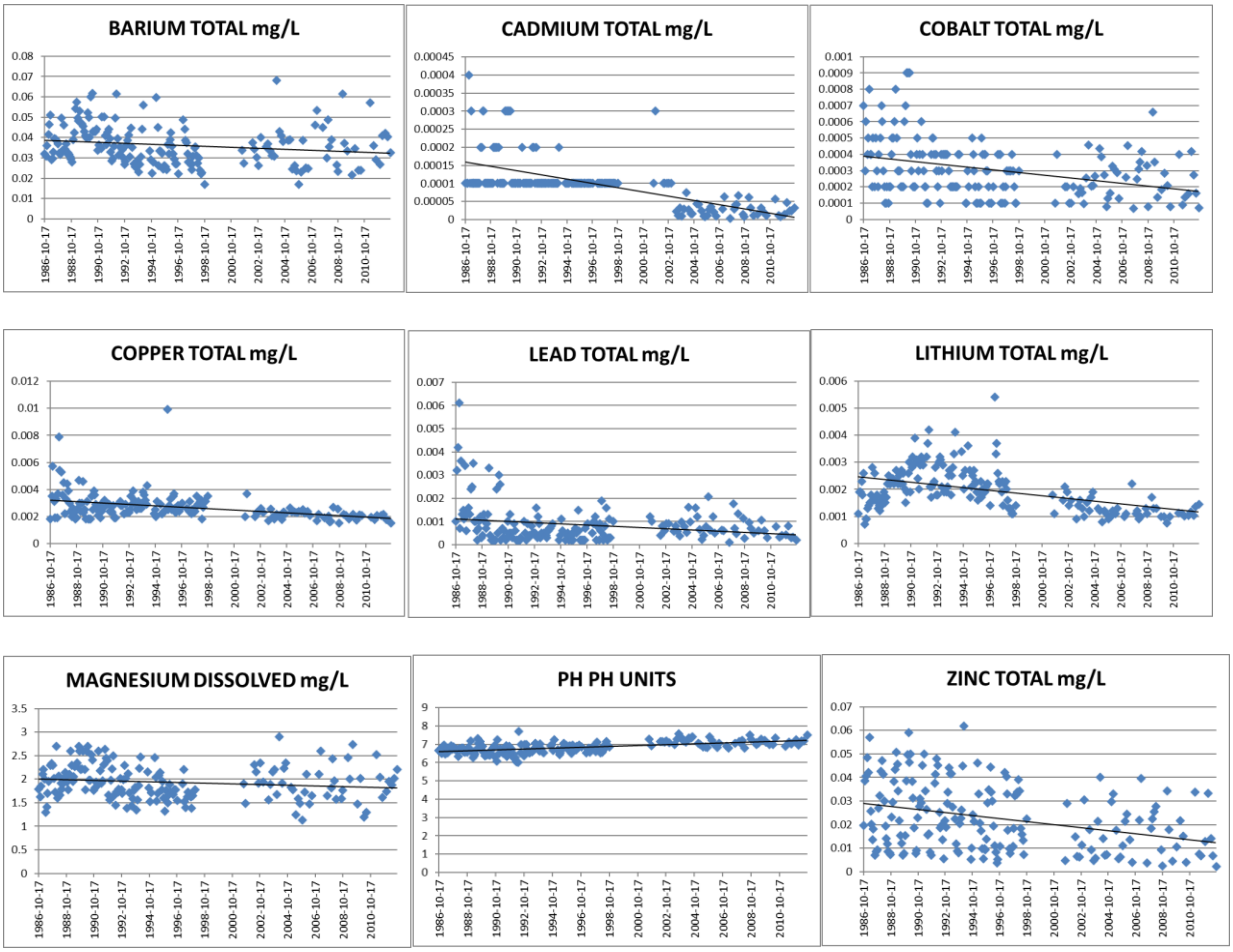
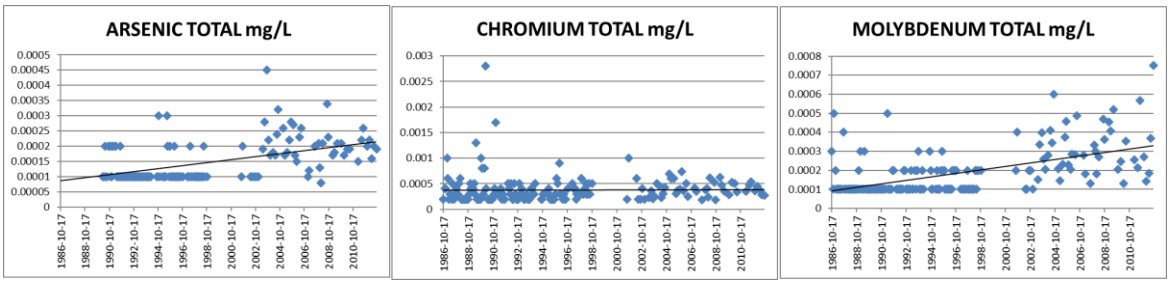
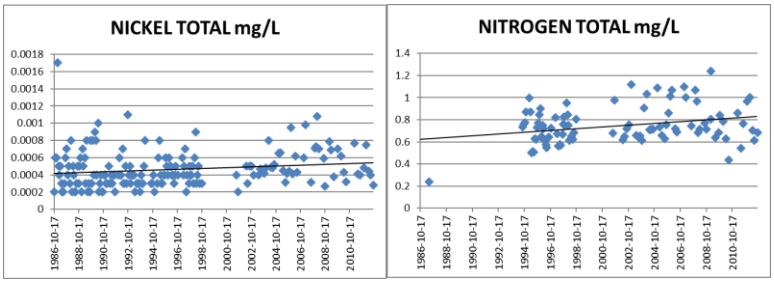
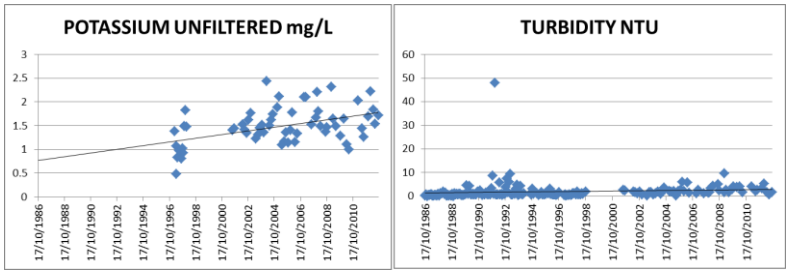


Figure 14: Quidi Vidi Lake at Outlet - Deteriorating Trend Parameters


ARSENIC TOTAL mg/L
CHROMIUM TOTAL mg/L
MOLYBDENUM TOTAL mg/L


NICKEL TOTAL mg/L
NITROGEN TOTAL mg/L


POTASSIUM UNFILTERED mg/L
TURBIDITY NTU

6.1.6.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 14 displays overall water quality parameters trend results for Quidi Vidi Lake at Outlet.

Table 14: Quidi Vidi Lake at Outlet - Parameter Trend Results

Parameter	Count	Sig Level	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	181	0.05	0.75	0.02	No	0.86	0.01	No
AST	139	0.05	0	0.48	Up	0	0.35	Up
BAT	181	0.05	0	-0.28	Down	0	-0.2	Down
BET	181	0.05	0.2	-0.1	No	0.57	-0.03	No
CAD	174	0.05	0.93	0.01	No	0.87	0.01	No
DOC	179	0.05	0.07	0.14	No	0.07	0.09	No
CDT	181	0.05	0	-0.74	Down	0	-0.58	Down
CLT	37	0.05	0.63	0.08	No	0.61	0.06	No
COLOURA	183	0.05	0.1	0.12	No	0.17	0.07	No
COND	183	0.05	0.78	0.02	No	0.83	0.01	No
COT	179	0.05	0	-0.35	Down	0	-0.25	Down
CRT	179	0.05	0.01	0.19	Up	0.01	0.14	Up
CUT	179	0.05	0	-0.42	Down	0	-0.3	Down
FET	179	0.05	0.09	-0.13	No	0.06	-0.1	No
LIT	179	0.05	0	-0.44	Down	0	-0.31	Down
MGD	174	0.05	0	-0.22	Down	0	-0.15	Down
MOT	179	0.05	0	0.57	Up	0	0.44	Up
NAU	62	0.05	0.54	0.08	No	0.48	0.06	No
NIT	179	0.05	0	0.21	Up	0	0.17	Up
NT	94	0.05	0.05	0.2	Up	0.03	0.15	Up
PBT	179	0.05	0.03	-0.16	Down	0.05	-0.1	Down
PH	183	0.05	0	0.58	Up	0	0.4	Up
PT	180	0.05	0.38	0.07	No	0.38	0.04	No
SET	89	0.05	0.26	0.12	No	0.38	0.07	No
SIO2	79	0.05	0.87	-0.02	No	0.88	-0.01	No
SOT	37	0.05	0.96	0.01	No	0.95	-0.01	No
SRT	179	0.05	0.12	-0.12	No	0.1	-0.08	No
TURB	183	0.05	0	0.49	Up	0	0.34	Up
VT	179	0.05	0.56	0.04	No	0.56	0.03	No
ZNT	179	0.05	0	-0.33	Down	0	-0.23	Down

6.1.6.3 Comparison and Causes of Change from Past

Table 15 compares trend for Quidi Vidi Lake between Phase I and Phase II.

Barium, cobalt, copper, lead, lithium, magnesium dissolved, pH and zinc displayed improving trend. Chromium, nickel, nitrogen, and turbidity displayed deteriorating trend. Cadmium and molybdenum displayed improving trend with censor majority data. Arsenic displayed deteriorating trend with censor majority data.

When comparing the trend results between Phase I and Phase II, barium, cobalt, lead, magnesium, and pH continued to improve over time while DOC, molybdenum, nitrogen, nitrate and nitrite, and turbidity deteriorated over the years.

Manganese, nitrate and nitrite which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Iron, phosphorus and strontium, which improved in the past, showed no trend in the current report. Colour, which deteriorated in the past, showed no trend in the current report. Potassium, having only one year of common data period with Phase I report, was considered insufficient for comparative analysis.

This site is in the heart of St. John's and heavily affected by urban development. The Quidi Vidi-Rennies River Development Foundation and Virginia River Conservation Society have spearheaded the cleanup of this system, promoting river enhancement and abatement of pollution causing practices. These activities have led to improving trends in metals such as barium, cobalt, copper, lead, lithium, magnesium and zinc. Abatement practices along with natural limestone geology, and lime application on lawns and farm fields may have also influenced pH.

Urban development, stream modification and quarrying activity have influenced colour and turbidity. Urban development also influenced chromium and nickel. A combination of urban activities including fertilizing lawns and the presence of two golf courses and sewage cross-connections influenced increased nitrogen and DOC levels.

Table 15: Quidi Vidi Lake at Outlet - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Barium	Abatement	Barium Total	Abatement
Cobalt	Abatement	Cobalt Total	Abatement
Iron	Abatement	Copper Total	Abatement
Lead	Abatement / Atmospheric Deposition	Lead Total	Abatement
Magnesium	Abatement / Climate Change	Lithium Total	Abatement
Manganese	Abatement	Magnesium Dissolved	Abatement
pH	Farming / Abatement / Urban Development / Natural Resources	pH	Farming / Abatement / Urban Development / Natural Resources
Phosphorus	Abatement	Zinc Total	Abatement
Strontium	Abatement		
Deteriorating Trend			
DOC	Urban Development / Farming	DOC	Urban Development / Farming
Colour	Urban Development / Mining / Stream Modification	Chromium Total	Urban Development
Nitrogen	Farming / Sewage / Recreation / Urban Development	Nickel Total	Urban Development
Nitrate and Nitrite	Farming / Sewage / Recreation / Urban Development	Nitrogen Total	Farming / Sewage / Recreation / Urban Development
Turbidity	Urban Development / Mining / Stream Modification	Turbidity	Urban Development / Mining / Stream Modification
Censored			
Molybdenum	Censored	Arsenic Total	Censored
		Cadmium Total	Censored
		Molybdenum	Censored

6.1.7 Rennies River at Carnell Drive (NF02ZM0016)

Rennies River at Carnell Drive is in the City of St. John's. The CESI land use category classifies the station as populated. CANAL lists the surrounding development pressure as medium. RBA ranks the level of overall risk to water quality as medium and the risk related to activities and sources of contamination and impact on water quality as high.

6.1.7.1 Parameter Time Series Graph

Figures 15 and 16 display the parameter time series graphs for improving and deteriorating trend parameters for Rennies River at Carnell Drive.

Figure 15: Rennies River at Carnell Drive - Improving Trend Parameters

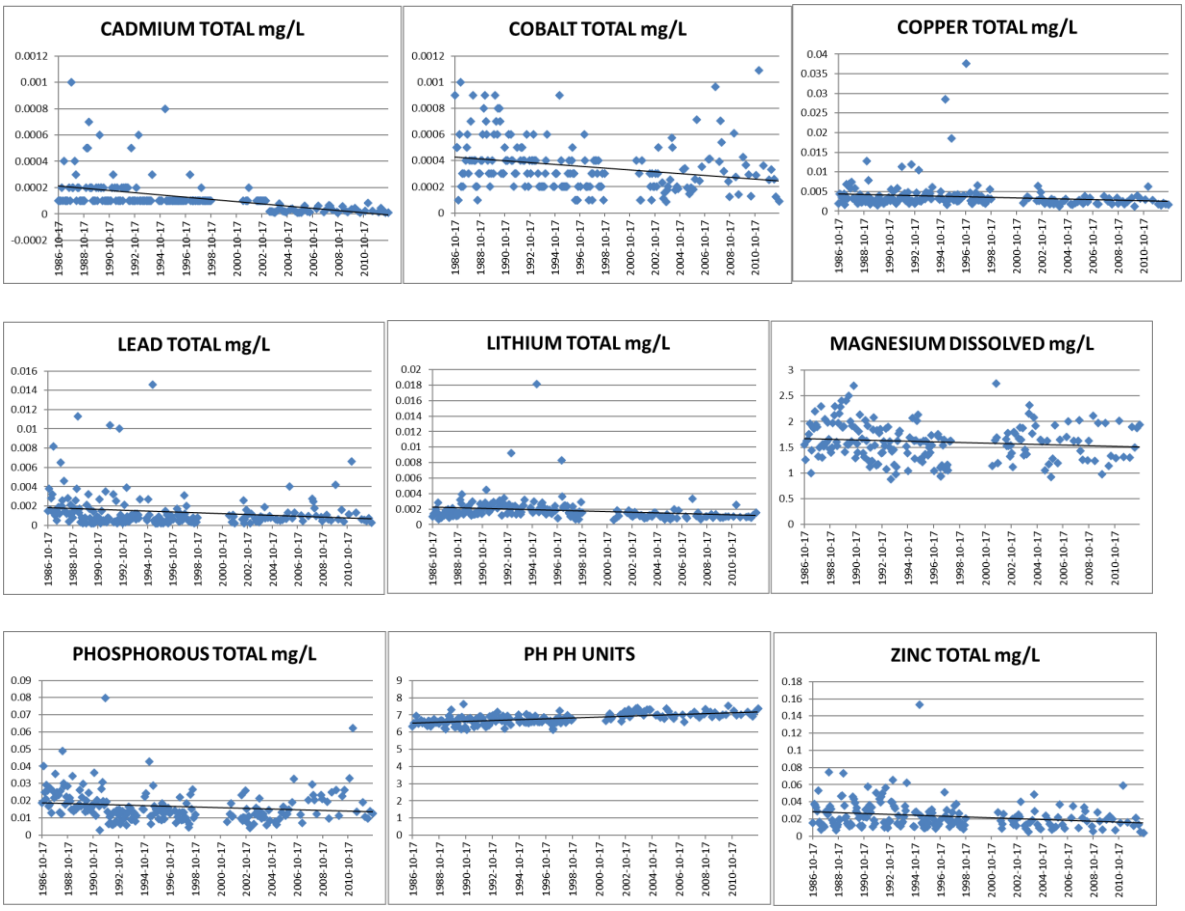
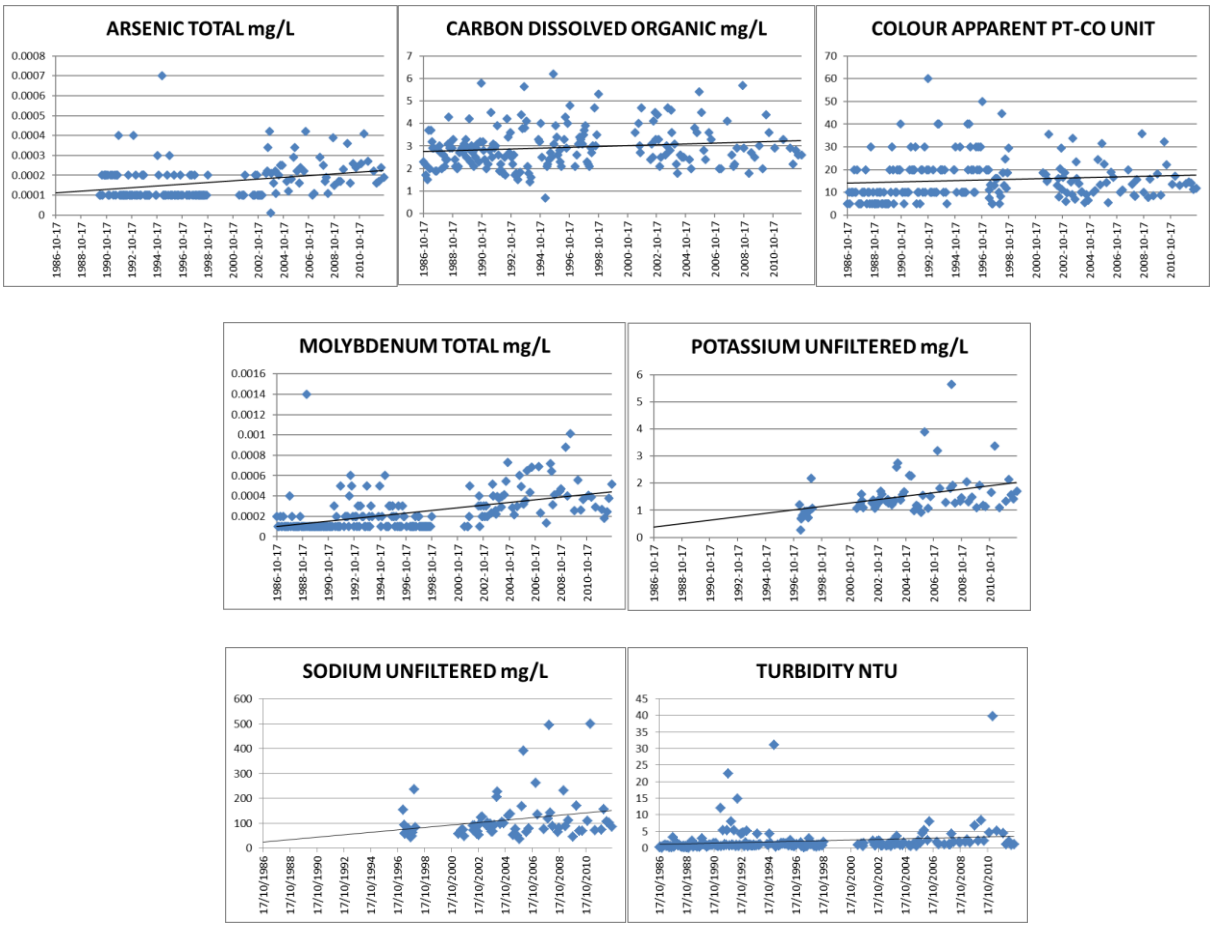


Figure 16: Rennies River at Carnell Drive - Deteriorating Trend Parameters



6.1.7.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 16 displays overall water quality parameters trend results for Rennies River at Carnell Drive.

Table 16: Rennies River at Carnell Drive - Parameter Trend Results

Parameter	Count	Sig Level	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	195	0.05	0.36	0.07	No	0.36	0.04	No
AST	153	0.05	0	0.36	Up	0	0.27	Up
BAT	195	0.05	0.07	-0.13	No	0.07	-0.09	No
BET	195	0.05	0.5	0.05	No	0.22	0.06	No
BT	46	0.05	0.94	-0.01	No	0.98	0	No
CAD	187	0.05	0.16	0.1	No	0.17	0.07	No
DOC	191	0.05	0.02	0.16	Up	0.03	0.11	Up
CDT	195	0.05	0	-0.74	Down	0	-0.59	Down
CLT	37	0.05	0.89	0.02	No	0.83	0.03	No
COLOURA	196	0.05	0	0.24	Up	0	0.15	Up
COND	196	0.05	0.06	0.13	No	0.06	0.09	No
COT	193	0.05	0	-0.33	Down	0	-0.24	Down
CRT	193	0.05	0.3	0.07	No	0.28	0.05	No
CUT	193	0.05	0	-0.28	Down	0	-0.19	Down
FET	193	0.05	0.3	-0.07	No	0.33	-0.05	No
LIT	193	0.05	0	-0.35	Down	0	-0.24	Down
MGD	188	0.05	0.03	-0.16	Down	0.04	-0.1	Down
MOT	193	0.05	0	0.58	Up	0	0.44	Up
NIT	193	0.05	0.19	0.1	No	0.13	0.08	No
NT	104	0.05	0.82	0.02	No	0.67	0.03	No
PBT	193	0.05	0	-0.22	Down	0.01	-0.14	Down
PH	196	0.05	0	0.64	Up	0	0.45	Up
PT	193	0.05	0	-0.29	Down	0	-0.2	Down
SET	92	0.05	0.2	0.13	No	0.27	0.08	No
SIO2	86	0.05	0.91	-0.01	No	0.86	-0.01	No
SOT	36	0.05	0.56	0.1	No	0.55	0.07	No
SRT	193	0.05	0.77	0.02	No	0.83	0.01	No
TURB	196	0.05	0	0.45	Up	0	0.31	Up
VT	193	0.05	0.96	0	No	0.97	0	No
ZNT	193	0.05	0	-0.23	Down	0	-0.16	Down

6.1.7.3 Comparison and Causes of Change from Past

Table 17 compares trend for Rennies River at Carnell Drive between Phase I and Phase II.

Cobalt, copper, lead, lithium, magnesium, phosphorus, pH, and zinc displayed improving trend. DOC, chloride, colour, and turbidity displayed deteriorating trend. Cadmium and molybdenum displayed improving trend with censor majority data. Arsenic displayed deteriorating trend with censor majority data.

When comparing the trend results between Phase I and Phase II, barium, cobalt, lead, magnesium, pH, and phosphorus continued to improve over time while DOC, colour, and turbidity deteriorated over the years. Cadmium, which improved in the past, continued to improve with censor majority data. Lithium, which deteriorated in the past, improved in the current report.

Manganese, nitrate and nitrite, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Barium, iron and strontium, which improved in the past, showed no trend in the current report. Nitrogen and sulphate, which deteriorated in the past, showed no trend in the current report. Sodium and potassium, having only one year of common data period with Phase I report, was considered insufficient for comparative analysis.

This station is in the heart of St. John's and heavily affected by urban development. The Quidi Vidi-Rennies River Development Foundation has spearheaded the cleanup of this system promoting river enhancement and abatement of pollution causing practices. These activities have led to improving trends in metals such as cobalt, copper, lead lithium and magnesium. Abatement practices along with natural limestone geology, and lime application on lawns and farm fields may have also influenced pH. The trend in phosphorous can be linked to phosphorous control measures started in the 1970's.

Urban development has influenced colour and turbidity. Urban activities such as lawn fertilizing and a major golf course located in the basin influenced DOC levels.

Table 17: Rennies River at Carnell Drive - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Barium	Abatement	Cobalt Total	Abatement
Cadmium	Abatement	Copper Total	Abatement
Cobalt	Abatement	Lead Total	Abatement / Atmospheric Deposition
Iron	Abatement	Lithium Total	Abatement / Atmospheric Deposition
Lead	Abatement / Atmospheric Deposition	Magnesium Dissolved	Abatement
Magnesium	Abatement	pH	Farming / Abatement / Urban Development / Natural Sources
Manganese	Abatement / Climate	Phosphorus Total	Abatement
pH	Farming / Abatement / Urban Development / Natural Sources	Zinc Total	Abatement
Phosphorus	Abatement		
Strontium	Abatement		
Deteriorating Trend			
DOC	Urban Development / Farming / Recreation	DOC	Urban Development / Farming / Recreation
Colour	Urban Development	Colour Apparent	Urban Development
Lithium	Urban Development	Turbidity	Urban Development
Nitrate and Nitrite	Urban Development / Farming / Recreation		
Nitrogen	Urban Development / Farming / Recreation		
Sulphate	Urban Development		
Turbidity	Urban Development		
Censored			
Molybdenum	Censored	Arsenic Total	Censored
		Cadmium Total	Censored
		Molybdenum	Censored

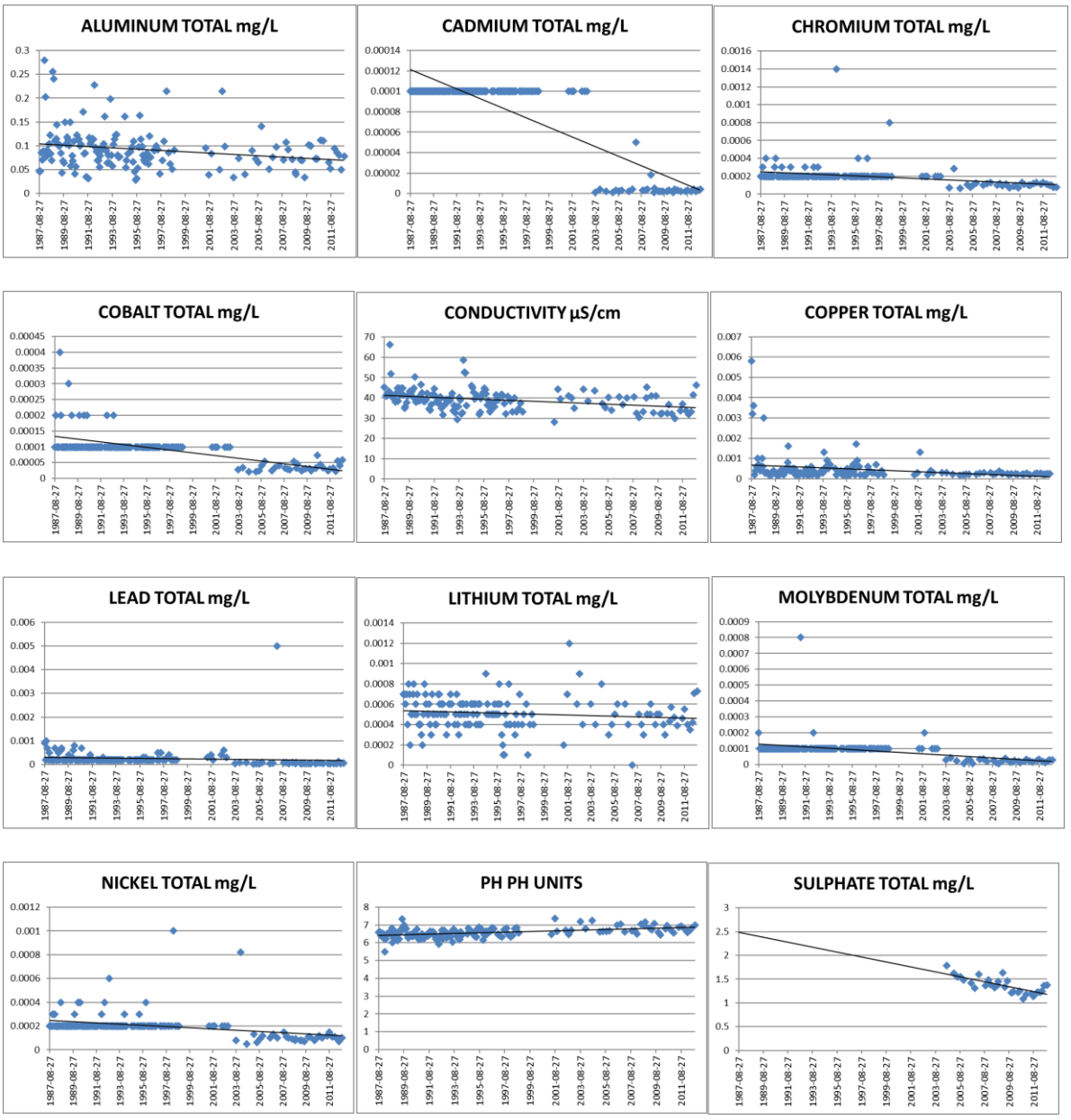
6.1.8 Salmonier River at St. Catherines (NF02ZN0004)

Salmonier River at St. Catherines is located near the community of St. Catherine's. The CESI land use category classifies the station as remote. CANAL lists the surrounding development pressure as medium. RBA ranks the level of overall risk to water quality as medium.

6.1.8.1 Parameter Time Series Graph

Figures 17 and 18 display the parameter time series graphs for improving and deteriorating trend parameters for Salmonier River at St. Catherines.

Figure 17: Salmonier River at St. Catherines - Improving Trend Parameters



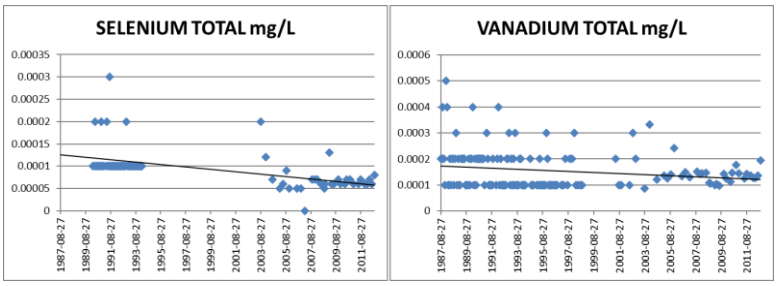
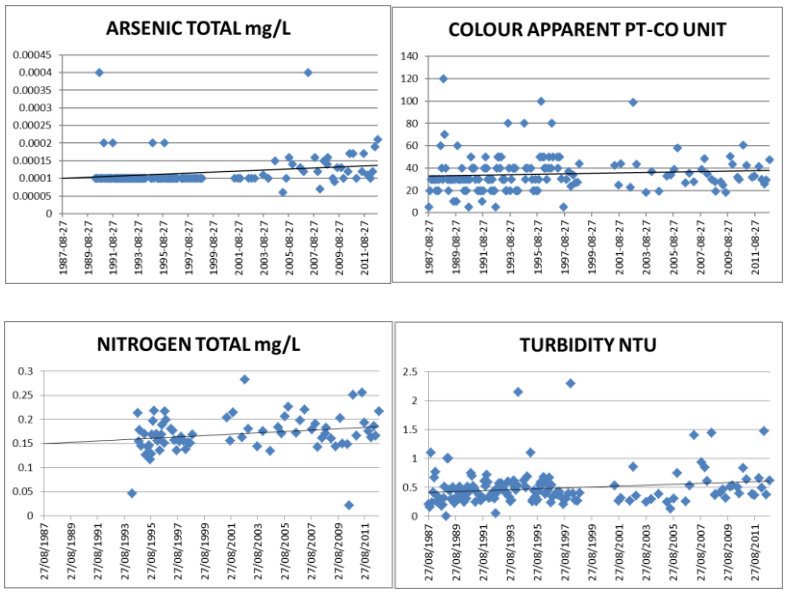


Figure 18: Salmonier River at St. Catherines - Deteriorating Trend Parameters



6.1.8.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 18 displays overall water quality parameters trend results for Salmonier River.

Table 18: Salmonier River at St. Catherines - Parameter Trend Results

Parameter	Count	Sig Level	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	154	0.05	0	-0.24	Down	0	-0.16	Down
AST	122	0.05	0	0.37	Up	0	0.3	Up
BAT	154	0.05	0.29	-0.09	No	0.34	-0.05	No
BET	154	0.05	0.04	-0.16	Down	0.53	-0.04	No
CAD	150	0.05	0.86	0.01	No	0.87	0.01	No
DOC	152	0.05	0.05	0.16	No	0.05	0.11	Up
CDT	154	0.05	0	-0.7	Down	0	-0.54	Down
CLT	30	0.05	0.13	-0.28	No	0.1	-0.22	No
COLOURA	154	0.05	0.04	0.17	Up	0.05	0.11	Up
COND	154	0.05	0	-0.39	Down	0	-0.27	Down
COT	152	0.05	0	-0.72	Down	0	-0.57	Down
CRT	152	0.05	0	-0.63	Down	0	-0.48	Down
CUT	152	0.05	0	-0.28	Down	0	-0.19	Down
FET	152	0.05	0.3	0.09	No	0.26	0.06	No
KU	45	0.05	0.28	-0.17	No	0.24	-0.13	No
LIT	152	0.05	0.01	-0.2	Down	0.01	-0.15	Down
MGD	150	0.05	0.12	-0.13	No	0.11	-0.09	No
MOT	152	0.05	0	-0.68	Down	0	-0.53	Down
NAU	45	0.05	0.45	-0.12	No	0.41	-0.09	No
NIT	152	0.05	0	-0.62	Down	0	-0.48	Down
NT	73	0.05	0.01	0.29	Up	0.01	0.2	Up
PBT	152	0.05	0	-0.57	Down	0	-0.42	Down
PH	154	0.05	0	0.46	Up	0	0.31	Up
PT	153	0.05	0.66	-0.04	No	0.72	-0.02	No
SET	79	0.05	0	-0.72	Down	0	-0.52	Down
SIO2	76	0.05	0.43	0.09	No	0.44	0.06	No
SRT	152	0.05	0.36	-0.08	No	0.32	-0.05	No
TURB	154	0.05	0.01	0.2	Up	0.01	0.13	Up
VT	152	0.05	0.04	-0.16	Down	0.09	-0.1	No
ZNT	152	0.05	0.19	-0.11	No	0.22	-0.07	No

6.1.8.3 Comparison and Causes of Change from Past

Table 19 compares trend for Salmonier River between Phase I and Phase II.

Aluminum, copper, conductivity lithium, and pH displayed improving trend. Arsenic, colour, nitrogen and turbidity displayed deteriorating trend. Cadmium, chromium, cobalt, lead, molybdenum, nickel, selenium, and vanadium displayed improving trend with censor majority data. Arsenic displayed deteriorating trend with censor majority data.

When comparing the trend results between Phase I and Phase II, aluminum, lithium, pH, and conductivity continued to improve over time while colour, nitrogen and turbidity deteriorated over the years. Vanadium, which improved in the past, continued to improve with censor majority data in the current report. Chromium and nickel, which deteriorated in the past, improved with censor majority data. Arsenic, which deteriorated in the past, continued to deteriorate with censor majority data.

Mercury, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Barium, chloride, iron, potassium, phosphorus, sodium, and strontium, which improved in the past, showed no trend in the current report.

Reductions in atmospheric deposition and various abatement practices have affected metal levels as seen in aluminum, copper, and lithium. The cause of the improving trend in pH is likely due to natural sources resulting from limestone geology in the area. Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow and decreasing conductivity, while increasing colour and turbidity.

Domestic wood harvesting and cabin development may also be affecting colour and turbidity. Sewage outfall from the Salmonier Correctional Institute and cabin septic systems may be affecting nitrogen levels.

Table 19: Salmonier River at St. Catherines - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Aluminum	Atmospheric Deposition / Abatement	Aluminum Total	Atmospheric Deposition / Abatement
Barium	Atmospheric Deposition / Abatement	Conductivity	Climate Change
Chloride	Climate Change	Copper Total	Atmospheric Deposition / Abatement
Conductivity	Climate Change	Lithium Total	Atmospheric Deposition / Abatement
Iron	Atmospheric Deposition / Abatement	pH	Abatement / Natural sources
Lithium	Atmospheric Deposition / Abatement		
Mercury	Atmospheric Deposition / Abatement		
Potassium	Climate Change		
pH	Abatement / Natural sources		
Phosphorus	Abatement		
Sodium	Climate Change		
Strontium	Atmospheric Deposition / Abatement		
Vanadium	Atmospheric Deposition / Abatement		
Deteriorating Trend			
Arsenic	Transportation	Colour	Climate Change / Forestry
Chromium	Transportation	Nitrogen Total	Sewage
Colour	Climate Change/Forestry	Turbidity	Climate Change / Forestry
Nickel	Transportation		
Nitrogen	Sewage		
Turbidity	Climate Change/Forestry		
Censored			
Beryllium	Censored	Arsenic Total	Censored
Cadmium	Censored	Cadmium Total	Censored
Molybdenum	Censored	Chromium Total	Censored
		Cobalt Total	Censored
		Lead Total	Censored
		Molybdenum Total	Censored
		Nickel Total	Censored
		Selenium Total	Censored
		Vanadium Total	Censored

6.1.9 Virginia River at the Boulevard (NF02ZM0014)

Virginia River at the Boulevard is in the City of St. John's. The CESI land use category classifies the station as populated. CANAL lists the surrounding development pressure as medium. RBA ranks the level of overall risk to water quality as medium.

6.1.9.1 Parameter Time Series Graph

Figures 19 and 20 display the parameter time series graphs for improving and deteriorating trend parameters for Virginia River at The Boulevard.

Figure 19: Virginia River at the Boulevard - Improving Trend Parameters

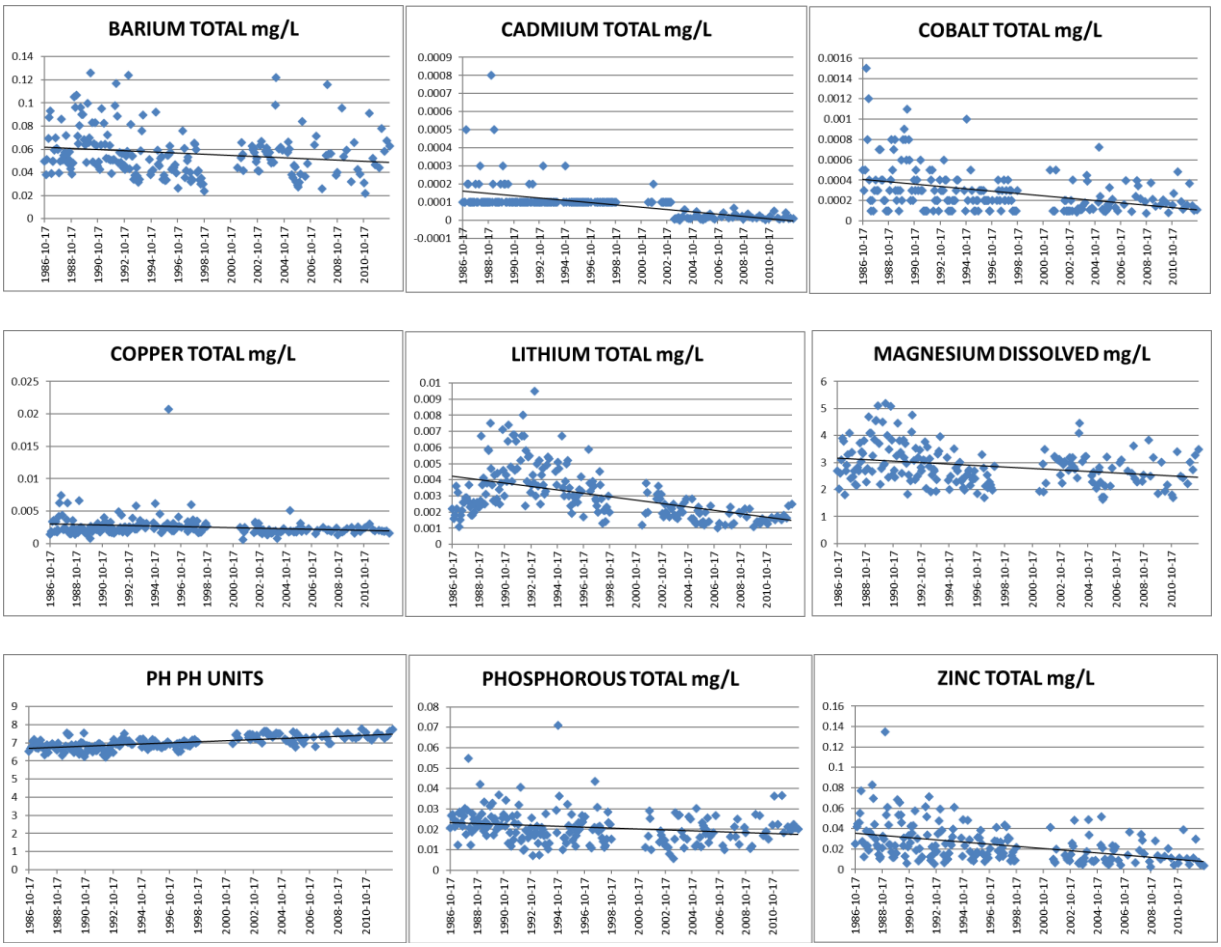
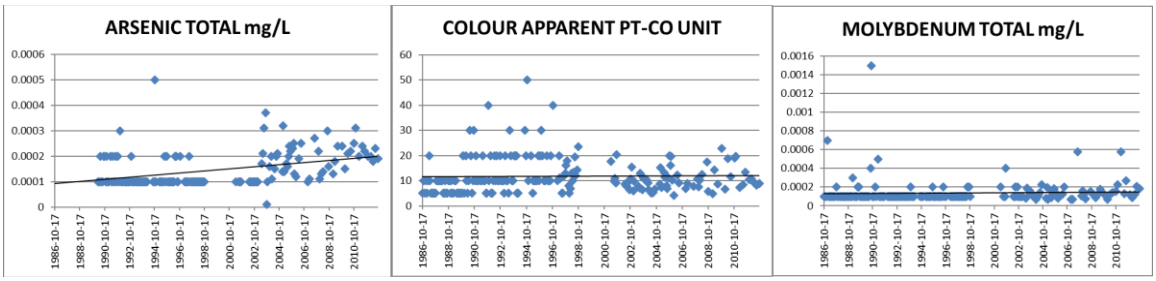
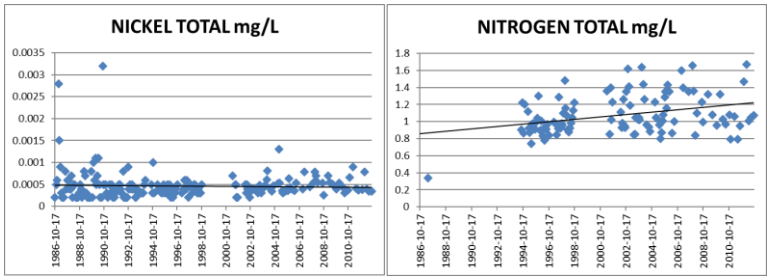
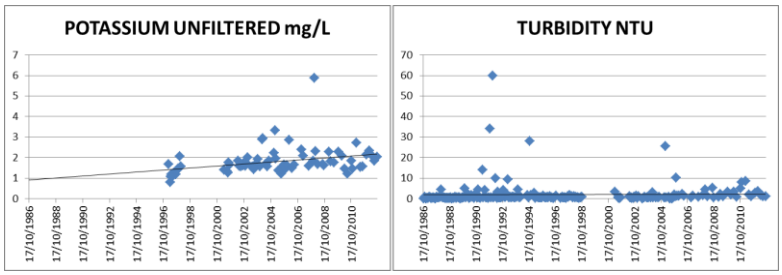


Figure 20: Virginia River at the Boulevard - Deteriorating Trend Parameters


ARSENIC TOTAL mg/L
COLOUR APPARENT PT-CO UNIT
MOLYBDENUM TOTAL mg/L


NICKEL TOTAL mg/L
NITROGEN TOTAL mg/L


POTASSIUM UNFILTERED mg/L
TURBIDITY NTU

6.1.9.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 20 displays overall water quality parameters trend results for Virginia River at the Boulevard.

Table 20: Virginia River at the Boulevard - Parameter Trend Results

Parameter	Count	Sig Level	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	201	0.05	0.53	-0.04	No	0.44	-0.04	No
AST	159	0.05	0	0.49	Up	0	0.37	Up
BAT	201	0.05	0	-0.22	Down	0	-0.15	Down
BET	201	0.05	0.33	-0.07	No	0.66	-0.02	No
CAD	193	0.05	0.24	-0.09	No	0.23	-0.06	No
DOC	198	0.05	0.78	0.02	No	0.83	0.01	No
CDT	201	0.05	0	-0.76	Down	0	-0.59	Down
CLT	44	0.05	0.67	0.07	No	0.69	0.04	No
COLOURA	201	0.05	0.02	0.16	Up	0.04	0.1	Up
COND	201	0.05	0.17	-0.1	No	0.19	-0.06	No
COT	199	0.05	0	-0.39	Down	0	-0.28	Down
CRT	199	0.05	0.39	0.06	No	0.42	0.04	No
CUT	199	0.05	0	-0.2	Down	0.01	-0.13	Down
FET	199	0.05	0.1	0.12	No	0.1	0.08	No
LIT	199	0.05	0	-0.5	Down	0	-0.36	Down
MGD	193	0.05	0	-0.29	Down	0	-0.19	Down
MOT	199	0.05	0	0.23	Up	0	0.16	Up
NAU	80	0.05	0.51	0.08	No	0.45	0.06	No
NIT	199	0.05	0.06	0.13	No	0.04	0.1	Up
NT	111	0.05	0	0.32	Up	0	0.22	Up
PBT	199	0.05	0.51	-0.05	No	0.66	-0.02	No
PH	201	0.05	0	0.65	Up	0	0.46	Up
PT	200	0.05	0	-0.26	Down	0	-0.17	Down
SET	100	0.05	0.1	0.17	No	0.11	0.11	No
SIO2	84	0.05	0.51	-0.07	No	0.54	-0.05	No
SOT	44	0.05	0.64	-0.07	No	0.67	-0.05	No
SRT	199	0.05	0.06	-0.13	No	0.06	-0.09	No
TURB	201	0.05	0	0.37	Up	0	0.26	Up
VT	199	0.05	0.23	-0.09	No	0.21	-0.06	No
ZNT	199	0.05	0	-0.48	Down	0	-0.34	Down

6.1.9.3 Comparison and Causes of Change from Past

Table 21 compares trend for Virginia River between Phase I and Phase II.

Barium, cobalt, copper, lithium, magnesium, pH, phosphorus, and zinc displayed improving trend. Colour, nitrogen, nickel, and turbidity displayed deteriorating trend. Cadmium and molybdenum displayed improving trend with censor majority data. Arsenic displayed deteriorating trend with censor majority data.

When comparing the trend results between Phase I and Phase II, aluminum, lithium, barium, cobalt, magnesium, pH, phosphorus, zinc continued to improve over time while colour, nitrogen and turbidity deteriorated over the years.

Nitrate and nitrite, which deteriorated in the past, was excluded from the current analysis due to unavailability of more recent data. Beryllium, calcium, selenium and strontium, which improved in the past, showed no trend in the current report. Sulphate, which deteriorated in the past, showed no trend in the current report. Potassium, having only one year of common data period with Phase I report, was considered insufficient for comparative analysis.

This site is in the heart of St. John's and heavily affected by urban development. The Virginia River Conservation Society has spearheaded the cleanup of this system promoting river enhancement and abatement of pollution causing practices. These activities have led to improving trends in metals such as barium, cobalt, copper, lithium, magnesium and zinc. Abatement practices along with natural limestone geology, and lime application on lawns may have also influenced pH. Climate change with increased precipitation improved magnesium concentration.

Urban development, a couple of quarries and extensive stream modification have influenced colour, nickel, and turbidity. Urban activities including fertilizing lawns and the presence of a major golf course influenced nitrogen, nitrate and nitrite levels.

Table 21: Virginia River at the Boulevard - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Barium	Abatement	Barium Total	Abatement
Beryllium	Abatement	Cobalt Total	Abatement
Cobalt	Abatement	Copper Total	Abatement
Calcium	Climate Change	Lithium Total	Abatement
Magnesium	Climate Change	Magnesium Total	Climate Change
pH	Abatement / Urban Development / Natural Sources	pH	Abatement / Urban Development / Natural Sources
Phosphorus	Abatement	Phosphorus Total	Abatement
Selenium	Abatement	Zinc Total	Abatement
Strontium	Abatement		
Zinc	Abatement		
Deteriorating Trend			
Colour	Urban Development	Colour	Urban Development
Nitrate and Nitrite	Urban Development / Recreation	Nitrogen Total	Urban Development / Sewage
Nitrogen	Urban Development / Recreation	Nickel Total	Urban Development
Sulphate	Urban Development	Turbidity	Urban Development / Mining / Stream Modification
Turbidity	Urban Development / Mining / Stream Modification		
Censored			
Molybdenum	Censored	Arsenic Total	Censored
		Cadmium Total	Censored
		Molybdenum Total	Censored

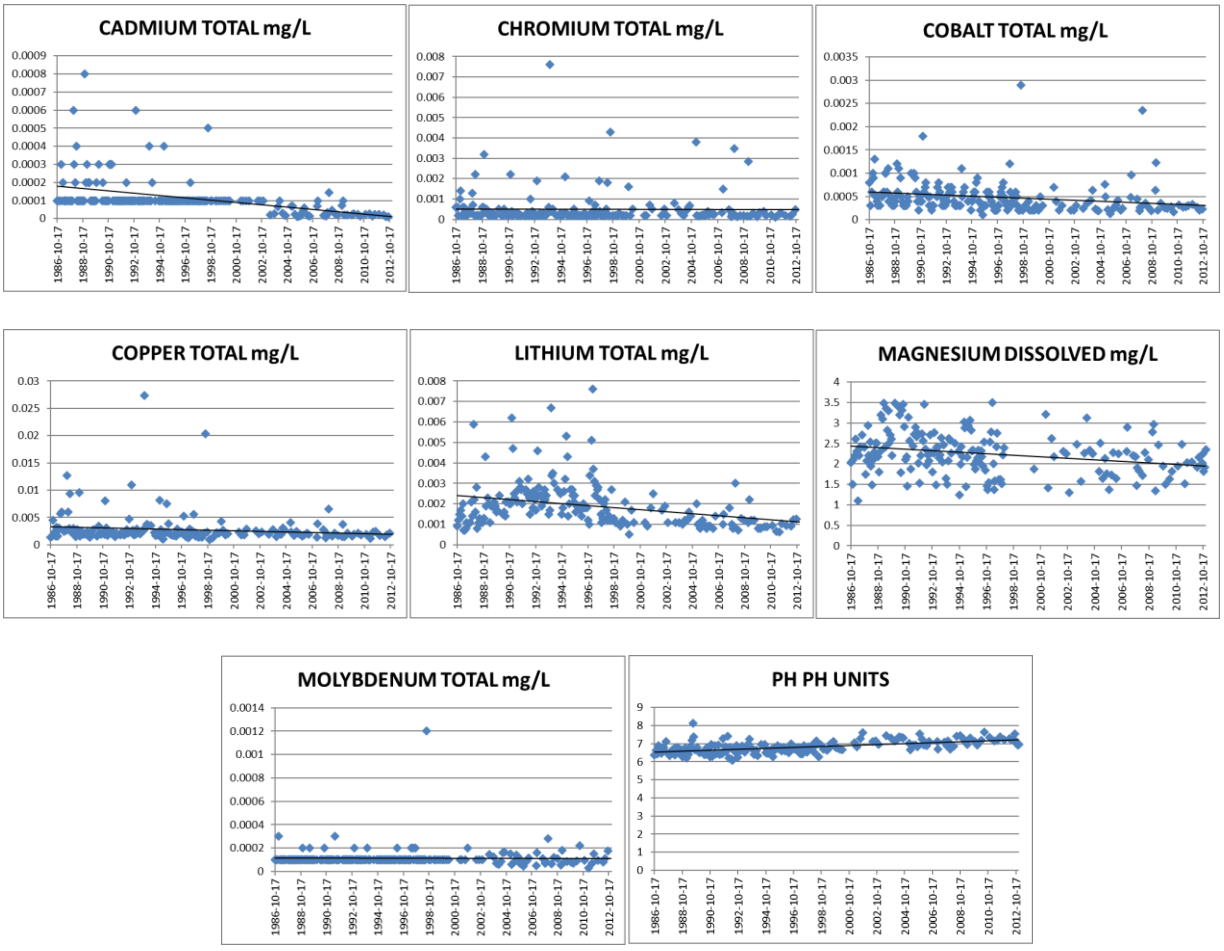
6.1.10 Waterford River at Kilbride (NF02ZM0009)

Waterford River at Kilbride is in the City of St. John's. The CESI land use category classifies the station as populated. CANAL lists the surrounding development pressure as medium. RBA ranks the level of overall risk to water quality as medium and the risk related to activities and sources of contamination and impact on water quality as high.

6.1.10.1 Parameter Time Series Graph

Figures 21 and 22 display the parameter time series graphs for improving and deteriorating trend parameters for Waterford River at Kilbride.

Figure 21: Waterford River at Kilbride - Improving Trend Parameters



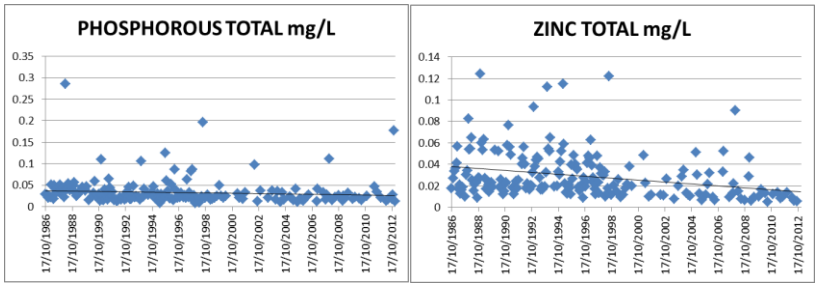
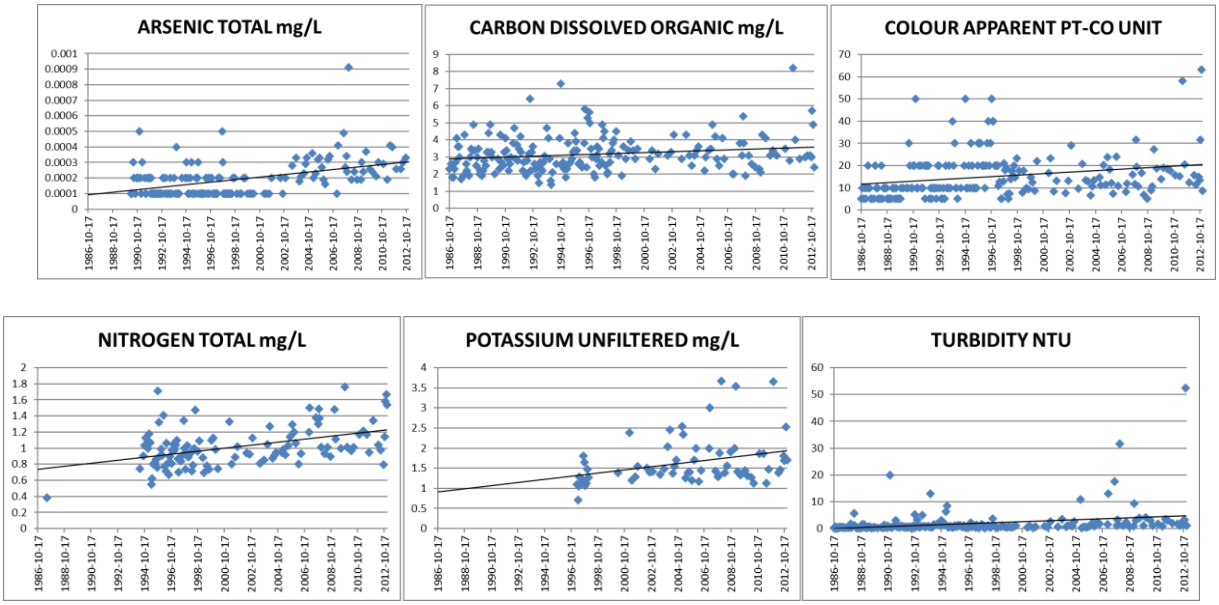


Figure 22: Waterford River at Kilbride - Deteriorating Trend Parameters



6.1.10.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 22 displays overall water quality parameters trend results for Waterford River.

Table 22: Waterford River at Kilbride - Parameter Trend Results

Parameter	Count	Sig Level	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	193	0.05	0.4	-0.06	No	0.41	-0.04	No
AST	155	0.05	0	0.42	Up	0	0.31	Up
BAT	193	0.05	0.12	-0.11	No	0.11	-0.08	No
BET	193	0.05	0.16	-0.1	No	0.65	-0.02	No
CAD	182	0.05	0.98	0	No	0.98	0	No
DOC	195	0.05	0	0.2	Up	0.01	0.14	Up
CDT	193	0.05	0	-0.68	Down	0	-0.54	Down
CLT	43	0.05	0.51	-0.1	No	0.6	-0.06	No
COLOURA	197	0.05	0	0.35	Up	0	0.24	Up
COND	197	0.05	0.12	0.11	No	0.13	0.07	No
COT	191	0.05	0	-0.43	Down	0	-0.3	Down
CRT	191	0.05	0.05	-0.14	Down	0.03	-0.11	Down
CUT	191	0.05	0	-0.22	Down	0	-0.15	Down
FET	191	0.05	0.89	0.01	No	0.88	0.01	No
LIT	191	0.05	0	-0.36	Down	0	-0.24	Down
MGD	182	0.05	0	-0.28	Down	0	-0.19	Down
MOT	191	0.05	0.05	-0.14	Down	0.06	-0.1	No
NAU	67	0.05	0.95	0.01	No	0.99	0	No
NIT	191	0.05	0.06	0.14	No	0.05	0.1	No
NT	113	0.05	0	0.39	Up	0	0.29	Up
PBT	191	0.05	0.4	-0.06	No	0.5	-0.03	No
PH	197	0.05	0	0.59	Up	0	0.42	Up
PT	196	0.05	0	-0.28	Down	0	-0.19	Down
SET	89	0.05	0.13	0.16	No	0.18	0.11	No
SIO2	96	0.05	0.59	-0.06	No	0.56	-0.04	No
SOT	43	0.05	0.7	-0.06	No	0.83	-0.02	No
SRT	191	0.05	0.05	-0.14	No	0.04	-0.1	Down
TURB	197	0.05	0	0.48	Up	0	0.34	Up
VT	191	0.05	0.67	0.03	No	0.66	0.02	No
ZNT	191	0.05	0	-0.39	Down	0	-0.27	Down

6.1.10.3 Comparison and Causes of Change from Past

Table 23 compares trend for Waterford River between Phase I and Phase II.

Cobalt, copper, lithium, magnesium, molybdenum, pH, phosphorus, zinc displayed improving trend. DOC, colour, nitrogen, potassium, and turbidity displayed deteriorating trend. Cadmium, chromium, and molybdenum displayed improving trend with censor majority data. Arsenic displayed deteriorating trend with censor majority data.

When comparing the trend results between Phase I and Phase II, cobalt, magnesium, pH, and phosphorus continued to improve over time while DOC, colour, nitrogen, sulphate and turbidity deteriorated over the years.

Mercury and manganese, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Nitrate and nitrite, which deteriorated in the past, was excluded from the current analysis due to unavailability of more recent data. Strontium, which improved in the past, showed no trend in the current report. Silica and sulphate, which deteriorated in the past, showed no trend in the current report. Lithium, which deteriorated in the past, improved in the current report. Potassium, having only one year of common data period with Phase I report, was considered insufficient for comparative analysis.

This site is located within St. John's and is heavily affected by urban development. The Friends and Lobbyists of the Waterford River have spearheaded the cleanup of this system promoting river enhancement and abatement of pollution causing practices. These activities have led to improving trends in metals such as cobalt, copper, lithium and zinc. Abatement practices along with natural limestone geology, and lime application on lawns and farm fields may have also influenced pH. Climate change has affected magnesium levels. The trend in phosphorous can be linked to phosphorous control measures started in the 1970s.

Urban development and two major quarries have influenced colour, and turbidity. Urban development has also affected potassium levels. A combination of urban activities such as lawn fertilizing, farming and sewage cross-connections increased nitrogen, nitrate, nitrite, and DOC levels.

Table 23: Waterford River at Kilbride - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Cobalt	Abatement	Cobalt Total	Abatement
Magnesium	Abatement / Climate Change	Copper Total	Abatement
Manganese	Abatement	Lithium Total	Abatement
Mercury	Abatement / Atmospheric Deposition	Magnesium Dissolved	Abatement / Climate Change
pH	Farming / Urban Development / Abatement / Natural Sources	pH	Farming / Urban Development / Abatement / Natural Sources
Phosphorus	Abatement	Phosphorus Total	Abatement
Strontium	Abatement	Zinc Total	Abatement
Deteriorating Trend			
DOC	Urban Development / Farming	DOC	Urban Development
Colour	Urban Development / Mining	Colour	Urban Development
Lithium	Urban Development	Nitrogen Total	Farming / Sewage / Urban Development
Nitrate & Nitrite	Farming / Sewage / Urban Development	Turbidity	Urban Development
Nitrogen	Farming / Sewage / Urban Development		
Silica	Urban Development / Farming		
Sulphate	Urban Development		
Turbidity	Urban Development / Mining		
Censored			
Beryllium	Censored	Arsenic Total	Censored
Molybdenum	Censored	Cadmium Total	Censored
		Chromium Total	Censored
		Molybdenum Total	Censored

6.1.11 Regional Trend for Selected Parameters

Regionally, copper showed the highest level of improvement with downward trend on all ten stations. This is followed by lithium, pH and zinc which showed improvement in most of the stations (downward for lithium and zinc, upward for pH). Magnesium and cobalt also showed improvement with downward trend at more than half of the stations.

Turbidity showed the highest level of deterioration with an upward trend for seven of the ten stations. This is followed by colour, nitrogen, and DOC with deterioration with upward trend in half the stations. The parameters which displayed trend with censor majority data (improving or deteriorating) were arsenic, beryllium, cadmium, chromium, lead, molybdenum, nickel, and selenium.

Most of the Eastern stations were in the City of St. John's with the highest population density in NL. Urban influence in both improving and deteriorating trend were observed for these stations. The river stewardship programs set for Virginia River Conservation Society, Quidi Vidi-Rennies River Development Foundation, and Friends and Lobbyists of the Waterford River increased public awareness of harmful activities and lead to improvement of metals such as copper, cobalt, lithium, magnesium and zinc. Abatement practices along with natural limestone geology, and lime application on lawns and farm fields may have improved pH. Abatement resulting from the Phosphorus Control Act resulted in the improvement of phosphorus in three stations.

Urban influence on the deteriorating trends of turbidity, colour, nitrogen, and DOC were noticeable resulting from stream modification, quarrying activity, road salt, and lawn fertilizer.

Reduction in atmospheric pollutants through international initiatives such as the ban on leaded gasoline lead to improvement in copper, lithium and zinc in non-urban stations. The natural limestone geology in the two remote stations helped improved pH. Climate change at these locations affected streamflow decreasing conductivity and major ion concentration.

Increased precipitation resulting from climate change lead to deteriorating turbidity and colour in the non-urban stations while the increase of carbon emissions observed globally across the north affected DOC levels. An increase in the natural background level of iron was observed in the non-urban stations.

Table 24 displays regional trend results for eastern water quality parameters. The last column of the table shows the percentage of parameters that either displaying no trend or consisted of censor majority data.

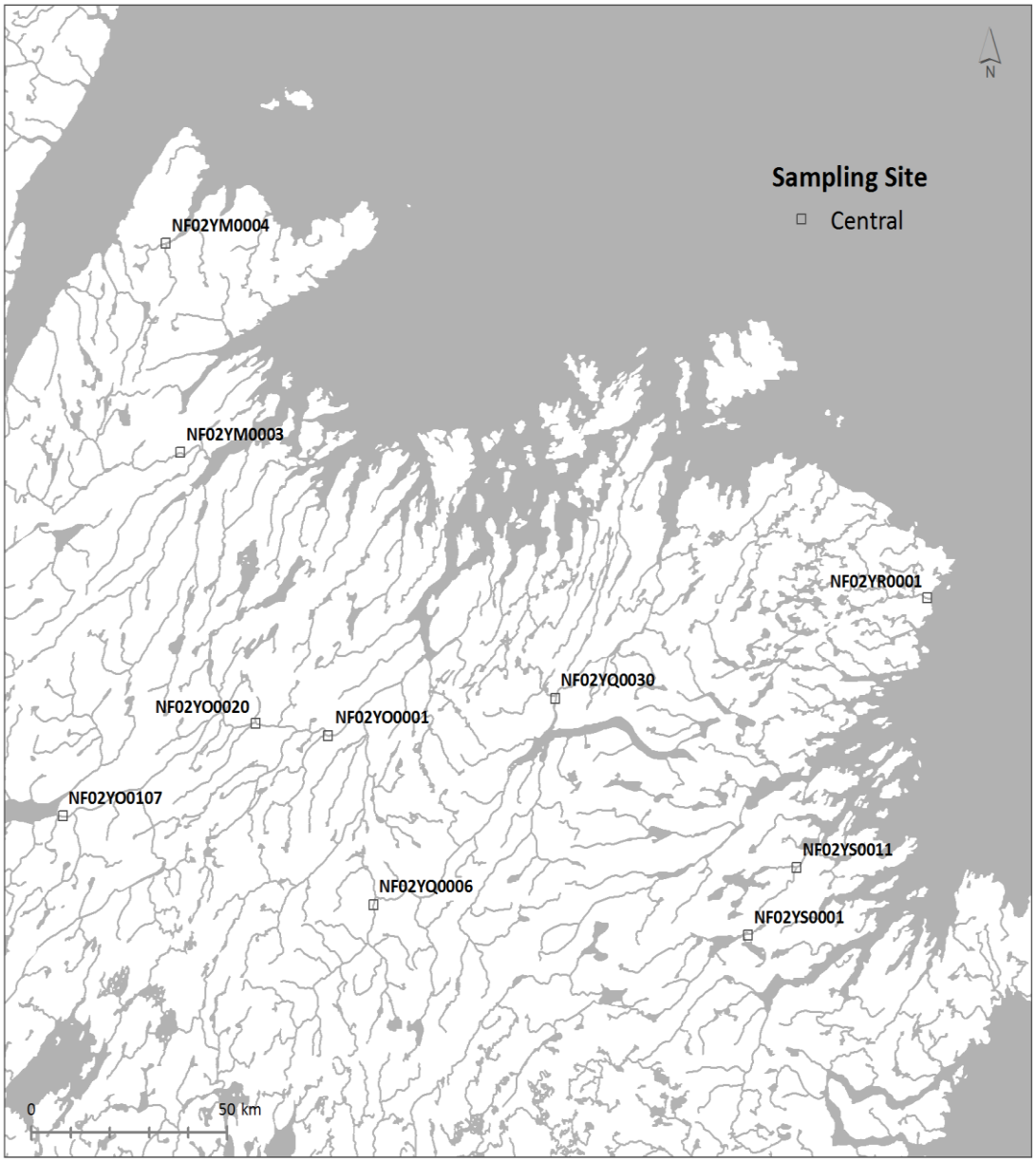
Table 24: Regional Trend for Eastern WQMA Stations

PARAMETER	COUNT	%DETERIORATIONG	%IMPROVING	%NONE OR CENSORED
ALT	10	0	30	70
AST	10	10	0	90
BAT	10	10	50	40
BET	10	0	20	80
CAD	10	20	10	70
DOC	10	50	0	50
CDT	10	0	10	90
CLT	10	0	0	100
COLOURA	10	50	20	30
COND	10	20	40	40
COT	10	0	60	40
CRT	10	10	0	90
CUT	10	0	100	0
FET	10	30	10	60
LIT	10	0	90	10
MGD	10	0	70	30
MOT	10	10	0	90
NIT	10	30	10	60
NT	10	50	20	30
PBT	10	0	20	80
PH	10	0	90	10
PT	10	10	40	50
SET	10	0	0	100
SIO2	10	0	0	100
SRT	10	20	10	70
TURB	10	70	0	30
VT	10	0	0	100
ZNT	10	10	80	10

6.2 Central Water Quality Station Trends

Figure 23 displays the 10 Central water quality stations included for trend analysis.

Figure 23: Selected Central WQMA Trend Stations



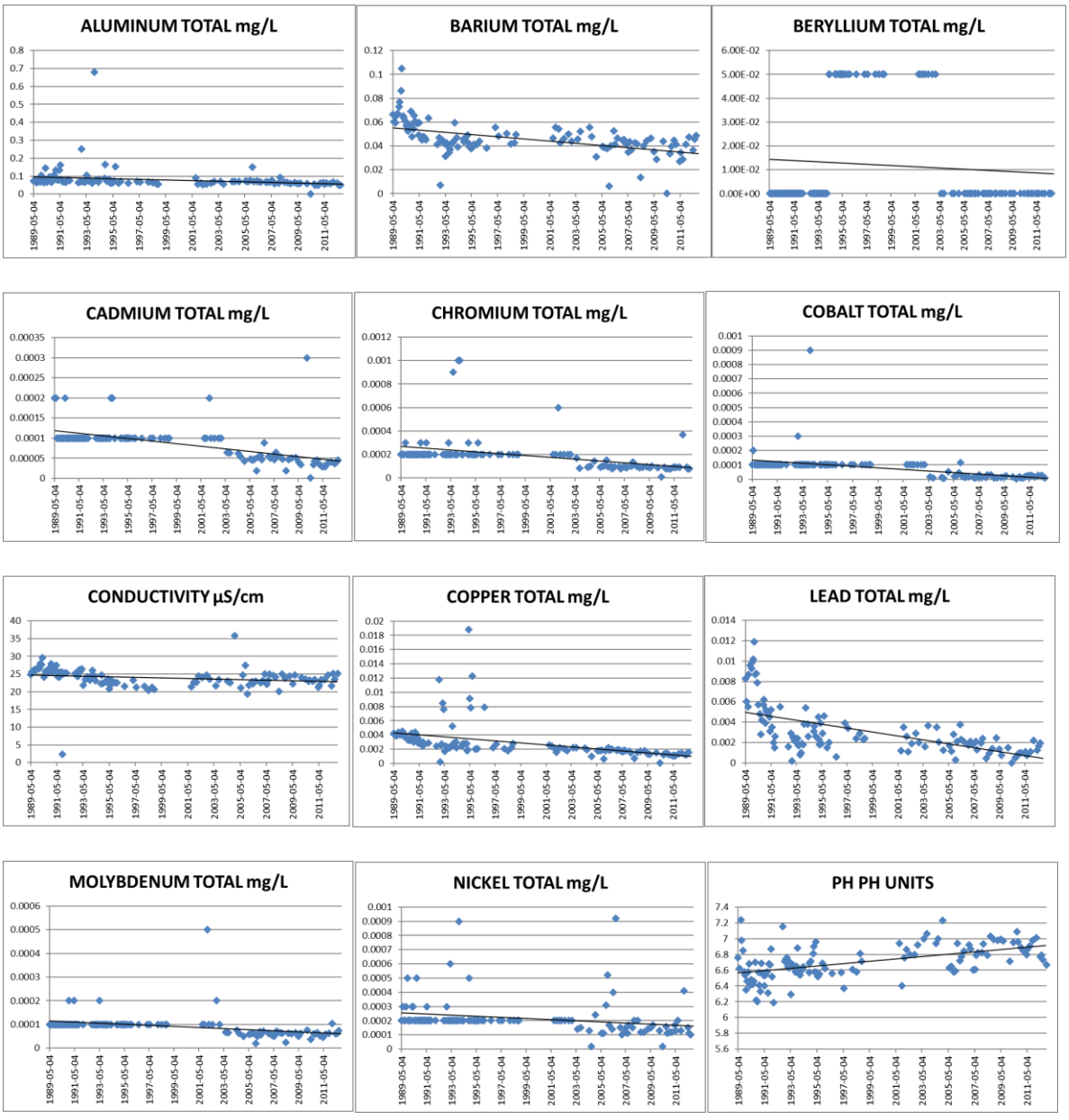
6.2.1 Exploits River near Millertown (NFO2Y00107)

Exploits River near Millertown is located near the community of Millertown. The CESI land use category classifies the station as mining. CANAL lists the surrounding development pressure as medium. RBA ranks the level of overall risk to water quality as medium.

6.2.1.1 Parameter Time Series Graph

Figures 24 and 25 display the parameter time series graphs for improving and deteriorating trend parameters for Exploits River near Millertown.

Figure 24: Exploits River near Millertown - Improving Trend Parameters



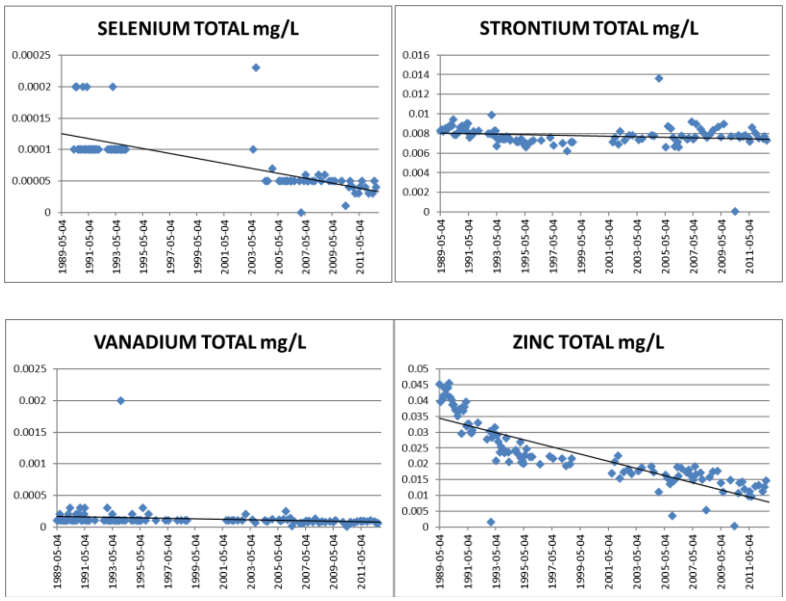
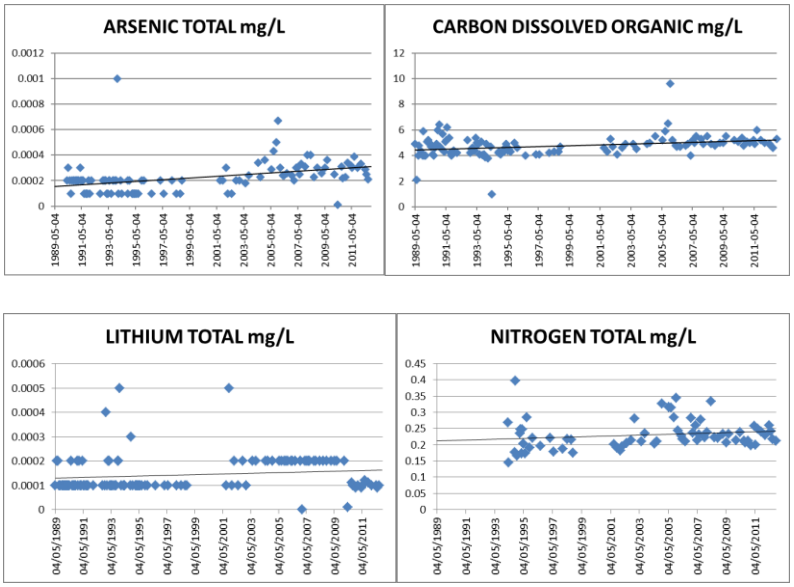


Figure 25: Exploits River near Millertown - Deteriorating Trend Parameters



6.2.1.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 25 displays overall water quality parameters trend results for Exploits River near Millertown.

Table 25: Exploits River near Millertown - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	118	0.05	0	-0.58	Down	0	-0.41	Down
AST	107	0.05	0	0.56	Up	0	0.38	Up
BAT	117	0.05	0	-0.61	Down	0	-0.44	Down
BET	118	0.05	0	-0.51	Down	0	-0.3	Down
CAD	114	0.05	0.33	-0.09	No	0.22	-0.08	No
DOC	119	0.05	0	0.34	Up	0	0.25	Up
CDT	118	0.05	0	-0.77	Down	0	-0.62	Down
CLT	40	0.05	0.01	0.39	Up	0.01	0.28	Up
COLOURA	118	0.05	1	0	No	0.99	0	No
COND	118	0.05	0	-0.55	Down	0	-0.37	Down
COT	115	0.05	0	-0.77	Down	0	-0.58	Down
CRT	115	0.05	0	-0.72	Down	0	-0.57	Down
CUT	115	0.05	0	-0.82	Down	0	-0.65	Down
FET	115	0.05	0.27	0.1	No	0.2	0.08	No
KU	50	0.05	0.26	-0.16	No	0.24	-0.12	No
LIT	115	0.05	0.03	0.2	Up	0.03	0.16	Up
MGD	114	0.05	0.11	-0.15	No	0.11	-0.11	No
MOT	115	0.05	0	-0.72	Down	0	-0.54	Down
NAU	50	0.05	0.94	-0.01	No	0.99	0	No
NIT	115	0.05	0	-0.59	Down	0	-0.45	Down
NT	70	0.05	0.03	0.26	Up	0.03	0.18	Up
PBT	115	0.05	0	-0.72	Down	0	-0.53	Down
PH	118	0.05	0	0.55	Up	0	0.38	Up
PT	118	0.05	0.31	-0.09	No	0.36	-0.06	No
SET	79	0.05	0	-0.87	Down	0	-0.71	Down
SIO2	50	0.05	0.10	-0.24	No	0.09	-0.17	No
SOT	40	0.05	0	-0.71	Down	0	-0.52	Down
SRT	115	0.05	0	-0.34	Down	0	-0.24	Down
TURB	118	0.05	0.12	0.14	No	0.12	0.1	No
VT	115	0.05	0	-0.54	Down	0	-0.38	Down
ZNT	115	0.05	0	-0.93	Down	0	-0.81	Down

6.2.1.3 Comparison and Causes of Change from Past

Table 26 compares trend for Exploits River near Millertown between Phase I and Phase II.

Aluminum, barium, copper, lead, pH, sodium, conductivity, strontium, and zinc displayed improving trend. DOC and nitrogen displayed deteriorating trend. Beryllium, cadmium, chromium, cobalt, lithium, molybdenum, nickel, selenium, and vanadium displayed improving trend with censor majority data. Arsenic displayed deteriorating trend with censor majority data.

When comparing the trend results between Phase I and Phase II, aluminum, barium, copper, conductivity, lead, pH, strontium, and zinc continued to improve over time. Nitrogen, which improved in the past, deteriorated in the current report. Arsenic, which improved in the past, deteriorated with censor majority data in the current report. Cadmium, which improved in the past, improved with censor majority data in the current report. Chromium, which deteriorated in the past, improved with censor majority data in the current report.

Manganese, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Calcium, chloride, magnesium, phosphorus, potassium, silica, sodium, and sulphate, which improved in the past, showed no trend in the current report.

Major cleanup operations took place after the closing of the now abandoned ASARCO mine leading to reduced level of metals for aluminum, barium, copper, lead, strontium, and zinc as well as improving pH levels. Reduction in atmospheric deposition also helped reduce the metals. Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow, decreasing conductivity concentration.

The increase of global carbon emission across the north likely caused the deterioration of DOC. Raw sewage discharge at three outlets in Buchans Brook by the community of Buchans likely increased nitrogen level.

Table 26: Exploits River near Millertown - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Aluminium	Abatement/ Atmospheric Deposition	Aluminum Total	Abatement/ Atmospheric Deposition
Arsenic	Abatement/ Atmospheric Deposition	Barium Total	Abatement/ Atmospheric Deposition
Barium	Abatement/ Atmospheric Deposition	Copper Total	Abatement/ Atmospheric Deposition
Cadmium	Abatement/ Atmospheric Deposition	Lead Total	Abatement/ Atmospheric Deposition
Calcium	Climate Change	pH	Abatement
Chloride	Climate Change	Conductivity	Climate Change
Conductivity	Climate Change	Strontium Total	Abatement/ Atmospheric Deposition

Copper	Abatement/ Atmospheric Deposition	Zinc Total	Abatement/ Atmospheric Deposition
Dissolved Oxygen	Abatement		
Lead	Abatement/ Atmospheric Deposition		
Magnesium	Climate Change		
Manganese	Abatement/ Atmospheric Deposition		
Nitrogen	Abatement		
pH	Abatement		
Phosphorous	Abatement		
Potassium	Climate Change		
Silica	Abatement		
Sodium	Climate Change		
Strontium	Abatement/ Atmospheric Deposition		
Sulphate	Climate Change / Atmospheric Deposition		
Zinc	Abatement/ Atmospheric Deposition		
Deteriorating Trend			
Chromium	Transportation	DOC	Global Carbon Emissions
		Nitrogen Total	Sewage
Censored			
Beryllium	Censored	Arsenic Total	Censored
		Beryllium Total	Censored
		Cadmium Total	Censored
		Chromium Total	Censored
		Cobalt Total	Censored
		Lithium Total	Censored
		Molybdenum Total	Censored
		Nickel Total	Censored
		Selenium Total	Censored
		Vanadium Total	Censored

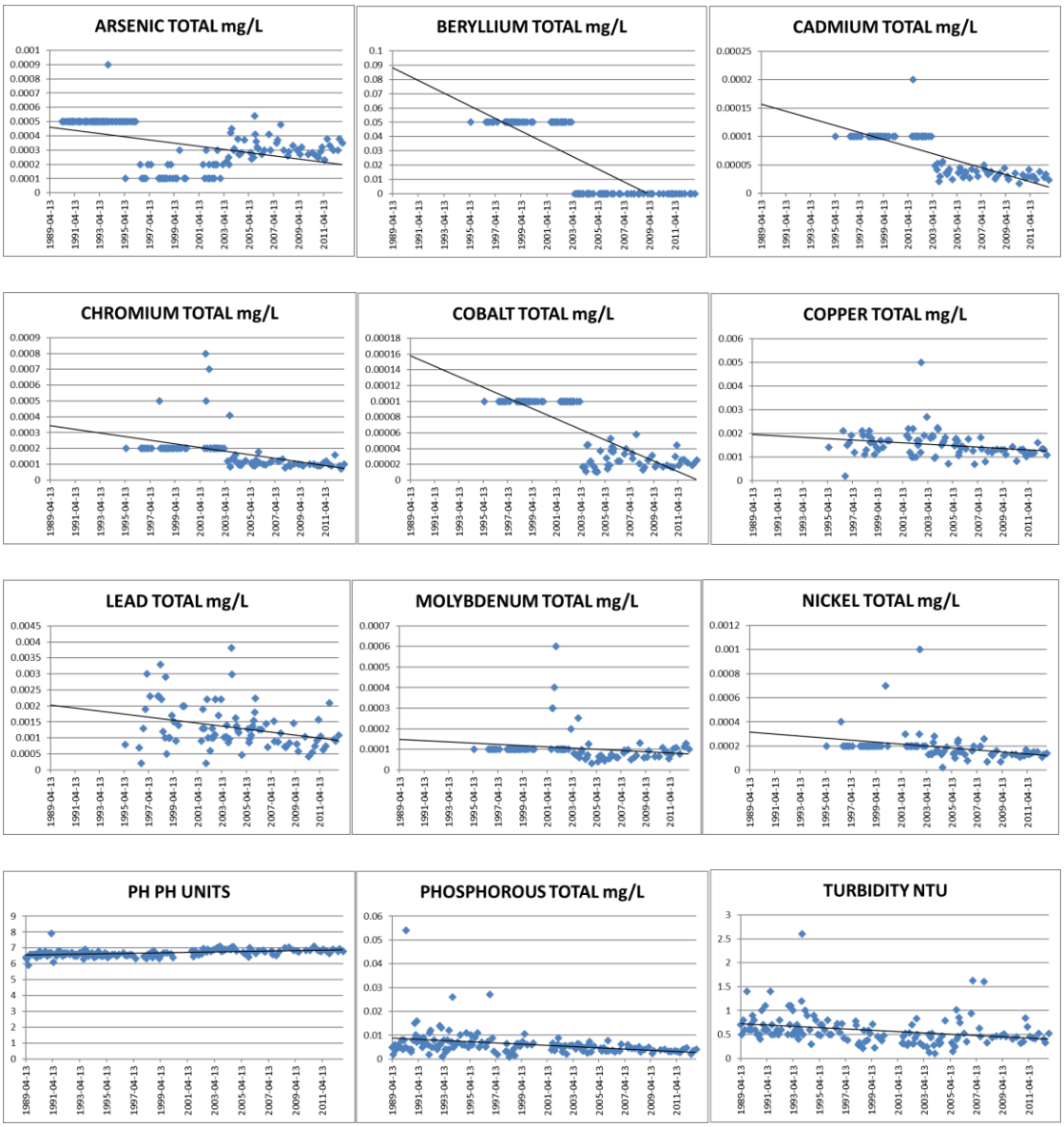
6.2.2 Exploits River at Grand Falls (NF02YO0001)

Exploits River at Grand Falls is located near the community of Grand Falls-Windsor. The CESI land use category classifies the station as mining. CANAL lists the surrounding development pressure as medium. RBA ranks the level of overall risk to water quality as medium.

6.2.2.1 Parameter Time Series Graph

Figures 26 and 27 display the parameter time series graphs for improving and deteriorating trend parameters for Exploits River at Grand Falls.

Figure 26: Exploits River at Grand Falls - Improving Trend Parameters



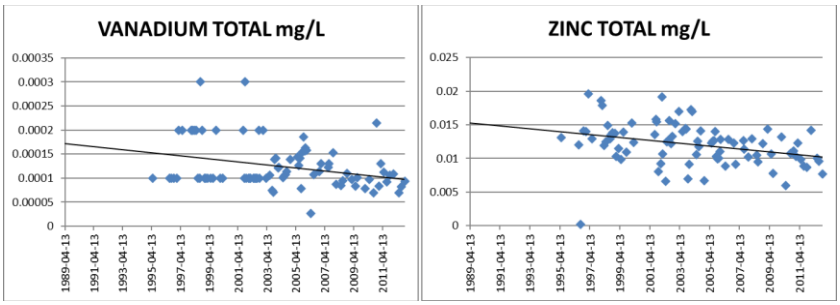
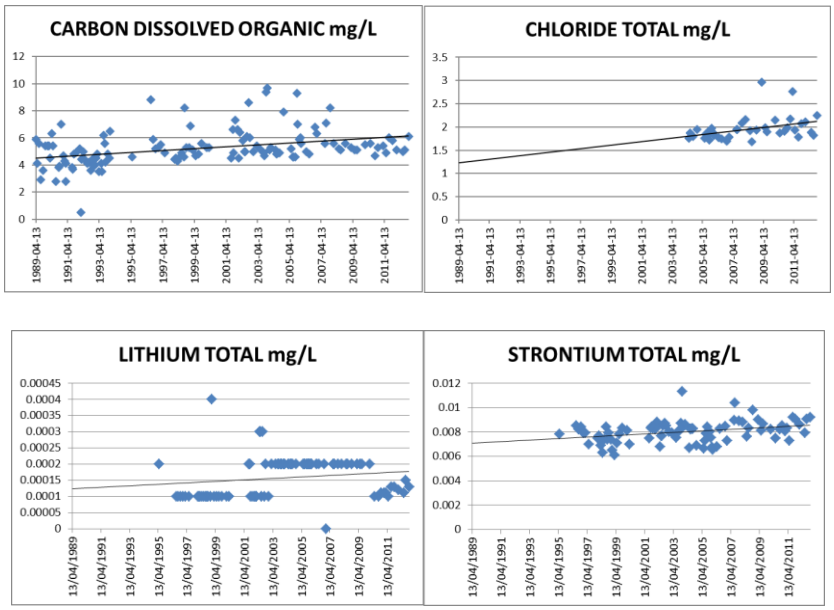


Figure 27: Exploits River at Grand Falls - Deteriorating Trend Parameters



6.2.2.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 27 displays overall water quality parameters trend results for Exploits River at Grand Falls.

Table 27: Exploits River at Grand Falls - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	86	0.05	0.08	-0.19	No	0.06	-0.14	No
AST	137	0.05	0	-0.51	Down	0	-0.29	Down
BAT	86	0.05	0.96	0.01	No	0.98	0	No
BET	86	0.05	0	-0.77	Down	0	-0.57	Down
CAD	130	0.05	0.52	0.06	No	0.46	0.04	No
DOC	130	0.05	0	0.43	Up	0	0.3	Up
CDT	86	0.05	0	-0.85	Down	0	-0.66	Down
COLOURA	145	0.05	0.63	0.04	No	0.63	0.03	No
COND	145	0.05	0.79	0.02	No	0.61	0.03	No
COT	86	0.05	0	-0.76	Down	0	-0.55	Down
CRT	86	0.05	0	-0.81	Down	0	-0.61	Down
CUT	86	0.05	0	-0.36	Down	0	-0.25	Down
FET	86	0.05	0.3	0.11	No	0.36	0.07	No
KU	64	0.05	0.13	-0.19	No	0.14	-0.13	No
LIT	86	0.05	0	0.38	Up	0	0.25	Up
MGD	130	0.05	0.18	-0.12	No	0.24	-0.07	No
MOT	86	0.05	0	-0.4	Down	0	-0.28	Down
NAU	64	0.05	0.96	0.01	No	0.89	0.01	No
NIT	86	0.05	0	-0.67	Down	0	-0.47	Down
NT	144	0.05	0	0.58	Up	0	0.37	Up
PBT	86	0.05	0.01	-0.3	Down	0	-0.21	Down
PH	145	0.05	0	0.52	Up	0	0.35	Up
PT	145	0.05	0	-0.41	Down	0	-0.3	Down
SET	48	0.05	0	-0.62	Down	0	-0.51	Down
SIO2	54	0.05	0.02	-0.32	Down	0.02	-0.22	Down
SOT	41	0.05	0.39	-0.14	No	0.29	-0.12	No
SRT	86	0.05	0	0.36	Up	0	0.24	Up
TURB	142	0.05	0	-0.41	Down	0	-0.28	Down
VT	86	0.05	0.03	-0.24	Down	0.06	-0.15	No
ZNT	86	0.05	0	-0.41	Down	0	-0.28	Down

6.2.2.3 Comparison and Causes of Change from Past

Table 28 compares trend for Exploits River at Grand Falls between Phase I and Phase II.

Copper, lead, molybdenum, nickel, pH, phosphorous, turbidity, vanadium, and zinc displayed improving trend. DOC, nitrogen, and strontium displayed deteriorating trend. Arsenic, beryllium, cadmium, chromium, cobalt, lithium, molybdenum, and nickel displayed improving trend with censor majority data.

When comparing the trend results between Phase I and Phase II, pH, and turbidity continued to improve over time. Arsenic, which improved in the past, improved with censor majority data in the current report. Nitrogen, which deteriorated in the past, continued to deteriorate. Chloride data was not available until 2005 and lacks a common period of data for comparison.

Nitrate and nitrite, which deteriorated in the past, was excluded from the current analysis due to unavailability of more recent data. Calcium, conductivity, magnesium, sodium, sulphate, which improved in the past showed no trend in the current report. Colour and nitrogen, which deteriorated in the past, showed no trend in the current report.

Reductions in atmospheric deposition affected metals such as copper, lead, vanadium, and zinc. The lessening effects of acid mine leachate from the now abandoned ASARCO also helped reduce copper, lead, vanadium, and zinc and improving pH levels. The closure and follow up cleanup operation of Abitibi Consolidated pulp and paper mill may also have caused improvement to the above parameters. The closure of the mill, which stopped floating of logs down the tributaries of the river, likely resulted in improvement of turbidity.

Sewage cross connections in the area may have caused an increase in nitrogen levels. The increase of global carbon emission across the north likely caused the deterioration of DOC. Abandoned mine with tailing leachate issues can influence increased strontium levels.

Table 28: Exploits River at Grand Falls - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Arsenic	Abatement/ Atmospheric Deposition	Copper Total	Abatement/ Atmospheric Deposition
Calcium	Climate Change/ Abatement	Lead Total	Abatement/ Atmospheric Deposition
Chloride	Climate Change/ Abatement	pH	Abatement
Conductivity	Climate Change/ Abatement	Phosphorous Total	Abatement
Magnesium	Climate Change/Abatement	Turbidity	Abatement
pH	Abatement	Vanadium Total	Abatement
Sodium	Climate Change/ Abatement	Zinc Total	Abatement
Sulphate	Climate Change/ Atmospheric Deposition / Abatement		
Turbidity	Abatement		
Deteriorating Trend			
Colour	Industry/ Climate Change	DOC	Global Carbon Emissions
Nitrate & Nitrite	Sewage	Nitrogen Total	Sewage
Nitrogen	Sewage	Strontium Total	Mining
Censored			
Beryllium	Censored	Arsenic Total	Censored
		Beryllium Total	Censored
		Cadmium Total	Censored
		Chromium Total	Censored
		Cobalt Total	Censored
		Lithium Total	Censored
		Molybdenum Total	Censored
		Nickel Total	Censored

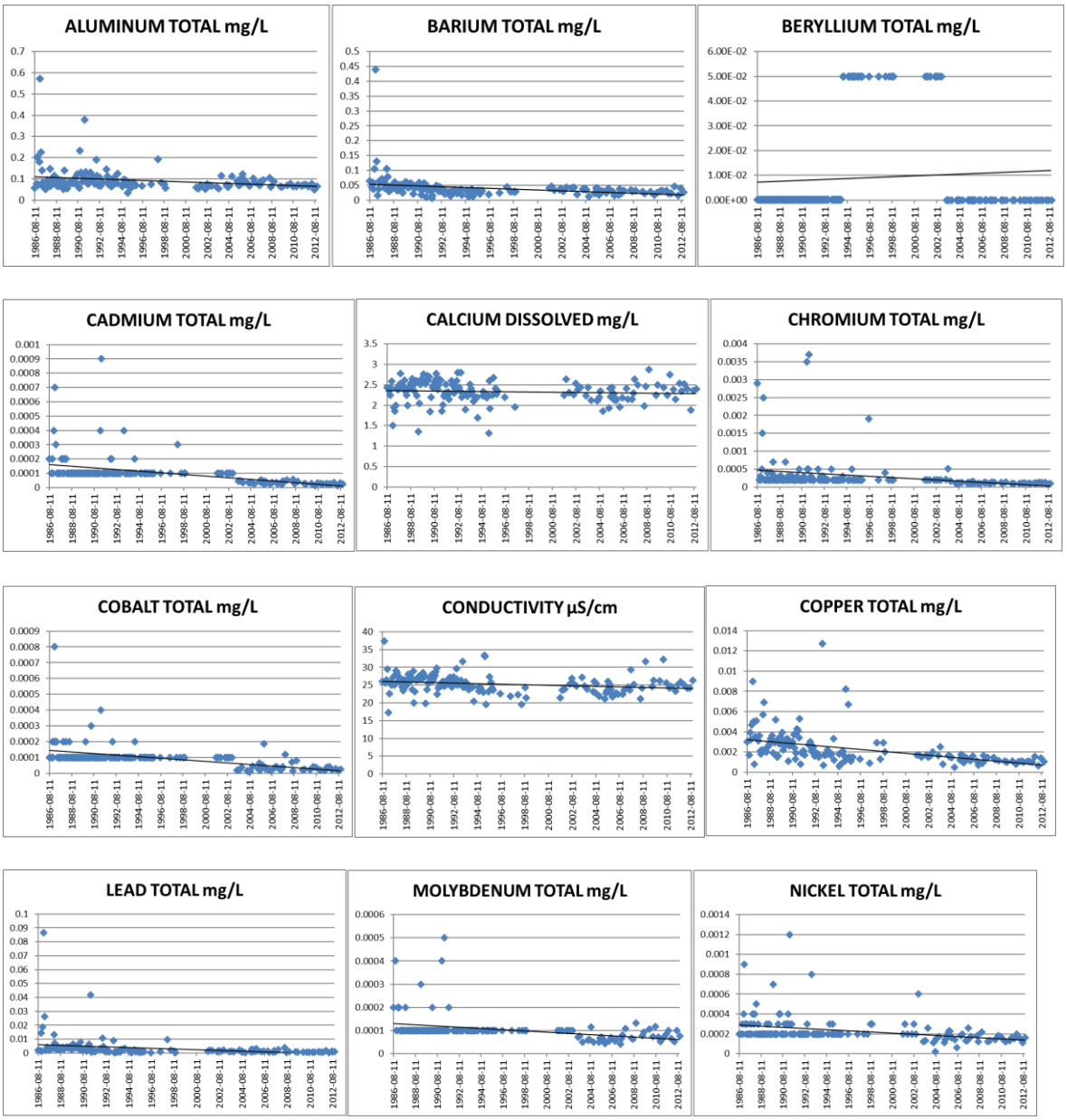
6.2.3 Exploits River at Aspen Brook (NF02YO0020)

Exploits River at Aspen Brook is located near the community of Grand Falls-Windsor. The CESI land use category classifies the station as mining. CANAL lists the surrounding development pressure as medium. RBA ranks the level of overall risk to water quality as medium.

6.2.3.1 Parameter Time Series Graph

Figures 28 and 29 display the parameter time series graphs for improving and deteriorating trend parameters for Exploits River at Aspen Brook.

Figure 28: Exploits River at Aspen Brook - Improving Trend Parameters



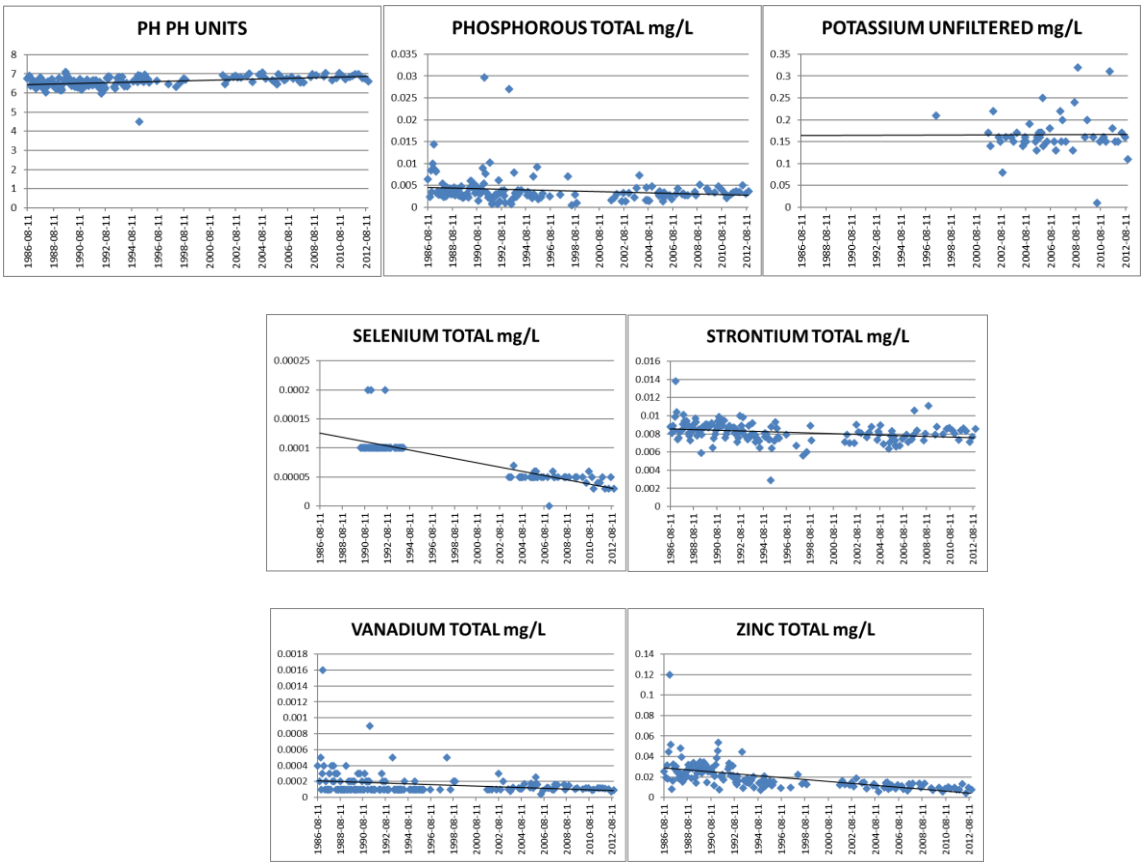
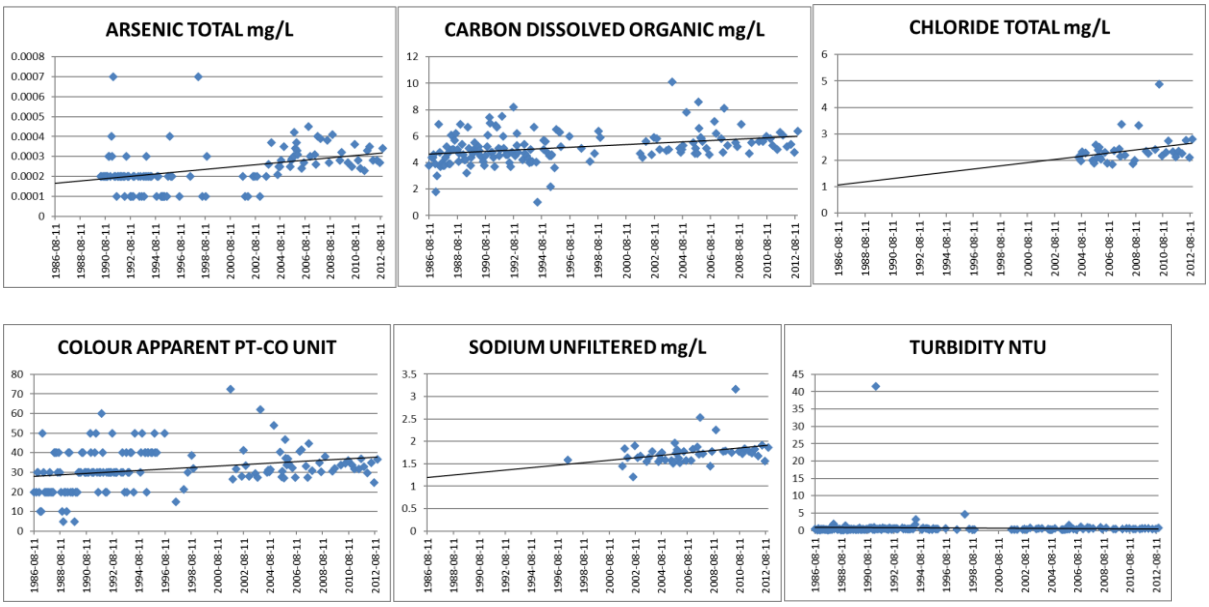


Figure 29: Exploits River at Aspen Brook - Deteriorating Trend Parameters



6.2.3.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 29 displays overall water quality parameters trend results for Exploits River at Grand Falls.

Table 29: Exploits River at Aspen Brook - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	156	0.05	0	-0.27	Down	0	-0.19	Down
AST	113	0.05	0	0.49	Up	0	0.34	Up
BAT	156	0.05	0	-0.57	Down	0	-0.4	Down
BET	156	0.05	0	-0.42	Down	0	-0.26	Down
CAD	152	0.05	0.01	-0.2	Down	0.01	-0.13	Down
DOC	156	0.05	0	0.41	Up	0	0.28	Up
CDT	156	0.05	0	-0.76	Down	0	-0.61	Down
CLT	39	0.05	0.02	0.36	Up	0.04	0.23	Up
COLOURA	156	0.05	0	0.4	Up	0	0.28	Up
COND	156	0.05	0	-0.36	Down	0	-0.25	Down
COT	153	0.05	0	-0.72	Down	0	-0.56	Down
CRT	153	0.05	0	-0.7	Down	0	-0.54	Down
CUT	153	0.05	0	-0.71	Down	0	-0.53	Down
FET	153	0.05	0.41	0.07	No	0.41	0.05	No
LIT	152	0.05	0.72	0.03	No	0.8	0.02	No
MGD	152	0.05	0.47	-0.06	No	0.5	-0.04	No
MOT	153	0.05	0	-0.58	Down	0	-0.44	Down
NIT	153	0.05	0	-0.56	Down	0	-0.42	Down
NT	71	0.05	0.84	0.02	No	0.87	0.01	No
PBT	153	0.05	0	-0.67	Down	0	-0.46	Down
PH	156	0.05	0	0.49	Up	0	0.33	Up
PT	154	0.05	0.03	-0.18	Down	0.04	-0.11	Down
SET	85	0.05	0	-0.87	Down	0	-0.71	Down
SIO2	55	0.05	0.07	-0.25	No	0.07	-0.17	No
SOT	39	0.05	0.57	-0.09	No	0.55	-0.07	No
SRT	153	0.05	0	-0.39	Down	0	-0.26	Down
TURB	156	0.05	0	0.26	Up	0	0.17	Up
VT	153	0.05	0.04	-0.16	Down	0.06	-0.11	No
ZNT	153	0.05	0	-0.77	Down	0	-0.58	Down

6.2.3.3 Comparison and Causes of Change from Past

Table 30 compares trend for Exploits River at Aspen Brook between Phase I and Phase II.

Aluminum, barium, calcium, chromium, copper, lead, pH, phosphorous, conductivity, strontium, vanadium, and zinc displayed improving trend. Colour, DOC, and turbidity displayed deteriorating trend. Beryllium, cadmium, cobalt, molybdenum, nickel, and selenium displayed improving trend with censor majority data. Arsenic displayed deteriorating trend with censor majority data.

When comparing the trend results between Phase I and Phase II, barium, calcium, conductivity, copper, lead, pH, phosphorus, strontium, and zinc continued to improve over time while colour deteriorated over the years. Arsenic, which improved in the past, deteriorated with censor majority data.

Mercury and manganese, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Barium, and lithium, which improved in the past, displayed no trend in the current report. Sodium, potassium, sulphate and chloride, having only one year of common data period with Phase I report, was considered insufficient for comparative analysis.

Reductions in atmospheric deposition have affected metals such as aluminum, barium, chromium, copper, lead, strontium, vanadium and zinc. Over time, effects of acid mine leachate from the now abandoned ASARCO on zinc, copper and lead have lessened, reducing metal and improving pH levels. Phosphorous levels have improved due to phosphorous control measures started in the 1970s.

Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow, decreasing conductivity and calcium, while increasing colour and turbidity. Forestry activity in the area can also affect colour. Farming, along with sewage cross connections in the area, may have caused an increase in nitrogen level. The increase of global carbon emissions observed across the north likely deteriorated DOC levels.

Table 30: Exploits River at Aspen Brook - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Arsenic	Abatement/ Atmospheric Deposition	Aluminum Total	Abatement/ Atmospheric Deposition
Barium	Abatement/ Atmospheric Deposition	Barium Total	Abatement/ Atmospheric Deposition
Calcium	Climate Change	Calcium Dissolved	Climate Change
Conductivity	Climate Change	Chromium Total	Abatement/ Atmospheric Deposition
Copper	Abatement/ Atmospheric Deposition	Conductivity	Climate Change
Lead	Abatement/ Atmospheric Deposition	Copper Total	Abatement/ Atmospheric Deposition
Lithium	Abatement/ Atmospheric Deposition	Lead Total	Abatement/ Atmospheric Deposition
Manganese	Abatement/ Atmospheric Deposition	pH	Abatement
Mercury	Abatement/ Atmospheric Deposition	Strontium Total	Abatement/ Atmospheric Deposition
pH	Abatement	Vanadium Total	Abatement/ Atmospheric Deposition
Phosphorous	Abatement	Zinc Total	Abatement/ Atmospheric Deposition
Potassium	Climate Change		
Strontium	Abatement/ Atmospheric Deposition		
Sulphate	Climate Change/ Atmospheric Deposition		
Zinc	Abatement/ Atmospheric Deposition		
Deteriorating Trend			
Colour	Climate Change/ Forestry	DOC	Global Carbon Emissions
		Colour Apparent	Climate Change/ Forestry
		Turbidity	Climate Change
Censored			
		Arsenic Total	Censored
		Beryllium Total	Censored
		Cadmium Total	Censored
		Cobalt Total	Censored
		Molybdenum Total	Censored
		Nickel Total	Censored
		Selenium Total	Censored

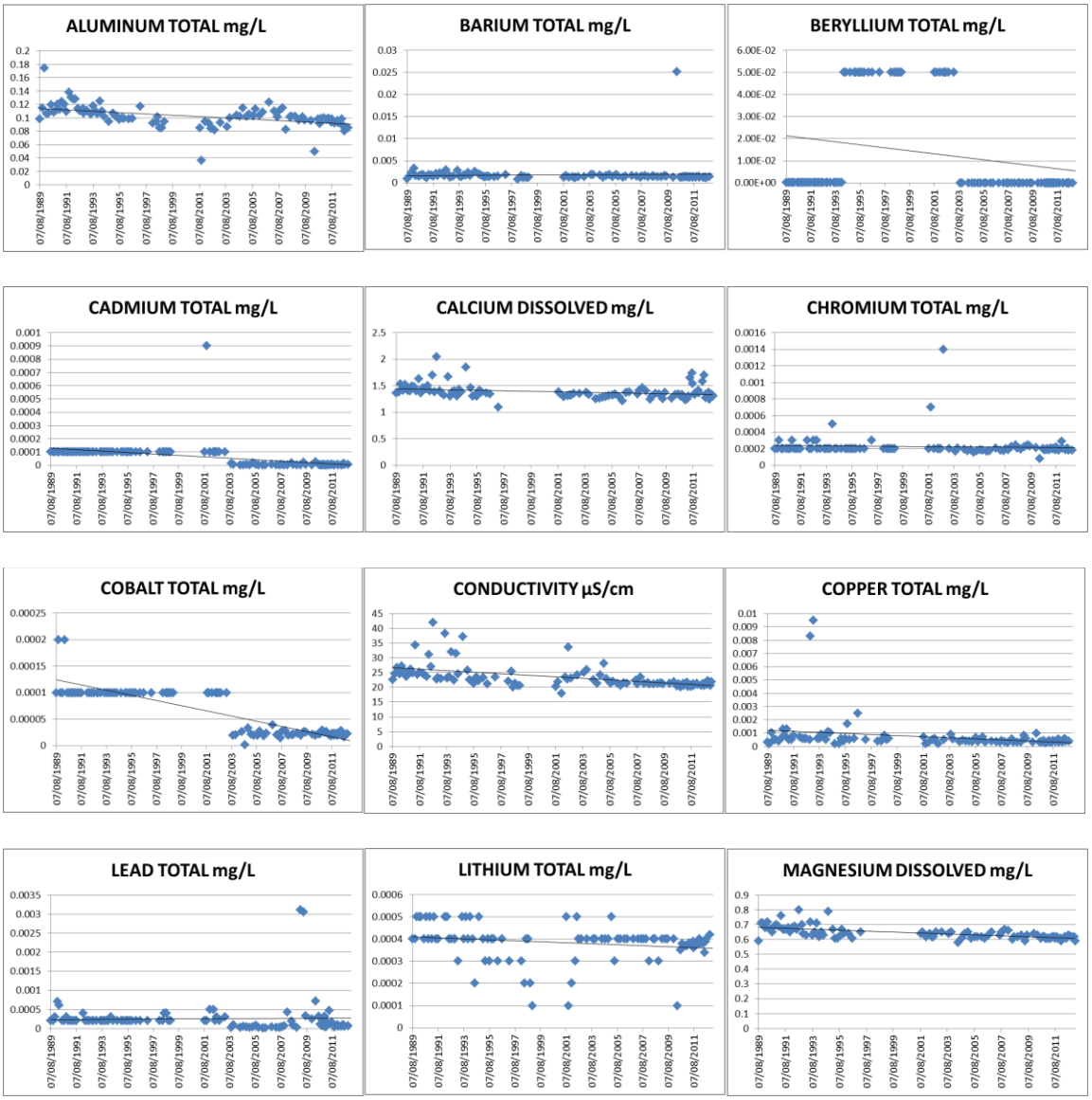
6.2.4 Gander River at Appleton (NF02YQ0030)

Gander River at Appleton is located near the community of Appleton. The CESI land use category classifies the station as mining. CANAL lists the surrounding development pressure as medium. RBA ranks the level of overall risk to water quality as medium.

6.2.4.1 Parameter Time Series Graph

Figures 30 and 31 display the parameter time series graphs for improving and deteriorating trend parameters for Gander River at Appleton.

Figure 30: Gander River at Appleton - Improving Trend Parameters



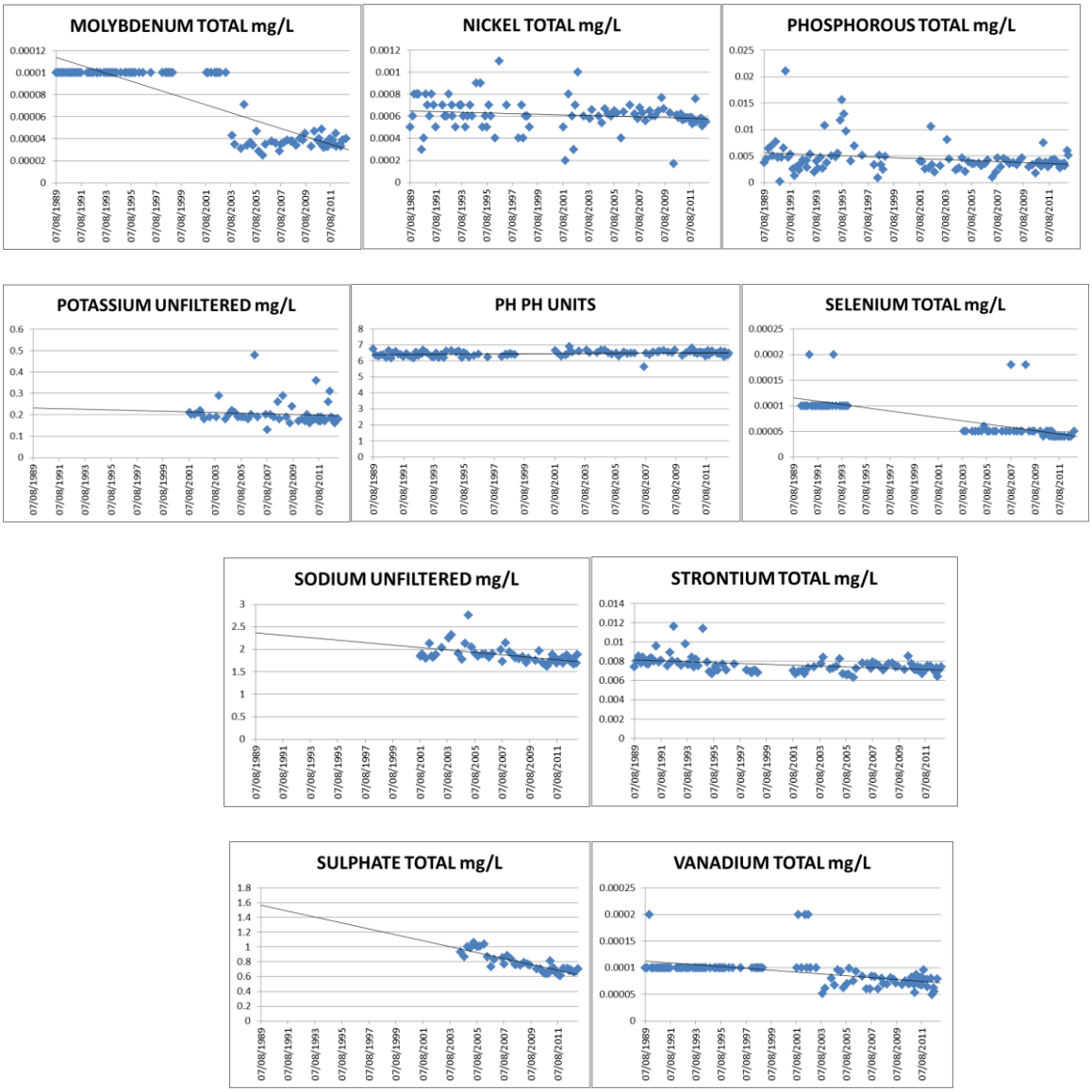
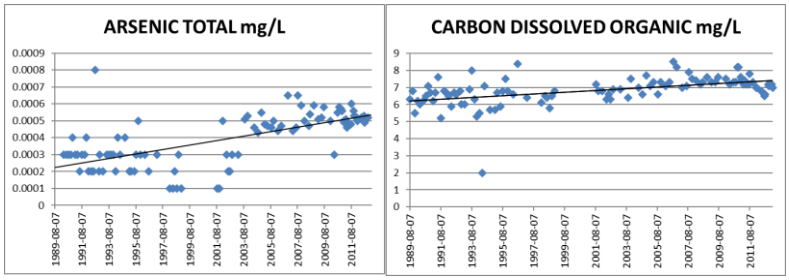


Figure 31: Gander River at Appleton - Deteriorating Trend Parameters



6.2.4.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 31 displays overall water quality parameters trend results for Gander River at Appleton.

Table 31: Gander River at Appleton - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	98	0.05	0	-0.59	Down	0	-0.43	Down
AST	94	0.05	0	0.68	Up	0	0.46	Up
BAT	98	0.05	0	-0.47	Down	0	-0.33	Down
BET	98	0.05	0	-0.63	Down	0	-0.38	Down
CAD	95	0.05	0	-0.39	Down	0	-0.28	Down
DOC	101	0.05	0	0.57	Up	0	0.39	Up
CDT	98	0.05	0	-0.8	Down	0	-0.58	Down
CLT	46	0.05	0.34	-0.14	No	0.51	-0.07	No
COLOURA	101	0.05	0.21	-0.12	No	0.25	-0.08	No
COND	101	0.05	0	-0.72	Down	0	-0.51	Down
COT	96	0.05	0	-0.82	Down	0	-0.61	Down
CRT	96	0.05	0.01	-0.26	Down	0.01	-0.19	Down
CUT	96	0.05	0	-0.45	Down	0	-0.32	Down
FET	96	0.05	0.11	0.17	No	0.18	0.09	No
KU	56	0.05	0	-0.4	Down	0	-0.28	Down
LIT	96	0.05	0	-0.41	Down	0	-0.3	Down
MGD	95	0.05	0	-0.67	Down	0	-0.5	Down
MOT	96	0.05	0	-0.8	Down	0	-0.58	Down
NAU	56	0.05	0	-0.59	Down	0	-0.4	Down
NIT	96	0.05	0.02	-0.23	Down	0.01	-0.18	Down
NT	75	0.05	0.8	0.03	No	0.8	0.02	No
PBT	96	0.05	0	-0.4	Down	0	-0.27	Down
PH	101	0.05	0	0.3	Up	0	0.2	Up
PT	101	0.05	0.03	-0.22	Down	0.04	-0.14	Down
SET	68	0.05	0	-0.85	Down	0	-0.72	Down
SIO2	37	0.05	0.05	-0.33	Down	0.05	-0.23	Down
SOT	46	0.05	0	-0.79	Down	0	-0.6	Down
SRT	96	0.05	0	-0.46	Down	0	-0.31	Down
TURB	101	0.05	0.38	-0.09	No	0.35	-0.06	No
VT	96	0.05	0	-0.79	Down	0	-0.58	Down
ZNT	96	0.05	0.93	-0.01	No	1	0	No

6.2.4.3 Comparison and Causes of Change from Past

Table 32 compares trend for Gander River at Appleton between Phase I and Phase II.

Aluminum, barium, calcium, conductivity, copper, lithium, magnesium, nickel, pH, phosphorous, and strontium displayed improving trend. DOC displayed deteriorating trend. Beryllium, cadmium, chromium, cobalt, lead, molybdenum, selenium, and vanadium displayed improving trend with censor majority data. Arsenic displayed deteriorating trend with censor majority data.

When comparing the trend results between Phase I and Phase II, aluminum, barium, calcium, conductivity, lithium, magnesium, and strontium continued to improve over time. Arsenic, which improved in the past, deteriorated with censor majority data in the current report. Vanadium, which deteriorated in the past, improved with censor majority data in the current report. Iron, which improved in the past, displayed no trend in the current report. Sodium, potassium, sulphate and silica, having only one year of common data period with Phase I report, was considered insufficient for comparative analysis.

Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow, decreasing conductivity and major ion concentrations. Reductions in atmospheric deposition may have affected the observed improving trends in aluminum, barium, lithium and nickel and pH. Phosphorous levels have improved due to phosphorous control measures started in the 1970s. The increase of global carbon emissions observed across the north likely deteriorated DOC levels.

Table 32: Gander River at Appleton - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Aluminium	Atmospheric Deposition	Aluminum Total	Atmospheric Deposition
Arsenic	Atmospheric Deposition	Barium Total	Atmospheric Deposition
Barium	Atmospheric Deposition	Calcium Dissolved	Climate Change
Calcium	Climate Change	Copper Total	Atmospheric Deposition
Conductivity	Climate Change	Conductivity	Climate Change
Iron	Atmospheric Deposition	Magnesium Dissolved	Climate Change
Lithium	Atmospheric Deposition	Lithium Total	Atmospheric Deposition
Magnesium	Climate Change	Nickel Total	Atmospheric Deposition
Potassium	Climate Change	pH	Atmospheric Deposition
Strontium	Atmospheric Deposition	Phosphorous Total	Abatement
		Strontium Total	Atmospheric Deposition
Deteriorating Trend			
Vanadium	Landfill/ Sewage	DOC	Global Carbon Emissions
Censored			
Beryllium	Censored	Arsenic Total	Censored
Cadmium	Censored	Beryllium Total	Censored
Molybdenum	Censored	Cadmium Total	Censored
		Chromium Total	Censored
		Cobalt Total	Censored
		Lead Total	Censored
		Molybdenum Total	Censored
		Selenium Total	Censored
		Vanadium Total	Censored

6.2.5 Indian Brook at Route 390 (NF02YM0003)

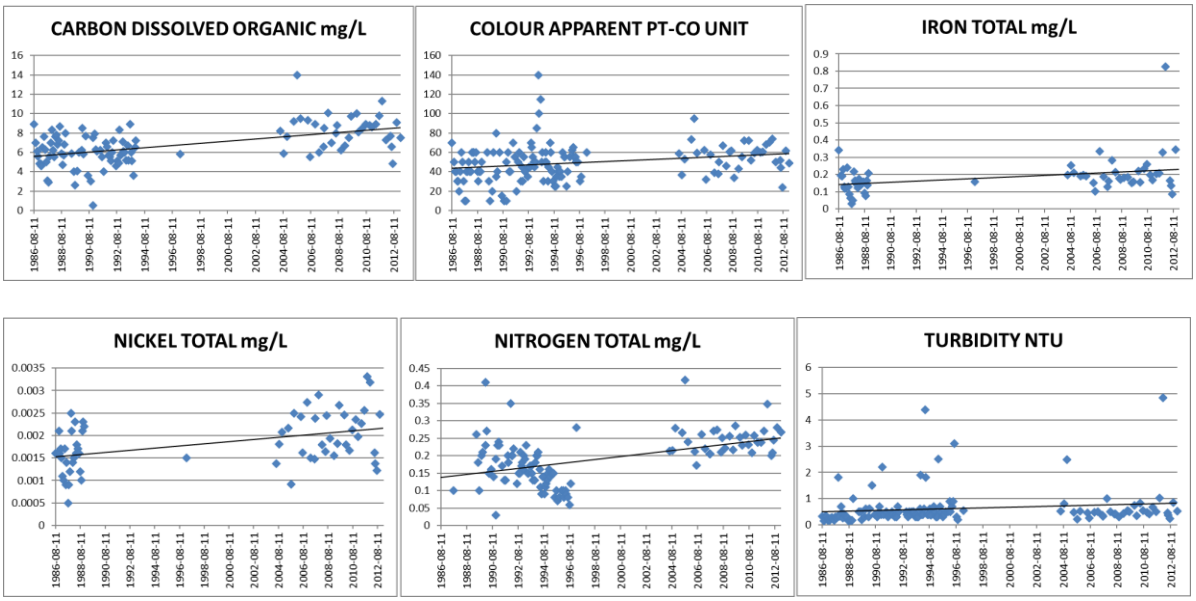
Indian Brook at Route 390 is located near the community of Springdale. There is no CESI land use category for the site but based on the RBA analysis there is potential for mineral exploration and lowly agriculture in the area. CANAL lists the surrounding development pressure as medium. RBA ranks the level of overall risk to water quality as low.

6.2.5.1 Parameter Time Series Graph

Figures 32 and 33 display the parameter time series graphs for improving and deteriorating trend parameters for Indian Brook at Route 390.

Figure 32: Indian Brook at Route 390 - Improving Trend Parameters

Figure 33: Indian Brook at Route 390 - Deteriorating Trend Parameters



6.2.5.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 33 displays overall water quality parameters trend results for Indian Brook at Route 390.

Table 33: Indian Brook at Route 390 - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	63	0.05	0.6	0.07	No	0.57	0.05	No
AST	97	0.05	0	-0.76	Down	0	-0.56	Down
BAT	63	0.05	0.24	-0.15	No	0.27	-0.1	No
BET	63	0.05	0	-0.74	Down	0	-0.5	Down
CAD	135	0.05	0.07	-0.16	No	0.07	-0.1	No
DOC	108	0.05	0	0.43	Up	0	0.29	Up
CDT	63	0.05	0	-0.82	Down	0	-0.62	Down
CLT	35	0.05	0.45	0.13	No	0.45	0.09	No
COLOURA	137	0.05	0	0.29	Up	0	0.2	Up
COND	137	0.05	0.01	-0.21	Down	0.01	-0.14	Down
COT	63	0.05	0	-0.64	Down	0	-0.46	Down
CRT	63	0.05	0.67	0.05	No	0.52	0.06	No
CUT	63	0.05	0	-0.51	Down	0	-0.38	Down
FET	63	0.05	0.01	0.32	Up	0.01	0.23	Up
KU	35	0.05	0.4	-0.15	No	0.38	-0.11	No
LIT	62	0.05	0.19	-0.17	No	0.16	-0.14	No
MGD	137	0.05	0.04	-0.18	Down	0.04	-0.12	Down
MOT	63	0.05	0.51	-0.08	No	0.4	-0.08	No
NAU	35	0.05	0.91	-0.02	No	1	0	No
NIT	63	0.05	0	0.44	Up	0	0.31	Up
NT	109	0.05	0	0.32	Up	0.01	0.18	Up
PBT	63	0.05	0	-0.71	Down	0	-0.55	Down
PH	135	0.05	0	0.25	Up	0.01	0.17	Up
PT	134	0.05	0.07	0.16	No	0.1	0.1	No
SET	34	0.05	0	-0.51	Down	0	-0.42	Down
SIO2	26	0.05	0.52	-0.13	No	0.58	-0.08	No
SRT	63	0.05	0.3	-0.13	No	0.3	-0.09	No
TURB	133	0.05	0	0.39	Up	0	0.27	Up
VT	63	0.05	0.78	0.04	No	0.86	0.02	No
ZNT	63	0.05	0.15	-0.19	No	0.16	-0.12	No

6.2.5.3 Comparison and Causes of Change from Past

Table 34 compares trend for Indian Brook near Springdale between Phase I and Phase II.

Conductivity, copper, lead, magnesium, and pH displayed improving trend. DOC, colour, iron, nickel, nitrogen and turbidity displayed deteriorating trend. Arsenic, beryllium, cadmium and cobalt displayed improving trend with censor majority data.

When comparing the trend results between Phase I and Phase II, conductivity and magnesium continued to improve over time while colour deteriorated over the years.

Calcium, chloride and sodium, which improved in the past, displayed no trend in the current report. Phosphorus, which deteriorated in the past, displayed no trend in the current report. Sulphate, having only one year of common data period with Phase I report, was considered insufficient for comparative analysis.

Reduction in atmospheric deposition helped improve metals such as copper and lead along with pH. Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow, decreasing conductivity and magnesium concentration, while increasing colour and turbidity.

Natural sources have deteriorated iron and nickel. In addition, commercial farming along with sewage cross connections in the area may have caused an increase in nitrogen levels. Forestry activity in the area may also be affecting colour and turbidity levels. The increase of global carbon emissions observed across the north likely deteriorated DOC levels.

Table 34: Indian Brook at Route 390 - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Calcium	Climate Change	Conductivity	Climate Change
Chloride	Climate Change	Copper Total	Atmospheric Deposition
Conductivity	Climate Change	Lead Total	Atmospheric Deposition /Abatement
Magnesium	Climate Change	Magnesium Dissolved	Climate Change
Sodium	Climate Change	pH	Atmospheric Deposition
Sulphate	Climate Change/ Atmospheric Deposition		
Deteriorating Trend			
Colour	Climate Change/ Forestry	DOC	Global Carbon Emissions
Phosphorous	Farming/ Rural Sewage Systems	Colour Apparent	Climate Change/ Forestry
		Iron Total	Natural Sources
		Nickel Total	Natural Sources
		Nitrogen Total	Farming/ Rural Sewage Systems
		Turbidity	Climate Change / Forestry
Censored			
		Arsenic Total	Censored
		Beryllium Total	Censored
		Cadmium Total	Censored
		Cobalt Total	Censored

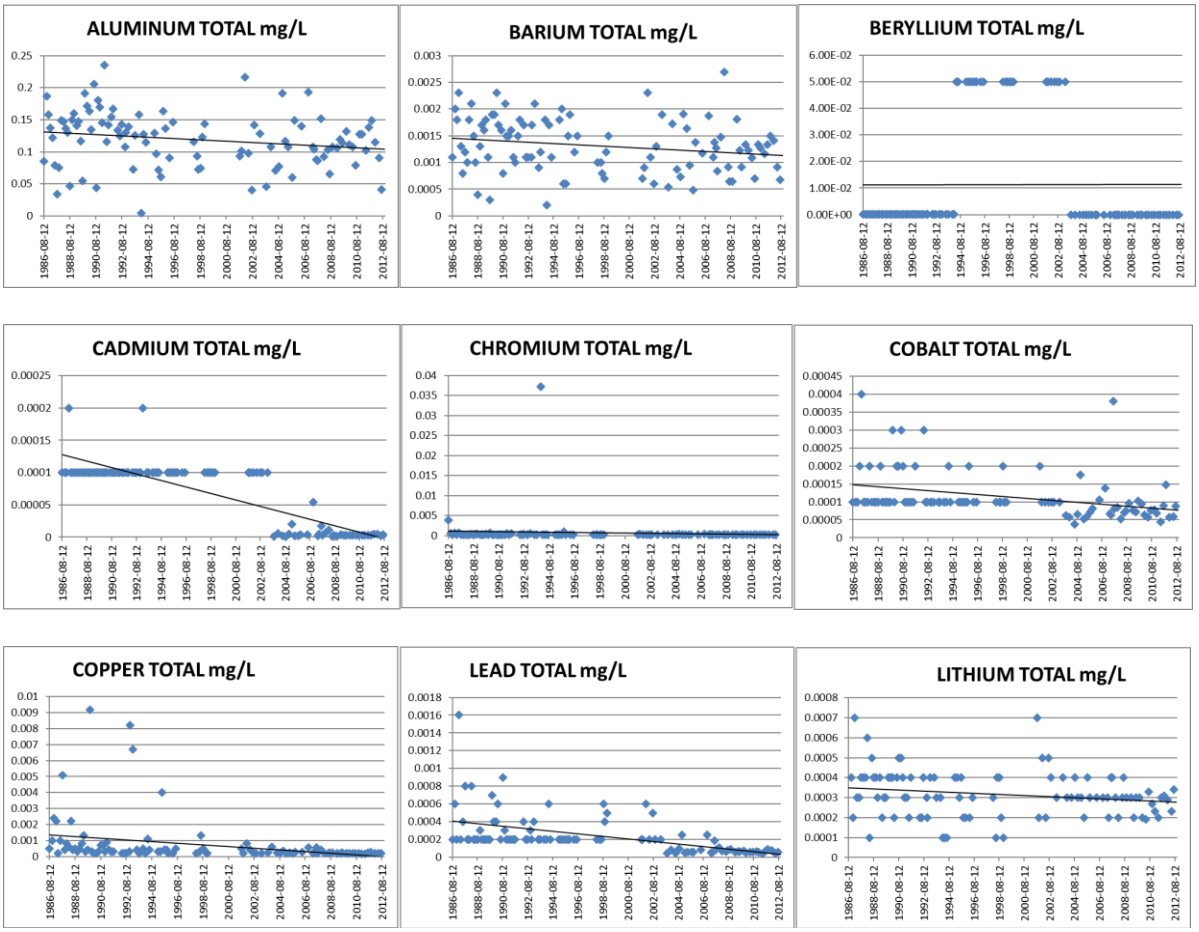
6.2.6 Northwest Gander River at Highway Bridge (NF02YQ0006)

Northwest Gander River is located about 58 km from Bishop's Fall. There is no CESI land use category for this station. There is no active community located nearby and the station is remote. CANAL lists the surrounding development pressure as low. RBA ranks the level of overall risk to water quality as low.

6.2.6.1 Parameter Time Series Graph

Figures 34 and 35 display the parameter time series graphs for improving and deteriorating trend parameters for Northwest Gander River at Highway Bridge.

Figure 34: Northwest Gander River at Highway Bridge - Improving Trend Parameters



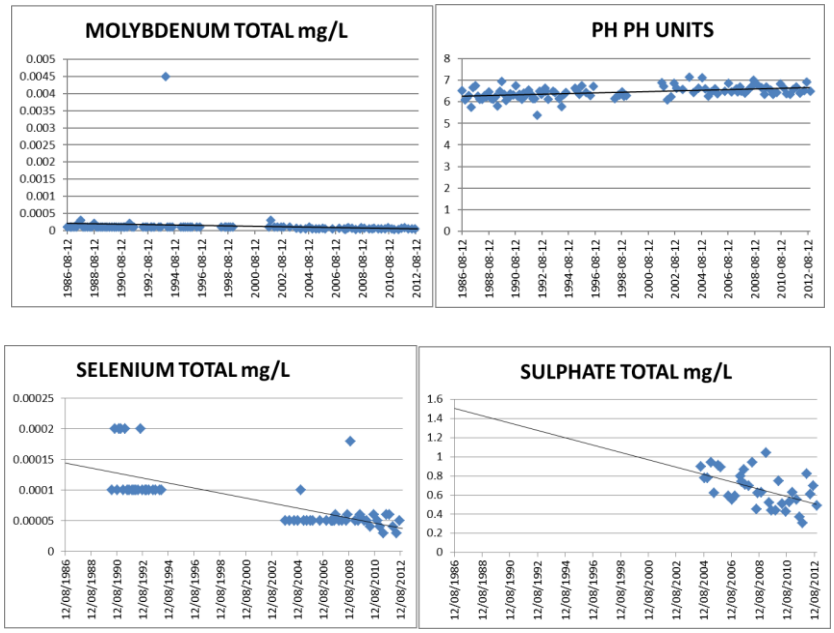
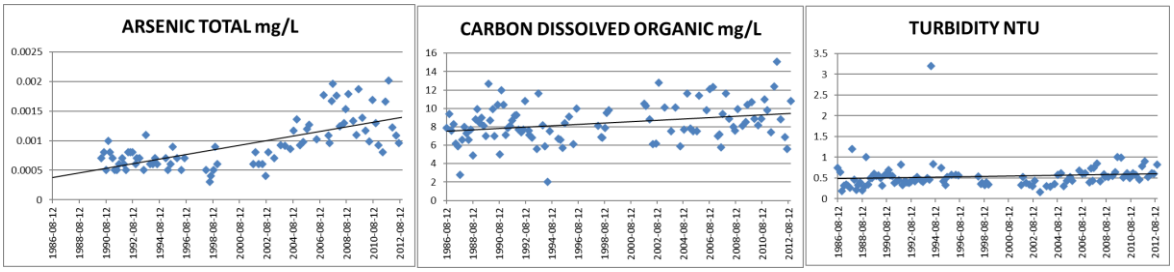


Figure 35: Northwest Gander River at Highway Bridge - Deteriorating Trend Parameters



6.2.6.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 35 displays overall water quality parameters trend results for Northwest Gander River at Highway Bridge.

Table 35: Northwest Gander River at Highway Bridge - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	101	0.05	0.01	-0.26	Down	0.01	-0.18	Down
AST	79	0.05	0	0.7	Up	0	0.49	Up
BAT	101	0.05	0.02	-0.23	Down	0.02	-0.16	Down
BET	101	0.05	0	-0.5	Down	0	-0.28	Down
CAD	97	0.05	0.28	-0.11	No	0.32	-0.07	No
DOC	103	0.05	0.01	0.25	Up	0.01	0.17	Up
CDT	101	0.05	0	-0.8	Down	0	-0.61	Down
CLT	35	0.05	0.81	0.04	No	0.78	0.04	No
COLOURA	103	0.05	1	0	No	1	0	No
COND	103	0.05	0.07	-0.18	No	0.08	-0.12	No
COT	99	0.05	0	-0.57	Down	0	-0.41	Down
CRT	99	0.05	0	-0.33	Down	0	-0.23	Down
CUT	99	0.05	0	-0.56	Down	0	-0.41	Down
FET	99	0.05	0.1	0.16	No	0.11	0.11	No
KU	44	0.05	0.78	-0.04	No	0.69	-0.04	No
LIT	98	0.05	0.01	-0.25	Down	0.01	-0.18	Down
MGD	97	0.05	0.24	0.12	No	0.28	0.08	No
MOT	99	0.05	0	-0.79	Down	0	-0.59	Down
NAU	44	0.05	0.07	-0.28	No	0.07	-0.19	No
NIT	99	0.05	0.09	0.17	No	0.1	0.11	No
NT	60	0.05	0.26	0.15	No	0.23	0.11	No
PBT	99	0.05	0	-0.71	Down	0	-0.52	Down
PH	103	0.05	0	0.49	Up	0	0.33	Up
PT	102	0.05	0.22	0.12	No	0.15	0.1	No
SET	57	0.05	0	-0.76	Down	0	-0.6	Down
SIO2	33	0.05	0.75	-0.06	No	0.82	-0.03	No
SRT	99	0.05	0.2	-0.13	No	0.21	-0.09	No
TURB	103	0.05	0	0.32	Up	0	0.22	Up
VT	99	0.05	0.93	0.01	No	0.93	0.01	No
ZNT	99	0.05	0.32	-0.1	No	0.38	-0.06	No

6.2.6.3 Comparison and Causes of Change from Past

Table 36 compares trend for Northwest Gander River between Phase I and Phase II.

Aluminum, barium, copper, lead, lithium, magnesium, and pH displayed improving trend. Arsenic, DOC, and turbidity displayed deteriorating trend. Beryllium, cadmium, chromium, cobalt, lead, molybdenum and selenium displayed improving trend with censor majority data.

When comparing the trend results between Phase I and Phase II, aluminum, barium, copper, and lithium continued to improve over time.

Mercury, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Phosphorus, potassium and vanadium, which improved in the past, displayed no trend in the current report. Arsenic, which improved in the past, deteriorated in the current report. Sulphate having only one year of common data period with Phase I report, was considered insufficient for comparative analysis.

Reductions in atmospheric deposition have affected metals such as copper and possibly other metals such as aluminum, barium and lithium. Natural sources, which improved pH, caused degradation of arsenic.

Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow, and increasing turbidity. The increase of global carbon emissions observed across the north is likely linked to the deterioration of DOC levels.

Table 36: Northwest Gander River at Highway Bridge - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Aluminium	Atmospheric Deposition	Aluminum Total	Atmospheric Deposition
Arsenic	Atmospheric Deposition	Barium Total	Atmospheric Deposition
Barium	Atmospheric Deposition	Copper Total	Atmospheric Deposition
Copper	Atmospheric Deposition	Lithium Total	Atmospheric Deposition
Lithium	Atmospheric Deposition	pH	Natural Sources
Mercury	Atmospheric Deposition		
Phosphorous	Natural Sources		
Potassium	Climate Change		
Sulphate	Climate Change/ Atmospheric Deposition		
Vanadium	Atmospheric Deposition		
Deteriorating Trend			
		Arsenic Total	Natural Sources
		DOC	Global Carbon Emissions
		Turbidity	Climate Change
Censored			
Beryllium	Censored	Beryllium Total	Censored
Cadmium	Censored	Cadmium Total	Censored
		Chromium Total	Censored
		Cobalt Total	Censored
		Lead Total	Censored
		Molybdenum Total	Censored
		Selenium Total	Censored

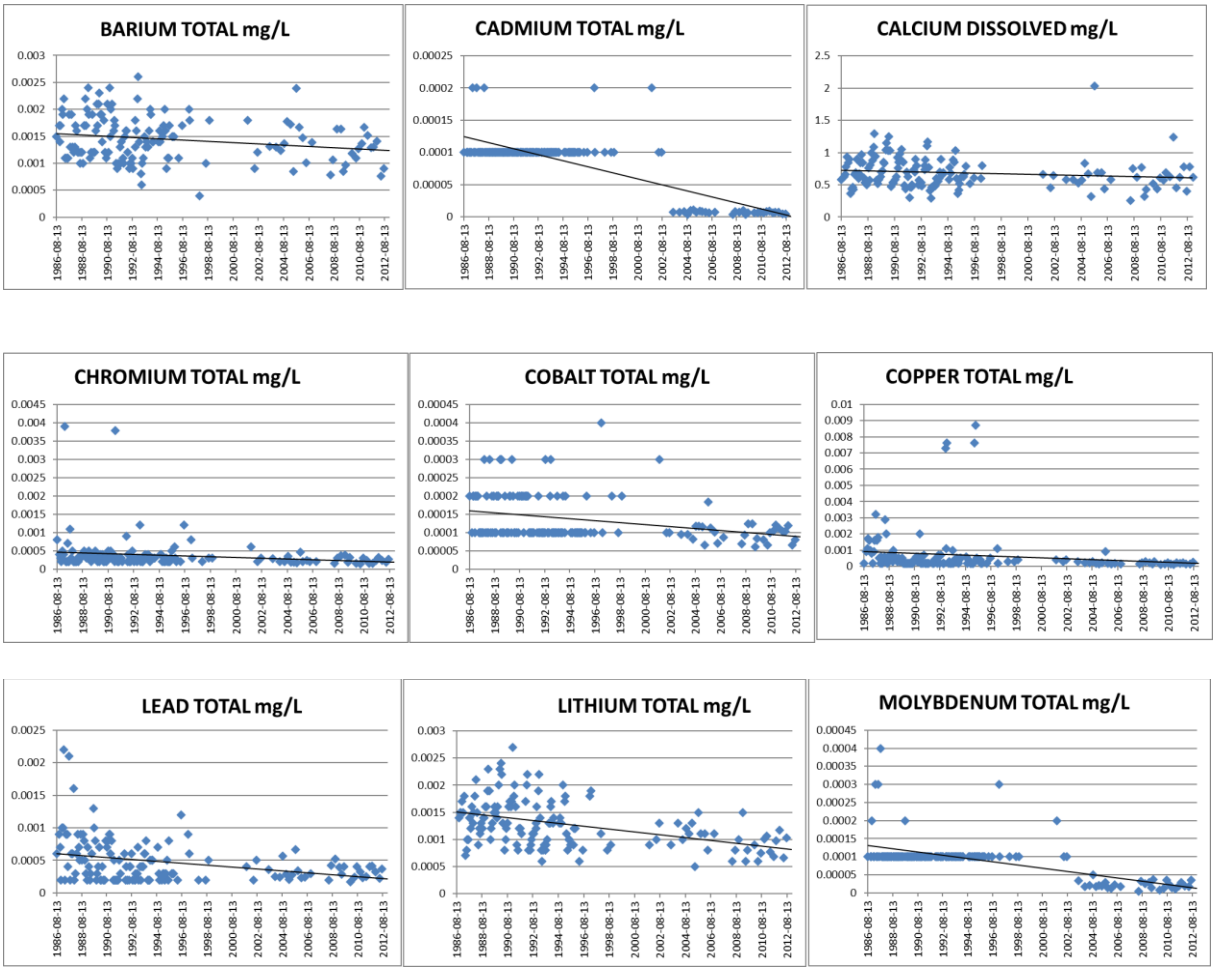
6.2.7 Pound Cove Brook at Route 330 (NF02YR0001)

Pound Cove Brook is located close to the communities of Lumsden and New-Wes-Valley. There is no CESI land use category for this station and the station is remote based on its location. CANAL lists the surrounding development pressure as low. RBA ranks the level of overall risk to water quality as low.

6.2.7.1 Parameter Time Series Graph

Figures 36 and 37 display the parameter time series graphs for improving and deteriorating trend parameters for Pound Cove Brook at Route 330.

Figure 36: Pound Cove Brook at Route 330 - Improving Trend Parameters



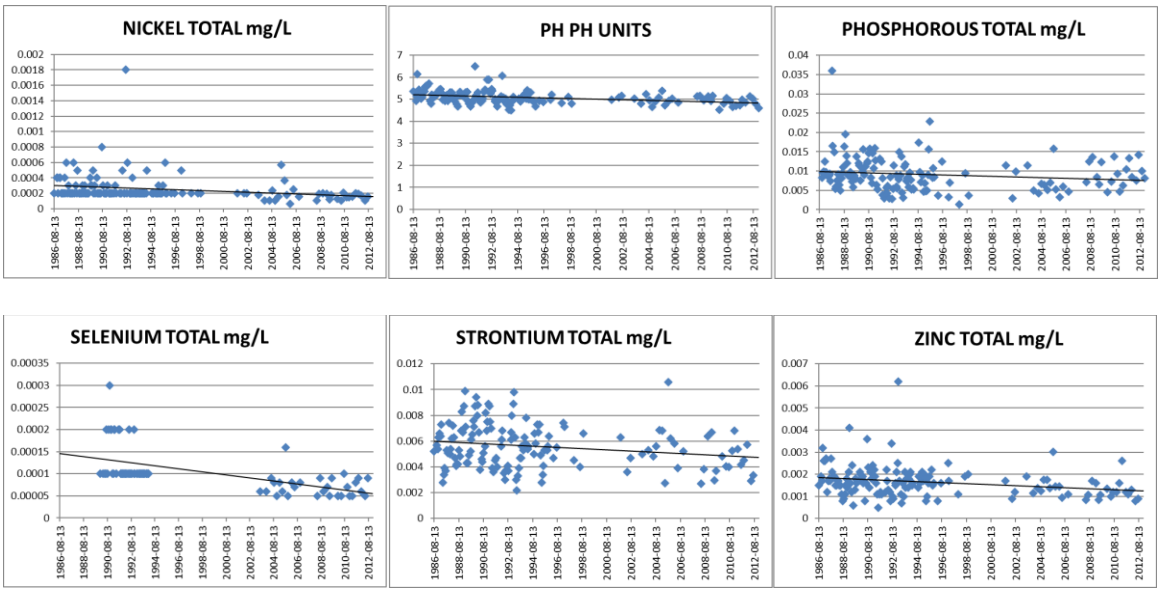
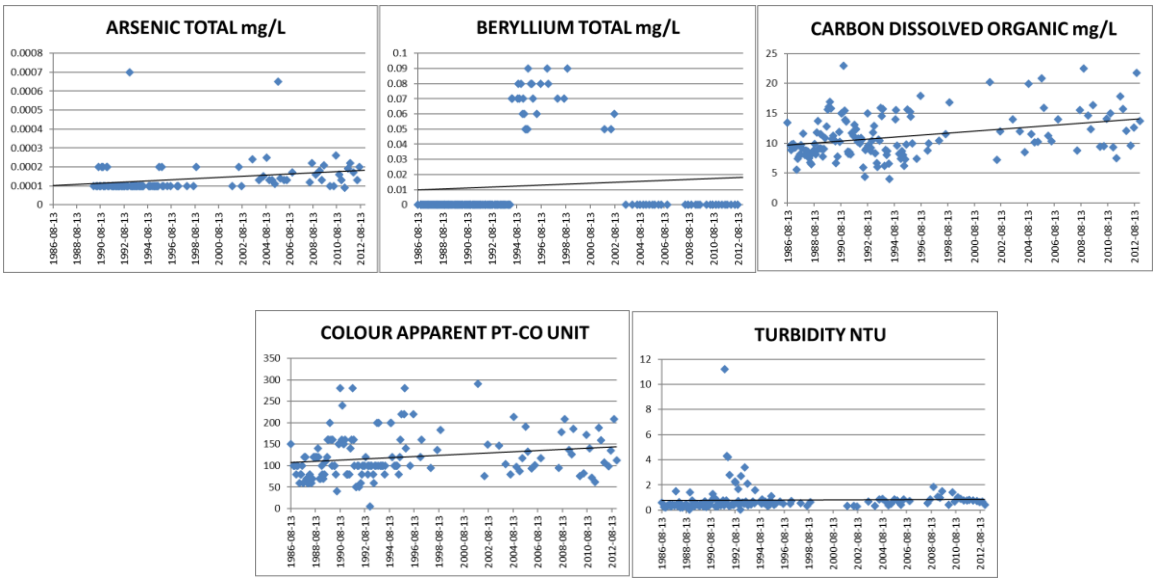


Figure 37: Pound Cove Brook at Route 330- Deteriorating Trend Parameters



6.2.7.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 37 displays overall water quality parameters trend results for Pound Cove Brook at Route 330.

Table 37: Pound Cove Brook at Route 330- Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	145	0.05	0.48	-0.06	No	0.53	-0.04	No
AST	101	0.05	0	0.44	Up	0	0.35	Up
BAT	145	0.05	0.02	-0.2	Down	0.02	-0.13	Down
BET	145	0.05	0	0.28	Up	0	0.2	Up
CAD	144	0.05	0.01	-0.21	Down	0.02	-0.13	Down
DOC	147	0.05	0	0.29	Up	0	0.19	Up
CDT	145	0.05	0	-0.66	Down	0	-0.53	Down
CLT	29	0.05	0.35	-0.18	No	0.37	-0.12	No
COLOURA	147	0.05	0	0.26	Up	0	0.18	Up
COND	147	0.05	0.72	-0.03	No	0.79	-0.01	No
COT	142	0.05	0	-0.31	Down	0	-0.24	Down
CRT	142	0.05	0	-0.27	Down	0	-0.2	Down
CUT	142	0.05	0	-0.44	Down	0	-0.33	Down
FET	142	0.05	0.59	0.05	No	0.61	0.03	No
KU	34	0.05	0.68	-0.07	No	0.8	-0.03	No
LIT	141	0.05	0	-0.45	Down	0	-0.3	Down
MGD	144	0.05	0.13	-0.13	No	0.15	-0.08	No
MOT	142	0.05	0	-0.67	Down	0	-0.53	Down
NAU	34	0.05	0.49	-0.12	No	0.51	-0.08	No
NIT	142	0.05	0	-0.49	Down	0	-0.37	Down
NT	57	0.05	0.78	0.04	No	0.79	0.02	No
PBT	142	0.05	0	-0.3	Down	0	-0.21	Down
PH	147	0.05	0	-0.42	Down	0	-0.28	Down
PT	143	0.05	0.01	-0.22	Down	0.01	-0.14	Down
SET	75	0.05	0	-0.78	Down	0	-0.61	Down
SOT	29	0.05	0.05	-0.36	No	0.06	-0.25	No
SRT	142	0.05	0.03	-0.18	Down	0.04	-0.12	Down
TURB	147	0.05	0	0.44	Up	0	0.3	Up
VT	142	0.05	0.67	-0.04	No	0.63	-0.03	No
ZNT	142	0.05	0	-0.28	Down	0	-0.19	Down

6.2.7.3 Comparison and Causes of Change from Past

Table 38 compares trend for Pound Cove Brook between Phase I and Phase II.

Barium, calcium, chromium, copper, lead, lithium, pH, phosphorus, strontium, and zinc displayed improving trend. DOC, colour, nitrogen and turbidity displayed deteriorating trend. Beryllium, cadmium, cobalt, molybdenum, nickel, and selenium displayed improving trend with censor majority data. Arsenic displayed deteriorating trend with censor majority data.

When comparing the trend results between Phase I and Phase II, calcium, copper, lead, lithium, and phosphorus continued to improve over time while colour, nitrogen and turbidity deteriorated over the years. pH, which deteriorated in the past, improved in the current report. Conductivity, nickel, selenium and sulphate, which improved in the past, displayed no trend in the current report. Nitrogen, which deteriorated in the past, displayed no trend in the current report.

Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow, decreasing calcium, while increasing turbidity and colour. Forestry activity in the basin may also be affecting colour and turbidity. Reductions in atmospheric deposition have also affected metals such as copper and lead. It may also be influencing improving trends in other metals such as barium, lithium and zinc. Natural geological sources may be responsible for the decrease in both phosphorous and pH. The increase of global carbon emissions observed across the north likely deteriorated DOC levels.

Table 38: Pound Cove Brook at Route 330- Past and Present Trend Comparisons

Improving Trend			
Phase I Trend (1986-2001)		**Phase II Trend (1986-2013)**	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Calcium	Climate Change	Barium Total	Atmospheric Deposition
Conductivity	Climate Change	Calcium Dissolved	Climate Change
Copper	Atmospheric Deposition	Chromium Total	Atmospheric Deposition
Lead	Atmospheric Deposition/ Abatement	Copper Total	Atmospheric Deposition
Lithium	Atmospheric Deposition	Lead Total	Atmospheric Deposition/ Abatement
Nickel	Atmospheric Deposition	Lithium Total	Atmospheric Deposition
Phosphorous	Natural Sources	pH	Natural Sources
Selenium	Atmospheric Deposition	Phosphorous Total	Natural Sources
Sulphate	Climate Change/ Atmospheric Deposition	Strontium Total	Atmospheric Deposition
		Zinc Total	Atmospheric Deposition
Deteriorating Trend			
Colour	Climate Change/ Forestry	DOC	Global Carbon Emissions
Nitrogen	Rural Sewage Systems	Colour Apparent	Climate Change/ Forestry
pH	Natural Sources	Turbidity	Climate Change
Turbidity	Climate Change/ Forestry		
Censored			
Cadmium	Censored	Arsenic Total	Censored
		Beryllium Total	Censored
		Cadmium Total	Censored
		Cobalt Total	Censored
		Molybdenum Total	Censored
		Nickel Total	Censored
		Selenium Total	Censored

6.2.8 South West Brook at Baie Verte (NF02YM0004)

South West Brook is located close to the community of Baie Verte. There is no CESI land use category for this station and the station is remote based on the location. CANAL lists the surrounding development pressure as medium. RBA ranks the level of overall risk to water quality as low.

6.2.8.1 Parameter Time Series Graph

Figures 38 and 39 display the parameter time series graphs for improving and deteriorating trend parameters for South West Brook at Baie Verte.

Figure 38: South West Brook at Baie Verte - Improving Trend Parameters

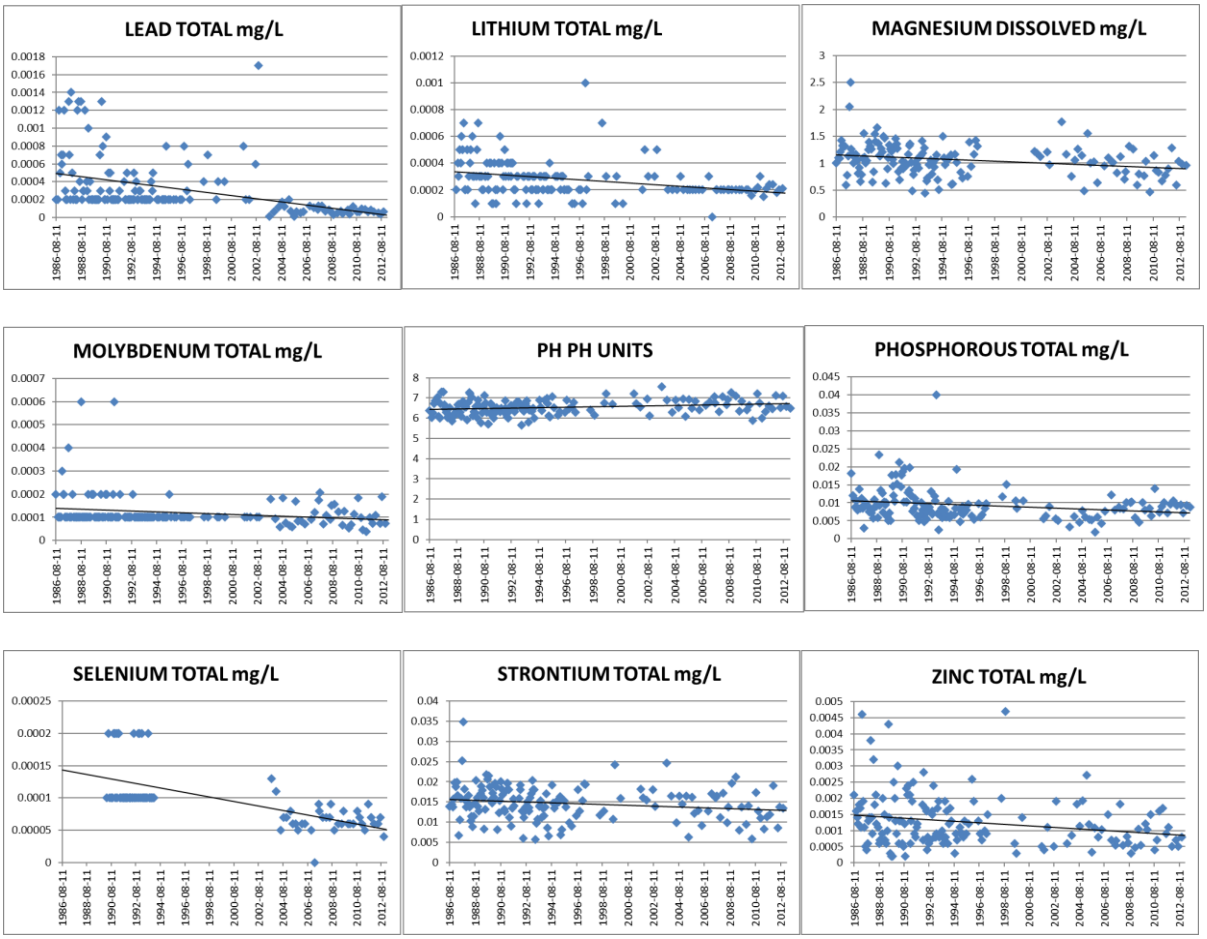
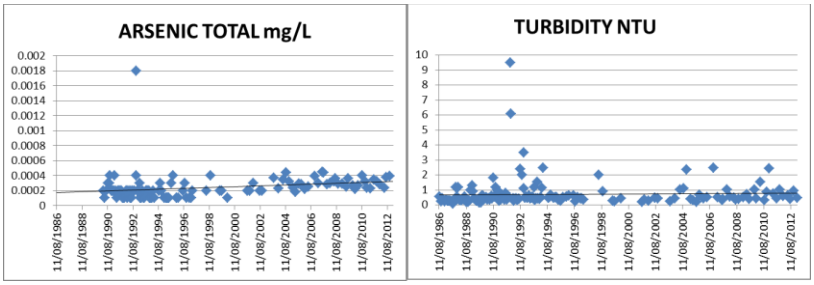


Figure 39: South West Brook at Baie Verte - Deteriorating Trend Parameters



6.2.8.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 39 displays overall water quality parameters trend results for South West Brook at Baie Verte.

Table 39: South West Brook at Baie Verte - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	158	0.05	0	-0.32	Down	0	-0.23	Down
AST	112	0.05	0	0.46	Up	0	0.32	Up
BAT	158	0.05	0	-0.41	Down	0	-0.29	Down
BET	158	0.05	0	-0.29	Down	0.02	-0.15	Down
CAD	153	0.05	0.01	-0.2	Down	0.01	-0.13	Down
DOC	158	0.05	0.48	0.06	No	0.62	0.03	No
CDT	158	0.05	0	-0.72	Down	0	-0.57	Down
CLT	35	0.05	0.54	-0.11	No	0.5	-0.08	No
COLOURA	157	0.05	0.63	-0.04	No	0.61	-0.03	No
COND	157	0.05	0.01	-0.21	Down	0.01	-0.13	Down
COT	155	0.05	0	-0.27	Down	0	-0.19	Down
CRT	155	0.05	0	-0.28	Down	0	-0.21	Down
CUT	155	0.05	0	-0.43	Down	0	-0.3	Down
FET	155	0.05	0.37	-0.07	No	0.34	-0.05	No
KU	43	0.05	0.41	-0.13	No	0.41	-0.09	No
LIT	154	0.05	0	-0.42	Down	0	-0.32	Down
MGD	153	0.05	0	-0.28	Down	0	-0.19	Down
MOT	155	0.05	0	-0.31	Down	0	-0.24	Down
NAU	43	0.05	0.01	-0.42	Down	0.01	-0.29	Down
NIT	155	0.05	0.89	-0.01	No	0.85	-0.01	No
NT	68	0.05	0.37	-0.11	No	0.38	-0.07	No
PBT	155	0.05	0	-0.64	Down	0	-0.49	Down
PH	157	0.05	0	0.23	Up	0	0.16	Up
PT	156	0.05	0	-0.26	Down	0	-0.17	Down
SET	82	0.05	0	-0.77	Down	0	-0.58	Down
SIO2	64	0.05	0.57	-0.07	No	0.64	-0.04	No
SOT	35	0.05	0.01	-0.41	Down	0.02	-0.29	Down
SRT	155	0.05	0.01	-0.21	Down	0.01	-0.14	Down
TURB	157	0.05	0	0.27	Up	0	0.18	Up
VT	155	0.05	0.18	-0.11	No	0.1	-0.09	No
ZNT	155	0.05	0	-0.23	Down	0	-0.16	Down

6.2.8.3 Comparison and Causes of Change from Past

Table 40 compares trend for South West Brook between Phase I and Phase II.

Aluminum, barium, calcium, chromium, cobalt, conductivity, copper, lead, lithium, magnesium, pH, phosphorus, strontium and zinc displayed improving trend. Arsenic and turbidity displayed deteriorating trend. Beryllium, cadmium, cobalt, molybdenum and selenium displayed improving trend with censor majority data.

When comparing the trend results between Phase I and Phase II, barium, calcium, conductivity, lead, lithium, magnesium, molybdenum, phosphorus and strontium continued to improve over time while turbidity deteriorated over the years.

Mercury, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Chloride and potassium, which improved in the past, displayed no trend in the current report. Nitrogen, which deteriorated in the past, showed no trend in the current report. Sodium, potassium and sulphate, having only one year of common data period with Phase I report, was considered insufficient for comparative analysis.

Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow, decreasing conductivity and major ions, while increasing turbidity. Forestry and quarrying activity in the basin may also be affecting turbidity. Reductions in atmospheric deposition have affected metals such as copper, lead, and likely influenced improving trends in other metals. The trend in phosphorous can be linked to phosphorous control measures started in the 1970s. Seepage from sewage systems and lawn fertilizing are possibly contributing to increased nitrogen levels. Natural geology sources have deteriorated arsenic and improved pH levels.

Table 40: South West Brook at Baie Verte - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Barium	Atmospheric Deposition	Aluminum Total	Atmospheric Deposition
Calcium	Climate Change	Barium Total	Atmospheric Deposition
Chloride	Climate Change	Calcium Dissolved	Climate Change
Conductivity	Climate Change	Chromium Total	Atmospheric Deposition
Lead	Atmospheric Deposition/ Abatement	Conductivity	Climate Change
Lithium	Atmospheric Deposition	Copper Total	Atmospheric Deposition
Magnesium	Climate Change	Lead Total	Atmospheric Deposition/ Abatement
Mercury	Atmospheric Deposition	Lithium Total	Atmospheric Deposition
Molybdenum	Atmospheric Deposition	Magnesium Dissolved	Climate Change
Phosphorous	Abatement	pH	Natural Sources
Potassium	Climate Change	Phosphorous Total	Abatement
Strontium	Atmospheric Deposition	Strontium Total	Atmospheric Deposition
Sodium	Climate Change	Zinc Total	Atmospheric Deposition
Sulphate	Climate Change/ Atmospheric Deposition		
Deteriorating Trend			
Nitrogen	Sewage/ Urban Development	Arsenic Total	Natural Sources
Turbidity	Climate Change/ Forestry/ Mining	Turbidity	Climate Change/ Forestry/ Mining
Censored			
Beryllium	Censored	Beryllium Total	Censored
		Cadmium Total	Censored
		Cobalt Total	Censored
		Molybdenum Total	Censored
		Selenium Total	Censored

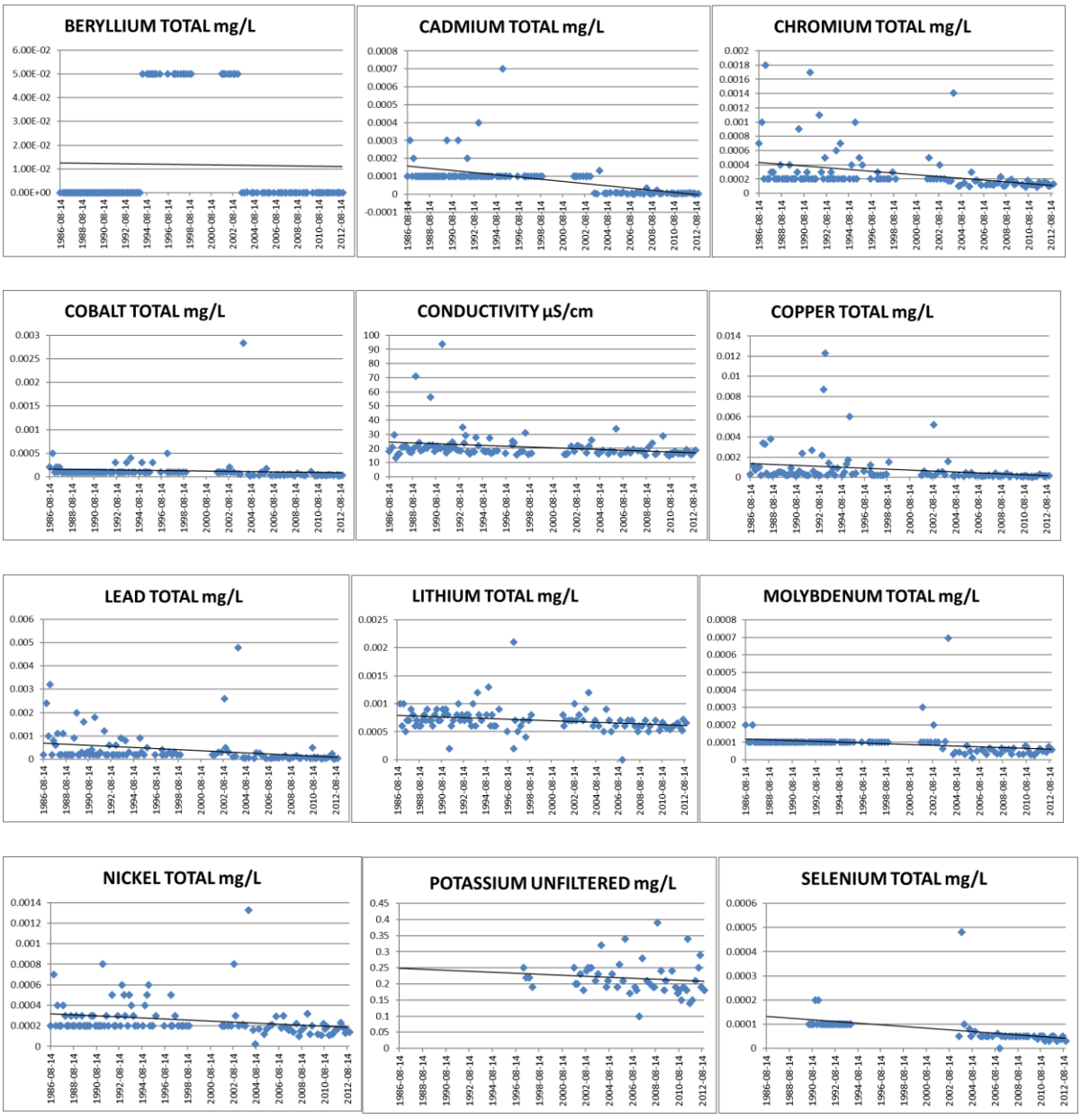
6.2.9 Terra Nova River at Spencer Bridge (NF02YS0011)

Terra Nova River at Spencer Bridge is in the Terra Nova National Park adjacent to Trans-Canada Highway. There CESI land use category lists the site as remote. CANAL lists the surrounding development pressure as low. RBA ranks the level of overall risk to water quality as low.

6.2.9.1 Parameter Time Series Graph

Figures 40 and 41 display the parameter time series graphs for improving and deteriorating trend parameters for Terra Nova River at Spencer Bridge.

Figure 40: Terra Nova River at Spencer Bridge - Improving Trend Parameters



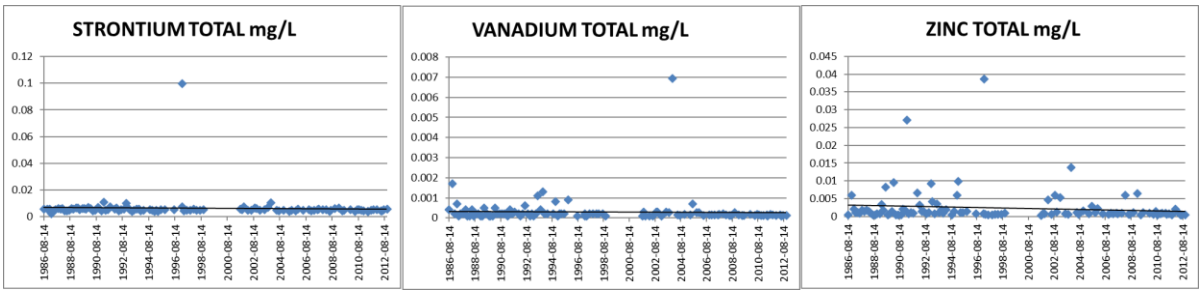
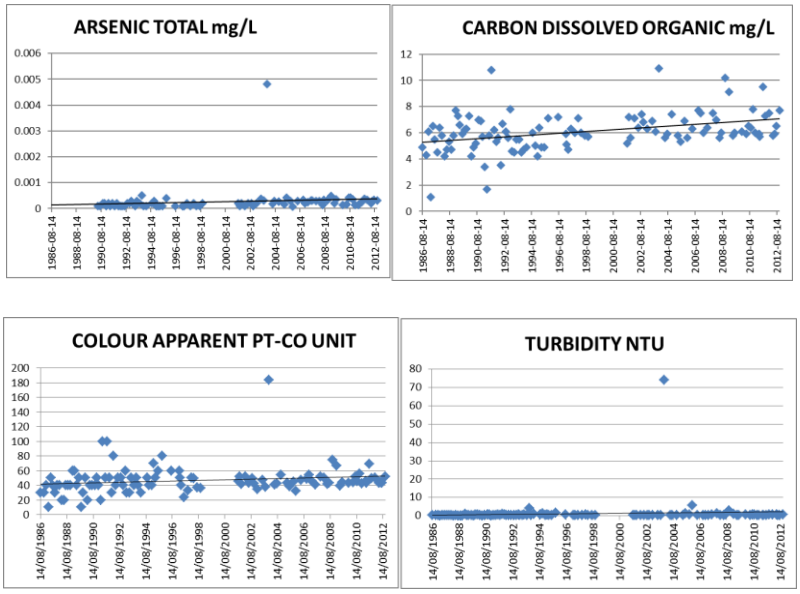


Figure 41: Terra Nova River at Spencer Bridge - Deteriorating Trend Parameters



6.2.9.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 41 displays overall water quality parameters trend results for Terra Nova River at Spencer Bridge.

Table 41: Terra Nova River at Spencer Bridge - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	110	0.05	0.24	-0.11	No	0.23	-0.08	No
AST	88	0.05	0	0.49	Up	0	0.35	Up
BAT	110	0.05	0.17	-0.13	No	0.17	-0.09	No
BET	110	0.05	0	-0.5	Down	0	-0.3	Down
CAD	106	0.05	0.16	-0.14	No	0.22	-0.08	No
DOC	109	0.05	0	0.39	Up	0	0.28	Up
CDT	110	0.05	0	-0.79	Down	0	-0.62	Down
CLT	35	0.05	0.86	-0.03	No	0.97	-0.01	No
COLOURA	109	0.05	0	0.32	Up	0	0.22	Up
COND	109	0.05	0	-0.37	Down	0	-0.25	Down
COT	109	0.05	0	-0.7	Down	0	-0.53	Down
CRT	109	0.05	0	-0.69	Down	0	-0.5	Down
CUT	109	0.05	0	-0.59	Down	0	-0.42	Down
FET	109	0.05	0.2	0.12	No	0.24	0.08	No
LIT	108	0.05	0	-0.37	Down	0	-0.26	Down
MGD	106	0.05	0.07	-0.18	No	0.08	-0.12	No
MOT	109	0.05	0	-0.74	Down	0	-0.54	Down
NAU	50	0.05	0.53	-0.09	No	0.6	-0.05	No
NIT	109	0.05	0	-0.51	Down	0	-0.36	Down
NT	64	0.05	0.07	0.22	No	0.06	0.16	No
PBT	109	0.05	0	-0.65	Down	0	-0.49	Down
PH	109	0.05	0.21	0.12	No	0.18	0.09	No
PT	107	0.05	0.12	-0.15	No	0.22	-0.08	No
SET	62	0.05	0	-0.87	Down	0	-0.73	Down
SIO2	40	0.05	0.35	-0.15	No	0.33	-0.11	No
SOT	35	0.05	0	-0.79	Down	0	-0.57	Down
SRT	109	0.05	0	-0.27	Down	0.01	-0.18	Down
TURB	109	0.05	0	0.33	Up	0	0.22	Up
VT	109	0.05	0.02	-0.22	Down	0.02	-0.16	Down
ZNT	109	0.05	0.03	-0.21	Down	0.02	-0.15	Down

6.2.9.3 Comparison and Causes of Change from Past

Table 42 compares trend for Terra Nova River at Spencer Bridge between Phase I and Phase II.

Conductivity, copper, lead, lithium, strontium, sulphate, vanadium and zinc displayed improving trend. Arsenic, DOC, colour, and turbidity displayed deteriorating trend. Beryllium, cadmium, chromium, cobalt, molybdenum, nickel and selenium displayed improving trend with censor majority data.

When comparing the trend results between Phase I and Phase II, lead continued to improve over time while turbidity deteriorated over the years.

Mercury, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Magnesium, which improved in the past, displayed no trend in the current report. Iron, which deteriorated in the past, displayed no trend in the current report. Potassium and sulphate, having only one year of common data period with Phase I report, was considered insufficient for comparative analysis.

Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow, decreasing conductivity while increasing colour and turbidity. Forestry and quarrying activity in the basin may also be affecting colour and turbidity levels. Reductions in atmospheric deposition have affected metals such as copper, lead, lithium, strontium, vanadium and zinc. The increase of global carbon emissions globally across the north likely linked to deteriorating DOC levels. Natural sources may have led to increased arsenic level.

Table 42: Terra Nova River at Spencer Bridge - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	Cause of Trend	Parameter	Cause of Trend
Improving Trend			
Lead	Atmospheric Deposition/ Abatement	Copper Total	Atmospheric Deposition
Magnesium	Climate Change	Conductivity	Climate Change
Mercury	Atmospheric Deposition	Lead Total	Atmospheric Deposition/ Abatement
		Lithium Total	Atmospheric Deposition
		Strontium Total	Atmospheric Deposition
		Vanadium Total	Atmospheric Deposition
		Zinc Total	Atmospheric Deposition
Deteriorating Trend			
Cobalt	Landfill/ Transportation	Arsenic Total	Natural Sources
Iron	Landfill/ Transportation	DOC	Global Carbon Emissions
Turbidity	Climate Change/ Forestry/ Mining	Colour Apparent	Climate Change /Forestry/Transportation
		Turbidity	Climate Change/ Forestry/Transportation
Censored			
Beryllium	Censored	Beryllium Total	Censored
Cadmium Total	Censored	Cadmium Total	Censored
		Chromium Total	Censored
		Cobalt Total	Censored
		Molybdenum Total	Censored
		Nickel Total	Censored
		Selenium Total	Censored

6.2.10 Terra Nova River at Terra Nova (NF02YS0001)

Terra Nova River at Terra Nova is in the community of Terra Nova. There CESI land use category lists the site as remote. CANAL lists the surrounding development pressure as low. RBA ranks the level of overall risk to water quality as low.

6.2.10.1 Parameter Time Series Graph

Figures 42 and 43 display the parameter time series graphs for improving and deteriorating trend parameters for Terra Nova River at Terra Nova.

Figure 42: Terra Nova River at Terra Nova - Improving Trend Parameters

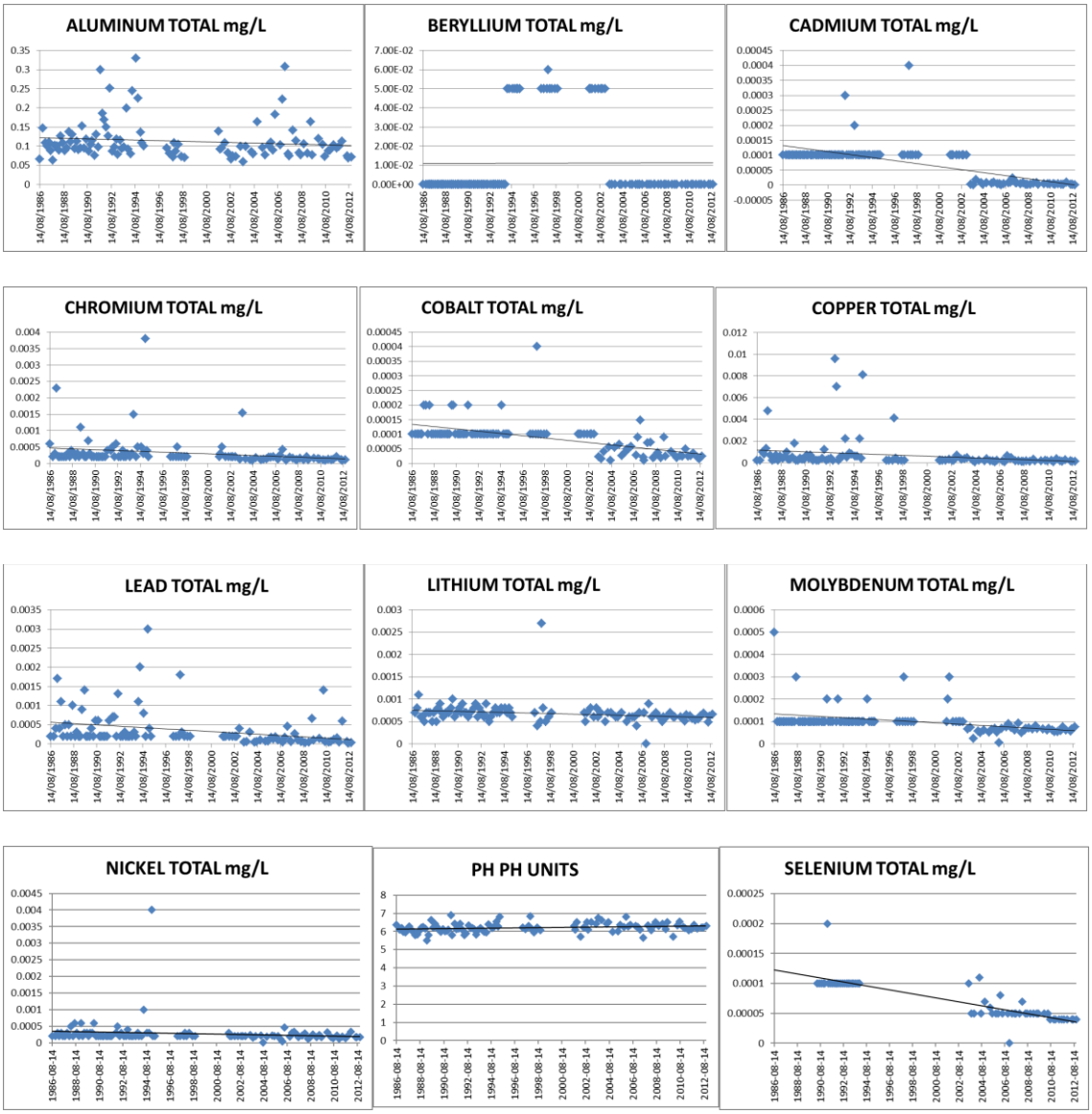
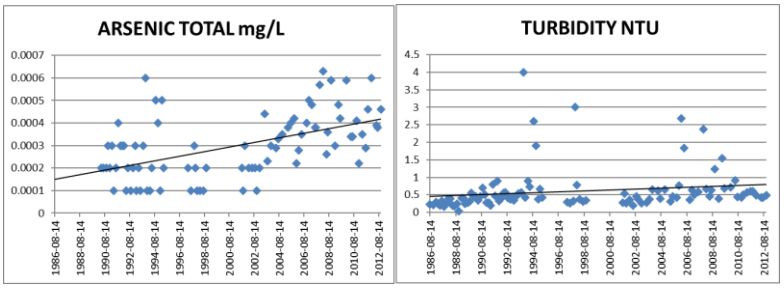


Figure 43: Terra Nova River at Terra Nova - Deteriorating Trend Parameters



6.2.10.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 43 displays overall water quality parameters trend results for Terra Nova River at Terra Nova.

Table 43: Terra Nova River at Terra Nova - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	105	0.05	0.04	-0.2	Down	0.04	-0.13	Down
AST	83	0.05	0	0.55	Up	0	0.39	Up
BAT	105	0.05	0.19	-0.13	No	0.2	-0.09	No
BET	105	0.05	0	-0.53	Down	0	-0.32	Down
CAD	101	0.05	0.51	0.07	No	0.46	0.05	No
DOC	104	0.05	0.06	0.19	No	0.04	0.14	Up
CDT	105	0.05	0	-0.79	Down	0	-0.62	Down
CLT	33	0.05	0.74	0.06	No	0.85	0.02	No
COLOURA	104	0.05	0.42	0.08	No	0.4	0.06	No
COND	104	0.05	0.12	-0.15	No	0.17	-0.09	No
COT	104	0.05	0	-0.76	Down	0	-0.59	Down
CRT	104	0.05	0	-0.59	Down	0	-0.43	Down
CUT	104	0.05	0	-0.55	Down	0	-0.39	Down
FET	104	0.05	0.96	0	No	0.94	0.01	No
KU	49	0.05	0.08	-0.25	No	0.09	-0.17	No
LIT	103	0.05	0	-0.37	Down	0	-0.26	Down
MGD	101	0.05	0.4	-0.08	No	0.43	-0.05	No
MOT	104	0.05	0	-0.74	Down	0	-0.54	Down
NAU	49	0.05	0.17	0.2	No	0.23	0.12	No
NIT	104	0.05	0	-0.34	Down	0	-0.24	Down
NT	59	0.05	0.5	0.09	No	0.35	0.08	No
PBT	104	0.05	0	-0.59	Down	0	-0.43	Down
PH	104	0.05	0	0.3	Up	0	0.2	Up
PT	102	0.05	0.58	-0.06	No	0.66	-0.03	No
SET	60	0.05	0	-0.89	Down	0	-0.74	Down
SIO2	37	0.05	0.60	-0.09	No	0.79	-0.03	No
SOT	33	0.05	0	-0.8	Down	0	-0.61	Down
SRT	104	0.05	0.71	-0.04	No	0.87	-0.01	No
TURB	104	0.05	0	0.48	Up	0	0.33	Up
VT	104	0.05	0.81	0.02	No	0.86	0.01	No
ZNT	104	0.05	0.97	0	No	0.94	-0.01	No

6.2.10.3 Comparison and Causes of Change from Past

Table 44 compares trend for Terra Nova River at Terra Nova between Phase I and Phase II.

Aluminum, copper, lead, lithium, pH, and sulphate displayed improving trend. Arsenic and turbidity displayed deteriorating trend. Beryllium, cadmium, chromium, cobalt, molybdenum, nickel and selenium displayed improving trend with censor majority data.

When comparing the trend results between Phase I and Phase II, turbidity deteriorated over the years. Selenium, which improved in the past, displayed censored in the current report.

Mercury, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Nitrate and nitrite, which deteriorated in the past, was excluded from the current analysis due to unavailability of more recent data. Calcium, chloride, nitrogen, potassium and silica, which deteriorated in the past, are showing no trend in the current report. Sulphate having only one year of common data period with Phase I report, was considered insufficient for comparative analysis.

Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow, and increasing turbidity. Forestry and quarrying activity in the basin may also be affecting turbidity levels. Reductions in atmospheric deposition have affected metals such as aluminum, copper, lead, and lithium. Natural geology sources have deteriorated arsenic and improved pH.

Table 44: Terra Nova River at Terra Nova - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	Cause of Trend	Parameter	Cause of Trend
Improving Trend			
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Mercury	Atmospheric Deposition	Aluminum Total	Atmospheric Deposition
Selenium	Atmospheric Deposition	Copper Total	Atmospheric Deposition
		Lead Total	Atmospheric Deposition
		Lithium Total	Atmospheric Deposition
		pH	Natural Sources
Deteriorating Trend			
Calcium	Landfill	Arsenic Total	Natural Sources
Chloride	Landfill	Turbidity	Climate Change/ Forestry/ Mining
Nitrate & Nitrite	Rural Septic Systems		
Nitrogen	Rural Septic Systems		
Potassium	Landfill		
Silica	Climate Change		
Turbidity	Climate Change/ Forestry/ Mining		
Censored			
Beryllium	Censored	Beryllium Total	Censored
Cadmium Total	Censored	Cadmium Total	Censored
		Chromium Total	Censored
		Cobalt Total	Censored
		Molybdenum Total	Censored
		Nickel Total	Censored
		Selenium Total	Censored

6.2.11 Regional Trend for Selected Parameters

Regionally, copper showed the highest level of improvement with downward trend in all ten stations. pH showed improvement with upward trend in eight of ten stations. Aluminum, barium, conductivity, lithium, strontium and zinc improved with downward trend in more than half the stations. Lastly, phosphorus improved with downward trend in half the stations.

DOC showed the highest level of deterioration with an upward trend for eight of ten stations. Turbidity (7 stations), colour (4 stations) and arsenic (4 stations) deteriorated with upward trend. The parameters, which displayed trend with censor majority data (improving or deteriorating), were beryllium, cadmium, chromium, cobalt, molybdenum, nickel and selenium.

Most of the central stations were either remote or influenced by mining in the past with little urban influence from the surrounding areas. The cleanup program followed by the winding down of some mines lead to improvement in metals like copper, aluminum, barium, conductivity, lithium, strontium and zinc as well as pH. Natural limestone geology in remote areas also contributed to improvement of pH. Abatement resulting from Phosphorus Control Act resulted in the improvement of phosphorus. Climate change affected streamflow decreasing conductivity and major ion concentration.

Increased precipitation resulting from climate change lead to deteriorating turbidity and colour in mining and remote stations. The increase of global carbon emissions across the north likely linked to the deterioration of DOC levels. Natural geology lead to increased arsenic level in remote stations.

Table 45 displays regional trend results for central water quality parameters. The last column of the table shows the percentage of parameters that either were displaying no trend or consists censor majority data.

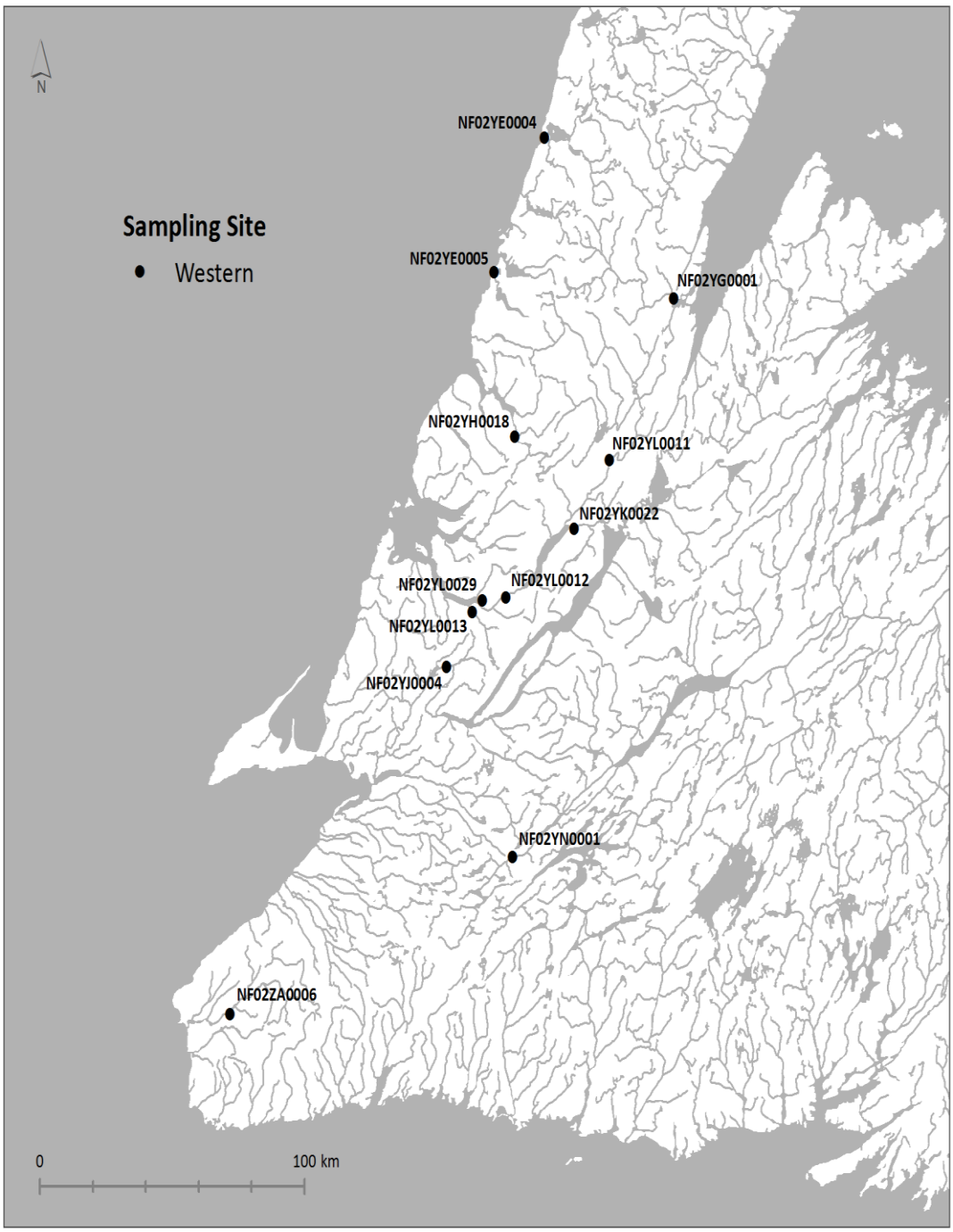
Table 45: Regional Trend for Central WQMA Stations

PARAMETER	COUNT	%DETERIORATING	%IMPROVING	%NONE OR CENSORED
ALT	10	0	60	40
AST	10	40	0	60
BAT	10	0	60	40
BET	10	0	0	100
CAD	10	0	40	60
DOC	10	80	0	20
CDT	10	0	0	100
CLT	10	30	0	70
COLOURA	10	40	0	60
COND	10	0	60	40
COT	10	0	0	100
CRT	10	0	30	70
CUT	10	0	100	0
FET	10	10	0	90
KU	10	0	30	70
LIT	10	0	60	40
MGD	10	0	30	70
MOT	10	0	0	100
NAU	10	10	20	70
NIT	10	10	10	80
NT	10	30	0	70
PBT	10	0	80	20
PH	10	10	80	10
PT	10	0	50	50
SET	10	0	20	80
SIO2	10	0	20	80
SOT	10	0	70	30
SRT	10	10	60	30
TURB	10	70	10	20
VT	10	0	30	70
ZNT	10	0	60	40

6.3 Western Water Quality Station Trends

Figure 44 shows the 12 western stations included for trend analysis.

Figure 44: Selected Western WQMA Trend Stations



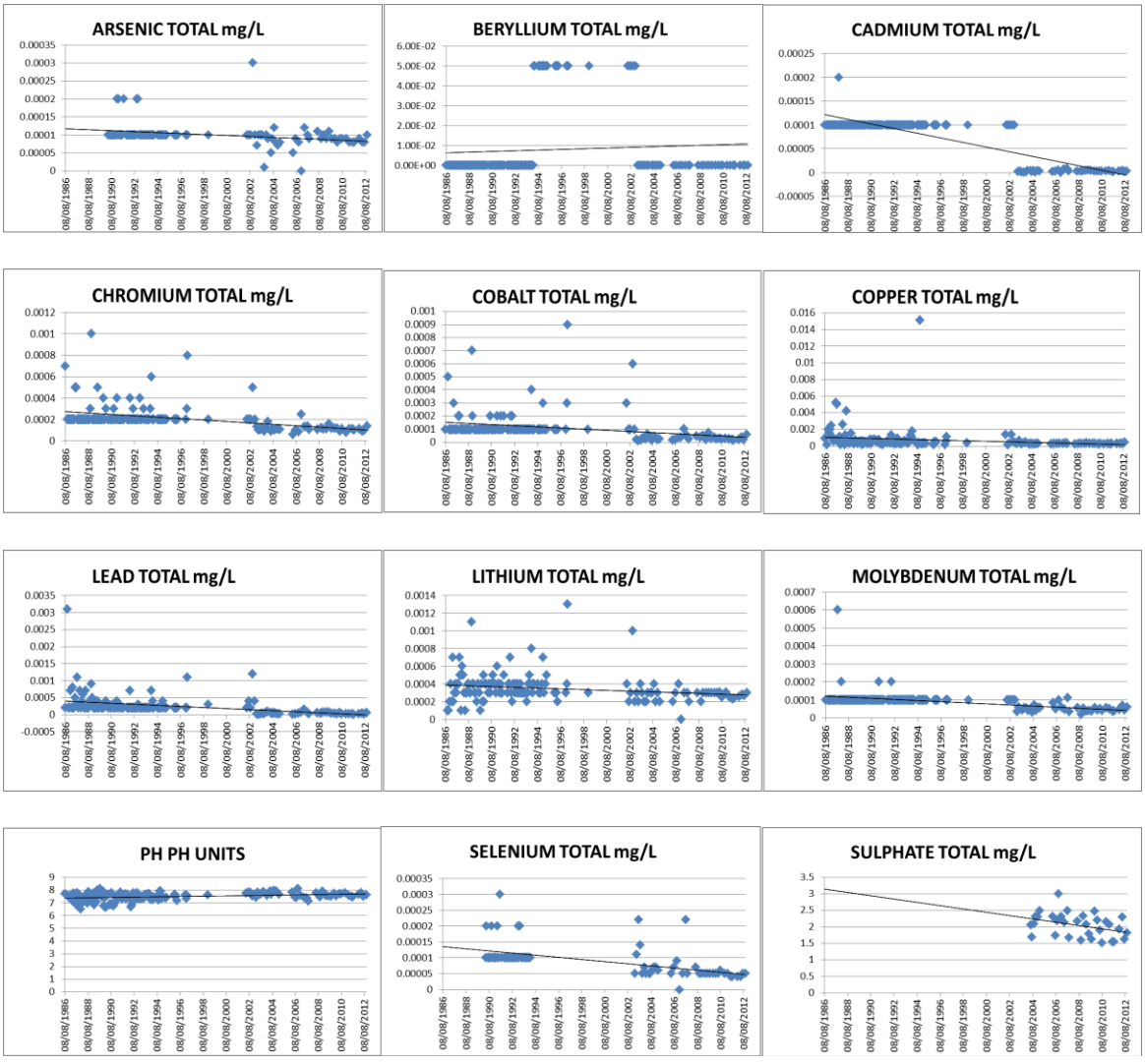
6.3.1 Corner Brook at Margaret Bowater Park (NF02YL0013)

Corner Brook River at Margaret Bowater Park is in the City of Corner Brook. The CESI land use category classifies the station as forestry. CANAL lists the surrounding development pressure as medium. RBA ranks the level of overall risk to water quality as low.

6.3.1.1 Parameter Time Series Graph

Figures 45 and 46 display the parameter time series graphs for improving and deteriorating trend parameters for Corner Brook at Margaret Bowater Park.

Figure 45: Corner Brook at Margaret Bowater Park - Improving Trend Parameters



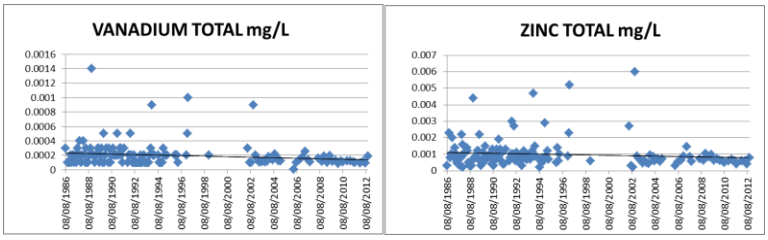
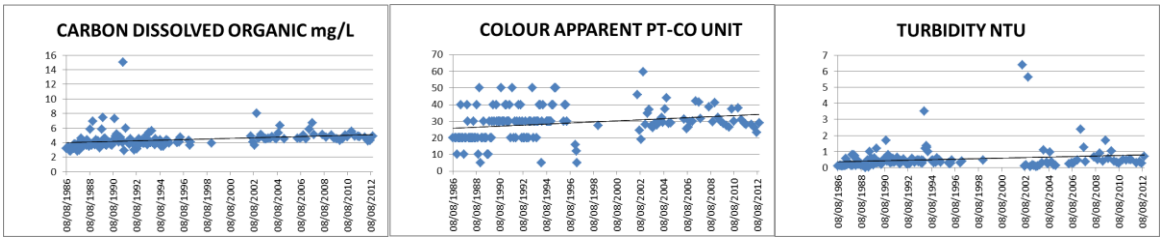


Figure 46: Corner Brook at Margaret Bowater Park - Deteriorating Trend Parameters



6.3.1.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 46 displays overall water quality parameters trend results for Corner Brook at Margaret Bowater Park.

Table 46: Corner Brook at Margaret Bowater Park - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	150	0.05	0.41	0.07	No	0.42	0.04	No
AST	107	0.05	0	-0.56	Down	0	-0.42	Down
BAT	150	0.05	0.74	0.03	No	0.69	0.02	No
BET	150	0.05	0	-0.39	Down	0	-0.22	Down
CAD	150	0.05	0.94	0.01	No	0.84	0.01	No
DOC	149	0.05	0	0.54	Up	0	0.4	Up
CDT	149	0.05	0	-0.74	Down	0	-0.57	Down
CLT	32	0.05	0.97	-0.01	No	0.92	0.01	No
COLOURA	150	0.05	0	0.31	Up	0	0.21	Up
COND	150	0.05	0.82	0.02	No	0.73	0.02	No
COT	149	0.05	0	-0.61	Down	0	-0.45	Down
CRT	149	0.05	0	-0.63	Down	0	-0.47	Down
CUT	149	0.05	0	-0.47	Down	0	-0.34	Down
FET	149	0.05	0.33	0.08	No	0.31	0.06	No
KU	47	0.05	0.35	0.14	No	0.28	0.11	No
LIT	148	0.05	0	-0.25	Down	0	-0.19	Down
MGD	150	0.05	0.92	0.01	No	0.85	0.01	No
MOT	149	0.05	0	-0.69	Down	0	-0.54	Down
NAU	47	0.05	0.41	0.12	No	0.33	0.1	No
NIT	149	0.05	0.3	0.09	No	0.3	0.06	No
NT	63	0.05	0.23	0.15	No	0.15	0.13	No
PBT	149	0.05	0	-0.68	Down	0	-0.52	Down
PH	150	0.05	0	0.29	Up	0	0.2	Up
PT	150	0.05	0.31	-0.08	No	0.41	-0.05	No
SET	83	0.05	0	-0.76	Down	0	-0.59	Down
SIO2	54	0.05	0.11	0.22	No	0.08	0.16	No
SRT	149	0.05	0.74	-0.03	No	0.75	-0.02	No
TURB	150	0.05	0	0.27	Up	0	0.18	Up
VT	149	0.05	0.01	-0.22	Down	0.01	-0.16	Down
ZNT	149	0.05	0.04	-0.17	Down	0.03	-0.12	Down

6.3.1.3 Comparison and Causes of Change from Past

Table 44 compares trend for Corner Brook at Margaret Bowater Park between Phase I and Phase II report.

Copper, lithium, pH, sulphate, vanadium and zinc displayed improving trend. DOC, colour and turbidity displayed deteriorating trend. Arsenic, beryllium, cadmium, chromium, cobalt, lead, molybdenum and selenium displayed improving trend with censor majority data.

When comparing the trend results between Phase I and Phase II, copper continued to improve over time while colour, carbon and turbidity deteriorated over the years. Lead, which improved in the past, continued to improve with censor majority data in the current report.

Mercury, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Nitrate and nitrite, which deteriorated in the past, was excluded from the current analysis due to unavailability of more recent data. Aluminum, iron and nitrogen, which deteriorated in the past, displayed no trend in the current report. Sulphate having only one year of common data period with Phase I report, was considered insufficient for comparative analysis.

Reductions in atmospheric deposition are affecting metals such as copper, lithium, vanadium and zinc. Natural sources resulting from forestry may have led to improved pH.

Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow and decreasing sulphate while increasing turbidity, colour and DOC. Forestry activity and several quarries may also be affecting colour and turbidity.

Table 47: Corner Brook at Margaret Bowater Park - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Copper	Atmospheric Deposition	Copper Total	Atmospheric Deposition
Lead	Atmospheric Deposition/ Abatement	Lithium Total	Atmospheric Deposition
Mercury	Atmospheric Deposition	pH	Natural Sources
		Vanadium Total	Atmospheric Deposition
		Zinc Total	Atmospheric Deposition
Deteriorating Trend			
Aluminium	Stream Modification/ Urban Development/Transportation	DOC	Global Carbon Emissions
Colour	Climate Change/ Forestry/Mining	Colour Apparent	Climate Change/ Forestry/Mining
DOC	Climate Change	Turbidity	Climate Change/Forestry/ Mining
Iron	Stream Modification/ Urban Development/Transportation		
Nitrate & Nitrite	Urban/ Recreation		
Nitrogen	Urban/ Recreation		
Turbidity	Climate Change/Forestry/ Mining		
Censored			
Beryllium	Censored	Arsenic Total	Censored
Cadmium Total	Censored	Beryllium Total	Censored
		Cadmium Total	Censored
		Chromium Total	Censored
		Cobalt Total	Censored
		Lead Total	Censored
		Molybdenum Total	Censored
		Selenium Total	Censored

6.3.2 Grand Codroy River Below Overfall Brook (NF02ZA0006)

Grand Codroy River Below Overfall Brook is close to the community of South Branch. The CESI land use category classifies the station as remote. CANAL lists the surrounding development pressure as medium. RBA ranks the level of overall risk to water quality as low.

6.3.2.1 Parameter Time Series Graph

Figures 47 and 48 display the parameter time series graphs for improving and deteriorating trend parameters for Grand Codroy River Below Overfall Brook.

Figure 47: Grand Codroy River Below Overfall Brook - Improving Trend Parameters

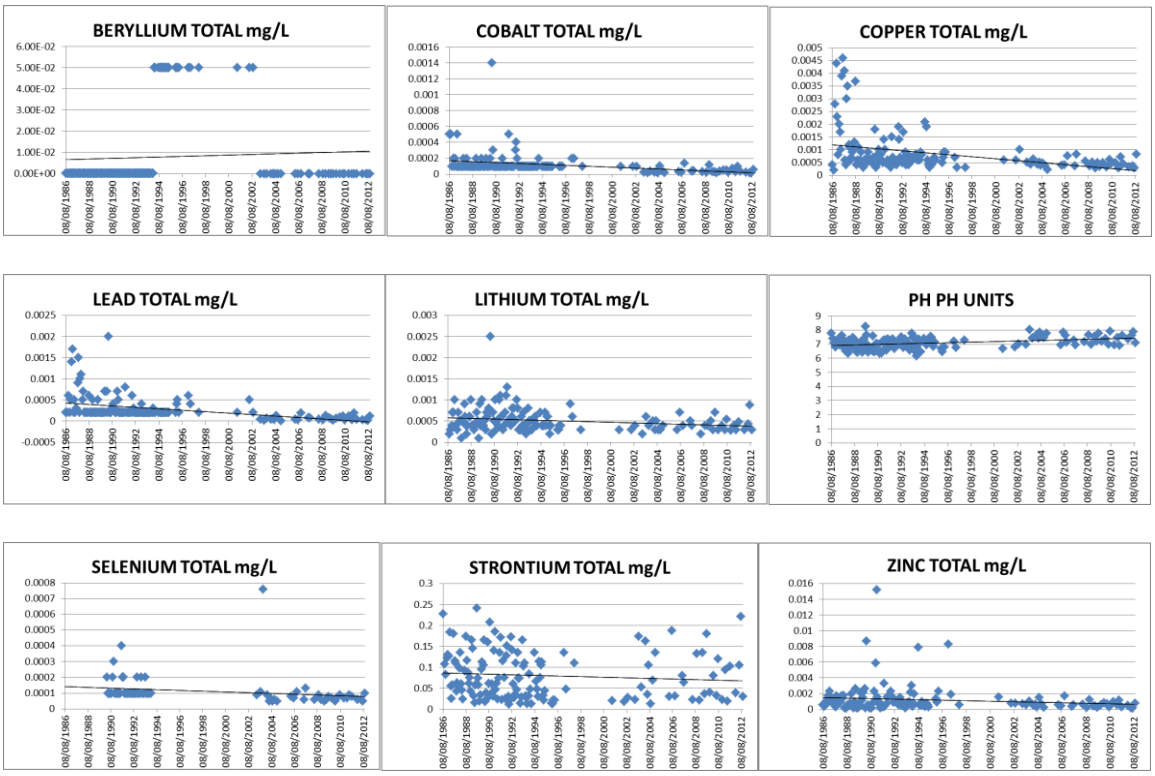
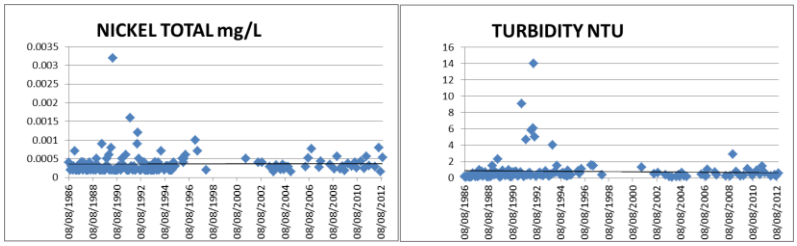


Figure 48: Grand Codroy River Below Overfall Brook - Deteriorating Trend Parameters



6.3.2.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 48 displays overall water quality parameters trend results for Grand Codroy River Below Overfall Brook.

Table 48: Grand Codroy River Below Overfall Brook - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	145	0.05	0.8	-0.02	No	0.81	-0.01	No
AST	102	0.05	0.1	0.17	No	0.08	0.13	No
BAT	145	0.05	0.34	-0.08	No	0.34	-0.05	No
BET	145	0.05	0	-0.32	Down	0.01	-0.18	Down
CAD	145	0.05	0.09	-0.14	No	0.08	-0.1	No
DOC	146	0.05	0.9	0.01	No	0.9	0.01	No
CDT	32	0.05	0.39	0.16	No	0.45	0.1	No
CLT	29	0.05	0.96	0.01	No	0.99	0	No
COLOURA	146	0.05	0.89	0.01	No	0.9	0.01	No
COND	146	0.05	0.1	-0.14	No	0.09	-0.09	No
COT	144	0.05	0	-0.59	Down	0	-0.45	Down
CRT	144	0.05	0.08	-0.15	No	0.13	-0.09	No
CUT	144	0.05	0	-0.42	Down	0	-0.3	Down
FET	144	0.05	0.3	-0.09	No	0.32	-0.06	No
KU	38	0.05	0.4	0.14	No	0.36	0.11	No
LIT	143	0.05	0.01	-0.22	Down	0.01	-0.16	Down
MGD	145	0.05	0.47	-0.06	No	0.49	-0.04	No
MOT	144	0.05	0.1	0.14	No	0.1	0.11	No
NAU	38	0.05	0.87	0.03	No	0.94	0.01	No
NIT	144	0.05	0.04	0.17	Up	0.04	0.12	Up
NT	57	0.05	0.18	0.18	No	0.13	0.14	No
PBT	144	0.05	0	-0.68	Down	0	-0.52	Down
PH	146	0.05	0	0.31	Up	0	0.21	Up
PT	145	0.05	0.42	-0.07	No	0.43	-0.04	No
SET	79	0.05	0	-0.66	Down	0	-0.48	Down
SIO2	57	0.05	0.18	0.18	No	0.16	0.13	No
SOT	29	0.05	0.75	-0.06	No	0.76	-0.04	No
SRT	144	0.05	0.02	-0.2	Down	0.02	-0.13	Down
TURB	146	0.05	0.02	0.19	Up	0.02	0.13	Up
VT	144	0.05	0.67	0.04	No	0.64	0.03	No
ZNT	144	0.05	0.05	-0.16	No	0.04	-0.12	Down

6.3.2.3 Comparison and Causes of Change from Past

Table 49 compares trend for Grand Codroy River between Phase I and Phase II.

Copper, lithium, pH, strontium and zinc displayed improving trend. Nickel and turbidity displayed deteriorating trend. Beryllium, cobalt, lead, nickel, selenium and silver displayed improving trend with censor majority data.

When comparing the trend results between Phase I and Phase II, copper and strontium continued to improve over time while turbidity deteriorated over the years. Lead, which improved in the past continued to improve with censor majority data in the current report. Nickel, which deteriorated in the past, improved with censor majority data in the current report.

Arsenic, barium, calcium, chloride, conductivity, magnesium, potassium, sodium and sulphate, which improved in the past, displayed no trend in the current report. Silica, which deteriorated in the past, did not have sufficient data for comparison in the current report.

A combination of abatement practices, atmospheric deposition and climate change have improved copper, lithium, pH, strontium and zinc. Changes in climate have resulted in an increasing trend in precipitation across the province, affecting streamflow and increasing turbidity levels.

Reductions in atmospheric deposition may be affecting copper, lithium, strontium and zinc. Natural geology may have led to improvement of pH. Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow and increasing turbidity. Forestry and several quarries may also be contributing to turbidity.

Table 49: Grand Codroy River Below Overfall Brook - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Arsenic	Atmospheric Deposition	Copper Total	Atmospheric Deposition
Barium	Atmospheric Deposition	Lithium Total	Atmospheric Deposition
Calcium	Climate Change	pH	Natural Causes
Chloride	Climate Change	Strontium Total	Atmospheric Deposition
Conductivity	Climate Change	Zinc Total	Atmospheric Deposition
Copper	Atmospheric Deposition		
Lead	Atmospheric Deposition/ Abatement		
Magnesium	Climate Change		
Potassium	Climate Change		
Sodium	Climate Change		
Strontium	Atmospheric Deposition		
Sulphate	Climate Change/ Atmospheric Deposition		
Deteriorating Trend			
Nickel	Transportation	Turbidity	Climate Change/ Forestry/ Mining
Silica	Climate Change		
Turbidity	Climate Change/ Forestry/ Mining		
Censored			
Molybdenum	Censored	Beryllium Total	Censored
		Cobalt Total	Censored
		Lead Total	Censored
		Nickel Total	Censored
		Selenium Total	Censored

6.3.3 Humber Canal at Main Dam Road (NF02YK0022)

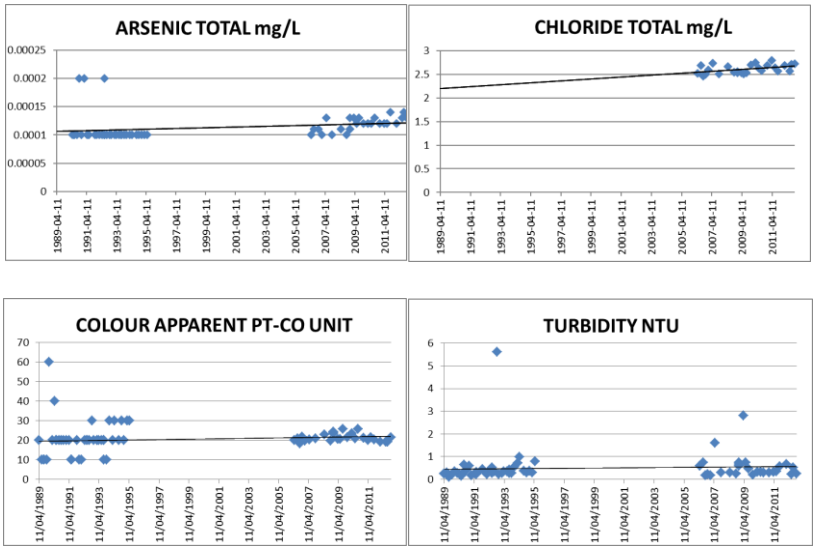
Humber Canal at Main Dam Road is in the community of Deer Lake. The CESI land use category classifies the station as remote. CANAL lists the surrounding development pressure as medium. RBA ranks the level of overall risk to water quality as medium.

6.3.3.1 Parameter Time Series Graph

Figures 49 and 50 display the parameter time series graphs for improving and deteriorating trend parameters for Humber Canal at Main Dam Road.

Figure 49: Humber Canal at Main Dam Road - Improving Trend Parameters

Figure 50: Humber Canal at Main Dam Road - Deteriorating Trend Parameters



6.3.3.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 50 displays overall water quality parameters trend results for Humber Canal at Main Dam Road.

Table 50: Humber Canal at Main Dam Road - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	71	0.05	0.1	-0.2	No	0.1	-0.13	No
AST	63	0.05	0	0.6	Up	0	0.51	Up
BAT	71	0.05	0.94	-0.01	No	0.93	-0.01	No
BET	71	0.05	0	-0.65	Down	0	-0.43	Down
CAD	72	0.05	0.3	-0.13	No	0.33	-0.08	No
DOC	70	0.05	0.26	0.14	No	0.33	0.08	No
CDT	71	0.05	0	-0.82	Down	0	-0.65	Down
COLOURA	72	0.05	0	0.42	Up	0	0.3	Up
COND	72	0.05	0	-0.54	Down	0	-0.32	Down
COT	70	0.05	0	-0.82	Down	0	-0.64	Down
CRT	70	0.05	0	-0.74	Down	0	-0.56	Down
CUT	70	0.05	0	-0.51	Down	0	-0.33	Down
FET	70	0.05	0.35	-0.11	No	0.33	-0.08	No
KU	27	0.05	0.32	-0.2	No	0.33	-0.14	No
LIT	70	0.05	0.29	0.13	No	0.43	0.07	No
MGD	72	0.05	0.11	-0.19	No	0.18	-0.12	No
MOT	70	0.05	0	-0.65	Down	0	-0.48	Down
NAU	27	0.05	0.12	-0.31	No	0.13	-0.21	No
NIT	70	0.05	0.17	0.17	No	0.21	0.11	No
NT	34	0.05	0.12	0.27	No	0.06	0.22	No
PBT	70	0.05	0	-0.75	Down	0	-0.55	Down
PH	72	0.05	0	0.43	Up	0	0.31	Up
PT	72	0.05	0.45	0.09	No	0.48	0.06	No
SET	56	0.05	0	-0.85	Down	0	-0.7	Down
SIO2	29	0.05	0.33	-0.19	No	0.28	-0.14	No
SRT	70	0.05	0.44	-0.09	No	0.42	-0.07	No
TURB	72	0.05	0	0.35	Up	0	0.25	Up
VT	70	0.05	0.07	-0.22	No	0.06	-0.16	No
ZNT	70	0.05	0.43	-0.1	No	0.37	-0.08	No

6.3.3.3 Comparison and Causes of Change from Past

Table 51 compares trend for Humber Canal between Phase I and Phase II.

Conductivity, copper and pH displayed improving trend. Colour and turbidity displayed deteriorating trend. Beryllium, cadmium, chromium, cobalt, lead, molybdenum and selenium displayed improving trend with censor majority data. Arsenic displayed deteriorating trend with censor majority data.

When comparing the trend results between Phase I and Phase II, pH continued to improve over time while chloride and turbidity deteriorated over the years. Arsenic, which improved in the past, deteriorated with censor majority data in the current report.

Mercury, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Nitrate, nitrite and dissolved oxygen, which deteriorated in the past, was excluded from the current analysis due to unavailability of more recent data. Sodium, which improved in the past, displayed no trend in the current report. Chloride and sulphate did not have data until 2007 for comparison with Phase I report.

Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow and decreasing the concentration of conductivity, while increasing colour and turbidity. Forestry and the presence of several quarries in the basin may also be affecting colour and turbidity. pH is affected by the natural limestone geology of the watershed. Reductions in atmospheric deposition have improved copper.

Table 51: Humber Canal at Main Dam Road - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Arsenic	Atmospheric Deposition	Conductivity	Climate Change
pH	Natural Sources	Copper Total	Atmospheric Deposition
Mercury	Atmospheric Deposition	pH	Natural Sources
Sodium	Climate Change		
Deteriorating Trend			
Chloride	Urban/ Transportation	Colour	Climate Change / Forestry
Dissolved Oxygen	Sewage/ Stream Modification	Turbidity	Climate Change/ Forestry
Nitrate & Nitrite	Sewage		
Turbidity	Climate Change/ Forestry/ Mining		
Censored			
		Arsenic Total	Censored
		Beryllium Total	Censored
		Cadmium Total	Censored
		Chromium Total	Censored
		Cobalt Total	Censored
		Lead Total	Censored
		Molybdenum Total	Censored
		Selenium Total	Censored

6.3.4 Humber River at Humber Village Bridge (NF02YL0012)

Humber River at Humber Village Bridge is 15km east of Corner Brook. The CESI land use category classifies the station as remote. CANAL lists the surrounding development pressure as high due to the presence of hydroelectric power plant in the watershed. RBA ranks the level of overall risk to water quality as medium.

6.3.4.1 Parameter Time Series Graph

Figures 51 and 52 display the parameter time series graphs for improving and deteriorating trend parameters for Humber River at Humber Village Bridge.

Figure 51: Humber River at Humber Village Bridge - Improving Trend Parameters

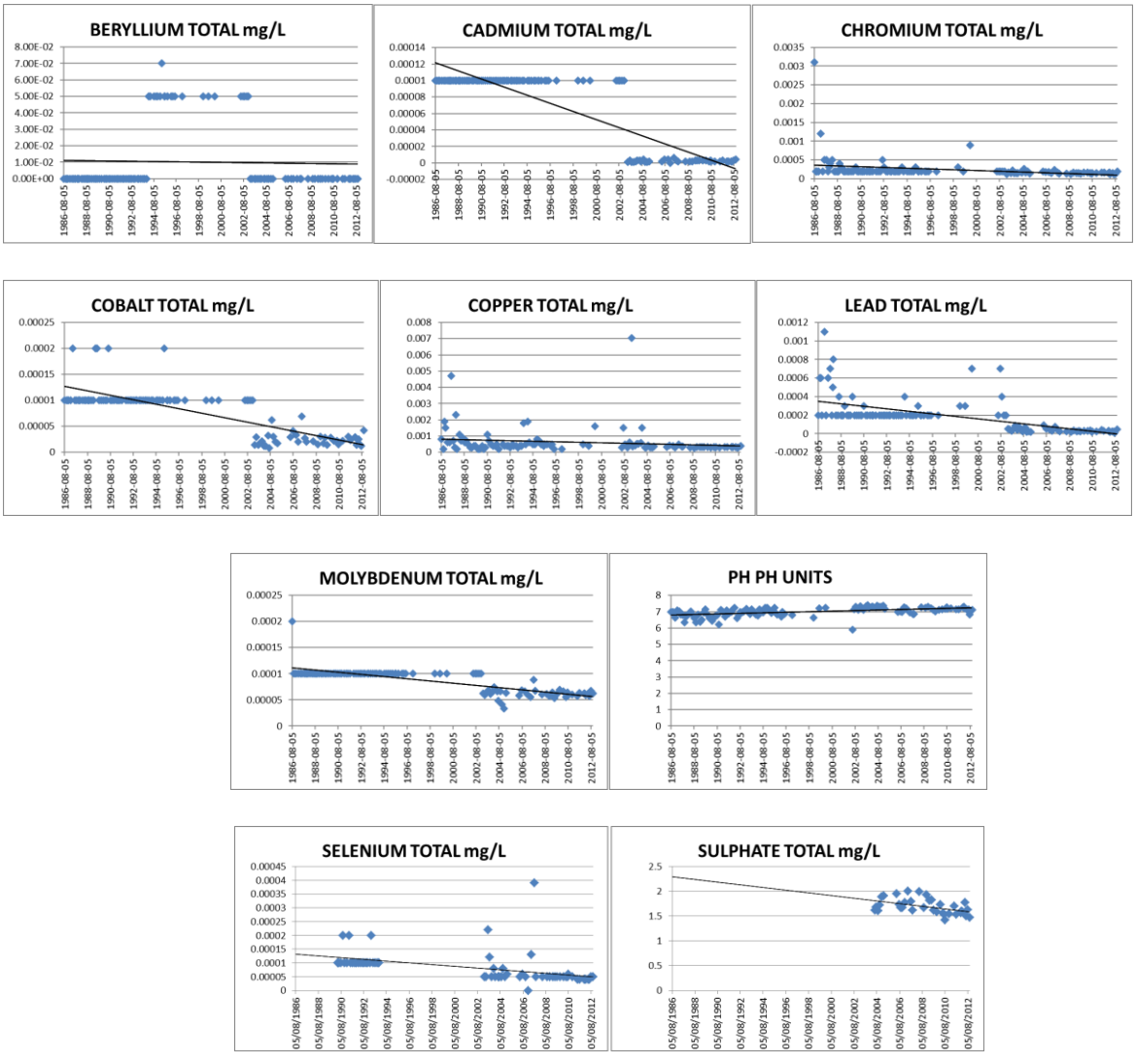
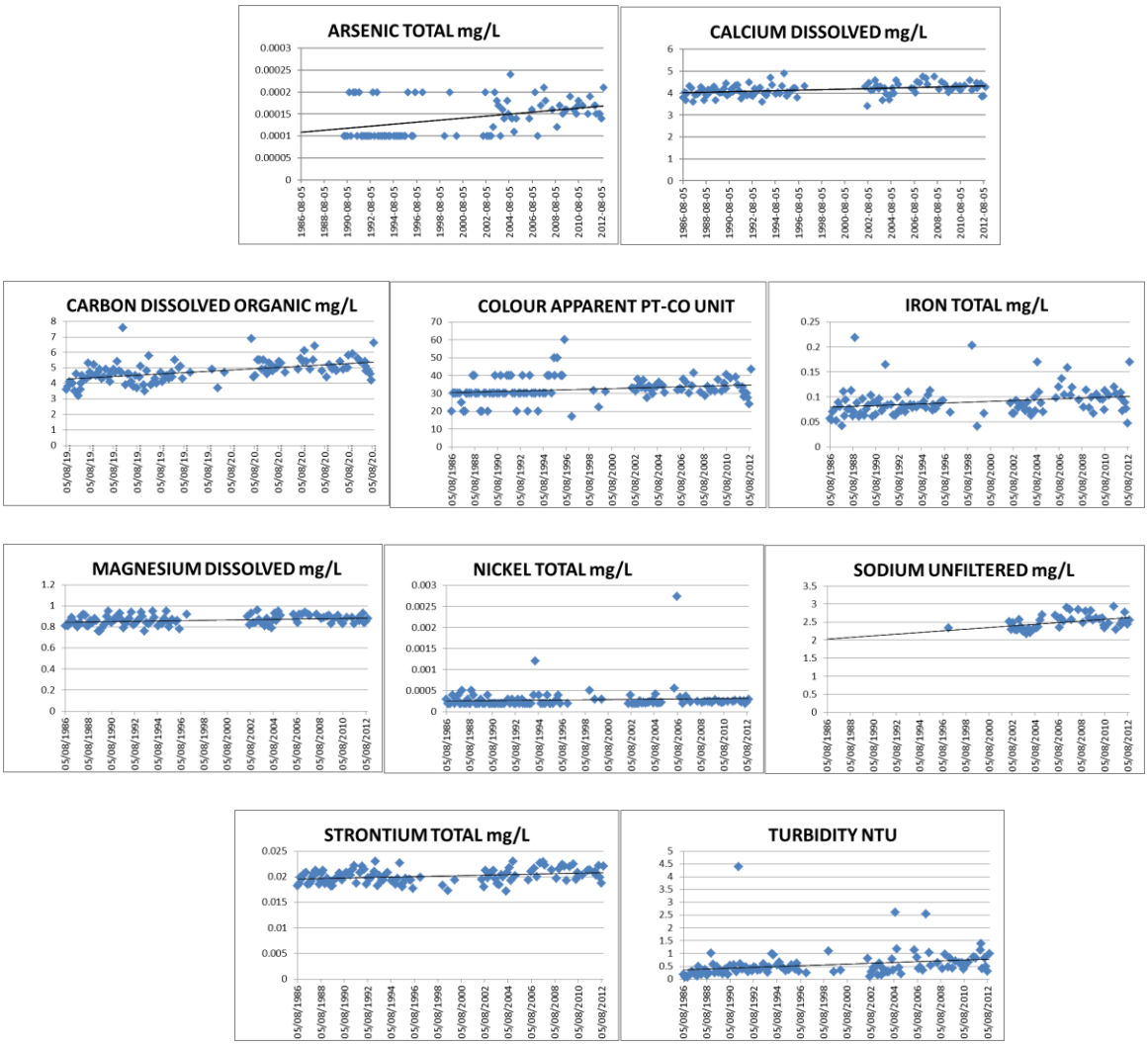


Figure 52: Humber River at Humber Village Bridge - Deteriorating Trend Parameters



6.3.4.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 52 displays overall water quality parameters trend results for Humber River at Humber Village Bridge.

Table 52: Humber River at Humber Village Bridge - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	111	0.05	0.59	0.05	No	0.66	0.03	No
AST	86	0.05	0	0.42	Up	0	0.31	Up
BAT	111	0.05	0.15	0.14	No	0.16	0.09	No
BET	111	0.05	0	-0.55	Down	0	-0.32	Down
CAD	109	0.05	0	0.41	Up	0	0.27	Up
DOC	111	0.05	0	0.57	Up	0	0.4	Up
CDT	110	0.05	0	-0.8	Down	0	-0.61	Down
CLT	35	0.05	0.24	0.2	No	0.27	0.13	No
COLOURA	112	0.05	0	0.36	Up	0	0.24	Up
COND	112	0.05	0.25	0.11	No	0.27	0.07	No
COT	110	0.05	0	-0.79	Down	0	-0.59	Down
CRT	110	0.05	0	-0.75	Down	0	-0.58	Down
CUT	110	0.05	0	-0.38	Down	0	-0.28	Down
FET	110	0.05	0	0.35	Up	0	0.25	Up
KU	48	0.05	0.46	0.11	No	0.47	0.08	No
LIT	109	0.05	0.99	0	No	1	0	No
MGD	109	0.05	0	0.29	Up	0	0.19	Up
MOT	110	0.05	0	-0.82	Down	0	-0.63	Down
NIT	110	0.05	0.01	0.25	Up	0.01	0.19	Up
NT	65	0.05	0.1	0.2	No	0.09	0.15	No
PBT	110	0.05	0	-0.8	Down	0	-0.63	Down
PH	112	0.05	0	0.6	Up	0	0.39	Up
PT	112	0.05	0.28	-0.1	No	0.39	-0.06	No
SET	64	0.05	0	-0.77	Down	0	-0.6	Down
SIO2	34	0.05	0.91	0.02	No	1.00	0.00	No
SRT	110	0.05	0	0.3	Up	0	0.2	Up
TURB	112	0.05	0	0.51	Up	0	0.37	Up
VT	110	0.05	0.69	0.04	No	0.91	0.01	No
ZNT	110	0.05	0.57	-0.06	No	0.58	-0.04	No

6.3.4.3 Comparison and Causes of Change from Past

Table 53 compares trend for Humber River between Phase I and Phase II.

Copper and pH displayed improving trend. DOC, colour, iron, magnesium, strontium and turbidity displayed deteriorating trend. Beryllium, cadmium, chromium, cobalt, lead, molybdenum, nickel and selenium displayed improving trend with censor majority data. Arsenic displayed deteriorating trend with censor majority data.

When comparing the trend results between Phase I and Phase II, pH continued to improve over time while calcium, colour, iron and turbidity deteriorated over the years. Lead, which improved in the past, showed censor majority data in the current report.

Mercury, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Nitrate, nitrite and dissolved oxygen which deteriorated in the past, was excluded from the current analysis due to unavailability of more recent data. Barium and potassium, which improved in the past, displayed no trend in the current report. Nitrogen and silica, which deteriorated in the past, displayed no trend in the current report.

Reductions in atmospheric deposition has improved copper. Natural limestone geology in this watershed and the application of lime for farming purposes improved pH.

Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow and decreasing the concentration of major ions, while increasing turbidity, colour and silica. Forestry, farming, several quarries, and urban development from Pasadena and Deer Lake are also affecting colour and turbidity. The increase of carbon global carbon emissions observed across the north have likely deteriorated DOC levels. Leachate from landfills in the basin or from stream alterations such as hydro dams and bridges may possibly have affected iron and strontium levels. The natural limestone geology and lime application in farming most likely influenced the increase of calcium and magnesium levels.

Table 53: Humber River at Humber Village Bridge - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Barium	Atmospheric Deposition	Copper Total	Atmospheric Deposition
Lead	Atmospheric Deposition	pH	Abatement
Mercury	Atmospheric Deposition		
pH	Natural Sources/ Farming		
Potassium	Climate Change		
Deteriorating Trend			
Calcium	Farming	Calcium Dissolved	Farming
Colour Apparent	Climate Change/ Forestry/ Farming/ Urban Development	DOC	Global Carbon Emissions
Dissolved Oxygen	Farming/ Sewage	Colour Apparent	Climate Change/ Forestry/ Farming/ Urban Development
Iron	Landfill/ Stream Modification	Iron Total	Landfill/ Stream Modification
Nitrate & Nitrite	Farming/ Sewage	Magnesium Dissolved	Farming
Nitrogen	Farming/ Sewage	Strontium Total	Landfill/ Stream Modification
Silica	Farming/ Climate Change	Turbidity	Climate Change/ Forestry/ Farming/ Mining/ Urban Development
Turbidity	Climate Change/ Forestry/ Farming/ Mining/ Urban Development		
Censored			
		Arsenic Total	Censored
		Beryllium Total	Censored
		Cadmium Total	Censored
		Chromium Total	Censored
		Cobalt Total	Censored
		Lead Total	Censored
		Molybdenum Total	Censored
		Nickel	Censored
		Selenium Total	Censored

6.3.5 Humber River at Little Falls Bridge (NF02YL0011)

Humber River at Little Falls Bridge is in Route #422 prior to Sir Richard Squires Memorial Park. The CESI land use category classifies the station as remote. CANAL lists the surrounding development pressure as low. RBA ranks the level of overall risk to water quality as low.

6.3.5.1 Parameter Time Series Graph

Figures 53 and 54 display the parameter time series graphs for improving and deteriorating trend parameters for Humber River at Little Falls Bridge.

Figure 53: Humber River at Little Falls Bridge - Improving Trend Parameters

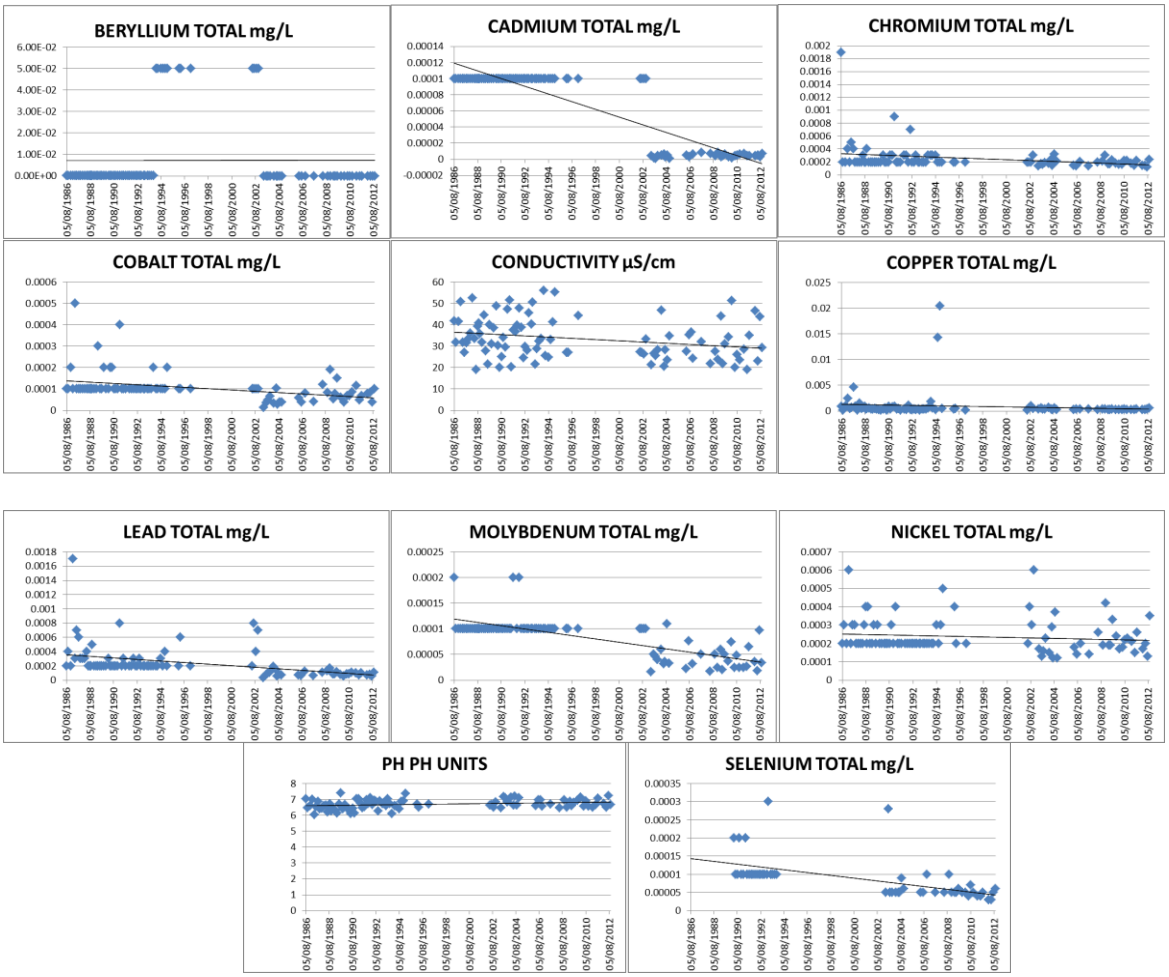
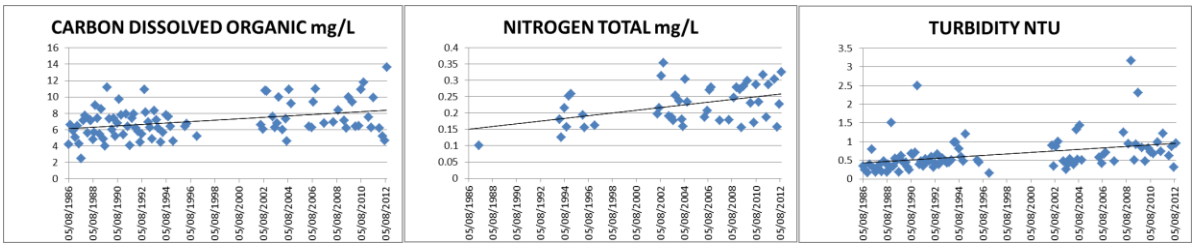


Figure 54: Humber River at Little Falls Bridge - Deteriorating Trend Parameters



6.3.5.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 54 displays overall water quality parameters trend results for Humber River at Little Falls Bridge.

Table 54: Humber River at Little Falls Bridge - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	90	0.05	0.82	-0.02	No	0.73	-0.03	No
AST	67	0.05	0.15	0.18	No	0.11	0.14	No
BAT	90	0.05	0.11	-0.17	No	0.13	-0.11	No
BET	90	0.05	0	-0.56	Down	0	-0.34	Down
CAD	91	0.05	0.16	-0.15	No	0.13	-0.11	No
DOC	90	0.05	0.01	0.29	Up	0.01	0.2	Up
CDT	90	0.05	0	-0.79	Down	0	-0.59	Down
CLT	27	0.05	0.46	0.15	No	0.06	0.07	No
COLOURA	91	0.05	0.05	0.21	No	0.05	0.14	No
COND	91	0.05	0.01	-0.26	Down	0.01	-0.18	Down
COT	89	0.05	0	-0.53	Down	0	-0.37	Down
CRT	89	0.05	0	-0.37	Down	0	-0.28	Down
CUT	89	0.05	0	-0.43	Down	0	-0.31	Down
FET	89	0.05	0.11	0.17	No	0.1	0.12	No
KU	37	0.05	0.76	0.05	No	0.79	0.03	No
LIT	88	0.05	0.1	-0.17	No	0.1	-0.13	No
MGD	91	0.05	0.06	-0.2	No	0.06	-0.14	No
MOT	89	0.05	0	-0.75	Down	0	-0.57	Down
NAU	37	0.05	0.57	0.1	No	0.5	0.08	No
NIT	89	0.05	0.03	-0.23	Down	0.03	-0.17	Down
NT	46	0.05	0.01	0.37	Up	0.01	0.27	Up
PBT	89	0.05	0	-0.74	Down	0	-0.54	Down
PH	91	0.05	0	0.3	Up	0.01	0.19	Up
PT	91	0.05	0.11	0.17	No	0.15	0.1	No
SET	54	0.05	0	-0.79	Down	0	-0.63	Down
SIO2	26	0.05	0.96	0.01	No	0.79	0.04	No
SOT	27	0.05	0.08	-0.34	No	0.07	-0.25	No
SRT	89	0.05	0.35	-0.1	No	0.32	-0.07	No
TURB	91	0.05	0	0.53	Up	0	0.38	Up
VT	89	0.05	0.73	-0.04	No	0.68	-0.03	No
ZNT	89	0.05	0.67	-0.05	No	0.69	-0.03	No

6.3.5.3 Comparison and Causes of Change from Past

Table 55 compares trend for Humber River at Little Falls Bridge between Phase I and Phase II.

Conductivity, copper, pH and sodium displayed improving trend. DOC, nitrogen and turbidity displayed deteriorating trend. Beryllium, cadmium, chromium, cobalt, lead, molybdenum, nickel and selenium displayed improving trend with censor majority data.

When comparing the trend results between Phase I and Phase II, turbidity deteriorated over the years. Mercury, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Sodium and sulphate, which improved in the past, displayed no trend in the current report. Colour, which deteriorated in the past, displayed no trend in the current report.

Reduction in atmospheric deposition has improved copper while natural limestone geology lead to improvement of pH.

Changes in climate since 1986 have resulted in an increased precipitation across the province, affecting streamflow and decreasing conductivity, while increasing nitrogen and turbidity levels. Forestry activity may also have affect nitrogen and turbidity levels. The increase of global carbon emissions observed across the north likely deteriorated DOC levels.

Table 55: Humber River at Little Falls Bridge - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Mercury	Atmospheric Deposition	Conductivity	Climate Change
Sodium	Climate Change	Copper Total	Atmospheric Deposition
Sulphate	Climate Change/ Atmospheric	pH	Natural Sources
Deteriorating Trend			
Colour	Climate Change/ Forestry	DOC	Global Carbon Emissions
Turbidity	Climate Change/ Forestry	Nitrogen Total	Climate Change/ Forestry
		Turbidity	Climate Change/ Forestry
Censored			
Beryllium	Censored	Beryllium Total	Censored
Cadmium	Censored	Cadmium Total	Censored
Molybdenum	Censored	Chromium Total	Censored
		Cobalt Total	Censored
		Lead Total	Censored
		Molybdenum Total	Censored
		Nickel Total	Censored
		Selenium Total	Censored

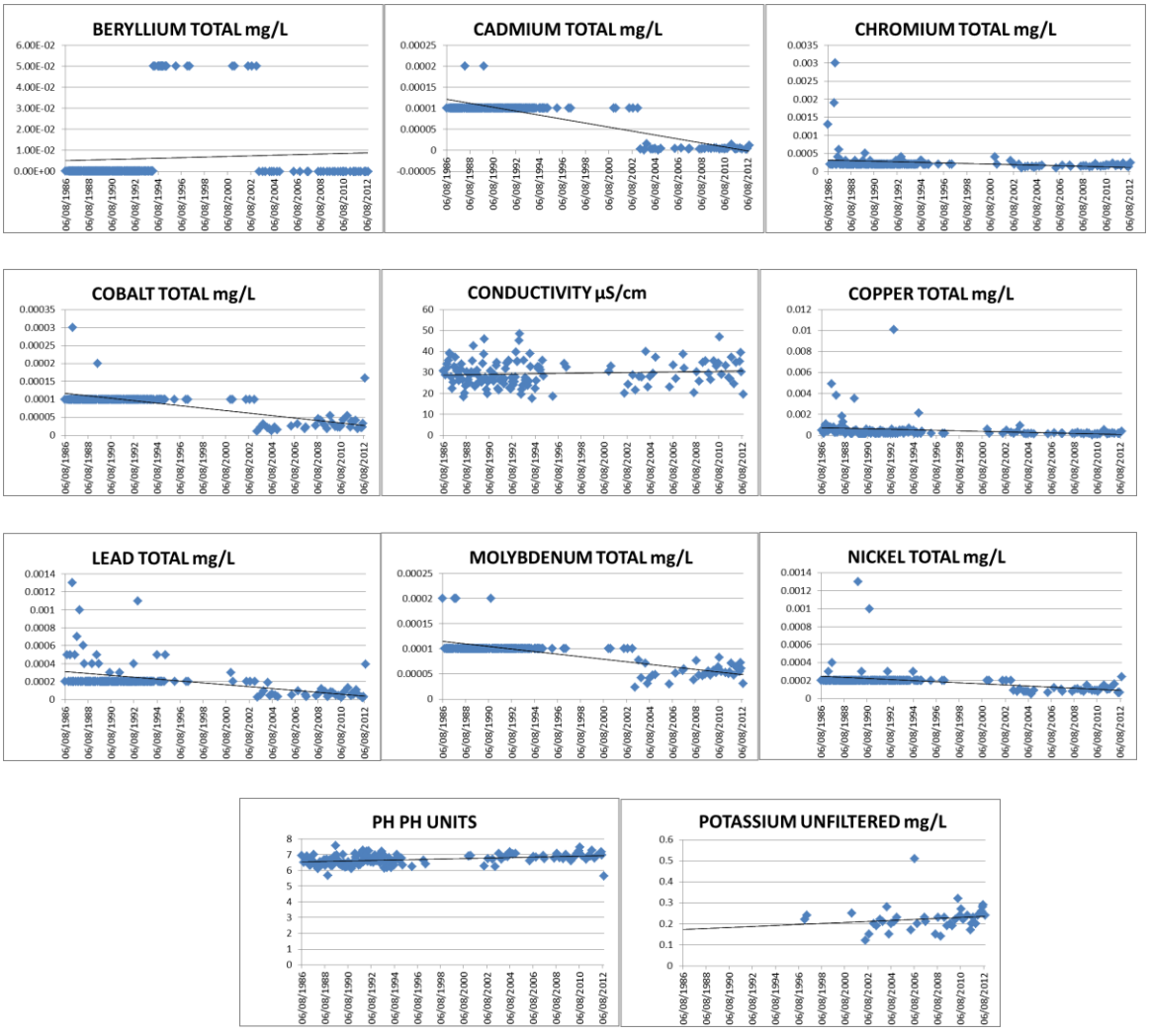
6.3.6 Lloyds River at Bridge at Burgeo Road (NFO2YN0001)

Lloyds River at Route 480 is in a remote area close to the south coast of the island of Newfoundland. The CESI land use category classifies the station as remote. CANAL lists the surrounding development pressure as low. RBA ranks the level of overall risk to water quality as low.

6.3.6.1 Parameter Time Series Graph

Figures 55 and 56 display the parameter time series graphs for improving and deteriorating trend parameters for Lloyds River at Bridge at Burgeo Road.

Figure 55: Lloyds River at Bridge at Burgeo Road - Improving Trend Parameters



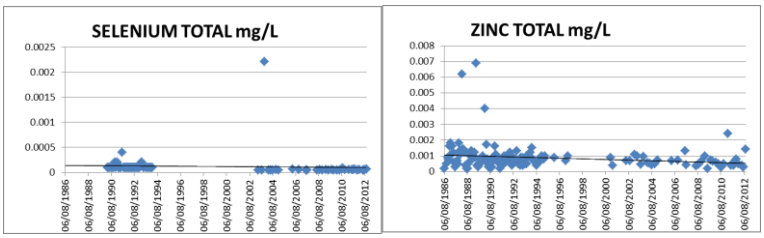
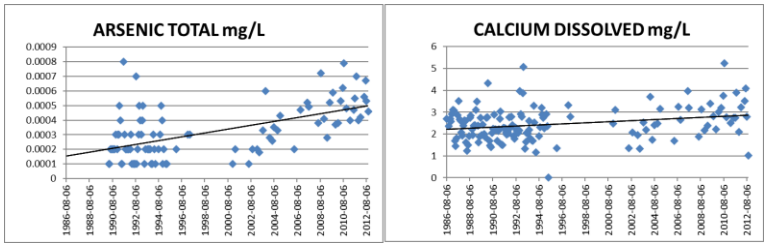
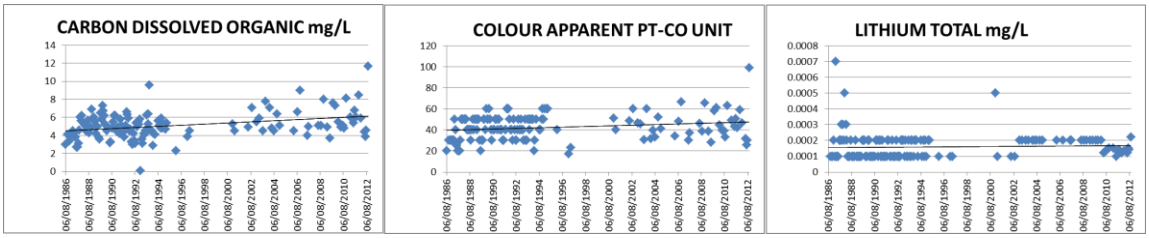
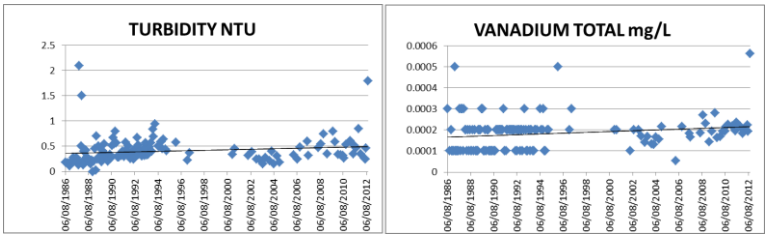


Figure 56: Lloyds River at Bridge at Burgeo Road - Deteriorating Trend Parameters







6.3.6.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 56 displays overall water quality parameters trend results for Lloyds River at Route 480.

Table 56: Lloyds River at Bridge at Burgeo Road - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	142	0.05	0.38	-0.07	No	0.27	-0.06	No
AST	98	0.05	0	0.52	Up	0	0.38	Up
BAT	142	0.05	0.58	-0.05	No	0.66	-0.03	No
BET	142	0.05	0	-0.42	Down	0	-0.26	Down
CAD	144	0.05	0.02	0.2	Up	0.02	0.14	Up
DOC	143	0.05	0	0.27	Up	0	0.18	Up
CDT	142	0.05	0	-0.73	Down	0	-0.56	Down
CLT	31	0.05	0.34	0.18	No	0.37	0.12	No
COLOURA	143	0.05	0.02	0.19	Up	0.02	0.14	Up
COND	101	0.05	0	-0.32	Down	0	-0.22	Down
COT	141	0.05	0	-0.68	Down	0	-0.52	Down
CRT	141	0.05	0	-0.53	Down	0	-0.4	Down
CUT	141	0.05	0	-0.55	Down	0	-0.4	Down
FET	141	0.05	0.62	0.04	No	0.64	0.03	No
LIT	140	0.05	0.02	0.19	Up	0.03	0.14	Up
MGD	144	0.05	1	0	No	0.98	0	No
MOT	141	0.05	0	-0.74	Down	0	-0.56	Down
NAU	143	0.05	0.39	0.07	No	0.42	0.05	No
NIT	141	0.05	0	-0.65	Down	0	-0.5	Down
NT	54	0.05	0.76	0.04	No	0.75	0.03	No
PBT	141	0.05	0	-0.67	Down	0	-0.52	Down
PH	143	0.05	0	0.39	Up	0	0.27	Up
PT	144	0.05	0.23	0.1	No	0.27	0.06	No
SET	80	0.05	0	-0.75	Down	0	-0.54	Down
SIO2	51	0.05	0.11	0.23	No	0.06	0.18	No
SOT	31	0.05	0.28	-0.2	No	0.23	-0.15	No
SRT	141	0.05	0.32	0.08	No	0.29	0.06	No
TURB	142	0.05	0	0.38	Up	0	0.28	Up
VT	141	0.05	0.01	0.22	Up	0.01	0.17	Up
ZNT	141	0.05	0	-0.24	Down	0	-0.18	Down

6.3.6.3 Comparison and Causes of Change from Past

Table 57 compares trend for Lloyds River between Phase I and Phase II.

Conductivity, copper, pH, potassium and zinc displayed improving trend. Arsenic, calcium, DOC, colour, nitrogen and turbidity displayed deteriorating trend. Beryllium, cadmium, chromium, cobalt, lead, lithium, molybdenum, nickel, selenium and vanadium displayed improving trend with censor majority data.

When comparing the trend results between Phase I and Phase II, copper continued to improve over time while turbidity deteriorated over the years. Cadmium and vanadium, which deteriorated in the past, showed improving trend with censor majority data in the current report.

Mercury, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Nitrate, nitrite and dissolved oxygen, which deteriorated in the past, was excluded from the current analysis due to unavailability of more recent data. Sodium, which improved in the past, displayed no trend in the current report. Potassium, having only one year of common data period with Phase I report, was considered insufficient for comparative analysis.

Reduction in atmospheric deposition have improved copper while natural limestone geology led to improvement of pH and deterioration of calcium. Natural geology sources may have also increased arsenic levels.

Changes in climate since 1986 have resulted in an increased precipitation across the province, affecting streamflow and decreasing conductivity and potassium, while increasing colour and turbidity levels. Forestry activity may also have affected calcium, colour and turbidity levels. The increase of global carbon emissions observed across the north likely deteriorated DOC levels.

Table 57: Lloyds River at Bridge at Burgeo Road - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Copper	Atmospheric Deposition	Copper Total	Atmospheric Deposition
Mercury	Atmospheric Deposition	Conductivity	Climate Change
Potassium	Climate Change	pH	Natural Sources
Sodium	Climate Change	Zinc Total	Atmospheric Deposition
Deteriorating Trend			
Cobalt	Unknown	Arsenic Total	Natural Sources
Dissolved Oxygen	Unknown	Calcium Dissolved	Forestry / Natural Sources
Nitrate & Nitrite	Unknown	DOC	Global Carbon Emissions
Turbidity	Climate Change/ Forestry/ Mining	Colour Apparent	Climate Change/ Forestry/ Mining
Vanadium	Unknown	Turbidity	Climate Change/ Forestry/ Mining
Censored Trend			
Beryllium	Censored	Beryllium Total	Censored
Cadmium	Censored	Cadmium Total	Censored
		Chromium Total	Censored
		Cobalt Total	Censored
		Lead Total	Censored
		Lithium Total	Censored
		Molybdenum Total	Censored
		Nickel	Censored
		Selenium Total	Censored
		Vanadium Total	Censored

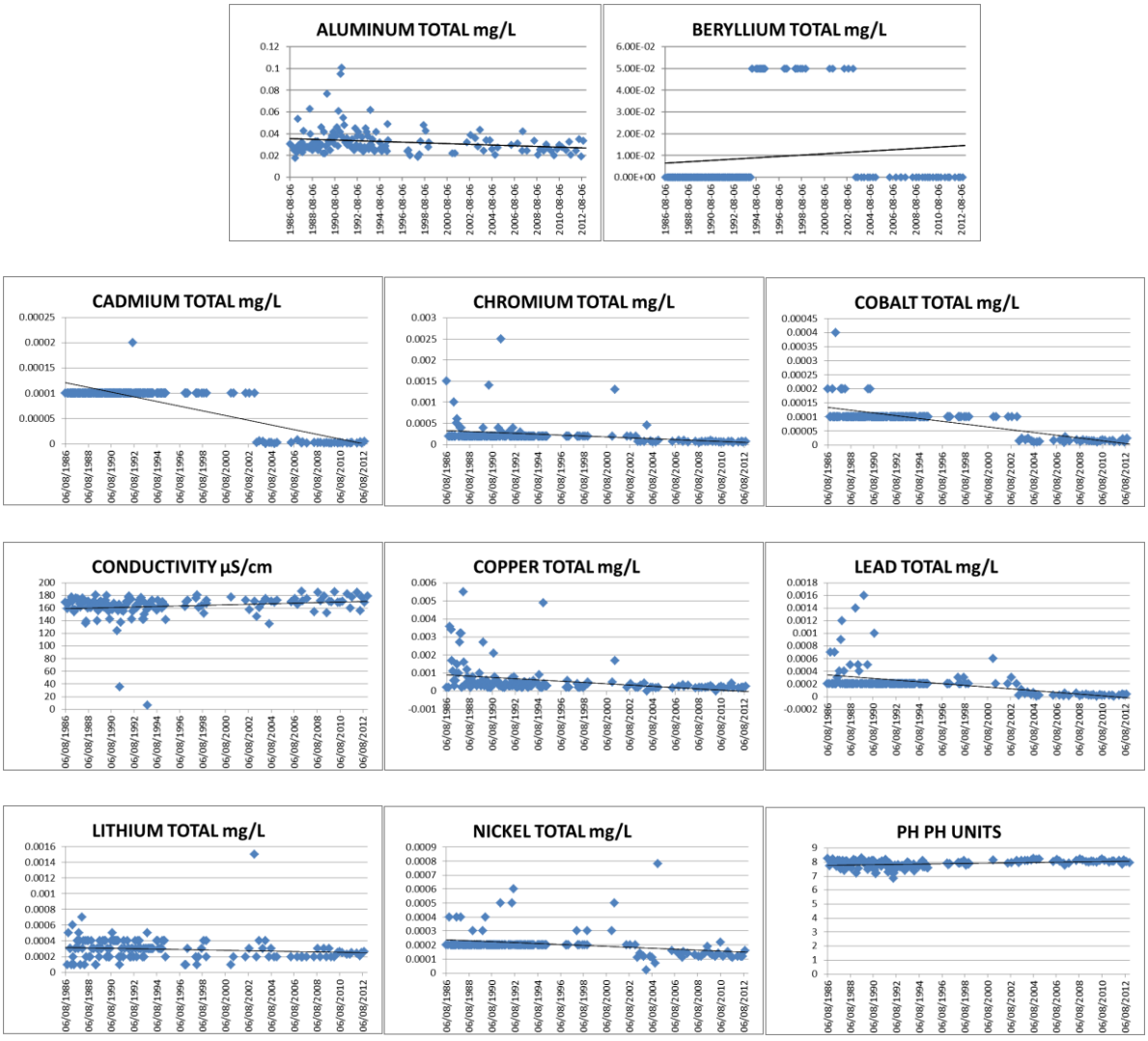
6.3.7 Lomond River at Route 431 (NF02YH0018)

Lomond River is located at Route 431 near the community of Lomond. The CESI land use category classifies the station as forestry. CANAL lists the surrounding development pressure as medium. RBA ranks the level of overall risk to water quality as medium.

6.3.7.1 Parameter Time Series Graph

Figures 57 and 58 display the parameter time series graphs for improving and deteriorating trend parameters for Lomond River at Route 431.

Figure 57: Lomond River at Route 431 - Improving Trend Parameters



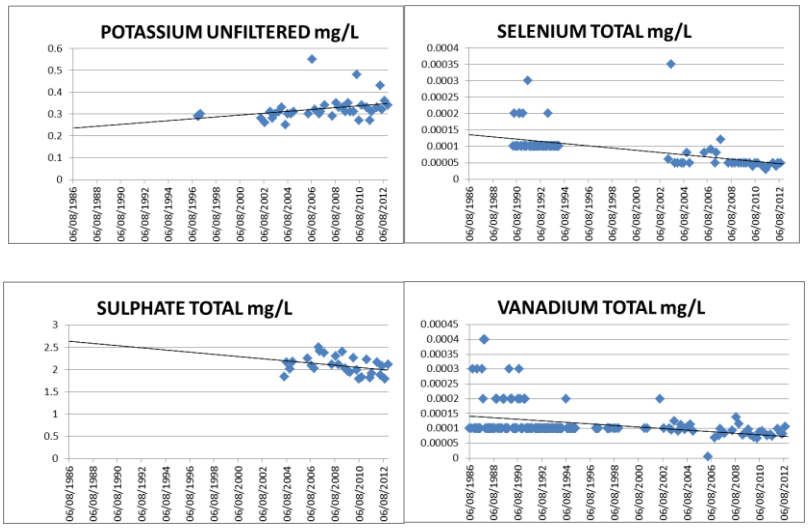
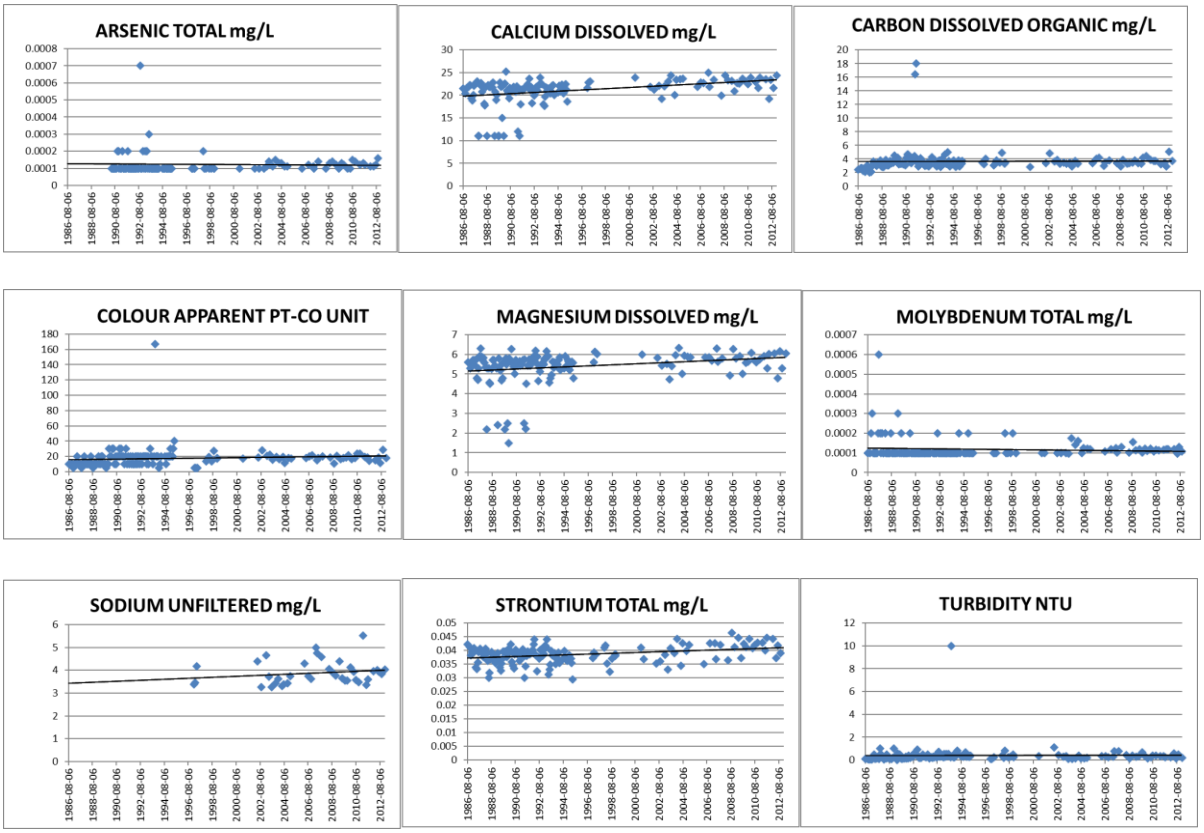


Figure 58: Lomond River at Route 431 - Deteriorating Trend Parameters



6.3.7.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 58 displays overall water quality parameters trend results for Lomond River at Route 431.

Table 58: Lomond River at Route 431 - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	147	0.05	0.04	-0.17	Down	0.04	-0.11	Down
AST	104	0.05	0	0.35	Up	0	0.28	Up
BAT	147	0.05	0.06	0.16	No	0.08	0.1	No
BET	147	0.05	0	-0.27	Down	0.03	-0.14	Down
CAD	142	0.05	0	0.38	Up	0	0.26	Up
DOC	149	0.05	0	0.28	Up	0	0.2	Up
CDT	147	0.05	0	-0.69	Down	0	-0.55	Down
CLT	29	0.05	0.78	-0.05	No	0.67	-0.06	No
COLOURA	149	0.05	0	0.35	Up	0	0.23	Up
COND	102	0.05	0	-0.39	Down	0	-0.27	Down
COT	145	0.05	0	-0.74	Down	0	-0.6	Down
CRT	145	0.05	0	-0.65	Down	0	-0.52	Down
CUT	145	0.05	0	-0.5	Down	0	-0.37	Down
FET	145	0.05	0.53	0.05	No	0.56	0.03	No
LIT	144	0.05	0.01	-0.22	Down	0.01	-0.16	Down
MGD	142	0.05	0	0.29	Up	0	0.2	Up
MOT	145	0.05	0.01	0.23	Up	0.01	0.18	Up
NIT	145	0.05	0	-0.54	Down	0	-0.41	Down
NT	60	0.05	0.06	0.25	No	0.04	0.18	Up
PBT	145	0.05	0	-0.69	Down	0	-0.54	Down
PH	149	0.05	0.05	0.16	Up	0.04	0.12	Up
PT	149	0.05	0.29	-0.09	No	0.35	-0.05	No
SET	78	0.05	0	-0.79	Down	0	-0.64	Down
SIO2	59	0.05	0.18	0.18	No	0.14	0.13	No
SRT	145	0.05	0.01	0.21	Up	0.02	0.13	Up
TURB	149	0.05	0	0.32	Up	0	0.23	Up
VT	145	0.05	0	-0.51	Down	0	-0.4	Down
ZNT	145	0.05	0.28	-0.09	No	0.34	-0.06	No

6.3.7.3 Comparison and Causes of Change from Past

Table 59 compares trend for Lomond River between Phase I and Phase II.

Aluminum, conductivity, copper, lithium and pH displayed improving trend. DOC, colour, magnesium, nitrogen, sodium, strontium and turbidity displayed deteriorating trend. Arsenic, beryllium, cadmium, chromium, cobalt, lead, molybdenum, nickel, selenium and vanadium displayed improving trend with censor majority data.

When comparing the trend results between Phase I and Phase II, copper continued to improve over time while colour, nitrogen, and turbidity deteriorated over the years.

Mercury, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Nitrate, nitrite, and dissolved oxygen, which deteriorated in the past, was excluded from the current analysis due to unavailability of more recent data. Barium and chloride, which improved in the past, are showing no trend in the current report. Silica and sulphate, which deteriorated in the past, is showing no trend in the current report. Potassium, sodium and sulphate having only one year of common data period with Phase I report, was considered insufficient for comparative analysis.

Reduction in atmospheric deposition may have led to improved aluminum, copper, and lithium. Natural limestone geology led to improvement of pH.

Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow and decreasing the concentration of conductivity, while increasing colour, and turbidity. The increase of global carbon emissions observed across the north likely linked to the deterioration of DOC levels. Forestry, cabin development, and several quarries might also have affected colour and turbidity along with calcium and magnesium. Cabin development and septic systems around Bonne Bay Big Pond and Bonne Bay Little Pond have contributed to deteriorating nitrogen levels. Mineral exploration in the area may lead to an increase in strontium levels.

Table 59: Lomond River at Route 431 - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Barium	Atmospheric Deposition	Aluminum Total	Atmospheric Deposition
Chloride	Climate Change	Copper Total	Atmospheric Deposition
Copper	Atmospheric Deposition	Conductivity	Climate Change
Mercury	Atmospheric Deposition	Lithium Total	Atmospheric Deposition
Potassium	Climate Change	pH	Natural Source
Sodium	Climate Change		
Deteriorating Trend			
Colour	Climate Change/ Forestry/ Recreation/ Mining	Calcium Dissolved	Forestry/ Recreation
Dissolved Organic Carbon	Climate Change	DOC	Global Carbon Emissions
Molybdenum	Censored	Colour Apparent	Climate Change/ Forestry/ Recreation/ Mining
Nitrate & Nitrite	Rural Sewage Systems	Magnesium Dissolved	Forestry/ Recreation
Nitrogen	Rural Sewage Systems	Nitrogen Total	Rural Sewage Systems
pH	Unknown	Strontium Total	Mining
Silica	Climate Change	Turbidity	Climate Change/ Forestry/ Recreation/ Mining
Turbidity	Climate Change/ Forestry/ Recreation/ Mining		
Censored Trend			
Beryllium	Censored	Beryllium Total	Censored
Cadmium	Censored	Cadmium Total	Censored
		Chromium Total	Censored
		Cobalt Total	Censored
		Lead Total	Censored
		Molybdenum Total	Censored
		Nickel Total	Censored
		Selenium Total	Censored
		Vanadium Total	Censored

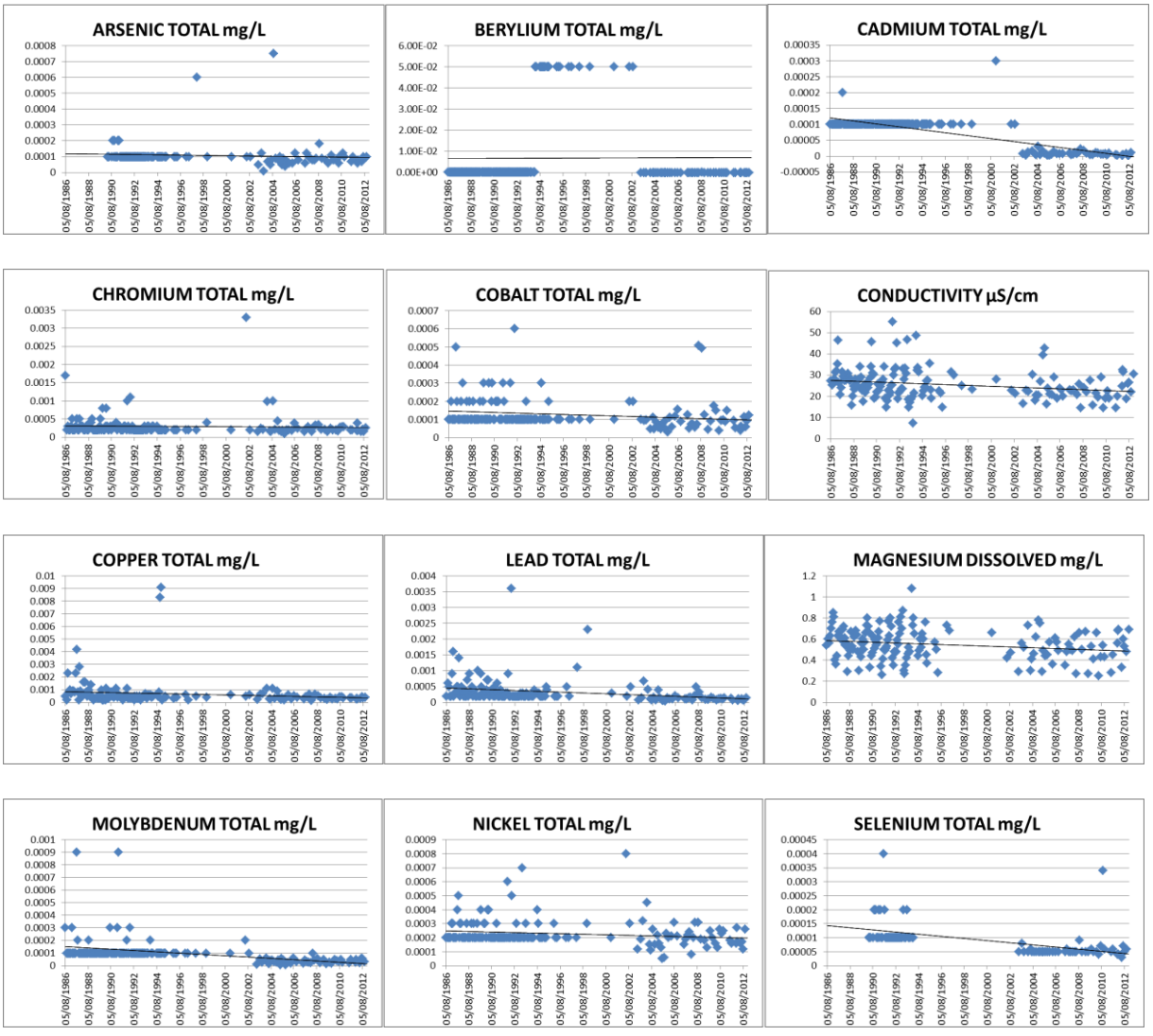
6.3.8 Main River at Route 420 (NF02YG0001)

Main River is located at Route 420. The CESI land use category classifies the station as remote. CANAL lists the surrounding development pressure as low. RBA ranks the level of overall risk to water quality as low.

6.3.8.1 Parameter Time Series Graph

Figures 59 and 60 display the parameter time series graphs for improving and deteriorating trend parameters for Main River at Route 420.

Figure 59: Main River at Route 420 - Improving Trend Parameters



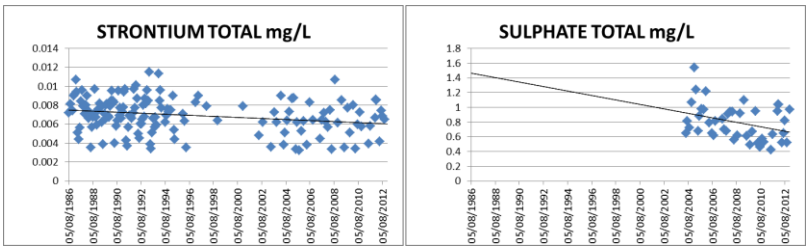
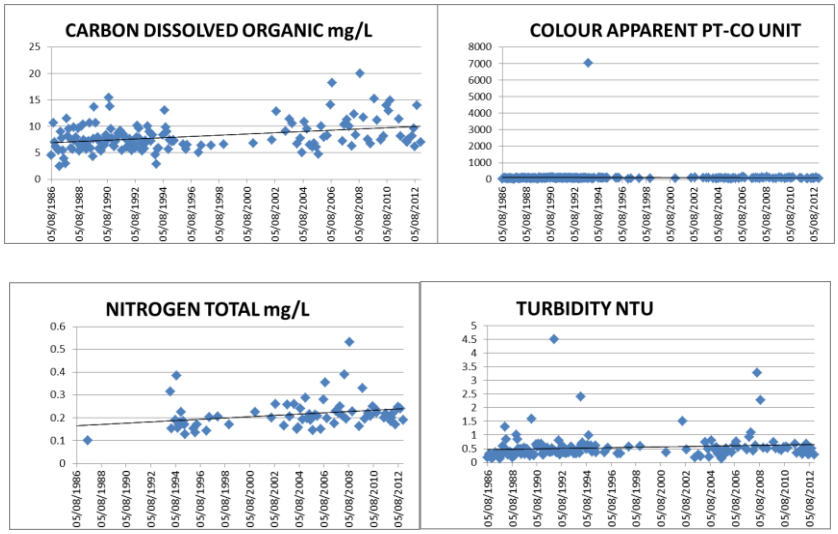


Figure 60: Main River at Route 420 - Deteriorating Trend Parameters



6.3.8.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 60: Main River at Route 420 - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	155	0.05	0.8	-0.02	No	0.68	-0.02	No
AST	111	0.05	0	-0.45	Down	0	-0.34	Down
BAT	155	0.05	0.06	-0.15	No	0.05	-0.11	No
BET	155	0.05	0	-0.5	Down	0	-0.31	Down
CAD	155	0.05	0.32	-0.08	No	0.33	-0.05	No
DOC	156	0.05	0	0.26	Up	0	0.17	Up
CDT	155	0.05	0	-0.76	Down	0	-0.6	Down
CLT	43	0.05	0.9	0.02	No	0.9	0.01	No
COLOURA	157	0.05	0.01	0.2	Up	0.02	0.13	Up
COND	157	0.05	0	-0.3	Down	0	-0.2	Down
COT	154	0.05	0	-0.38	Down	0	-0.29	Down
CRT	154	0.05	0	-0.27	Down	0	-0.2	Down
CUT	154	0.05	0	-0.34	Down	0	-0.24	Down
FET	154	0.05	0.1	0.13	No	0.1	0.09	No
KU	51	0.05	0.33	-0.14	No	0.32	-0.1	No
LIT	153	0.05	0.14	-0.12	No	0.17	-0.08	No
MGD	155	0.05	0.01	-0.2	Down	0.02	-0.13	Down
MOT	154	0.05	0	-0.74	Down	0	-0.55	Down
NAU	51	0.05	0.98	0	No	0.94	0.01	No
NIT	154	0.05	0	-0.23	Down	0.01	-0.17	Down
NT	68	0.05	0	0.34	Up	0.01	0.23	Up
PBT	154	0.05	0	-0.6	Down	0	-0.45	Down
PH	157	0.05	0.89	-0.01	No	0.94	0	No
PT	155	0.05	0.08	0.14	No	0.09	0.09	No
SET	90	0.05	0	-0.77	Down	0	-0.61	Down
SIO2	54	0.05	0.12	0.21	No	0.09	0.16	No
SRT	154	0.05	0	-0.24	Down	0	-0.16	Down
TURB	156	0.05	0	0.32	Up	0	0.22	Up
VT	154	0.05	0.12	0.13	No	0.12	0.09	No
ZNT	154	0.05	0.07	-0.14	No	0.09	-0.09	No

6.3.8.3 Comparison and Causes of Change from Past

Table 61 compares trend for Main River between Phase I and Phase II.

Main River showed an improvement in conductivity, copper, magnesium, potassium and strontium. It showed a deterioration of DOC, colour, nitrogen and turbidity. Arsenic, beryllium, cadmium, chromium, cobalt, lead, molybdenum, nickel and selenium displayed improving trend with censor majority data.

When comparing the trend results between Phase I and Phase II, conductivity, copper and sulphate continued to improve over time while colour and turbidity deteriorated over the years.

Mercury, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Chloride, potassium and sodium, which improved in the past, displayed no trend in the current report. Sulphate did not have common data for comparison between the two phases.

Reductions in atmospheric deposition may improve copper and strontium. Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow and decreasing the concentration of major ions and conductivity, while increasing turbidity, nitrogen and colour. Forestry, cabin development and several quarries might also be affecting colour, nitrogen and turbidity.

The increase of global carbon emissions observed across the north likely linked to the deterioration of DOC levels.

Table 61: Main River at Route 420 - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Conductivity	Climate Change	Conductivity	Climate Change
Chloride	Climate Change	Copper Total	Atmospheric Deposition
Copper	Atmospheric Deposition	Magnesium Dissolved	Climate Change
Lead	Atmospheric Deposition/ Abatement	Strontium Total	Atmospheric Deposition
Mercury	Atmospheric Deposition		
Potassium	Climate Change		
Sodium	Climate Change		
Sulphate	Climate Change/ Atmospheric Deposition		
Deteriorating Trend			
Colour	Climate Change/ Forestry	DOC	Global Carbon Emissions
Turbidity	Climate Change/ Forestry	Colour Apparent	Climate Change/ Forestry
		Nitrogen Total	Climate Change/ Forestry
		Turbidity	Climate Change/ Forestry
Censored Trend			
Beryllium	Censored	Arsenic Total	Censored
		Beryllium Total	Censored
		Cadmium Total	Censored
		Chromium Total	Censored
		Cobalt Total	Censored
		Lead Total	Censored
		Molybdenum Total	Censored
		Nickel Total	Censored
		Selenium Total	Censored

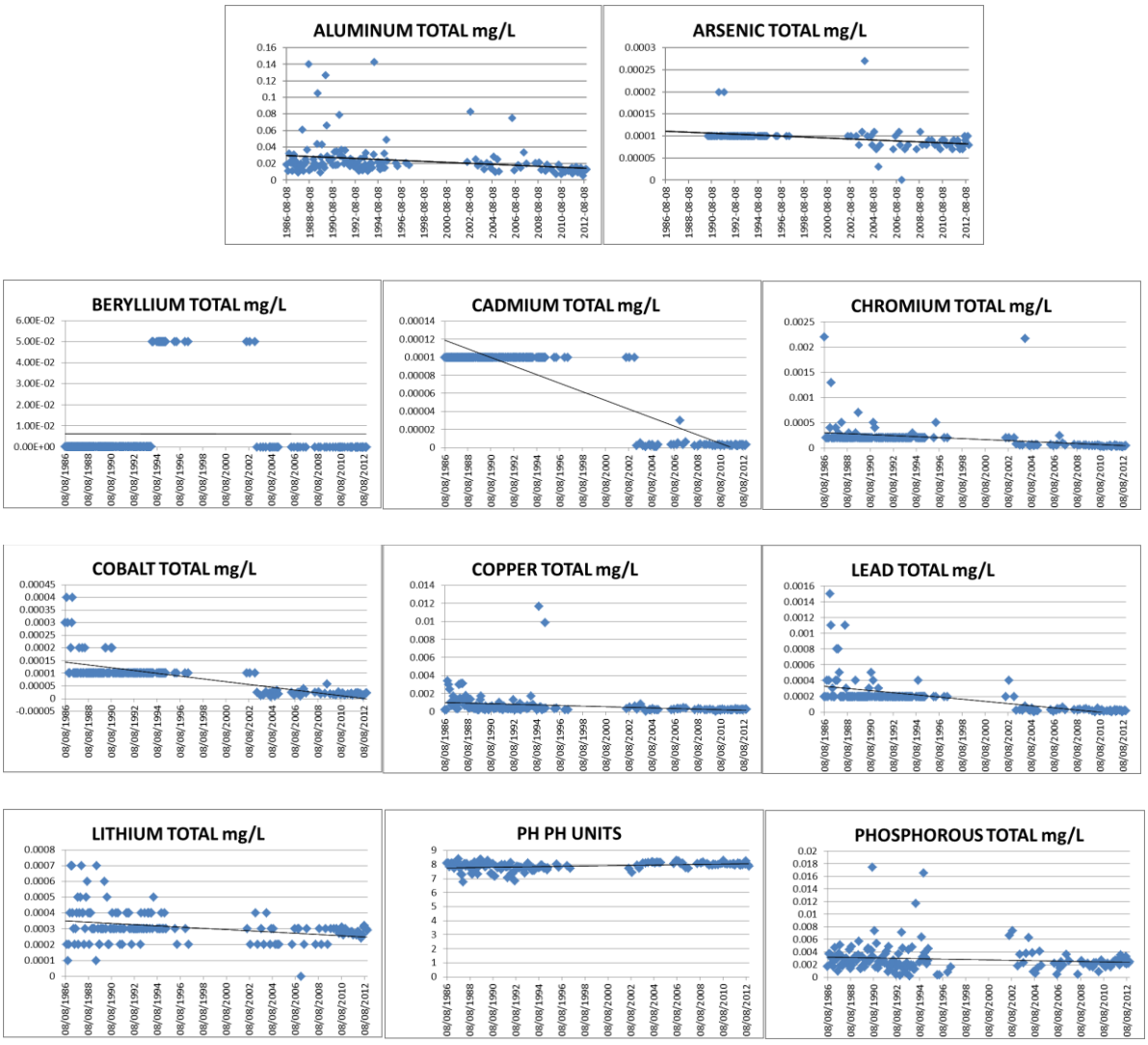
6.3.9 Pinchgut Brook at TCH (NF02YJ0004)

Pinchgut Brook is located on the TCH. The CESI land use category classifies the station as forestry. CANAL lists the surrounding development pressure as low. RBA ranks the level of overall risk to water quality as medium.

6.3.9.1 Parameter Time Series Graph

Figures 61 and 62 display the parameter time series graphs for improving and deteriorating trend parameters for Pinchgut Brook at TCH.

Figure 61: Pinchgut Brook at TCH - Improving Trend Parameters



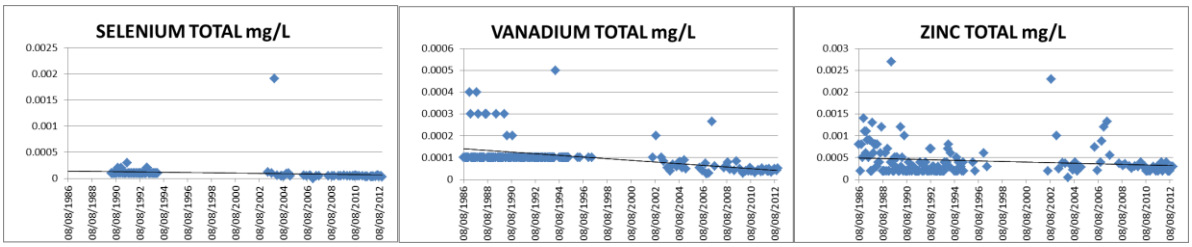
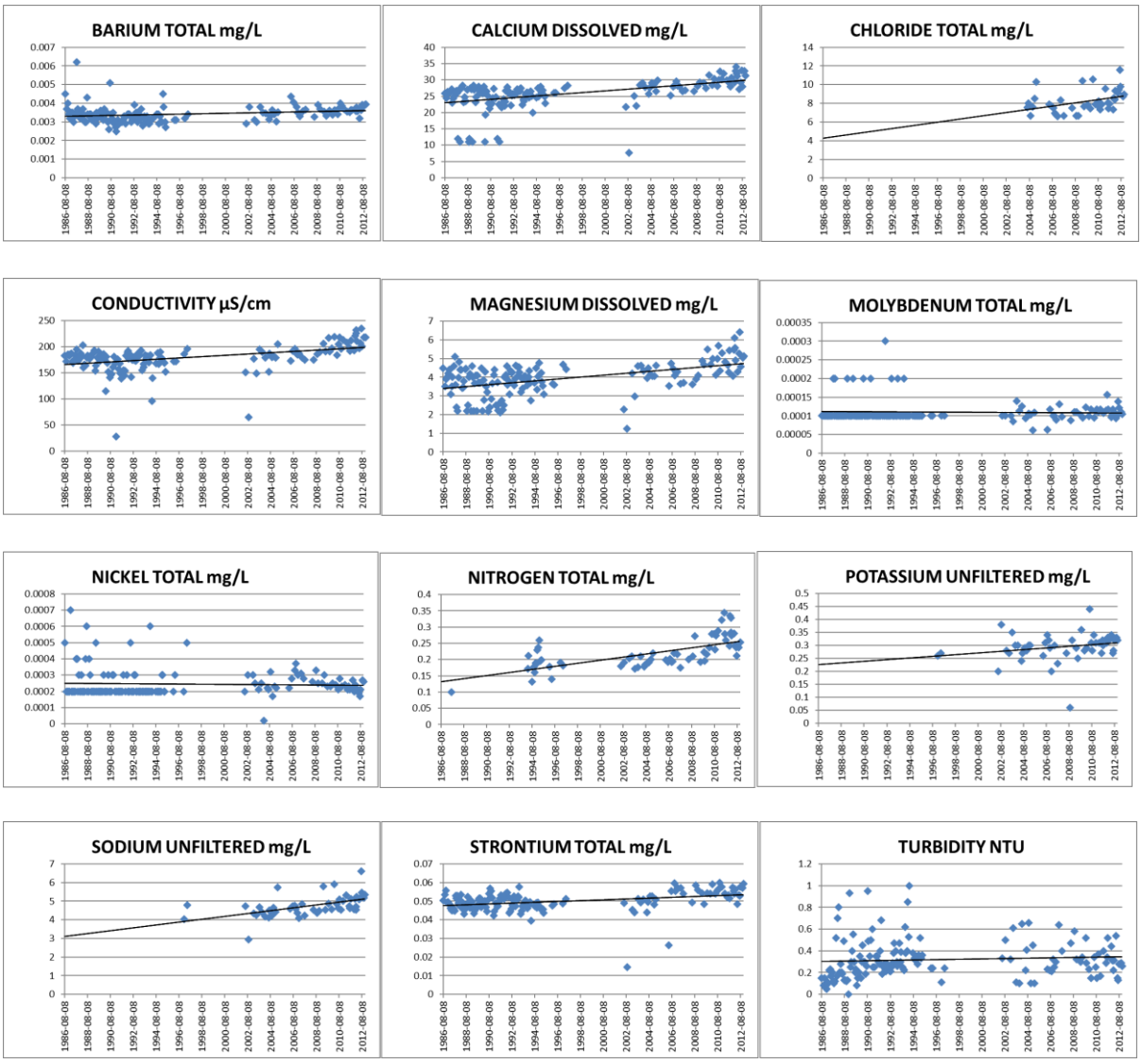


Figure 62: Pinchgut Brook at TCH - Deteriorating Trend Parameters



6.3.9.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 62: Pinchgut Brook at TCH - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	152	0.05	0.00	-0.37	Down	0.00	-0.37	Down
AST	109	0.05	0.00	-0.64	Down	0.00	-0.64	Down
BAT	152	0.05	0.00	0.24	Up	0.00	0.24	Up
BET	152	0.05	0.00	-0.53	Down	0.00	-0.53	Down
CAD	153	0.05	0.00	0.56	Up	0.00	0.56	Up
DOC	155	0.05	0.14	-0.12	No	0.14	-0.12	No
CDT	152	0.05	0.00	-0.78	Down	0.00	-0.78	Down
COLOURA	155	0.05	0.08	0.14	No	0.08	0.14	No
COND	155	0.05	0.00	0.43	Up	0.00	0.43	Up
COT	151	0.05	0.00	-0.82	Down	0.00	-0.82	Down
CRT	151	0.05	0.00	-0.75	Down	0.00	-0.75	Down
CUT	151	0.05	0.00	-0.55	Down	0.00	-0.55	Down
FET	151	0.05	0.13	-0.12	No	0.13	-0.12	No
KU	51	0.05	0.01	0.37	Up	0.01	0.37	Up
LIT	150	0.05	0.00	-0.31	Down	0.00	-0.31	Down
MGD	154	0.05	0.00	0.44	Up	0.00	0.44	Up
MOT	151	0.05	0.01	0.22	Up	0.01	0.22	Up
NAU	51	0.05	0.00	0.62	Up	0.00	0.62	Up
NIT	151	0.05	0.01	0.22	Up	0.01	0.22	Up
NT	66	0.05	0.00	0.74	Up	0.00	0.74	Up
PBT	151	0.05	0.00	-0.80	Down	0.00	-0.80	Down
PH	155	0.05	0.01	0.22	Up	0.01	0.22	Up
SET	90	0.05	0.00	-0.82	Down	0.00	-0.82	Down
SIO2	52	0.05	0.04	0.29	Up	0.04	0.29	Up
SRT	151	0.05	0.00	0.39	Up	0.00	0.39	Up
TURB	155	0.05	0.00	0.26	Up	0.00	0.26	Up
VT	151	0.05	0.00	-0.75	Down	0.00	-0.75	Down
ZNT	151	0.05	0.03	-0.18	Down	0.03	-0.18	Down

6.3.9.3 Comparison and Causes of Change from Past

Table 63 compares trend for Pinchgut Brook between Phase I and Phase II.

Aluminum, copper, pH, phosphorus and zinc displayed improving trend. Barium, calcium, conductivity, magnesium, nitrogen, strontium and turbidity displayed deteriorating trend. Arsenic, beryllium, cadmium, chromium, cobalt, lead, lithium, molybdenum, nickel, selenium, silver and vanadium displayed improving trend with censor majority data.

When comparing the trend results between Phase I and Phase II, copper and zinc continued to improve over time while turbidity deteriorated over the years. pH which deteriorated in the past, improved in the current report. Lead, which improved in the past, continued to improve with censor majority data in the current report. Barium, which improved in the past, showed deterioration in the current report. Potassium, sodium and chloride having only one year of common data period with Phase I report, was considered insufficient for comparative analysis.

Mercury, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Dissolved oxygen, nitrate and nitrite, which deteriorated in the past, was excluded from the current analysis due to unavailability of more recent data. Sulphate, which improved in the past, displayed no trend in the current report. Colour, DOC carbon and silica, which deteriorated in the past, showed no trend in the current report.

Reductions in atmospheric deposition are affecting aluminum, copper and zinc. The cause of the deteriorating trend in pH is unknown. Phosphorous Control Acts implemented in the mid 1970s and continued to reduce the amounts of phosphorous used in detergents evident in the improvement of phosphorus.

Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow and increasing nitrogen and turbidity. Forestry and cabin development along Pinchgut Lake may also be influencing turbidity along with barium, calcium, conductivity and magnesium. Septic systems may be influencing nitrogen levels.

Table 63: Pinchgut Brook at TCH - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Barium	Atmospheric Deposition	Aluminum Total	Atmospheric Deposition
Chloride	Climate Change	Copper Total	Atmospheric Deposition
Copper	Atmospheric Deposition	pH	Unknown
Lead	Atmospheric Deposition/ Abatement	Phosphorous Total	Abatement
Mercury	Atmospheric Deposition	Zinc Total	Atmospheric Deposition
Potassium	Climate Change		
Sodium	Climate Change		
Sulphate	Climate Change/ Atmospheric Deposition		
Zinc	Atmospheric Deposition		
Deteriorating Trend			
Colour	Climate Change/ Forestry/ Recreation	Barium Total	Forestry/ Recreation
Dissolved Organic Carbon	Climate Change	Calcium Dissolved	Forestry / Recreation
Dissolved Oxygen	Rural Sewage Systems	Conductivity	Forestry / Recreation
Nitrate & Nitrite	Rural Sewage Systems	Magnesium Dissolved	Forestry / Recreation
pH	Unknown	Nitrogen Total	Rural Sewage Systems
Silica	Climate Change	Strontium Total	Forestry
Turbidity	Climate Change/ Forestry/ Recreation	Turbidity	Climate Change/ Forestry/ Recreation
Censored Trend			
Beryllium	Censored	Arsenic Total	Censored
Cadmium	Censored	Beryllium Total	Censored
Molybdenum	Censored	Cadmium Total	Censored
		Chromium Total	Censored
		Cobalt Total	Censored
		Lead Total	Censored
		Lithium Total	Censored
		Molybdenum Total	Censored
		Nickel Total	Censored
		Selenium Total	Censored
		Vanadium Total	Censored

6.3.10 Portland Creek at Route 430 (NF02YE0004)

Portland Creek is located at Route 430. The CESI land use category classifies the station as remote. CANAL lists the surrounding development pressure as low. RBA ranks the level of overall risk to water quality as low.

6.3.10.1 Parameter Time Series Graph

Figures 63 and 64 display the parameter time series graphs for improving and deteriorating trend parameters for Portland Creek at Route 430.

Figure 63: Portland Creek at Route 430 - Improving Trend Parameters

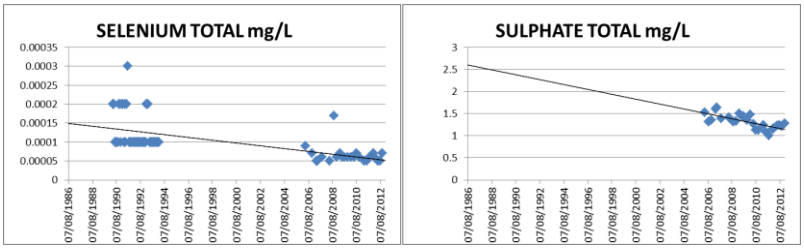
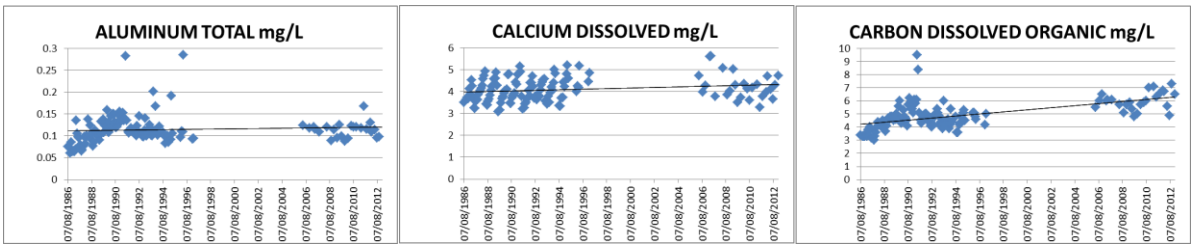
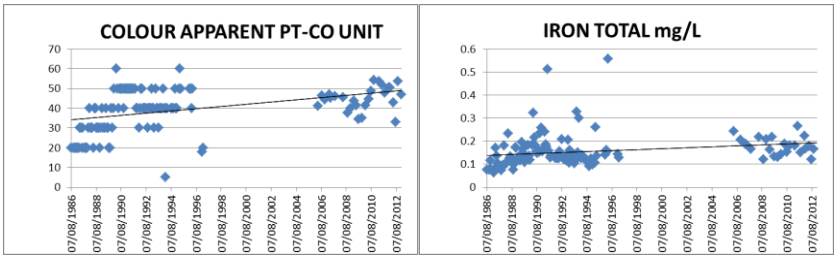
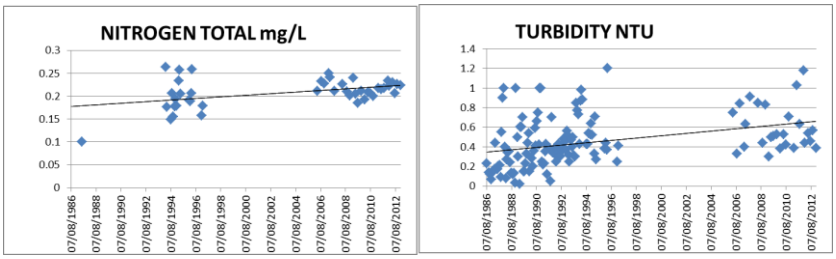


Figure 64: Portland Creek at Route 430 - Deteriorating Trend Parameters







6.3.10.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 64: Portland Creek at Route 430 - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	129	0.05	0.03	0.19	Up	0.04	0.12	Up
AST	87	0.05	0.34	-0.1	No	0.3	-0.09	No
BAT	129	0.05	0.03	-0.19	Down	0.04	-0.13	Down
BET	129	0.05	0	-0.28	Down	0.02	-0.16	Down
CAD	131	0.05	0.01	0.23	Up	0.01	0.16	Up
DOC	131	0.05	0	0.61	Up	0	0.45	Up
CDT	129	0.05	0	-0.65	Down	0	-0.52	Down
CLT	26	0.05	0.71	-0.08	No	0.64	-0.07	No
COLOURA	131	0.05	0	0.54	Up	0	0.4	Up
COND	131	0.05	0.04	-0.18	Down	0.07	-0.11	No
COT	127	0.05	0	-0.63	Down	0	-0.49	Down
CRT	127	0.05	0	-0.62	Down	0	-0.49	Down
CUT	127	0.05	0	-0.52	Down	0	-0.37	Down
FET	127	0.05	0	0.42	Up	0	0.29	Up
KU	28	0.05	0.36	-0.18	No	0.25	-0.16	No
LIT	126	0.05	0.32	-0.09	No	0.22	-0.08	No
MGD	131	0.05	0.27	0.1	No	0.2	0.08	No
MOT	127	0.05	0	-0.65	Down	0	-0.51	Down
NAU	28	0.05	0.16	-0.27	No	0.15	-0.2	No
NIT	127	0.05	0	-0.49	Down	0	-0.35	Down
NT	44	0.05	0.02	0.35	Up	0.02	0.25	Up
PBT	127	0.05	0	-0.65	Down	0	-0.51	Down
PH	131	0.05	0	0.37	Up	0	0.24	Up
PT	131	0.05	0.24	0.1	No	0.21	0.07	No
SET	70	0.05	0	-0.77	Down	0	-0.61	Down
SIO2	52	0.05	0.27	-0.16	No	0.26	-0.11	No
SOT	26	0.05	0	-0.72	Down	0	-0.46	Down
SRT	127	0.05	0.74	-0.03	No	0.8	-0.02	No
TURB	131	0.05	0	0.5	Up	0	0.35	Up
VT	127	0.05	0.5	-0.06	No	0.66	-0.03	No
ZNT	127	0.05	0.15	-0.13	No	0.14	-0.09	No

6.3.10.3 Comparison and Causes of Change from Past

Table 65 compares trend for Portland Creek between Phase I and Phase II.

Portland Creek showed an improvement in barium, conductivity, copper and pH. It showed a deterioration of aluminum, calcium, DOC, colour, iron, nitrogen and turbidity. Beryllium, cadmium, chromium, cobalt, lead, molybdenum, nickel and selenium displayed improving trend with censor majority data.

When comparing the trend results between Phase I and Phase II, barium, conductivity, copper and pH, continued to improve over time while aluminum, calcium, colour, DOC, iron, nitrogen and turbidity deteriorated over the years. Selenium, which improved in the past, improved with censor majority data in the current report. Beryllium, cadmium, cobalt, nickel and molybdenum, which deteriorated in the past, improved with censor majority data in the current report.

Mercury, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Nitrate, nitrite and manganese, which deteriorated in the past, was excluded from the current analysis due to unavailability of more recent data. Chloride, potassium and sodium, which improved in the past, showed no trend in the current report. Calcium, which deteriorated in the past, displayed no trend in the current report. Sulphate does not have common data in the two periods for comparison.

Reductions in atmospheric deposition have affected barium and copper. The improving trend in pH is likely due to natural geological conditions.

Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow, decreasing conductivity while increasing turbidity and colour. The increase of global carbon emissions observed across the north likely linked to the deterioration of DOC levels. Forestry activity may also be affecting colour and turbidity. Cabin development and septic systems around Portland Creek Pond have contributed to nutrient loading. No obvious explanation was found for the increase of aluminum in Portland Creek, unless it is a natural phenomenon. The cause of the deteriorating trend in calcium is unknown.

Table 65: Portland Creek at Route 430 - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Barium	Atmospheric Deposition	Barium Total	Atmospheric Deposition
Chloride	Climate Change	Copper Total	Atmospheric Deposition
Conductivity	Climate Change	Conductivity	Climate Change
Copper	Atmospheric Deposition	pH	Natural Sources
Lead	Atmospheric Deposition/ Abatement		
Mercury	Atmospheric Deposition		
pH	Natural Sources		
Potassium	Climate Change		
Selenium	Atmospheric Deposition		
Sodium	Climate Change		
Sulphate	Climate Change/ Atmospheric Deposition		
Deteriorating Trend			
Aluminium	Unknown/ Natural Sources	Aluminum Total	Natural Sources
Beryllium	Unknown/ Natural Sources	Calcium Dissolved	Unknown
Cadmium	Unknown/ Natural Sources	Carbon Dissolved Organic	Global Carbon Emissions
Calcium	Unknown	Colour Apparent	Climate Change/ Forestry
Cobalt	Unknown/ Natural Sources	Iron Total	Natural Sources
Colour	Climate Change/ Forestry	Nitrogen Total	Rural Sewage Systems
DOC	Climate Change	Turbidity	Climate Change/ Forestry
Iron	Unknown/ Natural Sources		
Manganese	Unknown/ Natural Sources		
Molybdenum	Unknown/ Natural Sources		
Nickel	Unknown/ Natural Sources		
Nitrate & Nitrite	Rural Sewage Systems		
Nitrogen	Rural Sewage Systems		
Turbidity	Climate Change/ Forestry		
Censored Trend			
		Beryllium Total	Censored
		Cadmium Total	Censored
		Chromium Total	Censored
		Cobalt Total	Censored
		Lead Total	Censored
		Molybdenum Total	Censored
		Nickel Total	Censored
		Selenium Total	Censored

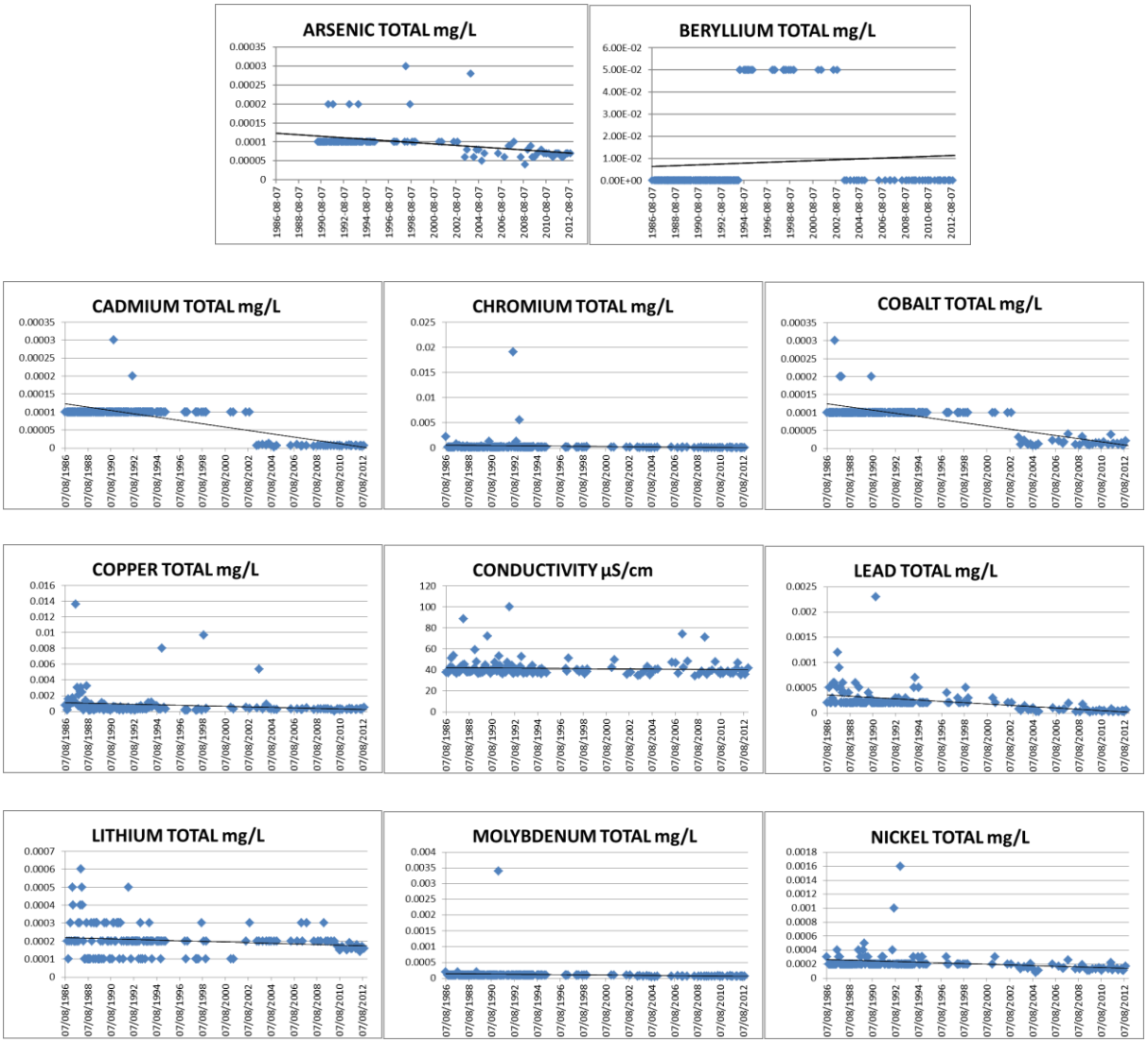
6.3.11 Western Brook at Route 430 (NF02YE0005)

Western Brook is located at Route 430. The CESI land use category classifies the station as remote. CANAL lists the surrounding development pressure as low. RBA ranks the level of overall risk to water quality as low.

6.3.11.1 Parameter Time Series Graph

Figures 65 and 66 display the parameter time series graphs for improving and deteriorating trend parameters for Western Brook at Route 430.

Figure 65: Western Brook at Route 430 - Improving Trend Parameters



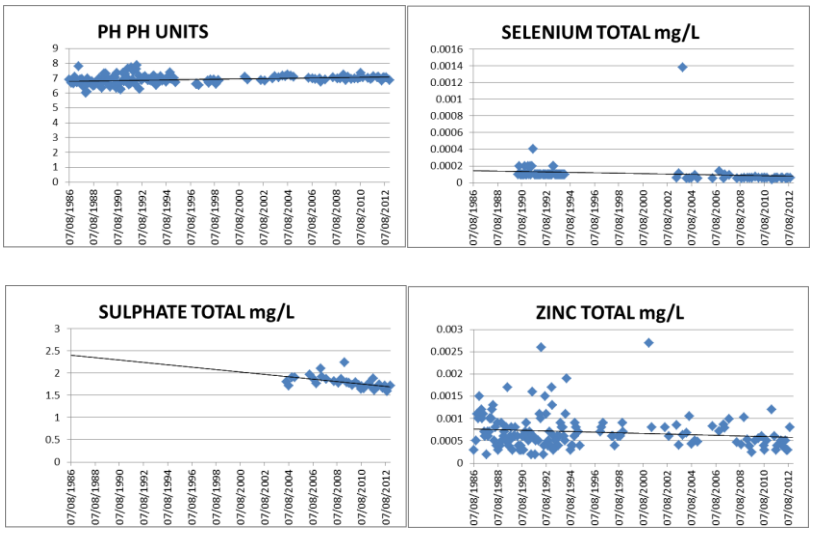
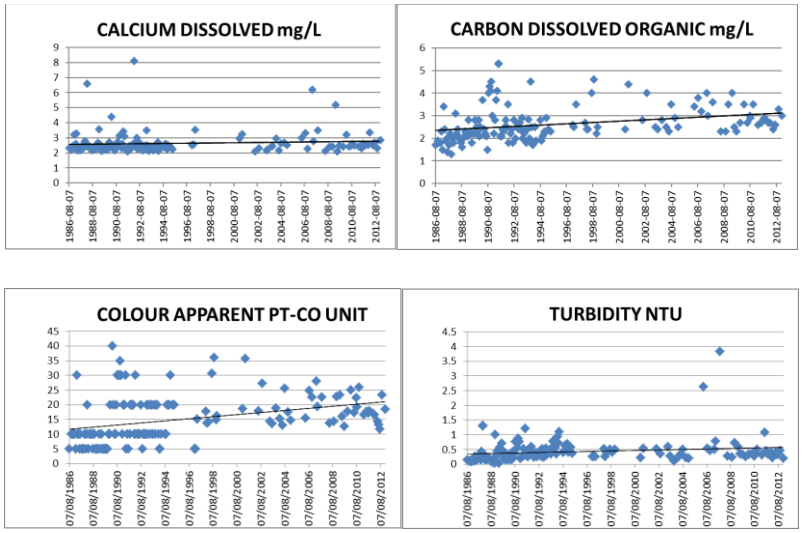


Figure 66: Western Brook at Route 430 – Deteriorating Trend Parameters



6.3.11.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 66: Western Brook at Route 430 - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	148	0.05	0.06	0.15	No	0.07	0.1	No
AST	105	0.05	0	-0.71	Down	0	-0.54	Down
BAT	148	0.05	0.79	0.02	No	0.8	0.01	No
BET	148	0.05	0	-0.35	Down	0	-0.19	Down
CAD	143	0.05	0.04	0.17	Up	0.04	0.12	Up
DOC	150	0.05	0	0.49	Up	0	0.35	Up
CDT	148	0.05	0	-0.72	Down	0	-0.58	Down
CLT	33	0.05	0.18	-0.24	No	0.24	-0.15	No
COLOURA	150	0.05	0	0.48	Up	0	0.33	Up
COND	150	0.05	0.05	-0.16	Down	0.05	-0.11	No
COT	146	0.05	0	-0.74	Down	0	-0.59	Down
CRT	146	0.05	0	-0.7	Down	0	-0.55	Down
CUT	146	0.05	0	-0.43	Down	0	-0.31	Down
FET	146	0.05	0.54	0.05	No	0.54	0.03	No
KU	43	0.05	0.91	-0.02	No	1	0	No
LIT	145	0.05	0.03	-0.18	Down	0.02	-0.15	Down
MGD	143	0.05	0.54	-0.05	No	0.57	-0.03	No
MOT	146	0.05	0	-0.73	Down	0	-0.57	Down
NAU	43	0.05	0.16	-0.22	No	0.17	-0.15	No
NIT	146	0.05	0	-0.54	Down	0	-0.42	Down
NT	62	0.05	0.3	-0.13	No	0.3	-0.09	No
PBT	146	0.05	0	-0.68	Down	0	-0.54	Down
PH	150	0.05	0	0.39	Up	0	0.26	Up
PT	150	0.05	0.79	0.02	No	0.7	0.02	No
SET	81	0.05	0	-0.73	Down	0	-0.54	Down
SIO2	57	0.05	0.56	0.08	No	0.47	0.07	No
SRT	146	0.05	0.46	-0.06	No	0.49	-0.04	No
TURB	150	0.05	0	0.35	Up	0	0.23	Up
VT	146	0.05	0.37	-0.08	No	0.21	-0.08	No
ZNT	146	0.05	0.05	-0.16	Down	0.05	-0.11	Down

6.3.11.3 Comparison and Causes of Change from Past

Table 67 compares trend for Western Brook between Phase I and Phase II.

Western Brook showed an improvement in conductivity, copper, pH, sulphate and zinc. It showed a deterioration of aluminum, calcium, DOC, colour, nitrate, thallium and turbidity. Arsenic, beryllium, cadmium, chromium, cobalt, lead, lithium, molybdenum, nickel and selenium displayed improving trend with censor majority data.

When comparing the trend results between Phase I and Phase II, conductivity, copper, pH continued to improve over time while DOC, colour and turbidity deteriorated over the years. Arsenic and cobalt, which deteriorated in the past, showed censored in the current report.

Mercury, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Nitrate and nitrite, which deteriorated in the past, was excluded from the current analysis due to unavailability of more recent data. Chloride, sodium and strontium, which improved in the past, displayed no trend in the current report. Aluminum, nitrogen and silica, which deteriorated in the past, displayed no trend in the current report. Suphate did not have a common period between the two phases for comparison.

Reductions in atmospheric deposition have affected copper and zinc. pH is possibly affected by the natural limestone geology of the watershed and may also deteriorate calcium levels. Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow and decreasing conductivity and major ion concentration, while increasing colour and turbidity. The increase of global carbon emissions observed across the north likely linked to the deterioration of DOC levels.

Table 67: Western Brook at Route 430 - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Chloride	Climate Change	Conductivity	Climate Change
Conductivity	Climate Change	Copper Total	Atmospheric Deposition
Copper	Atmospheric Deposition	pH	Natural Sources
Mercury	Atmospheric Deposition	Zinc Total	Atmospheric Deposition
pH	Natural Sources		
Sodium	Climate Change		
Strontium	Atmospheric Deposition		
Deteriorating Trend			
Aluminium	Recreation	Calcium Dissolved	Recreation
Arsenic	Recreation	DOC	Global Carbon Emissions
Cobalt	Recreation	Colour Apparent	Climate Change
Colour	Climate Change	Turbidity	Climate Change
DOC	Climate Change		
Nitrate & Nitrite	Rural Sewage Systems/ Recreation		
Nitrogen	Rural Sewage Systems/ Recreation		
Silica	Climate Change		
Turbidity	Climate Change		
Censored Trend			
Beryllium	Censored	Arsenic Total	Censored
Cadmium	Censored	Beryllium Total	Censored
Molybdenum	Censored	Cadmium Total	Censored
		Chromium Total	Censored
		Cobalt Total	Censored
		Lead Total	Censored
		Lithium Total	Censored
		Molybdenum Total	Censored
		Nickel Total	Censored
		Selenium Total	Censored

6.3.12 Wild Cove Brook at Route 440 (NF02YL0029)

Wild Cove Brook is located at Route 430. The CESI land use category classifies the station as forestry. CANAL lists the surrounding development pressure as low. RBA ranks the level of overall risk to water quality as medium.

6.3.12.1 Parameter Time Series Graph

Figures 66 and 67 display the parameter time series graphs for improving and deteriorating trend parameters for Wild Cove Brook at Route 440.

Figure 67: Wild Cove Brook at Route 440 - Improving Trend Parameters

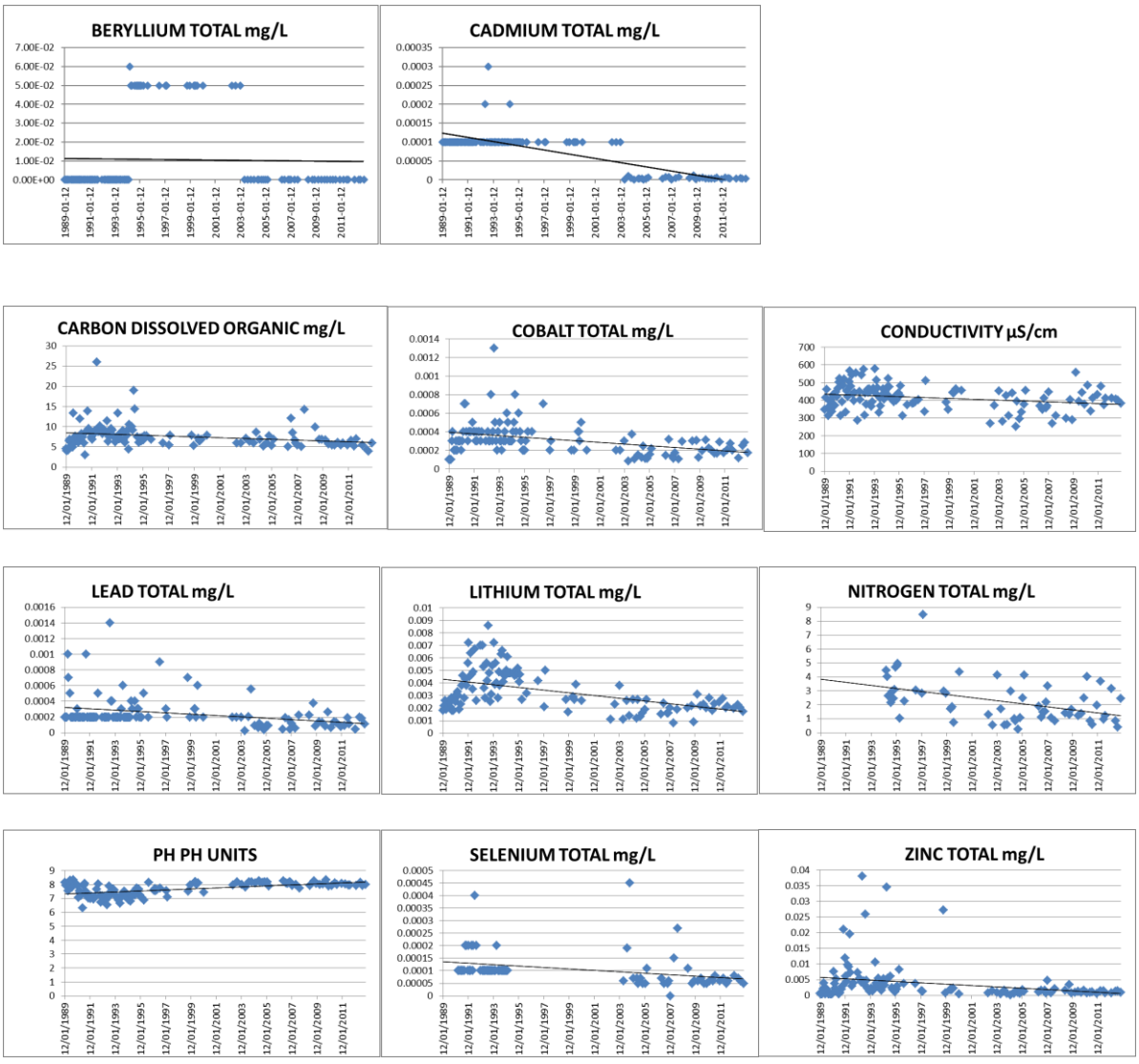
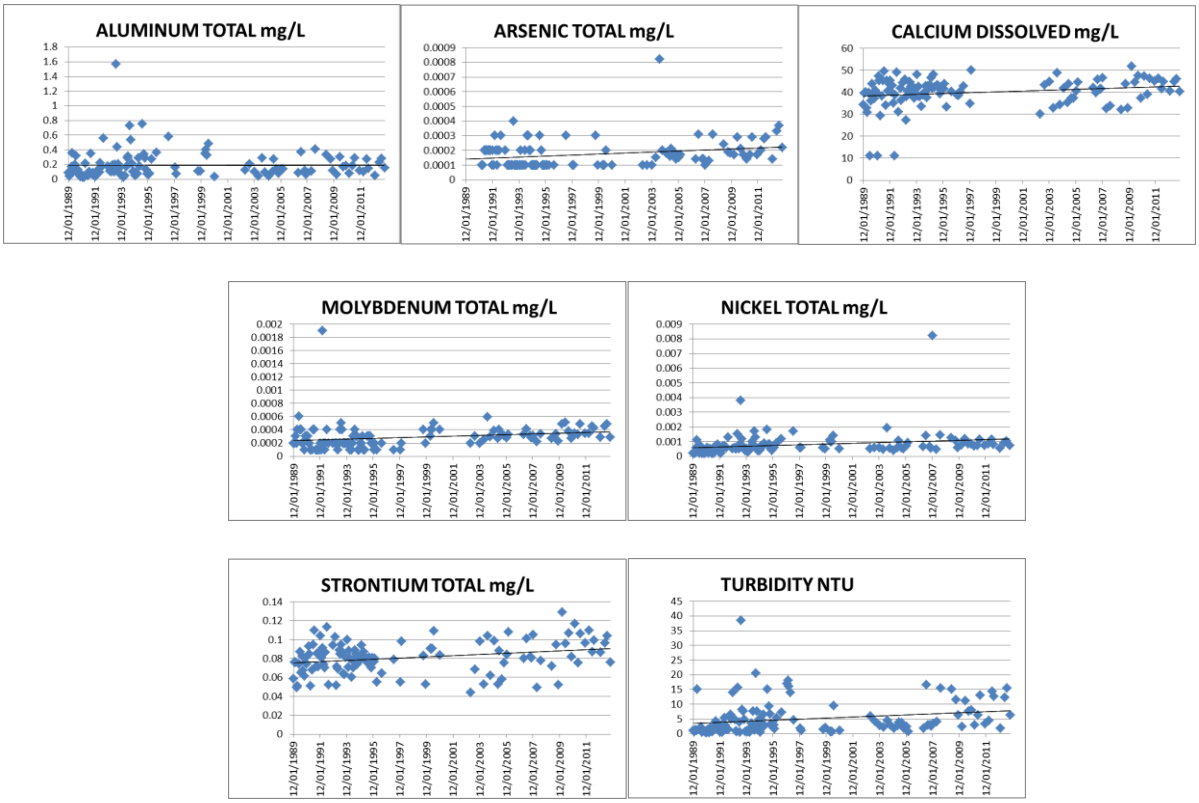


Figure 68: Wild Cove Brook at Route 440 – Deteriorating Trend Parameters



6.3.12.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 68: Wild Cove Brook at Route 440 - Parameter Trend Results

PARAMETER	COUNT	SIG LEVEL	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	118	0.05	0.02	0.21	Up	0.02	0.14	Up
AST	103	0.05	0.01	0.24	Up	0.01	0.19	Up
BAT	118	0.05	0.42	-0.07	No	0.32	-0.06	No
BET	118	0.05	0	-0.42	Down	0	-0.22	Down
CAD	118	0.05	0.02	0.22	Up	0.02	0.15	Up
DOC	121	0.05	0	-0.3	Down	0	-0.23	Down
CDT	118	0.05	0	-0.75	Down	0	-0.57	Down
CLT	32	0.05	0.21	0.23	No	0.19	0.17	No
COLOURA	125	0.05	0.1	-0.15	No	0.07	-0.11	No
COND	125	0.05	0.01	-0.22	Down	0.01	-0.15	Down
COT	118	0.05	0	-0.39	Down	0	-0.27	Down
CRT	118	0.05	0.19	-0.12	No	0.24	-0.08	No
CUT	118	0.05	0.52	-0.06	No	0.51	-0.04	No
FET	118	0.05	0.1	-0.15	No	0.11	-0.1	No
KU	41	0.05	0.2	0.2	No	0.19	0.14	No
LIT	118	0.05	0	-0.37	Down	0	-0.24	Down
MGD	118	0.05	0.86	0.02	No	0.84	0.01	No
MOT	118	0.05	0	0.38	Up	0	0.28	Up
NAU	41	0.05	0.2	0.2	No	0.18	0.15	No
NIT	118	0.05	0	0.5	Up	0	0.36	Up
NT	60	0.05	0	-0.41	Down	0	-0.28	Down
PBT	118	0.05	0	-0.45	Down	0	-0.3	Down
PH	125	0.05	0	0.41	Up	0	0.28	Up
PT	120	0.05	0.08	0.16	No	0.08	0.11	No
SET	78	0.05	0	-0.64	Down	0	-0.47	Down
SIO2	60	0.05	1.00	0.00	No	0.93	0.01	No
SOT	32	0.05	0.41	-0.15	No	0.53	-0.08	No
SRT	118	0.05	0	0.28	Up	0	0.18	Up
TURB	125	0.05	0	0.43	Up	0	0.29	Up
VT	118	0.05	0.13	0.14	No	0.13	0.1	No
ZNT	118	0.05	0	-0.26	Down	0	-0.21	Down

6.3.12.3 Comparison and Causes of Change from Past

Table 69 displays trend comparisons for Wild Cove Brook between Phase I and Phase II report.

Wild Cove Brook showed an improvement in DOC, conductivity, lithium, nitrogen, pH and zinc. It showed a deterioration of aluminum, calcium, molybdenum, nickel, strontium and turbidity. Arsenic, beryllium, cadmium, cobalt, lead and selenium displayed improving trend with censor majority data.

When comparing the trend results between Phase I and Phase II, aluminum, nickel and turbidity deteriorated over the years. Arsenic, which improved in the past, continued to improve with censor majority data in the current report. DOC, lithium, nitrogen, pH and zinc, which deteriorated in the past, improved in the current report.

Mercury, which improved in the past, was excluded from the current analysis due to unavailability of more recent data. Nitrate, nitrite and dissolved oxygen, which deteriorated in the past, was excluded from the current analysis due to unavailability of more recent data. Barium, iron and potassium, which deteriorated in the past, displayed no trend in the current report.

Changes in climate since 1986 have resulted in an increasing trend in precipitation across the province, affecting streamflow decreasing conductivity and increasing turbidity. Reductions in atmospheric deposition have affected carbon and metals such as lithium and zinc. The cause of improvement of nitrogen is unknown. Natural limestone geology, which results in improving pH, may also cause deterioration in calcium levels.

Leachate from the Corner Brook Landfill and Genesis Organics bark pile are affecting turbidity and metals such as aluminum, molybdenum, nickel and strontium.

Table 69: Wild Cove Brook at Route 440 - Past and Present Trend Comparisons

Phase I Trend (1986-2001)		Phase II Trend (1986-2013)	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Arsenic	Atmospheric Deposition	Carbon Dissolved Organic	Atmospheric Deposition
Mercury	Atmospheric Deposition	Lithium Total	Atmospheric Deposition
		Nitrogen Total	Unknown
		pH	Natural Sources
		Conductivity	Climate Change
		Zinc Total	Atmospheric Deposition
Deteriorating Trend			
Aluminium	Landfill	Aluminum Total	Landfill
Barium	Landfill	Calcium Dissolved	Landfill
Dissolved Organic Carbon	Landfill	Molybdenum Total	Landfill
Dissolved Oxygen	Landfill	Nickel Total	Landfill
Iron	Landfill	Strontium Total	Landfill
Lithium	Landfill	Turbidity	Climate Change / Landfill
Nickel	Landfill		
Nitrate & Nitrite	Landfill/ Natural		
Nitrogen	Landfill/ Natural		
pH	Landfill		
Potassium	Landfill		
Turbidity	Climate Change/ Landfill		
Zinc	Landfill		
Censored Trend			
		Arsenic Total	Censored
		Beryllium Total	Censored
		Cadmium Total	Censored
		Cobalt Total	Censored
		Lead Total	Censored
		Selenium Total	Censored

6.3.13 Regional Trend for Selected Parameters

Regionally copper and pH showed the highest level of improvement with downward trend on all ten stations. Conductivity showed improvement with downward trend in eight of twelve stations. Zinc showed improvement with downward trend in six of twelve stations. Turbidity showed the highest level of deterioration with an upward trend in all stations. DOC shows deterioration with upward trend in seven of twelve stations. Calcium and colour showed deterioration in half the stations. The parameters which displayed trend with censor majority data (improving or deteriorating), were arsenic, beryllium, cadmium, chromium, cobalt, lead, molybdenum and selenium.

Most of the western stations were either remote or influenced by forestry from the surrounding areas with little urban influence. Reductions in atmospheric deposition resulted in improvement of copper and zinc. Natural limestone geology in remote areas also contributed to improvement of pH. Climate change due to increased precipitation caused an increase in streamflow and decreasing conductivity.

Increased precipitation resulting from climate change lead to deteriorating turbidity and colour in remote stations. The increase of global carbon emissions observed across the north likely linked to the deterioration of DOC levels.

Table 70 displays regional trend results for western water quality parameters. The last column of the table shows the percentage of parameters that either were displaying no trend or consists censor majority data.

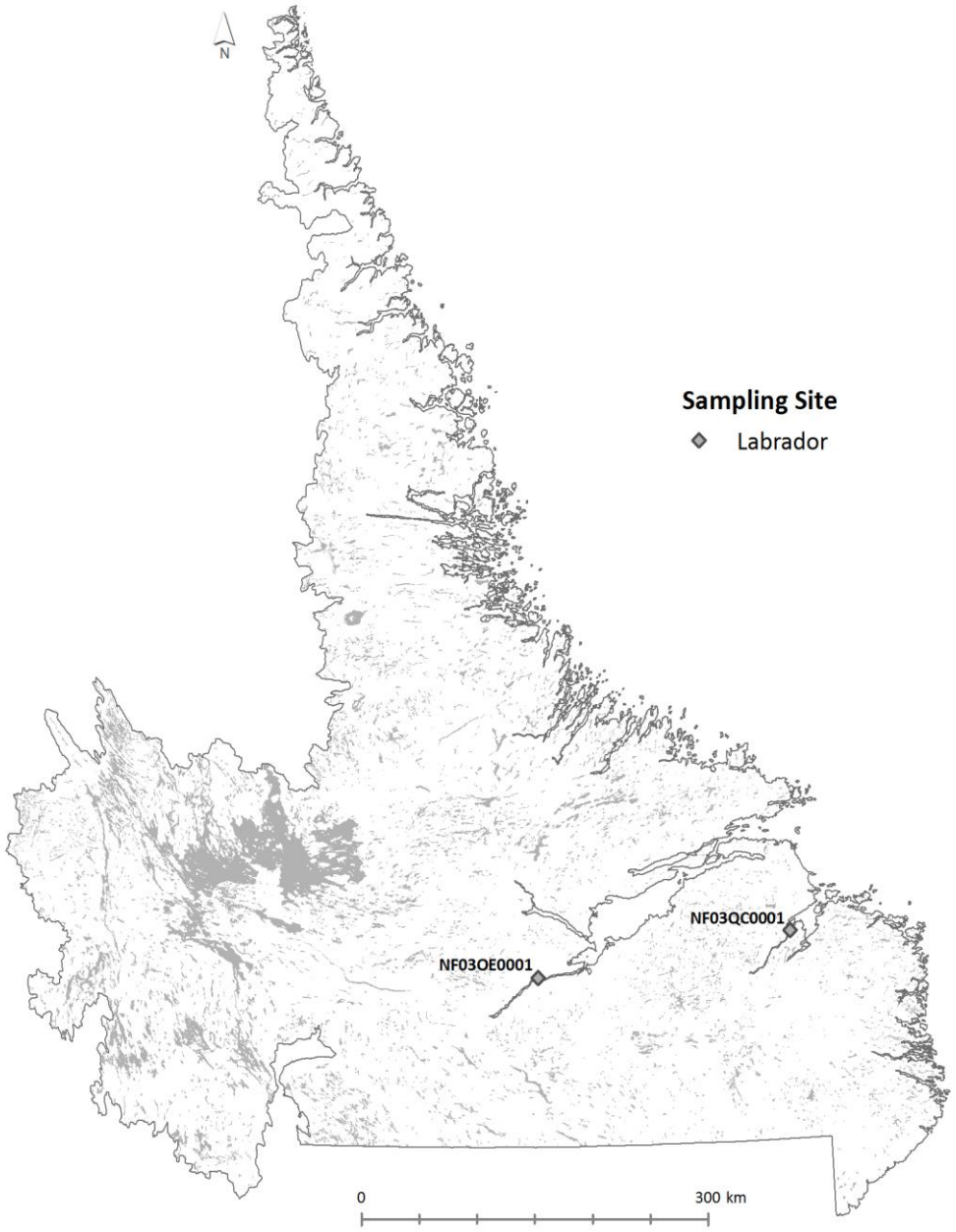
Table 70: Regional Trend for Western WQMA Stations

PARAMETER	COUNT	%DETERIORATING	%IMPROVING	%NONE OR CENSORED
ALT	12	16.67	16.67	66.67
AST	12	8.33	0	91.67
BAT	12	8.33	16.67	75
BET	12	0	0	100
CAD	12	58.33	0	41.67
CDT	12	0	0	100
CLT	12	0	41.67	58.33
COLOURA	12	58.33	0	41.67
COND	12	8.33	66.67	25
COT	12	0	0	100
CRT	12	0	0	100
CUT	12	0	91.67	8.33
DOC	12	66.67	8.33	25
FET	12	16.67	8.33	75
LIT	12	0	33.33	66.67
MGD	10	30	0	70
MOT	12	0	0	100
NIT	11	9.09	0	90.9
NT	12	33.33	8.33	58.33
PBT	12	0	0	100
PH	12	0	91.67	8.33
PT	12	0	8.33	91.67
SET	12	0	0	100
SRT	12	33.33	16.67	50
TURB	12	91.67	0	8.33
VT	12	0	8.33	91.67
ZNT	12	0	50	50

6.4 Labrador Water Quality Station Trends

Figure 69 shows the two Labrador stations included for trend analysis.

Figure 69: Selected Labrador WQMA Trend Stations



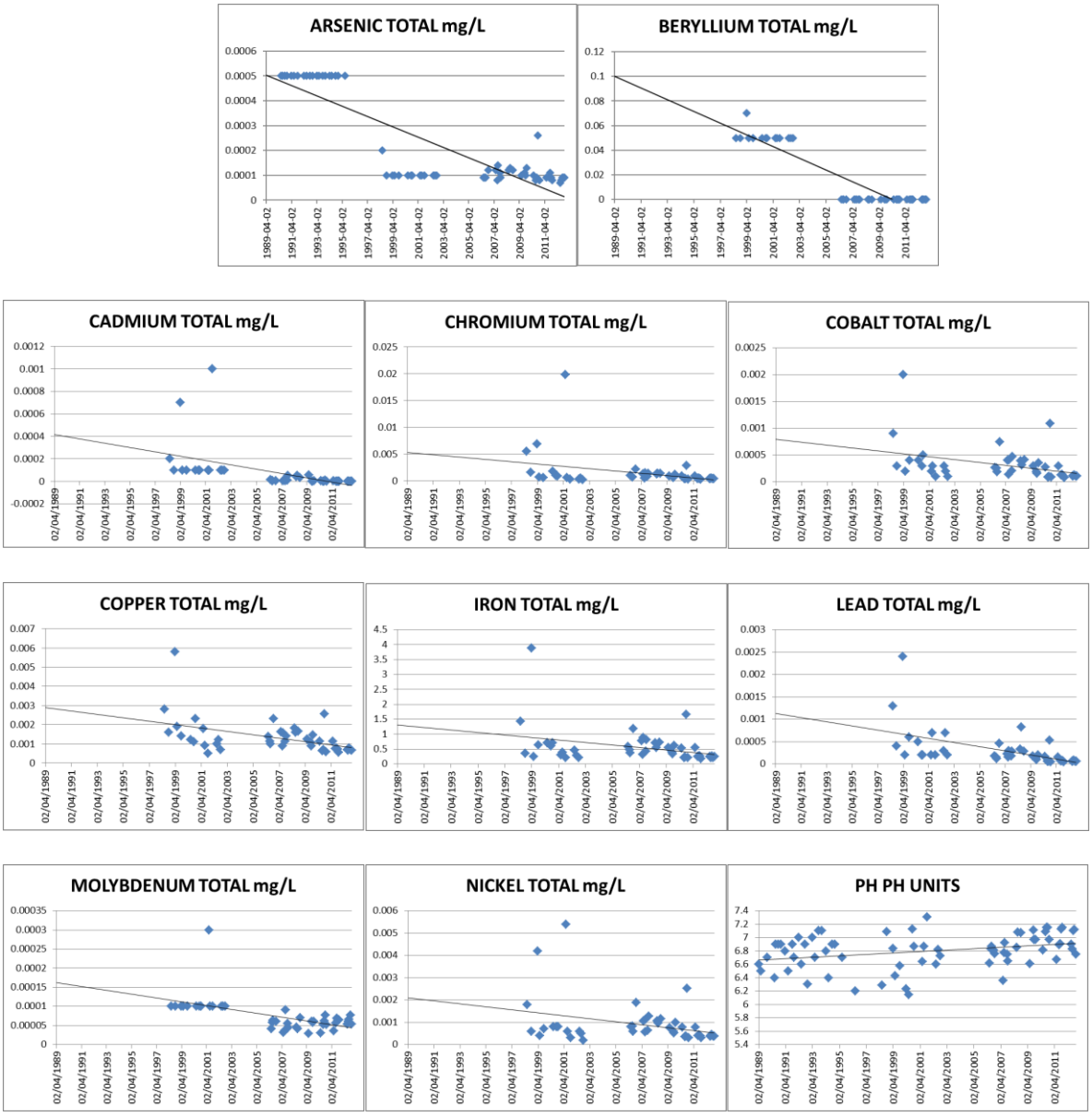
6.4.1 Churchill River Above Upper Muskrat Falls (NFO3OE0001)

Churchill River Above Upper Muskrat Falls is located on the south side of Lower Muskrat Falls. There is no CESI land use category for this station, but the majority of Labrador station are classified remote. CANAL lists the surrounding development pressure as medium. RBA ranks the level of overall risk to water quality as medium. This station had a partial dataset in Phase I report.

6.4.1.1 Parameter Time Series Graph

Figures 70 and 71 display the parameter time series graphs for improving and deteriorating trend parameters for Churchill River Above Upper Muskrat Falls.

Figure 70: Churchill River Above Upper Muskrat Falls - Improving Trend Parameters



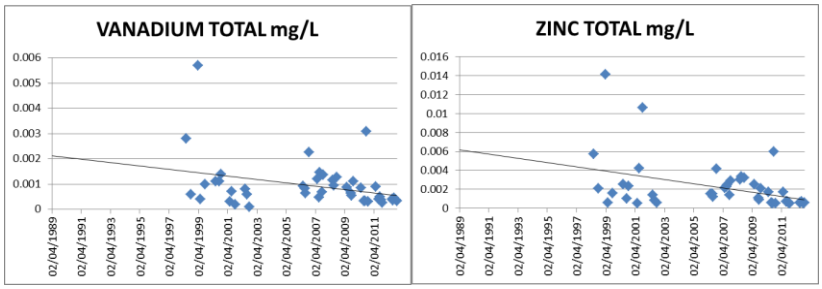
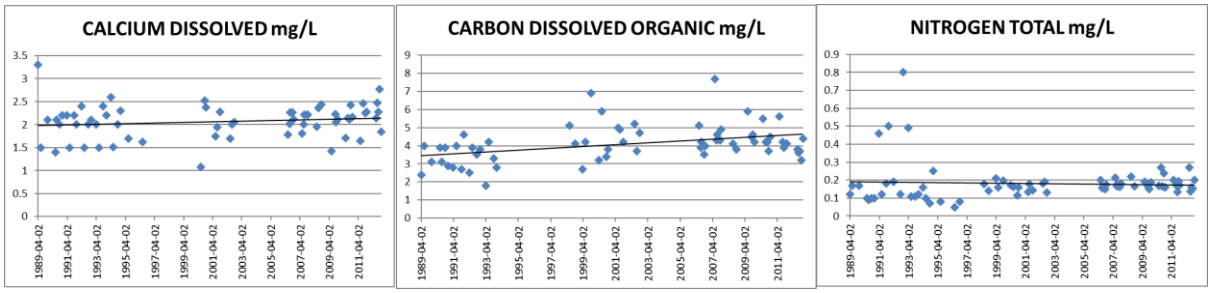


Figure 71: Churchill River Above Upper Muskrat Falls - Upward Trend (Deteriorating) Parameters



6.4.1.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 71: Churchill River Above Upper Muskrat Falls - Parameter Trend Results

Parameter	Count	Sig Level	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	45	0.05	0.08	-0.27	No	0.07	-0.19	No
AST	66	0.05	0	-0.79	Down	0	-0.61	Down
BAT	45	0.05	0.28	-0.17	No	0.18	-0.14	No
BET	45	0.05	0	-0.87	Down	0	-0.7	Down
CAD	66	0.05	0.02	0.28	Up	0.01	0.21	Up
DOC	64	0.05	0	0.37	Up	0.01	0.23	Up
CDT	45	0.05	0	-0.89	Down	0	-0.71	Down
CLT	32	0.05	0.46	-0.13	No	0.46	-0.1	No
COLOURA	73	0.05	0.15	-0.17	No	0.12	-0.13	No
COND	73	0.05	0.64	0.05	No	0.49	0.06	No
COT	45	0.05	0	-0.53	Down	0	-0.38	Down
CRT	45	0.05	0	-0.46	Down	0	-0.34	Down
CUT	45	0.05	0	-0.57	Down	0	-0.42	Down
FET	45	0.05	0	-0.45	Down	0	-0.31	Down
KU	41	0.05	0.18	-0.21	No	0.22	-0.14	No
LIT	45	0.05	0.51	-0.1	No	0.45	-0.08	No
MGD	66	0.05	0.17	0.17	No	0.13	0.13	No
MOT	45	0.05	0	-0.56	Down	0	-0.36	Down
NAU	41	0.05	0.87	0.03	No	0.96	0.01	No
NIT	45	0.05	0	-0.42	Down	0.01	-0.29	Down
NT	71	0.05	0.02	0.28	Up	0.02	0.2	Up
PBT	45	0.05	0	-0.75	Down	0	-0.56	Down
PH	72	0.05	0	0.37	Up	0	0.25	Up
PT	71	0.05	0.34	-0.12	No	0.42	-0.07	No
SET	31	0.05	0	-0.8	Down	0	-0.61	Down
SIO2	23	0.05	0.26	0.24	No	0.38	0.14	No
SOT	32	0.05	0.04	-0.37	Down	0.06	-0.24	No
SRT	45	0.05	0.16	0.21	No	0.26	0.12	No
TURB	71	0.05	0.47	0.09	No	0.61	0.04	No
VT	45	0.05	0.01	-0.39	Down	0.01	-0.28	Down
ZNT	45	0.05	0	-0.46	Down	0	-0.32	Down

6.4.1.3 Comparison and Causes of Change from Past

Table 72 compares trend for Churchill River between Phase I and Phase II.

Chromium, cobalt, chloride, copper, iron, lead, nickel, pH, vanadium and zinc displayed improving trend. Calcium, DOC and nitrogen displayed deteriorating trend. Arsenic, beryllium, cadmium and molybdenum displayed improving trend with censor majority data.

When comparing the trend results between Phase I and Phase II, nitrogen deteriorated over the years. Sulphate, which improved in the past, showed no trend in the current report. Colour and potassium, which deteriorated in the past, showed no trend in the current report.

Reduction in atmospheric deposition have improved chromium, cobalt, copper, iron, lead, nickel, vanadium and zinc. Natural sources due to limestone geology may have improved pH and caused increasing calcium level. Urban development in the communities of Labrador City and Wabush may also be influencing colour and nitrogen levels. The increase of global carbon emissions observed across the north likely linked to the deterioration of DOC levels.

Table 72: Churchill River Above Upper Muskrat Falls - Past and Present Trend Comparisons

Improving Trend			
Previous Report		**Current Report**	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Sulphate	Climate Change/ Atmospheric Deposition	Chromium Total	Atmospheric Deposition
		Cobalt Total	Atmospheric Deposition
		Copper Total	Atmospheric Deposition
		Iron Total	Atmospheric Deposition
		Lead Total	Atmospheric Deposition
		Nickel Total	Atmospheric Deposition
		pH	Natural Sources
		Vanadium Total	Atmospheric Deposition
		Zinc Total	Atmospheric Deposition
Deteriorating Trend			
Colour	Climate Change / Stream Alteration / Mining	Calcium Dissolved	Natural Sources
Nitrogen	Sewage	DOC	Global Carbon Emissions
Potassium	Unknown	Nitrogen Total	Sewage
Censored Trend			
		Arsenic Total	Censored
		Beryllium Total	Censored
		Cadmium Total	Censored
		Molybdenum Total	Censored

6.4.2 Eagle River Above Falls (NF03QC0001)

Eagle River above Falls is located approximately 36 km from Cartwright. There is no CESI land use category for this station, but the majority of Labrador station are classified remote. CANAL lists the surrounding development pressure as low. RBA ranks the level of overall risk to water quality as low. This station had a partial dataset in Phase I report.

6.4.2.1 Parameter Time Series Graph

Figures 72 and 73 display the parameter time series graphs for improving and deteriorating trend parameters for Eagle River Above Falls.

Figure 72: Eagle River Above Falls - Improving Trend Parameters

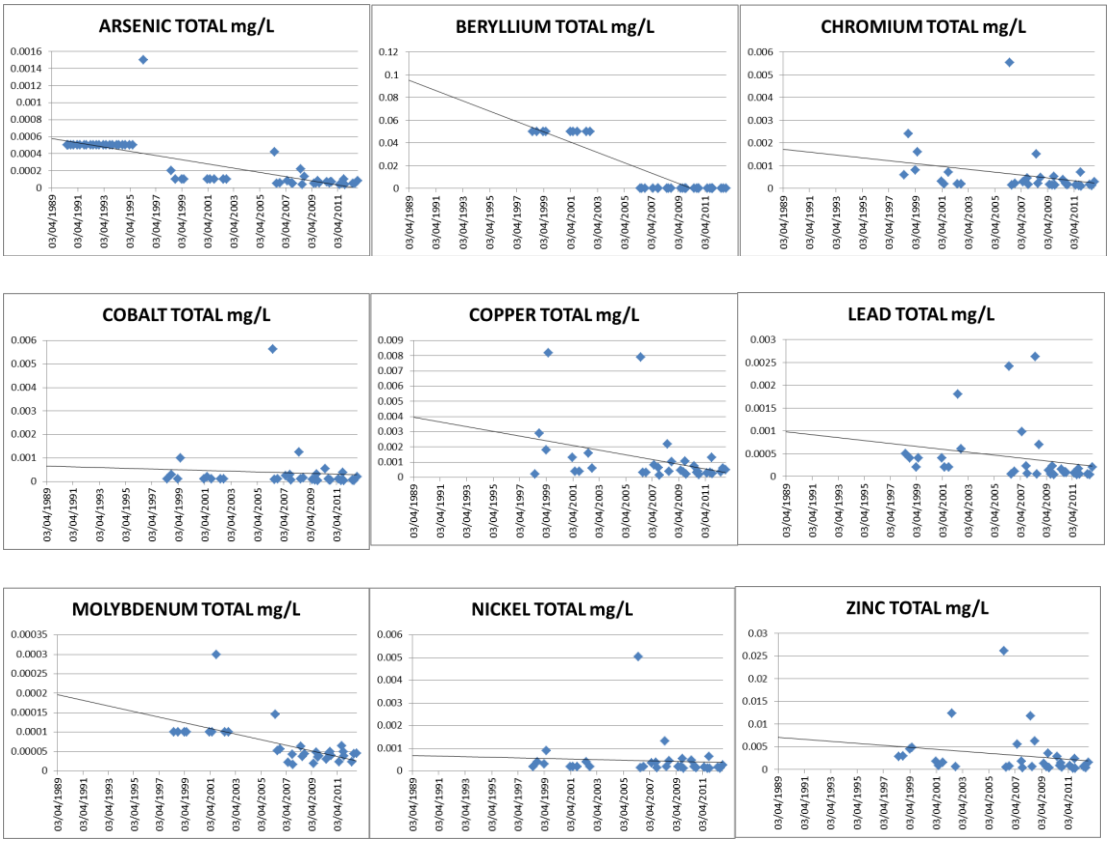
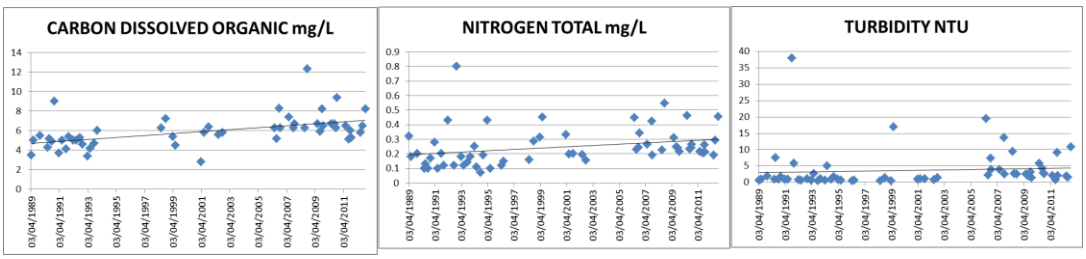


Figure 73: Eagle River Above Falls - Upward Trend (Deteriorating) Parameters



6.4.2.2 Overall Trend for Parameters: Rank Spearman and Mann-Kendall

Table 73: Eagle River Above Falls - Parameter Trend Results

Parameter	Count	Sig Level	RANK SPEARMANN			MANN-KENDALL		
			P-Value	rho	Result	P-Value	tau	Result
ALT	33	0.05	0.76	-0.06	No	0.74	-0.04	No
AST	56	0.05	0	-0.86	Down	0	-0.68	Down
BAT	33	0.05	0.59	-0.1	No	0.61	-0.06	No
BET	33	0.05	0	-0.65	Down	0	-0.5	Down
CAD	57	0.05	0.32	-0.13	No	0.33	-0.09	No
DOC	52	0.05	0	0.61	Up	0	0.42	Up
CDT	24	0.05	0.82	-0.05	No	0.98	-0.01	No
CLT	25	0.05	0.65	0.09	No	0.5	0.1	No
COLOURA	61	0.05	0.97	0.01	No	0.88	0.01	No
COND	61	0.05	0.23	-0.16	No	0.29	-0.09	No
COT	33	0.05	0.03	-0.39	Down	0.02	-0.29	Down
CRT	33	0.05	0	-0.55	Down	0	-0.4	Down
CUT	33	0.05	0.04	-0.36	Down	0.04	-0.26	Down
FET	33	0.05	0.98	-0.01	No	0.96	-0.01	No
KU	30	0.05	0.16	-0.27	No	0.16	-0.19	No
LIT	33	0.05	0.99	0	No	0.67	-0.06	No
MGD	57	0.05	0.45	-0.1	No	0.44	-0.07	No
MOT	33	0.05	0	-0.63	Down	0	-0.42	Down
NAU	30	0.05	1	0	No	0.87	0.02	No
NIT	33	0.05	0.03	-0.37	Down	0.04	-0.26	Down
NT	59	0.05	0	0.43	Up	0	0.29	Up
PBT	33	0.05	0	-0.59	Down	0	-0.41	Down
PH	61	0.05	0.11	0.2	No	0.09	0.15	No
PT	60	0.05	0.06	0.25	No	0.06	0.17	No
SOT	25	0.05	0.1	-0.33	No	0.15	-0.21	No
SRT	33	0.05	0.41	0.15	No	0.38	0.11	No
TURB	60	0.05	0	0.4	Up	0	0.25	Up
VT	33	0.05	0.87	0.03	No	0.89	-0.02	No
ZNT	33	0.05	0.01	-0.47	Down	0.01	-0.32	Down

6.4.2.3 Comparison and Causes of Change from Past

Table 74 compares trend for Eagle River between Phase I and Phase II.

Chromium, cobalt, copper, lead, molybdenum, nickel and zinc displayed improving trend. DOC, nitrogen and turbidity displayed deteriorating trend. Arsenic and beryllium displayed improving trend with censor majority data.

When comparing the trend results between Phase I and Phase II, nitrogen deteriorated over the years. Turbidity, which improved in the past, is showing deterioration in the current report. Nitrate and nitrite, which deteriorated in the past, was excluded from the current analysis due to unavailability of more recent data. Chloride and sulphate, which improved in the past, displayed no trend in the current report.

Reduction in atmospheric deposition lead to improvement of chromium, cobalt, copper, lead, molybdenum, nickel and zinc.

Septic systems from several outfitter camps may be contributing to nutrient levels. Increased precipitation across the province led to increased turbidity levels. The increase of global carbon emissions observed across the north likely linked to the deterioration of DOC levels.

Table 74: Eagle River above Falls - Past and Present Trend Comparisons

Previous Report		Current Report	
Parameter	**Cause of Trend**	**Parameter**	**Cause of Trend**
Improving Trend			
Chloride	Climate Change	Chromium Total	Atmospheric Deposition
Turbidity	Unknown	Cobalt Total	Atmospheric Deposition
Sulphate	Climate Change/ Atmospheric Deposition	Copper Total	Atmospheric Deposition
		Lead Total	Atmospheric Deposition
		Molybdenum Total	Atmospheric Deposition
		Nickel Total	Atmospheric Deposition
		Zinc Total	Atmospheric Deposition
Deteriorating Trend			
Nitrate & Nitrite	Recreation	DOC	Global Carbon Emissions
Nitrogen	Recreation	Nitrogen Total	Recreation
		Turbidity	Climate change
Censored Trend			
		Arsenic Total	Censored
		Beryllium Total	Censored

6.4.3 Regional Trend for Selected Parameters

Both Labrador stations consisted of partial datasets in Phase I report and there are three years of common parameter data for comparison. The Labrador stations land use classification are categorized remote. Global or non-anthropological factors rather than anthropogenic factors influences these stations.

Parameters which displayed improving trend in both stations, were chromium, cobalt, copper, lead, nickel and zinc. Parameter, which displayed deteriorating trend in both stations, were DOC and nitrogen. Parameters, which displayed improving trend with censor majority data, were beryllium cadmium and molybdenum. The only parameter showing deteriorating trend with censor majority data was arsenic.

Reduction in atmospheric deposition played role in the improvement of metals. The increase of global carbon emissions more likely lead to the deterioration of DOC levels. Recreational activities and septic systems may have deteriorated nitrogen level.

Table 75 shows the regional trend count, percent deteriorating, improving and censored or no trend for the two stations in Labrador.

Table 75: Regional Trend for Labrador WQMA Stations

PARAMETER	COUNT	%DETERIORATING	%IMPROVING	%NONE OR CENSORED
ALT	2	0	0	100
AST	2	0	0	100
BAT	2	0	0	100
BET	2	0	0	100
CAD	2	50	0	50
DOC	2	100	0	0
CDT	2	0	0	100
CLT	2	0	0	100
COLOURA	2	0	0	100
COND	2	0	0	100
COT	2	0	100	0
CRT	2	0	100	0
CUT	2	0	100	0
FET	2	0	50	50
KU	2	0	0	100
LIT	2	0	0	100
MGD	2	0	0	100
MOT	2	0	50	50
NAU	2	0	0	100
NIT	2	0	100	0
NT	2	100	0	0
PBT	2	0	100	0
PH	2	0	50	50
PT	2	0	0	100
SET	1	0	100	0
SIO2	1	0	0	100
SOT	2	0	50	50
SRT	2	0	0	100
TURB	2	50	0	50
VT	2	0	50	50
ZNT	2	0	100	0

6.5 Global Trends in selected Parameters across NL

Globally across the island of Newfoundland and Labrador, copper showed the highest level of improvement with a downward trend in 97% of all stations. This is followed by zinc (72.5%), lead (52.5%), pH (47.9%), lithium (45.8%) and conductivity (41.6%). Reduction in atmospheric deposition and increase in precipitation resulting from climate change, along with abatement practices, played an important role in the reduction of these parameters in water.

Turbidity showed the highest level of deterioration with an upward trend (70.4%) followed by DOC (67.5%), nitrogen total (53.3%) and colour (37%).

Improving or deteriorating trend with censor majority data was observed in arsenic, beryllium, cadmium, chromium, cobalt, lead, molybdenum and selenium.

Table 76 shows the global trend count, percent deteriorating, improving and censored or no trend for the selected parameters across the island of Newfoundland and Labrador.

Table 76: Global Trend for Selected Parameters across the island of Newfoundland and Labrador

PARAMETER	%DETERIORATING	%IMPROVING	%NONE OR CENSORED
ALT	4.17	26.67	69.16
AST	14.58	0	85.42
BAT	4.58	29.58	65.84
BET	0	7.08	92.92
CAD	32.08	12.5	55.42
DOC	74.17	2.08	23.75
CDT	0	4.58	95.42
CLT	11.67	0	88.33
COLOURA	39.17	5	55.83
COND	7.08	41.67	51.25
COT	0	40	60
CRT	2.5	32.5	65
CUT	0	97.92	2.08
FET	14.17	15	70.83
LIT	0	45.83	54.17
MGD	6.25	27.08	66.66
MOT	4.58	12.5	82.92
NIT	12.08	30	57.92
NT	53.34	7.08	39.58
PBT	0	52.08	47.92
PH	2.5	77.92	19.58
PT	2.5	24.58	72.92
SET	0	30	70
SIO2	2.08	5	92.92
SRT	15.83	21.67	62.5
TURB	72.5	2.5	25
VT	0	22.08	77.92
ZNT	2.5	70.41	27.09

7. Conclusion and Path Forward

Throughout the province, the top five parameters that displayed improving trends were copper, pH, zinc, conductivity and magnesium. Turbidity, DOC, colour and nitrogen showed the most common deteriorating trends. Improving or deteriorating trend with censor majority data were arsenic, beryllium, cadmium, chromium, cobalt, molybdenum and selenium. Major ion parameters such as potassium, sodium and sulphate, could not be compared with past results due to lack of common data period.

The results indicate that the majority of the parameters continued with the same trends as the previous report with the additional 10 years of data. Based on the Phase 2 report, it has been observed that anthropogenic, natural and global causes have played a role in these changes. Generally, urban station parameters were influenced by anthropogenic activities where local stressors played greater role in influencing parameter trend. In contrast, natural and global stressors affected stations with little urban influence. The RBA, CANAL and CESI helped interpret parameter trend results providing local, regional and land use context.

The river stewardship programs set for Rennies River, Waterford River, Cordroy Brook, and Corner Brook helped improve urban river enhancement activities including restoration to facilitate fish spawning, alleviation of pollution and development of appropriate public access to the system. These stewardship programs continue to increase public awareness and education of activities that are detrimental to urban waterways. The river stewardship programs led to improvement of metals such as copper, cobalt, lithium, magnesium and zinc in urban locations. The existence of these stewardship programs are essential for the continual improvement of parameter trends in our waters.

Global factors such as climate change and carbon emission played a role in the overall deteriorating trends for turbidity, colour, nitrogen and DOC. Corrective measures on a local scale to improve these parameters is not a practical solution. Some waterbodies in western Newfoundland may have been affected by forestry activities in the area. Effective forest management strategies and best management practices are in place through the Environmental Protection Guidelines for Forestry Operations. These Guidelines should continue to be monitored and revised to ensure they can improve turbidity, color and nitrogen. The Department should review any new versions of the Guidelines and provide feedback to protect the integrity of the Province's waterbodies.

The current report uses stations monitored since 1986. Many of these stations consisted of partial datasets with gaps of multiple years of data. Due to improvement in lab measurement techniques, many parameters previously considered censored now generate actual values. The inclusion of newer stations in recent periods requires a follow up trend report for all stations included in the WQMA network with the recent 10-12 years of data. The goal for this report would be to identify parameter trend for all WQMA stations where continuous data was obtained from the 2007-2019 period.

While the current report provides valuable information on parameter trend, a more recent data period would provide information on emerging trends. In addition, the inclusion of more stations would provide a clearer picture on regional trend. Labrador, with only two stations in the current

report, requires additional station analysis in order to be representative of that area. The follow up report would achieve that goal.

The follow up trend report would:

- Compute parameter trends for WQMA stations where data is available from the 2007-2019 period with the report updated every 10 years.
- As the main deteriorating trends are linked to global factors, turbidity, DOC, colour and nitrogen should be revisited every 5 years.
- Compute regional precipitation trend for the same period to identify the effect of climate change on parameter trend.
- Minimize the effect of censored data by using actual data with improvement in measurement technique.
- Compare WQI score for stations with parameter trend results i.e. whether improving or deteriorating parameter trend have an effect on WQI score.
- Generate provincial maps for all trend parameters in a user-friendly manner to disseminate information to the public and various watershed stewardship organizations creating greater awareness of water quality trends.

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9. APPENDIX A: Descriptive Parameter Statistics f or Water Quality Stations

9.1 Eastern

9.1.1 Broad Cove Brook near St. Phillips (NF02ZM0020)

Parameter	Min	Max	Mean	Median	SD	95th Perc.	5th Perc.	Count
ALT	0.02	0.313	0.09371	0.0902	0.04108	0.1596	0.03444	138
AST	0.00009	0.0003	0.00015	0.0001	0.00007	0.000299	0.0001	83
BAT	0.0021	0.0077	0.0042	0.0042	0.00103	0.005921	0.0027	138
BET	0.00001	0.05	0.01529	0.00003	0.02301	0.05	0.00001	36
CAD	1	8.4	2.23671	2.105	0.72687	3.231	1.537	140
DOC	1.8	10.2	4.13995	3.9	1.33459	6.7	2.5	141
CDT	0	0.001	0.00007	0.00001	0.00015	0.0001	0.000004	43
CLT	19.7	45	32.8285	33.8	7.64814	43.88	20.635	28
COLOURA	5	75.2	21.9514	20	12.5256	40.36	5	138
COND	45	176	89.9105	81.95	26.6632	155.9	63.035	142
COT	0.00008	0.0006	0.00017	0.00019	0.00008	0.0003	0.0001	124
CRT	0.00002	0.0016	0.00020	0.00017	0.00028	0.000365	0.00003	48
CUT	0.0002	0.0079	0.00078	0.0005	0.00106	0.00163	0.00023	128
FET	0.0523	0.574	0.20367	0.162	0.10750	0.40025	0.08715	136
KU	0.16	2.06	0.54543	0.51	0.28339	0.7	0.331	35
LIT	0	0.002	0.00054	0.0005	0.00019	0.0008	0.0003	136
MGD	0.5	1.25	0.9095	0.91	0.14009	1.14	0.67	140
MOT	0.00001	0.0002	0.00006	0.00003	0.00005	0.0002	0.00001	43
NAU	10.6	27.1	18.6971	18.1	5.17143	26.15	11.59	35
NIT	0.00012	0.0007	0.00026	0.0002	0.00012	0.0006	0.00016	80
NT	0.121	0.506	0.24394	0.244	0.06371	0.3408	0.1588	53
PBT	0.00003	0.0014	0.00038	0.0003	0.00036	0.00124	0.00006	77
PH	5.69	8.01	6.3438	6.32	0.32794	6.87	5.8905	142
PT	0.0014	0.0169	0.00583	0.0054	0.00286	0.0119	0.00219	140
SET	0.00005	0.0002	0.00009	0.0001	0.00003	0.0002	0.00006	52
SIO2	0.92	4.55	2.57868	2.73	1.00757	4.24	1.12	61
SOT	1.9	4.91	3.85678	3.955	0.6333	4.624	3.0535	28
SRT	0.0054	0.0151	0.00997	0.00975	0.00173	0.013275	0.00747	136
TURB	0	4.17	0.50542	0.4	0.43076	0.9955	0.201	142
VT	0.00006	0.0006	0.00017	0.00018	0.00008	0.0003	0.0001	126
ZNT	0.0007	0.0118	0.00320	0.0029	0.00176	0.006558	0.0011	136

9.1.2 Goulds Brook near Makinsons (NFO2ZL0029)

Parameter	Minimum	Maximun	Mean	Median	SD	95th Perc	5th Perc	Count
ALT	0.0211	0.315	0.080911	0.079	0.04051	0.148	0.029	141
AST	0.0001	0.00058	0.000202	0.0002	0.000113	0.00047	0.0001	121
BAT	0.0008	0.0067	0.002813	0.0027	0.000971	0.0042	0.00135	141
BET	0.000011	0.00006	0.00002	0.000018	0.000009	0.000034	0.000013	36
CAD	1.09	6.8	2.313134	2.24	0.717909	3.2085	1.482	134
DOC	2.7	10	4.930071	4.6	1.47168	7.71	3.195	140
CDT	0.000001	0.0002	0.000023	0.000003	0.000044	0.0001	0.000001	41
CLT	11.6	26.9	17.76364	17.6	3.040715	22.78	13.6	33
COLOURA	5	80	32.97826	30	12.55371	52.81	16.625	138
COND	1	129	77.34681	77.5	15.28295	99.3	54.3	141
COT	0.000047	0.0009	0.000142	0.0001	0.000113	0.0003	0.000061	128
CRT	0.000027	0.0034	0.000207	0.00006	0.000483	0.0005	0.00003	50
CUT	0.00017	0.0084	0.000502	0.0003	0.0009	0.000885	0.0002	124
FET	0.0936	1.02	0.213278	0.178	0.125826	0.4552	0.115	139
KU	0.18	1	0.448261	0.41	0.152875	0.6975	0.2625	46
LIT	0	0.0013	0.000748	0.0007	0.000233	0.0011	0.0004	139
MGD	0.53	1.5	0.943134	0.94	0.177274	1.2035	0.653	134
MOT	0.00001	0.0002	0.000067	0.000062	0.000041	0.0001	0.000018	59
NAU	7.78	49.4	12.1613	11.6	5.839577	15.1	8.835	46
NIT	0.00007	0.0018	0.000223	0.000135	0.000247	0.0006	0.00008	60
NT	0.151	1.97	0.469458	0.406	0.292685	0.9764	0.1724	83
PBT	0.000027	0.001	0.000218	0.000125	0.000239	0.000831	0.000033	66
PH	4.94	7.29	6.351348	6.36	0.360788	6.91	5.8	141
PT	0.0101	1.12	0.118404	0.0952	0.128353	0.328445	0.016345	140
SET	0.00004	0.00061	0.000102	0.0001	0.000084	0.0002	0.000047	55
SIO2	1.01	4.34	2.524268	2.44	0.848045	3.8685	1.3205	82
SOT	1.35	2.63	1.914242	1.94	0.29909	2.318	1.484	33
SRT	0.0054	0.0172	0.010346	0.0102	0.00216	0.01421	0.00689	139
TURB	0.15	60	1.04078	0.48	5.030911	1.02	0.25	141
VT	0.000068	0.0004	0.000125	0.0001	0.000053	0.0002	0.000087	125
ZNT	0.0003	0.0074	0.002035	0.0017	0.001292	0.0043	0.000596	137

9.1.3 Kelly's Brook at Portugal Cove Road (NFO2ZM0144)

Parameter	Minimum	Maximum	Mean	Median	S.D.	95th Perc	5th Perc	Count
ALT	0.018	2.72	0.243794	0.072	0.475888	1.6405	0.02687	118
AST	0.0001	0.0035	0.000404	0.0003	0.000393	0.001042	0.0001	114
BAT	0.00507	0.148	0.078658	0.07675	0.022806	0.12445	0.050325	118
BET	0.000022	0.16	0.024559	0.00008	0.036052	0.08	0.000034	104
CAD	2.7	76.8	25.96696	24.3	9.742	42.83	16.27	115
DOC	0.8	48.2	3.493155	2.8	4.549277	4.54	1.96	113
CDT	0.000007	0.0023	0.000273	0.0002	0.000341	0.0009	0.000028	117
CLT	37.2	2770	343.3737	199.5	469.2564	1013.25	132	38
COLOURA	3.3	100	24.01721	20	16.37322	50	5.715	122
COND	104	9540	1280.672	843.5	1475.983	4471	466.95	122
COT	0.000209	0.0023	0.000625	0.0005	0.000345	0.0014	0.0003	115
CRT	0.00005	0.0148	0.001266	0.0004	0.002271	0.00608	0.000191	111
CUT	0.00043	0.0687	0.009167	0.006	0.010568	0.02625	0.00248	116
FET	0.289	11.5	2.448879	1.965	1.873989	6.1525	0.7855	116
KU	0.46	19.5	3.067368	2.46	2.60447	5.606	1.488	57
LIT	0.00044	0.0427	0.005879	0.0046	0.005954	0.013325	0.001838	116
MGD	0.82	4.28	2.609652	2.56	0.61826	3.673	1.757	115
MOT	0.000034	0.00854	0.001225	0.0008	0.001446	0.004053	0.0001	114
NAU	23	1080	193.4789	121	214.0919	701.6	84.22	57
NIT	0.00019	0.0039	0.000682	0.00047	0.00067	0.002089	0.0002	103
NT	0.286	4.31	2.720759	2.66	0.812731	4.081	1.63	87
PBT	0.000177	0.0457	0.003805	0.001	0.007575	0.0167	0.000211	113
PH	6.03	7.78	7.085246	7.13	0.352969	7.6385	6.511	122
PT	0.0017	0.246	0.038361	0.0262	0.043253	0.12815	0.00541	118
SET	0.00006	0.001	0.000183	0.00014	0.000138	0.00045	0.0001	66
SIO2	0.56	6.54	4.7175	4.92	1.058865	6.1175	3.0225	76
SOT	3.42	111	19.33579	14.4	19.02635	41.615	9.21	38
SRT	0.0112	0.292	0.123498	0.118	0.042421	0.20675	0.074075	116
TURB	0.6	160	10.21909	4.1	22.48503	34.4	1	121
VT	0.000067	0.0101	0.000778	0.000237	0.001626	0.003817	0.0001	110
ZNT	0.0045	0.32	0.040159	0.027	0.046416	0.10825	0.012325	116

9.1.4 Mundy Pond at Outlet (NFO2ZM0109)

Parameter	Minimum	Maximum	Mean	Median	S.D.	95th Perc	5th Perc	Count
ALT	0.029	1.57	0.180283	0.133	0.197278	0.4318	0.045165	112
AST	0.00002	0.0017	0.000204	0.00019	0.000177	0.0004	0.0001	107
BAT	0.0122	0.105	0.040621	0.03505	0.019253	0.0866	0.0211	112
BET	0.000009	0.12	0.022892	0.000081	0.030149	0.07	0.000013	91
CAD	6.78	45.7	14.81324	13.1	6.636802	30.08	8.676	105
DOC	0.8	5.8	3.328078	3.35	0.864891	4.4	1.935	108
CDT	0.000009	0.0008	0.000147	0.0001	0.00014	0.0005	0.000011	100
CLT	60.4	1050	246.131	165	226.1769	759.4	87.08	29
COLOURA	5	50	17.68288	15.3	9.593418	40	7	111
COND	43.6	4861	1001.63	707	865.7383	3007.45	353	112
COT	0.000106	0.003	0.000596	0.0005	0.000467	0.001455	0.000172	110
CRT	0.0002	0.0034	0.000555	0.0004	0.000507	0.0013	0.0002	102
CUT	0.0017	0.015	0.004223	0.00385	0.002288	0.007885	0.002358	110
FET	0.14	5.16	0.536009	0.403	0.530643	1.082	0.2519	110
KU	0.9	8.68	2.4362	2.145	1.3785	5.011	1.2535	50
LIT	0.0009	0.0119	0.003185	0.0026	0.002209	0.008365	0.0011	110
MGD	1.07	3.05	1.708	1.64	0.45521	2.742	1.162	105
MOT	0.0001	0.0017	0.000395	0.0003	0.000285	0.000926	0.0001	107
NAU	41.5	948	166.142	115	159.9492	476.25	58.915	50
NIT	0.0002	0.0029	0.000745	0.0007	0.000316	0.001146	0.000408	109
NT	0.334	1.61	0.82362	0.818	0.301973	1.355	0.3985	79
PBT	0.0002	0.0216	0.002072	0.0011	0.002823	0.005645	0.000335	100
PH	6.18	7.65	6.8425	6.825	0.331919	7.41	6.312	112
PT	0.0002	0.0574	0.015789	0.0144	0.008779	0.031455	0.006845	110
SET	0.0001	0.0015	0.000171	0.00013	0.000191	0.000261	0.0001	54
SIO2	0.07	5.81	3.352933	3.67	1.587178	5.322	0.213	75
SOT	8.53	47.6	15.41897	12.2	8.372969	31.92	9.322	29
SRT	0.0242	0.189	0.055605	0.0468	0.027955	0.1122	0.02998	110
TURB	0.31	30	3.906071	2.305	4.622593	12.025	0.626	112
VT	0.0001	0.0031	0.000434	0.000301	0.000414	0.001	0.0001	106
ZNT	0.00322	0.136	0.038976	0.0263	0.03398	0.10955	0.004838	110

9.1.5 Northeast River near Placentia (NFO2ZK0005)

Parameter	Minimum	Maximum	Mean	Median	S.D.	95th Perc	5th Perc	Count
ALT	0.027	0.432	0.109997	0.101	0.053707	0.181	0.04386	119
AST	0.0001	0.00035	0.000145	0.0001	0.000063	0.000266	0.0001	89
BAT	0.0015	0.007	0.002572	0.0024	0.000794	0.00365	0.001872	119
BET	0.000004	0.05	0.017805	0.000015	0.023934	0.05	0.000008	59
CAD	1.1	2.4	1.533333	1.53	0.238722	1.855	1.195	111
DOC	2.8	15.6	5.654188	5.4	1.974911	8.56	3.38	117
CDT	0	0.0002	0.000047	0.00001	0.000049	0.0001	0.000003	63
CLT	5.72	12.6	7.731667	7.19	1.615903	11.075	5.9425	36
COLOURA	5	140	42.24958	40	19.12357	68.13	19.57	119
COND	30.5	76.9	43.86303	42.4	7.557131	56.64	33.72	119
COT	0.000049	0.0011	0.000145	0.0001	0.000116	0.0003	0.000069	106
CRT	0.000077	0.0013	0.000209	0.0002	0.000149	0.0004	0.0001	86
CUT	0.0002	0.017	0.00108	0.00046	0.002572	0.00366	0.000296	113
FET	0.0749	1	0.203483	0.1705	0.109802	0.43515	0.108	118
KU	0.01	0.34	0.145091	0.15	0.052497	0.213	0.034	55
LIT	0	0.001	0.000415	0.0004	0.000159	0.000628	0.0002	117
MGD	0.49	1.3	0.657838	0.65	0.118149	0.835	0.505	111
MOT	0.000005	0.0001	0.000052	0.000021	0.000042	0.0001	0.000008	64
NAU	3.76	8.15	5.321091	5.15	1.0073	7.431	4.084	55
NIT	0.0001	0.0009	0.000226	0.0002	0.000121	0.000415	0.000109	78
NT	0.112	0.325	0.176562	0.171	0.03868	0.2418	0.1346	73
PBT	0.000039	0.0013	0.000282	0.0002	0.000282	0.0009	0.000054	87
PH	5.29	6.98	6.308908	6.33	0.288505	6.783	5.855	119
PT	0.0003	0.0197	0.005656	0.00505	0.003058	0.01049	0.0027	118
SET	0	0.00026	0.000086	0.00008	0.000043	0.000187	0.000047	54
SIO2	0.53	2.51	1.604151	1.58	0.408233	2.374	1.052	53
SOT	1.22	1.95	1.478611	1.44	0.173976	1.8425	1.2475	36
SRT	0.0054	0.0129	0.00747	0.007425	0.00116	0.009307	0.00587	118
TURB	0.13	7.21	0.595462	0.47	0.730075	1.288	0.22	119
VT	0.00008	0.0006	0.000152	0.000113	0.00008	0.0003	0.000098	106
ZNT	0.0003	0.0105	0.001503	0.0013	0.001137	0.00292	0.0005	117

9.1.6 Quidi Vidi Lake at Outlet (NFO2ZM0015)

Parameter	Minimum	Maximum	Mean	Median	S.D.	95th Perc	5th Perc	Count
ALT	0.006	0.317	0.088472	0.07	0.060524	0.216	0.017	181
AST	0.00008	0.00045	0.000153	0.0001	0.000068	0.00028	0.0001	121
BAT	0.0169	0.0682	0.036119	0.0347	0.009636	0.0541	0.0232	181
BET	0.000009	0.07	0.014124	0.00006	0.023858	0.06	0.000018	115
BT	0.007	0.013	0.009337	0.0092	0.001431	0.01184	0.00741	43
CDT	0.000004	0.0004	0.000103	0.0001	0.000079	0.0003	0.000011	137
CAD	5.77	19	10.34989	10.05	2.40327	14.74	7.003	174
DOC	1.5	5.5	3.062682	3	0.735676	4.31	2	179
CLT	58	394	154.8757	153	66.35125	249.8	80.24	37
CRT	0.000181	0.0028	0.000413	0.00035	0.000285	0.0008	0.0002	151
COT	0.000068	0.0009	0.00031	0.0003	0.000179	0.000669	0.0001	176
COLOURA	5	40	15.07303	13.25	7.882177	30	5	178
CUT	0.0015	0.0099	0.002709	0.0025	0.000989	0.00431	0.001769	179
FET	0.0646	0.861	0.302789	0.284	0.121406	0.4925	0.1448	179
PBT	0.00011	0.0061	0.000912	0.0007	0.000833	0.00259	0.0002	163
LIT	0.0007	0.0054	0.001969	0.0019	0.000783	0.0033	0.000999	179
MGD	1.13	2.9	1.933046	1.9	0.357648	2.6	1.3965	174
MOT	0.0001	0.00075	0.00021	0.0002	0.000129	0.000477	0.0001	132
NIT	0.0002	0.0017	0.000483	0.0004	0.000207	0.0008	0.0003	167
NT	0.24	1.24	0.746734	0.718	0.165534	1.07	0.53015	94
PH	6.01	7.7	6.826284	6.81	0.304816	7.329	6.361	183
PT	0.0039	0.0406	0.014246	0.01235	0.006784	0.029305	0.006195	180
KU	0.48	2.44	1.486613	1.475	0.392247	2.205	0.8445	62
SET	0.00005	0.00171	0.000161	0.0001	0.000198	0.000327	0.00008	72
SIO2	0.06	4.86	2.490886	2.8	1.422496	4.41	0.098	79
NAU	37.1	243	93.46613	90.35	38.27191	174.45	51.025	62
COND	3	1380	545.623	488	216.8654	1000.3	310.1	183
SRT	0.0203	0.0915	0.045987	0.0444	0.01131	0.06481	0.02924	179
SOT	8.29	23.5	11.93811	11.5	3.103393	16.48	8.748	37
TURB	0	48	1.894426	1	3.798953	5.262	0.28	183
VT	0.000097	0.001	0.000257	0.0002	0.000146	0.0005	0.0001	171
ZNT	0.0021	0.0618	0.022781	0.0202	0.014181	0.04736	0.005161	179

9.1.7 Rennies River at Carnell Drive (NFO2ZM0016)

Parameter	Minimum	Maximum	Mean	Median	S.D.	95th Perc	5th Perc	Count
ALT	0.019	1.68	0.117896	0.088	0.150081	0.248	0.028	195
AST	0.0001	0.0007	0.000174	0.00016	0.000094	0.000371	0.0001	134
BAT	0.0155	0.146	0.033107	0.0308	0.013494	0.05287	0.01933	195
BET	0.000019	0.15	0.017292	0.00007	0.028035	0.06	0.00003	160
BT	0.007	0.0166	0.009611	0.0092	0.001875	0.0131	0.007225	46
CAD	4.84	36	10.3839	9.91	4.268506	16.89	5.789	187
DOC	0.7	6.2	2.937382	2.8	0.917162	4.65	1.8	191
CDT	0.000009	0.001	0.000133	0.0001	0.000144	0.0004	0.000013	161
CLT	55.2	799	213.9595	165	177.5361	703.2	74.18	37
COLOURA	5	60	15.76073	13.1	9.558307	34.65	5	191
COND	38.2	5545	636.9811	473	651.399	1515.75	257	196
COT	0.000084	0.00109	0.000358	0.0003	0.0002	0.0008	0.0001	192
CRT	0.00014	0.016	0.000676	0.0004	0.001326	0.0015	0.0002	177
CUT	0.00116	0.0376	0.003709	0.0029	0.003651	0.00688	0.001762	193
FET	0.217	4.53	0.551912	0.472	0.38322	0.959	0.2988	193
KU	0.27	5.65	1.517297	1.325	0.770118	2.901	0.7885	74
LIT	0.0006	0.0181	0.00183	0.0015	0.001546	0.00314	0.0008	193
MGD	0.88	2.74	1.604362	1.61	0.360458	2.186	1.05	188
MOT	0.0001	0.0014	0.000275	0.0002	0.000202	0.000649	0.0001	148
NAU	35.8	500	110.9419	85	86.74951	245.1	47.065	74
NIT	0.0002	0.00341	0.000479	0.0004	0.000366	0.0009	0.0002	174
NT	0.4	1.25	0.760971	0.749	0.156399	1.0355	0.53705	104
PBT	0.0002	0.0146	0.001476	0.0009	0.001939	0.00402	0.0003	181
PH	6.13	7.64	6.777041	6.75	0.295074	7.3025	6.29	196
PT	0.0029	0.0798	0.016801	0.0148	0.009564	0.0315	0.0064	193
SET	0.00005	0.00113	0.000159	0.0001	0.000163	0.000412	0.00007	77
SIO2	1.66	5.06	3.349033	3.25	0.779731	4.5225	2.0125	86
SOT	7.66	51.9	12.63944	10.45	7.678573	22.4	8.125	36
SRT	0.0204	0.145	0.047693	0.0435	0.01913	0.08044	0.02502	193
TURB	0	39.8	2.027398	0.945	4.180004	5.2625	0.38	196
VT	0.000084	0.0036	0.000319	0.0002	0.000367	0.000685	0.0001	184
ZNT	0.0037	0.153	0.02333	0.0194	0.016392	0.05082	0.008366	193

9.1.8 Salmonier River at St. Catherines (NFO2ZN0004)

Parameter	Minimum	Maximum	Mean	Median	S.D.	95th Perc	5th Perc	Count
ALT	0.028	0.279	0.092433	0.086	0.043167	0.18045	0.03978	154
AST	0.00006	0.0004	0.000123	0.0001	0.000054	0.0002	0.0001	83
BAT	0.0025	0.0072	0.003467	0.0033	0.000699	0.004935	0.0028	154
BET	0.00001	0.05	0.015638	0.00002	0.023167	0.05	0.000013	48
CAD	1.37	96.1	2.758467	2.17	7.655395	2.67	1.5245	150
DOC	2.4	25.4	5.228882	4.75	2.346021	8.1	3.155	152
CDT	0.000001	0.0001	0.000049	0.000012	0.000048	0.0001	0.000002	58
CLT	4.8	7.31	5.674333	5.5	0.701483	7.078	4.8945	30
COLOURA	5	120	35.11711	30	16.52293	60.27	19.41	152
COND	28.1	66.2	39.21299	39.3	5.277737	46.14	32.165	154
COT	0.000021	0.0004	0.00009	0.0001	0.000065	0.0002	0.000024	81
CRT	0.000068	0.0014	0.000204	0.0002	0.000178	0.0004	0.000077	74
CUT	0.00018	0.0058	0.000495	0.0003	0.000674	0.0013	0.0002	136
FET	0.0448	0.554	0.145579	0.1245	0.085962	0.29015	0.066355	152
KU	0.08	3.18	0.300444	0.23	0.43705	0.368	0.18	45
LIT	0	0.0012	0.000508	0.0005	0.000165	0.0008	0.000255	152
MGD	0.5	15.2	0.772867	0.675	1.18621	0.8255	0.53	150
MOT	0.000006	0.0008	0.000077	0.000034	0.00011	0.0002	0.000014	55
NAU	3.26	15.8	4.162222	3.87	1.80298	4.746	3.338	45
NIT	0.00005	0.001	0.000204	0.0002	0.000162	0.0004	0.000074	68
NT	0.021	0.282	0.169479	0.168	0.038667	0.2224	0.1272	73
PBT	0.000023	0.005	0.000305	0.0002	0.000571	0.0007	0.000035	81
PH	5.49	7.37	6.566623	6.575	0.272564	7.0105	6.17	154
PT	0.0007	0.0228	0.004987	0.0043	0.002954	0.00989	0.00221	152
SET	0	0.0003	0.000095	0.0001	0.000048	0.0002	0.00005	59
SIO2	0.83	14.8	1.987105	1.735	1.540759	2.6025	1.2875	76
SOT	1.08	1.79	1.369333	1.37	0.165125	1.6255	1.158	30
SRT	0.0062	0.013	0.009226	0.0092	0.001488	0.011345	0.007	152
TURB	0	2.3	0.484902	0.41	0.305661	1	0.222	153
VT	0.000087	0.0005	0.000159	0.000132	0.000076	0.0003	0.0001	142
ZNT	0.0002	0.0071	0.000841	0.0006	0.000877	0.002165	0.000235	148

9.1.9 Virginia River at The Boulevard (NF02ZM0014)

Parameter	Minimum	Maximum	Mean	Median	S.D.	95th Perc	5th Perc	Count
ALT	0.013	0.875	0.096573	0.0689	0.108491	0.269	0.022	201
AST	0.0001	0.0005	0.000153	0.0001	0.00007	0.000276	0.0001	137
BAT	0.022	0.126	0.056712	0.0534	0.0204	0.0964	0.0317	201
BET	0.00002	0.13	0.017638	0.00008	0.029686	0.07	0.000029	170
BT	0.0078	0.0136	0.010351	0.0102	0.001543	0.01292	0.00796	53
CAD	7	32.8	13.32896	12.7	3.91706	21.02	8.306	193
DOC	1.1	5.8	3.131364	3.1	0.758606	4.415	2	198
CDT	0.000003	0.0008	0.000095	0.0001	0.000106	0.00027	0.000007	127
CLT	72.6	750	167.4273	144	113.9961	372.65	77.935	44
COLOURA	4.3	50	11.96083	10	6.961389	21.275	5	194
COND	261	3734	629.4095	533	387.0458	1187	338	201
COT	0.000076	0.0015	0.000293	0.0002	0.000223	0.0008	0.0001	193
CRT	0.000134	0.0115	0.000487	0.0003	0.001023	0.0012	0.000186	146
CUT	0.0006	0.0207	0.00259	0.0023	0.001646	0.00463	0.0015	199
FET	0.0343	1.56	0.182349	0.139	0.169492	0.4247	0.05917	199
KU	0.8	5.89	1.790875	1.65	0.639099	2.8525	1.1895	80
LIT	0.001	0.0095	0.003129	0.0027	0.001582	0.0067	0.0013	199
MGD	1.63	5.2	2.88715	2.78	0.72597	4.264	1.89	193
MOT	0.000067	0.0015	0.000151	0.0001	0.000151	0.00033	0.00008	135
NAU	49	485	98.9475	82.6	60.0954	208.85	53.89	80
NIT	0.0002	0.0032	0.000497	0.0004	0.000335	0.0009	0.0002	177
NT	0.34	1.67	1.075315	1.02	0.225405	1.475	0.817	111
PBT	0.000121	0.00914	0.000856	0.000478	0.001265	0.00263	0.000189	156
PH	6.19	7.75	7.005672	6.97	0.338941	7.55	6.46	201
PT	0.0058	0.0708	0.020929	0.02055	0.008096	0.03345	0.010585	200
SET	0	0.00156	0.000157	0.00011	0.000162	0.000314	0.00006	94
SIO2	0.57	6.02	3.964101	4.035	1.077593	5.47	2.1425	84
SO4	10.3	30.3	13.63864	12.3	3.939094	21.355	10.8	44
SRT	0.025	0.125	0.054457	0.0518	0.017132	0.09032	0.03265	199
TURB	0	60	2.026766	0.69	5.645662	5.28	0.19	201
VT	0.00008	0.0018	0.000257	0.0002	0.000222	0.0006	0.0001	184
ZNT	0.00252	0.135	0.024539	0.0205	0.018346	0.05944	0.005715	199

9.1.10 Waterford River at Kilbride (NF02ZM0009)

Parameter	Minimum	Maximum	Mean	Median	S.D.	95th Perc	5th Perc	Count
ALT	0.023	1.57	0.137734	0.0855	0.198371	0.4166	0.039	193
AST	0.0001	0.00091	0.000201	0.0002	0.000113	0.0004	0.0001	139
BAT	0.00543	0.0517	0.020503	0.0179	0.008233	0.039	0.01114	193
BET	0.000018	0.19	0.016582	0.000052	0.030235	0.06	0.000021	110
BT	0.0055	0.0114	0.008567	0.0088	0.00156	0.01078	0.00594	43
CAD	4.5	27.7	12.00703	11.6	3.823772	18.785	6.625	182
DOC	1.4	8.2	3.161949	3	1.024907	4.9	1.9	195
CDT	0.000012	0.0008	0.000121	0.0001	0.000124	0.000365	0.000015	128
CLT	47.1	724	171.1209	134	116.9876	338.4	64.88	43
COLOURA	5	63.3	15.63351	12.35	9.97459	31.565	5	188
COND	12	2430	581.3381	492	344.0655	1228.6	257.2	197
COT	0.0001	0.0029	0.000484	0.0004	0.000345	0.00105	0.0002	191
CRT	0.00009	0.0076	0.000594	0.0003	0.000916	0.00218	0.000168	145
CUT	0.001	0.0274	0.002802	0.0021	0.002747	0.00625	0.0014	191
FET	0.104	2.81	0.304194	0.203	0.383046	0.8365	0.128	191
KU	0.71	3.67	1.649851	1.45	0.591924	2.862	1.106	67
LIT	0.0005	0.0076	0.001921	0.0017	0.001105	0.004	0.0008	191
MGD	1.1	3.5	2.249615	2.23	0.523138	3.2095	1.45	182
MOT	0.000031	0.0012	0.00013	0.0001	0.000124	0.000209	0.00006	92
NAU	30.9	437	99.87015	84.2	61.91286	170.2	46.04	67
NIT	0.0002	0.00198	0.000511	0.0004	0.000302	0.001204	0.000233	174
NT	0.38	1.76	1.018628	0.984	0.245524	1.494	0.708	113
PBT	0.000192	0.0296	0.001478	0.0005	0.003328	0.007874	0.0002	155
PH	6.09	8.12	6.803452	6.77	0.326457	7.372	6.322	197
PT	0.0081	0.2859	0.03316	0.024	0.030381	0.08315	0.014	196
SET	0	0.00711	0.00025	0.0001	0.00082	0.000353	0.000087	75
SIO2	0.96	5.87	4.166356	4.295	1.058093	5.4875	2.2625	96
SOT	7.06	34.7	13.07558	11.8	4.553604	18.78	9.194	43
SRT	0.0225	0.142	0.056308	0.0545	0.018484	0.0852	0.02975	191
TURB	0.11	52.4	1.961071	0.765	4.922228	5.85	0.2975	196
VT	0.000074	0.0035	0.000283	0.0002	0.000422	0.000829	0.0001	170
ZNT	0.0052	0.124	0.02909	0.0219	0.021537	0.0639	0.00845	191

9.2 Central

9.2.1 Exploits River near Millertown (NFO2Y00107)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.0485	0.68	0.080785	0.069	0.061887	0.1452	0.05492	117
AST	0.0001	0.001	0.00023	0.0002	0.000123	0.0004	0.0001	102
BAT	0.00643	0.105	0.046767	0.0449	0.013062	0.06675	0.0303	116
BET	0.000003	0.05	0.006133	0.00001	0.016386	0.05	0.000005	49
CAD	2.11	4.45	2.485526	2.445	0.268221	2.92	2.2	114
DOC	2.1	9.6	4.794746	4.8	0.751858	5.915	4	118
CDT	0.000019	0.0003	0.000087	0.0001	0.000044	0.0002	0.000034	103
CLT	1.39	2.02	1.76925	1.765	0.127875	1.9405	1.5785	40
COLOURA	10	59.3	28.99717	29.5	6.429456	40	20	117
COND	2.4	35.9	23.99915	24.1	2.947636	27.5	21.07	118
COT	0.000006	0.0009	0.000068	0.000028	0.000117	0.000114	0.000008	65
CRT	0.000077	0.001	0.000191	0.000099	0.000199	0.000589	0.00008	62
CUT	0.00009	0.0188	0.002959	0.00225	0.002471	0.00783	0.001068	115
FET	0.0286	1.16	0.080012	0.05825	0.112636	0.14105	0.035975	114
KU	0	0.38	0.1586	0.15	0.052	0.2465	0.1145	50
LIT	0.00009	0.0005	0.000137	0.0001	0.000084	0.00027	0.0001	67
MGD	0.36	0.58	0.417544	0.42	0.029515	0.47	0.38	114
MOT	0.000019	0.0005	0.000089	0.000076	0.000059	0.0002	0.000049	77
NAU	1.11	1.62	1.4082	1.42	0.087194	1.5855	1.2635	50
NIT	0.0001	0.00092	0.000229	0.0002	0.000151	0.000503	0.00011	78
NT	0.145	0.398	0.230457	0.2205	0.044783	0.32205	0.17445	70
PBT	0.0002	0.0119	0.003126	0.0024	0.002385	0.008735	0.000672	114
PH	6.19	7.24	6.709153	6.695	0.214217	7.013	6.347	118
PT	0.0007	0.0217	0.003389	0.0029	0.002434	0.006375	0.00123	114
SET	0.00003	0.00023	0.000086	0.0001	0.000051	0.0002	0.00003	51
SIO2	1.86	2.86	2.4076	2.41	0.200645	2.724	2.077	50
SOT	0.7	1.45	1.14425	1.17	0.171185	1.372	0.8685	40
SRT	0.0062	0.0136	0.007866	0.007725	0.000863	0.008994	0.006765	114
TURB	0.11	11.2	0.528983	0.405	1.019155	0.795	0.2255	118
VT	0.000008	0.002	0.000134	0.0001	0.000195	0.0003	0.000066	101
ZNT	0.0016	0.0455	0.023755	0.0217	0.010113	0.041675	0.010895	114

9.2.2 Exploits River at Grand Falls (NF02YO0001)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.0401	0.129	0.070816	0.06655	0.017475	0.104	0.0485	86
AST	0.0001	0.0009	0.000265	0.00027	0.00013	0.000477	0.0001	83
BAT	0.0031	0.0577	0.032662	0.03215	0.009537	0.0467	0.01805	86
BET	0.000005	0.05	0.00103	0.00001	0.007068	0.000013	0.000008	49
CAD	0.32	17.1	2.527923	2.48	1.320661	2.83	2	130
DOC	0.5	9.7	5.252308	5.1	1.305622	8.065	3.6	130
CDT	0.000017	0.0002	0.000053	0.000038	0.000034	0.0001	0.000023	64
CLT	1.68	2.97	1.950488	1.9	0.249115	2.25	1.72	41
COLOURA	10	80	34.33889	30.75	11.24242	54.76	20	144
COND	17.8	126	25.10828	24.3	8.90069	30	20.1	145
COT	0.00001	0.0001	0.000042	0.000026	0.000032	0.0001	0.000012	61
CRT	0.00007	0.0008	0.000158	0.00011	0.000142	0.0005	0.000087	57
CUT	0.0007	0.005	0.001522	0.00142	0.000541	0.002192	0.00096	85
FET	0.0383	0.23	0.099602	0.0872	0.042565	0.17475	0.050375	86
KU	0.11	0.35	0.181719	0.17	0.045605	0.287	0.14	64
LIT	0.0001	0.0004	0.000156	0.000115	0.000074	0.0003	0.0001	36
MGD	0.3	3.3	0.500392	0.46	0.319011	0.561	0.3845	130
MOT	0.000033	0.0006	0.000104	0.000087	0.000086	0.000283	0.00005	68
NAU	1.23	2.08	1.583594	1.57	0.119705	1.805	1.4515	64
NIT	0.00007	0.001	0.000191	0.00016	0.000131	0.0003	0.000103	67
NT	0.04	0.555	0.206347	0.213	0.062053	0.293	0.1115	144
PBT	0.000417	0.00382	0.00136	0.001185	0.000675	0.00281	0.000578	84
PH	5.9	7.9	6.687034	6.7	0.221911	7.02	6.384	145
PT	0.0009	0.054	0.006214	0.005	0.005399	0.012	0.00212	145
SET	0	0.00062	0.000073	0.00005	0.000115	0.000087	0.00004	24
SIO2	1.83	3.4	2.498519	2.525	0.386573	3.1	1.9725	54
SOT	0.94	1.74	1.332195	1.31	0.183297	1.65	1.03	41
SRT	0.0061	0.0113	0.008021	0.0081	0.000855	0.009153	0.006655	86
TURB	0.12	2.6	0.58695	0.5	0.315846	1.1	0.26	141
VT	0.000027	0.0003	0.000127	0.000106	0.000049	0.0002	0.000075	80
ZNT	0.006	0.0196	0.012231	0.0124	0.002833	0.01724	0.00772	85

9.2.3 Exploits River at Aspen Brook (NF02YO0020)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.033	0.572	0.092294	0.08015	0.054949	0.15625	0.054525	156
AST	0.0001	0.0007	0.000241	0.0002	0.000106	0.0004	0.0001	111
BAT	0.0064	0.44	0.039685	0.03365	0.036434	0.06345	0.015725	156
BET	0.000006	0.05	0.005112	0.00001	0.015132	0.05	0.000008	49
CAD	1.31	2.88	2.333026	2.355	0.265149	2.7135	1.871	152
DOC	1.8	10.1	5.152837	5	1.140506	7.03	3.77	155
CDT	0.000015	0.0009	0.000108	0.0001	0.000126	0.0003	0.000024	102
CLT	1.84	4.88	2.358974	2.26	0.530591	3.325	1.879	39
COLOURA	5	72.5	31.77161	30	10.27191	50	20	155
COND	17.3	37.4	25.32564	25.15	2.680888	29.525	21.325	156
COT	0.000011	0.0008	0.000095	0.0001	0.000106	0.0002	0.000016	83
CRT	0.00008	0.0037	0.000374	0.0002	0.000639	0.0016	0.000099	96
CUT	0.00051	0.0127	0.002291	0.0018	0.001621	0.00514	0.0008	153
FET	0.0384	1.1	0.12329	0.0975	0.112239	0.2838	0.05148	153
KU	0.01	0.32	0.166	0.16	0.047455	0.2455	0.119	50
LIT	0.0001	0.0007	0.000171	0.000135	0.000091	0.0003	0.0001	100
MGD	0.26	0.55	0.443355	0.44	0.041864	0.5	0.3755	152
MOT	0.000041	0.0005	0.000107	0.0001	0.000077	0.0002	0.000049	83
NAU	1.21	3.17	1.7474	1.73	0.284104	2.1295	1.477	50
NIT	0.00006	0.0012	0.000251	0.0002	0.000165	0.00051	0.00012	99
NT	0.084	1.42	0.240986	0.222	0.147792	0.31155	0.1748	70
PBT	0.0002	0.0864	0.0036	0.00199	0.008126	0.0094	0.000648	151
PH	4.49	7.1	6.60109	6.62	0.292065	6.98	6.2075	156
PT	0.0005	0.0297	0.003912	0.0032	0.003451	0.00847	0.00133	154
SET	0.00003	0.0002	0.000083	0.0001	0.00004	0.000165	0.00003	48
SIO2	1.43	3.25	2.478182	2.5	0.350123	3.042	2.047	55
SOT	0.89	1.64	1.187949	1.16	0.165408	1.47	0.936	39
SRT	0.0029	0.0138	0.00819	0.0082	0.001121	0.00984	0.00656	153
TURB	0.13	41.6	0.778013	0.42	3.314004	1.0025	0.21	156
VT	0.000037	0.0016	0.000178	0.000116	0.000171	0.0004	0.000097	127
ZNT	0.0042	0.12	0.019597	0.016	0.012827	0.0391	0.00764	153

9.2.4 Gander River Below at Appleton (NFO2YQ0030)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.036	0.174	0.102127	0.101	0.016124	0.12545	0.083715	98
AST	0.0001	0.0008	0.000388	0.000415	0.000154	0.00059	0.0001	94
BAT	0.0008	0.0252	0.001793	0.001455	0.002407	0.002345	0.0012	98
BET	0.000006	0.05	0.006742	0.000013	0.017061	0.05	0.000011	52
CAD	1.1	2.05	1.385684	1.36	0.138242	1.679	1.247	95
DOC	2	8.5	6.833465	6.88	0.81789	8	5.7	101
CDT	0.000002	0.0009	0.000037	0.000005	0.000124	0.0001	0.000002	53
CLT	2.19	4.1	2.483696	2.42	0.305659	2.945	2.21	46
COLOURA	37.2	65.4	47.83069	48.5	5.453362	60	40	101
COND	17.9	42	23.46931	22.3	3.970977	32	20.3	101
COT	0.000015	0.0002	0.000048	0.000025	0.000044	0.0001	0.000018	62
CRT	0.00008	0.0014	0.000227	0.0002	0.000144	0.0003	0.000173	88
CUT	0.0002	0.0095	0.000724	0.0005	0.001252	0.0013	0.00028	94
FET	0.0414	0.182	0.08478	0.08305	0.022006	0.11975	0.0533	96
KU	0.13	0.48	0.203571	0.19	0.054031	0.295	0.16	56
LIT	0.0001	0.0005	0.000386	0.0004	0.000079	0.0005	0.0002	95
MGD	0.58	0.8	0.642842	0.63	0.04041	0.713	0.597	95
MOT	0.000025	0.0001	0.000052	0.000039	0.000027	0.0001	0.000031	59
NAU	1.62	2.76	1.864643	1.83	0.189256	2.175	1.67	56
NIT	0.00017	0.0011	0.000617	0.0006	0.000135	0.0008	0.0004	95
NT	0.219	0.44	0.268707	0.263	0.030619	0.3087	0.2324	75
PBT	0.000014	0.00311	0.000277	0.00015	0.000529	0.00068	0.000018	65
PH	5.62	6.9	6.456832	6.48	0.168305	6.66	6.21	101
PT	0.0009	0.0211	0.004512	0.00375	0.002898	0.01061	0.0019	100
SET	0.00004	0.0002	0.000077	0.00005	0.000043	0.00018	0.00004	49
SIO2	1.69	2.78	2.351081	2.35	0.222052	2.624	2.02	37
SOT	0.61	1.06	0.765435	0.715	0.122859	1.0075	0.6325	46
SRT	0.00631	0.0116	0.00757	0.00741	0.000833	0.00863	0.006693	96
TURB	0.05	1.48	0.364257	0.31	0.205828	0.73	0.14	101
VT	0.000049	0.0002	0.00009	0.000084	0.00003	0.000125	0.000059	76
ZNT	0.0003	0.0087	0.001185	0.0009	0.001017	0.002203	0.0006	96

9.2.5 Indian Brook at Route 390 (NFO2YM0003)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.025	0.314	0.117013	0.116	0.047761	0.1678	0.0412	63
AST	0.0001	0.00055	0.000219	0.0002	0.000074	0.00032	0.000157	35
BAT	0.00377	0.00988	0.004769	0.00466	0.000891	0.00549	0.004013	63
BET	0.000006	0.05	0.001442	0.000014	0.008328	0.000022	0.000008	35
CAD	0.11	6.1	3.341704	3.35	0.916744	4.751	1.965	135
DOC	2.6	14	6.746729	6.6	1.875833	9.64	3.72	107
CDT	0	0.0001	0.000016	0.000005	0.000029	0.0001	0.000002	38
CLT	2.22	17.8	3.806	3.32	2.539829	5.29	2.341	35
COLOURA	10	140	49.01898	50	19.18328	73.64	20	137
COND	5.3	86.9	39.67226	39.3	10.04265	54.12	25.74	137
COT	0.000023	0.000419	0.000077	0.000048	0.000074	0.000205	0.000029	40
CRT	0.0003	0.0011	0.000517	0.0005	0.000162	0.00082	0.0003	59
CUT	0.0001	0.0041	0.000707	0.00033	0.000863	0.002805	0.0002	60
FET	0.0295	0.826	0.18503	0.168	0.104139	0.3325	0.0758	63
KU	0.07	0.33	0.230857	0.23	0.050164	0.32	0.171	35
LIT	0	0.0006	0.000218	0.0002	0.000092	0.0004	0.0001	56
MGD	0.1	2.5	1.304219	1.31	0.263592	1.652	0.912	137
MOT	0.000055	0.000247	0.000118	0.000101	0.000046	0.0002	0.000066	44
NAU	1.63	11.3	2.632857	2.27	1.553031	3.547	1.775	35
NIT	0.0005	0.00331	0.001837	0.0017	0.000575	0.002734	0.000928	63
NT	0.06	0.417	0.190579	0.2	0.068978	0.281	0.083	107
PBT	0.000015	0.00601	0.000354	0.00006	0.00086	0.001	0.000027	50
PH	5.96	7.5	6.886074	6.9	0.252437	7.3	6.5	135
PT	0.001	0.026	0.004676	0.0038	0.003634	0.011	0.001	130
SET	0.00002	0.00009	0.000051	0.00005	0.000013	0.000069	0.00004	24
SIO2	3.9	6.1	4.98	4.9	0.723326	6.08	3.92	25
SOT	0.54	1.26	0.888857	0.83	0.192662	1.193	0.59	35
SRT	0.0069	0.019	0.012506	0.0123	0.002986	0.01792	0.0083	63
TURB	0.14	4.85	0.609925	0.43	0.677747	1.84	0.18	133
VT	0.0001	0.001	0.000235	0.0002	0.000136	0.0004	0.0001	57
ZNT	0.0002	0.0058	0.001137	0.0008	0.001023	0.0026	0.0003	61

9.2.6 Northwest Gander River at Highway Bridge (NFO2YQ0006)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.004	0.235	0.118991	0.122	0.041785	0.191	0.0454	101
AST	0.0003	0.00202	0.000935	0.0008	0.000409	0.001772	0.0005	79
BAT	0.0002	0.00269	0.00131	0.00127	0.000496	0.0021	0.0006	101
BET	0.000001	0.05	0.007323	0.000008	0.01767	0.05	0.000004	41
CAD	0.61	1.91	1.248557	1.28	0.274373	1.704	0.806	97
DOC	2	15.1	8.41932	8.1	2.117513	12.09	5.61	103
CDT	0.000001	0.0002	0.000041	0.000005	0.000054	0.0001	0.000002	49
CLT	1.45	4.32	2.438571	2.34	0.650025	3.671	1.548	35
COLOURA	10	120	68.07864	70	19.01461	100	38.65	103
COND	11.8	78.4	24.8767	23.4	7.937195	37.5	17.23	103
COT	0.000037	0.0004	0.000119	0.0001	0.000071	0.00029	0.000057	83
CRT	0.00017	0.0372	0.000723	0.000224	0.003864	0.0006	0.000183	91
CUT	0.00016	0.0092	0.000764	0.0003	0.001501	0.0028	0.000198	96
FET	0.0066	0.883	0.268616	0.26	0.108054	0.4248	0.1353	99
KU	0.1	0.43	0.156818	0.15	0.052213	0.2255	0.11	44
LIT	0.0001	0.0007	0.000321	0.0003	0.000113	0.0005	0.000198	96
MGD	0.33	2.8	1.072577	1.01	0.399588	1.844	0.598	97
MOT	0.000026	0.0045	0.000161	0.000065	0.000588	0.000225	0.000036	56
NAU	1.25	2.65	1.806591	1.795	0.279805	2.2525	1.4075	44
NIT	0.0004	0.0057	0.001445	0.0012	0.000842	0.00298	0.000682	97
NT	0.109	0.429	0.2649	0.263	0.057844	0.3706	0.17815	60
PBT	0.000041	0.0016	0.000257	0.000147	0.000281	0.000785	0.000046	64
PH	5.39	7.14	6.435049	6.44	0.282172	6.888	6.1	103
PT	0.0007	0.0259	0.005427	0.0049	0.003286	0.008435	0.0024	100
SET	0.00003	0.0002	0.000089	0.00006	0.000052	0.0002	0.000039	39
SIO2	0.33	4.06	2	1.93	1.005593	3.446	0.504	33
SO4	0.31	1.04	0.661429	0.63	0.180652	0.94	0.412	35
SRT	0.0032	0.0108	0.007093	0.0072	0.001511	0.0096	0.004785	98
TURB	0.16	3.2	0.537864	0.5	0.323811	0.895	0.29	103
VT	0.000095	0.0006	0.000152	0.000126	0.00007	0.000217	0.0001	87
ZNT	0.0002	0.00375	0.00094	0.000715	0.000679	0.002435	0.0003	94

9.2.7 Pound Cove Brook at Route 330 (NFO2YR0001)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.13	0.499	0.2546	0.245	0.065353	0.3786	0.1594	145
AST	0.00009	0.0007	0.000147	0.0001	0.000097	0.000241	0.0001	79
BAT	0.0004	0.0026	0.001448	0.0014	0.000412	0.00218	0.0009	145
BET	0.000045	0.09	0.012656	0.000078	0.027673	0.08	0.00005	131
CDT	0.000004	0.0002	0.000062	0.000056	0.000061	0.0002	0.000005	58
CAD	0.26	2.03	0.685972	0.63	0.237397	1.084	0.4015	144
DOC	4	22.9	11.12381	10.2	3.651471	17.53	6.53	147
CLT	3.65	16.6	8.371034	7.83	3.024495	12.72	4.316	29
CRT	0.00014	0.0039	0.000389	0.0003	0.000472	0.0008	0.00018	129
COT	0.000061	0.0004	0.00014	0.0001	0.000066	0.0003	0.00008	129
COLOURA	40	290	120.6993	100	50.65817	218.5	60	146
CUT	0.00011	0.0087	0.000763	0.0003	0.001409	0.002045	0.00016	120
FET	0.162	0.992	0.434063	0.3895	0.177895	0.75595	0.2192	142
PBT	0.000173	0.0022	0.000532	0.000408	0.000342	0.001	0.0002	117
LIT	0.0005	0.0027	0.001282	0.0012	0.000438	0.0021	0.00068	141
MGD	0.26	1.37	0.70625	0.68	0.238726	1.1555	0.37	144
MOT	0.000007	0.0004	0.000077	0.000029	0.000096	0.0003	0.000012	42
NIT	0.00006	0.0018	0.000287	0.0002	0.000216	0.0006	0.00011	87
NT	0.158	0.642	0.351228	0.329	0.102819	0.5108	0.2074	57
PH	4.51	6.5	5.088095	5.06	0.301108	5.585	4.673	147
PT	0.0014	0.036	0.009087	0.0084	0.004449	0.0158	0.00334	143
KU	0.13	0.52	0.218529	0.21	0.07353	0.3315	0.1365	34
SET	0.00005	0.0003	0.000109	0.0001	0.000051	0.0002	0.00005	64
SIO2	0.18	3.84	1.541167	1.3	0.848361	2.8205	0.4345	60
NAU	2.75	10.7	5.185882	5.08	1.431345	6.5475	3.1965	34
COND	18.9	78.3	42.03425	40.5	12.20592	63.55	25.225	146
SRT	0.0022	0.0106	0.005581	0.005395	0.001703	0.0087	0.003	142
SOT	0.44	3.68	0.957931	0.75	0.606325	1.432	0.472	29
TURB	0.22	11.2	0.802345	0.52	1.085511	2.18	0.29	145
VT	0.0002	0.0008	0.000426	0.0004	0.000124	0.000663	0.000286	142
ZNT	0.0005	0.0062	0.001657	0.0016	0.000703	0.002695	0.0008	142

9.2.8 South West Brook at Baie Verte (NFO2YM0004)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.027	0.525	0.267117	0.2735	0.091798	0.3905	0.08344	158
AST	0.0001	0.0018	0.000245	0.0002	0.000178	0.0004	0.0001	108
BAT	0.00262	0.0104	0.004939	0.004725	0.00133	0.007515	0.003299	158
BET	0	0.000013	0.000009	0.00001	0.000003	0.000012	0.000003	36
CDT	0	0.0002	0.00004	0.000007	0.00005	0.0001	0.000002	54
CAD	1.4	11.7	4.045752	4	1.398616	5.844	2.022	153
DOC	1	22	13.90443	14	3.225322	19.1	7.94	158
CLT	3.73	24.1	9.660857	8.63	4.435329	16.74	3.978	35
CRT	0.000396	0.0027	0.000804	0.0007	0.000363	0.00147	0.000492	154
COT	0.000024	0.001	0.000199	0.0002	0.000137	0.0004	0.000083	145
COLOURA	5	210	109.2134	104	35.61356	164	50	157
CUT	0.00035	0.0111	0.001443	0.001	0.001602	0.004575	0.000597	154
FET	0.0184	0.622	0.296502	0.31	0.107737	0.4602	0.09025	155
PBT	0.000013	0.0017	0.000387	0.0003	0.000376	0.00128	0.000045	105
LIT	0	0.001	0.000283	0.0003	0.000137	0.0005	0.0001	150
MGD	0.44	2.5	1.064118	1.06	0.297257	1.5	0.606	153
MOT	0.000039	0.0006	0.00013	0.0001	0.000085	0.0002	0.000064	106
NIT	0.0005	0.002	0.00103	0.001	0.000266	0.0016	0.0007	154
NT	0.16	0.825	0.417426	0.4165	0.094431	0.53195	0.28195	68
PH	5.65	7.55	6.531783	6.51	0.373303	7.2	5.978	157
PT	0.0019	0.04	0.009321	0.0085	0.004437	0.01795	0.004775	156
KU	0.13	0.52	0.286047	0.26	0.085349	0.448	0.173	43
SET	0	0.0002	0.000101	0.0001	0.000046	0.0002	0.000058	76
SIO2	0.67	6.03	3.260781	2.945	1.611158	5.881	1.1345	64
NAU	2.7	26.1	7.314186	6.66	4.189875	15.02	3.137	43
COND	23.2	367	66.69554	60.4	37.74024	119.2	30.46	157
SRT	0.0057	0.0348	0.014681	0.0147	0.004275	0.02049	0.00807	155
SOT	0.42	1.59	0.911143	0.82	0.299588	1.54	0.544	35
TURB	0.1	9.5	0.716115	0.45	0.977877	2.068	0.238	157
VT	0.0001	0.0009	0.000374	0.000386	0.000128	0.0006	0.0002	154
ZNT	0.0002	0.0047	0.001263	0.0011	0.000797	0.002648	0.0004	153

9.2.9 Terra Nova River at Spencer Bridge (NFO2YS0011)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.05	1.62	0.148612	0.107	0.173494	0.3803	0.067485	110
AST	0.00007	0.00481	0.000279	0.0002	0.000517	0.00041	0.0001	81
BAT	0.0008	0.0411	0.002276	0.0015	0.004076	0.004047	0.001084	110
BET	0.000012	0.05	0.009637	0.000021	0.019695	0.05	0.000016	52
CAD	0.31	2.26	1.061321	1.02	0.251445	1.3775	0.7825	106
DOC	1.1	10.9	6.073119	6	1.445868	7.8	4.2	109
CDT	0	0.0007	0.000072	0.000008	0.000118	0.0003	0.000002	62
CLT	1.61	5.67	2.448	2.21	0.848184	4.218	1.712	35
COLOURA	10	184	46.4789	43.5	19.37747	72.58	21.6	109
COND	13.2	93.8	21.09358	18.4	10.02417	30.44	15.7	109
COT	0.000015	0.00284	0.00014	0.0001	0.000332	0.000335	0.000026	74
CRT	0.00009	0.0018	0.000307	0.0002	0.000327	0.001	0.0001	87
CUT	0.00003	0.0123	0.000839	0.0003	0.001702	0.00339	0.00011	103
FET	0.0611	15.2	0.371343	0.185	1.445442	0.6364	0.09776	109
KU	0.1	0.39	0.217	0.21	0.052621	0.331	0.15	50
LIT	0	0.0021	0.000706	0.0007	0.000226	0.001	0.0005	108
MGD	0.15	0.6	0.364151	0.355	0.065817	0.4725	0.2825	106
MOT	0.000013	0.000696	0.000088	0.000076	0.000088	0.0002	0.000031	68
NAU	1.3	3.59	1.8512	1.715	0.442884	2.6325	1.45	50
NIT	0.0001	0.00133	0.000275	0.0002	0.000187	0.0006	0.00012	84
NT	0.132	2.92	0.262391	0.218	0.340981	0.3108	0.1623	64
PBT	0.000025	0.00479	0.000478	0.0002	0.000769	0.00198	0.000033	83
PH	5.28	6.91	6.133211	6.14	0.241736	6.524	5.728	109
PT	0.0013	0.0369	0.00515	0.0039	0.004952	0.01486	0.00186	107
SET	0	0.00048	0.000084	0.000055	0.000079	0.0002	0.00003	36
SIO2	0.81	3.21	2.05275	2.17	0.625132	3.0605	0.848	40
SOT	0.46	0.96	0.660571	0.65	0.11885	0.851	0.501	35
SRT	0.0023	0.0997	0.006236	0.0052	0.009073	0.0073	0.004034	109
TURB	0.15	74	1.255278	0.4	7.066616	1.4	0.2	108
VT	0.000097	0.00694	0.00031	0.0002	0.000695	0.000781	0.0001	105
ZNT	0.0003	0.0386	0.002441	0.001	0.00483	0.00884	0.0004	109

9.2.10 Terra Nova River at Terra Nova (NF02YS0001)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.0586	0.33	0.113511	0.099	0.050486	0.2246	0.0704	105
AST	0.0001	0.00063	0.000303	0.0003	0.000141	0.00059	0.0001	80
BAT	0.0008	0.0552	0.001922	0.0013	0.005244	0.002048	0.00091	105
BET	0.000009	0.06	0.009127	0.000018	0.019636	0.05	0.000015	45
CAD	0.75	20.2	1.34703	1.08	1.913784	1.6	0.86	101
DOC	3.8	10.5	6.361346	6.1	1.32484	8.785	4.6	104
CDT	0.000001	0.0004	0.00005	0.000008	0.000077	0.000135	0.000002	54
CLT	1.45	7.97	2.423636	2.17	1.061057	3.284	1.8	33
COLOURA	22.8	400	49.94272	47	36.58189	70	30	103
COND	13.9	711	25.94423	18.25	67.64777	25.29	14.93	104
COT	0.00001	0.0004	0.000083	0.000091	0.000065	0.0002	0.000018	71
CRT	0.0001	0.0038	0.000353	0.0002	0.000516	0.00112	0.000109	80
CUT	0.00008	0.0096	0.000755	0.0003	0.00154	0.002865	0.00013	94
FET	0.0731	3.23	0.247887	0.172	0.369813	0.41265	0.10515	104
KU	0.13	2.31	0.263878	0.21	0.303401	0.376	0.144	49
LIT	0	0.0027	0.00068	0.0007	0.000242	0.0009	0.0005	103
MGD	0.3	2.03	0.42505	0.4	0.173853	0.55	0.32	101
MOT	0.000023	0.0005	0.000102	0.000076	0.000076	0.000285	0.000052	64
NAU	1.11	111	3.95449	1.66	15.45914	2.742	1.334	49
NIT	0.00004	0.004	0.0003	0.0002	0.000422	0.000575	0.00015	86
NT	0.157	2.2	0.271661	0.231	0.261879	0.3331	0.1765	59
PBT	0.000021	0.003	0.000416	0.0002	0.000529	0.001445	0.000042	78
PH	5.51	6.89	6.207885	6.195	0.254451	6.6285	5.7915	104
PT	0.0009	0.0171	0.004506	0.0042	0.002128	0.0081	0.0019	101
SET	0	0.0002	0.000074	0.00007	0.000035	0.000101	0.00004	39
SIO2	0.8	5.58	2.097838	2.07	0.795855	3.14	1.228	37
SOT	0.44	1.43	0.686364	0.66	0.17706	0.922	0.49	33
SRT	0.0043	0.0813	0.006648	0.0057	0.007453	0.00784	0.0046	104
TURB	0.16	4	0.61	0.43	0.610766	1.893	0.202	103
VT	0.00009	0.0009	0.0002	0.000147	0.000151	0.0005	0.0001	97
ZNT	0.0003	0.0366	0.00167	0.00101	0.003651	0.00419	0.000408	104

9.3 Western

9.3.1 Corner Brook at Margaret Bowater Park (NFO2YL0013)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.015	0.821	0.109263	0.086	0.097255	0.24375	0.05745	150
AST	0	0.0003	0.000103	0.0001	0.000039	0.0002	0.00007	74
BAT	0.00308	0.0197	0.004391	0.00419	0.001502	0.00566	0.0033	149
BET	0	0.05	0.007783	0.000006	0.018119	0.05	0.000002	45
CAD	5.78	26.8	12.22693	11.55	4.07549	19.11	7.245	150
DOC	2.8	15	4.396711	4.2	1.22047	5.92	3.14	149
CDT	0	0.0002	0.000032	0.000004	0.000049	0.0001	0.000002	47
CLT	4.26	14.7	7.643125	7.4	2.626732	12.71	4.4605	32
COLOURA	5	59.6	28.99257	30	9.399339	45.33	17.12	148
COND	50.7	488	100.13	93.9	41.88907	152.2	63.145	150
COT	0.000011	0.0009	0.000118	0.0001	0.000141	0.000325	0.00002	96
CRT	0.000058	0.001	0.000223	0.0002	0.000171	0.000515	0.00009	78
CUT	0.0002	0.0151	0.000748	0.0004	0.0014	0.00195	0.000235	146
FET	0.0005	1.25	0.112628	0.072	0.162615	0.358	0.0387	149
KU	0.28	0.54	0.415532	0.41	0.052665	0.5	0.353	47
LIT	0	0.0013	0.000357	0.0003	0.000162	0.00069	0.0002	143
MGD	0.92	4.17	1.908733	1.85	0.604233	2.963	1.1535	150
MOT	0.000018	0.0006	0.000084	0.00006	0.000075	0.000182	0.000036	65
NAU	2.83	8.32	4.509574	4.23	1.362463	7.573	2.97	47
NIT	0.00018	0.0014	0.000325	0.00026	0.000226	0.00068	0.0002	105
NT	0.014	0.312	0.216	0.2175	0.043629	0.2819	0.1601	62
PBT	0.000012	0.0031	0.000291	0.0002	0.000416	0.000895	0.000021	82
PH	6.51	8.14	7.499667	7.53	0.311725	7.92	6.8545	150
PT	0.0004	0.0204	0.00353	0.0029	0.002495	0.0073	0.00092	145
SET	0	0.0003	0.000095	0.0001	0.000055	0.0002	0.00004	61
SIO2	1.62	2.27	1.978519	2.035	0.196539	2.2535	1.6865	54
SOT	1.51	3	2.044063	2.085	0.347283	2.49	1.5455	32
SRT	0.0123	0.0541	0.020545	0.01915	0.006067	0.030315	0.014335	148
TURB	0	6.4	0.5264	0.35	0.765662	1.25	0.1145	150
VT	0.000085	0.0014	0.00021	0.0002	0.000175	0.0005	0.0001	135
ZNT	0.0002	0.006	0.001001	0.0008	0.000858	0.00256	0.0003	148

9.3.2 Grand Codroy River Below Overfall Brook (NFO2ZA0006)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.0185	1.84	0.147691	0.115	0.175783	0.3208	0.0402	145
AST	8.00E-05	0.0005	0.000139	0.00011	6.90E-05	0.0002	9.00E-05	71
BAT	0.0055	0.0544	0.021572	0.0189	0.010178	0.03968	0.00852	145
BET	3.00E-06	0.05	0.007327	8.00E-06	0.017668	0.05	3.00E-06	41
CAD	2.36	32.4	10.95917	9.23	6.767754	23.16	2.968	145
DOC	1.2	11.3	4.554134	4.15	2.058029	8.775	2.125	146
CDT	2.00E-06	0.0002	4.60E-05	7.00E-06	5.40E-05	0.0001	4.00E-06	52
CLT	5.51	21.6	11.68276	10.8	4.309598	17.82	6.138	29
COLOURA	5	140	37.73916	40	21.10033	76.4	10	143
COND	26.5	1480	120.2329	98.65	125.1201	201.75	44.7	146
COT	1.70E-05	0.0014	0.00013	0.0001	0.000162	0.000395	2.00E-05	102
CRT	0.00019	0.0037	0.000413	0.0003	0.000475	0.0008	0.0002	135
CUT	0.0002	0.0046	0.000857	0.0006	0.000812	0.002725	0.0003	144
FET	0.0136	1	0.138541	0.0974	0.136806	0.38545	0.032905	144
KU	0.25	0.75	0.470263	0.47	0.124065	0.7215	0.3085	38
LIT	0.0001	0.0025	0.000513	0.0004	0.000278	0.001	0.0002	142
MGD	0.4	2.93	1.554138	1.49	0.596348	2.57	0.732	145
MOT	3.50E-05	0.0022	0.000168	0.0001	0.000253	0.000242	9.20E-05	94
NAU	3.8	13.4	7.539737	7.035	2.665131	11.935	4.074	38
NIT	0.00015	0.0032	0.000401	0.0003	0.000342	0.00083	0.0002	115
NT	0.12	0.33	0.222263	0.226	0.050166	0.294	0.1346	57
PBT	1.20E-05	0.002	0.000352	0.0002	0.000397	0.001145	2.70E-05	78
PH	6.17	8.27	7.088767	7.05	0.403527	7.7675	6.4425	146
PT	0.0003	0.0543	0.004584	0.0036	0.005899	0.009375	0.001105	142
SET	5.00E-05	0.00076	0.000117	0.0001	9.90E-05	0.0002	5.00E-05	66
SIO2	1.38	5.45	3.141754	3.08	0.916041	4.648	1.918	57
SOT	3	40.8	12.9369	10.3	9.119098	28.88	3.678	29
SRT	0.0124	0.241	0.080432	0.0642	0.055429	0.180085	0.01596	144
TURB	0.1	14	0.831931	0.42	1.602163	2.796	0.154	145
VT	0.0001	0.0036	0.000336	0.0003	0.000321	0.0006	0.0002	138
ZNT	0.0002	0.0152	0.00127	0.0008	0.00178	0.0027	0.000285	136

9.3.3 Humber Canal at Main Dam Road (NFO2YK0022)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.011	0.123	0.064483	0.062	0.015867	0.09385	0.052	58
AST	0.0001	0.0002	0.000116	0.00011	2.30E-05	0.00014	0.0001	41
BAT	0.0049	0.0075	0.005922	0.0058	0.000574	0.0074	0.0051	58
BET	1.00E-05	1.60E-05	1.30E-05	1.30E-05	2.00E-06	1.50E-05	1.00E-05	23
CAD	0.09	14.5	3.802333	3.695	1.475194	3.9205	3.3	60
DOC	2.9	5.7	3.865	3.8	0.504917	4.715	3.2	60
CDT	0	2.30E-05	3.00E-06	2.00E-06	4.00E-06	4.00E-06	1.00E-06	24
CLT	2.46	2.79	2.6148	2.59	0.091657	2.748	2.502	25
COLOURA	10	60	21.15424	20	7.63949	30	10	59
COND	33.2	115	37.787	36.3	10.16015	39.205	34.1	60
COT	0	0.0002	3.60E-05	1.20E-05	4.60E-05	0.0001	8.00E-06	31
CRT	0.000119	0.0004	0.000177	0.00016	5.40E-05	0.000292	0.000125	43
CUT	0.0002	0.0485	0.001771	0.000335	0.00716	0.001625	0.00024	56
FET	0.024	0.148	0.0496	0.04395	0.0236	0.09284	0.02604	58
KU	0.01	0.39	0.2392	0.24	0.065049	0.336	0.15	25
LIT	0.0001	0.0004	0.000165	0.00019	5.90E-05	0.0002	0.0001	48
MGD	0.66	3.43	0.775	0.73	0.346446	0.7605	0.69	60
MOT	5.00E-05	0.000575	0.0001	7.20E-05	8.50E-05	0.0002	6.10E-05	37
NAU	1.89	2.25	1.999167	1.995	0.070173	2.07	1.9115	24
NIT	0.0002	0.0009	0.000277	0.00024	0.000115	0.0004	0.0002	48
NT	0.107	0.294	0.212344	0.2085	0.033594	0.2707	0.1624	32
PBT	8.00E-06	0.0013	0.000122	1.80E-05	0.000257	0.000535	1.00E-05	32
PH	6.18	7.61	7.009833	7.04	0.269744	7.3255	6.457	60
PT	0.0006	0.0059	0.002354	0.0022	0.001114	0.00441	0.0007	59
SET	3.00E-05	0.0002	8.00E-05	8.50E-05	4.20E-05	0.000165	4.00E-05	28
SIO2	0.94	3.44	3	3.07	0.461943	3.35	2.848	23
SOT	1.44	1.78	1.6588	1.66	0.081502	1.77	1.522	25
SRT	0.0128	0.0182	0.014822	0.0146	0.001019	0.016845	0.013755	58
TURB	0.17	5.6	0.529	0.33	0.766293	1.011	0.18	60
VT	1.80E-05	0.0003	0.000121	0.0001	4.70E-05	0.0002	8.70E-05	54
ZNT	9.00E-05	0.0041	0.00053	0.0003	0.000694	0.001584	0.000184	45

9.3.4 Humber River at Humber Village Bridge (NF02YL0012)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.051	0.184	0.077943	0.074	0.021579	0.1165	0.05505	111
AST	0.0001	0.00024	0.000148	0.00015	0.000041	0.0002	0.0001	75
BAT	0.0072	0.0137	0.008314	0.0082	0.000722	0.00929	0.00755	111
BET	0.000002	0.07	0.003872	0.00001	0.014492	0.042502	0.000006	44
CAD	3.42	4.91	4.151284	4.18	0.272421	4.59	3.69	109
DOC	3.2	7.6	4.772703	4.7	0.708241	5.85	3.7	111
CDT	0	0.0001	0.000012	0.000003	0.000029	0.0001	0.000002	40
CLT	3	4.36	3.621143	3.61	0.350378	4.209	3.086	35
COLOURA	17	60	32.34821	30.8	6.616092	40.225	20	112
COND	36.6	55.2	41.47321	40.9	2.736068	45.245	37.81	112
COT	0.000008	0.0002	0.000061	0.00003	0.000053	0.0002	0.000013	66
CRT	0.00013	0.0031	0.000269	0.0002	0.000363	0.0005	0.000131	77
CUT	0.00025	0.00703	0.000652	0.0004	0.000851	0.00179	0.00029	102
FET	0.0415	0.219	0.089156	0.08425	0.028684	0.1491	0.058245	110
KU	0.19	0.41	0.265	0.265	0.029721	0.29	0.2235	48
LIT	0	0.0004	0.000213	0.0002	0.000074	0.0004	0.0001	98
MGD	0.76	0.96	0.864128	0.86	0.046417	0.94	0.79	109
MOT	0.000033	0.0002	0.000077	0.000066	0.000025	0.0001	0.000054	66
NAU	2.18	2.93	2.501875	2.495	0.19302	2.84	2.237	48
NIT	0.00019	0.00274	0.00031	0.00024	0.000294	0.0005	0.0002	86
NT	0.1	1.08	0.238554	0.227	0.109042	0.2652	0.182	65
PBT	0.00001	0.0011	0.000187	0.00005	0.00024	0.0007	0.000018	66
PH	5.9	7.41	6.988661	7.02	0.273811	7.32	6.4785	112
PT	0.0004	0.0295	0.004039	0.0035	0.002824	0.006445	0.002055	112
SET	0	0.00039	0.00009	0.00008	0.000067	0.0002	0.00004	43
SIO2	1.54	3.3	2.747059	2.74	0.336396	3.224	2.3395	34
SOT	1.42	2	1.691143	1.67	0.149011	1.962	1.491	35
SRT	0.0172	0.023	0.020174	0.02005	0.001326	0.022455	0.0182	110
TURB	0.08	4.4	0.544375	0.42	0.532618	1.13	0.15	112
VT	0.00008	0.0004	0.00018	0.000184	0.000071	0.000313	0.0001	97
ZNT	0.0002	0.00154	0.000524	0.000455	0.000259	0.001	0.0003	102

9.3.5 Humber River at Little Falls Bridge (NF02YL0011)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.019	0.311	0.133762	0.134	0.05233	0.23575	0.05925	90
AST	0.00004	0.00033	0.000143	0.000115	0.000063	0.0003	0.00009	60
BAT	0.006	0.0201	0.010897	0.0105	0.002977	0.01597	0.006673	90
BET	0.000001	0.05	0.004417	0.000006	0.01418	0.05	0.000004	34
CAD	1.3	5.25	3.018681	2.79	1.020264	4.805	1.555	91
DOC	2.5	13.6	7.062556	6.65	2.039463	10.9	4.39	90
CDT	0.000002	0.0001	0.000027	0.000005	0.000041	0.0001	0.000003	38
CLT	1.81	5.4	2.991111	2.81	0.887824	4.486	1.975	27
COLOURA	10	104	59.68022	60	18.79652	92.05	28.85	91
COND	19	56	33.37363	31.8	9.373834	51	20.4	91
COT	0.000014	0.0005	0.000109	0.0001	0.000079	0.0002	0.000037	66
CRT	0.00012	0.0019	0.000262	0.0002	0.000223	0.00043	0.000144	75
CUT	0.0002	0.0204	0.000942	0.0004	0.002634	0.001725	0.00021	86
FET	0.0834	0.842	0.324308	0.304	0.121809	0.5396	0.1574	89
KU	0.15	0.39	0.25027	0.25	0.051385	0.328	0.18	37
LIT	0.0001	0.0005	0.000244	0.0002	0.000086	0.0004	0.0001	85
MGD	0.37	1.75	0.742088	0.69	0.24258	1.125	0.4	91
MOT	0.000016	0.0002	0.000065	0.00005	0.000048	0.000196	0.000018	42
NAU	1.44	3.18	2.176216	2.12	0.439215	3.054	1.646	37
NIT	0.00012	0.0006	0.000255	0.0002	0.000106	0.000419	0.000131	62
NT	0.125	0.353	0.228111	0.227	0.056383	0.3164	0.1562	45
PBT	0.000033	0.0017	0.000254	0.000168	0.000271	0.00071	0.000059	59
PH	6.05	7.4	6.696264	6.67	0.293305	7.15	6.17	91
PT	0.0004	0.0157	0.005408	0.0048	0.002657	0.0106	0.0023	91
SET	0.00003	0.0003	0.000096	0.0001	0.000064	0.00022	0.000038	36
SIO2	0.67	4.42	2.558462	2.655	1.162576	4.37	0.9425	26
SOT	0.58	1.99	1.005556	0.91	0.371975	1.836	0.633	27
SRT	0.0066	0.0654	0.017883	0.0163	0.008243	0.0301	0.008512	89
TURB	0.15	3.17	0.647473	0.5	0.475773	1.375	0.195	91
VT	0.0001	0.001	0.000318	0.0003	0.000123	0.0005	0.0002	89
ZNT	0.0004	0.0727	0.001921	0.001	0.007651	0.00231	0.000493	87

9.3.6 Lloyds River at Bridge at Burgeo Road (NFO2YN0001)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.037	0.353	0.098378	0.096	0.033582	0.13595	0.053625	142
AST	0.0001	0.0008	0.000327	0.0003	0.000177	0.000682	0.0001	93
BAT	0.0012	0.00476	0.002885	0.0029	0.000551	0.0038	0.0022	142
BET	0.000001	0.05	0.00556	0.000005	0.015712	0.05	0.000003	36
CDT	0.000001	0.0002	0.000029	0.000004	0.000052	0.0001	0.000003	43
CAD	1.01	5.25	2.468811	2.38	0.733831	3.859	1.414	143
DOC	0.1	11.7	5.080832	4.9	1.441481	7.57	3.1	143
CLT	2.34	5.5	3.468065	3.46	0.745816	4.9	2.645	31
CRT	0.000093	0.003	0.000278	0.0002	0.000383	0.000495	0.000124	82
COT	0.000011	0.0003	0.000072	0.0001	0.000049	0.0001	0.000019	72
COLOURA	17	99.2	42.55874	40	12.02635	60	23.2	143
CUT	0.00012	0.0101	0.00056	0.0003	0.001083	0.00129	0.00015	122
FET	0.0405	0.548	0.126752	0.124	0.055266	0.204	0.0563	141
PBT	0.000023	0.0013	0.000233	0.0002	0.000251	0.000655	0.000029	70
LIT	0.0001	0.0007	0.000169	0.0002	0.000089	0.0003	0.0001	100
MGD	0.29	0.82	0.522238	0.52	0.102612	0.69	0.35	143
MOT	0.000023	0.0002	0.000082	0.000077	0.000039	0.00018	0.000032	65
NIT	0.00005	0.0013	0.000184	0.00011	0.000204	0.00033	0.00007	55
NT	0.134	0.294	0.194264	0.193	0.031582	0.2392	0.1492	53
PH	5.65	7.57	6.664126	6.65	0.324641	7.197	6.211	143
PT	0.0003	0.11	0.004664	0.0036	0.00905	0.008325	0.001515	144
KU	0.12	0.51	0.222927	0.22	0.061456	0.29	0.15	41
SET	0.00005	0.00221	0.000133	0.000095	0.000291	0.0002	0.00005	54
SIO2	1.42	4.85	2.584614	2.38	0.94241	3.995	1.49	51
NAU	1.71	3.2	2.27561	2.27	0.320648	2.84	1.91	41
COND	17.5	48.5	29.61678	28.8	6.069907	39.47	20.22	143
SRT	0.0045	0.0141	0.008508	0.00851	0.001781	0.0112	0.0053	141
SOT	0.6	1.77	1.283548	1.25	0.256472	1.735	0.945	31
TURB	0	2.1	0.406338	0.34	0.267512	0.797	0.15	142
VT	0.000054	0.000562	0.000194	0.0002	0.000077	0.0003	0.0001	125
ZNT	0.00018	0.0069	0.000882	0.0007	0.00083	0.00161	0.0003	139

9.3.7 Lomond River at Route 431 (NFO2YH0018)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.018	0.101	0.03262	0.029	0.01205	0.0525	0.02093	147
AST	0.0001	0.0007	0.00013	0.0001	0.000076	0.0002	0.0001	76
BAT	0.0067	0.0111	0.008669	0.0087	0.000774	0.009851	0.00743	147
BET	0.000001	0.05	0.012502	0.000003	0.02165	0.05	0.000002	40
CAD	11	25.2	20.97183	21.8	2.994981	23.9	11.05	142
DOC	2	18	3.651007	3.4	1.678301	4.7	2.7	149
CDT	0.000002	0.0002	0.000035	0.000003	0.000051	0.0001	0.000002	42
CL	5.22	9.45	6.449655	6.23	1.065359	8.596	5.314	29
COLOURA	5	167	17.63288	18.2	13.98675	30	10	146
COND	6.54	187	163.3741	166	19.88826	179.6	140.8	149
COT	0.000009	0.0004	0.000081	0.0001	0.000067	0.0002	0.00001	81
CRT	0.000047	0.0025	0.000281	0.0002	0.00042	0.001285	0.00006	62
CUT	0.00018	0.0055	0.000638	0.0004	0.00086	0.0027	0.0002	133
FET	0.0123	0.0857	0.034709	0.0314	0.014806	0.07594	0.01754	145
KU	0.25	0.55	0.322821	0.31	0.055003	0.435	0.269	39
LIT	0.0001	0.0015	0.000303	0.0003	0.000144	0.00042	0.00018	137
MGD	1.49	6.33	5.385507	5.57	0.824901	6.1485	4.5	142
MOT	0.000096	0.0006	0.000126	0.0001	0.000062	0.0002	0.0001	108
NAU	3.25	5.52	3.881282	3.75	0.506927	4.766	3.314	39
NIT	0.00007	0.00078	0.00022	0.0002	0.000135	0.0005	0.00011	61
NT	0.121	0.232	0.180586	0.1765	0.023955	0.2263	0.1477	58
PBT	0.000008	0.0016	0.000258	0.000157	0.000349	0.00101	0.000015	60
PH	0.24	8.31	7.822215	7.92	0.674883	8.19	7.312	149
PT	0.0003	0.0162	0.002981	0.0026	0.001885	0.005975	0.0012	146
SET	0.00003	0.00035	0.000102	0.0001	0.000063	0.0002	0.00004	49
SIO2	1.53	2.4	1.981695	2	0.222232	2.265	1.654	59
SO4	1.79	2.5	2.08931	2.09	0.196397	2.406	1.798	29
SRT	0.0295	0.0465	0.038452	0.0387	0.00319	0.04386	0.03268	145
TURB	0.01	10	0.394797	0.3	0.817047	0.783	0.1	148
VT	0.000066	0.0004	0.000122	0.0001	0.000063	0.0003	0.000077	118
ZNT	0.00006	0.0019	0.000437	0.0003	0.000341	0.0012	0.0002	108

9.3.8 Main River at Route 420 (NFO2YG0001)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
AST	0.00004	0.00075	0.000113	0.0001	0.000103	0.0002	0.000055	70
ALT	0.045	0.362	0.200286	0.2	0.059967	0.2973	0.1078	155
BAT	0.0026	0.00899	0.00495	0.00479	0.001177	0.00736	0.003266	155
BET	0.000004	0.05	0.006009	0.000009	0.016245	0.05	0.000006	50
CAD	0.48	3.73	1.327548	1.29	0.459245	2.115	0.64	155
DOC	2.5	20	8.095513	7.4	2.764583	13.85	4.925	156
CDT	0.000002	0.0003	0.000044	0.00001	0.000056	0.0001	0.000003	69
CLT	1.6	8.11	3.481395	3.23	1.335747	5.745	2.078	43
COLOURA	20	7023	117.8936	70	553.3897	120	39.9	157
COND	7.38	55.2	25.60624	24.4	7.040041	36.3	15.88	157
COT	0.000032	0.0006	0.000135	0.0001	0.000095	0.0003	0.000049	123
CRT	0.000101	0.0033	0.000317	0.000211	0.000335	0.0008	0.00016	130
CUT	0.00016	0.0091	0.000684	0.0005	0.001053	0.00152	0.000216	149
FET	0.098	1.12	0.348422	0.3235	0.130457	0.58015	0.19425	154
KU	0.13	0.37	0.246863	0.24	0.060049	0.355	0.14	51
LIT	0.0001	0.0007	0.000229	0.0002	0.000092	0.0004	0.0001	137
MGD	0.25	1.08	0.548581	0.54	0.148665	0.786	0.29	155
MOT	0.000005	0.0009	0.000104	0.00005	0.000156	0.0003	0.000017	71
NAU	1.35	4.52	2.316863	2.25	0.567898	3.12	1.525	51
NIT	0.00005	0.0008	0.000242	0.0002	0.000111	0.000425	0.000125	111
NT	0.129	0.534	0.218119	0.206	0.066437	0.3482	0.1472	67
PBT	0.000048	0.0036	0.000364	0.000202	0.000442	0.00092	0.000079	117
PH	5.15	7.93	6.10949	6.12	0.492853	6.786	5.416	157
PT	0.0006	0.0222	0.005728	0.0051	0.002988	0.01001	0.00214	155
SET	0.00003	0.0004	0.000103	0.0001	0.00007	0.0002	0.00004	58
SIO2	0.25	5.2	2.837222	3.025	1.363592	4.696	0.6115	54
SO4	0.42	1.54	0.795116	0.79	0.238409	1.208	0.492	43
SRT	0.00324	0.0115	0.006927	0.007	0.001806	0.009635	0.00356	154
TURB	0.14	4.5	0.536603	0.435	0.494969	1.0225	0.2	156
VT	0.0001	0.000898	0.000288	0.000295	0.000125	0.0005	0.0001	152
ZNT	0.0002	0.0447	0.002222	0.001475	0.004681	0.003748	0.00059	154

9.3.9 Pinchgut Brook at TCH (NFO2YJ0004)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.0051	0.143	0.023935	0.0189	0.021313	0.06325	0.009465	152
AST	0	0.00027	0.000094	0.0001	0.000033	0.00011	0.00007	71
BAT	0.0025	0.0062	0.003406	0.0034	0.000441	0.003995	0.0029	152
BET	0	0.05	0.004653	0.000001	0.014523	0.05	0.000001	43
CAD	7.73	34.1	25.63876	26.4	4.502887	31.34	12	153
DOC	1.7	20.8	3.598359	3.4	1.716359	4.4	2.47	155
CDT	0.000002	0.0001	0.000016	0.000003	0.000032	0.0001	0.000002	48
CLT	6.6	11.6	8.187857	7.915	1.165178	10.395	6.6605	42
COLOURA	5	30	14.7894	14.5	5.711939	21.15	5	151
COND	28.1	235	178.38	181	25.2555	217.3	144.1	155
COT	0.000007	0.0004	0.000083	0.0001	0.000082	0.000225	0.000013	96
CRT	0.00003	0.0022	0.000217	0.000061	0.0004	0.00064	0.000033	67
CUT	0.00018	0.0117	0.000731	0.0004	0.001348	0.002395	0.0002	144
FET	0.0072	0.26	0.043722	0.0377	0.030691	0.0791	0.0148	151
KU	0.06	0.44	0.29451	0.3	0.052667	0.355	0.215	51
LIT	0	0.0007	0.000314	0.0003	0.000106	0.0005	0.0002	148
MGD	1.23	6.41	3.921312	4.055	0.885883	5.2705	2.2	154
MOT	0.000062	0.0003	0.000116	0.0001	0.000037	0.0002	0.000092	92
NAU	2.94	6.61	4.748627	4.64	0.561828	5.765	4.115	51
NIT	0.00017	0.0007	0.000272	0.00024	0.000098	0.0005	0.0002	96
NT	0.132	0.345	0.221077	0.21	0.046011	0.3152	0.1712	65
PBT	0.000007	0.0015	0.000189	0.000034	0.000288	0.0008	0.00001	71
PH	6.75	8.39	7.875097	7.95	0.291001	8.232	7.327	155
PT	0.0003	0.0174	0.002946	0.00245	0.002239	0.006345	0.000855	152
SET	0	0.00191	0.000112	0.00006	0.00024	0.0002	0.00004	60
SIO2	1.14	2	1.533077	1.56	0.201251	1.83	1.2055	52
SOT	2.21	3.34	2.44881	2.415	0.204686	2.7095	2.2205	42
SRT	0.0147	0.0599	0.049842	0.0495	0.005403	0.05755	0.0437	151
TURB	0	1	0.321111	0.29	0.177501	0.654	0.106	153
VT	0.000026	0.0005	0.000105	0.0001	0.000092	0.0003	0.000036	89
ZNT	0.0002	0.0027	0.000476	0.00031	0.000386	0.0012	0.0002	125

9.3.10 Portland Creek at Route 430 (NFO2YE0004)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.06	0.285	0.114156	0.109	0.03218	0.1578	0.0718	129
AST	0.00007	0.0002	0.000105	0.0001	0.000027	0.000183	0.00008	46
BAT	0.0037	0.0133	0.004526	0.0044	0.000869	0.0052	0.0039	129
BET	0.000013	0.05	0.008349	0.000017	0.018627	0.05	0.000015	30
CAD	3.08	5.64	4.083206	4.04	0.543555	5.02	3.27	131
DOC	3	9.5	4.885725	4.8	1.044514	6.6	3.3	131
CDT	0.000003	0.0004	0.000048	0.000006	0.000073	0.0001	0.000004	38
CLT	3.6	6.22	5.090769	5.08	0.643595	6.05	4.0725	26
COLOURA	18	60	39.05385	40	10.5095	50.4	20	130
COND	38.7	64.4	50.64962	50.4	5.221277	59.05	43.4	131
COT	0.000022	0.0004	0.000094	0.0001	0.000054	0.0002	0.000032	78
CRT	0.00007	0.0018	0.000242	0.0002	0.000279	0.0006	0.000073	56
CUT	0.00015	0.0186	0.000965	0.0004	0.002635	0.00255	0.00017	111
FET	0.065	0.558	0.155257	0.136	0.069539	0.2601	0.07809	127
KU	0.14	0.52	0.248214	0.24	0.064645	0.33	0.187	28
LIT	0.0001	0.0009	0.000307	0.0003	0.000101	0.0004	0.0002	123
MGD	1.16	2.05	1.515878	1.51	0.179239	1.8	1.27	131
MOT	0.000049	0.0002	0.000084	0.0001	0.000026	0.0001	0.000052	58
NAU	2.43	3.72	3.170357	3.165	0.293592	3.615	2.6115	28
NIT	0.00008	0.0009	0.000205	0.0002	0.000136	0.0004	0.00009	53
NT	0.149	0.264	0.210209	0.21	0.026529	0.2572	0.1599	43
PBT	0.000048	0.0017	0.000358	0.0002	0.000382	0.0012	0.00006	70
PH	6.02	7.8	7.091221	7.11	0.300158	7.515	6.56	131
PT	0.0003	0.0126	0.004621	0.0043	0.001956	0.0078	0.00215	131
SET	0.00005	0.0003	0.000108	0.0001	0.000058	0.0002	0.00005	56
SIO2	1.32	2.14	1.814231	1.86	0.200829	2.1035	1.5155	52
SOT	1	1.64	1.317692	1.32	0.158048	1.5825	1.0925	26
SRT	0.00812	0.0128	0.009684	0.0097	0.000801	0.011	0.0085	127
TURB	0.02	1.2	0.451395	0.4	0.253205	0.992	0.124	129
VT	0.000051	0.0006	0.000166	0.000141	0.000086	0.0003	0.0001	111
ZNT	0.0004	0.0199	0.001334	0.0009	0.002481	0.00197	0.000579	127

9.3.11 Western Brook at Route 430 (NFO2YE0005)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.044	0.179	0.067972	0.064	0.016775	0.097	0.05135	148
AST	0.00004	0.0003	0.000098	0.0001	0.000048	0.0002	0.00006	68
BAT	0.0051	0.0185	0.006362	0.006075	0.001414	0.0077	0.0054	148
BET	0.000002	0.05	0.011116	0.000006	0.020784	0.05	0.000003	45
CAD	2.09	8.1	2.627972	2.44	0.772959	3.499	2.151	143
DOC	1.3	5.3	2.6242	2.4	0.755976	4.1	1.745	150
CDT	0.000003	0.0003	0.000042	0.000007	0.00006	0.0001	0.000005	51
CL	4.75	10.3	5.724242	5.32	1.225774	8.008	4.91	33
COLOURA	5	40	15.46806	14.35	7.856868	30	5	144
COND	34.4	100	41.64	39.3	8.626633	53.175	35.845	150
COT	0.000008	0.0003	0.000067	0.0001	0.000057	0.000135	0.00001	74
CRT	0.000078	0.0191	0.000567	0.0002	0.002247	0.0013	0.00008	76
CUT	0.00002	0.0136	0.000811	0.0004	0.001606	0.002495	0.0002	142
FET	0.0216	0.336	0.068756	0.0527	0.047951	0.1485	0.02725	146
KU	0.18	0.56	0.269535	0.26	0.064048	0.369	0.192	43
LIT	0.0001	0.0006	0.00021	0.0002	0.000089	0.00036	0.0001	129
MGD	0.7	2.08	0.838182	0.79	0.172378	1.02	0.721	143
MOT	0.000037	0.0034	0.000129	0.0001	0.000376	0.00012	0.000056	77
NAU	3.04	6.2	3.588372	3.38	0.686596	4.705	3.052	43
NIT	0.00008	0.0016	0.000232	0.0002	0.000188	0.0004	0.00011	86
NT	0.18	0.342	0.236371	0.235	0.027274	0.2818	0.1953	62
PBT	0.000019	0.0023	0.00026	0.0002	0.000312	0.0006	0.000027	84
PH	6.02	7.88	6.899333	6.92	0.307358	7.351	6.3715	150
PT	0.0003	0.0145	0.002984	0.0027	0.001757	0.00538	0.0012	147
SET	0.00004	0.00138	0.000123	0.0001	0.000174	0.0002	0.00006	60
SIO2	1.6	2.97	2.039474	2.03	0.220306	2.296	1.73	57
SO4	1.59	2.24	1.790303	1.77	0.133178	2.022	1.632	33
SRT	0.0091	0.029	0.010866	0.0105	0.002111	0.01265	0.009563	146
TURB	0.03	3.82	0.434797	0.34	0.408951	0.972	0.12	148
VT	0.0001	0.0005	0.000186	0.0002	0.00008	0.0003	0.0001	136
ZNT	0.0002	0.0027	0.000705	0.0006	0.000396	0.00146	0.0003	145

9.3.12 Wild Cove Brook at Route 440 (NFO2YL0029)

Parameter	Min	Max	Mean	Median	S.D.	95thPerc	5th Perc	Count
ALT	0.023	1.57	0.188597	0.1275	0.192326	0.48825	0.03385	118
AST	0.0001	0.00082	0.000183	0.00017	0.000101	0.00031	0.0001	92
BAT	0.0092	0.0428	0.019551	0.0196	0.005903	0.0299	0.01121	118
BET	0	0.06	0.001634	0.000008	0.009728	0.000058	0.000002	37
CAD	11	51.8	39.98305	40.8	6.702255	48.015	30.795	118
DOC	3	26	7.630083	7	2.913228	13.4	4.6	121
CDT	0	0.0003	0.00006	0.0001	0.000061	0.0001	0.000003	66
CL	13	47.2	21.87188	20.35	6.690349	32.395	14.25	32
COLOURA	10	100	33.20248	30	18.19048	69.1	14.2	121
COND	251	578	413.7832	413	68.67251	540	295.8	125
COT	0.000083	0.0013	0.000316	0.0003	0.00017	0.00062	0.000113	117
CRT	0.000133	0.00813	0.000536	0.0004	0.000801	0.001	0.000199	111
CUT	0.0002	0.0138	0.000953	0.0005	0.001937	0.002134	0.0002	112
FET	0.0651	2.48	0.409634	0.335	0.327871	0.8094	0.09521	118
KU	2.4	11.7	6.028537	5.58	2.230373	10	3.1	41
LIT	0.0008	0.0086	0.00338	0.0028	0.00162	0.006615	0.001385	118
MGD	2.2	18.3	13.55027	13.95	2.987807	17.4	9.134	118
MOT	0.0001	0.0019	0.000298	0.00029	0.000192	0.000495	0.0001	110
NAU	7.67	30.5	15.67122	14.7	4.495007	22.7	9.74	41
NIT	0.0002	0.0082	0.000841	0.000645	0.000846	0.00163	0.0003	108
NT	0.256	8.48	2.245217	1.86	1.503705	4.696	0.54905	60
PBT	0.000025	0.0014	0.000288	0.0002	0.000267	0.00087	0.000045	64
PH	6.32	8.33	7.63096	7.72	0.478017	8.206	6.88	125
PT	0.0014	0.489	0.076015	0.05355	0.075692	0.21102	0.0045	120
SET	0	0.00045	0.000108	0.0001	0.000077	0.0002	0.00005	62
SIO2	2.41	5.95	3.910878	3.93	0.786074	5.096	2.89	60
SO4	3.07	11.9	5.784063	4.95	2.332235	10.81	3.1575	32
SRT	0.0442	0.129	0.080887	0.081	0.016769	0.10815	0.05214	118
TURB	0.25	38.4	5.03976	2.9	5.697323	15.58	0.55	125
VT	0.0002	0.004	0.000597	0.000447	0.000473	0.0014	0.0002	117
ZNT	0.0004	0.038	0.003884	0.0018	0.006183	0.01344	0.0005	117

9.4 Labrador

9.4.1 Churchill River Above Upper Muskrat Falls (NFO3OE0001)

Parameter	Min	Max	Mean	Median	S.D.	95th Per	5th Perc	Count
ALT	0.08	2.73	0.487422	0.334	0.48662	1.386	0.1232	45
AST	0.00007	0.0078	0.000308	0.0001	0.001202	0.000272	0.00008	40
BAT	0.0069	0.0328	0.012245	0.0105	0.005323	0.02448	0.0075	45
BET	0.000005	0.07	0.006301	0.000017	0.017737	0.05	0.000007	35
CAD	1.08	88.6	3.376061	2.115	10.57685	2.58	1.5	66
DOC	1.8	7.7	4.1	4.05	1.005765	5.855	2.7	64
CDT	0.000001	0.001	0.000072	0.000004	0.000185	0.0002	0.000002	41
CL	0.18	0.59	0.327188	0.3	0.082357	0.4545	0.24	32
COLOURA	5	225	32.73425	26.3	26.19223	59.7	15	73
COND	11.1	29.7	19.68904	20.1	3.736806	26.28	13.66	73
COT	0.000082	0.002	0.000319	0.000255	0.000328	0.00087	0.000093	45
CRT	0.0002	0.0198	0.001505	0.0007	0.003021	0.004962	0.000304	45
CUT	0.0005	0.0058	0.001317	0.00113	0.000872	0.00252	0.0006	45
FET	0.181	3.88	0.5722	0.395	0.591338	1.39	0.2136	45
KU	0.21	12.5	0.625122	0.32	1.878596	0.45	0.24	41
LIT	0.0001	0.0023	0.000505	0.0004	0.00039	0.00117	0.000115	44
MGD	0.33	47.8	1.423939	0.72	5.753857	0.95	0.4925	66
MOT	0.000029	0.0003	0.00007	0.00006	0.000043	0.0001	0.000032	39
NAU	0.47	61.5	2.18122	0.68	9.379889	1.04	0.55	41
NIT	0.0003	0.0054	0.000933	0.000625	0.000962	0.002424	0.000325	44
NT	0.05	0.8	0.181761	0.165	0.107526	0.365	0.085	71
PBT	0.000048	0.0024	0.000317	0.000181	0.000417	0.000823	0.000055	41
PH	6.15	7.31	6.8	6.835	0.256531	7.139	6.2955	72
PT	0.002	0.35	0.026363	0.012	0.050874	0.0963	0.0036	71
SET	0.00001	0.00011	0.000036	0.00003	0.000023	0.00008	0.000018	16
SIO2	1.58	3.09	2.362174	2.43	0.411339	3.02	1.7	23
SO4	0.64	1	0.84375	0.835	0.093399	0.9945	0.6775	32
SRT	0.0087	0.0189	0.012927	0.0128	0.001936	0.01646	0.01022	45
TURB	0.7	63	9.987042	5.1	12.05439	32.55	1.1	71
VT	0.0001	0.0057	0.000942	0.000686	0.000947	0.002692	0.000267	45
ZNT	0.0005	0.0141	0.002228	0.00151	0.002582	0.00594	0.0005	45

9.4.2 Eagle River Above Falls (NF03QC0001)

Parameter	Min	Max	Mean	Median	S.D.	95th Per	5th Perc	Count
ALT	0.026	4.12	0.3199	0.109	0.707992	0.9082	0.05478	33
AST	0.00004	0.0015	0.00015	0.00007	0.000267	0.00046	0.00004	31
BAT	0.0042	0.0728	0.009258	0.00599	0.011713	0.01748	0.00456	33
BET	0.000002	0.05	0.007151	0.000005	0.017493	0.05	0.000002	28
CDT	0.000001	0.0003	0.000071	0.000008	0.000098	0.000296	0.000001	30
CAD	0.9	4.5	1.862281	1.7	0.79417	3.7	0.998	57
DOC	2.8	12.3	5.932692	5.8	1.614325	8.615	3.61	52
CLT	0.32	1.6	0.5492	0.44	0.292669	1.2	0.334	25
CRT	0.0001	0.00553	0.000632	0.000255	0.001044	0.00204	0.00012	30
COT	0.000042	0.00563	0.000396	0.0001	0.001009	0.001138	0.000047	30
COLOURA	4.3	91.9	47.52295	47.4	14.85134	70	30	61
CUT	0.00013	0.0082	0.001168	0.00045	0.001857	0.004904	0.000196	33
FET	0.217	12.9	1.149273	0.545	2.171613	2.73	0.3312	33
PBT	0.000033	0.00263	0.000418	0.000154	0.000657	0.002105	0.000037	31
LIT	0.00009	0.0024	0.000291	0.00019	0.000444	0.000653	0.0001	26
MGD	0.26	1.5	0.649474	0.59	0.274568	1.22	0.344	57
MOT	0.000016	0.0003	0.000063	0.000046	0.000053	0.000125	0.00002	30
NIT	0.00011	0.00505	0.000478	0.0002	0.000887	0.001137	0.000125	30
NT	0.07	0.8	0.246898	0.217	0.130284	0.4566	0.1	59
PH	5.9	7.11	6.587213	6.62	0.286695	7.02	6.13	61
PT	0.003	0.13	0.017907	0.01115	0.022201	0.060645	0.005855	60
KU	0.07	0.64	0.208	0.19	0.102969	0.34	0.119	30
NAU	0.49	2.74	0.947333	0.835	0.422784	1.691	0.5925	30
COND	10	49	19.57869	16.8	8.834287	39	10.4	61
SRT	0.007	0.0442	0.01414	0.014	0.006071	0.01856	0.0078	33
SOT	0.41	1.06	0.6264	0.61	0.158868	0.996	0.42	25
TURB	0.49	38	3.7425	1.8	5.932992	13.77	0.5285	60
VT	0.0001	0.0142	0.001116	0.000404	0.002428	0.003268	0.0002	33
ZNT	0.0003	0.0261	0.003144	0.0014	0.005003	0.01204	0.000348	33

10. APPENDIX B: Sample Counts Categorized By Parameter Group

10.1 Physical And Chemical Parameters / Nutrients

Stations	Physical and Chemical Parameters				Nutrients		
	COLOURA	PH	COND	TURB	DOC	NT	PT
NF02YO0142	75	75	75	75	75	75	75
NF02YO0107	117	118	118	118	118	70	115
NF02YO0001	144	145	145	140	130	144	145
NF02YO0020	155	156	156	156	155	70	154
NF02YQ0030	101	101	101	101	101	75	100
NF02YM0003	137	135	137	132	107	107	129
NF02YQ0006	103	103	103	103	103	60	100
NF02YR0001	146	147	146	145	147	57	143
NF02YM0004	157	157	157	157	158	68	156
NF02YS0011	109	109	109	108	109	64	107
NF02YS0001	103	104	104	103	104	59	102
NF02ZM0020	138	142	142	141	141	53	140
NF02ZL0029	138	141	141	141	140	83	140
NF02ZM0144	122	122	121	122	113	87	118
NF02ZM0109	111	112	112	112	108	79	110
NF02ZK0005	119	119	119	119	117	73	118
NF02ZM0015	178	183	183	183	179	94	180
NF02ZM0016	191	196	195	196	191	104	193
NF02ZN0004	152	154	154	153	152	73	152
NF02ZM0014	194	201	201	201	198	111	200
NF02ZM0009	189	197	197	196	195	113	196
NF03OE0001	73	72	73	70	64	71	71
NF03QC0001	61	61	61	60	52	59	60
NF02YL0013	148	150	150	150	149	62	145
NF02ZA0006	143	146	146	145	146	57	143
NF02YK0022	59	60	60	60	59	31	59
NF02YL0012	112	112	112	112	111	65	112
NF02YL0011	91	91	91	91	90	45	90
NF02YN0001	143	143	142	142	143	53	144
NF02YH0018	146	149	149	148	149	58	146
NF02YG0001	157	157	157	156	156	67	155
NF02YJ0004	151	155	155	153	155	65	152
NF02YE0004	130	131	130	129	131	43	131
NF02YE0005	144	150	150	148	150	62	148
NF02YL0029	121	125	125	125	121	60	120

10.2 Major Ions, Trace Elements and Metals

Stations	Major Ions							Trace Elements and Metals					
	ALKT	CAD	CLD	MGD	KD	NAD	SO4	ALT	AST	BAT	BET	CDT	CRT
NF02YO0142	75	65	__	65	__	__	48	73	73	73	65	69	69
NF02YO0107	82	114	75	114	64	64	40	117	102	116	49	101	63
NF02YO0001	64	130	102	130	66	66	41	86	83	86	49	64	57
NF02YO0020	117	152	116	152	102	102	39	156	110	156	49	104	96
NF02YQ0030	52	95	54	95	39	39	46	98	94	98	52	53	88
NF02YM0003	61	135	100	137	98	99	35	63	35	63	35	38	59
NF02YQ0006	64	97	65	97	53	53	35	101	79	101	41	49	91
NF02YR0001	__	144	115	144	110	110	29	144	79	145	130	58	129
NF02YM0004	117	153	118	153	109	109	35	158	108	158	36	54	154
NF02YS0011	57	106	71	106	56	56	35	110	81	110	52	62	88
NF02YS0001	52	101	69	101	52	52	33	105	80	105	45	55	81
NF02ZM0020	103	140	112	140	105	105	28	138	82	138	36	45	49
NF02ZL0029	90	134	104	134	88	88	33	141	120	141	36	41	49
NF02ZM0144	120	115	82	115	58	58	38	118	114	118	104	117	111
NF02ZM0109	101	105	77	105	55	55	29	112	107	112	91	100	103
NF02ZK0005	65	111	80	111	56	56	36	119	89	119	59	64	87
NF02ZM0015	169	174	139	174	112	112	37	181	121	181	115	137	152
NF02ZM0016	180	187	153	188	114	114	36	195	134	195	160	161	176
NF02ZN0004	127	150	120	150	105	105	30	154	83	154	47	57	76
NF02ZM0014	193	193	153	193	113	113	44	201	137	201	170	126	147
NF02ZM0009	183	182	145	182	115	115	43	193	139	193	109	128	146
NF03OE0001	33	65	28	65	25	25	32	45	40	45	35	41	45
NF03QC0001	__	57	30	57	27	27	25	33	31	33	28	30	30
NF02YL0013	151	150	114	150	103	103	32	150	74	149	45	47	79
NF02ZA0006	139	145	113	145	107	107	29	145	69	145	41	52	136
NF02YK0022	52	60	33	60	35	35	__	58	40	58	__	__	42
NF02YL0012	105	109	76	109	61	61	35	111	76	111	44	40	78
NF02YL0011	66	91	62	91	54	54	27	90	61	90	34	38	75
NF02YN0001	119	143	108	143	101	101	31	142	93	142	36	43	82
NF02YH0018	149	142	113	142	102	102	29	146	76	146	40	41	63
NF02YG0001	68	155	109	155	103	103	43	155	69	155	50	67	132
NF02YJ0004	155	153	108	154	103	103	42	151	71	152	43	47	66
NF02YE0004	130	131	99	131	103	103	26	129	46	129	30	38	54
NF02YE0005	136	143	114	143	99	99	33	147	69	148	45	50	75
NF02YL0029	125	118	89	118	77	77	32	118	91	118	37	66	111

10.3 Trace Elements And Metals (contd.)

Stations	Trace Elements and Metals													
	COT	CUT	FET	PBT	LIT	MNT	MOT	NIT	SET	SIO2	SRT	UT	VT	ZNT
NF02YO0142	73	73	73	71	71	73	70	73	45	__	73	54	73	73
NF02YO0107	66	115	114	114	67	114	79	78	51	50	114	40	101	114
NF02YO0001	62	85	86	84	36	86	67	67	__	54	86	48	80	85
NF02YO0020	86	153	153	151	100	153	83	101	48	55	153	42	129	153
NF02YQ0030	61	94	96	65	95	96	59	95	49	37	96	45	77	96
NF02YM0003	41	60	63	50	56	63	42	63	__	25	63	34	57	61
NF02YQ0006	82	96	99	64	96	99	57	97	39	33	98	35	88	94
NF02YR0001	130	121	142	116	140	142	42	84	64	60	142	29	141	142
NF02YM0004	144	154	155	105	150	155	102	154	75	64	155	36	154	153
NF02YS0011	75	103	109	84	108	109	68	84	36	40	109	39	105	109
NF02YS0001	70	94	104	78	103	104	63	84	39	37	104	37	98	104
NF02ZM0020	124	128	136	78	136	136	44	79	54	61	136	__	125	136
NF02ZL0029	128	124	139	66	139	139	57	60	56	82	139	35	125	137
NF02ZM0144	115	116	116	113	116	116	114	102	65	76	116	38	110	116
NF02ZM0109	110	110	110	100	110	110	107	109	54	75	110	33	106	110
NF02ZK0005	107	113	118	86	117	__	63	79	54	53	118	38	107	117
NF02ZM0015	176	179	179	162	179	179	132	166	72	79	179	43	169	179
NF02ZM0016	192	193	193	181	193	193	147	174	77	86	193	46	183	193
NF02ZN0004	82	136	152	81	152	152	55	68	59	76	152	32	141	149
NF02ZM0014	193	199	199	156	199	199	135	177	95	84	199	53	183	199
NF02ZM0009	191	191	191	153	191	191	94	174	75	96	191	43	167	191
NF03OE0001	45	45	45	41	44	45	39	44	__	__	45	31	45	45
NF03QC0001	30	33	33	31	26	33	30	30	__	__	33	__	33	33
NF02YL0013	95	146	149	83	143	148	66	107	60	54	148	38	135	148

NF02ZA0006	102	144	144	79	142	144	94	114	65	57	144	32	138	136
NF02YK0022	30	56	58	31	48	58	37	47	27	__	58	__	54	44
NF02YL0012	65	102	110	63	98	110	67	85	44	34	110	41	97	103
NF02YL0011	66	86	89	58	85	89	43	63	36	26	89	31	89	87
NF02YN0001	72	122	141	70	100	141	66	55	54	51	141	34	126	138
NF02YH0018	81	132	144	58	136	145	106	59	49	59	145	31	118	108
NF02YG0001	123	149	154	116	136	154	73	112	58	54	154	45	152	154
NF02YJ0004	98	143	151	73	148	151	93	94	60	52	151	45	90	123
NF02YE0004	77	111	127	70	122	127	59	53	56	52	127	__	111	127
NF02YE0005	72	140	145	85	129	146	76	86	60	57	146	35	135	145
NF02YL0029	117	112	118	62	118	118	110	108	63	60	118	35	117	117