CORPORATION OF THE CITY OF
CLARENCE-ROCKLAND
COMMITTEE OF THE WHOLE

October 2, 2017, 8:00 pm
Council Chambers
415 rue Lemay Street, Clarence Creek, Ont.

Pages

1. Opening of the meeting

2. Adoption of the agenda

3. Disclosure of pecuniary interests

4. Delegations / Presentations

5. Petitions / Correspondence

   5.1 Letter dated May 9, 2017 from Mr. François Faucon requesting to rename the Clarence Creek Arena 5

6. Notice of Motion

   6.1 Resolution presented by Councillor Mario Zanth and seconded by Councillor Carl Grimard in regards to the Temporary Structure By-law

   WHEREAS a resident has approached his Ward Councillor with a request for an exemption from the provisions of By-law 2009-138, as amended in order to erect a two-vehicle temporary structure;

   BE IT RESOLVED THAT Council hereby mandates staff to prepare a by-law to amend By-law 2009-138 in order to allow for wider temporary structures that will accommodate two vehicles.

   6.2 Resolution presented by Councillor Jean-Marc Lalonde and seconded by Councillor Charles Berlinguette in regards to the Parking By-law

   BE IT RESOLVED THAT Council mandates the administration to prepare a by-law to amend the Traffic and Parking By-law in order to allow parking on both sides of Heritage Boulevard, from Sylvain and Raymond Streets to St-Jacques Street.

7. Comment/Question Period

Note: Members of the public may come forward to the podium and after seeking permission from the Presiding Officer, shall state their name and direct their question/comment on any matter which is related to any item included in this agenda to the Presiding Officer.
The maximum time allowed in all circumstances for a question/comment shall be three (3) minutes per person per meeting. There shall be a maximum of 30 minutes dedicated to the question/comment period. Any unasked questions/comments due to the time restriction may be submitted in writing to the Clerk.
At no time shall this question period be taken by members of the audience to make speeches or accusations.

8. Report from the United Counties of Prescott and Russell

9. Committee/Staff Reports

10. Other items

11. Adjournment

CORPORATION DE LA CITÉ DE
CLARENCE-ROCKLAND
COMITÉ PLÉNIER

le 2 octobre 2017, 20h00
Salle du Conseil
415 rue Lemay Street, Clarence Creek, Ont.

Pages

1. Ouverture de la réunion

2. Adoption de l'ordre du jour

3. Déclarations d'intérêts pécuniaires

4. Délégations / Présentations

5. Pétitions / Correspondance

   5.1 Lettre datée du 9 mai, 2017 de M. François Faucon demandant de changer le nom de l'Aréna de Clarence Creek 5

6. Avis de motion

   6.1 Résolution présentée par le conseiller Mario Zanth et appuyée par le conseiller Carl Grimard au sujet du Règlement sur les structures temporaires

   ATTENDU QU'un résident a communiqué avec son conseiller de quartier afin de demander une exemption aux dispositions du Règlement 2009-138, tel qu'amendé afin d'ériger une structure temporaire pour deux véhicules ;

   QU'IL SOIT RÉSOLU QUE le Conseil mandate le personnel à préparer un règlement pour amender le Règlement 2009-138 afin de permettre des structures temporaires plus larges qui pourra accueillir deux véhicules.

   6.2 Résolution présentée par le conseiller Jean-Marc Lalonde et appuyée par le conseiller Charles Berlinguette au sujet du règlement sur le stationnement

   QU'IL SOIT RÉSOLU QUE le Conseil mandate l'administration à préparer un règlement pour modifier le règlement de circulation et stationnement afin de permettre le stationnement des deux côtés du Boulevard Héritage à partir des rues Sylvain et Raymond, et ce jusqu'à la rue St-Jacques.

7. Période de Questions/Commentaires

Note: Les membres du public sont invités à se rendre au podium et après avoir reçu la permission du président de l'assemblée, doivent se nommer et adresser leur question et/ou commentaire sur tout sujet qui est relié à n'importe quel item qui figure à l'ordre du jour au président de réunion.
Le temps maximal accordé pour une question/commentaire dans toutes circonstances est de trois (3) minutes par personne par réunion. Il y aura un maximum de 30 minutes consacrés à la période de questions/ commentaires. Toutes questions et/ou commentaires qui n'ont pas été adressés par faute de temps peuvent être soumis par écrit à la greffière.
En aucun cas, cette période de questions/ commentaires ne peut être utilisée par les membres du public pour faire des discours ou porter des accusations.

8. Rapport des Comtés unis de Prescott et Russell

9. Rapports des Comités/Services

10. Autres items

11. Ajournement

Club de hockey
CASTORS DE CLARENCE CCHL Tier '2'
CLARENCE BEAVERS CCHL Tier '2'
Hockey team

clarencebeavers@hotmail.com

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9 mai 2017

M. Jean-Luc Jubinville,

L'équipe des Castors de Clarence de la ligue CCHL2 évoluait depuis 36 ans à Clarence Creek.

Suite à de gros changements au niveau de la ligue et en pleine réforme avec les clubs de la ligue centrale CCHL1, les Castors ont récemment été vendus au groupe de propriétaires de Carleton Place de la ligue CCHL1.

Cette vente marque également la retraite du pilier de cette équipe des Castors ; le gérant Charlie Lavictoire.

Charlie a occupé plusieurs postes au niveau de cette équipe en 36 ans. Ces plus gros succès ont été de gérer cette équipe qui a mené à 3 championnats de la ligue.

Tous ces accomplissements ne peuvent passer inaperçu. Je crois qu'il est maintenant temps de reconnaitre cet homme au niveau de la Cité.

L'exécutif des Castors aimerais proposer de considérer le changement du nom de l'aréna de Clarence Creek à l'aréna 'Charlie Lavictoire' !

Un tel honneur couronnerait parfaitement cet homme qui a consacré les 39 dernières années de sa vie au hockey mineur et junior.

Bien à vous,

François Faucon
Président

REPORT N° FIN 2017-031

Date	12/09/2017
Submitted by	Frédéric Desnoyers
Subject	Budget Status Report – August 2017
File N°	F05 Budgets and estimates

1) **NATURE/GOAL :**
This report sets out the financial status of City operations for the period ending August 31, 2017**.**

2) **DIRECTIVE/PREVIOUS POLICY :**
N/A

3) **DEPARTMENT'S RECOMMENDATION :**

THAT the financial operating budget status for the period ending August 31, 2017, be received as information.

QUE le rapport financier sur le budget opérationnel pour la période se terminant le 31 août 2017, soit reçu à titre d'information.

4) **BACKGROUND :**
N/A

5) **DISCUSSION :**
Corporate revenues and expenses - $212,454 deficit
Corporate contingency is expected to be in surplus by about $133,000 and the Investment income and penalties and interest on taxes are projected to be in surplus by $50,000. The vacancy factor causes a pressure of $110,000 for corporate accounts as the vacancy savings are shown in the departments.

There is a deficit of $150,000 expected in supplementary taxes and $135,000 deficit in the provincial offence revenues.

CAO and Corporate Services - $232,548 surplus:
$305,000 is being transferred from Corporate Services to the CAO's budget for the Clerk's office. There are savings of $105,000 from the legal fees and liability claims and $2,000 in Hydro rates. There is a pressure for an additional contract expense of $25,000 for the hiring of the Infrastructure Director and salary savings of $144,000 and $5,000 savings in advertising.

Flood expenses - $142,954 deficit

A claim was sent to the province for all flood expenses, the municipality portion not refunded by the program is expected to be $142,954.

Finance - $31,000 surplus

The department is expecting a surplus of $31,000 from audit savings from being more efficient.

Community Services - $7,795 surplus

The department is expecting a surplus of $7,795 due to the decrease in the electricity rates.

Protective Services - $143,503 deficit

The department is expecting $35,000 less in revenues primarily in Rescue – extrication services. There are $42,000 in overtime pressures and $22,000 in salaries and benefits as a result of severance payments.

There is also a materials budget pressure of $44,000 primarily related to supplies $9,000, protective clothing $20,000 and vehicle repairs $15,000.

Infrastructure and Planning - $61,235 surplus

The department is expecting a surplus of $61,235, $16,000 of which is due to the additional revenues from planning, $5,000 in savings from dust laying, $25,000 in legal fees and $15,000 in savings from the hydro rates.

Overall, the City is expecting a deficit of $166,333 which is primarly due to the Spring flooding events.

6) **CONSULTATION:**
N/A

7) **RECOMMENDATIONS OR COMMENTS FROM COMMITTEE/ OTHER DEPARTMENTS :**
N/A

8) **FINANCIAL IMPACT (expenses/material/etc.):**
As presented in this report.

9) **LEGAL IMPLICATIONS :**
N/A

10) **RISK MANAGEMENT :**
N/A

11) **STRATEGIC IMPLICATIONS :**
N/A

12) **SUPPORTING DOCUMENTS:**
Appendix A - Operating Budget Status Report - Year-end (Surplus)/ Deficit Projection – As at August 31, 2017.

Rapport de budget 2017 /Budget Status Report

Year-end (Surplus)/ Deficit Projection

As at August 31

FOND GENERALE/ GENERAL FUND	Mois courante/ Current month 2016	Mois courante/ Current month 2017	2015 à date/ ytd	2016 à date/ ytd	2017 à date/ ytd	2017 BUDGET	PREVISION/ FORECAST	(SURPLUS)/ DEFICIT
Revenues et dépenses corporatifs/ Corporate Revenue and Expense	- 3,110,959	- 290,845	- 17,898,871	- 15,619,195	- 16,182,306	- 17,068,968	- 16,856,514	212,454
Flood expense							142,954	142,954
Conseil/ City Council	32,183	27,338	197,138	207,476	213,185	352,330	352,330	-
Bureau du Directrice générale/ Chief Administrative Officer	25,463	103,226	555,361	401,534	703,945	941,056	1,141,652	200,596
Service corporatif/ Corporate Services	116,071	64,590	221,491	710,587	510,636	1,323,191	890,047	- 433,144
Finances/ Finance	120,236	100,357	877,117	1,146,028	1,007,640	1,679,722	1,648,722	- 31,000
Services communautaires/ Community Services	- 2,916	152,759	776,037	1,116,165	1,114,402	1,817,388	1,809,593	- 7,795
Services de garderie/ Day Care Services	45,495	149,479	548,894	197,110	196,522	- 52,109	- 52,109	-
Service de la protection/ Protective Services	408,671	423,065	2,783,265	3,005,288	2,967,508	5,262,770	5,406,273	143,503
Infrastructure et urbanisme/ Infrastructure and Planning	271,535	548,490	2,911,766	2,916,200	3,549,091	4,728,827	4,667,592	- 61,235
Transport en commun/ Public Transit	60,708	- 38,472	205,540	268,810	158,296	451,320	451,320	-
City tax-supported	- 2,033,514	1,239,987	- 8,822,262	- 5,649,997	- 5,761,080	- 564,473	- 398,140	166,333
Biblioteque publique/ Public library	39,384	37,078	344,889	340,189	401,189	564,473	564,473	-
Supporté par les taxes/ Tax-supported	- 1,994,130	1,277,064	- 8,477,373	- 5,309,808	- 5,359,891	-	166,333	166,333

REPORT N° INF2017-061

Date	21/09/2017
Submitted by	Denis Longpré
Subject	Annual Report – Biosolids Lagoons
File N°	INF2017-061

1) **NATURE/GOAL :**
The purpose of this report is to present to Council the annual report of the Clarence-Rockland wastewater treatment plant's biosolids lagoons completed as required under the site's Environmental Compliance Approval (ECA).

2) **DIRECTIVE/PREVIOUS POLICY :**
N/A

3) **DEPARTMENT'S RECOMMENDATION :**
THAT the report titled "2016 Monitoring Program Annual Report – Biosolids Storage Lagoons", be received as information.

QUE le rapport intitulé "2016 Monitoring Program Annual Report – Biosolids Storage Lagoons, soit reçu à titre d'information.

4) **BACKGROUND :**
In 1997, a new wastewater treatment plant was built in Rockland to replace the lagoon treatment system.

The excess biosolids produces during the treatment process were pumped into the old abandoned treatment lagoon, located at the end of Industrielle Road from 1997 to 2002. The biosolids were conveyed to the abandoned treatment lagoon using pumps and hoses placed along or on Industrielle Road (distance of approximately 400 m).

The new biosolids lagoons were constructed in the fall of 2002 and initiated operations at the beginning of 2003. They consist of two (2) lagoons of 0.14 hectare each in size and are located on land once formerly occupied by the aerations lagoons.

A requirement of the construction of the biosolids lagoons was to install monitoring wells around the perimeter in order to monitor their integrity (sealed containment) and ensure that they did not impact existing groundwater. In addition to the groundwater monitoring plan an "emergency action plan" was established in order to address any groundwater impact by the lagoons.

Over the course of several years, additional monitoring wells were installed in response to the Ministry of the Environment and Climate Change (MOEC) review of the annual reports.

5) **DISCUSSION :**

The scope of work for the 2016 monitoring plan was to assess the impact of any leakage from the lagoons to the groundwater, and to comply with the annual monitoring program required under Condition 2 of the ECA. The field work was carried out during two (2) monitoring sessions:

- Spring monitoring, and;
- Fall monitoring.

In addition, the 2016 monitoring program was to further assess previously noted groundwater impacts observed since approximately 2013.

The 2016 annual report, completed by Golder Associates, validates some impacts at monitoring wells located downgradient of the lagoons (towards river). Based on site conditions (previous data, lagoon construction and site conditions, etc.) impacts to the sand layer below the lagoons ("leakage") may have first occurred as early as 2009.

No off-site impacts (neighbours or river) have been indicated to be occurring.

Since the extent of the sand deposit and groundwater quality in the affected areas are unknown, new monitoring wells are recommended to be installed in order to further investigate the lateral extend of the groundwater impacts.

6) **CONSULTATION:**

N/A

7) **RECOMMENDATIONS OR COMMENTS FROM COMMITTEE/ OTHER DEPARTMENTS :**

N/A

8) **FINANCIAL IMPACT (expenses/material/etc.):**

N/A

9) **LEGAL IMPLICATIONS :**

N/A

10) **RISK MANAGEMENT :**

N/A

11) **STRATEGIC IMPLICATIONS :**

To further investigate the extent of the impacts of the lagoons, two (2) new monitoring wells will be installed in the fall of 2017. The annual reports are submitted to the Ministry of the Environment and Climate Change (MOEC) for review.

12) **SUPPORTING DOCUMENTS:**

2016 Monitoring Program Annual Report – Biosolids Storage Lagoons

Annual Groundwater Monitoring Program - 2015

Biosolids Lagoons
City of Clarence-Rockland

Prepared for:

Corporation of the City of Clarence-Rockland
1560 Laurier Street
Rockland, Ontario
K4K 1P7

Attention: Denis Longpré, Environment Manager, Infrastructure and Engineering

LRL File No.: 01201-A

March 31, 2016

5430 Canotek Road | Ottawa, ON, K1J 9G2 | info@lrl.ca | www.lrl.ca | (613) 842-3434

EXECUTIVE SUMMARY

The City of Clarence Rockland (City) has retained LRL Associates Ltd. (LRL) to conduct the yearly monitoring program for their biosolids lagoons. The monitoring program is performed to comply with Condition 2 of the amendment to the Certificate of Approval No. 3-0466-93-967. The program is required to detect and evaluate the impact of any spills or leakages on the local groundwater resource.

The biosolids lagoons are located in the City's industrial park, established on the north side of County Road 17. The Ottawa River is located 135 m from the north edge of the lagoons. Most of the property was once formerly occupied by aeration lagoons that covered the west-most half of the property. The biosolids lagoons were constructed in the Fall of 2002 and initiated operation at the beginning of 2003. Each lagoon is 0.14 ha in size and the site occupies approximately 0.64 ha with its associated structures (i.e. access roads, berms).

As part of the contract to construct the biosolids lagoons, three (3) monitoring wells were installed by the contractor: MW-1 was installed immediately east of the lagoon, but has since been demolished; MW-2 was installed north of the lagoon to intercept the down-gradient groundwater flow; and MW-3 is located southwest of the lagoon up-gradient with respect to groundwater flow. Two (2) additional monitoring wells were installed in 2004 by LRL north of the lagoons at the base of the slope to better intercept the groundwater flow. An additional well was incorporated into the monitoring program in May 2005: BH03-4, located immediately west of the lagoons. Five (5) additional wells (MW11-06 through MW11-10) were installed on the property by LRL in 2011 to better establish the groundwater conditions.

As per the Ministry of the Environment comments in the letter dated March 30, 2010, the groundwater quality and static water levels have been monitored and assessed to establish the integrity of the lagoons. Significant shifts in concentrations or water levels could be indicative of a leak. The median and standard deviation have been calculated for select parameters using historical data from each well and will be used to establish significant shifts. The trigger parameters used are total kjeldhal nitrogen (TKN), ammonia, nitrate, nitrite, chloride, sulphate, total phosphorous (TP), aluminum and iron. Background monitoring wells will also be used to determine whether levels are elevated. The background monitoring wells are established as MW-3 and MW11-10 in the west and east zones respectively. The data for MW-3 covers since 2003 and for MW11-10, since 2011.

Due to the lagoon's proximity to the Ottawa River, the groundwater quality of the monitoring wells located closest to the river (MW-4, MW-5 and MW11-6) are also compared and assessed in relation to the MOE's Provincial Water Quality Objectives (PWQO).

Collected groundwater elevations indicate that the unconfined overburden groundwater flow is directed towards the north which follows the general topography of the terrain.

The water chemistry of the surficial overburden groundwater table shows it being impacted by former aeration lagoons. In general, levels of nitrogen series parameters, chloride, sulphate, total phosphorous, total dissolved solids and aluminum were above the trigger concentrations. Exceedances were also observed for total phosphorous, aluminium, arsenic, boron, chromium, copper, iron, silver and vanadium relative to the PWQO in MW-4, MW-5 and MW11-6. The results of the groundwater sampling are:

Parameter	Background Monitors	Impact/Leakage Monitors	Surface Water Monitors	Comments
TKN	Levels in MW-3 exceed trigger concentration in the Spring. Levels in MW11-10 are significantly decreased since Spring 2013.	Exceed trigger concentration except MW11-9 in the Spring	Exceed trigger concentration except MW-4 in the Fall	An increasing trend continues in BH03-4 and MW-2. It is possible that the lagoons are contributing to these levels. Decreased levels observed further down-gradient indicates attenuation.
Ammonia	Do not exceed trigger concentration (not analyzed in the Spring)	Exceed trigger concentration (not analyzed in the Spring)	Exceed trigger concentration (not analyzed in the Spring)	An increasing trend continues in MW11-8, BH03-4 and MW-2. It is possible that the lagoons are contributing to these levels. Decreased levels observed further down-gradient indicating attenuation.
Nitrates	Exceed trigger concentrations for MW11-10 in the Fall	Exceedances to the trigger concentration were measured in MW-2, MW11-7 and MW11-9 in the Spring and in MW-2 and MW11-8 in the Fall	MW11-6 exceeds trigger concentration in the Fall	Levels continue to be elevated in MW-2 and MW11-7, immediately down-gradient of the lagoons. The highest levels are encountered in MW-2.
Nitrites	Not detected	Not detected	Not detected	Levels are comparable to previous sampling events.
Total Phosphorus	Exceed trigger concentration in MW- 3 and MW11-10 in the Spring	Exceed trigger concentration in MW11-8 in the Spring	Exceed trigger concentration in MW-4 and MW11-6 the PWQO in MW-5 in the Spring and exceed the PWQO in the Fall	The highest level was encountered in background monitor MW-3 which is an indication of a potential off-site source impacting the western portion of the Site. The levels measured down-gradient of the lagoons on the eastern portion of the Site are comparable to the background monitor (MW11-10).
Chloride	Levels exceed trigger concentration in the Spring	Exceed trigger concentration in MW11-7 in the Spring and MW-2 in the Fall	Exceed trigger concentration in MW-5 and MW11-6 in the Spring and in MW-6 in the Fall	Levels were above the respective trigger concentration in MW11-6, MW11-7, MW11-10 and in MW-5. The levels immediately down-gradient of the lagoons are generally lower than that of MW11-6. This may be an indication that the lagoon may not be contributing to the elevated levels of chloride.
Sulphate	Exceed the trigger concentration in MW11-10 in the Spring	Exceed the trigger concentration in MW11-9 and BH03-4 in the Fall	MW11-6 exceeds the trigger concentration in the Spring	Levels are generally less than or comparable to background monitors. The levels sulphate in monitoring wells within proximity to the lagoon are lower than those measured further down-gradient supporting the existence of a non-lagoon source of sulphate.
Aluminum	No exceedances	MW11-9 exceeds trigger concentration in the Spring and Fall	MW-4 and MW-5 exceed the trigger concentrations in the Spring and Fall.	The levels measured in surface water monitors down-gradient of the lagoons are higher than those closest to the lagoon indicating that the lagoon may not be the only source of the high levels of aluminum.
Iron	No exceedances	MW11-8 exceed the trigger concentration in the Spring and Fall	MW11-6 exceeds the PWQO in the Spring	General decrease in the levels of iron was detected. Levels of BH03-4 and MW11-8 remain elevated.

Various Metals	Metal parameters detected are comparable to remaining monitoring wells	Metal parameters detected are comparable to remaining monitoring wells	Select parameters exceed the PWQO.	The levels measured in the surface water monitors down-gradient of the lagoons are higher than the monitoring wells closest to the lagoon indicating that the lagoon is not the source of the high levels of these parameters.

Based on values obtained in 2015, significant shifts have been observed in the monitoring wells immediately down- and side- and up-gradient of Lagoon #1, namely MW-2, BH03-4 and MW11-8 respectively. This is an indicator that there may be an issue with the construction of Lagoon #1, and the emergency action plan (EAP) should be implemented. The permeability of the monitoring wells MW-2 and BH03-4 was verified using slug tests to ensure that they are sealed accordingly from surface water infiltration. The data reveals that no issues are present; therefore the remainder of the EAP should be implemented. This would include inspecting the conditions of the lagoon for leaks and cracks. Additional or new liner may be required along the perimeter of the lagoon.

Based on our findings during 2015, the following are recommended for the groundwater monitoring program in 2016:

- Commence the second stage of Emergency Action Plan by removing the contents of Lagoon #1 to verify and replace the low permeability linear walls and floor. The City should prepare a plan of action prior to commencing the emptying of Lagoon #1 so mobilization of the plan can be applied quickly if needed.
- Install an additional monitoring well downgradient of MW-2;
- Continue to sample all monitoring wells on a semi-annual basis in order to asses trend in groundwater chemistry (May and November 2016);
- MW-5 should be removed from the sampling program. Based on historic sampling events, the well produces low quantity and low recovery rates which limit the ability to obtain adequate quantities for all of the required parameters to be analysed. This may be an indication that the construction of the well has been compromised as the remaining wells in vicinity to MW-5 have higher volumes and sufficient recover rates;
- Continue to analyses of the following cations; calcium (Ca, magnesium (Mg), sodium (Na) and potassium (K) and anions, sulfate (SO4), chloride (Cl), carbonate (CO3) and hydrogen carbonate (CO3) and hydrogen carbonate (HCO3) to allow for better interpretation of previous data.

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FIGURES

(In order following text)

TABLES

(In order following Figures)

APPENDICES

(In order following Tables)

1 INTRODUCTION

The City of Clarence Rockland (City) has retained LRL Associates Ltd. (LRL) to conduct the yearly monitoring program for their biosolids lagoons. The monitoring program is performed to comply with Condition 2 of the amendment to the Certificate of Approval No. 3-0466-93-967. The program is required to detect and evaluate the impact of any spills or leakages on the local groundwater resources.

1.1 Scope of Work

LRL's scope of work for the 2015 monitoring program consisted of the following:

- Sample all onsite monitoring wells on a semi-annual basis (spring and fall) to monitor and identify potential groundwater impacts in the vicinity of the lagoons;
- Collect field parameters and water levels of all monitoring wells during each sampling event;
- Submit groundwater samples for chemical analysis of the Ministry of the Environment and Climate Change (MOECC) approved parameters list which include those typically associated with the groundwater impacts from biosolids lagoons; and
- Conduct a slug test on specific wells to determine whether their construction is compromised;
- Prepare an annual report including all monitoring and analytical test results with pertinent conclusions and recommendations.

2 SITE LOCATION AND DESCRIPTION

The biosolids lagoons are located in the City's industrial park, established on the north side of County Road 17 and accessed from Industrielle Street as present in **Figure 1**. The lagoons are located in the northwest portion of the park behind the sewage treatment plant. Most of the property was once occupied by the former aeration lagoons that covered the west-most half of the property. The biosolids lagoons were constructed in the Fall of 2002 and were activated at the beginning of 2003. Each lagoon is 0.14 ha and the site occupies approximately 0.64 ha with its associated structures (i.e. access roads, berms). The biosolids lagoons are located near the crest of a slope where grades fall from 53 m to 45 m above mean sea level (amsl), within less than 75 m, onto the flood plains of the Ottawa River. The Ottawa River is located 135 m north of the lagoons and these site features are presented in **Figure 2**.

All properties surrounding the biosolids lagoons are currently serviced by municipal water and no potable wells are known to exist in the local area. However one deep drilled well is located on the Pack All Manufacturing Inc. property (south of lagoons), whose water is used for their cooling process. High levels of ammonia have been found in this well and the MOECC has been made aware of these levels.

2.1 Monitoring Wells

As part of the contract to construct the biosolids lagoons, three (3) monitoring wells were installed by the contractor:

- MW-1 was installed immediately east of the lagoon. Since the sampling event in November 2005, this well was demolished assumingly during earthmoving activities;

- MW-2 was installed north of the lagoon to intercept the down-gradient groundwater flow; and
- MW-3 is located to the southwest in an up-gradient position with respect to groundwater flow.

Two (2) additional monitoring wells were installed by LRL in July 2004 to better intercept groundwater flow down gradient of the lagoons. These wells were located north of the lagoons at the base of the slope. Monitoring well MW-4 and MW-5 are respectively located 67 and 105 m from the Ottawa River. An additional well was incorporated in to the monitoring program in May 2005; BH03-4 installed by Golders Associates Ltd. in 2003 as part of their environmental investigation and is located immediately west of the lagoons.

Five (5) additional groundwater monitoring wells (MW11-06 through MW11-10) were installed on the property by LRL in June 2011 to address the comments by the Ontario Ministry of the Environment (MOE). There locations and rational are as follows:

- MW11-6 was installed down-gradient of MW-5 to establish if the exceedances observed in MW-5 are from the lagoons;
- MW11-7 was installed down-gradient of biosolids lagoons and up-gradient of MW-5 to establish if the exceedances observed in MW-5 are from the lagoons;
- MW11-8 was installed immediately south of Lagoon #1 to act as a leakage detector;
- MW11-9 was installed immediately east of Lagoon #2, and up-gradient of MW-4, to replace MW-1 which was previously destroyed; and
- MW11-10 was up-gradient of the biosolids lagoons to establish trigger conditions.

The locations of the monitoring wells are shown in **Figure 2**.

2.2 Biosolids Characteristics

During the Spring and Fall sampling events in 2004 and 2005, LRL collected representative biosolid samples from each of the lagoons (east and west). The samples were submitted for a general chemistry (nitrogen series, chloride, sulphate and total phosphorus) and metals analysis in order to characterize the material. The results of the analysis are included in **Appendix A**.

The average monthly process data report for 2015 was provided to LRL by the Ontario Clean Water Agency (OCWA) who maintains the operational process of the lagoons. Their performance assessment data is presented in **Appendix B**.

3 STANDARDS

3.1 Background and Trigger Concentrations

As per the MOECC comments in the letter dated March 30, 2010, the groundwater quality and static water levels have been monitored and assessed to establish the integrity of the lagoons. Significant shifts in concentrations or water levels could be indicative of a leak.

Previously, trigger concentrations were used as an indicator of elevated levels of select parameters. The trigger concentrations were established based on the average concentration of select parameters from background wells (MW-3 in the west portion and MW11-10 in the east portion). Upon further review, it was determined that this method does not aid in establishing

significant shifts in concentrations as multiple parameters from the wells are over the trigger parameters while showing consistent values.

Consequently, the method of analysis has been altered. The median and standard deviation have been calculated for select parameters using historical data from each well and will be used to establish significant shifts. High and low range trigger concentrations were established for select parameters by adding or subtracting the baseline and standard deviation values, respectively. The range between these values (trigger concentration range) has been established as acceptable levels. Background monitoring wells will also be used to determine whether levels are elevated. The background monitoring wells are established as MW-3 and MW11-10 in the west and east zones respectively. The data for MW-3 covers since 2003 and for MW11-10, since 2011.

3.2 Provincial Water Quality Objectives

Due to the lagoon's proximity to the Ottawa River, the groundwater quality of the monitoring wells located closest to the river (MW-4, MW-5 and MW11-6) are also compared against the MOE's Provincial Water Quality Objectives (PWQO).

3.3 Emergency Action Plan

The primary purpose of the monitoring program is to ensure that the lagoons are not leaching or leaking effluent into the subsurface that could adversely affect the general quality of the local groundwater. Any dramatic change of the groundwater chemistry over the years could indicate such an event, which would trigger the emergency action plan. Concentrations of select parameters are monitored and compared against historical values from each well (baseline quality). If a significant shift is detected, the emergency action plan will be implemented. The emergency action plan prepared for this site is included in **Appendix C**.

4 GROUNDWATER SAMPLING

Two (2) groundwater sampling events were conducted at the lagoons – during the spring and fall. These sampling events were carried out on July 14th and November 18th 2015, respectively.

Prior to sampling the monitoring wells, the static water level was measured using a water level meter and the wells were purged of standing water. Purging involved pumping the wells dry three (3) times or removing the equivalent of three (3) well volumes. The monitoring wells were purged using dedicated "Waterra" flexible tubing fitted with a foot valve. All "Waterra" tubing and foot valves were left in the monitoring wells to permit future sampling and avoid cross contamination. The samples were collected in laboratory-supplied bottles, placed in a cooler and immediately transported to the laboratory. MW-5 was found to have low volume and even lower recovery rates in historical sampling events. Therefore, during 2015, it was decided that purging would not be conducted.

All groundwater collected from the monitoring wells were tested in the field for parameters that included pH, temperature, conductivity and total dissolved solids (TDS) using a portable multi-meter (Hanna Instruments Model Hl 98129).

4.1 Chemical Analysis

All groundwater samples were submitted to Paracel Laboratories Ltd. (Ottawa, ON) for analysis of the following parameters:

- Nitrogen series – ammonia, nitrates, nitrites, Total Kjeldahl Nitrogen (TKN);
- Phosphorous;
- Sulphate, chloride and Total Dissolved Solids (TDS);
- Biological Oxygen Demand (BOD);
- Metals; and
- Calcium, magnesium, potassium and sodium.

The laboratory Certificates of Analysis are included in **Appendix D**.

5 RESULTS AND DISCUSSION

5.1 Groundwater Elevation and Flows

The groundwater levels of all monitoring wells were measured to determine the groundwater flow direction. **Table 1** presents the water levels and elevations measured during each sampling event. The groundwater was measured between 0.13 and 3.96 m below ground surface (bgs).

The closest monitoring wells in relation to the biosolids lagoons are BH03-4, MW11-8 and MW11-9. The water levels from these wells are between 1.54 and 4.07 m below the base of the lagoons (50.80 m). It does not appear that a hydraulic interconnection of the lagoons and the groundwater table exist.

The groundwater elevations obtained indicate that the surficial overburden groundwater flow direction is towards the north, which also follows the general topography of the terrain. Representative groundwater contours are presented in **Figure 3**.

6 BAIL AND SLUG TEST

Previous groundwater sampling events has revealed the concentrations of select parameters have been increasing in MW-2 and BH03-4, indicating the possibility that either the lagoon is leaking or the annular space seal of these wells is compromised.

A bail and slug test was carried out during the 2015 sampling period on MW-2 and BH03-4 to help determine if the annular space seal of the wells is compromised resulting in the increased levels in MW-2 and BH03-4.

A bail test is performed by removing the water within, in this case, a well, followed by the measurement of time it takes to recovery to its initial water level. A slug test is performed by adding a known volume of water into the well followed by subsequent water level and time measurements until the water level has decreased to the initial level. Any dramatic variation of the two values may indicate a breach of the bentonite seal. An assumed screened interval length of 3.0 m was applied during the analyses as details pertaining to the wells installation were not available. Both the slug a bail tests were analysed using the straight line (Hvorslev 1951) method and revealed nearly identical hydraulic conductivities (k) of approximately 2.0 x 10^{-5} and 3.0 x 10^{-6} m/sec for MW-2 and BH03-4, respectively. This provides further support that the wells seals have not been compromised and that the concentrations being measured are representative. The bail and slug test data and calculations are presented in **Appendix E**.

7 CHEMICAL ANALYSIS

7.1 Groundwater

The results of the groundwater analysis for 2015 are included in **Table 2** and **Table 3** and in **Figure 4**. A summary of the past sampling events is presented in the tables and charts included in **Appendix F** and **Appendix G**, respectively. Well-specific trigger parameter concentrations have been established for TKN, ammonia, nitrate, nitrite, chloride, sulphate, total phosphorus, total dissolved solids, aluminum and iron. The trigger concentrations were established using the median of historical data from each well and implementing the standard deviation to determine significant increases or decreases in concentrations. A significant shift will be established as a trend of significant increases or decreases.

In order to further develop our interpretation, the monitoring wells have been separated into eastern and western zones. As such, background monitor MW11-10, leakage monitors MW11-7 and MW11-9, and surface monitors MW-4, MW-5 and MW11-6 represent the eastern zone, and background monitor MW-3 and leakage monitors MW-2, BH03-4 and MW11-8 represent the western zone.

In general, levels of nitrogen series parameters, chloride, sulphate, total phosphorous, total dissolved solids and aluminum were above the trigger concentrations in 2015. A summary of the past sampling events is presented in the tables and charts included in **Appendix F** and **Appendix G**, respectively. As shown in the chart for TKN, levels in MW-2, BH03-4 and MW11-8 are showing an increasing trend since 2011. A similar trend is observable for ammonia. A correlation can be seen between the three wells for these parameters. The nitrate chart demonstrates the elevated levels in MW-2. For nitrite, an increasing trend is observable in MW-2, and MW11-7 and MW-5 had corresponding increases in Fall 2012 and Spring 2013. MW11-6 is showing increased levels of chloride and sulphate. Wells up-gradient have lower levels, indicating that the lagoon may not be contributing to the elevated levels.

The addition of the analysis of calcium, sodium, magnesium and potassium to the sampling program in Fall 2014 was initiated to aid to further classify and determine if the definition of background water classifications and trigger concentrations require refinement. Piper Trilinear diagrams were produced from this data and are discussed below.

7.2 Piper Trilinear Diagrams

Piper diagrams allow for the visual display of proportional equivalents of cations and anions. These trilinear plots help classify waters into “types” or “hydrochemical facies”. Multiple water types or distinct clusters are present across the Site and seems to confirm that the eastern and western zones are worthy distinctions. **Figure 5** presents the data collected in 2015 and additional data from future sampling events will allow for further interpretations. Seasonal variations appear to be evident at the majority of the wells except for MW-2 and MW11-8, which had similar proportional equivalents of cations and anions between the spring and fall. Both of these well are located in the western zone.

MW-3 and MW11-10 were identified as groundwater which represents background conditions and are presented on **Figure 6**. MW11-6 was also included on **Figure 6** as it provides insight into the variation of water types in the area and could be classified as a potential background groundwater condition located closest to the river. These analyses show variation within the representative background water conditions. This leads to some uncertainty in the calculation of the trigger concentrations which were established to identify a significant shift in concentrations.

Impact monitors MW-2, BH03-4 and MW11-8 show a similar correlation and are closely typed as calcium/magnesium/bicarbonate classification, **Figure 7**. Based on the limited dataset, we are unable to definitively identify the varied water types at this time. Continued sampling would be required to derive a more concise conclusion. However, results from MW11-6 appear to show a new background water type, sodium/chloride which might be a result of interactions with the hyporheic zone. MW11-7 and MW-5 also show a propensity towards this water type, **Figure 8**.

7.2.1 Background Monitors

The background monitoring wells are established as MW-3 and MW11-10 in the west and east zones, respectively. The data for MW-3 covers since 2003 and for MW11-10, since 2011. In general, the levels observed in 2015 are similar to historical data. Total phosphorous in MW-3 had significant increases in Spring 2015 with a level of 9.00 mg/L, above both the standard deviation and the baseline values of 1.70 and 2.22 mg/L, respectively. Levels of sulphate were lower than previous sampling events in Fall 2015 (61 mg/L), however, are comparable to historical levels.

In MW11-10, nitrate was observed for the first time in Fall 2015 with a level of 1.3 mg/L. An increasing trend in sulphate levels has been encountered in MW11-10 since Fall 2013 with values ranging between 130 and 162 mg/L, above the baseline value of 102 mg/L. Spring 2015 was comparable with a value of 153 mg/L. In Fall 2015, a significant decrease was observed in with a value of 22 mg/L, below the trigger concentration lower range of 93 mg/L. With regards to its trigger concentrations, levels were above for sulphate and TDS in the Spring and nitrate in the Fall. Generally, exceedances to the trigger concentration range in 2015 were encountered for TKN, ammonia (Fall only), sulphate, TP (Fall only), TDS (Spring only) and aluminum (Fall only).

7.2.2 Leakage Monitors

The leakage monitors in the east zone were established as MW11-7 and MW11-9 and in the west zone were established as MW-2, BH03-4 and MW11-8. Increased levels of chloride (695 mg/L) were encountered in MW11-7 during the Spring 2015 sampling event. The level encountered in the respective background monitor at this time was 243 mg/L and the trigger concentration range is between 236 and 504 mg/L. The Fall 2015 was below this range with a value of 84 mg/L. TDS (1530 mg/L) levels were also observed to be slightly higher in Spring 2015 when compared to historical events, and the background monitor value (1220 mg/L). A decrease in nitrate levels was encountered in MW11-7 in 2015 with values of 0.8 and <0.1 mg/L in Spring and Fall, respectively. The trigger concentration lower range value is 2.49 mg/L. The levels do not correspond to the values obtained in the respective background monitor (<0.1 and 1.3 mg/L, Spring and Fall, respectively). The remaining parameters analysed are generally comparable to the respective background monitor values.

MW11-9 saw a significant increase in chloride in Fall 2015 with a value of 144 mg/L, above the trigger concentration of 14 mg/L. This level is below that of background monitor MW11-10 (196 and 243 mg/L). Sulphate also had a significant increase in Fall 2015 with a level of 176 mg/L, above the higher trigger concentration range of 117 mg/L. The previously encountered increasing trend of nitrates in MW11-9 continued in 2015, however in Fall 2015, the level decreased below the detection limit of 0.1 mg/L. When compared to the background levels, historically, MW11-9 levels were consistently above the background levels. The is true fr the 2015 data with the exception to the Fall 2015 value of 1.3 mg/L in background monitor MW11-10, above the <0.1 mg/L value in MW11-9.

MW-2 is showing significant shifts in TKN, ammonia, nitrate, chloride and sulphate from between Spring 2011 and Fall 2012 into 2015. The levels of TKN and nitrate in the Spring and Fall are elevated compared to the background monitor MW-3, with levels are generally above its trigger concentration upper range. Sulphate was found to be below the range of 223 and 433 mg/L with levels of 56 and 68 mg/L. TDS also showed a significant shift from Fall 2012 to Fall 2014, however 2015 levels have returned to lower values comparable to historical events. The significant decreasing trend of sulphate, previously observed in Spring 2011 continued into 2015. The significant shifts indicate that MW-2 may be influenced by a leak in lagoon #1 and has been since 2011.

BH03-4 is showing significant shifts in TKN, ammonia, chloride and aluminium from between Spring 2011 and Fall 2012 to present. Levels of TKN and ammonia are elevated compared to the background monitor MW-3 with levels above its trigger concentrations in the Spring and Fall (TKN) and Fall (ammonia). A significant increase in sulphate was observed in Fall 2015 with a level above the background monitors trigger concentration. A significant decrease in total phosphorous was observed in Spring and Fall 2015. The significant shifts indicate that BH03-4 may be influenced by a leak in lagoon #1.

A significant shift was observed for TKN in MW11-8 since Spring 2014. The levels of TKN, as well as TDS are above the background monitors trigger concentrations in the Spring and Fall. Significant increases in chloride and total phosphorous were observed in Spring 2015. Significant increases in ammonia and nitrate were observed in Fall 2015 with levels above the background monitors trigger concentrations. The level of iron in the Fall was above the background monitors trigger concentration of 24.8 mg/L. A significant decrease has been observed in sulphate from Spring 2013 to 2015. The significant shifts observed could be an indication that MW11-8 is influenced by a leak in lagoon #1.

7.2.3 Surface Monitors

The surface monitors were established as MW-4, MW-5 and MW11-6. These monitoring wells were also compared against the PWQO due to their proximity to the Ottawa River. Exceedances to the applicable provincial standards (PWQO) were detected for aluminium, arsenic, boron, chromium, copper, iron, silver and vanadium. The levels are generally comparable to historical sampling events.

In MW-4, a significant increase in ammonia was observed in Fall 2015. Chloride had a significant shift from Fall 2012 to Spring 2015 with levels returning to historical levels in Spring 2014 and 2015. A significant decrease was noted in sulphate from Spring 2012 to Spring 2014, however levels have returned to historical levels. Total phosphorous has had significantly increased levels between Spring 2011 and Spring 2014 with levels bring above the PWQO since its installation in 2004. Aluminium has seen significant decreases between Spring 2013 and Spring 2015, however levels generally remain above the PWQO, and have since sampling began for this parameter in 2010. Iron levels were below the detection limit in the spring and had a level of 0.183 mg/L in the fall. Historically levels were as high as 51.3 mg/L and more recently, 9.18 mg/L in Fall 2013. Compared to the background monitor MW11-10, the levels of TKN and aluminum were above its trigger concentrations in the Spring and levels of nitrate and aluminum were above in the fall. Although nitrate and TKN were above its trigger concentration, the levels are comparable to MW11-10.

MW-5 has had significant decreases in TKN, Chloride and sulphate in Fall 2015. Significant decreases were also noted in iron since Fall 2014 and in Aluminium between Fall 2013 and Fall 2015 with a significant increase in Spring 2015. Total phosphorous levels remain above the PWQO as well as chromium and vanadium in Spring 2015. Boron was above the PWQO in Fall

2015 for the first time since Fall 2008. Historically, cobalt, copper, iron, lead and zinc were above the PWQO; however levels have not been above the standard since between Fall 2011 and Fall 2013. Compared to the background monitor MW11-10, the levels of TKN, chloride, TDS and aluminum were above its trigger concentrations in the Spring and levels of TKN, ammonia and TDS were above in the fall. Although nitrate was above its trigger concentration, the levels are comparable to MW11-10.

MW11-6 has had significant decreases in TKN, total phosphorous and iron since Spring 2013. Significant decreases were noted for ammonia, chloride and sulphate and a significant increase in nitrate was noted in Fall 2015. The levels of total phosphorous remain above the PWQO and have been since its installation in 2011. The levels of arsenic, chromium, copper, iron and vanadium remained above the PWQO in Spring 2015; however they had either non-detect levels or levels below the standard in Fall 2015. Silver was detected above the PWQO for the first time in Spring 2015; however levels returned to non-detect in Fall 2015. Levels of boron were above the PWQO in 2014, however they are below the standard in 2015. Cobalt historically had values above the PWQO; however levels have been below the standard since Fall 2012. Compared to the background monitor MW11-10, the levels of TKN, chloride, sulphate and TDS were above its trigger concentrations in the Spring and levels of TKN, ammonia, nitrate, chloride and TDS were above in the fall. The levels immediately down-gradient of the lagoons (MW-5 and MW11-7) are generally lower than those observed in MW11-6 in 2015 and in historical sampling events. This may be an indication that the lagoon may not be contributing to the elevated levels. As shown in Figure 2, MW11-6 is situated within the flood zone of the Ottawa River. Seasonal flooding of this area may be impacting the levels of certain parameters.

8 EMERGENCY ACTION PLAN

The trigger concentrations have been exceeded for the majority of the parameters since 2012. Initially it was decided that the emergency action plan would not need to be initiated. Based on values obtained in 2014, namely those of MW-2 and BH03-4, a noticeable increasing trend is apparent in the monitoring wells immediately down-gradient of Lagoon #1. This is an indicator that there may be an issue with the construction of Lagoon #1, and the emergency action plan (EAP) should be implemented. A copy of the EAP is included in **Appendix C**.

The first step of the implementation of the EAP would be to verify the permeability of the monitoring wells, namely those exhibiting elevated levels of the trigger parameters (MW-2 and BH03-4), to ensure that they are sealed accordingly from surface water infiltration. A bail and slug test was carried out as described in Section **Error! Reference source not found.**. If the data reveals that the seal may be faulty or incorrectly completed, the well shall be abandoned and a new well be constructed in replacement. Subsequent sampling would be carried out. If the permeability test reveals no issues, then the groundwater shall be sampled to confirm the exceedances, from all wells on the Site. The results of the bail and slug test revealed nearly identical hydraulic conductivities (k) of approximately 2.0×10^{-5} and 3.0×10^{-6} m/sec for MW-2 and BH03-4, respectively. This provides further support that the wells seals have not been compromised and that the concentrations being measured are representative.

If results continue to depict evidence of a leak in the lagoon, the remainder of the EAP would be implemented. This would include inspecting the conditions of the lagoon for leaks and cracks. An additional or new liner may be required along the perimeter of the lagoon.

9 CONCLUSIONS

Based on the results of the groundwater sampling and laboratory analytical program, LRL offers the following conclusions regarding the subject site:

- The groundwater elevations indicate that surface overburden groundwater flow direction is north, which also follows the general topography of the terrain;
- The closest monitoring wells in relation to the biosolids lagoons are BH03-4, MW11-8 and MW11-9. The water levels from these wells are between 1.54 and 4.07 m below the base of the lagoons (50.80 m). There does not appear to be any substantial hydraulic interconnection of the lagoons and the groundwater table;
- The water chemistry of the surficial overburden groundwater table shows it being impacted by the former aeration lagoons. Exceedances to the applicable trigger concentrations were detected across the site in all of the monitoring wells, including the background well MW-3 and MW11-10. Parameters detected above the trigger concentration included TKN, ammonia, nitrate, chloride, sulphate, total phosphorous, total dissolved solids and aluminum above their respective trigger concentrations. The high level of TDS were found during the initial sampling in 2002 prior to the lagoons operation therefore these levels cannot be attributed to the existing biosolids lagoons. Concentrations of parameters analysed during the 2015 monitoring year are generally comparable to historical sampling events with the following exceptions and observations:
    a. The level of TKN encountered in MW-2, BH03-4 and MW11-8 continue to show elevated concentrations with levels between four (4) and seven (7) time higher in the Spring and between eight (8) and thirty-three (33) times higher in the Fall when compared to the levels measured at MW-3. A significant shift has been observed in MW-2 and BH03-4 since Fall 2011 and in MW11-8 since Spring 2014;
    b. The respective trigger concentrations for ammonia were exceeded in MW-2, MW-4, BH03-4 and MW11-8 with significant increasing trends in MW-2 and BH03-4. This increase supports the trend being observed with respect to TKN at MW-2, BH03-4 and MW11-8 and further indicates that Lagoon #1 may be impacting groundwater;
    c. The previously identified increasing trend of nitrates in MW-2 continues. Levels in MW11-6, MW11-8 and MW11-10 were detected for the first time in Fall 2015. The levels of nitrites were also detected in MW11-7 and MW11-9 in the spring and in MW-4 in the fall. The levels of nitrites were below the laboratory detection limit of the monitoring wells;
    d. The highest level of total phosphorous encountered in 2015 was detected in MW-3 which is an indicator that a potential off-site source of phosphorous might be impacting wells within the western zone of the Site. Levels measured down-gradient of the lagoons in the eastern zone of the Site are generally comparable to that of the eastern background monitor. A significant increase was noted in Spring 2015 in MW11-8; and
    e. The highest level of chloride was measured in MW11-6 during the Spring 2015 sampling event with levels approximately fourteen (14) times greater than the trigger concentration of the background monitor MW11-10. The level is, however, comparable to historical levels. Significant shifts have been noted

in MW-2 since Spring 2011, in MW-4 from Fall 2012 to Spring 2015 and in BH03-4 since Fall 2011. More recently, MW11-9 has seen a significant increase in 2015. The levels immediately down-gradient of the lagoons are generally lower than that of MW11-6 in 2015 and in historical sampling events. This may be an indication that the lagoon may not be contributing to the elevated levels of chloride. MW11-6 is situated within the flood zone of the Ottawa River which could be a source of chloride from up-stream urban activities.

- Levels of TKN, ammonia and nitrates are found to decrease with increased distance from the lagoons indicating natural attenuation;
- The surface water impact monitors are MW-4, MW-5 and MW11-6. Total phosphorous levels were detected above the PWQO of 0.03 mg/L. The measured levels are attributed to the former sewage lagoon, which had occupied the majority of the western zone of the Site. Additional exceedances to the PWQO were also observed for aluminium, arsenic, boron, chromium, copper, iron and vanadium. These surface water monitors have measured levels generally higher than monitoring wells in proximity to the lagoons indicating a potential for another source of these parameters; and
- Multiple water types or distinct clusters are present across the Site and seems to confirm that the eastern and western zones are worthy distinctions. Seasonal variations appear to be evident at the majority of the wells except for MW-2 and MW11-8, which had similar proportional equivalents of cations and anions between the spring and fall. These analyses show variation within the representative background water conditions. This leads to some uncertainty in the calculation of the trigger concentrations which were established to identify a significant shift in concentrations. Based on the limited dataset, we are unable to definitively identify the varied water types at this time. Continued sampling would be required to derive a more concise conclusion. However, results from MW11-6 appear to show a new background water type, sodium/chloride which might be a result of interactions with the hyporheic zone.

10 RECOMMENDATIONS

Based on our findings during 2015, the following are recommended for the groundwater monitoring program in 2016:

- Commence the second stage of Emergency Action Plan by removing the contents of Lagoon #1 to verify and replace the low permeability linear walls and floor. The City should prepare a plan of action prior to commencing the emptying of Lagoon #1 so mobilization of the plan can be applied quickly if needed.
- Install an additional monitoring well downgradient of MW-2;
- Continue to sample all monitoring wells on a semi-annual basis in order to asses trend in groundwater chemistry (May and November 2016);
- MW-5 should be removed from the sampling program. Based on historic sampling events, the well produces low quantity and low recovery rates which limit the ability to obtain adequate quantities for all of the required parameters to be analysed. This may be an indication that the construction of the well has been compromised as the remaining wells in vicinity to MW-5 have higher volumes and sufficient recover rates;

- Continue to analyses of the following cations; calcium (Ca, magnesium (Mg), sodium (Na) and potassium (K) and anions, sulfate (SO4), chloride (Cl), carbonate (CO3) and hydrogen carbonate (CO3) and hydrogen carbonate (HCO3) to allow for better interpretation of previous data.

Yours truly,
LRL Associates Ltd.

LICENSED PROFESSIONAL ENGINEER
M. A. MELANEY
100167079
PROVINCE OF ONTARIO

Geneviève Marcoux
Environmental Technician

Michael Melaney, M. Eng., P. Eng.

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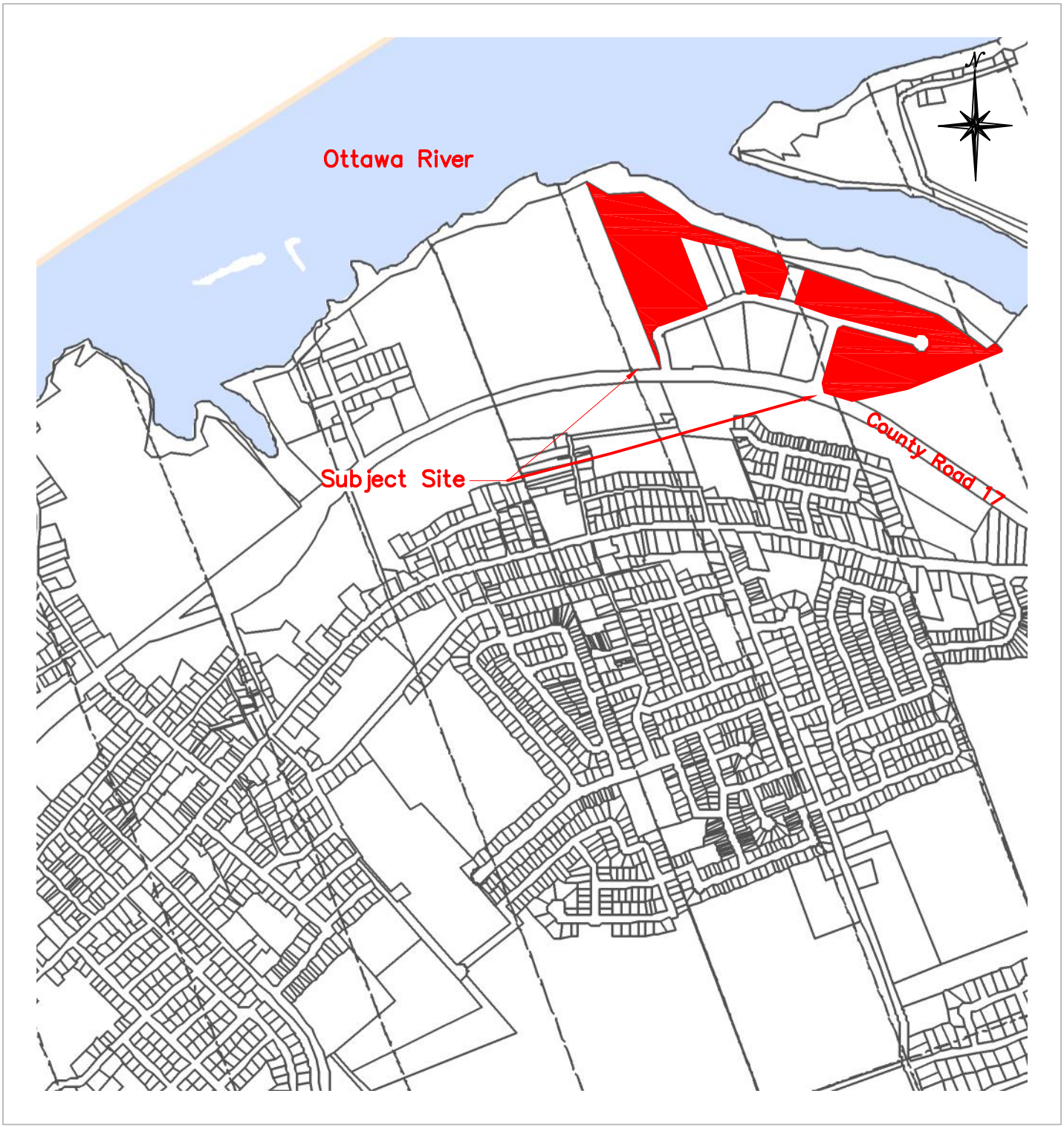
FIGURES

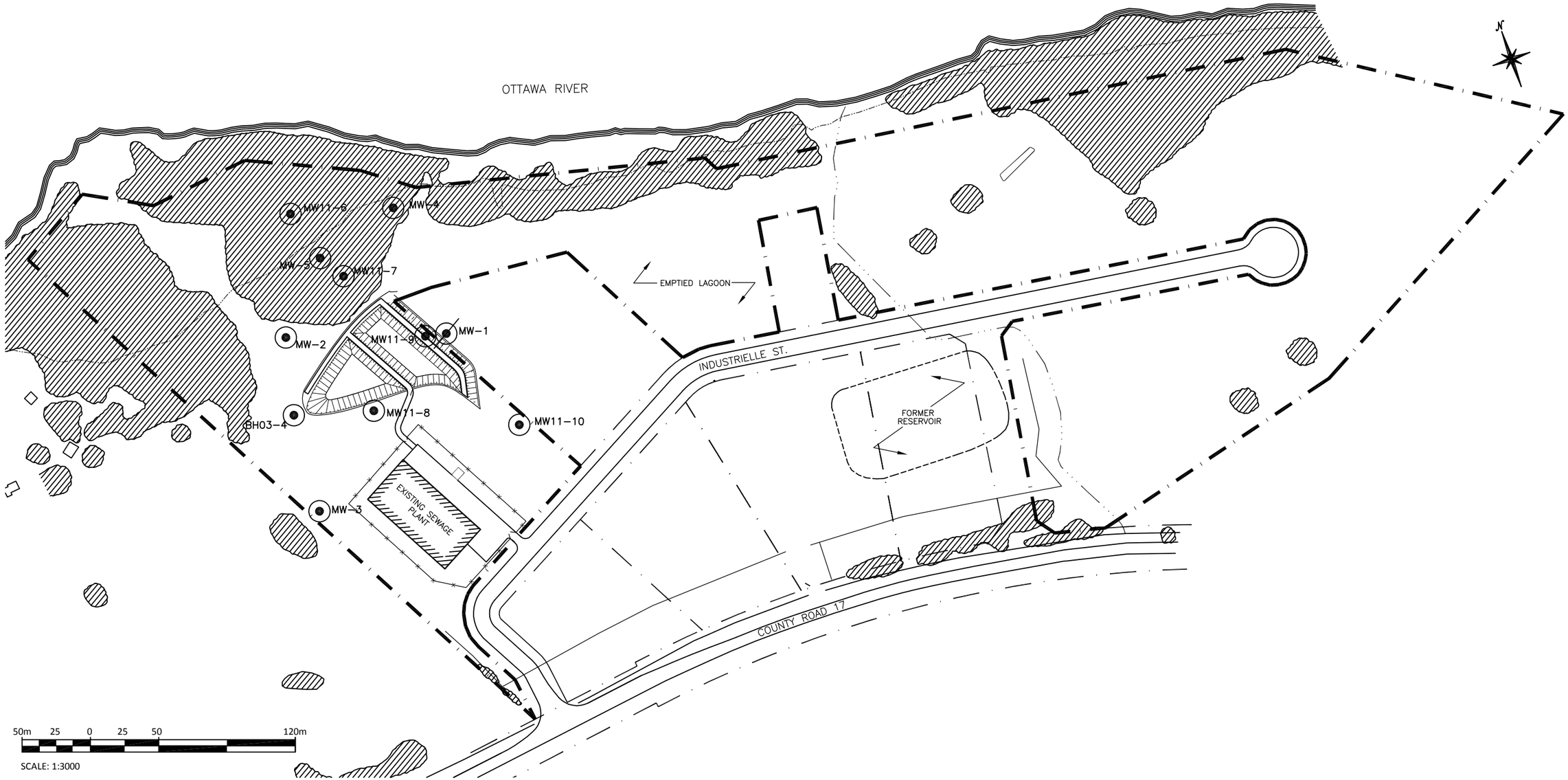
LRJ
ENGINEERING | INGÉNIERIE
5430 Canotek Road | Ottawa, ON, K1J 9G2
www.lrl.ca | (613) 842-3434

PROJECT
ANNUAL GROUNDWATER MONITORING PROGRAM
CITY OF CLARENCE-ROCKLAND
BIOSOLID STORAGE LAGOONS
2015

DRAWING TITLE
SITE LOCATION
Source: UCPR A La Carte
(Not to scale)

CLIENT	DATE	PROJECT	
CITY OF CLARENCE-ROCKLAND	MARCH 2016	01201-A	FIGURE 1





LEGEND

- SHORE LINE
- PROPERTY LINE
- DITCH
- FLOOD LINE
- VEGETATION / TREE LINE
- MW-99 MONITORING WELL
- MW-99 DESTROYED MONITORING WELL
- FENCE

No.	REVISIONS	BY	DATE
01	ISSUED FOR REVIEW	G.M.	03/04/16

LRJ
ENGINEERING | INGÉNIERIE
5430 Canotek Road | Ottawa, ON, K1J 9G2
www.lrl.ca | (613) 842-3434

CLIENT
CITY OF CLARENCE-ROCKLAND

DESIGNED BY:	DRAWN BY:	APPROVED BY:
	G.M.	M.M.

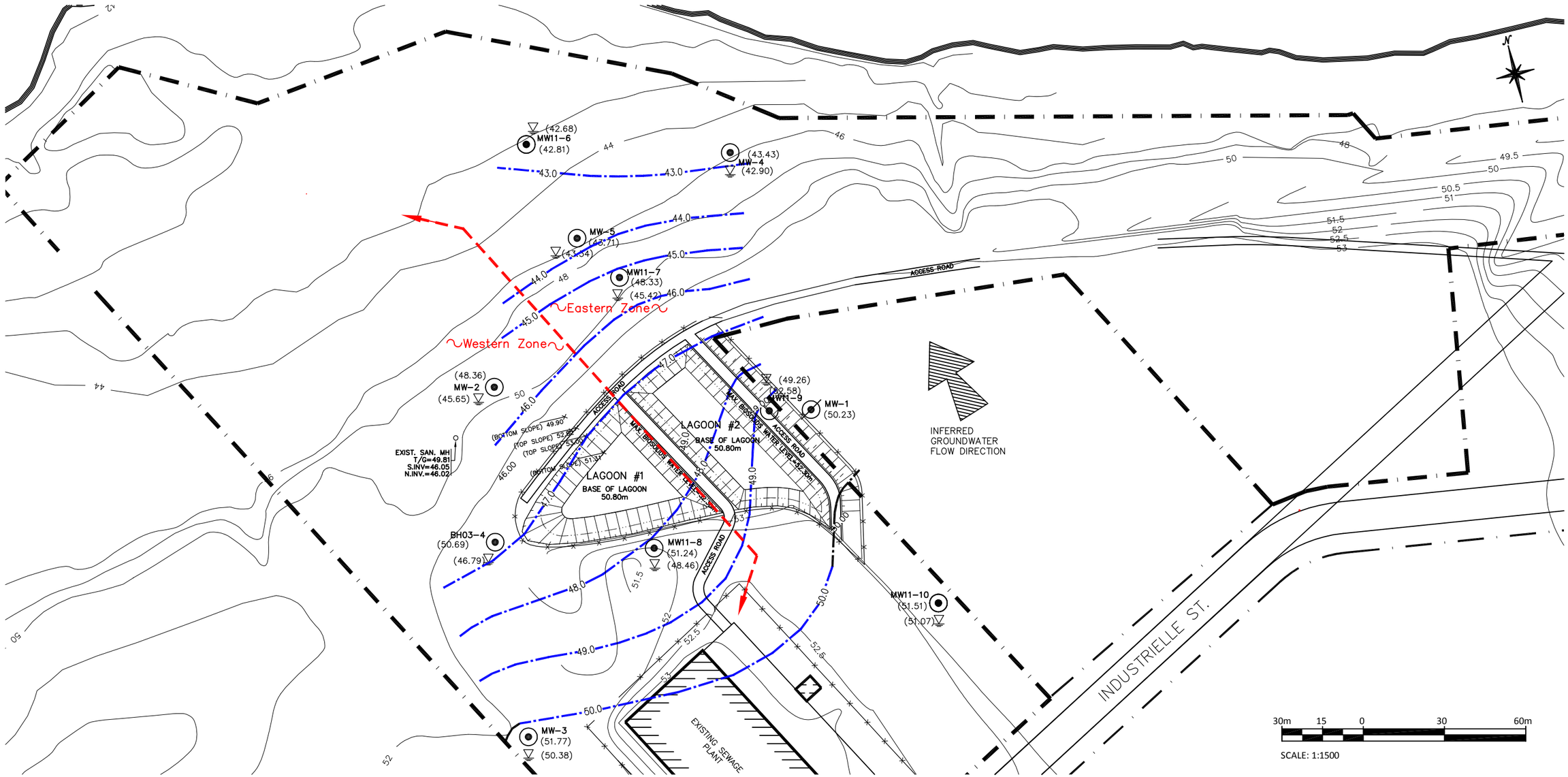
PROJECT
ANNUAL GROUNDWATER MONITORING PROGRAM
CITY OF CLARENCE-ROCKLAND
BIOSOLID STORAGE LAGOONS
2015

DRAWING TITLE
SITE PLAN AND MONITORING WELL LOCATIONS

PROJECT NO.
01201-A

DATE
MAR. 4, 2016

FIGURE 2



LEGEND

- PROPERTY LINE
- SHORELINE
- GROUND SURFACE CONTOUR LINE
- FENCE
- MW-99 (99.99) MONITORING WELL (GROUND SURFACE ELEVATION)
- (99.99) GROUNDWATER ELEVATION (NOV. 18, 2015)
- MW-99 DESTROYED MONITORING WELL
- 99.9 GROUNDWATER CONTOUR (NOV. 18, 2015)
- DIVISION BETWEEN EASTERN/WESTERN ZONES

No.	REVISIONS	BY	DATE
01	ISSUED FOR REVIEW	G.M.	03/04/16

LRL
ENGINEERING | INGÉNIERIE
5430 Canotek Road | Ottawa, ON, K1J 9G2
www.lrl.ca | (613) 842-3434

CLIENT
CITY OF CLARENCE-ROCKLAND

DESIGNED BY:	DRAWN BY:	APPROVED BY:
	G.M.	M.M.

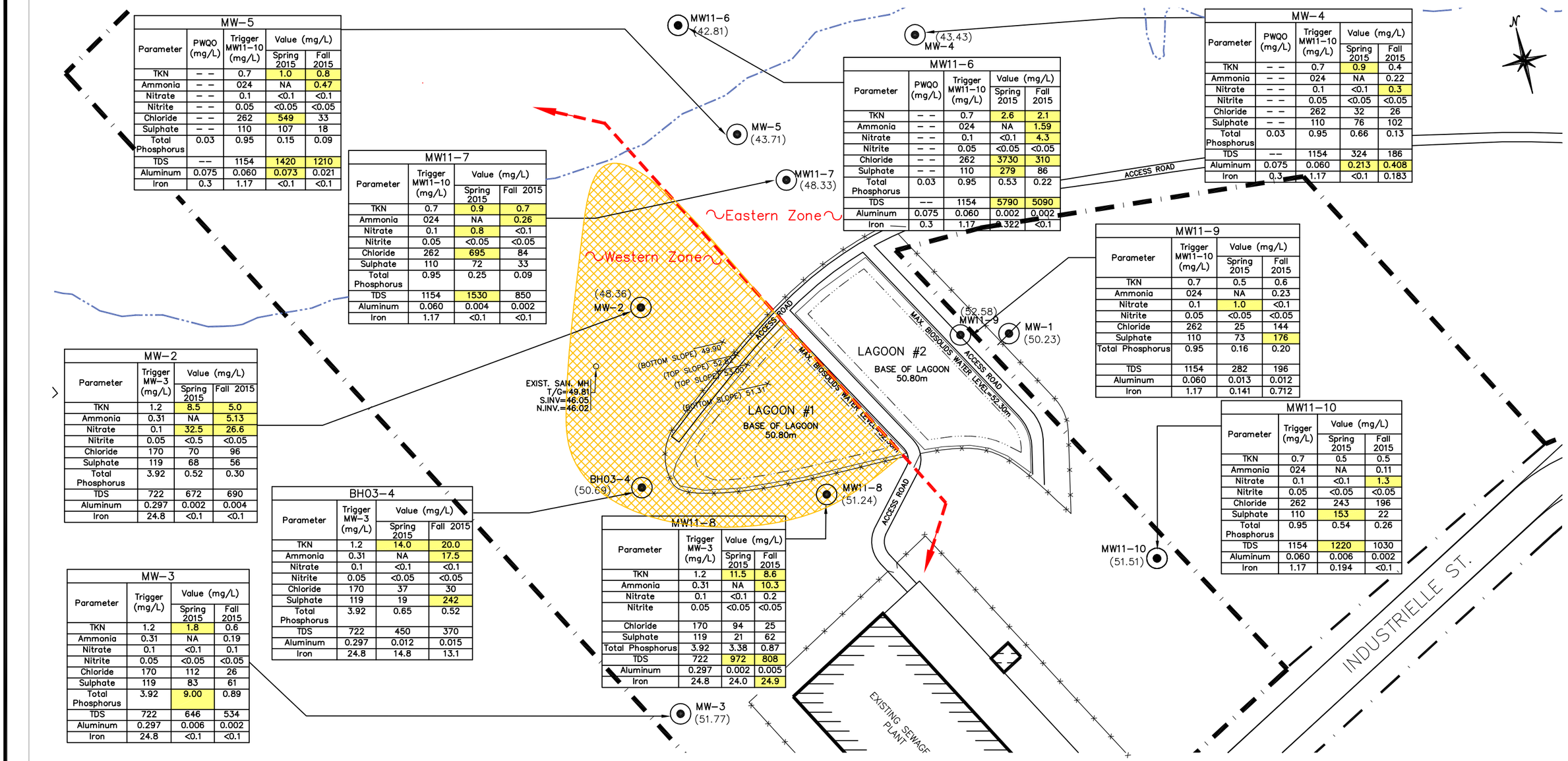
PROJECT
ANNUAL GROUNDWATER MONITORING PROGRAM
CITY OF CLARENCE-ROCKLAND
BIOSOLID STORAGE LAGOONS
2015

DRAWING TITLE
GROUNDWATER ELEVATIONS AND GROUNDWATER CONTOURS

PROJECT NO.
01201-A

DATE
MAR. 4, 2016

FIGURE 3



MW-5				
Parameter	PWQO (mg/L)	Trigger MW11-10 (mg/L)	Value (mg/L) Spring 2015	Value (mg/L) Fall 2015
TKN	– –	0.7	1.0	0.8
Ammonia	– –	024	NA	0.47
Nitrate	– –	0.1	<0.1	<0.1
Nitrite	– –	0.05	<0.05	<0.05
Chloride	– –	262	549	33
Sulphate	– –	110	107	18
Total Phosphorus	0.03	0.95	0.15	0.09
TDS	––	1154	1420	1210
Aluminum	0.075	0.060	0.073	0.021
Iron	0.3	1.17	<0.1	<0.1

MW11-7			
Parameter	Trigger MW11-10 (mg/L)	Value (mg/L) Spring 2015	Value (mg/L) Fall 2015
TKN	0.7	0.9	0.7
Ammonia	024	NA	0.26
Nitrate	0.1	0.8	<0.1
Nitrite	0.05	<0.05	<0.05
Chloride	262	695	84
Sulphate	110	72	33
Total Phosphorus	0.95	0.25	0.09
TDS	1154	1530	850
Aluminum	0.060	0.004	0.002
Iron	1.17	<0.1	<0.1

MW11-6				
Parameter	PWQO (mg/L)	Trigger MW11-10 (mg/L)	Value (mg/L) Spring 2015	Value (mg/L) Fall 2015
TKN	– –	0.7	2.6	2.1
Ammonia	– –	024	NA	1.59
Nitrate	– –	0.1	<0.1	4.3
Nitrite	– –	0.05	<0.05	<0.05
Chloride	– –	262	3730	310
Sulphate	– –	110	279	86
Total Phosphorus	0.03	0.95	0.53	0.22
TDS	––	1154	5790	5090
Aluminum	0.075	0.060	0.002	0.002
Iron	0.3	1.17	0.322	<0.1

MW-4				
Parameter	PWQO (mg/L)	Trigger MW11-10 (mg/L)	Value (mg/L) Spring 2015	Value (mg/L) Fall 2015
TKN	– –	0.7	0.9	0.4
Ammonia	– –	024	NA	0.22
Nitrate	– –	0.1	<0.1	0.3
Nitrite	– –	0.05	<0.05	<0.05
Chloride	– –	262	32	26
Sulphate	– –	110	76	102
Total Phosphorus	0.03	0.95	0.66	0.13
TDS	––	1154	324	186
Aluminum	0.075	0.060	0.213	0.408
Iron	0.3	1.17	<0.1	0.183

MW11-9			
Parameter	Trigger MW11-10 (mg/L)	Value (mg/L) Spring 2015	Value (mg/L) Fall 2015
TKN	0.7	0.5	0.6
Ammonia	024	NA	0.23
Nitrate	0.1	1.0	<0.1
Nitrite	0.05	<0.05	<0.05
Chloride	262	25	144
Sulphate	110	73	176
Total Phosphorus	0.95	0.16	0.20
TDS	1154	282	196
Aluminum	0.060	0.013	0.012
Iron	1.17	0.141	0.712

MW11-10			
Parameter	Trigger (mg/L)	Value (mg/L) Spring 2015	Value (mg/L) Fall 2015
TKN	0.7	0.5	0.5
Ammonia	024	NA	0.11
Nitrate	0.1	<0.1	1.3
Nitrite	0.05	<0.05	<0.05
Chloride	262	243	196
Sulphate	110	153	22
Total Phosphorus	0.95	0.54	0.26
TDS	1154	1220	1030
Aluminum	0.060	0.006	0.002
Iron	1.17	0.194	<0.1

MW-2			
Parameter	Trigger MW-3 (mg/L)	Value (mg/L) Spring 2015	Value (mg/L) Fall 2015
TKN	1.2	8.5	5.0
Ammonia	0.31	NA	5.13
Nitrate	0.1	32.5	26.6
Nitrite	0.05	<0.5	<0.05
Chloride	170	70	96
Sulphate	119	68	56
Total Phosphorus	3.92	0.52	0.30
TDS	722	672	690
Aluminum	0.297	0.002	0.004
Iron	24.8	<0.1	<0.1

BH03-4			
Parameter	Trigger MW-3 (mg/L)	Value (mg/L) Spring 2015	Value (mg/L) Fall 2015
TKN	1.2	14.0	20.0
Ammonia	0.31	NA	17.5
Nitrate	0.1	<0.1	<0.1
Nitrite	0.05	<0.05	<0.05
Chloride	170	37	30
Sulphate	119	19	242
Total Phosphorus	3.92	0.65	0.52
TDS	722	450	370
Aluminum	0.297	0.012	0.015
Iron	24.8	14.8	13.1

MW11-8			
Parameter	Trigger MW-3 (mg/L)	Value (mg/L) Spring 2015	Value (mg/L) Fall 2015
TKN	1.2	11.5	8.6
Ammonia	0.31	NA	10.3
Nitrate	0.1	<0.1	0.2
Nitrite	0.05	<0.05	<0.05
Chloride	170	94	25
Sulphate	119	21	62
Total Phosphorus	3.92	3.38	0.87
TDS	722	972	808
Aluminum	0.297	0.002	0.005
Iron	24.8	24.0	24.9

MW-3			
Parameter	Trigger (mg/L)	Value (mg/L) Spring 2015	Value (mg/L) Fall 2015
TKN	1.2	1.8	0.6
Ammonia	0.31	NA	0.19
Nitrate	0.1	<0.1	0.1
Nitrite	0.05	<0.05	<0.05
Chloride	170	112	26
Sulphate	119	83	61
Total Phosphorus	3.92	9.00	0.89
TDS	722	646	534
Aluminum	0.297	0.006	0.002
Iron	24.8	<0.1	<0.1

LEGEND

- PROPERTY LINE
- FENCE
- MW-99 (99.99) MONITORING WELL (GROUND SURFACE ELEVATION)
- MW-99 DESTROYED MONITORING WELL
- DIVISION BETWEEN EASTERN/WESTERN ZONES
- FLOOD LINE
- APPROXIMATE EXTENT OF IMPACTED GROUNDWATER PLUME
- ABOVE THE BACKGROUND MONITORS' TRIGGER CONCENTRATION

15m 0 30 60m

SCALE: 1:1250

No.	REVISIONS	BY	DATE
01	ISSUED FOR REVIEW	G.M.	03/04/16

LRJ ENGINEERING | INGÉNIERIE
5430 Canotek Road | Ottawa, ON, K1J 9G2
www.lrl.ca | (613) 842-3434

CLIENT
CITY OF CLARENCE-ROCKLAND

DESIGNED BY:	DRAWN BY:	APPROVED BY:
	G.M.	M.M.

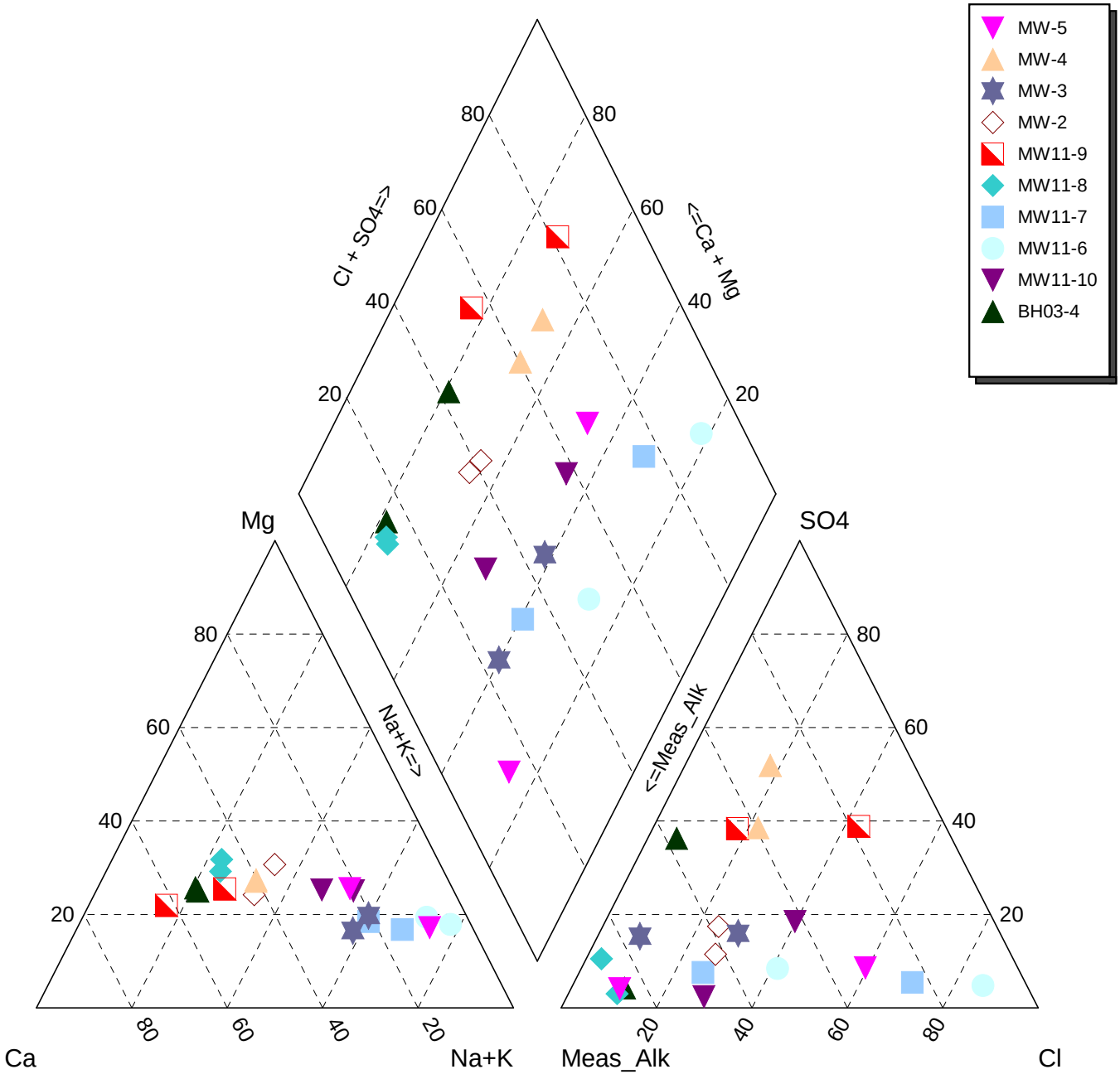
PROJECT
ANNUAL GROUNDWATER MONITORING PROGRAM
CITY OF CLARENCE-ROCKLAND
BIOSOLID STORAGE LAGOONS
2015

DRAWING TITLE
TRIGGER CONCENTRATION EXCEEDANCES

PROJECT NO.
01201-A

DATE
MAR. 4, 2016

FIGURE 4



DESCRIPTION: Figure 5 Trilinear Plot of All Groundwater Samples Collected 2015

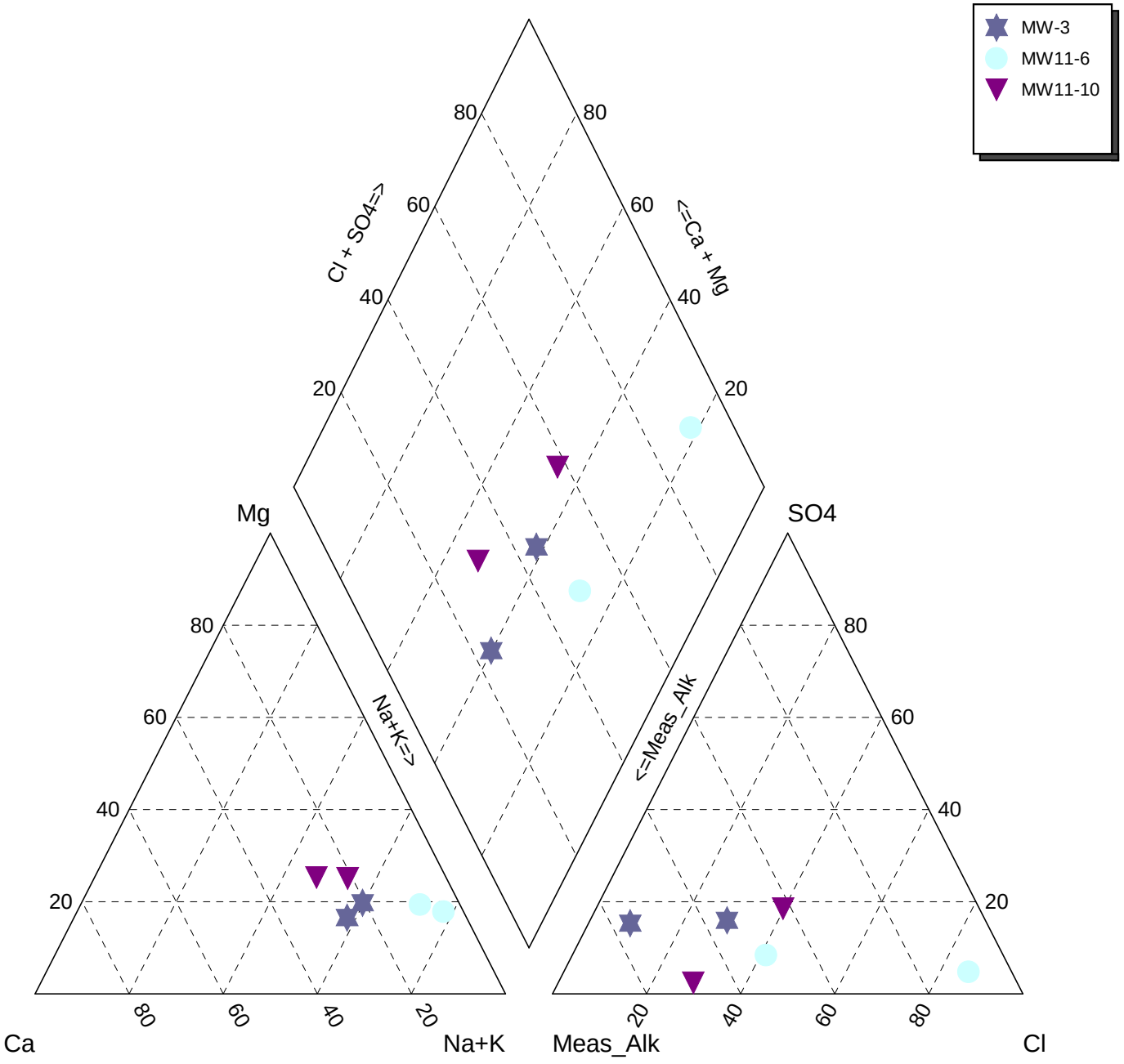
PROJECT: Annual Groundwater Monitoring Report - 2015

PROJECT NO: 01201-A

CLIENT: City of Clarence-Rockland

DATE: March 29, 2015

FILE NAME: 01201.aqc



DESCRIPTION: Figure 6 Trilinear Plot of Representative Background Wells Including MW11-6

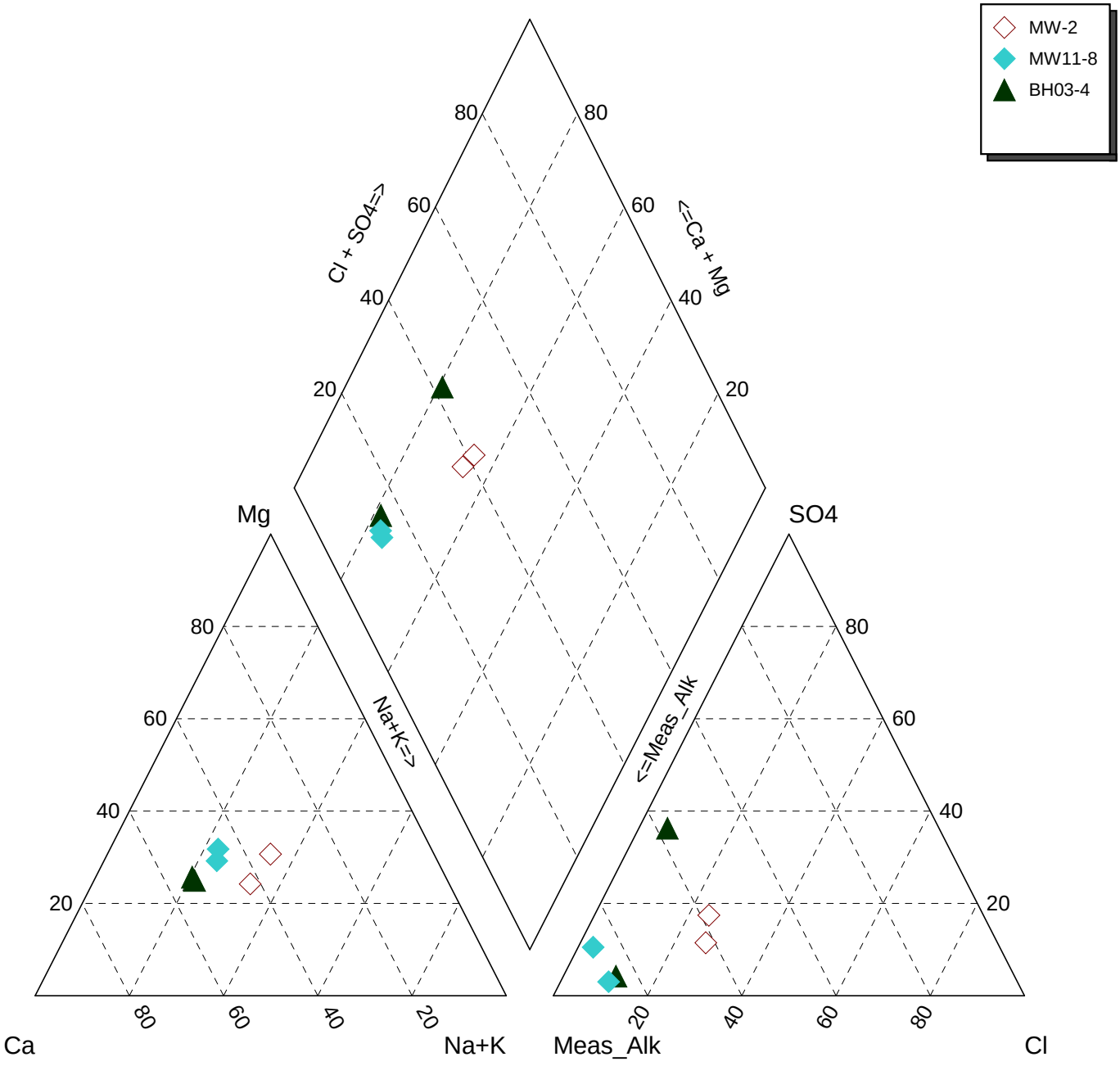
PROJECT: Annual Groundwater Monitoring Report - 2015

PROJECT NO: 01201-A

CLIENT: City of Clarence-Rockland

DATE: March 29, 2015

FILE NAME: 01201.aqc



DESCRIPTION: Figure 7 Trilinear Plot of Representative Impact Wells

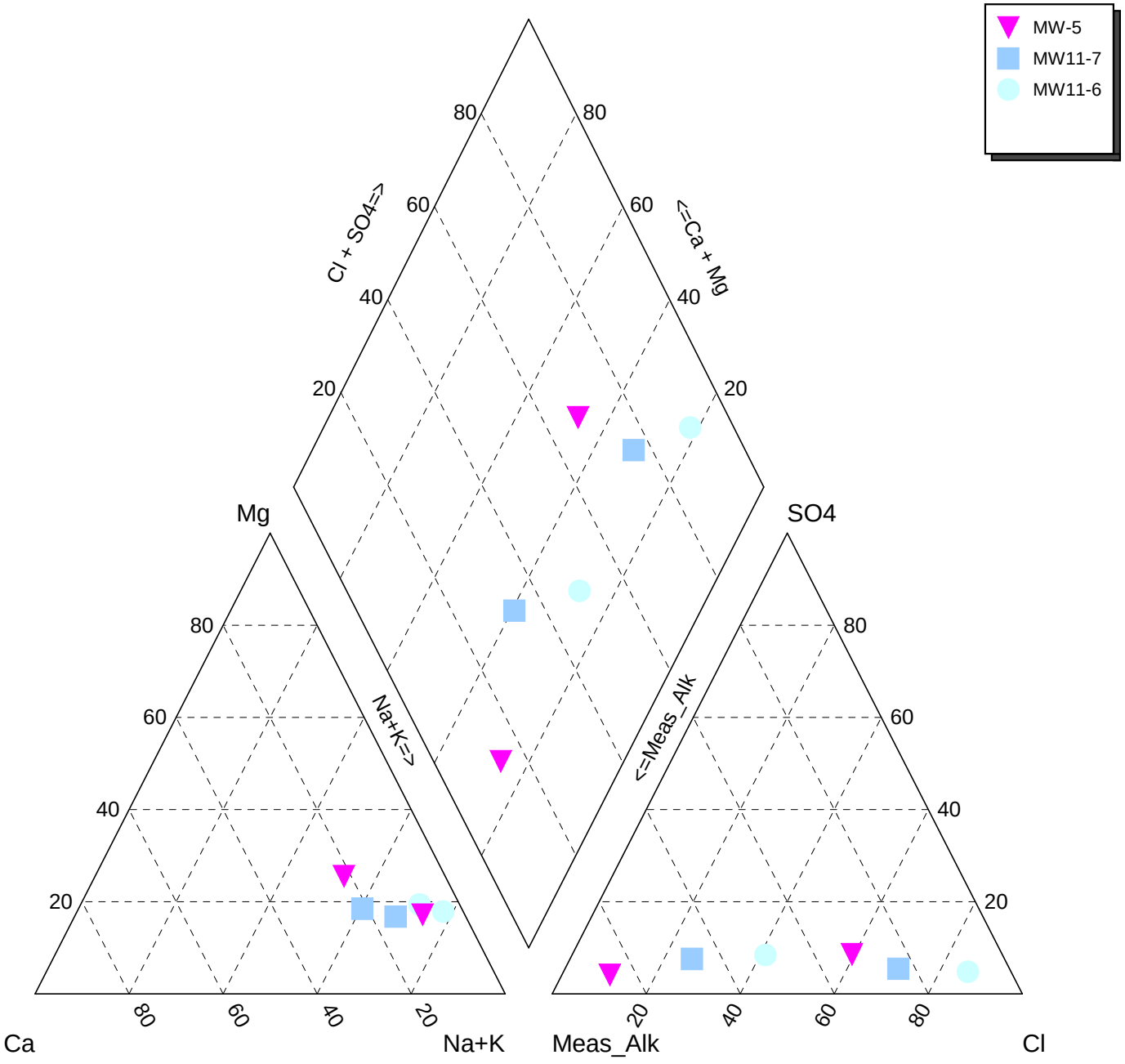
PROJECT: Annual Groundwater Monitoring Report - 2015

PROJECT NO: 01201-A

CLIENT: City of Clarence-Rockland

DATE: March 29, 2015

FILE NAME: 01201.aqc



DESCRIPTION: Figure 8 potential Hyporheic Zone

PROJECT:	Annual Groundwater Monitoring Report - 2015
PROJECT NO:	01201-A
CLIENT:	City of Clarence-Rockland
DATE:	March 29, 2015
FILE NAME:	01201.aqc

TABLES

Table 1
Summary of Groundwater Elevations
Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Monitoring Well	Well Depth (m)	Ground Surface Elevation[1] (m)	Reference Elevation[2] (m)	Spring (14-Jul-15)			Fall (18-Nov-15)		
				Depth To Water Table (m)		Groundwater Elevation (m)	Depth To Water Table (m)		Groundwater Elevation (m)
				Reference Point	Ground Surface		Reference Point	Ground Surface	
MW-2	5.81	48.36	49.09	3.42	2.69	45.67	3.45	2.72	45.65
MW-3	5.77	51.77	52.56	2.59	1.80	49.97	2.19	1.40	50.38
MW-4	3.82	43.43	44.68	2.34	1.09	42.34	1.78	0.53	42.90
MW-5	4.15	43.71	44.98	1.76	0.49	43.22	1.64	0.37	43.34
BH03-4	5.30	50.69	51.37	4.64	3.96	46.73	4.59	3.91	46.79
MW11-6	4.35	42.81	43.72	1.65	0.74	42.07	1.04	0.13	42.68
MW11-7	6.60	48.33	49.00	3.09	2.43	45.91	3.59	2.92	45.41
MW11-8	5.10	51.24	52.17	3.83	2.90	48.34	3.71	2.78	48.46
MW11-9	5.10	52.58	53.43	4.20	3.35	49.23	4.17	3.32	49.26
MW11-10	4.35	51.51	52.35	1.74	0.90	50.61	1.29	0.45	51.06

NOTES

[1] Elevations in m above mean sea level

[2] Reference elevation is top of PVC riser.

Table 2 (a)
Summary of groundwater analysis, July 14, 2015
Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

				Background Monitors	Trigger Concentration of Background Monitor[3]	Leakage Monitors		Surface Water Monitors		
Parameters	**Units**	**MDL**	**PWQO**	**MW11-10**		**MW11-7**	**MW11-9**	**MW-4**	**MW-5**	**MW11-6**
Field Parameters										
Temperature	°C	--	<30	12.3		10.1	9.4	13.6	12.2	9.5
pH	unitless	--	6.5-8.5	7.10		7.68	6.93	6.70	7.35	7.56
Chemical Analysis										
Total Kjeldhal Nitrogen	mg/L	0.1	--	0.5	0.7	**0.9**	0.5	**0.9**	**1.0**	**2.6**
Ammonia	mg/L	0.1	--	NA	--	NA	NA	NA	NA	NA
Nitrate	mg/L	0.1	--	<0.1	0.1	**0.8**	**1.0**	<0.1	<0.1	<0.1
Nitrite	mg/L	0.05	--	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chloride	mg/L	1	--	243	262	**695**	25	32	**549**	**3730**
Sulphate	mg/L	1	--	**153**	110	72	73	76	107	**279**
Total Phosphorus	uS	0.01	**0.03**	0.54	0.95	0.25	0.16	0.66	***0.15***	0.53
Conductivity	mg/L	5	--	2030		2940	420	433	2630	10100
Total Dissolved Solids	mg/L	10	--	**1220**	1154	**1530**	282	324	**1420**	**5790**
Biological Oxygen Demand	mg/L	2	--	<2		<2	<2	<2	6	11
Metals Analysis										
Aluminum	mg/L	0.001	**0.015/0.075**[2]	0.006	0.060	0.004	0.013	**0.213**	**0.073**	0.002
Antimony	mg/L	0.0005	**0.02**	<0.0005		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Arsenic	mg/L	0.001	**0.005**	0.002		0.002	<0.001	<0.001	0.001	***0.010***
Beryllium	mg/L	0.0005	**0.011**	<0.0005		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	0.01	**0.2**	0.134		0.114	0.026	0.027	0.095	0.189
Cadmium	mg/L	0.0001	**0.0001**	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	**0.001**	0.009		0.013	0.005	***0.002***	***0.008***	***0.027***
Cobalt	mg/L	0.0005	**0.0009**	0.0007		<0.0005	<0.0005	<0.0005	<0.0005	0.0005
Copper	mg/L	0.0005	**0.005**	0.0061		0.0080	0.0029	0.002	0.0042	***0.0206***
Iron	mg/L	0.1	**0.3**	0.194	1.17	<0.1	0.141	<0.1	<0.1	***0.322***
Lead	mg/L	0.0001	**0.001**	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/L	0.0005	**0.04**	0.0016		0.0006	<0.0005	0.0007	0.0008	0.0005
Nickel	mg/L	0.001	**0.025**	0.004		0.003	0.002	0.002	0.004	0.003
Selenium	mg/L	0.001	**0.1**	0.004		0.008	0.001	<0.001	0.003	0.035
Silver	mg/L	0.0001	**0.0001**	<0.0001		0.0001	<0.0001	<0.0001	<0.0001	***0.0002***
Thallium	mg/L	0.0001	**0.0003**	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tungsten	mg/L	0.01	**0.03**	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0001	**0.005**	0.0058		0.0018	<0.0001	<0.0001	<0.0001	0.0005
Vanadium	mg/L	0.0005	**0.006**	0.0152		0.0096	0.0053	0.0044	***0.0148***	***0.0102***
Zinc	mg/L	0.01	**0.03**	0.007		0.010	0.006	<0.005	0.010	0.006
Zirconium	mg/L	0.001	**0.004**	NA		NA	NA	NA	NA	NA

Notes

MDL	Method Detection Limit	--	No Value
NA	Not Applicable	NA	Not Analysed
--	No Value	1	[Organic Nitrogen] = [TKN] - [Ammonia]
Italics	Above PWQO	2	At pH 4.5 to 5.5 the Interim PWQO is 15µg/L, between pH >5.5 to 6.5 the aluminum concentration should not be more than 10% above natural background concentrations, and at pH >6.5 to 9.0 the PWQO is 75 µg/L based on inorganic monomeric aluminum measured in a clay-free sample
BOLD	Above background Trigger Concentration		
NS	Not Sampled	3	High Trigger Concentration from Background Monitor

Table 2 (b)
Summary of groundwater analysis, July 14, 2015
Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

				Background Monitors	Trigger Concentration of Background Monitor[3]	Leakage Monitors		
Parameters	**Units**	**MDL**	**PWQO**	**MW-3**		**MW-2**	**BH03-4**	**MW11-8**
Field Parameters								
Temperature	°C	--	<30	9.6		12.9	14.9	10.9
pH	unitless	--	6.5-8.5	7.85		6.62	6.68	6.72
Chemical Analysis								
Total Kjeldhal Nitrogen	mg/L	0.1	--	**1.8**	1.2	**8.5**	**14.0**	**11.5**
Ammonia	mg/L	0.1	--	NA	--	NA	NA	NA
Nitrate	mg/L	0.1	--	<0.1	0.1	**32.5**	<0.1	<0.1
Nitrite	mg/L	0.05	--	<0.05	0.05	<0.05	<0.05	<0.05
Chloride	mg/L	1	--	112	170	70	37	94
Sulphate	mg/L	1	--	83	119	68	19	21
Total Phosphorus	uS	0.01	**0.03**	**9.00**	3.92	0.52	0.65	3.38
Conductivity	mg/L	5	--	1070		1060	898	1710
Total Dissolved Solids	mg/L	10	--	646	722	672	450	**972**
Biological Oxygen Demand	mg/L	2	--	8		7	10	6
Metals Analysis								
Aluminum	mg/L	0.001	**0.015/0.075**[2]	0.006	0.297	0.002	0.012	0.002
Antimony	mg/L	0.0005	**0.02**	<0.0005		<0.0005	<0.0005	<0.0005
Arsenic	mg/L	0.001	**0.005**	0.002		<0.001	0.002	0.002
Beryllium	mg/L	0.0005	**0.011**	<0.0005		<0.0005	<0.0005	<0.0005
Boron	mg/L	0.01	**0.2**	0.117		0.079	0.041	0.061
Cadmium	mg/L	0.0001	**0.0001**	<0.0001		<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	**0.001**	0.005		0.005	0.007	0.014
Cobalt	mg/L	0.0005	**0.0009**	<0.0005		0.0012	<0.0005	0.0007
Copper	mg/L	0.0005	**0.005**	0.0047		0.0042	0.0009	0.0020
Iron	mg/L	0.1	**0.3**	<0.1	24.8	<0.1	14.8	24.0
Lead	mg/L	0.0001	**0.001**	<0.001		<0.001	<0.0001	<0.0001
Molybdenum	mg/L	0.0005	**0.04**	0.0010		<0.0005	<0.0005	<0.0005
Nickel	mg/L	0.001	**0.025**	0.003		0.005	0.003	0.005
Selenium	mg/L	0.001	**0.1**	0.002		0.001	<0.001	0.003
Silver	mg/L	0.0001	**0.0001**	<0.0001		<0.0001	<0.0001	<0.0001
Thallium	mg/L	0.0001	**0.0003**	<0.0001		<0.0001	<0.0001	<0.0001
Tungsten	mg/L	0.01	**0.03**	<0.01		<0.01	<0.01	<0.01
Uranium	mg/L	0.0001	**0.005**	0.0006		0.0014	0.0002	<0.0001
Vanadium	mg/L	0.0005	**0.006**	0.0089		0.0123	0.0173	0.0286
Zinc	mg/L	0.01	**0.03**	0.010		<0.005	0.008	0.009
Zirconium	mg/L	0.001	**0.004**	NA		NA	NA	NA

Notes

MDL Method Detection Limit
NA Not Applicable
-- No Value
BOLD Above background Trigger Concentration
NS Not Sampled
-- No Value

NA Not Analysed
1 [Organic Nitrogen] = [TKN] - [Ammonia]
2 At pH 4.5 to 5.5 the Interim PWQO is 15µg/L, between pH >5.5 to 6.5 the aluminum concentration should not be more than 10% above natural background concentrations, and at pH >6.5 to 9.0 the PWQO is 75 µg/L based on inorganic monomeric aluminum measured in a clay-free sample.
3 High Trigger Concentration from Background Monitor

Table 3 (a)
Summary of groundwater analysis, November 18, 2015
Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

				Background Monitors	Trigger Concentration of Background Monitor[3]	Leakage Monitors		Surface Water Monitors		
Parameters	Units	MDL	PWQO	MW11-10		MW11-7	MW11-9	MW-4	MW-5	MW11-6
Field Parameters										
Temperature	°C	--	<30	9.4		7.7	8.6	7.8	6.1	8.7
pH	unitless	--	6.5-8.5	7.37		6.91	7.37	7.36	7.65	7.58
Chemical Analysis										
Total Kjeldhal Nitrogen	mg/L	0.1	--	0.5	0.7	**0.7**	0.6	0.4	**0.8**	**2.1**
Ammonia	mg/L	0.1	--	0.11	0.24	**0.26**	0.23	0.22	**0.47**	**1.59**
Nitrate	mg/L	0.1	--	**1.3**	0.1	<0.1	<0.1	**0.3**	<0.1	**4.3**
Nitrite	mg/L	0.05	--	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chloride	mg/L	1	--	196	262	84	144	26	33	**310**
Sulphate	mg/L	1	--	22	110	33	**176**	102	18	86
Total Phosphorus	uS	0.01	**0.03**	0.26	0.95	0.09	0.20	***0.13***	***0.09***	***0.22***
Conductivity	mg/L	5	--	1820		1690	392	352	2380	8850
Total Dissolved Solids	mg/L	10	--	1030	1154	850	196	186	**1210**	**5090**
Biological Oxygen Demand	mg/L	2	--	<2		<100	<2	<20	3	6
Metals Analysis										
Aluminum	mg/L	0.001	**0.015/0.075**[2]	0.002	0.060	0.002	0.012	**0.408**	0.021	0.002
Antimony	mg/L	0.0005	**0.02**	<0.0005		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Arsenic	mg/L	0.001	**0.005**	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001
Beryllium	mg/L	0.0005	**0.011**	<0.0005		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	0.01	**0.2**	0.103		0.111	0.035	0.019	***0.242***	0.151
Cadmium	mg/L	0.0001	**0.0001**	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	**0.001**	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	mg/L	0.0005	**0.0009**	<0.0005		<0.0005	0.0008	<0.0005	<0.0005	<0.0005
Copper	mg/L	0.0005	**0.005**	<0.0005		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	0.1	**0.3**	<0.1	1.17	<0.1	0.712	0.183	<0.1	<0.1
Lead	mg/L	0.0001	**0.001**	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/L	0.0005	**0.04**	0.002		<0.0005	0.0005	<0.0005	0.0009	0.0006
Nickel	mg/L	0.001	**0.025**	<0.001		0.001	<0.001	<0.001	0.001	0.001
Selenium	mg/L	0.001	**0.1**	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001
Silver	mg/L	0.0001	**0.0001**	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Thallium	mg/L	0.0001	**0.0003**	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tungsten	mg/L	0.01	**0.03**	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0001	**0.005**	0.0100		0.0017	<0.0001	<0.0001	0.0027	0.0009
Vanadium	mg/L	0.0005	**0.006**	0.0011		<0.0005	0.0014	0.0009	0.0006	0.0009
Zinc	mg/L	0.01	**0.03**	0.011		0.012	0.016	<0.005	<0.005	0.012
Zirconium	mg/L	0.001	**0.004**	NA		NA	NA	NA	NA	NA

Notes

MDL Method Detection Limit
NA Not Applicable
-- No Value
Italics Above PWQO
BOLD Above background Trigger Concentration

-- No Value
NA Not Analysed
1 [Organic Nitrogen] = [TKN] - [Ammonia]
2 At pH 4.5 to 5.5 the Interim PWQO is 15µg/L, between pH >5.5 to 6.5 the aluminum concentration should not be more than 10% above natural background concentrations, and at pH >6.5 to 9.0 the PWQO is 75 µg/L based on inorganic monomeric aluminum measured in clay-free sample.
3 High Trigger Concentration from Background Monitor

Table 3 (b)
Summary of groundwater analysis, November 18, 2015
Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

				Background Monitors	Trigger Concentration of Background Monitor[3]	Leakage Monitors		
Parameters	**Units**	**MDL**	**PWQO**	**MW-3**		**MW-2**	**BH03-4**	**MW11-8**
Field Parameters								
Temperature	°C	--	<30	9.9		8.9	13.6	9.7
pH	unitless	--	6.5-8.5	7.46		7.17	6.82	6.80
Chemical Analysis								
Total Kjeldhal Nitrogen	mg/L	0.1	--	0.60	1.2	**5.0**	**20.0**	**8.6**
Ammonia	mg/L	0.1	--	0.19	0.31	**5.13**	**17.5**	**10.3**
Nitrate	mg/L	0.1	--	0.1	0.1	**26.6**	<0.1	**0.2**
Nitrite	mg/L	0.05	--	<0.05	0.05	<0.05	<0.05	<0.05
Chloride	mg/L	1	--	26	170	96	30	25
Sulphate	mg/L	1	--	61	119	56	**242**	62
Total Phosphorus	uS	0.01	**0.03**	0.89	3.92	0.30	0.52	0.87
Conductivity	mg/L	5	--	972		1180	886	1560
Total Dissolved Solids	mg/L	10	--	534	722	690	370	**808**
Biological Oxygen Demand	mg/L	2	--	4		9	10	<20
Metals Analysis								
Aluminum	mg/L	0.001	**0.015/0.075**[2]	0.002	0.297	0.004	0.015	0.005
Antimony	mg/L	0.0005	**0.02**	<0.0005		<0.0005	<0.0005	<0.0005
Arsenic	mg/L	0.001	**0.005**	<0.001		<0.001	<0.001	<0.001
Beryllium	mg/L	0.0005	**0.011**	<0.0005		<0.0005	<0.0005	<0.0005
Boron	mg/L	0.01	**0.2**	0.113		0.077	0.043	0.081
Cadmium	mg/L	0.0001	**0.0001**	<0.0001		0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	**0.001**	<0.01		<0.01	0.002	0.001
Cobalt	mg/L	0.0005	**0.0009**	<0.0005		0.0012	<0.0005	0.0006
Copper	mg/L	0.0005	**0.005**	<0.0005		<0.0005	<0.0005	<0.0005
Iron	mg/L	0.1	**0.3**	<0.1	24.8	<0.1	13.1	**24.9**
Lead	mg/L	0.0001	**0.001**	<0.001		<0.001	<0.0001	<0.0001
Molybdenum	mg/L	0.0005	**0.04**	0.0006		<0.0005	<0.0005	<0.0005
Nickel	mg/L	0.001	**0.025**	0.002		0.003	<0.001	<0.001
Selenium	mg/L	0.001	**0.1**	<0.001		<0.001	<0.001	<0.001
Silver	mg/L	0.0001	**0.0001**	<0.0001		<0.0001	<0.0001	<0.0001
Thallium	mg/L	0.0001	**0.0003**	<0.0001		<0.0001	<0.0001	<0.0001
Tungsten	mg/L	0.01	**0.03**	<0.01		<0.01	<0.01	<0.01
Uranium	mg/L	0.0001	**0.005**	0.0006		0.0017	0.0001	<0.0001
Vanadium	mg/L	0.0005	**0.006**	0.001		<0.0005	0.0022	0.0028
Zinc	mg/L	0.01	**0.03**	0.012		0.009	0.014	0.013
Zirconium	mg/L	0.001	**0.004**	NA		NA	NA	NA

Notes

MDL Method Detection Limit
NA Not Applicable
-- No Value
BOLD Above background Trigger Concentration
-- No Value

NA Not Analysed
1 [Organic Nitrogen] = [TKN] - [Ammonia]
2 At pH 4.5 to 5.5 the Interim PWQO is 15µg/L, between pH >5.5 to 6.5 the aluminum concentration should not be more than 10% above natural background concentrations, and at pH >6.5 to 9.0 the PWQO is 75 µg/L based on inorganic monomeric aluminum measured in a clay-free sample.
3 High Trigger Concentration from Background Monitor

APPENDIX A

Analysis of Lagoon Biosolids

Analysis of Biosolids

Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

			West Lagoon				East Lagoon			
			Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Parameters	**Units**	**MDL**	**9-Mar-04**	**30-Nov-04**	**26-May-05**	**11-Nov-05**	**9-Mar-04**	**30-Nov-04**	**26-May-05**	**11-Nov-05**
General Chemistry										
Ammonia	ug/g	1	950	--	5000	100	570	--	14000	240
Chloride	ug/g	1	1300	--	740	1500	830	--	2000	1100
Nitrate	ug/g	0.1	<0.1	--	81	1.8	11	--	3.6	5.7
Nitrite	ug/g	0.05	0.8	--	1.6	<0.05	1.2	--	1.3	1.1
Sulphate	ug/g	1	1000	--	1100	180	220	--	480	560
Conductivity	ug/g	5	1500	--	2900	1800	550	--	4800	2000
Total Phosphorus	ug/g	5	<5	--	<5	8000	<5	--	<5	14000
TKN	ug/g	10	13000	--	66000	8000	16000	--	18000	8800
Organic nitrogen	ug/g	0.1	12050	--	61000	7900	15430	--	4000	8560
Metals										
Antimony	ug/g	1	<1	1	<1	<1	1	1	<1	<1
Arsenic	ug/g	1	3	3	3	2	3	2	3	<1
Barium	ug/g	10	280	230	220	280	290	160	170	260
Beryllium	ug/g	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium	ug/g	0.5	3	2.5	3.5	<0.5	3	10	2.5	1.5
Calcium	ug/g	200	9800	19000	8400	--	13 000	1800	8000	--
Chromium	ug/g	5	20	25	20	20	20	20	15	30
Cobalt	ug/g	5	<5	<5	<5	<5	<5	<5	<5	<5
Copper	ug/g	5	260	140	140	190	290	90	130	180
Iron	ug/g	200	7200	13000	7000	6000	7 000	13000	5600	8600
Lead	ug/g	1	20	18	22	19	20	9	14	18
Magnesium	ug/g	200	3000	3000	2800	3000	3 200	3000	2400	3600
Molybdenum	ug/g	1	3	2	2	2	3	1	2	2
Nickel	ug/g	5	15	15	10	15	15	15	10	20
Selenium	ug/g	1	2	<1	<1	<1	2	<1	2	<1
Silver	ug/g	0.3	9	4.8	5.1	4.2	6.3	3.3	3.9	6.6
Sodium	ug/g	200	2 000	800	800	--	2 000	800	1200	--
Thallium	ug/g	1	<1	2	2	<1	<1	<1	<1	<1
Tin	ug/g	5	10	15	10	<5	10	10	10	<5
Vanadium	ug/g	10	<10	10	10	10	<10	10	<10	20
Zinc	ug/g	20	280	280	300	340	340	180	220	240

Notes

-- Not analysed

MDL Minimum Detection Limit

APPENDIX B

OCWA Performance Assessment Data

Ontario Clean Water Agency
Performance Assessment Report Wastewater/Lagoon

Report extracted 03/01/2016 10:12 **From: 01/01/2015 to 31/12/2015**

Facility: [6816] ROCKLAND WASTEWATER TREATMENT FACILITY

Works: [6816] ROCKLAND WASTEWATER TREATMENT FACILITY

	01/2015	02/2015	03/2015	04/2015	05/2015	06/2015	07/2015	08/2015	09/2015	10/2015	11/2015	12/2015	<--Total-->	<--Avg.-->	<--Max.-->	<--Criteria-->
Flows:																
Raw Flow: Total - Raw Sewage (m³)	108936	88542	59012	152858	124124	136786	123380	134103	115974	120941	125781	131958	1422395			
Raw Flow: Avg - Raw Sewage (m³/d)	3514.06	3162.21	3278.44	5095.27	4004	4559.53	3980	4325.9	3865.8	3901.32	4192.7	4256.71		4011.33		
Raw Flow: Max - Raw Sewage (m³/d)	4085	3596	3574	7146	4357	6398	4706	5902	4092	5561	4995	5042			7146	
Eff. Flow: Total - WPCP Effluent (m³)	108936	88542	59012	152858	124124	136786	123380	134103	115974	120941	125781	131958	1422395			
Eff. Flow: Avg - WPCP Effluent (m³/d)	3514.06	3162.21	3278.44	5095.27	4004	4559.53	3980	4325.9	3865.8	3901.32	4192.7	4256.71		4011.33		
Eff. Flow: Max - WPCP Effluent (m³/d)	4085	3596	3574	7146	4357	6398	4706	5902	4092	5561	4995	5042			7146	
Carbonaceous Biochemical Oxygen Demand: CBOD:																
Eff: Avg cBOD5 - WPCP Effluent (mg/L)	< 11.5	< 85.375	< 14.7	< 5.5	< 18.75	22.75	< 14.5	< 11.8	14.75	< 4.5	< 3	< 4.5		< 17.635	85.375	
Eff: # of samples of cBOD5 - WPCP Effluent	4	8	20	4	4	4	4	5	4	4	5	4	70			
Loading: cBOD5 - WPCP Effluent (kg/d)	< 40.412	< 269.974	< 48.193	< 28.024	< 75.075	103.729	< 57.71	< 51.046	57.021	< 17.556	< 12.578	< 19.155		< 65.039	269.974	
Biochemical Oxygen Demand: BOD5:																
Raw: Avg BOD5 - Raw Sewage (mg/L)	168.5	237.8	205.8	166	193	223.75	123.75	154	121.5	163	174.4	238.5		180.833	238.5	
Raw: # of samples of BOD5 - Raw Sewage	4	5	5	5	4	4	4	5	4	4	5	4	53			
Total Suspended Solids: TSS:																
Raw: Avg TSS - Raw Sewage (mg/L)	558.5	818.4	453.6	392.8	492	515	188	442.4	190	232	408.8	874		463.792	874	
Raw: # of samples of TSS - Raw Sewage (mg/L)	4	5	5	5	4	4	4	5	4	4	5	4	53			
Eff: Avg TSS - WPCP Effluent (mg/L)	31.75	26.125	21.5	12.25	12.75	17.5	23.75	14.2	14.5	16.75	14	15.75		18.402	31.75	
Eff: # of samples of TSS - WPCP Effluent (mg/L)	4	8	8	4	4	4	4	5	4	4	5	4	58			
Loading: TSS - WPCP Effluent (kg/d)	111.572	82.613	70.487	62.417	51.051	79.792	94.525	61.428	56.054	65.347	58.698	67.043		71.752	111.572	
Percent Removal: TSS - Raw Sewage (mg/L)	94.315	96.808	95.26	96.881	97.409	96.602	87.367	96.79	92.368	92.78	96.575	98.198			98.198	
Total Phosphorus: TP:																
Raw: Avg TP - Raw Sewage (mg/L)	5.515	8.11	5.696	5.182	7.63	6.633	4.882	5.596	5.598	6.153	6.294	5.79		6.09	8.11	
Raw: # of samples of TP - Raw Sewage (mg/L)	4	5	5	5	4	4	4	5	4	4	5	4	53			
Eff: Avg TP - WPCP Effluent (mg/L)	0.793	3.678	0.562	0.348	0.385	0.508	0.695	0.528	0.6	0.5	0.404	0.55		0.796	3.678	
Eff: # of samples of TP - WPCP Effluent (mg/L)	4	9	6	4	4	4	4	5	4	4	5	4	57			
Loading: TP - WPCP Effluent (kg/d)	2.785	11.63	1.841	1.771	1.542	2.314	2.766	2.284	2.319	1.951	1.694	2.341		2.936	11.63	
Percent Removal: TP - Raw Sewage (mg/L)	85.63	54.651	90.139	93.294	94.954	92.348	85.765	90.565	89.281	91.873	93.581	90.501			94.954	
Nitrogen Series:																
Raw: Avg TKN - Raw Sewage (mg/L)	49.95	56.06	50.42	41.58	54	47.95	41.075	45.04	44.775	48.35	49.6	46.875		47.973	56.06	
Raw: # of samples of TKN - Raw Sewage	4	5	5	5	4	4	4	5	4	4	5	4	53			
Eff: Avg TAN - WPCP Effluent (mg/L)	18.35	24.388	22.42	19.425	20.675	18.825	< 13.028	16.696	20.175	16.275	14.26	17.175		< 18.474	24.388	
Eff: # of samples of TAN - WPCP Effluent	4	8	5	4	4	4	4	5	4	4	5	4	55			
Loading: TAN - WPCP Effluent (kg/d)	64.483	77.119	73.503	98.976	82.783	85.833	< 51.849	72.225	77.993	63.494	59.788	73.109		< 73.429	98.976	
Eff: Avg NO3-N - WPCP Effluent (mg/L)	0.15	< 0.175	< 0.12	0.4	0.125	< 0.15	< 1.35	< 0.2	< 0.125	< 0.15	0.38	< 0.1		< 0.285	1.35	
Eff: # of samples of NO3-N - WPCP Effluent	4	8	5	4	4	4	4	5	4	4	5	4	55			
Eff: Avg NO2-N - WPCP Effluent (mg/L)	< 0.1	< 0.15	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.35	< 0.24	< 0.1		< 0.137	< 0.35	
Eff: # of samples of NO2-N - WPCP Effluent	4	8	5	4	4	4	4	5	4	4	5	4	55			
Disinfection:																
Eff: GMD E. Coli - WPCP Effluent (cfu/100mL)	1.189	12.04	2	2	2.378	34.748	21.09	2	2	2	2	2		7.12	34.748	
Eff: # of samples of E. Coli - WPCP Effluent	4	6	5	4	4	7	6	5	4	4	5	3	57			

APPENDIX C

Emergency Action Plan

The parameters measured in the monitoring wells that will be used to trigger the implementation of the action plan include nitrates, nitrites and total phosphorous. The following points regarding the lagoons and site conditions are noted:

- All neighbouring properties surrounding the biosolids lagoons are supplied by municipal water. A drilled well is located on the Pack All Manufacturing Inc. property south of the lagoons. However, it is only use for industrial processing operations.
- The dikes and the bottom of the lagoons are constructed over a thick clay deposit, whose hydraulic conductivity is lower than 0.03 m/year. Only the weathered clay crust would have a hydraulic conductivity higher than 3 m/year and it is expected that this layer less than 3 m thick.
- During the lagoon construction a 0.6 m layer of compacted clay was added at the base of the lagoons.
- The north and east portion of the lagoons' dikes have their exterior sides exposed to a lower area, which could be more sensitive to a spill or leak. All other sides of the lagoons are not exposed and all transfer pipes are located underground and therefore less susceptible to potential surficial leaks.

For these reasons, the events that could trigger exceeding levels of nitrates, nitrites or phosphorous are:

- Groundwater infiltration from the lagoons
- Breaks or leaks in the dikes or conduits;
- Overflow of the lagoons; or
- Spill during the biosolids transfer from the lagoon to the disposal site.

Groundwater infiltration from the lagoons is limited due the impervious soil conditions. The impact will be more critical in MW-3 than the other monitoring wells because:

- Dilution is possible before the trigger concentration levels reach the property boundaries;
- The area located downgradient of the assumed groundwater flow is vacant and will remain undeveloped;
- Towards the east of the lagoons, the proposed land use shall only be industrial development and is not considered a sensitive area;
- This terrain to the east of the lagoons was used for many years part of a sewage treatment lagoon; and
- The closest surficial and groundwater water receptor is the Ottawa River, which has a large dilution capability due to its large flow.

The permeability of MW-2 and BH03-4 were verified in 2015 in order to ensure that they are properly sealed from surface water infiltration. Slug and bail tests were conducted and were analysed using the straight line (Hvorslev 1951) method. The analysis revealed nearly identical hydraulic conductivities (k) for both the slug and bail tests of approximately 2.0×10^{-5} and 3.0×10^{-6} m/sec for MW-2 and BH03-4, respectively. This provides further support that the wells seals have not been compromised and that the concentrations being measured are representative.

GROUNDWATER RELATED ACTIONS

Exceeding levels of nitrites, nitrates or phosphorous have been measured in MW-2, MW11-6, MW11-8 and MW11-9. Since the permeability test on monitoring wells MW-2 and BH03-4 revealed no sealing issues, the exceeding levels may indicate the presence of a potential leak within the lagoons' operations, where the following actions shall be carried out:

a. Perform a detail inspection of the dikes and the conduits for cracks, leaks or breaks.
b. Stop the biosolids transfer to the lagoons.
c. If required, use an alternative disposal site for the biosolids during the investigation.
d. In the case of a spill or leak originating of the dikes, lower the current level of the lagoons as required to carry out the needed repairs of the dikes.
e. In the case of a conduit break. Locate the break and perform the necessary repairs.
f. Once the repairs are completed, restart the lagoon's operations.
g. Resample the monitoring wells at least 2 weeks after lagoon's operations have restarted.

APPENDIX D

Laboratory Certificates of Analysis

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Certificate of Analysis

LRL Associates Ltd.

5430 Canotek Road
Ottawa, ON K1J 9G2
Attn: Jessica Arthurs

Client PO:
Project: 01201-A
Custody: 22514

Report Date: 23-Jul-2015
Order Date: 14-Jul-2015

Order #: 1529161

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1529161-01	MW-3
1529161-02	MW-2
1529161-03	MW-4
1529161-04	MW-5
1529161-05	BH03-4
1529161-06	MW11-6
1529161-07	MW11-7
1529161-08	MW11-8
1529161-09	MW11-9
1529161-10	MW11-10

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Client: **LRL Associates Ltd.**

Client PO:

Report Date: 23-Jul-2015

Order Date:14-Jul-2015

Project Description: 01201-A

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	16-Jul-15	16-Jul-15
Anions	EPA 300.1 - IC	15-Jul-15	15-Jul-15
Biochemical Oxygen Demand	SM 5210B - DO Probe	15-Jul-15	20-Jul-15
Conductivity	EPA 9050A- probe @25 °C	15-Jul-15	15-Jul-15
Metals, ICP-MS	EPA 200.8 - ICP-MS	22-Jul-15	22-Jul-15
Phosphorus, total	EPA 365.4 - Auto Colour, digestion	16-Jul-15	17-Jul-15
TKN	EPA 351.2 - Auto Colour, digestion	16-Jul-15	17-Jul-15
Total Dissolved Solids	SM 2540C - gravimetric, filtration	15-Jul-15	20-Jul-15

Certificate of Analysis

Client: **LRL Associates Ltd.**

Client PO:

Report Date: 23-Jul-2015
Order Date:14-Jul-2015
Project Description: 01201-A

	Client ID:	MW-3	MW-2	MW-4	MW-5
	Sample Date:	14-Jul-15	14-Jul-15	14-Jul-15	14-Jul-15
	Sample ID:	1529161-01	1529161-02	1529161-03	1529161-04
	MDL/Units	Water	Water	Water	Water
General Inorganics					
Alkalinity, total	5 mg/L	298	237	81	416
BOD	2 mg/L	8	7	<2 [1]	6
Conductivity	5 uS/cm	1070	1060	433	2630
Phosphorus, total	0.01 mg/L	9.00	0.52	0.66	0.15
Total Dissolved Solids	10 mg/L	646	672	324	1420
Total Kjeldahl Nitrogen	0.1 mg/L	1.8	8.5	0.9	1.0
Anions					
Chloride	1 mg/L	112	70	32	549
Nitrate as N	0.1 mg/L	<0.1	32.5	<0.1	<0.1
Nitrite as N	0.05 mg/L	<0.05	<0.05	<0.05	<0.05
Sulphate	1 mg/L	83	68	76	107
Metals					
Aluminum	1 ug/L	6	2	213	73
Antimony	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Arsenic	1 ug/L	2	<1	<1	1
Barium	1 ug/L	20	103	19	21
Beryllium	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Boron	10 ug/L	117	79	27	95
Cadmium	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Calcium	100 ug/L	59400	58200	31000	57200
Chromium	1 ug/L	5	5	2	8
Cobalt	0.5 ug/L	<0.5	1.2	<0.5	<0.5
Copper	0.5 ug/L	4.7	4.2	2.0	4.2
Iron	100 ug/L	<100	<100	<100	<100
Lead	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Magnesium	200 ug/L	23500	31200	12800	41200
Manganese	5 ug/L	144	800	13	107
Molybdenum	0.5 ug/L	1.0	<0.5	0.7	0.8
Nickel	1 ug/L	3	5	2	4
Potassium	100 ug/L	4880	12100	3840	6010
Selenium	1 ug/L	2	1	<1	3
Silicon	10 ug/L	16400	14300	33000	11500
Silver	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Sodium	200 ug/L	153000	59500	26300	158000
Strontium	10 ug/L	194	1040	226	384

Certificate of Analysis

Client: **LRL Associates Ltd.**

Client PO:

Report Date: 23-Jul-2015
Order Date:14-Jul-2015
Project Description: 01201-A

	Client ID:	MW-3	MW-2	MW-4	MW-5
	Sample Date:	14-Jul-15	14-Jul-15	14-Jul-15	14-Jul-15
	Sample ID:	1529161-01	1529161-02	1529161-03	1529161-04
	MDL/Units	Water	Water	Water	Water
Thallium	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Tin	5 ug/L	<5	<5	<5	<5
Titanium	5 ug/L	<5	<5	9	<5
Tungsten	10 ug/L	<10	<10	<10	<10
Uranium	0.1 ug/L	0.6	1.4	<0.1	<0.1
Vanadium	0.5 ug/L	8.9	12.3	4.4	14.8
Zinc	5 ug/L	10	<5	<5	10

Certificate of Analysis

Client: **LRL Associates Ltd.**

Client PO:

Report Date: 23-Jul-2015
Order Date:14-Jul-2015
Project Description: 01201-A

	Client ID:	BH03-4	MW11-6	MW11-7	MW11-8
	Sample Date:	14-Jul-15	14-Jul-15	14-Jul-15	14-Jul-15
	Sample ID:	1529161-05	1529161-06	1529161-07	1529161-08
	MDL/Units	Water	Water	Water	Water
General Inorganics					
Alkalinity, total	5 mg/L	396	560	327	804
BOD	2 mg/L	10	11	<2	6
Conductivity	5 uS/cm	898	10100	2940	1710
Phosphorus, total	0.01 mg/L	0.65	0.53	0.25	3.38
Total Dissolved Solids	10 mg/L	450	5790	1530	972
Total Kjeldahl Nitrogen	0.1 mg/L	14.0	2.6	0.9	11.5
Anions					
Chloride	1 mg/L	37	3730	695	94
Nitrate as N	0.1 mg/L	<0.1	<0.1	0.8	<0.1
Nitrite as N	0.05 mg/L	<0.05	<0.05	<0.05	<0.05
Sulphate	1 mg/L	19	279	72	21
Metals					
Aluminum	1 ug/L	12	2	4	2
Antimony	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Arsenic	1 ug/L	2	10	2	2
Barium	1 ug/L	77	62	73	112
Beryllium	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Boron	10 ug/L	41	189	114	61
Cadmium	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Calcium	100 ug/L	86200	70200	68400	145000
Chromium	1 ug/L	7	27	13	14
Cobalt	0.5 ug/L	<0.5	0.5	<0.5	0.7
Copper	0.5 ug/L	0.9	20.6	8.0	2.0
Iron	100 ug/L	14800	322	<100	24000
Lead	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Magnesium	200 ug/L	24300	178000	46500	61700
Manganese	5 ug/L	1410	139	101	3200
Molybdenum	0.5 ug/L	<0.5	0.5	0.6	<0.5
Nickel	1 ug/L	3	3	3	5
Potassium	100 ug/L	5370	18100	8690	7510
Selenium	1 ug/L	<1	35	8	3
Silicon	10 ug/L	12600	17500	10300	31800
Silver	0.1 ug/L	<0.1	0.2	0.1	<0.1
Sodium	200 ug/L	36200	1470000	355000	79900
Strontium	10 ug/L	640	1160	589	1160

Certificate of Analysis

Report Date: 23-Jul-2015

Client: **LRL Associates Ltd.**

Order Date:14-Jul-2015

Client PO:

Project Description: 01201-A

	Client ID:	BH03-4	MW11-6	MW11-7	MW11-8
	Sample Date:	14-Jul-15	14-Jul-15	14-Jul-15	14-Jul-15
	Sample ID:	1529161-05	1529161-06	1529161-07	1529161-08
	MDL/Units	Water	Water	Water	Water
Thallium	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Tin	5 ug/L	<5	<5	<5	<5
Titanium	5 ug/L	<5	<5	<5	<5
Tungsten	10 ug/L	<10	<10	<10	<10
Uranium	0.1 ug/L	0.2	0.5	1.8	<0.1
Vanadium	0.5 ug/L	17.3	10.2	9.6	28.6
Zinc	5 ug/L	8	6	10	9

Certificate of Analysis

Report Date: 23-Jul-2015

Client: **LRL Associates Ltd.**

Order Date:14-Jul-2015

Client PO:

Project Description: 01201-A

	Client ID:	MW11-9	MW11-10	-	-
	Sample Date:	14-Jul-15	14-Jul-15	-	-
	Sample ID:	1529161-09	1529161-10	-	-
	MDL/Units	Water	Water	-	-
General Inorganics					
Alkalinity, total	5 mg/L	87	630	-	-
BOD	2 mg/L	<2	<2	-	-
Conductivity	5 uS/cm	420	2030	-	-
Phosphorus, total	0.01 mg/L	0.16	0.54	-	-
Total Dissolved Solids	10 mg/L	282	1220	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.5	0.5	-	-
Anions					
Chloride	1 mg/L	25	243	-	-
Nitrate as N	0.1 mg/L	1.0	<0.1	-	-
Nitrite as N	0.05 mg/L	<0.05	<0.05	-	-
Sulphate	1 mg/L	73	153	-	-
Metals					
Aluminum	1 ug/L	13	6	-	-
Antimony	0.5 ug/L	<0.5	<0.5	-	-
Arsenic	1 ug/L	<1	2	-	-
Barium	1 ug/L	25	36	-	-
Beryllium	0.5 ug/L	<0.5	<0.5	-	-
Boron	10 ug/L	26	134	-	-
Cadmium	0.1 ug/L	<0.1	<0.1	-	-
Calcium	100 ug/L	54800	96600	-	-
Chromium	1 ug/L	5	9	-	-
Cobalt	0.5 ug/L	<0.5	0.7	-	-
Copper	0.5 ug/L	2.9	6.1	-	-
Iron	100 ug/L	141	194	-	-
Lead	0.1 ug/L	<0.1	<0.1	-	-
Magnesium	200 ug/L	11800	69800	-	-
Manganese	5 ug/L	111	275	-	-
Molybdenum	0.5 ug/L	<0.5	1.6	-	-
Nickel	1 ug/L	2	4	-	-
Potassium	100 ug/L	2950	7340	-	-
Selenium	1 ug/L	1	4	-	-
Silicon	10 ug/L	5290	24800	-	-
Silver	0.1 ug/L	<0.1	<0.1	-	-
Sodium	200 ug/L	14900	280000	-	-
Strontium	10 ug/L	375	480	-	-

Certificate of Analysis

Report Date: 23-Jul-2015

Client: **LRL Associates Ltd.**

Order Date:14-Jul-2015

Client PO:

Project Description: 01201-A

	Client ID:	MW11-9	MW11-10	-	-
	Sample Date:	14-Jul-15	14-Jul-15	-	-
	Sample ID:	1529161-09	1529161-10	-	-
	MDL/Units	Water	Water	-	-
Thallium	0.1 ug/L	<0.1	<0.1	-	-
Tin	5 ug/L	<5	<5	-	-
Titanium	5 ug/L	<5	<5	-	-
Tungsten	10 ug/L	<10	<10	-	-
Uranium	0.1 ug/L	<0.1	5.8	-	-
Vanadium	0.5 ug/L	5.3	15.2	-	-
Zinc	5 ug/L	6	7	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Alkalinity, total	ND	5	mg/L						
BOD	ND	2	mg/L						
Conductivity	ND	5	uS/cm						
Phosphorus, total	ND	0.01	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Metals									
Aluminum	ND	1	ug/L						
Antimony	ND	0.5	ug/L						
Arsenic	ND	1	ug/L						
Barium	ND	1	ug/L						
Beryllium	ND	0.5	ug/L						
Boron	ND	10	ug/L						
Cadmium	ND	0.1	ug/L						
Calcium	ND	100	ug/L						
Chromium	ND	1	ug/L						
Cobalt	ND	0.5	ug/L						
Copper	ND	0.5	ug/L						
Iron	ND	100	ug/L						
Lead	ND	0.1	ug/L						
Magnesium	ND	200	ug/L						
Manganese	ND	5	ug/L						
Molybdenum	ND	0.5	ug/L						
Nickel	ND	1	ug/L						
Potassium	ND	100	ug/L						
Selenium	ND	1	ug/L						
Silicon	ND	10	ug/L						
Silver	ND	0.1	ug/L						
Sodium	ND	200	ug/L						
Strontium	ND	10	ug/L						
Thallium	ND	0.1	ug/L						
Tin	ND	5	ug/L						
Titanium	ND	5	ug/L						
Tungsten	ND	10	ug/L						
Uranium	ND	0.1	ug/L						
Vanadium	ND	0.5	ug/L						
Zinc	ND	5	ug/L						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	62.0	1	mg/L	62.1			0.1	10	
Nitrate as N	3.80	0.1	mg/L	3.81			0.2	20	
Nitrite as N	0.470	0.05	mg/L	0.489			3.9	20	
Sulphate	33.8	1	mg/L	34.1			1.0	10	
General Inorganics									
Alkalinity, total	138	5	mg/L	140			1.5	14	
BOD	402	2	mg/L	381			5.4	20	
Conductivity	559	5	uS/cm	553			1.0	11	
Phosphorus, total	0.446	0.01	mg/L	0.441			1.3	10	
Total Dissolved Solids	1220	10	mg/L	1220			0.2	10	
Total Kjeldahl Nitrogen	3.89	0.4	mg/L	3.66			6.1	10	
Metals									
Aluminum	3.9	1	ug/L	6.1			44.5	20	QR-01
Antimony	ND	0.5	ug/L	ND			0.0	20	
Arsenic	1.8	1	ug/L	1.7			8.2	20	
Barium	19.3	1	ug/L	20.1			4.1	20	
Beryllium	ND	0.5	ug/L	ND			0.0	20	
Boron	119	10	ug/L	117			2.0	20	
Cadmium	ND	0.1	ug/L	ND			0.0	20	
Calcium	60200	100	ug/L	59400			1.4	20	
Chromium	4.6	1	ug/L	4.6			0.9	20	
Cobalt	ND	0.5	ug/L	ND			0.0	20	
Copper	5.08	0.5	ug/L	4.67			8.5	20	
Iron	ND	100	ug/L	ND			0.0	20	
Lead	0.11	0.1	ug/L	ND			0.0	20	
Magnesium	23600	200	ug/L	23500			0.5	20	
Manganese	245	5	ug/L	144			52.1	20	
Molybdenum	1.11	0.5	ug/L	0.95			15.5	20	
Nickel	2.8	1	ug/L	2.8			2.2	20	
Potassium	4800	100	ug/L	4880			1.6	20	
Selenium	2.2	1	ug/L	2.0			9.4	20	
Silver	ND	0.1	ug/L	ND			0.0	20	
Strontium	206	10	ug/L	194			6.2	20	
Thallium	ND	0.1	ug/L	ND			0.0	20	
Tin	ND	5	ug/L	ND			0.0	20	
Titanium	ND	5	ug/L	ND			0.0	20	
Tungsten	ND	10	ug/L	ND			0.0	20	
Uranium	0.6	0.1	ug/L	0.6			3.9	20	
Vanadium	9.35	0.5	ug/L	8.87			5.3	20	
Zinc	7	5	ug/L	10			29.6	20	QR-01

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	69.9	1	mg/L	62.1	78.3	78-112			
Nitrate as N	4.68	0.1	mg/L	3.81	87.3	81-112			
Nitrite as N	1.48	0.05	mg/L	0.489	99.5	76-117			
Sulphate	42.8	1	mg/L	34.1	86.3	75-111			
General Inorganics									
BOD	197		mg/L	ND	98.5	71-121			
Phosphorus, total	0.987	0.01	mg/L	0.441	109	80-120			
Total Dissolved Solids	122	10	mg/L	ND	122	75-125			
Total Kjeldahl Nitrogen	2.10	0.1	mg/L	ND	105	81-126			
Metals									
Aluminum	23.8		ug/L	ND	95.1	80-120			
Antimony	23.2		ug/L	ND	93.0	80-120			
Arsenic	23.3		ug/L	ND	93.3	80-120			
Barium	23.9		ug/L	ND	95.7	80-120			
Beryllium	26.3		ug/L	ND	105	80-120			
Boron	27		ug/L	ND	107	80-120			
Cadmium	22.9		ug/L	ND	91.4	80-120			
Calcium	472		ug/L	ND	94.4	80-120			
Chromium	26.8		ug/L	ND	107	80-120			
Cobalt	26.0		ug/L	ND	104	80-120			
Copper	26.3		ug/L	ND	105	80-120			
Iron	470		ug/L	ND	94.0	80-120			
Lead	23.5		ug/L	ND	94.1	80-120			
Magnesium	497		ug/L	ND	99.3	80-120			
Manganese	26.8		ug/L	ND	107	80-120			
Molybdenum	21.6		ug/L	ND	86.4	80-120			
Nickel	25.8		ug/L	ND	103	80-120			
Potassium	501		ug/L	ND	100	80-120			
Selenium	22.5		ug/L	ND	90.0	80-120			
Silicon	20.9		ug/L	ND	83.6	80-120			
Silver	23.6		ug/L	ND	94.4	80-120			
Sodium	474		ug/L	ND	94.9	80-120			
Strontium	24		ug/L	ND	94.2	80-120			
Thallium	24.1		ug/L	ND	96.3	80-120			
Tin	20.1		ug/L	ND	80.4	80-120			
Titanium	25.8		ug/L	ND	103	80-120			
Tungsten	19.5		ug/L	ND	78.0	80-120			QS-02
Uranium	24.7		ug/L	ND	98.9	80-120			
Vanadium	26.5		ug/L	ND	106	80-120			
Zinc	22		ug/L	ND	88.2	80-120			

Qualifier Notes:

Login Qualifiers :

Sample - Filtered and preserved by Paracel upon receipt at the laboratory - metals bottle rinsed and not filtered

Applies to samples: MW-4, MW-5

Sample Qualifiers :

1 : Raised Reporting Limits for BOD due to dilutions based on preliminary COD screening results.

QC Qualifiers :

QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

QS-02 : Spike level outside of control limits. Analysis batch accepted based on other QC included in the batch.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

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Certificate of Analysis

LRL Associates Ltd.

5430 Canotek Road
Ottawa, ON K1J 9G2
Attn: Genevieve Marcoux

Client PO:
Project: 01201-A
Custody: 102851

Report Date: 25-Nov-2015
Order Date: 19-Nov-2015

Order #: 1547279

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1547279-01	MW-2
1547279-02	MW-3
1547279-03	MW-4
1547279-04	MW-5
1547279-05	BH03-4
1547279-06	MW11-6
1547279-07	MW11-7
1547279-08	MW11-8
1547279-09	MW11-9
1547279-10	MW11-10

Approved By:

Dale Robertson, BSc
Laboratory Director

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, bicarbonate	calculated from EPA 310.1 - Titration to pH 4.5	19-Nov-15	20-Nov-15
Alkalinity, carbonate	calculated from EPA 310.1 - Titration to pH 4.5	19-Nov-15	20-Nov-15
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	19-Nov-15	19-Nov-15
Anions	EPA 300.1 - IC	19-Nov-15	20-Nov-15
Biochemical Oxygen Demand	SM 5210B - DO Probe	20-Nov-15	25-Nov-15
Conductivity	EPA 9050A- probe @25 °C	19-Nov-15	19-Nov-15
Metals, ICP-MS	EPA 200.8 - ICP-MS	24-Nov-15	25-Nov-15
Phosphorus, total, water	EPA 365.4 - Auto Colour, digestion	20-Nov-15	24-Nov-15
Total Dissolved Solids	SM 2540C - gravimetric, filtration	24-Nov-15	25-Nov-15
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	20-Nov-15	24-Nov-15

Certificate of Analysis

Report Date: 25-Nov-2015

Client: **LRL Associates Ltd.**

Order Date:19-Nov-2015

Client PO:

Project Description: 01201-A

	Client ID:	MW-2	MW-3	MW-4	MW-5
	Sample Date:	18-Nov-15	18-Nov-15	18-Nov-15	18-Nov-15
	Sample ID:	1547279-01	1547279-02	1547279-03	1547279-04
	MDL/Units	Water	Water	Water	Water
General Inorganics					
Alkalinity, total	5 mg/L	315	314	62	391
Alkalinity, bicarbonate	5 mg/L	315	312	62	389
Alkalinity, carbonate	5 mg/L	<5	<5	<5	<5
BOD	2 mg/L	9	4	<20 [1]	3
Conductivity	5 uS/cm	1180	972	352	2380
Phosphorus, total	0.01 mg/L	0.30	0.89	0.13	0.09
Total Dissolved Solids	10 mg/L	690	534	186	1210
Total Kjeldahl Nitrogen	0.1 mg/L	5.0	0.6	0.4	0.8
Anions					
Chloride	1 mg/L	93	26	26	33
Nitrate as N	0.1 mg/L	26.6	0.1	0.3	<0.1
Nitrite as N	0.05 mg/L	<0.05	<0.05	<0.05	<0.05
Sulphate	1 mg/L	56	61	102	18
Metals					
Aluminum	1 ug/L	4	2	408	21
Antimony	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Arsenic	1 ug/L	<1	<1	<1	<1
Barium	1 ug/L	107	19	17	35
Beryllium	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Boron	10 ug/L	77	113	19	242
Cadmium	0.1 ug/L	0.1	<0.1	<0.1	<0.1
Calcium	100 ug/L	96900	40300	26800	61700
Chromium	1 ug/L	<1	<1	<1	<1
Cobalt	0.5 ug/L	1.2	<0.5	<0.5	<0.5
Copper	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Iron	100 ug/L	<100	<100	183	<100
Lead	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Magnesium	200 ug/L	33700	23600	10900	71700
Manganese	5 ug/L	1020	155	5	257
Molybdenum	0.5 ug/L	<0.5	0.6	<0.5	0.9
Nickel	1 ug/L	3	2	<1	1
Potassium	100 ug/L	11800	4840	3410	12900
Selenium	1 ug/L	<1	<1	<1	<1
Silicon	10 ug/L	6730	8510	7130	6940
Silver	0.1 ug/L	<0.1	<0.1	<0.1	<0.1

Certificate of Analysis

Report Date: 25-Nov-2015

Client: **LRL Associates Ltd.**

Order Date:19-Nov-2015

Client PO:

Project Description: 01201-A

	Client ID:	MW-2	MW-3	MW-4	MW-5
	Sample Date:	18-Nov-15	18-Nov-15	18-Nov-15	18-Nov-15
	Sample ID:	1547279-01	1547279-02	1547279-03	1547279-04
	MDL/Units	Water	Water	Water	Water
Sodium	200 ug/L	81300	132000	22700	575000
Strontium	10 ug/L	1190	190	189	590
Thallium	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Tin	5 ug/L	<5	<5	<5	<5
Titanium	5 ug/L	<5	<5	16	<5
Tungsten	10 ug/L	<10	<10	<10	<10
Uranium	0.1 ug/L	1.7	0.6	<0.1	2.7
Vanadium	0.5 ug/L	<0.5	1.0	0.9	0.6
Zinc	5 ug/L	9	12	<5	<5

Certificate of Analysis

Report Date: 25-Nov-2015

Client: **LRL Associates Ltd.**

Order Date:19-Nov-2015

Client PO:

Project Description: 01201-A

	Client ID:	BH03-4	MW11-6	MW11-7	MW11-8
	Sample Date:	18-Nov-15	18-Nov-15	18-Nov-15	18-Nov-15
	Sample ID:	1547279-05	1547279-06	1547279-07	1547279-08
	MDL/Units	Water	Water	Water	Water
General Inorganics					
Alkalinity, total	5 mg/L	401	536	303	744
Alkalinity, bicarbonate	5 mg/L	400	532	302	742
Alkalinity, carbonate	5 mg/L	<5	<5	<5	<5
BOD	2 mg/L	10	6	<100 [1]	<20 [1]
Conductivity	5 uS/cm	886	8850	1690	1560
Phosphorus, total	0.01 mg/L	0.52	0.22	0.09	0.87
Total Dissolved Solids	10 mg/L	370	5090	850	808
Total Kjeldahl Nitrogen	0.1 mg/L	20.0	2.1	0.7	8.6
Anions					
Chloride	1 mg/L	30	310	84	25
Nitrate as N	0.1 mg/L	<0.1	4.3	<0.1	0.2
Nitrite as N	0.05 mg/L	<0.05	<0.05	<0.05	<0.05
Sulphate	1 mg/L	242	86	33	62
Metals					
Aluminum	1 ug/L	15	2	2	5
Antimony	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Arsenic	1 ug/L	<1	<1	<1	<1
Barium	1 ug/L	89	34	54	114
Beryllium	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Boron	10 ug/L	43	151	111	81
Cadmium	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Calcium	100 ug/L	85700	55300	66800	159000
Chromium	1 ug/L	2	<1	<1	1
Cobalt	0.5 ug/L	<0.5	<0.5	<0.5	0.6
Copper	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Iron	100 ug/L	13100	<100	<100	24900
Lead	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Magnesium	200 ug/L	24800	76600	35400	60200
Manganese	5 ug/L	1420	73	162	3220
Molybdenum	0.5 ug/L	<0.5	0.6	<0.5	<0.5
Nickel	1 ug/L	<1	1	1	<1
Potassium	100 ug/L	7100	11200	7970	10900
Selenium	1 ug/L	<1	<1	<1	<1
Silicon	10 ug/L	6910	7980	6550	10800
Silver	0.1 ug/L	<0.1	<0.1	<0.1	<0.1

Certificate of Analysis

Report Date: 25-Nov-2015

Client: **LRL Associates Ltd.**

Order Date:19-Nov-2015

Client PO:

Project Description: 01201-A

	Client ID:	BH03-4	MW11-6	MW11-7	MW11-8
	Sample Date:	18-Nov-15	18-Nov-15	18-Nov-15	18-Nov-15
	Sample ID:	1547279-05	1547279-06	1547279-07	1547279-08
	MDL/Units	Water	Water	Water	Water
Sodium	200 ug/L	33300	533000	214000	87000
Strontium	10 ug/L	682	561	547	1290
Thallium	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Tin	5 ug/L	<5	<5	<5	<5
Titanium	5 ug/L	<5	<5	<5	<5
Tungsten	10 ug/L	<10	<10	<10	<10
Uranium	0.1 ug/L	0.1	0.9	1.7	<0.1
Vanadium	0.5 ug/L	2.2	0.9	<0.5	2.8
Zinc	5 ug/L	14	12	12	13

Certificate of Analysis

Report Date: 25-Nov-2015

Client: **LRL Associates Ltd.**

Order Date:19-Nov-2015

Client PO:

Project Description: 01201-A

	Client ID:	MW11-9	MW11-10	-	-
	Sample Date:	18-Nov-15	18-Nov-15	-	-
	Sample ID:	1547279-09	1547279-10	-	-
	MDL/Units	Water	Water	-	-
General Inorganics					
Alkalinity, total	5 mg/L	86	663	-	-
Alkalinity, bicarbonate	5 mg/L	86	659	-	-
Alkalinity, carbonate	5 mg/L	<5	<5	-	-
BOD	2 mg/L	<2	<2	-	-
Conductivity	5 uS/cm	392	1820	-	-
Phosphorus, total	0.01 mg/L	0.20	0.26	-	-
Total Dissolved Solids	10 mg/L	196	1030	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.6	0.5	-	-
Anions					
Chloride	1 mg/L	144	196	-	-
Nitrate as N	0.1 mg/L	<0.1	1.3	-	-
Nitrite as N	0.05 mg/L	<0.05	<0.05	-	-
Sulphate	1 mg/L	173	22	-	-
Metals					
Aluminum	1 ug/L	12	2	-	-
Antimony	0.5 ug/L	<0.5	<0.5	-	-
Arsenic	1 ug/L	<1	<1	-	-
Barium	1 ug/L	34	36	-	-
Beryllium	0.5 ug/L	<0.5	<0.5	-	-
Boron	10 ug/L	35	103	-	-
Cadmium	0.1 ug/L	<0.1	<0.1	-	-
Calcium	100 ug/L	36800	110000	-	-
Chromium	1 ug/L	<1	<1	-	-
Cobalt	0.5 ug/L	0.8	<0.5	-	-
Copper	0.5 ug/L	<0.5	<0.5	-	-
Iron	100 ug/L	712	<100	-	-
Lead	0.1 ug/L	<0.1	<0.1	-	-
Magnesium	200 ug/L	11900	61100	-	-
Manganese	5 ug/L	425	23	-	-
Molybdenum	0.5 ug/L	0.5	2.1	-	-
Nickel	1 ug/L	<1	<1	-	-
Potassium	100 ug/L	3720	6530	-	-
Selenium	1 ug/L	<1	<1	-	-
Silicon	10 ug/L	4350	8560	-	-
Silver	0.1 ug/L	<0.1	<0.1	-	-

Certificate of Analysis

Report Date: 25-Nov-2015

Client: **LRL Associates Ltd.**

Order Date:19-Nov-2015

Client PO:

Project Description: 01201-A

	Client ID:	MW11-9	MW11-10	-	-
	Sample Date:	18-Nov-15	18-Nov-15	-	-
	Sample ID:	1547279-09	1547279-10	-	-
	MDL/Units	Water	Water	-	-
Sodium	200 ug/L	21500	212000	-	-
Strontium	10 ug/L	552	463	-	-
Thallium	0.1 ug/L	<0.1	<0.1	-	-
Tin	5 ug/L	<5	<5	-	-
Titanium	5 ug/L	<5	<5	-	-
Tungsten	10 ug/L	<10	<10	-	-
Uranium	0.1 ug/L	<0.1	10.0	-	-
Vanadium	0.5 ug/L	1.4	1.1	-	-
Zinc	5 ug/L	16	11	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
Sulphate	ND	1	mg/L						
General Inorganics									
Alkalinity, total	ND	5	mg/L						
BOD	ND	2	mg/L						
Conductivity	ND	5	uS/cm						
Phosphorus, total	ND	0.01	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Metals									
Aluminum	ND	1	ug/L						
Antimony	ND	0.5	ug/L						
Arsenic	ND	1	ug/L						
Barium	ND	1	ug/L						
Beryllium	ND	0.5	ug/L						
Boron	ND	10	ug/L						
Cadmium	ND	0.1	ug/L						
Calcium	ND	100	ug/L						
Chromium	ND	1	ug/L						
Cobalt	ND	0.5	ug/L						
Copper	ND	0.5	ug/L						
Iron	ND	100	ug/L						
Lead	ND	0.1	ug/L						
Magnesium	ND	200	ug/L						
Manganese	ND	5	ug/L						
Molybdenum	ND	0.5	ug/L						
Nickel	ND	1	ug/L						
Potassium	ND	100	ug/L						
Selenium	ND	1	ug/L						
Silicon	ND	10	ug/L						
Silver	ND	0.1	ug/L						
Sodium	ND	200	ug/L						
Strontium	ND	10	ug/L						
Thallium	ND	0.1	ug/L						
Tin	ND	5	ug/L						
Titanium	ND	5	ug/L						
Tungsten	ND	10	ug/L						
Uranium	ND	0.1	ug/L						
Vanadium	ND	0.5	ug/L						
Zinc	ND	5	ug/L						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	1.28	1	mg/L	1.27			1.5	10	
Nitrate as N	0.26	0.1	mg/L	0.25			2.5	20	
Nitrite as N	ND	0.05	mg/L	ND				20	
Sulphate	11.6	1	mg/L	11.8			1.3	10	
General Inorganics									
Alkalinity, total	276	5	mg/L	277			0.1	14	
BOD	ND	30	mg/L	57			0.0	20	BOD01
Conductivity	663	5	uS/cm	669			0.9	11	
Phosphorus, total	0.016	0.01	mg/L	0.012			26.9	10	QR-01
Total Dissolved Solids	680	10	mg/L	690			1.5	10	
Total Kjeldahl Nitrogen	0.40	0.1	mg/L	0.38			6.2	10	
Metals									
Aluminum	3.8	1	ug/L	3.6			5.2	20	
Antimony	ND	0.5	ug/L	ND			0.0	20	
Arsenic	ND	1	ug/L	ND			0.0	20	
Barium	107	1	ug/L	107			0.0	20	
Beryllium	ND	0.5	ug/L	ND			0.0	20	
Boron	76	10	ug/L	77			1.6	20	
Cadmium	0.16	0.1	ug/L	0.15			7.6	20	
Calcium	93500	100	ug/L	96900			3.7	20	
Chromium	ND	1	ug/L	ND			0.0	20	
Cobalt	1.19	0.5	ug/L	1.19			0.3	20	
Copper	ND	0.5	ug/L	ND				20	
Iron	ND	100	ug/L	ND			0.0	20	
Lead	ND	0.1	ug/L	ND			0.0	20	
Magnesium	32700	200	ug/L	33700			2.9	20	
Manganese	1000	5	ug/L	1020			1.8	20	
Molybdenum	ND	0.5	ug/L	ND			0.0	20	
Nickel	3.5	1	ug/L	3.4			1.2	20	
Potassium	11600	100	ug/L	11800			1.1	20	
Selenium	ND	1	ug/L	ND			0.0	20	
Silicon	6520	10	ug/L	6730			3.1	20	
Silver	ND	0.1	ug/L	ND			0.0	20	
Sodium	79400	200	ug/L	81300			2.3	20	
Strontium	1160	10	ug/L	1190			2.7	20	
Thallium	ND	0.1	ug/L	ND			0.0	20	
Tin	ND	5	ug/L	ND			0.0	20	
Titanium	ND	5	ug/L	ND			0.0	20	
Tungsten	ND	10	ug/L	ND			0.0	20	
Uranium	1.7	0.1	ug/L	1.7			0.7	20	
Vanadium	ND	0.5	ug/L	ND			0.0	20	
Zinc	9	5	ug/L	9			3.7	20	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	10.7	1	mg/L	1.27	94.5	78-112			
Nitrate as N	0.94	0.1	mg/L	ND	93.8	81-112			
Nitrite as N	1.03	0.05	mg/L	ND	103	76-117			
Sulphate	21.9	1	mg/L	11.8	102	75-111			
General Inorganics									
BOD	198		mg/L	ND	99.2	71-121			
Phosphorus, total	0.501	0.01	mg/L	0.012	97.9	80-120			
Total Dissolved Solids	96.0	10	mg/L	ND	96.0	75-125			
Total Kjeldahl Nitrogen	2.43	0.1	mg/L	0.38	102	81-126			
Metals									
Aluminum	47.0		ug/L	3.6	86.8	80-120			
Antimony	44.6		ug/L	0.04	89.1	80-120			
Arsenic	45.8		ug/L	0.1	91.4	80-120			
Barium	147		ug/L	107	80.4	80-120			
Beryllium	43.4		ug/L	0.009	86.9	80-120			
Boron	77		ug/L	34	85.3	80-120			
Cadmium	41.1		ug/L	0.15	81.9	80-120			
Calcium	1530		ug/L	568	96.6	80-120			
Chromium	42.8		ug/L	0.6	84.3	80-120			
Cobalt	41.8		ug/L	1.19	81.2	80-120			
Copper	39.3		ug/L	ND	78.6	80-120			QM-07
Iron	848		ug/L	9	83.9	80-120			
Lead	44.8		ug/L	0.10	89.5	80-120			
Magnesium	1040		ug/L	24	102	80-120			
Manganese	49.5		ug/L	0.2	98.5	80-120			
Molybdenum	44.0		ug/L	0.11	87.8	80-120			
Nickel	43.4		ug/L	3.4	79.9	80-120			QM-07
Potassium	3870		ug/L	3020	84.7	80-120			
Selenium	47.1		ug/L	0.08	94.1	80-120			
Silicon	55.6		ug/L	2.5	106	80-120			
Silver	47.0		ug/L	0.0006	94.1	80-120			
Sodium	1080		ug/L	137	93.9	80-120			
Strontium	53		ug/L	3	101	80-120			
Thallium	40.2		ug/L	0.01	80.4	80-120			
Tin	43.2		ug/L	0.03	86.3	80-120			
Titanium	45.8		ug/L	0.09	91.5	80-120			
Tungsten	44.2		ug/L	0.02	88.3	80-120			
Uranium	45.4		ug/L	1.7	87.5	80-120			
Vanadium	43.9		ug/L	0.30	87.1	80-120			
Zinc	50		ug/L	9	82.9	80-120			

Qualifier Notes:

Login Qualifiers :

Sample - Filtered and preserved by Paracel upon receipt at the laboratory - Metals bottle.
Applies to samples: MW-4, MW-5

Sample Qualifiers :

1 : Raised Reporting Limits for BOD due to dilutions based on preliminary COD screening results.

QC Qualifiers :

BOD01 : Raised Reporting Limits for BOD due to dilutions based on preliminary COD screening results.

QM-07 : The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

QM-4X : The spike recovery was outside of QC acceptance limits due to elevated analyte concentration.

QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

APPENDIX E

Slug and Bail Test Data and Calculations

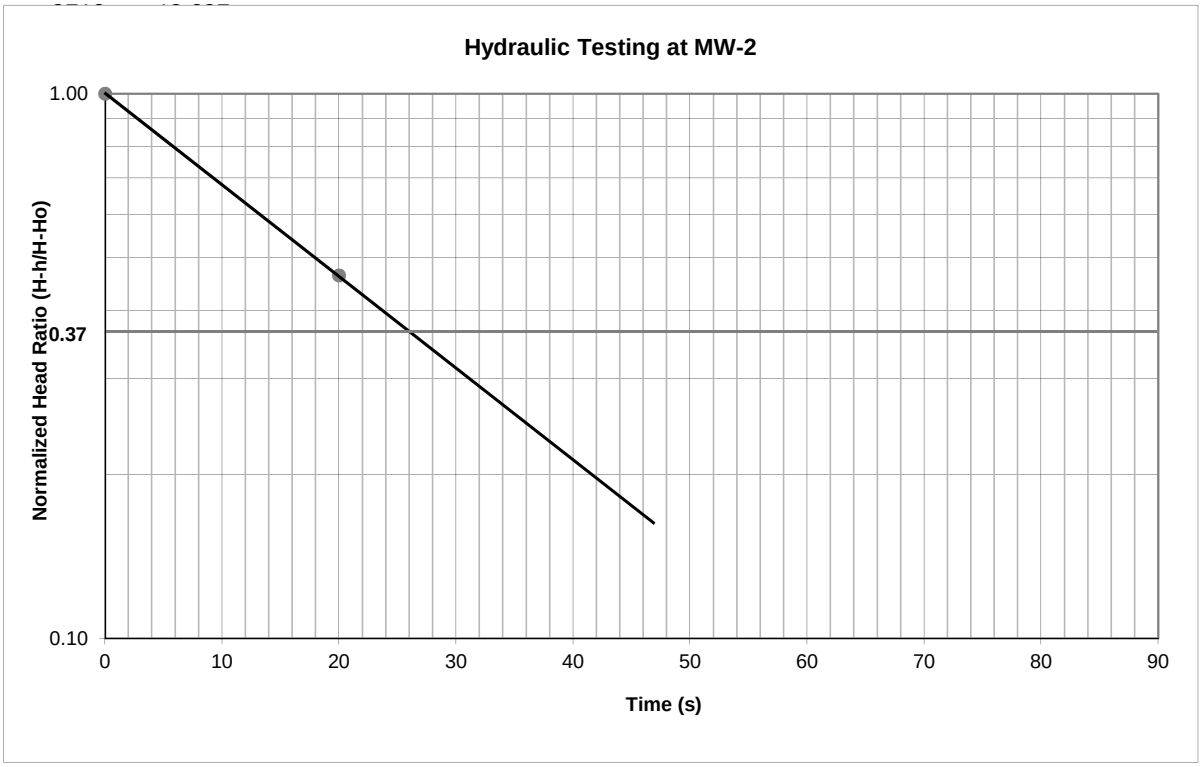
MW-2 Spring

Hvorslev -Test Method

Time (s)	h (m BTOR)	H-h (m)	(H-h/H-H_o)	Comments
0.00	3.83	0.410	1.000	H (m BTOR) = 3.42
20.00	3.61	0.190	0.463	H_o (m BTOR) = 3.83
90.00	3.42	0.000	0.000	
				H = static water level (assumed)
				H_O = water level at T = 0
				h = water level (m)
				$K = \frac{r_c^2 \ln\left(\frac{L}{R}\right)}{2 L T_o}$
				K = 1.61E-05 m/s
				R (borehole radius) 0.101 m
				L (interval length) 3 m
				r_c (radius of well casing) 0.025 m
				T_O (T = 63% recovery) 22 s

Notes:

Assumed



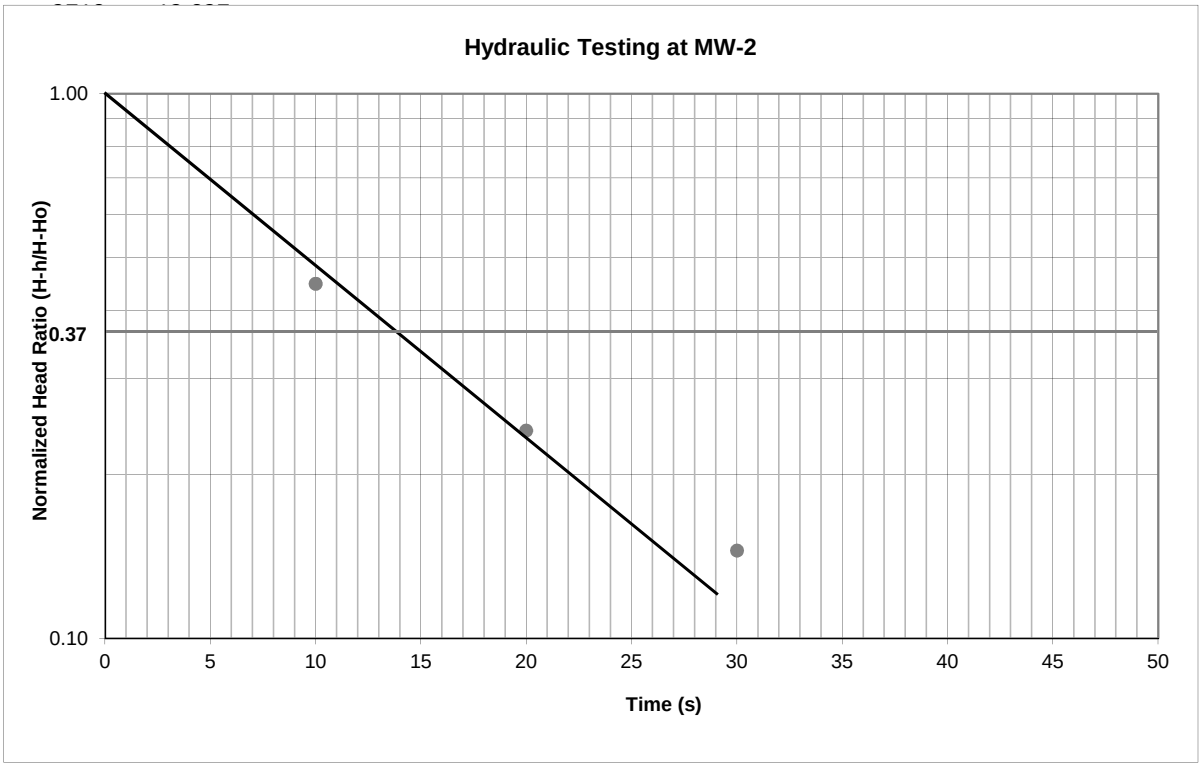
MW-2 Fall

Hvorslev -Test Method

Time (s)	h (m BTOR)	H-h (m)	(H-h/H-H_o)	Comments
0.00	13.88	1.140	1.000	H (m BTOR) = 12.74
10.00	13.25	0.510	0.447	H_o (m BTOR) = 13.88
20.00	13.01	0.274	0.241	
30.00	12.91	0.165	0.145	
40.00	12.85	0.107	0.094	H = static water level (assumed)
				H_O = water level at T = 0
				h = water level (m)
				$K = \frac{r_c^2 \ln\left(\frac{L}{R}\right)}{2 L T_o}$
				K = 2.52E-05 m/s
				R (borehole radius) 0.101 m
				L (interval length) 3 m
				r_c (radius of well casing) 0.025 m
				T_O (T = 63% recovery) 14 s

Notes:

Assumed



BH03-4 Spring

Hvorslev -Test Method

Time (s)	h (m BTOR)	H-h (m)	(H-h/H-H_o)
0	4.87	0.230	1.000
15	4.85	0.210	0.913
105	4.76	0.120	0.522
165	4.72	0.080	0.348
345	4.68	0.040	0.174
585	4.65	0.010	0.043

Comments

H (m BTOR) = 4.64

H_o (m BTOR) = 4.87

H = static water level (assumed)

H_O = water level at T = 0

h = water level (m)

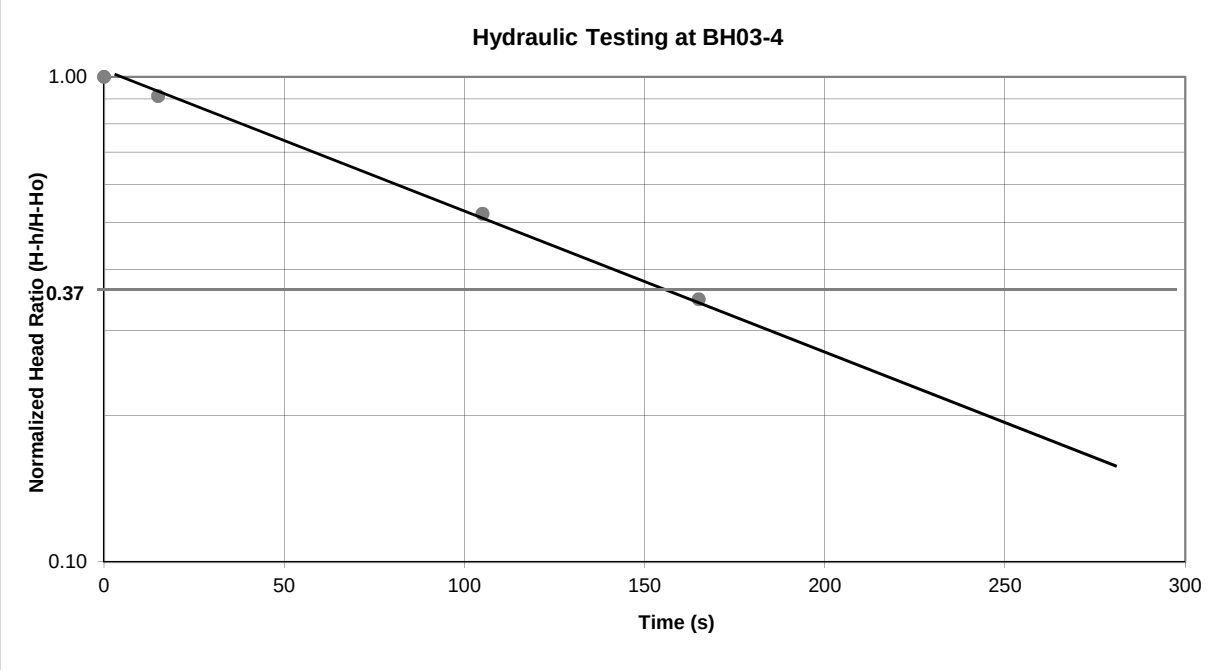
$$K = \frac{r_c^{\,2} \ln\left(\frac{L}{R}\right)}{2 L T_o}$$

K = 2.28E-06 m/s

R (borehole radius)	0.102	m
L (interval length)	3.00	m
r_c (radius of well casing)	0.025	m
T_O (T = 63% recovery)	160	s

Notes:

Assumed



BH03-4 Fall

Hvorslev -Test Method

Time (s)	h (m BTOR)	H-h (m)	(H-h/H-H_o)
0	4.06	0.525	1.000
5	4.07	0.515	0.981
25	4.16	0.425	0.810
45	4.245	0.340	0.648
75	4.355	0.230	0.438
105	4.415	0.170	0.324
165	4.49	0.095	0.181
195	4.505	0.080	0.152
225	4.515	0.070	0.133
255	4.52	0.065	0.124
315	4.528	0.057	0.109
375	4.532	0.053	0.101
465	4.537	0.048	0.091
585	4.54	0.045	0.086
765	4.545	0.040	0.076
2475	4.56	0.025	0.048

H (m BTOR) = 4.59

H_o (m BTOR) = 4.06

H = static water level (assumed)

H_O = water level at T = 0

h = water level (m)

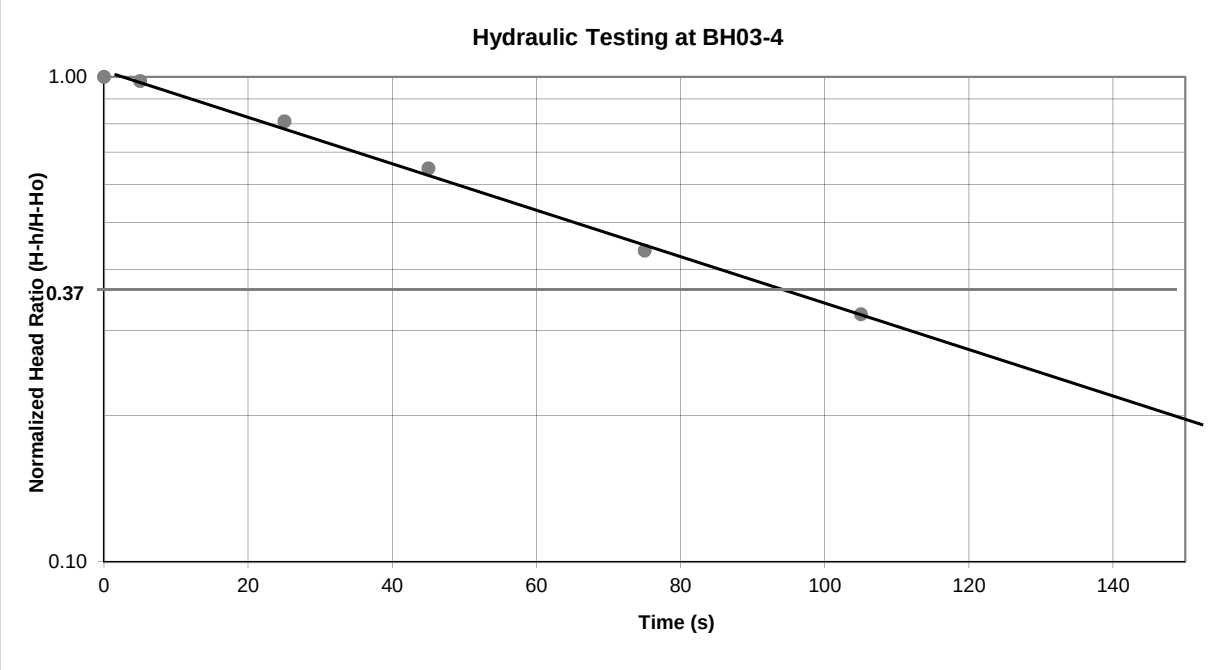
$$K = \frac{r_c^{\,2} \ln\left(\frac{L}{R}\right)}{2 L T_o}$$

K = 3.83E-06 m/s

R (borehole radius)	0.102	m
L (interval length)	3.00	m
r_c (radius of well casing)	0.025	m
T_O (T = 63% recovery)	95	s

Notes:

Assumed



APPENDIX F

Results of Previous Groundwater Monitoring Program

Summary of Field Measurements and Groundwater Analysis - MW1

Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Ground Surface Elevation: 50.23 m
Top of PVC Casing Elevation: 51.11 m
Well Depth: m
Monitoing Well Destroyed in late 2005

			2005				2004				2003			
			Fall	Summer	Spring	Winter	Fall	Summer	Spring	Winter	Fall	Summer	Spring	Winter
Parameters	Units	MDL	11-Nov-05	6-Sep-05	26-May-05	21-Mar-05	3-Nov-04	18-Aug-04	9-Jun-04	5-Mar-04	23-Oct-03	21-Jul-03	17-Apr-03	19-Dec-02
Field Parameters														
Water Level (Below PVC Casing)	m	--	1.64	1.97	1.58	2.02	--	--	--	--	--	--	NM	--
Water Level Depth	m	--	0.76	1.09	0.70	1.14	--	--	--	--	0.16	0.43	NM	1.42
Water Level Elevation	m	--	49.47	49.14	49.53	49.09	49.76	49.13	49.51	NM	50.07	49.80	NM	48.81
Conductivity	uS	--	856	1018	538	1225	1206	1487	1571	NM	NM	NM	NM	NM
Total Dissolved Solids	mg/L	--	427	512	1082	615	599	743	780	NM	NM	NM	NM	NM
Temperature	^{o}C	--	5.5	19.7	14.0	8.4	11.6	17.3	14.1	NM	NM	NM	NM	NM
pH	unitless	--	7.10	6.72	7.03	7.34	6.99	6.45	6.92	NM	NM	NM	NM	NM
Chemical Analysis														
Total Kjeldhal Nitrogen	mg/L	0.1	7.7	NS	9.5	NS	NS	NS	13	NS	17	18	15	11
Ammonia	mg/L	0.1	<0.1	NS	0.51	NS	NS	NS	10	NS	17	18	15	9.4
Nitrate	mg/L	0.1	3.1	NS	0.1	NS	NS	NS	<0.1	NS	6.7	<0.1	<0.1	<0.1
Nitrite	mg/L	0.05	<0.05	NS	<0.05	NS	NS	NS	<0.05	NS	<0.05	<0.05	<0.05	<0.05
Chloride	mg/L	1	36	NS	21	NS	NS	NS	21	NS	32	33	48	74
Sulphate	mg/L	1	420	NS	830	NS	NS	NS	720	NS	640	730	530	1
Total Phosphorus	mg/L	0.01	0.89	NS	0.41	NS	NS	NS	0.71	NS	0.27	0.21	0.83	0.60
Conductivity	uS	5	1200	NS	1500	NS	NS	NS	1500	NS	1136	1801	1138	796
Total Dissolved Solids	mg/L	10	980	NS	1300	NS	NS	NS	1300	NS	682	1081	683	478
Total Suspended Solids	mg/L	2	--	NS	670	NS	NS	NS	22	NS	4	270	34	2000
Biological Oxygen Demand	mg/L	2	<2	NS	<2	NS	NS	NS	<2	NS	2	3	<2	8

Notes

MDL	Method Detection Limit	NM	Not Measured
--	Not Applicable/No Value	NS	Not Sampled
NA	Not Analysed		

Summary of Field Measurements and Groundwater Analysis - MW2

Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Ground Surface Elevation: 48.36 m
Top of PVC Casing Elevation: 49.09 m
Well Depth: 5.81 m
Type of Monitoring Well: Leakage from lagoon

Parameters	Units	MDL	Trigger Concentration Range	2015		2014		2013		2012		2011		2010		2009		2008		2007				2006				2005				2004				2003			
				Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Summer	Spring	Winter	Fall	Summer	Spring	Winter	Fall	Summer	Spring	Winter	Fall	Summer	Spring	Winter	Fall	Summer	Spring	Winter
				18-Nov-15	14-Jul-15	5-Nov-14	13-May-14	20-Nov-13	31-May-13	21-Nov-12	15-May-12	24-Nov-11	9-Jun-11	16-Nov-10	17-May-10	12-Nov-09	12-May-09	20-Nov-08	8-May-08	14-Nov-07	14-Aug-07	6-Jun-07	26-Feb-07	14-Nov-06	17-Aug-06	8-May-06	24-Feb-06	11-Nov-05	6-Sep-05	26-May-05	21-Mar-05	3-Nov-04	18-Aug-04	9-Jun-04	5-Mar-04	23-Oct-03	21-Jul-03	17-Apr-03	19-Dec-02
Field Parameters																																					
Water Level (Below PVC Casing)	m	--		3.445	3.42	3.51	2.80	3.68	3.24	3.505	3.30	3.71	3.046	3.39	3.29	3.46	3.04	3.09	2.56	3.92	NS	3.14	3.45	--	3.34	--	--	3.28	3.50	3.00	3.51	--	--	--	--	--	--	NM	--
Water Level Depth	m	--		2.72	2.69	2.78	2.07	2.95	2.51	2.775	2.57	2.98	2.32	2.66	2.56	2.73	2.31	2.36	1.83	3.19	NS	2.41	2.72	2.85	2.61	2.66	3.20	2.55	2.77	2.27	2.78	--	--	--	--	2.69	2.59	NM	2.83
Water Level Elevation	m	--		45.65	45.67	45.58	46.29	45.41	45.85	45.59	45.79	45.38	46.04	45.70	45.80	45.63	46.05	46.00	46.53	45.17	NS	45.95	45.64	46.24	45.75	45.89	45.89	45.81	45.59	46.09	45.58	45.78	46.33	45.69	45.68	45.67	45.77	NM	45.53
Conductivity	uS	--		1060	1012	1237	1573	1305	313	1502	759	1138	1792	727	1227	893	872	1131	1248	1241	NS	1149	1213	1190	NM	956	902	807	830	965	882	1112	992	966	NM	NM	NM	NM	NM
Total Dissolved Solids	mg/L	--		531	509	618	763	650	156	714	360	565	885	363	539	450	430	567	624	635	NS	565	625	593	NM	483	449	399	417	485	440	557	494	483	NM	NM	NM	NM	NM
Temperature	°C	--		8.9	12.9	10.7	9.5	8.5	13.0	9.8	11.0	8.7	13.2	11.0	15.9	12.6	11.5	8.1	9.0	10.5	NS	11.6	7.1	10.1	NM	19.8	8.0	5.2	21.8	12.0	9.6	11.0	21.6	14.6	NM	NM	NM	NM	NM
pH	unitless	--		7.17	6.62	6.69	6.70	6.87	6.60	6.69	6.56	6.51	6.68	6.55	6.27	6.45	6.06	7.62	6.13	6.41	NS	8.53	6.79	6.09	NM	6.49	6.62	6.76	6.40	6.88	7.01	6.88	6.45	6.42	NM	NM	NM	NM	NM
Chemical Analysis																																					
Alkalinity (Total)	mg/L	5		315	237	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NS	NA	NS	NA	NS	NA	NS	NA	NS	NS	NS	NS	NA	NA	NA	NA	NA
Total Kjeldhal Nitrogen	mg/L	0.1	0.3 - 1.7	**5.0**	**8.5**	**9.8**	**4.8**	**8.7**	1.7	**3.1**	1.2	**1.9**	1.5	1.1	1.0	0.9	0.6	0.9	1.1	2.6	NS	0.9	NS	0.9	NS	2.0	NS	3.7	NS	1.5	NS	NS	NS	0.7	<0.1	8.8	6.9	7.5	5.2
Ammonia	mg/L	0.1	<1.31	**5.13**	NA	**8.71**	**4.65**	**11.5**	0.50	**1.65**	0.66	0.86	0.25	0.77	0.35	0.48	0.29	0.89	0.52	2.56	NS	0.50	NS	0.44	NS	0.57	NS	0.09	NS	0.66	NS	NS	NS	0.64	1.0	7.4	6.5	0.11	4.9
Nitrate	mg/L	0.1	3.6 - 8.4	**26.6**	**32.5**	**32.2**	**60.9**	**50.3**	**24.8**	**62.9**	7.2	***2.2***	6.4	6	6	5.7	6.8	7.8	4.3	0.4	NS	10.4	NS	9.2	NS	12.0	NS	0.5	NS	16.0	NS	NS	NS	2.6	0.6	<0.1	<0.1	0.2	0.8
Nitrite	mg/L	0.05	<0.10	<0.05	<0.05	<0.05	**0.35**	<0.05	**0.26**	<0.05	**0.17**	<0.05	<0.05	0.07	<0.05	<0.05	0.18	0.09	0.05	<0.05	NS	0.19	NS	0.20	NS	0.15	NS	<0.05	NS	<0.05	NS	NS	NS	0.20	<0.05	<0.05	<0.05	<0.05	<0.05
Chloride	mg/L	1	42 - 56	**96**	**70**	**92**	**86**	**118**	**79**	**120**	**87**	**123**	**88**	49	51	42	41	49	38	60	NS	33	NS	48	NS	130	NS	74	NS	130	NS	NS	NS	64	96	78	97	91	79
Sulphate	mg/L	1	223 - 433	**56**	**68**	**52**	**56**	**36**	**83**	**31**	**34**	**48**	**74**	145	207	328	350	406	443	301	NS	361	NS	270	NS	260	NS	220	NS	260	NS	NS	NS	290	220	100	85	21	4
Total Phosphorus	mg/L	0.01	<0.81	0.30	0.52	0.18	0.05	0.47	0.06	0.26	0.21	0.24	**1.26**	0.27	1.43	0.08	0.14	0.15	0.14	0.02	NS	0.31	NS	0.18	NS	0.04	NS	0.43	NS	0.17	NS	NS	NS	0.02	0.07	0.09	0.02	0.03	0.81
Conductivity	uS	5		1180	1060	1430	1400	1670	1410	1600	1010	1180	1030	834	898	992	1030	1190	1220	1150	NS	1100	NS	1200	NS	1100	NS	1100	NS	1200	NS	NS	NS	1000	1000	768	871	760	638
Total Dissolved Solids	mg/L	10	639 - 795	690	672	**888**	**966**	**1050**	**865**	**986**	611	726	191	562	673	717	698	802	770	746	NS	502	NS	720	NS	680	NS	590	NS	850	NS	NS	NS	750	640	682	1081	683	478
Total Suspended Solids	mg/L	2		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NS	NA	NS	210	NS	84	NS	NA	NS	450	NS	NS	NS	<2	2	4	2	4	1000
Biological Oxygen Demand	mg/L	2		9	7	14	7	<6	2	<12	<2	<2	22	<40	<60	2	<2	<2	<2	<2	NS	<2	NS	<2	NS	<2	NS	<2	NS	4	NS	NS	NS	<2	<2	<2	<2	1	<2
Metals																																					
Aluminum	mg/L	0.01	<0.134	0.004	0.002	0.003	0.037	0.035	<0.001	<0.01	0.019	0.064	0.01	0.215	0.012	NA																					
Antimony	mg/L	0.001		<0.0005	<0.0005	<0.0005	<0.0005	0.023	<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0025	<0.001																					
Arsenic	mg/L	0.01		<0.001	<0.001	0.01	<0.001	<0.005	0.001	<0.001	<0.001	<0.001	<0.005	<0.001	<0.005	<0.01																					
Barium	mg/L	0.01		0.107	0.103	0.078	NA	NA	NA	0.11	NA	NA	NA	NA	NA	0.068																					
Beryllium	mg/L	0.001		<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0025	<0.001																					
Boron	mg/L	0.05		0.077	0.079	0.312	0.097	0.076	0.036	0.07	0.052	0.078	0.098	0.1	0.0749	0.082																					
Cadmium	mg/L	0.001		0.0001	<0.0001	<0.0001	0.0002	0.0006	<0.0001	0.0002	0.0002	<0.0001	<0.0005	<0.0001	<0.0005	<0.001																					
Calcium	mg/L	0.2		96.9	58.2	59	NA	NA	NA	151	NA	NA	NA	NA	NA	NA																					
Chromium	mg/L	0.05		<0.01	0.005	0.023	0.007	0.059	0.013	<0.001	0.01	0.01	0.16	0.002	0.01	<0.05																					
Colbalt	mg/L	0.005		0.0012	0.0012	0.0006	0.0018	0.0160	0.0010	0.0017	0.0042	0.0015	0.0441	0.0005	0.0087	<0.005																					
Copper	mg/L	0.005		<0.0005	0.0042	0.0016	0.054	0.0339	0.0045	0.006	0.0097	0.0041	0.0794	0.0046	0.017	<0.005																					
Iron	mg/L	0.2	<30.70	<0.1	<0.1	0.398	<0.1	19	<0.1	<0.03	1.78	0.449	57.8	<0.1	4.9	0.367																					
Lead	mg/L	0.001		<0.001	<0.001	0.0001	<0.0001	0.0078	<0.0001	<0.001	0.0018	<0.0001	0.0239	<0.0001	0.0037	<0.001																					
Magnesium	mg/L	0.2		33.7	31.2	265	NA	NA	NA	54	NA	NA	NA	NA	NA	NA																					
Manganese	mg/L	0.05		1.02	0.8	0.259	NA	NA	NA	1.08	NA	NA	NA	NA	NA	NA																					
Mercury	mg/L	0.0001		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0001	NA	NA																					
Molybdenum	mg/L	0.005		<0.0005	<0.0005	0.0014	<0.0005	<0.0025	<0.0005	<0.005	<0.005	0.0005	<0.0025	<0.001	<0.005	<0.005																					
Nickel	mg/L	0.005		0.003	0.005	0.003	0.006	0.043	0.006	0.005	0.009	0.006	0.104	0.0	0.011	<0.005																					
Potassium	mg/L	0.2		11.8	12.1	30.4	NA	NA	NA	9	NA	NA	NA	NA	NA	NA																					
Selenium	mg/L	0.005		<0.001	0.001	0.005	<0.001	<0.005	<0.001	<0.005	0.001	0.002	<0.005	<0.001	<0.005	<0.005																					
Silver	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0005	<0.001																					
Sodium	mg/L	0.2		81.3	59.5	2070	NA	NA	NA	123	NA	NA	NA	NA	NA	60.7																					
Thallium	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0005	<0.001																					
Tin	mg/L	0.01		<0.005	<0.005	<0.005	NA	NA	NA	<0.01	NA	NA	NA	NA	NA	NA																					
Tungsten	mg/L	0.0001		<0.01	<0.01	<0.01	<0.01	<0.05	<0.01	NA	<0.01	<0.01	<0.05	<0.01	<0.05	NA																					
Uranium	mg/L	0.001		0.0017	0.0014	0.0003	0.019	<0.003	0.0023	0.001	0.0011	0.0005	0.003	0.001	0.0012	NA																					
Vanadium	mg/L	0.01		<0.0005	0.0123	0.0122	0.0157	0.0471	0.0081	<0.001	0.0075	0.02	0.13	0.00	0.01	<0.01																					
Zinc	mg/L	0.02		0.009	<0.005	0.008	0.017	0.064	<0.005	<0.01	0.016	<0.01	0.167	0.015	<0.05	<0.02																					
Zirconium	mg/L	0.001		NA	NA	NA	<0.001	0.016	<0.001	NA	0.001	<0.001	0.02	NA	NA	NA																					

Notes

MDL Method Detection Limit
-- Not Applicable/No Value
NA Not Analysed

BOLD Exceeds Trigger Concentration Range
NM Not Measured
NS Not Sampled

Summary of Field Measurements and Groundwater Analysis - MW3

Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Ground Surface Elevation: 51.77 m
Top of PVC Casing Elevation: 52.56 m
Well Depth: 5.77 m
Type of Monitoring Well: Background

Parameters	Units	MDL	Trigger Concentration Range	2015		2014		2013		2012		2011		2010		2009		2008		2007				2006				2005				2004				2003			
				Fall 18-Nov-15	Spring 14-Jul-15	Fall 5-Nov-14	Spring 13-May-14	Fall 20-Nov-13	Spring 31-May-13	Fall 21-Nov-12	Spring 15-May-12	Fall 24-Nov-11	Spring 9-Jun-11	Fall 16-Nov-10	Spring 17-May-10	Fall 12-Nov-09	Spring 12-May-09	Fall 20-Nov-08	Spring 8-May-08	Fall 14-Nov-07	Summer 14-Aug-07	Spring 6-Jun-07	Winter 26-Feb-07	Fall 14-Nov-06	Summer 17-Aug-06	Spring 8-May-06	Winter 24-Feb-06	Fall 11-Nov-05	Summer 6-Sep-05	Spring 26-May-05	Winter 21-Mar-05	Fall 3-Nov-04	Summer 18-Aug-04	Spring 9-Jun-04	Winter 5-Mar-04	Fall 23-Oct-03	Summer 21-Jul-03	Spring 17-Apr-03	Winter 19-Dec-02
Field Parameters																																					
Water Level (Below PVC Casing)	m	--		2.185	2.59	2.25	1.63	2.67	2.29	2.61	2.07	2.84	2.27	2.49	2.49	2.59	1.99	1.88	1.86	2.92	3.08	1.94	2.42	--	2.82	--	--	2.47	2.99	2.33	2.41	--	--	--	--	--	--	NM	--
Water Level Depth	m	--		1.40	1.80	1.46	0.84	1.88	1.50	1.82	1.28	2.05	1.48	1.70	1.70	1.80	1.20	1.09	1.07	2.13	2.29	1.15	1.63	1.94	2.03	2.02	1.99	1.68	2.2	1.54	1.62	--	--	--	--	1.96	1.96	1.98	2.33
Water Level Elevation	m	--		50.38	49.97	50.31	50.93	49.89	50.27	49.95	50.49	49.72	50.29	50.07	50.07	49.97	50.57	50.68	50.7	49.64	49.48	50.62	50.14	50.62	49.74	49.75	50.57	50.09	49.57	50.23	50.15	50.11	49.65	50.36	49.95	49.81	49.81	NM	49.44
Conductivity	uS	--		875	1043	836	852	724	224	762	565	843	993	866	952	873	764	993	982	988	1406	1229	1320	1022	NM	861	899	759	1024	898	862	1019	1274	886	NM	NM	NM	NM	NM
Total Dissolved Solids	mg/L	--		439	521	417	427	362	113	384	288	425	489	400	472	436	387	496	490	494	702	615	650	505	NM	448	450	353	512	440	432	510	639	512	NM	NM	NM	NM	NM
Temperature	°C	--		9.9	9.6	10.0	8.5	7.8	11.4	9.5	9.7	9.0	12.2	11.0	14.8	10.1	9.6	7.9	7.3	9.7	10.1	10.5	6.3	9.4	NM	14.9	7.8	6.0	26.5	11.0	8.3	9.2	18.3	11.7	NM	NM	NM	NM	NM
pH	unitless	--		7.46	7.85	6.95	7.10	7.24	7.85	7.16	6.99	7.15	6.78	7.37	7.36	7.69	7.52	7.85	6.98	7.52	8.55	8.70	7.85	7.30	NM	7.39	7.61	8.36	7.49	7.44	7.45	6.97	7.50	7.46	NM	NM	NM	NM	NM
Chemical Analysis																																					
Alkalinity (Total)	mg/L	5		314	298	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Kjeldhal Nitrogen	mg/L	0.1	0.2 - 1.2	0.6	**1.8**	1.0	0.4	0.8	0.6	**1.3**	0.9	**1.5**	1.1	0.9	1.5	2.1	0.3	0.6	0.7	0.7	1.6	0.9	0.8	0.5	0.6	0.3	0.6	0.6	1.8	0.8	0.7	0.9	0.3	0.3	0.4	0.7	0.5	6.4	0.4
Ammonia	mg/L	0.1	0.13 - 0.31	0.19	NA	0.28	0.20	0.24	**0.09**	0.19	0.16	0.23	0.17	0.24	0.20	0.32	0.16	0.26	0.27	0.30	0.31	0.24	0.10	0.08	<0.1	0.10	<0.1	0.14	<0.1	<0.1	0.13	<0.1	<0.1	0.11	0.12	0.26	0.14	6.40	0.33
Nitrate	mg/L	0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.2	<0.1	<0.1	0.1	<0.1	0.3	0.1	<0.1	0.2	0.2	<0.1	0.5	<0.1	0.2	1.1	0.1
Nitrite	mg/L	0.05	<0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.10
Chloride	mg/L	1	7 - 170	26	112	85	48	77	35	49	31	53	74	39	69	84	45	77	53	63	206	113	190	93	340	97	110	92	260	110	110	110	160	160	150	170	280	95	210
Sulphate	mg/L	1	69 - 119	**61**	83	89	109	89	**128**	91	**126**	85	100	95	137	107	116	100	125	94	49	85	64	80	60	92	94	77	41	74	69	51	42	50	52	44	34	49	39
Total Phosphorus	mg/L	0.01	0.52 - 3.92	0.89	**9.00**	2.13	0.53	2.01	1.17	2.85	2.16	2.99	1.17	2.55	3.99	2.04	1.47	6.01	3.56	3.61	3.87	1.86	2.40	0.51	0.13	0.08	1.10	0.80	1.10	0.94	4.30	0.23	0.15	0.05	0.08	0.09	0.08	0.06	0.66
Conductivity	uS	5		972	1070	996	858	923	818	846	814	889	977	864	950	1010	930	1040	1010	955	1420	1150	1300	1100	1400	1100	960	1000	1400	1100	1100	1100	1200	1200	1200	1045	1300	950	1235
Total Dissolved Solids	mg/L	10	444 - 722	534	646	572	584	538	455	533	532	622	**249**	204	626	387	526	600	558	566	694	658	720	540	730	520	610	560	730	700	610	570	630	660	620	627	798	570	741
Total Suspended Solids	mg/L	2		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2400	680	2400	3100	NS	5300	8000	5000	5500	14	<2	2	<2	<2	<2	8400
Biological Oxygen Demand	mg/L	2		4	8	3	2	3	<2	<12	4	<2	22	<40	<40	13	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	8	4	2	2	<2	<2	2	<2	<2	5
Metals																																					
Aluminum	mg/L	0.01	<0.297	0.002	0.006	0.005	0.092	0.154	<0.001	<0.01	0.029	0.111	0.034	0.492	0.009	NA																					
Antimony	mg/L	0.001		<0.0005	<0.0005	<0.0005	<0.0005	0.0077	<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0025	<0.001																					
Arsenic	mg/L	0.01		<0.001	0.002	0.001	<0.001	0.006	<0.001	<0.001	<0.001	0.002	<0.005	<0.001	<0.005	<0.01																					
Barium	mg/L	0.01		0.019	0.02	0.02	NA	NA	NA	0.02	NA	NA	NA	NA	NA	0.086																					
Beryllium	mg/L	0.001		<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	0.0005	<0.0025	<0.0005	<0.0025	<0.001																					
Boron	mg/L	0.05		0.113	0.117	0.084	0.089	0.092	0.035	0.1	0.064	0.091	0.086	0.094	0.0802	0.104																					
Cadmium	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0005	<0.001																					
Calcium	mg/L	0.2		40.3	59.4	38.9	NA	NA	NA	40	NA	NA	NA	NA	NA	NA																					
Chromium	mg/L	0.05		<0.01	0.005	0.005	0.003	0.120	0.007	<0.001	0.004	0.008	0.094	0.002	0.035	<0.05																					
Colbalt	mg/L	0.005		<0.0005	<0.0005	<0.0005	<0.0005	0.282	<0.0005	0.0002	<0.0005	0.0075	0.023	<0.0005	0.0088	0.005																					
Copper	mg/L	0.005		<0.0005	0.0047	0.0016	0.0023	0.0777	0.001	0.002	0.0018	0.02	0.06	0.0034	0.02	<0.005																					
Iron	mg/L	0.2	<25	<0.1	<0.1	<0.1	<0.1	**40.7**	<0.1	<0.03	<0.1	8.93	34.5	<0.1	14.8	5.41																					
Lead	mg/L	0.001		<0.001	<0.001	0.0002	<0.0001	0.0225	<0.0001	<0.001	0.0001	0.0063	0.0177	<0.0001	0.0055	0.002																					
Magnesium	mg/L	0.2		23.6	23.5	32.2	NA	NA	NA	22	NA	NA	NA	NA	NA	NA																					
Manganese	mg/L	0.05		0.155	0.144	0.211	NA	NA	NA	0.2	NA	NA	NA	NA	NA	NA																					
Mercury	mg/L	0.0001		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0001	NA	NA																					
Molybdenum	mg/L	0.005		0.0006	0.0010	0.0011	0.0005	<0.0025	0.0009	<0.005	0.0007	<0.0005	<0.0025	<0.001	<0.005	<0.005																					
Nickel	mg/L	0.005		0.002	0.003	0.003	0.002	0.043	0.002	<0.005	0.003	0.018	0.064	0.002	0.026	0.012																					
Potassium	mg/L	0.2		4.84	4.88	4.51	NA	NA	NA	4	NA	NA	NA	NA	NA	NA																					
Selenium	mg/L	0.005		<0.001	0.002	<0.001	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.005	<0.001	<0.005	<0.005																					
Silver	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0005	<0.001																					
Sodium	mg/L	0.2		132	153	172	NA	NA	NA	115	NA	NA	NA	NA	NA	149																					
Thallium	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0005	<0.001																					
Tin	mg/L	0.01		<0.005	<0.005	<0.005	NA	NA	NA	<0.01	NA	NA	NA	NA	NA	NA																					
Tungsten	mg/L	0.0001		<0.01	<0.01	<0.01	<0.01	<0.05	<0.01	NA	<0.01	<0.1	<0.05	<0.01	<0.05	NA																					
Uranium	mg/L	0.001		0.0006	0.0006	0.0005	0.0008	0.0036	0.0009	<0.001	0.0009	0.0015	0.0024	0.0009	0.0010	NA																					
Vanadium	mg/L	0.01		0.001	0.0089	0.0086	0.0079	0.0985	0.0029	<0.001	0.0025	0.0208	0.0889	0.004	0.03	<0.01																					
Zinc	mg/L	0.02		0.012	0.010	<0.005	0.019	0.147	<0.005	0.01	0.01	0.03	0.135	<0.01	0.082	<0.02																					
Zirconium	mg/L	0.001		NA	NA	NA	<0.001	0.018	<0.001	NA	<0.001	<0.001	0.02	NA	NA	NA																					

Notes

MDL Method Detection Limit
-- Not Applicable/No Value
NA Not Analysed

BOLD Exceeds Trigger Concentration Range
NM Not Measured
NS Not Sampled

Summary of Field Measurements and Groundwater Analysis - MW4

Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Ground Surface Elevation: 43.43 m
Top of PVC Casing Elevation: 44.68 m
Well Depth: 3.82 m
Type of Monitoring Well: Impact to river

Parameters	Units	MDL	PWQO	Trigger Concentration Range	2015 Fall 18-Nov-15	2015 Spring 14-Jul-15	2014 Fall 5-Nov-14	2014 Spring 13-May-14	2013 Fall 20-Nov-13	2013 Spring 31-May-13	2012 Fall 21-Nov-12	2012 Spring 15-May-12	2011 Fall 24-Nov-11	2011 Spring 9-Jun-11	2010 Fall 16-Nov-10	2010 Spring 17-May-10	2009 Fall 12-Nov-09	2009 Spring 12-May-09	2008 Fall 20-Nov-08	2008 Spring 8-May-08	2007 Fall 14-Nov-07	2007 Summer 14-Aug-07	2007 Spring 6-Jun-07	2007 Winter 26-Feb-07	2006 Fall 14-Nov-06	2006 Summer 17-Aug-06	2006 Spring 8-May-06	2006 Winter 24-Feb-06	2005 Fall 11-Nov-05	2005 Summer 6-Sep-05	2005 Spring 26-May-05	2005 Winter 21-Mar-05	2004 Fall 3-Nov-04	2004 Summer 18-Aug-04
Field Parameters																																		
Water Level (Below PVC Casing)	m	--	--		1.78	2.34	2.05	1.66	1.95	1.82	1.995	1.70	2.20	1.778	1.86	1.96	1.94	1.56	1.63	1.53	2.69	2.60	1.50	2.08	--	2.13	--	--	1.75	2.73	1.76	2.16	--	--
Water Level Depth	m	--	--		0.53	1.09	0.80	0.41	0.70	0.57	0.745	0.45	0.95	0.528	0.61	0.71	0.69	0.31	0.38	0.28	1.44	1.35	0.25	0.83	1.53	0.88	1.65	1.83	0.50	1.48	0.51	0.91	--	--
Water Level Elevation	m	--	--		42.90	42.34	42.63	43.02	42.73	42.86	42.69	42.98	42.48	42.902	42.82	42.72	42.74	43.12	43.05	43.15	41.99	42.08	43.18	42.60	43.15	42.55	43.03	42.85	42.93	41.95	42.92	42.52	42.74	42.96
Conductivity	uS	--	--		353	452	425	477	397	216	537	288	550	485	376	382	416	343	537	445	602	566	497	571	600	NM	434	488	523	528	435	584	555	548
Total Dissolved Solids	mg/L	--	--		207	226	511	239	198	105	274	144	267	240	153	186	207	180	273	222	315	284	247	380	305	NM	211	244	257	272	218	290	280	274
Temperature	°C	--	**<30**		7.8	13.6	10	7.9	5.8	12.4	7.0	11.7	8.1	14.5	8.8	12.0	8.3	10.0	7.8	8.0	9.0	14.2	9.4	8.5	10.5	NM	18.8	5.0	4.3	23.2	15.0	4.4	8.7	19.7
pH	unitless	--	**6.5-8.5**		7.36	6.70	7.36	7.19	7.71	6.80	7.54	7.45	7.40	5.59	7.33	7.34	7.34	6.39	7.74	6.08	6.65	8.30	8.01	7.52	6.30	NM	7.14	8.16	8.21	7.46	7.26	7.80	7.55	7.05
Chemical Analysis																																		
Alkalinity (Total)	mg/L	5	--		62	81	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Kjeldhal Nitrogen	mg/L	0.1	--	<1.4	0.4	0.9	0.5	**1.6**	0.4	1.3	0.8	1.3	1.9	4.1	0.8	0.3	2.0	0.2	0.3	0.7	0.4	0.7	0.5	3.1	1.8	0.5	0.4	0.9	0.2	1.7	<0.1	0.3	0.7	1.0
Ammonia	mg/L	0.1	--	0.02 - 0.17	**0.22**	NA	0.03	0.11	0.03	0.06	0.04	0.05	0.04	0.05	0.21	0.02	0.20	0.09	0.003	0.12	0.07	0.09	0.06	0.24	0.10	<0.1	0.10	<0.1	0.07	<0.1	<0.1	0.08	<0.1	0.01
Unionized Ammonia	mg/L		**0.02**		0.00078	--	0.00013	0.00027	0.00020	0.00008	0.00020	0.00030	0.00016	0.00001	0.00076	0.00009	0.00071	0.00004	0.00003	0.00002	0.00005	0.004	0.001	0.001	0.00004	--	0.00050	--	0.00131	--	--	0.00059	--	0.00004
Nitrate	mg/L	0.1	--	<1.41	0.3	<0.1	0.1	1.6	0.6	0.1	0.2	0.5	0.5	0.1	0.2	0.4	0.7	0.5	1.6	1.0	1.8	<	0.3	0.3	<	0.3	1.4	3.5	0.8	0.2	0.8	<0.1	0.1	0.3
Nitrite	mg/L	0.05	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chloride	mg/L	1	--	12 - 26	26	**32**	**42**	23	**51**	**33**	**72**	22	21	20	16	22	23	14	16	18	19	29	14	19	19	42	24	21	20	40	28	44	30	33
Sulphate	mg/L	1	--	68 - 153	102	76	111	**61**	**36**	**58**	**59**	**49**	144	**49**	67	83	161	54	113	91	208	103	108	120	140	160	88	160	170	58	82	130	170	20
Total Phosphorus	mg/L	0.01	**0.03**	<1.65	***0.13***	***0.66***	**0.25**	1.09	***0.47***	0.87	***0.36***	1.34	1.29	**1.71**	***0.8***	***0.24***	***0.86***	***0.40***	***0.11***	***1.43***	***0.72***	***0.58***	***0.69***	***3.8***	***1.1***	<0.01	***0.06***	***0.67***	***0.34***	***0.95***	***0.75***	***0.42***	***0.12***	***0.92***
Conductivity	uS	5	--		352	433	451	341	1670	356	447	292	466	330	343	380	461	333	471	420	571	579	475	510	520	560	470	520	550	550	440	590	590	540
Total Dissolved Solids	mg/L	10	--	248 - 352	**186**	324	288	351	**1050**	**207**	263	**460**	347	**205**	290	276	399	208	312	262	396	322	284	310	290	330	250	340	260	260	450	330	380	260
Total Suspended Solids	mg/L	2	--		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3000	930	1400	2500	NS	810	590	1100	2100	1900
Biological Oxygen Demand	mg/L	2	--		<20	<2	<2	<2	<6	<2	<30	6	<2	20	<40	<60	7	<2	<2	<2	3	<2	<2	<2	<2	18	<2	<2	<2	2	<2	6	2	6
Metals																																		
Aluminum	mg/L	0.01	**0.075**	0.348 - 1.259	***0.408***	**0.213**	**0.071**	***0.488***	**0.063**	**0.192**	**1.89**	***0.497***	***0.172***	***0.911***	***0.696***	***1.26***	NA																		
Antimony	mg/L	0.001	**0.02**		<0.0005	<0.0005	<0.0005	<0.0005	0.0045	<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0025	<0.001																	
Arsenic	mg/L	0.01	**0.005**		<0.001	<0.001	<0.001	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.005	<0.001	<0.005	<0.01																
Barium	mg/L	0.01	--		0.017	0.019	0.017	NA	NA	NA	0.06	NA	NA	NA	NA	NA	0.059																
Beryllium	mg/L	0.001	**0.011**		<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0005	0.0006	<0.0005	<0.0025	<0.0005	<0.0025	<0.001																
Boron	mg/L	0.05	**0.2**		0.019	0.027	0.016	0.023	<0.05	0.017	0.06	0.022	0.024	<0.05	0.026	<0.05	<0.05																
Cadmium	mg/L	0.001	**0.0001**		<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0005	<0.001																
Calcium	mg/L	0.2	--		26.8	31.0	37.5	NA	NA	NA	37	NA	NA	NA	NA	NA	NA																
Chromium	mg/L	0.05	**0.001**		<0.001	***0.002***	0.001	<0.001	***0.031***	<0.001	***0.004***	***0.016***	***0.006***	***0.144***	***0.004***	<0.005	<0.05																
Cobalt	mg/L	0.005	**0.0009**		<0.0005	<0.0005	<0.0005	<0.0005	***0.0053***	***0.0017***	***0.0020***	***0.0072***	***0.006***	***0.0318***	<0.0005	<0.0025	<0.005																
Copper	mg/L	0.005	**0.005**		<0.0005	0.002	0.002	0.0034	***0.0149***	***0.0198***	***0.012***	***0.0212***	***0.022***	***0.0809***	0.0043	<0.0025	***0.007***																
Iron	mg/L	0.2	**0.3**	<26.9	0.183	<0.1	<0.1	<0.1	***9.18***	***1.27***	***1.71***	***3.76***	***3.44***	***51.3***	<0.1	***0.6***	***0.767***																
Lead	mg/L	0.001	**0.001**		<0.0001	<0.0001	0.0005	0.0002	***0.0047***	***0.0047***	***0.005***	***0.0126***	***0.0062***	***0.0352***	<0.0001	0.0006	<0.001																
Magnesium	mg/L	0.2	--		10.9	12.8	14.8	NA	NA	NA	16	NA	NA	NA	NA	NA	NA																
Manganese	mg/L	0.05	--		0.005	0.013	0.01	NA	NA	NA	0.11	NA	NA	NA	NA	NA	NA																
Mercury	mg/L	0.0001	**0.0005**		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0001	NA	NA																
Molybdenum	mg/L	0.005	**0.04**		<0.0005	0.0007	<0.0005	<0.0005	<0.0025	<0.0005	<0.005	<0.0005	<0.0005	<0.0025	<0.001	<0.005	<0.005																
Nickel	mg/L	0.005	**0.025**		<0.001	0.002	0.002	0.002	0.018	0.006	<0.005	0.012	0.009	***0.094***	0.001	<0.005	<0.005																
Potassium	mg/L	0.2	--		3.41	3.84	4.09	NA	NA	NA	5	NA	NA	NA	NA	NA	NA																
Selenium	mg/L	0.005	**0.1**		<0.001	<0.001	<0.001	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.005	<0.001	<0.005	<0.005																
Silver	mg/L	0.001	**0.0001**		<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0005	<0.001																
Sodium	mg/L	0.2	--		22.7	26.3	35.1	NA	NA	NA	18	NA	NA	NA	NA	NA	26.3																
Thallium	mg/L	0.001	**0.0003**		<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0005	<0.001																
Tin	mg/L	0.01	--		<0.005	<0.005	<0.005	NA	NA	NA	<0.01	NA	NA	NA	NA	NA	NA																
Tungsten	mg/L	0.0001	**0.03**		<0.01	<0.01	<0.01	<0.01	<0.05	<0.01	NA	<0.01	<0.01	<0.05	<0.01	<0.05	NA																
Uranium	mg/L	0.001	**0.005**		<0.0001	<0.0001	<0.0001	<0.0001	0.0005	0.0003	<0.001	0.0015	0.0014	0.0033	<0.0001	<0.0005	NA																
Vanadium	mg/L	0.01	**0.006**		0.0009	0.0044	0.0018	0.0020	***0.0221***	0.0045	***0.007***	***0.0178***	***0.0161***	***0.124***	0.002	<0.005	<0.01																
Zinc	mg/L	0.02	**0.03**		<0.005	<0.005	0.006	0.006	***0.036***	0.025	***0.06***	0.03	***0.052***	***0.171***	0.016	<0.05	<0.02																
Zirconium	mg/L	0.001	**0.004**		NA	NA	NA	<0.001	<0.005	<0.001	NA	<0.001	<0.001	***0.007***	NA	NA	NA																

Notes

MDL Method Detection Limit
PWQO Provincial Water Quality Objectives
-- Not Applicable/Not Available/No Value
Italics Above PWQO
NS Not Sampled
NM Not Measured
NA Not Analysed
BOLD Exceeds Trigger Concentration Range

Summary of Field Measurements and Groundwater Analysis - BH03-4

Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Ground Surface Elevation: 50.69 m
Top of PVC Casing Elevation: 51.37 m
Well Depth: 5.3 m
Type of Monitoring Well: Leakage from lagoon

Parameters	Units	MDL	Trigger Concentration Range	2015 Fall 18-Nov-15	2015 Spring 14-Jul-15	2014 Fall 5-Nov-14	2014 Spring 13-May-14	2013 Fall 20-Nov-13	2013 Spring 31-May-13	2012 Fall 21-Nov-12	2012 Spring 15-May-12	2011 Fall 24-Nov-11	2011 Spring 9-Jun-11	2010 Fall 16-Nov-10	2010 Spring 17-May-10	2008 Fall 20-Nov-08	2008 Spring 8-May-08	2007 Fall 14-Nov-07	2007 Summer 14-Aug-07	2007 Spring 6-Jun-07	2007 Winter 26-Feb-07	2006 Fall 14-Nov-06	2006 Summer 17-Aug-06	2006 Spring 8-May-06	2006 Winter 24-Feb-06	2005 Fall 11-Nov-05	2005 Summer 6-Sep-05	2005 Spring 26-May-05
Field Parameters																												
Water Level (Below PVC Casing)	m	--		4.585	4.64	4.67	4.33	4.61	4.60	4.59	4.43	4.77	4.532	4.54	4.61	4.42	4.19	4.95	4.73	4.24	4.63	4.35	4.48	--	4.54	4.52	4.65	4.42
Water Level Depth	m	--		3.905	3.96	3.99	3.65	3.93	3.92	3.91	3.75	4.09	3.852	3.86	3.93	3.74	3.51	4.27	4.05	3.56	3.95	3.67	3.80	4.36	3.86	3.84	3.97	3.74
Water Level Elevation	m	--		46.79	46.73	46.70	47.04	46.76	46.77	46.78	46.94	46.60	46.838	46.83	46.76	46.95	47.18	46.42	46.64	47.13	46.74	47.02	46.89	47.01	46.83	46.85	46.72	46.95
Conductivity	uS	--		851	903	851	84.4	719	639	1121	514	937	620	706	778	646	552	1318	1038	726	1160	880	NM	779	1088	668	1101	1068
Total Dissolved Solids	mg/L	--		425	450	425	429	361	322	556	258	495	300	395	434	323	272	663	517	358	580	464	NM	396	344	336	525	530
Temperature	°C	--		13.6	14.9	13.1	10.2	11.5	13.9	12.9	13.4	10.5	16.6	13.5	25.6	8.8	9.9	12.1	15.3	13.1	6.9	11.2	NM	18.1	8.5	5.1	22.6	15.0
pH	unitless	--		6.82	6.68	6.55	6.74	6.88	6.75	6.69	6.43	6.63	6.64	6.80	6.57	7.59	6.45	6.47	7.67	8.48	7.08	6.50	NM	6.60	6.71	6.97	6.41	6.40
Chemical Analysis																												
Alkalinity (Total)	mg/L	5		401	396	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NS	NA	NS	NA	NS	NA	NS	NS	NS	NA
Total Kjeldhal Nitrogen	mg/L	0.1	2.3 - 8.3	**20.0**	**14.0**	**42.4**	8.1	**12.1**	6.5	**15.9**	7.2	**9.5**	6.8	6.0	5.3	5.3	4.0	11.9	NS	3.7	NS	5.1	NS	5.8	NS	NS	NS	11.0
Ammonia	mg/L	0.1	0.9 - 6.3	**17.5**	NA	**16.4**	**6.89**	**15.3**	5.39	**14.8**	**6.52**	**8.04**	**6.78**	5.08	3.62	3.01	2.91	10	NS	3.67	NS	3.70	NS	0.10	NS	NS	NS	<
Nitrate	mg/L	0.1	<0.10	<0.1	<0.1	<0.1	<0.1	<0.1	**0.2**	<0.1	<0.1	0.1	**0.2**	0.1	<0.1	<0.1	<0.1	<0.1	NS	<0.1	NS	<0.1	NS	<0.1	NS	NS	NS	<0.1
Nitrite	mg/L	0.05	0.03 - 0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.09	NS	<0.05	NS	<0.05	NS	<0.05	NS	NS	NS	<0.05
Chloride	mg/L	1	6.9 - 24.1	**30**	**37**	**67**	**25**	**42**	**33**	**68**	**26**	**43**	12	22	15	11	8	32	NS	16	NS	14	NS	25	NS	NS	NS	46
Sulphate	mg/L	1	<83	**242**	19	40	27	18	29	16	21	15	18	25	33	37	32	150	NS	50	NS	67	NS	91	NS	NS	NS	170
Total Phosphorus	mg/L	0.01	0.7 - 3.2	**0.52**	**0.65**	1.37	0.71	0.86	1.17	0.76	**3.47**	1.67	2.88	0.09	1.7	0.12	2.36	3.08	NS	2.21	NS	7.70	NS	0.69	NS	NS	NS	2.30
Conductivity	uS	5		886	898	942	630	847	702	1200	670	951	552	748	587	622	515	1120	NS	685	NS	740	NS	860	NS	NS	NS	1100
Total Dissolved Solids	mg/L	10	242 - 522	370	450	**524**	341	458	379	**660**	401	**546**	**152**	438	365	368	276	686	NS	396	NS	370	NS	500	NS	NS	NS	670
Total Suspended Solids	mg/L	2		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NS	NA	NS	2500	NS	950	NS	NS	NS	160
Biological Oxygen Demand	mg/L	2		10	10	27	26	15	<2	3	<2	4	3	<20	<12	<2	<2	<2	NS	<2	NS	<2	NS	4	NS	NS	NS	8
Metals																												
Aluminum	mg/L	0.01	<0.011	**0.015**	**0.012**	**0.019**	**0.013**	<0.001	<0.001	**0.020**	0.009	0.011	0.01	<0.001	<0.0005	NA												
Antimony	mg/L	0.001		<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0025	<0.001												
Arsenic	mg/L	0.01		<0.001	0.002	0.002	<0.001	<0.005	0.001	<0.001	<0.001	0.002	<0.005	0.001	<0.005	<0.01												
Barium	mg/L	0.01		0.089	0.077	0.093	NA	NA	NA	0.12	NA	NA	NA	NA	NA	0.056												
Beryllium	mg/L	0.001		<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0025	<0.001												
Boron	mg/L	0.05		0.043	0.041	0.052	0.028	<0.05	0.027	0.05	0.025	0.042	<0.05	0.0384	<0.05	<0.05												
Cadmium	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0005	<0.001												
Calcium	mg/L	0.2		85.7	86.2	72.9	NA	NA	NA	118	NA	NA	NA	NA	NA	NA												
Chromium	mg/L	0.05		0.002	0.007	0.005	0.004	0.015	<0.001	0.002	0.003	0.008	0.034	0.004	0.006	<0.05												
Colbalt	mg/L	0.005		<0.0005	<0.0005	0.0005	<0.0005	0.0032	<0.0005	0.0006	<0.0005	0.0015	0.0071	<0.0005	<0.0025	<0.005												
Copper	mg/L	0.005		<0.0005	0.0009	0.001	0.0006	0.0146	<0.0005	<0.001	0.001	0.0051	0.0167	0.0025	0.0039	<0.005												
Iron	mg/L	0.2	11.5 - 24.1	13.1	14.8	**10.9**	**5.84**	22.8	13.0	18.9	**7.82**	19.0	27.9	11.7	17.8	13.7												
Lead	mg/L	0.001		<0.0001	<0.0001	0.0001	<0.0001	0.004	<0.0001	<0.001	<0.0001	0.0039	0.0087	<0.0001	0.004	<0.001												
Magnesium	mg/L	0.2		24.8	24.3	34.7	NA	NA	NA	39	NA	NA	NA	NA	NA	NA												
Manganese	mg/L	0.05		1.42	1.41	1.64	NA	NA	NA	2.3	NA	NA	NA	NA	NA	NA												
Mercury	mg/L	0.0001		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0001	NA	NA												
Molybdenum	mg/L	0.005		<0.0005	<0.0005	0.0009	<0.0005	<0.0025	<0.0005	<0.005	<0.0005	<0.0005	<0.0025	<0.001	<0.005	<0.005												
Nickel	mg/L	0.005		<0.001	0.003	0.003	0.001	0.01	0.002	<0.005	0.002	0.003	0.02	0.002	<0.005	<0.005												
Potassium	mg/L	0.2		7.1	5.37	7.79	NA	NA	NA	8	NA	NA	NA	NA	NA	NA												
Selenium	mg/L	0.005		<0.001	<0.001	<0.001	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.005	<0.001	<0.005	<0.005												
Silver	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0005	<0.001												
Sodium	mg/L	0.2		33.3	36.2	66.4	NA	NA	NA	61	NA	NA	NA	NA	NA	27.2												
Thallium	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0005	<0.001												
Tin	mg/L	0.01		<0.005	<0.005	<0.005	NA	NA	NA	<0.01	NA	NA	NA	NA	NA	NA												
Tungsten	mg/L	0.0001		<0.01	<0.01	<0.01	<0.01	<0.05	<0.01	NA	<0.01	<0.01	<0.05	<0.01	<0.05	NA												
Uranium	mg/L	0.001		0.0001	0.0002	0.0005	<0.0001	<0.0005	0.0001	<0.001	<0.0001	0.0006	0.0008	<0.0001	<0.0005	NA												
Vanadium	mg/L	0.01		0.0022	0.0173	0.0135	0.0099	0.0270	0.0055	0.004	0.0041	0.361	0.0496	0.011	0.032	<0.01												
Zinc	mg/L	0.02		0.014	0.008	0.007	0.031	0.026	0.009	<0.01	0.012	0.022	<0.05	0.01	<0.05	<0.02												
Zirconium	mg/L	0.001		NA	NA	NA	<0.001	<0.005	<0.001	NA	<0.001	<0.001	0.006	NA	NA	NA												

Notes

MDL	Method Detection Limit	NS	Not Sampled
PWQO	Provincial Water Quality Objectives	NM	Not Measured
--	Not Applicable/Not Available/No Value	NA	Not Analysed
[1]	[Organic Nitrogen] = [TKN] - [Ammonia]	**BOLD**	Exceeds Trigger Concentration Range

Summary of Field Measurements and Groundwater Analysis - MW5

Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Ground Surface Elevation: 43.71 m
Top of PVC Casing Elevation: 44.98 m
Well Depth: 4.15 m
Type of Monitoring Well: Impact to river

Parameters	Units	MDL	PWQO	Trigger Concentration Range	2015 Fall 18-Nov-15	2015 Spring 14-Jul-15	2014 Fall 5-Nov-14	2014 Spring 13-May-14	2013 Fall 20-Nov-13	2013 Spring 31-May-13	2012 Fall 21-Nov-12	2012 Spring 15-May-12	2011 Fall 24-Nov-11	2011 Spring 9-Jun-11	2010 Fall 16-Nov-10	2010 Spring 17-May-10	2009 Fall 12-Nov-09	2009 Spring 12-May-09	2008 Fall 20-Nov-08	2008 Spring 8-May-08	2007 Fall 14-Nov-07	2007 Summer 17-Aug-07	2007 Spring 6-Jun-07	2007 Winter 26-Feb-07	2006 Fall 14-Nov-06	2006 Summer 17-Aug-06	2006 Spring 8-May-06	2006 Winter 24-Feb-06	2005 Fall 11-Nov-05	2005 Summer 6-Sep-05	2005 Spring 26-May-05	2005 Winter 21-Mar-05	2004 Fall 3-Nov-04	2004 Summer 18-Aug-04
Field Parameters																																		
Water Level (Below PVC Casing)	m	--	--		1.637	1.76	1.665	1.62	1.645	1.63	1.69	1.61	1.75	1.657	1.64	1.62	1.64	1.56	1.64	1.61	2.04	2.07	1.40	NM	--	1.86	--	1.66	1.64	1.76	2.57	1.71	--	--
Water Level Depth	m	--	--		0.367	0.49	0.395	0.35	0.375	0.36	0.42	0.34	0.48	0.387	0.37	0.35	0.37	0.29	0.37	0.34	0.77	0.80	0.13	NM	1.62	0.59	1.58	0.39	0.37	0.49	1.30	0.44	--	--
Water Level Elevation	m	--	--		43.34	43.22	43.32	43.36	43.34	43.36	43.29	43.37	43.23	43.323	43.34	43.36	43.34	43.42	43.34	43.37	42.94	42.91	43.58	NM	43.36	43.12	43.40	43.32	43.34	43.22	42.41	43.27	43.25	43.12
Conductivity	uS	--	--		>3999	3611	1437	1636	2272	NM	3179	1190	1282	3419	1412	3620	2071	2813	>3999	1975	3823	NM	3969	NM	2078	NM	1924	2346	2068	1535	1924	1993	1890	2027
Total Dissolved Solids	mg/L	--	--		>2000	1818	719	819	1133	NM	1479	561	642	1715	705	1800	1036	1428	>2000	987	1913	NM	1945	NM	1049	NM	969	1174	1037	770	960	995	946	1020
Temperature	°C	--	**<30**		6.1	12.2	9.9	7.9	5.7	NM	7.3	12.8	7.8	13.2	8.8	11.3	8.9	11.7	5.4	6.5	8.9	NM	8.4	NM	8.8	NM	18.8	5.0	4.3	21.9	12.0	4.0	6.2	21.4
pH	unitless	--	**6.5-8.5**		7.65	7.35	7.65	7.28	6.73	NM	6.81	7.34	7.05	6.57	7.35	7.42	7.45	7.28	7.84	6.39	7.49	NM	7.34	NM	6.94	NM	7.23	7.31	7.19	7.37	7.36	7.51	7.16	7.49
Chemical Analysis																																		
Alkalinity (Total)	mg/L	5	--		391	416	NA	NA	NA	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Kjeldhal Nitrogen	mg/L	0.1	--	0.9 - 1.9	**0.8**	1.0	0.9	1.8	0.9	NS	1.1	**0.7**	**2.7**	**2.2**	1.1	1.3	1.9	0.8	1.1	1.7	2.0	1.3	2.3	NS	1.6	1.4	1.0	2.0	2.1	2.7	1.3	2.5	1.7	0.6
Ammonia	mg/L	0.1	--	0.2 - 0.66	0.47	NA	0.48	0.33	0.38	NS	**0.12**	0.52	0.32	0.49	0.45	0.66	0.19	0.41	0.40	0.89	0.20	0.52	0.47	NS	0.64	<0.1	0.10	0.23	<0.1	<0.1	<0.1	0.43	0.15	0.28
Unionized Ammonia	mg/L	--	**0.02**		0.00284	**--**	0.00392	0.00099	0.00027	NS	0.00012	0.00261	0.00056	0.00043	0.0017	0.00355	0.0009	0.0016	0.0035	0.0003	0.001	NA	0.002	NS	0.001	--	0.001	0.001	--	--	--	0.002	0.0003	0.004
Nitrate	mg/L	0.1	--	<1.0	<0.1	<0.1	<0.1	0.4	**1.4**	NS	0.4	<0.1	**1.1**	0.1	1.2	0.7	2.1	0.1	0.7	0.2	0.9	0.7	0.3	NS	0.3	0.3	0.2	0.5	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrite	mg/L	0.05	--	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	NS	**0.13**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.08	0.05	<0.05	0.11	0.23	NS	0.15	0.10	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chloride	mg/L	1	--	294 - 714	**33**	549	**235**	420	391	NS	478	676	376	274	187	328	316	587	504	379	322	506	624	NS	680	42	760	640	730	900	620	650	940	890
Sulphate	mg/L	1	--	77 - 135	**18**	107	127	101	111	NS	109	108	118	130	138	182	162	106	114	106	88	87	93	NS	99	140	100	120	110	110	110	110	110	98
Total Phosphorus	mg/L	0.01	**0.03**	<1.0	***0.09***	***0.15***	***0.11***	***0.34***	***0.12***	NS	***0.11***	***0.09***	***0.3***	***0.17***	***0.16***	***0.13***	***0.15***	0.02	***0.13***	***0.18***	***0.30***	***0.04***	***0.22***	NS	***0.27***	<0.01	***0.13***	***3.1***	***0.12***	0.03	<0.01	***0.08***	***0.06***	***0.14***
Conductivity	uS	5	--		2380	2630	1510	2060	1640	NS	2220	3170	NA	2310	1310	1520	1540	1720	1170	1910	3050	2420	2850	NS	3200	3500	2500	3000	3200	3500	2700	3000	3700	3700
Total Dissolved Solids	mg/L	10	--	389 - 1325	1210	**1420**	846	1120	968	NS	1160	**1640**	1180	882	744	857	658	1280	1200	966	1650	1200	1390	NS	290	330	250	340	260	260	450	330	380	260
Total Suspended Solids	mg/L	2	--		NA	NA	NA	NA	NA	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NS	1600	1700	1400	1700	1600	2000	1500	1500	2000	2100
Biological Oxygen Demand	mg/L	2	--		3	6	3	NS	3	NS	4	<2	NA	20	<20	<12	<2	3	6	<2	10	11	10	NS	18	32	<2	<2	4	10	6	14	2	230
Metals																																		
Aluminum	mg/L	0.01	**0.075**	0.027 - 0.053	**0.021**	**0.073**	**0.004**	NS	**0.014**	NS	**0.42**	**0.01**	**0.026**	**0.023**	0.035	0.04	NA	NA	0.06	NA														
Antimony	mg/L	0	**0.02**		<0.0005	<0.0005	<0.0005	NS	0.0027	NS	<0.0005	<0.0005	0.0005	<0.0025	<0.0005	<0.0025	<0.001	0.018	<0.001	0.013														
Arsenic	mg/L	0.01	**0.005**		<0.001	0.001	<0.001	NS	<0.005	NS	<0.001	0.002	0.002	<0.005	0.003	<0.005	<0.01	<0.01	<0.01	<0.01														
Barium	mg/L	0.01	--		0.035	0.021	0.022	NS	NA	NS	0.02	NA	NA	NA	NA	NA	0.029	0.032	0.035	0.042														
Beryllium	mg/L	0	**0.011**		<0.0005	<0.0005	<0.0005	NS	<0.0025	NS	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0025	<0.001	<0.001	<0.001	<0.001														
Boron	mg/L	0.05	**0.2**		***0.242***	0.095	0.108	NS	0.158	NS	0.1	0.087	0.13	0.155	0.188	0.126	0.143	0.140	***0.209***	0.125														
Cadmium	mg/L	0	**0.0001**		<0.0001	<0.0001	<0.0001	NS	<0.0005	NS	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0005	<0.001	<0.001	<0.001	<0.001														
Calcium	mg/L	0.2	--		61.7	57.2	51.1	NS	NA	NS	54	NA	NA	NA	NA	NA	NA	NA	46.4	NA														
Chromium	mg/L	0.05	**0.001**		<0.001	***0.008***	***0.005***	NS	***<5***	NS	<0.001	***0.011***	***0.007***	***0.017***	***0.01***	<0.005	<0.05	<0.05	<0.05	<0.05														
Cobalt	mg/L	0.01	**0.0009**		<0.0005	<0.0005	0.0006	NS	<0.0025	NS	0.0007	0.0008	***0.0017***	***0.0041***	0.0005	<0.0025	<0.005	<0.005	<0.005	<0.005														
Copper	mg/L	0.01	**0.005**		<0.0005	0.0042	0.0009	NS	***0.0131***	NS	***0.012***	0.0035	***0.012***	***0.0128***	0.0024	<0.0025	<0.005	<0.005	0.005	***0.01***														
Iron	mg/L	0.2	**0.3**	<7.1	<0.1	<0.1	<0.1	NS	***2.13***	NS	***0.59***	***0.657***	***1.7***	***6.4***	***0.459***	***0.641***	***0.405***	<0.2	0.2	***15.20***														
Lead	mg/L	0	**0.001**		<0.0001	<0.0001	0.0007	NS	0.0009	NS	0.001	0.0007	***0.0021***	***0.0039***	0.0005	0.001	<0.001	<0.001	<0.001	***0.002***														
Magnesium	mg/L	0.2	--		71.7	41.2	61.7	NS	NA	NS	38	NA	NA	NA	NA	NA	NA	NA	62.7	NA														
Manganese	mg/L	0.05	--		0.257	0.107	0.709	NS	NA	NS	0.35	NA	NA	NA	NA	NA	NA	NA	0.176	NA														
Mercury	mg/L	0	**0.0005**		NA	NA	NA	NS	NA	NS	NA	NA	NA	NA	<0.0001	NA	NA	NA	NA	NA														
Molybdenum	mg/L	0.01	**0.04**		0.0009	0.0008	<0.0005	NS	<0.0025	NS	<0.005	<0.0005	<0.0005	<0.0025	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005														
Nickel	mg/L	0.01	**0.025**		0.001	0.004	0.004	NS	0.006	NS	<0.005	0.005	0.01	0.014	0.004	0.013	<0.005	0.005	0.007	0.01														
Potassium	mg/L	0.2	--		12.9	6.01	7.52	NS	NA	NS	7	NA	NA	NA	NA	NA	NA	NA	11.3	NA														
Selenium	mg/L	0.01	**0.1**		<0.001	0.003	0.002	NS	0.008	NS	<0.005	0.004	0.003	0.008	0.007	0.008	0.006	0.011	0.014	<0.005														
Silver	mg/L	0	**0.0001**		<0.0001	<0.0001	<0.0001	NS	<0.0005	NS	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0005	<0.001	<0.001	<0.001	<0.001														
Sodium	mg/L	0.2	--		575	158	237	NS	NA	NS	169	NA	NA	NA	NA	NA	391	384	593	259														
Thallium	mg/L	0	**0.0003**		<0.0001	<0.0001	<0.0001	NS	<0.0005	NS	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0005	<0.001	<0.001	<0.001	<0.001														
Tin	mg/L	0.01	--		<0.005	<0.005	<0.005	NS	NA	NS	<0.01	NA	NA	NA	NA	NA	NA	NA	<0.01	NA														
Tungsten	mg/L	0	**0.03**		<0.01	<0.01	<0.01	NS	<0.05	NS	NA	<0.01	<0.01	<0.05	<0.01	<0.05	NA	NA	NA	NA														
Uranium	mg/L	0	**0.005**		0.0027	<0.0001	0.0019	NS	0.0024	NS	0.001	0.0019	0.0023	0.0033	0.0024	0.0018	NA	NA	NA	NA														
Vanadium	mg/L	0.01	**0.006**		0.0006	***0.0148***	***0.0084***	NS	***0.0068***	NS	0.003	0.0053	***0.013***	***0.015***	***0.007***	<0.005	<0.01	<0.01	<0.01	***0.013***														
Zinc	mg/L	0.02	**0.03**		<0.005	0.010	0.009	NS	***<0.25***	NS	***0.05***	0.021	***0.126***	<0.05	0.019	***0.096***	<0.02	0.02	<0.02	***0.048***														
Zirconium	mg/L	0	**0.004**		NA	NA	NA	NS	<0.005	NS	NA	<0.001	<0.001	<0.005	NA	NA	NA	NA	NA	NA														

Notes

MDL Method Detection Limit
PWQO Provincial Water Quality Objectives
-- Not Applicable/Not Available/No Value
Italics Above PWQO
NS Not Sampled
NM Not Measured
NA Not Analysed
BOLD Exceeds Trigger Concentration Range

Summary of Field Measurements and Groundwater Analysis - MW11-6

Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Ground Surface Elevation: 42.81 m
Top of PVC Casing Elevation: 43.72 m
Well Depth: 4.3 m
Type of Monitoring Well: Impact to river

Parameters	Units	MDL	PWQO	Baseline (Median 2011-2012)	Trigger Concentration Range	2015 Fall 18-Nov-15	2015 Spring 14-Jul-15	2014 Fall 5-Nov-14	2014 Spring 13-May-14	2013 Fall 20-Nov-13	2013 Spring 31-May-13	2012 Fall 22-Nov-12	2012 Spring 15-May-12	2011 Fall 24-Nov-11	2011 Spring 24-Jun-11
Field Parameters															
Water Level (Below PVC Casing)	m	--	--			1.04	1.65	1.01	1.03	1.52	1.39	1.525	1.41	2.10	2.069
Water Level Depth	m	--	--			0.13	0.74	0.10	0.12	0.61	0.48	0.62	0.50	1.19	1.159
Water Level Elevation	m	--	--			42.68	42.07	42.71	42.69	42.20	42.33	42.20	42.31	41.62	41.651
Conductivity	uS	--	--			>3999	>3999	>3999	>3999	3218	397	>3999	1852	>3999	2855
Total Dissolved Solids	mg/L	--	--			>2000	>2000	>2000	>2000	1601	200	>2000	3602	>2000	1335
Temperature	°C	--	**<30**			8.7	9.5	10.2	7.7	7.1	11.1	9.0	10.0	8.8	10.6
pH	unitless	--	**6.5-8.5**			7.58	7.56	6.67	7.28	NM	7.47	7.22	7.41	7.40	7.52
Chemical Analysis															
Alkalinity (Total)	mg/L	5	--			536	560	NA	NA	NA	NA	NA	NA	NA	NA
Total Kjeldhal Nitrogen	mg/L	0.1	--	2.7	2.5 - 2.9	**2.1**	2.6	**1.9**	**2.4**	**0.9**	**1.8**	2.6	2.5	2.8	2.9
Ammonia	mg/L	0.1	--	1.92	1.67 - 2.17	**1.59**	NA	1.68	1.74	**0.75**	**0.99**	1.87	2.06	1.49	1.97
Nitrate	mg/L	--	--	0.1	0.1	**4.3**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrite	mg/L	0.1	--	0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chloride	mg/L	0.05	--	2780	1704 - 3856	**310**	3730	2450	2630	**<1**	2760	2730	3280	2830	849
Sulphate	mg/L	1	--	251	184 - 317	**86**	279	270	241	**165**	246	259	301	242	144
Total Phosphorus	mg/L	1	**0.03**	0.8	0.56 - 1.02	**0.22**	**0.53**	**0.48**	**0.43**	**0.13**	**0.35**	***0.39***	***0.74***	***0.84***	***0.89***
Conductivity	mg/L	0.01				8850	10100	8570	8800	4560	9200	8960	10900	9110	3560
Total Dissolved Solids	uS	5	--	4665	2543 - 6787	5090	5790	4970	4970	2550	5310	4860	7000	4470	1830
Biological Oxygen Demand	mg/L	2	--			6	11	12	10	4	5	<2	10	2	9
Metals															
Aluminum	mg/L	0.01	**0.075**	0.010	<0.022	0.002	0.002	0.003	**0.029**	0.004	<0.001	0.01	<0.001	0.028	0.005
Antimony	mg/L	0.001	**0.02**			<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Arsenic	mg/L	0.01	**0.005**			<0.001	***0.010***	***0.009***	***0.012***	***0.007***	***0.007***	***<0.1***	***0.015***	***0.012***	0.003
Barium	mg/L	0.01	--			0.034	0.062	0.076	NA	NA	NA	0.09	NA	NA	NA
Beryllium	mg/L	0.001	**0.011**			<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	0.05	**0.2**			0.151	0.189	***0.375***	***0.270***	0.163	0.146	***0.320***	0.20	***0.236***	0.098
Cadmium	mg/L	0.001	**0.0001**			<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcium	mg/L	0.2	--			55.3	70.2	82.3	NA	NA	NA	81	NA	NA	NA
Chromium	mg/L	0.05	**0.001**			<0.001	***0.027***	***0.023***	***0.022***	***0.007***	***0.012***	0.001	***0.005***	***0.032***	***0.012***
Colbalt	mg/L	0.005	**0.0009**			<0.0005	0.0005	0.0006	0.0006	<0.0025	<0.0005	***0.0011***	0.0009	***0.0014***	***0.0011***
Copper	mg/L	0.005	**0.005**			<0.0005	***0.0206***	0.004	0.0014	***0.205***	0.001	0.002	0.0017	0.0018	***0.0069***
Iron	mg/L	0.2	**0.3**	0.920	0.581 - 1.259	**<0.1**	**0.322**	**0.400**	***0.704***	**2.860**	**0.154**	***0.92***	***1.43***	***0.788***	<0.1
Lead	mg/L	0.001	**0.001**			<0.0001	<0.0001	0.0001	<0.0001	***0.0015***	<0.0001	<0.001	0.0002	<0.0001	<0.0001
Magnesium	mg/L	0.2	--			76.6	179	279	NA	NA	NA	200	NA	NA	NA
Manganese	mg/L	0.05	--			0.0073	0.139	0.199	NA	NA	NA	0.26	NA	NA	NA
Mercury	mg/L	0.0001	**0.0005**			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum	mg/L	0.005	**0.04**			0.0006	0.0005	0.0011	<0.0005	<0.0025	0.0011	<0.005	0.0012	0.0032	0.0017
Nickel	mg/L	0.005	**0.025**			0.001	0.003	0.003	0.003	0.007	0.003	0.008	0.004	0.005	0.004
Potassium	mg/L	0.2	--			11.2	18.1	34.7	NA	NA	NA	26	NA	NA	NA
Selenium	mg/L	0.005	**0.1**			<0.001	0.035	0.004	0.025	0.017	0.009	<0.1	0.033	0.002	0.008
Silver	mg/L	0.001	**0.0001**			<0.0001	***0.0002***	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sodium	mg/L	0.2	--			533	1470	2230	NA	NA	NA	1600	NA	NA	NA
Thallium	mg/L	0.001	**0.0003**			<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin	mg/L	0.01	--			<0.005	<0.005	<0.005	NA	NA	NA	<0.01	NA	NA	NA
Tungsten	mg/L	0.0001	**0.03**			<0.01	<0.01	<0.01	<0.01	<0.05	<0.01	NA	<0.01	<0.01	<0.01
Uranium	mg/L	0.001	**0.005**			0.0009	0.0005	0.0003	0.0004	0.0011	0.0006	<0.001	0.0011	0.0026	0.0027
Vanadium	mg/L	0.01	**0.006**			0.0009	***0.0102***	***0.0112***	***0.0133***	***0.0057***	***0.0037***	<0.001	<0.0005	***0.014***	***0.0075***
Zinc	mg/L	0.02	**0.03**			0.012	0.006	0.007	0.020	<0.25	<0.005	0.03	0.008	<0.01	<0.01
Zirconium	mg/L	0.001	**0.004**			NA	NA	NA	0.001	<0.005	<0.001	NA	<0.001	<0.001	<0.001

Notes

MDL	Method Detection Limit	NS	Not Sampled
PWQO	Provincial Water Quality Objectives	NM	Not Measured
--	Not Applicable/Not Available/No Value	NA	Not Analysed
Italics	Above PWQO	**BOLD**	Exceeds Trigger Concentration Range

Summary of Field Measurements and Groundwater Analysis - MW11-7

Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Ground Surface Elevation: 48.33 m
Top of PVC Casing Elevation: 49.00 m
Broken spring 2014: 48.965 m
Well Depth: 5.1 m
Type of Monitoring Well: Leakage from lagoon

Parameters	Units	MDL	Trigger Concentration Range	2015 Fall 18-Nov-15	2015 Spring 14-Jul-15	2014 Fall 5-Nov-14	2014 Spring 13-May-14	2013 Fall 20-Nov-13	2013 Spring 31-May-13	2012 Fall 21-Nov-12	2012 Spring 15-May-12	2011 Fall 24-Nov-11	2011 Spring 24-Jun-11
Field Parameters													
Water Level (Below PVC Casing)	m	--		3.585	3.09	3.69	2.93	3.98	3.80	3.895	3.85	4.08	3.64
Water Level Depth	m	--		2.92	2.45	3.02	2.30	3.31	3.13	3.23	3.18	3.41	2.97
Water Level Elevation	m	--		45.42	45.88	45.31	46.04	45.02	45.20	45.11	45.15	44.92	45.36
Conductivity	uS	--		1084	2262	1590	1596	1408	461	1835	1592	3811	1557
Total Dissolved Solids	mg/L	--		540	1120	796	793	717	231	961	796	1777	669
Temperature	^{o}C	--		7.7	10.1	8.9	8.7	5.8	6.46	7.2	10.0	7.1	10.9
pH	unitless	--		6.91	7.68	6.95	6.76	7.21	10.9	6.94	6.64	7.41	6.97
Chemical Analysis													
Alkalinity (Total)	mg/L	5		303	327	NA	NA	NA	NA	NA	NA	NA	NA
Total Kjeldhal Nitrogen	mg/L	0.1	<5.5	0.7	0.9	0.9	1.5	4.4	2.3	1.4	0.9	1.5	9.3
Ammonia	mg/L	0.1	0.06 - 0.44	0.26	NA	0.39	**0.57**	**0.58**	0.43	0.21	0.13	0.29	0.57
Nitrate	mg/L	0.1	2.49 - 8.11	**<0.1**	**0.8**	4.4	6.7	6.0	3.9	5.0	5.6	3.6	10.1
Nitrite	mg/L	0.05	<0.11	<0.05	<0.05	<0.05	<0.05	<0.05	**0.15**	0.17	<0.05	<0.05	<0.05
Chloride	mg/L	1	236 - 504	**84**	**695**	449	***217***	***<1***	370	401	421	339	128
Sulphate	mg/L	1	68 - 81	**33**	72	**101**	**63**	**98**	***67***	73	63	76	78
Total Phosphorus	mg/L	0.01	<7	0.09	0.25	0.32	0.84	5.42	1.77	1.18	0.42	0.81	12.5
Conductivity	uS	5		1690	2940	2110	1340	2560	1830	1900	2080	1740	1210
Total Dissolved Solids	mg/L	10	893 - 1297	***850***	**1530**	1180	**801**	**1420**	1010	1040	1210	1150	755
Biological Oxygen Demand	mg/L	2		<100	<2	3	5	2	2	<2	6	3	18
Metals													
Aluminum	mg/L	0.01	<0.049	0.002	0.004	0.003	0.044	**0.073**	**0.131**	<0.01	<0.001	0.089	<0.001
Antimony	mg/L	0.001		<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Arsenic	mg/L	0.01		<0.001	0.002	0.002	0.001	0.016	0.001	<0.001	0.002	<0.001	<0.001
Barium	mg/L	0.01		0.054	0.073	0.053	NA	NA	NA	0.09	NA	NA	NA
Beryllium	mg/L	0.001		<0.0005	<0.0005	<0.0005	<0.0005	0.0027	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	0.05		0.111	0.114	0.101	0.109	0.105	0.103	0.12	0.111	0.087	0.069
Cadmium	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	0.0006	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcium	mg/L	0.2		66.8	68.4	54.4	NA	NA	NA	86	NA	NA	NA
Chromium	mg/L	0.05		<0.001	0.013	0.028	0.008	0.276	0.002	<0.001	0.013	0.011	0.005
Colbalt	mg/L	0.005		<0.0005	<0.0005	0.0006	0.0006	0.0668	0.0008	0.001	0.0011	0.0067	0.0043
Copper	mg/L	0.005		<0.0005	0.0080	0.0031	0.0048	0.199	0.0044	0.004	0.0045	0.285	0.0037
Iron	mg/L	0.2	<2.972	<0.1	<0.1	<0.1	<0.1	**105**	<0.1	<0.03	<0.1	5.82	<0.1
Lead	mg/L	0.001		<0.0001	<0.0001	0.0001	<0.0001	0.116	<0.0001	<0.001	0.0002	0.0084	<0.0001
Magnesium	mg/L	0.2		35.4	46.5	58.2	NA	NA	NA	42	NA	NA	NA
Manganese	mg/L	0.05		0.162	0.101	0.188	NA	NA	NA	0.21	NA	NA	NA
Mercury	mg/L	0.0001		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum	mg/L	0.005		<0.0005	0.0006	0.001	<0.0005	<0.0025	0.0005	<0.005	0.0007	<0.0005	0.0006
Nickel	mg/L	0.005		0.001	0.003	0.003	0.003	0.166	0.003	<0.005	0.005	0.007	0.006
Potassium	mg/L	0.2		7.97	8.69	8.39	NA	NA	NA	9	NA	NA	NA
Selenium	mg/L	0.005		<0.001	0.008	0.004	0.003	0.005	0.003	<0.005	0.005	0.001	0.002
Silver	mg/L	0.001		<0.0001	0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sodium	mg/L	0.2		214	355	416	NA	NA	NA	249	NA	NA	NA
Thallium	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	0.0012	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin	mg/L	0.01		<0.005	<0.005	<0.005	NA	NA	NA	<0.01	NA	NA	NA
Tungsten	mg/L	0.0001		<0.01	<0.01	<0.01	<0.01	<0.05	<0.01	NA	<0.01	<0.01	<0.01
Uranium	mg/L	0.001		0.0017	0.0018	0.0014	0.0012	0.010	0.0011	0.002	0.0018	0.0033	0.0024
Vanadium	mg/L	0.01		<0.0005	0.0096	0.0084	0.0088	0.233	0.0031	<0.001	0.0031	0.0247	0.0103
Zinc	mg/L	0.02		0.012	0.010	0.006	0.033	0.185	0.009	0.01	0.011	<0.01	<0.01
Zirconium	mg/L	0.001		NA	NA	NA	<0.001	0.014	<0.001	NA	<0.001	<0.001	<0.001

Notes

MDL Method Detection Limit
PWQO Provincial Water Quality Objectives
-- Not Applicable/Not Available/No Value
NS Not Sampled
NM Not Measured
NA Not Analysed
BOLD Exceeds Trigger Concentration Range

Summary of Field Measurements and Groundwater Analysis - MW11-8

Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Ground Surface Elevation: 51.24 m
Top of PVC Casing Elevation: 52.17 m
Well Depth: 5.1 m
Type of Monitoring Well: Leakage from lagoon

Parameters	Units	MDL	Trigger Concentration Range	2015 Fall 18-Nov-15	2015 Spring 14-Jul-15	2014 Fall 5-Nov-14	2014 Spring 13-May-14	2013 Fall 20-Nov-13	2013 Spring 31-May-13	2012 Fall 21-Nov-12	2012 Spring 15-May-12	2011 Fall 24-Nov-11	2011 Spring 24-Jun-11
Field Parameters													
Water Level (Below PVC Casing)	m	--		3.71	3.83	3.715	3.31	3.69	3.62	3.785	3.48	4.02	3.77
Water Level Depth	m	--		2.78	2.90	2.785	2.38	2.76	2.69	2.855	2.55	3.09	2.84
Water Level Elevation	m	--		48.46	48.34	48.46	48.86	48.48	48.55	48.385	48.69	48.15	48.40
Conductivity	uS	--		1497	1539	1327	1605	1177	278	1391	1056	1455	1318
Total Dissolved Solids	mg/L	--		749	766	663	806	587	137	695	522	726	812
Temperature	°C	--		9.7	10.9	11.2	11.2	10.4	12.5	12.5	10.5	10.3	11.8
pH	unitless	--		6.80	6.72	6.75	6.58	6.84	6.93	6.74	6.52	6.72	6.86
Chemical Analysis													
Alkalinity (Total)	mg/L	5		744	804	NA	NA	NA	NA	NA	NA	NA	NA
Total Kjeldhal Nitrogen	mg/L	0.1	5.5 - 6.9	**8.6**	**11.5**	**8.1**	**7.2**	5.6	**4.9**	6.9	5.1	6.2	6.2
Ammonia	mg/L	0.1	2.6 - 7.1	**10.3**	NA	6.90	5.93	6.27	4.12	5.14	4.58	0.66	5.45
Nitrate	mg/L	0.1	<0.01	**0.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrite	mg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chloride	mg/L	1	63.8 - 86.2	**25**	**94**	85	84	**91**	**91**	76	74	76	53
Sulphate	mg/L	1	82 - 145	**62**	**21**	**46**	**42**	**75**	**75**	73	99	144	128
Total Phosphorus	mg/L	0.01	0.02 - 3.31	0.87	**3.38**	0.12	1.03	0.85	1.16	1.28	2.05	1.02	4.62
Conductivity	uS	5		1560	1710	1500	1490	1430	1390	1450	1460	1570	1190
Total Dissolved Solids	mg/L	10	776 - 1032	808	972	894	850	832	807	844	1060	964	771
Biological Oxygen Demand	mg/L	2		<20	6	5	21	22	<2	2	6	4	11
Metals													
Aluminum	mg/L	0.01	<0.014	0.005	0.002	0.005	0.002	0.003	<0.001	<0.01	<0.001	0.018	<0.001
Antimony	mg/L	0.001		<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Arsenic	mg/L	0.01		<0.001	0.002	0.001	<0.001	<0.005	0.001	<0.005	0.001	0.002	0.002
Barium	mg/L	0.01		0.114	0.112	0.11	NA	NA	NA	0.09	NA	NA	NA
Beryllium	mg/L	0.001		<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	0.05		0.081	0.061	0.076	0.085	0.072	0.07	0.09	0.077	0.083	0.058
Cadmium	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcium	mg/L	0.2		159	145	126	NA	NA	NA	137	NA	NA	NA
Chromium	mg/L	0.05		0.001	0.014	0.009	0.011	0.070	<0.001	<0.001	0.006	0.013	0.007
Colbalt	mg/L	0.005		0.0006	0.0007	0.0007	<0.0005	0.0168	<0.0005	0.0006	0.0005	0.0065	0.001
Copper	mg/L	0.005		<0.0005	0.0020	0.0009	0.0035	0.0664	0.001	0.001	0.0009	0.0016	0.0012
Iron	mg/L	0.2	10.7 - 26.7	24.9	24.0	19.6	13.7	**40.7**	22.9	20.8	16.6	31.3	12.6
Lead	mg/L	0.001		<0.0001	<0.0001	0.0001	<0.0001	0.0123	<0.0001	<0.001	<0.0001	0.0014	<0.0001
Magnesium	mg/L	0.2		60.2	61.7	92.4	NA	NA	NA	64	NA	NA	NA
Manganese	mg/L	0.05		3.22	3.20	3.41	NA	NA	NA	2.4	NA	NA	NA
Mercury	mg/L	0.0001		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum	mg/L	0.005		<0.0005	<0.0005	<0.00005	<0.0005	<0.0025	<0.0005	0.005	<0.0005	<0.0005	0.0009
Nickel	mg/L	0.005		<0.001	0.005	0.004	0.003	0.052	0.003	<0.005	0.004	0.013	0.004
Potassium	mg/L	0.2		10.9	7.51	9.51	NA	NA	NA	9	NA	NA	NA
Selenium	mg/L	0.005		<0.001	0.003	0.001	0.001	<0.005	<0.001	<0.001	0.001	<0.001	0.002
Silver	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sodium	mg/L	0.2		87	79.9	130	NA	NA	NA	92	NA	NA	NA
Thallium	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin	mg/L	0.01		<0.005	<0.005	<0.005	NA	NA	NA	<0.01	NA	NA	NA
Tungsten	mg/L	0.0001		<0.01	<0.01	<0.01	<0.01	<0.05	<0.01	NA	<0.01	<0.01	<0.01
Uranium	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	0.0015	<0.0001	<0.001	<0.0001	0.0002	0.0008
Vanadium	mg/L	0.01		0.0028	0.0286	0.0238	0.0242	0.0692	0.0082	0.003	0.0043	0.0376	0.0157
Zinc	mg/L	0.02		0.013	0.009	0.006	0.050	0.072	0.011	0.01	0.011	0.011	<0.01
Zirconium	mg/L	0.001		NA	NA	NA	<0.001	0.011	<0.001	NA	<0.001	0.001	<0.001

Notes

MDL Method Detection Limit
PWQO Provincial Water Quality Objectives
-- Not Applicable/Not Available/No Value
NM Not Measured
NA Not Analysed
BOLD Exceeds Trigger Concentration Range
NS Not Sampled

Summary of Field Measurements and Groundwater Analysis - MW11-9

Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Ground Surface Elevation: 52.58 m
Top of PVC Casing Elevation: 53.43 m
Well Depth: 6.6 m
Type of Monitoring Well: Leakage from lagoon

Parameters	Units	MDL	Trigger Concentration Range	2015 Fall 18-Nov-15	2015 Spring 14-Jul-15	2014 Fall 5-Nov-14	2014 Spring 13-May-14	2013 Fall 20-Nov-13	2013 Spring 31-May-13	2012 Fall 21-Nov-12	2012 Spring 15-May-12	2011 Fall 24-Nov-11	2011 Spring 24-Jun-11
Field Parameters													
Water Level (Below PVC Casing)	m	--		4.17	4.20	4.25	3.91	4.22	3.98	4.275	3.54	4.40	4.61
Water Level Depth	m	--		3.32	3.35	3.4	3.06	3.37	3.13	3.425	2.69	3.55	3.76
Water Level Elevation	m	--		49.26	49.23	49.18	49.52	49.21	49.45	49.16	49.89	49.03	48.83
Conductivity	uS	--		360	408	327	578	293	329	369	626	554	948
Total Dissolved Solids	mg/L	--		181	203	163	318	147	162	184	316	274	441
Temperature	°C	--		8.6	9.4	10.2	7.0	9.7	10.0	10.6	8.7	9.2	9.1
pH	unitless	--		7.37	6.93	7.57	7.15	7.16	6.97	7.08	6.42	6.69	7.05
Chemical Analysis													
Alkalinity (Total)	mg/L	5		86	87	NA	NA	NA	NA	NA	NA	NA	NA
Total Kjeldhal Nitrogen	mg/L	0.1	<21.2	0.6	0.5	0.6	0.46	0.5	0.9	1.6	4.6	9.0	33.2
Ammonia	mg/L	0.1	0.31 - 0.68	**0.23**	NA	**0.15**	**2.0**	**0.21**	**0.28**	0.40	0.70	0.28	0.59
Nitrate	mg/L	0.1	<0.7	<0.1	**1.0**	**0.8**	**3.3**	0.2	**1.3**	0.1	1.3	<0.1	<0.1
Nitrite	mg/L	0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chloride	mg/L	1	<14	**144**	**25**	10	9	9	7	21	7	5	5
Sulphate	mg/L	1	41 - 117	**176**	73	49	88	58	64	70	88	53	141
Total Phosphorus	mg/L	0.01	<26	0.20	0.16	1.09	1.25	0.16	0.24	0.76	5.34	11.7	40.4
Conductivity	uS	5		392	420	366	509	370	382	408	468	534	847
Total Dissolved Solids	mg/L	10	239 - 472	**196**	282	**208**	304	246	**188**	254	350	361	535
Biological Oxygen Demand	mg/L	2		<2	<2	<2	8	<2	<2	<12	11	<60	120
Metals													
Aluminum	mg/L	0.01	0.023 - 0.035	**0.012**	**0.013**	**0.011**	**0.006**	**0.007**	**<0.001**	0.020	0.029	0.030	<0.001
Antimony	mg/L	0.001		<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Arsenic	mg/L	0.01		<0.001	<0.001	<0.001	<0.001	<0.005	<0.001	<0.001	<0.001	0.001	<0.001
Barium	mg/L	0.01		0.034	0.025	0.024	NA	NA	NA	0.03	NA	NA	NA
Beryllium	mg/L	0.001		<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	0.05		0.035	0.026	0.026	0.017	<0.05	0.011	0.03	0.029	0.03	0.024
Cadmium	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	<0.005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcium	mg/L	0.2		36.8	54.8	44	NA	NA	NA	48	NA	NA	NA
Chromium	mg/L	0.05		<0.001	0.005	0.002	0.003	0.009	<0.001	<0.001	0.005	0.04	0.005
Colbalt	mg/L	0.005		0.0008	<0.0005	0.0006	0.0012	0.0026	0.001	0.0008	0.0012	0.0109	0.0025
Copper	mg/L	0.005		<0.0005	0.0029	0.0034	0.0036	0.0075	0.002	0.002	0.0026	0.0447	0.0018
Iron	mg/L	0.2	<11.41	0.712	0.141	0.637	0.860	7.32	2.76	1.56	2.19	20.5	0.66
Lead	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	0.0018	<0.0001	<0.001	0.0001	0.0262	<0.0001
Magnesium	mg/L	0.2		11.9	11.8	12.4	NA	NA	NA	13	NA	NA	NA
Manganese	mg/L	0.05		0.425	0.111	0.158	NA	NA	NA	0.24	NA	NA	NA
Mercury	mg/L	0.0001		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum	mg/L	0.005		0.0005	<0.0005	0.0009	<0.0005	<0.0025	<0.0005	<0.005	<0.0005	<0.0005	0.0026
Nickel	mg/L	0.005		<0.001	0.002	0.002	0.002	0.007	0.001	<0.005	0.002	0.014	0.005
Potassium	mg/L	0.2		3.72	2.95	2.9	NA	NA	NA	3	NA	NA	NA
Selenium	mg/L	0.005		<0.001	0.001	<0.001	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001
Silver	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sodium	mg/L	0.2		21.5	14.9	13.9	NA	NA	NA	12	NA	NA	NA
Thallium	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin	mg/L	0.01		<0.005	<0.005	<0.005	NA	NA	NA	<0.01	NA	NA	NA
Tungsten	mg/L	0.0001		<0.01	<0.01	<0.01	<0.01	<0.05	<0.01	NA	<0.01	<0.01	<0.01
Uranium	mg/L	0.001		<0.0001	<0.0001	<0.0001	0.0001	<0.0005	<0.0001	<0.001	0.0002	0.0027	0.0006
Vanadium	mg/L	0.01		0.0014	0.0053	0.0053	0.0062	0.0141	0.0017	<0.001	0.0023	0.146	0.0107
Zinc	mg/L	0.02		0.016	0.006	0.007	0.035	<0.25	0.007	0.01	0.015	0.024	0.011
Zirconium	mg/L	0.001		NA	NA	NA	<0.001	<0.005	<0.001	NA	<0.001	0.001	<0.001

Notes

MDL Method Detection Limit
PWQO Provincial Water Quality Objectives
-- Not Applicable/Not Available/No Value
BOLD Exceeds Trigger Concentration Range
NS Not Sampled
NM Not Measured
NA Not Analysed

Summary of Field Measurements and Groundwater Analysis - MW11-10

Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Ground Surface Elevation: 51.51 m
Top of PVC Casing Elevation: 52.35 m
Well Depth: 4.3 m
Type of Monitoring Well: Background

Parameters	Units	MDL	Trigger Concentration Range	2015 Fall 18-Nov-15	2015 Spring 14-Jul-15	2014 Fall 5-Nov-14	2014 Spring 13-May-14	2013 Fall 20-Nov-13	2013 Spring 31-May-13	2012 Fall 21-Nov-12	2012 Spring 15-May-12	2011 Fall 24-Nov-11	2011 Spring 24-Jun-11
Field Parameters													
Water Level (Below PVC Casing)	m	--		1.285	1.74	1.18	1.33	1.57	1.98	1.965	1.69	2.17	1.88
Water Level Depth	m	--		0.445	0.90	0.34	0.49	0.73	1.14	1.125	0.85	1.33	1.04
Water Level Elevation	m	--		51.07	50.61	51.17	51.02	50.78	50.37	50.385	50.66	50.18	50.47
Conductivity	uS	--		1664	1851	1615	1793	NM	1559	1669	1568	1677	1704
Total Dissolved Solids	mg/L	--		830	900	808	896	NM	773	832	788	840	849
Temperature	°C	--		9.4	12.3	11.5	9.4	NM	12.9	10.9	10.2	9.0	12.3
pH	unitless	--		7.37	7.10	7.01	6.84	NM	9.61	6.68	6.78	6.92	6.65
Chemical Analysis													
Alkalinity (Total)	mg/L	5		663	360	NA	NA	NA	NA	NA	NA	NA	NA
Total Kjeldhal Nitrogen	mg/L	0.1	0.6 - 0.7	**0.5**	**0.5**	**0.4**	**0.5**	**0.3**	**0.5**	0.6	0.7	0.7	0.6
Ammonia	mg/L	0.1	0.08 - 0.24	0.11	NA	0.14	**0.05**	**0.06**	0.08	0.09	0.26	0.11	0.21
Nitrate	mg/L	0.1	0.1	**1.3**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrite	mg/L	0.05		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chloride	mg/L	1	173 - 262	196	243	202	223	212	**268**	219	298	197	216
Sulphate	mg/L	1	93 - 110	**22**	**153**	**162**	**132**	**130**	109	99	95	104	115
Total Phosphorus	mg/L	0.01	0.35 - 0.95	**0.26**	0.54	0.37	0.44	**0.27**	**0.31**	0.71	0.59	1.08	0.37
Conductivity	uS	5		1820	2030	1890	1900	1710	1930	1840	1980	1830	1580
Total Dissolved Solids	mg/L	10	950 - 1154	1030	**1220**	1140	1030	1030	1030	994	1150	1110	930
Biological Oxygen Demand	mg/L	2		<2	<2	3	15	4	4	<30	8	<2	6
Metals													
Aluminum	mg/L	0.01	0.006 - 0.060	**0.002**	0.006	**0.002**	0.009	0.040	**<0.001**	0.060	0.007	0.033	<0.001
Antimony	mg/L	0.001		<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Arsenic	mg/L	0.01		<0.001	0.002	0.002	0.001	<0.005	0.001	<0.005	0.002	0.003	0.002
Barium	mg/L	0.01		0.036	0.036	0.037	NA	NA	NA	0.05	NA	NA	NA
Beryllium	mg/L	0.001		<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	0.05		0.103	0.134	0.127	0.095	0.100	0.108	0.12	0.113	0.102	0.069
Cadmium	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcium	mg/L	0.2		110	96.6	88.2	NA	NA	NA	95	NA	NA	NA
Chromium	mg/L	0.05		<0.001	0.009	0.007	0.008	0.028	<0.001	<0.001	0.016	0.009	0.007
Colbalt	mg/L	0.005		<0.0005	0.0007	<0.0005	<0.0005	0.0062	<0.0005	0.0004	0.0006	0.0035	0.0012
Copper	mg/L	0.005		<0.0005	0.0061	0.0014	0.0018	0.0172	0.0012	0.001	0.0016	0.0102	0.0016
Iron	mg/L	0.2	<1.173	<0.1	0.194	<0.1	<0.1	**9.71**	<0.1	0.11	<0.1	2.24	<0.1
Lead	mg/L	0.001		<0.0001	<0.0001	<0.0001	0.0002	0.0057	<0.0001	<0.001	<0.0001	0.0038	<0.0001
Magnesium	mg/L	0.2		61.1	69.8	86.7	NA	NA	NA	58	NA	NA	NA
Manganese	mg/L	0.05		0.023	0.275	0.109	NA	NA	NA	0.08	NA	NA	NA
Mercury	mg/L	0.0001		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum	mg/L	0.005		0.002	0.0016	0.0022	0.0020	0.003	0.0019	<0.005	0.0024	0.001	0.0028
Nickel	mg/L	0.005		<0.001	0.004	0.006	0.003	0.019	0.002	<0.005	0.004	0.01	0.004
Potassium	mg/L	0.2		7	7.34	7.68	NA	NA	NA	7	NA	NA	NA
Selenium	mg/L	0.005		<0.001	0.004	0.003	0.003	<0.005	0.003	<0.005	0.004	0.002	0.004
Silver	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sodium	mg/L	0.2		212	280	309	NA	NA	NA	231	NA	NA	NA
Thallium	mg/L	0.001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin	mg/L	0.01		<0.005	<0.005	<0.005	NA	NA	NA	<0.01	NA	NA	NA
Tungsten	mg/L	0.0001		<0.01	<0.01	<0.01	<0.01	<0.05	<0.01	NA	<0.01	<0.01	<0.01
Uranium	mg/L	0.001		0.0100	0.0058	0.0086	0.0096	0.0093	0.0052	0.008	0.0063	0.0088	0.0086
Vanadium	mg/L	0.01		0.0011	0.0152	0.016	0.0148	0.0224	0.0053	0.001	0.0045	0.0211	0.0128
Zinc	mg/L	0.02		0.011	0.007	0.006	0.012	0.029	<0.005	0.01	0.007	0.011	<0.01
Zirconium	mg/L	0.001		NA	NA	NA	<0.001	0.006	<0.001	NA	<0.001	<0.001	<0.001

Notes

MDL Method Detection Limit
PWQO Provincial Water Quality Objectives
-- Not Applicable/Not Available/No Value
[1] [Organic Nitrogen] = [TKN] - [Ammonia]

BOLD Exceeds Trigger Concentration Range
NS Not Sampled

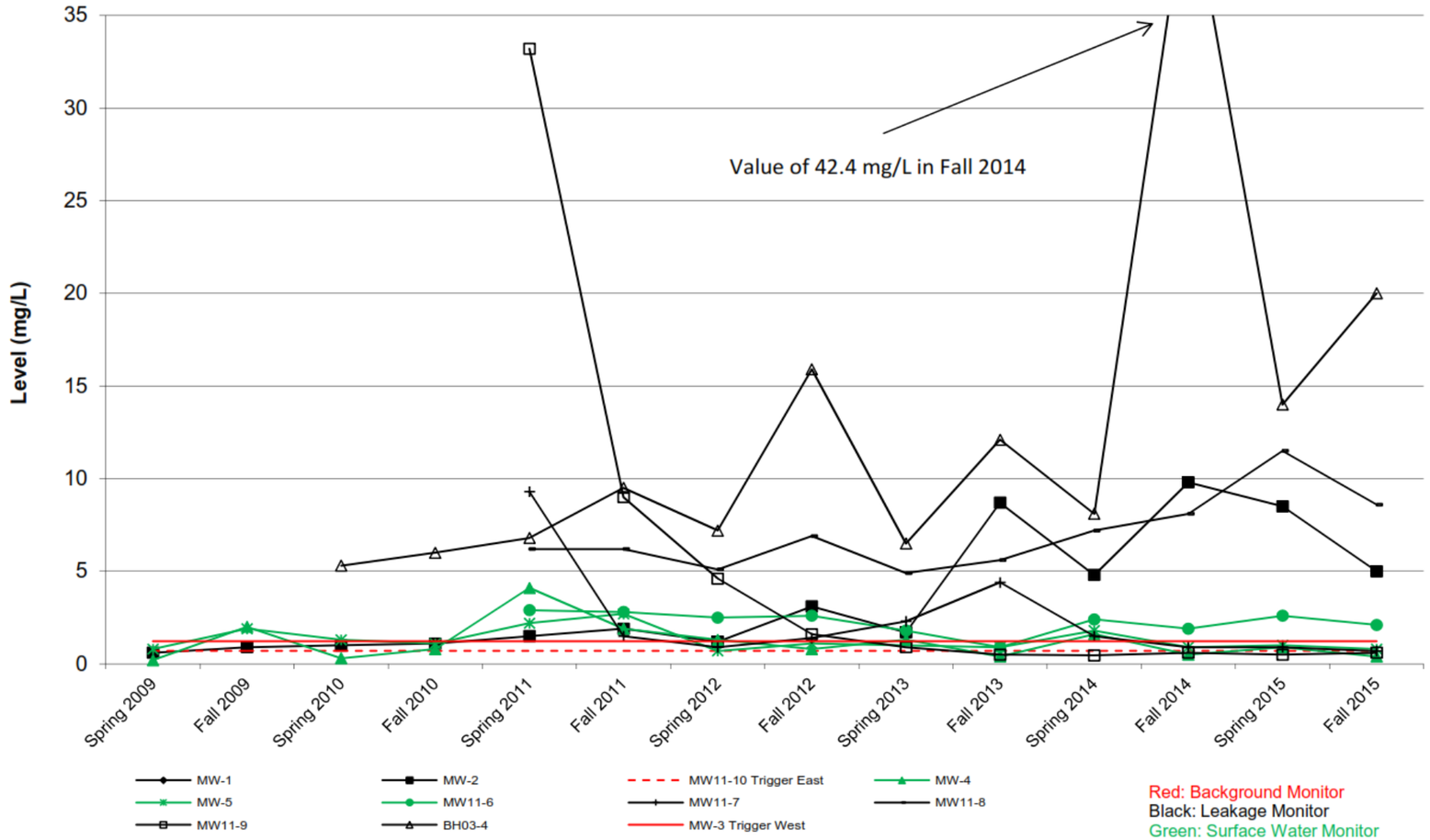
NM Not Measured
NA Not Analysed

APPENDIX G

Groundwater Analysis Summary Charts

Summary of Groundwater Analysis
Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Total Kjeldhal Nitrogen



No.	REVISIONS	BY	DATE
01	ISSUED FOR REVIEW	G.M.	03/04/16

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CLIENT
CITY OF CLARENCE-ROCKLAND

DESIGNED BY:	DRAWN BY:	APPROVED BY:
	G.M.	M.M.

PROJECT
ANNUAL GROUNDWATER MONITORING PROGRAM
CITY OF CLARENCE-ROCKLAND
BIOSOLID STORAGE LAGOONS
2015

DRAWING TITLE
TIME SERIES GRAPH: TKN

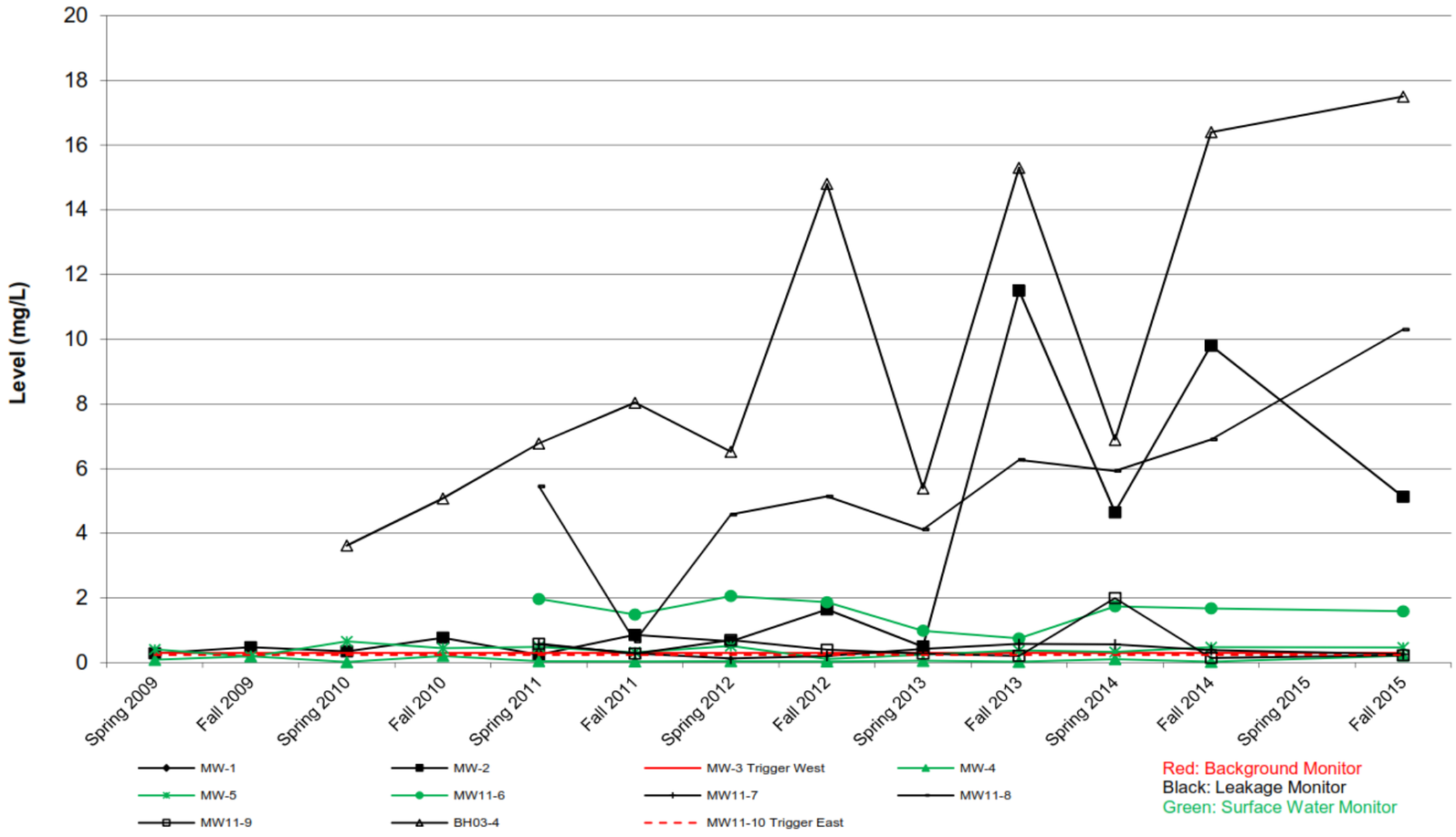
PROJECT NO.
01201-A

DATE
MAR. 4, 2016

CHART 1

Summary of Groundwater Analysis
Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Ammonia



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CITY OF CLARENCE-ROCKLAND
BIOSOLID STORAGE LAGOONS
2015

DRAWING TITLE
TIME SERIES GRAPH: AMMONIA

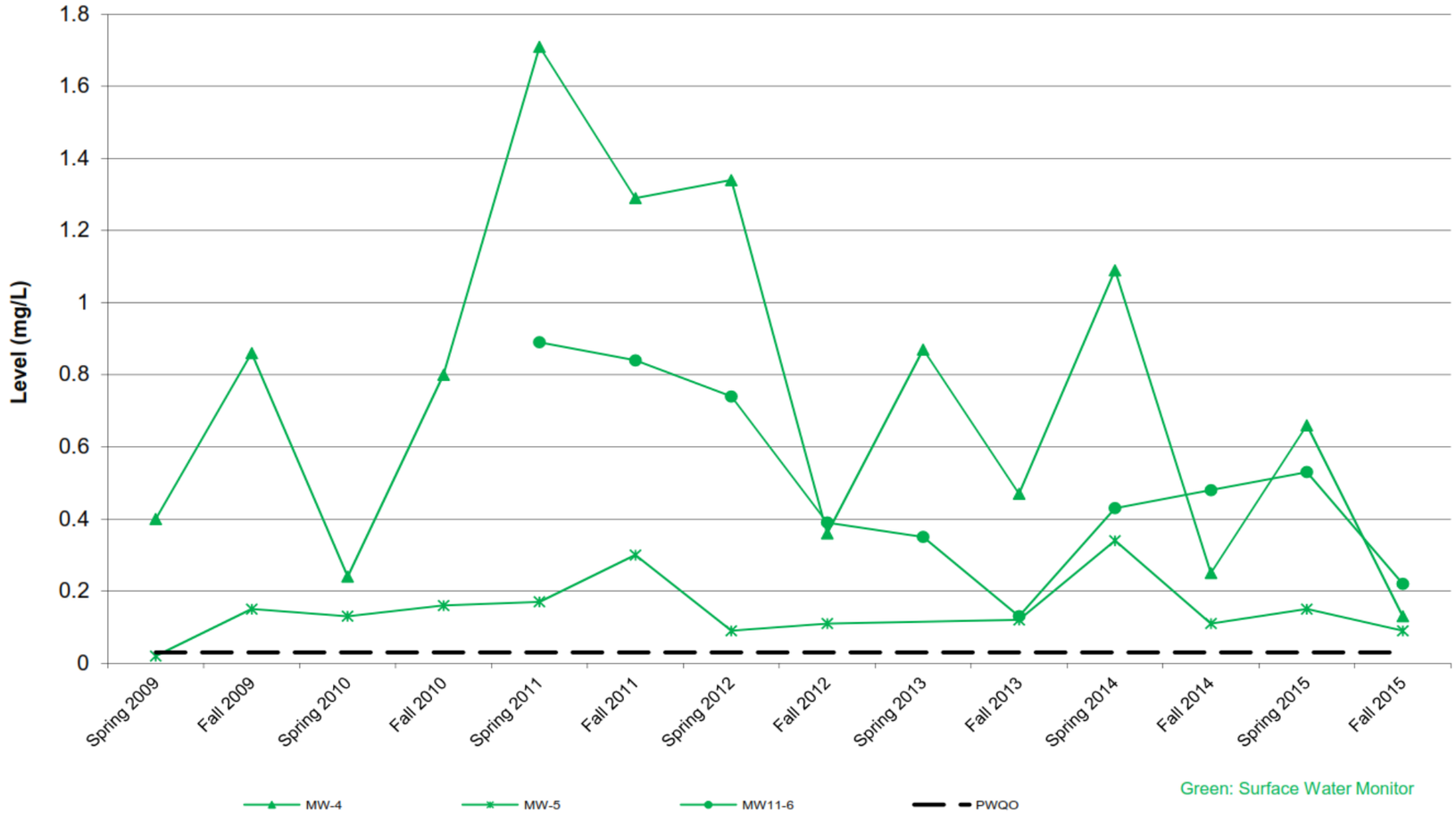
PROJECT NO.
01201-A

DATE
MAR. 4, 2016

CHART 2

Summary of Groundwater Analysis
Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Total Phosphorus
Surface Water Monitors



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	G.M.	M.M.

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CITY OF CLARENCE-ROCKLAND
BIOSOLID STORAGE LAGOONS
2015

DRAWING TITLE
TIME SERIES GRAPH:
TOTAL PHOSPHOROUS
(SURFACE WATER MONITORS)

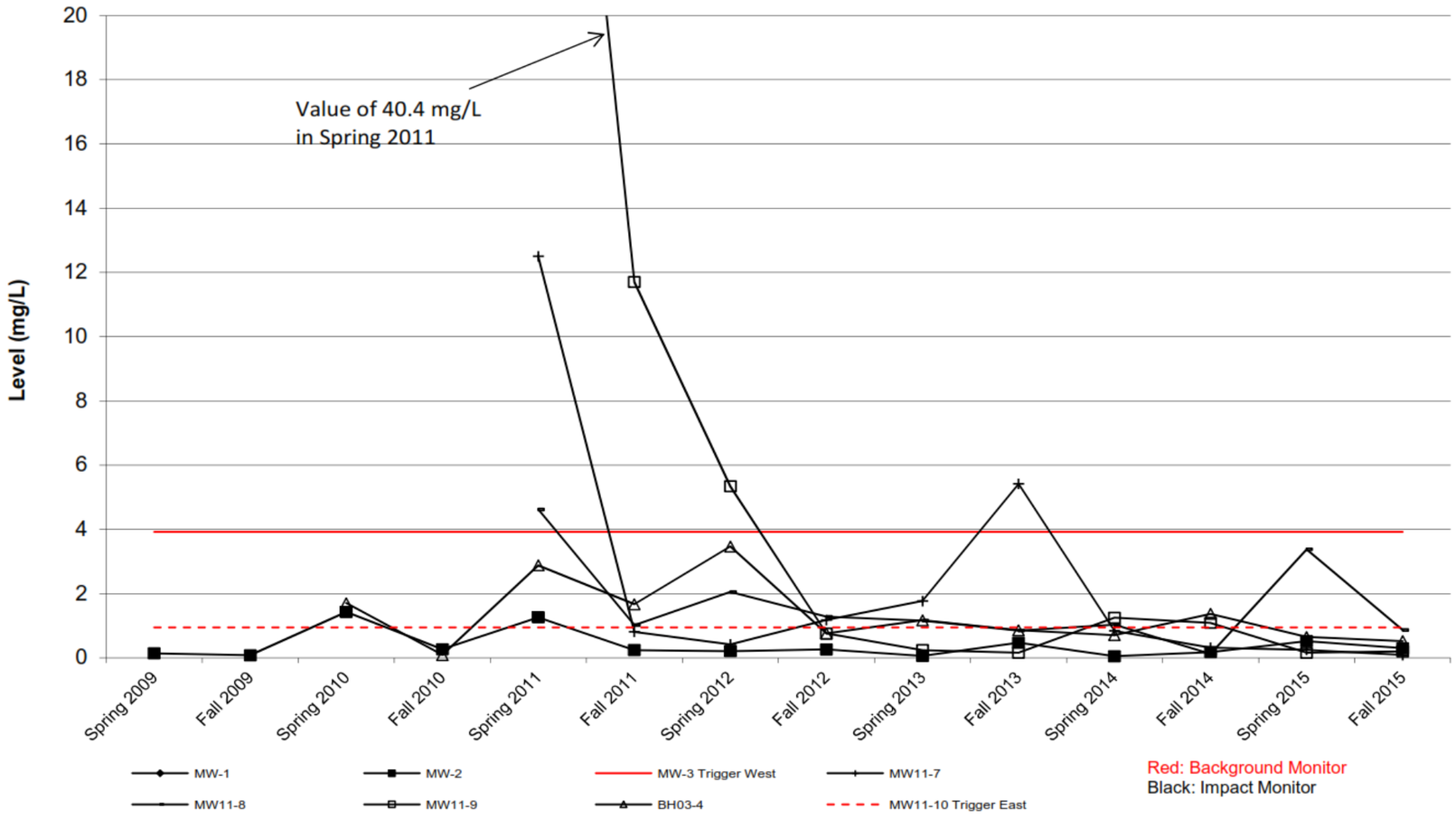
PROJECT NO.
01201-A

DATE
MAR. 4, 2016

CHART 3

Summary of Groundwater Analysis
Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Total Phosphorus
Background and Impact Monitors



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	G.M.	M.M.

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ANNUAL GROUNDWATER MONITORING PROGRAM
CITY OF CLARENCE-ROCKLAND
BIOSOLID STORAGE LAGOONS
2015

DRAWING TITLE
TIME SERIES GRAPH:
TOTAL PHOSPHOROUS
(BACKGROUND AND IMPACT MONITORS)

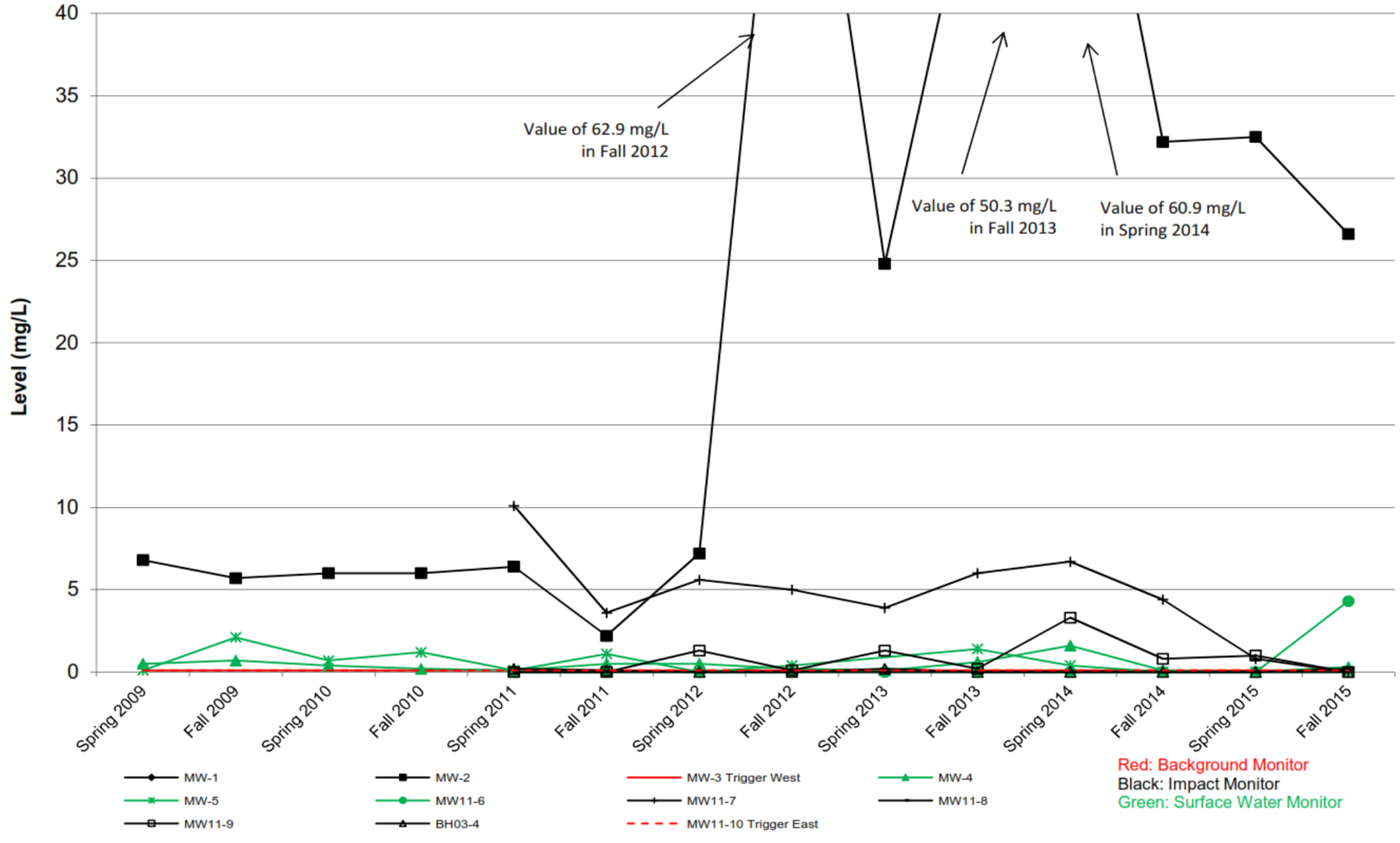
PROJECT NO.
01201-A

DATE
MAR. 4, 2016

CHART 4

Summary of Groundwater Analysis
Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Nitrate



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	G.M.	M.M.

PROJECT
ANNUAL GROUNDWATER MONITORING PROGRAM
CITY OF CLARENCE-ROCKLAND
BIOSOLID STORAGE LAGOONS
2015

DRAWING TITLE
TIME SERIES GRAPH: NITRATE

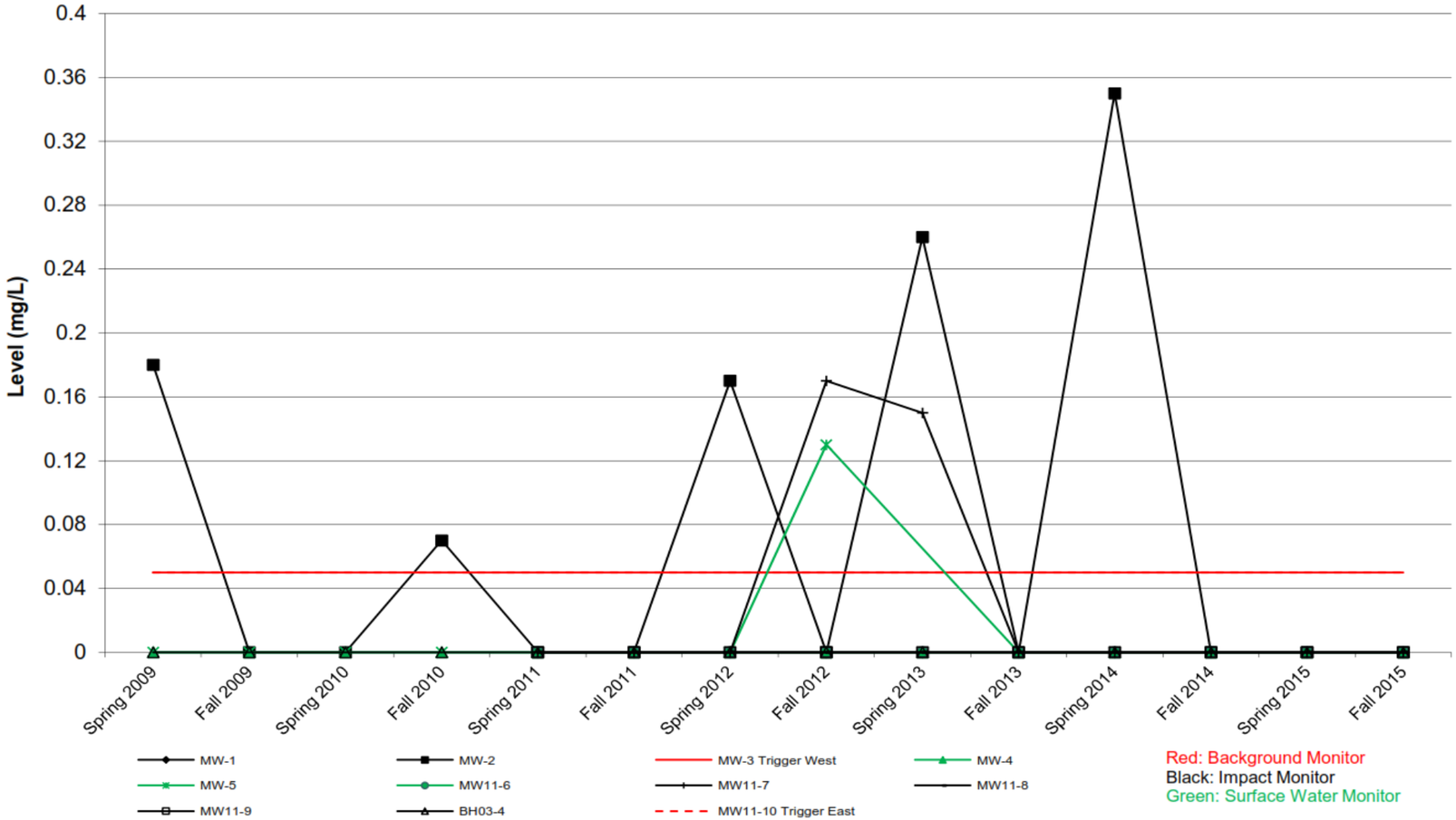
PROJECT NO.
01201-A

DATE
MAR. 4, 2016

CHART 5

Summary of Groundwater Analysis
Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Nitrite



No.	REVISIONS	BY	DATE
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	G.M.	M.M.

PROJECT
ANNUAL GROUNDWATER MONITORING PROGRAM
CITY OF CLARENCE-ROCKLAND
BIOSOLID STORAGE LAGOONS
2015

DRAWING TITLE
TIME SERIES GRAPH: NITRITE

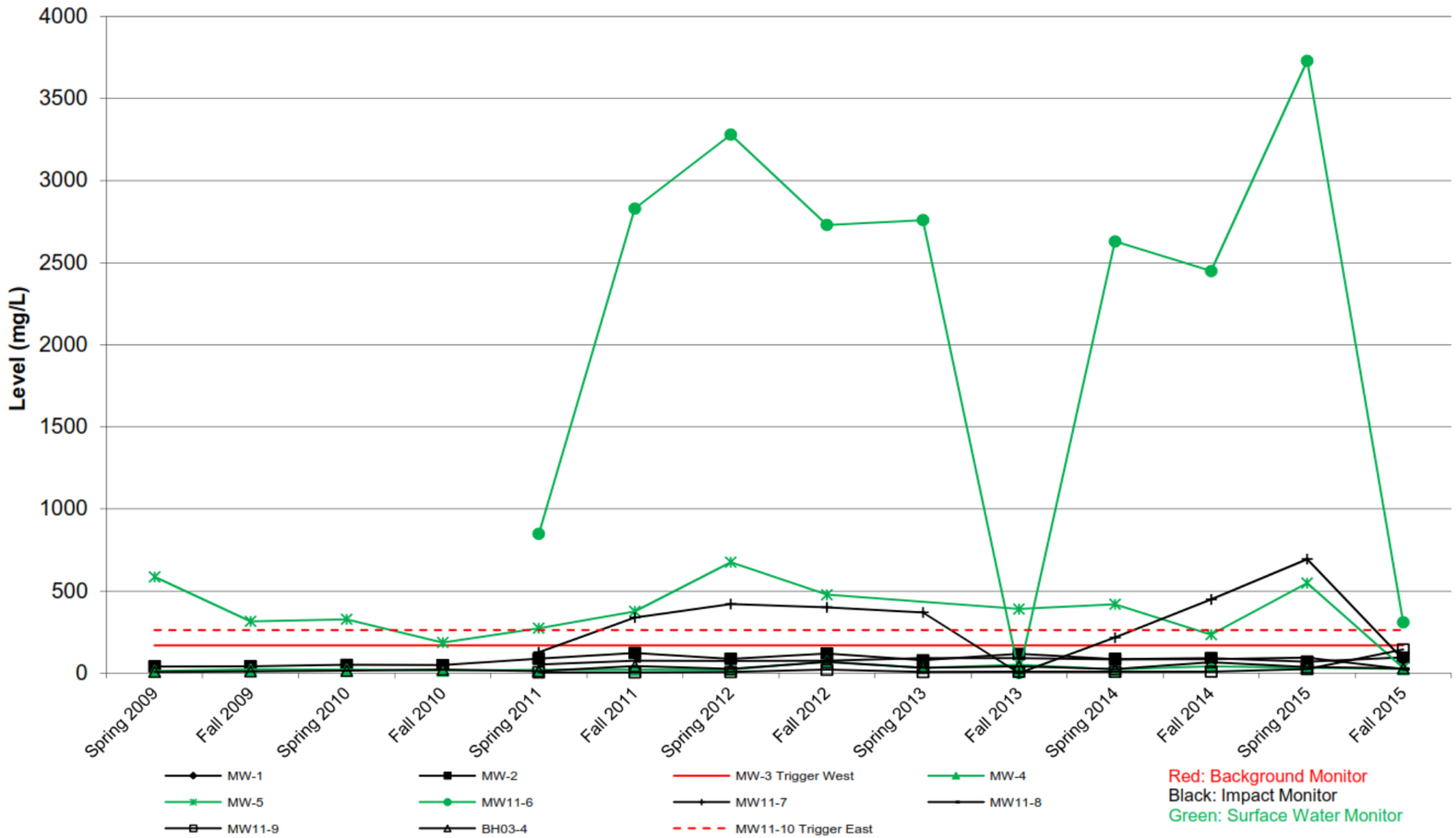
PROJECT NO.
01201-A

DATE
MAR. 4, 2016

CHART 6

Summary of Groundwater Analysis
Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Chloride



No.	REVISIONS	BY	DATE
01	ISSUED FOR REVIEW	G.M.	03/04/16

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CLIENT
CITY OF CLARENCE-ROCKLAND

DESIGNED BY:	DRAWN BY:	APPROVED BY:
	G.M.	M.M.

PROJECT
ANNUAL GROUNDWATER MONITORING PROGRAM
CITY OF CLARENCE-ROCKLAND
BIOSOLID STORAGE LAGOONS
2015

DRAWING TITLE
TIME SERIES GRAPH: CHLORIDE

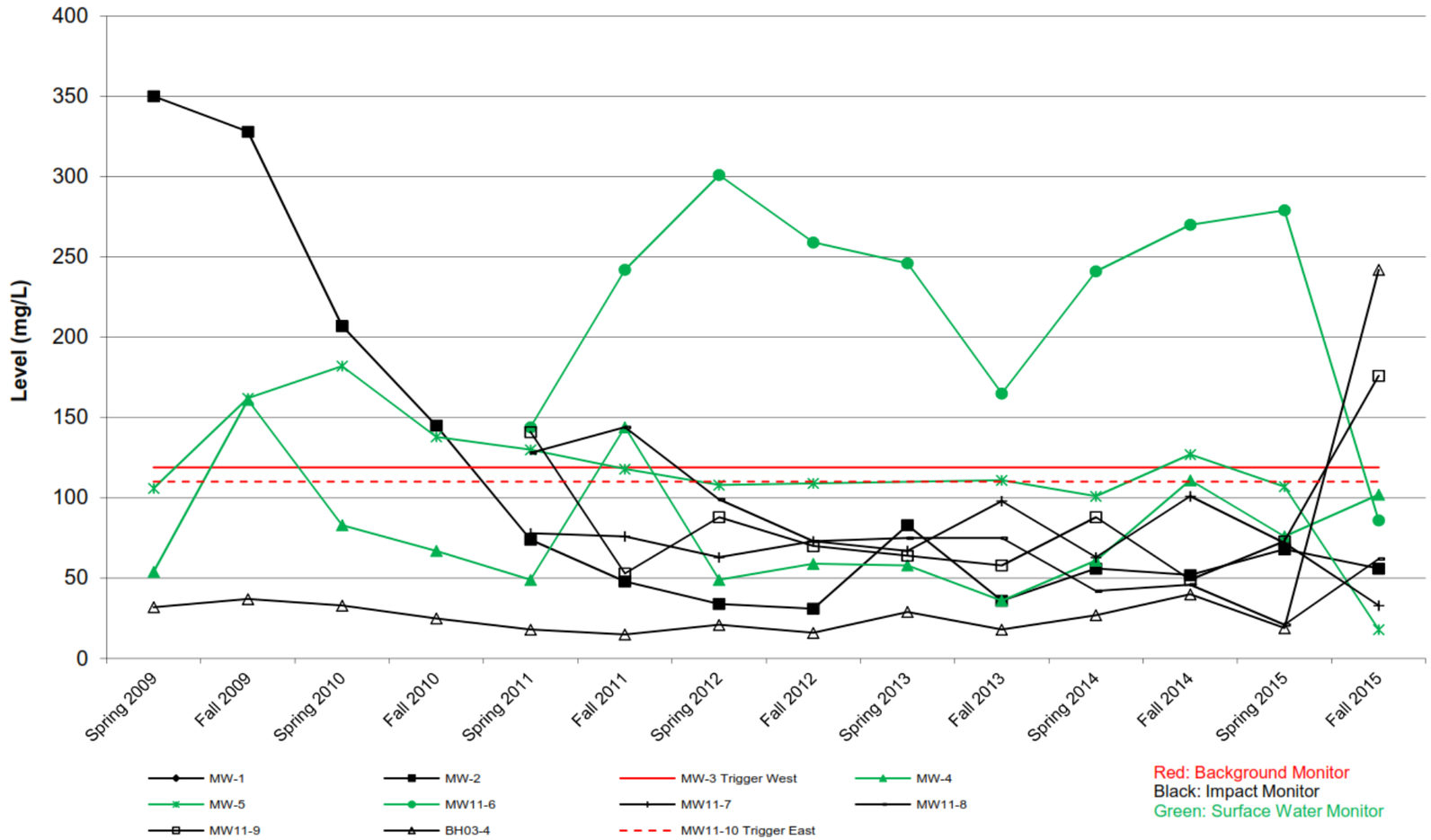
PROJECT NO.
01201-A

DATE
MAR. 4, 2016

CHART 7

Summary of Groundwater Analysis
Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Sulphate



No.	REVISIONS	BY	DATE
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	G.M.	M.M.

PROJECT
ANNUAL GROUNDWATER MONITORING PROGRAM
CITY OF CLARENCE-ROCKLAND
BIOSOLID STORAGE LAGOONS
2015

DRAWING TITLE
TIME SERIES GRAPH: SULPHATE

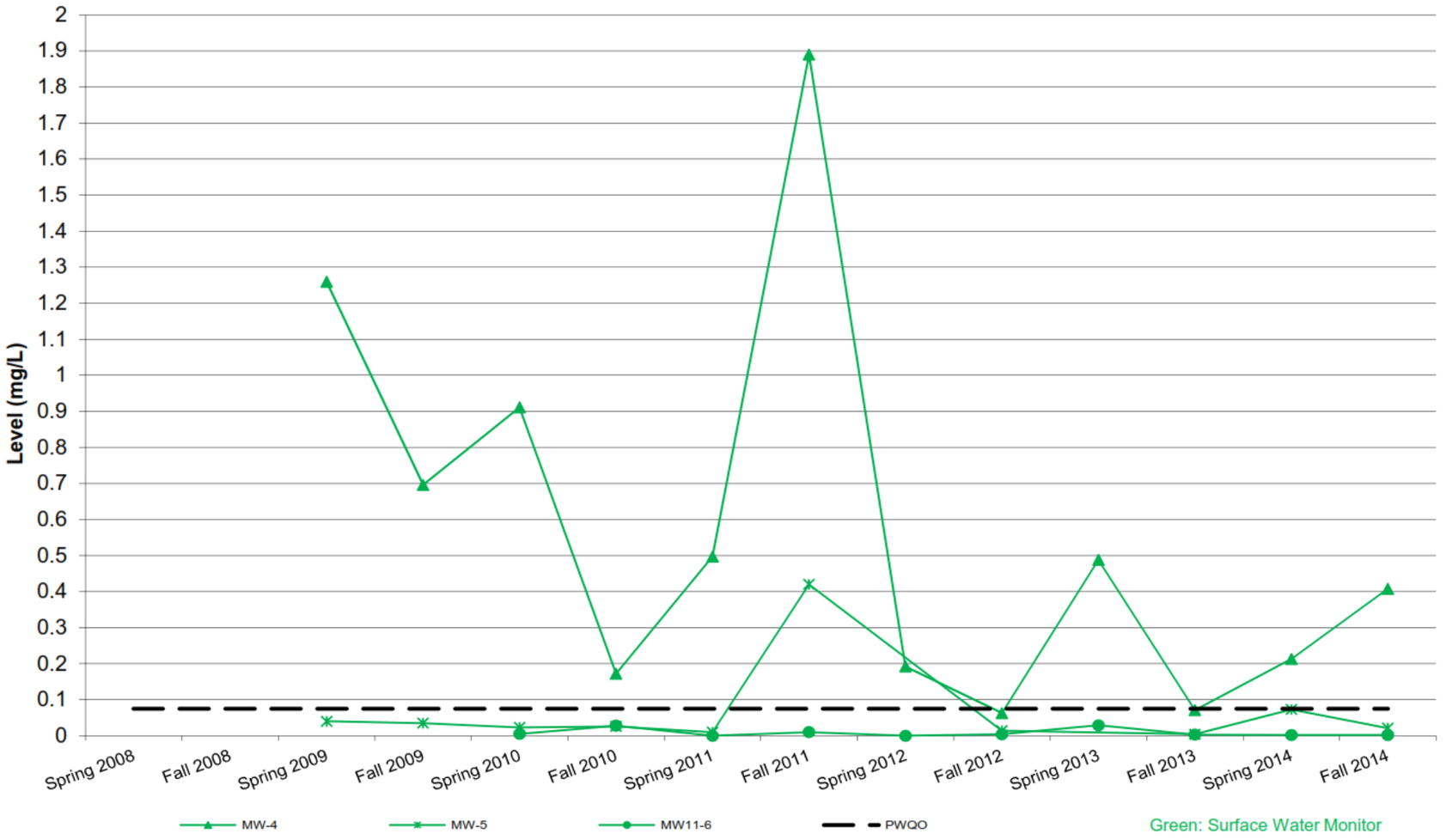
PROJECT NO.
01201-A

DATE
MAR. 4, 2016

CHART 8

Summary of Groundwater Analysis
Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Aluminum
Surface Water Monitors



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01	ISSUED FOR REVIEW	G.M.	03/04/16

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CITY OF CLARENCE-ROCKLAND

DESIGNED BY:	DRAWN BY:	APPROVED BY:
	G.M.	M.M.

PROJECT
ANNUAL GROUNDWATER MONITORING PROGRAM
CITY OF CLARENCE-ROCKLAND
BIOSOLID STORAGE LAGOONS
2015

DRAWING TITLE
TIME SERIES GRAPH:
ALUMINUM
(SURFACE WATER MONITORS)

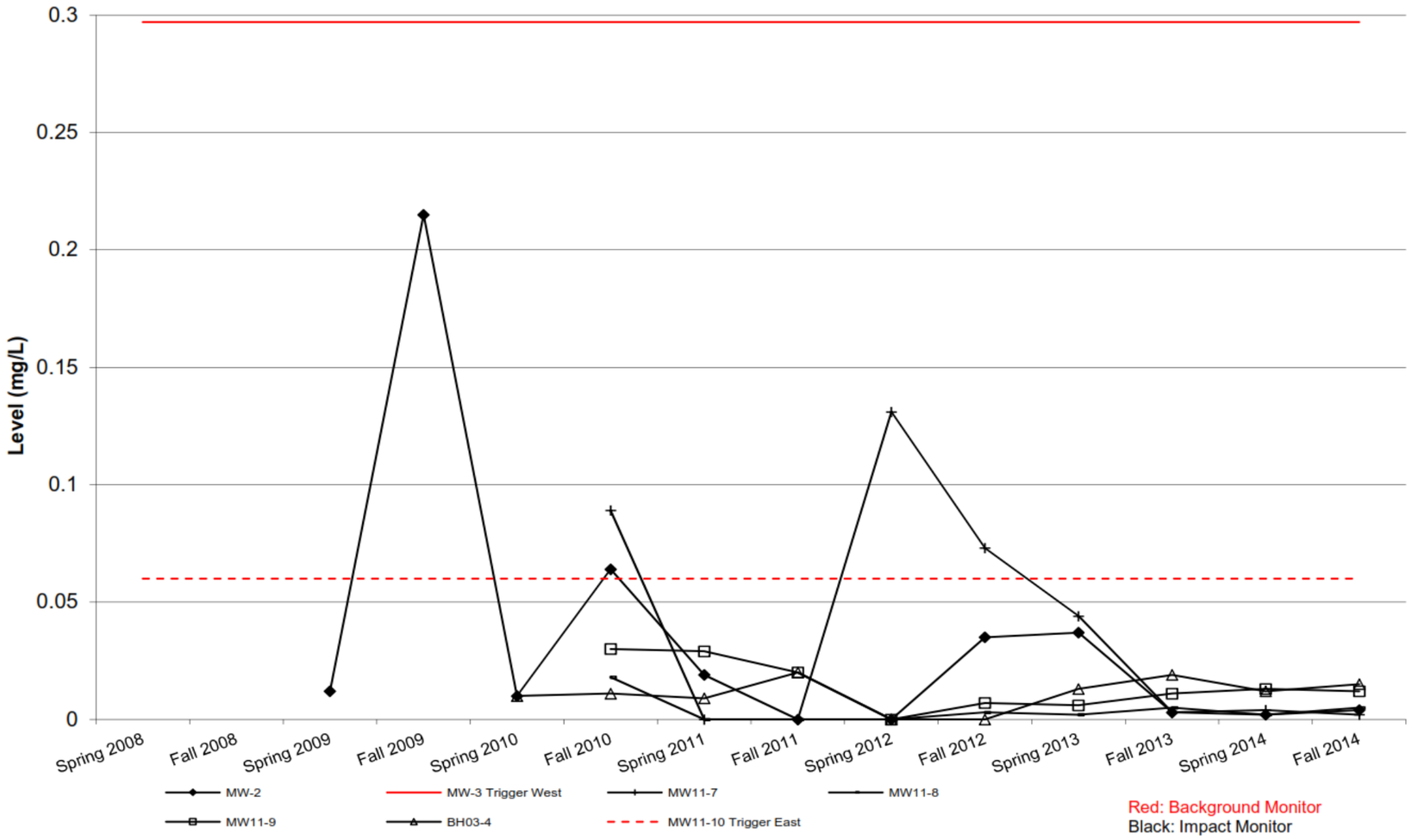
PROJECT NO.
01201-A

DATE
MAR. 4, 2016

CHART 9

Summary of Groundwater Analysis
Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Aluminum



No.	REVISIONS	BY	DATE
01	ISSUED FOR REVIEW	G.M.	03/04/16

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CLIENT
CITY OF CLARENCE-ROCKLAND

DESIGNED BY:	DRAWN BY:	APPROVED BY:
	G.M.	M.M.

PROJECT
ANNUAL GROUNDWATER MONITORING PROGRAM
CITY OF CLARENCE-ROCKLAND
BIOSOLID STORAGE LAGOONS
2015

DRAWING TITLE
TIME SERIES GRAPH: ALUMINUM

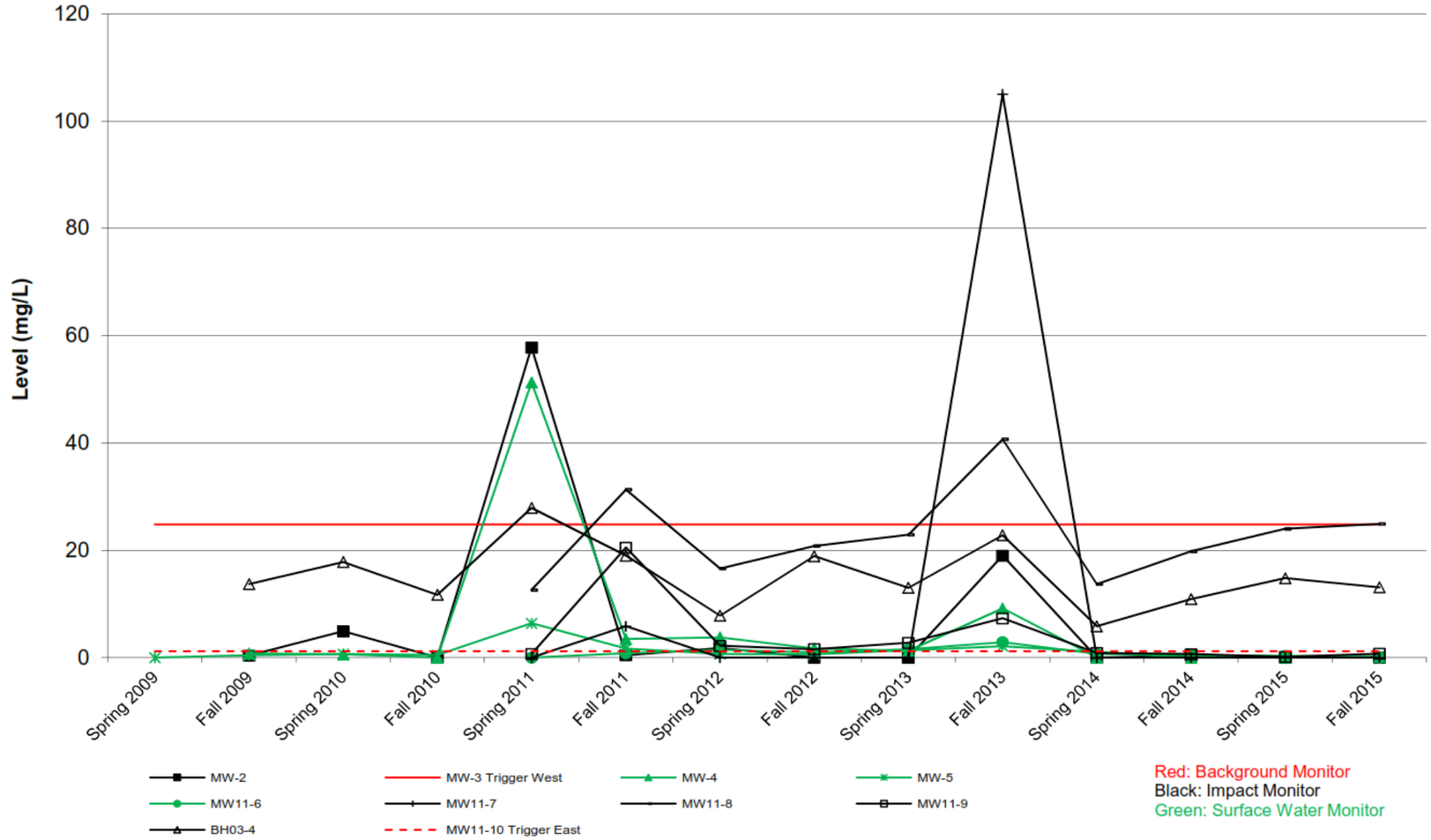
PROJECT NO.
01201-A

DATE
MAR. 4, 2016

CHART 10

Summary of Groundwater Analysis
Groundwater Monitoring Program 2015
City of Clarence-Rockland Biosolids Lagoons
LRL File: 01201-A

Iron



No.	REVISIONS	BY	DATE
01	ISSUED FOR REVIEW	G.M.	03/04/16

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CLIENT
CITY OF CLARENCE-ROCKLAND

DESIGNED BY:	DRAWN BY:	APPROVED BY:
	G.M.	M.M.

PROJECT
ANNUAL GROUNDWATER MONITORING PROGRAM
CITY OF CLARENCE-ROCKLAND
BIOSOLID STORAGE LAGOONS
2015

DRAWING TITLE
TIME SERIES GRAPH: IRON

PROJECT NO.
01201-A

DATE
MAR. 4, 2016

CHART 11

REPORT N° PRO2017-021

Date	02/10/2017
Submitted by	Brian Wilson
Subject	Fire Prevention and Public Education Policy
File N°	Click here to enter text.

1) **NATURE/GOAL :**
That Council determine an acceptable level of service in the provision of fire prevention and public education activities to be conducted by the Clarence-Rockland Fire Department, in accordance with the recommendations from the 2017 Master Fire Plan, and further that this new policy be included as an appendix to a revised Establishing and Regulating By-law.

2) **DIRECTIVE/PREVIOUS POLICY :**
None.

3) **DEPARTMENT'S RECOMMENDATION :**
THAT the Committee of the Whole recommends that Council approve the attached CRFD Fire Prevention and Public Education Policy as the established level of service for the Clarence-Rockland Fire Department; and

FURTHER THAT Council direct Administration to include the attached Fire Prevention and Public Education Policy in a revised Establishing and Regulating By-law.

QUE le Comité plénier recommande que le Conseil approuve la politique du service d'incendie sur la prévention et d'éducation publique en tant que niveau de service établi pour le service des incendies de Clarence-Rockland; et

QUE le conseil mandate l'administration d'inclure la politique du service d'incendie sur la prévention et d'éducation publique ci-jointe sous une révision du Règlement sur l'établissement et la réglementation d'un service d'incendie.

4) **BACKGROUND :**
The Fire Protection and Prevention Act, 1997 (FPPA), requires that a municipality "establish a program in the municipality which must include public education with respect to fire safety and certain components of fire prevention."

In the early implementation of the inspection requirements under the FPPA, inspections were only required upon complaint or request,

although many municipalities opted to provide routine inspections in an effort to improve life safety by removing or reducing fire risks through fire code enforcement.

The Ontario Government released Public Fire Safety Guideline # PFSG 04-45-12 in 2004, providing background information on Fire Prevention Policies, and identified that such a policy should be developed to establish: levels of service; types of activities and programs; and, responsibilities of personnel.

In 2013, Ontario Regulation 364/13 was passed, which established mandatory inspections of care occupancies, care and treatment occupancies, and retirement homes. This increased requirement led to Council approving the hiring of a full-time employee who was tasked with conducting these mandatory fire and life safety inspections of such properties within Clarence-Rockland in addition to delivering public education programs to various audiences, while also augmenting daytime responses to emergency incidents. This function is currently performed by the Division Chief of Fire Prevention and Public Education.

In the 2017 Master Fire Plan, a number of shortcomings were noted in regards to fire prevention and public education activities within Clarence-Rockland. This was in large part attributed to a lack of an established level of service, or fire prevention policy. One of the recommendations of the 2017 Master Fire Plan was to seek Council approval of a Fire Prevention Policy establishing a level of service expectation for the fire department, and to include this policy as an appendix to a revised Establishing and Regulating By-law.

5) **DISCUSSION :**

To meet the statutory requirements of the Fire Protection and Prevention Act, and to meet industry accepted best practices, it has become necessary for the Clarence-Rockland Fire Department to establish a Fire Prevention and Public Education Policy, which should be attached to a revised Establishing and Regulating By-law to establish an expected level of service within the community.

Based on current staffing levels, it is anticipated that the Department can substantially increased the number of preventative fire and life safety inspections conducted throughout the municipality, with the intended goal of reducing the likelihood of a fire occurring, and/or reducing the impact of a fire should one occur. This is done through Fire Code education and enforcement to responsible parties (usually property owners, but in some cases tenants, and in some cases both).

In reviewing the 2017 Master Fire Plan, along with information obtained from Fire Underwriters Survey, and comparing it to property numbers within Clarence-Rockland, the Fire Department hereby proposes the following inspection frequency for properties within the municipality.

Occupancy Class.	Description	Current Freq.	FUS Freq.	MFP Freq.	CRFD Policy Frequency
A1	**Assembly Occupancies** (theatres)	Complaint or Request	6 mos.	Annual	Annual
A2	**Assembly Occupancies** (schools, community halls, other)	Complaint or Request	6 mos.	Annual	Annual
A3	**Assembly Occupancies** (arenas, pools, rinks)	Complaint or Request	6 mos.	Annual	Annual
A4	**Assembly Occupancies** (open air – bleachers, grandstand, other)	Complaint or Request	6 mos.	Annual	Annual
B1	**Detention Occupancies** (police stations)	Complaint or Request	6 mos.	Annual	Annual
B2	**Care and Treatment Occupancies** (nursing homes, long-term care)	Annual	6 mos.	Annual	Annual
B3	**Care Occupancies** (residential care, group homes, etc.)	Annual	6 mos.	Annual	Annual
C	**Residential Occupancies** (houses, apartments, residences, shelters)	Complaint or Request	6 mos.	Smoke / 1 – 2 yrs.	Smoke / Annual
D	**Business and Personal Services Occupancies** (banks, medical offices, offices)	Complaint or Request	12 mos.	3 yrs.	2 yrs.
E	**Mercantile Occupancies** (stores)	Complaint or Request	12 mos.	3 yrs.	2 yrs.
F1	**High-Hazard Industrial Occupancies** (grain elevators, spray painting, feed mills)	Complaint or Request	3 mos.	3 yrs.	Annual
F2	**Medium-Hazard Industrial Occupancies** (repair garages, service stations, tire storage, warehouses)	Complaint or Request	6 mos.	3 yrs.	Annual

F3	**Low-Hazard Industrial Occupancies** (creameries, parking garages, power plants)	Complaint or Request	6 mos.	3 yrs.	Annual

Further, the department proposes an active pursuit of engaging school-aged children with public education programs, with an effort to engage all classrooms for grades 1-6 every year. This is a lofty goal, and would be implemented on a trial basis for the 2018 year, and if successful would be continued. If this goal cannot be met, it is proposed that at a minimum, the Fire Department should engage with all Grade 1, Grade 3, and Grade 6 classes in order to provide key messaging appropriate to each age category.

These public education activities are intended to compliment the other activities which are already ongoing within the department and are outlined in the attached Fire Prevention and Public Education Policy document.

Once this policy is approved in principal by Municipal Council, it will be included as an Appendix to a revised Establishing and Regulating By-law, to be brought forward for Council's consideration in the fall of 2017.

6) **CONSULTATION:**
None.

7) **RECOMMENDATIONS OR COMMENTS FROM COMMITTEE/ OTHER DEPARTMENTS :**
None.

8) **FINANCIAL IMPACT (expenses/material/etc.):**
None. It is anticipated that all costs associated with this program will be absorbed within the current operating budget.

9) **LEGAL IMPLICATIONS :**
This meets and/or exceeds the recommendations in the 2017 Master Fire Plan, and also exceeds the basic requirements under the Fire Protection and Prevention Act, and the corresponding Public Fire and Life Safety Guidelines.

10) **RISK MANAGEMENT :**
Improving fire prevention and public life safety education initiatives has long been proven to reduce the impact of fires in communities. By improving these programs, it is expected to lower the impact of fires in the municipality.

11) **STRATEGIC IMPLICATIONS :**

As noted above, this initiative will improve overall life safety for residents, property owners, and visitors to our municipality.

12) **SUPPORTING DOCUMENTS:**
2017 Master Fire Plan (Pgs. 88-89, 94)
Public Fire Safety Guideline 04-40-12 – Selection of Appropriate Fire Prevention Programs
Public Fire Safety Guideline 04-45-12 – Fire Prevention Policy

Schedule 'A'

To By-law No. 2017-XX

Clarence-Rockland Fire Department Fire Prevention Policy

INDEX

FIRE PREVENTION POLICY

1.0 PURPOSE

1.01 To establish policies and procedures for fire department personnel for fire prevention and public education programs and activities as a primary means of protecting lives and property from fire.

1.02 To maintain compliance with the fire prevention and public education activities as required by the Fire Protection and Prevention Act 1997, c. 4, as amended (FPPA).

2.0 GENERAL

2.01 This Fire Prevention Policy has been reviewed and approved by the Municipal Council of the City of Clarence-Rockland on ***[insert date here]***, and is applicable in its entirety for the whole municipality.

2.02 The Clarence-Rockland Fire Department, being duly appointed by Municipal Council shall report to the Fire Chief and will be responsible for the administration and delivery of all of the fire prevention activities, programs and to fulfill the requirements of this Fire Prevention Policy.

2.03 The Fire Chief, and or his/her designate, shall report to Municipal Council on all Fire Prevention activities, inclusive of but not limited to, public education programs, inspection programs, fire investigations, recommendations or changes to any programs, as applicable, and any changes to the Simplified Risk Assessment for the City of Clarence-Rockland, monthly and/or upon request.

3.0 FIRE PREVENTION RECORDS KEEPING AND RISK ASSESSMENT

3.01 Current records relating to all fire prevention activities and public education programs must be prepared and retained. These records include:

- Emergency response statistics using the current Office of the Fire Marshal Standard Incident Report;
- Fire Investigations;
- Fire prevention inspection program that includes complaints, requests, mortgage and resale, licensing, and other inspection types;
- Home inspection program;

- Smoke alarm program;
- Carbon monoxide alarm program;
- Distribution of Public Fire Safety information and media releases;
- Public displays, fire station tours, etc.;
- Lectures, demonstrations, presentations to the public;
- Simplified risk assessment and other needs analysis processes containing a current community profile identifying current public education and prevention needs.

4.0 RISK ASSESSMENT

4.01 The simplified risk assessment will be reviewed annually and updated as required, with programs modified as appropriate to best meet the needs of the community.

5.0 PUBLIC EDUCATION PROGRAMS

5.01 The Clarence-Rockland Fire Department, will provide fire prevention education programs within the community in accordance with the priorities identified in the community's simplified risk assessment priority setting worksheet, that may include; but are not limited to:

- Older and Wiser Program (fire safety program for older adults);
- Get Out Alive Program (community smoke alarm program);
- TAPP-C Program (The Arson Prevention Program for Children);
- Fire Extinguisher Training Program;
- Kitchen Care Program; and,
- The Safe Student Accommodation Program

5.02 In addition to these programs, public education initiatives targeted at specific work groups shall be provided based on building occupancy types as outlined below:

PUBLIC EDUCATION SCHEDULE

OCCUPANCY TYPE	**FREQUENCY**
Assembly Occupancies (A)	***Every 1 – 2 Years***
(e.g. School, Recreation Centers (Arenas), Curling/Golf Centers, Licensed Premises, Nursery/Day Care Facilities, Churches)	
Care and/or Detention Occupancies (B)	***Every 1 – 2 Years***
(e.g. Nursing Homes, Homes for Special Care, Retirement Homes, Police Stations)	
Residential (C)	***(See Below)***
Apartments / Condos (supervisory staff)	Every 1 – 2 Years
Single Family Homes / Apartments	Every 10 Years (Smoke /CO alarm)
Hotels/Motels	Every 1 – 2 Years
Dormitories	Every 1 – 2 Years
Business or Mercantile (D & E)	***Upon request***
(e.g. Stores, Shops, Banks, Offices, Medical Centres)	
Industrial (F)	***Every 3 – 4 Years***
(e.g. Factories, Complexes, Repair Garages)	
Others	***Upon request***
(e.g. any other group or event not covered above)	

5.03 In addition to these programs, social, service and special interest groups may request and/or the Clarence-Rockland Fire Department may initiate and provide fire safety related presentations, demonstrations, tours of fire stations, specific program courses for clubs, cubs, guides, babysitters, and fire safety orientation for boarding, rooming and lodging occupancies and employee fire safety/emergency procedures education.

5.04 Appropriate fire safety education materials, and voice and print media public service announcements will be distributed in an effective manner to address fire and safety issues and concerns based upon local needs and circumstances (utilization of OFM public education inclusive of seasonal messages and media resources)

5.05 Evaluations of the effectiveness of fire prevention programs are essential to ensure the most appropriate use of the community's resources. Regular evaluation of the effectiveness of all fire prevention and public education programs will be an on-going function for the Clarence-Rockland Fire Department.

6.0 INSPECTIONS AND ENFORCEMENT

6.01 Fire Life Safety Inspections are to be conducted for all complaints received by the fire department containing reports of potential Fire Code violations and/or potential fire hazards, and for all requests for inspections to assess fire safety.

6.02 Where the fire department receives a complaint regarding fire and life safety concerns about any premise or building in the municipality, the inspection shall be given priority, and conducted as soon as practical under authority of the Fire Protection and Prevention Act regardless of the frequency established in this Fire Prevention Policy.

6.03 It is the objective of the Clarence-Rockland Fire Department to conduct fire prevention inspections of occupancies at the frequency indicated below:

FIRE PREVENTION INSPECTION SCHEDULE

OCCUPANCY TYPE	**FREQUENCY**
Assembly Occupancies (A)	***Annually***
(e.g. School, Recreation Centers (Arenas), Curling/Golf Centers, Licensed Premises, Nursery/Day Care Facilities, Churches)	
Care and/or Detention Occupancies (B)	***Annually***
(e.g. Nursing Homes, Homes for Special Care, Retirement Homes, Police Stations)	
Residential (C)	***(See Below)***
Apartments / Condos (common areas)	Annually
Single Family Homes / Apartments	Every 10 Years (Smoke /CO alarm)
Hotels/Motels	Annually
Dormitories	Annually
Business or Mercantile (D & E)	***Every 2 Years***
(e.g. Stores, Shops, Banks, Offices, Medical Centres)	
Industrial (F)	***Annually***
(e.g. Factories, Complexes, Repair Garages)	

6.04 Additional Fire Prevention Inspections may be conducted of any occupancy or building as deemed necessary to address the needs and circumstances of the community or a targeted risk.

6.05 Where a fire has occurred, the Clarence-Rockland Fire Department may inspect the property to ensure compliance with the Ontario Fire Code or any provisions under the Fire Protection and Prevention Act.

6.06 Appropriate action will be taken to ensure the elimination of serious fire hazards, immediate threats to life from fire, and to enforce the Fire Code under the authority and in accordance with the provisions outlined in the Fire Protection and Prevention Act.

7.0 COMPLIANCE STRATEGIES FOR SMOKE ALARMS

7.01 As a result of many recent fire tragedies in Ontario, and through recommendations from the Office of the Fire Marshal, the Clarence-Rockland Fire Department will adopt a zero tolerance approach, under certain circumstances, when it comes to enforcing Fire Code smoke alarm requirements. The following compliance and enforcement strategies shall be utilized as part of the zero tolerance approach:

- ***Fire Department Emergency Response:*** In situations where the Fire Department has responded to a residential dwelling, a check to ensure the home is in compliance with the Fire Code will be made. In situations where a fire has occurred and lives have been put at risk, a warning to the homeowner may not be sufficient if the home is not in compliance with the requirements. In these situations the Fire Department may choose to issue a ticket under Part I of the Provincial Offences Act (POA) or lay an information under Part III of the POA and pursue a fine higher than allowed for the ticket;

- ***Enforcement Strategies for Homeowners:*** Whenever a home is found to be non-compliant with the Fire Code smoke and carbon monoxide alarm regulations, all efforts and strategies shall be used to gain compliance. If however the homeowner refuses or fails to comply, or has been found to have been in non-compliance previously, an Offence Notice (ticket) may be issued to the homeowner under Part I of the POA. Where a homeowner has refused to participate in the home smoke/CO alarm program (i.e. denied entry to firefighters), and is subsequently found to be non-compliant, an Offence Notice may be issued. If as a result of explicit non-compliance, such as refusing entry for the smoke/CO alarm program, lives are put in jeopardy (a fire in the building, smoke in the building, and so forth while the building is occupied), an Information may be sworn and a summons issued for the offence, or an Offence Notice may be issued;

- ***Enforcement Strategies for Landlords:*** Landlords who are found to be negligent in providing and maintaining smoke and carbon monoxide alarms for their rental dwelling units as determined through routine inspections or through a fire department response to a reported or actual fire, may be issued an Offence Notice under Part I of the Provincial Offences Act (POA) or lay an information under Part III of the POA and pursue a fine higher than allowed for the ticket;

- ***Enforcement Strategies for Tenants:*** Tenants in multi-unit rental accommodation who disable smoke and/or carbon monoxide alarms are not only putting themselves at risk, but also tenants in neighbouring units. Experience has shown that removing batteries or otherwise tampering with smoke and/or carbon monoxide alarms is often a common response to nuisance alarms. Tenants who admit to removing batteries or otherwise disabling a smoke and/or a carbon monoxide alarm may be issued an Offence Notice under Part I of the Provincial Offences Act (POA) or lay an information under Part III of the POA and pursue a fine higher than allowed for the ticket;

7.02 Education is a critical component in helping to ensure homeowners are educated about smoke and/or carbon monoxide alarm types, placement, installation, maintenance, and home escape planning. In addition, they must also be informed of the Fire Code requirements and the consequences for non-compliance. Through this policy all efforts

will be made to seek voluntary compliance. That said, there will always be those who do not comply with the regulations, and the fire department must be prepared to enforce them. It is however important to recognize that the individual circumstances of each case must be taken into consideration, and that the fire department will exercise discretion and flexibility in their approach.

7.03 In all instances where the occupancy lacks the required installation of working smoke and/or carbon monoxide alarms, the Clarence-Rockland Fire Department may provide the homeowner, occupant or tenant with a working smoke alarm on a loaner program. The homeowner or landlord must replace smoke and/or carbon monoxide alarm with same type of smoke and/or carbon monoxide alarm that was present in the dwelling. If the loaner smoke alarm is not returned to the Clarence-Rockland Fire Department, a fee will be charged in accordance to the municipal fee schedule.

8.0 ENFORCEMENT OF FIRE CODE VIOLATIONS

8.01 All Assistants to the Fire Marshall, are required under the Fire Protection and Prevention Act to enforce the Ontario Fire Code and its regulations. There is no exception to this statutory requirement, nor is an Assistant to the Fire Marshall permitted to allow deviation from the Fire Code once aware of a violation.

8.02 In an effort to encourage compliance, every effort should be made to educate property owners about requirements under the Fire Code, and encourage their voluntary participation. However, if a violation is of such a nature that should a fire occur that violation would jeopardize lives (such as exit doors locked and inoperable, or excessive buildup of combustibles in a means of egress or stairwell, or obstructed exits), an Offence Notice may be issued to the responsible party, and/or an Information may be laid pursuing a summons in accordance with Part III of the Provincial Offences Act.

8.03 Where responsible parties have previously been made aware of regulatory requirements, and subsequent violations are observed, an Offence Notice may be issued forthwith (where applicable), or a Part III summons may be sought.

8.04 All enforcement activities should always be weighed towards the intended goal of ensuring fire and life safety in all buildings within Clarence-Rockland. Property owners (or responsible parties) maintain the requirement to educate themselves of fire code requirements, it is not the responsibility of the Fire Department to explain everything within Canadian or Provincial Law. That said, gaining compliance through education often results in a better working relationship and outcome that strict enforcement. Such opportunities cannot be repeated to the same person, as this contradicts the overall goal of having fire safe buildings, thus repeated violations should be met with enforcement measures.

9.0 OPEN AIR BURNING

9.01 Open air burning is regulated under the Ontario Fire Code, O. Reg. 213/07, as amended, and is permitted in the City of Clarence-Rockland under by-law. All requests for open air burning will be directed to the Clarence-Rockland Client Services.

10.0 FIREPLACES AND SOLID-FUEL-BURNING APPLIANCES AND EQUIPMENT

10.01 New installations or alterations of fireplaces and solid-fuel-burning appliances and equipment will be directed to the Clarence-Rockland Building Department to be inspected in accordance with the Ontario Building Code Act and Regulations.

10.02 Existing installations of fireplaces and solid-fuel-burning appliances and equipment will be inspected upon request to the fire department; however, comments will be limited to the visible portions of the appliance and equipment only, at the time of the inspection. Fees for conducting these inspections and issuance of compliance letters and reports will be charged in accordance with the established municipal fee structure. Comprehensive inspections of existing installations of fireplaces and solid-fuel-burning appliances and equipment, to ensure compliance with the Ontario Fire Code may be requested by the Clarence-Rockland Fire Department and shall only be conducted by a certified Wood Energy Technology Transfer Technician (W.E.T.T). Fees for conducting W.E.T.T. inspections and issuance of compliance letters and/or reports will be the responsibility of the building owner/occupant.

11.0 REQUESTED INSPECTIONS FOR CHANGE OF OWNERSHIP

11.01 Inspections will be conducted within a reasonable period of time when requested by the purchaser's solicitor and only where written permission has been obtained from the owner or the owner's agent to inspect and release inspection results. Fees for conducting these inspections and issuance of compliance letters and reports will be charged in accordance with established municipal fee structure.

12.0 INVESTIGATION OF FIRES

12.01 The Fire Chief and/or members of the fire department delegated by the Fire Chief shall investigate the origin and cause of all fires within the municipality.

12.02 The Office of the Fire Marshall will be notified as per OFM Directives 2011-001 (Please see attached) Fatality or Serious Injury (likely to cause death), gaseous explosions, large loss fire or suspicion of arson. Fire Department personnel will assist the OFM investigator as requested.

12.03 Reporting a fire to another authority does not release Clarence-Rockland from its obligations under the Fire Protection and Prevention Act to investigate and report on the cause, origin, and circumstance of all fires. Thus, while another investigating party may have a higher precedence of investigation (such as a criminal arson investigation), the Clarence-Rockland Fire Department must still investigate the cause and origin, and may do so in concert with the other investigating agency, or if this is not possible, shall conduct a subsequent investigation until these matters are answered.

13.0 FEES FOR SERVICES

13.01 Fees may be charged for any or all of the above referenced services in accordance with the Municipal Fees By-Law, and any amendments thereto.

14.0 SUMMARY

14.01 This policy provides for the participation of all members of the Clarence-Rockland Fire Department in fire prevention and public education activities, during available hours and addresses the types of inspection services that have been approved by Council. It is intended as an affirmative direction to the Fire Chief, all fire department personnel, and the public.

reviewed: September 2017

Selection of Appropriate Fire Prevention Programs

Public Fire Safety Guidelines	**Subject Coding** **PFSG 04-40-12**
Section **Fire Prevention and Public Fire Safety Education**	Date **March 2001**
Subject **Selection of Appropriate Fire Prevention Programs**	Page

Under Review

Purpose:

To assist fire service managers in identifying the minimum fire prevention and public education activities required to comply with the Fire Protection and Prevention Act

Introduction:

Municipalities must develop a fire prevention and fire safety education program that addresses their needs and circumstances.

Minimum Required Services:

Section 2. (1) of the Fire Protection and Prevention Act states:
(1) Every municipality shall,

1. establish a program in the municipality which must include public education with respect to fire safety and certain components of fire prevention; and
2. provide such other fire protection services as it determines may be necessary in accordance with its needs and circumstances.

Therefore, as a minimum acceptable model municipalities must provide the services listed below. The simplified risk assessment should identify the extent to which additional services may be required to meet the local needs and circumstances of specific municipalities.
Municipalities may develop a different model for fire prevention and public education services provided they are able to demonstrate that their model meets the mandated requirements of the community's local needs.

1. Simplified risk assessment
2. A smoke alarm program
3. Fire safety education material distributed to residents/occupants
4. Inspections upon complaint or when requested to assist with code compliance

Simplified Risk Assessment:

A simplified risk assessment must be done for the comm

unity to determine the needs and circumstances of the municipality and to establish the level of fire prevention and public fire safety education required. Any significant risks identified through the analysis should be addressed. For example; if the risk assessment indicates a significant life or fire loss in multi-unit residential buildings, a program that will adequately improve their fire safety - such as routine inspections - would be appropriate to address the specific need of the community .

The scope and extent of the remaining three required programs can be determined by the results of the simplified risk assessment.

Smoke Alarm Program:

The objective of a smoke alarm program is the provision and maintenance of working smoke alarms and home escape planning activities for all residential occupancies in the municipality. The activities associated with the program may include any combination of the following:

- community surveys
- distribution of pamphlets or other education material
- instruction to residents regarding smoke alarms
- providing smoke alarms at reduced or no cost
- installation of smoke alarms
- inspecting premises to determine compliance with the smoke alarm provisions of the Fire Code.

Fire Safety Material:

Fire safety education material may be distributed to residents and/or occupants consistent with the community's needs and circumstances by any combination of the following activities:

- distribution of pamphlets or other education material
- public service announcements utilizing the available media
- instruction to residents/occupants on fire safety matters
- presentations to resident groups
- attendance at public events

Fire safety education material addresses such issues as preventing fire occurrence, the value of smoke alarms, planning escape from fire, and being prepared to deal with a fire incident. The OFM Regional Office can provide assistance with fire safety education material for the public. Fire safety education material may also be found on the OFM website.

Inspections:

Inspections of properties must be done, or arranged for, by the municipality when:

- a complaint is received regarding the fire safety of a property
- a request is made to assist a property owner or occupant to comply with the Fire Code and the involvement of the Chief Fire Official is required by the Ontario Fire Code

Any inspection conducted must include notification of the property owner or responsible person and appropriate follow-up with enforcement, if necessary.

Codes, Standards, and Best Practices:

Codes, Standards and Best Practices resources available to assist in establishing local policy on this assessment are listed below. All are available at **http://www.mcscs.jus.gov.on.ca/ .** Please feel free to copy and distribute this document. We ask that the document not be altered in any way, that the Office of the Fire Marshal be credited and that the documents be used for non-commercial purposes only.

See also PFSG
01-02-01 Comprehensive Fire Safety Effectiveness Model
04-12-13 Core Services
04-40A-03 Simplified Risk Assessments
04-40B-12 Smoke Alarm Programs
04-40C-12 Public Fire Safety Education Materials
04-40D-12 Inspections Upon Request or Complaint

Fire Prevention Policy

Public Fire Safety Guidelines	**Subject Coding** **PFSG 04-45-12**
Section **Fire Prevention and Public Education**	Date **August 1998**
Subject **Fire Prevention Policy**	Page

Under Review

Purpose:

To identify essential considerations for the development of a municipal fire prevention policy.

Service Delivery Implications:

- Fire prevention includes public fire safety education.
  Fire prevention is an integral part of overall fire protection.
  2(1) Fire Protection and Prevention Act
  Every municipality shall,
  (a) establish a program in the municipality which must include public education with respect to fire safety and certain components of fire prevention
- the fire department establishing and regulating by-law provides direction from council and sets out the principal fire prevention responsibilities
- specific policy should be developed to establish:
- level of service
- types of activities and programs
- responsibilities of personnel

Policy Requirements:

Policy statement should reflect the following fire prevention activities:

- inspection
- code enforcement
- fire and life safety education
- fire investigation and cause determination
- fire loss statistics
- Fire department operational guidelines will dictate how, when and where activities will be conducted.

Quality and Performance Measures:

The policy should:

- encourage the participation of all fire department personnel in prevention and fire and life safety education.
- provide clear direction from council to the chief, members of the department and the public.

Related Functions/ Considerations:

The fire prevention policy should describe:

- public fire and life safety education programs such as: *Learn Not To Burn; Older & Wiser; Alarmed For Life; The Arson Prevention Program For Children; and Risk Watch.*
- inspections, code enforcement programs such as: routine inspections; home safety checks; complaint inspections; request inspections; open air burning regulation; new construction inspection; and plans examination
- fire investigation / fire origin and cause determination - liaison with appropriate agencies

Codes, Standards, and Best Practices:

Codes, Standards and Best Practices resources available to assist in establishing local policy on this assessment are listed below. All are available at **http://www.mcscs.jus.gov.on.ca/ .** Please feel free to copy and distribute this document. We ask that the document not be altered in any way, that the Office of the Fire Marshal be credited and that the documents be used for non-commercial purposes only.

See also PFSG
01-02-01 Comprehensive Fire Safety Effectiveness Model
02-02-12 & **03** Fire Risk Assessment
02-03-01 Economic Circumstances
02-04-01 & **02-04-23** Capabilities of Existing Fire Protection Services
04-12-13 Core Services
04-39-12 Fire Prevention Effectiveness Model
04-40-12 & **04-40-03** Selection of Appropriate Fire Prevention Programs
04-41-12 Community Fire Safety Officer/Team

REPORT N° PRO2017-020

Date	02/10/2017
Submitted by	Brian Wilson
Subject	CRFD Water Rescue and Ice Rescue Service Level Report
File N°	Click here to enter text.

1) **NATURE/GOAL :**
That Council determine the desired service level for water and ice rescue capability to be performed by the Clarence-Rockland Fire Department.

2) **DIRECTIVE/PREVIOUS POLICY :**
Council has not previously determined a water and ice rescue capability in the form of service levels within an establishing and regulating bylaw.

The Clarence-Rockland Fire Department currently provides vessel-based water and ice rescue capabilities using both a donated boat and an inflatable 'rapid deployment craft' (RDC).

3) **DEPARTMENT'S RECOMMENDATION :**
THAT the Committee of the Whole recommends that Council directs the Clarence-Rockland Fire Department to provide Ice & Water Rescue to the following levels:

a) Surface (still) Water Rescue – Up to and including Entry-Based
b) Surface (still) Ice Rescue – Up to and including Entry-Based
c) Swift (moving) Water Rescue – Up to and including Vessel-Based
d) Swift (moving) Ice Rescue – Land-Based only

AND THAT Council requests that these levels of service be identified in a revised Establishing and Regulating By-law to be brought before Council for adoption.

QUE le Comité plénier recommande au Conseil de donner la directive au service d'incendie de Clarence-Rockland de fournir le Service de sauvetage sur glace et à l'eau aux niveaux suivants:

a) Sauvetage sur l'eau calme - jusqu'à et incluant jusqu'au point de l'entrée
b) Sauvetage sur glace calme - jusqu'à et incluant jusqu'au point de l'entrée
c) Sauvetage sur l'eau vive (en mouvement) - jusqu'à et incluant le déploiement du bateau

d) Sauvetage sur glace vive (en mouvement) – basé sur terre seulement

ET QUE le Conseil demande que ces niveaux de service soient identifiés dans la révision du Règlement municipal sur l'établissement et la réglementation d'un service d'incendie, qui sera présenté au conseil pour adoption.

4) **BACKGROUND :**

Pursuant to Section 2 (1) of the Fire Protection and Prevention Act, 1997, as amended, every municipality shall "provide such other fire protection services as it determines may be necessary in accordance with its needs and circumstances."

Pursuant to the Ontario Fire Marshall's Public Fire Safety Guideline #04-83-01 (attached), "the delivery of water and ice rescue services is not a fire department responsibility unless the service is clearly defined and authorized by council in the fire department establishing and regulating bylaw" and further, "the provision of water and ice rescue services ***may be a component of local public fire protection***."

Within the 2017 Master Fire Plan received by council, in Section 6.7.1 it states that "our analyses of historical emergency calls also indicates that the CRFD has responded to incidents on the river in the past including the use of the department's boat" and further recommends "that Operating Guideline SP3.1 – 2003 Water Ice Rescue be reviewed and that the proposed level of Water Rescue be presented to Council for consideration and approval and included within an updated Establishing and Regulating By-law."

Historically the Clarence-Rockland Fire Department has responded to an average of 2-3 calls for service on the Ottawa River or other bodies of water. So far in 2017, the Ice/Water Rescue Team has been used for standby during the spring floods, was deployed to search for any signs of a victim when an overturned kayak was found lodged under a tree along the edge of the river during the spring floods, and was deployed to assist OPP in searching for a missing person after a boat was found empty on a small island near the Clarence Point Ferry (the occupant of the boat was later found drowned downstream).

2017 Voisine Road Flood 1 - CBC News

Council approved the implementation strategy for the 2017 Master Fire Plan at Council on September 6, 2017, and directed Administration to bring back a separate report on the Water and Ice Rescue program offered by CRFD, which will then be included in a proposed new Establishing and Regulating By-Law later this year.

5) **DISCUSSION :**

The City of Clarence-Rockland is located along the southern shore of the Ottawa River, and operates waterfront parks, a boat launch, and also has a ferry terminal located within its municipal boundaries. Because the current in the open parts of The Ottawa River exceeds 1 knot, it is considered 'swift water' within most rescue standards and guidelines. The waterfront areas of the municipality are also prone to flooding, most recently experienced in the spring of 2017. There are numerous other bodies of water throughout the municipality, and some areas experience significant and predictable spring runoff flooding (i.e. Cobb's Lake). During the winter months, a number of area residents enjoy ice fishing along the Ottawa River, along with snowmobiling throughout the municipality.

The Clarence-Rockland Fire Department currently operates a hybrid model of both (c) and (d) noted below. The Department operates a donated boat and an inflatable rescue craft for vessel-based capabilities, and also trains for water and ice entry capabilities on an annual basis. The current boat is not designed nor intended for use as a rescue vessel, although has been used for that purpose since the department received the donation of it.

CRFD Firefighters - Entry Training 1 http://www.canaanconnexion.ca/Pics-C-R-Fire-Dept/CRFD-water-rescue-training.JPG

In the past several years there have been a number of water/ice rescue close calls and fatalities, including a UTV operator who went through the ice, capsized boaters and kayakers, boating mishaps, along with a number of waterfront events (such as the poker run, fishing derbies, and so forth).

There have been no recorded rescues along the Ottawa River since the Department began providing water rescue services. The CRFD has provided assistance to other agencies along the river, including the OPP, and assistance to other city departments as needed (e.g. Parks & Rec).

Given the exposure along the Ottawa River, along with the number of events and even the publicly operated boat launch, while the likelihood of a water/ice rescue situation remains relatively low within the municipality, the consequence of such a situation can be quite high (up to an including fatalities). Using a Hazard Risk Vulnerability Assessment (HRVA) model, this would indicate a high hazard risk for the City. Given the City operates a boat launch and facilitates water sport activities (poker run, fishing derbies, etc.), another consideration is liability in these operations and the requirement to provide a reasonable rescue mechanism for people using these facilities or engaged in these activities.

In following the Ontario Fire Marshal's Public Fire Safety Guideline (PFSG) #04-83-01 "Selecting a Water/Ice Rescue Capability", there are four identified options available for Council to consider. They are:

a. No Water and Ice Rescue Capability
b. Land-Based Water and Ice Rescue Capability
c. Vessel-Based Water and Ice Rescue Capability
d. Water and Ice Entry Rescue Capability

With the PFSG, it suggests that any department which drafts (draws water) from an open water source (i.e. stream, creek, river, or lake) should provide at a minimum Land-Based Water Rescue Capability.

Currently CRFD trains to, and provides this level of rescue capability out of Stations 1 (Bourget) and 2 (Clarence-Creek). Station 3 currently maintains the boat (Marine 3), inflatable rescue craft and the other tools and personal protective equipment for the other levels of water/ice rescue capability.

Training firefighters for land-based water and ice rescue is relatively straight forward, and fairly low-risk. It requires a minimum level of equipment, and is currently in place in the stations not exposed to the river hazard. There is minimal cost associated with this level of training (basic throw bags and personal floatation devices (PFDs)).
It is suggested that this level of training be maintained for firefighters operating out of these stations.

CRFD Rescue Boat - River Search 1 (Le Vision)

Training firefighters for vessel-based and/or entry capabilities involves more time and equipment. From a safety perspective, working from a vessel (boat or inflatable rescue craft) is far safer than entering the water, which is considered the highest level of risk to rescuers. Firefighters currently are required to maintain a swimming proficiency (tested annually) and participate in annual refresher training for both ice rescue and still-water (not open current) rescue skills. Firefighters also practice launching, operating, and recovering the boat and inflatable rescue craft.

Rapid Deployment Craft (RDC) 1(www.oceanid.com)

The costs associated with providing vessel and/or entry based ice/water rescue capability are as follows:

- 1 Rescue Vessel & Trailer – approx. $45,000 – 15 years
- 1 Rapid Deployment Craft – approx. $5,000 – 8 years
- 10 Personal Floatation Devices (PFDs) – approx. $500 – 4 years
- 6 Ice Rescue Suits – approx. $1,000 – 6 years
- Annual Swim Test & Water Rescue Drills – approx. $3,000 / year
- Annual Ice Refresher Training – approx. $5,000 / year
- Annual Boat Refresher Training – approx. $3,000 / year

Therefore the approximate annual cost of providing the current vessel and entry based capability is approximately $16,875 (operating and amortized capital).

Should Council elect to continue to offer vessel and entry based ice/water rescue capability, the current vessel should be replaced immediately with a more appropriate water rescue vessel (something similar to what Ottawa or Gatineau are currently using, such as pictured below):

Ottawa Fire Services Boat 1 (www.ottawasun.com)

Further, the current rapid deployment craft (RDC) has been patched numerous times, and is beyond its reasonable lifespan and should also be retired to training status with a new RDC purchased for operational use.

Therefore, should Council elect to continue with offering vessel and entry-based ice/water rescue capabilities, it would be imperative that the 2018 capital budget reflect replacing these two pieces of equipment (estimated total cost $50,000).

In evaluating the levels of rescue capability noted within the PFSG, it is important to note that the increasing level of rescue capability, by design, includes the lower levels of rescue. The intent in any rescue operation is to minimize the risk to the rescuers to the safest possible method to affect the rescue. For example, training CRFD firefighters to entry-based rescue would still require that the Incident Commander evaluate whether a rescue could be effected from shore first (least risk to the rescuers), or by vessel (boat or inflatable RDC) (moderate risk), and lastly by entry-based rescue (greatest risk).

In determining an appropriate level of ice/water rescue capability, it is strongly recommended that Council take into account the various ice/water conditions encountered within the City of Clarence-Rockland, and that appropriate levels of ice/water rescue capability be provided based on the hazards (and likely rescue potential) dependent on the water hazard encountered. Specifically, it is recommended that Council considering establishing the following levels of ice/water rescue capability:

- Still (non-moving) water – entry-based rescue
- Still (non-moving) ice – entry-based rescue

- Swift (moving) water – vessel-based rescue
- Swift (moving) ice/cold water (with ice floating) – land-based rescue

In proposing these levels of rescue capability, the recent Verdict of Coroner's Jury was examined in relation to two recent deaths of people training in swift ice water rescue skills training (since 2010). In the Coroner's report, it recommends that training be suspended in all swift (moving) ice water until adequate safety measures can be established. The Clarence-Rockland Fire Department has never trained in swift-water entry-based rescue (water or ice), which is why the above levels of ice/water rescue capability are being recommended to Council for adoption in a revised Establishing and Regulating By-Law.

In summary, given that the City of Clarence-Rockland not only exists along the shores of the Ottawa River and has water-based businesses, but also encourages water-based activities and recreation, it is recommended that Council ensure a reasonable level of rescue capability is available to residents and visitors who make use of our waterways. In order to meet statutory requirements, it is required that the City continue to properly train members who may be required to undertake rescue activities, and further that proper and adequate equipment be provided to members for this level of response.

6) **CONSULTATION:**

In discussions with Russell Twp. OPP, they do not have a pre-positioned ice/water rescue capability in the detachment, which would lead to significant delays in mobilizing equipment and manpower to provide any form of on-water capability. Further, given the historical partnerships between the OPP and CRFD, if CRFD continued to have these tools available, the OPP would continue to leverage those partnerships towards overall public safety within Clarence-Rockland.

7) **RECOMMENDATIONS OR COMMENTS FROM COMMITTEE/ OTHER DEPARTMENTS :**

None.

8) **FINANCIAL IMPACT (expenses/material/etc.):**

Should Council establish the recommended level of ice/water rescue, it would necessitate the following financial considerations:

2018 Operating Budget – no change (included in existing budget)
2018 Capital Budget - $50,000 (replacement of boat and inflatable)

There would be continuing costs for replacement of Ice Suits and floatation vests, which have historically been absorbed within the operating budget of the Department.

9) **LEGAL IMPLICATIONS :**

In accordance with the Municipal Act and the Fire Protection and Prevention Act, Council needs to establish a level of service in regards to all services offered by the Clarence-Rockland Fire Department. In regards to Ice/Water Rescue, Council should establish a level of service appropriate for the municipality which should then be included in the Establishing and Regulating By-law.

10) **RISK MANAGEMENT :**

There are two different risk management considerations that Council should consider in determining an appropriate level of Ice/Water rescue.

(1) What is the liability risk assumed by the City in operating water-based activities such as the boat launch and waterfront parks with regards to ensuring some level of water-based rescue is available should someone require it? It is therefore the Department's recommendation that a balanced approach to providing ice and water rescue be considered to provide a reasonable level of rescue capability should an emergency occur.

(2) What is the risk involved in the various levels of ice/water rescue that could be established? It is the Department's recommendation that a balanced approach to risk-vs-reward be employed such that where the risk can be adequately managed (such as in still water scenarios) that a higher level of ice/water rescue should be made available, and that where risk levels (to rescuers) rise, such as in swift water environments, that levels of ice/water rescue be reduced in such a way as to take into account a level of safety for rescuers to also match the survival profile of victims in these situations.

11) **STRATEGIC IMPLICATIONS :**

There has been a long-standing relationship between the City of Clarence-Rockland and the Ottawa River, and there will continue to be for decades to come. As such, establishing a way to encourage reasonable and safe water activities, including a contingency for emergency rescue, establishes a balanced approach to enjoying the beauty of the Ottawa River while preparing for potential emergencies which do occur from time-to-time.

12) **SUPPORTING DOCUMENTS:**

- PFSG 04-83-01 – Selecting a Water/Ice Rescue Capability
- Section 21 Guidance Note #6-3 – Water and Ice Rescue
- Clarence-Rockland 2017 Master Fire Plan (pg. 95)

Selecting A Water/Ice Rescue Capability

Public Fire Safety Guidelines	**Subject Coding** **PFSG 04-83-01**
Section **Emergency Response**	Date **August 1998**
Subject **Selecting A Water/Ice Rescue Capability**	Page

Under Review

Purpose:

To provide municipalities with options to guide and assist in developing the level of water and ice rescue responses provided to the public.

Introduction:

The delivery of water and ice rescue services is not a fire department responsibility unless the service is clearly defined and authorized by council in the fire department establishing and regulating bylaw. When a fire department is not responsible for these services, the municipal emergency plan should identify locally available resources for water and ice rescue.

Service Delivery Considerations:

- The provision of water and ice rescue services ***may be a component of local public fire protection.***
- Due to a variety of influences, not all communities are capable of or should consider delivering the same level of service.
- Water and ice rescue capabilities will vary from none to water and ice entry rescue techniques with effective rescue apparatus and adequate fire ground staffing.
- It is the responsibility of every community to determine the level of water and ice rescue capability that is to be provided.
- Municipal council shall then ensure that the fire department is provided with appropriate equipment, personnel and training to safely and effectively deliver the service.
- The level of water and ice rescue services being provided to the community must be thoroughly evaluated to determine if they are being delivered in a safe manner and are appropriate for the needs of the community

Service Delivery Options:

- Variety of options dependent on nature of the community
- Level chosen must be delivered safely and effectively
- Community risks and financial impact must be considered

- Risk to recreational users must be considered in tourism areas
- More effect may be gained through a combination of options
- Delivery option selected ***must be in compliance with Guidance Note 6-3 (August 2002)***

Consideration: No Water and Ice Rescue Capability:

WHY?

- Small communities with few calls for service
- Minimal water and ice rescue risk (No history of drownings or water/ice rescues)
- Unable to assemble required rescue team in a timely manner

CONSIDERATIONS

- If water and ice rescue risk is not addressed there is the potential for preventable and needless loss of life, including public safety personnel
- Potential for civil or criminal liability upon municipality

ALTERNATIVES

- Public water safety and drowning prevention programs

Consideration: Land Based Water and Ice Rescue Capability:

This level should be considered for all fire departments required to draft water from open static water sources

WHY?

- Fire departments often find themselves with an inadequate number of personnel to perform water and ice rescues of a high degree of danger and risk to the rescuers
- Significant impact on accident victims close to shore
- Improvement in the safety of fire service personnel (self-rescue)
- Inexpensive training program and equipment acquisition

BENEFITS

- Minimal risk to firefighters
- Increased level of community protection
- Improved public perception while meeting community needs

CONSIDERATIONS

- Increased rescue capability along with associated costs and expectations
- Loss of life occurring off shore (public perception and liability)

Consideration: Vessel Based Water and Ice Rescue Capability:

WHY?

- Deliver a higher level of service
- Ability to access a greater number of potential customers

- Meet the needs of communities economically dependent upon recreational users of public waterways

BENEFITS

- Greater potential to rescue live persons; increased level of public safety
- Dependent upon significant and costly additional resources
- Moderate level of risk to firefighters
- Requires a higher level of fire ground staffing
- Lack of public education may result in lack of support

CONSIDERATIONS

- Highly dependent upon rapid notification
- Provide water and ice entry rescue services
- Consider agreement with an area fire department or other services capable of delivering a higher level of water and ice rescue services

Consideration: Water and Ice Entry Rescue Capability:

WHY?

- Highest level of service to the community
- Capability to meet most ice rescue emergencies

CONSIDERATIONS

- Dependent upon strict and time consuming training
- Exceptionally costly service to implement and maintain vs. low call volume
- Highest degree of risk for the rescuer

ALTERNATIVES

- Most alternatives result in a reduced level of service

Consideration: Police, Commercial Contractor or Volunteer Search & Rescue (SAR) Group:

Agreement with the local policing authority, an area fire department, a commercial contractor or a volunteer marine search and rescue agency may be used in place of fire department delivered services

WHY?

- May be the most cost effective and efficient means available to deliver service
- Local public safety agencies unable to deliver level of service expected

CONSIDERATIONS

- Quality of service issues such as response time, training and level of service
- Public perception and acceptance of a non-traditional rescue agency
- Minimal commitment of municipality
- May pose risk management concerns related to Occupational Health and Safety Issues
- Potential for civil or criminal liability may rest with municipality

Codes, Standards, and Best Practices:

Codes, Standards and Best Practices resources available to assist in establishing local policy on this assessment are listed below. All are available at **http://www.mcscs.jus.gov.on.ca/ .** Please feel free to copy and distribute this document. We ask that the document not be altered in any way, that the Office of the Fire Marshal be credited and that the documents be used for non-commercial purposes only.

See also PFSG

02-02-12 & **03** Fire Risk Assessment (Special Hazards)
02-03-01 Economic Circumstances
02-04-01 & **23** Capabilities of Existing Fire Protection Services

FIRE FIGHTERS GUIDANCE NOTE # 6-3

ISSUE: WATER AND ICE RESCUE

Where fire departments respond to calls for water or ice rescues, employers should:

- Identify the emergency situations which may reasonably be expected to occur in that fire department's response area;
- Train and equip firefighters, so that they can respond to those emergencies quickly, safely and effectively;
- Select, acquire, and maintain the appropriate rescue equipment required to safely perform the operations that may be expected.

Minimum precautions should include:

- All rescuers who enter the water are to maintain controlled contact with the shore/boat (i.e. safety line, hand contact). It should be noted that some rescue situations, such as, but not limited to, certain swift water situations may preclude rescuers from safely being connected to a rope. In these situations, appropriate safety measures should be taken to ensure the safety of rescue personnel. Those fire departments that may need to perform rescues in swift water should ensure that specific training is provided that addresses the unique hazards of swift water rescue;
- Rescue personnel who may be within close proximity to water where there is an exposure to the hazard of falling into the water, should wear an approved personal flotation device;
- Rescue personnel proceeding onto ice should wear an approved personal flotation device and clothing to reduce the effects of hypothermia (Note: where immersion suits are used as personal flotation devices, the requirements in the notation below apply);
- Direct rescuers on the ice should be secured by rescue equipment, appropriate in the circumstances, to ensure the worker's rescue from the water/ice; and
- When using boats, ensure that the boat has the appropriate safety equipment and that the operator is competent to operate the vessel in the conditions encountered.

Note: **A life jacket or personal flotation device stamped or labelled and approved by Transport Canada or the Canadian Coast Guard, Department of Fisheries and Oceans, meet with the intent of this Guidance Note.**

RAPPORT N°INF-2017-063 Octroi d'un contrat pour installation d'enseignes municipal

Date	02/10/2017
Soumis par	Richard Campeau
Objet	Octroi d'un contrat pour installation d'enseignes municipal
# du dossier	N/A

1) **NATURE / OBJECTIF :**

L'objectif de ce rapport est d'autoriser le département d'infrastructures et aménagement du territoire à mettre en place le processus de signature du contrat avec Louis-XVI Signs en deux (2) temps afin qu'il puisse procéder avec la fabrication et l'installation des enseignes aux entrées de la Cité de Clarence-Rockland. Le prix de soumission a été divisé en deux sections, Section "A", pour la fabrication et l'installation d'enseignes en 2017 et une section "B", pour la fabrication et l'installation d'enseignes en 2018 conditionnel à l'approbation de cette item au budget 2018.

2) **DIRECTIVE/POLITIQUE ANTÉCÉDENTE :**

- Résolution 2016-60, 21 mars 2016. Le Conseil donne la directive de:
  - moderniser les enseignes existantes aux limites de chaque village.
  - présenter un rapport au conseil avec la nouvelle conception des enseignes.
- Résolution 2016-200, 19 septembre 2016;
  - Conseil accepte les standards de conception et sélection tel que listé dans le rapport INF2017-034.
  - Conseil approuve le projet en deux (2) étapes; 1- sélection d'une nouvelle conception. 2- fabriquer et installer les enseignes.
  - Une (1) enseigne à être ajouté sur le chemin Onésime Guibord, deux (2) nouvelles enseignes à Clarence Point et également deux (2) nouvelles enseignes à Clarence Creek.
  - Relocalisation de cinq (5) enseignes existante aux limites de villages tels que le Plan Officiel des Comtés Unis de Prescott-Russell.

3) **RECOMMANDATION DU SERVICE:**

QU'IL SOIT RÉSOLU QUE le Comité plénier recommande au Conseil

municipal d'adopter un règlement pour autoriser le Maire et la greffière à signer un contrat avec Louis-XVI Signs pour effectuer la fabrication et l'installation des enseignes municipal pour une somme de 142 865,00 $, excluant la T.V.H.; et

QU'IL SOIT ÉGALEMENT RÉSOLU QUE la section "B" de ce même contrat, dont la valeur est de 110 840.00 $ excluant la T.V.H., soit octroyé conditionnel à l'approbation du budget capital 2018.

BE IT RESOLVED THAT the Committee of the Whole recommends that Council approves a by-Law to authorize the Mayor and the City Clerk to sign a contract with Louis-XVI Signs for the manufacturing and installation of the municipal signs in the amount of $142 865.00, excluding HST; and

BE IT ALSO RESOLVED THAT the section "B" of this same contract, which has a value of $110,840.00 excluding HST, BE awarded conditional to the 2018 Capital Budget approval.

4) **HISTORIQUE :**

Une sélection a été faite pour la conception des nouvelles enseignes préalablement. Le concept proposé par le département d'infrastructures et aménagement du territoire a été présenté et approuvé au Conseil le 19 juin 2017. L'installation des nouveaux enseignes municipaux débuterait avec la première phase à l'automne 2017. Cette première phase, Section "A" des documents de soumission, inclue sept (7) nouvelles enseignes à être installé aux limites de la municipalité.

La deuxième phase, Section "B" des documents de soumission, est conditionnel a l'approbation de l'item au budget 2018 et inclus vingt-quatre (24) nouvelles enseignes à être installé aux limites des villages et autres endroits stratégiques.

5) **DISCUSSION :**

Le Département a publié un appel d'offres sur les sites internet Merx et de la Cité. Cet appel d'offres c'est terminé le 22 septembre 2017 à 14:00. Nous avons reçu deux (2) soumissions, dont une (1) qui a été reçue après 14:00h donc n'a pas été ouverte et a dû être disqualifié. Les soumissionnaires et les offres financiers total (Section A et B) sont le suivant:

ENTREPRENEURS	PRIX DE SOUMISSION 2017 (excl. TVH)	PRIX DE SOUMISSION 2018 (excl. TVH)	CONTRAT TOTAL (excl. TVH)
Louis-XVI Signs	32 025,00 $	110 840,00 $	142 865.00 $
Regional Signs Inc.	Disqualifié	Disqualifié	Disqualifié

Louis-XVI Signs a soumis la seul soumission conforme avec un prix de 32 025,00 $ (excluant la HST) pour les travaux prévu en 2017. Après vérification, le département d'infrastructures et aménagement du territoire confirme que la soumission est conforme aux exigences demandées et recommande d'octroyer le contrat à Louis-XVI Signs.

Les dépenses détaillées encourues et prévues, suite au processus d'appel d'offre, sont présentées dans le tableau ci-dessous pour les travaux en 2017 seulement.

Budget 2017 **Compte: 2-4-8110-9286**	**50 000$**

Items	**Coûts**
Coûts déjà encourues - Conception des enseignes	4 305 $
Contrat 2017, section "A" (excluant) TVH)	32 025 $
Contingences (10%)	3 200 $
Impact de la TVH (1.8%)	700 $
Coût total à la municipalité	**40 230 $**
Surplus / Déficit	**9 770 $**

Budget 2018 Sujet à approbation du Conseil	**125 000$**

6) **CONSULTATION :**
N/A

7) **RECOMMANDATION OU COMMENTAIRES DU COMITÉ :**
Voir en annexe Le concepts recommandé et présenté le 19 juin 2017 au conseil.

8) **IMPACT FINANCIER (monétaire/matériaux/etc.):**
Le budget 2017 des enseignes municipales a été approuvé lors des délibérations budgétaires de 2016 et la source de financement pour cette première phase proviendra du fond général.

La Phase 2 des travaux sera octroyé seulement en 2018 conditionnel à l'approbation du budget 2018. La source de financement pour cette deuxième partie du projet sera déterminée lors du processus budgétaire 2018.

9) **IMPLICATIONS LÉGALES :**
Aucune

10) **GESTION DU RISQUE (RISK MANAGEMENT) :**
Aucune

11) **IMPLICATIONS STRATÉGIQUES :**
Seulement une soumission a été circulée afin de générer de plus grosse quantités dans le contrat et par conséquent augmenter les chances à la municipalité d'obtenir de meilleur prix global.

12) **DOCUMENTS D'APPUI:**
Annexe A, Concept retenu pour les enseignes de la Cité de Clarence-Rockland.

BIENVENUE WELCOME

CITÉ DE / CITY OF

CLARENCE-ROCKLAND

www.clarence-rockland.com

RAPPORT N° LOI2017-10-02

Date	Le 27 septembre 2017
Soumis par	Pierre Boucher
Objet	Demande du CSDCEO
# du dossier	A21 CSD

1) **NATURE / OBJECTIF :**

Demande du Conseil scolaire de district catholique de l'Est ontarien afin d'entreprendre des discussions avec l'administration municipal d'une possibilité d'entente de partenariat.

2) **DIRECTIVE/POLITIQUE ANTÉCÉDENTE :**
N/A

3) **RECOMMANDATION DU SERVICE:**

QU'IL SOIT RÉSOLU que le conseil municipal autorise l'administration d'entreprendre les discussions avec l'administration du Conseil scolaire de district catholique de l'Est ontarien afin de voir à la possibilité d'établir un partenariat afin d'augmenter la capacité des installations sportives dans la communauté, tel que recommandé.

BE IT RESOLVED that Municipal Council hereby authorizes the administration to enter into discussions with the school administration under the Conseil scolaire de district catholique de l'Est ontarien for the purpose of potentially establishing a partnership to increase the capacity of recreational facilities in the community, as recommended.

4) **HISTORIQUE :**

Les Services communautaires ainsi qu'un représentant de l'administration du CSDCEO ont eu une rencontre récemment au sujet d'ajout d'une installation sportive possible sur la propriété du Conseil scolaire de l'École secondaire L'Escale de Rockland.

Cet ajout d'infrastructure saurait répondre aux besoins de la communauté grandissante sportive et fait partie d'une infrastructure identifiée dans le plan directeur des Loisirs de la Cité.

5) **DISCUSSION :**

Vous trouverez ici-bas la résolution du Conseil Scolaire accepté le 26 septembre 2017 :

Que le Conseil scolaire de district catholique de L'Est ontarien mandate l'administration à discuter de la possibilité d'établir un partenariat en vue d'augmenter la capacité des installations sportives à L'École secondaire L'Escale de Rockland.

6) **CONSULTATION :**
N/A

7) **RECOMMANDATION OU COMMENTAIRES DU COMITÉ :**
N/A

8) **IMPACT FINANCIER (monétaire/matériaux/etc.):**
N/A

9) **IMPLICATIONS LÉGALES :**
N/A

10) **GESTION DU RISQUE (RISK MANAGEMENT) :**
N/A

11) **IMPLICATIONS STRATÉGIQUES :**
N/A

12) **DOCUMENTS D'APPUI:**

Courriel de Monsieur Martin Lavigne Surintendant des affaires et trésorier du Conseil scolaire de district catholique de l'Est ontarien

Bonjour Madame Collier,

Le Conseil scolaire de district catholique de l'Est ontarien s'apprête à entreprendre une planification en vue d'ajouter des installations sportives à l'École secondaire catholique L'Escale de Rockland afin de répondre aux besoins des élèves.

Compte tenu de l'orientation stratégique que le gouvernement de l'Ontario met de l'avant au niveau des partenariats communautaires, le Conseil aimerait connaître votre intérêt à entretenir des pourparlers sur la possibilité d'un projet commun qui saurait bénéficier à toute la communauté de La Cité de Clarence-Rockland.

Hier soir, lors de sa séance ordinaire en public, le Conseil a adopté la résolution suivante :

> « Que le *Conseil scolaire de district catholique de l'Est ontarien* mandate l'administration à discuter de la possibilité d'établir un partenariat en vue d'augmenter la capacité des installations sportives à l'École secondaire catholique L'Escale de Rockland. »

La résolution a été proposée par le conseiller Jean Lemay et appuyée du conseiller Jonathan De Serres.

Pourriez-vous, Madame Collier, porter à l'attention du Conseil de la Cité de Clarence-Rockland cette résolution?

C'est toujours avec fierté que le conseil discute du partenariat existant avec La Cité de Clarence-Rockland.

Je vous remercie de l'attention que vous portez à cette résolution en souhaitant qu'il y ait une coïncidence des besoins de chacun afin d'entreprendre un projet commun.

Martin Lavigne
Surintendant des affaires et trésorier
Conseil scolaire de district catholique de l'Est ontarien
875, chemin de comté 17
L'Orignal (ON), K0B 1K0
Téléphone : 613 675-4691, poste 210
Télécopieur : 613 675-2921

REPORT N° INF2017-064

Date	02/10/2017
Submitted by	Dave Darch and Denis Longpré
Subject	Sanitary Sewage Treatment Plant & Main Pumping Station Upgrades
File N°	INF2017-064

1) **NATURE/GOAL :**
The purpose of this report is to secure approval of the schedule, scope of work and budget strategy for the necessary upgrades to the sanitary sewage pumping station.

2) **DIRECTIVE/PREVIOUS POLICY :**
Staff previously presented to Council (report 2016-032) recommending the appointment of RV Anderson to provide design, contract administration & commissioning services in April of 2016. The upset limit for their contract was $498,000.

Further to this report, a subsequent report (2016-094) for information on the sanitary sewage force main damage was presented in July 2017. Arising out of the discussion of this item, staff indicated that it would bring back a status report addressing the scope of work and budget requirements of the Sewage Treatment Plant (STP) capital program to a subsequent meeting of Council. This report addresses this undertaking.

3) **DEPARTMENT'S RECOMMENDATION :**
WHEREAS the 2014 capital works budget approved an amount of $5 million for required upgrades to the City's Sewage Treatment Plant.

AND WHEREAS the preliminary design for this project has highlighted the need for scope changes and amendments to the existing budget approval.

BE IT RESOLVED THAT the Committee of the Whole recommends that Council approves the scope of work, implementation schedule and process to amend the budget for the upgrades to the Sewage Treatment Plant and main pumping station as detailed in report INF2017-064.

QU'IL SOIT ATTENDU QU'un montant de 5 millions de dollars pour les améliorations nécessaires à l'usine de traitement des eaux usées de la Cité a été approuvé au budget d'immobilisations 2014; et

QU'IL SOIT ATTENDU QUE la conception préliminaire de ce projet a souligné le besoin de changements et de modifications à l'approbation

du budget existant.

QU'IL SOIT RÉSOLU QUE le Comité plénier recommande que le Conseil approuve l'ensemble des travaux, le calendrier des échéanciers et le processus visant à modifier le budget pour les améliorations de l'usine de traitement des eaux usées et de la station de pompage principale, tel que détaillé dans le rapport INF2017-064.

4) **BACKGROUND :**

In 2005, a feasibility study and conceptual design for the waste water infrastructure upgrades was completed and recommended the installation of a bar screen (preliminary screen) at the Sewage Treatment Plant (STP) and pumping station. The study ultimately recommended a new and separate screening facility at an estimated cost $833,000 (at the conceptual design stage) but the project did not proceed.

In 2013, a petition with 156 signatures was received by Council from area business owners with regards to on-going odours emitting from the STP to the surrounding neighbourhood. It was alleged that the on-going odour issues were causing loss of clients, employee time off and loss of enjoyment of their businesses.

Following receipt of the petition, the City retained the services of the Ontario Clean Water Agency (OCWA) in 2014 to further investigate the causes of the odours and identify recommendations to resolve this situation. The technical memorandum produced by OCWA ultimately identified the lack of pre-screening of the sanitary sewage as the main reason for odours at the treatment plant. OCWA's mandate was extended to include a complete review of the treatment plant operations, including a 20 year capital plan detailing anticipated upgrades based on projected growth.

An assessment report for the Sanitary Sewage Pumping Stations was completed in 2014 concurrently with the treatment plant performance review. Subsequently, a Request for Proposal (RFP) was prepared in Spring of 2015 to retain the services of an engineering firm to complete recommendations arising from both reports. The scope of work was to upgrade Sanitary Sewage Pumping Station No. 1, twinning of forcemain, repair to concrete floor slab and installation of a pre-screening system.

In November of 2015, a report to Council was presented with recommendations to enter into an agreement with RV Anderson Associates Ltd for the above noted scope of work. The agreement between the City and RV Anderson was finalised in May 2016.

5) **DISCUSSION :**

This section of the report will address the initial and revised scope of work components and associated budget requirements. It will also propose a tentative implementation schedule for this significant capital undertaking.

Table 1.1 summarizes the initial and revised scope of work, and associated budgets for this project.

Table 1.1

WATER TREATMENT PLANT UPGRADES

WORK ITEM	2014 BUDGET ($0,000)	2017 BUDGET ($0,000)	VARIANCE ($0,000)
Pre-screening	1,300	4,552	3,252
Pumping station	900	1,387	487
Forcemain twinning	2,000	473	(1,527)
Concrete floor	137	154	17
Equalization tank		2,800	2,800
TOTAL CONSTRUCTION	**4,337**	**9,366**	**5,029**
Engineering	498	800	302
EA		50	50
Contingency	165 (3%)	2,370 (18.5%)	2,205
TOTAL COST	**5,000**	**12,586**	**7,586**

It should be noted that the City has applied for funding assistance for this project under the Ontario Communities Infrastructure Fund (OCIF). If successful, the City would be eligible for a maximum grant of approximately $1,147,000. Given the uncertainty regarding approval of this application, this funding source has not been considered as part of the overall budget.

On review of the above table, it is apparent that the scope and budget of the project has changed significantly since inception in 2014. The following provides a detailed explanation of the rationale for the variances.

1. Project Scope:

Equalization Tank:

The Equalization Tank was considered as part of the initial project; however, in 2014, it was contemplated for implementation in 2018/2019 and, as such, funding was not identified for this work component in the approved $5 million budget.

High wet weather flows have been an issue at the STP. Currently, there is no wet weather flow storage at the STP and as such, there are often wash-outs of the plant which results in partially treated sewage being discharged into the Ottawa River.

Installation of an Equalization Tank will reduce the likelihood and amount of sewage discharge into the Ottawa River. It will also improve the quality of treated sewage.

Since there is limited land at the STP, it is opportune to construct the tank below the new headworks building.

Environmental Assessment:

There is a requirement to initiate Municipal Class Environmental Assessment (EA) – Schedule B for this project. This is a fairly quick undertaking. The EA was not contemplated as part of the original scope. This was not considered in the 2014 budget approval.

2. Budget Amendments:

Table 1.1 provides a detailed budget overview of the waste treatment plant project. In summary, the gross budget for this project has increased by $7.5 million. The reasons for the increased budget needs are detailed as follows:

2.1 Pre-Screening Work:

In 2016, the City's consultant completed a geotechnical investigation of the site which revealed significant poor soil conditions. This work item has resulted in a substantial budget variance of over $3.2 million. Because of the poor soil conditions, it is necessary to increase the cost of piling for the new building in order for the soils to be able to support the new building. This translates into a budget increase of approximately $2 million. The balance of the budget shortfall relates to increased costs for equipment, development of cost estimates based on very preliminary information.

Additionally, the projected construction costs did not include such miscellaneous expenditures as bonding/insurance; mobilization/demolition; contractor markup etc. These costs have now been included in the revised budget requirement for this line item.

2.2 Pumping Station No 1:

This element of the project has an increased budget amount of $487,000. In discussions with staff, it has become apparent that the initial budget estimates were not updated annually as part of the budget approval process. As well, the design requirements for this work component is at a more advanced level at this time.

The cost has been increased to include bonding and insurance; mobilization/demolition costs and contractor markup expenditures as well. These amounts were not considered in the initial budget estimates

2.3 Twinning of the Forcemain:

A recent assessment of the scope of this work and the associated budget, confirms that the initial budget can be reduced by $1.5 million.

2.4 Equalization Tank:

There is now no longer an ability to phase-in this item of work. As a separate project this Equalization Tank would have required additional land to construct the equalization tank; however, if it is included in this project, economies of scale will be realized since additional lands will not be required.

Including the equalization tank into this project requires $2.8 million in additional funding.

2.5 Engineering:

The initial budget approval contemplated $498,000 in engineering. In view of the revised scope and refined project budget, the engineering budget will be approximately $800,000. As noted in the Background section of this report, RV Anderson was retained to provide the required engineering services for this project to an upset limit of $498,000. A separate report will be forwarded for Committee's consideration after budget approval for the increased funding.

2.6 Environmental Assessment:

The initial budget for this project did not contemplate the requirement for an environmental assessment. Monies in the amount of $50,000 have been provided in the likelihood that an environmental assessment is required.

2.7 Contingency:

The initial budget for this project provided for a contingency of only $165,000. This was an extremely low and represented only 3% of the estimated project cost of $5 million. Since the project's design is at a preliminary stage, and in view of the uncertainties about this project [e.g. adverse soil conditions etc.], the Department recommends that a contingency of $2,370,000 be allocated for this project. This represents approximately 19% of the total gross project budget.

3. Implementation Schedule:

The key milestones associated with this project are summarized as follows:

OCIF Submission:	September 27, 2017
Council Approval-Amended Budget:	December 2017
OCIF Funding Recipients Announced:	January 2018
Project Design finalized:	August 2018
Tender:	September 2018
Contract Award:	October 2018
Construction Start:	December 2018
Construction Complete:	December 2019

6) **CONSULTATION:**
As noted earlier in this report, the municipality has had discussions with local affected residents and businesses regarding the issues surrounding the operation of the waste treatment plant.

7) **RECOMMENDATIONS OR COMMENTS FROM COMMITTEE/ OTHER DEPARTMENTS :**
N/A

8) **FINANCIAL IMPACT (expenses/material/etc.):**
The currently approved funding for this project in the amount of $5 million has been funded from development charges. Staff recommends that the increased budget requirement of $7.5 million be debt financed. A final decision of this funding source should be considered as part of the upcoming 2018 Capital Works Budget deliberation process. This will enable members of Council to consider this request in relation to other debt funded requirements.

9) **LEGAL IMPLICATIONS :**
Failure to implement the waste treatment plant upgrades could result in legal actions from the affected businesses and area residents. As well, the Ministry of Environment and Climate Change (MOECC) may elect to issue a Provincial Order if the municipality does not demonstrate a willingness to address the waste treatment plant

requirements. The City also increases the risk of wastewater discharge quality not meet MOECC criteria as stipulated in the City's ECA. This could result in the issuance of Provincial Orders or fines.

10) **RISK MANAGEMENT :**
Implementation of this program will demonstrate the municipality's commitment to providing effective stewardship of its infrastructure. The program will assist in mitigating the negative operational issues such as odour generation etc. at the treatment facility

11) **STRATEGIC IMPLICATIONS :**
The waste treatment plant upgrades are consistent with the objectives of the draft strategic plan in terms of implementing strategic rehabilitation needs to existing city infrastructure.

12) **SUPPORTING DOCUMENTS:**
Attachment A - Key Plan of Waste Treatment Plant Site

City of Clarence-Rockland

Map of Rockland Sewage Treatment Plant & Boundary of Project