

# **Drinking Water Source Quality Monitoring 2002-03**

## **Lakes District: Burns Lake, Francois Lake, Babine Lake and Burns Rural Groundwater**



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## SUMMARY

The Lakes District does not have water bodies with site-specific water quality objectives, and there is little or no monitoring data for most drinking water sources. In 2002-03 a comprehensive sampling program was implemented for a number of drinking water sources including Burns Lake, Francois Lake, Babine Lake and Burns Lake Rural Area groundwater.

In August and October 2002, and April and August 2003, drinking water samples were collected to investigate the quality of Lakes District drinking water. Five samples were collected from each site within a 30-day period in each sampling season (note: not all sites were monitored in each 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, 90<sup>th</sup> percentiles 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). For groundwater sites around Burns Lake, the *No Treatment* guideline was applied.

- Burns Lake has shown eutrophic characteristics and variable water quality in recent years, but it continues to be a drinking water source for some lakeshore residents. Source water was monitored at two intakes in 2002-03 to investigate seasonal patterns in water quality, and determine risks associated with eutrophication (high nutrient levels), failing lakeside sewage disposal systems and agricultural activities.
  - All three microbiological indicators were detected. Fecal coliform and *E. coli* 90<sup>th</sup> percentiles met MoE guidelines, but the enterococci guideline was not met in August.
  - Most samples had turbidity values that met the MoE guideline of  $\leq 5$  NTU, but no samples met the 15 TCU guideline for colour.
  - Phosphorus values were consistently above guideline levels, and excessive plant growth and periodic algae blooms are possible. Other physical and chemical parameters were below MoE drinking water guidelines.
- Francois Lake drinking water intakes have not been monitored by MoE in the past; a Lake Management Plan for Francois Lake identified possible contamination sources including residential development (fertilizers and septic systems), agriculture, forestry, mining, infrastructure, and boat sewage discharges. Four intakes were monitored in 2002-03.

- Microbiological indicators were occasionally detected in low concentrations. Most sample sets met MoE drinking water guidelines.
  - Turbidity and colour were well below MoE guideline levels.
  - Manganese exceeded the aesthetic drinking water guideline in one sample; other physical and chemical parameters were below guideline levels.
- Babine Lake has not been monitored by MoE in the past, but a complaint about possible sewage contamination in the Topley Landing area prompted limited sampling in October 2002. Samples were collected at two intakes to investigate this potential source water contamination issue
    - Enterococci were not detected, but fecal coliforms and *E. coli* were present in some samples from both sites. All microbiological indicator guidelines were met.
    - Turbidity values easily met the MoE drinking water guideline. Colour values did not meet the guideline in two of ten samples, and other physical and chemical parameters met guideline levels.
    - Phosphorus exceeded the guideline level at the site near the alleged contamination. Slightly elevated levels of bacteria and phosphorus at this site suggest that source water contamination is possible, but further investigation is required.
- Groundwater is a common drinking water source for residents living in or near the Village of Burns Lake. Groundwater sampling was conducted from wells in Gerow Island and Byetown subdivisions to investigate groundwater quality and determine its suitability as a desirable alternative to surface water intakes:
    - Low concentrations of enterococci were found in one of 15 samples from Gerow Island and five of nine samples from Byetown, exceeding the MoE (*No Treatment*) guidelines for enterococci.
    - Turbidity values at both sites were variable, and the drinking water guideline was often exceeded. Most samples met the guideline for colour.
    - Iron and manganese commonly exceeded aesthetic guideline levels, but the observed concentrations do not pose a risk to human health.
    - Further sampling is recommended to investigate water quality issues at the Byetown well.

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. Groundwater users should be reminded about the importance of adequate well head protection.
- Drinking water source quality data should be made readily available to any interested parties
- Provisional water quality objectives for Burns Lake should be re-visited with a more comprehensive sampling program, and potentially adopted.
- Babine Lake sampling should be expanded to include other sites to determine whether or not the sampling results from 2002 are indicative of sewage contamination.
- Byetown groundwater sampling should continue at the established site and be expanded to other sites in the subdivision to investigate water quality issues described in this report.

## ACKNOWLEDGEMENTS

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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 Lakes District, outlines water quality monitoring conducted in 2002-03, and presents the results of this work. Recommendations for future monitoring in the Lakes District 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>).

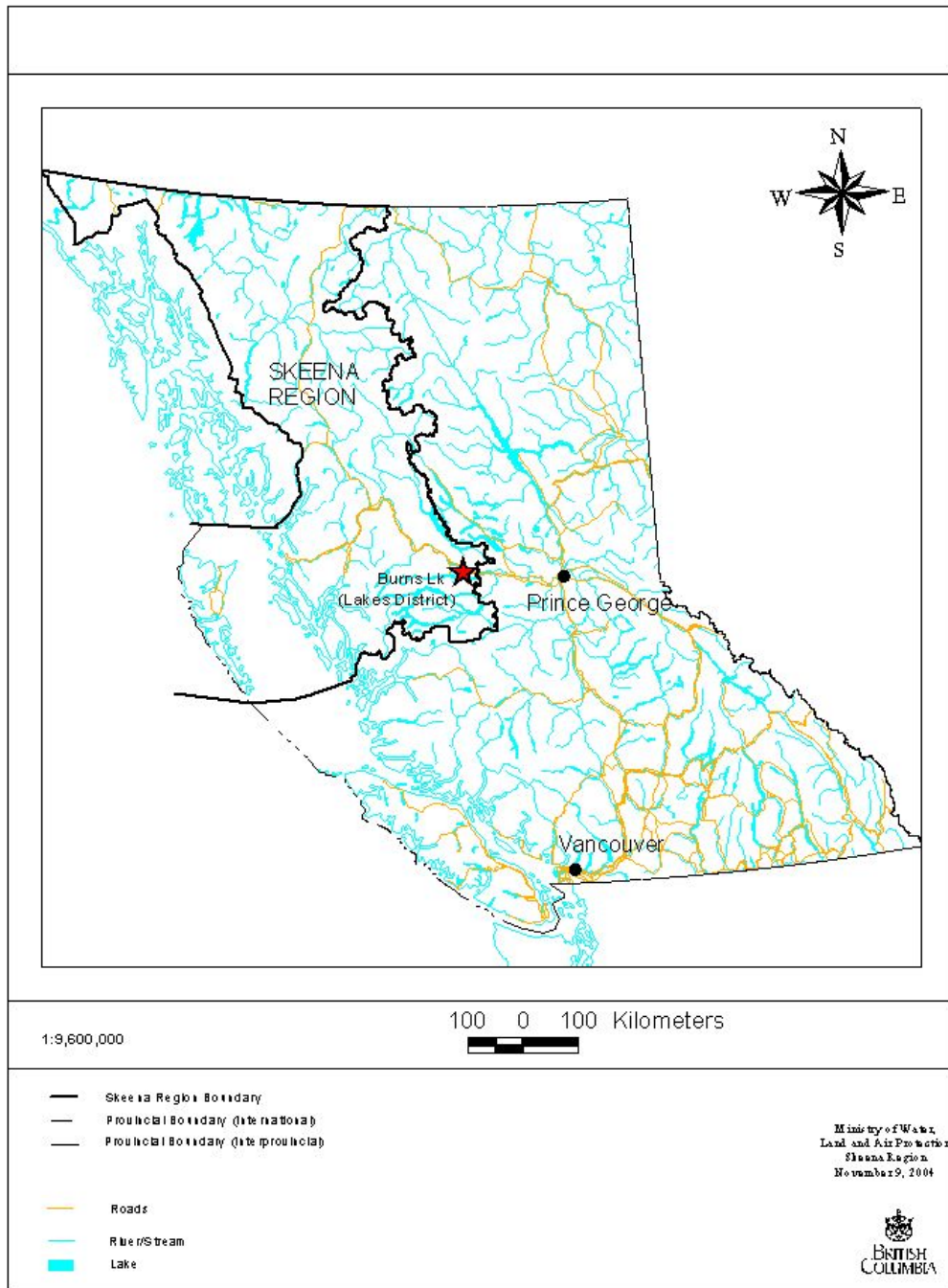
### 1.2 Skeena Region Overview

The Skeena Region covers an area of 266,441 km<sup>2</sup> (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 Lakes District**



### **1.3 The Lakes District**

The Lakes District lies between Prince George and Houston on the Central Interior Nechako Plateau of north-central British Columbia. Highway 16 traverses the Lakes District from east to west, and the Village of Burns Lake lies near the centre of the region. There are approximately 8,000 people living in Burns Lake and surrounding communities. Forestry activities are abundant in the Lakes District and other land uses include agriculture (mixed farming/ranching) and recreation.

Many residents live in rural parts of the Lakes District, 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, provisional water quality objectives have been established for Burns Lake to protect it for designated uses including drinking.

Surface water is commonly consumed in the Lakes District with little or no treatment. Recent drinking water quality studies have noted source quality concerns at many water bodies in the Skeena Region, but they have not included monitoring in the Lakes District (Remington, 2002). Lakes such as Burns, Francois and Babine serve as drinking water sources for individual and community water systems. This study provides important information needed to characterize water quality in Lakes District drinking water sources and 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	<i>E. coli</i>	Enterococci
Raw Drinking Water – No Treatment (GROUNDWATER)	0/100 mL	0/100 mL	0/100 mL
Raw Drinking Water – Disinfection Only (SURFACE WATER)	Less than or equal to 10/100 mL 90 <sup>th</sup> percentile	Less than or equal to 10/100 mL 90 <sup>th</sup> percentile	Less than or equal to 3/100 mL 90 <sup>th</sup> 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](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](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
<b>PHYSICAL</b>		
pH	6.5-8.5	aesthetic objective
Colour	≤ 15 TCU	aesthetic objective
Specific conductance	≤ 700 μS/cm	maximum acceptable concentration
Turbidity	≤ 5 NTU <sup>1</sup>	maximum acceptable concentration
Hardness Total – T	≤ 500	maximum acceptable concentration
<b>TOTAL ORGANIC CARBON</b>		
T.O.C.	≤ 4 <sup>2</sup>	maximum, to prevent THM formation
<b>ANIONS</b>		
Chloride Dissolved	≤ 250	aesthetic objective
Fluoride Dissolved	≤ 1.5	maximum acceptable concentration
<b>NUTRIENTS</b>		
Nitrate Nitrogen Dissolved	≤ 10	maximum acceptable concentration
Nitrite Nitrogen	≤ 1	maximum acceptable concentration
Phosphorus Total	≤ 0.01	maximum, to protect lakes from algae growth
<b>SULFATE</b>		
Sulfate	≤ 500	aesthetic objective
<b>METALS TOTAL</b>		
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 <sup>3</sup>	maximum acceptable concentration
Vanadium	≤ 0.1	maximum acceptable concentration
Zinc	≤ 5	aesthetic objective

<sup>1</sup> 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.

<sup>2</sup> No approved B.C. guideline, but US EPA guideline is 4 mg/L to prevent trihalomethane formation.

<sup>3</sup> B.C. interim max. acceptable concentration is ≤ 0.1 mg/L; Canadian guideline (≤ 0.02) is more stringent.

## **3.0 METHODS**

### **3.1 Lakes District Sampling Program (2002-03)**

The Lakes District sampling program was designed in consultation with the Northern Health Authority (NHA) Environmental Health Officer, and Health Canada and Regional District of Bulkley-Nechako (RDBN) representatives. The program included testing of five drinking water sources: Burns Lake, Francois Lake and Babine Lake surface waters, and groundwater below Gerow Island and Byetown Subdivisions. The program expanded and changed over the 2002-03 period (depending on the availability of water samplers) so not all sites were monitored in all seasons. 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, April 2003 and August 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, however, May 12, 2003 samples for microbiological analysis were not analysed before sample expiry.

### **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 Lakes District blank samples:

- Enterococci were present in one sample (May 12, 2003) at a concentration of 2 CFU/100 mL, indicating that contamination may have occurred on that date. Low bacteria concentrations in other samples from this date should be viewed with caution, as the detections may be due to contamination rather than actual water quality conditions. It is not known whether the contamination in the blank originated during the sampling, transport, or analysis stages.
- Turbidity and colour values were low and sample contamination is unlikely.
- In the comprehensive sample for physical and chemical parameters (April 16, 2003), the following physical and chemical parameters were detected at low concentrations which are far below drinking water guideline levels: Nitrate+nitrite, nitrite, total phosphorus, dissolved phosphorus, and some total metals (bismuth, calcium, copper, lead, strontium, tin, and zinc). 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).<sup>4</sup> The RPD for duplicate samples should be less than 25%; data with precision values greater than 25% should be interpreted with caution. In Lakes District duplicates:

- All RPD values for turbidity and colour duplicates were less than the 25% data quality objective.
- In the comprehensive duplicate samples from surface water site **F1**, RPD's for all parameters were less than 25% except nitrate+nitrite. There is no drinking water guideline for this parameter, and the nitrate concentration at all sampling sites was far below the guideline level so there are no concerns about data quality.
- In the comprehensive duplicate samples from groundwater site **BGW**, RPD values for chloride, ammonia, and cobalt exceeded the 25% objective. Extreme variability in water quality was observed at **BGW** over the sampling sessions, and it is suspected that the variability in the duplicates (collected one after the other from the tap) was caused by problems with the well itself rather than a data quality issue (see Section 5.4).

### 3.5 Reporting

Microbiological water quality results are reported 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), 90<sup>th</sup> percentiles were calculated for each indicator and the results were compared to the *Disinfection Only* MoE guideline level (Table 1). The 90<sup>th</sup> percentile concentration is the concentration below which 90% of the samples lie. For computing 90<sup>th</sup> 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.

For groundwater, samples were compared to the *No Treatment* guideline of zero organisms per 100 mL.

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

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<sup>4</sup> 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.

instrument or technique with a high degree of confidence. The MDL for colour is 5 Colour Units, and for turbidity is 0.1 Nephelometric Turbidity Units (NTU).

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

Ten drinking water sampling sites were monitored in the Lakes District to collect water quality data on three surface water sources and two groundwater sources.

### 4.1 Burns Lake

Burns Lake is located near the Village of Burns Lake on the Central Interior Nechako Plateau, approximately 225 km west from Prince George. It is long and narrow, with a complex shoreline, several islands and two basins. The lake is relatively shallow (maximum depth is 40 m and mean depth is 9 m) and has a surface area of approximately 1200 ha. The main inlet is the Endako River, which drains Decker Lake 1.5 km to the northwest. Burns Lake is a productive, eutrophic lake with naturally high nutrient concentrations. Additional information about the lake is available in Maclean (1985) and the Burns and Decker Lakes Management Plan (Downie and Wilson, 2002).

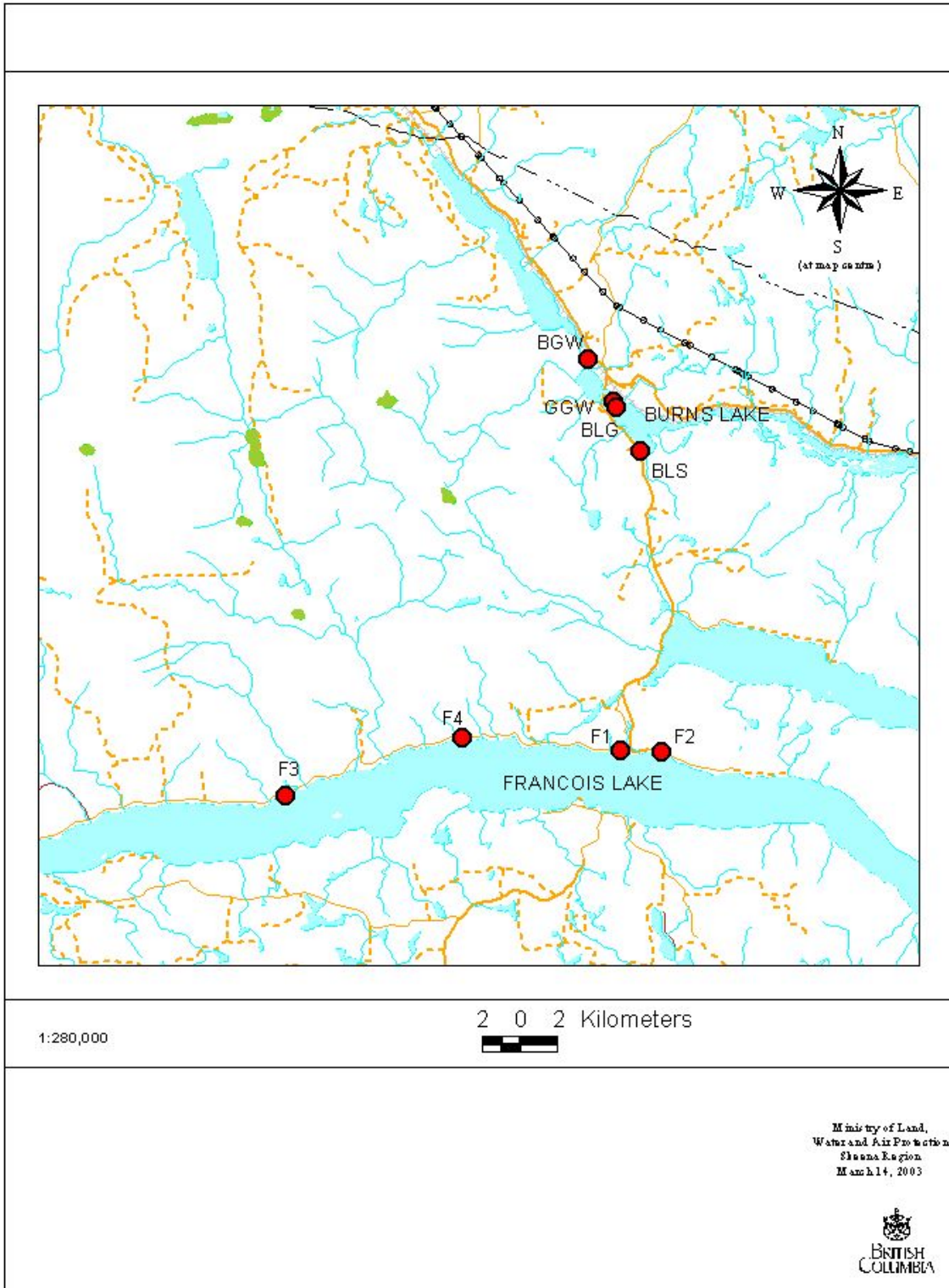
When provisional site-specific water quality objectives were established for Burns Lake in 1985, designated uses of the lake included raw drinking supply. Concerns were expressed that “establishing objectives to protect the most sensitive uses is complicated by the fact that several provisional criteria are already ‘naturally’ exceeded in Burns Lake” and “presence of humic substances and dissolved organics which contribute to colour (and trihalomethanes subsequent to chlorination) indicate that Burns Lake water quality is unsuitable as a public water supply” (Maclean, 1985). The overall conclusion was that Burns Lake is not a good drinking water supply, and other sources should be considered.

Subsequent to the report by Maclean (1985), the Village of Burns Lake switched to a groundwater supply for its community water system. There are some residents, however, who live outside the village boundary and continue to draw water from the lake. Drinking water quality concerns arise from the eutrophic nature of the lake (the surface water is subject to excessive algae growth and the bottom water is subject to oxygen depletion) and development along the north side of the lake. Failing lakeside sewage disposal systems at Gerow Island and Byetown Subdivision may be sources of contamination, especially during high water levels (Sharpe, 2002, pers. comm.). Runoff from other developments and activities in the watershed (agriculture, forestry, commercial/residential developments, transportation infrastructure, etc.) are potential sources of water quality degradation.

In August and October 2002 and April 2003, Burns Lake source water was sampled from intakes at two locations (Figure 2).

- **BLG** is located on Gerow Island, drawing water from between the east and west basins of the lake
- **BLS** is located on the south shore of the lake, drawing from the east basin of the lake

**Figure 2: Lakes District Drinking Water Quality Sampling Sites**



## 4.2 Francois Lake

Francois Lake is a long and narrow lake located south from Burns Lake on Highway 35. It is one of the largest lakes in the Lakes District, with a surface area of 258 km<sup>2</sup>, a maximum depth of 244 m, and a mean depth of 87 m (Province of B.C. Fish Wizard website, 2003). Francois Lake is considered oligotrophic, with low nutrient concentrations and clear water. Because of its large size, water remains in the lake for an average of 35 years. Additional information about the lake is available in Ellickson and Larkin (1969), and in the Francois Lake Management Plan (Westenhofer et al., 2000).

Francois Lake does not have site-specific water quality objectives established, and the lake has not been adequately tested by the Ministry in past monitoring programs. A Lake Management Plan was produced in 2000 by Westenhofer et al., and it includes some preliminary water quality data and a discussion about potential sources of water quality degradation. According to the Plan, many lakeshore residents still rely on the lake as a drinking water source, and they use their own private intake or receive water from small community systems. Most drinking water intakes on Francois Lake are located close to the shoreline, leaving them vulnerable to contamination from a number of watershed activities including residential development (fertilizers and septic systems), agriculture, forestry, mining, infrastructure, and boat sewage discharges (Westenhofer et al., 2000).

In October 2002 and April and August 2003 Francois Lake source water was sampled at four intake locations (Figure 2).

- **F1** is serves a small water system near the north shore ferry landing.
- **F2, F3, and F4** are private intakes located along the north shore of the lake

## 4.3 Babine Lake

Babine Lake is a large and complex lake located northwest from Burns Lake on the Northern Interior Plateau. The lake has a surface area of 465 km<sup>2</sup>, a maximum depth of 186 m, and a mean depth of 55 m (Province of B.C. Fish wizard website, 2003). The lake forms the headwaters of the Babine River, which has extremely high fisheries values. In the 1960's Babine Lake produced over 90% of the sockeye salmon that entered the Skeena River (Narver, 1967). The communities of Granisle and Topley Landing are located on the south shore of the lake. Apart from these small communities, the shoreline of the Babine Lake is undeveloped, with isolated cabins, lodges and camps. Resource extraction including forestry and mining are the primary land use activities in the watershed.

Like Francois Lake, water quality objectives for Babine Lake have not been established, and it has not been adequately sampled. The lake is a common drinking water source for residences, cabins and lodges, and many water users do not treat the water before they drink it. Water quality in the lake has not been a concern in the past; however, there have been recent complaints about possible sewage contamination in a bay at Topley Landing

(Tone, 2002, pers. comm.). It is known that a number of residences and at least one lodge draw water from a bay where sewage is alleged to be discharged at certain times. A limited monitoring program was implemented in October 2002 to investigate this potential source water contamination issue. Two intake sites were monitored (Figure 3).

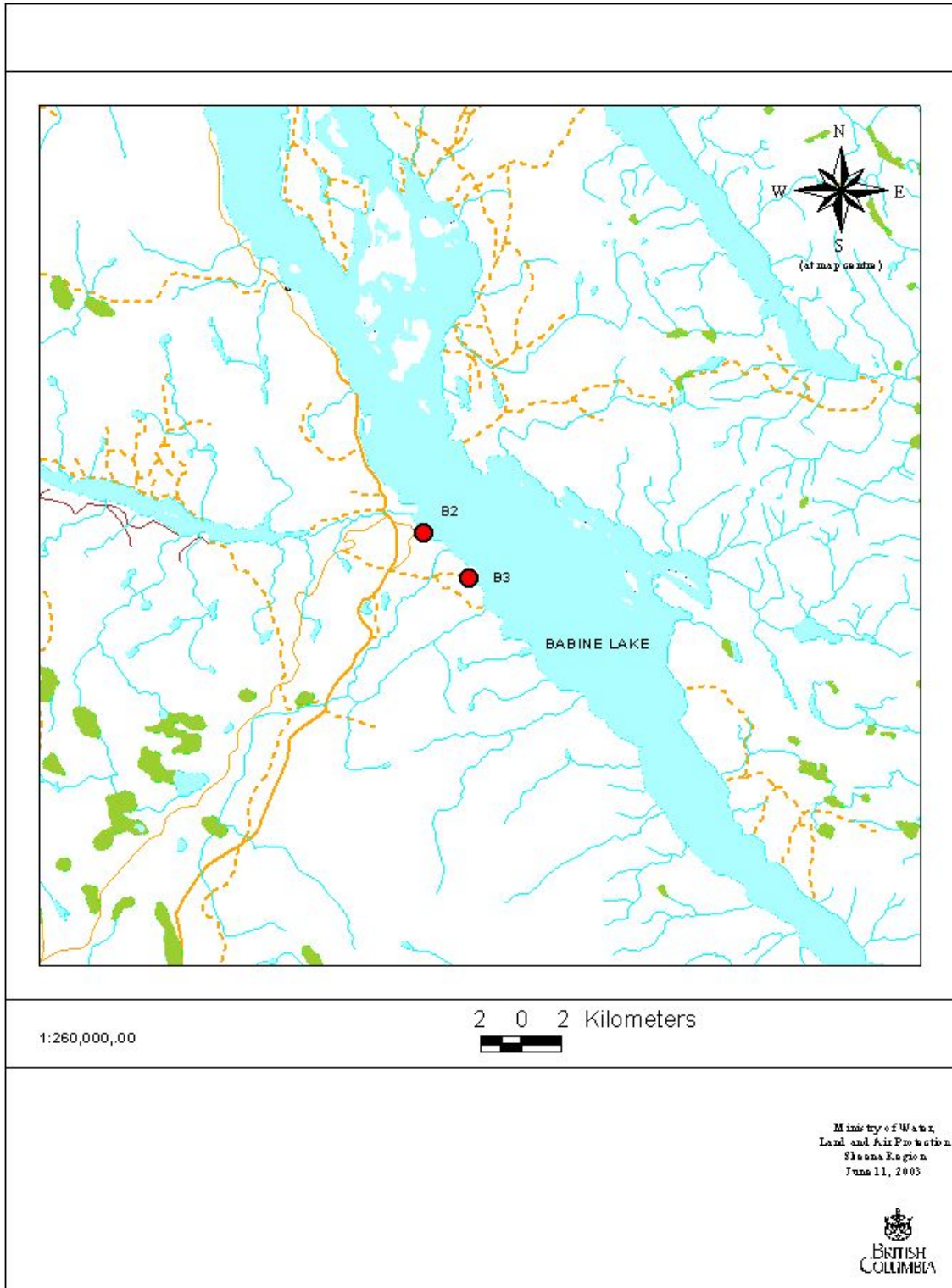
- **B2** is an intake located in the bay where the contamination is alleged
- **B3** is an intake approximately 3 km southeast from B2

#### **4.4 Burns Lake Rural Area Groundwater**

Groundwater is a common drinking water source for residents living in or near the Village of Burns Lake. Sampling was conducted at wells in two subdivisions near the Village:

- Gerow Island is a subdivision of approximately 30 residences on an island on Burns Lake. The homes are not served by village infrastructure, and homeowners have on-site sewage disposal systems on their lots. Most homes on the island receive their water from the lake or from shallow wells, both of which are vulnerable to contamination by failing sewage disposal systems. There is at least one deep well drilled on the island. This well (site **GGW**) is 45 m deep and serves a single residence on the south side of the island (Figure 1). It was sampled at an outside tap to determine whether or not the aquifer below Gerow Island is a desirable alternative to surface water for drinking.
- Byetown Subdivision also has no sewage collection or water distribution systems to serve it. The subdivision contains approximately 20 homes built on low-lying land next to the Endako River channel (immediately upstream of Burns Lake). The area is subject to annual flooding in the spring, and contamination of shallow drinking water wells by failing sewage disposal systems is probable (Sharpe, 2002, pers. comm.). One homeowner in the subdivision recently drilled a deep well for his water supply. This well (site **BGW**) is 33 m deep and serves two residences (Figure 1). It was sampled at an outside tap to investigate if contamination risks exist due to the presence of sewage disposal systems on low-lying land.

**Figure 3: Babine Lake Drinking Water Quality Sampling Sites**

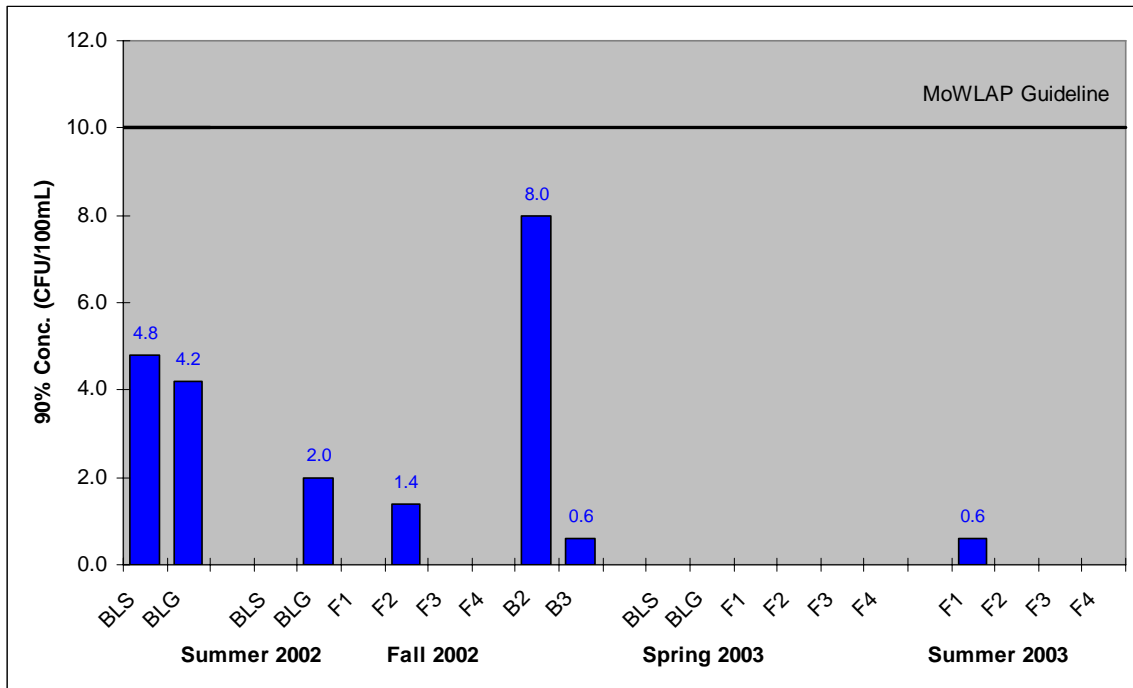


## 5.0 RESULTS AND DISCUSSION

Complete results of water quality sampling in the Lakes District 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 physical /chemical water quality parameters for each source.

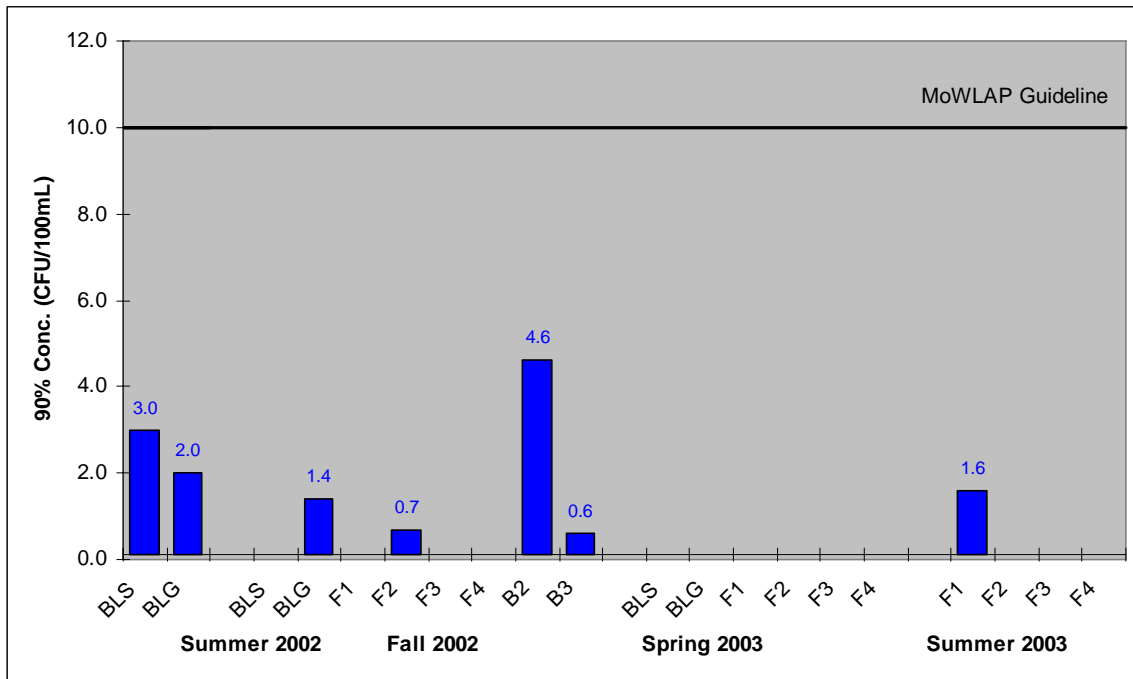
Figures 4-6 summarize the microbiological indicator results from Lakes District surface water sites (**BLS** and **BLG**, **F1-F4**, and **B2-B3**). *The microbiological indicator guidelines used for surface water sources in this study (and shown in the Figures) assume that the raw water is receiving disinfection prior to consumption.* The results from **GGW** and **BGW** are summarized and discussed separately because the *No Treatment* guideline applies for groundwater sources. It should be noted that May 12, 2003 samples were not analyzed within the recommended holding time. However, the results are not unusual so they are included in the results pages and calculations.

**Figure 4: Fecal Coliform 90<sup>th</sup> Percentile Concentrations<sup>5</sup> at Lakes District Sampling Sites**

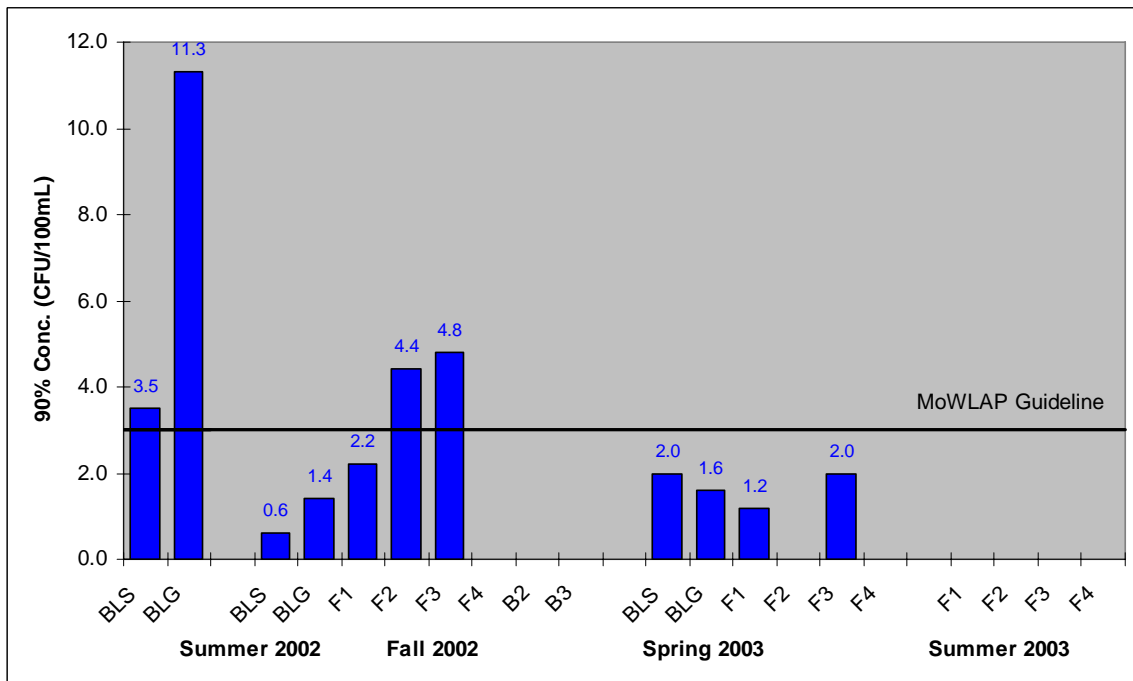


<sup>5</sup> The 90<sup>th</sup> percentile concentration is the concentration below which 90% of the samples lie. For computing 90<sup>th</sup> percentiles, values of <1 and <2 are assumed to be zero.

**Figure 5: *E. Coli* 90<sup>th</sup> Percentile Concentrations at Lakes District Sampling Sites**



**Figure 6: Enterococci 90<sup>th</sup> Percentile Concentrations at Lakes District Sampling Sites**



## 5.1 Burns Lake (BLG, BLS)

Burns Lake sampling sites showed all three microbiological indicators in 2002-03. At **BLS**, enterococci were detected in all three seasons, while fecal coliforms and *E. coli* were detected in the August 2002 sample set only. At **BLG**, the indicators were detected more frequently, especially in August 2002. Some samples from **BLG** were missed in October and April, so 90<sup>th</sup> percentile calculations for these sample sets are based on fewer than the recommended five samples.<sup>6</sup>

At both sites the 90<sup>th</sup> percentile concentrations for fecal coliforms and *E. coli* (Figures 4 and 5) met MoE guidelines at all times. Enterococci 90<sup>th</sup> percentile concentrations did not meet the guideline in August 2002 (Figure 6). Overall, microbiological water quality in this source was better during the fall and spring sampling periods and poorer in the summer.

All samples from **BLS** met the MoE turbidity guideline of  $\leq 5$  NTU. One of 11 samples from **BLG** did not meet the turbidity guideline. At both sites, colour values did not meet the 15 TCU guideline at all. Past sampling at Burns Lake has also revealed high colour values, and it is recognized that colour in this lake will likely continue to exceed provisional water quality objectives due to presence of humic substances and dissolved organics. Maclean (1985) recommended that “Burns Lake water quality is unsuitable as a public water supply”, and if it continues to be used for drinking it should be treated to remove organics (and colour).

Phosphorus was the only parameter that did not meet its guideline in Burns Lake. The MoE phosphorus drinking water guideline ( $\leq 0.01$  mg/L) is set to protect lake water from excessive algae and plant growth, and thus minimize treatment costs and reduce the risk of taste and odour from algae (Nordin, 1985). A site-specific provisional water quality objective of  $\leq 0.029$  mg/L has been proposed for the short-term for Burns Lake (Maclean, 1985). The table below summarizes the samples that did not meet the proposed site-specific objective:

Site	Parameter	MoE Guideline/Objective	Observed Concentration (Date)
BLG	Phosphorus	$\leq 0.29$ mg/L	0.038 mg/L (Oct 9)
			0.041 mg/L (Apr 16)
BLS	Phosphorus	$\leq 0.29$ mg/L	0.030 mg/L (Apr 16)

In recent years phosphorus concentrations have often exceeded the provisional objective, and the 2003-03 concentrations are not atypical. The elevated phosphorus concentrations indicate that the lake is vulnerable to algae blooms (which is a drinking water concern), but there are no immediate or direct health concerns associated with the observed phosphorus concentrations.

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<sup>6</sup> Samples from October 16, 2002, and May 7 and 12, 2003 were not collected due to freezing conditions in the water line and the unavailability of an alternate tap for sampling.



## 5.2 Francois Lake (F1 – F4)

All Francois Lake sites except **F4** had isolated low-concentration detections of microbiological indicators. Enterococci occurred most frequently, although fecal coliforms and *E. coli* were also detected. The May 12, 2003 samples from **F2** and **F3** contained enterococci concentrations equal to or less than the concentration observed in the blank sample from that date (see Section 3.4). The results are included in the calculations, but should be considered suspect as sample contamination may have occurred on this date.

The 90<sup>th</sup> percentile concentrations for fecal coliforms and *E. coli* easily met MoE guidelines in all sample sets at all sites (Figures 4 and 5). The enterococci guideline was not met in October, 2003 at **F2** and **F3** (Figure 6). There did not appear to be a significant seasonal difference in microbiological water quality at Francois Lake sampling sites, although 90<sup>th</sup> percentile concentrations were slightly elevated in the October 2002 sample set.

Turbidity values in Francois Lake were low and the MoE guideline of  $\leq 5$  NTU was easily met at all times. Colour values at Francois Lake sampling sites met the 15 TCU guideline at all times.

Manganese was the only other parameter that did not meet the MoE guideline level in Francois Lake, and it exceeded at one site on one date only:

Site	Parameter	MoE Guideline	Observed Concentration (Date)
F3	Manganese	$\leq 0.05$ mg/L (aesthetic)	0.0987 mg/L (Apr 16)

In drinking water, manganese is not typically a health concern and the guideline is for aesthetic purposes. Manganese is among the elements least toxic to mammals, but at concentrations about the guideline, it can stain plumbing fixtures and laundry, and produce undesirable tastes and odours (Health Canada, 2003).

## 5.3 Babine Lake (B2, B3)

Fecal coliforms and *E. coli* were detected at Babine Lake sampling sites in October 2002. **B2** samples had slightly higher concentrations and more frequent occurrences than **B3**. The 90<sup>th</sup> percentile concentrations for all three indicators met MoE guidelines at both Babine Lake sites (Figures 4, 5 and 6).

Turbidity values in Babine Lake were very low and easily met the MoE guideline of  $\leq 5$  NTU. Colour values ranged from 10 to 20 TCU, and the guideline was not met once at each sampling site.

Phosphorus was the only other parameter that did not meet guideline levels in Babine Lake:

Site	Parameter	MoE Guideline	Observed Concentration (Date)
B2	Phosphorus	≤ 0.01 mg/L	0.014 mg/L (Oct 9)

As discussed above, this drinking water guideline applies to lakes only and 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). Elevated concentrations indicate the lake may be vulnerable to algae blooms, but there are no immediate or direct health concerns associated with the concentration observed at **B2**.

Although there are no health concerns, the phosphorus concentration difference between **B2** and **B3** is significant. Elevated phosphorus concentrations in water bodies have been associated with impacts from sewage. In the case of Babine Lake, it is difficult to make any conclusions with only one sample from each site. More frequent detections of fecal coliforms and *E. coli* also suggest that contamination may be occurring in the bay at **B2**, but other parameters indicative of sewage impacts (chloride, ammonia, and nitrate) are not elevated at **B2**. Further sampling at these and additional sites, and specific information about the water intakes is required to determine if sewage contamination is occurring.

#### 5.4 Burns Lake Rural Area Groundwater (GGW, BGW)

Groundwater results from the Burns Lake Rural Area sampling sites are summarized in Table 3. *Because the No Treatment guideline (zero organisms detected) applies to microbiological indicators in groundwater samples, each detection represents a guideline exceedence.*

**Table 3: Summary of Microbiological Indicator Guideline Exceedences in Burns Lake Rural Groundwater**

Site	# Samples (n)	# Guideline Exceedences		
		Fecal Coliforms	<i>E. coli</i>	Enterococci
GGW	15	0	0	1
BGW	9	0	0	5

#### *Gerow Island Groundwater (GGW)*

Enterococci were detected once at a low concentration, and the MoE *No Treatment* guideline (for enterococci) was not met in one of 15 samples (Table 3). Fecal coliforms

and *E. coli* were not detected in any samples, and the MoE (*No Treatment*) guidelines for these indicators were met.

Turbidity at **GGW** ranged from 2.89 to 7.67 NTU, and was highly variable in all sampling seasons. The MoE guideline of  $\leq 5$  NTU was not met in eight of 15 samples. The guideline for colour was not met in one of 15 samples.

Manganese and iron were the only other parameters that did not meet guideline levels:

Site	Parameter	MoE Guideline	Observed Concentration (Date)
GGW	Iron	$\leq 0.3$ mg/L (aesthetic)	1.72 mg/L (Apr 16)
	Manganese	$\leq 0.05$ mg/L (aesthetic)	0.323 mg/L (Oct 9) 0.347 mg/L (Apr 16)

In drinking water, manganese and iron are not typically a health concern and the guideline is an aesthetic one. These elements are found naturally in groundwater in all regions of B.C. Manganese is among the elements least toxic to mammals, but at concentrations above the guideline, it can stain plumbing fixtures and laundry, and produce undesirable tastes and odours (Health Canada, 2003). Similar effects are possible with elevated iron concentrations.

### ***Byetown Groundwater (BGW)***

Enterococci were detected five times at low concentrations, and the MoE *No Treatment* guideline (for enterococci) was not met in five of 15 samples (Table 3). The May 12, 2003 sample contained an enterococci concentration less than the concentration observed in the blank sample from that date (see Section 3.4). The result is still reported, but should be considered suspect because sample contamination may have occurred on this date. Fecal coliforms and *E. coli* were not detected in any samples, and the MoE (*No Treatment*) guidelines for these indicators were met.

Turbidity at **BGW** ranged from 0.70 to 21.90 NTU and the MoE guideline was not met in two of nine samples. Turbidity spikes were observed on two dates, which is not common in drilled wells. It is possible that the turbidity increases may have been caused by metals precipitating out of the sample between the time it was collected and analyzed by the lab, and additional sampling should be conducted to determine if this was the case. Colour values were met the 15 TCU guideline in all samples.

Manganese and iron were the only other parameters that exceeded guideline levels:

Site	Parameter	MoE Guideline	Observed Concentration (Date)
BGW	Iron	$\leq 0.3$ mg/L (aesthetic)	1.69 mg/L (Oct 9) 0.328 mg/L (May 1)
	Manganese	$\leq 0.05$ mg/L (aesthetic)	0.268 mg/L (Oct 9) 0.236 (May 1)

As discussed above (under Gerow Island), manganese and iron are often naturally-occurring and are not typically a health concern in groundwater. The turbidity spikes and the occurrence of enterococci in five of nine groundwater samples, however, are not common and may indicate a health concern. The most likely source of groundwater well contamination is an insecure well-head, and investigation is required to determine if this is has resulted in enterococci presence. Low-level detection of both nitrate and chloride in samples from **BGW** suggests contamination from sewage could also be the source of enterococci. Further sampling combined with additional information about well development, well-head protection and surrounding substrate, may help isolate the source of contamination.

### **5.5 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 Lakes District 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 represents the first drinking water data sets for all sources. 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

To address water quality concerns and a lack of data for Lakes District drinking water sources, a comprehensive sampling program was implemented at a Burns Lake, Francois Lake, Babine Lake, and Burns Lake Rural Area groundwater. Because there is no historical data available for these sources, results cannot be compared to past data and it is not possible to comment on trends in water quality. However, the results do demonstrate short-term variability which is common in most surface water sources, and highlight the need for additional (year-round) monitoring of drinking water sources.

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

#### *Burns Lake*

- All three microbiological indicators were detected. While fecal coliform and *E. coli* 90<sup>th</sup> percentile concentrations met MoE guidelines at all times, enterococci concentrations indicate that treatment in addition to disinfection may be required to ensure potability of this water source.
- Turbidity ranged from 0.51 to 6.55 NTU and the MoE guideline was not met in one of 27 samples.
- Like past results from Burns Lake, the MoE colour guideline of 15 TCU was not met in any samples. The elevated colour values suggest a high concentration of organics in this water source, and water systems that use chlorination should treat for organics to reduce trihalomethane formation.
- Phosphorus values were consistently above drinking water guideline levels, and occasionally exceeded the proposed site-specific water quality objective. The eutrophic nature of the lake (and its potential for periodic algae blooms) is a concern for drinking water quality.
- Other physical and chemical parameters were all below (MoE) guideline levels.
- Provisional water quality objectives recommended by Maclean in 1984 should be re-visited with a more comprehensive sampling program, and potentially adopted.

#### *Francois Lake*

- All sites except **F4** had isolated low-concentration occurrences of microbiological indicators. Enterococci were detected most frequently and MoE guidelines were not met in two of 12 sample sets. All sample sets met the guidelines for fecal coliforms and *E. coli*.
- Turbidity and colour met MoE guidelines at all times.
- Manganese exceeded the aesthetic drinking water guideline in one sample, and other physical and chemical parameters were below guideline levels.

### ***Babine Lake***

- Enterococci were not detected, but fecal coliforms and *E. coli* were present in some samples from both sites. All microbiological indicator guidelines were met. **B2** samples had slightly higher indicator concentrations and more frequent occurrences than **B3**.
- Turbidity values were very low and easily met MoE guidelines. Colour values did not meet the guideline in two of ten samples, and other physical and chemical parameters were below guideline levels.
- Phosphorus exceeded the MoE guideline at **B2**; elevated levels of bacteria and phosphorus suggest that source water contamination may be occurring, but further investigation is required.

### ***Burns Area Groundwater***

- Enterococci was the only microbiological indicator detected, and most observed concentrations were low. One of 15 samples from **GGW** and five of nine samples from **BGW** did not meet the MoE (*No Treatment*) guideline that applies for groundwater. ***For groundwater, application of the No Treatment guideline means that each indicator detection is a guideline exceedence.***
- Turbidity values at both sites were variable and the MoE guideline was not met in eight of 15 samples at **GGW** and two of nine samples at **BGW**. The cause of this variability is not known and should be investigated.
- Iron and manganese commonly exceeded aesthetic guideline levels, but observed concentrations do not pose a risk to human health.
- Further sampling is recommended to investigate water quality issues at **BGW**.

## **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. Groundwater users should be reminded about the importance of adequate well head protection.

- Drinking water source quality data should be made readily available to any interested parties
- Provisional water quality objectives for Burns Lake should be re-visited with a more comprehensive sampling program, and potentially adopted.
- Babine Lake sampling should be expanded to include other sites to determine whether or not the sampling results from 2002 are indicative of sewage contamination.
- Byetown groundwater sampling should continue at the established site and be expanded to other sites in the subdivision to investigate water quality issues described in this report.

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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

**RDBN** – Regional District of Bulkley-Nechako

**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

<b>Aesthetic objective:</b>	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.
<b>Aquifer:</b>	A geological formation that consists of saturated permeable materials that yield economical quantities of water to wells and springs.
<b>Bacteria:</b>	Single-celled, microscopic organisms, some of which cause diseases in plants or animals.
<b>Blank sample:</b>	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.
<b>Colour (True):</b>	A measure of the dissolved colouring compounds in water, attributed to the presence of organic and inorganic materials. Reported in true colour units (TCU).
<b>Coliform bacteria:</b>	A bacteria carried in human and animal wastes. The presence of coliforms in water may indicate contamination from human or animal wastes.
<b>Disinfection:</b>	The process of destroying microorganisms in water by the application of a chemical agent (disinfectant) such as chlorine.
<b>Duplicate sample:</b>	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.
<b>Eutrophic:</b>	Describes a lake of high photosynthetic activity.
<b>Eutrophication:</b>	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.
<b>Groundwater:</b>	Water below the surface of the ground.
<b>Hardness:</b>	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 <sub>3</sub> ); greater than 120 mg/L is considered hard; less than 60 mg/L is soft.

<b>Interim maximum acceptable concentration:</b>	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.
<b>Maximum acceptable concentration:</b>	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.
<b>Method detection Limit (MDL):</b>	The minimum amount of a substance that can be routinely detected by the analytical instrument or technique with a high degree of confidence.
<b>Microbiological indicator:</b>	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, <i>Escherichia coli</i> ( <i>E. coli</i> ) and enterococci.
<b>Micrograms per litre (ug/L):</b>	One one-thousandth of one milligram per litre.
<b>Milligrams per litre (mg/L):</b>	A concentration unit of chemical constituents in solution; the weight of solute (substance) per unit volume of solvent (water).
<b>Nutrient:</b>	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.
<b>Oligotrophic:</b>	Describes a lake of low plant productivity.
<b>pH:</b>	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.
<b>QA/QC (Quality assurance /Quality control):</b>	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.
<b>Specific conductance:</b>	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 ( $\mu\text{S}/\text{cm}$ ).
<b>Total metal:</b>	A measure of metals in the dissolved state and those sorbed to particulate matter in suspension.

<b>Turbidity:</b>	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).
<b>Water quality guideline (Criteria):</b>	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.
<b>Water quality objective:</b>	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.
<b>Watershed:</b>	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**

### **Lakes District: Burns Lake, Francois Lake, Babine Lake and Burns Rural Groundwater**

## **DATA APPENDIX**



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

**Table 1A – Site BLS (EMS # E248962)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
08-Aug-02	<1	<1	n/a	50	1.59
13-Aug-02	<1	<1	<1	50	1.84
20-Aug-02	<1	<1	<1	40	2.30
28-Aug-02	8	5	<1	50	1.06
04-Sep-02	<1	<1	5	40	0.96
09-Oct-02	<1	<1	<1	50	1.55
16-Oct-02	<1	<1	<1	50	1.18
23-Oct-02	<1	<1	<1	40	1.88
30-Oct-02	<1	<1	1	50	1.74
06-Nov-02	<1	<1	<1	50	1.44
16-Apr-03	<2	<2	<2	40	0.51
24-Apr-03	<2	<2	<2	60	3.84
01-May-03	<2	<2	2	50	1.05
07-May-03	<2	<2	<2	50	2.13
12-May-03 *	<1	<1	2	50	2.21

\* Sample not analyzed within recommended holding time, and sample contamination may have occurred

**Table 1B – Site BLS (EMS # E248962)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
<b>Guideline:</b>	<b>≤ 10 (90%)</b>	<b>≤ 10 (90%)</b>	<b>≤ 3 (90%)</b>	<b>≤ 15</b>	<b>≤ 5</b>
<b>August, 2002</b>					
Maximum	8	5	5	50	2.30
Average	1.6	1.0	1.3	46	1.55
90th percentile	4.8	3.0	3.5	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Not Met</b>	<b>Not Met</b>	<b>Met</b>
Exceedences	-	-	-	5	0
<b>October, 2002</b>					
Maximum	<1	<1	1	50	1.88
Average	<1	<1	0.2	48	1.56
90th percentile	<1	<1	0.6	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Not Met</b>	<b>Met</b>
Exceedences	-	-	-	5	0
<b>April, 2003</b>					
Maximum	<1	<1	2	60	3.84
Average	<1	<1	0.8	50	1.95
90th percentile	<1	<1	2.0	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Not Met</b>	<b>Met</b>
Exceedences	-	-	-	5	0



**Table 2A – Site BLG (EMS # E248960)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
08-Aug-02	<1	<1	n/a	50	1.33
13-Aug-02	3	2	3	40	1.47
20-Aug-02	5	2	5	40	2.37
28-Aug-02	2	1	14	40	1.16
04-Sep-02	<1	<1	2	40	2.00
09-Oct-02	2	<1	2	50	1.37
16-Oct-02	n/a	n/a	n/a	n/a	n/a
23-Oct-02	<2	<2	<1	50	3.49
30-Oct-02	2	2	<1	50	1.65
06-Nov-02	1	<1	<1	50	2.55
16-Apr-03	<2	<2	2	40	1.05
24-Apr-03	<2	<2	<2	40	1.23
01-May-03	<2	<2	<2	60	6.55
07-May-03	n/a	n/a	n/a	n/a	n/a
12-May-03	n/a	n/a	n/a	n/a	n/a

**Table 2B – Site BLG (EMS # E248960)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
<b>Guideline:</b>	<b>≤ 10 (90%)</b>	<b>≤ 10 (90%)</b>	<b>≤ 3 (90%)</b>	<b>≤ 15</b>	<b>≤ 5</b>
<b>August, 2002</b>					
Maximum	5	2	14	50	2.37
Average	2.0	1.0	6.0	42	1.67
90th percentile	4.2	2.0	11.3	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Not Met</b>	<b>Not Met</b>	<b>Met</b>
Exceedences	-	-	-	5	0
<b>October, 2002</b>					
Maximum	2	2	2	50	3.49
Average	1.3	0.5	0.5	50	2.27
90th percentile	2.0	1.4	1.4	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Not Met</b>	<b>Met</b>
Exceedences	-	-	-	4	0
<b>April, 2003</b>					
Maximum	<1	<1	2	60	6.55
Average	<1	<1	0.7	47	2.94
90th percentile	<1	<1	1.6	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Not Met</b>	<b>Not Met</b>
Exceedences	-	-	-	3	1

**Table 3A – Site F1 (EMS # E249496)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
09-Oct-02	<1	<1	<1	10	2.61
16-Oct-02	<1	<1	3	5	1.04
23-Oct-02	<1	<1	<1	5	0.51
30-Oct-02	<1	<1	<1	5	0.20
07-Nov-02	<1	<1	1	10	0.84
16-Apr-03	<2	<2	<2	10	0.23
24-Apr-03	<2	<2	2	10	0.39
01-May-03	<2	<2	<2	10	0.33
07-May-03	<2	<2	<2	5	0.54
12-May-03 *	<1	<1	<1	10	0.32
05-Aug-03	<1	<1	<1	5	1.01
12-Aug-03	<1	2	<1	5	1.11
18-Aug-03	1	1	<1	5	0.71
26-Aug-03	<1	<1	<1	5	0.58
02-Sep-03	<1	<1	<1	5	0.59

\* Sample not analyzed within recommended holding time, and sample contamination may have occurred

**Table 3B – Site F1 (EMS # E249496)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
<b>Guideline:</b>	<b>≤ 10 (90%)</b>	<b>≤ 10 (90%)</b>	<b>≤ 3 (90%)</b>	<b>≤ 15</b>	<b>≤ 5</b>
<b>October, 2002</b>					
Maximum	<1	<1	3	10	2.61
Average	<1	<1	0.8	7	1.04
90th percentile	<1	<1	2.2	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>
Exceedences	-	-	-	0	0
<b>April, 2003</b>					
Maximum	<1	<1	2	10	0.54
Average	<1	<1	0.4	9	0.36
90th percentile	<1	<1	1.2	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>
Exceedences	-	-	-	0	0
<b>August, 2003</b>					
Maximum	1	2	<1	5	1.11
Average	0.2	0.6	<1	5	0.80
90th percentile	0.6	1.6	<1	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>
Exceedences	-	-	-	0	0

**Table 4A – Site F2 (EMS # E249497)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
09-Oct-02	2	1	3	10	0.49
16-Oct-02	<1	<1	<1	5	0.26
23-Oct-02	<1	<1	5	5	0.29
30-Oct-02	<1	<1	<1	5	0.22
07-Nov-02	n/a	n/a	n/a	n/a	n/a
16-Apr-03	<2	<2	<2	15	0.27
24-Apr-03	<2	<2	<2	15	0.17
01-May-03	<2	<2	<2	10	0.33
07-May-03	<2	<2	<2	5	0.22
12-May-03 *	<1	<1	1	10	0.31
05-Aug-03	<1	<1	<1	5	0.97
12-Aug-03	<1	<1	<1	5	0.41
18-Aug-03	<1	<1	<1	5	0.52
26-Aug-03	<1	<1	<1	5	0.29
02-Sep-03	<1	<1	<1	5	0.92

\* Sample not analyzed within recommended holding time, and sample contamination may have occurred

**Table 4B – Site F2 (EMS # E249497)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
<b>Guideline:</b>	<b>≤ 10 (90%)</b>	<b>≤ 10 (90%)</b>	<b>≤ 3 (90%)</b>	<b>≤ 15</b>	<b>≤ 5</b>
<b>October, 2002</b>					
Maximum	2	1	5	10	0.49
Average	0.5	0.3	2.0	6	0.32
90th percentile	1.4	0.7	4.4	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Not Met</b>	<b>Met</b>	<b>Met</b>
Exceedences	-	-	-	0	0
<b>April, 2003</b>					
Maximum	<1	<1	1	15	0.33
Average	<1	<1	0.2	11	0.26
90th percentile	<1	<1	0.6	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>
Exceedences	-	-	-	0	0
<b>August, 2003</b>					
Maximum	<1	<1	<1	5	0.97
Average	<1	<1	<1	5	0.62
90th percentile	<1	<1	<1	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>
Exceedences	-	-	-	0	0

**Table 5A – Site F3 (EMS # E249499)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
09-Oct-02	<1	<1	<1	10	0.26
16-Oct-02	<1	<1	<1	<5	0.20
23-Oct-02	<1	<1	<1	5	0.24
30-Oct-02	<1	<1	<1	5	0.20
07-Nov-02	<1	<1	8	10	0.37
16-Apr-03	<2	<2	<2	10	0.69
24-Apr-03	<2	<2	<2	5	0.70
01-May-03	<2	<2	2	10	0.74
07-May-03	<2	<2	<2	5	0.54
12-May-03 *	<1	<1	2	10	1.15
05-Aug-03	<1	<1	<1	5	0.50
12-Aug-03	<1	<1	<1	5	0.45
18-Aug-03	<1	<1	<1	5	0.26
26-Aug-03	<1	<1	<1	10	0.29
02-Sep-03	<1	<1	<1	5	0.29

\* Sample not analyzed within recommended holding time, and sample contamination may have occurred

**Table 5B – Site F3 (EMS # E249499)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
<b>Guideline:</b>	<b>≤ 10 (90%)</b>	<b>≤ 10 (90%)</b>	<b>≤ 3 (90%)</b>	<b>≤ 15</b>	<b>≤ 5</b>
<b>October, 2002</b>					
Maximum	<1	<1	8	10	0.37
Average	<1	<1	1.6	7	0.25
90th percentile	<1	<1	4.8	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Not Met</b>	<b>Met</b>	<b>Met</b>
Exceedences	-	-	-	0	0
<b>April, 2003</b>					
Maximum	<1	<1	2	10	1.15
Average	<1	<1	0.8	8	0.76
90th percentile	<1	<1	2.0	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>
Exceedences	-	-	-	0	0
<b>August, 2003</b>					
Maximum	<1	<1	<1	10	0.50
Average	<1	<1	<1	6	0.36
90th percentile	<1	<1	<1	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>
Exceedences	-	-	-	0	0

**Table 6A – Site F4 (EMS # E249498)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
09-Oct-02	<1	<1	<1	10	0.27
16-Oct-02	<1	<1	<1	10	0.18
23-Oct-02	<1	<1	<1	10	0.50
30-Oct-02	<1	<1	<1	5	0.21
07-Nov-02	<1	<1	<1	10	0.18
16-Apr-03	<2	<2	<2	10	0.27
24-Apr-03	<2	<2	<2	5	0.26
01-May-03	<2	<2	<2	10	0.19
07-May-03	<2	<2	<2	10	0.21
12-May-03	n/a	n/a	n/a	n/a	n/a
05-Aug-03	<1	<1	<1	5	0.21
12-Aug-03	<1	<1	<1	5	0.37
18-Aug-03	<1	<1	<1	5	0.24
26-Aug-03	<1	<1	<1	5	0.32
02-Sep-03	<1	<1	<1	5	0.39

**Table 6B – Site F4 (EMS # E249498)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
<b>Guideline:</b>	<b>≤ 10 (90%)</b>	<b>≤ 10 (90%)</b>	<b>≤ 3 (90%)</b>	<b>≤ 15</b>	<b>≤ 5</b>
<b>October, 2002</b>					
Maximum	<1	<1	<1	10	0.50
Average	<1	<1	<1	9	0.27
90th percentile	<1	<1	<1	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>
Exceedences	-	-	-	0	0
<b>April, 2003</b>					
Maximum	<1	<1	<1	10	0.27
Average	<1	<1	<1	9	0.23
90th percentile	<1	<1	<1	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>
Exceedences	-	-	-	0	0
<b>August, 2003</b>					
Maximum	<1	<1	<1	5	0.39
Average	<1	<1	<1	5	0.31
90th percentile	<1	<1	<1	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>
Exceedences	-	-	-	0	0

**Table 7A – Site B2 (EMS # E249494)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
10-Oct-02	2	1	<1	20	0.32
15-Oct-02	2	<1	<1	15	0.26
22-Oct-02	12	7	<1	10	0.30
30-Oct-02	<1	<1	<1	15	0.34
05-Nov-02	<1	<1	<1	15	0.27

**Table 7B – Site B2 (EMS # E249494)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
<b>Guideline:</b>	<b>≤ 10 (90%)</b>	<b>≤ 10 (90%)</b>	<b>≤ 3 (90%)</b>	<b>≤ 15</b>	<b>≤ 5</b>
<b>October, 2002</b>					
Maximum	12	7	<1	20	0.34
Average	3.2	1.6	<1	15	0.30
90th percentile	8.0	4.6	<1	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Not Met</b>	<b>Met</b>
Exceedences	-	-	-	1	0

**Table 8A – Site B3 (EMS # E249495)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
10-Oct-02	1	1	<1	20	0.28
15-Oct-02	<1	<1	<1	15	0.23
22-Oct-02	<1	<1	<1	10	0.21
30-Oct-02	<1	<1	<1	15	0.24
05-Nov-02	<1	<1	<1	15	0.19

**Table 8B – Site B3 (EMS # E249495)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
<b>Guideline:</b>	<b>≤ 10 (90%)</b>	<b>≤ 10 (90%)</b>	<b>≤ 3 (90%)</b>	<b>≤ 15</b>	<b>≤ 5</b>
<b>October, 2002</b>					
Maximum	1	1	<1	20	0.28
Average	0.2	0.2	<1	15	0.23
90th percentile	0.6	0.6	<1	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Not Met</b>	<b>Met</b>
Exceedences	-	-	-	1	0

**Table 9A – Site GGW (EMS # E248961)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
08-Aug-02	<1	<1	n/a	<5	4.83
13-Aug-02	<1	<1	<1	<5	2.68
20-Aug-02	<1	<1	<1	<5	4.52
28-Aug-02	<1	<1	<1	<5	3.63
04-Sep-02	<1	<1	<1	<5	5.78
09-Oct-02	<1	<1	1	15	5.95
16-Oct-02	<1	<1	<1	10	4.00
23-Oct-02	<1	<1	<1	5	6.32
30-Oct-02	<1	<1	<1	<5	6.05
06-Nov-02	<1	<1	<1	5	5.19
16-Apr-03	<2	<2	<2	20	7.67
24-Apr-03	<2	<2	<2	<5	5.95
01-May-03	<2	<2	<2	5	2.86
07-May-03	<2	<2	<2	<5	5.08
12-May-03 *	<1	<1	<1	5	2.89

\* Sample not analyzed within recommended holding time, and sample contamination may have occurred

**Table 9B – Site GGW (EMS # E248961)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
<b>Guideline:</b>	<b>≤ 10 (90%)</b>	<b>≤ 10 (90%)</b>	<b>≤ 3 (90%)</b>	<b>≤ 15</b>	<b>≤ 5</b>
<b>August, 2002</b>					
Maximum	<1	<1	<1	5	5.78
Average	<1	<1	<1	5	4.29
90th percentile	<1	<1	<1	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Not Met</b>
Exceedences	0	0	0	0	1
<b>October, 2002</b>					
Maximum	<1	<1	1	15	6.32
Average	<1	<1	0.2	8	5.50
90th percentile	<1	<1	0.6	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Not Met</b>	<b>Met</b>	<b>Not Met</b>
Exceedences	0	0	1	0	4
<b>April, 2003</b>					
Maximum	<1	<1	<1	20	7.67
Average	<1	<1	<1	8	4.89
90th percentile	<1	<1	<1	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Met</b>	<b>Not Met</b>	<b>Not Met</b>
Exceedences	0	0	0	1	3



**Table 10A – Site BGW (EMS # E249500)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
09-Oct-02	<1	<1	10	10	15.00
16-Oct-02	<1	<1	2	5	2.31
23-Oct-02	<1	<1	1	<5	21.90
30-Oct-02	<1	<1	<1	5	0.70
06-Nov-02	<1	<1	<1	<5	32.50
16-Apr-03	n/a	n/a	n/a	n/a	n/a
24-Apr-03	<2	<2	<2	5	1.00
01-May-03	<2	<2	2	<5	0.96
07-May-03	<2	<2	<2	<5	1.55
12-May-03 *	<1	<1	1	5	3.04

\* Sample not analyzed within recommended holding time, and sample contamination may have occurred

**Table 10B – Site BGW (EMS # E249500)**

	<b>Fecal coliform (CFU/100mL)</b>	<b><i>E. coli</i> (CFU/100mL)</b>	<b>Enterococci (CFU/100mL)</b>	<b>Colour True (Col.unit)</b>	<b>Turbidity (NTU)</b>
<b>Guideline:</b>	<b>≤ 10 (90%)</b>	<b>≤ 10 (90%)</b>	<b>≤ 3 (90%)</b>	<b>≤ 15</b>	<b>≤ 5</b>
<b>October, 2002</b>					
Maximum	<1	<1	10	10	32.50
Average	<1	<1	2.6	6	14.48
90th percentile	<1	<1	6.8	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Not Met</b>	<b>Met</b>	<b>Not Met</b>
Exceedences	0	0	3	0	3
<b>April, 2003</b>					
Maximum	<1	<1	2	5	3.04
Average	<1	<1	0.8	5	1.64
90th percentile	<1	<1	1.7	-	-
<b>Guideline</b>	<b>Met</b>	<b>Met</b>	<b>Not Met</b>	<b>Met</b>	<b>Met</b>
Exceedences	0	0	2	0	0

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

**Table 11A – Burns Lake Sites (BLS, BLG)**

(Values in mg/L unless otherwise noted)

	<b>EDS @ 3m 26-Aug-02</b>	<b>BLS 9-Oct-02</b>	<b>BLG 9-Oct-02</b>
<b>PYHSICAL</b>			
pH (pH units)	7.9	7.8	7.8
Specific Conductance (uS/cm)	106	111	113
Residue Filterable - TDS	n/a	n/a	n/a
Hardness Total - T	51	49.8	50.5
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a
<b>ANIONS</b>			
Chloride Dissolved	n/a	n/a	n/a
Fluoride Dissolved	n/a	n/a	n/a
<b>CARBON</b>			
Organic Carbon - Total	n/a	n/a	n/a
<b>NITROGEN</b>			
Total Kjeldahl N	0.58	0.52	0.64
Total N	0.59	0.54	0.73
Total Organic N	0.58	0.52	0.57
Ammonia N	< 0.005	< 0.005	0.07
Nitrate Nitrogen Dissolved	< 0.02	< 0.02	0.08
Nitrate+Nitrite	0.002	0.014	0.092
Nitrite Nitrogen	< 0.002	0.004	0.011
<b>PHOSPHORUS</b>			
Ortho-Phosphorus	0.003	n/a	n/a
Phosphorus Total Dissolved	0.008	0.013	0.014
Phosphorus Total	<b>0.022</b>	<b>0.023</b>	<b>0.038</b>
<b>SULFATE</b>			
Sulfate	n/a	n/a	n/a
<b>METALS TOTAL</b>			
Aluminum	0.0072	0.023	0.0303
Antimony	0.000056	0.00045	0.000037
Arsenic	0.0008	0.001	0.0012
Barium	0.0265	0.027	0.0285
Beryllium	< 0.00002	0.00002	0.00003
Bismuth	< 0.00002	< 0.00002	< 0.00002
Cadmium	< 0.00001	< 0.00001	0.00016
Calcium	12.9	12.8	13
Chromium	< 0.0002	< 0.0002	< 0.0002
Cobalt	< 0.000005	< 0.000005	< 0.000005
Copper	0.00131	0.0433	0.00805
Iron	0.072	0.116	0.221
Lead	< 0.00001	0.00023	0.00028
Lithium	0.00021	< 0.00005	< 0.00005
Magnesium	4.56	4.33	4.37
Manganese	0.00811	0.0311	0.0456
Molybdenum	0.00024	0.00033	0.00031
Nickel	0.00083	0.0008	0.0009
Selenium	< 0.0002	< 0.0002	< 0.0002
Silver	< 0.00002	< 0.00002	< 0.00002
Strontium	0.0824	0.0859	0.0898
Thallium	< 0.000002	< 0.000002	< 0.000002
Tin	< 0.00001	< 0.00001	< 0.00001
Uranium	0.000049	0.000052	0.000049
Vanadium	0.00062	0.00061	0.00058
Zinc	< 0.0001	0.0032	0.0163

**Table 11A – Burns Lake Sites (BLS, BLG) Continued**  
(Values in mg/L unless otherwise noted)

	<b>BLS 16-Apr-03</b>	<b>BLG 16-Apr-03</b>	<b>Drinking Water Guideline</b>		
<b>PHYSICAL</b>					
pH (pH units)	7.8	7.6	≤ 8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	120	101	≤ 700	mac	Met
Residue Filterable - TDS	n/a	n/a	≤ 500	ao	
Hardness Total - T	56.3	45.8	≤ 500	mac	Met
Alkalinity Total (mg/L CaCO <sub>3</sub> )	n/a	n/a			
<b>ANIONS</b>					
Chloride Dissolved	n/a	n/a	≤ 250	ao	
Fluoride Dissolved	n/a	n/a	≤ 1.5	mac	
<b>CARBON</b>					
Organic Carbon - Total	n/a	n/a	≤ 4	mac (THM)	
<b>NITROGEN</b>					
Total Kjeldahl N	0.46	0.49			
Total N	0.6	0.54			
Total Organic N	0.46	0.49			
Ammonia N	< 0.005	< 0.005			
Nitrate Nitrogen Dissolved	0.14	0.04	≤ 10	mac	Met
Nitrate+Nitrite	0.142	0.046			
Nitrite Nitrogen	0.005	0.003	≤ 1	mac	Met
<b>PHOSPHORUS</b>					
Ortho-Phosphorus	n/a	n/a			
Phosphorus Total Dissolved	0.029	0.017			
Phosphorus Total	<b>0.03</b>	<b>0.041</b>	≤ 0.01	mac (lakes)	<b>Not Met</b>
<b>SULFATE</b>					
Sulfate	n/a	n/a	≤ 500	ao	
<b>METALS TOTAL</b>					
Aluminum	0.01	0.0133	≤ 0.2	mac	Met
Antimony	0.000074	0.000056	≤ 0.006	imac	Met
Arsenic	0.0009	0.0008	≤ 0.025	imac	Met
Barium	0.0271	0.025	≤ 1	mac	Met
Beryllium	< 0.00002	< 0.00002			
Bismuth	0.00008	0.00006			
Cadmium	< 0.00001	0.00001	≤ 0.005	mac	Met
Calcium	14.5	11.9			
Chromium	< 0.0002	< 0.0002	≤ 0.05	mac	Met
Cobalt	< 0.000005	0.000017			
Copper	0.0398	0.0554	≤ 1	ao	Met
Iron	0.091	0.284	≤ 0.3	ao	Met
Lead	0.00019	0.00028	≤ 0.01	mac	Met
Lithium	0.00044	< 0.00126			
Magnesium	4.87	3.9	≤ 100	ao	Met
Manganese	0.0094	0.0322	≤ 0.05	ao	Met
Molybdenum	0.00034	0.00062	≤ 0.25	mac	Met
Nickel	0.00088	0.00075			
Selenium	0.0002	< 0.0002	≤ 0.01	mac	Met
Silver	< 0.00002	< 0.00002			
Strontium	0.0855	0.0718			
Thallium	< 0.000002	< 0.000002			
Tin	< 0.00001	0.00003			
Uranium	0.000054	0.000039	≤ 0.02	imac	Met
Vanadium	0.00038	0.00035	≤ 0.1	mac	Met
Zinc	0.002	0.015	≤ 5	ao	Met

**Table 11B – Burns Lake Sites (BLS, BLG)**  
(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline	
<b>PHYSICAL</b>						
pH (pH units)	5	7.6	7.9	7.8	≤ 8.5	ao (>6.5)
Specific Conductance (uS/cm)	5	101	120	110	≤ 700	mac
Residue Filterable - TDS	0				≤ 500	ao
Hardness Total - T	5	45.8	56.3	50.7	≤ 500	mac
Alkalinity Total (mg/L CaCO <sub>3</sub> )	0					
<b>ANIONS</b>						
Chloride Dissolved	0				≤ 250	ao
Fluoride Dissolved	0				≤ 1.5	mac
<b>CARBON</b>						
Organic Carbon - Total	0				≤ 4	mac (THM)
<b>NITROGEN</b>						
Total Kjeldahl N	5	0.46	0.64	0.54		
Total N	5	0.54	0.73	0.60		
Total Organic N	5	0.5	0.6	0.5		
Ammonia N	5	0.005	0.070	0.018		
Nitrate Nitrogen Dissolved	5	0.02	0.14	0.06	≤ 10	mac
Nitrate+Nitrite	5	0.002	0.142	0.059		
Nitrite Nitrogen	5	0.002	0.011	0.005	≤ 1	mac
<b>PHOSPHORUS</b>						
Ortho-Phosphorus	1	0.003	0.003	0.003		
Phosphorus Total Dissolved	5	0.008	0.029	0.016		
Phosphorus Total	5	0.022	0.041	0.031	≤ 0.01	mac (lakes)
<b>SULFATE</b>						
Sulfate	0				≤ 500	ao
<b>METALS TOTAL</b>						
Aluminum	5	0.0072	0.0303	0.0168	≤ 0.2	mac
Antimony	5	0.00004	0.00045	0.00013	≤ 0.006	imac
Arsenic	5	0.0008	0.0012	0.0009	≤ 0.025	imac
Barium	5	0.02500	0.02850	0.02682	≤ 1	mac
Beryllium	5	0.00002	0.00003	0.00002		
Bismuth	5	0.00002	0.00008	0.00004		
Cadmium	5	0.00001	0.00016	0.00004	≤ 0.005	mac
Calcium	5	11.90	14.50	13.02		
Chromium	5	0.0002	0.0002	0.0002	≤ 0.05	mac
Cobalt	5	0.000005	0.000017	0.000007		
Copper	5	0.00131	0.05540	0.02957	≤ 1	ao
Iron	5	0.072	0.284	0.157	≤ 0.3	ao
Lead	5	0.00001	0.00028	0.00020	≤ 0.01	mac
Lithium	5	0.00005	0.00126	0.00040		
Magnesium	5	3.90	4.87	4.41	≤ 100	ao
Manganese	5	0.008110	0.045600	0.025282	≤ 0.05	ao
Molybdenum	5	0.00024	0.00062	0.00037	≤ 0.25	mac
Nickel	5	0.00075	0.00090	0.00083		
Selenium	5	0.0002	0.0002	0.0002	≤ 0.01	mac
Silver	5	0.00002	0.00002	0.00002		
Strontium	5	0.071800	0.089800	0.083080		
Thallium	5	0.000002	0.000002	0.000002		
Tin	5	0.00001	0.00003	0.00001		
Uranium	5	0.000039	0.000054	0.000049	≤ 0.02	imac
Vanadium	5	0.00035	0.00062	0.00051	≤ 0.1	mac
Zinc	5	0.0001	0.0163	0.0073	≤ 5	ao

**Table 12A – Francois Lake Sites (F1 – F4)**  
(Values in mg/L unless otherwise noted)

	<b>F1 9-Oct-02</b>	<b>F2 9-Oct-02</b>	<b>F3 9-Oct-02</b>	<b>F4 9-Oct-02</b>	<b>F1 16-Apr-03</b>
<b>PYHSICAL</b>					
pH (pH units)	7.7	7.7	7.7	7.7	7.7
Specific Conductance (uS/cm)	83	83	83	83	84
Residue Filterable - TDS	n/a	n/a	n/a	n/a	n/a
Hardness Total - T	34.9	34.4	34.5	34.8	36.7
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a	n/a	n/a
<b>ANIONS</b>					
Chloride Dissolved	n/a	n/a	n/a	n/a	n/a
Fluoride Dissolved	n/a	n/a	n/a	n/a	n/a
<b>CARBON</b>					
Organic Carbon - Total	n/a	n/a	n/a	n/a	n/a
<b>NITROGEN</b>					
Total Kjeldahl N	0.19	0.17	0.19	0.19	0.16
Total N	0.23	0.2	0.23	0.23	0.21
Total Organic N	0.19	0.17	0.19	0.19	0.16
Ammonia N	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Nitrate Nitrogen Dissolved	0.04	0.03	0.05	0.04	0.05
Nitrate+Nitrite	0.041	0.025	0.046	0.042	0.054
Nitrite Nitrogen	< 0.002	< 0.002	< 0.002	< 0.002	0.002
<b>PHOSPHORUS</b>					
Ortho-Phosphorus	n/a	n/a	n/a	n/a	n/a
Phosphorus Total Dissolved	0.002	0.002	< 0.002	0.004	0.003
Phosphorus Total	0.007	0.002	< 0.002	0.002	0.004
<b>SULFATE</b>					
Sulfate	n/a	n/a	n/a	n/a	n/a
<b>METALS TOTAL</b>					
Aluminum	0.0221	0.01	0.0036	0.0033	0.0019
Antimony	0.00003	0.000032	0.000043	0.000012	0.000044
Arsenic	0.0004	0.0003	0.0003	0.0003	0.0002
Barium	0.0148	0.0136	0.0127	0.0133	0.0131
Beryllium	< 0.00002	< 0.00002	0.00002	< 0.00002	< 0.00002
Bismuth	< 0.00002	< 0.00002	< 0.00002	< 0.00002	0.00007
Cadmium	< 0.00001	< 0.00001	< 0.00001	< 0.00001	0.00001
Calcium	9.98	9.8	9.8	9.94	10.5
Chromium	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Cobalt	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Copper	0.00686	0.0383	0.00728	0.00386	0.00399
Iron	0.289	0.022	0.019	0.013	0.019
Lead	0.00336	0.00055	0.00008	0.00046	0.00022
Lithium	< 0.00005	< 0.00005	< 0.00005	< 0.00005	0.00037
Magnesium	2.43	2.4	2.44	2.42	2.55
Manganese	0.0161	0.00123	0.00248	0.000735	0.00073
Molybdenum	0.00424	0.00428	0.00409	0.00426	0.00471
Nickel	0.00014	0.00017	< 0.00005	0.00006	0.00028
Selenium	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Silver	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Strontium	0.0849	0.0848	0.0839	0.0844	0.0838
Thallium	< 0.000002	< 0.000002	< 0.000002	< 0.000002	< 0.000002
Tin	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Uranium	0.00006	0.000037	0.00004	0.000036	0.000047
Vanadium	0.00045	0.00032	0.00026	0.00022	0.00021
Zinc	0.0262	0.0096	0.0067	0.0015	0.0105

**Table 12A – Francois Lake Sites (F1 – F4) Continued**  
 (Values in mg/L unless otherwise noted)

	<b>F2 16-Apr-03</b>	<b>F3 16-Apr-03</b>	<b>F4 16-Apr-03</b>	<b>F1-1 5-Aug-03</b>	<b>F1-2 5-Aug-03</b>
<b>PYHSICAL</b>					
pH (pH units)	7.7	7.6	7.7	7.6	7.6
Specific Conductance (uS/cm)	87	103	83	84	84
Residue Filterable - TDS	n/a	n/a	n/a	56	48
Hardness Total - T	38	45.3	37.8	36.5	36.3
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a	36.3	36.2
<b>ANIONS</b>					
Chloride Dissolved	n/a	n/a	n/a	< 0.5	< 0.5
Fluoride Dissolved	n/a	n/a	n/a	0.04	0.05
<b>CARBON</b>					
Organic Carbon - Total	n/a	n/a	n/a	<b>5.2</b>	<b>5.3</b>
<b>NITROGEN</b>					
Total Kjeldahl N	0.19	0.18	0.16	n/a	n/a
Total N	0.24	0.23	0.21	n/a	n/a
Total Organic N	0.19	0.18	0.16	n/a	n/a
Ammonia N	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Nitrate Nitrogen Dissolved	0.05	0.05	0.05	0.05	0.04
Nitrate+Nitrite	0.052	0.05	0.053	0.053	0.039
Nitrite Nitrogen	0.002	0.002	0.005	0.002	< 0.002
<b>PHOSPHORUS</b>					
Ortho-Phosphorus	n/a	n/a	n/a	n/a	n/a
Phosphorus Total Dissolved	0.007	0.004	0.004	n/a	n/a
Phosphorus Total	0.009	0.007	0.005	0.002	0.002
<b>SULFATE</b>					
Sulfate	n/a	n/a	n/a	4.2	4.4
<b>METALS TOTAL</b>					
Aluminum	0.007	0.0028	0.0024	0.005	0.0048
Antimony	0.000043	0.00004	0.000062	0.000057	0.000048
Arsenic	0.0003	0.0004	0.0003	0.0004	0.0005
Barium	0.0133	0.0149	0.0132	0.013	0.0133
Beryllium	< 0.00002	< 0.00002	< 0.00002	0.00004	0.00002
Bismuth	0.00003	< 0.00002	0.00015	< 0.00002	< 0.00002
Cadmium	0.00002	0.00001	0.00001	0.00002	0.00002
Calcium	10.8	12.7	10.8	10.4	10.3
Chromium	< 0.0002	< 0.0002	< 0.0002	0.0008	< 0.0002
Cobalt	< 0.000005	0.0001	< 0.000005	0.000031	0.000039
Copper	0.0416	0.0299	0.0253	0.00359	0.00352
Iron	0.02	0.189	0.01	0.017	0.017
Lead	0.00077	0.00051	0.00152	0.00026	0.00025
Lithium	0.00046	0.0004	0.0004	0.00055	0.00047
Magnesium	2.67	3.29	2.62	2.55	2.56
Manganese	0.00214	<b>0.0987</b>	0.000691	0.00145	0.00137
Molybdenum	0.00521	0.00481	0.00508	0.00519	0.0053
Nickel	0.00073	0.00031	0.00021	0.00022	0.00022
Selenium	< 0.0002	< 0.0002	0.0003	0.0002	0.0004
Silver	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Strontium	0.0839	0.0948	0.0839	0.0761	0.0751
Thallium	< 0.000002	< 0.000002	< 0.000002	0.000002	0.000005
Tin	0.00002	0.00014	0.00014	0.00006	0.00002
Uranium	0.000053	0.00005	0.000053	0.000049	0.000048
Vanadium	0.0003	0.00027	0.00023	0.00042	0.00029
Zinc	0.008	0.014	0.0103	0.0129	0.0143

**Table 12A – Francois Lake Sites (F1 – F4) Continued**  
 (Values in mg/L unless otherwise noted)

	<b>F2 5-Aug-03</b>	<b>F3 5-Aug-03</b>	<b>F4 5-Aug-03</b>	<b>Drinking Water Guideline</b>			
<b>PYHSICAL</b>							
pH (pH units)	7.6	7.6	7.5	≤	8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	85	88	85	≤	700	mac	Met
Residue Filterable - TDS	58	58	60	≤	500	ao	Met
Hardness Total - T	35.1	37.5	36.1	≤	500	mac	Met
Alkalinity Total (mg/L CaCO3)	37.4	38.2	36.5				
<b>ANIONS</b>							
Chloride Dissolved	< 0.5	< 0.5	< 0.5	≤	250	ao	Met
Fluoride Dissolved	0.05	0.05	0.05	≤	1.5	mac	Met
<b>CARBON</b>							
Organic Carbon - Total	<b>5.2</b>	<b>5.1</b>	<b>4.9</b>	≤	4	mac (THM)	<b>Not Met</b>
<b>NITROGEN</b>							
Total Kjeldahl N	n/a	n/a	n/a				
Total N	n/a	n/a	n/a				
Total Organic N	n/a	n/a	n/a				
Ammonia N	0.013	< 0.005	0.005				
Nitrate Nitrogen Dissolved	0.03	0.06	0.06	≤	10	mac	Met
Nitrate+Nitrite	0.029	0.064	0.065				
Nitrite Nitrogen	< 0.002	< 0.002	< 0.002	≤	1	mac	Met
<b>PHOSPHORUS</b>							
Ortho-Phosphorus	n/a	n/a	n/a				
Phosphorus Total Dissolved	n/a	n/a	n/a				
Phosphorus Total	0.004	0.002	0.003	≤	0.01	mac (lakes)	Met
<b>SULFATE</b>							
Sulfate	3.9	4.1	4.6	≤	500	ao	Met
<b>METALS TOTAL</b>							
Aluminum	0.0087	0.0033	0.0022	≤	0.2	mac	Met
Antimony	0.000057	0.000053	0.000083	≤	0.006	imac	Met
Arsenic	0.0002	0.0003	0.0004	≤	0.025	imac	Met
Barium	0.0135	0.013	0.0144	≤	1	mac	Met
Beryllium	0.00002	0.00003	0.00003				
Bismuth	< 0.00002	< 0.00002	< 0.00002				
Cadmium	0.00003	0.00001	0.00002	≤	0.005	mac	Met
Calcium	10	10.7	10.3				
Chromium	0.0007	0.0008	0.0008	≤	0.05	mac	Met
Cobalt	0.000027	0.000029	0.000035				
Copper	0.0298	0.00633	0.00991	≤	1	ao	Met
Iron	0.025	0.028	0.031	≤	0.3	ao	Met
Lead	0.00054	0.00011	0.00125	≤	0.01	mac	Met
Lithium	0.00046	0.00045	0.00043				
Magnesium	2.46	2.61	2.51	≤	100	ao	Met
Manganese	0.0018	0.00412	0.00156	≤	0.05	ao	<b>Not Met</b>
Molybdenum	0.00511	0.00474	0.00524	≤	0.25	mac	Met
Nickel	0.00022	0.00013	0.00028				
Selenium	< 0.0002	< 0.0002	0.0005	≤	0.01	mac	Met
Silver	< 0.00002	< 0.00002	< 0.00002				
Strontium	0.0766	0.0792	0.077				
Thallium	0.000002	0.000003	0.000004				
Tin	0.00003	0.00001	0.00006				
Uranium	0.000043	0.000039	0.000032	≤	0.02	imac	Met
Vanadium	0.0005	0.00035	0.00045	≤	0.1	mac	Met
Zinc	0.0205	0.0084	0.0449	≤	5	ao	Met

**Table 12B – Francois Lake Sites (F1 – F4)**  
(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline	
<b>PHYSICAL</b>						
pH (pH units)	13	7.5	7.7	7.6	≤ 8.5	ao (>6.5)
Specific Conductance (uS/cm)	13	83	103	86	≤ 700	mac
Residue Filterable - TDS	5	48	60	56	≤ 500	ao
Hardness Total - T	13	34	45	37	≤ 500	mac
Alkalinity Total (mg/L CaCO3)	5	36	38	37		
<b>ANIONS</b>						
Chloride Dissolved	5	0.5	0.5	0.5	≤ 250	ao
Fluoride Dissolved	5	0.04	0.05	0.05	≤ 1.5	mac
<b>CARBON</b>						
Organic Carbon - Total	5	4.9	5.3	5.1	≤ 4	mac (THM)
<b>NITROGEN</b>						
Total Kjeldahl N	8	0.16	0.19	0.18		
Total N	8	0.20	0.24	0.22		
Total Organic N	8	0.2	0.2	0.2		
Ammonia N	13	0.005	0.013	0.006		
Nitrate Nitrogen Dissolved	13	0.03	0.06	0.05	≤ 10	mac
Nitrate+Nitrite	13	0.025	0.065	0.047		
Nitrite Nitrogen	13	0.002	0.005	0.002	≤ 1	mac
<b>PHOSPHORUS</b>						
Ortho-Phosphorus	0					
Phosphorus Total Dissolved	8	0.002	0.007	0.004		
Phosphorus Total	13	0.002	0.009	0.004	≤ 0.01	mac (lakes)
<b>SULFATE</b>						
Sulfate	5	3.9	4.6	4.2	≤ 500	ao
<b>METALS TOTAL</b>						
Aluminum	13	0.0019	0.0221	0.0059	≤ 0.2	mac
Antimony	13	0.00001	0.00008	0.00005	≤ 0.006	imac
Arsenic	13	0.0002	0.0005	0.0003	≤ 0.025	imac
Barium	13	0.01270	0.01490	0.01355	≤ 1	mac
Beryllium	13	0.00002	0.00004	0.00002		
Bismuth	13	0.00002	0.00015	0.00003		
Cadmium	13	0.00001	0.00003	0.00001	≤ 0.005	mac
Calcium	13	9.80	12.70	10.46		
Chromium	13	0.0002	0.0008	0.0004	≤ 0.05	mac
Cobalt	13	0.000005	0.0001	0.000023		
Copper	13	0.00352	0.04160	0.01617	≤ 1	ao
Iron	13	0.010	0.289	0.054	≤ 0.3	ao
Lead	13	0.00008	0.00336	0.00076	≤ 0.01	mac
Lithium	13	0.00005	0.00055	0.00032		
Magnesium	13	2.40	3.29	2.58	≤ 100	ao
Manganese	13	0.000691	0.098700	0.010239	≤ 0.05	ao
Molybdenum	13	0.00409	0.00530	0.00479	≤ 0.25	mac
Nickel	13	0.00005	0.00073	0.00023		
Selenium	13	0.0002	0.0005	0.0002	≤ 0.01	mac
Silver	13	0.00002	0.00002	0.00002		
Strontium	13	0.075100	0.094800	0.082185		
Thallium	13	0.000002	0.000005	0.000002		
Tin	13	0.00001	0.00014	0.00004		
Uranium	13	0.000032	0.000060	0.000045	≤ 0.02	imac
Vanadium	13	0.00021	0.00050	0.00033	≤ 0.1	mac
Zinc	13	0.0015	0.0449	0.0144	≤ 5	ao



**Table 13A – Babine Lake Sites (B2, B3)**  
(Values in mg/L unless otherwise noted)

	<b>B2 9-Oct-02</b>	<b>B3 9-Oct-02</b>	<b>Drinking Water Guideline</b>		
<b>PHYSICAL</b>					
pH (pH units)	7.9	7.9	≤ 8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	84	86	≤ 700	mac	Met
Residue Filterable - TDS	n/a	n/a	≤ 500	ao	
Hardness Total - T	38.4	39.3	≤ 500	mac	Met
Alkalinity Total (mg/L CaCO <sub>3</sub> )	n/a	n/a			
<b>ANIONS</b>					
Chloride Dissolved	< 0.5	< 0.5	≤ 250	ao	Met
Fluoride Dissolved	n/a	n/a	≤ 1.5	mac	
<b>CARBON</b>					
Organic Carbon - Total	n/a	n/a	≤ 4	mac (THM)	
<b>NITROGEN</b>					
Total Kjeldahl N	0.19	0.19			
Total N	0.27	0.25			
Total Organic N	0.19	0.19			
Ammonia N	< 0.005	< 0.005			
Nitrate Nitrogen Dissolved	0.08	0.06	≤ 10	mac	Met
Nitrate+Nitrite	0.084	0.061			
Nitrite Nitrogen	< 0.002	< 0.002	≤ 1	mac	Met
<b>PHOSPHORUS</b>					
Ortho-Phosphorus	n/a	n/a			
Phosphorus Total Dissolved	0.01	0.003			
Phosphorus Total	<b>0.014</b>	0.005	≤ 0.01	mac (lakes)	<b>Not Met</b>
<b>SULFATE</b>					
Sulfate	n/a	n/a	≤ 500	ao	
<b>METALS TOTAL</b>					
Aluminum	0.0115	0.0059	≤ 0.2	mac	Met
Antimony	0.000041	0.000044	≤ 0.006	imac	Met
Arsenic	0.0003	0.0003	≤ 0.025	imac	Met
Barium	0.021	0.0196	≤ 1	mac	Met
Beryllium	< 0.00002	< 0.00002			
Bismuth	< 0.00002	< 0.00002			
Cadmium	< 0.00001	< 0.00001	≤ 0.005	mac	Met
Calcium	11	11.2			
Chromium	< 0.0002	< 0.0002	≤ 0.05	mac	Met
Cobalt	< 0.000005	< 0.000005			
Copper	0.0367	0.0107	≤ 1	ao	Met
Iron	0.047	0.023	≤ 0.3	ao	Met
Lead	0.0002	0.00069	≤ 0.01	mac	Met
Lithium	< 0.00005	< 0.00005			
Magnesium	2.65	2.76	≤ 100	ao	Met
Manganese	0.00221	0.000688	≤ 0.05	ao	Met
Molybdenum	0.00047	0.00054	≤ 0.25	mac	Met
Nickel	0.00024	0.00039			
Selenium	< 0.0002	< 0.0002	≤ 0.01	mac	Met
Silver	< 0.00002	< 0.00002			
Strontium	0.0757	0.0785			
Thallium	< 0.000002	< 0.000002			
Tin	< 0.00001	< 0.00001			
Uranium	0.00002	0.000025	≤ 0.02	imac	Met
Vanadium	0.00024	0.00015	≤ 0.1	mac	Met
Zinc	0.0097	0.0053	≤ 5	ao	Met

**Table 13B – Babine Lake Sites (B2, B3)**  
(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline	
<b>PHYSICAL</b>						
pH (pH units)	2	7.9	7.9	7.9	≤ 8.5	ao (>6.5)
Specific Conductance (uS/cm)	2	84	86	85	≤ 700	mac
Residue Filterable - TDS	0				≤ 500	ao
Hardness Total - T	2	38.4	39.3	38.9	≤ 500	mac
Alkalinity Total (mg/L CaCO3)	0					
<b>ANIONS</b>						
Chloride Dissolved	2	0.5	0.5	0.5	≤ 250	ao
Fluoride Dissolved	0				≤ 1.5	mac
<b>CARBON</b>						
Organic Carbon - Total	0				≤ 4	mac (THM)
<b>NITROGEN</b>						
Total Kjeldahl N	2	0.19	0.19	0.19		
Total N	2	0.25	0.27	0.26		
Total Organic N	2	0.2	0.2	0.2		
Ammonia N	2	0.005	0.005	0.005		
Nitrate Nitrogen Dissolved	2	0.06	0.08	0.07	≤ 10	mac
Nitrate+Nitrite	2	0.061	0.084	0.073		
Nitrite Nitrogen	2	0.002	0.002	0.002	≤ 1	mac
<b>PHOSPHORUS</b>						
Ortho-Phosphorus	0					
Phosphorus Total Dissolved	2	0.003	0.010	0.007		
Phosphorus Total	2	0.005	0.014	0.010	≤ 0.01	mac (lakes)
<b>SULFATE</b>						
Sulfate	0				≤ 500	ao
<b>METALS TOTAL</b>						
Aluminum	2	0.0059	0.0115	0.0087	≤ 0.2	mac
Antimony	2	0.00004	0.00004	0.00004	≤ 0.006	imac
Arsenic	2	0.0003	0.0003	0.0003	≤ 0.025	imac
Barium	2	0.01960	0.02100	0.02030	≤ 1	mac
Beryllium	2	0.00002	0.00002	0.00002		
Bismuth	2	0.00002	0.00002	0.00002		
Cadmium	2	0.00001	0.00001	0.00001	≤ 0.005	mac
Calcium	2	11.00	11.20	11.10		
Chromium	2	0.0002	0.0002	0.0002	≤ 0.05	mac
Cobalt	2	0.000005	0.000005	0.000005		
Copper	2	0.01070	0.03670	0.02370	≤ 1	ao
Iron	2	0.023	0.047	0.035	≤ 0.3	ao
Lead	2	0.00020	0.00069	0.00045	≤ 0.01	mac
Lithium	2	0.00005	0.00005	0.00005		
Magnesium	2	2.65	2.76	2.71	≤ 100	ao
Manganese	2	0.000688	0.002210	0.001449	≤ 0.05	ao
Molybdenum	2	0.00047	0.00054	0.00051	≤ 0.25	mac
Nickel	2	0.00024	0.00039	0.00032		
Selenium	2	0.0002	0.0002	0.0002	≤ 0.01	mac
Silver	2	0.00002	0.00002	0.00002		
Strontium	2	0.075700	0.078500	0.077100		
Thallium	2	0.000002	0.000002	0.000002		
Tin	2	0.00001	0.00001	0.00001		
Uranium	2	0.000020	0.000025	0.000023	≤ 0.02	imac
Vanadium	2	0.00015	0.00024	0.00020	≤ 0.1	mac
Zinc	2	0.0053	0.0097	0.0075	≤ 5	ao

**Table 14A – Burns Area Groundwater Sites (GGW, BGW)**  
 (Values in mg/L unless otherwise noted)

	<b>GGW 8-Aug-02</b>	<b>GGW 9-Oct-02</b>	<b>BGW 9-Oct-02</b>
<b>PHYSICAL</b>			
pH (pH units)	n/a	8.1	8.1
Specific Conductance (uS/cm)	298	327	352
Residue Filterable - TDS	n/a	n/a	n/a
Hardness Total - T	n/a	161	143
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a
<b>ANIONS</b>			
Chloride Dissolved	< 0.5	< 0.5	1.2
Fluoride Dissolved	n/a	n/a	n/a
<b>CARBON</b>			
Organic Carbon - Total	n/a	n/a	n/a
<b>NITROGEN</b>			
Total Kjeldahl N	0.14	0.13	0.08
Total N	0.14	0.13	0.38
Total Organic N	< 0.1	< 0.1	< 0.1
Ammonia N	0.071	0.035	< 0.005
Nitrate Nitrogen Dissolved	< 0.02	< 0.02	0.3
Nitrate+Nitrite	< 0.002	< 0.002	0.296
Nitrite Nitrogen	< 0.002	< 0.002	< 0.002
<b>PHOSPHORUS</b>			
Ortho-Phosphorus	n/a	n/a	n/a
Phosphorus Total Dissolved	n/a	n/a	n/a
Phosphorus Total	n/a	n/a	n/a
<b>SULFATE</b>			
Sulfate	n/a	n/a	n/a
<b>METALS TOTAL</b>			
Aluminum	n/a	0.002	0.0184
Antimony	n/a	< 0.000005	0.000009
Arsenic	n/a	0.0064	0.0138
Barium	n/a	0.17	0.123
Beryllium	n/a	< 0.00002	< 0.00002
Bismuth	n/a	< 0.00002	< 0.00002
Cadmium	n/a	< 0.00001	< 0.00001
Calcium	n/a	45.4	39.1
Chromium	n/a	< 0.0002	< 0.0002
Cobalt	n/a	< 0.000005	< 0.000005
Copper	n/a	0.00052	0.00813
Iron	n/a	0.00105	<b>1.69</b>
Lead	n/a	< 0.00001	0.00067
Lithium	n/a	0.00114	0.00011
Magnesium	n/a	11.5	10.9
Manganese	n/a	<b>0.323</b>	<b>0.268</b>
Molybdenum	n/a	0.00138	0.00441
Nickel	n/a	< 0.00005	< 0.00005
Selenium	n/a	< 0.0002	< 0.0002
Silver	n/a	< 0.00002	< 0.00002
Strontium	n/a	0.304	0.353
Thallium	n/a	< 0.000002	< 0.000002
Tin	n/a	< 0.00001	< 0.00001
Uranium	n/a	0.000539	0.00133
Vanadium	n/a	0.0005	0.00083
Zinc	n/a	0.0005	0.008

**Table 14A – Burns Area Groundwater Sites (GGW, BGW) Continued**  
(Values in mg/L unless otherwise noted)

	GGW 16-Apr-03	BGW-1 1-May-03	BGW-2 1-May-03	Drinking Water Guideline			
<b>PHYSICAL</b>							
pH (pH units)	8.1	8.1	8.1	≤	8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	330	366	381	≤	700	mac	Met
Residue Filterable - TDS	n/a	n/a	n/a	≤	500	ao	
Hardness Total - T	167	167	163	≤	500	mac	Met
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a				
<b>ANIONS</b>							
Chloride Dissolved	0.5	2.7	23.3	≤	250	ao	Met
Fluoride Dissolved	n/a	n/a	n/a	≤	1.5	mac	
<b>CARBON</b>							
Organic Carbon - Total	n/a	n/a	n/a	≤	4	mac (THM)	
<b>NITROGEN</b>							
Total Kjeldahl N	0.12	0.25	0.26				
Total N	0.13	0.38	0.42				
Total Organic N	< 0.1	0.17	0.14				
Ammonia N	0.088	0.086	0.121				
Nitrate Nitrogen Dissolved	< 0.02	0.1	0.15	≤	10	mac	Met
Nitrate+Nitrite	0.006	0.13	0.16				
Nitrite Nitrogen	0.002	0.032	0.01	≤	1	mac	Met
<b>PHOSPHORUS</b>							
Ortho-Phosphorus	n/a	n/a	n/a				
Phosphorus Total Dissolved	n/a	n/a	n/a				
Phosphorus Total	n/a	n/a	n/a	≤	0.01	mac (lakes)	
<b>SULFATE</b>							
Sulfate	n/a	n/a	n/a	≤	500	ao	
<b>METALS TOTAL</b>							
Aluminum	0.002	0.0033	0.0036	≤	0.2	mac	Met
Antimony	< 0.000005	0.000062	0.000061	≤	0.006	imac	Met
Arsenic	0.0062	0.0072	0.0073	≤	0.025	imac	Met
Barium	0.174	0.102	0.111	≤	1	mac	Met
Beryllium	< 0.00002	< 0.00002	< 0.00002				
Bismuth	< 0.00002	0.00006	0.00006				
Cadmium	< 0.00001	0.00001	< 0.00001	≤	0.005	mac	Met
Calcium	47.3	44.6	43.8				
Chromium	< 0.0002	< 0.0002	< 0.0002	≤	0.05	mac	Met
Cobalt	< 0.000005	0.000032	0.000053				
Copper	0.00032	0.00488	0.00541	≤	1	ao	Met
Iron	<b>1.72</b>	<b>0.328</b>	<b>0.328</b>	≤	0.3	ao	<b>Not Met</b>
Lead	< 0.00002	0.0001	0.0001	≤	0.01	mac	Met
Lithium	0.00218	0.00179	0.00173				
Magnesium	11.9	13.4	13.1	≤	100	ao	Met
Manganese	<b>0.347</b>	<b>0.236</b>	<b>0.244</b>	≤	0.05	ao	<b>Not Met</b>
Molybdenum	0.00143	0.00458	0.00444	≤	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	0.315	0.376	0.406				
Thallium	< 0.000002	0.000007	0.000004				
Tin	0.00003	0.00001	0.000002				
Uranium	0.000483	0.0015	0.00149	≤	0.02	imac	Met
Vanadium	0.00015	0.00013	0.0003	≤	0.1	mac	Met
Zinc	0.0017	0.006	0.0059	≤	5	ao	Met

**Table 14B – Burns Area Groundwater Sites (GGW, BGW)**  
(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline	
<b>PHYSICAL</b>						
pH (pH units)	5	8.1	8.1	8.1	≤ 8.5	ao (>6.5)
Specific Conductance (uS/cm)	6	298	381	342	≤ 700	mac
Residue Filterable - TDS	0				≤ 500	ao
Hardness Total - T	5	143.0	167.0	160.2	≤ 500	mac
Alkalinity Total (mg/L CaCO3)	0					
<b>ANIONS</b>						
Chloride Dissolved	6	0.5	23.3	4.8	≤ 250	ao
Fluoride Dissolved	0				≤ 1.5	mac
<b>CARBON</b>						
Organic Carbon - Total	0				≤ 4	mac (THM)
<b>NITROGEN</b>						
Total Kjeldahl N	6	0.08	0.26	0.16		
Total N	6	0.13	0.42	0.26		
Total Organic N	6	0.1	0.2	0.1		
Ammonia N	6	0.005	0.121	0.068		
Nitrate Nitrogen Dissolved	6	0.02	0.30	0.10	≤ 10	mac
Nitrate+Nitrite	6	0.002	0.296	0.099		
Nitrite Nitrogen	6	0.002	0.032	0.008	≤ 1	mac
<b>PHOSPHORUS</b>						
Ortho-Phosphorus	0					
Phosphorus Total Dissolved	0					
Phosphorus Total	0				≤ 0.01	mac (lakes)
<b>SULFATE</b>						
Sulfate	0				≤ 500	ao
<b>METALS TOTAL</b>						
Aluminum	5	0.0020	0.0184	0.0059	≤ 0.2	mac
Antimony	5	0.00001	0.00006	0.00003	≤ 0.006	imac
Arsenic	5	0.0062	0.0138	0.0082	≤ 0.025	imac
Barium	5	0.10200	0.17400	0.13600	≤ 1	mac
Beryllium	5	0.00002	0.00002	0.00002		
Bismuth	5	0.00002	0.00006	0.00004		
Cadmium	5	0.00001	0.00001	0.00001	≤ 0.005	mac
Calcium	5	39.10	47.30	44.04		
Chromium	5	0.0002	0.0002	0.0002	≤ 0.05	mac
Cobalt	5	0.000005	0.000053	0.000020		
Copper	5	0.00032	0.00813	0.00385	≤ 1	ao
Iron	5	0.001	1.720	0.813	≤ 0.3	ao
Lead	5	0.00001	0.00067	0.00018	≤ 0.01	mac
Lithium	5	0.00011	0.00218	0.00139		
Magnesium	5	10.90	13.40	12.16	≤ 100	ao
Manganese	5	0.236000	0.347000	0.283600	≤ 0.05	ao
Molybdenum	5	0.00138	0.00458	0.00325	≤ 0.25	mac
Nickel	5	0.00005	0.00005	0.00005		
Selenium	5	0.0002	0.0002	0.0002	≤ 0.01	mac
Silver	5	0.00002	0.00002	0.00002		
Strontium	5	0.304000	0.406000	0.350800		
Thallium	5	0.000002	0.000007	0.000003		
Tin	5	0.00000	0.00003	0.00001		
Uranium	5	0.000483	0.001500	0.001068	≤ 0.02	imac
Vanadium	5	0.00013	0.00083	0.00038	≤ 0.1	mac
Zinc	5	0.0005	0.0080	0.0044	≤ 5	ao

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

**Table 15A – QA/QC Analysis of Microbiological Indicators & Colour and Turbidity (Weekly Results)**

(Values in mg/L unless otherwise noted)

**Blanks:**

Date	Fecal coliform (CFU/100mL)	<i>E. coli</i> (CFU/100mL)	Enterococci (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
30-Oct-02	< 1	< 1	< 1	< 5	< 0.1
07-Nov-02	< 1	< 1	< 1	< 5	0.17
16-Apr-03	< 2	< 2	< 2	< 5	< 0.1
24-Apr-03	< 2	< 2	< 2	< 5	< 0.1
01-May-03	< 2	< 2	< 2	5	< 0.1
07-May-03	< 2	< 2	< 2	< 5	< 0.1
12-May-03	< 1*	< 1*	2*	50	< 0.1
02-Sep-03	< 1	< 1	< 1	< 5	< 0.1

**Duplicates:**

Date	Site	Colour True Result 1	Colour True Result 2	RPD	Turbidity Result 1	Turbidity Result 2	RPD
01-May-03	BGW	< 5	5		0.96	1.02	-6.1
07-May-03	BLS	50	50	0.0	2.13	2.15	-0.9
02-Sep-03	F2	5	5		0.92	0.41	
24-Apr-03	F4	5	5		0.26	0.22	
18-Aug-03	F4	5	5		0.24	0.19	
12-May-03	GGW	5	10		2.89	3.12	-7.7

**Table 15B – QA/QC Analysis of Additional Water Quality Results**  
(Values in mg/L unless otherwise noted)

	MDL	Blanks		Duplicates		RPD
		ST1-LD 16-Apr-03	BGW-1 1-May-03	BGW-2 1-May-03		
<b>PHYSICAL</b>						
pH (pH units)	0.1	6.2	8.1	8.1	0.0	
Specific Conductance (uS/cm)	1	1	366	381	-4.0	
Residue Filterable - TDS	10		n/a	n/a		
Hardness Total - T	0.3	< 0.4	167	163	2.4	
Alkalinity Total (mg/L CaCO3)	0.3		n/a	n/a		
<b>ANIONS</b>						
Chloride Dissolved	0.5	< 0.5	2.7	23.3	-158.5	
Fluoride Dissolved	0.01		n/a	n/a		
<b>CARBON</b>						
Organic Carbon - Total	0.5		n/a	n/a		
<b>NITROGEN</b>						
Total Kjeldahl N	0.02	< 0.02	0.25	0.26	-3.9	
Total N	0.02	< 0.02	0.38	0.42	-10.0	
Total Organic N	0.1	< 0.1	0.17	0.14		
Ammonia N	0.005	< 0.005	0.086	0.121	-33.8	
Nitrate Nitrogen Dissolved	0.02	< 0.02	0.1	0.15		
Nitrate+Nitrite	0.002	0.006	0.13	0.16	-20.7	
Nitrite Nitrogen	0.002	0.002	0.032	0.01		
<b>PHOSPHORUS</b>						
Ortho-Phosphorus	0.001	n/a	n/a	n/a		
Phosphorus Total Dissolved	0.002	0.004	n/a	n/a		
Phosphorus Total	0.002	0.002	n/a	n/a		
<b>SULFATE</b>						
Sulfate	0.5		n/a	n/a		
<b>METALS TOTAL</b>						
Aluminum	0.0003	< 0.0003	0.0033	0.0036	-8.7	
Antimony	0.000005	< 0.000005	0.000062	0.000061	1.6	
Arsenic	0.0001	< 0.0001	0.0072	0.0073	-1.4	
Barium	0.00002	< 0.00002	0.102	0.111	-8.5	
Beryllium	0.00002	< 0.00002	< 0.00002	< 0.00002		
Bismuth	0.00002	0.00003	0.00006	0.00006		
Cadmium	0.00001	< 0.00001	0.00001	< 0.00001		
Calcium	0.05	0.06	44.6	43.8	1.8	
Chromium	0.0002	< 0.0002	< 0.0002	< 0.0002		
Cobalt	0.000005	< 0.000005	0.000032	0.000053	-49.4	
Copper	0.00005	0.00037	0.00488	0.00541	-10.3	
Iron	0.005	< 0.005	0.328	0.328	0.0	
Lead	0.00001	0.00002	0.0001	0.0001	0.0	
Lithium	0.00005	< 0.00005	0.00179	0.00173	3.4	
Magnesium	0.05	< 0.05	13.4	13.1	2.3	
Manganese	0.000008	< 0.00008	0.236	0.244	-3.3	
Molybdenum	0.00005	< 0.00005	0.00458	0.00444	3.1	
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	0.000005	0.000008	0.376	0.406	-7.7	
Thallium	0.000002	< 0.000002	0.000007	0.000004		
Tin	0.00001	0.00003	0.00001	0.000002		
Uranium	0.000002	< 0.000002	0.0015	0.00149	0.7	
Vanadium	0.00006	< 0.00006	0.00013	0.0003		
Zinc	0.0001	0.0002	0.006	0.0059	1.7	

**Table 15B – QA/QC Analysis of Additional Water Quality Results (Continued)**  
 (Values in mg/L unless otherwise noted)

	MDL	Duplicates		RPD
		F1-1 5-Aug-03	F1-2 5-Aug-03	
<b>PHYSICAL</b>				
pH (pH units)	0.1	7.6	7.6	0.0
Specific Conductance (uS/cm)	1	84	84	0.0
Residue Filterable - TDS	10	56	48	15.4
Hardness Total - T	0.3	36.5	36.3	0.5
Alkalinity Total (mg/L CaCO3)	0.3	36.3	36.2	0.3
<b>ANIONS</b>				
Chloride Dissolved	0.5	< 0.5	< 0.5	
Fluoride Dissolved	0.01	0.04	0.05	
<b>CARBON</b>				
Organic Carbon - Total	0.5	5.2	5.3	-1.9
<b>NITROGEN</b>				
Total Kjeldahl N	0.02	n/a	n/a	
Total N	0.02	n/a	n/a	
Total Organic N	0.1	n/a	n/a	
Ammonia N	0.005	< 0.005	< 0.005	
Nitrate Nitrogen Dissolved	0.02	0.05	0.04	
Nitrate+Nitrite	0.002	0.053	0.039	30.4
Nitrite Nitrogen	0.002	0.002	< 0.002	
<b>PHOSPHORUS</b>				
Ortho-Phosphorus	0.001	n/a	n/a	
Phosphorus Total Dissolved	0.002	n/a	n/a	
Phosphorus Total	0.002	<b>0.002</b>	<b>0.002</b>	
<b>SULFATE</b>				
Sulfate	0.5	4.2	4.4	-4.7
<b>METALS TOTAL</b>				
Aluminum	0.0003	0.005	0.0048	4.1
Antimony	0.000005	0.000057	0.000048	17.1
Arsenic	0.0001	0.0004	0.0005	
Barium	0.00002	0.013	0.0133	-2.3
Beryllium	0.00002	0.00004	0.00002	
Bismuth	0.00002	< 0.00002	< 0.00002	
Cadmium	0.00001	0.00002	0.00002	
Calcium	0.05	10.4	10.3	1.0
Chromium	0.0002	0.0008	< 0.0002	
Cobalt	0.000005	0.000031	0.000039	-22.9
Copper	0.00005	0.00359	0.00352	2.0
Iron	0.005	<b>0.017</b>	<b>0.017</b>	
Lead	0.00001	0.00026	0.00025	3.9
Lithium	0.00005	0.00055	0.00047	15.7
Magnesium	0.05	2.55	2.56	-0.4
Manganese	0.000008	0.00145	0.00137	5.7
Molybdenum	0.00005	0.00519	0.0053	-2.1
Nickel	0.00005	0.00022	0.00022	
Selenium	0.0002	0.0002	0.0004	
Silver	0.00002	< 0.00002	< 0.00002	
Strontium	0.000005	0.0761	0.0751	1.3
Thallium	0.000002	0.000002	0.000005	
Tin	0.00001	0.00006	0.00002	
Uranium	0.000002	0.000049	0.000048	2.1
Vanadium	0.00006	0.00042	0.00029	
Zinc	0.0001	0.0129	0.0143	-10.3