Drinking Water Source Quality Monitoring 2002-03

Bulkley Valley Surface Water Sources: Smithers Lakes, Kirby Lake, Chicago Creek, Bulkley River, Toboggan Creek and Thompson Creek

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SUMMARY

Water quality objectives have been set for some water bodies in the Smithers area, and past monitoring data reveals that the objectives are not always met. Numerous other surface drinking water sources in the Bulkley Valley that do not have site-specific objectives and little or no monitoring data is available. In 2002-03 a drinking water source quality sampling program was implemented for the Bulkley Valley.

In August and October 2002, and April 2003, drinking water samples were collected to investigate water quality at the Smithers Lakes, Kirby Lake, Chicago Creek, Bulkley River, Toboggan Creek and Thompson Creek. Five samples were collected from each site within a 30-day period in each sampling season. The samples were analyzed for three microbiological indicators (fecal coliforms, *E. coli* and enterococci), colour and turbidity. In each season, one sample from each site was analyzed for a comprehensive range of physical and chemical parameters to determine overall water quality and identify potential contamination.

Lab results were compared to MoE approved and working guidelines for drinking water quality. In each season, 90th percentile concentrations were calculated for the microbiological indicators and the results were compared to the *Disinfection Only* guideline level (which is the minimum treatment requirement for surface water sources under the Drinking Water Protection Regulation).

- The Smithers Lakes (Kathlyn, Seymour, Tyhee and Round Lakes) are relatively small lakes with eutrophic characteristics and variable water quality. They serve as drinking water sources for lakeside properties. Each lake was sampled at three intakes to monitor water quality objectives attainment, investigate seasonal patterns in water quality, and determine risks associated with failing lakeside sewage disposal systems and agricultural activities.

    - Overall, water quality results were similar to past results from these sites.
    - All three microbiological indicators were detected and guidelines were occasionally exceeded, indicating that disinfection alone may not be sufficient to ensure potability of the water and further treatment such as filtration may be required. Contamination sources were not determined, but may include natural (i.e. wildlife) and anthropogenic (i.e. agriculture, septic systems) sources.
    - Microbiological water quality was better during the spring sampling period and poorer during the summer and fall.
    - Most samples had turbidity values that met the MoE guideline of ≤ 5 NTU, but many were greater than the desirable level of ≤ 1 NTU.
    - Colour values were generally below the 15 TCU guideline level, except at Seymour Lake.
    - Phosphorus concentrations continue to exceeded the site-specific objective of ≤ 0.015 mg/L; other metals including aluminum, iron, and manganese

occasionally did not meet MoE drinking water guidelines, but observed concentrations do not pose a risk to human health.

- Kirby Lake is a very small and shallow eutrophic lake which serves as the drinking water source for the Fir Bluff Subdivision community water system. It has high organics levels and may be vulnerable to contamination from grazing cattle in the watershed. Source water was sampled from two locations: the shoreline of the lake near a gravel infiltration gallery intake, and a tap in the pump house.

    - Microbiological indicators were occasionally detected but MoE guidelines were met at all times.
    - The turbidity guideline was met at all times and values in the pump house were significantly lower than the lake, suggesting that the infiltration gallery removes some suspended material from the water.
    - Phosphorus and manganese concentrations were consistently above guideline levels and high levels of Total Organic Carbon indicate a risk of disinfection by-product formation.
    - Groundwater may provide an altertative drinking water source for the subdivision, but the proposed well has manganese concentrations far in excess of the drinking water guideline.

- Chicago Creek provides untreated drinking water to approximately 500 residents in South Hazelton. Contamination risks are low, however, a boil water advisory has been in effect for the past seven years due to isolated detections of fecal coliforms in the distribution system. Source water was sampled at two intake locations and one site in the distribution system.

    - Fecal coliform and *E. coli* drinking water guidelines (*for water receiving at least disinfection*) were met, but the enterococci guideline was not met in one sample set. Treatment is needed on this water source.
    - Turbidity, colour, and other physical and chemical parameters were well below guideline levels.

- The Bulkley River mainstem is prone to high-turbidity episodes, and potential sources of contamination include permitted discharges, agricultural runoff (livestock wastes, fertilizers and pesticides, and soils), septic tank leakage, and erosion from other land uses. The Village of Telkwa's drinking water intake site was sampled in 2002, and additional sites were sampled in November 2002 to investigate potential contamination from onsite sewage systems.

    - Microbiological indicators were commonly detected at low concentrations. Fecal coliform and *E. coli* concentrations met drinking water guidelines, but enterococci concentrations did not.

  - When multiple sites were monitored, indicator concentrations showed a general increasing trend in the downstream direction, likely due to inflows of tributary streams that drain agricultural areas.
  - Turbidity was variable, but values were generally below the 5 NTU guideline level. Colour values were also generally below the guideline level.
  - Aluminum and iron sometimes exceeded aesthetic drinking water guidelines, and other parameters were within acceptable guideline levels.
  - Results do not indicate a major source of sewage contamination in the Telkwa area.

- Toboggan Creek has widespread agricultural activity in its watershed and recent studies have found bacteria concentrations that exceed drinking water quality guidelines, especially during periods of high surface runoff. The creek, which is a water source for many watershed residents, was sampled at a site near its mouth.

  - Microbiological indicators were frequently detected, and guidelines were not met in most sample sets for all three indicators.
  - The turbidity guideline was commonly exceeded, and colour values did not meet the guideline level in the spring.
  - Aluminum and iron sometimes exceeded aesthetic drinking water guidelines, and other parameters were within acceptable guideline levels.

- Thompson Creek also has widespread agriculture in its watershed and recent studies showed elevated levels of fecal coliforms and ammonia in the creek, suggesting that fertilizers and animal wastes may be entering the creek during spring runoff. Source water was sampled from two locations: the creek near a gravel infiltration gallery, and a tap at a residence.

  - In the creek, all three indicators were frequently detected in August and October and guidelines were not met. April concentrations were significantly lower and guidelines were met. At the intake (after the infiltration gallery), indicator concentrations were much lower and most indicator guidelines were met.
  - Turbidity and colour were also significantly lower and much more stable at the intake, indicating that the infiltration gallery provides effective filtering of suspended material.
  - Other metals including aluminum, iron, and manganese exceeded drinking water guidelines, but do not pose a risk to human health.

Based on monitoring conducted in 2002-2003, we recommend that:

- The Ministry should continue to collaborate with the Northern Health Authority (NHA), local water suppliers, and other agencies interested in water quality in the Skeena Region.

- Monitoring of enterococci and *E. coli* levels (in addition to fecal coliform concentrations) should continue and these results should be included in water quality objectives development and updates.
- Future monitoring programs should include sampling in a range of (weather and flow) conditions to investigate variations in water quality.
- Through collaboration with NHA staff, residents and other users of land in (drinking water) watersheds should be made aware of the risks that land use activities pose on nearby surface water sources and groundwater wells. Residents should be reminded of the need to disinfect surface water supplies, and lake water users should be encouraged to extend intake pipes further into the lake to minimize potential sources of contamination.
- Drinking water source quality data should be made readily available to any interested parties.

ACKNOWLEDGEMENTS

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Representatives from the Northern Health Authority (NHA), Environment Canada, Village of Telkwa, and Remington Environmental helped design the 2002-03 monitoring program for the Bulkley Valley. Sampling sites were recommended by Ron Craig, Linda Drgon and David Butt, Environmental Health Officers with the Northern Health Authority.

Julia Kokelj (MoE) provided input and advice for this project, and helped with sample collection. Other MoE staff including Sean Sharpe, Les Swain, Kevin Rieberger and Jack Love, and Bob Watson (NHA consultant) helped edit the draft reports.

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1.0 INTRODUCTION

This document is one of a series of reports presenting results of the B.C. Ministry of Environment (MoE, formerly Water, Land and Air Protection, WLAP) Skeena Region's 2002-03 drinking water source quality monitoring program. It assesses drinking water sources in the Bulkley Valley, outlines water quality monitoring conducted in 2002-03, and presents the results of this work. Recommendations for future monitoring in the Bulkley Valley are provided, and a *List of Acronyms* and *Glossary* are included at the end of this report.

1.1 Provincial Expanded Water Quality Monitoring Program

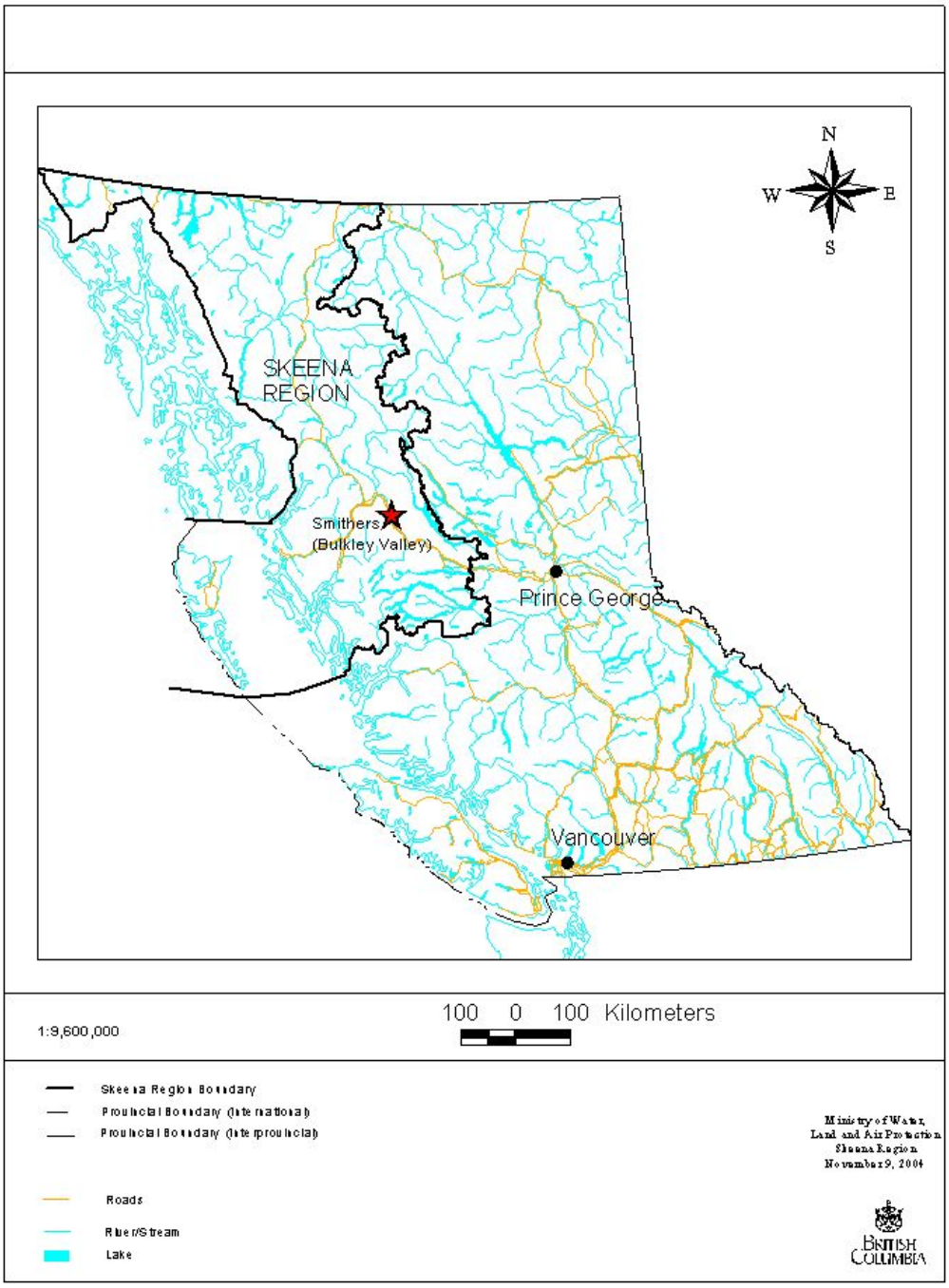
A safe and dependable supply of drinking water is critical to the health of all British Columbians. Recent reviews and reports have identified public health concerns related to the quality of drinking water in B.C. and the provincial government has created a Drinking Water Action Plan to prevent contamination, identify potential risks and improve water quality. The Plan recognizes that while the safety of drinking water is a health issue, providing safe drinking water requires an integrated approach and source protection is critical (Province of B.C., Provincial Health Officer, 2001; Ministry of Health website, 2002). In 2003, the new *Drinking Water Protection Act* and regulations were brought into force to protect drinking water in B.C. The Ministry of Environment monitors water quality at the source, and is mandated to provide and promote improved monitoring related to the protection of drinking water sources. Additional information about the Drinking Water Action Plan and the *Act* and regulations can be found on the Ministry of Health website (http://www.healthservices.gov.bc.ca/protect/water.html).

1.2 Skeena Region Overview

The Skeena Region covers an area of 266,441 km^2 (29% of the province) in the northwest quadrant of British Columbia (Figure 1). It includes the geographic area between Endako (near Burns Lake) in the east to Haida Gwaii (Queen Charlotte Islands) in the west; from Kitimat and North Tweedsmuir in the south to the Yukon and Alaska borders in the north. The region is relatively unpopulated; there are no large urban centers, and few communities are populated by greater than 5,000 people. Most of the region's communities are located along the Highway 16 corridor.

Water is abundant in the Skeena Region, and most drinking water systems use surface water sources. Surface water sources have a higher risk of contamination than groundwater, and MoE is working with the Northern Health Authority to ensure that all drinking water systems using surface water employ adequate forms of treatment. In general, there are very few large water suppliers in the region, and small water suppliers and private (single connection) water systems serve most of the population.

Figure 1: Skeena Region showing location of Bulkley Valley



1.3 The Bulkley Valley

The Bulkley Valley lies approximately 200 km inland from the Pacific coast. It runs in a roughly north-south direction between Houston and Hazelton, with the Town of Smithers (population approximately 6,000) near the middle. Agriculture occurs on the valley floor, and mineral exploration, timber harvesting, and outdoor recreation are the primary land use activities in the surrounding hills.

Many residents live in rural parts of the Bulkley Valley, where infrastructure like sewage and water distribution systems are not available. These residents obtain their domestic water from small water systems which they may have built and maintain themselves. The abundance of surface water, combined with the cheap cost of installing a surface water intake (compared to drilling a deep well), has resulted in a large number of people drinking water from surface sources. Recognizing this, water quality objectives have been established at some water bodies to protect them for various uses including drinking. The Bulkley River mainstem and the Smithers Lakes (Kathlyn, Seymour, Tyhee and Round Lakes) are examples of water bodies where drinking water is a designated use and the established objectives reflect this.

Surface water is commonly consumed in the Bulkley Valley with little or no treatment. Recent drinking water quality studies have noted source quality concerns at the Smithers Lakes and Bulkley River tributaries (Remington, 2002a and 2002b; Portman and Schley, 2001). Other lakes and streams in the Bulkley Valley (including Kirby Lake and Chicago Creek) serve as drinking water sources for community water systems, but have not been adequately sampled in the past.

This study provides important information needed to characterize water quality in Bulkley Valley drinking water sources and to promote effective source water protection and appropriate treatment measures.

2.0 B.C. DRINKING WATER QUALITY GUIDELINES

In British Columbia, the Ministry of Environment develops province-wide water quality guidelines (criteria) for assessing water quality data and preparing site-specific water quality objectives. Water quality guidelines are environmental benchmarks. They are considered to be safe levels of substances for the protection of a given water use, including drinking water, recreation, aquatic life, wildlife and agriculture. In most cases, B.C.'s drinking water source quality guidelines are based on Canadian guidelines developed by the Canadian Council of Ministers of the Environment (CCME, 1999). The guidelines are intended to be a water quality-screening tool. If data do not exceed the guidelines, problems are unlikely. If data exceed the guidelines, then a detailed assessment is recommended to determine the extent of the problem.

Disease resulting from microbiological contamination of drinking water is widely recognized as a significant water quality issue, and detection of microbiological indicators is an important component of the multi-barrier approach to safe drinking water. Indicator organisms, such as coliform bacteria, provide an estimate of the degree of fecal contamination from human and animal wastes that are in the water. If the indicator suggests that fecal contamination of the water has occurred, then disease-causing organisms may also be present.

Provincial monitoring protocols and water quality guidelines for microbiological indicators were published by Warrington in 1988. There are three guideline levels, which allow different concentrations of microbiological indicators in raw (untreated) drinking water, depending on the degree of treatment that will be applied. B.C. Health Authorities recommend that all drinking water supplies derived from surface water sources receive disinfection as a minimum treatment, and thus we assess surface water microbiological water quality using the ***Disinfection Only*** guideline level (this is also the minimum treatment requirement for surface water sources under the Drinking Water Protection Regulation; see Table 1).

Table 1: MoE Water Quality Guidelines for Microbiological Indicators

Water Use	Fecal Coliform	*E. coli*	Enterococci
Raw Drinking Water – Disinfection Only (SURFACE WATER)	Less than or equal to 10/100 mL 90^{th} percentile	Less than or equal to 10/100 mL 90^{th} percentile	Less than or equal to 3/100 mL 90^{th} percentile

Other B.C. (MoE) approved and working guidelines for physical and chemical water quality parameters are listed in Table 2. Additional information is available in Province of B.C. (1998a and 1998b), or on the following websites:

- Canadian Guidelines
  - http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/doc_sup-appui/index_e.html
- B.C. Guidelines
  - http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html

Table 2: MoE Physical /Chemical Drinking Water Source Quality Guidelines
(Province of B.C., 1998a and 1998b)

Parameter	Guideline (mg/L)	Guideline Type
PHYSICAL		
pH	6.5-8.5	aesthetic objective
Colour	≤ 15 TCU	aesthetic objective
Specific conductance	≤ 700 µS/cm	maximum acceptable concentration
Turbidity	≤ 5 NTU[1]	maximum acceptable concentration
Hardness Total – T	≤ 500	maximum acceptable concentration
TOTAL ORGANIC CARBON		
T.O.C.	≤ 4[2]	maximum, to prevent THM formation
ANIONS		
Chloride Dissolved	≤ 250	aesthetic objective
Fluoride Dissolved	≤ 1.5	maximum acceptable concentration
NUTRIENTS		
Nitrate Nitrogen Dissolved (N)	≤ 10	maximum acceptable concentration
Nitrite Nitrogen (N)	≤ 1	maximum acceptable concentration
Phosphorus Total (P)	≤ 0.01	maximum, to protect lakes from algae growth
SULFATE		
Sulfate	≤ 500	aesthetic objective
METALS TOTAL		
Aluminum	≤ 0.2	maximum acceptable concentration
Antimony	≤ 0.006	interim maximum acceptable concentration
Arsenic	≤ 0.025	interim maximum acceptable concentration
Barium	≤ 1	maximum acceptable concentration
Boron	≤ 5	maximum acceptable concentration
Cadmium	≤ 0.005	maximum acceptable concentration
Chromium	≤ 0.05	maximum acceptable concentration
Copper	≤ 1	aesthetic objective
Iron	≤ 0.3	aesthetic objective
Lead	≤ 0.01	maximum acceptable concentration
Magnesium	≤ 100	aesthetic objective
Manganese	≤ 0.05	aesthetic objective
Molybdenum	≤ 0.25	maximum acceptable concentration
Selenium	≤ 0.01	maximum acceptable concentration
Uranium	≤ 0.02[3]	maximum acceptable concentration
Vanadium	≤ 0.1	maximum acceptable concentration
Zinc	≤ 5	aesthetic objective

[1] Although some literature quotes a maximum acceptable level of 1 NTU, levels between 1 and 5 NTU do not typically pose a health concern. Depending on the origin of the turbidity (organic vs. inorganic), bacteria may be present and/or treatment system effectiveness may be compromised at levels between 1 and 5 NTU. Some site-specific Skeena Region reports apply a maximum level of 5 NTU and an average of 1 NTU. For this report, universal application of only the 5 NTU (max) guideline was decided by MoE water quality specialists.

[2] No approved BC guideline, but US EPA guideline is 4 mg/L to prevent trihalomethane formation.

[3] BC interim max. acceptable concentration is ≤ 0.1 mg/L; Canadian guideline (≤ 0.02) is more stringent.

3.0 METHODS

3.1 Bulkley Valley Surface Water Sampling Program (2002-03)

The Bulkley Valley sampling program was designed in consultation with the Northern Health Authority (NHA) Environmental Health Officers and representatives from Environment Canada, the Village of Telkwa, and Remington Environmental. The program included testing of nine surface drinking water sources: The Smithers Lakes (Kathlyn, Seymour, Tyhee and Round Lakes), Kirby Lake, Chicago Creek, Bulkley River, Toboggan Creek and Thompson Creek. The Smithers Lakes sampling program was designed (in part) according to monitoring recommendations for site-specific water quality objectives at these lakes (Boyd et al., 1985). Other sources were monitored using similar parameter lists and sampling frequencies. Most sample locations were selected so that untreated water samples could be collected at taps on pump houses and residences.

Water samples were collected weekly for five weeks beginning in August 2002, October 2002 and April 2003. The samples were analyzed for three microbiological indicators (fecal coliforms, *E. coli* and enterococci), turbidity and colour. In drinking water, turbidity and colour are most commonly aesthetic properties that tend to show a high degree of variability in the environment. Turbidity has been shown to be correlated with bacterial contamination, and thus is a good indicator of overall water quality. In each season, one sub-sample from each site was analyzed for a comprehensive range of physical and chemical water quality parameters which have health and aesthetic implications in drinking water. The parameters measured included many that are indicators of contamination by domestic sewage and agriculture (for example, chloride, phosphorus, nitrate and ammonia).

3.2 Sampling Methods

Water samples were collected following a minimum 3 minute flushing of the water lines and sampling was conducted according to methods outlined in Clark (1996). Microbiological samples were collected in 500 mL sterilized bacteriology bottles (provided by Cantest Ltd. in 2002 or JR Laboratories Inc. in 2003). Total metals samples were collected in 250 mL acid-washed polyethylene bottles (provided by PSC Analytical Services). Samples for physical and chemical analysis were collected in 1 L or 250 mL polyethylene bottles that were rinsed three times prior to collection. Samples were immediately placed in a cooler with ice and shipped to the analytical laboratories in Burnaby. All samples were received by the laboratory within the recommended time limits.

3.3 Analytical Methods

Microbiological analyses were performed by Cantest Ltd. in 2002 and JR Laboratories Inc. in 2003. Analysis began within 48 hours of sample collection. Both laboratories use

the Membrane Filtration (MF) method of enumeration, and analyses are performed using approved procedures (Province of B.C., 1994; APHA, 1998).

Maxxam Analytics Inc.(formerly PSC Analytical Services) performed the analyses of physical and chemical parameters. Total metals samples were analyzed using the low-level ICPMS scan to detect low concentrations. Maxxam Analytics also follows standard methods provided in APHA (1998).

3.4 QA/QC

All three analytical labs (Cantest, JR and Maxxam) must meet numerous QA/QC (Quality Assurance/Quality Control) requirements such as analysis of reference samples, blanks and duplicates, and are frequently audited. QA/QC information from individual batches of samples is reported with the results from each set of analyses. Other QA/QC procedures that were incorporated into our monitoring program include:

- Development of consistent sampling protocols;
- Training of field staff;
- Setting of data quality objectives; and
- Submission of QA samples (including field blanks and duplicates) to the lab.

Field blanks provide a test for potential contamination resulting from handling techniques and air exposure at the sampling location. Field blanks were collected regularly during 2003 sampling sessions and the results are included in the accompanying data appendix. In Bulkley Valley field blank samples:

- No microbiological indicators were detected in any samples, indicating that contamination during sampling, transport, and analysis is unlikely.
- Turbidity and colour values were low and sample contamination is unlikely.
- In the comprehensive sample for physical and chemical parameters (April 7, 2003), the following physical and chemical parameters were detected at low concentrations which are far below drinking water guideline levels: Nitrate+nitrite, dissolved phosphorus, and total copper, lead, molybdenum, strontium, and tin were detected at very low concentrations. Sample contamination is not a concern.

Duplicate samples provide an estimate of the overall precision associated with the field technique and laboratory analysis. A number of duplicate samples for physical and chemical parameters were collected during 2003 sampling sessions. Duplicates were not collected for microbiological indicators because their occurrence in the natural environment is not expected to be uniform. Precision analysis of the duplicate results was calculated using the Relative Percent Difference (RPD, see data appendix for results

and calculations).[4] The RPD for duplicate samples should be less than 25%, and data with precision values greater than 25% should be interpreted with caution. In Bulkley Valley duplicates:

- Most turbidity and all colour RPD values were less than the 25% data quality objective. Two pairs of turbidity samples (site **R4** and site **TMC**) had a RPD greater than the 25% data quality objective; the results are likely due to natural variation common in surface water sources, and data quality is not a concern.
- In the comprehensive duplicate samples from sites **K3**, **S3**, **KLP** and **CCL**, RPD values for all parameters were less than 25% and there are no concerns about data quality.
- In the comprehensive duplicate sample from site **TMC**, RPD values for arsenic, cobalt, lead, and zinc exceeded the 25% objective. It is suspected that the differences are due to natural variation in flowing water (the sampling site was a stream, and samples were collected one after the other); all grab samples from surface sources should be interpreted with caution, especially when the values are close to guideline levels. In the case of **TMC**, the parameters listed above were only detected at low concentrations (far below guideline levels) throughout the 2002-03 sampling program and data quality is not a concern.

3.5 Reporting

Microbiological water quality results are presented in colony forming units (CFU) per 100 mL of sample. A result of <1 indicates that no bacteria were detected in a sample of 100 mL and a result of <2 indicates that no bacteria were detected in a 50 mL sample.

For each surface water sample set (five weekly samples), 90th percentiles were calculated for each indicator and the results were compared to the *Disinfection Only* MoE guideline level (Table 1). The 90th percentile concentration is the concentration below which 90% of the samples lie. For computing 90th percentiles, values of <1 and <2 are assumed to be zero. The *Disinfection Only* guideline level was chosen because this is the minimum treatment requirement for surface water sources, under the Drinking Water Protection Regulation.

Colour and turbidity were tested once per week for five weeks, and individual sample results were compared to MoE guidelines. The Method Detection Limit (MDL) is the minimum amount of a substance that can be routinely detected by the analytical instrument or technique with a high degree of confidence. The MDL for colour is 5 True Colour Units (TCU), and for turbidity is 0.1 Nephelometric Turbidity Units (NTU).

[4] Precision is influenced by how close the analytical value is to the Method Detection Limit (MDL - the minimum amount of a substance that can be routinely detected by the analytical instrument or technique with a high degree of confidence), and the use of RPD is limited to values that are at least five times the MDL. For parameters measured at or near the MDL, small differences that are not significant can result in large RPD's. Many parameters tested had concentrations below five times the MDL, so RPD was not calculated.

Other physical and chemical water quality parameters (including metals) from individual samples were compared to MoE guidelines.

Individual sample results and statistical summaries are presented in the accompanying *Data Appendix*, and highlights are discussed in the *Results* section (5.0) below.

4.0 DRINKING WATER SOURCE PROFILES AND SAMPLING LOCATIONS

Twenty-four drinking water sampling sites were monitored in the Bulkley Valley to collect water quality data on nine drinking water sources. The sources and sites described in this report are surface water sources; results of groundwater sampling in the Town of Smithers are included in a separate report.

4.1 The Smithers Lakes (Kathlyn, Seymour, Tyhee and Round Lakes)

Kathlyn, Seymour, Tyhee, and Round Lakes are located along the Highway 16 corridor near the Town of Smithers and Village of Telkwa. Kathlyn and Seymour Lakes are small and shallow, with comparable volumes (Table 3). They have a relatively large surface area to depth ratio which facilitates increased wind mixing and productivity (Boyd et al, 1985). Tyhee and Round Lakes are slightly larger and deeper. In general, the Smithers Lakes are considered eutrophic because they are rich in nutrients and tend to produce abundant plant growth. Additional information about the lakes is available in Boyd *et al*. (1985), Rysavy and Sharpe (1995a and 1995b), and Downie and Kokelj (2004).

Table 3: Summary of Morphometric Data for the Smithers Lakes

Lake Name	Area (ha)	Maximum Depth (m)	Mean Depth (m)
Kathlyn	170	9.5	4.6
Seymour	89.5	9.2	5.7
Tyhee	318	22.2	11.1
Round	182	20.4	9.6

The Smithers Lakes are important for recreation, domestic water supply, and irrigation. Site-specific water quality objectives were established by Boyd *et al*. in 1985, and were set to protect the lake for uses including drinking. The primary concern was that the spread of agricultural and residential development around the lakes was contributing to eutrophication and that fecal coliform objectives should be met for drinking water and recreation. Objectives attainment monitoring has been conducted periodically over the past 15 years, and the lakes have shown a range of water quality and varying levels of objectives attainment. Most of the site-specific objectives are the same as the MoE drinking water guidelines, with the exception of phosphorus which has a site-specific objective of ≤ 0.015 mg/L rather than the guideline of ≤ 0.01 mg/L.

Sampling in the fall of 2001 revealed source quality concerns at a number of sites in the Bulkley Valley including the Smithers Lakes (Remington, 2002a). Drinking water intakes on the Smithers Lakes are currently vulnerable to contamination from a number of sources including residential developments, agriculture, forestry, commercial operations, and transportation infrastructure. Failing lakeside sewage disposal systems may be significant sources of contamination, and agricultural activities pose a risk to water quality in some water bodies.

In August and October 2002 and April 2003 the Smithers Lakes were each sampled at three residential intake locations (Figures 2 and 3).

- Kathlyn Lake – sampled at **K2**, **K3** and **K4**
- Seymour Lake – sampled at **S1**, **S2** and **S3**
- Tyhee Lake – sampled at **T2**, **T3** and **T4**
- Round Lake – sampled at **R3**, **R4** and **R5**

4.2 Kirby Lake

Kirby Lake is located approximately 2 km southeast of Tyhee Lake near the Village of Telkwa. The lake has a surface area of approximately 8 ha and a perimeter of less than 1300 m (Province of B.C. Fish wizard website, 2003). Kirby Lake serves as the drinking water source for Fir Bluff subdivision. The community water system draws through an intake pipe in a gravel infiltration gallery at the north end of the lake. The water is disinfected at a pump house before it is distributed to approximately 24 homes in the subdivision.

The lake has not been tested by MoE in past monitoring programs, and very source quality data exists. The lake contains abundant weed growth in the summer months, and the bottom substrate is suspected to have high organic content. Cattle grazing in the watershed may pose a risk to drinking water quality, especially during periods of high runoff when contaminants are mobilized. Many residents have commented that during the spring months when runoff is high, their water has undesirable colours and odours (Clark, 2002 pers. comm.).

In August and October 2002 and April 2003 raw water samples were collected from a tap at the pump house on Fir Road (**KBP**). During sample collection, the chlorinator was turned off and water was flushed through the pipe for approximately three minutes before the water sample was collected. In April 2003, source water samples were also collected from the shoreline of Kirby Lake adjacent to the infiltration gallery, to examine the effect the infiltration gallery on water quality (**KBS**, shown as KB in Figure 3).

At the request of the water system operator, an undeveloped groundwater well north from Kirby Lake (site **FGW**) was also sampled 3 times in the fall and spring to investigate water quality of an alternate drinking water source. It was not known if this shallow groundwater source is influenced by water from Kirby Lake, and the purpose of sampling this site was to determine if the groundwater is a better quality than the lake. The well is approximately 5 m deep, and it is suspected that water enters the well from about 2.5 m below the surface. The well was not being used to supply water to the system, but it was pumped for at least 24 hours before sampling.

Figure 2: Bulkley Valley (North) Drinking Water Quality Sampling Sites

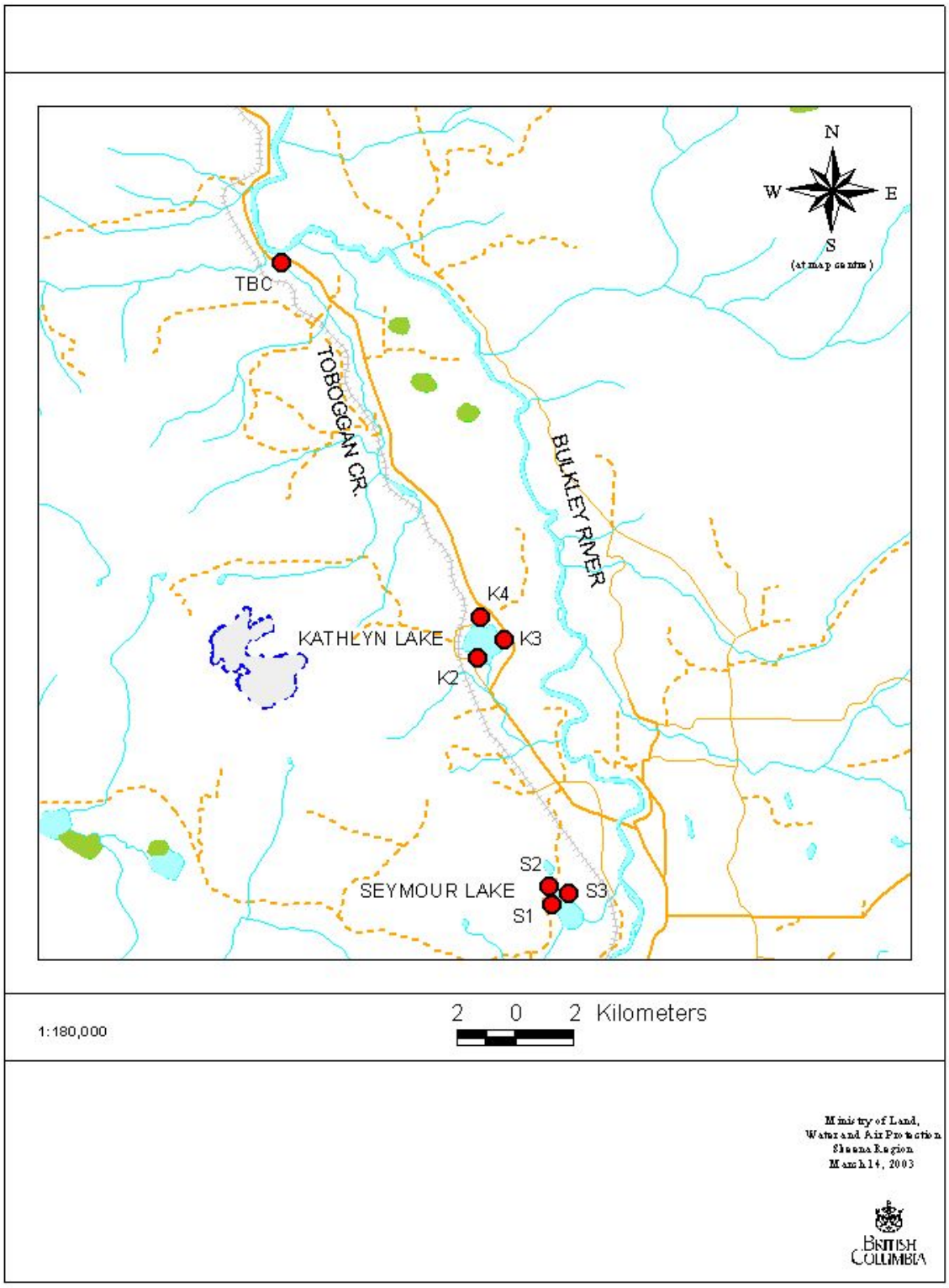
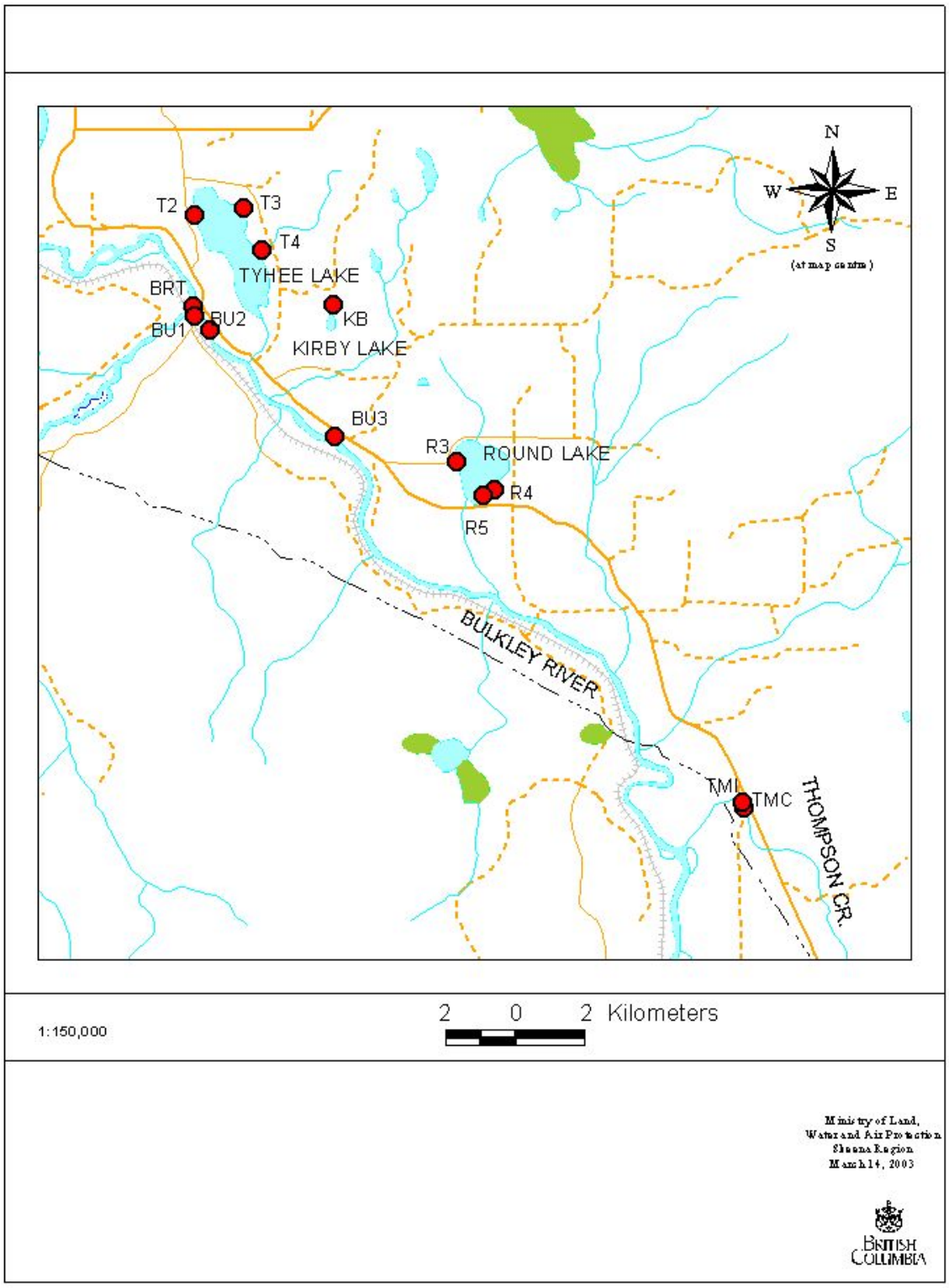


Figure 3: Bulkley Valley (South) Drinking Water Quality Sampling Sites



4.3 Chicago Creek

Chicago Creek drains the flanks of the Roucher Deboule mountain range south of Hazelton. The creek is approximately 7 km long, and flows into the Skeena River near South Hazelton. The South Hazelton Water Improvement District draws water for its distribution system from Chicago Creek. The water is collected through a gravel infiltration gallery constructed in a natural impoundment on the creek, and is piped under Highway 16 to the village. Water flows into the impoundment directly from the creek, and also through a pipe from an upstream catchment area. From late-spring to early-winter, water in the impoundment is a mix of water drawn from the two different locations on Chicago Creek. During winter and early-spring low flows, very little water enters the impoundment naturally (because the creek flow is subsurface), so most of the water in the impoundment area comes from the upstream catchment area through a pipe.

The South Hazelton water distribution system serves approximately 500 residents, and has no treatment. With the exception of a hiking trail, the watershed is undeveloped, and thus there is little risk of contamination from human activities. Because the water does not get treated, a boil water advisory has been in effect for the past seven years, and past NHA data has detected low levels of fecal coliforms at sites in the distribution system (Drgon, 2002, pers. comm.). Past studies by Energy, Mines, and Resources Canada showed high levels of uranium in creeks near Hazelton. In 1984 Chicago Creek had a uranium concentration of 0.6 ppb, the highest measured in the province (Energy, Mines and Resources Canada, 1984). The creek was included in the monitoring program because of its questionable water quality history, and because the system does not contain any treatment.

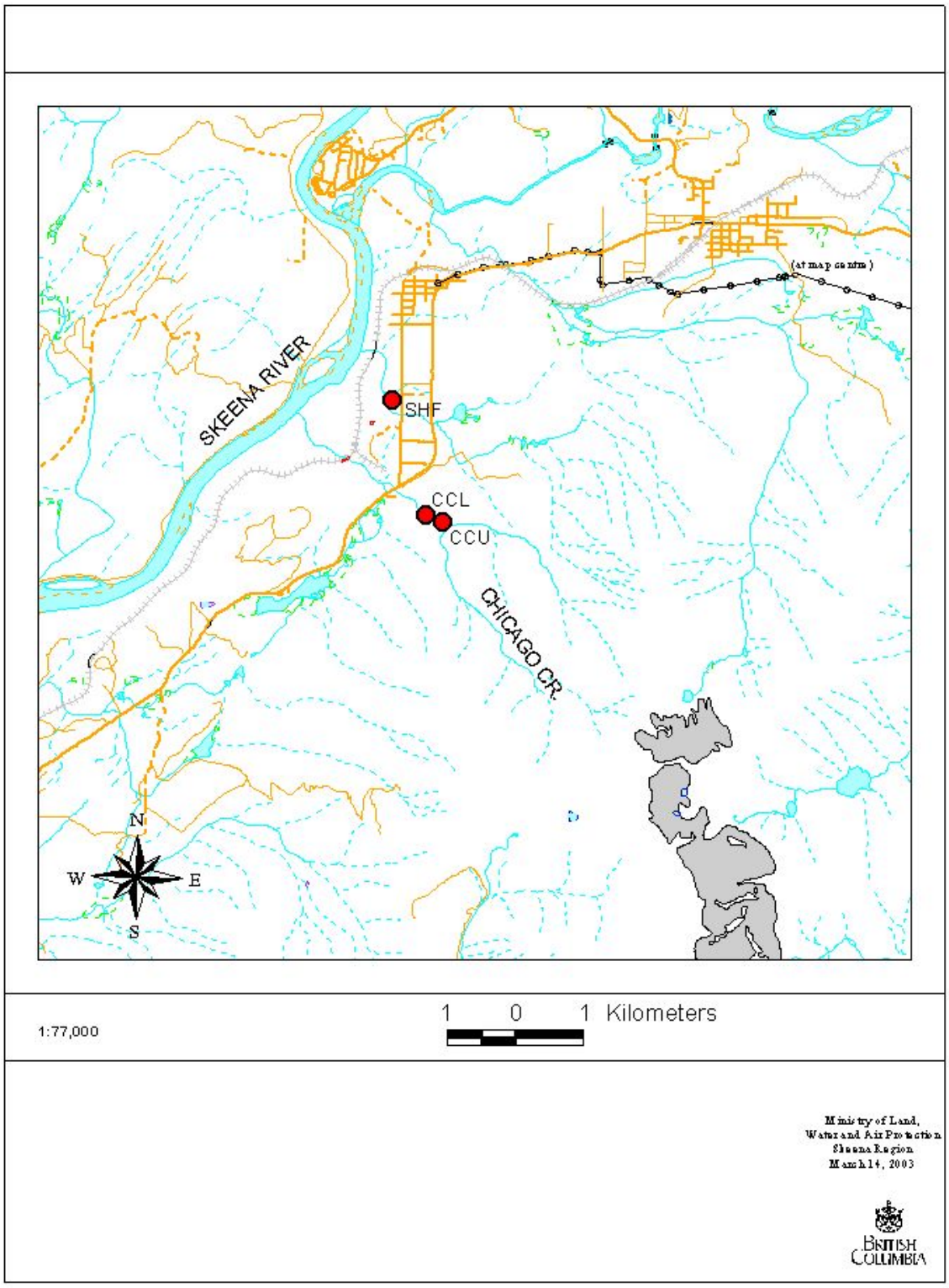
In October 2002 and April 2003 Chicago Creek source water was sampled at three locations (Figure 4):

- **CCL** is the impoundment area where the infiltration gallery and intake is located (grab samples were a mix of water entering the impoundment naturally and water entering through the pipe from upstream).
- **CCU** is a pool above a concrete catchment dam, approximately 200 m upstream from CCL. This is the piped water that supplements water in the lower impoundment area. During low flows (April 2003), all the water in the impoundment area is from this site.
- **SHF** is an outside tap (distribution system) at the South Hazelton Firehall. The site has been monitored in the past by the NHA and MoE.

4.4 Bulkley River

The Bulkley River is a major tributary to the Skeena River, and it drains an area of approximately 12,300 km^2. The river flows nearly 250 km northwest from its headwaters

Figure 4: Bulkley Valley (Hazelton area) Drinking Water Quality Sampling Sites



at Bulkley Lake (near Houston) before it enters the Skeena River near Hazelton. The mean annual flow in the river at Hazelton is about 201 m^3/s (Nijman, 1986). The Morice River joins the Bulkley fairly close to its headwaters, and supplies about 90% of the Bulkley River water.

Water quality objectives for the Bulkley River were established by Nijman in 1986. The river has many designated uses including drinking water, irrigation, livestock watering, and industrial use. It has high fisheries values as it is a migration route for steelhead and salmon, and it is used extensively for recreation. Permitted discharges to the Bulkley River and its tributaries include waste from a silver mine and treated sewage effluent. Diffuse sources of nutrients and suspended sediments include agricultural runoff (livestock wastes, fertilizers and pesticides, and soils), septic tank seepage (mostly from the Village of Telkwa), and erosion from other land uses (including forestry). All of the above are potential sources of water quality concerns (Nijman, 1986). In addition, leachate from a number of landfills near the river may pose a risk to water quality.

During peak summer demand, the Village of Telkwa supplements its groundwater supply with water from an infiltration gallery beside the Bulkley River. High turbidity and the occasional detection of microbiological indicators in the distribution system have led to a number of boil water advisories in recent years (a boil water advisory for the village was issued during the sampling period in August 2002, when *E. coli*. were detected in the water supply). In 2002-03 the Village of Telkwa was concerned about water quality in the river because they were designing a new river intake and water treatment plant. In a study completed between July 2001 and July 2002, Dayton and Knight Engineers reported that suspended sediment and contamination in the water system poses a risk to the health of village residents. In particular:

- Fecal coliform concentrations ranging from <1 to 58 CFU/100 mL were measured over the 2001 summer and fall seasons (August to November)
- Turbidity in the Bulkley and Telkwa Rivers normally ranges from <1 to 60 NTU, with high levels in both rivers associated with spring runoff and periods of heavy rainfall
- Colour levels up to 70 TCU were identified in the Bulkley River, with high levels also associated with the spring freshet
- Elevated levels of iron and manganese were reported, including levels that exceed the drinking water aesthetic objective (Dayton and Knight, 2002).

The Bulkley River was sampled in August and October 2002 because of its vulnerability to contamination and history of water quality concerns, and to provide information for development of the new water treatment system. **BRT** (Figure 3) is the site of the present water intake for the Village of Telkwa, in front of the Village office; it is immediately downstream of the Bulkley and Telkwa River confluence and reflects Telkwa River influences under some flow conditions.

At the request of the Village of Telkwa, a sample set was collected in November 2002 to determine whether development (and associated sewage disposal systems) upstream from

the village was affecting water quality. Three additional sites along the Bulkley River were chosen for monitoring water quality upstream from Telkwa (Figure 3):

- **BU1** is on the south side of the river in a pool approximately 150 m upstream of the Telkwa Bridge near the proposed intake site for the new water system. It is the lowest site on the Bulkley River before it joins the Telkwa River, and is immediately downstream from industrial properties.
- **BU2** is on the north side of the river, upstream from site **BU1** (and the industrial properties) and immediately downstream from developments including a resort and subdivision with a sewage treatment system discharge
- **BU3** is on the north side of the river at the east end of George Frontage Road. It is assumed to be above the influence of riverside developments near the Village of Telkwa.

4.5 Toboggan Creek

Toboggan Creek flows from its glacial headwaters on Hudson Bay Mountain to the Bulkley River approximately 21 km north (downstream) from Smithers. One of its main tributaries (Glacier Gulch Creek) flows through a small, shallow lake (Toboggan Lake) on the valley bottom. Toboggan Creek supports highly valued fisheries resources and a hatchery has operated on the creek since 1985. The watershed is traversed by both the railway and Highway 16, and has a long history of forestry and agriculture. Many rural residences exist in the Toboggan Creek watershed, and there are 34 water licenses for domestic purposes (eight are located on the mainstem within 6 km of the mouth) (Remington, 2002b). Water intakes in lower reaches of Toboggan Creek are highly vulnerable to contamination as they are situated downstream of agricultural activity.

A water quality and aquatic ecosystem trend monitoring study was initiated for Toboggan Creek in August 2001 and continued through 2002. Drinking water quality monitoring was included in this study, and results are available in Remington (2002b, 2003). Past studies in 1996 and 1997 found fecal coliform and fecal streptococci concentrations that exceeded drinking water quality guidelines on late summer sampling dates, and in October 2001 the mouth of Toboggan Creek exceeded drinking water quality guidelines for all three microbiological indicators tested. Monthly monitoring as part of the 2001/2002 trend monitoring study indicates that fecal contaminants are present throughout the year but are generally associated with periods of high surface runoff.

Toboggan Creek sampling in August and October 2002 and April 2003 provides additional information about current water quality to complement the trend monitoring study. Site **TBC** (Figure 2) is located on Toboggan Creek approximately 50 m upstream from the Highway 16 culvert at the creek mouth.

4.6 Thompson Creek

Thompson Creek is approximately 16 km long and flows into the Bulkley River approximately 25 km south (upstream) from Telkwa. It drains an agricultural watershed east of the Bulkley River near Hungry Hill. The river has high fisheries values (Portman and Schley, 2001) and has water licences issued for irrigation and domestic use. Near Walcott Road, at least two pump houses draw water from the creek for domestic (drinking) purposes, and a number of residents collect domestic water in containers from this location.

Agriculture in the Thompson Creek watershed poses a risk to water quality. In spring 2001, Portman and Schley found high concentrations of fecal coliforms and elevated levels of ammonia in the creek, indicating that there may be contaminants such as fertilizers and animal wastes entering the aquatic environment during spring runoff. Residents have also commented that during early spring Thompson Creek water has strong odours and colours and is not suitable for drinking. No water quality data was found for Thompson creek for seasons other than spring, so the creek was included in the 2002-03 sampling program to begin collection of this information. The **TMC** sampling site is just upstream from the Walcott Road culvert at the location of two domestic intakes drawing through infiltration galleries (Figure 3). It was sampled in August and October 2002 and April 2003.

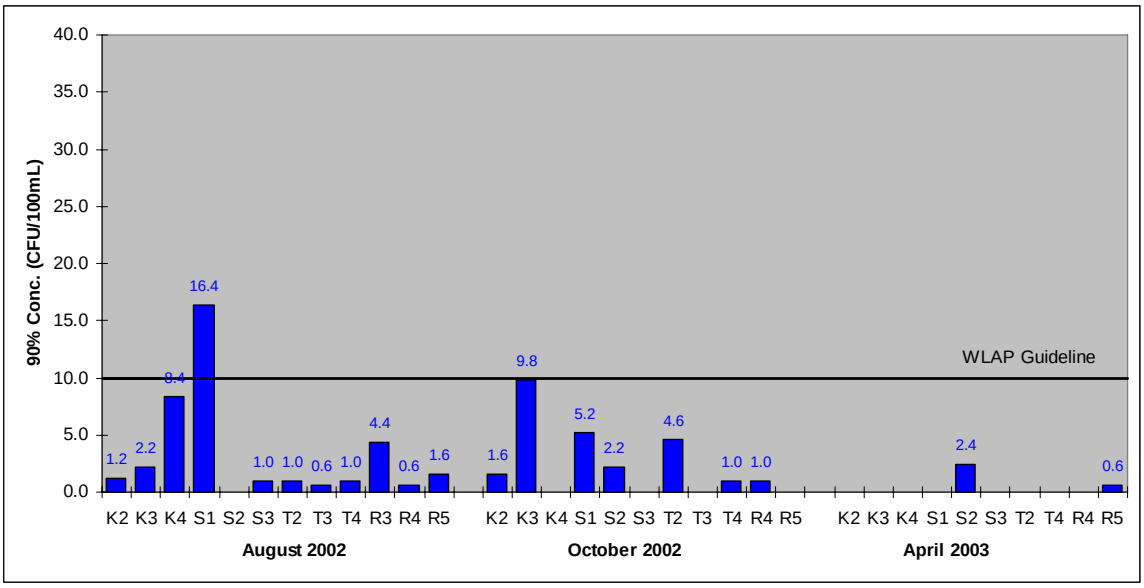
In October 2002 and April 2003 another Thompson Creek sampling site was added. **TMI** is an outside tap of the residence that draws water from the infiltration gallery on the side of Thompson Creek. These samples were collected to investigate the effect of the infiltration gallery on water quality.

5.0 RESULTS AND DISCUSSION

Complete results of surface water quality sampling in the Bulkley Valley are included in the accompanying *Data Appendix*. Also included in the Appendix is a statistical summary of the microbiological indicator data for each site, and a statistical summary of the other physical/chemical water quality parameters for each source.

Figures 5-7 summarize microbiological indicator results from Smithers Lakes sites, and Figures 8-10 summarize results from other Bulkley Valley surface water sites. ***The microbiological indicator guidelines used for surface water sources in this study (and shown in the Figures) assume that the raw water is receiving disinfection prior to consumption.***

Figure 5: Fecal Coliform 90th Percentile Concentrations[5] at Smithers Lakes Sites



[5] The 90th percentile concentration is the concentration below which 90% of the samples lie. For computing 90th percentiles, values of <1 and <2 are assumed to be zero.

Figure 6: *E. Coli* 90th Percentile Concentrations at Smithers Lakes Sites

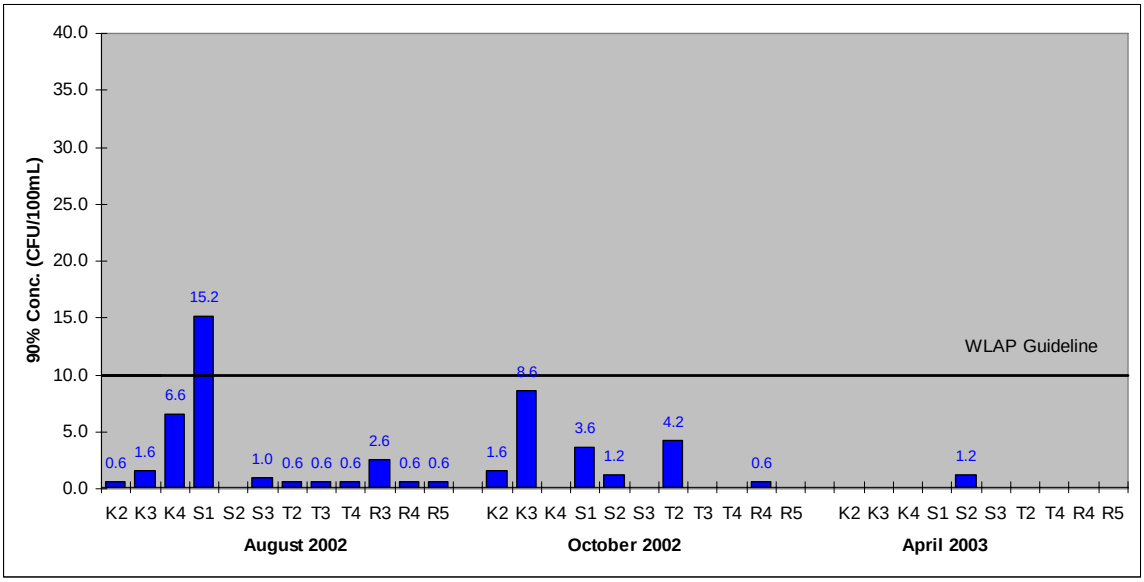
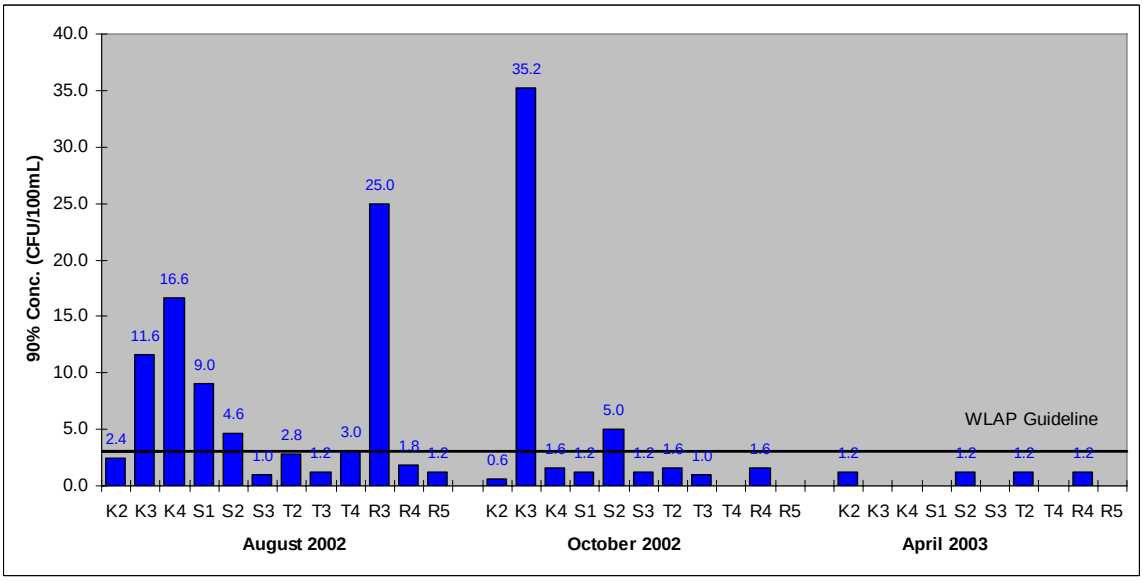


Figure 7: Enterococci 90th Percentile Concentrations at Smithers Lakes Sites



5.1 Lake Kathlyn (K2, K3, K4)

Lake Kathlyn sampling sites showed all three microbiological indicators during the sampling period. At **K2**, fecal coliforms and *E. coli* were frequently detected in low concentrations during August and October 2002, and enterococci were detected occasionally. **K3** had higher levels of all three indicators in August and October 2002, and **K4** showed elevated indicator concentrations on many dates in August 2002.

The 90th percentile concentrations for fecal coliforms and *E. coli* met MoE guidelines in all sample sets (Figures 5 and 6). Enterococci 90th percentile concentrations did not meet the guideline in August and October 2002 at **K3**, and in August 2002 at **K4** (Figure 7). All three sites had much better microbiological water quality in the spring sampling period, and poorer quality in the summer and fall periods.

Turbidity values in Lake Kathlyn ranged from 0.54 to 5.10 NTU, and the guideline of ≤ 5 NTU was not met in one sample from **K2**. Colour values did not meet the 15 TCU guideline in two samples from each of **K2** and **K4** (both sites exceeded the guideline on April 22 and 29, 2003). Colour and turbidity increases observed at all sites on April 22, 2003 may be related to mixing following ice-off, which occurred on April 16.

The table below summarizes other physical and chemical parameter guidelines that were not met at Lake Kathlyn sampling sites (note: in the case of phosphorus, concentrations are compared to the Smithers Lakes (site-specific) objective of ≤ 0.015 mg/L rather than the guideline of ≤ 0.01 mg/L):

Site	Parameter	MoE Guideline/Objective	Observed Concentration (Date)
Deep Station	Phosphorus	≤ 0.015 mg/L	0.021 mg/L (Aug 29)
	Aluminum	≤ 0.2 mg/L	0.447 mg/L (Aug 29)
	Manganese	≤ 0.05 mg/L (aesthetic)	0.276 mg/L (Aug 29)
K2	Iron	≤ 0.3 mg/L (aesthetic)	0.365 mg/L (Oct 7)
	Phosphorus	≤ 0.015 mg/L	0.020 mg/L (Apr 7)
K3	Iron	≤ 0.3 mg/L (aesthetic)	0.306 mg/L (Oct 7)
	Manganese	≤ 0.05 mg/L (aesthetic)	0.0761 mg/L (Oct 7)
	Phosphorus	≤ 0.015 mg/L	0.018 mg/L (Apr 7)
K4	Iron	≤ 0.3 mg/L (aesthetic)	0.366 mg/L (Oct 7)

The site-specific objective for phosphorus was derived from the drinking water guideline which applies to lakes only. This guideline has been set to protect the water from excessive algae and plant growth, and thus minimize treatment costs and reduce the risk of taste and odour from algae (Nordin, 1985). Over the past 15 years phosphorus concentrations have often exceeded the site-specific objective, and the 2003-03 concentrations are not atypical. The elevated concentrations indicate that the lake continues to be vulnerable to algae blooms, but there are no immediate or direct health concerns associated with the observed concentrations. The aluminum drinking water guideline level is intended to provide water consumers with a margin of safety from potential health risks associated with aluminum ingestion; there is presently no health evidence upon which to base a drinking water criterion (Butcher, 1988). Manganese and iron are also not typically a health concern in drinking water and the guidelines are for aesthetic purposes. Manganese is among the elements least toxic to mammals, but at concentrations above the guideline, manganese can stain plumbing fixtures and laundry, and produce undesirable tastes and odours (Health Canada, 2003). Iron can also collect and block pipes and plumbing fixtures, and produce colour, taste, and rust flakes in water (Health Canada, 2003).

5.2 Seymour Lake (S1, S2, S3)

Seymour Lake sampling sites showed all three microbiological indicators during the sampling period. **S1** had frequent occurrences of all three indicators in August and October 2002, while **S2** and **S3** had fewer detections and much lower concentrations. All April 2003 samples except one had no indicators present.

The 90th percentile concentrations for fecal coliforms and *E. coli* did not meet MoE guidelines in August 2002 at **S1** (Figures 5 and 6). Enterococci 90th percentile concentrations did not meet the guideline in August 2002 at **S1**, and August and October 2002 at **S2** (Figure 7). Overall, microbiological water quality was better during the fall and spring sampling periods, and poorer during the summer period.

Turbidity values in Seymour Lake ranged from 0.26 to 26.0 NTU. The MoE turbidity guideline of ≤ 5 NTU was not met in 11 (of 15) samples from **S1**. In recent sampling programs, **S1** has had substantially higher fecal coliform and turbidity values, compared to the other Seymour Lake sampling sites. It was recently learned that a landowner adjacent to this site has been feeding several hundred ducks and geese near the water intake. This activity may be influencing water quality conditions at **S1**, and the landowner has been advised of the sampling results and encouraged to discontinue this practice. For the purpose of collecting long-term trend monitoring data, results reported in this study from **S1** are probably not representative of current lake conditions, and a replacement site may be desirable for future monitoring.

Colour values at Seymour Lake sampling sites were consistently high. The 15 TCU guideline was not met in 44 of 45 samples. Past testing at Seymour Lake has revealed high colour values typical of bogs, and it is recognized that colour values in this lake will likely continue to exceed established water quality objectives, even following the implementation of lake management techniques. If the lake continues to be used for drinking, the water should be treated to remove colour to the water quality objective of 15 TCU.

The table below summarizes other physical and chemical parameter guidelines that were not met at Seymour Lake sampling sites:

Site	Parameter	MoE Guideline/Objective	Observed Concentration (Date)
S1	Phosphorus	≤ 0.015 mg/L	0.026 mg/L (Oct 7) 0.072 mg/L (Apr 7)
	Iron	≤ 0.3 mg/L (aesthetic)	1.53 mg/L (Oct 7) 1.20 mg/L (Apr 7)
	Manganese	≤ 0.05 mg/L (aesthetic)	0.0570 mg/L (Oct 7) 0.0715 mg/L (Apr 7)
S2	Phosphorus	≤ 0.015 mg/L	0.017 mg/L (Oct 7) 0.040 mg/L (Apr 14)
	Iron	≤ 0.3 mg/L (aesthetic)	0.378 mg/L (Oct 7) 0.659 mg/L (Apr 14)
	Manganese	≤ 0.05 mg/L (aesthetic)	0.1090 mg/L (Apr 14)

S3	Phosphorus	≤ 0.015 mg/L	0.021 mg/L (Oct 7) 0.017 mg/L (Apr 7)
	Iron	≤ 0.3 mg/L (aesthetic)	0.426 mg/L (Oct 7) 0.368 mg/L (Apr 7)
	Manganese	≤ 0.05 mg/L (aesthetic)	0.0531 mg/L (Oct 7)

Implications of these exceedences were discussed above in Section 5.1.

5.3 Tyhee Lake (T2, T3, T4)

Tyhee Lake sampling sites showed all three microbiological indicators during the sampling period. Fecal coliforms, *E. coli* and enterococci were frequently detected in low concentrations (most concentrations were 3 CFU/100 mL or less) at all sites in August and October 2002. In April 2003, no indicators were detected at **T4** and enterococci was the only indicator detected at **T2**. Sampling at **T3** was incomplete and 90th percentiles were not calculated for the April 2003.

The 90th percentile concentrations for all three microbiological indicators met MoE guidelines in all sample sets at Tyhee Lake (Figures 5, 6 and 7). Overall, microbiological water quality was better during the spring sampling period, and poorer in the summer and fall periods.

Turbidity values in Tyhee Lake met the MoE guideline of ≤ 5 NTU at all times. Colour values were consistently below the 15 TCU guideline, and the guideline was not met in only one sample (**T2**, colour was 20 TCU on April 7, 2003).

Phosphorus was the only other physical or chemical parameter that did not meet the objective level in Tyhee Lake. The table below summarizes the exceedences:

Site	Parameter	MoE Guideline/Objective	Observed Concentration (Date)
T2	Phosphorus	≤ 0.015 mg/L	0.037 mg/L (Apr 7)
T3	Phosphorus	≤ 0.015 mg/L	0.024 mg/L (Apr 7)

Implications of this were discussed above in Section 5.1.

5.4 Round Lake (R3, R4, R5)

Round Lake sampling sites showed all three microbiological indicators during the sampling period. At **R4** and **R5**, fecal coliforms, *E. coli* and enterococci were detected on isolated occasions in low concentrations. **R3** showed much higher concentrations and more frequent occurrences of all indicators during the August 2002 sample set. In October 2002 the **R3** intake was changed to a shoreline well, and sampling results showed extremely high fecal coliform and enterococci concentrations. Results from samples taken at **R3** during October 2002 and April 2003 were discarded because they

likely represent well development effects and are not representative of water quality conditions in the lake.

The 90th percentile concentrations for all three indicators met MoE guidelines in all three sample sets from **R4** and **R5** (Figures 5, 6 and 7). At **R3**, the enterococci 90th percentile did not meet the guideline in August 2002 (Figure 7). Overall, microbiological water quality was better during the spring sampling period, and poorer during the summer and fall.

Turbidity values in Round Lake did not meet the MoE guideline of ≤ 5 NTU in one sample from each sampling site. The three guideline exceedences all occurred on different dates, so no particular date was had poor turbidity overall. The colour guideline was not met in one of five samples from **R3**, four of 15 samples from **R4** and three of 14 samples from **R5**.

The table below summarizes other physical and chemical parameter guidelines that were not met at Round Lake sampling sites:

Site	Parameter	MoE Guideline/Objective	Observed Concentration (Date)
Deep Station	Phosphorus	≤ 0.015 mg/L	0.027 mg/L (Aug 28)
	Manganese	≤ 0.05 mg/L (aesthetic)	0.0507 mg/L (Aug 28)
R4	Phosphorus	≤ 0.015 mg/L	0.044 mg/L (Oct 7) 0.067 mg/L (Apr 7)
	Manganese	≤ 0.05 mg/L (aesthetic)	0.0627 mg/L (Oct 7)
R5	Phosphorus	≤ 0.015 mg/L	0.019 mg/L (Oct 7) 0.070 mg/L (Apr 14)

Note: There were no guideline exceedences at **R3** samples because physical and chemical parameters were not tested at this site in August 2002 (they were tested at the Deep Station instead), and October and April samples were discarded because changes were made to the water intake. Implications of the guideline exceedences listed in the table above were discussed in Section 5.1.

Figure 8: Fecal Coliform 90th Percentile Concentrations at Bulkley Valley Sites

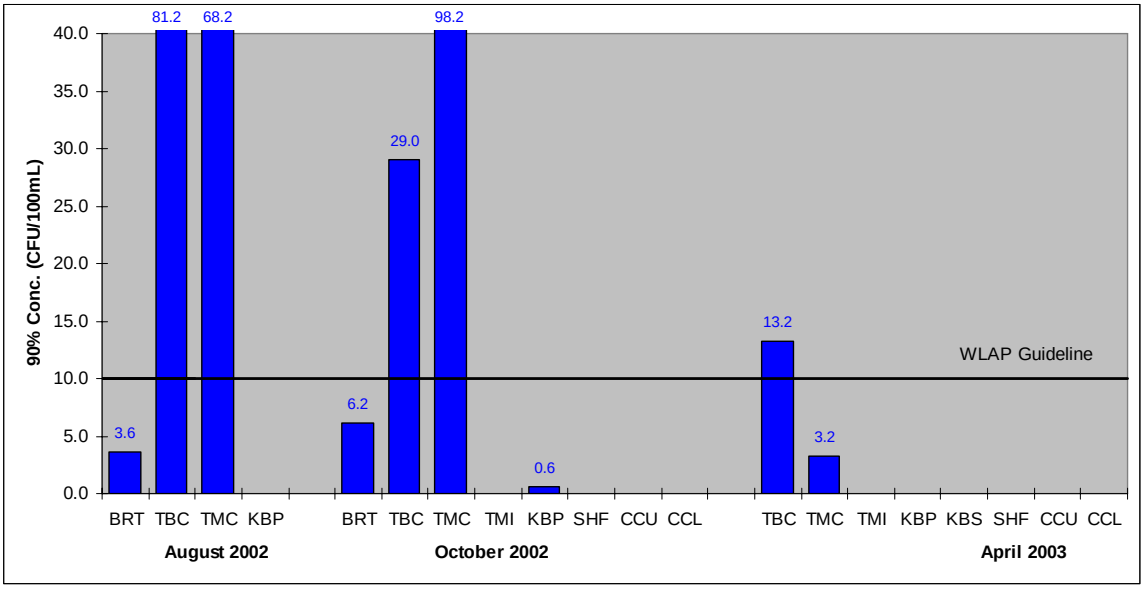


Figure 9: *E. Coli* 90th Percentile Concentrations at Bulkley Valley Sites

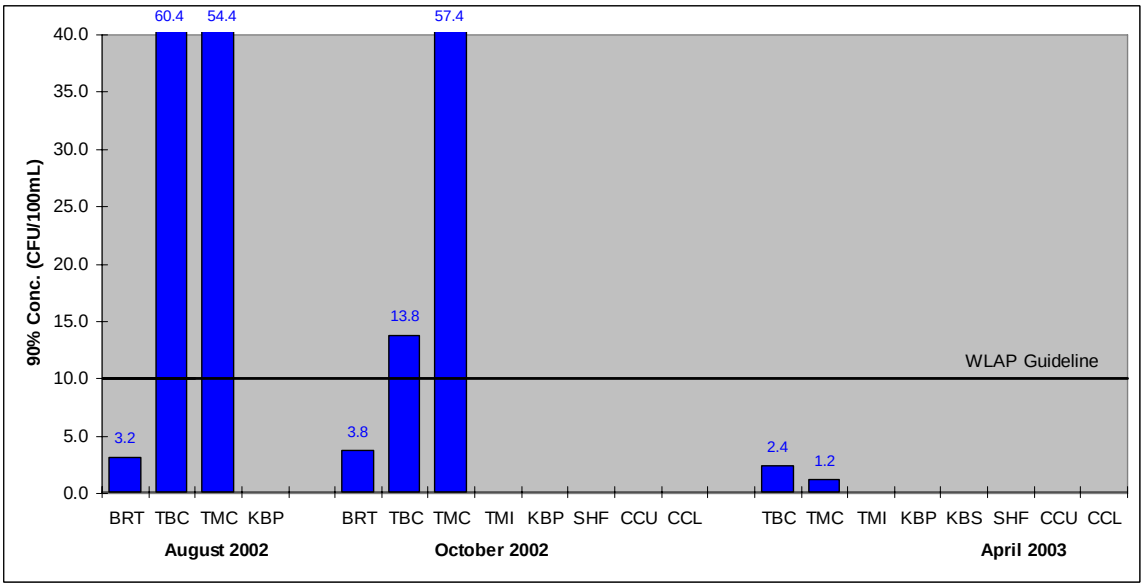
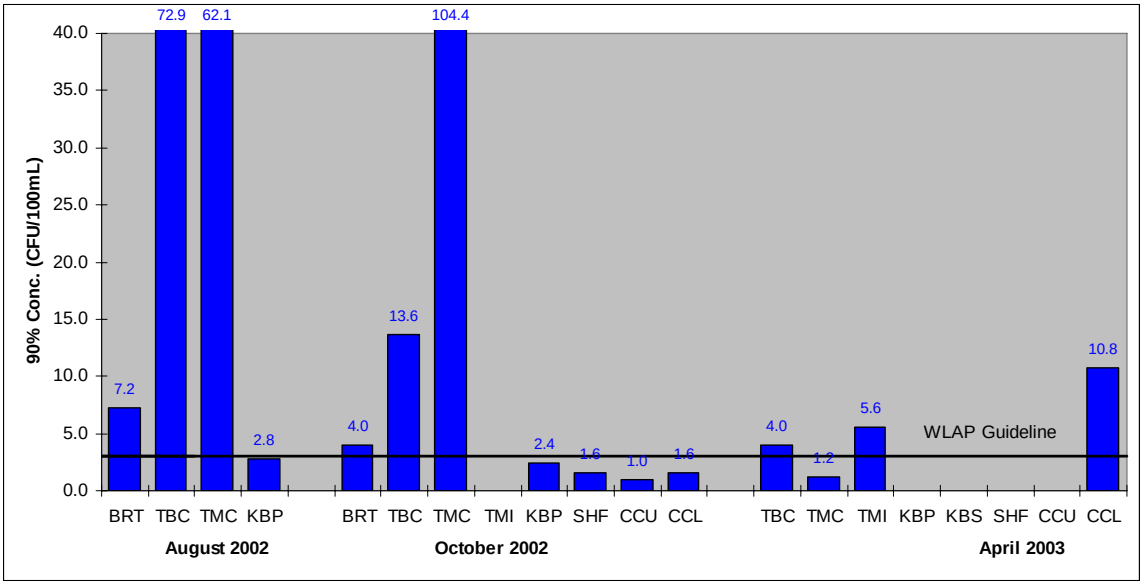


Figure 10: Enterococci 90th Percentile Concentrations at Bulkley Valley Sites



5.5 Kirby Lake (KBP, KBS, FGW)

Kirby Lake Surface Water (KBP, KBS)

Kirby Lake surface water was sampled at two locations: (1) along the shoreline of the lake near the infiltration gallery (**KBS**, sampled in April 2003 only**)**, and (2) after the infiltration gallery at the pump house (**KBP**, sampled in August and October 2002 and April 2003). At both sites, no microbiological indicators were present in the April 2003 samples. In the 2002 sample sets from **KBP**, fecal coliforms were detected in one (of 10) sample and enterococci were detected in two (of 9) samples. *E. coli* were not present in any water samples.

The 90th percentile concentrations for all three microbiological indicators met MoE guidelines in all three sample sets from **KBP** and in the single sample set from **KBS** (Figures 8, 9 and 10).

In 2002, the MoE turbidity guideline of ≤ 5 NTU was met at all times at **KBP**. Colour values did not meet the MoE guideline in one of 10 samples.

In April 2003, turbidity values met the MoE guideline. They were slightly higher at **KBP** than at **KBS**, but the values followed the same general pattern. The increase on April 24 may be related to ice-off, which occurred around this date. All five samples from **KBP** did not meet the colour guideline, while only one of five samples from **KBS** did not meet the guideline. The results of April 2003 turbidity and colour sampling from Kirby Lake shoreline (**KBS**) and the pump house (**KBP**) are summarized in Table 4.

Table 4: Kirby Lake Colour and Turbidity Values Pre- and Post- Infiltration Gallery

Date	Turbidity (NTU)		Colour (TCU)	
	Shoreline	Pump house	Shoreline	Pump house
7-Apr-03	n/a	0.33	n/a	30
14-Apr-03	1.62	0.81	5	30
24-Apr-03	1.88	1.43	5	30
29-Apr-03	1.48	0.69	15	20
6-May-03	1.46	0.57	15	30
12-May-03	0.98	n/a	20	n/a

The turbidity decrease from **KBS** to **KBP** suggests that the water system infrastructure, including infiltration gallery and piping, is effective at removing some suspended material from the water. According to Bob Watson (Public Health Engineer), "the gallery is reducing turbidity by a percentage similar to the full depth sand filter (no coagulants) used at the main water treatment plant on Saltspring Island, and the source may not be all that different…the reason for the increase in colour is unclear" (Watson, 2003 pers. comm.). Further sampling is required to determine if the colour is manganese or organic, as this will dictate removal options.

The table below summarizes other physical and chemical parameter guidelines that were not met at Kirby Lake sampling sites. Note that during the April/May 2003 sample set, multiple samples were sent for comprehensive analysis, rather than the usual single sample per season. This was done to improve our understanding of changes in source water quality associated with spring ice-off.

Site	Parameter	MoE Guideline	Observed Concentration (Date)
KBP	Organic Carbon	≤ 4 mg/L	10.7 mg/L (Apr 24) 13.5 mg/L (May 6)
	Phosphorus	≤ 0.01 mg/L	0.019 mg/L (Aug 8) 0.017 mg/L (Apr 7) 0.043 mg/L (Apr 24) 0.032 mg/L (May 6)
	Manganese	≤ 0.05 mg/L (aesthetic)	0.0943 mg/L (Aug 8) 0.0875 mg/L (Apr 7) 0.0977 mg/L (May 6)
KBS	Organic Carbon	≤ 4 mg/L	14.5 mg/L (May 6)
	Phosphorus	≤ 0.01 mg/L	0.047 mg/L (Apr 14) 0.023 mg/L (May 6)

Variability observed in the April/May 2003 sample results (see the Data Appendix for full results) can likely be attributed to ice-off and mixing processes, and runoff associated with low-elevation snowmelt. On April 14, Kirby Lake was just beginning to melt along the shoreline but was still largely under ice. The April 14 sample from **KBS** contains lower concentrations of most sampling parameters, suggesting dilution of lake water by recent snow and ice melting along the shoreline. The cause of the spike in total phosphorus concentration on this date is not known. However, because the dissolved fraction remains low, the increase in total phosphorus may be partly a result of sample

contamination from bottom sediments. Following spring freshet, ice-off, and mixing of the lake, the May 6 samples from both **KBP** and **KBS** show a shift towards previous conditions.

Although Kirby Lake samples show a range of phosphorus concentrations, the drinking water guideline was never met. Consistently high phosphorus levels indicate that Kirby Lake has eutrophic characteristics, and may be subject to excessive aquatic plant growth and periodic algae blooms.

Total Organic Carbon (TOC) concentrations at both Kirby Lake sites far exceed the MoE guideline set at 4 mg/L to avoid disinfection by-product production. Higher TOC levels make it difficult to maintain the chlorine residual necessary for protection from pathogenic bacteria and viruses, and can also result in the formation of disinfection by-products including trihalomethanes (THMs) and halo-acetic acids (HAAs). THMs are a know carcinogen and their formation in drinking water is a serious drinking water quality issue (see Moore, 1998 or Health Canada, 2003 for more information).

Implications of the manganese guideline exceedence were discussed above in Section 5.1.

Fir Bluff Subdivision Groundwater (FGW)

Fir Bluff Subdivision groundwater (site **FGW**) was tested on October 31, 2002, and April 24 and May 6, 2003. No microbiological indicators were detected in any water samples, and turbidity and colour were below MoE guideline levels. The water was very hard (hardness ranged from 341 to 396 mg/L) with high concentrations of calcium and magnesium. There is no drinking water guideline for calcium, and the aesthetic objective for magnesium is 100 mg/L (much higher than the concentration observed in the well).

Parameters that did not meet MoE guidelines are summarized in the table below:

Site	Parameter	MoE Guideline	Observed Concentration (Date)
FGW	Specific Conductance	≤ 700 µS/cm	720 µS/cm (Oct 31) 719 µS/cm (Apr 24)
	Organic Carbon	≤ 4 mg/L	6.7 mg/L (Apr 24) 8.0 mg/L (May 6)
	Manganese	≤ 0.05 mg/L (aesthetic)	2.110 mg/L (Oct 31) 1.570 mg/L (Apr 24) 0.823 mg/L (May 6)

Specific conductance, which is a measure of the concentration of ions in water, barely exceeded the drinking water guideline of 700 µS/cm. High conductance values are generally associated with the occurrence of Total Dissolved Solids (TDS) in water, and at high levels, TDS contribute to excessive hardness, unpalatability, mineral deposition, and corrosion (Health Canada, 2003). Manganese is not typically a health concern in drinking water and the guideline is for aesthetic purposes (see Section 5.1), but the concentrations detected in **FGW** samples are significantly higher than the guideline level.

Groundwater sampling results from 2001 indicate similar concentrations in the past, and further research is recommended to determine if these concentrations pose a health risk.

Surface Water vs. Groundwater

The April 2003 sampling at Kirby Lake did not reveal significant increases in turbidity or microbiological indicator concentrations during spring run-off, as have been documented by residents; further testing in future years is recommended to confirm that this is the case.

Water quality results from the lake indicate that water quality was acceptable during the periods sampled, provided the chlorinator is functioning properly. However, the high levels of TOC are a concern and alternative treatment methods (e.g. non-chlorine) or treatment to reduce disinfection by-products should be considered if this source continues to be used.

In the groundwater, specific conductance, hardness, and other physical and chemical parameter results were different than the lake results, suggesting that the water does not originate in the lake. Groundwater sources are usually more secure drinking water sources than surface waters, however, because this source is relatively shallow the Health Authority may still suggest (or require) disinfection of the water (Watson, 2003 pers. comm.). If the Water Board chooses to develop this source, they will need to ensure the well head is adequately protected, and may want to investigate options for removal of manganese and/or softening of the water.

5.6 Chicago Creek (SHF, CCU, CCL)

Chicago Creek was sampled in October 2002 and April 2003 and enterococci was the only microbiological indicator detected. It was found in two or three samples from each site, usually in low concentrations. The enterococci occurrences at the different sites were on different dates, with no particular date showing poorer water quality.

The 90th percentile concentrations for fecal coliforms and *E. coli* met MoE guidelines at all sites (Figures 8 and 9). The enterococci 90th percentile concentration did not meet the guideline at **CCL** in April (Figure 10).

Turbidity values in Chicago Creek source water were very low and the MoE guideline of $\leq$ 5 NTU was met at all times. Colour values were also low and easily met guideline levels, and all other physical and chemical parameters were below drinking water guidelines.

Water quality was similar at the three sites, with the exception of slightly elevated copper concentrations at **SHF**. This may be due to the presence of copper pipes somewhere in the distribution system. Total uranium was suspected to be high in Chicago Creek, and data from 2002-03 confirmed this. Concentrations measured in Chicago Creek were one

to two orders of magnitude higher than other sites in the Bulkley Valley, but were still below the drinking water guideline.

5.7 Bulkley River (BRT, BU1, BU2, BU3)

Bulkley River at Telkwa (BRT)

BRT showed all three microbiological indicators during the sampling period. Fecal coliforms, *E. coli* and enterococci were frequently detected at concentrations of 10 CFU/100 mL or less in the August, October, and November sample sets.[6] The 90th percentile concentrations for fecal coliforms and *E. coli* met MoE guidelines in all sample sets at **BRT** (Figures 8 and 9). Enterococci 90th percentile concentrations ranged from 4.0 to 7.6 CFU/100mL and did not meet the guideline in all sample sets (Figure 10). There was no apparent seasonal difference in microbiological water quality at **BRT**.

Turbidity in the Bulkley River at **BRT** ranged from 0.56 to 17.9 NTU and the MoE guideline of ≤ 5 NTU was not met in only one of 15 samples. Turbidity spikes were observed at least once in each sample set, which is consistent with previous studies that have shown the river is susceptible to episodes of high turbidity during periods of high runoff. The October 7 turbidity spike was accompanied by slight increases in nutrient and total metals concentrations, but not by an increase in colour. This suggests the elevated concentrations were caused by increased particulate material in the water, likely the result of recent rainfall and associated runoff in the watershed. Results from this date illustrate variability in Bulkley River water quality, and highlight the need for a treatment system that maintains effectiveness during episodes of turbid water.

Colour values at **BRT** met the 15 TCU guideline at all times. The table below summarizes the two other physical and chemical parameter guidelines that were not met at **BRT**:

Site	Parameter	MoE Guideline	Observed Concentration (Date)
BRT	Aluminum	≤ 0.2 mg/L	0.233 mg/L (Oct 7)
	Iron	≤ 0.3 mg/L (aesthetic)	0.604 mg/L (Oct 7)

The drinking water guidelines for these parameters are for aesthetic purposes, and the observed concentrations are not a concern (see Section 5.1).

Upstream Bulkley River Late-Fall Sampling (BRT, BU1, BU2, BU3)

In the November sample set, all three microbiological indicators were frequently detected at low concentrations at every site; November 3 was the only date where all sites had no

[6] The October sample set includes the five samples between October 7 and November 3, and the November sample set includes the five samples between October 28 and November 25; October 28 and November 3 samples are used in calculations for both sample sets.

indicators present. Enterococci concentrations were highest overall, and were elevated at all sites on November 18.

Table 5 summarizes the 90th percentile indicator concentrations with respect to their relative positions on the river. Ninetieth percentiles for fecal coliforms and *E. coli* met MoE guidelines at all Bulkley River sites. Enterococci 90th percentile concentrations did not meet the guideline level (≤ 3 CFU/100 mL) at any site. The observed concentrations are not atypical for a river whose watershed contains agricultural land (Odense, 2003 pers. comm.). Concentrations of the three indicators showed a general increasing trend in the downstream direction, with significant increases between **BU3** and **BU2**. This may be a result of the Helps Creek inflow, which drains an agricultural area. Testing on Toboggan and Thompson Creeks (see below) has revealed that small streams draining agricultural areas in the Bulkley Valley have high bacteria concentrations, and it is likely that Helps Creek would have similar concentrations. The concentration difference between **BU2** and **BU1** is not significant, and the lower concentrations at **BRT** may be caused by dilution from the Telkwa River.

Table 5: Microbiological Indicator 90th Percentile Concentrations (November 2002)

Telkwa River joins Bulkley River ↓

Upstream → Downstream

Indicator	Site			
	BU3	**BU2**	**BU1**	**BRT**
Fecal coliforms	2.6	5.6	6.4	5.0
E. coli	1.6	2.6	3.4	3.6
Enterococci	11.2	19.4	18.0	7.6

Turbidity in the Bulkley River during the November sample set was variable. The MoE guideline of ≤ 5 NTU not met in one sample from **BU3** (November 3). Colour values followed the same trend, with samples meeting the drinking water guideline at all times except **BU3** on November 3.

All other physical and chemical parameters tested were below acceptable guideline levels. Observed concentrations of chloride, nitrogen and phosphorus at the four sampling sites do not suggest any major point sources of sewage contamination on the section of the river tested. However, because the Bulkley River is very large it would be difficult to isolate sewage contamination without testing at the exact location where it is occurring. The increasing microbiological indicator concentrations may be caused by agricultural activities in the watershed, but more extensive study of all tributaries to the Bulkley River is needed before any conclusions can be made.

5.8 Toboggan Creek (TBC)

TBC showed all three microbiological indicators during the sampling period. Fecal coliforms, *E. coli* and enterococci were detected on every sampling date in the August and October 2002 sample sets, at concentrations up to 100 CFU/100 mL. The three indicators were detected in many samples during April, but at lower concentrations.

The 90th percentile concentrations from **TBC** are summarized in Figures 7, 8 and 9. MoE guidelines for fecal coliforms and enterococci were not met in any sample sets, and the *E. coli* guideline was not met in the August 2002 and October 2002 sample sets. Overall microbiological water quality was better during the spring sampling period and poorer in the summer and fall periods.

Turbidity was variable, and the MoE guideline of ≤ 5 NTU was not met in 10 of 15 samples. Turbidity values were significantly higher in the August 2002 and April 2003 sample sets, and nine of the ten exceedences occurred in these seasons. The 15 TCU colour guideline was not met in any sample from April.

The table below summarizes the two other physical and chemical parameter guidelines that were not met at **TBC**:

Site	Parameter	MoE Guideline	Observed Concentration (Date)
TBC	Aluminum	≤ 0.2 mg/L	0.290 mg/L (Aug 8)
	Iron	≤ 0.3 mg/L (aesthetic)	0.596 mg/L (Oct 7)

The drinking water guidelines for these parameters are for aesthetic purposes, and the observed concentrations are not a concern (see Section 5.1). It should be noted that the April 7, 2003 comprehensive sample had elevated levels of nutrients and physical parameters, but a metals analysis was not completed on this date.

5.9 Thompson Creek (TMC, TMI)

Thompson Creek water was sampled at two locations: the creek adjacent to an infiltration gallery (**TMC**, sampled in August and October 2002 and April 2003**)**, and after the infiltration gallery at a water system tap (**TMI**, sampled in October and April only).

At **TMC**, fecal coliforms, *E. coli* and enterococci were detected on every sampling date in the August and October sample sets at concentrations up to 160 CFU/100 mL. Lower concentrations later in the fall may be a result of reduced water flows and the ground and creek beginning to freeze. Indicator concentrations were much lower in the April sample set. The 90th percentile concentrations for all three indicators did not meet MoE guidelines in August and October (Figures 8, 9 and 10). Overall microbiological water quality was significantly better during the spring sampling period.

At **TMI**, fecal coliforms and *E. coli* were not detected and guidelines were met. Enterococci were detected twice in the April sample set, and the 90th percentile

concentration did not meet the guideline level in April. Microbiological water quality at **TMI** was better in the fall, and poorer in the spring.

Turbidity at **TMC** was higher in August than it was in October, and it was variable in April. The MoE guideline of ≤ 5 NTU was not met in one (of 15) sample at **TMC**. Turbidity at **TMI** was significantly lower and much more stable than it was at **TMC** on the same dates (Table 6), and the MoE guideline was easily met at all times.

Colour values at **TMC** did not meet the MoE guideline in any sample from April, 2003. At **TMI**, colour values were less than they were on corresponding dates at **TMC** (see Table 6) and the guideline was not met in only one sample.

Table 6: Thompson Creek Colour and Turbidity Values Pre- and Post- Infiltration Gallery

Date	Turbidity (NTU)		Colour (TCU)	
	Creek	Intake	Creek	Intake
9-Oct-02	1.44	0.26	15	5
15-Oct-02	1.01	0.28	10	5
22-Oct-02	1.24	0.21	15	10
30-Oct-03	1.19	0.19	15	5
7-Apr-03	6.46	0.42	30	15
14-Apr-03	3.36	0.43	30	15
24-Apr-03	4.04	0.23	30	10
29-Apr-03	3.21	0.20	30	15
6-May-03	1.45	0.28	20	20

The observed differences in bacteria concentrations, turbidity and colour between **TMC** and **TMI** are significant, suggesting that the gravel infiltration gallery provides effective filtering of suspended material (turbidity) and bacteria.

Other physical and chemical parameters that did not meet guideline levels at Thompson Creek sampling sites were as follows:

Site	Parameter	MoE Guideline	Observed Concentration (Date)
TMC	Aluminum	≤ 0.2 mg/L	0.202 mg/L (Apr 7)
	Iron	≤ 0.3 mg/L (aesthetic)	0.439 mg/L (Oct 9) 0.763 mg/L (Apr 7)
	Manganese	≤ 0.05 mg/L (aesthetic)	0.147 mg/L (Oct 9) 0.158 mg/L (Apr 7)

The drinking water guidelines for these parameters are for aesthetic purposes, and the observed concentrations are not a concern (see Section 5.1).

Microbiological indicator results from **TMC** were better in the spring and poorer in the summer and fall, while they were opposite at **TMI**. Other physical and chemical water quality results at both sites (including colour and turbidity) were better in the summer and fall and poorer in the spring. The April 2003 sample from **TMI** contained much higher levels of many parameters including specific conductance, hardness and many metals; the

cause of this occurrence is not known and further sampling is recommended to investigate this result. In addition, it is recommended that additional sampling be conducted to further investigate the anecdotal evidence of poorer water quality during spring freshet.

5.10 Seasonal Variations in Water Quality

The results and guideline comparisons discussed above reflect conditions at the time of sampling and do not necessarily represent all conditions in Bulkley Valley drinking water sources. Remington (2002) found that monitoring in mid-summer only does not reflect the range of year-round source water quality in the Skeena Region. She recommended that a more varied temporal schedule be devised for drinking water quality monitoring of surface water sources, which includes spring and fall periods. This study has been designed to gather information from different seasons, and this data represents the first data sets for many sources, and the first spring data sets for others. Future sampling efforts should be designed to confirm that the results from 2002-03 are representative of the seasonal conditions in these drinking water sources.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

A comprehensive sampling program was implemented for nine drinking water sources in the Bulkley Valley including the Smithers Lakes, Kirby Lake, Chicago Creek, the Bulkley River, Toboggan Creek and Thompson Creek. At most sites, there is little or no historical data with which to compare these results; however, where past sampling data exists, 2002-03 results do not suggest deteriorating trends in water quality. Rather, they demonstrate seasonal variations which are common in most surface water sources, and highlight the need for year-round monitoring of drinking water sources.

Highlights of the 2002-03 sampling results are summarized below:

Smithers Lakes

- As reported in the past (Remington, 2002a) microbiological indicators are commonly found in these water sources. While there is very little historical data for *E. coli* and enterococci, fecal coliform concentrations in 2002-03 were similar to past results. Most sites met MoE *Disinfection Only* guidelines for fecal coliforms and *E. coli*; the enterococci guideline was not met in seven of 34 sample sets. Contamination sources were not determined, but may include natural (i.e. wildlife) and anthropogenic (i.e. agriculture, septic systems) sources.
- Tyhee Lake was the only lake that didn't have microbiological indicator concentrations exceeding MoE guidelines.
- Microbiological water quality at all lakes was better during the spring sampling period and poorer in the summer and fall. Remington (2002a) also reported higher bacteria concentrations in the fall, suggesting that this is a critical time to monitor water quality.
- Turbidity and colour results were similar to past results. While only a few turbidity values did not meet the MoE guideline of ≤ 5 NTU, most were greater than a desirable level of 1 NTU. Seymour Lake samples far exceeded the colour guideline, as they have in the past.
- Phosphorus concentrations commonly exceeded the site-specific objective of ≤ 0.015 mg/L, indicating that the lakes continue to be vulnerable to algae blooms and plant growth. Metals and other physical/chemical parameters are not a concern; however aluminum, iron, and manganese occasionally exceeded MoE aesthetic drinking water guidelines.

Kirby Lake

- In 2002 samples were collected after the infiltration gallery only and microbiological indicators were very occasionally detected. No indicators were detected before or after the infiltration gallery in 2003.

- The turbidity guideline was met at all times. When two sites were monitored, turbidity at the pump house was significantly lower than the lake, suggesting that the infiltration gallery is effective at removing some suspended material from the water.
- The colour guideline was occasionally exceeded. Colour values were found to increase after the infiltration gallery in April 2003; the reason for this is unclear.
- Total Organic Carbon values far exceeded the drinking water guideline in all Kirby Lake samples, indicating a risk of disinfection by-product (DBP) formation. Groundwater may provide an alternative drinking water source with lower DBP risk, however, manganese concentrations in the proposed well significantly exceed the drinking water guideline.

Chicago Creek

- Water quality results from 2002-03 indicate that most parameters are well below drinking water guideline levels. However, occasional detections of micriobiological indicators (in this study as well as Remington's study in 2001), highlight the need for treatment of this water source.

Bulkley River

- The Bulkley River has site-specific water quality objectives but no monitoring data exists from this area before 2001.
- Results from 2002-03 showed low concentrations of all three microbiological indicators. Fecal coliform and *E. coli*. concentrations met the MoE drinking water guideline in all sample sets; enterococci concentrations did not meet the guideline.
- When multiple sites were monitored, indicator concentrations showed an increasing trend in the downstream direction. The increases are likely due to inflows of tributary streams that drain agricultural areas.
- Turbidity results were variable, and increases are likely associated with rainfall events and runoff in the watershed.
- Water quality testing did not indicate a major source of sewage contamination in the Telkwa area, but more extensive sampling is required to determine the source of bacteria.

Toboggan Creek

- As was the case in Remington's 2001 study (2002a), microbiological indicator concentrations often exceeded MoE guidelines. Less frequent detections and lower concentrations were observed in April 2003, suggesting better microbiological water quality in the spring.

- Turbidity values were significantly higher in August and April, and did not appear to be correlated with bacteria concentrations. The guideline was not met in 10 of 15 samples.
- Most other parameters were within acceptable drinking water guideline levels, with the exception of aluminum and iron, which sometimes exceeded aesthetic drinking water guidelines.

Thompson Creek

- All three indicators were frequently detected in August and October and MoE guidelines were not met. Like Toboggan Creek, microbiological indicators were detected less frequently and in lower concentrations in April.
- Samples collected after the infiltration gallery showed significantly lower concentrations of microbiological indicators and lower turbidity and colour levels, indicating that the infiltration gallery provides effective filtering of suspended material.
- Most other parameters were within acceptable drinking water guideline levels, with the exception of aluminum, iron and manganese, which sometimes exceeded aesthetic drinking water guidelines.

6.2 Recommendations

Based on monitoring conducted in 2002-2003, we recommend that:

- The Ministry should continue to collaborate with the Northern Health Authority (NHA), local water suppliers, and other agencies interested in water quality in the Skeena Region.
- Monitoring of enterococci and *E. coli* levels (in addition to fecal coliform concentrations) should continue and these results should be included in water quality objectives development and updates.
- Future monitoring programs should include sampling in a range of (weather and flow) conditions to investigate variations in water quality.
- Through collaboration with NHA staff, residents and other users of land in (drinking water) watersheds should be made aware of the risks that land use activities pose on nearby surface water sources and groundwater wells. Residents should be reminded of the need to disinfect surface water supplies, and lake water users should be encouraged to extend intake pipes further into the lake to minimize potential sources of contamination.
- Drinking water source quality data should be made readily available to any interested parties.

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LIST OF ACRONYMS

CCME – Canadian Council of Ministers of the Environment

CFU – Colony Forming Unit

EHO – Environmental Health Officer

ICPMS – Inductively Coupled Plasma - Mass Spectrometry

MDL – Method Detection Limit

MoE – Ministry of Environment (previously called Ministry of Water, Land and Air Protection (WLAP) from June 2001 – June 2005)

MF – Membrane Filtration

NHA – Northern Health Authority

NTU – Nephelometric Turbidity Units

QA/QC – Quality Assurance / Quality Control

RPD – Relative Percent Difference

TCU – True Colour Units

WLAP – Ministry of Water, Land and Air Protection (ministry name from June 2001 – June 2005; now called Ministry of Environment (MoE))

GLOSSARY

Aesthetic objective: The substance concentration or characteristic of drinking water that can affect its acceptance by consumers. Where an aesthetic objective is specified, the values are below those considered to constitute a health hazard.

Aquifer: A geological formation that consists of saturated permeable materials that yield economical quantities of water to wells and springs.

Bacteria: Single-celled, microscopic organisms, some of which cause diseases in plants or animals.

Blank sample: A sample of distilled, de-ionized water that has been exposed to the sampling environment at the sample site and handled in the same manner as the actual sample (e.g., preserved, filtered). It provides information on contamination resulting from the handling technique and from exposure to the atmosphere.

Colour (True): A measure of the dissolved colouring compounds in water, attributed to the presence of organic and inorganic materials. Reported in true colour units (TCU).

Coliform bacteria: A bacteria carried in human and animal wastes. The presence of coliforms in water may indicate contamination from human or animal wastes.

Disinfection: The process of destroying microorganisms in water by the application of a chemical agent (disinfectant) such as chlorine.

Duplicate sample: Two samples taken at the same time and place, designed to provide a rough estimate of the overall precision associated with the field technique and laboratory analysis.

Eutrophic: Describes a lake of high photosynthetic activity.

Eutrophication: The process of physical, chemical and biological changes associated with nutrient, organic matter and silt enrichment of a water body, that cause it to age.

Groundwater: Water below the surface of the ground.

Hardness: A property of water which causes an increase in the amount of soap that is needed to produce foam or lather and that also produces scale in hot water pipes, heaters, boilers and other units in which the temperature of water is increased. Hardness is generally due to the presence of calcium and magnesium in the water. Reported in milligrams per liter (mg/L) as calcium carbonate ($CaCO_3$); greater than 120 mg/L is considered hard; less than 60 mg/L is soft.

Interim maximum acceptable concentration:	Where there is insufficient toxicological data to derive a maximum acceptable concentration with reasonable certainty, the recommended maximum level based on the available health data and employing an uncertainty factor.
Maximum acceptable concentration:	The concentration established for certain substances that are known or suspected to cause adverse effects on health. These concentrations are derived to safeguard health assuming lifelong consumption of drinking water containing the substance at that concentration.
Method detection Limit (MDL):	The minimum amount of a substance that can be routinely detected by the analytical instrument or technique with a high degree of confidence.
Microbiological indicator:	Bacteria indicating a risk of disease from pathogenic bacteria; If it can be shown that fecal contamination of the water has occurred, then pathogenic organisms may also be present. Common indicator bacteria include fecal coliforms, *Escherichia* coli (*E. coli*) and enterococci.
Micrograms per litre (ug/L):	One one-thousandth of one milligram per litre.
Milligrams per litre (mg/L):	A concentration unit of chemical constituents in solution; the weight of solute (substance) per unit volume of solvent (water).
Nutrient:	A substance (element or compound) necessary for the growth and development of plants and animals. Lake studies commonly focus on nutrients critical to plant growth: nitrogen and phosphorus.
Oligotrophic:	Describes a lake of low plant productivity.
pH:	A measure of the hydrogen-ion concentration in water. A quantitative expression for acidity or alkalinity of solution. The scale ranges from 0 to 14, pH 7 is neutral; less than 7 is acid; more than 7 is alkaline.
QA/QC (Quality assurance /Quality control):	QA is the overall verification program which provides producers and users of data the assurance that predefined standards of quality were met. QC is the system of guidelines, procedures and practices intended to regulate and control the quality of the data from collection through to analysis.
Specific conductance:	A measure of the ability of water to conduct an electric current; the greater the content of ions (dissolved metals and other materials) in the water, the more current the water can carry. Reported in microsiemens per centimetre (µS/cm).
Total metal:	A measure of metals in the dissolved state and those sorbed to particulate matter in suspension.

Turbidity:	A measure of the suspended particulate matter in a water body, which interferes with the passage of a beam of light through the water. Materials that contribute to turbidity include clay, silt, finely divided organic and inorganic matter, plankton and other microscopic organisms. Higher turbidity levels are often associated with higher levels of disease-causing microorganisms. Reported in nephelometric turbidity units (NTU).
Water quality guideline (Criteria):	A numerical value(s) for a physical, chemical, or biological characteristic of water, biota, or sediment which must not be exceeded to prevent specified detrimental effects from occurring to water use; the safe level of a substance for the protection of a given water use.
Water quality objective:	A water quality criterion or guideline adapted to protect the most sensitive designated water use at a specific location with an adequate degree of safety, taking local circumstances into account.
Watershed:	A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.

Drinking Water Source Quality Monitoring 2002-03

Bulkley Valley Surface Water Sources: Smithers Lakes, Kirby Lake, Chicago Creek, Bulkley River, Toboggan Creek and Thompson Creek

DATA APPENDIX

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May 2006

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WEEKLY MICROBIOLOGICAL INDICATOR & COLOUR AND TURBIDITY RESULTS (TABLE A) AND STATISTICAL ANALYSIS (TABLE B)

Table 1A – Site K2 (EMS # E207549)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
6-Aug-02	<1	<1	4	5	1.35
12-Aug-02	2	1	<1	<5	5.10
19-Aug-02	<1	<1	<1	<5	2.40
27-Aug-02	<1	<1	<1	5	1.58
3-Sep-02	<1	<1	<1	5	2.85
7-Oct-02	1	1	1	10	2.04
15-Oct-02	1	1	<1	10	0.89
21-Oct-02	<1	<1	<1	10	0.88
28-Oct-02	2	2	<1	10	1.00
3-Nov-02	1	<1	<1	15	0.98
7-Apr-03	<2	<2	<2	15	1.23
14-Apr-03	<2	<2	<2	10	1.16
22-Apr-03	<2	<2	<2	20	2.59
29-Apr-03	<2	<2	<2	20	1.72
6-May-03	<2	<2	2	10	0.81

Table 1B – Site K2 (EMS # E207549)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
August, 2002					
Maximum	2	1	4	5	5.10
Average	0.4	0.2	0.8	5	2.66
90th percentile	1.2	0.6	2.4	-	-
Guideline	Met	Met	Met	Met	Not Met
Exceedences	-	-	-	0	1
October, 2002					
Maximum	2	2	1	15	2.04
Average	1.0	0.8	0.2	11	1.16
90th percentile	1.6	1.6	0.6	-	-
Guideline	Met	Met	Met	Met	Met
Exceedences	-	-	-	0	0
April, 2003					
Maximum	<1	<1	2	20	2.59
Average	<1	<1	0.4	15	1.50
90th percentile	<1	<1	1.2	-	-
Guideline	Met	Met	Met	Not Met	Met
Exceedences	-	-	-	2	0

Table 2A – Site K3 (EMS # E207550)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
6-Aug-02	<1	<1	14	5	2.00
12-Aug-02	1	1	8	<5	1.82
19-Aug-02	<1	<1	5	<5	2.27
27-Aug-02	<1	<1	1	<5	1.72
3-Sep-02	3	2	8	5	1.51
7-Oct-02	<1	<1	38	10	2.30
15-Oct-02	<1	<1	<1	10	0.82
21-Oct-02	13	13	<1	5	0.74
28-Oct-02	<1	<1	<1	10	0.95
3-Nov-02	5	2	31	15	0.94
7-Apr-03	<2	<2	<2	10	1.40
14-Apr-03	<2	<2	<2	10	1.33
22-Apr-03	<2	<2	<2	15	2.09
29-Apr-03	<2	<2	<2	15	1.78
6-May-03	<2	<2	<2	10	0.90

Table 2B – Site K3 (EMS # E207550)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
August, 2002					
Maximum	3	2	14	5	2.27
Average	0.8	0.6	7.2	5	1.86
90th percentile	2.2	1.6	11.6	-	-
Guideline	Met	Met	Not Met	Met	Met
Exceedences	-	-	-	0	0
October, 2002					
Maximum	13	13	38	15	2.30
Average	3.6	3.0	13.8	10	1.15
90th percentile	9.8	8.6	35.2	-	-
Guideline	Met	Met	Not Met	Met	Met
Exceedences	-	-	-	0	0
April, 2003					
Maximum	<1	<1	<1	15	2.09
Average	<1	<1	<1	12	1.50
90th percentile	<1	<1	<1	-	-
Guideline	Met	Met	Met	Met	Met
Exceedences	-	-	-	0	0

Table 3A – Site K4 (EMS # E207551)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
06-Aug-02	<1	<1	<1	<5	1.09
12-Aug-02	1	1	<1	<5	1.77
19-Aug-02	3	3	1	<5	3.30
27-Aug-02	2	<1	<1	<5	1.30
03-Sep-02	12	9	27	<5	2.35
07-Oct-02	<1	<1	<1	15	1.74
15-Oct-02	<1	<1	1	10	1.14
21-Oct-02	<1	<1	<1	10	0.96
28-Oct-02	<1	<1	2	10	0.90
03-Nov-02	<1	<1	<1	10	0.80
07-Apr-03	<2	<2	<2	15	0.60
14-Apr-03	<2	<2	<2	10	0.54
22-Apr-03	<2	<2	<2	20	2.26
29-Apr-03	<2	<2	<2	20	1.59
06-May-03	<2	<2	<2	15	0.94

Table 3B – Site K4 (EMS # E207551)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
August, 2002					
Maximum	12	9	27	5	3.30
Average	3.6	2.6	5.6	5	1.96
90th percentile	8.4	6.6	16.6	-	-
Guideline	Met	Met	Not Met	Met	Met
Exceedences	-	-	-	0	0
October, 2002					
Maximum	<1	<1	2	15	1.74
Average	<1	<1	0.6	11	1.11
90th percentile	<1	<1	1.6	-	-
Guideline	Met	Met	Met	Met	Met
Exceedences	-	-	-	0	0
April, 2003					
Maximum	<1	<1	<1	20	2.26
Average	<1	<1	<1	16	1.19
90th percentile	<1	<1	<1	-	-
Guideline	Met	Met	Met	Not Met	Met
Exceedences	-	-	-	2	0

Table 4A – Site S1 (EMS # E207552)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
06-Aug-02	22	20	11	120	26.00
12-Aug-02	8	8	6	5	18.50
19-Aug-02	2	2	1	70	13.90
27-Aug-02	<1	<1	<1	60	11.50
03-Sep-02	1	1	4	80	7.35
07-Oct-02	<1	<1	2	50	11.00
15-Oct-02	1	<1	<1	60	5.14
21-Oct-02	<1	<1	<1	60	6.35
28-Oct-02	8	6	<1	60	5.91
03-Nov-02	1	<1	<1	50	2.15
07-Apr-03	<2	<2	<2	50	6.25
14-Apr-03	<2	<2	<2	60	6.98
22-Apr-03	<2	<2	<2	50	4.98
29-Apr-03	<2	<2	<2	70	4.07
06-May-03	<2	<2	<2	70	4.22

Table 4B – Site S1 (EMS # E207552)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
August, 2002					
Maximum	22	20	11	120	26.00
Average	6.6	6.2	4.4	67	15.45
90th percentile	16.4	15.2	9.0	-	-
Guideline	Not Met	Not Met	Not Met	Not Met	Not Met
Exceedences	-	-	-	4	5
October, 2002					
Maximum	8	6	2	60	11.00
Average	2.0	1.2	0.4	56	6.11
90th percentile	5.2	3.6	1.2	-	-
Guideline	Met	Met	Met	Not Met	Not Met
Exceedences	-	-	-	5	4
April, 2003					
Maximum	<1	<1	<1	70	6.98
Average	<1	<1	<1	60	5.30
90th percentile	<1	<1	<1	-	-
Guideline	Met	Met	Met	Not Met	Not Met
Exceedences	-	-	-	5	2

Table 5A – Site S2 (EMS # E207553)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
06-Aug-02	<1	<1	7	40	0.26
12-Aug-02	<1	<1	<1	100	1.69
19-Aug-02	<1	<1	1	40	1.00
28-Aug-02	<1	<1	1	50	0.49
03-Sep-02	<1	<1	<1	30	2.13
07-Oct-02	3	2	7	40	3.24
15-Oct-02	1	<1	<1	40	1.92
21-Oct-02	<1	<1	<1	40	1.50
28-Oct-02	<1	<1	<1	40	1.38
03-Nov-02	<1	<1	2	60	2.47
14-Apr-03	4	2	2	20	4.32
24-Apr-03	<2	<2	<2	40	1.86
29-Apr-03	<2	<2	<2	40	2.08
06-May-03	<2	<2	<2	30	1.53
12-May-03 *	<1	<1	<1	50	1.05

* Sample not analyzed within recommended holding time

Table 5B – Site S2 (EMS # E207553)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
August, 2002					
Maximum	<1	<1	7	100	2.13
Average	<1	<1	1.8	52	1.11
90th percentile	<1	<1	4.6	-	-
Guideline	Met	Met	Not Met	Not Met	Met
Exceedences	-	-	-	5	0
October, 2002					
Maximum	3	2	7	60	3.24
Average	0.8	0.4	1.8	44	2.10
90th percentile	2.2	1.2	5.0	-	-
Guideline	Met	Met	Not Met	Not Met	Met
Exceedences	-	-	-	5	0
April, 2003					
Maximum	4	2	2	50	4.32
Average	0.8	0.4	0.4	36	2.17
90th percentile	2.4	1.2	1.2	-	-
Guideline	Met	Met	Met	Not Met	Met
Exceedences	-	-	-	5	0

Table 6A – Site S3 (EMS # E207554)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
06-Aug-02	<1	<1	<1	40	1.50
12-Aug-02	1	1	<1	40	0.89
19-Aug-02	1	1	1	40	2.77
27-Aug-02	<1	<1	<1	40	0.96
03-Sep-02	<1	<1	1	40	1.01
07-Oct-02	<1	<1	<1	50	2.88
15-Oct-02	<1	<1	<1	50	1.81
21-Oct-02	<1	<1	<1	50	1.04
28-Oct-02	<1	<1	2	50	2.21
03-Nov-02	<1	<1	<1	20	1.01
07-Apr-03	<2	<2	<2	50	3.19
14-Apr-03	<2	<2	<2	50	1.47
22-Apr-03	<2	<2	<2	40	1.53
29-Apr-03	<2	<2	<2	40	1.26
06-May-03	<2	<2	<2	40	0.99

Table 6B – Site S3 (EMS # E207554)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
August, 2002					
Maximum	1	1	1	40	2.77
Average	0.4	0.4	0.4	40	1.43
90th percentile	1.0	1.0	1.0	-	-
Guideline	Met	Met	Met	Not Met	Met
Exceedences	-	-	-	5	0
October, 2002					
Maximum	<1	<1	2	50	2.88
Average	<1	<1	0.4	44	1.79
90th percentile	<1	<1	1.2	-	-
Guideline	Met	Met	Met	Not Met	Met
Exceedences	-	-	-	5	0
April, 2003					
Maximum	<1	<1	<1	50	3.19
Average	<1	<1	<1	44	1.69
90th percentile	<1	<1	<1	-	-
Guideline	Met	Met	Met	Not Met	Met
Exceedences	-	-	-	5	0

Table 7A – Site T2 (EMS # E207560)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
6-Aug-02	1	1	1	<5	0.77
14-Aug-02	1	<1	4	<5	0.46
20-Aug-02	1	<1	<1	<5	0.45
27-Aug-02	<1	<1	1	<5	0.47
3-Sep-02	<1	<1	<1	<5	0.53
7-Oct-02	<1	<1	<1	10	0.52
15-Oct-02	1	<1	1	10	0.65
21-Oct-02	1	<1	1	10	0.44
28-Oct-02	7	7	<1	5	0.40
3-Nov-02	<1	<1	2	<5	<0.10
7-Apr-03	<2	<2	<2	20	1.78
14-Apr-03	<2	<2	2	15	1.22
22-Apr-03	<2	<2	<2	5	0.79
29-Apr-03	<2	<2	<2	5	0.73
6-May-03	<2	<2	<2	5	0.55

Table 7B – Site T2 (EMS # E207560)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
August, 2002					
Maximum	1	1	4	5	0.77
Average	0.6	0.2	1.2	5	0.54
90th percentile	1.0	0.6	2.8	-	-
Guideline	Met	Met	Met	Met	Met
Exceedences	-	-	-	0	0
October, 2002					
Maximum	7	7	2	10	0.65
Average	1.8	1.4	0.8	8	0.42
90th percentile	4.6	4.2	1.6	-	-
Guideline	Met	Met	Met	Met	Met
Exceedences	-	-	-	0	0
April, 2003					
Maximum	<1	<1	2	20	1.78
Average	<1	<1	0.4	10	1.01
90th percentile	<1	<1	1.2	-	-
Guideline	Met	Met	Met	Not Met	Met
Exceedences	-	-	-	1	0

Table 8A – Site T3 (EMS # E207561)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
06-Aug-02	<1	<1	<1	<5	2.16
14-Aug-02	<1	<1	2	<5	1.10
20-Aug-02	<1	<1	<1	<5	0.96
27-Aug-02	1	1	<1	<5	0.73
03-Sep-02	<1	<1	<1	<5	0.54
07-Oct-02	<1	<1	<1	5	0.56
15-Oct-02	<1	<1	1	5	0.56
21-Oct-02	<1	<1	<1	10	0.28
28-Oct-02	<1	<1	1	10	0.31
03-Nov-02	n/a	n/a	n/a	n/a	n/a
07-Apr-03	n/a	n/a	n/a	n/a	n/a
14-Apr-03	n/a	n/a	n/a	n/a	n/a
22-Apr-03	<2	<2	<2	10	1.33
29-Apr-03	n/a	n/a	n/a	n/a	n/a
06-May-03	n/a	n/a	n/a	n/a	n/a

Table 8B – Site T3 (EMS # E207561)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
August, 2002					
Maximum	1	1	2	5	2.16
Average	0.2	0.2	0.4	5	1.10
90th percentile	0.6	0.6	1.2	-	-
Guideline	Met	Met	Met	Met	Met
Exceedences	-	-	-	0	0
October, 2002					
Maximum	<1	<1	1	10	0.56
Average	<1	<1	0.5	8	0.43
90th percentile	<1	<1	1.0	-	-
Guideline	Met	Met	Met	Met	Met
Exceedences	-	-	-	0	0
April, 2003					
Maximum	<1	<1	<1	10	1.33
Average	<1	<1	<1	10	1.33
90th percentile	<1	<1	<1	-	-
Guideline	Met	Met	Met	Met	Met
Exceedences	-	-	-	0	0

Table 9A – Site T4 (EMS # E207562)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
06-Aug-02	1	1	3	<5	0.44
14-Aug-02	1	<1	1	<5	0.56
20-Aug-02	<1	<1	<1	5	0.51
27-Aug-02	<1	<1	3	10	2.13
03-Sep-02	<1	<1	1	<5	0.45
07-Oct-02	1	<1	<1	10	0.56
15-Oct-02	<1	<1	<1	10	0.48
21-Oct-02	1	<1	<1	15	1.53
28-Oct-02	<1	<1	<1	10	2.72
03-Nov-02	1	<1	<1	10	0.43
07-Apr-03	<2	<2	<2	10	0.65
14-Apr-03	<2	<2	<2	10	0.60
22-Apr-03	<2	<2	<2	10	1.28
29-Apr-03	<2	<2	<2	10	0.77
06-May-03	<2	<2	<2	10	0.33

Table 9B – Site T4 (EMS # E207562)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
August, 2002					
Maximum	1	1	3	10	2.13
Average	0.4	0.2	1.6	6	0.82
90th percentile	1.0	0.6	3.0	-	-
Guideline	Met	Met	Met	Met	Met
Exceedences	-	-	-	0	0
October, 2002					
Maximum	1	<1	<1	15	2.72
Average	0.6	<1	<1	11	1.14
90th percentile	1.0	<1	<1	-	-
Guideline	Met	Met	Met	Met	Met
Exceedences	-	-	-	0	0
April, 2003					
Maximum	<1	<1	<1	10	1.28
Average	<1	<1	<1	10	0.73
90th percentile	<1	<1	<1	-	-
Guideline	Met	Met	Met	Met	Met
Exceedences	-	-	-	0	0

Table 10A – Site R3 (EMS # E207557)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
06-Aug-02	2	2	7	15	0.83
14-Aug-02	<1	<1	7	30	8.25
20-Aug-02	<1	<1	<1	5	0.90
28-Aug-02	6	3	37	5	0.72
03-Sep-02	<1	<1	<1	5	0.73

Table 10B – Site R3 (EMS # E207557)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
August, 2002					
Maximum	6	3	37	30	8.25
Average	1.6	1.0	10.2	12	2.29
90th percentile	4.4	2.6	25.0	-	-
Guideline	Met	Met	Not Met	Not Met	Not Met
Exceedences	-	-	-	1	1

Table 11A – Site R4 (EMS # E207558)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
06-Aug-02	<1	<1	<1	10	1.86
14-Aug-02	<1	<1	<1	20	3.16
20-Aug-02	<1	<1	<1	10	0.99
28-Aug-02	1	1	3	5	0.80
03-Sep-02	<1	<1	<1	10	44.00
07-Oct-02	<1	<1	<1	15	1.50
15-Oct-02	<1	<1	<1	15	1.19
21-Oct-02	1	<1	2	20	1.10
28-Oct-02	1	1	1	15	1.27
03-Nov-02	<1	<1	<1	40	3.60
07-Apr-03	<2	<2	2	15	1.30
14-Apr-03	<2	<2	<2	15	1.22
22-Apr-03	<2	<2	<2	30	4.19
29-Apr-03	<2	<2	<2	15	1.81
06-May-03	<2	<2	<2	15	1.24

Table 11B – Site R4 (EMS # E207558)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
August, 2002					
Maximum	1	1	3	20	44.00
Average	0.2	0.2	0.6	11	10.16
90th percentile	0.6	0.6	1.8	-	-
Guideline	Met	Met	Met	Not Met	Not Met
Exceedences	-	-	-	1	1
October, 2002					
Maximum	1	1	2	40	3.60
Average	0.4	0.2	0.6	21	1.73
90th percentile	1.0	0.6	1.6	-	-
Guideline	Met	Met	Met	Not Met	Met
Exceedences	-	-	-	2	0
April, 2003					
Maximum	<1	<1	2	30	4.19
Average	<1	<1	0.4	18	1.95
90th percentile	<1	<1	1.2	-	-
Guideline	Met	Met	Met	Not Met	Met
Exceedences	-	-	-	1	0

Table 12A – Site R5 (EMS # E249107)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
06-Aug-02	<1	<1	<1	10	1.21
14-Aug-02	2	<1	<1	<5	1.27
20-Aug-02	<1	<1	<1	5	1.47
28-Aug-02	1	1	2	5	1.79
03-Sep-02	<1	<1	<1	10	1.33
07-Oct-02	<1	<1	<1	15	0.81
15-Oct-02	<1	<1	<1	15	1.71
21-Oct-02	<1	<1	<1	15	6.53
28-Oct-02	<1	<1	<1	20	1.18
03-Nov-02	n/a	n/a	n/a	n/a	n/a
14-Apr-03	<2	<2	<2	20	1.74
22-Apr-03	<2	<2	<2	15	1.15
29-Apr-03	<2	<2	<2	15	1.20
06-May-03	<2	<2	<2	15	0.75
12-May-03 *	1	<1	<1	20	0.65

* Sample not analyzed within recommended holding time

Table 12B – Site R5 (EMS # E249107)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
August, 2002					
Maximum	2	1	2	10	1.79
Average	0.6	0.2	0.4	7	1.41
90th percentile	1.6	0.6	1.2	-	-
Guideline	Met	Met	Met	Met	Met
Exceedences	-	-	-	0	0
October, 2002					
Maximum	<1	<1	<1	20	6.53
Average	<1	<1	<1	16	2.56
90th percentile	<1	<1	<1	-	-
Guideline	Met	Met	Met	Not Met	Not Met
Exceedences	-	-	-	1	1
April, 2003					
Maximum	1	<1	<1	20	1.74
Average	0.2	<1	<1	17	1.10
90th percentile	0.6	<1	<1	-	-
Guideline	Met	Met	Met	Not Met	Met
Exceedences	-	-	-	2	0

Table 13A – Site KBP (EMS # E248964)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
08-Aug-02	<1	<1	n/a	15	0.64
14-Aug-02	<1	<1	<1	10	0.82
20-Aug-02	<1	<1	4	5	0.38
27-Aug-02	<1	<1	<1	15	0.47
03-Sep-02	<1	<1	<1	15	0.35
08-Oct-02	1	<1	<1	15	0.55
15-Oct-02	<1	<1	<1	15	0.52
21-Oct-02	<1	<1	<1	15	0.45
28-Oct-02	<1	<1	4	20	0.73
03-Nov-02	<1	<1	<1	10	0.87
07-Apr-03	<2	<2	<2	30	0.33
14-Apr-03	<2	<2	<2	30	0.81
24-Apr-03	<2	<2	<2	30	1.43
29-Apr-03	<2	<2	<2	20	0.69
06-May-03	<2	<2	<2	30	0.57

Table 13B – Site KBP (EMS # E248964)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
August, 2002					
Maximum	<1	<1	4	15	0.82
Average	<1	<1	1.0	12	0.53
90th percentile	<1	<1	2.8	-	-
Guideline	Met	Met	Met	Met	Met
Exceedences	-	-	-	0	0
October, 2002					
Maximum	1	<1	4	20	0.87
Average	0.2	<1	0.8	15	0.62
90th percentile	0.6	<1	2.4	-	-
Guideline	Met	Met	Met	Not Met	Met
Exceedences	-	-	-	1	0
April, 2003					
Maximum	<1	<1	<1	30	1.43
Average	<1	<1	<1	28	0.77
90th percentile	<1	<1	<1	-	-
Guideline	Met	Met	Met	Not Met	Met
Exceedences	-	-	-	5	0

Table 14A – Site KBS (EMS # E251793)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
14-Apr-03	<2	<2	<2	5	1.62
24-Apr-03	<2	<2	<2	5	1.88
29-Apr-03	<2	<2	<2	15	1.48
06-May-03	<2	<2	<2	15	1.46
12-May-03 *	<1	<1	<1	20	0.98

* Sample not analyzed within recommended holding time

Table 14B – Site KBS (EMS # E251793)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
April, 2003					
Maximum	<1	<1	<1	20	1.88
Average	<1	<1	<1	12	1.48
90th percentile	<1	<1	<1	-	-
Guideline	Met	Met	Met	Not Met	Met
Exceedences	-	-	-	1	0

Table 15A – Site CCU (EMS # E249513)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
07-Oct-02	<1	<1	<1	5	0.25
15-Oct-02	<1	<1	<1	5	0.11
21-Oct-02	<1	<1	<1	5	0.10
28-Oct-02	<1	<1	1	5	0.12
03-Nov-02	<1	<1	1	5	0.12
15-Apr-03	<2	<2	<2	5	0.27
22-Apr-03	<2	<2	<2	10	0.68
29-Apr-03	<2	<2	<2	5	0.64
06-May-03	<2	<2	<2	5	0.18
12-May-03 *	<1	<1	<1	5	0.27

* Sample not analyzed within recommended holding time

Table 15B – Site CCU (EMS # E249513)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
October, 2002					
Maximum	<1	<1	1	5	0.25
Average	<1	<1	0.4	5	0.14
90th percentile	<1	<1	1.0	-	-
Guideline	Met	Met	Met	Met	Met
Exceedences	-	-	-	0	0
April, 2003					
Maximum	<1	<1	<1	10	0.68
Average	<1	<1	<1	6	0.41
90th percentile	<1	<1	<1	-	-
Guideline	Met	Met	Met	Met	Met
Exceedences	-	-	-	0	0

Table 16A – Site CCL (EMS # E249514)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
07-Oct-02	<1	<1	1	5	0.31
15-Oct-02	<1	<1	2	5	0.13
21-Oct-02	<1	<1	<1	5	0.10
28-Oct-02	<1	<1	<1	5	0.15
03-Nov-02	<1	<1	<1	5	0.12
15-Apr-03	<2	<2	<2	5	0.52
22-Apr-03	<2	<2	<2	10	0.68
29-Apr-03	<2	<2	<2	5	0.44
06-May-03	<2	<2	18	5	0.18
12-May-03 *	<1	<1	<1	5	0.17

* Sample not analyzed within recommended holding time

Table 16B – Site CCL (EMS # E249514)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
October, 2002					
Maximum	<1	<1	2	5	0.31
Average	<1	<1	0.6	5	0.16
90th percentile	<1	<1	1.6	-	-
Guideline	Met	Met	Met	Met	Met
Exceedences	-	-	-	0	0
April, 2003					
Maximum	<1	<1	18	10	0.68
Average	<1	<1	3.6	6	0.40
90th percentile	<1	<1	10.8	-	-
Guideline	Met	Met	Not Met	Met	Met
Exceedences	-	-	-	0	0

Table 17A – Site SHF (EMS # E246124)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
07-Oct-02	<1	<1	<1	5	0.37
15-Oct-02	<1	<1	2	5	0.11
21-Oct-02	<1	<1	<1	5	0.10
28-Oct-02	<1	<1	1	<5	0.12
03-Nov-02	<1	<1	<1	5	0.12
15-Apr-03	<2	<2	<2	5	0.59
22-Apr-03	<2	<2	<2	5	0.59
29-Apr-03	<2	<2	<2	10	0.43
06-May-03	<2	<2	<2	5	0.25
12-May-03 *	<1	<1	<1	5	0.17

* Sample not analyzed within recommended holding time

Table 17B – Site SHF (EMS # E246124)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
October, 2002					
Maximum	<1	<1	2	5	0.37
Average	<1	<1	0.6	5	0.16
90th percentile	<1	<1	1.6	-	-
Guideline	Met	Met	Met	Met	Met
Exceedences	-	-	-	0	0
April, 2003					
Maximum	<1	<1	<1	10	0.59
Average	<1	<1	<1	6	0.41
90th percentile	<1	<1	<1	-	-
Guideline	Met	Met	Met	Met	Met
Exceedences	-	-	-	0	0

Table 18A – Site BRT (EMS # E246125)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
08-Aug-02	<1	<1	n/a	<5	3.77
14-Aug-02	3	2	9	<5	4.28
20-Aug-02	2	1	2	<5	1.14
27-Aug-02	2	1	1	<5	1.02
03-Sep-02	4	4	3	<5	1.29
07-Oct-02	7	5	4	<5	17.90
15-Oct-02	5	2	<1	<5	1.24
21-Oct-02	1	<1	<1	5	0.86
28-Oct-02	1	<1	4	<5	0.78
03-Nov-02	<1	<1	<1	<5	0.56
28-Oct-02	1	<1	4	<5	0.78
03-Nov-02	<1	<1	<1	<5	0.56
12-Nov-02	2	2	3	<5	0.50
18-Nov-02	5	4	10	5	0.78
25-Nov-02	5	3	4	10	2.58

Table 18B – Site BRT (EMS # E246125)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
August, 2002					
Maximum	4	4	9	5	4.28
Average	2.2	1.6	3.8	5	2.30
90th percentile	3.6	3.2	7.2	-	-
Guideline	Met	Met	Not Met	Met	Met
Exceedences	-	-	-	0	0
October, 2002					
Maximum	7	5	4	5	17.90
Average	2.8	1.4	1.6	5	4.27
90th percentile	6.2	3.8	4.0	-	-
Guideline	Met	Met	Not Met	Met	Not Met
Exceedences	-	-	-	0	1
Nov., 2002					
Maximum	5	4	10	10	2.58
Average	2.6	1.8	4.2	6	1.04
90th percentile	5.0	3.6	7.6	-	-
Guideline	Met	Met	Not Met	Met	Met
Exceedences	-	-	-	0	0

Table 19A – Site BU1 (EMS # E249694)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
28-Oct-02	2	1	3	<5	0.80
03-Nov-02	<1	<1	<1	<5	0.51
12-Nov-02	8	5	<1	<5	0.47
18-Nov-02	3	1	28	5	0.70
25-Nov-02	4	1	2	10	2.21

Table 19B – Site BU1 (EMS # E249694)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
Nov., 2002					
Maximum	8	5	28	10	2.21
Average	3.4	1.6	6.6	6	0.94
90th percentile	6.4	3.4	18.0	-	-
Guideline	Met	Met	Not Met	Met	Met
Exceedences	-	-	-	0	0

Table 20A – Site BU2 (EMS # E249692)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
28-Oct-02	3	2	<1	<5	0.76
03-Nov-02	<1	<1	<1	<5	0.50
12-Nov-02	5	3	5	<5	0.48
18-Nov-02	6	2	29	5	0.80
25-Nov-02	5	2	2	10	2.41

Table 20B – Site BU2 (EMS # E249692)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
Nov., 2002					
Maximum	6	3	29	10	2.41
Average	3.8	1.8	7.2	6	0.99
90th percentile	5.6	2.6	19.4	-	-
Guideline	Met	Met	Not Met	Met	Met
Exceedences	-	-	-	0	0

Table 21A – Site BU3 (EMS # E249733)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
31-Oct-02	2	2	1	5	1.31
03-Nov-02	<1	<1	<1	60	6.05
12-Nov-02	2	<1	7	<5	0.47
18-Nov-02	2	<1	14	5	0.71
25-Nov-02	3	1	1	10	2.35

Table 21B – Site BU3 (EMS # E249733)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
Nov., 2002					
Maximum	3	2	14	60	6.05
Average	1.8	0.6	4.6	17	2.18
90th percentile	2.6	1.6	11.2	-	-
Guideline	Met	Met	Not Met	Not Met	Not Met
Exceedences	-	-	-	1	1

Table 22A – Site TBC (EMS # E245370)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
8-Aug-02	8	3	n/a	<5	9.66
12-Aug-02	25	21	9	<5	11.50
19-Aug-02	33	22	11	<5	11.80
27-Aug-02	100	78	93	5	13.30
3-Sep-02	53	34	26	10	14.40
7-Oct-02	37	15	14	5	5.95
15-Oct-02	14	8	13	10	1.44
21-Oct-02	4	4	1	10	1.38
28-Oct-02	17	12	4	10	1.30
3-Nov-02	12	5	2	10	1.43
7-Apr-03	6	4	2	70	12.40
14-Apr-03	<2	<2	4	60	13.40
22-Apr-03	14	<2	<2	70	20.20
29-Apr-03	12	<2	<2	50	6.72
6-May-03	8	<2	4	30	3.30

Table 22B – Site TBC (EMS # E245370)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
August, 2002					
Maximum	100	78	93	10	14.40
Average	43.8	31.6	34.8	6	12.13
90th percentile	81.2	60.4	72.9	-	-
Guideline	Not Met	Not Met	Not Met	Met	Not Met
Exceedences	-	-	-	0	5
October, 2002					
Maximum	37	15	14	10	5.95
Average	16.8	8.8	6.8	9	2.30
90th percentile	29.0	13.8	13.6	-	-
Guideline	Not Met	Not Met	Not Met	Met	Not Met
Exceedences	-	-	-	0	1
April, 2003					
Maximum	14	4	4	70	20.20
Average	8.0	0.8	2.0	56	11.20
90th percentile	13.2	2.4	4.0	-	-
Guideline	Not Met	Met	Not Met	Not Met	Not Met
Exceedences	-	-	-	5	4

Table 23A – Site TMC (EMS # E248965)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
08-Aug-02	79	64	n/a	5	2.76
14-Aug-02	39	35	15	10	2.40
20-Aug-02	25	13	25	5	3.00
28-Aug-02	15	9	23	15	1.99
03-Sep-02	52	40	78	15	2.12
09-Oct-02	22	22	21	15	1.44
15-Oct-02	16	9	4	10	1.01
22-Oct-02	149	81	160	15	1.24
30-Oct-02	13	7	3	15	1.19
05-Nov-02	6	5	1	10	1.00
07-Apr-03	2	<2	<2	30	6.46
14-Apr-03	2	<2	2	30	3.36
24-Apr-03	2	2	<2	30	4.04
29-Apr-03	<2	<2	<2	30	3.21
06-May-03	4	<2	<2	20	1.45

Table 23B – Site TMC (EMS # E248965)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
August, 2002					
Maximum	79	64	78	15	3.00
Average	42.0	32.2	35.3	10	2.45
90th percentile	68.2	54.4	62.1	-	-
Guideline	Not Met	Not Met	Not Met	Met	Met
Exceedences	-	-	-	0	0
October, 2002					
Maximum	149	81	160	15	1.44
Average	41.2	24.8	37.8	13	1.18
90th percentile	98.2	57.4	104.4	-	-
Guideline	Not Met	Not Met	Not Met	Met	Met
Exceedences	-	-	-	0	0
April, 2003					
Maximum	4	2	2	30	6.46
Average	2.0	0.4	0.4	28	3.70
90th percentile	3.2	1.2	1.2	-	-
Guideline	Met	Met	Met	Not Met	Not Met
Exceedences	-	-	-	5	1

Table 24A – Site TMI (EMS # E249515)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
09-Oct-02	<1	<1	<1	5	0.26
16-Oct-02	<1	<1	<1	5	0.28
22-Oct-02	<1	<1	<1	10	0.21
30-Oct-02	<1	<1	<1	5	0.19
05-Nov-02	n/a	n/a	n/a	n/a	n/a
07-Apr-03	<2	<2	<2	15	0.42
14-Apr-03	<2	<2	2	15	0.43
24-Apr-03	<2	<2	<2	10	0.23
29-Apr-03	<2	<2	<2	15	0.20
06-May-03	<2	<2	8	20	0.28

Table 24B – Site TMI (EMS # E249515)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
October, 2002					
Maximum	<1	<1	<1	10	0.28
Average	<1	<1	<1	6	0.24
90th percentile	<1	<1	<1	-	-
Guideline	Met	Met	Met	Met	Met
Exceedences	-	-	-	0	0
April, 2003					
Maximum	<1	<1	8	20	0.43
Average	<1	<1	2.0	15	0.31
90th percentile	<1	<1	5.6	-	-
Guideline	Met	Met	Not Met	Not Met	Met
Exceedences	-	-	-	1	0

ADDITIONAL WATER QUALITY RESULTS (TABLE A) AND STATISTICAL ANALYSIS & SUMMARY (TABLE B)

Table 25A – Kathlyn Lake Sites (K2 – K4)

(Values in mg/L unless otherwise noted)

	DS @ 4m 29-Aug-02	K2 7-Oct-02	K3 7-Oct-02	K4 7-Oct-02
PYHSICAL				
pH (pH units)	7.4	7.3	7.2	7.4
Specific Conductance (uS/cm)	44	44	44	46
Residue Filterable - TDS	n/a	n/a	n/a	n/a
Hardness Total - T	15.8	16.3	15.9	16.4
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a	n/a
ANIONS				
Chloride Dissolved	n/a	n/a	n/a	n/a
Fluoride Dissolved	n/a	n/a	n/a	n/a
CARBON				
Organic Carbon - Total	n/a	n/a	n/a	n/a
NITROGEN				
Total Kjeldahl N	0.15	0.1	0.18	0.22
Total N	0.16	0.17	0.18	0.22
Total Organic N	0.15	0.1	0.18	0.22
Ammonia N	< 0.005	< 0.005	< 0.005	< 0.005
Nitrate Nitrogen Dissolved	< 0.02	0.06	< 0.02	< 0.02
Nitrate+Nitrite	0.013	0.068	< 0.002	< 0.002
Nitrite Nitrogen	0.005	0.003	< 0.002	< 0.002
PHOSPHORUS				
Ortho-Phosphorus	0.003	n/a	n/a	n/a
Phosphorus Total Dissolved	0.006	0.005	0.005	0.007
Phosphorus Total	**0.021**	0.008	0.01	**0.014**
SULFATE				
Sulfate	n/a	n/a	n/a	n/a
METALS TOTAL				
Aluminum	**0.447**	0.0406	0.0353	0.0327
Antimony	0.000077	0.000074	0.000057	0.000078
Arsenic	0.0032	0.0028	0.0026	0.0026
Barium	0.0131	0.00613	0.00819	0.00655
Beryllium	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Bismuth	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Cadmium	0.00004	0.00002	0.00002	0.00002
Calcium	4.74	4.98	4.88	5.04
Chromium	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Cobalt	0.000119	< 0.000005	< 0.000005	< 0.000005
Copper	0.00995	0.026	0.0149	0.0469
Iron	n/a	**0.365**	**0.306**	**0.366**
Lead	0.00022	0.00081	0.00075	0.00038
Lithium	0.00138	< 0.00005	< 0.00005	< 0.00005
Magnesium	0.96	0.93	0.91	0.92
Manganese	**0.276**	0.022	**0.0761**	0.0319
Molybdenum	0.0218	0.0192	0.0189	0.017
Nickel	0.00016	< 0.00005	0.00129	< 0.00005
Selenium	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Silver	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Strontium	0.0219	0.0262	0.0261	0.0262
Thallium	0.000042	< 0.000002	< 0.000002	< 0.000002
Tin	< 0.00001	0.00002	0.00001	< 0.00001
Uranium	0.000026	0.000005	0.000004	0.000005
Vanadium	0.00123	0.00023	0.00021	0.00022
Zinc	0.0022	0.0131	0.002	0.0259

Table 25A – Kathlyn Lake Sites (K2 – K4) Continued

(Values in mg/L unless otherwise noted)

	K2 7-Apr-03	K3-1 7-Apr-03	K3-2 7-Apr-03	K4 7-Apr-03	Drinking Water Guideline[1]		
PYHSICAL							
pH (pH units)	7.3	7.2	7.2	7.3	≤ 8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	61	50	50	52	≤ 700	mac	Met
Residue Filterable - TDS	n/a	n/a	n/a	n/a	≤ 500	ao	
Hardness Total - T	20.7	17	17.3	18.8	≤ 500	mac	Met
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a	n/a			
ANIONS							
Chloride Dissolved	n/a	n/a	n/a	n/a	≤ 250	ao	
Fluoride Dissolved	n/a	n/a	n/a	n/a	≤ 1.5	mac	
CARBON							
Organic Carbon - Total	n/a	n/a	n/a	n/a	≤ 4	mac (THM)	
NITROGEN							
Total Kjeldahl N	0.23	0.22	0.22	0.17			
Total N	0.25	0.23	0.23	0.22			
Total Organic N	0.23	0.22	0.22	0.16			
Ammonia N	< 0.005	< 0.005	< 0.005	0.006			
Nitrate Nitrogen Dissolved	< 0.02	< 0.02	< 0.02	0.05	≤ 10	mac	Met
Nitrate+Nitrite	0.014	0.01	0.008	0.055			
Nitrite Nitrogen	< 0.002	< 0.002	< 0.002	0.002	≤ 1	mac	Met
PHOSPHORUS							
Ortho-Phosphorus	n/a	n/a	n/a	n/a			
Phosphorus Total Dissolved	0.011	0.012	0.01	0.008			
Phosphorus Total	**0.02**	**0.018**	**0.017**	**0.011**	≤ 0.01	mac (lakes)	**Not Met**
SULFATE							
Sulfate	n/a	n/a	n/a	n/a	≤ 500	ao	
METALS TOTAL							
Aluminum	0.0137	0.0215	0.0218	0.0122	≤ 0.2	mac	**Not Met**
Antimony	0.000087	0.000071	0.000083	0.000083	≤ 0.006	imac	Met
Arsenic	0.0013	0.0011	0.0011	0.0008	≤ 0.025	imac	Met
Barium	0.0066	0.00894	0.00908	0.00686	≤ 1	mac	Met
Beryllium	< 0.00002	< 0.00002	< 0.00002	< 0.00002			
Bismuth	0.00005	0.00002	0.00005	0.00004			
Cadmium	0.00003	0.00002	0.00001	0.00003	≤ 0.005	mac	Met
Calcium	6.04	5.07	5.14	5.67			
Chromium	< 0.0002	< 0.0002	< 0.0002	< 0.0002	≤ 0.05	mac	Met
Cobalt	0.000007	0.000015	0.000014	< 0.000005			
Copper	0.0232	0.0155	0.016	0.0465	≤ 1	ao	Met
Iron	0.268	0.252	0.261	0.143	≤ 0.3	ao	**Not Met**
Lead	0.00048	0.00081	0.00082	0.0004	≤ 0.01	mac	Met
Lithium	0.00015	0.00016	0.00009	0.00018			
Magnesium	1.36	1.05	1.08	1.12	≤ 100	ao	Met
Manganese	0.00905	0.0221	0.023	0.00497	≤ 0.05	ao	**Not Met**
Molybdenum	0.0128	0.007	0.0067	0.0129	≤ 0.25	mac	Met
Nickel	0.00012	0.00031	0.00036	0.0002			
Selenium	< 0.0002	< 0.0002	< 0.0002	< 0.0002	≤ 0.01	mac	Met
Silver	< 0.00002	< 0.00002	< 0.00002	< 0.00002			
Strontium	0.031	0.0253	0.0261	0.028			
Thallium	< 0.000002	< 0.000002	< 0.000002	0.000002			
Tin	< 0.00001	< 0.00001	0.00002	0.00001			
Uranium	0.000004	0.000003	0.000003	0.000003	≤ 0.02	imac	Met
Vanadium	0.00011	0.00013	0.00011	0.000007	≤ 0.1	mac	Met
Zinc	0.0153	0.0028	0.0029	0.0168	≤ 5	ao	Met

[1] Guideline types: ao = aesthetic objective; mac = maximum acceptable concentration; imac = interim maximum acceptable concentration

Table 25B – Kathlyn Lake Sites (K2 – K4)

(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline		
PYHSICAL							
pH (pH units)	8	7.2	7.4	7.3	≤	8.5	ao (>6.5)
Specific Conductance (uS/cm)	8	44	61	49	≤	700	mac
Residue Filterable - TDS	0				≤	500	ao
Hardness Total - T	8	15.8	20.7	17.3	≤	500	mac
Alkalinity Total (mg/L CaCO3)	0						
ANIONS							
Chloride Dissolved	0				≤	250	ao
Fluoride Dissolved	0				≤	1.5	mac
CARBON							
Organic Carbon - Total	0				≤	4	mac (THM)
NITROGEN							
Total Kjeldahl N	8	0.10	0.23	0.19			
Total N	8	0.16	0.25	0.21			
Total Organic N	8	0.1	0.2	0.2			
Ammonia N	8	0.005	0.006	0.005			
Nitrate Nitrogen Dissolved	8	0.02	0.06	0.03	≤	10	mac
Nitrate+Nitrite	8	0.002	0.068	0.022			
Nitrite Nitrogen	8	0.002	0.005	0.003	≤	1	mac
PHOSPHORUS							
Ortho-Phosphorus	1	0.003	0.003	0.003			
Phosphorus Total Dissolved	8	0.005	0.012	0.008			
Phosphorus Total	8	0.008	0.021	0.015	≤	0.01	mac (lakes)
SULFATE							
Sulfate	0				≤	500	ao
METALS TOTAL							
Aluminum	8	0.0122	0.4470	0.0781	≤	0.2	mac
Antimony	8	0.00006	0.00009	0.00008	≤	0.006	imac
Arsenic	8	0.0008	0.0032	0.0019	≤	0.025	imac
Barium	8	0.00613	0.01310	0.00818	≤	1	mac
Beryllium	8	0.00002	0.00002	0.00002			
Bismuth	8	0.00002	0.00005	0.00003			
Cadmium	8	0.00001	0.00004	0.00002	≤	0.005	mac
Calcium	8	4.74	6.04	5.20			
Chromium	8	0.0002	0.0002	0.0002	≤	0.05	mac
Cobalt	8	0.000005	0.000119	0.000022			
Copper	8	0.00995	0.04690	0.02487	≤	1	ao
Iron	7	0.143	0.366	0.280	≤	0.3	ao
Lead	8	0.00022	0.00082	0.00058	≤	0.01	mac
Lithium	8	0.00005	0.00138	0.00026			
Magnesium	8	0.91	1.36	1.04	≤	100	ao
Manganese	8	0.004970	0.276000	0.058140	≤	0.05	ao
Molybdenum	8	0.00670	0.02180	0.01454	≤	0.25	mac
Nickel	8	0.00005	0.00129	0.00032			
Selenium	8	0.0002	0.0002	0.0002	≤	0.01	mac
Silver	8	0.00002	0.00002	0.00002			
Strontium	8	0.021900	0.031000	0.026350			
Thallium	8	0.000002	0.000042	0.000007			
Tin	8	0.00001	0.00002	0.00001			
Uranium	8	0.000003	0.000026	0.000007	≤	0.02	imac
Vanadium	8	0.00001	0.00123	0.00028	≤	0.1	mac
Zinc	8	0.0020	0.0259	0.0101	≤	5	ao

Table 26A – Seymour Lake Sites (S1 – S3)
(Values in mg/L unless otherwise noted)

	DS @ 4m 29-Aug-02	S1 7-Oct-02	S2 7-Oct-02	S3 7-Oct-02
PYHSICAL				
pH (pH units)	7.6	7.5	7.5	7.5
Specific Conductance (uS/cm)	92	92	115	85
Residue Filterable - TDS	n/a	n/a	n/a	n/a
Hardness Total - T	43.8	44.8	55	40.5
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a	n/a
ANIONS				
Chloride Dissolved	n/a	n/a	n/a	n/a
Fluoride Dissolved	n/a	n/a	n/a	n/a
CARBON				
Organic Carbon - Total	n/a	n/a	n/a	n/a
NITROGEN				
Total Kjeldahl N	0.47	0.47	0.41	0.47
Total N	0.48	0.48	0.65	0.5
Total Organic N	0.47	0.47	0.41	0.47
Ammonia N	0.006	< 0.005	< 0.005	< 0.005
Nitrate Nitrogen Dissolved	< 0.02	< 0.02	0.23	0.03
Nitrate+Nitrite	0.006	0.016	0.233	0.034
Nitrite Nitrogen	0.006	< 0.002	< 0.002	< 0.002
PHOSPHORUS				
Ortho-Phosphorus	0.004	n/a	n/a	n/a
Phosphorus Total Dissolved	0.007	0.003	0.008	0.008
Phosphorus Total	**0.013**	**0.026**	**0.017**	**0.021**
SULFATE				
Sulfate	n/a	n/a	n/a	n/a
METALS TOTAL				
Aluminum	0.0142	0.0181	0.0551	0.0131
Antimony	0.000054	0.000056	0.000063	0.000043
Arsenic	0.0006	0.0006	0.0005	0.0006
Barium	0.039	0.0392	0.0472	0.0405
Beryllium	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Bismuth	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Cadmium	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Calcium	9.57	10.4	14	9.1
Chromium	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Cobalt	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Copper	0.00094	0.0227	0.0542	0.0122
Iron	0.29	**1.53**	**0.378**	**0.426**
Lead	0.00002	0.00067	0.00081	0.00056
Lithium	0.00131	0.00008	0.00006	< 0.00005
Magnesium	4.83	4.58	4.87	4.32
Manganese	0.0422	**0.057**	0.0269	**0.0531**
Molybdenum	0.00017	0.00031	0.00016	0.00015
Nickel	0.00025	0.00012	0.00014	0.00012
Selenium	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Silver	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Strontium	0.0592	0.0701	0.0889	0.0656
Thallium	< 0.000002	< 0.000002	< 0.000002	< 0.000002
Tin	< 0.00001	< 0.00001	< 0.00001	0.00003
Uranium	0.000013	0.000013	0.000022	0.000012
Vanadium	0.00025	0.00051	0.00047	0.00043
Zinc	0.0003	0.0827	0.019	0.0061

Table 26A – Seymour Lake Sites (S1 – S3) Continued

(Values in mg/L unless otherwise noted)

	S1 7-Apr-03	S2 14-Apr-03	S3-1 7-Apr-03	S3-2 7-Apr-03	Drinking Water Guideline		
PYHSICAL							
pH (pH units)	7.5	7.2	7.6	7.6	≤ 8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	85	269	103	103	≤ 700	mac	Met
Residue Filterable - TDS	n/a	n/a	n/a	n/a	≤ 500	ao	
Hardness Total - T	38.6	103	47	47.8	≤ 500	mac	Met
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a	n/a			
ANIONS							
Chloride Dissolved	n/a	n/a	n/a	n/a	≤ 250	ao	
Fluoride Dissolved	n/a	n/a	n/a	n/a	≤ 1.5	mac	
CARBON							
Organic Carbon - Total	n/a	n/a	n/a	n/a	≤ 4	mac (THM)	
NITROGEN							
Total Kjeldahl N	0.52	0.74	0.47	0.45			
Total N	0.55	2.76	0.52	0.5			
Total Organic N	0.51	0.73	0.47	0.44			
Ammonia N	0.005	0.01	< 0.005	< 0.009			
Nitrate Nitrogen Dissolved	0.03	2.02	0.05	0.05	≤ 10	mac	Met
Nitrate+Nitrite	0.031	2.03	0.056	0.058			
Nitrite Nitrogen	0.003	0.011	0.002	0.003	≤ 1	mac	Met
PHOSPHORUS							
Ortho-Phosphorus	n/a	n/a	n/a	n/a			
Phosphorus Total Dissolved	0.034	0.022	0.013	0.011			
Phosphorus Total	**0.072**	**0.04**	**0.017**	**0.018**	≤ 0.01	mac (lakes)	**Not Met**
SULFATE							
Sulfate	n/a	n/a	n/a	n/a	≤ 500	ao	
METALS TOTAL							
Aluminum	0.179	0.185	0.18	0.169	≤ 0.2	mac	Met
Antimony	0.000085	0.000142	0.000078	0.000069	≤ 0.006	imac	Met
Arsenic	0.0006	0.001	0.0004	0.0004	≤ 0.025	imac	Met
Barium	0.0374	0.066	0.0402	0.0411	≤ 1	mac	Met
Beryllium	< 0.00002	< 0.00002	0.00002	< 0.00002			
Bismuth	0.0001	< 0.00002	0.00009	0.00003			
Cadmium	< 0.00001	0.00003	< 0.00001	< 0.00001	≤ 0.005	mac	Met
Calcium	8.81	29.8	10.4	10.6			
Chromium	< 0.0002	< 0.0002	< 0.0002	< 0.0002	≤ 0.05	mac	Met
Cobalt	0.000112	0.0002	0.000041	0.000042			
Copper	0.0078	0.0197	0.0171	0.0177	≤ 1	ao	Met
Iron	**1.2**	**0.659**	**0.368**	**0.373**	≤ 0.3	ao	**Not Met**
Lead	0.00025	0.00118	0.00051	0.00056	≤ 0.01	mac	Met
Lithium	0.00057	0.00046	0.0008	0.00078			
Magnesium	4.04	7.03	5.11	5.17	≤ 100	ao	Met
Manganese	**0.0715**	**0.109**	0.0118	0.0124	≤ 0.05	ao	**Not Met**
Molybdenum	0.00013	0.00018	0.00016	0.00011	≤ 0.25	mac	Met
Nickel	0.0007	0.00152	0.00056	0.00059			
Selenium	< 0.0002	< 0.0002	< 0.0002	< 0.0002	≤ 0.01	mac	Met
Silver	< 0.00002	< 0.00002	< 0.00002	< 0.00002			
Strontium	0.0542	0.158	0.0649	0.0644			
Thallium	0.000004	< 0.000002	0.000002	0.000003			
Tin	< 0.00001	0.00005	0.00002	< 0.00001			
Uranium	0.000011	0.000082	0.000022	0.000015	≤ 0.02	imac	Met
Vanadium	0.00061	0.0007	0.0007	0.00058	≤ 0.1	mac	Met
Zinc	0.0382	0.0653	0.0072	0.0073	≤ 5	ao	Met

Table 26B – Seymour Lake Sites (S1 – S3)
(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline		
PYHSICAL							
pH (pH units)	8	7.2	7.6	7.5	≤	8.5	ao (>6.5)
Specific Conductance (uS/cm)	8	85	269	118	≤	700	mac
Residue Filterable - TDS	0				≤	500	ao
Hardness Total - T	8	38.6	103.0	52.6	≤	500	mac
Alkalinity Total (mg/L CaCO3)	0						
ANIONS							
Chloride Dissolved	0				≤	250	ao
Fluoride Dissolved	0				≤	1.5	mac
CARBON							
Organic Carbon - Total	0				≤	4	mac (THM)
NITROGEN							
Total Kjeldahl N	8	0.41	0.74	0.50			
Total N	8	0.48	2.76	0.81			
Total Organic N	8	0.4	0.7	0.5			
Ammonia N	8	0.005	0.010	0.006			
Nitrate Nitrogen Dissolved	8	0.02	2.02	0.31	≤	10	mac
Nitrate+Nitrite	8	0.006	2.030	0.308			
Nitrite Nitrogen	8	0.002	0.011	0.004	≤	1	mac
PHOSPHORUS							
Ortho-Phosphorus	1	0.004	0.004	0.004			
Phosphorus Total Dissolved	8	0.003	0.034	0.013			
Phosphorus Total	8	0.013	0.072	0.028	≤	0.01	mac (lakes)
SULFATE							
Sulfate	0				≤	500	ao
METALS TOTAL							
Aluminum	8	0.0131	0.1850	0.1017	≤	0.2	mac
Antimony	8	0.00004	0.00014	0.00007	≤	0.006	imac
Arsenic	8	0.0004	0.0010	0.0006	≤	0.025	imac
Barium	8	0.03740	0.06600	0.04383	≤	1	mac
Beryllium	8	0.00002	0.00002	0.00002			
Bismuth	8	0.00002	0.00010	0.00004			
Cadmium	8	0.00001	0.00003	0.00001	≤	0.005	mac
Calcium	8	8.81	29.80	12.84			
Chromium	8	0.0002	0.0002	0.0002	≤	0.05	mac
Cobalt	8	0.000005	0.0002	0.000052			
Copper	8	0.00094	0.05420	0.01904	≤	1	ao
Iron	8	0.290	1.530	0.653	≤	0.3	ao
Lead	8	0.00002	0.00118	0.00057	≤	0.01	mac
Lithium	8	0.00005	0.00131	0.00051			
Magnesium	8	4.04	7.03	4.99	≤	100	ao
Manganese	8	0.011800	0.109000	0.047988	≤	0.05	ao
Molybdenum	8	0.00011	0.00031	0.00017	≤	0.25	mac
Nickel	8	0.00012	0.00152	0.00050			
Selenium	8	0.0002	0.0002	0.0002	≤	0.01	mac
Silver	8	0.00002	0.00002	0.00002			
Strontium	8	0.054200	0.158000	0.078163			
Thallium	8	0.000002	0.000004	0.000002			
Tin	8	0.00001	0.00005	0.00002			
Uranium	8	0.000011	0.000082	0.000024	≤	0.02	imac
Vanadium	8	0.00025	0.00070	0.00053	≤	0.1	mac
Zinc	8	0.0003	0.0827	0.0283	≤	5	ao

Table 27A – Tyhee Lake Sites (T2 – T4)
(Values in mg/L unless otherwise noted)

	DS @ 5m 28-Aug-02	T2 7-Oct-02	T3 7-Oct-02	T4 7-Oct-02
PYHSICAL				
pH (pH units)	8.3	8.2	8	8.2
Specific Conductance (uS/cm)	269	228	242	225
Residue Filterable - TDS	n/a	n/a	n/a	n/a
Hardness Total - T	123	124	122	123
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a	n/a
ANIONS				
Chloride Dissolved	n/a	n/a	n/a	n/a
Fluoride Dissolved	n/a	n/a	n/a	n/a
CARBON				
Organic Carbon - Total	n/a	n/a	n/a	n/a
NITROGEN				
Total Kjeldahl N	0.57	0.56	0.63	0.56
Total N	0.57	0.56	0.65	0.61
Total Organic N	0.57	0.56	0.63	0.56
Ammonia N	0.005	< 0.005	< 0.005	< 0.005
Nitrate Nitrogen Dissolved	< 0.02	< 0.02	0.02	0.05
Nitrate+Nitrite	0.002	< 0.002	0.022	0.055
Nitrite Nitrogen	< 0.002	< 0.002	< 0.002	< 0.002
PHOSPHORUS				
Ortho-Phosphorus	0.002	n/a	n/a	n/a
Phosphorus Total Dissolved	0.004	0.006	0.003	0.005
Phosphorus Total	0.008	0.01	0.007	**0.011**
SULFATE				
Sulfate	n/a	n/a	n/a	n/a
METALS TOTAL				
Aluminum	0.009	0.0011	0.0008	0.0016
Antimony	0.00003	0.000111	0.00009	0.000026
Arsenic	0.0004	0.0004	0.0005	0.0004
Barium	0.0332	0.0362	0.0355	0.0364
Beryllium	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Bismuth	< 0.00002	0.00022	0.00012	< 0.00002
Cadmium	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Calcium	32.8	33.5	33	33.2
Chromium	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Cobalt	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Copper	0.00037	0.00143	0.0577	0.0782
Iron	< 0.005	0.007	0.01	0.017
Lead	< 0.00001	0.00005	0.00107	0.00011
Lithium	0.00203	0.00021	0.00096	0.0005
Magnesium	9.92	9.87	9.69	9.76
Manganese	0.00745	0.00835	0.00369	0.00646
Molybdenum	< 0.00005	0.00008	0.00006	0.00007
Nickel	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Selenium	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Silver	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Strontium	0.224	0.22	0.219	0.221
Thallium	0.00001	< 0.000002	< 0.000002	< 0.000002
Tin	< 0.00001	< 0.00001	0.00003	0.00006
Uranium	0.00001	0.000009	0.000009	0.000006
Vanadium	0.0001	0.00077	0.00086	0.0056
Zinc	0.0001	0.0038	0.16	0.0034

Table 27A – Tyhee Lake Sites (T2 – T4) Continued

(Values in mg/L unless otherwise noted)

	T2 7-Apr-03	T3 22-Apr-03	T4 7-Apr-03	Drinking Water Guideline		
PYHSICAL						
pH (pH units)	8.1	7.8	8.1	≤ 8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	271	284	294	≤ 700	mac	Met
Residue Filterable - TDS	n/a	n/a	n/a	≤ 500	ao	
Hardness Total - T	127	133	136	≤ 500	mac	Met
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a			
ANIONS						
Chloride Dissolved	n/a	n/a	n/a	≤ 250	ao	
Fluoride Dissolved	n/a	n/a	n/a	≤ 1.5	mac	
CARBON						
Organic Carbon - Total	n/a	n/a	n/a	≤ 4	mac (THM)	
NITROGEN						
Total Kjeldahl N	0.7	0.72	0.6			
Total N	0.71	0.76	0.66			
Total Organic N	0.7	0.7	0.59			
Ammonia N	< 0.005	0.013	0.011			
Nitrate Nitrogen Dissolved	< 0.02	0.04	0.05	≤ 10	mac	Met
Nitrate+Nitrite	0.014	0.047	0.054			
Nitrite Nitrogen	< 0.002	0.003	< 0.002	≤ 1	mac	Met
PHOSPHORUS						
Ortho-Phosphorus	n/a	n/a	n/a			
Phosphorus Total Dissolved	0.023	0.007	0.011			
Phosphorus Total	**0.037**	**0.024**	**0.014**	≤ 0.01	mac (lakes)	**Not Met**
SULFATE						
Sulfate	n/a	n/a	n/a	≤ 500	ao	
METALS TOTAL						
Aluminum	0.0318	0.0024	0.0032	≤ 0.2	mac	Met
Antimony	0.00006	0.000066	0.000034	≤ 0.006	imac	Met
Arsenic	0.0005	0.0006	0.0004	≤ 0.025	imac	Met
Barium	0.0323	0.0371	0.0362	≤ 1	mac	Met
Beryllium	< 0.00002	< 0.00002	< 0.00002			
Bismuth	0.00018	0.00009	< 0.00002			
Cadmium	< 0.00001	< 0.00001	< 0.00001	≤ 0.005	mac	Met
Calcium	34	35.8	37			
Chromium	< 0.0002	< 0.0002	< 0.0002	≤ 0.05	mac	Met
Cobalt	0.000016	< 0.000005	0.000012			
Copper	0.00202	0.0478	0.0542	≤ 1	ao	Met
Iron	0.046	0.127	0.013	≤ 0.3	ao	Met
Lead	0.00019	0.00098	0.00014	≤ 0.01	mac	Met
Lithium	0.00122	0.00122	0.00116			
Magnesium	10.2	10.5	10.7	≤ 100	ao	Met
Manganese	0.00398	0.0102	0.00277	≤ 0.05	ao	Met
Molybdenum	0.00012	0.00014	0.00007	≤ 0.25	mac	Met
Nickel	0.00007	< 0.00005	< 0.00005			
Selenium	0.0003	< 0.0002	< 0.0002	≤ 0.01	mac	Met
Silver	< 0.00002	< 0.00002	< 0.00002			
Strontium	0.2	0.221	0.223			
Thallium	0.000004	< 0.000002	0.000003			
Tin	< 0.00001	0.00012	< 0.00001			
Uranium	0.000016	0.000023	0.000009	≤ 0.02	imac	Met
Vanadium	0.00074	0.00243	0.00076	≤ 0.1	mac	Met
Zinc	0.0496	0.11	0.0063	≤ 5	ao	Met

Table 27B – Tyhee Lake Sites (T2 – T4)
(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline		
PYHSICAL							
pH (pH units)	7	7.8	8.3	8.1	≤	8.5	ao (>6.5)
Specific Conductance (uS/cm)	7	225	294	259	≤	700	mac
Residue Filterable - TDS	0				≤	500	ao
Hardness Total - T	7	122.0	136.0	126.9	≤	500	mac
Alkalinity Total (mg/L CaCO3)	0						
ANIONS							
Chloride Dissolved	0				≤	250	ao
Fluoride Dissolved	0				≤	1.5	mac
CARBON							
Organic Carbon - Total	0				≤	4	mac (THM)
NITROGEN							
Total Kjeldahl N	7	0.56	0.72	0.62			
Total N	7	0.56	0.76	0.65			
Total Organic N	7	0.6	0.7	0.6			
Ammonia N	7	0.005	0.013	0.007			
Nitrate Nitrogen Dissolved	7	0.02	0.05	0.03	≤	10	mac
Nitrate+Nitrite	7	0.002	0.055	0.028			
Nitrite Nitrogen	7	0.002	0.003	0.002	≤	1	mac
PHOSPHORUS							
Ortho-Phosphorus	1	0.002	0.002	0.002			
Phosphorus Total Dissolved	7	0.003	0.023	0.008			
Phosphorus Total	7	0.007	0.037	0.016	≤	0.01	mac (lakes)
SULFATE							
Sulfate	0				≤	500	ao
METALS TOTAL							
Aluminum	7	0.0008	0.0318	0.0071	≤	0.2	mac
Antimony	7	0.00003	0.00011	0.00006	≤	0.006	imac
Arsenic	7	0.0004	0.0006	0.0005	≤	0.025	imac
Barium	7	0.03230	0.03710	0.03527	≤	1	mac
Beryllium	7	0.00002	0.00002	0.00002			
Bismuth	7	0.00002	0.00022	0.00010			
Cadmium	7	0.00001	0.00001	0.00001	≤	0.005	mac
Calcium	7	32.80	37.00	34.19			
Chromium	7	0.0002	0.0002	0.0002	≤	0.05	mac
Cobalt	7	0.000005	0.000016	0.000008			
Copper	7	0.00037	0.07820	0.03453	≤	1	ao
Iron	7	0.005	0.127	0.032	≤	0.3	ao
Lead	7	0.00001	0.00107	0.00036	≤	0.01	mac
Lithium	7	0.00021	0.00203	0.00104			
Magnesium	7	9.69	10.70	10.09	≤	100	ao
Manganese	7	0.002770	0.010200	0.006129	≤	0.05	ao
Molybdenum	7	0.00005	0.00014	0.00008	≤	0.25	mac
Nickel	7	0.00005	0.00007	0.00005			
Selenium	7	0.0002	0.0003	0.0002	≤	0.01	mac
Silver	7	0.00002	0.00002	0.00002			
Strontium	7	0.200000	0.224000	0.218286			
Thallium	7	0.000002	0.000010	0.000004			
Tin	7	0.00001	0.00012	0.00004			
Uranium	7	0.000006	0.000023	0.000012	≤	0.02	imac
Vanadium	7	0.00010	0.00560	0.00161	≤	0.1	mac
Zinc	7	0.0001	0.1600	0.0476	≤	5	ao

Table 28A – Round Lake Sites (R3 – R5)

(Values in mg/L unless otherwise noted)

	DS @ 4m 28-Aug-02	R4 7-Oct-02	R5 7-Oct-02
PYHSICAL			
pH (pH units)	8.3	7.9	8
Specific Conductance (uS/cm)	240	229	215
Residue Filterable - TDS	n/a	n/a	n/a
Hardness Total - T	107	115	111
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a
ANIONS			
Chloride Dissolved	n/a	n/a	n/a
Fluoride Dissolved	n/a	n/a	n/a
CARBON			
Organic Carbon - Total	n/a	n/a	n/a
NITROGEN			
Total Kjeldahl N	1.05	0.92	0.86
Total N	1.06	1	0.89
Total Organic N	0.99	0.89	0.81
Ammonia N	0.057	0.03	0.043
Nitrate Nitrogen Dissolved	< 0.02	0.08	0.03
Nitrate+Nitrite	0.015	0.082	0.032
Nitrite Nitrogen	0.006	< 0.002	< 0.002
PHOSPHORUS			
Ortho-Phosphorus	< 0.001	n/a	n/a
Phosphorus Total Dissolved	0.012	0.009	0.009
Phosphorus Total	**0.027**	**0.044**	**0.019**
SULFATE			
Sulfate	n/a	n/a	n/a
METALS TOTAL			
Aluminum	0.0052	0.0057	0.002
Antimony	0.000036	0.000042	0.000043
Arsenic	0.0006	0.0006	0.0007
Barium	0.0352	0.0381	0.0364
Beryllium	< < 0.00002	< 0.00002	< 0.00002
Bismuth	< 0.00002	< 0.00002	< 0.00002
Cadmium	< 0.00001	< 0.00001	0.00006
Calcium	26.3	29.1	28.2
Chromium	< 0.0002	< 0.0002	< 0.0002
Cobalt	< 0.000005	< 0.000005	< 0.000005
Copper	0.00045	0.061	0.0176
Iron	0.027	0.084	0.039
Lead	0.00001	0.0013	0.00077
Lithium	0.00139	< 0.00005	< 0.00005
Magnesium	10	10.3	9.91
Manganese	**0.0507**	**0.0627**	0.0323
Molybdenum	0.00007	0.00011	0.00011
Nickel	< 0.00005	< 0.00005	0.00028
Selenium	< 0.0002	< 0.0002	< 0.0002
Silver	< 0.00002	< 0.00002	< 0.00002
Strontium	0.174	0.175	0.177
Thallium	0.000015	< 0.000002	< 0.000002
Tin	< 0.00001	0.00001	0.00003
Uranium	0.000041	0.000025	0.000024
Vanadium	0.00059	0.00058	0.00064
Zinc	< 0.0001	0.0065	0.0191

Table 28A – Round Lake Sites (R3 – R5) Continued

(Values in mg/L unless otherwise noted)

	R4 7-Apr-03	R5 14-Apr-03	Drinking Water Guideline		
PYHSICAL					
pH (pH units)	8	7.8	≤ 8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	269	264	≤ 700	mac	Met
Residue Filterable - TDS	n/a	n/a	≤ 500	ao	
Hardness Total - T	125	121	≤ 500	mac	Met
Alkalinity Total (mg/L CaCO3)	n/a	n/a			
ANIONS					
Chloride Dissolved	n/a	n/a	≤ 250	ao	
Fluoride Dissolved	n/a	n/a	≤ 1.5	mac	
CARBON					
Organic Carbon - Total	n/a	n/a	≤ 4	mac (THM)	
NITROGEN					
Total Kjeldahl N	0.86	0.85			
Total N	1.35	1.27			
Total Organic N	0.84	0.85			
Ammonia N	0.023	< 0.005			
Nitrate Nitrogen Dissolved	0.49	0.41	≤ 10	mac	Met
Nitrate+Nitrite	0.492	0.413			
Nitrite Nitrogen	0.007	0.003	≤ 1	mac	Met
PHOSPHORUS					
Ortho-Phosphorus	n/a	n/a			
Phosphorus Total Dissolved	0.057	0.05			
Phosphorus Total	**0.067**	**0.07**	≤ 0.01	mac (lakes)	**Not Met**
SULFATE					
Sulfate	n/a	n/a	≤ 500	ao	
METALS TOTAL					
Aluminum	0.0165	0.0128	≤ 0.2	mac	Met
Antimony	0.000051	0.000054	≤ 0.006	imac	Met
Arsenic	0.0006	0.0006	≤ 0.025	imac	Met
Barium	0.0378	0.0411	≤ 1	mac	Met
Beryllium	< 0.00002	< 0.00002			
Bismuth	0.00004	0.00028			
Cadmium	< 0.00001	0.00011	≤ 0.005	mac	Met
Calcium	31.6	30.5			
Chromium	< 0.0002	< 0.0002	≤ 0.05	mac	Met
Cobalt	0.000023	0.000037			
Copper	0.0562	0.0144	≤ 1	ao	Met
Iron	0.068	0.038	≤ 0.3	ao	Met
Lead	0.00108	0.00094	≤ 0.01	mac	Met
Lithium	0.00054	0.0005			
Magnesium	11.1	10.8	≤ 100	ao	Met
Manganese	0.0311	0.0451	≤ 0.05	ao	**Not Met**
Molybdenum	0.00009	0.00013	≤ 0.25	mac	Met
Nickel	0.00019	0.00063			
Selenium	< 0.0002	< 0.0002	≤ 0.01	mac	Met
Silver	< 0.00002	< 0.00002			
Strontium	0.175	0.173			
Thallium	0.000002	< 0.000002			
Tin	< 0.00001	0.00001			
Uranium	0.000025	0.000022	≤ 0.02	imac	Met
Vanadium	0.00078	0.00016	≤ 0.1	mac	Met
Zinc	0.0064	0.0225	≤ 5	ao	Met

Table 28B – Round Lake Sites (R3 – R5)

(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline		
PYHSICAL							
pH (pH units)	5	7.8	8.3	8.0	≤	8.5	ao (>6.5)
Specific Conductance (uS/cm)	5	215	269	243	≤	700	mac
Residue Filterable - TDS	0				≤	500	ao
Hardness Total - T	5	107.0	125.0	115.8	≤	500	mac
Alkalinity Total (mg/L CaCO3)	0						
ANIONS							
Chloride Dissolved	0				≤	250	ao
Fluoride Dissolved	0				≤	1.5	mac
CARBON							
Organic Carbon - Total	0				≤	4	mac (THM)
NITROGEN							
Total Kjeldahl N	5	0.85	1.05	0.91			
Total N	5	0.89	1.35	1.11			
Total Organic N	5	0.8	1.0	0.9			
Ammonia N	5	0.005	0.057	0.032			
Nitrate Nitrogen Dissolved	5	0.02	0.49	0.21	≤	10	mac
Nitrate+Nitrite	5	0.015	0.492	0.207			
Nitrite Nitrogen	5	0.002	0.007	0.004	≤	1	mac
PHOSPHORUS							
Ortho-Phosphorus	1	0.001	0.001	0.001			
Phosphorus Total Dissolved	5	0.009	0.057	0.027			
Phosphorus Total	5	0.019	0.070	0.045	≤	0.01	mac (lakes)
SULFATE							
Sulfate	0				≤	500	ao
METALS TOTAL							
Aluminum	5	0.0020	0.0165	0.0084	≤	0.2	mac
Antimony	5	0.00004	0.00005	0.00005	≤	0.006	imac
Arsenic	5	0.0006	0.0007	0.0006	≤	0.025	imac
Barium	5	0.03520	0.04110	0.03772	≤	1	mac
Beryllium	5	0.00002	0.00002	0.00002			
Bismuth	5	0.00002	0.00028	0.00008			
Cadmium	5	0.00001	0.00011	0.00004	≤	0.005	mac
Calcium	5	26.30	31.60	29.14			
Chromium	5	0.0002	0.0002	0.0002	≤	0.05	mac
Cobalt	5	0.000005	0.000037	0.000015			
Copper	5	0.00045	0.06100	0.02993	≤	1	ao
Iron	5	0.027	0.084	0.051	≤	0.3	ao
Lead	5	0.00001	0.00130	0.00082	≤	0.01	mac
Lithium	5	0.00005	0.00139	0.00051			
Magnesium	5	9.91	11.10	10.42	≤	100	ao
Manganese	5	0.031100	0.062700	0.044380	≤	0.05	ao
Molybdenum	5	0.00007	0.00013	0.00010	≤	0.25	mac
Nickel	5	0.00005	0.00063	0.00024			
Selenium	5	0.0002	0.0002	0.0002	≤	0.01	mac
Silver	5	0.00002	0.00002	0.00002			
Strontium	5	0.173000	0.177000	0.174800			
Thallium	5	0.000002	0.000015	0.000005			
Tin	5	0.00001	0.00003	0.00001			
Uranium	5	0.000022	0.000041	0.000027	≤	0.02	imac
Vanadium	5	0.00016	0.00078	0.00055	≤	0.1	mac
Zinc	5	0.0001	0.0225	0.0109	≤	5	ao

Table 29A – Kirby Lake Sites (KLP, KLS)

(Values in mg/L unless otherwise noted)

	KLP 8-Aug-02	KLP 7-Oct-02	KLP-1 7-Apr-03	KLP-2 7-Apr-03	KLP 24-Apr-03	KLP 6-May-03
PYHSICAL						
pH (pH units)	n/a	8.1	8	8	7.9	7.8
Specific Conductance (uS/cm)	290	264	259	258	258	280
Residue Filterable - TDS	n/a	n/a	n/a	n/a	n/a	n/a
Hardness Total - T	172	171	134	139	n/a	157
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a	n/a	n/a	n/a
ANIONS						
Chloride Dissolved	n/a	n/a	n/a	n/a	n/a	n/a
Fluoride Dissolved	n/a	n/a	n/a	n/a	n/a	n/a
CARBON						
Organic Carbon - Total	n/a	n/a	n/a	n/a	**10.7**	**13.5**
NITROGEN						
Total Kjeldahl N	0.79	0.78	0.7	0.63	0.75	0.84
Total N	0.81	0.81	0.76	0.69	0.75	0.85
Total Organic N	0.72	0.76	0.67	0.6	0.62	0.77
Ammonia N	0.069	0.02	0.036	0.034	0.125	0.063
Nitrate Nitrogen Dissolved	< 0.02	0.04	0.05	0.05	< 0.02	< 0.02
Nitrate+Nitrite	0.02	0.038	0.057	0.058	0.003	0.011
Nitrite Nitrogen	0.004	< 0.002	0.004	0.003	0.002	0.004
PHOSPHORUS						
Ortho-Phosphorus	n/a	n/a	n/a	n/a	n/a	n/a
Phosphorus Total Dissolved	0.011	0.01	0.013	0.013	0.028	0.019
Phosphorus Total	**0.019**	**0.021**	**0.017**	**0.017**	**0.043**	**0.032**
SULFATE						
Sulfate	n/a	n/a	n/a	n/a	n/a	n/a
METALS TOTAL						
Aluminum	0.0041	0.0026	0.0041	0.0038	n/a	0.0044
Antimony	0.000208	< 0.000005	0.000025	0.000061	n/a	< 0.000005
Arsenic	0.0006	0.0005	0.0003	0.0003	n/a	0.0004
Barium	0.0392	0.0356	0.032	0.0313	n/a	0.0371
Beryllium	< 0.00002	< 0.00002	< 0.00002	< 0.00002	n/a	< 0.00002
Bismuth	0.00049	< 0.00002	0.00003	0.00031	n/a	0.00003
Cadmium	< 0.00001	< 0.00001	< 0.00001	< 0.00001	n/a	< 0.00001
Calcium	48	47.9	37.1	38.7	n/a	43.9
Chromium	< 0.0002	< 0.0002	< 0.0002	< 0.0002	n/a	< 0.0002
Cobalt	< 0.000005	< 0.000005	0.00007	0.000057	n/a	0.000151
Copper	0.00062	0.00057	0.00128	0.00109	n/a	0.00046
Iron		0.099	0.123	0.125	n/a	0.275
Lead	0.00018	0.00013	0.00013	0.00012	n/a	0.00005
Lithium	0.00172	0.00072	0.00135	0.00139	n/a	0.00158
Magnesium	12.7	12.4	10	10.4	n/a	11.4
Manganese	**0.0943**	0.0468	**0.0875**	**0.0854**	n/a	**0.0977**
Molybdenum	0.00014	0.00009	0.00012	0.00007	n/a	0.00016
Nickel	< 0.00005	< 0.00005	< 0.00005	< 0.00005	n/a	0.0001
Selenium	0.0004	< 0.0002	< 0.0002	< 0.0002	n/a	< 0.0002
Silver	< 0.00002	< 0.00002	< 0.00002	< 0.00002	n/a	< 0.00002
Strontium	0.234	0.249	0.194	0.188	n/a	0.223
Thallium	0.000014	< 0.000002	0.000003	0.000004	n/a	< 0.000002
Tin	0.00001	< 0.00001	< 0.00001	< 0.00001	n/a	0.00001
Uranium	< 0.000002	0.000009	0.000037	0.000006	n/a	0.000027
Vanadium	0.00036	0.00108	0.00049	0.00047	n/a	0.00038
Zinc	0.0061	0.0032	0.0028	0.0029	n/a	0.0023

Table 29A – Kirby Lake Sites (KLP, KLS) Continued

(Values in mg/L unless otherwise noted)

	KLS 14-Apr-03	KLS 6-May-03	Drinking Water Guideline		
PYHSICAL					
pH (pH units)	7.6	8.1	≤ 8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	82	296	≤ 700	mac	Met
Residue Filterable - TDS	n/a	n/a	≤ 500	ao	
Hardness Total - T	41.4	157	≤ 500	mac	Met
Alkalinity Total (mg/L CaCO3)	n/a	n/a			
ANIONS					
Chloride Dissolved	n/a	n/a	≤ 250	ao	
Fluoride Dissolved	n/a	n/a	≤ 1.5	mac	
CARBON					
Organic Carbon - Total	n/a	**14.5**	≤ 4	mac (THM)	**Not Met**
NITROGEN					
Total Kjeldahl N	0.59	0.93			
Total N	0.59	0.93			
Total Organic N	0.58	0.93			
Ammonia N	0.011	< 0.005			
Nitrate Nitrogen Dissolved	< 0.02	< 0.02	≤ 10	mac	Met
Nitrate+Nitrite	0.006	0.006			
Nitrite Nitrogen	0.003	0.003	≤ 1	mac	Met
PHOSPHORUS					
Ortho-Phosphorus	n/a	n/a			
Phosphorus Total Dissolved	0.01	0.016			
Phosphorus Total	**0.047**	**0.023**	≤ 0.01	mac (lakes)	**Not Met**
SULFATE					
Sulfate	n/a	n/a	≤ 500	ao	
METALS TOTAL					
Aluminum	0.0173	0.0065	≤ 0.2	mac	Met
Antimony	< 0.000005	< 0.000005	≤ 0.006	imac	Met
Arsenic	< 0.0001	0.0003	≤ 0.025	imac	Met
Barium	0.00979	0.0324	≤ 1	mac	Met
Beryllium	< 0.00002	< 0.00002			
Bismuth	< 0.00002	0.00007			
Cadmium	0.00001	< 0.00001	≤ 0.005	mac	Met
Calcium	11.5	44			
Chromium	< 0.0002	< 0.0002	≤ 0.05	mac	Met
Cobalt	< 0.000005	0.000058			
Copper	0.00027	0.00062	≤ 1	ao	Met
Iron	0.027	0.027	≤ 0.3	ao	Met
Lead	0.00002	0.00005	≤ 0.01	mac	Met
Lithium	0.00041	0.00164			
Magnesium	3.08	11.5	≤ 100	ao	Met
Manganese	0.0176	0.00936	≤ 0.05	ao	**Not Met**
Molybdenum	0.00006	0.00006	≤ 0.25	mac	Met
Nickel	< 0.00005	0.0002			
Selenium	< 0.0002	< 0.0002	≤ 0.01	mac	Met
Silver	< 0.00002	< 0.00002			
Strontium	0.0589	0.168			
Thallium	< 0.000002	< 0.000002			
Tin	0.00001	0.00005			
Uranium	0.000003	0.000008	≤ 0.02	imac	Met
Vanadium	0.00006	0.00029	≤ 0.1	mac	Met
Zinc	0.0009	0.0013	≤ 5	ao	Met

Table 29B – Kirby Lake Sites (KLP, KLS)

(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline		
PYHSICAL							
pH (pH units)	7	7.6	8.1	7.9	≤	8.5	ao (>6.5)
Specific Conductance (uS/cm)	8	82	296	248	≤	700	mac
Residue Filterable - TDS	0				≤	500	ao
Hardness Total - T	7	41.4	172.0	138.8	≤	500	mac
Alkalinity Total (mg/L CaCO3)	0						
ANIONS							
Chloride Dissolved	0				≤	250	ao
Fluoride Dissolved	0				≤	1.5	mac
CARBON							
Organic Carbon - Total	3	10.7	14.5	12.9	≤	4	mac (THM)
NITROGEN							
Total Kjeldahl N	8	0.59	0.93	0.75			
Total N	8	0.59	0.93	0.77			
Total Organic N	8	0.6	0.9	0.7			
Ammonia N	8	0.005	0.125	0.045			
Nitrate Nitrogen Dissolved	8	0.02	0.05	0.03	≤	10	mac
Nitrate+Nitrite	8	0.003	0.058	0.025			
Nitrite Nitrogen	8	0.002	0.004	0.003	≤	1	mac
PHOSPHORUS							
Ortho-Phosphorus	0						
Phosphorus Total Dissolved	8	0.010	0.028	0.015			
Phosphorus Total	8	0.017	0.047	0.027	≤	0.01	mac (lakes)
SULFATE							
Sulfate	0				≤	500	ao
METALS TOTAL							
Aluminum	7	0.0026	0.0173	0.0061	≤	0.2	mac
Antimony	7	0.00001	0.00021	0.00004	≤	0.006	imac
Arsenic	7	0.0001	0.0006	0.0004	≤	0.025	imac
Barium	7	0.00979	0.03920	0.03106	≤	1	mac
Beryllium	7	0.00002	0.00002	0.00002			
Bismuth	7	0.00002	0.00049	0.00014			
Cadmium	7	0.00001	0.00001	0.00001	≤	0.005	mac
Calcium	7	11.50	48.00	38.73			
Chromium	7	0.0002	0.0002	0.0002	≤	0.05	mac
Cobalt	7	0.000005	0.000151	0.000050			
Copper	7	0.00027	0.00128	0.00070	≤	1	ao
Iron	7	0.027	0.275	0.113	≤	0.3	ao
Lead	7	0.00002	0.00018	0.00010	≤	0.01	mac
Lithium	7	0.00041	0.00172	0.00126			
Magnesium	7	3.08	12.70	10.21	≤	100	ao
Manganese	7	0.009360	0.097700	0.062666	≤	0.05	ao
Molybdenum	7	0.00006	0.00016	0.00010	≤	0.25	mac
Nickel	7	0.00005	0.00020	0.00008			
Selenium	7	0.0002	0.0004	0.0002	≤	0.01	mac
Silver	7	0.00002	0.00002	0.00002			
Strontium	7	0.058900	0.249000	0.187843			
Thallium	7	0.000002	0.000014	0.000004			
Tin	7	0.00001	0.00005	0.00002			
Uranium	7	0.000002	0.000037	0.000013	≤	0.02	imac
Vanadium	7	0.00006	0.00108	0.00045	≤	0.1	mac
Zinc	7	0.0009	0.0061	0.0028	≤	5	ao

Table 30A – Fir Bluff Subdivision Groundwater Sites (FGW, FST)
(Values in mg/L unless otherwise noted)

	FGW 31-Oct-02	FGW 24-Apr-03	FGW-1 6-May-03
PYHSICAL			
pH (pH units)	7.8	7.8	8
Specific Conductance (uS/cm)	720	719	630
Residue Filterable - TDS	n/a	n/a	n/a
Hardness Total - T	396	383	341
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a
ANIONS			
Chloride Dissolved	11.3	15.6	12.9
Fluoride Dissolved	n/a	n/a	n/a
CARBON			
Organic Carbon - Total	n/a	**6.7**	**8.0**
NITROGEN			
Total Kjeldahl N	0.37	0.31	0.36
Total N	0.38	0.31	0.036
Total Organic N	0.34	0.28	0.035
Ammonia N	0.027	0.029	0.01
Nitrate Nitrogen Dissolved	< 0.02	< 0.02	< 0.02
Nitrate+Nitrite	0.009	< 0.002	0.007
Nitrite Nitrogen	< 0.002	< 0.002	0.003
PHOSPHORUS			
Ortho-Phosphorus	n/a	n/a	n/a
Phosphorus Total Dissolved	0.007	0.005	0.009
Phosphorus Total	0.007	0.004	0.009
SULFATE			
Sulfate	n/a	n/a	n/a
METALS TOTAL			
Aluminum	0.0013	0.0048	0.0045
Antimony	0.000065	0.000077	0.000037
Arsenic	0.0006	0.0007	0.0006
Barium	0.0965	0.0841	0.0744
Beryllium	< 0.00002	< 0.00002	< 0.00002
Bismuth	< 0.00002	< 0.00002	< 0.00002
Cadmium	0.00032	0.00008	0.00006
Calcium	120	116	103
Chromium	< 0.0002	< 0.0002	< 0.0002
Cobalt	0.000738	0.00086	0.000854
Copper	0.00284	0.00104	0.00108
Iron	0.066	0.154	0.166
Lead	0.00012	< 0.00001	0.00003
Lithium	0.00227	0.00186	0.00214
Magnesium	23.5	22.7	20.4
Manganese	**2.11**	**1.57**	**0.823**
Molybdenum	0.00099	0.00091	0.00072
Nickel	0.00066	0.00109	0.00213
Selenium	< 0.0002	< 0.0002	< 0.0002
Silver	< 0.00002	< 0.00002	< 0.00002
Strontium	0.715	0.504	0.343
Thallium	0.000003	0.000011	0.000006
Tin	< 0.00001	< 0.00001	0.00002
Uranium	0.000281	0.000215	0.000175
Vanadium	0.00048	0.00075	0.00035
Zinc	< 0.0001	0.001	0.0009

Table 30A – Fir Bluff Subdivision Groundwater Sites (FGW, FST) Continued
(Values in mg/L unless otherwise noted)

	FGW-2 6-May-03	FST 6-May-03	Drinking Water Guideline		
PYHSICAL					
pH (pH units)	7.7	7.7	≤ 8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	595	583	≤ 700	mac	Not Met
Residue Filterable - TDS	n/a	n/a	≤ 500	ao	
Hardness Total - T	335	329	≤ 500	mac	Met
Alkalinity Total (mg/L CaCO3)	n/a	n/a			
ANIONS					
Chloride Dissolved	12.8	12.2	≤ 250	ao	Met
Fluoride Dissolved	n/a	n/a	≤ 1.5	mac	
CARBON					
Organic Carbon - Total	**8.0**	**7.6**	≤ 4	mac (THM)	**Not Met**
NITROGEN					
Total Kjeldahl N	0.35	0.37			
Total N	0.36	0.38			
Total Organic N	0.34	< 0.1			
Ammonia N	0.011	0.495			
Nitrate Nitrogen Dissolved	< 0.02	< 0.02	≤ 10	mac	Met
Nitrate+Nitrite	0.006	0.003			
Nitrite Nitrogen	0.003	0.003	≤ 1	mac	Met
PHOSPHORUS					
Ortho-Phosphorus	n/a	n/a			
Phosphorus Total Dissolved	0.009	0.01			
Phosphorus Total	0.009	0.011	≤ 0.01	mac (lakes)	
SULFATE					
Sulfate	n/a	n/a	≤ 500	ao	
METALS TOTAL					
Aluminum	0.0048	0.0613	≤ 0.2	mac	Met
Antimony	0.000037	0.000052	≤ 0.006	imac	Met
Arsenic	0.0007	0.0006	≤ 0.025	imac	Met
Barium	0.0757	0.0661	≤ 1	mac	Met
Beryllium	< 0.00002	< 0.00002			
Bismuth	0.00014	0.00005			
Cadmium	0.00006	0.00004	≤ 0.005	mac	Met
Calcium	101	99.2			
Chromium	< 0.0002	< 0.0002	≤ 0.05	mac	Met
Cobalt	0.000858	0.000662			
Copper	0.00117	0.0335	≤ 1	ao	Met
Iron	0.12	0.154	≤ 0.3	ao	Met
Lead	0.00004	0.00065	≤ 0.01	mac	Met
Lithium	0.00201	0.00203			
Magnesium	20	19.7	≤ 100	ao	Met
Manganese	**0.785**	**0.623**	≤ 0.05	ao	**Not Met**
Molybdenum	0.00071	0.00065	≤ 0.25	mac	Met
Nickel	0.00245	0.00228			
Selenium	< 0.0002	0.0004	≤ 0.01	mac	Met
Silver	< 0.00002	< 0.00002			
Strontium	0.335	0.327			
Thallium	0.000009	0.000004			
Tin	0.00002	0.00006			
Uranium	0.00017	0.000152	≤ 0.02	imac	Met
Vanadium	0.0003	0.00058	≤ 0.1	mac	Met
Zinc	0.0008	0.0174	≤ 5	ao	Met

Table 30B – Fir Bluff Subdivision Groundwater Sites (FGW, FST)
(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline		
PYHSICAL							
pH (pH units)	5	7.7	8.0	7.8	≤	8.5	ao (>6.5)
Specific Conductance (uS/cm)	5	583	720	649	≤	700	mac
Residue Filterable - TDS	0				≤	500	ao
Hardness Total - T	5	329.0	396.0	356.8	≤	500	mac
Alkalinity Total (mg/L CaCO3)	0						
ANIONS							
Chloride Dissolved	5	11.3	15.6	13.0	≤	250	ao
Fluoride Dissolved	0				≤	1.5	mac
CARBON							
Organic Carbon - Total	4	6.7	8.0	7.6	≤	4	mac (THM)
NITROGEN							
Total Kjeldahl N	5	0.31	0.37	0.35			
Total N	5	0.04	0.38	0.29			
Total Organic N	5	0.0	0.3	0.2			
Ammonia N	5	0.010	0.495	0.114			
Nitrate Nitrogen Dissolved	5	0.02	0.02	0.02	≤	10	mac
Nitrate+Nitrite	5	0.002	0.009	0.005			
Nitrite Nitrogen	5	0.002	0.003	0.003	≤	1	mac
PHOSPHORUS							
Ortho-Phosphorus	0						
Phosphorus Total Dissolved	5	0.005	0.010	0.008			
Phosphorus Total	5	0.004	0.011	0.008	≤	0.01	mac (lakes)
SULFATE							
Sulfate	0				≤	500	ao
METALS TOTAL							
Aluminum	5	0.0013	0.0613	0.0153	≤	0.2	mac
Antimony	5	0.00004	0.00008	0.00005	≤	0.006	imac
Arsenic	5	0.0006	0.0007	0.0006	≤	0.025	imac
Barium	5	0.06610	0.09650	0.07936	≤	1	mac
Beryllium	5	0.00002	0.00002	0.00002			
Bismuth	5	0.00002	0.00014	0.00005			
Cadmium	5	0.00004	0.00032	0.00011	≤	0.005	mac
Calcium	5	99.20	120.00	107.84			
Chromium	5	0.0002	0.0002	0.0002	≤	0.05	mac
Cobalt	5	0.000662	0.00086	0.000794			
Copper	5	0.00104	0.03350	0.00793	≤	1	ao
Iron	5	0.066	0.166	0.132	≤	0.3	ao
Lead	5	0.00001	0.00065	0.00017	≤	0.01	mac
Lithium	5	0.00186	0.00227	0.00206			
Magnesium	5	19.70	23.50	21.26	≤	100	ao
Manganese	5	0.623000	2.110000	1.182200	≤	0.05	ao
Molybdenum	5	0.00065	0.00099	0.00080	≤	0.25	mac
Nickel	5	0.00066	0.00245	0.00172			
Selenium	5	0.0002	0.0004	0.0002	≤	0.01	mac
Silver	5	0.00002	0.00002	0.00002			
Strontium	5	0.327000	0.715000	0.444800			
Thallium	5	0.000003	0.000011	0.000007			
Tin	5	0.00001	0.00006	0.00002			
Uranium	5	0.000152	0.000281	0.000199	≤	0.02	imac
Vanadium	5	0.00030	0.00075	0.00049	≤	0.1	mac
Zinc	5	0.0001	0.0174	0.0040	≤	5	ao

Table 31A – Chicago Creek Sites (SHF, CCU, CCL)
(Values in mg/L unless otherwise noted)

	SHF 7-Oct-02	CCU 7-Oct-02	CCL 7-Oct-02	SHF 15-Apr-03
PYHSICAL				
pH (pH units)	7.4	7.4	7.4	7.4
Specific Conductance (uS/cm)	45	45	45	57
Residue Filterable - TDS	n/a	n/a	n/a	n/a
Hardness Total - T	19.1	19.1	18.9	26
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a	n/a
ANIONS				
Chloride Dissolved	n/a	n/a	n/a	n/a
Fluoride Dissolved	n/a	n/a	n/a	n/a
CARBON				
Organic Carbon - Total	n/a	n/a	n/a	n/a
NITROGEN				
Total Kjeldahl N	< 0.02	0.04	< 0.02	0.03
Total N	0.09	0.11	0.09	0.16
Total Organic N	< 0.1	< 0.1	< 0.1	< 0.1
Ammonia N	< 0.005	< 0.005	< 0.005	< 0.005
Nitrate Nitrogen Dissolved	0.08	0.07	0.07	0.14
Nitrate+Nitrite	0.079	0.068	0.068	0.137
Nitrite Nitrogen	< 0.002	< 0.002	0.002	< 0.002
PHOSPHORUS				
Ortho-Phosphorus	0.001	< 0.001	< 0.001	n/a
Phosphorus Total Dissolved	n/a	n/a	n/a	n/a
Phosphorus Total	0.005	0.005	0.005	n/a
SULFATE				
Sulfate	n/a	n/a	n/a	n/a
METALS TOTAL				
Aluminum	0.0144	0.0199	0.0154	0.0205
Antimony	0.000386	0.000416	0.000381	0.000334
Arsenic	0.0003	0.0002	0.0002	0.0002
Barium	0.00544	0.00559	0.00553	0.00716
Beryllium	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Bismuth	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Cadmium	0.00003	0.00003	0.00003	0.00008
Calcium	7.15	7.01	6.96	9.58
Chromium	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Cobalt	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Copper	0.0406	0.00046	0.00047	0.0683
Iron	0.007	0.012	0.01	0.0106
Lead	0.00018	< 0.00001	< 0.00001	0.00025
Lithium	< 0.00005	0.00005	< 0.00005	< 0.00018
Magnesium	0.3	0.38	0.37	0.5
Manganese	0.000203	0.000196	0.000263	0.000343
Molybdenum	0.0244	0.0248	0.0248	0.0375
Nickel	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Selenium	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Silver	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Strontium	0.0355	0.034	0.0339	0.0414
Thallium	< 0.000002	< 0.000002	< 0.000002	< 0.000002
Tin	< 0.00001	< 0.00001	0.00001	0.00001
Uranium	0.00147	0.00164	0.00163	0.00199
Vanadium	0.00054	0.00056	0.00057	0.0004
Zinc	0.001	< 0.0001	< 0.0001	0.002

Table 31A – Chicago Creek Sites (SHF, CCU, CCL) Continued

(Values in mg/L unless otherwise noted)

	CCU 15-Apr-03	CCL-1 15-Apr-03	CCL-2 15-Apr-03	Drinking Water Guideline		
PYHSICAL						
pH (pH units)	7.4	7.5	7.4	≤ 8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	56	57	56	≤ 700	mac	Met
Residue Filterable - TDS	n/a	n/a	n/a	≤ 500	ao	
Hardness Total - T	25.5	25.8	25.6	≤ 500	mac	Met
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a			
ANIONS						
Chloride Dissolved	n/a	n/a	n/a	≤ 250	ao	
Fluoride Dissolved	n/a	n/a	n/a	≤ 1.5	mac	
CARBON						
Organic Carbon - Total	n/a	n/a	n/a	≤ 4	mac (THM)	
NITROGEN						
Total Kjeldahl N	0.03	0.04	0.04			
Total N	0.16	0.16	0.18			
Total Organic N	< 0.1	< 0.1	< 0.1			
Ammonia N	< 0.005	< 0.005	< 0.005			
Nitrate Nitrogen Dissolved	0.13	0.13	0.14	≤ 10	mac	Met
Nitrate+Nitrite	0.13	0.126	0.14			
Nitrite Nitrogen	< 0.002	< 0.002	< 0.002	≤ 1	mac	Met
PHOSPHORUS						
Ortho-Phosphorus	0.008	0.002	0.002			
Phosphorus Total Dissolved	n/a	n/a	n/a			
Phosphorus Total	0.003	0.003	0.004	≤ 0.01	mac (lakes)	
SULFATE						
Sulfate	n/a	n/a	n/a	≤ 500	ao	
METALS TOTAL						
Aluminum	0.021	0.0219	0.0212	≤ 0.2	mac	Met
Antimony	0.000332	0.000334	0.000311	≤ 0.006	imac	Met
Arsenic	0.0003	0.0002	0.0003	≤ 0.025	imac	Met
Barium	0.00714	0.00705	0.0072	≤ 1	mac	Met
Beryllium	< 0.00002	< 0.00002	< 0.00002			
Bismuth	< 0.00002	< 0.00002	< 0.00002			
Cadmium	0.00007	0.00007	0.00008	≤ 0.005	mac	Met
Calcium	9.32	9.4	9.36			
Chromium	< 0.0002	< 0.0002	< 0.0002	≤ 0.05	mac	Met
Cobalt	0.000006	< 0.000005	< 0.000005			
Copper	0.00076	0.00076	0.00075	≤ 1	ao	Met
Iron	0.018	0.02	0.015	≤ 0.3	ao	Met
Lead	0.00001	0.00002	0.00003	≤ 0.01	mac	Met
Lithium	0.00015	0.00018	0.00017			
Magnesium	0.53	0.56	0.55	≤ 100	ao	Met
Manganese	0.000246	0.000291	0.000275	≤ 0.05	ao	Met
Molybdenum	0.0367	0.0337	0.0368	≤ 0.25	mac	Met
Nickel	< 0.00005	< 0.00005	< 0.00005			
Selenium	< 0.0002	< 0.0002	0.0002	≤ 0.01	mac	Met
Silver	< 0.00002	< 0.00002	< 0.00002			
Strontium	0.0394	0.0394	0.0391			
Thallium	< 0.000002	< 0.000002	< 0.000002			
Tin	< 0.00001	< 0.00001	0.00002			
Uranium	0.0021	0.002	0.00207	≤ 0.02	imac	Met
Vanadium	0.00041	0.00036	0.00037	≤ 0.1	mac	Met
Zinc	< 0.0001	0.0004	0.0012	≤ 5	ao	Met

Table 31B – Chicago Creek Sites (SHF, CCU, CCL)
(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline		
PYHSICAL							
pH (pH units)	7	7.4	7.5	7.4	≤	8.5	ao (>6.5)
Specific Conductance (uS/cm)	7	45	57	52	≤	700	mac
Residue Filterable - TDS	0				≤	500	ao
Hardness Total - T	7	18.9	26.0	22.9	≤	500	mac
Alkalinity Total (mg/L CaCO3)	0						
ANIONS							
Chloride Dissolved	0				≤	250	ao
Fluoride Dissolved	0				≤	1.5	mac
CARBON							
Organic Carbon - Total	0				≤	4	mac (THM)
NITROGEN							
Total Kjeldahl N	7	0.02	0.04	0.03			
Total N	7	0.09	0.18	0.14			
Total Organic N	7	0.1	0.1	0.1			
Ammonia N	7	0.005	0.005	0.005			
Nitrate Nitrogen Dissolved	7	0.07	0.14	0.11	≤	10	mac
Nitrate+Nitrite	7	0.068	0.140	0.107			
Nitrite Nitrogen	7	0.002	0.002	0.002	≤	1	mac
PHOSPHORUS							
Ortho-Phosphorus	6	0.001	0.008	0.003			
Phosphorus Total Dissolved	0						
Phosphorus Total	6	0.003	0.005	0.004	≤	0.01	mac (lakes)
SULFATE							
Sulfate	0				≤	500	ao
METALS TOTAL							
Aluminum	7	0.0144	0.0219	0.0192	≤	0.2	mac
Antimony	7	0.00031	0.00042	0.00036	≤	0.006	imac
Arsenic	7	0.0002	0.0003	0.0002	≤	0.025	imac
Barium	7	0.00544	0.00720	0.00644	≤	1	mac
Beryllium	7	0.00002	0.00002	0.00002			
Bismuth	7	0.00002	0.00002	0.00002			
Cadmium	7	0.00003	0.00008	0.00006	≤	0.005	mac
Calcium	7	6.96	9.58	8.40			
Chromium	7	0.0002	0.0002	0.0002	≤	0.05	mac
Cobalt	7	0.000005	0.000006	0.000005			
Copper	7	0.00046	0.06830	0.01601	≤	1	ao
Iron	7	0.007	0.020	0.013	≤	0.3	ao
Lead	7	0.00001	0.00025	0.00007	≤	0.01	mac
Lithium	7	0.00005	0.00018	0.00012			
Magnesium	7	0.30	0.56	0.46	≤	100	ao
Manganese	7	0.000196	0.000343	0.000260	≤	0.05	ao
Molybdenum	7	0.02440	0.03750	0.03124	≤	0.25	mac
Nickel	7	0.00005	0.00005	0.00005			
Selenium	7	0.0002	0.0002	0.0002	≤	0.01	mac
Silver	7	0.00002	0.00002	0.00002			
Strontium	7	0.033900	0.041400	0.037529			
Thallium	7	0.000002	0.000002	0.000002			
Tin	7	0.00001	0.00002	0.00001			
Uranium	7	0.001470	0.002100	0.001843	≤	0.02	imac
Vanadium	7	0.00036	0.00057	0.00046	≤	0.1	mac
Zinc	7	0.0001	0.0020	0.0007	≤	5	ao

Table 32A – Bulkley River Sites (BRT, BU1 – BU3)
(Values in mg/L unless otherwise noted)

	BRT 8-Aug-02	BRT 7-Oct-02	BRT 28-Oct-02	BU2-1 28-Oct-02
PYHSICAL				
pH (pH units)	n/a	7.7	7.7	7.4
Specific Conductance (uS/cm)	52	51	58	59
Residue Filterable - TDS	n/a	n/a	n/a	n/a
Hardness Total - T	23.1	24.5	26.7	26.9
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a	n/a
ANIONS				
Chloride Dissolved	n/a	n/a	0.5	0.7
Fluoride Dissolved	n/a	n/a	n/a	n/a
CARBON				
Organic Carbon - Total	n/a	n/a	n/a	n/a
NITROGEN				
Total Kjeldahl N	0.04	0.21	0.04	0.05
Total N	0.07	0.21	0.06	0.06
Total Organic N	< 0.1	0.2	< 0.1	< 0.1
Ammonia N	< 0.005	0.009	< 0.005	< 0.005
Nitrate Nitrogen Dissolved	0.03	< 0.02	< 0.02	< 0.02
Nitrate+Nitrite	0.029	0.006	0.013	0.008
Nitrite Nitrogen	0.002	< 0.002	< 0.002	< 0.002
PHOSPHORUS				
Ortho-Phosphorus	< 0.001	0.002	0.002	< 0.001
Phosphorus Total Dissolved	n/a	n/a	n/a	n/a
Phosphorus Total	0.003	0.016	< 0.002	0.002
SULFATE				
Sulfate	n/a	n/a	n/a	n/a
METALS TOTAL				
Aluminum	0.0878	**0.233**	0.0243	0.0564
Antimony	0.000021	0.00001	0.000011	0.000009
Arsenic	0.0002	0.0001	0.0001	< 0.0001
Barium	0.0203	0.0293	0.0188	0.02
Beryllium	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Bismuth	< 0.00002	< 0.00002	< 0.00002	0.00002
Cadmium	< 0.00001	< 0.00001	< 0.00001	0.00001
Calcium	7.85	8.16	8.94	8.97
Chromium	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Cobalt	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Copper	0.0008	0.00191	0.00034	0.00095
Iron	n/a	**0.604**	0.041	0.117
Lead	0.00013	0.00102	< 0.00001	0.00005
Lithium	< 0.00005	0.00008	0.00053	0.00117
Magnesium	0.85	0.99	1.07	1.1
Manganese	0.00996	0.0251	0.00151	0.00603
Molybdenum	0.00035	0.0004	0.0004	0.00043
Nickel	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Selenium	0.0003	< 0.0002	< 0.0002	< 0.0002
Silver	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Strontium	0.0315	0.0388	0.0355	0.0376
Thallium	< 0.000002	< 0.000002	< 0.000002	< 0.000002
Tin	0.00002	< 0.00001	0.00002	0.00003
Uranium	< 0.000002	0.000043	0.000007	0.000022
Vanadium	0.00032	0.00096	0.00032	0.00024
Zinc	0.0005	0.0018	< 0.0001	0.0166

Table 32A – Bulkley River Sites (BRT, BU1 – BU3) Continued
(Values in mg/L unless otherwise noted)

	BU2-2 28-Oct-02	BU1 28-Oct-02	BU3 31-Oct-02	Drinking Water Guideline		
PYHSICAL						
pH (pH units)	7.2	7.9	7.4	≤ 8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	58	58	59	≤ 700	mac	Met
Residue Filterable - TDS	n/a	n/a	n/a	≤ 500	ao	
Hardness Total - T	27.2	25.7	27.3	≤ 500	mac	Met
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a			
ANIONS						
Chloride Dissolved	< 0.5	< 0.5	0.6	≤ 250	ao	
Fluoride Dissolved	n/a	n/a	n/a	≤ 1.5	mac	
CARBON						
Organic Carbon - Total	n/a	n/a	n/a	≤ 4	mac (THM)	
NITROGEN						
Total Kjeldahl N	0.05	0.04	0.05			
Total N	0.06	0.06	0.07			
Total Organic N	< 0.1	< 0.1	< 0.1			
Ammonia N	< 0.005	< 0.005	< 0.005			
Nitrate Nitrogen Dissolved	< 0.02	< 0.02	0.02	≤ 10	mac	Met
Nitrate+Nitrite	0.006	0.014	0.021			
Nitrite Nitrogen	< 0.002	< 0.002	< 0.002	≤ 1	mac	Met
PHOSPHORUS						
Ortho-Phosphorus	0.001	< 0.001	0.002			
Phosphorus Total Dissolved	n/a	n/a	n/a			
Phosphorus Total	< 0.002	< 0.002	0.004	≤ 0.01	mac (lakes)	
SULFATE						
Sulfate	n/a	n/a	n/a	≤ 500	ao	
METALS TOTAL						
Aluminum	0.0398	0.0448	0.0616	≤ 0.2	mac	Not Met
Antimony	0.000016	< 0.000005	0.000013	≤ 0.006	imac	Met
Arsenic	< 0.0001	< 0.0001	0.0002	≤ 0.025	imac	Met
Barium	0.0201	0.0205	0.0218	≤ 1	mac	Met
Beryllium	< 0.00002	< 0.00002	< 0.00002			
Bismuth	0.00011	< 0.00002	< 0.00002			
Cadmium	< 0.00001	< 0.00001	0.00004	≤ 0.005	mac	Met
Calcium	9.09	8.61	9.09			
Chromium	< 0.0002	< 0.0002	< 0.0002	≤ 0.05	mac	Met
Cobalt	< 0.000005	< 0.000005	< 0.000005			
Copper	0.00057	0.00049	0.00082	≤ 1	ao	Met
Iron	0.073	0.084	0.125	≤ 0.3	ao	Not Met
Lead	0.00001	< 0.00001	0.00003	≤ 0.01	mac	Met
Lithium	0.00075	0.00059	< 0.00005			
Magnesium	1.1	1.03	1.11	≤ 100	ao	Met
Manganese	0.00459	0.0066	0.0139	≤ 0.05	ao	Met
Molybdenum	0.00042	0.00041	0.00034	≤ 0.25	mac	Met
Nickel	< 0.00005	< 0.00005	< 0.00005			
Selenium	< 0.0002	< 0.0002	0.0002	≤ 0.01	mac	Met
Silver	< 0.00002	< 0.00002	< 0.00002			
Strontium	0.038	0.0371	0.039			
Thallium	< 0.000002	< 0.000002	< 0.000002			
Tin	0.00003	< 0.00001	< 0.00001			
Uranium	0.000019	0.000025	0.000028	≤ 0.02	imac	Met
Vanadium	0.00023	0.00023	0.00024	≤ 0.1	mac	Met
Zinc	0.015	0.014	< 0.0001	≤ 5	ao	Met

Table 32B – Bulkley River Sites (BRT, BU1 – BU3)
(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline		
PYHSICAL							
pH (pH units)	6	7.2	7.9	7.6	≤	8.5	ao (>6.5)
Specific Conductance (uS/cm)	7	51	59	56	≤	700	mac
Residue Filterable - TDS	0				≤	500	ao
Hardness Total - T	7	23.1	27.3	25.9	≤	500	mac
Alkalinity Total (mg/L CaCO3)	0						
ANIONS							
Chloride Dissolved	5	0.5	0.7	0.6	≤	250	ao
Fluoride Dissolved	0				≤	1.5	mac
CARBON							
Organic Carbon - Total	0				≤	4	mac (THM)
NITROGEN							
Total Kjeldahl N	7	0.04	0.21	0.07			
Total N	7	0.06	0.21	0.08			
Total Organic N	7	0.1	0.2	0.1			
Ammonia N	7	0.005	0.009	0.006			
Nitrate Nitrogen Dissolved	7	0.02	0.03	0.02	≤	10	mac
Nitrate+Nitrite	7	0.006	0.029	0.014			
Nitrite Nitrogen	7	0.002	0.002	0.002	≤	1	mac
PHOSPHORUS							
Ortho-Phosphorus	7	0.001	0.002	0.001			
Phosphorus Total Dissolved	0						
Phosphorus Total	7	0.002	0.016	0.004	≤	0.01	mac (lakes)
SULFATE							
Sulfate	0				≤	500	ao
METALS TOTAL							
Aluminum	7	0.0243	0.2330	0.0782	≤	0.2	mac
Antimony	7	0.00001	0.00002	0.00001	≤	0.006	imac
Arsenic	7	0.0001	0.0002	0.0001	≤	0.025	imac
Barium	7	0.01880	0.02930	0.02154	≤	1	mac
Beryllium	7	0.00002	0.00002	0.00002			
Bismuth	7	0.00002	0.00011	0.00003			
Cadmium	7	0.00001	0.00004	0.00001	≤	0.005	mac
Calcium	7	7.85	9.09	8.67			
Chromium	7	0.0002	0.0002	0.0002	≤	0.05	mac
Cobalt	7	0.000005	0.000005	0.000005			
Copper	7	0.00034	0.00191	0.00084	≤	1	ao
Iron	6	0.041	0.604	0.174	≤	0.3	ao
Lead	7	0.00001	0.00102	0.00018	≤	0.01	mac
Lithium	7	0.00005	0.00117	0.00046			
Magnesium	7	0.85	1.11	1.04	≤	100	ao
Manganese	7	0.001510	0.025100	0.009670	≤	0.05	ao
Molybdenum	7	0.00034	0.00043	0.00039	≤	0.25	mac
Nickel	7	0.00005	0.00005	0.00005			
Selenium	7	0.0002	0.0003	0.0002	≤	0.01	mac
Silver	7	0.00002	0.00002	0.00002			
Strontium	7	0.031500	0.039000	0.036786			
Thallium	7	0.000002	0.000002	0.000002			
Tin	7	0.00001	0.00003	0.00002			
Uranium	7	0.000002	0.000043	0.000021	≤	0.02	imac
Vanadium	7	0.00023	0.00096	0.00036	≤	0.1	mac
Zinc	7	0.0001	0.0166	0.0069	≤	5	ao

Table 33A – Toboggan Creek Site (TBC)
(Values in mg/L unless otherwise noted)

	TBC 8-Aug-02	TBC 7-Oct-02	TBC 7-Apr-03	Drinking Water Guideline		
PYHSICAL						
pH (pH units)	n/a	7.6	7.7	≤ 8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	68	66	126	≤ 700	mac	Met
Residue Filterable - TDS	n/a	n/a	n/a	≤ 500	ao	
Hardness Total - T	31.2	30.5	n/a	≤ 500	mac	Met
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a			
ANIONS						
Chloride Dissolved	n/a	n/a	n/a	≤ 250	ao	
Fluoride Dissolved	n/a	n/a	n/a	≤ 1.5	mac	
CARBON						
Organic Carbon - Total	n/a	n/a	n/a	≤ 4	mac (THM)	
NITROGEN						
Total Kjeldahl N	0.06	0.09	0.58			
Total N	0.11	0.18	0.74			
Total Organic N	< 0.1	< 0.1	0.56			
Ammonia N	< 0.005	0.006	0.02			
Nitrate Nitrogen Dissolved	0.04	0.08	0.16	≤ 10	mac	Met
Nitrate+Nitrite	0.047	0.081	0.16			
Nitrite Nitrogen	0.004	0.003	0.005	≤ 1	mac	Met
PHOSPHORUS						
Ortho-Phosphorus	0.004	0.002	0.005			
Phosphorus Total Dissolved	n/a	n/a	n/a			
Phosphorus Total	0.008	0.013	0.053	≤ 0.01	mac (lakes)	
SULFATE						
Sulfate	n/a	n/a	n/a	≤ 500	ao	
METALS TOTAL						
Aluminum	**0.29**	0.172	n/a	≤ 0.2	mac	**Not Met**
Antimony	0.000078	0.000088	n/a	≤ 0.006	imac	Met
Arsenic	0.0008	0.0007	n/a	≤ 0.025	imac	Met
Barium	0.0126	0.0109	n/a	≤ 1	mac	Met
Beryllium	< 0.00002	< 0.00002	n/a			
Bismuth	0.00003	< 0.00002	n/a			
Cadmium	0.00003	0.00002	n/a	≤ 0.005	mac	Met
Calcium	9.97	9.92	n/a			
Chromium	< 0.0002	< 0.0002	n/a	≤ 0.05	mac	Met
Cobalt	0.000122	< 0.000005	n/a			
Copper	0.0044	0.00294	n/a	≤ 1	ao	Met
Iron	n/a	**0.596**	n/a	≤ 0.3	ao	**Not Met**
Lead	0.00022	0.00014	n/a	≤ 0.01	mac	Met
Lithium	0.00046	< 0.000005	n/a			
Magnesium	1.52	1.4	n/a	≤ 100	ao	Met
Manganese	0.0283	0.0274	n/a	≤ 0.05	ao	Met
Molybdenum	0.0104	0.0104	n/a	≤ 0.25	mac	Met
Nickel	< 0.00005	< 0.00005	n/a			
Selenium	< 0.0002	< 0.0002	n/a	≤ 0.01	mac	Met
Silver	< 0.00002	< 0.00002	n/a			
Strontium	0.0307	0.0374	n/a			
Thallium	0.00001	< 0.000002	n/a			
Tin	0.00001	0.00004	n/a			
Uranium	< 0.000002	0.000016	n/a	≤ 0.02	imac	Met
Vanadium	0.00091	0.00079	n/a	≤ 0.1	mac	Met
Zinc	0.0016	0.0016	n/a	≤ 5	ao	Met

Table 33B – Toboggan Creek Site (TBC)
(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline		
PYHSICAL							
pH (pH units)	2	7.6	7.7	7.7	≤	8.5	ao (>6.5)
Specific Conductance (uS/cm)	3	66	126	87	≤	700	mac
Residue Filterable - TDS	0				≤	500	ao
Hardness Total - T	2	30.5	31.2	30.9	≤	500	mac
Alkalinity Total (mg/L CaCO3)	0						
ANIONS							
Chloride Dissolved	0				≤	250	ao
Fluoride Dissolved	0				≤	1.5	mac
CARBON							
Organic Carbon - Total	0				≤	4	mac (THM)
NITROGEN							
Total Kjeldahl N	3	0.06	0.58	0.24			
Total N	3	0.11	0.74	0.34			
Total Organic N	3	0.1	0.6	0.3			
Ammonia N	3	0.005	0.020	0.010			
Nitrate Nitrogen Dissolved	3	0.04	0.16	0.09	≤	10	mac
Nitrate+Nitrite	3	0.047	0.160	0.096			
Nitrite Nitrogen	3	0.003	0.005	0.004	≤	1	mac
PHOSPHORUS							
Ortho-Phosphorus	3	0.002	0.005	0.004			
Phosphorus Total Dissolved	0						
Phosphorus Total	3	0.008	0.053	0.025	≤	0.01	mac (lakes)
SULFATE							
Sulfate	0				≤	500	ao
METALS TOTAL							
Aluminum	2	0.1720	0.2900	0.2310	≤	0.2	mac
Antimony	2	0.00008	0.00009	0.00008	≤	0.006	imac
Arsenic	2	0.0007	0.0008	0.0008	≤	0.025	imac
Barium	2	0.01090	0.01260	0.01175	≤	1	mac
Beryllium	2	0.00002	0.00002	0.00002			
Bismuth	2	0.00002	0.00003	0.00003			
Cadmium	2	0.00002	0.00003	0.00003	≤	0.005	mac
Calcium	2	9.92	9.97	9.95			
Chromium	2	0.0002	0.0002	0.0002	≤	0.05	mac
Cobalt	2	0.000005	0.000122	0.000064			
Copper	2	0.00294	0.00440	0.00367	≤	1	ao
Iron	1	0.596	0.596	0.596	≤	0.3	ao
Lead	2	0.00014	0.00022	0.00018	≤	0.01	mac
Lithium	2	0.00001	0.00046	0.00023			
Magnesium	2	1.40	1.52	1.46	≤	100	ao
Manganese	2	0.027400	0.028300	0.027850	≤	0.05	ao
Molybdenum	2	0.01040	0.01040	0.01040	≤	0.25	mac
Nickel	2	0.00005	0.00005	0.00005			
Selenium	2	0.0002	0.0002	0.0002	≤	0.01	mac
Silver	2	0.00002	0.00002	0.00002			
Strontium	2	0.030700	0.037400	0.034050			
Thallium	2	0.000002	0.000010	0.000006			
Tin	2	0.00001	0.00004	0.00003			
Uranium	2	0.000002	0.000016	0.000009	≤	0.02	imac
Vanadium	2	0.00079	0.00091	0.00085	≤	0.1	mac
Zinc	2	0.0016	0.0016	0.0016	≤	5	ao

Table 34A – Thompson Creek Sites (TMC, TMI)
(Values in mg/L unless otherwise noted)

	TMC 8-Aug-02	TMC 16-Sep-02	TMC 9-Oct-02	TMI 9-Oct-02
PYHSICAL				
pH (pH units)	n/a	n/a	8.1	8.1
Specific Conductance (uS/cm)	230	234	280	357
Residue Filterable - TDS	n/a	n/a	n/a	n/a
Hardness Total - T	127	n/a	138	122
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a	n/a
ANIONS				
Chloride Dissolved	n/a	n/a	n/a	n/a
Fluoride Dissolved	n/a	n/a	n/a	n/a
CARBON				
Organic Carbon - Total	n/a	n/a	n/a	n/a
NITROGEN				
Total Kjeldahl N	0.16	0.17	0.18	0.26
Total N	0.3	0.25	0.17	0.32
Total Organic N	0.16	0.17	0.18	0.26
Ammonia N	< 0.005	< 0.005	< 0.005	< 0.005
Nitrate Nitrogen Dissolved	0.14	0.08	< 0.02	0.06
Nitrate+Nitrite	0.147	0.079	< 0.002	0.058
Nitrite Nitrogen	0.004	0.004	< 0.002	< 0.002
PHOSPHORUS				
Ortho-Phosphorus	0.01	0.002	0.003	0.006
Phosphorus Total Dissolved	n/a	n/a	n/a	n/a
Phosphorus Total	0.01	0.015	0.014	0.017
SULFATE				
Sulfate	n/a	n/a	n/a	n/a
METALS TOTAL				
Aluminum	0.0613	n/a	0.0231	0.0067
Antimony	0.000078	n/a	0.000028	0.000082
Arsenic	0.001	n/a	0.0009	0.0004
Barium	0.0435	n/a	0.0412	0.077
Beryllium	< 0.00002	n/a	< 0.00002	< 0.00002
Bismuth	< 0.00002	n/a	< 0.00002	< 0.00002
Cadmium	< 0.00001	n/a	< 0.00001	< 0.00001
Calcium	44.2	n/a	48	33.6
Chromium	< 0.0002	n/a	< 0.0002	< 0.0002
Cobalt	< 0.000005	n/a	< 0.000005	< 0.000005
Copper	0.00101	n/a	0.00024	0.0136
Iron	n/a	n/a	**0.439**	0.014
Lead	0.00014	n/a	0.00003	0.00019
Lithium	< 0.00058	n/a	< 0.00005	< 0.00005
Magnesium	4.12	n/a	4.51	9.17
Manganese	0.145	n/a	**0.147**	0.00276
Molybdenum	0.0009	n/a	0.00064	0.00074
Nickel	< 0.00005	n/a	< 0.00005	< 0.00005
Selenium	0.0003	n/a	0.0002	< 0.0002
Silver	< 0.00002	n/a	< 0.00002	< 0.00002
Strontium	0.17	n/a	0.175	0.192
Thallium	< 0.000002	n/a	< 0.000002	< 0.000002
Tin	0.00002	n/a	< 0.00001	< 0.00001
Uranium	< 0.000002	n/a	0.000093	0.000283
Vanadium	0.0004	n/a	0.0004	0.0009
Zinc	0.0012	n/a	0.0007	0.0297

Table 34A – Thompson Creek Sites (TMC, TMI) Continued

(Values in mg/L unless otherwise noted)

	TMC-1 7-Apr-03	TMC-2 7-Apr-03	TMI 7-Apr-03	Drinking Water Guideline		
PYHSICAL						
pH (pH units)	8	8.1	8	≤ 8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	279	279	682	≤ 700	mac	Met
Residue Filterable - TDS	n/a	n/a	n/a	≤ 500	ao	
Hardness Total - T	123	126	281	≤ 500	mac	Met
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a			
ANIONS						
Chloride Dissolved	n/a	n/a	n/a	≤ 250	ao	
Fluoride Dissolved	n/a	n/a	n/a	≤ 1.5	mac	
CARBON						
Organic Carbon - Total	n/a	n/a	n/a	≤ 4	mac (THM)	
NITROGEN						
Total Kjeldahl N	0.53	0.56	0.71			
Total N	0.75	0.78	7.47			
Total Organic N	0.48	0.51	0.7			
Ammonia N	0.053	0.053	0.008			
Nitrate Nitrogen Dissolved	0.21	0.22	6.76	≤ 10	mac	Met
Nitrate+Nitrite	0.218	0.219	6.76			
Nitrite Nitrogen	0.004	0.004	0.005	≤ 1	mac	Met
PHOSPHORUS						
Ortho-Phosphorus	0.009	0.008	0.011			
Phosphorus Total Dissolved	n/a	n/a	n/a			
Phosphorus Total	0.058	0.057	0.031	≤ 0.01	mac (lakes)	
SULFATE						
Sulfate	n/a	n/a	n/a	≤ 500	ao	
METALS TOTAL						
Aluminum	**0.202**	0.185	0.0067	≤ 0.2	mac	**Not Met**
Antimony	0.00013	0.000119	0.000155	≤ 0.006	imac	Met
Arsenic	0.0008	0.0006	0.0004	≤ 0.025	imac	Met
Barium	0.0436	0.0422	0.129	≤ 1	mac	Met
Beryllium	0.00002	< 0.00002	< 0.00002			
Bismuth	0.00007	0.00017	0.0002			
Cadmium	0.00002	0.00002	0.00002	≤ 0.005	mac	Met
Calcium	40.5	41.7	80.7			
Chromium	< 0.0002	< 0.0002	< 0.0002	≤ 0.05	mac	Met
Cobalt	0.000125	0.000091	0.000152			
Copper	0.00158	0.00143	0.0161	≤ 1	ao	Met
Iron	**0.763**	**0.641**	0.052	≤ 0.3	ao	**Not Met**
Lead	0.00014	0.00009	0.00015	≤ 0.01	mac	Met
Lithium	0.00038	0.00044	0.00018			
Magnesium	5.31	5.42	19.2	≤ 100	ao	Met
Manganese	**0.158**	**0.124**	0.0175	≤ 0.05	ao	**Not Met**
Molybdenum	0.00071	0.0007	0.00047	≤ 0.25	mac	Met
Nickel	0.00019	0.00042	< 0.00005			
Selenium	0.0003	< 0.0002	0.0002	≤ 0.01	mac	Met
Silver	< 0.00002	< 0.00002	< 0.00002			
Strontium	0.156	0.152	0.44			
Thallium	0.000005	0.000007	0.000008			
Tin	< 0.00001	< 0.00001	< 0.00001			
Uranium	0.000117	0.000111	0.00101	≤ 0.02	imac	Met
Vanadium	0.0009	0.00076	0.00478	≤ 0.1	mac	Met
Zinc	0.0017	0.0012	0.0644	≤ 5	ao	Met

Table 34B – Thompson Creek Sites (TMC, TMI)
(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline		
PYHSICAL							
pH (pH units)	5	8.0	8.1	8.1	≤	8.5	ao (>6.5)
Specific Conductance (uS/cm)	7	230	682	334	≤	700	mac
Residue Filterable - TDS	0				≤	500	ao
Hardness Total - T	6	122.0	281.0	152.8	≤	500	mac
Alkalinity Total (mg/L CaCO3)	0						
ANIONS							
Chloride Dissolved	0				≤	250	ao
Fluoride Dissolved	0				≤	1.5	mac
CARBON							
Organic Carbon - Total	0				≤	4	mac (THM)
NITROGEN							
Total Kjeldahl N	7	0.16	0.71	0.37			
Total N	7	0.17	7.47	1.43			
Total Organic N	7	0.2	0.7	0.4			
Ammonia N	7	0.005	0.053	0.019			
Nitrate Nitrogen Dissolved	7	0.02	6.76	1.07	≤	10	mac
Nitrate+Nitrite	7	0.002	6.760	1.069			
Nitrite Nitrogen	7	0.002	0.005	0.004	≤	1	mac
PHOSPHORUS							
Ortho-Phosphorus	7	0.002	0.011	0.007			
Phosphorus Total Dissolved	0						
Phosphorus Total	7	0.010	0.058	0.029	≤	0.01	mac (lakes)
SULFATE							
Sulfate	0				≤	500	ao
METALS TOTAL							
Aluminum	6	0.0067	0.2020	0.0808	≤	0.2	mac
Antimony	6	0.00003	0.00016	0.00010	≤	0.006	imac
Arsenic	6	0.0004	0.0010	0.0007	≤	0.025	imac
Barium	6	0.04120	0.12900	0.06275	≤	1	mac
Beryllium	6	0.00002	0.00002	0.00002			
Bismuth	6	0.00002	0.00020	0.00008			
Cadmium	6	0.00001	0.00002	0.00002	≤	0.005	mac
Calcium	6	33.60	80.70	48.12			
Chromium	6	0.0002	0.0002	0.0002	≤	0.05	mac
Cobalt	6	0.000005	0.000152	0.000064			
Copper	6	0.00024	0.01610	0.00566	≤	1	ao
Iron	5	0.014	0.763	0.382	≤	0.3	ao
Lead	6	0.00003	0.00019	0.00012	≤	0.01	mac
Lithium	6	0.00005	0.00058	0.00028			
Magnesium	6	4.12	19.20	7.96	≤	100	ao
Manganese	6	0.002760	0.158000	0.099043	≤	0.05	ao
Molybdenum	6	0.00047	0.00090	0.00069	≤	0.25	mac
Nickel	6	0.00005	0.00042	0.00014			
Selenium	6	0.0002	0.0003	0.0002	≤	0.01	mac
Silver	6	0.00002	0.00002	0.00002			
Strontium	6	0.152000	0.440000	0.214167			
Thallium	6	0.000002	0.000008	0.000004			
Tin	6	0.00001	0.00002	0.00001			
Uranium	6	0.000002	0.001010	0.000269	≤	0.02	imac
Vanadium	6	0.00040	0.00478	0.00136	≤	0.1	mac
Zinc	6	0.0007	0.0644	0.0165	≤	5	ao

QA/QC ANALYSIS OF WEEKLY RESULTS (TABLE A) AND ADDITIONAL WATER QUALITY RESULTS (TABLE B)

Table 35A – QA/QC Analysis of Microbiological Indicators & Colour and Turbidity (Weekly Results)

(Values in mg/L unless otherwise noted)

Blanks:

Date	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
03-Nov-02	< 1	< 1	< 1	5	0.57
18-Nov-02	< 1	< 1	< 1	< 5	< 0.1
25-Nov-02	< 1	< 1	< 1	< 5	0.19
29-Apr-03	< 2	< 2	< 2	< 5	0.14
16-Sep-02	< 1	< 1	< 1	< 5	0.17
16-Oct-02	< 1	< 1	< 1	< 5	0.13
30-Oct-02	< 1	< 1	< 1	< 5	0.14
07-Apr-03	< 2	< 2	< 2	5	< 0.1
14-Apr-03	< 2	< 2	< 2	5	0.13
22-Apr-03	< 2	< 2	< 2	< 5	0.11
06-May-03	< 2	< 2	< 2	< 5	< 0.1

Duplicates:

Date	Site	Colour True Result 1	Colour True Result 2	RPD	Turbidity Result 1	Turbidity Result 2	RPD
07-Apr-03	S3	50	50	0.0	3.19	3.17	0.6
07-Apr-03	TMC	30	30	0.0	4.46	6.2	**-32.6**
07-Apr-03	K3	10	15		1.4	1.43	-2.1
07-Apr-03	KLP	30	30	0.0	0.33	0.45	
14-Apr-03	R4	15	15		1.22	1.62	**-28.2**
14-Apr-03	T4	10	5		0.6	0.58	3.4
15-Apr-03	CCL	5	5		0.52	0.33	
22-Apr-03	K2	20	20		2.59	2.47	4.7
29-Apr-03	T2	5	10		0.73	0.81	-10.4
06-May-03	S2	30	30	0.0	1.53	1.59	-3.8
12-May-03	CCL	5	5		0.17	0.18	

Table 35B – QA/QC Analysis of Additional Water Quality Results

(Values in mg/L unless otherwise noted)

	MDL	Blanks	Duplicates		
		ST1-BV 7-Apr-03	K3-1 7-Apr-03	K3-2 7-Apr-03	RPD
PYHSICAL					
pH (pH units)	0.1	6.2	7.2	7.2	0.0
Specific Conductance (uS/cm)	1	1	50	50	0.0
Residue Filterable - TDS	10		n/a	n/a	
Hardness Total - T	0.3	< 0.3	17	17.3	-1.7
Alkalinity Total (mg/L CaCO3)	0.3		n/a	n/a	
ANIONS					
Chloride Dissolved	0.5	n/a	n/a	n/a	
Fluoride Dissolved	0.01		n/a	n/a	
CARBON					
Organic Carbon - Total	0.5		n/a	n/a	
NITROGEN					
Total Kjeldahl N	0.02	< 0.02	0.22	0.22	0.0
Total N	0.02	< 0.02	0.23	0.23	0.0
Total Organic N	0.1	< 0.1	0.22	0.22	
Ammonia N	0.005	< 0.005	< 0.005	< 0.005	
Nitrate Nitrogen Dissolved	0.02	< 0.02	< 0.02	< 0.02	
Nitrate+Nitrite	0.002	0.011	0.01	0.008	
Nitrite Nitrogen	0.002	< 0.002	< 0.002	< 0.002	
PHOSPHORUS					
Ortho-Phosphorus	0.001	n/a	n/a	n/a	
Phosphorus Total Dissolved	0.002	0.004	0.012	0.01	
Phosphorus Total	0.002	< 0.002	**0.018**	**0.017**	5.7
SULFATE					
Sulfate	0.5		n/a	n/a	
METALS TOTAL					
Aluminum	0.0003	< 0.0003	0.0215	0.0218	-1.4
Antimony	0.000005	< 0.000005	0.000071	0.000083	-15.6
Arsenic	0.0001	< 0.0001	0.0011	0.0011	0.0
Barium	0.00002	< 0.00002	0.00894	0.00908	-1.6
Beryllium	0.00002	< 0.00002	< 0.00002	< 0.00002	
Bismuth	0.00002	< 0.00002	0.00002	0.00005	
Cadmium	0.00001	< 0.00001	0.00002	0.00001	
Calcium	0.05	< 0.05	5.07	5.14	-1.4
Chromium	0.0002	< 0.0002	< 0.0002	< 0.0002	
Cobalt	0.000005	< 0.000005	0.000015	0.000014	
Copper	0.00005	0.00021	0.0155	0.016	-3.2
Iron	0.005	< 0.005	0.252	0.261	-3.5
Lead	0.00001	0.00002	0.00081	0.00082	-1.2
Lithium	0.00005	< 0.00005	0.00016	0.00009	
Magnesium	0.05	< 0.05	1.05	1.08	-2.8
Manganese	0.000008	< 0.00008	0.0221	0.023	-4.0
Molybdenum	0.00005	0.00009	0.007	0.0067	4.4
Nickel	0.00005	< 0.00005	0.00031	0.00036	-14.9
Selenium	0.0002	< 0.0002	< 0.0002	< 0.0002	
Silver	0.00002	< 0.00002	< 0.00002	< 0.00002	
Strontium	0.000005	0.000034	0.0253	0.0261	-3.1
Thallium	0.000002	< 0.000002	< 0.000002	< 0.000002	
Tin	0.00001	0.00003	< 0.00001	0.00002	
Uranium	0.000002	< 0.000002	0.000003	0.000003	
Vanadium	0.00006	< 0.00006	0.00013	0.00011	
Zinc	0.0001	< 0.0001	0.0028	0.0029	-3.5

Table 35B – QA/QC Analysis of Additional Water Quality Results Continued
(Values in mg/L unless otherwise noted)

	MDL	Duplicates			Duplicates		
		S3-1 7-Apr-03	S3-2 7-Apr-03	RPD	TMC-1 7-Apr-03	TMC-2 7-Apr-03	RPD
PYHSICAL							
pH (pH units)	0.1	7.6	7.6	0.0	8	8.1	-1.2
Specific Conductance (uS/cm)	1	103	103	0.0	279	279	0.0
Residue Filterable - TDS	10	n/a	n/a		n/a	n/a	
Hardness Total - T	0.3	47	47.8	-1.7	123	126	-2.4
Alkalinity Total (mg/L CaCO3)	0.3	n/a	n/a		n/a	n/a	
ANIONS							
Chloride Dissolved	0.5	n/a	n/a		n/a	n/a	
Fluoride Dissolved	0.01	n/a	n/a		n/a	n/a	
CARBON							
Organic Carbon - Total	0.5	n/a	n/a		n/a	n/a	
NITROGEN							
Total Kjeldahl N	0.02	0.47	0.45	4.3	0.53	0.56	-5.5
Total N	0.02	0.52	0.5	3.9	0.75	0.78	-3.9
Total Organic N	0.1	0.47	0.44		0.48	0.51	-6.1
Ammonia N	0.005	< 0.005	< 0.009		0.053	0.053	0.0
Nitrate Nitrogen Dissolved	0.02	0.05	0.05		0.21	0.22	-4.7
Nitrate+Nitrite	0.002	0.056	0.058	-3.5	0.218	0.219	-0.5
Nitrite Nitrogen	0.002	0.002	0.003		0.004	0.004	
PHOSPHORUS							
Ortho-Phosphorus	0.001	n/a	n/a		0.009	0.008	11.8
Phosphorus Total Dissolved	0.002	0.013	0.011	16.7	n/a	n/a	
Phosphorus Total	0.002	**0.017**	**0.018**	-5.7	0.058	0.057	1.7
SULFATE							
Sulfate	0.5	n/a	n/a		n/a	n/a	
METALS TOTAL							
Aluminum	0.0003	0.18	0.169	6.3	**0.202**	0.185	8.8
Antimony	0.000005	0.000078	0.000069	12.2	0.00013	0.000119	8.8
Arsenic	0.0001	0.0004	0.0004		0.0008	0.0006	28.6
Barium	0.00002	0.0402	0.0411	-2.2	0.0436	0.0422	3.3
Beryllium	0.00002	0.00002	< 0.00002		0.00002	< 0.00002	
Bismuth	0.00002	0.00009	0.00003		0.00007	0.00017	
Cadmium	0.00001	< 0.00001	< 0.00001		0.00002	0.00002	
Calcium	0.05	10.4	10.6	-1.9	40.5	41.7	-2.9
Chromium	0.0002	< 0.0002	< 0.0002		< 0.0002	< 0.0002	
Cobalt	0.000005	0.000041	0.000042	-2.4	0.000125	0.000091	31.5
Copper	0.00005	0.0171	0.0177	-3.4	0.00158	0.00143	10.0
Iron	0.005	**0.368**	**0.373**	-1.3	**0.763**	**0.641**	17.4
Lead	0.00001	0.00051	0.00056	-9.3	0.00014	0.00009	43.5
Lithium	0.00005	0.0008	0.00078	2.5	0.00038	0.00044	-14.6
Magnesium	0.05	5.11	5.17	-1.2	5.31	5.42	-2.1
Manganese	0.000008	0.0118	0.0124	-5.0	**0.158**	**0.124**	24.1
Molybdenum	0.00005	0.00016	0.00011		0.00071	0.0007	1.4
Nickel	0.00005	0.00056	0.00059	-5.2	0.00019	0.00042	
Selenium	0.0002	< 0.0002	< 0.0002		0.0003	< 0.0002	
Silver	0.00002	< 0.00002	< 0.00002		< 0.00002	< 0.00002	
Strontium	0.000005	0.0649	0.0644	0.8	0.156	0.152	2.6
Thallium	0.000002	0.000002	0.000003		0.000005	0.000007	
Tin	0.00001	0.00002	< 0.00001		< 0.00001	< 0.00001	
Uranium	0.000002	0.000022	0.000015	37.8	0.000117	0.000111	5.3
Vanadium	0.00006	0.0007	0.00058	18.8	0.0009	0.00076	16.9
Zinc	0.0001	0.0072	0.0073	-1.4	0.0017	0.0012	34.5

Table 35B – QA/QC Analysis of Additional Water Quality Results Continued
(Values in mg/L unless otherwise noted)

	MDL	Duplicates			Duplicates		
		KLP-1 7-Apr-03	KLP-2 7-Apr-03	RPD	FGW-1 6-May-03	FGW-2 6-May-03	RPD
PYHSICAL							
pH (pH units)	0.1	8	8	0.0	8	7.7	3.8
Specific Conductance (uS/cm)	1	259	258	0.4	630	595	5.7
Residue Filterable - TDS	10	n/a	n/a		n/a	n/a	
Hardness Total - T	0.3	134	139	-3.7	341	335	1.8
Alkalinity Total (mg/L CaCO3)	0.3	n/a	n/a		n/a	n/a	
ANIONS							
Chloride Dissolved	0.5	n/a	n/a		12.9	12.8	0.8
Fluoride Dissolved	0.01	n/a	n/a		n/a	n/a	
CARBON							
Organic Carbon - Total	0.5	n/a	n/a		n/a	n/a	
NITROGEN							
Total Kjeldahl N	0.02	0.7	0.63	10.5	0.36	0.35	2.8
Total N	0.02	0.76	0.69	9.7	0.036	0.36	
Total Organic N	0.1	0.67	0.6	11.0	0.035	0.34	
Ammonia N	0.005	0.036	0.034	5.7	0.01	0.011	
Nitrate Nitrogen Dissolved	0.02	0.05	0.05		< 0.02	< 0.02	
Nitrate+Nitrite	0.002	0.057	0.058	-1.7	0.007	0.006	
Nitrite Nitrogen	0.002	0.004	0.003		0.003	0.003	
PHOSPHORUS							
Ortho-Phosphorus	0.001	n/a	n/a		n/a	n/a	
Phosphorus Total Dissolved	0.002	0.013	0.013	0.0	0.009	0.009	
Phosphorus Total	0.002	**0.017**	**0.017**	0.0	0.009	0.009	
SULFATE							
Sulfate	0.5	n/a	n/a		n/a	n/a	
METALS TOTAL							
Aluminum	0.0003	0.0041	0.0038	7.6	0.0045	0.0048	-6.5
Antimony	0.000005	0.000025	0.000061		0.000037	0.000037	0.0
Arsenic	0.0001	0.0003	0.0003		0.0006	0.0007	-15.4
Barium	0.00002	0.032	0.0313	2.2	0.0744	0.0757	-1.7
Beryllium	0.00002	< 0.00002	< 0.00002		< 0.00002	< 0.00002	
Bismuth	0.00002	0.00003	0.00031		< 0.00002	0.00014	
Cadmium	0.00001	< 0.00001	< 0.00001		0.00006	0.00006	0.0
Calcium	0.05	37.1	38.7	-4.2	103	101	2.0
Chromium	0.0002	< 0.0002	< 0.0002		< 0.0002	< 0.0002	
Cobalt	0.000005	0.00007	0.000057	20.5	0.000854	0.000858	-0.5
Copper	0.00005	0.00128	0.00109	16.0	0.00108	0.00117	-8.0
Iron	0.005	0.123	0.125	-1.6	0.166	0.12	32.2
Lead	0.00001	0.00013	0.00012	8.0	0.00003	0.00004	
Lithium	0.00005	0.00135	0.00139	-2.9	0.00214	0.00201	6.3
Magnesium	0.05	10	10.4	-3.9	20.4	20	2.0
Manganese	0.000008	**0.0875**	**0.0854**	2.4	**0.823**	**0.785**	4.7
Molybdenum	0.00005	0.00012	0.00007		0.00072	0.00071	1.4
Nickel	0.00005	< 0.00005	< 0.00005		0.00213	0.00245	-14.0
Selenium	0.0002	< 0.0002	< 0.0002		< 0.0002	< 0.0002	
Silver	0.00002	< 0.00002	< 0.00002		< 0.00002	< 0.00002	
Strontium	0.000005	0.194	0.188	3.1	0.343	0.335	2.4
Thallium	0.000002	0.000003	0.000004		0.000006	0.000009	
Tin	0.00001	< 0.00001	< 0.00001		0.00002	0.00002	
Uranium	0.000002	0.000037	0.000006		0.000175	0.00017	2.9
Vanadium	0.00006	0.00049	0.00047	4.2	0.00035	0.0003	
Zinc	0.0001	0.0028	0.0029	-3.5	0.0009	0.0008	11.8

Table 35B – QA/QC Analysis of Additional Water Quality Results Continued
(Values in mg/L unless otherwise noted)

	MDL	Duplicates		
		CCL-1 15-Apr-03	CCL-2 15-Apr-03	RPD
PYHSICAL				
pH (pH units)	0.1	7.5	7.4	1.3
Specific Conductance (uS/cm)	1	57	56	1.8
Residue Filterable - TDS	10	n/a	n/a	
Hardness Total - T	0.3	25.8	25.6	0.8
Alkalinity Total (mg/L CaCO3)	0.3	n/a	n/a	
ANIONS				
Chloride Dissolved	0.5	n/a	n/a	
Fluoride Dissolved	0.01	n/a	n/a	
CARBON				
Organic Carbon - Total	0.5	n/a	n/a	
NITROGEN				
Total Kjeldahl N	0.02	0.04	0.04	
Total N	0.02	0.16	0.18	-11.8
Total Organic N	0.1	< 0.1	< 0.1	
Ammonia N	0.005	< 0.005	< 0.005	
Nitrate Nitrogen Dissolved	0.02	0.13	0.14	-7.4
Nitrate+Nitrite	0.002	0.126	0.14	-10.5
Nitrite Nitrogen	0.002	< 0.002	< 0.002	
PHOSPHORUS				
Ortho-Phosphorus	0.001	0.002	0.002	
Phosphorus Total Dissolved	0.002	n/a	n/a	
Phosphorus Total	0.002	0.003	0.004	
SULFATE				
Sulfate	0.5	n/a	n/a	
METALS TOTAL				
Aluminum	0.0003	0.0219	0.0212	3.2
Antimony	0.000005	0.000334	0.000311	7.1
Arsenic	0.0001	0.0002	0.0003	
Barium	0.00002	0.00705	0.0072	-2.1
Beryllium	0.00002	< 0.00002	< 0.00002	
Bismuth	0.00002	< 0.00002	< 0.00002	
Cadmium	0.00001	0.00007	0.00008	-13.3
Calcium	0.05	9.4	9.36	0.4
Chromium	0.0002	< 0.0002	< 0.0002	
Cobalt	0.000005	< 0.000005	< 0.000005	
Copper	0.00005	0.00076	0.00075	1.3
Iron	0.005	0.02	0.015	
Lead	0.00001	0.00002	0.00003	
Lithium	0.00005	0.00018	0.00017	
Magnesium	0.05	0.56	0.55	1.8
Manganese	0.000008	0.000291	0.000275	5.7
Molybdenum	0.00005	0.0337	0.0368	-8.8
Nickel	0.00005	< 0.00005	< 0.00005	
Selenium	0.0002	< 0.0002	0.0002	
Silver	0.00002	< 0.00002	< 0.00002	
Strontium	0.000005	0.0394	0.0391	0.8
Thallium	0.000002	< 0.000002	< 0.000002	
Tin	0.00001	< 0.00001	0.00002	
Uranium	0.000002	0.002	0.00207	-3.4
Vanadium	0.00006	0.00036	0.00037	-2.7
Zinc	0.0001	0.0004	0.0012	