Drinking Water Source Quality Monitoring 2002-03

Atlin & Area: Atlin Lake, Warm Bay Road Spring, Fourth of July Creek and Groundwater

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**Ministry of
Water, Land and Air
Protection**

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SUMMARY

Water quality has been a longstanding concern for residents of the Atlin area and for agencies concerned with public health and/or water quality issues. Representatives from the Ministry of Water, Land and Air Protection (WLAP), Northern Health Authority (NHA), Health Canada (HC), and the Taku River Tlingit First Nation (TRTFN) identified water quality concerns in Atlin as a priority.

Atlin Lake is the most common drinking water source in the Atlin area, and water samples were collected in August 2002 and in August and October 2003. Sampling was also conducted at three alternate drinking water sources: Warm Bay Road Spring, Fourth of July Creek (2003 only), and groundwater. Five samples were collected from each site within a 30-day period in each sampling season. The samples were analyzed for three microbiological indicators (fecal coliforms, *E. coli* and enterococci), colour and turbidity. In each season, one sample from each site was analyzed for a comprehensive range of physical and chemical parameters (including mercury at some sites) to determine overall water quality and identify potential contamination by domestic sewage.

Lab results were compared to WLAP approved and working guidelines for drinking water quality. At surface water sites, 90th 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, the *No Treatment* guideline was applied.

- Atlin Lake surface water was sampled at five locations to investigate potential contamination from domestic sewage.
    - Enterococci were detected most frequently, but all microbiological indicators were present. Most sites met WLAP guideline levels for fecal coliforms and *E. coli*. The enterococci guideline was exceeded many times, indicating that disinfection alone may not be sufficient to ensure potability of the water. Overall, Atlin Lake source water is subject to occasional contamination by fecal material and is not safe to drink untreated.
    - Turbidity and colour values were low and WLAP drinking water guidelines were met. Other physical and chemical parameters were also below (WLAP) guideline levels.
    - Results from other sewage indicator parameters do not suggest that the lake was being contaminated by domestic sewage during the sampling seasons.
    - When tested, mercury was not found in any Atlin Lake samples.

- Local residents and tourists use a surface water spring adjacent to Warm Bay Road extensively as a drinking water source. This water source is not approved nor sampled by the NHA.

    - Enterococci were detected in low concentrations in August 2003, but all microbiological indicator guidelines were met. The enterococci occurrences indicate that the spring is subject to occasional contamination by fecal material and is not safe to drink untreated.
    - Turbidity, colour, and other physical and chemical parameters were well below guideline levels.

- Fourth of July Creek flows into Atlin Lake north of the community, and at the highway it is used as a drinking water source by residents and tourists. This water source is also not approved nor sampled by the NHA.

    - Enterococci were detected in most samples, and August 2003 concentrations were very high. The enterococci guideline was not met in any sample set. Fecal coliform and *E. coli* concentrations were low and 90^{th} percentiles met WLAP guideline levels. Overall, this drinking water source is not safe to drink untreated.
    - Turbidity, colour, and other physical and chemical parameters were well below (WLAP) guideline levels.

- There are two known groundwater wells that serve single residences on the Five Mile Reserve. One well was sampled to determine groundwater quality.

    - Enterococci was the only microbiological indicator detected. It was found in only one sample, so the *No Treatment* guideline was not met once.
    - Turbidity, colour, and other physical and chemical parameters were well below guideline levels.

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

- WLAP should continue to collaborate with agencies (such as the NHA and TRTFN) interested in water quality in the Atlin area.
- Through collaboration with NHA staff, residents should be informed of the need to protect drinking water sources from contamination and disinfect surface water supplies prior to consumption.
- Although sampling results have already been provided to those using each source, drinking water source quality data should be made available to other interested parties.
- Monitoring programs should include sampling in different seasons to investigate seasonal water quality patterns and to specifically determine if sewage contamination in Atlin Lake occurs.

- Enterococci and *E. coli*. should continue to be used as indicators and should be considered in water quality objectives development and updates.
- To further assess possible mercury contamination in Atlin Lake, a caged bi-valve reconnaissance study (using "Musselwatch" design) should be conducted.

ACKNOWLEDGEMENTS

This series of reports on drinking water source quality in the Skeena Region was prepared under the direction of Ian Sharpe, Sean Sharpe and Remi Odense, Impact Assessment Biologists with the B.C. Ministry of Water, Land and Air Protection, Environmental Quality Section. Representatives from the Northern Health Authority, Health Canada, and the Taku River Tlingit First Nation (TRTFN) helped design the 2002-2003 monitoring program for the Atlin area. Most Atlin area sampling sites were recommended by George Holman, Water Treatment Plant Operator and Water Delivery Driver for the TRTFN (and unofficial mayor of Atlin).

A.J. Downie and Randy Keleher (TRTFN) collected the water samples. Julia Kokelj provided input and advice throughout this project, and Sean Sharpe, Les Swain, Kevin Rieberger, Lyn Smirl (all from WLAP) and Bob Watson and Ron Craig (NHA) helped edit the draft reports.

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1.0 INTRODUCTION

This document is part of a series presenting results of the B.C. Ministry of Water, Land and Air Protection (WLAP) Skeena Region's 2002-03 water quality monitoring program. It assesses drinking water sources in the Atlin area of North-western British Columbia, outlines water quality monitoring conducted in 2002-03, and presents the results of this work. Recommendations for future monitoring in the Atlin area are included.

1.1 Provincial Expanded Water Quality Monitoring Program

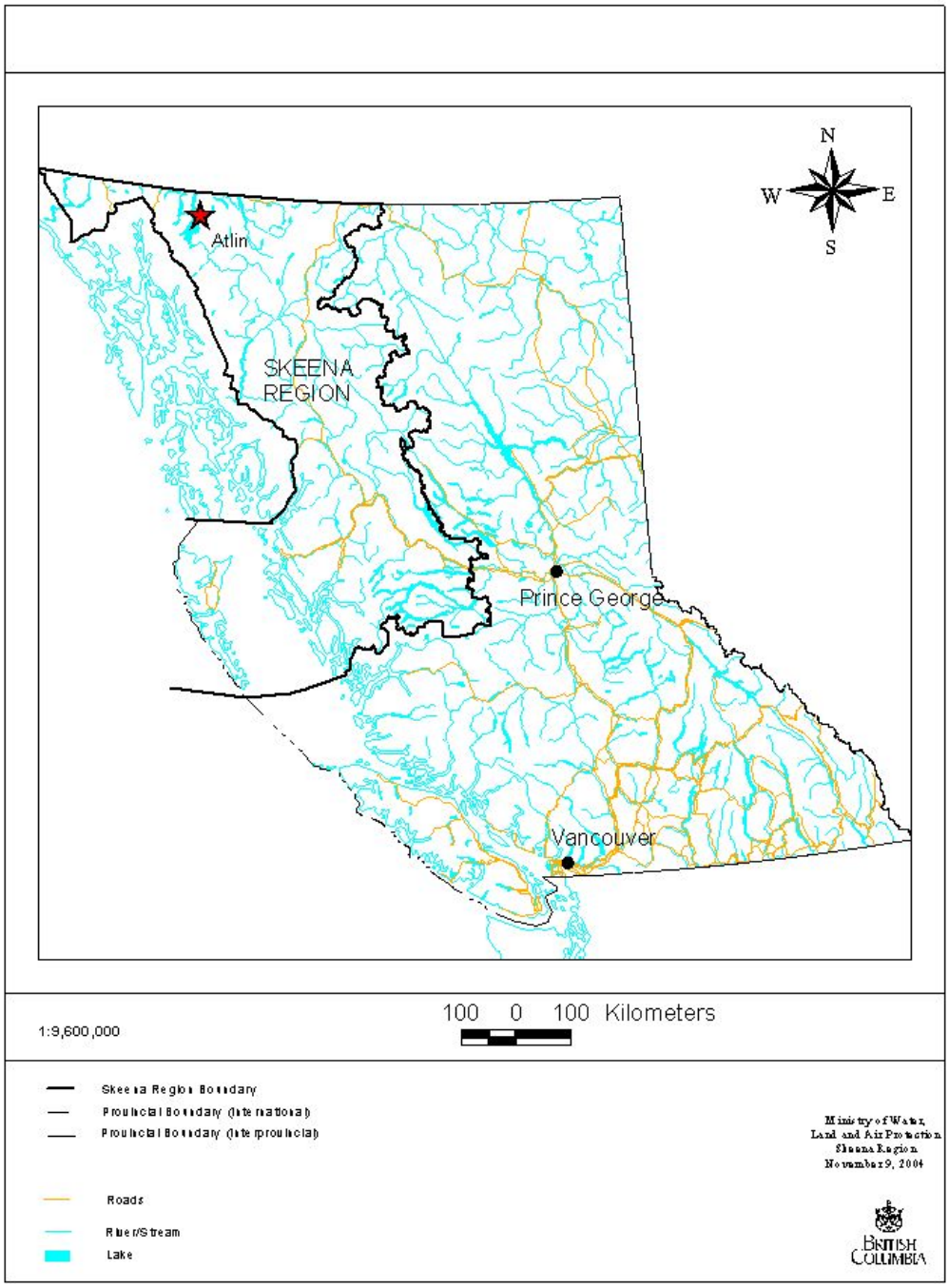
A safe and dependable supply of drinking water is critical to the health of all British Columbians. Recent reviews and reports have identified public health concerns relating to the quality of drinking water in B.C. and the provincial government has created a Drinking Water Action Plan to prevent contamination, 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 Planning website, 2002). In 2003, the new Drinking Water Protection Act and regulations were brought into force to protect drinking water in B.C. WLAP is responsible for managing and regulating activities in watersheds that have a potential to affect water quality. It 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 Services website (http://www.healthservices.gov.bc.ca/protect/water.html).

1.2 Skeena Region Overview

The Skeena Region covers an area of 266,441 km^2 (29% of the province) in the northwest quadrant of British Columbia. 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 USA 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 (Province of B.C. WLAP, 2003).

Water is abundant in the Skeena Region, and most drinking water systems use surface water sources. Many do not employ any form of treatment. There are very few large water purveyors in the region, and small purveyors and individual water systems serve most of the population.

Figure 1: Skeena Region showing location of Atlin



1.3 Atlin & Area Overview

The community of Atlin is located 100 km south from the Yukon border on the eastern shoreline of Atlin Lake in the northwest corner of British Columbia (59º35'N latitude and 133º40'W longitude). The community has approximately 450 permanent residents and 100-200 seasonal residents (Atlin Community Website, 2002).

Atlin has no official regional government and therefore no governance for infrastructure like sewage and water systems. Soils in the Atlin area are generally unsuitable for septic systems, and many residents collect their domestic sewage in holding tanks that are pumped out on a regular basis. In the past, effluent runoff from antiquated septic fields and holding tanks has been known to run off into the lake (Robson, 2002).

Atlin Lake is the primary drinking water source and most residents of the community have water delivered to their homes by water truck. Some residents and businesses draw their own water from the lake through private intakes. Although some of these systems include treatment processes, many do not. Groundwater is not commonly used, but there are two wells that serve individual residences on the Five Mile Reserve. A spring on Warm Bay Road (south from the community) and Fourth of July Creek (north from the community) are also used as sources of drinking water.

Drinking water quality has been a longstanding concern in the Atlin area. A 2002 health study (*Robson & Associates Nursing Consultants*) highlighted specific issues related to health and health care in Atlin. It concluded that significant and urgent issues surround the matter of safe drinking water sources, treatment, testing and delivery to a large proportion of the Atlin population, and that this is a most critical issue requiring urgent attention. Representatives from WLAP, Northern Health Authority (NHA), Health Canada (HC), and the Taku River Tlingit First Nation (TRTFN) all concur that water quality concerns in Atlin are a priority.

2.0 B.C. DRINKING WATER QUALITY GUIDELINES

In British Columbia WLAP develops province-wide water quality guidelines for assessing water quality data and preparing site-specific water quality objectives. Water quality guidelines (criteria) are environmental benchmarks. They are 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 with periodic updates). 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 multiple-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 in 1988 (Warrington, 1988). B.C. Health Authorities recommend that all drinking water supplies derived from surface water sources receive disinfection as a minimum treatment. The B.C. (WLAP) guidelines assume that the degree of treatment needed is a function of the quality of the raw water. Although three guidelines are listed in Warrington (1988), we assess surface water microbiological water quality using the ***Disinfection Only*** guideline (which is the minimum treatment requirement for surface water sources under the Drinking Water Protection Regulation; see Table 1). Groundwater quality is judged using the ***No Treatment*** guideline.

Table 1: WLAP Water Quality Guidelines for Microbiological Indicators

Water Use	Fecal Coliform	*E. coli*	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^{th} percentile	Less than or equal to 10/100 mL 90^{th} percentile	Less than or equal to 3/100 mL 90^{th} percentile

Other B.C. (WLAP) 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.ccme.ca/publications/pubs_updates.html#101
  - http://www.hc-sc.gc.ca/hecs-sesc/water/index.htm
- B.C. Guidelines
  - http://wlapwww.gov.bc.ca/wat/wq/wq_guidelines.html

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

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

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

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

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

3.0 METHODS

3.1 Atlin Area Sampling Program (2002-03)

The Atlin area sampling program was designed in consultation with NHA and Health Canada Environmental Health Officers (EHOs) and TRTFN employees and representatives. The program included testing of Atlin Lake source water at five sites (four sites in 2003), as well as three alternative drinking water sources: Warm Bay Road Spring, Fourth of July Creek (added in 2003) and groundwater (tested at a residential well). 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, August 2003, and October 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 also 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 also 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. Past sampling by the TRTFN has revealed elevated levels of mercury in Atlin Lake, and they are concerned about present levels in their drinking water (Connor, 2002 pers. comm.). To address this concern, mercury levels were tested at three Atlin Lake sites (AL2, AL4, AL5) in August 2002.

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 analysis laboratories in Burnaby, B.C. All samples were received by the laboratory within the recommended time limits.

3.3 Analytical Methods

Microbiological analyses were performed by Cantest Ltd. laboratory 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).

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. PSC also follows standard methods provided in APHA (1998).

3.4 QA/QC

All three analysis labs used (Cantest, JR and PSC) must meet numerous QA/QC (Quality Assurance, Quality Control) requirements such as analysis of reference samples, blanks and duplicates, and they 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 blank and duplicate samples) to the lab
- Determination of potential errors in the results

Field blanks provide a test for potential contamination resulting from handling technique and from air exposure at the sampling location. Field blanks were collected on the first date in each 2003 sampling session and results of the field blanks are included in the accompanying data appendix. In Atlin area blanks:

- No microbiological indicators were detected in any samples, indicating that contamination during sampling, transport, and analysis is unlikely.
- Some physical/chemical parameters were detected at low concentrations. Because all drinking water guidelines were met, sample contamination is not a concern.

Duplicate samples provide a rough estimate of the overall precision associated with the field technique and laboratory analysis. Colour and turbidity duplicates were collected on August 2003 sample dates, and a duplicate sample for physical and chemical parameters was collected on October 6, 2003. Duplicates were not collected for microbiological indicators because their occurrence in the natural environment is not expected to be uniform. Precision analysis of the duplicate results was calculated using the Relative Percent Difference (RPD, see data appendix for results and calculations).[4]

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

The RPD for duplicate samples should be less than 25%, and data with precision values greater than 25% should be interpreted with caution. In the Atlin area duplicates:

- Turbidity sample pairs from two sites (**AGW** and **AFJ**) had a RPD greater than the 25% data quality objective; results from both of these sources were variable over the sampling periods and the RPD's likely reflect natural variation. Turbidity values in Atlin generally met guideline levels easily, and data quality is not a concern.
- In the comprehensive duplicate sample (from **AFJ**) RPD's for all parameters were less than the data quality objective except total aluminium and manganese. It is suspected that the differences are due to natural variation in flowing water (the sampling site was a stream, and samples were collected one after the other); all grab samples from surface sources should be interpreted with caution, especially when the values are close to guideline levels.

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), 90th percentiles were calculated for each indicator and the results were compared to the *Disinfection Only* WLAP guideline level (Table 1). The 90th percentile concentration is the concentration below which 90% of the samples lie. For computing 90th percentiles, values of <1 and <2 are assumed to be zero. The *Disinfection Only* guideline level was chosen because this is the minimum treatment requirement for surface water sources, under the Drinking Water Protection Regulation.
- 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 the WLAP guideline. The Method Detection Limit (MDL) is the minimum amount of a substance that can be routinely detected by the analytical instrument or technique with a high degree of confidence. The MDL for colour is 5 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 WLAP guidelines.

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large RPD's. Many parameters tested had concentrations below five times the MDL, so RPD was not calculated.

4.0 PROFILE OF DRINKING WATER SOURCES AND SAMPLING LOCATIONS

Eight drinking water sampling sites were monitored in the Atlin area to collect water quality data on three surface water sources and one groundwater source.

4.1 Atlin Lake

Atlin Lake is the largest natural lake in B.C., with a mean depth of 86 m, a maximum depth of 283 m, and a surface area of 589 km^2. It forms the headwaters of the Yukon River, and its primary inflows include snowmelt and surface runoff (Kirkland and Gray, 1986). Due to its remote location, the lake has not been adequately sampled in the past and water quality objectives have not been established. A study in 1982-1983 classified the lake as ultra-oligotrophic due to very low nutrient levels. Algal biomass is low, and turbidity is derived primarily from glacial sources (Kirkland and Gray, 1986). The community of Atlin is located on the eastern shore of the lake, and it is the only developed area in the watershed. With the exception of some past and present mining activity, human land use activities in other parts of the watershed are minimal.

Atlin Lake is the most convenient (and common) drinking water source in the Atlin area. Only a few drinking water systems employ any form of treatment and there is risk of contamination near the Atlin town site. In the past, the Atlin town site has had visible surface runoff that contains sewage effluent from septic fields and overflow from underground septic tanks and holding tanks (Drgon, Holman, Keleher, Sporado, pers. comm. 2002). The *Atlin Community Health Study* (Robson, 2002) mentions "visible sewage overflow cut into the snow and ice, flowing directly into the lake within 50 feet of the water pump house." The 2002-03 sampling program investigated this source water contamination issue, and assessed other impacts to water quality from surface runoff and boats.

Atlin Lake source water was sampled at five locations in 2002 and four locations in 2003. Four sites (**AL1**-**AL4**) are located near the Atlin town site on the eastern shore of the lake, and one site (**AL5**) is located on the TRTFN's Five Mile Reserve south from Atlin (Figures 2 and 3).

- **AL1** is a pump house intake that provides water to a system that serves a number of local businesses. There is no treatment installed on the water system, and source water was sampled at an outside tap in the distribution system.
- **AL2** is a pump house intake that serves government buildings and a water delivery truck (until 2002 only). A water treatment system was added in October 2002 and sampling of raw water was not possible after 2002.
- **AL3** is a sample taken directly from the lake, at a location near a resort intake.
- **AL4** is a pump house intake that serves a resort. There is no treatment installed on the water system, and source water was sampled from a tap at the pump house.
- **AL5** is a pump house intake that draws water for a delivery truck that distributes treated water. Source water was sampled at a raw water tap in the pump house.

Figure 2: Atlin Area Drinking Water Quality Sampling Sites

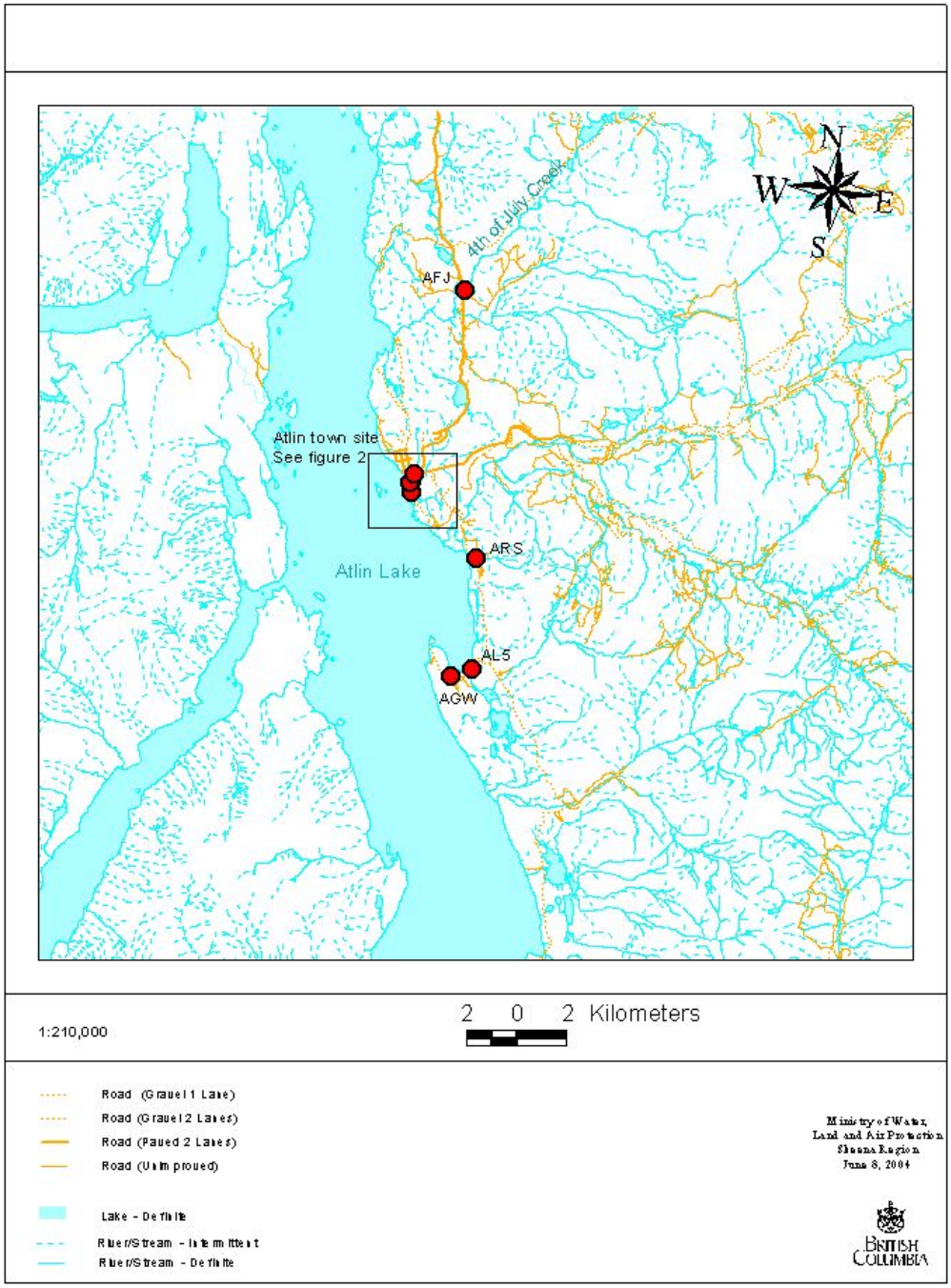
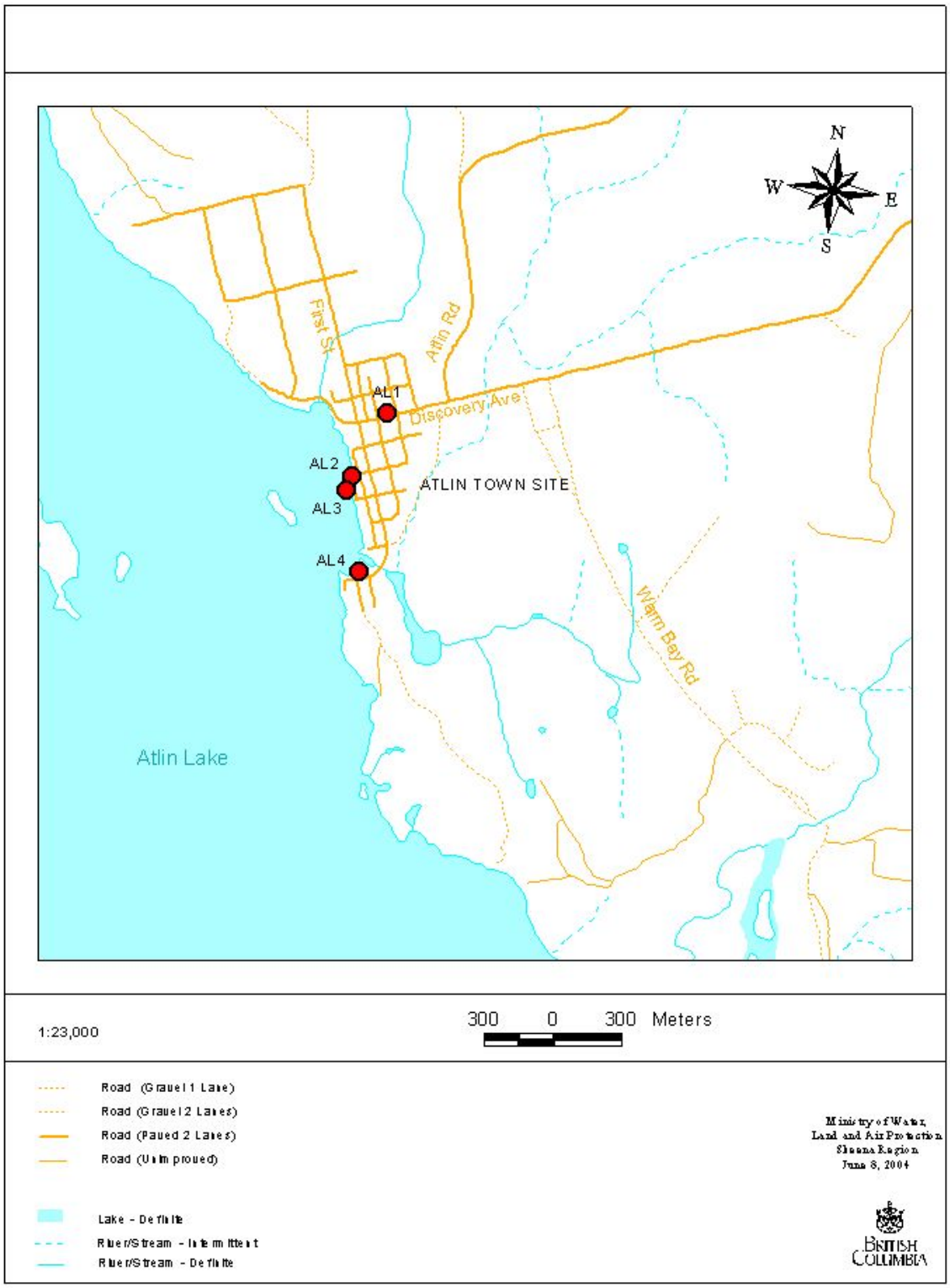


Figure 3: Atlin Town Site Drinking Water Quality Sampling Sites



4.2 Warm Bay Road Spring

There is a small spring located south from Atlin on the eastern side of Warm Bay Road, approximately 1.6 km south from the Pine Creek Bridge. Holman (2002, pers. comm.) indicated that the water is actually a surface flow further up the hillside, so the roadside location is not the first place where the water reaches the surface. Although there is limited development uphill from the spring, a risk of contamination exists.

The spring is marked with a sign reading "Drinking Water" and an upright culvert has been placed in the ground beside the road. Water flowing from within the hillside comes to the surface on the bank above the road. It collects in a puddle before it flows into and out from the culvert through metal pipes. Many residents and tourists take water at the roadside spring, however, this source is not approved nor is its quality monitored by the NHA. In 2002 and 2003 water quality samples were collected from the pipe that flows out from the culvert (**ARS**, Figure 1).

4.3 Fourth of July Creek

Fourth of July Creek flows southwest from Gladys Lake for approximately 40 km, into Atlin Lake. The creek also flows through McDonald Lake and an extensive wetland area. An old silver mine that operated until the mid 1930's is located in the watershed, and today there are approximately 20 active mining tenures in the area (Keleher, 2003 pers. comm.). Beaver dams were noted along the creek in 1983, but their current presence and/or abundance is not known. Although the exact number of residences in the watershed is also unknown, it is estimated that there are five to ten homes situated along the creek. Fourth of July Creek crosses the highway at two large culverts approximately 10 km north from the town site. This is a popular site for residents and tourists to obtain drinking water; however, this site is not approved as a drinking water source, nor is its quality monitored by the NHA. The creek was sampled adjacent to the highway (**AFJ,** Figure 1).

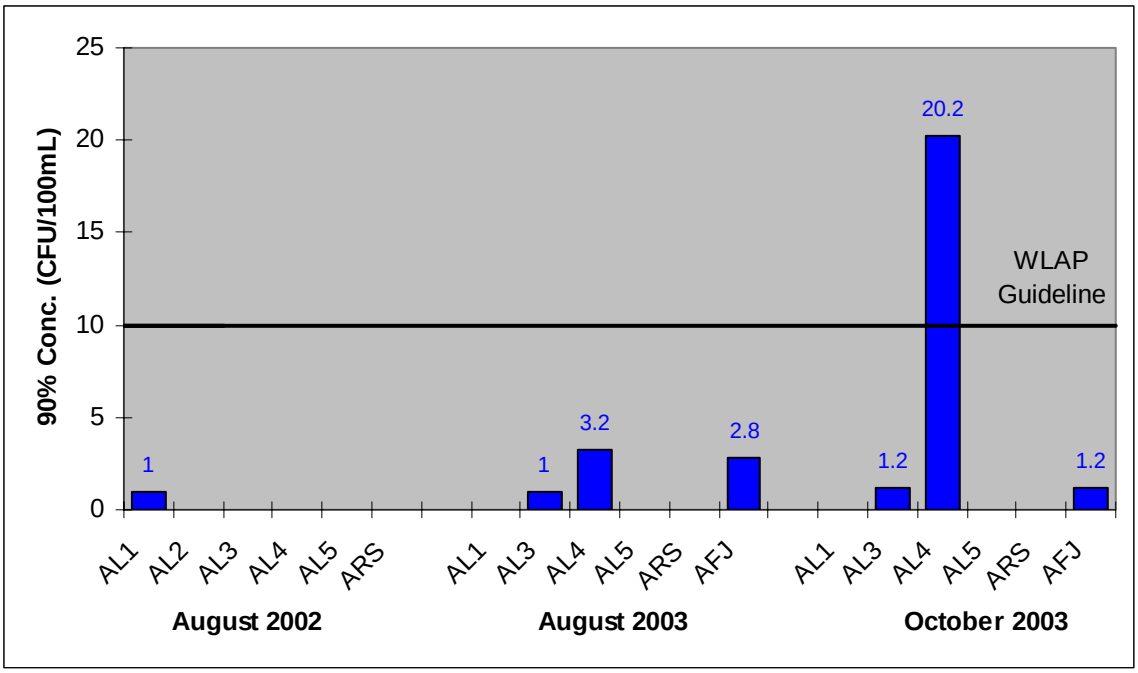
4.4 Five Mile Reserve Groundwater Well

Groundwater is not a common drinking water source in the Atlin area; however, there are at least two known wells that serve individual residences on the Five Mile Reserve south from the community. The wells are located close together and likely draw from the same aquifer. They are estimated to be 80 m to 100 m deep (Holman and Keleher, 2002 pers. comm.). One groundwater well (**AGW**) on the Five Mile Reserve was included in the 2002-03 sampling program (Figure 1). No concerns related to this water have been raised and the purpose of the testing the well was to determine groundwater quality in the Atlin area. Water samples were taken from an outside tap on a residence.

5.0 RESULTS AND DISCUSSION

Complete results of water quality sampling in the Atlin area are included in the accompanying Data Appendix. Figures 4-6 summarize microbiological indicator results from Atlin area surface water sites (**AL1-AL5**, **ARS**, **AFJ**). ***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.*** Groundwater results from **AGW** are discussed separately in Section 8.4 because the *No Treatment* guideline of zero organisms applies to microbiological indicators in groundwater samples.

Figure 4: Fecal Coliform 90th Percentile Concentrations[5] at Atlin Sampling Sites



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

Figure 5: *E. Coli* 90th Percentile Concentrations at Atlin Sampling Sites

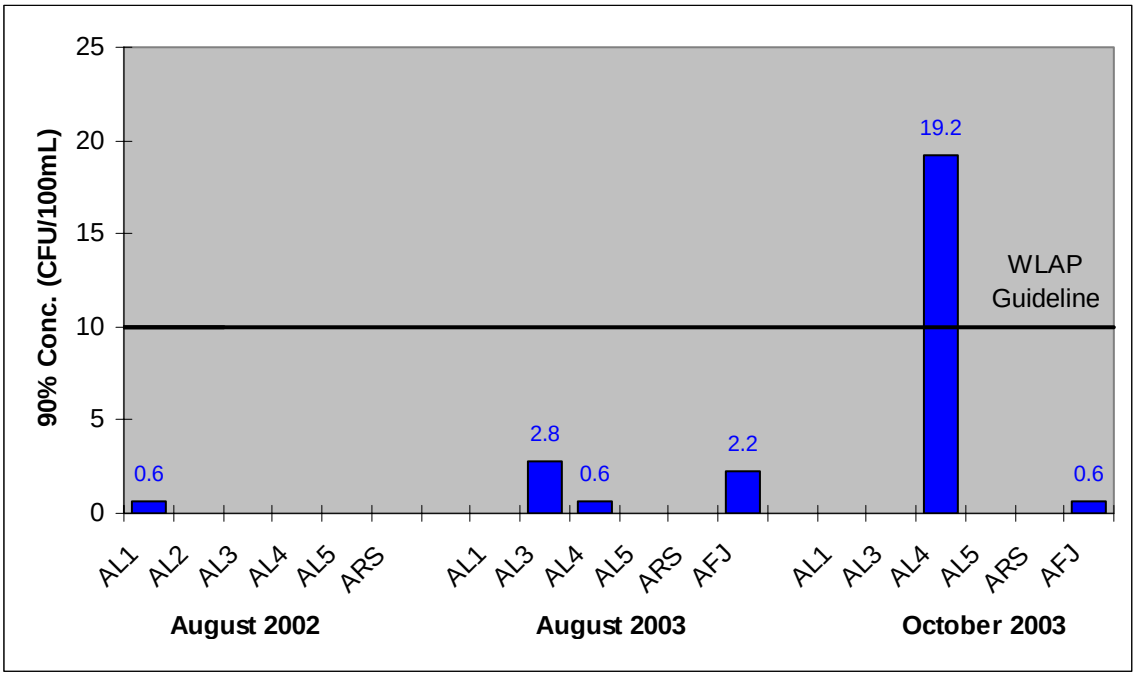
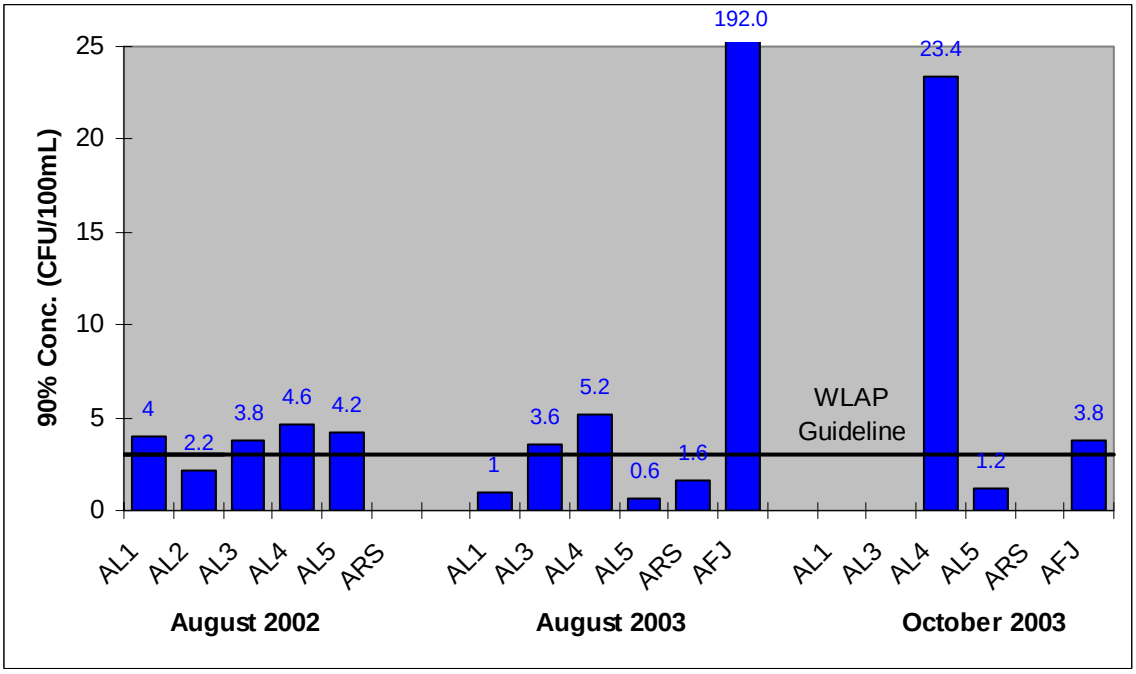


Figure 6: Enterococci 90th Percentile Concentrations at Atlin Sampling Sites



5.1 Atlin Lake (AL1 – AL5)

Atlin Lake sampling sites showed all three microbiological indicators in 2002-03. Samples from **AL2** and **AL5** did not contain fecal coliforms or *E. coli*, and other sites showed low concentrations on isolated occasions. At all sites, enterococci were detected more frequently and at higher concentrations than the other two indicators. One sample from **AL4** (October 28, 2003) contained unusually high concentrations of all three indicators, in conjunction with a spike in turbidity. It is suspected that this occurrence is related to some or all of the following: a violent storm that resulted in six to eight foot waves hitting the shore near the intake, the pulling of houseboats from the lake near the intake, and the hanging of a dead moose (ageing the meat) over the water for a week near the intake (Keleher, 2003 pers. comm.).

The 90th percentile concentrations for fecal coliforms and *E. coli* (Figures 4 and 5) did not meet WLAP guideline levels at **AL4** in October 2003, a result of the elevated concentrations in the October 28 sample. Enterococci 90th percentile concentrations did not meet WLAP guidelines at four of the five sites: the guideline was exceeded in one of three sample sets from **AL1**, two of three sets from **AL3**, three of three sets from **AL4** and one of five sets from **AL5** (Figure 6). Although individual sites showed seasonal changes in microbiological water quality, no overall seasonal trend was observed in Atlin Lake source water quality.

Most Atlin Lake samples had very low turbidity values and the WLAP guideline of ≤ 5 NTU was not met in only one sample from **AL4** (October 28, 2003). Samples were generally below the recommended level of 1 NTU for water entering a distribution system so effectiveness of water treatment and/or disinfection should not be compromised by suspended material in the water. Colour values were 5 TCU or less at all times and met the WLAP drinking water guideline. All other physical and chemical parameters were also below WLAP drinking water guidelines and mercury was below the MDL at the three sites where it was sampled in August 2002.

Sewage Contamination in Atlin Lake

Microbiological indicators were present in Atlin Lake, but they were generally detected in low concentrations. In most samples, chloride, ammonia, and nitrate (which are indicative of sewage contamination) were not detected. The occurrence of all three indicators (at concentrations greater than 30 CFU/100 mL) at **AL4** on October 28 is unusual and it is likely that contamination of the source water or water system infrastructure (water line, pump house, tap, etc.) occurred on this date (see above). Other sites did not show combinations of parameters that would suggest sewage contamination during the sampling seasons. Enterococci 90th percentile concentrations were close to the guideline level in many seasons, and further monitoring is recommended to determine the level of treatment required. Sampling in other seasons, especially in the late winter and early-spring should be conducted to investigate seasonal patterns in water quality, and to monitor the source water at times when sewage contamination is suspected and most likely to be occurring.

5.2 Warm Bay Road Spring (ARS)

Enterococci were detected in low concentrations on three dates in August 2003. No other microbiological indicators were found in samples from **ARS** and 90th percentile concentrations for all indicators met WLAP guidelines (for *Disinfection Only*) in all sample sets (Figures 4 to 6).

Turbidity was very low and the WLAP guideline of ≤ 5 NTU was met at all times. Colour values were also low and met guideline levels. Other physical and chemical parameters were all below WLAP drinking water guidelines.

5.3 Fourth of July Creek (AFJ)

Enterococci were detected in most samples, with very high concentrations observed in August, 2003. Fecal coliforms and *E. coli* were also detected in samples from **AFJ**, but observed concentrations were significantly lower. Fecal coliform and *E. coli* 90th percentile concentrations met the WLAP guideline in both seasons (Figures 4 and 5). The enterococci 90th percentiles did not meet WLAP guidelines in either season, and the August concentration (90th percentile) was 192.0 CFU/100 mL, which far exceeds the guideline level (Figure 6).

Turbidity in Fourth of July Creek was low and the WLAP guideline of ≤ 5 NTU was met at all times. Colour values at **AFJ** met the 15 TCU guideline at all times, and other physical and chemical parameters were within acceptable (WLAP) guideline levels.

It is not known what caused the elevated bacteria levels in August, or if the levels are common. Spikes in enterococci concentrations were not accompanied by increases in turbidity. A 1983 study indicated that extensive beaver dams exist over a 10 km stretch in the creek about 22 km from the mouth, and if beavers are still present, they may be partly responsible for the elevated enterococci concentrations. Levels of chloride, ammonia and nitrate do not suggest that sewage is the cause of the bacteria, but further research should be conducted to evaluate sewage disposal methods being used by homes alongside the creek. Sampling in other seasons should also be conducted to investigate if the microbiological indicator concentrations observed in 2003 are common, and to determine if there are seasonal trends in water quality.

5.4 Five Mile Reserve Groundwater Well (AGW)

Fecal coliforms and *E. coli* were not found in any samples from **AGW** and the water met the (*No Treatment*) WLAP guidelines that apply for groundwater. Enterococci were detected in one sample in 2002 (August 27 sample had a concentration of 4 CFU/100 mL). Because the *No Treatment* guideline (zero organisms detected) applies to microbiological indicators in groundwater samples, every detection represents a guideline exceedence and water from **AGW** did mot meet the guideline once. Water from the well does not receive treatment prior to consumption; further sampling is required to confirm if the occurrence of Enterococci in the source water is an ongoing health concern.

Turbidity in **AGW** samples met the WLAP guideline of ≤ 5 NTU at all times. Colour values were 5 TCU or less at all times and met the 15 TCU guideline. Other physical and chemical parameters were also within acceptable (WLAP) guideline levels.

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 Atlin area drinking water sources. Remington (2002) found that monitoring only in mid-summer 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 objectives monitoring of surface water sources, which includes spring and fall periods. Many individuals have commented that Atlin drinking water quality tends to be fine in the summer, but deteriorates significantly in the winter months (Ciocca, Drgon, Holman, Keleher and Otto pers. comm. 2002). The *Atlin Community Health Study* (Robson, 2002) describes, with photos, sewage running over the ice into the lake. Furthermore, drinking water quality is widely speculated to be a contributing factor to outbreaks of illness in the spring months. Due to sampling logistics, it was not possible to conduct sampling during the late winter/early spring in 2003. Those designing future sampling programs in Atlin should recognize possible seasonal variability in source water quality, and experiments should be designed to quantify the variability and investigate its causes.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Anecdotal information suggests that there are water quality concerns in the Atlin area. This report provides some objective confirmation of these concerns. Results of sampling in 2002-2003 are summarized below:

Atlin Lake

- All microbiological indicators were detected in Atlin Lake source water. Enterococci were found more frequently and at higher concentrations than other indicators. Enterococci 90th percentile concentrations exceeded the guideline level many times, indicating that disinfection alone may not be sufficient to ensure potability of the water. ***The surface water guideline used in this study assumes that the raw water is receiving disinfection prior to consumption. Water users should be cautioned that water is not assumed safe for consumption without disinfection, even when the guideline is met.*** The WLAP guidelines for fecal coliforms and *E. coli* were not met at one site in October 2003, due to a spike in concentrations on one date. Overall, Atlin Lake source water is subject to occasional contamination by fecal material and is not safe to drink untreated.
- Turbidity values were generally low, and the WLAP guideline was not met only once. All colour values were below the guideline level, and other physical and chemical parameters were below (WLAP) guidelines on all dates at all sites.
- Microbiological indicators were commonly detected in Atlin Lake, but results from other sewage indicator parameters do not suggest that the lake was contaminated by domestic sewage during the sampling seasons. Further seasonal monitoring is recommended.
- When tested, mercury was not found in any Atlin Lake samples.

Warm Bay Road Spring

- Enterococci were detected in low concentrations on three dates in August 2003, but all (WLAP) microbiological indicator guidelines were met. The enterococci occurrences indicate that the spring is subject to occasional contamination by fecal material and is not safe to drink untreated.
- Turbidity, colour, and other physical and chemical parameters were well below (WLAP) guideline levels.

Fourth of July Creek

- Enterococci were detected in most samples, and August 2003 concentrations were very high. The enterococci guideline was not met in any sample set. Fecal coliform and *E. coli* concentrations were low and 90th percentiles met WLAP guideline levels. Overall, this drinking water source is not safe to drink untreated.
- Turbidity, colour, and other physical and chemical parameters were well below guideline levels.

Five Mile Reserve Groundwater Well

- Enterococci were the only microbiological indicator detected, and it was found in only one sample. ***For groundwater, application of the No Treatment guideline means that every indicator detection is a guideline exceedence***, so microbiological indicator guidelines were not met once. Water from the well does not receive treatment prior to consumption, and further sampling is required to confirm if the occurrence of enterococci is an ongoing health concern.
- Turbidity, colour, and other physical and chemical parameters were well below (WLAP) guideline levels.

6.2 Recommendations

Based on monitoring conducted in 2002-03, we recommend that:

- WLAP should continue to collaborate with agencies (such as the NHA and TRTFN) interested in water quality in the Atlin area, and monitoring of Atlin Lake should continue at the five established sampling sites.
- Through collaboration with NHA staff, residents should be informed of the need protect drinking water sources from contamination and to disinfect all surface water supplies prior to consumption. Lake water users should also be encouraged to extend intake pipes further into the lake to reduce contamination risks.
- Although sampling results have already been provided to those using each source, drinking water source quality data should be made available to other interested parties.
- Monitoring programs should include sampling in different seasons to investigate seasonal water quality patterns. Additional sampling is needed at Fourth of July Creek to assess year-round water quality and investigate the high enterococci levels, and at Atlin Lake sites to specifically determine if sewage contamination occurs. A new raw water sampling tap should be established at **AL2** so source water monitoring can continue at this site.
- Enterococci and *E. coli*. should remain in use and should be considered in water quality objectives development and updates.
- To further assess possible mercury contamination in Atlin Lake, a caged bi-valve reconnaissance study (using "Musselwatch" design) should be conducted.

REFERENCES

American Public Health Association, American Water Works Association, Water Environment Federation. 1998. Standard Methods for the Examination of Water and Wastewater (20th edition). *Edited by* Greenberg, A.E., L. S. Clesceri, and A. D. Eaton. American Public Health Association, Washington DC.

Atlin Community Website. 2002. http://www.atlin.net

Canadian Council of Ministers of the Environment (CCME). 1999, revised March 2001. Canadian Environmental Quality Guidelines. CCME, Winnipeg.

Ciocca, Paolo. 2002. Personal communication. Environmental Health Officer, Health Canada (Vancouver).

Clark, M. J. (editor). 1996. British Columbia Field Sampling Manual. Laboratory and Systems Management, Ministry of Environment, Lands, and Parks, Victoria.

Connor, M. 2002. Personal communication. Fisheries Biologist, Taku River Tlingit First Nation (Atlin).

Drgon, L. 2002. Personal communication. Environmental Health Officer, Ministry of Health (Terrace).

Holman, G. 2002. Personal communication. Water Delivery Truck Driver and Pump house Operator, Taku River Tlingit First Nation (Atlin).

Keleher, R. 2002 and 2003. Personal communication. Lands and Resources Department, Taku River Tlingit First Nation (Atlin).

Kirkland, R. A. and C. B. J. Gray. 1986. Reconnaissance of the chemical and biological limnology in four large lakes of the Yukon River basin. National Water Research Institute, Pacific and Yukon Region, Environment Canada.

Odense, R. 2002 and 2003. Personal communication. Impact Assessment Biologist, Ministry of Water, Land and Air Protection (Smithers).

Otto, R. 2002. Personal communication. British Columbia Buildings Corporation (Prince George).

Province of British Columbia, BC Environment. 1994. B.C. environmental laboratory manual for the analysis of water, wastewater, sediment, and biological materials. Ministry of Environment, Lands and Parks.

Province of British Columbia, BC Environment. 1998a. British Columbia water quality guidelines (criteria). Water Quality Section, Ministry of Environment, Lands and Parks. http://wlapwww.gov.bc.ca/wat/wq/BCguidelines/approved.html

Province of British Columbia, BC Environment. 1998b. A compendium of working water quality guidelines for British Columbia. Water Quality Section, Ministry of Environment, Lands and Parks. http://wlapwww.gov.bc.ca/wat/wq/BCguidelines/working.html

Province of British Columbia, Provincial Health Officer. 2001. A report on the health of British Columbians. Provincial Health Officer's Annual Report 2000, *Drinking water quality in British Columbia: The public health perspective.* Ministry of Health Services, Victoria. http://www.healthservices.gov.bc.ca/pho/pdf/phoannual2000.pdf.

Province of British Columbia, Ministry of Health Services. 2002. Drinking Water Program website – News release, backgrounder, and cabinet submission from June 19, 2002. http://www.healthservices.gov.bc.ca/protect/water.html

Remington, D. 2002. Drinking water source quality monitoring: Skeena Region 2001.

Robson and Associates Nursing Consultants. 2002. Atlin Community Health Study. Canadian Red Cross.

Sporado, T. 2002. Personal communication. Conservation Officer, Ministry of Water, Land and Air Protection (Atlin).

Warrington, P. D. 1988. Water quality criteria for microbiological indicators. Water Management Branch, Ministry of Environment, Lands and Parks.

LIST OF ACRONYMS

CCME – Canadian Council of Ministers of the Environment

CFU – Colony Forming Unit

EHO – Environmental Health Officer

HC – Health Canada

ICPMS – Inductively Coupled Plasma - Mass Spectrometry

MDL – Method Detection Limit

MF – Membrane Filtration

NHA – Northern Health Authority

NTU – Nephelometric Turbidity Units

QA/QC – Quality Assurance / Quality Control

RPD – Relative Percent Difference

TCU – True Colour Units

TRTFN – Taku River Tlingit First Nation

WLAP – Water, Land and Air Protection

GLOSSARY

Aesthetic objective:	The substance concentration or characteristic of drinking water that can affect its acceptance by consumers. Where an aesthetic objective is specified, the values are below those considered to constitute a health hazard.
Aquifer:	A geological formation that consists of saturated permeable materials that yield economical quantities of water to wells and springs.
Bacteria:	Single-celled, microscopic organisms, some of which cause diseases in plants or animals.
Blank sample:	A sample of distilled, de-ionized water that has been exposed to the sampling environment at the sample site and handled in the same manner as the actual sample (e.g., preserved, filtered). It provides information on contamination resulting from the handling technique and from exposure to the atmosphere.
Colour (True):	A measure of the dissolved colouring compounds in water, attributed to the presence of organic and inorganic materials. Reported in true colour units (TCU).
Coliform bacteria:	A bacteria carried in human and animal wastes. The presence of coliforms in water may indicate contamination from human or animal wastes.
Disinfection:	The process of destroying microorganisms in water by the application of a chemical agent (disinfectant) such as chlorine.
Duplicate sample:	Two samples taken at the same time and place, designed to provide a rough estimate of the overall precision associated with the field technique and laboratory analysis.
Eutrophic:	Describes a lake of high photosynthetic activity.
Eutrophication:	The process of physical, chemical and biological changes associated with nutrient, organic matter and silt enrichment of a water body, that cause it to age.
Groundwater:	Water below the surface of the ground.
Hardness:	A property of water which causes an increase in the amount of soap that is needed to produce foam or lather and that also produces scale in hot water pipes, heaters, boilers and other units in which the temperature of water is increased. Hardness is generally due to the presence of calcium and magnesium in the water. Reported in milligrams per liter (mg/L) as calcium carbonate ($CaCO_3$); greater than 120 mg/L is considered hard; less than 60 mg/L is soft.

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

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

Drinking Water Source Quality Monitoring

Atlin & Area: Atlin Lake and Warm Bay Road Spring

2004 Addendum

A.J. Downie
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Ministry of
Water, Land and Air
Protection

March 2005

2004 SUMMARY OF WATER QUALITY SAMPLING

Introduction

Water quality sampling in 2002-03 revealed microbiological indicators in all Atlin area drinking water sources, indicating occasional low-level contamination of drinking water sources. The study did not find widespread evidence of sewage contamination in Atlin Lake, but recommended that additional sampling be conducted during the late winter and early spring because this time of year has a history of poor water quality conditions.

Most sampling sites that were monitored in 2002-03 are not accessible during the winter (due to frozen water lines, pumps not running, or surface water sources frozen); however, two sampling sites were available for sampling in March 2004. Microbiological indicators, colour and turbidity were tested once per week for five consecutive weeks beginning March 9, and other physical and chemical parameters were tested once on the first sampling date. Sampling was conducted according to the same procedures as 2002-03, and samples were analyzed and interpreted using the same techniques as those from 2002-03 (refer to the 2002-03 report for details). The March 2004 sampling showed low-level contamination by enterococci in the Warm Bay Road Spring, and no contamination in Atlin Lake.

Results

Atlin Lake surface water was sampled at **AL5** (EMS # E249123). Warm Bay Road Spring, site **ARS** (EMS # E249121) was also sampled. Complete results of all water quality sampling at **AL5** and **ARS** are included in Tables 1-4 at the end of this report. Figures 1-3 are updated versions of the 2002-03 charts which summarize microbiological indicator results from all Atlin area surface water sites (**AL1**-**AL5**, **ARS**, **AFJ**). ***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.***

Atlin Lake (AL5)

No microbiological indicators were detected in March 2004, and WLAP drinking water guidelines for all three indicators were met (Figures 1 to 3). Colour values were 5 TCU or less at all times and turbidity values were also low and easily met guideline levels. The physical/chemical parameter sample from March 9 at **AL5** showed results similar to past samples from this site. All measured values were below WLAP drinking water guidelines, but should be interpreted with caution until additional samples confirm if the water quality at this site changes seasonally.

Figure 1: Fecal Coliform 90th Percentile Concentrations[1] at Atlin Sampling Sites

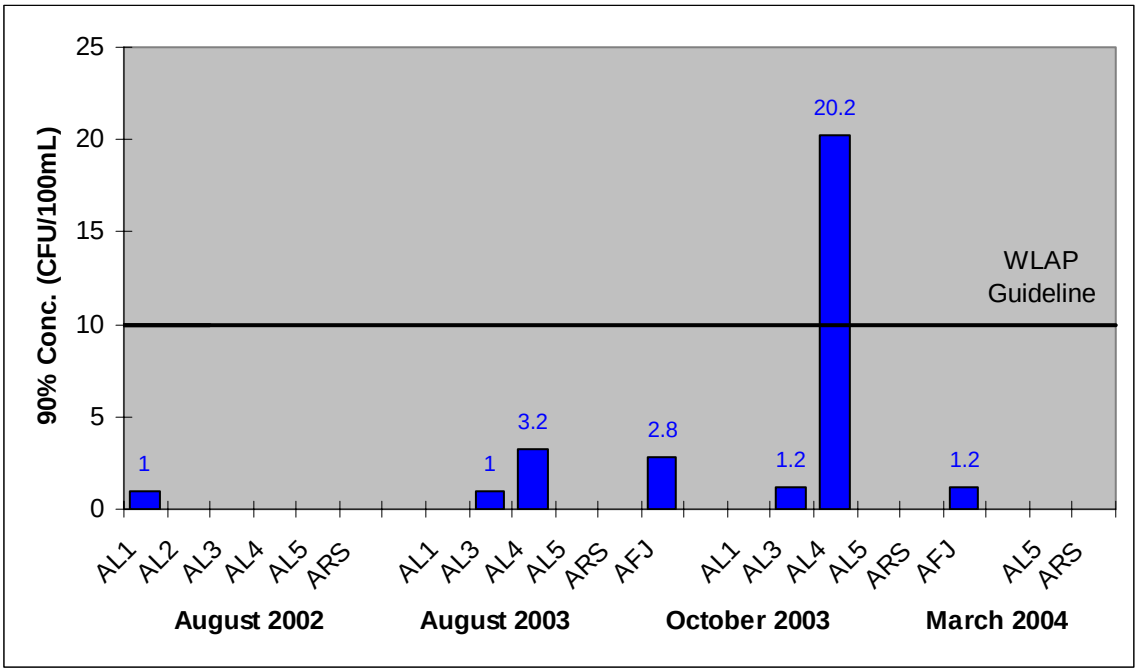
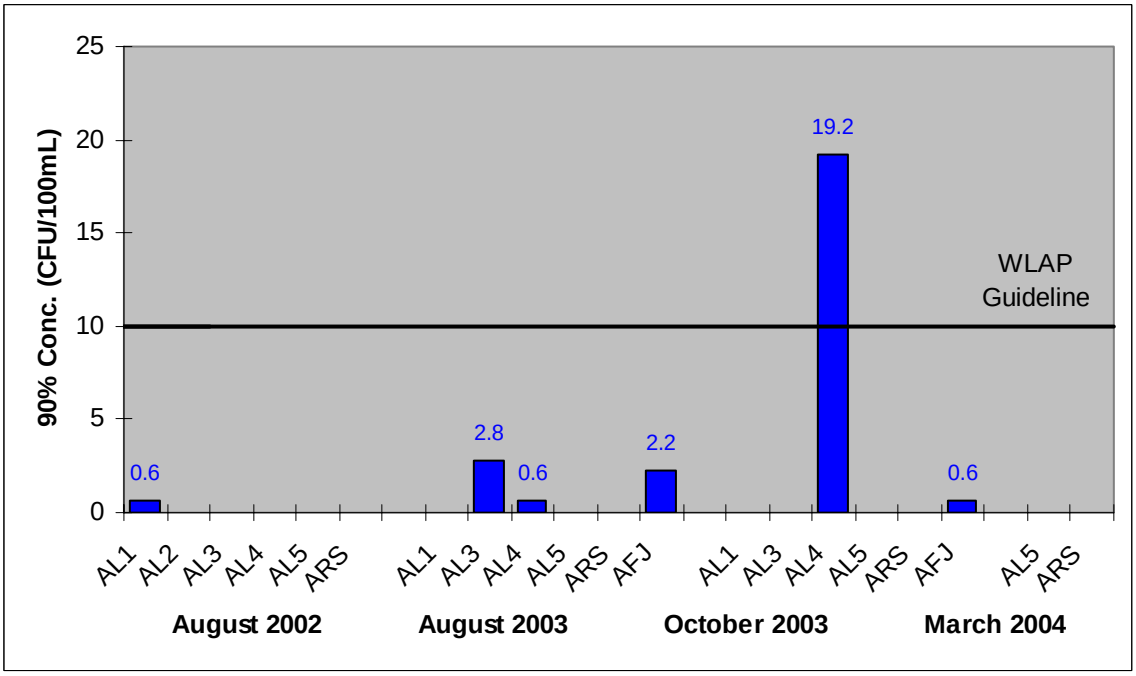
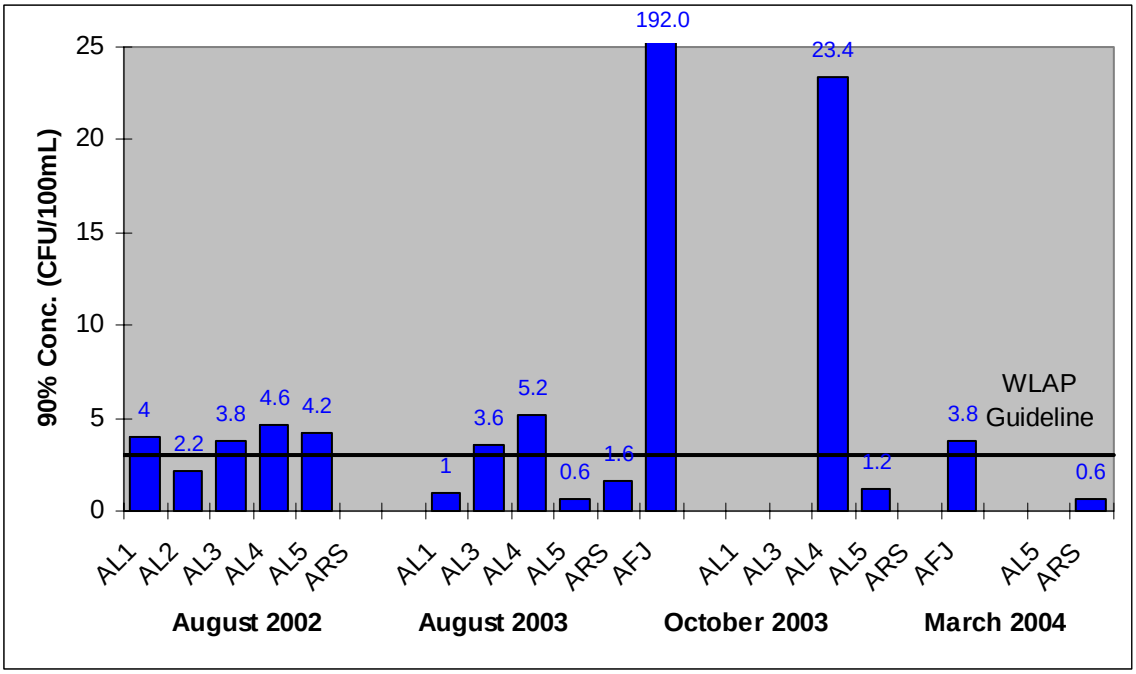


Figure 2: *E. Coli* 90th Percentile Concentrations at Atlin Sampling Sites



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

Figure 3: Enterococci 90th Percentile Concentrations at Atlin Sampling Sites



Warm Bay Road Spring (ARS)

Enterococci were detected in the March 30 sample at a concentration of 1 CFU/100mL. No other microbiological indicators were found in samples from **ARS** and 90th percentile concentrations for all indicators met WLAP guidelines (for *Disinfection Only*). Colour, turbidity, and other physical and chemical parameters were below WLAP drinking water guidelines.

Summary

The results and guideline comparisons discussed above reflect conditions at the time of sampling and do not necessarily represent all conditions in the Atlin area drinking water sources. In March 2004, microbiological indicators were not detected and there is no evidence to suggest sewage contamination of Atlin Lake was occurring near **AL5**. However, local residents and Environmental Health professionals (Ciocca, Drgon, Holman, Keleher and Otto pers. comm. 2002) suspect that Atlin Lake water quality can deteriorate significantly in the winter months (especially near the town site), and may have been a contributing factor to past outbreaks of illness in the community. Furthermore, sewage contamination has been documented by Robson & Associates (2002). Thus, it is recommended that Atlin area residents and businesses be reminded of the importance of properly maintaining and servicing their sewage holding tanks to avoid

source water contamination from this source. Overall, results from 2002-04 indicate that Atlin Lake source water is subject to occasional contamination by fecal material and is not safe to drink untreated. Establishing a new raw water sampling tap at **AL2** is recommended, and periodic monitoring and reporting of this drinking water source should occur.

The occurrence of enterococci in the Warm Bay Road Spring (**ARS**) illustrates that this source may occasionally be contaminated by fecal material, and disease-causing organisms may also be present. This source is not approved nor is its quality monitored by the NHA, and it is not safe for consumption unless it is treated.

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

Table 1A – AL5 (EMS # E249123)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Color True (Col.unit)	Turbidity (NTU)
18-Aug-02	<1	<1	<1	5	1.08
27-Aug-02	<1	<1	5	5	0.36
04-Sep-02	<1	<1	1	5	0.44
11-Sep-02	<1	<1	3	5	0.38
17-Sep-02	<1	<1	<1	5	0.34
06-Aug-03	<1	<1	<1	<5	1.11
13-Aug-03	<1	<1	<1	<5	0.89
19-Aug-03	<1	<1	<1	<5	0.70
26-Aug-03	<1	<1	1	5	0.51
02-Sep-03	<1	<1	<1	<5	0.57
06-Oct-03	<1	<1	2	5	1.96
14-Oct-03	<1	<1	<1	5	0.95
21-Oct-03	<1	<1	<1	5	0.50
28-Oct-03	<1	<1	<1	<5	0.80
04-Nov-03	<1	<1	<1	<5	0.52
09-Mar-04	<1	<1	<1	5	0.50
14-Mar-04	<1	<1	<1	<5	0.40
22-Mar-04	<1	<1	<1	<5	0.50
30-Mar-04	<1	<1	<1	<5	0.33
06-Apr-04	<1	<1	<1	<5	0.42

Table 1B – AL5 (EMS # E249123)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Color True (Col.unit)	Turbidity (NTU)
Guideline:	**<= 10 (90%)**	**<= 10 (90%)**	**<= 3 (90%)**	**<= 15**	**<= 5**
August, 2002					
Maximum	<1	<1	5	5	1.08
Average	<1	<1	1.8	5	0.52
90th percentile	<1	<1	4.2	-	-
Guideline	**Met**	**Met**	**Not Met**	**Met**	**Met**
Exceedences	-	-	-	0	0
August, 2003					
Maximum	<1	<1	1	5	1.11
Average	<1	<1	0.2	5	0.76
90th percentile	<1	<1	0.6	-	-
Guideline	**Met**	**Met**	**Met**	**Met**	**Met**
Exceedences	-	-	-	0	0
October, 2003					
Maximum	<1	<1	2	5	1.96
Average	<1	<1	0.4	5	0.95
90th percentile	<1	<1	1.2	-	-
Guideline	**Met**	**Met**	**Met**	**Met**	**Met**
Exceedences	-	-	-	0	0
March, 2004					
Maximum	<1	<1	<1	5	0.50
Average	<1	<1	<1	5	0.43
90th percentile	<1	<1	<1	-	-
Guideline	**Met**	**Met**	**Met**	**Met**	**Met**
Exceedences	-	-	-	0	0

Table 2A – ARS (EMS # E249121)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Color True (Col.unit)	Turbidity (NTU)
18-Aug-02	<1	<1	<1	5	0.82
27-Aug-02	<1	<1	<1	5	0.10
04-Sep-02	<1	<1	<1	5	0.10
11-Sep-02	<1	<1	<1	5	0.12
17-Sep-02	<1	<1	<1	5	0.10
06-Aug-03	<1	<1	<1	5	0.12
13-Aug-03	<1	<1	1	5	<0.1
19-Aug-03	<1	<1	1	5	0.20
26-Aug-03	<1	<1	<1	5	0.13
02-Sep-03	<1	<1	2	5	0.13
06-Oct-03	<1	<1	<1	5	0.27
14-Oct-03	<1	<1	<1	5	<0.1
21-Oct-03	<1	<1	<1	5	<0.1
28-Oct-03	<1	<1	<1	5	<0.1
04-Nov-03	<1	<1	<1	5	0.13
09-Mar-04	<1	<1	<1	5	0.20
14-Mar-04	<1	<1	<1	<5	0.34
22-Mar-04	<1	<1	<1	<5	<0.1
30-Mar-04	<1	<1	1	<5	0.20
06-Apr-04	<1	<1	<1	5	0.18

Table 2B – ARS (EMS # E249121)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Color True (Col.unit)	Turbidity (NTU)
Guideline:	**<= 10 (90%)**	**<= 10 (90%)**	**<= 3 (90%)**	**<= 15**	**<= 5**
August, 2002					
Maximum	<1	<1	<1	5	0.82
Average	<1	<1	<1	5	0.25
90th percentile	<1	<1	<1	-	-
Guideline	**Met**	**Met**	**Met**	**Met**	**Met**
Exceedences	-	-	-	0	0
August, 2003					
Maximum	<1	<1	2	5	0.20
Average	<1	<1	0.8	5	0.14
90th percentile	<1	<1	1.6	-	-
Guideline	**Met**	**Met**	**Met**	**Met**	**Met**
Exceedences	-	-	-	0	0
October, 2003					
Maximum	<1	<1	<1	5	0.27
Average	<1	<1	<1	5	0.14
90th percentile	<1	<1	<1	-	-
Guideline	**Met**	**Met**	**Met**	**Met**	**Met**
Exceedences	-	-	-	0	0
March, 2004					
Maximum	<1	<1	1	5	0.34
Average	<1	<1	0.2	5	0.20
90th percentile	<1	<1	0.6	-	-
Guideline	**Met**	**Met**	**Met**	**Met**	**Met**
Exceedences	-	-	-	0	0

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

Table 3A – Atlin Lake Sites (AL1 – AL5)
(Values in mg/L unless otherwise noted)

	AL1 18-Aug-02	AL2 18-Aug-02	AL3 18-Aug-02	AL4 18-Aug-02	AL5 18-Aug-02
PHYSICAL					
pH (pH units)	7.9	7.9	8	7.9	7.9
Specific Conductance (uS/cm)	98	98	98	98	97
Residue Filterable - TDS	n/a	n/a	n/a	n/a	n/a
Hardness Total - T	52.4	52.9	52	52.5	52.6
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a	n/a	n/a
ANIONS					
Chloride Dissolved	0.9	< 0.5	< 0.5	< 0.5	n/a
Fluoride Dissolved	n/a	n/a	n/a	n/a	n/a
CARBON					
Organic Carbon - Total	n/a	n/a	n/a	n/a	n/a
NITROGEN					
Total Kjeldahl N	0.02	< 0.02	0.04	0.03	< 0.02
Total N	< 0.02	< 0.02	0.04	0.03	< 0.02
Total Organic N	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ammonia N	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Nitrate Nitrogen Dissolved	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Nitrate+Nitrite	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Nitrite Nitrogen	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
PHOSPHORUS					
Ortho-Phosphorus	n/a	n/a	0.001	n/a	n/a
Phosphorus Total Dissolved	n/a	n/a	< 0.002	n/a	n/a
Phosphorus Total	n/a	n/a	< 0.002	n/a	n/a
SULFATE					
Sulfate	n/a	n/a	n/a	n/a	n/a
METALS TOTAL					
Aluminum	0.0296	0.0333	0.0243	0.0308	0.0362
Antimony	0.000143	0.000305	0.000177	0.00015	0.000161
Arsenic	0.0002	0.0003	0.0002	0.0002	0.0002
Barium	0.0344	0.0349	0.0345	0.0351	0.0348
Beryllium	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Bismuth	< 0.00002	0.00017	0.00004	< 0.00002	< 0.00002
Cadmium	< 0.00001	0.00003	< 0.00001	< 0.00001	0.00001
Calcium	15.9	16	15.8	15.9	16
Chromium	0.0003	< 0.0002	< 0.0002	< 0.0002	0.0002
Cobalt	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Copper	0.0015	0.00136	0.00037	0.0005	0.00138
Iron	n/a	n/a	n/a	n/a	n/a
Lead	0.00023	0.00054	0.00002	0.00009	0.00008
Lithium	0.00052	0.00049	< 0.00005	0.00022	0.00038
Magnesium	3.08	3.15	3.04	3.1	3.06
Manganese	0.000913	0.00218	0.000658	0.000608	0.00171
Molybdenum	0.00118	0.00108	0.00108	0.0011	0.00101
Nickel	0.00023	0.00018	0.00016	0.00018	0.00018
Selenium	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0003
Silver	< 0.00002	0.00004	< 0.00002	< 0.00002	< 0.00002
Strontium	0.0677	0.0674	0.0676	0.068	0.0671
Thallium	0.000008	0.000046	0.000003	< 0.000002	0.000002
Tin	< 0.00001	< 0.00001	0.00002	0.00003	< 0.00001
Uranium	0.000578	0.000566	0.000558	0.000562	0.000546
Vanadium	0.00074	0.00049	0.00064	0.00043	0.00069
Zinc	0.0087	0.0272	0.0001	0.0028	0.005
Mercury	n/a	< 0.00005	n/a	< 0.00005	< 0.00005

Table 3A – Atlin Lake Sites (AL1 – AL5) Continued
(Values in mg/L unless otherwise noted)

	AL1 6-Aug-03	AL3 6-Aug-03	AL4 6-Aug-03	AL5 6-Aug-03
PHYSICAL				
pH (pH units)	8	8	8	8
Specific Conductance (uS/cm)	102	101	101	100
Residue Filterable - TDS	60	n/a	68	64
Hardness Total - T	47.9	48.9	50.3	49.9
Alkalinity Total (mg/L CaCO3)	44.5	44.4	43.8	43.8
ANIONS				
Chloride Dissolved	< 0.5	< 0.5	< 0.5	< 0.5
Fluoride Dissolved	0.09	0.09	0.09	0.09
CARBON				
Organic Carbon - Total	n/a	n/a	n/a	n/a
NITROGEN				
Total Kjeldahl N	n/a	n/a	n/a	n/a
Total N	n/a	n/a	n/a	n/a
Total Organic N	n/a	n/a	n/a	n/a
Ammonia N	< 0.005	< 0.005	< 0.005	< 0.005
Nitrate Nitrogen Dissolved	< 0.02	< 0.02	< 0.02	< 0.02
Nitrate+Nitrite	0.009	0.006	0.007	0.006
Nitrite Nitrogen	0.002	< 0.002	< 0.002	< 0.002
PHOSPHORUS				
Ortho-Phosphorus	n/a	n/a	n/a	n/a
Phosphorus Total Dissolved	n/a	n/a	n/a	n/a
Phosphorus Total	n/a	0.006	n/a	n/a
SULFATE				
Sulfate	5.4	5.5	5.8	5.7
METALS TOTAL				
Aluminum	0.0222	0.0215	0.0244	0.0307
Antimony	0.000155	0.000154	0.000154	0.000158
Arsenic	0.0004	0.0004	0.0004	0.0004
Barium	0.0347	0.0344	0.0348	0.0351
Beryllium	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Bismuth	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Cadmium	0.00001	< 0.00001	< 0.00001	0.00006
Calcium	14.4	14.8	15.2	15.1
Chromium	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Cobalt	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Copper	0.00889	0.0002	0.00041	0.00141
Iron	0.01	< 0.005	0.01	0.14
Lead	0.00032	< 0.00001	0.00004	0.00001
Lithium	0.00077	0.00077	0.00067	0.00068
Magnesium	2.89	2.91	2.99	2.95
Manganese	0.000486	0.000468	0.000579	0.00249
Molybdenum	0.00116	0.00116	0.00117	0.00105
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	0.067	0.0679	0.0681	0.0683
Thallium	< 0.000002	< 0.000002	< 0.000002	< 0.000002
Tin	< 0.00001	0.00001	< 0.00001	< 0.00001
Uranium	0.000556	0.000586	0.000574	0.000575
Vanadium	< 0.00006	0.00008	0.00009	0.0001
Zinc	0.0243	0.0002	0.0035	0.0068
Mercury	n/a	n/a	n/a	n/a

Table 3A – Atlin Lake Sites (AL1 – AL5) Continued
(Values in mg/L unless otherwise noted)

	AL1 6-Oct-03	AL3 6-Oct-03	AL4 6-Oct-03	AL5 6-Oct-03
PHYSICAL				
pH (pH units)	7.1	7.5	7.5	7.4
Specific Conductance (uS/cm)	100	99	100	100
Residue Filterable - TDS	62	60	62	68
Hardness Total - T	49.9	49.1	50.6	51.9
Alkalinity Total (mg/L CaCO3)	41.1	41.3	41.1	41.5
ANIONS				
Chloride Dissolved	< 0.5	< 0.5	< 0.5	< 0.5
Fluoride Dissolved	0.06	0.08	0.09	0.06
CARBON				
Organic Carbon - Total	n/a	n/a	n/a	n/a
NITROGEN				
Total Kjeldahl N	n/a	n/a	n/a	n/a
Total N	n/a	n/a	n/a	n/a
Total Organic N	n/a	n/a	n/a	n/a
Ammonia N	< 0.005	< 0.005	< 0.005	0.015
Nitrate Nitrogen Dissolved	< 0.02	< 0.02	< 0.02	< 0.02
Nitrate+Nitrite	0.009	0.007	< 0.002	0.007
Nitrite Nitrogen	0.002	0.004	0.002	0.003
PHOSPHORUS				
Ortho-Phosphorus	n/a	n/a	n/a	n/a
Phosphorus Total Dissolved	n/a	n/a	n/a	n/a
Phosphorus Total	n/a	< 0.002	n/a	n/a
SULFATE				
Sulfate	6.3	6.6	6.1	6.9
METALS TOTAL				
Aluminum	0.0331	0.0512	0.0494	0.0535
Antimony	0.000167	0.000158	0.000157	0.000149
Arsenic	0.0003	0.0004	0.0004	0.0003
Barium	0.0363	0.0321	0.0334	0.0323
Beryllium	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Bismuth	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Cadmium	0.00002	< 0.00001	< 0.00001	0.00001
Calcium	15.2	14.9	15.2	15.8
Chromium	0.0003	0.0003	0.0005	0.0005
Cobalt	0.000014	0.000008	0.00002	0.00002
Copper	0.00597	0.00027	0.00029	0.00053
Iron	0.023	0.046	0.047	0.094
Lead	0.00023	0.00005	0.00005	0.00007
Lithium	0.00057	0.00061	0.00068	0.00057
Magnesium	2.89	2.89	3.07	3.03
Manganese	0.00128	0.00132	0.00162	0.0021
Molybdenum	0.0011	0.00116	0.00114	0.00105
Nickel	0.00028	0.00018	0.00034	0.00027
Selenium	0.0002	0.0004	0.0002	< 0.0002
Silver	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Strontium	0.0667	0.0595	0.0612	0.06
Thallium	0.000004	0.000003	0.000002	0.000002
Tin	< 0.00001	< 0.00001	0.00001	< 0.00001
Uranium	0.000458	0.000652	0.000684	0.000619
Vanadium	0.00022	0.00028	0.00035	0.00034
Zinc	0.0295	0.0006	0.0004	0.0026
Mercury	n/a	n/a	n/a	n/a

Table 3A – Atlin Lake Sites (AL1 – AL5) Continued
(Values in mg/L unless otherwise noted)

	AL5 9-Mar-04	AL5 DUP* 9-Mar-04	Drinking Water Guideline		
PHYSICAL					
pH (pH units)	7.8	7.8	≤ 8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	107	107	≤ 700	mac	Met
Residue Filterable - TDS	58	48	≤ 500	ao	Met
Hardness Total - T	52.1	53.1	≤ 500	mac	Met
Alkalinity Total (mg/L CaCO3)	47.8	47.4			
ANIONS					
Chloride Dissolved	< 0.5	< 0.5	≤ 250	ao	Met
Fluoride Dissolved	0.09	0.09	≤ 1.5	mac	Met
CARBON					
Organic Carbon - Total	n/a	n/a	≤ 4	mac (THM)	
NITROGEN					
Total Kjeldahl N	n/a	n/a			
Total N	n/a	n/a			
Total Organic N	n/a	n/a			
Ammonia N	0.007	0.013			
Nitrate Nitrogen Dissolved	< 0.02	< 0.02	≤ 10	mac	Met
Nitrate+Nitrite	0.016	0.017			
Nitrite Nitrogen	0.002	0.003	≤ 1	mac	Met
PHOSPHORUS					
Ortho-Phosphorus	n/a	n/a			
Phosphorus Total Dissolved	n/a	n/a			
Phosphorus Total	n/a	n/a	≤ 0.01	mac (lakes)	Met
SULFATE					
Sulfate	6.3	6.8	≤ 500	ao	Met
METALS TOTAL					
Aluminum	0.0202	0.0226	≤ 0.2	mac	Met
Antimony	0.000147	0.00015	≤ 0.006	imac	Met
Arsenic	0.0003	0.0003	≤ 0.025	imac	Met
Barium	0.0335	0.0356	≤ 1	mac	Met
Beryllium	< 0.00002	< 0.00002			
Bismuth	< 0.00002	< 0.00002			
Cadmium	0.00001	0.00002	≤ 0.005	mac	Met
Calcium	15.7	16			
Chromium	0.0002	0.0003	≤ 0.05	mac	Met
Cobalt	< 0.000005	< 0.000005			
Copper	0.00106	0.0017	≤ 1	ao	Met
Iron	0.076	0.078	≤ 0.3	ao	Met
Lead	0.00009	0.00012	≤ 0.01	mac	Met
Lithium	0.00062	0.00072			
Magnesium	3.14	3.19	≤ 100	ao	Met
Manganese	0.00107	0.00133	≤ 0.05	ao	Met
Molybdenum	0.00109	0.00108	≤ 0.25	mac	Met
Nickel	< 0.00005	< 0.00005			
Selenium	0.0003	0.0003	≤ 0.01	mac	Met
Silver	< 0.00002	< 0.00002			
Strontium	0.0651	0.0686			
Thallium	< 0.000002	0.000002			
Tin	0.00002	0.00005			
Uranium	0.000582	0.000625	≤ 0.02	imac	Met
Vanadium	0.00021	0.00022	≤ 0.1	mac	Met
Zinc	0.0106	0.0112	≤ 5	ao	Met
Mercury	n/a	n/a	≤ 0.001	mac	Met

* Duplicate sample

Table 3B – Atlin Lake Sites (AL1 – AL5)
(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline		
PHYSICAL							
pH (pH units)	14	7.1	8.0	7.8	≤	8.5	ao (>6.5)
Specific Conductance (uS/cm)	14	97	107	100	≤	700	mac
Residue Filterable - TDS	8	48	68	61	≤	500	ao
Hardness Total - T	14	47.9	53.1	51.1	≤	500	mac
Alkalinity Total (mg/L CaCO3)	9	41.1	47.8	43.7			
ANIONS							
Chloride Dissolved	13	0.5	0.9	0.5	≤	250	ao
Fluoride Dissolved	9	0.06	0.09	0.08	≤	1.5	mac
CARBON							
Organic Carbon - Total	0				≤	4	mac (THM)
NITROGEN							
Total Kjeldahl N	5	0.02	0.04	0.03			
Total N	5	0.02	0.04	0.03			
Total Organic N	5	0.1	0.1	0.1			
Ammonia N	14	0.005	0.015	0.006			
Nitrate Nitrogen Dissolved	14	0.02	0.02	0.02	≤	10	mac
Nitrate+Nitrite	14	0.002	0.017	0.006			
Nitrite Nitrogen	14	0.002	0.004	0.002	≤	1	mac
PHOSPHORUS							
Ortho-Phosphorus	1	0.001	0.001	0.001			
Phosphorus Total Dissolved	1	0.002	0.002	0.002			
Phosphorus Total	3	0.002	0.006	0.003	≤	0.01	mac (lakes)
SULFATE							
Sulfate	9	5.4	6.9	6.1	≤	500	ao
METALS TOTAL							
Aluminum	14	0.0202	0.0535	0.0322	≤	0.2	mac
Antimony	14	0.00014	0.00031	0.00017	≤	0.006	imac
Arsenic	14	0.0002	0.0004	0.0003	≤	0.025	imac
Barium	14	0.03210	0.03630	0.03439	≤	1	mac
Beryllium	14	0.00002	0.00002	0.00002			
Bismuth	14	0.00002	0.00017	0.00003			
Cadmium	14	0.00001	0.00006	0.00002	≤	0.005	mac
Calcium	14	14.40	16.00	15.46			
Chromium	14	0.0002	0.0005	0.0003	≤	0.05	mac
Cobalt	14	0.000005	0.00002	0.0000078			
Copper	14	0.00020	0.00889	0.00172	≤	1	ao
Iron	9	0.005	0.140	0.053	≤	0.3	ao
Lead	14	0.00001	0.00054	0.00013	≤	0.01	mac
Lithium	14	0.00005	0.00077	0.00055			
Magnesium	14	2.89	3.19	3.03	≤	100	ao
Manganese	14	0.000468	0.002490	0.001254	≤	0.05	ao
Molybdenum	14	0.00101	0.00118	0.00111	≤	0.25	mac
Nickel	14	0.00005	0.00034	0.00015			
Selenium	14	0.0002	0.0004	0.0002	≤	0.01	mac
Silver	14	0.00002	0.00004	0.00002			
Strontium	14	0.059500	0.068600	0.066013			
Thallium	14	0.000002	0.000046	0.000006			
Tin	14	0.00001	0.00005	0.00002			
Uranium	14	0.000458	0.000684	0.000581	≤	0.02	imac
Vanadium	14	0.00006	0.00074	0.00033	≤	0.1	mac
Zinc	14	0.0001	0.0295	0.0089	≤	5	ao
Mercury	3	0.00005	0.00005	0.00005	≤	0.001	mac

Table 4A - ARS
(Values in mg/L unless otherwise noted)

	ARS 18-Aug-02	ARS 6-Aug-03	ARS 6-Oct-03	ARS 9-Mar-04	Drinking Water Guideline		
PYHSICAL							
pH (pH units)	8	8.2	7.8	8.3	≤ 8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	596	622	608	575	≤ 700	mac	Met
Residue Filterable - TDS	n/a	352	350	318	≤ 500	ao	Met
Hardness Total - T	370	361	354	338	≤ 500	mac	Met
Alkalinity Total (mg/L CaCO3)	n/a	334	320	327			
ANIONS							
Chloride Dissolved	n/a	0.7	< 0.05	1	≤ 250	ao	Met
Fluoride Dissolved	n/a	< 0.01	0.04	0.03	≤ 1.5	mac	Met
CARBON							
Organic Carbon - Total	n/a	n/a	n/a	n/a	≤ 4	mac (THM)	
NITROGEN							
Total Kjeldahl N	0.13	n/a	n/a	n/a			
Total N	0.2	n/a	n/a	n/a			
Total Organic N	0.13	n/a	n/a	n/a			
Ammonia N	< 0.005	< 0.005	< 0.005	0.01			
Nitrate Nitrogen Dissolved	0.07	0.08	0.08	0.16	≤ 10	mac	Met
Nitrate+Nitrite	0.066	0.081	0.083	0.161			
Nitrite Nitrogen	< 0.002	< 0.002	0.004	0.002	≤ 1	mac	Met
PHOSPHORUS							
Ortho-Phosphorus	n/a	n/a	n/a	n/a			
Phosphorus Total Dissolved	n/a	n/a	n/a	n/a			
Phosphorus Total	n/a	n/a	n/a	n/a	≤ 0.01	mac (lakes)	
SULFATE							
Sulfate	n/a	18.3	19.4	20.8	≤ 500	ao	Met
METALS TOTAL							
Aluminum	0.0012	0.0014	0.0012	0.0016	≤ 0.2	mac	Met
Antimony	0.000234	0.000237	0.000225	0.000228	≤ 0.006	imac	Met
Arsenic	0.002	0.0018	0.002	0.0016	≤ 0.025	imac	Met
Barium	0.0536	0.0529	0.0487	0.0507	≤ 1	mac	Met
Beryllium	< 0.00002	< 0.00002	< 0.00002	< 0.00002			
Bismuth	< 0.00002	< 0.00002	< 0.00002	< 0.00002			
Cadmium	0.00003	0.00001	< 0.00001	< 0.00001	≤ 0.005	mac	Met
Calcium	46.5	44.8	43.8	41.7			
Chromium	0.0026	0.0023	0.0132	0.0024	≤ 0.05	mac	Met
Cobalt	< 0.000005	< 0.000005	0.000026	< 0.000005			
Copper	0.00167	0.00109	0.00117	0.00102	≤ 1	ao	Met
Iron	n/a	< 0.005	< 0.005	< 0.005	≤ 0.3	ao	Met
Lead	< 0.00001	< 0.00001	< 0.00001	0.00004	≤ 0.01	mac	Met
Lithium	0.00064	0.00095	0.00095	0.00091			
Magnesium	61.6	60.4	59.4	56.8	≤ 100	ao	Met
Manganese	< 0.000008	0.000095	0.000114	0.000082	≤ 0.05	ao	Met
Molybdenum	0.00078	0.00082	0.00076	0.00088	≤ 0.25	mac	Met
Nickel	0.0142	0.0152	0.0147	0.0126			
Selenium	0.0002	< 0.0002	< 0.0002	0.0004	≤ 0.01	mac	Met
Silver	< 0.00002	< 0.00002	< 0.00002	< 0.00002			
Strontium	0.123	0.115	0.0998	0.114			
Thallium	0.000067	< 0.000002	< 0.000002	< 0.000002			
Tin	0.00003	< 0.00001	< 0.00001	0.00001			
Uranium	0.000156	0.000148	0.00018	0.000178	≤ 0.02	imac	Met
Vanadium	0.00395	0.00076	0.00386	0.00076	≤ 0.1	mac	Met
Zinc	0.0011	0.0006	0.0007	0.0019	≤ 5	ao	Met
Mercury	n/a	n/a	n/a	n/a	≤ 0.001	mac	

Table 4B - ARS
(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline		
PYHSICAL							
pH (pH units)	4	7.8	8.3	8.1	≤	8.5	ao (>6.5)
Specific Conductance (uS/cm)	4	575	622	600	≤	700	mac
Residue Filterable - TDS	3	318	352	340	≤	500	ao
Hardness Total - T	4	338.0	370.0	355.8	≤	500	mac
Alkalinity Total (mg/L CaCO3)	3	320.0	334.0	327.0			
ANIONS							
Chloride Dissolved	3	0.1	1.0	0.6	≤	250	ao
Fluoride Dissolved	3	0.01	0.04	0.03	≤	1.5	mac
CARBON							
Organic Carbon - Total	0				≤	4	mac (THM)
NITROGEN							
Total Kjeldahl N	1	0.13	0.13	0.13			
Total N	1	0.20	0.20	0.20			
Total Organic N	1	0.1	0.1	0.1			
Ammonia N	4	0.005	0.010	0.006			
Nitrate Nitrogen Dissolved	4	0.07	0.16	0.10	≤	10	mac
Nitrate+Nitrite	4	0.066	0.161	0.098			
Nitrite Nitrogen	4	0.002	0.004	0.003	≤	1	mac
PHOSPHORUS							
Ortho-Phosphorus	0						
Phosphorus Total Dissolved	0						
Phosphorus Total	0				≤	0.01	mac (lakes)
SULFATE							
Sulfate	3	18.3	20.8	19.5	≤	500	ao
METALS TOTAL							
Aluminum	4	0.0012	0.0016	0.0014	≤	0.2	mac
Antimony	4	0.00023	0.00024	0.00023	≤	0.006	imac
Arsenic	4	0.0016	0.0020	0.0019	≤	0.025	imac
Barium	4	0.04870	0.05360	0.05148	≤	1	mac
Beryllium	4	0.00002	0.00002	0.00002			
Bismuth	4	0.00002	0.00002	0.00002			
Cadmium	4	0.00001	0.00003	0.00002	≤	0.005	mac
Calcium	4	41.70	46.50	44.20			
Chromium	4	0.0023	0.0132	0.0051	≤	0.05	mac
Cobalt	4	0.000005	0.000026	.000010			
Copper	4	0.00102	0.00167	0.00124	≤	1	ao
Iron	3	0.005	0.005	0.005	≤	0.3	ao
Lead	4	0.00001	0.00004	0.00002	≤	0.01	mac
Lithium	4	0.00064	0.00095	0.00086			
Magnesium	4	56.80	61.60	59.55	≤	100	ao
Manganese	4	0.000008	0.000114	0.000075	≤	0.05	ao
Molybdenum	4	0.00076	0.00088	0.00081	≤	0.25	mac
Nickel	4	0.01260	0.01520	0.01418			
Selenium	4	0.0002	0.0004	0.0003	≤	0.01	mac
Silver	4	0.00002	0.00002	0.00002			
Strontium	4	0.099800	0.123000	0.112950			
Thallium	4	0.000002	0.000067	0.000018			
Tin	4	0.00001	0.00003	0.00002			
Uranium	4	0.000148	0.000180	0.000166	≤	0.02	imac*
Vanadium	4	0.00076	0.00395	0.00233	≤	0.1	mac
Zinc	4	0.0006	0.0019	0.0011	≤	5	ao

Drinking Water Source Quality Monitoring 2002-03

Atlin & Area: Atlin Lake, Warm Bay Road Spring, Fourth of July Creek and Groundwater

DATA APPENDIX

Ministry of
Water, Land and Air
Protection

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

Table 1A - AL1 (EMS # E249120)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
18-Aug-02	1	1	6	5	1.46
27-Aug-02	<1	<1	<1	5	0.60
04-Sep-02	<1	<1	<1	5	0.23
11-Sep-02	<1	<1	<1	5	0.20
17-Sep-02	1	<1	1	5	0.28
06-Aug-03	<1	<1	1	<5	0.36
13-Aug-03	<1	<1	1	<5	0.17
19-Aug-03	<1	<1	<1	<5	0.29
26-Aug-03	<1	<1	<1	5	0.22
02-Sep-03	<1	<1	<1	<5	0.31
06-Oct-03	<1	<1	<1	5	0.47
14-Oct-03	<1	<1	<1	<5	0.39
21-Oct-03	<1	<1	<1	<5	0.32
28-Oct-03	<1	<1	<1	<5	0.43
04-Nov-03	<1	<1	<1	5	0.35

Table 1B - AL1 (EMS # E249120)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**≤ 10 (90%)**	**≤ 10 (90%)**	**≤ 3 (90%)**	**≤ 15**	**≤ 5**
August, 2002					
Maximum	1	1	6	5	1.46
Average	0.4	0.2	1.4	5	0.55
90th percentile	1.0	0.6	4.0	-	-
Guideline	**Met**	**Met**	**Not Met**	**Met**	**Met**
Exceedences	-	-	-	0	0
August, 2003					
Maximum	<1	<1	1	5	0.36
Average	<1	<1	0.4	5	0.27
90th percentile	<1	<1	1.0	-	-
Guideline	**Met**	**Met**	**Met**	**Met**	**Met**
Exceedences	-	-	-	0	0
October, 2003					
Maximum	<1	<1	<1	5	0.47
Average	<1	<1	<1	5	0.39
90th percentile	<1	<1	<1	-	-
Guideline	**Met**	**Met**	**Met**	**Met**	**Met**
Exceedences	-	-	-	0	0

Table 2A - AL2 (EMS # E249118)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
18-Aug-02	<1	<1	<1	5	1.04
27-Aug-02	<1	<1	3	5	0.51
04-Sep-02	<1	<1	<1	5	0.37
11-Sep-02	<1	<1	1	5	0.30
17-Sep-02	<1	<1	<1	5	0.41

Table 2B - AL2 (EMS # E249118)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**<= 10 (90%)**	**<= 10 (90%)**	**<= 3 (90%)**	**<= 15**	**<= 5**
August, 2002					
Maximum	<1	<1	3	5	1.04
Average	<1	<1	0.8	5	0.53
90th percentile	<1	<1	2.2	-	-
Guideline	**Met**	**Met**	**Met**	**Met**	**Met**
Exceedences	-	-	-	0	0

Table 3A - AL3 (EMS # E249119)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
18-Aug-02	<1	<1	5	5	0.92
27-Aug-02	<1	<1	2	5	0.38
04-Sep-02	<1	<1	1	5	0.18
11-Sep-02	<1	<1	1	5	0.30
17-Sep-02	<1	<1	<1	5	0.29
06-Aug-03	<1	<1	<1	<5	0.37
13-Aug-03	1	1	4	<5	0.18
19-Aug-03	1	<1	<1	5	0.36
26-Aug-03	<1	<1	<1	<5	0.27
02-Sep-03	1	4	3	<5	0.50
06-Oct-03	<1	<1	<1	<5	0.77
14-Oct-03	<1	<1	<1	<5	0.52
21-Oct-03	<1	<1	<1	<5	0.30
28-Oct-03	<1	<1	<1	<5	0.23
04-Nov-03	2	<1	<1	<5	0.29

Table 3B - AL3 (EMS # E249119)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**<= 10 (90%)**	**<= 10 (90%)**	**<= 3 (90%)**	**<= 15**	**<= 5**
August, 2002					
Maximum	<1	<1	5	5	0.92
Average	<1	<1	1.8	5	0.41
90th percentile	<1	<1	3.8	-	-
Guideline	**Met**	**Met**	**Not Met**	**Met**	**Met**
Exceedences	-	-	-	0	0
August, 2003					
Maximum	1	4	4	5	0.50
Average	0.6	1.0	1.4	5	0.34
90th percentile	1.0	2.8	3.6	-	-
Guideline	**Met**	**Met**	**Not Met**	**Met**	**Met**
Exceedences	-	-	-	0	0
October, 2003					
Maximum	2	<1	<1	5	0.77
Average	0.4	<1	<1	5	0.42
90th percentile	1.2	<1	<1	-	-
Guideline	**Met**	**Met**	**Met**	**Met**	**Met**
Exceedences	-	-	-	0	0

Table 4A - AL4 (EMS # E249124)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
18-Aug-02	<1	<1	4	5	0.50
27-Aug-02	<1	<1	<1	5	0.40
04-Sep-02	<1	<1	<1	5	0.20
11-Sep-02	<1	<1	5	5	0.47
17-Sep-02	<1	<1	<1	5	0.33
06-Aug-03	1	<1	<1	<5	0.51
13-Aug-03	2	<1	1	<5	0.23
19-Aug-03	4	<1	1	<5	0.36
26-Aug-03	<1	<1	<1	5	0.37
02-Sep-03	<1	1	8	<5	0.41
06-Oct-03	<1	<1	<1	5	1.33
14-Oct-03	<1	<1	<1	<5	0.61
21-Oct-03	<1	<1	<1	<5	0.33
28-Oct-03	33	32	39	5	5.21
04-Nov-03	1	<1	<1	<5	0.29

Table 4B - AL4 (EMS # E249124)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**<= 10 (90%)**	**<= 10 (90%)**	**<= 3 (90%)**	**<= 15**	**<= 5**
August, 2002					
Maximum	<1	<1	5	5	0.50
Average	<1	<1	1.8	5	0.38
90th percentile	<1	<1	4.6	-	-
Guideline	**Met**	**Met**	**Not Met**	**Met**	**Met**
Exceedences	-	-	-	0	0
August, 2003					
Maximum	4	1	8	5	0.51
Average	1.4	0.2	2.0	5	0.38
90th percentile	3.2	0.6	5.2	-	-
Guideline	**Met**	**Met**	**Not Met**	**Met**	**Met**
Exceedences	-	-	-	0	0
October, 2003					
Maximum	33	32	39	5	5.21
Average	6.8	6.4	7.8	5	1.55
90th percentile	20.2	19.2	23.4	-	-
Guideline	**Not Met**	**Not Met**	**Not Met**	**Met**	**Not Met**
Exceedences	-	-	-	0	1

Table 5A - AL5 (EMS # E249123)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
18-Aug-02	<1	<1	<1	5	1.08
27-Aug-02	<1	<1	5	5	0.36
04-Sep-02	<1	<1	1	5	0.44
11-Sep-02	<1	<1	3	5	0.38
17-Sep-02	<1	<1	<1	5	0.34
06-Aug-03	<1	<1	<1	<5	1.11
13-Aug-03	<1	<1	<1	<5	0.89
19-Aug-03	<1	<1	<1	<5	0.70
26-Aug-03	<1	<1	1	5	0.51
02-Sep-03	<1	<1	<1	<5	0.57
06-Oct-03	<1	<1	2	5	1.96
14-Oct-03	<1	<1	<1	5	0.95
21-Oct-03	<1	<1	<1	5	0.50
28-Oct-03	<1	<1	<1	<5	0.80
04-Nov-03	<1	<1	<1	<5	0.52

Table 5B - AL5 (EMS # E249123)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**<= 10 (90%)**	**<= 10 (90%)**	**<= 3 (90%)**	**<= 15**	**<= 5**
August, 2002					
Maximum	<1	<1	5	5	1.08
Average	<1	<1	1.8	5	0.52
90th percentile	<1	<1	4.2	-	-
Guideline	**Met**	**Met**	**Not Met**	**Met**	**Met**
Exceedences	-	-	-	0	0
August, 2003					
Maximum	<1	<1	1	5	1.11
Average	<1	<1	0.2	5	0.76
90th percentile	<1	<1	0.6	-	-
Guideline	**Met**	**Met**	**Met**	**Met**	**Met**
Exceedences	-	-	-	0	0
October, 2003					
Maximum	<1	<1	2	5	1.96
Average	<1	<1	0.4	5	0.95
90th percentile	<1	<1	1.2	-	-
Guideline	**Met**	**Met**	**Met**	**Met**	**Met**
Exceedences	-	-	-	0	0

Table 6A - ARS (EMS # E249121)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
18-Aug-02	<1	<1	<1	5	0.82
27-Aug-02	<1	<1	<1	5	0.10
04-Sep-02	<1	<1	<1	5	0.10
11-Sep-02	<1	<1	<1	5	0.12
17-Sep-02	<1	<1	<1	5	0.10
06-Aug-03	<1	<1	<1	5	0.12
13-Aug-03	<1	<1	1	5	<0.10
19-Aug-03	<1	<1	1	5	0.20
26-Aug-03	<1	<1	<1	5	0.13
02-Sep-03	<1	<1	2	5	0.13
06-Oct-03	<1	<1	<1	5	0.27
14-Oct-03	<1	<1	<1	5	<0.10
21-Oct-03	<1	<1	<1	5	<0.10
28-Oct-03	<1	<1	<1	5	<0.10
04-Nov-03	<1	<1	<1	5	0.13

Table 6B - ARS (EMS # E249121)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**<= 10 (90%)**	**<= 10 (90%)**	**<= 3 (90%)**	**<= 15**	**<= 5**
August, 2002					
Maximum	<1	<1	<1	5	0.82
Average	<1	<1	<1	5	0.25
90th percentile	<1	<1	<1	-	-
Guideline	**Met**	**Met**	**Met**	**Met**	**Met**
Exceedences	-	-	-	0	0
August, 2003					
Maximum	<1	<1	2	5	0.20
Average	<1	<1	0.8	5	0.14
90th percentile	<1	<1	1.6	-	-
Guideline	**Met**	**Met**	**Met**	**Met**	**Met**
Exceedences	-	-	-	0	0
October, 2003					
Maximum	<1	<1	<1	5	0.27
Average	<1	<1	<1	5	0.14
90th percentile	<1	<1	<1	-	-
Guideline	**Met**	**Met**	**Met**	**Met**	**Met**
Exceedences	-	-	-	0	0

Table 7A - AFJ (EMS # E252871)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
06-Aug-03	1	3	180	5	0.95
13-Aug-03	4	<1	45	5	0.64
19-Aug-03	<1	<1	200	10	0.50
26-Aug-03	<1	<1	16	10	0.39
02-Sep-03	<1	1	38	5	0.55
06-Oct-03	<1	<1	2	5	0.78
14-Oct-03	<1	<1	<1	5	1.26
21-Oct-03	2	1	<1	5	1.11
28-Oct-03	<1	<1	<1	5	1.31
04-Nov-03	<1	<1	5	5	0.81

Table 7B - AFJ (EMS # E252871)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**<= 10 (90%)**	**<= 10 (90%)**	**<= 3 (90%)**	**<= 15**	**<= 5**
August, 2003					
Maximum	4	3	200	10	0.95
Average	1.0	0.8	95.8	7	0.61
90th percentile	2.8	2.2	192.0	-	-
Guideline	**Met**	**Met**	**Not Met**	**Met**	**Met**
Exceedences	-	-	-	0	0
October, 2003					
Maximum	2	1	5	5	1.31
Average	0.4	0.2	1.4	5	1.05
90th percentile	1.2	0.6	3.8	-	-
Guideline	**Met**	**Met**	**Not Met**	**Met**	**Met**
Exceedences	-	-	-	0	0

Table 8A - AGW (EMS # E249122)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
18-Aug-02	<1	<1	<1	5	2.02
27-Aug-02	<1	<1	4	5	0.75
04-Sep-02	<1	<1	<1	5	1.35
11-Sep-02	<1	<1	<1	5	1.40
17-Sep-02	<1	<1	<1	5	0.96
06-Aug-03	<1	<1	<1	<5	1.21
13-Aug-03	<1	<1	<1	<5	0.80
19-Aug-03	<1	<1	<1	<5	2.01
26-Aug-03	<1	<1	<1	5	1.25
02-Sep-03	<1	<1	<1	<5	1.04
06-Oct-03	<1	<1	<1	5	1.89
14-Oct-03	<1	<1	<1	5	1.20
21-Oct-03	<1	<1	<1	<5	0.88
28-Oct-03	<1	<1	<1	<5	0.82
04-Nov-03	<1	<1	<1	5	1.14

Table 8B - AGW (EMS # E249122)

	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
Guideline:	**<= 10 (90%)**	**<= 10 (90%)**	**<= 3 (90%)**	**<= 15**	**<= 5**
August, 2002					
Maximum	<1	<1	4	5	2.02
Average	<1	<1	0.8	5	1.30
90th percentile	<1	<1	2.4	-	-
Guideline	**Met**	**Met**	**Met**	**Met**	**Met**
Exceedences	-	-	-	0	0
August, 2003					
Maximum	<1	<1	<1	5	2.01
Average	<1	<1	<1	5	1.26
90th percentile	<1	<1	<1	-	-
Guideline	**Met**	**Met**	**Met**	**Met**	**Met**
Exceedences	-	-	-	0	0
October, 2003					
Maximum	<1	<1	<1	5	1.89
Average	<1	<1	<1	5	1.19
90th percentile	<1	<1	<1	-	-
Guideline	**Met**	**Met**	**Met**	**Met**	**Met**
Exceedences	-	-	-	0	0

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

Table 9A – Atlin Lake Sites (AL1 – AL5)
(Values in mg/L unless otherwise noted)

	AL1 18-Aug-02	AL2 18-Aug-02	AL3 18-Aug-02	AL4 18-Aug-02	AL5 18-Aug-02
PHYSICAL					
pH (pH units)	7.9	7.9	8	7.9	7.9
Specific Conductance (uS/cm)	98	98	98	98	97
Residue Filterable - TDS	n/a	n/a	n/a	n/a	n/a
Hardness Total - T	52.4	52.9	52	52.5	52.6
Alkalinity Total (mg/L CaCO3)	n/a	n/a	n/a	n/a	n/a
ANIONS					
Chloride Dissolved	0.9	< 0.5	< 0.5	< 0.5	n/a
Fluoride Dissolved	n/a	n/a	n/a	n/a	n/a
CARBON					
Organic Carbon - Total	n/a	n/a	n/a	n/a	n/a
NITROGEN					
Total Kjeldahl N	0.02	< 0.02	0.04	0.03	< 0.02
Total N	< 0.02	< 0.02	0.04	0.03	< 0.02
Total Organic N	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ammonia N	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Nitrate Nitrogen Dissolved	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Nitrate+Nitrite	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Nitrite Nitrogen	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
PHOSPHORUS					
Ortho-Phosphorus	n/a	n/a	0.001	n/a	n/a
Phosphorus Total Dissolved	n/a	n/a	< 0.002	n/a	n/a
Phosphorus Total	n/a	n/a	< 0.002	n/a	n/a
SULFATE					
Sulfate	n/a	n/a	n/a	n/a	n/a
METALS TOTAL					
Aluminum	0.0296	0.0333	0.0243	0.0308	0.0362
Antimony	0.000143	0.000305	0.000177	0.00015	0.000161
Arsenic	0.0002	0.0003	0.0002	0.0002	0.0002
Barium	0.0344	0.0349	0.0345	0.0351	0.0348
Beryllium	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Bismuth	< 0.00002	0.00017	0.00004	< 0.00002	< 0.00002
Cadmium	< 0.00001	0.00003	< 0.00001	< 0.00001	0.00001
Calcium	15.9	16	15.8	15.9	16
Chromium	0.0003	< 0.0002	< 0.0002	< 0.0002	0.0002
Cobalt	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Copper	0.0015	0.00136	0.00037	0.0005	0.00138
Iron	n/a	n/a	n/a	n/a	n/a
Lead	0.00023	0.00054	0.00002	0.00009	0.00008
Lithium	0.00052	0.00049	< 0.00005	0.00022	0.00038
Magnesium	3.08	3.15	3.04	3.1	3.06
Manganese	0.000913	0.00218	0.000658	0.000608	0.00171
Molybdenum	0.00118	0.00108	0.00108	0.0011	0.00101
Nickel	0.00023	0.00018	0.00016	0.00018	0.00018
Selenium	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0003
Silver	< 0.00002	0.00004	< 0.00002	< 0.00002	< 0.00002
Strontium	0.0677	0.0674	0.0676	0.068	0.0671
Thallium	0.000008	0.000046	0.000003	< 0.000002	0.000002
Tin	< 0.00001	< 0.00001	0.00002	0.00003	< 0.00001
Uranium	0.000578	0.000566	0.000558	0.000562	0.000546
Vanadium	0.00074	0.00049	0.00064	0.00043	0.00069
Zinc	0.0087	0.0272	0.0001	0.0028	0.005
Mercury	n/a	< 0.00005	n/a	< 0.00005	< 0.00005

Table 9A - Atlin Lake Sites (AL1 – AL5) Continued
(Values in mg/L unless otherwise noted)

	AL1 6-Aug-03	AL3 6-Aug-03	AL4 6-Aug-03	AL5 6-Aug-03
PHYSICAL				
pH (pH units)	8	8	8	8
Specific Conductance (uS/cm)	102	101	101	100
Residue Filterable - TDS	60	n/a	68	64
Hardness Total - T	47.9	48.9	50.3	49.9
Alkalinity Total (mg/L CaCO3)	44.5	44.4	43.8	43.8
ANIONS				
Chloride Dissolved	< 0.5	< 0.5	< 0.5	< 0.5
Fluoride Dissolved	0.09	0.09	0.09	0.09
CARBON				
Organic Carbon - Total	n/a	n/a	n/a	n/a
NITROGEN				
Total Kjeldahl N	n/a	n/a	n/a	n/a
Total N	n/a	n/a	n/a	n/a
Total Organic N	n/a	n/a	n/a	n/a
Ammonia N	< 0.005	< 0.005	< 0.005	< 0.005
Nitrate Nitrogen Dissolved	< 0.02	< 0.02	< 0.02	< 0.02
Nitrate+Nitrite	0.009	0.006	0.007	0.006
Nitrite Nitrogen	0.002	< 0.002	< 0.002	< 0.002
PHOSPHORUS				
Ortho-Phosphorus	n/a	n/a	n/a	n/a
Phosphorus Total Dissolved	n/a	n/a	n/a	n/a
Phosphorus Total	n/a	0.006	n/a	n/a
SULFATE				
Sulfate	5.4	5.5	5.8	5.7
METALS TOTAL				
Aluminum	0.0222	0.0215	0.0244	0.0307
Antimony	0.000155	0.000154	0.000154	0.000158
Arsenic	0.0004	0.0004	0.0004	0.0004
Barium	0.0347	0.0344	0.0348	0.0351
Beryllium	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Bismuth	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Cadmium	0.00001	< 0.00001	< 0.00001	0.00006
Calcium	14.4	14.8	15.2	15.1
Chromium	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Cobalt	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Copper	0.00889	0.0002	0.00041	0.00141
Iron	0.01	< 0.005	0.01	0.14
Lead	0.00032	< 0.00001	0.00004	0.00001
Lithium	0.00077	0.00077	0.00067	0.00068
Magnesium	2.89	2.91	2.99	2.95
Manganese	0.000486	0.000468	0.000579	0.00249
Molybdenum	0.00116	0.00116	0.00117	0.00105
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	0.067	0.0679	0.0681	0.0683
Thallium	< 0.000002	< 0.000002	< 0.000002	< 0.000002
Tin	< 0.00001	0.00001	< 0.00001	< 0.00001
Uranium	0.000556	0.000586	0.000574	0.000575
Vanadium	< 0.00006	0.00008	0.00009	0.0001
Zinc	0.0243	0.0002	0.0035	0.0068
Mercury	n/a	n/a	n/a	n/a

Table 9A - Atlin Lake Sites (AL1 – AL5) Continued
(Values in mg/L unless otherwise noted)

	AL1 6-Oct-03	AL3 6-Oct-03	AL4 6-Oct-03	AL5 6-Oct-03	Drinking Water Guideline		
PHYSICAL							
pH (pH units)	7.1	7.5	7.5	7.4	≤ 8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	100	99	100	100	≤ 700	mac	Met
Residue Filterable - TDS	62	60	62	68	≤ 500	ao	Met
Hardness Total - T	49.9	49.1	50.6	51.9	≤ 500	mac	Met
Alkalinity Total (mg/L CaCO3)	41.1	41.3	41.1	41.5			
ANIONS							
Chloride Dissolved	< 0.5	< 0.5	< 0.5	< 0.5	≤ 250	ao	Met
Fluoride Dissolved	0.06	0.08	0.09	0.06	≤ 1.5	mac	Met
CARBON							
Organic Carbon - Total	n/a	n/a	n/a	n/a	≤ 4	mac (THM)	
NITROGEN							
Total Kjeldahl N	n/a	n/a	n/a	n/a			
Total N	n/a	n/a	n/a	n/a			
Total Organic N	n/a	n/a	n/a	n/a			
Ammonia N	< 0.005	< 0.005	< 0.005	0.015			
Nitrate Nitrogen Dissolved	< 0.02	< 0.02	< 0.02	< 0.02	≤ 10	mac	Met
Nitrate+Nitrite	0.009	0.007	< 0.002	0.007			
Nitrite Nitrogen	0.002	0.004	0.002	0.003	≤ 1	mac	Met
PHOSPHORUS							
Ortho-Phosphorus	n/a	n/a	n/a	n/a			
Phosphorus Total Dissolved	n/a	n/a	n/a	n/a			
Phosphorus Total	n/a	< 0.002	n/a	n/a	≤ 0.01	mac (lakes)	Met
SULFATE							
Sulfate	6.3	6.6	6.1	6.9	≤ 500	ao	Met
METALS TOTAL							
Aluminum	0.0331	0.0512	0.0494	0.0535	≤ 0.2	mac	Met
Antimony	0.000167	0.000158	0.000157	0.000149	≤ 0.006	imac	Met
Arsenic	0.0003	0.0004	0.0004	0.0003	≤ 0.025	imac	Met
Barium	0.0363	0.0321	0.0334	0.0323	≤ 1	mac	Met
Beryllium	< 0.00002	< 0.00002	< 0.00002	< 0.00002			
Bismuth	< 0.00002	< 0.00002	< 0.00002	< 0.00002			
Cadmium	0.00002	< 0.00001	< 0.00001	0.00001	≤ 0.005	mac	Met
Calcium	15.2	14.9	15.2	15.8			
Chromium	0.0003	0.0003	0.0005	0.0005	≤ 0.05	mac	Met
Cobalt	0.000014	0.000008	0.00002	0.00002			
Copper	0.00597	0.00027	0.00029	0.00053	≤ 1	ao	Met
Iron	0.023	0.046	0.047	0.094	≤ 0.3	ao	Met
Lead	0.00023	0.00005	0.00005	0.00007	≤ 0.01	mac	Met
Lithium	0.00057	0.00061	0.00068	0.00057			
Magnesium	2.89	2.89	3.07	3.03	≤ 100	ao	Met
Manganese	0.00128	0.00132	0.00162	0.0021	≤ 0.05	ao	Met
Molybdenum	0.0011	0.00116	0.00114	0.00105	≤ 0.25	mac	Met
Nickel	0.00028	0.00018	0.00034	0.00027			
Selenium	0.0002	0.0004	0.0002	< 0.0002	≤ 0.01	mac	Met
Silver	< 0.00002	< 0.00002	< 0.00002	< 0.00002			
Strontium	0.0667	0.0595	0.0612	0.06			
Thallium	0.000004	0.000003	0.000002	0.000002			
Tin	< 0.00001	< 0.00001	0.00001	< 0.00001			
Uranium	0.000458	0.000652	0.000684	0.000619	≤ 0.02	imac	Met
Vanadium	0.00022	0.00028	0.00035	0.00034	≤ 0.1	mac	Met
Zinc	0.0295	0.0006	0.0004	0.0026	≤ 5	ao	Met
Mercury	n/a	n/a	n/a	n/a	≤ 0.001	mac	Met

Table 9B – Atlin Lake Sites (AL1 – AL5)
(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline		
PHYSICAL							
pH (pH units)	13	7.1	8.0	7.8	≤	8.5	ao (>6.5)
Specific Conductance (uS/cm)	13	97	102	99	≤	700	mac
Residue Filterable - TDS	7	60	68	63	≤	500	ao
Hardness Total - T	13	47.9	52.9	50.8	≤	500	mac
Alkalinity Total (mg/L CaCO3)	8	41.1	44.5	42.7			
ANIONS							
Chloride Dissolved	12	0.5	0.9	0.5	≤	250	ao
Fluoride Dissolved	8	0.06	0.09	0.08	≤	1.5	mac
CARBON							
Organic Carbon - Total	0				≤	4	mac (THM)
NITROGEN							
Total Kjeldahl N	5	0.02	0.04	0.03			
Total N	5	0.02	0.04	0.03			
Total Organic N	5	0.1	0.1	0.1			
Ammonia N	13	0.005	0.015	0.006			
Nitrate Nitrogen Dissolved	13	0.02	0.02	0.02	≤	10	mac
Nitrate+Nitrite	13	0.002	0.009	0.005			
Nitrite Nitrogen	13	0.002	0.004	0.002	≤	1	mac
PHOSPHORUS							
Ortho-Phosphorus	1	0.001	0.001	0.001			
Phosphorus Total Dissolved	1	0.002	0.002	0.002			
Phosphorus Total	3	0.002	0.006	0.003	≤	0.01	mac (lakes)
SULFATE							
Sulfate	8	5.4	6.9	6.0	≤	500	ao
METALS TOTAL							
Aluminum	13	0.0215	0.0535	0.0339	≤	0.2	mac
Antimony	13	0.00014	0.00031	0.00017	≤	0.006	imac
Arsenic	13	0.0002	0.0004	0.0003	≤	0.025	imac
Barium	13	0.03210	0.03630	0.03437	≤	1	mac
Beryllium	13	0.00002	0.00002	0.00002			
Bismuth	13	0.00002	0.00017	0.00003			
Cadmium	13	0.00001	0.00006	0.00002	≤	0.005	mac
Calcium	13	14.40	16.00	15.40			
Chromium	13	0.0002	0.0005	0.0003	≤	0.05	mac
Cobalt	13	0.000005	0.00002	0.000008			
Copper	13	0.00020	0.00889	0.00178	≤	1	ao
Iron	8	0.005	0.140	0.047	≤	0.3	ao
Lead	13	0.00001	0.00054	0.00013	≤	0.01	mac
Lithium	13	0.00005	0.00077	0.00054			
Magnesium	13	2.89	3.15	3.00	≤	100	ao
Manganese	13	0.000468	0.002490	0.001262	≤	0.05	ao
Molybdenum	13	0.00101	0.00118	0.00111	≤	0.25	mac
Nickel	13	0.00005	0.00034	0.00017			
Selenium	13	0.0002	0.0004	0.0002	≤	0.01	mac
Silver	13	0.00002	0.00004	0.00002			
Strontium	13	0.059500	0.068300	0.065885			
Thallium	13	0.000002	0.000046	0.000006			
Tin	13	0.00001	0.00003	0.00001			
Uranium	13	0.000458	0.000684	0.000578	≤	0.02	imac
Vanadium	13	0.00006	0.00074	0.00035	≤	0.1	mac
Zinc	13	0.0001	0.0295	0.0086	≤	5	ao
Mercury	3	0.00005	0.00005	0.00005	≤	0.001	mac

Table 10A - ARS
(Values in mg/L unless otherwise noted)

	ARS 18-Aug-02	ARS 6-Aug-03	ARS 6-Oct-03	Drinking Water Guideline			
PHYSICAL							
pH (pH units)	8	8.2	7.8	≤	8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	596	622	608	≤	700	mac	Met
Residue Filterable - TDS	n/a	352	350	≤	500	ao	Met
Hardness Total - T	370	361	354	≤	500	mac	Met
Alkalinity Total (mg/L CaCO3)	n/a	334	320				
ANIONS							
Chloride Dissolved	n/a	0.7	< 0.05	≤	250	ao	Met
Fluoride Dissolved	n/a	< 0.01	0.04	≤	1.5	mac	Met
CARBON							
Organic Carbon - Total	n/a	n/a	n/a	≤	4	mac (THM)	
NITROGEN							
Total Kjeldahl N	0.13	n/a	n/a				
Total N	0.2	n/a	n/a				
Total Organic N	0.13	n/a	n/a				
Ammonia N	< 0.005	< 0.005	< 0.005				
Nitrate Nitrogen Dissolved	0.07	0.08	0.08	≤	10	mac	Met
Nitrate+Nitrite	0.066	0.081	0.083				
Nitrite Nitrogen	< 0.002	< 0.002	0.004	≤	1	mac	Met
PHOSPHORUS							
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)	
SULFATE							
Sulfate	n/a	18.3	19.4	≤	500	ao	Met
METALS TOTAL							
Aluminum	0.0012	0.0014	0.0012	≤	0.2	mac	Met
Antimony	0.000234	0.000237	0.000225	≤	0.006	imac	Met
Arsenic	0.002	0.0018	0.002	≤	0.025	imac	Met
Barium	0.0536	0.0529	0.0487	≤	1	mac	Met
Beryllium	< 0.00002	< 0.00002	< 0.00002				
Bismuth	< 0.00002	< 0.00002	< 0.00002				
Cadmium	0.00003	0.00001	< 0.00001	≤	0.005	mac	Met
Calcium	46.5	44.8	43.8				
Chromium	0.0026	0.0023	0.0132	≤	0.05	mac	Met
Cobalt	< 0.000005	< 0.000005	0.000026				
Copper	0.00167	0.00109	0.00117	≤	1	ao	Met
Iron	n/a	< 0.005	< 0.005	≤	0.3	ao	Met
Lead	< 0.00001	< 0.00001	< 0.00001	≤	0.01	mac	Met
Lithium	0.00064	0.00095	0.00095				
Magnesium	61.6	60.4	59.4	≤	100	ao	Met
Manganese	< 0.000008	0.000095	0.000114	≤	0.05	ao	Met
Molybdenum	0.00078	0.00082	0.00076	≤	0.25	mac	Met
Nickel	0.0142	0.0152	0.0147				
Selenium	0.0002	< 0.0002	< 0.0002	≤	0.01	mac	Met
Silver	< 0.00002	< 0.00002	< 0.00002				
Strontium	0.123	0.115	0.0998				
Thallium	0.000067	< 0.000002	< 0.000002				
Tin	0.00003	< 0.00001	< 0.00001				
Uranium	0.000156	0.000148	0.00018	≤	0.02	imac	Met
Vanadium	0.00395	0.00076	0.00386	≤	0.1	mac	Met
Zinc	0.0011	0.0006	0.0007	≤	5	ao	Met
Mercury	n/a	n/a	n/a	≤	0.001	mac	

Table 10B - ARS
(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline		
PHYSICAL							
pH (pH units)	3	7.8	8.2	8.0	≤	8.5	ao (>6.5)
Specific Conductance (uS/cm)	3	596	622	609	≤	700	mac
Residue Filterable - TDS	2	350	352	351	≤	500	ao
Hardness Total - T	3	354.0	370.0	361.7	≤	500	mac
Alkalinity Total (mg/L CaCO3)	2	320.0	334.0	327.0			
ANIONS							
Chloride Dissolved	2	0.1	0.7	0.4	≤	250	ao
Fluoride Dissolved	2	0.01	0.04	0.03	≤	1.5	mac
CARBON							
Organic Carbon - Total	0				≤	4	mac (THM)
NITROGEN							
Total Kjeldahl N	1	0.13	0.13	0.13			
Total N	1	0.20	0.20	0.20			
Total Organic N	1	0.1	0.1	0.1			
Ammonia N	3	0.005	0.005	0.005			
Nitrate Nitrogen Dissolved	3	0.07	0.08	0.08	≤	10	mac
Nitrate+Nitrite	3	0.066	0.083	0.077			
Nitrite Nitrogen	3	0.002	0.004	0.003	≤	1	mac
PHOSPHORUS							
Ortho-Phosphorus	0						
Phosphorus Total Dissolved	0						
Phosphorus Total	0				≤	0.01	mac (lakes)
SULFATE							
Sulfate	2	18.3	19.4	18.9	≤	500	ao
METALS TOTAL							
Aluminum	3	0.0012	0.0014	0.0013	≤	0.2	mac
Antimony	3	0.00023	0.00024	0.00023	≤	0.006	imac
Arsenic	3	0.0018	0.0020	0.0019	≤	0.025	imac
Barium	3	0.04870	0.05360	0.05173	≤	1	mac
Beryllium	3	0.00002	0.00002	0.00002			
Bismuth	3	0.00002	0.00002	0.00002			
Cadmium	3	0.00001	0.00003	0.00002	≤	0.005	mac
Calcium	3	43.80	46.50	45.03			
Chromium	3	0.0023	0.0132	0.0060	≤	0.05	mac
Cobalt	3	0.000005	0.000026	0.000012			
Copper	3	0.00109	0.00167	0.00131	≤	1	ao
Iron	2	0.005	0.005	0.005	≤	0.3	ao
Lead	3	0.00001	0.00001	0.00001	≤	0.01	mac
Lithium	3	0.00064	0.00095	0.00085			
Magnesium	3	59.40	61.60	60.47	≤	100	ao
Manganese	3	0.000008	0.000114	0.000072	≤	0.05	ao
Molybdenum	3	0.00076	0.00082	0.00079	≤	0.25	mac
Nickel	3	0.01420	0.01520	0.01470			
Selenium	3	0.0002	0.0002	0.0002	≤	0.01	mac
Silver	3	0.00002	0.00002	0.00002			
Strontium	3	0.099800	0.123000	0.112600			
Thallium	3	0.000002	0.000067	0.000024			
Tin	3	0.00001	0.00003	0.00002			
Uranium	3	0.000148	0.000180	0.000161	≤	0.02	imac*
Vanadium	3	0.00076	0.00395	0.00286	≤	0.1	mac
Zinc	3	0.0006	0.0011	0.0008	≤	5	ao

Table 11A - AFJ
(Values in mg/L unless otherwise noted)

	AFJ 6-Aug-03	AFJ-1 6-Oct-03	AFJ-2 6-Oct-03	Drinking Water Guideline		
PHYSICAL						
pH (pH units)	8	7.5	7.5	≤ 8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	100	109	109	≤ 700	mac	Met
Residue Filterable - TDS	74	76	66	≤ 500	ao	Met
Hardness Total - T	49.3	52.2	52.9	≤ 500	mac	Met
Alkalinity Total (mg/L CaCO3)	43.1	43.8	43.3			
ANIONS						
Chloride Dissolved	< 0.5	< 0.5	< 0.5	≤ 250	ao	Met
Fluoride Dissolved	0.16	0.14	0.14	≤ 1.5	mac	Met
CARBON						
Organic Carbon - Total	n/a	n/a	n/a	≤ 4	mac (THM)	
NITROGEN						
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	< 0.005	< 0.005	< 0.005			
Nitrate Nitrogen Dissolved	< 0.02	< 0.02	< 0.02	≤ 10	mac	Met
Nitrate+Nitrite	0.01	0.006	< 0.002			
Nitrite Nitrogen	< 0.002	0.004	0.002	≤ 1	mac	Met
PHOSPHORUS						
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)	
SULFATE						
Sulfate	6.2	7.8	7.8	≤ 500	ao	Met
METALS TOTAL						
Aluminum	0.021	0.0165	0.0048	≤ 0.2	mac	Met
Antimony	0.000083	0.000082	0.000086	≤ 0.006	imac	Met
Arsenic	0.0029	0.0027	0.0027	≤ 0.025	imac	Met
Barium	0.0206	0.0222	0.0216	≤ 1	mac	Met
Beryllium	< 0.00002	< 0.00002	< 0.00002			
Bismuth	< 0.00002	< 0.00002	< 0.00002			
Cadmium	0.00002	0.00002	0.00002	≤ 0.005	mac	Met
Calcium	12.6	13.6	13.8			
Chromium	< 0.0002	0.0003	< 0.0002	≤ 0.05	mac	Met
Cobalt	0.000038	0.000042	0.000018			
Copper	0.00082	0.00087	0.00071	≤ 1	ao	Met
Iron	0.087	0.07	0.065	≤ 0.3	ao	Met
Lead	< 0.00001	0.00004	0.00001	≤ 0.01	mac	Met
Lithium	0.00108	0.00109	0.00113			
Magnesium	4.32	4.44	4.49	≤ 100	ao	Met
Manganese	0.0131	0.0119	0.00572	≤ 0.05	ao	Met
Molybdenum	0.00578	0.00549	0.00566	≤ 0.25	mac	Met
Nickel	0.00091	0.00107	0.00091			
Selenium	< 0.0002	< 0.0002	< 0.0002	≤ 0.01	mac	Met
Silver	< 0.00002	< 0.00002	< 0.00002			
Strontium	0.0808	0.0782	0.0749			
Thallium	< 0.000002	0.000003	0.000002			
Tin	< 0.00001	0.00001	< 0.00001			
Uranium	0.000512	0.00059	0.000581	≤ 0.02	imac	Met
Vanadium	0.00032	0.00036	0.00025	≤ 0.1	mac	Met
Zinc	0.0004	0.0006	0.0003	≤ 5	ao	Met
Mercury	n/a	n/a	n/a	≤ 0.001	mac	

Table 11B - AFJ
(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline		
PHYSICAL							
pH (pH units)	3	7.5	8.0	7.7	≤	8.5	ao (>6.5)
Specific Conductance (uS/cm)	3	100	109	106	≤	700	mac
Residue Filterable - TDS	3	66	76	72	≤	500	ao
Hardness Total - T	3	49.3	52.9	51.5	≤	500	mac
Alkalinity Total (mg/L CaCO3)	3	43.1	43.8	43.4			
ANIONS							
Chloride Dissolved	3	0.5	0.5	0.5	≤	250	ao
Fluoride Dissolved	3	0.14	0.16	0.15	≤	1.5	mac
CARBON							
Organic Carbon - Total	0				≤	4	mac (THM)
NITROGEN							
Total Kjeldahl N	0						
Total N	0						
Total Organic N	0						
Ammonia N	3	0.005	0.005	0.005			
Nitrate Nitrogen Dissolved	3	0.02	0.02	0.02	≤	10	mac
Nitrate+Nitrite	3	0.002	0.010	0.006			
Nitrite Nitrogen	3	0.002	0.004	0.003	≤	1	mac
PHOSPHORUS							
Ortho-Phosphorus	0						
Phosphorus Total Dissolved	0						
Phosphorus Total	0				≤	0.01	mac (lakes)
SULFATE							
Sulfate	3	6.2	7.8	7.3	≤	500	ao
METALS TOTAL							
Aluminum	3	0.0048	0.0210	0.0141	≤	0.2	mac
Antimony	3	0.00008	0.00009	0.00008	≤	0.006	imac
Arsenic	3	0.0027	0.0029	0.0028	≤	0.025	imac
Barium	3	0.02060	0.02220	0.02147	≤	1	mac
Beryllium	3	0.00002	0.00002	0.00002			
Bismuth	3	0.00002	0.00002	0.00002			
Cadmium	3	0.00002	0.00002	0.00002	≤	0.005	mac
Calcium	3	12.60	13.80	13.33			
Chromium	3	0.0002	0.0003	0.0002	≤	0.05	mac
Cobalt	3	0.000018	0.000042	0.000033			
Copper	3	0.00071	0.00087	0.00080	≤	1	ao
Iron	3	0.065	0.087	0.074	≤	0.3	ao
Lead	3	0.00001	0.00004	0.00002	≤	0.01	mac
Lithium	3	0.00108	0.00113	0.00110			
Magnesium	3	4.32	4.49	4.42	≤	100	ao
Manganese	3	0.005720	0.013100	0.010240	≤	0.05	ao
Molybdenum	3	0.00549	0.00578	0.00564	≤	0.25	mac
Nickel	3	0.00091	0.00107	0.00096			
Selenium	3	0.0002	0.0002	0.0002	≤	0.01	mac
Silver	3	0.00002	0.00002	0.00002			
Strontium	3	0.074900	0.080800	0.077967			
Thallium	3	0.000002	0.000003	0.000002			
Tin	3	0.00001	0.00001	0.00001			
Uranium	3	0.000512	0.000590	0.000561	≤	0.02	imac*
Vanadium	3	0.00025	0.00036	0.00031	≤	0.1	mac
Zinc	3	0.0003	0.0006	0.0004	≤	5	ao

Table 12A - AGW
(Values in mg/L unless otherwise noted)

	AGW 18-Aug-02	AGW 6-Aug-03	AGW 6-Oct-03	Drinking Water Guideline			
PHYSICAL							
pH (pH units)	8.3	8.3	8	≤	8.5	ao (>6.5)	Met
Specific Conductance (uS/cm)	563	584	567	≤	700	mac	Met
Residue Filterable - TDS	n/a	340	330	≤	500	ao	Met
Hardness Total - T	232	220	221	≤	500	mac	Met
Alkalinity Total (mg/L CaCO3)	n/a	203	191				
ANIONS							
Chloride Dissolved	n/a	0.8	< 0.5	≤	250	ao	Met
Fluoride Dissolved	n/a	0.24	0.23	≤	1.5	mac	Met
CARBON							
Organic Carbon - Total	n/a	n/a	n/a	≤	4	mac (THM)	
NITROGEN							
Total Kjeldahl N	0.06	n/a	n/a				
Total N	0.06	n/a	n/a				
Total Organic N	< 0.1	n/a	n/a				
Ammonia N	0.022	0.048	0.05				
Nitrate Nitrogen Dissolved	< 0.02	< 0.02	< 0.02	≤	10	mac	Met
Nitrate+Nitrite	< 0.002	0.004	0.006				
Nitrite Nitrogen	< 0.002	< 0.002	0.005	≤	1	mac	Met
PHOSPHORUS							
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)	
SULFATE							
Sulfate	n/a	109	104	≤	500	ao	Met
METALS TOTAL							
Aluminum	0.0009	< 0.0003	< 0.0005	≤	0.2	mac	Met
Antimony	0.000014	0.000021	0.000023	≤	0.006	imac	Met
Arsenic	0.0014	0.0013	0.0014	≤	0.025	imac	Met
Barium	0.0187	0.0185	0.0182	≤	1	mac	Met
Beryllium	< 0.00002	< 0.00002	< 0.00002				
Bismuth	< 0.00002	< 0.00002	< 0.00002				
Cadmium	0.00003	0.00004	0.00004	≤	0.005	mac	Met
Calcium	24.5	23	23.9				
Chromium	0.0006	< 0.0002	0.002	≤	0.05	mac	Met
Cobalt	< 0.000005	< 0.000005	< 0.000005				
Copper	0.0157	0.00056	0.00529	≤	1	ao	Met
Iron	n/a	0.162	0.186	≤	0.3	ao	Met
Lead	0.00019	0.00005	0.00027	≤	0.01	mac	Met
Lithium	0.0133	0.0141	0.0127				
Magnesium	41.5	39.5	39.2	≤	100	ao	Met
Manganese	0.00601	0.00664	0.00747	≤	0.05	ao	Met
Molybdenum	0.0133	0.0145	0.0123	≤	0.25	mac	Met
Nickel	0.00011	< 0.00005	0.00031				
Selenium	< 0.0002	< 0.0002	< 0.0002	≤	0.01	mac	Met
Silver	< 0.00002	< 0.00002	< 0.00002				
Strontium	0.247	0.227	0.214				
Thallium	0.000018	< 0.000002	< 0.000002				
Tin	0.00006	0.00001	0.00004				
Uranium	0.00272	0.00266	0.00278	≤	0.02	imac	Met
Vanadium	0.00179	< 0.00006	0.00057	≤	0.1	mac	Met
Zinc	0.199	0.206	0.156	≤	5	ao	Met
Mercury	n/a	n/a	n/a	≤	0.001	mac	

Table 12B - AGW
(Values in mg/L unless otherwise noted)

	# Values	Minimum	Maximum	Mean	Drinking Water Guideline		
PHYSICAL							
pH (pH units)	3	8.0	8.3	8.2	≤	8.5	ao (>6.5)
Specific Conductance (uS/cm)	3	563	584	571	≤	700	mac
Residue Filterable - TDS	2	330	340	335	≤	500	ao
Hardness Total - T	3	220.0	232.0	224.3	≤	500	mac
Alkalinity Total (mg/L CaCO3)	2	191.0	203.0	197.0			
ANIONS							
Chloride Dissolved	2	0.5	0.8	0.7	≤	250	ao
Fluoride Dissolved	2	0.23	0.24	0.24	≤	1.5	mac
CARBON							
Organic Carbon - Total	0				≤	4	mac (THM)
NITROGEN							
Total Kjeldahl N	1	0.06	0.06	0.06			
Total N	1	0.06	0.06	0.06			
Total Organic N	1	0.1	0.1	0.1			
Ammonia N	3	0.022	0.050	0.040			
Nitrate Nitrogen Dissolved	3	0.02	0.02	0.02	≤	10	mac
Nitrate+Nitrite	3	0.002	0.006	0.004			
Nitrite Nitrogen	3	0.002	0.005	0.003	≤	1	mac
PHOSPHORUS							
Ortho-Phosphorus	0						
Phosphorus Total Dissolved	0						
Phosphorus Total	0				≤	0.01	mac (lakes)
SULFATE							
Sulfate	2	104.0	109.0	106.5	≤	500	ao
METALS TOTAL							
Aluminum	3	0.0003	0.0009	0.0006	≤	0.2	mac
Antimony	3	0.00001	0.00002	0.00002	≤	0.006	imac
Arsenic	3	0.0013	0.0014	0.0014	≤	0.025	imac
Barium	3	0.01820	0.01870	0.01847	≤	1	mac
Beryllium	3	0.00002	0.00002	0.00002			
Bismuth	3	0.00002	0.00002	0.00002			
Cadmium	3	0.00003	0.00004	0.00004	≤	0.005	mac
Calcium	3	23.00	24.50	23.80			
Chromium	3	0.0002	0.0020	0.0009	≤	0.05	mac
Cobalt	3	0.000005	0.000005	0.000005			
Copper	3	0.00056	0.01570	0.00718	≤	1	ao
Iron	2	0.162	0.186	0.174	≤	0.3	ao
Lead	3	0.00005	0.00027	0.00017	≤	0.01	mac
Lithium	3	0.01270	0.01410	0.01337			
Magnesium	3	39.20	41.50	40.07	≤	100	ao
Manganese	3	0.006010	0.007470	0.006707	≤	0.05	ao
Molybdenum	3	0.01230	0.01450	0.01337	≤	0.25	mac
Nickel	3	0.00005	0.00031	0.00016			
Selenium	3	0.0002	0.0002	0.0002	≤	0.01	mac
Silver	3	0.00002	0.00002	0.00002			
Strontium	3	0.214000	0.247000	0.229333			
Thallium	3	0.000002	0.000018	0.000007			
Tin	3	0.00001	0.00006	0.00004			
Uranium	3	0.002660	0.002780	0.002720	≤	0.02	imac*
Vanadium	3	0.00006	0.00179	0.00081	≤	0.1	mac
Zinc	3	0.1560	0.2060	0.1870	≤	5	ao

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

Table 13A – QA/QC Analysis of Microbiological Indicators & Colour and Turbidity (Weekly Results)
(Values in mg/L unless otherwise noted)

Blanks:

Date	Fecal coliform (CFU/100mL)	*E. coli* (CFU/100mL)	*Enterococci* (CFU/100mL)	Colour True (Col.unit)	Turbidity (NTU)
06-Aug-03	< 1	< 1	< 1	< 5	**0.22**
6-Oct-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
26-Aug-03	AL5	5	5		0.51	0.43	17.0
19-Aug-03	AGW	< 5	< 5		2.01	2.73	**-30.4**
02-Sep-03	AL1	< 5	< 5		0.31	0.33	
06-Oct-03	AFJ	5	10		0.78	0.52	**40.0**
13-Aug-03	ARS	5	5		< 0.1	< 0.1	

Table 13B – QA/QC Analysis of Additional Water Quality Results
(Values in mg/L unless otherwise noted)

	MDL	Blanks		Duplicates		
		AT1 6-Aug-03	**AT1 6-Oct-03**	**AFJ-1 6-Oct-03**	**AFJ-2 6-Oct-03**	**RPD**
PHYSICAL						
pH (pH units)	0.1	6.5	5.2	7.5	7.5	0.0
Specific Conductance (uS/cm)	1	1	1	109	109	0.0
Residue Filterable - TDS	10	< 0.1	10	76	66	14.1
Hardness Total - T	0.3	< 0.4	< 0.4	52.2	52.9	-1.3
Alkalinity Total (mg/L CaCO3)	0.3	**1.2**	< 0.5	43.8	43.3	1.1
ANIONS						
Chloride Dissolved	0.5	< 0.5	< 0.5	< 0.5	< 0.5	
Fluoride Dissolved	0.01	< 0.01	< 0.01	0.14	0.14	0.0
CARBON						
Organic Carbon - Total	0.5	n/a	n/a	n/a	n/a	
NITROGEN						
Total Kjeldahl N	0.02	n/a	n/a	n/a	n/a	
Total N	0.02	n/a	n/a	n/a	n/a	
Total Organic N	0.1	n/a	n/a	n/a	n/a	
Ammonia N	0.005	< 0.005	< 0.005	< 0.005	< 0.005	
Nitrate Nitrogen Dissolved	0.02	< 0.02	< 0.02	< 0.02	< 0.02	
Nitrate+Nitrite	0.002	< 0.002	**0.004**	0.006	< 0.002	
Nitrite Nitrogen	0.002	< 0.002	**0.003**	0.004	0.002	
PHOSPHORUS						
Ortho-Phosphorus	0.001	n/a	n/a	n/a	n/a	
Phosphorus Total Dissolved	0.002	n/a	n/a	n/a	n/a	
Phosphorus Total	0.002	**0.005**	< 0.002	n/a	n/a	
SULFATE						
Sulfate	0.5	< 0.5	< 0.5	7.8	7.8	0.0
METALS TOTAL						
Aluminum	0.0003	**0.00008**	**0.0004**	0.0165	0.0048	**109.9**
Antimony	0.000005	< 0.000005	< 0.000005	0.000082	0.000086	-4.8
Arsenic	0.0001	**0.00001**	< 0.0001	0.0027	0.0027	0.0
Barium	0.00002	**0.00003**	< 0.00002	0.0222	0.0216	2.7
Beryllium	0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	
Bismuth	0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	
Cadmium	0.00001	**0.00001**	< 0.00001	0.00002	0.00002	
Calcium	0.05	**0.08**	**0.06**	13.6	13.8	-1.5
Chromium	0.0002	< 0.0002	< 0.0002	0.0003	< 0.0002	
Cobalt	0.000005	< 0.000005	< 0.000005	0.000042	0.000018	
Copper	0.00005	**0.00005**	**0.00042**	0.00087	0.00071	20.3
Iron	0.005	**0.02**	< 0.005	0.07	0.065	7.4
Lead	0.00001	< 0.00001	**0.00002**	0.00004	0.00001	
Lithium	0.00005	**0.00005**	< 0.00005	0.00109	0.00113	-3.6
Magnesium	0.05	< 0.05	< 0.05	4.44	4.49	-1.1
Manganese	0.000008	< 0.00008	**0.000022**	0.0119	0.00572	**70.1**
Molybdenum	0.00005	< .0.0005	**0.00009**	0.00549	0.00566	-3.0
Nickel	0.00005	< 0.00005	< 0.00005	0.00107	0.00091	16.2
Selenium	0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	
Silver	0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	
Strontium	0.000005	**0.000019**	**0.000027**	0.0782	0.0749	4.3
Thallium	0.000002	< 0.000002	< 0.000002	0.000003	0.000002	
Tin	0.00001	< 0.00001	< 0.00001	0.00001	< 0.00001	
Uranium	0.000002	< 0.000002	0.000006	0.00059	0.000581	1.5
Vanadium	0.00006	< 0.00006	< 0.00006	0.00036	0.00025	
Zinc	0.0001	**0.0005**	**0.0004**	0.0006	0.0003	
Mercury	0.00005	n/a	n/a	n/a	n/a	