A G E N D A

"Greenwood Source Water Protection Advisory Committee Meeting"

Greenwood Village Office, Greenwood N.S.

September 26, 2018
10:00 a.m.

1. Meeting to Order

2. Roll Call

3. Amendments to the Agenda

4. Approval of the agenda

5. Business Arising from previous minutes
   - Draft of Conservation By-law
   - Public Education – Information Packets (Septic System Guide)

6. Approval of Minutes

7. Disclosure of Conflict of Interest

8. Business
   - Management Plan Evaluation
     Agricultural Best Management Practices
   - Citizen Representative (Term)

9. Other Business
   - Municipal Land-Use Planning updates
   - Landowner concerns

10. Correspondence

11. Date of Next Meeting

12. Public Comments

13. Adjournment

GREENWOOD SOURCE WATER PROTECTION
ADVISORY COMMITTEE
MINUTES OF March 29, 2018

1. Meeting to Order:
Chairperson Paul Spicer called the meeting to order at 10:00 a.m.

2. Roll Call:
Attending:
Councilor Paul Spicer, Chair
Holden Armstrong, Citizen Representative
Commissioner Bob Baker, Village of Greenwood
Mark Fredericks, Planner, Municipality of Kings County
Lisa Langille, Compliance Officer, Municipality of Kings County
Dawn MacNeill, Nova Scotia Environment

Regrets:
Scott Quinn, Director EPW, Lands and Parks

3. Amendments to the Agenda:
None

4. Approval of the Agenda:

The agenda for the March 29, 2018 meeting of the Greenwood Source Water Advisory Committee was circulated.

Commissioner Baker moved for approval of the agenda; seconded by Mr. Armstrong. MOTION CARRIED.

5. Business Arising from the Minutes:
Generator – Lisa Langille reviewed the background to this project. It was established that a diesel generator was not ideal to have in a wellfield. A propane one was purchased and is now installed and operational.

It was discussed that there would be a tour of the wellfield offered for the next meeting to see the new generator.

6. Approval of the Minutes:
The minutes of the October, 16, 2017 meeting of the Greenwood Source Water Advisory Committee were circulated with the agenda and reviewed.

Mr. Armstrong moved for approval of the minutes and was seconded by Commissioner Baker.

7. <u>Disclosure of Conflict of Interest:</u>
None

8. <u>Business:</u>
Water Conservation by-law – Background; as an item for our approval to operate, we are required to have a water conservation plan in place and in addition to this, we had a study done in 2017 by Terry Hennigar to determine parameters for conservation with our well levels. We currently have a water conservation plan in place but all elements of it are voluntary. To add an element of enforcement, it was determined that a bylaw would be a good tool. It was discussed that a Draft of the Conservation By-law will be submitted to the Source Water Protection Committee for comment by June 1st.

Management Plan Evaluation – It was asked that the Monitoring Plan be distributed electronically.

- It was asked if there is a review date for the LUB's related to this plan. It was indicated that this would be part of the Municipal Planning Strategy that is happening right now.
- It was requested that a Review of new BMP's be added to the September agenda. Agricultural Best Management Practices has been updated.
- We have noticed conductivity and pH in monitoring Well #1 are affected by rainfall. The only difference is they have cleared the land in this area. We will continue to monitor. It was requested that a review of monitoring well depths vs production well depths be presented at the next meeting.
- pH of production wells were within guidelines.
- Microbial testing – one positive on raw, probably a post well contamination as all follow-up testing came back fine.
- 2 year and 5 year testing all came back in compliance.
- MPA sampling came back with two Giardia follow up testing indicated zero. We have UV treatment in place for this possibility. We are moving forward with some recommendations made by the consultant to improve the wellfield.

Education Discussion

- Information packets to remind people or communicate that they currently live in a wellfield. Something for Community Development to put something together. Digby is an example of a Town / Municipality,
- Dawn discussed a brochure that was published by the Village of Lawrencetown, which is a good educational tool. Lisa will contact them to determine if this were something they would be willing to share.

9. Other Business:

New Well – Looking at a back-up well to provide additional water as needed. This is located at Bedford Road. The water quality appears good. Will keep the committee apprised of updates.

Mark Fredericks reiterated the importance of public engagement, making sure people have the proper information delivered to them within the wellfield.

Questions about the land ownership and previous uses was discussed. Need to determine if there was a lift station or small sewage treatment plant there in the past.

Testing of this site has indicated it is most likely non-GUDI.

10. Correspondence:

None

11. Date of Next Meeting:

It was agreed the next meeting of the Committee will take place on Thursday, September 27, 2018 at 10 a.m.

12. Public Comments:

Agenda suggestion – Dawn MacNeill suggested additional agenda sections be added, 1. Landowner concerns and 2. Municipal Land use Planning updates. It was agreed these could be added under "Business".

It was suggested that a list of committee members be made available to the public, so they know whom to contact with concerns. Newsletter, tax bill, Village of Greenwood Website. In addition, a tab could be added to the website discussing the wellfield and providing public education.

Need to determine when the citizen representations is up and Holden Armstrong is interested in reoffering. Lisa will follow-up with Janny Postema.

13. Adjournment:

With no further business to discuss, the meeting was adjourned at 11:14am as moved by Commissioner Baker and seconded by Mark Fredericks.

MUNICIPALITY OF THE COUNTY OF KINGS

For By-Law information contact the Municipal Clerk
Tel: (902) 678-6141 Fax: (902) 678-9279 E-mail: municipalclerk@countyofkings.ca

BY-LAW # xxx

MUNICPAL WATER CONSERVATION

SUBTITLE

A By-law to regulate the consumption of water in accordance with the Municipality's Source Water Protection Plans.

PREAMBLE & ENACTMENT

WHEREAS the Municipality owns and operates Municipal Water Utilities, public water utilities serving the Village of Greenwood and the Village of Aylesford (Sandy Court);

AND WHEREAS the Municipality is required through regulations enabled under the legislation to implement a Source Water Protection Plan to ensure the long term sustainability of the ground water source supplying the Municipal Water Utilities;

AND WHEREAS the Source Water Protection Plan is based on the following principles:

The development and maintenance of a mutually beneficial, locally developed and administered Source Water Protection Program that protects the water source(s) of Municipal Water Utilities. The goal of the plan is to protect source water of the Municipal Water Utilities.

AND WHEREAS the Municipality desires to enact a by-law to temporarily limit water consumption that is not required to support public health and safety in times of high demand to satisfy regulatory requirements or operational requirements;

BE IT ENACTED by the Council of the Municipality as follows:

PART 1: TITLE

This By-law may be cited as the Water Conservation By-law for the Municipality of the County of Kings, and shall apply to the area serviced by the Municipality.

PART 2: INTERPRETATION

In this By-law the word "shall" is mandatory and not permissive. Word used in the present tense shall include the future. Words used in the singular shall include the plural except where otherwise indicated, and words used in the plural shall include the singular.

PART 3: DEFINITIONS

3.1 AESTHETIC CLEANING means the use of water for cleaning when it is not for a health or safety reason.

3.2 AESTHETIC WATER FEATURE means a fountain, pond, or other water feature that primarily serves an aesthetic purpose. It does not include ponds that contain fish.

3.3 AUTOMATIC SHUT-OFF DEVICE means a device attached to a water hose that shuts off the supply of water automatically unless hand pressure is applied to operate the device.

3.4 COMMERCIAL CLEANING OPERATION means a company, partnership or person that offers commercial cleaning services, including pressure washing, window cleaning and other similar building cleaning services, to the public for a fee.

3.5 COMMERCIAL VEHICLE WASHING means commercial vehicle washing services offered to the public for a fee, but excludes car dealerships, fleet vehicle washing facilities, and charity car washes.

3.6 COUNCIL means the Council of the Municipality.

3.7 DRIP IRRIGATION means an irrigation system that delivers water directly to the root zone of the plant at a low flow rate through individual emission points (emitters) using droplets of water and excludes sprinkler irrigation systems, micro-spray systems, misting systems, and soaker hoses.

3.8 EDIBLE PLANT means a plant grown for the purpose of human consumption.

3.9 ENGINEER means the Director of Engineering and Public Works, Lands, and Park Services of the Municipality and includes a person acting under the supervision and direction of the Engineer.

3.10 GOLF COURSE means the greens, tee areas, and fairways that are designed and maintained as playing surfaces for golf, but does not include rough areas or lawns that are not maintained as playing surfaces.

3.11 GWU means the Greenwood Water Utility, a public water utility owned by the Municipality.

3.12 IMPERMEABLE SURFACE means a material added to the surface of the ground, or on the exterior of a building or structure that is impermeable to water, including but not limited to glass, wood, concrete, asphalt, paving stones and other similar materials.

3.13 LAWN means a cultivated area surrounding or adjacent to a building that is covered by grass, turf, or a ground cover plant such as clover, including areas such as boulevards, parks, school yards and cemeteries, but excluding golf courses, soil-based playing fields, and sand-based playing fields.

3.14 MUNICIPALITY means the Municipality of the County of Kings.

3.15 NEW LAWN means a Lawn that is newly established either by seeding or laying of new sod or turf.

3.16 OWNER as it refers to the owner of the property includes:

i. a part owner, joint owner, tenant in common or joint tenant of the whole or any part or parcel of land or a building;

ii. In the case of the absence or incapacity of the Person having title to the Lot or Building, a trustee, an executor, an administrator, a guardian, an agent, a mortgagee in possession or other Person having the care or control of any Lot or Building; and

iii. In the absence of proof to the contrary, the Person assessed for the taxes on the parcel of land or building.

3.17 PERMIT means a permit issued under Part 5 of the By-law.

3.18 PERSON includes a corporation and the heirs, executors, administrators or other legal representatives of a Person, but specifically excludes the Municipality.

3.19 PUBLIC ANNOUNCEMENT means an advertisement or public service announcement in any of following mediums:

(a) a television or radio broadcast from a station that broadcasts to the area;

(b) a newspaper or other publication intended for general circulation, including one that is distributed without charge to the reader that contains news and advertising, and is distributed within the area at least once per week; and

(c) other methods as prescribed in a communication plan approved by Policy of Council.

3.20 RESTRICTION STAGE means restrictions upon the use of water as prescribed in this By-law.

3.21 SAND-BASED PLAYING FIELD means a playing field that is constructed with a highly permeable sand-based root zone typically 30 to 40 centimetres deep over a drainage system with drain pipes bedded in gravel, and is designed and maintained to be playable year-round.

3.22 SCWU means the (Aylesford) Sandy Court Water Utility, a public water utility owned by the Municipality.

3.23 SOAKER HOSE means a garden hose or pipe with small holes that allows water to seep into the ground to the roots of plants, discharging water through the entire length of its porous surface.

3.24 SOIL-BASED PLAYING FIELD means a playing field that is covered with grass, sod or turf that is designed and maintained to be played upon, or that is used for sporting or other community events and activities, but does not include lawns, golf courses, or sand-based playing fields.

3.25 WATER used as a noun means Water supplied directly or indirectly by Municipal Utilities, whether or not mixed with rain Water, gray Water or recycled Water.

3.26 WATER used as a verb, and "Watering" or "Watered", mean the application or distribution of Water (used as a noun) to lands or plants but does not include Drip Irrigation.

3.27 WATER MANAGEMENT PLAN means a plan proposed by the owner or operator of a golf course, soil-based playing field, and sand-based playing field operators and approved by the Municipality of Kings. The plan sets out terms such as water use targets

during the different stages of conservation, restrictions to reduce water use, and reporting requirements for the owner or operator.

3.28 WATER PLAY PARK means a recreational facility that is primarily outdoors, including spray pools and wading pools, spray parks, splash pads, and water slides.

3.29 WATERING LAWN means applying water to a lawn with any device or tool including but not limited to a sprinkler, hose, mister, or drip irrigation.

3.30 WATER SYSTEM means a water system; consisting of the source, structures, pipes, hydrants, meters, service laterals, devices, equipment or other things used, or intended, for the collection, transportation, pumping or treatment of water.

PART 4: IMPLEMENTATION OF WATER USE RESTRICTIONS

4.1 Stage 1 Restrictions are effective within all areas serviced by the Utility from May 15 to October 15 each year. The Engineer may suspend Stage 1 Restrictions, and rescind same, if, in the Engineer's opinion, there has been higher than average rainfall amounts and that a suspension will not adversely impact the Utility.

4.2 The Engineer is authorized to activate, extend or deactivate any Restriction Stages 2 through 4 inclusive as prescribed in Schedule "A" of this By-law, in the Engineer's opinion:

a) Seasonal
b) drought conditions, or other water shortage
c) activated based on the rare occurrence of a significant emergency, such as an earthquake, flood, wild land and interface fire, severe weather, or a prolonged regional power outage that causes significant impacts to the water system infrastructure (e.g. damage to major water transmission lines, pump stations, or treatment plants).

4.3 The Municipality, in its absolute discretion, is authorized to impose at any time any other water use regulation, which it deems advisable to further limit the hours of external water use on permitted days and to ban completely the external use of water at any time.

4.4

a) The Engineer shall make a Public Announcement when either:
   i. Stage 1 Restrictions have been suspended under Section 4.1; or
   ii. Any additional restrictions that is activated, extended, or deactivated under Sections 4.2 and 4.3.
b) Public Announcements will include:
   i. The effective date of any actions implemented under Sections 4.1, 4.2 or 4.3;
   ii. Information on additional restrictions activated or extended as per Sections 4.2 and 4.3; or
   iii. Other information that the Engineer deems necessary for implementation of any provisions of Part 4.

4.5 Following a Public Announcement for the activation or extension of any additional restrictions, no Person shall use Water except in accordance the restriction in force at the time.

PART 5: WATER MANAGEMENT VARIANCE

5.1 The Owner of a Golf Course, Soil-Based Playing Field, or a Sand-Based Playing Field may apply in writing to the Engineer for a Water Management Variance to have their water usage regulated by a Water Management Plan. A variance is valid for three (3) years from the date of approval, inclusive of that date.

5.2 The Owner or his/her agent shall submit an application for a Water Management Variance. The application shall be in the form prescribed by the Engineer, including a Water Management Plan as prescribed in Section 6.3. A Water Management Variance Application Fee, as set out by Policy of Council, shall be submitted with the application. An application is not complete until all supporting documentation and all fees required by Policy of Council are received by the Engineer. Within 30 business days of receipt of a complete application, the Engineer shall approve the application if it complies with this By-law. If the application is refused, the Engineer shall inform the applicant, in writing, of the reason(s) for the refusal.

5.3 Water Management Plan shall, at a minimum, contain the following information to the satisfaction of the Engineer:

(a) Map of the property subject to the Water Management Plan showing property boundary, areas to be Watered, connections to the Water System,
(b) Other sources of water at the subject property
(c) Water consumption rates between May 1 and October 15 of the previous 3 years;
(d) Proposed volume of Water to be consumed from May 1 to October 15 of each year for the term of the Water Management Variance;
(e) Measures that the Owner will use during the term of the Water Management Variance to conserve Water and to reduce the use of Water;
(f) Schedule for Watering specified areas within the operation for each Restrictions Stage, except Stage 4;
(g) reporting of actual Water use to the Engineer not less than once per month when Stage 1 Restrictions or Stage 2 Restrictions are in force, and not less than once every two weeks when Stage 3 Restrictions are in force; and
(h) any other information, commitments, conditions or restrictions the Engineer may require.

5.4 The Engineer may terminate or suspend a Water Management Variance by notifying the Owner or his/her agent in writing at least five business days before the termination or suspension date.

5.5 All Water Management Variances shall be suspended when the Engineer activates a Stage 4 Restriction or when the Municipality exercises its authority to impose further restrictions under Section 4.3. The suspension will terminate when the applicable restriction is deactivated.

5.6 An Owner may terminate a Water Management Variance by notifying the Engineer in writing on the date specified in the written termination or the date on which the Engineer receives the written termination, whichever is later.

5.7 An Owner may apply, in the same manner prescribed in Section 5.2, to modify an approved Water Management Variance.

PART 6: WATERING PERMIT

6.1 A Person who installs a new Lawn, either by seeding or by placing sod or turf or wishes to apply nematodes to an existing lawn may apply in writing to the Engineer for a Watering Permit may apply to the Engineer for a Permit authorizing the applicant to Water when Stage 1 Restrictions or Stage 2 Restrictions are in force. A permit is valid for twenty-one (21) calendar days from the date of approval, inclusive of that date. The applicant may apply for a one-time twenty-one (21) calendar day extension, except for Watering Permits issued for nematode application.

6.2 All applications for a permit or an extension shall be in the form prescribed by the Engineer. A Watering Permit Application Fee, as set out by Policy of Council, shall be submitted with the application. An application is not complete until all supporting documentation and all fees required by Policy of Council are received by the Engineer. Within five (5) business days of receipt of a complete application, the Engineer shall approve the application if it complies with this By-law. If the application is refused, the Engineer shall inform the applicant, in writing, of the reason(s) for the refusal.

6.3 The Engineer will not approve any applications under Part 6 while a Stage 3 or a Stage 4 Restriction is in effect; or when the Municipality has imposed further restrictions under Section 4.3.

6.4 All Watering Permits shall be suspended when the Engineer activates a Stage 3 of a Stage 4 or Restriction; or when the Municipality exercises its authority to impose further restrictions under Section 4.3. The suspension will terminate when the applicable restriction is deactivated.

6.5 A Person who has been issued a Watering Permit must fix the Watering Permit to a post on the premises facing the street, beside the principal driveway so that it is visible from the street.

6.6 The Engineer may revoke a Permit issued under this section for any reason.

PART 7: OFFENCES AND PENALTIES

Any Person who violates any of the provisions of this By-law shall be guilty of an offence and shall be liable on summary conviction to a fine not exceeding the sum of $10,000.00 and not less than $275.00, and each day during which any violation, contravention or breach shall continue shall be deemed as a separate offence.

PART 8: MUNICIPALITY EXEMPTION

Notwithstanding the activation of any stage of water restrictions, the Municipality may use water and is exempt from the water restrictions applicable to that stage, where use of water is needed to carry out activities needed for protecting public health and safety.

PART 9: SEVERABILITY

If any portion of this By-law is declared invalid by a court of competent jurisdiction, then the invalid portion must be severed and the remainder of the By-law is deemed valid.

PART 10: EFFECTIVE DATE

This By-law comes into force and effect on the XX day of XX, 2018.

Schedule "A" – Restriction Stages

GENERAL RESTRICTIONS FOR ALL STAGES (1 THROUGH 4)

1) All hoses must have an automatic shut-off device.
2) Water must not unnecessarily run off on impermeable surfaces such as driveways, curbs, pathways, or gutters when watering lawns and plants.
3) Artificial playing turf and outdoor tracks must not be watered except for a health or safety reason.
4) Hoses and taps must not run unnecessarily.
5) Irrigation systems must not be faulty, leaking, or misdirected.

STAGE 1 WATER RESTRICTIONS

User	Water Use	Restriction
RESIDENTIAL	Watering lawns	Even-numbered civic addresses: on Wednesdays and Saturdays from 4 am to 9 am Odd-numbered civic addresses: on Thursdays and Sundays from 4 am to 9 am
	Watering new lawns or lawns being treated for the European Chafer	Outside restricted lawn watering times if in compliance with a local government permit
	Watering trees, shrubs, and flowers excluding edible plants	On any day from 4 am to 9 am if using a sprinkler On any day at any time if using a handheld hose, soaker hose, water container, or drip irrigation
NON-RESIDENTIAL	Watering lawns (mixed-use buildings e.g. residential and commercial should follow Non-residential watering	Even-numbered civic addresses: on Mondays from 1 am to 6 am and on Fridays from 4 am to 9 am Odd-numbered civic addresses: on Tuesdays from 1 am to 6 am and on Fridays from 4 am to 9 am
	Watering new lawns or lawns being treated for European	Outside restricted lawn watering times if in compliance with a local government permit
	Watering trees, shrubs, and flowers excluding edible plants	On any day from 1 am to 9 am if using a sprinkler On any day at any time if using a handheld hose, soaker hose, water container, or drip irrigation

GOVERNMENTS/ SCHOOLS/PARKS	Watering lawns and grass boulevards	Even-numbered civic addresses: on Mondays from 1 am to 6 am and on Fridays from 4 am to 9 am Odd-numbered civic addresses: on Tuesdays from 1 am to 6 am and on Fridays from 4 am to 9 am
	Watering new lawns or lawns being treated for the European Chafer	Outside restricted lawn watering times if in compliance with a local government permit
	Watering trees, shrubs, and flowers excluding edible plants	On any day from 1 am to 9 am if using a sprinkler On any day at any time if using a handheld hose, soaker hose, water container, or drip irrigation
	Watering soil-based playing fields	On any day from 7 pm to 9 am, except if: - Watering newly over-seeded fields if in compliance with a local government permit - Operating under an approved local government water management plan
	Watering sand-based playing fields	On any day from 7 pm to 9 am, except if: - Watering newly over-seeded fields if in compliance with a local government permit - Operating under an approved local government water management plan
	Flushing water mains	Prohibited

STAGE 2 WATER RESTRICTIONS

User	Water Use	Restriction
RESIDENTIAL	Watering lawns	Even-numbered civic addresses: on Wednesdays from 4 am to 9 am Odd-numbered civic addresses: on Thursdays from 4 am to 9 am
	Watering new lawns or lawns being treated for the European Chafer Beetle	Outside restricted lawn watering times if in compliance with a local government permit
	Watering trees, shrubs, and flowers excluding edible plants	On any day from 4 am to 9 am if using a sprinkler On any day at any time if using a handheld hose, soaker hose, water container, or drip irrigation
	Washing impermeable surfaces	Prohibited except if: - For a health or safety reason - Preparing a surface for painting or similar treatment - Aesthetic cleaning by a commercial cleaning operation
	Topping up or filling aesthetic water features	Prohibited

User	Water Use	Restriction
NON-RESIDENTIAL	Watering lawns (mixed-use buildings e.g. residential and commercial should follow Non- residential watering times)	Even-numbered civic addresses: on Mondays from 1 am to 6 am Odd-numbered civic addresses: on Tuesdays from 1 am to 6 am
	Watering new lawns or lawns being treated for the European Chafer Beetle	Outside restricted lawn watering times if in compliance with a local government permit
	Watering trees, shrubs, and flowers excluding edible plants	On any day from 1 am to 9 am if using a sprinkler On any day at any time if using a handheld hose, soaker hose, water container, or drip irrigation
	Watering golf courses	Fairways watering anytime on any one day in a 7-day period, except if operating under an approved local government water management plan
	Washing impermeable surfaces	Prohibited except if: - For a health or safety reason - Preparing a surface for painting or similar treatment - Aesthetic cleaning by a commercial cleaning operation
	Topping up or filling aesthetic water features	Prohibited

User	Water Use	Restriction
GOVERNMENTS/SCHOOLS/PARKS	Watering lawns and grass boulevards	Even-numbered civic addresses: on Mondays from 1 am to 6 am Odd-numbered civic addresses: on Tuesdays from 1 am to 6 am
	Watering new lawns or lawns being treated for the European Chafer Beetle	Outside restricted lawn watering times if in compliance with a local government permit
	Watering trees, shrubs, and flowers excluding edible plants	On any day from 1 am to 9 am if using a sprinkler On any day at any time if using a handheld hose, soaker hose, water container, or drip irrigation
	Watering soil-based playing fields	No more than 4 days in a 7-day period from 7 pm to 9 am, except if: - Watering newly over-seeded fields if in compliance with a local government permit - Operating under an approved local government water management plan
	Watering sand-based playing fields	On any day from 7 pm to 9 am, except if: - Watering newly over-seeded fields if in compliance with a local government permit - Operating under an approved local government water management plan
	Flushing water mains	Prohibited
	Operating water play parks and pools	Prohibited except water play parks with user-activated switches
	Topping up or filling aesthetic water features	Prohibited

PART 3 – STAGE 3 WATER RESTRICTIONS

Stage 3 restrictions respond to serious drought conditions, or other water shortage, and achieve further reductions in drinking water use by implementing a lawn watering ban and additional stricter measures.

User	Water Use	Restriction
RESIDENTIAL	Watering lawns	Prohibited
	Watering new lawns or lawns being treated for the European Chafer Beetle	Local government permits issued in Stages 1 or 2 remain in effect until permit expires No new permits issued or renewed
	Watering trees, shrubs, and flowers excluding edible plants	Prohibited if using a sprinkler or soaker hose On any day at any time if using a handheld hose, water container, or drip irrigation
	Washing impermeable surfaces	Prohibited except if: - For a health or safety reason - Preparing a surface for painting or similar treatment by a commercial cleaning operation
	Topping up or filling aesthetic water features	Prohibited
	Topping up or filling pools and hot tubs	Prohibited
	Washing vehicles and boats	Prohibited except to clean windows, lights, mirrors, license plates, and boat engines for safety

User	Water Use	Restriction
NON-RESIDENTIAL	Watering lawns (mixed-use buildings e.g. residential and commercial should follow Non- residential watering times)	Prohibited
	Watering new lawns or lawns being treated for the European Chafer Beetle	Local government permits issued in Stages 1 or 2 remain in effect until permit expires No new permits issued or renewed
	Watering trees, shrubs, and flowers excluding edible plants	Prohibited if using a sprinkler or soaker hose On any day at any time if using a handheld hose, water container, or drip irrigation
	Watering golf courses	Fairways watering prohibited except if operating under an approved local government water management plan
	Washing impermeable surfaces	Prohibited except if: - For a health or safety reason - Preparing a surface for painting or similar treatment by a commercial cleaning operation
	Topping up or filling aesthetic water features	Prohibited
	Topping up or filling pools and hot tubs	Prohibited except for pools and hot tubs with a permit to operate in accordance with health authorities having jurisdiction over pool and hot tub regulation
	Washing vehicles and boats	Prohibited except to clean windows, lights, mirrors, licence plates, and boat engines for safety
	Commercial vehicle washing	Prohibited except if: - A facility that installed an automatic vehicle wash system before November 1, 2017, is operating on a basic wash and rinse cycle only - A facility that installed an automatic vehicle wash system after November 1, 2017, is operating using a water recycling system that achieves a minimum 60% water recovery rate over the full wash cycle A hand wash and self-service facility, is operating using high-pressure wands or brushes that achieve a maximum flow rate of 11.4 litres per minute

User	Water Use	Restriction
GOVERNMENTS/SCHOOLS/PARKS	Watering lawns and grass boulevards	Prohibited
	Watering new lawns or lawns being treated for the European Chafer Beetle	Local government permits issued in Stages 1 or 2 remain in effect until permit expires No new permits issued or renewed
	Watering trees, shrubs, and flowers	Prohibited if using a sprinkler or soaker hose On any day at any time if using a handheld hose, water container, or drip irrigation
	Watering soil-based playing fields	No more than 3 days in a 7-day period from 7 pm to 9 am except if: - Watering newly over-seeded fields if in compliance with a local government permit - Operating under an approved local government water management plan
	Watering sand-based playing fields	No more than 5 days in a 7-day period from 7 pm to 9 am, except if: - Watering newly over-seeded fields if in compliance with a local government permit - Operating under an approved local government water management plan
	Flushing water mains	Prohibited
	Operating water play parks	Prohibited except water play parks with user-activated switches
	Topping up or filling aesthetic water features	Prohibited
	Topping up or filling pools and hot tubs	Prohibited except for pools and hot tubs with a permit to operate in accordance with health authorities having jurisdiction over pool and hot tub regulation
	Washing vehicles and boats	Prohibited except to clean windows, lights, mirrors, licence plates, and boat engines for safety

PART 4 – STAGE 4 WATER RESTRICTIONS

Stage 4 is an emergency stage that limits both indoor and outdoor water uses as much as possible to ensure an adequate supply of drinking water for human consumption, use in firefighting and to protect the quality of drinking water within the water system for public health.

Stage 4 is activated based on the rare occurrence of a significant emergency, such as an earthquake, flood, wild land and interface fire, severe weather, or a prolonged regional power outage that causes significant impacts to the water system infrastructure (e.g. damage to major water transmission lines, pump stations, or treatment plants).

In addition to the following outdoor water restrictions, the Municipality could request that industrial water users implement voluntary reductions or reschedule production processes that consume large amounts of water until Stage 4 is deactivated.

User	Water Use	Restriction
RESIDENTIAL	Watering lawns	Prohibited
	Watering new lawns or lawns being treated for the European Chafer Beetle	All local government permits issued for lawn watering are invalidated
	Watering trees, shrubs, flowers and edible plants	Prohibited
	Topping up or filling aesthetic water features	Prohibited
	Topping up or filling pools and hot tubs	Prohibited
	Washing impermeable surfaces	Prohibited except if ordered by a regulatory authority having jurisdiction for a health or safety
	Washing vehicles and boats	Prohibited except to clean windows, lights, mirrors, licence plates, and boat engines for safety

User	Water Use	Restriction
NON-RESIDENTIAL	Watering lawns (mixed-use buildings e.g. residential and commercial should follow Non- residential watering times)	Prohibited
	Watering new lawns or lawns being treated for the European Chafer Beetle	All local government permits issued for lawn watering are invalidated
	Watering trees, shrubs, flowers and edible plants	Prohibited
	Watering golf courses	Prohibited
	Washing impermeable surfaces	Prohibited except if ordered by a regulatory authority having jurisdiction for health or
	Topping up or filling aesthetic water features	Prohibited
	Topping up or filling pools and hot tubs	Prohibited
	Washing vehicles and boats	Prohibited except to clean windows, lights, mirrors, licence plates, and boat engines for safety
	Commercial vehicle washing	Prohibited

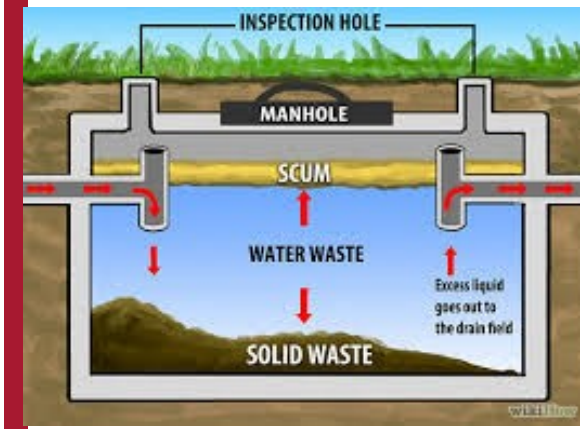
User	Water Use	Restriction
GOVERNMENTS/SCHOOLS/PARKS	Watering lawns and grass boulevards	Prohibited
	Watering new lawns or lawns being treated for European Chafer Beetle	All local government permits issued for lawn watering are invalidated
	Watering trees, shrubs, flowers and edible plants	Prohibited
	Watering soil-based playing fields	Prohibited
	Watering sand-based playing fields	Prohibited
	Flushing water mains	Prohibited
	Operating water play parks	Prohibited
	Topping up or filling aesthetic water features	Prohibited
	Topping up or filling pools and hot tubs	Prohibited
	Washing vehicles and boats	Prohibited except to clean windows, lights, mirrors, licence plates, and boat engines for safety

HOMEOWNER'S GUIDE TO SEPTIC SYSTEMS

Did you know that as a homeowner you're responsible for maintaining your septic system?

Did you know that maintaining your septic system protects your investment in your home?

Did you know that you should regularly inspect your system and pump out your septic tank?



Why should I maintain my septic system?

Saving money

A key reason to maintain your septic system is to save money. Failing septic systems are expensive to repair or replace, and poor maintenance is often the culprit. Having your septic system inspected every 3 years is a bargain when you consider the cost of replacing the entire system. Your system will need pumping every 3 to 5 years, depending on how many people live in the house and the size of the tank. An unusable septic system or one in disrepair will lower your property value and could pose a legal liability.

Protecting health and the environment

Other good reasons for safe treatment of sewage include preventing the spread of disease and protecting water resources. Typical pollutants in household wastewater include nitrogen, phosphorous, and disease-causing bacteria and viruses. If a septic system is working properly, it will remove most of these pollutants.

How do I maintain my septic system?

Inspect and pump frequently

You should have your septic system assessed at least every 3 years and have your tank pumped every 3 to 5 years. A Qualified Person or certified septic system installer can assess all parts of your septic system, and a certified pumping professional can assess the condition of your septic tank.

Use water efficiently

Average indoor water use in a typical single-family home is about 1000 litres per day. Leaky toilets can waste as much as 900 litres each day. The more water a household conserves, the less water enters the septic system. Efficient water use can improve the operation of the septic system and reduce the risk of failure.

Watch your drains

What goes down the drain can have a major impact on how well your septic system works.

Care for your drainfield

Plant only grass over and near your septic system. Roots from trees/shrubs might clog or damage the drainfield; Don't drive or park vehicles on any part of your septic system; Keep roof drains, basement sump pump drains, and other rainwater or surface water drainage systems away from the drainfield.

SEPTIC SYSTEM DO'S

* Pump your septic system every 3 to 5 years.
* Spread water use out over time. The slower you run sewage through your septic tank, the better the tank performs.
* Keep pumping records, system approval and design info with your deed.
* Plant and maintain a healthy grass cover over the drainfield.
* Divert roof drain and up slope rain water from the drain field.

SEPTIC SYSTEM DON'TS

* Don't overload your septic with water.
* Don't wash more than 2 loads of laundry per day.
* Don't drive vehicles on the drain field.
* Don't allow water from sump drains or roof drains to enter your septic system.
* Don't divert laundry water or sink/ wash water away from the septic system. This is referred to as "greywater" which is sewage and can cause harm to the environment and human health.
* Don't dump fat or oils down the drain.

Four Major factors influence the frequency of pumping:

1. The number of people in your household
2. The amount of wastewater generated
3. The volume of solids in the wastewater
4. The size of your septic tank

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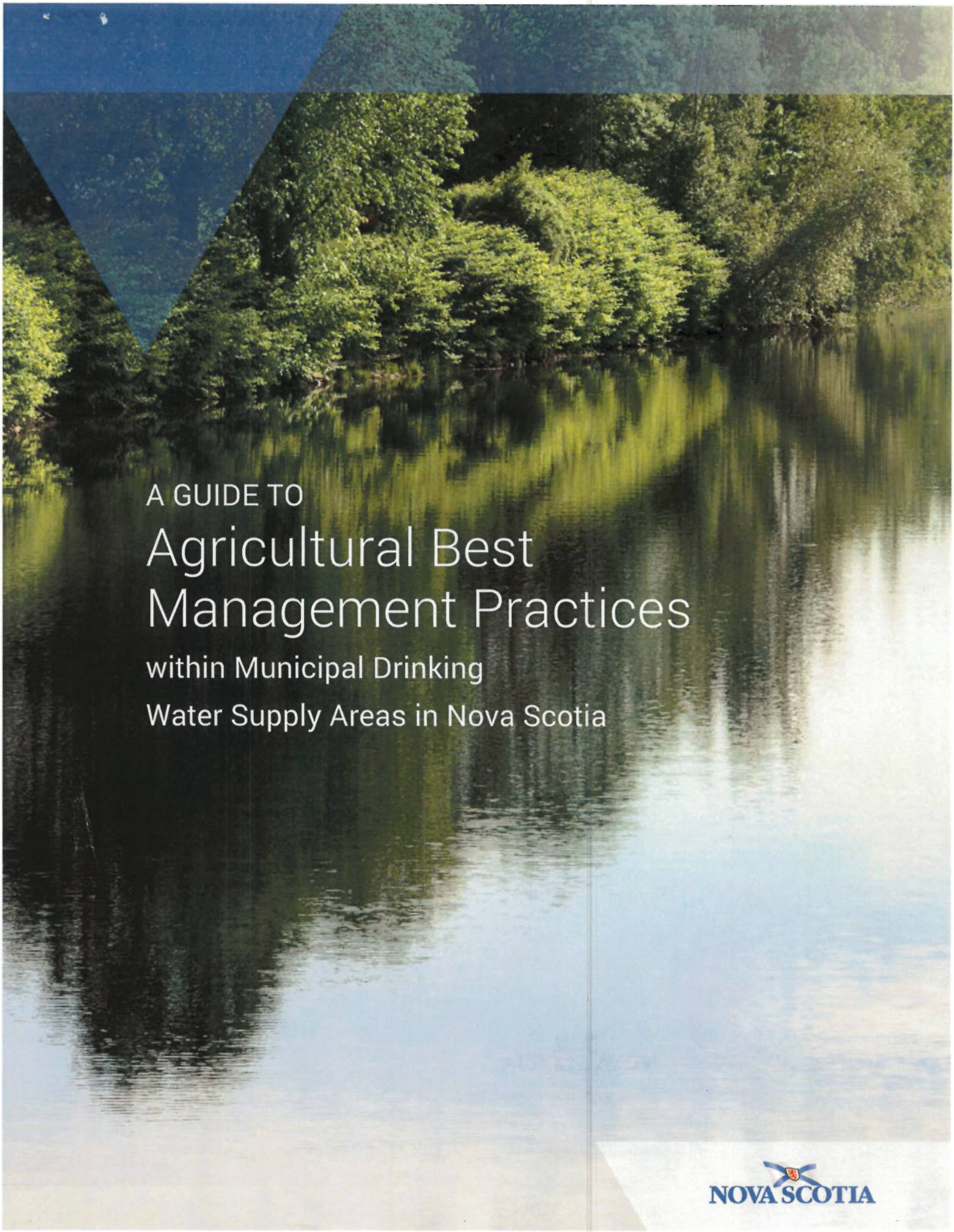

A GUIDE TO

Agricultural Best Management Practices

within Municipal Drinking Water Supply Areas in Nova Scotia

NOVA SCOTIA

Contents

NOVA SCOTIA

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Prepared by Department of Agriculture & Department of Environment

1.0 Introduction

This document is a guide to help farmers and land owners* in municipal drinking water supply areas protect the quality and quantity of these water supplies.

This guide provides

- recommended management practices and setback distances that can be incorporated into daily farming activities to help protect municipal drinking water supplies
- information on potential restrictions that may apply to specific municipal drinking water supply areas
- planning tools and resources available to farms

This guide aims to minimize the risk of an impact on municipal drinking water supply areas, while recognizing that no method ensures an absolute zero-risk approach.

Best management practice (BMP): a method or technique found to be the most effective and practical means in preventing or reducing contaminants generated by an activity.

The practices identified in this document are not regulations, but are recommended approaches based on known science that, if followed, should allow farmers help reduce risks to a drinking water supply.

Farmers operating within an area contributing to a municipal drinking water supply are required to contact the local water utility, Nova Scotia Department of Agriculture, and Nova Scotia Department of Environment to identify if any regulations and or by-laws exist within the area of operation.

About 60% of Nova Scotians receive treated drinking water from central supplies operated by municipal water utilities. As of April 2014, Nova Scotia has 85 municipal drinking water systems. Municipal drinking water systems in Nova Scotia may be either surface water or groundwater.

Link to map of municipal drinking water systems:
www.novascotia.ca/nse/water/publicwater.municipal.supply.asp

* Several options are available to municipal governments protecting their drinking water supplies, including the best management practices discussed in this document; property acquisition, land use bylaws, contingency planning, designation pursuant to the Environment Act, and education. See Nova Scotia Department of Environment's Step 4 booklet for more information: www.novascotia.ca/nse/water/sourcewater.asp

Some types of agricultural practices, if not carefully managed, can impair drinking water quality. Sediment, nutrients (especially nitrogen and phosphorous), bacteria such as *E.coli*, pathogens, and pesticides are all potential pollutants. Farmers need to balance agricultural production with the protection and conservation of water quality in order to ensure sustainable agriculture.

1.1 Environmental Farm Plans and Nutrient Management Plans

Is your farm located in a municipal drinking water supply area?

If yes, we recommend that you establish and follow both an environmental farm plan and a nutrient management plan or equivalent (if applicable):

- Environmental Farm Plan (EFP): promotes environmental stewardship on farms by helping farmers identify potential areas of environmental risk and provide practical solutions to minimize these risks.
- Nutrient Management Plan (NMP): a farm-specific tool that determines the amount, timing, and application of nutrients from manures and fertilizer.

1.1.2 Environmental Farm Plan

The EFP is a federally and provincially supported voluntary program that helps farmers identify and assess environmental risks on their property. Farmers work with Nova Scotia Federation of Agriculture staff to develop a confidential plan for their operation at no cost.

The objective of the EFP Initiative is to help farmers develop a practical plan for operating the farm in an environmentally responsible manner. The EFP acts as an educational guide that enables farm families to incorporate sound environmental practices into their operations. The EFP Initiative is industry-led and industry-driven.

For more information, contact:
Environmental Farm Plan Coordinator
NSFA office: (902) 893-2293
Email: info@nsfa-fane.ca
Website: www.nsfa-fane.ca/efp

1.1.3 Nutrient Management Plan

The NMP is a farm-specific tool that determines the amount, timing, and application of nutrients from manures and fertilizer. Individuals are accredited to be Nutrient Management Planners. Farmers operating in municipal drinking water supply areas are strongly encouraged to develop a nutrient management plan for their farming operations.

Major elements of a Nutrient Management Plan:

- Producer identification and operation description
- At least three cropping years:
  - Three year manure plan (timing and amount of application)
  - Three year fertilizer plan (timing and amount of application)
  - Three year lime and wood ash program template
- Manure and/or commercial fertilizer recommendations based on previous two years history of manure and crops to be grown
- Recommendations to be based on current soil analysis and manure analysis (not older than one year)
- Farm land base: farm maps (aerial and line); field names, sizes, and soil types
- Nutrient balance sheets
- Phosphorous level description and spreadsheet
- Environmental concerns (including information on surface water bodies and wells)
- Manure AUE/ha and alternative manure plan (if needed)

For more information:
www.nsfa-fane.ca/efp/wp-content/uploads/2014/06/Nutrient-Management-Planning_website.pdf

2.0 Regulations and Where To Find Them

Beyond the BMPs described in this guide, there may be additional provincial or municipal restrictions to which a farm must adhere. This section provides examples of the federal, provincial, and municipal regulations that are relevant to agricultural practices in municipal drinking water supply areas.

Additionally, there are relevant guidelines that help support these regulations, such as

Manure Management Guidelines
novascotia.ca/thinkfarm/support/#page=publications

Guidelines for the Land Application and Storage of Municipal Biosolids in Nova Scotia
nsfa-fane.ca/wp-content/uploads/2011/06/BiosolidGuidelines.pdf

The table below is a guide for finding information and regulations regarding setback distances. It is recommended to use the largest setback distance from the applicable regulations and/or guide.

Finding Setback Distances

Are you located in a **Protected Water Area**?	**If yes**, review regulations for restricted and/or prohibited activities and setback distances. *See page 5.*	**Always use largest setback distance.**
Are you located in an area with a **Municipal Land-Use Bylaw**?	**If yes**, review restrictions and setback distances. *See page 5.*	
Are you a **licenced fur farm**?	**If yes**, review the Fur Act/Regulation requirements and setback distances. *See page 6.*	
Are you located in a **municipal drinking water supply area** in Nova Scotia?	**If yes**, review this guide and the setback distances in Appendix A. *See page 18.*	

2.1 Protected Water Areas (Special Designations)

About one-third of municipal drinking water supply areas have special designations known as Protected Water Areas where regulations apply. Contact the water utility or Nova Scotia Department of Environment to determine whether you are within a Protected Water Area.

Find a map of Protected Water Areas:
www.novascotia.ca/nse/water/docs/Protected.Water.Areas.Map.pdf

Find regulations in effect for existing designated Protected Water Areas:
novascotia.ca/just/regulations/rxaa-l.htm#env

Find a summary of the activities that are regulated:
www.novascotia.ca/nse/water/docs/ProtectedWaterAreasRegulations.pdf

Examples of agricultural activities that may be restricted or prohibited in a Protected Water Areas:

- grazing livestock
- storage of agricultural waste
- spreading manure
- pesticide use
- construction
- refueling
- removal of water

Always refer to the regulations for the most up to date information on restricted activities.

2.2 Municipal Land-use By-laws

About one-half of municipal drinking water supply areas have municipal land-use bylaws specifically designed to protect water quality. For example, some bylaws have setback requirements for new or expanding farms.

Contact the water utility operator responsible to determine whether they are within an area protected by zoning bylaws.

2.3 Other Acts and Regulations

Fisheries Act (federal): requires an approval to alter fish habitat; forbids the fouling of water frequented by fish: "no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish" or where the substance may enter water frequented by fish.

Environment Act (provincial): prohibits the release (knowingly or not) of a substance into the environment that causes or may cause a significant adverse effect. Sediment, nutrients, bacteria, pathogens, and pesticides can become pollutants from agricultural activities if not properly managed.

Fur Industry Act and Regulations (provincial): licensed fur farms must protect water quality; includes building requirements, setback distances, and water quality monitoring: novascotia.ca/agri/laws-and-regulations

Farm Practices Act (provincial): provides a mechanism for the establishment of normal farm practices. It is also designed to protect farmers who are following normal farm practices from civil action due to nuisance or negligence: novascotia.ca/agri/laws-and-regulations

Nova Scotia Department of Environment (provincial): Approvals may be required for activities such as withdrawal of greater than 23,000 litres per day of either surface or groundwater, or altering a wetland. Other activities may require either an approval or notification to the Nova Scotia Department of Environment, such as installation of a culvert or bridge. A complete list of regulations is available online at novascotia.ca/nse/resources/legislation.asp

Environmental Regulations for Nova Scotia Department of Agriculture: http://nsfa-fane.ca/wp-content/uploads/2011/06/env_handbk.pdf

Codes of Practice (national) for the care and handling of farm animals, including animal care requirements and recommended practices: www.nfacc.ca/codes-of-practice

3.0 Recommended Best Management Practices

Farmers operating within areas contributing to municipal drinking water supplies are expected to take every reasonable precaution to prevent or minimize impacts from activities that can impair water quality. One approach to achieve this is through the use of BMPs. The BMPs outlined in this guide have a proven record of success in reducing impacts to water quality from farming activities.

3.1 Water Management

The agriculture industry is highly dependent on a quality source of water for many aspects of production, whether it is for growing crops, livestock or sanitation of equipment or application of pest control products.

The following BMPs should be employed when managing water in municipal drinking water supply areas:

3.1.1 Clean Surface Water

- Divert clean surface water from rainfall or snowmelt away from manure storages or livestock yards to prevent contamination.
- Construct eaves trough on buildings, diversion ditches, or catch basins that drain into a tile drainage line to prevent contamination of clean water.

3.1.2 Additional Water Treatment

Examples of water systems that need additional treatment:

- food processing wash water
- milkhouse wash water
- abattoir wash water
- mink feed cart and feed tub wash water
- cull vegetable runoff
- livestock yard runoff

Additional treatment methods should be properly designed and maintained.

Examples of additional treatment methods:

- Use constructed wetlands to slow water flow and allow for naturally occurring physical, chemical, and biological processes to provide year round waste water management.
- Use vegetated infiltration areas to treat wastewater: solids are deposited on the surface and then broken down; dissolved pollutants infiltrate the soil where they are degraded by microorganisms.
- Use a water treatment septic system, designed by a qualified engineer, with underground settling tanks and earth filtration system to dissolve pollutants.

In any of the above water treatment systems, water recycling is encouraged where possible. This involves collecting the initial waste water and reusing it for an approved alternate use. The recycling of wash water and runoff can lower input costs, reduce the volume of clean water being used, and protect water supply.

Under certain environmental conditions, tile drainage discharge has the potential to contain pollutants such as ***E.coli*** and nutrients. Consider using vegetated ditches and/or vegetated infiltration areas for tile drainage discharge.

3.2 Livestock Manures and On-Farm Composting

The land application of livestock manure is recognized as an acceptable farming practice; however, manure application must be managed to minimize the impact on municipal drinking water supplies. Use the most recent version of the provincial Manure Management Guidelines along with this document to ensure protection of municipal drinking water supplies.

The following sections list BMPs that should be practiced when managing manure in municipal drinking water supply areas:

3.2.1 Manure Storage

Design manure storage to prevent farm runoff, whether you are using liquid or solid manure storage, roofed or open storage, yard storage and stockpiling.

Ensure that manure storage structures have the capacity to hold the total volume of manure, wastewater, and bedding produced between periods of land application — at least seven months storage.

Plan the location of animal production and manure storage facilities so that they meet the separation distances from water sources.

3.2.2 Field Application

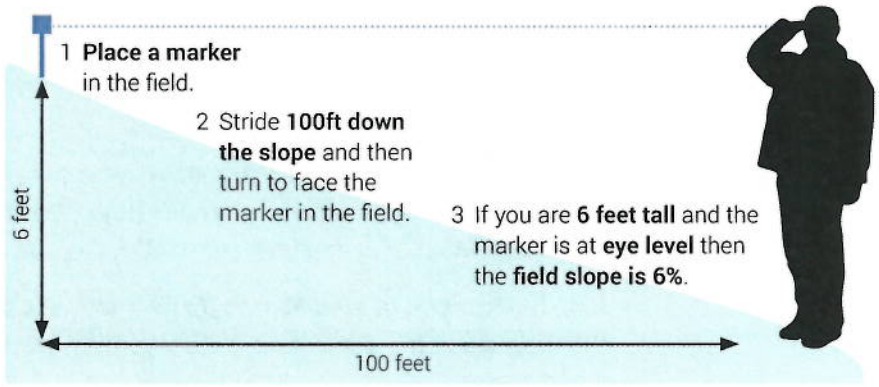
- Manage manure through a nutrient management plan. Benefits: allows for field rotation, avoids nutrient build-up, and maximizes utilization.
- Match manure hauling and spreading equipment to the type and consistency of the manure produced on your farm.
- Time the field application of manure to reduce the potential for environmental contamination and to provide the greatest benefit for soils and crops:
  - Avoid applying manure on wet soils to minimize compaction, farm runoff, and leaching.
  - Apply manure during the growing season to allow for uptake of nutrients and reduce farm runoff potential.
  - Avoid applying manure to frozen, snow covered, or saturated ground.
  - Avoid spreading manure between December 1 and April 1.
- Apply manure only on land with less than a 10% slope (see Figure 2 for how to determine slope).

Adjust the separation distance from a watercourse based on slope:

- 20 metres when slopes are less than 2%
- 50 metres when slopes are between 2–5%
- 100 metres when slopes are between 5–10% and apply mature only between May 15 and September 15

Determining Field Slope

Field slope is the percentage of land elevation over the length of the slope. A rough way to estimate field slope is shown below.



3.2.3 Compost

The Manure Management BMPs listed above apply to on-farm generated compost and off-farm generated compost from an approved facility. Composting off-farm feedstock requires an approval from Nova Scotia Department of Environment.

Additional information can be found in the *On-farm Management Through Composting Guidance* document.

3.2.4 Setback Distances

The recommended setback distances from water features for manure and compost storage and application are outlined in Appendix A.

3.3 Livestock Production

Activities associated with livestock production that may have the potential for water contamination include pasturing of livestock, feed storage, and deadstock management. Allowing livestock access to watercourses may result in the deposit of feces and urine into the watercourse, creating a source of bacteria and nutrients in the municipal drinking water supply. Erosion and sedimentation may result from livestock entering and exiting the watercourse. As well, density of livestock and timeframe while pasturing can impact municipal drinking water supplies.

Best management practices for managing livestock in municipal drinking water supply areas:

- Fence pasture land to prohibit the entry of livestock into adjacent watercourses.
- Construct an approved crossing if you pasture livestock on both sides of the water supply — so the livestock or farm machinery can cross without entering and disturbing the watercourse.
- Maintain an appropriate livestock-to-acreage ratio: Livestock pastured in confined areas below the allowable acreage (as calculated in a NMP or using the Manure Management Guidelines) for more than 15 days will be considered manure storage, not a pasture.
- Implement management practices when supplemental feeding on pastures during non-productive periods. Feeding areas may have to be rotated to prevent exceeding manure application rates and separation distances. Bale grazing is an acceptable alternative provided livestock frequently have access to new bale grazing areas.
- Manage stored feed (like silage, mink feed) to prevent runoff/seepage; contain stored feed to prevent contact with water.
- Locate stored feed structures at least 100 metres away from of any intake source, wellhead, watercourse, or ditch.
- Minimize feed additives such as phosphoric acid and ammonium chloride; prefer products with low nutrient additives that offer similar results.
- Use fresh mixed feed and shortened mixing intervals to reduce the need for preservatives.
- Dispose of feed waste frequently in accordance with a waste management plan (if applicable).

- Remove dead livestock within 100 m of any intake source, wellhead, watercourse, or ditch as soon as possible.
- Dispose of dead livestock at an approved disposal facility or by on-farm composting. Dead livestock (excluding fur carcasses) may be buried under at least 2 feet of soil within 48 hours after death.

3.3.1 Setback Distances

The recommended setback distances from water features for pasturing livestock are outlined in Appendix A.

3.4 Commercial Fertilizers

Commercial fertilizers have the potential to be contaminants in both surface and groundwater supplies. The land application of commercial fertilizers is recognized as an acceptable farming practice; however, fertilizer application, handling and storage must be managed to minimize the impact on municipal drinking water supplies.

The following BMPs should be employed when storing, handling, and applying chemical fertilizers in municipal drinking water supply areas:

3.4.1 Storage, Application, and Handling

Store fertilizer in an area protected from rainfall and run-off.

Apply fertilizer at a rate to meet crop nutrient requirements as defined in an approved NMP or equivalent. Never exceed the application rates recommended on the product label.

3.4.2 Setback Distances

The recommended setback distances from water features associated with chemical fertilizers are outlined in Appendix A.

3.5 Pest Control Products

Pest control products have the potential to contaminate both surface and groundwater supplies. The use of pesticides presents a number of opportunities for risk of exposure to the applicator and the environment. The land application of pesticides is recognized as an acceptable farming practice; however, pesticide application, handling, and storage must be managed to minimize the impact on municipal drinking water supplies.

Under the Pesticide Regulations and the Activities Designation Regulations, Nova Scotia Department of Environment regulates the sale, use, storage, and disposal of pesticides. These regulations also require applicators and vendors of restricted or commercial class pesticides to become certified. If pesticides are being applied from an aircraft, applicators also require an approval from Nova Scotia Department of Environment.

All users of pest control products within a municipal drinking water supply area MUST hold a valid certificate of qualification or be directly supervised by a certified applicator as defined in the Pesticide Regulations of the ***Nova Scotia Environment Act*** (1995).

The following BMPs should be employed when storing, applying, and handling pest control products in municipal drinking water supply areas:

3.5.1 Storage, Application, and Handling

- Make sure the pesticide is registered for the planned use — read the manufacturer's label.
- Store pesticides according to the information contained on the manufacturer's label.
- Use secondary containment (recommended).
- Calibrate the pesticide sprayer regularly; replace nozzles as required.
- Choose low drift technologies for nozzles.
- Prevent backflow potential and water source contamination when filling a sprayer, water must be acquired in a manner that prevents backflow potential or water source contamination.
- Choose a mixing and loading area that is outdoors or in a well-ventilated area.
- A closed mixing system is recommended.

- Watch closely when filling a sprayer to prevent overflow.
- Check wind speed before spraying —Do not spray pesticides when wind speed is over 17.6 km per hour (11 mph) or the speed indicated on the label.
- Establish a simple emergency preparedness and response plan in case of a pesticide spill.
- Use pesticides as part of an integrated pest management program only.

3.5.2 Setback Distances

The recommended setback distances from water features associated with pest control products are outlined in Appendix A.

3.6 Soil Conservation

Soil loss is a problem both for farmers and for the environment. Farmers experience this as loss of organic matter and fertility. Lost soil can cause sedimentation in municipal drinking water supplies. This is a bigger problem when soil particles contain contaminants such as pesticides or nutrients.

Farmers are encouraged to use erosion control methods for annual crops and perennial crops that are subject to erosion, like small fruits and tree fruits.

Farmers are also encouraged to use erosion control methods when tillage operations or harvesting expose bare soil during mid-October through mid-April.

3.6.1 Erosion Control

The following BMPs should be employed to reduce the impact of soil erosion and promote soil conservation in municipal drinking water supply areas:

- Practice crop rotation, reduced tillage, mulching, cover cropping, and cross-slope farming.
- Reduce soil compaction by not tilling or harvesting when soil is wet.
- Avoid exposing large areas of bare soil during the winter period. For fields with bare soil or less than 50% cover, mulch with hay or straw if it is too late to provide adequate field cover with cover crops.

- Construct erosion control structures when erosion cannot be controlled by other means — terraces or grassed waterways.
- Use soil moisture monitoring technology to conserve water and reduce run off risk to prevent soil erosion during irrigation.

3.6.2 Buffer Strips

Buffer strips separate farm activities from sensitive areas. Buffers are strips of land in permanent vegetation that when strategically placed can reduce soil erosion, as well as manage many other potential issues. Buffers include filter strips, grassed waterways, shelterbelts, windbreaks, living snow fences, shallow water areas for wildlife, field borders, alley cropping, and vegetative barriers. Riparian buffers refer to a buffer strip along a stream.

The following BMPs should be employed when implementing buffer strips to reduce the impact of soil erosion and promote soil conservation in municipal drinking water supply areas:

- Construct a 5 metre wide buffer strip between a field boundary and a watercourse.
- If the field is row cropped, leave an additional 5 m wide grass buffer strip.
- Maintain buffer strips.

3.7 Fuel and Petroleum Products

Both fuel and oil are frequently used on farms. As a result of their extensive use, fuel handling and storage must be managed to minimize the impact on municipal drinking water supplies.

The following BMPs should be employed when storing and handling fuel in municipal drinking water supply areas:

3.7.1 Storage and Handling

- Store fuel away from other stored chemicals and combustible materials.
- Ensure that your fuel storage has secondary containment — like a dedicated fuel storage shed with a concrete floor and curb, or a double-walled tank.
- Choose fuel tanks that are approved by Underwriters Laboratories of Canada (ULC) or Canadian Standards Association (CSA).
- Register all underground petroleum storage tanks and any aboveground petroleum storage tank with a capacity of 4000 litres or more with Nova Scotia Department of Environment.
- Protect fuel storage with a barrier.
- Make sure that electric pumps have an automatic shut-off.
- Follow insurance company recommendations on replacement timing for fuel tanks.
- Inspect fuel tanks and dispensing equipment monthly — both by visual observation and by running a hand underneath the tank to check for moisture.
- Establish a simple emergency preparedness and response plan in case of a fuel spill or leak.
- Make every effort to use fuel rather than disposing of it as a waste product. If the fuel is no longer needed, find out if it can be returned to a supplier. Contact a supplier appropriate to the particular material (e.g., fuel oil, gasoline). Fuel that can not be returned must be disposed of at a hazardous waste facility.

3.7.2 Setback Distances

The recommended setback distances from water features associated with fuel handling and storage are outlined in Appendix A.

Appendix A Minimum Setback Distances

Recommended minimum setback distances from water features within the municipal water supply areas for agriculture activities in Nova Scotia. Use the largest setback distance from the applicable regulations and/or guide.

Agriculture Activity	Minimum Setback Distance (Meters)			
	Intake Source[1]	Wellhead	Lake, River, Brook	Ditches
Manure and Compost Application	200	200	20 [2]	5
Pasturing Livestock	30	30/15 [3]	5	5
Livestock Facilities [4] (Non-Contained Storage - Solid manure)	200	200	100	20
Livestock Facilities [3] (Fully Contained Storage - Liquid manure)	200	100	50	20
Chemical Fertilizer Loading	200	200	200	200
Chemical Fertilizer Application	50	50	10	5
Fuel Storage	200	200	200	30
Pesticide Storage and Handling	200	200	30	30
Pesticide Application [5]	200	30	30	5

1 The source water body in which an intake structure is located. In the case of a river, beyond 200 m upstream, the setback distance for lakes, rivers, and brooks applies.

2 As per Section 3.2.2, 20m if slope is less than 2%; 50m if slope 2-5%; 100m if slope 5-10%.

3 30m to a dug well and 15m to a drilled well.

4 New Livestock facilities

5 Pesticide application should follow the recommended setback distances in this table or the distances supplied on the label, whichever is higher.

Appendix B Glossary

Animal unit equivalent (AUE) – a measurement of livestock based on the equivalent of a mature cow (about 454kg live weight); roughly one cow, one horse, one mule, five sheep, five swine, or six goats

Ditch – an excavated channel for the purpose of draining water not including land formed runs on dykelands or grassed waterways on uplands

Farm runoff – surface water generated from rain or snow melt that flows through farm yards or fields picking up contaminates like manure, silage effluent, or vegetable waste, etc.

Groundwater – all water naturally occurring beneath the surface of the earth. It is water in the ground that is stored in an aquifer from which wells, springs, and groundwater runoff are supplied

Intake – infrastructure located in a surface water body that draws water into the municipal water supply system

Land-use bylaws – municipally developed restrictions on uses of land

Municipal drinking water supply – either a surface water body (e.g., a lake, river or stream) or a groundwater well that supplies a municipal drinking water system

Municipal drinking water supply area – the area of the surface water watershed that contributes all the water that is used to supply the municipal drinking water source; in the case of a groundwater supply, it is the land area that contributes water to the municipal well, also known as the wellfield area

Pesticide – a substance that can be used to control pests such as plants, animals, or virus; refer to the Pesticide Regulations for a more detailed definition: www.novascotia.ca/just/regulations/regs/ENVPEST.HTM

Protected Water Area – an area designated under Section 106 of the Nova Scotia Environment Act; find regulations specific to each Protected Water Area at https://www.novascotia.ca/just/regulations/rxaa-l.htm#env – the Environment Act specifies that designation is put into place only after a formal request is received from the municipality or water works operator and sufficient public consultation has occurred

Runoff – the water from rain, snowmelt, or irrigation that flows over the land surface and is not absorbed into the ground, instead flowing into streams or other surface waters or land depressions

Surface water – water located in lakes, ponds, rivers, streams, brooks, springs, and wetlands

Watercourse – the bed and shore of every river, stream, lake, creek, pond, spring, lagoon or other natural body of water, and the water therein, within the jurisdiction of the province, whether it contains water or not, and all ground water

Wellhead – the above ground structure associated with each well

Appendix C Resources

General

Nova Scotia Department of Agriculture - www.novascotia.ca/agri/

Nova Scotia Department of Environment - www.novascotia.ca/nse/

Nova Scotia Department of Environment "Water Portal" - waterforlife.gov.ns.ca/

Environmental Regulations Handbook for Nova Scotia Agriculture, Second Edition, 2004. Nova Scotia Department of Agriculture and Fisheries, Nova Scotia Department of Environment nsfa-fane.ca/wp-content/uploads/2011/06/env_handbk.pdf

Protected Water Areas designated pursuant to the Environment Act:
Map: www.novascotia.ca/nse/water/docs/Protected.Water.Areas.Map.pdf
Regulations: www.novascotia.ca/just/regulations/rxaa-l.htm#env

Manure

Manure Management Guidelines. Nova Scotia Department of Agriculture, novascotia.ca/thinkfarm/support/#page=publications

Fact Sheets available on Nova Scotia Federation of Agriculture Environmental Farm Plan website www.nsfa-fane.ca/efp/resources/factsheets :

- *Nutrient Management Plans*
- *Manure Calibration*
- *On-Farm Livestock Mortality Management*
- *Manure Management Through Composting*
- *On-farm Composting of Mink Manure*
- *Guidelines for Land Application and Storage of Municipal Biosolids in Nova Scotia*
- *Constructed Wetlands for the Treatment of Agricultural Wastewater in Atlantic Canada*

Livestock

Fact Sheets available on Nova Scotia Federation of Agriculture Environmental Farm Plan website www.nsfa-fane.ca/efp/resources/factsheets :

- *On-Farm Livestock Mortality Management*
- *Silage Seepage*

Water

Fact Sheets available on Nova Scotia Federation of Agriculture Environmental Farm Plan website www.nsfa-fane.ca/efp/resources/factsheets :

- *Livestock Watering Systems for Pastures*
- *Electric Fencing for Pastures*
- *Providing Water with Limited Access Ramps*
- *Solar Powered Pumping Systems for Livestock Watering*
- *Lab Tests for Water Quality*
- *Well Water Quality Concerns*
- *Canadian Drinking Water Quality Guidelines*
- *Disinfection of Water Wells by Chlorination*
- *NSDA Analytical Lab Information (water samples)*

Chemical Fertilizers

Nutrient Management Plans - Environmental Farm Plan Fact Sheet
www.nsfa-fane.ca/efp/resources/factsheets

Fuel

Farm Fuel Storage and Handling - Environmental Farm Plan Fact Sheet
www.nsfa-fane.ca/efp/resources/factsheets

Pest Control Products

Fact Sheets available on Nova Scotia Federation of Agriculture website www.nsfa-fane.ca/efp/resources/factsheets :

- *On-farm Pesticide Use*
- *Tree-Row-Volume: concept, calculations and application*
- *Air-Blast Sprayer Calibration for Orchards and Vineyards*
- *Field Sprayer Calibration*
- *Nozzle Selection for Blueberry Growers*
- *Choosing Drift-Reducing Nozzles*
- *Selecting the Correct Nozzle to Reduce Spray Drift*
- *Pesticide Storage and Handling*
- *How can I get a Pesticide License?*

To learn more about pesticide certificates, approvals, exams and exam study materials, contact **Nova Scotia Department of Environment's Regional Offices**:

Central Region	902-424-7773
Northern Region	902-893-5880
Western Region	902-679-6086
Eastern Region	902-563-2100

Soil Conservation

Fact Sheets available on Nova Scotia Federation of Agriculture website www.nsfa-fane.ca/efp/resources/factsheets :

- *Soil Conservation Practices*
- *BMPs for Riparian Zones in Atlantic Canada*
- *Shelterbelts: A Growing Investment*
- *A Guide to Using Cover Crops in the Maritimes*
- *No-till Alternative for Nova Scotia Producers*
- *Irrigation Water Management for Farmers*
- *Irrigation Systems Types and Typical Applications*
- *Trickle Irrigation: How long do I trickle?*
- *Soil Moisture Monitoring (ATTRA)*

The **Nova Scotia Soil Erosion Tool** can be used to help determine soil erosion levels based on available soil information, rainfall data and inputs of crops, cropping practices and slope length.
www.nsfa-fane.ca/efp/nova-scotia-soil-erosion-tool

Greenwood Source Water Protection Monitoring Plan Evaluation

2017

1. By-Laws

Complete Jan. 12/12.

2. Best Management Practices

Adopted as a resource March 24, 2016.

3. Greenwood Sewage Treatment Plant Monitoring Wells Program

The Groundwater monitoring wells were tested weekly as per the "Groundwater Monitoring Program for the Greenwood Sewage Treatment Facility" developed for the Municipality by CBCL Ltd.

The weekly parameters are attached (Jan 2016-Dec 2017), the graph results are as follows:

Temperature – Following normal seasonal trends.

Water level – Following normal seasonal trends. Well 3B was dry for most of the year.

Conductivity – We are seeing some lower conductivity values in Well #1, this is upstream of the plant and it generally more apparent following a heavy rain. This area has been cleared of trees in the last year and we feel this may be affecting the pH and conductivity due to the organics break down which affects the well values when it rains. We will continue to monitor this. The remainder of the wells are following normal seasonal trends.

DO (Dissolved Oxygen) - Following normal seasonal trends.

pH - We are seeing some higher pH values in Well #1, this is upstream of the plant and it generally more apparent following a heavy rain. This area has been cleared of trees in the last year and we feel this may be affecting the pH and conductivity due to the organics break down which affects the well values when it rains. We will continue to monitor this. The remainder of the wells are following normal seasonal trends.

4. Raw Water pH Monitoring

The wells are following normal seasonal trends, within the vicinity of 5.5-6.5. There are no indications of water quality issues based on pH.

5. Greenwood Production Well Weekly/Annual Sampling:

One weekly microbial testing came back present for coliform and absent for E.coli on July 25th, resampling results taken on July 26th yielded absent for both. This is typically indicative of post well contamination and/or sampling error.

Guidelines for Monitoring Public Drinking Water Supplies – completed in July and all within compliance.

Guidelines for Canadian Drinking Water Quality testing, conducted every 5 years, was also completed in July, all results were within the guidelines.

In the spring we conducted our "every 2 year" microscopic particulate analysis sampling, to ensure the GUDI status of the wells has not changed. Initial testing in Well GW#8 yielded 2 Giardia, follow up testing indicated 0. We currently sit at medium risk GUDI status and this will not change. There were a list of recommendations that were made in this that would further protect the wellfield form surface water infiltration. We are in the process of putting some of these recommendations in place.

6. Contingency Planning:

Up to date.

7. Education and Stewardship:

For discussion.

Appendix A

Greenwood Sewage Treatment Plant Groundwater Monitoring Wells – Quarterly

Greenwood Sewage Treatment Plant Monitoring Well

Well #1

Parameter	Unit	G/S (mg/L)	RDL	Baseline	3/22/2016	6/20/2016	9/19/2016	12/17/2016	3/27/2017	7/4/2017	10/2/2017	1/9/2018
Anion Sum	me/L			1.34	0.74	0.91	0.99	0.66	0.29	0.58	0.95	0.57
Bicarb Alkalinity (CaCO3)	mg/L		5	46	23	30	34	26	10	22	36	23
Calculated TDS	mg/L	AO </= 500	1	65	40	47	58	33	16	31	47	29
Carb Alkalinity	mg/L		10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Cation Sum	mg/L			1.07	0.74	0.87	1.28	0.6	0.35	0.57	0.78	0.51
Hardness	mg/L			42.6	26.6	32.5	48.4	20.1	12.1	20.7	29.7	17.9
Ion Balance	%			11.4	0.3	2.1	13	4.9	9.6	1.2	9.9	6.4
Langelier Index (20C)	NA			-0.96	-2.28	-1.82	-1.8	-2.09	-2.75	-2.19	-1.72	-1.94
Langelier Index (4C)	NA			-1.28	-2.6	-2.14	-2.12	-2.41	-3.07	-2.51	-2.04	-2.26
Saturation pH (20C)	NA	6.5-8.5		8.76	9.28	9.08	8.85	9.35	9.94	9.39	9.04	9.43
Saturation pH (4C)	NA	6.5-8.5		9.08	9.6	9.4	9.17	9.67	10.3	9.71	9.36	9.75
pH	NA	6.5-8.5		7.8	7	7.26	7.05	7.26	7.19	7.2	7.32	7.49
Reactive Silica as SiO2	mg/L		0.5	12.5	11.1	11.5	11.7	13.1	8.8	8.8	10.3	9.7
Chloride	mg/L	AO </= 250	1	11	7	7		3	3	3	3	3
Fluoride	mg/L	1.5	0.1	0.1	<0.12	<0.12	0.12	<0.12	0.14	<0.12	<0.12	<0.12
Sulphate	mg/L	AO </= 500	2	5	4	5	5	2	<2	2	4	<2
Alkalinity	mg/L		5	46	23	30	34	26	10	22	36	23
True Colour	TCU	AO </= 15	5	<5	5	22	9	<5	8	<5	9	11
Turbidity	NTU		0.1	7200	4.4	3.4	3.3	16.8	3.9	86.1	2.3	10.4
Electrical Conductivity	umho/cm		1	135	105	92	104	68	38	63	93	60
Nitrate+Nitrite as N	mg/L		0.05	0.11	0.06	0.07	0.06	0.18	0.07	0.25	0.81	0.41
Nitrate as N	mg/L	10	0.05	0.11	0.06	0.07	0.06	0.18	0.07	0.25	0.81	0.41
Nitrite as N	mg/L	1	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ammonia as N	mg/L		0.05	0.05	0.05	0.12	<0.03	0.03	<0.03	<0.03	<0.03	<0.03
Total Organic Carbon	mg/L		0.5	3	0.7	<0.5	1	3	1.1	1.6	1.7	1.3
Dissolved Organic Carbon	mg/L		0.5	0.7	0.7			2.3	0.9	1.5	1.1	1.3
Ortho-Phosphate as P	mg/L		0.01	0.02	<0.01	0.01	0.02	0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus	mg/L		0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.02
Hydroxide	mg/L		5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Biochemical Oxygen Demand	mg/L		2	<2	<2	<2	<2		<2	3	<2	<2
Total Suspended Solids	mg/L			8300								
Total Kjaldahl Nitrogen as N	mg/L		0.4	2.4	0.5	<0.4	1.4	0.5	<0.4	0.9	0.5	0.5
Total Coliforms	MPN/100mL	0	1	<2	<1	2	52	1	<1	<1	<1	<1
Escherichia coli	MPN/100mL	0	1	<2	<1	<1	<1	<1	<1	<1	<1	<1
Fecal	CFU/100mL	0	2									
Aluminum	ug/L	OG < 100	10	<5	94	<5	67	<5	<5	<5	<5	<5
Antimony	ug/L	6	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Arsenic	ug/L	10	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Barium	ug/L	1000	5	7	6	5	7	<5	<5	<5	<5	<5
Beryllium	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Bismuth	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Boron	ug/L	5000	5	8	<5	<5	<5	7	<5	<5	<5	<5
Cadmium	ug/L	5	0.3	<0.017	0.105	0.029	0.201	<0.017	0.027	0.304	0.024	0.209
Chromium	ug/L	50	2	<1	<1	1	1	<1	<1	<1	1	<1
Cobalt	ug/L		1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Copper	ug/L	AO </= 1000	2	<2	<2	<2	25	<2	<2	<2	<2	<2
Iron	ug/L	AO </= 300	50	<50	68	<50	<50	50	<50	<50	<50	<50
Lead	ug/L	10	0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	<0.5	<0.5
Manganese	ug/L	AO </= 50	2	3	6	<2	<2	<2	<2	<2	<2	<2
Mercury	ug/L	1										
Molybdenum	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Nickel	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Selenium	ug/L	10	2	<1	<1	<1	<1	<1	<1	<1	<1	<1
Silver	ug/L		0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	<0.1
Strontium	ug/L		5	44	25	29	33	19	11	18	24	15
Thallium	ug/L		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Titanium	ug/L		2	<2	4	<2	<2	<2	<2	<2	<2	<2
Uranium	ug/L	20	0.1	0.9	0.1	<0.1	0.2	<0.1	<0.1	<0.1	0.3	<0.1
Vanadium	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Zinc	ug/L	AO </= 500	5	<5	<5	<5	14	<5	<5	<5	<5	<5
Sodium	mg/L		0.1	4.1	3.9	4.3	6.2	4	2.2	3.2	3.7	3
Potassium	mg/L		0.1	1.3	0.9	0.9	1.3	0.8	0.5	0.7	0.8	0.7
Calcium	mg/L		0.1	14.1	8	9.9	15.1	5.9	3.7	6.3	9.1	5.5
Magnesium	mg/L		0.1	1.8	1.6	1.9	2.6	1.3	0.7	1.2	1.7	1
Benzene	ug/L		1									
1,4-Dichlorobenzene	ug/L		1									
Methylene Chloride	ug/L		2									
Toluene	ug/L		2									
Vinyl Chloride	ug/L		0.6									
Chemical Oxygen Demand	mg/L		3									
Phenolics	mg/L		0.001									

Greenwood Sewage Treatment Plant Monitoring Well

Well #2

Parameter	Unit	G/S (mg/L)	RDL	Baseline	3/22/2016	6/20/2016	9/19/2016	12/17/2016	3/27/2017	7/4/2017	10/2/2017	1/9/2018
Anion Sum	me/L			3.67	0.43	0.63	0.92	0.65	0.59	0.71	0.85	0.73
Bicarb Alkalinity (CaCO3)	mg/L		5	52	11	16	29	21	16	22	26	20
Calculated TDS	mg/L	AO </= 500	1	194	25	35	48	35	33	37	43	39
Carb Alkalinity	mg/L		10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Cation Sum	mg/L			3.21	0.51	0.65	0.88	0.64	0.62	0.63	0.68	0.64
Hardness	mg/L			77.1	14.8	21.1	27.8	20.1	20.9	19.7	22.1	20.9
Ion Balance	%			6.6	8.1	1.7	2.3	0.3	2.2	6.5	10.7	6.7
Langelier Index (20C)	NA			-0.61	-3.15	-2.74	-3.08	-3.02	-2.85	-3.03	-2.57	-2.78
Langelier Index (4C)	NA			-0.99	-3.47	-3.06	-3.4	-3.34	-3.17	-3.35	-2.89	-3.1
Saturation pH (20C)	NA	6.5-8.5		8.51	9.87	9.54	9.25	9.49	9.56	9.47	9.34	9.47
Saturation pH (4C)	NA	6.5-8.5		8.83	10.2	9.86	9.57	9.81	9.55	9.79	9.66	9.79
pH	NA	6.5-8.5		7.9	6.72	6.8	6.17	6.47	6.71	6.44	6.77	6.69
Reactive Silica as SiO2	mg/L		0.5	12.6	8.8	10.7	12.2	11.2	11.6	10.7	10.7	11.1
Chloride	mg/L	AO </= 250	1	89	5	7	8	5	7	7	8	7
Fluoride	mg/L	1.5	0.1	<0.1	<0.12	0.13	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12
Sulphate	mg/L	AO </= 500	2	5	3	5	5	3	3	3	4	4
Alkalinity	mg/L		5	52	11	16	29	21	16	22	26	20
True Colour	TCU	AO </= 15	5	<5	10	25	7	<5	5	5	15	<5
Turbidity	NTU		0.1	3000	8.5	8.6	2.9	7.4	4	74.6	3	3.1
Electrical Conductivity	umho/cm		1	405	76	70	100	73	73	76	85	83
Nitrate+Nitrite as N	mg/L		0.05	0.16	0.1	0.06	0.09	0.34	0.21	0.16	0.28	0.74
Nitrate as N	mg/L	10	0.05	0.16	0.1	0.06	0.09	0.34	0.21	0.16	0.28	0.74
Nitrite as N	mg/L	1	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ammonia as N	mg/L		0.05	0.04	0.05	0.13	<0.03	0.08	<0.03	<0.03	<0.03	<0.03
Total Organic Carbon	mg/L		0.5	2.5	0.7	<0.5	1.4	2.4	1.2	1.5	1.1	1.2
Dissolved Organic Carbon	mg/L		0.5	0.6	0.8		1.4	0.8	0.8	1.5	0.9	1.3
Ortho-Phosphate as P	mg/L		0.01	0.01	<0.01	<0.01	0.01	<0.01	0.01	0.01	<0.01	<0.01
Phosphorus	mg/L		0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.02
Hydroxide	mg/L		5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Biochemical Oxygen Demand	mg/L		2	<2	<2	<2	<2		<2	<2	<2	<2
Total Suspended Solids	mg/L			9580								
Total Kjeldahl Nitrogen as N	mg/L		0.4	4.2	0.5	1.5	0.7	<0.4	<0.4	<0.4	0.5	0.5
Total Coliforms	MPN/100mL	0	1	<2	<1	<1	1410	16	<1	10	179	<1
Escherichia coli	MPN/100mL	0	1	<2	<1	<1	<1	<1	<1	<1	<1	<1
Fecal	CFU/100mL	0	2									
Aluminium	ug/L	OG <100	10	<5	128	<5	83	<5	<5	<5	<5	<5
Antimony	ug/L	6	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Arsenic	ug/L	10	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Barium	ug/L	1000	5	32	6	<5	8	<5	5	5	5	6
Beryllium	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Bismuth	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Boron	ug/L	5000	5	12	5	<5	<5	8	<5	<5	<5	<5
Cadmium	ug/L	5	0.3	<0.017	0.03	<0.017	0.095	0.039	0.031	0.247	0.261	0.069
Chromium	ug/L	50	2	<1	<1	<1	<1	1	1	2	2	2
Cobalt	ug/L		1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Copper	ug/L	AO </= 1000	2	<2	2	<2	18	<2	<2	<2	<2	<2
Iron	ug/L	AO </= 300	50	<50	92	<50	<50	<50	<50	<50	<50	<50
Lead	ug/L	10	0.5	0.6	<0.5	<0.5	1.2	<0.5	<0.5	<0.5	<0.5	<0.5
Manganese	ug/L	AO </= 50	2	30	4	<2	<2	<2	<2	<2	<2	<2
Mercury	ug/L	1										
Molybdenum	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Nickel	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Selenium	ug/L	10	2	<1	<1	<1	<1	<1	<1	<1	<1	<1
Silver	ug/L		0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1
Strontium	ug/L		5	156	17	22	35	26	25	24	24	25
Thallium	ug/L		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Titanium	ug/L		2	<2	5	<2	3	<2	<2	<2	<2	<2
Uranium	ug/L	20	0.1	0.7	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Zinc	ug/L	AO </= 500	5	<5	<5	<5	14	<5	<5	<5	<5	<5
Sodium	mg/L		0.1	36.9	3.9	4.5	6.3	4.9	4.2	4.8	5	4.6
Potassium	mg/L		0.1	2.5	0.8	0.8	1.4	0.9	0.8	0.9	1	0.9
Calcium	mg/L		0.1	24.6	4.1	6.3	7	5.4	5.9	5.4	6.2	5.9
Magnesium	mg/L		0.1	3.5	1.1	1.3	2.5	1.6	1.5	1.5	1.6	1.5
Benzene	ug/L		1									
1,4-Dichlorobenzene	ug/L		1									
Methylene Chloride	ug/L		2									
Toluene	ug/L		2									
Vinyl Chloride	ug/L		0.6									
Chemical Oxygen Demand	mg/L		3									
Phenolics	mg/L		0.001									

Greenwood Sewage Treatment Plant Monitoring Well

Well 3A

Parameter	Unit	G/S (mg/L)	RDL	Baseline	3/22/2016	6/20/2016	9/19/2016	12/17/2016	3/27/2017	7/4/2017	10/2/2017	1/9/2018
Anion Sum	me/L			1.13	0.58	0.65	0.72	0.8	0.67	0.6	0.75	0.8
Bicarb Alkalinity (CaCO3)	mg/L		5	28	16	16	18	27	20	18	24	26
Calculated TDS	mg/L	AO </= 500	1	56	33	35	45	42	36	32	38	42
Carb Alkalinity	mg/L		10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Cation Sum	mg/L			0.82	0.63	0.62	0.99	0.73	0.64	0.58	0.65	0.71
Hardness	mg/L			25.5	20.3	19.7	32.2	24.2	21.2	19.1	21.7	24.1
Ion Balance	%			15.8	3.9	2.1	16.2	4.6	2.5	2.1	7.4	6.8
Langelier Index (20C)	NA			-1.72	-2.64	-2.64	-2.78	-2.54	-2.62	-2.76	-2.37	-2.37
Langelier Index (4C)	NA			-2.04	-2.96	-2.96	-3.1	-2.86	-2.94	-3.08	-2.69	-2.69
Saturation pH (20C)	NA	6.5-8.5		9.22	9.56	9.59	9.34	9.28	9.45	9.54	9.36	9.29
Saturation pH (4C)	NA	6.5-8.5		9.54	9.88	9.91	9.66	9.6	9.77	9.86	9.68	9.61
pH	NA	6.5-8.5		7.5	6.92	6.95	6.56	6.74	6.83	6.78	6.99	6.92
Reactive Silica as SiO2	mg/L		0.5	14.1	10	11.2	11.2	12.3	13.4	11.3	11.5	13.5
Chloride	mg/L	AO </= 250	1	16	6	8	9	6	6	6	7	6
Fluoride	mg/L	1.5	0.1	<0.1	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12
Sulphate	mg/L	AO </= 500	2	5	4	5	5	4	4	3	3	4
Alkalinity	mg/L		5	28	16	16	18	27	20	18	24	26
True Colour	TCU	AO </= 15	5	5	5	15	8	<5	<5	<5	19	<5
Turbidity	NTU		0.1	4800	1	1.2	2	2.5	1.2	1.6	4	1.4
Electrical Conductivity	umho/cm		1	115	95	73	86	86	77	71	77	90
Nitrate+Nitrite as N	mg/L		0.05	0.21	0.08	<0.05	<0.05	0.16	0.3	0.12	0.16	0.41
Nitrate as N	mg/L	10	0.05	0.09	0.08	<0.05	<0.05	0.16	0.3	0.12	0.16	0.41
Nitrite as N	mg/L	1	0.05	0.12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ammonia as N	mg/L		0.05	<0.03	0.04	0.13	<0.03	0.05	<0.03	<0.03	0.03	0.04
Total Organic Carbon	mg/L		0.5	2.6	0.8	<0.5	1.1	2.5	1.4	1	0.7	1.7
Dissolved Organic Carbon	mg/L		0.5	1.5	0.7		1	0.7	1.2	1.1	0.8	1
Ortho-Phosphate as P	mg/L		0.01	0.01	<0.01	<0.01	0.01	<0.01	0.02	<0.01	<0.01	<0.01
Phosphorus	mg/L		0.1	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	0.02		<0.02
Hydroxide	mg/L		5	<5	<5	<5		<5	<5	<5	<5	<5
Biochemical Oxygen Demand	mg/L		2	<2	<2	<2	<2		<2	<2	<2	<2
Total Suspended Solids	mg/L			7860								
Total Kjeldahl Nitrogen as N	mg/L		0.4	1.6	0.5	<0.4	<0.4	<0.4	<0.4	<0.4	6.7	0.5
Total Coliforms	MPN/100mL	0	1	<2	<1	<1	68	7	<1	10	299	<1
Escherichia coli	MPN/100mL	0	1	<2	<1	<1	<1	<1	<1	<1	<1	<1
Fecal	CFU/100mL	0	2									
Aluminum	ug/L	OG < 100	10	<5	11	<5	83	<5	<5	<5	<5	<5
Antimony	ug/L	6	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Arsenic	ug/L	10	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Barium	ug/L	1000	5	9	<5	<5	6	5	5	<5	<5	6
Beryllium	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Bismuth	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Boron	ug/L	5000	5	8	6	<5	<5	8	<5	<5	<5	<5
Cadmium	ug/L	5	0.3	<0.017	0.08	0.025	0.137	0.061	0.051	0.032	0.056	0.051
Chromium	ug/L	50	2	<1	<1	<1	<1	1	1	1	1	2
Cobalt	ug/L		1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Copper	ug/L	AO </= 1000	2	<2	<2	<2	24	<2	<2	<2	<2	<2
Iron	ug/L	AO </= 300	50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Lead	ug/L	10	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Manganese	ug/L	AO </= 50	2	20	<2	<2	<2	<2	<2	<2	<2	<2
Mercury	ug/L	1										
Molybdenum	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Nickel	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Selenium	ug/L	10	2	<1	<1	<1	<1	<1	<1	<1	<1	<1
Silver	ug/L		0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Strontium	ug/L		5	48	23	22	29	28	25	21	21	27
Thallium	ug/L		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Titanium	ug/L		2	<2	<2	<2	4	<2	<2	<2	<2	<2
Uranium	ug/L	20	0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Zinc	ug/L	AO </= 500	5	<5	<5	<5	19	<5	<5	<5	11	11
Sodium	mg/L		0.1	6.4	4.4	4.5	7	5.1	4.5	4	4.3	4.6
Potassium	mg/L		0.1	1.5	0.9	0.9	1.4	0.9	0.8	0.8	0.9	0.9
Calcium	mg/L		0.1	7.8	6	5.6	9.1	6.9	6.2	5.5	6.4	7
Magnesium	mg/L		0.1	1.4	1.3	1.4	2.3	1.7	1.4	1.3	1.4	1.6
Benzene	ug/L		1									
1,4-Dichlorobenzene	ug/L		1									
Methylene Chloride	ug/L		2									
Toluene	ug/L		2									
Vinyl Chloride	ug/L		0.6									
Chemical Oxygen Demand	mg/L		3									
Phenolics	mg/L		0.001									

Greenwood Sewage Treatment Plant Monitoring Well

Well #4A

Parameter	Unit	G/S (mg/L)	RDL	Baseline	3/22/2016	6/20/2016	9/19/2016	12/17/2016	3/27/2017	7/4/2017	10/2/2017	1/9/2018
Anion Sum	me/L			1.73	0.64	0.6	0.72	0.68	0.62	0.82	0.93	0.86
Bicarb Alkalinity (CaCO3)	mg/L		5	24	16	15	21	18	15	25	29	26
Calculated TDS	mg/L	AO </= 500	1	99	38	34	42	35	36	42	47	45
Carb Alkalinity	mg/L		10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Cation Sum	mg/L			1.72	0.75	0.61	0.86	0.63	0.66	0.71	0.74	0.74
Hardness	mg/L			23.1	22.5	18.7	26.7	19.7	20.9	23.1	24.8	24.8
Ion Balance	%			0.2		0.5	8.9	0.3	2.4	7.3	11.1	7.5
Langelier Index (20C)	NA			-2.62	-3.02	-3.13	-2.94	-2.97	-2.91	-2.66	-2.47	-2.43
Langelier Index (4C)	NA			-2.94	-3.34	-3.45	-3.26	-3.29	-3.23	-2.98	-2.79	-2.75
Saturation pH (20C)	NA	6.5-8.5		9.42	9.56	9.65	9.86	9.54	9.6	9.83	9.23	9.27
Saturation pH (4C)	NA	6.5-8.5		9.74	9.88	9.97	9.68	9.86	9.92	9.65	9.55	9.59
pH	NA	6.5-8.5		6.8	6.54	6.52	6.42	6.57	6.89	6.67	6.76	6.84
Reactive Silica as SiO2	mg/L		0.5	11.4	9.7	10.2	12.4	12.7	12.1	13.4	12.4	10.6
Chloride	mg/L	AO </= 250	1	38	6	6	6	3	7	7	8	8
Fluoride	mg/L	1.5	0.1	<0.1	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12
Sulphate	mg/L	AO </= 500	2	6	5	5	5	4	4	4	4	4
Alkalinity	mg/L		5	24	16	15	21	18	15	25	29	26
True Colour	TCU	AO </= 15	5	<5	6	23	6	5	8	<5	17	<5
Turbidity	NTU		0.1	2200	9.2	14.6	44.1	7.6	10.7	14.3	36.4	39.6
Electrical Conductivity	umho/cm		1	183	105	89	77	77	79	90	92	97
Nitrate+Nitrite as N	mg/L		0.05	0.71	0.66	0.44	0.32	0.22	0.66	0.51	0.55	0.46
Nitrate as N	mg/L	10	0.05	0.62	0.66	0.44	0.32	0.22	0.66	0.51	0.55	0.46
Nitrite as N	mg/L	1	0.05	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ammonia as N	mg/L		0.05	0.04	0.04	0.12	<0.03	0.07	0.08	<0.03	0.04	0.04
Total Organic Carbon	mg/L		0.5	2.5	1.1	<0.5	1.4	2.6	1.1	1.5	1	1.7
Dissolved Organic Carbon	mg/L		0.5	1.6	0.9		1.2	0.9	1	1.4	1	1.2
Ortho-Phosphate as P	mg/L		0.01	<0.01	<0.01	0.01	0.02	<0.01	0.04	<0.01	0.01	<0.01
Phosphorus	mg/L		0.1	<0.02	<0.02	<0.02	0.09	<0.02	<0.02	0.02		<0.02
Hydroxide	mg/L		5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Biochemical Oxygen Demand	mg/L		2	<2	<2	<2	<2		<2	<2	<2	<2
Total Suspended Solids	mg/L			4700								
Total Kjeldahl Nitrogen as N	mg/L		0.4	1	0.6	<0.4	<0.4	<0.4	0.5	0.4	<0.4	0.8
Total Coliforms	MPN/100mL	0	1	<2	<1	37	>2420	3	4	165	41	1
Escherichia coli	MPN/100mL	0	1	<2	<1	<1	<1	<1	<1	<1	<1	<1
Fecal	CFU/100mL	0	2									
Aluminum	ug/L	OG < 100	10	<5	264	<5	221	6	<5	<5	<5	<5
Antimony	ug/L	6	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Arsenic	ug/L	10	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Barium	ug/L	1000	5	20	14	8	20	6	9	9	5	5
Beryllium	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Bismuth	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Boron	ug/L	5000	5	9	7	6	<5	9	5	<5	5	5
Cadmium	ug/L	5	0.3	0.038	0.14	0.112	0.243	0.049	0.139	0.146	0.065	0.779
Chromium	ug/L	50	2	1	<1	<1	<1	1	2	2	2	2
Cobalt	ug/L		1	1	<1	<1	<1	<1	<1	<1	<1	<1
Copper	ug/L	AO </= 1000	2	<2	<2	<2	19	<2	<2	<2	<2	<2
Iron	ug/L	AO </= 300	50	<50	142	<50	69	<50	<50	<50	<50	<50
Lead	ug/L	10	0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5
Manganese	ug/L	AO </= 50	2	61	8	<2	8	<2	<2	<2	<2	<2
Mercury	ug/L	1										
Molybdenum	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Nickel	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Selenium	ug/L	10	2	<1	<1	<1	<1	<1	<1	<1	<1	<1
Silver	ug/L		0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Strontium	ug/L		5	39	33	26	31	28	28	35	29	35
Thallium	ug/L		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Titanium	ug/L		2	<2	9	<2	3	<2	<2	<2	<2	<2
Uranium	ug/L	20	0.1	0.2	0.2	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	ug/L		2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Zinc	ug/L	AO </= 500	5	<5	<5	<5	20	<5	<5	<5	<5	<5
Sodium	mg/L		0.1	28	5.2	4.7	6	4.8	5	5.1	5	5
Potassium	mg/L		0.1	1.5	1	0.9	1.3	0.9	0.9	0.9	1	1
Calcium	mg/L		0.1	6.1	6	5.2	7.4	5.6	5.9	6.6	7.3	7.3
Magnesium	mg/L		0.1	1.9	1.9	1.4	2	1.4	1.5	1.6	1.6	1.6
Benzene	ug/L		1				0.09					
1,4-Dichlorobenzene	ug/L		1									
Methylene Chloride	ug/L		2									
Toluene	ug/L		2									
Vinyl Chloride	ug/L		0.6									
Chemical Oxygen Demand	mg/L		3									
Phenolics	mg/L		0.001									

Greenwood Sewage Treatment Plant Monitoring Well

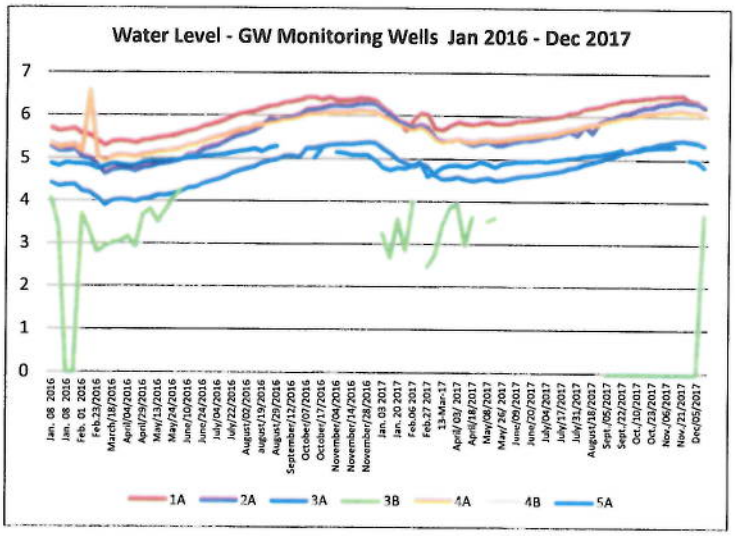
Well #5

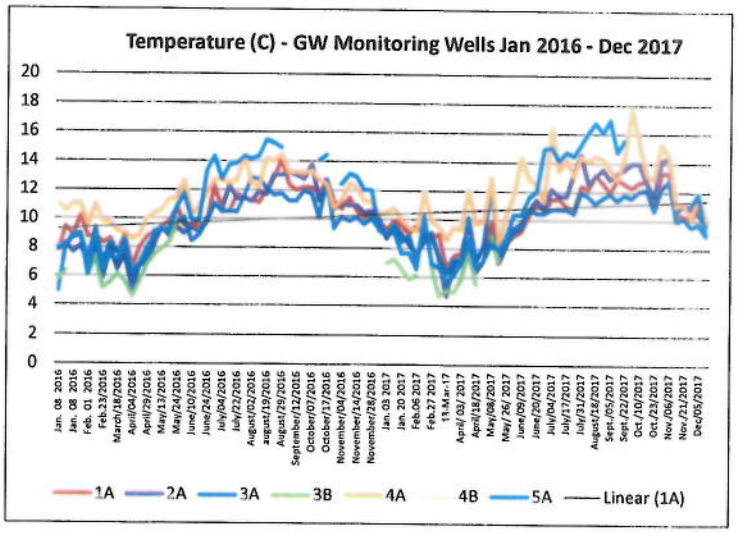
Parameter	Unit	G/S (mg/L)	RDL	Baseline	3/22/2016	6/20/2016	9/19/2016	12/17/2016	3/27/2017	7/4/2017	10/2/2017	1/9/2018
Anion Sum	me/L			1.06	0.65	0.65	Dry	1.58	0.59	0.72	0.92	0.78
Bicarb Alkalinity (CaCO3)	mg/L		5	28	21	20		51	16	21	28	23
Calculated TDS	mg/L	AO </= 500	1	56	38	36		96	34	39	50	42
Carb Alkalinity	mg/L		10	<10	<10	<10		<10	<10	<10	<10	<10
Cation Sum	mg/L			0.85	0.74	0.66		1.8	0.62	0.69	0.79	0.71
Hardness	mg/L			27.2	26.4	23.1		70.8	21.3	24.7	27.5	24.1
Ion Balance	%			10.8	6.8	0.9		6.4	2.6		7.6	5.1
Langelier Index (20C)	NA			-2.18	-2.68	-3.03		-1.85	-2.78	-2.79	-2.59	-2.51
Langelier Index (4C)	NA			-2.5	-3	-3.35		-2.17	-3.1	-3.11	-2.91	-2.82
Saturation pH (20C)	NA	6.5-8.5		9.28	9.29	9.39		8.49	9.5	9.34	9.17	9.29
Saturation pH (4C)	NA	6.5-8.5		9.6	9.61	9.71		8.81	9.82	9.66	9.49	9.6
pH	NA	6.5-8.5		7.1	6.61	6.36		6.64	6.72	6.55	6.58	6.78
Reactive Silica as SiO2	mg/L		0.5	6.8	4.6	5.8		7.6	4.8	5.9	6.3	5.8
Chloride	mg/L	AO </= 250	1	14	3	4		6	5	6	6	6
Fluoride	mg/L	1.5	0.1	<0.1	<0.12	<0.12		<0.12	<0.12	<0.12	<0.12	<0.12
Sulphate	mg/L	AO </= 500	2	7	5	5		5	4	4	4	5
Alkalinity	mg/L		5	23	21	20		51	16	21	28	23
True Colour	TCU	AO </= 15	5	<5	7	23		<5	14	6	8	<5
Turbidity	NTU		0.1	2300	8.5	16.4		33.1	9.6	5.4	48.4	8
Electrical Conductivity	umho/cm		1	105	99	68		169	73	81	92	96
Nitrate+Nitrite as N	mg/L		0.05	0.82	0.52	0.42		4.04	0.61	0.65	1.56	0.67
Nitrate as N	mg/L	10	0.05	0.75	0.52	0.42		4.04	0.61	0.65	1.56	0.67
Nitrite as N	mg/L	1	0.05	0.07	<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05
Ammonia as N	mg/L		0.05	0.03	0.05	0.11		0.04	<0.03	<0.03	0.03	0.03
Total Organic Carbon	mg/L		0.5	2.5	1.2	0.5		2	1.1	1.4	<0.5	1.7
Dissolved Organic Carbon	mg/L		0.5	1.7	1.2			2	1	1.4	<0.5	1.6
Ortho-Phosphate as P	mg/L		0.01	<0.01	<0.01	<0.01		<0.01	0.03	<0.01	<0.01	<0.01
Phosphorus	mg/L		0.1	<0.02	<0.02	<0.02		<0.02	<0.02	<0.02		<0.02
Hydroxide	mg/L		5	<5	<5	<5		<5	<5	<5	<5	<5
Biochemical Oxygen Demand	mg/L		2	<2	<2	<2			<2	<2	<2	<2
Total Suspended Solids	mg/L			4370								
Total Kjeldahl Nitrogen as N	mg/L		0.4	1.1	0.7	<0.4		2	0.4	0.8	1.2	0.5
Total Coliforms	MPN/100mL	0	1	690	<1	5		41	<1	14	39	1
Escherichia coli	MPN/100mL	0	1	<2	<1	<1		<1	<1	<1	<1	<1
Fecal	CFU/100mL	0	2									
Aluminum	ug/L	OG < 100	10	22	194	6		<5	7	<5	<5	5
Antimony	ug/L	6	2	<2	<2	<2		<2	<2	<2	<2	<2
Arsenic	ug/L	10	2	<2	<2	<2		<2	<2	<2	<2	<2
Barium	ug/L	1000	5	27	19	13		28	14	15	<5	16
Beryllium	ug/L		2	<2	<2	<2		<2	<2	<2	<2	<2
Bismuth	ug/L		2	<2	<2	<2		<2	<2	<2	<2	<2
Boron	ug/L	5000	5	5	6	6		25	<5	<5	9	6
Cadmium	ug/L	5	0.3	0.03	0.76	0.09		0.153	0.175	0.161	0.081	0.17
Chromium	ug/L	50	2	<1	<1	<1		2	1	1	2	2
Cobalt	ug/L		1	<1	<1	<1		<1	<1	<1	<1	<1
Copper	ug/L	AO </= 1000	2	<2	3	<2		<2	<2	<2	<2	<2
Iron	ug/L	AO </= 300	50	<50	<50	<50		<50	<50	<50	<50	<50
Lead	ug/L	10	0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5
Manganese	ug/L	AO </= 50	2	49	6	2		4	<2	2	<2	2
Mercury		1										
Molybdenum	ug/L		2	<2	<2	<2		<2	2	<2	<2	<2
Nickel	ug/L		2	<2	<2	<2		<2	<2	<2	<2	<2
Selenium	ug/L	10	2	<1	<1	<1		<1	<1	<1	<1	<1
Silver	ug/L		0.5	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1
Strontium	ug/L		5	40	38	31		100	34	39	41	41
Thallium	ug/L		0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1
Tin	ug/L		2	<2	<2	<2		<2	<2	<2	<2	<2
Titanium	ug/L		2	<2	2	<2		<2	<2	<2	<2	<2
Uranium	ug/L	20	0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	ug/L		2	<2	<2	<2		<2	<2	<2	<2	<2
Zinc	ug/L	AO </= 500	5	6	<5	<5		<5	<5	<5	<5	<5
Sodium	mg/L		0.1	6.5	3.8	3.9		7.9	1	4.1	4.9	4.6
Potassium	mg/L		0.1	0.8	0.8	0.7		1.3	0.7	0.7	1.1	0.8
Calcium	mg/L		0.1	8.4	8.6	7.1		24.4	6.9	7.6	8.7	8
Magnesium	mg/L		0.1	1.5	1.2	1.3		2.4	1	1.4	1.4	1
Benzene	ug/L		1									
1,4-Dichlorobenzene	ug/L		1									
Methylene Chloride	ug/L		2									
Toluene	ug/L		2									
Vinyl Chloride	ug/L		0.6									
Chemical Oxygen Demand	mg/L		3									
Phenolics	mg/L		0.001									

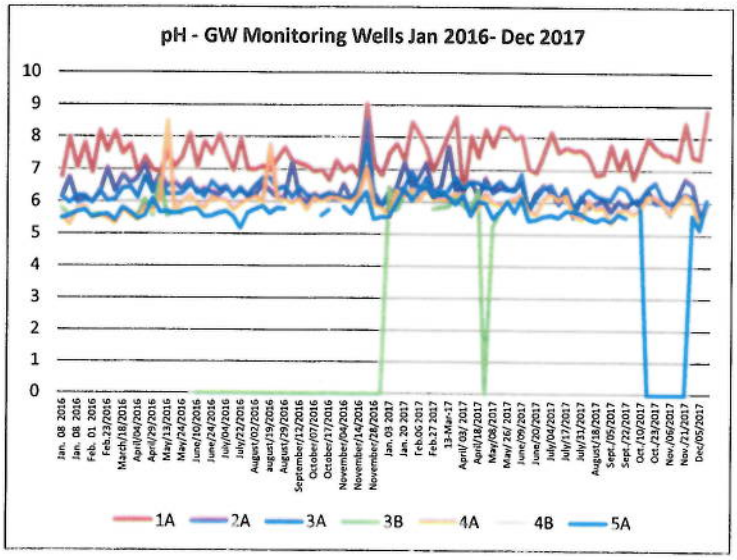
Appendix B

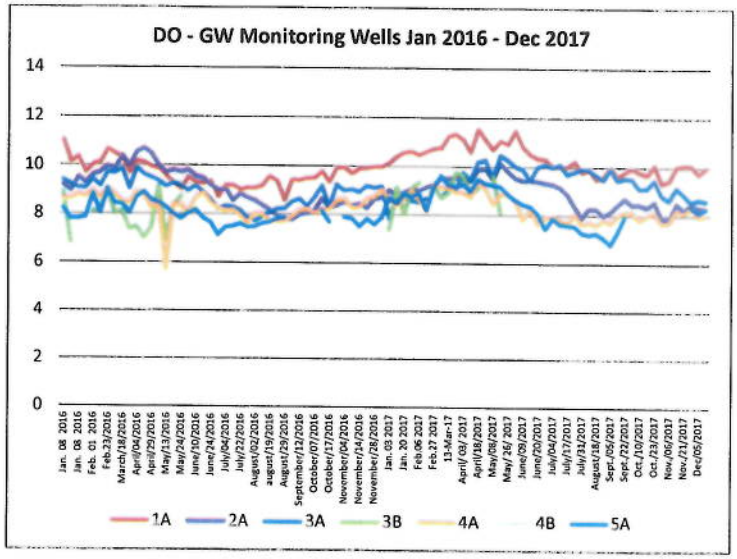
Greenwood Sewage Treatment Plant Groundwater Monitoring Wells – Weekly

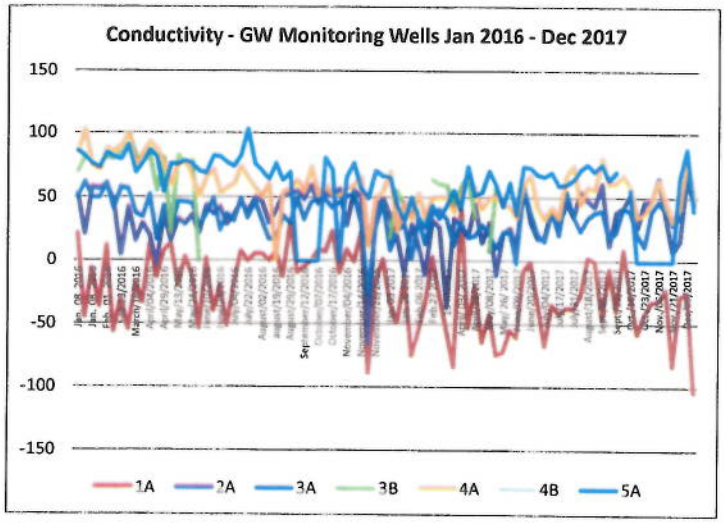
Greenwood STP Monitoring Wells - Weekly Parameters











Appendix C

Greenwood Water Microscopic Particulate Analysis - 2017

CBCL Ltd.

Municipality of Kings
Microscopic Particulate Analysis
Sampling 2017

Final Report

170816.01 • Final Report • October, 2017

Prepared for:

Municipality of the County of Kings

Prepared by:

CBCL LIMITED

Consulting Engineers

Final Report		10/06/2017	C. Walker
Draft Report v2		08/21/2017	C. Walker
Draft Report	C. Walker	07/26/2017	L. Jenkins
Issue or Revision	***Reviewed By:***	***Date***	***Issued By:***

CBCL LIMITED
Consulting Engineers

CBCL LIMITED
Consulting Engineers

October 6, 2017

Ms. Lisa Langille
Compliance Officer
Municipality of the County of Kings
87 Cornwallis Street
PO Box 100
Kentville, NS B4N 3W3

Dear Ms. Langille:

RE: Final Report – Engineering Services, Greenwood and Sandy Court Water Utility Production Wells MPA Testing

CBCL Limited is pleased to present our final report on the MPA sampling program at the Village of Greenwood well field (Tremont) and the community of Aylesford well field (Sandy Court). I encourage you to contact the undersigned with any questions or concerns at your convenience.

Yours very truly,

CBCL Limited

Colin Walker, M.Sc., P.Geo
Hydrogeologist
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Project No: 170816.01

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Contents

Appendices

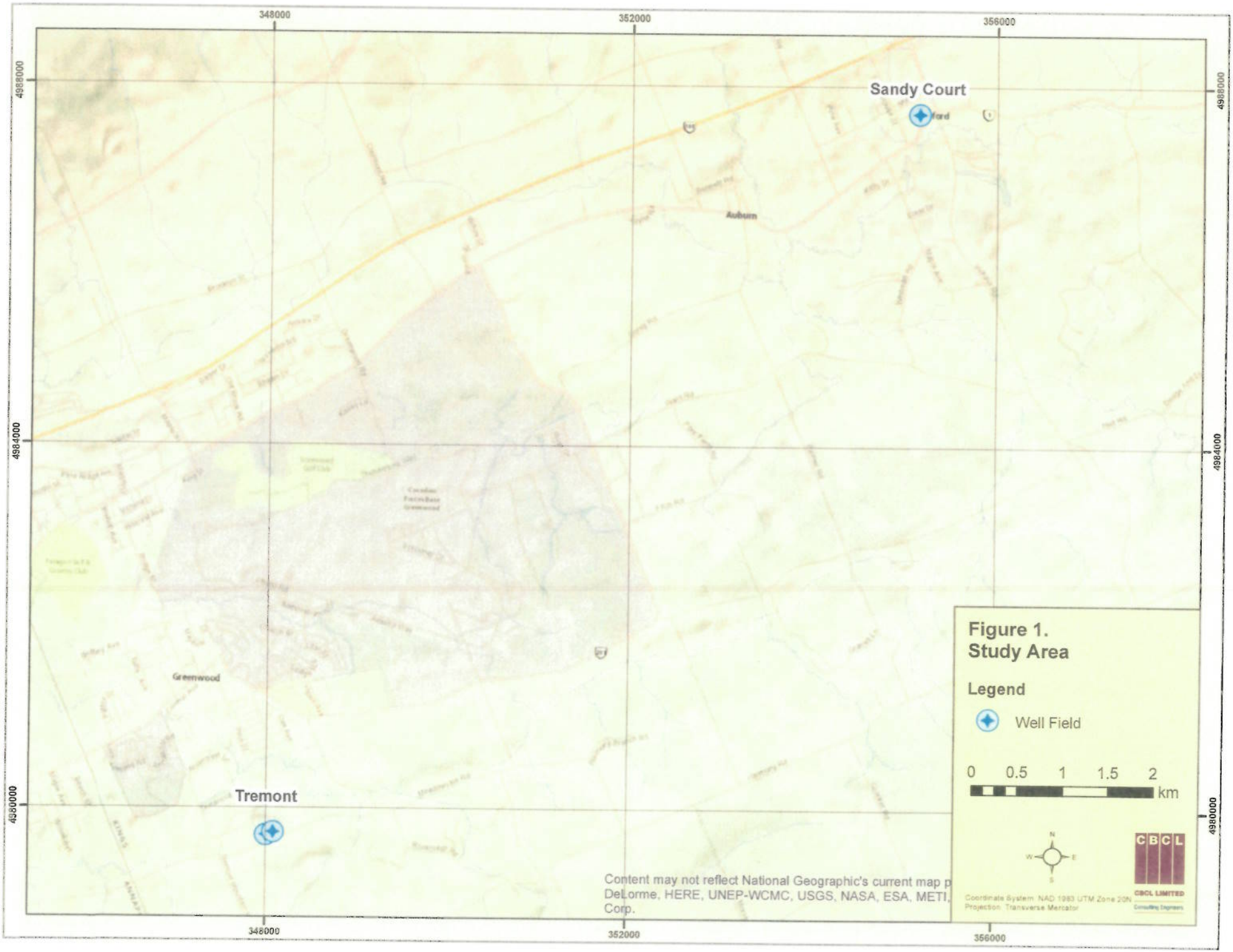
CHAPTER 1 INTRODUCTION

1.1 Objective

CBCL Limited (CBCL) was retained by the County of Kings, NS, to conduct Microscopic Particulate Analysis (MPA) sampling at the Tremont and Sandy Court well fields, shown in Figure 1. MPA sampling is a part of the Greenwood and Aylesford utility monitoring programs to test for microscopic particulates (associated with GUDI sources). Both the Tremont well field and the Sandy Court well were identified in earlier studies as potentially Groundwater Under the Direct Influence of surface water (GUDI) as a result of Step 2 GUDI Investigations.

The Tremont well field, shown in Figure 2, supplies water to the Village of Greenwood Water Utility, drawing water that was identified as Groundwater Under the Direct Influence of surface water (GUDI). The GUDI classification of the Tremont well field was a result of a Step 2 GUDI Investigation conducted by AMEC Earth and Environmental (2004), and a 2008 MPA sampling result that showed a risk score of "Medium". MPA sampling is performed every two years as mandated by Nova Scotia Environment (NSE), and has been conducted at the Tremont well field since 2004. The Sandy Court well, identified as potentially GUDI (as per Step 2 testing), supplies water to the community of Aylesford, shown in Figure 3. MPA sampling has been conducted at the Sandy Court since 2013 as per a recommendation of Step 2 Reporting, and the results showed a risk score of "Low"".

MPA samples were obtained and analyzed using methods satisfying the NSE document "Protocol for determining Groundwater Under the Direct Influence of Surface Water", which refers to the 1992 USEPA document: "Consensus Method for Determining Groundwater Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA). U.S. Environmental Protection Agency. EPA 910/9-92-029. October 1992."


348000
352000
356000
4988000
4984000
4980000
Sandy Court
Auburn
Greenwood
Tremont
Figure 1.
Study Area
Legend
Well Field
0 0.5 1 1.5 2
km
N
W
E
S
CBCL LIMITED
Consulting Engineers
Coordinate System: NAD 1983 UTM Zone 20N
Projection: Transverse Mercator
Content may not reflect National Geographic's current map p
DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI,
Corp.


347500
348000
4980000
4979500
GW8
GW13
Meadowvale Road
0 50 100 150 200
m
Figure 2.
Tremont Well Field
Legend
Wells
Well Field Fence
Property Lines
Stream / Ditch
Coordinate System: NAD 1983 UTM Zone 20N
Projection: Transverse Mercator
CBCL LIMITED
Consulting Engineers


354500
355000
355500
4988000
4987500
Sandy Court
0 50 100 150 200
m
Figure 3.
Sandy Court Well Field
Legend
Well
Property Lines
Stream / Ditch
CBCL LIMITED
Consulting Engineers
Coordinate System: NAD 1983 UTM Zone 20N
Projection: Transverse Mercator

1.2 Site Description

1.2.1 Tremont Well Field

The Tremont well field is located at 893 Meadowvale Road, Greenwood, in the community of Tremont. The groundwater is disinfected using ultraviolet light and distributed to the community by reservoir. The Greenwood well field comprises of two wells, GW8 and GW13, located at the foot of the South Mountain at an approximate elevation of 30 m geodetic. The well field draws water from a buried outwash valley aquifer, a linear deposit of stratified well sorted sand and gravel occupying a depression in the bedrock surface.

Production wells GW8 and GW13 were drilled to 23.8 m below grade (mbg) and 27.1 mbg respectively. A 5 m thick sequence of sandy silt forms a semi-confining layer over the sand and gravel aquifer. The upper part of the aquifer is described primarily as sand, extending to a depth of 15 to 20 mbg. The gravel content increases significantly at 20 mbg, indicating the presence of a deeper high permeability zone. The wells are screened over the most productive interval of gravel, near the base of each borehole.

Drawdown curves were reported to exhibit semi-confined to unconfined behaviour, showing early Theis response followed by steady state conditions. Well performance data are shown in Table 1.1 below.

Table 1.1: Well Performance Data

Well ID	Well Diameter (mm)	Screen Interval (mbg)	Casing Depth (mbg)	Storativity	Transmissivity (m^2/d)	Safe Yield Pumping Rate (L/min)
GW8	254	15.2-23.5	18.60	10^{-1} to 10^{-3}	492	532
GW13	254	22.9-25.9	24.40	10^{-1} to 10^{-3}	775	591
Sandy Court	254	21.7-23.2	20.13	8.6×10^{-3}	757	91

The average demand for water in Greenwood varied from an average of 420 L/min in 2005 to 560 L/min from January 2006 to July 2007, with peak demands reaching up to 1,378 L/min during the summer months. The combined capacity of the well field was estimated to be 1,545 L/min (2,225 m^3/day) at peak demand, and 1,123 L/min (1,617 m^3/day) under long-term sustainable use. Production well characteristics are summarized in Table 1.2.

Table 1.2: Production Well Characteristics

Well ID	Northing	Easting	PID	TOC Elevation (m geodetic)	Borehole Depth (m)	Max Capacity (m^3/day)	Date Drilled	Driller
GW8	4979744	348091	5182951	35.1	23.80	818	30-Apr-90	W&R
GW13	4978709	337670	5180187	34.0	27.10	1407	10-Jun-04	Valley Well
Sandy Court	4987721	355148	55092407	34.0	23.18	10	12-Jun-09	Trask & Sons

1.2.2 Sandy Court Well Field

The Sandy Court Well Field is located at 1090 Sandy Court, adjacent to a Senior's complex in the community of Aylesford. The well supplies water directly to the village via a small holding tank and treatment system. Demand in the community is typically less than 15,000 L/day. The aquifer is described as an unconfined deposit of interbedded sand and gravel, mapped as ice-contact stratified drift. The well is screened in this aquifer from 21.66 to 23.18 metres below the ground surface. The well casing is grouted to a depth of 20.13 metres, which exceeds requirements under the NSE Well Construction Regulations.

A Step 2 GUDI assessment of the well was completed between December 2011 and December 2012. Utility staff maintained detailed records of road salt application and in situ measurements of water pumped from the Sandy Court well. Chloride concentrations and conductivity increased during the winter months in response to road salting. The approximate response time was 30 to 50 days, indicating that the time of travel of infiltrating water to the well intake is less than 90 days. A Step 3 GUDI assessment (MPA sampling) was recommended based on these findings (Terry W. Hennigar, WATER Consulting, 2013).

CHAPTER 2 METHODOLOGY

2.1 MPA Sampling

MPA samples were collected as specified in the NSE document "Protocol for Determining Groundwater Under the Direct Influence of Surface Water", which refers to the 1992 USEPA Consensus Method to test for Groundwater Under the Direct Influence. This method has been further developed into the 2009 modified Method 1623-MPA protocol (Wallis and Henschke, in press) to improve the sensitivity of the method and reduce required pumping volumes. The reduction of pumping volume decreased the costs and logistic challenges associated with MPA sampling while improving the actual results of sampling.

The EPA methodology specifies that samples are to be collected from each groundwater supply well separately. The sampling process described below was conducted independently at each well (GW8, GW13 and Sandy Court) for a total of five MPA samples. Samples were collected at Sandy Court on May 11, 2017, the Tremont well field on May 10, 2015, and the Tremont well field again on May 27th. Sampling followed a major rainfall event, during which total precipitation exceeded 25 mm. Total rainfall 96 hours prior to sampling on May 10 and 11 was 58 mm (Environment Canada, Greenwood Airport).

Each well was flushed for 30 minutes to ensure development of the well and that a representative sample was collected. Water drawn from the wellhead was directed through a sampling assembly including a flow meter, Filta-Max 1-micrometer cartridge filter, and discharge hose. Overflow from GW8 and GW13 were directed away from the wellhead to a drainage swale located near the centre of the well field (approximately 10 metres from the wellhead). Overflow from the Sandy Court well was directed to a drain in the pumping station connecting to the roadside drainage ditch (approximately 10 metres away from the wellhead).

The modified sampling method specified a maximum pumping rate of 3.8 litres/minute requiring a sampling time of approximately 1.5 hours per well. The flow rate at Sandy Court is typically lower due to the pump cycling off and on, therefore requiring a longer sampling time. To increase the flow rate, the demand of the well was increased by opening a sampling port and a bathroom tap initiating continuous pumping thus increasing the flow rate and reducing the sampling time to 1.5 hours. In situ chemical parameters were measured in samples of the water discharging from the sampling assembly. Flow rate measurements and chemical data are shown in the field sampling log in Appendix A.

The water pressure was measured at the sampling port of each wellhead to ensure that appropriate pressure was maintained during sampling (the Filta-Max cartridge system has an optimal operating pressure of 40 to 75 psi). The pressure at production wells GW8 and GW13 was 59 and 58 psi respectively, and the pressure at the Sandy Court well varied from 40 - 54 psi. The sampling schedule was confirmed with the utility operator to ensure cycling of the pumps as required (each well was sampled independently, with the adjacent well was turned off).

Upon completion of each sampling interval the sample cartridges were bagged and preserved on ice for transport to the laboratory. Sample cartridges were express couriered to Hyperion Research Limited, in Medicine Hat, Alberta for analysis within 96 hours of sampling. Material from the cartridges was recovered by the lab and analyzed by varying techniques for indicators of surface water influence (Giardia cysts, Cryptosporidium oocysts, diatoms and other algae, insects/larvae, rotifers, plant debris, nematodes, crustaceans, amoeba, ciliates, and flagellates).

Additional sampling and inspection work was completed following detection of giardia cysts at GW8 during the first round of sampling. CBCL visited and inspected the well field, the pump buildings / chamber, and the surrounding area on the day following notification of giardia on the sample filter. Field inspections were focused on identifying areas of standing water, and potential short circuit pathways associated with the condition and setting of each well head.

The Tremont well field was re-sampled on May 27th, after a total rainfall on May 26th of 21.4 mm (Environment Canada, Greenwood Airport). The methodology of the re-sampling program was consistent to the aforementioned procedure. Additional care in disinfecting the sampling taps and hoses was performed by the Municipality. The water pressure measured at production wells GW8 and GW13 was 60 and 58 psi respectively. In situ chemical parameters were measured in samples of the water discharging from the sampling assembly. Flow rate measurements and chemical data are shown in the field sampling log in Appendix A. Additional surface water samples were collected from drainage ditches near the well field, at the locations shown in Figure 4. These surface water samples were analyzed for spores to test for activity by aerobic spore forming bacteria. Spore forming bacteria are abundant in surface water and shallow soil but not in groundwater.


347500
348000
4979500
Inactive Pits
Grubbings
Cemetery
Meadowvale Road
0
30
60
90
120
m
Figure 4.
Surface Water
Sample Locations
Legend
Wells
Sample Location
Horse Paddock
Well Field Fence
Property Lines
Stream / Ditch
Coordinate System: NAD 1983 UTM Zone 20N
Projection: Transverse Mercator
CBCL LIMITED

CHAPTER 3 RESULTS

3.1 MPA Sample Results

A summary of MPA risk scores is provided in Table 3.1, and laboratory certificates of analysis for 2017 samples are provided in Appendix B. Risk scores at GW8 have generally been low, varying from 0 to 9 between 2004 and 2017. The May 10th sampling event at GW8 resulted in a risk score of 0, but two giardia cysts were present on the filter (a count of 0.5 cysts/100 L). The groundwater supplied by the Tremont well field is disinfected by ultraviolet (UV) light. Extra care was taken by the Municipality to check the disinfection system and ensure that it was operating adequately. As the giardia count was low and UV treatment is effective in inactivating Giardia, no further action was necessary.

MPA risk scores for GW13 have generally been Low, varying between 0 and 9, and remaining at 0 between 2013 and 2017. One sample in 2008 showed a risk score 14, indicating a Moderate risk of drawing surface-related pathogens into the well. Risk scores at Sandy Court have been Low since sampling began in 2013.

Table 3.1: MPA Risk Scores (2004-2017), Tremont and Sandy Court Well Fields

Date	GW8	GW13	Sandy Court
April 2004	0 (Low)	X	X
October 2004	0 (Low)	X	X
June 2005	9 (Low)	9 (Low)	X
December 2006	X	0 (Low)	X
May 2008	X	14 (Moderate)	X
May 2011	4 (Low)	1 (Low)	X
June 2013	0 (Low)	0 (Low)	0 (Low)
Oct 2013	X	X	0 (Low)
June 2015	6 (Low)	0 (Low)	4 (Low)
May 10, 2017	0 (High)*	0 (Low)	0 (Low)
May 27, 2017	0 (Low)	0 (Low)	X

X – no sample

*Risk score was adjusted to "High" due to presence of Giardia

Particulate sampling results are shown in Table 3.2. GW8 showed a risk score of 0 in combination with detection of giardia cysts. Although this condition is rare, the laboratory reported that this does occasionally occur. The absence of other particulate matter would tend to indicate that the giardia spores may have entered the well through a means other than filtration through the aquifer material. Possibilities would typically include infiltration through fissures in the well casing, cap, or annular seal, however, the condition of the casing at GW8 was good, with no indications of short-circuit pathways between the ground surface and well screen.

To further investigate potential connections between surface water and the outwash valley aquifer, spore samples were taken from selected surface water shown on Figure 4, and from each of the production wells. Spore counts in raw well water were 60 CFU/L at GW8 and 0 CFU/L at GW13. The surface water sample from the ditch at the entrance of the well field had a spore count of 206400 CFU/L, and the spore sample at the creel contained a count of 40800 CFU/L. Both surface water samples contained algae, rotifers, ciliates, filamentous bacteria and plant matter. The counts and composition of surface water particulates were significantly different from those of the wells. In-situ chemical measurements, field sampling logs, and analytical laboratory results are provided in Appendix A and B respectively.

Hyperion Laboratory reported that, provided the filters are removed from the sealed protective packaging with new, clean rubber gloves, the potential for cross-contamination and/or lab error is essentially nil (giardia spores are detected by physical observation within the folds of the MPA filter). The laboratory further indicated that when giardia is present in the absence of other particulates, fecal contamination can be related to animal activity near the well head. The site inspection showed no evidence of and little potential for animal activity at GW8; the well is located in a heated building with a dry, competent concrete floor. GW13 is located in a well pit with fissures that are open to the ground surface, and requires a sump pump to keep the pit dry. Although there is potential for animal activity in the well pit, no giardia cysts have been observed at this location. Photographs of the well head at GW8, and the stem extending from the pit of GW 13 are provided in Appendix C.

Standing water in ditches was identified as the most likely source of giardia to the aquifer. The ditches collect roadside water, and may be affected by properties surrounding the well field. There is a horse paddock 300 metres to the southwest of the well field. Several other homes adjacent to the well field would also rely on on-site systems for sewage disposal. A failing septic bed could contribute pathogens to the subsurface or nearby ditches. Giardia is most commonly present in surface water occupied by aquatic animals such as muskrats or beavers. Other animals which could contribute giardia to surface water include rats, mice, horses, dogs, and human sewage. Other features in the area that would increase the risk of shallow contaminants entering the aquifer include inactive pits, a pile of grubbed organic material (roots, stumps etc.), and a cemetery, shown on Figure 4.

The periodic deeper infiltration of particulate material is attributed to the intensity and duration of rainfall, which results in increased infiltration and the presence of standing water in ditches. These conditions would be expected to increase the potential for migration of particulates downward into the aquifer and toward well screens. Rainfall records from Greenwood airport in May 2008 show a total

rainfall of 92 mm, exceeding the seasonal norm. Rainfall in the 96 hours preceding the May 10, 2017 samples was 58 mm, also exceeding average rainfall.

Table 3.2: Summary of MPA Sampling Results (2004-2017), Tremont Well Fields

	June 2005	Dec 2006	May 2008	May 2011	June 2013	June 2015	May 10, 2017	May 27, 2017	April 2004	Oct 2004	June 2005	May 2011	June 2013	June 2015	May 10, 2017	May 27, 2017
Location		GW13								GW8						
Risk Score	9	0	14	1	0	0	0	0	0	0	9	4	0	6	0	6
Risk Description	LOW	LOW	MOD-ERATE	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	HIGH*	LOW
Giardia (cysts/100 L)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0
Cryptosporidium (oocysts/100 L)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Algae[1]	52	0	4800	0.9	0	0	0	0	-	0	34	13.8	0	1.91	0	1.0
Insect/Larvae[1]	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0
Rotifers[1]	0	0	0	1.79	0	0	0	0	-	0	0	0	0	0	0	0
Plant Debris[1]	1.0	0	0	0.9	0	10.5	18.3	14.4	-	0	0	0.86	0	17.22	18.2	16.3
Pollen[1]	9.0	0	4.0	0	69.9	1	0	0	-	0	2.0	0.9	4.8	0	0	0
Nematodes[1]	0	0	0	0	0	0	5.8	0	-	8.4	1.0	0	0	0	1.9	0
Crustacea[1]	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0
Amoebae[1]	0	0	4.4	0	0	0	0	0	-	0	0	0	0	0	0	0
Ciliate/Flagellates[1]	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0
Other Protozoa[1]	0	29	-	-	-	-	-	-	-	1400	0	-	-	-	0	-
Spore Count CFU/L	-	-	-	-	-	-	-	0	-	-	-	--	-	-	-	60

1: Units recorded as count per volume sampled

*Risk score of HIGH was assigned due to presence of two giardia cysts

Table 3.3: Summary of MPA Sampling Results (2013-2017), Sandy Court Well Field

	June 2013	Oct 2013	Jun 2015	May 2017
Location	Sandy Court			
Risk Score	0	0	4	0
Risk Description	LOW	LOW	LOW	LOW
Giardia (cysts/100 L)	0	0	0	0
Cryptosporidium (oocysts/100 L)	0	0	0	0
Total Algae[1]	0	0	2.88	0
Insect/Larvae[1]	0	0	0	0
Rotifers[1]	0	0	0	0
Plant Debris[1]	0	0	3.84	10.6
Pollen[1]	0	0	0	0
Nematodes[1]	0	0	0	5.8
Crustacea[1]	0	0	0	0
Amoebae[1]	0	0	0	0
Ciliate/Flagellates[1]	0	0	0	0
Other Protozoa[1]	-	-	-	-

CHAPTER 4 CONCLUSIONS & RECOMMENDATIONS

4.1 Conclusions

4.1.1 Tremont Well Field

Historical sampling results have shown evidence of limited interaction between surface water and the Tremont aquifer. Reported risks have been generally low since sampling began in 2004, indicating that the log-filtration credit assigned to the aquifer is functioning as expected. Elevated counts of algae in 2008, and giardia spores detected in 2017 suggest that, periodically, surface-derived constituents can reach the well screens. Risk conditions in the aquifer are Low at most times of the year, but are elevated to Moderate following intensive or extended periods of precipitation. Raw water from the Tremont aquifer is treated with a UV light, which was installed as a precautionary measure to address this type of condition.

4.1.2 Sandy Court Well Field

The analytical results showed minor evidence of groundwater-surface water interaction in the pumping well at Sandy Court. Reported risks to each aquifer were "Low" in 2013 to 2017, suggesting that the thickness of the unsaturated and saturated material between the well screens and nearby surface water or infiltration locations was sufficient to remove potentially harmful microscopic particulates. *Giardia* cysts and *Cryptosporidium* oocysts (health-related parameters) have not been detected at this location.

4.2 Recommendations

4.2.1 Tremont Well Field

Continued MPA sampling will be required to provide indications of the risk level associated with raw water, and to ensure that intensive rain events do not elevate the risk score to High. MPA samples should be collected when seasonal rainfall is above average, and after intensive rainfall events.

The following items are furthermore recommended to encourage more timely and effective monitoring:

- Consider continuous down-hole (SCADA) monitoring of temperature and conductivity and establish trigger levels using 1 to 2 years of monitoring data;
- Establish detailed and careful record of meltwater and rain events;

- Collect samples for analysis of total coliform bacteria and E. coli (in addition to existing monitoring work):
  - After major rain events (total precipitation exceeding 20 mm in 24 hours);
  - When temperature and/or conductivity exceed trigger levels;
  - During periods of peak pumping (trigger level to be determined); and
- Review monitoring data and monitoring strategy annually.

In order to reduce the potential for local sources to contribute pathogens to the Tremont aquifer, the following measures are recommended:

- Extend the casing of well GW13 and seal the well pit;
- Dredge or regrade the ditches to the south and west of the well buildings to ensure that there is no standing water after rainfall ceases;
- Low-lying zones along the southern edge of the well field collect shallow pools of standing water during and after rainfall; these areas should be infilled and graded to direct water into the roadside ditch;
- Arrange for a detailed inspection of the properties to the west and east of the well field to determine potential for sewage and/or manure to affect the quality of water in ditches and the shallow sub-surface regime.

4.2.2 Sandy Court Well Field

Low risk scores in 2013, 2015, and 2017 indicate that water pumped at the Sandy Court well field is classified as low risk according to guidelines. Changes to the monitoring program may be considered.

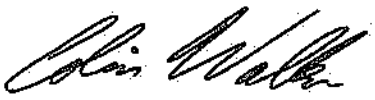
CHAPTER 5 CLOSURE

This report has been prepared for the sole benefit of the County of Kings, NS. The report may not be relied upon by any other person or entity without the express written consent of CBCL Limited, and the County of Kings, NS.

Any use that a third party makes of this report and any reliance on decisions made based on it, are the responsibility of such third parties. CBCL Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions or actions made based on this report.

The conclusions and recommendations presented represent the best judgement of the assessor based on current environmental standards and on the observed site conditions. Due to the nature of the investigation and the limited data available, the assessor cannot warrant against undiscovered environmental liabilities.

The conclusions are based on results from specific testing and/or sampling locations, and can only be extrapolated to an undefined limited area around these locations. The extent of the limited area depends on the soil and groundwater conditions, as well as the history of the site reflecting natural, construction and other activities. In addition, analysis has been carried out for a limited number of parameters, and it should not be inferred that other species are not present. Should additional information become available, CBCL Limited requests that this information be brought to our attention so that we may re-assess the conclusions presented herein.



Prepared by:
Colin Walker, M.Sc., P.Geo.
Hydrogeologist

APPENDIX A

Field Sampling Logs

Field Log

Site: GW13
Date: May 10th, 2017
Weather: Overcast with few showers, 10.5°C

Pressure Checked: 58 psi
Pump cycled on: 10:08
Filter Line Opened: 11:05
Filter Line Closed: 13:01
Flow rate check (t_i = 11:15): 3.8 L/min
Flow rate check (t_f = 12:50): 3.55 L/min

Initial Flow Meter reading (Pre flush): 6150.3 L
Initial Flow Meter Reading (Pre sample): 6306.2 L
Final Flow Meter Reading: 6701.2 L
Flush Volume: 155.9 L
Filtered Volume: 395 L
Total Sampling time: 116 min
Total Sampling including flush: 173 min

Field Parameters:

Temperature:	9.21 °C
pH:	6.04
Conductivity:	0.195 mS/cm
DO:	13.44 mg/L
Turbidity:	0.0 NTU
ORP:	194 mV
TDS:	0.127 mg/L

Notes: Had filter in backwards and pressure was increased. Extra handling using nitrile gloves.

Field Log

Site: GW8
Date: May 10th, 2017
Weather: Overcast with few showers, 10.5°C

Pressure Checked: 59 psi
Pump cycled on: 13:01
Filter Line Opened: 13:35
Filter Line Closed: 15:29
Flow rate check (t_i = 13:45): 3.4 L/min
Flow rate check (t_f = 15:15): 3.7 L/min

Initial Flow Meter Reading (Pre sample): 6713.99 L
Final Flow Meter Reading: 7108.99 L
Flush Volume: 116 L
Filtered Volume: 395 L
Total Sampling time: 114 min
Total Sampling including flush: 148 min

Field Parameters:

Temperature:	9.58 °C
pH:	6.10
Conductivity:	0.189 mS/cm
DO:	13.03 mg/L
Turbidity:	0.0 NTU
ORP:	282 mV
TDS:	0.123 mg/L

Field Log

Site: Sandy Court
Date: May 11th, 2017
Weather: Overcast, 11.2°C

Pressure Checked: 40 - 54 psi
Pump cycled on: 9:15
Filter Line Opened: 9:50
Filter Line Closed: 11:45
Flow rate check (t_i = 9:58): 3.6 L/min
Flow rate check (t_f = 11:43): 3.4 L/min

Initial Flow Meter reading (Pre flush): 7108.99 L
Initial Flow Meter Reading (Pre sample): 7169.2 L
Final Flow Meter Reading: 7565.2 L
Flush Volume: 60.2 L
Filtered Volume: 396 L
Total Sampling time: 115 min
Total Sampling including flush: 150 min

Field Parameters:

Temperature:	10.03 °C
pH:	6.14
Conductivity:	0.210 mS/cm
DO:	8.73 mg/L
Turbidity:	0.0 NTU
ORP:	304 mV
TDS:	0.137 mg/L

Field Log

Site: GW8
Date: May 27th, 2017
Weather: Overcast, 8°C

Pressure Checked: 60 psi
Pump cycled on: 8:53 am
Filter Line Opened: 9:30 am
Filter Line Closed: 11:30 am
Flow rate check (t_i = 9:46): 3.65 L/min
Flow rate check (t_f = 11:14): 3.8 L/min

Initial Flow Meter reading (Pre flush): 7565.55 L
Initial Flow Meter Reading (Pre sample): 7709.0 L
Final Flow Meter Reading: 8104.11 L
Flush Volume: 143.45 L
Filtered Volume: 395.11 L
Total Sampling time: 120 min
Total Sampling including flush: 157 min

Field Parameters:

Temperature:	9.16 °C
pH:	6.53
Conductivity:	0.191 mS/cm
DO:	17.46 mg/L
Turbidity:	1.5 NTU
ORP:	254 mV
TDS:	0.124 mg/L

Notes: Used disinfected hose provided by Municipality. Spore sample collected.

Field Log

Site: GW13
Date: May 27th, 2017
Weather: Overcast, 8°C

Pressure Checked: 57 - 58 psi
Pump cycled on: 11:59 am
Filter Line Opened: 12:45
Filter Line Closed: 14:43
Flow rate check (t_i = 12:53): 3.55 L/min
Flow rate check (t_f = 14:24): 3.5 L/min

Initial Flow Meter reading (Pre flush): 8104.47 L
Initial Flow Meter Reading (Pre sample): 8219.02 L
Final Flow Meter Reading: 8614.05 L
Flush Volume: 114.55 L
Filtered Volume: 395.03 L
Total Sampling time: 118 min
Total Sampling including flush: 162 min

Field Parameters:

Temperature:	9.08 °C
pH:	6.46
Conductivity:	0.193 mS/cm
DO:	10.82 mg/L
Turbidity:	1.8 NTU
ORP:	174 mV
TDS:	0.126 mg/L

Notes: Used disinfected hose provided by Municipality. Spore sample collected.

Field Log – Spore Samples

Site: Ditch – See map for location of spore samples
Date: May 27th, 2017
Weather: Overcast, 8°C

Field Parameters:

Temperature:	11.35 °C
pH:	7.15
Conductivity:	0.151 mS/cm
DO:	23.00 mg/L
Turbidity:	3.6 NTU
ORP:	187 mV
TDS:	0.098 mg/L

Field Log – Spore Samples

Site: Stream – See map for location of spore samples
Date: May 27th, 2017
Weather: Overcast, 8°C

Field Parameters:

Temperature:	12.15 °C
pH:	6.69
Conductivity:	0.381 mS/cm
DO:	17.14 mg/L
Turbidity:	16 - 22 NTU
ORP:	188 mV
TDS:	0.227 mg/L

APPENDIX B

Laboratory Analytical Reports

Hyperion Research Ltd.

1008 Allowance Ave. SE, Medicine Hat, AB T1A 3G8
Telephone (888) 529-0847 Fax (403) 5290852 hyperion@telusplanet.net
www.hyperionlab.ca

To: **Colin Walker**
CBCL
1489 Holis ST
Halifax NS
B3J 2R7
902 421-7241
ColinW@cbcl.ca

Sample Date:	10-May-17
Sample Type:	Raw
LIMS:	
Volume Filtered (L):	396
Rec'd within 96h?:	No
Temp on arrival <20 °C?:	Yes
Conductivity (uS/cm):	0.189

Project #:	
Upload to DB?:	
Field pH:	6.10
Field Temp °C:	9.58
Field Turb (NTU)	0
Location:	GW8

The methodology used to produce this report conforms to USEPA Method 1623 and/or the USEPA Consensus Method for the Microscopic Particulate Analysis. Based on the validation data, the method is fit for its intended use Hyperion Research Ltd. is accredited for this analysis by CALA under the ISO/IEC 17025 standard.

Raw Data

Primary Particulates	Total Count	#/380L (100 US gal)	Relative Risk Factor
Diatoms	0	0.0	0
Other Algae	0	0.0	0
Insect/larvae	0	0.0	0
Rotifers	0	0.0	0
Plant Debris	19	18.2	0
Sum of Relative Risk Factors =			**0**

From the EPA Consensus Method:
Risk of Surface Water Contamination based on sum of Relative Risk Factors

0 to 9	Low Risk
10 to 19	Moderate Risk
20+	High Risk

Secondary Particulates	Total Count	#/380L (100 US gal)	
Nematodes	2	1.9	These particulates are sometimes found in groundwater and are not considered to add risk
Pollen	0	0.0	
Crustacea	0	0.0	
Unknown	0	0.0	

Minerals Observed: iron silica clay

Giardia cysts/100L 0.5 *Cryptosporidium oocysts/100L* 0

Spore Count Surface Water CFU/L:

Spore Count Well 1 Water CFU/L:

Spore Count Well 2 Water CFU/L:

Processing Data

Date/Time Rec'd:	5/15/2017 12:15:00 PM
Sample Temp:	17.2
Lab ID:	57106
Filter Type	Filta-Max
Date/Time Conc:	5/16/2017 11:45:00 AM
Eluted By	EL
IMS System	Dynal
IMS Lot No:	00441399
Pellet Vol (mL):	0.1
Resusp Vol (uL):	100.0
MAb Conjugate:	Giardi-a-glo Crypt-a-glo
MAb Lot No:	G33 C35
Control G:	4
Control C:	4
Date/Time Stained:	5/17/2017 11:00:00 AM
Stained By	EL
Read By	KW
Vol Used (uL):	100.0
Sample Equivalent Vol (L)	396

Recovery efficiencies for particles are known to be low by the Consensus method. Minimum recovery was measured to be 6.5 +/-1.2% for Giardia cysts, 0.5 +/-0.2% for Cryptosporidium oocysts and 4.2+/2.3% for Euglena (algae). The average recovery using the MPA-1623 Method is 69.0+/-6.9 for Giardia, 62.7+/-2.9 for Cryptosporidium and 23.1+/-6.5% for Diatoms.

Comments:
GUDI due to presents of Giardia.

Analyst:

Peter M. Wallis, Ph.D.

Conclusion: Based on this sample, the risk of surface water contamination is judged to be: **High**

Hyperion Research Ltd.

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www.hyperionlab.ca

To: **Colin Walker**
CBCL
1489 Holis ST
Halifax NS
B3J 2R7
902 421-7241
ColinW@cbcl.ca

Sample Date:	11-May-17
Sample Type:	Raw
LIMS:	
Volume Filtered (L):	396
Rec'd within 96h?:	No
Temp on arrival <20 °C?:	Yes
Conductivity (uS/cm):	0.210

Project #:	
Upload to DB?:	
Field pH:	6.14
Field Temp °C:	10.03
Field Turb (NTU)	0
Location:	Sandy Court AylesFord

The methodology used to produce this report conforms to USEPA Method 1623 and/or the USEPA Consensus Method for the Microscopic Particulate Analysis. Based on the validation data, the method is fit for its intended use Hyperion Research Ltd. is accredited for this analysis by CALA under the ISO/IEC 17025 standard.

Raw Data

Primary Particulates	Total Count	#/380L (100 US gal)	Relative Risk Factor
Diatoms	0	0.0	0
Other Algae	0	0.0	0
Insect/larvae	0	0.0	0
Rotifers	0	0.0	0
Plant Debris	11	10.6	0
Sum of Relative Risk Factors =			**0**

From the EPA Consensus Method:
Risk of Surface Water Contamination based on sum of Relative Risk Factors

0 to 9	Low Risk
10 to 19	Moderate Risk
20+	High Risk

Secondary Particulates	Total Count	#/380L (100 US gal)	
Nematodes	6	5.8	These particulates are sometimes found in groundwater and are not considered to add risk
Pollen	0	0.0	
Crustacea	0	0.0	
Unknown	0	0.0	

Minerals Observed: iron silica clay

Giardia cysts/100L 0 *Cryptosporidium oocysts/100L* 0

Spore Count Surface Water CFU/L:

Spore Count Well 1 Water CFU/L:

Spore Count Well 2 Water CFU/L:

Processing Data

Date/Time Rec'd:	5/15/2017 12:15:00 PM
Sample Temp:	17.5
Lab ID:	57107
Filter Type	Filta-Max
Date/Time Conc:	5/16/2017 11:45:00 AM
Eluted By	EL
IMS System	Dynal
IMS Lot No:	00441399
Pellet Vol (mL):	0.1
Resusp Vol (uL):	100.0
MAb Conjugate:	Giardi-a-glo Crypt-a-glo
MAb Lot No:	G33 C35
Control G:	4
Control C:	4
Date/Time Stained:	5/17/2017 11:00:00 AM
Stained By	EL
Read By	KW
Vol Used (uL):	100.0
Sample Equivalent Vol (L)	396

Recovery efficiencies for particles are known to be low by the Consensus method. Minimum recovery was measured to be 6.5 +/-1.2% for Giardia cysts, 0.5 +/-0.2% for Cryptosporidium oocysts and 4.2+/2.3% for Euglena (algae). The average recovery using the MPA-1623 Method is 69.0+/-6.9 for Giardia, 62.7+/-2.9 for Cryptosporidium and 23.1+/-6.5% for Diatoms.

Comments:

Analyst:

Peter M. Wallis, Ph.D.

Conclusion: Based on this sample, the risk of surface water contamination is judged to be: **Low**

Hyperion Research Ltd.

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www.hyperionlab.ca

To: **Colin Walker**
CBCL
1489 Holis ST
Halifax NS
B3J 2R7
902 421-7241
ColinW@cbcl.ca

Sample Date:	10-May-17
Sample Type:	Raw
LIMS:	
Volume Filtered (L):	395
Rec'd within 96h?:	No
Temp on arrival <20 °C?:	Yes
Conductivity (uS/cm):	0.195

Project #:	
Upload to DB?:	
Field pH:	6.04
Field Temp °C:	9.21
Field Turb (NTU)	0
Location:	GW13

The methodology used to produce this report conforms to USEPA Method 1623 and/or the USEPA Consensus Method for the Microscopic Particulate Analysis. Based on the validation data, the method is fit for its intended use Hyperion Research Ltd. is accredited for this analysis by CALA under the ISO/IEC 17025 standard.

Raw Data

Primary Particulates	Total Count	#/380L (100 US gal)	Relative Risk Factor
Diatoms	0	0.0	0
Other Algae	0	0.0	0
Insect/larvae	0	0.0	0
Rotifers	0	0.0	0
Plant Debris	19	18.3	0
Sum of Relative Risk Factors =			**0**

From the EPA Consensus Method:
Risk of Surface Water Contamination based on sum of Relative Risk Factors

0 to 9	Low Risk
10 to 19	Moderate Risk
20+	High Risk

Secondary Particulates	Total Count	#/380L (100 US gal)	
Nematodes	6	5.8	These particulates are sometimes found in groundwater and are not considered to add risk
Pollen	0	0.0	
Crustacea	0	0.0	
Unknown	0	0.0	

Minerals Observed: iron silica clay

Giardia cysts/100L 0 *Cryptosporidium oocysts/100L* 0

Spore Count Surface Water CFU/L:

Spore Count Well 1 Water CFU/L:

Spore Count Well 2 Water CFU/L:

Processing Data

Date/Time Rec'd:	5/15/2017 12:15:00 PM
Sample Temp:	17.5
Lab ID:	57108
Filter Type	Filta-Max
Date/Time Conc:	5/16/2017 11:45:00 AM
Eluted By	EL
IMS System	Dynal
IMS Lot No:	00441399
Pellet Vol (mL):	0.1
Resusp Vol (uL):	100.0
MAb Conjugate:	Giardi-a-glo Crypt-a-glo
MAb Lot No:	G33 C35
Control G:	4
Control C:	4
Date/Time Stained:	5/17/2017 11:00:00 AM
Stained By	EL
Read By	KW
Vol Used (uL):	100.0
Sample Equivalent Vol (L)	395

Recovery efficiencies for particles are known to be low by the Consensus method. Minimum recovery was measured to be 6.5 +/-1.2% for Giardia cysts, 0.5 +/-0.2% for Cryptosporidium oocysts and 4.2+/2.3% for Euglena (algae). The average recovery using the MPA-1623 Method is 69.0+/-6.9 for Giardia, 62.7+/-2.9 for Cryptosporidium and 23.1+/-6.5% for Diatoms.

Comments:

Analyst:

Peter M. Wallis, Ph.D.

Conclusion: Based on this sample, the risk of surface water contamination is judged to be: **Low**

Hyperion Research Ltd.

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To: **Colin Walker**
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B3J 2R7
902 421-7241
ColinW@cbcl.ca

Sample Date:	27-May-17
Sample Type:	Raw
LIMS:	
Volume Filtered (L):	395.11
Rec'd within 96h?:	Yes
Temp on arrival <20 °C?:	Yes
Conductivity (uS/cm):	0.191

Project #:	
Upload to DB?:	
Field pH:	6.53
Field Temp °C:	9.16
Field Turb (NTU)	1.5
Location:	GW8

The methodology used to produce this report conforms to USEPA Method 1623 and/or the USEPA Consensus Method for the Microscopic Particulate Analysis. Based on the validation data, the method is fit for its intended use Hyperion Research Ltd. is accredited for this analysis by CALA under the ISO/IEC 17025 standard.

Raw Data

Primary Particulates	Total Count	#/380L (100 US gal)	Relative Risk Factor
Diatoms	1	1.0	6
Other Algae	0	0.0	0
Insect/larvae	0	0.0	0
Rotifers	0	0.0	0
Plant Debris	17	16.3	0
Sum of Relative Risk Factors =			**6**

From the EPA Consensus Method:
Risk of Surface Water Contamination based on sum of Relative Risk Factors

0 to 9	Low Risk
10 to 19	Moderate Risk
20+	High Risk

Secondary Particulates	Total Count	#/380L (100 US gal)	
Nematodes	0	0.0	These particulates are sometimes found in groundwater and are not considered to add risk
Pollen	0	0.0	
Crustacea	0	0.0	
Unknown	0	0.0	

Minerals Observed: iron silica clay

Giardia cysts/100L 0 *Cryptosporidium oocysts/100L* 0

Spore Count Surface Water CFU/L:

Spore Count Well Water CFU/L: 60

Processing Data

Date/Time Rec'd:	5/30/2017 12:45:00 PM
Sample Temp:	13.1
Lab ID:	57136
Filter Type	Filta-Max
Date/Time Conc:	5/31/2017 10:15:00 AM
Eluted By	EL
IMS System	Dynal
IMS Lot No:	00458402
Pellet Vol (mL):	0.1
Resusp Vol (uL):	100.0
MAb Conjugate:	Giardi-a-glo Crypt-a-glo
MAb Lot No:	G33 C34
Control G:	4
Control C:	4
Date/Time Stained:	6/1/2017 10:30:00 AM
Stained By	EL
Read By	KW
Vol Used (uL):	100.0
Sample Equivalent Vol (L)	395

Recovery efficiencies for particles are known to be low by the Consensus method. Minimum recovery was measured to be 6.5 +/-1.2% for Giardia cysts, 0.5 +/-0.2% for Cryptosporidium oocysts and 4.2+/2.3% for Euglena (algae). The average recovery using the MPA-1623 Method is 69.0+/-6.9 for Giardia, 62.7+/-2.9 for Cryptosporidium and 23.1+/-6.5% for Diatoms.

Comments:
Surface water ditch Spores:206400CFU/L contains algae diatoms rotifers ciliates and plant matter.

Analyst:

Peter M. Wallis, Ph.D.

Conclusion: Based on this sample, the risk of surface water contamination is judged to be: **Low**

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www.hyperionlab.ca

To: **Colin Walker**
CBCL
1489 Holis ST
Halifax NS
B3J 2R7
902 421-7241
ColinW@cbcl.ca

Sample Date:	27-May-17
Sample Type:	Raw
LIMS:	
Volume Filtered (L):	395.03
Rec'd within 96h?:	Yes
Temp on arrival <20 °C?:	Yes
Conductivity (uS/cm):	0.193

Project #:	
Upload to DB?:	
Field pH:	6.46
Field Temp °C:	9.08
Field Turb (NTU)	1.8
Location:	GW13

The methodology used to produce this report conforms to USEPA Method 1623 and/or the USEPA Consensus Method for the Microscopic Particulate Analysis. Based on the validation data, the method is fit for its intended use Hyperion Research Ltd. is accredited for this analysis by CALA under the ISO/IEC 17025 standard.

Raw Data

Primary Particulates	Total Count	#/380L (100 US gal)	Relative Risk Factor
Diatoms	0	0.0	0
Other Algae	0	0.0	0
Insect/larvae	0	0.0	0
Rotifers	0	0.0	0
Plant Debris	15	14.4	0
Sum of Relative Risk Factors =			**0**

From the EPA Consensus Method:
Risk of Surface Water Contamination based on sum of Relative Risk Factors

0 to 9	Low Risk
10 to 19	Moderate Risk
20+	High Risk

Secondary Particulates	Total Count	#/380L (100 US gal)	
Nematodes	0	0.0	These particulates are sometimes found in groundwater and are not considered to add risk
Pollen	0	0.0	
Crustacea	0	0.0	
Unknown	0	0.0	

Minerals Observed: iron silica clay

Giardia cysts/100L 0 *Cryptosporidium oocysts/100L* 0

Spore Count Surface Water CFU/L:

Spore Count Well Water CFU/L: 0

Processing Data

Date/Time Rec'd:	5/30/2017 12:45:00 PM
Sample Temp:	14.1
Lab ID:	57137
Filter Type	Filta-Max
Date/Time Conc:	5/31/2017 10:15:00 AM
Eluted By	EL
IMS System	Dynal
IMS Lot No:	00458402
Pellet Vol (mL):	0.1
Resusp Vol (uL):	100.0
MAb Conjugate:	Giardi-a-glo Crypt-a-glo
MAb Lot No:	G33 C35
Control G:	4
Control C:	4
Date/Time Stained:	6/1/2017 10:30:00 AM
Stained By	EL
Read By	KW
Vol Used (uL):	100.0
Sample Equivalent Vol (L)	395

Recovery efficiencies for particles are known to be low by the Consensus method. Minimum recovery was measured to be 6.5 +/-1.2% for Giardia cysts, 0.5 +/-0.2% for Cryptosporidium oocysts and 4.2+/2.3% for Euglena (algae). The average recovery using the MPA-1623 Method is 69.0+/-6.9 for Giardia, 62.7+/-2.9 for Cryptosporidium and 23.1+/-6.5% for Diatoms.

Comments:
Surface water creek contains Spores 40800CFU/L A variety of algae ciliates filamentous bacteria and plant matter.

Analyst:
Peter M. Wallis, Ph.D.

Conclusion: Based on this sample, the risk of surface water contamination is judged to be: **Low**

APPENDIX C

Photographs of Well Heads

GW8 Well Head

GW13 Well Stem, from pit