Status and Trends of Hydrology, Water Quality and Suspended Sediment Quality of the Hay River

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ACRONYMS AND ABBREVIATIONS

AANDC	Aboriginal Affairs and Northern Development Canada
ADE	Alberta
ANCOVA	analysis of covariance
CAS	Chemical Abstract Service
CCME	Canadian Council of the Ministries of the Environment
cm	centimetre(s)
dam^3	cubic decametre(s)
FOD	frequency of detection
HR/B	Hay River at the Alberta/NWT Border
HR/WC	Hay River at the West Channel Bridge
km	kilometre(s)
km^2	kilometre(s) squared
mg/kg	milligrams per kilogram
mm	millimetre(s)
m^3/s	cubic meter(s) per second
NWT	Northwest Territories
PAH	polycyclic aromatic hydrocarbon
PCA	Principal Components Analysis
PCB	polychlorinated biphenyl
SVOC	semivolatile organic compound
TOC	total organic carbon
µg/L	micrograms per litre
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WSC	Water Survey of Canada

1 Background

At the request of the Aboriginal Affairs and Northern Development Canada (AANDC) ENVIRON has evaluated the status and trends of the water quality of the Hay River.

1.1 Setting

The Hay River lies primarily in the northwest region of the province of Alberta (Figure 1.1). The headwaters of both the Hay River and its major tributary, the Chinchaga River, lie in British Columbia. The Hay River flows generally to the northeast through Alberta and into the Northwest Territories (NWT), discharging into Great Slave Lake after 702 kilometres (km).

The basin of the Hay River covers 48,000 square kilometres (km²) (Environment Canada 1985). It has a very low population density, containing fewer than two people per km^2 in most of the basin. Near the center of the basin are Hay Lake and Zama Lake and the more populous towns of Chateh and Habay. The town of Hay River, located at the mouth of the river on Great Slave Lake, is the most heavily populated area of the basin, with 3,600 people in a 133 km² area (Statistics Canada 2012).

The Hay River basin contains minor coal and mineral reserves but no active coal or metal mines. The basin contains no hydroelectric dams or uranium resources. The central lowland areas surrounding Zama Lake contain oil fields and oil sands, with one major crude oil transmission trunk line running north to south (Atlas of Canada 2009). Of the surface water allocated in the basin, 89% (4,356 cubic decametres [dam^3]) is allotted to the petroleum industry for use in activities such as oilfield injection and petrochemical plant operations (Water Matters Society of Alberta 2012). The use of hydrocarbon reserves and pipelines lead to concern for potential hydrocarbon contamination and increasing salinity due to salt water injection wells (Environment Canada 1985).

The geology of the basin consists of sedimentary bedrock with soils formed from rock, till, and organic deposits (Environment Canada 1985). The climate is classified as Boreal, with average annual rainfall totalling 203.1 millimetres (mm) and average annual snowfall of 125 centimetres (cm). Average daily temperatures by month range from -27.6°C in January to 21.1°C in July (National Climate Data and Information Archive 2012).

The Hay River passes through a variety of geographic regions. The Hay River starts in the mountainous regions of western Alberta, flows through lowlands near Hay and Zama Lake, and then discharges into the Great Slave Lake in the NWT. Both Alberta and the NWT are relatively dry with low precipitation and low runoff (Environment Canada 2010). The vegetation is a mix of coniferous and deciduous forest with grassland and marshes covering the region around Hay Lake and Zama Lake (The Nature Conservancy 2012, Environment Canada 1985).

1.2 Goals

The goals of this report are to describe the status and trends of the hydrology, water quality, and suspended sediment quality, and are specifically defined as follows:

- For the relevant historical hydrology data

    a. calculate basic statistics such as seasonal maximum and minimum;
    b. assess seasonality and long-term trends; and
    c. examine the frequency of extreme events over time.

- For the water quality data

    a. calculate basic statistics for each parameter;
    b. compare to relevant guidelines;
    c. assess long-term and seasonal trends; and
    d. examine the relationships between parameters.

- For the suspended sediment data

    a. compare to relevant guidelines; and
    b. examine the long-term trends and the relationship of the parameters with total organic carbon and flow.

The report includes an analysis of the available datasets of water and sediment quality and water quantity/hydrology. The monitoring data was analyzed using standard statistical techniques to enable informed interpretations. The results documented in this preliminary report will be finalized by AANDC at a later date. This document is intended to provide a sound and defensible basis from which to reach out to the community, facilitate engagement of key stakeholders, and foster consensus on the path forward.

1.3 Data Sources

The water and suspended sediment quality data consists of chemical and analytical monitoring data that were collected from two sampling locations on the Hay River, namely, the Hay River at the Alberta/NWT Border (HR/B) and the Hay River at West Channel Bridge (HR/WC) (Figure 1.1). The first sampling location is on the HR/B, whereas the West Channel sampling location is approximately 5 km upstream from the mouth of the Hay River to Great Slave Lake. The hydrometric flow measurements were collected by a Water Survey of Canada (WSC) stream gauging station, located approximately 17 km from the mouth of the river (Figure 1.1). Since 1963, Environment Canada has operated the stream gauging station. The hydrometric data considers flow readings by Julian Date from 1963 to 2010.

Both surface water and suspended sediment samples were collected from the HR/B. Environment Canada has been sampling surface water from this location routinely since 1988. Samples have been analyzed for routine parameters including pH, conductivity, and turbidity, as well as major ions, nutrients, and dissolved metals. Dissolved metals were added to the analytical program in 2003. Since 2004, surface water samples have also been analyzed occasionally for organic parameters such as polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs). The analytical dataset contains results for samples collected from 1988 to 2010.

AANDC has collected centrifugate water and suspended sediment quality samples from the HR/B sampling location four times from 2004 to 2005. These samples have been analyzed for organic chemicals. Centrifugate samples are surface water samples that have had a portion of the suspended solids removed using a centrifuge in the field.

AANDC has sampled surface water from the HR/WC location twice a year since 1982, usually in May and October. The analytical dataset contains 28 years of these bi-annual records, from 1982 to 2010. The surface water samples were analyzed for routine parameters including pH, conductivity, turbidity, and suspended solids, as well as major ions, nutrients, and total metals. Two fractions—total (i.e. unfiltered) and dissolved (i.e. passed through a 6.45µm filter)—were measured in the surface water samples.

The sample dates by location, matrix, and fraction are presented in Table 1-1.

1.4 Data Standardization

All analytical datasets were transcribed into a standardized format, which allowed for the creation of a unified dataset in Microsoft Access. The final database design uses one record per sample per analyte in order to facilitate a more streamlined analysis. All chemical names were normalized for spelling and punctuation and assigned Chemical Abstract Service (CAS) numbers. For parameters without formal CAS numbers, United States Environmental Protection Agency (USEPA) Region 5 pseudo CAS numbers were used. For example, for total organic carbon (TOC) the pseudo CAS # used is TOC. All original parameter names were retained in the Column ‘OParameter’ and units were retained as reported.

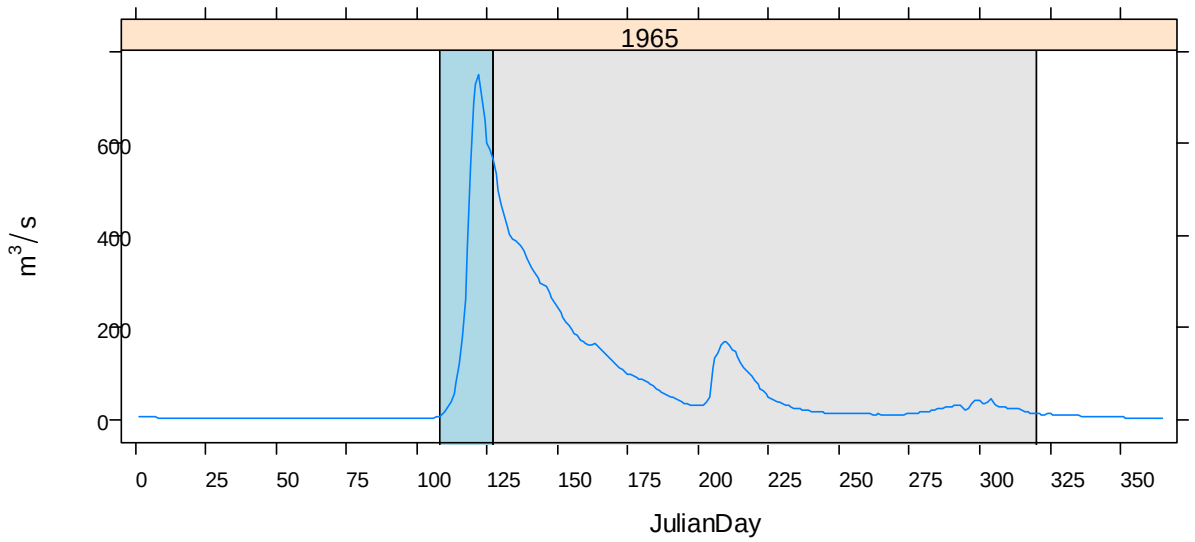
Surface water samples were classified as total or dissolved, with dissolved samples being filtered. Aside from basic summary statistics, the extractable samples were not evaluated in this assessment. Replicate samples were averaged with both the individual measurements and the averages included in the database, but only discrete and averaged samples were included in the assessment. Table 1-2 summarizes and describes the normalized fields in the database (Appendix A).

2 Statistical Methods

The statistical methods employed were based on those documented in the statistical methods report (ENVIRON 2012) and are described in detail below. The monitoring parameters were divided into two classifications: target and non-target. The target parameters were defined as the parameters routinely measured at the HR/WC location, as well as the following additional parameters specifically identified by AANDC: benzo(a)pyrene, C11-C60 range hydrocarbons, organic carbon, xylenes, pyrene, strontium, uranium, and vanadium. The complete list of target parameters is presented in Table 2-1. The results were compared to ecological- and human health-based screening values that were obtained from guidelines in the following series of documents. Documents for surface water screening values were consulted in the following order: *Canadian Water Quality Guidelines for the Protection of Aquatic Life*, *Canadian Environmental Quality Guidelines Summary Tables*, and *Surface Water Quality Guidelines for Use in Alberta*. To obtain sediment screening values, the *Canadian Sediment Quality Guidelines for the Protection of Aquatic Life* was first consulted, followed by the *Canadian Environmental Quality Guidelines Summary Tables*. To determine drinking water screening values, *Guidelines for Canadian Drinking Water Quality Summary Table* was consulted. Screening values were indentified from relevant guidelines for all of the target parameters and for the non-target parameters that were detected. Ecological screening level guidelines represent a value below which ecological impacts are unlikely for even sensitive species or life history stages and in sensitive environments. Thus, chemical concentrations above an ecological screening value are not presumptive evidence for ecological impacts.

2.1 Hydrology

Each year was divided into three hydrometric classifications: (1) Base flow—the period of low flow during which the river is generally ice covered, (2) Freshet—the period during the spring thaw, and (3) Recession—the period of decreasing flow following the spring melt. Although defined in broad terms, no formal definition for the delineation between the flow seasons in the Hay River exists. Therefore, the delineation of flow season in this analysis is based on (1) both previously published results, (2) general rules of thumb that are specific to this site, and (3) professional judgment. The date of the spring transition from base flow to freshet was defined as the date on which the flow exceeded 2 times the average flow for the previous 30 days (Burn and Cunderlink 2004). The transition between freshet and recession was defined as the date on which the flow fell below 75% of the maximum spring peak flow (professional judgement). The transition between recession and base flow was defined as the date on which the flow fell below 2 times the average for the flow measured between December 10 and December 31 (professional judgement). In this typical flow profile from 1965, the freshet season is shaded blue, recession is shown in gray, and base flow is not shaded.



In approximately 10% of the years between 1963 and 2010, the flow did not follow a traditional pattern, and therefore, the criteria described above could not be reliably applied. The delineation during these unusual years was based on professional judgment.

Summary statistics were calculated for the hydrometric data, which included the minimum, maximum, and average flow value for each year. In addition, the cumulative flow volume for each flow season—defined as the total cubic metres over the entire flow season for each year—was calculated. The 7Q10 and the 1Q10 for both low flows and high flows were calculated (USGS 1982, USEPA 1986). The 7Q10s are defined as the minimum and maximum flows likely to be experienced during seven consecutive days over a 10-year period. The 1Q10s are the minimum and maximum flows likely to be experienced during one day over a 10-year period. These statistics present the highest and lowest flow values for a single day and over seven days likely to occur over a 10-year period. These values provide a simple assessment of likely high-end and low-end flow values.

A previous analysis of flow data for the Hay River suggests an increase in the probability of flooding when peak flows exceed 675 cubic metres per second (m^3/s), and flooding is all but assured when peak flows exceed 1,020 m^3/s (University of Alberta 2012). Note that these thresholds predict flooding due to high flow volumes and are not directly related to the flooding due to ice dams during the spring thaw. These flow thresholds, along with the 80^{th} percentile of the flow for the entire monitoring period, were used to define extreme flow events.

The frequency of extreme events were calculated for each year and were defined using the above mentioned three thresholds: (1) the number of days per year the flow exceeds the 80^{th} percentile flow value for the entire monitoring period, (2) the number of days per year the flow exceeds 675 m^3/s, and (3) the number of days per year the flow exceeds 1020 m^3/s. Changes in

these values over the course of the monitoring period were used to assess the trend of extreme flow events (i.e., more frequent or less frequent).

2.2 Surface Water

Basic summary statistics were calculated for all measured parameters in surface water for all fractions (total and dissolved). For these analyses, the data were grouped by sampling station and media. The summary statistics include the following:

- Minimum, maximum, median, average, and standard deviation
- Minimum and maximum non-detect value
- Minimum and maximum detected value
- Ecological screening value
- Frequency of exceedance of the ecological screening value
- Human health screening value
- Frequency of exceedance of the human health screening value

For the purpose of calculating the mean and the median, the detection limit was used as a surrogate value for non-detects.

The routine water quality monitoring data was analyzed for trends over both the entire dataset and the last decade using two methods: (1) linear correlation/regression analysis and (2) analysis of covariance (ANCOVA). The goals of the trend analyses are listed below:

- Assess the presence of trends over the entire monitoring period.
- Test for differences in the trends between the two monitoring locations and flow season over the entire monitoring period.
- Assess the presence of trends over the last 10 years.
- Test for differences in the trends between the two monitoring locations and flow season over the last 10 years.

In addition, paired sample t-tests were used to test for differences between the two locations based on data collected from both stations at approximately the same time. In general, samples were collected from the HR/WC in May and October. The HR/WC surface water samples were paired to the closest HR/B surface water sampling event to test for location effects. The paired sample dates are shown in Table 2-2.

In addition to the routine analyses described above, the surface water data was further examined to explore the possible relationships between the monitoring parameters. The relationship between dissolved and total concentrations in the surface water parameters was explored by calculating the sample-specific ratio between these fractions. A confidence interval for this ratio was calculated for each parameter to determine (a) if the ratios are significantly less

than one and (b) what the variability is in these ratios. If the ratio is consistent, it may be possible to predict the concentration of dissolved species based on the total concentrations. For the surface water parameters, the correlation between the monitoring parameters was calculated. These correlations are used to determine which parameters are unrelated to each other, which parameters co-vary, and which parameters are inversely related.

2.3 Centrifugate

As described above, centrifugate samples are surface water samples that have had a portion of the suspended solids removed using a centrifuge in the field. Basic summary statistics were calculated for all measured parameters in the centrifugate samples. As centrifugate was collected from a single monitoring location, differences between locations were not evaluated. The summary statistics include the following:

- Minimum, maximum, median, average, and standard deviation
- Minimum and maximum non-detect value
- Minimum and maximum detected value
- Ecological screening value
- Frequency of exceedance of the ecological screening value
- Human health screening value
- Frequency of exceedance of the human health screening value

For the purposes of calculating the mean and the median, the detection limit was used as a surrogate value for non-detects.

2.4 Suspended Sediment

Basic summary statistics were calculated for all measured parameters in the suspended sediment. As suspended sediment was collected from a single monitoring location, differences were not evaluated. The summary statistics include the following:

- Minimum, maximum, median, average, and standard deviation
- Minimum and maximum non-detect value
- Minimum and maximum detected value
- Ecological screening value
- Frequency of exceedance of the ecological screening value
- Human health screening value
- Frequency of exceedance of the human health screening value

For the purposes of calculating the mean and the median, the detection limit was used as a surrogate value for non-detects.

The suspended sediment monitoring data was analyzed for relationships between the monitoring parameters date, river flow, and TOC. Trends and relationships were tested using linear correlation/regression analysis. Although grain size was identified as a potential related variable, the sample size (n=1) was too small to allow such comparisons.

3 Results and Discussion

The current and historical conditions in the Hay River were assessed using the monitoring of surface water, centrifugate, and suspended sediments. The assessment includes the development of summary statistics, testing for paired differences, trends analysis, and testing for correlations in the chemical and hydrographic parameters. As described in Section 2, the monitoring parameters were separated into two classifications: target parameters and non-target parameters. The data analyses for hydrology, surface water, and suspended sediment are discussed below.

3.1 Hydrology

Water flow was monitored at the Hay River hydrology station (station number 07OB001) that lies 17 km upstream of the mouth of the river (Figure 1.1). This station is maintained by Environment Canada's WSC as part of the National Hydrometric Program. Daily flow rates have been reported since 1963, excepting a short time period during 2010 when the station was down. Flow rates during this downtime were based on the average of the two measurements that bracket the event.

3.1.1 Hydrographs

The flow data and the flow season delineations are presented in Figures 3.1.a-p. The dates of the transitions between flow seasons are also summarized in Table 3-1. The results show that freshet generally begins around April 18, but can begin as early as April 3 and as late as May 1. During freshet, the flow volume rapidly increases over a period ranging from 10 days to 57 days (with an average of 25 days) before peaking. Recession generally begins on May 13, but has begun as early as April 30 and as late as June 9. Recession is generally characterized by a gradual decrease in flow as the year progresses, but it is punctuated by periods of high flow that correspond to periods of high precipitation. Base flow generally begins around November 18, but has begun as early as September 7 and as late as December 17. Base flow is characterized by low stable flow rates.

3.1.2 Flow Statistics

Basic summary statistics were calculated for each year of data and each flow season and include the minimum, maximum, and average daily flow for each year, as well as the yearly average flow by flow season (m^3/s) (Figure 3.2). The lower panel also presents the cumulative flow volume by year for each flow season (m^3/year). As described in Section 2, the cumulative flow is defined as the total flow volume over an entire flow season for a given year. Thus, the total cumulative flow value summed across all flow seasons is the total flow volume for the entire year.

The results show little evidence of strong trends in the magnitude of the flow, as characterized by the minimum, maximum, or average. There was a modest increase in the flow during base flow over the monitoring period based on a linear regression analysis ($p = 0.02$). No other significant trends were found. The results demonstrate that although the instantaneous flow volume is highest during freshet, followed by recession and base flow, the cumulative flow volume is highest during recession, due to an extended time period of high-moderate flows.

The low and high flow 7Q10s and 1Q10s (USGS 1982, USEPA 1986) were calculated for the 1964 to 2010 data. These statistics present the highest and lowest flow values for a single day and over seven days likely to occur over a 10-year period. These values provide an assessment of likely high-end and low-end flow values. The results show a dramatic difference between the low flow and the high flow value (Table 3-2). Note that the difference between the 7Q10s and 1Q10s was less than 5%.

The flow measurements describe a river with a highly variable flow character. In the Hay River, the spring thaw is highly pronounced and accounts for a significant portion of the total yearly flow. The recession period is characterized by a gradual decline from the high flows observed during freshet. Base flow is characterized by stable and low flows.

3.1.3 Analysis of Extreme Events

The frequency of extreme flow events was measured based on the number of days during which the flow volume (in m^3/s) exceeded three thresholds, as described in Section 2.1. The 80^{th} percentile of the flow data over the entire monitoring period was 201 m^3/s, which was rounded to 200 m^3/s. As described in University of Alberta 2012, there is an increase in the probability of flooding when peak flows exceed 675 m^3/s, and flooding is all but assured when peak flows exceed 1,020 m^3/s (University of Alberta 2012). Note that these thresholds and flooding predictions are independent of the flooding due to ice dams and therefore, only reflect trends in the flow volumes. The results of this analysis are shown in Figure 3.3. The results show no evidence for an increase in the frequency of flow events exceeding 200, 675, or 1,020 m^3/s over the period between 1964 and 2010. In fact, there were almost no observations of flows exceeding 1,020 m^3/s after 1995. The frequency of extreme events was further quantified using linear regression based trend tests. The results of the regression analyses show no significant increase or decrease in the frequency of 200, 675, and 1,020 m^3/s flow events over the duration of the monitoring period (p values > 0.05)

3.2 Surface Water

Surface water was monitored at two locations, the HR/B and the HR/WC (Figure 1.1). The analyses included both total, dissolved, and centrifugate measurements. Although the centrifugate samples have had a portion of the particulates removed, they were not considered to be equivalent to filtered samples, and therefore, they were considered separately from the dissolved samples. As described previously, the water quality parameters were segregated into target and non-target parameters. For the non-target parameters the assessment was limited to the calculation of summary statistics and the comparisons to relevant standards. The non-target parameters were not subject to trend analysis nor were they examined for relationships between the parameters.

3.2.1 Summary Statistics and Comparisons to Guidelines

Summary statistics were calculated for all the measured parameters for the entire dataset through 2010. The statistics are presented in Table 3-3 for both the target and the non-target parameters. The values include

- Minimum, maximum, median, average, and standard deviation

- Minimum and maximum non-detect value
- Minimum and maximum detected value
- Ecological screening value
- Frequency of exceedance of the ecological screening value
- Human health screening value
- Frequency of exceedance of the human health screening value

Screening values were compiled for both ecological receptors and drinking water. The ecological screening values were risk-based screening values for the protection of wildlife. Ecological screening level guidelines represent a value below which ecological impacts are unlikely, for even sensitive species or life history stages and in sensitive environments. For ecological screening values of surface water, the following documents were consulted; *Canadian Water Quality Guidelines for the Protection of Aquatic Life*, *Canadian Environmental Quality Guidelines Summary Tables*, and *Surface Water Quality Guidelines for Use in Alberta*. To obtain ecological screening values for sediment *Canadian Environmental Quality Guidelines Summary Tables* and *Canadian Sediment Quality Guidelines for the Protection of Aquatic Life* were consulted. To obtain drinking water screening values *Guidelines for Canadian Drinking Water Quality Summary Table* was consulted.

3.2.1.1 Target Parameters

Summary statistics for the target parameters, as well as comparisons of the results to the screening values for detected chemicals, are presented in the top portion of Table 3-3. Of the 40 target parameters, 26 parameters were analyzed for both total and dissolved fractions. The results were segregated by location (HR/B versus HR/WC), resulting in 86 distinct sets of summary statistics (Table 3-3). Of the 86 summaries, a total of 6 had no detections. Of the parameters analyzed for total concentrations, 37 had detected concentrations in the total fraction, with C11-C60 hydrocarbons being the only target parameters not detected in the total fraction.

Dissolved concentrations were measured for 27 parameters, with 22 having detected concentrations in the dissolved fraction. There were ecological screening values available for 14 parameters. Dissolved and total cadmium and total phosphorus had the highest frequency of exceedance of the ecological screening value at 100%. Only nickel, naphthalene, chromium, and chloride did not have exceedances of the ecological screening value in either the total or dissolved fraction.

There were drinking water screening values available for 6 parameters; of the 14 resultant data sets, only 3 had exceedances of the drinking water screening value (total lead, dissolved lead and total benzo[a]pyrene). Generally, metals tended to have the highest frequency of detection (FOD), while VOCs and semi-volatile organic compounds (SVOCs) tended to have a lower FOD (Table 3-3).

3.2.1.2 Non-Target Parameters

Summary statistics for the non-target parameters, as well as comparisons of the results to the screening values for detected chemicals, are presented in the second half of Table 3-3. There were 188 parameters analyzed for total concentration, and 89 parameters analyzed for both total and dissolved concentrations. The results were segregated by location (HR/B versus HR/WC) resulting in 229 unique data summaries.

The bulk of the non-target parameters were organic chemicals analyzed in HR/B samples in 2004 and 2005. For 110 of the data summaries the parameter was not detected, and for 46 data sets it was detected in 100% of the samples.

Ecological screening values were identified for 29 data sets (parameter/fraction combinations), of these, 6 exceed the value. Drinking water standards were identified for 8 data sets, of these, only selenium exceeds the value. Generally, metals tended to have the highest FOD, while VOCs and SVOCs tended to have a lower FOD (Table 3-3).

3.2.2 Trend Analysis

A stepwise approach was taken for the statistical analysis of the presence of trends for the entire data set and for the last 10 years (2000-2010). Trend analysis was conducted for target parameters that had data collected over at least 10 years and for which the analyte was detected in at least 70% of the samples and the parameter was detected in a minimum of 5 samples. These criteria helped ensure that a sufficiently representative time period was considered, and the trend analysis was less likely to be compromised by laboratory analytical considerations. If an analyte was infrequently detected, trend analysis can be flawed due to the likelihood of trends in the detection limits.

The presence of trends was assessed using regression analysis for simple temporal trends in the entire dataset and by location, and ANCOVA was used to assess trends by flow season/location. However, while ANCOVA can provide information on the presence of trends, the slope of the trend and its relationship to location and to season are not characterized by this analysis. It is important to note that ANCOVA provides a powerful tool for testing for the presence of significant trends, but methods for determining which individual trends are significant are less powerful. Therefore the interpretation of the ANCOVA results was expanded by performing regression analysis on each location/season combination for which enough data was available based on the trend analysis criteria described above. Thus it is possible to determine that there are significant temporal trends among the various combinations of location and flow season, but the analysis may not be able to pinpoint the specific significant combination.

3.2.2.1 Simple Temporal Trends and Trends by Flow Season and Location

Trend tests for the entire dataset are presented in Table 3-4. The regression-based trends are depicted graphically in Figure 3.4.a-ll. In the figures, the dotted horizontal yellow line denotes the ecological screening value when present. Dashed lines indicated the slope of the regression line when it is not significantly different from zero. A solid line indicates a slope that is significantly different from zero. The gray region denotes the 95% confidence interval. The

results of this analysis show that there are significant trends for a number of parameters. The relevance of these trends are described in detail in Section 3.5.2 and Section 4. As shown in Appendix B, the data for each location, irrespective of season, was also analyzed for temporal trends. The results of this analysis are described in Section 3.5.2.

3.2.2.2 Temporal Trends in the Last 10 Years

Trend analysis was also conducted for the 2000-2010 data using the same selection criteria applied to all of the data. The results are tabulated in Table 3-5 and presented graphically in Figure 3.5(a-kk) using the same annotation described above. The results show that for the 2000-2010 time period, significant temporal trends were identified for fewer parameters than was observed for all of the data (Section 3.2.2.1). The relevance of these trends are discussed in detail in Section 3.5.2 and Section 4.

3.2.3 Comparison of Alberta/NWT Border and West Channel Bridge

The differences between HR/B and HR/WC bridge was examined in two ways. The ANCOVA analyses (presented in Section 3.2.2) tested for a location effect, as well as for an interaction between the temporal trend and location. Differences by location were significant for a number of parameters (Table 3-4). The table indicates statistical significant at various confidence levels (<0.05 = *, <0.01 = ** and <0.001 = ***). However, the sampling design was unbalanced (Table 1-2), meaning that not all of the HR/B samples were collected at the same time as a HR/WC sample. Thus, differences between the locations could be impacted by temporal trends and other potential confounding factors. The locations were compared using a paired sample t-test, which ensures a balanced statistical design. For each HR/WC sample, an HR/B sample was chosen to closely coincide with the sampling date (Section 2.2, Table 2-2). The results of the analysis are shown in Table 3-6. Of the 20 parameters for which sufficient data were available, 5 showed significant differences between the HR/B and HR/WC locations. Of the 5 parameters with a significant difference, chromium magnesium, pH, and sodium all increased between the Border and the West Channel Bridge locations.

3.2.4 Dissolved versus Total

The relationship between total and dissolved concentrations was explored by calculating the ratio of dissolved/total concentration for each sample. For each target parameter, the t-statistic was used to calculate the confidence interval of the mean (Table 3-7). The results are shown graphically in Figure 3.6, with the blank vertical lines presenting the range of the data, and the red interval showing the 95% confidence interval of the mean. The analysis was not conducted for chemicals for which there were no detections or for which total and dissolved were not measured on the same day and in the same location. The results show that for most parameters (arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, vanadium, and zinc), the ratios range from 0.30 to 0.75. For a smaller set of parameters (magnesium, sodium, strontium, and uranium), the ratio was near 1. The results suggest that for the parameters with a ratio near 1, the majority of the parameter exits in the dissolved phase. Although the narrow confidence intervals might suggest that, on average, the dissolved concentration could be adequately predicted based on its ratio to the total concentration, the wide range of values suggest caution against this approach.

3.2.5 Correlations

As demonstrated in Section 3.2.2, the relationship between the concentrations of the target parameters and time can be positive, negative, or non-existent. The finding that not all parameters behave similarly suggests that some water column monitoring parameters may be related to each other in the form of a positive or negative (inverse) relationship. The relationship between the total/unfiltered water column parameters was explored using correlation analysis. The results of this analysis are shown in Table 3-8 including the correlation coefficient, the probability of a statistically significant difference (p-value), and sample size. The results are also shown graphically in Figure 3.7. The shape of the ellipse depicts the correlation coefficient. A circular ellipse indicates a weak or nonexistent correlation, and an elongated ellipse indicates a strong correlation, the orientation of the ellipse indicates a positive or negative correlation.

The results show a number of significant correlations in the water column parameters. For example, alkalinity is negatively correlated to the bulk of the metals, and PAHs are often correlated to each other. Conductivity has a strong positive correlation to alkalinity, calcium, chloride, hardness, manganese, magnesium, nitrate, sodium, strontium, sulphate, total dissolved solids, and uranium. Conductivity is negatively correlated to chromium, cobalt, copper, iron, lead, naphthalene, nickel, pH, phosphate, suspended solids, turbidity, vanadium, and zinc. Other strong positive correlations include strontium and chromium, cobalt and iron, arsenic and cobalt, arsenic and copper, arsenic and iron, arsenic and vanadium, chromium and vanadium, nickel and cobalt, copper and iron, copper and nickel, copper and vanadium, vanadium and iron, manganese and strontium, zinc and uranium, and zinc and vanadium. Thus, the concentrations of many of the metals are correlated.

3.3 Centrifugate

Centrifugate was monitored at a single location, the NWT/Alberta Border (Figure 1.1). Although the centrifugate samples have had a portion of the particulates removed, they were not considered to be equivalent to filtered samples, and therefore, they were considered separately from the dissolved samples. As described previously, the parameters were segregated into target and non-target categories.

3.3.1 Summary Statistics and Comparisons to Guidelines

Summary statistics were calculated for the all of the measured parameters for the entire dataset, through 2010. The statistics calculated included the following:

- Minimum, maximum, median, average, and standard deviation
- Minimum and maximum non-detect value
- Minimum and maximum detected value
- Ecological screening value
- Frequency of exceedance of the ecological screening value
- Human health screening value
- Frequency of exceedance of the human health screening value

Screening values were compiled for both ecological receptors and drinking water standards. The ecological screening values were risk-based screening values for the protection of wildlife. Ecological screening level guidelines represent a value below which ecological impacts are unlikely. The results are shown in Table 3-9. Of the 6 target parameters measured in the centrifugate, only naphthalene was detected. Although naphthalene was detected in 50% of the samples, it did not exceed the ecological screening value. Of the 66 non-target parameters, only 5 were detected, and of these 5, only 1 exceeds the ecological screening and none exceed the drinking water standards.

3.4 Suspended Sediment

Many of the parameters are expected to be influenced by flow season. For example, contaminants can be deposited in the snow pack, resulting in a pulse as the snow pack melts during freshet.

3.4.1 Summary Statistics and Comparisons to Guidelines

Summary statistics were calculated for the all of the measured parameters for the entire dataset through 2010. The statistics are presented in Table 3-10 and include the following:

- Minimum, maximum, median, average, and standard deviation
- Minimum and maximum non-detect value
- Minimum and maximum detected value
- Ecological screening value
- Frequency of exceedance of the ecological screening value
- Human health screening value
- Frequency of exceedance of the human health screening value

Screening values were compiled for ecological receptors based on screening values for the protection of wildlife as described in Section 2 (Table 3-10). Ecological screening level guidelines represent a value below which ecological impacts are unlikely, for even sensitive species or life history stages and in sensitive environments. Suspended sediment was only collected from the HR/B location. A total of 24 target parameters and 78 non-target parameters were measured. Of the target parameters, only 5 were not detected in every sample and only 3 were never detected (benzo[a]pyrene, naphthalene, and pyrene). Of the 78 non-target parameters, the majority of which are organic chemicals, only 18 were detected. The majority of the detected non-target parameters were metals. Only a few organic chemicals were detected (4-methylnaphthalene, methoxychlor, DDT, and perylene).

3.4.2 Trend Analysis

The criteria for trend analysis were met for a total of 11 parameters in suspended sediment. The trend analysis included the exploration of temporal trends and the relationship with flow and TOC (Figure 3.8a-k).

3.4.3 Correlations

The relationship between the concentrations of the target parameters in the suspended sediment and time, flow, and/or TOC can be positive, negative, or non-existent. The relationships between the target suspended sediment parameters were explored using correlation analysis (Table 3-11 and Figure 3.9). In Figure 3.9, the shape of the ellipse depicts the correlation coefficient. A circular ellipse indicates a weak or nonexistent correlation, and an elongated ellipse indicates a strong correlation.

The results show a number of significant correlations in the suspended sediment parameters. Positive correlations include manganese and calcium, naphthalene and benzo(a)pyrene, naphthalene and pyrene, copper and zinc, iron and manganese, iron and zinc, lead and potassium, manganese and sodium, nickel and uranium, nickel and zinc, potassium and vanadium, sodium and vanadium, and sodium and zinc. Negative correlation includes cobalt and phosphate and copper and strontium. As with the surface water, the concentrations of many of the metals in suspended sediments are correlated.

Many of the parameters are expected to be influenced by flow season. For example, contaminants can be deposited in or on the snow pack, resulting in a pulse as the snow pack melts during freshet. Alternatively, the low flow volumes during base flow may serve to concentrate parameters.

3.5 Synthesis

The analyses described above, when interpreted together, provide a more complete understanding of conditions in the Hay River. The integration of these many lines of evidence can be strengthened by multivariate analyses such as principal components analysis (PCA). Although the data quality expectations are high for these types of techniques, PCA can provide a unique tool by which multiple chemicals and media might be integrated in a single analysis. In addition, accounting of the results by parameter across media can also provide important insight and serve to create a more complete picture of the analyses.

3.5.1 Principal Components Analysis

As described in the methods report, multivariate techniques that consider the relationships between variables can provide useful insight into complex datasets. Techniques such as PCA reduce the dimensionality of the dataset and simplify complex relationships. However, PCA requires a balanced design in which all parameters are measured in all samples. The surface water and suspended sediment datasets both have highly unbalanced designs, so much so, that if incomplete observations are excluded, the sample size is too small to allow a meaningful analysis. Interpolation techniques were too uncertain to allow an estimate of missing values, and therefore, PCA could not be reliably applied to these datasets.

3.5.2 Discussion of Target Parameters

The water quality parameters were segregated into target and non-target parameters by media. For target parameters, the assessment included the calculation of summary statistics and comparisons to relevant guidelines. The target parameters were also subject to trend analysis

and additional analyses (e.g., correlation analysis). The statistical analyses have been summarized in Table 3-12 and Table 3-13. Table 3-12 also presents the results of the by location trend analysis that did not included season as a covariate that is presented as an additional analysis in Appendix B. The results for each target parameter are discussed in detail below.

Alkalinity

Alkalinity was measured in total fraction of surface water only. It was detected in all of the samples, and no applicable screening value was identified (Table 3-12). The highest alkalinity values are generally observed during base flow. Lower values are observed during freshet and recession. When all of the data was analyzed together, there was a trend of significantly decreasing alkalinity with time. When the data was analyzed by location across all seasons an increasing trend was found in the HR/B data. However, when the data was analyzed by location and flow season, no significant trends were observed. No trends were observed when the 2000-2010 data is considered, but the analysis may not have been sufficiently powerful to detect trends in this smaller data set. The paired samples in Table 3.6 indicate the mean and median are higher at HR/WC than HR/B, but these differences are relatively small and not statistically significant. In summary, the results suggest there may have been elevated alkalinity values prior to recent monitoring at HR/B; however, no trends are apparent in the more recent data. If any seasonal differences exist, they are modest and could not be detected using the available data.

Arsenic

Arsenic was measured in surface water and suspended sediment. For surface water, arsenic was measured in the dissolved fraction at the HR/B location. The total fraction was measured at both locations (Table 3-12). The results for total arsenic exceed the surface water ecological screening value of 5 micrograms per litre (µg/L) in 3% of the HR/B samples and 6% of the HR/WC samples The maximum arsenic surface water concentration detected was 9.6 µg/L. However, for the dissolved arsenic samples from HR/B, there were no exceedances. There was a significant increase in the dissolved arsenic concentration over the entire monitoring period. However there was a high degree of censoring at the beginning of the monitoring period which likely accounts for the observed trend rather than indicating a real change in the surface water concentrations. The by season trend was statistically significant for all flow season combined and for the recession flow season only at HR/B. Significant trends were not detected during base flow and freshet. When the 2000-2010 data is considered, there is still an increase, but it is not statistically significant. The total arsenic data had a much smaller sample size than the dissolved data, and the sample coverage makes comparison difficult. The data coverage does not allow a comparison of arsenic between the two locations. Arsenic was measured in the suspended sediment fraction at the HR/B location (Table 3-13). It was detected in 100% of the samples and exceeds the suspended sediment ecological screening value of 5.9 milligrams per kilogram (mg/kg) in 100% of the samples. The maximum concentration of arsenic detected in suspended sediment was 20 mg/kg. No significant trends were found between the suspended sediment arsenic data and time, flow, or TOC.

Benzo(a)pyrene

Benzo(a)pyrene was measured in surface water and suspended sediment from the HR/B location only (Table 3-12). For surface water, benzo(a)pyrene was never detected in the dissolved fraction and was detected in only 3% of the total fraction samples when the detection limit is used a surrogate for the measured concentration. Benzo(a)pyrene exceeds both the surface water ecological (0.15 µg/L) and drinking water screening values in 78% of the total fraction samples. The maximum benzo(a)pyrene concentration in surface water was 0.38 µg/L. Benzo(a)pyrene was measured in the centrifugate samples from HR/B, but it was not detected. Benzo(a)pyrene was not detected in suspended sediment at the HR/B location, but the detection limit exceeds the ecological screening value of 0.032 mg/kg in 75% of the samples (Table 3-13). Because benzo(a)pyrene was rarely detected in surface water samples and was never detected in suspended sediment samples, no trends could be assessed.

C11-C60 Hydrocarbons

C11-C60 hydrocarbons were measured at the HR/B location in surface water (both total and dissolved fractions) and in suspended sediment (Table 3-12 and 3-13). The parameter was not detected in either surface water fraction, and no screening value was identified. C11-C60 hydrocarbons were also not detected in the centrifugate samples. C11-C60 hydrocarbons were detected in 100% of the suspended sediment samples, but again, no screening value was identified for comparison.

Cadmium

Cadmium was measured in the dissolved and total fractions of surface water samples from the HR/B location and in the total fraction of surface water samples from the HR/WC location (Table 3-12). The results exceed the surface water ecological screening value of 0.17 µg/L for 100% of the dissolved samples from HR/B, 86% of the total samples from HR/B, and 30% of the total samples from HR/WC. The surface water maximum detected cadmium concentration was 2.6 µg/L, and the maximum non-detect value was 5 µg/L. However, no surface water samples exceed the drinking water screening value. Dissolved cadmium was only measured at HR/B, and there was a significant decrease in the concentration of dissolved cadmium in the combined data. However, when the dissolved cadmium data was analyzed by season, no significant trends were found. There was a significant decrease in the total cadmium concentration over the entire monitoring period but the trend was not significant in the by location and by season analyses Analysis of the total fraction from the 2000-2010 dataset indicates no significant trend in the more recent data set. The power to detect trends is reduced due to the smaller sample size in the recent data. There was no significant difference between the paired samples from the HR/B and HR/WC locations (Table 3-6). Cadmium was sampled in suspended sediment from the HR/B location, where it was detected in 50% of the samples. In the suspended sediment samples where cadmium was detected, it exceeds the suspended sediment ecological screening value of 0.6 mg/kg in 100% of them (Table 3-13). The maximum concentration of cadmium detected in suspended sediment was 0.9 mg/kg. The FOD was below 70% for the suspended sediment samples, and therefore, trends in this matrix were not assessed.

Calcium

Calcium was measured in the dissolved fraction of surface water from HR/B and in the total surface water fraction from HR/WC (Table 3-12). Calcium was detected in 100% of the samples, but there was no ecological or drinking water screening value identified for comparison. There was a significant decrease in the dissolved calcium concentration over the entire monitoring period, which was attributed to the HR/B location based on the by location testing, but there was no significant trend in the total fraction over the same period. Significant trends were not detected during separate seasons for either fraction when the entire monitoring period was considered or when only the 2000-2010 monitoring period was considered. Calcium was detected in 100% of the sediment samples from the HR/B location (Table 3-13). There is no identified screening value with which to compare the suspended sediment results. There was insufficient data for trend testing of the suspended sediment results.

Dissolved Organic Carbon

Dissolved organic carbon was measured in the surface water at the HR/B location, where it was detected in 100% of the samples (Table 3-12). No screening value was identified for comparison. While it appears there is a slight increasing trend in concentration for the entire dataset and throughout each season, no trends were statistically significant. The trends appear to be opposite (slight decreases) the 2000-2010 data, but again, none of the trends are statistically significant.

Total Organic Carbon

TOC was measured in the total surface water fraction from HR/B, where it was detected in 100% of the samples (Table 3-12). No screening value was identified for comparison. When the entire dataset was analyzed for trends, the only significant trend was an increasing trend during base flow, and no trend was observed when all data was combined. No significant trends were found in the more recent data from the 2000-2010 time period. TOC was measured in suspended sediment from the HR/B location, where it was detected in 100% of the samples (Table 3-13). Trend analyses revealed no statistically significant temporal trend in suspended sediment TOC concentration during the monitoring period. There was a significant negative relationship between TOC and flow. The results suggest that as the flow increases TOC is likely diluted by other suspended material.

Chloride

Chloride was measured in surface water only (Table 3-12). Dissolved fraction samples were collected from HR/B, while total fraction samples came from HR/WC. Chloride was detected in 100% of the samples. None of the samples exceed the ecological screening value of 2 µg/L, and no drinking water screening value was identified. In both the dissolved and total fraction, trend analyses reveal that the chloride concentrations from the entire dataset exhibited no trend. However, when analyzed by season, there was a significant decreasing trend in the dissolved concentrations associated with base flow and a decreasing trend associated with recession. These trends were not found in the total fraction. In the recent data (2000-2010) there was a significant decrease in the dissolved concentrations for the recession flow season data. The importance of the observed results are difficult to interpret given that dissolved chloride was measured at one location and total was measured at a different location.

Chromium

Chromium was measured in the dissolved and total fractions of surface water from HR/B, and was measured in the total fraction of surface water from HR/WC (Table 3-12). Concentrations of total chromium in the dissolved fraction did not exceed the surface water ecological screening value of 1µg/L for hexavalent chromium, but 29% of the total fraction samples from HR/B and 67% of the total fraction samples from HR/WC did exceed the screening value. It is important to note that the majority of the chromium in surface water is expected to be in the form of chromium (III), which is less toxic than hexavalent chromium and does not have an identified screening value. There were no significant trends in concentrations from the total fraction over the entire monitoring period. When the 2000-2010 data was considered, the only significant trend was found during recession at the HR/WC location. The paired HR/B and HR/WC analysis did detect a significant difference in chromium concentrations between the two locations, with the HR/WC measured being higher than those observed at HR/B (Table 3-6). Total chromium was measured in suspended sediment samples from the HR/B location, where it was detected in 100% of the samples (Table 3-13). The concentration exceeds the suspended sediment ecological screening value of 37 mg/kg for hexavalent chromium in 100% of the samples. The maximum detected chromium concentration was 118 mg/kg. Once again, no screening value is identified for the more common chromium (III) form. No significant trends were found between the suspended sediment data and time, flow, or TOC.

Cobalt

Cobalt was measured in surface water from both the HR/B and the HR/WC stations (Table 3-12). The dissolved fraction was measured at HR/B only, while total was measured at both locations. Cobalt was detected in 100% of the dissolved samples from HR/B and in 95% of the total samples from HR/B and 86% of the total samples from HR/WC. There are no applicable screening values identified for cobalt. There were no significant trends with time for the total fraction over the entire monitoring period or for the 2000-2010 time period, either for all locations and season combined or when analyzed separately. Trends were not assessed in the dissolved fraction. No differences were found in the paired samples comparing the two locations (Table 3-6). Cobalt was measured in eight suspended sediment samples from the HR/B and was detected in 100% of the samples (Table 3-13). No ecological screening value was identified for cobalt in suspended sediment. The analysis reveals no significant relationships between cobalt and time, flow, or TOC.

Color

Color was measured in samples from both the HR/B and HR/WC (Table 3-12). When all of the data was combined, there was a significant increasing trend over the entire monitoring period and during the 2000-2010 time period. When that data was analyzed by location and season, the increasing trend was limited to the HR/WC location and the recession season for both the entire monitoring period and 2000-2010. There was no significant difference between HR/B and HR/WC in the paired sample analysis (Table 3-6).

Conductivity

Conductivity was measured in samples from the HR/B and HR/WC locations (Table 3-12). No temporal trends were found for either the entire monitoring period or the 2000-2010 time period. The paired samples from HR/B and HR/WC were virtually identical, with no significant differences observed (Table 3-6).

Copper

Copper was measured in the dissolved fraction in surface water at HR/B and in the total fractions in surface water at both locations (Table 3-12). Copper exceeds the surface water ecological screening value of 3 µg/L in 6% of the dissolved samples and 33% of the total sample from HR/B and 53% of the total samples from HR/WC. The maximum detected copper concentration in surface water was 24 µg/L. There were insufficient samples for trend testing of the dissolved fraction. Trend testing in the total fraction revealed no significant temporal trends for the entire data set or for the 2000-2010 time period. The paired testing by location found no statistically significant differences between the locations (Table 3-6). Copper was measured in suspended sediment samples HR/B and was detected in 100% of the samples (Table 3-13). The suspended sediment samples exceed the ecological screening value of 36 mg/kg for sediment in 13% of the samples. The maximum detected copper concentration in suspended sediment was 43 mg/kg. There were no statistically significant temporal trends or trends with respect to TOC or flow.

Hardness

Hardness (as $CaCO^3$) was measured at both HR/B and HR/WC (Table 3-12). Hardness was detected in 100% of the samples from both locations. A significant decrease over the entire monitoring period in hardness was identified that was attributed to the HR/B location but not to a specific season. No statistically significant trends were detected in the 2000-2010 time period. The paired HR/B and HR/WC samples showed no significant difference (Table 3-6).

Iron

Iron was measured in both the total and dissolved fractions at HR/B and in the total fraction at HR/WC (Table 3-12). It was detected in 100% of the samples and exceeds the surface water ecological screening value of 300 µg/L in more than 95% of the samples. The maximum iron concentration detected was 24,000 µg/L. There was insufficient data for trend testing of the dissolved data. For the total fraction, no statistically significant trends were observed for all data combined or for specific locations and flow season for both the entire monitoring period and the 2000-2010 time period. The paired HR/B and HR/WC samples showed no significant difference between the two locations (Table 3-6). Iron was measured in eight suspended sediment samples from the HR/B and was detected in 100% of the samples (Table 3-13). No suspended sediment ecological screening value was identified for iron. The analysis reveals no significant relationships between iron and time or flow, but does show a significant positive relationship with TOC. Although there was no statistically significant relationship with flow, the results do show a trend of lower iron concentrations at higher flows.

Lead

Lead was measured in the dissolved fraction from HR/B and in the total fraction for both HR/B and HR/WC (Table 3-12). In the dissolved fraction, lead was detected in 100% of the samples and did not exceed the surface water ecological screening value of 4 µg/L. The frequency of detection was 100% in the total fraction, with 5% of the samples from HR/B and 16% of the samples from HR/WC exceeding the ecological screening value. The maximum detected lead concentration was 62 µg/L. Trend testing was not performed on the dissolved fraction. In the total fraction, no temporal trends were identified for either all samples or by location and flow season for both the entire monitoring period and the 2000-2020 time period. The paired HR/B and HR/WC analysis showed no significant difference in lead concentrations between the two locations (Table 3-6). Lead was measured in the suspended sediment samples from HR/B and was detected in 100% of the samples (Table 3-13). None of the detects exceed the suspended sediment ecological screening value of 35 mg/kg. Although the data suggests a possible positive relationship between lead and date and a negative relationship with flow and TOC, the results are not statistically significant.

Magnesium

Magnesium was measured in dissolved samples from HR/B and in the total samples from HR/B and HR/WC (Table 3-12). Magnesium was detected in 100% of the samples, and no ecological screening values were identified. For dissolved samples there was a significant decrease in magnesium across all dates and for the HR/B location. However there was a significant increase during recession for 2000-2010 data. There were no statistically significant temporal trends in total magnesium samples. The paired HR/B and HR/WC samples revealed that magnesium was significantly higher at HR/WC than at HR/B (Table 3-6). Magnesium was detected in 100% of the suspended sediment samples (Table 3-13). The trend analysis revealed no significant negative relationship with date, flow, or TOC.

Manganese

Manganese was measured in dissolved (HR/B) and total (HR/WC) surface water samples (Table 3-12). This parameter was detected in 100% of the dissolved and total samples. No ecological or drinking water screening values were identified for manganese. This parameter did not meet the criteria for temporal trend testing for the dissolved fraction. In the total fraction no temporal trends were observed. Differences by location could not be tested due to the unbalanced dataset. Manganese was measured in eight suspended sediment samples from HR/B and was detected in 100% of them (Table 3-13). No suspended sediment ecological screening value was identified for manganese. The trend analysis reveals no significant temporal relationship in the suspended sediment. There was a strong positive relationship with TOC and a strong negative relationship with flow.

Mercury

Total mercury was measured in surface water at HR/WC only and was detected in 100% of the samples (Table 3-12). Mercury exceeds the surface water ecological screening value of 0.026 µg/L in 62% of the samples. The maximum surface water detected total mercury concentration

was 0.42 µg/L. There was insufficient data for reliable trend testing. Mercury was measured in eight suspended sediment samples collected from HR/B and was detected in all of the samples (Table 3-13). None of the results exceed the suspended sediment ecological screening value for mercury of 0.17 mg/kg. The trend analysis reveals no significant temporal trend. There was a strong positive relationship with flow and no significant relationship with TOC.

Naphthalene

Naphthalene was measured in both the dissolved and total fraction from HR/B (Table 3-12). Naphthalene was not detected in the dissolved fraction and was detected in 19% of the total samples; none of the results exceed the surface water ecological screening value of 1.1 µg/L. The maximum detect for naphthalene was 0.024 µg/L and the maximum non-detect for naphthalene was 0.05 µg/L. There was insufficient data for trend testing. Naphthalene was measured in 10 suspended sediment samples collected from the HR/B (Table 3-13). Naphthalene was not detected in any of the suspended sediment samples, and therefore, trends were not assessed.

Nickel

Nickel was analyzed in surface water at HR/B (dissolved and total) and HR/WC (total) (Table 3-12). Nickel was detected in 100% of the dissolved and 100% of the total samples from HR/B, it was detected in 91% of the total samples from HR/WC. None of the surface water results exceed the surface water ecological screening value of 110 µg/L. There was a statistically significant decrease in the total nickel values from the HR/WC location, no other temporal trends were observed. The paired nickel samples from HR/B and HR/WC showed no statistically significant difference between these two locations (Table 3-6). Nickel was measured in suspended sediment samples from HR/B (Table 3-13) and was detected in all of the samples. No suspended sediment ecological screening value was identified for the concentration in suspended sediment. The trend analysis reveals no significant relationship with time, flow, or TOC.

Total Kjeldahl Nitrogen

Total Kjeldahl nitrogen was detected in 100% of the sample from HR/WC (Table 3-12). No drinking water or surface water ecological screening value was identified for total kjeldahl nitrogen. There was a significant decrease in concentration over the monitoring period that was attributed to the HR/WC location. Samples were only collected during recession, so trends during other flow season cannot be assessed.

Nitrate, Nitrite, Nitrate+Nitrite

Nitrate, nitrite and nitrate+nitrite were measured at HR/B, and nitrate+nitrite was measure at HR/WC (Table 3-12). Dissolved nitrate+nitrate was also measured at HR/B. For nitrate+nitrite in the total fraction, the FOD was 85% for HR/B and 57% for HR/WC. No ecological screening values were identified. For the bulk of the analytes in this group, there was insufficient data for trend analysis. However, trend analysis was possible for the dissolve nitrate+nitrite at HR/B,

which revealed an increasing temporal trend for the entire monitoring period and the recession data from the entire monitoring period.

pH

As shown in Table 3-12 pH was measured from both HR/B and HR/WC. There are no surface water ecological or drinking water screening values for pH. The trend analysis shows a significant increase in pH over time for both locations. When location and flow season are both considered, only HR/WC during recession has a significant increasing trend. The paired sample analysis of HR/B and HR/WC shows that pH is significantly higher at HR/WC than at HR/B (Table 3-6).

Phosphorus

Total phosphorous was measured at both HR/B and HR/WC (Table 3-12). It was detected in 99% of the samples from HR/B and 89% of the samples from HR/WC. None of the results exceed the surface water ecological screening value of 0.05 µg/L. The trend analysis found a statistically significant increase with time when all data from the entire monitoring period was considered and this was attributed the HR/B location. However, no significant trends were found where the data was examined by location/flow season or when only the 2000-2010 data was considered. The paired sample analysis showed no statistically significant difference between the HR/B and HR/WC results (Table 3-6). As shown in Table 3-13, phosphorus (total as P) was measured in suspended sediment samples from the HR/B location and was detected in 100% of the samples. There was insufficient data to allow a trend analysis of the suspended sediment data.

Potassium

Potassium was measured in dissolved surface water samples from HR/B and in total surface water samples from HR/WC (Table 3-12). All sample results were detects, and no ecological screening value for surface water was identified. The dissolved samples (HR/B) showed a significant decrease during recession for the entire monitoring period and an increase only during recession for recent data. These contradictory results appear to be anomalous based on an examination of the time series plot (Figure 3.4aa), which shows no temporal patterns. The total samples (HR/WC) showed a significant decrease overall and during recession using all sample dates. Potassium was measured in suspended sediment samples collected from HR/B and was detected in all of the samples (Table 3-13). No ecological screening value for suspended sediment was identified. There was insufficient data for trend analysis of the suspended sediment data .

Pyrene

Pyrene was measured in dissolved surface water samples and total surface water samples at HR/B (Table 3-12). None of the dissolved sample results were detects, and 9% of the total samples were detected. While there is no identified drinking water screening value for pyrene, 3% of the total samples exceed the surface water ecological screening value of 0.025 µg/L. The maximum detect was 0.0078 and maximum non-detect for pyrene was 0.058 µg/L. Given the

low frequency of detects, trends were not calculated for either total or dissolved surface water samples. Pyrene was measured in suspended sediment samples collected from HR/B (Table 3-13). Pyrene was not detected in any of the samples, and therefore, trends were not assessed.

Sodium

Sodium was measured in dissolved surface water samples and total surface water samples from the HR/B location (Table 3-12). All sample results were detects, and no surface water ecological or drinking water screening values for sodium were identified. The trend analysis revealed no trends when all of the data was combined, but when the base flow data was considered, a significant increasing trend was observed for the total fraction. No temporal trends were identified in the 2000-2010 time period. Sodium was measured in suspended sediment samples from the HR/B location (Table 3-13). Given the low frequency of detection and small sample size, trends were not assessed.

Strontium

Strontium was measured in surface water at HR/B in both the dissolved and total fractions (Table 3-12). All sample results were detects, and no ecological or drinking water screening values were identified for strontium. There was insufficient data for trend analysis of the dissolved fraction, and no statistically significant trends were observed in the total fraction. Strontium was measured in suspended sediment samples collected during recession from the HR/B location (Table 3-16). Strontium was detected in all of the suspended sediment samples. No ecological screening value was identified. Due to the small sample size, no trend analysis was performed on the suspended sediment data.

Sulphate

Dissolved sulphate samples were measured in surface water from the HR/B location and total sulphate samples were measured in surface water from the HR/WC location (Table 3-12). All of the HR/B dissolved phase results were detects, and sulphate was detected in 98% of the total samples from HR/WC. There were no surface water ecological or drinking water screening values identified for sulphate. The trend analysis of the dissolved results from HR/B shows a significant decrease over the entire monitoring period, but the detailed analysis by location/season did not find any significant trends. Sulphate was not measured in the suspended sediment samples.

Suspended Solids

Suspended solid samples were measured at the HR/B and HR/C locations (Table 3-12). At HR/B, 93% of the results were detects and 90% of the HR/WC results were detects. No ecological or drinking water screening values were identified for suspended solids. The trend analysis showed no significant trends for the combined data or for any location/season combination. The paired samples comparison did not detect a statistically significant difference between the two locations (Table 3-6).

Total Dissolved Solids

Total dissolved solids samples were taken from both locations (Table 3-12). All sample results were detects, and no ecological screening values were identified. The trend analysis showed no significant trends for the combined data or for any location/season combination. The paired sample comparison showed significantly higher total dissolved solids at the HR/WC location than at the HR/B location. The p-value associated with this analysis was < 0.0001 (Table 3-6).

Turbidity

Turbidity was measured at both locations (Table 3-12) and all results were detects. No ecological screening value was identified. The temporal trend analysis found no statistically significant trends, either for the combined data or for any location/season combination. The paired sample analysis did not detect any statistically significant difference between the HR/B and HR/WC locations (Table 3-6).

Uranium

Total uranium was measured in total and dissolved samples in surface water from the HR/B location (Table 3-12). Uranium was detected in all of the samples. No surface water screening values were identified for uranium. There was insufficient data for a trend analysis. Uranium was measured in suspended sediment samples collected from HR/B and was detected in all of the samples (Table 3-13). There were no suspended sediment screening values identified for uranium. Due to small sample size, no trend analysis was performed on the suspended sediment results.

Vanadium

Dissolved and total vanadium were measured in surface water at the HR/B location (Table 3-12). Vanadium was detected in 100% of the dissolved samples and in 86% of the total samples. There were no surface water ecological or drinking water screening values identified for vanadium. There was insufficient data for a trend analysis of the dissolved samples. For the total samples, there was a significant increase in the vanadium concentrations in the combined data for entire monitoring period. This trend is likely due to a high degree of data censoring at the beginning of the record and likely does not reflect any long term trends in the actual concentrations. When all seasons for HR/B were considered, there was also a significantly increasing trend, but not for HR/WC. However, no trends were apparent when the data was subdivided by both location and season or when the just 2000-2010 data was considered. Vanadium was measured in suspended sediment samples collected during recession from the HR/B location and it was detected in all of the samples (Table 3-13). No suspended sediment ecological screening value was identified. There was insufficient data to perform a trend analysis.

Xylenes

M,P-Xylene and O-Xylene were measured in dissolved and total surface water samples from the HR/B location (Table 3-12). The chemicals were not detected in any of the samples, and there are no identified applicable screening values for Xylenes. There was insufficient data for trend analysis.

Zinc

Dissolved and total zinc was measured in surface water at the HR/B location and total zinc was measured in surface water at the HR/WC location (Table 3-12). Zinc was detected in 100% of the dissolved HR/B sample, in 100% of the HR/B total samples, and in 71% of the HR/WC total samples. For the HR/B dissolved samples, none of the results exceed the surface water ecological screening value of 30 µg/L. For the total samples, 6% of the HR/B samples and 14% of the HR/WC samples exceed the ecological screening value. The maximum concentration detected for zinc was 101 µg/L. Trend analysis of the total samples showed no significant trend when all data was considered. For the HR/B base flow season there was a significant increase with time when the entire monitoring period was considered, but not when only the 2000-2010 time period was considered. The paired sample analysis revealed no significant differences between the HR/B and HR/WC locations (Table 3-6). Zinc was measured in eight suspended sediment samples collected from HR/B (Table 3-13) and was detected in all of the samples. The suspended sediment ecological screening value of 123 mg/kg was exceeded for 88% of the results. The maximum suspended sediment zinc concentration detected was 158 mg/kg. The trend analysis of the suspended sediment data shows that there is no significant relationship with time, flow, or TOC.

3.5.3 Discussion of Non-Target Parameters

The bulk of the non-target parameters were organic chemicals analyzed in HR/B samples in 2004 and 2005.

In surface water, ecological screening values were identified for 29 data sets, of these, 6 exceed the screening value. Drinking water standards were identified for 8 data sets, of these, selenium was the only one that exceeds the screening value. Metals tend to have the highest FOD, while VOCs and SVOCs tend to have a lower FOD.

Of the 66 non-target parameters measured in the centrifugate, only 5 were detected and of these 5, only 1 exceeds the ecological screening value and none exceed the drinking water standards.

A total of 78 non-target parameters were measured in suspended sediment, the majority of which are organic chemicals and only 18 of which were detected. The majority of the detected non-target parameters were metals. Only a few organic chemical were detected (4-methylnaphthalene, methoxychlor, DDT, and perylene).

4 Summary

Substantial data was collected from the Hay River that was used in this assessment of the status and trends of the surface water and suspended sediment. This assessment includes an analysis of both hydrology and chemicals/nutrients.

The hydrological evaluation described the Hay River as having a highly variable flow character during the year. The increase in water flows due to the spring thaw is highly pronounced and accounts for a significant portion of the total yearly flow. The recession period is characterized by a gradual decline from the high flows observed during freshet and also accounts for a significant portion of the yearly flow. Base flow is characterized by stable and low flows. There was no evidence for trends in the minimum, maximum, or average yearly flow or the flow during the three-flow season. The results show no evidence for an increase in the frequency of extreme flow events between 1964 and 2010.

The assessment included both target parameters, as defined by AANDC, and non-target parameters. The non-target parameters were assessed for simple summary statistics and comparison to applicable standards. The target parameters were also assessed for both temporal trends and location trends. The comparisons included an assessment of the differences between dissolved and total fractions, as well as correlations between the parameters.

As documented in Section 3, greater than 50% of the non-target parameters in surface water and suspended sediments were not detected in the monitoring samples. The non-target parameters included pesticides, PCBs, SVOCs, etc. Of the target parameters detected in surface water for which ecological screening values were identified, about two-thirds exceed the screening values. Of the seven target parameters detected in suspended sediments with screening values, only two (lead and mercury) did not exceed the screening values. However, copper exceeds the screening value in only a single sample. Ecological screening level guidelines represent a value below which ecological impacts are unlikely, for even sensitive species or life history stages and in sensitive environments. Therefore, these results of this analysis do not provide presumptive evidence for ecological effects.

The analysis of trends reveals that among the target parameters there is no consistent increase or decrease in the surface water monitoring parameters over the monitoring period (summarized in Table 3-12). In fact, for the majority of the parameters, no statistically significant trends were detected. However, in the entire dataset (All Dates) the number of increasing trends (4) was half of the number of decreasing trends (8). Very few significant trends were observed when the data was subdivided by location and flow season. In fact, no statistically significant trends were observed during freshet.

The results show significant differences between the two locations for only a small number of parameters (5 of 20). The variability at a location was much greater than the variability across locations.

One possible complicating factor in the trend analysis is the presence of a high value for many of the surface water parameters in 2003. If the high value sample is determined to be an outlier and is excluded from the analysis, some of the observations of a decreasing trend may no longer hold true. However, in general, the observation of a high value in the absence of other information is insufficient to warrant the removal of a possibly important data point.

The analysis of trends in the suspended sediment included time, flow, and TOC (Table 3-13). The analysis of temporal trends reveals no trend for the evaluated parameters. Similarly there were no trends with respect to flow for the majority of parameters excluding negative trends for TOC and manganese and a positive trend for mercury. The analysis of trends related to TOC found significant trends for iron and manganese.

In general, the ratio of dissolved to total for the target surface water parameters ranged between 0.3 and 0.75 with a few exceptions. The ratio was approximately 1 for magnesium, sodium, strontium, and uranium. The correlation analysis did not reveal any consistent trends with respect to parameters for either surface water or suspended sediments. For example the metals did not co-vary. However, the PAHs did tend to co-vary.

The correlation analysis shows that similar parameters tend to be correlated to each other. For example the PAHs are correlated to each other in both media. Also, the majority of the metals are correlated to each other in both media. However, the correlations to general water quality parameters such as conductivity are not generally consistent across the parameter list.

In conclusion, the results do not reveal any consistent changes in the target parameters over the course of the monitoring period. There is some evidence that more surface water parameter concentrations are decreasing than increasing. There are no consistent trends with respect to time, flow, or TOC in the suspended sediment. The analysis also revealed very few significant differences between the two monitoring locations (chromium, magnesium, pH, sodium, and total dissolved solids). For all of these significant differences between HR/B and HR/WC, the concentrations at HR/WC were higher than that observed upriver at HR/B.

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Tables

Table 1-1. Sampling Events

Matrix	Sort	Fraction	Year	Month	HR/B	HR/WC
Surface water	1	Total	1982	6		X
Surface water	1	Total	1982	10		X
Surface water	1	Total	1983	5		X
Surface water	1	Total	1983	10		X
Surface water	1	Total	1984	5		X
Surface water	1	Total	1984	10		X
Surface water	1	Total	1985	6		X
Surface water	1	Total	1985	10		X
Surface water	1	Total	1986	5		X
Surface water	1	Total	1987	5		X
Surface water	1	Total	1987	10		X
Surface water	1	Total	1988	4		X
Surface water	1	Total	1988	10	X	X
Surface water	1	Total	1988	11	X	
Surface water	1	Total	1988	12	X	
Surface water	1	Total	1989	1	X	
Surface water	1	Total	1989	2	X	
Surface water	1	Total	1989	3	X	
Surface water	1	Total	1989	4	X	
Surface water	1	Total	1989	5	X	X
Surface water	1	Total	1989	6	X	
Surface water	1	Total	1989	7	X	
Surface water	1	Total	1989	8	X	
Surface water	1	Total	1989	9	X	
Surface water	1	Total	1989	10	X	X
Surface water	1	Total	1989	11	X	
Surface water	1	Total	1990	1	X	
Surface water	1	Total	1990	2	X	
Surface water	1	Total	1990	3	X	
Surface water	1	Total	1990	4	X	
Surface water	1	Total	1990	5	X	X
Surface water	1	Total	1990	6	X	
Surface water	1	Total	1990	7	X	
Surface water	1	Total	1990	8	X	
Surface water	1	Total	1990	9	X	
Surface water	1	Total	1990	10	X	X
Surface water	1	Total	1990	11	X	
Surface water	1	Total	1991	1	X	
Surface water	1	Total	1991	2	X	
Surface water	1	Total	1991	3	X	
Surface water	1	Total	1991	4	X	
Surface water	1	Total	1991	5	X	
Surface water	1	Total	1991	6	X	X
Surface water	1	Total	1991	7	X	
Surface water	1	Total	1991	8	X	
Surface water	1	Total	1991	9	X	
Surface water	1	Total	1991	10	X	X
Surface water	1	Total	1991	11	X	
Surface water	1	Total	1991	12	X	
Surface water	1	Total	1992	1	X	
Surface water	1	Total	1992	2	X	
Surface water	1	Total	1992	3	X	
Surface water	1	Total	1992	4	X	
Surface water	1	Total	1992	5	X	X
Surface water	1	Total	1992	6	X	
Surface water	1	Total	1992	7	X	
Surface water	1	Total	1992	8	X	
Surface water	1	Total	1992	9	X	
Surface water	1	Total	1992	10	X	X
Surface water	1	Total	1992	11	X	

Table 1-1. Sampling Events

Matrix	Sort	Fraction	Year	Month	HR/B	HR/WC
Surface water	1	Total	1992	12	X	
Surface water	1	Total	1993	1	X	
Surface water	1	Total	1993	2	X	
Surface water	1	Total	1993	3	X	
Surface water	1	Total	1993	4	X	
Surface water	1	Total	1993	5	X	
Surface water	1	Total	1993	6	X	X
Surface water	1	Total	1993	7	X	
Surface water	1	Total	1993	8	X	
Surface water	1	Total	1993	9	X	
Surface water	1	Total	1993	10	X	X
Surface water	1	Total	1993	11	X	
Surface water	1	Total	1993	12	X	
Surface water	1	Total	1994	1	X	
Surface water	1	Total	1994	2	X	
Surface water	1	Total	1994	3	X	
Surface water	1	Total	1994	4	X	
Surface water	1	Total	1994	5	X	X
Surface water	1	Total	1994	6	X	
Surface water	1	Total	1994	7	X	
Surface water	1	Total	1994	8	X	
Surface water	1	Total	1994	9	X	
Surface water	1	Total	1994	10	X	X
Surface water	1	Total	1994	11	X	
Surface water	1	Total	1994	12	X	
Surface water	1	Total	1995	1	X	
Surface water	1	Total	1995	2	X	
Surface water	1	Total	1995	6	X	X
Surface water	1	Total	1995	7	X	
Surface water	1	Total	1995	9	X	
Surface water	1	Total	1995	10		X
Surface water	1	Total	1995	11	X	
Surface water	1	Total	1996	4	X	
Surface water	1	Total	1996	5	X	
Surface water	1	Total	1996	6		X
Surface water	1	Total	1996	7	X	
Surface water	1	Total	1996	10	X	X
Surface water	1	Total	1996	12	X	
Surface water	1	Total	1997	2	X	
Surface water	1	Total	1997	4	X	
Surface water	1	Total	1997	5	X	X
Surface water	1	Total	1997	7	X	
Surface water	1	Total	1997	9	X	
Surface water	1	Total	1997	10		X
Surface water	1	Total	1997	12	X	
Surface water	1	Total	1998	2	X	
Surface water	1	Total	1998	4	X	
Surface water	1	Total	1998	5	X	X
Surface water	1	Total	1998	7	X	
Surface water	1	Total	1998	9	X	
Surface water	1	Total	1998	10		X
Surface water	1	Total	1998	12	X	
Surface water	1	Total	1999	1	X	
Surface water	1	Total	1999	4	X	
Surface water	1	Total	1999	6	X	X
Surface water	1	Total	1999	7	X	
Surface water	1	Total	1999	9	X	
Surface water	1	Total	1999	10		X
Surface water	1	Total	1999	12	X	
Surface water	1	Total	2000	2	X	

Table 1-1. Sampling Events

Matrix	Sort	Fraction	Year	Month	HR/B	HR/WC
Surface water	1	Total	2000	4	X	
Surface water	1	Total	2000	5	X	X
Surface water	1	Total	2000	7	X	
Surface water	1	Total	2000	9	X	
Surface water	1	Total	2000	10		X
Surface water	1	Total	2001	4	X	
Surface water	1	Total	2001	5	X	X
Surface water	1	Total	2001	6	X	
Surface water	1	Total	2001	9	X	
Surface water	1	Total	2001	10		X
Surface water	1	Total	2002	4	X	
Surface water	1	Total	2002	5		X
Surface water	1	Total	2002	6	X	
Surface water	1	Total	2002	7	X	
Surface water	1	Total	2002	9	X	
Surface water	1	Total	2002	10		X
Surface water	1	Total	2003	4	X	
Surface water	1	Total	2003	5		X
Surface water	1	Total	2003	6	X	
Surface water	1	Total	2003	7	X	
Surface water	1	Total	2003	9	X	
Surface water	1	Total	2003	10		X
Surface water	1	Total	2004	4	X	
Surface water	1	Total	2004	6	X	X
Surface water	1	Total	2004	7	X	
Surface water	1	Total	2004	8	X	
Surface water	1	Total	2004	10		X
Surface water	1	Total	2004	12	X	
Surface water	1	Total	2005	4	X	
Surface water	1	Total	2005	5	X	X
Surface water	1	Total	2005	6	X	
Surface water	1	Total	2005	7	X	
Surface water	1	Total	2005	8	X	
Surface water	1	Total	2005	10		X
Surface water	1	Total	2006	4	X	
Surface water	1	Total	2006	5	X	X
Surface water	1	Total	2006	8	X	
Surface water	1	Total	2006	10		X
Surface water	1	Total	2007	4	X	
Surface water	1	Total	2007	5	X	
Surface water	1	Total	2007	6		X
Surface water	1	Total	2007	7	X	
Surface water	1	Total	2007	8	X	
Surface water	1	Total	2007	10		X
Surface water	1	Total	2008	4	X	
Surface water	1	Total	2008	5		X
Surface water	1	Total	2008	7	X	
Surface water	1	Total	2008	9	X	
Surface water	1	Total	2008	10		X
Surface water	1	Total	2009	5	X	X
Surface water	1	Total	2009	6	X	
Surface water	1	Total	2009	9	X	
Surface water	1	Total	2009	10		X
Surface water	1	Total	2010	4	X	
Surface water	1	Total	2010	5	X	X
Surface water	1	Total	2010	6	X	
Surface water	1	Total	2010	8	X	
Surface water	1	Total	2010	10		X
Surface water	1	Total	2011	4	X	
Surface water	1	Total	2011	7	X	

Table 1-1. Sampling Events

Matrix	Sort	Fraction	Year	Month	HR/B	HR/WC
Surface water	1	Total	2011	8	X	
Surface water	1	Total	2011	9	X	
Surface water	1	Total	2011	10	X	
Surface water	2	Dissolved	1988	10	X	
Surface water	2	Dissolved	1988	11	X	
Surface water	2	Dissolved	1988	12	X	
Surface water	2	Dissolved	1989	1	X	
Surface water	2	Dissolved	1989	2	X	
Surface water	2	Dissolved	1989	3	X	
Surface water	2	Dissolved	1989	4	X	
Surface water	2	Dissolved	1989	5	X	
Surface water	2	Dissolved	1989	6	X	
Surface water	2	Dissolved	1989	7	X	
Surface water	2	Dissolved	1989	8	X	
Surface water	2	Dissolved	1989	9	X	
Surface water	2	Dissolved	1989	10	X	
Surface water	2	Dissolved	1989	11	X	
Surface water	2	Dissolved	1990	1	X	
Surface water	2	Dissolved	1990	2	X	
Surface water	2	Dissolved	1990	3	X	
Surface water	2	Dissolved	1990	4	X	
Surface water	2	Dissolved	1990	5	X	
Surface water	2	Dissolved	1990	6	X	
Surface water	2	Dissolved	1990	7	X	
Surface water	2	Dissolved	1990	8	X	
Surface water	2	Dissolved	1990	9	X	
Surface water	2	Dissolved	1990	10	X	
Surface water	2	Dissolved	1990	11	X	
Surface water	2	Dissolved	1991	1	X	
Surface water	2	Dissolved	1991	2	X	
Surface water	2	Dissolved	1991	3	X	
Surface water	2	Dissolved	1991	4	X	
Surface water	2	Dissolved	1991	5	X	
Surface water	2	Dissolved	1991	6	X	
Surface water	2	Dissolved	1991	7	X	
Surface water	2	Dissolved	1991	8	X	
Surface water	2	Dissolved	1991	9	X	
Surface water	2	Dissolved	1991	10	X	
Surface water	2	Dissolved	1991	11	X	
Surface water	2	Dissolved	1991	12	X	
Surface water	2	Dissolved	1992	1	X	
Surface water	2	Dissolved	1992	2	X	
Surface water	2	Dissolved	1992	3	X	
Surface water	2	Dissolved	1992	4	X	
Surface water	2	Dissolved	1992	5	X	
Surface water	2	Dissolved	1992	6	X	
Surface water	2	Dissolved	1992	7	X	
Surface water	2	Dissolved	1992	8	X	
Surface water	2	Dissolved	1992	9	X	
Surface water	2	Dissolved	1992	10	X	
Surface water	2	Dissolved	1992	11	X	
Surface water	2	Dissolved	1992	12	X	
Surface water	2	Dissolved	1993	1	X	
Surface water	2	Dissolved	1993	2	X	
Surface water	2	Dissolved	1993	3	X	
Surface water	2	Dissolved	1993	4	X	
Surface water	2	Dissolved	1993	5	X	
Surface water	2	Dissolved	1993	6	X	
Surface water	2	Dissolved	1993	7	X	
Surface water	2	Dissolved	1993	8	X	

Table 1-1. Sampling Events

Matrix	Sort	Fraction	Year	Month	HR/B	HR/WC
Surface water	2	Dissolved	1993	9	X	
Surface water	2	Dissolved	1993	10	X	
Surface water	2	Dissolved	1993	11	X	
Surface water	2	Dissolved	1993	12	X	
Surface water	2	Dissolved	1994	1	X	
Surface water	2	Dissolved	1994	2	X	
Surface water	2	Dissolved	1994	3	X	
Surface water	2	Dissolved	1994	4	X	
Surface water	2	Dissolved	1994	5	X	
Surface water	2	Dissolved	1994	6	X	
Surface water	2	Dissolved	1994	7	X	
Surface water	2	Dissolved	1994	8	X	
Surface water	2	Dissolved	1994	9	X	
Surface water	2	Dissolved	1994	10	X	
Surface water	2	Dissolved	1994	11	X	
Surface water	2	Dissolved	1994	12	X	
Surface water	2	Dissolved	1995	1	X	
Surface water	2	Dissolved	1995	2	X	
Surface water	2	Dissolved	1995	6	X	
Surface water	2	Dissolved	1995	7	X	
Surface water	2	Dissolved	1995	9	X	
Surface water	2	Dissolved	1995	11	X	
Surface water	2	Dissolved	1996	4	X	
Surface water	2	Dissolved	1996	5	X	
Surface water	2	Dissolved	1996	7	X	
Surface water	2	Dissolved	1996	10	X	
Surface water	2	Dissolved	1996	12	X	
Surface water	2	Dissolved	1997	2	X	
Surface water	2	Dissolved	1997	4	X	
Surface water	2	Dissolved	1997	5	X	
Surface water	2	Dissolved	1997	7	X	
Surface water	2	Dissolved	1997	9	X	
Surface water	2	Dissolved	1997	12	X	
Surface water	2	Dissolved	1998	2	X	
Surface water	2	Dissolved	1998	4	X	
Surface water	2	Dissolved	1998	5	X	
Surface water	2	Dissolved	1998	7	X	
Surface water	2	Dissolved	1998	9	X	
Surface water	2	Dissolved	1998	12	X	
Surface water	2	Dissolved	1999	4	X	
Surface water	2	Dissolved	1999	6	X	
Surface water	2	Dissolved	1999	7	X	
Surface water	2	Dissolved	1999	9	X	
Surface water	2	Dissolved	1999	12	X	
Surface water	2	Dissolved	2000	2	X	
Surface water	2	Dissolved	2000	4	X	
Surface water	2	Dissolved	2000	5	X	
Surface water	2	Dissolved	2000	7	X	
Surface water	2	Dissolved	2000	9	X	
Surface water	2	Dissolved	2001	4	X	
Surface water	2	Dissolved	2001	5	X	
Surface water	2	Dissolved	2001	6	X	
Surface water	2	Dissolved	2001	9	X	
Surface water	2	Dissolved	2002	4	X	
Surface water	2	Dissolved	2002	6	X	
Surface water	2	Dissolved	2002	7	X	
Surface water	2	Dissolved	2002	9	X	
Surface water	2	Dissolved	2003	4	X	
Surface water	2	Dissolved	2003	6	X	
Surface water	2	Dissolved	2003	7	X	

Table 1-1. Sampling Events

Matrix	Sort	Fraction	Year	Month	HR/B	HR/WC
Surface water	2	Dissolved	2003	9	X	
Surface water	2	Dissolved	2004	4	X	
Surface water	2	Dissolved	2004	6	X	
Surface water	2	Dissolved	2004	7	X	
Surface water	2	Dissolved	2004	8	X	
Surface water	2	Dissolved	2004	12	X	
Surface water	2	Dissolved	2005	4	X	
Surface water	2	Dissolved	2005	5	X	
Surface water	2	Dissolved	2005	6	X	
Surface water	2	Dissolved	2005	7	X	
Surface water	2	Dissolved	2005	8	X	
Surface water	2	Dissolved	2006	4	X	
Surface water	2	Dissolved	2006	5	X	
Surface water	2	Dissolved	2006	8	X	
Surface water	2	Dissolved	2007	4	X	
Surface water	2	Dissolved	2007	5	X	
Surface water	2	Dissolved	2007	7	X	
Surface water	2	Dissolved	2007	8	X	
Surface water	2	Dissolved	2008	4	X	
Surface water	2	Dissolved	2008	7	X	
Surface water	2	Dissolved	2008	9	X	
Surface water	2	Dissolved	2009	5	X	
Surface water	2	Dissolved	2009	6	X	
Surface water	2	Dissolved	2009	9	X	
Surface water	2	Dissolved	2010	4	X	
Surface water	2	Dissolved	2010	5	X	
Surface water	2	Dissolved	2010	6	X	
Surface water	2	Dissolved	2010	8	X	
Surface water	2	Dissolved	2011	4	X	
Surface water	2	Dissolved	2011	7	X	
Surface water	2	Dissolved	2011	9	X	
Surface water	2	Dissolved	2011	10	X	
Surface water	3	Centrifugate	2004	6	X	
Surface water	3	Centrifugate	2004	7	X	
Surface water	3	Centrifugate	2005	5	X	
Surface water	3	Centrifugate	2005	6	X	
Surface water	3	Centrifugate	2011	8	X	
Suspended sediment	1	Total	1995	6	X	
Suspended sediment	1	Total	1996	5	X	
Suspended sediment	1	Total	1997	5	X	
Suspended sediment	1	Total	1998	5	X	
Suspended sediment	1	Total	1999	6	X	
Suspended sediment	1	Total	2004	6	X	
Suspended sediment	1	Total	2004	7	X	
Suspended sediment	1	Total	2005	5	X	
Suspended sediment	1	Total	2005	6	X	
Suspended sediment	1	Total	2011	8	X	
Suspended sediment	1	Total	2011	9	X	

Table 1-2. Normalized Database Fields

Field Name	Data Type	Description
SampleID	Text	A unique ID by sample
LocationID	Text	A unique ID by location
Loaction Name	Text	Standardize Location Name
SampleType	Text	The type of sample (discrete, replicate, triplicate, average)
LocationName	Text	A description of the sample location
Date	Text	Date the sample was taken
Year	Text	Year the sample was taken
Omatrix	Text	The original reported matrix
Matrix	Text	The normalized matrix
Oparameter	Text	The original reported paramter
Parameter	Text	The normalized paramter
Fraction	Text	Total, dissolved, extractable, surrogate
ResType	Text	Reg for regular results
CAS	Text	The CAS number
Result	Text	The analysis value
Units	Text	The units for the given result
Qualifier	Text	Analytical qualifier
detect	Text	Whether or not the parameter was detected
DetectLimit	Text	The dection limit
RepResult	Text	The reported result from the original datafile
Basis	Text	
Notes	Text	Quality assurance/quality control or other pertinent information
FResult	Text	The analysis value after unit conversion
FUnits	Text	The final, converted units

Table 2-1. Target Parameters

Parameter	CAS
Alkalinity, Total (As Caco3)	ALK
Arsenic	7440-38-2
Benzo(a)Pyrene	50-32-8
C11-C60 Hydrocrabons	C11C60
Cadmium	7440-43-9
Calcium	7440-70-2
Carbon Dissolved Organic	CORD
Carbon Organic	CORG
Chloride (As Cl)	16887-00-6
Chromium, Total	7440-47-3
Cobalt	7440-48-4
Color	COLOR
Conductivity	COND
Copper	7440-50-8
Hardness (As Caco3)	HARD
Iron	7439-89-6
Lead	7439-92-1
M,P-Xylene (Sum Of Isomers)	XYLMP
Magnesium	7439-95-4
Manganese	7439-96-5
Mercury	7439-97-6
Naphthalene	91-20-3
Nickel	7440-02-0
Nitrogen, Kjeldahl, Total	KN
Nitrogen, Nitrate (As N)	14797-55-8
Nitrogen, Nitrate-Nitrite	NO3NO2N
Nitrogen, Nitrite	14797-65-0
O-Xylene (1,2-Dimethylbenzene)	95-47-6
pH	pH
Phosphorus, Total (As P)	14596-37-3
Potassium	9-7-7440
Pyrene	129-00-0
Sodium	7440-23-5
Strontium	7440-24-6
Sulfate (As SO4)	14808-79-8
Suspended Solids (Residue, Non-Filterable)	SS
Total Dissolved Solids (Residue, Filterable)	TDS
Turbidity	TURB
Uranium	7440-61-1
Vanadium	7440-62-2
Zinc	7440-66-6

Table 2-2. Paired Surface Water Samples

		Paired Sample Dates	
Year	**Season**	**HR/B**	**HR/WC**
1988	Spring		4/21/1988
1988	Fall	10/27/1988	10/21/1988
1989	Spring	5/10/1989	5/16/1989
1989	Fall	10/16/1989	10/25/1989
1990	Spring	5/22/1990	5/23/2990
1990	Fall	10/29/1990	10/30/1990
1991	Spring	6/10/1991	6/5/1991
1991	Fall	10/22/1991	10/22/1991
1992	Spring	5/20/1992	5/27/1992
1992	Fall	10/13/1992	10/7/1992
1993	Spring	6/14/1993	6/15/1993
1993	Fall	10/18/1993	10/21/1993
1994	Spring	5/17/1994	5/21/1994
1994	Fall	10/12/1994	10/25/1994
1995	Spring	6/13/1995	6/13/1995
1995	Fall	11/16/1995	10/26/1995
1996	Spring	5/14/1996	6/12/1996
1996	Fall	10/2/1996	10/31/1996
1997	Spring	5/27/1997	5/15/1997
1997	Fall	9/9/1997	10/15/1997
1998	Spring	5/7/1998	5/19/1998
1998	Fall	9/21/1998	10/22/1998
1999	Spring	6/3/1999	6/14/1999
1999	Fall	9/27/1999	10/6/1999
2000	Spring	5/30/2000	5/29/2000
2000	Fall	9/18/2000	10/17/2000
2001	Spring	5/14/2001	5/15/2001
2001	Fall	9/25/2001	10/30/2001
2002	Spring	6/4/2002	5/28/2002
2002	Fall	9/2/2002	10/17/2002
2003	Spring	6/3/2003	5/20/2003
2003	Fall	9/18/2003	10/22/2003
2004	Spring	6/1/2004	6/2/2004
2004	Fall	8/25/2004	10/21/2004
2005	Spring	5/16/2005	5/17/2005
2005	Fall	8/29/2005	10/18/2005
2006	Spring	5/31/2006	5/25/2006
2006	Fall	8/28/2006	10/18/2006
2007	Spring	5/3/2007	6/4/2007
2007	Fall	8/30/2007	10/17/2007
2008	Spring	4/14/2008	5/26/2008
2008	Fall	9/10/2008	10/27/2008
2009	Spring	5/14/2009	5/21/2009
2009	Fall	9/2/2009	10/21/2009
2010	Spring	5/10/2010	5/31/2010
2010	Fall	8/18/2010	10/24/2010

HR/B: Hay River at the Alberta/NWT border
HR/WC: Hay River at the West Channel Bridge

Table 3-1. Dates of Flow Season Transitions

	Julian Day			Date		
Year	Start of Freshet	Start of Recession	Start of Base Flow	Start of Freshet	Start of Recession	Start of Base Flow
1963	110	130	320	4/20/1963	5/10/1963	11/16/1963
1964	118	139	332	4/27/1964	5/18/1964	11/27/1964
1965	108	127	320	4/18/1965	5/7/1965	11/16/1965
1966	104	138	317	4/14/1966	5/18/1966	11/13/1966
1967	122	147	316	5/2/1967	5/27/1967	11/12/1967
1968	102	134	320	4/11/1968	5/13/1968	11/15/1968
1969	107	132	333	4/17/1969	5/12/1969	11/29/1969
1970	114	135	332	4/24/1970	5/15/1970	11/28/1970
1971	109	124	316	4/19/1971	5/4/1971	11/12/1971
1972	119	142	284	4/28/1972	5/21/1972	10/10/1972
1973	103	132	329	4/13/1973	5/12/1973	11/25/1973
1974	102	136	329	4/12/1974	5/16/1974	11/25/1974
1975	109	122	320	4/19/1975	5/2/1975	11/16/1975
1976	104	144	345	4/13/1976	5/23/1976	12/10/1976
1977	109	127	342	4/19/1977	5/7/1977	12/8/1977
1978	118	128	331	4/28/1978	5/8/1978	11/27/1978
1979	104	161	331	4/14/1979	6/10/1979	11/27/1979
1980	106	121	341	4/15/1980	4/30/1980	12/6/1980
1981	119	131	251	4/29/1981	5/11/1981	9/8/1981
1982	119	145	314	4/29/1982	5/25/1982	11/10/1982
1983	107	124	312	4/17/1983	5/4/1983	11/8/1983
1984	105	125	333	4/14/1984	5/4/1984	11/28/1984
1985	109	134	323	4/19/1985	5/14/1985	11/19/1985
1986	115	142	327	4/25/1986	5/22/1986	11/23/1986
1987	110	131	331	4/20/1987	5/11/1987	11/27/1987
1988	110	125	325	4/19/1988	5/4/1988	11/20/1988
1989	112	134	326	4/22/1989	5/14/1989	11/22/1989
1990	110	137	286	4/20/1990	5/17/1990	10/13/1990
1991	104	133	315	4/14/1991	5/13/1991	11/11/1991
1992	102	134	320	4/11/1992	5/13/1992	11/15/1992
1993	94	130	317	4/4/1993	5/10/1993	11/13/1993
1994	106	134	275	4/16/1994	5/14/1994	10/2/1994
1995	114	129	282	4/24/1995	5/9/1995	10/9/1995
1996	121	133	325	4/30/1996	5/12/1996	11/20/1996
1997	112	143	322	4/22/1997	5/23/1997	11/18/1997
1998	101	124	325	4/11/1998	5/4/1998	11/21/1998
1999	102	136	350	4/12/1999	5/16/1999	12/16/1999
2000	113	158	345	4/22/2000	6/6/2000	12/10/2000
2001	106	137	340	4/16/2001	5/17/2001	12/6/2001
2002	117	148	329	4/27/2002	5/28/2002	11/25/2002
2003	108	130	325	4/18/2003	5/10/2003	11/21/2003
2004	103	134	320	4/12/2004	5/13/2004	11/15/2004
2005	101	125	341	4/11/2005	5/5/2005	12/7/2005
2006	105	129	310	4/15/2006	5/9/2006	11/6/2006
2007	110	138	350	4/20/2007	5/18/2007	12/16/2007
2008	113	138	352	4/22/2008	5/17/2008	12/17/2008
2009	114	139	351	4/24/2009	5/19/2009	12/17/2009
2010	107	131	343	4/17/2010	5/11/2010	12/9/2010
Post 1963 Summary						
Average	109	134	323	4/18	5/13	11/18
Earliest	94	121	251	4/3	4/30	9/7
Latest	122	161	352	5/1	6/9	12/17

Table 3-2. Hay River Flow Statistics

Flow Conditions	Over 7 Days (7Q10 m^3/s)	Over 1 Day (1Q10 m^3/s)
High Flow Conditions	1165	1230
Low Flow Conditions	0.77	0.72

Table 3-3. Summary Statistics-Surface Water

Parameter	Fraction	Location	n	Mean	St Dev	Median	Min	Max	Min Detect	Max Detect	Min Non-Detect	Max Non-Detect	Units	FOD	EcoSV[a]	Eco Source	Eco FOE[b]	DwSV[c]	DW Source	DW FOE[d]	Date Range
Target																					
Alkalinity, Total (as Caco3)	Total	HR/B	146	134904	66220	115500	14700	305000	14700	305000			µg/L	100%	NSV		NA	NSV		NA	1988-2010
Alkalinity, Total (as Caco3)	Total	HR/WC	57	96251	36556	84700	45000	207000	45000	207000			µg/L	100%	NSV		NA	NSV		NA	1982-2010
Arsenic	Dissolved	HR/B	128	0.53	0.26	0.5	0.1	1.6	0.1	1.6			µg/L	100%	5	1	0%	10	5	0%	1988-2010
Arsenic	Total	HR/B	34	1.6	0.92	1.4	0.19	5.8	0.19	5.8			µg/L	100%	5	1	3%	10	5	0%	2003-2010
Arsenic	Total	HR/WC	32	1.7	2	1	0.1	9.6	0.1	9.6	0.2	2.5	µg/L	69%	5	1	6%	10	5	0%	1982-1998
Benzo(a)pyrene	Dissolved	HR/B	1	0.01	NA	0.01	0.01	0.01			0.01	0.01	µg/L	0%	0.015	1	0%	0.01	5	0%	2005-2005
Benzo(a)pyrene	Total	HR/B	32	0.06	0.067	0.069	0.006	0.38	0.38	0.38	0.006	0.17	µg/L	3%	0.015	1	78%	0.01	5	78%	1994-2010
C11-C60 Hydrocarbons	Dissolved	HR/B	3	50	0	50	50	50			50	50	µg/L	0%	NSV		NA	NSV		NA	2005-2005
C11-C60 Hydrocarbons	Total	HR/B	9	50	0	50	50	50			50	50	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Cadmium	Dissolved	HR/B	16	0.046	0.044	0.03	0.02	0.19	0.02	0.19			µg/L	100%	0.017	1	100%	5	5	0%	2003-2010
Cadmium	Total	HR/B	146	0.26	0.32	0.2	0.016	2.6	0.016	2.6	0.1	0.1	µg/L	86%	0.017	1	99%	5	5	0%	1988-2010
Cadmium	Total	HR/WC	56	0.29	0.66	0.2	0.05	5	0.05	0.4	0.1	5	µg/L	30%	0.017	1	100%	5	5	0%	1982-2010
Calcium	Dissolved	HR/B	203	52094	23536	44500	10000	135167	10000	135167			µg/L	100%	NSV		NA	NSV		NA	1988-2010
Calcium	Total	HR/WC	56	40629	11507	38850	23900	78700	23900	78700			µg/L	100%	NSV		NA	NSV		NA	1982-2010
Carbon Dissolved Organic	Dissolved	HR/B	143	26712	8817	26200	2858	72533	2858	72533			µg/L	100%	NSV		NA	NSV		NA	1988-2010
Carbon Organic	Total	HR/B	131	28948	9539	28730	3417	73157	3417	73157			µg/L	100%	NSV		NA	NSV		NA	1988-2007
Chloride (as Cl)	Dissolved	HR/B	146	5279	3485	4245	1360	24400	1360	24400			µg/L	100%	120000	2	0%	NSV		NA	1988-2010
Chloride (as Cl)	Total	HR/WC	57	4252	1956	3700	1600	9590	1600	9590			µg/L	100%	120000	2	0%	NSV		NA	1982-2010
Chromium, Total	Dissolved	HR/B	16	0.16	0.051	0.15	0.09	0.28	0.09	0.28			µg/L	100%	1	1	0%	NSV		NA	2003-2010
Chromium, Total	Total	HR/B	93	1.1	1.6	0.5	0.02	12	0.12	12	0.02	0.2	µg/L	96%	1	1	29%	NSV		NA	1993-2010
Chromium, Total	Total	HR/WC	54	3.6	5.4	2	0.2	35	0.3	35	0.2	3.7	µg/L	72%	1	1	67%	NSV		NA	1983-2010
Cobalt	Dissolved	HR/B	16	0.42	0.51	0.24	0.12	2.2	0.12	2.2			µg/L	100%	NSV		NA	NSV		NA	2003-2010
Cobalt	Total	HR/B	146	1	0.99	0.7	0.067	8.9	0.067	8.9	0.5	0.5	µg/L	95%	NSV		NA	NSV		NA	1988-2010
Cobalt	Total	HR/WC	36	1.3	1.6	0.95	0.1	7.3	0.1	7.3	1	1	µg/L	86%	NSV		NA	NSV		NA	1993-2010
Color	Total	HR/B	28	117	48	120	5	240	5	240			CU	100%	NSV		NA	NSV		NA	2001-2007
Color	Total	HR/WC	57	163	124	120	40	786	40	786	100	100	CU	96%	NSV		NA	NSV		NA	1982-2010
Conductivity	Total	HR/B	152	400	159	355	100	820	123	820	100	100	uS/cm	99%	NSV		NA	NSV		NA	1988-2010
Conductivity	Total	HR/WC	57	329	86	324	188	541	188	541			uS/cm	100%	NSV		NA	NSV		NA	1982-2010
Copper	Dissolved	HR/B	16	2.2	0.64	2.1	1.3	3.9	1.3	3.9			µg/L	100%	3	1	6%	NSV		NA	2003-2010
Copper	Total	HR/B	146	3.1	2.4	2.5	0.55	24	0.55	24			µg/L	100%	3	1	33%	NSV		NA	1988-2010
Copper	Total	HR/WC	55	4.6	4.2	3.3	0.5	19	1	19	0.5	2	µg/L	91%	3	1	53%	NSV		NA	1982-2010
Hardness (as Caco3)	Total	HR/B	134	195992	83707	166038	51554	421400	51554	421400			µg/L	100%	NSV		NA	NSV		NA	1988-2010
Hardness (as Caco3)	Total	HR/WC	51	148359	41441	142000	88100	266000	88100	266000			µg/L	100%	NSV		NA	NSV		NA	1982-2010
Iron	Dissolved	HR/B	16	772	676	587	237	3037	237	3037			µg/L	100%	300	1	94%	NSV		NA	2003-2010
Iron	Total	HR/B	93	2508	2587	2010	257	21500	257	21500			µg/L	100%	300	1	98%	NSV		NA	1993-2010
Iron	Total	HR/WC	57	3305	4041	1830	110	24000	110	24000			µg/L	100%	300	1	98%	NSV		NA	1982-2010
Lead	Dissolved	HR/B	16	0.19	0.12	0.18	0.026	0.54	0.026	0.54			µg/L	100%	4	1	0%	10	5	0%	2003-2010
Lead	Total	HR/B	146	1.1	1.3	0.7	0.1	11	0.1	11	0.2	0.7	µg/L	80%	4	1	5%	10	5	1%	1988-2010
Lead	Total	HR/WC	56	3.4	8.6	1.1	0.03	62	0.1	62	0.03	20	µg/L	75%	4	1	16%	10	5	5%	1982-2010
M,P-Xylene (sum of isomers)	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Magnesium	Dissolved	HR/B	146	15316	6727	13133	3000	32600	3000	32600			µg/L	100%	NSV		NA	NSV		NA	1988-2010
Magnesium	Total	HR/B	55	14613	6323	12400	6760	31600	6760	31600			µg/L	100%	NSV		NA	NSV		NA	1993-2001
Magnesium	Total	HR/WC	56	11479	3776	11150	4700	20000	4700	20000			µg/L	100%	NSV		NA	NSV		NA	1982-2010
Manganese	Dissolved	HR/B	16	107	189	22	3.2	682	3.2	682			µg/L	100%	NSV		NA	NSV		NA	2003-2010
Manganese	Total	HR/B	93	151	189	91	6.5	1340	6.5	1340			µg/L	100%	NSV		NA	NSV		NA	1993-2010
Mercury	Total	HR/WC	16	0.068	0.1	0.03	0.01	0.42	0.02	0.42	0.01	0.04	µg/L	63%	0.026	1	63%	1	5	0%	1982-1990
Naphthalene	Dissolved	HR/B	1	0.01	NA	0.01	0.01	0.01			0.01	0.01	µg/L	0%	1.1	1	0%	NSV		NA	2005-2005
Naphthalene	Total	HR/B	27	0.019	0.008	0.02	0.0058	0.05	0.0058	0.024	0.0058	0.05	µg/L	19%	1.1	1	0%	NSV		NA	1997-2010
Nickel	Dissolved	HR/B	16	3.5	1.4	3.2	2.3	7.8	2.3	7.8			µg/L	100%	110	1	0%	NSV		NA	2003-2010
Nickel	Total	HR/B	146	4.7	3	3.9	0.74	27	0.74	27			µg/L	100%	110	1	0%	NSV		NA	1988-2010
Nickel	Total	HR/WC	56	6.8	7.3	4	1	50	1.8	24	1	50	µg/L	91%	110	1	0%	NSV		NA	1982-2010
Nitrogen, Kjeldahl, Total	Total	HR/WC	9	976	587	940	93	2200	93	2200			µg/L	100%	NSV		NA	NSV		NA	1982-1998
Nitrogen, Nitrate (as N)	Total	HR/B	14	194	188	128	10	580	10	580			µg/L	100%	NSV		NA	NSV		NA	2007-2010
Nitrogen, Nitrate-Nitrite	Dissolved	HR/B	109	226	403	101	8	2460	8	2460	8	2000	µg/L	89%	NSV		NA	NSV		NA	1988-2004
Nitrogen, Nitrate-Nitrite	Total	HR/B	20	295	471	54	10	1730	10	1730	10	20	µg/L	85%	NSV		NA	NSV		NA	2005-2010
Nitrogen, Nitrate-Nitrite	Total	HR/WC	56	77	132	40	8	900	10	900	8	200	µg/L	57%	NSV		NA	NSV		NA	1982-2010
Nitrogen, Nitrite	Total	HR/B	14	105	311	10	10	1180	30	1180	10	10	µg/L	29%	NSV		NA	NSV		NA	2007-2010
O-Xylene (1,2-Dimethylbenzene)	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Ph	Total	HR/B	150	7.6	0.37	7.7	5.9	9	5.9	9				100%	NSV		NA	NSV		NA	1988-2010
Ph	Total	HR/WC	57	7.9	0.25	7.9	7.2	8.8	7.2	8.8				100%	NSV		NA	NSV		NA	1982-2010

Table 3-3. Summary Statistics-Surface Water

Parameter	Fraction	Location	n	Mean	St Dev	Median	Min	Max	Min Detect	Max Detect	Min Non-Detect	Max Non-Detect	Units	FOD	EcoSV[a]	Eco Source	Eco FOE[b]	DwSV[c]	DW Source	DW FOE[d]	Date Range
Phosphorus, Total (as P)	Total	HR/B	148	111	107	79	10	728	10	728	10	10	µg/L	99%	0.05	3	100%	NSV		NA	1988-2010
Phosphorus, Total (as P)	Total	HR/WC	56	135	133	80	19	620	19	620	50	50	µg/L	89%	0.05	3	100%	NSV		NA	1982-2010
Potassium	Dissolved	HR/B	146	2111	627	2025	330	4790	330	4790			µg/L	100%	NSV		NA	NSV		NA	1988-2010
Potassium	Total	HR/WC	50	2215	1022	2050	700	7500	700	7500			µg/L	100%	NSV		NA	NSV		NA	1983-2010
Pyrene	Dissolved	HR/B	1	0.01	NA	0.01	0.01	0.01			0.01	0.01	µg/L	0%	0.025	1	0%	NSV		NA	2005-2005
Pyrene	Total	HR/B	34	0.011	0.009	0.0078	0.0039	0.058	0.0051	0.0078	0.0039	0.058	µg/L	9%	0.025	1	3%	NSV		NA	1994-2010
Sodium	Dissolved	HR/B	146	16421	6802	14450	3960	35100	3960	35100			µg/L	100%	NSV		NA	NSV		NA	1988-2010
Sodium	Total	HR/B	55	16395	9884	14000	4580	49000	4580	49000			µg/L	100%	NSV		NA	NSV		NA	1993-2001
Sodium	Total	HR/WC	50	12859	3504	12350	5870	21200	5870	21200			µg/L	100%	NSV		NA	NSV		NA	1983-2010
Strontium	Dissolved	HR/B	16	153	70	138	65	323	65	323			µg/L	100%	NSV		NA	NSV		NA	2003-2010
Strontium	Total	HR/B	93	154	62	137	50	346	50	346			µg/L	100%	NSV		NA	NSV		NA	1993-2010
Sulfate (As So4)	Dissolved	HR/B	146	78535	28562	72200	11800	151000	11800	151000			µg/L	100%	NSV		NA	NSV		NA	1988-2010
Sulfate (As So4)	Total	HR/WC	57	62586	26479	59500	1000	124000	7700	124000	1000	1000	µg/L	98%	NSV		NA	NSV		NA	1982-2010
Suspended Solids (Residue, Non-Filterable)	Total	HR/B	149	49386	93289	11000	1000	766500	1000	766500	3000	3000	µg/L	93%	NSV		NA	NSV		NA	1988-2010
Suspended Solids (Residue, Non-Filterable)	Total	HR/WC	54	82370	101453	34000	3000	406000	3000	406000	3000	5000	µg/L	91%	NSV		NA	NSV		NA	1982-2010
Total Dissolved Solids (Residue, Filterable)	Total	HR/B	223	285094	196472	247000	42000	2700000	42000	2700000			µg/L	100%	NSV		NA	NSV		NA	1988-2010
Total Dissolved Solids (Residue, Filterable)	Total	HR/WC	56	266089	63132	264000	168000	478000	168000	478000			µg/L	100%	NSV		NA	NSV		NA	1982-2010
Turbidity	Total	HR/B	149	43	72	17	0.2	595	0.2	595			NTU	100%	NSV		NA	NSV		NA	1988-2010
Turbidity	Total	HR/WC	57	64	89	30	3.4	488	3.4	488			NTU	100%	NSV		NA	NSV		NA	1982-2010
Uranium	Dissolved	HR/B	16	0.73	0.52	0.5	0.25	2	0.25	2			µg/L	100%	NSV		NA	20	5	0%	2003-2010
Uranium	Total	HR/B	34	0.75	0.41	0.59	0.24	2.1	0.24	2.1			µg/L	100%	NSV		NA	20	5	0%	2003-2010
Vanadium	Dissolved	HR/B	16	0.42	0.14	0.45	0.15	0.69	0.15	0.69			µg/L	100%	NSV		NA	NSV		NA	2003-2010
Vanadium	Total	HR/B	146	1.8	2.6	0.95	0.1	23	0.11	23	0.1	0.5	µg/L	86%	NSV		NA	NSV		NA	1988-2010
Zinc	Dissolved	HR/B	16	3.6	4.3	1.5	0.6	14	0.6	14			µg/L	100%	30	1	0%	NSV		NA	2003-2010
Zinc	Total	HR/B	146	8.9	10	5.6	0.5	91	0.5	91			µg/L	100%	30	1	6%	NSV		NA	1988-2010
Zinc	Total	HR/WC	56	18	19	10	1	101	1	101	1	15	µg/L	71%	30	1	14%	NSV		NA	1982-2010
Non-Target																					
1,1,1-Trichloroethane	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
1,1,2,2-Tetrachloroethane	Total	HR/B	4	20	0	20	20	20			20	20	µg/L	0%	NSV		NA	NSV		NA	2004-2005
1,1,2-Trichloroethane	Total	HR/B	4	2	0	2	2	2			2	2	µg/L	0%	NSV		NA	NSV		NA	2004-2005
1,1-Dichloroethane	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
1,1-Dichloroethene	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
1,2,3,4-Tetrachlorobenzene	Total	HR/B	1	0.00069	NA	0.00069	0.00069	0.00069			0.00069	0.00069	µg/L	0%	NSV		NA	NSV		NA	1997-1997
1,2,3,4-Tetrahydronaphthalene	Total	HR/B	32	0.016	0.013	0.017	0.0057	0.081	0.017	0.017	0.0057	0.081	µg/L	3%	NSV		NA	NSV		NA	1994-2010
1,2,3-Trichlorobenzene	Total	HR/B	1	0.0019	NA	0.0019	0.0019	0.0019			0.0019	0.0019	µg/L	0%	NSV		NA	NSV		NA	1997-1997
1,2,3-Trichloropropane	Total	HR/B	4	5	0	5	5	5			5	5	µg/L	0%	NSV		NA	NSV		NA	2004-2005
1,2,4-Trichlorobenzene	Total	HR/B	1	0.00094	NA	0.00094	0.00094	0.00094			0.00094	0.00094	µg/L	0%	NSV		NA	NSV		NA	1997-1997
1,2-Dibromoethane (Ethylene dibromide)	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
1,2-Dichlorobenzene	Total	HR/B	5	0.8	0.45	1	0.004	1			0.004	1	µg/L	0%	150	1	0%	NSV		NA	1997-2005
1,2-Dichloroethane	Total	HR/B	4	2	0	2	2	2			2	2	µg/L	0%	100	1	0%	5	5	0%	2004-2005
1,2-Dichloropropane	Total	HR/B	4	2	0	2	2	2			2	2	µg/L	0%	NSV		NA	NSV		NA	2004-2005
1,3,5-Trichlorobenzene	Total	HR/B	1	0.0012	NA	0.0012	0.0012	0.0012			0.0012	0.0012	µg/L	0%	NSV		NA	NSV		NA	1997-1997
1,3-Dichlorobenzene	Total	HR/B	5	1.9	1.9	1	1	5.3	5.3	5.3	1	1	µg/L	20%	NSV		NA	NSV		NA	1997-2005
1,4-Dichlorobenzene	Total	HR/B	5	1.8	1.7	1	1	4.9			1	4.9	µg/L	0%	NSV		NA	NSV		NA	1997-2005
1-Bromo-4-Fluorobenzene (4-Bromofluorobenzene)	Total	HR/B	4	94	5.6	94	88	101	88	101			%	100%	NSV		NA	NSV		NA	2004-2005
1-Methylnaphthalene	Total	HR/B	32	0.022	0.022	0.022	0.0067	0.12	0.012	0.12	0.0067	0.081	µg/L	6%	NSV		NA	NSV		NA	1994-2010
2,3,4,5,6-Pentachloroanisole	Total	HR/B	11	0.00022	0.000062	0.00017	0.00017	0.00031	0.00031	0.00031	0.00017	0.00028	µg/L	9%	NSV		NA	NSV		NA	2005-2010
2,4 DB	Total	HR/B	3	0.005	0	0.005	0.005	0.005			0.005	0.005	µg/L	0%	NSV		NA	NSV		NA	1997-1998
2,4-D (Dichlorophenoxyacetic Acid)	Total	HR/B	2	0.005	0	0.005	0.005	0.005			0.005	0.005	µg/L	0%	NSV		NA	NSV		NA	1998-1998
2-Chloroethyl vinyl ether	Total	HR/B	4	10	0	10	10	10			10	10	µg/L	0%	NSV		NA	NSV		NA	2004-2005
2-Chloronaphthalene	Total	HR/B	32	0.023	0.022	0.022	0.0067	0.12	0.12	0.12	0.0067	0.077	µg/L	3%	NSV		NA	NSV		NA	1994-2010
2-Fluorobiphenyl	Dissolved	HR/B	1	84	NA	84	84	84	84	84			%	100%	NSV		NA	NSV		NA	2005-2005
2-Fluorobiphenyl	Total	HR/B	2	103	3.5	103	100	105	100	105			%	100%	NSV		NA	NSV		NA	2004-2004
2-Hexanone	Total	HR/B	4	10	0	10	10	10			10	10	µg/L	0%	NSV		NA	NSV		NA	2004-2005
2-Methylnaphthalene	Total	HR/B	32	0.026	0.025	0.026	0.0076	0.15	0.015	0.15	0.0076	0.073	µg/L	6%	NSV		NA	NSV		NA	1994-2010
3-(3,4-Dichlorophenyl)-1,1-Dimethylurea	Total	HR/B	3	0.2	0	0.2	0.2	0.2			0.2	0.2	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Acenaphthene	Dissolved	HR/B	1	0.01	NA	0.01	0.01	0.01			0.01	0.01	µg/L	0%	5.8	1	0%	NSV		NA	2005-2005
Acenaphthene	Total	HR/B	34	0.024	0.026	0.024	0.0052	0.13	0.13	0.13	0.0052	0.12	µg/L	3%	5.8	1	0%	NSV		NA	1994-2010
Acenaphthylene	Dissolved	HR/B	1	0.01	NA	0.01	0.01	0.01			0.01	0.01	µg/L	0%	NSV		NA	NSV		NA	2005-2005
Acenaphthylene	Total	HR/B	34	0.018	0.018	0.016	0.0065	0.089	0.089	0.089	0.0065	0.083	µg/L	3%	NSV		NA	NSV		NA	1994-2010

Table 3-3. Summary Statistics-Surface Water

Parameter	Fraction	Location	n	Mean	St Dev	Median	Min	Max	Min Detect	Max Detect	Min Non-Detect	Max Non-Detect	Units	FOD	EcoSV[a]	Eco Source	Eco FOE[b]	DwSV[c]	DW Source	DW FOE[d]	Date Range
Acetone	Total	HR/B	4	100	0	100	100	100			100	100	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Acrolein	Total	HR/B	4	100	0	100	100	100			100	100	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Acrylonitrile	Total	HR/B	4	100	0	100	100	100			100	100	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Aldrin	Total	HR/B	28	0.00044	0.00021	0.00051	0.00017	0.00091	0.00061	0.00061	0.00017	0.00091	µg/L	4%	NSV		NA	NSV		NA	1994-2010
Alkalinity, Phenolphthalein	Total	HR/B	80	0	0	0	0	0	0	0	0	0	µg/L	14%	NA		0%	NA		0%	1988-1995
Alpha Endosulfan	Total	HR/B	30	0.0007	0.0012	0.00038	0.00022	0.005	0.00022	0.00022	0.00022	0.005	µg/L	3%	NSV		NA	NSV		NA	1994-2010
Alpha-Benzenehexachloride	Total	HR/B	30	0.0006	0.0012	0.00022	0.0002	0.005	0.0002	0.00024	0.0002	0.005	µg/L	7%	NSV		NA	NSV		NA	1994-2010
Alpha-Chlordane	Total	HR/B	28	0.00042	0.00019	0.00037	0.00031	0.0012	0.00031	0.00031	0.00031	0.0012	µg/L	4%	NSV		NA	NSV		NA	1994-2010
Aluminum	Dissolved	HR/B	16	29	18	24	11	81	11	81			µg/L	100%	100	1	0%	NSV		NA	2003-2010
Aluminum	Total	HR/B	90	1348	7426	210	11	70400	11	70400			µg/L	100%	100	1	78%	NSV		NA	1993-2010
Ammonia un-ionized (Calcd.)	Total	HR/B	92	0.065	0.29	0	0	2	0	2	0	0	µg/L	18%	NSV		NA	NSV		NA	1988-2007
Anthracene	Dissolved	HR/B	1	0.01	NA	0.01	0.01	0.01			0.01	0.01	µg/L	0%	NSV		NA	NSV		NA	2005-2005
Anthracene	Total	HR/B	27	0.018	0.0083	0.02	0.0061	0.05	0.02	0.02	0.0061	0.05	µg/L	4%	NSV		NA	NSV		NA	1997-2010
Antimony	Dissolved	HR/B	16	0.15	0.049	0.15	0.084	0.28	0.084	0.28			µg/L	100%	NSV		NA	NSV		NA	2003-2010
Antimony	Total	HR/B	38	0.11	0.039	0.11	0.03	0.26	0.03	0.26			µg/L	100%	NSV		NA	NSV		NA	2002-2010
Atrazine	Total	HR/B	3	0.005	0	0.005	0.005	0.005			0.005	0.005	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Azinphos, Methyl (Guthion)	Total	HR/B	8	0.086	0.095	0.025	0.0087	0.2	0.036	0.036	0.0087	0.2	µg/L	13%	NSV		NA	NSV		NA	1997-2010
Barium	Dissolved	HR/B	16	44	17	41	27	94	27	94			µg/L	100%	NSV		NA	NSV		NA	2003-2010
Barium	Total	HR/B	146	73	32	68	19	301	19	301	80	80	µg/L	77%	NSV		NA	NSV		NA	1988-2010
Benzene	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Benzo(a)anthracene	Dissolved	HR/B	1	0.01	NA	0.01	0.01	0.01			0.01	0.01	µg/L	0%	0.018	1	0%	NSV		NA	2005-2005
Benzo(a)anthracene	Total	HR/B	27	0.019	0.0075	0.02	0.01	0.05	0.02	0.02	0.01	0.05	µg/L	4%	0.018	1	78%	NSV		NA	1997-2010
Benzo(b)fluoranthene	Dissolved	HR/B	1	0.01	NA	0.01	0.01	0.01			0.01	0.01	µg/L	0%	NSV		NA	NSV		NA	2005-2005
Benzo(b)fluoranthene	Total	HR/B	32	0.07	0.081	0.084	0.0064	0.46	0.46	0.46	0.0064	0.17	µg/L	3%	NSV		NA	NSV		NA	1994-2010
Benzo(g,h,i)perylene	Dissolved	HR/B	1	0.01	NA	0.01	0.01	0.01			0.01	0.01	µg/L	0%	NSV		NA	NSV		NA	2005-2005
Benzo(g,h,i)perylene	Total	HR/B	32	0.081	0.068	0.11	0.01	0.36	0.11	0.11	0.01	0.36	µg/L	3%	NSV		NA	NSV		NA	1994-2010
Benzo(k)fluoranthene	Dissolved	HR/B	1	0.01	NA	0.01	0.01	0.01			0.01	0.01	µg/L	0%	NSV		NA	NSV		NA	2005-2005
Benzo(k)fluoranthene	Total	HR/B	32	0.071	0.084	0.081	0.0055	0.45	0.45	0.45	0.0055	0.26	µg/L	3%	NSV		NA	NSV		NA	1994-2010
Benzo[e]pyrene	Total	HR/B	23	0.056	0.026	0.07	0.0056	0.07	0.07	0.07	0.0056	0.07	µg/L	4%	NSV		NA	NSV		NA	1997-2010
Beryllium	Dissolved	HR/B	16	0.013	0.0031	0.013	0.009	0.02	0.009	0.02			µg/L	100%	NSV		NA	NSV		NA	2003-2010
Beryllium	Total	HR/B	93	0.066	0.067	0.05	0.003	0.55	0.003	0.55	0.05	0.05	µg/L	62%	NSV		NA	NSV		NA	1993-2010
Beta Bhc (Beta Hexachlorocyclohexane)	Total	HR/B	11	0.0013	0.00032	0.001	0.001	0.0016			0.001	0.0016	µg/L	0%	NSV		NA	NSV		NA	2005-2010
Beta Endosulfan	Total	HR/B	28	0.00074	0.00047	0.00074	0.00036	0.0029	0.00088	0.00088	0.00036	0.0029	µg/L	4%	NSV		NA	NSV		NA	1994-2010
Bicarbonate (Calcd.)	Total	HR/B	85	181212	82020	167000	66100	371800	66100	371800			µg/L	100%	NSV		NA	NSV		NA	1988-1998
Bismuth	Dissolved	HR/B	16	0.0029	0.0016	0.003	0.001	0.0063	0.001	0.0063	0.001	0.001	µg/L	94%	NSV		NA	NSV		NA	2003-2010
Bismuth	Total	HR/B	30	0.012	0.011	0.01	0.001	0.06	0.001	0.06	0.001	0.001	µg/L	97%	NSV		NA	NSV		NA	2003-2009
Boron	Dissolved	HR/B	16	34	11	30	22	60	22	60			µg/L	100%	1500	2	0%	5000	5	0%	2003-2010
Boron	Total	HR/B	38	32	10	31	9.1	62	9.1	62			µg/L	100%	1500	2	0%	5000	5	0%	2002-2010
Bromacil	Total	HR/B	3	0.03	0	0.03	0.03	0.03			0.03	0.03	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Bromodichloromethane	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Bromoform	Total	HR/B	4	3	0	3	3	3			3	3	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Bromomethane	Total	HR/B	4	10	0	10	10	10			10	10	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Bromoxynil	Total	HR/B	3	0.005	0	0.005	0.005	0.005			0.005	0.005	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Carbon Disulfide	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Carbon Inorganic	Total	HR/B	1	120	NA	120	120	120	120	120			µg/L	100%	NSV		NA	NSV		NA	1995-1995
Carbon Particulate Organic	Total	HR/B	146	2058	3666	1080	45	37067	45	37067			µg/L	100%	NSV		NA	NSV		NA	1988-2010
Carbon Tetrachloride	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Carbonate (Calcd.)	Total	HR/B	85	0	0	0	0	0	0	0	0	0	µg/L	14%	NSV		NA	NSV		NA	1988-1998
Cerium	Dissolved	HR/B	16	0.29	0.13	0.29	0.12	0.56	0.12	0.56			µg/L	100%	NSV		NA	NSV		NA	2003-2010
Cerium	Total	HR/B	34	2.4	3.9	1.2	0.054	22	0.054	22			µg/L	100%	NSV		NA	NSV		NA	2002-2010
Cesium	Dissolved	HR/B	16	0.0054	0.0029	0.005	0.002	0.015	0.002	0.015	0.005	0.005	µg/L	69%	NSV		NA	NSV		NA	2003-2010
Cesium	Total	HR/B	38	0.13	0.17	0.082	0.005	0.94	0.007	0.94	0.005	0.005	µg/L	97%	NSV		NA	NSV		NA	2002-2010
Chlorobenzene	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Chloroethane	Total	HR/B	4	10	0	10	10	10			10	10	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Chloroform	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Chloromethane	Total	HR/B	4	10	0	10	10	10			10	10	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Chlorpyrifos	Total	HR/B	3	0.005	0	0.005	0.005	0.005			0.005	0.005	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Chrysene	Dissolved	HR/B	1	0.01	NA	0.01	0.01	0.01			0.01	0.01	µg/L	0%	NSV		NA	NSV		NA	2005-2005
Chrysene	Total	HR/B	27	0.018	0.0088	0.02	0.003	0.05	0.0071	0.02	0.003	0.05	µg/L	7%	NSV		NA	NSV		NA	1997-2010
Cis-1,2-Dichloroethylene	Total	HR/B	2	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2005-2005
Cis-1,3-Dichloropropene	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005

Table 3-3. Summary Statistics-Surface Water

Parameter	Fraction	Location	n	Mean	St Dev	Median	Min	Max	Min Detect	Max Detect	Min Non-Detect	Max Non-Detect	Units	FOD	EcoSV[a]	Eco Source	Eco FOE[b]	DwSV[c]	DW Source	DW FOE[d]	Date Range
Cis-1,4-Dichloro-2-butene	Total	HR/B	4	10	0	10	10	10			10	10	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Cis-Nonachlor	Total	HR/B	11	0.00087	0.00021	0.00068	0.00068	0.0011			0.00068	0.0011	µg/L	0%	NSV		NA	NSV		NA	2005-2010
Clopyralid	Total	HR/B	3	0.02	0	0.02	0.02	0.02			0.02	0.02	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Coliform	Total	HR/B	78	684	1752	75	1	13000	1	13000	1	10	NO/100 ML	83%	NSV		NA	NSV		NA	1993-2010
Colour True	Total	HR/B	119	113	36	110	5	275	40	275	5	5	REL UNITS	99%	NSV		NA	NSV		NA	1988-2010
Cyanazine	Total	HR/B	3	0.05	0	0.05	0.05	0.05			0.05	0.05	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Desethyl Atrazine	Total	HR/B	2	0.05	0	0.05	0.05	0.05			0.05	0.05	µg/L	0%	NSV		NA	NSV		NA	1998-1998
Desisopropyl Atrazine	Total	HR/B	2	0.05	0	0.05	0.05	0.05			0.05	0.05	µg/L	0%	NSV		NA	NSV		NA	1998-1998
Diazinon	Total	HR/B	3	0.005	0	0.005	0.005	0.005			0.005	0.005	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Dibenz(a,h)anthracene	Dissolved	HR/B	1	0.01	NA	0.01	0.01	0.01			0.01	0.01	µg/L	0%	NSV		NA	NSV		NA	2005-2005
Dibenz(a,h)anthracene	Total	HR/B	25	0.076	0.037	0.1	0.01	0.1	0.055	0.055	0.01	0.1	µg/L	4%	NSV		NA	NSV		NA	1997-2010
Dibenzothiophene (Synfuel)	Total	HR/B	5	0.0076	0.0013	0.0082	0.0052	0.0082			0.0052	0.0082	µg/L	0%	NSV		NA	NSV		NA	2007-2010
Dibromochloromethane	Total	HR/B	4	3	0	3	3	3			3	3	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Dibromomethane	Total	HR/B	4	3	0	3	3	3			3	3	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Dicamba	Total	HR/B	3	0.02	0	0.02	0.02	0.02			0.02	0.02	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Dichlorodifluoromethane	Total	HR/B	4	3	0	3	3	3			3	3	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Dichloroprop	Total	HR/B	3	0.005	0	0.005	0.005	0.005			0.005	0.005	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Diclofop-methyl	Total	HR/B	3	0.02	0	0.02	0.02	0.02			0.02	0.02	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Dieldrin	Total	HR/B	28	0.00059	0.00033	0.0004	0.00035	0.0015	0.00035	0.00035	0.00035	0.0015	µg/L	4%	NSV		NA	NSV		NA	1994-2010
Dimethoate	Total	HR/B	2	0.05	0	0.05	0.05	0.05			0.05	0.05	µg/L	0%	NSV		NA	NSV		NA	1998-1998
Disulfoton	Total	HR/B	3	0.2	0	0.2	0.2	0.2			0.2	0.2	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Endrin	Total	HR/B	28	0.00078	0.00044	0.00055	0.0004	0.0025	0.00055	0.00055	0.0004	0.0025	µg/L	4%	NSV		NA	NSV		NA	1994-2010
Ethalfluralin	Total	HR/B	3	0.005	0	0.005	0.005	0.005			0.005	0.005	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Ethanol	Total	HR/B	4	300	0	300	300	300			300	300	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Ethion	Total	HR/B	3	0.1	0	0.1	0.1	0.1			0.1	0.1	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Ethyl Methacrylate	Total	HR/B	4	10	0	10	10	10			10	10	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Ethylbenzene	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Fecal Coliform	Total	HR/B	77	6.4	9.1	2	1	48	1	48	1	10	NO/100 ML	64%	NSV		NA	NSV		NA	1993-2010
Fecal Streptococci, Kf Agar	Total	HR/B	13	3.3	2.8	1	1	8.4	1	8.4	1	1	NO/100 ML	85%	NSV		NA	NSV		NA	2007-2010
Fenoxaprop-p-ethyl	Total	HR/B	2	0.04	0	0.04	0.04	0.04			0.04	0.04	µg/L	0%	NSV		NA	NSV		NA	1998-1998
Fluoranthene	Dissolved	HR/B	1	0.01	NA	0.01	0.01	0.01			0.01	0.01	µg/L	0%	0.04	1	0%	NSV		NA	2005-2005
Fluoranthene	Total	HR/B	34	0.011	0.008	0.0087	0.0041	0.053	0.0048	0.0087	0.0041	0.053	µg/L	9%	0.04	1	3%	NSV		NA	1994-2010
Fluorene	Dissolved	HR/B	1	0.01	NA	0.01	0.01	0.01			0.01	0.01	µg/L	0%	3	1	0%	NSV		NA	2005-2005
Fluorene	Total	HR/B	34	0.026	0.026	0.025	0.0064	0.14	0.0079	0.14	0.0064	0.11	µg/L	6%	3	1	0%	NSV		NA	1994-2010
Fluoride	Dissolved	HR/B	145	118	29	120	30	210	30	210			µg/L	100%	NSV		NA	NSV		NA	1988-2010
Free Co2 (Calcd.)	Total	HR/B	133	10306	31634	3260	120	354250	120	354250			µg/L	100%	NSV		NA	NSV		NA	1988-2010
Gallium	Dissolved	HR/B	32	0.014	0.0048	0.013	0.007	0.025	0.007	0.025			µg/L	100%	NSV		NA	NSV		NA	2003-2010
Gallium	Total	HR/B	76	0.23	0.45	0.099	0.004	2.7	0.004	2.7			µg/L	100%	NSV		NA	NSV		NA	2002-2010
Gamma Bhc (Lindane)	Total	HR/B	30	0.00079	0.0012	0.0004	0.00015	0.005	0.00015	0.0016	0.00015	0.005	µg/L	23%	NSV		NA	NSV		NA	1994-2010
Gamma-Chlordane	Total	HR/B	28	0.00033	0.00017	0.00033	0.00019	0.0012	0.00033	0.00033	0.00019	0.0012	µg/L	4%	NSV		NA	NSV		NA	1994-2010
Hardness (as Caco3), Noncarbonate	Total	HR/B	132	60760	30839	55143	6354	325697	6354	325697			µg/L	100%	NSV		NA	NSV		NA	1988-2010
Heptachlor	Total	HR/B	28	0.00064	0.00022	0.00069	0.00035	0.0011	0.00082	0.00082	0.00035	0.0011	µg/L	4%	NSV		NA	NSV		NA	1994-2010
Heptachlor Epoxide	Total	HR/B	28	0.00026	0.00016	0.0002	0.00017	0.00096	0.00017	0.00017	0.00017	0.00096	µg/L	4%	NSV		NA	NSV		NA	1994-2010
Hexachlorobenzene	Total	HR/B	28	0.00061	0.00067	0.00048	0.00029	0.004	0.00047	0.004	0.00029	0.00062	µg/L	11%	NSV		NA	NSV		NA	1994-2010
Hexachlorobutadiene	Total	HR/B	11	0.00032	0.000084	0.00025	0.00025	0.00041			0.00025	0.00041	µg/L	0%	NSV		NA	NSV		NA	2005-2010
Hydroxide (Calcd.)	Total	HR/B	85	0	0	0	0	0	0	0	0	0	µg/L	14%	NSV		NA	NSV		NA	1988-1998
Imazamethabenz-Methyl (a)	Total	HR/B	3	0.05	0	0.05	0.05	0.05			0.05	0.05	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Imazethapyr (Imidazolinone)	Total	HR/B	2	0.02	0	0.02	0.02	0.02			0.02	0.02	µg/L	0%	NSV		NA	NSV		NA	1998-1998
Indene	Total	HR/B	32	0.015	0.014	0.015	0.0051	0.087	0.015	0.015	0.0051	0.087	µg/L	3%	NSV		NA	NSV		NA	1994-2010
Indeno(1,2,3-C,D)Pyrene	Dissolved	HR/B	1	0.01	NA	0.01	0.01	0.01			0.01	0.01	µg/L	0%	NSV		NA	NSV		NA	2005-2005
Indeno(1,2,3-C,D)Pyrene	Total	HR/B	32	0.088	0.061	0.13	0.01	0.23	0.13	0.13	0.01	0.23	µg/L	3%	NSV		NA	NSV		NA	1994-2010
Iodomethane (Methyl iodide)	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Lanthanum	Dissolved	HR/B	16	0.14	0.057	0.15	0.052	0.25	0.052	0.25			µg/L	100%	NSV		NA	NSV		NA	2003-2010
Lanthanum	Total	HR/B	38	1	1.7	0.53	0.03	10	0.03	10			µg/L	100%	NSV		NA	NSV		NA	2002-2010
Lithium	Dissolved	HR/B	16	15	6.5	14	7.1	30	7.1	30			µg/L	100%	NSV		NA	NSV		NA	2003-2010
Lithium	Total	HR/B	93	20	13	15	3.4	70	3.4	70			µg/L	100%	NSV		NA	NSV		NA	1993-2010
Malathion	Total	HR/B	3	0.05	0	0.05	0.05	0.05			0.05	0.05	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Mcpa	Total	HR/B	3	0.005	0	0.005	0.005	0.005			0.005	0.005	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Mcpb	Total	HR/B	3	0.02	0	0.02	0.02	0.02			0.02	0.02	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Mcpp	Total	HR/B	3	0.005	0	0.005	0.005	0.005			0.005	0.005	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Methoxychlor	Total	HR/B	30	0.0075	0.0069	0.0079	0.0004	0.03	0.0079	0.0079	0.0004	0.03	µg/L	3%	NSV		NA	900	5	0%	1994-2010

Table 3-3. Summary Statistics-Surface Water

Parameter	Fraction	Location	n	Mean	St Dev	Median	Min	Max	Min Detect	Max Detect	Min Non-Detect	Max Non-Detect	Units	FOD	EcoSV[a]	Eco Source	Eco FOE[b]	DwSV[c]	DW Source	DW FOE[d]	Date Range
Methyl Ethyl Ketone (2-Butanone)	Total	HR/B	4	100	0	100	100	100			100	100	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	Total	HR/B	4	10	0	10	10	10			10	10	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Methylene Chloride	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	98	1	0%	NSV		NA	2004-2005
Methylnaphthalenes (sum of isomers)	Dissolved	HR/B	1	0.01	NA	0.01	0.01	0.01			0.01	0.01	µg/L	0%	NSV		NA	NSV		NA	2005-2005
Methylnaphthalenes (sum of isomers)	Total	HR/B	2	0.01	0	0.01	0.01	0.01			0.01	0.01	µg/L	0%	NSV		NA	NSV		NA	2004-2004
Mirex	Total	HR/B	28	0.001	0.00043	0.0011	0.0004	0.0014	0.0014	0.0014	0.0004	0.0014	µg/L	4%	NSV		NA	NSV		NA	1994-2010
Molybdenum	Dissolved	HR/B	16	0.78	0.17	0.76	0.54	1.1	0.54	1.1			µg/L	100%	73	1	0%	NSV		NA	2003-2010
Molybdenum	Total	HR/B	93	0.77	0.32	0.75	0.1	1.9	0.15	1.9	0.1	0.1	µg/L	99%	73	1	0%	NSV		NA	1993-2010
Niobium	Dissolved	HR/B	16	0.0069	0.0039	0.006	0.001	0.014	0.001	0.014			µg/L	100%	NSV		NA	NSV		NA	2003-2010
Niobium	Total	HR/B	38	0.028	0.037	0.015	0.0013	0.22	0.0013	0.22			µg/L	100%	NSV		NA	NSV		NA	2002-2010
Nitrogen	Dissolved	HR/B	9	1231	182	1260	950	1440	950	1440			µg/L	100%	1	3	100%	NSV		NA	2008-2010
Nitrogen Particulate	Total	HR/B	145	204	234	136	3	1945	3	1945			µg/L	100%	NSV		NA	NSV		NA	1988-2010
Nitrogen Particulate Organic	Total	HR/B	1	850	NA	850	850	850	850	850			µg/L	100%	NSV		NA	NSV		NA	1995-1995
Nitrogen Total	Total	HR/B	147	857	517	865	23	3726	23	3726	40	40	µg/L	99%	NSV		NA	NSV		NA	1988-2010
Nitrogen Total Dissolved	Dissolved	HR/B	138	669	509	643	8	3470	44	3470	8	40	µg/L	86%	NSV		NA	NSV		NA	1988-2008
Nitrogen, Ammonia (as N)	Dissolved	HR/B	95	60	113	22	2	938	2	938	2	10	µg/L	94%	NSV		NA	NSV		NA	1993-2010
Nitrogen, Ammonia (as N)	Total	HR/WC	57	36	47	21	5	225	6	225	5	50	µg/L	79%	NSV		NA	NSV		NA	1982-2010
O,P'-Ddd	Total	HR/B	11	0.00062	0.00016	0.00048	0.00048	0.00078			0.00048	0.00078	µg/L	0%	NSV		NA	NSV		NA	2005-2010
O,P'-Dde	Total	HR/B	11	0.00094	0.00024	0.00074	0.00074	0.0012			0.00074	0.0012	µg/L	0%	NSV		NA	NSV		NA	2005-2010
O,P'-Ddt	Total	HR/B	28	0.00074	0.00082	0.00066	0.00035	0.0049	0.00075	0.00075	0.00035	0.0049	µg/L	4%	NSV		NA	NSV		NA	1994-2010
Oxychlordane	Total	HR/B	11	0.00082	0.00021	0.00064	0.00064	0.001			0.00064	0.001	µg/L	0%	NSV		NA	NSV		NA	2005-2010
Oxygen Dissolved	Dissolved	HR/B	102	7622	2836	8100	340	13810	340	13810			µg/L	100%	NSV		NA	NSV		NA	1990-2010
p,p'-DDD	Total	HR/B	28	0.0014	0.00082	0.00088	0.0004	0.0022	0.0022	0.0022	0.0004	0.0022	µg/L	4%	NSV		NA	NSV		NA	1994-2010
p,p'-DDE	Total	HR/B	28	0.00093	0.00049	0.00097	0.0004	0.0023	0.0013	0.0015	0.0004	0.0023	µg/L	7%	NSV		NA	NSV		NA	1994-2010
p,p'-DDT	Total	HR/B	28	0.0011	0.00038	0.0012	0.0004	0.0021	0.0013	0.0013	0.0004	0.0021	µg/L	4%	NSV		NA	NSV		NA	1994-2010
PCB, Total	Total	HR/B	17	0.0047	0.0067	0.00034	0.00021	0.022	0.011	0.013	0.00021	0.022	µg/L	12%	NSV		NA	NSV		NA	1994-2010
Pentachlorobenzene	Total	HR/B	4	0.00057	0.00029	0.00063	0.00021	0.0008			0.00021	0.0008	µg/L	0%	NSV		NA	NSV		NA	1997-2007
Perylene	Total	HR/B	23	0.085	0.038	0.1	0.009	0.17	0.055	0.17	0.009	0.1	µg/L	13%	NSV		NA	NSV		NA	1997-2010
Ph Field	Total	HR/B	135	7.6	0.42	7.6	5.9	9	5.9	9			PH UNITS	100%	NSV		NA	NSV		NA	1988-2010
Ph Lab	Total	HR/B	147	7.7	0.29	7.7	6.9	8.3	6.9	8.3			PH UNITS	100%	NSV		NA	NSV		NA	1988-2010
Phenanthrene	Dissolved	HR/B	1	0.01	NA	0.01	0.01	0.01			0.01	0.01	µg/L	0%	0.4	1	0%	NSV		NA	2005-2005
Phenanthrene	Total	HR/B	34	0.033	0.032	0.034	0.0062	0.19	0.008	0.19	0.0062	0.1	µg/L	15%	0.4	1	0%	NSV		NA	1994-2010
Phorate	Total	HR/B	3	0.005	0	0.005	0.005	0.005			0.005	0.005	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Phosphorous Particulate (Calcd.)	Total	HR/B	138	74	101	34	4	698	5	698	4	144	µg/L	77%	NSV		NA	NSV		NA	1988-2007
Phosphorus, Dissolved (as P)	Dissolved	HR/B	148	35	43	26	8	447	8	447	10	10	µg/L	97%	NSV		NA	NSV		NA	1988-2010
Picloram	Total	HR/B	3	0.005	0	0.005	0.005	0.005			0.005	0.005	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Platinum	Dissolved	HR/B	16	0.001	0.000063	0.001	0.001	0.0013	0.001	0.0013	0.001	0.001	µg/L	31%	NSV		NA	NSV		NA	2003-2010
Platinum	Total	HR/B	38	0.0012	0.00037	0.001	0.001	0.002	0.001	0.002	0.001	0.002	µg/L	34%	NSV		NA	NSV		NA	2002-2010
Pyridaben	Total	HR/B	2	0.02	0	0.02	0.02	0.02			0.02	0.02	µg/L	0%	NSV		NA	NSV		NA	1998-1998
Quinclorac (Quinolinecarboxylic Acid)	Total	HR/B	2	0.005	0	0.005	0.005	0.005			0.005	0.005	µg/L	0%	NSV		NA	NSV		NA	1998-1998
Rubidium	Dissolved	HR/B	16	1.2	0.41	1.2	0.73	2.3	0.73	2.3			µg/L	100%	NSV		NA	NSV		NA	2003-2010
Rubidium	Total	HR/B	38	2.5	2.6	1.9	0.24	16	0.24	16			µg/L	100%	NSV		NA	NSV		NA	2002-2010
Saturation Index (Calcd.)	Total	HR/B	119	N/A	0.74	N/A	N/A	1.8	N/A	1.8			PH UNITS	100%	NSV		NA	NSV		NA	1988-2010
Selenium	Dissolved	HR/B	128	8.1	88	0.2	0.1	1000	0.1	1000	0.1	0.1	µg/L	97%	1	1	1%	10	5	1%	1988-2010
Selenium	Total	HR/B	34	0.24	0.07	0.24	0.06	0.44	0.06	0.44			µg/L	100%	1	1	0%	10	5	0%	2003-2010
Silica Reactive	Total	HR/B	19	6061	2136	6050	2270	9970	2270	9970			µg/L	100%	NSV		NA	NSV		NA	1988-1990
Silver	Dissolved	HR/B	16	0.0075	0.011	0.004	0.001	0.047	0.001	0.047	0.001	0.001	µg/L	94%	0.1	1	0%	NSV		NA	2003-2010
Silver	Total	HR/B	62	0.062	0.048	0.052	0.002	0.2	0.002	0.2	0.1	0.1	µg/L	73%	0.1	1	5%	NSV		NA	1996-2010
Sio2	Total	HR/B	127	5535	2336	5080	1490	12600	1490	12600			µg/L	100%	NSV		NA	NSV		NA	1990-2010
Sodium Percentage (Calcd.)	Total	HR/B	134	15	1.5	15	12	20	12	20			%	100%	NSV		NA	NSV		NA	1988-2010
Stability Index (Calcd.)	Total	HR/B	119	8.1	1.1	8.1	5.5	13	5.5	13			PH UNITS	100%	NSV		NA	NSV		NA	1988-2010
Styrene	Total	HR/B	4	1	0	1	1	1			1	1	ug/L	0%	NSV		NA	NSV		NA	2004-2005
Temperature Water	Total	HR/B	142	8.4	8.6	6.4	0	26	0	26	0	0	DEG C	82%	NSV		NA	NSV		NA	1988-2010
Terbufos	Total	HR/B	3	0.03	0	0.03	0.03	0.03			0.03	0.03	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Tetrachloroethylene(PCE)	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Thallium	Dissolved	HR/B	16	0.0099	0.0042	0.0085	0.006	0.021	0.006	0.021			µg/L	100%	0.8	1	0%	NSV		NA	2003-2010
Thallium	Total	HR/B	38	0.028	0.034	0.018	0.003	0.21	0.003	0.21			µg/L	100%	0.8	1	0%	NSV		NA	2002-2010
Tin	Dissolved	HR/B	16	0.0091	0.0061	0.0055	0.005	0.024	0.005	0.024	0.005	0.005	µg/L	63%	NSV		NA	NSV		NA	2003-2010
Tin	Total	HR/B	38	0.0086	0.0079	0.005	0.005	0.04	0.005	0.04	0.005	0.005	µg/L	42%	NSV		NA	NSV		NA	2002-2010
Toluene	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	2	1	0%	NSV		NA	2004-2005
Trans-1,2-Dichloroethene	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005

Table 3-3. Summary Statistics-Surface Water

Parameter	Fraction	Location	n	Mean	St Dev	Median	Min	Max	Min Detect	Max Detect	Min Non-Detect	Max Non-Detect	Units	FOD	EcoSV[a]	Eco Source	Eco FOE[b]	DwSV[c]	DW Source	DW FOE[d]	Date Range
Trans-1,3-Dichloropropene	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Trans-1,4-Dichloro-2-Butene	Total	HR/B	4	10	0	10	10	10			10	10	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Trans-Nonachlor	Total	HR/B	11	0.00059	0.00015	0.00046	0.00046	0.00074			0.00046	0.00074	µg/L	0%	NSV		NA	NSV		NA	2005-2010
Triallate	Total	HR/B	3	0.005	0	0.005	0.005	0.005			0.005	0.005	µg/L	0%	NSV		NA	NSV		NA	1997-1998
Trichloroethylene (TCE)	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Trichlorofluoromethane	Total	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Trifluralin	Total	HR/B	3	0.005	0	0.005	0.005	0.005			0.005	0.005	µg/L	0%	0.2	1	0%	45	5	0%	1997-1998
Tungsten	Dissolved	HR/B	16	0.0035	0.0054	0.002	0.001	0.023	0.001	0.023	0.001	0.001	µg/L	81%	NSV		NA	NSV		NA	2003-2010
Tungsten	Total	HR/B	38	0.0037	0.0052	0.002	0.001	0.033	0.001	0.033	0.001	0.002	µg/L	79%	NSV		NA	NSV		NA	2002-2010
Vinyl Acetate	Total	HR/B	4	100	0	100	100	100			100	100	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Vinyl Chloride	Total	HR/B	4	2	0	2	2	2			2	2	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Yttrium	Dissolved	HR/B	16	0.3	0.09	0.27	0.16	0.45	0.16	0.45			µg/L	100%	NSV		NA	NSV		NA	2003-2010
Yttrium	Total	HR/B	38	1.3	1.9	0.76	0.06	11	0.06	11			µg/L	100%	NSV		NA	NSV		NA	2002-2010

a: Ecological Screening Value
b: Ecological Screening Value-Frequency of Exceedance
c: Drinking Water Screening Value
d: Drinking Water Screening Value-Frequency of Exceedance

DW: drinking water
Dw/SV: drinking water screening value
FOD: frequency of detection
FOE: frequency of exceedance
µg/L: micrograms per litre
NSV: no screening value
uS/cm: micro Siemens per centimeter

Screening Values Sources
1: CCME 2007
2: CEQG Summary Tables
3: Alberta Environment 1999
4: CCME 2002
5: Health Canada 2010

Table 3-4. Surface Water All Data ANCOVA Results Summary

Parameter	Fraction	Time	Season	Location
Alkalinity(as CaCO3)	Total	*	***	***
Arsenic	Dissolved	***	***	
Arsenic	Total	-	***	***
Cadmium	Total	*	-	*
Calcium	Dissolved	**	***	
Calcium	Total	-	***	
Carbon Organic	Dissolved	-	**	
Carbon Organic	Total	-	-	
Chloride (as Cl)	Dissolved	-	***	
Chloride (as Cl)	Total	-	**	
Chromium Total	Total	-	***	***
Cobalt	Total	-	***	**
Color	Total	*	-	***
Conductivity	Total	-	***	***
Copper	Total	-	***	***
Hardness (CACO3)	Total	*	***	***
Iron	Total	-	***	***
Lead	Total	-	-	**
Magnesium	Dissolved	**	***	
Magnesium	Total	-	***	***
Manganese	Total	-	***	
Nickel	Total	-	**	**
Nitrogen, Nitrate-Nitrite	Dissolved	*	**	
Nitrogen, Kjeldahl Total	Total	*		
pH	Total	**	***	***
Phosphorus (as P)	Total	**	***	-
Potassium	Dissolved	-	***	
Potassium	Total	***	-	
Sodium	Dissolved	-	***	
Sodium	Total	-	***	**
Strontium	Total	-	***	
Sulfate (SO4)	Dissolved	**	***	
Sulfate (SO4)	Total	-	*	
Suspended Solids (Residue, Non-Filterable)	Total	-	***	*
Total Dissolved Solids (Residue, Filterable)	Total	-	***	**
Turbidity	Total	-	***	-
Vanadium	Total	*	***	
Zinc	Total	-	***	***

-: Not Significant
*: 0.05
**: 0.01
***: 0.001

Table 3-5. Surface Water 2000-2010 ANCOVA Results Summary

Parameter	Fraction	Time	Season	Location
Alkalinity(as CaCO3)	Total	-	***	-
Arsenic	Dissolved	-	*	
Arsenic	Total	-	*	
Cadmium	Total	*	-	-
Calcium	Dissolved	-	***	
Calcium	Total	-	-	
Carbon, Organic	Dissolved	-	*	
Carbon, Organic	Total	-	*	
Chloride (as Cl)	Dissolved	-	***	
Chloride (as Cl)	Total	-	-	
Chromium, Total	Total	-	***	**
Cobalt	Total	-	**	-
Color	Total	***	-	*
Conductivity	Total	-	***	-
Copper	Total	-	*	-
Hardness (CACO3)	Total	-	***	-
Iron	Total	-	**	-
Lead	Total	-	-	-
Magnesium	Dissolved	-	***	
Magnesium	Total	-	**	-
Manganese	Total	-	***	
Nickel	Total	-	*	-
Nitrogen, Nitrate-Nitrite	Dissolved	**	-	
pH	Total	-	***	***
Phosphorus (P)	Total	-	**	-
Potassium	Dissolved	-	***	
Potassium	Total	-	-	
Sodium	Dissolved	-	***	
Sodium	Total	-	**	-
Strontium	Total	-	***	
Sulfate (SO4)	Dissolved	-	***	
Sulfate (SO4)	Total	-	-	
Suspended Solids (Residue, Non-Filterable)	Total	-	***	-
Total Dissolved Solids (Residue, Filterable)	Total	-	***	-
Turbidity	Total	-	***	-
Vanadium	Total	-	**	
Zinc	Total	-	*	*

-: Not Significant
*: 0.05
**: 0.01
***: 0.001

Table 3-6. HR/B versus HR/WC Comparisons in Surface Water

Parameter	Fraction	n	HR/B Mean	HR/WC Mean	HR/B Median	HR/WC Median	HR/WC - HR/B Mean	t statitics	p-value
Alkalinity, Total (As Caco3)	Total	44	95585	98868	83650	87500	3283	0.86	0.3969
Cadmium	Total	43	0.296	0.181	0.200	0.200	-0.115	-1.72	0.0926
Chromium, Total	Total	35	1.55	3.67	0.63	1.80	2.12	2.14	0.0396 *
Cobalt	Total	35	1.25	1.35	0.69	1.00	0.10	0.31	0.7607
Color	Total	12	132	154	140	134	22	0.96	0.3567
Conductivity	Total	45	313	331	307	324	18	1.47	0.1486
Copper	Total	43	4.08	4.46	2.87	3.30	0.37	0.56	0.5775
Hardness (As Caco3)	Total	36	145462	151669	146396	144000	6207	1.06	0.2968
Iron	Total	35	3232	3609	2111	1860	377	0.42	0.6769
Lead	Total	43	1.57	3.35	0.73	1.00	1.78	1.24	0.2237
Magnesium	Total	16	10182	11635	9930	10500	1453	2.52	0.0235 *
Nickel	Total	43	5.26	5.76	4.09	4.00	0.50	0.68	0.5020
Nitrogen, Nitrate-Nitrite	Total	11	113	110	48	60	-2.5	-0.06	0.9504
pH	Total	45	7.79	7.96	7.77	7.94	0.18	3.35	0.0017 **
Phosphorus, Total (As P)	Total	44	157	136	109	80	-20	-0.87	0.3909
Sodium	Total	17	11095	13108	10400	12600	2012	3.15	0.0063 **
Suspended Solids (Residue, Non-Filterable)	Total	42	96033	74571	38700	33000	-21462	-1.06	0.2972
Total Dissolved Solids (Residue, Filterable)	Total	44	223723	267386	216533	265000	43663	4.27	0.0001 ***
Turbidity	Total	45	75	62	28	28	-13	-0.79	0.4330
Zinc	Total	43	12	16	7	10	4.0	1.21	0.2332

HR/B: Hay River at the Alberta/NWT Border

HR/WC: HayRiver at the West Channel Bridge

Table 3-7. Comparison of Dissolved versus Total

Name	n	Mean	Standard Deviation	Lower Confidence Limit	Upper Confidence Limit
Arsenic	16	0.58	0.23	0.46	0.71
Cadmium	16	0.47	0.26	0.33	0.61
Chromium	16	0.35	0.33	0.17	0.53
Cobalt	16	0.43	0.31	0.26	0.59
Copper	16	0.75	0.30	0.59	0.90
Iron	16	0.34	0.24	0.21	0.47
Lead	16	0.33	0.38	0.13	0.53
Magnesium	55	1.07	0.28	0.99	1.14
Manganese	16	0.34	0.37	0.14	0.54
Naphthalene	3	0.83	0.58	-0.60	2.27
Nickel	16	0.73	0.25	0.59	0.86
Sodium	55	1.14	0.47	1.01	1.27
Strontium	16	0.94	0.10	0.89	1.00
Uranium	16	0.98	0.78	0.57	1.40
Vanadium	16	0.36	0.28	0.21	0.51
Zinc	16	0.38	0.31	0.22	0.54

Table 3-8. Correlation Analysis of Surface Water Parameters

	ALKALINITY	ARSENIC	CADMIUM	CALCIUM	CHLORIDE
Alkalinity		-0.38(**) n=66	-0.05(NS) n=201	0.9(***) n=56	0.75(***) n=57
Arsenic	-0.38(**) n=66		-0.03(NS) n=65	-0.46(**) n=31	-0.38(*) n=32
Cadmium	-0.05(NS) n=201	-0.03(NS) n=65		0.04(NS) n=55	-0.02(NS) n=56
Calcium	0.9(***) n=56	-0.46(**) n=31	0.04(NS) n=55		0.75(***) n=56
Chloride	0.75(***) n=57	-0.38(*) n=32	-0.02(NS) n=56	0.75(***) n=56	
Chromium	-0.31(***) n=147	0.65(***) n=63	0.09(NS) n=147	-0.35(*) n=53	-0.19(NS) n=54
Cobalt	-0.32(***) n=181	0.87(***) n=45	0.23(**) n=182	-0.54(***) n=35	-0.37(*) n=36
Color	-0.17(NS) n=85	0.38(**) n=53	-0.08(NS) n=84	-0.26(NS) n=56	-0.4(**) n=57
Conductivity	0.89(***) n=203	-0.42(***) n=66	-0.02(NS) n=202	0.92(***) n=56	0.78(***) n=57
Copper	-0.37(***) n=200	0.77(***) n=64	0.23(***) n=201	-0.51(***) n=54	-0.4(**) n=55
Carbon Organic	0.08(NS) n=130	0.08(NS) n=24	0.05(NS) n=130		
Hardness	0.94(***) n=185	-0.39(**) n=63	0.01(NS) n=183	0.97(***) n=51	0.74(***) n=51
Iron	-0.31(***) n=150	0.88(***) n=66	0.09(NS) n=149	-0.52(***) n=56	-0.4(**) n=57
Lead	-0.21(**) n=201	0.55(***) n=65	0.27(***) n=202	-0.29(*) n=55	-0.24(NS) n=56
Magnesium	0.9(***) n=111	-0.54(**) n=31	-0.06(NS) n=110	0.77(***) n=56	0.65(***) n=56
Manganese	0.33(**) n=93	0.28(NS) n=34	0.11(NS) n=93		
Mercury	-0.12(NS) n=16	0.11(NS) n=16	-0.09(NS) n=15	-0.32(NS) n=16	-0.15(NS) n=16
Nickel	-0.3(***) n=201	0.49(***) n=65	0.58(***) n=202	-0.29(*) n=55	-0.26(*) n=56
Nitrogen, Nitrate-Nitrite	0.2(NS) n=75	-0.03(NS) n=50	-0.06(NS) n=74	0.01(NS) n=55	-0.08(NS) n=56
Nitrogen, Nitrate	0.88(***) n=13	-0.49(NS) n=13	-0.07(NS) n=13		
pH	-0.34(***) n=202	-0.18(NS) n=66	-0.08(NS) n=200	0.7(***) n=56	0.42(**) n=57
Phosphorus	-0.42(***) n=200	0.66(***) n=65	0.08(NS) n=199	-0.62(***) n=55	-0.52(***) n=56
Potassium	-0.23(NS) n=50	0.15(NS) n=25	0.11(NS) n=50	-0.11(NS) n=49	0.24(NS) n=50
Sodium	0.84(***) n=105	-0.65(***) n=25	-0.14(NS) n=105	0.83(***) n=49	0.71(***) n=50
Strontium	0.9(***) n=93	-0.29(NS) n=34	-0.16(NS) n=93		
Sulfate	0.49(***) n=57	-0.45(**) n=32	-0.08(NS) n=56	0.52(***) n=56	0.52(***) n=57
Suspended Solids	-0.46(***) n=199	0.53(***) n=63	0.1(NS) n=198	-0.63(***) n=53	-0.44(***) n=54
Total Kjeldahl Nitrogen	0.56(NS) n=9	-0.15(NS) n=8	0.68(NS) n=8	0.41(NS) n=9	0.1(NS) n=9
Total Dissolved Solids	0.39(***) n=199	-0.37(**) n=65	0.02(NS) n=197	0.7(***) n=55	0.62(***) n=56
Turbidity	-0.42(***) n=202	0.77(***) n=66	0.08(NS) n=201	-0.55(***) n=56	-0.41(**) n=57
Uranium	0.49(**) n=34	0.27(NS) n=34	0.04(NS) n=34		
Vanadium	-0.44(***) n=145	0.96(***) n=34	0.3(***) n=146		
Zinc	-0.33(***) n=201	0.54(***) n=65	0.12(NS) n=202	-0.54(***) n=55	-0.41(**) n=56

Table 3-8. Correlation Analysis of Surface Water Parameters

	CHROMIUM	COBALT	COLOR	CONDUCTIVITY	COPPER	CARBON ORGANIC
Alkalinity	-0.31(***) n=147	-0.32(***) n=181	-0.17(NS) n=85	0.89(***) n=203	-0.37(***) n=200	0.08(NS) n=130
Arsenic	0.65(***) n=63	0.87(***) n=45	0.38(**) n=53	-0.42(***) n=66	0.77(***) n=64	0.08(NS) n=24
Cadmium	0.09(NS) n=147	0.23(**) n=182	-0.08(NS) n=84	-0.02(NS) n=202	0.23(***) n=201	0.05(NS) n=130
Calcium	-0.35(*) n=53	-0.54(***) n=35	-0.26(NS) n=56	0.92(***) n=56	-0.51(***) n=54	
Chloride	-0.19(NS) n=54	-0.37(*) n=36	-0.4(**) n=57	0.78(***) n=57	-0.4(**) n=55	
Chromium		0.75(***) n=129	-0.01(NS) n=82	-0.33(***) n=147	0.69(***) n=147	0.06(NS) n=77
Cobalt	0.75(***) n=129		0.2(NS) n=64	-0.33(***) n=182	0.91(***) n=182	0.18(*) n=130
Color	-0.01(NS) n=82	0.2(NS) n=64		-0.17(NS) n=85	0.2(NS) n=83	0.17(NS) n=28
Conductivity	-0.33(***) n=147	-0.33(***) n=182	-0.17(NS) n=85		-0.38(***) n=201	0.09(NS) n=131
Copper	0.69(***) n=147	0.91(***) n=182	0.2(NS) n=83	-0.38(***) n=201		0.09(NS) n=130
Carbon Organic	0.06(NS) n=77	0.18(*) n=130	0.17(NS) n=28	0.09(NS) n=131	0.09(NS) n=130	
Hardness	-0.36(***) n=131	-0.3(***) n=163	-0.16(NS) n=79	0.95(***) n=185	-0.37(***) n=182	0.11(NS) n=118
Iron	0.77(***) n=147	0.96(***) n=129	0.2(NS) n=85	-0.35(***) n=150	0.83(***) n=148	0.15(NS) n=77
Lead	0.38(***) n=147	0.58(***) n=182	0(NS) n=84	-0.22(**) n=202	0.52(***) n=201	0.09(NS) n=130
Magnesium	-0.31(***) n=108	-0.39(***) n=90	-0.25(NS) n=59	0.9(***) n=111	-0.43(***) n=109	-0.1(NS) n=49
Manganese	0.1(NS) n=93	0.35(***) n=93	0.16(NS) n=28	0.32(**) n=93	0.07(NS) n=93	0.27(*) n=77
Mercury	-0.23(NS) n=13		0.02(NS) n=16	-0.2(NS) n=16	0(NS) n=14	
Nickel	0.7(***) n=147	0.9(***) n=182	0.09(NS) n=84	-0.26(***) n=202	0.77(***) n=201	0.17(NS) n=130
Nitrogen, Nitrate-Nitrite	-0.1(NS) n=72	0.01(NS) n=55	0.05(NS) n=63	0.19(NS) n=75	-0.06(NS) n=73	-0.01(NS) n=10
Nitrogen, Nitrate	-0.37(NS) n=13	-0.23(NS) n=13		0.82(***) n=13	-0.33(NS) n=13	0.87(NS) n=4
pH	0.05(NS) n=147	-0.02(NS) n=180	-0.03(NS) n=85	-0.33(***) n=207	0.01(NS) n=199	-0.01(NS) n=129
Phosphorus	0.39(***) n=144	0.75(***) n=179	0.32(**) n=83	-0.45(***) n=204	0.68(***) n=198	0.12(NS) n=129
Potassium	0(NS) n=50	0.48(**) n=36	-0.05(NS) n=50	-0.1(NS) n=50	0.08(NS) n=50	
Sodium	-0.27(**) n=105	-0.33(**) n=91	-0.18(NS) n=53	0.85(***) n=105	-0.35(***) n=105	-0.14(NS) n=49
Strontium	-0.35(***) n=93	-0.25(*) n=93	0.16(NS) n=28	0.95(***) n=93	-0.27(**) n=93	0.16(NS) n=77
Sulfate	-0.29(*) n=54	-0.44(**) n=36	-0.19(NS) n=57	0.64(***) n=57	-0.39(**) n=55	
Suspended Solids	0.4(***) n=143	0.79(***) n=180	0.35(**) n=82	-0.47(***) n=203	0.76(***) n=197	0.07(NS) n=130
Total Kjeldahl Nitrogen	0.29(NS) n=7		-0.21(NS) n=9	0.46(NS) n=9	0.7(NS) n=8	
Total Dissolved Solids	-0.14(NS) n=145	-0.17(*) n=178	-0.07(NS) n=84	0.41(***) n=202	-0.2(**) n=196	0.03(NS) n=127
Turbidity	0.66(***) n=146	0.89(***) n=181	0.25(*) n=85	-0.43(***) n=206	0.82(***) n=200	0.09(NS) n=130
Uranium	0.39(*) n=34	0.52(**) n=34	0.41(NS) n=21	0.51(**) n=34	0.44(**) n=34	0.47(*) n=24
Vanadium	0.99(***) n=93	0.84(***) n=146	0.15(NS) n=28	-0.42(***) n=146	0.93(***) n=146	0.07(NS) n=130
Zinc	0.44(***) n=147	0.78(***) n=182	0.19(NS) n=84	-0.33(***) n=202	0.78(***) n=201	0.11(NS) n=130

Table 3-8. Correlation Analysis of Surface Water Parameters

	HARDNESS	IRON	LEAD	MAGNESIUM	MANGANESE	MERCURY
Alkalinity	0.94(***) n=185	-0.31(***) n=150	-0.21(**) n=201	0.9(***) n=111	0.33(**) n=93	-0.12(NS) n=16
Arsenic	-0.39(**) n=63	0.88(***) n=66	0.55(***) n=65	-0.54(**) n=31	0.28(NS) n=34	0.11(NS) n=16
Cadmium	0.01(NS) n=183	0.09(NS) n=149	0.27(***) n=202	-0.06(NS) n=110	0.11(NS) n=93	-0.09(NS) n=15
Calcium	0.97(***) n=51	-0.52(***) n=56	-0.29(*) n=55	0.77(***) n=56		-0.32(NS) n=16
Chloride	0.74(***) n=51	-0.4(**) n=57	-0.24(NS) n=56	0.65(***) n=56		-0.15(NS) n=16
Chromium	-0.36(***) n=131	0.77(***) n=147	0.38(***) n=147	-0.31(***) n=108	0.1(NS) n=93	-0.23(NS) n=13
Cobalt	-0.3(***) n=163	0.96(***) n=129	0.58(***) n=182	-0.39(***) n=90	0.35(***) n=93	
Color	-0.16(NS) n=79	0.2(NS) n=85	0(NS) n=84	-0.25(NS) n=59	0.16(NS) n=28	0.02(NS) n=16
Conductivity	0.95(***) n=185	-0.35(***) n=150	-0.22(**) n=202	0.9(***) n=111	0.32(**) n=93	-0.2(NS) n=16
Copper	-0.37(***) n=182	0.83(***) n=148	0.52(***) n=201	-0.43(***) n=109	0.07(NS) n=93	0(NS) n=14
Carbon Organic	0.11(NS) n=118	0.15(NS) n=77	0.09(NS) n=130	-0.1(NS) n=49	0.27(*) n=77	
Hardness		-0.31(***) n=134	-0.2(**) n=183	0.92(***) n=96	0.35(**) n=83	-0.29(NS) n=16
Iron	-0.31(***) n=134		0.53(***) n=149	-0.36(***) n=111	0.31(**) n=93	0.04(NS) n=16
Lead	-0.2(**) n=183	0.53(***) n=149		-0.23(*) n=110	0.09(NS) n=93	0.16(NS) n=15
Magnesium	0.92(***) n=96	-0.36(***) n=111	-0.23(*) n=110		0.31(*) n=55	-0.24(NS) n=16
Manganese	0.35(**) n=83	0.31(**) n=93	0.09(NS) n=93	0.31(*) n=55		
Mercury	-0.29(NS) n=16	0.04(NS) n=16	0.16(NS) n=15	-0.24(NS) n=16		
Nickel	-0.23(**) n=183	0.62(***) n=149	0.51(***) n=202	-0.28(**) n=110	0.18(NS) n=93	-0.08(NS) n=15
Nitrogen, Nitrate-Nitrite	0.19(NS) n=69	-0.04(NS) n=75	-0.09(NS) n=74	0.14(NS) n=55	0.53(*) n=19	-0.2(NS) n=15
Nitrogen, Nitrate	0.86(***) n=13	-0.3(NS) n=13	-0.39(NS) n=13		0.32(NS) n=13	
pH	-0.35(***) n=184	-0.1(NS) n=150	0.04(NS) n=200	-0.32(***) n=111	-0.23(*) n=93	-0.32(NS) n=16
Phosphorus	-0.44(***) n=182	0.72(***) n=147	0.39(***) n=199	-0.43(***) n=109	0.29(**) n=91	0.22(NS) n=16
Potassium	-0.1(NS) n=44	0.12(NS) n=50	0.12(NS) n=50	-0.16(NS) n=49		-0.31(NS) n=10
Sodium	0.84(***) n=89	-0.3(**) n=105	-0.19(NS) n=105	0.9(***) n=104	0.23(NS) n=55	0.45(NS) n=10
Strontium	0.99(***) n=83	-0.2(NS) n=93	-0.39(***) n=93	0.93(***) n=55	0.34(***) n=93	
Sulfate	0.53(***) n=51	-0.4(**) n=57	-0.24(NS) n=56	0.6(***) n=56		-0.25(NS) n=16
Suspended Solids	-0.48(***) n=181	0.71(***) n=146	0.36(***) n=198	-0.55(***) n=107	0.09(NS) n=92	0.06(NS) n=16
Total Kjeldahl Nitrogen	0.44(NS) n=9	-0.53(NS) n=9	-0.04(NS) n=8	0.45(NS) n=9		-0.53(NS) n=8
Total Dissolved Solids	0.9(***) n=183	-0.15(NS) n=148	-0.09(NS) n=197	0.24(*) n=109	0.16(NS) n=92	-0.28(NS) n=15
Turbidity	-0.43(***) n=184	0.86(***) n=149	0.42(***) n=201	-0.49(***) n=110	0.1(NS) n=92	0.06(NS) n=16
Uranium	0.49(**) n=34	0.47(**) n=34	0.37(*) n=34		0.45(**) n=34	
Vanadium	-0.43(***) n=133	0.93(***) n=93	0.88(***) n=146	-0.53(***) n=55	0.05(NS) n=93	
Zinc	-0.32(***) n=183	0.69(***) n=149	0.62(***) n=202	-0.43(***) n=110	0.17(NS) n=93	0.21(NS) n=15

Table 3-8. Correlation Analysis of Surface Water Parameters

	NICKEL	NITROGEN, NTRATE-NITRITE	NITROGEN, NITRATE	pH
Alkalinity	-0.3(***) n=201	0.2(NS) n=75	0.88(***) n=13	-0.34(***) n=202
Arsenic	0.49(***) n=65	-0.03(NS) n=50	-0.49(NS) n=13	-0.18(NS) n=66
Cadmium	0.58(***) n=202	-0.06(NS) n=74	-0.07(NS) n=13	-0.08(NS) n=200
Calcium	-0.29(*) n=55	0.01(NS) n=55		0.7(***) n=56
Chloride	-0.26(*) n=56	-0.08(NS) n=56		0.42(**) n=57
Chromium	0.7(***) n=147	-0.1(NS) n=72	-0.37(NS) n=13	0.05(NS) n=147
Cobalt	0.9(***) n=182	0.01(NS) n=55	-0.23(NS) n=13	-0.02(NS) n=180
Color	0.09(NS) n=84	0.05(NS) n=63		-0.03(NS) n=85
Conductivity	-0.26(***) n=202	0.19(NS) n=75	0.82(***) n=13	-0.33(***) n=207
Copper	0.77(***) n=201	-0.06(NS) n=73	-0.33(NS) n=13	0.01(NS) n=199
Carbon Organic	0.17(NS) n=130	-0.01(NS) n=10	0.87(NS) n=4	-0.01(NS) n=129
Hardness	-0.23(**) n=183	0.19(NS) n=69	0.86(***) n=13	-0.35(***) n=184
Iron	0.62(***) n=149	-0.04(NS) n=75	-0.3(NS) n=13	-0.1(NS) n=150
Lead	0.51(***) n=202	-0.09(NS) n=74	-0.39(NS) n=13	0.04(NS) n=200
Magnesium	-0.28(**) n=110	0.14(NS) n=55		-0.32(***) n=111
Manganese	0.18(NS) n=93	0.53(*) n=19	0.32(NS) n=13	-0.23(*) n=93
Mercury	-0.08(NS) n=15	-0.2(NS) n=15		-0.32(NS) n=16
Nickel		-0.08(NS) n=74	-0.21(NS) n=13	-0.01(NS) n=200
Nitrogen, Nitrate-Nitrite	-0.08(NS) n=74		0.53(NS) n=14	-0.16(NS) n=75
Nitrogen, Nitrate	-0.21(NS) n=13	0.53(NS) n=14		-0.24(NS) n=13
pH	-0.01(NS) n=200	-0.16(NS) n=75	-0.24(NS) n=13	
Phosphorus	0.45(***) n=199	0.04(NS) n=74	-0.45(NS) n=13	-0.03(NS) n=202
Potassium	0.22(NS) n=50	-0.04(NS) n=49		-0.29(*) n=50
Sodium	-0.33(***) n=105	0.14(NS) n=49		-0.44(***) n=105
Strontium	-0.19(NS) n=93	0.16(NS) n=19	0.85(***) n=13	-0.54(***) n=93
Sulfate	-0.3(*) n=56	-0.11(NS) n=56		0.37(**) n=57
Suspended Solids	0.53(***) n=198	-0.05(NS) n=72	-0.4(NS) n=13	-0.03(NS) n=201
Total Kjeldahl Nitrogen	-0.07(NS) n=8	0.03(NS) n=9		0.48(NS) n=9
Total Dissolved Solids	-0.14(NS) n=197	0.08(NS) n=75	0.83(***) n=13	-0.21(**) n=201
Turbidity	0.6(***) n=201	-0.06(NS) n=75	-0.37(NS) n=13	-0.01(NS) n=204
Uranium	0.53(**) n=34	0.22(NS) n=19	0.54(NS) n=13	-0.49(**) n=34
Vanadium	0.77(***) n=146	-0.07(NS) n=19	-0.39(NS) n=13	0.07(NS) n=144
Zinc	0.52(***) n=202	-0.01(NS) n=74	-0.19(NS) n=13	-0.04(NS) n=200

Table 3-8. Correlation Analysis of Surface Water Parameters

	PHOSPHORUS	POTASSIUM	SODIUM	STRONTIUM	SULFATE
Alkalinity	-0.42(***) n=200	-0.23(NS) n=50	0.84(***) n=105	0.9(***) n=93	0.49(***) n=57
Arsenic	0.66(***) n=65	0.15(NS) n=25	-0.65(***) n=25	-0.29(NS) n=34	-0.45(**) n=32
Cadmium	0.08(NS) n=199	0.11(NS) n=50	-0.14(NS) n=105	-0.16(NS) n=93	-0.08(NS) n=56
Calcium	-0.62(***) n=55	-0.11(NS) n=49	0.83(***) n=49		0.52(***) n=56
Chloride	-0.52(***) n=56	0.24(NS) n=50	0.71(***) n=50		0.52(***) n=57
Chromium	0.39(***) n=144	0(NS) n=50	-0.27(**) n=105	-0.35(***) n=93	-0.29(*) n=54
Cobalt	0.75(***) n=179	0.48(**) n=36	-0.33(**) n=91	-0.25(*) n=93	-0.44(**) n=36
Color	0.32(**) n=83	-0.05(NS) n=50	-0.18(NS) n=53	0.16(NS) n=28	-0.19(NS) n=57
Conductivity	-0.45(***) n=204	-0.1(NS) n=50	0.85(***) n=105	0.95(***) n=93	0.64(***) n=57
Copper	0.68(***) n=198	0.08(NS) n=50	-0.35(***) n=105	-0.27(**) n=93	-0.39(**) n=55
Carbon Organic	0.12(NS) n=129		-0.14(NS) n=49	0.16(NS) n=77	
Hardness	-0.44(***) n=182	-0.1(NS) n=44	0.84(***) n=89	0.99(***) n=83	0.53(***) n=51
Iron	0.72(***) n=147	0.12(NS) n=50	-0.3(**) n=105	-0.2(NS) n=93	-0.4(**) n=57
Lead	0.39(***) n=199	0.12(NS) n=50	-0.19(NS) n=105	-0.39(***) n=93	-0.24(NS) n=56
Magnesium	-0.43(***) n=109	-0.16(NS) n=49	0.9(***) n=104	0.93(***) n=55	0.6(***) n=56
Manganese	0.29(**) n=91		0.23(NS) n=55	0.34(***) n=93	
Mercury	0.22(NS) n=16	-0.31(NS) n=10	0.45(NS) n=10		-0.25(NS) n=16
Nickel	0.45(***) n=199	0.22(NS) n=50	-0.33(***) n=105	-0.19(NS) n=93	-0.3(*) n=56
Nitrogen, Nitrate-Nitrite	0.04(NS) n=74	-0.04(NS) n=49	0.14(NS) n=49	0.16(NS) n=19	-0.11(NS) n=56
Nitrogen, Nitrate	-0.45(NS) n=13			0.85(***) n=13	
pH	-0.03(NS) n=202	-0.29(*) n=50	-0.44(***) n=105	-0.54(***) n=93	0.37(**) n=57
Phosphorus		0.15(NS) n=49	-0.36(***) n=103	-0.36(***) n=91	-0.51(***) n=56
Potassium	0.15(NS) n=49		-0.22(NS) n=50		-0.05(NS) n=50
Sodium	-0.36(***) n=103	-0.22(NS) n=50		0.88(***) n=55	0.53(***) n=50
Strontium	-0.36(***) n=91		0.88(***) n=55		
Sulfate	-0.51(***) n=56	-0.05(NS) n=50	0.53(***) n=50		
Suspended Solids	0.84(***) n=201	0.25(NS) n=47	-0.41(***) n=101	-0.38(***) n=92	-0.48(***) n=54
Total Kjeldahl Nitrogen	-0.31(NS) n=8	0.01(NS) n=4	0.32(NS) n=4		0.35(NS) n=9
Total Dissolved Solids	-0.18(**) n=200	0.01(NS) n=49	0.21(*) n=103	0.28(**) n=92	0.35(**) n=56
Turbidity	0.76(***) n=204	0.24(NS) n=50	-0.39(***) n=104	-0.34(**) n=92	-0.44(***) n=57
Uranium	0.32(NS) n=33			0.54(**) n=34	
Vanadium	0.72(***) n=144		-0.43(**) n=55	-0.4(***) n=93	
Zinc	0.67(***) n=199	0.15(NS) n=50	-0.32(**) n=105	-0.16(NS) n=93	-0.41(**) n=56

Table 3-8. Correlation Analysis of Surface Water Parameters

	SUSPENDED SOLIDS	TOTAL KJELDAHL NITROGEN	TOTAL DISSOLVED SOLIDS	TURBIDITY	URANIUM	VANADIUM	ZINC
Alkalinity	-0.46(***) n=199	0.56(NS) n=9	0.39(***) n=199	-0.42(***) n=202	0.49(**) n=34	-0.44(***) n=145	-0.33(***) n=201
Arsenic	0.53(***) n=63	-0.15(NS) n=8	-0.37(**) n=65	0.77(***) n=66	0.27(NS) n=34	0.96(***) n=34	0.54(***) n=65
Cadmium	0.1(NS) n=198	0.68(NS) n=8	0.02(NS) n=197	0.08(NS) n=201	0.04(NS) n=34	0.3(***) n=146	0.12(NS) n=202
Calcium	-0.63(***) n=53	0.41(NS) n=9	0.7(***) n=55	-0.55(***) n=56			-0.54(***) n=55
Chloride	-0.44(***) n=54	0.1(NS) n=9	0.62(***) n=56	-0.41(**) n=57			-0.41(**) n=56
Chromium	0.4(***) n=143	0.29(NS) n=7	-0.14(NS) n=145	0.66(***) n=146	0.39(*) n=34	0.99(***) n=93	0.44(***) n=147
Cobalt	0.79(***) n=180		-0.17(*) n=178	0.89(***) n=181	0.52(**) n=34	0.84(***) n=146	0.78(***) n=182
Color	0.35(**) n=82	-0.21(NS) n=9	-0.07(NS) n=84	0.25(*) n=85	0.41(NS) n=21	0.15(NS) n=28	0.19(NS) n=84
Conductivity	-0.47(***) n=203	0.46(NS) n=9	0.41(***) n=202	-0.43(***) n=206	0.51(**) n=34	-0.42(***) n=146	-0.33(***) n=202
Copper	0.76(***) n=197	0.7(NS) n=8	-0.2(**) n=196	0.82(***) n=200	0.44(**) n=34	0.93(***) n=146	0.78(***) n=201
Carbon Organic	0.07(NS) n=130		0.03(NS) n=127	0.09(NS) n=130	0.47(*) n=24	0.07(NS) n=130	0.11(NS) n=130
Hardness	-0.48(***) n=181	0.44(NS) n=9	0.9(***) n=183	-0.43(***) n=184	0.49(**) n=34	-0.43(***) n=133	-0.32(***) n=183
Iron	0.71(***) n=146	-0.53(NS) n=9	-0.15(NS) n=148	0.86(***) n=149	0.47(**) n=34	0.93(***) n=93	0.69(***) n=149
Lead	0.36(***) n=198	-0.04(NS) n=8	-0.09(NS) n=197	0.42(***) n=201	0.37(*) n=34	0.88(***) n=146	0.62(***) n=202
Magnesium	-0.55(***) n=107	0.45(NS) n=9	0.24(*) n=109	-0.49(***) n=110		-0.53(***) n=55	-0.43(***) n=110
Manganese	0.09(NS) n=92		0.16(NS) n=92	0.1(NS) n=92	0.45(**) n=34	0.05(NS) n=93	0.17(NS) n=93
Mercury	0.06(NS) n=16	-0.53(NS) n=8	-0.28(NS) n=15	0.06(NS) n=16			0.21(NS) n=15
Nickel	0.53(***) n=198	-0.07(NS) n=8	-0.14(NS) n=197	0.6(***) n=201	0.53(**) n=34	0.77(***) n=146	0.52(***) n=202
Nitrogen, Nitrate-Nitrite	-0.05(NS) n=72	0.03(NS) n=9	0.08(NS) n=75	-0.06(NS) n=75	0.22(NS) n=19	-0.07(NS) n=19	-0.01(NS) n=74
Nitrogen, Nitrate	-0.4(NS) n=13		0.83(***) n=13	-0.37(NS) n=13	0.54(NS) n=13	-0.39(NS) n=13	-0.19(NS) n=13
pH	-0.03(NS) n=201	0.48(NS) n=9	-0.21(**) n=201	-0.01(NS) n=204	-0.49(**) n=34	0.07(NS) n=144	-0.04(NS) n=200
Phosphorus	0.84(***) n=201	-0.31(NS) n=8	-0.18(**) n=200	0.76(***) n=204	0.32(NS) n=33	0.72(***) n=144	0.67(***) n=199
Potassium	0.25(NS) n=47	0.01(NS) n=4	0.01(NS) n=49	0.24(NS) n=50			0.15(NS) n=50
Sodium	-0.41(***) n=101	0.32(NS) n=4	0.21(*) n=103	-0.39(***) n=104		-0.43(**) n=55	-0.32(**) n=105
Strontium	-0.38(***) n=92		0.28(**) n=92	-0.34(**) n=92	0.54(**) n=34	-0.4(***) n=93	-0.16(NS) n=93
Sulfate	-0.48(***) n=54	0.35(NS) n=9	0.35(**) n=56	-0.44(***) n=57			-0.41(**) n=56
Suspended Solids		-0.01(NS) n=9	-0.24(***) n=199	0.86(***) n=203	0.37(*) n=34	0.89(***) n=145	0.78(***) n=198
Total Kjeldahl Nitrogen	-0.01(NS) n=9		0.5(NS) n=9	0.06(NS) n=9			0.14(NS) n=8
Total Dissolved Solids	-0.24(***) n=199	0.5(NS) n=9		-0.22(**) n=202	0.46(**) n=34	-0.21(*) n=142	-0.14(NS) n=197
Turbidity	0.86(***) n=203	0.06(NS) n=9	-0.22(**) n=202		0.4(*) n=34	0.85(***) n=145	0.73(***) n=201
Uranium	0.37(*) n=34		0.46(**) n=34	0.4(*) n=34		0.36(*) n=34	0.53(**) n=34
Vanadium	0.89(***) n=145		-0.21(*) n=142	0.85(***) n=145	0.36(*) n=34		0.83(***) n=146
Zinc	0.78(***) n=198	0.14(NS) n=8	-0.14(NS) n=197	0.73(***) n=201	0.53(**) n=34	0.83(***) n=146	

Notes
* = p < 0.05
** = p < 0.01
*** = p < 0.005

Table 3-9. Summary Statistics-Centrifugate

Parameter	Fraction	Location	n	Mean	St Dev	Median	Min	Max	Min Detect	Max Detect	Min Non-Detect	Max Non-Detect	Units	FOD	EcoSV[a]	Eco Source	Eco FOE[b]	DwSV[c]	DW Source	DW FOE[d]	Date Range
Target																					
Benzo(a)pyrene	Centrifugate	HR/B	2	0.01	0	0.01	0.01	0.01			0.01	0.01	µg/L	0%	0.015	1	0%	0.01	5	0%	2004-2005
C11-C60 Hydrocarbons	Centrifugate	HR/B	4	50	0	50	50	50			50	50	µg/L	0%	NSV		NA	NSV		NA	2004-2005
M,P-Xylene (sum of isomers)	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Naphthalene	Centrifugate	HR/B	2	0.02	0.014	0.02	0.01	0.03	0.03	0.03	0.01	0.01	µg/L	50%	1.1	1	0%	NSV		NA	2004-2005
O-Xylene (1,2-Dimethylbenzene)	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Pyrene	Centrifugate	HR/B	2	0.01	0	0.01	0.01	0.01			0.01	0.01	µg/L	0%	0.025	1	0%	NSV		NA	2004-2005
Non-Target																					
1,1,1-Trichloroethane	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
1,1,2,2-Tetrachloroethane	Centrifugate	HR/B	4	20	0	20	20	20			20	20	µg/L	0%	NSV		NA	NSV		NA	2004-2005
1,1,2-Trichloroethane	Centrifugate	HR/B	4	2	0	2	2	2			2	2	µg/L	0%	NSV		NA	NSV		NA	2004-2005
1,1-Dichloroethane	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
1,1-Dichloroethene	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
1,2,3-Trichloropropane	Centrifugate	HR/B	4	5	0	5	5	5			5	5	µg/L	0%	NSV		NA	NSV		NA	2004-2005
1,2-Dibromoethane (Ethylene dibromide)	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
1,2-Dichlorobenzene	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	150	1	0%	NSV		NA	2004-2005
1,2-Dichloroethane	Centrifugate	HR/B	4	2	0	2	2	2			2	2	µg/L	0%	100	1	0%	5	5	0%	2004-2005
1,2-Dichloropropane	Centrifugate	HR/B	4	2	0	2	2	2			2	2	µg/L	0%	NSV		NA	NSV		NA	2004-2005
1,3-Dichlorobenzene	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
1,4-Dichlorobenzene	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
1-Bromo-4-fluorobenzene (4-Bromofluorobenzene)	Centrifugate	HR/B	4	98	2.9	98	94	101	94	101			%	100%	NSV		NA	NSV		NA	2004-2005
2-Chloroethyl vinyl ether	Centrifugate	HR/B	4	10	0	10	10	10			10	10	µg/L	0%	NSV		NA	NSV		NA	2004-2005
2-Fluorobiphenyl	Centrifugate	HR/B	2	68	13	68	58	77	58	77			%	100%	NSV		NA	NSV		NA	2004-2005
2-Hexanone	Centrifugate	HR/B	4	10	0	10	10	10			10	10	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Acenaphthene	Centrifugate	HR/B	2	0.015	0.0071	0.015	0.01	0.02	0.02	0.02	0.01	0.01	µg/L	50%	5.8	1	0%	NSV		NA	2004-2005
Acenaphthylene	Centrifugate	HR/B	2	0.01	0	0.01	0.01	0.01			0.01	0.01	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Acetone	Centrifugate	HR/B	4	100	0	100	100	100			100	100	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Acrolein	Centrifugate	HR/B	4	100	0	100	100	100			100	100	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Acrylonitrile	Centrifugate	HR/B	4	100	0	100	100	100			100	100	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Anthracene	Centrifugate	HR/B	2	0.01	0	0.01	0.01	0.01			0.01	0.01	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Benzene	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Benzo(a)anthracene	Centrifugate	HR/B	2	0.01	0	0.01	0.01	0.01			0.01	0.01	µg/L	0%	0.018	1	0%	NSV		NA	2004-2005
Benzo(b)fluoranthene	Centrifugate	HR/B	2	0.01	0	0.01	0.01	0.01			0.01	0.01	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Benzo(g,h,i)perylene	Centrifugate	HR/B	2	0.01	0	0.01	0.01	0.01			0.01	0.01	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Benzo(k)fluoranthene	Centrifugate	HR/B	2	0.01	0	0.01	0.01	0.01			0.01	0.01	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Bromodichloromethane	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Bromoform	Centrifugate	HR/B	4	3	0	3	3	3			3	3	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Bromomethane	Centrifugate	HR/B	4	10	0	10	10	10			10	10	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Carbon Disulfide	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Carbon Tetrachloride	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Chlorobenzene	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Chloroethane	Centrifugate	HR/B	4	10	0	10	10	10			10	10	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Chloroform	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Chloromethane	Centrifugate	HR/B	4	10	0	10	10	10			10	10	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Chrysene	Centrifugate	HR/B	2	0.01	0	0.01	0.01	0.01			0.01	0.01	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Cis-1,2-Dichloroethylene	Centrifugate	HR/B	2	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2005-2005
Cis-1,3-Dichloropropene	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Cis-1,4-Dichloro-2-Butene	Centrifugate	HR/B	4	10	0	10	10	10			10	10	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Dibenz(a,h)anthracene	Centrifugate	HR/B	2	0.01	0	0.01	0.01	0.01			0.01	0.01	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Dibromochloromethane	Centrifugate	HR/B	4	3	0	3	3	3			3	3	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Dibromomethane	Centrifugate	HR/B	4	3	0	3	3	3			3	3	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Dichlorodifluoromethane	Centrifugate	HR/B	4	3	0	3	3	3			3	3	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Ethanol	Centrifugate	HR/B	4	300	0	300	300	300			300	300	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Ethyl Methacrylate	Centrifugate	HR/B	4	10	0	10	10	10			10	10	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Ethylbenzene	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Fluoranthene	Centrifugate	HR/B	2	0.01	0	0.01	0.01	0.01			0.01	0.01	µg/L	0%	0.04	1	0%	NSV		NA	2004-2005
Fluorene	Centrifugate	HR/B	2	0.02	0.014	0.02	0.01	0.03	0.03	0.03	0.01	0.01	µg/L	50%	3	1	0%	NSV		NA	2004-2005

Table 3-9. Summary Statistics-Centrifugate

Parameter	Fraction	Location	n	Mean	St Dev	Median	Min	Max	Min Detect	Max Detect	Min Non-Detect	Max Non-Detect	Units	FOD	EcoSV[a]	Eco Source	Eco FOE[b]	DwSV[c]	DW Source	DW FOE[d]	Date Range
Indeno(1,2,3-c,d)pyrene	Centrifugate	HR/B	2	0.01	0	0.01	0.01	0.01			0.01	0.01	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Iodomethane (Methyl Iodide)	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Methyl Ethyl Ketone (2-Butanone)	Centrifugate	HR/B	4	100	0	100	100	100			100	100	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	Centrifugate	HR/B	4	10	0	10	10	10			10	10	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Methylene Chloride	Centrifugate	HR/B	4	454	897	8	1	1800	6	1800	1	1	µg/L	75%	98	1	25%	NSV		NA	2004-2005
Methylnaphthalenes (sum of isomers)	Centrifugate	HR/B	2	0.03	0.014	0.03	0.02	0.04	0.02	0.04			µg/L	100%	NSV		NA	NSV		NA	2004-2005
Phenanthrene	Centrifugate	HR/B	2	0.03	0.028	0.03	0.01	0.05			0.01	0.05	µg/L	0%	0.4	1	0%	NSV		NA	2004-2005
Styrene	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Tetrachloroethylene(PCE)	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Toluene	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	2	1	0%	NSV		NA	2004-2005
Trans-1,2-Dichloroethene	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Trans-1,3-Dichloropropene	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Trans-1,4-Dichloro-2-Butene	Centrifugate	HR/B	4	10	0	10	10	10			10	10	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Trichloroethylene (TCE)	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Trichlorofluoromethane	Centrifugate	HR/B	4	1	0	1	1	1			1	1	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Vinyl Acetate	Centrifugate	HR/B	4	100	0	100	100	100			100	100	µg/L	0%	NSV		NA	NSV		NA	2004-2005
Vinyl Chloride	Centrifugate	HR/B	4	2	0	2	2	2			2	2	µg/L	0%	NSV		NA	NSV		NA	2004-2005

a: Ecological Screening Value
b: Ecological Screening Value-Frequency of Exceedance
c: Drinking Water Screening Value
d: Drinking Water Screening Value-Frequency of Exceedance

DW: drinking water
Dw/SV: drinking water screening value
FOD: frequency of detection
FOE: frequency of exceedance
HR/B: Hay River at the Alberta/NWT Border
µg/L: micrograms per litre
NA: not available
NSV: no screening value
uS/cm: micro Siemens per centimeter

Screening Values Sources
1: CCME 2007
2: CEQG Summary Tables
3: Alberta Environment 1999
4: CCME 2002
5: Health Canada 2010

Table 3-10. Summary Statistics-Suspended Sediment

Parameter	Fraction	Location	n	Mean	St Dev	Median	Min	Max	Min Detect	Max Detect	Min Non-Detect	Max Non-Detect	Units	FOD	EcoSV[a]	Eco Source	Eco FOE[b]	Date Range
Target																		
Arsenic	Total	HR/B	8	18	1.3	18	16	20	16	20			mg/kg	100%	5.9	2	100%	1995-2005
Benzo(a)pyrene	Total	HR/B	12	0.18	0.13	0.28	0.01	0.29			0.01	0.29	mg/kg	0%	0.032	2	75%	1995-2005
C11-C60 Hydrocarbons	Total	HR/B	3	397	326	300	130	760	130	760			mg/kg	100%	NSV		NA	2004-2005
Cadmium	Total	HR/B	8	0.93	0.1	0.95	0.7	1	0.7	0.9	1	1	mg/kg	50%	0.6	2	100%	1995-2005
Calcium	Total	HR/B	4	10068	616	9960	9450	10900	9450	10900			mg/kg	100%	NSV		NA	1999-2005
Carbon Organic	Total	HR/B	8	3.2	1.6	2.8	2	6.9	2	6.9			%	100%	NSV		NA	1995-2005
Chromium, Total	Total	HR/B	8	83	16	81	67	118	67	118			mg/kg	100%	37	2	100%	1995-2005
Cobalt	Total	HR/B	8	15	2.1	14	11	18	11	18			mg/kg	100%	NSV		NA	1995-2005
Copper	Total	HR/B	8	29	7.6	28	17	43	17	43			mg/kg	100%	36	2	13%	1995-2005
Iron	Total	HR/B	8	39875	4784	39100	32900	48400	32900	48400			mg/kg	100%	NSV		NA	1995-2005
Lead	Total	HR/B	8	15	2.7	15	10	18	10	18			mg/kg	100%	35	2	0%	1995-2005
Magnesium	Total	HR/B	4	9115	884	8875	8410	10300	8410	10300			mg/kg	100%	NSV		NA	1999-2005
Manganese	Total	HR/B	8	1022	899	758	409	3190	409	3190			mg/kg	100%	NSV		NA	1995-2005
Mercury	Total	HR/B	8	0.083	0.0085	0.087	0.07	0.092	0.07	0.092			mg/kg	100%	0.17	2	0%	1995-2005
Naphthalene	Total	HR/B	10	0.061	0.035	0.083	0.01	0.086			0.01	0.086	mg/kg	0%	0.035	2	70%	1997-2005
Nickel	Total	HR/B	8	42	6.7	42	30	53	30	53			mg/kg	100%	NSV		NA	1995-2005
Phosphorus, Total (as P)	Total	HR/B	4	1086	110	1100	952	1190	952	1190			mg/kg	100%	NSV		NA	1999-2005
Potassium	Total	HR/B	4	11508	2739	11530	8770	14200	8770	14200			mg/kg	100%	NSV		NA	1999-2005
Pyrene	Total	HR/B	12	0.063	0.042	0.094	0.01	0.1			0.01	0.1	mg/kg	0%	0.053	2	58%	1995-2005
Sodium	Total	HR/B	4	532	39	524	500	579	548	579	500	500	mg/kg	50%	NSV		NA	1999-2005
Strontium	Total	HR/B	4	71	41	85	11	104	11	104			mg/kg	100%	NSV		NA	1999-2005
Uranium	Total	HR/B	4	2.6	0.32	2.6	2.2	3	2.2	3			mg/kg	100%	NSV		NA	1999-2005
Vanadium	Total	HR/B	5	156	23	156	130	183	130	183			mg/kg	100%	NSV		NA	1998-2005
Zinc	Total	HR/B	8	143	15	147	110	158	110	158			mg/kg	100%	123	2	88%	1995-2005
Non-Target																		
1,2,3,4-Tetrachlorobenzene	Total	HR/B	4	0.0031	0.0022	0.0031	0.0012	0.005			0.0012	0.005	mg/kg	0%	NSV		NA	1995-1999
1,2,3,4-Tetrahydronaphthalene	Total	HR/B	9	0.11	0.052	0.14	0.017	0.14			0.017	0.14	mg/kg	0%	NSV		NA	1995-2005
1,2,3-Trichlorobenzene	Total	HR/B	4	0.0027	0.00053	0.0027	0.0022	0.0031			0.0022	0.0031	mg/kg	0%	NSV		NA	1995-1999
1,2,4-Trichlorobenzene	Total	HR/B	4	0.0029	0.0015	0.0029	0.0016	0.0042			0.0016	0.0042	mg/kg	0%	NSV		NA	1995-1999
1,2-Dichlorobenzene	Total	HR/B	4	0.013	0.0071	0.013	0.0067	0.019			0.0067	0.019	mg/kg	0%	NSV		NA	1995-1999
1,3,5-Trichlorobenzene	Total	HR/B	4	0.002	0.00004	0.002	0.0019	0.002			0.0019	0.002	mg/kg	0%	NSV		NA	1995-1999
1,3-Dichlorobenzene	Total	HR/B	3	0.016	0.0057	0.019	0.0089	0.019			0.0089	0.019	mg/kg	0%	NSV		NA	1995-1997
1,4-Dichlorobenzene	Total	HR/B	4	0.013	0.0053	0.013	0.0082	0.017			0.0082	0.017	mg/kg	0%	NSV		NA	1995-1999
1-Methylnaphthalene	Total	HR/B	11	0.093	0.059	0.13	0.01	0.14	0.01	0.03	0.017	0.14	mg/kg	18%	NSV		NA	1995-2005
2-Chloronaphthalene	Total	HR/B	9	0.1	0.049	0.13	0.017	0.13			0.017	0.13	mg/kg	0%	NSV		NA	1995-2005
2-Methylnaphthalene	Total	HR/B	9	0.076	0.04	0.073	0.017	0.13			0.017	0.13	mg/kg	0%	0.02	4	78%	1995-2005
Acenaphthene	Total	HR/B	11	0.13	0.09	0.19	0.01	0.2			0.01	0.2	mg/kg	0%	0.0067	2	100%	1995-2005
Acenaphthylene	Total	HR/B	11	0.093	0.063	0.14	0.01	0.14			0.01	0.14	mg/kg	0%	0.0059	2	100%	1995-2005
Aldrin	Total	HR/B	10	0.0019	0.0013	0.0015	0.00067	0.005			0.00067	0.005	mg/kg	0%	NSV		NA	1995-2005
Alpha Bhc (Alpha Hexachlorocyclohexane)	Total	HR/B	10	0.002	0.0014	0.0017	0.00067	0.005			0.00067	0.005	mg/kg	0%	NSV		NA	1995-2005
Alpha Endosulfan	Total	HR/B	10	0.0025	0.0015	0.0025	0.00067	0.0052			0.00067	0.0052	mg/kg	0%	NSV		NA	1995-2005
Alpha-Chlordane	Total	HR/B	10	0.0033	0.0022	0.0034	0.00067	0.0081			0.00067	0.0081	mg/kg	0%	NSV		NA	1995-2005
Aluminum	Total	HR/B	8	61200	13593	61850	41500	77800	41500	77800			mg/kg	100%	NSV		NA	1995-2005
Anthracene	Total	HR/B	9	0.068	0.034	0.083	0.01	0.1			0.01	0.1	mg/kg	0%	NSV		NA	1997-2005
Antimony	Total	HR/B	4	0.43	0.15	0.4	0.3	0.6	0.3	0.6			mg/kg	100%	NSV		NA	1999-2005
Barium	Total	HR/B	5	632	123	614	528	840	528	840			mg/kg	100%	NSV		NA	1998-2005
Benzo(a)anthracene	Total	HR/B	10	0.063	0.037	0.083	0.01	0.1			0.01	0.1	mg/kg	0%	0.032	2	70%	1997-2005
Benzo(b)fluoranthene	Total	HR/B	12	0.18	0.13	0.28	0.01	0.3			0.01	0.3	mg/kg	0%	NSV		NA	1995-2005
Benzo(g,h,i)perylene	Total	HR/B	11	0.39	0.28	0.58	0.01	0.61			0.01	0.61	mg/kg	0%	NSV		NA	1995-2005
Benzo(k)fluoranthene	Total	HR/B	12	0.27	0.21	0.43	0.01	0.46			0.01	0.46	mg/kg	0%	NSV		NA	1995-2005
Benzo[e]pyrene	Total	HR/B	7	0.083	0.0015	0.083	0.081	0.086			0.081	0.086	mg/kg	0%	NSV		NA	1997-2005
Beryllium	Total	HR/B	4	1.8	0.26	1.8	1.5	2.1	1.5	2.1			mg/kg	100%	NSV		NA	1999-2005

Table 3-10. Summary Statistics-Suspended Sediment

Parameter	Fraction	Location	n	Mean	St Dev	Median	Min	Max	Min Detect	Max Detect	Min Non-Detect	Max Non-Detect	Units	FOD	EcoSV[a]	Eco Source	Eco FOE[b]	Date Range
Beta Bhc (Beta Hexachlorocyclohexane)	Total	HR/B	3	0.0023	0.0023	0.001	0.001	0.005			0.001	0.005	mg/kg	0%	NSV		NA	2004-2005
Beta Endosulfan	Total	HR/B	11	0.0042	0.0026	0.0048	0.00067	0.0098			0.00067	0.0098	mg/kg	0%	NSV		NA	1995-2005
Bismuth	Total	HR/B	4	0.28	0.096	0.25	0.2	0.4	0.2	0.4			mg/kg	100%	NSV		NA	1999-2005
Carbon Inorganic	Total	HR/B	8	0.28	0.14	0.32	0.03	0.43	0.03	0.43			%	100%	NSV		NA	1995-2005
Chrysene	Total	HR/B	9	0.067	0.032	0.083	0.01	0.086			0.01	0.086	mg/kg	0%	0.057	2	78%	1997-2005
Clay	Total	HR/B	1	26	NA	26	26	26	26	26			%	100%	NSV		NA	2005-2005
Dibenz(a,h)anthracene	Total	HR/B	10	0.12	0.076	0.17	0.01	0.17			0.01	0.17	mg/kg	0%	0.0062	2	100%	1997-2005
Dieldrin	Total	HR/B	10	0.0026	0.002	0.0025	0.0004	0.0068			0.0004	0.0068	mg/kg	0%	NSV		NA	1995-2005
Endrin	Total	HR/B	10	0.0041	0.0033	0.0041	0.00067	0.012			0.00067	0.012	mg/kg	0%	NSV		NA	1995-2005
Fluoranthene	Total	HR/B	11	0.062	0.036	0.087	0.01	0.091			0.01	0.091	mg/kg	0%	0.11	2	0%	1995-2005
Fluorene	Total	HR/B	11	0.12	0.081	0.18	0.01	0.18			0.01	0.18	mg/kg	0%	0.021	2	82%	1995-2005
Gamma BHC (Lindane)	Total	HR/B	9	0.0022	0.0019	0.0013	0.001	0.0058			0.001	0.0058	mg/kg	0%	NSV		NA	1996-2005
Gamma-Chlordane	Total	HR/B	10	0.0022	0.0015	0.0019	0.00067	0.005			0.00067	0.005	mg/kg	0%	NSV		NA	1995-2005
Heptachlor	Total	HR/B	10	0.0024	0.0021	0.0019	0.00067	0.0072			0.00067	0.0072	mg/kg	0%	NSV		NA	1995-2005
Heptachlor Epoxide	Total	HR/B	10	0.0021	0.0017	0.0016	0.00067	0.0053			0.00067	0.0053	mg/kg	0%	NSV		NA	1995-2005
Hexachlorobenzene	Total	HR/B	7	0.0015	0.0019	0.00082	0.00067	0.0058			0.00067	0.0058	mg/kg	0%	NSV		NA	1995-2005
Indene	Total	HR/B	9	0.12	0.056	0.15	0.017	0.15			0.017	0.15	mg/kg	0%	NSV		NA	1995-2005
Indeno(1,2,3-c,d)pyrene	Total	HR/B	12	0.23	0.18	0.37	0.01	0.39			0.01	0.39	mg/kg	0%	NSV		NA	1995-2005
Lithium	Total	HR/B	3	54	9.1	55	44	62	44	62			mg/kg	100%	NSV		NA	2004-2005
Methoxychlor	Total	HR/B	11	0.022	0.022	0.025	0.00067	0.08	0.001	0.001	0.00067	0.08	mg/kg	9%	NSV		NA	1995-2005
Mirex	Total	HR/B	11	0.0025	0.002	0.0022	0.00067	0.0073			0.00067	0.0073	mg/kg	0%	NSV		NA	1995-2005
Moisture, Percent	Total	HR/B	12	40	1.7	40	38	44	38	44			%	100%	NSV		NA	1995-2005
Molybdenum	Total	HR/B	5	5.3	3.1	3.9	2.3	10	2.3	6.8	10	10	mg/kg	80%	NSV		NA	1998-2005
Nitrogen	Total	HR/B	1	0.31	NA	0.31	0.31	0.31	0.31	0.31			%	100%	NSV		NA	1999-1999
Nitrogen Organic	Total	HR/B	8	0.32	0.23	0.21	0.17	0.85	0.17	0.85			%	100%	NSV		NA	1995-2005
O,P'-DDT	Total	HR/B	8	0.0081	0.004	0.0081	0.00067	0.016			0.00067	0.016	mg/kg	0%	NSV		NA	1995-2005
Oxychlordane	Total	HR/B	3	0.0023	0.0023	0.001	0.001	0.005			0.001	0.005	mg/kg	0%	NSV		NA	2004-2005
P,P'-DDD	Total	HR/B	11	0.0039	0.008	0.0013	0.00067	0.028			0.00067	0.028	mg/kg	0%	NSV		NA	1995-2005
P,P'-DDT	Total	HR/B	22	0.004	0.0033	0.0035	0.00067	0.016	0.00067	0.00067	0.00067	0.016	mg/kg	5%	0.0012	4	77%	1995-2005
PCB, Total	Total	HR/B	7	0.055	0.043	0.05	0.015	0.15			0.015	0.15	mg/kg	0%	NSV		NA	1995-2005
PCB-1016 (Aroclor 1016)	Total	HR/B	3	0.01	0	0.01	0.01	0.01			0.01	0.01	mg/kg	0%	NSV		NA	2004-2005
PCB-1221 (Aroclor 1221)	Total	HR/B	3	0.01	0	0.01	0.01	0.01			0.01	0.01	mg/kg	0%	NSV		NA	2004-2005
PCB-1232 (Aroclor 1232)	Total	HR/B	3	0.01	0	0.01	0.01	0.01			0.01	0.01	mg/kg	0%	NSV		NA	2004-2005
PCB-1242 (Aroclor 1242)	Total	HR/B	3	0.01	0	0.01	0.01	0.01			0.01	0.01	mg/kg	0%	NSV		NA	2004-2005
PCB-1248 (Aroclor 1248)	Total	HR/B	3	0.01	0	0.01	0.01	0.01			0.01	0.01	mg/kg	0%	NSV		NA	2004-2005
PCB-1254 (Aroclor 1254)	Total	HR/B	3	0.01	0	0.01	0.01	0.01			0.01	0.01	mg/kg	0%	NSV		NA	2004-2005
PCB-1260 (Aroclor 1260)	Total	HR/B	3	0.01	0	0.01	0.01	0.01			0.01	0.01	mg/kg	0%	NSV		NA	2004-2005
PCB-1262 (Aroclor 1262)	Total	HR/B	3	0.01	0	0.01	0.01	0.01			0.01	0.01	mg/kg	0%	NSV		NA	2004-2005
PCB-1268 (Aroclor 1268)	Total	HR/B	3	0.01	0	0.01	0.01	0.01			0.01	0.01	mg/kg	0%	NSV		NA	2004-2005
Pentachlorobenzene	Total	HR/B	8	0.0017	0.0017	0.00077	0.00074	0.0045			0.00074	0.0045	mg/kg	0%	NSV		NA	1995-2005
Pentachloronitrobenzene	Total	HR/B	3	0.0023	0.0023	0.001	0.001	0.005			0.001	0.005	mg/kg	0%	NSV		NA	2004-2005
Perylene	Total	HR/B	7	0.16	0.043	0.16	0.1	0.24	0.13	0.24	0.1	0.16	mg/kg	57%	NSV		NA	1997-2005
Phenanthrene	Total	HR/B	12	0.1	0.078	0.16	0.01	0.17			0.01	0.17	mg/kg	0%	0.042	2	58%	1995-2005
Quinoline	Total	HR/B	1	0.01	NA	0.01	0.01	0.01			0.01	0.01	mg/kg	0%	NSV		NA	2004-2004
Sand	Total	HR/B	1	45	NA	45	45	45	45	45			%	100%	NSV		NA	2005-2005
Selenium	Total	HR/B	4	1.2	0.17	1.1	1	1.4	1	1.4			mg/kg	100%	NSV		NA	1995-1998
Silt	Total	HR/B	1	29	NA	29	29	29	29	29			%	100%	NSV		NA	2005-2005
Thallium	Total	HR/B	4	0.7	0.15	0.7	0.55	0.85	0.55	0.85			mg/kg	100%	NSV		NA	1999-2005

Table 3-10. Summary Statistics-Suspended Sediment

Parameter	Fraction	Location	n	Mean	St Dev	Median	Min	Max	Min Detect	Max Detect	Min Non-Detect	Max Non-Detect	Units	FOD	EcoSV[a]	Eco Source	Eco FOE[b]	Date Range
Tin	Total	HR/B	3	0.4	0.17	0.3	0.3	0.6	0.3	0.6			mg/kg	100%	NSV		NA	2004-2005
Toxaphene	Total	HR/B	1	0.01	NA	0.01	0.01	0.01			0.01	0.01	mg/kg	0%	NSV		NA	2004-2004
Trans-Nonachlor	Total	HR/B	3	0.0023	0.0023	0.001	0.001	0.005			0.001	0.005	mg/kg	0%	NSV		NA	2004-2005

a: Ecological Screening Value
b: Ecological Screening Value-Frequency of Exceedance

FOD: frequency of detection
FOE: frequency of exceedance
HR/B: Hay River at the Alberta/NWT border
mg/kg: milligrams per kilogram
NA: not available
NSV: no screening value
Screening Values Sources
1: CCME 2007
2: CEQG Summary Tables
3: Alberta Environment 1999
4: CCME 2002
5: Health Canada 2010

Table 3-11. Correlations in Suspended Sediment

	ARSENIC	BENZO(A)PYRENE	CADMIUM	CALCIUM	CHROMIUM	COBALT	COPPER
Arsenic		-0.31(NS) n=8	0.57(NS) n=8	-0.19(NS) n=4	0.45(NS) n=8	0.51(NS) n=8	0.46(NS) n=8
Benzo(a)pyrene	-0.31(NS) n=8		0.04(NS) n=8	-0.02(NS) n=4	-0.05(NS) n=8	-0.22(NS) n=8	-0.04(NS) n=8
Cadmium	0.57(NS) n=8	0.04(NS) n=8		0.27(NS) n=4	0.18(NS) n=8	0.07(NS) n=8	0.03(NS) n=8
Calcium	-0.19(NS) n=4	-0.02(NS) n=4	0.27(NS) n=4		-0.62(NS) n=4	0.87(NS) n=4	0.28(NS) n=4
Chromium	0.45(NS) n=8	-0.05(NS) n=8	0.18(NS) n=8	-0.62(NS) n=4		0.25(NS) n=8	0.19(NS) n=8
Cobalt	0.51(NS) n=8	-0.22(NS) n=8	0.07(NS) n=8	0.87(NS) n=4	0.25(NS) n=8		0.47(NS) n=8
Copper	0.46(NS) n=8	-0.04(NS) n=8	0.03(NS) n=8	0.28(NS) n=4	0.19(NS) n=8	0.47(NS) n=8	
Carbon Organic	0.53(NS) n=8	-0.55(NS) n=8	0.15(NS) n=8	-0.09(NS) n=4	-0.06(NS) n=8	-0.2(NS) n=8	0.02(NS) n=8
Iron	0.67(NS) n=8	-0.48(NS) n=8	-0.05(NS) n=8	-0.83(NS) n=4	0.34(NS) n=8	0.08(NS) n=8	0.38(NS) n=8
Lead	-0.32(NS) n=8	-0.1(NS) n=8	-0.39(NS) n=8	-0.35(NS) n=4	0.31(NS) n=8	-0.24(NS) n=8	0.39(NS) n=8
Magnesium	0.81(NS) n=4	0.92(NS) n=4	0.53(NS) n=4	-0.26(NS) n=4	0.41(NS) n=4	-0.67(NS) n=4	0.84(NS) n=4
Manganese	0.53(NS) n=8	-0.51(NS) n=8	0.15(NS) n=8	-0.97(*) n=4	-0.06(NS) n=8	-0.22(NS) n=8	0(NS) n=8
Mercury	-0.13(NS) n=8	0.19(NS) n=8	0.33(NS) n=8	-0.11(NS) n=4	0.41(NS) n=8	0.29(NS) n=8	-0.29(NS) n=8
Naphthalene	0.3(NS) n=6	1(***) n=7	0.68(NS) n=6	-0.01(NS) n=4	-0.13(NS) n=6	-0.07(NS) n=6	0.17(NS) n=6
Nickel	0.35(NS) n=8	-0.47(NS) n=8	-0.26(NS) n=8	-0.3(NS) n=4	0.64(NS) n=8	0.19(NS) n=8	0.41(NS) n=8
Phosphorus	0.71(NS) n=4	0.5(NS) n=4	0.28(NS) n=4	-0.8(NS) n=4	0.77(NS) n=4	-0.99(*) n=4	0.29(NS) n=4
Potassium	0.94(NS) n=4	0.69(NS) n=4	0.67(NS) n=4	-0.41(NS) n=4	0.72(NS) n=4	-0.8(NS) n=4	0.62(NS) n=4
Pyrene	-0.29(NS) n=8	1(***) n=9	0.06(NS) n=8	-0.02(NS) n=4	-0.05(NS) n=8	-0.22(NS) n=8	-0.03(NS) n=8
Sodium	0.86(NS) n=4	0.84(NS) n=4	0.55(NS) n=4	-0.38(NS) n=4	0.54(NS) n=4	-0.77(NS) n=4	0.74(NS) n=4
Strontium	-0.36(NS) n=4	-0.96(*) n=4	-0.24(NS) n=4	-0.21(NS) n=4	0.26(NS) n=4	0.13(NS) n=4	-0.95(*) n=4
C11-C60 Hydrocarbons	0.97(NS) n=3	0.87(NS) n=3	0.71(NS) n=3	-0.49(NS) n=3	0.99(NS) n=3	-0.75(NS) n=3	0.07(NS) n=3
Uranium	0.74(NS) n=4	-0.14(NS) n=4	0.73(NS) n=4	-0.28(NS) n=4	0.92(NS) n=4	-0.47(NS) n=4	-0.09(NS) n=4
Vanadium	0.77(NS) n=5	0.57(NS) n=5	0.51(NS) n=5	-0.42(NS) n=4	0.65(NS) n=5	-0.17(NS) n=5	0.49(NS) n=5
Zinc	0.58(NS) n=8	-0.43(NS) n=8	-0.21(NS) n=8	-0.6(NS) n=4	0.53(NS) n=8	0.5(NS) n=8	0.74(*) n=8

Notes

* = p < 0.05

** = p < 0.01

*** = p < 0.005

Table 3-11. Correlations in Suspended Sediment

	CARBON ORGANIC	IRON	LEAD	MAGNESIUM	MANGANESE	MERCURY	NAPHTHALENE
Arsenic	0.53(NS) n=8	0.67(NS) n=8	-0.32(NS) n=8	0.81(NS) n=4	0.53(NS) n=8	-0.13(NS) n=8	0.3(NS) n=6
Benzo(a)pyrene	-0.55(NS) n=8	-0.48(NS) n=8	-0.1(NS) n=8	0.92(NS) n=4	-0.51(NS) n=8	0.19(NS) n=8	1(***) n=7
Cadmium	0.15(NS) n=8	-0.05(NS) n=8	-0.39(NS) n=8	0.53(NS) n=4	0.15(NS) n=8	0.33(NS) n=8	0.68(NS) n=6
Calcium	-0.09(NS) n=4	-0.83(NS) n=4	-0.35(NS) n=4	-0.26(NS) n=4	-0.97(*) n=4	-0.11(NS) n=4	-0.01(NS) n=4
Chromium	-0.06(NS) n=8	0.34(NS) n=8	0.31(NS) n=8	0.41(NS) n=4	-0.06(NS) n=8	0.41(NS) n=8	-0.13(NS) n=6
Cobalt	-0.2(NS) n=8	0.08(NS) n=8	-0.24(NS) n=8	-0.67(NS) n=4	-0.22(NS) n=8	0.29(NS) n=8	-0.07(NS) n=6
Copper	0.02(NS) n=8	0.38(NS) n=8	0.39(NS) n=8	0.84(NS) n=4	0(NS) n=8	-0.29(NS) n=8	0.17(NS) n=6
Carbon Organic		0.8(*) n=8	-0.21(NS) n=8	0.08(NS) n=4	0.99(***) n=8	-0.7(NS) n=8	-0.72(NS) n=6
Iron	0.8(*) n=8		0.07(NS) n=8	0.75(NS) n=4	0.82(*) n=8	-0.65(NS) n=8	-0.28(NS) n=6
Lead	-0.21(NS) n=8	0.07(NS) n=8		0.89(NS) n=4	-0.25(NS) n=8	-0.05(NS) n=8	-0.41(NS) n=6
Magnesium	0.08(NS) n=4	0.75(NS) n=4	0.89(NS) n=4		0.49(NS) n=4	-0.34(NS) n=4	0.92(NS) n=4
Manganese	0.99(***) n=8	0.82(*) n=8	-0.25(NS) n=8	0.49(NS) n=4		-0.72(*) n=8	-0.48(NS) n=6
Mercury	-0.7(NS) n=8	-0.65(NS) n=8	-0.05(NS) n=8	-0.34(NS) n=4	-0.72(*) n=8		0.07(NS) n=6
Naphthalene	-0.72(NS) n=6	-0.28(NS) n=6	-0.41(NS) n=6	0.92(NS) n=4	-0.48(NS) n=6	0.07(NS) n=6	
Nickel	0.35(NS) n=8	0.64(NS) n=8	0.54(NS) n=8	0.19(NS) n=4	0.29(NS) n=8	-0.17(NS) n=8	-0.65(NS) n=6
Phosphorus	0.28(NS) n=4	0.99(**) n=4	0.84(NS) n=4	0.77(NS) n=4	0.92(NS) n=4	0.03(NS) n=4	0.5(NS) n=4
Potassium	0.42(NS) n=4	0.84(NS) n=4	0.99(**) n=4	0.92(NS) n=4	0.63(NS) n=4	0.04(NS) n=4	0.7(NS) n=4
Pyrene	-0.55(NS) n=8	-0.48(NS) n=8	-0.11(NS) n=8	0.92(NS) n=4	-0.51(NS) n=8	0.19(NS) n=8	1(***) n=7
Sodium	0.18(NS) n=4	0.83(NS) n=4	0.94(NS) n=4	0.99(*) n=4	0.6(NS) n=4	-0.22(NS) n=4	0.84(NS) n=4
Strontium	0.44(NS) n=4	-0.26(NS) n=4	-0.43(NS) n=4	-0.77(NS) n=4	0.02(NS) n=4	0.78(NS) n=4	-0.96(*) n=4
C11-C60 Hydrocarbons	0.91(NS) n=3	0.73(NS) n=3	1(**) n=3	0.98(NS) n=3	0.6(NS) n=3	0.92(NS) n=3	0.9(NS) n=3
Uranium	0.97(*) n=4	0.4(NS) n=4	0.65(NS) n=4	0.24(NS) n=4	0.36(NS) n=4	0.83(NS) n=4	-0.13(NS) n=4
Vanadium	0.17(NS) n=5	0.52(NS) n=5	0.71(NS) n=5	0.94(NS) n=4	0.48(NS) n=5	0(NS) n=5	0.57(NS) n=5
Zinc	0.31(NS) n=8	0.76(*) n=8	0.41(NS) n=8	0.91(NS) n=4	0.29(NS) n=8	-0.32(NS) n=8	-0.34(NS) n=6

Notes

* = p < 0.05

** = p < 0.01

*** = p < 0.005

Table 3-11. Correlations in Suspended Sediment

	NICKEL	PHOSPHORUS	POTASSIUM	PYRENE	SODIUM	STRONTIUM	C11-C60 HYDROCARBONS
Arsenic	0.35(NS) n=8	0.71(NS) n=4	0.94(NS) n=4	-0.29(NS) n=8	0.86(NS) n=4	-0.36(NS) n=4	0.97(NS) n=3
Benzo(a)pyrene	-0.47(NS) n=8	0.5(NS) n=4	0.69(NS) n=4	1(***) n=9	0.84(NS) n=4	-0.96(*) n=4	0.87(NS) n=3
Cadmium	-0.26(NS) n=8	0.28(NS) n=4	0.67(NS) n=4	0.06(NS) n=8	0.55(NS) n=4	-0.24(NS) n=4	0.71(NS) n=3
Calcium	-0.3(NS) n=4	-0.8(NS) n=4	-0.41(NS) n=4	-0.02(NS) n=4	-0.38(NS) n=4	-0.21(NS) n=4	-0.49(NS) n=3
Chromium	0.64(NS) n=8	0.77(NS) n=4	0.72(NS) n=4	-0.05(NS) n=8	0.54(NS) n=4	0.26(NS) n=4	0.99(NS) n=3
Cobalt	0.19(NS) n=8	-0.99(*) n=4	-0.8(NS) n=4	-0.22(NS) n=8	-0.77(NS) n=4	0.13(NS) n=4	-0.75(NS) n=3
Copper	0.41(NS) n=8	0.29(NS) n=4	0.62(NS) n=4	-0.03(NS) n=8	0.74(NS) n=4	-0.95(*) n=4	0.07(NS) n=3
Carbon Organic	0.35(NS) n=8	0.28(NS) n=4	0.42(NS) n=4	-0.55(NS) n=8	0.18(NS) n=4	0.44(NS) n=4	0.91(NS) n=3
Iron	0.64(NS) n=8	0.99(**) n=4	0.84(NS) n=4	-0.48(NS) n=8	0.83(NS) n=4	-0.26(NS) n=4	0.73(NS) n=3
Lead	0.54(NS) n=8	0.84(NS) n=4	0.99(**) n=4	-0.11(NS) n=8	0.94(NS) n=4	-0.43(NS) n=4	1(**) n=3
Magnesium	0.19(NS) n=4	0.77(NS) n=4	0.92(NS) n=4	0.92(NS) n=4	0.99(*) n=4	-0.77(NS) n=4	0.98(NS) n=3
Manganese	0.29(NS) n=8	0.92(NS) n=4	0.63(NS) n=4	-0.51(NS) n=8	0.6(NS) n=4	0.02(NS) n=4	0.6(NS) n=3
Mercury	-0.17(NS) n=8	0.03(NS) n=4	0.04(NS) n=4	0.19(NS) n=8	-0.22(NS) n=4	0.78(NS) n=4	0.92(NS) n=3
Naphthalene	-0.65(NS) n=6	0.5(NS) n=4	0.7(NS) n=4	1(***) n=7	0.84(NS) n=4	-0.96(*) n=4	0.9(NS) n=3
Nickel		0.47(NS) n=4	0.54(NS) n=4	-0.48(NS) n=8	0.31(NS) n=4	0.42(NS) n=4	0.98(NS) n=3
Phosphorus	0.47(NS) n=4		0.88(NS) n=4	0.51(NS) n=4	0.85(NS) n=4	-0.24(NS) n=4	0.8(NS) n=3
Potassium	0.54(NS) n=4	0.88(NS) n=4		0.7(NS) n=4	0.97(*) n=4	-0.47(NS) n=4	0.99(NS) n=3
Pyrene	-0.48(NS) n=8	0.51(NS) n=4	0.7(NS) n=4		0.85(NS) n=4	-0.96(*) n=4	0.86(NS) n=3
Sodium	0.31(NS) n=4	0.85(NS) n=4	0.97(*) n=4	0.85(NS) n=4		-0.66(NS) n=4	0.97(NS) n=3
Strontium	0.42(NS) n=4	-0.24(NS) n=4	-0.47(NS) n=4	-0.96(*) n=4	-0.66(NS) n=4		0.92(NS) n=3
C11-C60 Hydrocarbons	0.98(NS) n=3	0.8(NS) n=3	0.99(NS) n=3	0.86(NS) n=3	0.97(NS) n=3	0.92(NS) n=3	
Uranium	1(**) n=4	0.49(NS) n=4	0.58(NS) n=4	-0.13(NS) n=4	0.36(NS) n=4	0.36(NS) n=4	0.97(NS) n=3
Vanadium	0.27(NS) n=5	0.88(NS) n=4	1(***) n=4	0.58(NS) n=5	0.98(*) n=4	-0.5(NS) n=4	0.99(NS) n=3
Zinc	0.81(*) n=8	0.96(*) n=4	0.97(*) n=4	-0.43(NS) n=8	0.96(*) n=4	-0.45(NS) n=4	0.9(NS) n=3

Notes

* = p < 0.05

** = p < 0.01

*** = p < 0.005

Table 3-11. Correlations in Suspended Sediment

	URANIUM	VANADIUM	ZINC
Arsenic	0.74(NS) n=4	0.77(NS) n=5	0.58(NS) n=8
Benzo(a)pyrene	-0.14(NS) n=4	0.57(NS) n=5	-0.43(NS) n=8
Cadmium	0.73(NS) n=4	0.51(NS) n=5	-0.21(NS) n=8
Calcium	-0.28(NS) n=4	-0.42(NS) n=4	-0.6(NS) n=4
Chromium	0.92(NS) n=4	0.65(NS) n=5	0.53(NS) n=8
Cobalt	-0.47(NS) n=4	-0.17(NS) n=5	0.5(NS) n=8
Copper	-0.09(NS) n=4	0.49(NS) n=5	0.74(*) n=8
Carbon Organic	0.97(*) n=4	0.17(NS) n=5	0.31(NS) n=8
Iron	0.4(NS) n=4	0.52(NS) n=5	0.76(*) n=8
Lead	0.65(NS) n=4	0.71(NS) n=5	0.41(NS) n=8
Magnesium	0.24(NS) n=4	0.94(NS) n=4	0.91(NS) n=4
Manganese	0.36(NS) n=4	0.48(NS) n=5	0.29(NS) n=8
Mercury	0.83(NS) n=4	0(NS) n=5	-0.32(NS) n=8
Naphthalene	-0.13(NS) n=4	0.57(NS) n=5	-0.34(NS) n=6
Nickel	1(**) n=4	0.27(NS) n=5	0.81(*) n=8
Phosphorus	0.49(NS) n=4	0.88(NS) n=4	0.96(*) n=4
Potassium	0.58(NS) n=4	1(***) n=4	0.97(*) n=4
Pyrene	-0.13(NS) n=4	0.58(NS) n=5	-0.43(NS) n=8
Sodium	0.36(NS) n=4	0.98(*) n=4	0.96(*) n=4
Strontium	0.36(NS) n=4	-0.5(NS) n=4	-0.45(NS) n=4
C11-C60 Hydrocarbons	0.97(NS) n=3	0.99(NS) n=3	0.9(NS) n=3
Uranium		0.55(NS) n=4	0.47(NS) n=4
Vanadium	0.55(NS) n=4		0.39(NS) n=5
Zinc	0.47(NS) n=4	0.39(NS) n=5	

Notes
* = p < 0.05
** = p < 0.01
*** = p < 0.005

Table 3-12. Summary of Results-Surface Water

		All Data															2000-2010						
		HR/B & HR/WC		HR/B						HR/WC							HR/B & HR/WC	HR/B			HR/WC		
Parameter	Fraction	Trend	Location[a]	FOD	EcoFOE[b]	All Seasons (p-value)	Base	Freshet	Recession	FOD	EcoFOE[b]	All Seasons (p-value)	Base	Freshet	Recession	Trend	Base	Freshet	Recession	Base	Freshet	Recession
Alkalinity, Total (as Caco3)	Total	↓	–	100%	NA	↓ 0.002	-	-	-	100%	NA	– 0.483	-	-	-	-	-	-	-	NA	-	-
Arsenic	Dissolved	↑	NA	100%	0%	↑ < 0.001	-	-	↑	NA	NA	NA	NA	NA	NA	-	-	-	-	NA	NA	NA
Arsenic	Total	–	NA	100%	3%	– 0.633	-	-	-	69%	6%	NA	-	-	-	-	-	-	-	NA	NA	NA
Benzo(a)pyrene	Dissolved	NA	NA	0%	0%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	Total	NA	NA	3%	78%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C11-C60 Hydrocarbons	Dissolved	NA	NA	0%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C11-C60 Hydrocarbons	Total	NA	NA	0%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	Dissolved	↓	NA	100%	100%	– 0.331	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	Total	↓	–	86%	99%	- 0.633	-	-	-	30%	100%	NA	-	-	-	-	-	-	-	NA	-	-
Calcium	Dissolved	↓	NA	100%	NA	↓ 0.002	-	-	-	NA	NA	NA	NA	NA	NA	-	-	-	-	NA	NA	NA
Calcium	Total	–	NA	NA	NA	NA	NA	NA	NA	100%	NA	- 0.529	-	-	-	-	NA	NA	NA	NA	-	-
Carbon Dissolved Organic	Dissolved	–	NA	100%	NA	– 0.225	–	–	–	NA	NA	NA	NA	NA	NA	-	-	-	-	NA	NA	NA
Carbon Organic	Total	–	NA	100%	NA	– 0.184	↑	–	–	NA	NA	NA	NA	NA	NA	-	-	-	-	NA	NA	NA
Chloride (as Cl)	Dissolved	–	NA	100%	0%	– 0.076	↑	-	↓	NA	NA	NA	NA	NA	NA	-	-	-	↓	NA	NA	NA
Chloride (as Cl)	Total	–	NA	NA	NA	NA	NA	NA	NA	100%	0%	- 0.168	-	-	-	-	NA	NA	NA	NA	-	-
Chromium, Total	Dissolved	NA	NA	100%	0%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium, Total	Total	–	↑(WC)	96%	29%	– 0.366	–	–	–	72%	67%	– 0.532	–	–	–	-	-	-	-	NA	-	-
Cobalt	Dissolved	NA	NA	100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	Total	–	–	95%	NA	– 0.547	–	–	–	86%	NA	– 0.892	–	–	–	-	-	-	-	NA	-	-
Color	Total	↑	–	100%	NA	– 0.502	–	–	–	96%	NA	↑ 0.001	–	–	↑	↑	-	-	-	NA	-	↑
Conductivity	Total	–	–	99%	NA	↓ 0.046	–	–	–	100%	NA	– 0.884	–	–	–	-	-	-	-	NA	-	-
Copper	Dissolved	NA	NA	100%	6%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	Total	–	–	100%	33%	– 0.101	–	–	–	91%	53%	– 0.381	–	–	–	-	-	-	-	NA	-	-
Hardness (as Caco3)	Total	↓	–	100%	NA	↓ 0.005	–	–	–	100%	NA	– 0.660	–	–	–	-	-	-	-	NA	-	-
Iron	Dissolved	NA	NA	100%	94%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	Total	–	–	100%	98%	– 0.238	–	–	–	100%	98%	– 0.586	–	–	–	-	-	-	-	NA	-	-
Lead	Dissolved	NA	NA	100%	0%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	Total	–	–	80%	5%	– 0.715	–	–	–	75%	16%	– 0.984	–	–	–	-	-	-	-	NA	-	-
M,P-Xylene (sum of isomers)	Total	NA	NA	0%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	Dissolved	↓	NA	100%	NA	↓ 0.005	–	–	–	NA	NA	NA	NA	NA	NA	-	-	-	↑	NA	NA	NA
Magnesium	Total	–	↑(WC)	100%	NA	– 0.390	–	–	–	100%	NA	– 0.863	–	–	–	-	-	-	-	NA	-	-
Manganese	Dissolved	NA	NA	100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	Total	–	NA	100%	NA	– 0.919	–	–	–	NA	NA	NA	NA	NA	NA	-	-	-	-	NA	NA	NA
Mercury	Total	NA	NA	NA	NA	NA	NA	NA	NA	63%	63%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	Dissolved	NA	NA	0%	0%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	Total	NA	NA	19%	0%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	Dissolved	NA	NA	100%	0%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	Total	–	–	100%	0%	– 0.605	–	–	–	91%	0%	↓ 0.038	–	–	–	-	-	-	-	NA	-	-
Nitrogen, Kjeldahl, Total	Total	↓	NA	NA	NA	NA	NA	NA	NA	100%	NA	↓ 0.046	NA	NA	↓	NA	NA	NA	NA	NA	NA	NA
Nitrogen, Nitrate (as N)	Total	NA	NA	100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrogen, Nitrate-Nitrite	Dissolved	↑	NA	89%	NA	↑ 0.026	–	–	↑	NA	NA	NA	NA	NA	NA	↑	-	-	-	NA	NA	NA
Nitrogen, Nitrate-Nitrite	Total	NA	–	85%	NA	NA	NA	NA	NA	57%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrogen, Nitrite	Total	NA	NA	29%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
O-Xylene (1,2-Dimethylbenzene)	Total	NA	NA	0%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 3-12. Summary of Results-Surface Water

		All Data															2000-2010						
		HR/B & HR/WC		HR/B						HR/WC							HR/B & HR/WC	HR/B			HR/WC		
Parameter	Fraction	Trend	Location[a]	FOD	EcoFOE[b]	All Seasons (p-value)		Base	Freshet	Recession	FOD	EcoFOE[b]	All Seasons (p-value)		Base	Freshet	Recession	Trend	Base	Freshet	Recession	Base	Freshet	Recession
pH	Total	↑	↑(WC)	100%	NA	↑	0.031	–	–	–	100%	NA	↑	0.015	–	–	↑	-	-	-	-	NA	-	-
Phosphorus, Total (as P)	Total	↑	–	99%	100%	↑	0.005	–	–	–	89%	100%	–	0.424	–	–	–	-	-	-	-	NA	-	-
Potassium	Dissolved	–	NA	100%	NA	–	0.107	–	–	↓	NA	NA	NA		NA	NA	NA	-	-	-	↑	NA	NA	NA
Potassium	Total	↓	NA	NA	NA	NA		NA	NA	NA	100%	NA	↓	< 0.001	–	–	↓	-	NA	NA	NA	NA	-	-
Pyrene	Dissolved	NA	NA	0%	0%	NA		NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	Total	NA	NA	9%	3%	NA		NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	Dissolved	–	NA	100%	NA	–	0.174	↑	–	–	NA	NA	NA		NA	NA	NA	-	-	-	-	NA	NA	NA
Sodium	Total	–	↑(WC)	100%	NA	–	0.292	–	–	–	100%	NA	–	0.217	–	–	–	-	-	-	-	NA	-	-
Strontium	Dissolved	NA	NA	100%	NA	NA		NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Strontium	Total	–	NA	100%	NA	–	0.050	–	–	–	NA	NA	NA		NA	NA	NA	-	-	-	-	NA	NA	NA
Sulfate (as SO4)	Dissolved	↓	NA	100%	NA	↓	0.001	–	–	–	NA	NA	NA		NA	NA	NA	-	-	-	-	NA	NA	NA
Sulfate (as SO4)	Total	–	NA	NA	NA	NA		NA	NA	NA	98%	NA	–	0.941	–	–	–	-	NA	NA	NA	NA	-	-
Suspended Solids (Residue, Non-Filterable)	Total	–	–	93%	NA	–	0.161	–	–	–	91%	NA	–	0.594	–	–	–	-	-	-	-	NA	-	-
Total Dissolved Solids (Residue, Filterable)	Total	–	↑(WC)	100%	NA	–	0.097	–	–	–	100%	NA	–	0.164	–	–	–	-	-	-	-	NA	-	-
Turbidity	Total	–	–	100%	NA	–	0.212	–	–	–	100%	NA	–	0.915	–	–	–	-	-	-	-	NA	-	-
Uranium	Dissolved	NA	NA	100%	NA	NA		NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium	Total	NA	NA	100%	NA	NA		NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	Dissolved	NA	NA	100%	NA	NA		NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	Total	↑	NA	86%	NA	↑	0.010	–	–	–	NA	NA	NA		NA	NA	NA	-	-	-	-	NA	NA	NA
Zinc	Dissolved	NA	NA	100%	0%	NA		NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	Total	–	–	100%	6%	–	0.072	↑	–	–	71%	14%	–	0.543	–	–	–	-	-	-	-	NA	-	-

a: ↑(WC)= West Channel Bridge is significantly greater than Border

b: Ecological Screening Value-Frequency of Exceedance

↓: significant decreasing trend

↑: significant increasing trend

⊞ no significant trend

FOD: frequency of detection

FOE: frequency of exceedance

HR/B: Hay River at the Alberta/NWT border

HR/WC: HayRiver at the West Channel Bridge

NA: not available

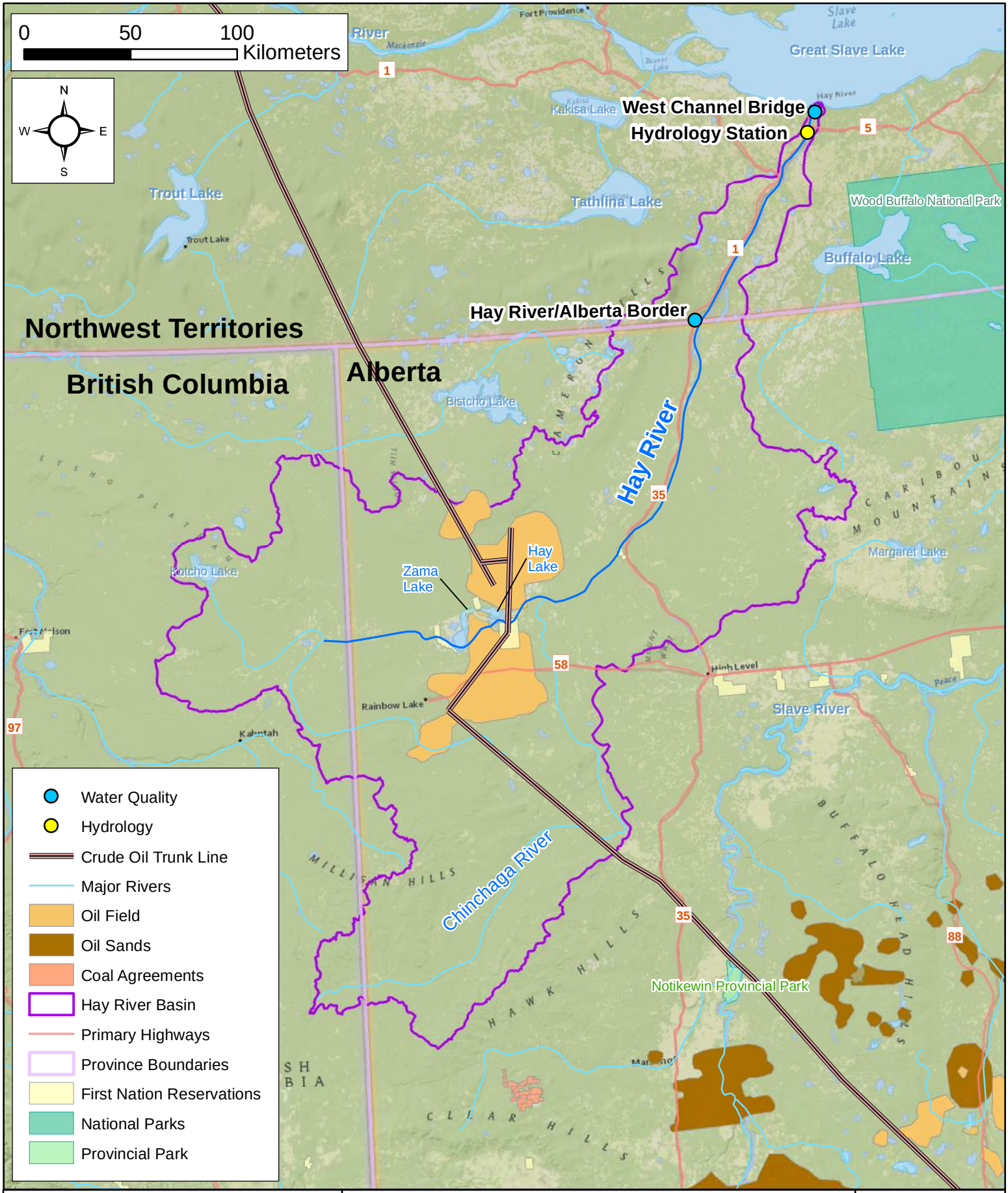
p-values are provide for the all seasons trend analysis for each location, these p-values are not presented in the figures

Table 3-13. Summary of Results-Suspended Sediment

Parameter	Station	Trend	Flow	TOC	FOD[a]	EcoFOE[b]
Suspended Sediment						
Arsenic	HR/B	–	–	–	100%	100%
Benzo(a)pyrene	HR/B	NA	NA	NA	0%	75%
C11-C60 Hydrocarbons	HR/B	NA	NA	NA	100%	NA
Cadmium	HR/B	NA	NA	NA	50%	100%
Calcium	HR/B	NA	NA	NA	100%	NA
Carbon Organic	HR/B	–	↓	↑	100%	NA
Chromium, Total	HR/B	–	–	–	100%	100%
Cobalt	HR/B	–	–	–	100%	NA
Copper	HR/B	–	–	–	100%	13%
Iron	HR/B	–	–	↑	100%	NA
Lead	HR/B	–	–	–	100%	0%
Magnesium	HR/B	NA	NA	NA	100%	NA
Manganese	HR/B	–	↓	↑	100%	NA
Mercury	HR/B	–	↑	–	100%	0%
Naphthalene	HR/B	NA	NA	NA	0%	70%
Nickel	HR/B	–	–	–	100%	NA
Phosphorus, Total (as P)	HR/B	NA	NA	NA	100%	NA
Potassium	HR/B	NA	NA	NA	100%	NA
Pyrene	HR/B	NA	NA	NA	0%	58%
Sodium	HR/B	NA	NA	NA	50%	NA
Strontium	HR/B	NA	NA	NA	100%	NA
Uranium	HR/B	NA	NA	NA	100%	NA
Vanadium	HR/B	NA	NA	NA	100%	NA
Zinc	HR/B	–	–	–	100%	88%

a: frequency of detection
b: Ecological Screening Value-Frequency of Exceedance
TOC: total organic carbon
FOD: frequency of detection
FOE: frequency of exceedance
NA: not available
↓: significant decreasing trend
↑: significant increasing trend
– no significant trend

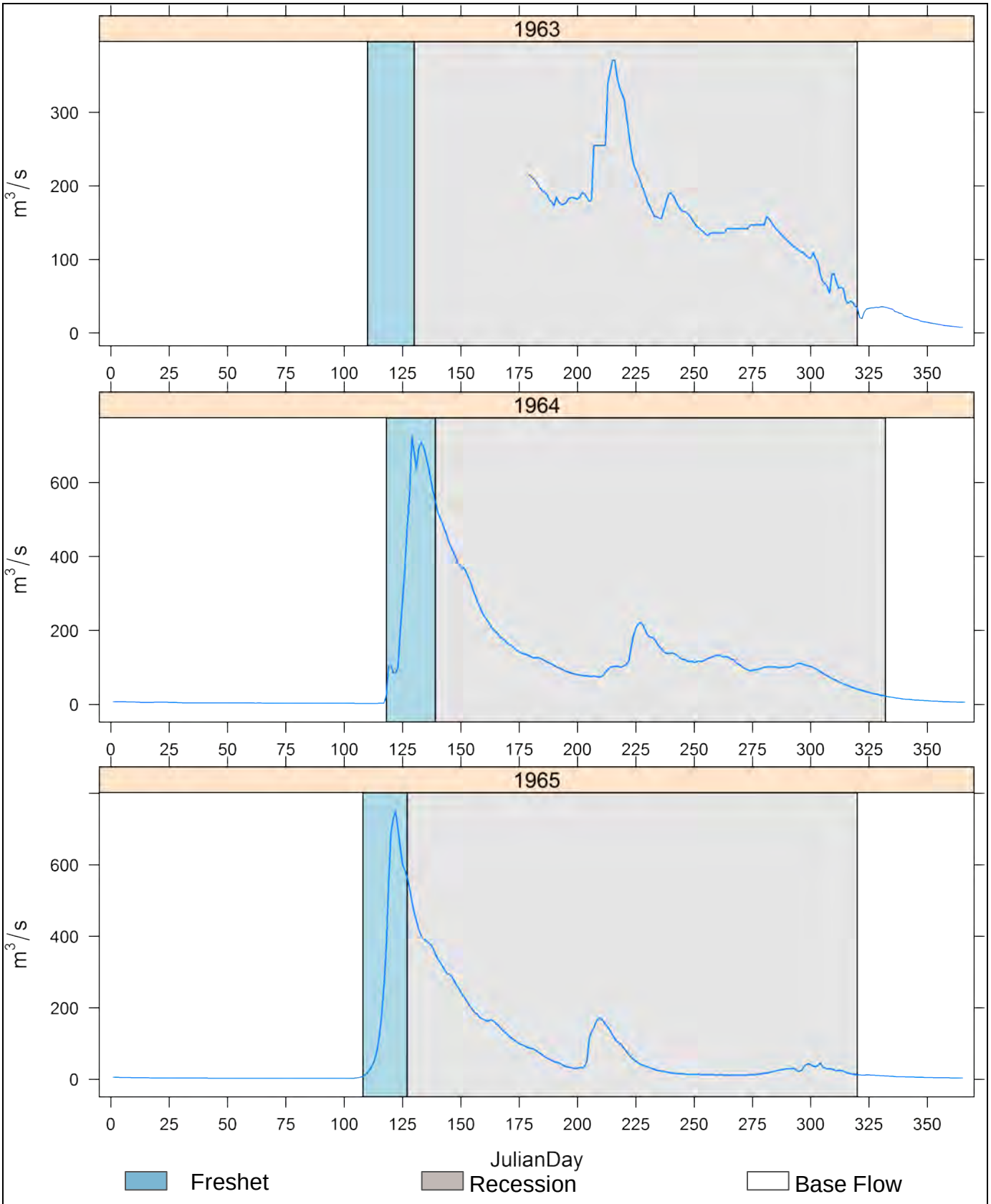
Figures



ENVIRON

Hay River Basin with Sampling Locations

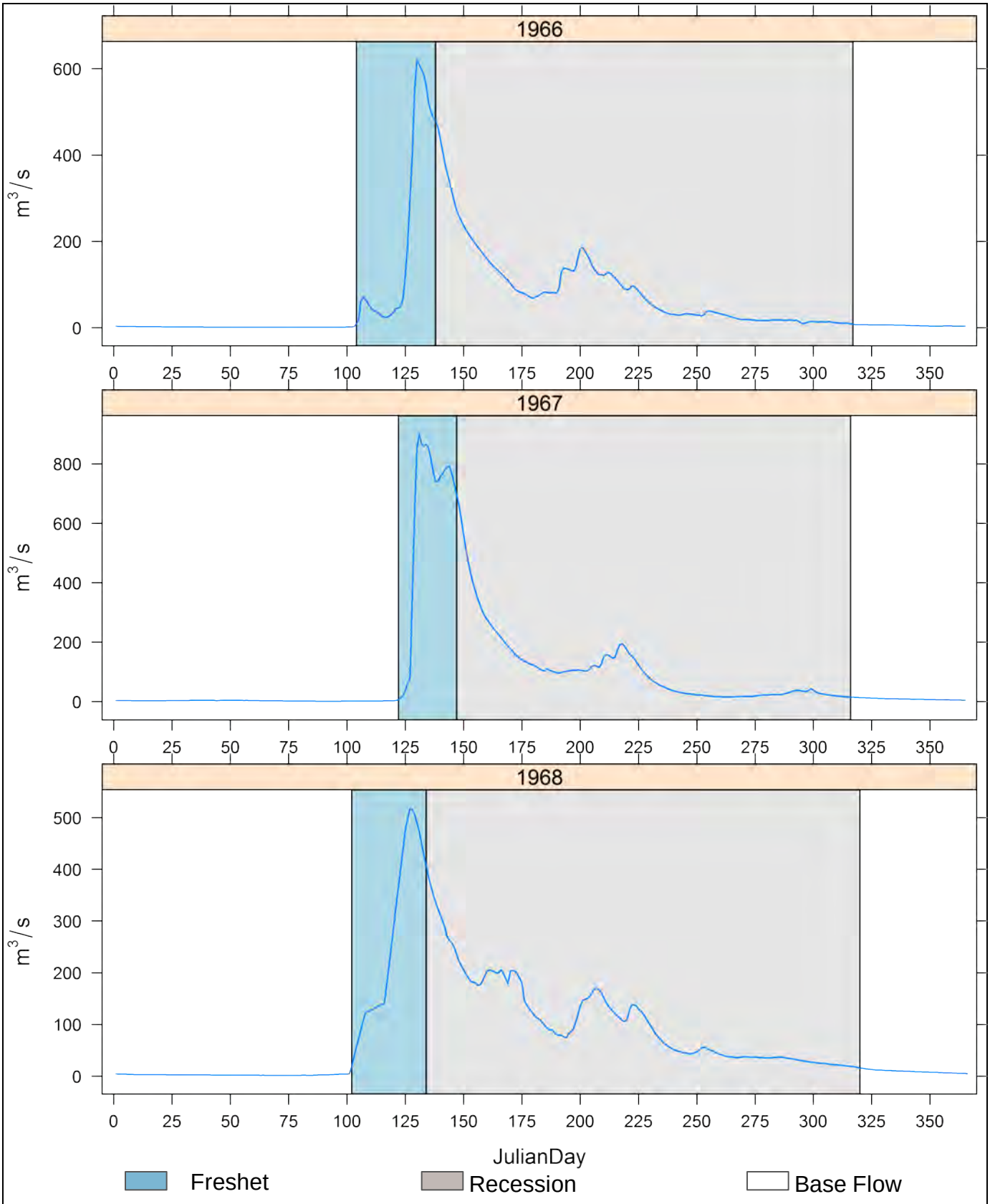
Figure 1.1



ENVIRON

Hay River Flow Time Series: 1963-1965

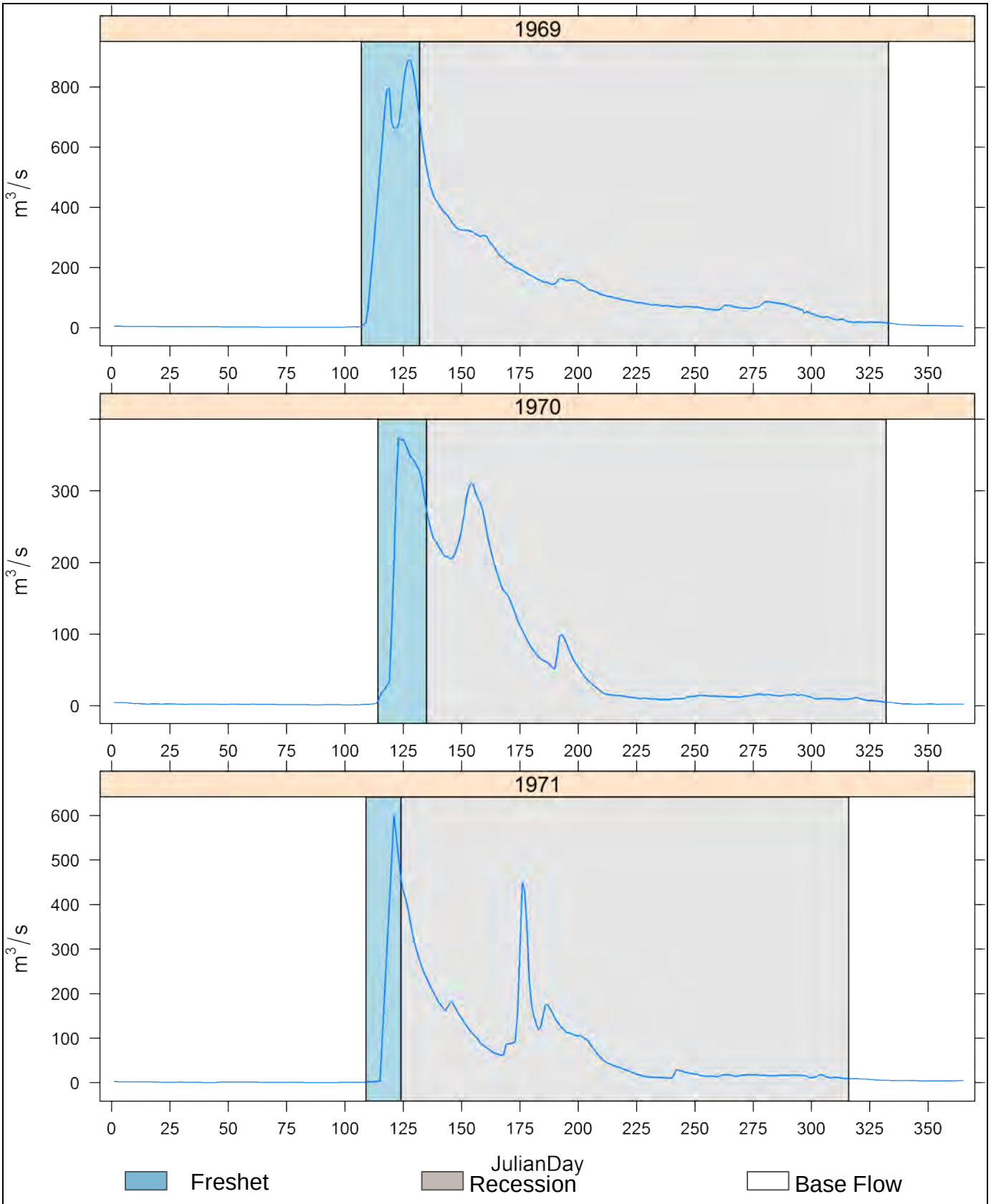
Figure 3.1.a



ENVIRON

Hay River Flow Time Series: 1966-1968

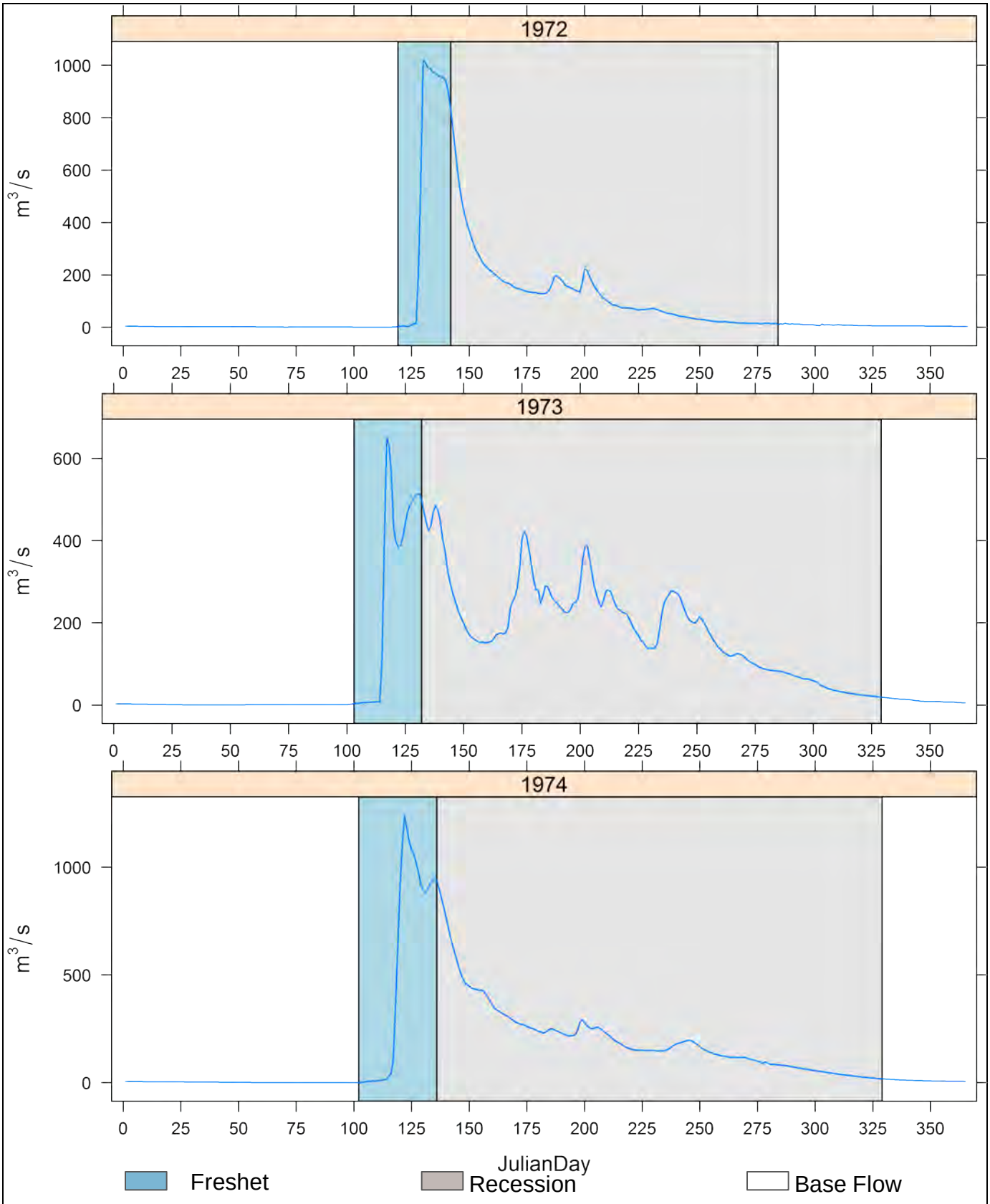
Figure 3.1.b



ENVIRON

Hay River Flow Time Series: 1969-1971

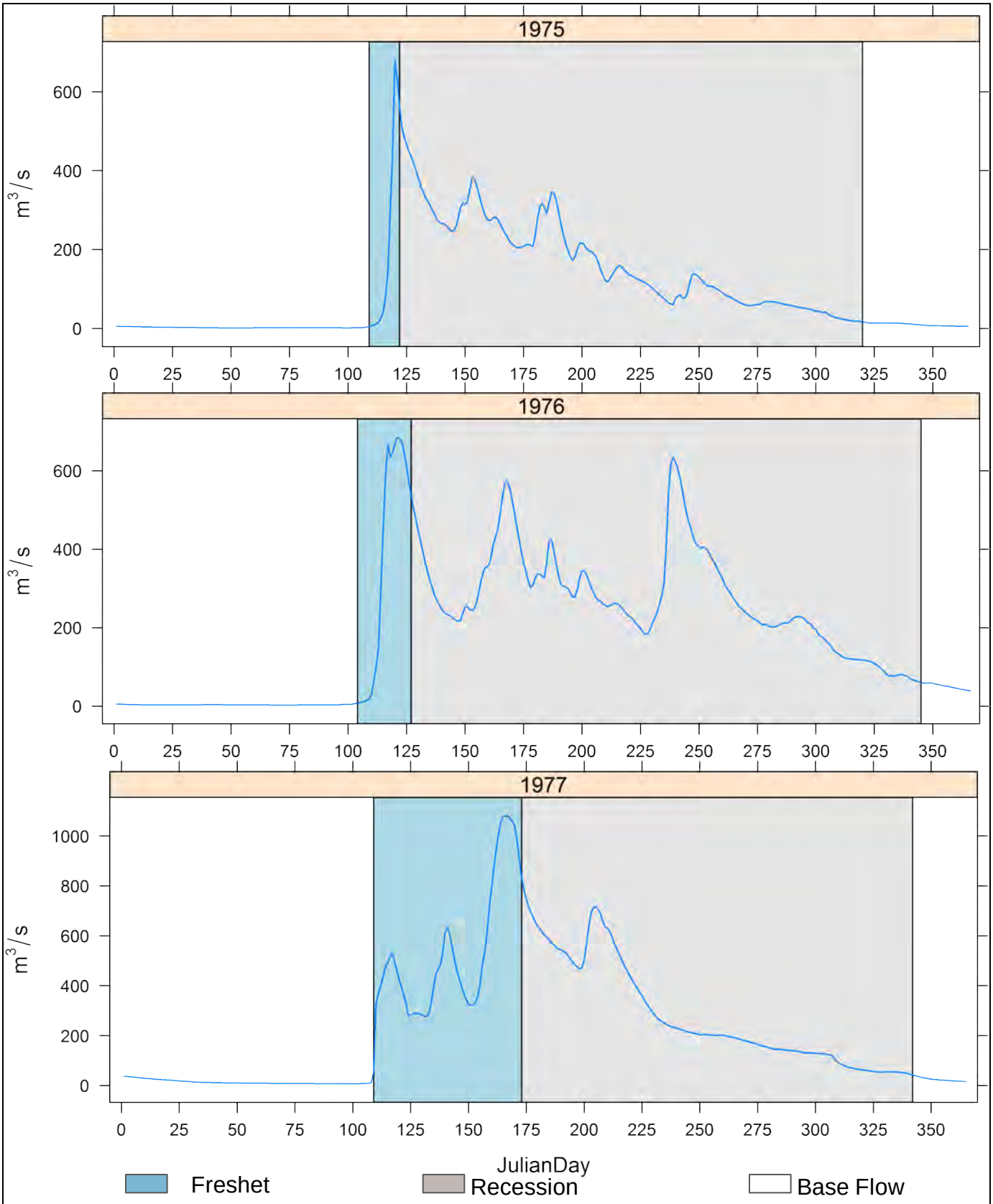
Figure 3.1.c



ENVIRON

Hay River Flow Time Series: 1972-1974

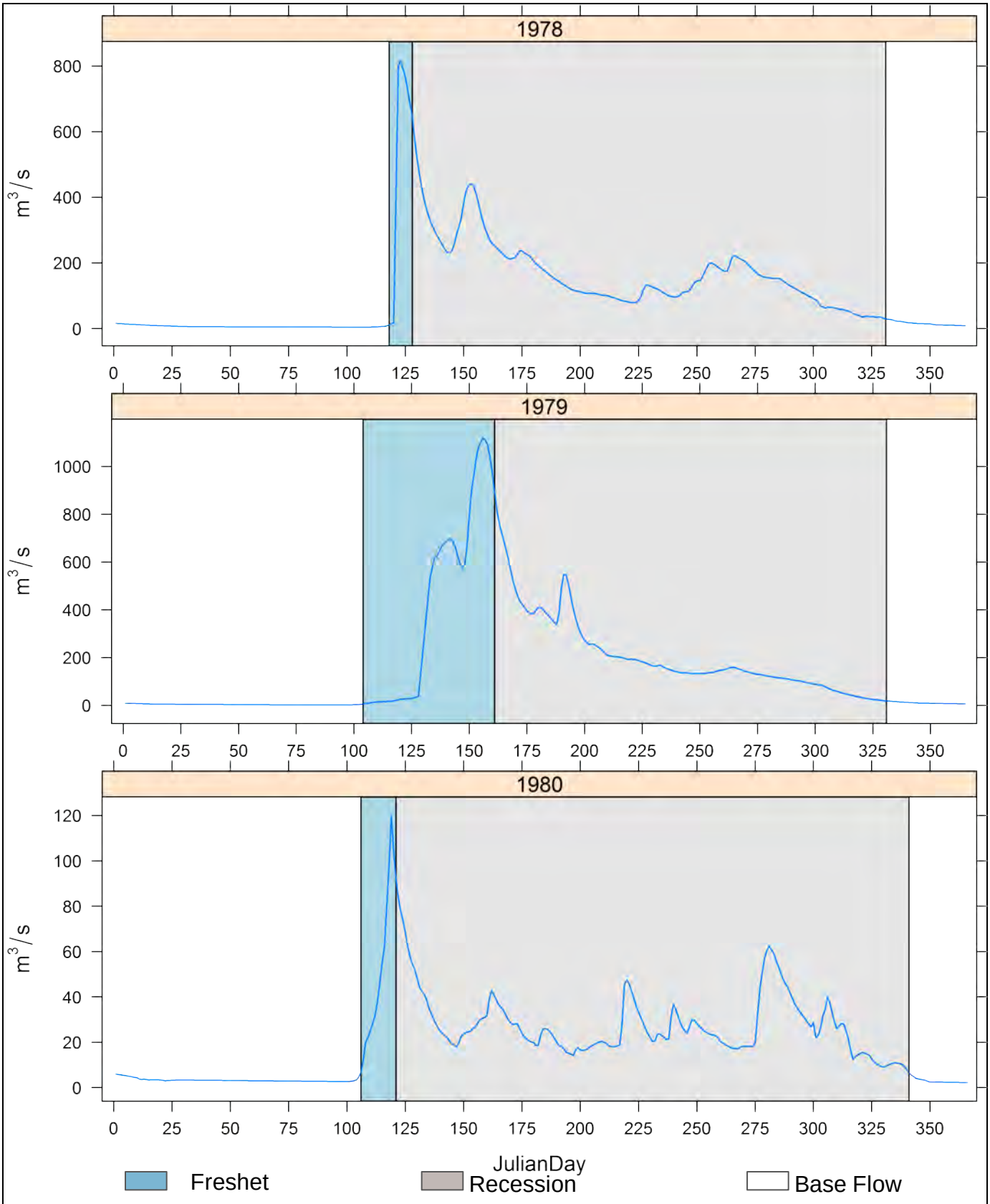
Figure 3.1.d



ENVIRON

Hay River Flow Time Series: 1975-1977

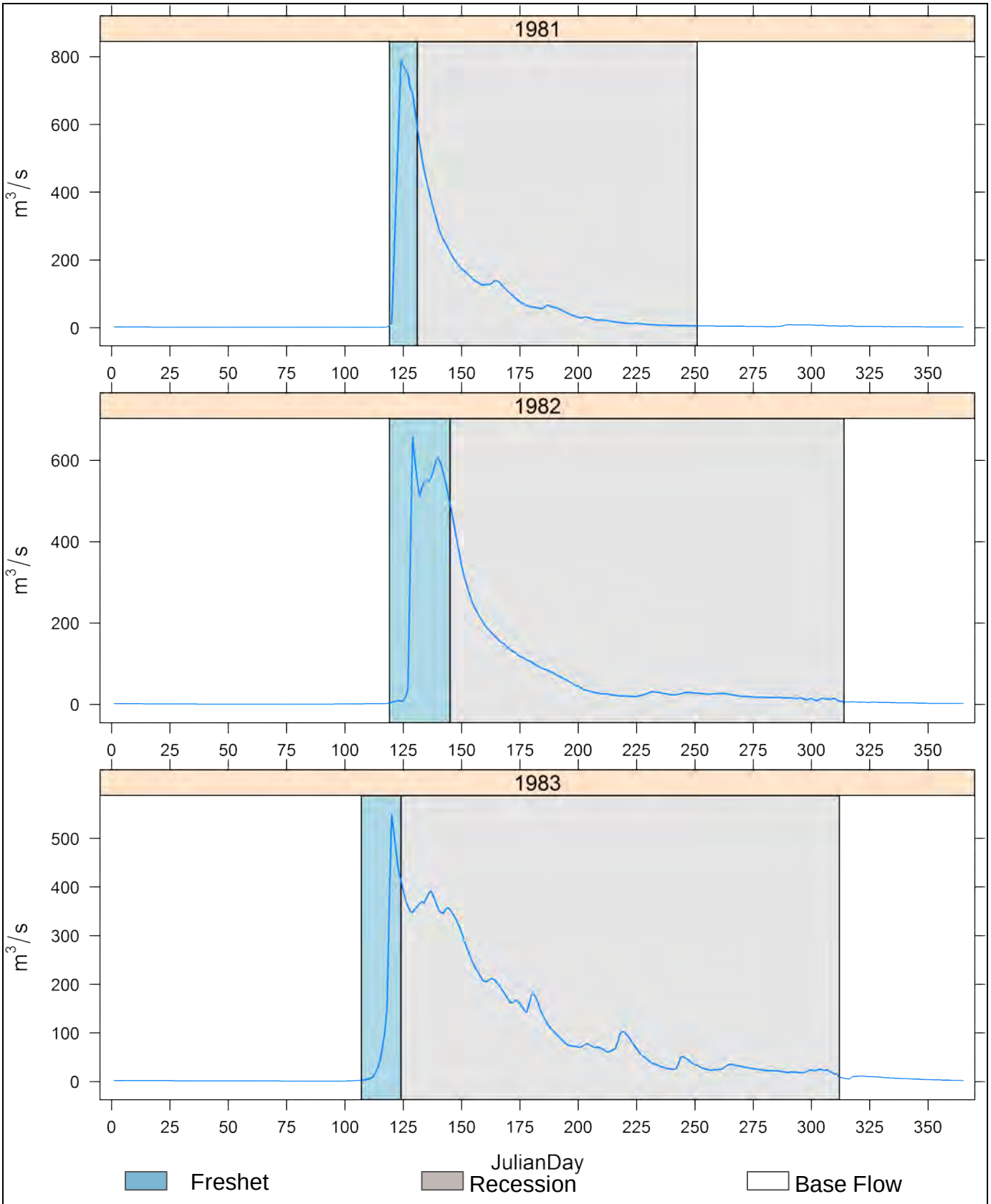
Figure 3.1.e



ENVIRON

Hay River Flow Time Series: 1978-1980

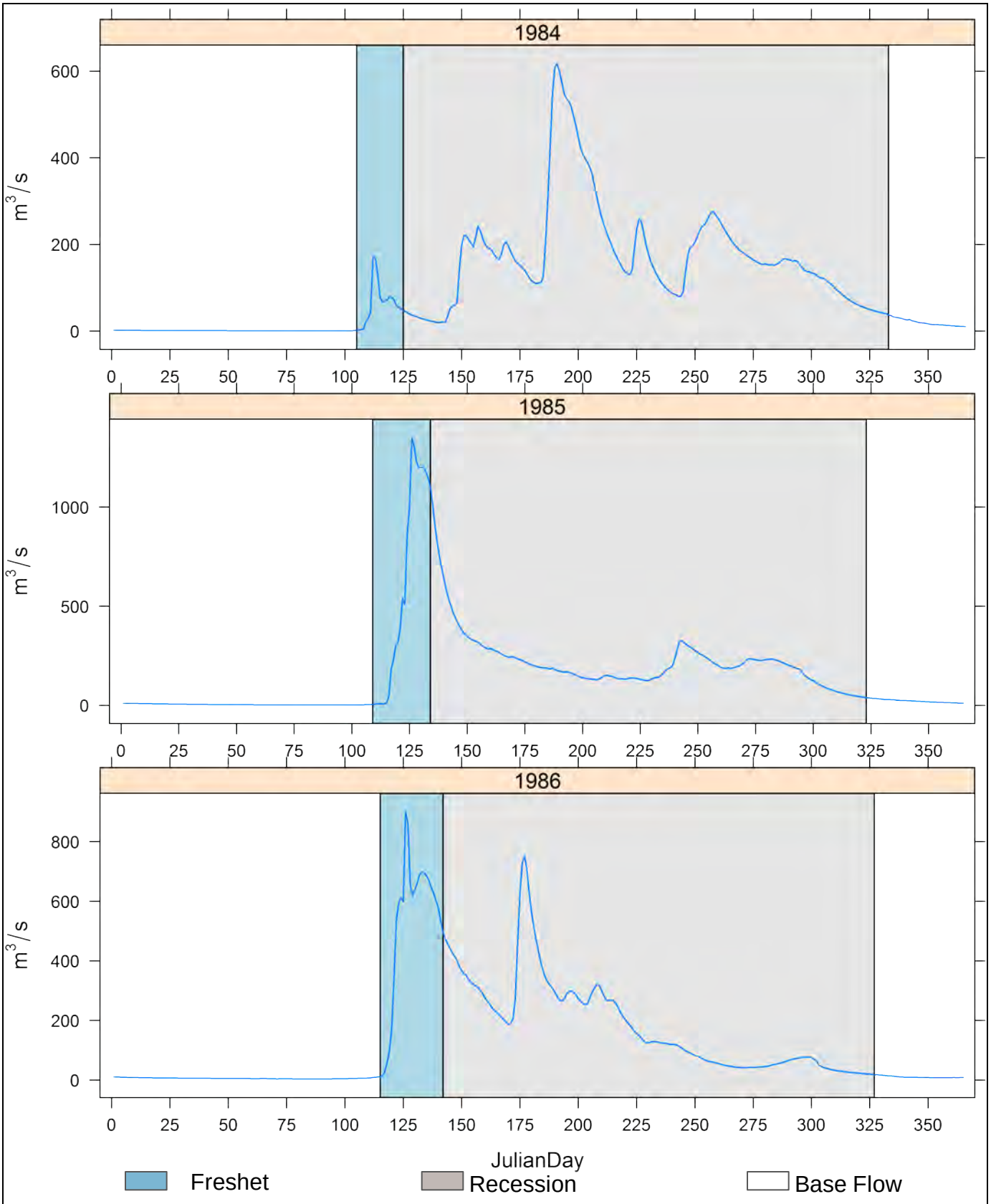
Figure 3.1.f



ENVIRON

Hay River Flow Time Series: 1981-1983

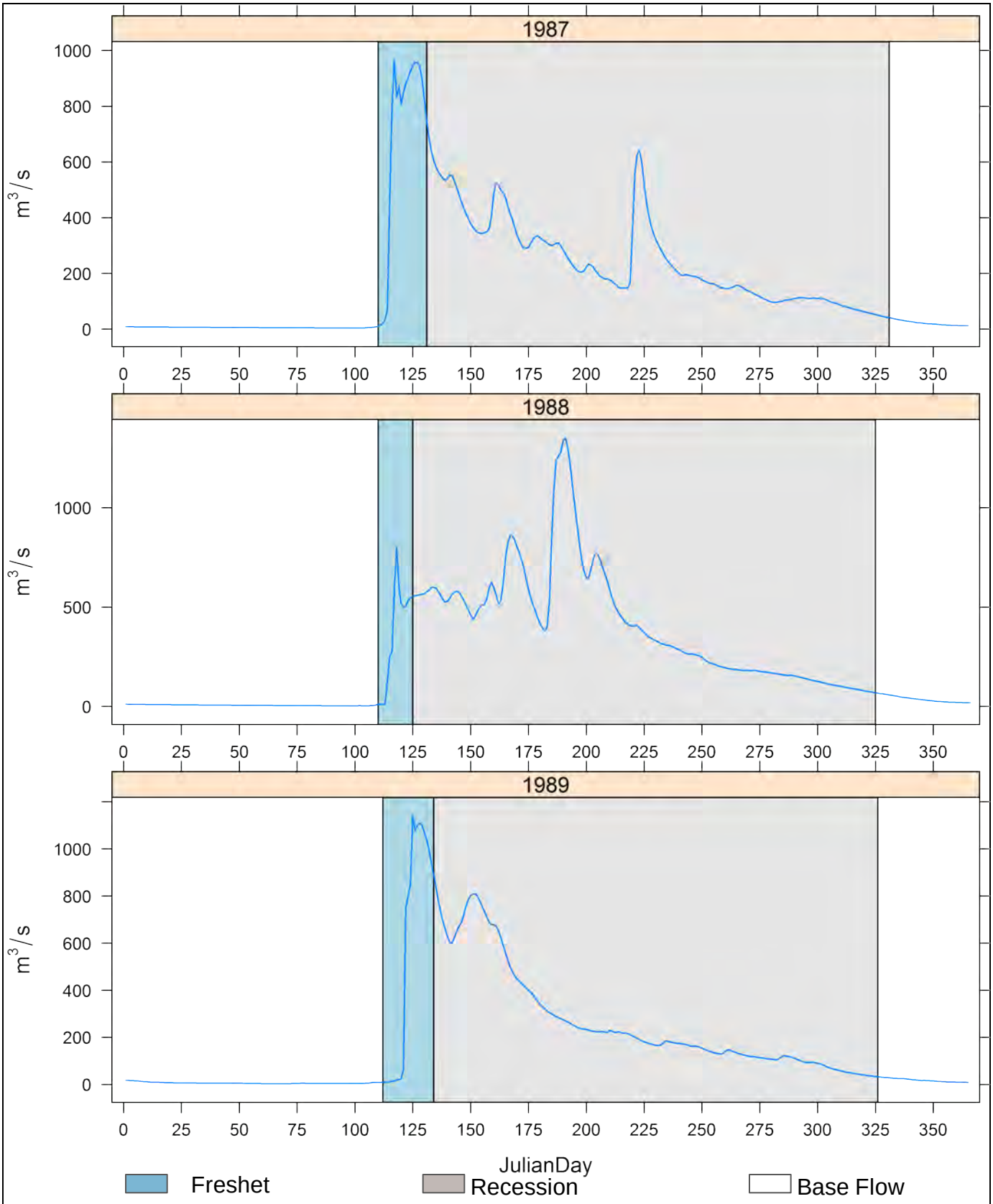
Figure 3.1.g



ENVIRON

Hay River Flow Time Series: 1984-1986

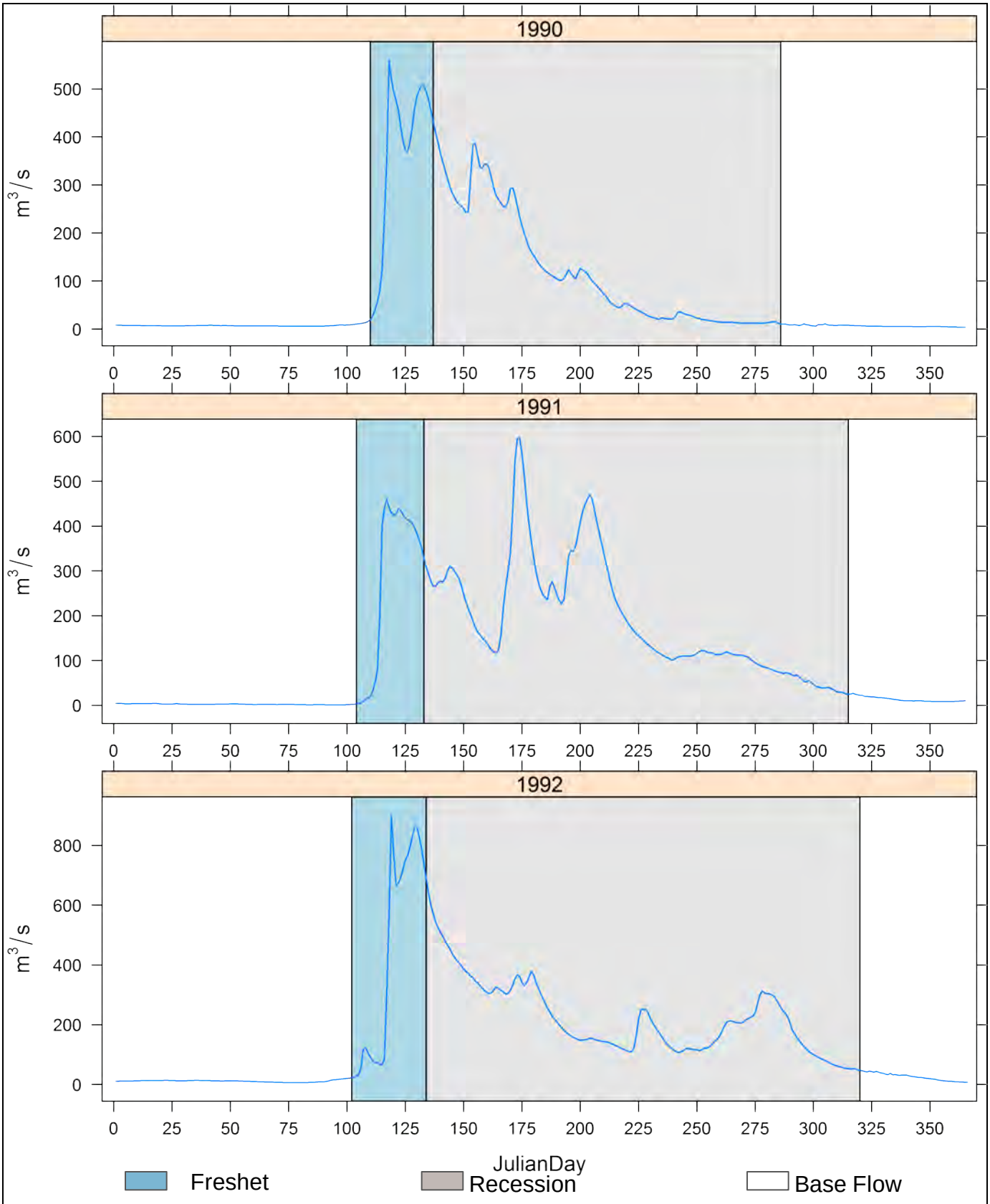
Figure 3.1.h



ENVIRON

Hay River Flow Time Series: 1987-1989

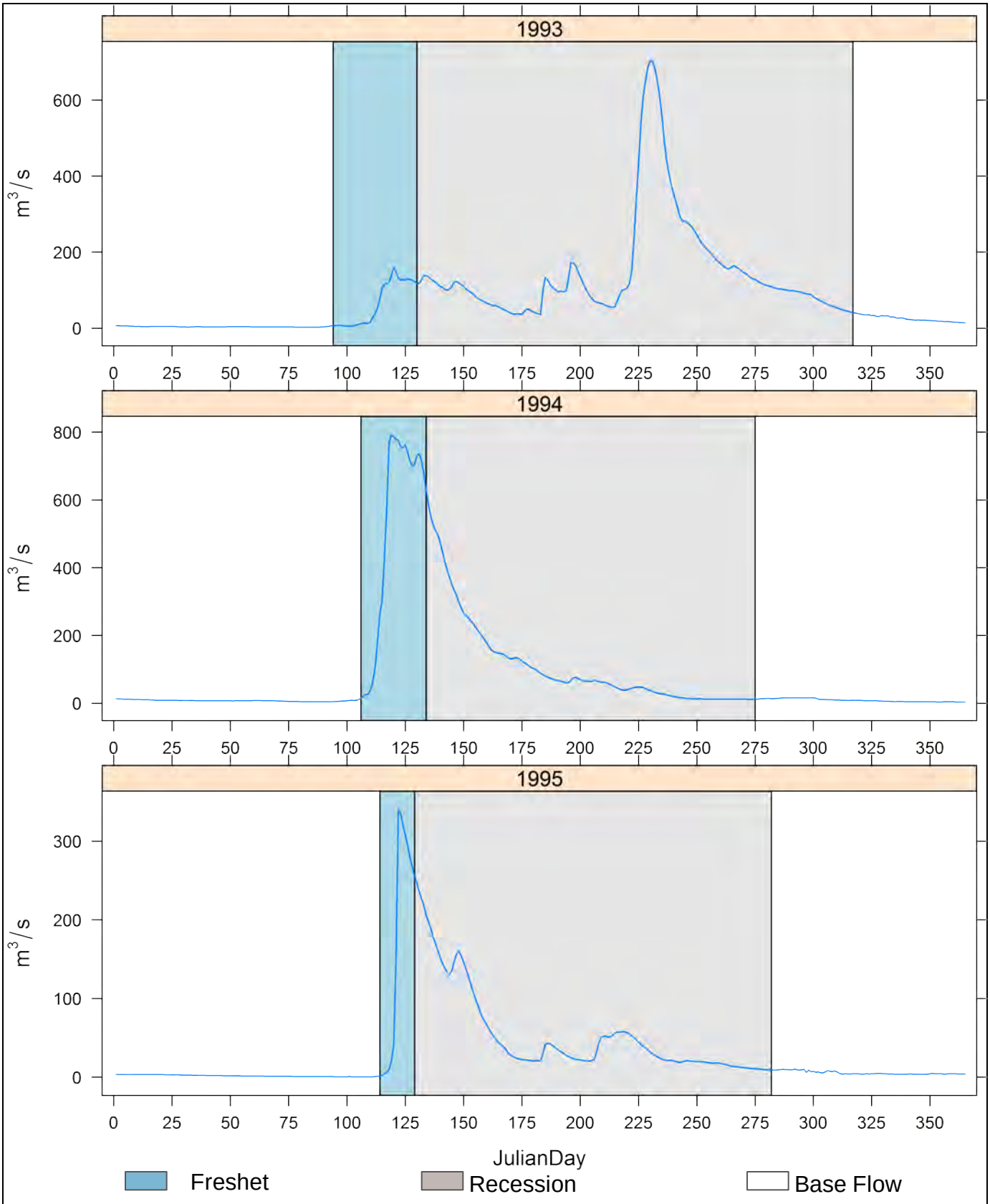
Figure 3.1.i



ENVIRON

Hay River Flow Time Series: 1990 -1992

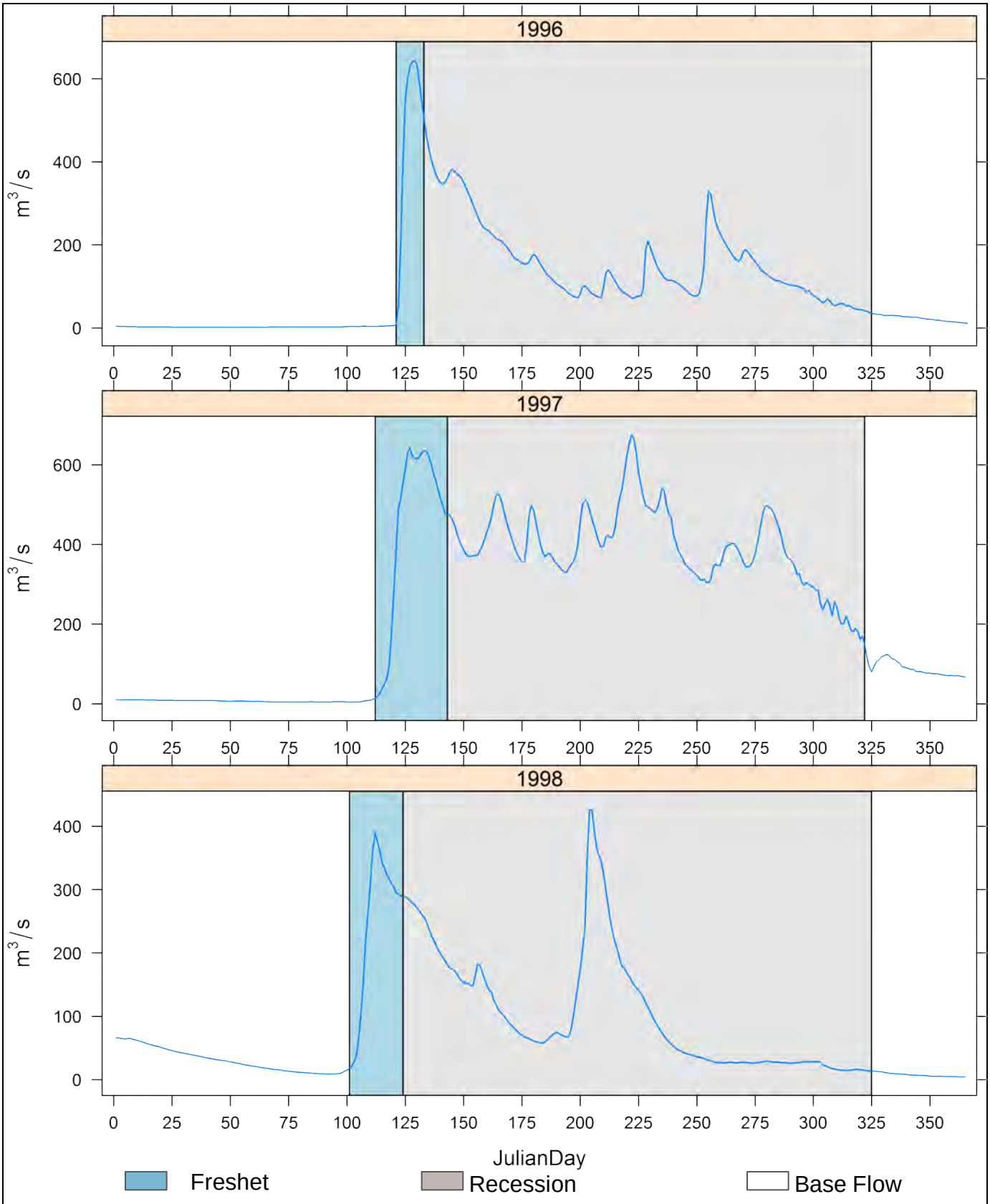
Figure 3.1.j



ENVIRON

Hay River Flow Time Series: 1993 -1995

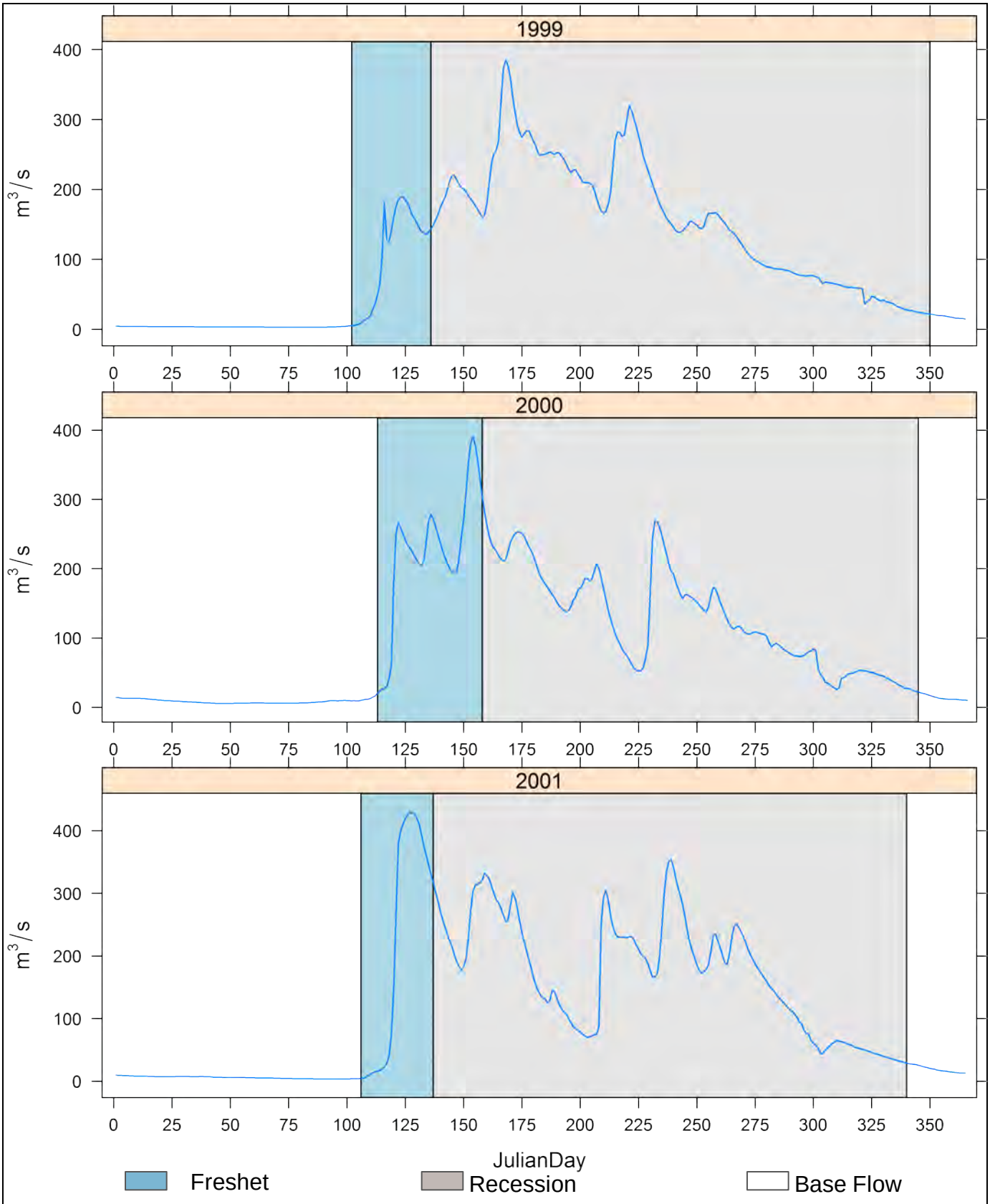
Figure 3.1.k



ENVIRON

Hay River Flow Time Series: 1996 -1998

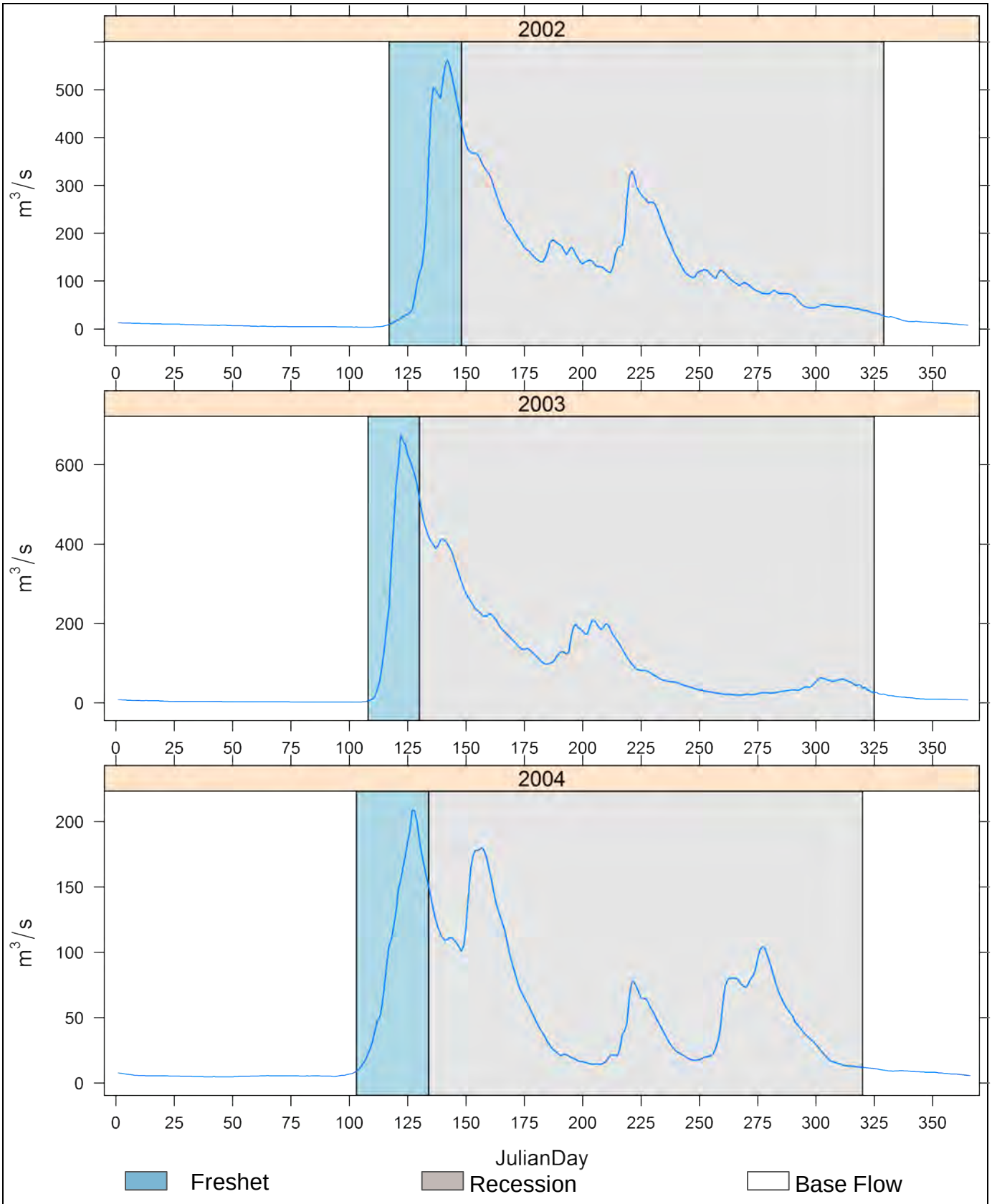
Figure 3.1.l



ENVIRON

Hay River Flow Time Series: 1999-2001

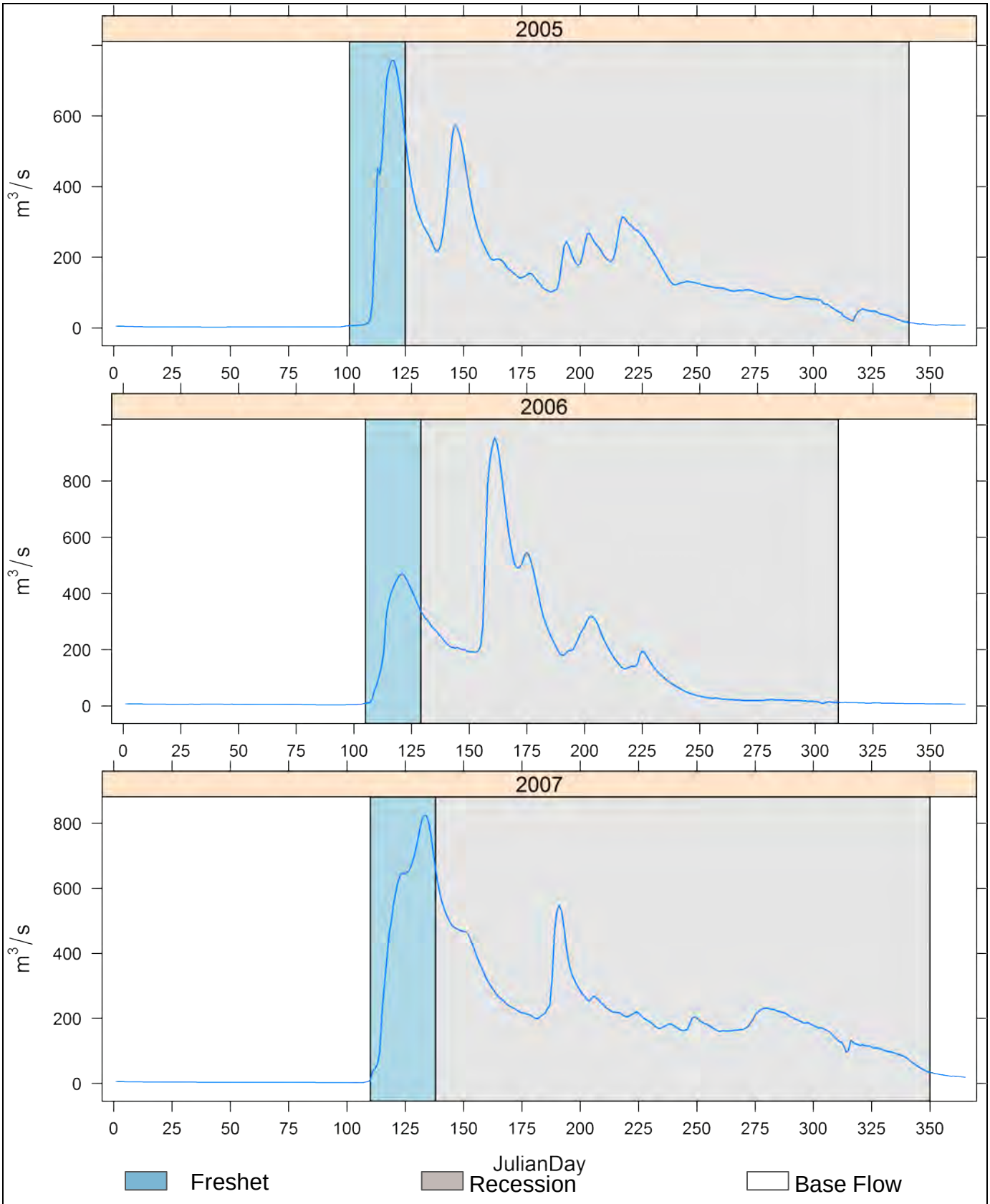
Figure 3.1.m



ENVIRON

Hay River Flow Time Series: 2002 - 2004

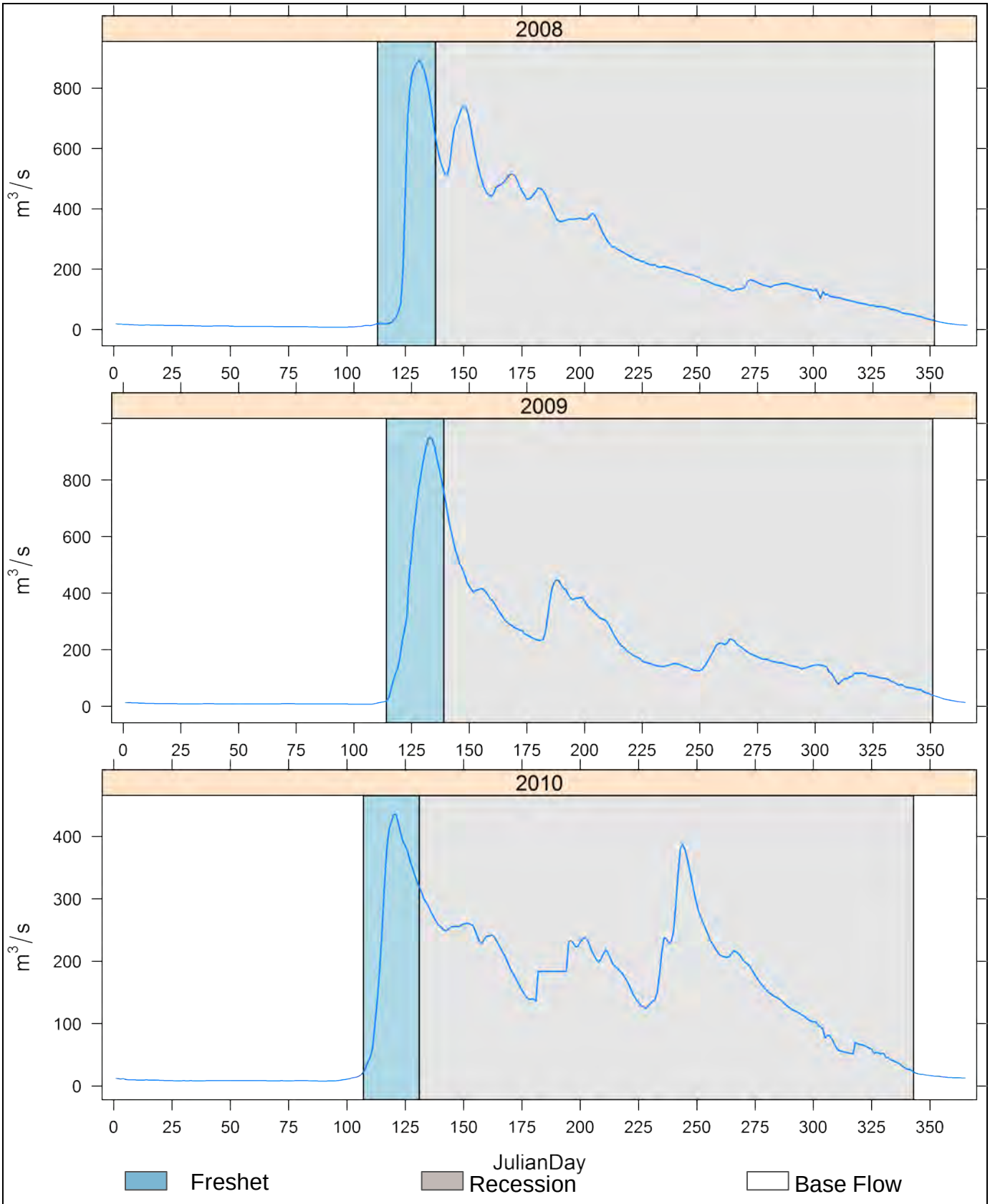
Figure 3.1.n



ENVIRON

Hay River Flow Time Series: 2005 - 2007

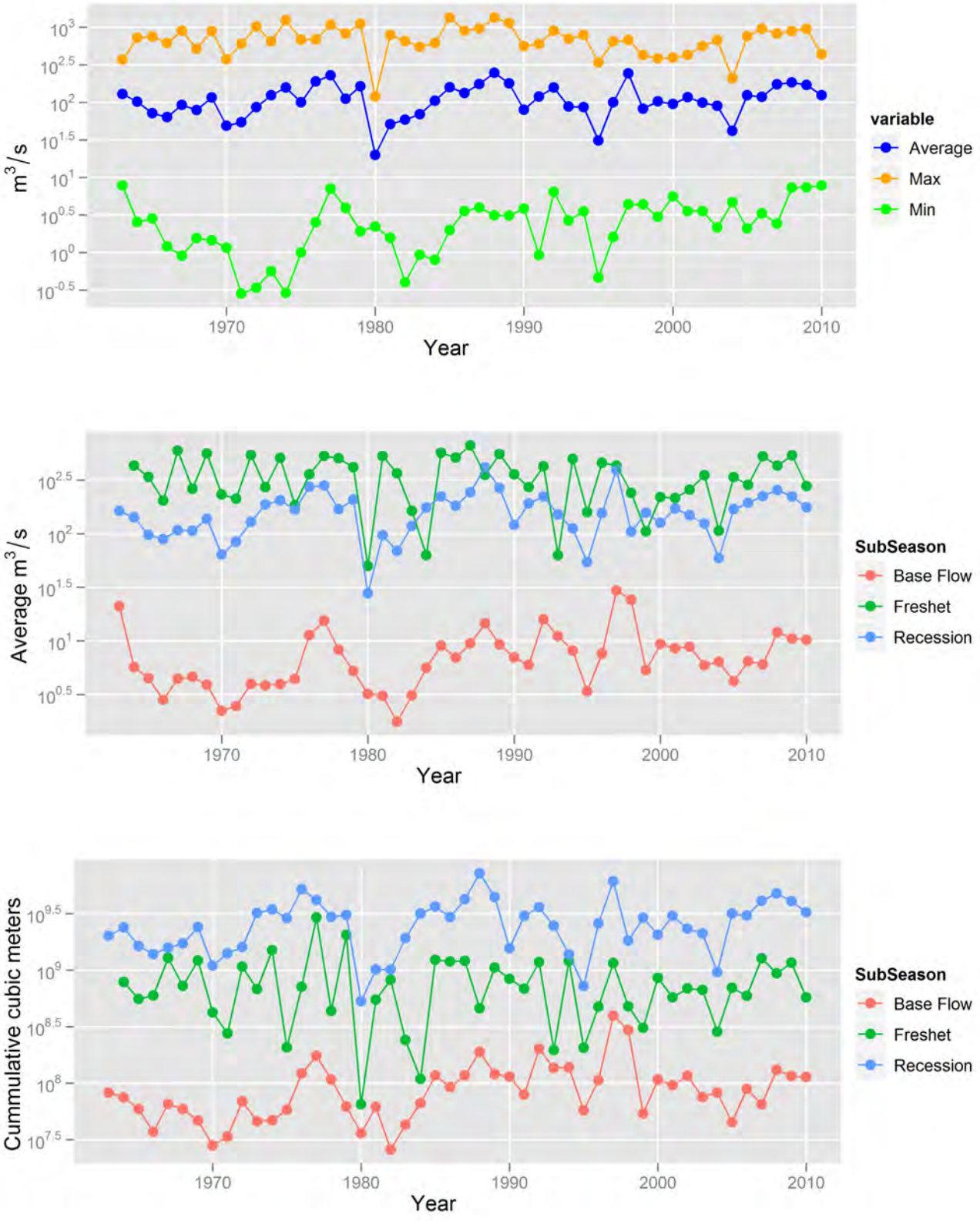
Figure 3.1.o



ENVIRON

Hay River Flow Time Series: 2008 - 2010

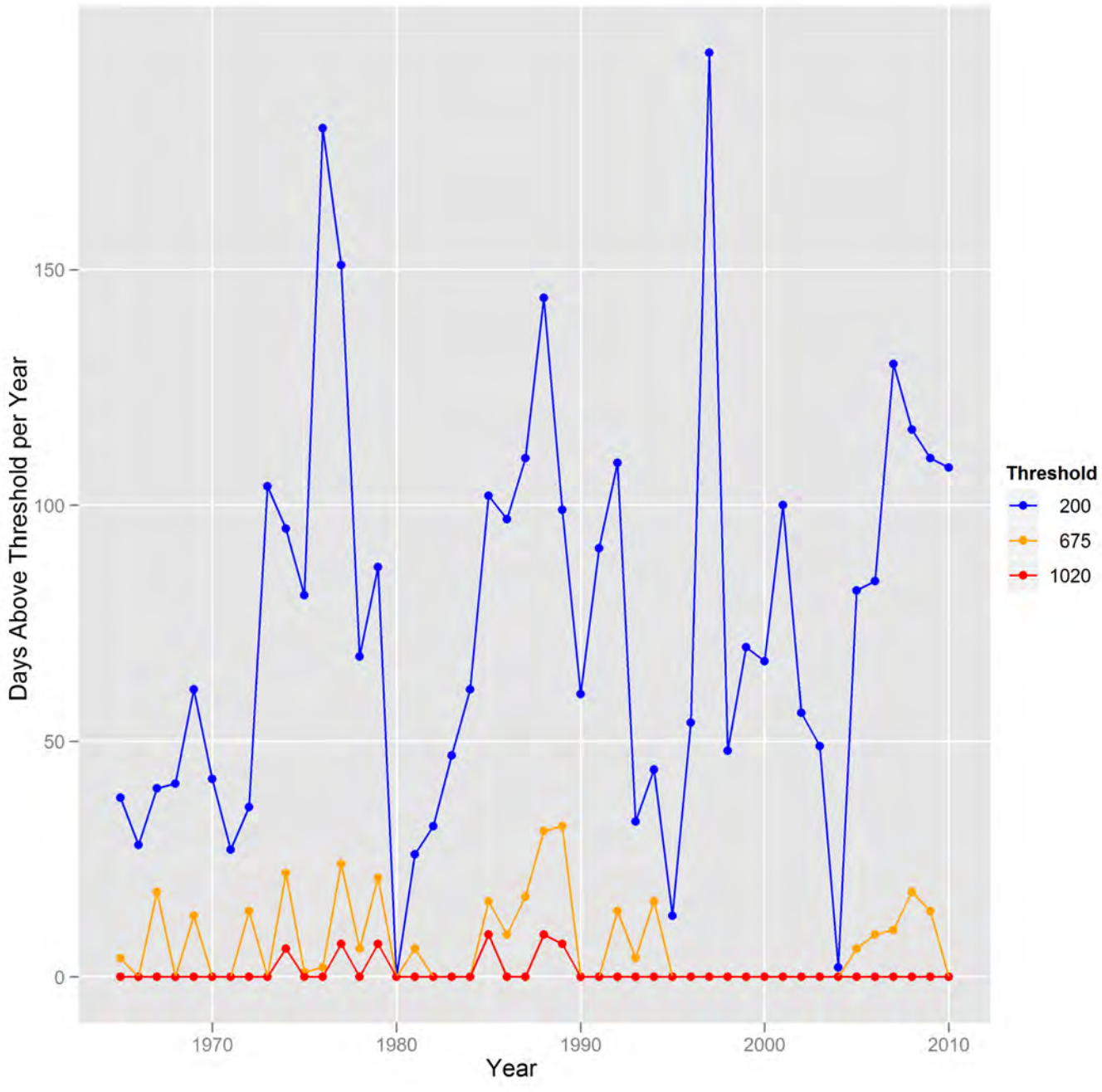
Figure 3.1.p



ENVIRON

Yearly Flow Characteristics

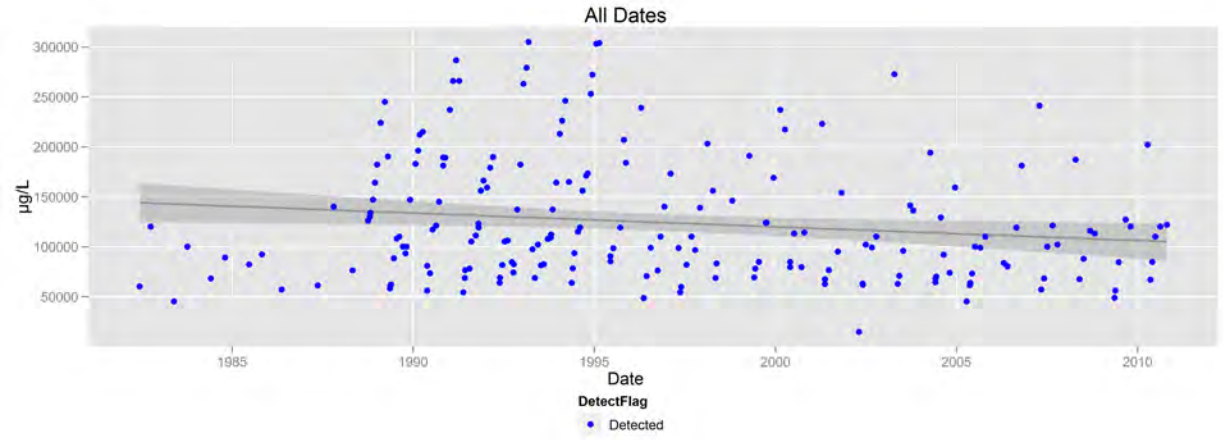
Figure 3.2



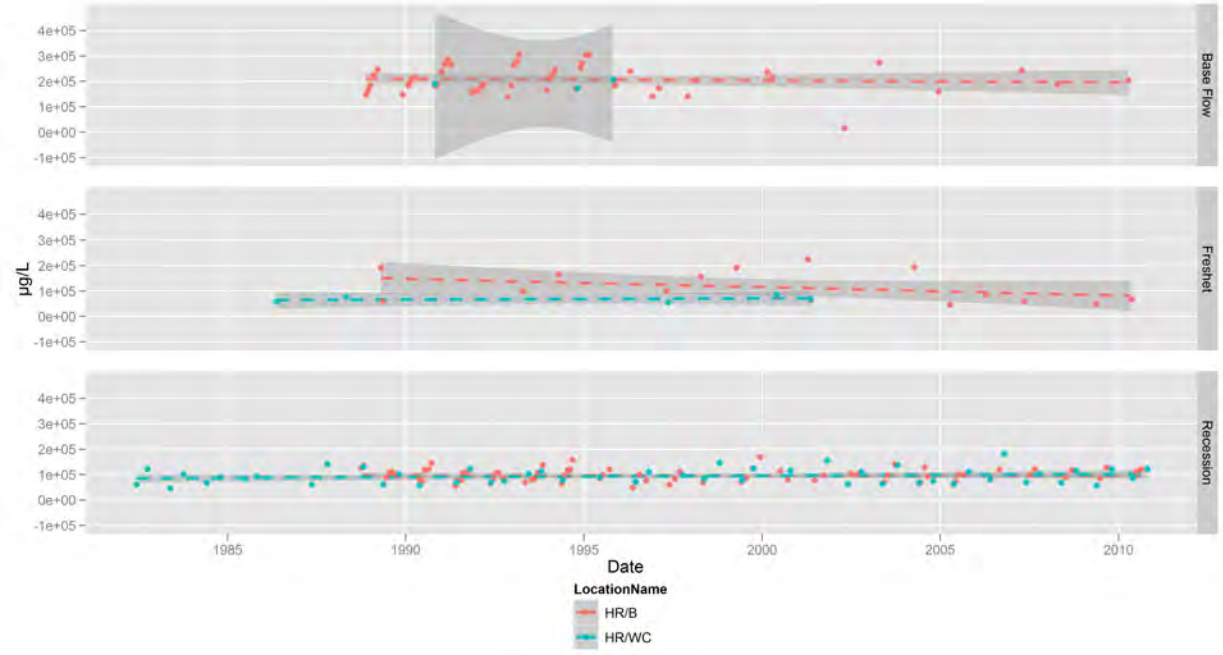
ENVIRON

Frequency of Extreme Flows

Figure 3.3



Group	n	Detects	Slope	slope.p
All Dates	203	203	-1380	0.027



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	49	49	-706	0.648
HR/B	Freshet	16	16	-3310	0.18
HR/B	Recession	81	81	-112	0.797
HR/WC	Base Flow	3	3	NC	NC
HR/WC	Freshet	5	5	486	0.668
HR/WC	Recession	49	49	571	0.249

Ecological Screening Value

Significant Trend

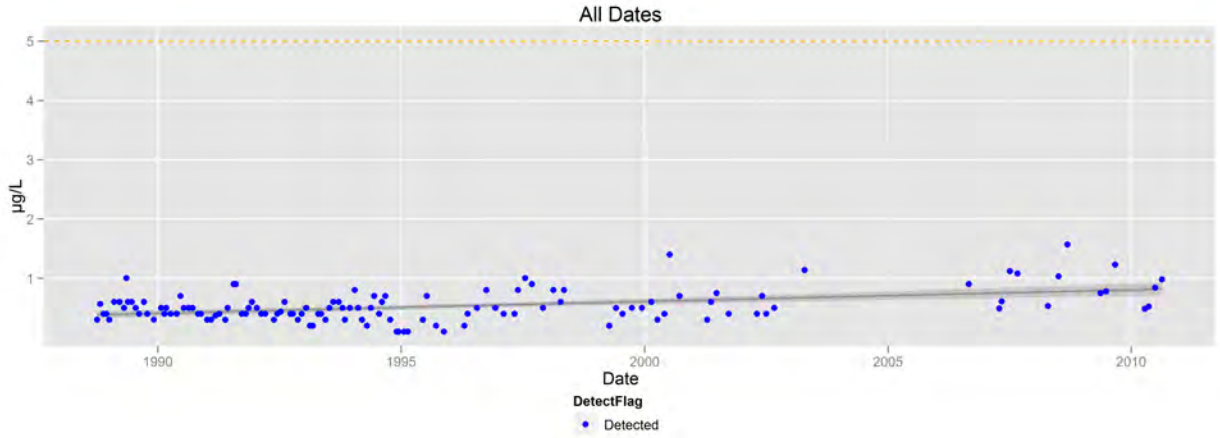
No Significant Trend

95% Confidence Interval

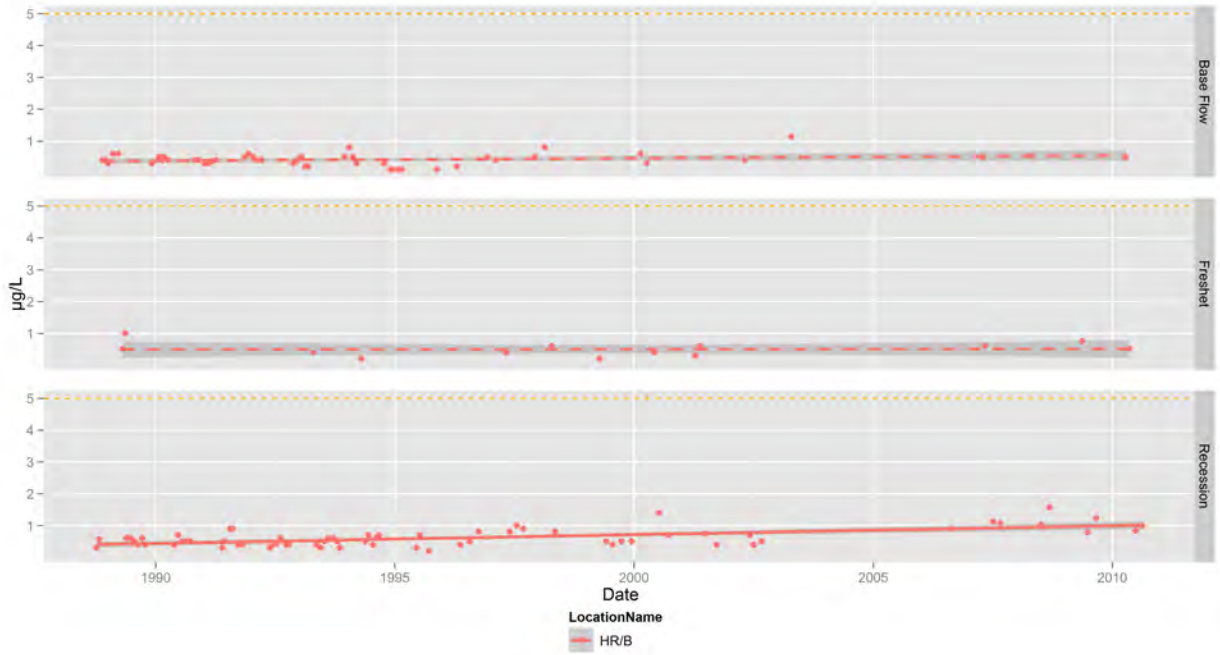
ENVIRON

Surface Water Time Series-All Dates
Alkalinity (as CaCO3)

Figure 3.4.a



Group	n	Detects	Slope	slope.p
All Dates	128	128	0.0197	6.83e-08



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	48	48	0.008250	1.43e-01
HR/B	Freshet	13	13	0.000983	9.22e-01
HR/B	Recession	67	67	0.027700	2.20e-08

Ecological Screening Value

Significant Trend

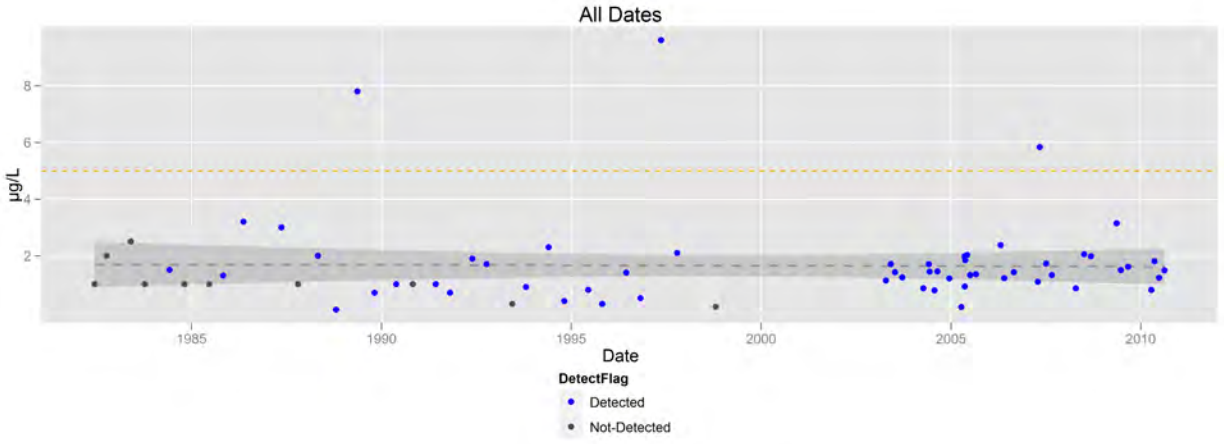
No Significant Trend

95% Confidence Interval

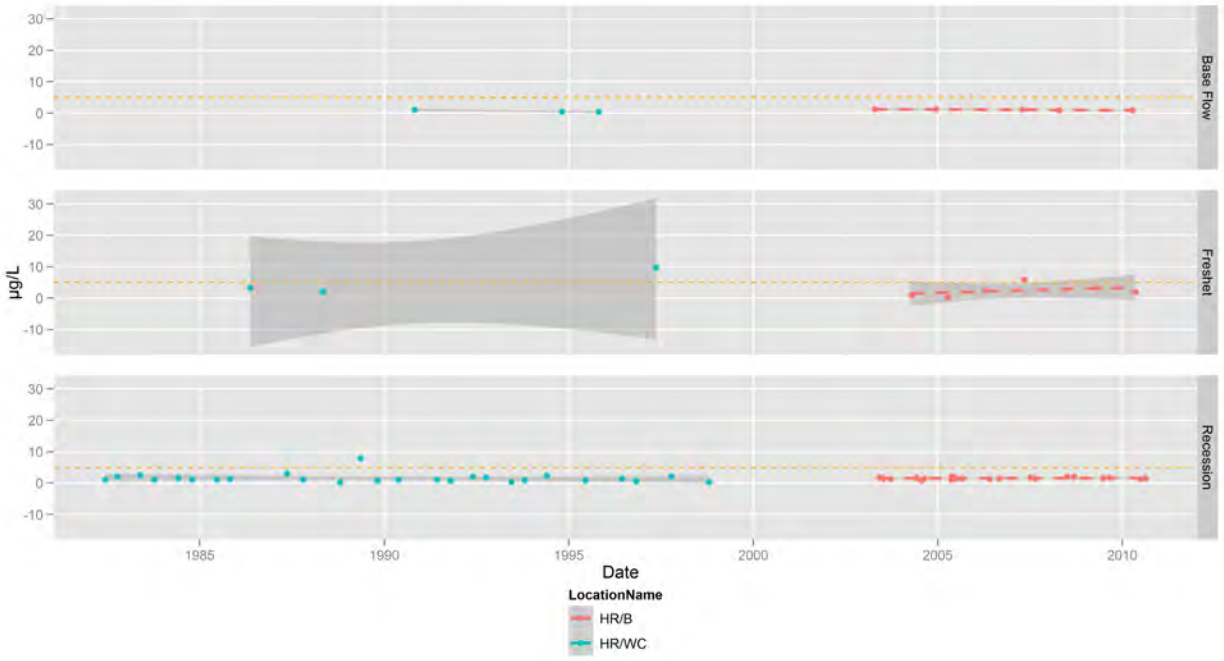
ENVIRON

Surface Water Time Series-All Dates
Arsenic Dissolved

Figure
3.4.b



Group	n	Detects	Slope	slope.p
All Dates	66	56	-0.00248	0.908



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	5	5	-0.0563	0.051
HR/B	Freshet	6	6	0.325	0.453
HR/B	Recession	23	23	0.0208	0.526
HR/WC	Base Flow	3	2	NC	NC
HR/WC	Freshet	3	3	NC	NC
HR/WC	Recession	26	17	NC	NC

Ecological Screening Value

Significant Trend

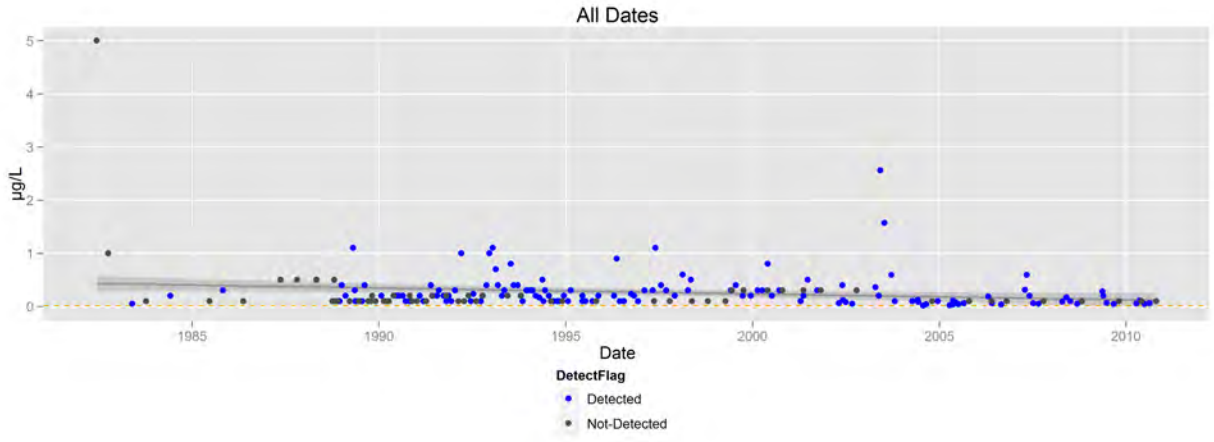
No Significant Trend

95% Confidence Interval

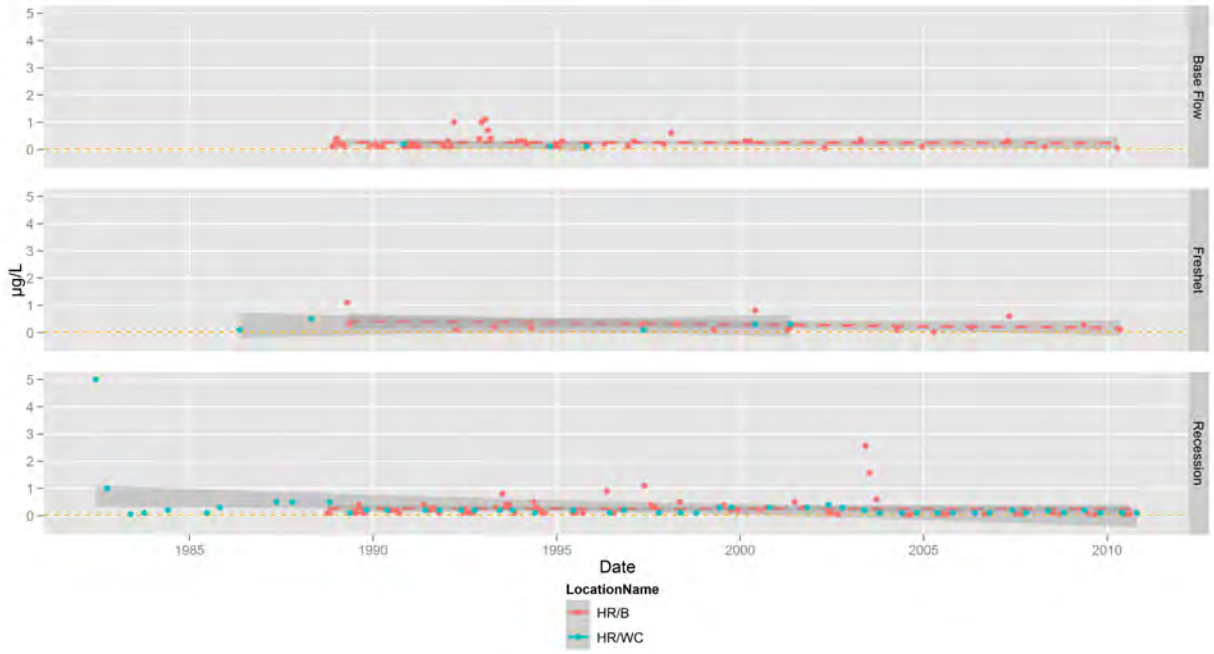
ENVIRON

Surface Water Time Series-All Dates
Arsenic Total

Figure
3.4.c



Group	n	Detects	Slope	slope.p
All Dates	202	143	-0.011	0.0126



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	49	38	-0.00184	0.786
HR/B	Freshet	17	15	-0.0121	0.269
HR/B	Recession	80	73	-0.000579	0.927
HR/WC	Base Flow	3	1	NC	NC
HR/WC	Freshet	5	0	NC	NC
HR/WC	Recession	48	16	NC	NC

Ecological Screening Value

Significant Trend

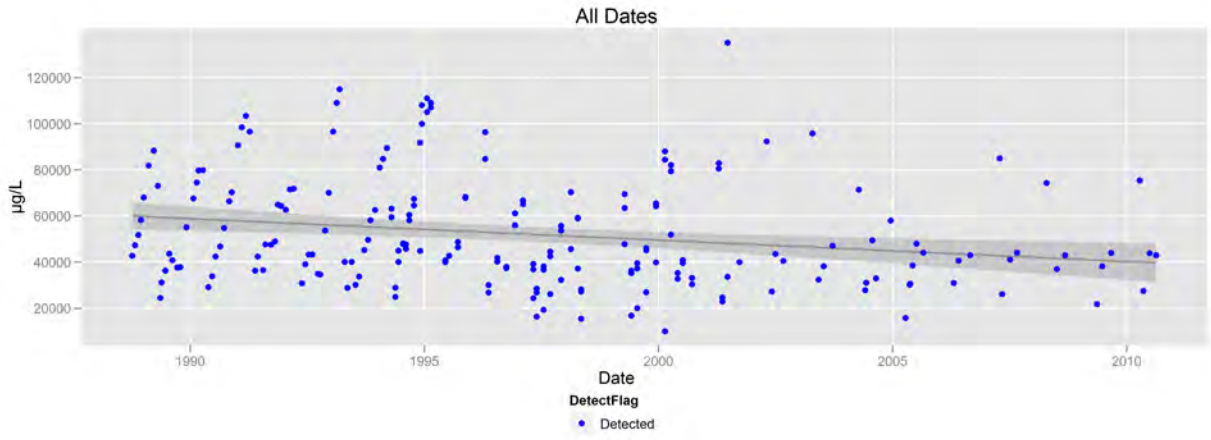
No Significant Trend

95% Confidence Interval

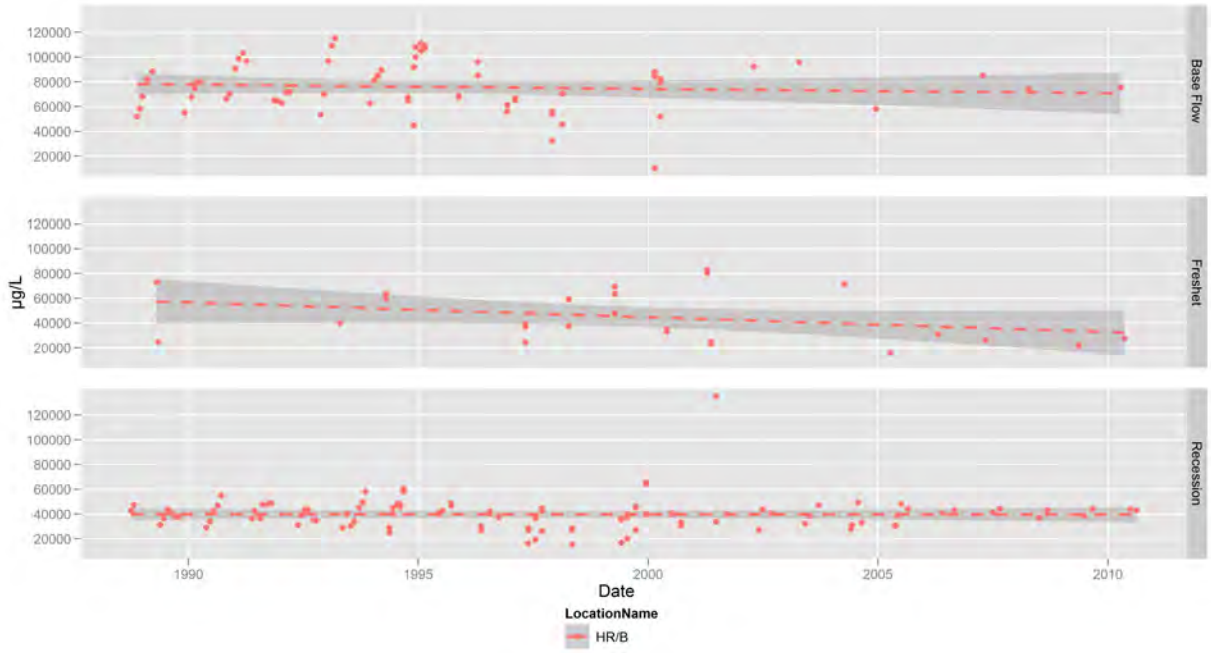
ENVIRON

Surface Water Time Series-All Dates
Cadmium Total

Figure 3.4.d



Group	n	Detects	Slope	slope.p
All Dates	203	203	-930	0.00183



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	66	66	-350.0	0.513
HR/B	Freshet	26	26	-1200.0	0.122
HR/B	Recession	111	111	-18.2	0.935

Ecological Screening Value

Significant Trend

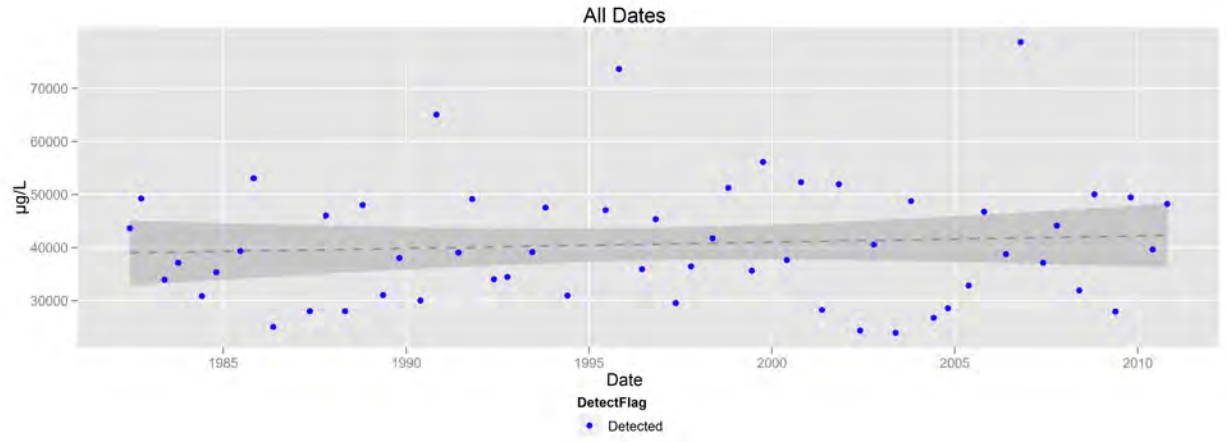
No Significant Trend

95% Confidence Interval

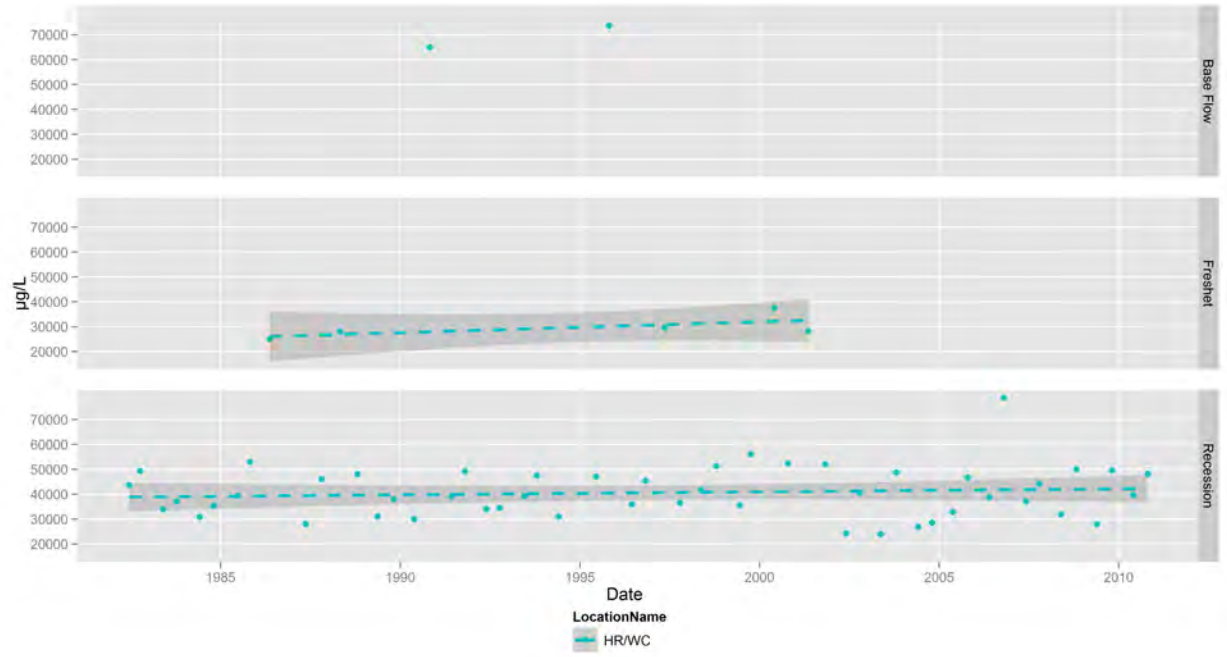
ENVIRON

Surface Water Time Series-All Dates
Calcium Dissolved

Figure
3.4.e



Group	n	Detects	Slope	slope.p
All Dates	56	56	116	0.529



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/WC	Base Flow	2	2	NC	NC
HR/WC	Freshet	5	5	436	0.244
HR/WC	Recession	49	49	120	0.477

Ecological Screening Value

Significant Trend

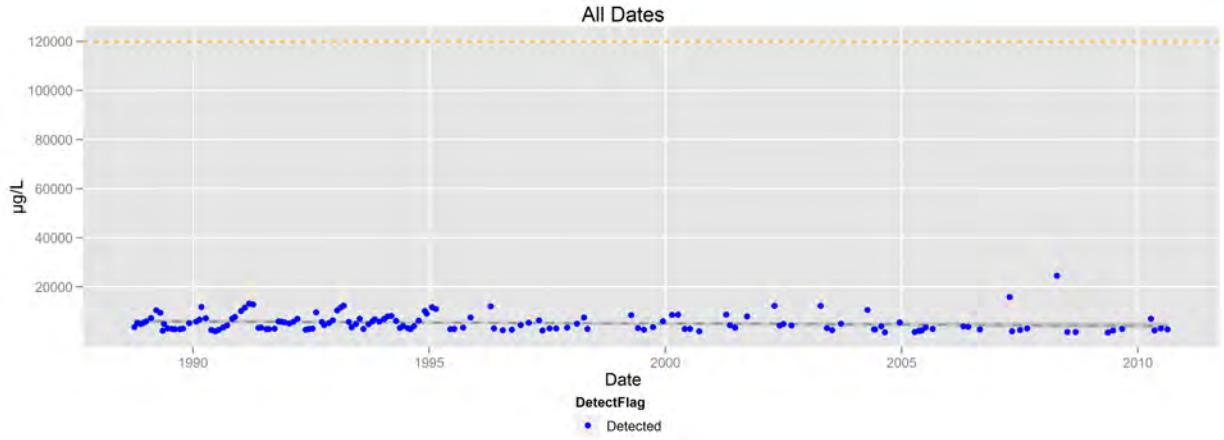
No Significant Trend

95% Confidence Interval

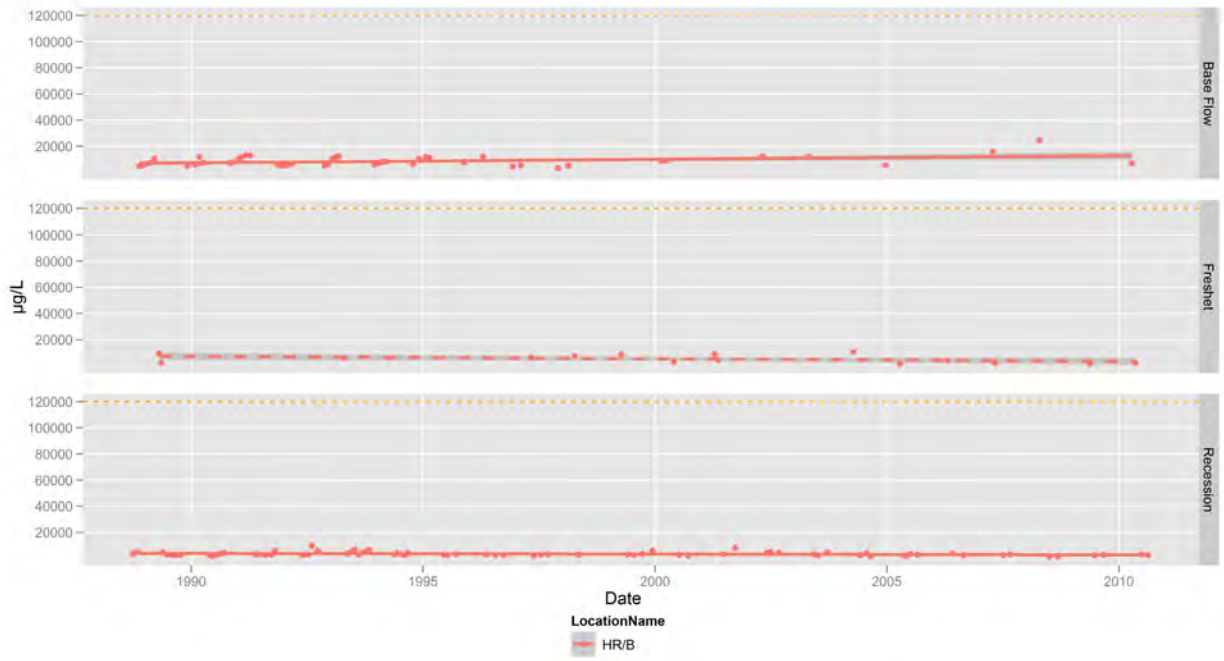
ENVIRON

Surface Water Time Series-All Dates
Calcium Total

Figure
3.4.f



Group	n	Detects	Slope	slope.p
All Dates	146	146	-80.9	0.0759



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	49	49	267.0	0.00807
HR/B	Freshet	16	16	-187.0	0.12200
HR/B	Recession	81	81	-58.8	0.01740

Ecological Screening Value

Significant Trend

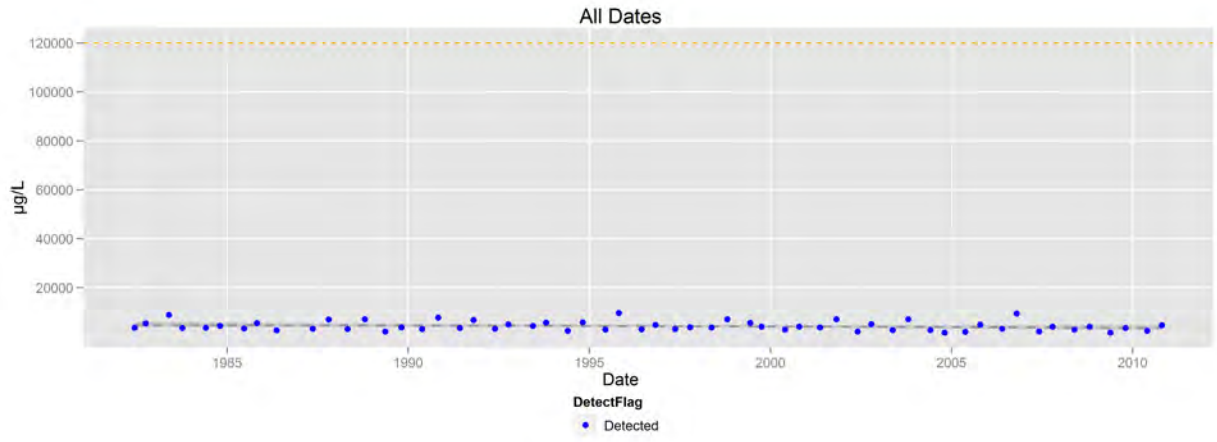
No Significant Trend

95% Confidence Interval

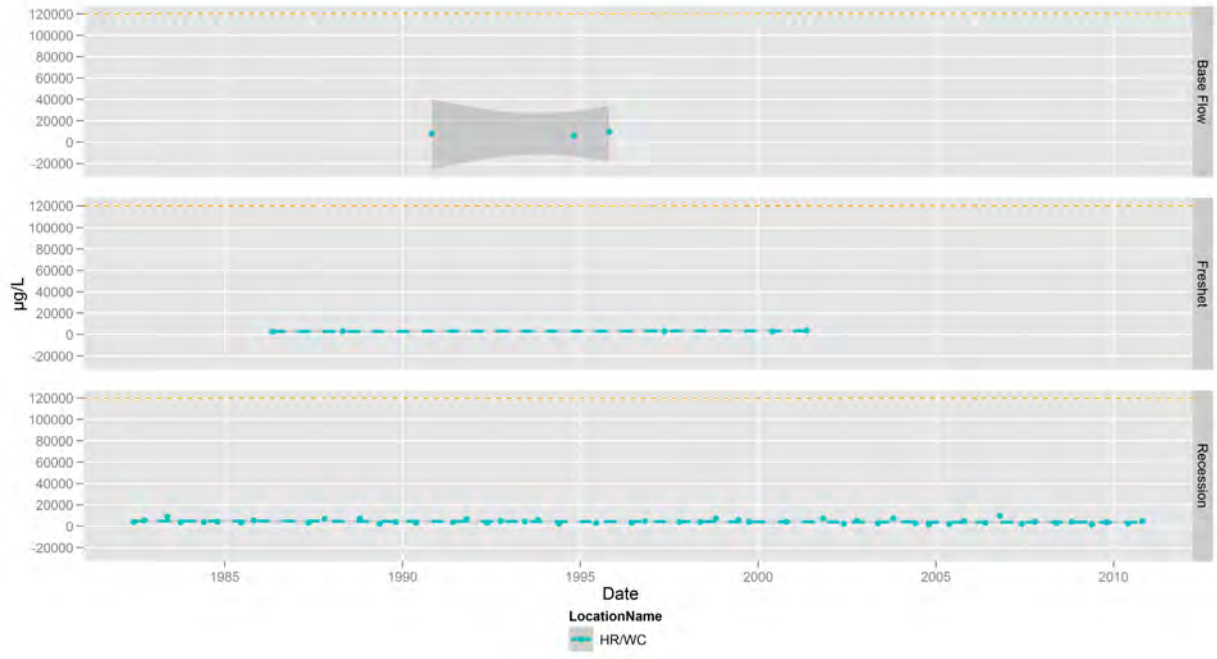
ENVIRON

Surface Water Time Series-All Dates
Chloride (as Cl) Dissolved

Figure 3.4.g



Group	n	Detects	Slope	slope.p
All Dates	57	57	-43.1	0.168



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/WC	Base Flow	3	3	NC	NC
HR/WC	Freshet	5	5	40.4	0.248
HR/WC	Recession	49	49	-43.4	0.153

Ecological Screening Value

Significant Trend

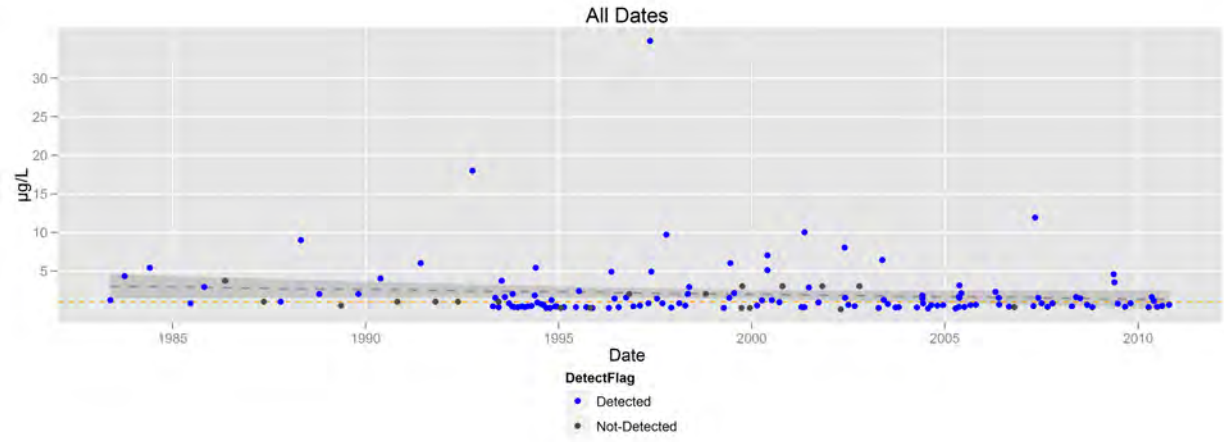
No Significant Trend

95% Confidence Interval

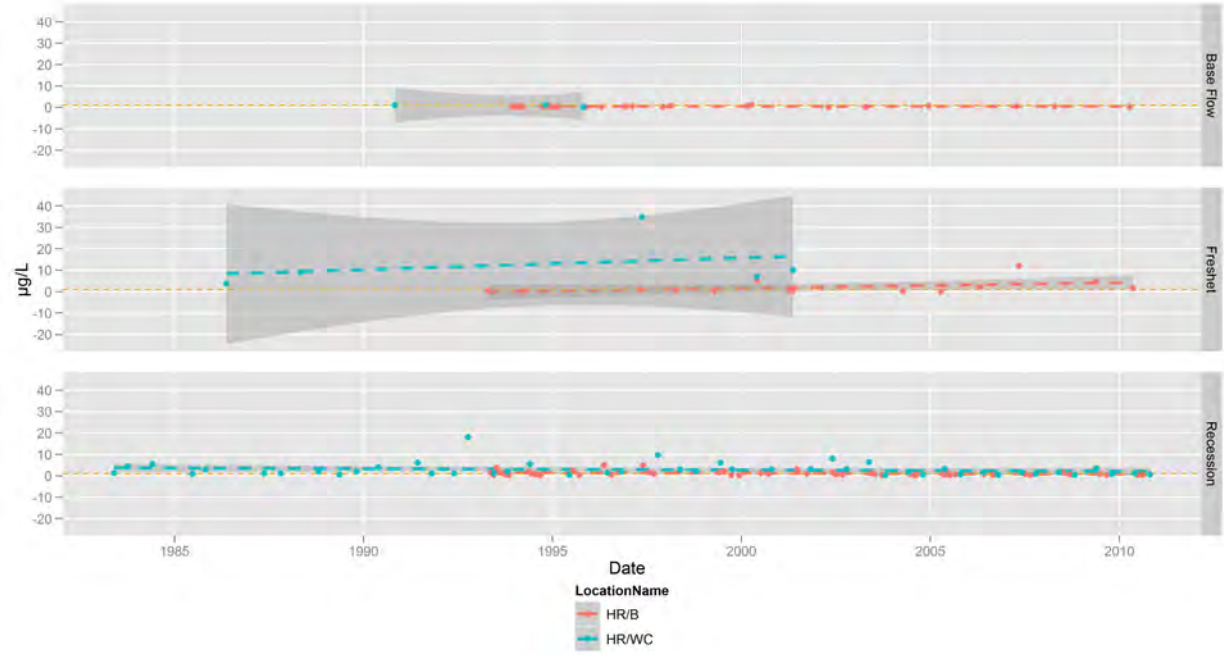
ENVIRON

Surface Water Time Series-All Dates
Chloride (as Cl)Total

Figure 3.4.h



Group	n	Detects	Slope	slope.p
All Dates	147	128	-0.062	0.184



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	23	21	0.00428	0.677
HR/B	Freshet	14	14	0.267	0.12
HR/B	Recession	56	54	-0.0496	0.0585
HR/WC	Base Flow	3	1	NC	NC
HR/WC	Freshet	5	4	0.551	0.615
HR/WC	Recession	46	34	-0.0608	0.288

Ecological Screening Value

Significant Trend

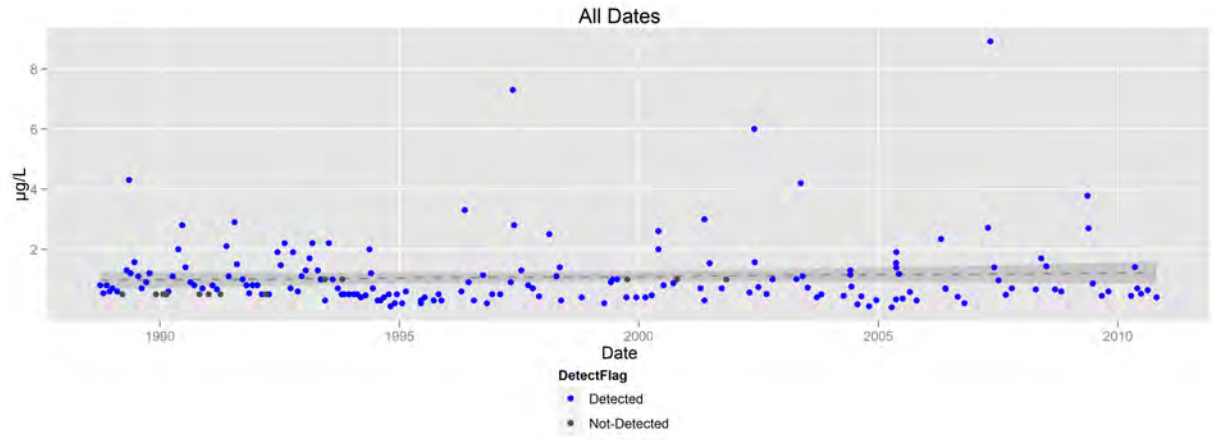
No Significant Trend

95% Confidence Interval

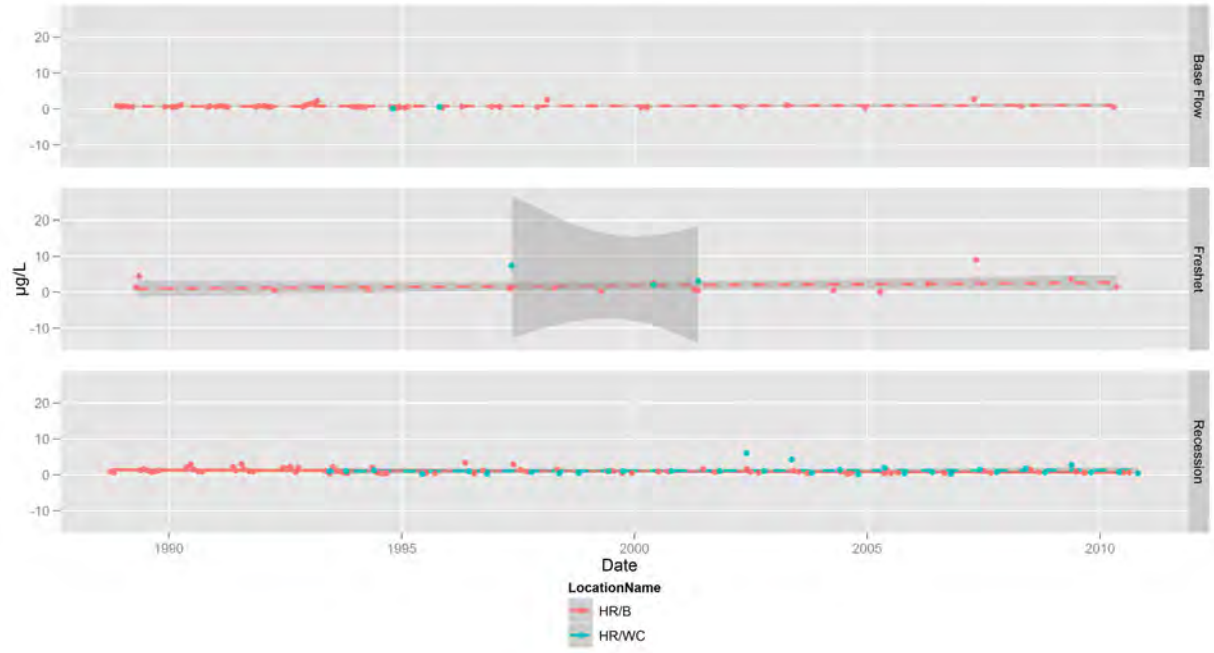
ENVIRON

Surface Water Time Series-All Dates
Chromium Total, Total

Figure 3.4.i



Group	n	Detects	Slope	slope.p
All Dates	182	169	0.0112	0.391



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	49	41	0.0153	0.297
HR/B	Freshet	17	17	0.0792	0.354
HR/B	Recession	80	80	-0.0316	0.00601
HR/WC	Base Flow	2	2	NC	NC
HR/WC	Freshet	3	3	NC	NC
HR/WC	Recession	31	26	0.0166	0.701

Ecological Screening Value

Significant Trend

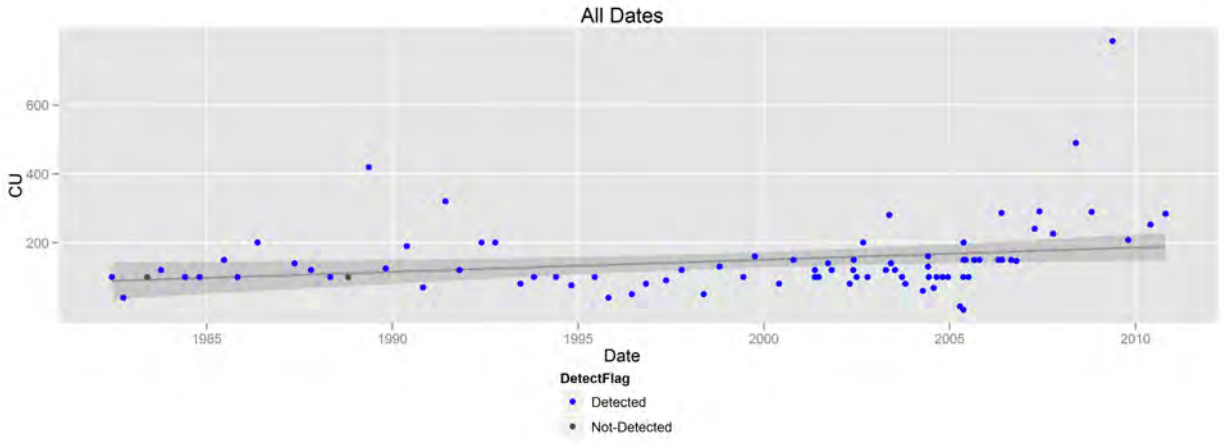
No Significant Trend

95% Confidence Interval

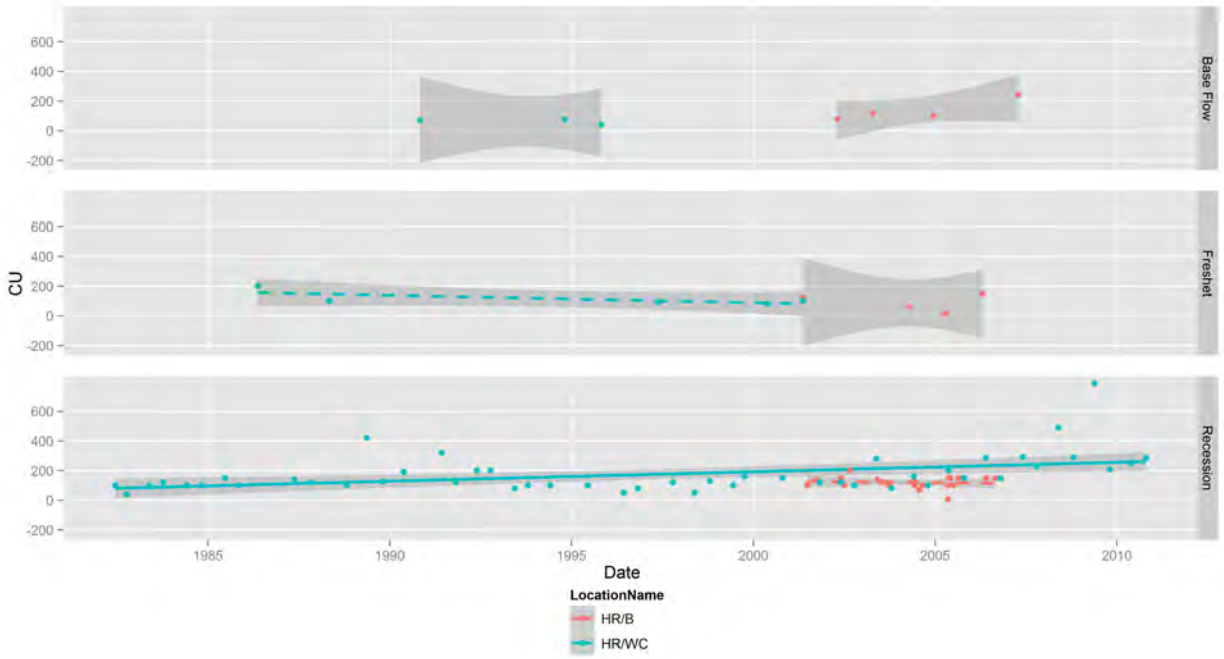
ENVIRON

Surface Water Time Series-All Dates
Cobalt Total

Figure 3.4.j



Group	n	Detects	Slope	slope.p
All Dates	85	83	3.52	0.0178



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	4	4	NC	NC
HR/B	Freshet	4	4	NC	NC
HR/B	Recession	20	20	-2.31	0.717
HR/WC	Base Flow	3	3	NC	NC
HR/WC	Freshet	5	5	-5.04	0.17
HR/WC	Recession	49	47	6.35	0.0019

Ecological Screening Value

Significant Trend

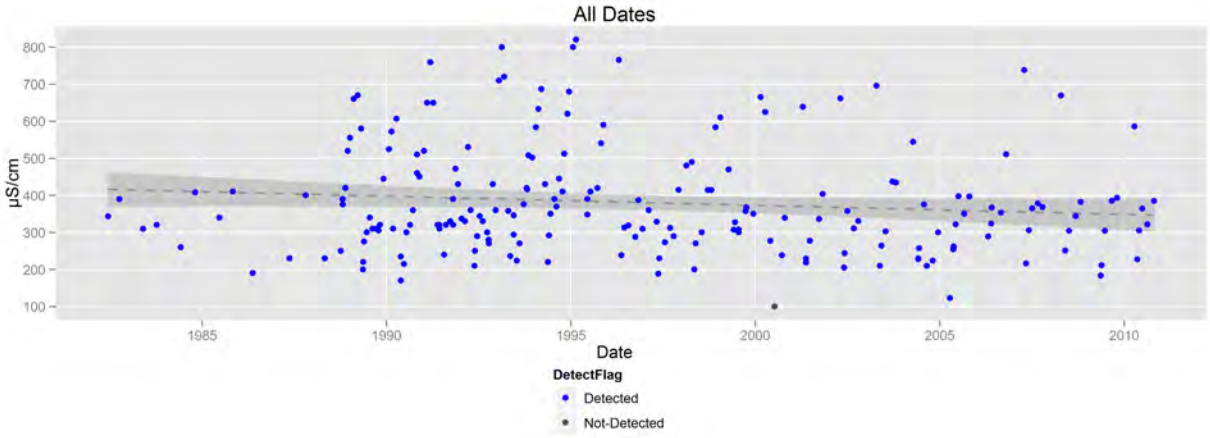
No Significant Trend

95% Confidence Interval

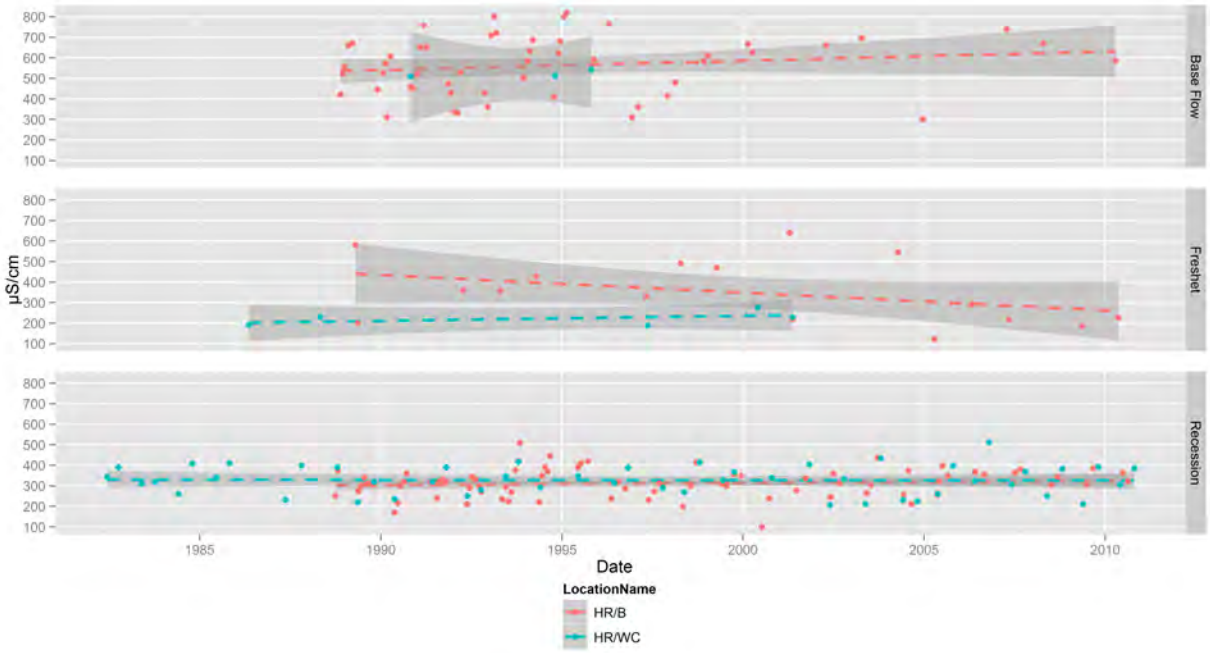
ENVIRON

Surface Water Time Series-All Dates
Color

Figure
3.4.k



Group	n	Detects	Slope	slope.p
All Dates	209	208	-2.45	0.096



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	51	51	4.48	0.251
HR/B	Freshet	17	17	-8.59	0.139
HR/B	Recession	84	83	0.903	0.441
HR/WC	Base Flow	3	3	NC	NC
HR/WC	Freshet	5	5	2.5	0.416
HR/WC	Recession	49	49	-0.187	0.875

Ecological Screening Value

Significant Trend

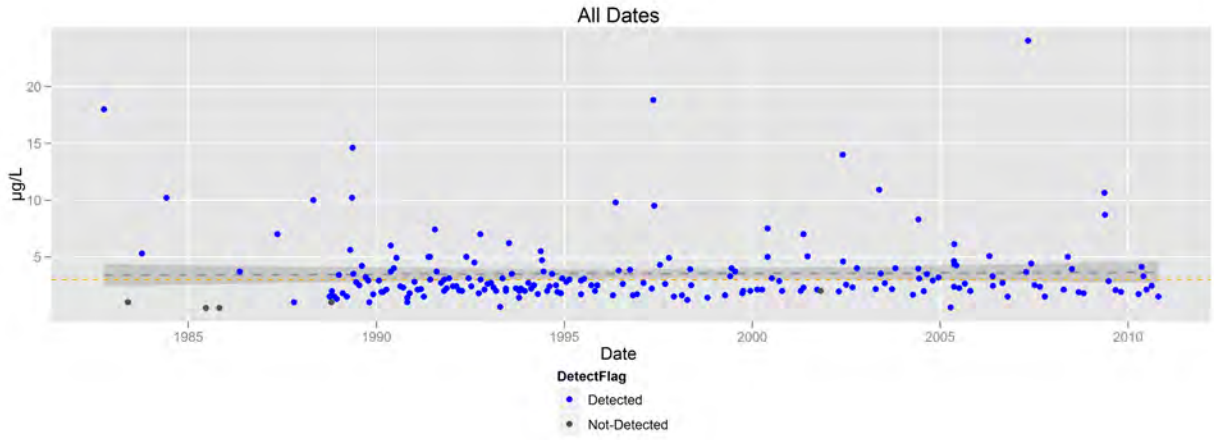
No Significant Trend

95% Confidence Interval

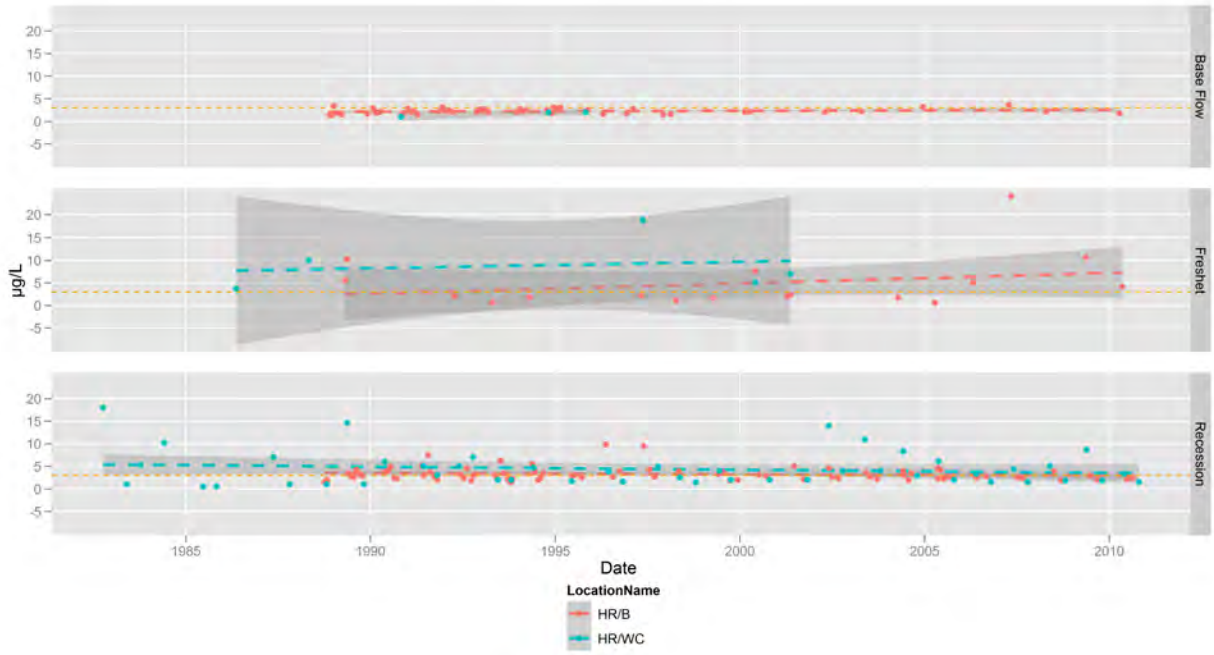
ENVIRON

Surface Water Time Series-All Dates
Conductivity

Figure
3.4.I



Group	n	Detects	Slope	slope.p
All Dates	201	196	0.0094	0.767



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	49	49	0.0177	0.254
HR/B	Freshet	17	17	0.232	0.305
HR/B	Recession	80	80	-0.0273	0.295
HR/WC	Base Flow	3	3	NC	NC
HR/WC	Freshet	5	5	0.143	0.79
HR/WC	Recession	47	42	-0.0685	0.316

Ecological Screening Value

Significant Trend

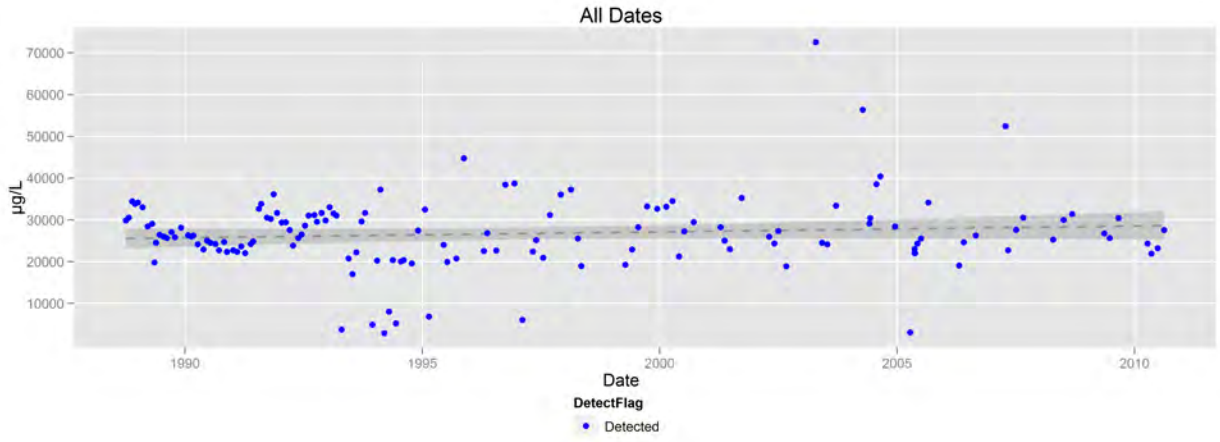
No Significant Trend

95% Confidence Interval

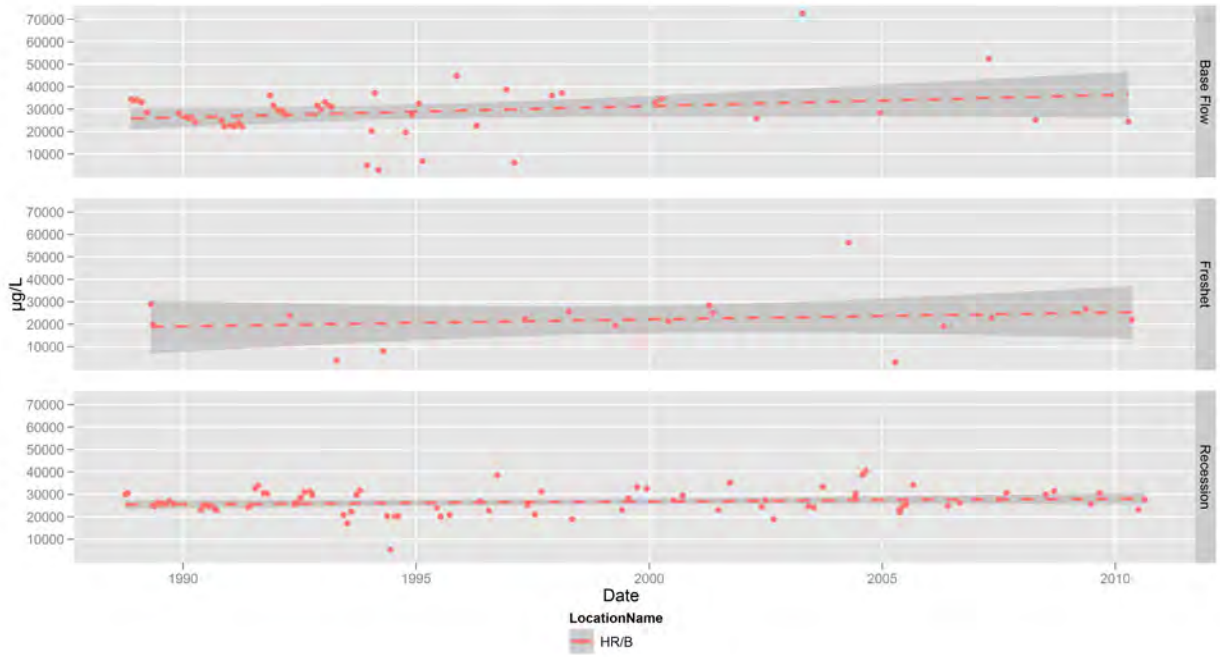
ENVIRON

Surface Water Time Series-All Dates
Copper Total

Figure
3.4.m



Group	n	Detects	Slope	slope.p
All Dates	143	143	140	0.225



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	48	48	500	0.110
HR/B	Freshet	17	17	307	0.504
HR/B	Recession	78	78	124	0.188

Ecological Screening Value

Significant Trend

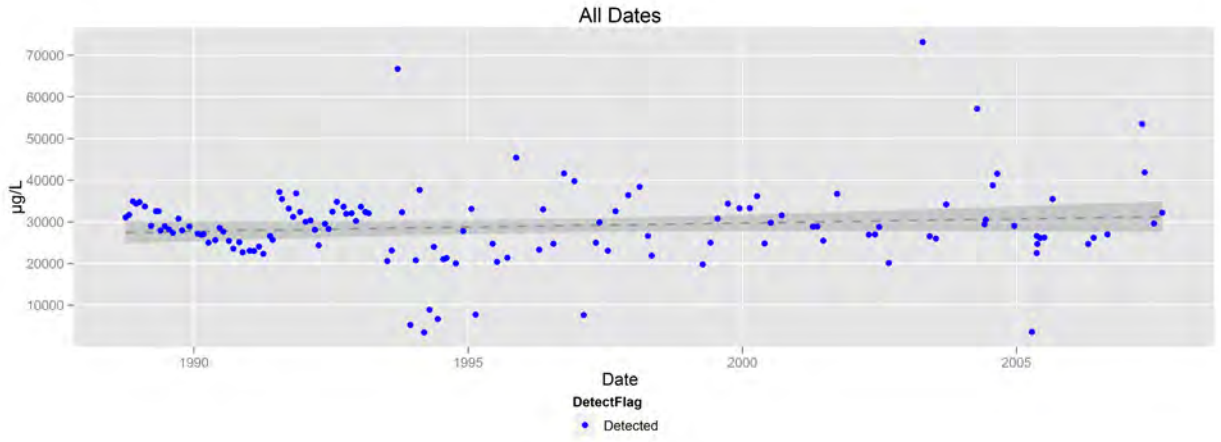
No Significant Trend

95% Confidence Interval

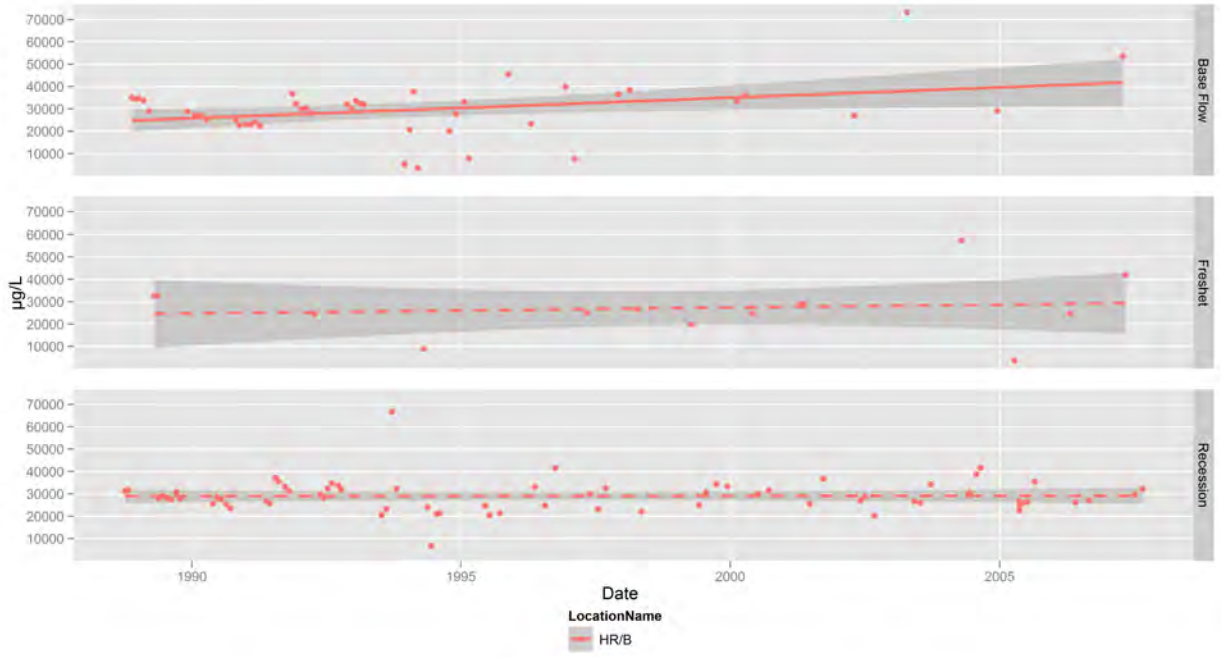
ENVIRON

Surface Water Time Series-All Dates
Carbon, Organic Dissolved

Figure
3.4.n



Group	n	Detects	Slope	slope.p
All Dates	131	131	197	0.184



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	46	46	919	0.0175
HR/B	Freshet	14	14	265	0.6760
HR/B	Recession	71	71	11	0.9400

Ecological Screening Value

Significant Trend

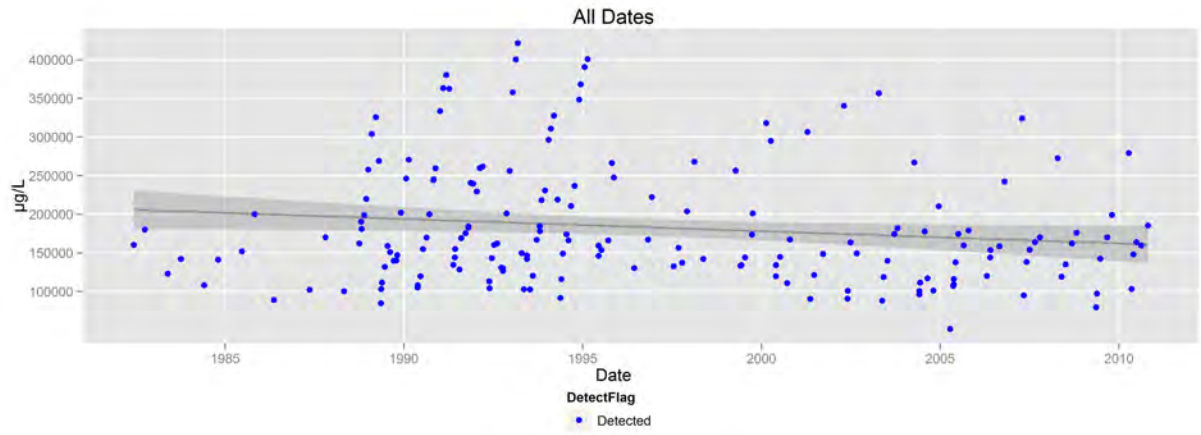
No Significant Trend

95% Confidence Interval

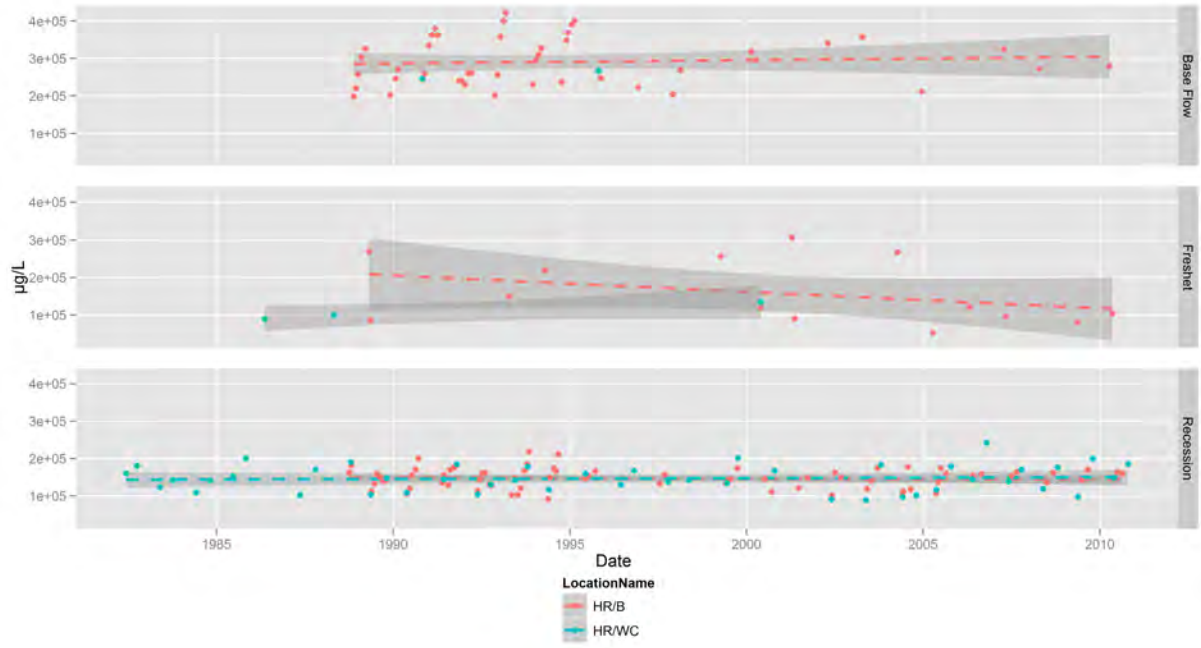
ENVIRON

Surface Water Time Series-All Dates
Carbon, Organic Total

Figure
3.4.o



Group	n	Detects	Slope	slope.p
All Dates	185	185	-1580	0.0449



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	45	45	861	0.63
HR/B	Freshet	14	14	-4390	0.212
HR/B	Recession	75	75	-294	0.533
HR/WC	Base Flow	2	2	NC	NC
HR/WC	Freshet	3	3	NC	NC
HR/WC	Recession	46	46	240	0.687

Ecological Screening Value

Significant Trend

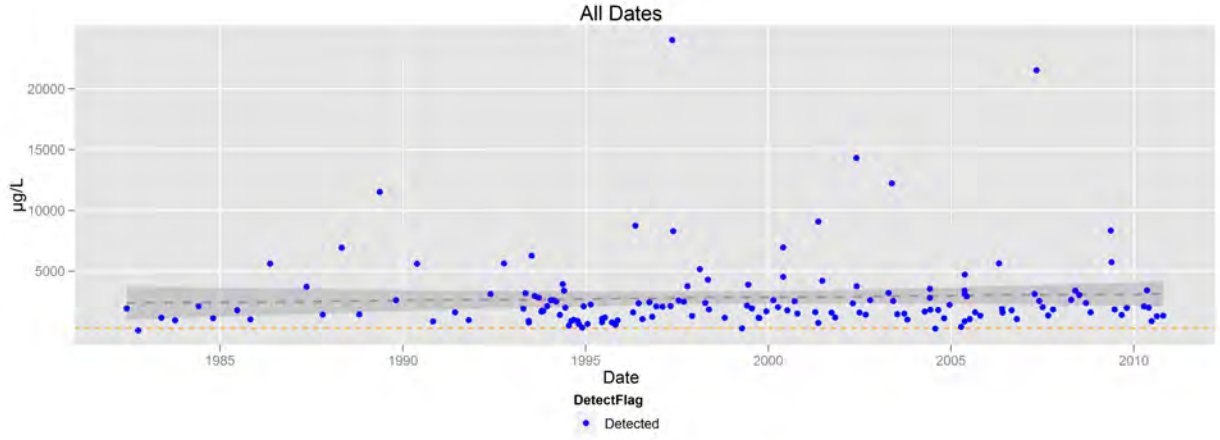
No Significant Trend

95% Confidence Interval

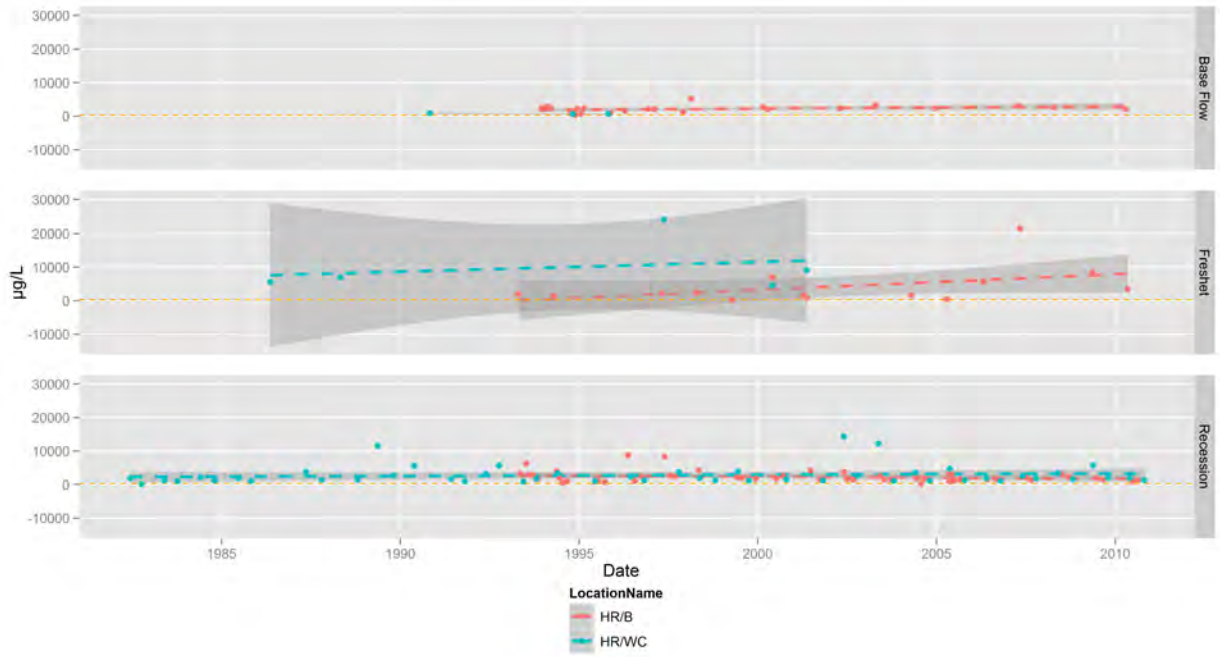
ENVIRON

Surface Water Time Series-All Dates
Hardness (as CaCO3)

Figure
3.4.p



Group	n	Detects	Slope	slope.p
All Dates	150	150	26.9	0.485



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	23	23	61.8	0.147
HR/B	Freshet	14	14	469	0.107
HR/B	Recession	56	56	-59.9	0.147
HR/WC	Base Flow	3	3	NC	NC
HR/WC	Freshet	5	5	290	0.682
HR/WC	Recession	49	49	37.5	0.435

Ecological Screening Value

Significant Trend

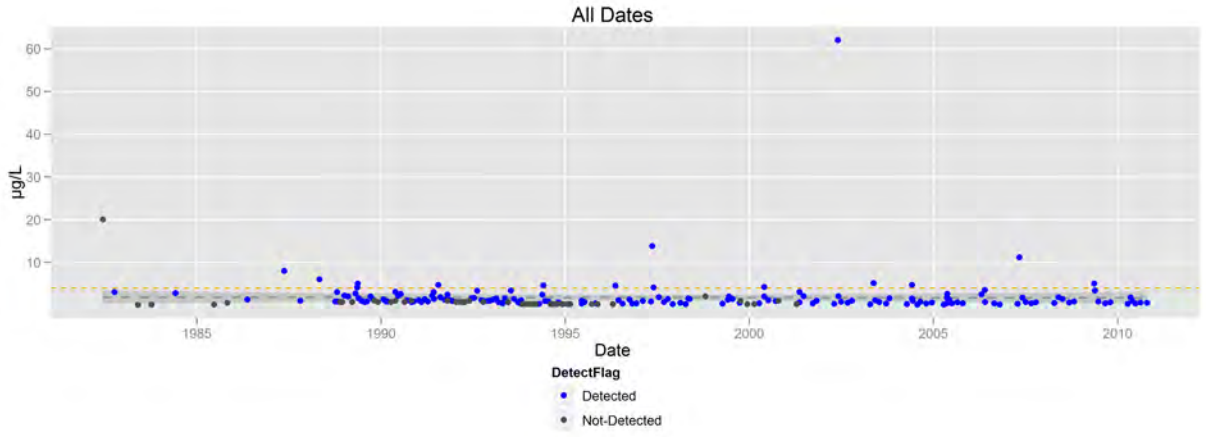
No Significant Trend

95% Confidence Interval

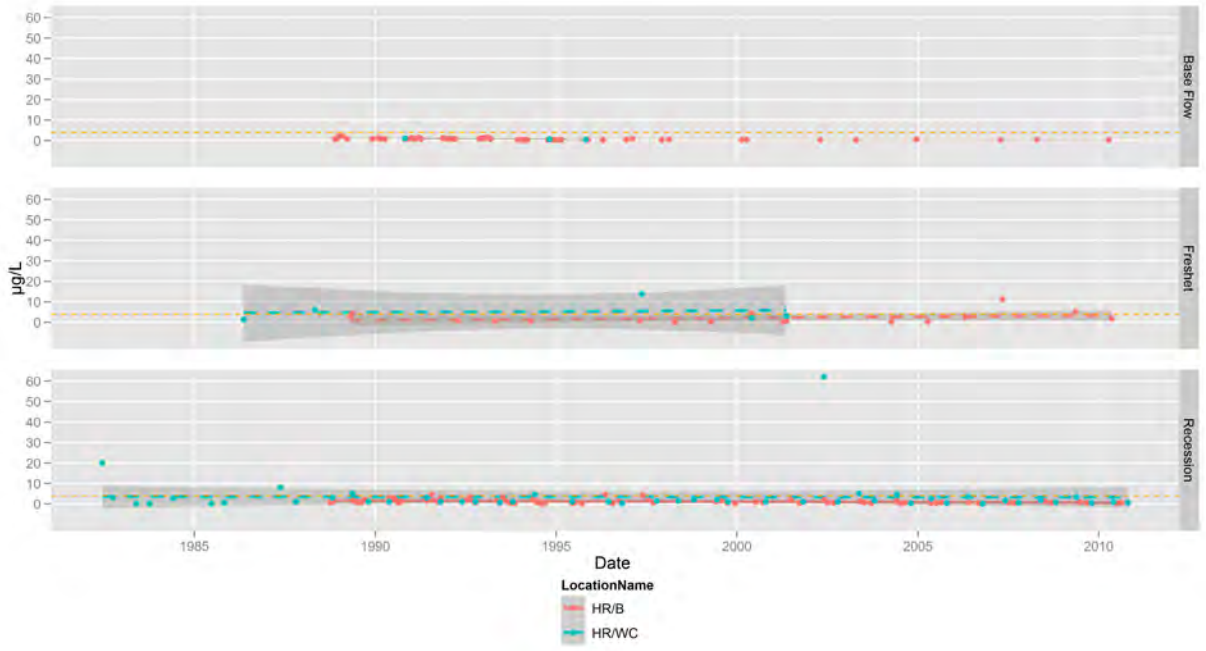
ENVIRON

Surface Water Time Series-All Dates
Iron Total

Figure
3.4.q



Group	n	Detects	Slope	slope.p
All Dates	202	159	-0.00557	0.909



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	49	29	NC	NC
HR/B	Freshet	17	15	0.117	0.288
HR/B	Recession	80	73	-0.0499	0.00279
HR/WC	Base Flow	3	2	NC	NC
HR/WC	Freshet	5	5	0.0896	0.845
HR/WC	Recession	48	35	-0.00901	0.954

Ecological Screening Value

Significant Trend

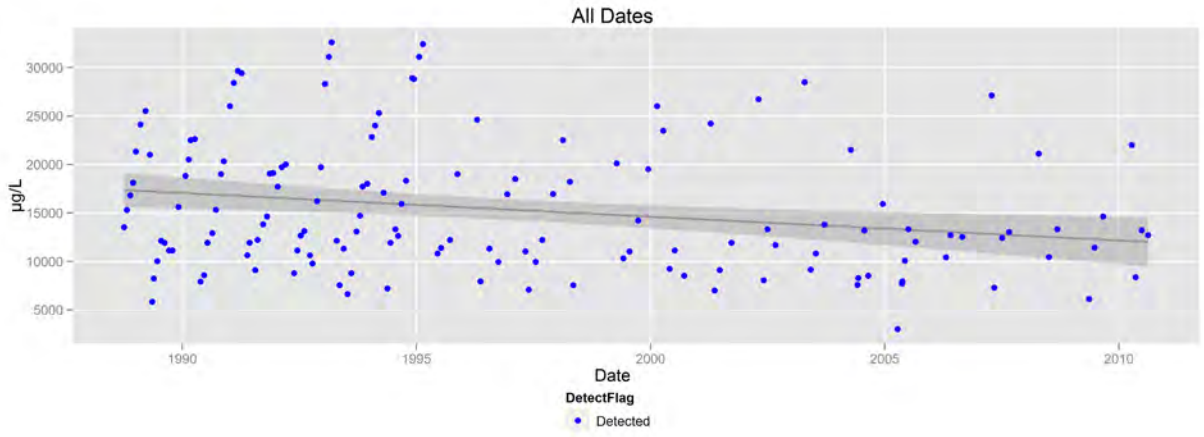
No Significant Trend

95% Confidence Interval

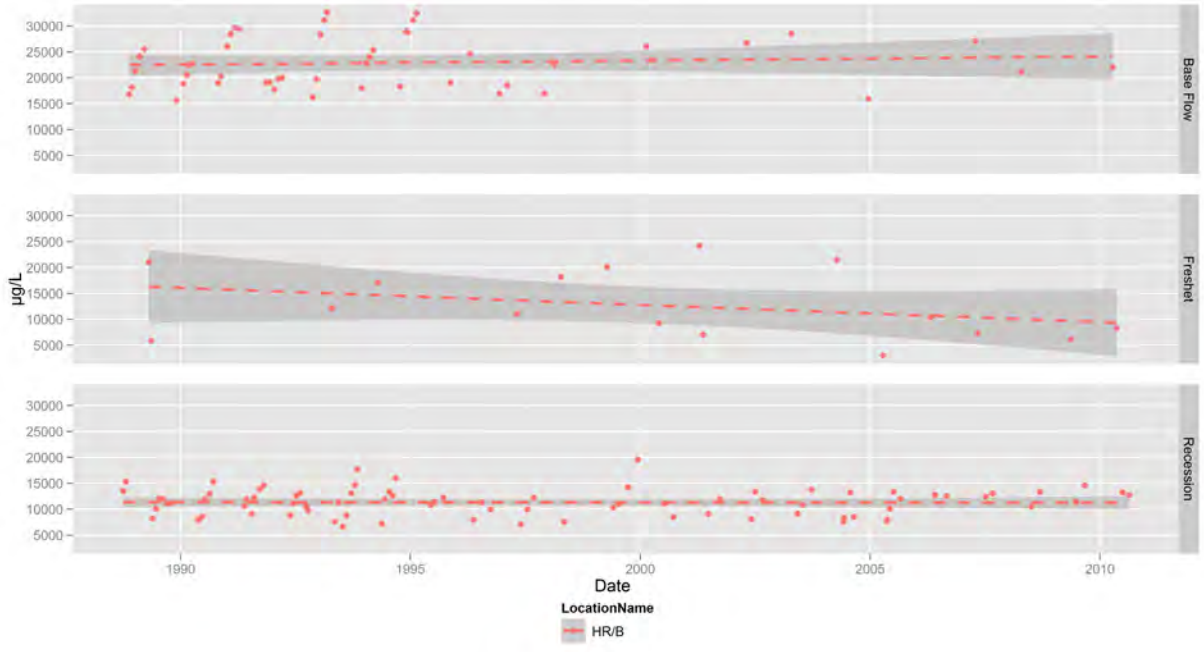
ENVIRON

Surface Water Time Series-All Dates
Lead Total

Figure
3.4.r



Group	n	Detects	Slope	slope.p
All Dates	146	146	-245	0.00501



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	49	49	78.30	0.564
HR/B	Freshet	16	16	-331.00	0.217
HR/B	Recession	81	81	-6.31	0.887

Ecological Screening Value

Significant Trend

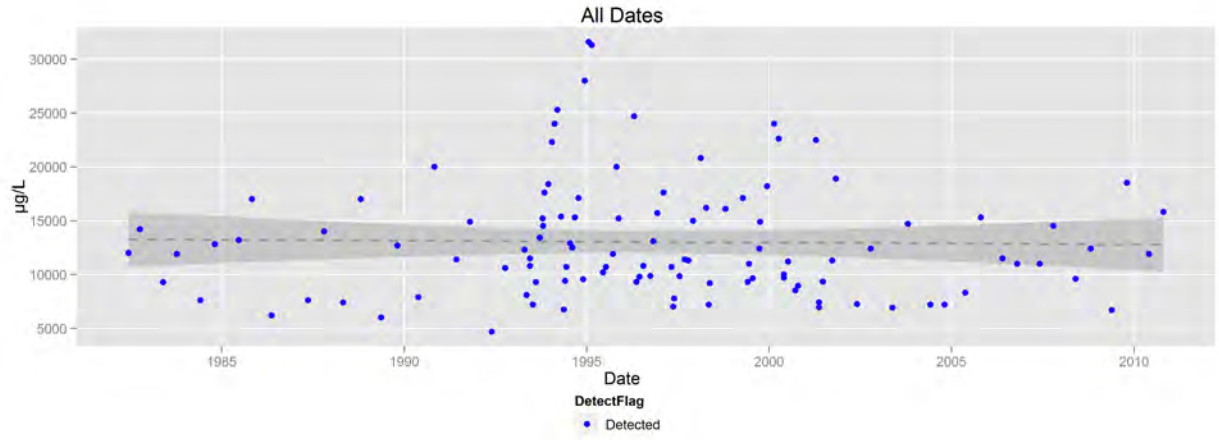
No Significant Trend

95% Confidence Interval

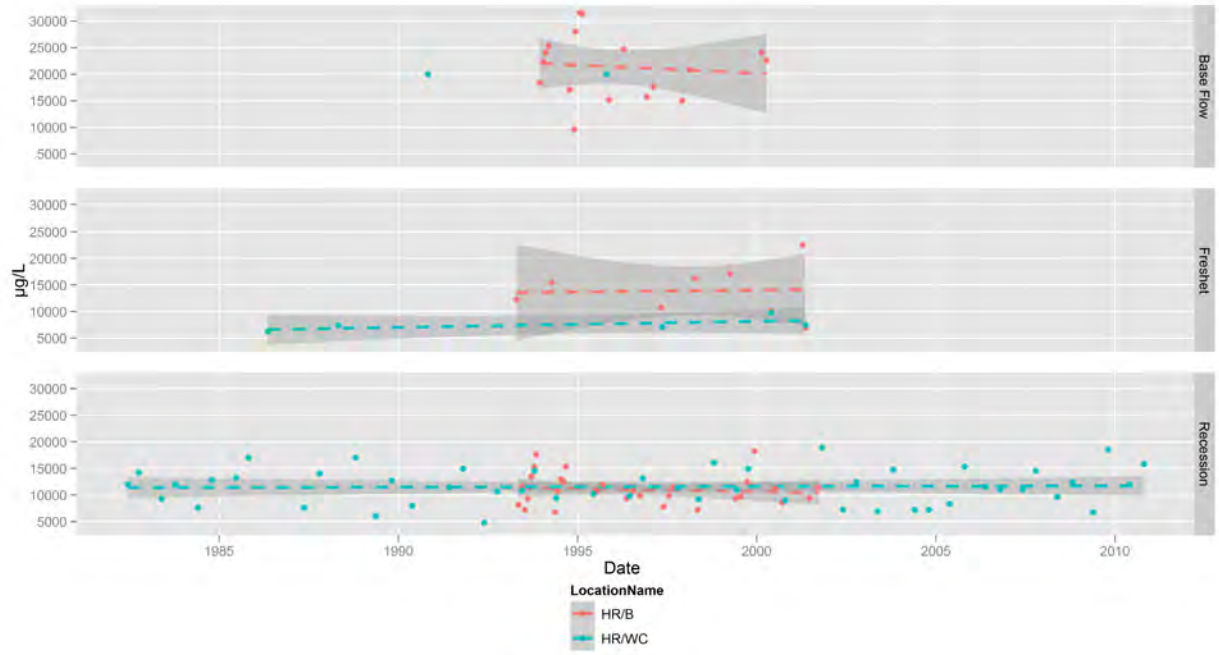
ENVIRON

Surface Water Time Series-All Dates
Magnesium Dissolved

Figure
3.4.s



Group	n	Detects	Slope	slope.p
All Dates	111	111	-17.2	0.835



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	17	17	-302	0.699
HR/B	Freshet	8	8	67.1	0.922
HR/B	Recession	30	30	-107	0.593
HR/WC	Base Flow	2	2	NC	NC
HR/WC	Freshet	5	5	114	0.274
HR/WC	Recession	49	49	10.2	0.857

Ecological Screening Value

Significant Trend

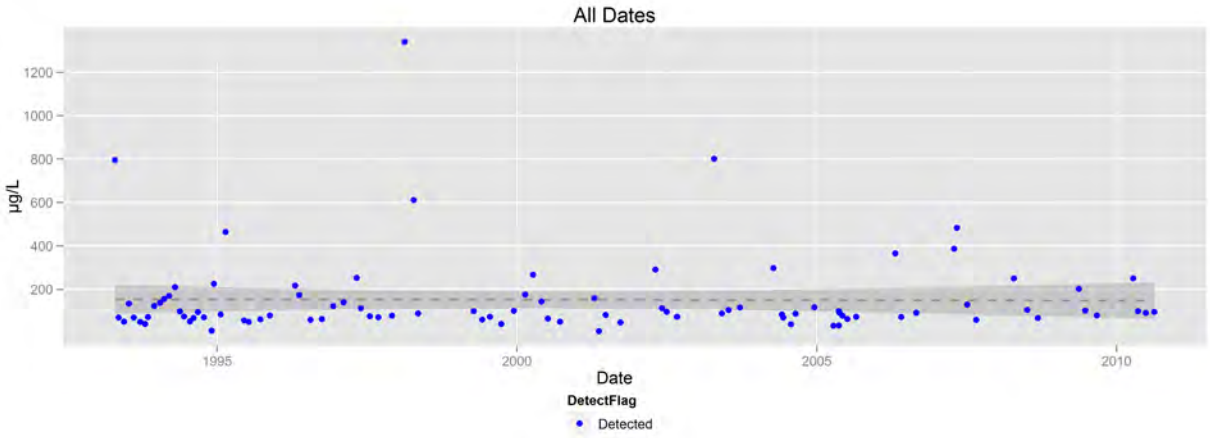
No Significant Trend

95% Confidence Interval

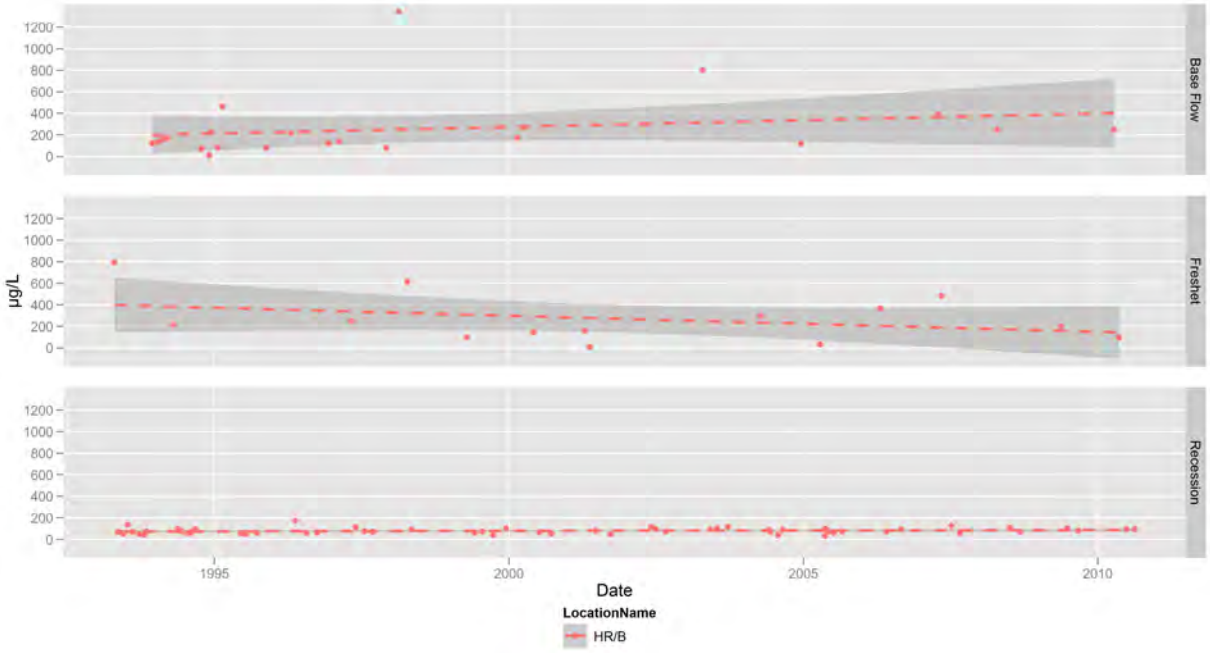
ENVIRON

Surface Water Time Series-All Dates
Magnesium Total

Figure
3.4.t



Group	n	Detects	Slope	slope.p
All Dates	93	93	-0.381	0.919



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	23	23	12.400	0.322
HR/B	Freshet	14	14	-14.900	0.221
HR/B	Recession	56	56	0.859	0.196

Ecological Screening Value

Significant Trend

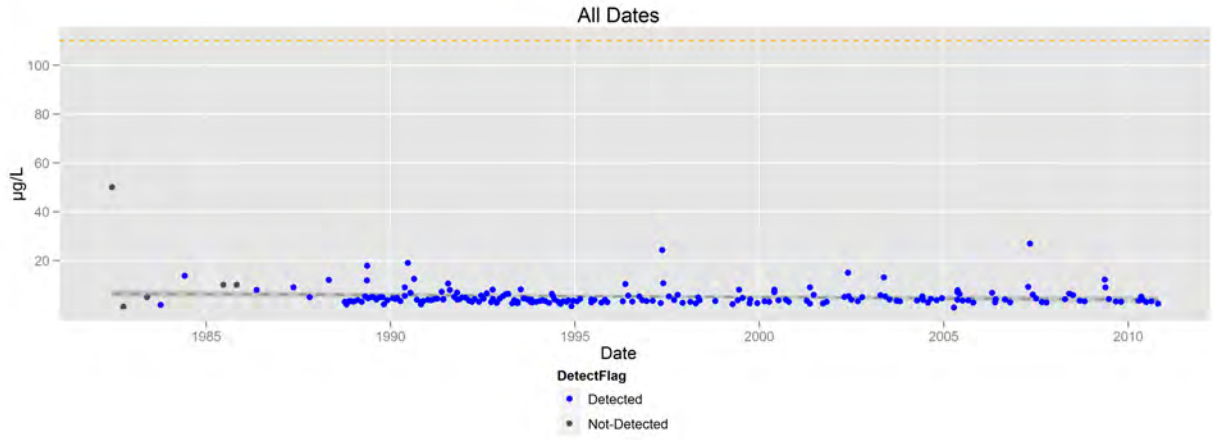
No Significant Trend

95% Confidence Interval

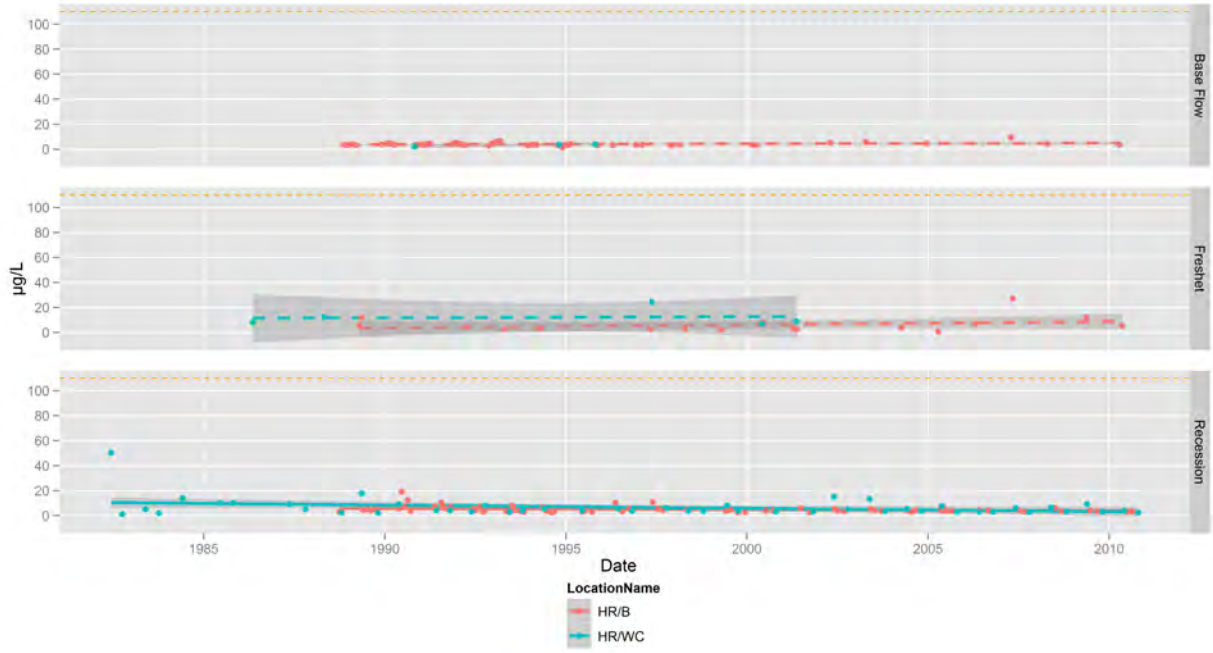
ENVIRON

Surface Water Time Series-All Dates
Manganese Total

Figure
3.4.u



Group	n	Detects	Slope	slope.p
All Dates	202	197	-0.0849	0.0749



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	49	49	0.0621	0.0636
HR/B	Freshet	17	17	0.257	0.29
HR/B	Recession	80	80	-0.0956	0.0303
HR/WC	Base Flow	3	3	NC	NC
HR/WC	Freshet	5	5	0.0949	0.882
HR/WC	Recession	48	43	-0.261	0.0338

Ecological Screening Value

Significant Trend

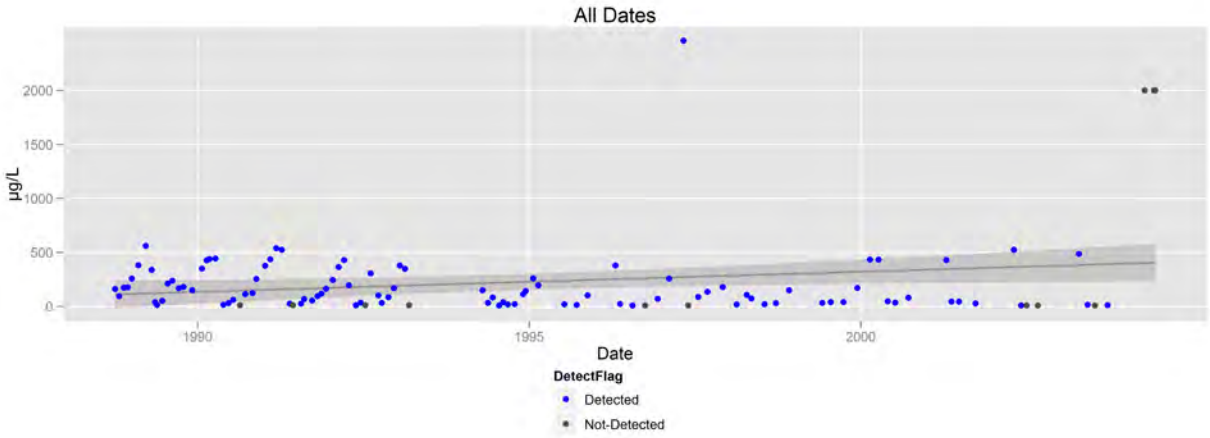
No Significant Trend

95% Confidence Interval

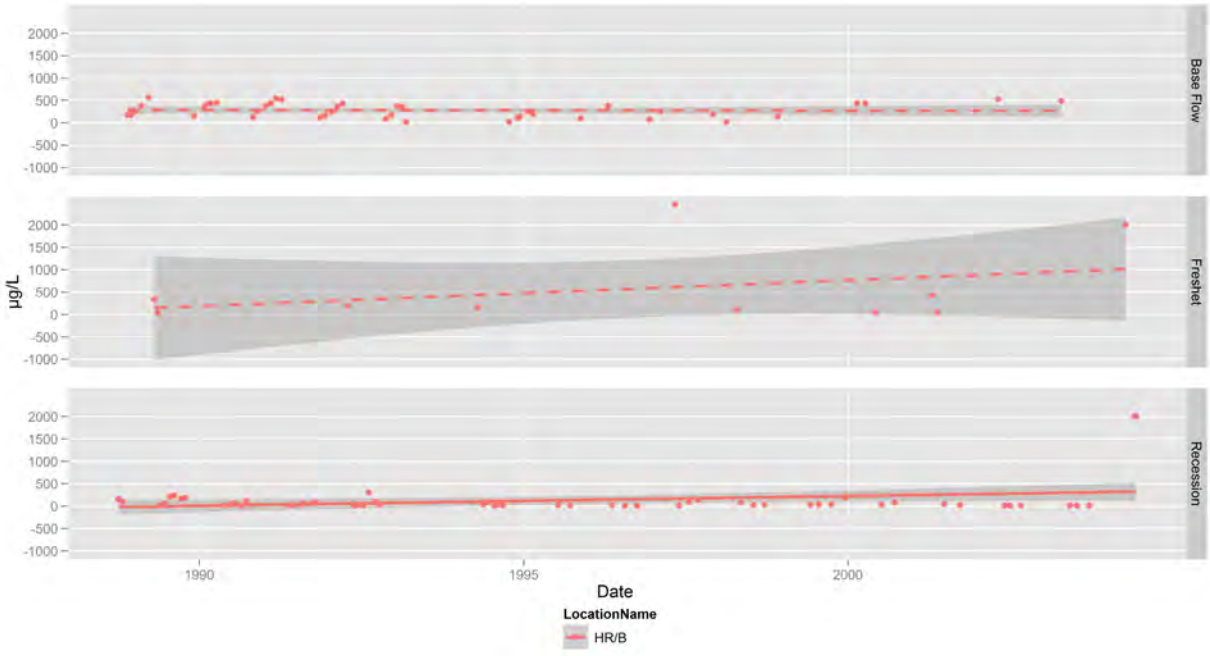
ENVIRON

Surface Water Time Series-All Dates
Nickel Total

Figure 3.4.v



Group	n	Detects	Slope	slope.p
All Dates	109	97	18.7	0.0259



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	42	41	-1.34	0.8420
HR/B	Freshet	10	9	57.90	0.3290
HR/B	Recession	57	47	21.80	0.0297

Ecological Screening Value

Significant Trend

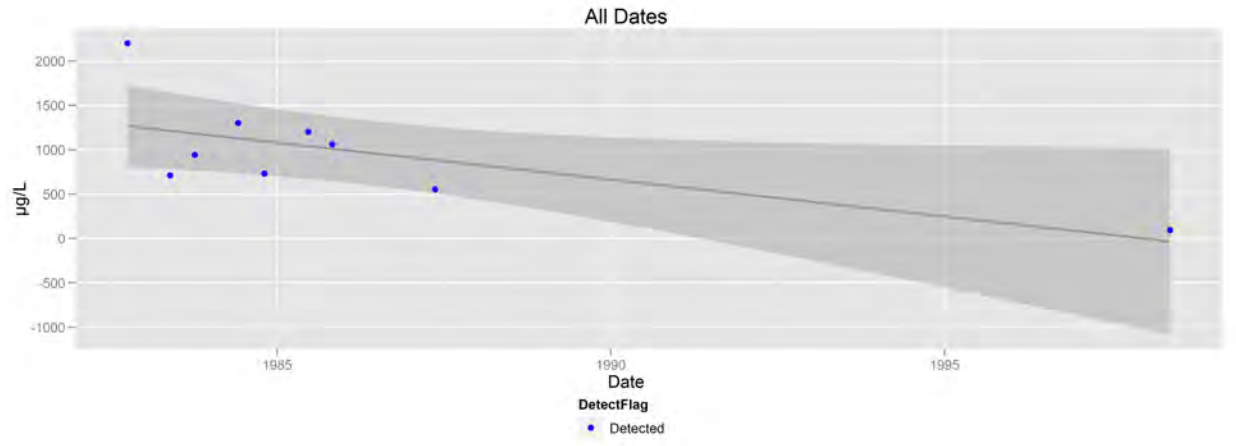
No Significant Trend

95% Confidence Interval

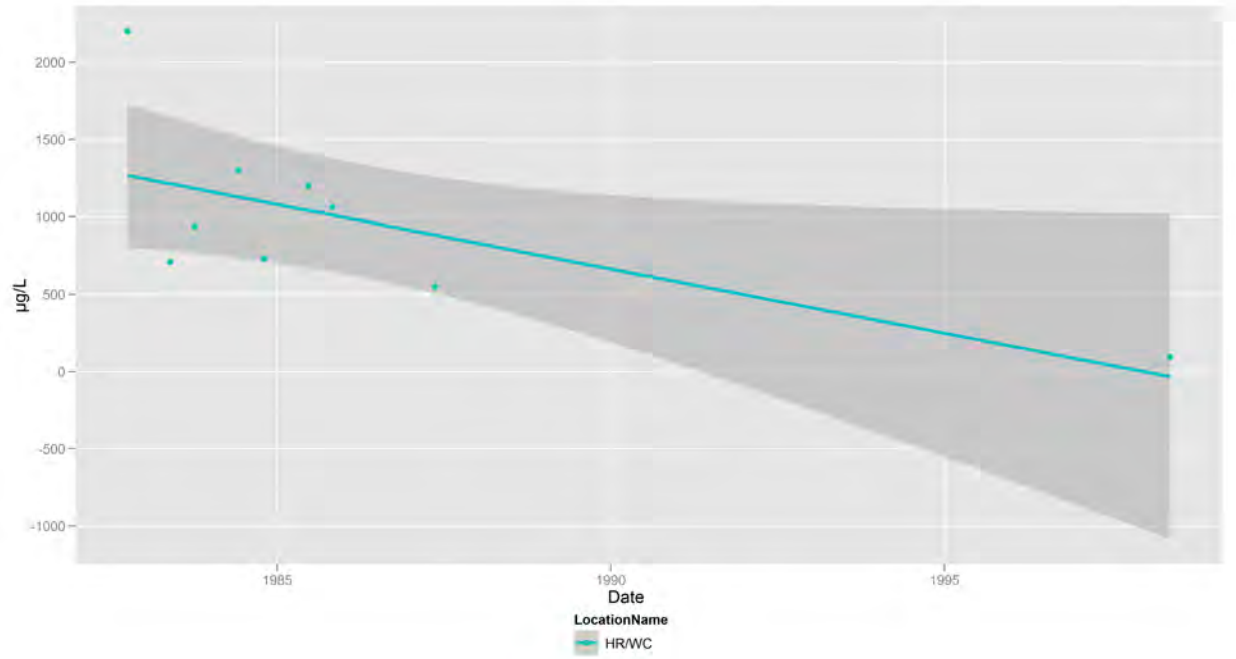
ENVIRON

Surface Water Time Series-All Dates
Nitrogen, Nitrate-Nitrite Dissolved

Figure
3.4.w



Group	n	Detects	Slope	slope.p
All Dates	9	9	-83.2	0.0463



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/WC	Recession	9	9	-83.2	0.0463

Ecological Screening Value

Significant Trend

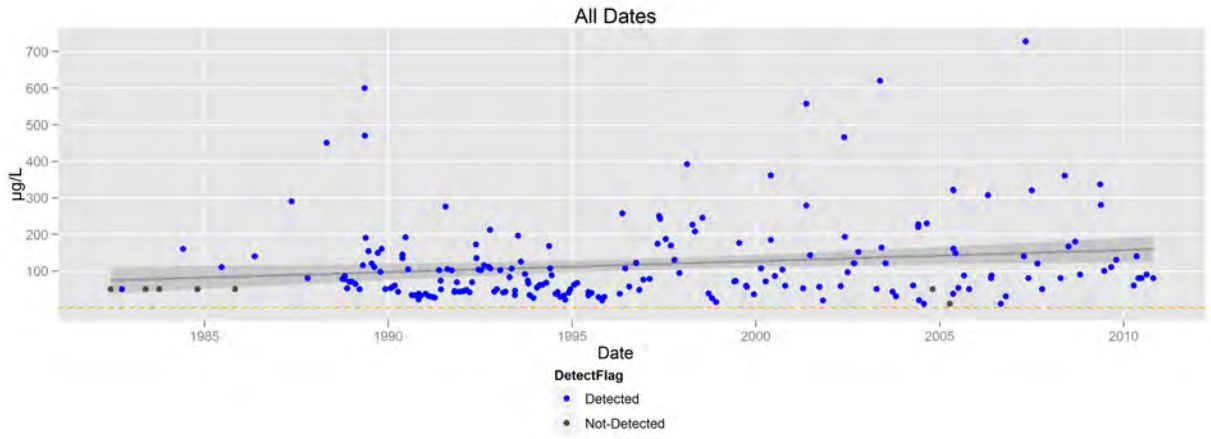
No Significant Trend

95% Confidence Interval

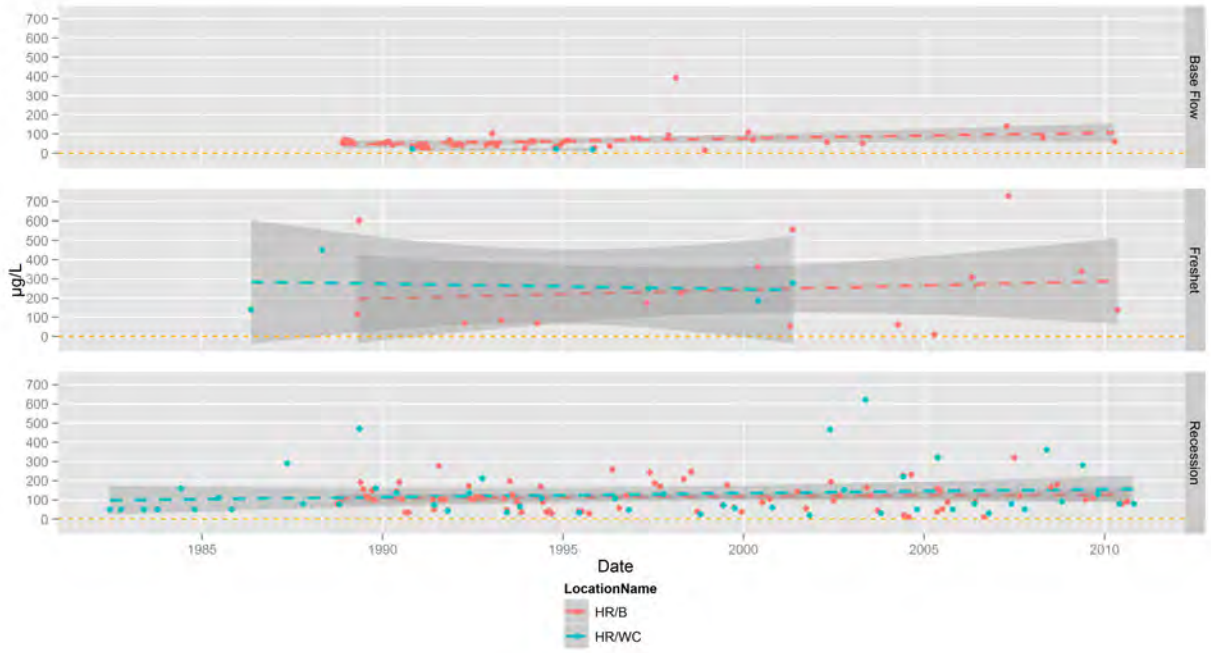
ENVIRON

Surface Water Time Series-All Dates
Nitrogen, Kjeldahl Total

Figure
3.4.x



Group	n	Detects	Slope	slope.p
All Dates	204	197	2.99	0.00954



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	49	49	2.86	0.0591
HR/B	Freshet	16	15	4.47	0.606
HR/B	Recession	83	83	1.01	0.412
HR/WC	Base Flow	3	3	NC	NC
HR/WC	Freshet	5	5	-2.78	0.794
HR/WC	Recession	48	42	2.07	0.338

Ecological Screening Value

Significant Trend

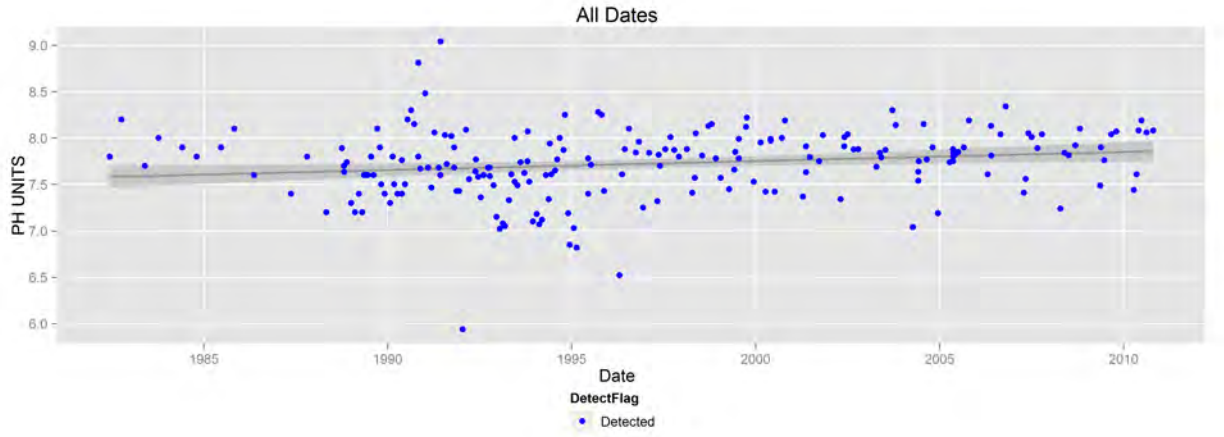
No Significant Trend

95% Confidence Interval

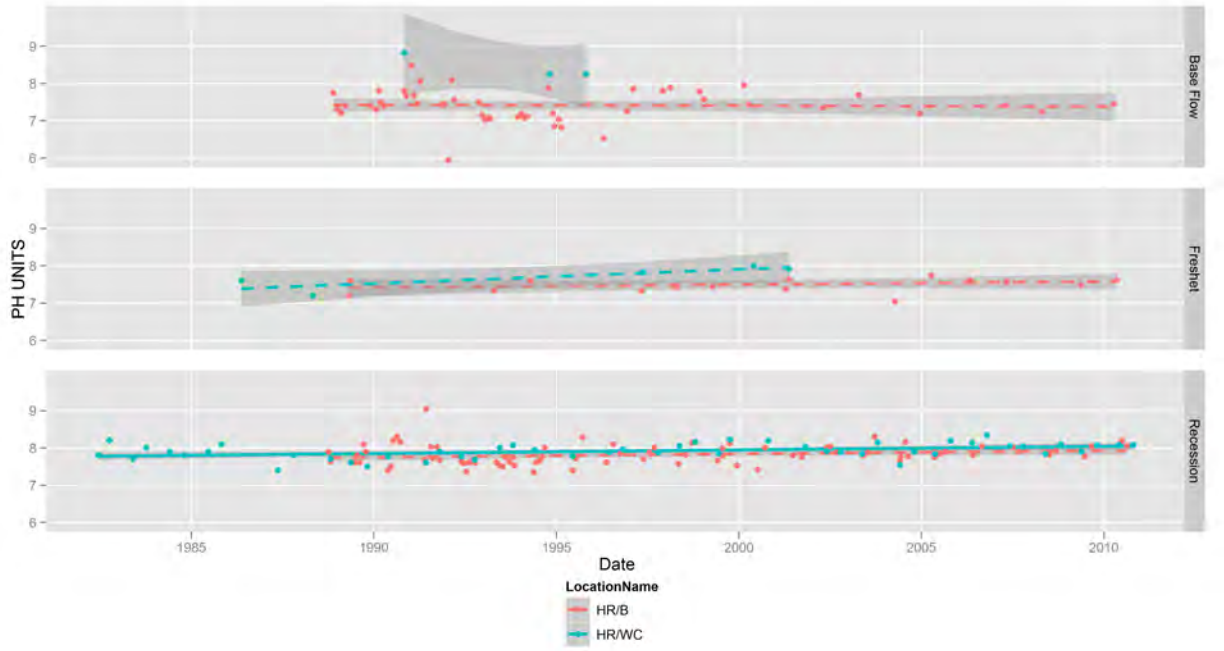
ENVIRON

Surface Water Time Series-All Dates
Phosphorus (as P) Total

Figure 3.4.y



Group	n	Detects	Slope	slope.p
All Dates	207	207	0.00976	0.00828



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	50	50	-0.00184	0.876
HR/B	Freshet	16	16	0.00778	0.387
HR/B	Recession	84	84	0.00881	0.0523
HR/WC	Base Flow	3	3	NC	NC
HR/WC	Freshet	5	5	0.0381	0.0775
HR/WC	Recession	49	49	0.00952	0.00315

Ecological Screening Value

Significant Trend

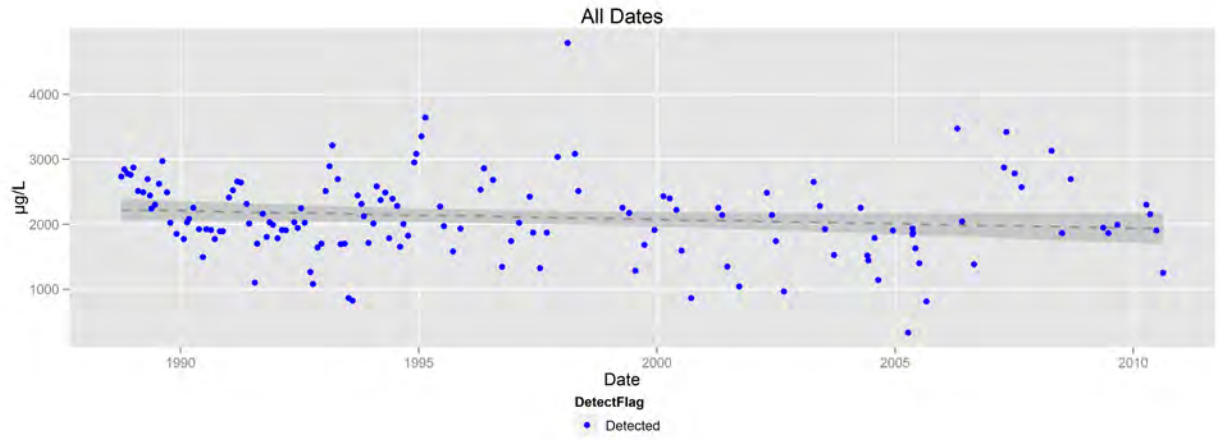
No Significant Trend

95% Confidence Interval

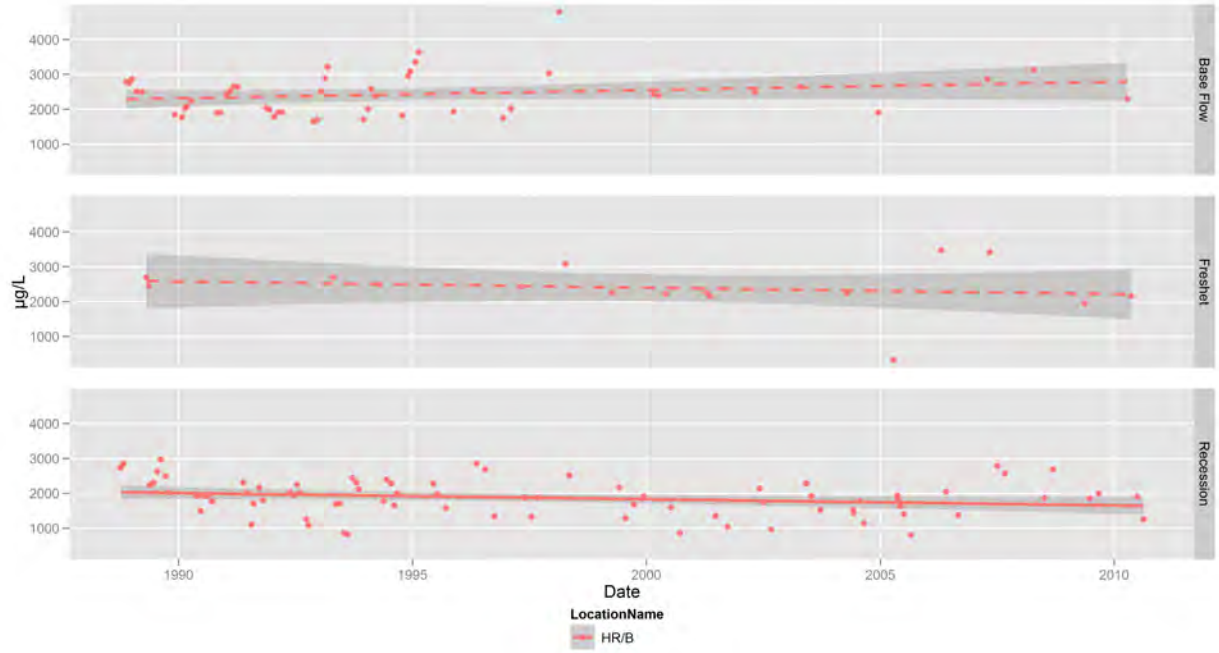
ENVIRON

Surface Water Time Series-All Dates
pH

Figure
3.4.z



Group	n	Detects	Slope	slope.p
All Dates	146	146	-13.2	0.107



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	49	49	23.6	0.1580
HR/B	Freshet	16	16	-18.1	0.5330
HR/B	Recession	81	81	-17.7	0.0461

Ecological Screening Value

Significant Trend

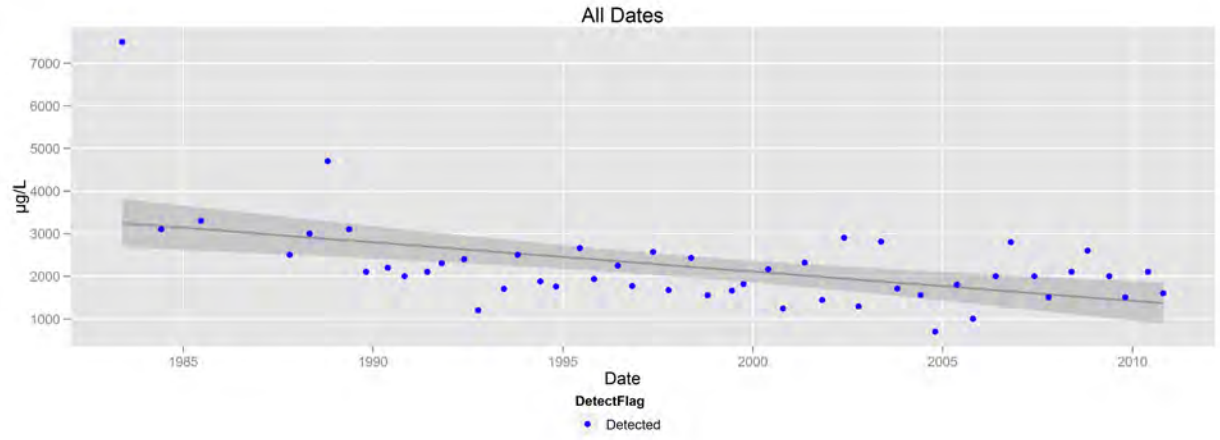
No Significant Trend

95% Confidence Interval

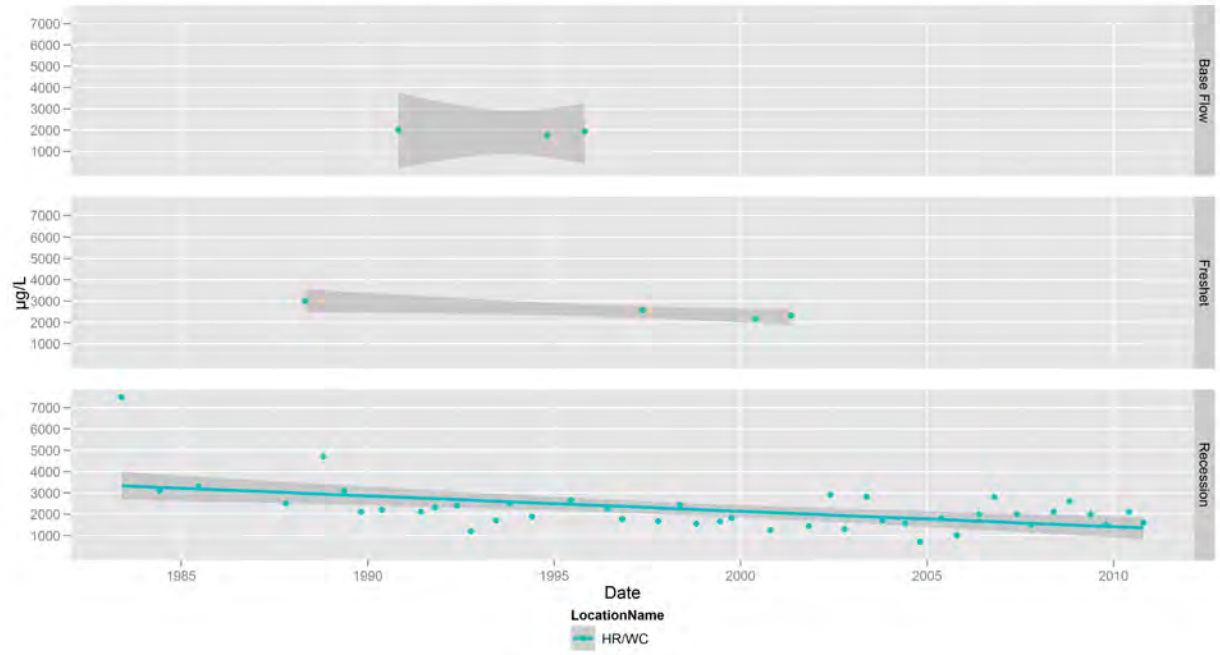
ENVIRON

Surface Water Time Series-All Dates
Potassium Dissolved

Figure
3.4.aa



Group	n	Detects	Slope	slope.p
All Dates	50	50	-68.6	0.000172



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/WC	Base Flow	3	3	NC	NC
HR/WC	Freshet	4	4	NC	NC
HR/WC	Recession	43	43	-72.4	0.000345

Ecological Screening Value

Significant Trend

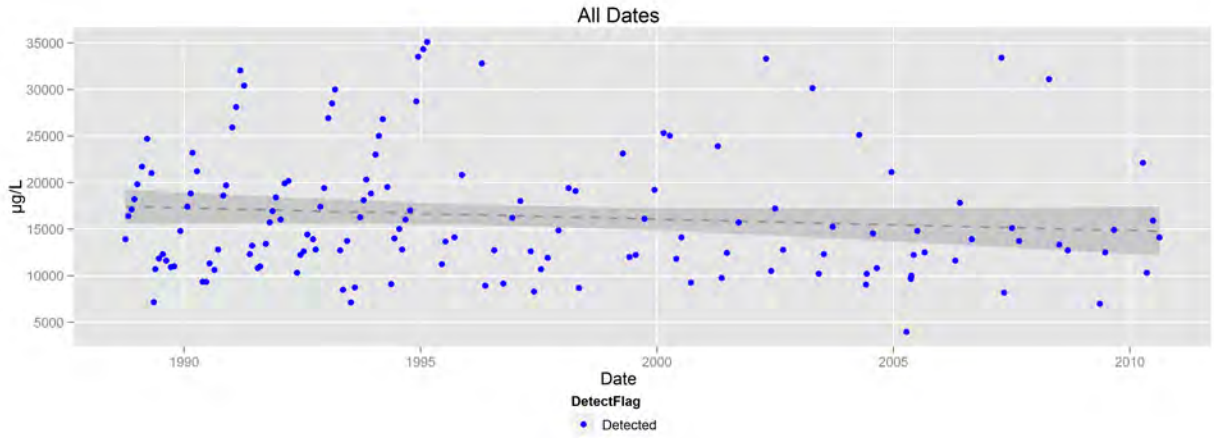
No Significant Trend

95% Confidence Interval

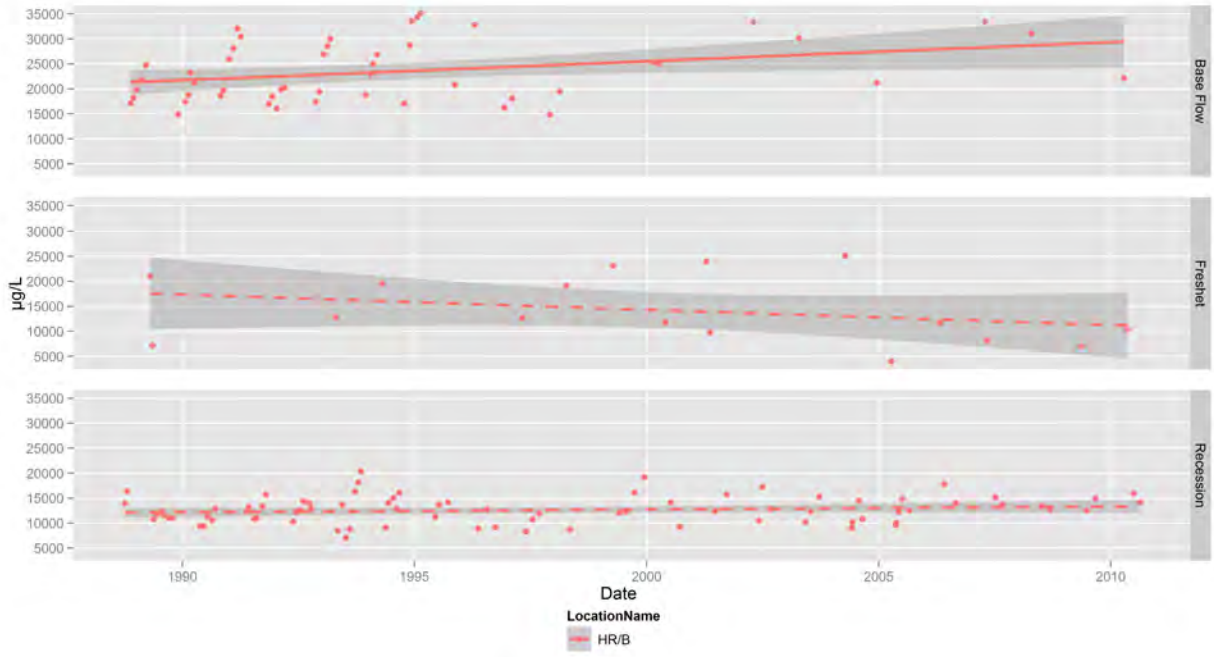
ENVIRON

Surface Water Time Series-All Dates
Potassium Total

Figure
3.4.bb



Group	n	Detects	Slope	slope.p
All Dates	146	146	-121	0.174



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	49	49	379.0	0.0203
HR/B	Freshet	16	16	-306.0	0.2630
HR/B	Recession	81	81	57.9	0.2130

Ecological Screening Value

Significant Trend

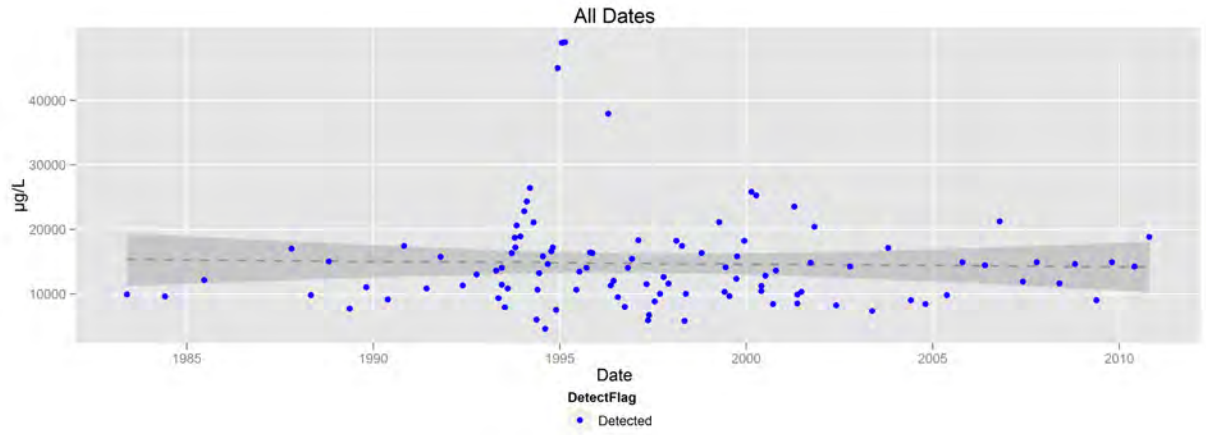
No Significant Trend

95% Confidence Interval

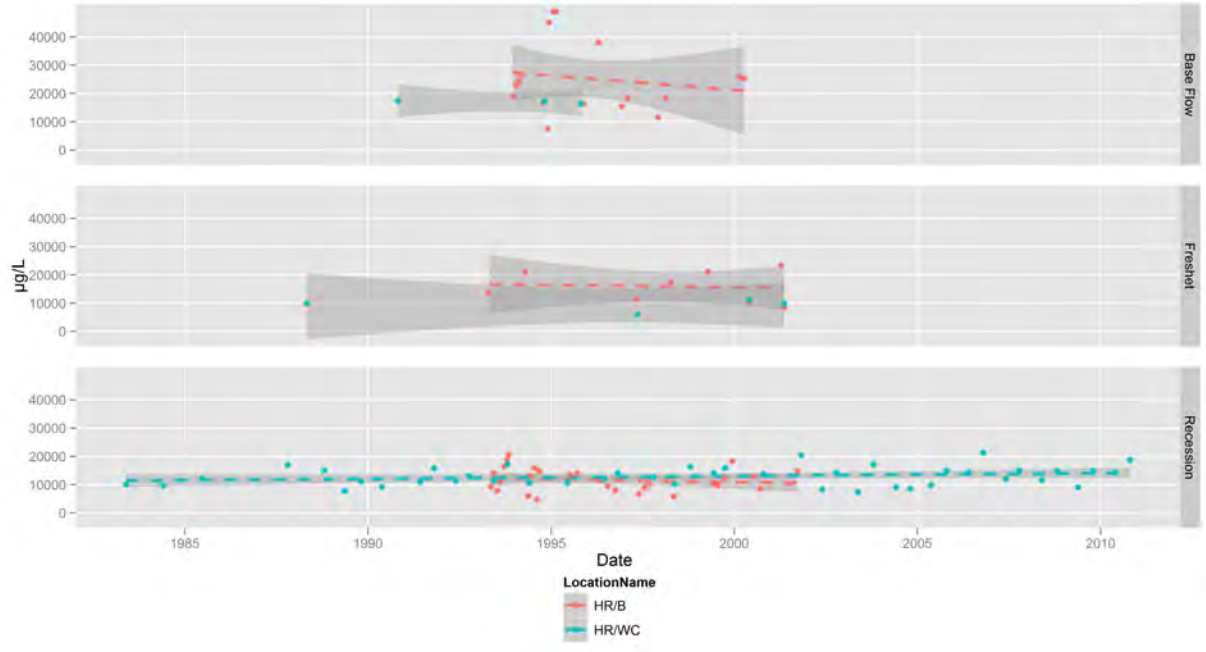
ENVIRON

Surface Water Time Series-All Dates
Sodium Dissolved

Figure
3.4.cc



Group	n	Detects	Slope	slope.p
All Dates	105	105	-41.8	0.759



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	17	17	-1020	0.533
HR/B	Freshet	8	8	-176	0.823
HR/B	Recession	30	30	-193	0.488
HR/WC	Base Flow	3	3	NC	NC
HR/WC	Freshet	4	4	NC	NC
HR/WC	Recession	43	43	101	0.129

Ecological Screening Value

Significant Trend

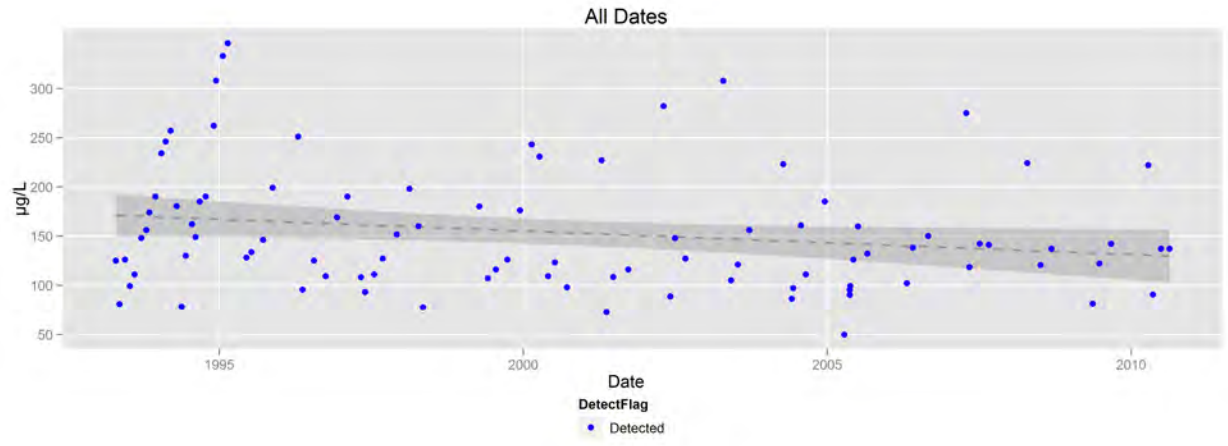
No Significant Trend

95% Confidence Interval

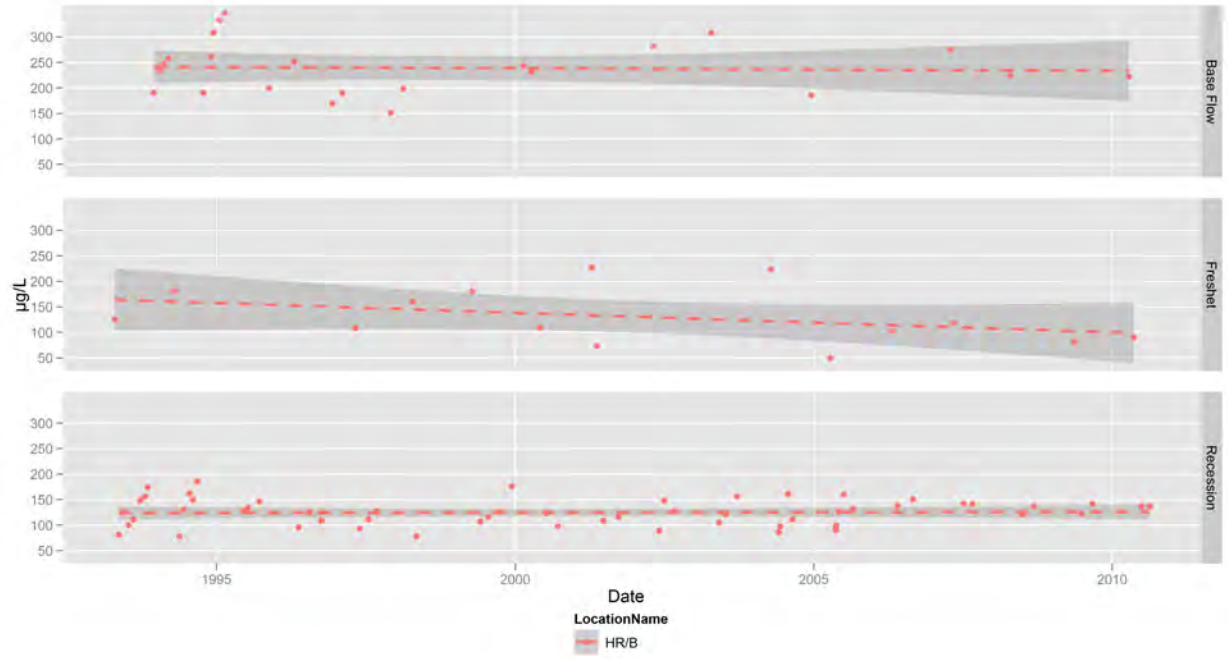
ENVIRON

Surface Water Time Series-All Dates
Sodium Total

Figure
3.4.dd



Group	n	Detects	Slope	slope.p
All Dates	93	93	-2.38	0.0501



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	23	23	-0.477	0.836
HR/B	Freshet	14	14	-3.830	0.192
HR/B	Recession	56	56	0.113	0.864

Ecological Screening Value

Significant Trend

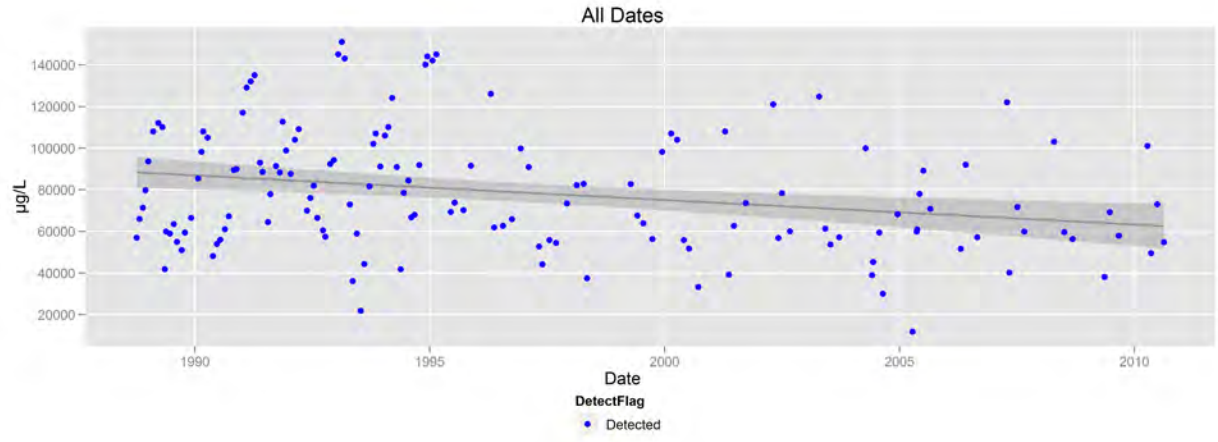
No Significant Trend

95% Confidence Interval

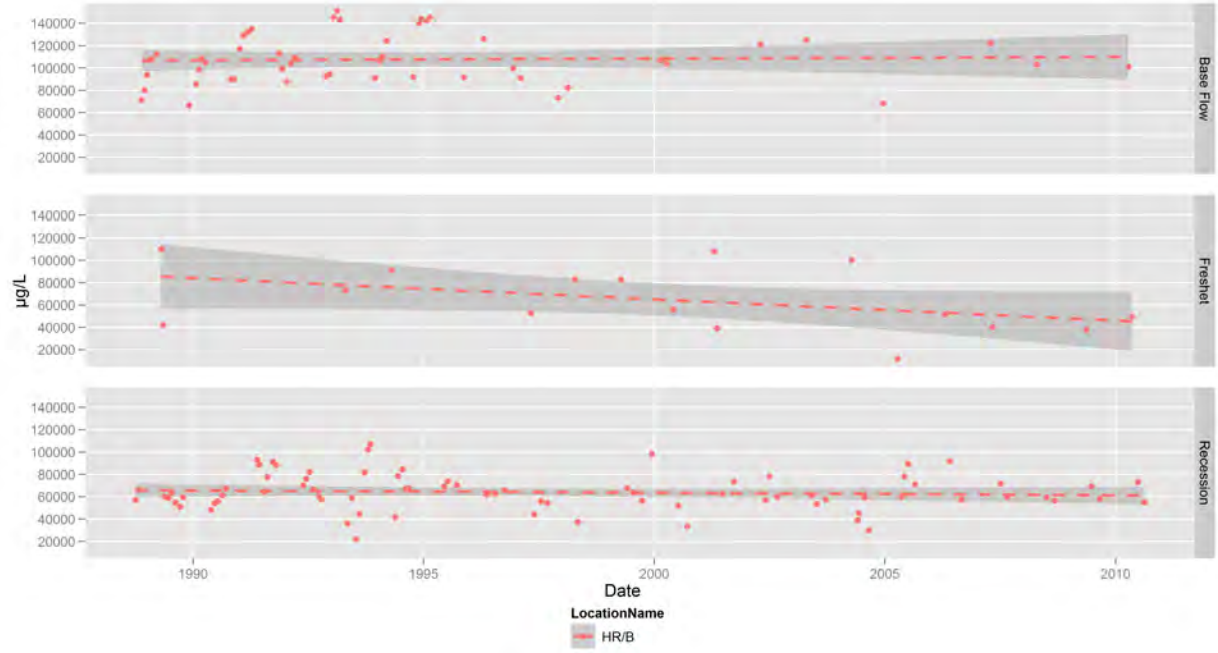
ENVIRON

Surface Water Time Series-All Dates
Strontium Total

Figure
3.4.ee



Group	n	Detects	Slope	slope.p
All Dates	146	146	-1180	0.00133



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	49	49	151	0.8070
HR/B	Freshet	16	16	-1900	0.0934
HR/B	Recession	81	81	-221	0.4290

Ecological Screening Value

Significant Trend

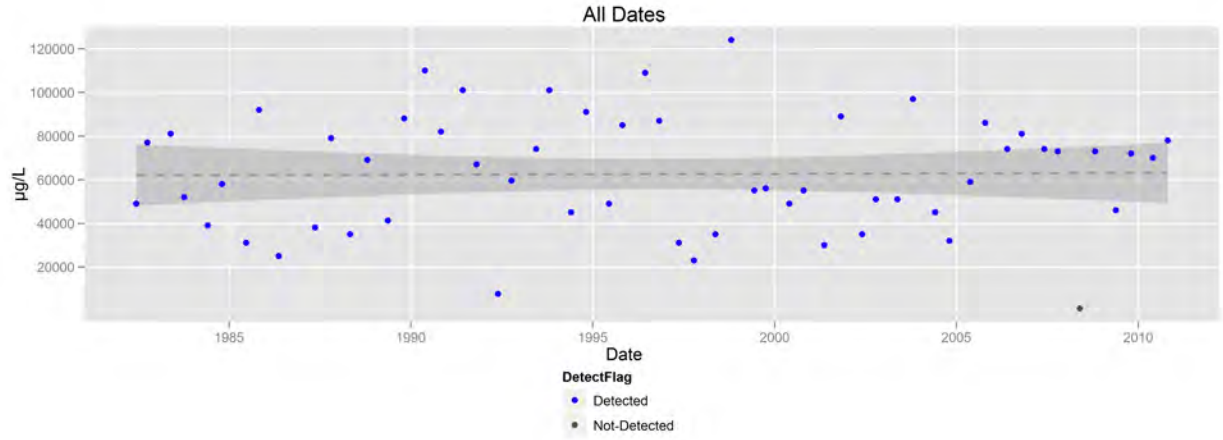
No Significant Trend

95% Confidence Interval

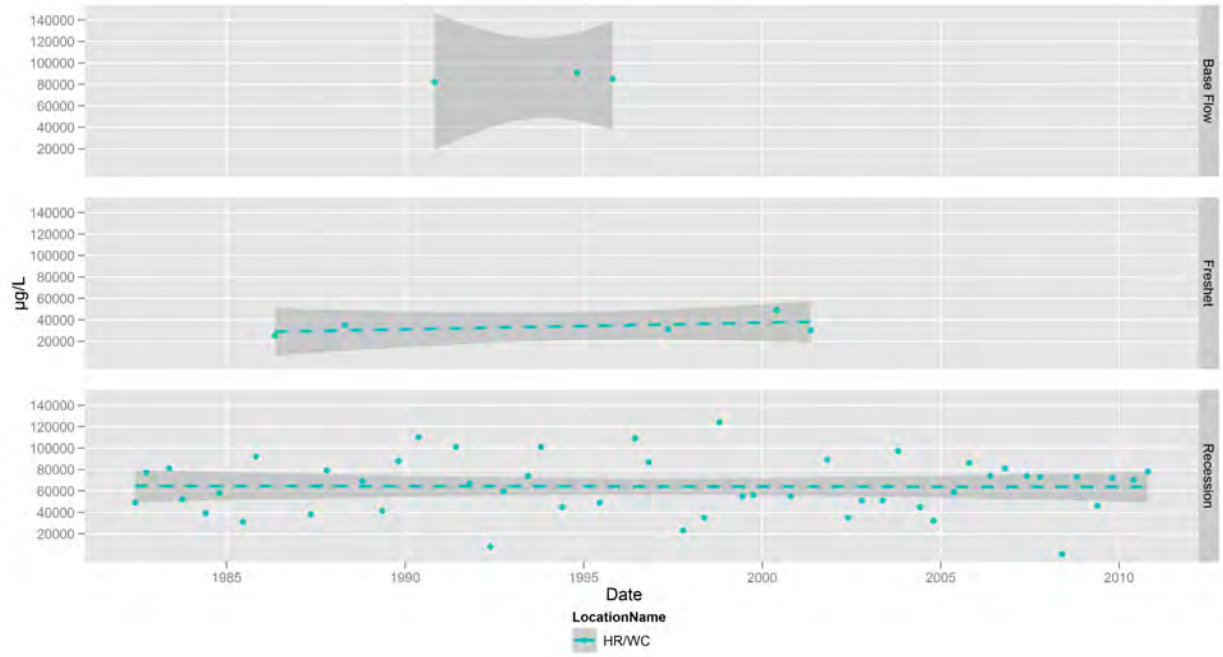
ENVIRON

Surface Water Time Series-All Dates
Sulfate (as SO4) Dissolved

Figure
3.4.ff



Group	n	Detects	Slope	slope.p
All Dates	57	56	31.7	0.941



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/WC	Base Flow	3	3	NC	NC
HR/WC	Freshet	5	5	616	0.423
HR/WC	Recession	49	48	-31.4	0.943

Ecological Screening Value

Significant Trend

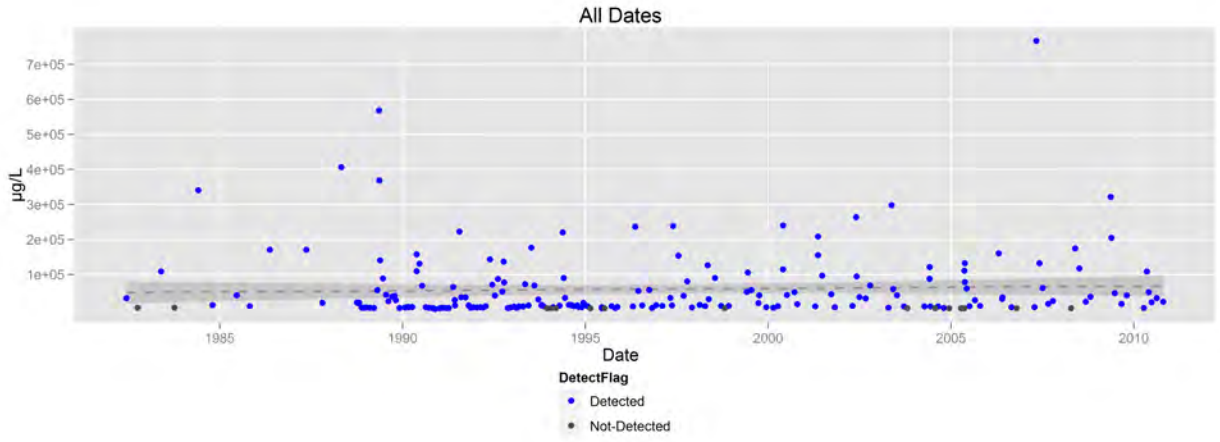
No Significant Trend

95% Confidence Interval

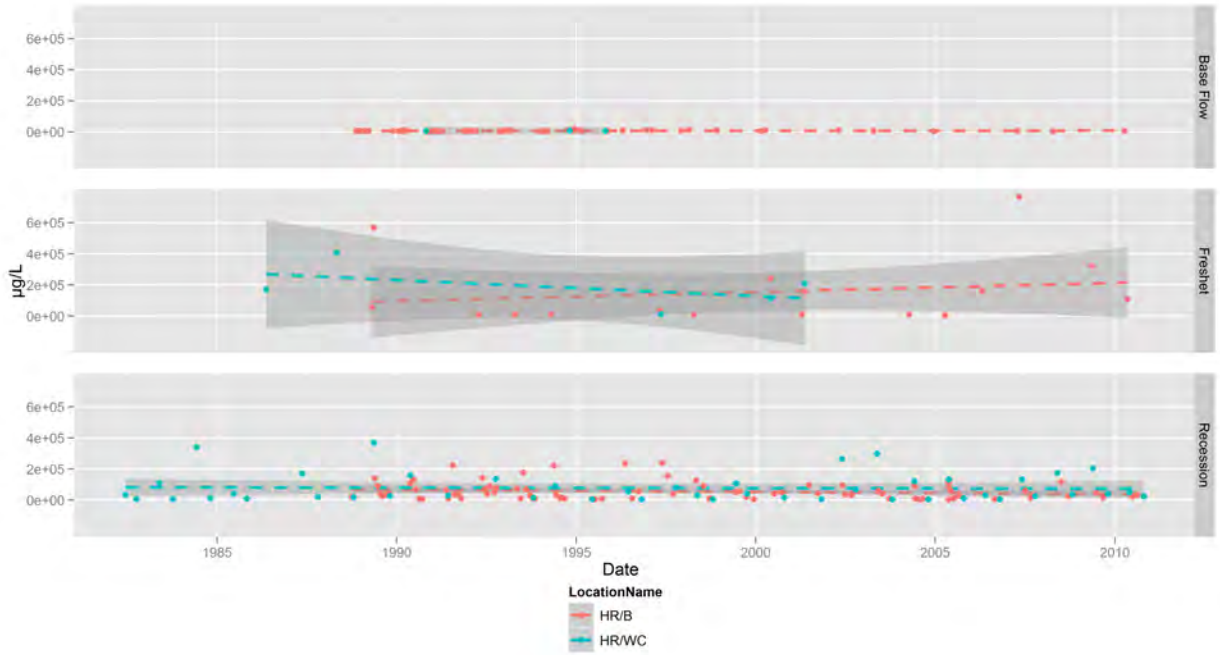
ENVIRON

Surface Water Time Series-All Dates
Sulfate (as SO4) Total

Figure
3.4.gg



Group	n	Detects	Slope	slope.p
All Dates	203	188	671	0.493



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	50	44	90.5	0.308
HR/B	Freshet	16	15	5870	0.504
HR/B	Recession	83	80	-1380	0.154
HR/WC	Base Flow	3	3	NC	NC
HR/WC	Freshet	5	5	-10300	0.4
HR/WC	Recession	46	41	-257	0.87

Ecological Screening Value

Significant Trend

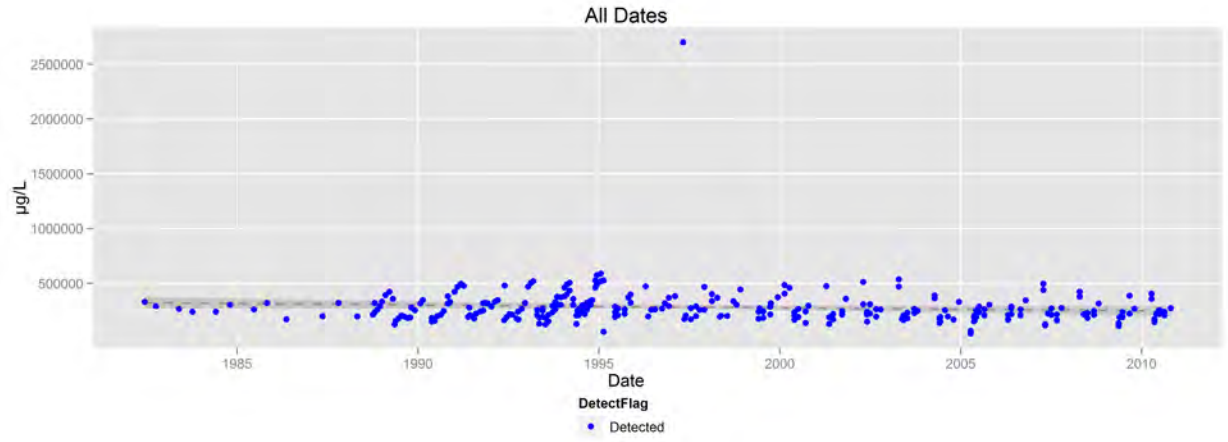
No Significant Trend

95% Confidence Interval

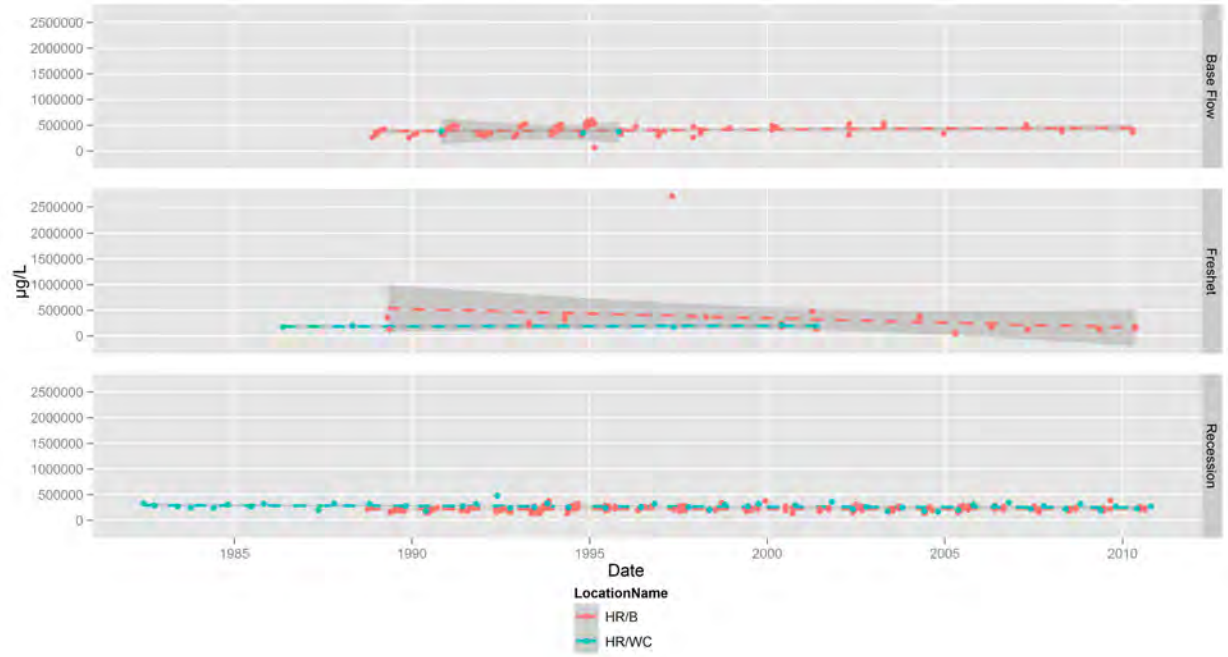
ENVIRON

Surface Water Time Series-All Dates
Suspended Solids (Residue, Non-Filterable)

Figure
3.4.hh



Group	n	Detects	Slope	slope.p
All Dates	279	279	-2710	0.0835



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	67	67	3320	0.124
HR/B	Freshet	25	25	-17800	0.279
HR/B	Recession	131	131	485	0.494
HR/WC	Base Flow	3	3	NC	NC
HR/WC	Freshet	5	5	903	0.491
HR/WC	Recession	48	48	-1540	0.108

Ecological Screening Value

Significant Trend

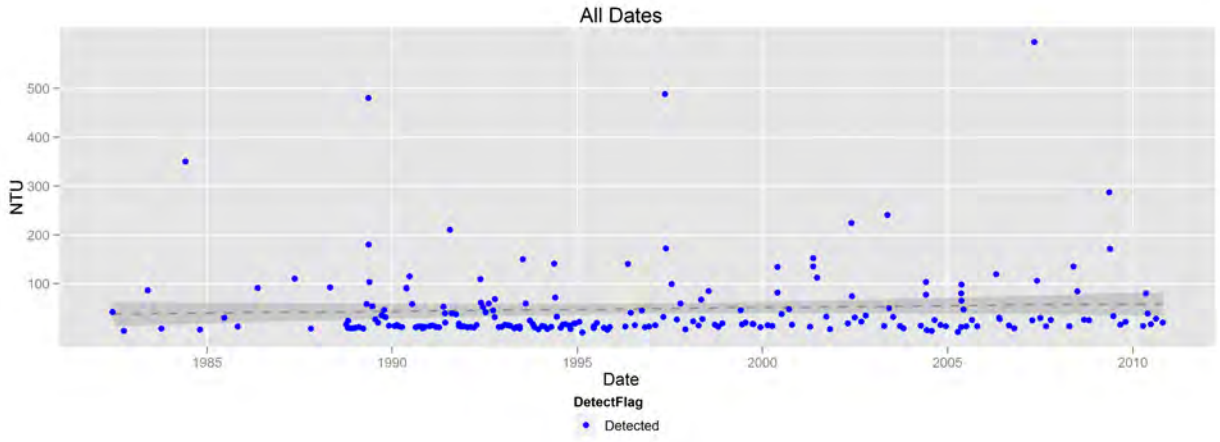
No Significant Trend

95% Confidence Interval

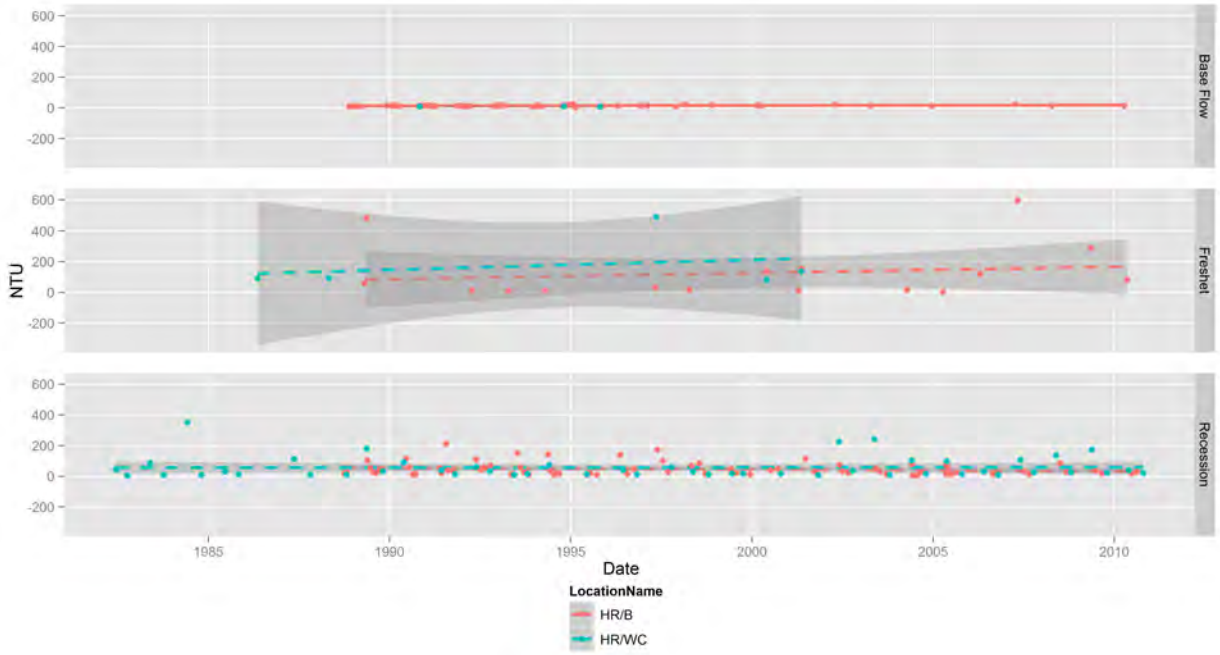
ENVIRON

Surface Water Time Series-All Dates
Total Dissolved Solids (Residue, Filterable)

Figure 3.4.ii



Group	n	Detects	Slope	slope.p
All Dates	206	206	0.743	0.344



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	50	50	0.292	0.0101
HR/B	Freshet	16	16	4.02	0.566
HR/B	Recession	83	83	-1.16	0.102
HR/WC	Base Flow	3	3	NC	NC
HR/WC	Freshet	5	5	6.51	0.674
HR/WC	Recession	49	49	0.0371	0.975

Ecological Screening Value

Significant Trend

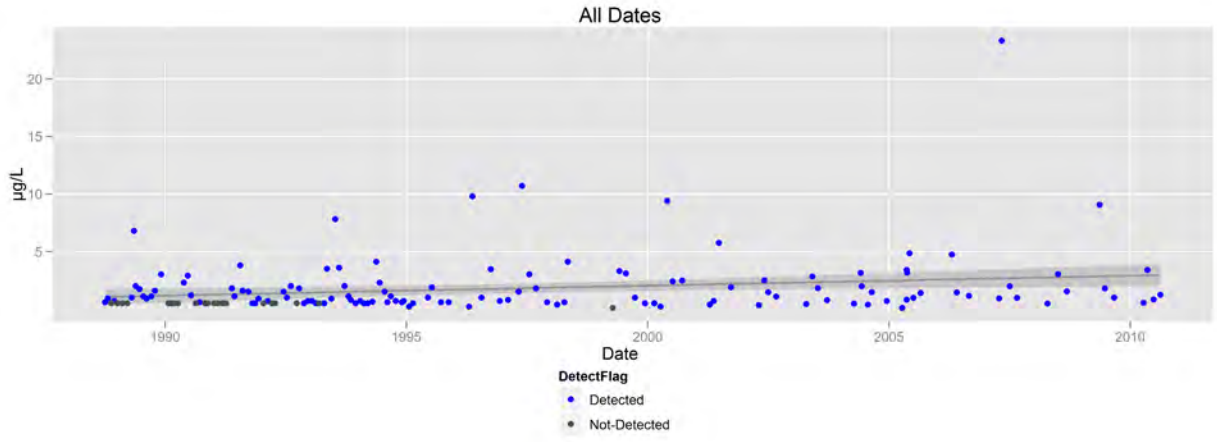
No Significant Trend

95% Confidence Interval

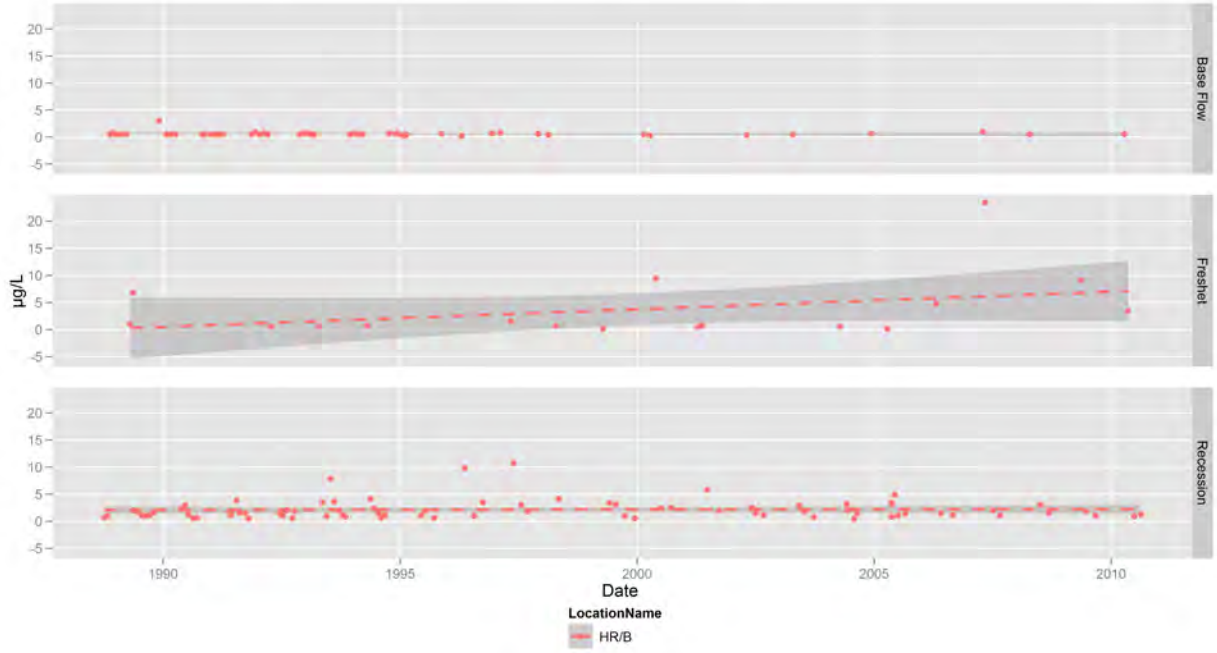
ENVIRON

Surface Water Time Series-All Dates
Turbidity

Figure
3.4.jj



Group	n	Detects	Slope	slope.p
All Dates	146	125	0.0865	0.0104



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	49	32	NC	NC
HR/B	Freshet	17	15	0.325	0.149
HR/B	Recession	80	78	0.00757	0.814

Ecological Screening Value

Significant Trend

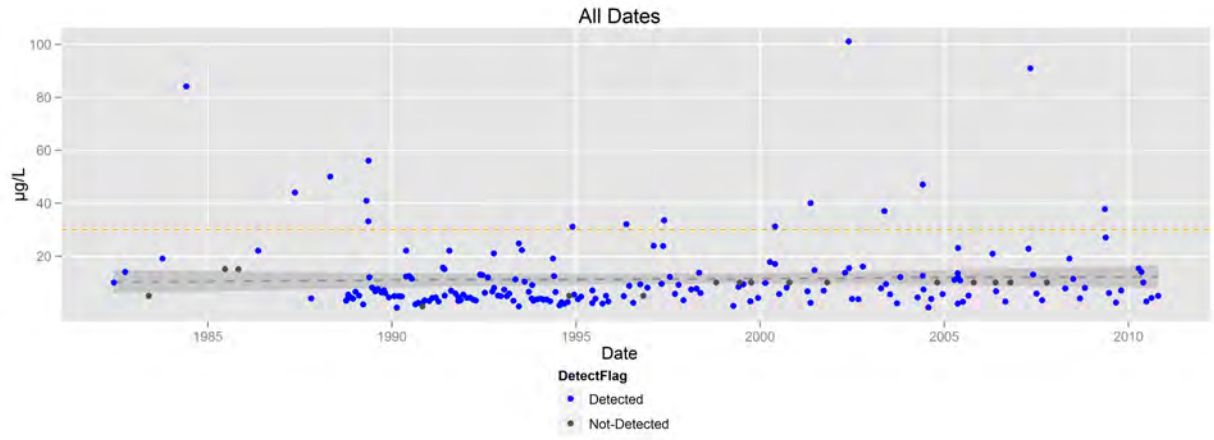
No Significant Trend

95% Confidence Interval

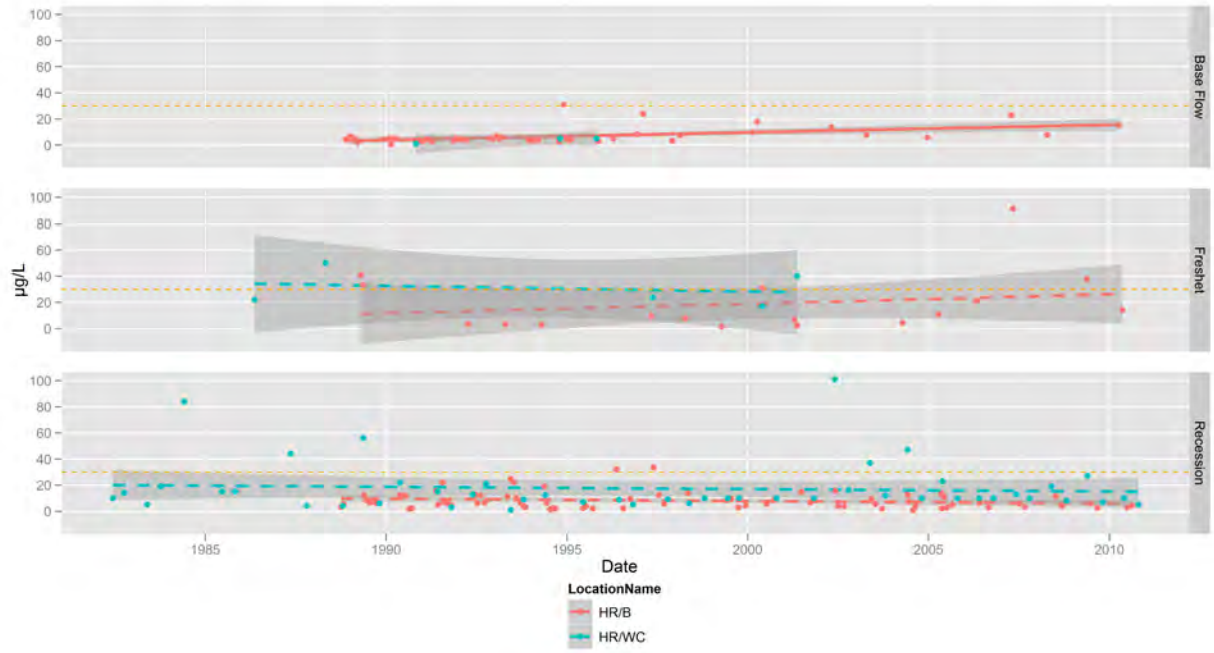
ENVIRON

Surface Water Time Series-All Dates
Vanadium Total

Figure
3.4.kk



Group	n	Detects	Slope	slope.p
All Dates	202	186	0.0683	0.63



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	49	49	0.582	0.000183
HR/B	Freshet	17	17	0.727	0.413
HR/B	Recession	80	80	-0.176	0.115
HR/WC	Base Flow	3	1	NC	NC
HR/WC	Freshet	5	5	-0.438	0.722
HR/WC	Recession	48	34	-0.18	0.588

Ecological Screening Value

Significant Trend

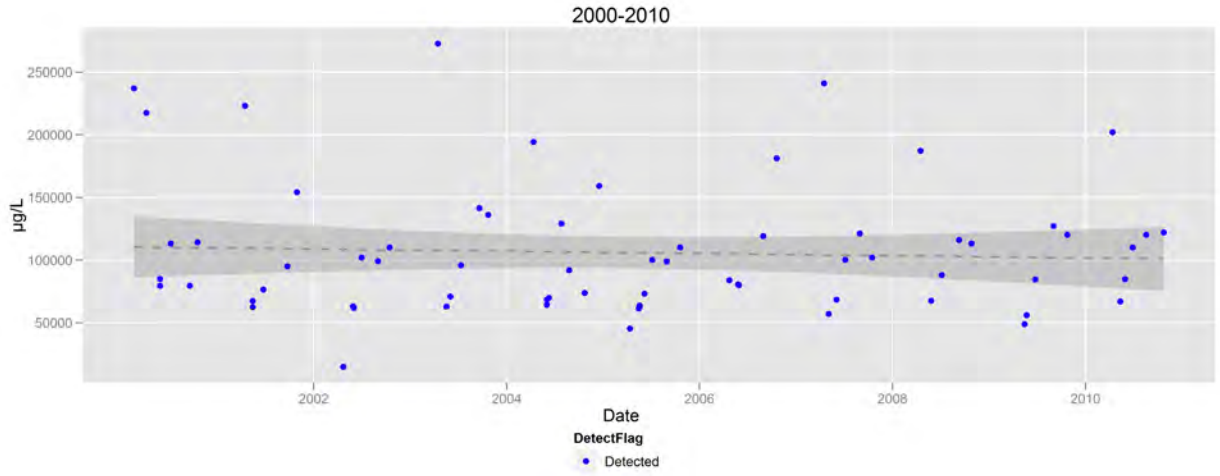
No Significant Trend

95% Confidence Interval

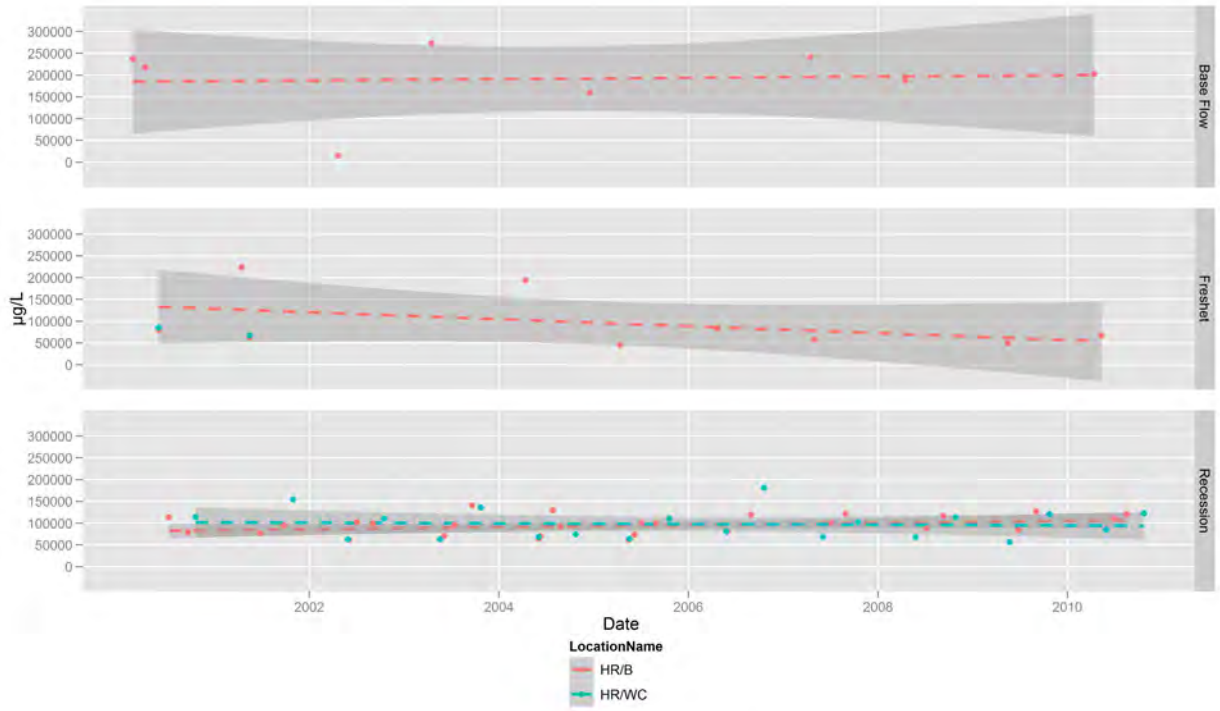
ENVIRON

Surface Water Time Series-All Dates
Zinc Total

Figure
3.4.ll



Group	n	Detects	Slope	slope.p
2000-2010	69	69	-895	0.661



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	1500	0.867
HR/B	Freshet	9	9	-8000	0.238
HR/B	Recession	30	30	2380	0.115
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	20	-776	0.776

Ecological Screening Value

Significant Trend

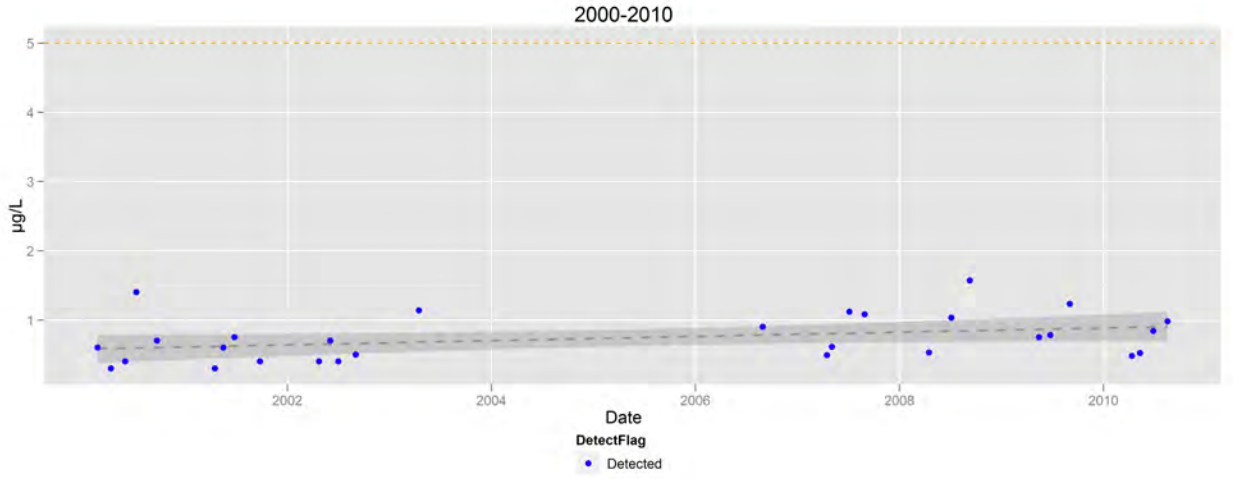
No Significant Trend

95% Confidence Interval

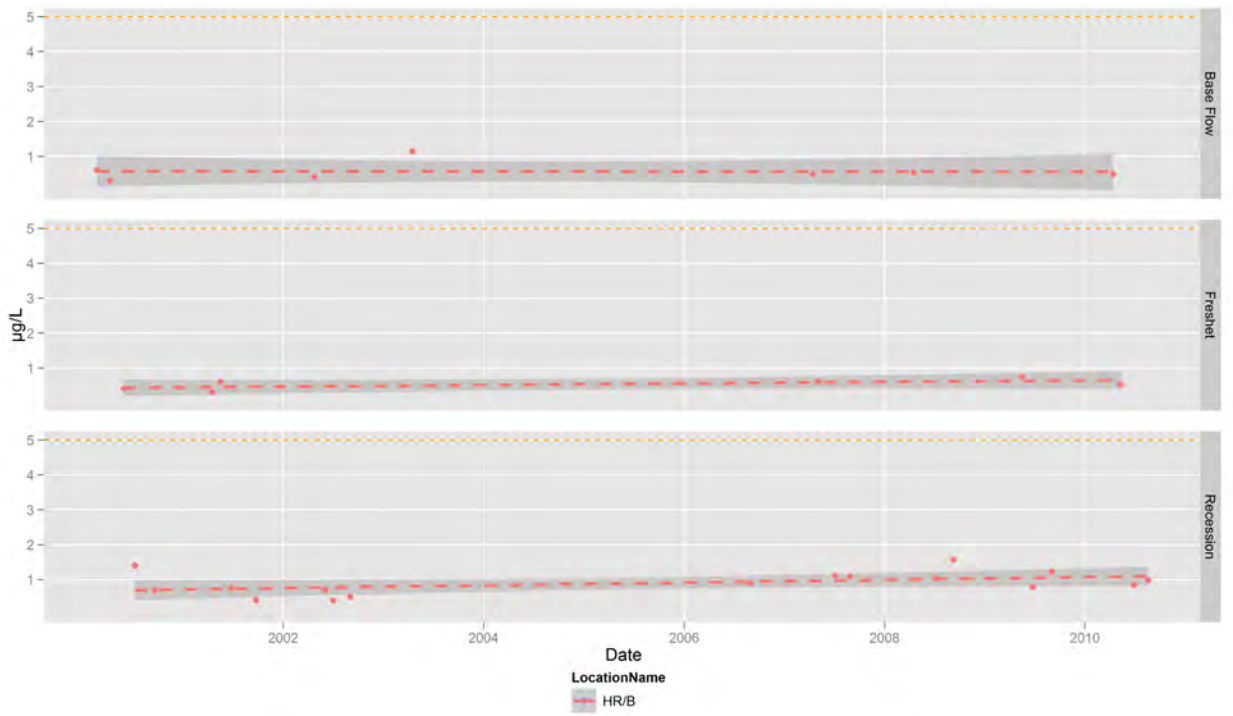
ENVIRON

Surface Water Time Series-2000-2010
Alkalinity (as CaCO3)

Figure 3.5.a



Group	n	Detects	Slope	slope.p
2000-2010	29	29	0.0306	0.0586



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	7	7	-0.00197	0.9500
HR/B	Freshet	6	6	0.02260	0.1780
HR/B	Recession	16	16	0.03950	0.0824

Ecological Screening Value

Significant Trend

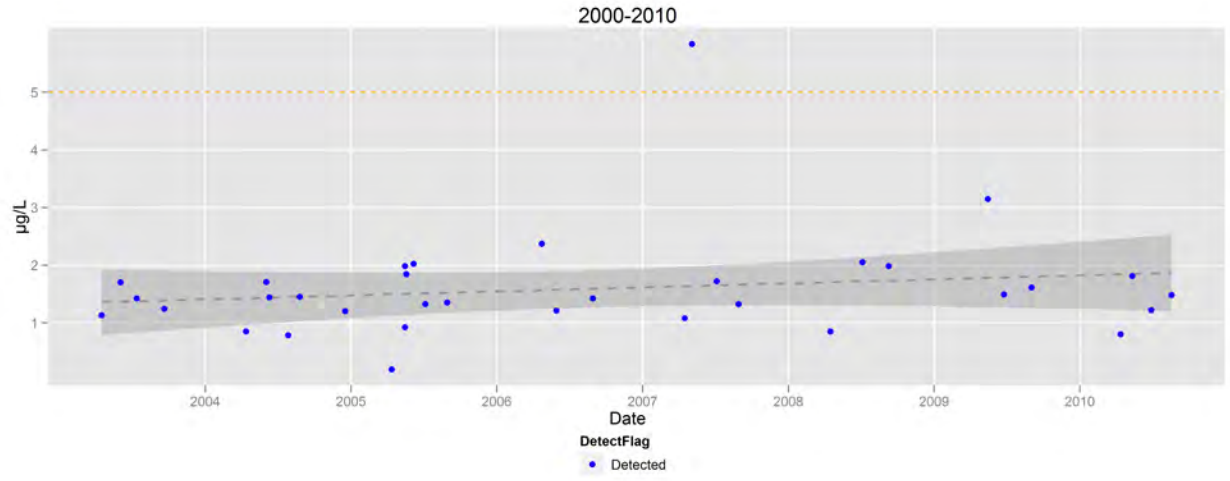
No Significant Trend

95% Confidence Interval

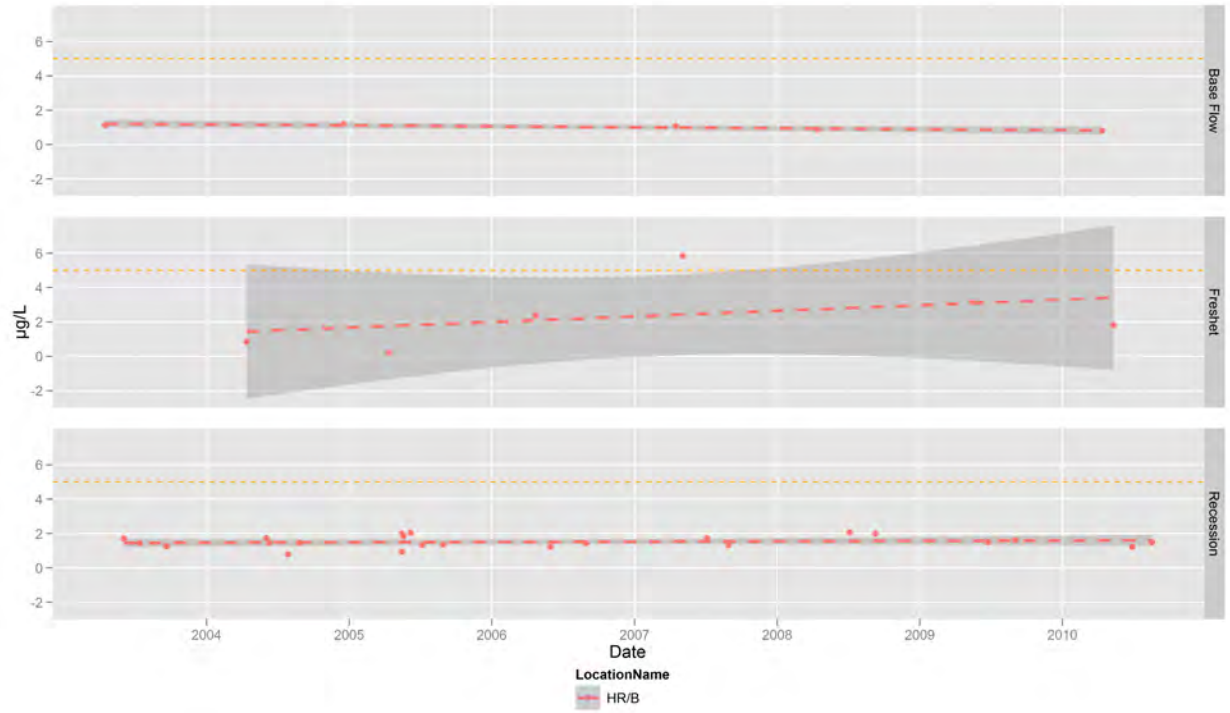
ENVIRON

Surface Water Time Series-2000-2010
Arsenic Dissolved

Figure 3.5.b



Group	n	Detects	Slope	slope.p
2000-2010	34	34	0.0694	0.331



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	5	5	-0.0563	0.051
HR/B	Freshet	6	6	0.3250	0.453
HR/B	Recession	23	23	0.0208	0.526

Ecological Screening Value

Significant Trend

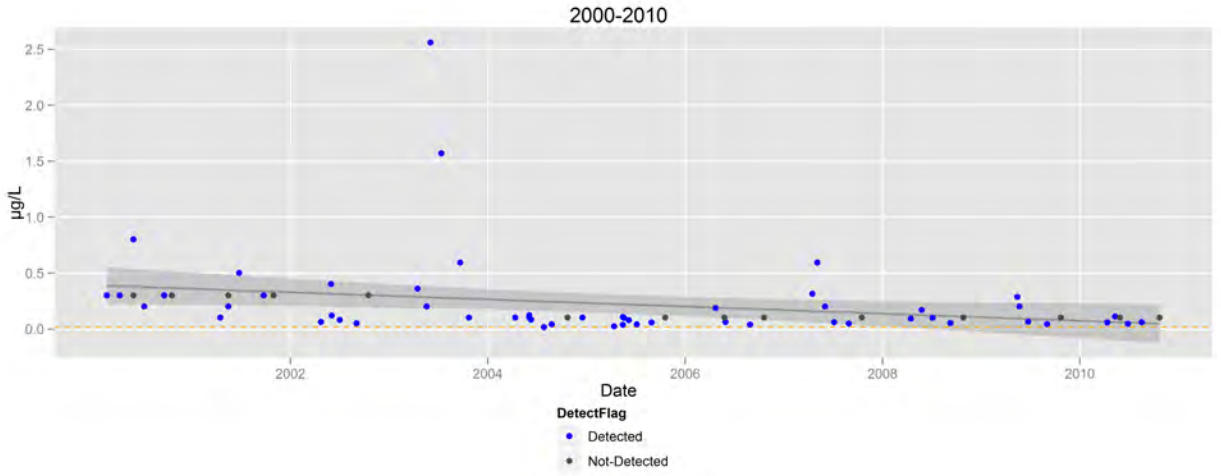
No Significant Trend

95% Confidence Interval

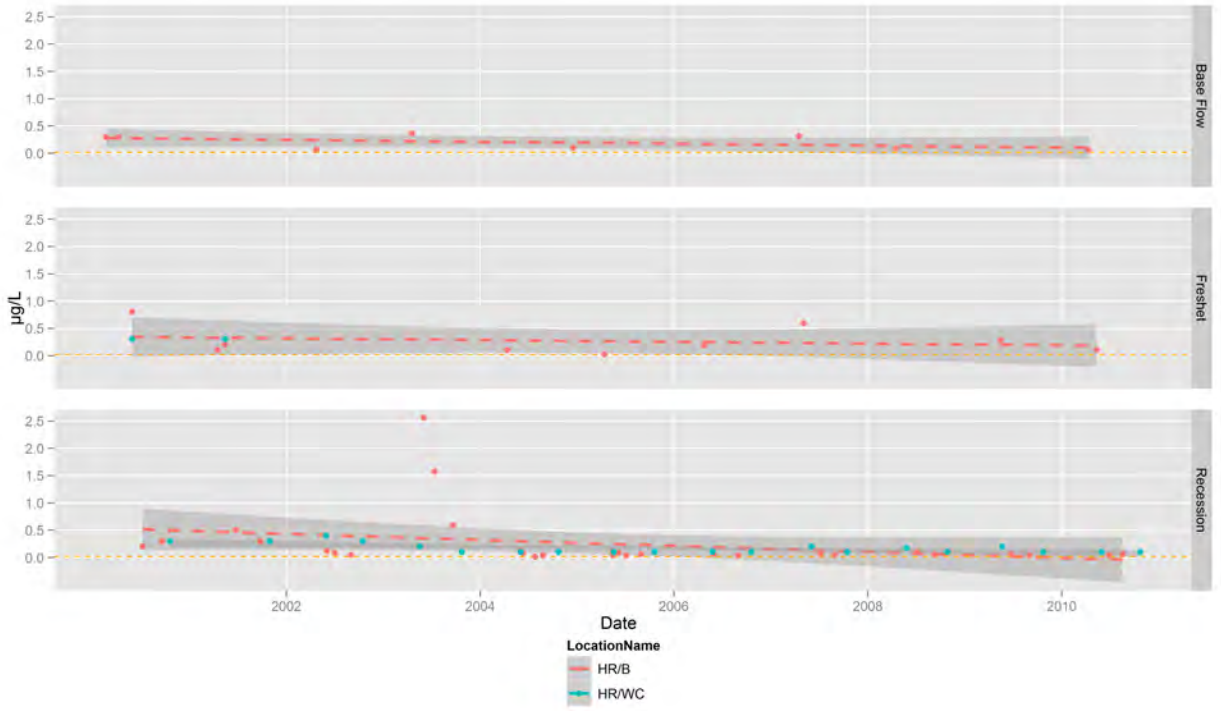
ENVIRON

Surface Water Time Series-2000-2010
Arsenic Total

Figure 3.5.c



Group	n	Detects	Slope	slope.p
2000-2010	69	55	-0.0318	0.0234



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	-0.0174	0.207
HR/B	Freshet	9	9	-0.0159	0.57
HR/B	Recession	30	30	-0.0553	0.111
HR/WC	Freshet	2	0	NC	NC
HR/WC	Recession	20	8	NC	NC

Ecological Screening Value

Significant Trend

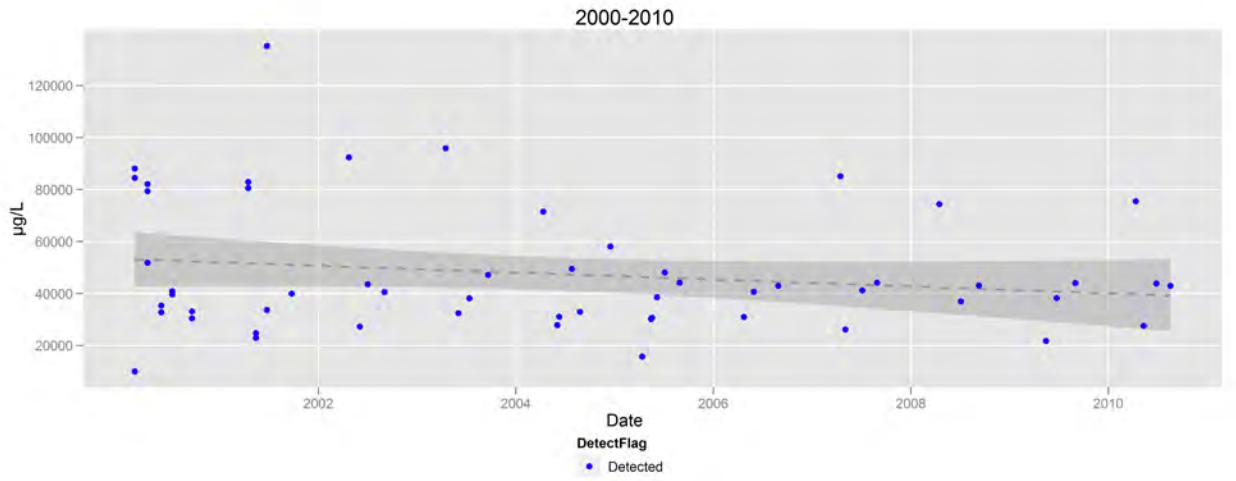
No Significant Trend

95% Confidence Interval

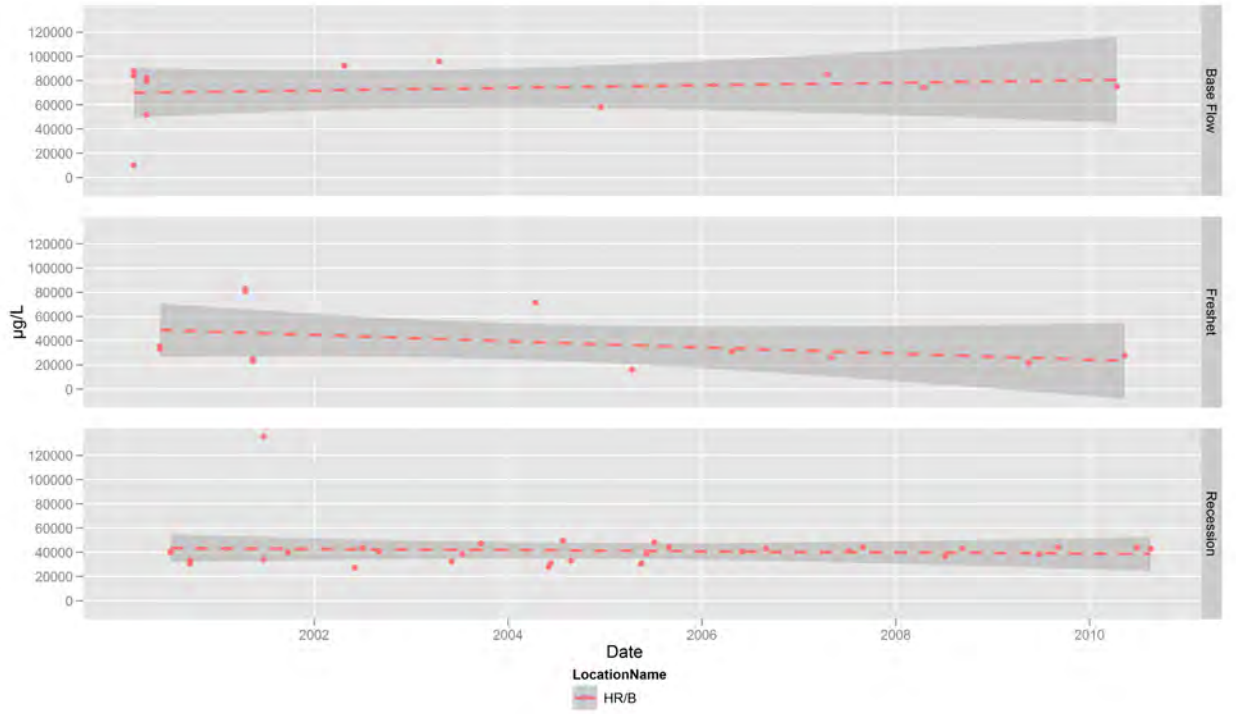
ENVIRON

Surface Water Time Series-2000-2010
Cadmium Total

Figure 3.5.d



Group	n	Detects	Slope	slope.p
2000-2010	57	57	-1320	0.181



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	12	12	1060	0.606
HR/B	Freshet	12	12	-2570	0.220
HR/B	Recession	33	33	-479	0.658

Ecological Screening Value

Significant Trend

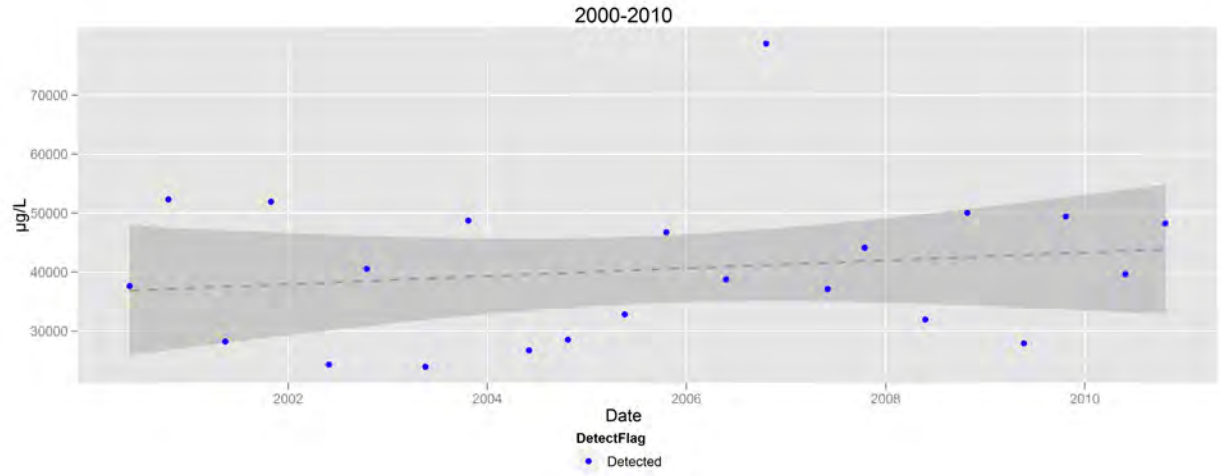
No Significant Trend

95% Confidence Interval

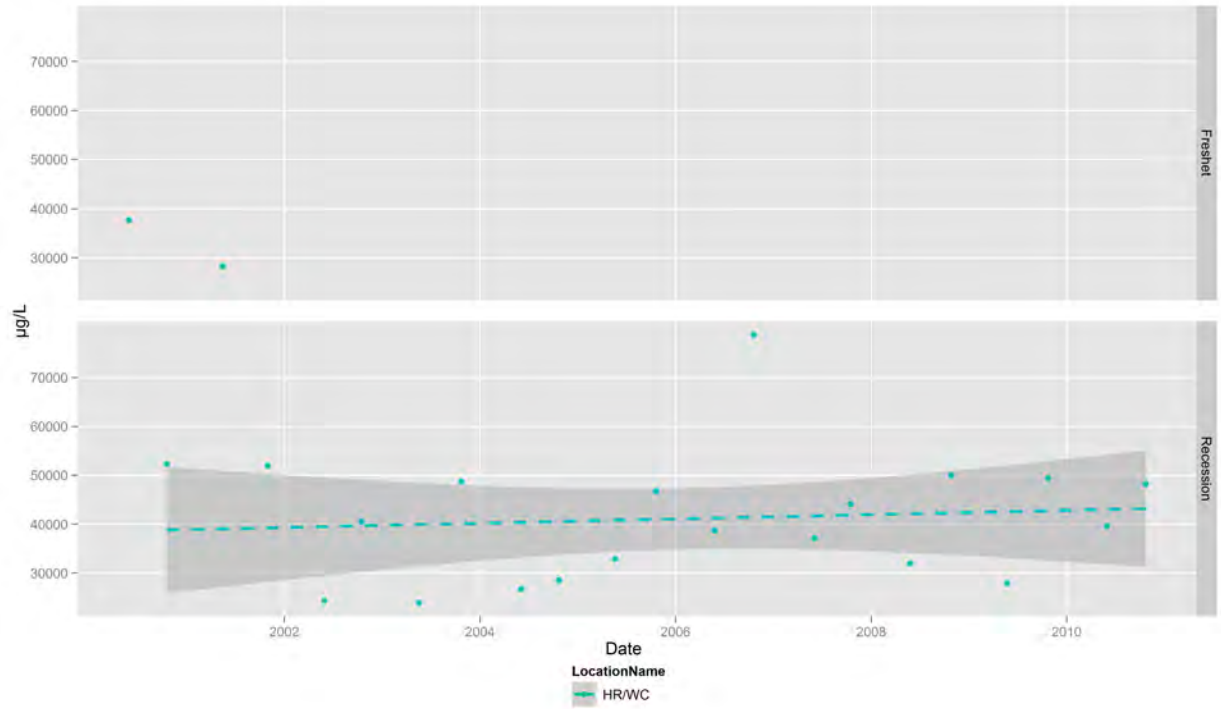
ENVIRON

Surface Water Time Series-2000-2010
Calcium Dissolved

Figure
3.5.e



Group	n	Detects	Slope	slope.p
2000-2010	22	22	670	0.448



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	20	439	0.672

Ecological Screening Value

Significant Trend

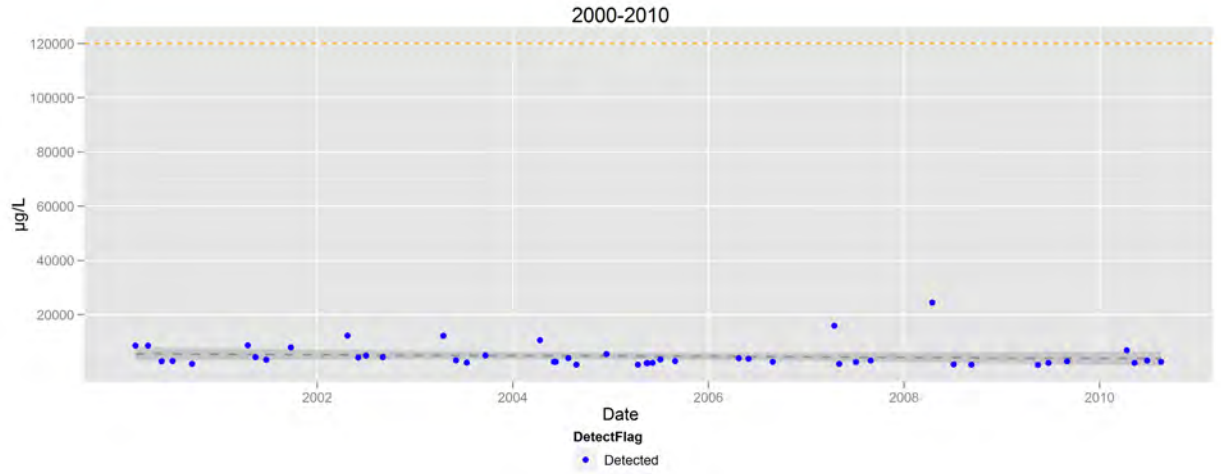
No Significant Trend

95% Confidence Interval

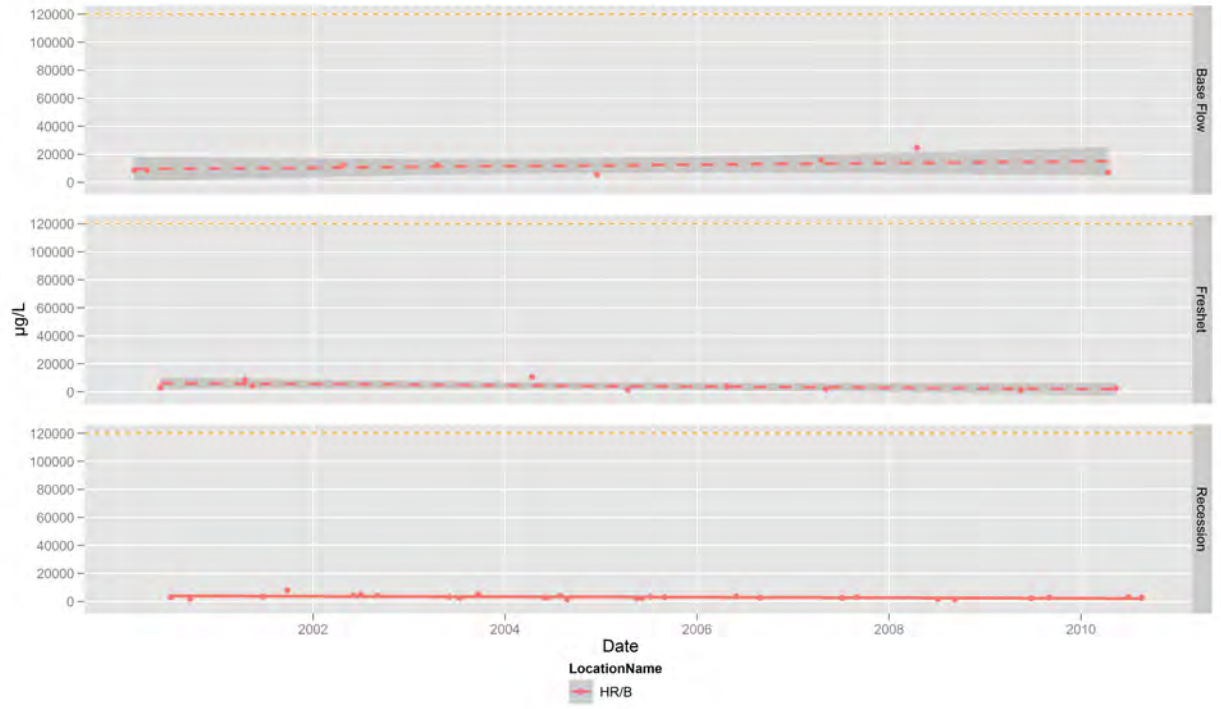
ENVIRON

Surface Water Time Series-2000-2010
Calcium Total

Figure
3.5.f



Group	n	Detects	Slope	slope.p
2000-2010	47	47	-164	0.441



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	547	0.4150
HR/B	Freshet	9	9	-431	0.2000
HR/B	Recession	30	30	-182	0.0294

Ecological Screening Value

Significant Trend

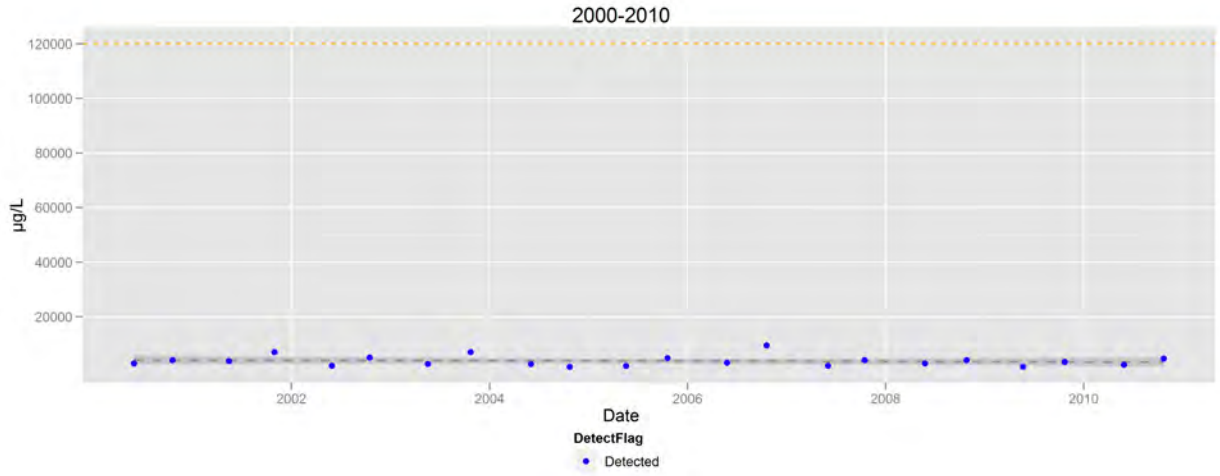
No Significant Trend

95% Confidence Interval

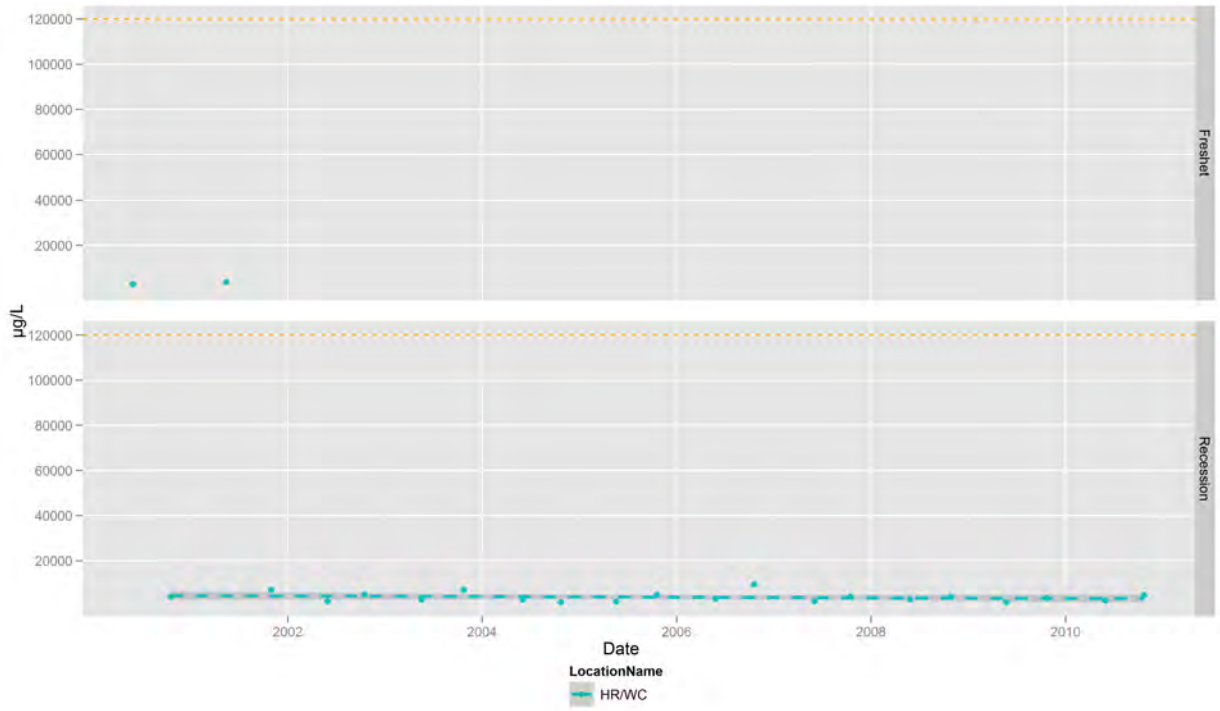
ENVIRON

Surface Water Time Series-2000-2010
Chloride (as Cl) Dissolved

Figure 3.5.g



Group	n	Detects	Slope	slope.p
2000-2010	22	22	-73.4	0.594



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	20	-126	0.439

Ecological Screening Value

Significant Trend

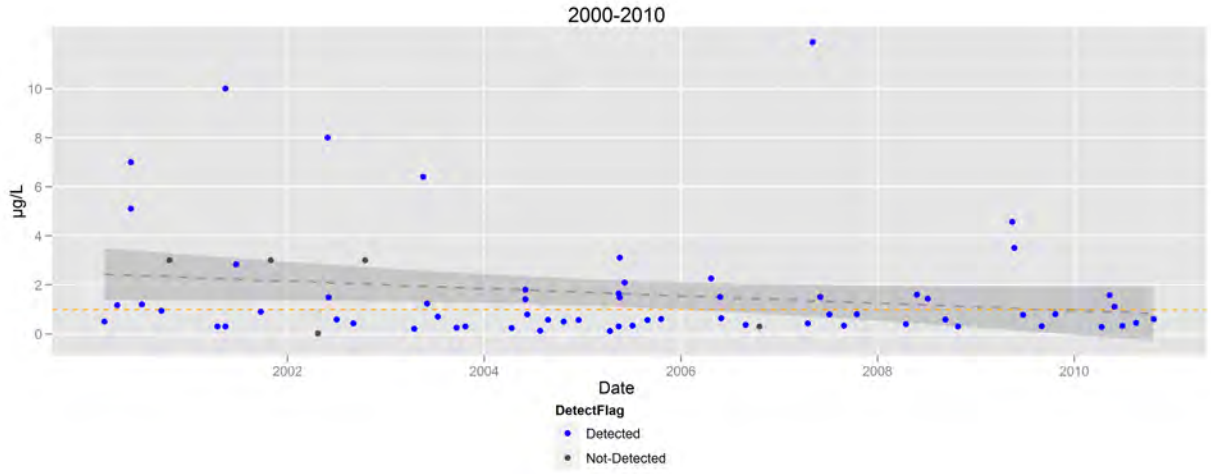
No Significant Trend

95% Confidence Interval

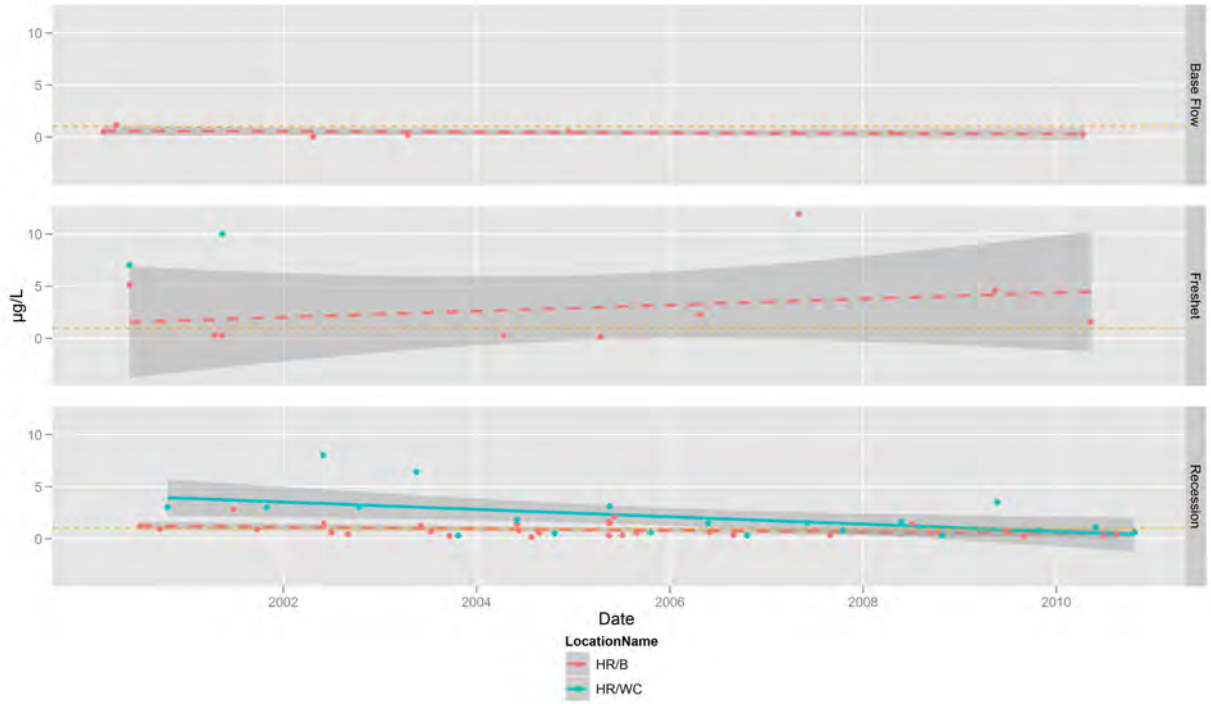
ENVIRON

Surface Water Time Series-2000-2010
Chloride (as Cl) Total

Figure 3.5.h



Group	n	Detects	Slope	slope.p
2000-2010	69	64	-0.15	0.0941



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	7	-0.0327	0.378
HR/B	Freshet	9	9	0.295	0.474
HR/B	Recession	30	30	-0.0766	0.0571
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	16	-0.353	0.0202

Ecological Screening Value

Significant Trend

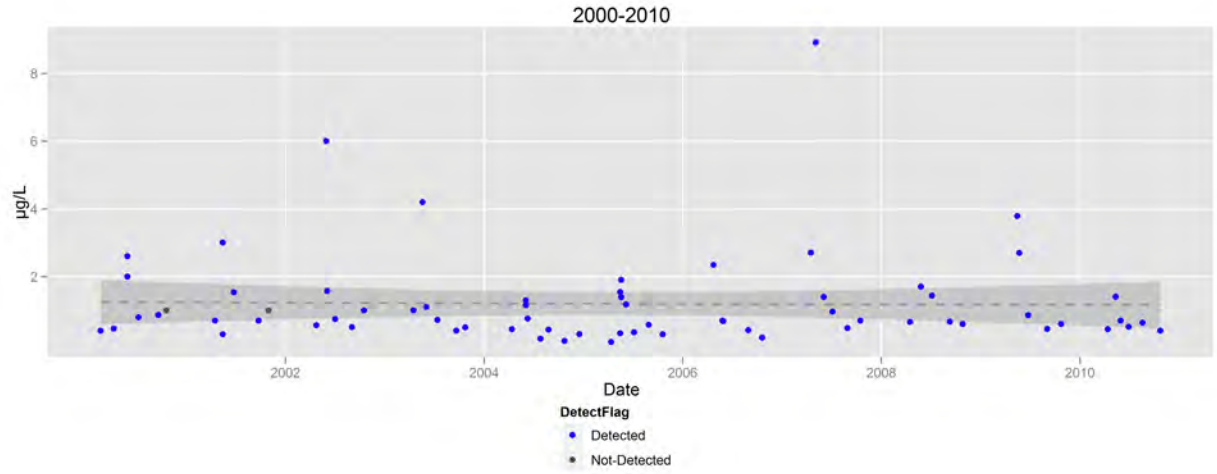
No Significant Trend

95% Confidence Interval

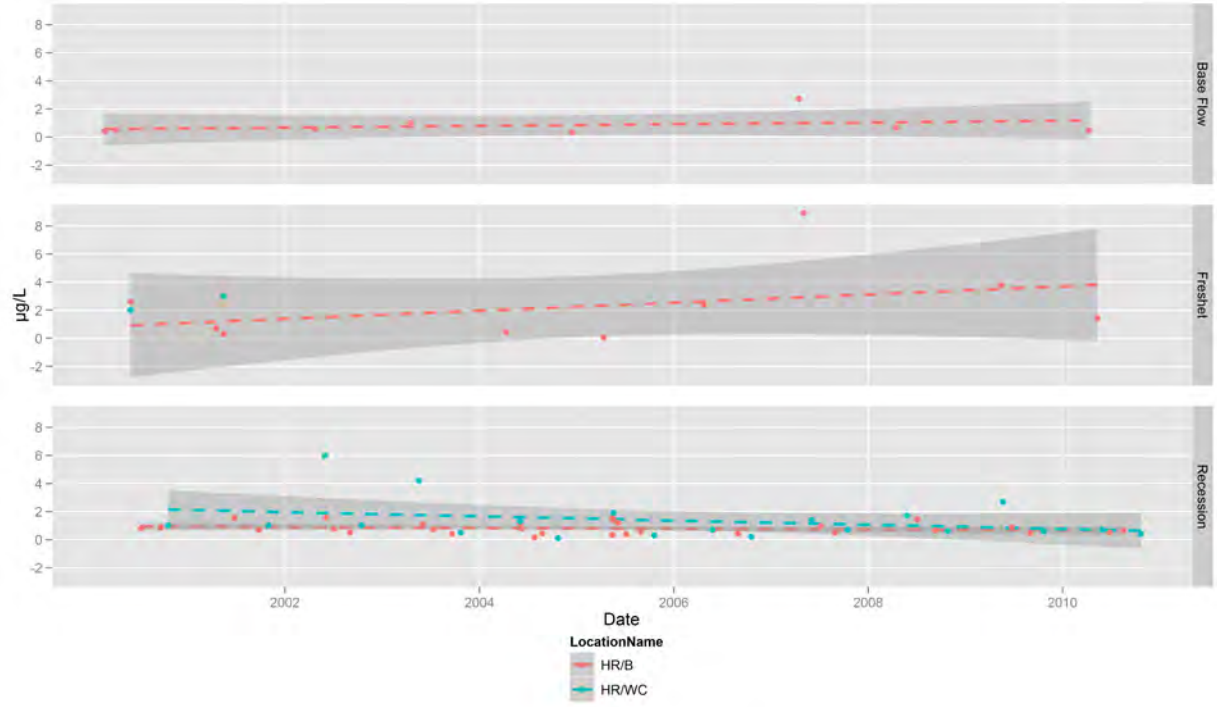
ENVIRON

Surface Water Time Series-2000-2010
Chromium, Total Total

Figure 3.5.i



Group	n	Detects	Slope	slope.p
2000-2010	69	67	-0.00749	0.891



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	0.0603	0.493
HR/B	Freshet	9	9	0.288	0.324
HR/B	Recession	30	30	-0.0279	0.292
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	18	-0.15	0.185

Ecological Screening Value

Significant Trend

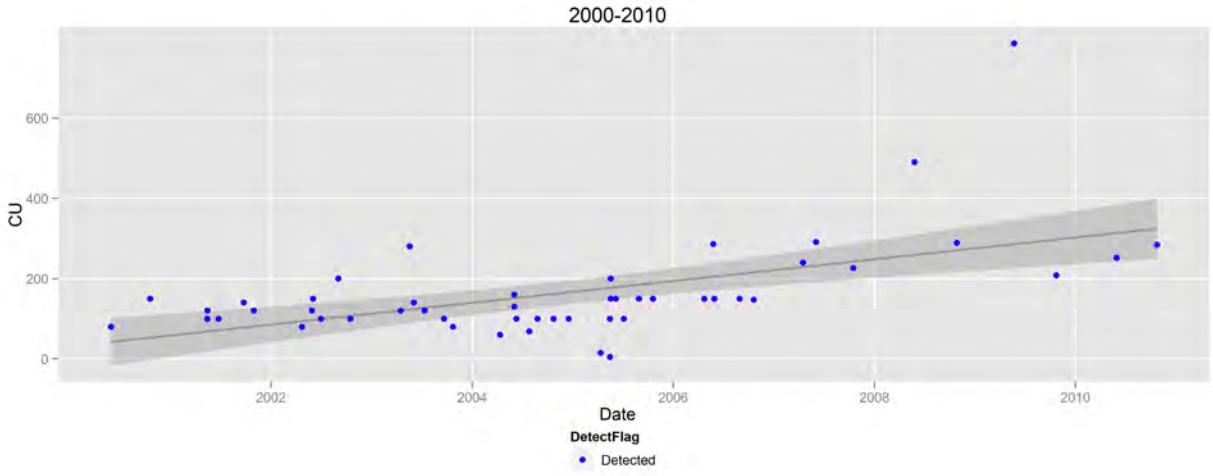
No Significant Trend

95% Confidence Interval

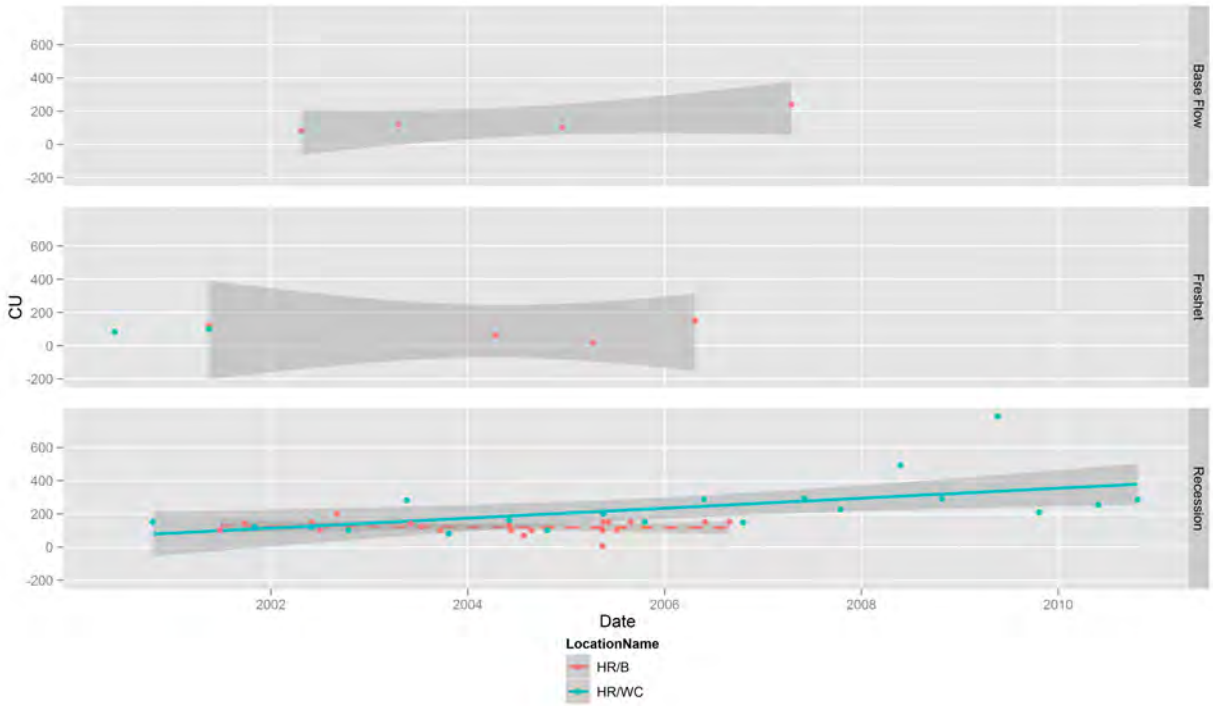
ENVIRON

Surface Water Time Series-2000-2010
Cobalt Total

Figure 3.5.j



Group	n	Detects	Slope	slope.p
2000-2010	50	50	27.1	2.39e-05



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	4	4	NC	NC
HR/B	Freshet	4	4	NC	NC
HR/B	Recession	20	20	-2.31	0.717
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	20	30	0.0107

Ecological Screening Value

Significant Trend

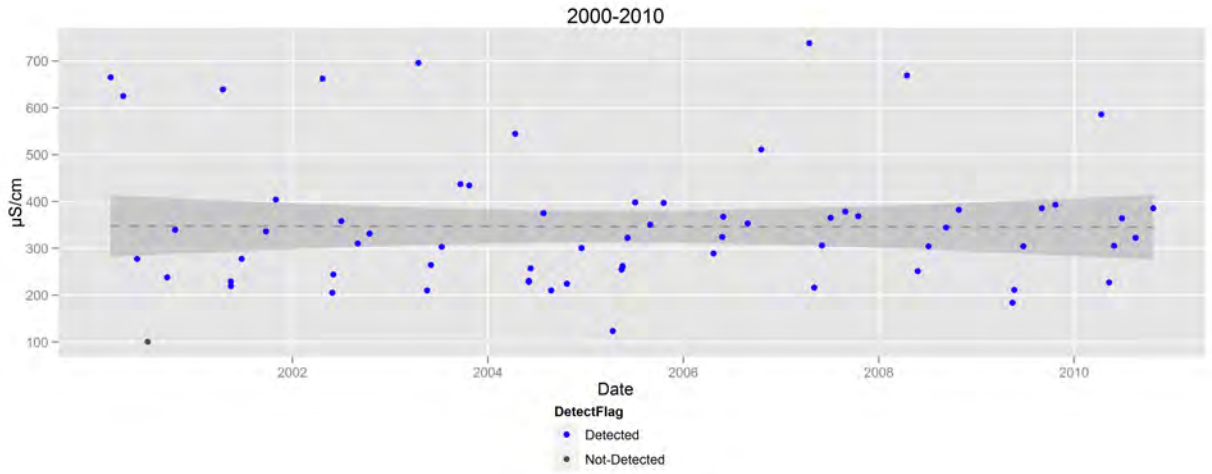
No Significant Trend

95% Confidence Interval

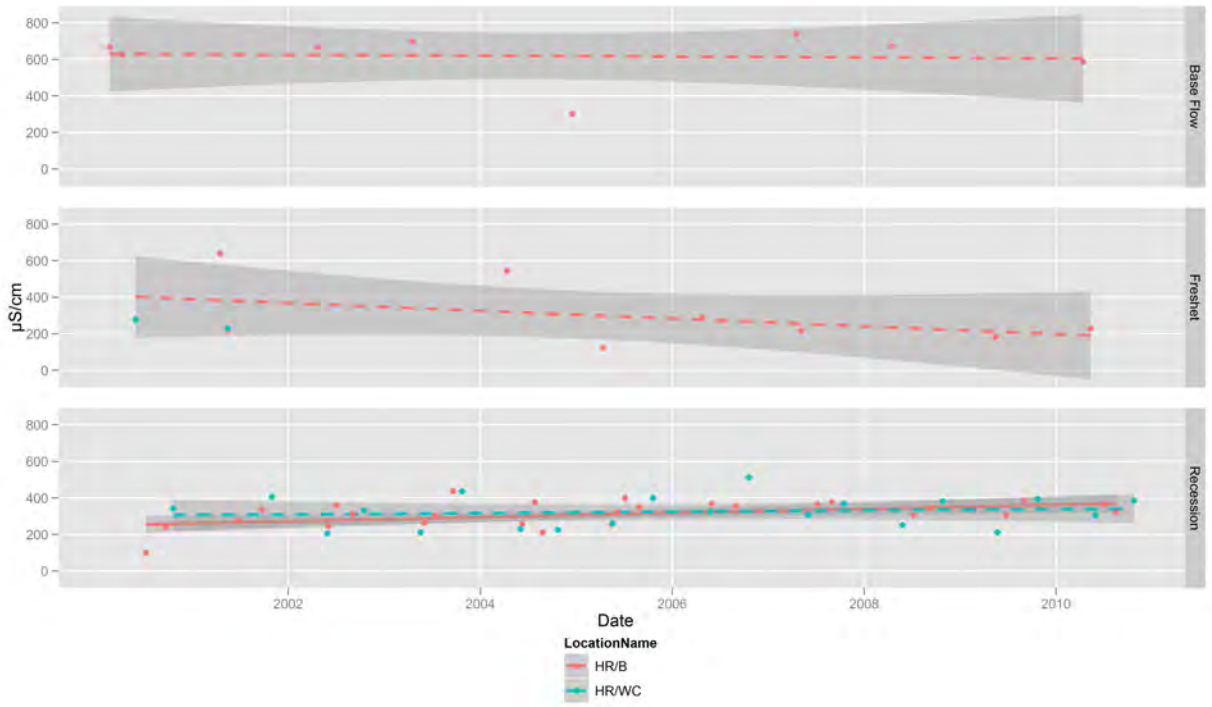
ENVIRON

Surface Water Time Series-2000-2010
Color

Figure
3.5.k



Group	n	Detects	Slope	slope.p
2000-2010	69	68	-0.26	0.962



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	-2.3	0.881
HR/B	Freshet	9	9	-21.2	0.234
HR/B	Recession	30	29	11.3	0.0107
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	20	3.64	0.595

Ecological Screening Value

Significant Trend

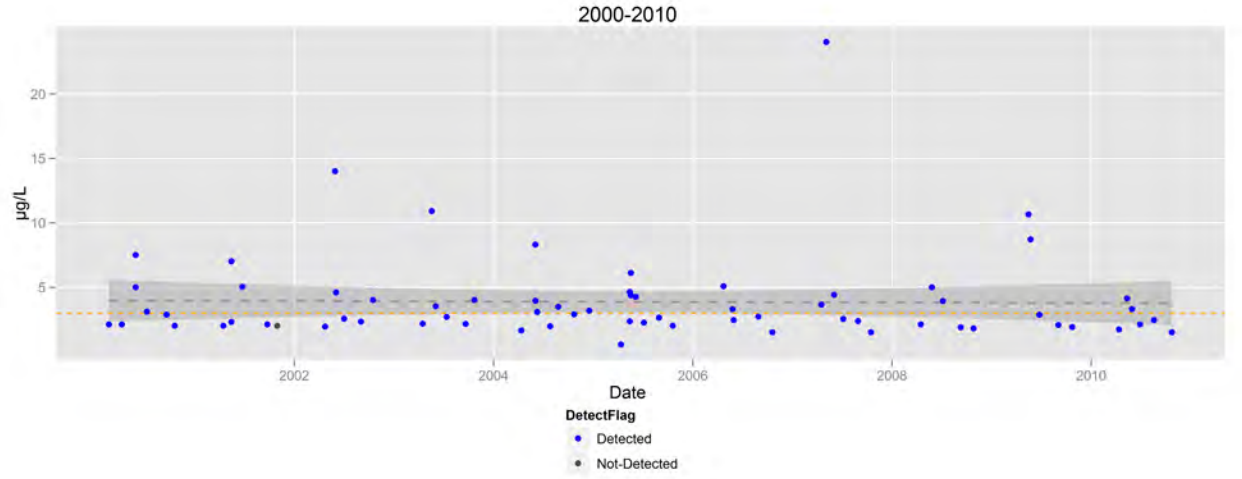
No Significant Trend

95% Confidence Interval

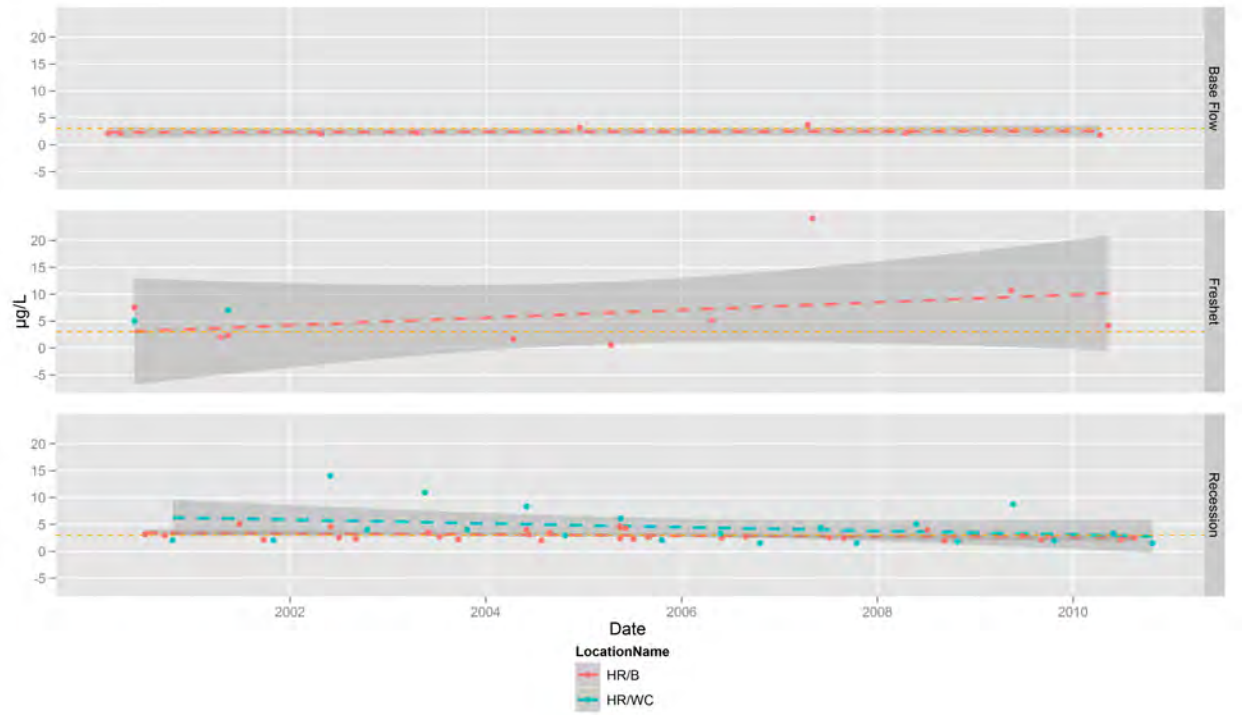
ENVIRON

Surface Water Time Series-2000-2010
Conductivity

Figure
3.5.l



Group	n	Detects	Slope	slope.p
2000-2010	69	68	-0.0151	0.911



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	0.0268	0.722
HR/B	Freshet	9	9	0.712	0.357
HR/B	Recession	30	30	-0.0942	0.113
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	19	-0.346	0.202

Ecological Screening Value

Significant Trend

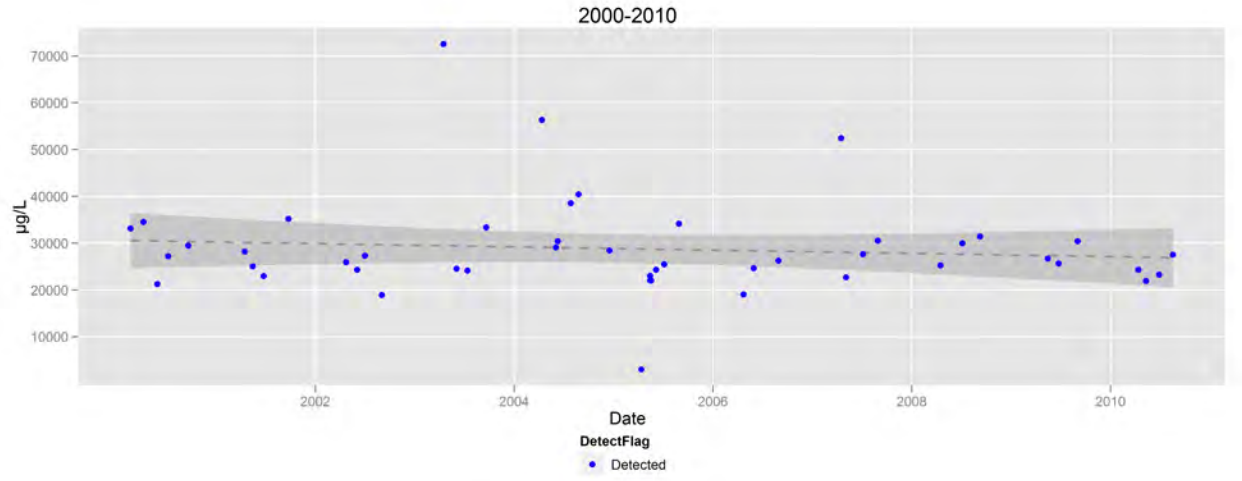
No Significant Trend

95% Confidence Interval

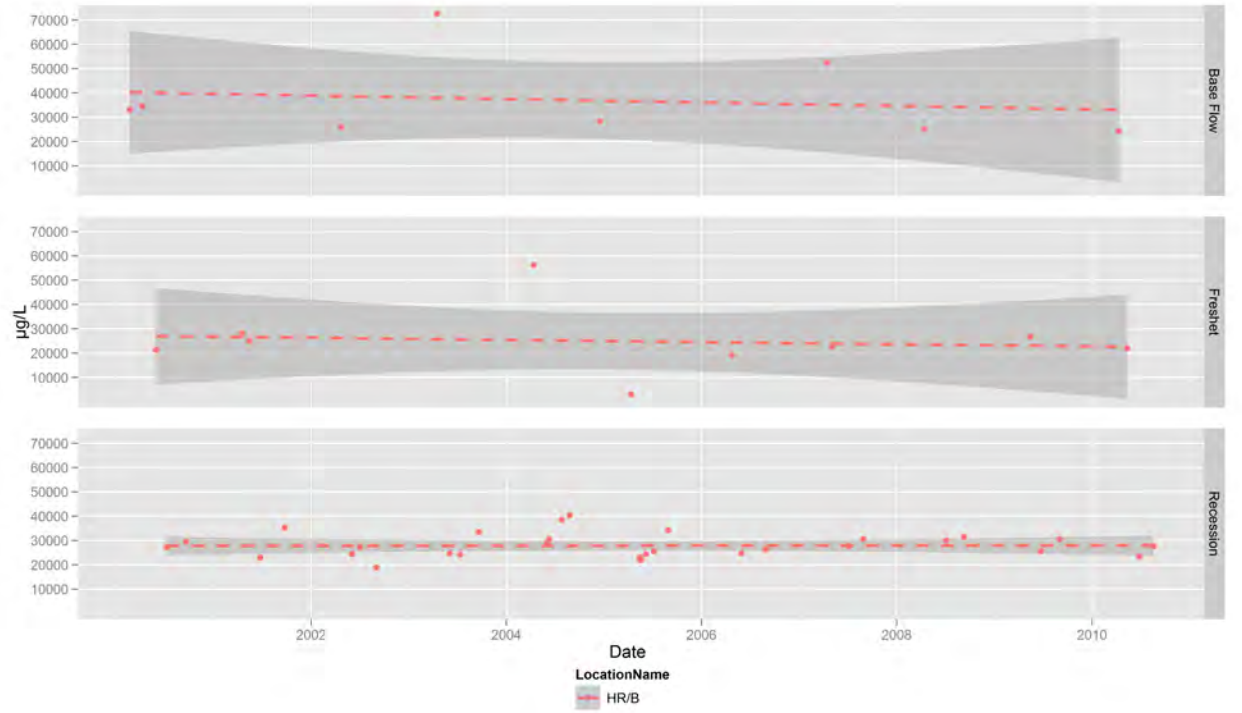
ENVIRON

Surface Water Time Series-2000-2010
Copper Total

Figure
3.5.m



Group	n	Detects	Slope	slope.p
2000-2010	47	47	-346	0.493



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	-711.0	0.710
HR/B	Freshet	9	9	-440.0	0.771
HR/B	Recession	30	30	14.1	0.967

Ecological Screening Value

Significant Trend

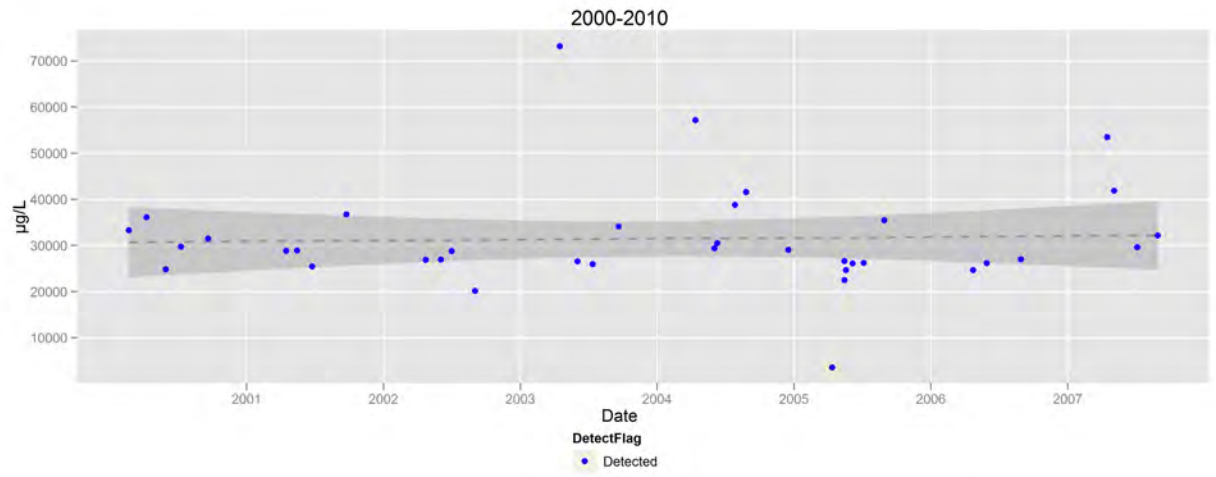
No Significant Trend

95% Confidence Interval

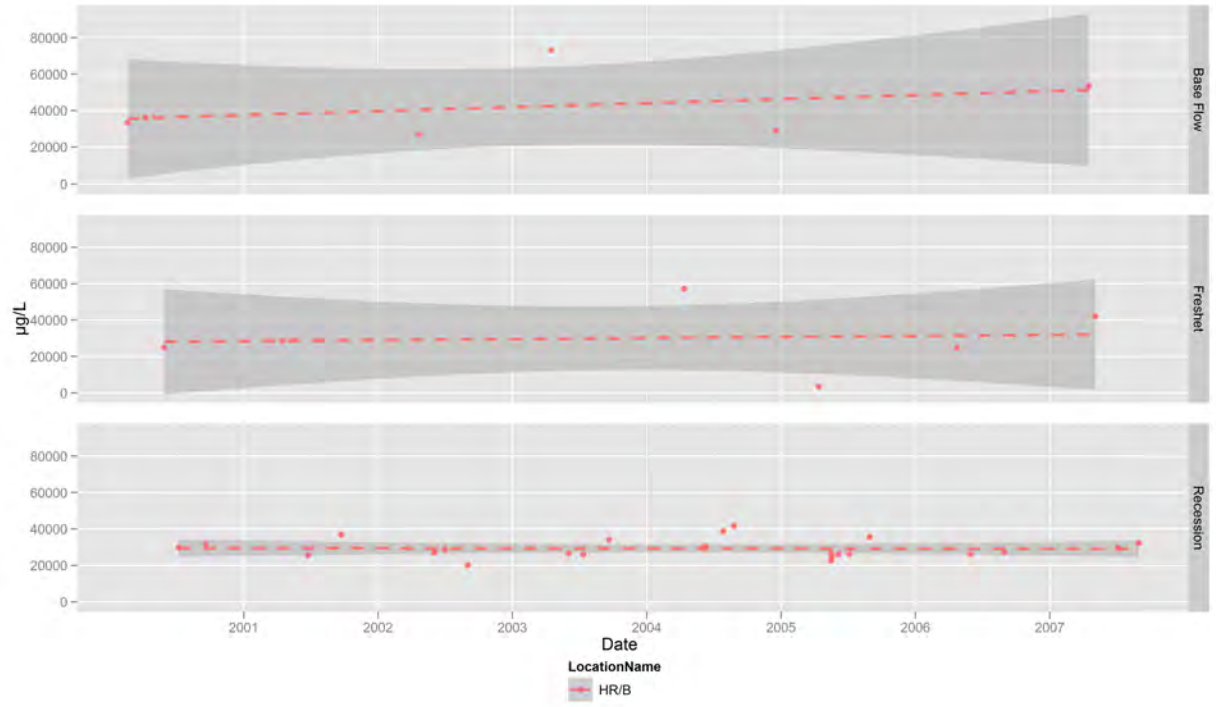
ENVIRON

Surface Water Time Series-2000-2010
Carbon, Organic Dissolved

Figure
3.5.n



Group	n	Detects	Slope	slope.p
2000-2010	37	37	193	0.822



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	6	6	2190.0	0.512
HR/B	Freshet	7	7	572.0	0.840
HR/B	Recession	24	24	-44.1	0.936

Ecological Screening Value

Significant Trend

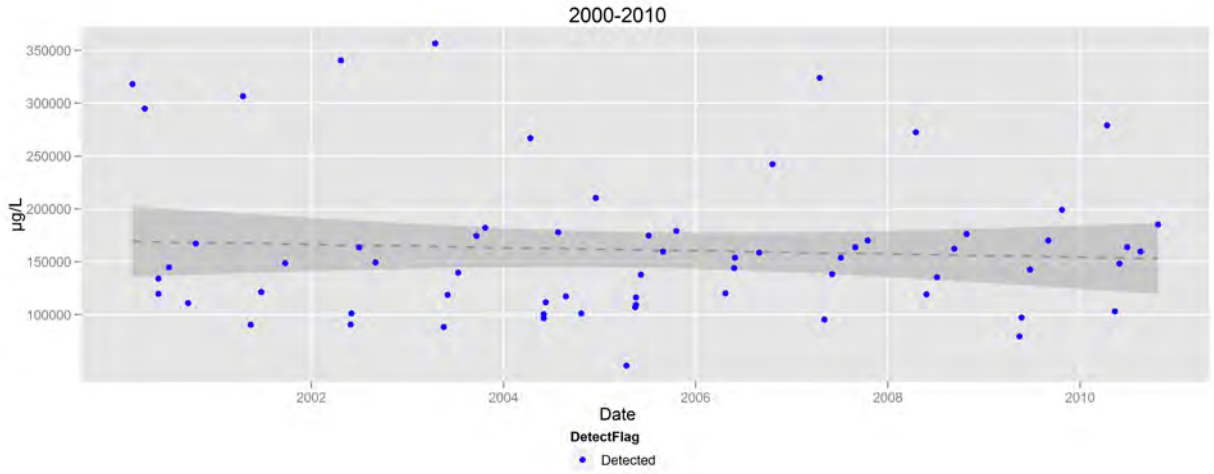
No Significant Trend

95% Confidence Interval

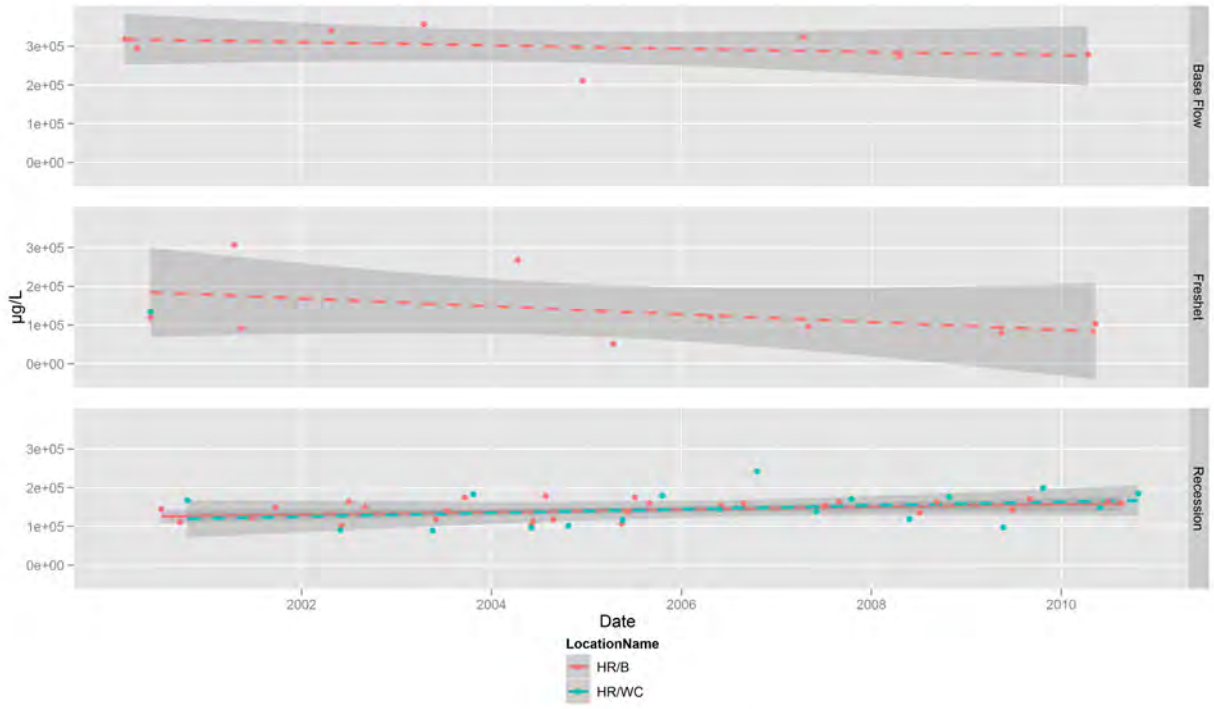
ENVIRON

Surface Water Time Series-2000-2010
Carbon, Organic Total

Figure
3.5.o



Group	n	Detects	Slope	slope.p
2000-2010	66	66	-1510	0.584



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	-4180	0.41
HR/B	Freshet	9	9	-10200	0.266
HR/B	Recession	30	30	3300	0.0394
HR/WC	Freshet	1	1	NC	NC
HR/WC	Recession	18	18	4730	0.212

Ecological Screening Value

Significant Trend

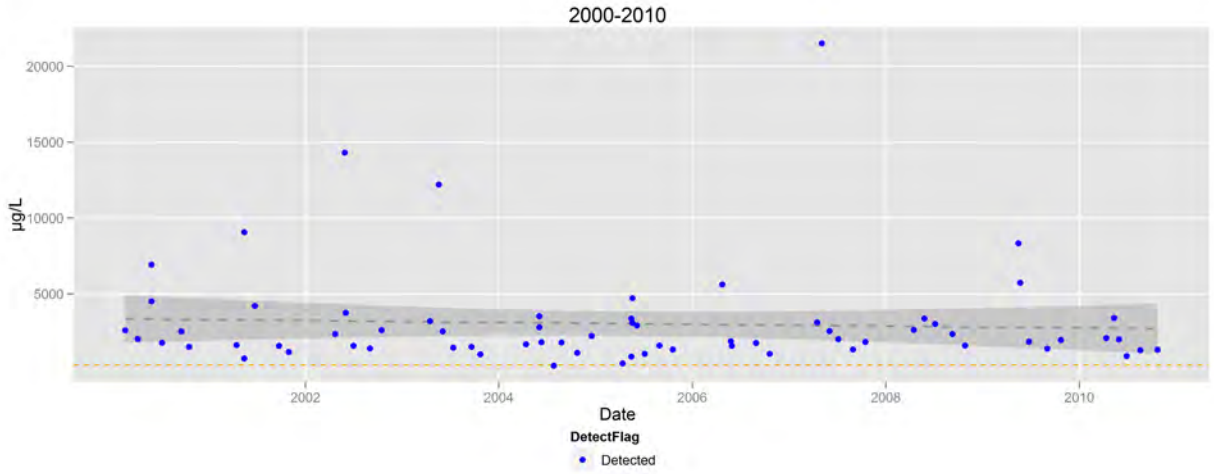
No Significant Trend

95% Confidence Interval

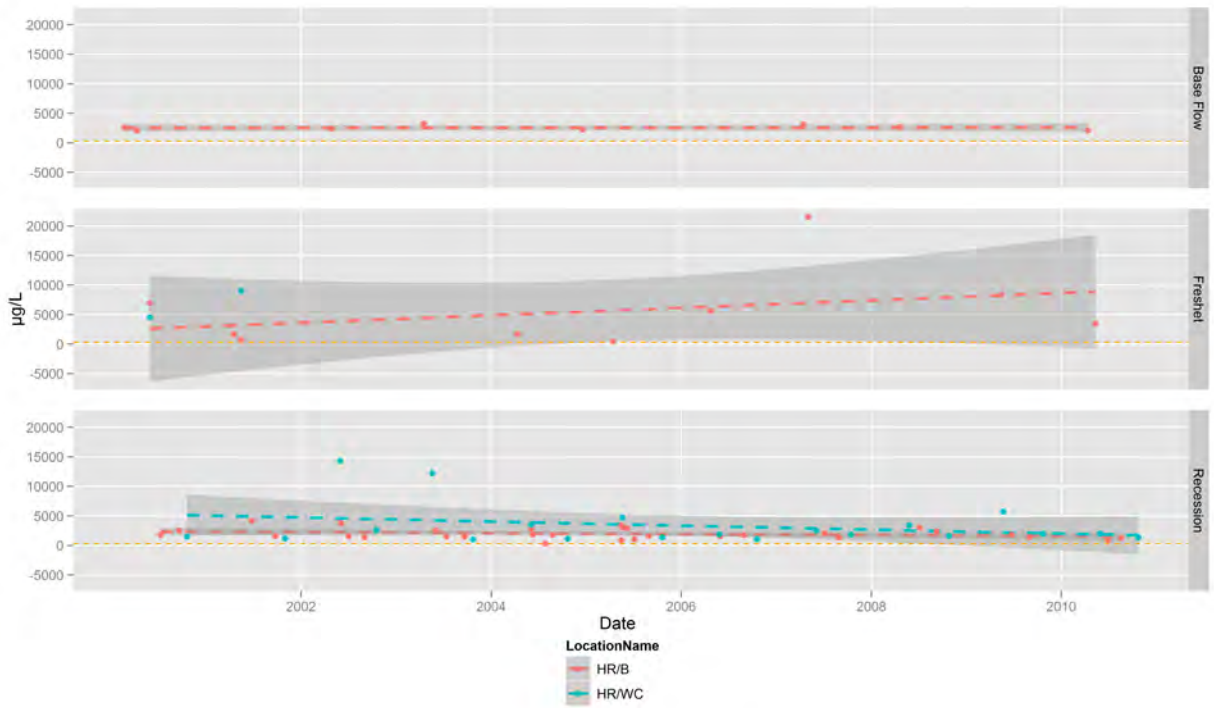
ENVIRON

Surface Water Time Series-2000-2010
Hardness (as CaCO3)

Figure
3.5.p



Group	n	Detects	Slope	slope.p
2000-2010	69	69	-60.9	0.642



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	6.99	0.889
HR/B	Freshet	9	9	630	0.366
HR/B	Recession	30	30	-84.9	0.155
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	20	-340	0.229

Ecological Screening Value

Significant Trend

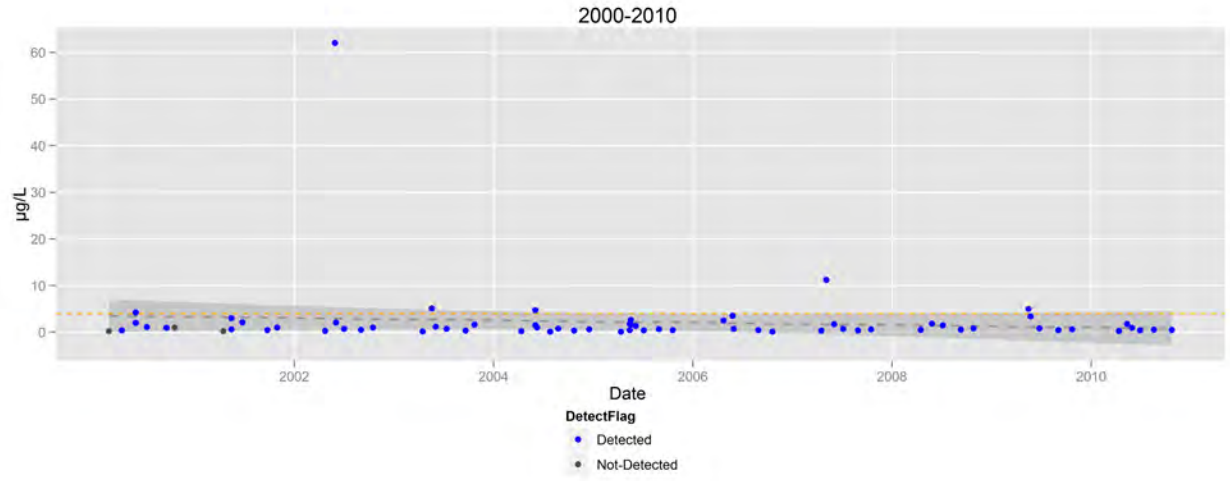
No Significant Trend

95% Confidence Interval

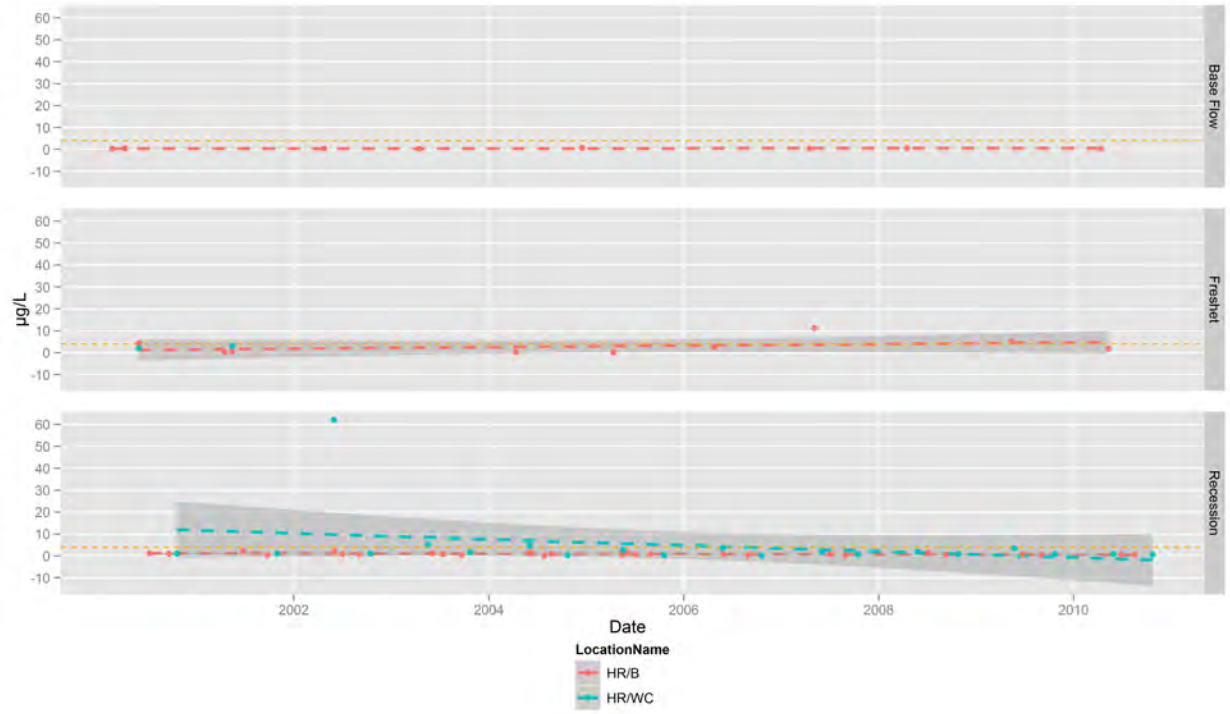
ENVIRON

Surface Water Time Series-2000-2010
Iron Total

Figure 3.5.q



Group	n	Detects	Slope	slope.p
2000-2010	69	66	-0.255	0.385



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	7	0.00826	0.595
HR/B	Freshet	9	8	0.343	0.367
HR/B	Recession	30	30	-0.0599	0.0849
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	19	-1.38	0.191

Ecological Screening Value

Significant Trend

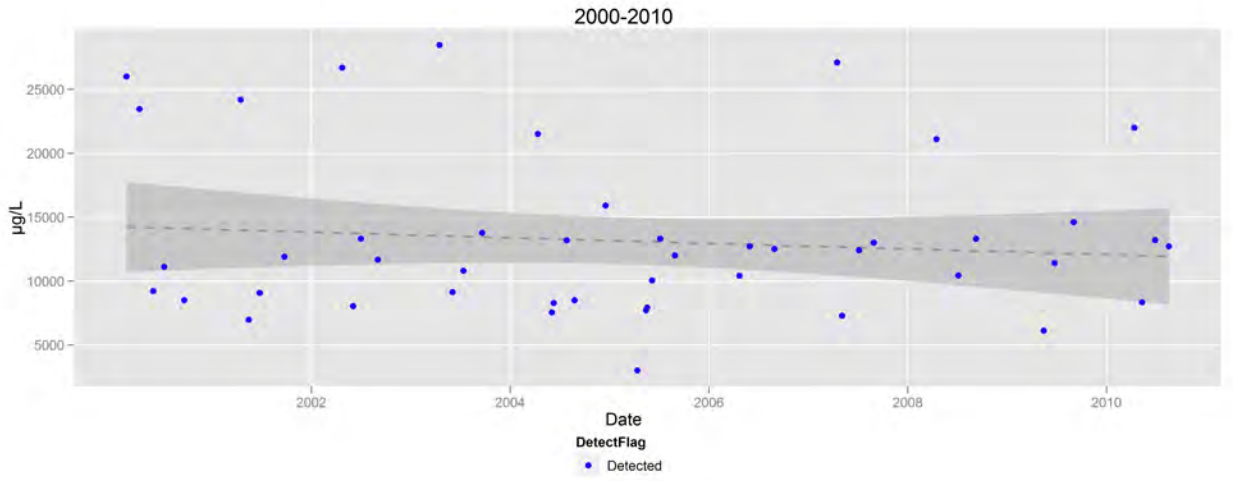
No Significant Trend

95% Confidence Interval

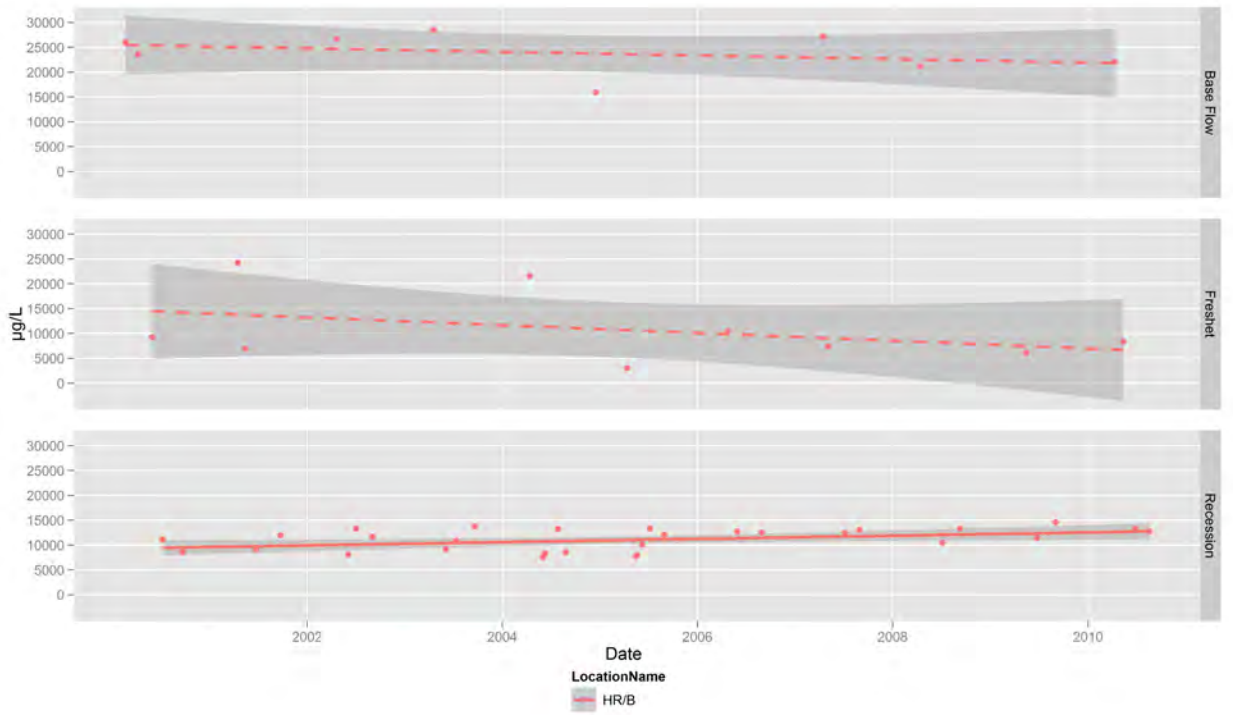
ENVIRON

Surface Water Time Series-2000-2010
Lead Total

Figure 3.5.r



Group	n	Detects	Slope	slope.p
2000-2010	47	47	-219	0.467



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	-357	0.432
HR/B	Freshet	9	9	-782	0.297
HR/B	Recession	30	30	326	0.022

Ecological Screening Value

Significant Trend

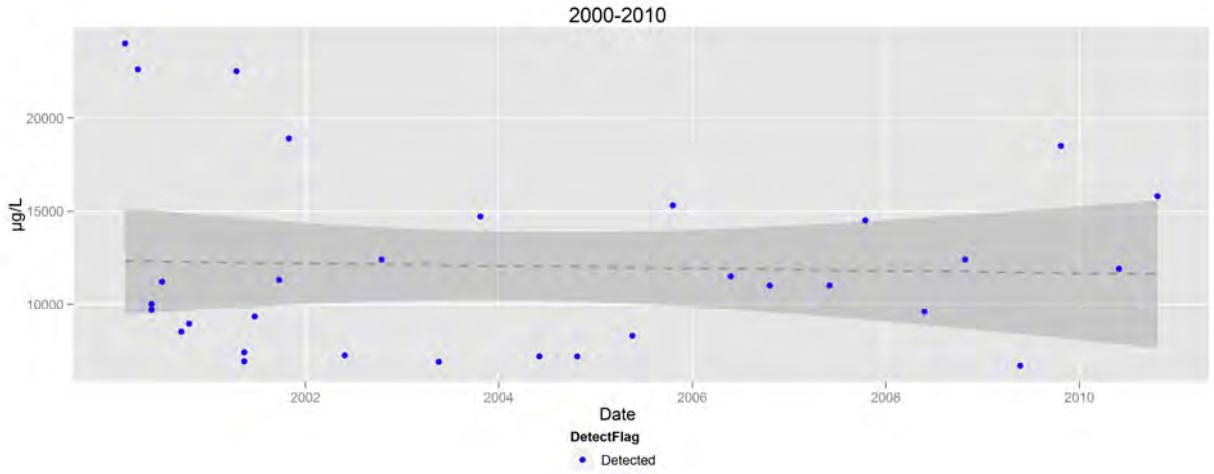
No Significant Trend

95% Confidence Interval

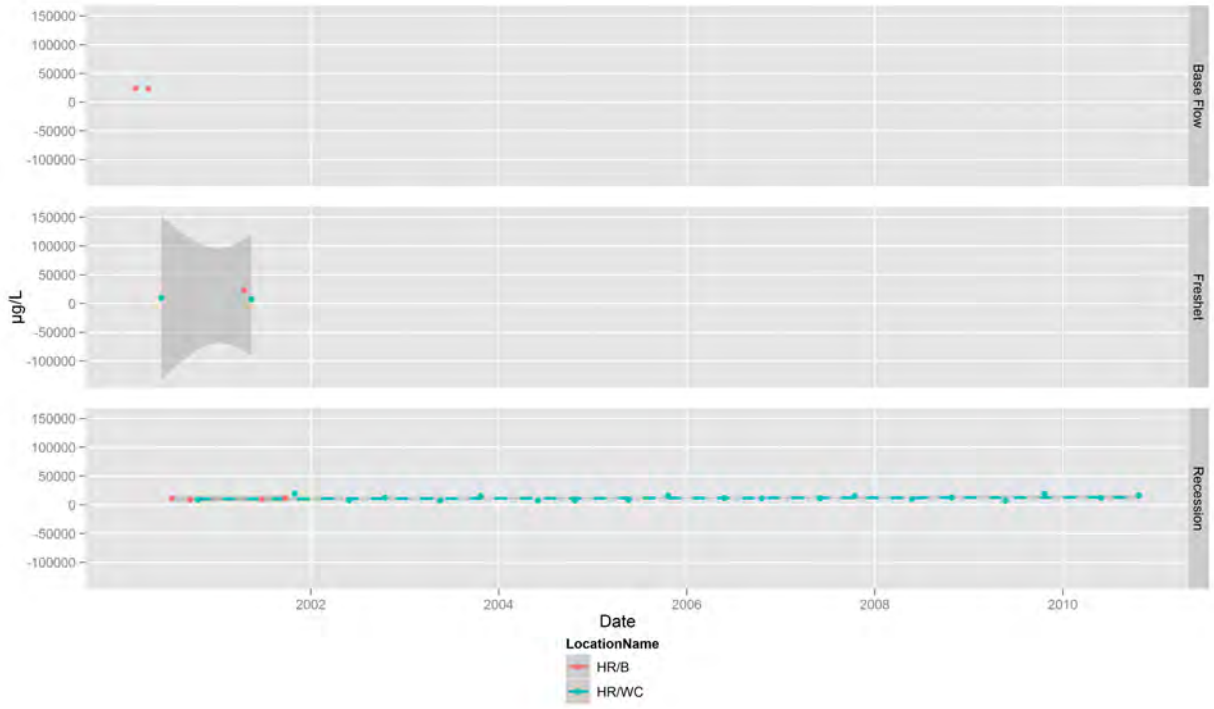
ENVIRON

Surface Water Time Series-2000-2010
Magnesium Dissolved

Figure
3.5.s



Group	n	Detects	Slope	slope.p
2000-2010	31	31	-65.7	0.803



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	2	2	NC	NC
HR/B	Freshet	3	3	NC	NC
HR/B	Recession	4	4	NC	NC
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	20	279	0.352

Ecological Screening Value

Significant Trend

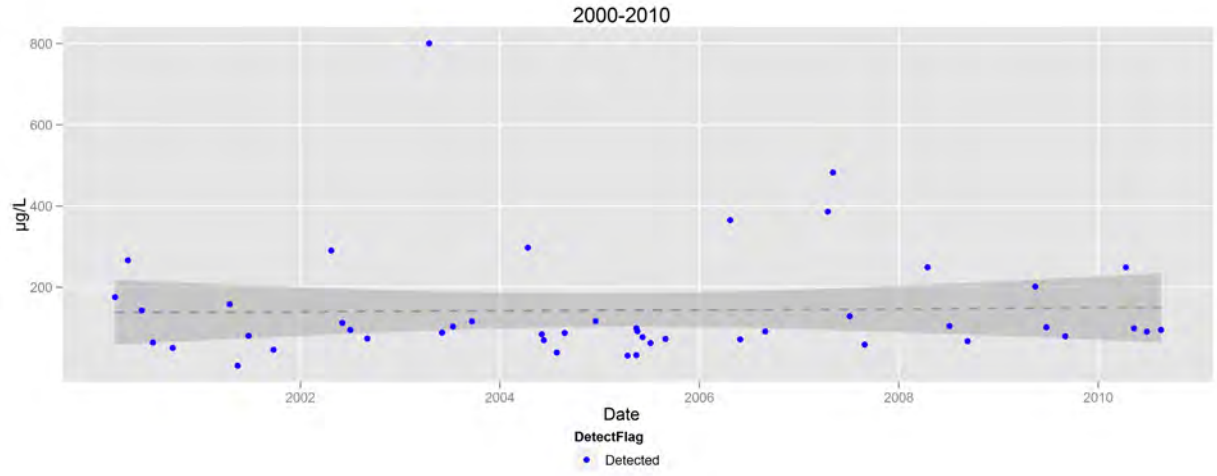
No Significant Trend

95% Confidence Interval

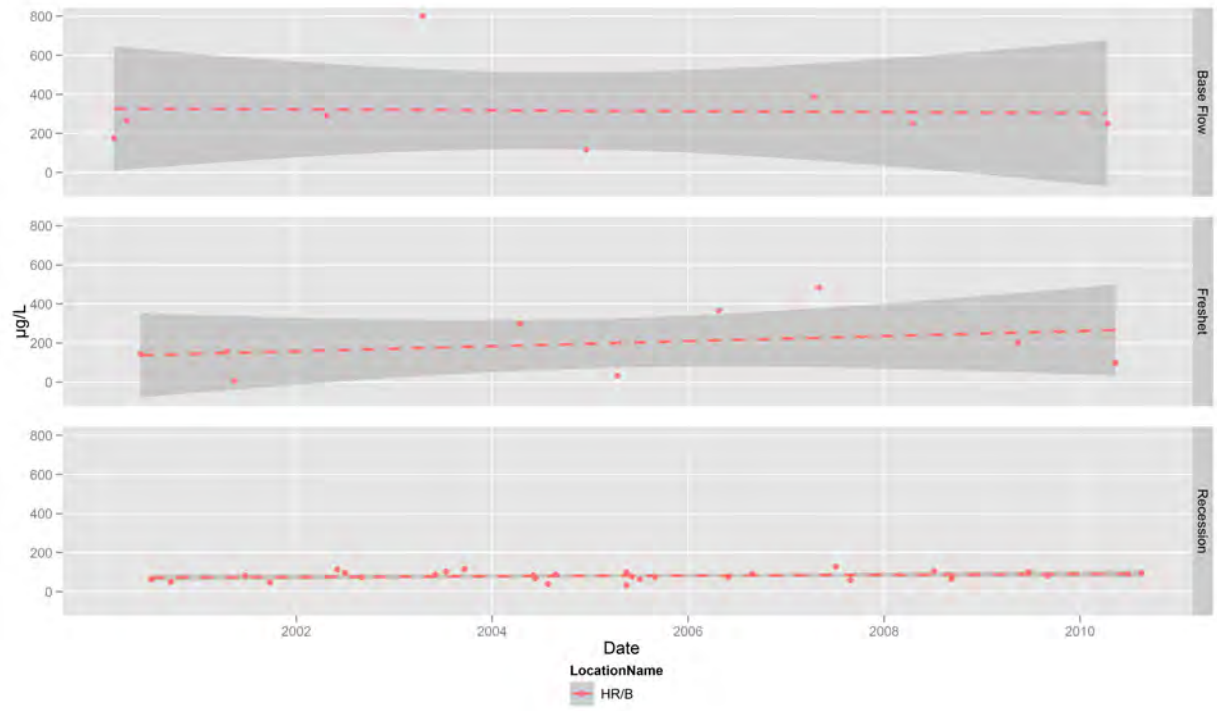
ENVIRON

Surface Water Time Series-2000-2010
Magnesium Total

Figure 3.5.t



Group	n	Detects	Slope	slope.p
2000-2010	47	47	1.07	0.875



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	-2.42	0.919
HR/B	Freshet	9	9	13.00	0.439
HR/B	Recession	30	30	1.89	0.210

Ecological Screening Value

Significant Trend

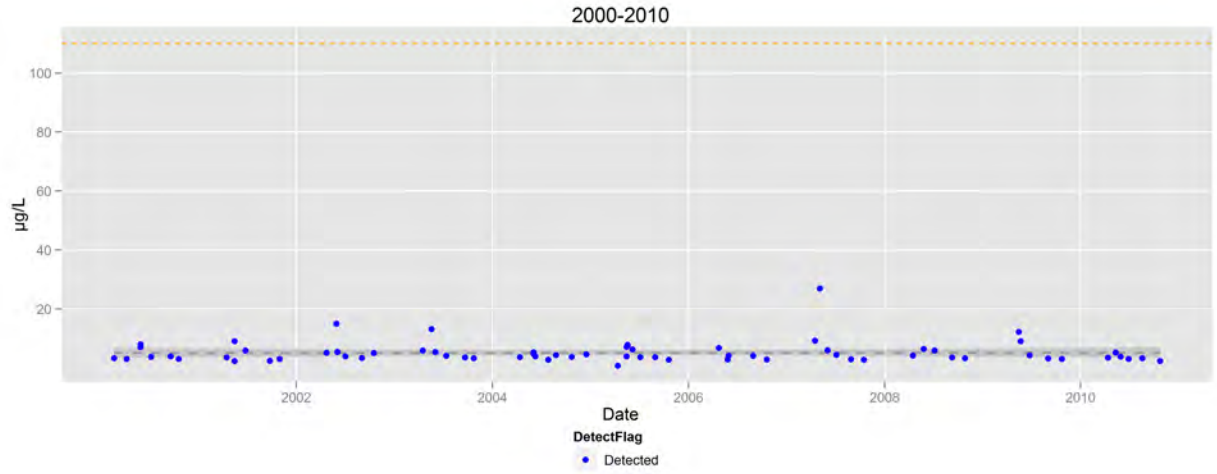
No Significant Trend

95% Confidence Interval

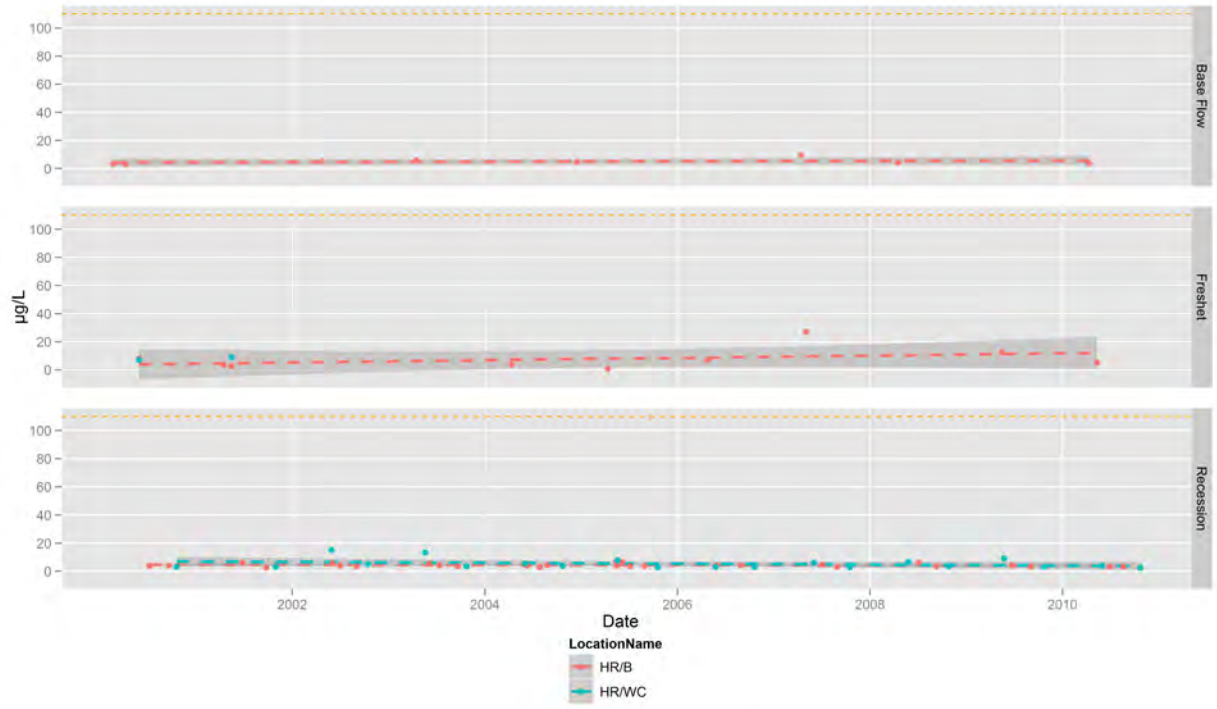
ENVIRON

Surface Water Time Series-2000-2010
Manganese Total

Figure
3.5.u



Group	n	Detects	Slope	slope.p
2000-2010	69	69	0.00975	0.946



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	0.142	0.528
HR/B	Freshet	9	9	0.816	0.329
HR/B	Recession	30	30	-0.05	0.56
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	20	-0.315	0.255

Ecological Screening Value

Significant Trend

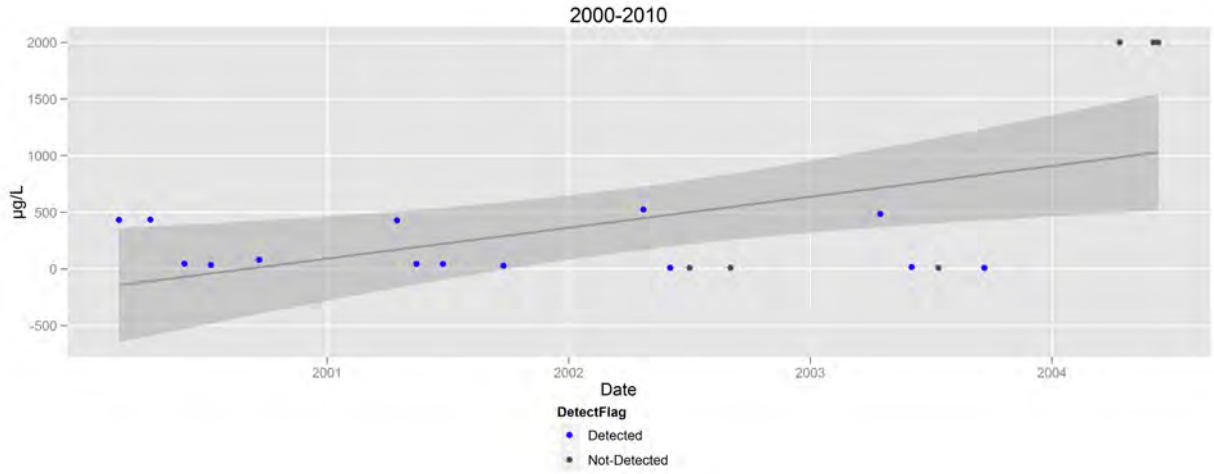
No Significant Trend

95% Confidence Interval

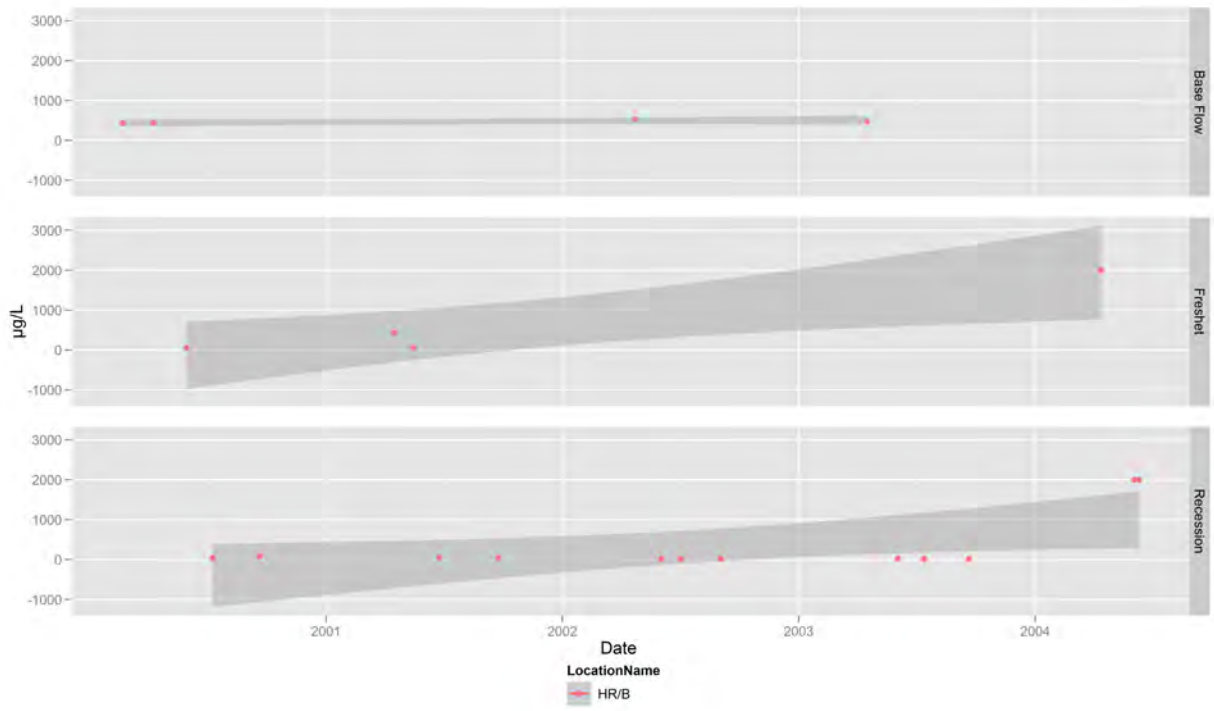
ENVIRON

Surface Water Time Series-2000-2010
Nickel Total

Figure 3.5.v



Group	n	Detects	Slope	slope.p
2000-2010	20	14	273	0.00975



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	4	4	NC	NC
HR/B	Freshet	4	3	NC	NC
HR/B	Recession	12	7	NC	NC

Ecological Screening Value

Significant Trend

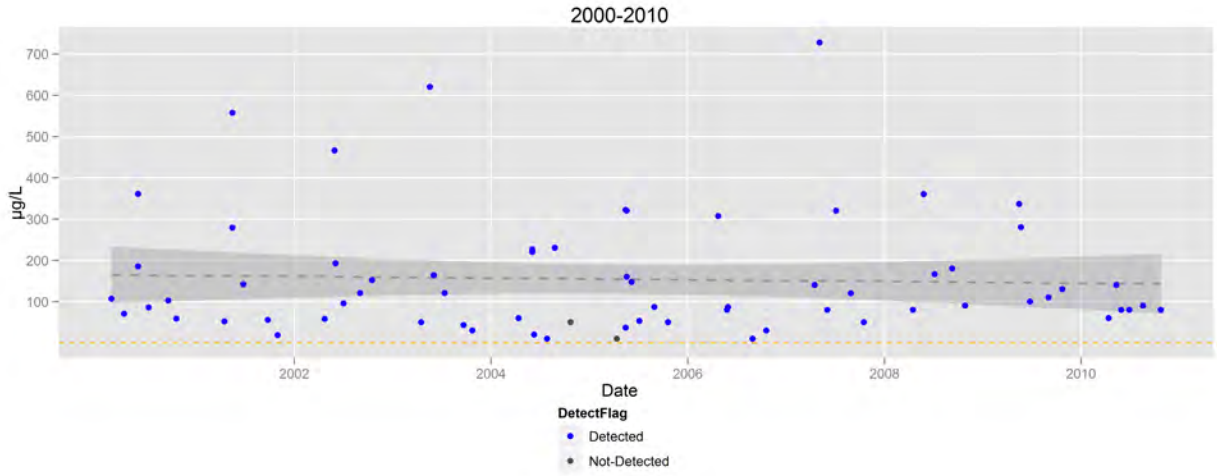
No Significant Trend

95% Confidence Interval

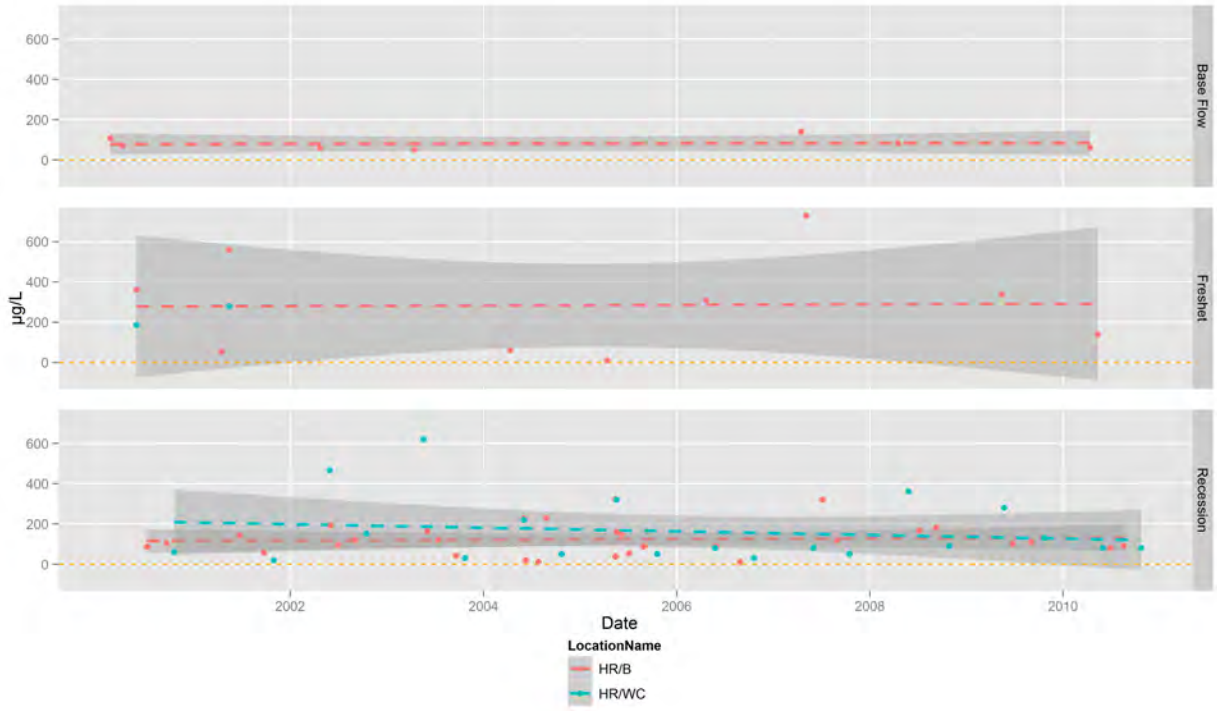
ENVIRON

Surface Water Time Series-2000-2010
Nitrogen, Nitrate-Nitrite (Dissolved)

Figure 3.5.w



Group	n	Detects	Slope	slope.p
2000-2010	68	66	-2	0.726



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	7	7	0.566	0.879
HR/B	Freshet	9	8	1.23	0.963
HR/B	Recession	30	30	1.62	0.761
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	19	-8.93	0.494

Ecological Screening Value

Significant Trend

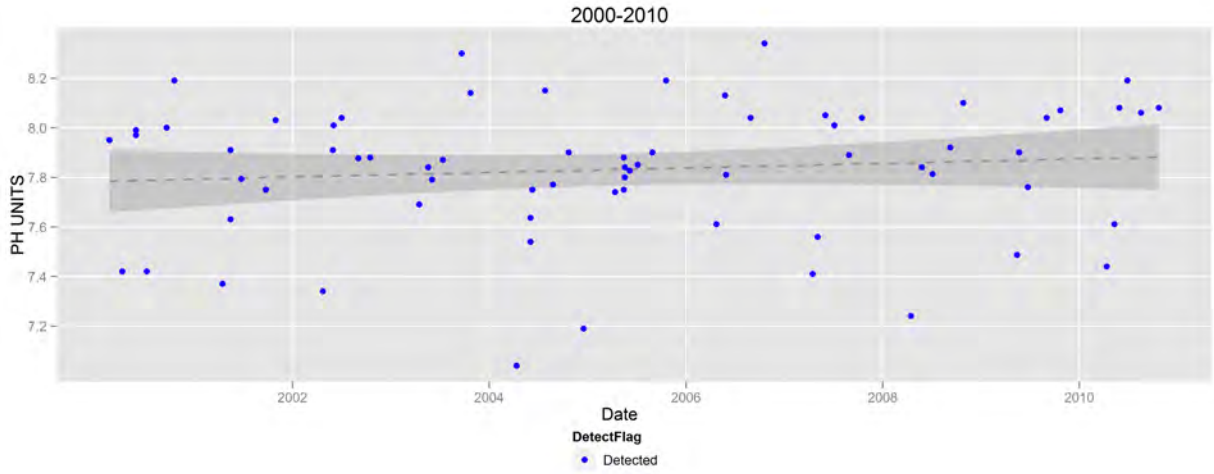
No Significant Trend

95% Confidence Interval

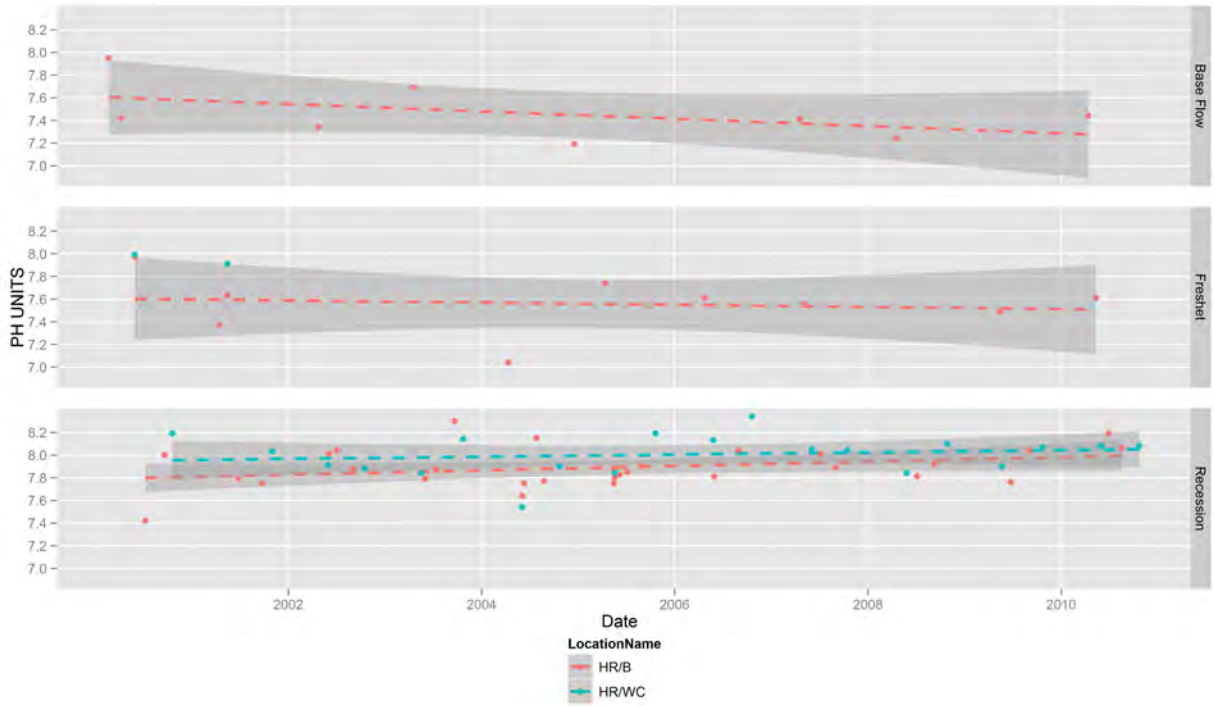
ENVIRON

Surface Water Time Series-2000-2010
Phosphorus (as P) Total

Figure 3.5.x



Group	n	Detects	Slope	slope.p
2000-2010	69	69	0.00914	0.387



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	-0.0323	0.219
HR/B	Freshet	9	9	-0.00957	0.73
HR/B	Recession	30	30	0.0192	0.0944
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	20	0.00953	0.492

Ecological Screening Value

Significant Trend

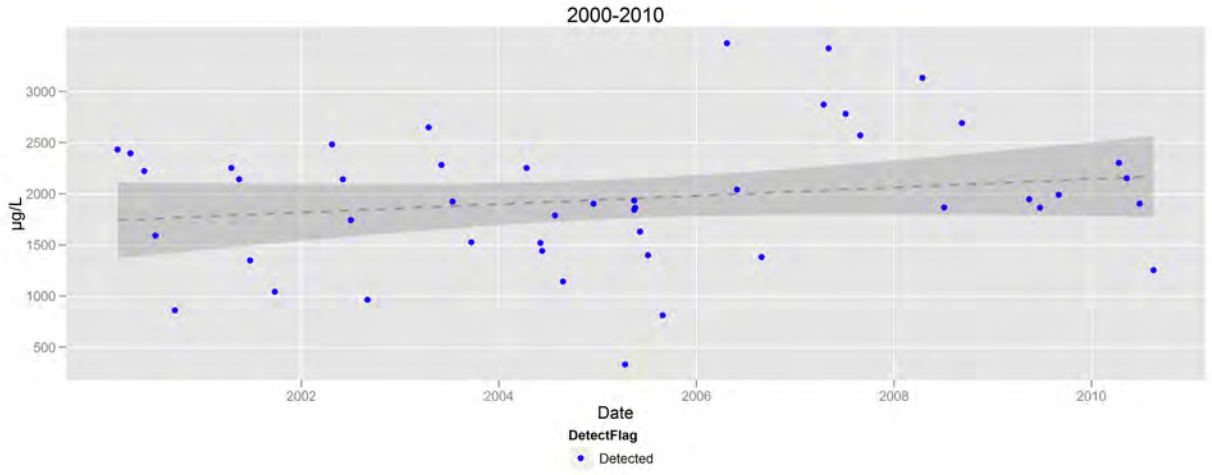
No Significant Trend

95% Confidence Interval

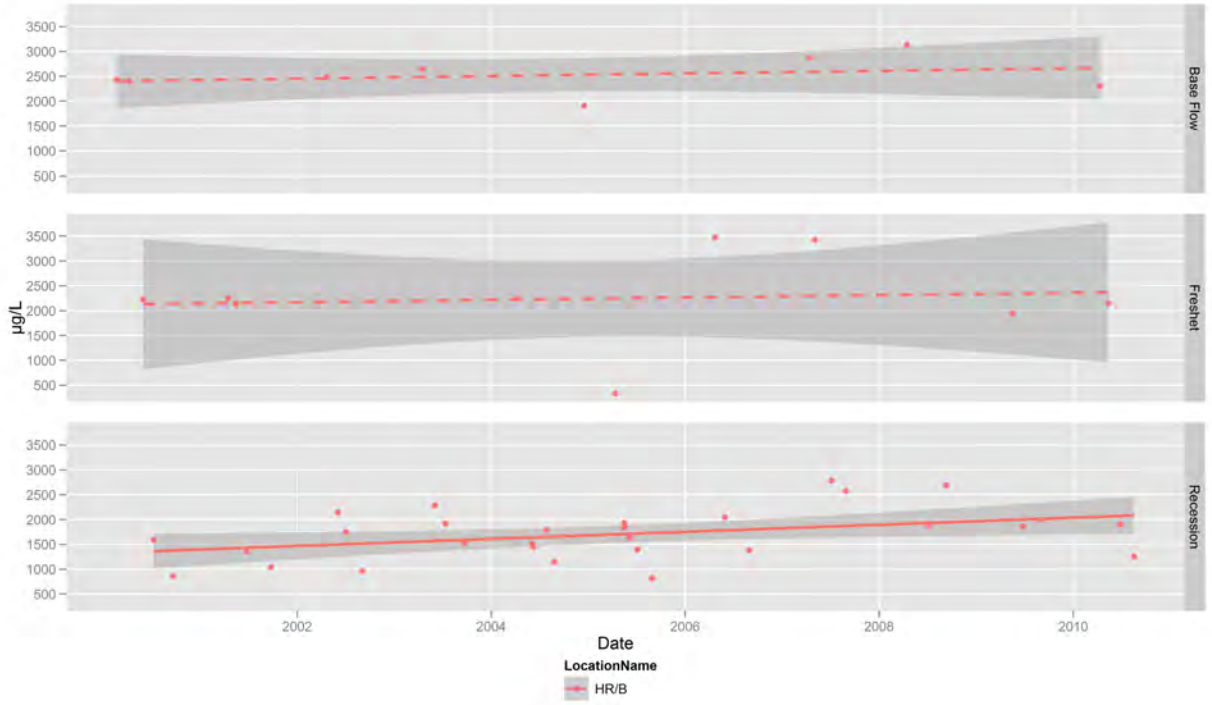
ENVIRON

Surface Water Time Series-2000-2010
pH

Figure
3.5.y



Group	n	Detects	Slope	slope.p
2000-2010	47	47	40.8	0.2



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	26.3	0.526
HR/B	Freshet	9	9	23.8	0.810
HR/B	Recession	30	30	71.2	0.028

Ecological Screening Value

Significant Trend

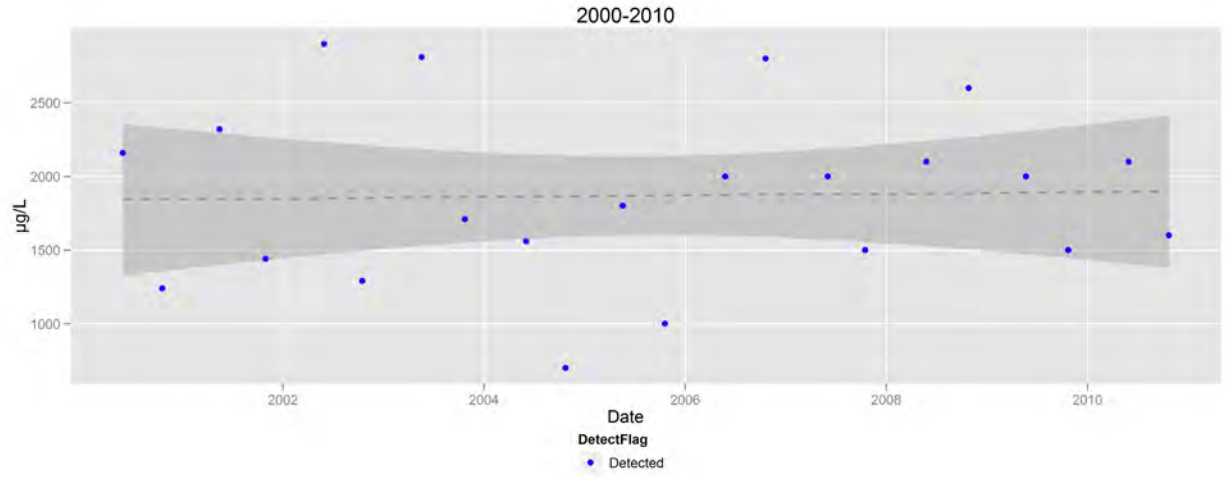
No Significant Trend

95% Confidence Interval

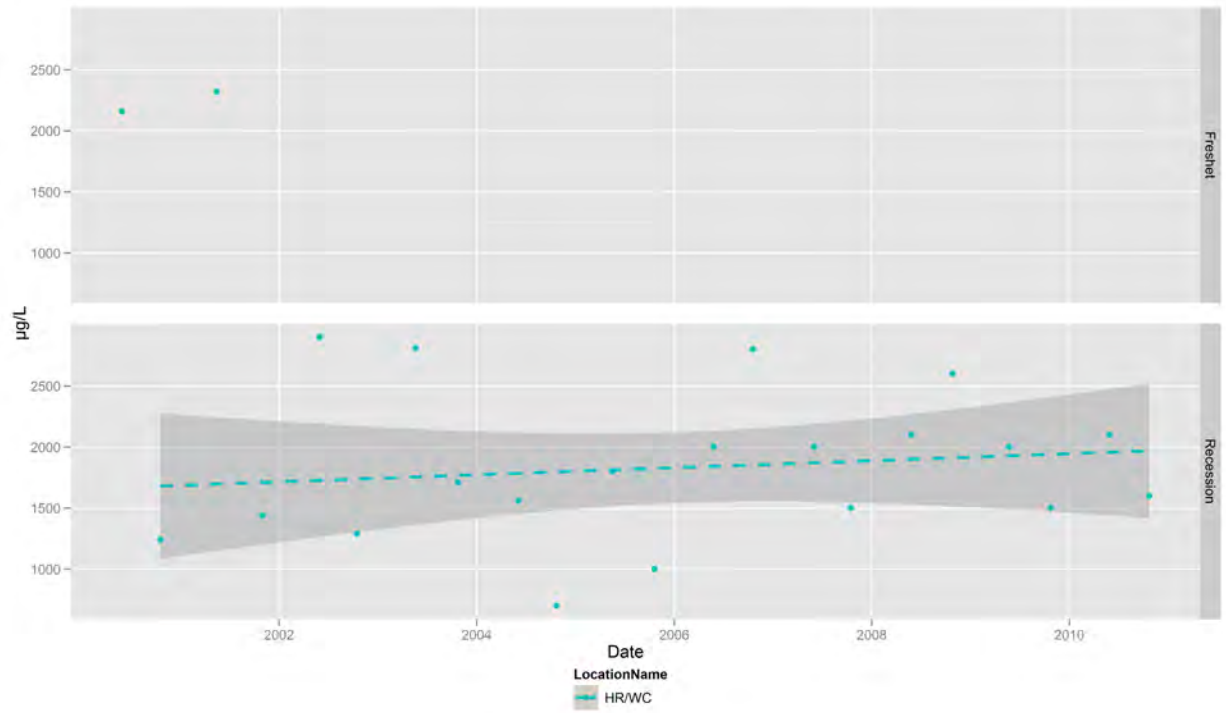
ENVIRON

Surface Water Time Series-2000-2010
Potassium Dissolved

Figure 3.5.z



Group	n	Detects	Slope	slope.p
2000-2010	22	22	5.37	0.896



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	20	28.8	0.548

Ecological Screening Value

Significant Trend

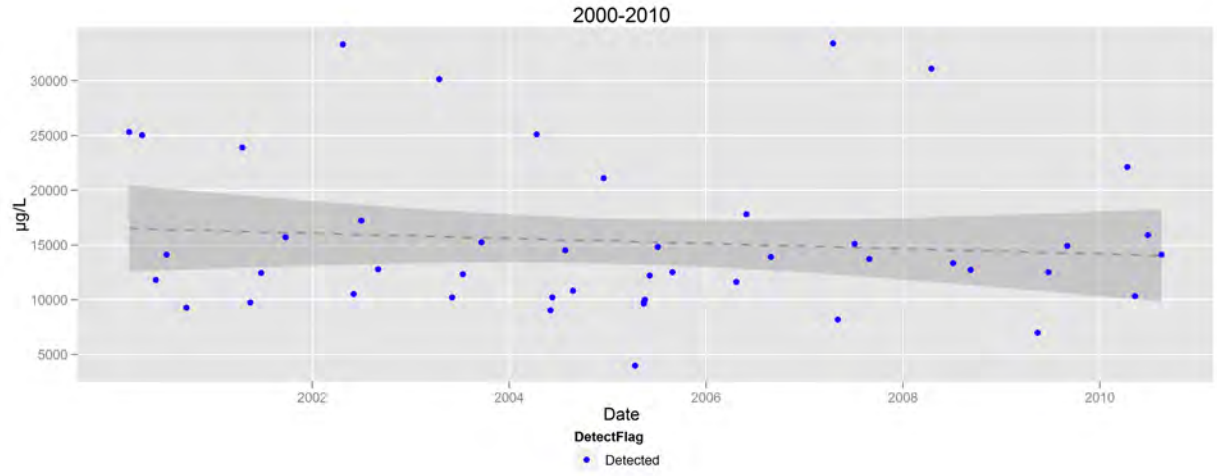
No Significant Trend

95% Confidence Interval

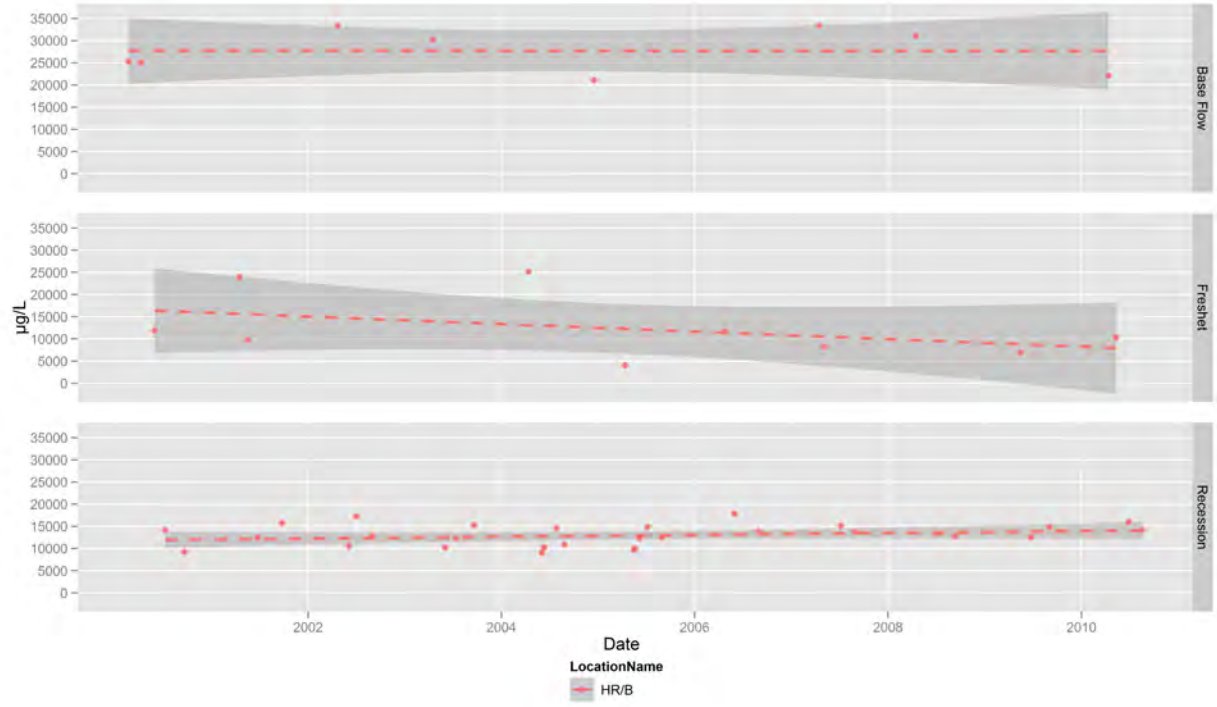
ENVIRON

Surface Water Time Series-2000-2010
Potassium Total

Figure
3.5.aa



Group	n	Detects	Slope	slope.p
2000-2010	47	47	-235	0.487



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	-0.663	0.999
HR/B	Freshet	9	9	-847.000	0.263
HR/B	Recession	30	30	211.000	0.186

Ecological Screening Value

Significant Trend

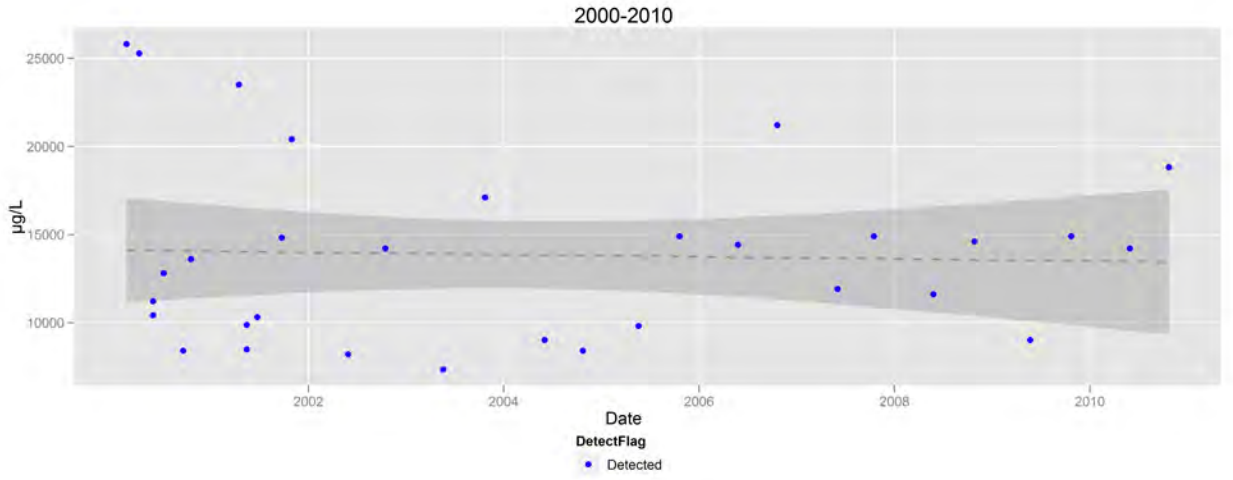
No Significant Trend

95% Confidence Interval

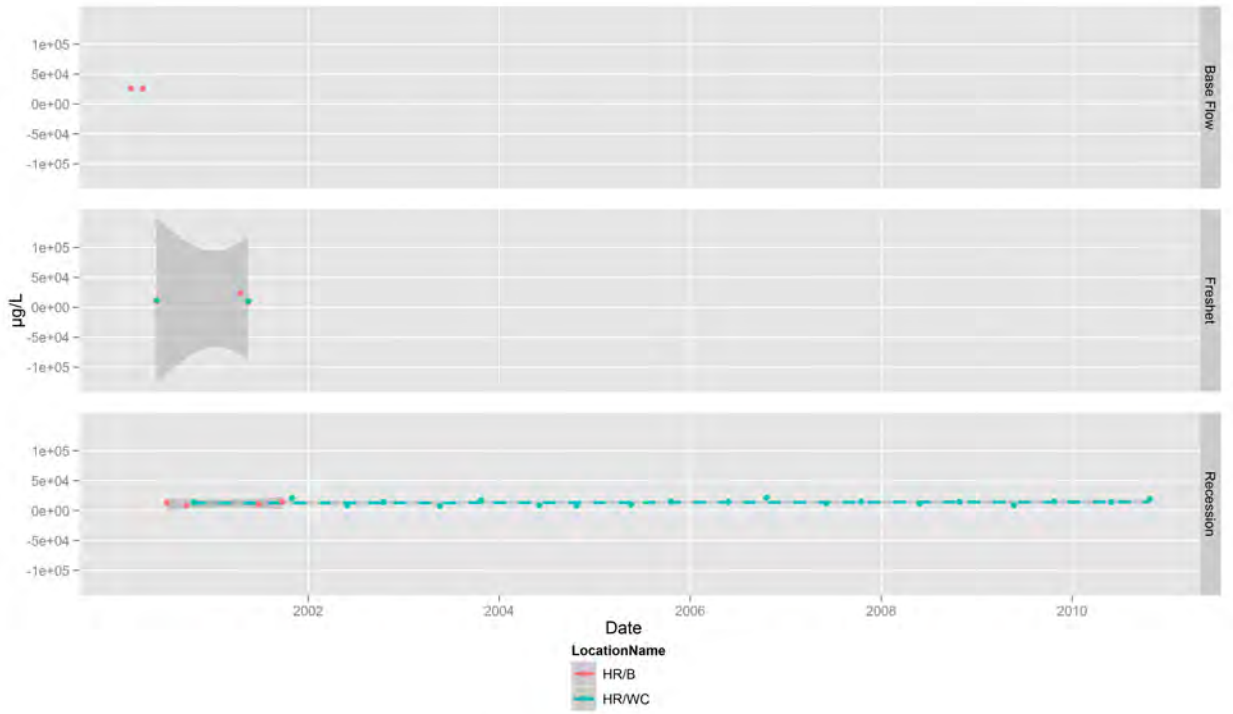
ENVIRON

Surface Water Time Series-2000-2010
Sodium Dissolved

Figure
3.5.bb



Group	n	Detects	Slope	slope.p
2000-2010	31	31	-62.1	0.821



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	2	2	NC	NC
HR/B	Freshet	3	3	NC	NC
HR/B	Recession	4	4	NC	NC
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	20	204	0.523

Ecological Screening Value

Significant Trend

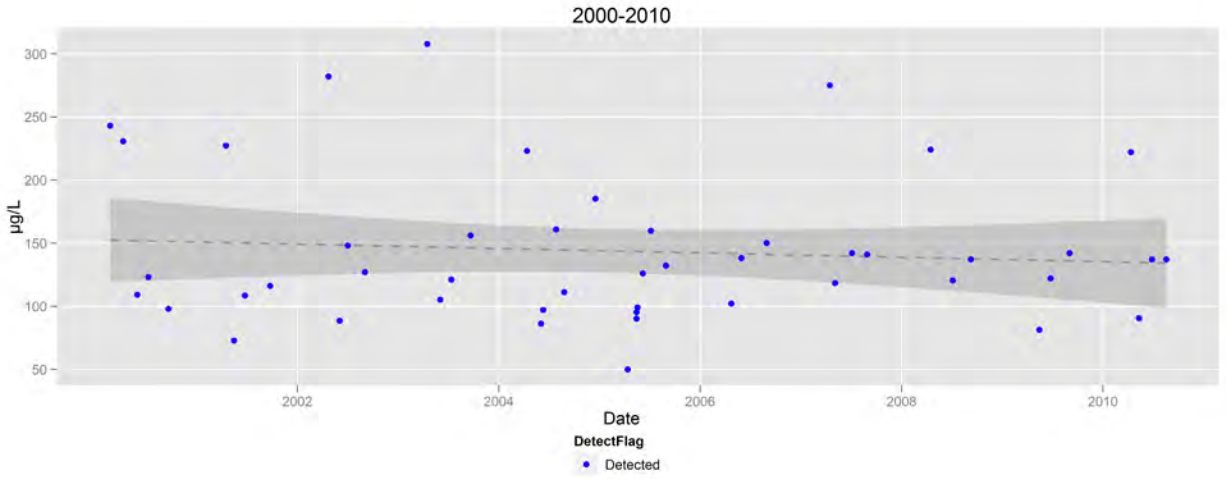
No Significant Trend

95% Confidence Interval

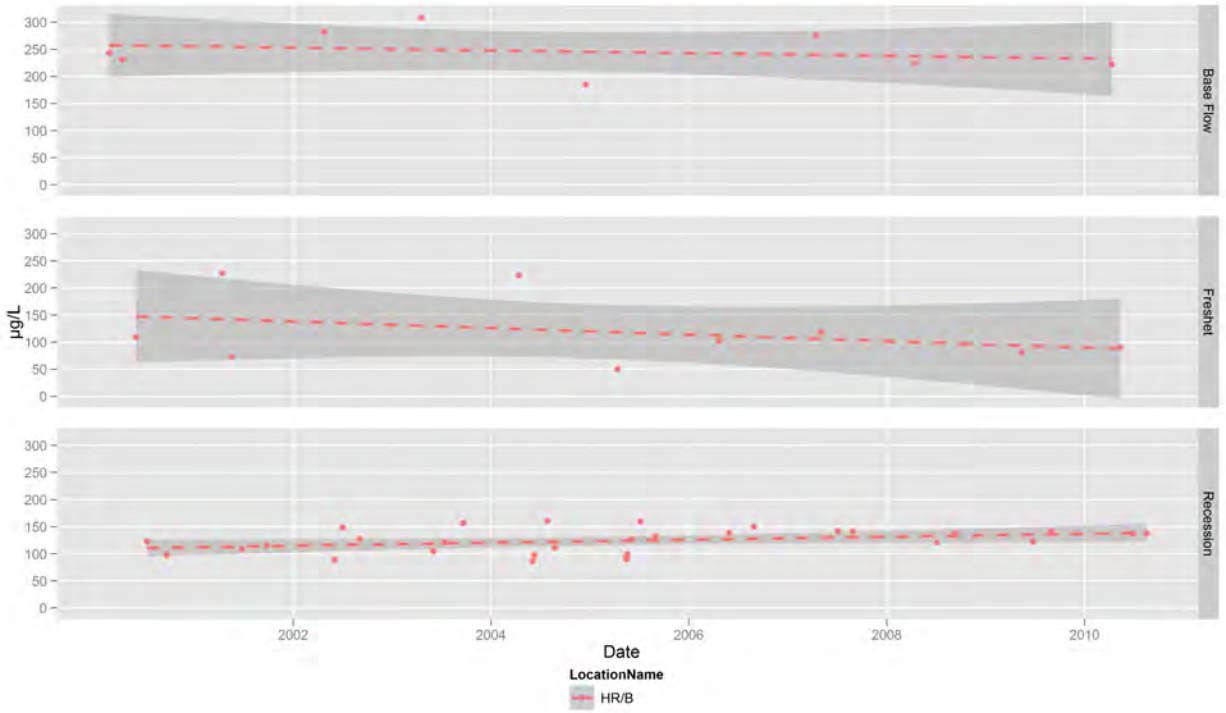
ENVIRON

Surface Water Time Series-2000-2010
Sodium Total

Figure
3.5.cc



Group	n	Detects	Slope	slope.p
2000-2010	47	47	-1.73	0.543



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	-2.48	0.5750
HR/B	Freshet	9	9	-6.03	0.3660
HR/B	Recession	30	30	2.76	0.0551

Ecological Screening Value

Significant Trend

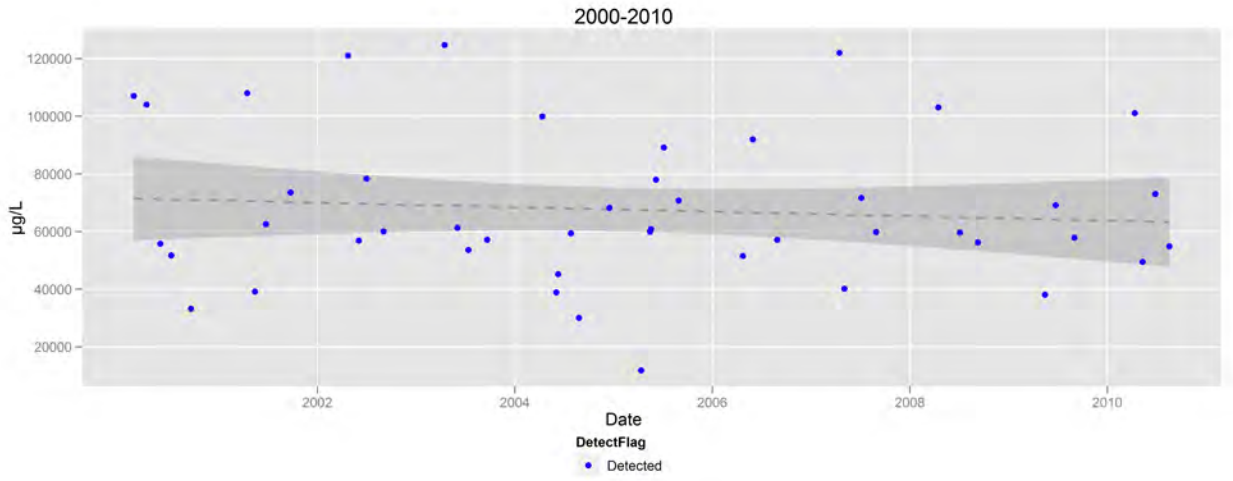
No Significant Trend

95% Confidence Interval

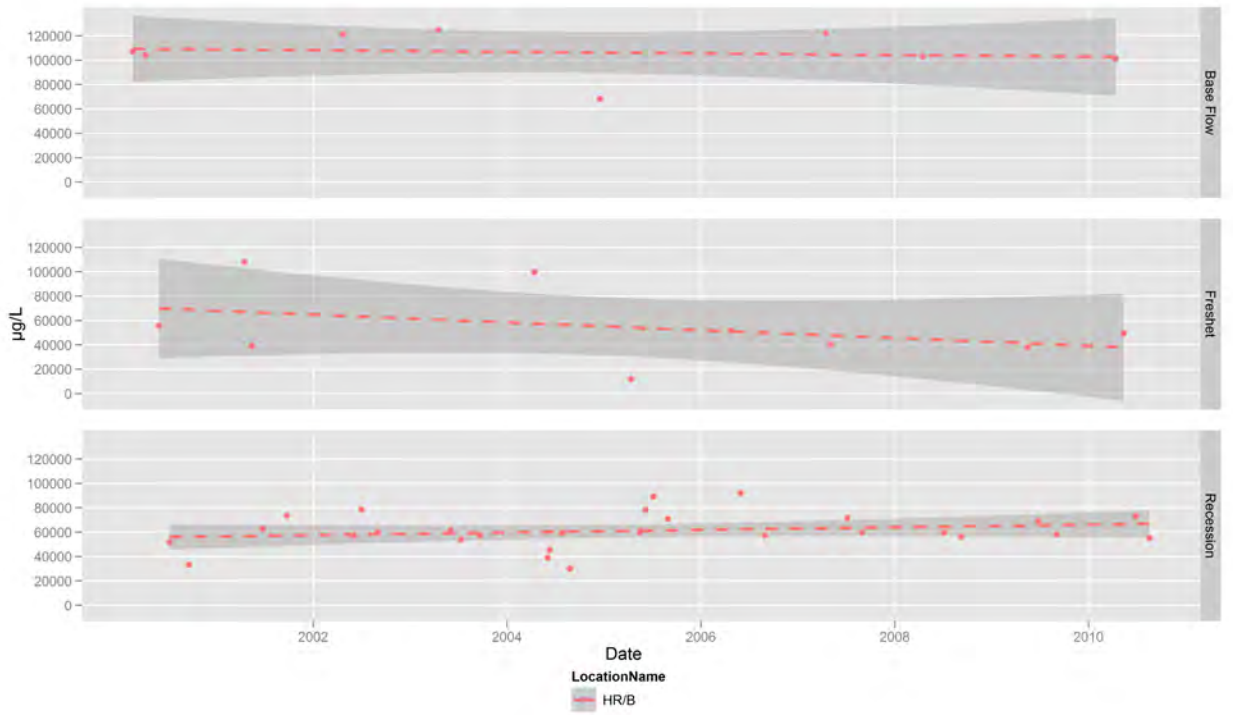
ENVIRON

Surface Water Time Series-2000-2010
Strontium Total

Figure
3.5.dd



Group	n	Detects	Slope	slope.p
2000-2010	47	47	-776	0.532



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	-654	0.749
HR/B	Freshet	9	9	-3190	0.320
HR/B	Recession	30	30	1070	0.247

Ecological Screening Value

Significant Trend

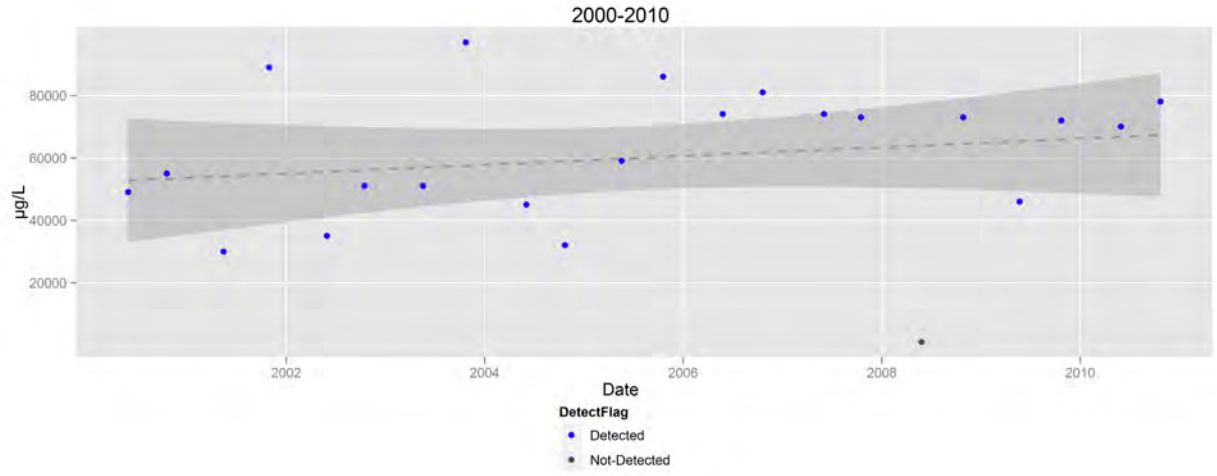
No Significant Trend

95% Confidence Interval

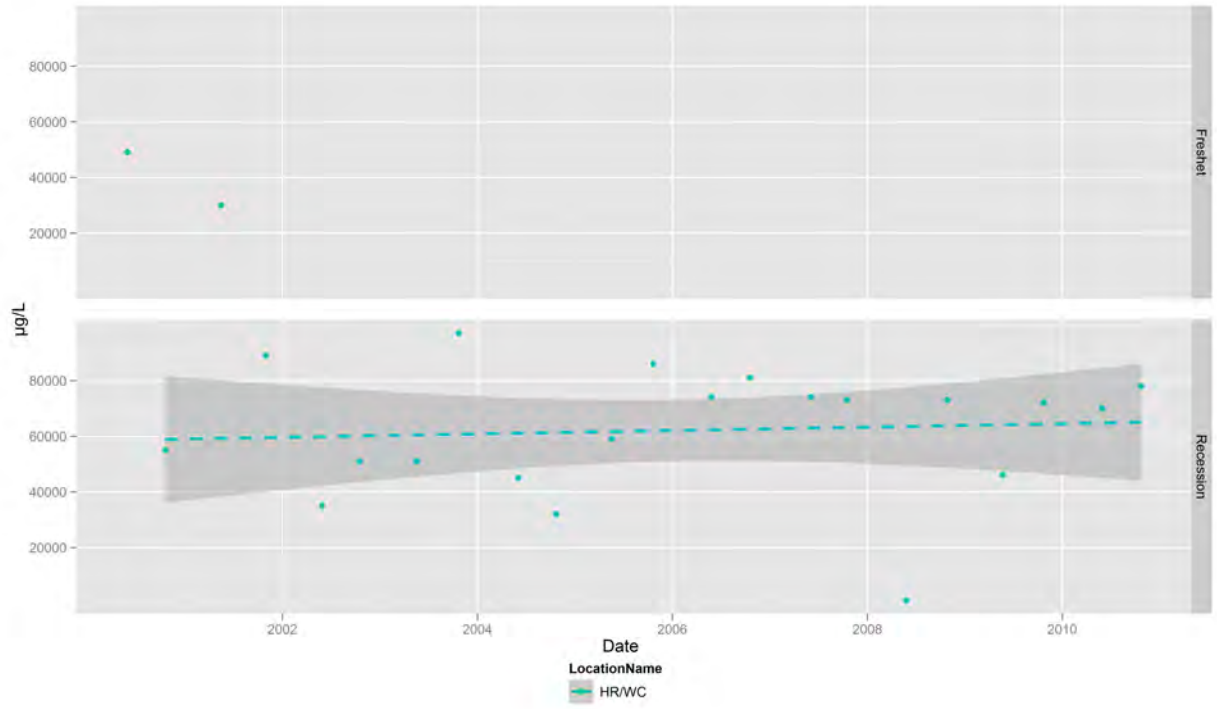
ENVIRON

Surface Water Time Series-2000-2010
Sulfate (as SO4) Dissolved

Figure
3.5.ee



Group	n	Detects	Slope	slope.p
2000-2010	22	21	1400	0.38



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	19	612	0.737

Ecological Screening Value

Significant Trend

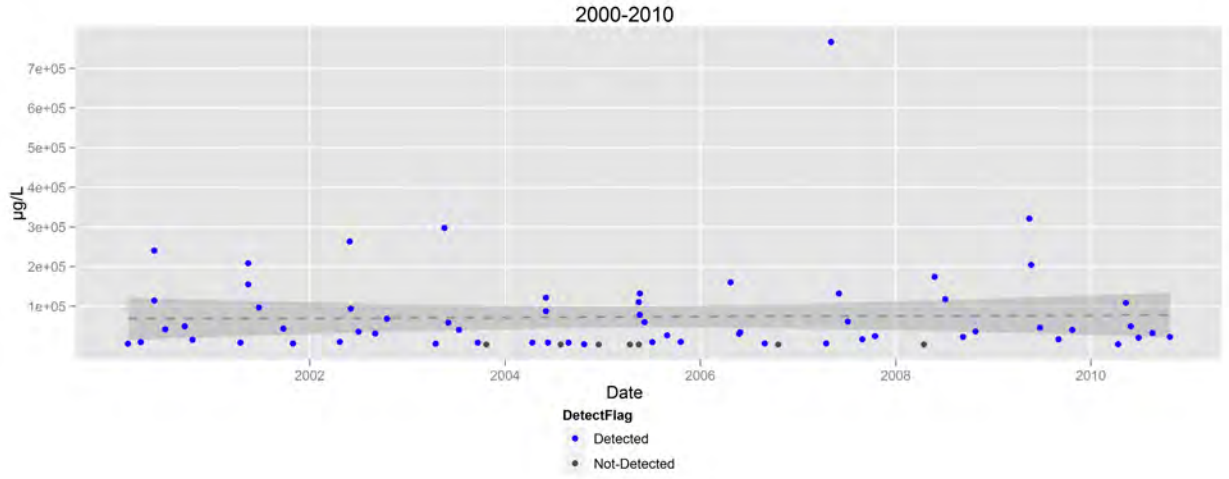
No Significant Trend

95% Confidence Interval

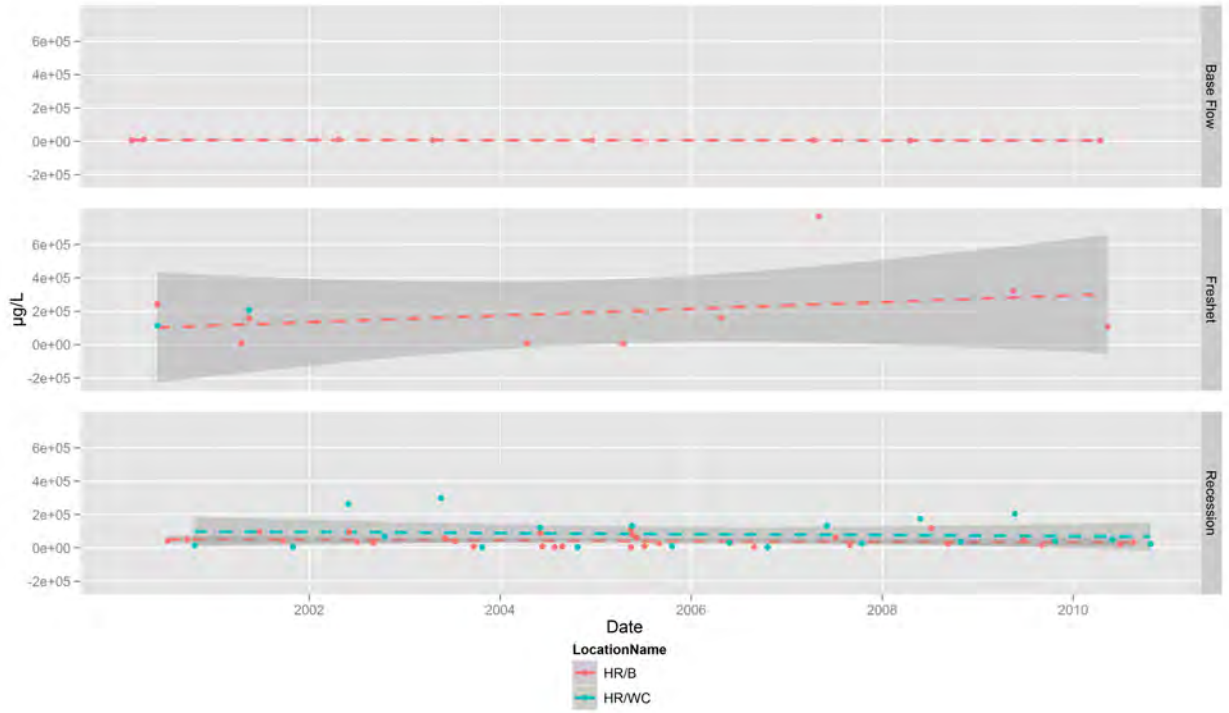
ENVIRON

Surface Water Time Series-2000-2010
Sulfate (as SO4) Total

Figure 3.5.ff



Group	n	Detects	Slope	slope.p
2000-2010	69	62	968	0.828



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	6	-418	0.126
HR/B	Freshet	9	8	20200	0.43
HR/B	Recession	30	28	-1900	0.39
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	18	-3030	0.675

Ecological Screening Value

Significant Trend

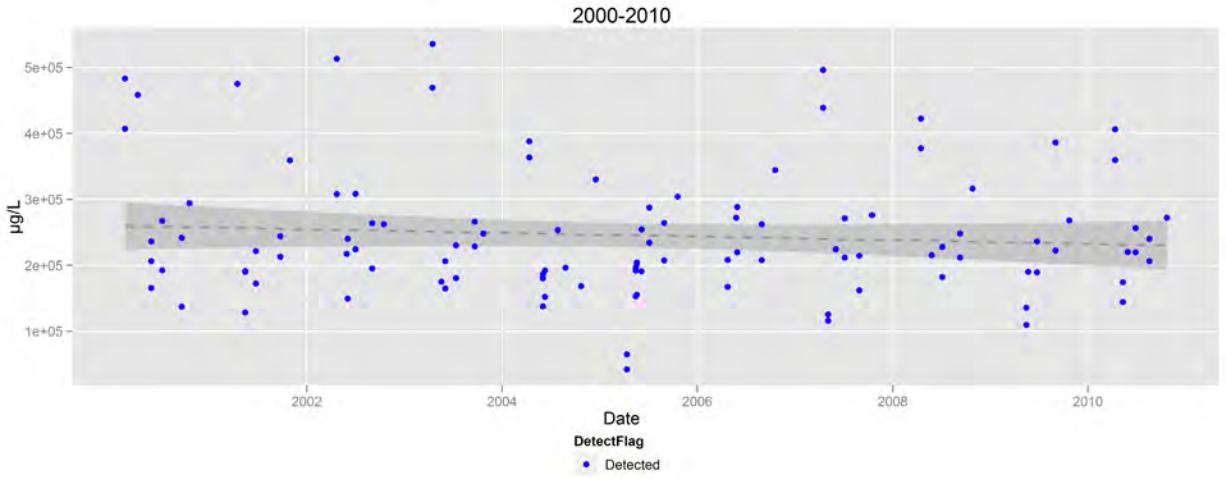
No Significant Trend

95% Confidence Interval

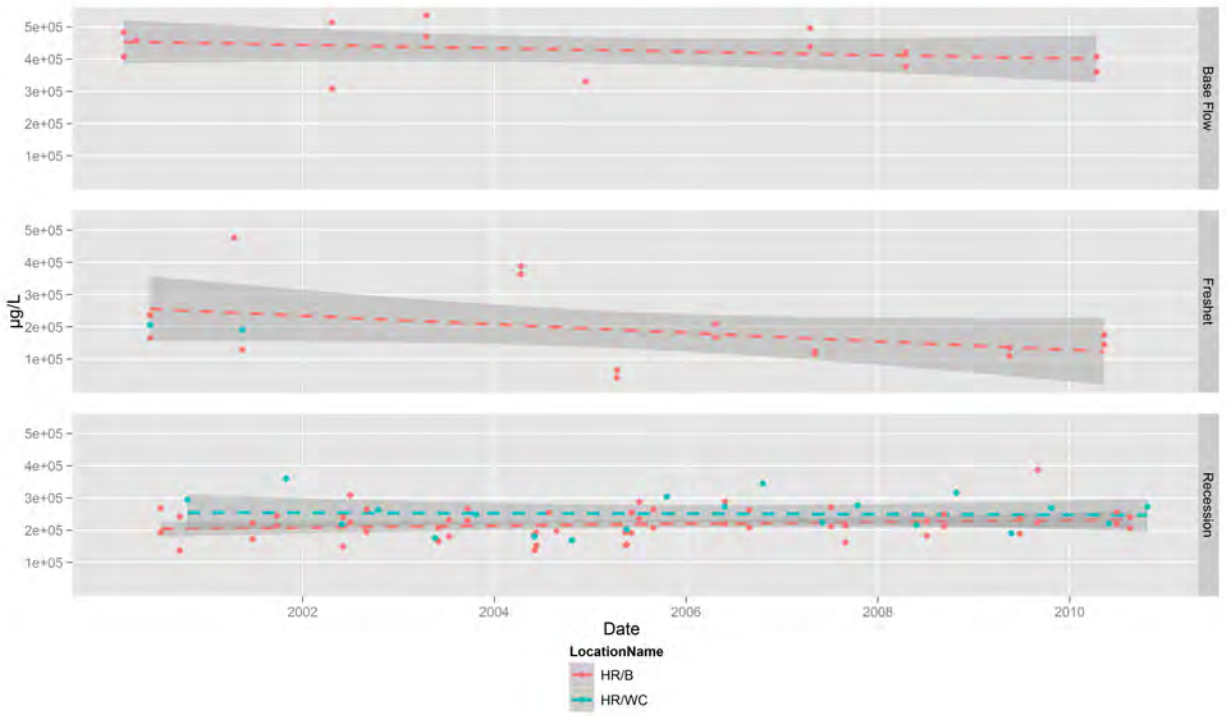
ENVIRON

Surface Water Time Series-2000-2010
Suspended Solids (Residue, Non-Filterable)

Figure 3.5.gg



Group	n	Detects	Slope	slope.p
2000-2010	111	111	-2760	0.355



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	14	14	-5320	0.322
HR/B	Freshet	17	17	-13200	0.118
HR/B	Recession	58	58	2900	0.175
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	20	-823	0.853

Ecological Screening Value

Significant Trend

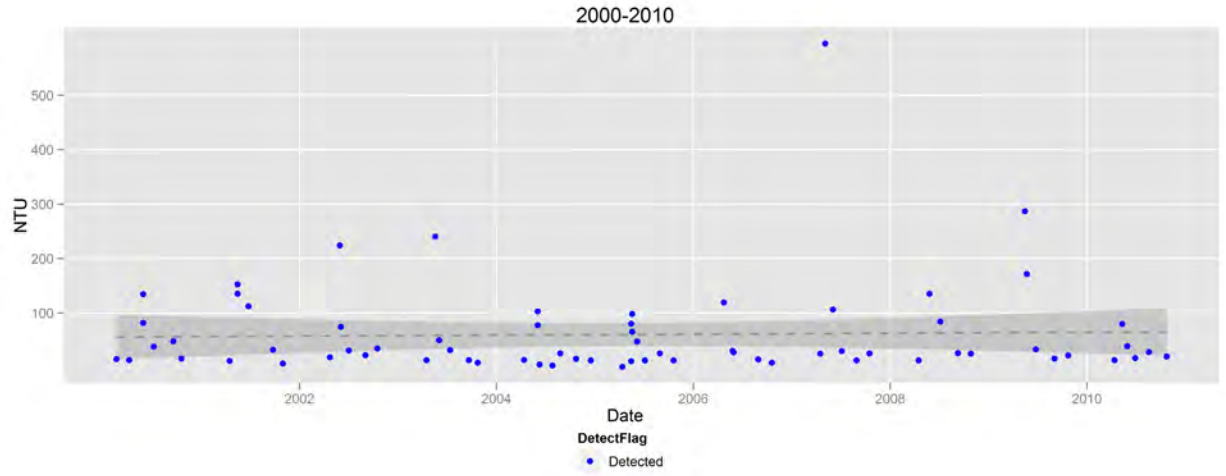
No Significant Trend

95% Confidence Interval

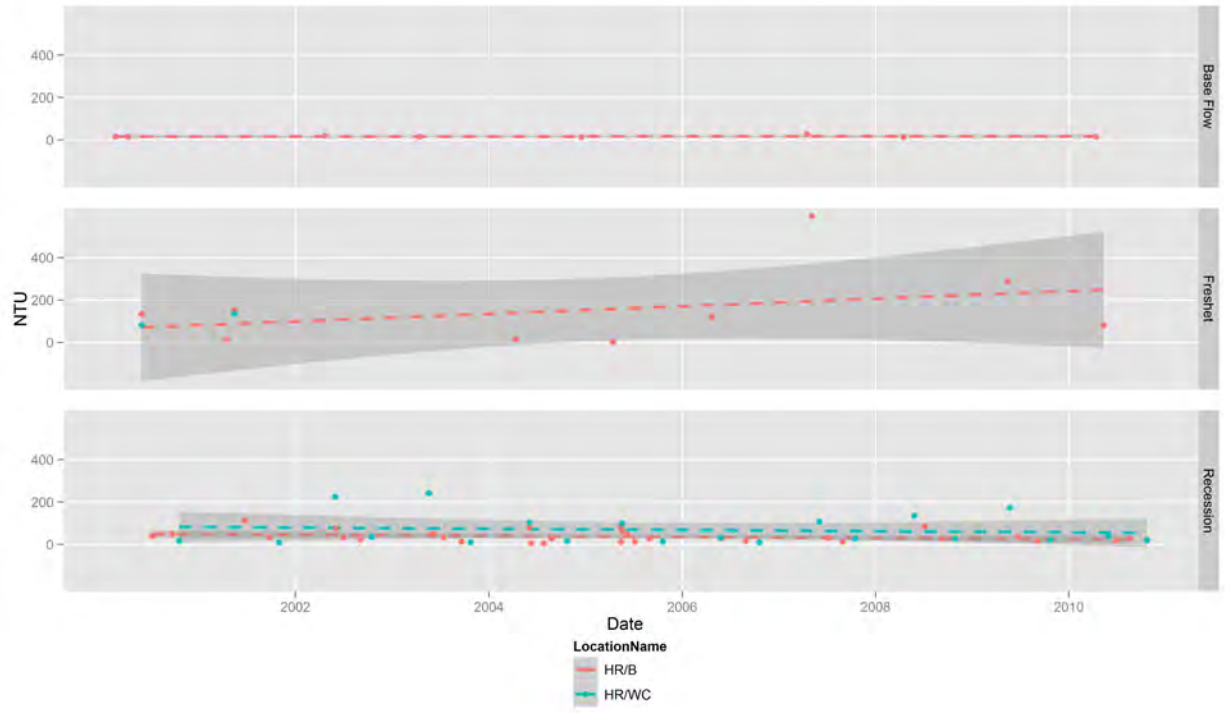
ENVIRON

Surface Water Time Series-2000-2010
Total Dissolved Solids (Residue Filterable)

Figure 3.5.hh



Group	n	Detects	Slope	slope.p
2000-2010	69	69	0.875	0.8



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	0.106	0.829
HR/B	Freshet	9	9	17.9	0.367
HR/B	Recession	30	30	-2.54	0.15
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	20	-2.79	0.633

Ecological Screening Value

Significant Trend

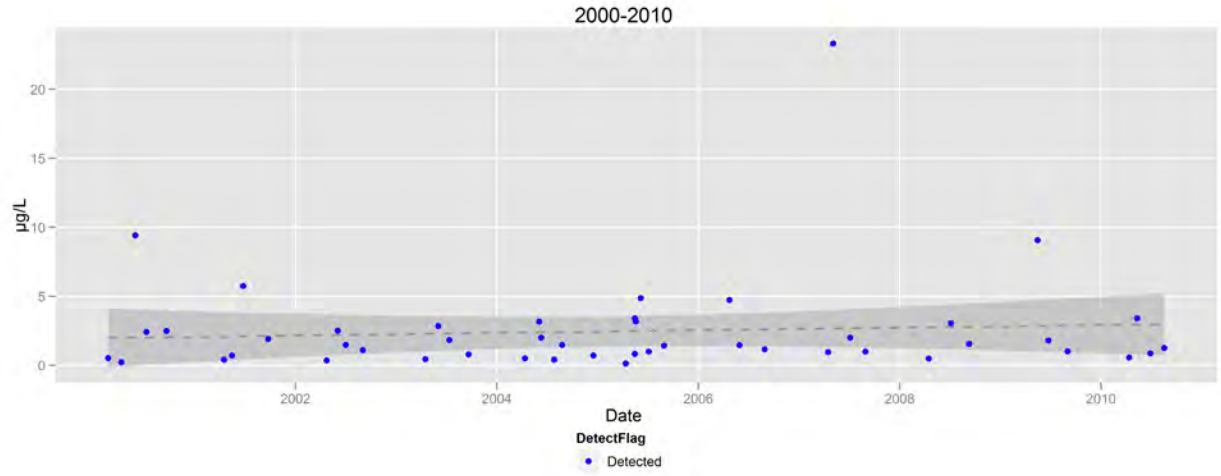
No Significant Trend

95% Confidence Interval

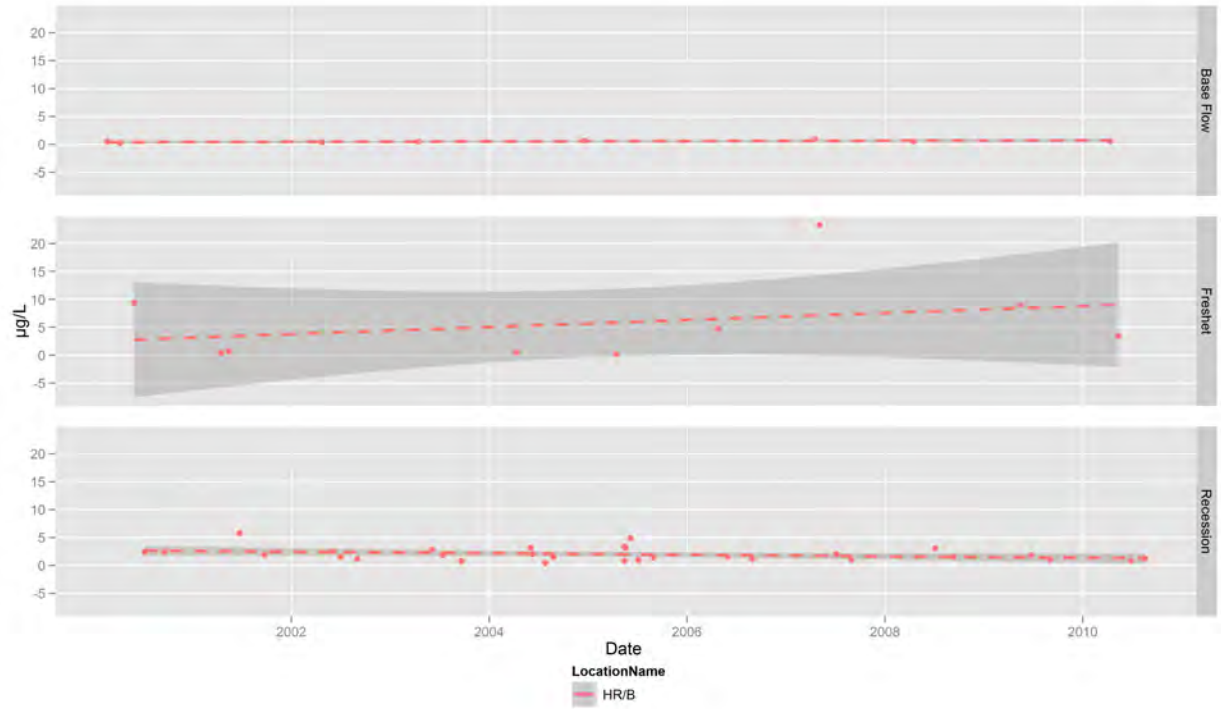
ENVIRON

Surface Water Time Series-2000-2010
Turbidity

Figure
3.5.ii



Group	n	Detects	Slope	slope.p
2000-2010	47	47	0.0945	0.598



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	0.0317	0.1710
HR/B	Freshet	9	9	0.6300	0.4310
HR/B	Recession	30	30	-0.1370	0.0839

Ecological Screening Value

Significant Trend

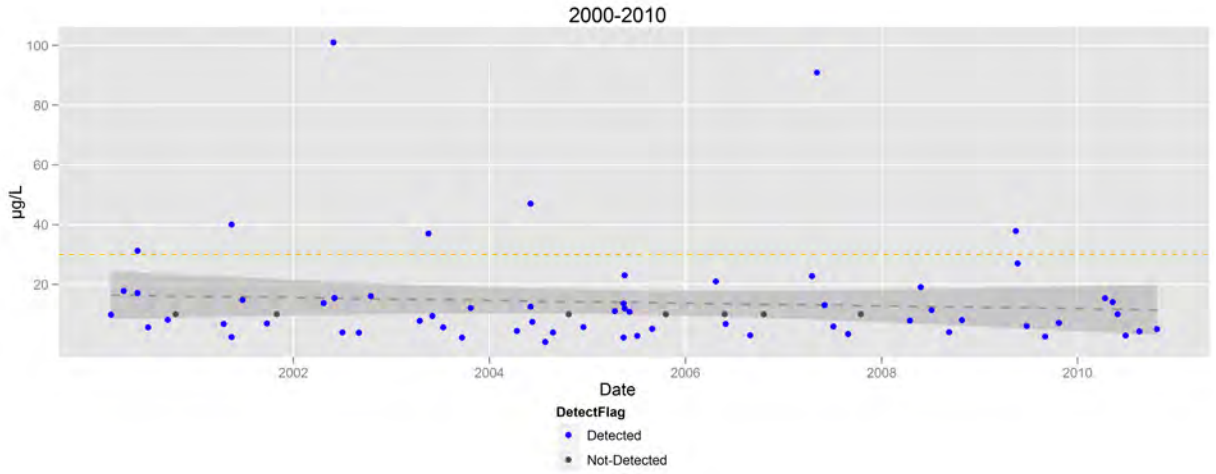
No Significant Trend

95% Confidence Interval

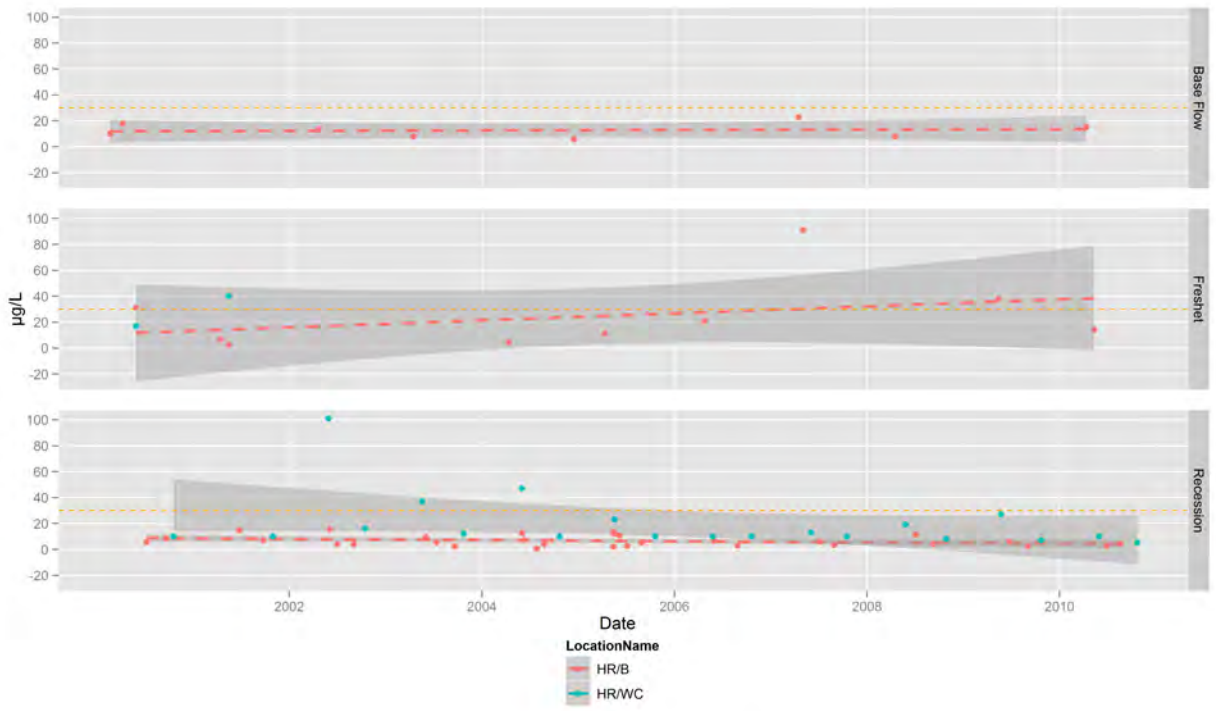
ENVIRON

Surface Water Time Series-2000-2010
Vanadium Total

Figure
3.5.jj



Group	n	Detects	Slope	slope.p
2000-2010	69	62	-0.46	0.494



LocationName	SubSeason	n	Detects	Slope	slope.p
HR/B	Base Flow	8	8	0.163	0.805
HR/B	Freshet	9	9	2.7	0.356
HR/B	Recession	30	30	-0.435	0.108
HR/WC	Freshet	2	2	NC	NC
HR/WC	Recession	20	13	NC	NC

Ecological Screening Value

Significant Trend

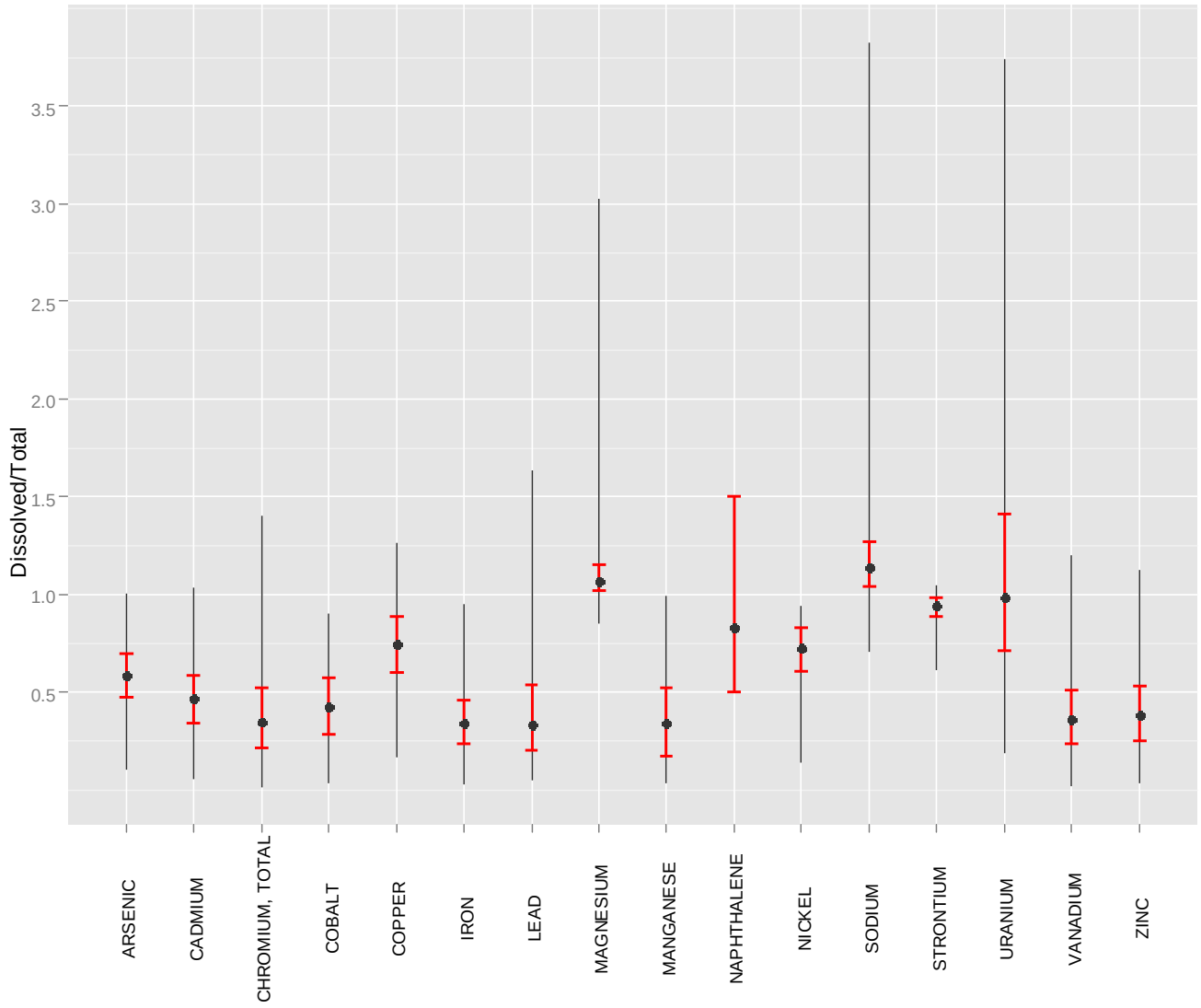
No Significant Trend

95% Confidence Interval

ENVIRON

Surface Water Time Series-2000-2010
Zinc Total

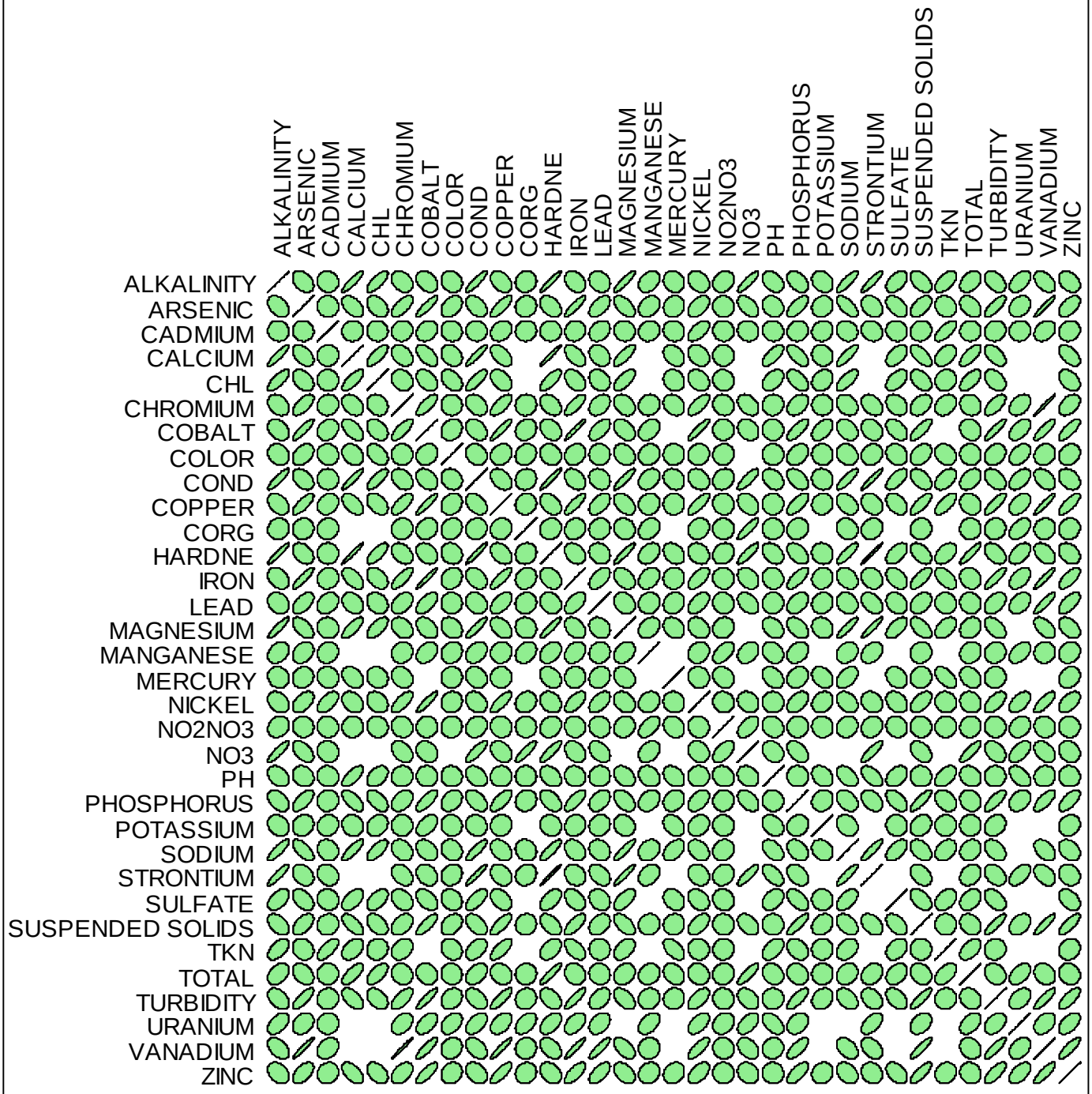
Figure
3.5.kk



ENVIRON

Dissolved/Total for Surface Water Samples

Figure 3.6



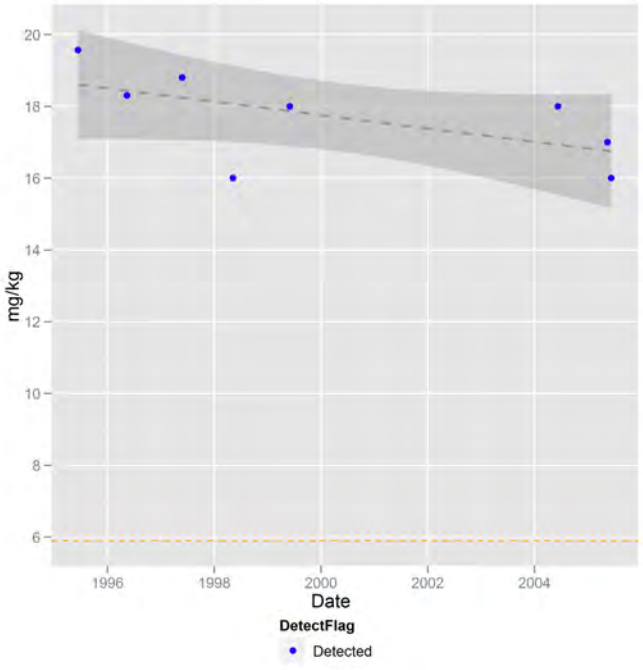
CHL: Chloride (as Cl)
COND: Conductivity
CORG: Carbon Organic
HARDNE: Hardness (as CaCO3)

NO2NO3: Nitrogen, Nitrate-Nitrite
NO3: Nitrogen, Nitrite
TKN: Total Kjeldahl Nitrogen
TOTAL: Total Dissolved Solids

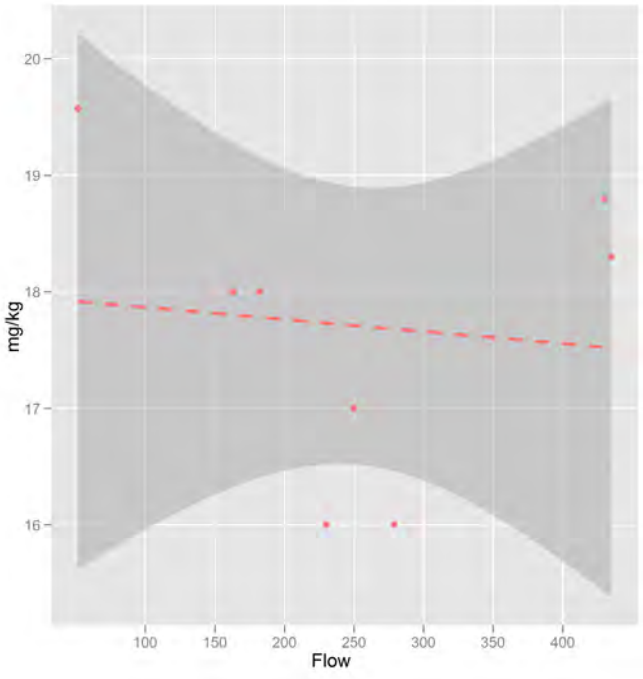
ENVIRON

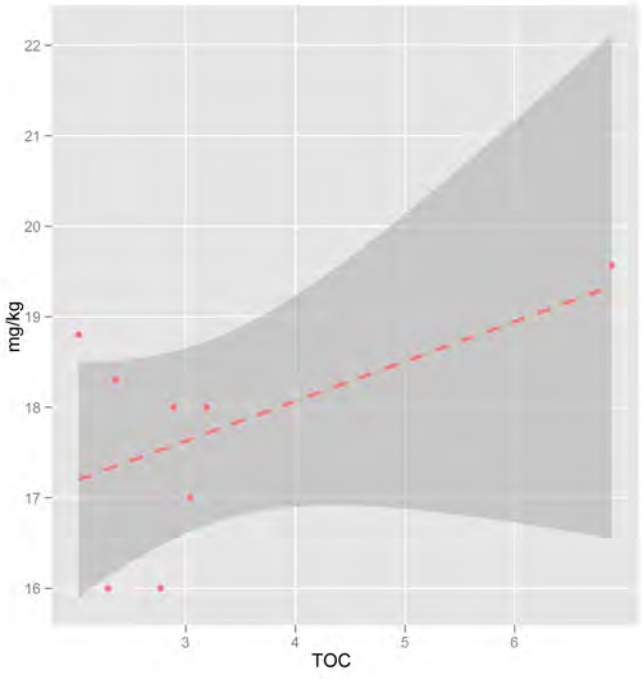
Correlation Coefficients for Surface Water, Total

Figure 3.7



Group	n	Detects	Slope	Slope.p
Time	8	8	-0.18700	0.112
Flow	8	8	-0.00104	0.803
TOC	8	8	0.43900	0.176





Ecological Screening Value

Significant Trend

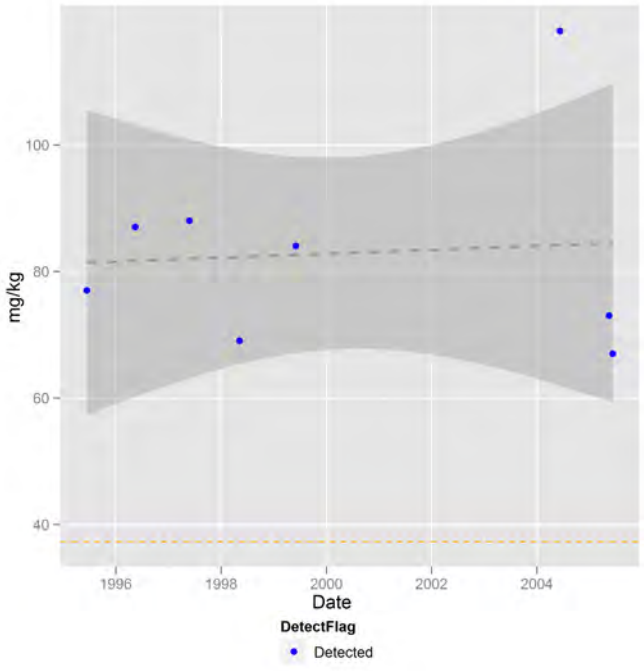
95% Confidence Interval

No Significant Trend

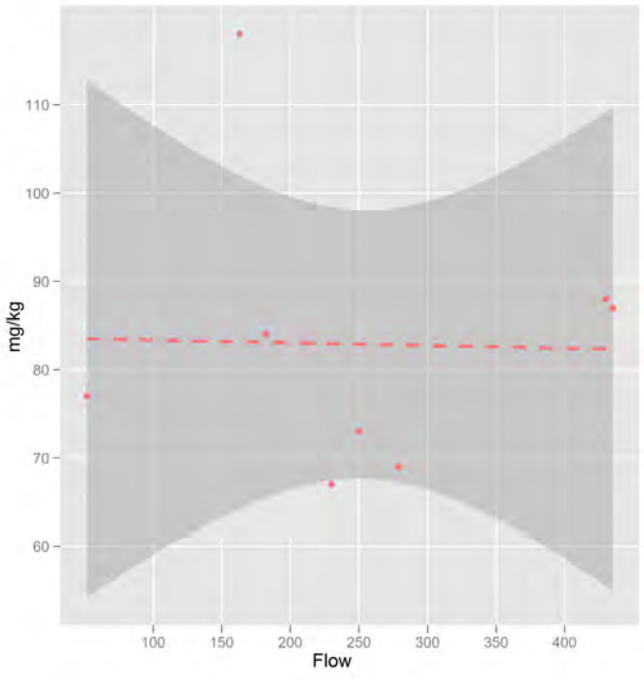
ENVIRON

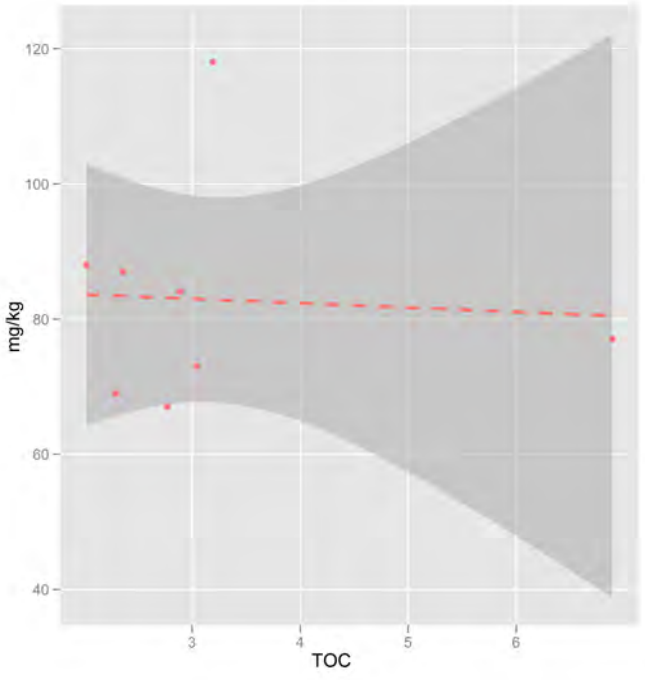
Trends: Suspended Sediment Arsenic

Figure 3.8.a



Group	n	Detects	Slope	Slope.p
Time	8	8	0.30700	0.853
Flow	8	8	-0.00307	0.954
TOC	8	8	-0.64500	0.885





Ecological Screening Value

95% Confidence Interval

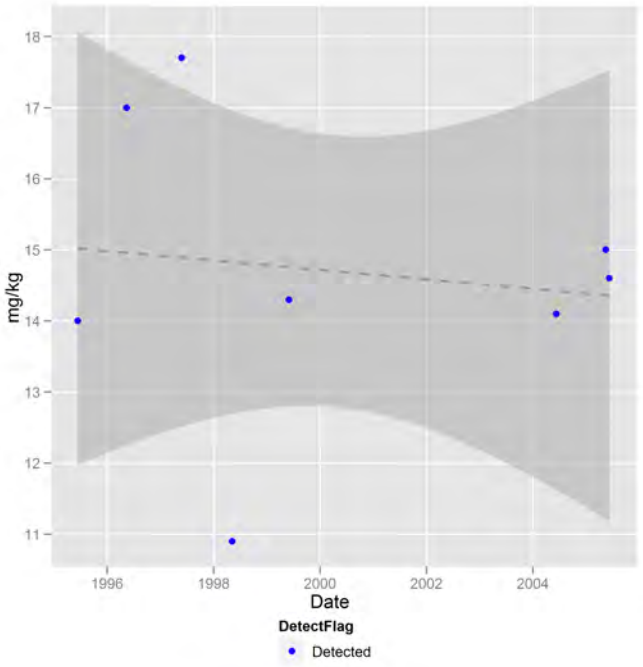
Significant Trend

No Significant Trend

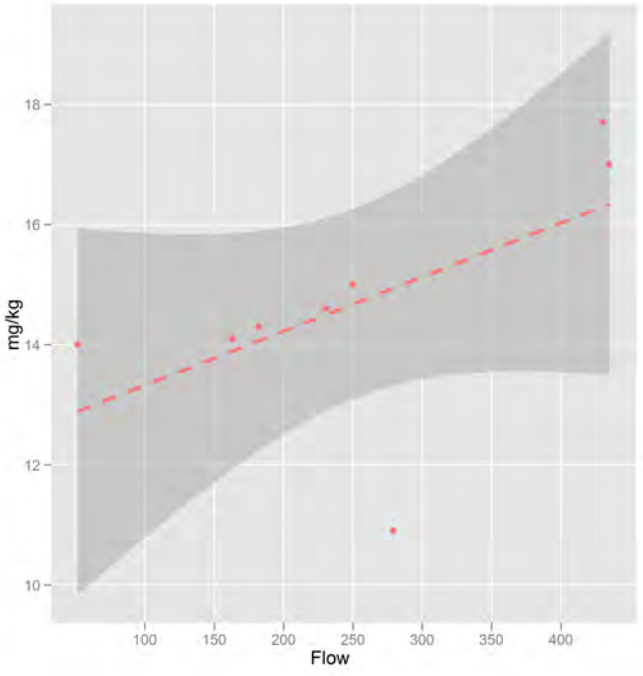
ENVIRON

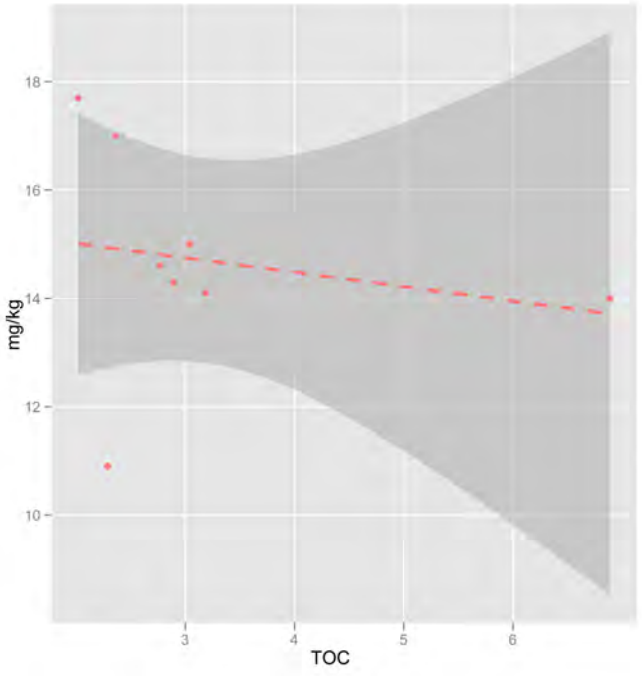
Trends: Suspended Sediment Chromium

Figure 3.8.b



Group	n	Detects	Slope	Slope.p
Time	8	8	-0.06650	0.752
Flow	8	8	0.00901	0.140
TOC	8	8	-0.26500	0.636





Ecological Screening Value

95% Confidence Interval

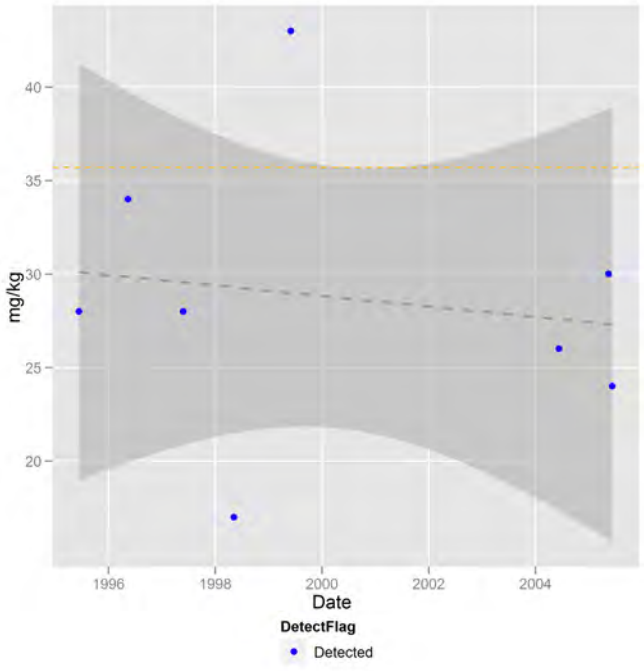
Significant Trend

No Significant Trend

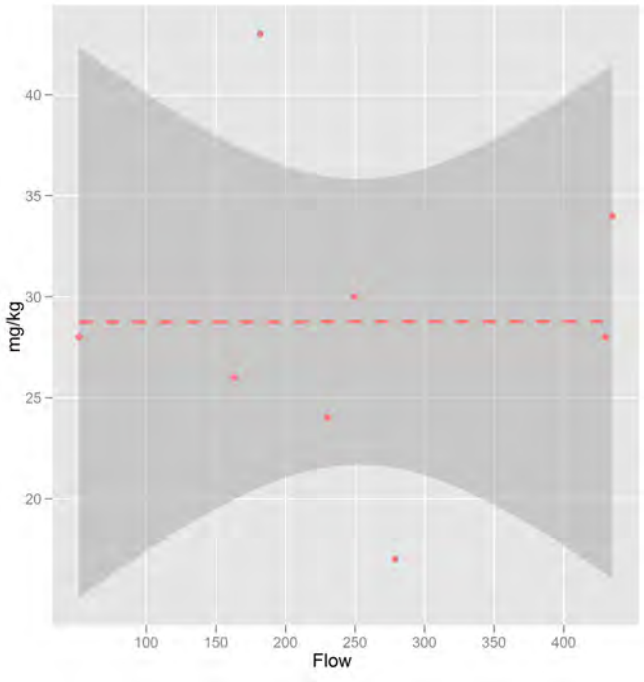
ENVIRON

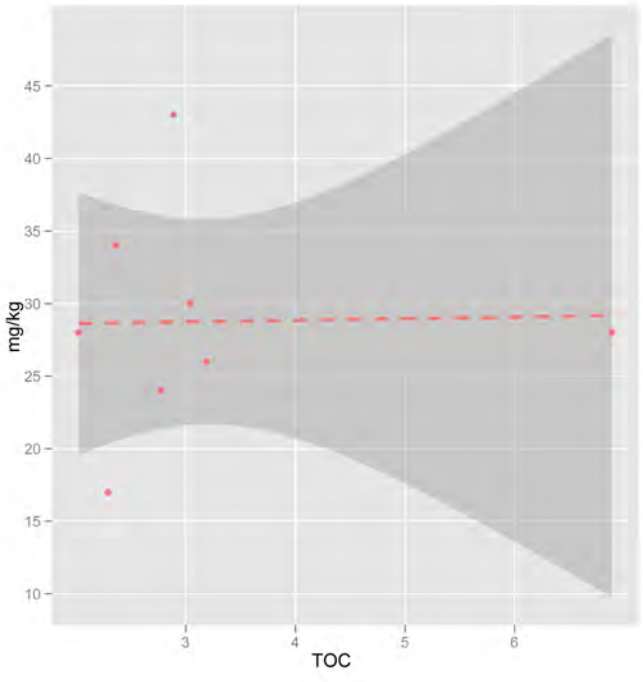
Trends: Suspended Sediment
Cobalt

Figure
3.8.c



Group	n	Detects	Slope	Slope.p
Time	8	8	-0.28000	0.716
Flow	8	8	0.00008	0.997
TOC	8	8	0.11000	0.958





Ecological Screening Value

Significant Trend

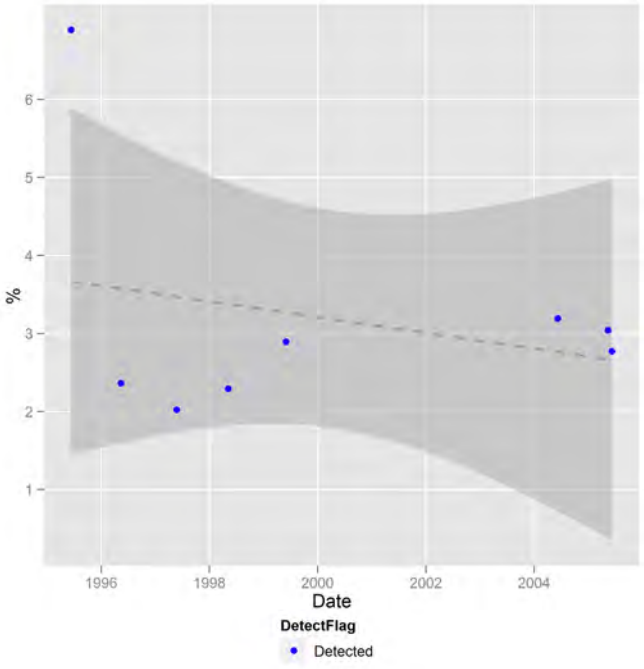
95% Confidence Interval

No Significant Trend

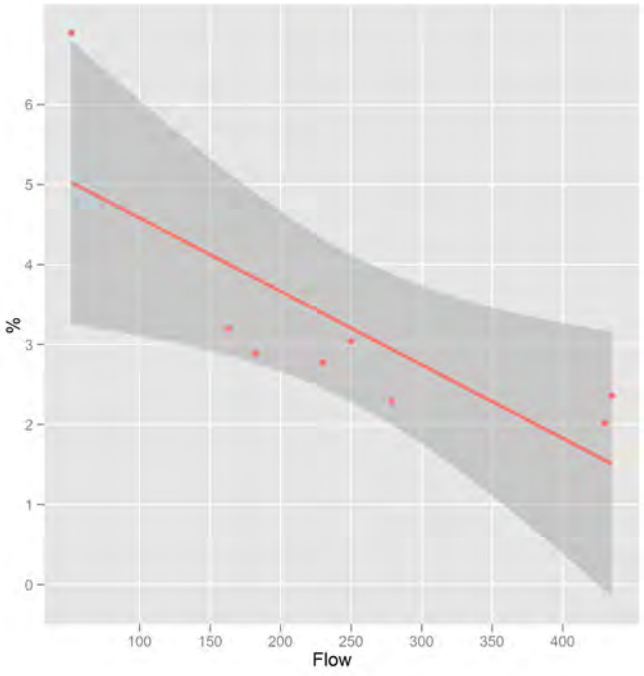
ENVIRON

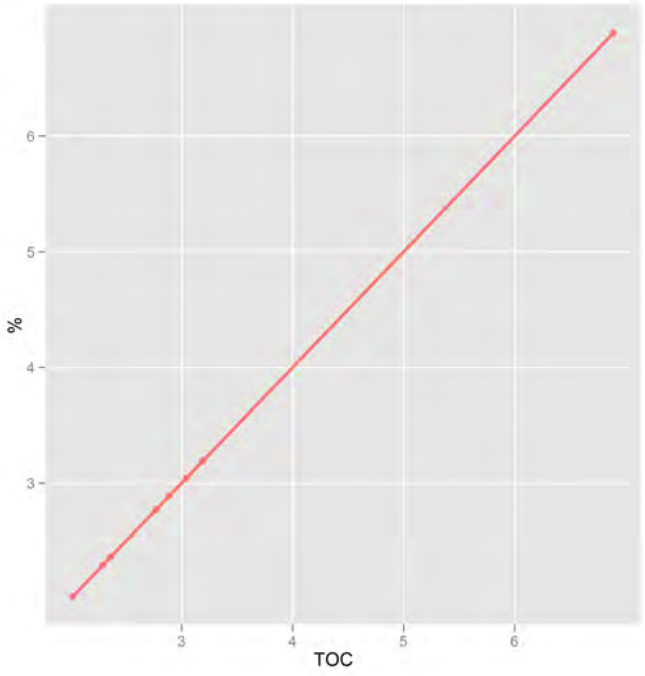
Trends: Suspended Sediment
Copper

Figure
3.8.d



Group	n	Detects	Slope	Slope.p
Time	8	8	-0.10100	5.18e-01
Flow	8	8	-0.00918	2.47e-02
TOC	8	8	1.00000	2.48e-95





Ecological Screening Value

95% Confidence Interval

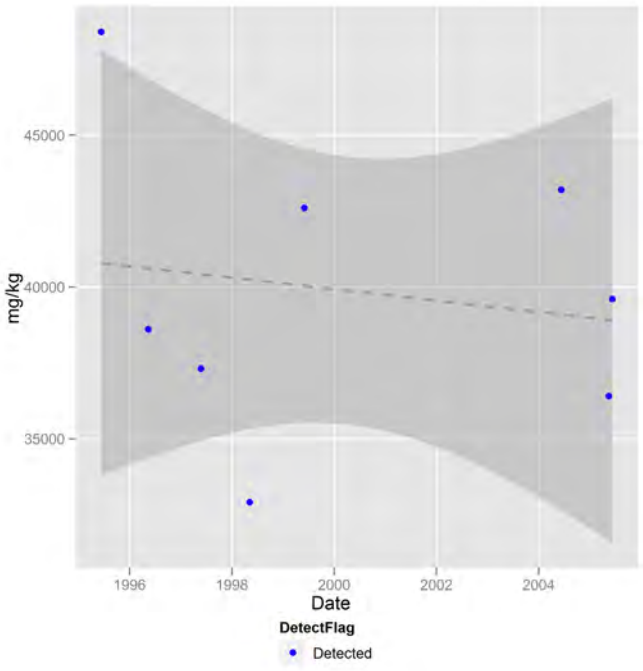
Significant Trend

No Significant Trend

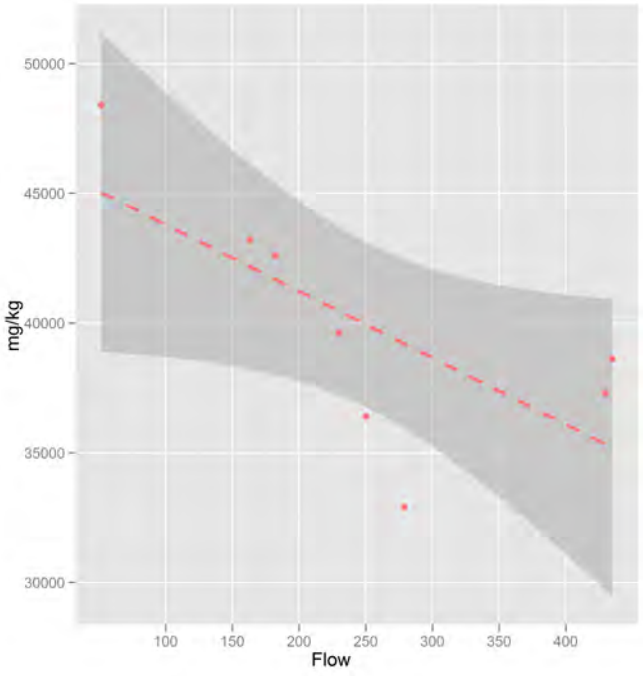
ENVIRON

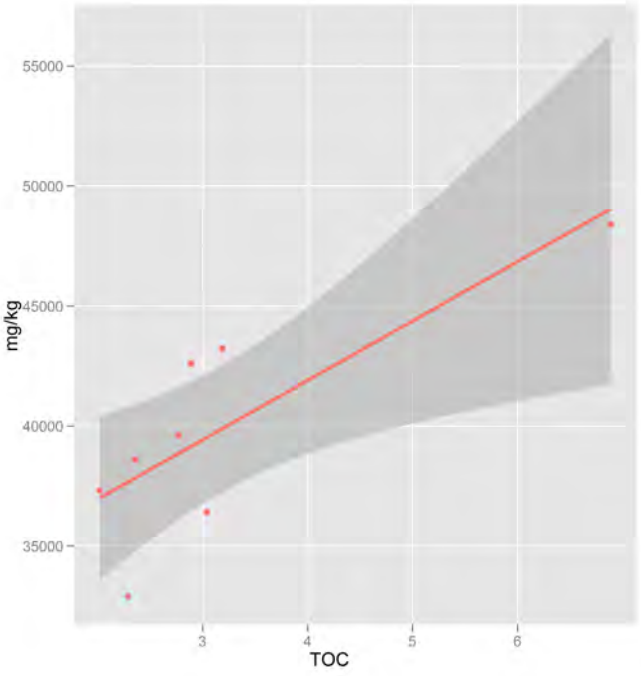
Trends: Suspended Sediment
Carbon Organic

Figure
3.8.e



Group	n	Detects	Slope	Slope.p
Time	8	8	-189.0	0.6970
Flow	8	8	-25.7	0.0531
TOC	8	8	2480.0	0.0164





Ecological Screening Value

Significant Trend

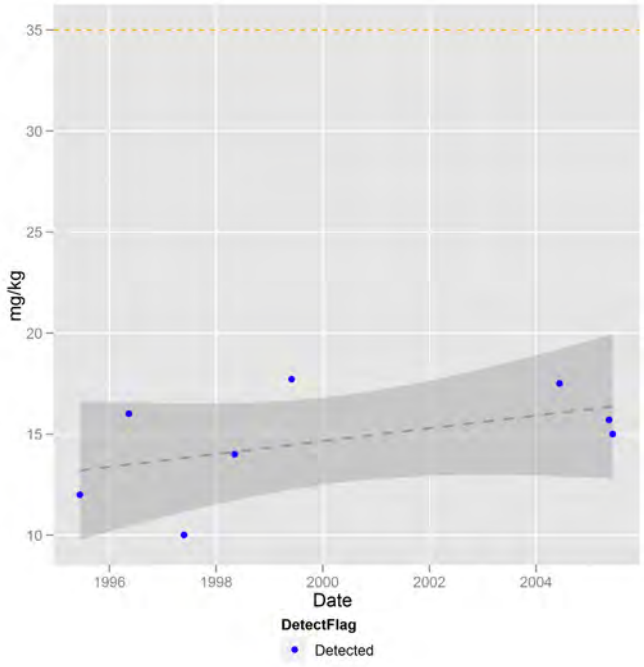
95% Confidence Interval

No Significant Trend

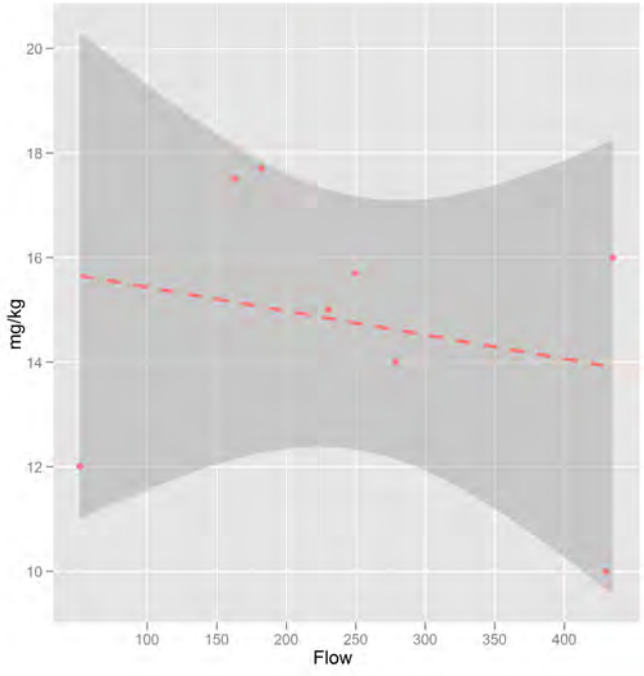
ENVIRON

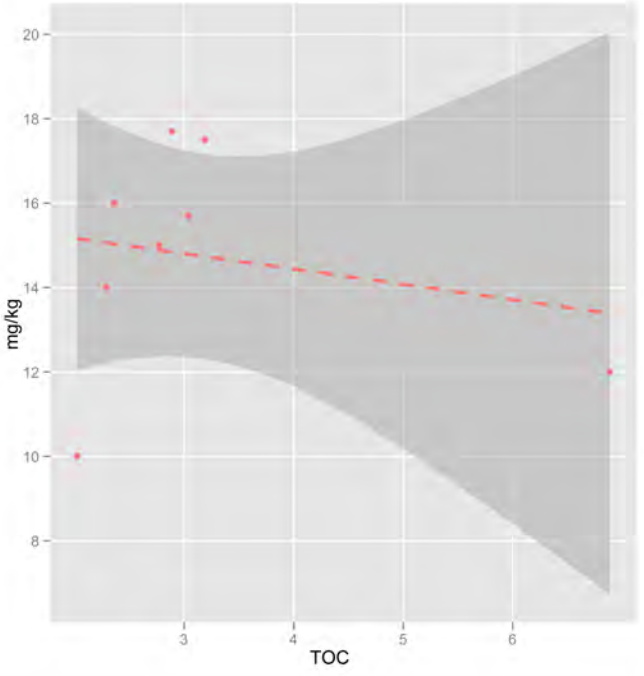
Trends: Suspended Sediment
Iron

Figure
3.8.f



Group	n	Detects	Slope	Slope.p
Time	8	8	0.31800	0.209
Flow	8	8	-0.00456	0.594
TOC	8	8	-0.36300	0.615





Ecological Screening Value

95% Confidence Interval

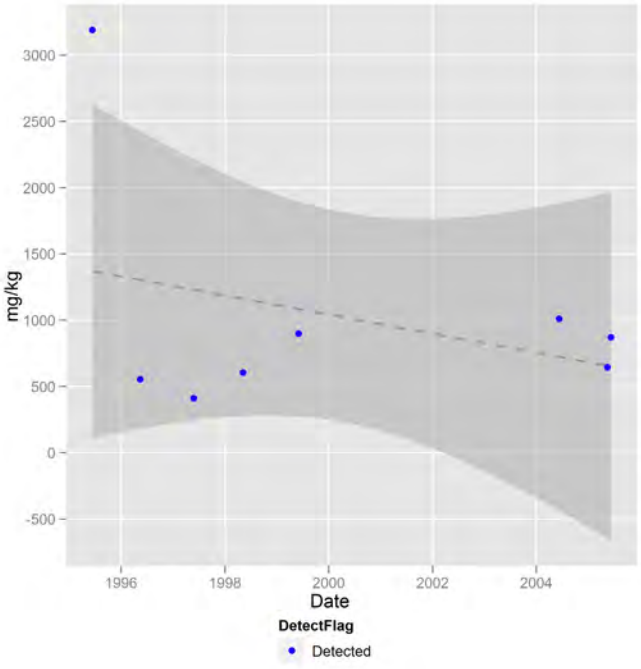
Significant Trend

No Significant Trend

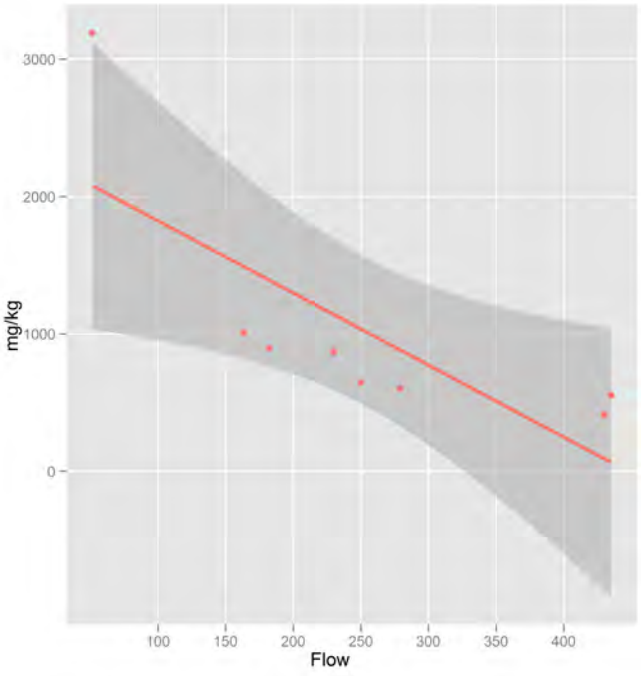
ENVIRON

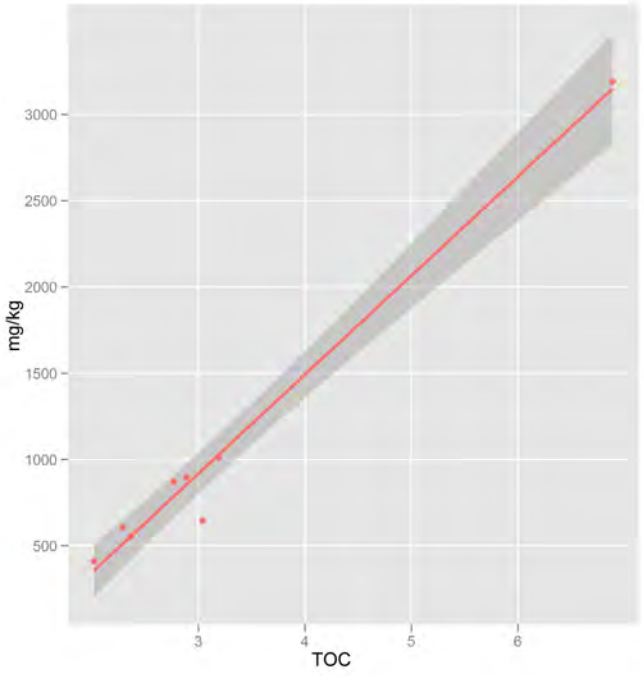
Trends: Suspended Sediment
Lead

Figure
3.8.g



Group	n	Detects	Slope	Slope.p
Time	8	8	-71.90	4.21e-01
Flow	8	8	-5.25	2.76e-02
TOC	8	8	574.00	2.36e-06





Ecological Screening Value

95% Confidence Interval

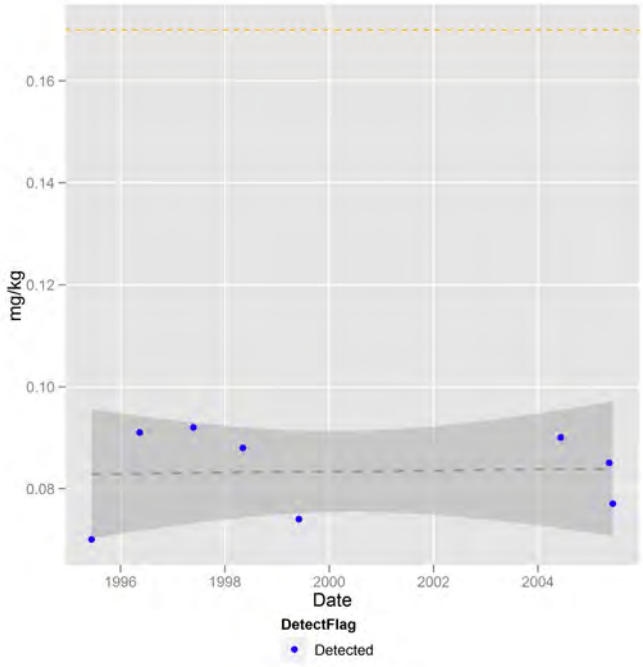
Significant Trend

No Significant Trend

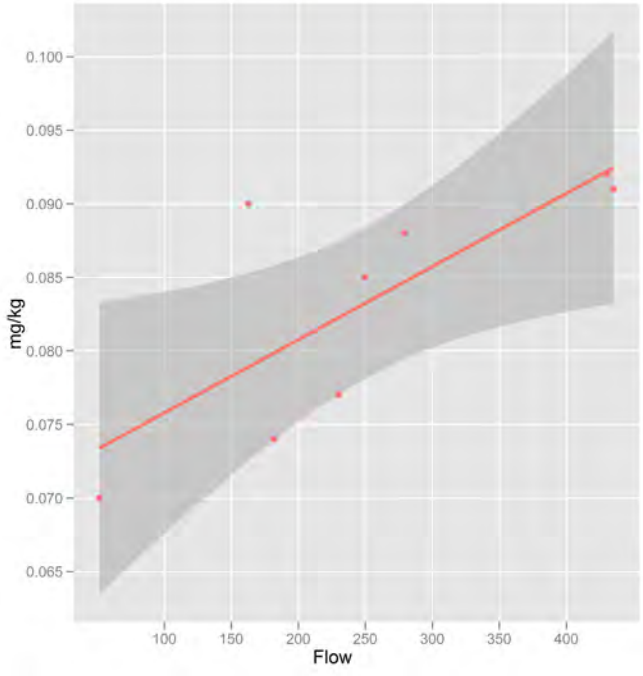
ENVIRON

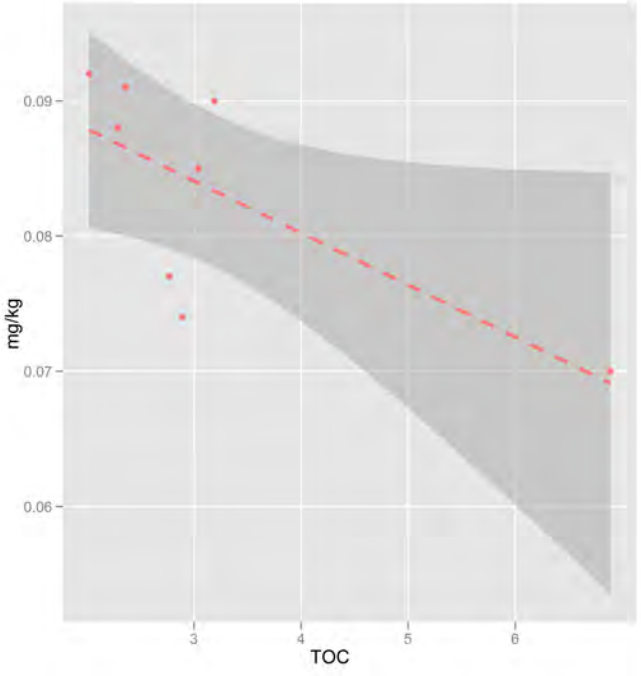
Trends: Suspended Sediment Manganese

Figure 3.8.h



Group	n	Detects	Slope	Slope.p
Time	8	8	9.92e-05	0.9090
Flow	8	8	4.98e-05	0.0277
TOC	8	8	-3.85e-03	0.0528





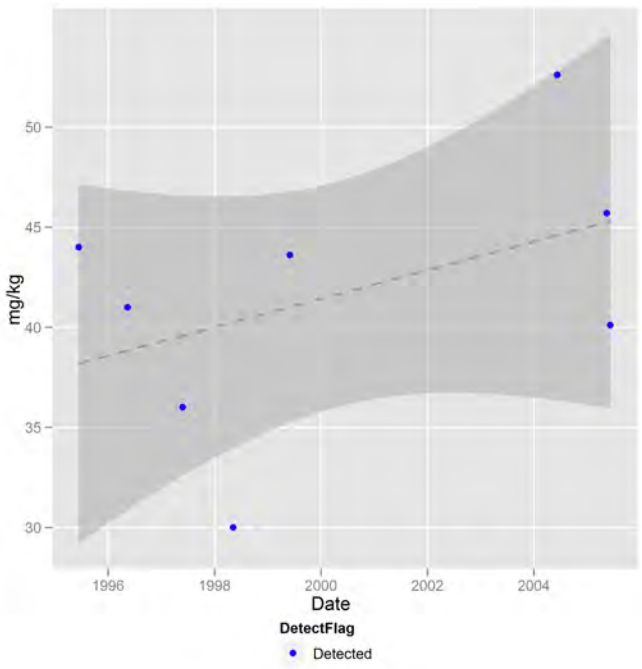
Ecological Screening Value

Significant Trend

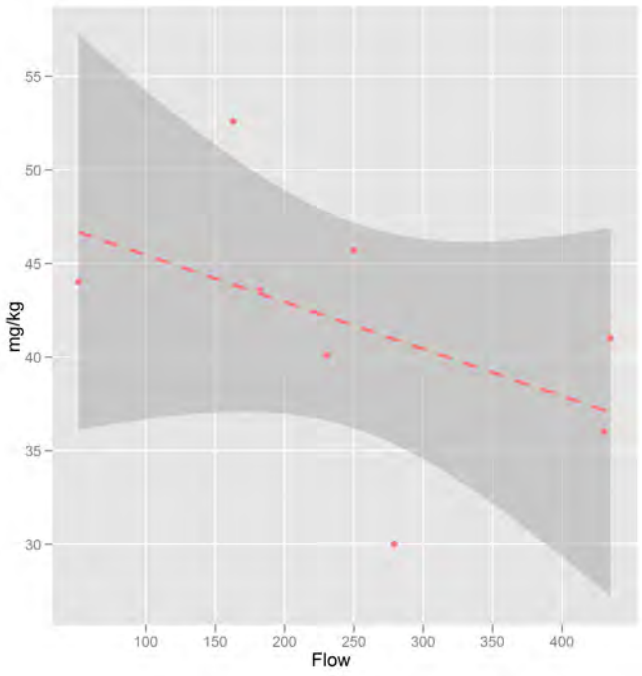
95% Confidence Interval

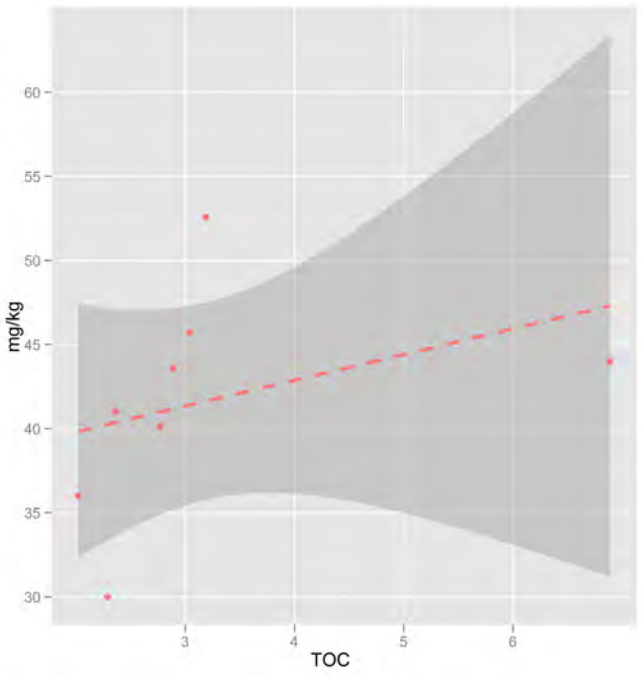
No Significant Trend

ENVIRON	Trends: Suspended Sediment Mercury	Figure 3.8.i



Group	n	Detects	Slope	Slope.p
Time	8	8	0.7130	0.273
Flow	8	8	-0.0251	0.220
TOC	8	8	1.5300	0.391





Ecological Screening Value

95% Confidence Interval

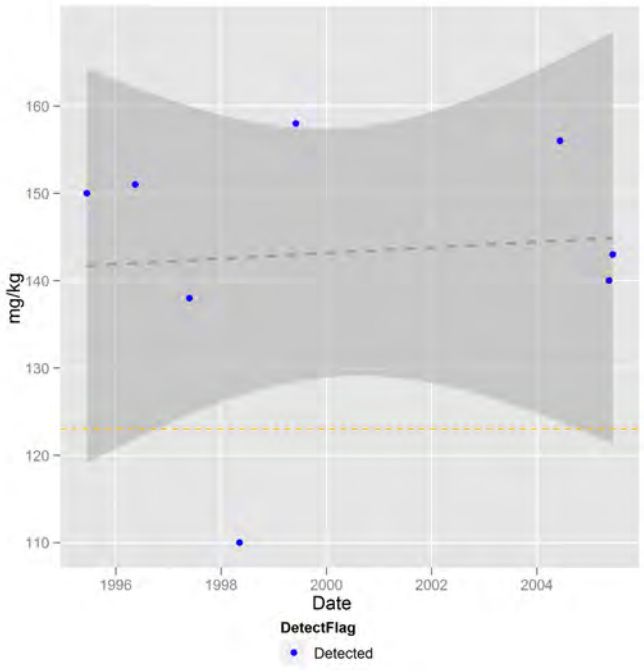
Significant Trend

No Significant Trend

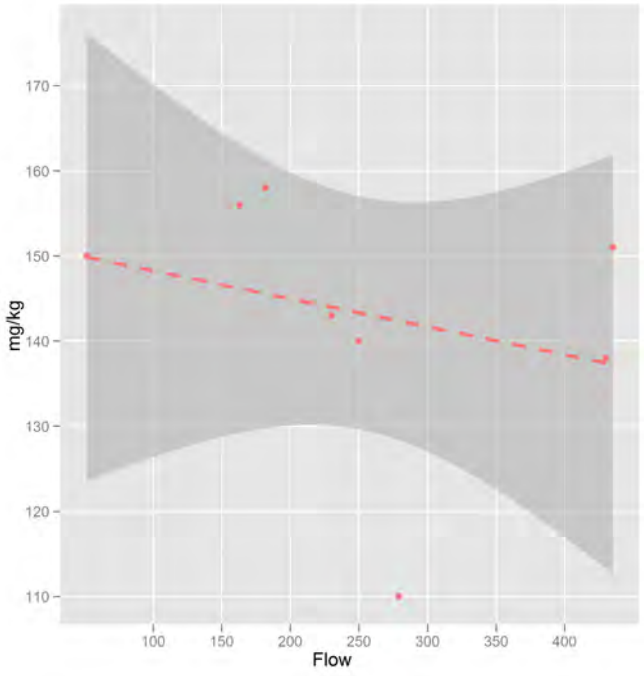
ENVIRON

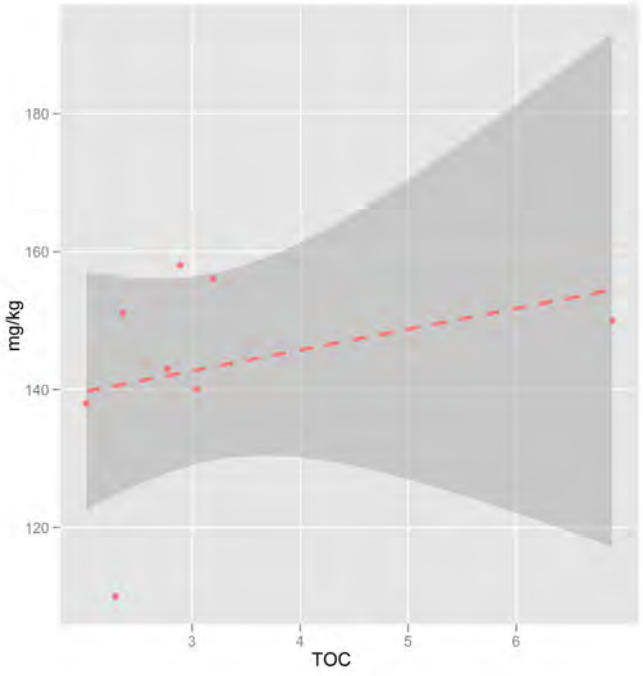
Trends: Suspended Sediment
Nickel

Figure
3.8.j



Group	n	Detects	Slope	Slope.p
Time	8	8	0.3210	0.837
Flow	8	8	-0.0329	0.500
TOC	8	8	3.0100	0.460





Ecological Screening Value

Significant Trend

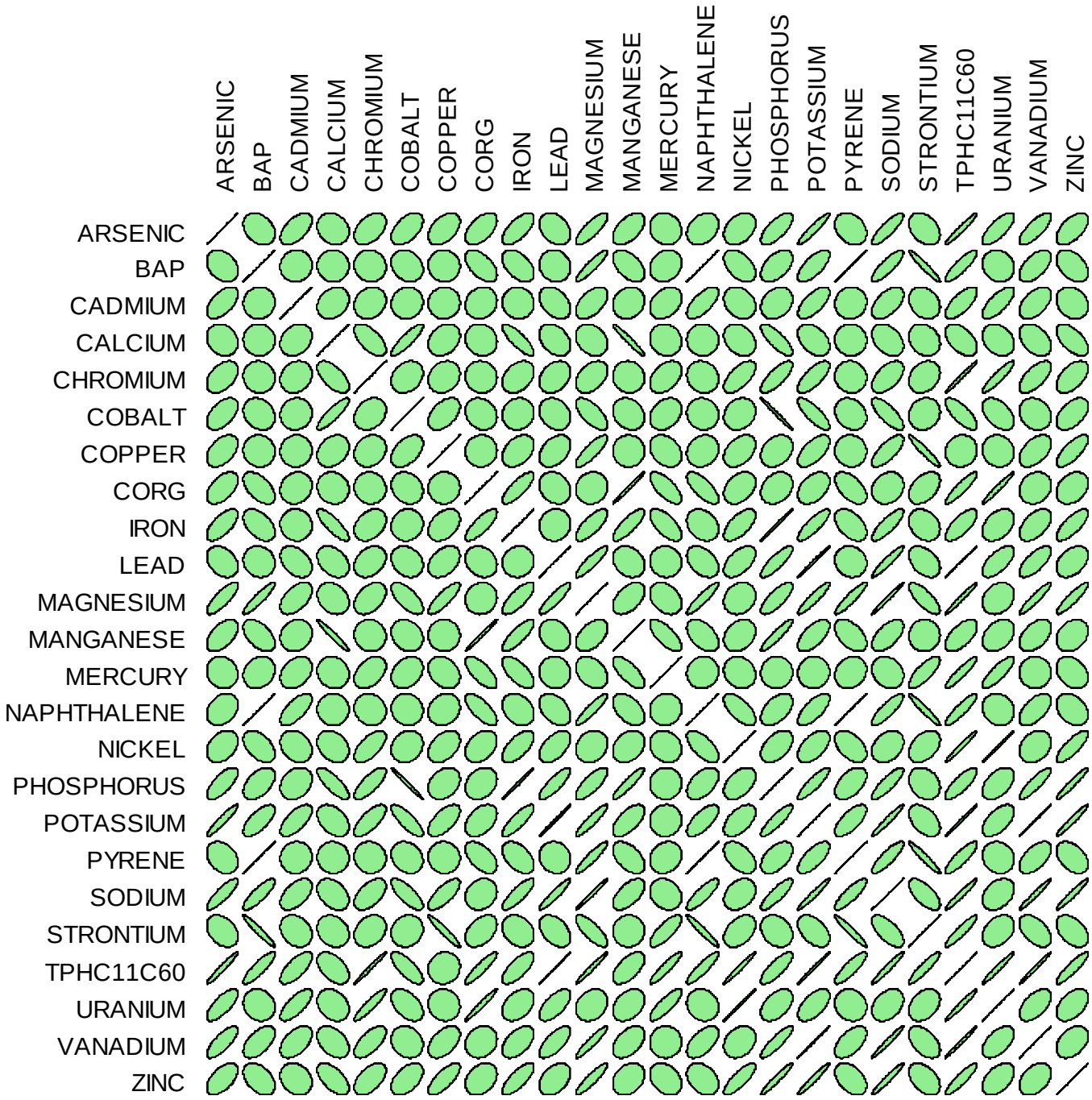
95% Confidence Interval

No Significant Trend

ENVIRON

Trends: Suspended Sediment
Zinc

Figure
3.8.k



BAP: Benzo(a)Pyrene
CONG: Carbon, Organic
TPHC11C60: C11-C60 Hydrocarbons

ENVIRON

Correlation Coefficients for Suspended Sediment

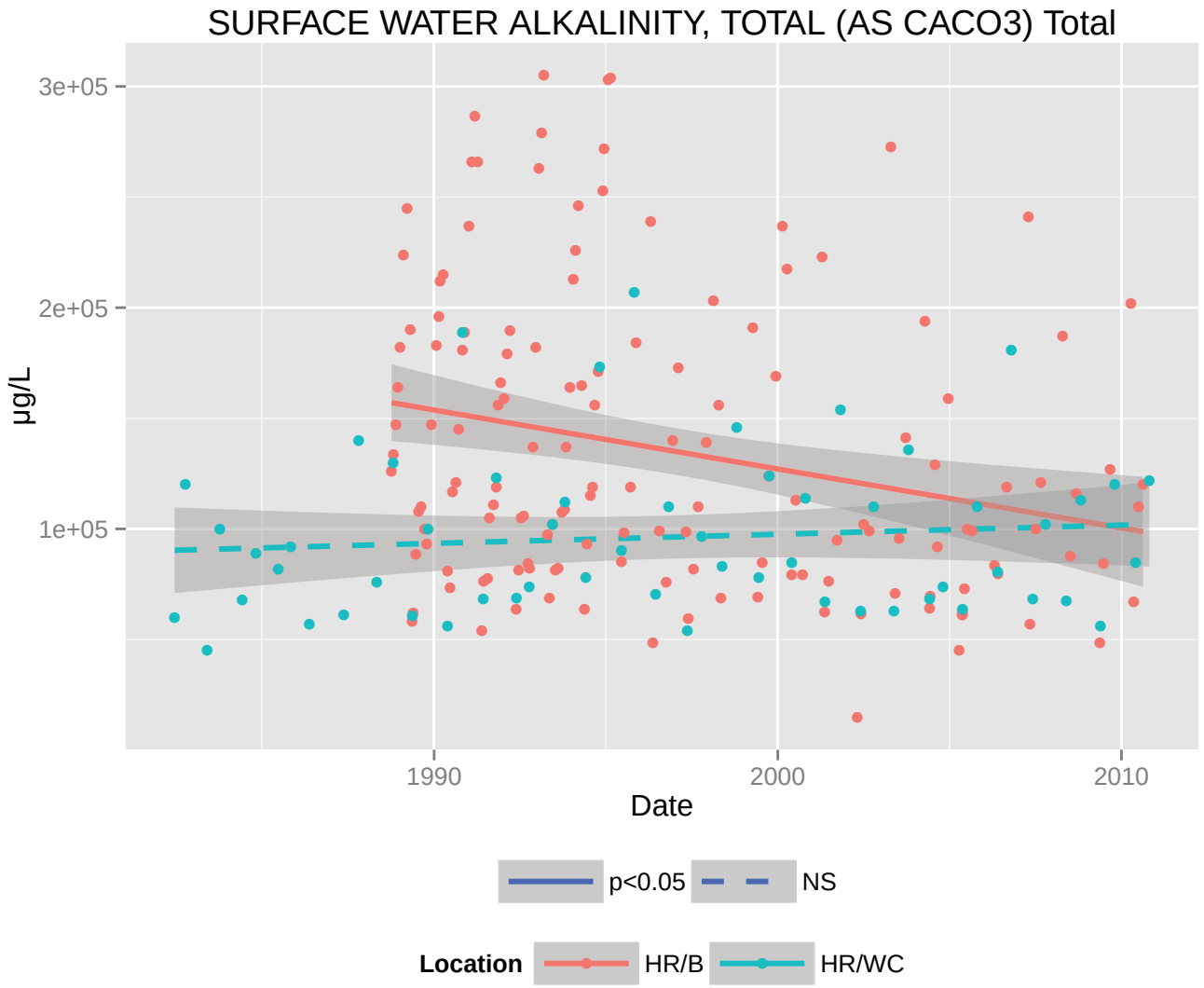
Figure 3.9

Appendix A

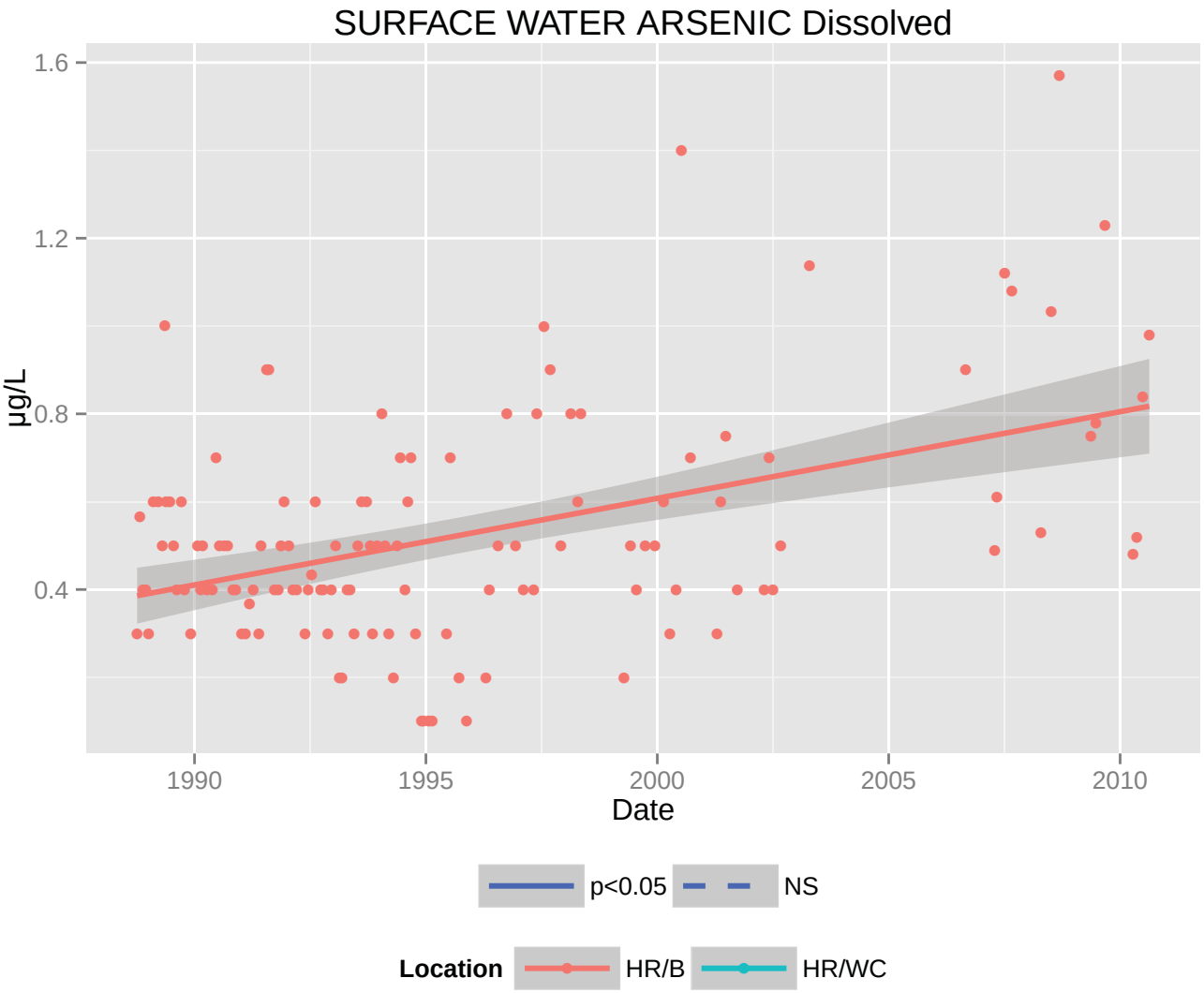
Electronic File: Monitoring Data

Appendix B

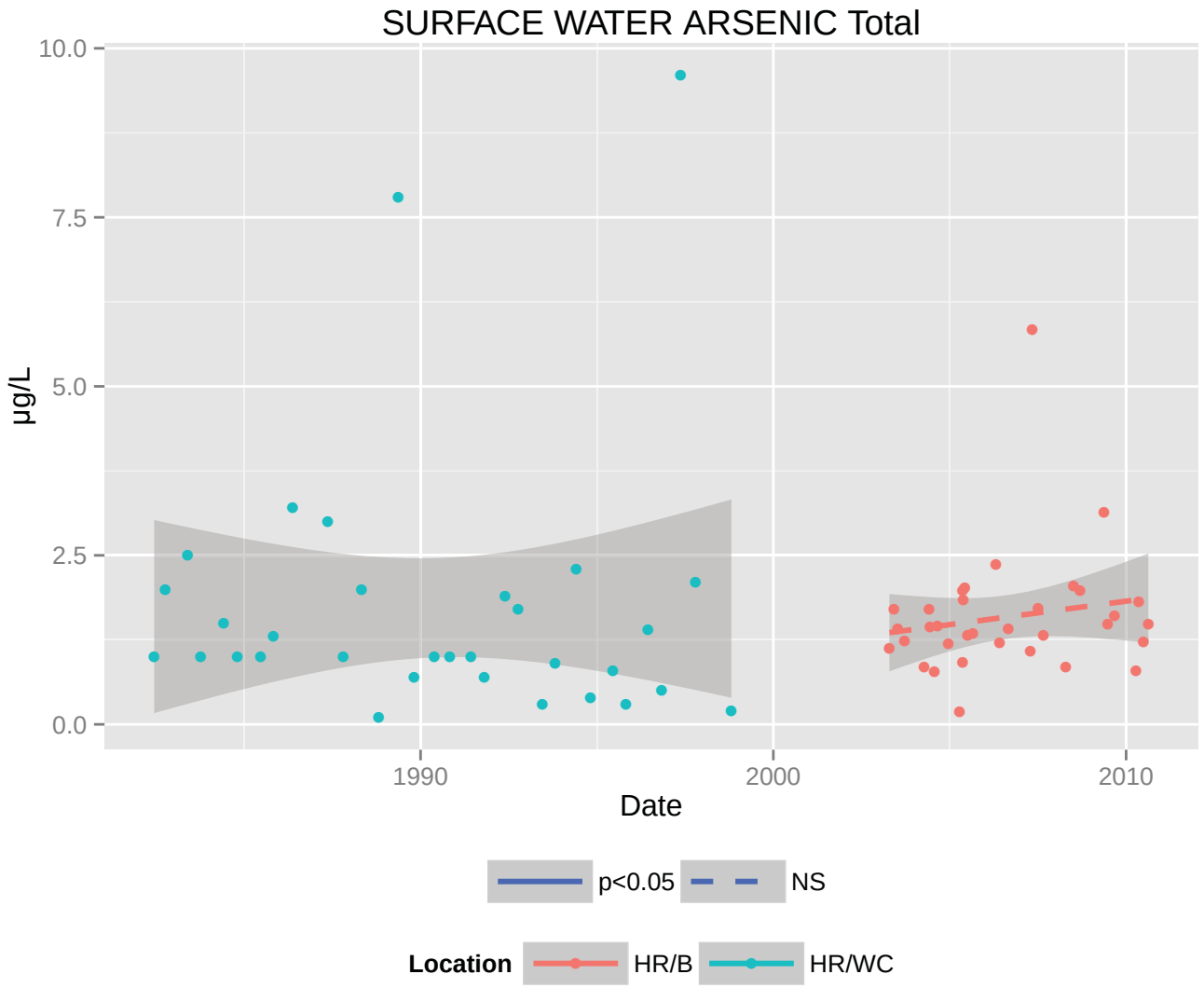
Surface Water Time Series by Monitoring Site



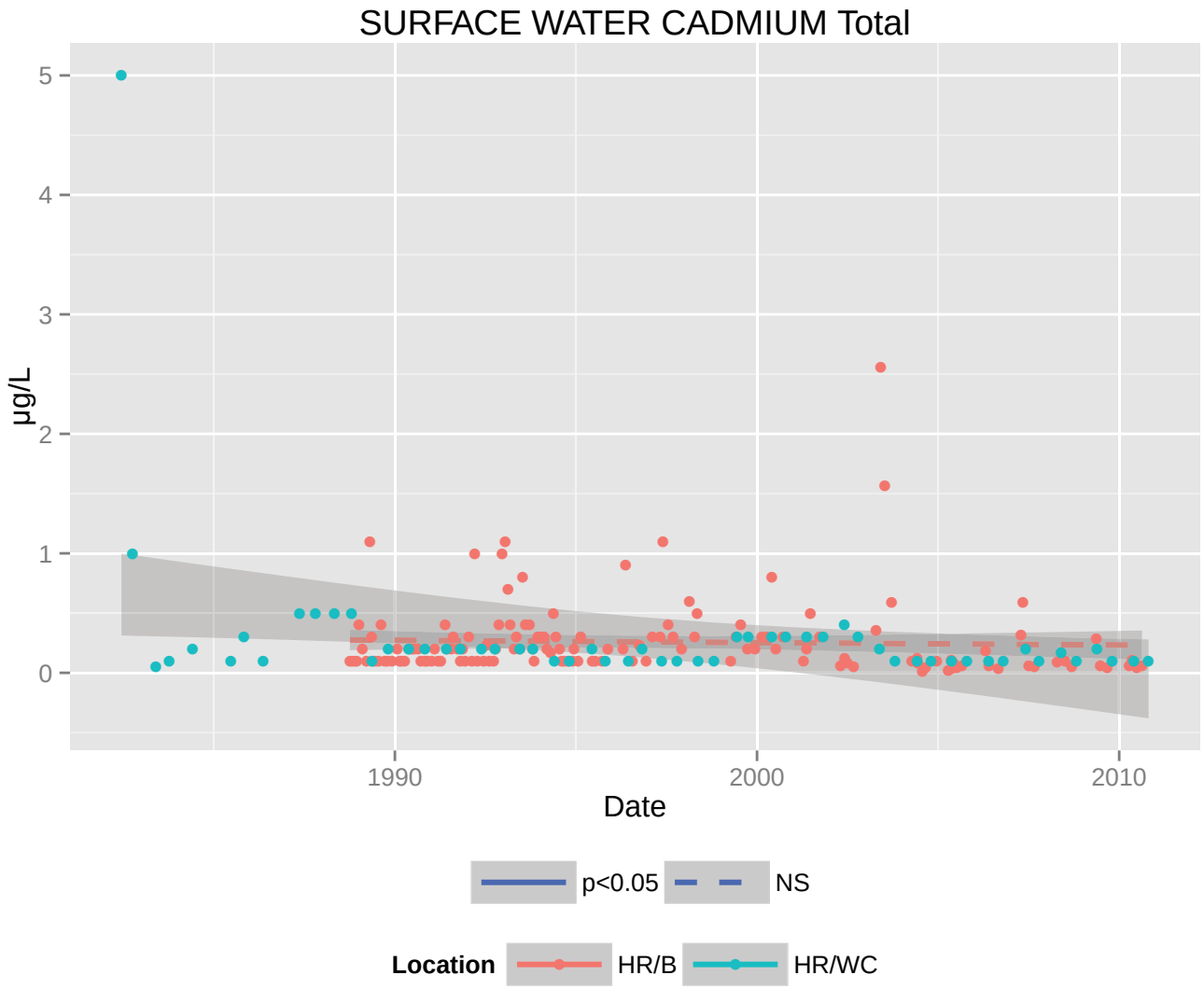
Location	n	Detects	Slope	p−value
HR/B	146	146	−2670	0.00184
HR/WC	57	57	412	0.48300



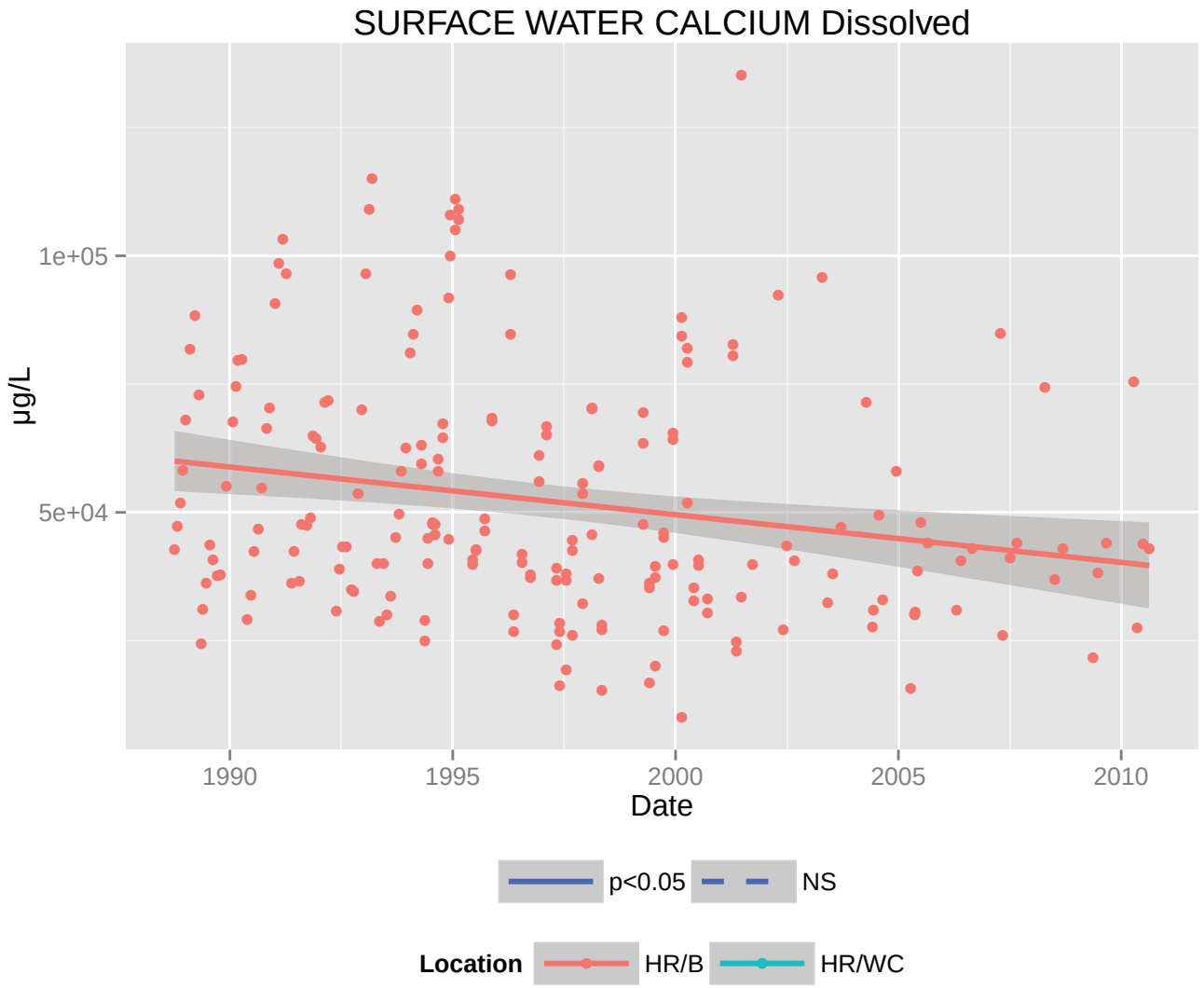
Location	n	Detects	Slope	p−value
HR/B	128	128	0.0197	6.83e−08



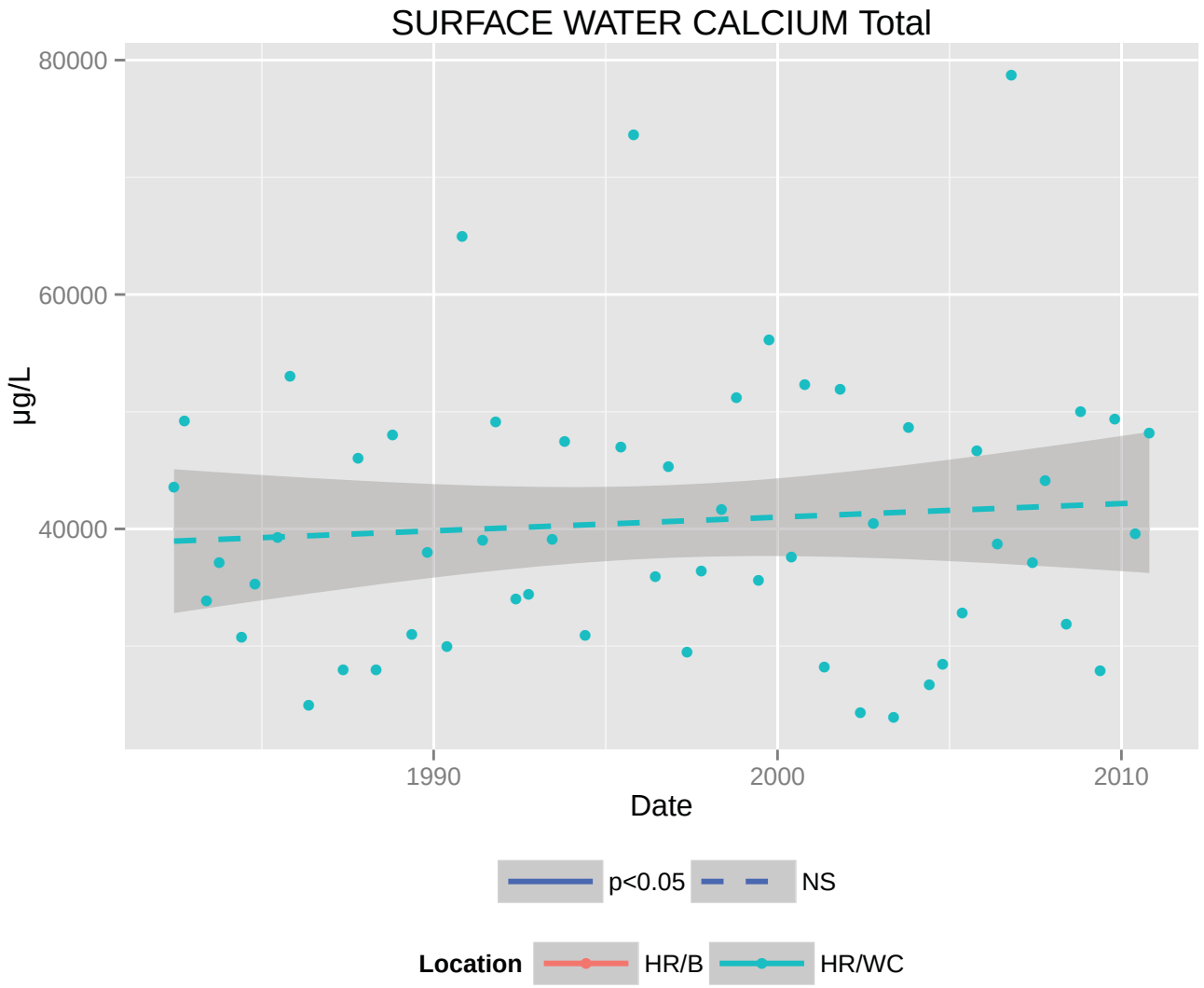
Location	n	Detects	Slope	p−value
HR/B	34	34	0.0694	0.331
HR/WC	32	22	NC	NC



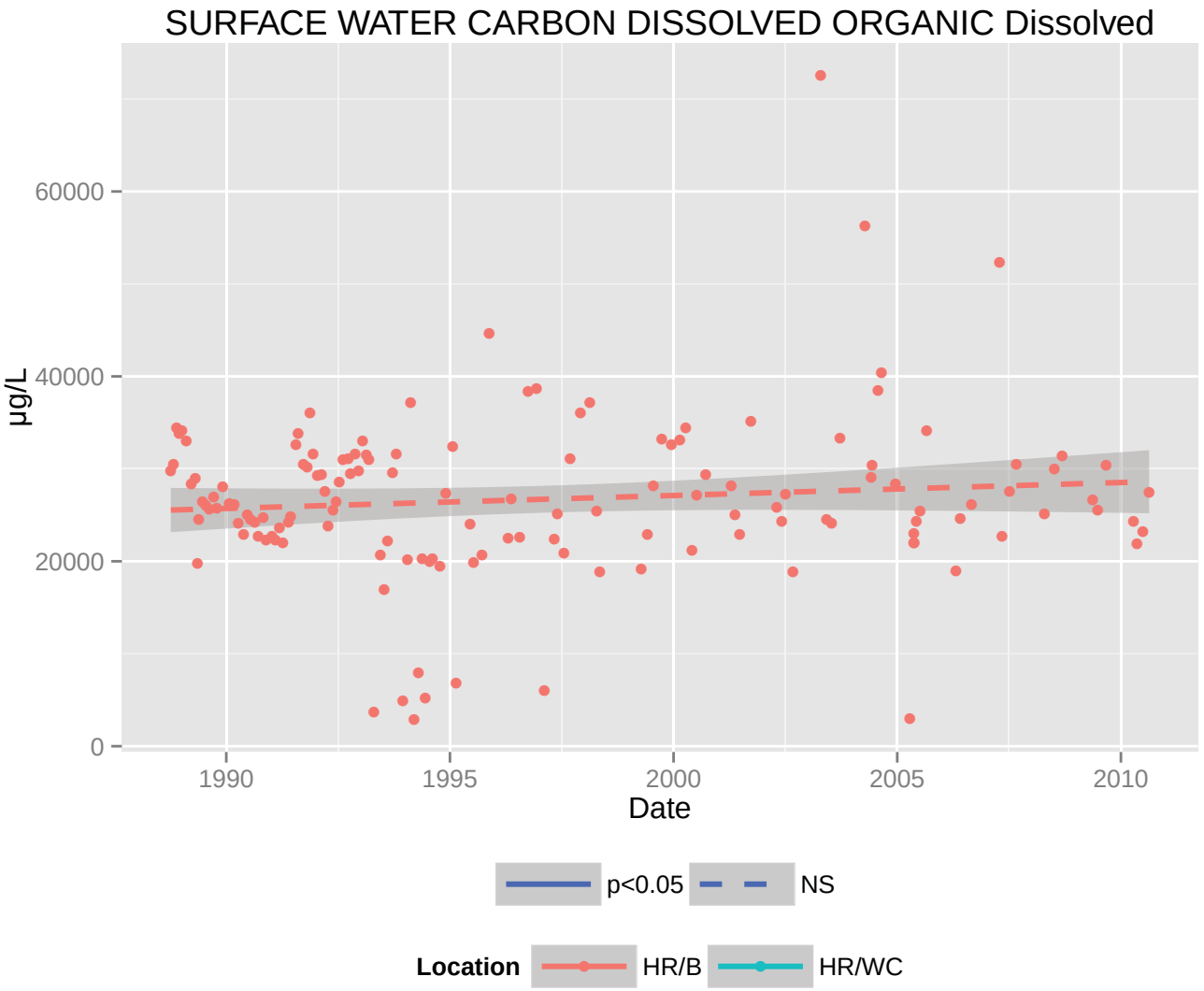
Location	n	Detects	Slope	p−value
HR/B	146	126	−0.00198	0.633
HR/WC	56	17	NC	NC



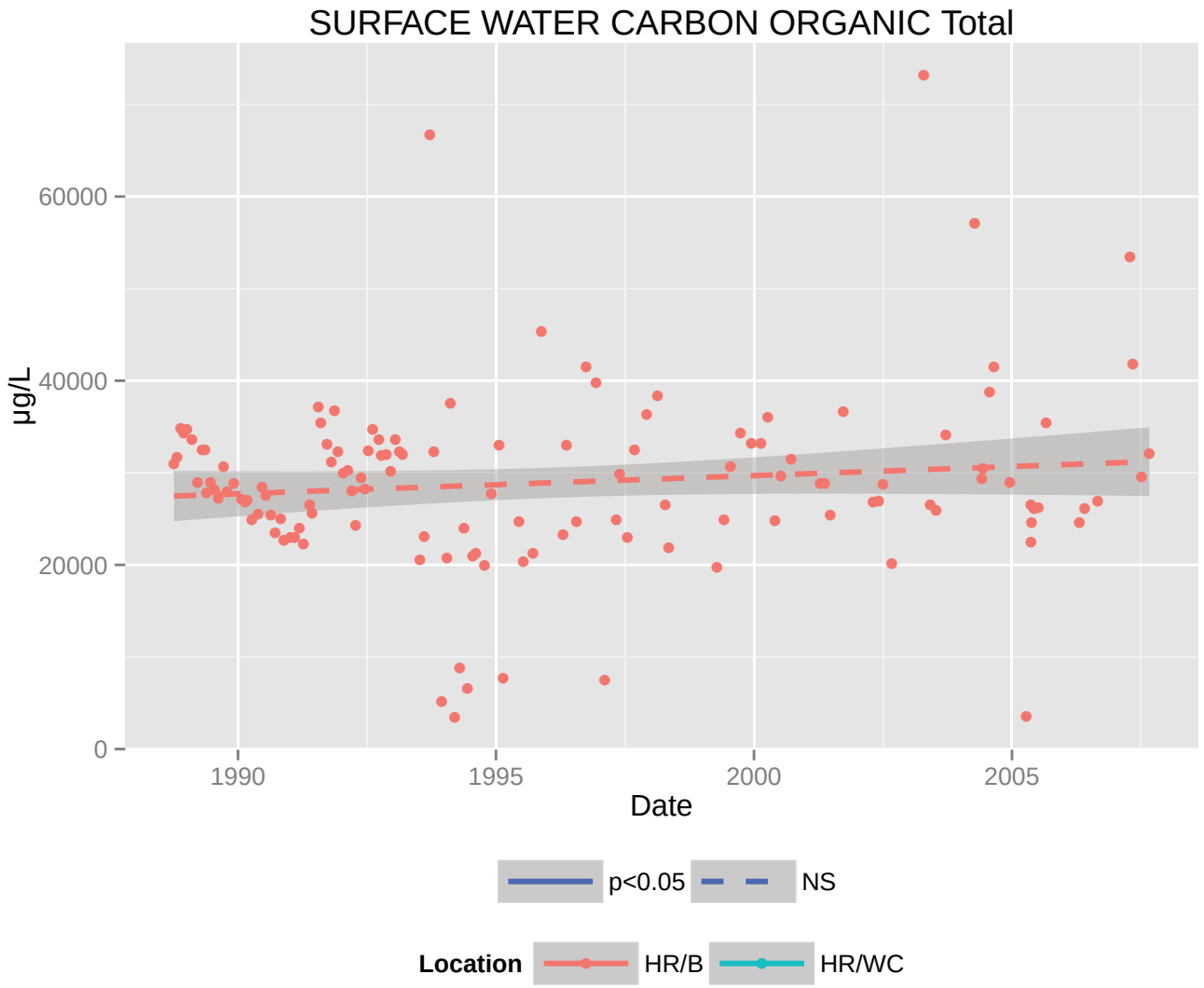
Location	n	Detects	Slope	p−value
HR/B	203	203	−930	0.00183



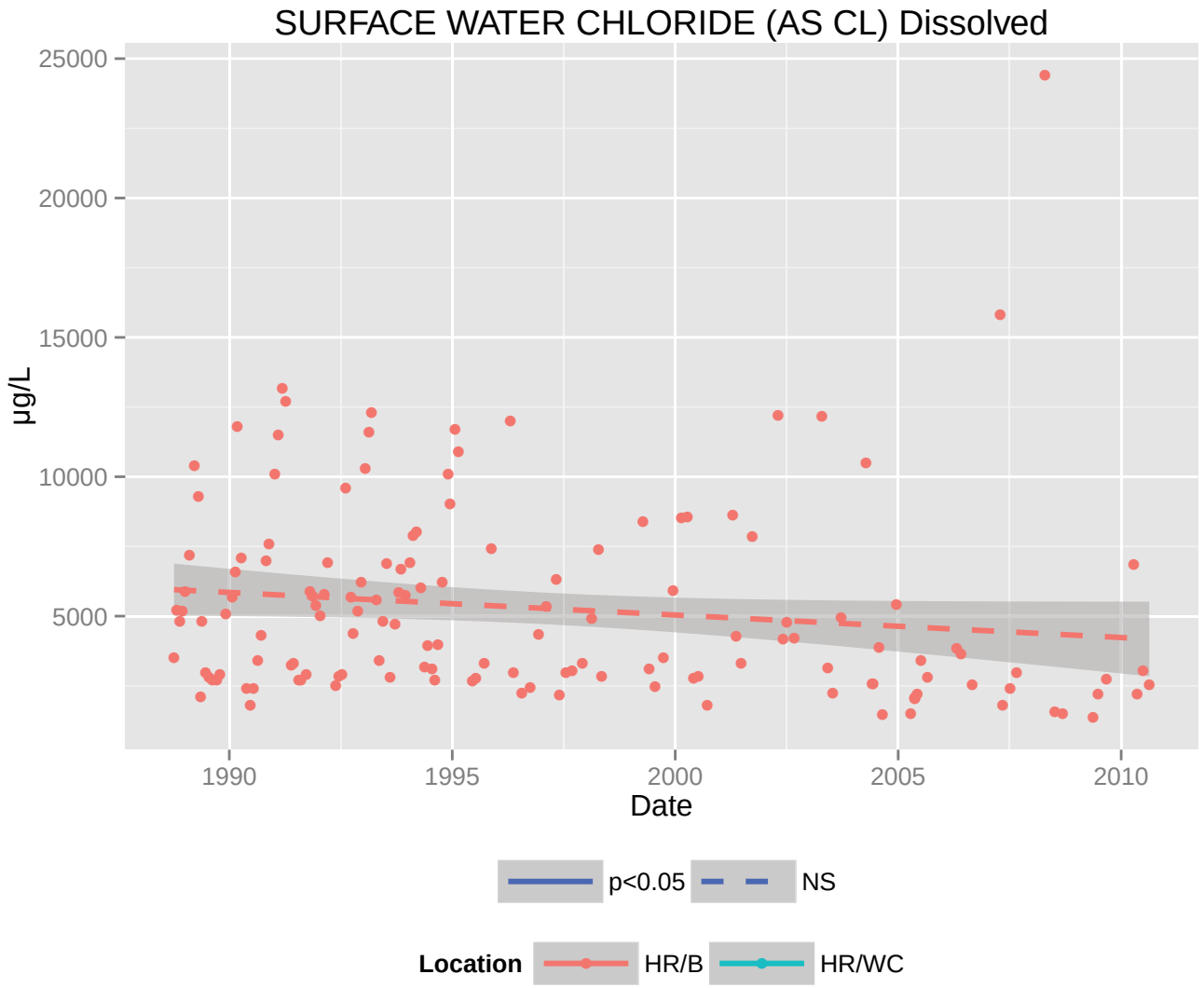
Location	n	Detects	Slope	p−value
HR/WC	56	56	116	0.529



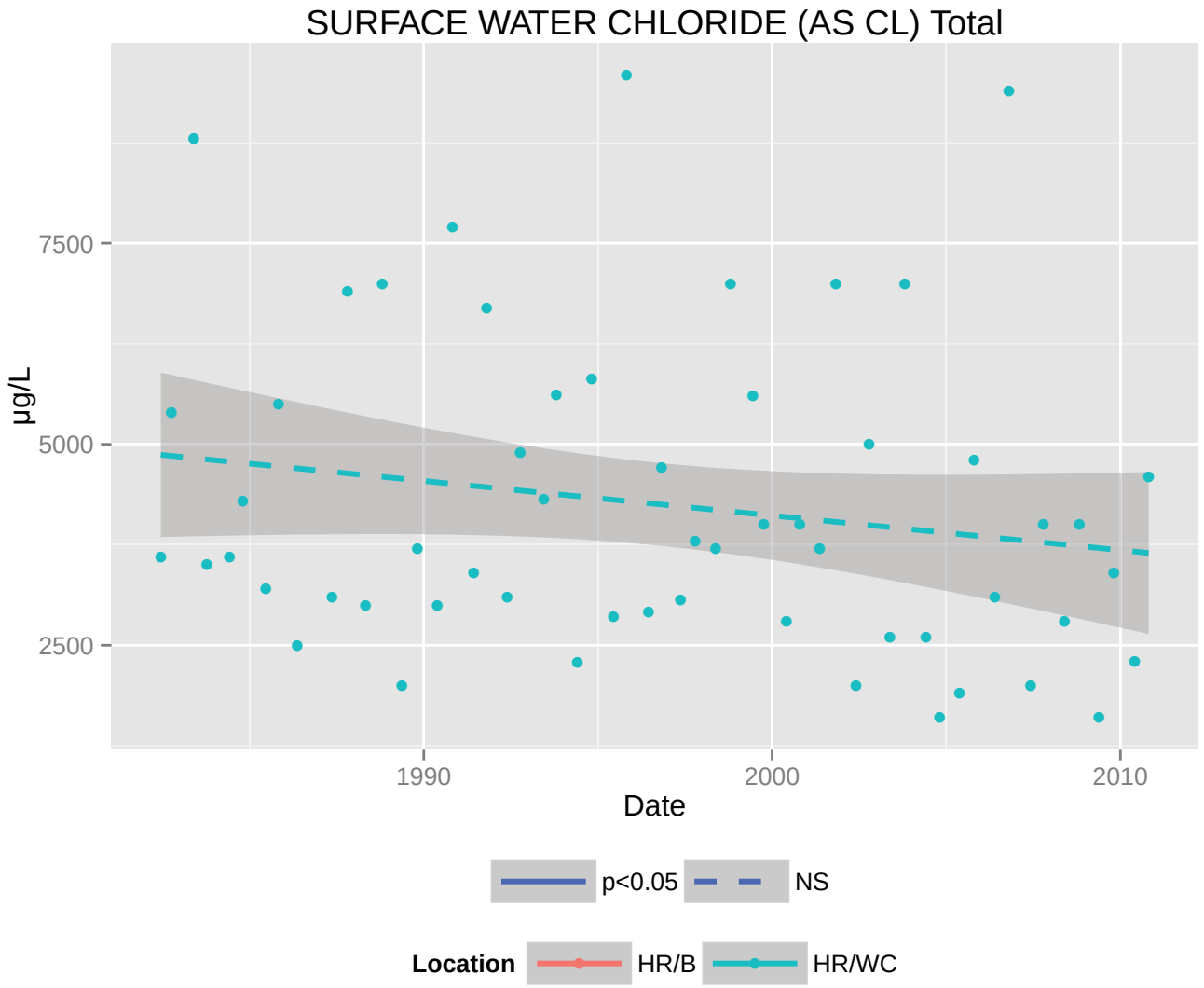
Location	n	Detects	Slope	p−value
HR/B	143	143	140	0.225



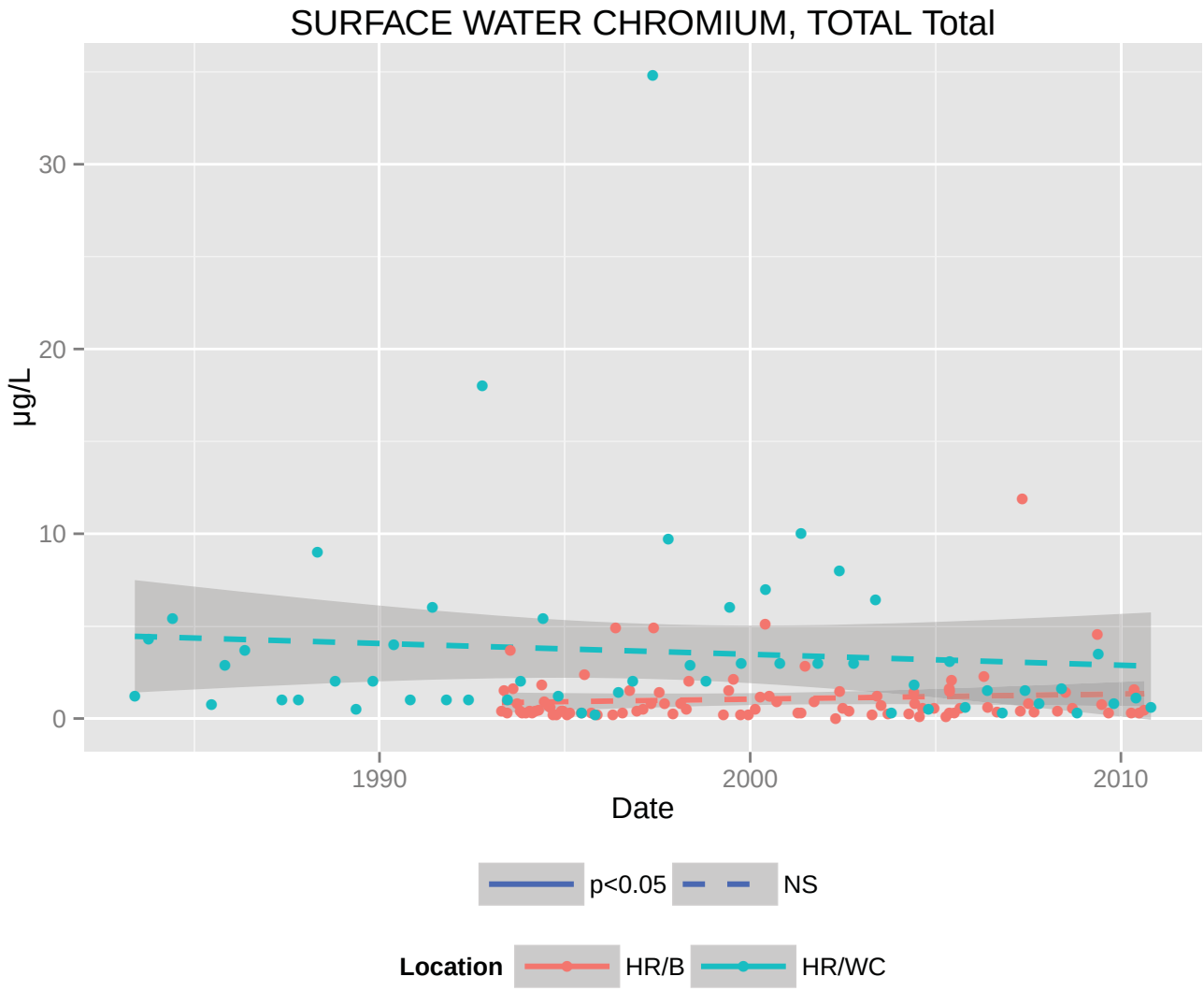
Location	n	Detects	Slope	p−value
HR/B	131	131	197	0.184



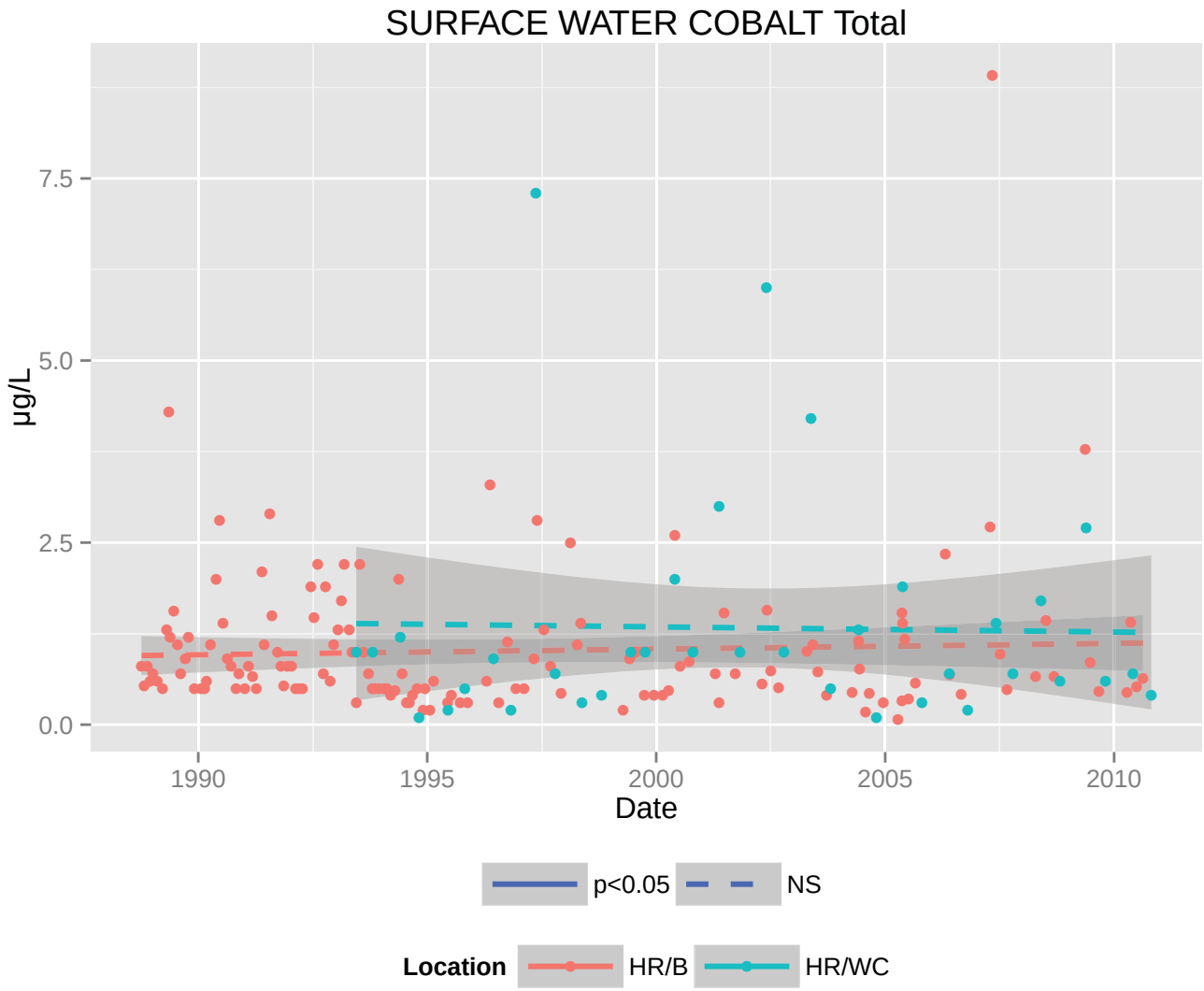
Location	n	Detects	Slope	p−value
HR/B	146	146	−80.9	0.0759



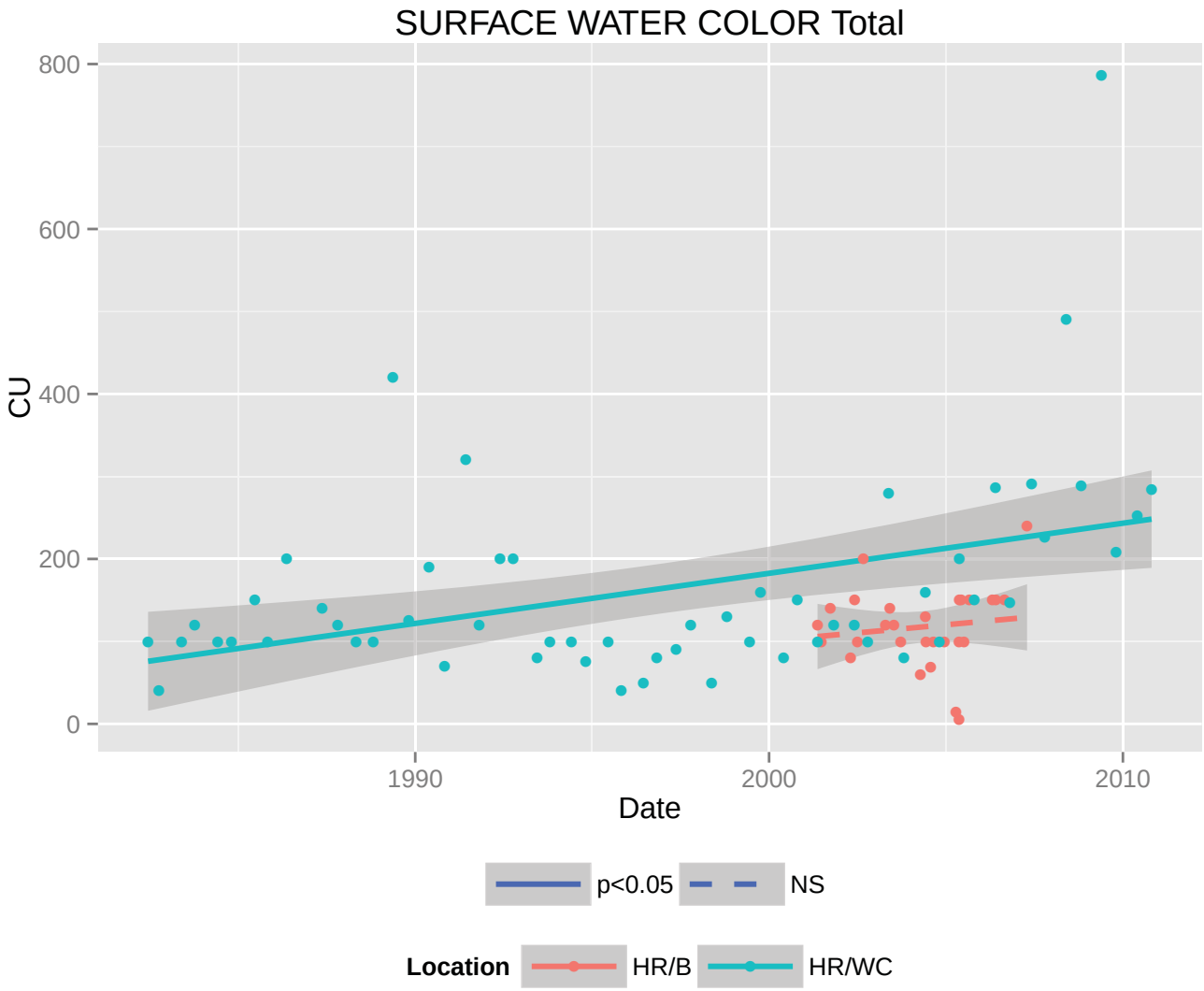
Location	n	Detects	Slope	p−value
HR/WC	57	57	−43.1	0.168



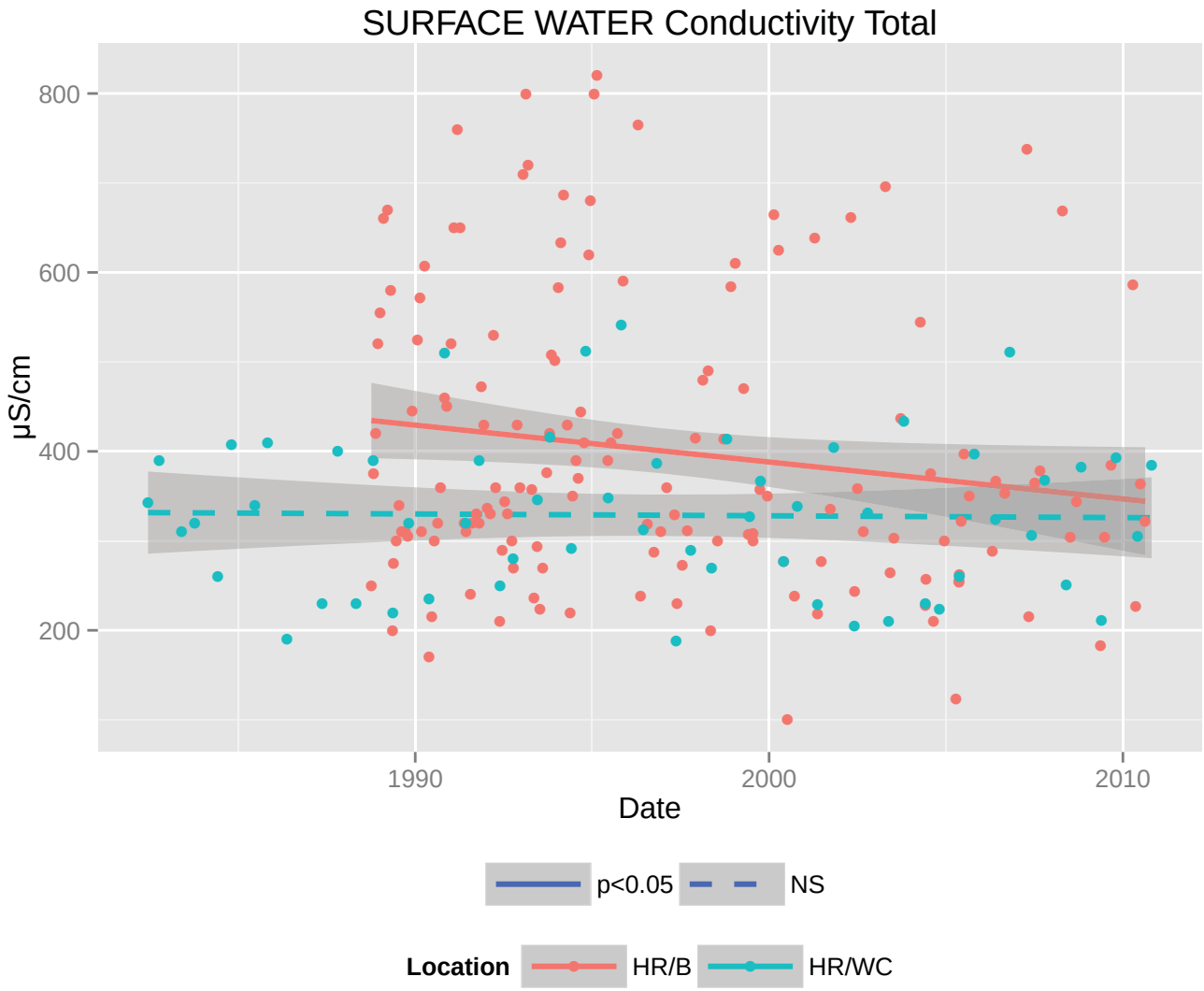
Location	n	Detects	Slope	p−value
HR/B	93	89	0.0277	0.366
HR/WC	54	39	−0.0588	0.532



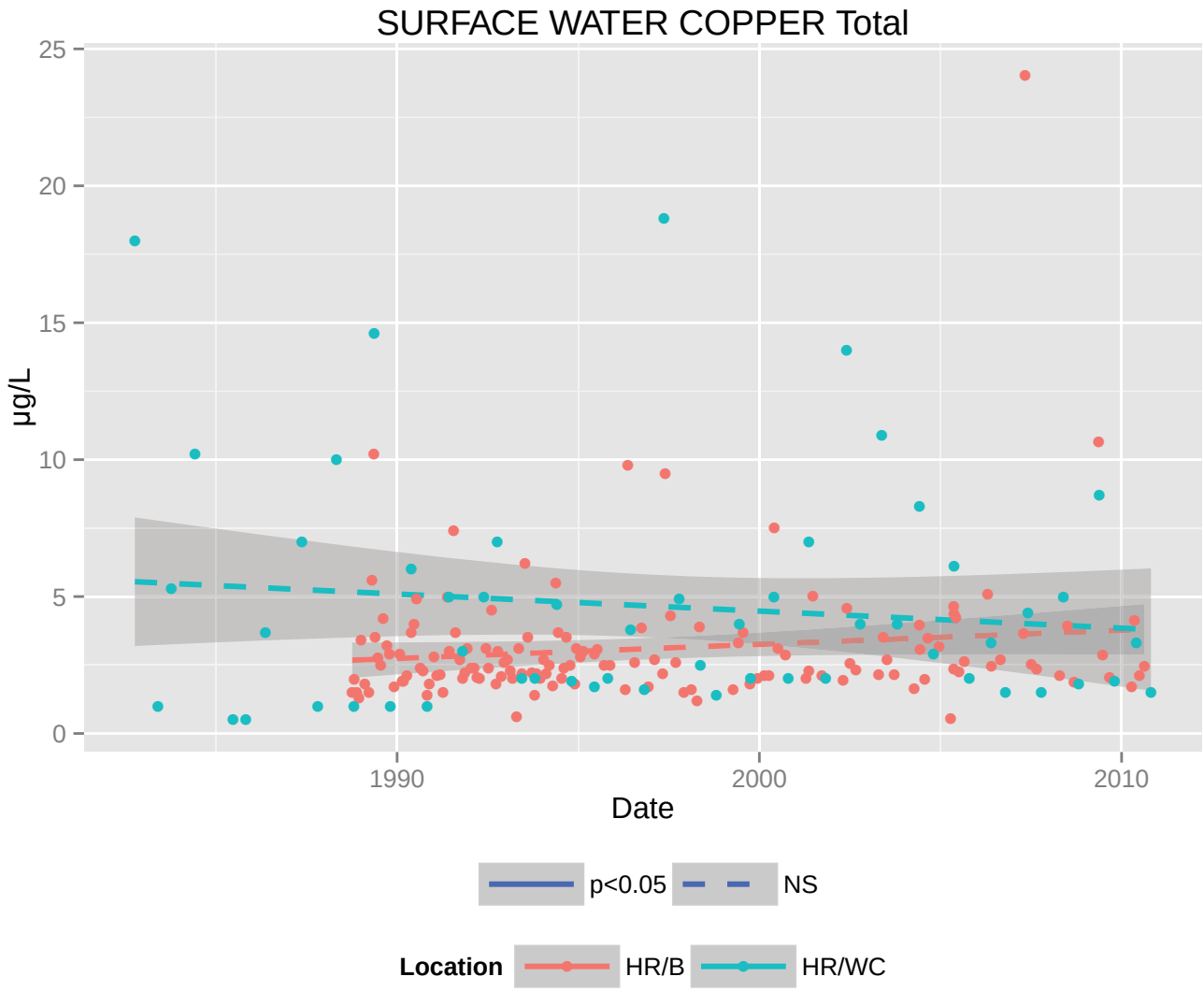
Location	n	Detects	Slope	p−value
HR/B	146	138	0.00782	0.547
HR/WC	36	31	−0.00704	0.892



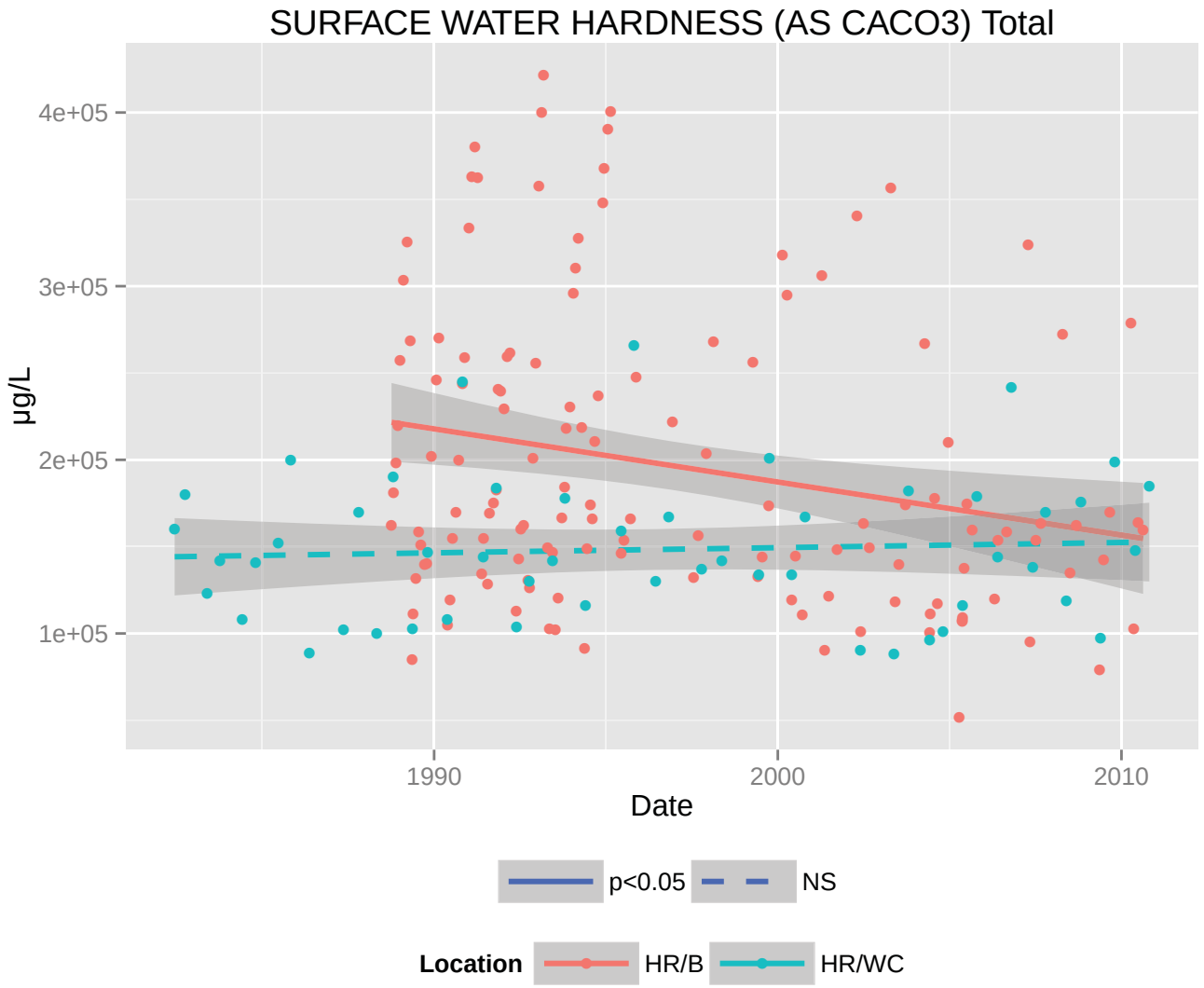
Location	n	Detects	Slope	p−value
HR/B	28	28	3.92	0.5020
HR/WC	57	55	6.08	0.0014



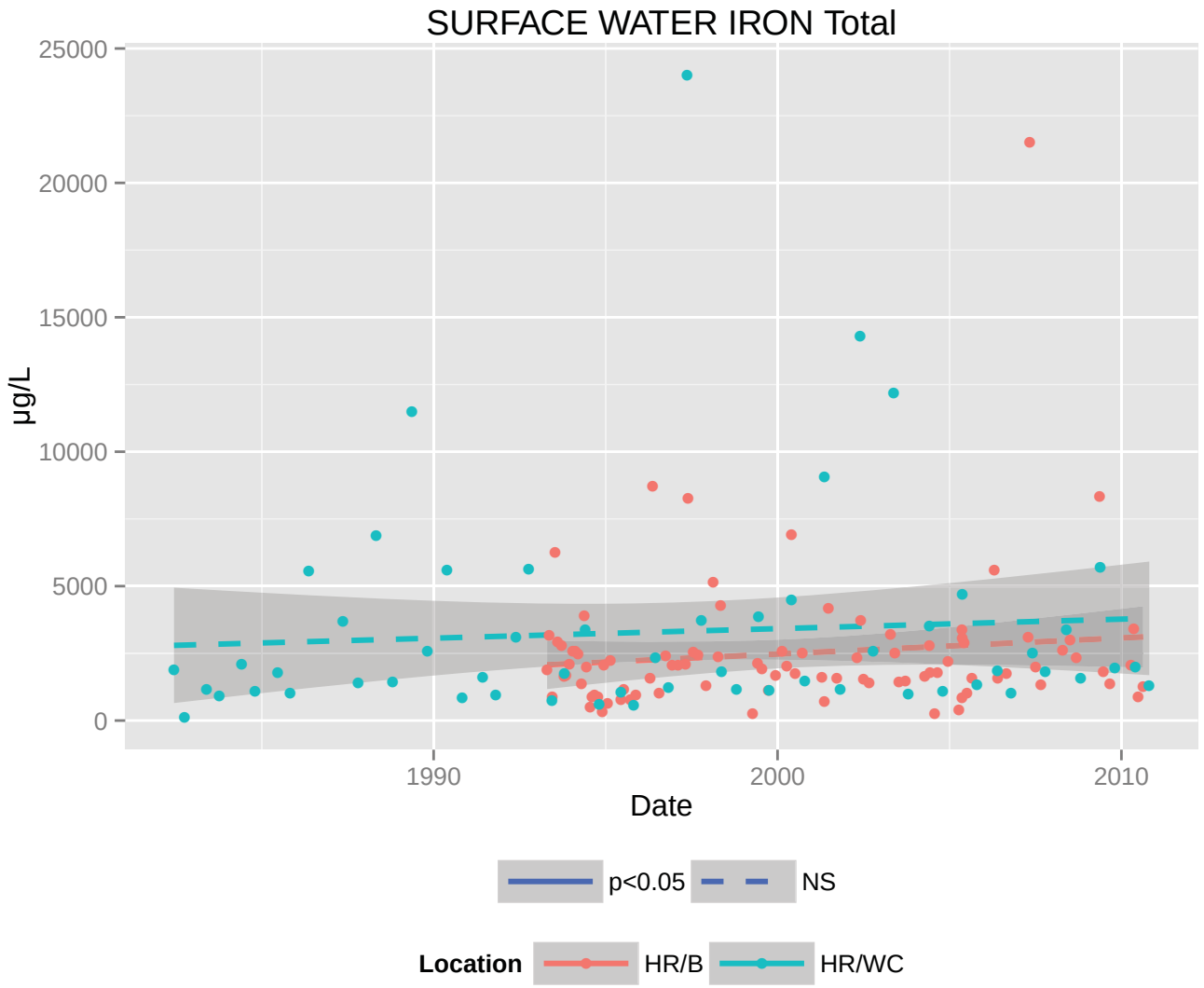
Location	n	Detects	Slope	p−value
HR/B	152	151	−4.120	0.046
HR/WC	57	57	−0.203	0.884



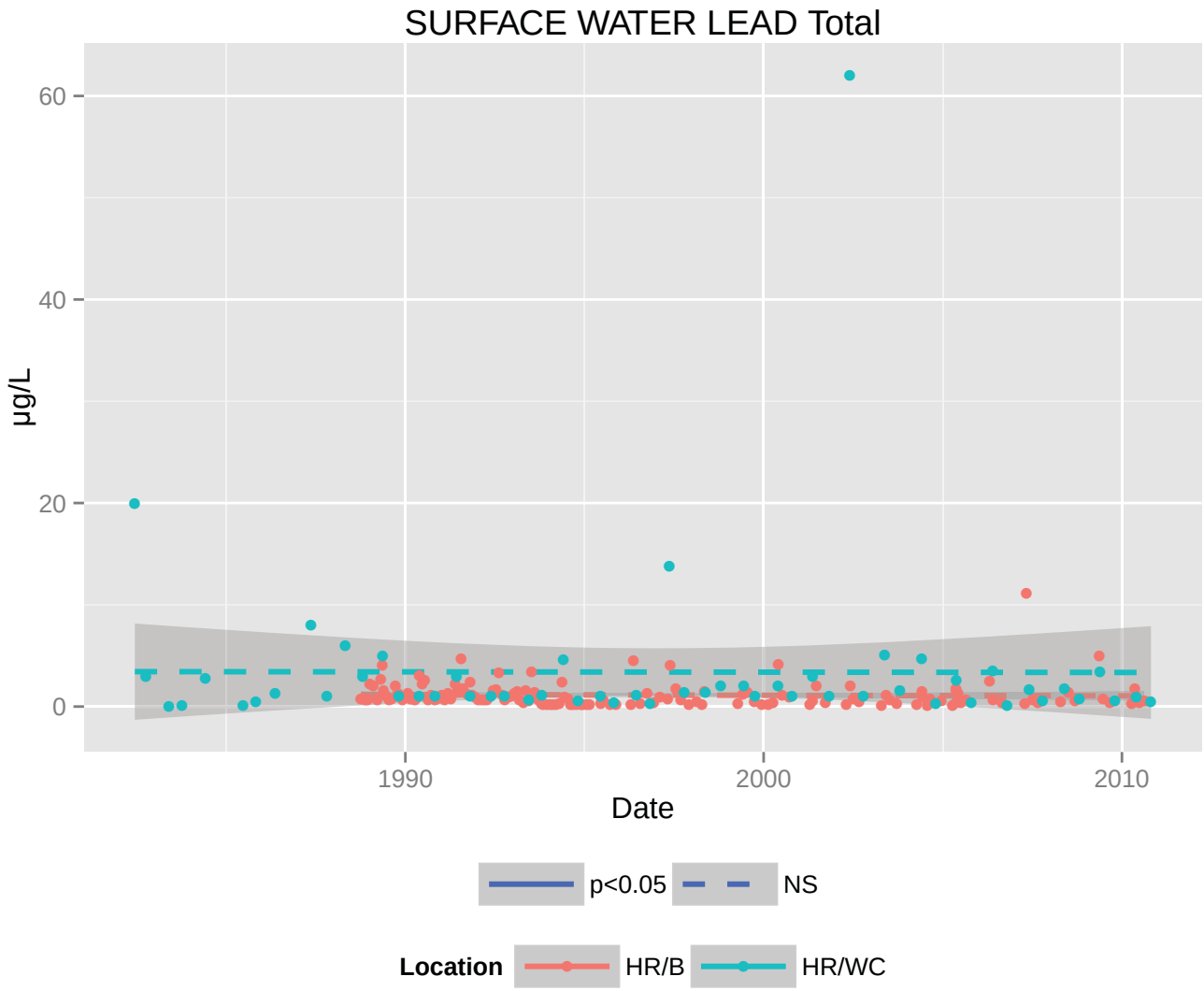
Location	n	Detects	Slope	p−value
HR/B	146	146	0.0515	0.101
HR/WC	55	50	−0.0623	0.381



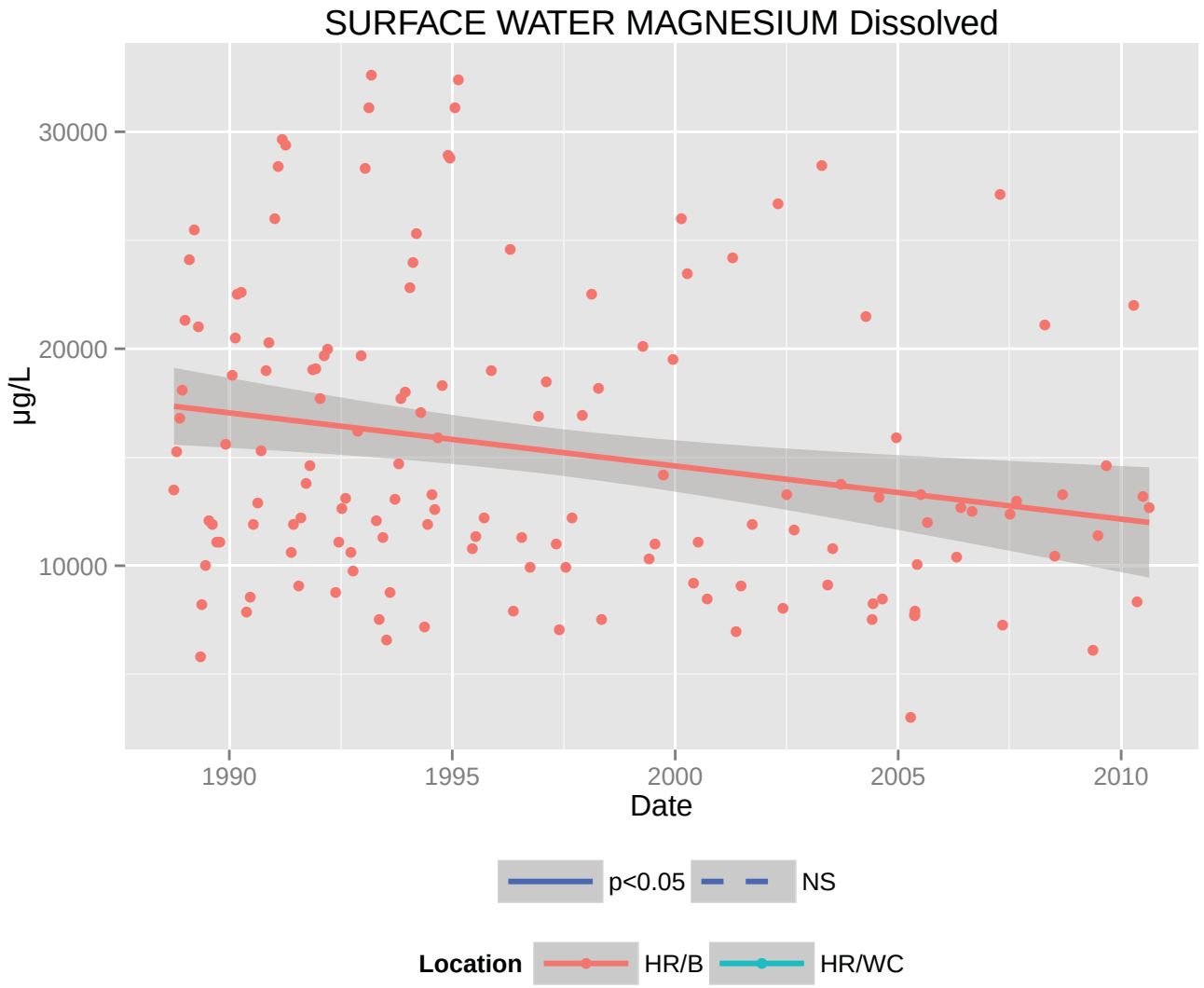
Location	n	Detects	Slope	p−value
HR/B	134	134	−3060	0.00523
HR/WC	51	51	298	0.66000



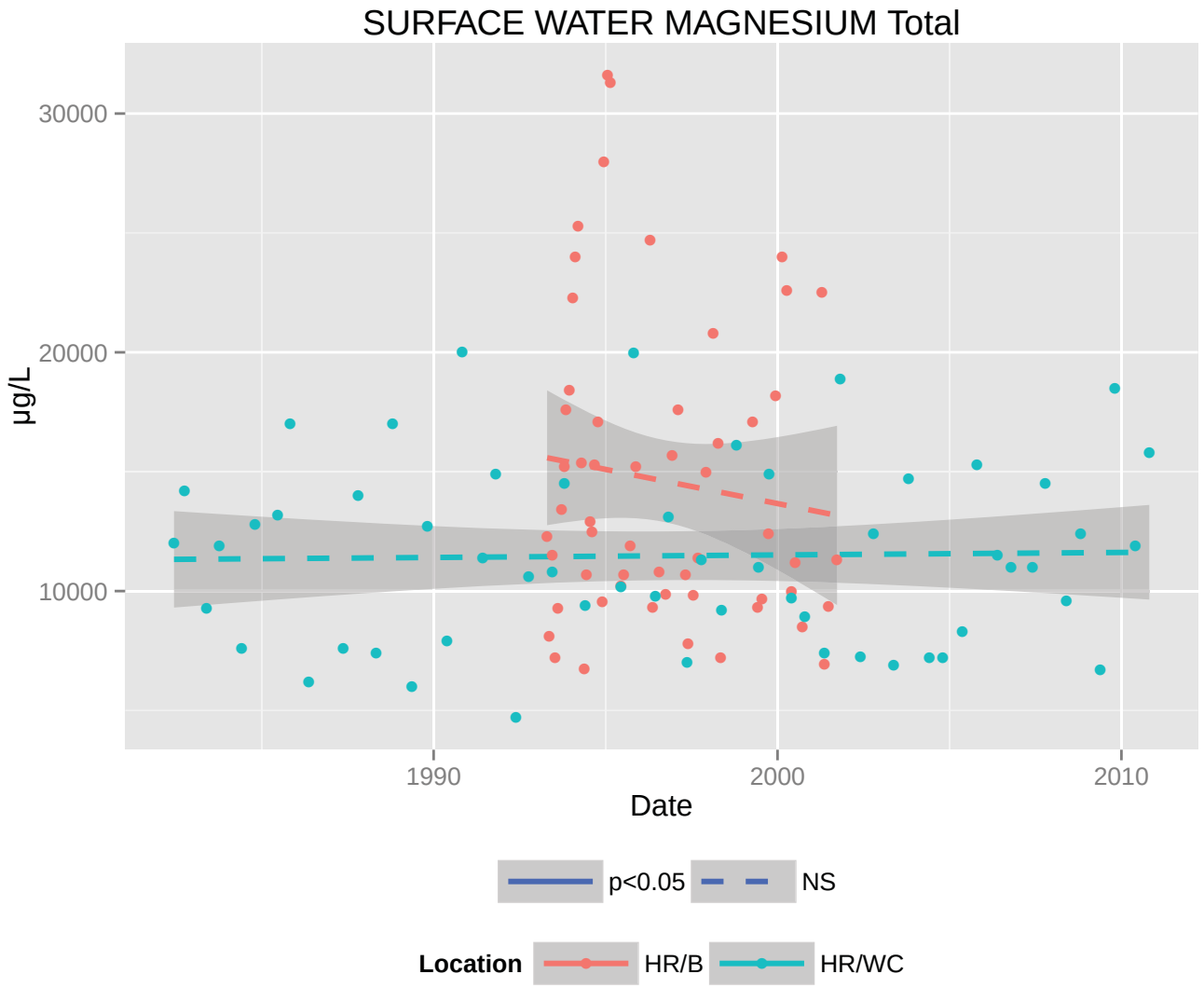
Location	n	Detects	Slope	p−value
HR/B	93	93	59.9	0.238
HR/WC	57	57	35.4	0.586



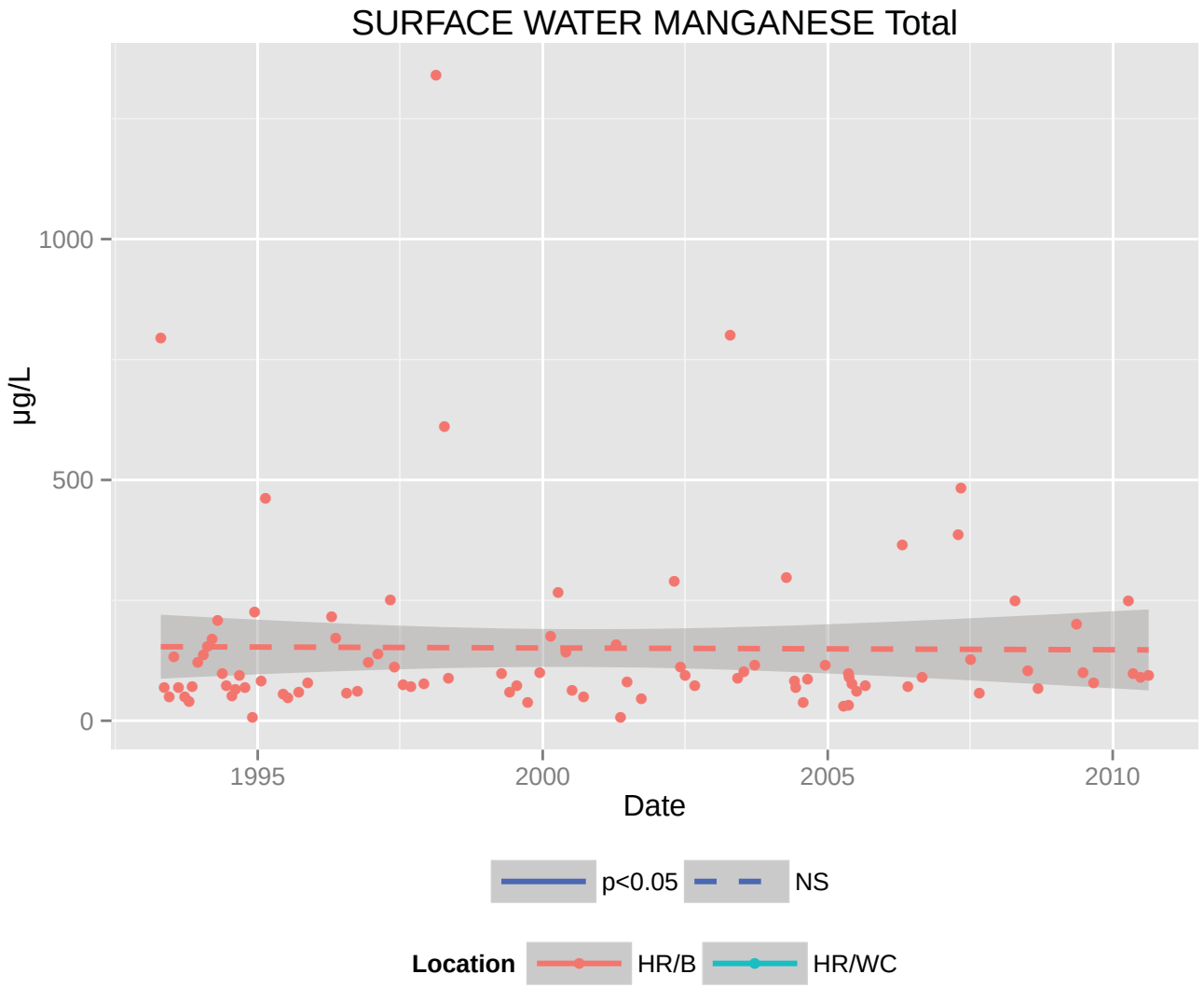
Location	n	Detects	Slope	p−value
HR/B	146	117	−0.00621	0.715
HR/WC	56	42	−0.00288	0.984



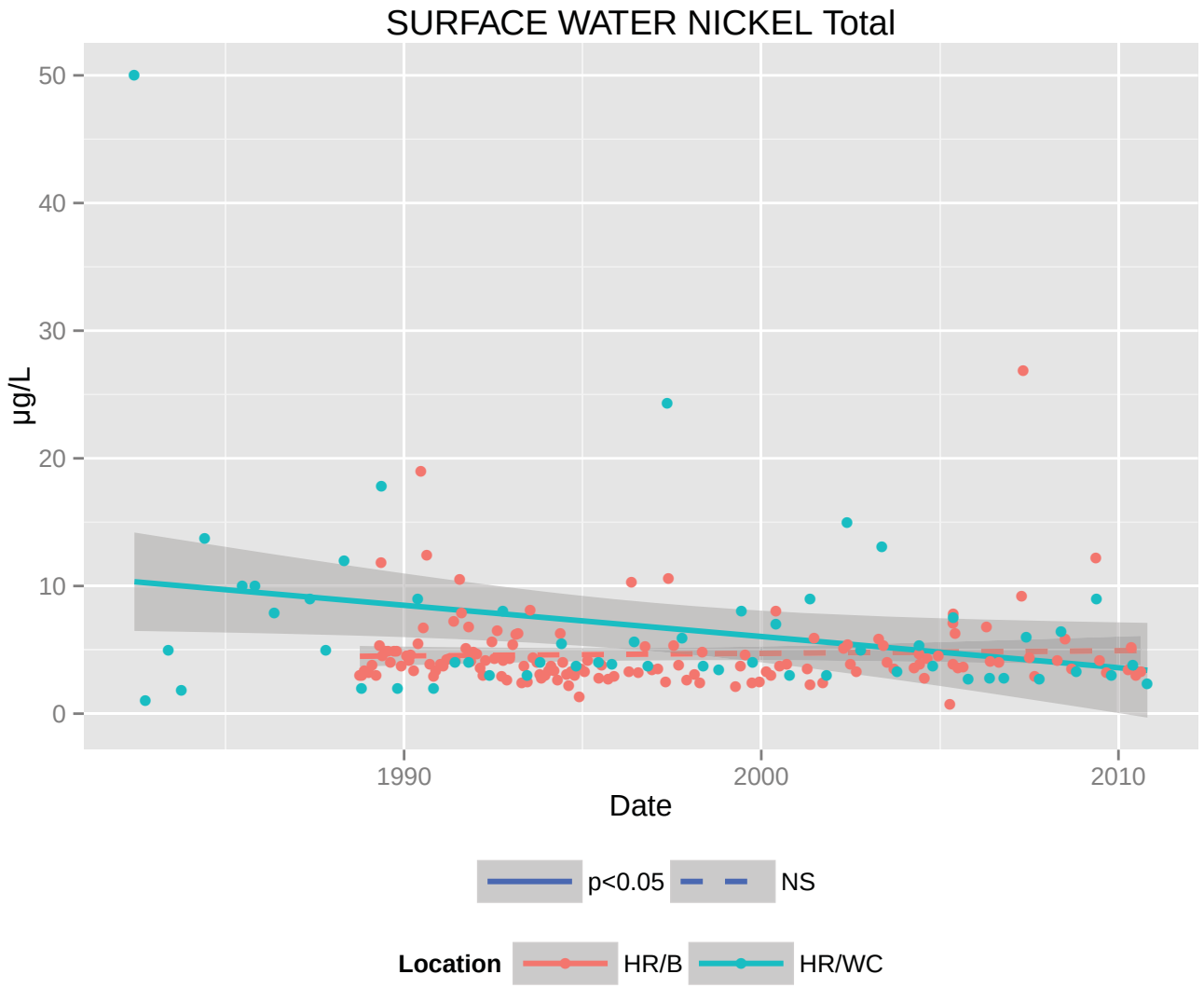
Location	n	Detects	Slope	p−value
HR/B	146	146	−245	0.00501



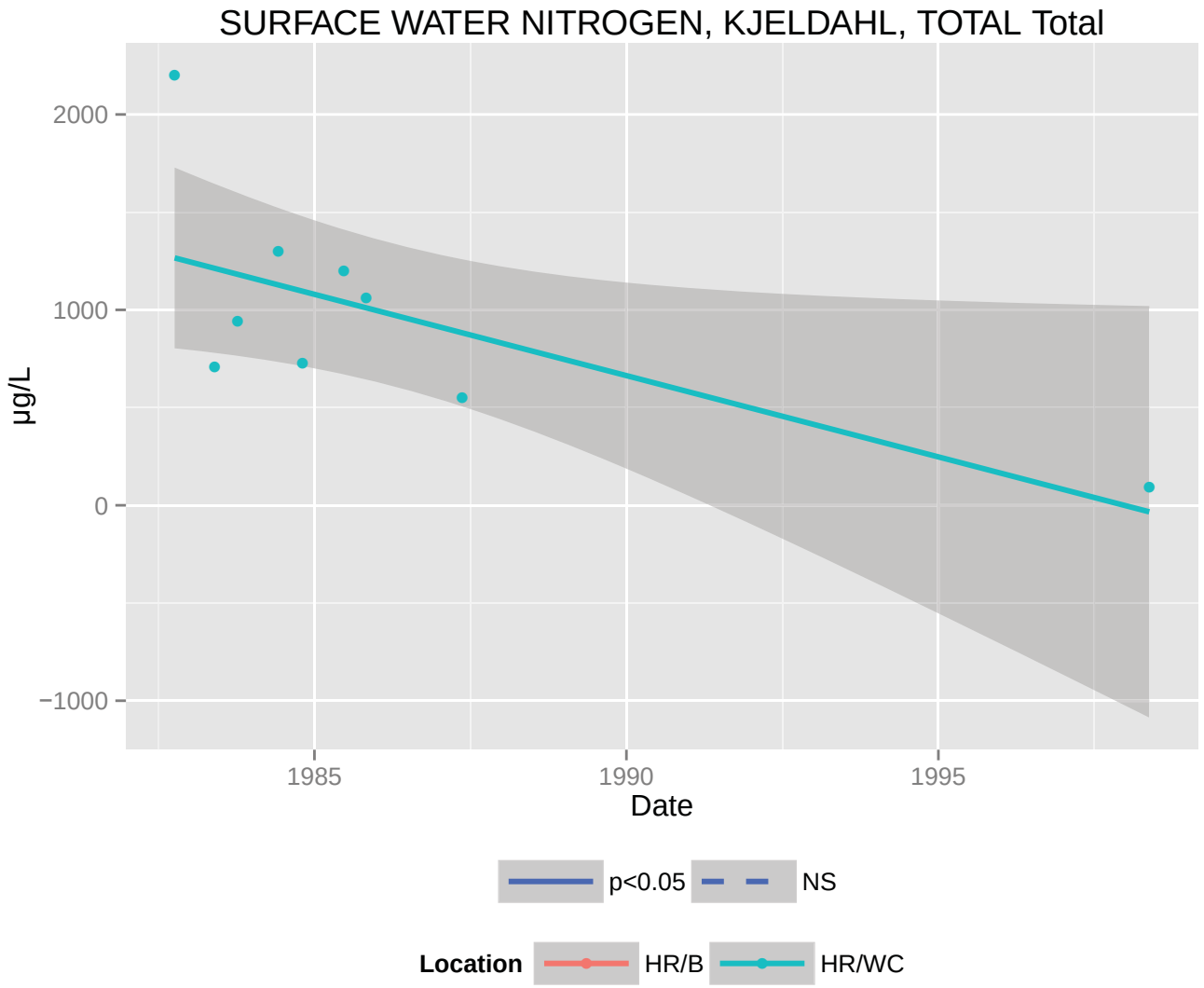
Location	n	Detects	Slope	p−value
HR/B	55	55	−286.0	0.390
HR/WC	56	56	10.5	0.863



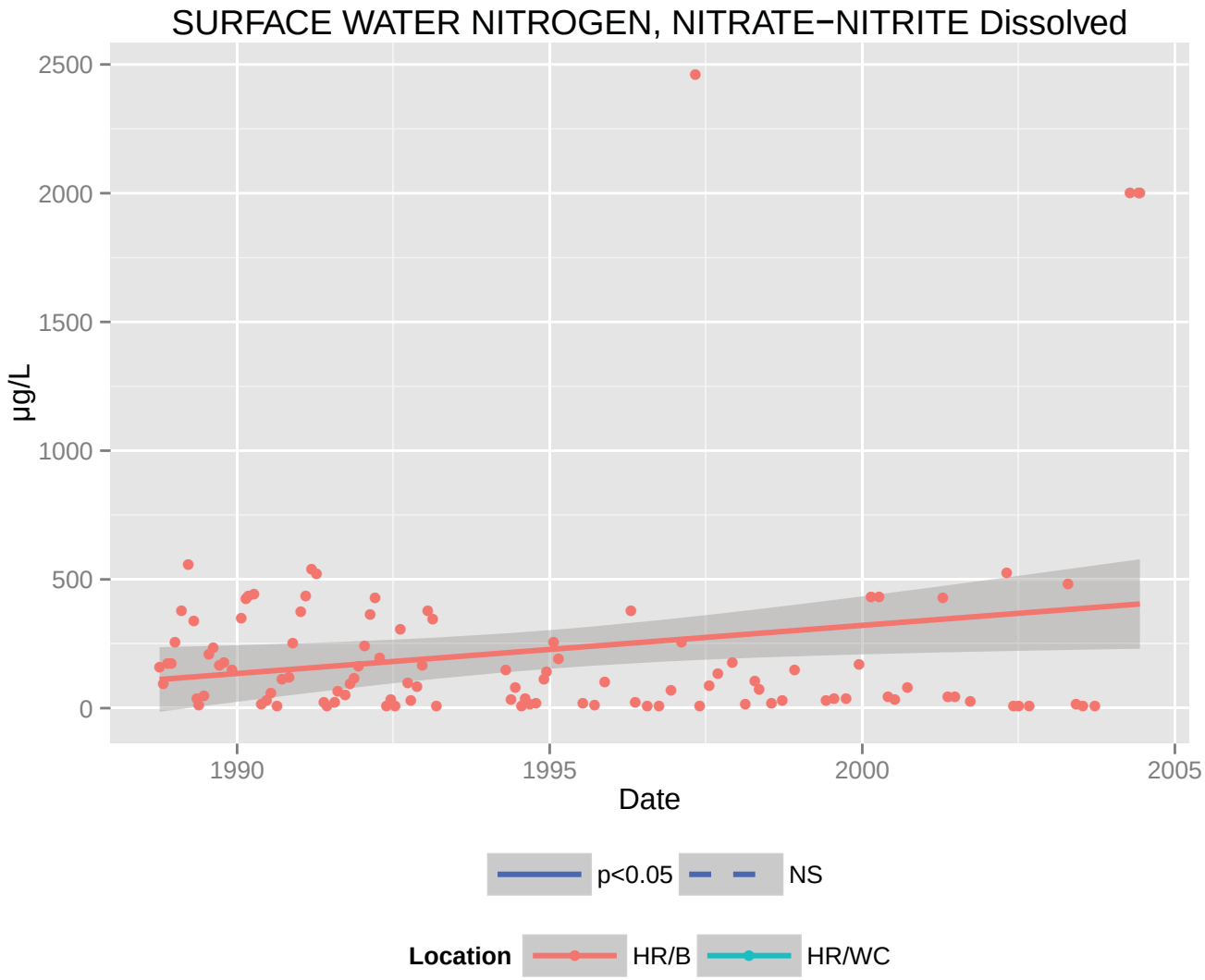
Location	n	Detects	Slope	p−value
HR/B	93	93	−0.381	0.919



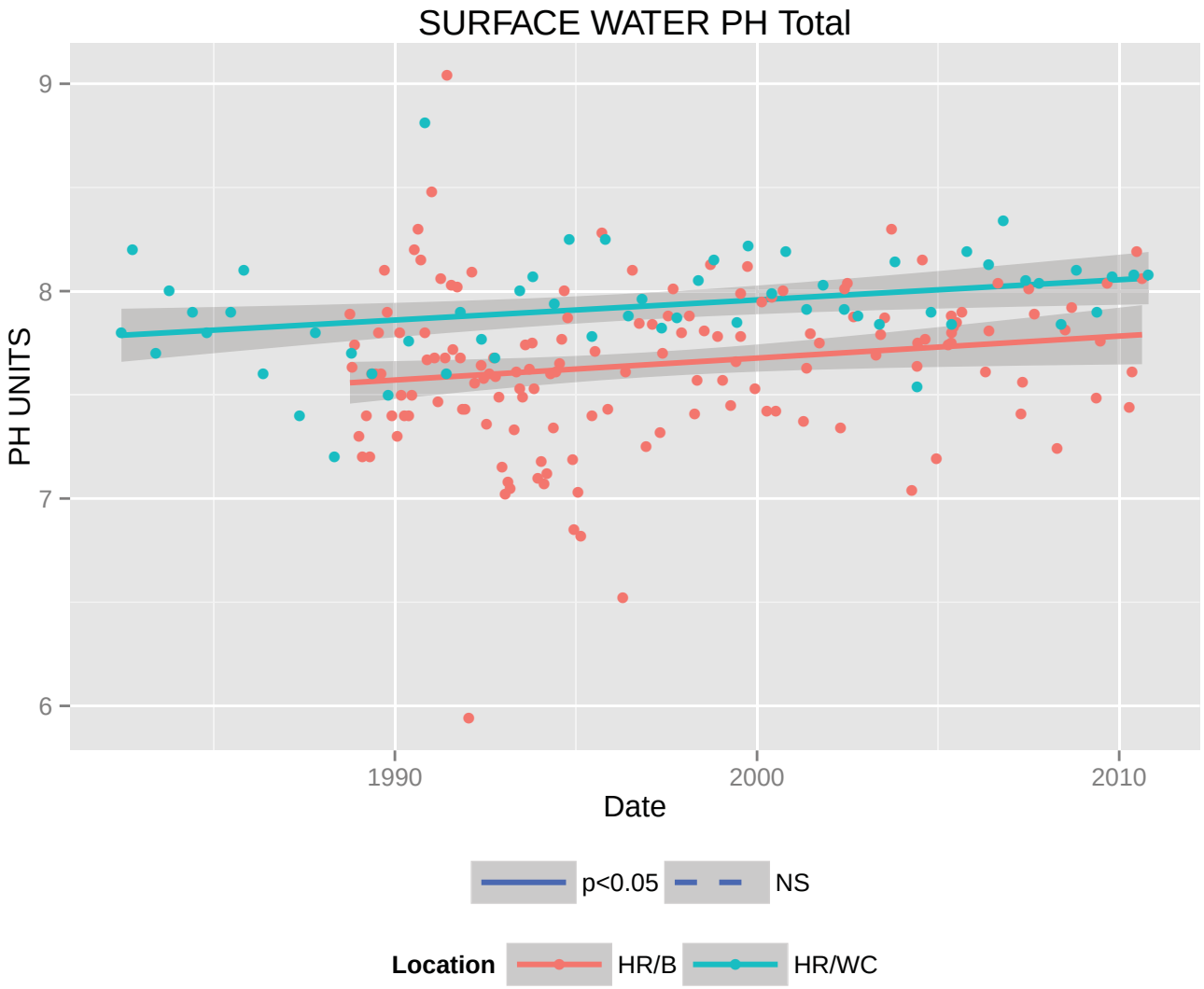
Location	n	Detects	Slope	p−value
HR/B	146	146	0.0203	0.605
HR/WC	56	51	−0.2440	0.038



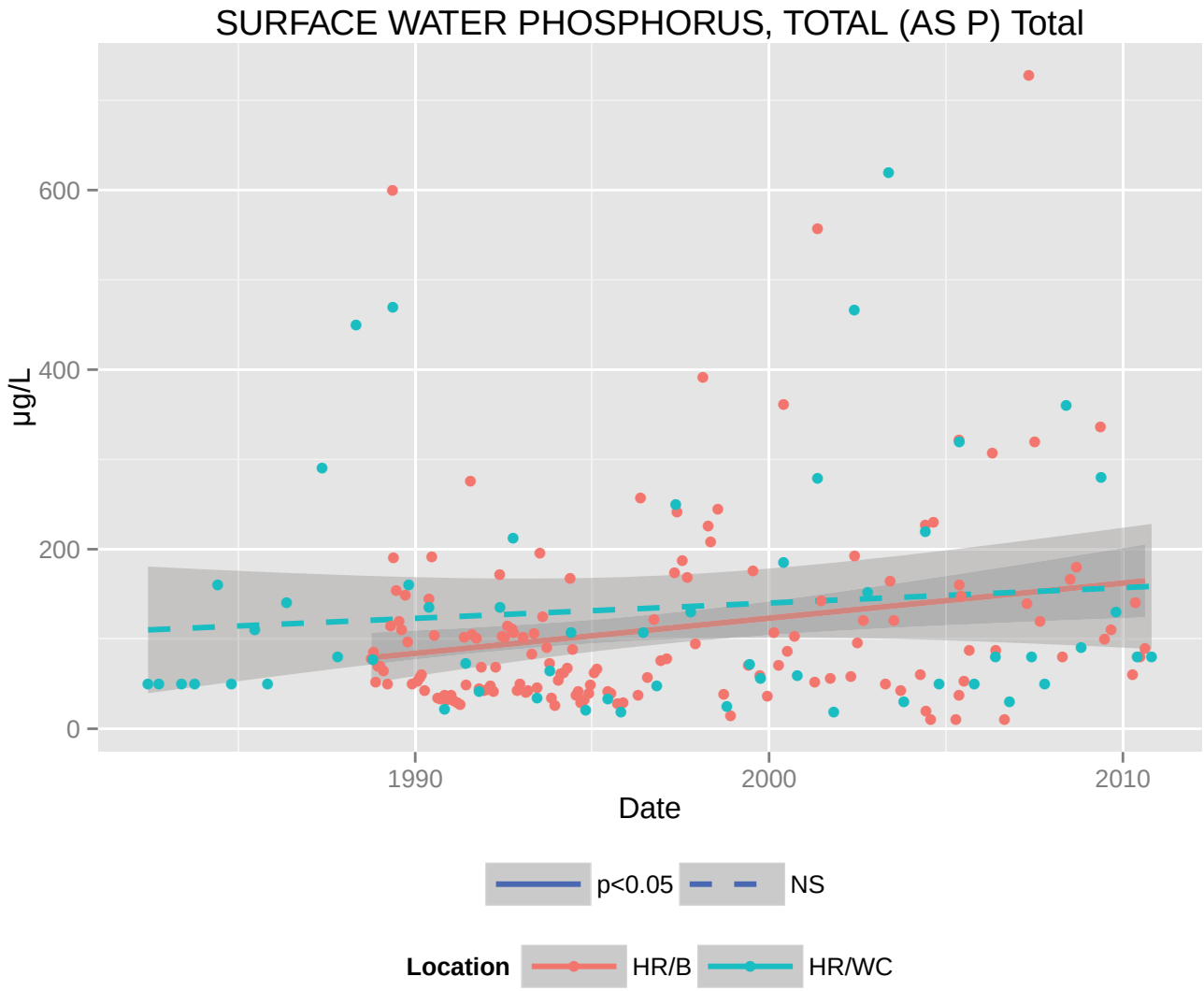
Location	n	Detects	Slope	p−value
HR/WC	9	9	−83.2	0.0463



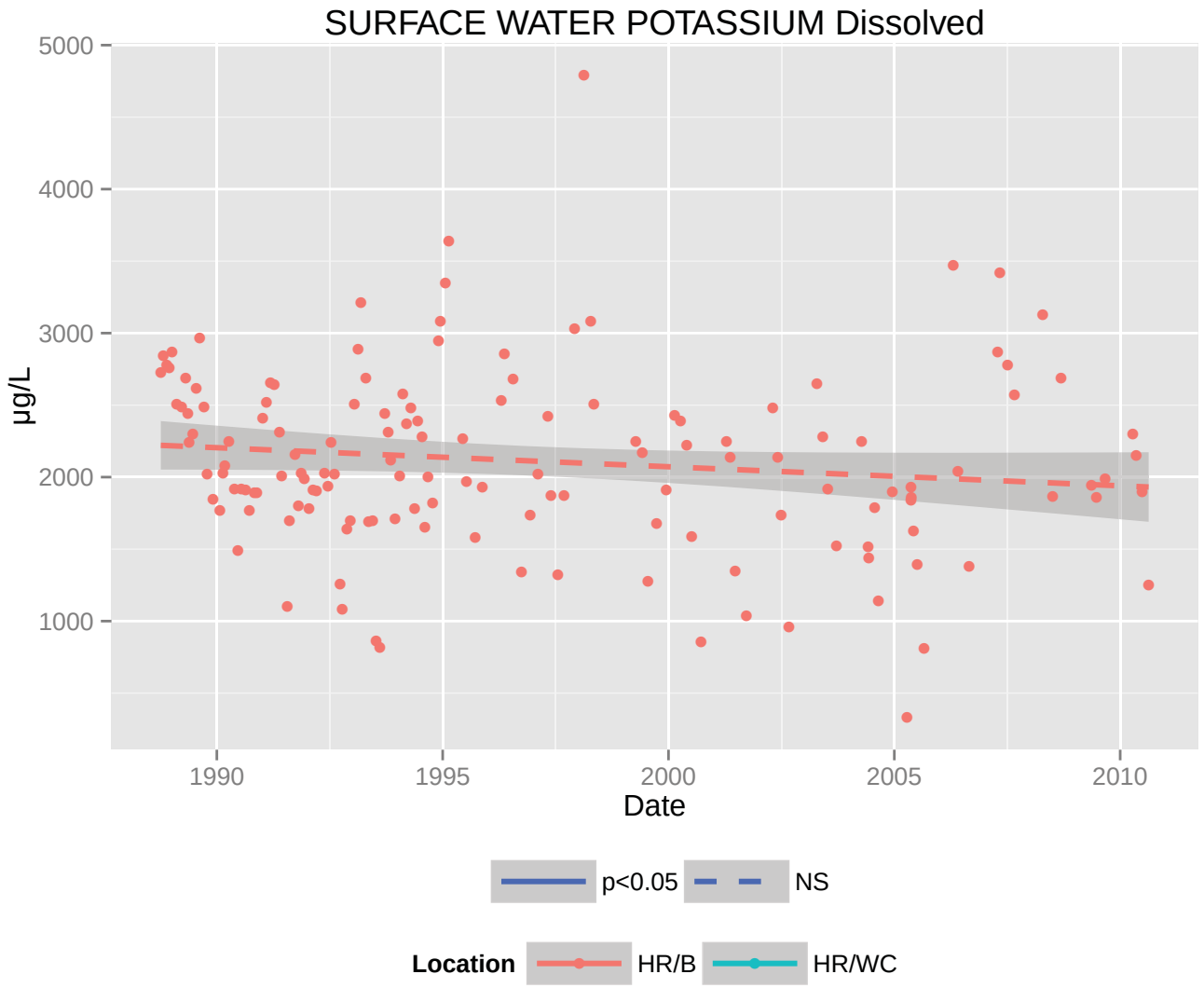
Location	n	Detects	Slope	p−value
HR/B	109	97	18.7	0.0259



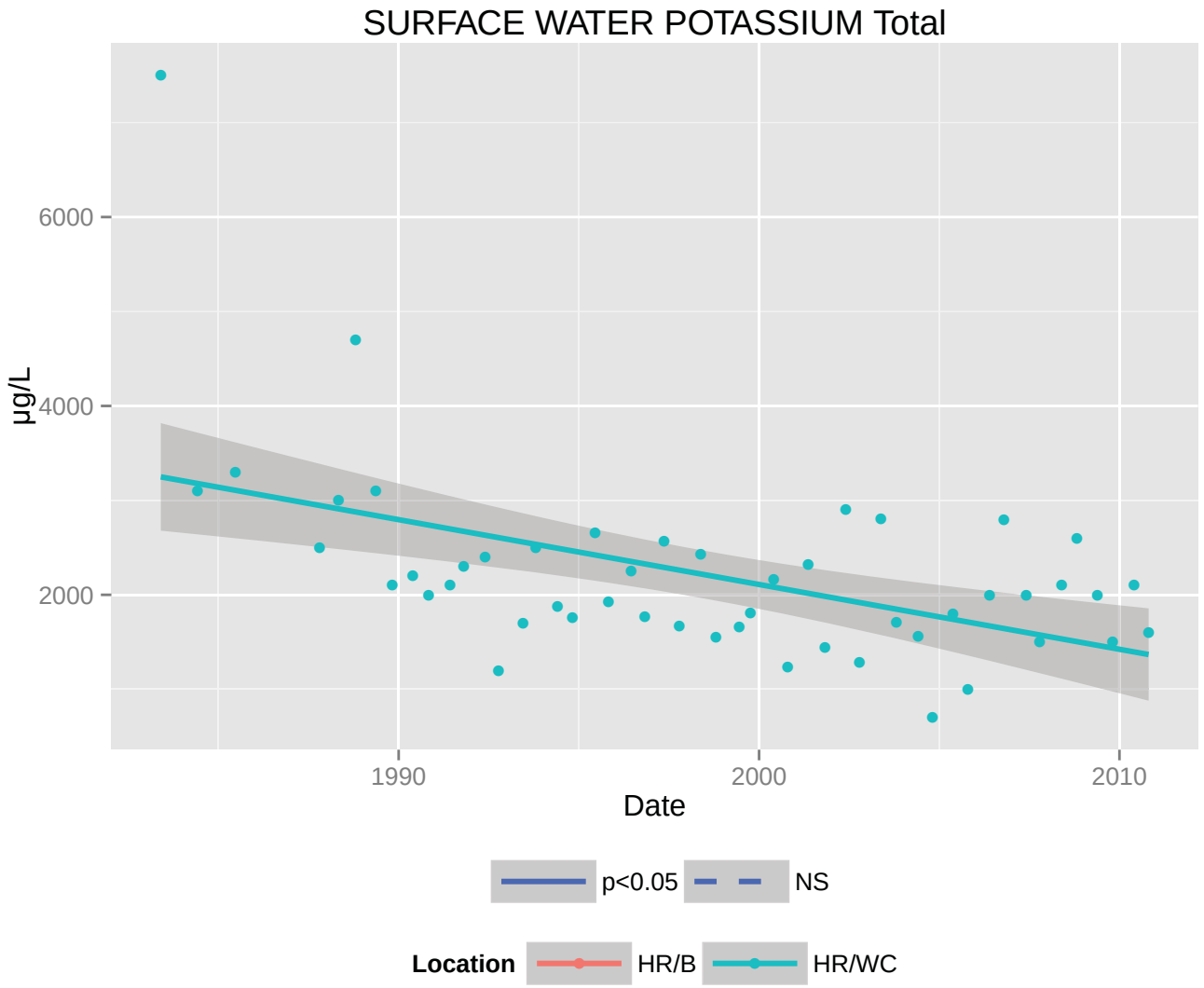
Location	n	Detects	Slope	p−value
HR/B	150	150	0.01060	0.0309
HR/WC	57	57	0.00972	0.0145



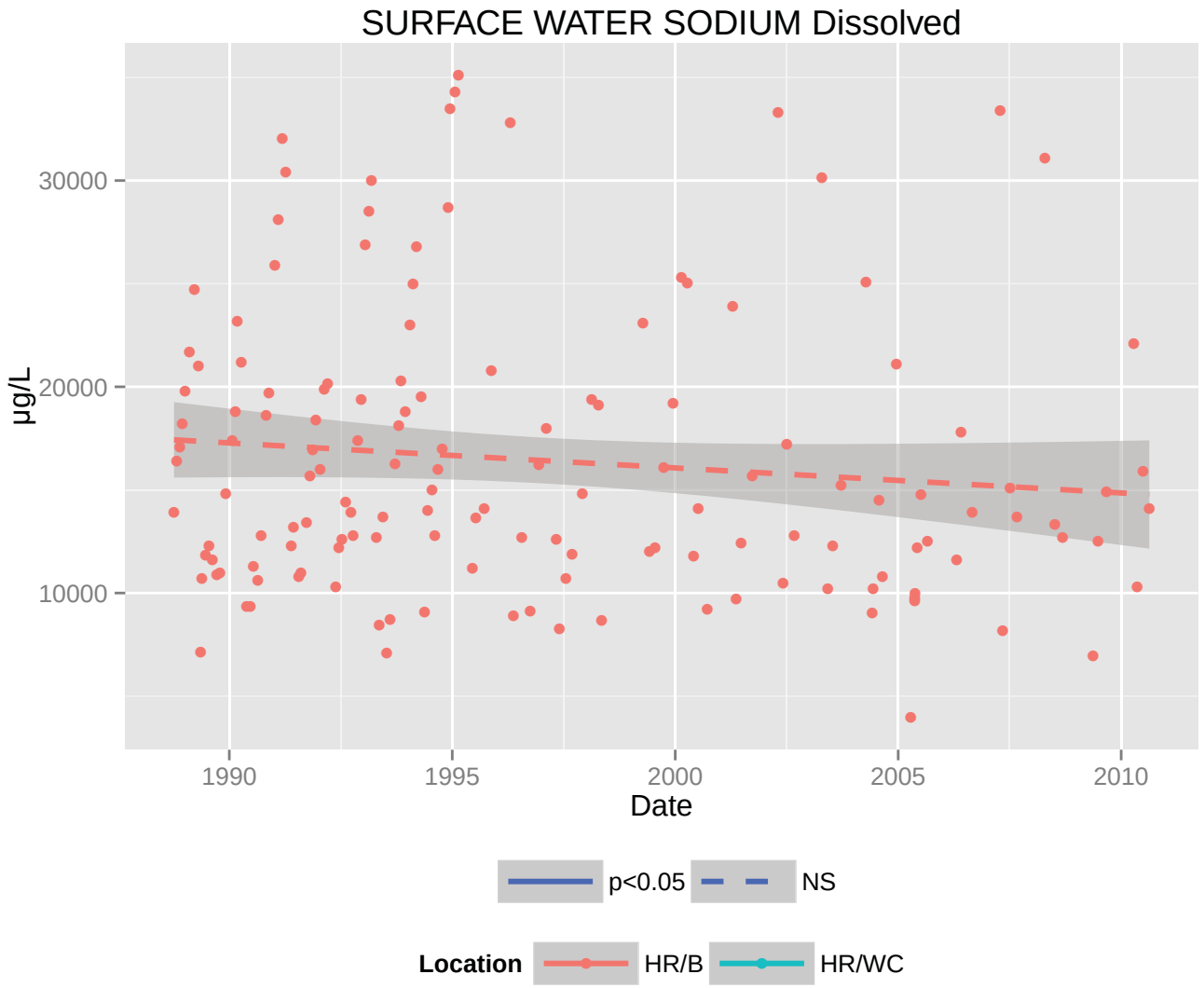
Location	n	Detects	Slope	p−value
HR/B	148	147	3.91	0.00485
HR/WC	56	50	1.71	0.42400



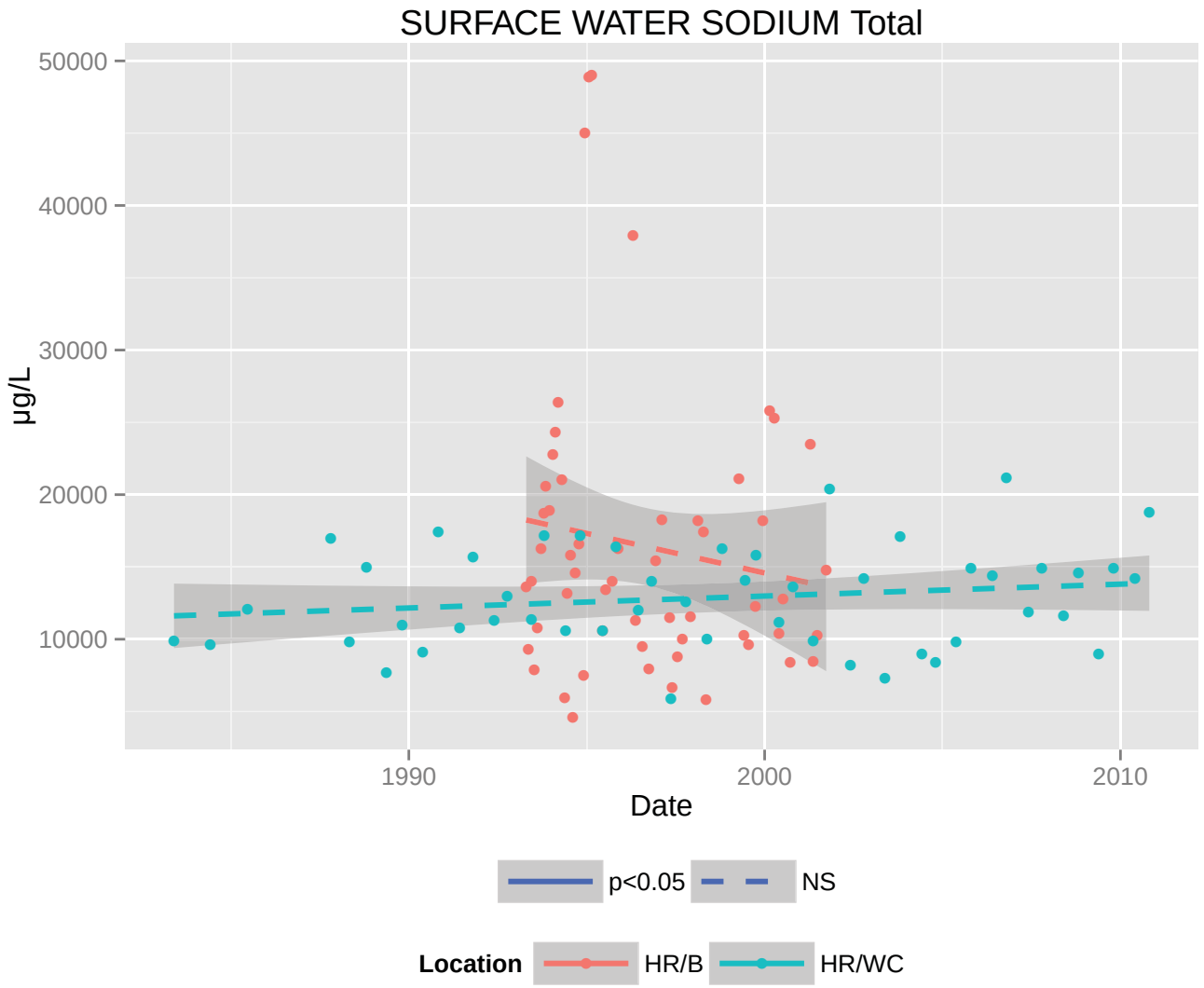
Location	n	Detects	Slope	p−value
HR/B	146	146	−13.2	0.107



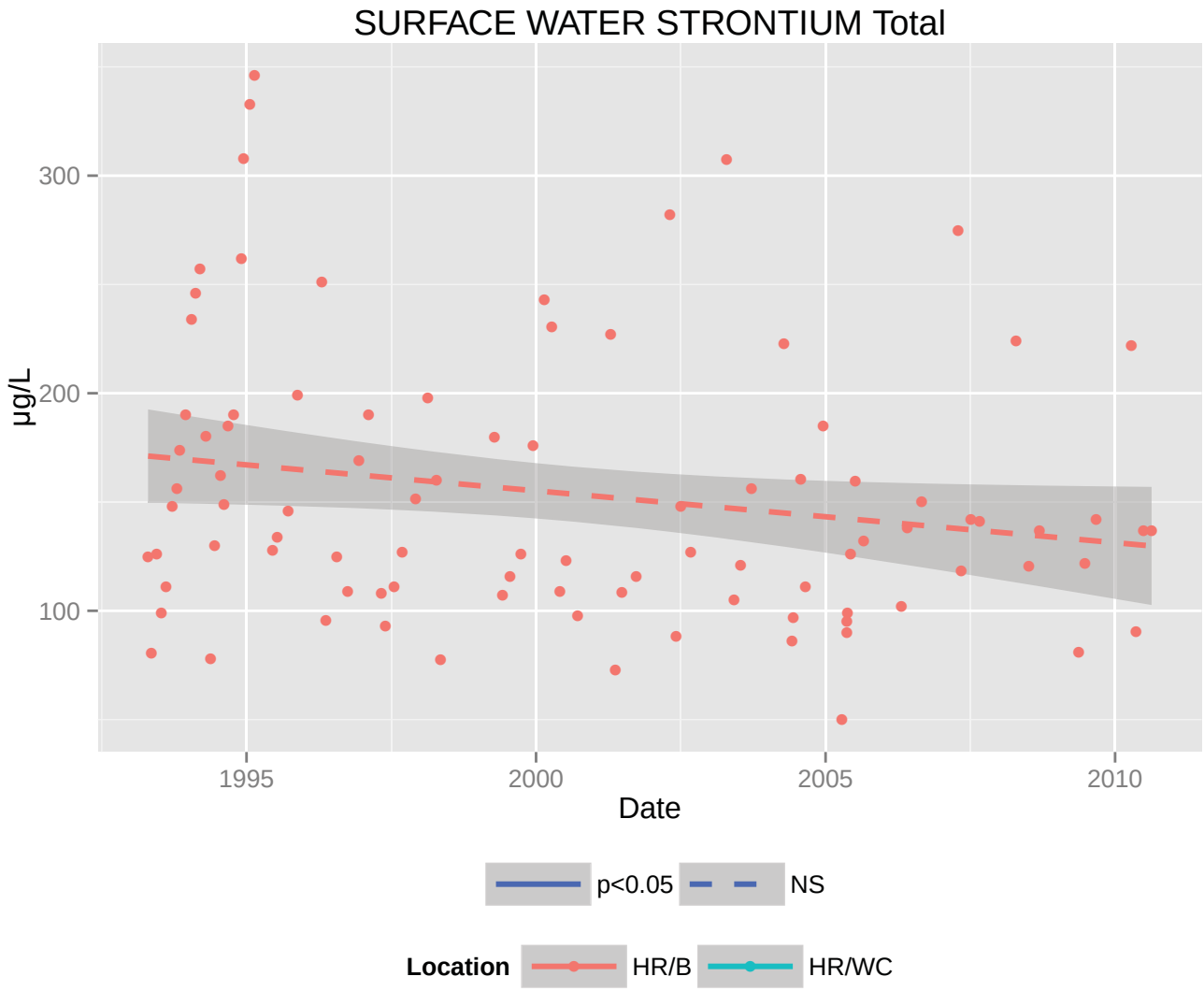
Location	n	Detects	Slope	p−value
HR/WC	50	50	−68.6	0.000172



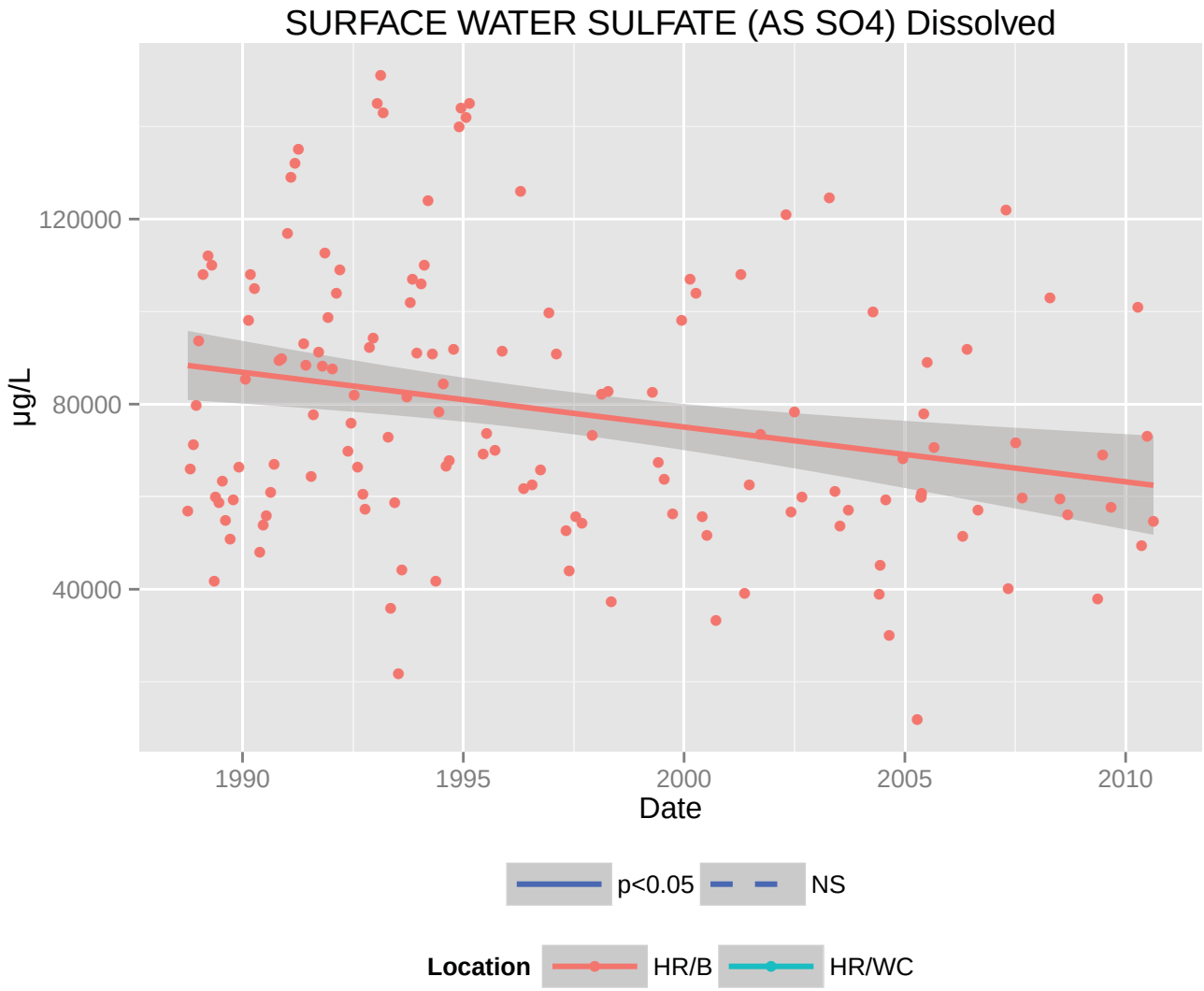
Location	n	Detects	Slope	p−value
HR/B	146	146	−121	0.174



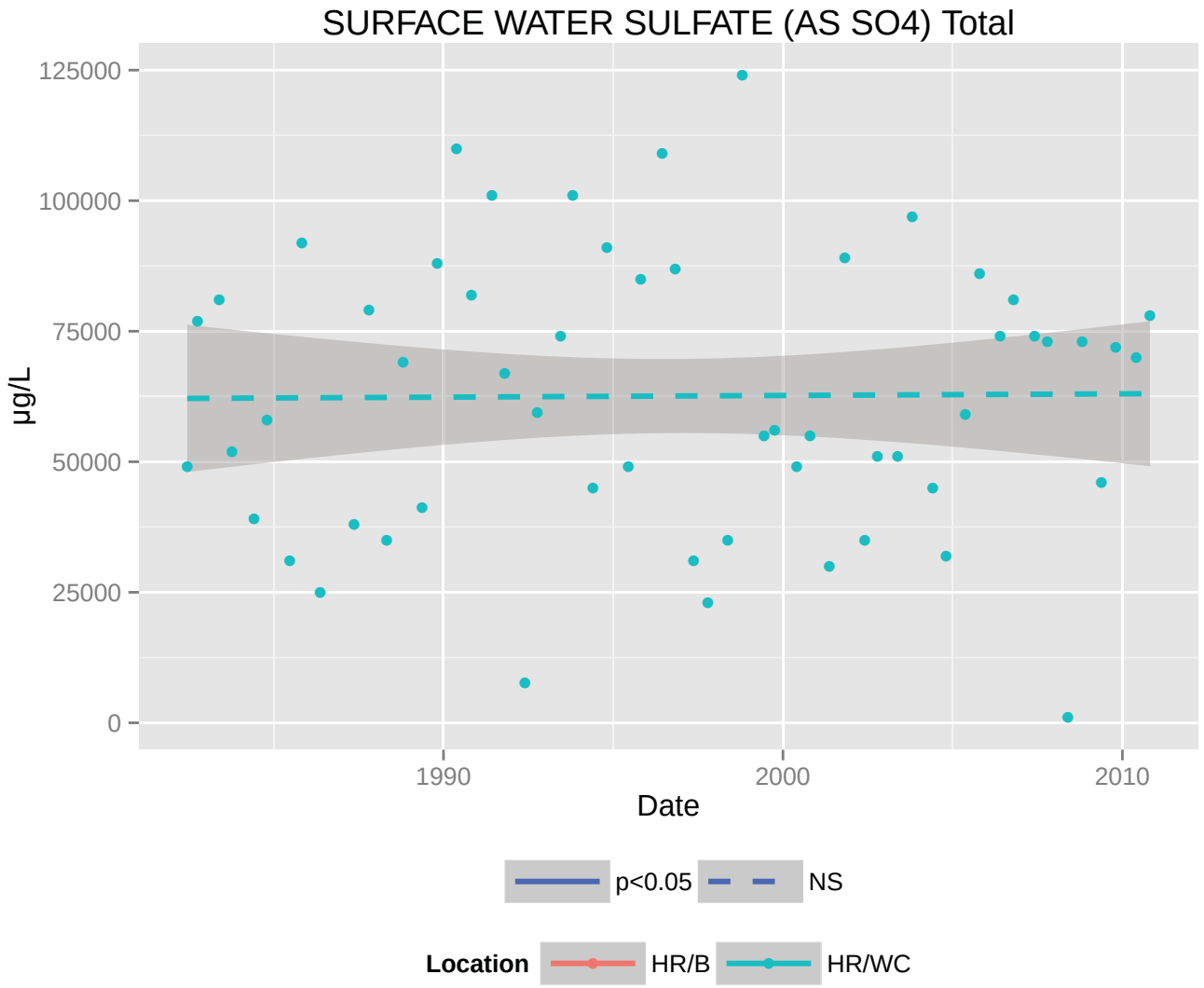
Location	n	Detects	Slope	p−value
HR/B	55	55	−548.0	0.292
HR/WC	50	50	82.4	0.217



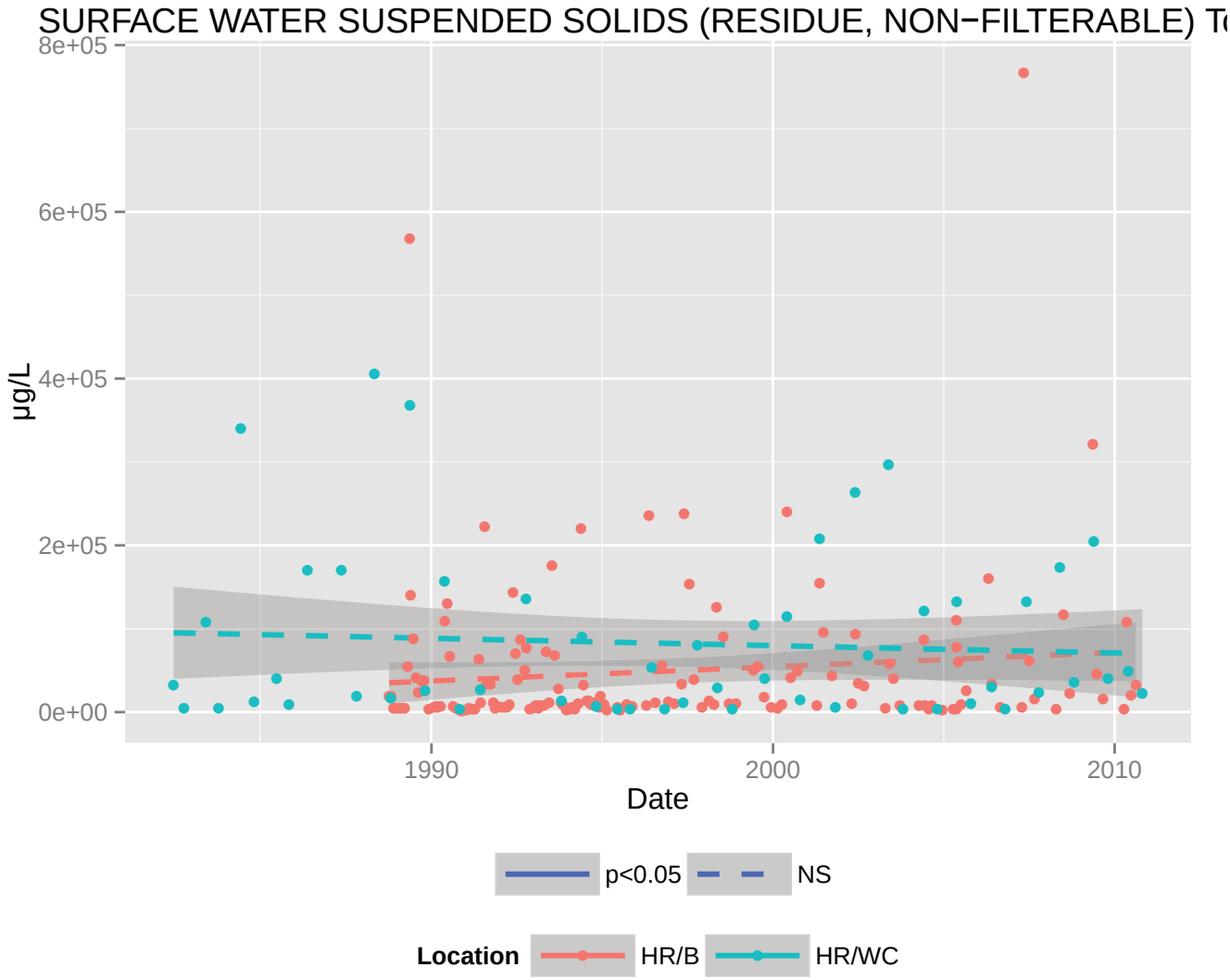
Location	n	Detects	Slope	p−value
HR/B	93	93	−2.38	0.0501



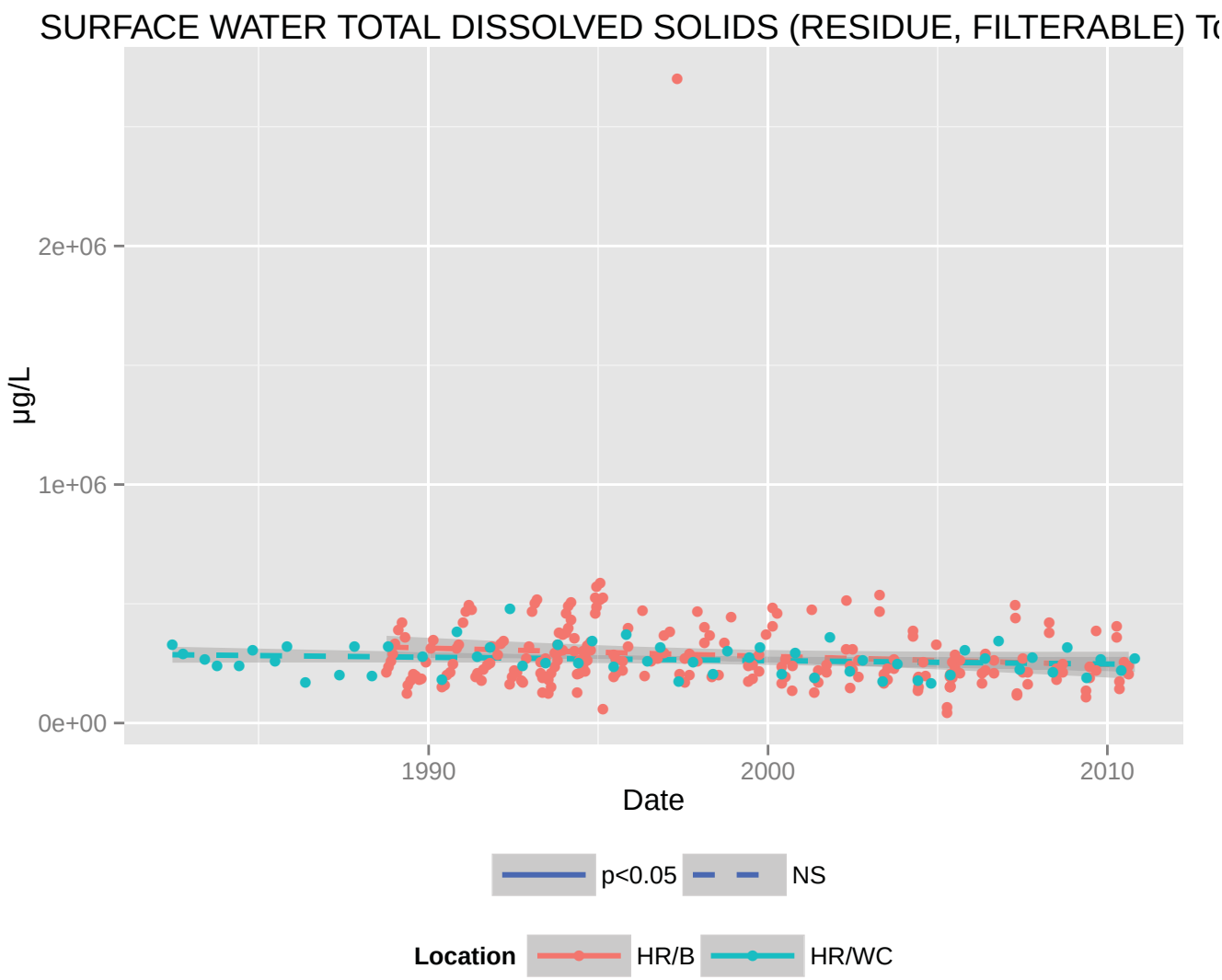
Location	n	Detects	Slope	p−value
HR/B	146	146	−1180	0.00133



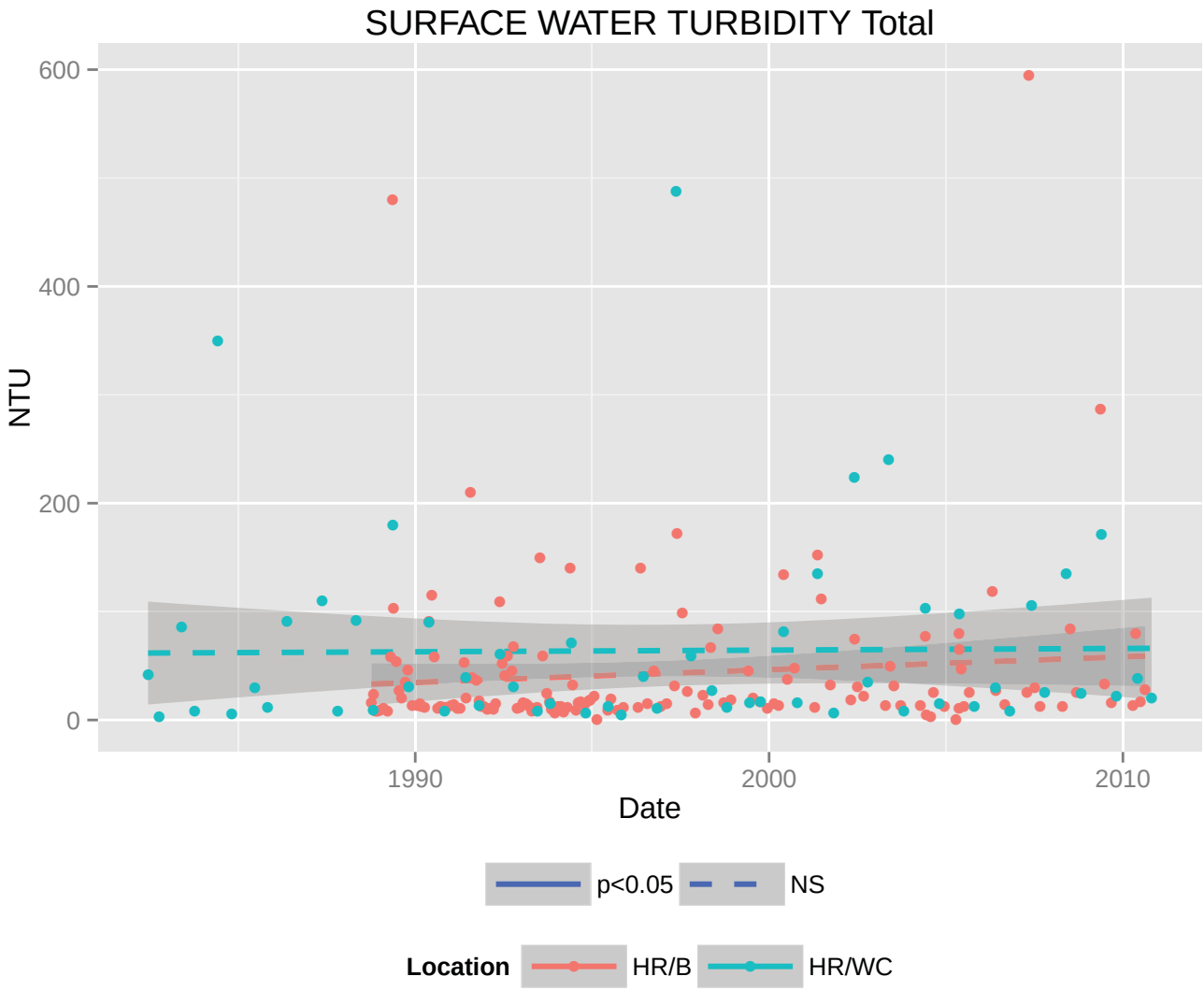
Location	n	Detects	Slope	p−value
HR/WC	57	56	31.7	0.941



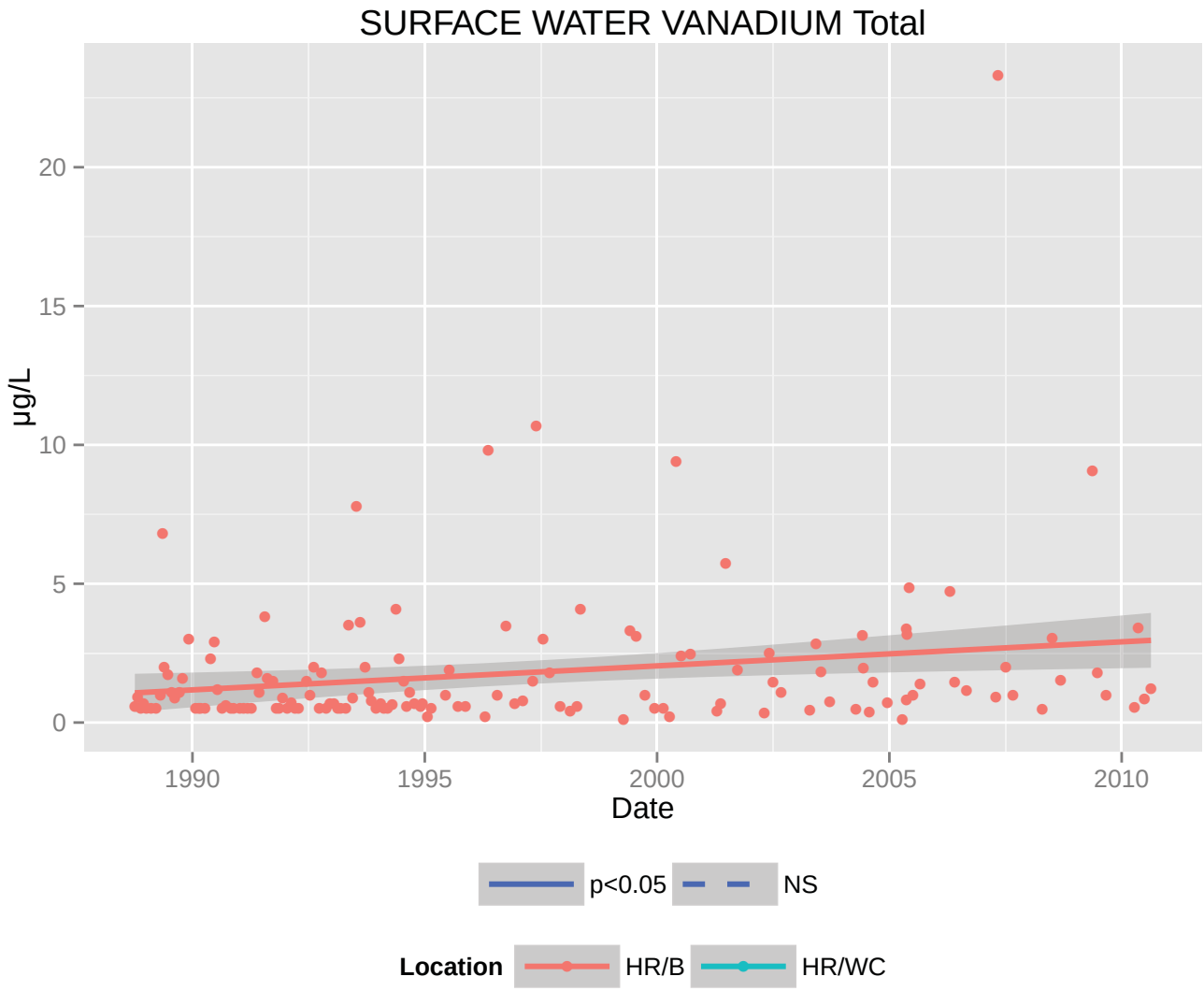
Location	n	Detects	Slope	p−value
HR/B	149	139	1710	0.161
HR/WC	54	49	−876	0.594



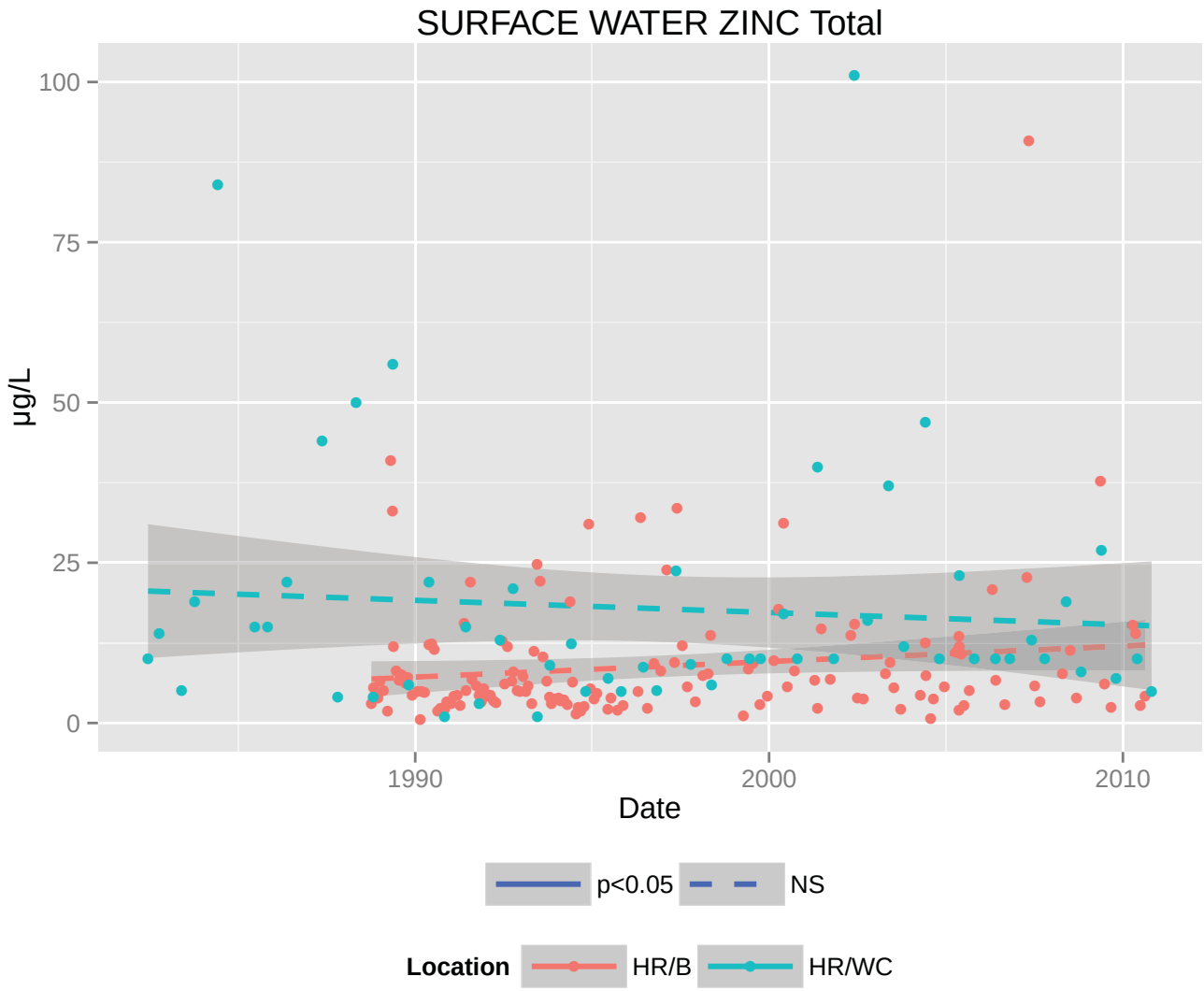
Location	n	Detects	Slope	p−value
HR/B	223	223	−3460	0.0968
HR/WC	56	56	−1410	0.1640



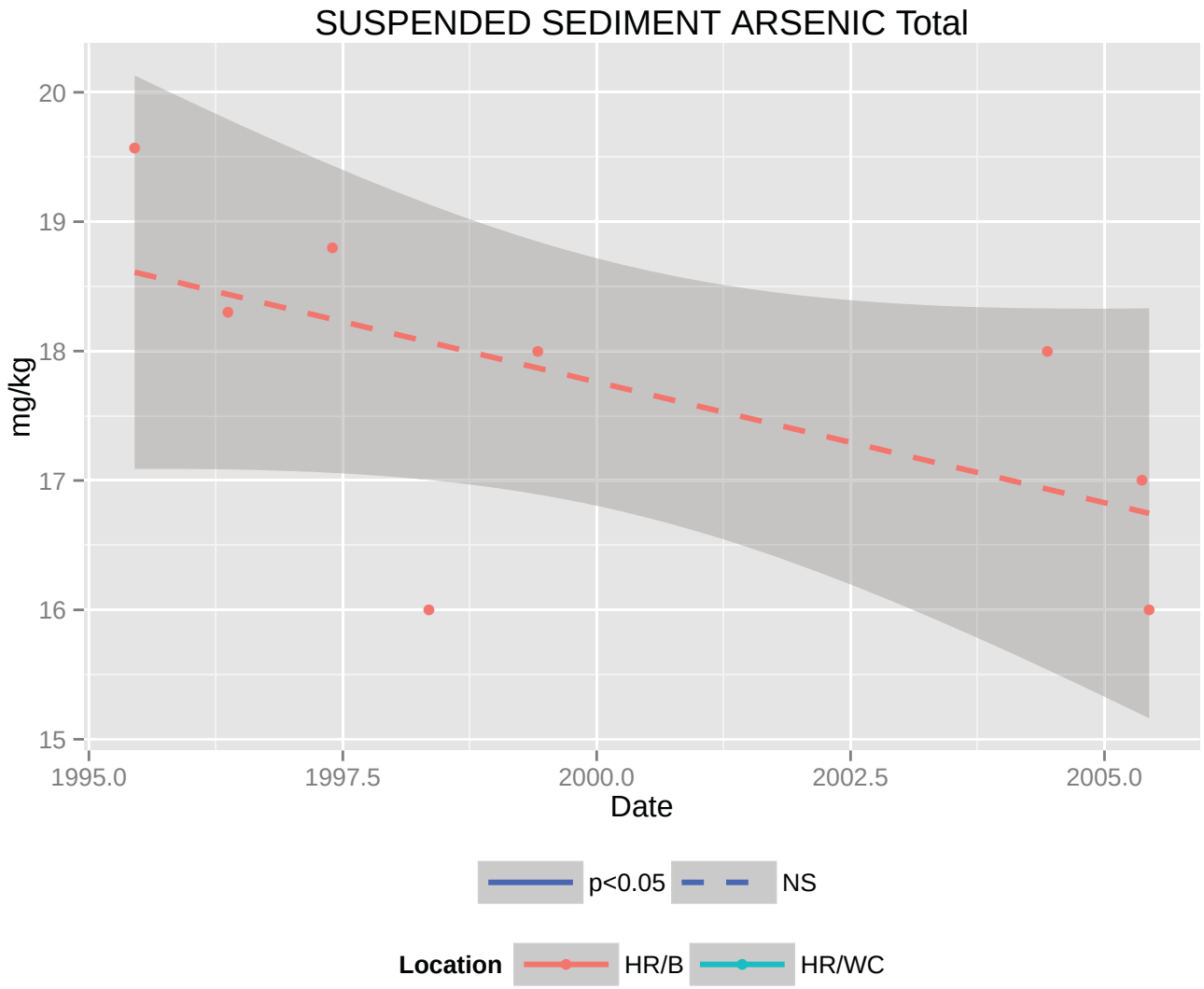
Location	n	Detects	Slope	p−value
HR/B	149	149	1.180	0.212
HR/WC	57	57	0.153	0.915



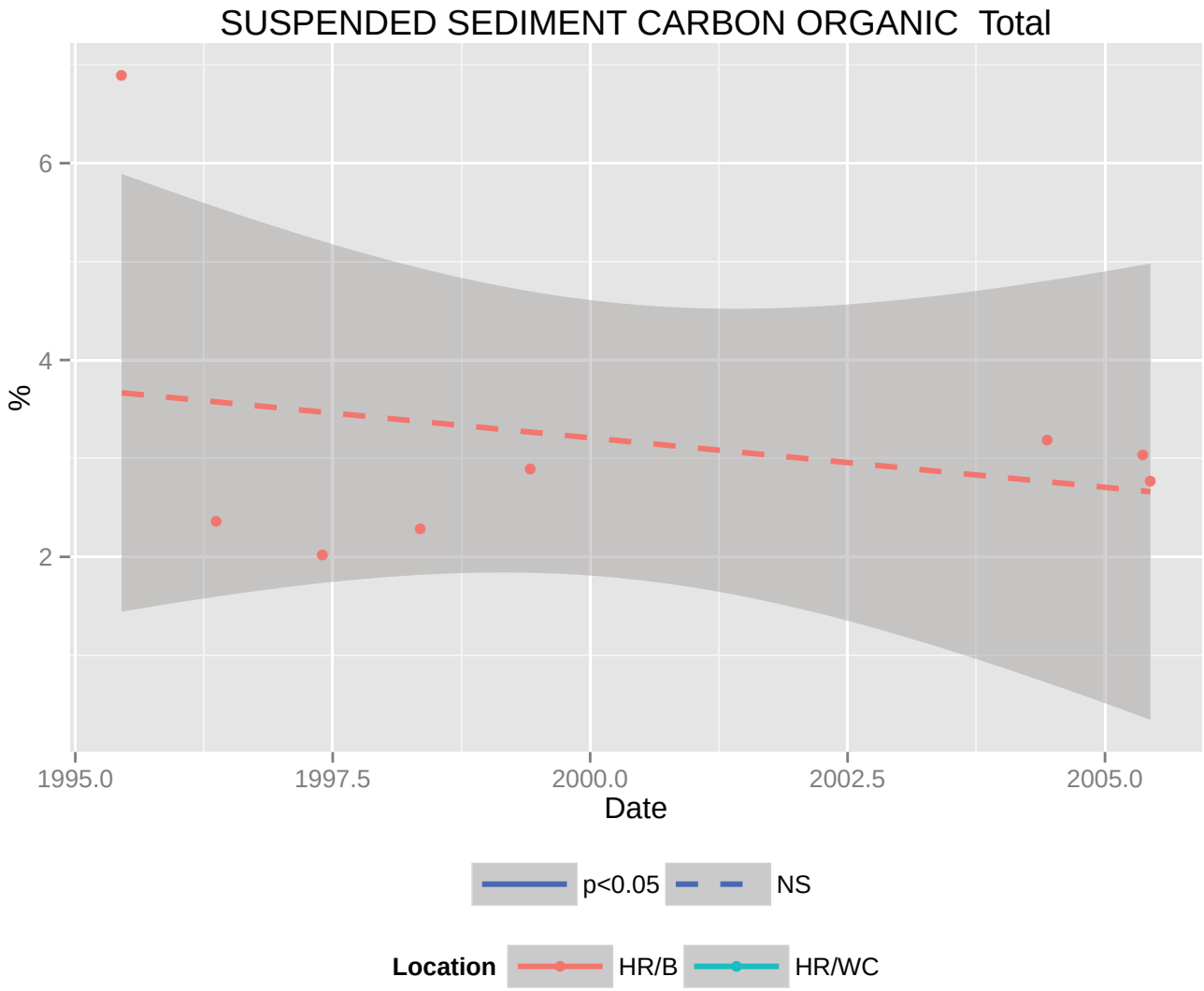
Location	n	Detects	Slope	p−value
HR/B	146	125	0.0865	0.0104



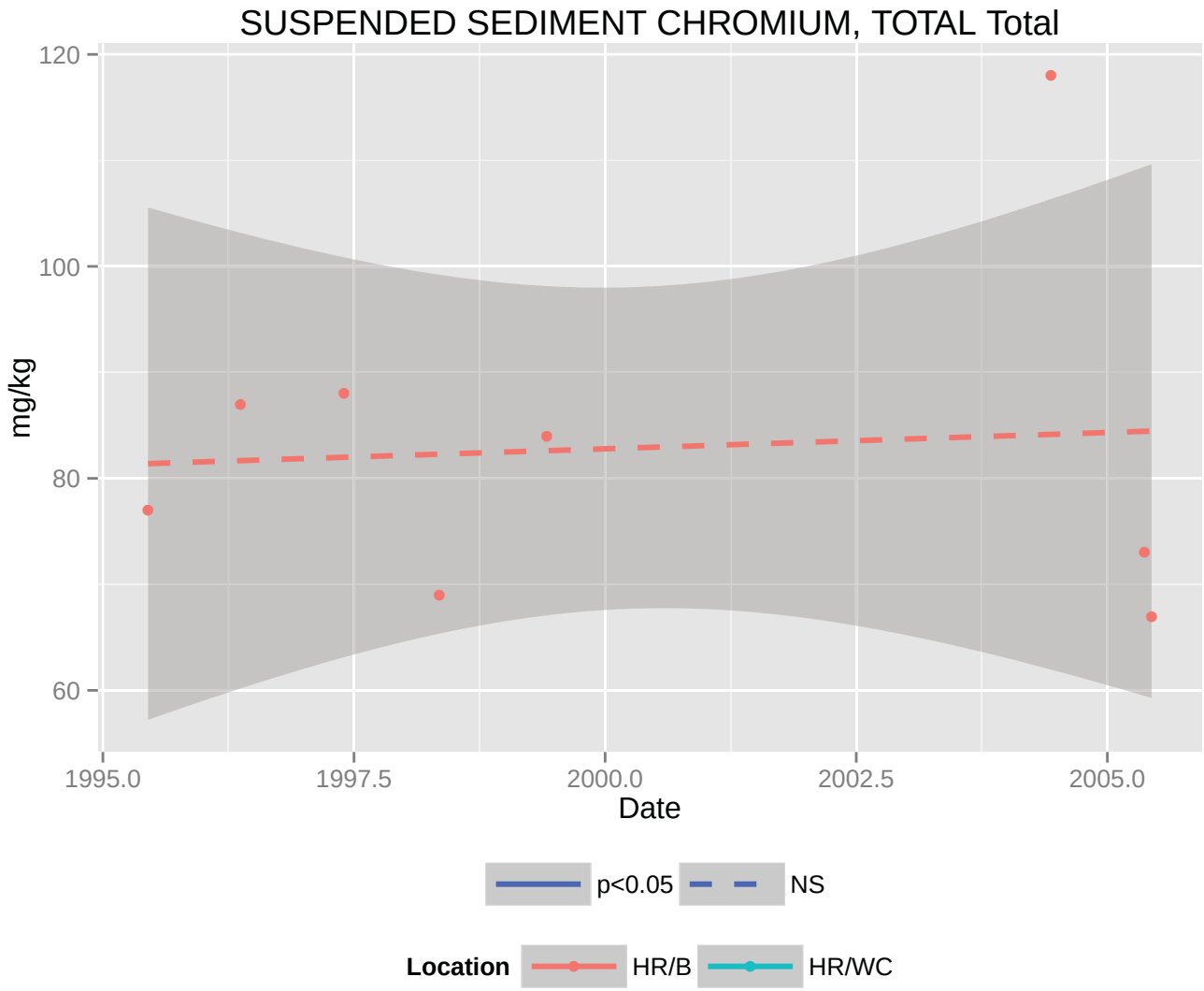
Location	n	Detects	Slope	p−value
HR/B	146	146	0.242	0.0724
HR/WC	56	40	−0.191	0.5430



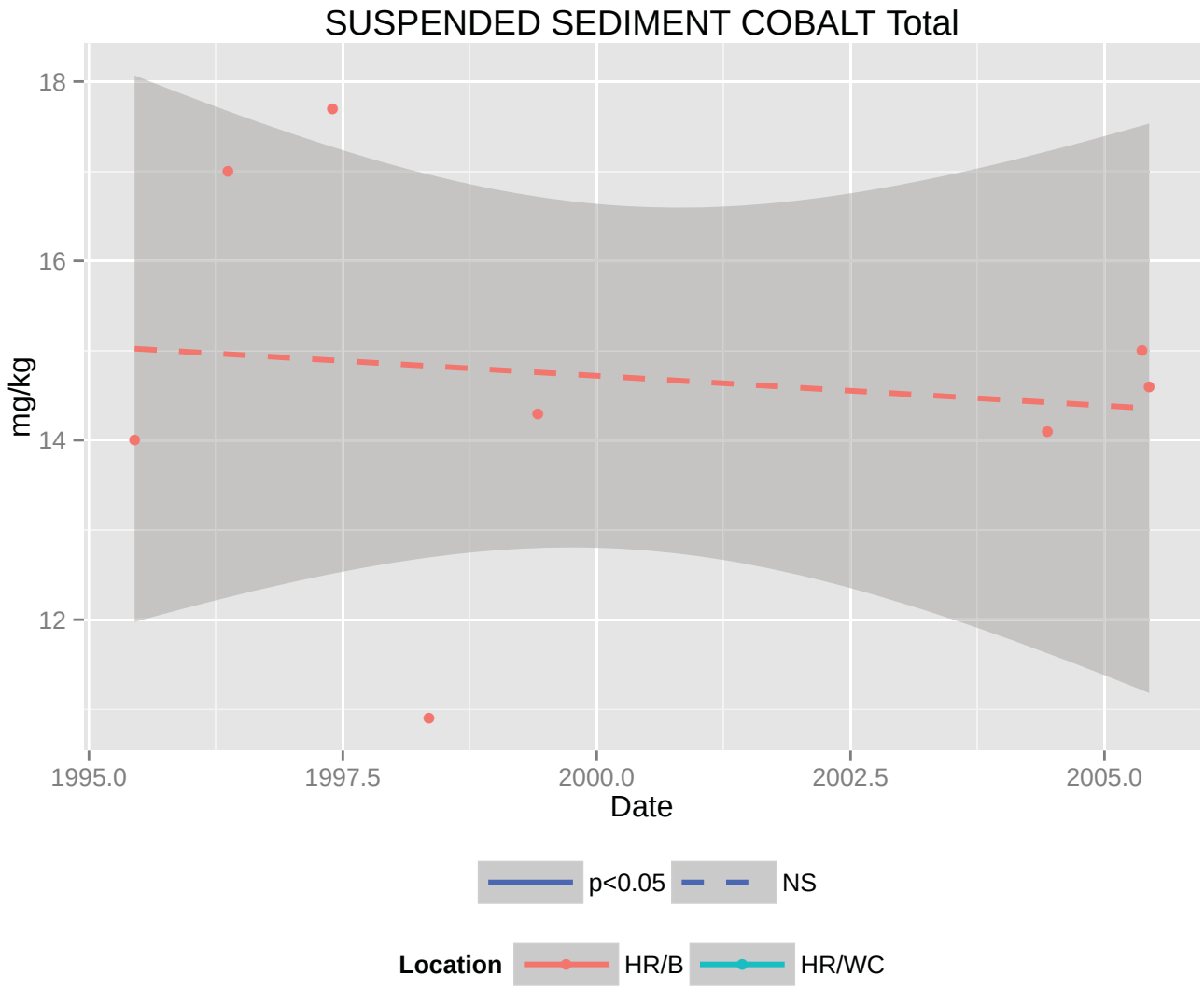
Location	n	Detects	Slope	p−value
HR/B	8	8	−0.187	0.112



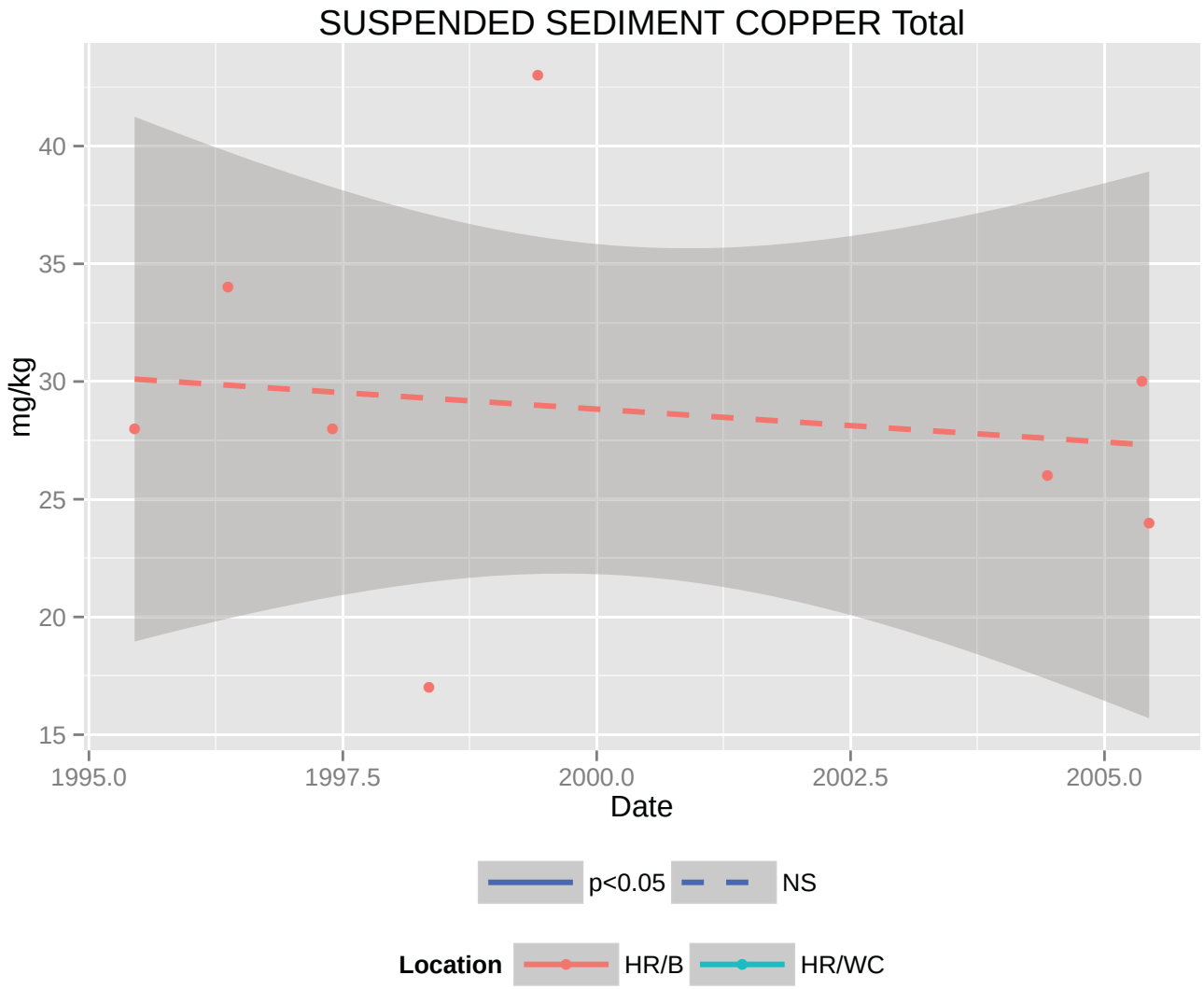
Location	n	Detects	Slope	p−value
HR/B	8	8	−0.101	0.518



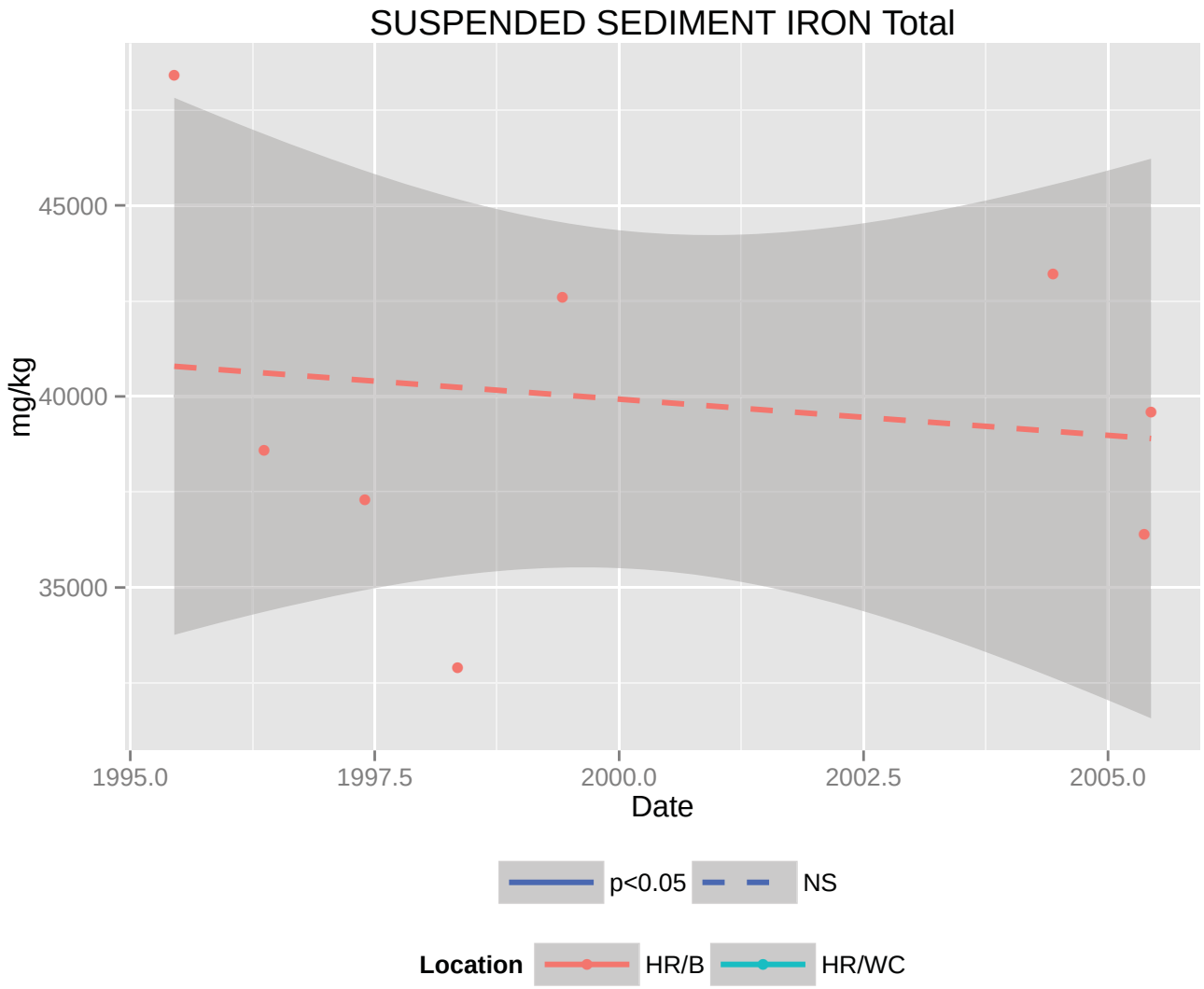
Location	n	Detects	Slope	p−value
HR/B	8	8	0.307	0.853



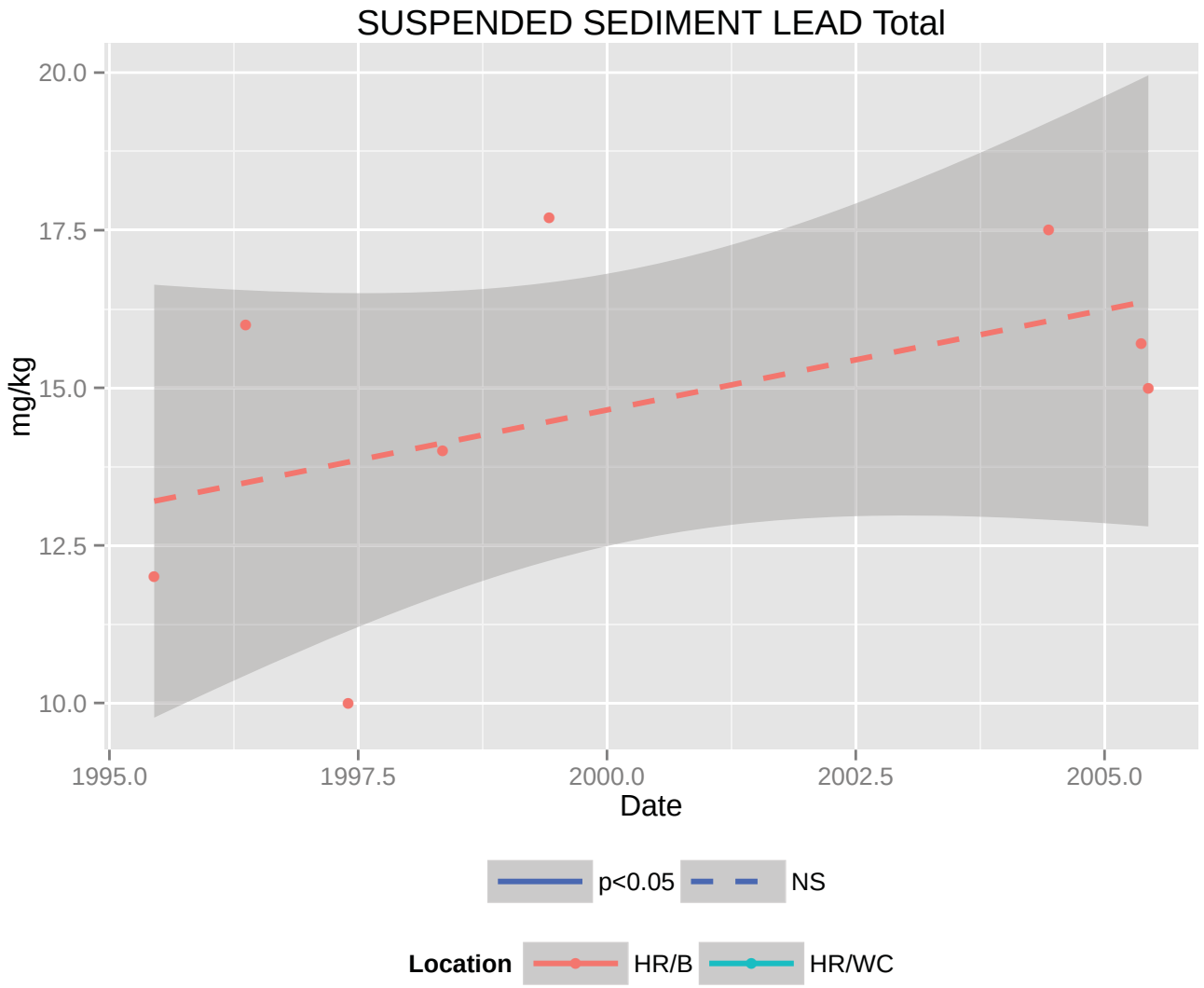
Location	n	Detects	Slope	p−value
HR/B	8	8	−0.0665	0.752



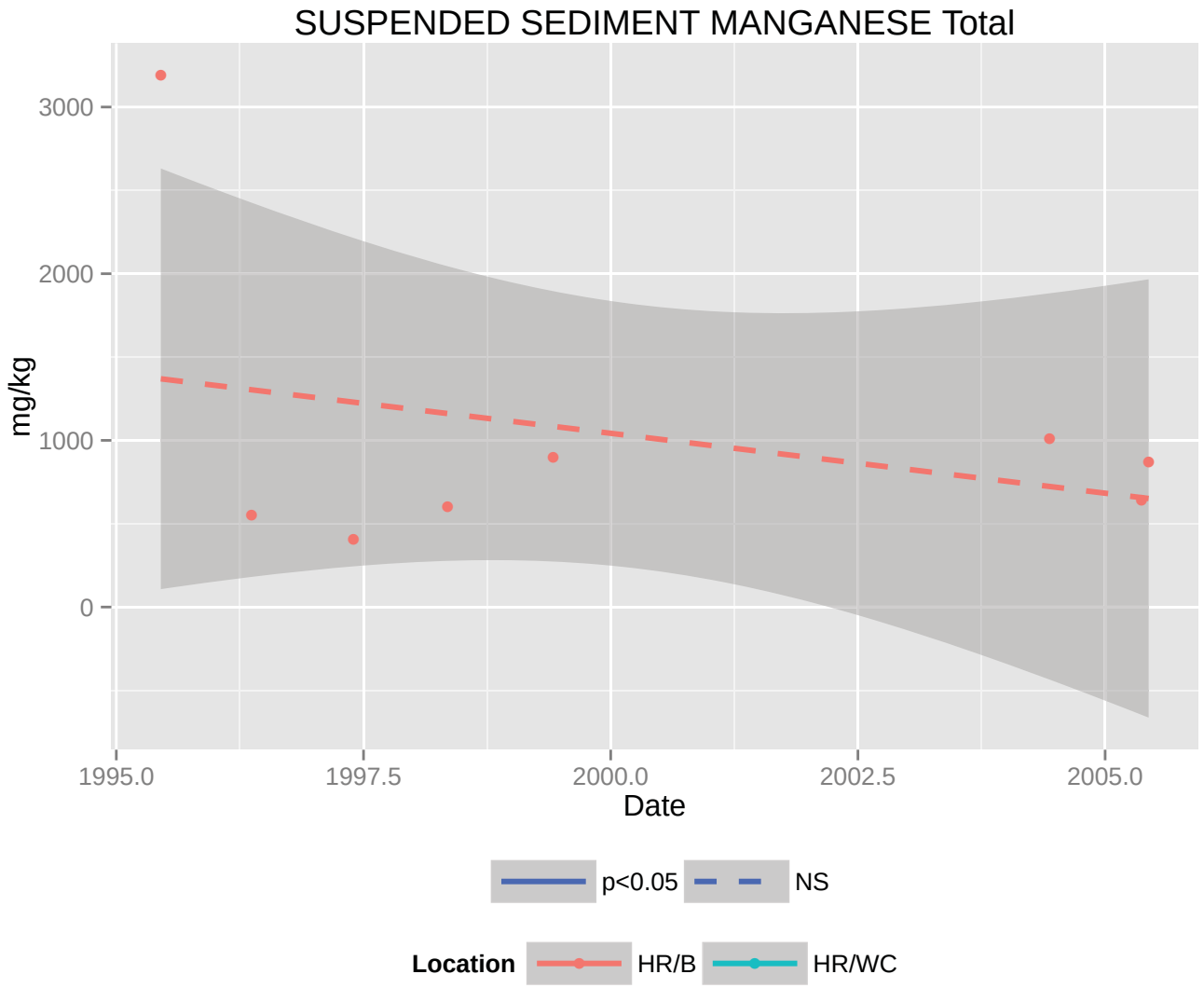
Location	n	Detects	Slope	p−value
HR/B	8	8	−0.28	0.716



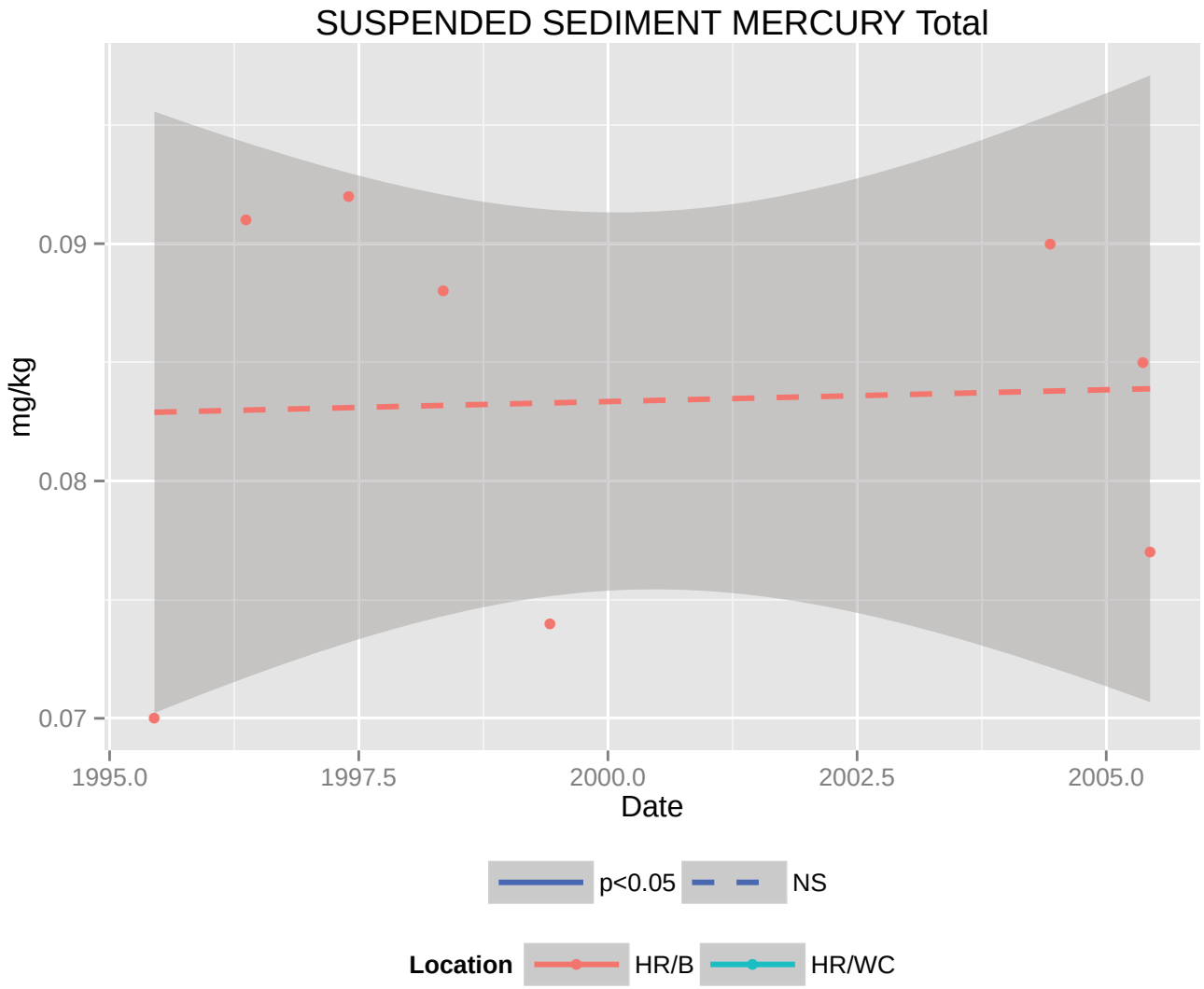
Location	n	Detects	Slope	p−value
HR/B	8	8	−189	0.697



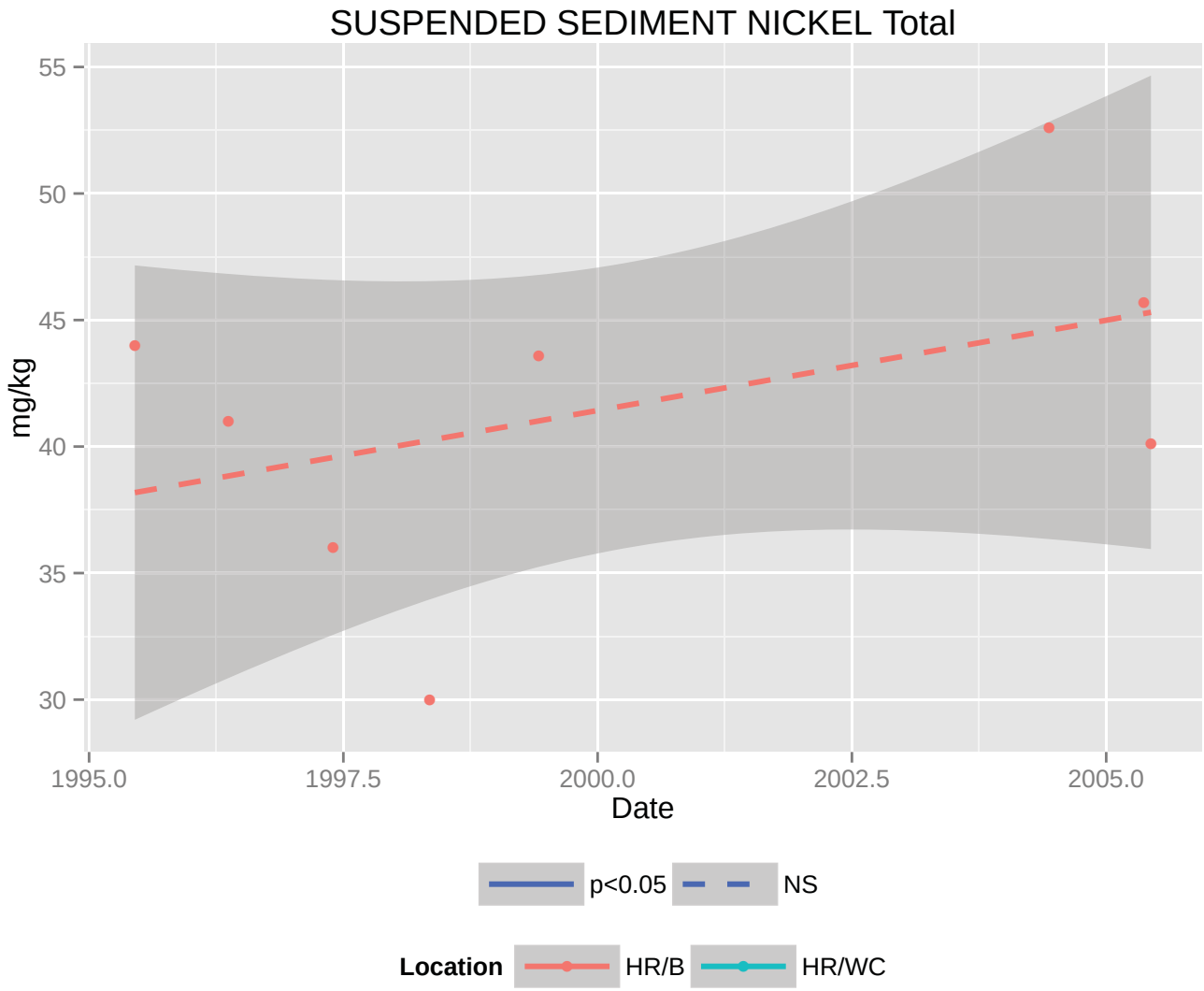
Location	n	Detects	Slope	p−value
HR/B	8	8	0.318	0.209



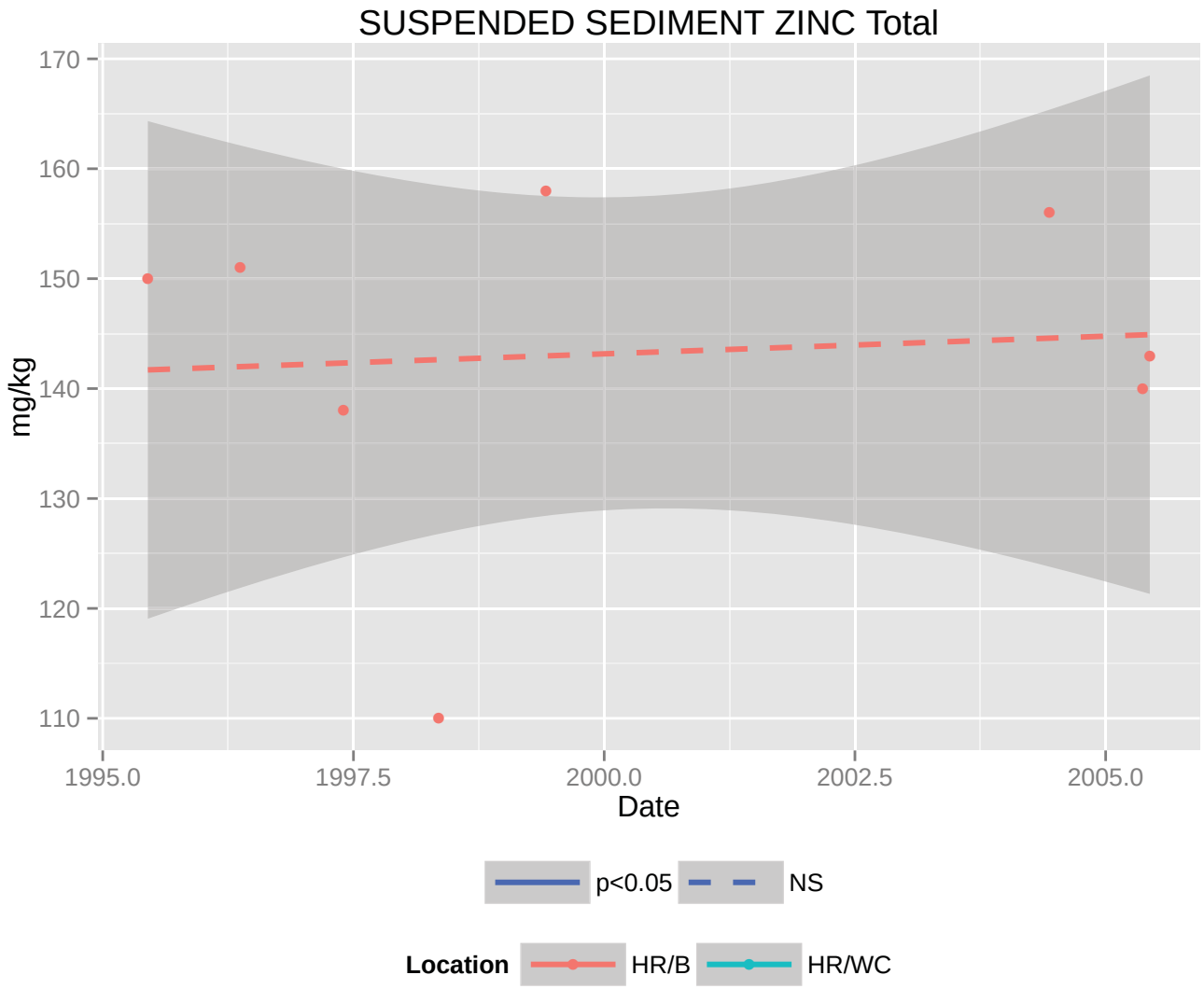
Location	n	Detects	Slope	p−value
HR/B	8	8	−71.9	0.421



Location	n	Detects	Slope	p−value
HR/B	8	8	9.92e−05	0.909



Location	n	Detects	Slope	p−value
HR/B	8	8	0.713	0.273



Location	n	Detects	Slope	p−value
HR/B	8	8	0.321	0.837