ANNUAL REPORT 2013

Vermilion Bay Drinking Water System

NORTHERN WATERWORKS INC.

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INTRODUCTION

The Vermilion Bay Drinking Water System (DWS# 210000997) is obligated to meet the requirements of Ontario's *Safe Drinking Water Act* and the regulations therein, in addition to requirements associated with system approvals. Specifically, this system must meet extensive treatment and testing requirements in order to ensure that human health is protected.

This Annual Report has been prepared in accordance with both Schedule 22 and section 11 of Ontario Regulation 170/03. In this manner, the Summary Reports for Municipalities required by Schedule 22 and the Annual Reports required by section 11 have been consolidated into a single document. This Report is intended to brief the ownership of the Vermilion Bay Drinking Water System (VBDWS) on the system's performance over the past calendar year (January 1, 2013 to December 31, 2013).

A summary of this Drinking Water System (DWS) is difficult to produce without the use of technical terms, some of which the reader may not be familiar with. It is recommended that the reader refer to the *Technical Support Document for Ontario Drinking Water Standards, Objectives, and Guidelines*. Within this document the reader will find information on provincial water quality standards, objectives and guidelines, rationale for monitoring, and a brief description of water quality parameters. This document can be found at the following website address:

http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079707.pdf

Users of this Drinking Water System are also encouraged to contact a representative of Northern Waterworks Inc. for assistance in interpreting this Annual Report.

Report Availability

In accordance with section 11 of O. Reg. 170/03, this Annual Report must be made available for inspection by any member of the public, without charge, at the Municipal Office. Additionally, the Municipality of Machin is encouraged to make available this Annual Report on the community's website.

In accordance with Schedule 22 of O. Reg. 170/03, this Annual Report must be distributed to the members of the municipal council. Effective January 1, 2013, section 19 (Standard of care, municipal drinking water system) of Ontario's *Safe Drinking Water Act* places certain responsibilities upon those municipal officials who oversee an accredited operating authority or exercise decision-making authority over a system. Such municipal officials would be exercising diligence by becoming familiar with this Annual Report.

SYSTEM DESCRIPTION

Classified as a large municipal residential system, this drinking water system (DWS) provides a potable water supply to the community of Vermilion Bay. This DWS is composed of the Vermilion Bay Low Lift Pumping Station (VBLLPS), the Vermilion Bay Water Treatment Plant (VBWTP), and the Vermilion Bay distribution system. This DWS is owned by the Corporation of the Municipality of Machin and is operated by Northern Waterworks Inc. Potential pathogenic organisms are removed from the source water by coagulation, flocculation, sedimentation, filtration, and primary disinfection processes.

The VBLLPS draws surface water from Eagle Lake, such that two low lift pumps are capable of transferring the raw water from the source to the treatment units located at the VBWTP. Lime solution (pH/alkalinity adjustment) and polyaluminum chloride (primary coagulant) are injected into the raw water upstream from the treatment units. A cationic polymer (flocculation aid) is then injected during the flocculation stage in order to create a strong and dense floc, which will facilitate settling in the sedimentation stage. In the sedimentation tanks, water flows upward through a maintained floc blanket and tube settlers and enters the perforated clarifier effluent pipe which directs flow to the filters. Any suspended particles that did not settle in the sedimentation tanks will be removed by two dual-media filters (composed of anthracite and silica sand, on a layer of support gravel). Filter effluent is then directed to a non-chlorinated reservoir for subsequent transfer through the GAC (granular activated carbon) filter units. Sodium hypochlorite (disinfectant) is then added to the GAC filter effluent water.

The chlorinated water is held in the treated water storage reservoirs to allow for the necessary time required to achieve primary disinfection. Treated water is then transferred to the distribution system by the use of high lift pumps located at the VBWTP. Secondary disinfection requirements in the distribution system are achieved by the maintenance of a residual as free chlorine.

System Expenses

It is within the scope of this Report to describe any major expenses incurred during the reporting period to install, repair or replace required equipment. Such major expenses for the Vermilion Bay DWS include:

- $ 15,000.00 May 30th, 2013 related to the repair of a broken saddle and service on the force main along Bay street which serviced 26 Bay street, requiring the excavation, removal and replacement of approximately 100 M^3 of aggregate and the repaving of the road surface along Bay street.

WATER QUALITY

The Vermilion Bay Drinking Water System continued to produce water of exceptional quality in 2013. The descriptions below provide brief summaries of the parameters tested in the VBDWS, and the reader is asked to consult **Appendix A** for a comprehensive summary of 2013 water quality.

In-House Analyses

The Vermilion Bay DWS employs an extensive in-house testing program which includes analyses of water quality indicators beyond that required by Ontario's *Safe Drinking Water Act*. Such analyses are conducted on source, treated, and process water, and include testing for turbidity, colour, pH, temperature, alkalinity, aluminum, and residual free chlorine. Approximately 5600 routine independent in-house water quality tests were conducted with respect to this system in 2013.

Microbiological Analyses in 2013, as required by Schedule 10 of O. Reg. 170/03. These water samples were collected on a weekly basis, and included tests for E. coli, total coliforms, and heterotrophic plate counts. All routine samples tested absent for E. coli and total coliform parameters.

Organic Parameters and Trihalomethanes

Organic parameters are sampled on an annual basis in treated water in accordance with Schedules 13 and 24 of O. Reg. 170/03. These parameters include various acids, pesticides, herbicides, PCBs, volatile organics, and other organic chemicals. With respect to the Vermilion Bay DWS, sampling for organic parameters was conducted on February 7, 2013. The results of all organic parameter testing were below the lower detectable limits (with the exception of trihalomethanes).

Trihalomethanes (THMs) are sampled on a quarterly basis from the farthest point in the Vermilion Bay distribution system, in accordance with Schedule 13 of O. Reg. 170/03. Compliance with the provincial standard for trihalomethane concentrations is determined by calculating a running annual average (with a Maximum Acceptable Concentration of 0.100 mg/L or 100 ug/L). In 2013, the running annual average was 56.4 ug/L

Microbiological analyses are conducted on source, treated, and distribution system water. A total of 269 routine water samples were collected for bacteriological analysis by an accredited laboratory

WATER QUALITY (continued)

Inorganic Parameters and Nitrate/Nitrite

Inorganic parameters are sampled on an annual basis in treated water in accordance with Schedules 13 and 23 of O. Reg. 170/03. Inorganic sampling includes various parameters such as Antimony, Arsenic, Cadmium, Mercury, and Uranium. With respect to the Vermilion Bay DWS, required annual sampling for inorganic parameters was conducted on February 7, 2013.

Treated water is also tested for nitrate and nitrite concentrations on a quarterly basis in accordance with Schedule 13 of O. Reg. 170/03. There was no exceedance for any inorganic parameter in 2013.

Community Lead Sampling

Based on results of the community lead sampling program in 2012, the Vermilion Bay DWS has qualified for reduced sampling in accordance with Schedule 15.1 of O. Reg. 170/03. Such reduced sampling will resume in the period corresponding to December 15, 2014 to April 15, 2015.

2013 Lead Sampling Results

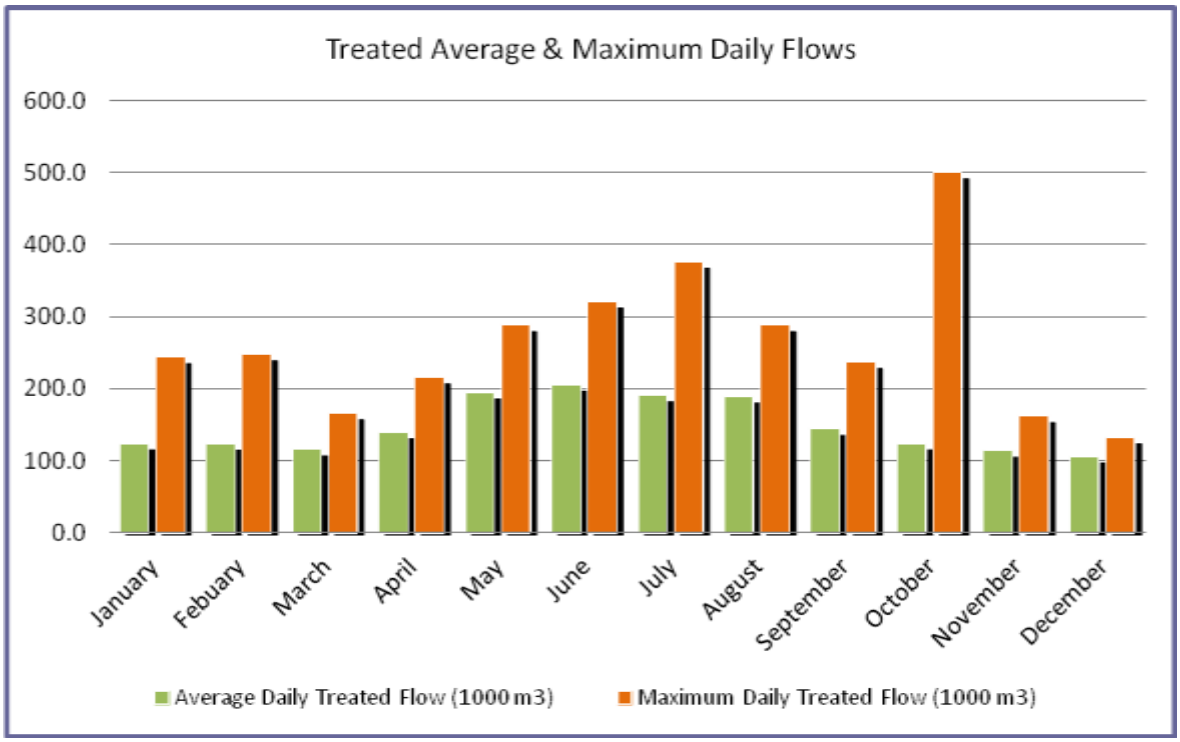
Sample Type	Number of Samples	Minimum Result (ug/L)	Maximum Result (ug/L)	ODWQS[1] (ug/L)	Number of Exceedances	Number of Samples Below LDL[2] (<1.0 ug/L)	Number of Samples Between LDL and ODWQS
Plumbing	0						
Distribution	0						

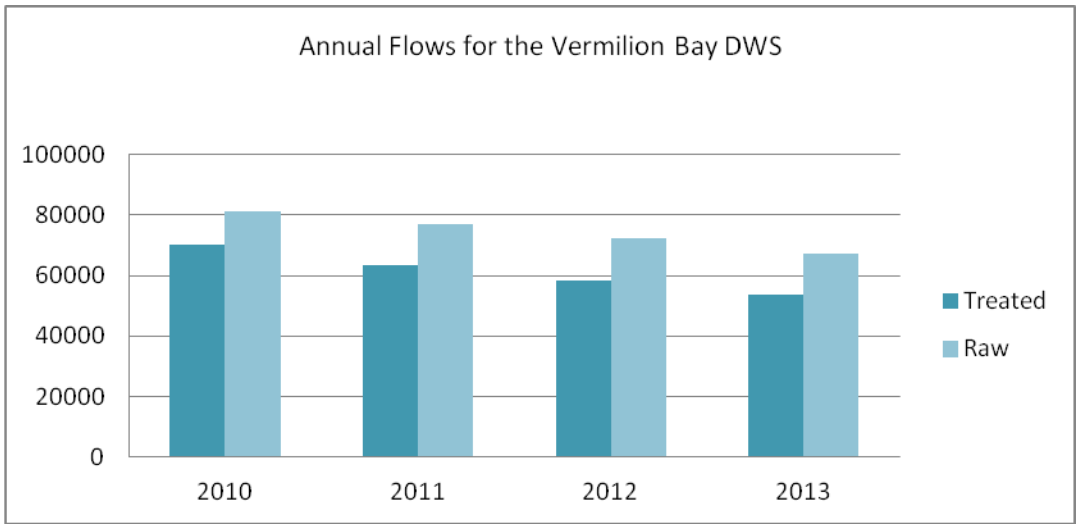
1. ODWQS = Ontario Drinking Water Quality Standard; a value above this threshold is considered to be an exceedance.
2. LDL = lower detectable limit; lead concentrations below the LDL are not detected by current analytical methods.

FLOWS

2013 Flows

Throughout the reporting period, the Vermilion Bay DWS supplied 53,790 m^3 of treated water to consumers. On an average day in 2013, 147 m^3 of treated water was supplied to the community. This average daily flow rate in 2013 represented 10.8 % of the rated capacity of the Vermilion Bay WTP (1,360 m^3/day). The maximum daily flow rate in 2013 was 499 m^3/day, which represented 36.7 % of the rated capacity of the Vermilion Bay WTP. The maximum day flow was due to the events of Oct 30th when the fire hydrants were vandalized. The reader is asked to consult **Appendix B** for a complete summary of 2013 flow data.





There was a decrease in the amount of water supplied in 2013 when compared to the previous calendar year. In 2013, 58,217 m^3 of treated water was supplied to users of the Vermilion Bay DWS, compared to 53,790 m^3 in 2013. This represents a 8.2 % decrease in the amount of treated water supplied to the community. The reader is asked to consult **Appendix B** for a summary of historical flow data.

FLOWS (continued)

Chemical Consumptions

Increases in the consumption of lime in recent years are associated with corrosion control measures intended to reduce lead concentrations in premise plumbing. These measures have proven effective in controlling lead release, and it is reasonable to expect that future lime dosages will be similar to those encountered in 2012 and 2013.

The table below summarizes all the water treatment chemicals used during the reporting period and their consumption data. All chemicals used in the treatment process are NSF 60 certified for use in potable water, as required by system approvals.

Chemical Consumptions & Average Dosages

Year	Lime		Polyaluminum chloride		Polymer		Sodium hypochlorite	
	Quantity Used (kg)	Average Dosage (mg/L)	Quantity Used (L)	Average Dosage (mg/L)	Quantity Used (kg)	Average Dosage (mg/L)	Quantity Used (L)	Average Dosage[1] (mg/L)
2010	287	3.5	4394	21.7	13.4	0.16	2262	3.86
2011	462	6.0	4306	22.5	7.6	0.10	2256	4.25
2012	417	5.8	3418	18.9	7.0	0.10	2469	5.09
2013	464	6.9	3375	20.2	4.4	0.07	2548	7.75

1. GAC transfer volumes (as opposed to raw water volumes) are used in the average dosage calculations for sodium hypochlorite. Using such volumes provides a better indication of applied dosages. Discrepancies in the reported dosages between this and previous Annual Reports can be attributed to using raw water volumes in such calculations.

COMPLIANCE

Ensuring Compliance

Northern Waterworks Inc. operates the Vermilion Bay Drinking Water System for the Municipality of Machin, and must comply with legislative and regulatory requirements in addition to the terms and conditions of a number of site-specific system approvals. Staffing is maintained at levels to ensure that adequate numbers of trained and licensed personnel are available for proper operations, during emergency or upset conditions, for vacation/sick relief, or to deal with equipment breakdown. Emergency response procedures and operations manuals are established and located in the appropriate facilities, and are available to all staff members. Operations manuals include information necessary for the day-to-day operation and maintenance of the treatment and distribution systems, as well as information that may be required to be accessed quickly for various purposes. Emergency response procedures include information that may be required for proper operation of the system during emergency or upset conditions, and contains items such as emergency plans and contact lists.

The operational strategy of Northern Waterworks Inc. includes ensuring that permits and approvals are in place, ensuring efficient maintenance and operations, and ensuring that the quality of water supplied to its customers meets or exceeds the minimum requirements as set out in the *Safe Drinking Water Act*. It is also our responsibility to ensure that permissible flow rates are not exceeded. Flow measuring devices for measuring the amount of water taken and the amount of water supplied are calibrated annually. Accuracy in these measurements ensures that treatment chemicals are precisely applied and that flows do not exceed the capacity at which the system is designed to be effective. These flows are recorded to provide current and historical information for decision making purposes, in addition to being used by the Ministry of the Environment to review treatment operations.

Water quality analyzers are in place to continuously monitor water quality after critical treatment processes. Each filter is equipped with a filter effluent turbidity analyzer which monitors the amount of suspended particles in the water leaving the filter. A chlorine residual analyzer continuously monitors the free chlorine residual at a point where primary disinfection is complete. Each piece of equipment is equipped with an alarm indicating adverse water quality, and is maintained in accordance with manufacturer's recommendations. Additionally, a water sampling program is conducted to exceed the minimum requirements of O. Reg. 170/03 under the *Safe Drinking Water Act*. Raw water sampling is conducted to give operational staff the information required to effectively operate the treatment process, and samples are collected throughout the process to determine the effectiveness of treatment at each stage. Treated and distribution system sampling provide information regarding the quality of water delivered to consumers. All of these samples are analyzed by licensed staff or by an accredited laboratory.

Compliance with System Approvals

The Municipal Drinking Water Licence for the Vermilion Bay DWS requires that effluent discharged into the natural environment has an annual average total suspended solids concentration below 15 mg/L. This effluent is returned to Eagle Lake, and originates from the water consumed for plant process purposes (such as filter backwashing, clarifier "desludging", and filter rinsing-to-waste). In 2013, the annual average concentration for decant effluent total suspended solids was 2.2 mg/L. The annual average concentration calculation assumes that sample results found to be below the lower detectable limit are equivalent to that limit.

COMPLIANCE (continued)

Incidents of Non-Compliance

There were no known incidents of non-compliance in 2013. Such an incident contravenes regulatory requirements, and corrective actions are required to address such items.

Summary of 2013 Incident of Non-Compliance	
Incident Description	
Explanation	
Corrective Actions	

Incidents of Adverse Water Quality

Under O. Reg 170/03, reporting procedures and corrective actions are required for any instance where a sample result shows that a parameter used to measure water quality exceeded a certain standard, or where other observations indicate that the safety of the water cannot be guaranteed. There were no such incidents for the Vermilion Bay DWS in 2013. The reader is asked to consult **Appendix C** for a summary of adverse water quality incidents which occurred in 2013.

Although treated water turbidity is considered an "aesthetic objective" and not a reportable parameter, A high turbidity was recorded due to a fire flow in the distribution system and this incident was reported to the MOE's Spill Action Centre as a precaution. AWQI # 114620 was issued. Turbidity stabilized after fire flows subsided.

APPENDIX A: WATER QUALITY

Microbiological Parameters

Parameter (Sample Type)	Units	Number of Samples	Minimum	Maximum	ODWQS[1]	Compliant ODWQS
E. Coli (Raw)	MPN/100mL	52	0	1	---	---
E. Coli (Treated)	p/a/100mL	52	absent	absent	not detectable	✓
E. Coli (Distribution)	p/a/100mL	165	absent	absent	not detectable	✓
Total Coliforms (Raw)	MPN/100mL	52	0	2420	---	---
Total Coliforms (Treated)	p/a/100mL	52	absent	absent	not detectable	✓
Total Coliforms (Distribution)	p/a/100mL	165	absent	absent	not detectable	✓
HPC (Treated)	CFU/mL	52	0	2	---	---
HPC (Distribution)	CFU/mL	112	0	7	---	---

1. ODWQS = Ontario Drinking Water Quality Standard; a value above this threshold is considered to be an exceedance.

Chemical and Physical Parameters (In-House)

Parameter	Units	Number of Samples	Minimum[1]	Maximum	Annual Average[3]	Compliant ODWQS
Turbidity (Filter #1/#2)	NTU	Continuous	0.01/0.01	0.09/0.09	0.067/0.068	✓
Turbidity (Treated)	NTU	Continuous	0.041	5.16[2]	0.106	---
Residual Free Chlorine	mg/L	Continuous	0.49	1.67	1.21	---
pH (Treated)	pH units	Continuous	6.7	7.6	7.1	---
Total Alkalinity (Treated)	mg/L $CaCO_3$	~250	13.7	22.5	19.4	---
Residual Aluminum (Treated)	mg/L	~250	0.005	0.030	0.016	---

1. The minimum and maximum values for the parameters of Turbidity (Treated), pH (Treated), Total Alkalinity (Treated), and Residual Aluminum (Treated) are given as minimum and maximum monthly averages.
2. Maximum values for Distribution turbidity are associated with fire flows which occurred on October 17 and 30th,2013.
3. Annual averages are the averages of all in-house analyses conducted within the year for a given parameter.

Inorganic Parameters

Parameter (Treated Water)	Units	Result	ODWQS	Compliant ODWQS
Antimony	ug/L	<0.60	6	✓
Arsenic	ug/L	<1.0	25	✓
Barium	ug/L	<10	1000	✓
Boron	ug/L	<50	5000	✓
Cadmium	ug/L	<0.10	5	✓
Chromium	ug/L	<1.0	50	✓
Fluoride	mg/L	<0.030	1.5	✓
Mercury	ug/L	<0.10	1	✓
Selenium	ug/L	<1.0	10	✓
Sodium	mg/L	6.95[1]	20[2]	✓
Uranium	ug/L	<2.0	20	✓

1. Treated water must be tested for sodium concentrations once every 5 years. This most recent result pertains to a sample collected on February 22, 2010.
2. This value for the parameter Sodium is not associated with a Standard as prescribed in O. Reg. 169/03, although an exceedance of this value is associated with reporting requirements and corrective actions.

Nitrate & Nitrite

Sample Date (2013)	Nitrate Result (mg/L)	Nitrite Result (mg/L)	Nitrate + Nitrite (mg/L)	Compliant ODWQS
February 7	0.039	<0.020	0.039	✓
May 14	0.038	<0.020	0.038	✓
August 14	0.046	<0.020	0.046	✓
November 2	0.033	<0.020	0.033	✓
ODWQS (mg/L)	10	1	10	

APPENDIX A: WATER QUALITY (continued)

Organic Parameters

Parameter (Treated Water)	Result (ug/L)	ODWQS (ug/L)	Compliant ODWQS	Parameter (Treated Water)	Result (ug/L)	ODWQS (ug/L)	Compliant ODWQS
Alachlor	<0.10	5	✓	Diquat	<1.0	70	✓
Aldicarb	<1.0	9	✓	Diuron	<1.0	150	✓
Aldrin + Dieldrin	<0.040	0.7	✓	Glyphosate	<5.0	280	✓
Atrazine + N-dealkylated metabolites	<0.20	5	✓	Heptachlor + Heptachlor Epoxide	<0.20	3	✓
Azinphos-methyl	<0.10	20	✓	Lindane (Total)	<0.10	4	✓
Bendiocarb	<0.20	40	✓	Malathion	<0.10	190	✓
Benzene	<0.50	5	✓	Methoxychlor	<0.10	900	✓
Benzo(a)pyrene	<0.010	0.01	✓	Metolachlor	<0.10	50	✓
Bromoxynil	<0.20	5	✓	Metribuzin	<0.10	80	✓
Carbaryl	<0.20	90	✓	Monochlorobenzene	<0.50	80	✓
Carbofuran	<0.20	90	✓	Paraquat	<1.0	10	✓
Carbon Tetrachloride	<0.5	5	✓	Parathion	<0.10	50	✓
Chlordane (Total)	<0.3	7	✓	Pentachlorophenol	<0.50	60	✓
Chlorpyrifos	<0.10	90	✓	Phorate	<0.10	2	✓
Cyanazine	<0.10	10	✓	Picloram	<0.20	190	✓
Diazinon	<0.10	20	✓	Polychlorinated Biphenyls (PCBs)	<0.035	3	✓
Dicamba	<0.20	120	✓	Prometryne	<0.10	1	✓
1,2-Dichlorobenzene	<0.50	200	✓	Simazine	<0.10	10	✓
1,4-Dichlorobenzene	<0.50	5	✓	Temephos	<0.10	280	✓
DDT + metabolites	<0.40	30	✓	Terbufos	<0.20	1	✓
1,2-Dichloroethane	<0.50	5	✓	Tetrachloroethylene	<0.50	30	✓
1,1-Dichloroethylene	<0.50	14	✓	2,3,4,6-Tetrachlorophenol	<0.50	100	✓
Dichloromethane	<0.50	50	✓	Triallate	<0.10	230	✓
2,4 -Dichlorophenol	<0.30	900	✓	Trichloroethylene	<0.50	5	✓
2,4-Dichlorophenoxy acetic acid	<0.20	100	✓	2,4,6-Trichlorophenol	<0.50	5	✓
Diclofop-methyl	<0.20	9	✓	2,4,5-Trichlorophenoxy acetic acid	<0.20	280	✓
Dimethoate	<0.10	20	✓	Trifluralin	<0.10	45	✓
Dinoseb	<0.20	10	✓	Vinyl Chloride	<0.50	2	✓

Trihalomethanes

Sample Date (2013)	Total THMs Result (ug/L)	2013 Annual Average (ug/L)	2012 Annual Average (ug/L)	2011 Annual Average (ug/L)	2010 Annual Average (ug/L)	ODWQS[1] (ug/L)	Compliant ODWQS
February 7	49.0	56.4	74.9	79.9	52.6	100	✓
May 20	38.0						
August 10	58.0						
November 25	80.6						

1. ODWQS = Ontario Drinking Water Quality Standard; a value above this threshold is considered to be an exceedance.

APPENDIX B: FLOW STATISTICS

2013 Flow Statistics (values expressed as m^3)

Month	Total Raw Water Flow	Total GAC Treated Water Flow[1]	Average Treated Water Daily Flow[1]	Maximum Treated Water Daily Flow[2]	Plant Efficiency	% Capacity Performance (Average Flows)	% Capacity Performance (Maximum Flows)
Jan.	5047.000	3944.000	123	243	78.1	9.1	17.9
Feb.	4398.000	3448.000	123	247	78.4	9.1	18.2
March	4491.000	3559.000	115	165	79.2	8.4	12.1
April	5329.000	4167.000	139	215	78.2	10.2	15.8
May	7286.000	6021.000	194	287	82.6	14.3	21.1
June	7405.000	6134.000	204	320	82.8	15.0	23.5
July	7106.000	5896.000	190	375	83.0	14.0	27.6
Aug.	7118.000	5842.000	188	287	82.1	13.9	21.1
Sept.	5265.000	4304.000	143	236	81.7	10.5	17.4
Oct.	4763.000	3822.000	123	499	80.2	9.1	36.7
Nov.	4322.000	3393.000	113	161	78.5	8.3	11.8
Dec.	4508.000	3260.000	105	132	72.3	7.7	9.7
Total	**67038.00**	**53790.00**	---	---	---	---	---
Avg.			**147**	---	---	---	---

1. The recirculation of treated water via pressure relief valves located downstream of the treated water (distribution) flowmeter had previously resulted in inaccurate estimates with respect to the amount of water being supplied to the community. For this reason, the values for total treated water flow and average treated water daily flow were derived from actual transfer flows through the GAC filter units. In this way, such flows were not derived from data collected from the treated water (distribution) flowmeter.
2. Values for maximum daily flows were derived from data collected from the treated water (distribution) flowmeter.

Flow Statistics by Year (values expressed as m^3)

Year	Total Raw Water Flow	Total Treated Water Flow[1]	Plant Efficiency	% Change in Total Raw Flow from Previous Year	% Change in Total Treated Flow from Previous Year
2010	81,227	70,388	86.7%	---	---
2011	76,863	63,729	82.9%	-5.4%	-9.5%
2012	72,418	58,217	80.4%	-5.8%	-8.6%
2013	67,038	53,790	79.8%	-8.0%	-8.2%

1. Estimates for total treated water annual flow were derived from actual transfer flows through the GAC filter units. Previous Annual Reports derived such estimates from the treated water (distribution) flowmeter, and as such there is discrepancy with the estimates provided above. The estimates provided in this Report are considered to be more accurate in depicting the actual amount of treated water supplied to the community.

APPENDIX C: ADVERSE WATER QUALITY INCIDENTS

2013 Adverse Water Quality Incidents

AWQI#: 114620	Incident Date: October 17, 2013	Resolution Date: October 17, 2013
Incident Description	Data from continuous monitoring equipment (distribution turbidimeter) indicated a turbidity of 5.16 ntu. During fire flows. Although treated water turbidity is considered an "aesthetic objective" and not a reportable parameter, A high turbidity was recorded due to a fire flow in the distribution system and this incident was reported to the MOE's Spill Action Centre as a precaution. AWQI # 114620 was issued. Turbidity stabilized after fire flows subsided.	
Corrective Action(s)	Corrective action involved allowing the Turbidity to stabilize after fire flows subsided on Oct 17, 2013.	

1. MOE SAC – Ministry of the Environment Spills Action Centre