

2016 Annual Report

Hudson Drinking Water System

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Prepared by



for the Corporation of the
Municipality of Sioux Lookout

Introduction

This consolidated Annual Report (the Report) has been prepared in accordance with both section 11 (Annual Reports) and Schedule 22 (Summary Reports for Municipalities) of Ontario Regulation 170/03 (Drinking Water Systems Regulation). This Report is intended to inform both the public and the Municipal Council on the operation of the system over the previous calendar year (January 1 to December 31, 2016).

Section 11 of O. Reg. 170/03 requires the development and adequate distribution to the public of an annual report summarizing water quality monitoring results, adverse water quality incidents, system expenses, and chemicals used in the water treatment process.

Schedule 22 of O. Reg. 170/03 requires the development and distribution to Municipal Council of an annual report summarizing incidents of regulatory non-compliance and associated corrective actions, in addition to providing flow monitoring results for the purpose of enabling the Owner to assess the capability of the system to meet existing and planned demand.

Report Availability

In accordance with section 11 of O. Reg. 170/03 this Report must be given, without charge, to every person who requests a copy. Effective steps must also be taken to advise users of water from the system that copies of the report are available, without charge, and of how a copy may be obtained. This Annual Report shall be made available for inspection by the public at the following locations:

- (1) Municipal Office, Customer Service Desk, Sioux Lookout
- (2) Lost Lake Seniors Drop-In Centre, Hudson
- (3) Municipal Website (www.siuoxlookout.ca)
- (4) NWI Website (www.nwi.ca/publications)

In accordance with Schedule 22 of O. Reg. 170/03, this Annual Report must be given to the members of Municipal Council. Section 19 (Standard of care, municipal drinking-water system) of Ontario's *Safe Drinking Water Act* also places certain responsibilities upon those municipal officials who oversee an accredited operating authority or exercise decision-making authority over a system. The examination of this Report is one of the methods by which municipal officials may fulfil the obligations required by section 19 of O. Reg. 170/03.

System users and members of Council are strongly encouraged to contact a representative of Northern Waterworks Incorporated (NWI) for assistance in interpreting this Report. Questions and comments may be directed to the local NWI Operations Manager or by email to compliance@nwi.ca.

(System Overview)

The Hudson Drinking Water System (DWS No. 220005385) must meet extensive treatment and testing requirements in order to ensure that human health is protected. The operation and maintenance of the system is governed by Ontario's *Safe Drinking Water Act* and the regulations therein, in addition to requirements within system-specific approvals.

System Description

The Hudson DWS is classified as a large municipal residential system, and it is composed of a raw water pumping station, the Hudson Water Treatment Plant (WTP), and the Hudson distribution system. The system is owned by the Corporation of the Municipality of Sioux Lookout and is operated and maintained by Northern Waterworks Incorporated. Potential pathogenic organisms are removed and inactivated by chemical coagulation, flocculation, clarification, rapid sand filtration and ultraviolet disinfection.

Raw water flows by gravity from the intake structure located in Lost Lake to an underground wet well located at the raw water pumping station. Pumps then transfer water from the wet well directly to the treatment units at the WTP through a transmission line. At the Hudson WTP, polyaluminum chloride (coagulant) is injected and rapidly mixed into the raw water immediately upstream from the package treatment units. Coagulated water enters two treatment units each including a three-chambered flocculation basin, a clarifier and filter. Water is gently mixed as it passes through the flocculation basins in order to promote floc formation. The optional application of polymer (flocculant) at this stage of treatment is intended to form larger floc aggregates. Process water then enters the clarifier, where its velocity is reduced to allow for the separation and settling of floc. Supernatant overflows into the clarifier effluent launders and is directed to the filter; settled floc (sludge) is automatically removed from the bottom of the clarifier.

Any suspended particles that did not settle in the clarifier are removed by passing water through a dual media filter (composed of anthracite and silica sand on a layer of support gravel). The filters are periodically cleaned by using an air scour to agitate the entire media bed and reversing the flow of water through the filter using dedicated pumps. Sodium metabisulfite may be used as required to dechlorinate the treated water that is used clean the filters.

As filtrate is directed to the treated water storage reservoir, it is passed through one of two available UV reactors for disinfection. A super-chlorinated solution (secondary disinfection – gas chlorine) and sodium hydroxide (pH adjustment) are also applied to the filtrate. Disinfected water is stored in the reservoir and is transferred to the Hudson distribution system by the use of pumps located at the WTP.

The Hudson distribution system was installed exclusively in 1990 and includes approximately 6 km of water mains, 46 water main gate valves, and 7 hydrants. Watermain materials consist of HDPE and PVC, ranging in size from 50 to 150 mm in diameter. Secondary disinfection requirements in the distribution system are achieved by the maintenance of a free chlorine residual.

Water Treatment Chemicals

In accordance with section 11 of O. Reg. 170/03, this Report must include a list of all water treatment chemicals used by the system during the period covered by the report (**Table 1**). All chemicals used in the treatment process are NSF/ANSI 60 certified for use in potable water, as required by system approvals. The Hudson Drinking Water System did not require the use of polymer as a flocculant or sodium metabisulfite as a dechlorinating agent during the reporting period.

Table 1: Water treatment chemicals used in 2016.

Treatment Chemical	Application
polyaluminum chloride (SternPAC)	coagulant
sodium hydroxide (25%)	pH/alkalinity adjustment
chlorine gas	secondary disinfectant

System Expenses

In accordance with section 11 of O. Reg. 170/03, this Report must describe any major expenses incurred during the reporting period to install, repair or replace required equipment. This Report also summarizes those expenses related to strengthening equipment inventories and to maintenance activities undertaken by subcontracted service providers. Major expenses incurred in 2016 include:

- > The replacement of the fuel tank at the raw water pumping station;
- > the replacement of the programmable logic controller at the raw water pumping station;
- > the replacement of the transient voltage suppression system at the raw water pumping station;
- > the purchase of three (3) inline pH sensors;
- > the purchase of two (2) rebuild kits for the differential regulating valves associated with gas chlorination equipment;
- > the purchase of a benchtop pH meter and probe;
- > the purchase of a UV intensity reference sensor; and,
- > the calibration verification of flow measuring devices.

Water Quality

In accordance with section 11 of O.Reg. 170/03, this Report must summarize the results of water quality tests required by regulations, approvals, and orders. The following sections use technical water quality 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* available at the following website: <http://www.ontla.on.ca/library/repository/mon/14000/263450.pdf>. 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.

Operational Parameters

In accordance with Schedule 7 (Operational checks) of O. Reg. 170/03, regulated operational parameters that must be monitored include raw water turbidity, filtrate turbidity, and the free chlorine residuals associated with primary and secondary disinfection. The Hudson DWS employs a comprehensive monitoring program that extends beyond these regulated operational parameters to include additional tests conducted on source, process and treated water samples. **Table 2** summarizes water quality results for regulated and selected unregulated operational parameters. In accordance with Schedule 6 (Operational checks, sampling and testing – general) of O. Reg. 170/03, certain operational parameters are continuously monitored.

Table 2: Results summary for operational parameters.

Parameter (Sample Type) ¹	Sample Method (Minimum Frequency)	Units	Minimum Result	Maximum Result	Annual Average	Adverse Result ²
Turbidity (Raw Water)	Grab (3x weekly)	NTU	0.60	2.51	1.22	n/a
Turbidity (Filter 1)	Continuous	NTU	0.02	2.83	0.04	>1.0
Turbidity (Filter 2)	Continuous	NTU	0.02	2.00	0.04	>1.0
Turbidity (Treated)	Continuous	NTU	0.21	1.69	0.39	n/a
pH (Treated)	Continuous	---	7.16	8.23	7.59	n/a
FRC (Treated)	Continuous	mg/L	0.51	1.85	1.06	n/a
FRC (Distribution)	Grab (Daily)	mg/L	0.41	1.62	0.82	<0.05

1. FRC = free residual chlorine.

2. Adverse results are prescribed within Schedule 16 of O. Reg. 170/03. There are additional factors not included in the table which are necessary to determine whether a result is adverse, such as the duration of the result and whether water is being directed to the next stage of the treatment process.

Conventional Filtration Performance

In accordance with the *Procedure for Disinfection of Drinking Water in Ontario*, conventional filtration facilities must meet certain performance criteria in order to claim log removal and inactivation credits for credits for *Cryptosporidium* oocysts, *Giardia* cysts and viruses. In addition to continuously monitoring filtrate turbidity and other requirements, filtrate turbidity must be less than or equal to 0.3 NTU in at least 95% of the measurements each month. **Table 3** summarizes filtrate turbidity compliance against the <0.3 NTU/95% performance criterion. Minimum and maximum values in the table correspond to the proportion of time that filtered water turbidity was less than or equal to 0.3 NTU in a calendar month in 2016.

Table 3: Conventional filtration performance.

Filter	Monthly Min.	Monthly Max.	Adverse Result
Filter 1	99.8% (February)	100%	<95%
Filter 2	99.8% (April)	100%	<95%
Combined	99.9% (February)	100%	<95%

Microbiological Parameters

Microbiological analyses are performed on source, treated, and distribution system water. 260 routine water samples were collected for microbiological analysis by an accredited laboratory in 2016, as required by Schedule 10 (Microbiological sampling and testing) of O. Reg. 170/03. These water samples were collected on a weekly basis, and included tests for E. coli (EC), total coliforms (TC), and heterotrophic plate counts (HPC). Results from microbiological analyses are provided in **Table 4**. All results were below the associated Ontario Drinking Water Quality Standards.

Table 4: Microbiological sampling results.

Sample Type	# of Samples	EC Results Range ¹ (MPN/100mL)	TC Results Range ¹ (MPN/100mL)	# of HPC Samples	HPC Results Range (CFU/mL)
Raw Water	52	<1 to 12	<1 to 249	---	---
Treated Water	52	absent	absent	51	0 to 119
Distribution	156	absent	absent	50	0 to 5

1. The Ontario Drinking Water Quality Standard for E. Coli and Total Coliforms in a treated or distribution sample is 'not detectable'. The presence of either parameter in a treated or distribution sample is considered an exceedance.

Environmental Discharge Sampling

The Municipal Drinking Water Licence for the Hudson DWS requires additional sampling associated with environmental discharges. Specifically, samples must be collected on a quarterly basis from settling tank effluent and analyzed for the parameter total suspended solids (TSS). This effluent is discharged to a disbursement field which has been designed for the management of residues produced during the normal operation of the WTP. Results of environmental discharge sampling are provided in **Table 5**.

Trihalomethanes

Trihalomethanes (THMs) are required to be sampled on a quarterly basis from a distribution system location that is likely to have an elevated potential for THM formation, in accordance with Schedule 13 (Chemical sampling and testing) 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 100 µg/L). Total THM results are summarized in **Table 6**.

Nitrate and Nitrite

Treated water is tested for nitrate and nitrite concentrations on a quarterly basis in accordance with Schedule 13 (Chemical sampling and testing) of O. Reg. 170/03. Nitrate and nitrite results are provided in **Table 7**. All results were below the Ontario Drinking Water Quality Standards.

Table 5: Environmental discharge results.

Sample Date	TSS Result (mg/L)
23-Feb-2016	90.7
09-May-2016	341
09-Aug-2016	154
08-Nov-2016	<2.0

Table 6: Total THM results.

Sample Date	Result (µg/L)
16-Feb-2016	50.4
9-May-2016	70.9
9-Aug-2016	104
8-Nov-2016	73.8
Average	74.8
ODWQS (RAA)	100

Table 7: Nitrate and nitrite results.

Sample Date	Nitrate Result (mg/L)	Nitrite Result (mg/L)	Nitrate + Nitrite (mg/L)
16-Feb-2016	0.053	<0.010	0.053
9-May-2016	<0.020	<0.010	<0.040
9-Aug-2016	<0.020	<0.010	<0.040
8-Nov-2016	<0.020	<0.010	<0.040
ODWQS	10	1	10

Lead Sampling

The Hudson DWS followed the reduced lead sampling schedule in accordance with Schedule 15.1 (Lead) of O. Reg. 170/03 during the first sampling period in 2016 (i.e. between December 15, 2015 and April 15, 2016). In the second sampling period in 2016 (i.e. between June 15, 2016 and October 15, 2016), the Hudson DWS followed the standard lead sampling schedule. Beginning in 2017, the system will adhere to the lead monitoring program outlined in the system's *Municipal Drinking Water Licence*. **Table 8** summarizes the results of community lead sampling conducted in 2016.

Inorganic & Organic Parameters

Inorganic and organic parameters are sampled on an annual basis in treated water in accordance with Schedules 13 (Chemical sampling and testing), 23 (Inorganic parameters) and 24 (Organic parameters) of O. Reg. 170/03. The most recent inorganic parameter sampling results are provided in **Table 9**. All results were below the associated ODWQ Standards.

Organic parameters include various acids, pesticides, herbicides, PCBs, volatile organics, and other organic chemicals. Organic parameter sampling results are provided in **Table 10** on the following page. Sampling for all organic parameters was conducted on February 16, 2016. All results were below the associated ODWQS Standards.

Table 8: Lead sampling results.

Sample Type	Distribution	Plumbing ¹
Total No. of Sample Points ²	4	22
Total No. of Samples	4	44
Minimum Result (µg/L)	<1.0	<1.0
Maximum Result (µg/L)	2.3	19.5
No. of Sample Points greater than ODWQS (>10 µg/L)	0	2
No. of Samples greater than ODWQS (>10 µg/L)	0	2
No. of Samples between LDL ³ and ODWQS (1 - 10 µg/L)	1	19
No. of Samples below LDL (<1.0 µg/L)	3	23

1. Results provided for plumbing samples include resamples.
2. In accordance with the sampling protocol outlined in Schedule 15.1 of O. Reg. 170/03, two samples are collected and analyzed for lead at each sample point for plumbing samples.
3. LDL = lower detectable limit (i.e. <1.0 µg/L); lead concentrations below the LDL are not detected by the analytical method.

Table 9: Inorganic sampling results.

Parameter	Sample Date	Units	Result	ODWQS
Antimony	16-Feb-2016	µg/L	<0.60	6
Arsenic	16-Feb-2016	µg/L	<1.0	25
Barium	16-Feb-2016	µg/L	<10	1000
Boron	16-Feb-2016	µg/L	<50	5000
Cadmium	16-Feb-2016	µg/L	<0.10	5
Chromium	16-Feb-2016	µg/L	<1.0	50
Fluoride ¹	17-Feb-2015	mg/L	<0.020	1.5
Mercury	16-Feb-2016	µg/L	<0.10	1
Selenium	16-Feb-2016	µg/L	<1.0	10
Sodium ¹	17-Feb-2015	mg/L	6.87	20
Uranium	16-Feb-2016	µg/L	<2.0	20

1. Fluoride and sodium are sampled every five (5) years in accordance with Schedules 13 and 23 of O. Reg. 170/03.

Table 10: Organic parameter sampling results.

Parameter	Result (µg/L)	ODWQS (µg/L)	Parameter	Result (µg/L)	ODWQS (µg/L)
Alachlor	<0.10	5	Diuron	<1.0	150
Atrazine + N-dealkylated metabolites	<0.20	5	Glyphosate	<5.0	280
Azinphos-methyl	<0.10	20	Malathion	<0.10	190
Benzene	<0.50	1	2-Methyl-4-Chlorophenoxy-acetic acid (MCPA)	<0.20	100
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	<0.50	2	Pentachlorophenol	<0.50	60
Chlorpyrifos	<0.10	90	Phorate	<0.10	2
Diazinon	<0.10	20	Picloram	<0.20	190
Dicamba	<0.20	120	Polychlorinated Biphenyls (PCBs)	<0.035	3
1,2-Dichlorobenzene	<0.50	200	Prometryne	<0.10	1
1,4-Dichlorobenzene	<0.50	5	Simazine	<0.10	10
1,2-Dichloroethane	<0.50	5	Terbufos	<0.20	1
1,1-Dichloroethylene	<0.50	14	Tetrachloroethylene	<0.50	30
Dichloromethane	<5.0	50	2,3,4,6-Tetrachlorophenol	<0.50	100
2,4 -Dichlorophenol	<0.30	900	Triallate	<0.10	230
2,4-Dichlorophenoxy acetic acid	<0.20	100	Trichloroethylene	<0.50	5
Diclofop-methyl	<0.20	9	2,4,6-Trichlorophenol	<0.50	5
Dimethoate	<0.10	20	Trifluralin	<0.10	45
Diquat	<1.0	70	Vinyl Chloride	<0.20	1

Flow Monitoring

In accordance with Schedule 22 (Summary Reports for Municipalities) of O. Reg. 170/03, this Annual Report must include certain information for the purpose of enabling the Owner to assess the capability of the system to meet existing and planned uses. Specifically, this Report must include a summary of the quantities and flow rates of the water supplied during the reporting period, including monthly average and maximum daily flows. The Report must also include a comparison of flow monitoring results to the rated capacity and flow rates approved in the system's Municipal Drinking Water Licence.

Throughout the reporting period, the Hudson DWS operated within its rated capacity and supplied a total of 21,186 m³ of treated water. On an average day in 2016, 57.9 m³ of treated water was supplied to the community. The average daily flow in 2016 represents 8% of the rated capacity of the Hudson WTP (726 m³/day). The maximum daily flow in 2016 was 118.9 m³/day, which represents 16% of the rated capacity of the Hudson WTP. 2016 flow monitoring results are summarized in **Table 11** and **Figure 1**.

Table 11: 2016 total volumes, daily flows, and capacity assessments.

Month	Total Volumes (m ³)		Daily Flows (m ³ /day)		Capacity Assessments ¹	
	Raw Water	Treated Water	Average - Treated Water	Maximum - Treated Water	Average - Treated Water	Maximum - Treated Water
Jan	2,293	1,728	55.7	108.6	8%	15%
Feb	1,998	1,460	50.4	67.6	7%	9%
Mar	2,100	1,526	49.2	57.2	7%	8%
Apr	2,027	1,549	51.6	62.0	7%	9%
May	2,383	1,883	60.7	97.8	8%	13%
Jun	2,260	1,789	59.6	96.5	8%	13%
Jul	2,438	1,984	64.0	118.9	9%	16%
Aug	2,296	1,840	59.3	111.5	8%	15%
Sep	2,251	1,632	54.4	108.0	7%	15%
Oct	2,357	1,892	61.0	88.1	8%	12%
Nov	2,318	1,832	61.1	79.1	8%	11%
Dec	2,605	2,073	66.9	104.0	9%	14%
Total	27,326	21,186	---	---	---	---
Avg.	2,277	1,766	57.9	---	8%	---

1. Capacity assessments compare average and maximum daily treated water flows to the rated capacity of the treatment facility (726 m³/day), as provided within the Municipal Drinking Water Licence for the Hudson DWS.

Figure 1: 2016 average and maximum daily treated water flows.

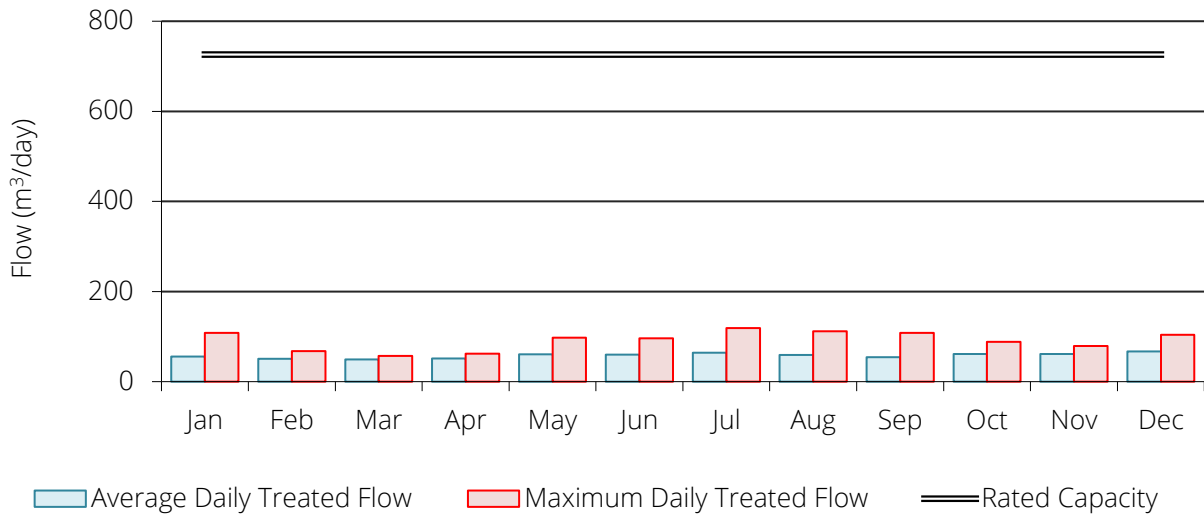


Table 12 summarizes annual flow monitoring results for the Hudson DWS. There were modest reductions in the amounts of source water withdrawn and treated water supplied in 2016 when compared to 2015. Total annual volumes of treated water supplied in the near future may be expected to be between 15,000 m³ and 35,000 m³, which represents approximately 6% to 13% of the rated capacity of the Hudson WTP.

Table 12: Recent historical flow monitoring results.

Year	Total Volumes (m ³)		Daily Flows (m ³ /day)		Annual % Change	
	Raw Water	Treated Water	Average – Treated Water	Maximum – Treated Water	Raw Water	Treated Water
2011	52,922	45,980	126.0	238.1	+23.2%	+22.7%
2012	33,668	25,760	70.4	236.0	-36.4%	-44.0%
2013	28,380	20,642	56.6	135.9	-15.7%	-19.9%
2014	32,466	24,077	66.0	201.8	+14.4%	+16.6%
2015	29,321	22,501	61.6	157.0	-9.7%	-6.5%
2016	27,326	21,186	57.9	118.9	-6.8%	-5.8%

Compliance

Northern Waterworks Incorporated and the Municipality of Sioux Lookout employ an operational strategy that is committed to achieving the following goals:

- 1) Providing a safe and reliable supply of drinking water to the community of Hudson;
- 2) Meeting or exceeding all applicable legislative and regulatory requirements;
- 3) Maintaining and continually improving the operation and maintenance of the system; and,
- 4) Maintaining and operating the Hudson Drinking Water System in a responsible manner in accordance with documented quality management system policies and procedures.

The following sections will summarize incidents of adverse water quality and noncompliance that occurred during the reporting period. NWI is committed to employing timely and effective corrective actions to prevent recurrence of all identified incidents of noncompliance and adverse water quality.

Adverse Water Quality Incidents

In accordance with section 11 (Annual Reports) of O. Reg. 170/03, this Report must summarize any reports made to the Ministry under subsection 18(1) (Duty to report adverse test results) of *the Act* or section 16-4 (Duty to report other observations) of Schedule 16 of O. Reg. 170/03. Additionally, this Report must describe any corrective actions taken under Schedule 17 of O. Reg. 170/03 during the period covered by the report.

There were no adverse water quality incidents during the report period for the Hudson DWS.

Regulatory Noncompliance

In accordance with Schedule 22 (Summary Reports for Municipalities) of O. Reg. 170/03, this Report must list any requirements of the *Act*, the regulations, the system's approval, drinking water works permit, municipal drinking water licence, and any orders applicable to the system that were not met at any time during the period covered by the report (i.e. an incident of regulatory noncompliance). Additionally, this Report must specify the duration of the failure and the measures that were taken to correct the failure.

Two (2) incidents of regulatory noncompliance were identified during the most recent inspection by Ontario's Ministry of the Environment and Climate Change (MOECC) initiated on May 24, 2016:

- The process wastewater discharge monitoring program and discharge quality did not comply with requirements established in the Municipal Drinking Water Licence issued under Part V of the SDWA.

MDWL #236-101, Schedule C, Section 4.2 states that quarterly composite samples must be taken on the effluent side of the settling tank and tested for total suspended solids (TSS). Each composite must include a sample taken at the start, half-way through and near the end of a backwash cycle to obtain a composite sample representative of the entire backwash cycle. Wastewater samples were collected and tested for TSS three out of the four quarters represented by the inspection review period; operators forgot to take a sample during the third quarter of 2015. Of the three samples that were taken, TSS results ranged from 2.8 mg/L to 341 mg/L. MDWL #236-101 does not contain discharge limits for TSS.

Since the missed sample in August 2015, operators have collected all required quarterly composite samples, each done in accordance with the requirements of MDWL #236-101. Northern Waterworks Inc. also instituted a sampling tracking and reminder system in an effort to prevent similar noncompliance items from occurring in the future.

- All changes to the system registration information were not provided within ten (10) days of the change.

At the time of the inspection, the DWS profile information was reviewed with the ORO. The email address for the "24/7 Contact" was no longer accurate. The inspection report required that the profile information be updated by July 29, 2016, by submitting a completed *Drinking Water System Profile Information* form to appropriate parties.

A completed *Drinking Water System Profile Information* form was completed and submitted on July 14, 2016, and it was updated to specify that the 24/7 contact was the on-call operator and that the corresponding email address was the project-specific NWI email address (i.e. siouxlookout@nwi.ca).