

G-2

MDEQ Limnological Study of Streams  
in the Vicinity of the Eagle Project

**PROJECT REPORT**  
**Project Number 04-02**

**Baseline Limnological Studies of Streams in the Vicinity of  
a Proposed Sulfide Mine in Marquette County, Michigan**



**Prepared for:**

Michigan Department of Environmental Quality  
Water Division (MDEQ-WD)  
Technical Contact: William Taft

**Prepared by:**

White Water Associates, Inc.  
Contact: Dean B. Premo, Ph.D., President  
and  
Great Lakes Environmental Center (Prime Contractor)  
Contacts: Mick DeGraeve/Dennis McCauley  
**Contract number:** 071B1001643

**Date:** March 23, 2005

---

**PROJECT REPORT**  
**Project Number 04-02**

**Baseline Limnological Studies of Streams in the Vicinity of  
a Proposed Sulfide Mine in Marquette County, Michigan**

**Prepared for:**

Michigan Department of Environmental Quality  
Water Division (MDEQ-WD)  
Technical Contact: William Taft  
PO Box 30273  
Lansing, MI 48909-7773  
Phone: 517-335-4205, Fax 517-373-9958  
E-mail: taftw@michigan.gov

**Prepared by:**

White Water Associates, Inc.  
Contact: Dean B. Premo, Ph.D., President  
429 River Lane  
Amasa, Michigan 49903  
Phone: (906) 822-7889  
Fax: (906) 822-7977  
E-mail: whitewtr@up.net

**and**

Great Lakes Environmental Center (Prime Contractor)  
Contacts: Mick DeGraeve/Dennis McCauley  
739 Hastings Street  
Traverse City, MI 49686  
Phone: (231) 941-2230  
Fax: (231) 941-2240  
**Contract number:** 071B1001643

**Date:** March 23, 2005

---

**PROJECT REPORT**  
**Project Number 04-02**

**Baseline Limnological Studies of Streams in the Vicinity of  
a Proposed Sulfide Mine in Marquette County, Michigan**

Fieldwork:

Dean Premo, White Water Associates, Inc.  
David Tiller, White Water Associates, Inc.  
Kari Divine, White Water Associates, Inc.  
James Bond, White Water Associates, Inc.  
Ryan White, White Water Associates, Inc.  
William Taft, Michigan Department of Environmental Quality  
Kay Edly, Michigan Department of Environmental Quality  
Edward Baker, Michigan Department of Natural Resources

Laboratory Analyses:

Michigan Department of Environmental  
Quality Environmental Laboratory  
White Water Associates Laboratory  
Wisconsin State Laboratory of Hygiene  
PhycoTech, Inc.  
TriMatrix Laboratories, Inc.

Data and Report:

Dean Premo, Ph.D., Senior Ecologist  
Kent Premo, M.S., Technical Support Scientist  
Bette Premo, Ph.D., Limnologist

Cite as:

Premo, Dean, Kent Premo, and Bette Premo. 2005. Baseline  
Limnological Studies of Streams in the Vicinity of a Proposed  
Sulfide Mine in Marquette County, Michigan. White Water  
Associates, Inc. Report: MI/DEQ/WB-05/029.

---

---

## TABLE OF CONTENTS

|                                                  |    |
|--------------------------------------------------|----|
| INTRODUCTION .....                               | 1  |
| STUDY AREA .....                                 | 2  |
| METHODS .....                                    | 6  |
| Streamside Measurements .....                    | 6  |
| Water and Sediment Chemistry .....               | 8  |
| Fish Community Study.....                        | 9  |
| Aquatic Macroinvertebrate and Habitat Study..... | 10 |
| Macrophyte Community Observations .....          | 10 |
| Periphyton Community Study .....                 | 11 |
| RESULTS .....                                    | 12 |
| Streamside Measurements .....                    | 12 |
| Water and Sediment Chemistry .....               | 14 |
| Fish Community Study.....                        | 16 |
| Aquatic Macroinvertebrate and Habitat Study..... | 18 |
| Macrophyte Community Observations .....          | 19 |
| Periphyton Community Study .....                 | 19 |
| LITERATURE CITED .....                           | 22 |
| APPENDIX A – Exhibits (Maps & Photos)            |    |
| APPENDIX B – Tables                              |    |
| APPENDIX C – Figures                             |    |
| APPENDIX D – Laboratory Reports                  |    |
| APPENDIX E – Periphyton Report                   |    |

---

---

## **Contents of Appendix A**

### **Exhibits (Maps & Photos)**

- Exhibit 1. Map Of The Study Landscape, Study Streams, and Sampling Stations
  - Exhibit 2. Topographic Map Showing Sampling Stations 1 and 6
  - Exhibit 3. Topographic Map Showing Sampling Stations 2, 4, and 7
  - Exhibit 4. Topographic Map Showing Sampling Station 3
  - Exhibit 5. Topographic Map Showing Sampling Station 5
  - Exhibit 6. Photographs of the Yellow Dog River at Station 1
  - Exhibit 7. Photographs of the Yellow Dog River at Station 2
  - Exhibit 8. Photographs of the Salmon Trout River at Station 3
  - Exhibit 9. Photographs of the Salmon Trout River at Station 4
  - Exhibit 10. Photographs of the Cedar Creek at Station 5
  - Exhibit 11. Photographs of the Big Pup Creek at Station 6
  - Exhibit 12. Photographs of the Salmon Trout River at Station 7
-

---

## **Contents of Appendix B**

### **Tables**

|           |                                                                                                                                           |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Table 1.  | Location Description for Each of Seven Sampling Stations                                                                                  |
| Table 2.  | Analytical Chemistry Conducted for 2004 Baseline Limnological Study                                                                       |
| Table 3.  | Discharge and Stage Height by Date for Sampling Stations 1–6 in 2004                                                                      |
| Table 4.  | Yield for Sampling Stations 1–7 in 2004.                                                                                                  |
| Table 5.  | History of pH Recorded at Sampling Stations During 2004                                                                                   |
| Table 6.  | Specific Conductance Recorded at Sampling Stations During 2004                                                                            |
| Table 7.  | Dissolved Oxygen Recorded at Sampling Stations During 2004                                                                                |
| Table 8.  | Comparison Between NIST Thermometer Reading and Optic Stowaway Temperature Reading Nearest in Time for Site Visits from June–October 2004 |
| Table 9.  | Summary Temperature Statistics for Stations 1–7                                                                                           |
| Table 10. | Summary of Stream Temperature Data by Station over the Entire Study Period                                                                |
| Table 11. | Water Chemistry Results for All Sampling Stations and Dates                                                                               |
| Table 12. | Low-Level Mercury Results in Monthly Water Samples from All Stations                                                                      |
| Table 13. | Low-Level Metals Results for September Sampling at All Stations                                                                           |
| Table 14. | Summary of Water Chemistry Results for All Sampling Stations                                                                              |
| Table 15. | Sediment Chemistry Results for All Stations During June and August 2004 Sampling                                                          |
| Table 16. | Comparison of Fish Populations in the Vicinity of Sampling Stations with Emphasis on Brook Trout                                          |
| Table 17. | Habitat Evaluations for Sampling Stations 1–6, June 14–16, 2004                                                                           |
| Table 18. | Qualitative Macroinvertebrate Sampling Results for Sampling Stations 1–6, June 14–16, 2004                                                |
| Table 19. | Taxonomic Summary for Qualitative Macroinvertebrate Sampling Results for Sampling Stations 1–6, June 14–16, 2004                          |
| Table 20. | Riparian (Ri), Aquatic (Aq), and Aquatic-Riparian (Aq-Ri) Plant Species Identified on August 3 and 4, 2004 at Sampling Stations 1–7       |

---

---

## Contents of Appendix C

### Figures

- Figure 1. Monthly Discharges Observed at Sampling Stations 1–6
- Figure 2. Stage Height and Discharge Graphs for Yellow Dog River Stations
- Figure 3. Stage Height and Discharge Graphs for Salmon Trout River Stations
- Figure 4. Stage Height and Discharge Graphs for Cedar Creek and Big Pup Creek Stations
- Figure 5. Graphs of pH and Specific Conductance for Sampling Stations 1–7
- Figure 6. Graph of Dissolved Oxygen for Sampling Stations 1–7
- Figures 7a–f. Temperatures at Yellow Dog River Stations for May–October 2004
- Figures 8a–f. Temperatures at Salmon Trout River Stations for May–October 2004
- Figures 9a–f. Temperatures at Cedar Creek and Big Pup Creek Stations for May–October 2004
- Figure 10. Number of Algal Divisions Detected at Sample Stations
- Figure 11. Algal Species Richness (Excluding Picoplankton)
- Figure 12. Algal Shannon Diversity (Excluding Picoplankton)
- Figure 13. Alpha Algal Cell Concentration (Excluding Picoplankton)
- Figure 14. Diatom Species Richness (Excluding Picoplankton)
- Figure 15. Diatom Shannon Diversity (Excluding Picoplankton)
- Figure 16. Relative Abundance of *Achnanthes minutissima*
- Figure 17. RA Sensitive Algal Cell Concentration
- Figure 18. Algal Siltation Index (Diatoms)
-

---

## **Contents of Appendix D**

### **Laboratory Reports**

White Water Associates Analytical Report for Job #20576 –  
June 14, 2004 Sampling Bout – 3 pages

White Water Associates Analytical Report for Job #20685 –  
July 6, 2004 Sampling Bout – 4 pages

White Water Associates Analytical Report for Job #20806 –  
August 3, 2004 Sampling Bout – 3 pages

White Water Associates Analytical Report for Job #20811 –  
August 4, 2004 Sampling Bout – 3 pages

White Water Associates Analytical Report for Job #21001 –  
September 14, 2004 Sampling Bout – 3 pages

White Water Associates Analytical Report for Job #21098 –  
October 5, 2004 Sampling Bout – 4 pages

White Water Associates Analytical Report for Job #21265 –  
November 9, 2004 Sampling Bout – 4 pages

TriMatrix Laboratories Analytical Report for Submittal #36675-121 –  
August, 2004 Sampling Bout – 18 pages

---

---

## **Contents of Appendix E**

### **Periphyton Report**

Algae Analysis Report and Data Set, for samples collected on August 3 and 4, 2004

---

---

## INTRODUCTION

Kennecott Exploration Company is conducting mineral exploration in northern Marquette County, Michigan with the prospect of establishing a sulfide mining operation. Mining activities could impact surface waters in the area and the Michigan Department of Environmental Quality (MDEQ) Water Bureau (WB) decided to establish an independent, comprehensive baseline limnological characterization of several streams in the region, including the Yellow Dog River, Salmon Trout River, Cedar Creek, and Big Pup Creek. Although future mining-related operations may not influence all or any of these streams, collecting pre-mining data is essential to detect any future water quality changes in these stream ecosystems and to support informed natural resource management decisions. White Water Associates, Inc., an independent environmental consulting firm, conducted this study for the MDEQ. The baseline stream studies reported herein were primarily funded with Clean Michigan Initiative-Clean Water Fund (CMI-CWF) monies.

The overall goal of the first study phase was to establish a comprehensive baseline limnological characterization (including chemical, physical, and biological parameters) of several streams in the vicinity of the proposed Kennecott mining operation. This document reports on the baseline study. It presents the chemical, physical, and biological study elements that were investigated May through November 2004. The investigation follows a work plan prepared by White Water Associates with significant contributions by the MDEQ. Slight modifications of the original work plan were implemented as the study proceeded (for example, the addition of a seventh sampling site and several chemical parameters), and these are described in the Methods section.

This report is organized as five sections: Introduction, Study Area, Methods, Results, and Literature Cited. Five Appendices augment the report. Appendix A contains Exhibits 1–12 (maps and photos). Appendix B contains Tables 1–20. Appendix C contains Figures 1–18. Appendix D contains laboratory reports from MDEQ, White Water Associates, Inc., and TriMatrix Laboratories, Inc. Appendix E contains the periphyton analysis report from PhycoTech, Inc.

---

## STUDY AREA

The study landscape is in northern Marquette County, Michigan, and includes the watersheds of the Yellow Dog River, Salmon Trout River, Cedar Creek, and Big Pup Creek. This landscape involves the political townships of Michigamme, Champion, Powell, and Ishpeming. This general area is referred to as the Marquette Highland physiographic region (Summers 1977). The area's mean annual precipitation is 32 to 34 inches (rain equivalent) and mean annual temperature is 42° to 44° F (Summers 1977). This region tends to have about 120 to 140 days or more of snow cover of one inch or greater, and has an average annual snowfall of about 120 inches (Summers 1977).

The study landscape includes many streams and lakes. For the purpose of this investigation, however, four were of particular focus: the Yellow Dog River, Salmon Trout River, Cedar Creek, and Big Pup Creek. All four of the subject streams are designated coldwater streams by the Michigan Department of Natural Resources (MDNR). Limited sampling was conducted by the MDEQ in July 2001 on selected streams within this area of interest including the Salmon Trout River, Yellow Dog River and Big Pup Creek (Godby 2002). Additional general water chemistry and metals data were collected by the MDEQ in December 2003 when split sampling was conducted with Kennecott's consultants at four stations. Data from these sampling efforts, along with available information about the area of possible mining activity, were used by the MDEQ to recommend six sampling stations on the four study streams. The MDEQ selected four stations (Stations 1 through 4) based on current and historical information, the probability of being influenced by Kennecott mining activities, relative accessibility with vehicles, and locations within the Yellow Dog and Salmon Trout River watersheds. Stations 5 and 6 (Cedar Creek and Big Pup Creek, respectively) were selected because they were likely to be outside the area of influence of the proposed mine. A seventh sampling station located in the wetland headwaters of the Salmon Trout River was added in August 2004 based on a recommendation by stakeholders at a June 24, 2004 meeting hosted by the MDEQ in Marquette, Michigan.

The six originally recommended sampling stations were visited by White Water Associates scientists on reconnaissance investigations on May 26 and 27, 2004. The primary purpose of this reconnaissance was to select the actual locations for sampling. In addition, several streamside measurements (for example, pH, conductivity, temperature, dissolved oxygen, and stream discharge) were collected during the reconnaissance visit. A similar reconnaissance effort took

---

place later in the season in finalizing the location of the additional seventh sampling station. Sampling stations were marked using a handheld global positioning system (GPS) unit (Garmin GPSMap76S) and readings were measured as latitude and longitude (in decimal degrees) and the latitude-longitude data recorded on field data sheets and in a field log. Table 1 presents geographic information and a short locational description of each of the seven stations. Exhibit 1 (Appendix A) illustrates the study landscape, study streams, and seven sampling stations. The remainder of this section provides a description of each of the seven sampling stations.

***Station 1 – Yellow Dog River.*** This station was located just upstream of the County Road 510 bridge on the Yellow Dog River. Station 1 was the downstream-most station of two sampling sites on the Yellow Dog River. It was about 24 feet wide at the point of our discharge sampling with a depth that ranged up to 2.3 feet (during high water in May). The stream in the vicinity of the sampling station contained a series of deep riffles, glides, and pools, with a fair amount of large woody material. Substrate was sand and gravel. The water at Station 1 was tea-colored. The riparian area was composed of mixed upland hardwoods and some conifers. Exhibit 2 is a topographic map that shows the location of Station 1. Exhibit 6 includes photographs of the stream at this station.

***Station 2 – Yellow Dog River.*** This station was located on the Yellow Dog River, just upstream of the bridge crossing of a snowmobile trail/road and about one mile south of the Triple A Road. Station 2 was the upstream-most station of two sampling sites on the Yellow Dog River (approximately 10 miles upstream of Station 1). The Yellow Dog River was about 10 feet wide at the point of our discharge sampling with a depth that ranged up to 2.2 feet (during high water in May). At Station 2, discharge was measured under the bridge. The water and sediment samples were collected about 100 yards upstream where both access and stream conditions were more convenient. The stream in the vicinity of the sampling station contained glides and pools with very little riffle habitat. Large woody material consisted of some old beaver dam material and tag alders that had fallen into the stream. Substrate was sand and gravel. The water at Station 2 was tea-colored. The riparian area was composed of tag alder swamp. Exhibit 3 is a topographic map that shows the location of Station 2. Exhibit 7 has photographs of the Yellow Dog River at this station.

***Station 3 – Salmon Trout River.*** Station 3 was one of three sampling stations on the Salmon Trout River. This station was located just upstream of the Northwestern Road bridge crossing. Station 3 was the downstream-most station on the Salmon Trout River (approximately

---

2½ miles downstream of Station 4 and four miles downstream of Station 7). The sampling station was about 50 feet upstream of the bridge and a few feet upstream of a small tributary that entered from the east. The stream was about 10 feet wide at the point of our discharge sampling with a depth that ranged up to 1.1 feet (during high water in May). The stream in the vicinity of the sampling station consisted of a fairly smooth glide, but was the downstream extent of an area with a considerable number of riffles and pools. Large woody material consisted of some sticks and logs in the stream. Substrate was sand in the sampling area, but more cobble and gravel immediately upstream. The water at Station 3 was tea-colored. The riparian area in the immediate vicinity of the station was marsh (resulting from an old beaver flooding). Immediately upstream of the station, the canopy cover was nearly 100% as the stream went through a mixed lowland hardwood and conifer forest. Exhibit 4 is a topographic map that shows the location of Station 3. Exhibit 8 has photographs of the Salmon Trout River at Station 3.

***Station 4 – Salmon Trout River.*** Station 4 was the intermediate of three sampling stations on the Salmon Trout River. This station was located just upstream of the Triple A Road culvert crossing. Station 4 was 1½ mile downstream of Station 7 (headwaters). The sampling station was about 20-30 feet upstream of the upstream end of the culvert, and about 20-30 feet downstream of a small spring that flowed into the river from the west side (river left). The stream was about 5 feet wide at the point of our discharge sampling with a depth that ranged up to about 0.7 foot (during high water in May). The stream in the vicinity of the sampling station consisted of narrow glides with very little riffle habitat. Large woody material consisted of some sticks and tag alders that overhung the stream. Substrate was composed of sand in the sampling area with more cobble and gravel immediately downstream of the culvert. During May through September monthly sampling bouts, discharge was measured immediately downstream of the culvert where the stream morphology and gradient was most convenient for this activity. During mid-September, however, a new and larger culvert was installed at Station 4, while simultaneously widening the Triple A Road at this point. As result of this change, we measured discharge upstream of the culvert during the October and November bouts. The water at Station 4 was slightly tea-colored. The riparian area in the immediate vicinity of the station was marsh and tag alder swamp. Exhibit 3 is a topographic map that shows the location of Station 4. Exhibit 9 has photographs of the Salmon Trout River at Station 4.

***Station 5 – Cedar Creek.*** This sampling station was located just upstream of the Northwestern Road log bridge on the Cedar Creek. Station 5 was the sole sampling station on

---

Cedar Creek. The creek was about 20 feet wide at the point of our discharge sampling (immediately downstream of the bridge) with a depth that ranged up to 1.5 feet (during high water in May). The water quality sampling station was about 40 feet upstream of the bridge. The stream in the vicinity of the sampling station contained a series of riffles, glides, and pools, with a fair amount of large woody material. Substrate was mostly sand with some gravel and cobble. There was a fair amount of aquatic vegetation. The water at Station 5 was colorless. The riparian area was composed of marsh, tag alders, and some conifer. Exhibit 5 is a topographic map that shows the location of Station 5. Exhibit 10 has photographs of the stream at this station.

***Station 6 – Big Pup Creek.*** This sampling station was located just upstream of the County Road 510 bridge on Big Pup Creek. Station 6 was the sole sampling station on Big Pup Creek. The creek was about 14 feet wide at the point of our discharge sampling (immediately upstream of the bridge) with a depth that ranged up to about 1 foot (during high water in May). The water quality sampling station was about 70 feet upstream of the bridge. The stream in the vicinity of the sampling station contained a series of riffles and glides, with a fairly small amount of large woody material. Substrate was sand, gravel, and cobble. The water at Station 6 was colorless. The riparian area was a mixed upland hardwoods and conifer stand with nearly 100% canopy cover over the stream. Exhibit 2 is a topographic map that shows the location of Station 6. Exhibit 11 has photographs of the stream at this station.

***Station 7 – Salmon Trout River.*** Station 7 was the upstream-most of three sampling stations on the Salmon Trout River. This station was located close to the headwaters of the stream and not near any roadway or stream crossing. Station 7 was 1½ miles upstream of Station 4 on the Salmon Trout River. Station 7 was added about midway through the sampling season and was first sampled during the August sampling bout. The Salmon Trout River, in the vicinity of the station, had very little flow and often appeared rather stagnant. There were numerous beaver dams in the large marsh in which Station 7 was located, including one rather large dam about 40 feet upstream of the sampling station. The stream at Station 7 was about 5 feet wide and about 2 feet deep. The stream in the vicinity of the sampling station was sluggish with no riffles. Large woody material consisted of some sticks from beaver activity and some overhanging tag alders in the stream. Substrate was soft sediment. The water at Station 7 was nearly colorless. The riparian area in the immediate vicinity of the station was marsh and tag alder swamp. Exhibit 3 is a topographic map that shows the location of Station 7. Exhibit 12 has photographs of the Salmon Trout River at Station 7.

---

## METHODS

The baseline limnological investigations on the seven stream sampling stations included chemical, physical, and biological components in order to provide an in-depth characterization of the stream ecosystems that can be repeated at any time in the future. The various measurements were all conducted using standardized, scientifically accepted protocols. Field procedures were carried out in accordance with the *MDEQ Quality Assurance Manual for Water, Sediment, and Biological Sampling* and instrument specific manufacturer's procedures. All field measurements and observations were recorded on field forms and/or in a field journal.

The investigative efforts conducted during this baseline study can be organized under six general areas for the purposes of describing methodology and reporting results. The six areas include: (1) streamside measurements, (2) water and sediment chemistry, (3) fish community study, (4) aquatic macroinvertebrate and habitat study, (5) macrophyte community observations, and (6) periphyton community study. This section describes methods used in each of these areas under corresponding headings.

### Streamside Measurements

Stage height (staff gauge and fixed point), discharge, qualitative observations of water and weather conditions, and “grab” measures of water temperature, pH, specific conductance, and dissolved oxygen were collected on each visit to the sampling stations. In addition, continuous water temperature was recorded through most of the field season.

A fixed reference point for stage monitoring was established at each sampling station. These stage monitoring reference points were relatively permanent, stationary structures from which accurate vertical measurement to stream surface could be made using a tape measure. At Station 1 (Yellow Dog River), the fixed-point stage height was measured at the bridge by hooking the tape measure at the top of the lower lip of the upstream-most I-beam at a point one-third of the stream width from the north bank of the river. At Station 2 (Yellow Dog River), the fixed-point stage was measured at the bridge by hooking the tape measure at the top of the lower lip of the downstream-most I-beam at midstream. In the case of Station 3 (Salmon Trout River), the fixed-point consisted of a screw placed in a dead tree in the stream. In the case of Station 4

---

(Salmon Trout River), during the May through September sampling bouts, the fixed-point stage height was measured from the top of the culvert on the downstream end. During the October and November sampling bouts, the fixed-point measured from the top of the culvert on the upstream end because a new culvert had been installed. At Station 5 (Cedar Creek), the fixed-point stage height was measured at the bridge from the top of the upstream-most wood timber (the timber was perpendicular to stream flow) at midstream. At Station 6 (Big Pup Creek), the fixed-point stage height was measured at the bridge from the bottom of the bridge I-beam on the south edge of the river. No fixed point was established at Station 7 (Salmon Trout River), as this was an open large marsh with little structure that afforded a suitable reference. In addition to the fixed reference points, a manufactured staff gauge (readable to 0.01 foot increments) was installed at each station by driving a metal fence post deep into the streambed and fixing the gauge to the posts with wire. Stream stage was recorded during each visit to a station.

During each sampling bout, physical measurements were recorded at each station to determine stream discharge. Stream depth, width, and velocity were measured at wadable sections of the streams. A tag line was stretched between capped iron stakes (or other fixed points) on the two sides of the stream and used to establish stream segments for stream velocity measurements. When possible, at least twenty stream intervals were used in discharge measurements. A Global Flow Probe was used in accordance with the manufacturer's suggested methods and the procedure described in Harrelson et al. (1994). Discharge was calculated according to GLEAS Procedure #77 (MDEQ 1995). Discharge was measured on seven visits for Stations 1 through 6 (May through November) under a range of discharge values and stage heights. Because of difficult stream conditions (primarily extremely small and diffuse flow), discharge was estimated at Station 7 only once (August) using the "float" method.

On every visit to Stations 1 through 7, water pH and specific conductance were measured using a handheld Myron L Ultrameter™ 6P. Over the course of the study, pH readings were monitored to determine if observed variability warranted continuous reading pH measurements.

During every visit to a sampling station, stream temperature was also measured using a Traceable® thermometer calibrated with a National Institute of Standards and Technology (NIST) Reference Thermometer. Stream temperatures were continuously recorded at Stations 1 through 6 from late May through October 5, and at Station 7 from August 3 through October 5. The temperature loggers used were Onset Computer Corporation Optic Stowaway 32K loggers with accuracy of 0.5°C, range of -4°C to 38°C, and a response time of four minutes. Temperature loggers were set to record data at 0.5-hour intervals. Data was downloaded from each unit at the

---

approximate midway point through the deployment period (August sampling bout) and at the end of the deployment period. Quality control checks of the temperature data loggers were performed in the laboratory pre- and post-deployment, and in the field at deployment, mid-study, and at the time of retrieval of the units at the end of the data collection period. Pre- and post-deployment laboratory quality checks were performed to ensure each temperature logger recorded within 0.5°C of NIST Reference Thermometer reading. For laboratory calibrations, readings were taken at the expected range of temperatures (in the case of pre-deployment), and over the actual range of temperatures recorded (in the case of post-deployment).

During each sampling bout, dissolved oxygen was measured using a handheld YSI Model 51B meter. Each of the instruments used during the study was done so in accordance with the manufacturers' suggested methods.

## **Water and Sediment Chemistry**

Grab samples of water and sediment were collected in the field for later analyses in the laboratory for a variety of chemical constituents. Table 2 (Appendix B) provides the types of analytical chemistry samples and the frequency of collection for the 2004 baseline study. Field procedures, sample collection, chain of custody, and data handling were carried out according to procedures outlined in the *MDEQ Quality Assurance Manual for Water, Sediment, and Biological Sampling*. One field blank and one field duplicate were collected for each monthly sampling bout.

Water samples were collected from Stations 1–6 on a monthly basis from June through November. Station 7 water sampling commenced during the August sampling bout and continued through November. The analytes tested are presented in Table 2. Sulfide was analyzed starting with the July sampling bout and continuing through November.

On the monthly sampling bouts, low-level mercury (LL Hg) samples were collected and analyzed using clean techniques (EPA Method 1631). These samples were placed in bottles supplied by the MDEQ Laboratory and sent to the MDEQ via overnight shipping. A description of this LL Hg sampling is also presented in Table 2. During the September sampling bout (9/14/04), water samples were collected from Stations 1–7 using clean techniques and were placed in bottles supplied by the Wisconsin State Laboratory of Hygiene (WSLH). These were shipped to WSLH for analysis for low-level concentrations of arsenic, boron, cadmium, cobalt, chromium, copper, nickel, lead, selenium, silver, and zinc.

---

During June, sediment samples were collected from Stations 1 through 6. A duplicate sample was collected from one station. A second round of sediment sampling was conducted in August and included Stations 1 through 7. Sediment samples were collected following GLEAS Procedure #64 (MDEQ 1992). Analytes for the sediment samples included arsenic, barium, cadmium, chromium, zinc, iron, lithium, copper, nickel, lead, selenium, strontium, silver, mercury, % total solids, sulfide, and total volatile solids (sulfide and total volatile solids were analyzed in August only).

## **Fish Community Study**

The four streams studied are designated coldwater fisheries. Not only are trout important subjects of human recreational interests, they are known to be particularly susceptible to environmental stressors such as low pH. Trout are also top predators in the aquatic food web and a crucial component in these coldwater ecosystems. For these reasons, populations of trout and other fish species present in the aquatic community were investigated in this study.

Michigan Department of Natural Resources (MDNR) biologist Edward Baker conducted a three-pass depletion electro-fishing survey of fish communities in the stream reaches immediately upstream of Stations 1, 2, 3, 4, and 5. MDEQ and White Water Associates staff assisted in the survey. Station 6 (Big Pup Creek) was not sampled in the 2004 season since data from 1997 and 2003 fish surveys (using the same sampling protocol) on this area of the Big Pup Creek were available for the 2004 study. The stream reach being surveyed was less than 100 meters in length and was blocked with seines at the upper and lower extents to minimize fish movement in and out of the study reach during sampling. Fish were identified, measured, and placed in a holding container until the survey was completed. Fish sampling was done with stream-shocking equipment used for wadable streams such as pulsed DC backpack powered by either battery or small generator (Schneider and Merna 2000). Backpack style shockers were used on all sites except for Station 1 (Yellow Dog River) where a barge was used with the shocker mounted on-board. Population estimates were established using fish removal sampling technique (Lockwood and Schneider 2000). The team used a three-pass sampling protocol. In some cases the specific conductivity of the stream water was too low for effective conduction for stunning fish. In these cases (Stations 1 and 2 on the Yellow Dog River), pulverized sodium chloride was introduced upstream of the study reach in order to temporarily elevate conductivity to sufficient levels to

---

allow the electrofishing equipment to operate effectively. Population estimates were calculated by the MDNR using formulae presented by Zippin (1956, 1958). Population data were provided by the MDNR to White Water Associates for inclusion in this report.

## **Aquatic Macroinvertebrate and Habitat Study**

Aquatic macroinvertebrates form a diverse community of consumers in the subject streams. Because of their diversity, abundance, and specific ecological niches, macroinvertebrates are a valuable tool for evaluating status and trends in lotic habitats as well as identifying and understanding various environmental stressors. Scientifically established standard protocols are available for surveying benthic macroinvertebrates.

In the immediate vicinities of Stations 1 through 6, MDEQ biologists characterized macroinvertebrate assemblages and associated habitat measurements following GLEAS Procedure #51 (Creal *et al* 1998, MDEQ 2002). The fieldwork for aquatic macroinvertebrates was conducted during the June sampling bout (June 14 and 15). No collection was made at Station 7. This station was added after the macroinvertebrate sampling was conducted at the other localities. In addition, since Station 7 was located in a beaver-influenced wetland, GLEAS Procedure #51 was not applicable to this site. The MDEQ provided results from the macroinvertebrate and habitat surveys to White Water Associates for inclusion in this report.

## **Macrophyte Community Observations**

During the August sampling bout, a White Water field biologist identified aquatic and riparian macrophytes in the vicinity of the sampling stations. Most were identified to species. Although not part of the original work plan, this information was easily obtained and presents a more complete picture of the stream ecosystems.

---

## Periphyton Community Study

Periphyton are an important component of lotic ecosystems. Because of the diversity of taxa and availability of autecological information about individual species, periphyton are sensitive indicators for detecting changes in ecosystem health.

White Water Associates biologists sampled periphyton qualitatively from instream habitats for the purpose of documenting the presence of algal taxa in the immediate vicinities of Stations 1–7. The periphyton sampling was conducted during the August field bout (August 3 and 4). National Water-Quality Assessment Program (NAQWA) qualitative multihabitat sampling methods (Moulton et al. 2002) were used. Discrete collections of micro and macroalgae were taken by scraping and brushing from submerged substrates in five distinct habitats:

- (1) Epilithic – benthic habitat consisting of coarse-grained substrates such as gravels, cobbles, boulders, and bedrock;
- (2) Epidendric – benthic habitat consisting of woody substrates;
- (3) Epiphytic – benthic habitat consisting of plants on which organisms are attached or loosely associated;
- (4) Epipsammic – benthic habitat consisting of sand-sized particles on which organisms are attached or loosely associated; and
- (5) Epipellic – benthic habitat consisting of silt-sized streambed sediments on which organisms are loosely associated (low velocity areas where silt deposits).

These habitat types were sampled in a stratified approach (in relative proportion to each habitat's occurrence in the stream reach). Samples were placed in 125ml plastic bottles, labeled by station and habitat type and preserved in gluteraldehyde. The Qualitative Multihabitat (QMH) Sample was formed by combining the discrete habitat collections from each station. Samples were shipped to PhycoTech Inc. for processing and identification. United States Environmental Protection Agency (US-EPA) Rapid Bioassessment Protocols (Barbour et al. 1999) were followed for the sample handling and data analyses phases of the periphyton assessment.

---

## RESULTS

The combination of chemical, physical, and biological study components establishes an understanding of the current status of the aquatic ecosystems of each of the study stream reaches, and provides a foundation for detecting future changes. Results from the 2004 investigative efforts are presented in this section under six subsections: (1) streamside measurements, (2) water and sediment chemistry, (3) fish community study, (4) aquatic macroinvertebrate and habitat study, (5) macrophyte community observations, and (6) periphyton community study.

### Streamside Measurements

The record of stage height and discharge for Stations 1–6 is presented in Table 3. Figure 1 illustrates the discharge data for each sampling station by date of measurement. Station 1 (Yellow Dog River) consistently had the highest discharge of any of the stations. The upstream station on the Yellow Dog River (Station 2) had the second highest discharge with the exception of the September sampling when it was slightly lower than Station 5 (Cedar Creek). The smallest discharge was consistently observed at Station 4 on the Salmon Trout River, with Station 3 (downstream on the Salmon Trout River) being consistently higher than Station 4 and very similar in discharge to the Big Pup Creek (Station 6). Cedar Creek (Station 5) was the third highest discharge, except for the September bout when it was second highest by slightly exceeding Station 2. Discharge at Station 7 (Salmon Trout River) was measured on August 3 only and was 0.41 cfs. This was the lowest of all seven stations measured in August.

The Yellow Dog River at Stations 1 and 2 exhibited the greatest range of discharge values over the course of the study. The discharge measured at Station 2 during the September bout was only 12% of that measured during the May sampling. For Station 1 (Yellow Dog River) the corresponding relationship was 21%. In contrast, Cedar Creek (Station 5) exhibited the most stable discharge regimen with the lowest discharge (measured in September) being 34% of the discharge measured in May. Stations 3 (28%) and 4 (28%) on the Salmon Trout River and Station 6 (25%) on the Big Pup Creek exhibited similar and fairly stable discharges over the study.

---

Another way to examine the discharge data for the study streams is by calculating “yield” (discharge in cubic feet per second divided by drainage area in square miles). Table 4 displays the calculated yields by sampling station and date. This allows within and between stream comparisons. The Yellow Dog River stations (1 and 2) display quite similar yields during each sampling bout. The Cedar Creek (Station 5) consistently showed the highest yields each month with values ranging from 2.1 to 5.4.

Corresponding measurements of stage height and discharge displayed close relationships at each of the sampling stations. Figures 2, 3, and 4 graphically display these relationships for Stations 1 through 6. Since these measurements were collected over a wide range of discharge values, these graphs can be used to estimate discharge from a stage height reading. In the case of Station 4 on the Salmon Trout River (see bottom graph of Figure 3), the installation of a new and larger culvert on the Triple A Road in mid-September changed the relationship of discharge and stage height. This is illustrated by the two points on the lower part of the graph (representing readings from October and November) that seem to be outliers from the more linear relationship of upper five points (collected prior to the new culvert installation).

Table 5 presents the history of pH readings taken at all seven sampling stations over the sampling season. These data are graphically presented in the upper graph in Figure 5. In comparing the sampling stations and dates, the pH went from a high of 8.08 (measured at Station 1 on the Yellow Dog River in September) to a low of 6.08 (measured at Station 2 on the Yellow Dog River in June). In comparing individual sampling stations, the greatest ranges of pH values over the entire study were observed at Station 1 (range=1.43) and Station 3 (range=1.48). The smallest range of pH values (range=0.74) was observed at Station 4 on the Salmon Trout River, except for Station 7 (range=0.53), which was not sampled during the spring and early summer.

Table 6 presents the history of specific conductance readings taken at all seven stations over the course of the sampling season. These data are graphically presented in the bottom graph in Figure 5. The Yellow Dog River sampling stations showed the greatest range of specific conductance with Station 2 range being 107.7  $\mu\text{S}/\text{cm}$  and Station 1 range being 74.78  $\mu\text{S}/\text{cm}$ . Station 4 on the Salmon Trout River showed the smallest range (18.80  $\mu\text{S}/\text{cm}$ ) over the course of the sampling season.

Dissolved oxygen measurements taken over the course of the study for all seven stations are presented in Table 7. Figure 6 graphically displays the results. Dissolved oxygen at Station 7 on the Salmon Trout River was very low in August, September, and October readings which is typical of a stagnant beaver-flooded wetland. The reach of the Salmon Trout River in the vicinity

---

of Station 7 was very slow moving and spread throughout a large marsh due in part to beaver activity. The water temperature at Station 7 was correspondingly warm.

Stream temperatures were recorded at 0.5 hour intervals from late May through October 5 for Stations 1 through 6, and August 3 through October 5 for Station 7. These data give a thorough picture of the temperature relations of the study streams. Table 8 reports NIST thermometer measurements recorded during field visits from June through October, compared to the nearest temperature readings taken by the continuous reading Optic Stowaway units for each location (all but 4 readings were within  $\pm 0.5^{\circ}\text{C}$  of the NIST measures). Table 9 summarizes the data for each sampling month (May through October) providing monthly maximum, minimum, and mean (along with corresponding statistics). July had the warmest mean temperatures for each stream and October had the lowest mean temperatures. June had the highest maximum temperature for each station and October had the lowest minimum temperatures. Figures 7 (a–f), 8 (a–f), and 9 (a–f) graphically depict the temperature data for each of the six study months. Table 10 gives a summary of stream temperatures by station over the entire study period. At Station 4 (Salmon Trout River) a new and larger culvert was installed during mid-September. This change resulted in the water level dropping several inches upstream of the road and exposed the temperature-reading device to the air (Figure 8c). Thus, some stream temperatures for September and all stream temperatures for October were not obtained at Station 4.

## **Water and Sediment Chemistry**

Water samples were collected from Stations 1–6 on a monthly basis from June through November. Station 7 (headwaters of the Salmon Trout River) water sampling began in August and continued through November. Table 11 presents water chemistry results for all sampling stations and dates, except for the September metals data that were analyzed by the Wisconsin State Laboratory of Hygiene. Low-level mercury results from the monthly water sample collections for all stations are presented in Table 12. Low-level metals results for September sampling at all stations are presented in Table 13. Finally, Table 14 summarizes water chemistry data by station and date providing both mean and maximum values for each analyte.

Table 15 summarizes results from the two bouts of sediment sampling (June and August). Sulfide and total volatile solids were measured for the August sediment samples only. TriMatrix Laboratories, Inc., conducted these analyses and results are summarized in Table 15. The TriMatrix laboratory report is contained in Appendix D.

---

Quality assurance/quality control samples (that is, field duplicates, field blanks, and trip blanks) were taken during each sampling bout as specified in the work plan. Results from these samples demonstrated good conformance with the *MDEQ Quality Assurance Manual for Water, Sediment, and Biological Sampling*. There were no field blank detections with the occasional exception of low-level “hits” (near the detection limit) of ammonia, total suspended solids, total phosphorus, total Kjeldahl nitrogen, nitrate-nitrite nitrogen, ortho-phosphorus, and total dissolved solids (Table 11). The August field blank taken for nitrate-nitrite nitrogen was mistakenly preserved with nitric acid resulting in an erroneously high level (1100 mg/l, Table 11). Field duplicates fell within the expected range ( $\pm 20\%$ ) with the exceptions of total Kjeldahl nitrogen and total phosphorus in August and October, total suspended solids in October, and iron and manganese in August and September (Table 11).

In general, water quality was good at all locations with metals and nutrients found at low levels. Elements such as boron, lead, selenium, silver, zinc, and cobalt were not detected using the standard quantification levels of the MDEQ Laboratory. Nevertheless, the ultra low-level analysis conducted at the Wisconsin State Laboratory of Hygiene detected all these elements in the low parts per billion (ug/l) range. Concentrations of copper, nickel, cadmium, chromium, arsenic, barium, and manganese were either not detected or found at low concentrations. Important nutrients such as total phosphorus were found at characteristically low levels. The remote and forested nature of the subject watersheds along with the corresponding local soil types control the available phosphorus concentrations in this part of the Upper Peninsula. None of these elements were found at levels that exceed Michigan Water Quality Standards with the exception of total mercury.

The mercury levels were found in the low parts per trillion (ppt) ranges. The reported levels periodically exceeded MDEQ Rule 57(2) water quality value of 1.3 ppt, however, these results were not unexpected due to similar reported total mercury concentrations in other Michigan streams (Aiello 2004) and current mercury concentrations found in precipitation from the upper Midwest.

---

## **Fish Community Study**

In the 2004 field season, fish population data were collected for Stations 1, 2, 3, 4, and 5. Station 6 (Big Pup Creek) was not surveyed in 2004, but data from 2003 and 1997 were available for this stream reach and are reported herein. No fish sampling was conducted at Station 7 during the 2004 season or in the past. Results are reported for each station in the following paragraphs and summarized in Table 16 for convenient review and comparison.

***Station 1 (Yellow Dog River at County Road 510)*** – At this station, 68.3 meters of stream were sampled. The average width of stream sampled was 10.9 meters and the surface area sampled was 745 square meters. Three electrofishing passes were conducted and brown trout, rainbow trout, sculpin, and white sucker were detected. No brook trout were detected. No fish were caught on the second and third passes. Ten brown trout and three rainbow trout were caught with a total weight of 498 and 305 grams, respectively. Using the three-pass algorithm, the population estimate for the reach sampled was ten brown trout and three rainbow trout. The estimated number of brown trout and rainbow trout per hectare was 134 and 40, respectively. The estimated mass of brown trout and rainbow trout per hectare is 6.7 kg and 4.1 kg, respectively. The estimated number of brown trout and rainbow trout per kilometer of stream is 146 and 44, respectively.

***Station 2 (Yellow Dog River at Triple A Road)*** – At this station, the fish crew sampled 119.8 meters of stream. The average width of stream sampled was 6.5 meters and the surface area sampled was 775 square meters. A single electrofishing pass was conducted and brook trout, sculpin, blacknose dace, creek chub, and brook stickleback were detected. Two brook trout were caught with a total weight of 285 grams. The population estimate for the reach sampled was two brook trout and the estimated number of trout per hectare of stream is 25.8. The estimated mass of brook trout per hectare is 3.7 kg and the estimated number of brook trout per kilometer of stream is 16.7. It should be noted that the Yellow Dog River at this station had low conductivity and is generally deep making fish community sampling less efficient. Chloride was added to temporarily increase stream conductivity to facilitate more efficient fish sampling.

---

***Station 3 (Salmon Trout River at Northwest Road)*** – At this station, the fish crew sampled 57.9 meters of stream. The average width of stream sampled was 3.1 meters and the surface area sampled was 180 square meters. Three electrofishing passes were conducted and brook trout, brook stickleback, and northern redbelly dace were detected. Forty brook trout were caught with a total weight of 1,227 grams. Using the three-pass algorithm, the population estimate for the reach sampled was 40 brook trout and the estimated number of trout per hectare of stream is 2,223. The estimated mass of brook trout per hectare is 68.2 kg and the estimated number of brook trout per kilometer of stream is 690.8.

***Station 4 (Salmon Trout River at Triple A Road)*** – At this very small stream, 38.4 meters of stream was sampled. The average width of the reach sampled was 2.6 meters and the surface area sampled was 102 square meters. Three electrofishing passes were conducted and brook trout was the only fish species detected. Eleven brook trout were caught with a total weight of 265 grams. Using the three-pass algorithm, the population estimate for the reach was 11 brook trout and the estimated number of trout per hectare of stream is 1,084. The estimated mass of brook trout per hectare is 26 kg and the estimated number of brook trout per kilometer of stream is 286.

***Station 5 (Cedar Creek at Northwest Road)*** – The fish crew sampled 75.0 meters of stream at Station 5. The average width of stream sampled was 4.6 meters and the surface area sampled was 346 square meters. Three electrofishing passes were conducted and brook trout and northern redbelly dace were detected. Eighty brook trout were caught with a total weight of 275 grams. Using the three-pass method, the population estimate for the reach sampled was 108.4 brook trout and the estimated number of trout per hectare of stream is 3,129. The estimated mass of trout per hectare is 10.8 kg and the estimated number of brook trout per kilometer of stream is 1,446.

***Station 6 (Big Pup Creek at County Road 510)*** – During 1997 and 2003, an MDNR fish crew sampled 66.4 meters of stream in the vicinity of Station 6. The average width of stream sampled was 3.8 meters and the surface area was 142 square meters. Three electrofishing passes were conducted during these surveys and brook trout was the only species detected. In 1997, 140 brook trout were caught with a total weight of 1,068 grams. In 2003, 46 brook trout were caught with a total weight of 452 grams. Using the three-pass method, the population estimates for the reach sampled in 1997 and 2003 were 157 and 56, respectively. This corresponds to estimated biomasses of 1,200 grams (1997) and 546 grams (2003). In 1997, the estimated number of fish

---

per hectare was 11,094. In 2003, the corresponding estimate was 3,918 fish per hectare. The estimates for mass of fish per hectare were 84.6 kg in 1997 and 38.5 kg in 2003. Finally, the estimated number of brook trout per kilometer of stream was 2,363 in 1997 and 843 in 2003.

Fish species richness varied from one stream station to another. Station 2 (Yellow Dog River) had the highest number of fish species encountered (five). Stations 4 (Salmon Trout River) and 6 (Big Pup Creek) each had only one species in the collection (Table 16). Whether measuring by estimated number of brook trout per hectare or per kilometer of stream, the stations ranked (highest to lowest): 6 > 5 > 3 > 4 > 2 > 1. When measuring by biomass of brook trout per hectare, however, the stream rankings were (highest to lowest): 6 > 3 > 4 > 5 > 2 > 1. In terms of mass of brook trout per hectare, Big Pup Creek (Station 6) and Salmon Trout River (Station 4) rank in the top ten brook trout producing streams in the Upper Peninsula (personal communication, Edward Baker, MDNR).

### **Aquatic Macroinvertebrate and Habitat Study**

For Stations 1 through 6, MDEQ biologists characterized stream habitat following GLEAS Procedure #51 (Creal *et al.* 1998, MDEQ 2002). Results of the habitat characterization are provided in Table 17. The two Yellow Dog River sites (Stations 1 and 2) and the Big Pup Creek site (Station 6) were rated as “Good (Slightly Impaired)” habitat relative to the elements of substrate and instream cover, channel morphology, and riparian and bank structure. The two Salmon Trout River sites (Stations 3 and 4) and the Cedar Creek site (Station 5) were rated as “Excellent (Non-Impaired)” with regard to the same elements.

Following Procedure #51, MDEQ biologists characterized macroinvertebrates assemblages for Stations 1 through 6. The large diversity of macroinvertebrate taxa identified at each station is listed in Table 18. A summary of the taxonomic composition of each station is provided in Table 19 along with the total metric score and overall rating. A macroinvertebrate community rating of “Excellent” was given to Stations 1 and 2 (Yellow Dog River), Station 3 (Salmon Trout River), Station 5 (Cedar Creek), and Station 6 (Big Pup Creek). Station 4 (Salmon Trout River at Triple A Road) was assigned a macroinvertebrate community rating of “acceptable.” Nevertheless, the total metric score (+4) obtained at this station was very near the “+5” threshold required for an “Excellent” rating.

---

## Macrophyte Community Observations

Table 20 presents the riparian and aquatic plant species identified at each sampling station during the August sampling bout. A total of 64 species were identified over all seven stations (43 riparian species and 21 aquatic or aquatic-riparian species). The most species-rich site was Station 5 (Cedar Creek) with 12 aquatic and aquatic-riparian plant species and 19 riparian plant species. Station 6 (Big Pup Creek) had the least number of species with only 1 aquatic species and 6 riparian species.

## Periphyton Community Study

During the August sampling bout, White Water biologists collected samples from Stations 1 through 7 for qualitative analyses of periphyton. These samples were shipped to PhycoTech, Inc., for taxonomic identification of all periphyton and data analyses including ecological metrics. PhycoTech delivered data to White Water Associates as Adobe Portable Document Files (PDF) and as Microsoft Excel files (XLS).<sup>1</sup> The “Algae Analysis Report and Data Set” is included as Appendix E. In this subsection, pertinent results are highlighted. In general, the periphyton data indicate that the study streams support algal communities reflective of healthy aquatic ecosystems.

A total of six algal divisions were recorded including Bacillariophyta (diatoms), Chlorophyta (green algae), Cyanophyta (blue-green algae), Rhodophyta (red algae), Pyrrhophyta (dinoflagellates), and Cryptophyta (cryptomonads). Bacillariophyta, Chlorophyta, and Cyanophyta were present in the samples from all seven sites. Rhodophyta were recorded at four sites (Stations 1, 2, 4, 6). Pyrrhophyta and Cryptophyta were each recorded from one station (Stations 2 and 7, respectively), and each division was represented by only a single species in low numbers (see Appendix E). Figure 10 illustrates the number of algal divisions recorded at each

---

<sup>1</sup> All of the PhycoTech PDF and XLS files are included as part of this study’s electronic deliverables, including the full “Algae Analysis Report and Data Set” (included as hardcopy in Appendix E) and additional periphyton information (available upon request in electronic form) that analyzes all data except for picoplankton (plankton less than 2 µm). Picoplankton are distributed worldwide in all types of aquatic ecosystems. Extensive literature has documented the importance played by the activity of picoplankton in global primary production of aquatic ecosystems (Callieri and Stockner 2002). Though extremely small, they can be numerous and can sometimes dominate the sample. For this reason, periphyton analyses sometime exclude picoplankton (Ann St. Amand, PhycoTech, Inc. pers. com.). The data sets provided as electronic deliverables have both standard calculations for diversity indices and “small sample size” calculations (preferred for some interpretations). In the context of this report, standard calculations have been used.

---

station. Summary Graphics in the Algae Analysis report (Appendix E, pages 4, 7, 10, 13, 16, and 19) illustrate the relative community components of each division by station with Bacillariophyta and Cyanophyta consistently comprising the largest portions of the communities. Green algae (Chlorophyta) are the third largest component. When picoplankton are excluded from the data set, the relative importance of blue-green algae is somewhat reduced. Bacillariophyta (diatoms) is the most species-rich division in the study data set, with Cyanophyta being second and Chlorophyta third.

When considering algal species diversity at the seven sampling stations, species richness ranged from 32 to 45 (excluding picoplankton) with an average of about 39 species at each station. Figure 11 compares species richness across all seven stations. Stations 1 (lower Yellow Dog River) and 5 (Cedar Creek) had the highest diversity with 45 species each and Station 7 (Salmon Trout River headwaters) had the lowest diversity with 32 species. The Shannon Diversity Index (excluding picoplankton) indicates a fairly similar diversity across stations with Station 5 being the highest (3.01) and Station 7 the lowest (1.89) (Figure 12). The mean Shannon Diversity Index for all stations is 2.52.

The alpha algal cell concentration is an alternate diversity index based on species richness with good discriminate ability and low sensitivity to sample size (Ann St. Amand, PhycoTech, Inc., pers. com.). Higher values of alpha algal cell concentration indicate higher diversity. This index is quite similar across all stations as can be viewed in Figure 13.

Because of the relatively large number of diatom species, certain indices were calculated separately for this division (Bacillariophyta). Diatom richness (excluding picoplankton) ranged from 20 species at Station 7 (Salmon Trout River headwaters) to 35 species at Station 5 (Cedar Creek). Station 1 on the Yellow Dog River is second highest in diatom species richness at 30 species. These patterns can be seen in Figure 14. A similar pattern is observed when considering diatom diversity (excluding picoplankton) with the Shannon Diversity Index (Figure 15). In this figure, Cedar Creek (Station 5) shows the highest diversity and Station 7 (Salmon Trout River) displays the lowest diversity.

Specific autecological knowledge about diatom species allows derivation of several environmental quality indices. For example, *Achnanthes minutissima* is a generalist diatom whose dominance has been associated with disturbances such as scouring flows, acid mine drainage, and toxins (Stevenson and Bahls 1999). *A. minutissima* is an attached diatom with broad ecological amplitude. It is often the first species to pioneer a recently scoured site, sometimes to the exclusion of all other algae. The percent abundance of *A. minutissima* has been found to be

---

directly proportional to the time that has elapsed since the last scouring flow or episode of toxic pollution. For use in bioassessment, the quartiles of this metric from a population of sites has been used to establish judgment criteria, e.g., 0–25% = no disturbance, 25–50% = minor disturbance, 50–75% = moderate disturbance, and 75–100% = severe disturbance (Stevenson and Bahls 1999). The relative abundance of *A. minutissima* is graphed in Figure 16. Percent abundance can be derived from the relative abundance values by multiplying by 100. Stations 5 and 7 show the lowest relative abundance (0.053 and 0.004, respectively). The highest abundance was determined at Station 3 (0.520).

The RA-sensitive algal cell concentration values (see Figure 17) are indicators of pollution tolerance as they reflect percent sensitive diatoms. Theoretically, the values range from 0 to 1 (0 to 100%) with higher values indicating higher water quality. Stations 1–7 all reflect high water quality by this standard (Ann St. Amand, PhycoTech, Inc., pers. com.). The percent sensitive diatoms metric is especially important in smaller-order streams where primary productivity may be naturally low, causing many other metrics to underestimate water quality (Stevenson and Bahls 1999).

Figure 18 displays the algal siltation index calculated for Stations 1–7. This index is a measure of the percentage of motile diatoms in the sample. The rationale for this index is that, a high percentage of motile diatoms indicates a community impacted by siltation (the motile forms can travel up out of the silt, while non-motile diatoms would remain buried). A low percentage of motile diatoms (or conversely, a higher percentage of non-motile forms) indicate that the community does not have silt as a prominent stressor (Ann St. Amand, PhycoTech, Inc., pers. com.). The siltation index values for Stations 1–7 reflect fairly low siltation.

---

## LITERATURE CITED

- Aiello, C. 2004. Michigan Water Chemistry Monitoring Great Lakes Tributaries 2002 Report. MDEQ-WB Report #MI/DEQ/WD-04/049.
- Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.
- Callieri, Cristiana and John Stockner. 2002. Freshwater Autotrophic Picoplankton: A Review. *Journal of Limnology*, 61(1):1-14.
- Creal, W., S. Hanshue, S. Kosek, M. Oemke, and M. Walterhouse. 1998 Update of GLEAS Procedure 51 Metric Scoring and Interpretation June 1996. Revised May 1998.
- Godby, N. 2002. A Biological Survey of Lake Superior Coastal Tributaries in Northern Marquette County. July 2001. MI/DEQ/SWQ-02/017.
- Harrelson, Cheryl C. 1994. Stream Channel Reference Sites: An Illustrated Guide to Field Technique, General Technical Report RM-245, United States Department of Agriculture, Forest Service, Fort Collins, CO.
- Lockwood, R. & J. Schneider. 2000. MDNR Manual of Fisheries Survey Methods II. Ch. 7: Stream Fish Pop. Estimates.
- MDEQ. 1992. GLEAS Procedure 64. Sediment Sampling and Safety Procedures (12/92).
- MDEQ. 1995. GLEAS Procedure 77. Stream Gauging. MDEQ Surface Water Quality Division. Great Lakes and Environmental Assessment Section.
- MDEQ. 2002. Revision of GLEAS Procedure 51: Qualitative Biological and Habitat Survey Protocols for Wadeable Streams and Rivers.

- 
- Moulton, S. R. II, J. G. Kennen, Robert M. Goldstein, and Julie A. Hambrook. 2002. Revised Protocols for Sampling Algal, Invertebrate, and Fish Communities as Part of the National Water-Quality Assessment Program. Open-File Report 02-150. Reston, Virginia.
- Schneider, J.C. and James W. Merna. 2000. MDNR Manual of Fisheries Survey Methods II. Chapter 3: Fishing Gear
- Stevenson, R.J. and L.L. Bahls. 1999. Periphyton protocols. Pages 6.1–6.22 in M.T. Barbour, J. Gerritson, B.D. Snyder, and J.B. Stribling, eds. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers. 2nd edition. Office of Water, U.S. Environmental Protection Agency, Washington, DC. EPA 841-B-99-002.
- Summers, L.M. (ed.). 1977. Atlas of Michigan. Michigan State University Press, W.B. Eerdmans Publishing Co. 242 pp.
- Zippin, C. 1956. An evaluation of the removal method of estimating animal populations. Biometrics 12:163-189.
- Zippin, C. 1958. The removal method of population estimation. Journal of Wildlife Management 22:82-90.

---

## **APPENDIX A**

### **Exhibits (Maps & Photos)**

---

**Exhibit 1. Map of the Study Landscape, Study Streams, and Sampling Stations**

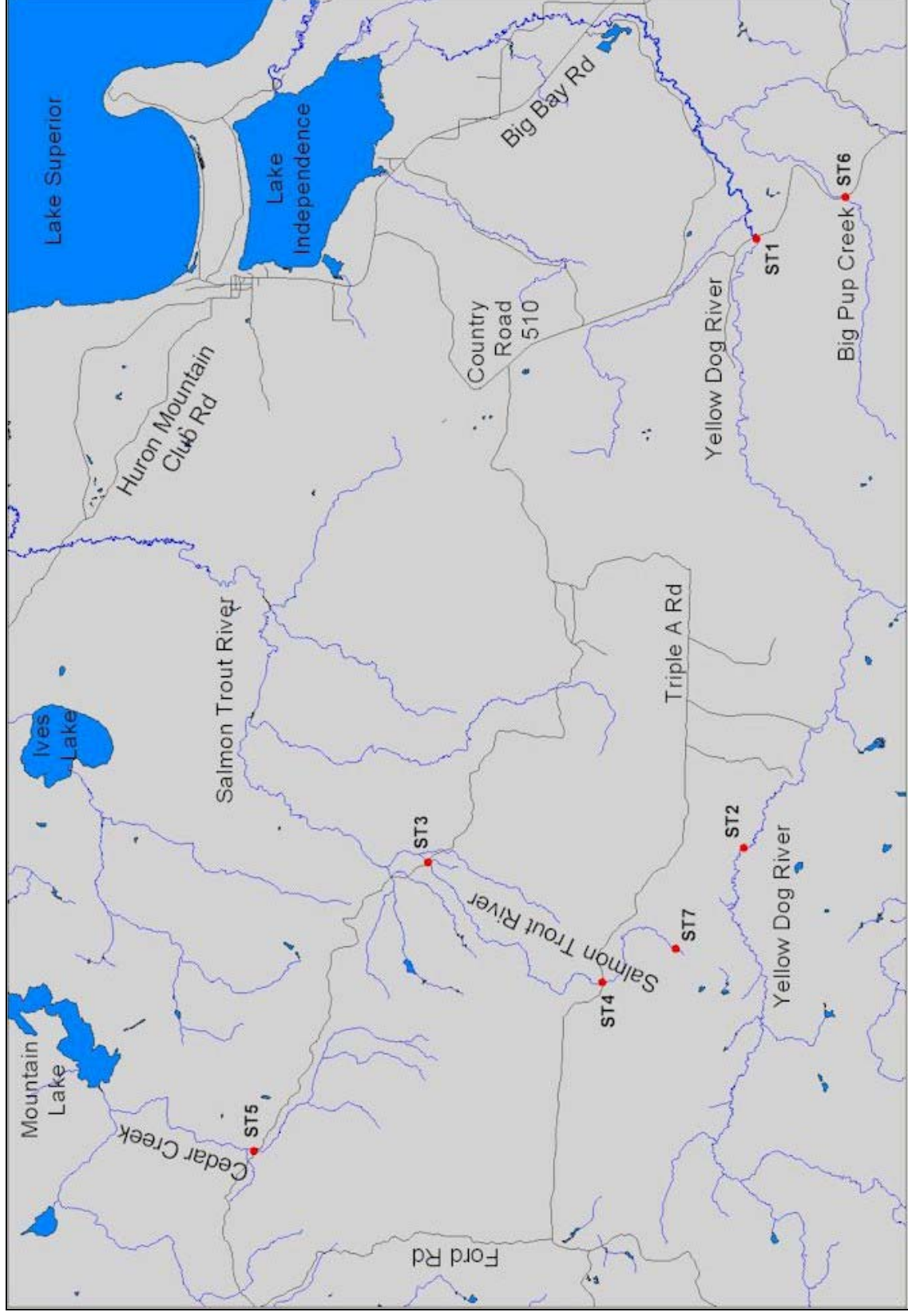


**Exhibit 2. Topographic Map Showing Sampling Stations 1 and 6**

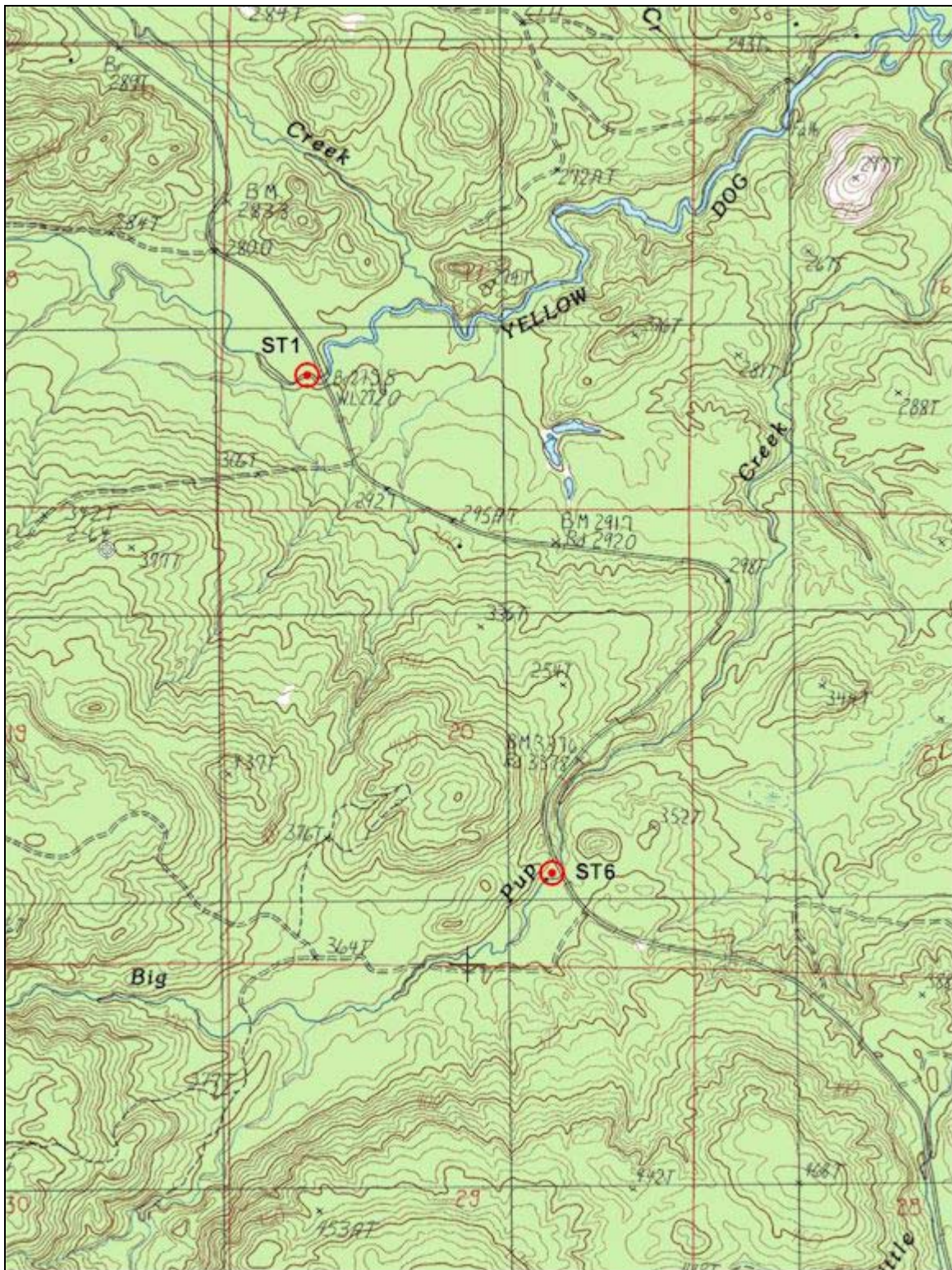


Exhibit 3. Topographic Map Showing Sampling Stations 2, 4, and 7

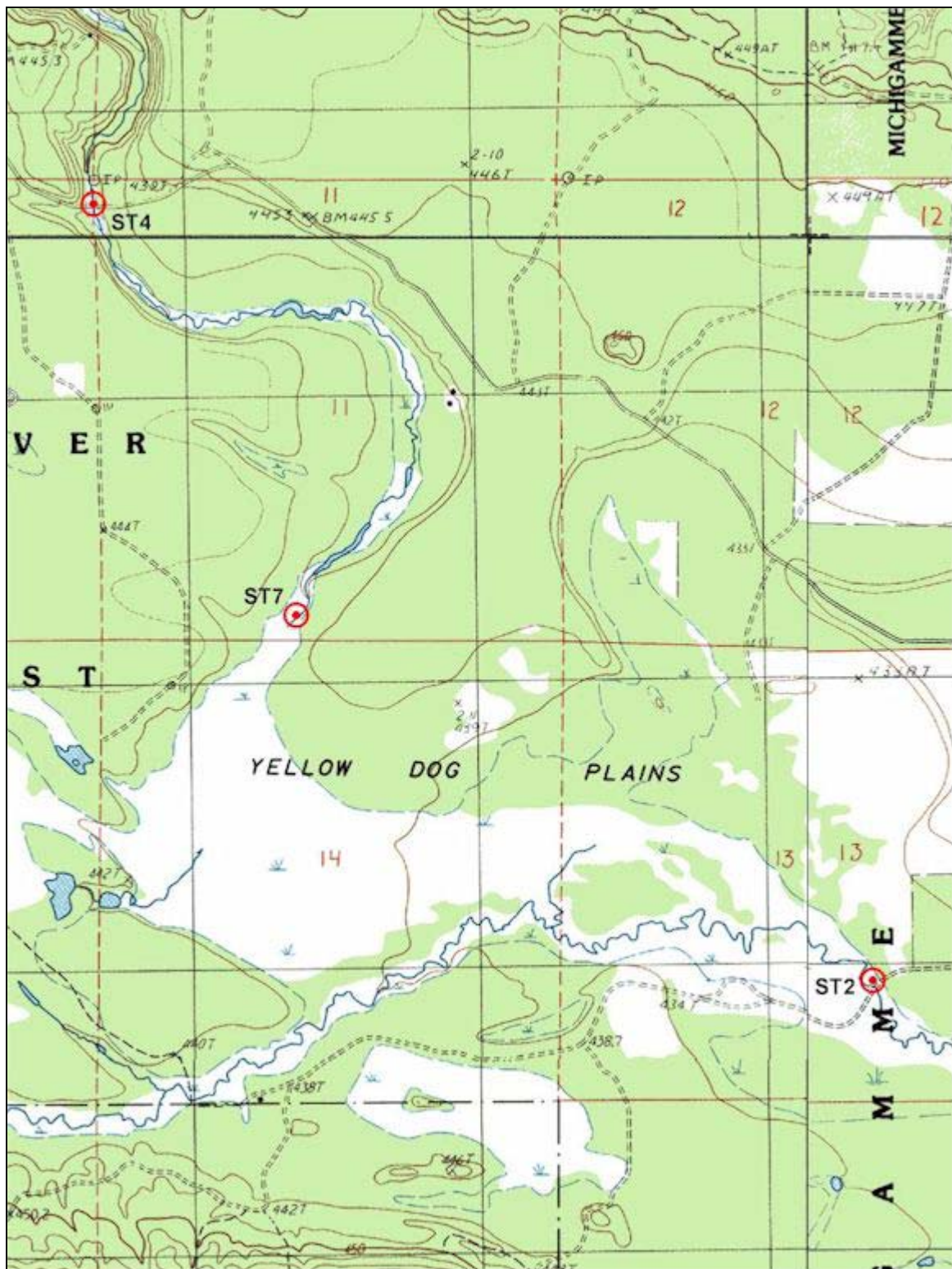


**Exhibit 4. Topographic Map Showing Sampling Station 3**

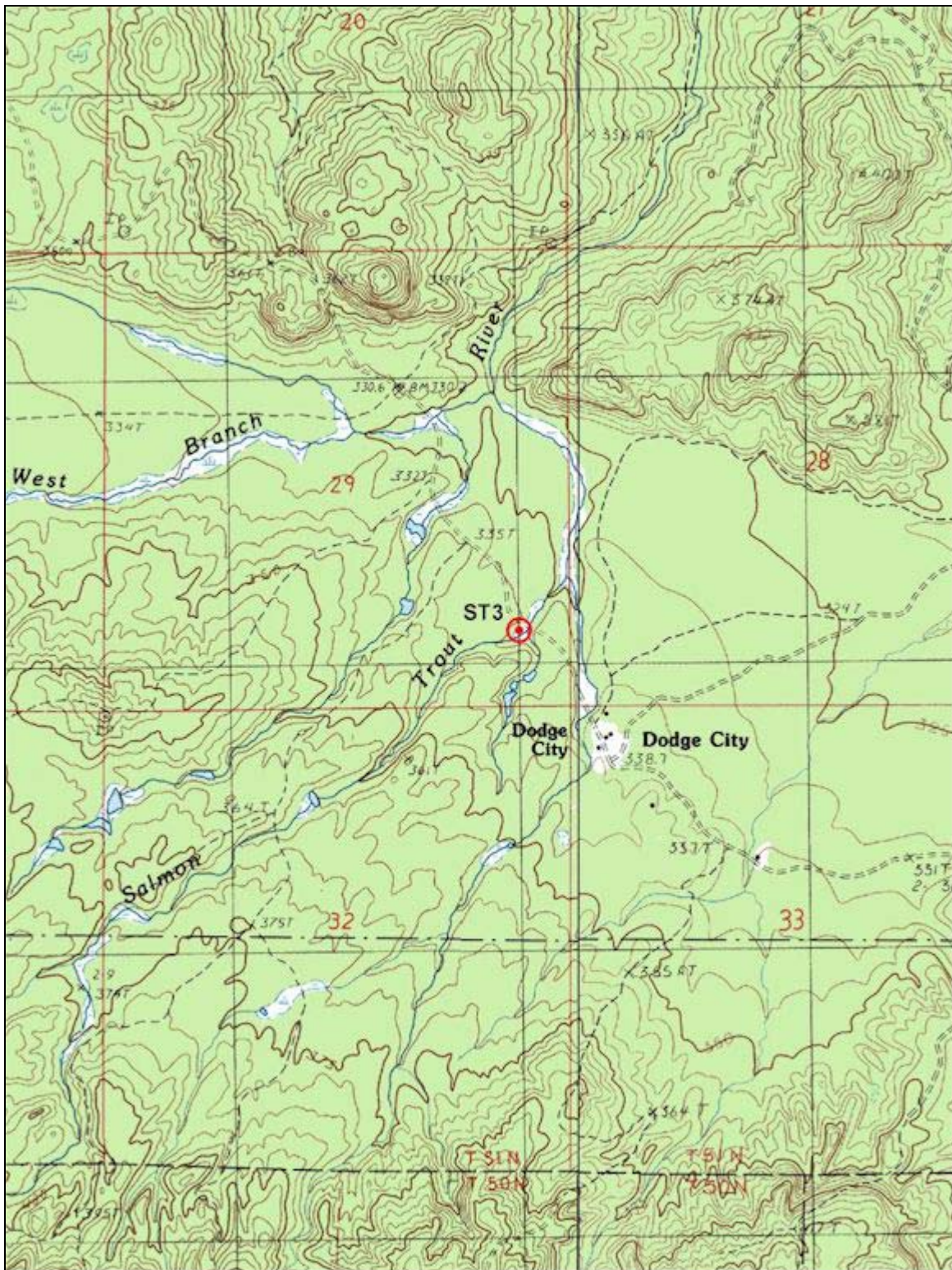
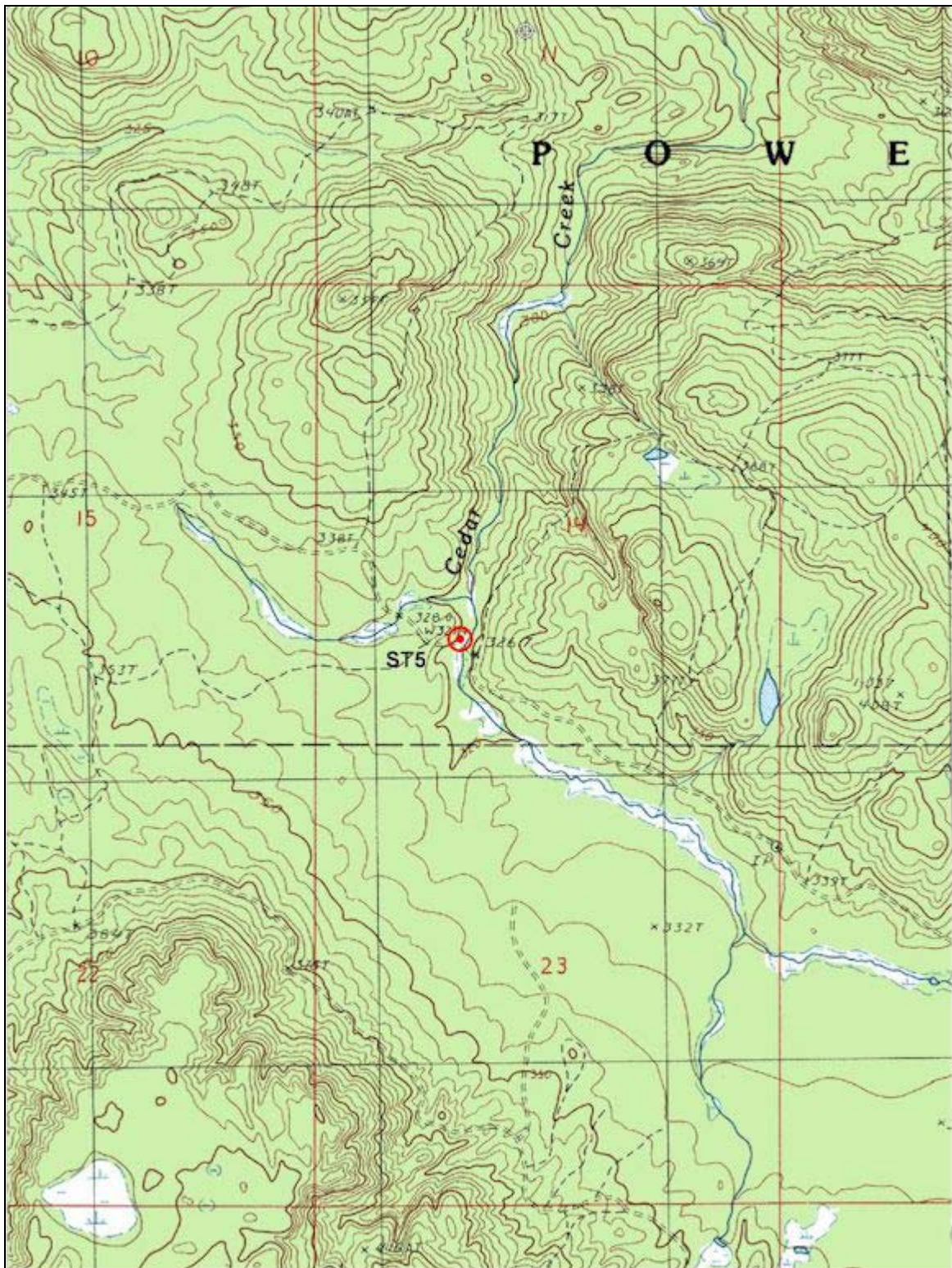
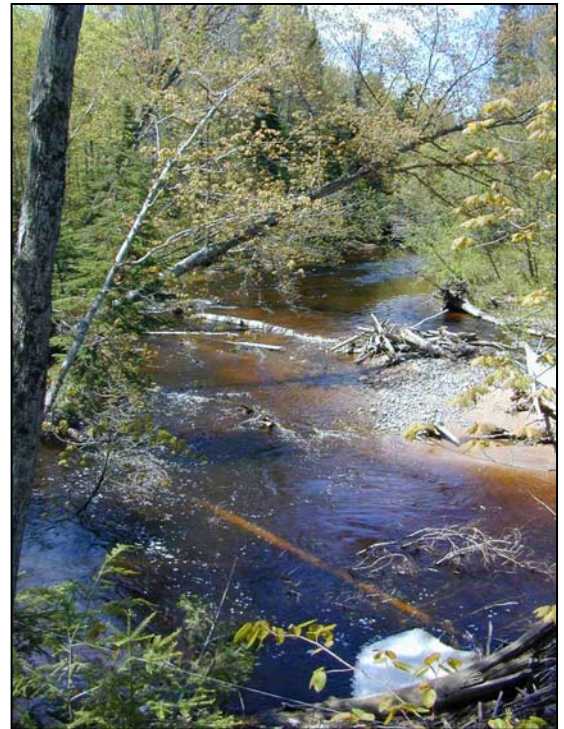


**Exhibit 5. Topographic Map Showing Sampling Station 5**



---

**Exhibit 6. Photographs of the Yellow Dog River at Station 1**



---

**Exhibit 7. Photographs of the Yellow Dog River at Station 2**



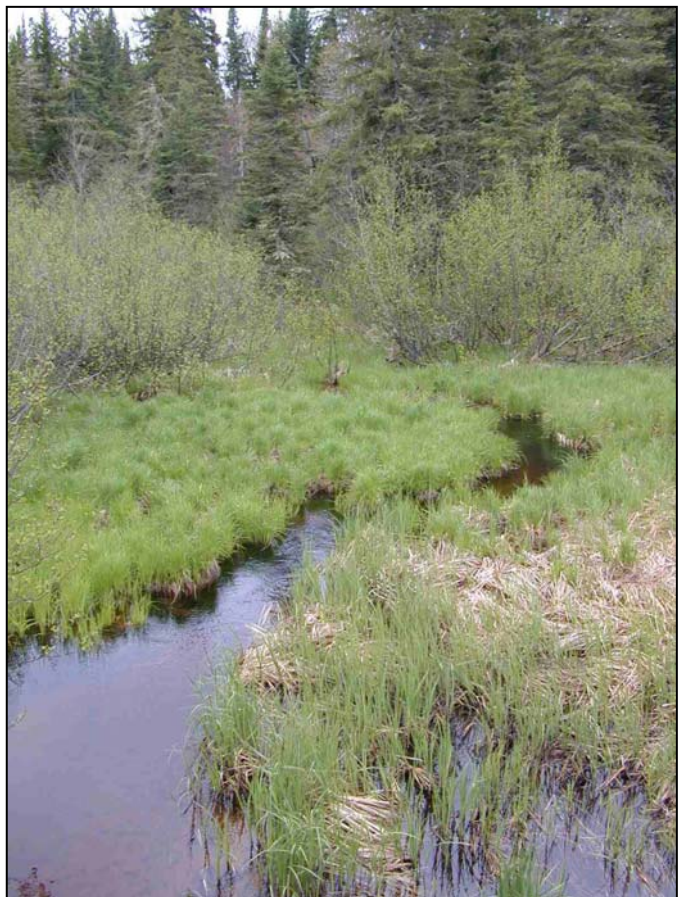
---

**Exhibit 8. Photographs of the Salmon Trout River at Station 3**



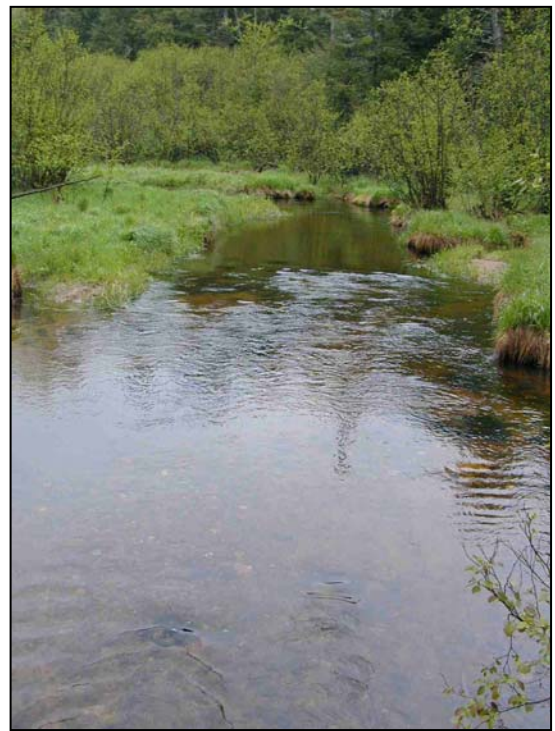
---

**Exhibit 9. Photographs of the Salmon Trout River at Station 4**



---

**Exhibit 10. Photographs of the Cedar Creek at Station 5**



---

**Exhibit 11. Photographs of the Big Pup Creek at Station 6**



---

**Exhibit 12. Photographs of the Salmon Trout River at Station 7**



---

## **APPENDIX B**

### **Tables**

---

---

| <b>Table 1. Location Description for Each of Seven Sampling Stations</b> |                          |                        |                                                                         |                  |                               |
|--------------------------------------------------------------------------|--------------------------|------------------------|-------------------------------------------------------------------------|------------------|-------------------------------|
| Station Number                                                           | Stream Name              | Latitude/<br>Longitude | Township /<br>Range / Section                                           | STORET<br>Number | Station<br>Location           |
| 1                                                                        | Yellow<br>Dog<br>River   | N46.72666<br>W87.71554 | T.50N.-R.27W.,<br>Section 17<br>(NW $\frac{1}{4}$ of SW $\frac{1}{4}$ ) | 520272           | CR-510<br>Crossing            |
| 2                                                                        | Yellow<br>Dog<br>River   | N46.72651<br>W87.87194 | T.50N.-R.29W.,<br>Section 13<br>(SW $\frac{1}{4}$ of SE $\frac{1}{4}$ ) | 520317           | Triple A-Road<br>Crossing     |
| 3                                                                        | Salmon<br>Trout<br>River | N46.78211<br>W87.87764 | T.51N.-R.28W.,<br>Section 29<br>(SE $\frac{1}{4}$ of SE $\frac{1}{4}$ ) | 520270           | Northwestern<br>Road Crossing |
| 4                                                                        | Salmon<br>Trout<br>River | N46.75094<br>W87.90749 | T.50N.-R.29W.,<br>Section 11<br>(NW $\frac{1}{4}$ of NW $\frac{1}{4}$ ) | 520318           | Triple A-Road<br>Crossing     |
| 5                                                                        | Cedar<br>Creek           | N46.81173<br>W87.95296 | T.51N.-R.29W.,<br>Section 14<br>(SE $\frac{1}{4}$ of SW $\frac{1}{4}$ ) | 520316           | Northwestern<br>Road Crossing |
| 6                                                                        | Big<br>Pup<br>Creek      | N46.71102<br>W87.70440 | T.50N.-R.27W.,<br>Section 20<br>(SW $\frac{1}{4}$ of SE $\frac{1}{4}$ ) | 520273           | CR-510<br>Crossing            |
| 7                                                                        | Salmon<br>Trout<br>River | N46.73803<br>W87.89825 | T.50N.-R.29W.,<br>Section 11<br>(SE $\frac{1}{4}$ of SW $\frac{1}{4}$ ) | 520324           | Near<br>headwaters            |

---

**Table 2. Analytical Chemistry Conducted for 2004 Baseline Limnological Study**

*Metals analyses conducted at the MDEQ Laboratory. Low-level metals analyses (other than mercury) conducted at Wisconsin State Laboratory of Hygiene. White Water Associates Laboratory conducted analyses for nutrients, COD, sulfate, alkalinity, conductivity, TSS, TDS, chlorides, and pH.*

| Sample Type                                                                                                    | Samples and Description                                                                                                                                                                                                                                                                                                                           | Analytes                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GA ( <i>general chemistry-acid preserved</i> )                                                                 | One water sample each from Stations 1-6 collected monthly June through November. Station 7 was added for August through November. One field blank and one field duplicate were collected in each sampling bout. Samples shipped to MDEQ laboratory for analyses.                                                                                  | Ammonia, Nitrate plus Nitrite, TKN, Total Phosphorus, COD                                                                                                          |
| S ( <i>sulfide-preserved with zinc acetate and sodium hydroxide</i> ) (MDEQ Laboratory)                        | One water sample each from Stations 1-6 collected monthly July through November. Station 7 was added for August through November. One field blank and one field duplicate were collected in each sampling bout. Samples shipped to MDEQ laboratory for analyses.                                                                                  | Sulfide                                                                                                                                                            |
| GN ( <i>general chemistry – not preserved</i> ) (White Water Laboratory)                                       | One water sample each from Stations 1-6 collected monthly (June-November). Station 7 was added for August through November. One field blank and one field duplicate were collected in each sampling bout. Samples delivered to White Water laboratory.                                                                                            | Total Dissolved Solids, TSS, Ortho-phosphorus                                                                                                                      |
| MN ( <i>inorganic-not preserved</i> ) (White Water Laboratory)                                                 | One water sample each from Stations 1-6 collected monthly (June-November). Station 7 was added for August through November. One field blank and one field duplicate were collected in each sampling bout. Samples delivered to White Water laboratory.                                                                                            | Alkalinity, Chloride, Sulfate                                                                                                                                      |
| MA ( <i>inorganic-preserved with 1ml per 100ml of 1:1 HNO<sub>3</sub> to a pH of &lt;2</i> ) (MDEQ Laboratory) | One water sample each from Stations 1-6 collected monthly (June-November). Station 7 was added for August through November. One field blank and one field duplicate were collected in each sampling bout. Samples shipped to MDEQ laboratory.                                                                                                     | Hardness (Ca, Mg, Na, K), Arsenic, Barium, Cadmium, Chromium, Zinc, Iron, Lithium, Manganese, Copper, Nickel, Lead, Selenium, Strontium, Silver, Boron             |
| Low-Level Hg (MDEQ Laboratory)                                                                                 | One water sample each from Stations 1-6 collected monthly (June-November). Station 7 was added for August through November. One field blank, one field duplicate, and one trip blank were collected in each sampling bout. Samples collected using clean techniques (EPA 1631) with bottles supplied by MDEQ. Samples shipped to MDEQ laboratory. | Low-Level Mercury                                                                                                                                                  |
| Low-Level Metals (Wisconsin State Laboratory of Hygiene)                                                       | One water sample each from Stations 1-7 collected on one sampling bout. One field blank and one field duplicate were collected. Samples collected using clean techniques (EPA 1631) with bottles supplied by Wisconsin State Laboratory of Hygiene (WSLH). Samples shipped to WSLH.                                                               | Arsenic, Boron, Cadmium, Cobalt, Chromium, Copper, Nickel, Lead, Selenium, Silver, Zinc                                                                            |
| MS ( <i>general chemistry metals in sediments</i> ) (MDEQ Laboratory)                                          | One sediment sample each from Stations 1-6 plus one field duplicate sample in June sampling bout. One sediment sample collected from Stations 1-7 plus one field duplicate sample in August sampling bout. Samples collected following SWQAS Procedure #64. Sulfide and total volatile solids analyzed in August only.                            | Arsenic, Barium, Cadmium, Chromium, Zinc, Iron, Lithium, Copper, Nickel, Lead, Selenium, Strontium Silver, Mercury, % Total Solids, Sulfide, Total Volatile Solids |

---

| <b>Table 3. Discharge and Stage Height by Date for Sampling Stations 1–6 in 2004</b> |                        |       |                        |       |                        |       |                        |       |                       |       |                         |       |
|--------------------------------------------------------------------------------------|------------------------|-------|------------------------|-------|------------------------|-------|------------------------|-------|-----------------------|-------|-------------------------|-------|
|                                                                                      | Station 1 – Yellow Dog |       | Station 2 – Yellow Dog |       | Station 3 – Salmon Trt |       | Station 4 – Salmon Trt |       | Station 5 – Cedar Crk |       | Station 6 – Big Pup Crk |       |
| Drainage Area                                                                        | 46.3 mi <sup>2</sup>   |       | 28.8 mi <sup>2</sup>   |       | 5.1 mi <sup>2</sup>    |       | 3.1 mi <sup>2</sup>    |       | 5.1 mi <sup>2</sup>   |       | 5.1 mi <sup>2</sup>     |       |
| Date (2004)                                                                          | CFS                    | Stage | CFS                    | Stage | CFS                    | Stage | CFS                    | Stage | CFS                   | Stage | CFS                     | Stage |
| 5/26-27                                                                              | 105.7                  | 2.00  | 65.19                  | 2.10  | 10.25                  | 0.82  | 4.30                   | 1.22  | 27.77                 | 1.48  | 14.24                   | 1.72  |
| 6/14-15                                                                              | 52.40                  | 1.61  | 35.63                  | 1.34  | 5.00                   | 0.52  | 2.14                   | 0.88  | 14.04                 | 1.22  | 5.76                    | 1.58  |
| 7/6                                                                                  | 41.98                  | 1.52  | 24.58                  | 0.96  | 5.60                   | 0.46  | 2.43                   | 0.86  | 13.49                 | 1.18  | 5.71                    | 1.53  |
| 8/3-4                                                                                | 28.39                  | 1.36  | 14.26                  | 0.72  | 3.01                   | 0.44  | 1.38                   | 0.81  | 10.79                 | 1.10  | 4.78                    | 1.54  |
| 9/14                                                                                 | 23.06                  | 1.24  | 7.74                   | 0.42  | 2.92                   | 0.40  | 1.22                   | 0.79  | 9.57                  | 0.92  | 3.62                    | 1.50  |
| 10/5                                                                                 | 27.44                  | 1.32  | 13.55                  | 0.63  | 4.36                   | 0.44  | 2.18                   | -0.08 | 11.91                 | 1.06  | 4.65                    | 1.50  |
| 11/9                                                                                 | 39.50                  | 1.54  | 24.85                  | 1.1   | 4.59                   | 0.45  | 2.25                   | -0.04 | 12.69                 | 1.08  | 4.77                    | 1.54  |

*Note: Discharge is measured in cubic feet per second (cfs).*

*Note: Stage height is measured in decimal feet.*

*Note: Drainage Area (in square miles) values provided by MDEQ Hydrology Unit. The drainage area for Station 7 (headwaters of the Salmon Trout River) was estimated at 0.16 square mile.*

*Note: Station 7 at the headwaters of the Salmon Trout River had very sluggish and diffuse flow for which discharge was estimated using the float method during an August 3<sup>rd</sup> sampling bout. Discharge was determined to be 0.41 cfs. A staff gauge installed at this site read 0.0 feet on August 3.*

---

---

| <b>Table 4. Yield for Sampling Stations 1–7 in 2004.</b> |                                                                                                                           |                                  |                                 |                                 |                             |                               |                                 |
|----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|----------------------------------|---------------------------------|---------------------------------|-----------------------------|-------------------------------|---------------------------------|
|                                                          | Station 1<br>Yellow<br>Dog River                                                                                          | Station 2<br>Yellow<br>Dog River | Station 3<br>Salmon<br>Trout R. | Station 4<br>Salmon<br>Trout R. | Station 5<br>Cedar<br>Creek | Station 6<br>Big Pup<br>Creek | Station 7<br>Salmon<br>Trout R. |
| Drainage<br>Area                                         | 46.3 mi <sup>2</sup>                                                                                                      | 28.8 mi <sup>2</sup>             | 5.1 mi <sup>2</sup>             | 3.1 mi <sup>2</sup>             | 5.1 mi <sup>2</sup>         | 5.1 mi <sup>2</sup>           | 0.16 mi <sup>2</sup>            |
| Date<br>(2004)                                           | Yield (calculated by dividing discharge by drainage area) by date and sampling station<br>(units are cfs per square mile) |                                  |                                 |                                 |                             |                               |                                 |
| 5/26-27                                                  | 2.3                                                                                                                       | 2.3                              | 2.0                             | 1.4                             | 5.4                         | 2.8                           | --                              |
| 6/14-15                                                  | 1.1                                                                                                                       | 1.2                              | 1.0                             | 0.7                             | 2.8                         | 1.1                           | --                              |
| 7/6                                                      | 0.9                                                                                                                       | 0.8                              | 1.1                             | 0.8                             | 2.6                         | 1.1                           | --                              |
| 8/3-4                                                    | 0.6                                                                                                                       | 0.5                              | 0.6                             | 0.4                             | 2.1                         | 0.9                           | 2.6 <sup>*</sup>                |
| 9/14                                                     | 0.5                                                                                                                       | 0.3                              | 0.6                             | 0.4                             | 1.9                         | 0.7                           | --                              |
| 10/5                                                     | 0.6                                                                                                                       | 0.5                              | 0.9                             | 0.7                             | 2.3                         | 0.9                           | --                              |
| 11/9                                                     | 0.8                                                                                                                       | 0.9                              | 0.9                             | 0.7                             | 2.5                         | 0.9                           | --                              |

*\* Note: The drainage area for Station 7 (headwaters of the Salmon Trout River) was estimated by MDEQ Hydrology Unit at 0.16 square mile, but is very near the headwaters of the stream and was therefore difficult to get an accurate estimate. Likewise, it was difficult to obtain an accurate estimate of discharge at Station 7 because of sluggish and diffuse flow. Because of these conditions, the value for yield at Station 7 is a rough estimate.*

---

---

| Table 5. History of pH Recorded at Sampling Stations During 2004 |             |             |             |             |             |             |             |
|------------------------------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Date                                                             | Station 1   | Station 2   | Station 3   | Station 4   | Station 5   | Station 6   | Station 7   |
| 5/26/04                                                          | 7.08        | 6.27        | 6.80        | <u>6.36</u> | 6.76        | <u>6.52</u> | --          |
| 6/14/04                                                          | <u>6.65</u> | <u>6.08</u> | <u>6.50</u> | 6.74        | <u>6.38</u> | 6.84        | --          |
| 7/6/04                                                           | 6.84        | 6.53        | 6.52        | 6.43        | 6.65        | 7.23        | --          |
| 8/3/04                                                           | 7.75        | 6.93        | <u>7.98</u> | <u>7.10</u> | <u>7.69</u> | 7.62        | 6.53        |
| 9/14/04                                                          | <u>8.08</u> | 6.86        | 7.46        | 6.75        | 7.43        | <u>7.85</u> | <u>6.28</u> |
| 10/5/04                                                          | 7.85        | <u>7.28</u> | 7.74        | <u>6.36</u> | 7.55        | 7.83        | 6.51        |
| 11/9/04                                                          | 7.28        | 6.92        | 7.35        | 6.84        | 6.84        | 7.40        | <u>6.81</u> |
| Range                                                            | 1.43        | 1.20        | 1.48        | 0.74        | 1.31        | 1.33        | 0.53        |

*Note: Highest and lowest pH values are underlined for each sampling station.*

---

---

| <b>Table 6. Specific Conductance Recorded at Sampling Stations During 2004</b> |              |              |              |              |              |              |              |
|--------------------------------------------------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Date                                                                           | Station 1    | Station 2    | Station 3    | Station 4    | Station 5    | Station 6    | Station 7    |
| 5/26/04                                                                        | <u>52.22</u> | <u>31.66</u> | <u>65.52</u> | <u>49.80</u> | <u>106.4</u> | <u>51.53</u> | --           |
| 6/14/04                                                                        | 80.55        | 50.72        | 81.17        | 54.06        | 132.0        | 80.62        | --           |
| 7/6/04                                                                         | 96.15        | 65.55        | 84.05        | 63.30        | 140.3        | 87.40        | --           |
| 8/3/04                                                                         | 108.3        | 64.10        | 89.43        | 64.30        | 142.1        | 98.62        | <u>79.80</u> |
| 9/14/04                                                                        | <u>127.0</u> | <u>139.4</u> | <u>92.00</u> | <u>68.60</u> | <u>146.0</u> | <u>102.5</u> | 65.8         |
| 10/5/04                                                                        | 110.0        | 74.80        | 83.00        | 56.28        | 134.0        | 97.00        | 41.00        |
| 11/9/04                                                                        | 83.90        | 48.40        | 80.70        | 53.00        | 125.3        | 92.20        | <u>40.80</u> |
| Range                                                                          | 74.78        | 107.7        | 26.48        | 18.80        | 39.60        | 50.97        | 39.00        |

*Note: Specific conductance is reported in micro-Siemens per centimeter ( $\mu\text{S}/\text{cm}$ ).*

*Note: Highest and lowest specific conductance values are underlined for each sampling station.*

---

---

| <b>Table 7. Dissolved Oxygen Recorded at Sampling Stations During 2004</b> |           |           |           |           |           |           |            |
|----------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|------------|
| Date                                                                       | Station 1 | Station 2 | Station 3 | Station 4 | Station 5 | Station 6 | Station 7  |
| 5/26/04                                                                    | 10.8      | 10.6      | 10.7      | 9.6       | 9.8       | 11.2      | --         |
| 6/14/04                                                                    | 9.8       | 8.2       | 10.3      | 9.9       | 10.8      | 10.0      | --         |
| 7/6/04                                                                     | 10.6      | 8.8       | 10.7      | 8.8       | 10.1      | 11.3      | --         |
| 8/3/04                                                                     | 9.5       | 9.2       | 10.2      | 9.3       | 8.6       | 9.8       | <u>1.4</u> |
| 9/14/04                                                                    | 9.9       | 7.6       | 10.4      | 8.6       | 10.5      | 9.4       | <u>4.3</u> |
| 10/5/04                                                                    | 14.0      | 11.4      | 12.7      | 12.2      | 13.1      | 11.9      | <u>6.4</u> |
| 11/9/04                                                                    | 13.5      | 13.9      | 12.6      | 14.2      | 8.0       | 13.6      | 8.4        |

*Note: Dissolved oxygen is reported in milligrams per liter (mg/L).*

*Note: Readings less than 7.0 are underlined.*

---

**Table 8. Comparison Between NIST Thermometer Reading and Optic Stowaway Temperature Reading Nearest in Time for Site Visits from June–October 2004**

| Station | Stream             | NIST<br>Date/Time (ET) | NIST<br>Temp. | Stowaway<br>Temp. | Diff.<br>(NIST –<br>Stow.) | Stowaway<br>Date/Time |
|---------|--------------------|------------------------|---------------|-------------------|----------------------------|-----------------------|
| 1       | Yellow Dog River   | 6-15-04 15:00          | 15.6          | 15.96             | -0.4                       | 6-15-2004 15:00       |
|         |                    | 7-6-04 11:30           | 10.4          | 10.98             | -0.5                       | 7-6-2004 11:30        |
|         |                    | 8-4-04 10:30           | 12.7          | 12.99             | -0.3                       | 8-4-2004 10:30        |
|         |                    | 9-14-04 13:50          | 15.6          | 15.49             | 0.1                        | 9-14-2004 13:39       |
|         |                    | 10-5-04 14:30          | 6.8           | 6.81              | 0.0                        | 10-5-2004 15:09       |
| 2       | Yellow Dog River   | 6-14-04 15:30          | 16.7          | 16.47             | 0.2                        | 6-14-2004 15:30       |
|         |                    | 7-6-04 15:00           | 12.8          | 13.19             | -0.4                       | 7-6-2004 15:00        |
|         |                    | 8-3-04 9:00            | 17.2          | 16.79             | 0.4                        | 8-3-2004 9:30         |
|         |                    | 9-14-04 9:00           | 16.7          | 16.47             | 0.2                        | 9-14-2004 9:13        |
|         |                    | 10-5-04 9:00           | 5.9           | 5.91              | 0.0                        | 10-5-2004 9:13        |
| 3       | Salmon Trout River | 6-14-04 12:30          | 12.6          | 12.92             | -0.3                       | 6-14-2004 12:30       |
|         |                    | 7-6-04 13:00           | 9.8           | 10.28             | -0.5                       | 7-6-2004 13:00        |
|         |                    | 8-4-04 12:00           | 11.7          | 12.14             | -0.4                       | 8-4-2004 12:00        |
|         |                    | 9-14-04 12:50          | 14.7          | 14.62             | 0.1                        | 9-14-2004 12:43       |
|         |                    | 10-5-04 13:30          | 5.7           | 5.32              | 0.4                        | 10-5-2004 13:13       |
| 4       | Salmon Trout River | 6-14-04 14:30          | 16.4          | 16.33             | 0.1                        | 6-14-2004 14:30       |
|         |                    | 7-6-04 15:30           | 11.1          | 12.89             | -1.8                       | 7-6-2004 15:30        |
|         |                    | 8-3-04 11:00           | 16.3          | 16.02             | 0.3                        | 8-3-2004 11:00        |
|         |                    | 9-14-04 10:30          | 15.2          | 15.7              | -0.5                       | 9-14-2004 10:15       |
| 5       | Cedar Creek        | 6-14-04 10:30          | 11.7          | 12.12             | -0.4                       | 6-14-2004 10:30       |
|         |                    | 7-6-04 17:00           | 10.3          | 10.73             | -0.4                       | 7-6-2004 17:00        |
|         |                    | 8-3-04 16:30           | 15.2          | 15.23             | 0.0                        | 8-3-2004 16:30        |
|         |                    | 9-14-04 11:35          | 14.4          | 14.44             | 0.0                        | 9-14-2004 11:36       |
|         |                    | 10-5-04 12:00          | 5.7           | 5.31              | 0.4                        | 10-5-2004 11:36       |
| 6       | Big Pup Creek      | 6-15-04 15:45          | 12.4          | 13.07             | -0.7                       | 6-15-2004 16:00       |
|         |                    | 7-6-04 10:30           | 8.1           | 8.43              | -0.3                       | 7-6-2004 10:30        |
|         |                    | 8-4-04 9:00            | 9.9           | 10.28             | -0.4                       | 8-4-2004 9:00         |
|         |                    | 9-14-04 14:40          | 14.2          | 14.31             | -0.1                       | 9-14-2004 14:48       |
|         |                    | 10-5-04 15:30          | 6.2           | 5.95              | 0.2                        | 10-5-2004 15:18       |
| 7       | Salmon Trout River | 8-3-04 15:00           | 20.2          | 18.99             | 1.2                        | 8-3-2004 15:18        |
|         |                    | 9-14-04 10:00          | 16.9          | 16.43             | 0.5                        | 9-14-2004 10:18       |
|         |                    | 10-5-04 10:15          | 4.9           | 4.31              | 0.6                        | 10-5-2004 9:48        |

---

**Table 9. Summary Temperature (°C) Statistics for Stations 1–7****MAY 2004**

| Station | STORET | RIVER         | MAX   | MIN  | MEAN  | SD   | N   | 95%CI± |
|---------|--------|---------------|-------|------|-------|------|-----|--------|
| 1       | 520272 | Yellow Dog    | 15.17 | 7.42 | 11.07 | 1.87 | 260 | 0.23   |
| 2       | 520317 | Yellow Dog    | 14.89 | 8.08 | 11.69 | 1.64 | 260 | 0.20   |
| 3       | 520270 | Salmon Trout  | 14.62 | 6.10 | 10.28 | 2.12 | 209 | 0.29   |
| 4       | 520318 | Salmon Trout  | 16.81 | 7.02 | 11.98 | 2.51 | 206 | 0.34   |
| 5       | 520316 | Cedar Creek   | 14.91 | 6.08 | 10.55 | 2.22 | 215 | 0.30   |
| 6       | 520273 | Big Pup Creek | 12.92 | 5.64 | 9.29  | 1.77 | 265 | 0.21   |

**JUNE 2004**

| Station | STORET | RIVER         | MAX   | MIN  | MEAN  | SD   | N    | 95%CI± |
|---------|--------|---------------|-------|------|-------|------|------|--------|
| 1       | 520272 | Yellow Dog    | 19.98 | 8.35 | 13.68 | 2.38 | 1396 | 0.12   |
| 2       | 520317 | Yellow Dog    | 20.99 | 8.85 | 15.05 | 2.38 | 1396 | 0.12   |
| 3       | 520270 | Salmon Trout  | 18.93 | 7.19 | 12.45 | 2.24 | 1390 | 0.12   |
| 4       | 520318 | Salmon Trout  | 21.67 | 7.79 | 14.80 | 2.74 | 1399 | 0.14   |
| 5       | 520316 | Cedar Creek   | 19.23 | 7.17 | 12.71 | 2.34 | 1392 | 0.12   |
| 6       | 520273 | Big Pup Creek | 16.68 | 6.88 | 10.90 | 1.89 | 1395 | 0.10   |

**JULY 2004**

| Station | STORET | RIVER         | MAX   | MIN   | MEAN  | SD   | N    | 95%CI± |
|---------|--------|---------------|-------|-------|-------|------|------|--------|
| 1       | 520272 | Yellow Dog    | 19.66 | 10.21 | 14.75 | 2.20 | 1488 | 0.11   |
| 2       | 520317 | Yellow Dog    | 20.66 | 10.71 | 16.52 | 2.20 | 1488 | 0.11   |
| 3       | 520270 | Salmon Trout  | 17.32 | 9.35  | 13.36 | 1.79 | 1488 | 0.09   |
| 4       | 520318 | Salmon Trout  | 21.33 | 10.42 | 16.46 | 2.53 | 1488 | 0.13   |
| 5       | 520316 | Cedar Creek   | 17.13 | 9.63  | 13.57 | 1.80 | 1488 | 0.09   |
| 6       | 520273 | Big Pup Creek | 16.20 | 8.27  | 11.94 | 1.62 | 1488 | 0.08   |

Continued next page...

---

**Table 9. Summary Temperature (°C) Statistics for Stations 1–7...concluded****AUGUST 2004**

| Station | STORET | RIVER        | MAX   | MIN   | MEAN  | SD   | N    | 95%CI± |
|---------|--------|--------------|-------|-------|-------|------|------|--------|
| 1       | 520272 | Yellow Dog   | 18.52 | 9.89  | 13.48 | 1.87 | 1488 | 0.10   |
| 2       | 520317 | Yellow Dog   | 19.52 | 11.02 | 15.01 | 1.98 | 1488 | 0.10   |
| 3       | 520270 | Salmon Trout | 16.04 | 9.19  | 12.29 | 1.48 | 1488 | 0.08   |
| 4       | 520318 | Salmon Trout | 20.35 | 10.58 | 15.10 | 2.15 | 1488 | 0.11   |
| 5       | 520316 | Cedar Creek  | 16.18 | 9.17  | 12.53 | 1.44 | 1488 | 0.07   |
| 6       | 520273 | Big Pup Crk  | 15.09 | 8.12  | 11.15 | 1.46 | 1488 | 0.07   |
| 7       | 520324 | Salmon Trout | 20.94 | 10.97 | 15.74 | 2.15 | 1362 | 0.11   |

**SEPTEMBER 2004**

| Station | STORET | RIVER        | MAX   | MIN   | MEAN  | SD   | N    | 95%CI± |
|---------|--------|--------------|-------|-------|-------|------|------|--------|
| 1       | 520272 | Yellow Dog   | 17.55 | 7.42  | 12.98 | 2.02 | 1440 | 0.10   |
| 2       | 520317 | Yellow Dog   | 19.36 | 9.77  | 15.21 | 1.91 | 1440 | 0.10   |
| 3       | 520270 | Salmon Trout | 15.89 | 7.03  | 12.40 | 1.85 | 1440 | 0.10   |
| 4       | 520318 | Salmon Trout | 19.22 | 10.27 | 15.25 | 1.87 | 1008 | 0.12   |
| 5       | 520316 | Cedar Creek  | 15.86 | 7.48  | 12.62 | 1.76 | 1440 | 0.09   |
| 6       | 520273 | Big Pup Crk  | 15.41 | 6.88  | 11.62 | 1.76 | 1440 | 0.09   |
| 7       | 520324 | Salmon Trout | 20.28 | 8.81  | 15.04 | 2.05 | 1440 | 0.11   |

**OCTOBER 2004**

| Station | STORET | RIVER        | MAX   | MIN  | MEAN | SD   | N   | 95%CI± |
|---------|--------|--------------|-------|------|------|------|-----|--------|
| 1       | 520272 | Yellow Dog   | 12.06 | 4.63 | 8.10 | 1.78 | 223 | 0.23   |
| 2       | 520317 | Yellow Dog   | 12.10 | 5.91 | 9.28 | 1.59 | 211 | 0.21   |
| 3       | 520270 | Salmon Trout | 11.37 | 4.38 | 7.76 | 1.78 | 219 | 0.24   |
| 4       | 520318 | Salmon Trout | --    | --   | --   | --   | --  | --     |
| 5       | 520316 | Cedar Creek  | 11.49 | 4.99 | 8.31 | 1.61 | 216 | 0.21   |
| 6       | 520273 | Big Pup Crk  | 10.91 | 4.08 | 7.23 | 1.75 | 223 | 0.23   |
| 7       | 520324 | Salmon Trout | 13.29 | 4.31 | 9.02 | 2.04 | 212 | 0.27   |

*Note: In Sept. there were several days of missing data at Station 4 because of a drop in water level.*

*Note: In October there were no readings for Station 4 because of a drop in water level.*

---

---

**Table 10. Summary of Stream Temperature (°C) Data by Station over the Entire Study Period**

**MAY–OCTOBER 2004**

| Station | STORET | RIVER        | MAX   | MIN  | MEAN  | SD   | N    | 95%CI± |
|---------|--------|--------------|-------|------|-------|------|------|--------|
| 1       | 520272 | Yellow Dog   | 19.98 | 4.63 | 13.42 | 2.47 | 6295 | 0.06   |
| 2       | 520317 | Yellow Dog   | 20.99 | 5.91 | 15.09 | 2.54 | 6283 | 0.06   |
| 3       | 520270 | Salmon Trout | 18.93 | 4.38 | 12.38 | 2.14 | 6234 | 0.05   |
| 4       | 520318 | Salmon Trout | 21.67 | 7.02 | 15.30 | 2.55 | 5588 | 0.07   |
| 5       | 520316 | Cedar Creek  | 19.23 | 4.99 | 12.63 | 2.11 | 6238 | 0.05   |
| 6       | 520273 | Big Pup Crk  | 16.68 | 4.08 | 11.17 | 1.94 | 6298 | 0.05   |
| 7       | 520324 | Salmon Trout | 20.94 | 4.31 | 14.93 | 2.67 | 3014 | 0.10   |

---

**Table 11. Water Chemistry Results for All Sampling Stations and Dates**

(continues on subsequent pages)

| Parameter (Units)       | Station | 2004 Sampling Bouts |       |       |       |       |       |
|-------------------------|---------|---------------------|-------|-------|-------|-------|-------|
|                         |         | June                | July  | Aug   | Sept  | Oct   | Nov   |
| Alkalinity (mg/L)       | 1       | 36                  | 40    | 47    | 55    | 49    | 38    |
|                         | 2       | 24                  | 25    | 19    | 36    | 33    | 22    |
|                         | 3       | 36                  | 34    | 42    | 42    | 36    | 35    |
|                         | 4       | 27                  | 24    | 30    | 25    | 26    | 24    |
|                         | 5       | 72                  | 64    | 68    | 69    | 64    | 52    |
|                         | 6       | 38                  | 38    | 41    | 40    | 41    | 38    |
|                         | 6 (DUP) | 34                  | 34    | 32    | 43    | 42    | 40    |
|                         | 7       |                     |       | 23    | 27    | 18    | 14    |
|                         | FB      | ND                  | ND    | ND    | ND    | ND    | ND    |
| Aluminum - Total (µg/L) | 1       | 140                 | 91    | 210   | ND    | ND    | 65    |
|                         | 2       | 110                 | 62    | 59    | ND    | ND    | 96    |
|                         | 3       | 110                 | 97    | ND    | ND    | ND    | ND    |
|                         | 4       | ND                  | 58    | ND    | ND    | 54    | ND    |
|                         | 5       | ND                  | ND    | ND    | ND    | ND    | ND    |
|                         | 6       | 52                  | ND    | ND    | ND    | 100   | ND    |
|                         | 6 (DUP) | 55                  | ND    | ND    | ND    | 86    | ND    |
|                         | 7       |                     |       | ND    | ND    | ND    | ND    |
|                         | FB      | ND                  | ND    | ND    | ND    | ND    | ND    |
| Ammonia (mg N/L)        | 1       | ND                  | 0.011 | 0.007 | 0.004 | 0.007 | 0.006 |
|                         | 2       | ND                  | 0.021 | 0.018 | 0.007 | 0.014 | 0.021 |
|                         | 3       | ND                  | 0.01  | 0.006 | 0.002 | 0.006 | 0.003 |
|                         | 4       | ND                  | 0.011 | 0.016 | 0.009 | 0.01  | 0.009 |
|                         | 5       | ND                  | 0.007 | 0.006 | 0.002 | 0.006 | 0.004 |
|                         | 6       | ND                  | 0.004 | 0.005 | 0.003 | 0.004 | 0.002 |
|                         | 6 (DUP) | ND                  | 0.004 | 0.005 | 0.003 | 0.005 | 0.002 |
|                         | 7       |                     |       | 0.046 | 0.02  | 0.015 | 0.01  |
|                         | FB      | ND                  | ND    | ND    | 0.001 | 0.003 | ND    |
| Arsenic - Total (µg/L)  | 1       | ND                  | ND    | 1.1   |       | ND    | ND    |
|                         | 2       | 1.1                 | ND    | 1.1   |       | ND    | ND    |
|                         | 3       | 1.3                 | 1.2   | 1.2   |       | ND    | 1     |
|                         | 4       | ND                  | ND    | ND    |       | ND    | ND    |
|                         | 5       | 1.8                 | 1.8   | 2.2   |       | 1.4   | 1.6   |
|                         | 6       | ND                  | ND    | ND    |       | ND    | ND    |
|                         | 6 (DUP) | ND                  | ND    | ND    |       | ND    | ND    |
|                         | 7       |                     |       | 1.3   |       | ND    | ND    |
|                         | FB      | ND                  | ND    | ND    |       | ND    | ND    |
| Barium - Total (µg/L)   | 1       | 11                  | 9.8   | 13    | 11    | 10    | 9.3   |
|                         | 2       | 9.4                 | 8.1   | 9.1   | 9.6   | 7.9   | 7.4   |
|                         | 3       | 10                  | 9.3   | 9.4   | 9.9   | 8.4   | 8.7   |
|                         | 4       | 11                  | 11    | 12    | 12    | 9.9   | 9.8   |
|                         | 5       | 15                  | 14    | 15    | 15    | 12    | 12    |
|                         | 6       | 11                  | 9.5   | 9.7   | 10    | 9.5   | 7.9   |
|                         | 6 (DUP) | 11                  | 9.6   | 9.8   | 9.9   | 9.1   | 7.3   |
|                         | 7       |                     |       | 29    | 22    | 9.3   | 8.2   |
|                         | FB      | ND                  | ND    | ND    | ND    | ND    | ND    |

**Table 11. Water Chemistry Results for All Sampling Stations and Dates...continued**

| Parameter (Units)       | Station | 2004 Sampling Bouts |      |      |      |      |      |
|-------------------------|---------|---------------------|------|------|------|------|------|
|                         |         | June                | July | Aug  | Sept | Oct  | Nov  |
| Boron – Total (µg/L)    | 1       | ND                  | ND   | ND   |      | ND   | ND   |
|                         | 2       | ND                  | ND   | ND   |      | ND   | ND   |
|                         | 3       | ND                  | ND   | ND   |      | ND   | ND   |
|                         | 4       | ND                  | ND   | ND   |      | ND   | ND   |
|                         | 5       | ND                  | ND   | ND   |      | ND   | ND   |
|                         | 6       | ND                  | ND   | ND   |      | ND   | ND   |
|                         | 6 (DUP) | ND                  | ND   | ND   |      | ND   | ND   |
|                         | 7       |                     |      | ND   |      | ND   | ND   |
|                         | FB      | ND                  | ND   | ND   |      | ND   | ND   |
| Cadmium – Total (µg/L)  | 1       | ND                  | ND   | ND   |      | ND   | ND   |
|                         | 2       | ND                  | ND   | ND   |      | ND   | ND   |
|                         | 3       | ND                  | ND   | ND   |      | ND   | ND   |
|                         | 4       | ND                  | ND   | ND   |      | ND   | ND   |
|                         | 5       | ND                  | ND   | 0.56 |      | ND   | ND   |
|                         | 6       | ND                  | ND   | ND   |      | ND   | ND   |
|                         | 6 (DUP) | ND                  | ND   | ND   |      | ND   | ND   |
|                         | 7       |                     |      | ND   |      | ND   | ND   |
|                         | FB      | ND                  | ND   | ND   |      | ND   | ND   |
| Calcium – Total (mg/L)  | 1       | 12.9                | 13.9 | 16.5 | 18.7 | 16.9 | 12.8 |
|                         | 2       | 7.6                 | 8.3  | 9.5  | 13.3 | 11   | 7.6  |
|                         | 3       | 12.8                | 12.4 | 13.7 | 14.4 | 13   | 12.8 |
|                         | 4       | 8.3                 | 7.9  | 9.7  | 10.2 | 8.1  | 7.9  |
|                         | 5       | 21.8                | 22.6 | 23.4 | 23   | 21.1 | 21.1 |
|                         | 6       | 11.9                | 12.9 | 14.9 | 15.1 | 14.8 | 13.6 |
|                         | 6 (DUP) | 12                  | 12.6 | 14.8 | 15.4 | 14.7 | 13.7 |
|                         | 7       |                     |      | 11.2 | 9.6  | 4.9  | 4.6  |
|                         | FB      | ND                  | ND   | ND   | ND   | ND   | ND   |
| Chloride (mg/L)         | 1       | 0.5                 | ND   | ND   | 1.4  | ND   | ND   |
|                         | 2       | 0.8                 | ND   | ND   | 1.1  | ND   | 0.7  |
|                         | 3       | ND                  | ND   | ND   | 0.6  | ND   | ND   |
|                         | 4       | ND                  | ND   | ND   | 2.8  | ND   | 0.6  |
|                         | 5       | ND                  | ND   | ND   | 1.4  | ND   | 0.5  |
|                         | 6       | ND                  | ND   | ND   | 2.2  | ND   | ND   |
|                         | 6 (DUP) | ND                  | ND   | ND   | ND   | ND   | ND   |
|                         | 7       |                     |      | 0.7  | ND   | ND   | ND   |
|                         | FB      | ND                  | ND   | ND   | ND   | ND   | ND   |
| Chromium – Total (µg/L) | 1       | ND                  | ND   | ND   |      | ND   | ND   |
|                         | 2       | ND                  | ND   | ND   |      | ND   | ND   |
|                         | 3       | ND                  | ND   | ND   |      | ND   | ND   |
|                         | 4       | ND                  | ND   | ND   |      | ND   | ND   |
|                         | 5       | ND                  | ND   | ND   |      | ND   | ND   |
|                         | 6       | 1.5                 | ND   | ND   |      | ND   | ND   |
|                         | 6 (DUP) | ND                  | ND   | ND   |      | ND   | ND   |
|                         | 7       |                     |      | ND   |      | ND   | ND   |
|                         | FB      | ND                  | ND   | ND   |      | ND   | ND   |

**Table 11. Water Chemistry Results for All Sampling Stations and Dates...continued**

| Parameter (Units)            | Station | 2004 Sampling Bouts |      |      |      |     |     |
|------------------------------|---------|---------------------|------|------|------|-----|-----|
|                              |         | June                | July | Aug  | Sept | Oct | Nov |
| Cobalt – Total (µg/L)        | 1       | ND                  | ND   | ND   |      | ND  | ND  |
|                              | 2       | ND                  | ND   | ND   |      | ND  | ND  |
|                              | 3       | ND                  | ND   | ND   |      | ND  | ND  |
|                              | 4       | ND                  | ND   | ND   |      | ND  | ND  |
|                              | 5       | ND                  | ND   | ND   |      | ND  | ND  |
|                              | 6       | ND                  | ND   | ND   |      | ND  | ND  |
|                              | 6 (DUP) | ND                  | ND   | ND   |      | ND  | ND  |
|                              | 7       |                     |      | ND   |      | ND  | ND  |
|                              | FB      | ND                  | ND   | ND   |      | ND  | ND  |
| COD (mg/L)                   | 1       | 24                  | 17   | 16   | 8.7  | 8.1 | 21  |
|                              | 2       | 38                  | 26   | 31   | 16   | 30  | 40  |
|                              | 3       | 15                  | 15   | 11   | 9    | 21  | 14  |
|                              | 4       | 20                  | 29   | 25   | 16   | 10  | 16  |
|                              | 5       | 8.9                 | 10   | 7.9  | 10   | 7.6 | 11  |
|                              | 6       | 5.1                 | 9.4  | 12   | 6.8  | ND  | 11  |
|                              | 6 (DUP) | 5.9                 | 7.8  | 11   | 5.9  | ND  | 8.7 |
|                              | 7       |                     |      | 44   | 23   | 17  | 17  |
|                              | FB      | ND                  | ND   | ND   | ND   | ND  | ND  |
| Copper – Total (µg/L)        | 1       | ND                  | ND   | ND   |      | ND  | ND  |
|                              | 2       | ND                  | ND   | ND   |      | ND  | ND  |
|                              | 3       | ND                  | ND   | ND   |      | ND  | ND  |
|                              | 4       | ND                  | ND   | ND   |      | ND  | ND  |
|                              | 5       | ND                  | ND   | 6.7  |      | ND  | ND  |
|                              | 6       | ND                  | ND   | ND   |      | ND  | ND  |
|                              | 6 (DUP) | ND                  | ND   | ND   |      | ND  | ND  |
|                              | 7       |                     |      | ND   |      | ND  | ND  |
|                              | FB      | ND                  | ND   | ND   |      | ND  | ND  |
| Hardness – Calculated (mg/L) | 1       | 42                  | 47   | 55   | 61   | 56  | 43  |
|                              | 2       | 25                  | 28   | 31   | 44   | 37  | 26  |
|                              | 3       | 40                  | 41   | 45   | 46   | 42  | 42  |
|                              | 4       | 27                  | 27   | 31   | 34   | 28  | 27  |
|                              | 5       | 68                  | 71   | 73   | 72   | 68  | 67  |
|                              | 6       | 38                  | 43   | 48   | 48   | 49  | 45  |
|                              | 6 (DUP) | 39                  | 41   | 48   | 49   | 48  | 45  |
|                              | 7       |                     |      | 36   | 32   | 17  | 16  |
|                              | FB      | ND                  | ND   | ND   | ND   | ND  | ND  |
| Iron – Total (µg/L)          | 1       | 570                 | 520  | 830  | 350  | 430 | 430 |
|                              | 2       | 940                 | 860  | 1100 | 1200 | 940 | 790 |
|                              | 3       | 310                 | 340  | 240  | 200  | 190 | 180 |
|                              | 4       | 420                 | 530  | 540  | 370  | 340 | 280 |
|                              | 5       | 160                 | 140  | 150  | 160  | 120 | 110 |
|                              | 6       | 70                  | 75   | 87   | 91   | 170 | 72  |
|                              | 6 (DUP) | 72                  | 66   | 51   | 54   | 160 | 60  |
|                              | 7       |                     |      | 5300 | 2600 | 500 | 340 |
|                              | FB      | ND                  | ND   | ND   | ND   | ND  | ND  |

**Table 11. Water Chemistry Results for All Sampling Stations and Dates...continued**

| 2004 Sampling Bouts      |         |      |      |     |      |     |     |
|--------------------------|---------|------|------|-----|------|-----|-----|
| Parameter (Units)        | Station | June | July | Aug | Sept | Oct | Nov |
| Lead - Total (µg/L)      | 1       | ND   | ND   | ND  |      | ND  | ND  |
|                          | 2       | ND   | ND   | ND  |      | ND  | ND  |
|                          | 3       | ND   | ND   | ND  |      | ND  | ND  |
|                          | 4       | ND   | ND   | ND  |      | ND  | ND  |
|                          | 5       | ND   | ND   | ND  |      | ND  | ND  |
|                          | 6       | ND   | ND   | ND  |      | ND  | ND  |
|                          | 6 (DUP) | ND   | ND   | ND  |      | ND  | ND  |
|                          | 7       |      |      | ND  |      | ND  | ND  |
|                          | FB      | ND   | ND   | ND  |      | ND  | ND  |
| Lithium - Total (µg/L)   | 1       | ND   | ND   | ND  | ND   | ND  | ND  |
|                          | 2       | ND   | ND   | ND  | ND   | ND  | ND  |
|                          | 3       | ND   | ND   | ND  | ND   | ND  | ND  |
|                          | 4       | ND   | ND   | ND  | ND   | ND  | ND  |
|                          | 5       | ND   | ND   | ND  | ND   | ND  | ND  |
|                          | 6       | ND   | ND   | ND  | ND   | ND  | ND  |
|                          | 6 (DUP) | ND   | ND   | ND  | ND   | ND  | ND  |
|                          | 7       |      |      | ND  | ND   | ND  | ND  |
|                          | FB      | ND   | ND   | ND  | ND   | ND  | ND  |
| Magnesium - Total (mg/L) | 1       | 2.4  | 2.9  | 3.3 | 3.4  | 3.3 | 2.7 |
|                          | 2       | 1.4  | 1.8  | 1.8 | 2.6  | 2.3 | 1.6 |
|                          | 3       | 2    | 2.4  | 2.5 | 2.5  | 2.3 | 2.4 |
|                          | 4       | 1.5  | 1.7  | 1.7 | 2    | 1.8 | 1.7 |
|                          | 5       | 3.2  | 3.6  | 3.6 | 3.5  | 3.6 | 3.5 |
|                          | 6       | 2.1  | 2.5  | 2.7 | 2.6  | 2.8 | 2.7 |
|                          | 6 (DUP) | 2.1  | 2.4  | 2.7 | 2.6  | 2.8 | 2.7 |
|                          | 7       |      |      | 2   | 1.9  | 1.1 | 1.1 |
|                          | FB      | ND   | ND   | ND  | ND   | ND  | ND  |
| Manganese - Total (µg/L) | 1       | 18   | 14   | 31  | 9.6  | 11  | 9.1 |
|                          | 2       | 43   | 34   | 33  | 21   | 21  | 32  |
|                          | 3       | 18   | 18   | 11  | 11   | 9.8 | 9.8 |
|                          | 4       | 27   | 26   | 24  | 15   | 13  | 8.8 |
|                          | 5       | 21   | 17   | 21  | 13   | 13  | 13  |
|                          | 6       | 8.3  | 6.4  | 13  | 9.4  | 19  | 9   |
|                          | 6 (DUP) | 8.5  | 6.3  | 6.6 | 5.8  | 21  | 6.9 |
|                          | 7       |      |      | 360 | 130  | 21  | 15  |
|                          | FB      | ND   | ND   | ND  | ND   | ND  | ND  |
| Nickel - Total (µg/L)    | 1       | ND   | ND   | ND  |      | ND  | ND  |
|                          | 2       | ND   | ND   | ND  |      | ND  | ND  |
|                          | 3       | ND   | ND   | ND  |      | ND  | ND  |
|                          | 4       | ND   | ND   | ND  |      | ND  | ND  |
|                          | 5       | ND   | ND   | 2.8 |      | ND  | ND  |
|                          | 6       | ND   | ND   | ND  |      | ND  | ND  |
|                          | 6 (DUP) | ND   | ND   | ND  |      | ND  | ND  |
|                          | 7       |      |      | ND  |      | ND  | ND  |
|                          | FB      | ND   | ND   | ND  |      | ND  | ND  |

**Table 11. Water Chemistry Results for All Sampling Stations and Dates...continued**

| 2004 Sampling Bouts        |         |       |       |       |       |       |       |
|----------------------------|---------|-------|-------|-------|-------|-------|-------|
| Parameter (Units)          | Station | June  | July  | Aug   | Sept  | Oct   | Nov   |
| Nitrate + Nitrite (mg N/L) | 1       | 0.07  | 0.098 | 0.098 | 0.083 | 0.096 | 0.096 |
|                            | 2       | ND    | 0.037 | 0.035 | 0.015 | 0.028 | 0.045 |
|                            | 3       | 0.12  | 0.124 | 0.141 | 0.115 | 0.115 | 0.127 |
|                            | 4       | ND    | 0.02  | 0.025 | 0.023 | 0.025 | 0.042 |
|                            | 5       | ND    | 0.031 | 0.037 | 0.026 | 0.037 | 0.051 |
|                            | 6       | 0.33  | 0.37  | 0.51  | 0.56  | 0.54  | 0.46  |
|                            | 6 (DUP) | 0.33  | 0.37  | 0.51  | 0.57  | 0.53  | 0.46  |
|                            | 7       |       |       | 0.004 | 0.005 | 0.004 | 0.013 |
|                            | FB      | 0.001 | ND    | 1100  | ND    | ND    | ND    |
| o-Phosphorus (mg/L)        | 1       | 0.02  | ND    | ND    | ND    | ND    | ND    |
|                            | 2       | ND    | ND    | ND    | ND    | ND    | ND    |
|                            | 3       | ND    | ND    | ND    | ND    | ND    | ND    |
|                            | 4       | ND    | ND    | ND    | ND    | ND    | ND    |
|                            | 5       | ND    | ND    | ND    | ND    | ND    | ND    |
|                            | 6       | ND    | ND    | ND    | ND    | ND    | ND    |
|                            | 6 (DUP) | 0.01  | ND    | ND    | ND    | ND    | ND    |
|                            | 7       |       |       | ND    | ND    | ND    | ND    |
|                            | FB      | 0.02  | ND    | ND    | ND    | ND    | ND    |
| Potassium – Total (mg/L)   | 1       | 0.4   | 0.6   | 0.5   | 0.5   | 0.6   | 0.4   |
|                            | 2       | 0.4   | 0.4   | 0.4   | 0.5   | 0.5   | 0.4   |
|                            | 3       | 0.5   | 0.5   | 0.5   | 0.6   | 0.6   | 0.6   |
|                            | 4       | 0.4   | 0.4   | 0.4   | 0.5   | 0.6   | 0.6   |
|                            | 5       | 0.5   | 0.4   | 0.4   | 0.5   | 0.5   | 0.6   |
|                            | 6       | 0.4   | 0.4   | 0.4   | 0.5   | 0.5   | 0.5   |
|                            | 6 (DUP) | 0.4   | 0.4   | 0.4   | 0.5   | 0.5   | 0.5   |
|                            | 7       |       |       | 0.6   | 0.8   | 0.7   | 0.6   |
|                            | FB      | ND    | ND    | ND    | ND    | ND    | ND    |
| Selenium – Total (µg/L)    | 1       | ND    | ND    | ND    |       | ND    | ND    |
|                            | 2       | ND    | ND    | ND    |       | ND    | ND    |
|                            | 3       | ND    | ND    | ND    |       | ND    | ND    |
|                            | 4       | ND    | ND    | ND    |       | ND    | ND    |
|                            | 5       | ND    | ND    | ND    |       | ND    | ND    |
|                            | 6       | ND    | ND    | ND    |       | ND    | ND    |
|                            | 6 (DUP) | ND    | ND    | ND    |       | ND    | ND    |
|                            | 7       |       |       | ND    |       | ND    | ND    |
|                            | FB      | ND    | ND    | ND    |       | ND    | ND    |
| Silver –Total (µg/L)       | 1       | ND    | ND    | ND    |       | ND    | ND    |
|                            | 2       | ND    | ND    | ND    |       | ND    | ND    |
|                            | 3       | ND    | ND    | ND    |       | ND    | ND    |
|                            | 4       | ND    | ND    | ND    |       | ND    | ND    |
|                            | 5       | ND    | ND    | ND    |       | ND    | ND    |
|                            | 6       | ND    | ND    | ND    |       | ND    | ND    |
|                            | 6 (DUP) | ND    | ND    | ND    |       | ND    | ND    |
|                            | 7       |       |       | ND    |       | ND    | ND    |
|                            | FB      | ND    | ND    | ND    |       | ND    | ND    |

**Table 11. Water Chemistry Results for All Sampling Stations and Dates...continued**

| 2004 Sampling Bouts      |         |      |      |     |      |     |     |
|--------------------------|---------|------|------|-----|------|-----|-----|
| Parameter (Units)        | Station | June | July | Aug | Sept | Oct | Nov |
| Sodium – Total (mg/L)    | 1       | 1.2  | ND   | ND  | ND   | ND  | ND  |
|                          | 2       | 1.1  | ND   | ND  | 1.5  | ND  | ND  |
|                          | 3       | ND   | ND   | ND  | ND   | ND  | ND  |
|                          | 4       | ND   | ND   | ND  | 1.4  | ND  | 1.3 |
|                          | 5       | ND   | ND   | ND  | 1.8  | 1.3 | 1.4 |
|                          | 6       | ND   | ND   | ND  | 1.5  | ND  | ND  |
|                          | 6 (DUP) | ND   | ND   | ND  | 2    | ND  | ND  |
|                          | 7       |      |      | ND  | 1.7  | ND  | ND  |
|                          | FB      | ND   | ND   | ND  | ND   | ND  | ND  |
| Strontium – Total (µg/L) | 1       | 22   | 23   | 26  | 28   | 27  | 20  |
|                          | 2       | 16   | 17   | 19  | 23   | 19  | 13  |
|                          | 3       | 22   | 21   | 24  | 24   | 21  | 19  |
|                          | 4       | 17   | 16   | 19  | 19   | 15  | 14  |
|                          | 5       | 32   | 30   | 32  | 31   | 28  | 28  |
|                          | 6       | 22   | 21   | 24  | 23   | 22  | 20  |
|                          | 6 (DUP) | 22   | 21   | 24  | 24   | 22  | 20  |
|                          | 7       |      |      | 29  | 24   | 12  | 9.2 |
|                          | FB      | ND   | ND   | ND  | ND   | ND  | ND  |
| Sulfate (mg/L)           | 1       | ND   | ND   | ND  | ND   | ND  | ND  |
|                          | 2       | ND   | ND   | 4   | ND   | ND  | ND  |
|                          | 3       | ND   | ND   | ND  | ND   | ND  | ND  |
|                          | 4       | ND   | ND   | ND  | ND   | ND  | ND  |
|                          | 5       | ND   | ND   | ND  | ND   | ND  | ND  |
|                          | 6       | ND   | ND   | ND  | ND   | ND  | ND  |
|                          | 6 (DUP) | ND   | ND   | ND  | ND   | ND  | ND  |
|                          | 7       |      |      | 6   | ND   | ND  | ND  |
|                          | FB      | ND   | ND   | ND  | ND   | ND  | ND  |
| Sulfide (mg/L)           | 1       |      | ND   | ND  | ND   | ND  | ND  |
|                          | 2       |      | ND   | ND  | ND   | ND  | ND  |
|                          | 3       |      | ND   | ND  | ND   | ND  | ND  |
|                          | 4       |      | ND   | ND  | ND   | ND  | ND  |
|                          | 5       |      | ND   | ND  | ND   | ND  | ND  |
|                          | 6       |      | ND   | ND  | ND   | ND  | ND  |
|                          | 6 (DUP) |      | ND   | ND  | ND   | ND  | ND  |
|                          | 7       |      |      | ND  | ND   | ND  | ND  |
|                          | FB      |      | ND   | ND  | ND   | ND  | ND  |
| TOC – Dissolved (mg/L)   | 1       | 8.2  | 6    | 4.7 | 3    | 4.5 | 7.6 |
|                          | 2       | 12   | 9.6  | 8.6 | 6.1  | 9.1 | 12  |
|                          | 3       | 5.8  | 5.6  | 3.8 | 3.2  | 4.1 | 3.8 |
|                          | 4       | 8.3  | 9.4  | 7.7 | 5.3  | 6.5 | 6.2 |
|                          | 5       | 4.3  | 4    | 3.5 | 3.2  | 3.3 | 3.3 |
|                          | 6       | 3.8  | 3.4  | 2.1 | 2    | 1.9 | 2.6 |
|                          | 6 (DUP) | 3.4  | 3.4  | 2.1 | 2    | 2.1 | 2.7 |
|                          | 7       |      |      | 12  | 9.7  | 4.4 | 5   |
|                          | FB      | ND   | ND   | ND  | ND   | ND  | ND  |

**Table 11. Water Chemistry Results for All Sampling Stations and Dates...concluded**

| 2004 Sampling Bouts              |         |       |       |       |       |       |       |
|----------------------------------|---------|-------|-------|-------|-------|-------|-------|
| Parameter (Units)                | Station | June  | July  | Aug   | Sept  | Oct   | Nov   |
| Total Dissolved Solids (mg/L)    | 1       | 100   | 115   | 120   | 85    | 70    | 69    |
|                                  | 2       | 100   | 85    | 35    | 65    | 54    | 57    |
|                                  | 3       | 100   | 110   | 105   | 65    | 47    | 56    |
|                                  | 4       | 90    | 85    | 25    | 50    | 43    | 44    |
|                                  | 5       | 95    | 120   | 50    | 90    | 78    | 89    |
|                                  | 6       | 80    | 70    | 130   | 75    | 57    | 61    |
|                                  | 6 (DUP) | 55    | 75    | 115   | 65    | 61    | 60    |
|                                  | 7       |       |       | 60    | 60    | 27    | 29    |
|                                  | FB      | 55    | ND    | 25    | 30    | ND    | ND    |
| Total Kjeldahl Nitrogen (mg N/L) | 1       | 0.3   | 0.3   | 0.3   | 0.1   | 0.17  | 0.27  |
|                                  | 2       | 0.48  | 0.37  | 0.37  | 0.26  | 0.33  | 0.39  |
|                                  | 3       | 0.25  | 0.24  | 0.14  | 0.13  | 0.12  | 0.14  |
|                                  | 4       | 0.27  | 0.32  | 0.28  | 0.2   | 0.23  | 0.2   |
|                                  | 5       | 0.16  | 0.15  | 0.12  | 0.13  | 0.12  | 0.12  |
|                                  | 6       | 0.2   | 0.13  | 0.16  | 0.11  | 0.07  | 0.1   |
|                                  | 6 (DUP) | 0.17  | 0.12  | 0.1   | 0.09  | 0.11  | 0.09  |
|                                  | 7       |       |       | 0.53  | 0.38  | 0.16  | 0.17  |
|                                  | FB      | ND    | 0.01  | ND    | 0.01  | ND    | 0.01  |
| Total Phosphorous (mg P/L)       | 1       | 0.018 | 0.019 | 0.03  | 0.014 | 0.014 | 0.011 |
|                                  | 2       | 0.015 | 0.015 | 0.015 | 0.019 | 0.014 | 0.013 |
|                                  | 3       | 0.023 | 0.023 | 0.02  | 0.017 | 0.011 | 0.011 |
|                                  | 4       | 0.015 | 0.015 | 0.016 | 0.013 | 0.014 | 0.008 |
|                                  | 5       | 0.012 | 0.014 | 0.015 | 0.015 | 0.011 | 0.012 |
|                                  | 6       | 0.01  | 0.007 | 0.02  | 0.01  | 0.007 | 0.005 |
|                                  | 6 (DUP) | 0.008 | 0.006 | ND    | 0.009 | 0.013 | 0.005 |
|                                  | 7       |       |       | 0.02  | 0.014 | 0.004 | 0.004 |
|                                  | FB      | 0.001 | 0.001 | ND    | 0.004 | 0.001 | 0.003 |
| Total Suspended Solids (mg/L)    | 1       | 5     | 4     | 2     | ND    | 3     | 1     |
|                                  | 2       | 2     | ND    | ND    | ND    | ND    | 1     |
|                                  | 3       | 6     | 6     | 2     | ND    | 2     | 2     |
|                                  | 4       | 9     | 2     | ND    | ND    | 4     | 2     |
|                                  | 5       | 2     | 2     | ND    | ND    | 2     | 2     |
|                                  | 6       | 1     | ND    | ND    | 3     | 7     | ND    |
|                                  | 6 (DUP) | ND    | ND    | ND    | ND    | 5     | ND    |
|                                  | 7       |       |       | 4     | ND    | ND    | ND    |
|                                  | FB      | ND    | ND    | ND    | ND    | ND    | ND    |
| Zinc - Total (µg/L)              | 1       | ND    | ND    | ND    |       | ND    | ND    |
|                                  | 2       | ND    | ND    | ND    |       | ND    | ND    |
|                                  | 3       | ND    | ND    | ND    |       | ND    | ND    |
|                                  | 4       | ND    | ND    | ND    |       | ND    | ND    |
|                                  | 5       | ND    | ND    | ND    |       | ND    | ND    |
|                                  | 6       | ND    | ND    | ND    |       | ND    | ND    |
|                                  | 6 (DUP) | ND    | ND    | ND    |       | ND    | ND    |
|                                  | 7       |       |       | ND    |       | ND    | ND    |
|                                  | FB      | ND    | ND    | ND    |       | ND    | ND    |

---

**Table 12. Low-Level Mercury Results in 2004 Monthly Water Samples from All Stations**

| Sampling Station | Low Level Mercury Results (nanograms per liter) by Sampling Bout |      |        |           |         |          |
|------------------|------------------------------------------------------------------|------|--------|-----------|---------|----------|
|                  | June                                                             | July | August | September | October | November |
| 1                | 3.9                                                              | 2.5  | 1.7    | 1.1       | 1.3     | 2.6      |
| 2                | 5.3                                                              | 3.4  | 3.2    | 1.8       | 2.5     | 4.0      |
| 3                | 3.1                                                              | 2.2  | 0.8    | 1.0       | 1.0     | 1.2      |
| 4                | 2.4                                                              | 1.1  | 2.0    | 1.0       | 1.4     | 1.6      |
| 5                | 1.0                                                              | 2.8  | 0.9    | 0.7       | 0.6     | 0.8      |
| 6                | 1.2                                                              | 1.0  | 0      | 0.5       | 1.0     | 0        |
| 6 Dup            | 1.2                                                              | 1.3  | 0      | 0.6       | 0       | 0.6      |
| 7                | --                                                               | --   | 3.2    | 1.9       | 0       | 0.6      |
| Field Blank      | 0                                                                | 0    | 0      | 0         | 0       | 0        |
| Trip Blank       | 0                                                                | 0    | 0      | 0         | 0       | 0        |

---

---

**Table 13. Low-Level Metals Results for September 2004 Sampling at All Stations**

| Analyte / Units      | Sampling Station, Duplicate, Field Blank (FB) |         |         |         |        |        |         |        |          |
|----------------------|-----------------------------------------------|---------|---------|---------|--------|--------|---------|--------|----------|
|                      | 1                                             | 2       | 3       | 4       | 5      | 6      | 6 Dup   | 7      | FB       |
| Silver (Ag) (µg/L)   | 0.0214                                        | 0.0133  | 0.0555  | 0.0092  | 0.0287 | 0.0158 | 0.00036 | 0.0058 | 0.0931   |
| Arsenic (As) (µg/L)  | 1.03                                          | 1.15    | 1.41    | 0.586   | 2.43   | 0.314  | 0.306   | 0.89   | -0.00925 |
| Boron (B) (µg/L)     | 6.56                                          | 5.31    | 7       | 5.39    | 8.24   | 5.87   | 5.77    | 3.29   | -0.1476  |
| Cadmium (Cd) (µg/L)  | 0.013                                         | 0.00842 | 0.00452 | 0.00352 | 0.003  | 0.0037 | 0.00438 | 0.0025 | 0.0001   |
| Cobalt (Co) (µg/L)   | 0.0679                                        | 0.0824  | 0.0536  | 0.0536  | 0.0594 | 0.0466 | 0.0527  | 0.23   | -0.00363 |
| Chromium (Cr) (µg/L) | 0.276                                         | 0.307   | 0.276   | 0.214   | 0.201  | 0.254  | 0.312   | 0.131  | 0.05196  |
| Copper (Cu) (µg/L)   | 0.402                                         | 0.179   | 0.156   | 0.077   | 0.119  | 0.315  | 0.33    | 0.044  | -0.00536 |
| Nickel (Ni) (µg/L)   | 0.455                                         | 0.487   | 0.281   | 0.211   | 0.398  | 0.293  | 0.308   | 0.215  | -0.00171 |
| Lead (Pb) (µg/L)     | 0.0401                                        | 0.0827  | 0.0503  | 0.0645  | 0.027  | 0.0111 | 0.0237  | 0.163  | -0.00105 |
| Selenium (Se) (µg/L) | 0.1191                                        | 0.1243  | 0.08963 | 0.08579 | 0.1058 | 0.115  | 0.08457 | 0.1146 | 0.01686  |
| Zinc (Zn) (µg/L)     | 1.21                                          | 0.66    | 0.53    | 0.45    | 1.5    | 0.46   | 0.31    | 1.19   | 0.09     |

---

**Table 14. Summary of Water Chemistry Results for All Sampling Stations, 2004**

(continues on subsequent pages)

| Parameter (Units)            | Statistic | Station |       |       |       |       |       |       |
|------------------------------|-----------|---------|-------|-------|-------|-------|-------|-------|
|                              |           | 1       | 2     | 3     | 4     | 5     | 6     | 7     |
| Alkalinity (mg/L)            | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                              | Mean      | 44      | 27    | 38    | 26    | 65    | 38    | 21    |
|                              | Max       | 55      | 36    | 42    | 30    | 72    | 43    | 27    |
| Aluminum - Total (µg/L)      | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                              | Mean      | 84      | 55    | 35    | 19    | 0     | 24    | 0     |
|                              | Max       | 210     | 110   | 110   | 58    | 0     | 100   | 0     |
| Ammonia (mg N/L)             | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                              | Mean      | 0.006   | 0.014 | 0.005 | 0.009 | 0.004 | 0.003 | 0.023 |
|                              | Max       | 0.011   | 0.021 | 0.01  | 0.016 | 0.007 | 0.005 | 0.046 |
| Arsenic - Total (µg/L)       | Count     | 5       | 5     | 5     | 5     | 5     | 10    | 3     |
|                              | Mean      | 0.2     | 0.4   | 0.9   | 0     | 1.8   | 0     | 0.4   |
|                              | Max       | 1.1     | 1.1   | 1.3   | 0     | 2.2   | 0     | 1.3   |
| Barium - Total (µg/L)        | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                              | Mean      | 10.7    | 8.6   | 9.3   | 11.0  | 13.8  | 9.5   | 17.1  |
|                              | Max       | 13      | 9.6   | 10    | 12    | 15    | 11    | 29    |
| Boron - Total (µg/L)         | Count     | 5       | 5     | 5     | 5     | 5     | 10    | 3     |
|                              | Mean      | 0       | 0     | 0     | 0     | 0     | 0     | 0     |
|                              | Max       | 0       | 0     | 0     | 0     | 0     | 0     | 0     |
| Cadmium - Total (µg/L)       | Count     | 5       | 5     | 5     | 5     | 5     | 10    | 3     |
|                              | Mean      | 0       | 0     | 0     | 0     | 0.11  | 0     | 0     |
|                              | Max       | 0       | 0     | 0     | 0     | 0.56  | 0     | 0     |
| Calcium - Total (mg/L)       | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                              | Mean      | 15.3    | 9.6   | 13.2  | 8.7   | 22.2  | 13.9  | 7.6   |
|                              | Max       | 18.7    | 13.3  | 14.4  | 10.2  | 23.4  | 15.4  | 11.2  |
| Chloride (mg/L)              | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                              | Mean      | 0.3     | 0.4   | 0.1   | 0.6   | 0.3   | 0.2   | 0.2   |
|                              | Max       | 1.4     | 1.1   | 0.6   | 2.8   | 1.4   | 2.2   | 0.7   |
| Chromium - Total (µg/L)      | Count     | 5       | 5     | 5     | 5     | 5     | 10    | 3     |
|                              | Mean      | 0       | 0     | 0     | 0     | 0     | 0.15  | 0     |
|                              | Max       | 0       | 0     | 0     | 0     | 0     | 1.5   | 0     |
| Cobalt - Total (µg/L)        | Count     | 5       | 5     | 5     | 5     | 5     | 10    | 3     |
|                              | Mean      | 0       | 0     | 0     | 0     | 0     | 0     | 0     |
|                              | Max       | 0       | 0     | 0     | 0     | 0     | 0     | 0     |
| COD (mg/L)                   | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                              | Mean      | 16      | 30    | 14    | 19    | 9     | 7     | 25    |
|                              | Max       | 24      | 40    | 21    | 29    | 11    | 12    | 44    |
| Copper - Total (µg/L)        | Count     | 5       | 5     | 5     | 5     | 5     | 10    | 3     |
|                              | Mean      | 0       | 0     | 0     | 0     | 1.34  | 0     | 0     |
|                              | Max       | 0       | 0     | 0     | 0     | 6.7   | 0     | 0     |
| Hardness - Calculated (mg/L) | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                              | Mean      | 51      | 32    | 43    | 29    | 70    | 45    | 25    |
|                              | Max       | 61      | 44    | 46    | 34    | 73    | 49    | 36    |
| Iron - Total (µg/L)          | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                              | Mean      | 522     | 972   | 243   | 413   | 140   | 86    | 2185  |
|                              | Max       | 830     | 1200  | 340   | 540   | 160   | 170   | 5300  |

**Table 14. Summary of Water Chemistry Results for All Sampling Stations, 2004...continued**

| Parameter (Units)                | Statistic | Station |       |       |       |       |       |       |
|----------------------------------|-----------|---------|-------|-------|-------|-------|-------|-------|
|                                  |           | 1       | 2     | 3     | 4     | 5     | 6     | 7     |
| Lead - Total (µg/L)              | Count     | 5       | 5     | 5     | 5     | 5     | 10    | 3     |
|                                  | Mean      | 0       | 0     | 0     | 0     | 0     | 0     | 0     |
|                                  | Max       | 0       | 0     | 0     | 0     | 0     | 0     | 0     |
| Lithium - Total (µg/L)           | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                                  | Mean      | 0       | 0     | 0     | 0     | 0     | 0     | 0     |
|                                  | Max       | 0       | 0     | 0     | 0     | 0     | 0     | 0     |
| Low Level Mercury - Total (ng/L) | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                                  | Mean      | 2.2     | 3.4   | 1.6   | 1.6   | 1.1   | 0.6   | 1.4   |
|                                  | Max       | 3.9     | 5.3   | 3.1   | 2.4   | 2.8   | 1.3   | 3.2   |
| Magnesium - Total (mg/L)         | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                                  | Mean      | 3.0     | 1.9   | 2.4   | 1.7   | 3.5   | 2.6   | 1.5   |
|                                  | Max       | 3.4     | 2.6   | 2.5   | 2     | 3.6   | 2.8   | 2     |
| Manganese - Total (µg/L)         | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                                  | Mean      | 15      | 31    | 13    | 19    | 16    | 10    | 132   |
|                                  | Max       | 31      | 43    | 18    | 27    | 21    | 21    | 360   |
| Nickel - Total (µg/L)            | Count     | 5       | 5     | 5     | 5     | 5     | 10    | 3     |
|                                  | Mean      | 0       | 0     | 0     | 0     | 0.56  | 0     | 0     |
|                                  | Max       | 0       | 0     | 0     | 0     | 2.8   | 0     | 0     |
| Nitrate + Nitrite (mg N/L)       | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                                  | Mean      | 0.090   | 0.027 | 0.124 | 0.023 | 0.030 | 0.462 | 0.007 |
|                                  | Max       | 0.098   | 0.045 | 0.141 | 0.042 | 0.051 | 0.57  | 0.013 |
| o-Phosphorus (mg/L)              | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                                  | Mean      | 0.003   | 0     | 0     | 0     | 0     | 0.001 | 0     |
|                                  | Max       | 0.02    | 0     | 0     | 0     | 0     | 0.01  | 0     |
| Potassium - Total (mg/L)         | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                                  | Mean      | 0.5     | 0.4   | 0.6   | 0.5   | 0.5   | 0.5   | 0.7   |
|                                  | Max       | 0.6     | 0.5   | 0.6   | 0.6   | 0.6   | 0.5   | 0.8   |
| Selenium - Total (µg/L)          | Count     | 5       | 5     | 5     | 5     | 5     | 10    | 3     |
|                                  | Mean      | 0       | 0     | 0     | 0     | 0     | 0     | 0     |
|                                  | Max       | 0       | 0     | 0     | 0     | 0     | 0     | 0     |
| Silver -Total (µg/L)             | Count     | 5       | 5     | 5     | 5     | 5     | 10    | 3     |
|                                  | Mean      | 0       | 0     | 0     | 0     | 0     | 0     | 0     |
|                                  | Max       | 0       | 0     | 0     | 0     | 0     | 0     | 0     |
| Sodium - Total (mg/L)            | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                                  | Mean      | 0.2     | 0.4   | 0     | 0.5   | 0.8   | 0.3   | 0.4   |
|                                  | Max       | 1.2     | 1.5   | 0     | 1.4   | 1.8   | 2     | 1.7   |
| Strontium - Total (µg/L)         | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                                  | Mean      | 24      | 18    | 22    | 17    | 30    | 22    | 19    |
|                                  | Max       | 28      | 23    | 24    | 19    | 32    | 24    | 29    |
| Sulfate (mg/L)                   | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                                  | Mean      | 0       | 0.7   | 0     | 0     | 0     | 0     | 1.5   |
|                                  | Max       | 0       | 4     | 0     | 0     | 0     | 0     | 6     |
| Sulfide (mg/L)                   | Count     | 5       | 5     | 5     | 5     | 5     | 10    | 4     |
|                                  | Mean      | 0       | 0     | 0     | 0     | 0     | 0     | 0     |
|                                  | Max       | 0       | 0     | 0     | 0     | 0     | 0     | 0     |

---

**Table 14. Summary of Water Chemistry Results for All Sampling Stations, 2004...concluded**

| Parameter (Units)                | Statistic | Station |       |       |       |       |       |       |
|----------------------------------|-----------|---------|-------|-------|-------|-------|-------|-------|
|                                  |           | 1       | 2     | 3     | 4     | 5     | 6     | 7     |
| TOC - Dissolved (mg/L)           | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                                  | Mean      | 5.7     | 9.6   | 4.4   | 7.2   | 3.6   | 2.6   | 7.8   |
|                                  | Max       | 8.2     | 12    | 5.8   | 9.4   | 4.3   | 3.8   | 12    |
| Total Dissolved Solids (mg/L)    | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                                  | Mean      | 93      | 66    | 81    | 56    | 87    | 75    | 44    |
|                                  | Max       | 120     | 100   | 110   | 90    | 120   | 130   | 60    |
| Total Kjeldahl Nitrogen (mg N/L) | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                                  | Mean      | 0.24    | 0.37  | 0.17  | 0.25  | 0.13  | 0.12  | 0.31  |
|                                  | Max       | 0.3     | 0.48  | 0.25  | 0.32  | 0.16  | 0.2   | 0.53  |
| Total Phosphorus (mg P/L)        | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                                  | Mean      | 0.018   | 0.015 | 0.018 | 0.014 | 0.013 | 0.008 | 0.011 |
|                                  | Max       | 0.03    | 0.019 | 0.023 | 0.016 | 0.015 | 0.02  | 0.02  |
| Total Suspended Solids (mg/L)    | Count     | 6       | 6     | 6     | 6     | 6     | 12    | 4     |
|                                  | Mean      | 2.5     | 0.5   | 3.0   | 2.8   | 1.3   | 1.3   | 1.0   |
|                                  | Max       | 5       | 2     | 6     | 9     | 2     | 7     | 4     |
| Zinc - Total (µg/L)              | Count     | 5       | 5     | 5     | 5     | 5     | 10    | 3     |
|                                  | Mean      | 0       | 0     | 0     | 0     | 0     | 0     | 0     |
|                                  | Max       | 0       | 0     | 0     | 0     | 0     | 0     | 0     |

---

**Table 15. Sediment Chemistry Results for All Stations During June and August 2004 Sampling**

| Parameter (Units)               | Station | Sampling Bout |      |
|---------------------------------|---------|---------------|------|
|                                 |         | June          | Aug  |
| % Total Solids (%)              | 1       | 79.4          | 50.3 |
|                                 | 2       | 48.2          | 59.1 |
|                                 | 3       | 55.4          | 59.9 |
|                                 | 4       | 29.6          | 43.3 |
|                                 | 5       | 47.6          | 38.5 |
|                                 | 6       | 66.4          | 63.7 |
|                                 | 6 (DUP) | 66.2          | 62.5 |
|                                 | 7       |               | 8.5  |
| Aluminum - Sediment (mg/Kg dry) | 1       | 1400          | 3300 |
|                                 | 2       | 2300          | 2000 |
|                                 | 3       | 2100          | 2100 |
|                                 | 4       | 2200          | 1600 |
|                                 | 5       | 1600          | 2000 |
|                                 | 6       | 1800          | 2300 |
|                                 | 6 (DUP) | 2200          | 2200 |
|                                 | 7       |               | 2200 |
| Arsenic - Sediment (mg/Kg dry)  | 1       | 1             | 2.5  |
|                                 | 2       | 2.4           | 2.1  |
|                                 | 3       | 2.6           | 3.6  |
|                                 | 4       | 5.5           | 2    |
|                                 | 5       | 3.9           | 6.3  |
|                                 | 6       | 0.6           | 1.6  |
|                                 | 6 (DUP) | 1.1           | 1.4  |
|                                 | 7       |               | 6.5  |
| Barium - Sediment (mg/Kg dry)   | 1       | 8.8           | 26   |
|                                 | 2       | 19            | 19   |
|                                 | 3       | 17            | 18   |
|                                 | 4       | 29            | 20   |
|                                 | 5       | 19            | 25   |
|                                 | 6       | 13            | 21   |
|                                 | 6 (DUP) | 15            | 19   |
|                                 | 7       |               | 92   |
| Cadmium - Sediment (mg/Kg dry)  | 1       | ND            | ND   |
|                                 | 2       | ND            | ND   |
|                                 | 3       | ND            | ND   |
|                                 | 4       | ND            | ND   |
|                                 | 5       | ND            | ND   |
|                                 | 6       | ND            | ND   |
|                                 | 6 (DUP) | ND            | ND   |
|                                 | 7       |               | ND   |

(Continues on subsequent pages)

**Table 15. Sediment Chemistry Results for All Stations During June and August 2004  
Sampling...continued**

| Parameter (Units)                  | Station | Sampling Bout |      |
|------------------------------------|---------|---------------|------|
|                                    |         | June          | Aug  |
| Chromium – Sediment<br>(mg/Kg dry) | 1       | 2.9           | 7.7  |
|                                    | 2       | 5             | 3.9  |
|                                    | 3       | 5.5           | 5    |
|                                    | 4       | 7.4           | 4.2  |
|                                    | 5       | 5             | 5.8  |
|                                    | 6       | 4.1           | 4.6  |
|                                    | 6 (DUP) | 4.9           | 4.3  |
|                                    | 7       |               | 8.5  |
| Cobalt – Sediment<br>(mg/Kg dry)   | 1       | ND            | 2.7  |
|                                    | 2       | ND            | ND   |
|                                    | 3       | ND            | ND   |
|                                    | 4       | ND            | ND   |
|                                    | 5       | ND            | ND   |
|                                    | 6       | ND            | ND   |
|                                    | 6 (DUP) | ND            | ND   |
|                                    | 7       |               | 2.4  |
| Copper – Sediment<br>(mg/Kg dry)   | 1       | 3.1           | 6.4  |
|                                    | 2       | 3.5           | ND   |
|                                    | 3       | 3.5           | 2    |
|                                    | 4       | 5             | 2    |
|                                    | 5       | 3.1           | 2.9  |
|                                    | 6       | 2.9           | 3.3  |
|                                    | 6 (DUP) | 3.2           | 3.5  |
|                                    | 7       |               | 12   |
| Iron – Sediment<br>(mg/Kg dry)     | 1       | 3300          | 6900 |
|                                    | 2       | 5200          | 4700 |
|                                    | 3       | 4100          | 4200 |
|                                    | 4       | 4700          | 4300 |
|                                    | 5       | 3500          | 4500 |
|                                    | 6       | 3500          | 4000 |
|                                    | 6 (DUP) | 3900          | 3600 |
|                                    | 7       |               | 7400 |
| Lead – Sediment<br>(mg/Kg dry)     | 1       | ND            | ND   |
|                                    | 2       | ND            | ND   |
|                                    | 3       | ND            | ND   |
|                                    | 4       | ND            | ND   |
|                                    | 5       | ND            | 6.1  |
|                                    | 6       | ND            | ND   |
|                                    | 6 (DUP) | ND            | ND   |
|                                    | 7       |               | 24   |

**Table 15. Sediment Chemistry Results for All Stations During June and August 2004  
Sampling...continued**

| Parameter (Units)                  | Station | Sampling Bout |       |
|------------------------------------|---------|---------------|-------|
|                                    |         | June          | Aug   |
| Lithium – Sediment<br>(mg/Kg dry)  | 1       | 2.1           | 3.7   |
|                                    | 2       | 2.9           | 2.2   |
|                                    | 3       | 2.7           | 2.6   |
|                                    | 4       | 2.5           | ND    |
|                                    | 5       | 2             | 2.2   |
|                                    | 6       | 2.5           | 2.4   |
|                                    | 6 (DUP) | 2.6           | 2.1   |
|                                    | 7       |               | ND    |
| Mercury – Sediment<br>(mg/Kg dry)  | 1       | ND            | ND    |
|                                    | 2       | ND            | 0.013 |
|                                    | 3       | ND            | ND    |
|                                    | 4       | ND            | 0.027 |
|                                    | 5       | ND            | 0.04  |
|                                    | 6       | ND            | ND    |
|                                    | 6 (DUP) | ND            | ND    |
|                                    | 7       |               | 0.16  |
| Nickel – Sediment<br>(mg/Kg dry)   | 1       | ND            | 5.3   |
|                                    | 2       | ND            | ND    |
|                                    | 3       | ND            | ND    |
|                                    | 4       | ND            | ND    |
|                                    | 5       | ND            | ND    |
|                                    | 6       | ND            | ND    |
|                                    | 6 (DUP) | ND            | ND    |
|                                    | 7       |               | ND    |
| Selenium – Sediment<br>(mg/Kg dry) | 1       | ND            | ND    |
|                                    | 2       | ND            | ND    |
|                                    | 3       | ND            | ND    |
|                                    | 4       | ND            | ND    |
|                                    | 5       | ND            | ND    |
|                                    | 6       | ND            | ND    |
|                                    | 6 (DUP) | ND            | ND    |
|                                    | 7       |               | 1.5   |
| Silver – Sediment<br>(mg/Kg dry)   | 1       | ND            | ND    |
|                                    | 2       | ND            | ND    |
|                                    | 3       | ND            | ND    |
|                                    | 4       | ND            | ND    |
|                                    | 5       | ND            | ND    |
|                                    | 6       | ND            | ND    |
|                                    | 6 (DUP) | ND            | ND    |
|                                    | 7       |               | ND    |

**Table 15. Sediment Chemistry Results for All Stations During June and August 2004**  
**Sampling...concluded**

| Parameter (Units)                          | Station | Sampling Bout |      |
|--------------------------------------------|---------|---------------|------|
|                                            |         | June          | Aug  |
| Strontium - Sediment<br>(mg/Kg dry)        | 1       | 2.3           | 7    |
|                                            | 2       | 2.8           | 2.6  |
|                                            | 3       | 3.4           | 3.6  |
|                                            | 4       | 6.4           | 3.5  |
|                                            | 5       | 3.8           | 4.4  |
|                                            | 6       | 2.3           | 3.3  |
|                                            | 6 (DUP) | 2.7           | 3.2  |
|                                            | 7       |               | 55   |
| Sulfide - Sediment<br>(mg/Kg dry)          | 1       |               | ND   |
|                                            | 2       |               | ND   |
|                                            | 3       |               | ND   |
|                                            | 4       |               | ND   |
|                                            | 5       |               | ND   |
|                                            | 6       |               | ND   |
|                                            | 6 (DUP) |               | ND   |
|                                            | 7       |               | ND   |
| Total Volatile Solids -<br>Sediment (%TVS) | 1       |               | 5.2  |
|                                            | 2       |               | 3    |
|                                            | 3       |               | 3.5  |
|                                            | 4       |               | 7.4  |
|                                            | 5       |               | 12.3 |
|                                            | 6       |               | 2.7  |
|                                            | 6 (DUP) |               | 2.5  |
|                                            | 7       |               | 72.4 |
| Zinc - Sediment<br>(mg/Kg dry)             | 1       | 12            | 26   |
|                                            | 2       | 20            | 16   |
|                                            | 3       | 15            | 13   |
|                                            | 4       | 19            | 11   |
|                                            | 5       | 13            | 15   |
|                                            | 6       | 12            | 14   |
|                                            | 6 (DUP) | 13            | 14   |
|                                            | 7       |               | 68   |

**Table 16. Comparison of Fish Populations in the Vicinity of Sampling Stations with Emphasis on Brook Trout**

| Stream and Fish Metrics                          | Stations, Streams, and Locations                  |                                                                     |                                                        |                                                  |                                            |                                             |
|--------------------------------------------------|---------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------|--------------------------------------------|---------------------------------------------|
|                                                  | Station 1<br>———<br>Yellow Dog River at CR510     | Station 2<br>———<br>Yellow Dog River at Triple A Rd                 | Station 3<br>———<br>Salmon Trout River at NW Rd        | Station 4<br>———<br>Salmon Trout River at AAA Rd | Station 5<br>———<br>Cedar Creek at NW Road | Station 6<br>———<br>Big Pup Creek at CR510* |
| Length of stream sampled (m)                     | 68.3                                              | 119.8                                                               | 57.9                                                   | 38.4                                             | 75.0                                       | 66.4                                        |
| Number of electrofishing passes                  | 3                                                 | 1                                                                   | 3                                                      | 3                                                | 3                                          | 3                                           |
| Number of fish species                           | 4                                                 | 5                                                                   | 3                                                      | 1                                                | 2                                          | 1                                           |
| Names of fish species detected                   | brown trout, rainbow trout, sculpin, white sucker | brook trout, sculpin, blacknose dace, creek chub, brook stickleback | brook trout, brook stickleback, northern redbelly dace | brook trout                                      | brook trout, northern redbelly dace        | brook trout                                 |
| Number of brook trout caught                     | 0                                                 | 2                                                                   | 40                                                     | 11                                               | 80                                         | 140 (1997)<br>46 (2003)                     |
| Total weight of brook trout caught (g)           | 0                                                 | 285                                                                 | 1,227                                                  | 265                                              | 275                                        | 1,068 (1997)<br>452 (2003)                  |
| Estimated brook trout per hectare                | 0                                                 | 25.8                                                                | 2,223                                                  | 1,084                                            | 3,129                                      | 11,094 (1997)<br>3,918 (2003)               |
| Estimated brook trout per kilometer of stream    | 0                                                 | 16.7                                                                | 690.8                                                  | 286                                              | 1,446                                      | 2,363 (1997)<br>843 (2003)                  |
| Estimated kilograms brook trout per hectare (kg) | 0                                                 | 3.7                                                                 | 68.2                                                   | 26.1                                             | 10.8                                       | 84.6 (1997)<br>38.5 (2003)                  |

\* Data for Station 6 from surveys conducted in 1997 and 2003.

**Table 17. Habitat Evaluations for Sampling Stations 1–6, June 14–16, 2004**

|                                     | Yellow Dog<br>River               | Upper Yellow<br>Dog River          | Salmon-Trout<br>River                   | Salmon Trout<br>River               | Cedar Creek                             | Big Pup Creek                         |
|-------------------------------------|-----------------------------------|------------------------------------|-----------------------------------------|-------------------------------------|-----------------------------------------|---------------------------------------|
|                                     | CR 510<br>Riffle/Run<br>Station 1 | AAA Road<br>Glide/Pool<br>Station2 | N'western Rd<br>Riffle/Run<br>Station 3 | AAA Road<br>Glide/Pool<br>Station 4 | N'western Rd<br>Glide/Pool<br>Station 5 | u/s CR 510<br>Riffle/Run<br>Station 6 |
| <b>HABITAT METRIC</b>               |                                   |                                    |                                         |                                     |                                         |                                       |
| <b>Substrate and Instream Cover</b> |                                   |                                    |                                         |                                     |                                         |                                       |
| Epifaunal Substrate/ Avail Cover    | 15                                | 10                                 | 15                                      | 10                                  | 10                                      | 11                                    |
| Embeddedness*                       | 12                                |                                    | 15                                      |                                     |                                         | 8                                     |
| Velocity/Depth Regime*              | 15                                |                                    | 16                                      |                                     |                                         | 9                                     |
| Pool Substrate Characterization**   |                                   | 11                                 |                                         | 14                                  | 13                                      |                                       |
| Pool Variability**                  |                                   | 14                                 |                                         | 14                                  | 10                                      |                                       |
| <b>Channel Morphology</b>           |                                   |                                    |                                         |                                     |                                         |                                       |
| Sediment Deposition                 | 9                                 | 16                                 | 12                                      | 16                                  | 15                                      | 8                                     |
| Flow Status - Maint. Flow Volume    | 7                                 | 8                                  | 7                                       | 9                                   | 9                                       | 8                                     |
| Flow Status - Flashiness            | 6                                 | 7                                  | 7                                       | 7                                   | 10                                      | 8                                     |
| Channel Alteration                  | 20                                | 20                                 | 19                                      | 20                                  | 20                                      | 20                                    |
| Frequency of Riffles/Bends*         | 15                                |                                    | 14                                      |                                     |                                         | 17                                    |
| Channel Sinuosity**                 |                                   | 14                                 |                                         | 18                                  | 11                                      |                                       |
| <b>Riparian and Bank Structure</b>  |                                   |                                    |                                         |                                     |                                         |                                       |
| Bank Stability (L)                  | 8                                 | 9                                  | 7                                       | 9                                   | 10                                      | 9                                     |
| Bank Stability (R)                  | 5                                 | 6                                  | 7                                       | 9                                   | 10                                      | 9                                     |
| Vegetative Protection (L)           | 10                                | 9                                  | 10                                      | 9                                   | 10                                      | 9                                     |
| Vegetative Protection (R)           | 7                                 | 9                                  | 10                                      | 9                                   | 10                                      | 9                                     |
| Riparian Veg. Zone Width (L)        | 10                                | 10                                 | 10                                      | 10                                  | 10                                      | 9                                     |
| Riparian Veg. Zone Width (R)        | 9                                 | 8                                  | 10                                      | 10                                  | 10                                      | 9                                     |
| TOTAL SCORE (200):                  | 148                               | 151                                | 159                                     | 164                                 | 158                                     | 143                                   |
| HABITAT RATING:                     | GOOD<br>(SLIGHTLY<br>IMPAIRED)    | GOOD<br>(SLIGHTLY<br>IMPAIRED)     | EXCELLENT<br>(NON-<br>IMPAIRED)         | EXCELLENT<br>(NON-<br>IMPAIRED)     | EXCELLENT<br>(NON-<br>IMPAIRED)         | GOOD<br>(SLIGHTLY<br>IMPAIRED)        |

Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).

Note: Habitat Rating categories are established as a range of the total scores such that a total score in the range of 105-154 is designated as "Good" and a total score that is greater than 154 is rated as "Excellent." The three stations that were designated as "Good" habitat (Stations 1, 2, and 6) were all at the high end of the category range.

**Table 18. Qualitative Macroinvertebrate Sampling Results for Sampling Stations 1–6, June 14–16, 2004**

(continues on next page)

| TAXA                              | STATIONS |   |   |   |   |    |
|-----------------------------------|----------|---|---|---|---|----|
|                                   | 1        | 2 | 3 | 4 | 5 | 6  |
| <b>ANNELIDA (segmented worms)</b> |          |   |   |   |   |    |
| Hirudinea (leeches)               |          | 1 |   |   | 1 |    |
| Oligochaeta (worms)               |          |   | 2 | 2 | 1 | 2  |
| <b>ARTHROPODA</b>                 |          |   |   |   |   |    |
| Crustacea                         |          |   |   |   |   |    |
| Amphipoda (scuds)                 |          |   |   | 2 | 3 |    |
| Arachnoidea                       |          |   |   |   |   |    |
| Hydracarina                       | 5        | 2 |   |   |   | 4  |
| <b>INSECTA</b>                    |          |   |   |   |   |    |
| Ephemeroptera (mayflies)          |          |   |   |   |   |    |
| Baetiscidae                       |          | 3 |   |   |   |    |
| Baetidae                          | 5        | 7 | 9 | 5 | 8 | 9  |
| Caenidae                          |          | 3 |   |   |   |    |
| Ephemerellidae                    | 8        | 2 | 7 | 1 | 6 | 5  |
| Ephemeridae                       |          |   | 2 | 1 | 2 |    |
| Heptageniidae                     | 8        | 3 | 7 |   | 3 | 10 |
| Isonychiidae                      |          | 1 |   |   |   |    |
| Leptophlebiidae                   | 4        |   | 4 | 1 | 2 |    |
| Odonata                           |          |   |   |   |   |    |
| Anisoptera (dragonflies)          |          |   |   |   |   |    |
| Aeshnidae                         | 3        | 3 |   | 3 | 2 |    |
| Cordulegastridae                  | 3        | 3 | 2 | 4 | 3 | 2  |
| Gomphidae                         |          | 6 |   |   |   |    |
| Libellulidae                      |          |   |   |   | 2 |    |
| Zygoptera (damselflies)           |          |   |   |   |   |    |
| Coenagrionidae                    |          |   |   |   | 2 |    |
| Calopterygidae                    |          | 6 |   | 9 |   |    |
| Plecoptera (stoneflies)           |          |   |   |   |   |    |
| Leuctridae                        |          |   |   |   |   | 4  |
| Perlidae                          | 3        | 2 |   |   |   |    |
| Perlodidae                        |          |   | 2 |   | 3 | 2  |
| Pteronarcyidae                    | 3        |   | 1 |   | 3 |    |
| Hemiptera (true bugs)             |          |   |   |   |   |    |
| Corixidae                         |          | 2 |   |   |   |    |
| Gerridae                          | 3        | 3 | 4 | 3 | 3 | 2  |
| Nepidae                           |          | 1 |   |   |   |    |
| Veliidae                          | 1        |   | 2 |   |   |    |

**Table 18. Qualitative Macroinvertebrate Sampling Results for Sampling Stations 1–6, June 14–16, 2004...concluded**

| TAXA                      | STATIONS |     |    |     |     |     |
|---------------------------|----------|-----|----|-----|-----|-----|
|                           | 1        | 2   | 3  | 4   | 5   | 6   |
| Megaloptera               |          |     |    |     |     |     |
| Sialidae (alder flies)    |          | 4   |    |     | 2   |     |
| Trichoptera (caddisflies) |          |     |    |     |     |     |
| Brachycentridae           | 5        | 1   |    | 3   |     |     |
| Glossosomatidae           | 5        | 1   | 3  |     | 3   | 4   |
| Hydropsychidae            | 4        | 2   | 2  | 2   | 2   | 2   |
| Hydroptilidae             | 1        |     |    |     |     |     |
| Lepidostomatidae          | 3        |     | 5  | 2   | 4   | 4   |
| Leptoceridae              |          | 2   |    |     |     |     |
| Limnephilidae             | 6        | 9   | 8  | 11  | 7   | 11  |
| Molannidae                |          | 2   |    | 3   |     |     |
| Philopotamidae            |          |     |    |     | 6   | 4   |
| Polycentropodidae         |          |     |    | 4   |     |     |
| Rhyacophilidae            | 3        |     | 2  |     | 2   | 3   |
| Uenoidae                  |          |     | 4  | 2   | 4   | 2   |
| Coleoptera (beetles)      |          |     |    |     |     |     |
| Dytiscidae (total)        | 2        | 2   |    |     |     |     |
| Gyrinidae (adults)        |          | 2   |    |     |     |     |
| Haliplidae (adults)       |          |     |    |     | 1   |     |
| Hydrophilidae (total)     |          |     | 1  |     |     |     |
| Dryopidae                 | 4        |     |    |     |     |     |
| Elmidae                   | 4        | 2   | 4  | 2   | 3   |     |
| Diptera (flies)           |          |     |    |     |     |     |
| Athericidae               |          | 3   | 3  | 2   | 5   |     |
| Ceratopogonidae           |          | 2   |    |     | 2   |     |
| Chironomidae              | 11       | 9   | 10 | 13  | 9   | 22  |
| Simuliidae                | 4        | 5   | 8  | 18  | 5   | 7   |
| Stratiomyidae             |          |     |    |     | 2   |     |
| Tabanidae                 |          | 2   |    | 2   |     | 1   |
| Tipulidae                 | 2        | 1   | 3  |     |     | 2   |
| <b>MOLLUSCA</b>           |          |     |    |     |     |     |
| Gastropoda (snails)       |          |     |    |     |     |     |
| Physidae                  | 3        |     |    |     | 1   |     |
| Planorbidae               |          | 2   |    |     |     |     |
| Pelecypoda (bivalves)     |          |     |    |     |     |     |
| Sphaeriidae (clams)       |          | 3   |    | 8   |     |     |
| <b>TOTAL INDIVIDUALS</b>  | 103      | 102 | 95 | 103 | 102 | 102 |

**Table 19. Taxonomic Summary for Qualitative Macroinvertebrate Sampling Results for Sampling Stations 1–6, June 14–16, 2004**

| METRIC                       | STATIONS                   |       |                            |       |                              |       |                              |       |                       |       |                         |       |
|------------------------------|----------------------------|-------|----------------------------|-------|------------------------------|-------|------------------------------|-------|-----------------------|-------|-------------------------|-------|
|                              | Yellow Dog River Station 1 |       | Yellow Dog River Station 2 |       | Salmon Trout River Station 3 |       | Salmon Trout River Station 4 |       | Cedar Creek Station 5 |       | Big Pup Creek Station 6 |       |
|                              | Value                      | Score | Value                      | Score | Value                        | Score | Value                        | Score | Value                 | Score | Value                   | Score |
| Total Number Of Taxa         | 25*                        | 0     | 34                         | 1     | 23                           | 0     | 23                           | 1     | 31                    | 1     | 20                      | 0     |
| Number Of Mayfly Taxa        | 4                          | 0     | 6                          | 1     | 5                            | 1     | 4                            | 1     | 5                     | 1     | 3                       | 0     |
| Number Of Caddisfly Taxa     | 7                          | 1     | 6                          | 1     | 6                            | 1     | 7                            | 1     | 7                     | 1     | 7                       | 1     |
| Number Of Stonefly Taxa      | 2                          | 1     | 1                          | 0     | 2                            | 1     | 0                            | -1    | 2                     | 1     | 2                       | 1     |
| Percent Mayfly Comp.         | 24.27                      | 1     | 18.63                      | 0     | 30.53                        | 1     | 7.77                         | 0     | 20.59                 | 0     | 23.53                   | 1     |
| Percent Caddisfly Comp.      | 26.21                      | 0     | 16.67                      | 0     | 25.26                        | 0     | 26.21                        | 0     | 27.45                 | 0     | 29.41                   | 0     |
| Percent Dominant Taxon       | 10.68                      | 1     | 8.82                       | 1     | 10.53                        | 1     | 17.48                        | 0     | 8.82                  | 1     | 21.57                   | 0     |
| Percent Isopod, Snail, Leech | 2.91                       | 1     | 2.94                       | 1     | 0.00                         | 1     | 0.00                         | 1     | 1.96                  | 1     | 0.00                    | 1     |
| Percent Surf. Air Breathers  | 5.83                       | 0     | 9.80                       | 0     | 7.37                         | 0     | 2.91                         | 1     | 5.88                  | 0     | 1.96                    | 1     |
| Total Score                  |                            | 5     |                            | 5     |                              | 6     |                              | 4     |                       | 6     |                         | 5     |
| Macroinv. Community Rating   | Excellent                  |       | Excellent                  |       | Excellent                    |       | Acceptable                   |       | Excellent             |       | Excellent               |       |

\* Note: Blephariceridae ("waterfall flies") were collected at Station 1 on the Yellow Dog River, but were not included under the total number of taxa. They are not currently included in the list of insect families in the MDEQ Procedure #51 protocol due to their general scarcity in stream samples across the state.

**Table 20. Riparian (Ri), Aquatic (Aq), and Aquatic-Riparian (Aq-Ri) Plant Species\* Identified on August 3 and 4, 2004 at Sampling Stations 1–7 (3 pgs.)**

| Species Name, Common Name                                          | Station Number |   |   |   |   |   |   |
|--------------------------------------------------------------------|----------------|---|---|---|---|---|---|
|                                                                    | 1              | 2 | 3 | 4 | 5 | 6 | 7 |
| <i>Agrostis gigantea</i> , Redtop (Ri)                             | +              |   | + |   |   |   |   |
| <i>Alnus rugosa</i> , Speckled Alder (Ri)                          | +              | + | + | + | + | + | + |
| <i>Calamagrostis canadensis</i> , Bluejoint grass (Ri)             |                | + | + | + | + | + |   |
| <i>Caltha palustris</i> , Marsh Marigold (Aq-Ri)                   |                |   |   | + | + |   |   |
| <i>Callitriche</i> sp., Water Starwort (Aq)                        |                | + | + |   | + |   |   |
| <i>Carex gynandra</i> , Sedge (Ri)                                 | +              | + |   |   |   |   |   |
| <i>Carex hystricina</i> , Porcupine Sedge (Ri)                     | +              |   |   |   |   |   |   |
| <i>Carex lacustris</i> , Lake Sedge (Ri)                           |                |   |   | + |   |   |   |
| <i>Carex stricta</i> , Tussock sedge (Ri)                          |                | + |   | + |   |   |   |
| <i>Carex</i> spp., Sedges (Ri)                                     |                |   | + |   | + |   | + |
| <i>Chamaedaphne calyculata</i> , Leatherleaf (Ri)                  |                |   |   |   |   |   | + |
| <i>Chara</i> sp., Musk Grass (Aq)                                  |                | + |   |   |   |   |   |
| <i>Chelone glabera</i> , Turtlehead (Ri)                           |                |   |   | + | + |   |   |
| <i>Circuta bulbifera</i> , Bulb-Bearing Water Hemlock (Aq-Ri)      |                |   |   | + |   |   |   |
| <i>Cornus amomum</i> , Silky Dogwood (Ri)                          |                | + |   |   |   |   |   |
| <i>Dulichium arundinaceum</i> , Three-way sedge (Aq-Ri)            |                |   |   |   |   |   | + |
| <i>Eleocharis acicularis</i> , Needle Spikerush, submerged (Aq-Ri) |                | + |   |   |   |   |   |
| <i>Eleocharis smallii</i> , Creeping Spikerush (Aq-Ri)             |                | + |   |   |   |   |   |
| <i>Eleocharis</i> sp., Spikerush (Aq-Ri)                           | +              |   |   |   |   |   |   |
| <i>Elodea canadensis</i> , Common Waterweed (Aq)                   |                |   |   |   | + |   |   |
| <i>Epilobium</i> sp., Willow Herb (Ri)                             |                |   | + | + | + |   |   |
| <i>Equisetum pretense</i> , Meadow Horsetail (Ri)                  |                |   |   |   |   | + |   |
| <i>Eupatorium maculatum</i> , Joe Pye Weed (Ri)                    | +              | + | + |   | + |   |   |
| <i>Eupatorium perfoliatum</i> , Boneset (Ri)                       | +              |   | + |   | + |   |   |
| <i>Eutamia graminifolia</i> , Grass-leaved Goldenrod (Ri)          | +              | + |   |   |   |   |   |
| <i>Fontinalis</i> sp., Aquatic Moss (Aq)                           |                |   | + |   | + | + |   |
| <i>Galium</i> sp., Bedstraw (Ri)                                   |                |   |   | + |   | + |   |

**Table 20. Riparian (Ri), Aquatic (Aq), and Aquatic-Riparian (Aq-Ri) Plant Species\* Identified on August 3 and 4, 2004 at Sampling Stations 1–7 (3 pgs.)**

| Species Name, Common Name                                   | Station Number |   |   |   |   |   |   |
|-------------------------------------------------------------|----------------|---|---|---|---|---|---|
|                                                             | 1              | 2 | 3 | 4 | 5 | 6 | 7 |
| <i>Gentiana andrewsii</i> , Closed Gentian (Ri)             |                | + |   |   |   |   |   |
| <i>Glyceria canadensis</i> , Rattlesnake Grass (Ri)         | +              | + |   | + | + |   | + |
| <i>Glyceria grandis</i> , Reed Manna Grass (Ri)             |                |   | + |   | + |   |   |
| <i>Glyceria striata</i> , Fowl Manna Grass (Ri)             |                | + |   |   | + |   |   |
| <i>Hypericum sp.</i> , St. Johnswort (Ri)                   |                | + |   |   |   |   |   |
| <i>Impatiens capensis</i> , Jewelweed (Ri)                  |                |   | + | + | + |   |   |
| <i>Iris versicolor</i> , Blue Flag (Ri)                     |                |   |   |   | + |   | + |
| <i>Juncus sp.</i> , Rush (Ri)                               | +              | + | + |   | + |   |   |
| <i>Lemna minor</i> , Duckweed (Aq)                          |                |   |   | + | + |   |   |
| Liverwort (Ri)                                              |                |   |   |   | + |   |   |
| <i>Lycopus sp.</i> , Bugleweed (Ri)                         | +              |   |   |   |   |   |   |
| <i>Mentha arvensis</i> , Wild Mint (Ri)                     | +              |   | + |   | + |   |   |
| <i>Mimulus ringens</i> , Monkey-Flower (Ri)                 | +              |   | + |   | + |   |   |
| <i>Onoclea sensibilis</i> , Sensitive Fern (Ri)             |                | + | + | + |   | + |   |
| <i>Phalaris arundinacea</i> , Reed Canary (Ri)              |                |   |   | + |   |   |   |
| <i>Physocarpus opulifolius</i> , Ninebark (Ri)              | +              |   |   |   |   |   |   |
| <i>Polygonum sp.</i> , Knotweed (Aq-Ri)                     |                |   | + | + |   |   |   |
| <i>Potentilla palustris</i> , Marsh cinquefoil (Ri)         |                |   |   |   |   |   | + |
| <i>Potamogeton richardsonii</i> , Richardsons Pondweed (Aq) |                | + |   |   | + |   | + |
| <i>Potamogeton sp.</i> , Unknown Pondweed (Aq)              |                |   |   |   | + |   |   |
| <i>Rorippa nasturtium-aquaticum</i> , Water Cress (Aq)      |                |   |   | + | + |   |   |
| <i>Rumex orbiculatus</i> , Water Dock (Ri)                  |                |   |   | + |   |   |   |
| <i>Sagittaria latifolia</i> , Arrowhead (Aq-Ri)             |                | + |   | + | + |   |   |
| <i>Salix sp.</i> , Willow (Ri)                              | +              |   | + |   |   |   |   |
| <i>Scirpus atrovirens</i> , Dark Green Bulrush (Ri)         | +              | + |   | + |   |   |   |
| <i>Scirpus cyperinus</i> , Wool Grass (Ri)                  | +              |   | + |   | + |   |   |
| <i>Scutellaria lateriflora</i> , Mad-Dog Skullcap (Ri)      |                |   |   | + | + |   |   |

**Table 20. Riparian (Ri), Aquatic (Aq), and Aquatic-Riparian (Aq-Ri) Plant Species\* Identified on August 3 and 4, 2004 at Sampling Stations 1–7 (3 pgs.)**

| Species Name, Common Name                                       | Station Number |    |    |    |    |   |    |
|-----------------------------------------------------------------|----------------|----|----|----|----|---|----|
|                                                                 | 1              | 2  | 3  | 4  | 5  | 6 | 7  |
| <i>Solanum dulcamara</i> , Nightshade (Ri)                      |                |    |    |    | +  |   |    |
| <i>Sparganium angustifolium</i> , Narrow-leaved Burreed (Aq-Ri) |                | +  |    |    |    |   |    |
| <i>Sparganium clorocarpum</i> , Green-Fruited Burreed (Aq-Ri)   |                | +  |    |    | +  |   |    |
| <i>Sphagnum sp.</i> (Ri)                                        |                |    |    |    |    |   | +  |
| <i>Spirea alba</i> , Meadowsweet (Ri)                           |                | +  |    |    |    |   |    |
| <i>Thalictrum dasycarpum</i> , Tall-Meadow Rue (Ri)             |                |    | +  | +  |    | + |    |
| <i>Utricularia minor</i> , Small Bladderwort (Aq)               |                |    |    |    |    |   | +  |
| <i>Vallisneria americana</i> , Wild Celery (Aq)                 |                | +  |    | +  | +  |   |    |
| <i>Verbena hastata</i> , Vervain (Ri)                           |                |    | +  |    | +  |   |    |
| <i>Veronica beccabunga</i> , Brooklime (Ri)                     |                |    | +  |    |    |   |    |
| Total Number of Aquatic/Riparian Plant Species Identified       | 2              | 10 | 4  | 7  | 12 | 1 | 3  |
| Total Number of Riparian Plant Species Identified               | 15             | 14 | 17 | 15 | 19 | 6 | 7  |
| Total Number of Plant Species Identified at Each Station        | 17             | 24 | 21 | 22 | 31 | 7 | 10 |
| Total Number of Plant Species Overall Stations                  | 64             |    |    |    |    |   |    |

\* For the purposes of this table, plant species were categorized as “Riparian” (Ri), “Aquatic” (Aq), or “Aquatic-Riparian” (Aq-Ri). The Aq-Ri category represents species that have the ability to grow in either an aquatic habitat or damp riparian habitat.

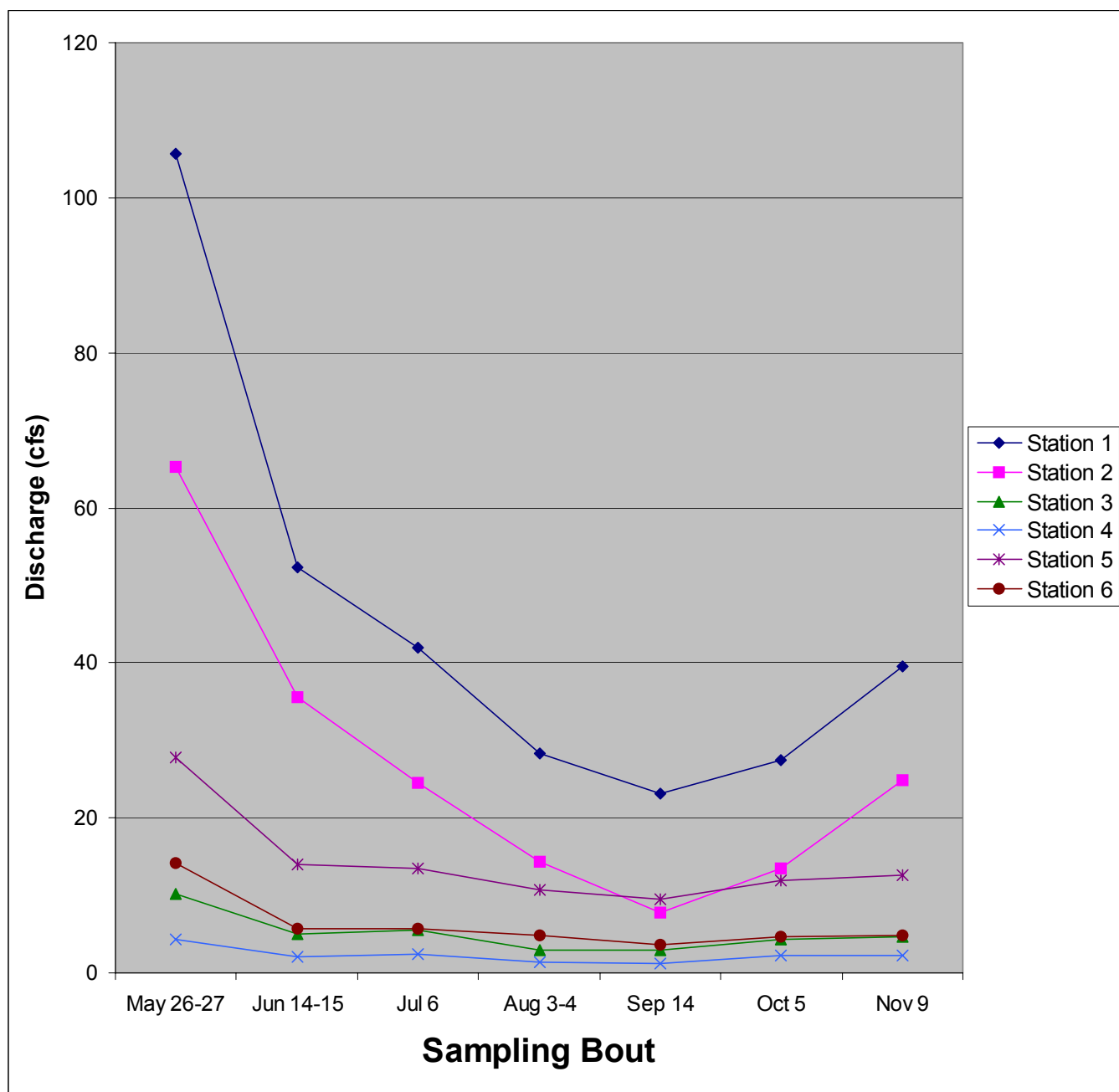
---

## **APPENDIX C**

### **Figures**

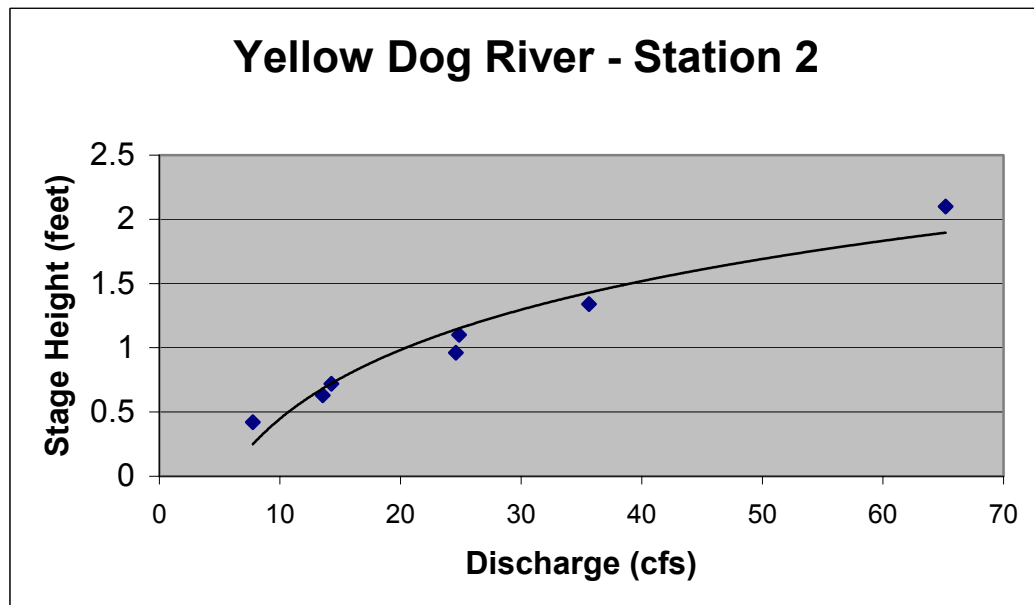
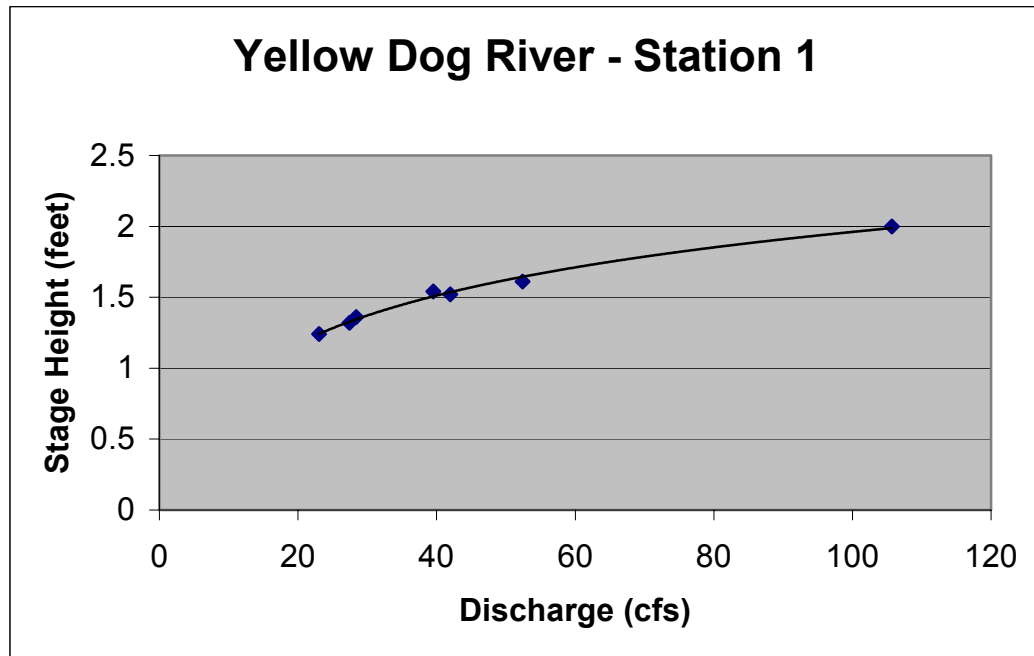
---

**Figure 1. Monthly Discharges Observed at Sampling Stations 1–6**



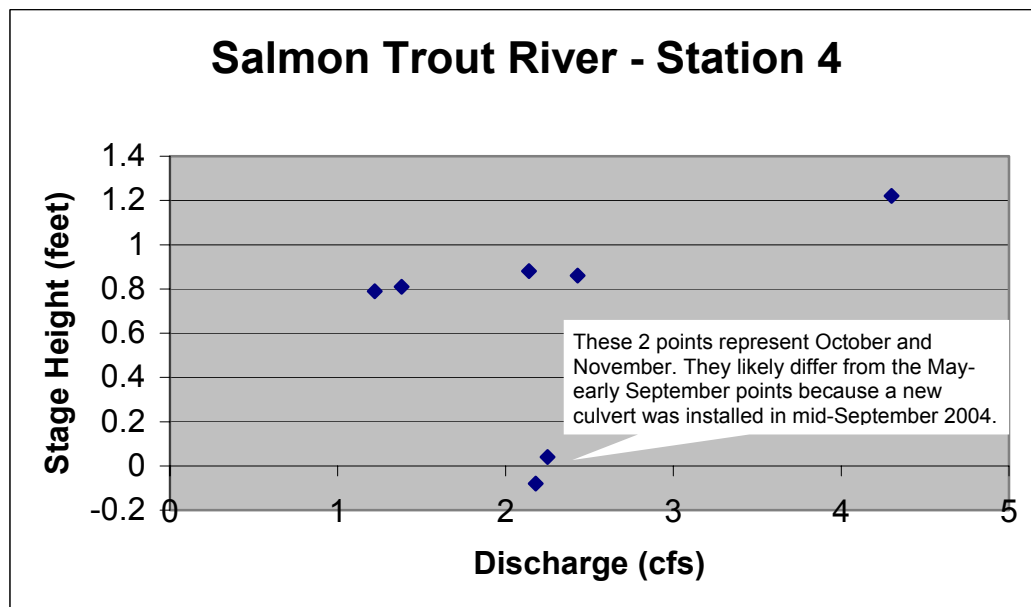
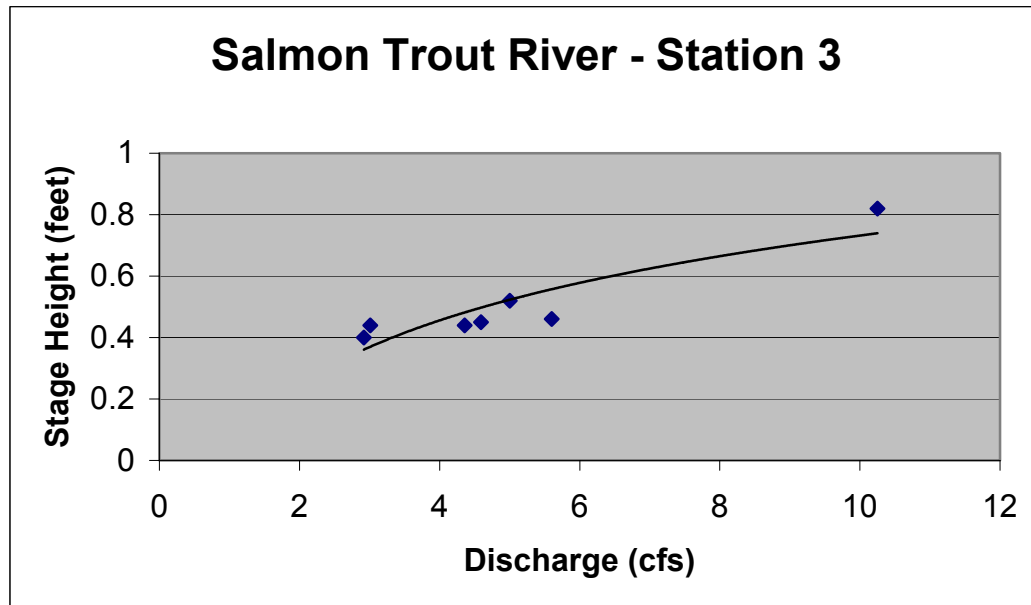
---

**Figure 2. Stage Height and Discharge Graphs for Yellow Dog River Stations**



---

**Figure 3. Stage Height and Discharge Graphs for Salmon Trout River Stations**



---

**Figure 4. Stage Height and Discharge Graphs for Cedar Creek and Big Pup Creek Stations**

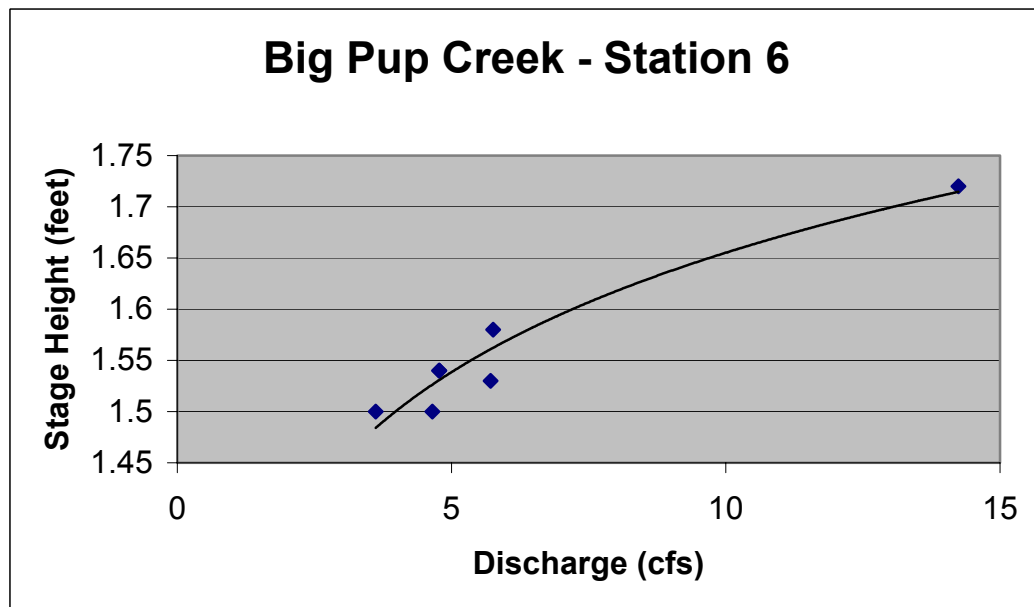
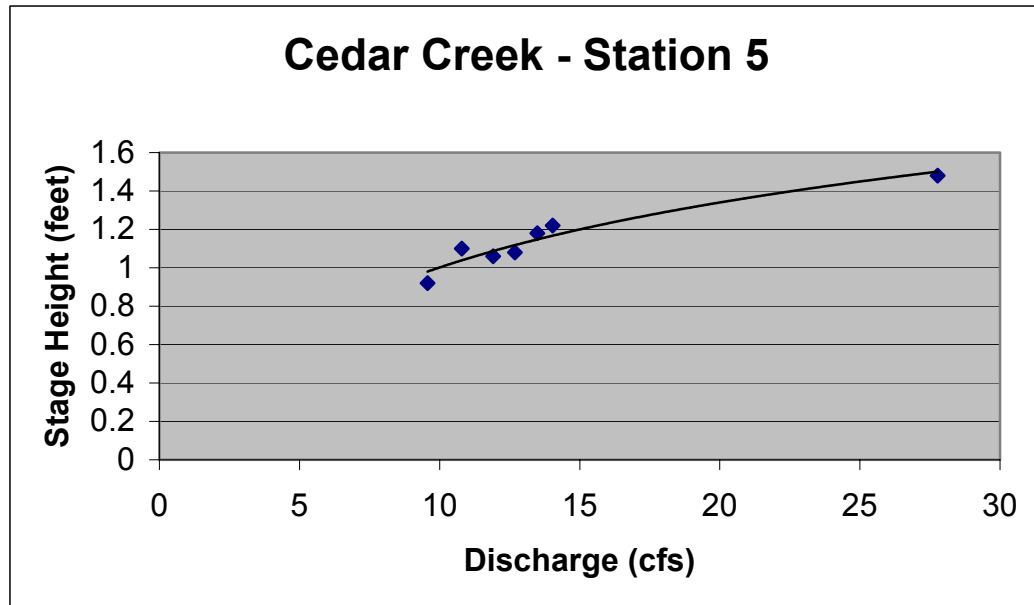


**Figure 5. Graphs of pH and Specific Conductance for Sampling Stations 1–7**

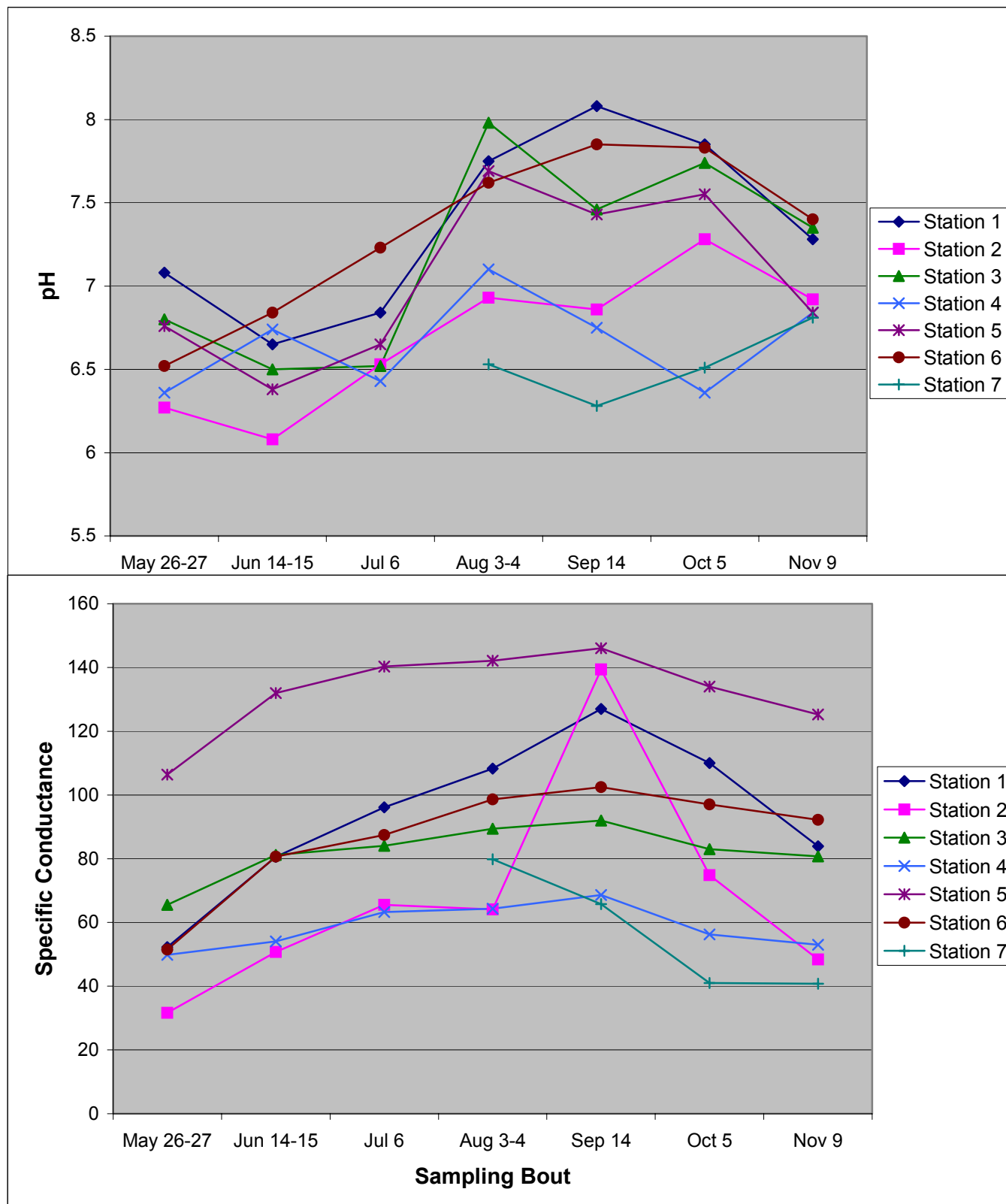


**Figure 6. Graph of Dissolved Oxygen for Sampling Stations 1–7**

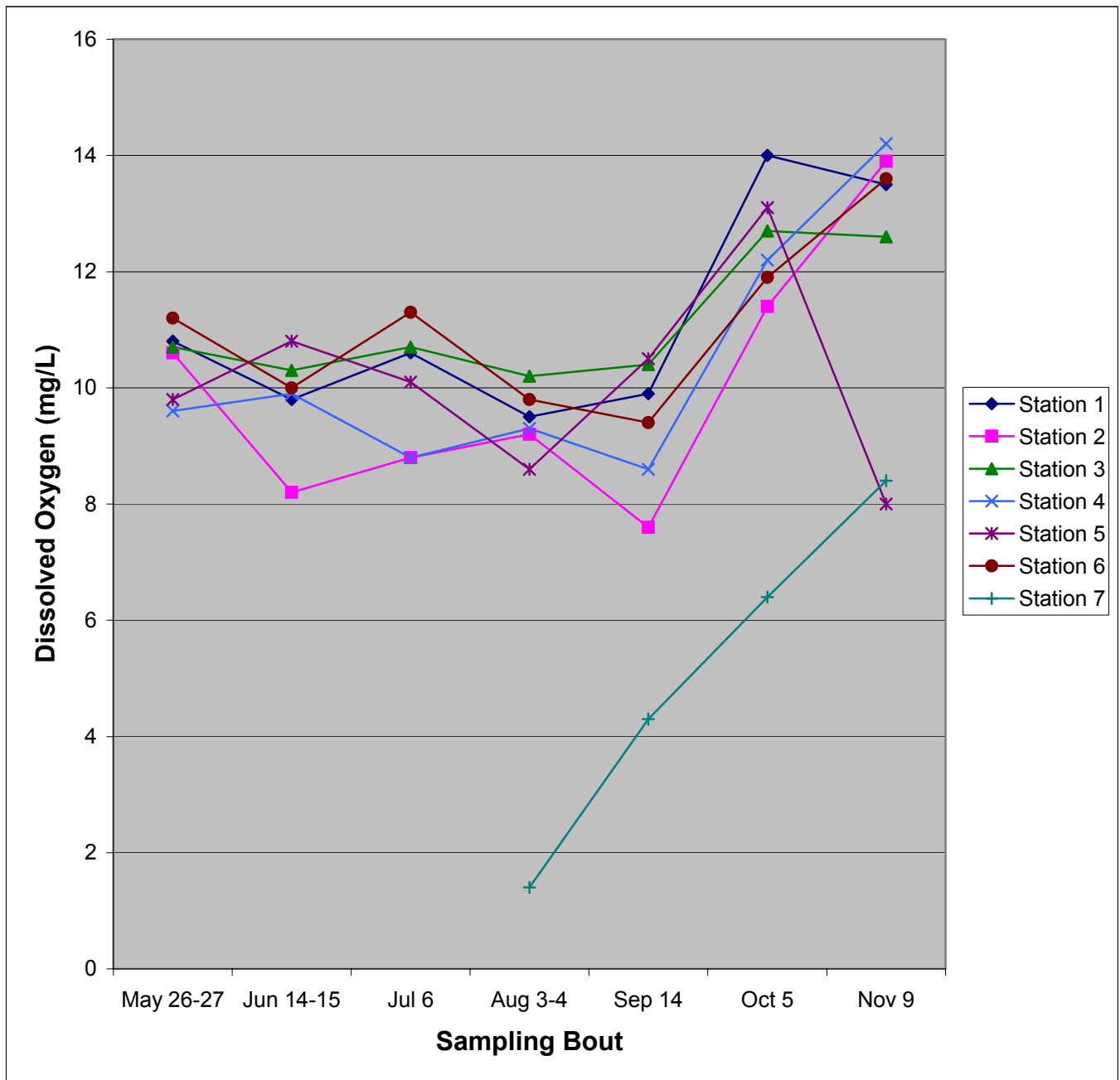


Figure 7a: Temperatures at Yellow Dog River stations for May

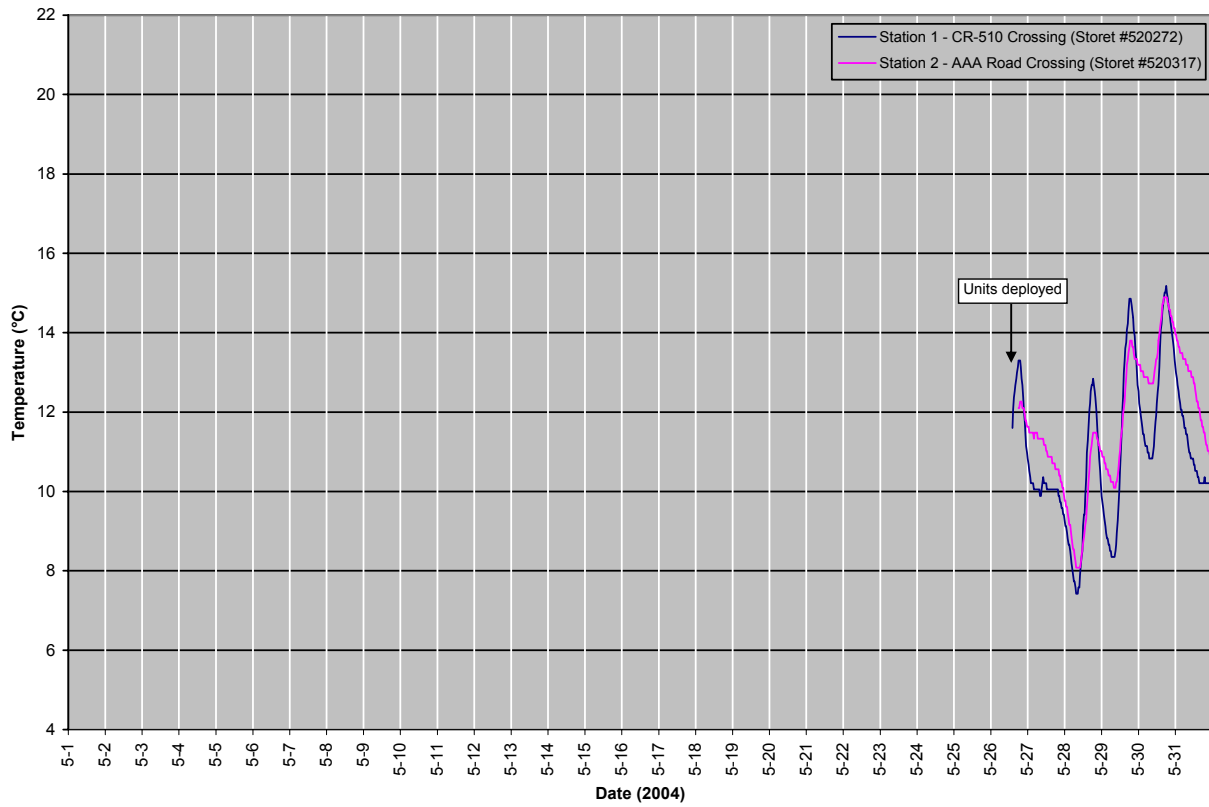


Figure 7b: Temperatures at Yellow Dog River stations for June

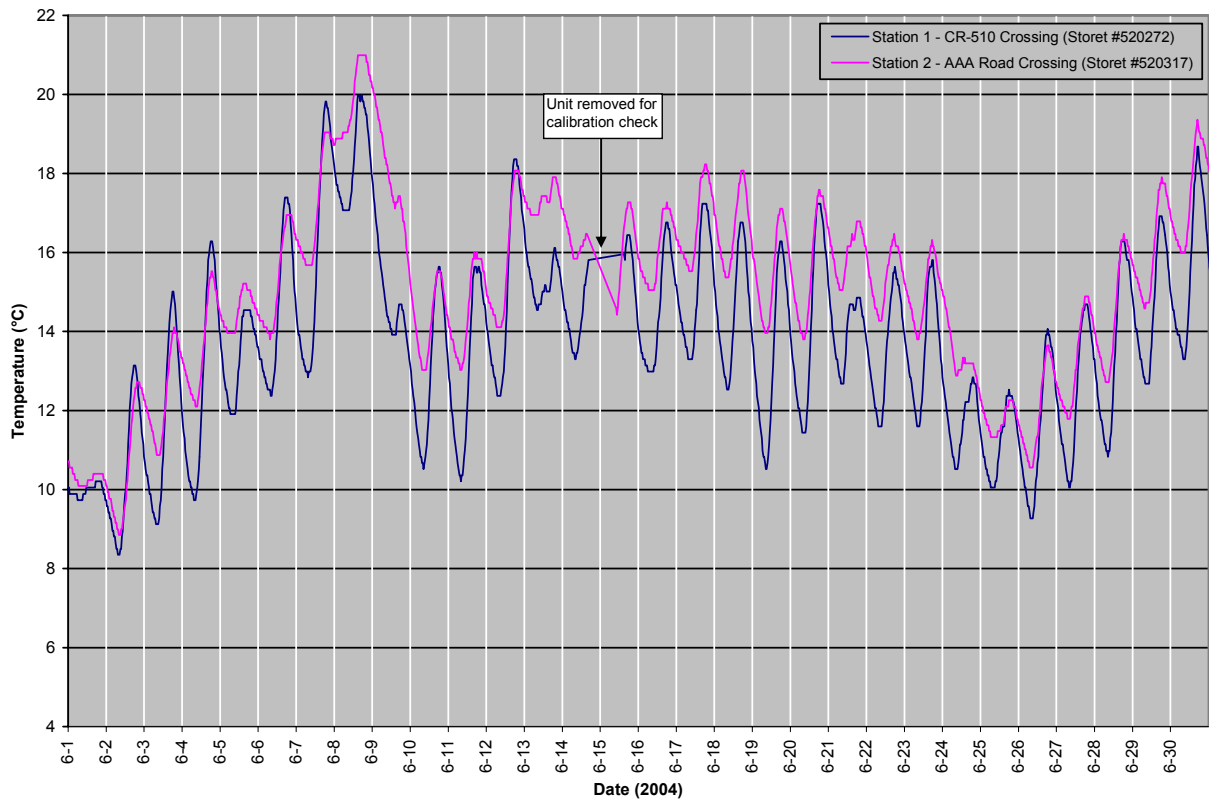


Figure 7c: Temperatures at Yellow Dog River stations for July

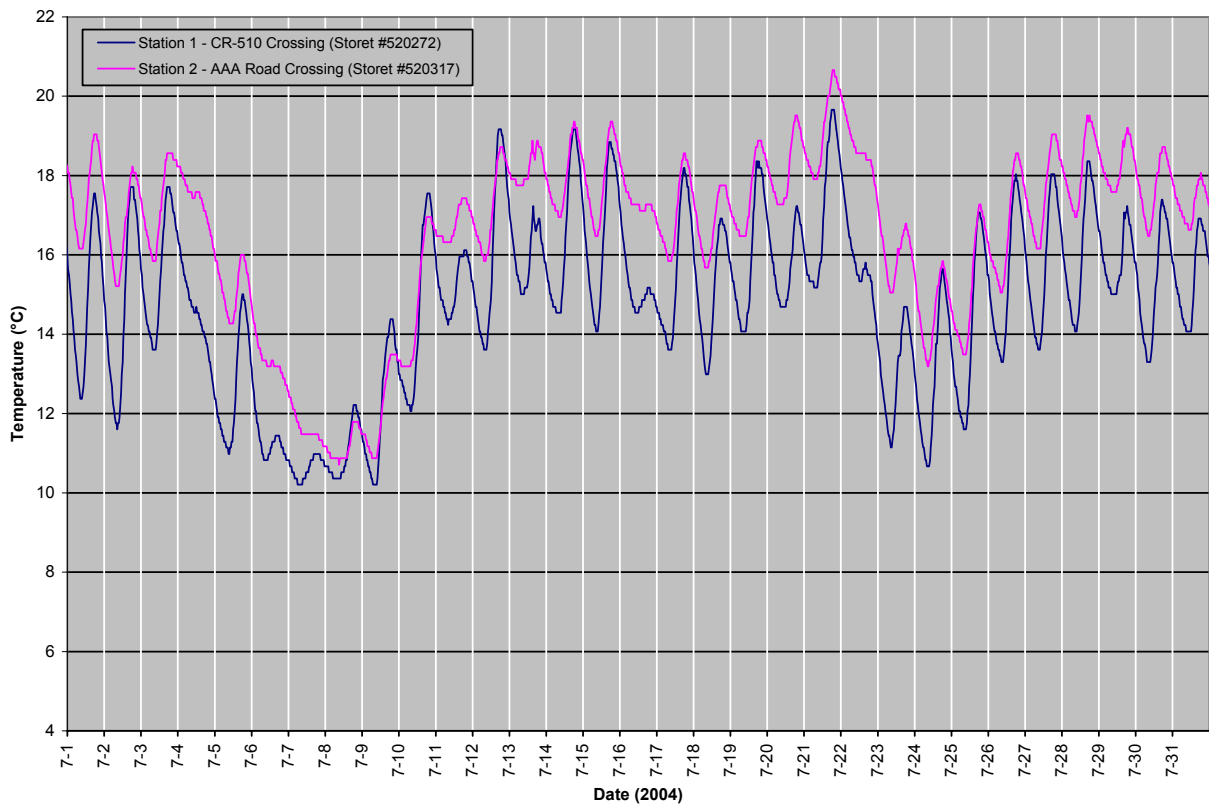


Figure 7d: Temperatures at Yellow Dog River stations for August

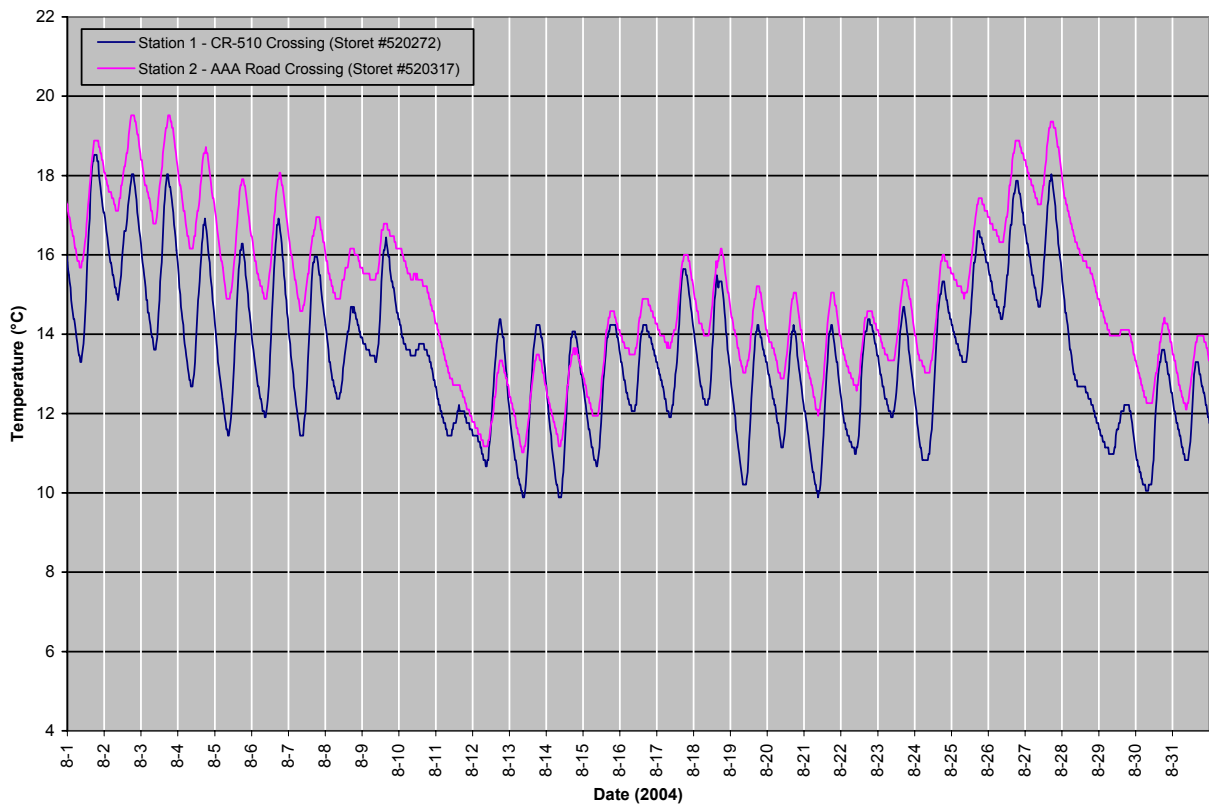


Figure 7e: Temperatures at Yellow Dog River stations for September

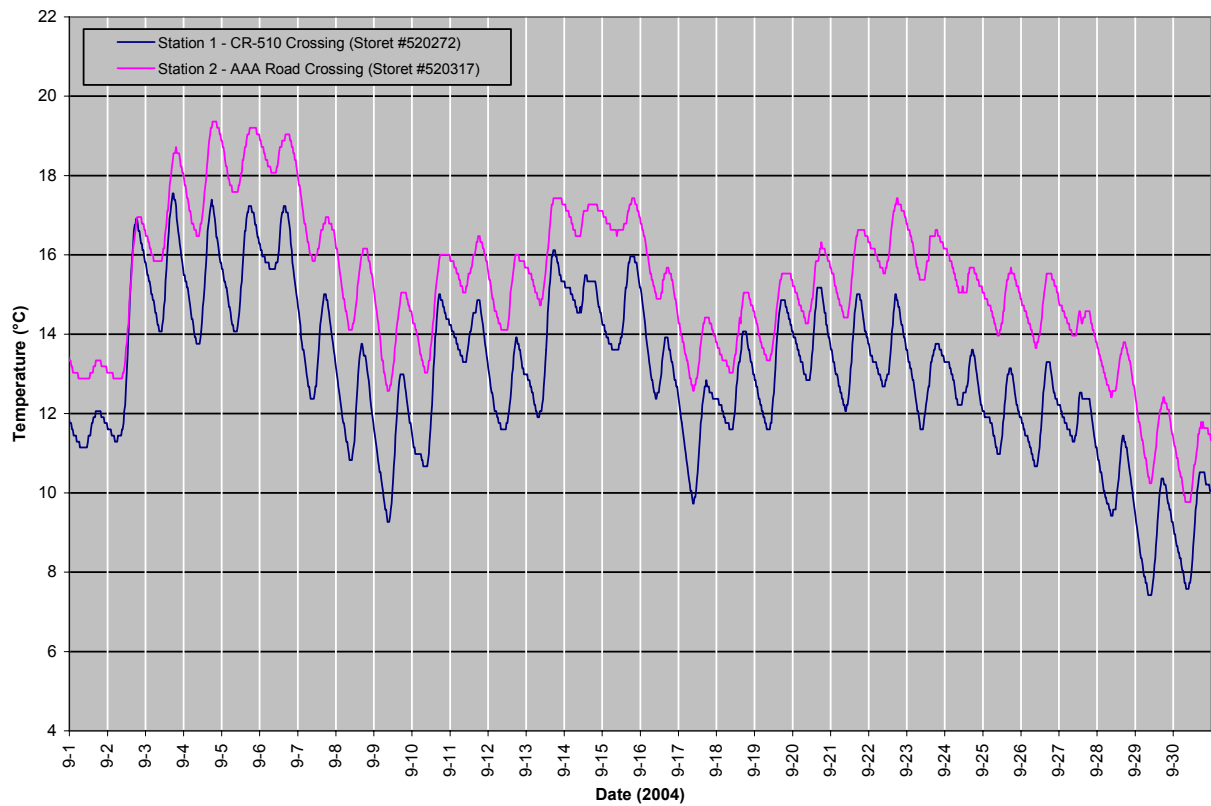


Figure 7f: Temperatures at Yellow Dog River stations for October

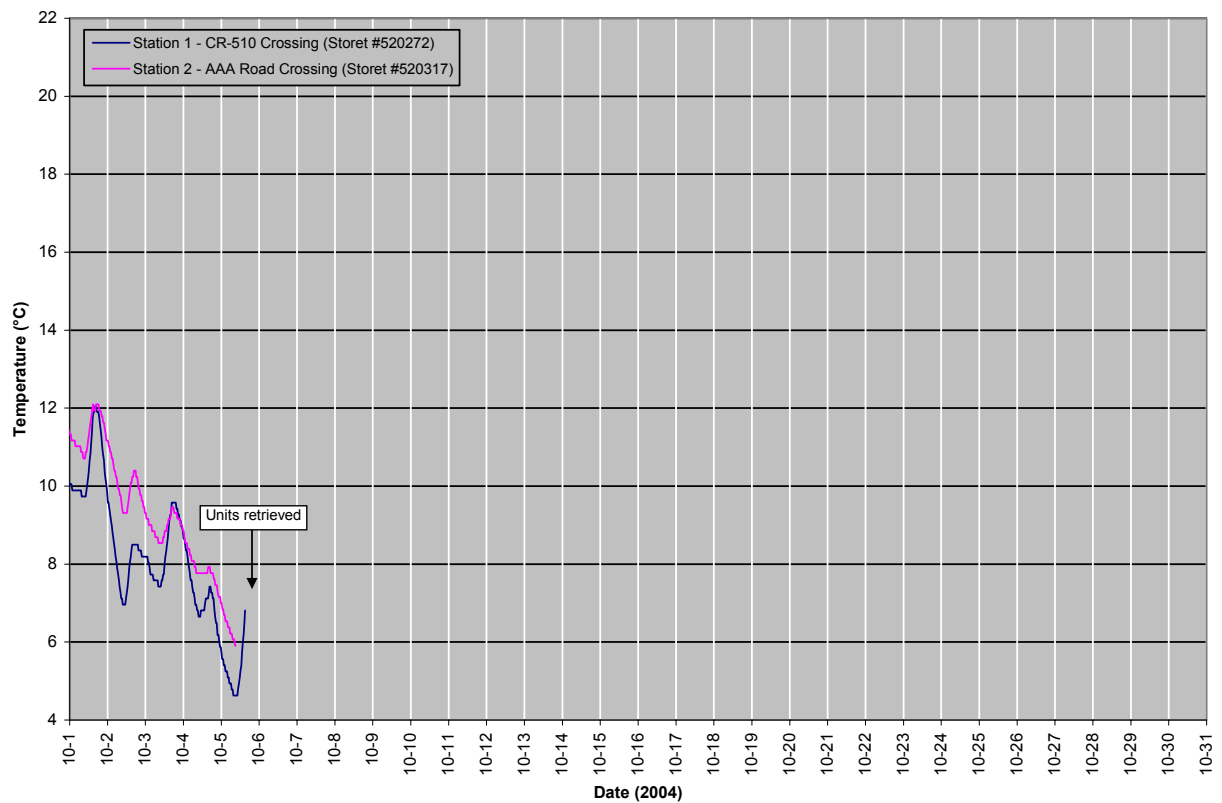


Figure 8a: Temperatures at Salmon Trout River stations for May

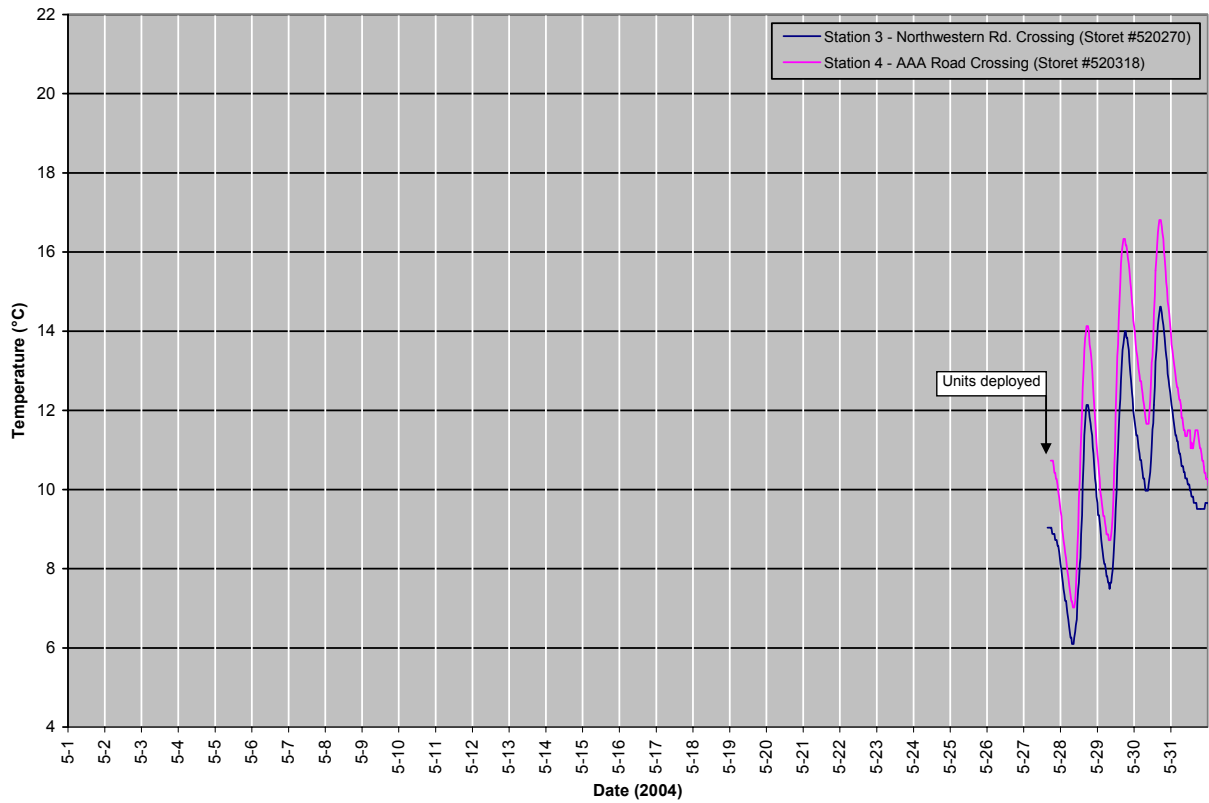


Figure 8b: Temperatures at Salmon Trout River stations for June

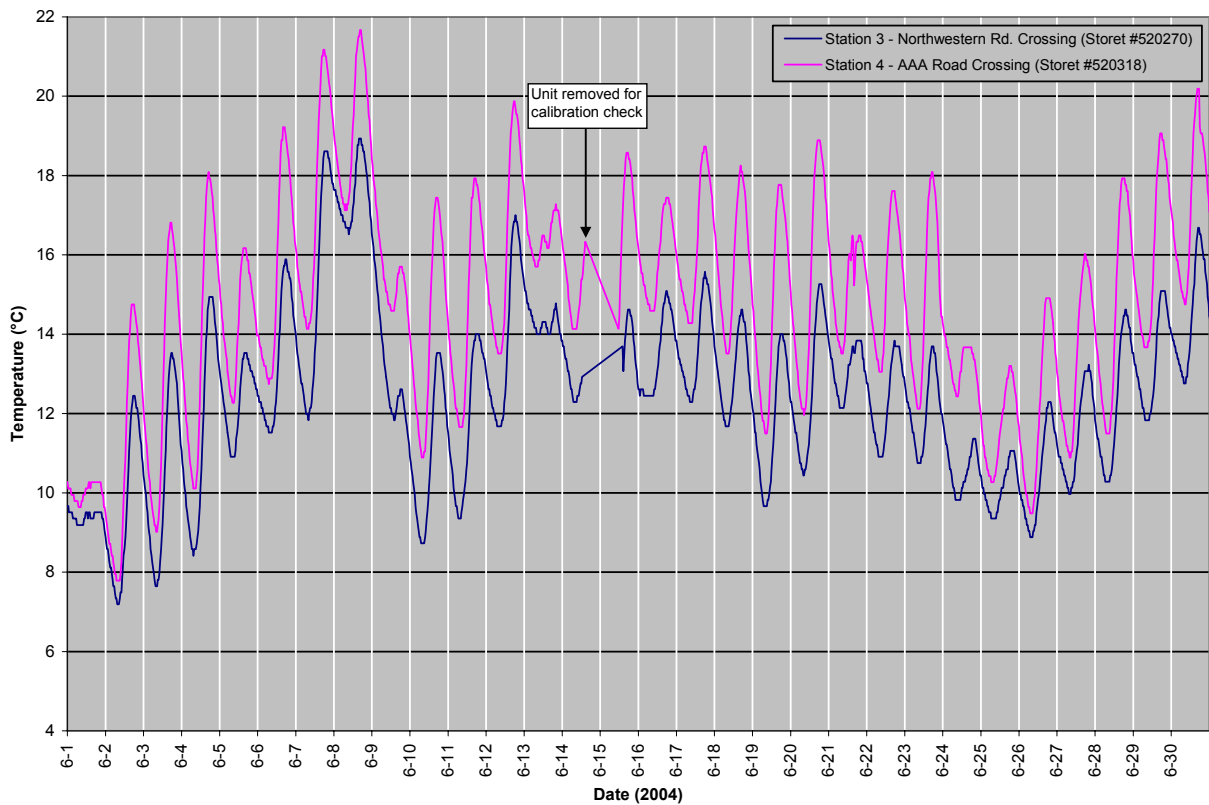


Figure 8c: Temperatures at Salmon Trout River stations for July

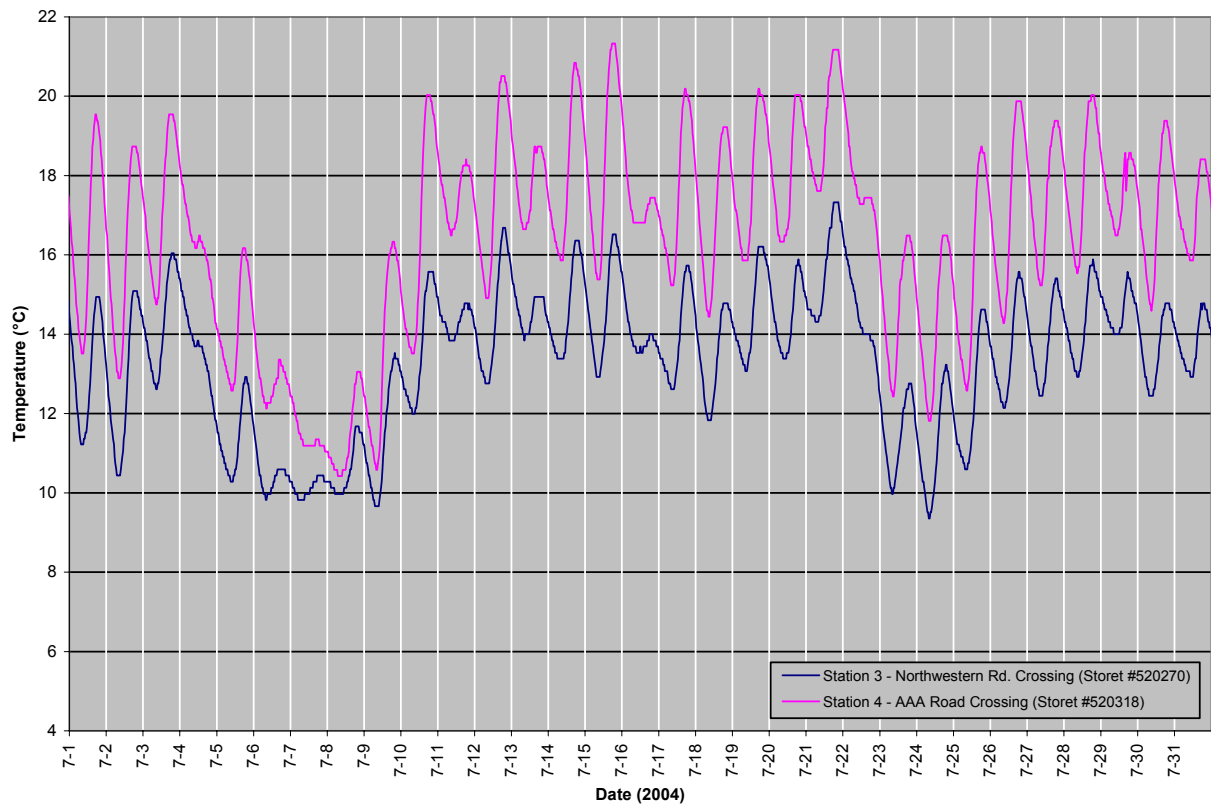


Figure 8d: Temperatures at Salmon Trout River stations for August

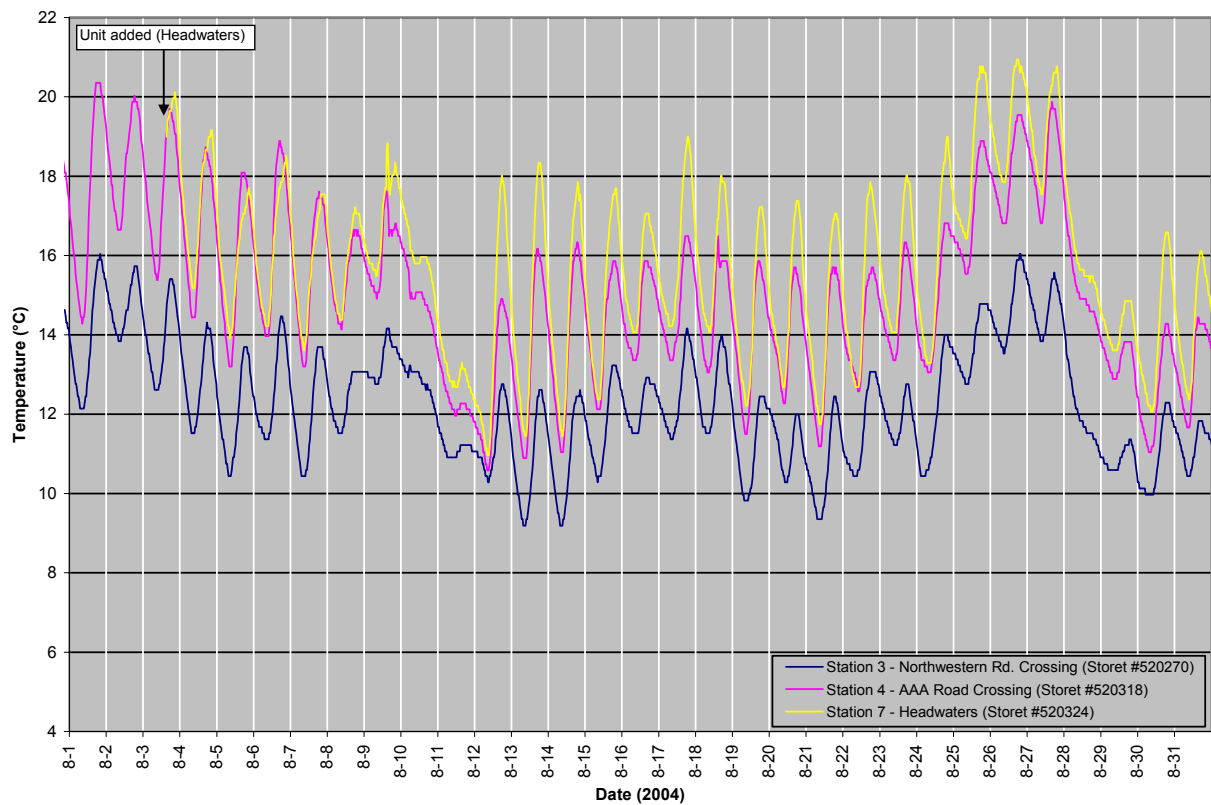


Figure 8e: Temperatures at Salmon Trout River stations for September

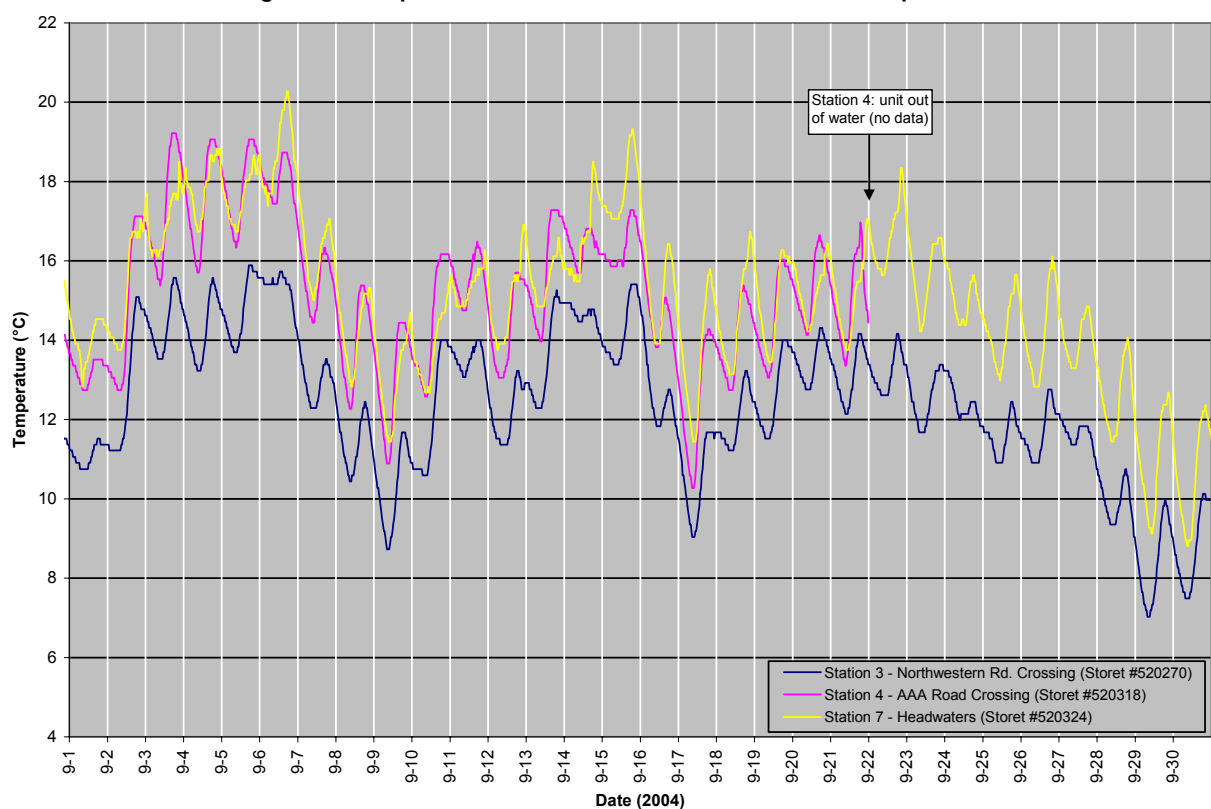


Figure 8f: Temperatures at Salmon Trout River stations for October

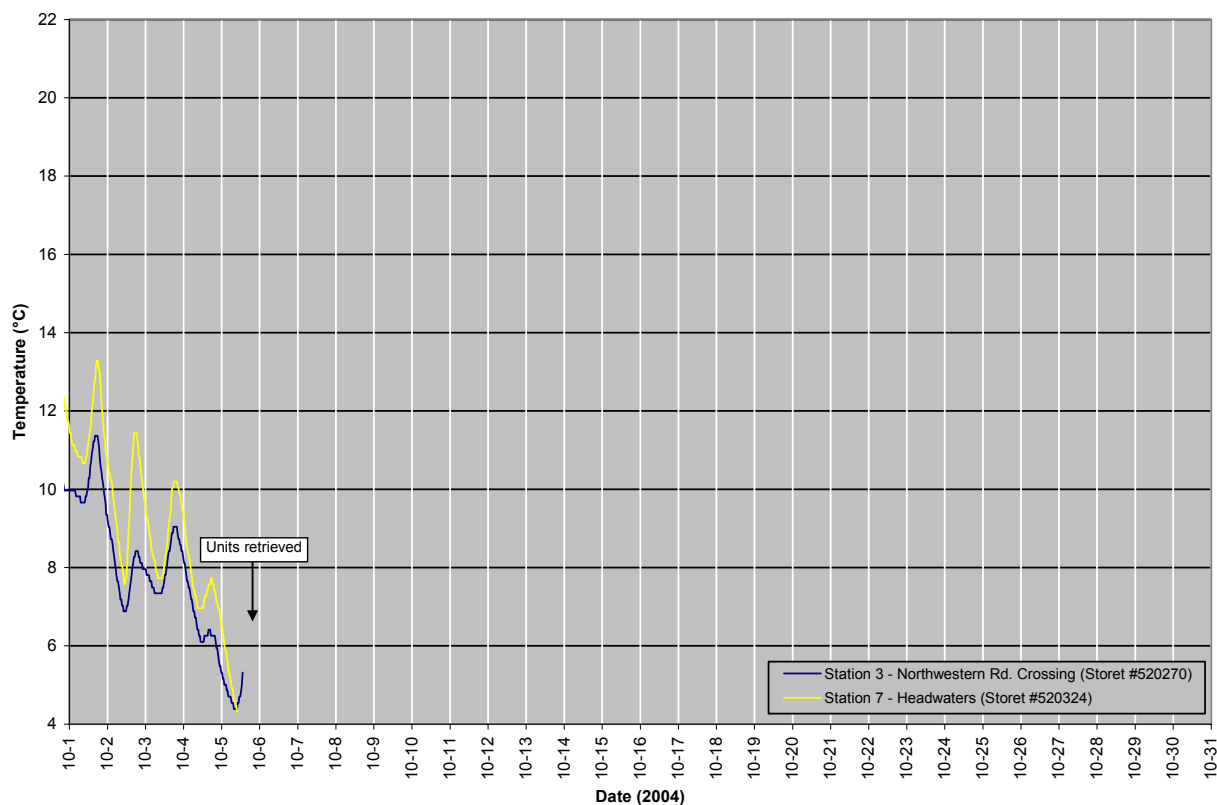


Figure 9a: Temperatures at Cedar Creek and Big Pup Creek stations for May

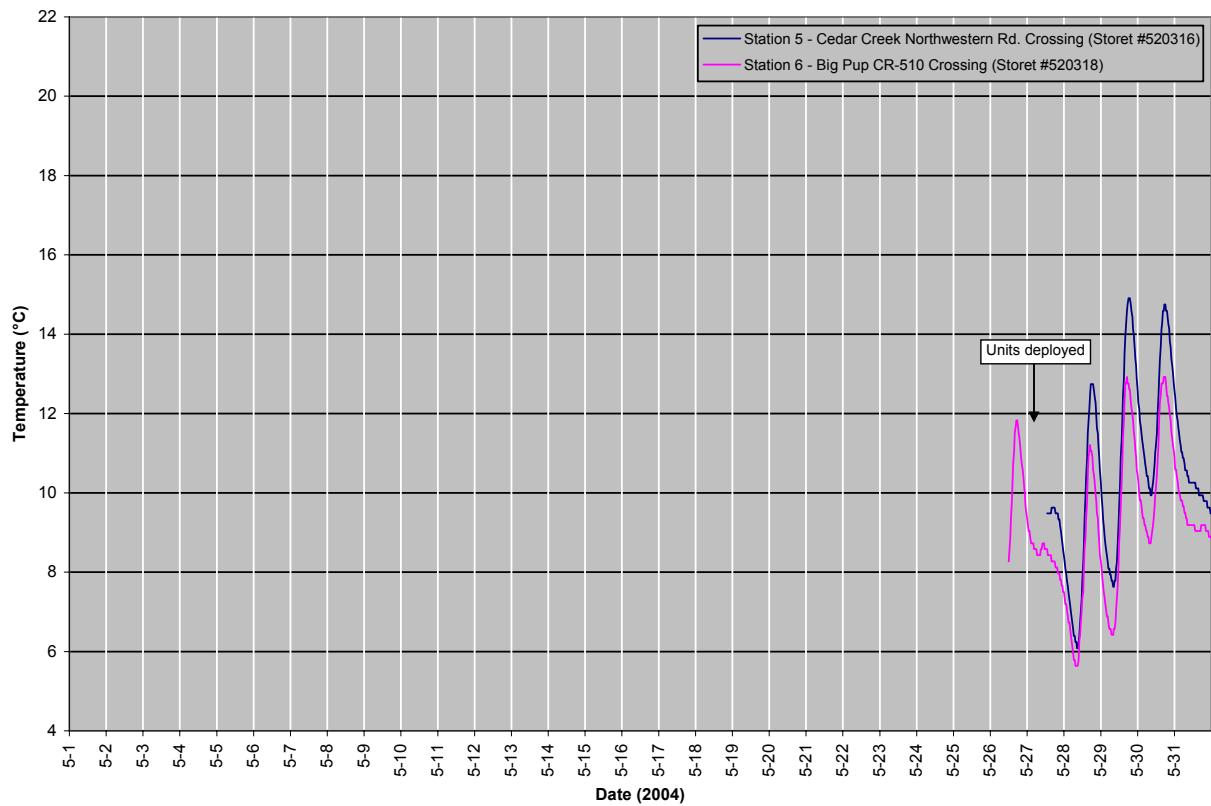


Figure 9b: Temperatures at Cedar Creek and Big Pup Creek stations for June

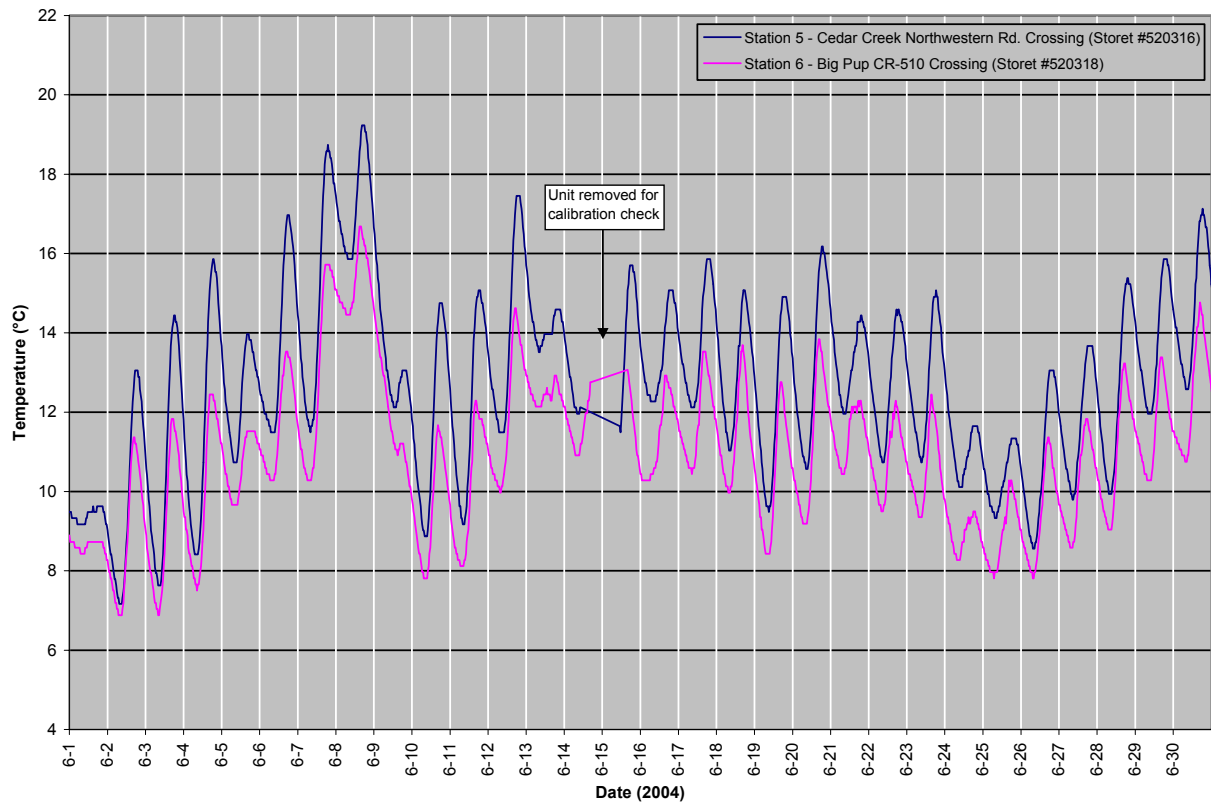


Figure 9c: Temperatures at Cedar Creek and Big Pup Creek stations for July

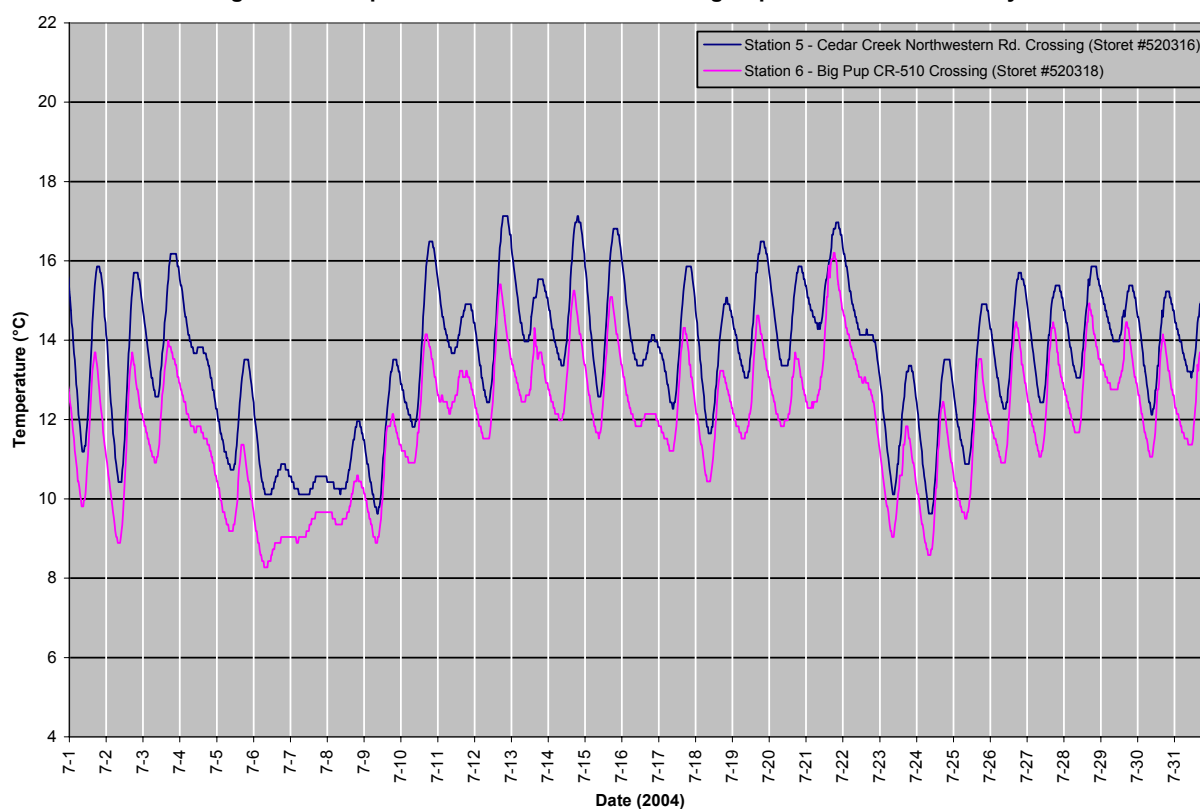


Figure 9d: Temperatures at Cedar Creek and Big Pup Creek stations for August

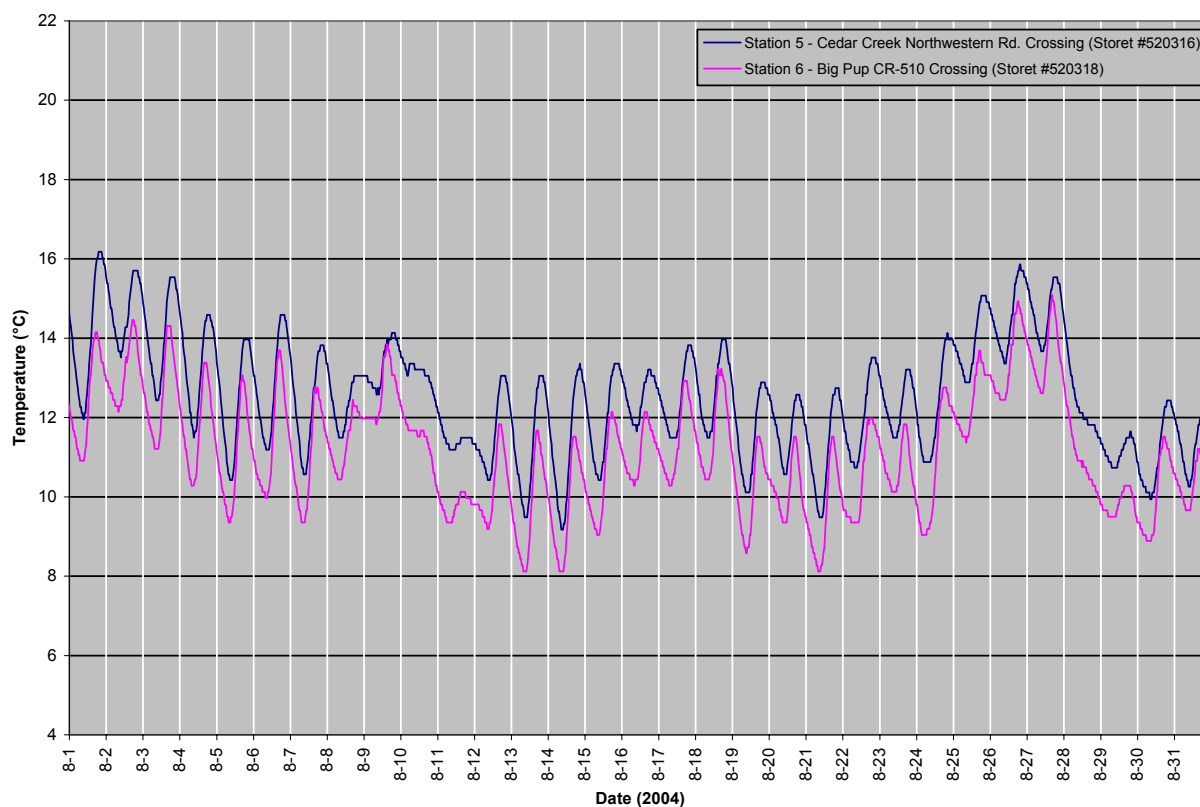


Figure 9e: Temperatures at Cedar Creek and Big Pup Creek stations for September

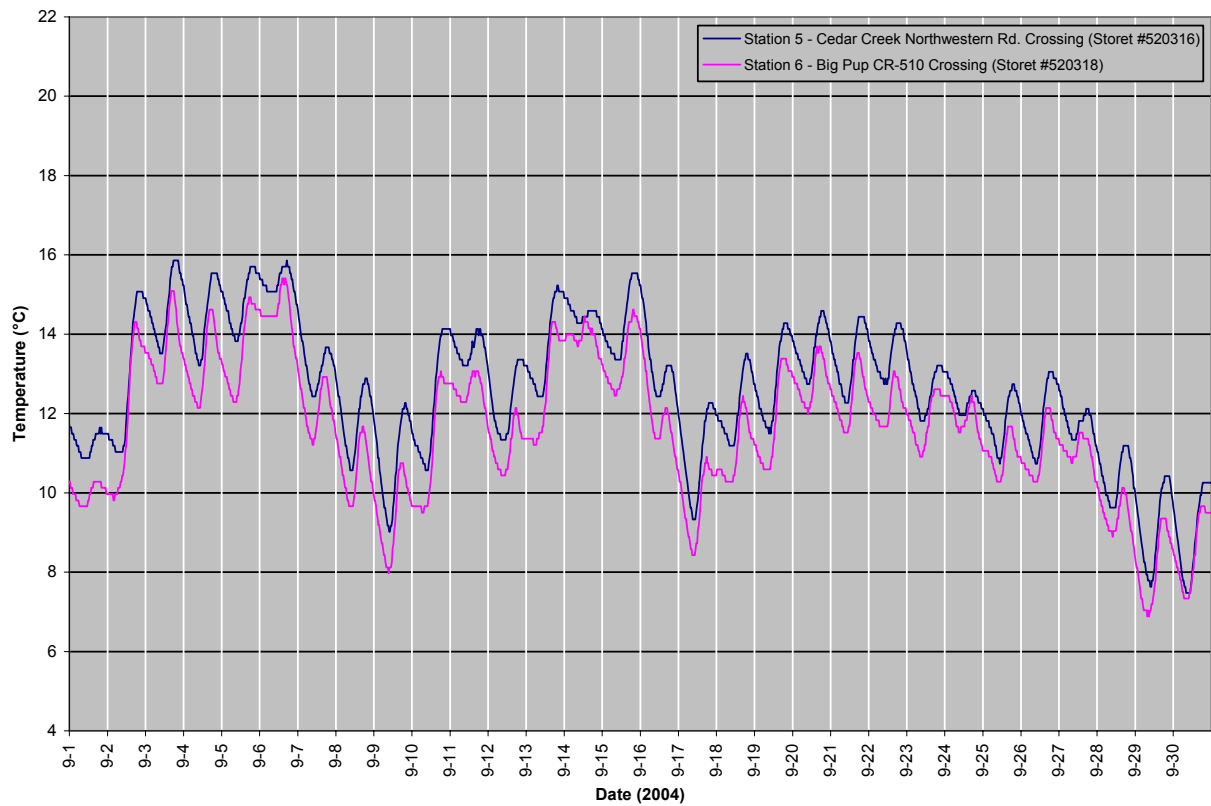
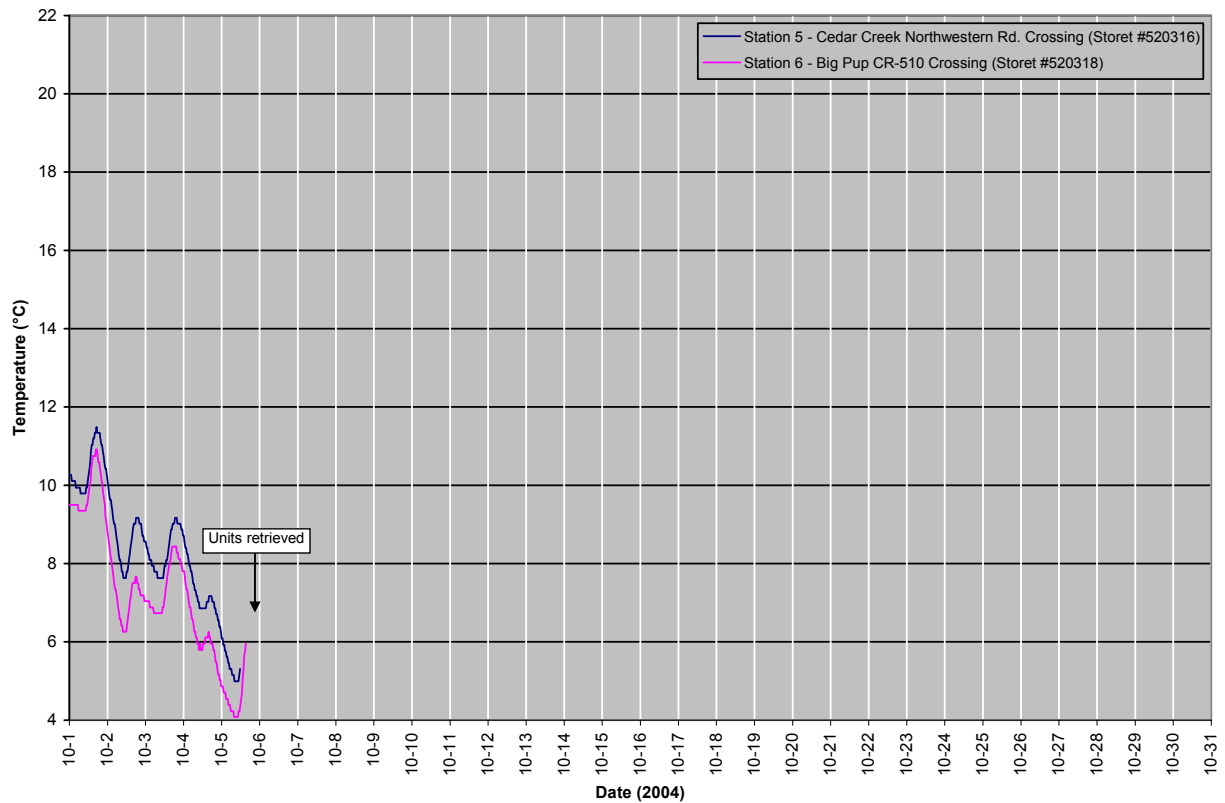


Figure 9f: Temperatures at Cedar Creek and Big Pup Creek stations for October



---

**Figure 10. Number of Algal Divisions Detected at Sample Stations**

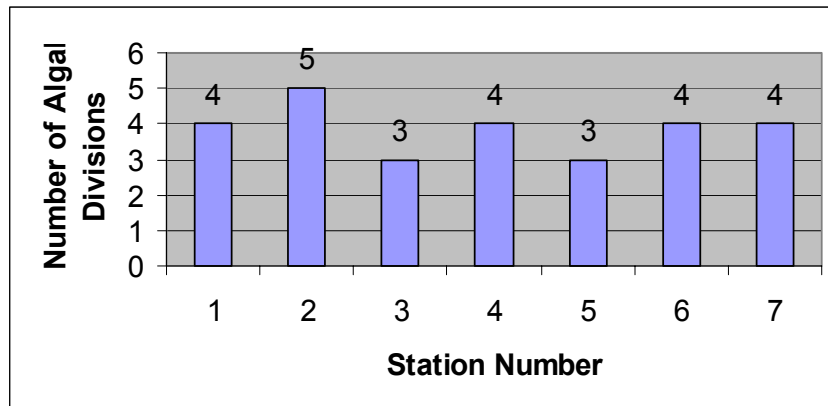


**Figure 11. Algal Species Richness (Excluding Picoplankton)**

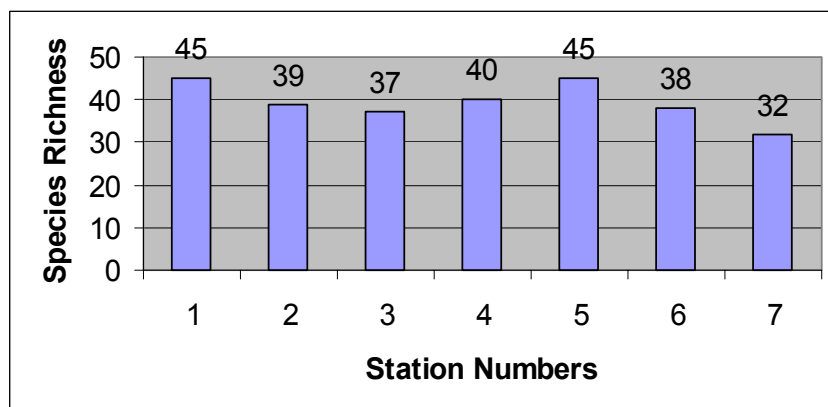
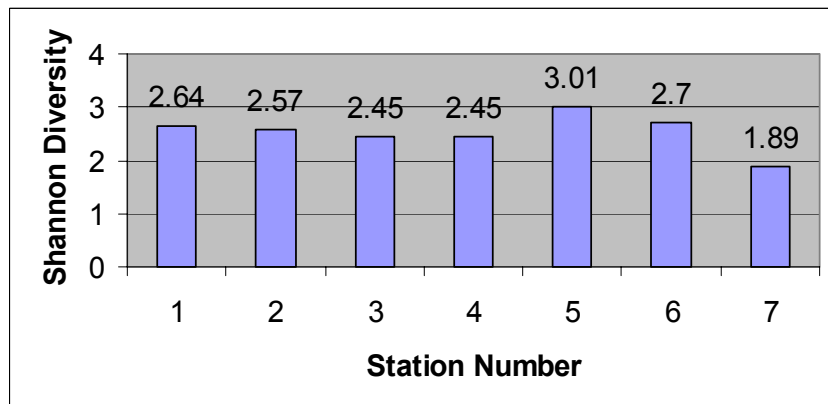


**Figure 12. Algal Shannon Diversity (Excluding Picoplankton)**



---

**Figure 13. Alpha Algal Cell Concentration (Excluding Picoplankton)**

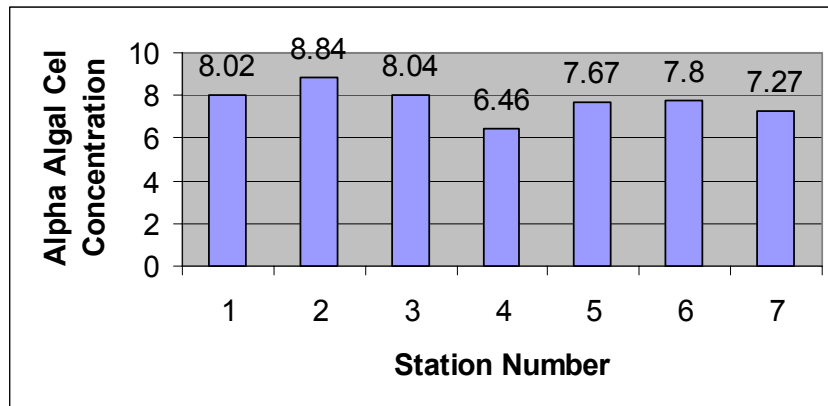


**Figure 14. Diatom Species Richness (Excluding Picoplankton)**

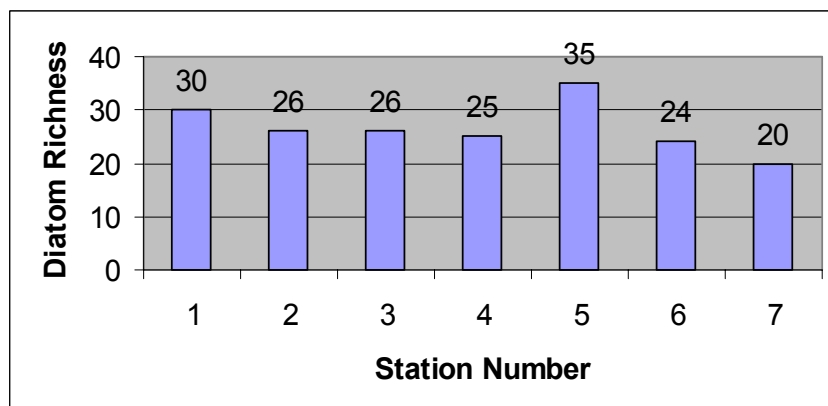


**Figure 15. Diatom Shannon Diversity (Excluding Picoplankton)**

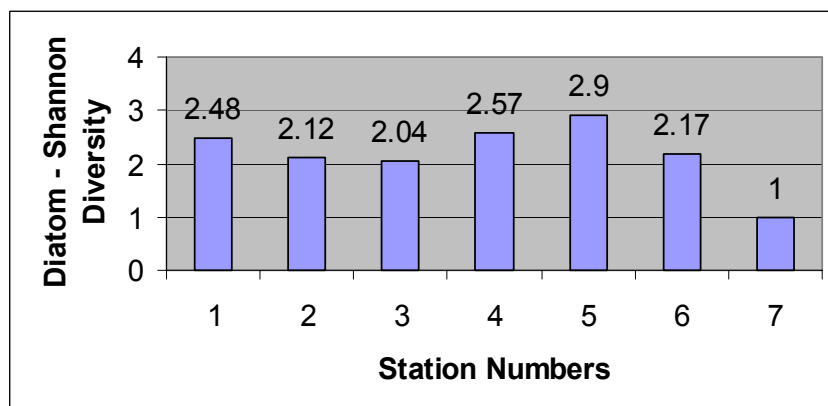


**Figure 16. Relative Abundance of *Achnanthes minutissima***

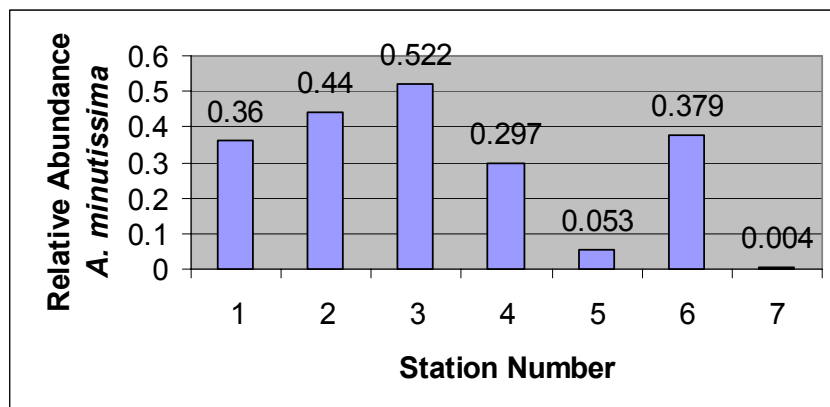


**Figure 17. RA Sensitive Algal Cell Concentration**

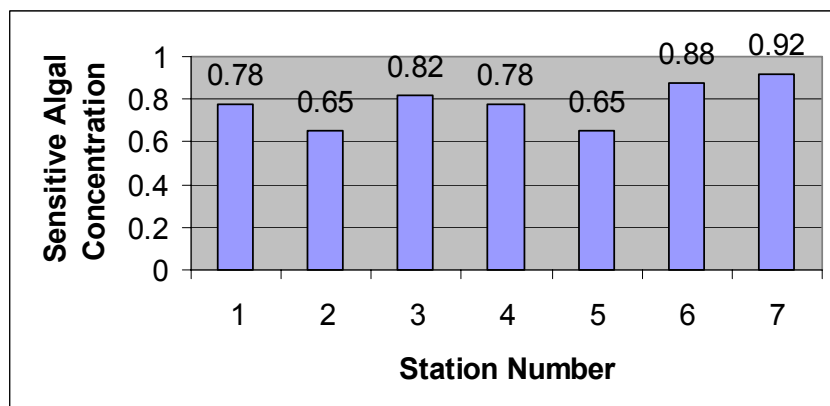
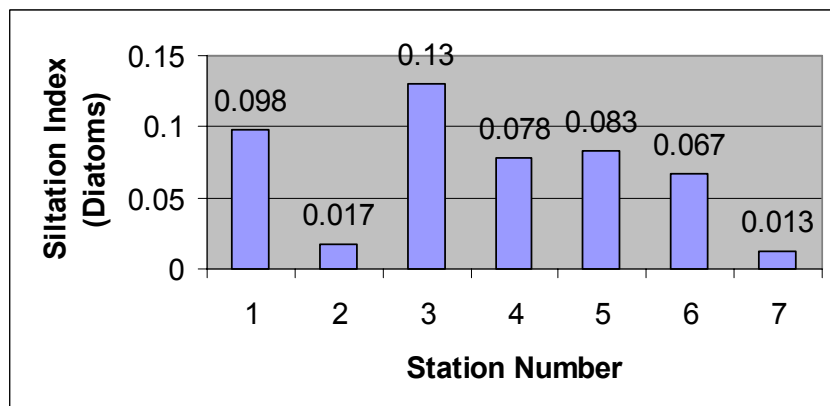


**Figure 18. Algal Siltation Index (Diatoms)**

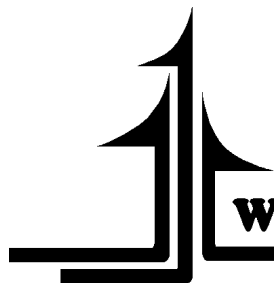


---

## **APPENDIX D**

### **Laboratory Reports**

---

**WHITE WATER ASSOCIATES, INC.****Cover Page**

All analyses performed according to EPA Methods (EPA-600/4-79/020, March 1983 or SW-846, Third Edition). Sample chain-of-custody form(s) attached.

**Client:** MDEQ**WWA Job #:** 20576

**Project:** Kennecott Project 04-02  
**Date Received:** 6-14-2004

**Sample Matrix:** Water  
**Date Reported:** 1-25-2005

| Sample Number | Client Sample ID | Date Sampled |
|---------------|------------------|--------------|
| 20576-001     | Station 2        | 06-14-04     |
| 20576-002     | Station 3        | 06-14-04     |
| 20576-003     | Station 4        | 06-14-04     |
| 20576-004     | Station 5        | 06-14-04     |

**Comments (if any):**

J: The analyte was positively identified, the quantitation is an estimation.

**Key to Laboratory Flags:**

B: The analyte was found in the associated blank as well as in the sample.

J: The analyte was positively identified, the quantitation is an estimation.

M: A matrix effect was present.

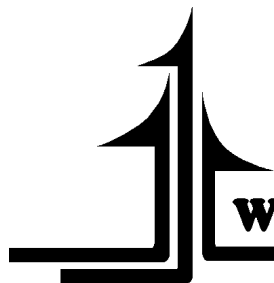
Q: Batch QC data associated with samples does not meet stated objectives.

U: The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.

I certify that the data contained in this Final Report has been generated and reviewed in accordance with approved methods and White Water Associates Standard Operating Procedures. Exceptions, if any, are discussed in the accompanying sample narrative. Release of this Final Report is authorized by White Water Associates management, as is verified by the following signature.

**Approved By:** \_\_\_\_\_

Electronically signed by Bette J. Premo



# WHITE WATER ASSOCIATES, INC.

Client: MDEQ

WWA Job #: 20576

Project: Kennecott Project 04-02

Sample Matrix: Water

Date Received: 6-14-2004

Date Reported: 1-25-2005

## General Chemistry, Demands and Physical Data

| Sample / Client Sample ID | Result | Units | Date      | Method | MDL  | MQL  |
|---------------------------|--------|-------|-----------|--------|------|------|
| 20576-001 / Station 2     |        |       |           |        |      |      |
| Alkalinity                | 24     | mg/L  | 6-25-2004 | 310.1  | 5    | 10   |
| Chloride                  | 0.8 J  | mg/L  | 7-13-2004 | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 6-15-2004 | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 7-2-2004  | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 100    | mg/L  | 6-17-2004 | 160.1  | 20   | 20   |
| Total Suspended Solids    | 2      | mg/L  | 6-15-2004 | 160.2  | 1    | 1    |
| 20576-002 / Station 3     |        |       |           |        |      |      |
| Alkalinity                | 36     | mg/L  | 6-25-2004 | 310.1  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 7-13-2004 | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 6-15-2004 | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 7-2-2004  | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 100    | mg/L  | 6-17-2004 | 160.1  | 20   | 20   |
| Total Suspended Solids    | 6      | mg/L  | 6-15-2004 | 160.2  | 1    | 1    |
| 20576-003 / Station 4     |        |       |           |        |      |      |
| Alkalinity                | 27     | mg/L  | 6-25-2004 | 310.1  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 7-13-2004 | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 6-15-2004 | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 7-2-2004  | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 90     | mg/L  | 6-17-2004 | 160.1  | 20   | 20   |
| Total Suspended Solids    | 9      | mg/L  | 6-15-2004 | 160.2  | 1    | 1    |

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit,  
ppm = mg/l (liquid) or mg/kg (solid), ppb = ug/l (liquid) or ug/kg (solid)



Client: MDEQ

WWA Job #: 20576

Project: Kennecott Project 04-02

Sample Matrix: Water

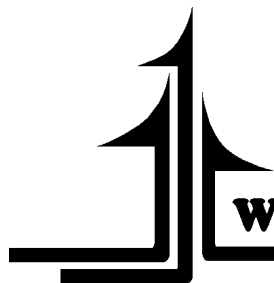
Date Received: 6-14-2004

Date Reported: 1-25-2005

### General Chemistry, Demands and Physical Data

| Sample / Client Sample ID | Result | Units | Date      | Method | MDL  | MQL  |
|---------------------------|--------|-------|-----------|--------|------|------|
| 20576-004 / Station 5     |        |       |           |        |      |      |
| Alkalinity                | 72     | mg/L  | 6-25-2004 | 310.1  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 7-13-2004 | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 6-15-2004 | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 7-2-2004  | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 95     | mg/L  | 6-17-2004 | 160.1  | 20   | 20   |
| Total Suspended Solids    | 2      | mg/L  | 6-15-2004 | 160.2  | 1    | 1    |

J: The analyte was positively identified, the quantitation is an estimation.

**WHITE WATER ASSOCIATES, INC.****Cover Page**

All analyses performed according to EPA Methods (EPA-600/4-79/020, March 1983 or SW-846, Third Edition). Sample chain-of-custody form(s) attached.

**Client:** MDEQ**WWA Job #:** 20685**Project:** Kennecott 04-02**Sample Matrix:** Water**Date Received:** 7-6-2004**Date Reported:** 1-25-2005

| Sample Number | Client Sample ID | Date Sampled |
|---------------|------------------|--------------|
| 20685-001     | Station 1        | 07-06-04     |
| 20685-002     | Station 2        | 07-06-04     |
| 20685-003     | Station 3        | 07-06-04     |
| 20685-004     | Station 4        | 07-06-04     |
| 20685-005     | Station 5        | 07-06-04     |
| 20685-006     | Station 6        | 07-06-04     |
| 20685-007     | Station 6 - Dup  | 07-06-04     |
| 20685-008     | Field Blank      | 07-06-04     |

**Comments (if any):****Key to Laboratory Flags:**

B: The analyte was found in the associated blank as well as in the sample.

J: The analyte was positively identified, the quantitation is an estimation.

M: A matrix effect was present.

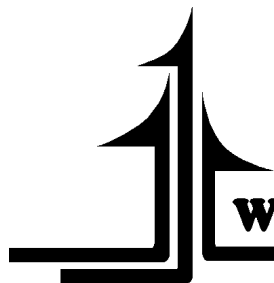
Q: Batch QC data associated with samples does not meet stated objectives.

U: The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.

I certify that the data contained in this Final Report has been generated and reviewed in accordance with approved methods and White Water Associates Standard Operating Procedures. Exceptions, if any, are discussed in the accompanying sample narrative. Release of this Final Report is authorized by White Water Associates management, as is verified by the following signature.

**Approved By:** \_\_\_\_\_

Electronically signed by Bette J. Premo



# WHITE WATER ASSOCIATES, INC.

Client: MDEQ

WWA Job #: 20685

Project: Kennecott 04-02

Sample Matrix: Water

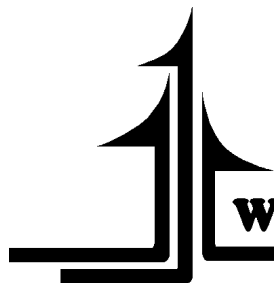
Date Received: 7-6-2004

Date Reported: 1-25-2005

## General Chemistry, Demands and Physical Data

| Sample / Client Sample ID | Result | Units | Date      | Method | MDL  | MQL  |
|---------------------------|--------|-------|-----------|--------|------|------|
| 20685-001 / Station 1     |        |       |           |        |      |      |
| Alkalinity                | 40     | mg/L  | 7-19-2004 | 310.1  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 7-13-2004 | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 7-7-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 7-27-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 115    | mg/L  | 7-9-2004  | 160.1  | 20   | 40   |
| Total Suspended Solids    | 4      | mg/L  | 7-9-2004  | 160.2  | 1    | 2    |
| 20685-002 / Station 2     |        |       |           |        |      |      |
| Alkalinity                | 25     | mg/L  | 7-19-2004 | 310.1  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 7-13-2004 | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 7-7-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 7-27-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 85     | mg/L  | 7-7-2004  | 160.1  | 20   | 40   |
| Total Suspended Solids    | ND     | mg/L  | 7-9-2004  | 160.2  | 1    | 2    |
| 20685-003 / Station 3     |        |       |           |        |      |      |
| Alkalinity                | 34     | mg/L  | 7-19-2004 | 310.1  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 7-13-2004 | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 7-7-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 7-27-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 110    | mg/L  | 7-9-2004  | 160.1  | 20   | 40   |
| Total Suspended Solids    | 6      | mg/L  | 7-9-2004  | 160.2  | 1    | 2    |

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit,  
ppm = mg/l (liquid) or mg/kg (solid), ppb = ug/l (liquid) or ug/kg (solid)



# WHITE WATER ASSOCIATES, INC.

Client: MDEQ

WWA Job #: 20685

Project: Kennecott 04-02

Sample Matrix: Water

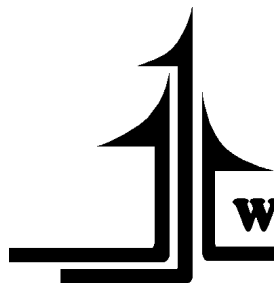
Date Received: 7-6-2004

Date Reported: 1-25-2005

## General Chemistry, Demands and Physical Data

| Sample / Client Sample ID | Result | Units | Date      | Method | MDL  | MQL  |
|---------------------------|--------|-------|-----------|--------|------|------|
| 20685-004 / Station 4     |        |       |           |        |      |      |
| Alkalinity                | 24     | mg/L  | 7-19-2004 | 310.1  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 7-13-2004 | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 7-7-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 7-27-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 85     | mg/L  | 7-9-2004  | 160.1  | 20   | 40   |
| Total Suspended Solids    | 2      | mg/L  | 7-9-2004  | 160.2  | 1    | 2    |
| 20685-005 / Station 5     |        |       |           |        |      |      |
| Alkalinity                | 64     | mg/L  | 7-19-2004 | 310.1  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 7-13-2004 | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 7-7-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 7-27-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 120    | mg/L  | 7-9-2004  | 160.1  | 20   | 40   |
| Total Suspended Solids    | 2      | mg/L  | 7-9-2004  | 160.2  | 1    | 2    |
| 20685-006 / Station 6     |        |       |           |        |      |      |
| Alkalinity                | 38     | mg/L  | 7-19-2004 | 310.1  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 7-13-2004 | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 7-7-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 7-27-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 70     | mg/L  | 7-9-2004  | 160.1  | 20   | 40   |
| Total Suspended Solids    | ND     | mg/L  | 7-9-2004  | 160.2  | 1    | 2    |

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit,  
ppm = mg/l (liquid) or mg/kg (solid), ppb = ug/l (liquid) or ug/kg (solid)



# WHITE WATER ASSOCIATES, INC.

Client: MDEQ

WWA Job #: 20685

Project: Kennecott 04-02

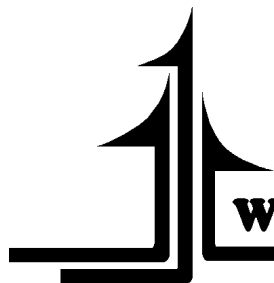
Sample Matrix: Water

Date Received: 7-6-2004

Date Reported: 1-25-2005

## General Chemistry, Demands and Physical Data

| Sample / Client Sample ID   | Result | Units | Date      | Method | MDL  | MQL  |
|-----------------------------|--------|-------|-----------|--------|------|------|
| 20685-007 / Station 6 - Dup |        |       |           |        |      |      |
| Alkalinity                  | 34     | mg/L  | 7-19-2004 | 310.1  | 5    | 10   |
| Chloride                    | ND     | mg/L  | 7-13-2004 | 325.1  | 0.5  | 1.0  |
| o-Phosphorus                | ND     | mg/L  | 7-7-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                     | ND     | mg/L  | 7-27-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids      | 75     | mg/L  | 7-9-2004  | 160.1  | 20   | 40   |
| Total Suspended Solids      | ND     | mg/L  | 7-9-2004  | 160.2  | 1    | 2    |
| 20685-008 / Field Blank     |        |       |           |        |      |      |
| Alkalinity                  | ND     | mg/L  | 7-19-2004 | 310.1  | 5    | 10   |
| Chloride                    | ND     | mg/L  | 7-13-2004 | 325.1  | 0.5  | 1.0  |
| o-Phosphorus                | ND     | mg/L  | 7-7-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                     | ND     | mg/L  | 7-27-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids      | ND     | mg/L  | 7-9-2004  | 160.1  | 20   | 40   |
| Total Suspended Solids      | ND     | mg/L  | 7-9-2004  | 160.2  | 1    | 2    |

**WHITE WATER ASSOCIATES, INC.****Cover Page**

All analyses performed according to EPA Methods (EPA-600/4-79/020, March 1983 or SW-846, Third Edition). Sample chain-of-custody form(s) attached.

**Client:** MDEQ**WWA Job #:** 20806**Project:** Kennecott 04-02**Sample Matrix:** Water**Date Received:** 8-3-2004**Date Reported:** 1-24-2005

| Sample Number | Client Sample ID | Date Sampled |
|---------------|------------------|--------------|
| 20806-001     | Station 2        | 08-03-04     |
| 20806-002     | Station 4        | 08-03-04     |
| 20806-003     | Station 5        | 08-03-04     |
| 20806-004     | Station 7        | 08-03-04     |

**Comments (if any):****Key to Laboratory Flags:**

B: The analyte was found in the associated blank as well as in the sample.

J: The analyte was positively identified, the quantitation is an estimation.

M: A matrix effect was present.

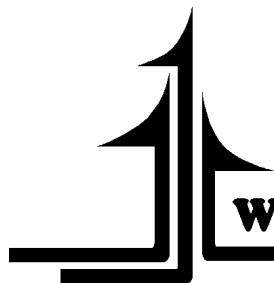
Q: Batch QC data associated with samples does not meet stated objectives.

U: The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.

I certify that the data contained in this Final Report has been generated and reviewed in accordance with approved methods and White Water Associates Standard Operating Procedures. Exceptions, if any, are discussed in the accompanying sample narrative. Release of this Final Report is authorized by White Water Associates management, as is verified by the following signature.

**Approved By:** \_\_\_\_\_

Electronically signed by Bette J. Premo



# WHITE WATER ASSOCIATES, INC.

Client: MDEQ

WWA Job #: 20806

Project: Kennecott 04-02

Sample Matrix: Water

Date Received: 8-3-2004

Date Reported: 1-24-2005

## General Chemistry, Demands and Physical Data

| Sample / Client Sample ID | Result | Units | Date      | Method | MDL  | MQL  |
|---------------------------|--------|-------|-----------|--------|------|------|
| 20806-001 / Station 2     |        |       |           |        |      |      |
| Alkalinity                | 19     | mg/L  | 8-5-2004  | 310.1  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 8-10-2004 | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 8-5-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                   | 4 M,J  | mg/L  | 8-12-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 35     | mg/L  | 8-5-2004  | 160.1  | 20   | 20   |
| Total Suspended Solids    | ND     | mg/L  | 8-4-2004  | 160.2  | 2    | 4    |
| 20806-002 / Station 4     |        |       |           |        |      |      |
| Alkalinity                | 30     | mg/L  | 8-5-2004  | 310.1  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 8-10-2004 | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 8-5-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND M   | mg/L  | 8-12-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 25     | mg/L  | 8-5-2004  | 160.1  | 20   | 20   |
| Total Suspended Solids    | ND     | mg/L  | 8-4-2004  | 160.2  | 1    | 2    |
| 20806-003 / Station 5     |        |       |           |        |      |      |
| Alkalinity                | 68     | mg/L  | 8-5-2004  | 310.1  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 8-10-2004 | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 8-5-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 8-12-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 50     | mg/L  | 8-5-2004  | 160.1  | 20   | 20   |
| Total Suspended Solids    | ND     | mg/L  | 8-4-2004  | 160.2  | 2    | 4    |

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit,  
ppm = mg/l (liquid) or mg/kg (solid), ppb = ug/l (liquid) or ug/kg (solid)



Client: MDEQ

WWA Job #: 20806

Project: Kennecott 04-02

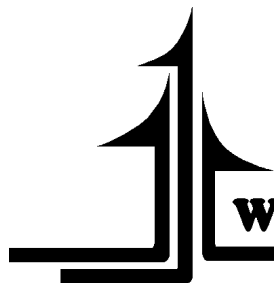
Sample Matrix: Water

Date Received: 8-3-2004

Date Reported: 1-24-2005

**General Chemistry, Demands and Physical Data**

| Sample / Client Sample ID | Result | Units | Date      | Method | MDL  | MQL  |
|---------------------------|--------|-------|-----------|--------|------|------|
| 20806-004 / Station 7     |        |       |           |        |      |      |
| Alkalinity                | 23     | mg/L  | 8-5-2004  | 310.1  | 5    | 10   |
| Chloride                  | 0.7 J  | mg/L  | 8-10-2004 | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 8-5-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                   | 6      | mg/L  | 8-12-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 60     | mg/L  | 8-5-2004  | 160.1  | 20   | 20   |
| Total Suspended Solids    | 4      | mg/L  | 8-4-2004  | 160.2  | 3    | 6    |

**WHITE WATER ASSOCIATES, INC.****Cover Page**

All analyses performed according to EPA Methods (EPA-600/4-79/020, March 1983 or SW-846, Third Edition). Sample chain-of-custody form(s) attached.

**Client:** MDEQ**WWA Job #:** 20811**Project:** Kennecott 04-02**Sample Matrix:** Water**Date Received:** 8-4-2004**Date Reported:** 1-25-2005

| Sample Number | Client Sample ID | Date Sampled |
|---------------|------------------|--------------|
| 20811-001     | Station 1        | 08-04-04     |
| 20811-002     | Station 3        | 08-04-04     |
| 20811-003     | Station 6        | 08-04-04     |
| 20811-004     | Station 6 - Dup  | 08-04-04     |
| 20811-005     | Field Blank      | 08-04-04     |

**Comments (if any):****Key to Laboratory Flags:**

B: The analyte was found in the associated blank as well as in the sample.

J: The analyte was positively identified, the quantitation is an estimation.

M: A matrix effect was present.

Q: Batch QC data associated with samples does not meet stated objectives.

U: The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.

I certify that the data contained in this Final Report has been generated and reviewed in accordance with approved methods and White Water Associates Standard Operating Procedures. Exceptions, if any, are discussed in the accompanying sample narrative. Release of this Final Report is authorized by White Water Associates management, as is verified by the following signature.

**Approved By:** \_\_\_\_\_

Electronically signed by Bette J. Premo



Client: MDEQ

WWA Job #: 20811

Project: Kennecott 04-02

Sample Matrix: Water

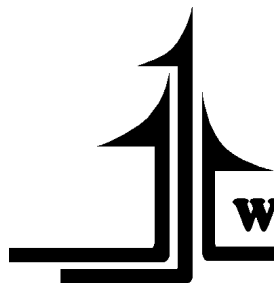
Date Received: 8-4-2004

Date Reported: 1-25-2005

### General Chemistry, Demands and Physical Data

| Sample / Client Sample ID | Result | Units | Date      | Method | MDL   | MQL  |
|---------------------------|--------|-------|-----------|--------|-------|------|
| 20811-001 / Station 1     |        |       |           |        |       |      |
| Alkalinity                | 47     | mg/L  | 8-5-2004  | 310.1  | 5     | 10   |
| Chloride                  | ND     | mg/L  | 8-10-2004 | 325.1  | 0.5   | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 8-5-2004  | 365.1  | 0.005 | 0.02 |
| Sulfate                   | ND     | mg/L  | 8-12-2004 | 375.2  | 3     | 10   |
| Total Dissolved Solids    | 120    | mg/L  | 8-11-2004 | 160.1  | 20    | 20   |
| Total Suspended Solids    | 2      | mg/L  | 8-5-2004  | 160.2  | 1     | 2    |
| 20811-002 / Station 3     |        |       |           |        |       |      |
| Alkalinity                | 42     | mg/L  | 8-5-2004  | 310.1  | 5     | 10   |
| Chloride                  | ND     | mg/L  | 8-10-2004 | 325.1  | 0.5   | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 8-5-2004  | 365.1  | 0.005 | 0.02 |
| Sulfate                   | ND     | mg/L  | 8-12-2004 | 375.2  | 3     | 10   |
| Total Dissolved Solids    | 105    | mg/L  | 8-11-2004 | 160.1  | 20    | 20   |
| Total Suspended Solids    | 2      | mg/L  | 8-5-2004  | 160.2  | 1     | 2    |
| 20811-003 / Station 6     |        |       |           |        |       |      |
| Alkalinity                | 41     | mg/L  | 8-5-2004  | 310.1  | 5     | 10   |
| Chloride                  | ND     | mg/L  | 8-10-2004 | 325.1  | 0.5   | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 8-5-2004  | 365.1  | 0.005 | 0.02 |
| Sulfate                   | ND     | mg/L  | 8-12-2004 | 375.2  | 3     | 10   |
| Total Dissolved Solids    | 130    | mg/L  | 8-11-2004 | 160.1  | 20    | 20   |
| Total Suspended Solids    | ND     | mg/L  | 8-5-2004  | 160.2  | 1     | 2    |

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit,  
ppm = mg/l (liquid) or mg/kg (solid), ppb = ug/l (liquid) or ug/kg (solid)



# WHITE WATER ASSOCIATES, INC.

Client: MDEQ

WWA Job #: 20811

Project: Kennecott 04-02

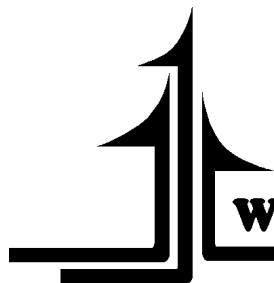
Sample Matrix: Water

Date Received: 8-4-2004

Date Reported: 1-25-2005

## General Chemistry, Demands and Physical Data

| Sample / Client Sample ID   | Result | Units | Date      | Method | MDL   | MQL  |
|-----------------------------|--------|-------|-----------|--------|-------|------|
| 20811-004 / Station 6 - Dup |        |       |           |        |       |      |
| Alkalinity                  | 32     | mg/L  | 8-5-2004  | 310.1  | 5     | 10   |
| Chloride                    | ND     | mg/L  | 8-10-2004 | 325.1  | 0.5   | 1.0  |
| o-Phosphorus                | ND     | mg/L  | 8-5-2004  | 365.1  | 0.005 | 0.02 |
| Sulfate                     | ND     | mg/L  | 8-12-2004 | 375.2  | 3     | 10   |
| Total Dissolved Solids      | 115    | mg/L  | 8-11-2004 | 160.1  | 20    | 20   |
| Total Suspended Solids      | ND     | mg/L  | 8-5-2004  | 160.2  | 1     | 2    |
| 20811-005 / Field Blank     |        |       |           |        |       |      |
| Alkalinity                  | ND     | mg/L  | 8-5-2004  | 310.1  | 5     | 10   |
| Chloride                    | ND     | mg/L  | 8-10-2004 | 325.1  | 0.5   | 1.0  |
| o-Phosphorus                | ND     | mg/L  | 8-5-2004  | 365.1  | 0.005 | 0.02 |
| Sulfate                     | ND     | mg/L  | 8-12-2004 | 375.2  | 3     | 10   |
| Total Dissolved Solids      | 25     | mg/L  | 8-11-2004 | 160.1  | 20    | 20   |
| Total Suspended Solids      | ND     | mg/L  | 8-5-2004  | 160.2  | 1     | 2    |

**WHITE WATER ASSOCIATES, INC.****Cover Page**

All analyses performed according to EPA Methods (EPA-600/4-79/020, March 1983 or SW-846, Third Edition). Sample chain-of-custody form(s) attached.

Client: MDEQ

WWA Job #: 21001

Project: Kennecott Project  
Date Received: 9-14-2004

Sample Matrix: Water  
Date Reported: 1-25-2005

| Sample Number | Client Sample ID | Date Sampled |
|---------------|------------------|--------------|
| 21001-001     | Station 1        | 09-14-04     |
| 21001-002     | Station 2        | 09-14-04     |
| 21001-003     | Station 3        | 09-14-04     |
| 21001-004     | Station 4        | 09-14-04     |
| 21001-005     | Station 5        | 09-14-04     |
| 21001-006     | Station 6        | 09-14-04     |
| 21001-007     | Station 6-Dup    | 09-14-04     |
| 21001-008     | Station 7        | 09-14-04     |
| 21001-009     | Field Blank      | 09-14-04     |

Comments (if any):

**Key to Laboratory Flags:**

B: The analyte was found in the associated blank as well as in the sample.

J: The analyte was positively identified, the quantitation is an estimation.

M: A matrix effect was present.

Q: Batch QC data associated with samples does not meet stated objectives.

U: The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.

I certify that the data contained in this Final Report has been generated and reviewed in accordance with approved methods and White Water Associates Standard Operating Procedures. Exceptions, if any, are discussed in the accompanying sample narrative. Release of this Final Report is authorized by White Water Associates management, as is verified by the following signature.

Approved By: \_\_\_\_\_

Electronically signed by Bette J. Premo



Client: MDEQ

WWA Job #: 20811

Project: Kennecott 04-02

Sample Matrix: Water

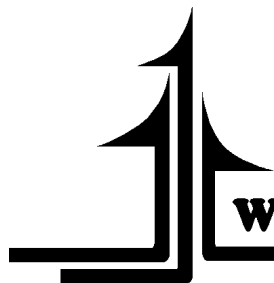
Date Received: 8-4-2004

Date Reported: 1-25-2005

### General Chemistry, Demands and Physical Data

| Sample / Client Sample ID | Result | Units | Date      | Method | MDL   | MQL  |
|---------------------------|--------|-------|-----------|--------|-------|------|
| 20811-001 / Station 1     |        |       |           |        |       |      |
| Alkalinity                | 47     | mg/L  | 8-5-2004  | 310.1  | 5     | 10   |
| Chloride                  | ND     | mg/L  | 8-10-2004 | 325.1  | 0.5   | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 8-5-2004  | 365.1  | 0.005 | 0.02 |
| Sulfate                   | ND     | mg/L  | 8-12-2004 | 375.2  | 3     | 10   |
| Total Dissolved Solids    | 120    | mg/L  | 8-11-2004 | 160.1  | 20    | 20   |
| Total Suspended Solids    | 2      | mg/L  | 8-5-2004  | 160.2  | 1     | 2    |
| 20811-002 / Station 3     |        |       |           |        |       |      |
| Alkalinity                | 42     | mg/L  | 8-5-2004  | 310.1  | 5     | 10   |
| Chloride                  | ND     | mg/L  | 8-10-2004 | 325.1  | 0.5   | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 8-5-2004  | 365.1  | 0.005 | 0.02 |
| Sulfate                   | ND     | mg/L  | 8-12-2004 | 375.2  | 3     | 10   |
| Total Dissolved Solids    | 105    | mg/L  | 8-11-2004 | 160.1  | 20    | 20   |
| Total Suspended Solids    | 2      | mg/L  | 8-5-2004  | 160.2  | 1     | 2    |
| 20811-003 / Station 6     |        |       |           |        |       |      |
| Alkalinity                | 41     | mg/L  | 8-5-2004  | 310.1  | 5     | 10   |
| Chloride                  | ND     | mg/L  | 8-10-2004 | 325.1  | 0.5   | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 8-5-2004  | 365.1  | 0.005 | 0.02 |
| Sulfate                   | ND     | mg/L  | 8-12-2004 | 375.2  | 3     | 10   |
| Total Dissolved Solids    | 130    | mg/L  | 8-11-2004 | 160.1  | 20    | 20   |
| Total Suspended Solids    | ND     | mg/L  | 8-5-2004  | 160.2  | 1     | 2    |

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit,  
ppm = mg/l (liquid) or mg/kg (solid), ppb = ug/l (liquid) or ug/kg (solid)



# WHITE WATER ASSOCIATES, INC.

Client: MDEQ

WWA Job #: 20811

Project: Kennecott 04-02

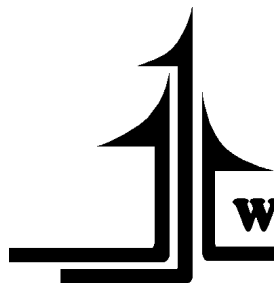
Sample Matrix: Water

Date Received: 8-4-2004

Date Reported: 1-25-2005

## General Chemistry, Demands and Physical Data

| Sample / Client Sample ID   | Result | Units | Date      | Method | MDL   | MQL  |
|-----------------------------|--------|-------|-----------|--------|-------|------|
| 20811-004 / Station 6 - Dup |        |       |           |        |       |      |
| Alkalinity                  | 32     | mg/L  | 8-5-2004  | 310.1  | 5     | 10   |
| Chloride                    | ND     | mg/L  | 8-10-2004 | 325.1  | 0.5   | 1.0  |
| o-Phosphorus                | ND     | mg/L  | 8-5-2004  | 365.1  | 0.005 | 0.02 |
| Sulfate                     | ND     | mg/L  | 8-12-2004 | 375.2  | 3     | 10   |
| Total Dissolved Solids      | 115    | mg/L  | 8-11-2004 | 160.1  | 20    | 20   |
| Total Suspended Solids      | ND     | mg/L  | 8-5-2004  | 160.2  | 1     | 2    |
| 20811-005 / Field Blank     |        |       |           |        |       |      |
| Alkalinity                  | ND     | mg/L  | 8-5-2004  | 310.1  | 5     | 10   |
| Chloride                    | ND     | mg/L  | 8-10-2004 | 325.1  | 0.5   | 1.0  |
| o-Phosphorus                | ND     | mg/L  | 8-5-2004  | 365.1  | 0.005 | 0.02 |
| Sulfate                     | ND     | mg/L  | 8-12-2004 | 375.2  | 3     | 10   |
| Total Dissolved Solids      | 25     | mg/L  | 8-11-2004 | 160.1  | 20    | 20   |
| Total Suspended Solids      | ND     | mg/L  | 8-5-2004  | 160.2  | 1     | 2    |



# WHITE WATER ASSOCIATES, INC.

## Cover Page

All analyses performed according to EPA Methods (EPA-600/4-79/020, March 1983 or SW-846, Third Edition). Sample chain-of-custody form(s) attached.

Client: MDEQ

WWA Job #: 21098

Project: Kennicott Project 04-02  
Date Received: 10-5-2004

Sample Matrix: Water  
Date Reported: 1-25-2005

| Sample Number | Client Sample ID | Date Sampled |
|---------------|------------------|--------------|
| 21098-001     | Station 1        | 10-05-04     |
| 21098-002     | Station 2        | 10-05-04     |
| 21098-003     | Station 3        | 10-05-04     |
| 21098-004     | Station 4        | 10-05-04     |
| 21098-005     | Station 5        | 10-05-04     |
| 21098-006     | Station 6        | 10-05-04     |
| 21098-007     | Station 6 Dup    | 10-05-04     |
| 21098-008     | Station 7        | 10-05-04     |
| 21098-009     | Field Blank      | 10-05-04     |

Comments (if any):

### Key to Laboratory Flags:

B: The analyte was found in the associated blank as well as in the sample.

J: The analyte was positively identified, the quantitation is an estimation.

M: A matrix effect was present.

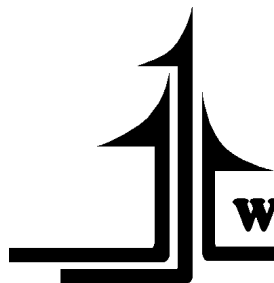
Q: Batch QC data associated with samples does not meet stated objectives.

U: The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.

I certify that the data contained in this Final Report has been generated and reviewed in accordance with approved methods and White Water Associates Standard Operating Procedures. Exceptions, if any, are discussed in the accompanying sample narrative. Release of this Final Report is authorized by White Water Associates management, as is verified by the following signature.

Approved By: \_\_\_\_\_

Electronically signed by Bette J. Premo



# WHITE WATER ASSOCIATES, INC.

Client: MDEQ

WWA Job #: 21098

Project: Kennicott Project 04-02

Sample Matrix: Water

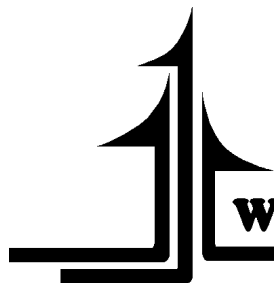
Date Received: 10-5-2004

Date Reported: 1-25-2005

## General Chemistry, Demands and Physical Data

| Sample / Client Sample ID | Result | Units | Date       | Method | MDL  | MQL  |
|---------------------------|--------|-------|------------|--------|------|------|
| 21098-001 / Station 1     |        |       |            |        |      |      |
| Alkalinity                | 49     | mg/L  | 10-11-2004 | 2320B  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 10-12-2004 | 325.1  | 0.5  | 2.0  |
| o-Phosphorus              | ND     | mg/L  | 10-6-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 10-22-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 70     | mg/L  | 10-12-2004 | 2540C  | 20   | 20   |
| Total Suspended Solids    | 3      | mg/L  | 10-8-2004  | 160.2  | 1    | 1    |
| 21098-002 / Station 2     |        |       |            |        |      |      |
| Alkalinity                | 33     | mg/L  | 10-11-2004 | 2320B  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 10-12-2004 | 325.1  | 0.5  | 2.0  |
| o-Phosphorus              | ND     | mg/L  | 10-6-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 10-22-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 54     | mg/L  | 10-12-2004 | 2540C  | 20   | 20   |
| Total Suspended Solids    | ND     | mg/L  | 10-8-2004  | 160.2  | 1    | 1    |
| 21098-003 / Station 3     |        |       |            |        |      |      |
| Alkalinity                | 36     | mg/L  | 10-11-2004 | 2320B  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 10-12-2004 | 325.1  | 0.5  | 2.0  |
| o-Phosphorus              | ND     | mg/L  | 10-6-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 10-22-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 47     | mg/L  | 10-12-2004 | 2540C  | 20   | 20   |
| Total Suspended Solids    | 2      | mg/L  | 10-8-2004  | 160.2  | 1    | 1    |

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit,  
ppm = mg/l (liquid) or mg/kg (solid), ppb = ug/l (liquid) or ug/kg (solid)



# WHITE WATER ASSOCIATES, INC.

Client: MDEQ

WWA Job #: 21098

Project: Kennicott Project 04-02

Sample Matrix: Water

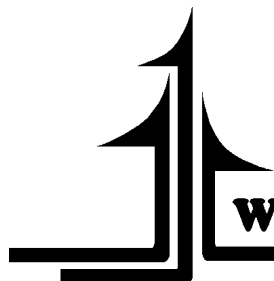
Date Received: 10-5-2004

Date Reported: 1-25-2005

## General Chemistry, Demands and Physical Data

| Sample / Client Sample ID | Result | Units | Date       | Method | MDL  | MQL  |
|---------------------------|--------|-------|------------|--------|------|------|
| 21098-004 / Station 4     |        |       |            |        |      |      |
| Alkalinity                | 26     | mg/L  | 10-11-2004 | 2320B  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 10-12-2004 | 325.1  | 0.5  | 2.0  |
| o-Phosphorus              | ND     | mg/L  | 10-6-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 10-22-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 43     | mg/L  | 10-12-2004 | 2540C  | 20   | 20   |
| Total Suspended Solids    | 4      | mg/L  | 10-8-2004  | 160.2  | 1    | 1    |
| 21098-005 / Station 5     |        |       |            |        |      |      |
| Alkalinity                | 64     | mg/L  | 10-11-2004 | 2320B  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 10-12-2004 | 325.1  | 0.5  | 2.0  |
| o-Phosphorus              | ND     | mg/L  | 10-6-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 10-22-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 78     | mg/L  | 10-12-2004 | 2540C  | 20   | 20   |
| Total Suspended Solids    | 2      | mg/L  | 10-8-2004  | 160.2  | 1    | 1    |
| 21098-006 / Station 6     |        |       |            |        |      |      |
| Alkalinity                | 41     | mg/L  | 10-11-2004 | 2320B  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 10-12-2004 | 325.1  | 0.5  | 2.0  |
| o-Phosphorus              | ND     | mg/L  | 10-6-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 10-22-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 57     | mg/L  | 10-12-2004 | 2540C  | 20   | 20   |
| Total Suspended Solids    | 7      | mg/L  | 10-8-2004  | 160.2  | 1    | 1    |

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit,  
ppm = mg/l (liquid) or mg/kg (solid), ppb = ug/l (liquid) or ug/kg (solid)



# WHITE WATER ASSOCIATES, INC.

Client: MDEQ

WWA Job #: 21098

Project: Kennicott Project 04-02

Sample Matrix: Water

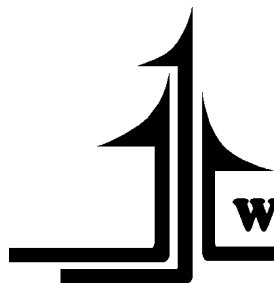
Date Received: 10-5-2004

Date Reported: 1-25-2005

## General Chemistry, Demands and Physical Data

| Sample / Client Sample ID | Result | Units | Date       | Method | MDL  | MQL  |
|---------------------------|--------|-------|------------|--------|------|------|
| 21098-007 / Station 6 Dup |        |       |            |        |      |      |
| Alkalinity                | 42     | mg/L  | 10-11-2004 | 2320B  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 10-12-2004 | 325.1  | 0.5  | 2.0  |
| o-Phosphorus              | ND     | mg/L  | 10-6-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 10-22-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 61     | mg/L  | 10-12-2004 | 2540C  | 20   | 20   |
| Total Suspended Solids    | 5      | mg/L  | 10-8-2004  | 160.2  | 1    | 1    |
| 21098-008 / Station 7     |        |       |            |        |      |      |
| Alkalinity                | 18     | mg/L  | 10-11-2004 | 2320B  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 10-12-2004 | 325.1  | 0.5  | 2.0  |
| o-Phosphorus              | ND     | mg/L  | 10-6-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 10-22-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 27     | mg/L  | 10-12-2004 | 2540C  | 20   | 20   |
| Total Suspended Solids    | ND     | mg/L  | 10-8-2004  | 160.2  | 1    | 1    |
| 21098-009 / Field Blank   |        |       |            |        |      |      |
| Alkalinity                | ND     | mg/L  | 10-11-2004 | 2320B  | 5    | 10   |
| Chloride                  | ND     | mg/L  | 10-12-2004 | 325.1  | 0.5  | 2.0  |
| o-Phosphorus              | ND     | mg/L  | 10-6-2004  | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 10-22-2004 | 375.2  | 3    | 10   |
| Total Dissolved Solids    | ND     | mg/L  | 10-12-2004 | 2540C  | 20   | 20   |
| Total Suspended Solids    | ND     | mg/L  | 10-8-2004  | 160.2  | 1    | 1    |

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit,  
ppm = mg/l (liquid) or mg/kg (solid), ppb = ug/l (liquid) or ug/kg (solid)



# WHITE WATER ASSOCIATES, INC.

## Cover Page

All analyses performed according to EPA Methods (EPA-600/4-79/020, March 1983 or SW-846, Third Edition). Sample chain-of-custody form(s) attached.

Client: MDEQ

WWA Job #: 21265

Project: Kennecott Project  
Date Received: 11-9-2004

Sample Matrix: Water  
Date Reported: 1-25-2005

| Sample Number | Client Sample ID | Date Sampled |
|---------------|------------------|--------------|
| 21265-001     | Station 1        | 11-09-04     |
| 21265-002     | Station 2        | 11-09-04     |
| 21265-003     | Station 3        | 11-09-04     |
| 21265-004     | Station 4        | 11-09-04     |
| 21265-005     | Station 5        | 11-09-04     |
| 21265-006     | Station 6        | 11-09-04     |
| 21265-007     | Station 6 Dup    | 11-09-04     |
| 21265-008     | Station 7        | 11-09-04     |
| 21265-009     | Field Blank      | 11-09-04     |

Comments (if any):

### Key to Laboratory Flags:

B: The analyte was found in the associated blank as well as in the sample.

J: The analyte was positively identified, the quantitation is an estimation.

M: A matrix effect was present.

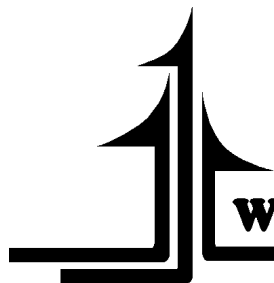
Q: Batch QC data associated with samples does not meet stated objectives.

U: The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.

I certify that the data contained in this Final Report has been generated and reviewed in accordance with approved methods and White Water Associates Standard Operating Procedures. Exceptions, if any, are discussed in the accompanying sample narrative. Release of this Final Report is authorized by White Water Associates management, as is verified by the following signature.

Approved By: \_\_\_\_\_

Electronically signed by Bette J. Premo



# WHITE WATER ASSOCIATES, INC.

Client: MDEQ

WWA Job #: 21265

Project: Kennecott Project

Sample Matrix: Water

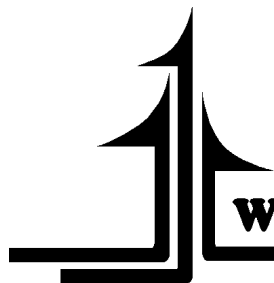
Date Received: 11-9-2004

Date Reported: 1-25-2005

## General Chemistry, Demands and Physical Data

| Sample / Client Sample ID | Result | Units | Date       | Method | MDL  | MQL  |
|---------------------------|--------|-------|------------|--------|------|------|
| 21265-001 / Station 1     |        |       |            |        |      |      |
| Alkalinity                | 38     | mg/L  | 11-19-2004 | 2320B  | 5    | 5    |
| Chloride                  | ND     | mg/L  | 12-7-2004  | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 11-10-2004 | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 12-1-2004  | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 69     | mg/L  | 11-16-2004 | 2540C  | 10   | 20   |
| Total Suspended Solids    | 1      | mg/L  | 11-15-2004 | 160.2  | 1    | 1    |
| 21265-002 / Station 2     |        |       |            |        |      |      |
| Alkalinity                | 22     | mg/L  | 11-19-2004 | 2320B  | 5    | 5    |
| Chloride                  | 0.7 J  | mg/L  | 12-7-2004  | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 11-10-2004 | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 12-1-2004  | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 57     | mg/L  | 11-16-2004 | 2540C  | 10   | 20   |
| Total Suspended Solids    | 1      | mg/L  | 11-15-2004 | 160.2  | 1    | 1    |
| 21265-003 / Station 3     |        |       |            |        |      |      |
| Alkalinity                | 35     | mg/L  | 11-19-2004 | 2320B  | 5    | 5    |
| Chloride                  | ND     | mg/L  | 12-7-2004  | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 11-10-2004 | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 12-1-2004  | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 56     | mg/L  | 11-16-2004 | 2540C  | 10   | 20   |
| Total Suspended Solids    | 2      | mg/L  | 11-15-2004 | 160.2  | 1    | 1    |

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit,  
ppm = mg/l (liquid) or mg/kg (solid), ppb = ug/l (liquid) or ug/kg (solid)



# WHITE WATER ASSOCIATES, INC.

Client: MDEQ

WWA Job #: 21265

Project: Kennecott Project

Sample Matrix: Water

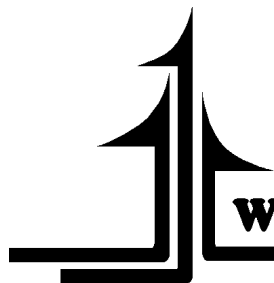
Date Received: 11-9-2004

Date Reported: 1-25-2005

## General Chemistry, Demands and Physical Data

| Sample / Client Sample ID | Result | Units | Date       | Method | MDL  | MQL  |
|---------------------------|--------|-------|------------|--------|------|------|
| 21265-004 / Station 4     |        |       |            |        |      |      |
| Alkalinity                | 24     | mg/L  | 11-19-2004 | 2320B  | 5    | 5    |
| Chloride                  | 0.6 J  | mg/L  | 12-7-2004  | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 11-10-2004 | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 12-1-2004  | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 44     | mg/L  | 11-16-2004 | 2540C  | 10   | 20   |
| Total Suspended Solids    | 2      | mg/L  | 11-15-2004 | 160.2  | 1    | 1    |
| 21265-005 / Station 5     |        |       |            |        |      |      |
| Alkalinity                | 52     | mg/L  | 11-19-2004 | 2320B  | 5    | 5    |
| Chloride                  | 0.5 J  | mg/L  | 12-7-2004  | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 11-10-2004 | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 12-1-2004  | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 89     | mg/L  | 11-16-2004 | 2540C  | 10   | 20   |
| Total Suspended Solids    | 2      | mg/L  | 11-15-2004 | 160.2  | 1    | 1    |
| 21265-006 / Station 6     |        |       |            |        |      |      |
| Alkalinity                | 38     | mg/L  | 11-19-2004 | 2320B  | 5    | 5    |
| Chloride                  | ND     | mg/L  | 12-7-2004  | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 11-10-2004 | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 12-1-2004  | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 61     | mg/L  | 11-16-2004 | 2540C  | 10   | 20   |
| Total Suspended Solids    | ND     | mg/L  | 11-15-2004 | 160.2  | 1    | 1    |

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit,  
ppm = mg/l (liquid) or mg/kg (solid), ppb = ug/l (liquid) or ug/kg (solid)



# WHITE WATER ASSOCIATES, INC.

Client: MDEQ

WWA Job #: 21265

Project: Kennecott Project

Sample Matrix: Water

Date Received: 11-9-2004

Date Reported: 1-25-2005

## General Chemistry, Demands and Physical Data

| Sample / Client Sample ID | Result | Units | Date       | Method | MDL  | MQL  |
|---------------------------|--------|-------|------------|--------|------|------|
| 21265-007 / Station 6 Dup |        |       |            |        |      |      |
| Alkalinity                | 40     | mg/L  | 11-19-2004 | 2320B  | 5    | 5    |
| Chloride                  | ND     | mg/L  | 12-7-2004  | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 11-10-2004 | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 12-1-2004  | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 60     | mg/L  | 11-16-2004 | 2540C  | 10   | 20   |
| Total Suspended Solids    | ND     | mg/L  | 11-15-2004 | 160.2  | 1    | 1    |
| 21265-008 / Station 7     |        |       |            |        |      |      |
| Alkalinity                | 14     | mg/L  | 11-19-2004 | 2320B  | 5    | 5    |
| Chloride                  | ND     | mg/L  | 12-7-2004  | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 11-10-2004 | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 12-1-2004  | 375.2  | 3    | 10   |
| Total Dissolved Solids    | 29     | mg/L  | 11-16-2004 | 2540C  | 10   | 20   |
| Total Suspended Solids    | ND     | mg/L  | 11-15-2004 | 160.2  | 1    | 1    |
| 21265-009 / Field Blank   |        |       |            |        |      |      |
| Alkalinity                | ND     | mg/L  | 11-19-2004 | 2320B  | 5    | 5    |
| Chloride                  | ND     | mg/L  | 12-7-2004  | 325.1  | 0.5  | 1.0  |
| o-Phosphorus              | ND     | mg/L  | 11-10-2004 | 365.1  | 0.01 | 0.02 |
| Sulfate                   | ND     | mg/L  | 12-1-2004  | 375.2  | 3    | 10   |
| Total Dissolved Solids    | ND     | mg/L  | 11-16-2004 | 2540C  | 10   | 20   |
| Total Suspended Solids    | ND     | mg/L  | 11-15-2004 | 160.2  | 1    | 1    |

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit,  
ppm = mg/l (liquid) or mg/kg (solid), ppb = ug/l (liquid) or ug/kg (solid)



August 20, 2004

MDEQ - Water Division  
Attn: Mr. William Taft  
525 West Allegan Street  
P.O. Box 30630  
Lansing, MI 48909-8130

RE: Kennecott Project Yellow Dog  
Submittal Number: 36675-1  
PO: 37506,41016

Dear Mr. William Taft:

Enclosed is a copy of your laboratory report for test samples received by our laboratory on August 10, 2004.

Please note that the test results of the enclosed analyses relate only to the sample(s) as received at the laboratory, and are in compliance with the requirements of the National Environmental Laboratory Accreditation Conference (NELAC) standards. Qualification of test standards, including sample acceptance requirements, are presented within the Statement of Data Qualifications.

Estimates of analytical uncertainties for the test results contained within this report are available upon request.

If you have any questions or require further information, please do not hesitate to contact me.

Sincerely,

Nancy Biermacher-King  
Project Chemist

Enclosure(s)

cc: dbpremo@up.net

The total number of pages in this report, including this page, is 18.

**STATEMENT OF DATA QUALIFICATIONS**

All analyses have been validated and comply with our Quality Control Program. No qualifications required.

Page 1 - End of Statement of Data Qualifications

**Note:** This document is included as a part of the analytical report for the above referenced project and submittal, and should be retained as a permanent record thereof.

## CASE NARRATIVE

Analysis: Sulfide  
Titrimetric Procedure for Sulfides  
SOIL USEPA-9034

## Narrative:

The reporting limit for this sample and corresponding analysis is elevated due to the percent solids content of this sample.

|                     |        |           |     |
|---------------------|--------|-----------|-----|
| Sample(s) Narrated: | 367389 | Station 2 |     |
|                     | 367390 | Station 4 |     |
|                     | 367391 | Station 5 |     |
|                     | 367392 | Station 7 |     |
|                     | 367393 | Station 1 |     |
|                     | 367394 | Station 3 |     |
|                     | 367395 | Station 6 |     |
|                     | 367396 | Station 6 | Dup |

## Narrative:

Matrix quality control analysis unavailable due to insufficient sample volume received.

|                     |        |           |     |
|---------------------|--------|-----------|-----|
| Sample(s) Narrated: | 367389 | Station 2 |     |
|                     | 367390 | Station 4 |     |
|                     | 367391 | Station 5 |     |
|                     | 367392 | Station 7 |     |
|                     | 367393 | Station 1 |     |
|                     | 367394 | Station 3 |     |
|                     | 367395 | Station 6 |     |
|                     | 367396 | Station 6 | Dup |

## ANALYTICAL REPORT

Client: MDEQ - Water Division  
 Project: Kennecott Project  
 Yellow Dog

Sampled: 08/03/04 @ 09:00  
 Sampler: K.D./D.P.  
 Received: 08/09/04 @ 18:15

Submittal #: 36675-1  
 Submittal: August 3 & 4, 2004 Samples

Sample ID: Station 2  
 Sample #: 367389  
 Matrix: Soil/Solid

Percent Solids: 51

| Parameter      | Analytical<br>Result | Reporting<br>Limit | MDL | Unit      | Analysis<br>Date | Chem | Reference<br>Citation |
|----------------|----------------------|--------------------|-----|-----------|------------------|------|-----------------------|
| Sulfide        | ND U                 | 20                 |     | mg/kg dry | 08/10/04         | HLB  | USEPA-9034            |
| Percent Solids | 51                   | 0.1                | 0.1 | %         | 08/11/04         | TAM  | SW-846 3550B          |

## ANALYTICAL REPORT

Client: MDEQ - Water Division  
Project: Kennecott Project  
Yellow Dog

Sampled: 08/03/04 @ 11:00  
Sampler: K.D./D.P.  
Received: 08/09/04 @ 18:15

Submittal #: 36675-1  
Submittal: August 3 & 4, 2004 Samples

Sample ID: Station 4  
Sample #: 367390  
Matrix: Soil/Solid

Percent Solids: 29

| Parameter      | Analytical<br>Result | Reporting<br>Limit | MDL | Unit      | Analysis<br>Date | Chem | Reference<br>Citation |
|----------------|----------------------|--------------------|-----|-----------|------------------|------|-----------------------|
| Sulfide        | ND U                 | 35                 |     | mg/kg dry | 08/10/04         | HLB  | USEPA-9034            |
| Percent Solids | 29                   | 0.1                |     | %         | 08/11/04         | TAM  | SW-846 3550B          |

## ANALYTICAL REPORT

Client: MDEQ - Water Division  
 Project: Kennecott Project  
 Yellow Dog

Sampled: 08/03/04 @ 16:30  
 Sampler: K.D./D.P.  
 Received: 08/09/04 @ 18:15

Submittal #: 36675-1  
 Submittal: August 3 & 4, 2004 Samples

Sample ID: Station 5  
 Sample #: 367391  
 Matrix: Soil/Solid

Percent Solids: 29

| Parameter      | Analytical<br>Result | Reporting<br>Limit | MDL | Unit      | Analysis<br>Date | Chem | Reference<br>Citation |
|----------------|----------------------|--------------------|-----|-----------|------------------|------|-----------------------|
| Sulfide        | ND U                 | 35                 |     | mg/kg dry | 08/10/04         | HLB  | USEPA-9034            |
| Percent Solids | 29                   | 0.1                |     | %         | 08/11/04         | TAM  | SW-846 3550B          |

# ANALYTICAL REPORT

Client: MDEQ - Water Division  
 Project: Kennecott Project  
 Yellow Dog

Sampled: 08/03/04 @ 14:30  
 Sampler: K.D./D.P.  
 Received: 08/09/04 @ 18:15

Submittal #: 36675-1  
 Submittal: August 3 & 4, 2004 Samples

Sample ID: Station 7  
 Sample #: 367392  
 Matrix: Soil/Solid

Percent Solids: 8

| Parameter      | Analytical<br>Result | Reporting<br>Limit | MDL | Unit      | Analysis<br>Date | Chem | Reference<br>Citation |
|----------------|----------------------|--------------------|-----|-----------|------------------|------|-----------------------|
| Sulfide        | ND U                 | 129                |     | mg/kg dry | 08/10/04         | HLB  | USEPA-9034            |
| Percent Solids | 7.8                  | 0.1                |     | %         | 08/11/04         | TAM  | SW-846 3550B          |

## ANALYTICAL REPORT

Client: MDEQ - Water Division  
 Project: Kennecott Project  
 Yellow Dog

Sampled: 08/04/04 @ 10:30  
 Sampler: K.D./D.P.  
 Received: 08/09/04 @ 18:15

Submittal #: 36675-1  
 Submittal: August 3 & 4, 2004 Samples

Sample ID: Station 1  
 Sample #: 367393  
 Matrix: Soil/Solid

Percent Solids: 35

| Parameter      | Analytical<br>Result | Reporting<br>Limit | MDL | Unit      | Analysis<br>Date | Chem | Reference<br>Citation |
|----------------|----------------------|--------------------|-----|-----------|------------------|------|-----------------------|
| Sulfide        | ND U                 | 29                 |     | mg/kg dry | 08/10/04         | HLB  | USEPA-9034            |
| Percent Solids | 35                   | 0.1                |     | %         | 08/11/04         | TAM  | SW-846 3550B          |

## ANALYTICAL REPORT

Client: MDEQ - Water Division  
Project: Kennecott Project  
Yellow Dog

Sampled: 08/04/04 @ 11:50  
Sampler: K.D./D.P.  
Received: 08/09/04 @ 18:15

Submittal #: 36675-1  
Submittal: August 3 & 4, 2004 Samples

Sample ID: Station 3  
Sample #: 367394  
Matrix: Soil/Solid

Percent Solids: 46

| Parameter      | Analytical<br>Result | Reporting<br>Limit | MDL | Unit      | Analysis<br>Date | Chem | Reference<br>Citation |
|----------------|----------------------|--------------------|-----|-----------|------------------|------|-----------------------|
| Sulfide        | ND U                 | 22                 |     | mg/kg dry | 08/10/04         | HLB  | USEPA-9034            |
| Percent Solids | 46                   | 0.1                |     | %         | 08/11/04         | TAM  | SW-846 3550B          |

# ANALYTICAL REPORT

Client: MDEQ - Water Division  
 Project: Kennecott Project  
 Yellow Dog

Sampled: 08/04/04 @ 09:00  
 Sampler: K.D./D.P.  
 Received: 08/09/04 @ 18:15

Submittal #: 36675-1  
 Submittal: August 3 & 4, 2004 Samples

Sample ID: Station 6  
 Sample #: 367395  
 Matrix: Soil/Solid

Percent Solids: 58

| Parameter      | Analytical<br>Result | Reporting<br>Limit | MDL | Unit      | Analysis<br>Date | Chem | Reference<br>Citation |
|----------------|----------------------|--------------------|-----|-----------|------------------|------|-----------------------|
| Sulfide        | ND U                 | 18                 |     | mg/kg dry | 08/10/04         | HLB  | USEPA-9034            |
| Percent Solids | 58                   | 0.1                |     | %         | 08/11/04         | TAM  | SW-846 3550B          |

# ANALYTICAL REPORT

Client: MDEQ - Water Division  
 Project: Kennecott Project  
 Yellow Dog

Sampled: 08/04/04 @ 09:00  
 Sampler: K.D./D.P.  
 Received: 08/09/04 @ 18:15

Submittal #: 36675-1  
 Submittal: August 3 & 4, 2004 Samples

Sample ID: Station 6 Dup  
 Sample #: 367396  
 Matrix: Soil/Solid

Percent Solids: 47

| Parameter      | Analytical<br>Result | Reporting<br>Limit | MDL | Unit      | Analysis<br>Date | Chem | Reference<br>Citation |
|----------------|----------------------|--------------------|-----|-----------|------------------|------|-----------------------|
| Sulfide        | ND U                 | 22                 |     | mg/kg dry | 08/10/04         | HLB  | USEPA-9034            |
| Percent Solids | 47                   | 0.1                |     | %         | 08/11/04         | TAM  | SW-846 3550B          |

## QUALITY CONTROL REPORT

Parameter: Percent Solids  
Method: Determination of Percent Dry Weight SW-846 3550B SOIL  
Units: %

## Instrument Blank

| Test<br>Date | Analytical<br>Batch Number | Analyst | Blank<br>Conc |
|--------------|----------------------------|---------|---------------|
| 08/11/04     | 220219                     | TAM     | <0.1          |

## Duplicate Percent Difference

| Sample<br>Number | Test<br>Date | QC<br>Batch # | Analyst | Sample<br>Conc | Duplicate<br>Conc | RPD | QC<br>Limits |
|------------------|--------------|---------------|---------|----------------|-------------------|-----|--------------|
| 367394           | 08/11/04     | 98259         | TAM     | 46             | 48                | 4   | 0- 20        |

## QUALITY CONTROL REPORT

Parameter: **Sulfide**  
Method: Titrimetric Procedure for Sulfides USEPA-9034 SOIL  
Units: mg/kg dry

## Method Preparation Blank

| Test<br>Date | QC<br>Batch # | Analyst | Blank<br>Conc |
|--------------|---------------|---------|---------------|
| 08/10/04     | 98261         | HLB     | <10           |

## Laboratory Fortified Blank

| Test<br>Date | QC<br>Batch # | Analyst | Spike<br>Qty | Spike<br>Result | Recovery | QC<br>Limits |
|--------------|---------------|---------|--------------|-----------------|----------|--------------|
| 08/10/04     | 98261         | HLB     | 380          | 236             | 62       | 47-107       |

## METHODS PAGE

Parameter: Inorganic Pretreatment  
 Method: Titrimetric Procedure for Sulfides  
 Application: SOIL Reference Citation: USEPA-9034  
 Analyst: Heather L. Brady (HLB) Date Analyzed: 08/10/04

| Sample Number | Sample Description | Analytical Batch | QC Batch |
|---------------|--------------------|------------------|----------|
| 367389        | Station 2          | 219933           | -110     |
| 367390        | Station 4          | 219933           | -110     |
| 367391        | Station 5          | 219933           | -110     |
| 367392        | Station 7          | 219933           | -110     |
| 367393        | Station 1          | 219933           | -110     |
| 367394        | Station 3          | 219933           | -110     |
| 367395        | Station 6          | 219933           | -110     |
| 367396        | Station 6 Dup      | 219933           | -110     |

Parameter: Percent Solids  
 Method: Determination of Percent Dry Weight  
 Application: SOIL Reference Citation: SW-846 3550B  
 Analyst: Tiffani A. Miller (TAM) Date Analyzed: 08/11/04

| Sample Number | Sample Description | Analytical Batch | QC Batch  |
|---------------|--------------------|------------------|-----------|
| 367389        | Station 2          | 220219           | 98259-211 |
| 367390        | Station 4          | 220219           | 98259-211 |
| 367391        | Station 5          | 220219           | 98259-211 |
| 367392        | Station 7          | 220219           | 98259-211 |
| 367393        | Station 1          | 220219           | 98259-211 |
| 367394        | Station 3          | 220219           | 98259-211 |
| 367395        | Station 6          | 220219           | 98259-211 |
| 367396        | Station 6 Dup      | 220219           | 98259-211 |

Parameter: Sulfide  
 Method: Titrimetric Procedure for Sulfides  
 Application: SOIL Reference Citation: USEPA-9034  
 Analyst: Heather L. Brady (HLB) Date Analyzed: 08/10/04

| Sample Number | Sample Description | Analytical Batch | QC Batch  |
|---------------|--------------------|------------------|-----------|
| 367389        | Station 2          | 220221           | 98261-110 |
| 367390        | Station 4          | 220221           | 98261-110 |
| 367391        | Station 5          | 220221           | 98261-110 |
| 367392        | Station 7          | 220221           | 98261-110 |
| 367393        | Station 1          | 220221           | 98261-110 |

## METHODS PAGE

Parameter: Sulfide  
Method: Titrimetric Procedure for Sulfides  
Application: SOIL Reference Citation: USEPA-9034  
Analyst: Heather L. Brady (HLB) Date Analyzed: 08/10/04

| Sample<br>Number | Sample Description | Analytical<br>Batch | QC<br>Batch |
|------------------|--------------------|---------------------|-------------|
| -----            | -----              | -----               | -----       |
| 367394           | Station 3          | 220221              | 98261-110   |
| 367395           | Station 6          | 220221              | 98261-110   |
| 367396           | Station 6 Dup      | 220221              | 98261-110   |







40800102

MICHIGAN DEPT. OF ENVIRONMENTAL QUALITY  
ENVIRONMENTAL LABORATORY  
ANALYSIS REQUEST SHEET

36475-1

Goldensrod

LAB ORDER # 4080-2/6/04

MATRIX=SEDIMENT/SOIL/SOLIDS

|                                                              |                                 |                                                                   |                           |
|--------------------------------------------------------------|---------------------------------|-------------------------------------------------------------------|---------------------------|
| SITE NAME<br>Kenbase 04 Kennebec Project - Yellow Dog        |                                 | CITY/STATE/ZIP<br>CMI STD NDEES Standard                          |                           |
| DIVISION<br>MOBQ-WD Lansing                                  | DISTRICT/OFFICE<br>William Taft | PHONE<br>517-335-4205                                             | ACCEPT HT CODES<br>YES/NO |
| PRIMARY CONTACT PERSON<br>Bill Taft                          |                                 | PHONE<br>taftw@michigan.gov                                       | AY: INDEX: PCA:           |
| OVERFLOW LAB (Required for RRD & CMI samples)<br>2ND CHOICE: |                                 | PROJECT: 04-02 PH:                                                |                           |
| COLLECTED BY<br>Kari Divine / Dean Preme: White Water Assoc. |                                 | E-MAIL ADDRESSES TO SEND ADDITIONAL REPORTS TO:<br>dbprema@up.net |                           |

\*\*\* SAFETY INFORMATION REQUIRED \*\*\*

SEE BACK OF FORM

| LAB USE ONLY | SAMPLE DESCRIPTION | SAMPLE COLLECTED |                  | COMMENTS                                                  |
|--------------|--------------------|------------------|------------------|-----------------------------------------------------------|
|              |                    | DATE<br>MM/DD/YY | TIME<br>MILITARY |                                                           |
| 1 AA         | Station 1          | 8/4/04           | 1030             |                                                           |
| 2 AA         | Station 3          | 8/4/04           | 1150             |                                                           |
| 3 AA         | Station 6          | 8/4/04           | 0900             |                                                           |
| 4 AA         | Station 6 - DUP    | 8/4/04           | 0900             |                                                           |
| 5 AA         |                    |                  |                  | Samples split at<br>MOEQ Lab per B. Preme<br>RD<br>8/6/04 |
| 6 AA         |                    |                  |                  |                                                           |
| 7 AA         |                    |                  |                  |                                                           |
| 8 AA         |                    |                  |                  |                                                           |
| 9 AA         |                    |                  |                  |                                                           |
| 10 AA        |                    |                  |                  |                                                           |

## ORGANIC

|                                 |                      |
|---------------------------------|----------------------|
| VOA VOLATILES (MCHS260)         |                      |
| VOC - Full List                 | 1 2 3 4 5 6 7 8 9 10 |
| STEV/NTSE only                  | 1 2 3 4 5 6 7 8 9 10 |
| OS PESTICIDES/PCBS (S081/S082)  |                      |
| Pesticides & PCBs               | 1 2 3 4 5 6 7 8 9 10 |
| Pesticides only                 | 1 2 3 4 5 6 7 8 9 10 |
| PCBs only                       | 1 2 3 4 5 6 7 8 9 10 |
| BNA BASE NEUTRAL & ACIDS (S270) |                      |
| BNAs                            | 1 2 3 4 5 6 7 8 9 10 |
| PNAs only                       | 1 2 3 4 5 6 7 8 9 10 |
| BNs only                        | 1 2 3 4 5 6 7 8 9 10 |

## ORGANIC SPECIAL REQUESTS

|                              |                      |
|------------------------------|----------------------|
| Library Search (Qualitative) |                      |
| Volatiles                    | 1 2 3 4 5 6 7 8 9 10 |
| Semivolatiles                | 1 2 3 4 5 6 7 8 9 10 |
| Fingerprints                 | 1 2 3 4 5 6 7 8 9 10 |

## GENERAL CHEMISTRY

|                |                      |
|----------------|----------------------|
| GS             |                      |
| COD            | 1 2 3 4 5 6 7 8 9 10 |
| KJEL N, Tot P  | 1 2 3 4 5 6 7 8 9 10 |
| Phenolics      | 1 2 3 4 5 6 7 8 9 10 |
| Total CN       | 1 2 3 4 5 6 7 8 9 10 |
| % Total Solids | 1 2 3 4 5 6 7 8 9 10 |
| Sulfide        | 1 2 3 4 5 6 7 8 9 10 |

## INORGANIC

|               |                      |
|---------------|----------------------|
| MS            |                      |
| TI - Thallium | 1 2 3 4 5 6 7 8 9 10 |
| Cd Mg Na K    | 1 2 3 4 5 6 7 8 9 10 |
|               | 1 2 3 4 5 6 7 8 9 10 |
|               | 1 2 3 4 5 6 7 8 9 10 |
|               | 1 2 3 4 5 6 7 8 9 10 |

\*MeOH Preservative Tracking Number

PL-

| Chain-of-Custody | RELEASED BY / ORGANIZATION    |             | RECEIVED BY / ORGANIZATION |           | DATE   | TIME |
|------------------|-------------------------------|-------------|----------------------------|-----------|--------|------|
|                  | Print Name & Organization     | Signature   | Print Name & Organization  | Signature |        |      |
|                  | Bette Preme White Water Assoc | Bette Preme |                            |           | 8/5/05 | 1400 |
|                  | Dropped UPS                   |             | Dean Preme                 |           | 8/6/04 | 1610 |
|                  |                               |             |                            |           |        |      |

---

**APPENDIX E**  
**Periphyton Report**

---



620 Broad Street - Suite 100 - St. Joseph - MI 49085 - Phone: 269-983-3654 - Fax: 269-983-3653  
info@phycotech.com - www.phycotech.com

---

## **Algae Analysis Report and Data Set**

Customer ID : 141  
Calc Type : Qualitative

Tracking Code: 040001-141  
 Customer ID: 141  
 Job Number: 1  
 System Name: Big Pup Creek

Sample ID .  
 Sample Date: 8/4/2004  
 Station: 6  
 Site: CR510 Bridge

Replicate # 1  
 Level .  
 Depth 0  
 Preservative Glutaraldehyde

Report Notes .

| Taxa Id                          | Genus             | Species             | Subspecies            | Variety           | Form | Morph | Structure  | Relative<br>Concentration | Relative<br>Algal Cell<br>Concentration |
|----------------------------------|-------------------|---------------------|-----------------------|-------------------|------|-------|------------|---------------------------|-----------------------------------------|
| <b>Division: Bacillariophyta</b> |                   |                     |                       |                   |      |       |            |                           |                                         |
| 9013                             | <i>Achnanthes</i> | <i>bioretii</i>     | .                     | .                 | .    | .     | Vegetative | 2.80                      | 0.89                                    |
| 9761                             | <i>Achnanthes</i> | <i>lanceolata</i>   | <i>frequentissima</i> | .                 | .    | .     | Vegetative | 0.62                      | 0.20                                    |
| 9341                             | <i>Achnanthes</i> | <i>linearis</i>     | .                     | .                 | .    | .     | Vegetative | 0.31                      | 0.10                                    |
| 1013                             | <i>Achnanthes</i> | <i>minutissima</i>  | .                     | .                 | .    | .     | Vegetative | 22.98                     | 7.34                                    |
| 9454                             | <i>Achnanthes</i> | <i>subatomoides</i> | .                     | .                 | .    | .     | Vegetative | 0.62                      | 0.20                                    |
| 1010                             | <i>Achnanthes</i> | <i>spp</i>          | .                     | .                 | .    | .     | Vegetative | 1.24                      | 0.40                                    |
| 1343                             | <i>Amphora</i>    | <i>pediculus</i>    | .                     | .                 | .    | .     | Vegetative | 0.62                      | 0.20                                    |
| 1000449                          | <i>Cocconeis</i>  | <i>placentula</i>   | .                     | <i>lineata</i>    | .    | .     | Vegetative | 0.31                      | 0.10                                    |
| 9212                             | <i>Cocconeis</i>  | <i>placentula</i>   | .                     | <i>lineata</i>    | .    | .     | Vegetative | 9.32                      | 2.97                                    |
| 1119                             | <i>Cymbella</i>   | <i>sinuata</i>      | .                     | .                 | .    | .     | Vegetative | 1.55                      | 0.50                                    |
| 1097                             | <i>Cymbella</i>   | <i>amphicephala</i> | .                     | <i>citrus</i>     | .    | .     | Vegetative | 0.31                      | 0.10                                    |
| 1095                             | <i>Cymbella</i>   | <i>silesiaca</i>    | .                     | .                 | .    | .     | Vegetative | 1.24                      | 0.40                                    |
| 9397                             | <i>Fragilaria</i> | <i>capucina</i>     | .                     | <i>vaucheriae</i> | .    | .     | Vegetative | 2.17                      | 0.69                                    |
| 1155                             | <i>Fragilaria</i> | <i>leptostauron</i> | .                     | .                 | .    | .     | Vegetative | 0.62                      | 0.20                                    |
| 9038                             | <i>Fragilaria</i> | <i>pinnata</i>      | .                     | <i>pinnata</i>    | .    | .     | Vegetative | 0.62                      | 0.20                                    |
| 1161                             | <i>Gomphonema</i> | <i>parvulum</i>     | .                     | .                 | .    | .     | Vegetative | 0.62                      | 0.20                                    |
| 1201                             | <i>Meridion</i>   | <i>circulare</i>    | .                     | .                 | .    | .     | Vegetative | 0.31                      | 1.59                                    |
| 9305                             | <i>Navicula</i>   | <i>decussis</i>     | .                     | <i>decussis</i>   | .    | .     | Vegetative | 0.31                      | 0.10                                    |
| 10355                            | <i>Navicula</i>   | <i>pelliculosa</i>  | .                     | .                 | .    | .     | Vegetative | 0.31                      | 0.10                                    |
| 10352                            | <i>Navicula</i>   | <i>gregaria</i>     | .                     | .                 | .    | .     | Vegetative | 0.62                      | 0.20                                    |
| 9113                             | <i>Nitzschia</i>  | <i>dissipata</i>    | .                     | .                 | .    | .     | Vegetative | 0.93                      | 0.30                                    |
| 9123                             | <i>Nitzschia</i>  | <i>palea</i>        | .                     | .                 | .    | .     | Vegetative | 1.86                      | 0.59                                    |
| 1223                             | <i>Nitzschia</i>  | <i>perminuta</i>    | .                     | .                 | .    | .     | Vegetative | 0.31                      | 0.10                                    |

☒ = Identification is uncertain

\* = Family level identification

040001-141

Monday, January 17, 2005

Page 2 of 26

|                                           |                        |                  |   |   |   |   |                 |              |              |
|-------------------------------------------|------------------------|------------------|---|---|---|---|-----------------|--------------|--------------|
| 9180                                      | <i>Opephora</i>        | <i>spp</i>       | . | . | . | . | Vegetative      | 0.31         | 0.10         |
| <b>TOTALS Bacillariophyta</b>             |                        |                  |   |   |   |   |                 | <b>50.93</b> | <b>17.75</b> |
| <hr/>                                     |                        |                  |   |   |   |   |                 |              |              |
| <b>Division:</b>                          | <b>Chlorophyta</b>     |                  |   |   |   |   |                 |              |              |
| 2100                                      | <i>Chlorococcum</i>    | <i>spp</i>       | . | . | . | . | Vegetative      | 0.31         | 0.10         |
| 2160                                      | <i>Closterium</i>      | <i>spp</i>       | . | . | . | . | Vegetative      | 0.31         | 0.10         |
| <hr/>                                     |                        |                  |   |   |   |   |                 |              |              |
| <b>TOTALS Chlorophyta</b>                 |                        |                  |   |   |   |   |                 | <b>0.62</b>  | <b>0.20</b>  |
| <hr/>                                     |                        |                  |   |   |   |   |                 |              |              |
| <b>Division:</b>                          | <b>Cyanophyta</b>      |                  |   |   |   |   |                 |              |              |
| 4050                                      | <i>Aphanocapsa</i>     | <i>spp</i>       | . | . | . | . | Vegetative      | 1.86         | 5.80         |
| 4060                                      | <i>Aphanothece</i>     | <i>spp</i>       | . | . | . | . | Vegetative      | 1.86         | 2.83         |
| 4140                                      | <i>Gloeotheca</i>      | <i>spp</i>       | . | . | . | . | Vegetative      | 0.31         | 0.59         |
| 4150                                      | <i>Lyngbya</i>         | <i>spp</i>       | . | . | . | . | Vegetative      | 5.28         | 17.66        |
| 4168                                      | <i>Merismopedia</i>    | <i>punctata</i>  | . | . | . | . | Vegetative      | 0.31         | 1.59         |
| 4352                                      | <i>Oscillatoria</i>    | <i>sp. 2</i>     | . | . | . | . | Vegetative      | 0.31         | 3.47         |
| <input checked="" type="checkbox"/> 4194  | <i>Phormidium</i>      | <i>fragile</i>   | . | . | . | . | Vegetative      | 3.73         | 30.93        |
| 4460                                      | <i>Pseudanabaena</i>   | <i>spp</i>       | . | . | . | . | Vegetative      | 0.31         | 0.30         |
| 4463                                      | <i>Pseudanabaena</i>   | <i>galeata</i>   | . | . | . | . | Vegetative      | 0.93         | 4.31         |
| 4321                                      | <i>Synechococcus</i>   | <i>elongatus</i> | . | . | . | . | Vegetative      | 14.91        | 4.76         |
| 4323                                      | <i>Synechococcus</i>   | <i>sp. 1</i>     | . | . | . | . | < 1um ovoid     | 1.86         | 0.59         |
| 4660                                      | <i>Synechocystis</i>   | <i>spp</i>       | . | . | . | . | Vegetative      | 7.14         | 2.28         |
| 4285                                      | <i>Synechocystis</i>   | <i>spp</i>       | . | . | . | . | >1 um spherical | 9.32         | 2.97         |
| <hr/>                                     |                        |                  |   |   |   |   |                 |              |              |
| <b>TOTALS Cyanophyta</b>                  |                        |                  |   |   |   |   |                 | <b>48.14</b> | <b>78.09</b> |
| <hr/>                                     |                        |                  |   |   |   |   |                 |              |              |
| <b>Division:</b>                          | <b>Rhodophyta</b>      |                  |   |   |   |   |                 |              |              |
| <input checked="" type="checkbox"/> 10741 | <i>Batrachospermum</i> | <i>vagum</i>     | . | . | . | . | Vegetative      | 0.31         | 3.97         |
| <hr/>                                     |                        |                  |   |   |   |   |                 |              |              |
| <b>TOTALS Rhodophyta</b>                  |                        |                  |   |   |   |   |                 | <b>0.31</b>  | <b>3.97</b>  |
| <hr/>                                     |                        |                  |   |   |   |   |                 |              |              |

☒ = Identification is uncertain

\* = Family level identification

040001-141

Monday, January 17, 2005

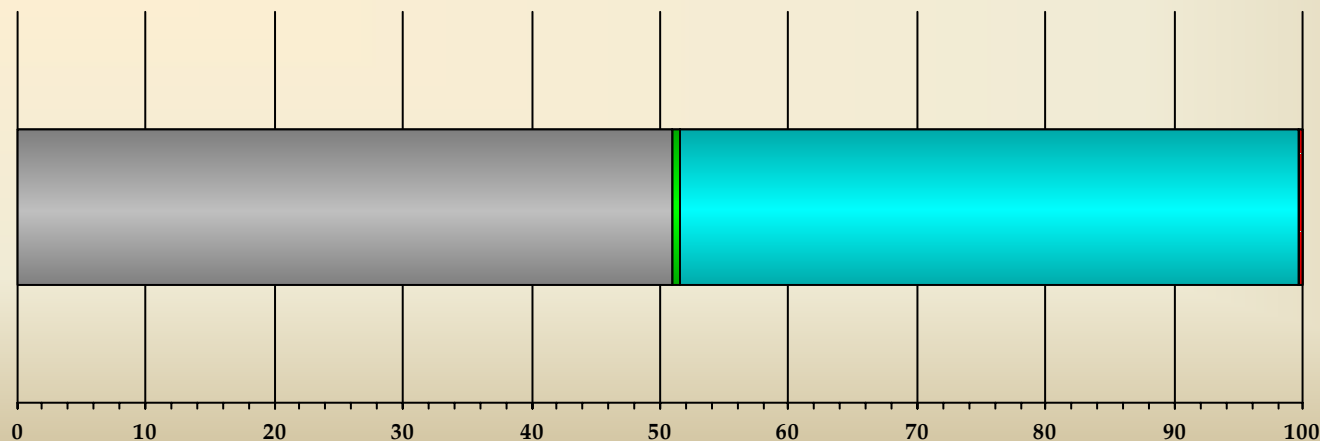
Page 3 of 26

# Summary Graphics

Total Sample Concentration  
100.00

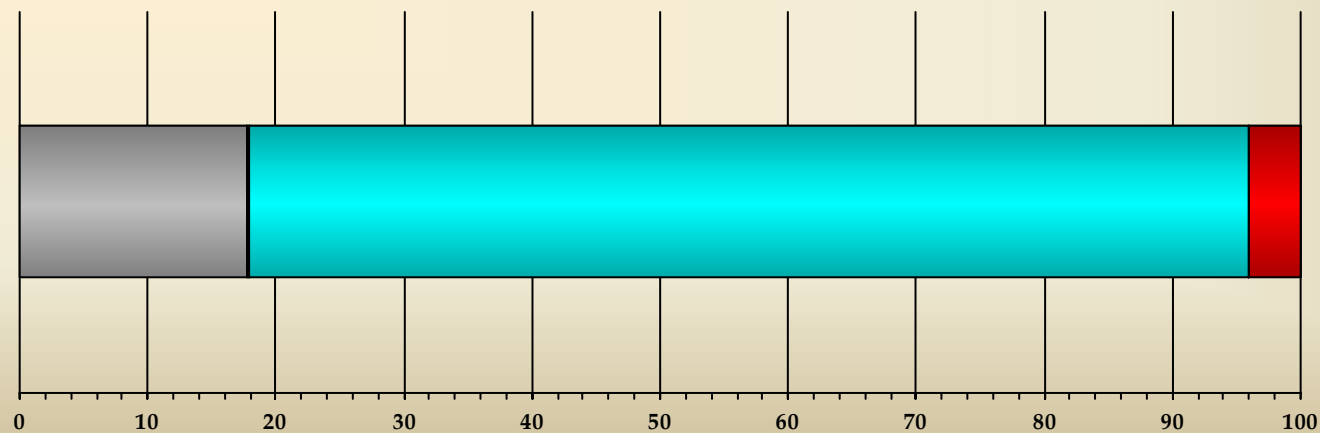
Total Sample Cell Concentration  
100.00

Sample Relative Concentration



- Bacillariophyta
- Chloromonadophyta
- Chlorophyta
- Chrysophyta
- Cryptophyta
- Cyanophyta
- Euglenophyta
- Haptophyta
- Miscellaneous
- Phaeophyta
- Pyrrhophyta
- Rhodophyta
- Xanthophyta

Sample Relative Cell Concentration



- Bacillariophyta
- Chloromonadophyta
- Chlorophyta
- Chrysophyta
- Cryptophyta
- Cyanophyta
- Euglenophyta
- Haptophyta
- Miscellaneous
- Phaeophyta
- Pyrrhophyta
- Rhodophyta
- Xanthophyta

☑ = Identification is uncertain

\* = Family level identification

040001-141

Monday, January 17, 2005

Page 4 of 26

Tracking Code: 040002-141  
 Customer ID: 141  
 Job Number: 1  
 System Name: Cedar Creek

Sample ID .  
 Sample Date: 8/3/2004  
 Station: 5  
 Site: NW Road

Replicate # 1  
 Level .  
 Depth 0  
 Preservative Glutaraldehyde

Report Notes .

| Taxa Id                                   | Genus              | Species             | Subspecies            | Variety           | Form           | Morph | Structure  | Relative<br>Concentration | Relative<br>Algal Cell<br>Concentration |
|-------------------------------------------|--------------------|---------------------|-----------------------|-------------------|----------------|-------|------------|---------------------------|-----------------------------------------|
| <b>Division: Bacillariophyta</b>          |                    |                     |                       |                   |                |       |            |                           |                                         |
| 9761                                      | <i>Achnanthes</i>  | <i>lanceolata</i>   | <i>frequentissima</i> | .                 | .              | .     | Vegetative | 7.42                      | 1.20                                    |
| 9454                                      | <i>Achnanthes</i>  | <i>subatomoides</i> | .                     | .                 | .              | .     | Vegetative | 0.45                      | 0.07                                    |
| 10308                                     | <i>Achnanthes</i>  | <i>lanceolata</i>   | <i>robusta</i>        | .                 | .              | .     | Vegetative | 2.25                      | 0.36                                    |
| 1178                                      | <i>Achnanthes</i>  | <i>exigua</i>       | .                     | .                 | .              | .     | Vegetative | 0.45                      | 0.07                                    |
| 9334                                      | <i>Achnanthes</i>  | <i>delicatula</i>   | .                     | .                 | .              | .     | Vegetative | 0.67                      | 0.11                                    |
| <input checked="" type="checkbox"/> 10304 | <i>Achnanthes</i>  | <i>clevei</i>       | .                     | <i>clevei</i>     | .              | .     | Vegetative | 0.90                      | 0.15                                    |
| 9013                                      | <i>Achnanthes</i>  | <i>bioretii</i>     | .                     | .                 | .              | .     | Vegetative | 0.45                      | 0.07                                    |
| 1013                                      | <i>Achnanthes</i>  | <i>minutissima</i>  | .                     | .                 | .              | .     | Vegetative | 2.70                      | 0.44                                    |
| 1341                                      | <i>Amphora</i>     | <i>ovalis</i>       | .                     | .                 | .              | .     | Vegetative | 0.45                      | 0.07                                    |
| 1343                                      | <i>Amphora</i>     | <i>pediculus</i>    | .                     | .                 | .              | .     | Vegetative | 1.80                      | 0.29                                    |
| 1434                                      | <i>Aulacoseira</i> | <i>italica</i>      | .                     | .                 | .              | .     | Vegetative | 0.22                      | 0.07                                    |
| 9212                                      | <i>Cocconeis</i>   | <i>placentula</i>   | .                     | <i>lineata</i>    | .              | .     | Vegetative | 8.09                      | 1.31                                    |
| 1076                                      | <i>Cyclotella</i>  | <i>meneghiniana</i> | .                     | .                 | .              | .     | Vegetative | 0.22                      | 0.04                                    |
| 1095                                      | <i>Cymbella</i>    | <i>silesiaca</i>    | .                     | .                 | .              | .     | Vegetative | 0.22                      | 0.04                                    |
| 1119                                      | <i>Cymbella</i>    | <i>sinuata</i>      | .                     | .                 | .              | .     | Vegetative | 0.67                      | 0.11                                    |
| 1140                                      | <i>Eunotia</i>     | <i>spp</i>          | .                     | .                 | .              | .     | Vegetative | 0.67                      | 0.11                                    |
| 9038                                      | <i>Fragilaria</i>  | <i>pinnata</i>      | .                     | <i>pinnata</i>    | .              | .     | Vegetative | 0.90                      | 0.15                                    |
| 1150                                      | <i>Fragilaria</i>  | <i>spp</i>          | .                     | .                 | .              | .     | Vegetative | 1.35                      | 0.22                                    |
| 1157                                      | <i>Fragilaria</i>  | <i>brevistriata</i> | .                     | .                 | .              | .     | Vegetative | 2.70                      | 0.44                                    |
| 9397                                      | <i>Fragilaria</i>  | <i>capucina</i>     | .                     | <i>vaucheriae</i> | .              | .     | Vegetative | 0.67                      | 0.11                                    |
| 9045                                      | <i>Fragilaria</i>  | <i>construens</i>   | .                     | .                 | <i>venter</i>  | .     | Vegetative | 3.60                      | 0.58                                    |
| 10374                                     | <i>Fragilaria</i>  | <i>construens</i>   | .                     | .                 | <i>binodis</i> | .     | Vegetative | 1.35                      | 0.22                                    |
| 1155                                      | <i>Fragilaria</i>  | <i>leptostauron</i> | .                     | .                 | .              | .     | Vegetative | 7.19                      | 1.16                                    |

☒ = Identification is uncertain

\* = Family level identification

040002-141

Monday, January 17, 2005

Page 5 of 26

|                                          |                       |                      |   |                 |   |                      |            |       |       |
|------------------------------------------|-----------------------|----------------------|---|-----------------|---|----------------------|------------|-------|-------|
| 1161                                     | <i>Gomphonema</i>     | <i>parvulum</i>      | . | .               | . | .                    | Vegetative | 0.45  | 0.07  |
| 1201                                     | <i>Meridion</i>       | <i>circulare</i>     | . | .               | . | .                    | Vegetative | 0.90  | 0.15  |
| 1210                                     | <i>Navicula</i>       | <i>spp</i>           | . | .               | . | .                    | Vegetative | 0.22  | 0.04  |
| 9072                                     | <i>Navicula</i>       | <i>cryptotenella</i> | . | .               | . | .                    | Vegetative | 0.90  | 0.15  |
| 9305                                     | <i>Navicula</i>       | <i>decussis</i>      | . | <i>decussis</i> | . | .                    | Vegetative | 0.45  | 0.07  |
| 10352                                    | <i>Navicula</i>       | <i>gregaria</i>      | . | .               | . | .                    | Vegetative | 0.45  | 0.07  |
| 9101                                     | <i>Navicula</i>       | <i>subminuscula</i>  | . | .               | . | .                    | Vegetative | 0.22  | 0.04  |
| 9102                                     | <i>Navicula</i>       | <i>tripunctata</i>   | . | .               | . | .                    | Vegetative | 0.45  | 0.07  |
| 9223                                     | <i>Navicula</i>       | <i>viridula</i>      | . | <i>linearis</i> | . | .                    | Vegetative | 0.90  | 0.15  |
| 9123                                     | <i>Nitzschia</i>      | <i>palea</i>         | . | .               | . | .                    | Vegetative | 0.22  | 0.04  |
| 1220                                     | <i>Nitzschia</i>      | <i>spp</i>           | . | .               | . | .                    | Vegetative | 0.22  | 0.04  |
| 9118                                     | <i>Nitzschia</i>      | <i>linearis</i>      | . | .               | . | .                    | Vegetative | 0.22  | 0.04  |
| TOTALS Bacillariophyta                   |                       |                      |   |                 |   |                      |            | 51.01 | 8.29  |
| <hr/>                                    |                       |                      |   |                 |   |                      |            |       |       |
| Division: Chlorophyta                    |                       |                      |   |                 |   |                      |            |       |       |
| 2031                                     | <i>Ankistrodesmus</i> | <i>falcatus</i>      | . | .               | . | <i>monoraphidiod</i> | Vegetative | 0.22  | 0.15  |
| 2100                                     | <i>Chlorococcum</i>   | <i>spp</i>           | . | .               | . | .                    | Vegetative | 0.67  | 1.53  |
| TOTALS Chlorophyta                       |                       |                      |   |                 |   |                      |            | 0.90  | 1.67  |
| <hr/>                                    |                       |                      |   |                 |   |                      |            |       |       |
| Division: Cyanophyta                     |                       |                      |   |                 |   |                      |            |       |       |
| <input checked="" type="checkbox"/> 4010 | <i>Anabaena</i>       | <i>spp</i>           | . | .               | . | .                    | Vegetative | 17.08 | 77.42 |
| 4050                                     | <i>Aphanocapsa</i>    | <i>spp</i>           | . | .               | . | .                    | Vegetative | 0.67  | 1.64  |
| 4150                                     | <i>Lyngbya</i>        | <i>spp</i>           | . | .               | . | .                    | Vegetative | 0.45  | 2.18  |
| 4170                                     | <i>Oscillatoria</i>   | <i>spp</i>           | . | .               | . | .                    | Vegetative | 0.45  | 1.04  |
| 4194                                     | <i>Phormidium</i>     | <i>fragile</i>       | . | .               | . | .                    | Vegetative | 4.04  | 3.49  |
| 4463                                     | <i>Pseudanabaena</i>  | <i>galeata</i>       | . | .               | . | .                    | Vegetative | 0.45  | 0.22  |
| 4323                                     | <i>Synechococcus</i>  | <i>sp. 1</i>         | . | .               | . | < 1um ovoid          | Vegetative | 0.67  | 0.11  |
| 4321                                     | <i>Synechococcus</i>  | <i>elongatus</i>     | . | .               | . | .                    | Vegetative | 4.72  | 0.76  |
| 4660                                     | <i>Synechocystis</i>  | <i>spp</i>           | . | .               | . | .                    | Vegetative | 11.46 | 1.86  |
| 4285                                     | <i>Synechocystis</i>  | <i>spp</i>           | . | .               | . | >1 um spherical      | Vegetative | 8.09  | 1.31  |
| TOTALS Cyanophyta                        |                       |                      |   |                 |   |                      |            | 48.09 | 90.03 |

☒ = Identification is uncertain

\* = Family level identification

040002-141

Monday, January 17, 2005

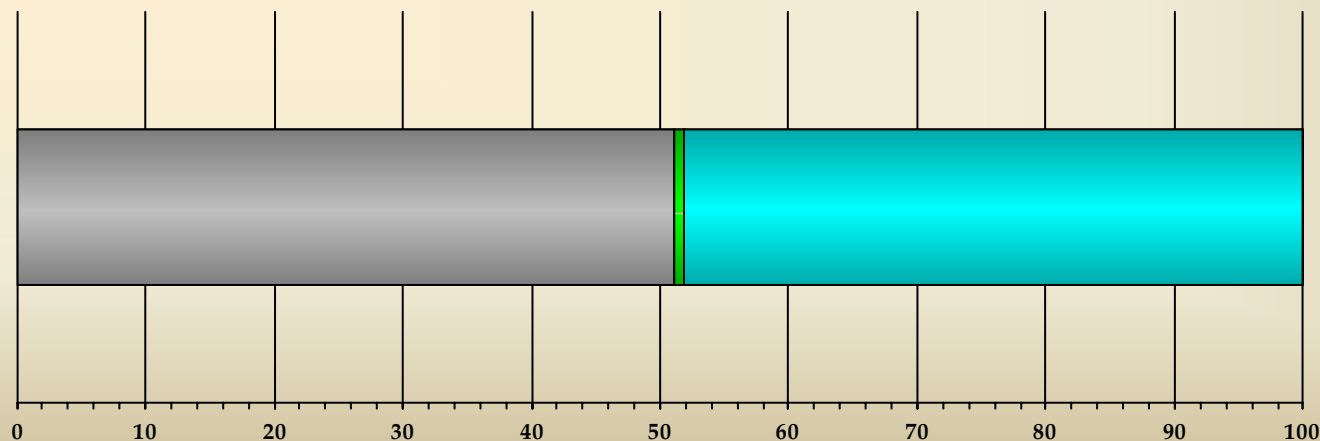
Page 6 of 26

# Summary Graphics

Total Sample Concentration  
100.00

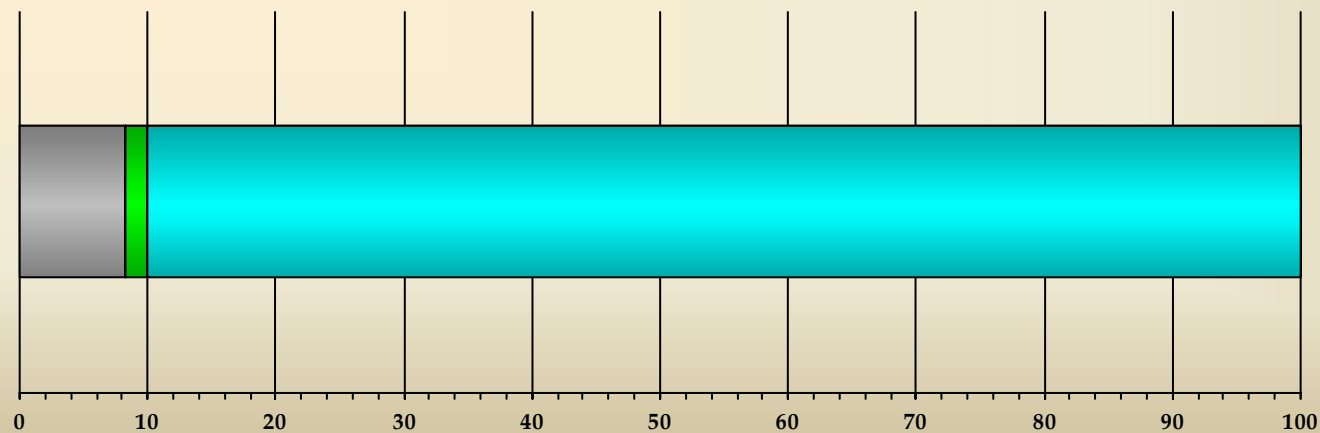
Total Sample Cell Concentration  
100.00

Sample Relative Concentration



- Bacillariophyta
- Chloromonadophyta
- Chlorophyta
- Chrysophyta
- Cryptophyta
- Cyanophyta
- Euglenophyta
- Haptophyta
- Miscellaneous
- Phaeophyta
- Pyrrhophyta
- Rhodophyta
- Xanthophyta

Sample Relative Cell Concentration



- Bacillariophyta
- Chloromonadophyta
- Chlorophyta
- Chrysophyta
- Cryptophyta
- Cyanophyta
- Euglenophyta
- Haptophyta
- Miscellaneous
- Phaeophyta
- Pyrrhophyta
- Rhodophyta
- Xanthophyta

☑ = Identification is uncertain

\* = Family level identification

040002-141

Monday, January 17, 2005

Page 7 of 26

Tracking Code: 040003-141  
 Customer ID: 141  
 Job Number: 1  
 System Name: Salmon Trout River

Sample ID .  
 Sample Date: 8/3/2004  
 Station: 4  
 Site: AAA Road

Replicate # 1  
 Level .  
 Depth 0  
 Preservative Glutaraldehyde

Report Notes .

| Taxa Id                          | Genus             | Species              | Subspecies            | Variety         | Form           | Morph | Structure  | Relative<br>Concentration | Relative<br>Algal Cell<br>Concentration |
|----------------------------------|-------------------|----------------------|-----------------------|-----------------|----------------|-------|------------|---------------------------|-----------------------------------------|
| <b>Division: Bacillariophyta</b> |                   |                      |                       |                 |                |       |            |                           |                                         |
| 9341                             | <i>Achnanthes</i> | <i>linearis</i>      | .                     | .               | .              | .     | Vegetative | 0.22                      | 0.03                                    |
| 1178                             | <i>Achnanthes</i> | <i>exigua</i>        | .                     | .               | .              | .     | Vegetative | 0.22                      | 0.03                                    |
| 9454                             | <i>Achnanthes</i> | <i>subatomoides</i>  | .                     | .               | .              | .     | Vegetative | 0.22                      | 0.03                                    |
| 10305                            | <i>Achnanthes</i> | <i>oestripii</i>     | .                     | .               | .              | .     | Vegetative | 0.66                      | 0.09                                    |
| 1013                             | <i>Achnanthes</i> | <i>minutissima</i>   | .                     | .               | .              | .     | Vegetative | 6.62                      | 0.94                                    |
| 10308                            | <i>Achnanthes</i> | <i>lanceolata</i>    | <i>robusta</i>        | .               | .              | .     | Vegetative | 0.22                      | 0.03                                    |
| 1010                             | <i>Achnanthes</i> | <i>spp</i>           | .                     | .               | .              | .     | Vegetative | 0.44                      | 0.06                                    |
| 9013                             | <i>Achnanthes</i> | <i>bioretii</i>      | .                     | .               | .              | .     | Vegetative | 0.44                      | 0.06                                    |
| 9761                             | <i>Achnanthes</i> | <i>lanceolata</i>    | <i>frequentissima</i> | .               | .              | .     | Vegetative | 0.44                      | 0.06                                    |
| 9212                             | <i>Cocconeis</i>  | <i>placentula</i>    | .                     | <i>lineata</i>  | .              | .     | Vegetative | 3.09                      | 0.44                                    |
| 1119                             | <i>Cymbella</i>   | <i>sinuata</i>       | .                     | .               | .              | .     | Vegetative | 0.66                      | 0.14                                    |
| 1097                             | <i>Cymbella</i>   | <i>amphicephala</i>  | .                     | <i>citrus</i>   | .              | .     | Vegetative | 0.22                      | 0.03                                    |
| 1095                             | <i>Cymbella</i>   | <i>silesiaca</i>     | .                     | .               | .              | .     | Vegetative | 0.22                      | 0.03                                    |
| 1140                             | <i>Eunotia</i>    | <i>spp</i>           | .                     | .               | .              | .     | Vegetative | 1.32                      | 0.19                                    |
| 9045                             | <i>Fragilaria</i> | <i>construens</i>    | .                     | .               | <i>venter</i>  | .     | Vegetative | 1.55                      | 0.22                                    |
| 10374                            | <i>Fragilaria</i> | <i>construens</i>    | .                     | .               | <i>binodis</i> | .     | Vegetative | 0.22                      | 0.03                                    |
| 1155                             | <i>Fragilaria</i> | <i>leptostauron</i>  | .                     | .               | .              | .     | Vegetative | 1.99                      | 0.28                                    |
| 1157                             | <i>Fragilaria</i> | <i>brevistriata</i>  | .                     | .               | .              | .     | Vegetative | 0.44                      | 0.06                                    |
| 1161                             | <i>Gomphonema</i> | <i>parvulum</i>      | .                     | .               | .              | .     | Vegetative | 0.88                      | 0.13                                    |
| 9223                             | <i>Navicula</i>   | <i>viridula</i>      | .                     | <i>linearis</i> | .              | .     | Vegetative | 0.22                      | 0.03                                    |
| 1369                             | <i>Navicula</i>   | <i>pupula</i>        | .                     | .               | .              | .     | Vegetative | 0.22                      | 0.03                                    |
| 9305                             | <i>Navicula</i>   | <i>decussis</i>      | .                     | <i>decussis</i> | .              | .     | Vegetative | 0.22                      | 0.03                                    |
| 9072                             | <i>Navicula</i>   | <i>cryptotenella</i> | .                     | .               | .              | .     | Vegetative | 0.66                      | 0.09                                    |

☒ = Identification is uncertain

\* = Family level identification

040003-141

Monday, January 17, 2005

Page 8 of 26

|                                           |                        |                   |   |   |   |                 |            |       |       |
|-------------------------------------------|------------------------|-------------------|---|---|---|-----------------|------------|-------|-------|
| 9123                                      | <i>Nitzschia</i>       | <i>palea</i>      | . | . | . | .               | Vegetative | 0.44  | 0.06  |
| <input checked="" type="checkbox"/> 9504  | <i>Synedra</i>         | <i>tenera</i>     | . | . | . | .               | Vegetative | 0.44  | 0.06  |
| TOTALS Bacillariophyta                    |                        |                   |   |   |   |                 |            | 22.30 | 3.22  |
| Division: Chlorophyta                     |                        |                   |   |   |   |                 |            |       |       |
| <input checked="" type="checkbox"/> 8260  | <i>Apodochloris</i>    | <i>spp</i>        | . | . | . | .               | Vegetative | 0.22  | 0.03  |
| 2100                                      | <i>Chlorococcum</i>    | <i>spp</i>        | . | . | . | .               | Vegetative | 1.55  | 0.55  |
| 8030                                      | <i>Microspora</i>      | <i>spp</i>        | . | . | . | .               | Vegetative | 0.22  | 10.05 |
| TOTALS Chlorophyta                        |                        |                   |   |   |   |                 |            | 1.99  | 10.63 |
| Division: Cyanophyta                      |                        |                   |   |   |   |                 |            |       |       |
| <input checked="" type="checkbox"/> 4010  | <i>Anabaena</i>        | <i>spp</i>        | . | . | . | .               | Vegetative | 0.22  | 0.09  |
| 4050                                      | <i>Aphanocapsa</i>     | <i>spp</i>        | . | . | . | .               | Vegetative | 0.66  | 0.94  |
| 4060                                      | <i>Aphanothece</i>     | <i>spp</i>        | . | . | . | .               | Vegetative | 2.21  | 2.93  |
| 4310                                      | <i>Calothrix</i>       | <i>spp</i>        | . | . | . | .               | Vegetative | 0.22  | 0.85  |
| 4150                                      | <i>Lyngbya</i>         | <i>spp</i>        | . | . | . | .               | Vegetative | 1.99  | 5.12  |
| 4170                                      | <i>Oscillatoria</i>    | <i>spp</i>        | . | . | . | .               | Vegetative | 2.43  | 59.16 |
| 4194                                      | <i>Phormidium</i>      | <i>fragile</i>    | . | . | . | .               | Vegetative | 5.30  | 6.91  |
| 4463                                      | <i>Pseudanabaena</i>   | <i>galeata</i>    | . | . | . | .               | Vegetative | 2.65  | 1.13  |
| 4323                                      | <i>Synechococcus</i>   | <i>sp. 1</i>      | . | . | . | < 1um ovoid     | Vegetative | 2.87  | 0.41  |
| 107397                                    | <i>Synechococcus</i>   | <i>aeruginosa</i> | . | . | . | .               | Vegetative | 0.22  | 0.03  |
| 4321                                      | <i>Synechococcus</i>   | <i>elongatus</i>  | . | . | . | .               | Vegetative | 15.89 | 2.26  |
| 4285                                      | <i>Synechocystis</i>   | <i>spp</i>        | . | . | . | >1 um spherical | Vegetative | 32.45 | 4.62  |
| 4660                                      | <i>Synechocystis</i>   | <i>spp</i>        | . | . | . | .               | Vegetative | 7.51  | 1.07  |
| TOTALS Cyanophyta                         |                        |                   |   |   |   |                 |            | 74.61 | 85.52 |
| Division: Rhodophyta                      |                        |                   |   |   |   |                 |            |       |       |
| <input checked="" type="checkbox"/> 10741 | <i>Batrachospermum</i> | <i>vagum</i>      | . | . | . | .               | Vegetative | 1.10  | 0.63  |
| TOTALS Rhodophyta                         |                        |                   |   |   |   |                 |            | 1.10  | 0.63  |

☒ = Identification is uncertain

\* = Family level identification

040003-141

Monday, January 17, 2005

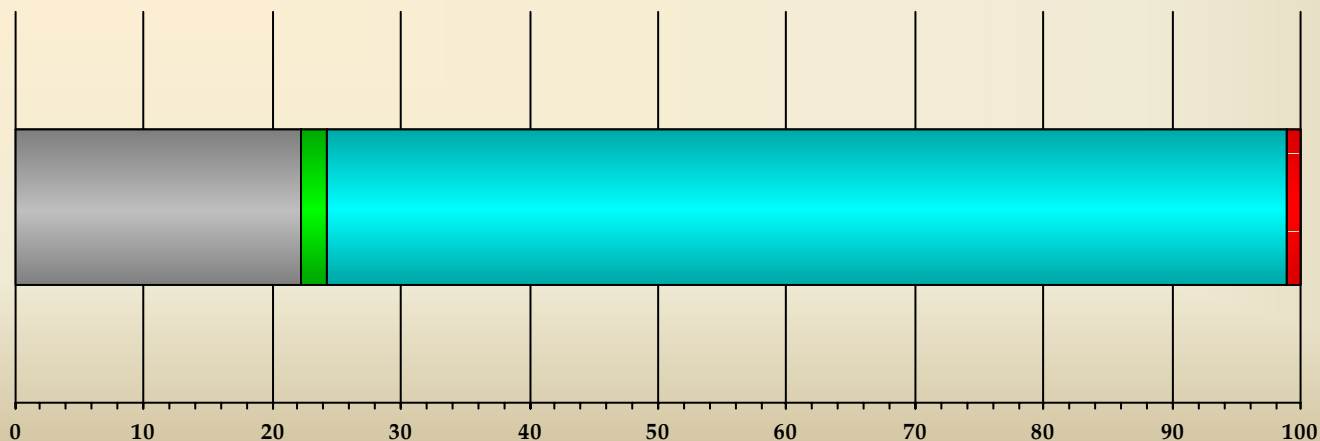
Page 9 of 26

# Summary Graphics

Total Sample Concentration  
100.00

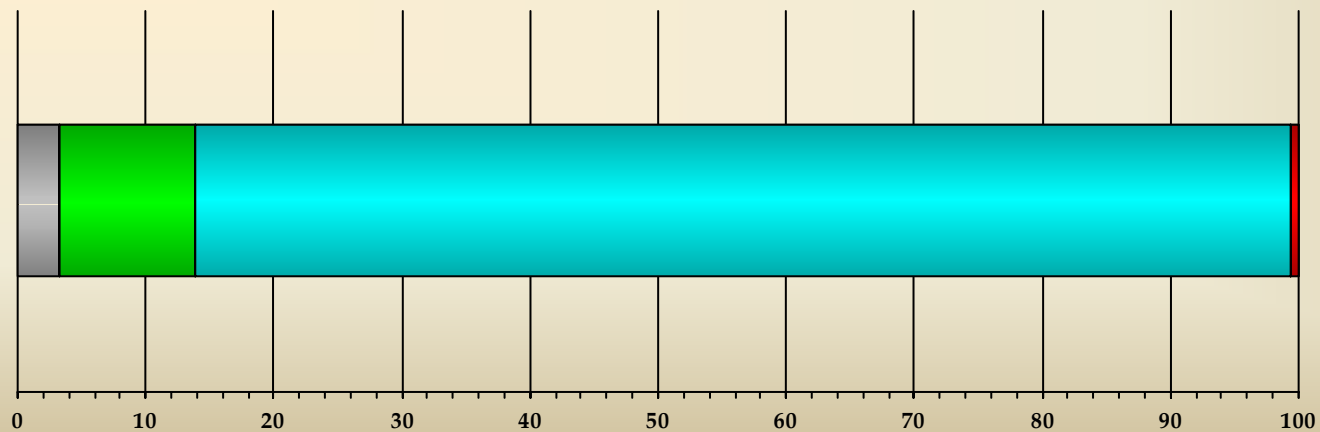
Total Sample Cell Concentration  
100.00

Sample Relative Concentration



- Bacillariophyta
- Chloromonadophyta
- Chlorophyta
- Chrysophyta
- Cryptophyta
- Cyanophyta
- Euglenophyta
- Haptophyta
- Miscellaneous
- Phaeophyta
- Pyrrhophyta
- Rhodophyta
- Xanthophyta

Sample Relative Cell Concentration



- Bacillariophyta
- Chloromonadophyta
- Chlorophyta
- Chrysophyta
- Cryptophyta
- Cyanophyta
- Euglenophyta
- Haptophyta
- Miscellaneous
- Phaeophyta
- Pyrrhophyta
- Rhodophyta
- Xanthophyta

☐ = Identification is uncertain

\* = Family level identification

040003-141

Monday, January 17, 2005

Page 10 of 26

Tracking Code: 040004-141  
Customer ID: 141  
Job Number: 1  
System Name: Salmon Trout River

Sample ID .  
Sample Date: 8/3/2004  
Station: 7  
Site: Upstream

Replicate # 1  
Level .  
Depth 0  
Preservative Glutaraldehyde

Report Notes .

| Taxa Id                   | Genus              | Species             | Subspecies | Variety          | Form          | Morph | Structure  | Relative<br>Concentration | Relative<br>Algal Cell<br>Concentration |
|---------------------------|--------------------|---------------------|------------|------------------|---------------|-------|------------|---------------------------|-----------------------------------------|
| Division: Bacillariophyta |                    |                     |            |                  |               |       |            |                           |                                         |
| 1013                      | <i>Achnanthes</i>  | <i>minutissima</i>  | .          | .                | .             | .     | Vegetative | 0.25                      | 0.16                                    |
| 1343                      | <i>Amphora</i>     | <i>pediculus</i>    | .          | .                | .             | .     | Vegetative | 0.25                      | 0.16                                    |
| 1434                      | <i>Aulacoseira</i> | <i>italica</i>      | .          | .                | .             | .     | Vegetative | 0.25                      | 0.31                                    |
| 9371                      | <i>Cymbella</i>    | <i>gracilis</i>     | .          | .                | .             | .     | Vegetative | 0.49                      | 0.31                                    |
| 1095                      | <i>Cymbella</i>    | <i>silesiaca</i>    | .          | .                | .             | .     | Vegetative | 0.25                      | 0.16                                    |
| 1149                      | <i>Eunotia</i>     | <i>bilunaris</i>    | .          | .                | .             | .     | Vegetative | 0.74                      | 0.63                                    |
| 109221                    | <i>Eunotia</i>     | <i>flexuosa</i>     | .          | .                | .             | .     | Vegetative | 0.74                      | 0.47                                    |
| 9383                      | <i>Eunotia</i>     | <i>praerupta</i>    | .          | <i>praerupta</i> | .             | .     | Vegetative | 0.49                      | 0.31                                    |
| 9045                      | <i>Fragilaria</i>  | <i>construens</i>   | .          | .                | <i>venter</i> | .     | Vegetative | 44.12                     | 28.17                                   |
| 1155                      | <i>Fragilaria</i>  | <i>leptostauron</i> | .          | .                | .             | .     | Vegetative | 0.25                      | 0.16                                    |
| 1165                      | <i>Gomphonema</i>  | <i>acuminatum</i>   | .          | .                | .             | .     | Vegetative | 0.49                      | 0.31                                    |
| 10352                     | <i>Navicula</i>    | <i>gregaria</i>     | .          | .                | .             | .     | Vegetative | 0.25                      | 0.16                                    |
| 9482                      | <i>Navicula</i>    | <i>salinarum</i>    | .          | .                | .             | .     | Vegetative | 0.25                      | 0.16                                    |
| 9101                      | <i>Navicula</i>    | <i>subminuscula</i> | .          | .                | .             | .     | Vegetative | 0.25                      | 0.16                                    |
| 1814                      | <i>Pinnularia</i>  | <i>microstauron</i> | .          | .                | .             | .     | Vegetative | 0.49                      | 0.31                                    |
| 1817                      | <i>Pinnularia</i>  | <i>subcapitata</i>  | .          | .                | .             | .     | Vegetative | 0.25                      | 0.16                                    |
| 9506                      | <i>Synedra</i>     | <i>ulna</i>         | .          | <i>ulna</i>      | .             | .     | Vegetative | 0.49                      | 0.31                                    |
| 9504                      | <i>Synedra</i>     | <i>tenera</i>       | .          | .                | .             | .     | Vegetative | 1.72                      | 1.10                                    |
| 1331                      | <i>Tabellaria</i>  | <i>fenestrata</i>   | .          | .                | .             | .     | Vegetative | 2.70                      | 1.72                                    |
| 1333                      | <i>Tabellaria</i>  | <i>flocculosa</i>   | .          | .                | .             | .     | Vegetative | 0.25                      | 0.16                                    |
| TOTALS Bacillariophyta    |                    |                     |            |                  |               |       |            | 54.90                     | 35.37                                   |

Division: Chlorophyta

- ☒ = Identification is uncertain  
\* = Family level identification

040004-141

|                    |                       |                    |   |   |   |                 |            |       |       |
|--------------------|-----------------------|--------------------|---|---|---|-----------------|------------|-------|-------|
| 2035               | <i>Ankistrodesmus</i> | <i>convolutus</i>  | . | . | . | .               | Vegetative | 0.25  | 0.16  |
| 2100               | <i>Chlorococcum</i>   | <i>spp</i>         | . | . | . | .               | Vegetative | 5.39  | 3.44  |
| 8060               | <i>Pleurotaenium</i>  | <i>spp</i>         | . | . | . | .               | Vegetative | 0.25  | 0.16  |
| 8451               | <i>Protoderma</i>     | <i>viride</i>      | . | . | . | .               | Vegetative | 0.25  | 1.88  |
| 2884               | <i>Scenedesmus</i>    | <i>quadricauda</i> | . | . | . | .               | Vegetative | 0.25  | 0.63  |
| TOTALS Chlorophyta |                       |                    |   |   |   |                 |            | 6.37  | 6.26  |
| <hr/>              |                       |                    |   |   |   |                 |            |       |       |
| Division:          | Cryptophyta           |                    |   |   |   |                 |            |       |       |
| 3015               | <i>Cryptomonas</i>    | <i>erosa</i>       | . | . | . | .               | Vegetative | 1.47  | 0.94  |
| TOTALS Cryptophyta |                       |                    |   |   |   |                 |            | 1.47  | 0.94  |
| <hr/>              |                       |                    |   |   |   |                 |            |       |       |
| Division:          | Cyanophyta            |                    |   |   |   |                 |            |       |       |
| 4050               | <i>Aphanocapsa</i>    | <i>spp</i>         | . | . | . | .               | Vegetative | 1.96  | 25.04 |
| 4060               | <i>Aphanothece</i>    | <i>spp</i>         | . | . | . | .               | Vegetative | 0.49  | 3.13  |
| 4150               | <i>Lyngbya</i>        | <i>spp</i>         | . | . | . | .               | Vegetative | 0.49  | 6.26  |
| 4170               | <i>Oscillatoria</i>   | <i>spp</i>         | . | . | . | .               | Vegetative | 0.25  | 1.25  |
| 4321               | <i>Synechococcus</i>  | <i>elongatus</i>   | . | . | . | .               | Vegetative | 7.35  | 4.69  |
| 4323               | <i>Synechococcus</i>  | <i>sp. 1</i>       | . | . | . | < 1um ovoid     | Vegetative | 2.70  | 1.72  |
| 4285               | <i>Synechocystis</i>  | <i>spp</i>         | . | . | . | >1 um spherical | Vegetative | 13.97 | 8.92  |
| 4660               | <i>Synechocystis</i>  | <i>spp</i>         | . | . | . | .               | Vegetative | 10.05 | 6.42  |
| TOTALS Cyanophyta  |                       |                    |   |   |   |                 |            | 37.25 | 57.43 |

☒ = Identification is uncertain

\* = Family level identification

040004-141

Monday, January 17, 2005

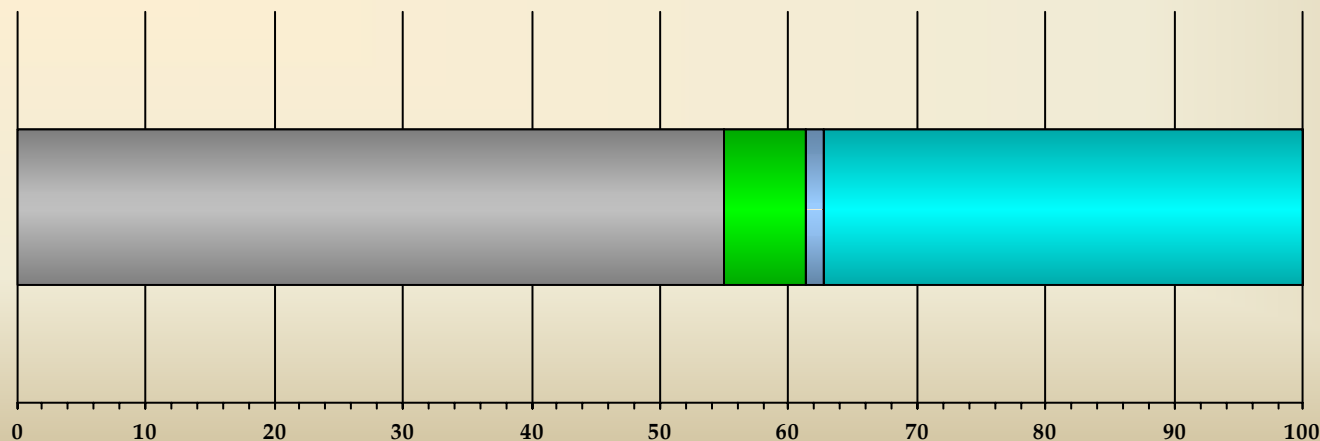
Page 12 of 26

# Summary Graphics

Total Sample Concentration  
100.00

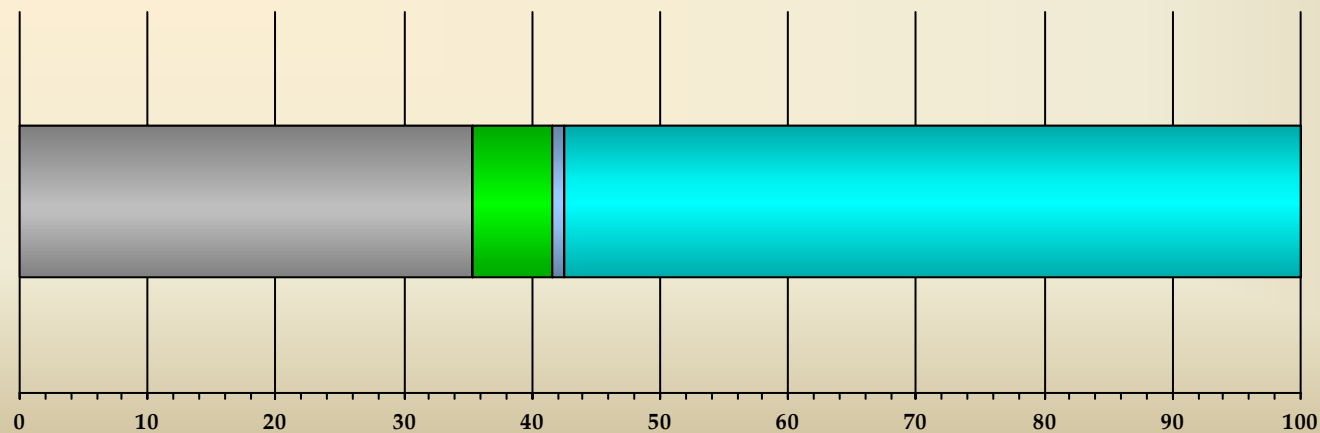
Total Sample Cell Concentration  
100.00

Sample Relative Concentration



- Bacillariophyta
- Chloromonadophyta
- Chlorophyta
- Chrysophyta
- Cryptophyta
- Cyanophyta
- Euglenophyta
- Haptophyta
- Miscellaneous
- Phaeophyta
- Pyrrhophyta
- Rhodophyta
- Xanthophyta

Sample Relative Cell Concentration



- Bacillariophyta
- Chloromonadophyta
- Chlorophyta
- Chrysophyta
- Cryptophyta
- Cyanophyta
- Euglenophyta
- Haptophyta
- Miscellaneous
- Phaeophyta
- Pyrrhophyta
- Rhodophyta
- Xanthophyta

☐ = Identification is uncertain

\* = Family level identification

040004-141

Monday, January 17, 2005

Page 13 of 26

Tracking Code: 040005-141  
 Customer ID: 141  
 Job Number: 1  
 System Name: Salmon Trout River

Sample ID .  
 Sample Date: 8/4/2004  
 Station: 3  
 Site: NW Road

Replicate # 1  
 Level .  
 Depth 0  
 Preservative Glutaraldehyde

Report Notes .

| Taxa Id                          | Genus             | Species              | Subspecies            | Variety          | Form          | Morph | Structure  | Relative<br>Concentration | Relative<br>Algal Cell<br>Concentration |
|----------------------------------|-------------------|----------------------|-----------------------|------------------|---------------|-------|------------|---------------------------|-----------------------------------------|
| <b>Division: Bacillariophyta</b> |                   |                      |                       |                  |               |       |            |                           |                                         |
| 9761                             | <i>Achnanthes</i> | <i>lanceolata</i>    | <i>frequentissima</i> | .                | .             | .     | Vegetative | 0.43                      | 0.22                                    |
| 1019                             | <i>Achnanthes</i> | <i>lanceolata</i>    | .                     | <i>apiculata</i> | .             | .     | Vegetative | 0.22                      | 0.11                                    |
| 1013                             | <i>Achnanthes</i> | <i>minutissima</i>   | .                     | .                | .             | .     | Vegetative | 12.99                     | 6.63                                    |
| 9454                             | <i>Achnanthes</i> | <i>subatomoides</i>  | .                     | .                | .             | .     | Vegetative | 0.22                      | 0.11                                    |
| 1343                             | <i>Amphora</i>    | <i>pediculus</i>     | .                     | .                | .             | .     | Vegetative | 0.65                      | 0.33                                    |
| 9212                             | <i>Cocconeis</i>  | <i>placentula</i>    | .                     | <i>lineata</i>   | .             | .     | Vegetative | 2.38                      | 1.22                                    |
| 1095                             | <i>Cymbella</i>   | <i>silesiaca</i>     | .                     | .                | .             | .     | Vegetative | 0.22                      | 0.11                                    |
| 1104                             | <i>Diatoma</i>    | <i>mesodon</i>       | .                     | .                | .             | .     | Vegetative | 0.22                      | 0.11                                    |
| 1132                             | <i>Diploneis</i>  | <i>puella</i>        | .                     | .                | .             | .     | Vegetative | 0.43                      | 0.22                                    |
| 9045                             | <i>Fragilaria</i> | <i>construens</i>    | .                     | .                | <i>venter</i> | .     | Vegetative | 1.73                      | 0.88                                    |
| 9038                             | <i>Fragilaria</i> | <i>pinnata</i>       | .                     | <i>pinnata</i>   | .             | .     | Vegetative | 0.22                      | 0.11                                    |
| 1155                             | <i>Fragilaria</i> | <i>leptostauron</i>  | .                     | .                | .             | .     | Vegetative | 1.08                      | 0.55                                    |
| 1165                             | <i>Gomphonema</i> | <i>acuminatum</i>    | .                     | .                | .             | .     | Vegetative | 0.22                      | 0.11                                    |
| 1201                             | <i>Meridion</i>   | <i>circulare</i>     | .                     | .                | .             | .     | Vegetative | 0.22                      | 0.11                                    |
| 9458                             | <i>Navicula</i>   | <i>cf.</i>           | .                     | .                | .             | .     | Vegetative | 0.43                      | 0.22                                    |
| 1214                             | <i>Navicula</i>   | <i>cryptocephala</i> | .                     | .                | .             | .     | Vegetative | 0.22                      | 0.11                                    |
| 9072                             | <i>Navicula</i>   | <i>cryptotenella</i> | .                     | .                | .             | .     | Vegetative | 0.22                      | 0.11                                    |
| 9305                             | <i>Navicula</i>   | <i>decussis</i>      | .                     | <i>decussis</i>  | .             | .     | Vegetative | 0.22                      | 0.11                                    |
| 10681                            | <i>Navicula</i>   | <i>ignota</i>        | .                     | <i>palustris</i> | .             | .     | Vegetative | 0.22                      | 0.11                                    |
| 9101                             | <i>Navicula</i>   | <i>subminuscula</i>  | .                     | .                | .             | .     | Vegetative | 0.65                      | 0.33                                    |
| 9223                             | <i>Navicula</i>   | <i>viridula</i>      | .                     | <i>linearis</i>  | .             | .     | Vegetative | 0.65                      | 0.33                                    |
| 9123                             | <i>Nitzschia</i>  | <i>palea</i>         | .                     | .                | .             | .     | Vegetative | 0.22                      | 0.11                                    |
| 9113                             | <i>Nitzschia</i>  | <i>dissipata</i>     | .                     | .                | .             | .     | Vegetative | 0.22                      | 0.11                                    |

☒ = Identification is uncertain

\* = Family level identification

040005-141

Monday, January 17, 2005

Page 14 of 26

|                                          |                      |                     |   |   |   |                 |            |                           |                    |
|------------------------------------------|----------------------|---------------------|---|---|---|-----------------|------------|---------------------------|--------------------|
| 1222                                     | <i>Nitzschia</i>     | <i>gracilis</i>     | . | . | . | .               | Vegetative | 0.22                      | 0.11               |
| 1814                                     | <i>Pinnularia</i>    | <i>microstauron</i> | . | . | . | .               | Vegetative | 0.22                      | 0.11               |
| 1315                                     | <i>Synedra</i>       | <i>ulna</i>         | . | . | . | .               | Vegetative | 0.22                      | 0.11               |
| <b>TOTALS Bacillariophyta</b>            |                      |                     |   |   |   |                 |            | <b>24.89</b>              | <b>12.70</b>       |
| <hr/>                                    |                      |                     |   |   |   |                 |            |                           |                    |
| <b>Division:</b>                         | <b>Chlorophyta</b>   |                     |   |   |   |                 |            |                           |                    |
| <input checked="" type="checkbox"/> 2100 | <i>Chlorococcum</i>  | <i>spp</i>          | . | . | . | .               | Vegetative | 0.65                      | 0.33               |
| <hr/>                                    |                      |                     |   |   |   |                 |            | <b>TOTALS Chlorophyta</b> | <b>0.65 0.33</b>   |
| <hr/>                                    |                      |                     |   |   |   |                 |            |                           |                    |
| <b>Division:</b>                         | <b>Cyanophyta</b>    |                     |   |   |   |                 |            |                           |                    |
| 4010                                     | <i>Anabaena</i>      | <i>spp</i>          | . | . | . | .               | Vegetative | 1.30                      | 14.58              |
| 4050                                     | <i>Aphanocapsa</i>   | <i>spp</i>          | . | . | . | .               | Vegetative | 3.25                      | 18.83              |
| 4060                                     | <i>Aphanothece</i>   | <i>spp</i>          | . | . | . | .               | Vegetative | 0.43                      | 4.20               |
| 4220                                     | <i>Chamaesiphon</i>  | <i>spp</i>          | . | . | . | .               | Vegetative | 8.23                      | 4.20               |
| 4150                                     | <i>Lyngbya</i>       | <i>spp</i>          | . | . | . | .               | Vegetative | 0.65                      | 1.66               |
| 4170                                     | <i>Oscillatoria</i>  | <i>spp</i>          | . | . | . | .               | Vegetative | 0.87                      | 9.98               |
| 4194                                     | <i>Phormidium</i>    | <i>fragile</i>      | . | . | . | .               | Vegetative | 2.38                      | 4.25               |
| 107397                                   | <i>Synechococcus</i> | <i>aeruginosa</i>   | . | . | . | .               | Vegetative | 0.65                      | 0.33               |
| 4321                                     | <i>Synechococcus</i> | <i>elongatus</i>    | . | . | . | .               | Vegetative | 13.64                     | 6.96               |
| 4323                                     | <i>Synechococcus</i> | <i>sp. 1</i>        | . | . | . | < 1um ovoid     | Vegetative | 1.52                      | 0.77               |
| 4285                                     | <i>Synechocystis</i> | <i>spp</i>          | . | . | . | >1 um spherical | Vegetative | 18.83                     | 9.61               |
| 4660                                     | <i>Synechocystis</i> | <i>spp</i>          | . | . | . | .               | Vegetative | 22.73                     | 11.60              |
| <hr/>                                    |                      |                     |   |   |   |                 |            | <b>TOTALS Cyanophyta</b>  | <b>74.46 86.97</b> |
| <hr/>                                    |                      |                     |   |   |   |                 |            |                           |                    |

☒ = Identification is uncertain

\* = Family level identification

040005-141

Monday, January 17, 2005

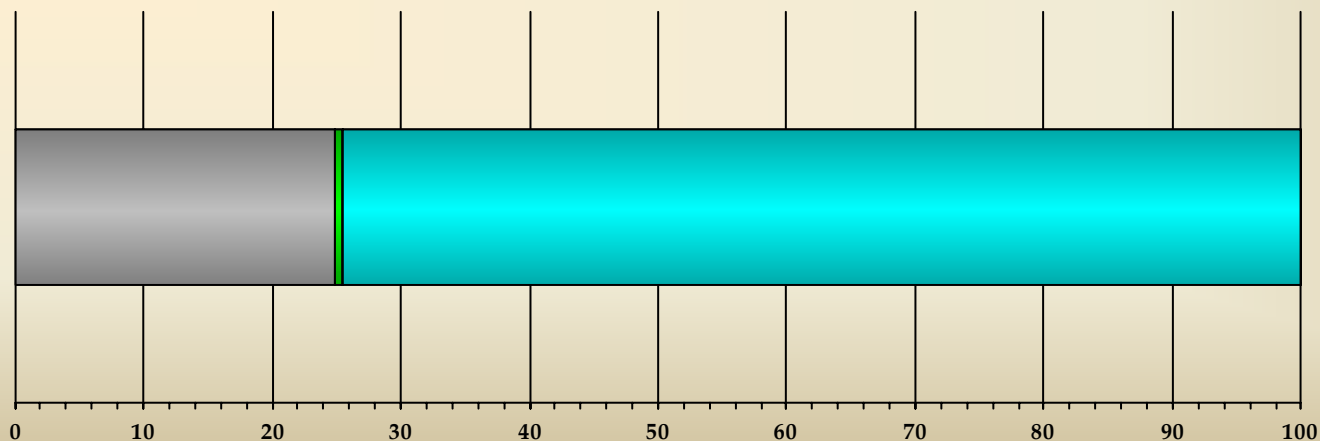
Page 15 of 26

# Summary Graphics

Total Sample Concentration  
100.00

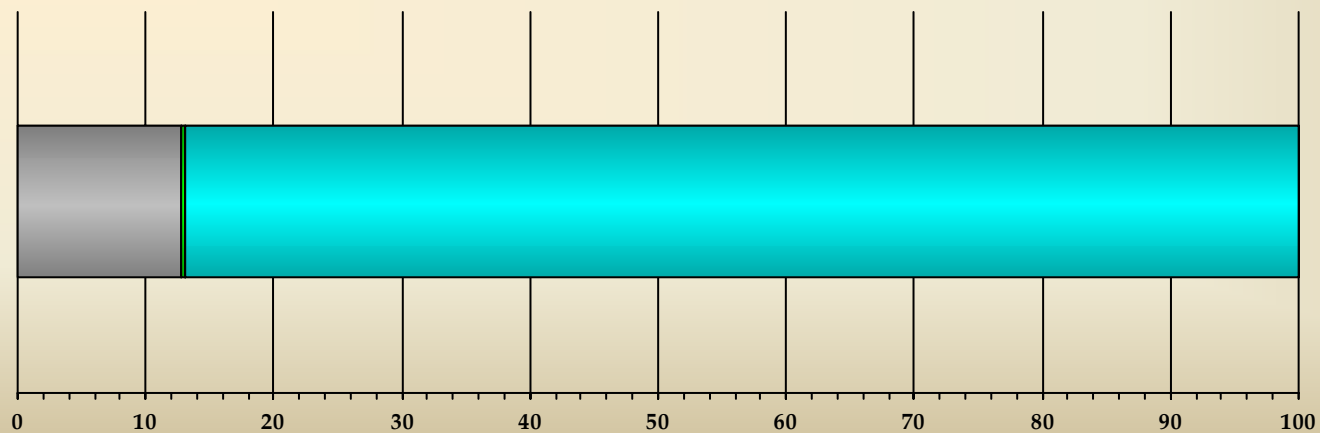
Total Sample Cell Concentration  
100.00

Sample Relative Concentration



- Bacillariophyta
- Chloromonadophyta
- Chlorophyta
- Chrysophyta
- Cryptophyta
- Cyanophyta
- Euglenophyta
- Haptophyta
- Miscellaneous
- Phaeophyta
- Pyrrhophyta
- Rhodophyta
- Xanthophyta

Sample Relative Cell Concentration



- Bacillariophyta
- Chloromonadophyta
- Chlorophyta
- Chrysophyta
- Cryptophyta
- Cyanophyta
- Euglenophyta
- Haptophyta
- Miscellaneous
- Phaeophyta
- Pyrrhophyta
- Rhodophyta
- Xanthophyta

☑ = Identification is uncertain

\* = Family level identification

040005-141

Monday, January 17, 2005

Page 16 of 26

Tracking Code: 040006-141  
 Customer ID: 141  
 Job Number: 1  
 System Name: Yellow Dog River

Sample ID .  
 Sample Date: 8/3/2004  
 Station: 2  
 Site: AAA Road

Replicate # 1  
 Level .  
 Depth 0  
 Preservative Glutaraldehyde

Report Notes .

| Taxa Id                          | Genus              | Species             | Subspecies | Variety           | Form           | Morph | Structure  | Relative<br>Concentration | Relative<br>Algal Cell<br>Concentration |
|----------------------------------|--------------------|---------------------|------------|-------------------|----------------|-------|------------|---------------------------|-----------------------------------------|
| <b>Division: Bacillariophyta</b> |                    |                     |            |                   |                |       |            |                           |                                         |
| 9013                             | <i>Achnanthes</i>  | <i>bioretii</i>     | .          | .                 | .              | .     | Vegetative | 0.25                      | 0.13                                    |
| 9341                             | <i>Achnanthes</i>  | <i>linearis</i>     | .          | .                 | .              | .     | Vegetative | 0.50                      | 0.26                                    |
| 1013                             | <i>Achnanthes</i>  | <i>minutissima</i>  | .          | .                 | .              | .     | Vegetative | 19.25                     | 9.99                                    |
| 9454                             | <i>Achnanthes</i>  | <i>subatomoides</i> | .          | .                 | .              | .     | Vegetative | 0.25                      | 0.13                                    |
| 9141                             | <i>Anomoeoneis</i> | <i>vitrea</i>       | .          | .                 | <i>costata</i> | .     | Vegetative | 0.25                      | 0.13                                    |
| 1434                             | <i>Aulacoseira</i> | <i>italica</i>      | .          | .                 | .              | .     | Vegetative | 0.25                      | 0.13                                    |
| 1095                             | <i>Cymbella</i>    | <i>silesiaca</i>    | .          | .                 | .              | .     | Vegetative | 3.00                      | 1.56                                    |
| 9695                             | <i>Diploneis</i>   | <i>finnica</i>      | .          | .                 | .              | .     | Vegetative | 0.50                      | 0.26                                    |
| 109221                           | <i>Eunotia</i>     | <i>flexuosa</i>     | .          | .                 | .              | .     | Vegetative | 1.00                      | 0.52                                    |
| 9389                             | <i>Eunotia</i>     | <i>pirla</i>        | .          | .                 | .              | .     | Vegetative | 0.75                      | 0.39                                    |
| 9383                             | <i>Eunotia</i>     | <i>praerupta</i>    | .          | <i>praerupta</i>  | .              | .     | Vegetative | 0.25                      | 0.13                                    |
| 9397                             | <i>Fragilaria</i>  | <i>capucina</i>     | .          | <i>vaucheriae</i> | .              | .     | Vegetative | 3.50                      | 1.82                                    |
| 1157                             | <i>Fragilaria</i>  | <i>brevistriata</i> | .          | .                 | .              | .     | Vegetative | 0.25                      | 0.13                                    |
| 9045                             | <i>Fragilaria</i>  | <i>construens</i>   | .          | .                 | <i>venter</i>  | .     | Vegetative | 3.50                      | 1.82                                    |
| 9395                             | <i>Fragilaria</i>  | <i>capucina</i>     | .          | <i>gracilis</i>   | .              | .     | Vegetative | 5.25                      | 2.72                                    |
| 1161                             | <i>Gomphonema</i>  | <i>parvulum</i>     | .          | .                 | .              | .     | Vegetative | 0.25                      | 0.13                                    |
| 1165                             | <i>Gomphonema</i>  | <i>acuminatum</i>   | .          | .                 | .              | .     | Vegetative | 0.25                      | 0.13                                    |
| 9223                             | <i>Navicula</i>    | <i>viridula</i>     | .          | <i>linearis</i>   | .              | .     | Vegetative | 0.25                      | 0.13                                    |
| 9101                             | <i>Navicula</i>    | <i>subminuscula</i> | .          | .                 | .              | .     | Vegetative | 0.25                      | 0.13                                    |
| 9113                             | <i>Nitzschia</i>   | <i>dissipata</i>    | .          | .                 | .              | .     | Vegetative | 0.25                      | 0.13                                    |
| 1817                             | <i>Pinnularia</i>  | <i>subcapitata</i>  | .          | .                 | .              | .     | Vegetative | 0.25                      | 0.13                                    |
| 1814                             | <i>Pinnularia</i>  | <i>microstauron</i> | .          | .                 | .              | .     | Vegetative | 0.25                      | 0.13                                    |
| 1240                             | <i>Pinnularia</i>  | <i>spp</i>          | .          | .                 | .              | .     | Vegetative | 0.25                      | 0.13                                    |

☒ = Identification is uncertain

\* = Family level identification

040006-141

Monday, January 17, 2005

Page 17 of 26

|                                          |                        |                   |   |             |   |                 |            |                           |                    |
|------------------------------------------|------------------------|-------------------|---|-------------|---|-----------------|------------|---------------------------|--------------------|
| 9506                                     | <i>Synedra</i>         | <i>ulna</i>       | . | <i>ulna</i> | . | .               | Vegetative | 0.25                      | 0.13               |
| <input checked="" type="checkbox"/> 9504 | <i>Synedra</i>         | <i>tenera</i>     | . | .           | . | .               | Vegetative | 1.25                      | 0.65               |
| 1333                                     | <i>Tabellaria</i>      | <i>flocculosa</i> | . | .           | . | .               | Vegetative | 1.50                      | 0.78               |
| <b>TOTALS Bacillariophyta</b>            |                        |                   |   |             |   |                 |            | <b>43.75</b>              | <b>22.71</b>       |
| <hr/>                                    |                        |                   |   |             |   |                 |            |                           |                    |
| <b>Division:</b>                         | <b>Chlorophyta</b>     |                   |   |             |   |                 |            |                           |                    |
| 2100                                     | <i>Chlorococcum</i>    | <i>spp</i>        | . | .           | . | .               | Vegetative | 0.75                      | 0.39               |
| 2180                                     | <i>Cosmarium</i>       | <i>spp</i>        | . | .           | . | .               | Vegetative | 0.25                      | 0.13               |
| 8308                                     | <i>Scenedesmus</i>     | <i>serratus</i>   | . | .           | . | .               | Vegetative | 0.25                      | 0.26               |
| <hr/>                                    |                        |                   |   |             |   |                 |            | <b>TOTALS Chlorophyta</b> | <b>1.25 0.78</b>   |
| <hr/>                                    |                        |                   |   |             |   |                 |            |                           |                    |
| <b>Division:</b>                         | <b>Cyanophyta</b>      |                   |   |             |   |                 |            |                           |                    |
| 4050                                     | <i>Aphanocapsa</i>     | <i>spp</i>        | . | .           | . | .               | Vegetative | 0.75                      | 7.01               |
| 4220                                     | <i>Chamaesiphon</i>    | <i>spp</i>        | . | .           | . | .               | Vegetative | 5.00                      | 2.60               |
| 4150                                     | <i>Lyngbya</i>         | <i>spp</i>        | . | .           | . | .               | Vegetative | 3.00                      | 38.49              |
| 4194                                     | <i>Phormidium</i>      | <i>fragile</i>    | . | .           | . | .               | Vegetative | 1.00                      | 2.08               |
| 4463                                     | <i>Pseudanabaena</i>   | <i>galeata</i>    | . | .           | . | .               | Vegetative | 0.25                      | 0.52               |
| 4321                                     | <i>Synechococcus</i>   | <i>elongatus</i>  | . | .           | . | .               | Vegetative | 6.75                      | 3.50               |
| 107397                                   | <i>Synechococcus</i>   | <i>aeruginosa</i> | . | .           | . | .               | Vegetative | 3.25                      | 1.69               |
| 4323                                     | <i>Synechococcus</i>   | <i>sp. 1</i>      | . | .           | . | < 1um ovoid     | Vegetative | 0.25                      | 0.13               |
| 4285                                     | <i>Synechocystis</i>   | <i>spp</i>        | . | .           | . | >1 um spherical | Vegetative | 21.75                     | 11.29              |
| 4660                                     | <i>Synechocystis</i>   | <i>spp</i>        | . | .           | . | .               | Vegetative | 12.50                     | 6.49               |
| <hr/>                                    |                        |                   |   |             |   |                 |            | <b>TOTALS Cyanophyta</b>  | <b>54.50 73.79</b> |
| <hr/>                                    |                        |                   |   |             |   |                 |            |                           |                    |
| <b>Division:</b>                         | <b>Pyrrhophyta</b>     |                   |   |             |   |                 |            |                           |                    |
| 6032                                     | <i>Gymnodinium</i>     | <i>sp. 1</i>      | . | .           | . | .               | Vegetative | 0.25                      | 0.13               |
| <hr/>                                    |                        |                   |   |             |   |                 |            | <b>TOTALS Pyrrhophyta</b> | <b>0.25 0.13</b>   |
| <hr/>                                    |                        |                   |   |             |   |                 |            |                           |                    |
| <b>Division:</b>                         | <b>Rhodophyta</b>      |                   |   |             |   |                 |            |                           |                    |
| 10741                                    | <i>Batrachospermum</i> | <i>vagum</i>      | . | .           | . | .               | Vegetative | 0.25                      | 2.60               |
| <hr/>                                    |                        |                   |   |             |   |                 |            | <b>TOTALS Rhodophyta</b>  | <b>0.25 2.60</b>   |
| <hr/>                                    |                        |                   |   |             |   |                 |            |                           |                    |

☒ = Identification is uncertain

\* = Family level identification

040006-141

Monday, January 17, 2005

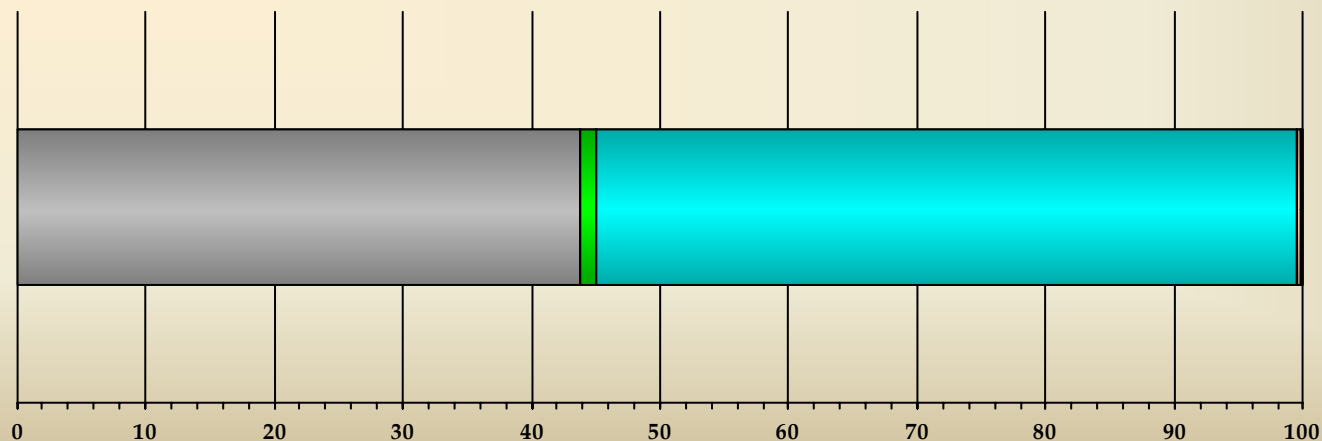
Page 18 of 26

# Summary Graphics

Total Sample Concentration  
100.00

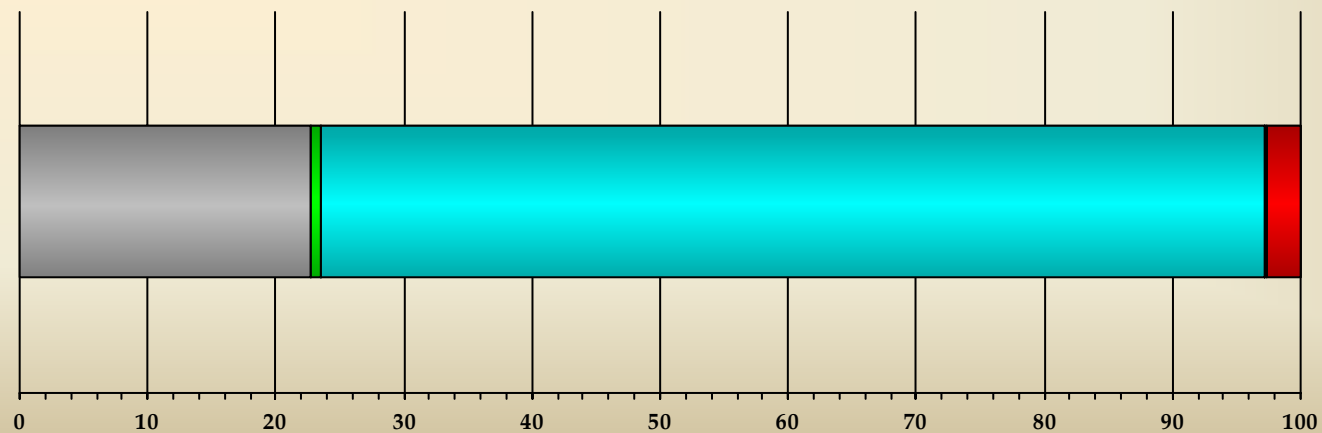
Total Sample Cell Concentration  
100.00

Sample Relative Concentration



- Bacillariophyta
- Chloromonadophyta
- Chlorophyta
- Chrysophyta
- Cryptophyta
- Cyanophyta
- Euglenophyta
- Haptophyta
- Miscellaneous
- Phaeophyta
- Pyrrhophyta
- Rhodophyta
- Xanthophyta

Sample Relative Cell Concentration



- Bacillariophyta
- Chloromonadophyta
- Chlorophyta
- Chrysophyta
- Cryptophyta
- Cyanophyta
- Euglenophyta
- Haptophyta
- Miscellaneous
- Phaeophyta
- Pyrrhophyta
- Rhodophyta
- Xanthophyta

☑ = Identification is uncertain

\* = Family level identification

040006-141

Monday, January 17, 2005

Page 19 of 26

Tracking Code: 040007-141  
 Customer ID: 141  
 Job Number: 1  
 System Name: Yellow Dog River

Sample ID .  
 Sample Date: 8/4/2004  
 Station: 1  
 Site: CR510

Replicate # 1  
 Level .  
 Depth 0  
 Preservative Glutaraldehyde

Report Notes .

| Taxa Id                                   | Genus              | Species              | Subspecies            | Variety              | Form           | Morph | Structure  | Relative<br>Concentration | Relative<br>Algal Cell<br>Concentration |
|-------------------------------------------|--------------------|----------------------|-----------------------|----------------------|----------------|-------|------------|---------------------------|-----------------------------------------|
| <b>Division: Bacillariophyta</b>          |                    |                      |                       |                      |                |       |            |                           |                                         |
| 9761                                      | <i>Achnanthes</i>  | <i>lanceolata</i>    | <i>frequentissima</i> | .                    | .              | .     | Vegetative | 0.24                      | 0.04                                    |
| <input checked="" type="checkbox"/> 10939 | <i>Achnanthes</i>  | <i>laevis</i>        | .                     | .                    | .              | .     | Vegetative | 1.45                      | 0.26                                    |
| 4275                                      | <i>Achnanthes</i>  | <i>flexella</i>      | .                     | .                    | .              | .     | Vegetative | 0.24                      | 0.04                                    |
| 1176                                      | <i>Achnanthes</i>  | <i>biasolettiana</i> | .                     | <i>biasolettiana</i> | .              | .     | Vegetative | 0.24                      | 0.04                                    |
| 1013                                      | <i>Achnanthes</i>  | <i>minutissima</i>   | .                     | .                    | .              | .     | Vegetative | 8.72                      | 1.59                                    |
| 9454                                      | <i>Achnanthes</i>  | <i>subatomoides</i>  | .                     | .                    | .              | .     | Vegetative | 0.24                      | 0.04                                    |
| 9341                                      | <i>Achnanthes</i>  | <i>linearis</i>      | .                     | .                    | .              | .     | Vegetative | 0.48                      | 0.09                                    |
| 1771                                      | <i>Amphipleura</i> | <i>pellucida</i>     | .                     | .                    | .              | .     | Vegetative | 0.24                      | 0.04                                    |
| 1343                                      | <i>Amphora</i>     | <i>pediculus</i>     | .                     | .                    | .              | .     | Vegetative | 0.97                      | 0.18                                    |
| 9141                                      | <i>Anomoeoneis</i> | <i>vitrea</i>        | .                     | .                    | <i>costata</i> | .     | Vegetative | 1.21                      | 0.22                                    |
| <input checked="" type="checkbox"/> 1434  | <i>Aulacoseira</i> | <i>italica</i>       | .                     | .                    | .              | .     | Vegetative | 0.24                      | 0.13                                    |
| 9212                                      | <i>Cocconeis</i>   | <i>placentula</i>    | .                     | <i>lineata</i>       | .              | .     | Vegetative | 4.12                      | 0.75                                    |
| 1119                                      | <i>Cymbella</i>    | <i>sinuata</i>       | .                     | .                    | .              | .     | Vegetative | 0.73                      | 0.13                                    |
| 1865                                      | <i>Cymbella</i>    | <i>amphicephala</i>  | .                     | .                    | .              | .     | Vegetative | 0.24                      | 0.04                                    |
| 1091                                      | <i>Cymbella</i>    | <i>microcephala</i>  | .                     | .                    | .              | .     | Vegetative | 0.24                      | 0.04                                    |
| 1096                                      | <i>Cymbella</i>    | <i>tumida</i>        | .                     | .                    | .              | .     | Vegetative | 0.24                      | 0.04                                    |
| 1095                                      | <i>Cymbella</i>    | <i>silesiaca</i>     | .                     | .                    | .              | .     | Vegetative | 0.24                      | 0.04                                    |
| 1155                                      | <i>Fragilaria</i>  | <i>leptostauron</i>  | .                     | .                    | .              | .     | Vegetative | 0.24                      | 0.04                                    |
| 9045                                      | <i>Fragilaria</i>  | <i>construens</i>    | .                     | .                    | <i>venter</i>  | .     | Vegetative | 0.24                      | 0.04                                    |
| 9395                                      | <i>Fragilaria</i>  | <i>capucina</i>      | .                     | <i>gracilis</i>      | .              | .     | Vegetative | 0.24                      | 0.04                                    |
| 1371                                      | <i>Frustulia</i>   | <i>rhomboides</i>    | .                     | .                    | .              | .     | Vegetative | 0.48                      | 0.09                                    |
| 1164                                      | <i>Gomphonema</i>  | <i>gracile</i>       | .                     | .                    | .              | .     | Vegetative | 0.24                      | 0.04                                    |
| 9223                                      | <i>Navicula</i>    | <i>viridula</i>      | .                     | <i>linearis</i>      | .              | .     | Vegetative | 0.24                      | 0.04                                    |

☒ = Identification is uncertain

\* = Family level identification

040007-141

Monday, January 17, 2005

Page 20 of 26

|                        |                   |                      |   |                 |   |   |            |       |      |
|------------------------|-------------------|----------------------|---|-----------------|---|---|------------|-------|------|
| 9101                   | <i>Navicula</i>   | <i>subminuscula</i>  | . | .               | . | . | Vegetative | 0.73  | 0.13 |
| 9072                   | <i>Navicula</i>   | <i>cryptotenella</i> | . | .               | . | . | Vegetative | 0.48  | 0.09 |
| 9305                   | <i>Navicula</i>   | <i>decussis</i>      | . | <i>decussis</i> | . | . | Vegetative | 0.24  | 0.04 |
| 9236                   | <i>Nitzschia</i>  | <i>constricta</i>    | . | .               | . | . | Vegetative | 0.24  | 0.04 |
| 9118                   | <i>Nitzschia</i>  | <i>linearis</i>      | . | .               | . | . | Vegetative | 0.24  | 0.04 |
| 9123                   | <i>Nitzschia</i>  | <i>palea</i>         | . | .               | . | . | Vegetative | 0.24  | 0.04 |
| 1817                   | <i>Pinnularia</i> | <i>subcapitata</i>   | . | .               | . | . | Vegetative | 0.24  | 0.04 |
| TOTALS Bacillariophyta |                   |                      |   |                 |   |   |            | 24.21 | 4.49 |

**Division: Chlorophyta**

|                    |                     |            |   |   |   |   |            |      |      |
|--------------------|---------------------|------------|---|---|---|---|------------|------|------|
| 2100               | <i>Chlorococcum</i> | <i>spp</i> | . | . | . | . | Vegetative | 0.48 | 0.09 |
| 2950               | <i>Spirogyra</i>    | <i>spp</i> | . | . | . | . | Vegetative | 0.24 | 0.18 |
| TOTALS Chlorophyta |                     |            |   |   |   |   |            | 0.73 | 0.26 |

**Division: Cyanophyta**

|                   |                      |                   |   |   |   |                 |            |       |       |
|-------------------|----------------------|-------------------|---|---|---|-----------------|------------|-------|-------|
| 4010              | <i>Anabaena</i>      | <i>spp</i>        | . | . | . | .               | Vegetative | 0.48  | 0.26  |
| 4050              | <i>Aphanocapsa</i>   | <i>spp</i>        | . | . | . | .               | Vegetative | 0.24  | 1.32  |
| 4060              | <i>Aphanothece</i>   | <i>spp</i>        | . | . | . | .               | Vegetative | 0.97  | 1.15  |
| 4220              | <i>Chamaesiphon</i>  | <i>spp</i>        | . | . | . | .               | Vegetative | 0.73  | 2.29  |
| ☑ 4141            | <i>Gloeotheca</i>    | <i>rupestris</i>  | . | . | . | .               | Vegetative | 0.48  | 0.44  |
| 4150              | <i>Lyngbya</i>       | <i>spp</i>        | . | . | . | .               | Vegetative | 4.36  | 9.52  |
| 4169              | <i>Merismopedia</i>  | <i>elegans</i>    | . | . | . | .               | Vegetative | 0.24  | 1.41  |
| 4170              | <i>Oscillatoria</i>  | <i>spp</i>        | . | . | . | .               | Vegetative | 9.20  | 65.19 |
| 4463              | <i>Pseudanabaena</i> | <i>galeata</i>    | . | . | . | .               | Vegetative | 1.94  | 1.94  |
| 107397            | <i>Synechococcus</i> | <i>aeruginosa</i> | . | . | . | .               | Vegetative | 2.42  | 0.44  |
| 4321              | <i>Synechococcus</i> | <i>elongatus</i>  | . | . | . | .               | Vegetative | 23.00 | 4.19  |
| 4323              | <i>Synechococcus</i> | <i>sp. 1</i>      | . | . | . | < 1um ovoid     | Vegetative | 3.87  | 0.71  |
| 4285              | <i>Synechocystis</i> | <i>spp</i>        | . | . | . | >1 um spherical | Vegetative | 10.90 | 1.98  |
| 4660              | <i>Synechocystis</i> | <i>spp</i>        | . | . | . | .               | Vegetative | 15.98 | 2.91  |
| TOTALS Cyanophyta |                      |                   |   |   |   |                 |            | 74.82 | 93.74 |

**Division: Rhodophyta**

|                   |                        |              |   |   |   |   |            |      |      |
|-------------------|------------------------|--------------|---|---|---|---|------------|------|------|
| 10741             | <i>Batrachospermum</i> | <i>vagum</i> | . | . | . | . | Vegetative | 0.24 | 1.50 |
| TOTALS Rhodophyta |                        |              |   |   |   |   |            | 0.24 | 1.50 |

☑ = Identification is uncertain

\* = Family level identification

040007-141

Monday, January 17, 2005

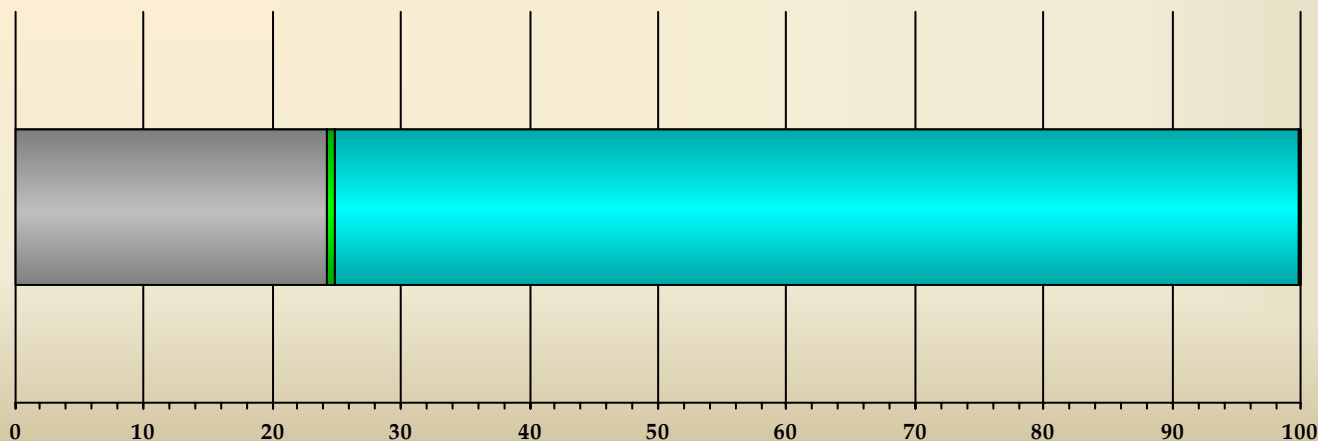
Page 21 of 26

# Summary Graphics

Total Sample Concentration  
100.00

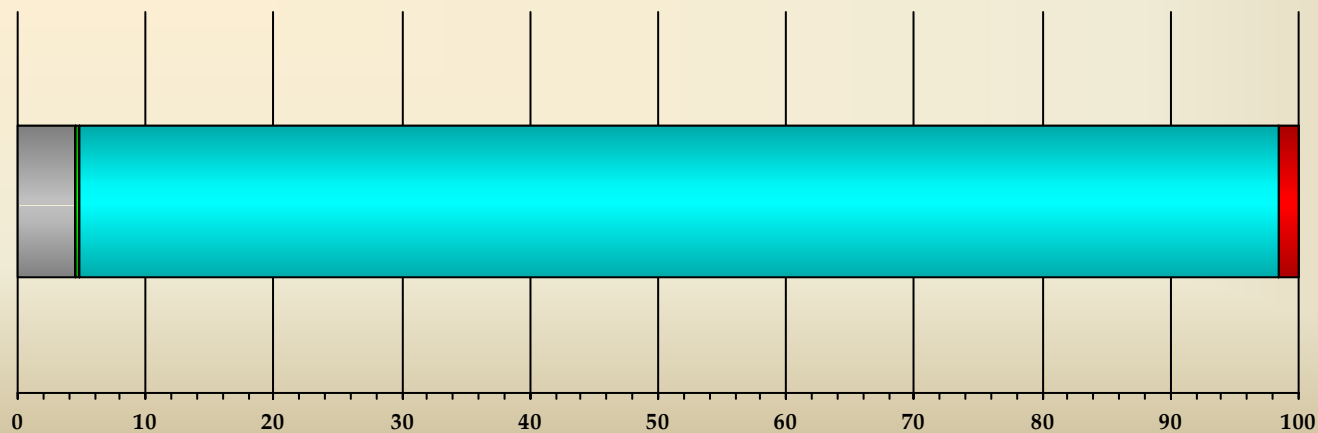
Total Sample Cell Concentration  
100.00

Sample Relative Concentration



- Bacillariophyta
- Chloromonadophyta
- Chlorophyta
- Chrysophyta
- Cryptophyta
- Cyanophyta
- Euglenophyta
- Haptophyta
- Miscellaneous
- Phaeophyta
- Pyrrhophyta
- Rhodophyta
- Xanthophyta

Sample Relative Cell Concentration



- Bacillariophyta
- Chloromonadophyta
- Chlorophyta
- Chrysophyta
- Cryptophyta
- Cyanophyta
- Euglenophyta
- Haptophyta
- Miscellaneous
- Phaeophyta
- Pyrrhophyta
- Rhodophyta
- Xanthophyta

☐ = Identification is uncertain

\* = Family level identification

040007-141

Monday, January 17, 2005

Page 22 of 26

## Species List

| Taxa Code                        | Genus              | Species             | Subspecies            | Variety             | Form           | Morph | Structure  | Authority                            |
|----------------------------------|--------------------|---------------------|-----------------------|---------------------|----------------|-------|------------|--------------------------------------|
| <b>Division:</b> Bacillariophyta |                    |                     |                       |                     |                |       |            |                                      |
| 1010                             | <i>Achnanthes</i>  | <i>spp</i>          | .                     | .                   | .              | .     | Vegetative | (Greg.) Hust.                        |
| 1176                             | <i>Achnanthes</i>  | <i>biasoletiana</i> | .                     | <i>biasoletiana</i> | .              | .     | Vegetative | Grunow                               |
| 9013                             | <i>Achnanthes</i>  | <i>bioretii</i>     | .                     | .                   | .              | .     | Vegetative | Germain                              |
| 10304                            | <i>Achnanthes</i>  | <i>clevei</i>       | .                     | <i>clevei</i>       | .              | .     | Vegetative | Grunow                               |
| 9334                             | <i>Achnanthes</i>  | <i>delicatula</i>   | .                     | .                   | .              | .     | Vegetative | (Kutzing) Grunow                     |
| 1178                             | <i>Achnanthes</i>  | <i>exigua</i>       | .                     | .                   | .              | .     | Vegetative | Grunow                               |
| 4275                             | <i>Achnanthes</i>  | <i>flexella</i>     | .                     | .                   | .              | .     | Vegetative | Brun                                 |
| 10939                            | <i>Achnanthes</i>  | <i>laevis</i>       | .                     | .                   | .              | .     | Vegetative | Ostrup                               |
| 1019                             | <i>Achnanthes</i>  | <i>lanceolata</i>   | .                     | <i>apiculata</i>    | .              | .     | Vegetative | Patrick                              |
| 9761                             | <i>Achnanthes</i>  | <i>lanceolata</i>   | <i>frequentissima</i> | .                   | .              | .     | Vegetative | Lange-Bertalot                       |
| 10308                            | <i>Achnanthes</i>  | <i>lanceolata</i>   | <i>robusta</i>        | .                   | .              | .     | Vegetative | ( Hustedt ) Lange-Bertalot           |
| 9341                             | <i>Achnanthes</i>  | <i>linearis</i>     | .                     | .                   | .              | .     | Vegetative | (W. Smith) Grunow                    |
| 1013                             | <i>Achnanthes</i>  | <i>minutissima</i>  | .                     | .                   | .              | .     | Vegetative | Kutzing                              |
| 10305                            | <i>Achnanthes</i>  | <i>oestripii</i>    | .                     | .                   | .              | .     | Vegetative | ( Cleve-Euler ) Hustedt.             |
| 9454                             | <i>Achnanthes</i>  | <i>subatomoides</i> | .                     | .                   | .              | .     | Vegetative | (Hustedt) Lange-Bertalot & Archibald |
| 1771                             | <i>Amphipleura</i> | <i>pellucida</i>    | .                     | .                   | .              | .     | Vegetative | (Kutzing) Kutzing                    |
| 1341                             | <i>Amphora</i>     | <i>ovalis</i>       | .                     | .                   | .              | .     | Vegetative | (Kutzing) Kutzing                    |
| 1343                             | <i>Amphora</i>     | <i>pediculus</i>    | .                     | .                   | .              | .     | Vegetative | ( Kutzing ) Grunow                   |
| 9141                             | <i>Anomoeoneis</i> | <i>vitrea</i>       | .                     | .                   | <i>costata</i> | .     | Vegetative | (Grunow) Ross                        |
| 1434                             | <i>Aulacoseira</i> | <i>italica</i>      | .                     | .                   | .              | .     | Vegetative | (Ehrenb.) Simonsen                   |
| 1000449                          | <i>Cocconeis</i>   | <i>placentula</i>   | .                     | <i>lineata</i>      | .              | .     | Vegetative | (Ehrenb.) Van Heurck                 |
| 9212                             | <i>Cocconeis</i>   | <i>placentula</i>   | .                     | <i>lineata</i>      | .              | .     | Vegetative | (Ehrenb.) Van Heurck                 |
| 1076                             | <i>Cyclotella</i>  | <i>meneghiniana</i> | .                     | .                   | .              | .     | Vegetative | Kutzing                              |
| 1865                             | <i>Cymbella</i>    | <i>amphicephala</i> | .                     | .                   | .              | .     | Vegetative | N.geli                               |
| 1097                             | <i>Cymbella</i>    | <i>amphicephala</i> | .                     | <i>citrus</i>       | .              | .     | Vegetative | (Carter & Bailey-Watts) Krammer      |
| 9371                             | <i>Cymbella</i>    | <i>gracilis</i>     | .                     | .                   | .              | .     | Vegetative | (Ehrenberg) Kutzing                  |
| 1091                             | <i>Cymbella</i>    | <i>microcephala</i> | .                     | .                   | .              | .     | Vegetative | Grunow                               |
| 1095                             | <i>Cymbella</i>    | <i>silesiaca</i>    | .                     | .                   | .              | .     | Vegetative | Bleisch                              |
| 1119                             | <i>Cymbella</i>    | <i>sinuata</i>      | .                     | .                   | .              | .     | Vegetative | Gregory                              |
| 1096                             | <i>Cymbella</i>    | <i>tumida</i>       | .                     | .                   | .              | .     | Vegetative | (Br,b.) Van Heurck                   |
| 1104                             | <i>Diatoma</i>     | <i>mesodon</i>      | .                     | .                   | .              | .     | Vegetative | (Ehrenberg) Kutzing                  |
| 9695                             | <i>Diploneis</i>   | <i>finnica</i>      | .                     | .                   | .              | .     | Vegetative | (Ehrenb.) Cleve                      |
| 1132                             | <i>Diploneis</i>   | <i>puella</i>       | .                     | .                   | .              | .     | Vegetative | (Schum.) Cleve                       |
| 1140                             | <i>Eunotia</i>     | <i>spp</i>          | .                     | .                   | .              | .     | Vegetative | N"rpell-Schempp & Lange-Bert. in L   |
| 1149                             | <i>Eunotia</i>     | <i>bilunaris</i>    | .                     | .                   | .              | .     | Vegetative | (Ehrenberg) Mills                    |
| 109221                           | <i>Eunotia</i>     | <i>flexuosa</i>     | .                     | .                   | .              | .     | Vegetative | Br,b. ex K□tz.                       |

☒ = Identification is uncertain

\* = Family level identification

Monday, January 17, 2005

Page 23 of 26

040007-141

|       |                   |                            |   |                   |                |            |                           |
|-------|-------------------|----------------------------|---|-------------------|----------------|------------|---------------------------|
| 9389  | <i>Eunotia</i>    | <i>pirla</i>               | . | .                 | .              | Vegetative | Carter & Flower           |
| 9383  | <i>Eunotia</i>    | <i>praeurupta</i>          | . | <i>praeurupta</i> | .              | Vegetative | Ehrenberg                 |
| 1150  | <i>Fragilaria</i> | <i>spp</i>                 | . | .                 | .              | Vegetative | Lyngbye                   |
| 1157  | <i>Fragilaria</i> | <i>brevistriata</i>        | . | .                 | .              | Vegetative | Grunow in Van Heurck      |
| 9397  | <i>Fragilaria</i> | <i>capucina</i>            | . | <i>vaucheriae</i> | .              | Vegetative | (Kutzing) Lange-Bertalot  |
| 9395  | <i>Fragilaria</i> | <i>capucina</i>            | . | <i>gracilis</i>   | .              | Vegetative | (ostrup) Hustedt          |
| 10374 | <i>Fragilaria</i> | <i>construens</i>          | . | .                 | <i>binodis</i> | Vegetative | (Ehrenberg) Hustedt       |
| 9045  | <i>Fragilaria</i> | <i>construens</i>          | . | .                 | <i>venter</i>  | Vegetative | (Ehrenberg) Hustedt       |
| 1155  | <i>Fragilaria</i> | <i>leptostauron</i>        | . | .                 | .              | Vegetative | (Ehrenberg) Hustedt       |
| 9038  | <i>Fragilaria</i> | <i>pinnata</i>             | . | <i>pinnata</i>    | .              | Vegetative | Ehrenberg                 |
| 1371  | <i>Frustulia</i>  | <i>rhomboides</i>          | . | .                 | .              | Vegetative | (Ehrenb.) DeToni          |
| 1165  | <i>Gomphonema</i> | <i>acuminatum</i>          | . | .                 | .              | Vegetative | Ehrenb.                   |
| 1164  | <i>Gomphonema</i> | <i>gracile</i>             | . | .                 | .              | Vegetative | Ehrenb. emend. Van Heurck |
| 1161  | <i>Gomphonema</i> | <i>parvulum</i>            | . | .                 | .              | Vegetative | (Kütz.) Kütz.             |
| 1201  | <i>Meridion</i>   | <i>circulare</i>           | . | .                 | .              | Vegetative | (Greville) C. Agardh      |
| 1210  | <i>Navicula</i>   | <i>spp</i>                 | . | .                 | .              | Vegetative | Bory .                    |
| 9458  | <i>Navicula</i>   | <i>cf. lacunolaciniata</i> | . | .                 | .              | Vegetative | Lange-Bertalot & Bonik    |
| 1214  | <i>Navicula</i>   | <i>cryptocephala</i>       | . | .                 | .              | Vegetative | Kütz.                     |
| 9072  | <i>Navicula</i>   | <i>cryptotenella</i>       | . | .                 | .              | Vegetative | Lange-Bert.               |
| 9305  | <i>Navicula</i>   | <i>decussis</i>            | . | <i>decussis</i>   | .              | Vegetative | Ostrup                    |
| 10352 | <i>Navicula</i>   | <i>gregaria</i>            | . | .                 | .              | Vegetative | Donkin                    |
| 10681 | <i>Navicula</i>   | <i>ignota</i>              | . | <i>palustris</i>  | .              | Vegetative | (Hustedt) Lund            |
| 10355 | <i>Navicula</i>   | <i>pelliculosa</i>         | . | .                 | .              | Vegetative | Hilse                     |
| 1369  | <i>Navicula</i>   | <i>pupula</i>              | . | .                 | .              | Vegetative | Kutzing                   |
| 9482  | <i>Navicula</i>   | <i>salinarum</i>           | . | .                 | .              | Vegetative | Grunow                    |
| 9101  | <i>Navicula</i>   | <i>subminuscula</i>        | . | .                 | .              | Vegetative | Manguin                   |
| 9102  | <i>Navicula</i>   | <i>tripunctata</i>         | . | .                 | .              | Vegetative | (O. F. Møll.) Bory        |
| 9223  | <i>Navicula</i>   | <i>viridula</i>            | . | <i>linearis</i>   | .              | Vegetative | Hust.                     |
| 1220  | <i>Nitzschia</i>  | <i>spp</i>                 | . | .                 | .              | Vegetative | Hassall                   |
| 9236  | <i>Nitzschia</i>  | <i>constricta</i>          | . | .                 | .              | Vegetative | (Kutzing) Ralfs .         |
| 9113  | <i>Nitzschia</i>  | <i>dissipata</i>           | . | .                 | .              | Vegetative | (Kütz.) Grunow            |
| 1222  | <i>Nitzschia</i>  | <i>gracilis</i>            | . | .                 | .              | Vegetative | Hantzsch                  |
| 9118  | <i>Nitzschia</i>  | <i>linearis</i>            | . | .                 | .              | Vegetative | (C. Agardh) W. Sm.        |
| 9123  | <i>Nitzschia</i>  | <i>palea</i>               | . | .                 | .              | Vegetative | (Kütz.) W. Sm.            |
| 1223  | <i>Nitzschia</i>  | <i>perminuta</i>           | . | .                 | .              | Vegetative | (Grunow) M. Perag.        |
| 9180  | <i>Opephora</i>   | <i>spp</i>                 | . | .                 | .              | Vegetative | Peragallo                 |
| 1240  | <i>Pinnularia</i> | <i>spp</i>                 | . | .                 | .              | Vegetative | (Pant.) R. Ross           |
| 1814  | <i>Pinnularia</i> | <i>microstauron</i>        | . | .                 | .              | Vegetative | (Ehrenb.) Cleve           |
| 1817  | <i>Pinnularia</i> | <i>subcapitata</i>         | . | .                 | .              | Vegetative | W. Greg.                  |
| 9504  | <i>Synedra</i>    | <i>tenera</i>              | . | .                 | .              | Vegetative | W. Sm.                    |
| 1315  | <i>Synedra</i>    | <i>ulna</i>                | . | .                 | .              | Vegetative | (Nitzsch) Ehrenb.         |

☐ = Identification is uncertain

\* = Family level identification

040007-141

Monday, January 17, 2005

Page 24 of 26

|      |                   |                   |   |             |   |   |            |                   |
|------|-------------------|-------------------|---|-------------|---|---|------------|-------------------|
| 9506 | <i>Synedra</i>    | <i>ulna</i>       | . | <i>ulna</i> | . | . | Vegetative | (Nitzsch) Ehrenb. |
| 1331 | <i>Tabellaria</i> | <i>fenestrata</i> | . | .           | . | . | Vegetative | (Lyngb.) Kütz.    |
| 1333 | <i>Tabellaria</i> | <i>flocculosa</i> | . | .           | . | . | Vegetative | (Roth) Kütz.      |

### Division: Chlorophyta

|      |                       |                    |   |   |   |                      |            |                         |
|------|-----------------------|--------------------|---|---|---|----------------------|------------|-------------------------|
| 2035 | <i>Ankistrodesmus</i> | <i>convolutus</i>  | . | . | . | .                    | Vegetative | Corda                   |
| 2031 | <i>Ankistrodesmus</i> | <i>falcatus</i>    | . | . | . | <i>monoraphidiod</i> | Vegetative | (Corda) Ralfs           |
| 8260 | <i>Apodochloris</i>   | <i>spp</i>         | . | . | . | .                    | Vegetative | Komarek                 |
| 2100 | <i>Chlorococcum</i>   | <i>spp</i>         | . | . | . | .                    | Vegetative | (Naegeli) Rabenhor      |
| 2160 | <i>Closterium</i>     | <i>spp</i>         | . | . | . | .                    | Vegetative | Nitzsch                 |
| 2180 | <i>Cosmarium</i>      | <i>spp</i>         | . | . | . | .                    | Vegetative | Corda                   |
| 8030 | <i>Microspora</i>     | <i>spp</i>         | . | . | . | .                    | Vegetative | (Kuetzing) Rabenhorst   |
| 8060 | <i>Pleurotaenium</i>  | <i>spp</i>         | . | . | . | .                    | Vegetative | (Roy and Biss) Playfair |
| 8451 | <i>Protoderma</i>     | <i>viride</i>      | . | . | . | .                    | Vegetative | Kuetzing                |
| 2884 | <i>Scenedesmus</i>    | <i>quadricauda</i> | . | . | . | .                    | Vegetative | (Turpin) Breb.          |
| 8308 | <i>Scenedesmus</i>    | <i>serratus</i>    | . | . | . | .                    | Vegetative | (Corda) Bohlin          |
| 2950 | <i>Spirogyra</i>      | <i>spp</i>         | . | . | . | .                    | Vegetative | Skuja                   |

### Division: Cryptophyta

|      |                    |              |   |   |   |   |            |             |
|------|--------------------|--------------|---|---|---|---|------------|-------------|
| 3015 | <i>Cryptomonas</i> | <i>erosa</i> | . | . | . | . | Vegetative | Ehrenberg . |
|------|--------------------|--------------|---|---|---|---|------------|-------------|

### Division: Cyanophyta

|        |                      |                   |   |   |   |   |            |                         |
|--------|----------------------|-------------------|---|---|---|---|------------|-------------------------|
| 4010   | <i>Anabaena</i>      | <i>spp</i>        | . | . | . | . | Vegetative | Bory                    |
| 4050   | <i>Aphanocapsa</i>   | <i>spp</i>        | . | . | . | . | Vegetative | W. and G. S. West       |
| 4060   | <i>Aphanothece</i>   | <i>spp</i>        | . | . | . | . | Vegetative | West and West 1912      |
| 4310   | <i>Calothrix</i>     | <i>spp</i>        | . | . | . | . | Vegetative | (Naeg.) Born. and Flah. |
| 4220   | <i>Chamaesiphon</i>  | <i>spp</i>        | . | . | . | . | Vegetative | A. Braun 1726           |
| 4140   | <i>Gloeotheca</i>    | <i>spp</i>        | . | . | . | . | Vegetative | Naegeli                 |
| 4141   | <i>Gloeotheca</i>    | <i>rupestris</i>  | . | . | . | . | Vegetative | (Lyngbye) Bornet        |
| 4150   | <i>Lyngbya</i>       | <i>spp</i>        | . | . | . | . | Vegetative | Agardh                  |
| 4169   | <i>Merismopedia</i>  | <i>elegans</i>    | . | . | . | . | Vegetative | A. Br. In Kutz 1849     |
| 4168   | <i>Merismopedia</i>  | <i>punctata</i>   | . | . | . | . | Vegetative | Meyer In Wiegmann       |
| 4170   | <i>Oscillatoria</i>  | <i>spp</i>        | . | . | . | . | Vegetative | Gomont                  |
| 4352   | <i>Oscillatoria</i>  | <i>sp. 2</i>      | . | . | . | . | Vegetative | Gomont                  |
| 4194   | <i>Phormidium</i>    | <i>fragile</i>    | . | . | . | . | Vegetative | Gomont                  |
| 4460   | <i>Pseudanabaena</i> | <i>spp</i>        | . | . | . | . | Vegetative | Lauterborn              |
| 4463   | <i>Pseudanabaena</i> | <i>galeata</i>    | . | . | . | . | Vegetative | Bocher .                |
| 107397 | <i>Synechococcus</i> | <i>aeruginosa</i> | . | . | . | . | Vegetative | .                       |
| 4321   | <i>Synechococcus</i> | <i>elongatus</i>  | . | . | . | . | Vegetative | Nageli                  |

☒ = Identification is uncertain

\* = Family level identification

040007-141

Monday, January 17, 2005

Page 25 of 26

|      |                      |              |   |   |   |                 |            |                   |
|------|----------------------|--------------|---|---|---|-----------------|------------|-------------------|
| 4323 | <i>Synechococcus</i> | <i>sp. 1</i> | . | . | . | < 1um ovoid     | Vegetative | Nageli            |
| 4660 | <i>Synechocystis</i> | <i>spp</i>   | . | . | . | .               | Vegetative | C. Sauvageau 1892 |
| 4285 | <i>Synechocystis</i> | <i>spp</i>   | . | . | . | >1 um spherical | Vegetative | N/A               |

**Division:** Pyrrhophyta

|      |                    |              |   |   |   |   |            |       |
|------|--------------------|--------------|---|---|---|---|------------|-------|
| 6032 | <i>Gymnodinium</i> | <i>sp. 1</i> | . | . | . | . | Vegetative | Stein |
|------|--------------------|--------------|---|---|---|---|------------|-------|

**Division:** Rhodophyta

|       |                        |              |   |   |   |   |            |               |
|-------|------------------------|--------------|---|---|---|---|------------|---------------|
| 10741 | <i>Batrachospermum</i> | <i>vagum</i> | . | . | . | . | Vegetative | (Roth) Agardh |
|-------|------------------------|--------------|---|---|---|---|------------|---------------|

☒ = Identification is uncertain  
\* = Family level identification