

**Windy Point Inn Drinking Water Supply:
Source Water Characteristics**

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Ministry of
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Introduction

In British Columbia, drinking water quality is becoming a significant public issue. We all want to have confidence in the quality of the water we consume. Its protection is also important to local purveyors, who act as our water suppliers, and to provincial government ministries responsible for water management. Within the Omineca-Peace region of B.C., our most common potable source per capita is ground water, although many communities do make use of rivers, streams or lakes. Our basic drinking water quality is determined by a number of factors including local geology, climate and hydrology. In addition to these, human land use activities such as urbanization, agriculture and forestry, and the pollution they may cause, are becoming increasingly important influences. Environmental managers have a responsibility to control land use development so as to minimise the effects of these activities on source water quality.

The province's Drinking Water Protection Act, enacted in October, 2002, places the responsibility for drinking water quality protection with the B.C. Ministry of Health and local water purveyors. However, through the B.C. Environmental Management Act, the British Columbia Ministry of Environment (MOE) is responsible for managing and regulating activities in watersheds that have a potential to affect water quality. Accordingly, the Ministry plans to take an active role in protecting drinking water quality at its source.

MOE implemented a raw water quality and stream sediment monitoring program at selected communities in the Omineca-Peace region in 2002. Community sites were selected using a risk assessment process that considered:

- whether the source supply was surface water or ground water,
- the level of water treatment used,
- the population size served,
- the potential for upstream diffuse and point-source pollution,
- the availability of current, high-quality and representative data on each raw water source,
- whether past outbreaks of waterborne illness had been reported,
- the ability/willingness of local purveyors to assist with sampling.

Through this process and with available funding, 18 community water supplies in the Omineca-Peace region were selected for monitoring during 2002/03, with four or more sites being selected each subsequent year.

This brief report will summarise water quality data collected from the Windy Point Inn raw potable water source (ground water) (Figure 1). The data are compared to current provincial drinking water quality guidelines meant to protect finished water. This comparison should identify parameters with concentrations that represent a risk to human health. It is intended that this process will lead to the identification of human activities responsible for unacceptable source water quality, and that it will assist water managers to develop measures to improve raw water quality, where needed.

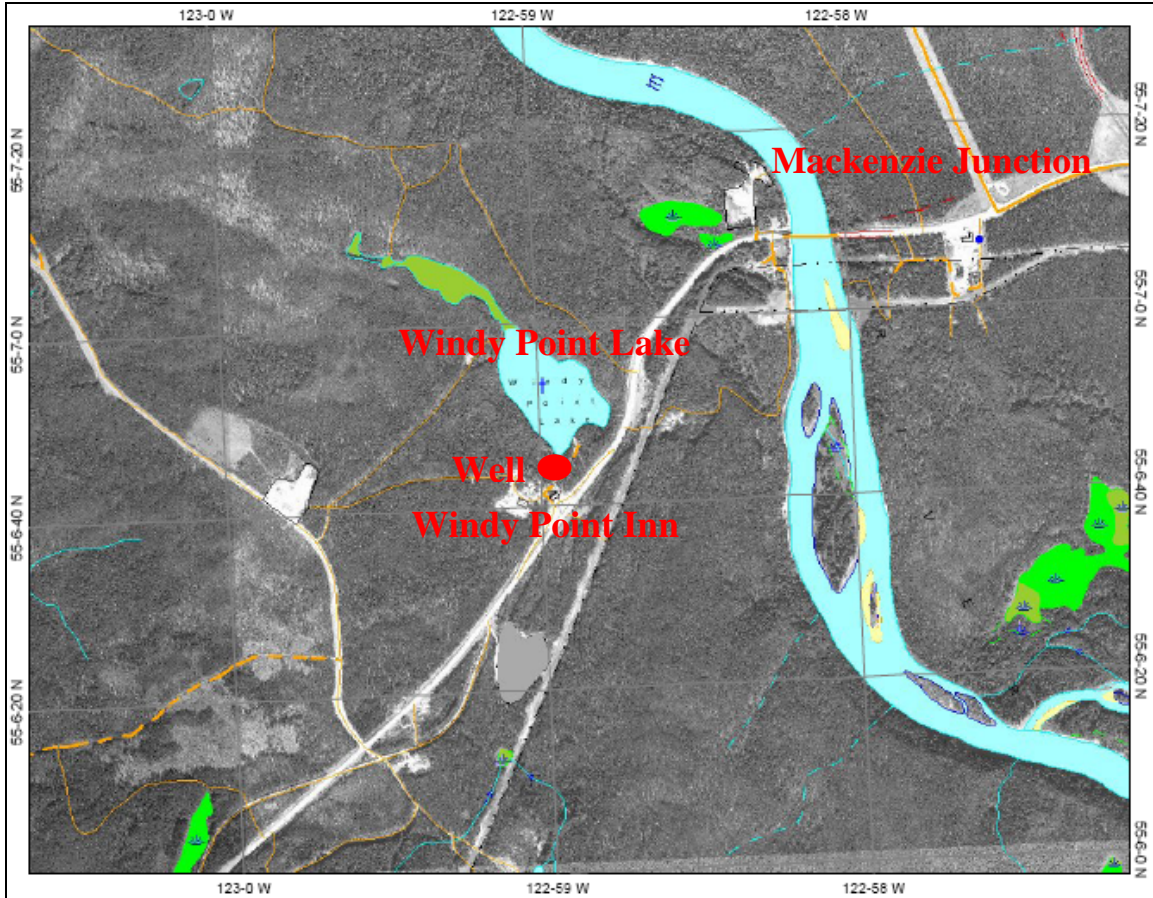


Figure 1. Windy Point Inn overview map. The map scale is 1:20,000.

Site Description

Watershed Overview

Windy Point Inn is located south of the Mackenzie junction, approximately 150km north of Prince George, B.C.. This area lies within the Sub-Boreal Spruce biogeoclimatic zone, which is characterized by gently rolling terrain, dense coniferous forests, and extremes in the annual temperature range of -40°C to 30°C (B.C. Ministry of Forests, 1998).

The land use activity immediately surrounding the well includes a campground, a major highway and Windy Point Inn sewage disposal.

The Windy Point well is located in a gravel lithology beside Windy Point Lake. Given the shallow depth of the well and the close proximity to the lake, the well is likely dependant on surface water. Since there is no confining layer to help prevent contaminants from entering the well, it may be prone to possible contamination.

Drinking Water Supply & Treatment

The Windy Point Inn draws its water from a shallow (~5m deep) well approximately 10m from Windy Point Lake. The well is located at the approximate UTM co-ordinates 10U 501178, 6107368. The water is pumped from the well and distributed to the campground, restaurant and bunk house. The number of water users varies depending on the season, with

greater than fifty during the summer to less than five during the winter. There is currently no holding reservoir and the water is not treated.

Mr. Jeroen Van Lu, the caretaker of Windy Point Inn, does not currently have any major quality or quantity concerns regarding the water supply. He did indicate that no major issues have arisen in the past, except for a freezing pump and a total coliform exceedance during the construction of a new bunkhouse. Follow-up monitoring occurred after the positive coliform test; however, no further results suggested the presence of bacteria.

Materials & Methods

Sample Collection & Analyses for the 2005/06 Water Monitoring Program

An experienced MOE staff member collected water samples in laboratory certified polyethylene bottles for a variety of chemical and bacterial analyses. Representative grab samples were collected inside the restaurant kitchen at the large sink (raw water tap).

Bottles used for general ion analyses were rinsed three times with source water prior to sample collection. Metal and bacterial bottles were not rinsed and metal samples were lab preserved. Water samples were shipped by overnight courier in coolers with ice packs to Cantest Laboratories Inc. for bacteria and Maxxam Analytical Services for chemistry analysis. Bacterial samples were analysed using membrane filtration. Metals analysis made use of ICPMS technology.

Quality Assessment (QA)

To ensure accuracy and precision of data, quality assurance and control (QA/QC) procedures were incorporated into the monitoring program. This included use of rigorous sampling protocols, proper training of field staff, setting of data quality objectives (DQO) and the submission of QA samples to the lab. Field QA included duplicate and blind blank samples.

Blank samples detect contamination introduced in the field and/or in the lab. A comparison of duplicate results measures the effect of combined field error, laboratory error and real between-sample variability. The blind blank and duplicate program accounted for roughly 10% of the overall chemistry and bacterial sample numbers.

Results

Water Monitoring Program (2005/06)

Quality Assessment (QA)

The field blank and duplicate results indicate that minimal field or lab contamination of samples with bacteria occurred and that acceptable precision in bacterial sampling and analysis was observed.

The water chemistry field blank and replicate samples were all considered to be of good quality. There were no blanks that exceeded the lab acceptance criteria of 5 times the minimum detectable level (MDL) and no replicates exceeding our set objective of 25%

relative percent difference.

Since there were no data quality objective (DQO) exceedances during this sampling program, all data are considered to be of good quality and suitable for review.

Bacteriology

The 2005/06 bacterial data are summarised in Table 1.

Drinking water quality guidelines for *E. coli*, *Enterococci* and fecal coliforms are 0 CFU/100mL for raw water supplies that undergo no treatment. The guideline for total coliforms is 0 CFU/100mL if only one sample was collected during a one month period (the guideline is 10CFU/100mL if 90th percentiles are calculated).

As seen in Table 1, no bacteria were detected during this sampling program. However, because the Inn currently uses no form of water treatment, ongoing bacterial sampling should occur. Given the shallow depth of the well and the close proximity to surface water, there is potential for contamination.

Table 1. Results of bacterial analysis for Windy Point Inn source water. Results are in CFU/100mL.

Date	Total Coliforms	<i>E.coli</i>	<i>Enterococci</i>	Fecal Coliforms
Provincial Guideline	0 CFU/100 mL	0 CFU/100 mL	0 CFU/100 mL	0 CFU/100 mL
10/06/05	<1	<1	<1	<1
01/11/06	<1	<1	<1	<1
03/21/06	<1	<1	<1	<1
05/16/06	<1	-	<1	<1
08/02/06	<1	<1	<1	<1

Water Chemistry

In 2005/06, water samples were analysed for general parameters as well as for the ICPMS low level metals package that include metals in the total and dissolved form (Table 2).

Of the chemical and physical parameters tested through the duration of this study, none exceeded recommended drinking water guidelines. However, one parameter was of note.

Hardness, Total (mg/L CaCO₃) - Water hardness, which can often be a problem in ground water supplies, had a mean concentration of 176 mg/L CaCO₃. This is considered hard (120-180 mg/L CaCO₃) and above the optimum range of 80-100 mg/L CaCO₃ for a drinking water supply. This hardness is mainly due to the presence of calcium and magnesium in the water. Hard water can reduce the toxicity of some metals, but can also leave scale deposits on piping (RIC, 1998). Some anthropogenic sources that contribute to water hardness include mining and industrial effluents (not likely applicable to Windy Point Inn). High hardness values also occur naturally in areas where there is an abundance of calcium and magnesium bearing rocks and minerals.

The data from 2005/06 suggest that all parameters are well below recommended drinking water guidelines and that Windy Point Inn has excellent water quality.

Table 2. Results of chemical analysis for the Windy Point water supply. MDL=Minimum Detectable Limit.

	MDL	Sample Date	Sample Date	Sample Date	Sample Date	Sample Date	DW Guideline	Guideline Type	
		10/06/05	11/01/06	3/21/06	5/16/06	2/08/06			
Bacteria									
Total Coliforms	CFU/100mL	1	<1	<1	<1	<1	10		
Fecal Coliforms	CFU/100mL	1	<1	<1	<1	<1	0		
E.Coli	CFU/100mL	1	<1	<1	<1	<1	0		
Enterococci	CFU/100mL	1	<1	<1	<1	<1	0		
Misc. Inorganics									
Bromide (Br)	mg/L	0.1	<0.1	<0.1	<0.1	<0.1			
Fluoride (F)	mg/L	0.01	0.06	0.05	0.06	0.04	1.5	Maxium	
Preparation									
Filter and HNO3 Preservation	N/A	N/A	YES	YES	YES	YES			
Calculated Parameters									
Total Hardness (CaCO3)	mg/L	0.5	180	180	180	150	190		
Misc. Inorganics									
Dissolved Hardness (CaCO3)	mg/L	0.5	180	180	180	150	190	500	
Alkalinity (Total as CaCO3)	mg/L	0.5	163	164	165	143	180		
Total Organic Carbon (C)	mg/L	0.5	<0.5	<0.5	0.7	0.5	<0.5	4	Max when chlorination
Anions									
Dissolved Sulphate (SO4)	mg/L	0.5	2.8	2.8	3.2	2.1	1.6	500	Aesthetic
Dissolved Chloride (Cl)	mg/L	0.5	3.8	4.3	3.6	2.5	7.3	250	
Dissolved Metals by ICPMS									
Dissolved Aluminum (Al)	ug/L	0.3	0.6	0.5	<0.3	1	1.1	200	Maxium
Dissolved Antimony (Sb)	ug/L	0.005	0.018	0.007	0.022	0.013	0.022		
Dissolved Arsenic (As)	ug/L	0.1	<0.1	<0.1	0.1	<0.1	<0.1		
Dissolved Barium (Ba)	ug/L	0.02	30.3	27.4	23.9	23.2	26.9		
Dissolved Beryllium (Be)	ug/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02		
Dissolved Bismuth (Bi)	ug/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02		
Dissolved Cadmium (Cd)	ug/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
Dissolved Chromium (Cr)	ug/L	0.2	1.4	<0.2	0.2	<0.2	<0.2		
Dissolved Cobalt (Co)	ug/L	0.005	0.005	<0.005	<0.005	0.015	<0.005		
Dissolved Copper (Cu)	ug/L	0.05	5.14	3.97	3.52	5.32	4.94		
Dissolved Lead (Pb)	ug/L	0.01	0.13	0.04	0.11	0.14	0.15		
Dissolved Lithium (Li)	ug/L	0.05	1.31	1.82	1.35	1.85	1.68		
Dissolved Manganese (Mn)	ug/L	0.008	<0.008	0.076	<0.008	0.013	<0.008		
Dissolved Molybdenum (Mo)	ug/L	0.05	0.21	0.20	0.16	0.27	0.22		
Dissolved Nickel (Ni)	ug/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
Dissolved Selenium (Se)	ug/L	0.2	<0.2	<0.2	0.2	<0.2	<0.2		
Dissolved Silver (Ag)	ug/L	0.02	<0.02	<0.02	<0.02	<0.02	0.02		
Dissolved Strontium (Sr)	ug/L	0.005	199	186	155	158	159		
Dissolved Thallium (Tl)	ug/L	0.002	0.004	0.002	0.003	<0.002	<0.002		
Dissolved Tin (Sn)	ug/L	0.01	<0.01		0.02	<0.01	0.02		
Dissolved Uranium (U)	ug/L	0.002	0.604	0.655	0.487	0.491	0.574		
Dissolved Vanadium (V)	ug/L	0.06	<0.06	0.07	0.07	<0.06	<0.06		
Dissolved Zinc (Zn)	ug/L	0.1	2.3	2.6	1.8	3.7	<0.1		
Leachable Metals									
Total Aluminum (Al)	ug/L	0.3	0.7	0.6	<0.3	1.5	0.9		
Total Antimony (Sb)	ug/L	0.005	0.019	0.011	0.021	0.012	0.016	6	Interim Maxium
Total Arsenic (As)	ug/L	0.1	0.1	<0.1	0.1	<0.1	0.1	10	Interim Maxium
Total Barium (Ba)	ug/L	0.02	31.1	28.8	30.5	23.2	25	1000	Maxium
Total Beryllium (Be)	ug/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	4	EPA Guideline
Total Bismuth (Bi)	ug/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02		
Total Cadmium (Cd)	ug/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5	Maxium
Total Chromium (Cr)	ug/L	0.2	1.4	0.6	0.3	<0.2	<0.2	50	Maxium
Total Cobalt (Co)	ug/L	0.005	0.007	0.006	<0.005	0.014	<0.005		
Total Copper (Cu)	ug/L	0.05	5.23	4.35	4.76	5.95	4.74	1000	Maxium
Total Lead (Pb)	ug/L	0.01	0.14	0.16	0.15	0.17	0.15	10	Maxium
Total Lithium (Li)	ug/L	0.05	1.3	1.89	1.65	1.75	1.7		
Total Manganese (Mn)	ug/L	0.008	<0.008	0.117	<0.008	0.033	<0.008	50	Aesthetic
Total Molybdenum (Mo)	ug/L	0.05	0.22	0.21	0.22	0.29	0.23	250	Maxium
Total Nickel (Ni)	ug/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
Total Selenium (Se)	ug/L	0.2	<0.2	<0.2	0.4	<0.2	0.3	10	Maxium
Total Silver (Ag)	ug/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02		
Total Strontium (Sr)	ug/L	0.005	202	195	198	168	149		
Total Thallium (Tl)	ug/L	0.002	0.003	0.004	0.005	<0.002	<0.002	2	EPA Guideline
Total Tin (Sn)	ug/L	0.01	0.02	0.02	0.02	0.01	<0.01		
Total Uranium (U)	ug/L	0.002	0.584	0.654	0.671	0.525	0.537	100	Maxium
Total Vanadium (V)	ug/L	0.06	0.07	0.10	0.08	0.07	<0.06		
Total Zinc (Zn)	ug/L	0.1	2.2	2.8	2.2	3.9	0.9	5000	Aesthetic
MISCELLANEOUS									
True Colour	Col. Unit	5	<5	<5	<5	<5	<5	15	Aesthetic
Nutrients									
Total Kjeldahl Nitrogen (Calc)	mg/L	0.02	0.02	0.03	0.03	0.23	<0.02		
Total Organic Nitrogen (N)	mg/L	0.02	0.02	0.03	0.03	0.23	<0.02		
Dissolved Phosphorus (P)	mg/L	0.002	<0.002	<0.002	0.004	0.003	<0.002		
Ammonia (N)	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	Refer to tables	
Total Inorganic Carbon C	mg/L	0.5		40.2	41.7	35.1	39.7		
Nitrate plus Nitrite (N)	mg/L	0.002	0.163	0.167	0.168	0.101	0.189	10	
Total Nitrogen (N)	mg/L	0.02	0.18	0.20	0.2	0.33	0.2		
Total Phosphorus (P)	mg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002		
Physical Properties									
Conductivity	uS/cm	1	321	322	322	269	327	700	Maxium
pH	pH Units	0.1	8.2	8.2	8.1	7.9	8.1	6.5-8.5	Aesthetic
Physical Properties									
Total Suspended Solids	mg/L	4	<4	<4	<4	<4	<4	Refer to tables	
Turbidity	NTU	0.1	0.4	0.2	<0.1	<0.1	<0.1	1	Maxium
Dissolved Metals by ICP									
Dissolved Boron (B)	mg/L	0.008		<0.008					
Dissolved Calcium (Ca)	mg/L	0.05	56.9	57.5	57.2	47.9	60.6		
Dissolved Iron (Fe)	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.3	Aesthetic
Dissolved Magnesium (Mg)	mg/L	0.05	8.31	8.77	8.7	7.61	9.12	100	Taste for sensitive
Dissolved Phosphorus (P)	mg/L	0.1		<1					
Dissolved Potassium (K)	mg/L	1		<1					
Dissolved Sodium (Na)	mg/L	0.05		2.57					
Dissolved Sulphur (S)	mg/L	0.1		0.9					
Dissolved Titanium (Ti)	mg/L	0.003		<0.003					
Dissolved Zirconium (Zr)	mg/L	0.005		<0.005					
Total Metals by ICP									
Total Boron (B)	mg/L	<0.008		<0.008					
Total Calcium (Ca)	mg/L	0.05	58.0	56.4	53.4	48.4	52.1		
Total Iron (Fe)	mg/L	0.005	<0.005	0.016	<0.005	<0.005	<0.005		
Total Magnesium (Mg)	mg/L	0.05	8.65	8.47	7.96	7.58	7.99		
Total Phosphorus (P)	mg/L	1		<1					
Total Potassium (K)	mg/L	1		<1					
Total Sodium (Na)	mg/L	0.05	2.60	2.33	2.21	2.13	2.76	200 (20 for sensitive)	Aesthetic
Total Sulphur (S)	mg/L	0.1		0.9					
Total Titanium (Ti)	mg/L	0.003		<0.003					
Total Zirconium (Zr)	mg/L	0.005		<0.005					

Conclusions & Recommendations

Review of the Windy Point Inn water supply suggests an overall excellent water quality with all water soluble contaminants present below their Canadian Drinking Water Guideline.

Without conducting a more detailed assessment on the well in question, a 300m radius can be arbitrarily assigned as the zone where contamination is most likely to happen (Mike Wei, Senior Hydrogeologist, MOE, p.c.). Since the Windy Point well is shallow (~5m) in a gravel aquifer, the well is vulnerable to contamination. Given the close proximity to Windy Point Lake, water moving to the well from the surface may impact the water quality, especially coliforms originating from waterfowl and wildlife.

It is recommended that Windy Point Inn securely cap their well and ensure no external water can enter the pump house. These problems were identified by Northern Health during routine inspections. Because the source water is not currently treated, any surface water or rodents entering the well might degrade the quality of the finished water. Furthermore, as stated in the British Columbia Ground Water Protection Regulation (GWPR) (2004):

10 (2) On or before October 31, 2007, the owner of an existing well must install and maintain a secure well cap, or well cap and well cover, to the opening of the well to do all of the following:

(a) to prevent direct and unintended entry into the well of any water at the surface of the ground, including floodwater and ponded water, or anything that is set out in section 79 (1) of the Act;

(b) to prevent persons or animals entering the well;

(c) to prevent or minimize the flow of water from a flowing artesian well.

The Water Act (2001) section 79 (1) states:

79 (1) A person must not introduce, allow to be introduced or cause to be introduced any of the following into a well:

(a) refuse;

(b) carcasses;

(c) human or animal waste;

(d) pesticides or fertilizers;

(e) material, natural or otherwise, from construction or demolition;

(f) any other prescribed matter or substance;

(g) a contaminant, or a prescribed matter or substance, in such amounts or in such a manner as to cause or to be likely to cause a significant adverse impact on

(i) the quality of ground water in the well, or

(ii) the existing uses made of the ground water from the well.

By installing a secure well cap and flood proofing the well, these requirements should be met.

Continued monitoring for total coliforms and *E. coli* is recommended. Because the supply is so dependant on a surface source, it may be beneficial to increase the sample frequency during high risk periods; more specifically, spring freshet and after heavy rain events.

All health related issues concerning this water supply should be discussed with the regional Drinking Water Leader at Northern Health.

This study is one part of a broader water quality management program being carried out by the Environmental Quality Section in MOE's Omineca-Peace Region. The overall objectives of this program are to monitor water quality to identify problems, to determine causes, and to work with local governments, landowners and other interested parties to improve or otherwise protect water quality and aquatic life. Information sharing between governments, specifically MOE, Northern Health and various Regional and Municipal governments, is an ongoing practice.

Acknowledgements

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Contact Information

For more information regarding either this short report, watershed protection and/or drinking water, please contact:

- Ministry of Environment (Prince George) - James Jacklin, 250-565-4403
- Northern Health (Prince George) - Bruce Gaunt, 250-565-2150

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