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URBANSYSTEMS.

MEMORANDUM

date:	January 20, 2011
to:	Sasha Bird
cc:	
from:	Ehren Lee, P.Eng. and Brad Minnes, P.Eng, MBA
file #:	0788.0018.01
subject:	***GRAND FORKS WATER DEMAND MANAGEMENT: AN ACTION PLAN***

1.0 SUMMARY

This Demand Management Action Plan is comprised of two, interrelated sections: water conservation and water auditing. The water audit was conducted first, to create a detailed pie chart for water use based on all customer classes and known demand types. The water conservation strategy was conducted second, and incorporates the work of previous conservation, drought, and water meter business case reports. When the audit and the conservation plan are combined into a demand management action plan, the City will be provided with recommendations to reduce utility costs, minimize the City's water footprint, increase efficiencies, and demonstrate to its customers (residents, etc.) that conserving water is a priority.

The focus of this document is to move from awareness to action. As such, the focus of the assignment is to provide action steps that will initiate new utility management techniques to reduce water use. The remainder of the document summarizes the analyses and develops strategic objectives for action. Ultimately, Grand Forks can get started on demand management by conducting the following:

1. ***Complete a Meter Implementation Strategy***
   a. Topics to explore include meter installation phasing plan, selecting a voluntary or a mandatory program, determining budget requirements (short term and long term), determining financing options, selecting accounting protocols and investigating the use of mock-billing.
   b. Timeline: Complete Prior to February 1, 2011
2. ***Submit an application to the General Strategic Priorities Fund as part of the Gas Tax Agreement***
   a. Include the Water Meter Implementation Strategy to demonstrate a high-level of organization
   b. Timeline: Application Deadline is February 1, 2011
3. ***Initiate the First Step in reducing Unaccounted-for-water***
   a. Initiate a winter bleed water survey
   b. Timeline: Late January 2011 (to coincide with the cold weather)

2.0 PURPOSE

The purpose of this document is to integrate the results of the water audit with the goals and methods of water conservation to create a progressive action plan that requires routine monitoring, adequate funding, and strong local support.

2.1 Action Plan Format

This report has been formatted so that the key outcomes of the analysis along with recommendations are presented. The supporting documentation (data and calculations) relied upon to create the plan is enclosed at the back of this memorandum.

3.0 BACKGROUND

Over the past ten years, USL and others have been involved in helping the City of Grand Forks gather information and formulate recommendations on how to better handle its water supply and distribution system. In 2000 USL provided the Universal Water Metering Feasibility Assessment, which indicated that the City would derive significant economic savings and qualitative benefits by implementing a metering program. Subsequent studies by Dobson Engineering (Drought Management & Conservation Plan, 2005) and Kerr Wood Leidal (Water Conservation Plan, 2010) have supported the recommendation to implement a universal metering program (particularly the residential component since metering has been implemented for industrial and commercial operations). This report adds further valuable information from a water audit and demand management theory to formulate a plan of action to accomplish real water conservation for the City of Grand Forks.

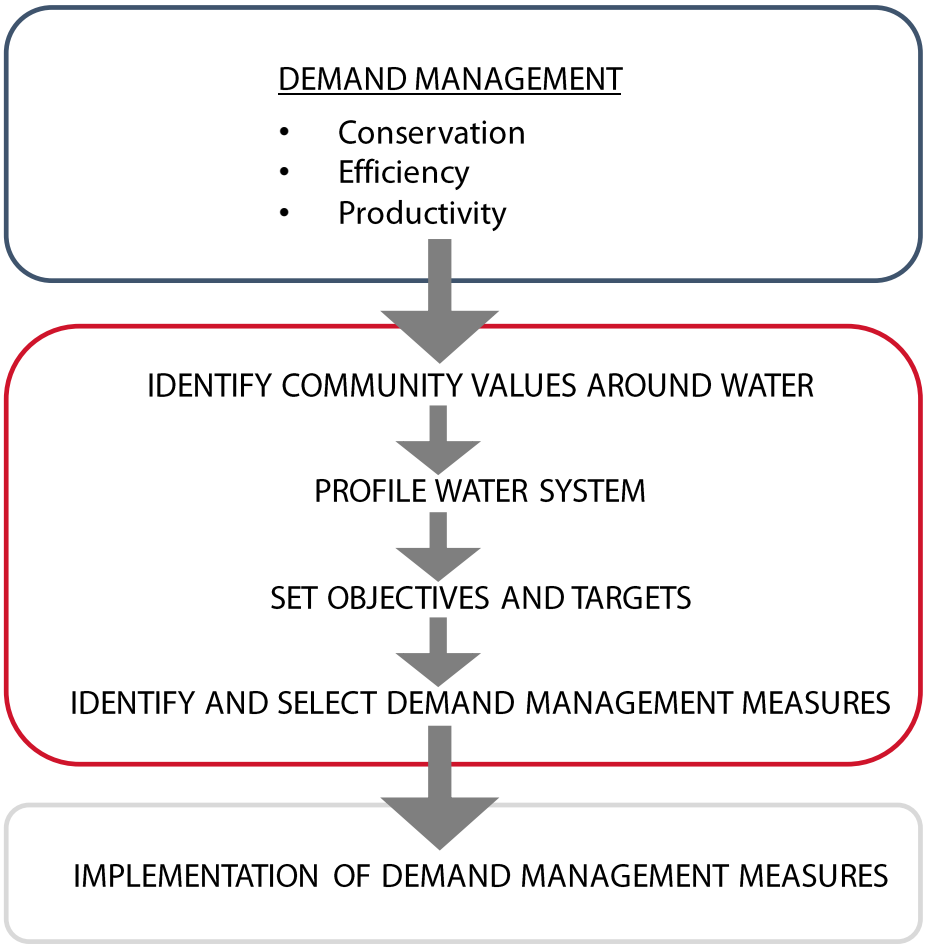
3.1 Water Audit

An effective water audit results in a characterization of supply and consumption within the network. In other words, it includes an examination of the difference (what, where, why) between water extracted from the source and what is ultimately delivered to paying customers. It is not uncommon for the difference between 'supplied' and 'consumed' to be in the order of 25% or more. When considering expenditures for a water utility, this is not an insignificant figure.

3.2 Water Conservation

The Living Water Smart Plan released by the BC Government calls for a new way to utilize and manage community water resources. One of the quantitative action items is a call for 33% reduction in water use by 2020. This will mean that approximately half of all new development water needs will be provided by conservation measures. Although the development rate in Grand Forks may be low, and the water supply is adequate, the economic benefits are enough on their own to make a strong case for conservation measures such as a broad-based metering program.

To accomplish water conservation, as well as efficiency and productivity, means to balance and manage supply and demand. Given the adequacy on the supply side in Grand Forks, this report will focus on the demand side with the following plan structure:



4.0 SYSTEM PROFILE AND WATER DEMANDS

The baseline information selected for this assignment is the 2009 water use summary. Table 1 summarizes the volume of water supplied by the 5 wells.

Table 1 – Groundwater Supply from Wells in Grand Forks

Well	2009 Supply Volume (m^3)
Well 2	319,462
Well 3A	444,995
Well 3	503,247
Well 4	217,564
Well 5	374,590
Total	1,859,858

4.1 Metered Use

Meters are currently installed at Industrial/Commercial (IC) connections and at the City's private water hauling station. The IC connections include two large industrial and 194 multi-family, commercial and institutional customers. The total water demand for IC customers in 2009 was 412,210 m^3 (22%) The total water demand from the water hauling station in 2009 was 1,032 m^3 (0.05%).

4.2 Unaccounted-For Water

Unaccounted for water includes water that is supplied to a non-paying customer. The list of uses that are considered unaccounted-for is much greater in a municipality that does not employ a comprehensive metering program. To some utilities, all non-metered water use is considered unaccounted-for because the connection between consumption and payment is not clear on an individual connection basis.

In Grand Forks however, unaccounted for water includes park irrigation, fire department use, leaks, and meter inaccuracies to name a few.

4.2.1 Authorized, Non-metered Municipal Use

The following list summarizes the municipal water demands.

- City Owned Facilities: e.g. airport terminal, camp ground washrooms, the court house and the cemetery shack, among others. (<1% overall).
- City Parks: e.g. roadway boulevards, the cenotaph, and the cemetery among others. (7.4% overall).
- System Flushing: the flushing program includes operating approximately 100 hydrants, blow-offs, or stand pipes for period of 15 to 30 minutes (<1% overall).
- Fire Department: e.g. annual training, emergency events, and parking lot washdowns (<1% overall).
- Line Freeze Prevention: e.g. bleed lines at residential and commercial connections (<1% overall).
- Private Water Hauling: e.g. construction use (<1% overall). Revenue is collected for all private water hauling.

4.2.2 Losses

Water losses are often separated into two conventional categories: real and apparent.

Real Losses

Real losses are water demands that are not delivered to, or beneficially used by, a utility customer. They are physical losses of water which has value added to it such as energy (pumped) and water quality enhancements (chlorine, filtration, etc). Real losses vary but common types include: breaks and leaks through pipes, fittings, joints, reservoir walls, and reservoir overflows.

Apparent Losses

Apparent losses are water demands that are delivered and ultimately consumed but not accounted-for. They are nonphysical losses but they have a similar effect as a real loss because they do not culminate into revenue. For example, meter inaccuracies (specifically those that consistently read low) result in revenue losses. Other common examples of apparent losses are unauthorized connections that do not have a billing account.

To make the distinction to real losses, apparent losses are a function of water demands that are beneficially used whereas real losses are not associated with a beneficial use; they are simply 'lost'. Apparent losses in Grand Forks are important but are not currently a major contributor to losses.

4.3 Estimating Base Flows

In 2006, the City engaged a leakage detection contractor to survey targeted locations throughout the network. Sixty-five locations were investigated and only one leak was detected. Since that time there have been no further investigations.

In addition to acoustic leak detection, the City coordinated a night-time reservoir draw-down test to estimate base flows and losses.

Three reservoir draw down tests were conducted in February and March 2010. The results of the tests indicated that reservoir levels remained constant but only because Well 2 operates continuously, at a rate of 98 m^3/hr. This base demand of 98 m^3/hr includes night-time IC and residential use as well as losses. About 20% of these flows are presumed to be used by two large industrial connections as well as a small fraction of ordinary night-time residential needs. The remaining ~70 m^3/hr is projected to be a combination of winter bleed water and leakage. To complete the water balance for this assignment, the amount of winter bleed water was estimated based on the following:

- Practicing winter bleed water occurs from November 1 to March 15, every year[1].
- Approximately 100 connections city-wide (approximately 5% of connections only) still rely on winter bleed water to prevent line freezing[2].
- The average rate of winter bleed water is 2 USgpm.

The estimated winter bleed water is 45 m^3/hr for about 5 months of the year. The total annual winter bleed volume for 2009 is 146,071 m^3 (7.8%). The remaining flow, 24.9 m^3/hr, is presumed to be leakage which may be considered relatively constant year round.

[1] Therefore, winter bleed water does not occur from March 16 to October 31. This should be confirmed through residential surveys, meter records (future) and additional water use analyses.
[2] In some cases, winter bleed water is useful in preventing line freezing whereas in other instances, it is not necessary.

4.4 Residential Water Use

The estimated total residential water demand (indoor and outdoor) in 2009 is 1,070,082 m^3, or 58% of all uses. Average annual day use[3] is approximately 723 liters per person based on a population of 4,050.

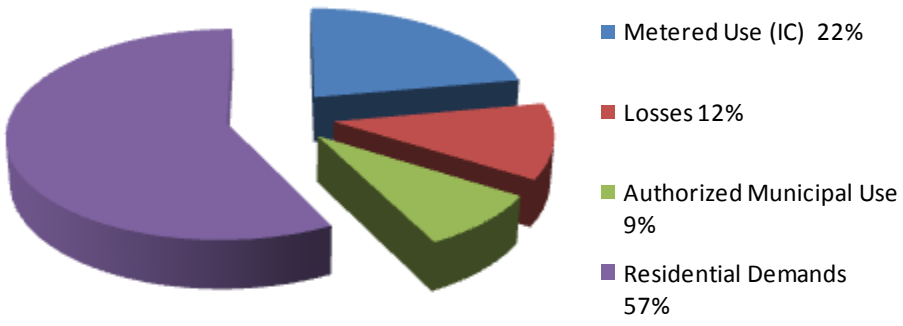
Although initially this figure appears low, it is well above both the BC residential average (426 liters per person per day) and the Canadian residential average (329 liters per person per day).

All customer classes appear to increase water use during the summer. This is a result of multiple factors, but outdoor use and summer irrigation peaks is the primary contributor. The peaking factor from winter to summer demand for residential water use is 2.83. Reducing outdoor water will be a key objective to reduce the need for new capital works and to lower utility costs.

4.5 Overall Water Use Breakdown

Figure 1 summarizes the water use breakdown by customer sector.

Figure 1 – Water Use by Consumer Segment.



Approximately 77% of all water use in Grand Forks is unmetered.

[3] Average annual daily use is the total volume of water consumed by the customer class in a year divided by the 365.

5.0 WATER AUDIT

Grand Forks has recognized the need to quantify the difference between supply and demand within its water system.

5.1 Methodology

The audit was conducted with reference to the AWWA Water Audit methodology. The level of effort of each step is dependent upon the amount of information that is available. Overall, the objective is to analyze water use patterns and develop action steps to mitigate financial losses and improve the efficiency of water supply in the City.

5.2 Summary of Findings

The following bullets outline the salient findings of the audit:

- Less than 23% of all water demands are metered.
- Unaccounted-for-water is high.
- Residential water consumption habits are not well known.
- Winter bleed water is estimated to be a significant water use from November 1 to March 15.
- Real losses such as (leaks) are not well known.
- Apparent losses are not well known but could be high for large commercial and industrial customers (meter accuracy decreases as flow range increases).
- Irrigation on City Parks represents the majority of municipal, authorized, nonrevenue water use.
- Water system maintenance activities are not a major water consumer.

6.0 CONSERVATION

Demand management is at the core of water conservation; however, water usage reductions can only be successful in a context. Supply, as well as demand, must be considered when developing management strategies. In Grand Forks, water supply is very good as the source aquifer is highly productive. Thus, other needs must be examined in order to create the context for conservation. Other major community needs that relate to conservation are cost recovery and control, along with environmental or social responsibility. In this context we can establish objectives for water conservation in the form of demand management, as outlined in Section 3.2 of this report.

6.1 Methodology

Dobson Engineering, USL, and KWL have previously identified current and proposed conservation methods for Grand Forks. These include current water restriction bylaws and water meters for new construction and industrial operations, as well as, proposed universal water metering, education, regulatory methods, leak detection and repair, toilet and fixture replacement, sprinkling restrictions, and conservation water pricing.

6.2 Summary of Findings

In light of the water audit results presented in this report and the recommendations provided previously by Dobson Engineering, USL and KWL, key findings can be summarized as follows:

- Little residential water metering combined with a low cost, decreasing pricing structure and no price increases continues to reduce Grand Forks' ability to adequately finance infrastructure improvements and recover costs for existing infrastructure construction and operation.
- Given the large volume of unaccounted for water, water use data collection will be imperative to determine the appropriate utility response to minimizing financial losses. Winter bleed water surveys and leak detection and repair will be a crucial part of an effective conservation plan.
- Current demands indicate residential usage provides a good opportunity for water savings using methods already mentioned.
- Water metering has been shown to provide the largest benefits for water savings in other jurisdictions.

– The cost benefit analyses previously performed indicate that universal metering has a long term net economic benefit to Grand Forks, and should be implemented as an essential component of its water conservation plan.

7.0 STRATEGIC OBJECTIVES

In order to establish appropriate action items for demand management and conservation, strategic objectives need to be formulated. These are discussed below.

7.1 Summarize and Look at Body of Evidence and Historical Case

Over the past ten years, Grand Forks has been investigating water issues including drought, conservation and demand management. Many plans and reports have been submitted that all indicate there is a serious problem with high consumption; however specific measures can be taken to conserve and benefit the City in the long term. A common thread amongst these measures is the need for data monitoring and cost control, which could be provided primarily by metering and loss containment (among other things).

7.2 Reduce Unaccounted-for-Water

Prior to finding further opportunities and methods to reduce usage and conserve water, the large apparent losses must be located and reduced. This is the most economic and effective way to conserve water now. The savings could be substantial and the costs could be minimal when compared to other methods.

7.3 Long Term Quantitative Economic Value through Cost Control and Reduction

The economic benefits mentioned previously included capital and interest deferral, operating cost deferral, and electricity cost reduction. All of these savings still apply, as well as new savings in the form of the impending Climate Action Charter, which will add further cost savings in the form of carbon tax avoidance. As well, conservation focused water pricing will add cost recovery to cost control and reduction. The current declining block structure for pricing discourages conservation. An increasing block per unit volume model (with a cost recovery baseline) would give the necessary incentive for conservation. This collection of economic cost benefits would be tremendous.

7.4 Long Term Qualitative Value

The benefits do not end with economic cost savings and recovery. There is also environmental stewardship and water quality enhancement, greenhouse gas and energy efficiency, and social equity benefits. It is important to weave demand management fundamentals from this report into the City's Community Sustainability Plan. Grand Forks is poised to demonstrate leadership to its residents and the industry by acting on sustainability initiatives, including this demand management action plan.

7.5 Utility Leadership

Many utilities in the Interior are looking to meters as a useful tool for reducing water use. A recent survey of 20 utilities in the Okanagan showed that 64% of all connections are metered. Also, as part of the Columbia Basin Trust Water Smart initiative, 21 communities are preparing 5 year water conservation action plans. It appears that almost 2/3rd's of the participating communities are currently installing meters, will be installing meters, or are preparing meter implementation strategies. Overall, water meters have become a basic function for most utilities in BC.

7.6 Capitalize on Available Revenue Sources

There are many opportunities for cost savings or revenue generation in a water utility. One available option is the General Strategic Priorities Fund as part of the Gas Tax Agreement. The Fund does not specify maximum award amounts. However, because the program will be spread over a 3 year period, the City should consider a phased approach and apply for support for meter installations in each year. Water meters are commonly successful in the General Strategic Priorities.

8.0 DEMAND MANAGEMENT ACTION PLAN

The following action steps are based on the strategic objectives in the previous section.

8.1 Getting Started

We propose the following recommendations to begin implementation of the demand management action plan:

1. ***Complete a Meter Implementation Strategy***
   a. Topics to explore include meter installation phasing plan, selecting a voluntary or a mandatory program, determining budget requirements (short term and long term), determining financing options, selecting accounting protocols and investigating the use of mock-billing.
   b. Timeline: Complete Prior to February 1, 2011

2. ***Submit an application to the General Strategic Priorities Fund as part of the Gas Tax Agreement***
   a. Include the Water Meter Implementation Strategy to demonstrate a high-level of organization
   b. Timeline: Application Deadline is February 1, 2011

3. ***Initiate the First Step in reducing Unaccounted-for-water***
   a. Initiate a winter bleed water survey
   b. Timeline: Late January 2011 (to coincide with the cold weather)

8.2 Actions to Sustain Demand Management Practices

1. Conduct a real losses detection program
   – Develop a leak detection and repair policy
   – Create a water main repair tracking system that includes time, leak rate, failure type, repair details, and estimate of losses
   – Update leakage estimates
   – Timeline: ***Spring 2011***

2. Conduct water use surveys with each of the 11 largest industrial and commercial customers. The surveys should be conducted to determine:
   – Patterns throughout the day and the year
   – Compare survey results to the 2009 reported water use from these meters (develop an estimate of apparent losses)
   – Optimizing water meter diameters to reduce the risk of apparent losses (meters operating outside of their design range
   – Conducting water meter accuracy tests at select connections in conjunction with the manufacturer (if needed)
   – ***Timeline: Summer 2011***

3. Develop corporate demand management program, that includes:
   - Creation of a water conservation policy
   - Parks irrigation, tracking and accounting

   - Fire department use, tracking, and accounting
   - Updating local design standards to reflect conservation-oriented water management policies
   - Develop a water meter calibration and accuracy testing protocol for all well City owned meters
   - Create a water use tracking and accounting database with a focus on automation with existing billing software
   - ***Timeline:*** ***Fall 2011***

9.0 CLOSURE

Please feel free to contact either of the undersigned, should you have any questions or comments regarding the above.

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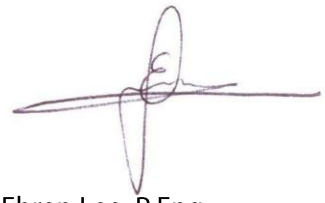

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Encl: Water Audit Calculations

/mr
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2009 Baseline Water Use

Well	Volume	
Well 2	319,462	m3
Well 3A	444,995	m3
Well 3	503,247	m3
Well 4	217,564	m3
Well 5	374,590	m3
Total	1,859,858	m3

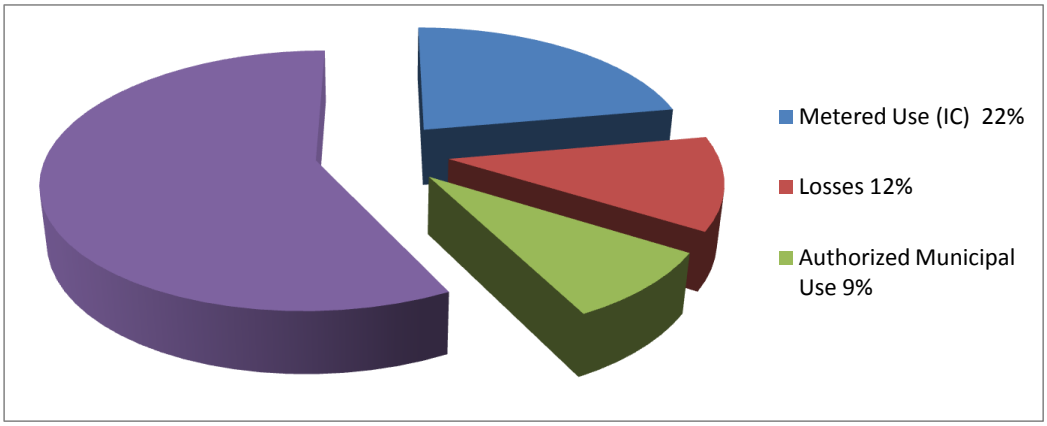
2009 Summary	
Total Usage	1,859,858
ICI Usage	412,210
Water Hauling	1032
Non Metered Usage	1,446,616

ter Use Compon	2009 Volume	%
Metered Use (IC)	412,000	22.2%
Losses 12%	217,738	11.7%
Authorized Muni	160,038	8.6%
Residential Dema	1,070,082	57.5%
Total	**1,859,858**	**100%**

Authorized/Unbilled	Demand Volume	%
City Facilities 4.1%	6,535	4.1%
City Parks 86.0%	137,561	86.0%
System Flushing 8.5%	13,673	8.5%
Fire Department 0.4%	623	0.4%
Line Freeze Prevention 1.0%	1,646	1.0%
Total	**160,038**	**100%**

Residential ADD Check	**723.9**	lcd

2009 Water Use Summary



2006 Contractor Leakage Reports

Year of Testing:	2006
Number of Tests:	65
Leaks found:	1
Line Size:	50mm
Location:	Valve box at Trailer Park/Motel near 72 Ave

Reservoir Draw Down Tests

Tuesday February 23, 2010

Test 1 Start Date/Time	23/02/2010 2:02	
Test 1 End Date/Time	23/02/2010 4:02	
Test 1 Reservoir % Full @Start	87.8%	
Test 1 Reservoir % Full @End	87.7%	
Pump(s) On ?	Yes	
Pump #	2	
Pump Rate	94.8	m3/hr

Friday March 3, 2010

Test 2 Start Date/Time	05/03/2010 2:00	
Test 2 End Date/Time	05/03/2010 4:00	
Test 2 Reservoir % Full @Start	88.3%	
Test 2 Reservoir % Full @End	88.3%	
Pump(s) On ?	Yes	
Pump #	2	
Pump Rate	94.8	m3/hr

Saturday March 6, 2010

Test 3 Start Date/Time	06/03/2010 2:00	
Test 3 End Date/Time	06/03/2010 3:59	
Test 3 Reservoir % Full @Start	86.5%	
Test 3 Reservoir % Full @End	86.5%	
Pump(s) On ?	Yes	
Pump #	2	
Pump Rate	94.8	m3/hr

Losses = Change in reservoir volume + Well Withdrawal – Night Time demands

Note: Night Time Demands includes industrial, residential, some commercial, and winter bleed water

Losses	24.9	m3/hr
	6.9	L/s

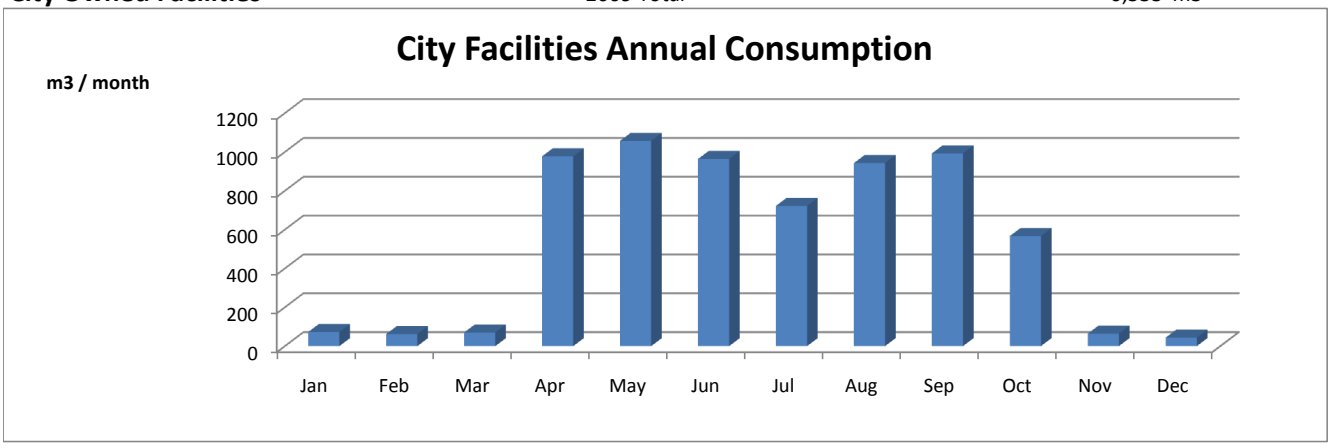
Winter Bleed Rate Estimate

Number of homes		100	(~10%)
Bleed Rate		2 usgpm	
	or,	0.4542 m3/hr	
Total Est. Bleed Rate per hour		45.42 m3/hr	
Start Day		Nov-01	
End Day		Mar-02	
Total Days		134 days	
	or,	3216 hours	
Total Annual Volume		146,071 m3	

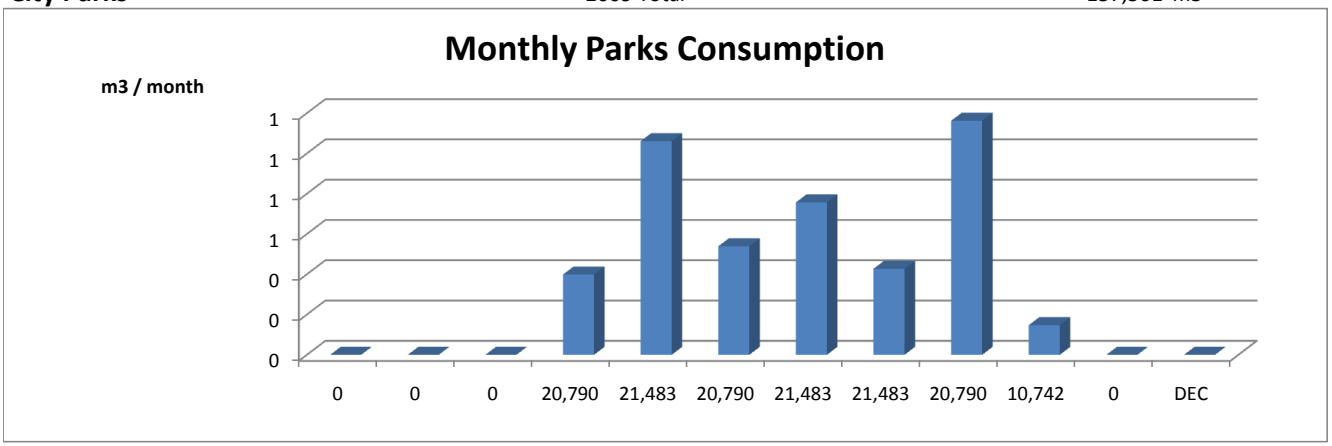
	Customers	Units
Commercial Office	151	154
Commerical Laundry/Car	3	3
Commerical Hotels	27	27
Institutions	15	18
Total	196	202

Number of Meters on the System:	238
Number of Meters with 0 Consumption:	12

City Owned Facilities 2009 Total 6,535 m3



City Parks 2009 Total 137,561 m3



Maintenance Activities

Annual Flushing Program

Total Hydrants Flushed		93		
Total Blowoffs/Dead Ends		20		
Hydrant Throughput		0.094625	m3/sec	1500 Usgpı AWWA Est.
Dead End Throughput		0.015770833	m3/sec	250 Usgpm Est.
Time of Flush	15 to 35 minutes			
Average	25 minutes			
Total Annual Flushing Volume		13,673	m3	

Fire Department

Annual Training Consumption	182	m3	
Fire Events in 2009	20		
Events Total	304.58	m3	
Parking Lot Washdowns	136.38	m3	
Total Fire Department	623	m3	

Municipal Winter Bleed Water

Number of Bleed-outs	2	L/s	(or 1gpm)
Average Bleed Rate per Connection	0.0631		
Start Date	Nov-09		
End Date	Apr-10		
Total Days	151		
Total Seconds	13,046,400		
Loss Volume	1,646	m3	

Water Hauling Station

Start Date	18-Jun-09		
End Date	16-Jun-10		
Period	1 Year		
Total Volume	1031540	Liters	
	1,032	m3	
Estimated Revenue	$ 9,861.31		

Nominal Residential and Commercial Night-time Usage

Average Columbia Basin Indoor Demand	300	l/c/d
Equivalent m3/hr	0.0125	m3/hr
Assume rate is 5% of average during night time	0.000625	m3/hr
Total capita	4130	
Nominal Residential and Commercial Night-time Usage	2.58125	m3/hr