WATER QUALITY REPORT 2013

Salmon Arm

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1.0 INTRODUCTION

As required by the British Columbia Drinking Water Protection Act, the City of Salmon Arm provides the following annual water quality report. This information has been compiled by the City of Salmon Arm to help you better understand your drinking water.

This report outlines where your water comes from, how it is distributed, and how we ensure it is safe to drink. This information will provide those who want to further inform themselves about their drinking water to do so.

"Water links us to our neighbour in a way more profound and complex than any other."

John Thorson

Drinking water can be a complex issue and much of the information provided in the report is technical in nature. Every effort has been made to provide it in a format that is as understandable as possible. Please contact the City of Salmon Arm Engineering & Public Works Department at 803-4000, should you have any questions.

2.0 BACKGROUND

The City currently operates and maintains a public water distribution system under the regulations of the http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_96483_01

The Interior Health Authority (IHA) have advised the City that *"Under the legislation, the province has increased the basic expectations around assessing water systems, certifying operators and suppliers, and monitoring and reporting on water quality. The legislation gives provincial drinking water officers (i.e. Interior Health Authority) increased powers to protect water sources from contamination by a drinking-water health hazard. In addition, the drinking-water officers will oversee a source-to-tap assessment of every drinking-water system in the province to address all potential risks to human health."*

The City of Salmon Arm commissioned a new water treatment plant in 2009. The new water plant was built to insure consistent safe drinking water for the growing population of Salmon Arm and to meet new potable water regulations.

3.0 WATER SYSTEM OVERVIEW

The City's water is supplied by way of two (2) primary sources: East Canoe Creek at Metford Dam and Shuswap Lake at Canoe Beach. A secondary water source at Rumball Creek provides untreated and non-disinfected water for irrigation at the Mt. Ida Cemetery. The Shuswap Lake source has a new Water Treatment Plant that meets the Interior Health Authority 4-3-2-1-0 water treatment objective of four (4) log inactivation of viruses, three (3) log removal/inactivation of Giardia Lamblia and Cryptosporidium, two (2) treatment processes for surface water sources, one (1) for less than 1 NTU of turbidity, and zero (0) total and fecal coliforms and E. Coli. The East Canoe Creek source has been recently upgraded to utilize two forms of disinfection: ultra-violet light (UV) and sodium hypochlorite chlorination. The water from Metford Dam is only used when the turbidity is less than 1 NTU. Extensive SCADA programming and interlocks are in place to prevent the distribution of inadequately treated water from either source. The distribution system includes approximately 200 km of watermain, varying in diameter from 100 mm to 600 mm. The City's waterworks system provides water through gravity and pump systems. The waterworks system is complex and is comprised of eight (8) pressure zones, 890 hydrants, seven (7) pumping stations, fourteen (14) reservoirs and one (1) dam. There is a total storage capacity of 24,538 cubic meters servicing a population of approximately 14,000 people and over 7,000 connections. Approximately 27% of the City's customers are on water meters.

Did you know …?

- *Canada holds 20% of the world's freshwater, but has only 9% of the world's renewable freshwater supply; the rest is "fossil water", a legacy of the melting of large ice sheets that once covered much of Canada.*
- *Canada has more lake area than any other country in the world.*
- *Every time Beethoven sat down to write music, he poured ice water over his head.*
- *Once you drink water, it leaves your stomach in about 5 minutes!*

Figure 1 – Water Treatment Plant in Salmon Arm

"When the well is dry, we learn the worth of water."

Benjamin Franklin

The public water system services an area of approximately 7,290 hectares (see Appendix 2) of which 969 hectares includes Band Lands. The City distributes water in pipes made of a variety of materials.

Pipe Material	Length In Service	Comments
Cast Iron	0.1 km	Majority installed prior to 1978
Ductile Iron	17.7 km	Ductile iron is still used in some applications in Salmon Arm
PVC	91.3 km	Most pipe installed since 1979 has been PVC
Asbestos Cement	88.2 km	Majority installed prior to 1978
High Density Polyethylene	0.5 km	Used for specialized applications

Figure 2 - Pipe materials in service in Salmon Arm

Shuswap Lake is at a nominal elevation of about 347 m (1135 ft.) Geodetic Survey of Canada (GSC) datum while the Metford Dam intake on East Canoe Creek is at elevation 567 m (1860 ft.) GSC. The Utilities Division attempts to maximize the supply of water from East Canoe Creek so that pumping into the system from Shuswap Lake and the associated costs are minimized. The flow of water from East Canoe Creek into the water system is by gravity.

Did you know …?

- *About 70% of the earth is covered in water.*
- *3% of the water on earth is freshwater and only 1% is available for human consumption.*
- *Nearly 70% of the earth's fresh water exists in the form of glaciers and permanent snow cover.*
- *Only 0.3% of total global fresh water is stored in lakes and rivers.*

Periodic problems are experienced with East Canoe Creek, such as:

- turbidity levels that exceed the Interior Health Maximum Allowable Concentration. High turbidity levels are typically associated with higher creek flows during the spring snowmelt and extended high rainfall events in the watershed; and
- peak summer water demands that exceed the low natural summer flows in the creek.

The distribution system is segregated into eight (8) pressure zones. The storage reservoir in the highest pressure zone (Zone 5) is at elevation 615 m (2020 ft.) GSC above sea level. Water has to be pumped over 269 m (885 ft.) in elevation from Shuswap Lake to the storage reservoir at the highest elevation.

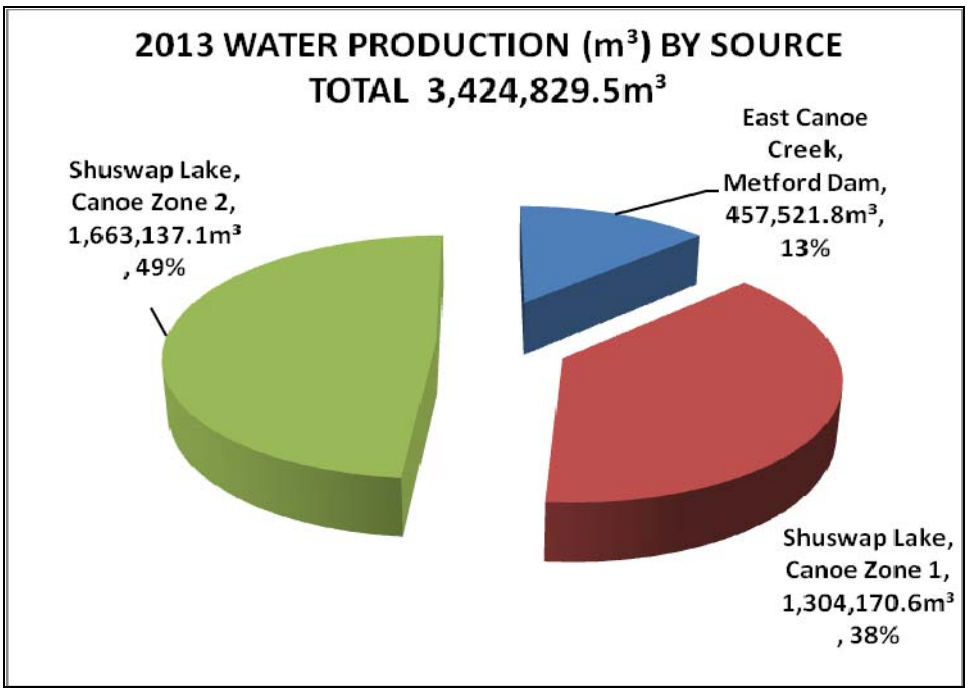


Figure 3 - Water Source Distribution

"If there is magic on this planet, it is contained in water."

Loran Eisley (Anthropologist), The Immense Journey, 1957

Water treatment Plant

The new Water Treatment Plant was put online in May 2009 and dramatically improved the water quality for all City residents. The treatment process includes coagulation, flocculation, and filtration, followed by disinfection with ultraviolet light and chlorine (via sodium hypochlorite generated on-site). The raw water intake was extended further offshore and lowered to provide a more consistent raw water supply for the water treatment plant.

Water Pumping Stations

The municipal water system includes 14 water storage facilities and seven pumping stations. Normally, if there is a major pumping station or storage facility failure, water service to a large area of the community could be discontinued or adversely affected until repair work is completed. With our gravity feed supply source at Metford Dam, water can be cascaded down through all the zones, with the exception of Zone 5.

The pump stations house a combined total of 26 pumps with a service life of approximately 40 to 50 years for each pump.

Figure 4 - Zone 1 Pumping Station Canoe

The following illustrates how many gallons of water it takes to make some everyday items.

Apple	*16*
Orange	*22*
Egg	*85*
Loaf of Bread	*150*
Pound of Steel	*270*
Sunday Paper	*280*
Pound of Aluminum	*1000*
Pound of cotton	*1300*
Pound of Beef	*3000*

Laura McDonald, Freshwater Society

System Control – "SCADA" (Supervisory **C**ontrol **A**nd **D**ata **A**cquisition **S**oftware)

Maintaining reservoir water levels, operating pumps, monitoring quality control equipment and maintaining a historical data file of the water systems operations is made easier by a comprehensive software program employed by the Utilities Department. Connected by wireless links, the SCADA software is able to monitor sensors at all the reservoirs and pump stations. Interpreting the data received, it then automatically turns pumps on and off to keep the system flowing smoothly. When trouble is detected within the system the software issues alarms and the Utilities Division staff is notified.

Pressure-Reducing Valve Stations

The maximum design water pressure for piping within the majority of the municipal water system is 1034 kPa (150 psi). We have two Pressure reducing valve stations containing one Pressure-reducing valve (PRV) each. Pressure reducing valves are used to control the pressure in the water system by creating head losses that prevent pressures from exceeding the design maximum. The failure of a PRV could disrupt flows and mainline pressures to large areas within the community.

The Utilities Division currently maintains and upgrades the PRV stations as required, in an effort to extend their service life. Most individual premises also have secondary PRV's as fluctuating pressures can place excessive stress on internal plumbing systems and fixtures.

"Throughout the history of literature, the guy who poisons the well has been the worst of all villains..."

Author unknown

3.1 Water System Value

The total value of our primary water distribution system, as detailed in Figure 6 below, is approximately $81,160,000. We budgeted $755,955 in 2013 on water infrastructure replacement. The replacement program is designed to address some of these previously discussed replacement components and other general deficiencies within the system on a priority basis. However; a thorough and comprehensive maintenance program also helps to extend the life expectancy of a majority of these water infrastructure elements.

System Components	Quantity in Use in Salmon Arm	Approximate Replacement Cost
Water mains	197.8 km	$ 50,000,000
Treatment Plant	1	$ 16,000,000
Reservoirs/Tanks	14 Reservoirs/ 1 Dam	$ 8,700,000
Pumping Stations	7	$ 6,100,000
System Control	1	$ 460,000
Total		**$ 81,260,000**

Figure 5 - Infrastructure replacement value

Did you know …?

- *In Canada, there is more water underground than on the surface.*
- *Canadians are among the biggest water users in the world.*
- *Annually, Canada's rivers discharge 7% of the world's renewable water supply.*
- *40% of Canada's boundary with the United States is composed of water.*

4.0 STAFFING

The City of Salmon Arm Engineering and Public Works Department is responsible for this municipal function. The Utilities Division is responsible for the operation and maintenance of the water supply and distribution system.

Staff Overview:

Engineering and Public Works
Robert Niewenhuizen, A.Sc.T., Director of Engineering and Public Works
Jennifer Wilson, P. Eng., LEED ® AP, City Engineer
Gerry Rasmuson, B.Sc., Manager of Utilities

Between 1972 and 1991, Canada's withdrawal of freshwater resources increased from 24 billion cubic meters/year to over 45 cubic meters/year – a rise of 80%: in the same period, the population increased only 3%.

watercan.com

Utilities Division	
Larry Kipp ***Utilities Supervisor*** • Level I - Wastewater Collection • Level II – Water Distribution • Level I – Water Treatment	**Tyrone McCabe** ***Water Treatment and Distribution Chief Operator*** • Level III - Water Treatment • Level III – Wastewater Treatment • Level I Water Distribution
Ray Muller • Level I – Water Distribution • Level I - Wastewater Collection	**Marcus Miller** • Level III - Water Treatment • Level II - Water Distribution
Merv Arvay • Level II – Water Distribution • Level I - Wastewater Collection	**Rick Webb** • Level II – Water Treatment • Level III – Water Distribution • Level II - Wastewater Collection
Jason Philps • Level I – Water Distribution • Level I – Wastewater Collection	**Devon Tulak** • Level I – Water Distribution • Level I – Wastewater Collection
Tyler Stevenson • Level I – Water Distribution • Level I – Wastewater Collection	**Jason Baker** • Level I – Water Distribution

Figure 6 - Staff Overview

5.0 MONITORING PROGRAM

Drinking water quality is a function of source water quality, water treatment, and water quality changes after treatment. As a result the monitoring of drinking water quality consists of three components: source (raw) water monitoring, treatment process monitoring, and monitoring in the distribution system.

5.1 TESTING PARAMETERS

Did you know …?

- *Up to 60% of the human body is water.*
- *The brain is composed of 70% water.*
- *Blood is 82% water.*
- *The lungs are nearly 90% water.*

The water treatment plant has continuous online monitoring for treated water turbidity, particle counts, pH, temperature, chlorine residual, and UV transmittance. These parameters are trended and monitored daily by the operators for abnormal conditions and corrective actions are taken. Frequent grab samples are collected and analyzed to confirm the operation of the online instrumentation.

The City of Salmon Arm is required to collect a minimum of 14 bacteriological samples per month as outlined in the BC Drinking Water Protection Regulation. These samples are collected from representative points throughout the distribution system.

For more information regarding testing parameters and MAC levels, please visit Health Canada's website at http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/2012-sum_guide-res_recom/index-eng.php

Turbidity

Turbidity measurements relate to the optical properties of water. Poor turbidity is caused by suspended matter such as clay, silt, finely divided organic and inorganic matter, soluble coloured organic compounds, plankton, and other microscopic organisms.

Excessive turbidity not only detracts from the appearance and taste of water, it can shield organisms from disinfection methods. The unit of measurement is the nephelometric turbidity unit (NTU). Turbidity from the treatment plant shall be less than or equal to 0.3 NTU in at least 95% of the measurements made, or at least 95% of the time each calendar month, and shall not exceed 1.0 NTU at any time. The unfiltered East Canoe Creek source automatically shuts down at a turbidity of 1 NTU. The system is then flushed until the turbidity is within the acceptable range (<1 NTU). Turbidity is continuously measured at both water supply sources.

Chemical Analysis

The Utilities Division takes samples on a bi-annual basis from raw water sources for a chemical analysis of common minerals and other chemical parameters (such as hardness). Results are checked against the *Guidelines for Canadian Drinking Water Quality* (see Appendix 1). Samples are also collected bi-annually from representative points throughout the distribution system and analyzed for disinfection byproducts

5.2 TESTING PROGRAM

"Anyone who can solve the problems of water will be worthy of two Nobel prizes - one for peace and one for science."

John F. Kennedy

Water at the nine sampling sites is tested and sampled every second week (see Appendix 3) by the water treatment plant operators. Field tests are performed for temperature, pH, free and total chlorine, and turbidity. Samples are taken in accordance with the *20th Edition of Standard Methods for the Examination of Water and Wastewater*, and delivered to a certified laboratory for testing (Caro Environmental Services in Kelowna). The water is tested for total coliforms and E. Coli. All results are submitted to the Utilities Manager and Water Treatment/Distribution Chief Operator. In the event of a positive sample, the City of Salmon Arm and Caro will notify the IHA Drinking Water Officer. Depending on the location and type of positive test result, the City and Health Authority will institute one or more of the following responses in accordance with the Emergency Response Plan:

a) further testing to confirm the previous test results;
b) main flushing to remove stagnant water;
c) disinfection, if it appears to have contamination from an outside source; and
d) Boil Water Advisory, if there is a health risk to users.

The City has instituted an additional testing program. Random sites are periodically tested for pH, temperature, free and total chlorine, and turbidity. These sites are located in key locations on the extremities of the system known to have low flow or stagnant water conditions. This ensures that no biological re-growth is occurring within the system. Where any of these parameters reaches the set limits, flushing to refresh the water supply is instituted.

The health of our water system and public trust in it are issues the City takes seriously. Our Utilities Division staff work closely with Interior Health so that a program is in place that ensures our citizens are provided with safe and healthy drinking water.

Did you know...?

- *You can refill an 8-oz glass of water approximately 15,000 times for the same cost as a six pack of soda.*
- *If all the world's water were fit into a gallon jug, the fresh water available for us to use would equal only about one tablespoon.*
- *There is the same amount of water on Earth as there was when the Earth was formed. The water from your faucet could contain molecules that dinosaurs drank.*

New Water mains

Disinfection of a new water main is completed in accordance with AWWA C651-05. If the samples are not clean, the whole process is repeated.

6.0 WATERMAIN BREAKS

Most water utilities frequently experience minor disruptions. Pipes break, valves stick, hydrants leak and power outages occur. Although these are not anticipated, the problems experienced can usually be corrected with minimal disruption, and regular service can be quickly restored.

In 2013, our staff responded to and repaired two watermain breaks. (Note: service connections or hydrant lead breaks are not included in this total.)

In cases of water main breaks, the City adheres to the procedures set out in the American Water Works Association (AWWA) Standard C651-05 regarding water main chlorination prior to re-commissioning of the main.

7.0 NOTIFICATION PROTOCOL

Normally, breaks or disruption to water service are caused by conditions that can be repaired and reinstated quickly, directly by City forces without risk to the public health. Sometimes however, situations arise that require extra care to guarantee that the integrity of our water infrastructure has not been compromised. The Utilities Department endeavours to keep the Medical Health Officer apprised of any extraordinary situations that may adversely impact the City's water system.

Many Canadians lose more water from leaky taps than they need for cooking and drinking.

watercan.com

8.0 Capital Works Projects

Water main Upgrading

In addition to repairing water mains that break, aging water mains must be replaced. An ongoing replacement/preventative measures program is in place, targeting areas with older piping materials in susceptible condition and areas identified with inadequate fire flow. Future development is also factored into the overall plan.

Water Supply and Distribution System Upgrading

"We forget that the water cycle and the life cycle are one"

Jacques Cousteau

Capital Projects completed in 2013
• Improvement/Upsizing of watermain (400 block 4 Avenue SE)
• Homely Reservoir – Zone 2 Pump Installation
• Metford Dam – Safety Review Report
• Continuation of the Cities water meter program
• Hydrant infill program
• Mainline valve installation program

Figure 10 – Capital Projects

9.0 WATER CONSUMPTION

"Man - despite his artistic pretensions, his sophistication, and his many accomplishments - owes his existence to a six inch layer of topsoil and the fact that it rains."

Unknown author

Our community has an above average per capita water use when compared to other Canadian municipalities. Some possible causes of this excessively high per capita consumption may include undetected system leaks, illegal connections, high residential summer irrigation demand, and inaccurate metering. In 2003 the Water Use Efficiency Committee brought forward a Water Conservation policy which Council adopted (see Appendix 9).

It is evident that leakage within the system combined with actual consumption (as well as unauthorized use) creates somewhat skewed municipal water consumption data. Regardless of potential losses in the system, production data can be used to illustrate consumption trends and is therefore useful in identifying areas where conservation measures can be implemented.
See Appendix 6 and 7 for further total consumption data.

10.0 TEST RESULTS

The Guidelines for Canadian Drinking Water Quality, and the *British Columbia Drinking Water Protection Regulation* have established the following microbiological criteria:

- No sample should contain more than one total coliform organisms per 100 ml, none of which should be E. Coli;
- No two consecutive samples from the same site should show the presence of coliform organisms; and
- At least 90% of the samples must have zero total coliforms per 100 mL.

11.0 2013 CHALLENGES TO DRINKING WATER QUALITY

Did you know …?

- *The value of the in-ground assets of Canadian municipal water supply and wastewater systems totals over $100 billion.*
- *About 82% of Canadians (1994 data) are served by wastewater treatment plants, compared with 75% Americans, 86.5% Germans, and 99% Swedes.*
- *Less than 3% of the water produced at a large municipal water treatment plant is used for drinking purposes; during the summer, about half of all treated water is sprayed onto lawns and gardens.*

No Public Water Quality Advisory Notices were required during 2013 though the City of Salmon Arm did encountered minimal challenges to drinking water supply.

The implementation of the new Ultraviolet disinfection system for the East Canoe Creek water supply proved difficult at times due to technological and operational issues with the new equipment. The unidirectional flushing program, which concentrated in and around the downtown core in 2013, was performed to minimize impact to the commercial, retail and residential properties ensuring a water supply of highly aesthetic quality.

The late spring/early summer rains also resulted in significant turbidity issues with East Canoe Creek system. The elevated turbidity (>1 NTU) resulted in the water source being unavailable for the majority of the spring through to early summer.

12.0 CONCLUSION

The City of Salmon Arm has made a lot of progress in the implementation of BC's Drinking Water Protection Act and Regulations. While there is always ongoing work to do, City staff continues to work hard to maximize the safety and reliability of the water we deliver to our customers.

The City of Salmon Arm is pleased to present the 2013 Annual Water Quality Report, detailing the health and direction of our water system. If you have any questions about this report or want more information about water consumption and production, please contact the Engineering & Public Works Department at 803-4000.

The following illustrates how many gallons of water it takes to do some everyday Things.

Brush Teeth	*2*
Flush Toilet	*2 to 7*
Run Dishwasher	*9 to 12*
Wash Dishes by Hand	*20*
Clothes Washer	*50*
10 Min Shower	*25 to 50*
Bath	*25 to 50*

APPENDIX 1

CITY OF SALMON ARM
SOURCE WATER CHEMICAL ANALYSIS
TEST RESULTS

Medford Dam Source
Raw Water Quality

CDWG : Canadian Drinking Water Quality Guidelines
CDWG*1 Maximum acceptable concentration
CDWG*2 Aesthetic concentration

Test	CDWG*1	CDWG*2	RDL Units	30-Mar-06	19-Jun-06	22-Jun-07	21-Aug-07	29-Jan-08	26-Aug-08	01-Jun-09	12-Jan-10	06-Jul-10	15-Feb-11	26-Jul-11	10-Jan-12	08-Aug-12	05-Feb-13	30-Jul-13
Alkalinity (Total as CaCO3) mg/L			1					197	177	161	210	169	185	196	188	**193**	**202**	**184**
pH (units)		**6.5-8.5**	**0.1**	8.0	7.9	7.6	7.8	7.9	7.6	8.31	8.12	8.26	8.32	8.26	8.28	**8.29**	**8.19**	**8.26**
Conductivity at 25 deg C (umhos/cm)	-		**5**	393	349	342	346	411	370	309	422	324	381	365	398	**390**	**419**	**389**
Dissolved Solids (Total) mg/L		**<500**	**5**	247	215	209	229	258	234	199	238	205	217	222	226	**219**	**244**	**207**
Turbidity (NTU)			**0.1**			0.6	0.5	0.2	0.6	0.7	0.2	0.4	0.2	0.5	0.2	**0.6**	**0.2**	**0.8**
Hardness (Total) mg/L as CaCO3		**<500**	**2.07**	196	177	158	168	222	164	177	219	181	189	199	223	**214**	**241**	**197**
Colour, true (colour units)		**<15**	**5**			<5	<5	<5	<5	<5	<5	<5	<5	5	<5	**<5**	**<5**	**<5**
Nitrate mg/L as N	**<10**		**0.01**	<0.01	0.02	<0.010	<0.010	0.014	<.01	<.01	<.01	0.08	0.06	<.01	<.01	**<.01**	**0.214**	**<.01**
Nitrite mg/L as N	**<1**		**0.01**	<0.01	<0.01	<0.010	<0.010	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	**<.01**	**<.01**	**<.01**
Fluoride mg/L	**1.5**		**0.1**	0.15	0.20	<0.10	0.11	0.11	<.1	<.1	0.13	<.1	0.25	<.1	0.14	**<.1**	**0.19**	**0.01**
Total Coliform (Colonies/100mL)	**		**1**	0	26	23	59	2	74	19	5	41	5	110	4	**64**	**8**	**410**
E. Coli	**<1**		**1**					<1	7	1	<1	<1	<1	5	<1	**8**	**<1**	**5**
Aluminum (Total) mg/L	**0.1**		**0.05**	<0.01	<0.01	0.01	<0.01	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	**<.05**	**<.05**	**<.05**
Antimony (Total) mg/L	**0.006**		**0.003**	<0.0005	<0.0005	<0.0006	<0.0006	<.003	<.003	<.001	<.001	<.001	<.001	<.001	<.001	**<.001**	**<.001**	**<.001**
Arsenic (Total) mg/L	**0.01**		**0.005**	<0.001	<0.001	<0.001	<0.001	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	**<.005**	**<.005**	**<.005**
Barium (Total) mg/L	**1.0**		**0.005**	0.03	0.03	0.027	0.032	0.033	0.031	0.0235	0.0324	<.005	<.05	<.05	<.05	**<.05**	**<.05**	**<.05**
Beryllium (Total) mg/L			**0.002**					<.002	<.002	<.001	<.001	<.001	<.001	<.001	<.001	**<.001**	**<.001**	**<.001**
Boron (Total) mg/L	**5.0**		**0.02**	<0.1	<0.1	<0.002	0.003	<.02	<.02	<.02	<.02	<.04	<.04	<.04	<.04	**<.04**	**<.04**	**<.04**
Cadmium (Total) mg/L	**0.005**		**0.0001**	<0.0002	<0.0002	<0.00001	<0.00001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	**<.0001**	**<.0001**	**<.0001**
Calcium (Total) mg/L	-		**0.5**	65	62	67.3	64.2	73	54.1	61.3	68.1	61.7	59.4	68.4	71.8	**72**	**77**	**66**
Chloride (Total) mg/L		**<250**	**0.1**	0.50	0.50	0.26	0.28	0.28	0.27	0.24	0.51	0.12	0.7	0.25	0.37	**0.28**	**0.63**	**0.3**
Chromium (Total) mg/L	**0.05**		**0.015**	<0.002	<0.002	<0.003	0.003	<.015	<.015	<.005	<.005	<.005	<.005	<.005	<.005	**<.005**	**<.005**	**<.005**
Cobalt (Total) mg/L			**0.0005**					<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	**<.0005**	**<.0005**	**<.0005**
Copper (Total) mg/L		**<1.0**	**0.003**	<0.01	<0.01	<0.001	<0.001	<.003	<.003	<.001	<.001	0.004	<.002	<.002	<.002	**<.002**	**<.002**	**<.002**
Cyanide (total) mg/L			**0.01**			<0.01	<0.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	**<.01**	**<.01**	**<.01**
Iron (Total) mg/L	**0.3**		**0.2**	<0.03	<0.03	0.15	0.3	<.2	<.2	<.1	<.1	<.1	<.1	<.1	<.1	**<.1**	**<.1**	**<.1**
Lead (Total) mg/L	**0.01**		**0.001**	<0.001	<0.001	<0.0002	<0.0002	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	**<.001**	**<.001**	**<.001**
Magnesium (Total) mg/L	-		**0.2**	8.1	5.4	6.2	10.2	9.69	7.04	5.8	11.8	6.53	9.75	6.84	10.7	**8.1**	**11.9**	**7.6**
Manganese (Total) mg/L		**0.05**	**0.005**	<0.002	<0.002	0.001	0.006	<.005	0.0144	<.002	0.0042	<.002	0.0024	0.0024	0.0043	**0.004**	**0.003**	**0.003**
Mercury (Total) mg/L	**0.001**		**0.0003**	<0.0002	<0.0002	0.00005	<0.00005	<.0003	<.0003	<.0005	<.0005	<.0005	<.0002	<.0002	<.0002	**<.0002**	**<.0002**	**<.0002**
Molybdenum (Total) mg/L			**0.001**	<0.03	<0.03	0.0011	0.0011	0.0012	<.001	<.001	0.0013	0.001	0.0012	<.001	0.0016	**0.001**	**0.002**	**<0.001**
Nickel (Total) mg/L			**0.005**					<.005	<.005	<.002	<.002	<.002	<.002	<.002	<.002	**<.002**	**<.002**	**<.002**
Phosphorus (Total) mg/L			**0.2**					<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2	**0.3**	**0.2**	**<0.2**
Potassium (Total) mg/L			**0.2**	1.5	1.3	1.43	1.98	1.51	1.31	1.13	1.77	1.4	1.44	1.45	1.47	**1.4**	**2**	**1.3**
Selenium (Total) mg/L	**0.01**		**0.005**	<0.001	<0.001	<0.001	<0.001	<.005	<.005	<.003	<.003	<.003	<.005	<.005	<.005	**<.005**	**<.005**	**<.005**
Silicon (Total) mg/L			**1**			7.4	8.1	6	5.6	6.8	11.8	28.8	6.6	5.8	7.7	**8**	**<5**	**7**
Silver (Total) mg/L			**0.0004**					<.0004	<.0004	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	**<.0005**	**<.0005**	**<.0005**
Sodium (Total) mg/L		**<200**	**0.2**	3	<2	1.84	2.78	2.81	1.87	1.52	3.13	1.91	2.55	1.97	2.95	**2.1**	**3.2**	**1.7**
Sulphate (Total) mg/L		**<500**	**1**	25	13	13.7	19.9	23.1		11.8	31.1	15.1	24.9	13	25.6	**17.1**	**25.8**	**17.8**
Uranium (Total) mg/L	**0.02**		**0.0005**	0.00090	0.00060	0.0007	0.0008	0.001	0.0007	0.00052	0.00103	0.00063	0.00082	0.00063	0.00093	**0.0008**	**0.0011**	**0.0007**
Vanadium (Total) mg/L			**0.01**					<.01			<.01	<.01	<.01	<.01	<.01	**<.01**	**<.01**	**<.01**
Zinc (Total) mg/L		**<.05**	**0.03**	<0.05	<0.05	0.007	0.014	<.03	<.01	<.01	<.01	<.01	<.04	<.04	<.04	**<.04**	**<.04**	**<.04**

Notes:

Hardness: 80-100 as CaCO3
>200 as CaCO3
>500 as CaCO3

Aluminum - No health guideline "operational guidance values" for water treatment are 0.10 or 0.20 mg/l depending on treatment type.

** Microbiological Characteristics:
For total coliform the maximum acceptable concentration is 0 colonies/100mL. However, due to uneven distribution in water:
1) No sample should contain more than 10 total coliform organisms per 100 mL none of which should be fecal coliforms.
2) No consecutive samples from the same site should show any coliforms
3) If any coliforms are detected, or if there are more than 200 background colonies on a toal coliform membrane filter per 100 100 mL, the site should be resampled, and if results confirmed, cause should be determined and remediation undertaken.

Shuswap Lake Source
Raw Water Quality

CDWG : Canadian Drinking Water Quality Guidelines

CDWG*1 Maximum acceptable concentration

CDWG*2 Aesthetic concentration

	CDWG*1	CDWG*2	RDL Units	30-Mar-06	19-Jun-06	22-Jun-07	21-Aug-07	29-Jan-08	26-Aug-08	01-Jun-09	12-Jan-10	06-Jul-10	11-Jan-11	26-Jul-11	10-Jan-12	08-Aug-12	05-Feb-13	30-Jul-13	28-Jan-14
Alkalinity (Total as CaCO3) mg/L			1					43	42	48.9	46.9	49.6	44.9	46.4	45.2	42	45	46	46
pH (units)		6.5-8.5	0.1	7.3	7.0	6.9	6.9	7.2	6.8	7.87	7.75	8.06	7.74	7.52	7.77	7.56	7.63	7.61	7.63
Conductivity at 25 deg C (umhos/cm	-		5	128	118	118	110	113	110	113	107	113	105	117	100	108	110	112	112
Dissolved Solids (Total) mg/L		<500	5	73	72	68	74	68	61	84	59	79	70	67	57	55.9	60.4	56.4	55.5
Turbidity (NTU)			0.1			1.3	15	1.6	11	0.9	0.5	1.9	0.4	0.1	0.3	0.6	0.5	1.5	0.4
Hardness (Total) mg/L as CaCO3		<500	2.07	51	50	41	58.5	51.4	44.7	54.5	48.4	54.3	49.6	49.2	51.4	50.6	56.3	47	44.5
Clour, True			5			<5	<5	11	<5	<5	<5	12	6	<5	<5	5	5	6	5
Nitrate mg/L as N	<10		0.01	0.07	0.12	0.096	0.083	0.066	0.1	0.07	0.09	<.01	0.09	0.101	0.088	0.083	0.087	0.077	0.088
Nitrite mg/L as N	<1		0.01	<0.01	<0.01	<0.010	<0.010	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.010	<.01	<.010	<.01
Fluoride mg/L	<1.5		0.1	0.15	0.1	<0.10	<0.10	<.1	<.1	<.1	<.1	<0.1	<0.1	<0.1	<0.1	<0.10	<.01	<0.10	<.01
Total Coliform (Colonies/100mL)	**		1	0	17	6	1	1	11	1	2	13	3	<1	2	<1	1	>5	3
E. Coli	<1		1					<1	<1	<1	1	1	<1	<1	<1	<1	<1	<1	<1
Aluminum (Total) mg/l			0.05	0.04	0.07	0.12	0.75	0.42	0.657	<.05	<.05	0.075	<.05	<.05	<.05	<.05	<.05	<.05	<.05
Antimony (Total) mg/l			0.003	<0.0005	<0.0005	<0.006	<0.0006	<.003	<.003	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Arsenic (Total) mg/L	<.01		0.005	<0.001	<0.001	<0.010	<0.001	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Barium (Total) mg/L	1.0		0.005	<0.02	<0.02	0.012	0.018	0.019	0.019	0.0122	0.0099	<.005	<.05	<.05	<.05	<.05	<.05	<.05	<.05
Beryllium			0.002					<.002	<.002	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Boron (Total) mg/L	5.0		0.02	<0.1	<0.1	<0.02	<0.002	<.02	<0.02	<0.02	<0.02	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04
Cadmium (Total) mg/L	0.005		0.0001	<0.0002	<0.0002	<0.00010	0.00001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Calcium (Total) mg/L	-		0.5	16	16	17.1	18.3	16.3	13.9	16.9	15	16.8	15.5	15.7	16.3	16	18	15	14.1
Chloride mg/L		<250	0.1	1.20	1.15	0.91		0.69	0.89	1.07	1.09	0.85	0.92	4.3	0.97	0.97	1	1	1.02
Chromium (Total) mg/L	0.05		0.015	<0.002	<0.002	<0.030	0.003	<.015	<.015	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Cobalt (Total) mg/L			0.0005					<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005
Copper (Total) mg/L		<1.0	0.003	<0.01	<0.01	<0.010	0.004	0.0065	0.0087	<.001	0.0011	0.226	<.002	0.0123	<.002	<.002	<.002	<.002	<.002
Cyanide (total)			0.01			<0.01		<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
Iron (Total) mg/L	0.3		0.2	0.08	0.14	<0.30	1.00	0.50	0.87	<.1	<.1	0.15	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Lead (Total) mg/L	0.01		0.001	<0.001	<0.001	<0.0020	0.0006	<.001	<.001	<.001	<.001	0.0097	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Magnesium (Total) mg/L	-		0.2	2.7	2.4	3.02	3.13	2.61	2.44	3	2.63	3.01	2.65	2.44	2.59	2.7	2.9	2.6	2.3
Manganese (Total) mg/L		0.05	0.005	0.017	0.026	0.018	0.092	0.057	0.0858	0.004	0.0025	0.0039	0.0049	0.0032	0.0025	0.005	0.004	0.007	0.003
Mercury (Total) mg/L	0.001		0.0003	<0.0002	<0.0002	<0.00050	<0.00005	<.0003	<.0003	<.0005	<.0005	<.0005	0.00025	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
Molybdenum (Total) mg/l			0.001	<0.03	<0.03	<0.0050	0.0007	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	0.002	0.001	<.001	0.001
Nickel (Total) mg/L			0.005					<.005	<.005	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
Phosphorus (Total) mg/L			0.2					<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2
Potassium (Total) mg/l			0.2	1.1	1.0	1.02	1.36	1.12	0.98	0.99	1.09	1.17	1	1.06	0.94	0.8	1.1	0.7	0.9
Selenium (Total) mg/L	0.01		0.005	<0.001	<0.001	<0.010	<0.001	<.005	<.005	<.003	<.003	<.003	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Silicon			1			3.9	6.4	5.6	5.6	3.7	7.8	17.2	<5	<5	<5	<5	<5	<5	<5
Silver (Total) mg/L			0.0004					<.0004	<.0004	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005
Sodium (Total) mg/L		<200	0.2	3	<2	2.3	2.38	2.11	1.87	2.46	2.19	2.52	2.17	4.32	2.28	2.2	2.4	1.8	1.9
Sulphate mg/L		<500	1	9.1	7.6	8		7.3	7.4	8	8.2	6.8	7.6	6.7	7.2	7.1	7.2	7.5	7.3
Uranium (Total) mg/l	<0.02		0.0005	0.0005	0.0004	<0.0010	0.0005	<.0005	0.0007	0.0004	0.00037	0.00039	0.0003	<.0002	0.00033	0.0004	0.0004	0.0004	0.0003
Zinc (Total) mg/L		<0.05	0.03	<0.05	<0.05	0.054	0.006	<.03	<.01	<.01	<.01	1.32	<.04	N/A	<.04	<.04	<.04	<.04	<.04

Notes:

Hardness: 80-100 as CaCO3
>200 as CaCO3
>500 as CaCO3

Aluminum - No health guideline "operational guidance values" for water treatment are 0.10 or 0.20 mg/l depending on treatment type.

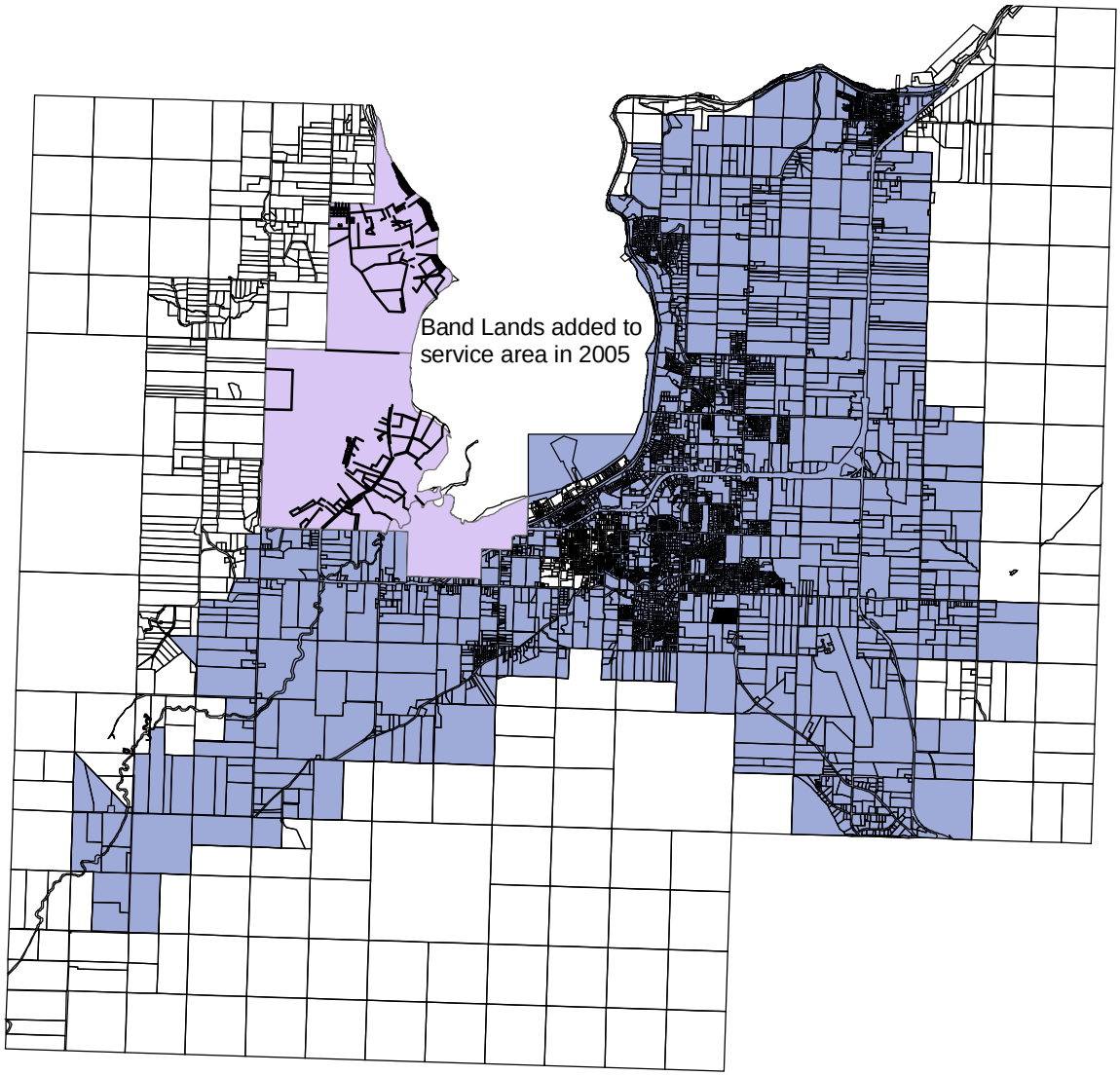
** Microbiological Characteristics:
For total coliform the maximum acceptable concentration is 0 colonies/100mL. However, due to uneven distribution in water:
1) No sample should contain more than 10 total coliform organisms per 100 mL none of which should be fecal coliforms.
2) No consecutive samples from the same site should show any coliforms
3) If any coliforms are detected, or if there are more than 200 background colonies on a toal coliform membrane filter per 100 100 mL, the site should be resampled, and if results confirmed, cause should be determined and remediation undertaken.

APPENDIX 2

CITY OF SALMON ARM
WATER SERVICE AREA

3

CITY OF SALMON ARM
WATER SERVICE AREA



APPENDIX 3

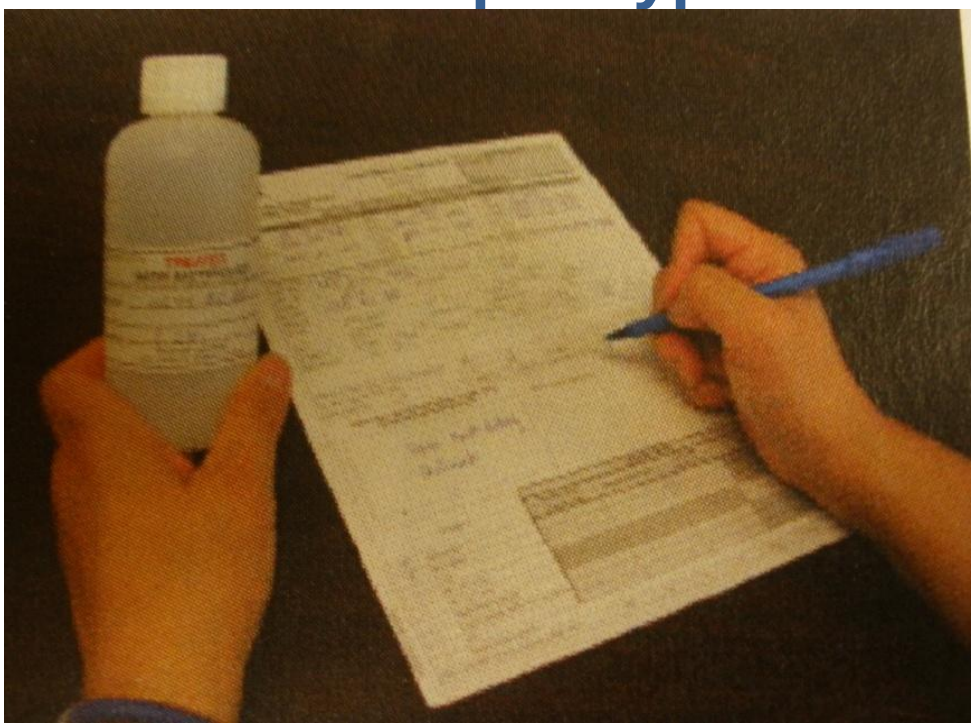
INTERIOR HEALTH AUTHORITY
CITY OF SALMON ARM
WATER SAMPLE SCHEDULE

Subject: Water Samples	Effective Date: Feb 10 2011	Revision Due Date: Feb 2014	
Department: Water Services			
Author: Rick Webb			

City of Salmon Arm

Water Sample

Site Locations / Sample Procedures and Sample Types



3751 Canoe Beach Drive
Salmon Arm BC
VOE 1K0
250.832.2780

S.O.P. #: 7
Revision #: 1

Document History

Document Location

This is an on-line document. Paper copies are valid only on the day they are printed. Refer to the author if you are in any doubt about the accuracy of this document.

Directory Path to Document:
X:\WaterServices \Water SOP's\SOP – Water Sample Procedure and Sites.docx

Revision History

Date of this revision:	Name:
Feb 7/2013	Tyrone McCabe
Date of next revision:	
Feb 2014	

Approvals

This document requires following approvals:

Name:	Title:	Signature:
Gerry Rasmuson	Utilities Manager	
Robert Niewenhuisen	Director of Engineering/PW	

Distribution

This document has been distributed to:

Name:	Title:
Tyrone McCabe	WTP Chief Operator
Rick Webb	Water Treatment Plant Operator II
Marcus Miller	Water Treatment Plant Operator II

CITY OF SALMON ARM

WATER SAMPLING PLAN

- Testing of the City water system is done in accordance with the BC Ministry of Health regulations in agreement with the Interior Health Authority, Thompson Cariboo Shuswap Region.

- The frequency and quantity of water sample testing is determined on the basis of the number of water users on the system. Under the Safe Drinking Water Regulation, it is up to the medical officer in each region to establish the testing protocol, frequency and location of samples. As per the Canadian Drinking Water Guideline population served 5,000 to 90,000 the number of samples per month is 1 per 1,000 population.

- The water sample test sites are at various locations within the Municipality that are furthest from the raw water sources/disinfection point and at present there are nine (9) test sites for treated water as well as two (2) sites for source water.

- The water samples collected from each site are tested twice a month for Total Coliform and Fecal Coliform and the testing at present is done by Caro Environmental Services, 102 3677 Highway 97B, Kelowna BC. The company is a "Certified Laboratory" and approved by the BC Ministry of Health. The water samples are collected by the City Water Utility staff that are trained in the handling, sampling, storage and transportation of water samples as per the guidelines.

- Once a year both water sources have a Chemical Water Analysis done which is compared to the Canadian Drinking Water Guidelines. We also do a Comprehensive Mineral Analysis twice a year and test for THM and HAA twice a year

- Attached are a list of the water sample sites & locations; the water sample test schedule and procedures.

Schedule A
Water Quality Standards for Potable Water

Parameter:	Standard:
Fecal coliform bacteria	No detectable fecal coliform bacteria per 100 ml
Escherichia coli	No detectable *Escherichia coli* per 100 ml
Total coliform bacteria	
(a) 1 sample in a 30 day period	No detectable total coliform bacteria per 100 ml
(b) more than 1 sample in a 30 day period	At least 90% of samples have no detectable total coliform bacteria per 100 ml and no sample has more than 10 total coliform bacteria per 100 ml

Schedule B
Frequency of Monitoring Samples for Prescribed Water Supply Systems

Population Served by the Prescribed Water Supply System:	Number of Samples Per Month:
less than 5 000	4
5 000 to 90 000	1 per 1 000 of population
more than 90 000	90 plus 1 per 10 000 of population in excess of 90 000

Important Notes

- Care must be taken not to contaminate lid or the top of the bottle when taking sample.
- Samples must be delivered to the top shop before 10 AM in order for the courier to deliver to Kelowna that day.
- Allow water to run approx. five (5) minutes to allow the standing water to be flushed out of the line and then a good representative sample can be collected.
- Fill all sampling containers to the appropriate levels and store in cooler with ice packs.
- Sample containers supplied by CARO may contain preservatives (if applicable). Use caution as the preservatives are *Corrosive. Do not dump* as they are necessary to ensure accurate results.
- Do not walk on the ice. Use an alternate sample location (upstream weir) when Metford Dam is frozen over.

Equipment Needed

- Appropriate PPE
- Cooler with 2 Ice Packs per Cooler
- CARO Chain - of - Custody (COC) Form for the sample week & Zip Lock-Bag
- Water Quality Site Form
- Colorimeter
- Turbidity Meter
- pH Meter
- Thermometer

Sample Types

- Bacteriological - Collected Weekly (Every Tuesday)
- Mineral - Collected Bi-annually (January & July)
- Beach Samples - Collected June, July, August And September
- Pesticides - Collected at the WTP once a year
- THM & HAA – collected Bi-annually (January & July)

Sample Types

Yearly Beach Sampling – Samples are to taken from the beach at the East end, Center, and West End. The samples are to be taken in June, July, August and September of each year. Samples should be taken at the point in the water where bathers would be wading, usually thigh deep. The actual sample should be taken at 15 to 30cm in depth. The bottle should be pushed ahead, underwater, and not be completely filled, to allow for the specimen to be shaken during testing. Sampling is best undertaken when the beach is in use, with many bathers present. This will present a worst-case scenario, and mirror the risk to which the bathers are exposed. Experience has indicated the time of sampling can influence results. That is, samples taken in the early morning, when the water is calm and there are no swimmers, will result in low bacterial counts. Samples taken later in the day when the wind is blowing and/or bathers are present will result in higher numbers. Send these tests to Interior health for shipping. We are a "Low Risk Hazard" swimming area. Refer to sampling SOP attached.

Mineral samples - Samples are to be taken from both raw water sources. We will sample in January and July of each year. Bottles will be provided by CARO services.

THM and HAA Samples – Samples are to be taken from the furthest point of use (Mt Ida sample site) and twice per year in January and July. Temperature affects results. When Metford Dam is on line we will grab a set of these samples from Zone 5 sample site as well. Refer to sampling SOP attached.

Pesticides – Sample will be taken once per year from the Water Treatment Plant raw water sample pump located in the lab.

Bacteriological Sample Schedule

Treated Sample Site Names		Sample Site Address
Week 1 & 3	Canoe Fire Hall	6600 – 50th Street NE (Salmon Arm)
Week 1 & 3	Mt Ida. School	7381 – 50th Avenue SW (Salmon Arm)
Week 1 & 3	Zone 5 Sample Site	4750 – 40th Avenue SE (Salmon Arm)
Week 1 & 3	Zone 2A Reservoir (Twins)	2540 – 50 Street NW (Salmon Arm)
Week 2 & 4	TCH East	4040 50th Street NE (Salmon Arm)
Week 2 & 4	IR3 Reservoir	251 Gleneden Road NW (Salmon Arm)
Week 2 & 4	Zone 3 Reservoir	4921 – 30th Street NE (Salmon Arm)
Week 2 & 4	DSA Gravel Pit (Alternate)*	6641 10th Avenue SE (Salmon Arm)
Week 2 & 4	Homely Reservoir	851 – 10th Avenue SE (Salmon Arm)
Raw Water Sample Site		**Sample Site Address**
Week 1 & 3	City of Salmon Arm WTP	3751 – Canoe Beach Drive NE (Salmon Arm)
Week 2 & 4 *	Metford Dam	7101 – 10th Avenue SE (Salmon Arm)

City of Salmon Arm gravel pit is an alternate site when Metford Dam is not in use.

Sample Site Locations

Water Treatment Plant

3751 Canoe Beach Dr NE

Fire Hall #1

6600 50th St NE

TCH East

4940 50th St NE

CSA Gravel Pit

6641 10th Ave SE

Metford Dam

7101 10th Ave SE

Zone 5 Sample Station

4750 40th Ave SE

Mt. Ida Sample Station

7380 50th Ave. SW

Zone #3 Reservoir

4921 30th St NE

Zone 2A Reservoir

2540 50th St NW

IR #3 Reservoir

251 Gleneden Road

Homely Reservoir

851 10th Ave SE

Sampling Procedure for Bacteriological Sampling

1. Water samples are collected once per week, typically every Tuesday on a four (4) week rotation.

2. The day prior to sample day, prepare the Chain of Custody (COC) Form on the computer and print. Fill in the information label on the sample bottles for each site.

3. On sample day proceed to each site and flush the water for at least five (5) minutes.

4. Record the current time on the bottle and fill to between the shoulder and the neck of the bottle. Replace the lid snuggly and place the sample bottle in the cooler with the ice packs.

5. Test the water for chlorine (free and total), pH, temperature and turbidity and record on the Water Quality Site Form. Record the chlorine residual, time and temperature on the COC Form.

6. When all sites have been sampled, tested and the information recorded on the COC Form, fold the COC form and place in the zip-lock bag. Place COC form in the cooler with the sample bottles.

7. Advise the Purchaser that water samples are ready to go out. Deliver the cooler to the Top Shop before 10 AM.

8. Make a copy of the Water Quality Site Form. Keep the original to file at the water plant and give the copy to the receptionist for the Utilities Manager.

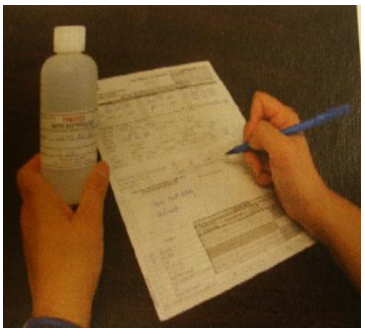
Sample Procedure for Mineral Samples

1. Mineral samples are taken twice a year, once in January and once in July.
2. Use the bottles supplied by CARO for mineral samples. Set of 4 bottles used, see picture of bottles at right.

3. Samples are to be taken from the Water Treatment Plant Raw Water Line and from the reservoir at Metford Dam.
4. On the day prior to sampling, enter the data on the Chain of Custody (COC) Form on the computer and print. Fill in the information label on the sample bottles for each site.
5. On sample day, open the Raw Water sample valve at the WTP and let run for at least five (5) minutes.
6. Record the current time on the bottle, fill to the neck of the bottle, replace the lid snuggly and place the sample bottles in the cooler with the ice packs.
7. Proceed to Metford Dam and record the time on the bottles. Dip the bottles in the reservoir to collect the samples. Place bottles in the cooler with the WTP raw water samples.
    - *If reservoir is frozen over, collect sample from the upstream weir.*

Sample Procedure for Beach Samples

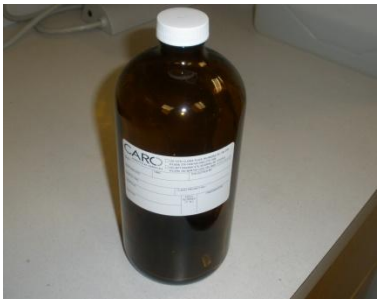
1. Beach samples are taken once a month for the months of June, July, August and September.
2. The day prior to sampling, complete the Requisition Form supplied by Interior Health for the appropriate month.



3. Using bottles supplied by Interior Health, complete the information label on the bottles. Record the time the sample is collected immediately prior to collecting the sample.
4. Beach samples are to be taken from three different points on the beach: west end, middle and east end. Samples must be taken in at least 30” of water and at a depth of 6” to 12” below the surface of the water. Replace lid and tighten snuggly.
5. Place the completed Requisition Form for the appropriate sample in a zip-loc bag and attach the sealed bag to its corresponding bottle with an elastic band
6. Place filled bottles in the cooler with the ice packs
7. Take the cooler with the bottles to the Interior Health Facility on corner of Tenth Ave. NE and 16th St. NE

Procedure for Pesticide Samples

1. Pesticide samples are taken once a year from the raw water line at the Water Treatment Plant.
2. The day prior to sampling, enter the data on the Chain of Custody (COC) Form on the computer print. Fill in the information label on the sample bottles.
3. On sample day, open the raw water sample valve and let run for five (5) minutes. Using the bottles supplied by CARO (2 – 1 liter amber bottles), record the time on the bottle, collect the samples filling to the shoulder of the bottle, replace lid, tighten snuggly and then place in cooler with the ice packs.



Procedure for THM & HAA Samples

1. THM & HAA samples are taken twice a year; once in January and once in July
2. The day prior to sampling, enter the data on the Chain of Custody (COC) Form on the computer and print. Fill in the information label on the sample bottles.
3. The samples are collected from the Zone Five Sample Stn. and the Mt. Ida Sample Stn.
4. The samples are collected in special bottles supplied by CARO. There are three bottles for each test. Check the preservative to confirm you have the right bottle.(see below)

Amber

THM

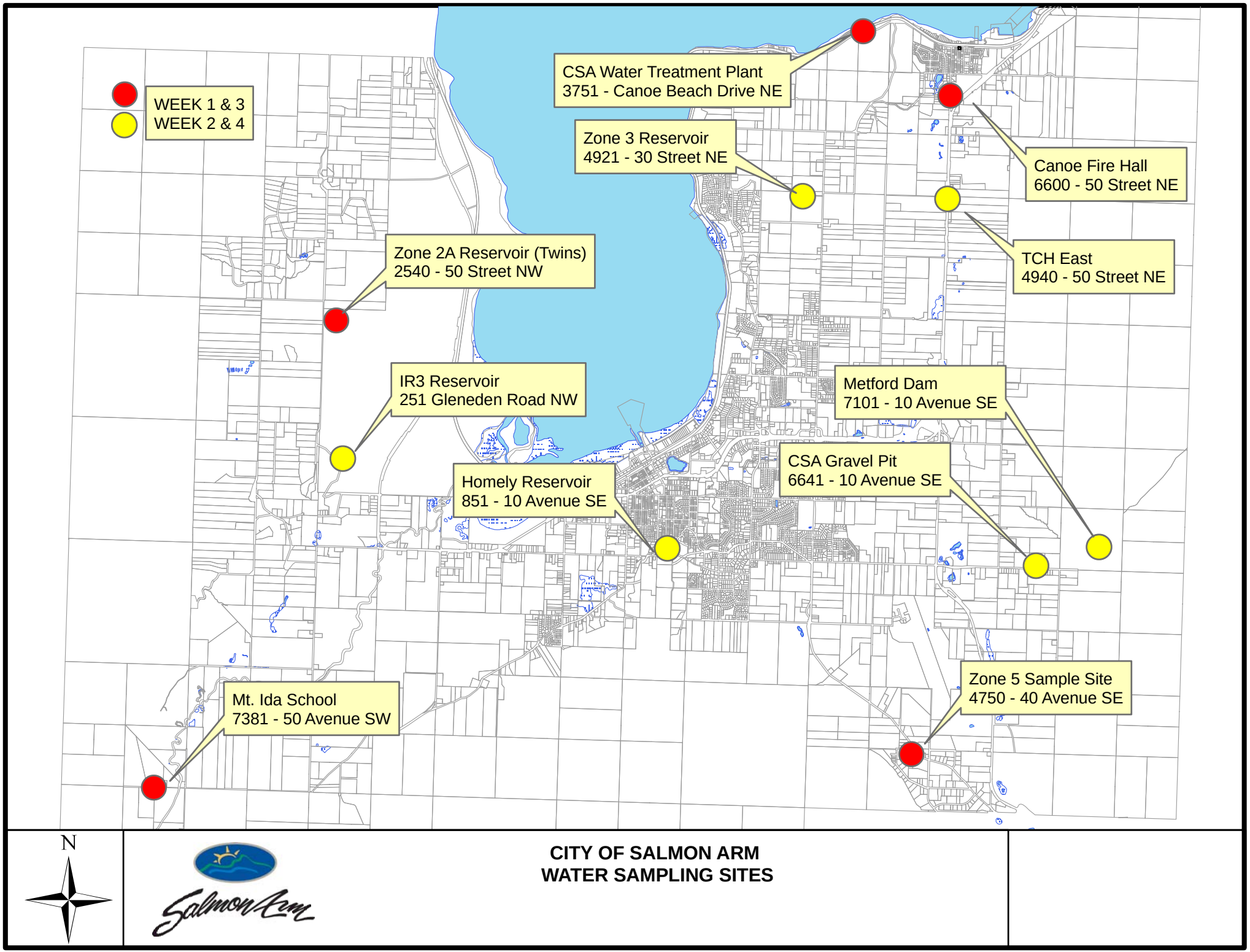
Preservative – Na2S2O3
Sodium Thiosulophate

Clear or Amber

HAA

Preservative – NaHSO4
Sodium Bisulphate

5. Let the water run for five (5) minutes before collecting the sample. Fill each bottle to overflowing so that there is a positive meniscus, place the bottle on a level surface and tighten the cap snuggly. Check the bottle to make sure that there is no air in it, if there is air present in the bottle, remove the cap and top up the bottle and then replace the lid and check again for air. Repeat until all air is removed from the sample bottle.
6. Place sample in cooler with the ice packs.


WEEK 1 & 3
WEEK 2 & 4
CSA Water Treatment Plant
3751 - Canoe Beach Drive NE
Zone 3 Reservoir
4921 - 30 Street NE
Canoe Fire Hall
6600 - 50 Street NE
Zone 2A Reservoir (Twins)
2540 - 50 Street NW
TCH East
4940 - 50 Street NE
IR3 Reservoir
251 Gleneden Road NW
Metford Dam
7101 - 10 Avenue SE
CSA Gravel Pit
6641 - 10 Avenue SE
Homely Reservoir
851 - 10 Avenue SE
Zone 5 Sample Site
4750 - 40 Avenue SE
Mt. Ida School
7381 - 50 Avenue SW
N
Salmon Arm
CITY OF SALMON ARM
WATER SAMPLING SITES

APPENDIX 4

INTERIOR HEALTH AUTHORITY
CITY OF SALMON ARM WATER SYSTEM
BIOLOGICAL MONITORING REPORTS

CARO ENVIRONMENTAL SERVICES
E.COLI AND COLIFORM TESTING - PART 1

2013 Week 1 & 3 E.Coli & Coliform testing

Date	Fire Hall #1			Zone 5 Sample Stn			Mt Ida Sample Stn			Zone 2A Reservoir			Water Treatment Plant [Raw]			Sample Retests			Additional Samples		
	Total	E.Coli	Over	Total	E.Coli	Over	Total	E.Coli	Over	Total	E.Coli	Over	Total	E.Coli	Over	Total	E.Coli	Over	Total	E.Coli	Over
2013																					
02-Jan	<1	<1		<1	<1		<1	<1		<1	<1		**3**	1							
15-Jan	<1	<1		<1	<1		<1	<1		<1	<1		<1	<1							
04-Feb	<1	<1		<1	<1		<1	<1		<1	<1		<1	<1							
19-Feb	<1	<1		<1	<1		<1	<1		<1	<1		<1	<1							
05-Mar	<1	<1		<1	<1		<1	<1		<1	<1		**1**	**1**							
18-Mar	<1	<1		<1	<1		<1	<1		<1	<1		<1	<1					<1	<1	
02-Apr	<1	<1		<1	<1		<1	<1		<1	<1		**1**	<1							
16-Apr	<1	<1		<1	<1		<1	<1		<1	<1		**1**	<1							
07-May	<1	<1		<1	<1		<1	<1		<1	<1		4	<1							
21-May	<1	<1		<1	<1		<1	<1		<1	<1										
22-May													**4**	**1**							
04-Jun	<1	<1		<1	<1		<1	<1		<1	<1		**1**	<1							
11-Jun																					
18-Jun	<1	<1		<1	<1		<1	<1		<1	<1										
19-Jun													**2**	**<1**							
02-Jul	<1	<1		<1	<1		<1	<1		<1	<1		**≥3**	<1							
16-Jul	<1	<1		<1	<1		<1	<1		<1	<1		<1	<1							
06-Aug	<1	<1		<1	<1		<1	<1		<1	<1		<1	<1							
21-Aug	<1	<1		<1	<1		<1	<1		**1**	<1		**≥2**	<1							
03-Sep	<1	<1		<1	<1		<1	<1		<1	<1										
04-Sep													<1	<1							
17-Sep	<1	<1		<1	<1		<1	<1		<1	<1		**1**	**1**							
08-Oct	<1	<1		<1	<1		<1	<1		<1	<1		<1	<1							
22-Oct	<1	<1		<1	<1		<1	<1		<1	<1		**≥1**	<1							
05-Nov	<1	<1		<1	<1		<1	<1		<1	<1		**2**	**2**							
03-Dec	<1	<1		<1	<1		<1	<1		<1	<1		<1	<1							
18-Dec	<1	<1		<1	<1		<1	<1		<1	<1		**1**	<1							

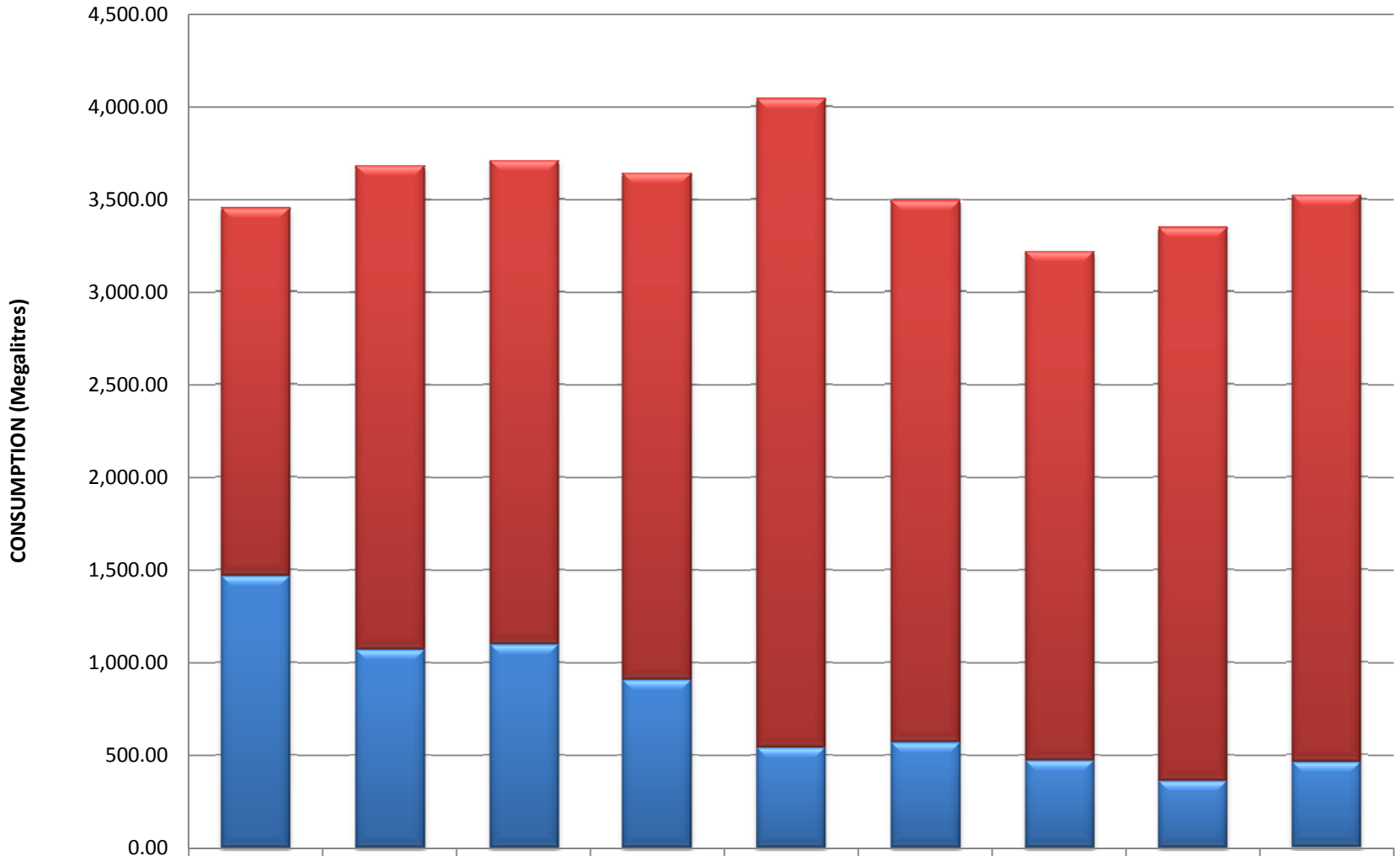
2013 Week 2 & 4 E.Coli & Coliform testing

Date	Zone # 3 Reservoir			TCH East			CSA Gravel Pit			Metford Dam [Raw]			Homely Reservoir			IR #3 Reservoir			Sample Retests			Additional Samples		
	Total	E.Coli	Over	Total	E.Coli	Over	Total	E.Coli	Over	Total	E.Coli	Over	Total	E.Coli	Over	Total	E.Coli	Over	Total	E.Coli	Over	Total	E.Coli	Over
2013																								
08-Jan	<1	<1		<1	<1		<1	<1		**2**	<1		<1	<1		<1	<1							
22-Jan	<1	<1		<1	<1		<1	<1		**20**	<1		<1	<1		<1	<1							
12-Feb	<1	<1		<1	<1		<1	<1		**17**	<1		<1	<1		<1	<1							
26-Feb	<1	<1		<1	<1		<1	<1		**9**	<1		<1	<1		<1	<1							
12-Mar	<1	<1		<1	<1		<1	<1		**4**	<1		<1	<1		<1	<1							
25-Mar	<1	<1		<1	<1		<1	<1		**6**	<1		<1	<1		<1	<1							
09-Apr	<1	<1		<1	<1		<1	<1					<1	<1		<1	<1							
23-Apr	<1	<1		<1	<1		<1	<1					<1	<1		<1	<1							
14-May	<1	<1		<1	<1		<1	<1					<1	<1		<1	<1							
28-May	<1	<1		<1	<1		<1	<1					<1	<1		<1	<1							
04-Jun										**44**	**1**													
11-Jun	<1	<1		<1	<1		<1	<1					<1	<1		<1	<1							
12-Jun										**≥16**	**3**													
09-Jul	<1	<1		<1	<1		<1	<1		**110**	**6**		<1	<1		<1	<1							
16-Jul										**≥33**	4													
23-Jul	<1	<1		<1	<1		<1	<1		**500**	**5**		<1	<1		<1	<1							
13-Aug	<1	<1		<1	<1		<1	<1		**41**	**8**		<1	<1		<1	<1							
27-Aug	<1	<1		<1	<1		<1	<1					<1	<1		<1	<1							
10-Sep	<1	<1		<1	<1		<1	<1		**240**	1		<1	<1		<1	<1							
24-Sep	<1	<1		<1	<1		<1	<1		**210**	<1		<1	<1		<1	<1							
15-Oct	<1	<1		<1	<1		<1	<1					<1	<1		<1	<1							
16-Oct										**92**	<1													
29-Oct	<1	<1		<1	<1		<1	<1		**32**	<1		<1	<1		<1	<1							
12-Nov	<1	<1		<1	<1		<1	<1		**72**	<1		<1	<1		<1	<1							
26-Nov	<1	<1		<1	<1		<1	<1		**43**	<1		<1	<1		<1	<1							
10-Dec	<1	<1		<1	<1		<1	<1		**6**	<1		<1	<1		<1	<1							

APPENDIX 5

ANNUAL WATER CONSUMPTION 2005 TO 2013

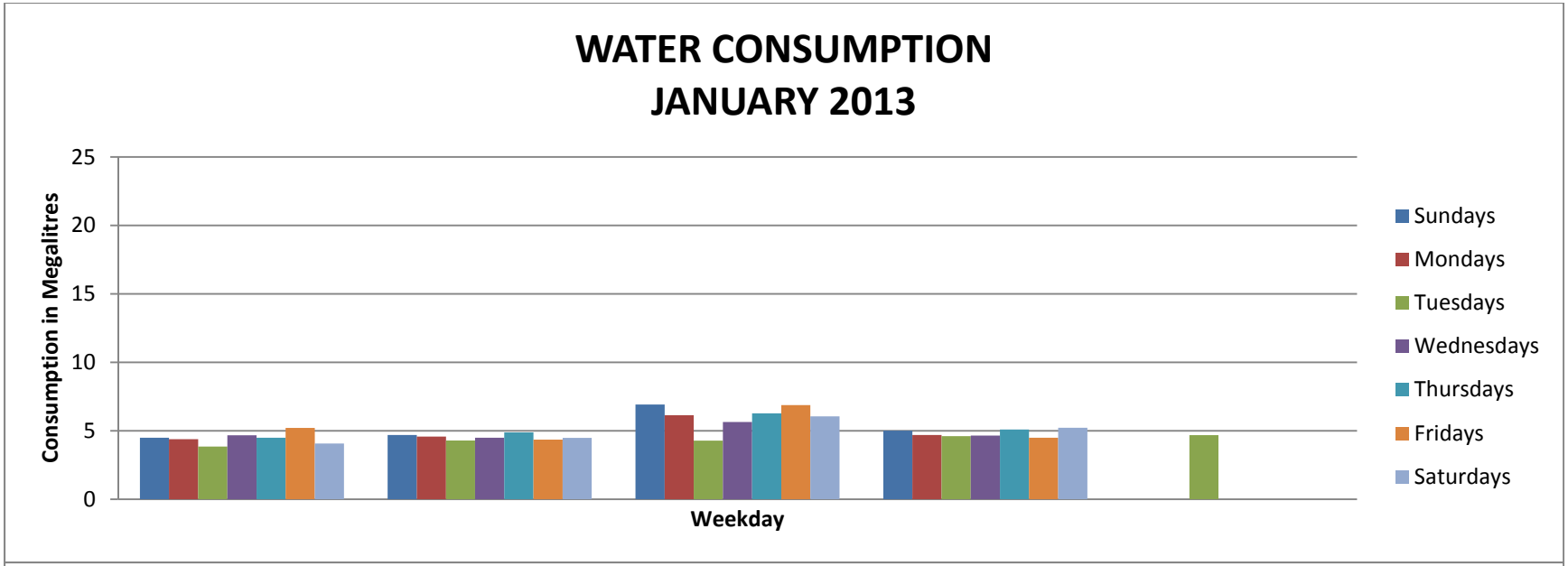
ANNUAL WATER CONSUMPTION

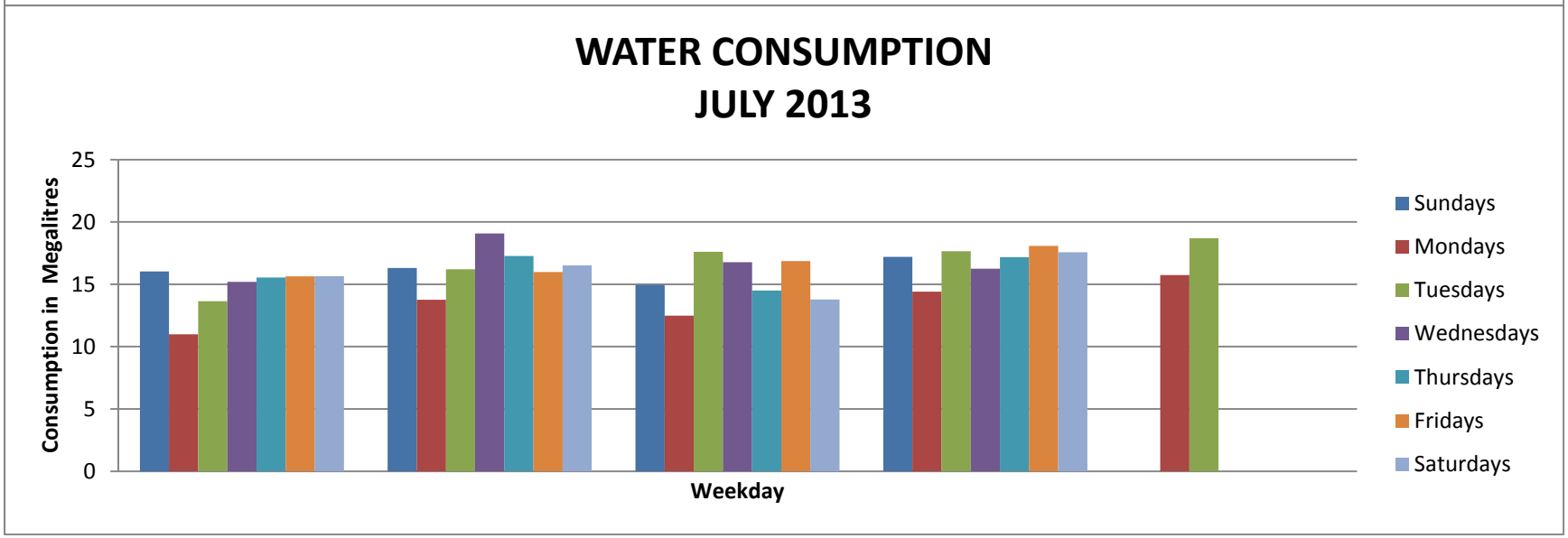


	2005	2006	2007	2008	2009	2010	2011	2012	2013
SHUSWAP LAKE	1,983.57	2,616.31	2,610.87	2,735.02	3,501.05	2,923.01	2,749.18	2,984.96	3,062.37
METFORD DAM	1,464.58	1,068.09	1,094.97	906.99	541.37	566.52	470.74	359.01	457.52

APPENDIX 6

JANUARY AND JULY WATER CONSUMPTION COMPARISON


WATER CONSUMPTION
JANUARY 2013
Consumption in Megalitres
25
20
15
10
5
0
Weekday
Sundays
Mondays
Tuesdays
Wednesdays
Thursdays
Fridays
Saturdays


WATER CONSUMPTION
JULY 2013
Consumption in Megalitres
25
20
15
10
5
0
Weekday
Sundays
Mondays
Tuesdays
Wednesdays
Thursdays
Fridays
Saturdays

APPENDIX 7

MAINTENANCE PROGRAM

SYSTEM MAINTENANCE

Regular inspections, maintenance and water quality testing is performed by certified operators to ensure optimal operation of the City's water system.

To assist the operators of our water system, the City purchased a new, state of the art, maintenance management program in 2009.

Maintenance of the Salmon Arm water system involves five key programs:

1) Air Valves – servicing and upgrading.
2) Water mains – flushing, scouring for taste and odour control.
3) Hydrants – servicing, painting and upgrading.
4) Reservoirs – inspection and cleaning.
5) Clearing of trees and brush along City rights of ways

As replacement of the entire distribution grid is not financially viable, system maintenance becomes a critical component in the management of the water infrastructure.

ANNUAL MAINTENANCE PROGRAM

Air Valves

Turbulence created in the water as it flows through the system causes some of the dissolved air in the water to collect as bubbles in the pipes. These air bubbles collect at the high points in the system and restrict water flow. We have approximately 109 air valves installed in below-ground chambers that automatically

Bleed air from the pressurized piping system. If an air valve failed, negative pressures could allow groundwater to infiltrate and contaminate the water system. Air valves receive regular maintenance as required and are replaced at the end of their service life, which is approximately 20 years.

Water mains

Water main maintenance involves both the upgrading of aging water mains and ensuring that existing water mains are operating effectively.

Water main Flushing

As water travels from the watersheds, it collects organic particles and transports them to the water system. As these particles travel to areas of the water system with lower flow velocities they settle out. Accumulated debris and stagnant water inhibit flow through mains, cause dirty water and potentially create a favourable environment for bacterial growth. In response to these concerns, the Utilities Department initiated a water main flushing program for identified problem areas. Each main is flushed annually during

daytime hours. When flushing, a hydrant is opened and the water stream is used to expel the contents of the main. There are approximately 47 locations throughout the municipality referred to as “high maintenance areas” where water demand is low or where water mains terminate in a dead end. These areas are flushed as required, sometimes as often as every month during the summer.

Hydrant Maintenance

To ensure proper fire protection, Salmon Arm implemented a fire hydrant maintenance program. The program requires staff to check the pressure on each hydrant before it is serviced and dismantles each hydrant, renewing worn parts as necessary. The
hydrant is then lubricated and reassembled. All hydrants get an overhaul biannually.

Reservoir Maintenance

Debris can accumulate in reservoirs and bacteria and algae can grow on the walls. Each year, the Utilities Department staff cleans and services two different reservoirs. The program involves decommissioning the reservoir, draining it, removing any sediment, repairing leaks, and disinfection. The reservoir is then refilled, chlorinated and tested for water quality. This program requires approximately two days to complete before the reservoir can be brought back into service.

APPENDIX 8

WATER CONSERVATION POLICY

DISTRICT OF SALMON ARM **POLICY NO. 5.16**

TOPIC: To establish District water reduction goals and a water use efficiency program

PURPOSE:

1. to effectively defer the need for water & sewage system capacity improvements and the resultant other associated infrastructure costs;
2. to reduce operating / maintenance (o & m) costs;
3. to establish a more fair and equitable water rates structure;
4. to contribute directly or indirectly to the reduction of impact on the environment;
5. to have in place a District water conservation strategy so as to qualify for senior government funding programs.

POLICY
(**GOALS**) Goals: Years 2003, 2004 and 2005 (3 years)

1. Develop and deliver a public awareness & education program for VOLUNTARY water use efficiencies to achieve
   a. a reduction of PEAK daily use by 20% (Factor of 1:5)
   b. a reduction of AVERAGE daily use by 14% (Factor of 1:7)

   There shall be a report back to Council in 2005 / 2006.

POLICY
(IMPLEMENTATION) Implementation Strategy – Goals

1. Formalize the rationale in support of deferral of infrastructure and related costs in relation to peak daily demand.
2. Formalize the rationale in support of reduction in average daily demand.
3. Approach the goals on three fronts:
   a. Public use (leakage & public land sprinkling).
   b. Business use: water audits and / or inventory of use.
   c. Residential use: conservation by education.
4. Review the water user fee rates (i.e. metered vs non-metered).
5. Review commercial, industrial, institutional and multi-family metered accounts to ensure consistency.

6. Adopt a Bylaw requiring "ultra-low" flush toilets.
7. Develop a Water Efficiency Program using internal resources (staff) and external resources (consultant or others), funded through the Water Management budget; such program to include, at minimum, the following elements:
    a. Water efficiency theme, logo, or slogan for purposes of branding and imaging of objectives.
    b. Education materials for multi-media communication purposes, such materials to clearly present the goals, rationale and strategies being pursued in the interests of conservation.
    c. Establish media partnerships, as appropriate, with newspaper, radio, television and internet services for short and long-term use of multi-media communication with water users.
    d. Establish business partnerships, as appropriate, with suppliers, service businesses and others to facilitate and encourage more efficient water management in and around the home and business.
    e. As appropriate from year to year, engage the resources of third party agencies to supplement the primary efforts of the District in public education.

8. Amend Bylaw No. 1274 to effectively convert permissible outdoor sprinkling from the current "alternate odd/even days" which results in potential 50% peak daily demand to a "three-day cycle" which results in a potential 33% peak daily demand.
9. Develop and implement an evaluation process to monitor the success of the Water Efficiency Program, the results of which shall be made public at intervals as part of the public education process.

Prepared by: Director of Operations	Date: March 15, 2003
Approved by Council	Date: March 24, 2003
Amended:	

APPENDIX 9

WATER EMERGENCY RESPONSE PLAN

City of Salmon Arm

EMERGENCY RESPONSE PLAN

FOR CONTINUED SUPPLY OF

SAFE POTABLE DRINKING WATER

& WATER FOR FIRE FIGHTING PURPOSES

During a major emergency a command centre will be set up at the Water Plant or City Hall whichever site is the safest. A plan of action and notifications will be determined and put in place to correctly deal with the emergency by the individual who is in charge. Communications must be submitted to all who are involved.

January 13, 2014

CONTENTS

INTRODUCTION

PROTECTING PUBLIC HEALTH

Safe and reliable drinking water is vital to every community. Emergency response planning is an essential part of managing a drinking water system. Most public water systems have had routine operating emergencies such as pipe breaks, pump malfunctions, bacteriological contamination, and power outages. These are manageable if the water system has an emergency response plan that can be put into action. More serious non-routine emergencies may result from intentional acts of vandalism, chemical spills, floods, earthquakes, windstorms, or droughts. These can drastically affect the system and the community that depends on it. Each emergency has unique effects on different parts of a water system. Floods can cause widespread bacterial contamination, earthquakes can damage water sources, distribution systems and treatment systems, and storms can disrupt power supplies. The common element is that each emergency may threaten the system's ability to deliver potable and palatable drinking water. Emergency response planning is a process by which water system managers and staff explore vulnerabilities, make improvements, and establish procedures to follow in an emergency situation. It is also a process that encourages people to form partnerships and get to know one another. Preparing a response plan and practicing it can save lives, prevent illness, enhance system security, minimize property damage, and lessen the overall burden of a catastrophic event and the cost associated to the disaster.

EMERGENCY RESPONSE PLAN MISSION AND GOALS

Mission statement for Emergency Response Plan	In an emergency, the mission of The City of Salmon Arm is to protect the health of customers by being prepared to respond immediately to a variety of events that may result in contamination of the water or disruption of supplying water via floods, storms, earthquakes, and vandalism
Goal 1	Be able to quickly identify an emergency and initiate a timely and effective response to the situation at hand
Goal 2	Be able to quickly notify local and regional authorities to assist in the response if utilities cannot respond effectively
Goal 3	Protect public health by being able to quickly determine if the water is not potable nor palatable to drink or use and being able to immediately notify customers effectively of the situation and advise them of an appropriate protective action plan.
Goal 4	To be able to quickly respond and repair damages to minimize system down time and the potential of illness associated to water quality in the event of a rare emergency.

SYSTEM INFORMATION

Facility Certificate Number	647 Water Distribution System 1709 Water Treatment Plant	
System name and address	City of Salmon Arm Water Treatment/Distribution System 3751 Canoe Beach Drive NE Salmon Arm BC	
Directions to the system	Located 5 Km East of Salmon Arm in community of Canoe. Go to public beach and through the rail tunnel on the east is the distribution pump station. The Water Treatment Plant is to the west of the parking lot.	
Basic description and location of system facilities	The raw water is pumped to the WTP from Low Lift Pumps that draw from Shuswap Lake. The WTP consists of a multi barrier approach with coagulation/flocculation, filtration, UV disinfection and hypo chlorite added as the secondary disinfectant. Raw water chemicals added are PACl, HF222, and filter aid HF502. Treated water then gravity flows into the clear well to the Canoe pump station where it is then pumped into the distribution system. There are 4 booster pump stations and 2 main pumping stations within the system. The system contains 14 reservoirs and 1 Dam which is located on East Canoe Creek.	
Location/Town	City of Salmon Arm	
Population served	15,000 residences	
System owner	The City of Salmon Arm	
Name, title & telephone number of person responsible for maintaining and implementing the emergency plan	Rob Niewenhuizen Director of Engineering & Public Works	250-803-4017

WATER SOURCE

The City water system consists of two [2] main raw water sources, Shuswap Lake and East Canoe Creek. Treatment systems for both water sources are in place and include an extensive water pumping, distribution, and storage system within the City. The Water Treatment Plant provides a multi-barrier approach for drinking using the 4-3-2-1-0 guidelines. East Canoe Creek has been upgraded in 2012 to ultraviolet light (UV) and sodium hypochlorite disinfection.

Shuswap Lake is at a nominal elevation of 346 m [1135 ft] while the Metford Dam intake on East Canoe Creek is at elevation 567 m [1860 ft]. The Water Services Department attempts to maximize the supply of water from East Canoe Creek so that pumping into the system from Shuswap Lake is minimized to save on pumping costs and O&M costs. The flow of water from East Canoe Creek into the water system is by gravity and feeds into Little Mountain reservoir where it is then utilized as part of the distribution system optimization strategy.

DISTRIBUTION SYSTEM

The public water system services an area of approximately 6,322 hectares [see Appendix 2]. The City distributes water in pipes made of a variety of materials. The first water mains were made of wood and these wooden mains have since been replaced with ductile iron, PVC, polyethylene, asbestos cement, and some copper piping.

The distribution system includes approximately 205 km of water main varying in diameter from 100mm to 600mm. The distribution system also includes six different pressure zones, fourteen reservoirs, one dam and six pump stations.

PRESSURE ZONES

The distribution system is segregated into eight [8] pressure zones. The storage reservoir in the highest pressure zone is at elevation 615m [2020 ft]. Water has to be pumped over 269m [885 ft] in elevation from WTP to the storage reservoir at the highest elevation.

EVENTS THAT CAUSE EMERGENCIES

The main purpose of this plan is to address a situation where the raw water for the City of Salmon Arm has been contaminated due to an accident on the railway or highway. CPR tracks and the Trans Canada Highway run parallel with Shuswap Lake, creating risk management concerns. Other possible emergencies considered include:

- Natural disasters
- Accidents
- Deliberate acts of vandalism or terrorism
- System neglect or deferred maintenance

An emergency may affect the entire water system or only isolated sections. Each type of event can cause different types of damage to system components or contamination resulting in a disruption in service. Evaluations should be considered in how to respond to these actions.

NATURAL DISASTERS

EARTHQUAKES

Damage resulting from the earth shifting along geologic faults resulting in shaking and settling of the ground can cause severe structural damage to virtually all water system facilities, including sources, transmission and distribution lines, storage reservoirs, and pump-houses.

FLOODS

Floods can cause widespread contamination as turbid waters carry bacteria that can overflow sources, transmission lines, treatment facilities, and pumping facilities. Floods can also ruin electrical components and telemetry systems. Fortunately, from past experience, the City of Salmon Arm drinking water system has not been vulnerable to high flooding.

HIGH WINDS

Every so often high winds occur in the region and they can pose a threat mainly to the power supply. The Zone 1 & 2 pump station in Canoe has the capability of being powered from a large semi-trailer generator to ensure the supply of water.

DROUGHT

Severe droughts have the potential to compromise the water supply network especially the East Canoe Creek Watershed which typically endures periods of significant reduction in volume late in the summer.

WATERBORNE DISEASES

Organisms such as *Giardia*, *Cryptosporidium, E. coli and viruses* can contaminate water supplies and cause waterborne diseases. It is very important to monitor the treatment processes, maintain positive pressure and maintain an adequate disinfection residual throughout the water distribution network to ensure the delivery of safe, potable water.

HUMAN-CAUSED EVENTS:

HUMAN-CAUSED EVENTS THAT CAN RESULT IN A WATER SYSTEM EMERGENCY INCLUDE CHEMICAL SPILLS, VANDALISM, TERRORISM, CYBER-ATTACK, FIRES, CONSTRUCTION ACCIDENTS, AND BASIC NEGLECT OF MAINTAINING THE SYSTEM.

VANDALISM

Vandalism is generally a spur-of-the-moment act using materials at hand rather than pre-planned or pre-meditated activities. Vandals often break into systems, damage facilities, and paint graffiti. These acts are relatively easy to prevent by enhancing security, increasing lighting, installing locks on doors and hatches, and installing and maintaining security fencing.

TERRORISM

Acts of terrorism are conducted by someone whose intent is to instill fear or induce harm to people and facilities. Acts of terrorism are a very real threat. Even though it may seem unlikely, it would only take one well-staged event to undermine confidence in drinking water safety. Being prepared and knowing what to look for are crucial elements of preventing an attack on the system.

There are many potential terrorist threats to drinking water systems, including chemical, biological or radiological contamination as well as damage to infrastructure and computer systems. In most cases, contamination using biological or chemical agents would cause the most concern for a drinking water system. Although it would be difficult to effectively contaminate a large water supply with these agents or cause major damage, the possibility

should not be taken lightly. The threat is real, and drinking water systems need to enhance security around facilities and be prepared to respond.

SYSTEM NEGLECT

System neglect, often referred to as deferred maintenance, is a significant cause of emergencies. System components that are aging and need replacement go without attention for so long that they fail, causing an emergency. Drinking water systems need to continuously evaluate facilities and replace them before a large scale failure occurs.

CROSS CONNECTIONS

A cross connection is an actual or potential physical connection between a public water system and any source of non-potable liquid, solid, or gas that could potentially contaminate water supply through a backflow event. Cross connections usually occur unknowingly when someone makes a connection in the system. Backflow is the reverse flow of water or other substances into the public water system. Under backflow conditions, unprotected cross-connections can provide a path for biological, chemical, or physical contaminants to enter the water supply. These contaminants can lead to waterborne disease outbreaks, chemical poisonings, and sometimes death. Backflow usually occurs when there is a loss of pressure somewhere in the system causing water flow to reverse.

CONSTRUCTION INCIDENTS

Construction incidents may fall into the category of an operating emergency e.g. a contractor damages a water line and the system needs to be shut down for repair. If the response is not timely and effective, this kind of incident can turn into a serious emergency. The system may lose pressure, resulting in the potential for backflow incidents to occur that contaminate the water distribution network. The utility must be aware of construction in and around the system and be prepared to respond quickly to an incident if it occurs.

CHEMICAL SPILLS

Many chemicals that are routinely transported can harm humans directly or by contaminating air or water. No drinking water system is safe from a hazardous chemical spill and the resulting contamination. Spills can come from motor vehicles, trains, airplanes, boats, or fixed containers. They can occur at any time without warning.

EMERGENCY SEVERITY

Emergencies usually have a wide range of severity. Defining categories of severity can significantly aid in determining appropriate response actions and notifying correct agencies to assist with the emergency. Knowing the severity of the emergency and being able to communicate it to others will help system personnel keep their response balanced and effective.

Making a decision on severity should be collaborative among system personnel with who could be potentially involved with the emergency. The individual in charge may also choose to coordinate with external parties, especially if partnerships have been formed and are part of the ERP contacts. The information for making the decision will progressively increase over time and may result in the level of severity being changed and other actions required.

After an assessment of the severity, the assessment must be communicated immediately to all those dealing with the emergency. Make sure personnel have cell phones and/or radios when they are in the field assisting. Remember to have an alternative method of communicating if cell phones don't work or in a worst case scenario event. The buddy system should be utilized if personnel power is available.

TYPE I – ROUTINE EMERGENCY

The system experiences a normal emergency, such as a line break or power outage. System personnel are able to handle the problem with minimal assistance. The situation is not likely to negatively impact public health. Although it is important to begin responding, personnel should have no difficulty remaining calm and work thoroughly through the situation. Normal events can usually be resolved within 24 hours.

Description: The City of Salmon Arm Water System Type 1 Emergencies

- Distribution line breaks, PRV station failure
- Short power outages
- Minor mechanical problems in pump-houses
- Other minor situations where it is not likely that public health be affected (Fire hydrant strike)

The system has specific response activities identified for these types of emergencies, including proper sampling, disinfection, and pressure testing activities. System personnel are advised and are directed to work on the problem and are usually capable of resolving the problem within 24 hours from the first notification. If it is determined the event will last longer than 24 hours and storage is likely to be drawn down below a safe operating level, the situation may be elevated to a Type 2.

TYPE II – MINOR EMERGENCY

The system experiences minor disruption in supply or has indications of possible contamination where it may need to coordinate with Interior Health Authority (IHA) and consider issuing an advisory to customers. In these types of emergencies, health may be jeopardized, so it is important for system personnel to be on alert and initiate a quick response. These emergencies can usually be resolved within 48 - 72 hours.

Description: The City of Salmon Arm Water System Type II Emergencies:

- Disruption in supply such as a transmission main line break, pump failure with a potential for backflow and loss of pressure
- Storage is not adequate to handle disruption in supply
- An initial positive bacteriological sample (E. coli)
- An initial primary chemical contaminant sample
- A minor act of vandalism
- Drought conditions

TYPE III – SIGNIFICANT EMERGENCY

The system experiences significant mechanical or contamination problems where disruption in supply is inevitable and assistance from Interior Health Authority (IHA) is needed. Major emergencies should be reported to Interior Health Authority and Ministry of Environment as soon as possible to determine the best available means of protection. System personnel are directed to the situation and outside agencies are notified to aid in the response. Major emergencies may extend beyond 72 hours before resolution.

Description: The City of Salmon Arm Water System Type III Emergencies:

- A confirmed coliform MCL or E. coli/fecal positive sample, requiring immediate consideration of a boil water advisory notice to customers
- A confirmed sample of another primary contaminant requiring immediate consideration of a boil water advisory notice to customers (ie. Cryptosparidum, Giardia Lamblia, Turbidity)
- A loss or complete malfunction of the Water Treatment Facilities for surface water treatment, including disinfection
- A major line break or other system failure resulting in a water shortage or requiring system shutdown
- An act of vandalism or terrorist threat such as damage to Water System Facilities
- UV Disinfection failure

TYPE IV – CATASTROPHIC DISASTER/MAJOR EMERGENCY:

The water system experiences major damage or contamination from a natural disaster, an accident, an act of terrorism, and/or vandalism. These incidents require immediate notification of local law enforcement and local emergency governing services (IHA, MOE, PEP). Immediate notification of Interior Health Authorities is critical to protect public health. These types of emergencies are usually not resolved quickly, depending on circumstances.

Description: The City of Salmon Arm Water System Type IV Emergencies:

- Chemical spill that comes into area of the system's source(s)
- High flood that infiltrates into system
- Act of terrorism possibly contaminating the water system with biological or chemical agents
- Storm that significantly damages power grid and system operations
- Intrusion alarms

WATER QUALITY SAMPLING

Many types of emergencies can jeopardize the quality of water and adversely affect those using the water. The primary objective for any water system is to protect human health, the system must know how to act quickly and make decisions on whether to issue a health advisory. Sampling and obtaining results from a lab takes time.

If there is reason to believe that the water has been contaminated, the Manager of Utilities and/or Chief Operator should consult Interior Health Authorities and consider issuing a health advisory as soon as possible – often before conducting water quality sampling.

Contamination of drinking water, whether intentional or unintentional, comes in many forms, which are classified in four general categories:

- Inorganics such as metals or cyanide
- Organics such as pesticides or volatile compounds
- Radionuclides
- Pathogenic microorganisms or microbial organisms

If the water system is experiencing an emergency caused by a natural event or intentional act and contamination is suspected, system personnel may be faced with making a decision about what contaminants to test for and how to get the tests performed quickly.

If contamination is suspected, Interior Health Authorities should be contacted to assist with the direction as to what testing should be completed. If it is suspected that someone intentionally sabotaged the system or contaminated the water, this may be a crime scene and Interior Health shall be notified immediately as well as the local RCMP detachment.

Coliform Bacteria: In the event of an emergency, testing for coliform is a standard first test, and if detected it is a signal that the system may be contaminated. Coliform bacteria are organisms that are present in the environment and in the feces of all warm-blooded animals, including humans. Coliform bacteria generally do not cause illness, but their presence indicates that other disease-causing organisms (pathogens) may be present in the water system. Most pathogens that contaminate water supplies come from the feces of humans or animals. Testing drinking water for all possible pathogens is complex, time-consuming, and expensive. Coliform testing is, however, relatively quick, easy, and inexpensive. Public water systems must test for coliform bacteria regularly as per the GCDWQ.

Heterotrophic Plate Count (HPC): This test provides information regarding the numbers of bacteria that may have been introduced into the water. HPC counts with significant growth require immediate action. Very high levels (1000 – 10,000 and greater) would suggest a problem that needs immediate evaluation.

Chlorine Residual: In chlorinated systems, this test indicates if materials introduced into the water have created a demand for the chlorine, leaving lower-than-normal or no residual and signaling the need for further evaluations. Samples need to be taken at the distal end of the distribution system (the point farthest from the start of the distribution system).

Chlorine Demand: This test reveals unusual demands on the oxidizing capability of the added chlorine, indicating the presence of a contaminant that warrants further investigation.

Total Organic Carbon (TOC): Relatively simple to perform, normal expected levels range from 0.2 to 4.0 mg/L for surface water and 0.01 to 2.0 mg/L for groundwater. Higher levels may indicate the presence of organic materials that could pose a health concern.

Trihalomethanes & Haloacetic Acid (THM & HAA): Disinfection by-products such as Trihalomethanes and Haloacetic acids. High levels suggest that contamination has occurred or that organic materials have been added to enable formation of disinfection by-products.

Cyanide: This test is not easily performed, but should be done immediately if cyanide contamination is suspected. Presence may indicate a source of water pollution that must be traced and eliminated. It may be noted that toxicity is related to pH with a deleterious effect at pH = 6 and can become innocuous at pH > 8 (may be decomposed to carbon dioxide and nitrogen gas). Deterioration of cyanide happens in open streams and further reduction because of bacterial action. Time is the key for the reduction of cyanide. Cyanide is very poisonous. The lungs, gastrointestinal tract and skin absorb cyanide.

Sampling SOP is attached in appendix. Testing agency is listed in contact list.

EFFECTIVE COMMUNICATION

Effective communications is a key element of emergency response.

Developing partnerships with others in your local emergency response network, establishing relationships with our customers and the media, and creating communication tools such as fact sheets and media releases ahead of time will help us communicate efficiently and successfully during a crisis.

All questions and concerns should be directed to the designated spokesperson.

COMMUNICATION TIPS

Do:

- Be prepared.
- Designate a spokesperson.
- Provide complete, accurate, and timely information.
- Tell the truth.
- Express empathy.
- Acknowledge uncertainty and offer to get back with more information later.
- Document your communications.

Do not:

- Speculate on the cause or outcome of an incident.
- Blame or debate.
- Minimize or brush off concerns of customers.

Media Spokesperson	Alternate 1	Alternate 2
City Administrator	Director of Engineering & Public Works	Manager of Utilities

KEY MESSAGES

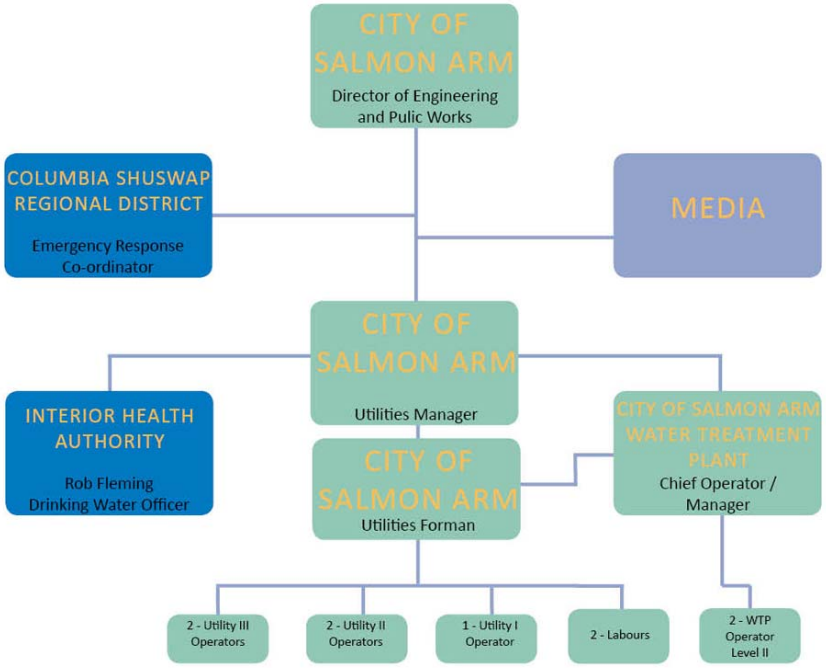
Develop possible messages in advance, and update them as the emergency develops:

- We are taking this incident seriously and doing everything we can to resolve it.
- Our primary concern is protecting our customers' health.
- Another important concern is keeping the system operational and preventing damage.
- What we know right now is_?????????????
- The information we have is incomplete at this time, we will keep you informed as soon as we know

more.

- We have contacted regional and local authorities to help us respond effectively and to correct the current situation as soon as possible
- If you think you may be ill or need medical advice, contact your local physician or go to the emergency room of the hospital.
- We are sampling the water and doing tests to determine whether there is a potential cause of contamination.

CHAIN OF CUSTODY



RESPONSIVE ACTIONS

GENERAL

EXTENDED POWER FAILURE – TYPE IV

1. Call Power Company at 1-866-693-7007 to check status and duration of power outage.
2. Increase Metford flow and balance distribution to utilize Metford water.
3. Decrease system pressures and notify contacts list of the possibility of water shortages if power outage is prolonged.

DISTRIBUTION/WTP COMMUNICATION LOSS FOR EXTENDED PERIOD – TYPE IV

1. Determine if problem is radio or SCADA issue.
2. Call City of Salmon Arm IT department and IITS for assistance if problem cannot be rectified by operations.
3. If communication problem persists call out operations personnel to operate and monitor distribution or Water Treatment Plant manually.

CHEMICAL SPILLS – TYPE IV

AT CITY FACILITY OR WATER PLANT

1. Obtain MSDS if possible and report spill (required by law);
2. Contain and prevent spill from entering storm or sanitary sewer by using rubber or clay mats and sandbags; contact personnel to bring out Vacuum Truck;
3. Use proper PPE including appropriate respiratory protection for specific chemical;
4. If possible neutralize chemicals which are alkaline or acid using spill kit neutralizers.

TRANSPORT CHEMICAL TRUCK SPILL

1. Contain and prevent spill from entering storm or sanitary sewer by using rubber mats or sandbags. Contact Fire Department and City personnel to bring out Vacuum truck;
2. By law all chemical spills are to be reported.
3. Use proper PPE and necessary breathing protection for specific chemical.
4. If possible neutralize chemical which are alkaline or acid using spill kit neutralizers.

TRAIN DERAILMENT AND CONTAMINATION

1. Assess damage. If there is a liquid chemical spill, shut down the raw water intake to the plant. Use contact notification list and get emergency help;
2. The ditch that is between the water plant and railroad tracks drains into the storm sewers by the walkway tunnel. These storm sewers drain into the lake near the water plant intake. Sandbag ditch to contain spill and seal storm sewer manhole covers with clay or rubber mats;
3. If there is a gas leak, evacuate plant and use laptop at a safe location to operate facilities.

FIRE AT WTP OR DISTRIBUTION BUILDINGS – TYPE IV

1. If fire cannot be contained using a fire extinguisher, evacuate building leaving doors closed and call 911 or 1-866-215-4086;
2. Once outside take roll call of all contractors, chemical delivery personnel and employees;
3. Open all gate accesses to the plant or facility for fire department;
4. **Fire Safety Plan** for the water plant should be reviewed yearly by employees open link below \\dserver\global\WaterServices\Safety\FIRE SAFETY PLAN master copy.docx

FOREST FIRE ENCROACHING CITY – TYPE IV

1. Increase all reservoir fill set points and maintain maximum water storage capacity for fire fighting.
2. Have Metford Dam ready for increased flow capacity including disinfection quantities on hand and sufficient to last for the duration.
3. Increase manpower to monitor and assist with operation and to work with the fire department's need for volume and increased pressure.

LAKE FLOOD LEVEL – TYPE IV

1. In the event the lake level rises above normal conditions at the High Lift Canoe Pump Station risk of lake water entering the treated pump wells.
2. Organize a task force to sand bag and, using polyethylene plastic, seal off High Lift pump station.
3. Use a backhoe/loader to move beach sand around pump house to build a safety dike.
4. The overflow line back to the lake will be affected by elevation of lake water. Monitor overflow chamber when processing filter backwash water.

INTRUSION ALARMS – TYPE IV

1. Dispatch will call standby personnel with location of site intrusion alarm;
2. Do a drive-by of location and have dispatch call the RCMP if location is not secure or suspicious activity is observed;
3. Record license plate numbers and description of vehicle and/or individuals if safe to do so. Do not confront individuals. Wait for the RCMP;
4. Thoroughly check area for any possible type of sabotage or vandalism.

WATER TREATMENT PLANT

EXTENDED POWER FAILURE – LOCAL – TYPE IV

1. Call Power Company at 1-866-693-7007 to check status and duration of power outage.
2. Increase Metford flow and balance distribution to utilize Metford water.
3. Decrease system pressures and notify contacts list of the possibility of water shortages if power outage is prolonged.

FIRE AT WTP – TYPE IV

1. If fire cannot be contained using a fire extinguisher, evacuate building leaving doors closed and call 911 or 1-866-215-4086;
2. Once outside take roll call of all contractors, chemical delivery personnel and employees;
3. Open all gate accesses to the plant for fire department;
4. **Fire Safety Plan** for the water plant should be reviewed annually by employees: \\dserver\global\WaterServices\Safety\FIRE SAFETY PLAN master copy.docx

INTRUSION ALARM – LOCAL – TYPE IV

1. Dispatch will call standby personnel with location of intrusion alarm;
2. Do a drive-by of water plant and have dispatch call the RCMP if it is not secure or suspicious activity is observed;
3. Record license plate numbers and description of vehicle and/or individuals if safe to do so. Do not confront individuals. Wait for the RCMP;
4. Thoroughly check plant for any possible type of sabotage or vandalism.

CHEMICAL SPILL – TYPE IV

AT WATER PLANT

1. Obtain MSDS if possible and report spill (required by law);
2. Contain and prevent spill from entering storm or sanitary sewer by using rubber or clay mats and sandbags; contact personnel to bring out Vacuum Truck;
3. Use proper PPE including appropriate respiratory protection for specific chemical;
4. If possible neutralize chemicals which are alkaline or acid using spill kit neutralizers.

TANKER TRUCK AND/OR TRAIN DERAILMENT

1. Assess damage. If there is a liquid chemical spill, shut down the raw water intake to the water plant. Use contact notification list and get emergency help;
2. The ditch that is between the water plant and railroad tracks drains into the storm sewers by the walkway tunnel. These storm sewers drain into the lake near the water plant intake. Sandbag ditch to contain spill and seal storm sewer manhole covers with clay or rubber mats;
3. If there is a gas leak, evacuate water plant and use laptop at a safe location to operate facilities.

WATER PLANT LOSS OF SODIUM HYPOCHLORITE GENERATOR- TYPE II

1. There should be sufficient storage in the sodium hypochlorite tanks to run for several hours. Emergency smaller diameter peristaltic hose stored above the pumps can be connected to a pump and a pail of 12% sodium hypochlorite which is kept on site for this purpose.
2. Set feed rate by dividing the mg/l by 12. Example: plant was dosing at .90 mg/l divided by 12 =.075 mg/l.
3. The above procedure will allow time to pick up sodium hypochlorite from the Waste Treatment Plant using the emergency tote which is kept on site and has appropriate fitting to hook up a garden hose to fill the sodium hypochlorite storage tank with 12% Hypo.
4. If problem is deemed to be for an extended period, order a load of 12% sodium hypochlorite to fill storage tanks.

LOSS OF CHLORINE RESIDUAL IN CLEARWELL – TYPE II

1. If chlorine residual is 0.5mg/l or less in the clearwell, test manually. If residual is still low, shut down high lift pumps and disable start-up. Start pumps when emergency feed is running. Currently we have a Cl_2 analyzer located in Zone 1 pump station as a secondary source for control. If analyzer is not functional refer to emergency procedure.

WATER PLANT UV REACTORS FAILURE – TYPE II

1. Assess nature and cause of problem;
2. Try to rectify problem, call appropriated personnel if needed;
3. Call Manager of Utilities and/or Director of Engineering & Public Works;
4. Call IHA contact – Rob Fleming and review options;
5. Arrange for alternate drinking water source if necessary;

6. Alert local media requesting public water conservation or Water Quality Advisory notices handed out by assisting water personnel;
7. Do not start up WTP (if at all) until initial communication has been completed with IHA, Manager of Utilities, Director of Engineering & Public Works, and/or Chief Operator;
8. If acceptable with all agencies and WTP is allowed to operate:
    a. Operate UV valve manually to allow flow of water into clear well;
    b. Low lift pumps run in manual and controlled from VFD, must be monitored on a continuous basis, adjusting accordingly;
    c. Ensure hypochlorite is set at 1.2 mg/l for post hypo chlorination to compensate for loss of UV disinfection (DNA destruction of the bacteria);
    d. Ensure all chemicals are feeding at correct dosages and adjust, watch for filter blinding if chemicals are increased to minimize filter break through;
    e. Optimize distribution system using Metford Dam if time of year permits to decrease WTP flow until issue is resolved;
    f. Monitor status of plant on a continual basis and work with personnel to rectify problem. Update appropriate agencies every 2 hours on conditions.

WATER PLANT UV REACTORS CRITICAL ALARM – TYPE I- REACTOR SHUTS DOWN BEFORE VALVE CAN CLOSE (50 SEC. DELAY)

1. Assess nature and cause of problem;
2. Try to rectify problem, call appropriate personnel if needed;
3. Monitor Clearwell residuals
4. Note occurrence, time and any particulars in log

INTRUSION ALARM – LOCAL – TYPE IV

1. Dispatch will call standby personnel with location of intrusion alarm;
2. Do a drive-by and have dispatch call the RCMP if Metford Dam is not secure or suspicious activity is observed;
3. Record license plate numbers and description of vehicle and/or individuals if safe to do so. Do not confront individuals. Wait for the RCMP;
4. Thoroughly check Intake, Dam, and UV Building for any possible type of sabotage or vandalism.

FAILURE OF DAM STRUCTURE – TYPE IV

1. Water Treatment Plant Operators inspect the dam and water level each week. If a soil crack appears on the dam or if soil or roadway movement is noticed on the upper portion of the dam, the dam will be immediately drained.
2. Dam leakage is monitored and measured from 3 different locations and if the leakage noticeably increases the dam will be immediately drained.
3. To drain, the operator will open the two 6 inch blow down drains located on the opposite side of dam wall. If deemed necessary all residents will be notified of an immediate evacuation along 60th Street and Okanagan Avenue and 10th Street N/E. It is estimated that it will take 8 hours to empty the dam completely.
4. The dam will not be refilled unless a qualified dam engineer / inspector has inspected the dam and remedial action has taken place to rectify all issues.
5. If extensive long term repairs are necessary, the upper stream will be diverted using the 12 inch PVC pipe running from the top pond to the Metford spillway. It may be necessary to run an additional line during spring runoff or during summer rainy season.

SODIUM HYPOCHLORITE SYSTEM FAILURE – TYPE III

1. Assess nature and cause of problem;
2. Isolate Dam from distribution system using valves at UV Building and 70th Ave SE & 10th St SE;
3. Notify Chief Operator and Manager of Utilities;
4. If un-chlorinated water entered the distribution system, notify users of water disinfection failure and issue a Boil Water Advisory as directed by the IHA;
    a. Ensure that at-risk users i.e. hospitals, nursing homes are contacted directly
    b. Post notice on all public water taps and fountains [shut off if possible]

c. Flush affected areas until chlorine residual is within guidelines;
d. Submit samples to Caro, report results to IHA, rescind advisory, and issue a "*Notice – Drinking Water Problem Corrected*"

5. Repair sodium hypochlorite system failure
6. Flush Metford water through hydrant into gravel pit until all water quality parameters meet the guidelines;
7. Open the valve at 70th Ave SE & 10th St SE and restore water source.

LOSS OF WATER SOURCE – MUDSLIDE, WILDFIRE – TYPE III

1. Determine the source and nature of contamination;
2. Review trending of turbidity and disinfection to see if/when contamination started;
3. Metford Dam will shutoff automatically when turbidity exceeds the high limit for 5 minutes (1.0 NTU) and/or chlorine residual is less than 0.7 mg/L or greater than 1.8 mg/L.
4. If automatic shutdown did not occur, shutdown Metford Dam using the SCADA system to disable the control valve or manually close butterfly valve located in the UV Building to isolate source;
5. If it is unsafe to enter the UV building, locate valve at 70th Ave SE & 10 St SE and shut valve off there for source elimination;
6. Notify Chief Operator and Utilities Manager of event;
7. Notify local residences with proper Water Quality notices;
8. Determine action plan if mudslide caused the loss of source:
    a. Investigate and evaluate amount of debris that sloughed into water source,
    b. Determine if intake is damaged. If structure is sound, let Dam stabilize for a few days and flush the line. Open blow-downs, monitor Dam level and add sodium hypochlorite to help with disinfecting line,
    c. If not satisfied with results of flushing, lower the dam water level and evaluate situation again,
    d. Excavation may be required to remove debris if there is an accumulation affecting the intake structure,
    e. If a wildfire is in the area, contact local wildfire agency and communicate status and chemical being used to fight fire if other than water.
9. Adjust Water Treatment Plant settings to compensate for higher flows,
10. Metford Dam must remain isolated from the distribution system until the event is resolved, water quality results have been received and the IHA is notified.

EXTENDED POWER FAILURE – LOCAL – TYPE III

1. Call Power Company at 1-866-693-7007 to check status and duration of power outage;
2. Contact electrician to connect back-up generator and restore power to hypochlorite injection pumps and PLC (plug in UPS);
3. Increase Metford flow and balance distribution system to utilize Metford water (if water quality allows);
4. Notify contact list of the possibility of water shortages if power outage is prolonged;
5. Notify customers of water use restrictions and rationing.

UV REACTOR FAILURE – TYPE III

1. Assess nature and cause of problem;
2. Shut down Metford Dam (if automatic shut down failed) and isolate from Distribution System;
3. Contact Chief Operator and/or Manager of Utilities;
4. Optimize distribution system using the Water Treatment Plant;
5. Try to rectify problem, call appropriated personnel if needed;
6. Do not start up Metford Dam (if at all) until initial communication has been completed with IHA, Manager of Utilities, and/or Chief Operator;
7. If acceptable with all agencies and Metford is ***required*** to operate without UV:
    a. Ensure hypochlorite is set at 1.6 mg/l for to compensate for loss of UV disinfection (DNA destruction of the bacteria); and
    b. Monitor status of plant on a continual basis and work with personnel to rectify problem. Update appropriate agencies daily on conditions.

DISTRIBUTION SYSTEM

POSITIVE BACTERIOLOGICAL SAMPLE – E.COLI (OVER 1 CFU/100ML) – TYPE II

1. Notification protocol from City of Salmon Arm's Testing Laboratory (CARO) for a positive E.Coli sample is to contact the Utility Manager and IHA;
2. Utility Manager to contact Rob Fleming IHA to discuss and assess the situation.
3. Utility Manager to contact water plant staff to test and record chlorine residual from sample site that had the positive.
4. If the residual is acceptable (above 0.25 ppm) resample and send to City of Salmon Arm's Testing Laboratory (CARO)
5. If the residual is below 0.25 ppm flush the mainline until 0.50 ppm is reached and resample;
6. Upon completion of testing for chlorine residual review results with IHA, Rob Fleming, and determine whether emergency notification procedures for E.Coli are to be followed;
7. Document test results and details under Water Incident file and determine why positive count occurred, if possible.

POSITIVE BACTERIOLOGICAL SAMPLE – TOTAL COLIFORM PRESENCE – TYPE II

1. Notification protocol from City of Salmon Arm's Testing Laboratory (CARO) for a positive total coliform sample is to contact the Utility Manager;
2. Utility Manager to contact Rob Fleming IHA to discuss and assess the situation.
3. Utility Manager to contact water plant staff to test and record chlorine residual from sample site that had the positive.
4. If the residual is acceptable (above 0.25 ppm) review with IHA – Rob Fleming
5. If the residual is below 0.25 ppm flush the mainline until 0.50 ppm is reached and resample;
6. Upon completion of testing for chlorine residual review results with IHA, Rob Fleming, and determine whether emergency notification procedures for Total Coliform are to be followed;
7. Document test results and details under Water Incident file and determine why positive count occurred, if possible.

LOSS OF RESERVOIR STORAGE – CONTAMINATION – TYPE III

1. If suspected contamination is imminent, isolate reservoir from the distribution system;
2. Ensure isolation from distribution system is complete and take all necessary steps to ensure the integrity of the distribution system is not further compromised;
3. Contact proper authorities (i.e. Manager of Utilities, IHA, Director of Engineering & Public Works) and assess the situation;

4. Under the guidance of the IHA, Notify customers that water is unsafe to use via door to door distribution, media, etc. If home owners are not home at the time of notification, leave notice at the residences;
5. Notify local fire department that volume of water is decreased (indicate volume that is contained in affected reservoir);
6. After isolation and assessment of reservoir, drain reservoir notifying appropriate agencies depending on the contaminant that is suspected;
7. De-contaminate the reservoir, fill and sample;
8. Put reservoir back online once approved by the IHA (typically upon receipt of satisfactory water quality sample results);
9. Lift all notices distributed to water users.

LOSS OF RESERVOIR STORAGE – STRUCTURE – TYPE III

8. Isolate reservoir from distribution system and assess the area;
9. If required during the assessment, run a pump to maintain positive pressure. Ensure that the distribution system does not increase in pressure but does remain positive within the system;
10. Contact proper authorities (i.e. Manager of Utilities, IHA, Director of Engineering & Public Works) and assess the situation;
11. Notify local fire department that volume of water is decreased (indicate volume that is contained in affected reservoir);
12. If affected areas lack system capacity, implement Water Conservation Program and notify the affected users by going door to door or through other informational avenues;
13. Upon completion of repairs (as approved by the City Engineer), fill and sample the reservoir;
14. Put reservoir back online once approved by the IHA (typically upon receipt of satisfactory water quality sample results or review by Public Health Engineer);
15. Lift all notices distributed to water users.

LOSS OF PRESSURE – PIPE BREAK – TYPE III

1. Identify the cause and location of the loss of pressure in the distribution system;
2. Contact proper authorities (i.e. Manager of Utilities, IHA, Director of Engineering & Public Works) and assess the situation;
3. Ensure pumps are operating and positive pressure is maintained throughout the system. Ensure the minimum water levels are maintained in the reservoirs to maintain system integrity;
4. Issue a Voluntary Conservation Notice or Mandatory Conservation Notice as deemed necessary following the notification protocol;

5. When problem area is located and repaired, follow AWWA guidelines for disinfection of the water mains and/or reservoirs;
6. Notify water users when system integrity is back to normal, the proper authority has been informed and the test results are in hand.

BACKFLOW CONTAMINATION – TYPE II (POTENTIAL TYPE III)

1. Assess nature and cause of backflow contamination issue;
2. Contact proper authorities (i.e. Manager of Utilities, IHA, Director of Engineering & Public Works) and assess the situation;
3. Isolate area if possible;
4. Arrange for alternate drinking water source if unable to isolate the affected area;
5. Notify users of potential water contamination. In case of bacteriological contamination, issue a Boil Water Order. In case of chemical or toxic substance, advise accordingly;
6. Make corrections to fix or eliminate the source of contaminant;
7. Once issue is rectified, initiate water flushing and disinfection procedures in distribution system to remove contaminant as required;
8. When safe to do so and permission has been received from the Interior Health Authority, turn water source back on issuing to the consumers "Notice – Drinking Water Problem Corrected".

PUMP FAILURE – TYPE II

1. Determine if sufficient capacity is still available to supply the water distribution network;
2. Maximize East Canoe Creek source if water quality allows;
3. Assess nature and cause of pump problem (if pump is located at a reservoir, re-route water if possible). If unable to correct contact appropriate supplier/consultant for assistance;
4. Contact BC Hydro if power failure is cause of pump failure;
5. Notify users of potential water shortage and the need for conservation (if demand is higher than Metford can supply) where total water supply may be insufficient and issue a *Notice for Voluntary Conservation* or *Mandatory Conservation Notice*. In addition, notify the Fire Department that fire flows/storage may be reduced;
6. Once pump failure is corrected put back into service;
7. Contact all affected users and inform them the pump is back on-line, issue *Water System Recovering Notice*.

BROKEN WATERMAIN – TYPE I

1. Isolate break at nearest valves;
2. Determine zone of influence
    a. If break is limited to a specific area, inform affected users of temporary loss of service or pressure reductions while repairs are being completed

b. If break affects overall system, proceed to “Loss of Pressure Response”

3. Repair water main as quickly as possible following the AWWA guidelines for disinfection of water mains;
4. Once repair is completed, initiate water flushing and disinfection procedures in affected water mains;
5. Re-instate main operation after test results received (if any) and contact affected users and issue “Notice – Water System Recovering” if deemed necessary.

PRESSURE REDUCING VALVE FAILURE – TYPE I

1. Assess nature and cause of problem. Manually control system pressure with valves;
2. Determine zone of influence. With a large PRV failure, the small PRV may become the primary source of water supply to users and pressure reductions may occur during peak demand conditions. Notify affected users and, if deemed necessary, issue *Voluntary Conservation Notice* or *Mandatory Conservation Notice* to reduce water consumption;
3. Notify the Fire Department of locations where fire fighting flows have been reduced;
4. Once corrected, notify affected users and the Fire Department that the PRV is back in service and issue *“Notice – Water System Recovering”* if deemed necessary.

APPENDIX A - RISK ASSESMENT

Type of event	Probability or risk (High – Med – Low)	Comments
Earthquake	Low	Never experienced a major earthquake.
Flood	Low	Distribution system as whole is not a vulnerable zone for flooding. Zone 1& 2 pumping station may be vulnerable if lake becomes high during freshet period and infiltrate into clear wells.
High winds	Med	System may be vulnerable to high wind events. Power can be disrupted for extended periods in certain areas
Drought	Low	Climate change poses an increasing threat to source waters.
Terrorism	Low	Need to be trained on suspicious activity, being prepared is a must.
Construction accident	Low	Construction crews can hit pipes if the locates are not done properly. May lead to system failure because of backflow and contamination.
Chemical spill	High	The probability is low but the risk is very high due to the severity of the consequences and the paths by which these chemicals are transported.

APPENDIX B – CONTAMINATION OF SOURCE

Assessment	Shuswap Lake is vulnerable to contamination especially because there is the possibility of a derailment and adjacent rivers and streams that flow into Shuswap Lake. CPR should notify The City of Salmon Arm in the event of an occurrence and where.
Immediate actions	1. Isolate the intake valves, preventing contaminated water entering the WTP. 2. Implement water response actions to inform customers to reduce water usage until situation is resolved. Arrange for alternative drinking water if necessary and initiate water flushing throughout the City of Salmon Arm. Response actions may require personnel to go door to door to deliver the appropriate notices.
Notifications	1. Notify Interior Health (Public Health Officer) 2. Local RCMP Detachment 3. Columbia Shuswap Regional District 4. Notify Caro Environmental Services of increased testing
Follow-up actions	1. Collect water samples. 2. Follow Interior Health recommendations 3. Return all systems to normal after test confirmed and all is good 4. Reporting to Interior health

APPENDIX C – ADVISORY NOTICES

City of Salmon Arm

WATER QUALITY ADVISORY

[High Turbidity Levels]

High turbidity levels have been detected in the drinking water supply. High turbidity [cloudiness] levels may occur in surface water sources due to seasonal weather changes causing excessive surface runoff, flooding or lake turnover. A high turbidity level may impair the effectiveness of the disinfection treatment system. If disinfection is impaired, disease-causing microorganisms may escape into the water distribution system resulting in an increased risk of intestinal illness. People with undeveloped immune or severely weakened immune systems, infants and elderly may be at increased risk.

Due to the above concerns and as a precautionary measure, water users are advised to bring all water to a rolling boil for at least one minute and let it cool before using it or, use bottled water. Boiled or bottled water should be used for drinking, making ice, brushing teeth and food preparation until further notice. We will inform you when the Water Quality Advisory is removed.

THIS WATER QUALITY NOTICE IS EFFECTIVE _____ UNTIL FURTHER NOTICE.

ENQUIRIES?

Please call Rob Niewenhuizen, Director of Engineering & Public Works, City of Salmon Arm at 250-803-4017

Interior Health – Drinking Water Officer 250-833-4100 (SA)

Kamloops Toll Free 1-866-847-4372

PLEASE SPREAD THE WORD TO YOUR NEIGHBOURS

Please share this information with all the other people who drink this water, especially those who may not have received this notice directly [for example: people in apartments, rental units, nursing homes, schools, preschools, churches and businesses]. You can do this by posting this notice in a public place or distributing copies by hand or mail.

Signature: _____

Rob Niewenhuizen, Director of Engineering & Public Works

City of Salmon Arm

WATER QUALITY ADVISORY

[Total Coliform Presence]

Laboratory tests indicate the presence of total coliform bacteria in the drinking water. The "total coliforms" may be due to inadequate disinfection treatment or distribution pipes that are in need of maintenance. Total coliform bacteria are naturally present in the environment and they are generally not harmful themselves but they indicate an increased chance that organisms causing intestinal illness may be present in the drinking water. People with undeveloped immune or severely weakened immune systems, infants and elderly may be at increased risk.

Due to the above concerns and as a precautionary measure, water users are advised to bring all water to a rolling boil for at least one minute and let it cool before using it or, use bottled water. Boiled or bottled water should be used for drinking, making ice, brushing teeth and food preparation until further notice. We will inform you when the Water Quality Advisory is removed.

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Signature: _____

Rob Niewenhuizen, Director of Engineering & Public Works

City of Salmon Arm

BOIL WATER NOTICE

[Contaminated Water]

Contaminated water has entered the distribution system and we've receive reports of people with symptoms typical of waterborne illness. Disease-causing organisms [bacteria, viruses or parasites] may have entered the distribution system. These organisms can cause symptoms such as diarrhea, abdominal cramps, headaches, nausea, vomiting or other symptoms. Boiling the water kill these organisms. People with weakened or undeveloped immune systems are most at risk [this includes: elderly people, pregnant women and their unborn, very young children [under 2], people with AIDS, cancer, diabetes or kidney disease and people being treated with immuno-suppressing medications].

Water users are advised to bring all water to a rolling boil for at least one minute and let it cool before using it or, use bottled water. Boiled or bottled water should be used for drinking, making ice, washing dishes, brushing teeth and food preparation until further notice. We will inform you when you no longer need to boil your water.

THIS BOIL WATER NOTICE IS EFFECTIVE _____ UNTIL FURTHER NOTICE.

ENQUIRIES?

Please call Rob Niewenhuizen, Director of Engineering & Public Works, City of Salmon Arm at 250-803-4017

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Signature: _____

Rob Niewenhuizen, Director of Engineering & Public Works

City of Salmon Arm

DRINKING WATER NOTICE

We have recently discovered that an unknown quantity of a chemical contaminant may have entered the water supply system. Water samples are being collected to determine if the water quality meets the standards of the *Guidelines for Canadian Drinking Water Quality.* The chemical contaminant may be at a level that makes our water supply toxic and unfit for drinking or bathing.

As a precautionary measure to avoid health risks, we are advising water users to use bottle water or an alternate source of water for drinking, making ice, washing dishes, brushing teeth, bathing and food preparation until further notice. ***BOILING THE WATER WILL NOT MAKE IT SAFE***. If alternate water sources are used, the water must be from Interior Health approved sources only. The water in your hot water tank may also be unsafe. Please consult a qualified plumber before draining you hot water tank.

DO NOT USE WATER NOTICE

IS EFFECTIVE_____UNTIL FURTHER NOTICE

ENQUIRIES?

Please call Rob Niewenhuizen, Director of Engineering & Public Works, City of Salmon Arm at 250-803-4017

Interior Health – Drinking Water Officer 250-833-4100 (SA)

Kamloops Toll Free 1-866-847-4372

PLEASE SPREAD THE WORD TO YOUR NEIGHBOURS

Please share this information with all the other people who drink this water, especially those who may not have received this notice directly [for example: people in apartments, rental units, nursing homes, schools, preschools, churches and businesses]. You can do this by posting this notice in a public place or distributing copies by hand or mail.

Signature: _____

Rob Niewenhuizen, Director of Engineering & Public Works

City of Salmon Arm

NOTICE

VOLUNTARY CONSERVATION

As a result of the recent incident involving _____, there is a strong possibility that pumping systems will have to be shut down. All water users are requested to reduce water consumption immediately and to be prepared for a temporary water shortage. It is recommended that you store a small quantity of water for consumption and general household use. As an extra precaution, you may want to disinfect this emergency water supply by adding household chlorine bleach [two drops of bleach to 1 litre of water or 0.5mL bleach to 1 Imperial Gallon/4.55 litre of water] Please ensure that only clean potable water containers are used for storing these emergency supplies.

EFFECTIVE _____ UNTIL FURTHER NOTICE

THANK YOU FOR YOUR PATIENCE AND CO-OPERATION

ENQUIRIES?

Please call Rob Niewenhuizen, Director of Engineering & Public Works, City of Salmon Arm at 250-803-4017

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Kamloops Toll Free 1-866-847-4372

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Signature: _____

Rob Niewenhuizen, Director of Engineering & Public Works

City of Salmon Arm

NOTICE

MANDATORY CONSERVATION

As a result of the recent incident involving _____, the main pumping system is not in operation – there is no water entering the distribution system. Please refrain from using faucets and other plumbing fixtures and please use stored water, bottled water or an alternate source of water for domestic purposes. Draining your hot water tank is not recommended unless you have consulted a qualified plumber. If alternate water source are used, the water must be from Interior Health approved sources only.

EFFECTIVE _____ UNTIL FURTHER NOTICE

THANK YOU FOR YOUR PATIENCE AND CO-OPERATION

ENQUIRIES?

Please call Rob Niewenhuizen, Director of Engineering & Public Works, City of Salmon Arm at 250-803-4017

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Signature: _____

Rob Niewenhuizen, Director of Engineering & Public Works

City of Salmon Arm

NOTICE

WATER SYSTEM RECOVERING

The water supply system has been inspected and, where necessary, repairs have been made. All pumping systems are now fully operational. While the system is recovering to normal operating levels, your assistance with conservative water use over the next two or three days would be appreciated. If you have received a *Boil Water Notice* or a *Water Quality Advisory*, please continue to take the necessary precautions until you've seen the *Drinking Water Problem Corrected* notice.

EFFECTIVE _____

THANK YOU FOR YOUR PATIENCE AND CO-OPERATION

ENQUIRIES?

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Signature: _____

Rob Niewenhuizen, Director of Engineering & Public Works

City of Salmon Arm

NOTICE

DRINKING WATER ISSUE CORRECTED

Water samples collected from our water system indicate that **it is no longer necessary to boil water prior to consumption**. Chlorine levels will be increased for a short period of time and you may detect a stronger chlorine taste and odour. Chlorine levels will be reduced to normal operating range as soon as possible.

EFFECTIVE _____

THANK YOU FOR YOUR PATIENCE AND CO-OPERATION

ENQUIRIES?

Please call Rob Niewenhuizen, Director of Engineering & Public Works, City of Salmon Arm at 250-803-4017

Interior Health – Drinking Water Officer 250-833-4100 (SA)

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Signature: _____

Rob Niewenhuizen, Director of Engineering & Public Works

City of Salmon Arm

NOTICE

DRINKING WATER ISSUE CORRECTED

The *Do Not Use Water Notice* is Removed

Water samples collected from our water system indicate that **it is no longer necessary to use bottled water or other alternate sources of drinking water**. We may find it necessary to increase chlorine levels for a short period of time and you may detect a stronger chlorine taste and odour. Chlorine levels will be reduced to normal operating range as soon as possible.

EFFECTIVE _____

THANK YOU FOR YOUR PATIENCE AND CO-OPERATION

ENQUIRIES?

Please call Rob Niewenhuizen, Director of Engineering & Public Works, City of Salmon Arm at 250-803-4017

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Signature: _____

Rob Niewenhuizen, Director of Engineering & Public Works

Acknowledgements

This report was assembled and edited by the Operations Department, City of Salmon Arm.

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