District of 100 Mile House

WATER CONSERVATION PLAN

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1.0 INTRODUCTION

Bridge Creek is the District of 100 Mile House's main source of water. The water quality of Bridge Creek has been an issue dating back to 1968 when the Provincial Pollution Control Branch first showed initial concerns. Numerous studies have linked these water quality concerns to agriculture, which is abundant and essential for the economy in the area. In response to these concerns, a slow sand filtration system was built in 1985 to improve the water quality. Recently, due to low water levels in Bridge Creek during the winter months, a standby well (Well No. 4) has been used to supplement the primary Bridge Creek supply. However, there are concerns regarding surface water influence, hardness and manganese content of the well water. Changes to the water system and conservation measures are necessary in order to ensure the sustainability of 100 Mile House and to accommodate growth and development in the area.

1.1.1 Well Water Quantity

The maximum capacity of the well is 75 L/s. The well is capable of continually producing a flow rate of 53.7 L/s. The production well pump is rated for 50.5 L/s (800 USGPM).

1.1.2 Well Water Quality

Golder Associates collected well water samples from the production well during the well pumping tests in 2003 and 2004.

The water quality of the well water is very hard and very high in total dissolved solids (TDS). The hardness and TDS are in the range of 500 to 600 mg/L and 800 to 1000 mg/L, exceeding the aesthetic objectives (AOs) of the Guidelines for Canadian Drinking Water Quality (GCDWQ) of 200 mg/L and 500 mg/L respectively.

Manganese, which is also an aesthetic parameter, has a concentration in the range of 0.2 to 0.3 mg/L and also exceeds the AO of 0.05 mg/L. Iron results seem to be somewhat variable, and are likely relative to the solids content/turbidity of the water. In the 2003 sample, the turbidity was 1.8 NTU and the iron was 0.25 mg/L (i.e. less than the AO of 0.3 mg/L). However, in the 2006 sample, the turbidity was 130 NTU and the iron was extremely high at 11 mg/L.

A high lead result of 0.0157 mg/L seen in the 2003 samples raised concerns as it exceeded the maximum allowable concentration (MAC) of 0.01 mg/L. However, further testing has indicated that lead concentrations meet the MAC.Testing has also indicated that selenium levels may be somewhat elevated, and are in the rangeof 0.007 to 0.01. The MAC for selenium is 0.01 mg/L.

1.2 Bridge Creek

Bridge Creek is the primary source of water for the District. An intake on Bridge Creek supplies water to a slow sand filtration system, which is then chlorinated and sent to the distribution system. Information regarding Bridge Creek has been compiled from the reports on Water Quality and Use in the Bridge Creek Basin (Hart, 1993) and the Horse Lake – Bridge Creek Water Quality Assessment (Zirnhelt, 1997).

The water flow rate of Bridge Creek is controlled by the Bridge Creek control structure at the west end of Horse Lake. The creek flows through 100 Mile House and outlets in Canim Lake.

1.2.1 Bridge Creek Water Quantity

The quantity of water that flows in Bridge Creek varies depending on rainfall, snow pack and the Bridge Creek structure, which controls the flow of water out of Horse Lake.

The District is licensed to use up to 2,000,000 Imperial gallons/day from Bridge Creek, or 9092 m^3/d (0.105 m^3/s). They are also licensed to store 2,686 acre-feet or 3,313 ML in Horse Lake between October 1 and May 31.

1.3 Horse Lake

Information regarding Horse Lake has been compiled from the reports on Water Quality and Use in the Bridge Creek Basin (Zirnhelt, 1997) and the Horse Lake – Bridge Creek Water Quality Assessment (Hart, 1997).

Horse Lake is located within the Bridge Creek Basin. The tributaries for Horse Lake are Attwood, Evergreen, Fawn, Longbow, 93 Mile, and Bridge Creek. The lake outflows into Bridge Creek, eventually draining into the Fraser River.

Horse Lake is enjoyed by a wide range of water sport enthusiasts and is home to a wide range of fish and wildlife. There are seven water licenses allowing direct withdrawal from Horse Lake for domestic and irrigation purposes totalling 284,545 m_3 of water annually.

1.3.1 Horse Lake Quantity

Snow is the main form of precipitation during the winter and the resulting run-off leads to high water levels in May and June. The lake level is at a seasonal low level during October and November due to low precipitation and summer evaporation. Horse Lake has an average depth of 15.2 m and a maximum depth of 34.0 m. The approximate surface area and volume of Horse Water Supply Study Lake is 11.2 km_2 and $174.6 \times 10_6$ m_3, respectively. The outflow volume of the lake is 49,953,024 m_3/year with a residence time of approximately 3.49 years.

1.3.2 Horse Lake Water Quality

Historical results indicate that the turbidity ranges between 0.2 and 0.6 NTU. It is unclear whether this information is reflective of the average conditions or provides the real range of turbidity.

The Horse Lake water is relatively hard at about 140 mg/L. It is also alkaline, with pH in the range of 8.0 to 8.5. Colour readings appear to be lower than the AO of 15 TCU.

All measured water criteria parameters meet the GCDWQ. Total and Dissolved Organic Carbon readings were not available for Horse Lake; therefore, no comparison can be made to the Bridge Creek results for these parameters. Disinfection by-product formation potential results were not available. UV Transmissivity results were not available.

No protozoa readings were found for Horse Lake; therefore an assessment cannot be made as to the level of protozoa present in the lake. However, protozoa are assumed to be present in all surface waters.

1.4 Implementation

District Council supports the efforts of staff in the development and implementation of a Water Conservation Plan and a Watershed Management Plan. District Engineering, Planning and Building Inspection staff will be working with consultants, Interior Health, CRD and stakeholders to develop strategies and educational tools to work towards meeting the Living Water Smart objectives.

2.0 Community Water System Profile

There are several uses in the watershed that could have an impact on the water quality of Horse Lake. These uses include agriculture, forestry, wastewater collection/disposal, commercial/industrial, recreation/boating, and other types of activities. These activities/impacts may be beyond the District's boundary and/or may be beyond their ability to control.

The District is committed to initiating a Watershed Management Plan as stated in Section 1.4

2.1 Population and Water Demands

Future water demands are based on population growth, current demand characteristics and designated land usage.

2.1.1 Population Projections

Population estimates are summarized in the April 24, 2007 memo from Urban Systems entitled District of 100 Mile House – Population Forecast (Appendix A). It is difficult to forecast community growth with any degree of accuracy and the District has indicated that there are several new developments planned within the community. Therefore, instead of tying water distributions system improvements to population growth, improvements are recommended in terms of:

1. Existing Deficiencies;
2. Improvements required for specific developments and;
3. General improvements for increased water quality and operability
4. Development and implementation of a Water Conservation Program

2.1.2 Water Demands

Using the 2006 population and water consumption records, the per capita annual average day demand (ADD) was calculated to be:

$$1{,}374{,}000L/d/1{,}829people=751\ L/cap/day$$

The 2006 maximum day demand (MDD), found to be on June 30, 2006, was calculated to be:

$$3{,}443{,}000L/d/1{,}829people=1{,}882L/cap/day$$

The MDD/ADD ratio is 2.51.

A comparison of the ADD and MDD from various BC communities has been provided below in Table 2-1. This table shows that the District's water consumption is consistent with other communities in BC.

Table 2-1: ADD and MDD Comparison

	ADD	MDD
District of 100 Mile House	751	1,882
Village of Valemount (2004)	645	1,980
Quesnel (2003)	630	1,250
Logan Lake (2001)	560	2,046

2.1.3 Land Use

For the purpose of this study, land use areas are based on the District of 100 Mile House Official Community Plan Bylaw No. 990. The District of 100 Mile House land use consists of approximately 62 hectares of developed industrial land, 150 hectares of residential land including the two modular home parks and 134 hectares of commercial / institutional land.

2.2 WATER SYSTEM OVERVIEW

In general, the District of 100 Mile House water system consists of three main components:

1. water treatment;
2. water distribution; (Appendix C) and
3. water storage.

2.3 Water Treatment

The District of 100 Mile House largely relies on Bridge Creek to fulfill its water demands. The District water treatment plant utilizes a slow sand filter system combined with chlorination to treat the water prior to delivery to the distribution system. The intake and water treatment plant (WTP) are located adjacent to Bridge Creek and the public works yard.

The District has a groundwater well which can be used to supplement the supply from the WTP.

The well is located north of Little Bridge Creek on the west side of Cariboo Highway. Although the well is finished in a relatively high yield aquifer, poor aesthetic water quality, including hardness and iron, prevent this well from being used on a regular basis. In addition, this well is situated within a fractured bedrock aquifer and is likely under the influence of surface water.

2.4 Water Distribution

The District water distribution system consists of two pressure zones, each with its own reservoir for balancing storage. Water from both the WTP and Well No. 4 pump water into the low pressure zone. The high pressure zone is fed via a booster station located near the low zone reservoir. A pressure reducing station located just north of Fifth Street on a side road east of the Caribou Highway allows water from the high zone to be fed back to the low zone.

2.5 Water Storage

The District water system has two reservoirs which provide balancing storage for the distribution system. The low zone reservoir is located adjacent to the public works yard, and the high zone reservoir is located near the southwest District boundary. The total water storage provided by the district reservoirs is 1610 m_3.

2.6 Water Usage Data

See the 2007-2008 District of 100 Mile Annual Water Report Appendix B

3.0 Sewer System

The District of 100 Mile House upgraded their treatment works in 1992 through the addition of aerated lagoons and a winter storage cell (cell 3). All of the raw sewage from the District is pumped to the two aerated lagoons. Effluent then overflows into Cell 3. During the irrigation season effluent is pumped from Cell 3, and is spray irrigated on fields around the area.

3.1 EXISTING SYSTEMS

Appendix D illustrates where the sewage collection systems are
located. The transmission and treatment components include:

.1 Main lift station: two 25 hp hydromatic pumps, and a level sensor to calculate flows;
.2 Forcemain: 920 m at 250 mm diameter;
.3 Gravity sewer into Cell 1: 380 m at 350 mm diameter;
.4 Aerated Cell 1: 23,862 m_3, depth 5 m, 1 m freeboard, 24 diffusers;
.5 Aerated Cell 2: 30,548 m_3, depth 5 m, 1 m freeboard, 14 diffusers; and
.6 One 50 hp Aerzen blower, equates to 0.92 Hp/1000 m_3 of lagoon volume.
(There are two Hoffman blowers that are not functional.)

The disposal facilities include:
.1 Storage Cell 3: 286,620 m_3, depth 5 m and 7.3 m, 1 m freeboard;
.2 Effluent spray irrigation pumps (vertical turbines)
- Two at 20 Hp for areas closer to town served by an irrigation canon;
approximate pumping rate is (160 USgpm)
- One at 20 Hp for Hillside (± 250 USgpm);
.3 Forcemains to the irrigation areas; and

.4 Irrigation sites, complete with irrigation sprinklers/canon, as noted below and as shown on Figure 4.1.

Site	Area (Ha)	Name	Land Owner
1	4.92	Barn South	100 Mile Ranch
2	9.94	Barn North	100 Mile Ranch
3	4.71	Old Lagoons	100 Mile Ranch
4	10.01	Willowdale	100 Mile Ranch
5	52.8	Site 5	District of 100 Mile House
6	1.82	Hillside	

4.0 Targets for Sustainable Community Water

The current demand on the water treatment plant and sewage disposal systems, in conjunction with the District's commitment to sustainable environmental policies has initiated the following parameters:

- To conserve the water thereby enhancing the natural environment
- Reduce the volume of waste water to the District's sewer system
- Education and awareness of the public with regards to water resources
- Implementation of a watershed management plan
- Minimizing greenhouse gas emissions by reducing energy consumption

The Districts OCP Natural Environment objectives also support these initiatives:

.1 Continue to strive to enhance Environmentally Sensitive Areas (ESA's) within the District boundaries;

.2 Exercise good stewardship of the Bridge Creek watershed;

.3 Provide a level of protection for both people and property from identifiable natural hazards in the District; and

.4 Maintain high water quality in surface water, ground water and aquifers.

The District's 2008 tax roll lists the following breakdown of eligible units:

• Residential	582
• Farm	5
• Strata (residential)	100
• Commercial	249
• Industrial	31

The program will be structured to target residential users (687 total) first as this would potentially net the most reduction.

5.0 Conservation Methods

To date the District's conservation method has been seasonal sprinkler restrictions, commercial metering and limited public education.
The 2006 BC Building Code initiatives OE1 Energy Efficiency and OE2 Water Efficiency ensure new construction meets the Districts sustainability policies.

The District supports the implementation of the following initiatives subject to Council review and budget constraints.

- Continue sprinkler restrictions
- Enhance public education and awareness
- Implement residential plumbing fixture replacement program
- Implement commercial plumbing fixture replacement program
- Require installation of residential meters in new residential construction
- Meter existing residential units
- Initiate residential metering program

6.0 Implementation

The implementation process and dates are subject to budget and human resource allocation limitations. The program aims to set realistic target dates with cost estimates to be used in subsequent budget deliberations.

6.1 Public Education

The District's utility billing is mailed out quarterly in which the District can insert educational pamphlets. The District will work in conjunction with Interior Health to promote conservation and watershed stewardship. Informational brochures on efficient plumbing, xeriscaped landscaping, composting toilets ect. can be inserted. While data indicates educational promotions do not net large conservation results the costs are relatively low.

Implementation date March 2010 estimated cost $600 per year

6.2 Residential plumbing fixture replacement program

The District in 2008 had a residential roll count of 687 including strata units. With a well managed program the District hopes to generate a participation rate of 40% in the first five years. The District plan includes the replacement of 13L per flush toilets with high efficiency <6L per flush toilets in conjunction with water efficient shower heads and faucet aerators. The program will be developed as a multi-year initiative at a projected cost of $300 per household.

Similar programs in B.C. have shown an average decrease in household consumption of 24%.

- Planning and development including projected flow reductions- completion date October 2011
- Budget consideration for 2012 - November 2011
- Implementation of program March 2012 (budget 60 units) $ 18,000 per year

6.2 Commercial plumbing fixture replacement program

Extension of the program to include commercial and institutional users would be initiated following analysis of the results of the residential program. Examples from the Sunshine Coast Regional District's commercial pilot program show and average of 34% reduction in consumption.

- Review residential program and develop commercial program March 2014
- Budget consideration for 2015 - November 2014
- Implementation of program March 2015 Costs to be determined in development stage

6.2 Metering

The Districts long term plan includes an initiative to meter residential users.

- Require installation of meters for new construction Bylaw update 2011
- Retrofit existing residences with meters program development 2015
- Implement global metering 2020

REFERENCE DOCUMENTS

- Sewage Treatment and Disposal Study - Urban Systems Ltd. 2007
- Water Treatment Study – Urban Systems Ltd. 2007
- Population Forecast – Urban Systems 2007
- Water Supply Study – Urban Systems Ltd. 2008
- District of 100 Mile House Annual Water Report 2009