City of Thompson
Public Water System
Annual Report
- 2014 -

Since the development of Vale's Thompson operations and the City of Thompson, Vale has been providing safe, potable water for both its own facilities and for the residents of the Thompson community.

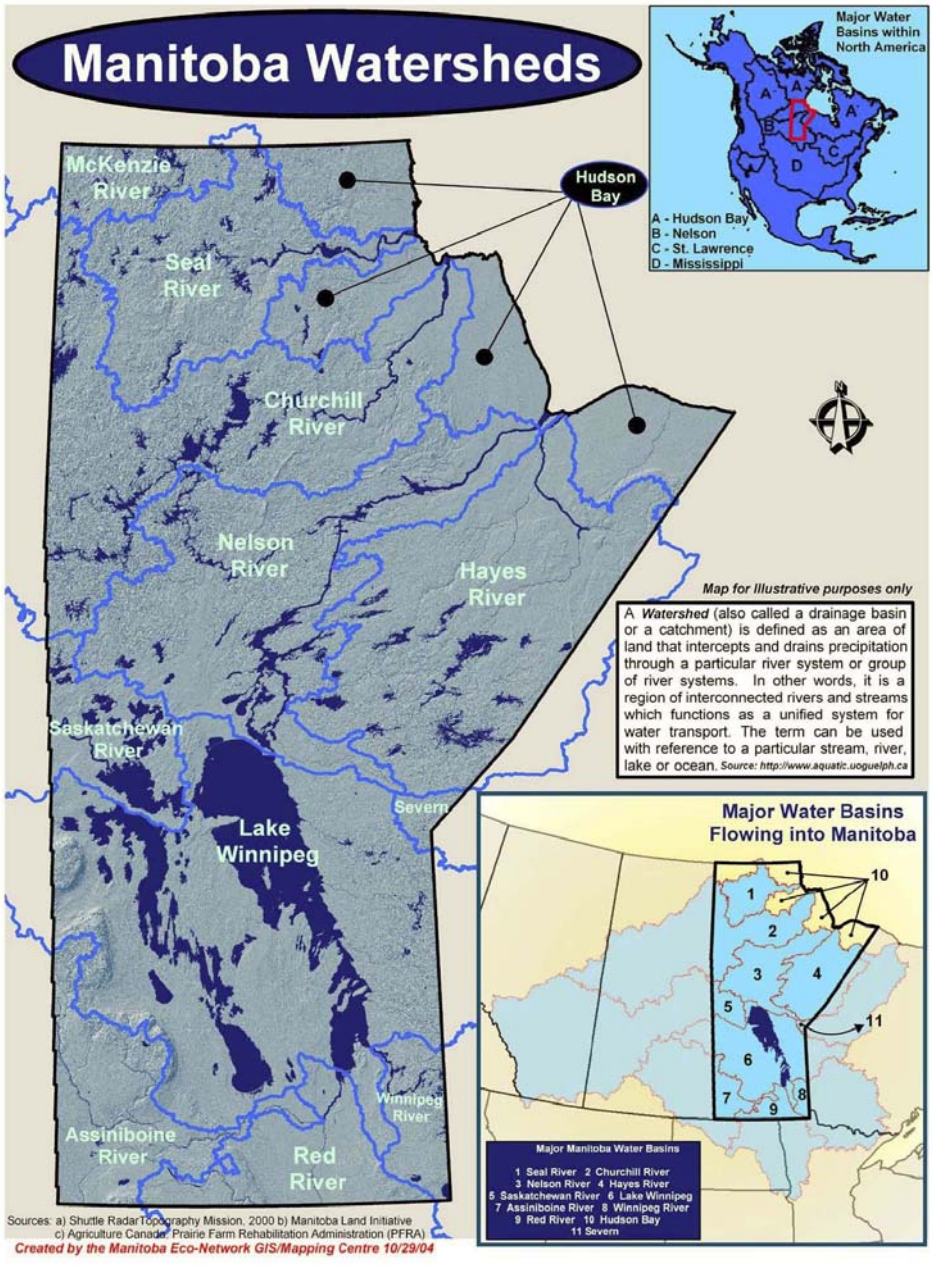
It is a shared goal of Vale and the City of Thompson to sustainably treat, maintain and distribute safe and aesthetically pleasing drinking water in accordance with all legislative and regulatory requirements. This report was created to provide members of the public with access to the information available about the drinking water they consume.

The following pages are in question answer format.
If you have additional questions, please contact:

The City of Thompson at mwebb@thompson.ca
Or Vale at thompsoninfo@vale.com

Where does our drinking water come from?

The water supply for the City of Thompson is drawn from the Burntwood River. The Burntwood River receives its water from the Nelson River watershed. The Nelson River watershed includes South Indian Lake, which flows into the Thompson watershed at the Notigi control station. Here the water enters the feed stream that eventually becomes the Burntwood River. The Burntwood River joins the Nelson River northeast of the City of Thompson as the river flows north.



Source: http://mbeconetwork.org/gis_mapping_center/gis_projects/mb_watershed_atlas/
Retrieved: January 16th, 2012

A vast catchment area combined with an extremely low population density makes for some of the most pristine water on the continent.

- Despite the pristine source, river water can be *more* susceptible to seasonal influences, such as high periods of flow that stir up sediments in the spring, than other water sources such as groundwater, lakes and manmade impoundments. High flow volumes through the Burntwood River occur year round, due to the Churchill River Diversion, minimizing the degree to which seasonal variations occur in the Burntwood River.[1]

[1] *The Churchill River Diversion, completed in 1977, redirects most of the flow of the Churchill River at Southern Indian Lake into the Rat River, then the Burntwood River, and eventually through the generating stations on the lower Nelson River*.

How is the water purified for drinking?

Untreated (raw) river water destined for treatment at the Vale Water Treatment Plant (the "Water Treatment Plant") is pumped from the river pump house, located at the west end of the city, to the Water Treatment Plant. The river pump house is situated in a secure, restricted access area.

A multi-barrier approach is taken to ensure safe water. The term "barrier" is used for illustrative purposes as it is intended to highlight the layers of protection that are in place to ensure citizens have access to good-quality drinking water. The first barrier to ensuring the citizens of the City of Thompson have good-quality water to drink is accomplished through the protection of the water source.

Vale mitigates its impacts on the streams which feed the water supply. For example, surface water runoff and treated water discharges from Vale's Birchtree Mine are released to the Manasan River, which flows into to the Burntwood River at a location several kilometers upstream from where drinking water for the City of Thompson is drawn. Prior to its release into the Manasan River, Vale treats the discharge water to meet and exceed regulatory and industry quality standards. In 2008, Vale commissioned a new wastewater treatment facility for Birchtree Mine. This new plant doubled the water treatment capacity and achieves 99% contaminant removal efficiency.

The second barrier to ensuring citizens and employees have safe and clean drinking water is the removal of contaminants from the water supply. Contaminant removal starts with the clarification stage in the water treatment process. Clarification refers to the removal of particles, resulting in water that is clear and colorless. Raw river water coming into the Water Treatment Plant reports to one of two receiver systems – the solid contact unit or the rapid mix system. Within both systems, chemicals are added to the water to remove solids and microorganisms through the process of clarification. The chemicals promote the coagulation of suspended particles prior to the next stages of treatment.

Once coagulated, the particles undergo a process called flocculation, which causes settling of the coagulated particles. This process is helped by the addition of a chemical (flocculent). The flocculent mixes with the water to help the coagulated particles stick together and form larger, heavier particles which are called floc. The floc settles and collects at the bottom of the tank before being discharged to the sewer system for treatment by the municipal wastewater treatment plant. After the coagulation and flocculation stage, the water is clear and ready for disinfection and filtration.

The overflow from the two receiver systems – the contact unit and the rapid mix tank - is pre-chlorinated on its path to the next stage of treatment which takes place in the rapid gravity multi-media filtration system. This system filters out any remaining suspended particles to achieve a turbidity value of less than 0.3 nephlometric units (NTU). Once filtered, the clear water is stored in reservoirs.

Gaseous chlorine is added to the clear water to inactivate and destroy any viable microorganisms or pathogens that may still be present after the contaminant removal and filtration stages. Chlorine is a powerful disinfectant; it acts as a strong oxidant that is capable of quickly and effectively killing many water borne pathogens and microorganisms.

The final barrier is to ensure good quality drinking water is to prevent recontamination. This is accomplished by adding more chlorine to the treated water just prior to its release into the distribution system. This chlorine is added to ensure adequate levels of residual chlorine are present in the distribution system. This is called the residual free chlorine level. The level of free chlorine in the treated water stored in the reservoir is tested daily.

This residual chlorine ensures that enough chlorine was added to the water to kill off any microorganisms initially, and that the water still has some chlorine in it to kill off any microorganisms the water may come into contact with while in storage or flowing through the distribution system. The presence of chlorine in water from your tap at home is the primary indicator that the water is potable (safe to drink).

After treatment, the water is piped to the houses and business in the City of Thompson via a system of pipes and mains that are operated and maintained by the City of Thompson public works department. The treated water is also piped to Vale's Thompson Mine and surface plants via a separate system of pipes and mains. This portion of the distribution system is operated and maintained by Vale.

What is the distribution system?

The water distribution system is the network of underground pipes used to convey the treated water from the Water Treatment Plant to the homes and businesses in the City of Thompson. The City of Thompson public works department carries out preventative maintenance on the distribution system, such as seasonal line flushing to keep the lines clean. Most of the distribution pipes are made of ductile and cast iron.

Is the water tested?

The water is tested regularly by both the City of Thompson and Vale, as required by the Manitoba Drinking Water Safety Act and Vale's Public Water System Operating License.

What does the City of Thompson test for?

Water samples are taken on a weekly basis, both from the Water Treatment Plant and the City of Thompson distribution system. Every week, the City of Thompson tests raw water (untreated river water), treated water (water leaving the WTP), the 3 distribution locations, chosen based on area and availability (mostly schools/commercial premises). These samples are then sent to Maxxam Analytics for analysis. All water quality testing results are submitted to the provincial Office of Drinking Water for review.

What is water in the distribution system tested for?

Bacterial testing: Every week these samples are tested for the presence of Total Coliform and E. coli bacteria. If these bacteria are present in the water it is an indication that disease causing organisms may also be present.

Disinfectant testing: Chlorine levels are tested at the water treatment plant and in the distribution system every time we take water samples for bacterial analysis.

Trihalomethane testing: Trihalomethanes (THM's) are formed as a by-product when chlorine is used to disinfect water. They result from the reaction of chlorine and organic

matter in the water being treated. The THM's produced may have adverse health effects at high concentrations.

City of Thompson's Monitoring Program	**Regulatory Requirement**
Free Chlorine Residual in the Distribution System	≥ 0.1 mg/L
Number of Raw/Incoming Water Samples	52
Number of Treated Water Samples	52
Number of Distribution Water Samples	156
Frequency of Testing	bi-weekly
Total Coliform Present in Water Samples	0 TC per 100 mL
E. Coli Present in Water Samples	0 EC per 100 mL
Trihalomethane Sampling Requirements	4 times per year
Total Trihalomethane Standard	0.1 mg/L

What does Vale test for?

The treated water is monitored daily by the Water Treatment Plant operators to ensure adequate levels of chlorination and turbidity to ensure safe and clean water for drinking. Treated and untreated water samples are also collected at quarterly and monthly frequencies and sent to ALS Environmental Laboratories, located in Winnipeg. Test methods conform to APHA9222B and the method of testing for the presence of Coliform bacteria in drinking water is accredited by the Canadian Association for Laboratory Accreditation Ltd.

Comprehensive water chemistry testing, for the purpose of profiling the finished water quality, is voluntarily undertaken by Vale on a quarterly basis. The test parameters include Alkalinity, Chlorides, Hardness, Metals, Mercury, Nitrates, Organics, Radionuclides, Sulphates and Total Suspended Solids.

The results of this testing is compared to Health Canada's microbiological, chemical and radiological water quality guidelines and standards that are set out in the Canadian Drinking Water Guidelines (CDWQG). For some parameters, a Maximum Acceptable Concentration (MAC) limit has been set, and for others, only an Aesthetic Objective (AO) has been defined. Aesthetic quality guidelines address water quality indicators such as taste, color and odor that do not necessarily pose adverse health risks and/or do not warrant the application of a MAC limit.

The frequency of sampling for these parameters and performance achieved (# of non-compliances with Health Canada limits) is summarized in the table below:

Samples Collected by Vale in 2013	# Collected	# Required	# of Non-Compliances	*Note*
Treated Water General Chemistry	2	2	0	*Quarterly*
Raw Water General Chemistry	2	2	N/A	*1x / each 6 mnths*
Raw Water Cryptosporidium	1	N/A	N/A	*Voluntary*
Raw Water Giardia Lamblia	1	N/A	N/A	*Voluntary*
Distribution System - THM's & Bromo.	1	0	0	*Voluntary*
Vale Distribution System - Coliforms	83	N/A	0	*Voluntary*

N/A = Not Applicable

The results of Vale's water chemistry testing campaigns are summarized in the following tables:

Location	WTP Lab Tap	WTP Lab Tap	CDWQG	CDWQG
Date	5-Mar-14	29-Oct-14	MAC	AO
	Manitoba Test 72D			
Fluoride (F)	<0.10	<0.10	**1.5**	
Chloride (Cl)	13.7	14.4		**<250**
pH.	7.11	7.54		**6.5-8.5**
Turbidity	0.14	<0.10	**1.0**	
Tot. Dissolved Solids	89	79		**<500**
Total Organic Carbon	52.7	4.7		
Conductivity	174	150		
Langlier Index (4 C)	-1.5	-1.1		
Langlier Index (60 C)	-0.75	-0.35		
Sulphate	2.45	2.16	**500**	
Total Ammonia (N)	0.021	<0.010		
Nitrite	<0.050	<0.0010		
Nitrate	0.081	0.035		
Total Metals				
Aluminum (Al)	0.0129	0.025		**0.1**
Arsenic (As)	0.00025	0.00026	**0.010**	
Boron (B)	0.016	0.017	**5**	
Barium (Ba)	0.0131	0.0119	**1**	
Berylium (Be)	<0.00020	<0.00020		
Bismuth (Bi)	<0.00020	<0.00020		
Calcium (Ca)	17.4	17.4		
Cadmium (Cd)	<0.000010	<0.000010	**0.005**	
Cobalt (Co)	<0.00020	<0.00020		
Chromium (Cr)	<0.0010	<0.0010	**0.05**	
Cesium (Cs)	<0.00010	<0.00010		
Copper (Cu)	0.00381	0.00367		**<1.0**
Iron (Fe)	<0.10	<0.10		**<0.3**
Potassium (K)	1.3	1.12		
Magnesium (Mg)	5.16	5.04		
Manganese (Mn)	0.00471	0.00165		**<0.05**
Molybdenum (Mo)	<0.00020	<0.00020		
Sodium (Na)	3.57	3.13		**<200**
Nickel (Ni)	<0.0020	<0.0020		
Phosphorous (P)	<0.20	<0.10		

Total Metals				
Lead (Pb)	0.00419	0.00338	**0.010**	
Rubidium (Rb)	0.00127	0.00093		
Antimony (Sb)	<0.00020	<0.00020	**0.006**	
Selenium (Se)	<0.0010	<0.0010	**0.01**	
Silicon (Si)	2.09	1.46		
Tin (Sn)	<0.00020	<0.00020		
Strontium (Sr)	0.0473	0.0410		
Tellurium (Te)	<0.00020	<0.00020		
Titanium (Ti)	<0.00050	0.0199		
Thallium (Tl)	<0.00010	<0.00010		
Uranium (U)	<0.00010	<0.00010	**0.02**	
Vanadium (V)	0.00021	<0.00020		
Tungsten (W)	<0.0010	<0.00010		
Zinc (Zn)	<0.0050	0.005		**<5**
Zirconium (Zr)	<0.00040	<0.00040		
Location	**WTP Lab Tap**	**WTP Lab Tap**	**CDWQG MAC**	**CDWQG AO**
Date				
Calculated				
Hardness(CaCO3)	64.8	64.2		
Conductivity	174	150		
Tot. Alkalinity	51	47		
Bicarbonate (HCO3)	62	57		
Carbonate (CO3)	<12	<12		
Hydroxide (OH)	<6.8	<6.8		
Cyanide	<0.0020		**0.2**	
Radium 226	<0.010		**0.5**	
Bacteriological				
HPC				
Total Coliforms	0		**0**	
Escherichia Coli	0		**0**	

***MAC** = Maximum Acceptable Concentration*

***MAC** = Maximum Acceptable Concentration*

***AO** = Aesthetic Objective*

What is the water drawn from the Burntwood River tested for?

The results of Vale's chemistry testing of the raw, untreated, river water entering the treatment plant prior to undergoing the treatment process are summarized in the following table:

Location		WTP Raw	WTP Raw
Date	Units	5-Mar-14	29-Oct-14
Langlier Index (4 C)		-0.59	-0.36
Langlier Index (60 C)		0.19	0.41
Sulphate	mg/L	2.3	2.17
Nitrite	mg/L	<0.050	0.0012
Nitrate	mg/L	0.081	0.0375
Fluoride (F)	mg/L	<0.10	<0.10
pH.	pH units	7.96	8.16
Turbidity	NTU	25.1	37.8
TDS (Calculated)	mg/L	94.4	101
Hardness(CaCO3)	mg/L	67	71.3
Conductivity	umhos/cm	149	132
Total Ammonia as N	mg/L	0.028	<0.010
Bicarbonate (HCO3)	mg/L	77	76
Carbonate (CO3)	mg/L	<12	<12
Hydroxide (OH)	mg/L	<6.8	<6.8
Chloride	mg/L	1.24	1.01
Aluminum (Al)	mg/L	1.3	2.46
Arsenic (As)	mg/L	0.00057	0.00073
Boron (B)	mg/L	0.012	0.015
Barium (Ba)	mg/L	0.0239	0.0316
Berylium (Be)	mg/L	<0.00020	<0.00020
Bismuth (Bi)	mg/L	<0.00020	<0.00020
Calcium (Ca)	mg/L	17.4	18.8
Cadmium (Cd)	mg/L	<0.000010	<0.000010
Cobalt (Co)	mg/L	0.00054	0.00077
Chromium (Cr)	mg/L	0.00230	0.00360
Cesium (Cs)	mg/L	0.00016	0.00027
Copper (Cu)	mg/L	0.00736	0.00277
Iron (Fe)	mg/L	1.17	1.87
Potassium (K)	mg/L	1.69	1.9
Magnesium (Mg)	mg/L	5.7	5.92
Manganese (Mn)	mg/L	0.0238	0.0321
Molybdenum (Mo)	mg/L	<0.00020	<0.00020
Sodium (Na)	mg/L	3.5	3.37
Nickel (Ni)	mg/L	0.0021	0.0028
Phosphorous (P)	mg/L	<0.20	<0.10
Lead (Pb)	mg/L	0.00138	0.000923

Location	Units	WTP Raw	WTP Raw
Date		**5-Mar-14**	**29-Oct-14**
Rubidium (Rb)	**mg/L**	0.00419	0.00611
Antimony (Sb)	**mg/L**	<0.00020	<0.00020
Selenium (Se)	**mg/L**	<0.0010	<0.0010
Silicon (Si)	**mg/L**	4.93	7.27
Tin (Sn)	**mg/L**	<0.00020	<0.00020
Zinc (Zn)	**mg/L**	0.0086	0.0083
Strontium (Sr)	**mg/L**	0.0504	0.0489
Tellurium (Te)	**mg/L**	<0.00020	<0.00020
Titanium (Ti)	**mg/L**	0.0571	0.101
Thallium (Tl)	**mg/L**	<0.00010	<0.00010
Uranium (U)	**mg/L**	0.00024	0.00024
Vanadium (V)	**mg/L**	0.00234	0.00392
Tungsten (W)	**mg/L**	<0.0010	<0.00010
Zinc (Zn)	**mg/L**	0.0086	0.0083
Zirconium (Zr)	**mg/L**	0.00128	0.00248

In 2008, Vale started testing for Protozoa, testing for Cryptosporidium Oocysts and Giardia Lambia Cysts (viable, non-viable and amorphous). The campaign was intended to profile the biology of the raw water. Since the testing began in 2008, 100% of the results have been negative; no oocysts and no viable cysts have been recovered from the raw water.

What was the treated water tested for in the plant?

The treated water supply is tested by the Water Treatment Plant operators daily for turbidity and chlorine residual. The table below shows the results of this testing:

Parameter Tested	DWQG MAC	Average Result (Min/Max)	Did the results meet the performance standard?	# of Samples in 2014
Free Chlorine Residual	0.5 mg/L	1.12 mg/L (0.79 / 1.70)	100% of the time the result met the standard	365
Effluent Turbidity	0.3 NTU	0.065 NTU (0.03 / 0.53)	99.7% of the time the result met the standard	365

The City of Thompson *and* Vale test for the presence of Tihalomethanes in the distribution system, at different locations. Trihalomethanes are compounds that can form when chlorine used to disinfect drinking water reacts with naturally occurring organic matter that is present in the distribution sytstem. The trihalomethanes that are most often found in drinking water are bromodichloromethane, bromoform, chloroform and dibromochloromethane.

The results of the testing for the presence of Trihalomethanes in Vale's distribution system are summarized below:

Distribution System	*Vale Firehall* 7-Jul-14	CDWQG MAC
Bromodichloromethane	0.00392	**0.016**
Bromoform	<0.00050	**0.100**
Chloroform	0.0828	**0.100**
Chlorodibromomethane	<0.00050	**0.100**
Trihalomethanes	0.0867	**0.100**

Were there any operational issues at the Water Treatment Plant that affected water quality in 2014?

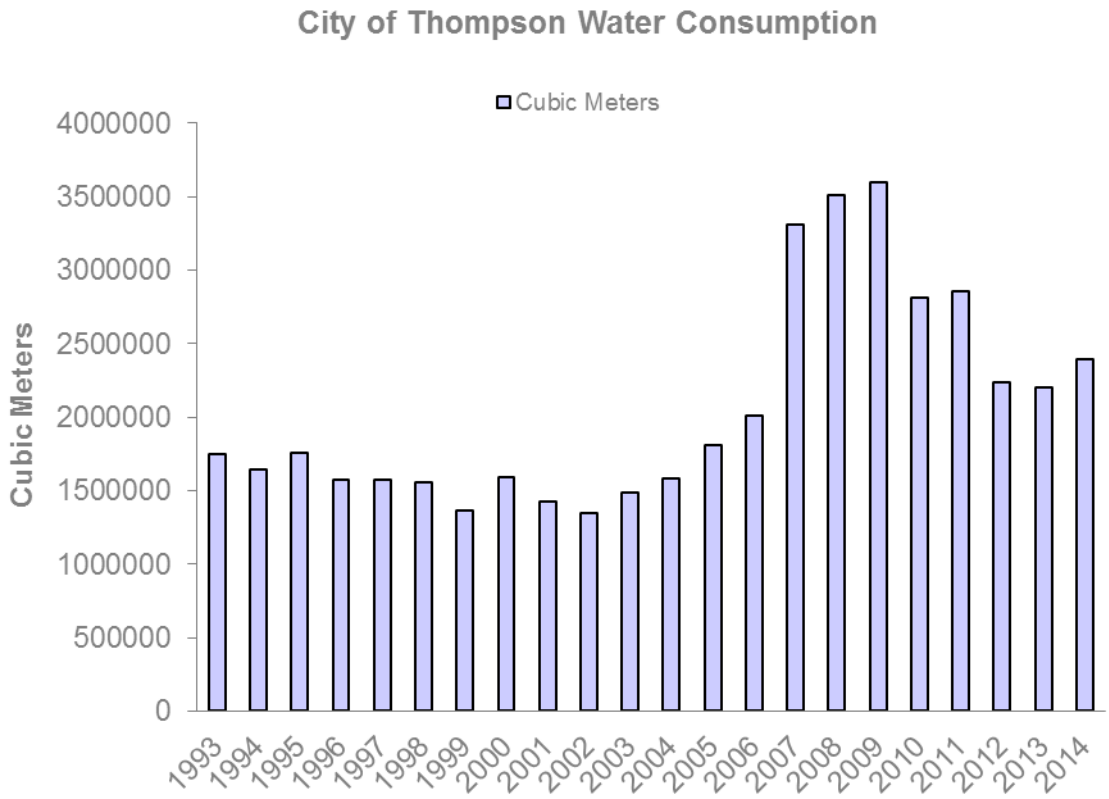
Filtered water turbidity exceeded the (0.3 NTU) standard on one of three effluent filters on January 22nd, April 16th, May 4th, 9th, 12th, 16th, 20th, June 23rd, August 9th and 20th. In each instance the treatment process was adjusted to restore the effectiveness of the affected filter and acceptable turbidity readings were achieved.

Were any improvements, upgrades or capital investments made to the Water Treatment Plant in 2014?

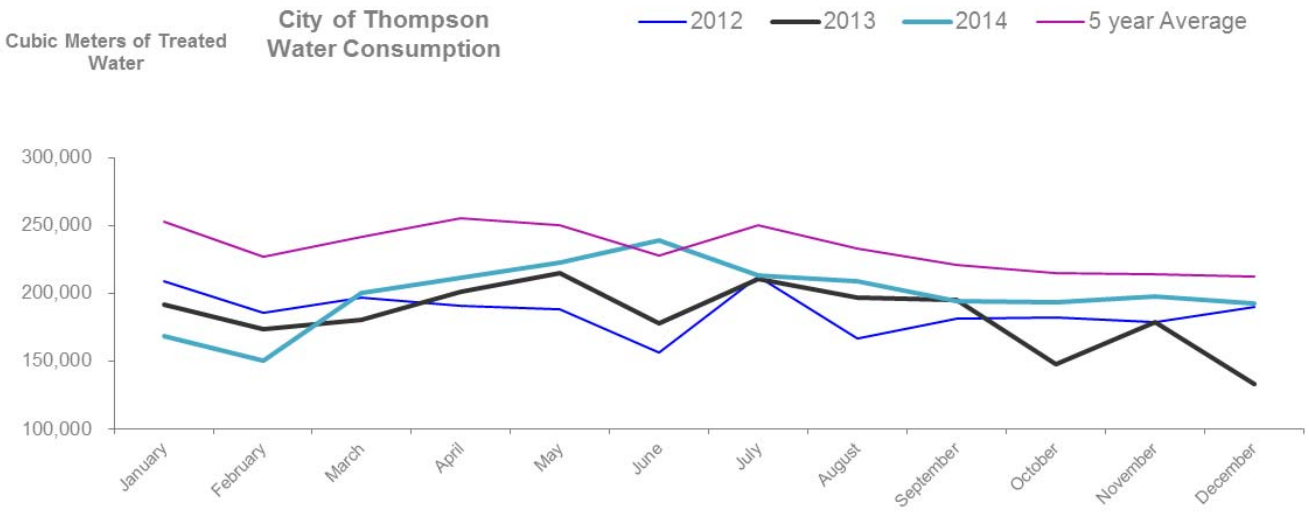
Major capital improvements were made at the Water Treatment Plant in 2012 & 2013; including filter upgrades and a new chlorine system. In 2014, repairs were made to the filter tank walls and the concrete steps at the front door were replaced.

How much water did the City of Thompson consume in 2014?

The City of Thompson consumed a total of 2,392,232 cubic meters of treated water in 2014. Water consumption decreased after the installation of meters in residential homes began in late July 2010, as part of the municipal Water Utility Initiative.

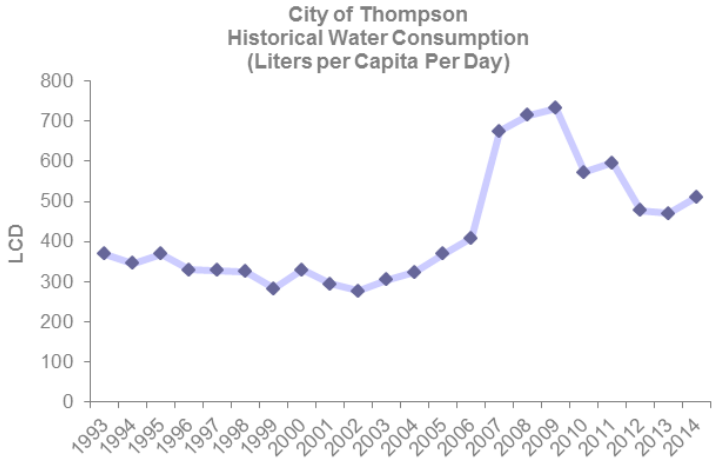


In 2014, the annual consumption increased by 191,786 cubic meters from 2013, representing an increase of 9%, and overall the consumption has decreased by 13% from the 5 year average. The peak periods of water consumption occurred in the months of May & June.



Based on the total consumption of water by all sources including residential homes, businesses, industrial operations within the city limits and water lost to water main breaks, residents of the City of Thompson consumed 510 liters of water per person per day (LCD). The rate of consumption has decreased by 43% over the past 5 years, but remains greater than the National and Provincial averages[1].

[1]Source: 2011 Municipal Water Use Report – Municipal Water Use 2009 Statistics, Environment Canada



These consumption figures include water lost due to water main breaks within the city, and do not include water consumed by Vale's operations.

Where can I find copies of the water testing results?

Copies of the City of Thompson's water testing results are kept at the public works yard. Reports are available for viewing upon request. For more information, please contact the City of Thompson.

Copies of Vale's water testing results are kept at the Thompson Mine General Office Environment Office. Reports are available for viewing upon request. For more information, please contact Vale at thompsoninfo@vale.com

Where can I get a hard copy of the water system report?

To obtain a printed copy of the Public Water System Annual Report, please contact Vale at thompsoninfo@vale.com