



REPORT

**BIOSOLIDS LAGOONS 2023 ANNUAL
GROUNDWATER MONITORING REPORT**
CITY OF CLARENCE-ROCKLAND

Submitted to:

City Of Clarence-Rockland

1560 Laurier Street, Rockland, Ontario, K4K 1P7

Submitted by:

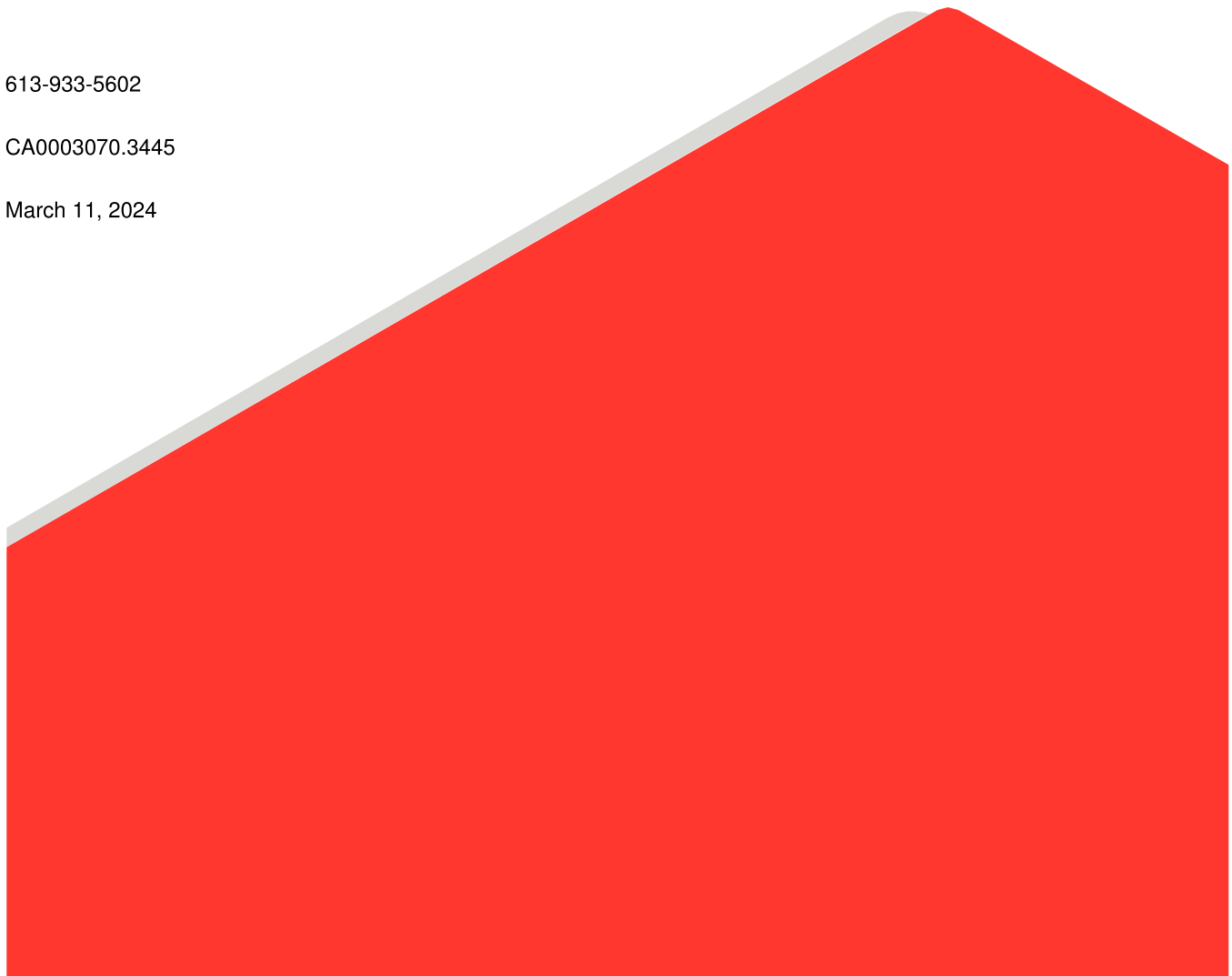
WSP Canada Inc.

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CA0003070.3445

March 11, 2024



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1 Electronic Copy - Willy de Wit, WSP Canada Inc. (WSP)

1 Electronic Copy – Phil Cormier, City of Clarence-Rockland

March 11, 2024

CITY OF CLARENCE-ROCKLAND
1560 Laurier Street
Rockland, Ontario
K4K 1P7

Attention: Nicolas Burelle, Infrastructure and Environmental Technologist

Subject: City of Clarence-Rockland Biosolid Lagoons

Dear Mr. Burelle,

WSP Canada Inc. (WSP) was retained by the City of Clarence-Rockland to complete the 2023 annual groundwater monitoring of the Clarence-Rockland Biosolids Lagoons in accordance with the conditions of the Site's Environmental Compliance Approval (ECA) No. 3-0466-93-967. WSP is pleased to submit herein the results of the groundwater monitoring program in the City of Clarence-Rockland Biosolids Lagoons 2023 Annual Groundwater Monitoring Report in electronic format. Should a hard copy be required, one can be provided upon request.

Should you require further information concerning this report, please do not hesitate to contact the undersigned.

Sincerely,



Jennifer Brown-Hawn
Senior Lead – Earth and Environment

JBH/jbh

cc: Willy de Wit (WSP)
Phil Cormier, City of Clarence-Rockland

WSP ref.:CA0003070.3445

LIMITATIONS

This Report was prepared for the Corporation of the City of Clarence-Rockland, solely for their exclusive use to provide an Assessment of current environmental/geotechnical conditions in association with the Site. WSP will not be responsible for any use of this report by any other party, for any decisions to be made based on it, or for the consequences thereof unless written reliance is granted by WSP. Unless otherwise agreed in writing by WSP, it shall not be used to express or imply warranty as to the suitability of the property for a particular purpose. WSP disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

The Report is intended to be used in its entirety. No excerpts may be taken to be representative of the findings in the assessment.

In evaluating the Site, WSP has relied in good faith on information provided by others, as noted in the Report. WSP has assumed that the information provided is correct and WSP assumes no responsibility for the accuracy, completeness or workmanship of any such information.

This project has been carried out using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by WSP and other engineering/scientific practitioners, working under similar conditions and subject to the time, financial and physical constraints applicable to this project. The conclusions presented in this Report are based on Work undertaken by trained professional and technical staff and the reasonable and professional interpretation using accepted engineering and scientific practices current at the time the work was performed. Conclusions presented in this report should not be construed as legal advice. WSP makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in the Report, including, but not limited to, ownership of any property, or the application of any law to the findings of the Assessment.

The Report summarizes WSP's review of available data in accordance with the principal components of the stated regulations, standards and guidelines and the scope, terms and conditions of the contract or proposal to which the Assignment was conducted. No other warranties are either expressed or implied with respect to the professional services provided under the terms of the contract or proposal and represented in this Report. Conditions may exist which were not detected given the nature of the inquiry WSP was retained to undertake with respect to the Site. Additional environmental studies and actions may be recommended.

The Report is based on data and information collected at the time of this Assessment, as stated in the Report. Site use or conditions change and the information and conclusions in the Report may no longer apply following the date of this Report. If any conditions become apparent that differ significantly from that presented in this Report, we request that we be notified to reassess the conclusions and recommendations provided herein. WSP disclaims any obligation to update this Report for conditions that may be identified after the date of this Report; however, WSP reserves the right to amend or supplement this report based on additional information, documentation or evidence.

Conclusions are based on the Site conditions observed by WSP at the time the work was performed and may include information obtained at specific testing and/or sampling locations. It is recognized that overall conditions can only be extrapolated to an undefined limited area around these testing and sampling locations. The conditions that WSP interprets to exist between testing and sampling points may differ from those that actually exist. The accuracy of any extrapolation and interpretation beyond the sampling locations will depend on natural conditions, the history of Site development and changes through construction and other activities. In addition, analysis has been carried out for the identified chemical and physical parameters only, and it should not be inferred that other

chemical species or physical conditions are not present. WSP cannot warrant against undiscovered environmental liabilities or adverse impacts off-Site.

Benchmark and elevations used in this report are primarily to establish relative elevation differences between the specific testing and/or sampling locations and should not be used for other purposes, such as grading, excavating, construction, planning, development, etc.

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1.0 INTRODUCTION

1.1 SCOPE

WSP Canada Inc. (WSP) was retained by the Corporation of the City of Clarence Rockland (City) to undertake the annual groundwater monitoring and reporting pursuant to satisfying the conditions prescribed by the amended Certificate of Approval (CofA) number 3-0466-93-967, Notice 3 originally issued February 8, 1996, included in **Appendix D**. This report covers the activities at the Site for the period of January 2023 to January 2024. This includes:

- Details of the groundwater and wastewater monitoring program.
- Assessment of the Site on the local groundwater and surface water resources.
- Assessment of the Site's compliance with the CofA (No. 3-0466-93967, Notice 3).
- To assess the compliance of the groundwater and wastewater quality with the Ontario Drinking Water Quality Standards (ODWQS), the Provincial Water Quality Objectives (PWQO) and the Ministry of the Environment, Conservation and Parks (MECP) Guideline B-7, where applicable.
- Provide recommendations associated with the 2023 monitoring program.

1.2 FACILITY DESCRIPTION

The City owns and operates a municipal wastewater treatment plant on part of Lots 22 and 23, Concession 1 in the City of Clarence-Rockland, at the municipal address of 700 Rue Industrielle (the Site), as illustrated in **Figure 1**, included in **Appendix A**. The facility includes two biosolids storage lagoons located within a fenced area with closed access to the public.

The Site is located in an area designated as Business Park in accordance with the City of Clarence-Rockland Official Plan, which permits general light industrial activities. The land surrounding the Site to the south and east are developed industrial properties. The area adjacent to the west is currently zoned to accommodate low-density residential land use. The Ottawa River is located approximately 120 meters north/northeast of the biosolids lagoons. The municipal wastewater treatment plant, as well as a municipal leaf and yard waste transfer station, are located on the premises immediately to the south of the lagoons.

1.3 GEOLOGY

The geology of the Site was evaluated based on a review of six borehole logs and well records for the area provided by the MECP. **Figure 1**, included in **Appendix A**, illustrates the monitoring well locations and the approximate Site boundary. Borehole logs for some of the monitoring wells on the property were not available for review. Borehole logs that were available for review are included in **Appendix C**.

The Site is generally composed of a topsoil layer overlaying a fine to a medium-grain sand layer above a deposit of gray-brown clay. Monitoring wells MW11-6 (north) and MW11-10 (south) did not present a sand layer; instead, the clay layer was evident below the topsoil. This indicates that the sand layer is localized to the area between monitors MW11-6 and MW11-10. It is also noted that a clayey fill material was observed from boreholes in the immediate vicinity of the lagoons, namely BH03-4, MW11-8, and MW11-9, possibly associated with the construction of the lagoons.

2.0 MONITORING PROGRAM

The monitoring program has been developed in consultation with the MECP and is documented in the Site's CofA. Modifications to the monitoring plan were recommended by WSP and implemented prior to the 2020 monitoring program in consultation with the City of Clarence-Rockland. These modifications are documented in the City of Clarence-Rockland, Biosolids Lagoon 2019 Annual Groundwater Monitoring Report prepared by WSP dated April 30, 2020. Specifically, the scope of the monitoring program for 2023 included:

- Record quarterly measurements of the static water elevations at the twelve on-site monitoring wells and semi-annual measurements from the two biosolids lagoons (spring and fall).
- Collect representative groundwater samples from each of the twelve monitoring wells and each of the on-site lagoons two times per year (spring and fall).
- Complete a semi-annual visual inspection of the integrity of the lagoon berms, lagoon visual and odour quality and surrounding area.
- Compare groundwater sampling results to the established groundwater triggers, ODWQS, or the PWQO as appropriate.
- Compile and interpret the data and prepare a report summarizing the findings of the assessment.

The monitoring wells are distributed to generally characterize the overburden groundwater upgradient and downgradient of the lagoons. Section 2.1 of the CofA requires groundwater quality to be compared against regulatory trigger limits and to ensure a 0.5m separation of the water table from the extent of the works.

2.1 GROUNDWATER

During each sampling event, the static groundwater elevations were measured prior to well development. Each monitoring well was purged a minimum of three well volumes or purged dry and allowed to recover prior to sampling using dedicated LDPE tubing equipped with a foot valve.

Representative groundwater samples were collected in laboratory-prepared sample bottles. Samples collected for dissolved metals analysis were field-filtered with disposable in-line 0.45 µm filters. All sample bottles were filled to the shoulder or neck of the bottle unless otherwise instructed by the laboratory. Samples were packed into coolers with ice under a chain of custody and shipped the same day to a Canadian Association for Laboratory Accreditation (CALA) accredited laboratory for analysis. Field water quality measurements, including pH, conductivity, temperature, and oxygen-reduction potential (ORP), were recorded at the time of sampling. The groundwater samples were analyzed by the laboratory for the following parameters, in accordance with the CofA and recommendations provided by historic annual monitoring reports:

- Total ammonia, Nitrate, Nitrite, Sulphate, Chloride, Sodium, Potassium
- Total phosphorus (TP), Total Kjeldahl Nitrogen (TKN), Organic Nitrogen
- Biological Oxygen Demand (BOD), Total Dissolved Solids (TDS), Total Organic Carbon (TOC)
- Dissolved metals: Aluminum, Antimony, Arsenic, Beryllium, Boron, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Molybdenum, Nickel, Selenium, Silver, Titanium, Thallium, Tungsten, Uranium, Vanadium, Zinc and Zirconium.

2.2 LAGOON SUPERNATANT

Measurement of the operating levels and samples of the supernatant from the biosolids lagoons were collected on May 15 and November 15, 2023, alongside the groundwater sample collection. During each sampling event, a visual inspection of the lagoons was completed. WSP inspection reports are included in **Appendix F**. Supernatant subsamples were collected from multiple locations in each of the lagoons and were composited to represent a composite sample from each lagoon. The composite sample was decanted into the proper laboratory-prepared sample bottles. All sample bottles were filled to the shoulder or neck of the bottle unless otherwise instructed by the laboratory. Samples were packed into coolers with ice under a chain of custody and shipped the same day to a CALA-accredited laboratory for analysis. Field water quality measurements, including pH, conductivity, temperature, and ORP, were recorded at the time of sampling. The lagoon supernatant composite samples were analyzed by the laboratory for the following parameters:

- Sulphate, Chloride, Sodium, Potassium
- TP
- TKN, Organic Nitrogen, Total Ammonia, Nitrate, Nitrite
- BOD, TOC
- Total Suspended Solids (TSS), TDS
- Dissolved metals; Aluminum, Antimony, Arsenic, Beryllium, Boron, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Molybdenum, Nickel, Selenium, Silver, Thallium, Tungsten, Uranium, Vanadium, Zinc and Zirconium.

3.0 RESULTS

3.1 GROUNDWATER

3.1.1 GROUNDWATER REGIME

Monitoring well 17-02 had an insufficient amount of water during the May, August, and November 2023 events and, therefore, could not provide a water elevation as it was evidently below the screened interval. Similarly, monitoring well MW11-7 could not provide a water elevation during the August 2023 event because the monitor could not be located due to excess vegetation. At monitoring wells MW-5, MW11-7, and MW11-8, elevations were not taken during the February 2023 event due to the inaccessibility of the wells associated with snow and ice coverage. Additionally, the water level was not collected at MW11-10 as the compound gate was locked, and keys were not available.

Section 2 of the CofA requires a 0.5 m separation from the base of the biosolid lagoons to the water table. This is monitored via a comparison of the water levels at monitors MW11-8 and MW11-9. Monitoring wells MW11-8 and MW11-9 are located within the vicinity of the lagoons and are screened appropriately to evaluate compliance with this condition of the CofA. In 2023, these wells indicated the water table was below the maximum elevation (~50.30 mASL) to provide a 0.5 m separation from the base of the biosolids lagoons (~50.80 mASL). This is consistent with historical results. It is important to note that the elevation assigned from the bottom of the lagoons is based on a review of the as-built information included in **Appendix G** and has not been independently confirmed.

Inferred potentiometric groundwater contours were developed for the overburden based on the May 15, 2023, elevations, which are summarized in **Table 1** and included in **Appendix B**. The inferred groundwater flow direction in the overburden is generally north towards the Ottawa River and Clarence Creek, as illustrated in **Figure 2**,

included in **Appendix A**. These observations are generally consistent with the findings of historical monitoring programs.

Some groundwater mounding effects are apparent in the immediate vicinity of the lagoons based on the water levels measured at MW11-8 and MW11-9. This is particularly apparent in MW11-9, as water levels at this monitor are consistently higher than at other monitoring wells at similar relative positions along the gradient. Due to the suspected mounding effects, MW11-9 is excluded from the calculations for the production of overburden groundwater contours associated with the May 2023 sampling event.

3.1.2 GROUNDWATER QUALITY

The results of the groundwater chemical analysis are summarized in **Table 2**, included in **Appendix B**. The analytical results were evaluated to assess for exceedances of the Site's trigger values, as well as for comparison against the limits prescribed by the ODWQS and MECP publication PWQO, since there are groundwater uses on adjacent properties and groundwater discharges to nearby surface water, respectively. The comparison to the ODWQS and PWQO are for information purposes only. The laboratory reports are included in **Appendix E**.

Monitoring wells MW-3 and MW11-10 are upgradient of the lagoons at the facility and, therefore, are considered representative of the background conditions (background monitors). After a review of the monitoring well construction, the locations of the monitoring wells, the overburden groundwater flow direction, and proximity to the adjacent features and activities (wastewater treatment works, leaf and yard waste transfer station, a high-traffic road, and neighbouring storage facility), it was determined that the water quality at monitoring well MW11-10 may be more vulnerable to influence by the adjacent on-site and off-site activities than monitoring well MW-3.

Additionally, based on information in the available borehole logs and as-built drawings for the works, the lagoons are located within the area of the Site where the geology includes a localized sand layer, which is separated only by about 1 m of native clayey silt from the bottom of the lagoons. For this reason, the sand layer is considered the most sensitive receiver of any exfiltration from the lagoons. The geochemical data for the major ions were plotted graphically using Schoeller's method to compare the groundwater and lagoon supernatant water quality results. It should be noted that a sample of the west lagoon supernatant could not be obtained in the spring of 2023 due to the levels in the lagoons being too low to collect a representative sample. The plots are illustrated in **Figure 3-1 and Figure 3-2**. It is evident in these plots that monitoring wells that are screened (or, in the absence of borehole logs, thought to be screened) to interface the sand layer on the Site have fairly distinct hydrochemical signatures compared to those screened within the clay. As such, monitoring well MW-3 has been adopted for use as a representative upgradient monitor since it is screened within the localized sand layer, while MW11-10 is screened at a similar depth but is not located within the localized sand layer and interfaces only with the clay.

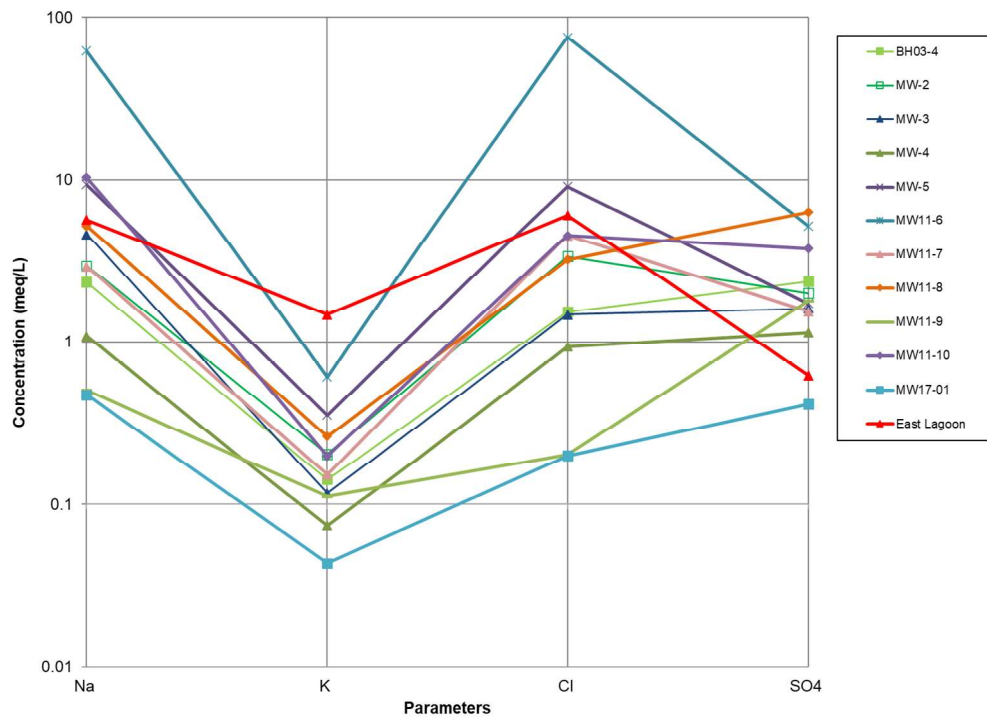


Figure 3-1: Lagoon Supernatant and Groundwater Schoeller Plot (May 2023)

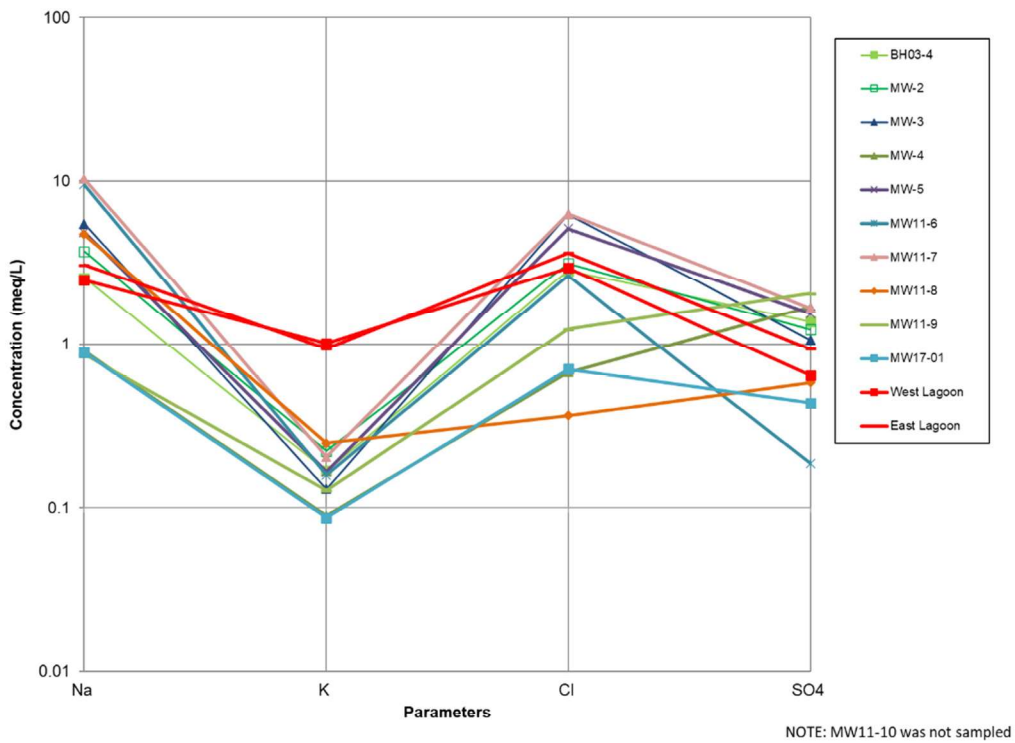


Figure 3-2: Lagoon Supernatant and Groundwater Plot (November 2023)

The following are specific noteworthy observations associated with the groundwater quality:

- Monitoring wells MW11-8 (adjacent to the lagoons) and BH03-4 (directly downgradient of the lagoons) had significantly elevated ammonia concentrations compared to the background monitor MW-3. This is indicative of impact associated with exfiltration from the biosolid lagoons.
- Monitoring wells BH03-04, MW-3, MW-2, MW-5, MW11-6, MW11-7, MW11-8 and MW11-10 exceeded the ODWQS total dissolved solids (TDS) limit (500 mg/L) during both sampling events. The West and East lagoon both exceeded the ODWQS TDS limit of 500 mg/L during the November sampling event. This could imply the lagoons having slight impact on the monitoring wells as both the East and West lagoon during the fall event had exceeded the ODWS limit (500 mg/L).
- In the spring monitoring event, monitoring wells MW-5 and MW11-6 demonstrate concentrations of chloride and sodium above the prescribed ODWQS limit (250 mg/L and 200 mg/L, respectively) and are significantly elevated compared to the background monitor MW-3 and to that of the lagoon supernatant. These monitors are located within the area of low relief and are not screened within the localized sand layer. Elevated sodium and chloride concentrations may be attributed to salt-impacted stormwater drainage from the winter-maintained service roads and parking areas at the Site and adjacent facilities since we do not see elevated sodium or chloride content in the lagoon supernatant, nor do we observe them at MW11-8 and MW11-9..
- Organic Nitrogen concentrations exceeded the ODWQS limit of 0.15 mg/L during the fall event for monitoring wells MW-3, BH03-04, MW-4. Monitor MW11-10 exceeded in the spring event and monitors MW17-01, MW11-9, MW11-7, MW11-6, MW-5, and MW-2 exceeded the ODWQS limit during both monitoring events in 2023.
- Monitoring well MW-2 exceeded the limit prescribed by the ODWS for nitrate (10 mg/L) during the November sampling event. Although not exceeding, monitoring wells MW17-01, MW-5, MW11-7 and the November event for BH03-04 demonstrated nitrate concentrations more elevated than the background monitoring MW-3. Other downgradient monitors have detectable concentrations of nitrate comparable to or slightly more elevated than the background monitor.
- Monitoring well MW-4 exceeded the PWQO limit for iron (0.3 mg/L) during the November event, and MW11-8 and BH03-4 exceeded the PWQO limit during both sampling event. Samples from monitoring wells BH03-4 and MW11-8 had significantly elevated iron concentrations compared to background well MW-3 and on the same order of magnitude as the west biosolid lagoon supernatant. All sampled waste lagoon monitoring events exceeded the PWQO iron limit (0.3 mg/L).
- Total Phosphorus concentrations exceeded the PWQO limit of 0.2 mg/L at each monitoring well consistently since 2019, with the exception of the May 2023 event at the interim background monitoring well, MW-3.
- Monitor MW11-10 continues to demonstrate an exceedance to the PWQO for uranium (0.005 mg/L).
- During the spring monitoring event, monitor MW11-6 demonstrated an exceedance of the PWQO limit for silver (0.0001 mg/L).
- For each monitoring event in 2023, monitors MW11-8, BH03-4, and monitor MW11-10 in the November 2023 event had elevated total kjeldahl nitrogen (TKN) compared to the background monitor MW-3.

3.1.3 GROUNDWATER TRIGGER ASSESSMENT

In accordance with the Site's CofA, nitrate, nitrite and total phosphorus are required to be assessed as indicators of downgradient groundwater impacts associated with the activities at the Site. If trigger concentrations are exceeded at the downgradient or boundary monitoring wells, then the "plan of action" described in the CofA shall be implemented. Specific details associated with the "plan of action" or otherwise contingency measures associated with trigger exceedances were not reviewed as part of this mandate. Based on correspondence with the MECP by other consultants, total ammonia was recommended to be included as an additional indicator parameter and has been included in WSP's assessment.

Previous annual reports prepared by others designated monitoring wells MW-3 and MW11-10 as the background for the trigger evaluation; however, as discussed in **Section 3.1.2**, monitoring well MW-3 has been designated for this purpose on an interim basis for trigger assessment.

Based on previous annual monitoring reports prepared by others, the trigger limit has been assigned as the median value for each parameter, including data from historical monitoring programs since 2003. **Table 4**, included in **Appendix B**, compares the trigger value calculated at monitoring well MW-3 to the values measured at the boundary monitoring wells MW-4, MW-5, MW11-6, MW17-01, and MW17-02 during each sampling event. Monitoring well MW17-02 was dry during the spring and fall events.

The trigger limit was exceeded during the May and November 2023 sampling events for nitrate at background well MW-3, boundary monitors MW-4 and MW17-01 and in the November sampling event for MW-5. It should be noted that background monitor MW-3 is also exceeding, which indicates natural or other sources causing elevated nitrate upgradient.

Nitrite appears to exceed the Trigger limit of 0.05 mg/L at MW-5 and at MW11-6 during the spring event as the nitrite concentration was reported by the laboratory as <0.5 mg/L. This means that the concentration was below the detection limit of 0.5 mg/L but could not be quantified with an exact number; therefore, nitrite may or may not be exceeding the 0.05 mg/L Trigger limit as the exact concentration of nitrite could not be reported at these locations.

The trigger limits were exceeded for ammonia during the May 2023 sampling event at MW-5, MW11-6, background monitoring well MW-3, and boundary wells MW-4 and MW11-6 during the November sampling event. It should be noted that the ammonia concentration was elevated at the background monitoring well MW3 in November.

3.1.4 GROUNDWATER RUP ASSESSMENT

An assessment of the groundwater quality in accordance with the guidance in the MECP publication *Incorporation of the reasonable use concept into MOEE groundwater management activities, Guideline B-7* (Guideline B-7) to determine acceptable concentrations of contaminants in the groundwater at the Site boundary. This guidance establishes the basis for determining the "reasonable use" of groundwater on property adjacent to sources of contaminants and for determining the levels of contaminant discharges considered acceptable. Specifically, the publication makes reference to the technical procedure described in the MECP publication *Procedure B-7-1: Determination of Contaminant Limits and Attenuation Zones*. This mechanism is described as the Reasonable Use Policy (RUP).

The reference concentration for each parameter is established by calculating the geometric mean of the historical results for that parameter at the background monitor, which for this purpose has been assigned as monitoring well MW-3. The RUP criteria are calculated using the geometric mean value of the data from the background monitor

(MW-3) and the ODWQS maximum acceptable or maximum desirable concentrations and applying the following relationship:

$$C_m = C_b + x(C_r - C_b)$$

where (C_b) is the background concentration, (C_r) is the applicable ODWQS/OG limit, and x is 0.5 for non-health-related parameters or 0.25 for health-related parameters.

The parameters chosen for the assessment include those parameters which form part of the groundwater monitoring suite of analysis and have limits prescribed by the ODWQS. The RUP limit was calculated for the spring and fall events and are summarized in **Table 5**, included in **Appendix B**. Nitrite, iron, sodium, chloride, and Total Dissolved Solids (TDS) exceeded the RUP criteria at several monitoring wells in 2023. The following should be noted:

Although nitrite appears to exceed the RUP, it was reported by the laboratory as <0.5 mg/L at MW-5, MW11-6, and MW11-10 during the spring event. This means that the concentration was below the detection limit of 0.5 mg/L but could not be quantified with an exact number; therefore, nitrite may or may not exceed the 0.29 mg/L RUP limit as the exact concentration of nitrite could not be reported at these locations.

The RUP criteria for sodium was exceeded at MW5 and MW11-10 in the spring event and during both events at MW11-6. TDS exceeded the RUP criteria for MW11-10, MW-5, and MW11-6 during the spring and fall events and during the fall event at background monitor MW-3. Chloride exceeded the RUP criteria for MW-5 (both events), MW11-6 (spring only) and MW11-10 (fall only). The RUP criteria for iron was exceeded in the fall at MW-4 and MW11-9.

Chloride, iron, sodium, TDS and organic nitrogen exceedances are associated with aesthetic water quality parameters and are not health-related.

Sodium, chloride, and TDS are elevated at certain boundary monitors, particularly those screened in the native clay in the area of low relief north of the lagoons. It is important to note that the supernatant in the biosolid lagoons does not exhibit elevated concentrations of sodium or chloride.

3.2 SITE CONDITIONS

3.2.1 BIOSOLIDS LAGOON SUPERNATANT

The results of the lagoon supernatant chemical analysis are summarized in **Table 3**, included in **Appendix B**, and laboratory reports are included in **Appendix E**.

No sample was collected from the west lagoon on May 15, 2023, due to the water level in the lagoon being too low to collect a representative composite sample.

3.2.2 GROUNDWATER MONITORS

The groundwater monitors are visually inspected during each sampling event by WSP employees. During site visits, it was noted that monitoring wells MW11-8 is flush to the ground; however, is not cased in a proper flush mount casing and MW11-7 was approximately 0.25 m above grade (**Appendix F**). These monitors should be extended above grade as per the requirements of Ontario Regulation (O.Reg.) 903. Additionally, the monitoring well casings for MW-4 and MW-5 were discovered to be leaning, applying pressure to the internal PVC (**Appendix F**). Repair to the casings and PVC should be completed to protect the integrity of these monitors. Tree clearing and maintenance were also required to gain access to the monitoring wells.

3.2.3 INSPECTIONS

The lagoon embankments were visually inspected by WSP on May 15 and November 15, 2023. WSP inspection reports are included in **Appendix F**. The results of the inspections are summarized below:

- The extent of the exterior embankments of the lagoons at the time of the inspection was in good condition with no evidence of erosion, breakouts or conditions that would result in significant exfiltration.
- There was evidence of erosion of the interior embankment at the south edge of the East lagoon and on the south and north edges of the west lagoon. As a result, the interior slopes of the lagoons are greater than as indicated on the available as-built information. During the November inspection, the East lagoon was overgrown with vegetation impeding proper assessment of the lagoon slopes.
- The south sides of both lagoons exhibit more defined erosion issues as the south side is used for emptying the lagoons throughout the year.
- A chain link fence and locked gates to the south and east are used to provide site security around the biosolids lagoons. A section of the perimeter remains unfenced at the southwest corner of the lagoons, facing the undeveloped forest.
- No signage is present or visible indicating the risks associated with the biosolid lagoons. It is recommended to post signs at the entrance gate to the lagoons to identify the biosolids lagoons and advise of the risks associated with entry, namely drowning, as well as biological and chemical exposure.
- No lifesaving devices and/or rescue aids were observed in the immediate vicinity of the lagoons.
- A small animal borrow was noted at the top of the berm for the west lagoon on the northeast side.
- Vegetation on the dividing berm and exterior embankments were noted to be previously maintained but were in need of maintenance, as well as the inside slope of the berms during the May 15 inspection. During the November 15, 2023, inspection, the top of the berm was maintained, and the inside slope of the berm was not maintained.
- The lagoons were noted to produce a moderate level of odour during the May 15 inspection and a mild odour during the November 15 inspection.

4.0 CONCLUSIONS

It is evident that there are groundwater impacts associated with the operation of the biosolids storage lagoons. There is evidence of groundwater mounding in the vicinity of the lagoons, and the elevated concentrations of some contaminants in the groundwater downgradient and in the immediate vicinity of the lagoons suggest that exfiltration from the lagoons may be occurring.

Based on information in the available borehole logs and as-built drawings for the works, the lagoons are located within the area of the Site where the geology includes a localized sand layer, which is separated by about 1 m of clayey silt from the bottom of the lagoons and dewatering subdrain structures. The separation from the sand layer is even more reduced in the vicinity of the west lagoon based on the information in the borehole log for monitoring well MW11-9. Based on this apparent separation distance, there is an increased risk of lagoon exfiltration in this area, which may explain the apparent groundwater mounding phenomena observed at monitoring wells MW11-8 and MW11-9.

Trigger concentrations have been exceeded at boundary monitoring wells. As such, the “plan of action” described in the CofA should be implemented. Specific details associated with the “plan of action” or otherwise contingency measures associated with trigger exceedances are not described in the ECA, and otherwise, no specific information associated with approved contingency measures was available for review by WSP.

5.0 RECOMMENDATIONS

- Trigger concentrations have been exceeded at boundary monitoring wells. As such, the “plan of action” described in the CofA should be implemented.
- Continue to implement the current monitoring and reporting program, including provisions for groundwater static elevation measurements, groundwater and lagoon supernatant sampling, and visual inspections of the condition of the works.
- Signage indicating the water hazards should be installed, and lifesaving devices and/or rescue aids should be available in the immediate vicinity of the lagoons in an appropriate and prominent location.
- Staff gauges or other suitable apparatus for indicating/sensing the operating levels of the lagoon should be added to ensure appropriate freeboards are respected and total liquid volume can be monitored.
- Outdoor lighting in vehicular traffic and heavy equipment operation areas in the vicinity of the lagoons should be added.
- Berms should be inspected regularly to confirm the integrity of the berm. If signs of burrowing are evident, further investigation is required and the issue rectified to maintain the integrity of the lagoon berms (i.e. removal of the burrowing animals and repair to the berms).
- MW11-8 and MW11-7 should be extended to meet the requirements of O. Reg 903. Repair to the casings and PVC of MW-4 and MW-5 should be completed to protect the integrity of these monitors and to avoid damage to PVC.
- Continue to monitor the groundwater chemistry at MW-3 to evaluate its suitability for use as an interim background monitor. Additional investigation should be considered to confirm the well construction details and geology in the vicinity of the well to ensure that this monitor is not influenced by local surface water or other sources with the potential to impact the groundwater quality.
- Monitoring wells MW11-6 concentrations of sodium and chloride are considerably elevated compared to other monitors. These elevated concentrations are not evident in other monitoring wells exhibiting evidence of impact associated with the biosolids lagoons, nor are there significant quantities of sodium and chlorine in the lagoon supernatant.
- At the next opportunity when sludge removal takes place, a detailed survey of the lagoons to confirm the as-built condition of the works should be undertaken to provide confidence in the separation of the overburden groundwater and the bottom extent of the works. The survey should also include an intrusive examination of the construction of the bottom of the lagoon and the underlying geology to establish the level of hydraulic security provided by the lagoon construction and underlying native soils.
- There was evidence of recent refurbishment of structures within the lagoons that appear to be for the purpose of improving the decanting and passive dewatering performance of the lagoons. These structures do not appear

on the available as-built information for the Site, and there are no provisions for such decanting devices in the CofA. The CofA should be amended to reflect the as-built condition of the works.

Signature Page

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