



**Committee of Adjustment
Planning Advisory Committee Meeting
Monday, August 28, 2023 – 1:00 p.m.
Municipal Office – Council Chambers
6648 Road 506, Plevna, ON
[Zoom Meeting Registration](#)**

Page

1. Call to Order

2. Approval of Agenda

a) August 28, 2023

Be It Resolved That the Committee approves the Agenda for the August 28, 2023 Meeting, as circulated.

3. Disclosure of Pecuniary Interest and General Nature Thereof

4. Delegations

None.

5. Adoption of Minutes

3 - 6

a) Minutes of Meeting

Be It Resolved That the Committee adopts the Minutes of a Meeting held July 24, 2023 as circulated.

6. Business Arising from the Minutes

7 - 23

a) Resolution #23-23: File #A07/23 - Part of Lot 6, Concession 12 - 2260 Grindstone Lake Road, Geographic Township of Miller - Request for Permission to Expand Legal Non-Complying Structure (Davidson)

24 - 103

b) Resolution #38-23: File #A10/23 – Application for Minor Variance – 9489C Road 509 - Minor Variance for Reduced Setback from Licenced Boundary of Aggregate Pit (Poulin)

7. Zoning By-law Amendment Application (Recommendation to Council)

None.

8. Consent Applications

None.

9. Minor Variance Applications

104 - 331

- a) File #A11/23 - Part of Lot 19, South West Range, Geographic Township of Clarendon (1230D Austris Road) - Minor Variance for Reduced Setback from Waste Management Facility

10. Other Business

None.

11. Adjournment

- a) Adjournment of the Committee Meeting

Be It Resolved That the meeting adjourns at _____ p.m. until September 25, 2023 at 1:00 p.m. or at the call of the Chair.

“Accessible formats and communication support are available upon request. The Township of North Frontenac is committed to accessibility for persons with disabilities. Please contact Eric Korhonen, Accessibility Coordinator at firechief@northfrontenac.ca if you have an Accessible accommodation request.”

8. Zoning By-law Amendment Application (Recommendation to Council)

None.

9. Consent Applications

None.

10. Minor Variance Applications

a) File #A10/23 - Part of Lot 28, Concession 1, Geographic Township of Palmerston (9489C Road 509) - Minor Variance for Reduced Setback from the Licenced Boundary of an Aggregate Pit

Joseph Poulin, applicant, attended the meeting in person.

Dmitry Kurylovich provided an overview of the application. He noted he is not the planner on file for the application; however would provide the background information in the absence of the commenting planner, Jennie Kapusta.

Kurylovich advised the application was to permit a sensitive land use (dwelling) within the setback of licenced pit. He noted the proposed separation distance from the lot line of the licenced pit to the lot line where the dwelling is located is 0 metres; and that the minimum distance required in the Zoning By-law is 70 metres.

Kurylovich advised an application was submitted in 2021 which required a D Series study. The applicant provided a report advising further investigation was required. Based on this information, the Committee denied the application. This decision was appealed by the applicant to the Local Planning Approval Tribunal (LPAT), which is now the Ontario Land tribunal (OLT). The Tribunal upheld the decision to deny the application due to the insufficient study.

Kurylovich advised the applicant provided a new application and assessment, which requires a peer review to ensure the study and recommendations are adequate. He recommended deferral of the application until the peer review has been completed.

Wood advised he attended the site on July 9, 2023. He noted the front of the lot is quite steep; however there is a plateau at the top towards the rear of the property. He noted the rear of the property is heavily treed between the dwelling and the licenced pit.

Wood noted a survey plan with the building envelope shown would be helpful in showing where a dwelling could be located to meet the required setbacks. Kurylovich advised measurement for the required setback from the licenced pit is from lot line to lot line; and development on the lot cannot meet the required 70 metre setback. He noted the minor variance is specifically looking at the area identified for development; the purpose is not to identify the best building envelope but to determine if the location of the dwelling can be supported by a reduced setback.

Ogilvie asked what is the setback from the limit of extraction to the lot line; and what is the impact of sound with the vegetative buffer in place. Kurylovich advised the impact of sound will be addressed in the assessment, which looked at the impact if the operation

Date May 29, 2023



Resolution # 23-23

**Resolution of the Committee of Adjustment/
Planning Advisory Committee
of the Corporation of the Township of North Frontenac**

Moved By:
Carl Tooley

Seconded By:
Garry Wood

Be It Resolved That Planning Application File #A07/23 – Request for Permission to Expand Non-Complying Structure– James Davidson and Anne Pitman, 2260 Grindstone Road - shall be deferred until the required Slope Stability Report has been provided.

Carried

Chairperson



Planning Report

To: Members of Committee of Adjustment

Prepared By: Dmitry Kurylovich, Community Planner, County of Frontenac

Reviewed By: Sonya Bolton, Manager, Community Planning, County of Frontenac

Re: **Application for Permission to Expand a Legal Non-Complying Structure (Dwelling)**

Address: 2260 Grindstone Lake Road

Legal Description: Part Lot 6, Concession 12, Geographic Township of Miller

File Number: A07/23 (Davidson & Pitman)

Owner(s): James Davidson and Anne Pitman

Applicant(s): Same as Owners

Date Prepared: May 16, 2023

Date of Public Meeting: May 29, 2023

Date of Report: August 22, 2023

Recommendation:

That the Committee of Adjustment for the Township of North Frontenac approve the application subject to the conditions outlined in Appendix A of this report.

Proposal:

This application proposes to construct a one storey 35.3 square metre (380 square foot) dwelling addition to the existing two storey 100 square metre (1,066 square foot) dwelling with two attached decks totaling 30 square metres (320 square feet)

The addition is to an existing cottage that was initially constructed in 1987 within the 30-metre (98.4 foot) setback to the high-water mark now required by the Township Zoning

By-Law Number 55-19. Permission is required to expand the size of the non-complying dwelling. Refer to the site plan (Attachment 2) and the list of existing structures below for the site context.

Existing Development

- A two storey dwelling with a one storey bedroom addition and an enclosed screened porch, totalling 100 square metres (1,066 square feet). The dwelling supports two attached decks totaling 30 square metres (320 square feet). The existing dwelling is located approximately 21 metres (69 feet) from the estimated highwater mark of Grindstone Lake.
- A 17.7 square metre (190 square foot) sleep cabin located approximately 33.5 metres (100 feet) from the edge of Grindstone Lake.
- A 13.4 square metre (144 square foot) bath house located approximately 39 metres (130 feet) from the edge of Grindstone Lake.
- A Class-4 sewage disposal system that is located approximately 39.6 metres (130 feet) from the waterbody. The tile bed is proposed to be replaced and expanded in 2023 to accommodate the washhouse. The sewage disposal system is not subject to this application.

Background Information

Information Category	Response
Official Plan designation	Waterfront Area
Zoning	Limited Service Waterfront (LSW)
Current size (area) of subject property	0.34 hectares (0.84 acres)
Existing road frontage and access	Approximately 80 metres (262 feet) on Grindstone Lake Road (an unmaintained section of a Township Road)
Waterfront	Approximately 80 metres (262 feet) on Grindstone Lake
Natural heritage features	Shoreline vegetation is mostly intact.
Surrounding land uses	The lot is located on a spit on a southeastern shore of Grindstone Lake.

Information Category	Response
	The lot is bordered by waterfront residential properties of smaller size to the east, west, and south.

Update Following Initial Public Meeting – May 29, 2023

This application was deferred at the May 29th Committee meeting because the original concept included a covered deck that was proposed to be constructed within 15 metres (50 feet) of a top of slope that was identified to be potentially unstable by the Mississippi Valley Conservation Authority (MVCA).

The applicant has since modified the proposed concept and removed the covered deck and slope setback encroachment and increased the size of addition by 3.72 square metres (40 square feet). The proposed development now appears to be located at least 15 metres (50 feet) from the top of slope as required by Section 3.18 Hazardous Sites of the Zoning By-law. A variance from the top of slope is no longer required.

The top of slope and 15 metre (50 foot) setback was identified by the Township's Chief Building Official with a stake which was plotted onto the applicant's site plan. The application can now be considered solely under Section 45(2) of the Planning Act, which deals with the expansion of legally non-complying uses and structures.

The initial application considered by the Committee on May 29, 2023 was to construct:

- A one storey 33.4 square metre (360 square foot) dwelling addition the existing two storey 100 square metre (1,066 square foot) dwelling with two attached decks totaling 30 square metres (320 square feet), and
- A 13.4 square metre (144 square foot) covered deck on the north side of the proposed addition.

Pre-application Consultation:

The property owner consulted with Township and County planning staff prior to the submission of this application.

Public Notice

Notice of the public meeting before the Committee of Adjustment on May 29, 2023, was given in accordance with the requirements of the Planning Act. A notice was placed on the subject property and mailed to all property owners within 60 metres of subject property, 10 days in advance of the meeting.

Comments

Mississippi Valley Conservation Authority (MVCA)

Comments dated May 19, 2023, indicate that the proposed addition will be located within the required 15 metre (50 foot) top of slope setback required by Section 3.18 of the Township Zoning By-law. The slope identified on the property meets the criteria of being potentially unstable and therefore a slope stability assessment is required to support the proposal.

MVCA staff provided two options to the applicant. Option 1 was to relocate the addition outside of the 15 metre (50 foot) top of slope setback. Option 2 was to complete a slope stability study to support an encroachment into the required 15 metre (50 foot) top of slope setback.

The applicant has modified the addition to ensure that it meets the required 15 metres (50 foot) slope setback.

Septic Approval Authority (Township of South Frontenac)

The septic approval authority was not circulated on the proposed application because the existing septic system is located outside of the waterbody setback and is therefore not subject to this application. The applicant is in the process of upgrading their existing tile bed to accommodate the construction of a bath house (not subject to this application).

Public Comments

County planning staff are not aware of any public comments received at the time of drafting this report.

Conformity and Consistency with Policy Planning Documents

Applications for permission are required to be consistent with the Provincial Policy Statement, 2020 and conform to both the County of Frontenac Official Plan and the Township of North Frontenac Official Plan. It is the opinion of planning staff that the proposed expansion is consistent with and conforms to the planning policies of all these documents.

The key policies of each document that are applicable to the subject applications are outlined in Appendix B of this report, and the policy issues are addressed in the planning analysis below.

North Frontenac Zoning By-Law Number 55-19

The subject property is zoned Limited Service Waterfront (LSW) in the Township of North Frontenac Zoning By-Law Number 55-19. The LSW Zone permits single detached dwellings and a variety of low-impact accessory uses.

The LSW zone permits a maximum lot coverage of 15% and a minimum waterbody setback of 30 metres (98 feet) for all principal uses and structures (dwelling) within 60 metres (200 feet) of the shoreline. The lot coverage proposed by this application falls below the maximum set out in the Zoning By-law.

The existing dwelling was constructed within the required 30 metre (98.4 foot) waterbody setback before the current zoning by-law came into effect and is therefore considered to be a non-complying structure. Section 3.24 of the Zoning By-law allows the renovation, repair, or reconstruction of existing non-complying structures as long as the footprint and volume of the structures are not increased. Since the application proposes to increase the existing footprint of the dwelling, approval is required under Section 45(2) of the Planning Act.

The intent of the 30 metres (98.4 foot) waterbody setback is to provide a vegetative buffer between a development envelope and shoreline for the purpose of maintaining aquatic habitat, run-off filtration, and reducing visual impacts of development on the waterfront character of the area.

The proposed dwelling addition will be located farther from the water than the existing dwelling. No extensive vegetation will be removed to accommodate the proposed addition.

Planning Analysis and Considerations

This application was reviewed against the policies of the Provincial Policy Statement, the County of Frontenac Official Plan, and the Township of North Frontenac Official Plan. The analysis below summarizes all relevant policies by theme. A list of all land-use planning policies relevant to this application is found in Appendix B of this report.

Waterfront Character

County planning staff are of the opinion that the proposed dwelling enlargement will have no impact on the waterfront character and surrounding area. The proposed addition will be shorter and located farther from the water than the existing dwelling. The existing development envelope is screened from the waterbody by an intact riparian area consisting of large trees and extensive ground vegetation.

Sewage Disposal System Services

The existing dwelling is serviced with an existing septic system that is located downslope of the shoreline and approximately 39 metres (130 feet) from the edge of Grindstone Lake. Although the existing septic system is being upgraded to

accommodate the existing bathhouse, it is not subject to this application. County planning staff are of the opinion that the existing septic system is in the most ideal location with respect to lake health.

Natural Heritage

No significant vegetation removal is proposed. The proposed dwelling addition will be located in an already cleared area on the subject property. Based on historical satellite imagery, the area proposed for development has been cleared since at least 2008. The dwelling addition is not anticipated to require significant land alteration. The existing shoreline vegetation will not be impacted by this development.



Figure 1: Photo of the existing dwelling. No significant vegetation is evident within the area of the proposed addition.

Minimum Distance Separation

No livestock facilities, aggregate extraction operations, or landfills were identified within the applicable screening areas surrounding the subject property.

Natural Hazards

Aside from the steep slope and associated 15 metre (50 foot) setback, no additional natural hazards were identified on the site. County planning staff are satisfied that the revised site plan demonstrates that the proposed development will be located outside of the slope setback.

Legal Non-Conforming Structures

In accordance with Section 45(2) of the *Planning Act*, the Committee of Adjustment may permit the enlargement or extension of an existing legal non-conforming building or structure, where the use of such building or structure does not conform with the provisions of the Zoning By-law but legally has been in continuous existence before and following the date the By-law was passed. No permission may be given by the Committee to enlarge or extend the building or structure beyond the original limits of the land where the legal non-conforming building or structure is situated.

In considering whether to grant a permission pursuant to Section 45(2), the relevant tests are:

1. Is the application desirable for appropriate development of the subject property?

County planning staff are of the opinion that the application is desirable for the appropriate development of the subject property.

The proposed addition will allow the dwelling to be expanded to accommodate the land owner's needs without any vegetation removal or significant land alteration. The proposed development will also be located outside of the required 15 metre (50 foot) slope setback.

The total footprint proposed by this application falls below the maximum lot coverage required by the Zoning By-law.

2. Will the application result in undue adverse impacts on the surrounding properties and neighbourhood?

County planning staff are of the opinion that the proposed addition will not result in any undue adverse impacts on the surrounding properties and neighbourhood.

The proposed dwelling addition will be located farther from the waterbody than the existing dwelling. The addition is anticipated to match or compliment the façade of the existing dwelling and will be screened from the shoreline by the intact vegetative buffer.

No shoreline vegetation is anticipated to be removed and no impact is anticipated on the aesthetic or quality of the shoreline and waterbody. The proposed addition meets all other zoning provisions and is not anticipated to impact adjacent properties.

Recommendation

Subject to any additional comments received prior to, or during, the Committee of Adjustment meeting, it is recommended that the Committee of Adjustment approve application A07/23, as per the plans submitted with the application, and with the recommended conditions attached in Appendix A.

Attachments

Appendix A: Draft Conditions of Approval

Appendix B: Relevant Planning Policy and Legislation

Attachment 1 – Key Map

Attachment 2 – Applicant Submitted Site Plan

Attachment 3 – Building Drawings

Appendix A: Draft Conditions of Approval

Note: Conditions are a decision of the Committee of Adjustment; the conditions below are recommended. The final approved conditions will be included in the signed decision.

Recommended Conditions for Application A07/23 (Davidson & Pitman)

Applicability

1. That the permission granted through application A07/23 is only to construct:
 - a. A one storey 35.3 square metre (380 square foot) dwelling addition to the existing two storey 100 square metre (1,066 square foot) dwelling with two attached decks totaling 30 square metres (320 square feet).
2. This permission does not include a reduction in the required setbacks along the entire width/length and depth of the property or for any future structures.

No Adverse Impacts

3. The owner/applicant shall ensure that there are no adverse impacts on neighbouring properties as a result of the approved proposal, nor shall there be any increased runoff or grade changes to the property as a result of any excavation or downspout orientation.

Building Permits

4. A building permit is required for all demolition and construction on the property. There shall be no additional development, or demolition of existing structures, on the property without approval from the Township of North Frontenac.
5. The owner/applicant shall provide to the Building Department a copy of the decision of the Committee of Adjustment, together with a copy of any approved drawings. The drawings submitted with the building permit application must, in the opinion of the Township, conform to the general intent and description of any approved drawings, including any amendments and conditions approved by the Committee of Adjustment, as stated in the decision. Additional variances may be required should further zoning deficiencies be identified through the Building Permit application process.

Conservation Authority

6. The applicant should be advised that, pursuant to Ontario Regulation 153/06 – Development, Interference with Wetlands and Alterations to Shorelines and Watercourses”, a permit is required from MVCA prior to any alterations to the shoreline of the lake.

Construction Method

7. Sediment control measures shall be implemented throughout the construction process (mainly the placement of a sediment barrier such as staked straw bales between exposed soil and the lake). The sediment barrier shall remain in place and in good working order until all disturbed areas have been stabilized and re-vegetated.
8. All excavated material and accumulated sediment along sediment control measures shall be disposed of more than 30 metres (98 feet) of the waterbody. Excess soil or fill shall not be placed in any low area and shall not interfere with any seasonal or permanent wetlands or watercourse.
9. Natural drainage patterns on the site shall not be substantially altered such that additional run-off is directed towards the lake, or onto neighboring properties. In order to achieve this, eaves troughing shall be installed on the additions and outlet away from the lake, to a leach pit or well-vegetated area to maximize infiltration.

Appendix B: Relevant Planning Policy

Provincial Policy Statement (2020)

The Provincial Policy Statement (PPS) provides direction on matters of Provincial interest related to land use planning and development. The PPS promotes efficient land use and development patterns that support strong, liveable and healthy communities, protect the environment and public health and safety, and facilitate economic growth. Under Section 3 of the Planning Act, all municipal decisions regarding planning applications “shall be consistent with” applicable provincial policy.

When assessing consent applications on rural lands, planning authorities must comply with Section 1.1.5.1 of the PPS, which requires the approval authority to apply the relevant policies of the following sections:

- Section 1: Building Strong Healthy Communities of the PPS promotes the building of healthy communities and includes policies about avoiding development and land use patterns which may cause environmental or public health and safety concerns.
- Section 2: Wise Use and Management of Resources of the PPS contains policies that encourage the protection of natural heritage, water, agricultural land, mineral and aggregate resources, and cultural heritage and archaeological resources for their economic, environmental and social benefits.
- Section 3: Protecting Public Health and Safety of the PPS contains policies intended to reduce the potential for public cost or risk to Ontario’s residents from natural or human-made hazards. Conservation Authorities have provincially delegated responsibilities to represent Provincial interests regarding natural hazards under Section 3.1 of the PPS.

The following policies are applicable to this application:

- Avoiding development and land use patterns which may cause environmental or public health and safety concerns (Section 1.1.1.c).
- Permitted uses on rural lands include residential development that is locally appropriate (Section 1.1.5.2.c).
- Supporting healthy, integrated and viable rural areas by building upon rural character and leveraging rural amenities and assets (Section 1.1.4.1.a).
- Promoting development that is compatible with the rural landscape and can be sustained by rural service levels (Section 1.1.5.4).
- Natural features and areas shall be protected for the long term (Section 2.1.1).

- Development shall be directed away from areas of natural or human-made hazards where there is an unacceptable risk to public health or safety or of property damage, and not create new or aggravate existing hazards (Section 3).

County of Frontenac Official Plan (2016)

The County of Frontenac Official Plan is a framework for guiding development in the County through the management and protection of the natural environment and by providing direction and influence on growth patterns. It is focused on the six themes of economic sustainability, growth management, community building, housing and social services, heritage and culture, and environmental sustainability.

The following policies are applicable to this application:

- Section 3.3, Rural Lands, provides policies for all lands outside of the settlement areas. The Plan recognizes that rural lands are used as an alternative location for those preferring a rural lifestyle. Low density residential development, as well as rural-related commercial, industrial, recreational and institutional development, is permitted.
- Section 4.2, Servicing, includes policies for the use of private on-site water and sewage services, provided that site conditions are suitable for the long-term provision of such services with no negative impacts.
- Section 7, Environmental Sustainability, sets out policies for environmental sustainability and the protection of the natural heritage system and the ecological functions it provides.

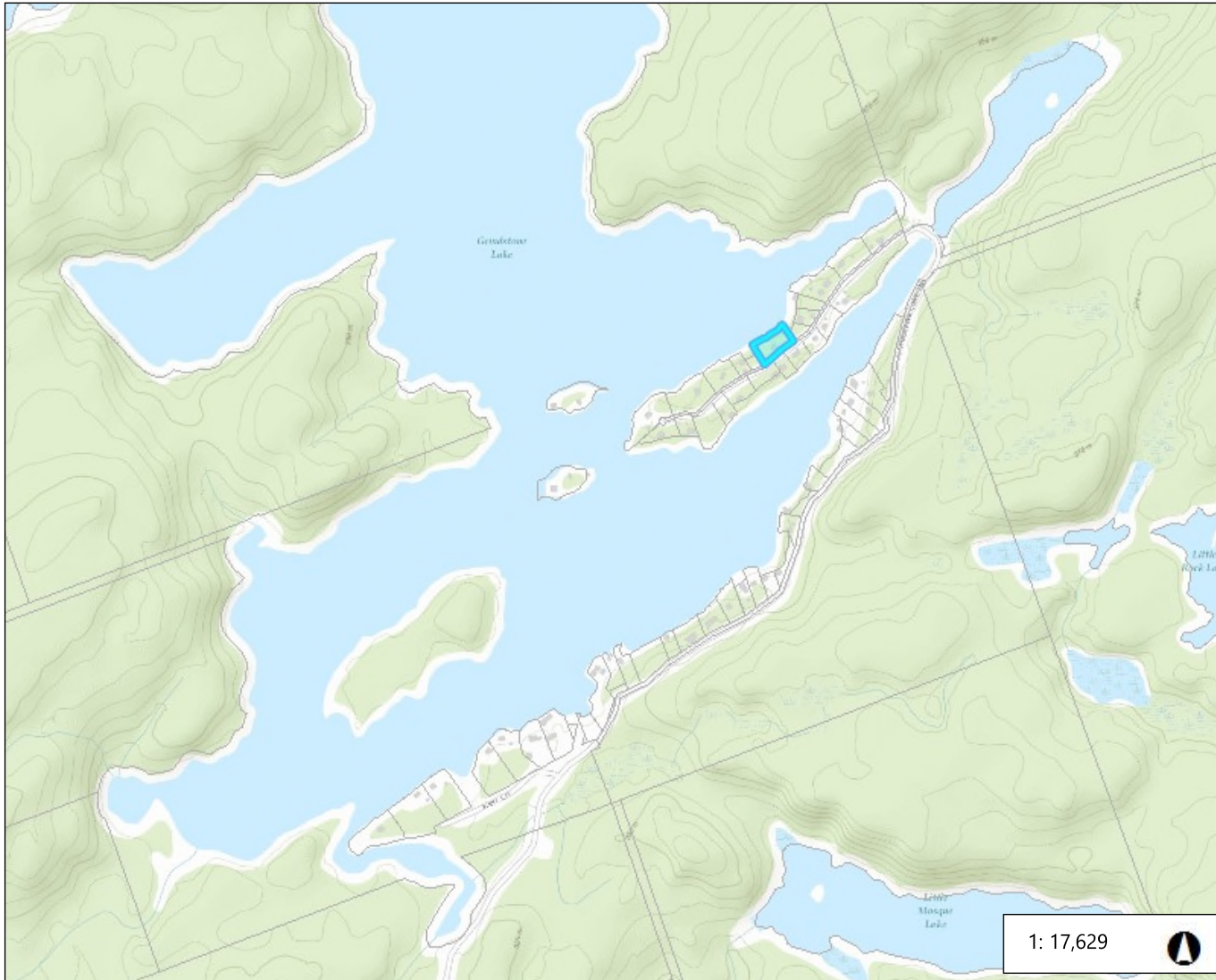
Township of North Frontenac Official Plan (2017)

The property is designated as Waterfront Area in the Township of North Frontenac's Official Plan (2017). Waterfront Area policies are intended to govern development within 150 metres (500 feet) of waterbodies and on islands with the intent of protecting water quality, shoreline amenities and natural habitat areas. It is Council's intent that the water quality of all waterbodies in the Municipality will be maintained at their present level or enhanced. New development must be considered in light of its impact on the environmental quality of any lake or river.

- Section 4.10.5 Objectives sets out the objectives of the Waterfront Area including character, access and servicing, natural areas, and development. Limiting the density of buildings and structures in the Waterfront Area is an important part of protecting the character of waterbodies in North Frontenac. The Official Plan also speaks to the preservation and protection of the appearance of the shoreline in a natural vegetated state shall be encouraged.

- The objective listed in Section 4.10.5 (O) is to support redevelopment opportunities of waterfront properties while maintaining the character of the waterfront area.
- Section 4.10.6 (A) states that where development occurs in the Waterfront Area, it should enhance and protect, where possible, those qualities that contribute to character.
- Section 4.10.6 (B) states that natural form should dominate the character of the Waterfront. Natural shorelines may visually screen development viewed from the water and buffer uses
- Section 4.10.6 (D) states that where development occurs in the Waterfront, it should complement the natural and built form and should enhance and protect those qualities that contribute to character.

FRONTENAC | Key Map



- Legend**
- Assessment Parcels
 - Citations

1: 17,629

0.9 0 0.45 0.9 Kilometers

WGS_1984_Web_Mercator_Auxiliary_Sphere
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This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Notes

2260 GRINDSTONE LAKE ROAD - EXISTING CONDITIONS

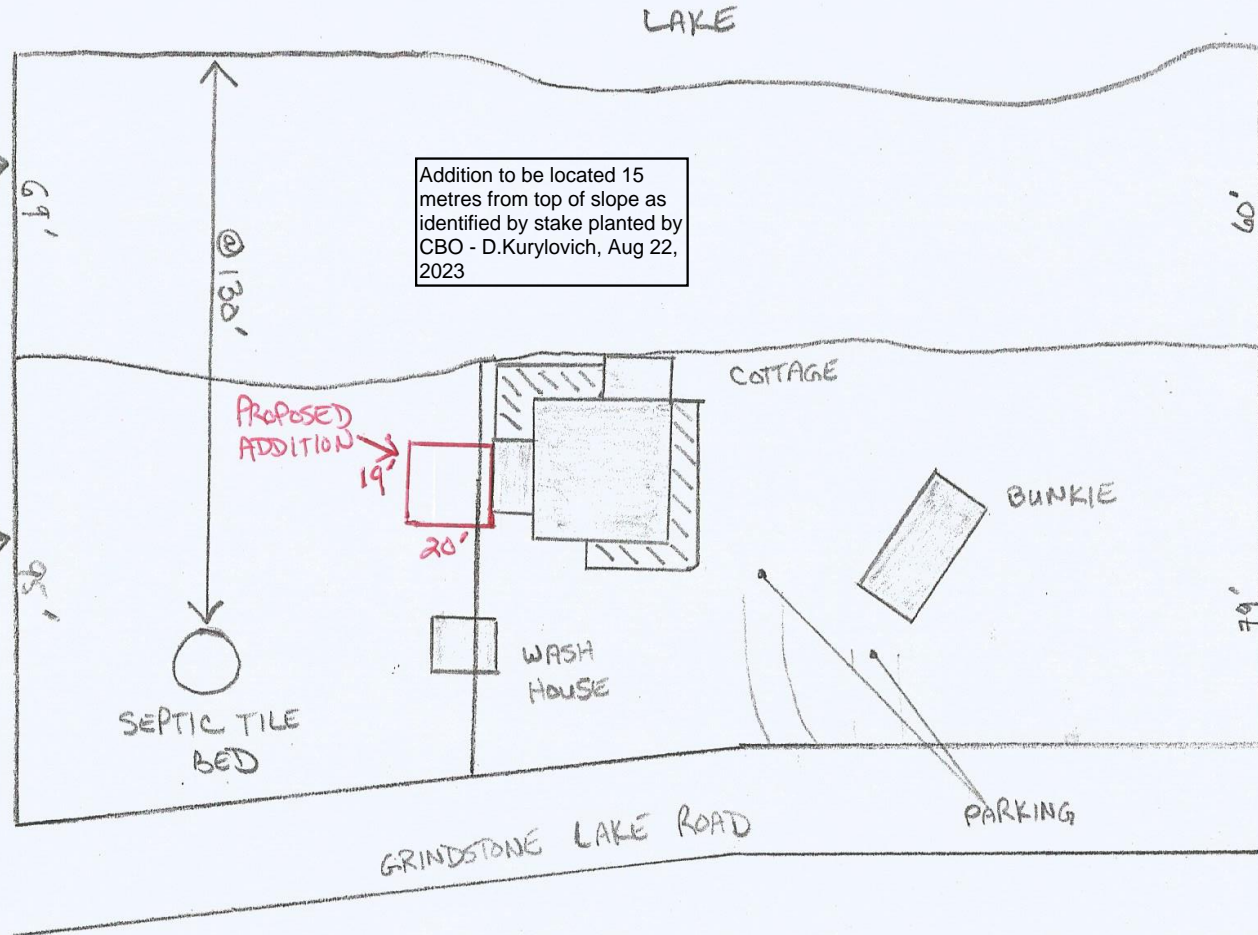
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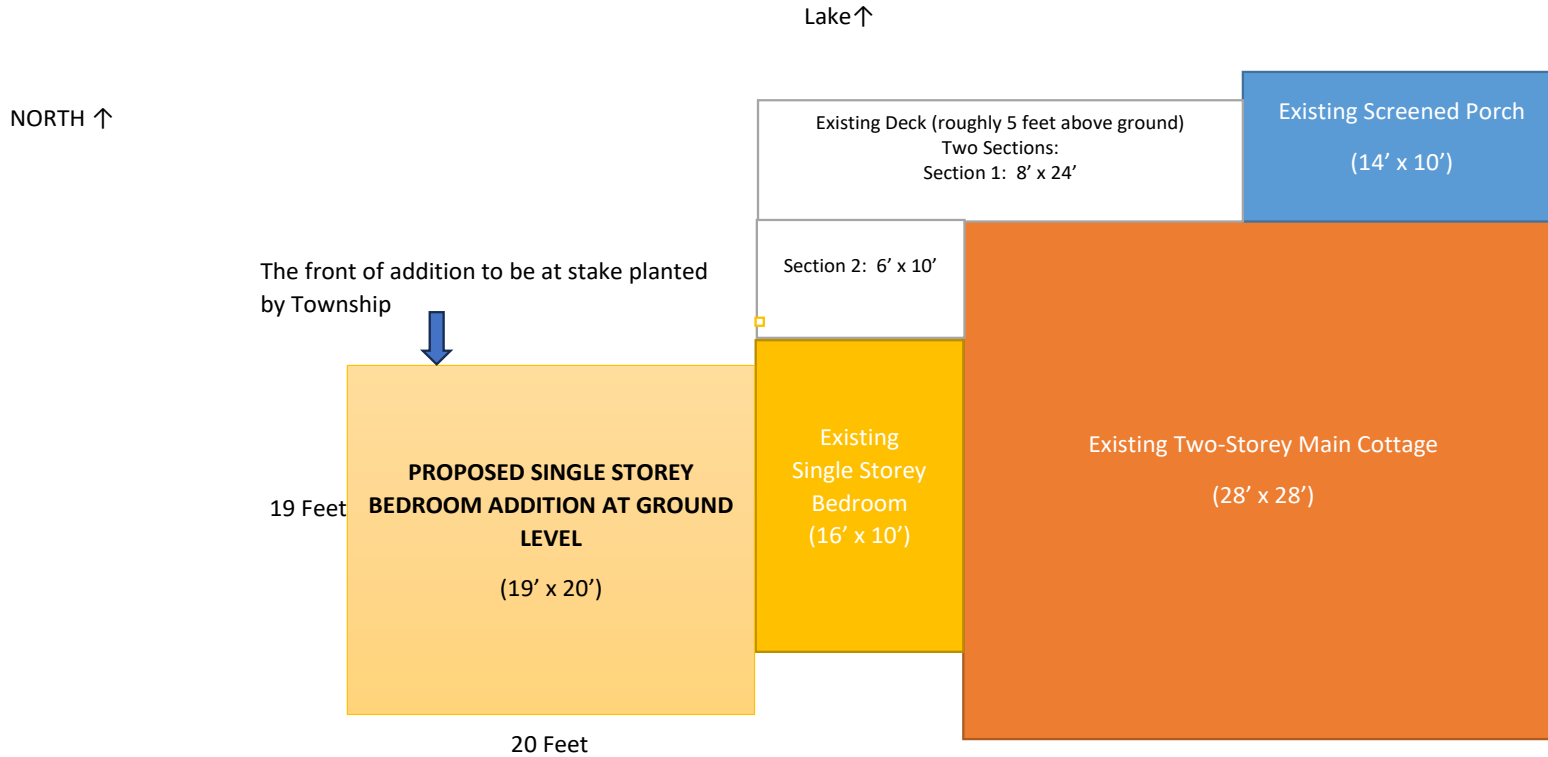
PART 1
13R-22245

PART 5
PLAN 13R-214

PART 4
PLAN
13R-214



Addition to be located 15 metres from top of slope as identified by stake planted by CBO - D.Kurylovich, Aug 22, 2023



- Proposed Addition to be about 1 foot above grade, constructed on concrete footings, dug down to bedrock.
- Proposed Addition to have no basement.
- Existing Single Storey Bedroom is about five feet above grade. Roof for the Existing Bedroom Addition to be extended (at same slope) over the Proposed Addition and Proposed Deck

2260 Grindstone Lake Road
Proposed Addition
James Davidson and Anne Pitman
August 2023

Date July 24, 2023



Resolution # 38-23

**Resolution of the Council of the
Corporation of the Township of North Frontenac**

Moved By:
Garry Wood

Seconded By:
Jim Ogilvie

Be It Resolved That Planning Application File #A010/23 – Application for Minor Variance – Joseph Poulin, 9489C Road 509 - shall be deferred until the study submitted in support of the application has been peer reviewed.

Carried

Mayor



Planning Report

To: Members of Committee of Adjustment

Prepared By: Jennie Kapusta, Community Planner, County of Frontenac

Reviewed By: Sonya Bolton, Manager of Community Planning, County of Frontenac

Re: Application for Minor Variance to Permit a Reduction in Setback to a Licenced Aggregate Operation

Address: 9489C Road 509

Legal Description: Part Lot 28, Concession 1, Geographic Township of Palmerston

File Number: A10/23 (Poulin)

Owner: Joseph Poulin

Applicant: Same as Owner

Date Prepared: August 16, 2023

Date of Meeting: August 28, 2023, July 24, 2023 (Public Meeting)

Recommendation:

Planning staff are recommending that the Committee of Adjustment approve this application subject to the recommended conditions.

Proposal:

The proposal is to obtain minor variance approval for the single residential dwelling that was built without the required permits or planning approvals. The application has been reviewed in the same manner as an application where the work has not yet been completed.

The applicant has constructed a single residential dwelling with a footprint of approximately 111.5 square metres (1,200 square feet), including attached decks. Per the survey sketch completed by McIntosh Perry Surveying Inc. dated August 25, 2022,

this dwelling is located a minimum of 20.68 metres (67.85 feet) from the rear lot line, which abuts a licenced pit. This setback is measured to the closest point of the attached rear deck. Planning staff would like to note that the 22.17 metre (72.74 foot) setback stated on the application form and referenced in the study prepared by Freefield Ltd. is the measurement from the rear lot line to the base of the dwelling.

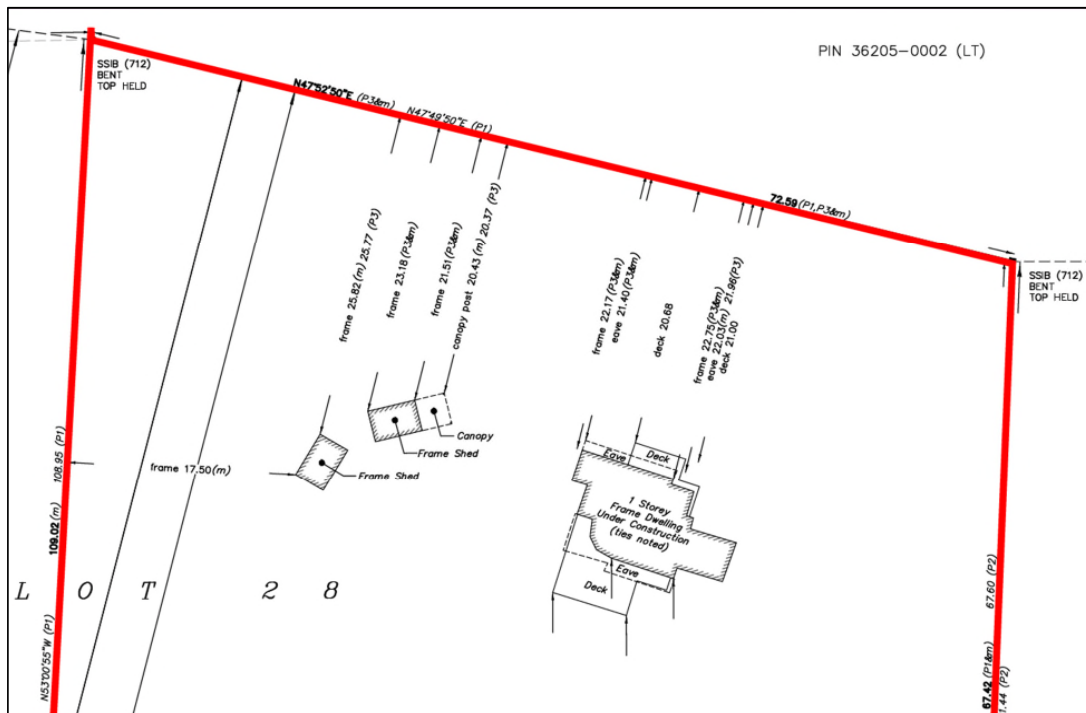


Figure 1: A portion of the survey sketch submitted with the application showing the existing development and measured setbacks to the lot line abutting the licenced pit. The red outline shows the boundary of the Poulin property.

Minor variance from the zoning by-law is required to permit the proposed development for the following reason:

Variance 1: Section 3.27(c)(ii) of the zoning by-law states that the influence area from a licenced pit is 300 metres and the minimum separation distance from a licenced pit is 70 metres, measured from the property line of the sensitive land use and the licence boundary of the pit. The entirety of the lot that encompasses the pit is within the licenced area of the pit. As such the lot line abutting the rear of the subject property is also the licenced boundary of the pit. Based on this, the proposed reduction in minimum setback is zero metres, a variance request of 70 metres.

Background Information

Information Category	Response
Official Plan designation	Hamlet and subject to Area of Natural and Scientific Interest (ANSI) overlay
Zoning	Hamlet (H)
Current size (area) of subject property	0.72 hectares (1.78 acres)
Existing road frontage and access	72.9 metres (239 feet) on Road 509
Waterfront	None
Natural heritage features	None
Surrounding land uses	Licensed pit abutting to the north, licensed pit south of Road 509, developed residential properties within the hamlet of Ompah

The subject property rises steeply from Road 509 towards the rear of the lot before leveling out in the vicinity of the existing structures. This steep slope limits the ability to access the lot directly from Road 509 and was the basis for the creation of the deeded right-of-way for access over the neighbouring property. The dwelling and accessory storage buildings are located more than 15 metres from the top of this steep slope, as required by Section 3.18 of the Township of North Frontenac Zoning By-law Number 55-19.

This property was the subject of an application for minor variance (application number A4/21) to recognize the construction of the dwelling in April 2021. That application was not approved by the Committee of Adjustment as the applicant had not provided sufficient evidence to support the proposed reduction. An impact assessment was provided in support of the prior application, however, the conclusion of that assessment was that further study was needed to determine the impact of the proposed dwelling and what, if any mitigation measures were required.

The property owner has retained the services of a different company (Freefield Ltd.) to undertake the assessment submitted in support of this minor variance application. Neither planning staff nor Township staff are qualified to appropriately review the submitted assessment to ensure compliance with the Provincial D-Series Guidelines or review the recommended mitigation measures. As such, the submitted study has been peer reviewed by Northern Applied Sciences Inc. at the expense of the applicant.

A Noise Impact Assessment (NIA) has been completed by Freefield Ltd. in support of this application for minor variance. This NIA was completed by July 18, 2022 and updated June 21, 2023 to incorporate the survey information including the accurate location of the partially constructed dwelling along with site topography details at the dwelling location and along the elevated ridge at the rear of the subject property. It is the conclusion of this NIA that the establishment of the proposed sensitive land use is compatible with the abutting aggregate operation provided some mitigation measures are undertaken both on the subject property and on the pit property. The NIA made some calculated assumptions on the type of equipment that will be operated on the pit property and serve as significant sources of noise. These assumptions were made as the abutting pit does not operate on a regular basis and as such noise measurements made on site would not necessarily reflect the full extent of potential noise impact. Additionally, potential impacts and mitigation measures were considered on a worst-case scenario basis of the extraction face being located at the closest point to the proposed dwelling permitted by the current extraction licence.

The conclusions off this NIA were that noise control measures were not required during regular day to day operations of loaders, excavators and haul trucks during the daytime period (07:00 to 19:00 hours). However, during the evening and nighttime period (19:00 to 07:00 hours) the sounds levels exceed the applicable limits, requiring noise control measures. It was further determined that sound level limits are exceeded at all times when the mobile crushing and screening plant is in operation on the pit property, approximately two weeks per year.

The NIA recommends a combination of mitigation measures be established at both the site of the sensitive lands use and at the source point (Sproule Pit). The NIA also recommends that the implementation and maintenance of these measures be included in an agreement between the owner of the subject property, the pit owner and the land use planning authority (Township of North Frontenac) and be registered on title of the subject property.

It was noted that the noise control measures recommended for the Sproule Pit are presented as a guide only to demonstrate possible compliance. Alternative noise control measures such as locating the portable crushing and screening plant at a greater distance from the subject property and/or at a lower elevation may also be suitable.

The mitigation measures to be implemented on the subject property for the dwelling (including any future alterations or additions) include:

- The rear façade of the structure be located no closer to the rear lot line than the existing structure (22.1 metres (72.5 feet)).
- The structure be a maximum of a single storey in height.
- The structure be located below the 295 metre above sea level (ASL) contour line.
- The structure be constructed to “face away” from the Sproule Pit property, not containing any windows serving indoor sensitive spaces such as bedrooms.

- Interior construction methods that limit the noise transmission inside the dwelling from the existing kitchen window and patio door facing the Sproule Pit.
- That no outdoor amenity areas be established above the 295 metre ASL contour line; and that the primary outdoor amenity area be located on the south side of the building in a “shielded” location.

Several mitigation measures were recommended (as a guide only) for measures that could be taken on the Sproule Pit property including the following:

- A noise barrier could be established along the full length of the rear of the subject property boundary located in the setback limits of the Sproule Pit, on the boundary with the subject site, or fully within the subject property. This barrier would need to be established and maintained at a minimum elevation on 302 metres ASL.
- A minimum 12 metre high noise barrier such as a stockpile lift face or berm located at a minimum distance of 15 metres from the portable crushing and screening plant could be established to shield line of sight from the plant to the subject property.
- Details on what would constitute an appropriate noise barrier were detailed.

Provided the above mitigation measures are implemented, Freefield Ltd. is of the opinion that establishment of the sensitive land use should not impact aggregate operations or cause any negative human impacts.

Planning staff are recommending as a condition of approval that the applicant be required to enter into a development agreement with the Township of North Frontenac prior to the issuance of any building permits for this property. This development agreement shall be registered on title of the subject property and will contain details on the required mitigation measures as identified in the report from Freefield Ltd.

Planning staff are not recommending the implementation of any mitigation measures on the pit property. Provided the pit is operating within its license and all applicable legislation, there is no ability of the Township to require the pit operator to implement any mitigation measures, as the pit property is not the subject of this application.

Pre-application Consultation:

The property owner consulted with Township staff prior to the submission of this application.

Public Notice

The public meeting regarding this application was held on July 24, 2023. Notice of the public meeting before the Committee of Adjustment was given in accordance with the requirements of the Planning Act. A notice was placed on the subject property and

mailed to all property owners within 60 metres of subject property, 10 days in advance of the public meeting.

Comments

Peer Review – Northern Applied Sciences Inc.

The Noise Impact Assessment completed by Freefield Ltd. was peer reviewed by Northern Applied Sciences Inc. (at the expense of the applicant). This review had the following findings:

- The NIA was conducted according to MECP Noise Assessment Guidelines, including NPC-300 and that this is the most appropriate noise assessment guidance and criteria to follow.
- The Cadna-A noise model was used to predict sound level impacts; and worst-case gravel pit impacts were assessed both at residential building façade and outdoor living space receptors, which is appropriate.
- Sound Output from Noise Generating Equipment was estimated from other representative sites and therefore have the potential to underpredict actual sound levels. Actual site-specific sound level measurement is recommended to confirm sound levels.
- The NIA concluded that noise levels from the assumed worst-case scenario pit operations at the subject site are in compliance with NPC-300 sound level limits provided that the noise mitigation measures are followed. Any mitigation measures to be implemented on the Sproule Pit property would require the appropriate knowledge, consent and agreement of the pit owner.

Planning staff would like to note that the reason estimates were used with regards to noise output for sound generating equipment is that day to day operations at the Sproule Pit are limited which makes it challenging to conduct a site visit to measure sounds levels when the pit is in operation. It is the understanding of planning staff that estimations are appropriate in situations such as these where recording of actual on-site measurements are challenging or not possible.

Mississippi Valley Conservation Authority (MVCA)

This application was not circulated for review by MVCA as the subject property is not located within an area regulated by the conservation authority. There is a steep slope on the subject property, however, the proposed dwelling is located outside the minimum required setback from the top of slope so there are no natural hazard concerns with regards to this application.

Septic Approval Authority (Township of South Frontenac)

The applicant has applied to the Township of South Frontenac (septic approval authority) for a permit for the installation of a septic system to service this dwelling. As of the date of the writing of this report, approval of the septic permit application had not been granted.

Public Comments

Several public comments have been received regarding this application.

Comments received from a neighbour along Road 509 stated no objection to the applicant continuing to build a residence on his property and they are of the opinion that the applicant is a good neighbour. Further, that they have never heard any of the activity that occurs within the Sproule Pit.

Comments received from the owner of the pit property that abuts the subject property to the north expressed concerns with some of the recommended mitigation measures in the report submitted by Freefield Ltd. in support of this application. The pit owner had objections that the recommendations to mitigate negative noise impacts on the proposed dwelling included additional measures to be undertaken at the source (on the pit property), as well as objecting to needing to be a party to the development agreement to be registered on title of the subject property.

Planning staff would like to note that per the NIA the mitigation measures recommended were provided as a guide only to demonstrate possible compliance. Planning staff are not recommending implementation of any mitigation measures on the pit property.

Further, correspondence with the applicant states an intention of the applicant to erect a double-sided fence on the subject property, at his own cost. A double-sided fence was one of the options provided in NIA that would meet the definition of an appropriate noise barrier.

Conformity and Consistency with Policy Planning Documents

Applications for minor variance are required to be consistent with the Provincial Policy Statement, 2020 and conform to both the County of Frontenac Official Plan and the Township of North Frontenac Official Plan. It is the opinion of planning staff that the proposed development is consistent with and conforms to the planning policies of all these documents.

The key policies of each document that are applicable to the subject application are outlined in Appendix B of this report, and the policy issues are addressed in the planning analysis below.

North Frontenac Zoning By-Law Number 55-19

The subject property is zoned as Hamlet within the Township of North Frontenac Zoning By-Law and is located within the Hamlet of Ompah. Land uses in the Hamlet Zone are

to provide for basic community services required to serve the needs of area residents and visitors. Within the Hamlet Zone a mix of land uses are permitted, including residential, public service, commercial, and industrial.

Minimum Distance Separation, Influence Areas and Special Setbacks, Section 3.27(c) of the Zoning By-law states that the minimum separation distance for a pit shall be 70 metres measured from the lot line of the sensitive land use and the license boundary of the pit.

County planning staff are of the opinion that although the setback to a licenced aggregate operation is proposed to be reduced for the new dwelling, the application still complies with the purpose and intent of the zoning by-law because with the appropriate mitigation measures, as detailed in the submitted study, indicate that there will be no negative impacts to either the continued operation of the existing aggregate pit or to human health and safety.

Planning Analysis and Considerations

This application was reviewed against the policies of the Provincial Policy Statement, the County of Frontenac Official Plan, and the Township of North Frontenac Official Plan. The analysis below summarizes all relevant policies by theme. A list of all land-use planning policies relevant to this application is found in Appendix B of this report.

Sewage Disposal System Services

The applicant has applied to the septic approval authority for a permit for the installation of a sewage disposal system to service this dwelling. As of the date of the writing of this report, approval of the septic permit application had not been granted. Staff are recommending that the issuance of a permit for a sewage disposal system be included as a condition of approval.

Natural Heritage

There were no natural heritage features identified on or abutting the subject property.

Minimum Distance Separation

As discussed above, the subject property is within the influence area of a licenced aggregate operation. The property owner has submitted an impact assessment in support of this application, which has been peer reviewed by an independent company. Based on the submitted study, with the appropriate mitigation measures in place, there are no negative impacts anticipated either to the continued operation of the aggregate operation or to human health and safety.

No livestock facilities or landfills were identified within the applicable screening areas surrounding the subject property.

Natural Hazards

The subject property rises steeply from Road 509 towards the rear of the lot before leveling out in the vicinity of the existing structures. This steep slope limits the ability to access the lot directly from Road 509 and was the basis for the creation of the deeded right-of-way for access over the neighbouring property. The dwelling and accessory storage buildings are located more than 15 metres from the top of this steep slope. As such no further studies are required.

Minor Variance

Under Section 45(1) of the *Planning Act* a minor variance application must meet all the four tests of minor variance. The four tests are:

1. Is the application minor?
2. Is the application desirable for the appropriate development of the lands in question?
3. Does the application conform to the general intent and purpose of the Zoning By-law?
4. Does the application conform to the general intent and purpose of the Official Plan?

Planning staff are of the opinion that the proposed minor variance to permit a reduction in setback to a licenced aggregate operation for the construction of a new dwelling meets the four tests of minor variance for the following reasons:

Is the application minor?

It is the opinion of planning staff that this application is minor because the proposed residential use is a permitted use on the subject property and is similar to other existing residential uses on nearby lots. The location of the subject property makes it impossible to locate the dwelling in such a way as to meet the provisions of the zoning by-law regarding aggregate operations.

Is the application desirable for the appropriate development of the lands in question?

County planning staff are of the opinion that the proposed development is desirable and appropriate for the lands in question. The subject property is an existing lot of record in the Hamlet of Ompah and is zoned to permit residential development, as proposed through this application. Provided the appropriate mitigation measures are implemented, negative impacts are not anticipated to either the continued operation of the abutting aggregate pit or to human health and safety.

Does the application conform to the general intent and purpose of the Zoning By-law?

County planning staff are of the opinion that although the setback to a licenced aggregate operation is proposed to be reduced for the new dwelling, the application still complies with the purpose and intent of the zoning by-law because with the appropriate mitigation measures, as detailed in the submitted study, there will be no negative impacts to either the continued operation of the existing aggregate pit or to human

health and safety. Further, the location of the new dwelling complies with the minimum required 15 metre setback from the top of a steep slope.

Does the application conform to the general intent and purpose of the Official Plan?

The subject property is located within the Hamlet of Ompah and has been developed as a residential property. Traditionally, these settlement areas (communities) have developed as residential, social and commercial centres servicing the surrounding agricultural, mining and forestry communities. While these traditional roles will continue to be encouraged it is recognized that changes and improvements to transportation facilities over time have lessened the emphasis on hamlets (settlement areas) as rural service centres and increased their role as residential settlements. Neighbouring properties have also been developed with residential dwellings.

Recommendation

It is recommended that the Committee of Adjustment approve application A10/23 to permit the construction of a dwelling within the minimum required setback to a licenced aggregate operation subject to the recommended conditions attached in Appendix A.

Attachments

Appendix A: Draft Conditions of Approval

Appendix B: Relevant Planning Policy and Legislation

Attachment 1 – Noise Impact Assessment prepared by Freefield Ltd., dated June 21, 2023

Attachment 2 – Peer review prepared by Northern Applied Sciences Inc., dated August 15, 2023

Attachment 3 – Site Plan prepared by McIntosh Perry

Appendix A: Draft Conditions of Approval

Note: Conditions are a decision of the Committee of Adjustment; the conditions below are recommended. The final approved conditions will be included in the signed decision.

Recommended Conditions for Application A10/23 (Poulin)

Applicability

1. That the permission granted through application A10/23 is only to permit a reduction in the required setback to a licenced aggregate operation from 70 metres to zero metres to permit the construction of a residential dwelling.
 - a. The minimum setback to the rear lot line for this dwelling shall be 20.68 metres (67.85 feet), measured to the edge of the attached deck and 22.17 metres (72.74 feet) measured to the base of the building.

No Adverse Impacts

2. The owner/applicant shall ensure that there are no adverse impacts on neighbouring properties as a result of the approved proposal, nor shall there be any increased runoff or grade changes to the property as a result of any excavation.

Building Permits

3. Prior to the issuance of a building permit for the dwelling as approved through application A10/23, the property owner shall enter into a Development Agreement with the Township of North Frontenac that outlines the required mitigation measures identified in the Noise Impact Assessment prepared by Freefield Ltd., dated June 21, 2023. This Development Agreement shall be registered on title of the subject property.
4. Prior to the issuance of a building permit for the dwelling as approved through application A10/23, the property owner shall provide the Township with a copy of a permit for an appropriate sewage disposal system from the appropriate authority.
5. A building permit is required for all demolition and construction on the property. There shall be no additional development, or demolition of existing structures, on the property without approval from the Township of North Frontenac.
6. The owner/applicant shall provide to the Building Department a copy of the decision of the Committee of Adjustment, together with a copy of any approved drawings. The drawings submitted with the building permit application must, in the opinion of the Township, conform to the general intent and description of any approved drawings, including any amendments and conditions approved by the Committee of Adjustment, as stated in the decision. Additional variances may be required should further zoning deficiencies be identified through the Building Permit application process.

Appendix B: Relevant Planning Policy

Provincial Policy Statement (2020)

The Provincial Policy Statement (PPS) provides direction on matters of Provincial interest related to land use planning and development. The PPS promotes efficient land use and development patterns that support strong, liveable and healthy communities, protect the environment and public health and safety, and facilitate economic growth. Under Section 3 of the Planning Act, all municipal decisions regarding planning applications “shall be consistent with” applicable provincial policy.

When assessing consent applications on rural lands, planning authorities must comply with Section 1.1.5.1 of the PPS, which requires the approval authority to apply the relevant policies of the following sections:

- Section 1: Building Strong Healthy Communities of the PPS promotes the building of healthy communities and includes policies about avoiding development and land use patterns which may cause environmental or public health and safety concerns.
- Section 2: Wise Use and Management of Resources of the PPS contains policies that encourage the protection of natural heritage, water, agricultural land, mineral and aggregate resources, and cultural heritage and archaeological resources for their economic, environmental and social benefits.
- 2.5: Mineral Aggregate Resources speaks to protecting these resources for long-term use through identification of mineral aggregate resource deposits and limiting development and activities that would preclude or hinder the establishment, expansion or continued use of resources.
- Section 3: Protecting Public Health and Safety of the PPS contains policies intended to reduce the potential for public cost or risk to Ontario’s residents from natural or human-made hazards. Conservation Authorities have provincially delegated responsibilities to represent Provincial interests regarding natural hazards under Section 3.1 of the PPS.

The following policies are applicable to this application:

- Avoiding development and land use patterns which may cause environmental or public health and safety concerns (Section 1.1.1.c).
- Settlement areas are critical to the long-term economic prosperity of communities. It is in the interest of all communities to use land and resources wisely, to promote efficient development patterns, protect resources, promote green spaces, ensure effective use of infrastructure and public service facilities and minimize unnecessary public expenditures (Section 1.1.3).
- Settlement areas shall be the focus of growth and development (Section 1.1.3.1).

- Appropriate development standards should be promoted which facilitate intensification, redevelopment and compact form, while avoiding or mitigating risks to public health and safety (Section 1.1.3.4).
- Natural features and areas shall be protected for the long term (Section 2.1.1).
- Development shall be directed away from areas of natural or human-made hazards where there is an unacceptable risk to public health or safety or of property damage, and not create new or aggravate existing hazards (Section 3).

County of Frontenac Official Plan (2016)

The County of Frontenac Official Plan is a framework for guiding development in the County through the management and protection of the natural environment and by providing direction and influence on growth patterns. It is focused on the six themes of economic sustainability, growth management, community building, housing and social services, heritage and culture, and environmental sustainability.

The following policies are applicable to this application:

- Section 3.2, Settlement Areas, contains policies specific to the settlement areas that are intended to set a planning framework that will encourage and support the existing settlement areas, both mixed use and primarily residential. These policies recognize that due to the lack of municipal services (water and sewer) new development is encouraged in both the settlement areas as well as in rural locations. Traditionally, these settlement areas (communities) have developed as residential, social and commercial centres servicing the surrounding agricultural, mining and forestry communities. While these traditional roles will continue to be encouraged it is recognized that changes and improvements to transportation facilities over time have lessened the emphasis on hamlets (settlement areas) as rural service centres and increased their role as residential settlements.
- Section 4.2, Servicing, includes policies for the use of private on-site water and sewage services, provided that site conditions are suitable for the long-term provision of such services with no negative impacts.
- Section 7, Environmental Sustainability, sets out policies for environmental sustainability and the protection of the natural heritage system and the ecological functions it provides.

Township of North Frontenac Official Plan (2017)

The subject property is designated as Hamlet within the Township of North Frontenac Official Plan and is located within the Hamlet of Ompah. The intent of policies in the Hamlet designation are to provide the focus for basic community services required to serve the needs of area residents and visitors. Within the Hamlet Settlement Areas a mix of land uses are permitted, including residential, public service, commercial, and industrial.

The following policies are applicable to this application:

- Section 3.3, Buffering and Land Use Conflicts, where land uses may create a land use conflict or are incompatible with each other or may potentially lead to adverse effects, buffering may be required. The intent of this Plan is to require that matters of land use incompatibility be addressed in the review of all planning applications and that buffering and/or mitigation is undertaken wherever required to avoid land use conflicts. Buffering may consist of a fence, open space, a berm, a wall, landscaping or plantings, a separation distance, an intervening land use that is different from the conflicting land uses but compatible with both, or any combination of these measures.
- Section 4.1.3.A, Hamlet Policies, ensuring that lot size is adequate for the proposed use.
- Section 4.1.3.G Council will encourage development to occur on existing approved lots before considering new development. Opportunities for intensification and redevelopment shall also be promoted where it can be accommodated in the Hamlets through existing building stock, infill, on existing lots of record and through the rehabilitation and redevelopment of brownfields.
- Section 4.15.2, Mineral Aggregate Resources, it is a policy that mineral aggregate resources will be protected for their resource value and their long-term use through the designation of active pits and quarries and mineral aggregate reserves as a Mineral Aggregate Resources Area.
- Section 4.15.4, Influence Area, it is a policy to recognize an influence area as a means of protecting against incompatible land uses in the vicinity of proposed pits and quarries and to protect existing pits and quarries from encroachment from other incompatible land uses. It is a policy of Council to discourage incompatible land uses in areas surrounding Mineral Aggregate Resource Areas. For the purposes of this plan, the influence area shall be considered to be 300 m (984.2 ft.) for pits with a recommended separation distance of 70 m (229.6 ft.).



FREEFIELD LTD.

Ottawa, Ontario

**NOISE IMPACT ASSESSMENT
FOR RESIDENCE
LOCATED WITHIN THE
INFLUENCE AREA OF THE
EXISTING LICENSED
SPROULE PIT,
TOWNSHIP OF
NORTH FRONTENAC,
ONTARIO**



Prepared for

PEO License No. 90532110

Mr. Joseph Poulin

Prepared by

Freefield Ltd.

Original Issue Date: 18th July 2022

Updated to incorporate New Survey Information: 21st June 2023 (This version)

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NOISE IMPACT ASSESSMENT FOR RESIDENCE LOCATED WITHIN THE INFLUENCE AREA OF THE EXISTING LICENSED SPROULE PIT, TOWNSHIP OF NORTH FRONTENAC, ONTARIO

Executive Summary

Mr. Joseph Poulin, Poulin, is applying to municipal authorities for a building permit for his partially constructed single storey residence located at 9489C Road 509, Geographic Township of Ompah, Township of North Frontenac, Ontario, as shown in Figures 1 to 6 (subject site).

The site lies immediately south of, and is in the influence area, of the existing licensed Class B, Gravel Pit, License Number 6224220 (Sproule Pit).

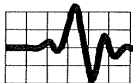
As per the townships official plan³, development within the influence area may be permitted where it is demonstrated with an assessment of noise impacts, that impacts from noise can be mitigated to comply with relevant provincial criteria.

A noise impact assessment for the residence was completed by Freefield Ltd. dated July 18, 2022⁶ (2022 Assessment) and submitted to the Township of North Frontenac to support the building permit application. Since, 2022 Assessment was completed new survey information has become available including the location of the partially constructed residence with respect to the rear boundary as well as site topography details related to the existing ground elevations at the residence and the existing ridge located behind the residence in the direction of the Sproule Pit. As such there is a need to prepare an updated noise impact assessment incorporating this new survey information.

Freefield Ltd. has been retained by Poulin to complete this noise impact assessment.

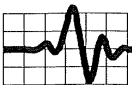
The noise impact assessment has been carried out according to the applicable MECP Noise Assessment Guidelines, including NPC-300, published August 2013.

The assessment considers the impact on the subject site of noise generated by all on-site equipment operations at Sproule Pit, including extraction by loaders, aggregate processing by a crushing and screening plant, loading operations by loaders, stockpiling operations by an excavator or bulldozer, and on-site truck movements used for stockpiling and shipping of product.



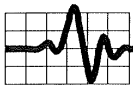
Noise impacts have been predicted and compared to the MECP sound level limits as set out in NPC-300. Where applicable, noise mitigation measures have been designed to ensure that, after the establishment of the new noise sensitive development, Sproule Pit can be operated in compliance with the applicable sound level limits.

Assessment methodology and a description of the subject site and surrounding area is provided in Section 1. A detailed description of Sproule Pit and its operations is provided in Section 2. Noise sources associated with operations at the pit are summarized in Section 3. Noise sensitive points of reception are described in Section 1 and Section 4, with Section 5, 6 and 7 detailing applicable assessment criteria, an assessment of noise impacts and recommended mitigation measures.



Version Control

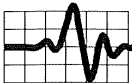
Title	Comments	Prepared By	Issue Date
Noise Impact Assessment for Residence within the Influence Area of Licensed Pit, Township of North Frontenac, Ontario	Submitted to Township of North Frontenac to support existing permit application.	Freefield Ltd.	18 July 2022
Noise Impact Assessment for Residence within the Influence Area of Licensed Pit, Township of North Frontenac, Ontario	Updated to incorporate new survey information relating to location of residence and site topography.	Freefield Ltd.	21 st June 2023 (This report)



NOISE IMPACT ASSESSMENT FOR RESIDENCE LOCATED WITHIN THE INFLUENCE AREA OF THE EXISTING LICENSED SPROULES PIT, TOWNSHIP OF NORTH FRONTENAC, ONTARIO

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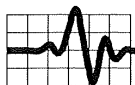
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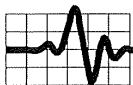
Appendix 1 Zoning Maps

Zoning Map: Township of North Frontenac Zoning By-Law

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Resumes: Hugh Williamson, Michael Wells



NOISE IMPACT ASSESSMENT FOR RESIDENCE LOCATED WITHIN THE INFLUENCE AREA OF THE EXISTING LICENSED SPROULES PIT, TOWNSHIP OF NORTH FRONTENAC, ONTARIO

1.0 Introduction

Mr. Joseph Poulin, Poulin, is applying to municipal authorities, for a building permit for his partially constructed single storey residence located at 9489C Road 509, Geographic Township of Ompah, Township of North Frontenac, Ontario, as shown in Figures 1 and 2 (subject site).

The subject site lies immediately south of, and is in the influence area, of the existing licensed Class B, Gravel Pit, License Number 6224220 (Sproule Pit).

As per the townships official plan³, development within the influence area may be permitted where it is demonstrated with an assessment of noise impacts, that impacts from noise can be mitigated to comply with relevant provincial criteria.

A noise impact assessment for the residence was completed by Freefield Ltd. dated July 18, 2022⁶ (2022 Assessment) and submitted to the Township of North Frontenac to support the building permit application. Since, July Assessment was completed new survey information has become available including the location of the partially constructed residence with respect to the rear boundary as well as site topography details related to the existing ground elevations at the residence and the existing ridge located behind the residence in the direction of the Sproule Pit.

This report describes an assessment, carried out by Freefield Ltd., of the potential impact of noise from operations at Sproule Pit on nearby noise sensitive points of reception at the subject site, incorporating the new survey information, in accordance with MECP guidelines for stationary noise sources.¹

This assessment has been carried out in accordance with the MECP Document NPC-300, *Stationary and Transportation Sources – Approval and Planning*, August 2013.¹

This analysis is based on a visit to the subject site and Sproule Pit in May 2022, a review of the site plan for the Sproule Pit⁵ provided by the owner / operator of the pit, a review of the site and building plans for the subject site, received electronically from Poulin, and discussions with Poulin and the owner operator of Sproule Pit and survey information provided by McIntosh Perry Surveying Inc.⁷



The noise assessment methodology is summarised below.

- Identification of noise sensitive points of reception on the subject site. Potential noise sensitive points of reception include Outdoor Points of Reception and Plane of Window locations located on noise sensitive areas of the residence.
- Determination of the MECP sound level limits¹ which apply at each point of reception.
- Identification of the sources of noise that arise from existing and future pit operations. In the current study, the strengths of the various noise sources were obtained from noise measurements of similar equipment at other aggregate operations in Ontario by Freefield Ltd.
- Based on the strengths of the individual noise sources, noise levels due to pit operations are predicted at the points of reception at the subject site using a prediction procedure² which is favoured by the MECP. The MECP methodology requires that compliance be assessed under predictable “worst case” conditions for normal operations.
- Assessment of compliance of the noise due to the pit operations with MECP sound level limits. Where appropriate mitigation measures are recommended such that compliance, with MECP sound level limits, is achieved at all points of reception.

Note that this assessment considers all significant noise sources in operation at Sproule Pit. The pit is not a significant source of vibration therefore an assessment of vibration impacts is not required.

1.1 General Description of the Site and Surrounding Area:

Directions in this report are referenced to site north as shown in Figure 1.

The subject site is located on the north side of Road 509, approximately 530 m east of the intersection with Mosque Lake Road, in the Township of North Frontenac, County of Frontenac, Ontario.

The site consists of sloped topography rising in a northerly direction from an approximate elevation of 275 mASL at the site’s southern boundary fronting Road 509, to an approximate elevation of 296 mASL, at a ridge at the site’s northern boundary, abutting Sproule Pit.

The land surrounding the site consists of undulating topography with moderate changes in elevation, rising locally in a northerly direction from Road 509 to a ridge running in an east westerly direction at the rear property boundary of the subject site and adjacent strip of Hamlet zoned lands fronting Road 509, as described below. This ridge provides significant shielding of noise impacts from Sproule Pit to the existing residents fronting Road 509.

The legal description of the subject site and is as follows:

**9489C Road 509
Township of North Frontenac
County of Frontenac, Ontario**



A location plan showing the site with respect to the surrounding area is provided in Figure 1. A site layout plan, showing the sites detailed arrangement and elevation contours, is provided in Figure 2. A land use zoning map is provided in Appendix 1.

The site is located on a strip of Hamlet (H) zoned lands fronting Road 509. The Hamlet zoned lands extend to the east and west of the site and consist of a mix of vacant lots, zoned of potential noise sensitive use, and existing residences, within the influence area of Sproule Pit.

The closest existing residences to the subject site are located immediately east of the subject site at 9489A and 9489B Road 509. These existing residences share a similar exposure to noise from operations at Sproule Pit. Immediately west of the site the land is zoned Hamlet (H) and consists of two vacant lots. Further west the land is zoned Mineral Extraction (MXE) with a small pocket of Rural (RU) zoned land fronting Road 509. The MXE zoned land in this direction is part of the licensed boundary of Sproule Pit, with an existing residence located on the Rural zoned land at 9395 Road 509.

Sproule pit lies immediately north of the site on land zoned Mineral Aggregate Extraction (MXE). The pit extends for the full width of the rear property boundary of the subject site and adjacent Hamlet and Rural zoned lots as described above.

Road 509 forms the southern boundary of the site. Further south, on the southern side of Road 509, the land is zoned Mineral Extraction (MXE).

1.2 General Description of Development

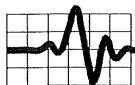
The site consists of a mix of cleared and wooded land with a partially constructed single storey residence and two additional single storey 10ft x 10ft storage sheds located to the west of the main residence.

The residence consists of a living room, bedroom, bathroom and kitchen. An outdoor living area, in the form of a yard and deck, is located on the south side of the residence, with views in a southerly direction, out over the escarpment. The layout of the site and residence is shown on Figure 3.1, 3.2 and 4.

The existing residence is set forward of the rear property boundary by 72.7 ft (22.17 m) at its closest point with the corresponding ground elevation at this location at an approximate elevation of 295 mASL. The land rises steeply immediately north of the residence to an approximate elevation of 299 mASL at the top of the ridge as described in greater detail above. This ridge provides significant shielding at the residence and associated outdoor living area.

The noise sensitive noise sensitive points of reception selected for detailed analysis are shown in Figures 1 to 5 and described in greater detail in Section 4.0.

Table 1 lists the noise sensitive points of reception selected for analysis.



2.0 Facility Description – Sproule Pit

The following description of operations is based on the provided site plan for the Sproule Pit and discussions with the owner of the Sproule Pit.

Sproule Pit produces various grades of sand and aggregate (gravel) and has an annual production limit of 20,000 tonnes.

The raw material (sand and aggregate) is extracted by loaders which load the extracted material onto highway trucks for delivery off-site.

At certain times loaders will feed the extracted raw material into a mobile crushing and screening plant which is brought to site, when needed, and located near the extraction face. The mobile crushing and screening plant typically operates on-site for approximately 2 weeks per calendar year.

From the crushing and screening plant, various grades of sand and aggregate are placed into stockpiles using conveyors and stackers.

A loader is then used to load the processed sand and aggregate from stockpiles onto highway trucks which are used to haul the product off-site.

At certain time aggregate trucks are used on-site during crushing to maintain stockpiles on-site.

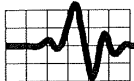
Sproule pit will be extracted in a number of lifts typically ranging from 10 m to 20 m in depth. The final pit floor will be at an elevation of approximately 265 mASL.

Sproule Pit is partially excavated with the pit floor of the first lift at an approximate elevation ranging from 279 mASL to 281 mASL at the extraction face closest to the subject site. To assess worst case noise impacts it has been assumed that extraction will proceed from the current lift face to the setback limits closest to the subject site with the lift floor at an elevation of 281 mASL.

Access for shipping sand and aggregate is from the pit entry off Road 509 as shown in Figure 2.

It has been assumed that the following equipment will be operated at the pit and is included in this assessment as significant sources of noise:

- One mobile crushing and screening plant, consisting of primary secondary and tertiary crushing and screening units, conveyors and stackers, and an associated diesel engine, brought to site occasionally, when required,
- Up to three loaders carrying out extraction, loading and stockpiling operations,
- One excavator or bulldozer used for stockpiling,
- Aggregate trucks used for stockpiling,
- Highway trucks used to ship the product off site,
- Portable equipment for site preparation and rehabilitation, including excavators, hydraulic shovels, dozers and scrapers.



A description of each operation follows:

Mobile Crushing Plant

A mobile crushing and screening plant (crusher) is brought to site as needed and located on the pit floor near the extraction face. To process the annual production limit of 20,000 tonnes of crushed gravel, crushing operations (campaigns) typically occur for approximately 2 weeks per calendar year. The crusher would typically consist of a hopper (feed bin), primary, secondary and tertiary crushing and screening units, a diesel engine, conveyors and stackers.

Loaders and Excavators

Typically, loaders and excavators are required on-site for the following:

- Extracting raw material from the extraction face,
- Loading extracted material into the hoppers to feed the mobile crushing plant,
- Loading processed aggregate on to aggregate trucks for stockpiling,
- Loading processed aggregate on to trucks for shipping off-site,
- Generally pushing around rock and aggregate to maintain the site in a safe state,
- Removing overburden and site preparation,

Aggregate Trucks

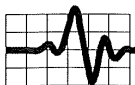
Aggregate trucks are used to transport processed aggregate from the crushing plant to stockpiles. It is understood that three aggregate trucks typically operate on-site during crushing and screening operations. The aggregate trucks travel relatively slowly, typically 30 kph or less.

Highway Trucks

Highway trucks are used for shipping processed sand and aggregate off site. Based on discussions with the pit operator it is understood 15 loads per hour are shipped from the mobile crushing plant during periods of maximum capacity. The highway trucks travel relatively slowly, typically 30 kph or less.

Portable equipment for site preparations and rehabilitation

Portable construction equipment will be used occasionally for site preparation (e.g. land clearing and construction of berms) and rehabilitation. This equipment would typically include excavators, hydraulic shovels, dozers and scrapers. To minimize the impact of noise during site preparation and rehabilitation, construction equipment used, excavators, bulldozers, etc., is to comply with MECP Publication NPC-115,⁵ Construction Equipment, August 1978. This publication gives noise standards to be met by construction equipment in Ontario.



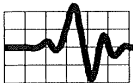
Hours of Operation

Daytime Operations (07:00 – 19:00) - During the daytime period, all significant noise sources are assumed to be in operation and include the following:

- One mobile crushing and screening plant,
- Up to three loaders,
- On-site truck movements, to deliver material to stockpiles and ship product off-site.

Evening Operations (19:00 – 20:00) – During the evening period the following significant noise sources are assumed to be in operation:

- Up to three loaders,
- On-site truck movements, to deliver material to stockpiles and ship product off-site.



3.0 Noise Source Summary

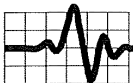
The following noise sources have been used to model noise generated by operations at Sproule Pit. In brackets are the shortened names of the noise sources as used in the acoustic model. The characteristics of these sources, as used in acoustic modelling, are summarized in Table 2.

- One Mobile Crushing and Screening Plant (Source: Crusher),
- Three Loaders (Source: Loader_1, Loader_2 and Loader_3),
- One Excavator (Source: Excavator_1),
- Aggregate trucks used for delivery of raw material to stockpiles (Source: IHR_Aggregate);
- Highway trucks used for delivery and shipping of product (Source: IHR_Shipping);

The strengths of the noise sources, i.e. the sound powers shown in Table 2, and used in this analysis, are taken from a database of noise measurements by Freefield Ltd. of similar operations made at other aggregate operations in Ontario.

Noise from the haul routes is estimated using the moving point source method and modelled as a continuous line source. Two internal haul route operations have been assessed. One haul route representing aggregate trucks delivering processed aggregate from the crushing plant to stockpiles, and one haul route representing highway trucks used for delivery and shipping of product off site.

Refer Figure 7, 9, 11 and 13 for location of sources for worst case scenarios analysed.



4.0 Point of Reception Summary

As per MECP Guideline NPC-300, two points of reception (POR) have been selected at the subject site for which worst case sound levels have been calculated.

POW – Plane of window (POW) points of reception are located on the dwelling at noise sensitive areas of the building. While the MECP typically requires assessment at 1.5 m above ground for single storey dwellings, this assessment has considered a height of 2.3 m above grade based on the approximate height above grade. to the centre of plane of window locations assessed.

OPR – Outdoor Point of Reception, an area on the property of the residence used to provide outdoor amenity to the occupants. For large properties, the OPR point of reception can be up to 30 m from the dwelling at a height of 1.5 m above ground.

The noise sensitive noise sensitive points of reception selected for detailed analysis are shown in Figures 1 to 5.

These were selected as being worst case the noise sensitive locations on the subject site most likely impacted by noise from the operations at Sproule Pit taking into consideration the use of the space.

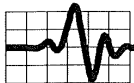
In the 2022 Assessment a plane of window point of reception was located on the north facade of the residence’s kitchen facing Sproule Pit.

In the current study additional plane of window points of reception have been included at the north facade of the residence, at a living room location facing Sproule Pit, and the west facade of the residence, at the living room location with ninety degrees exposure to Sproule Pit. These locations are set approximately 2.4 m and 3.6 m, respectively, forward (away) from Sproule Pit relative to the point of reception located on the north facade of the residence’s kitchen included in the 2022 Assessment and represent the worst-case plane of window locations on the residence serving a noise sensitive area inside the dwelling.

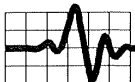
It is noted as per NPC-300, Part C4.5, “the plane of a window sound level limits, Sections C4.5.1 and C4.5.2, apply to a location in the plane of any window on a noise sensitive space. The limits are not required to be applied to windows in noise insensitive areas such as staircases, corridors, bathrooms, closets, utility rooms, etc., that are fully partitioned from noise sensitive spaces.

While the 2022 Assessment, and this report, present the results at the plane of window location on the north facade of the residence serving the kitchen, this area is not considered a noise sensitive interior area, hence, the analysis at this location has been used to inform applicable noise mitigation measures that may be applicable to the interior partitioning of the dwelling. Refer to Section 7.0 for further details.

Outdoor Points of reception have been located at the proposed outdoor living area associated with the residence.



Refer Figure 3, 4 and 5 showing the sites detail arrangement, interior building layout and building elevations.



5.0 Assessment Criteria, Performance Limits

Sound level limits, as specified in the MECP guideline NPC-300¹, depend on the acoustical classification of the area as Class 1, 2, 3 or 4.

Class 1 area ‘an area with an acoustical environment typical of a major population centre, where the background sound level is dominated by the activities of people, usually road traffic, often referred to as urban hum.’

Class 2 area ‘an area with an acoustical environment that has qualities representative of both Class 1 and Class 3 areas: sound levels characteristic of Class 1 during daytime (07:00 to 19:00 or to 23:00 hours); and low evening and night background sound level defined by natural environment and infrequent human activity starting as early as 19:00 hours (19:00 or 23:00 to 07:00 hours).’

Class 3 area ‘a rural area with an acoustical environment that is dominated by natural sounds having little or no road traffic, such as: a small community; agricultural area; a rural resort area such as a cottage or resort area; or a wilderness area.’

Class 4 area ‘an area or specific site that would otherwise be defined as Class 1 or 2 and which: is an area intended for development with new noise sensitive land use(s) that are not yet built; is in proximity to existing, lawfully established stationary source(s); and, has formal confirmation from the land use planning authority with the Class 4 area classification which is determined during the land use planning process. Additionally, areas with existing noise sensitive land use(s) cannot be classified as Class 4 areas.’

Due to the relatively low levels of road traffic along Road 509, and the dominant rural character of the area, the area in which the subject site is located is classified as Class 3 Area.

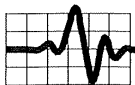
The applicable outdoor sound level limit at a point of reception is the higher of the applicable exclusion limit value, given in Tables 3 and Table 4, or the background sound level for that point of reception.

Background sound level means the sound level that is present in the environment, produced by noise sources other than the source under assessment.

A background noise assessment was not carried out, hence, the levels given in Tables 3 and 4 are taken as the sound level limits at all points of reception for the purpose of this assessment according to their location in a Class 3 Area.

The applicable sound level limits for each point of reception are set out in Table 5.

Sound levels are assessed in terms of the 1-hour equivalent sound level, L_{eq} , effectively the average sound level over each hour. All sound levels are A-weighted, A-weighting being a frequency weighting with represents sensitivity of human hearing to sounds of differing frequencies.



6.0 Impact Assessment

Noise levels have been predicted at the noise sensitive receptors using “predictable worst case” assumptions under normal operations and using ISO 9613-2 sound propagation methodology² as implemented in the sound prediction software Cadna-A, Version 2022. The “predictable worst case” is interpreted as meaning the greatest noise impact anticipated under normal operating conditions. The ISO methodology provides a conservative (i.e. high) estimate of the noise level at a receptor taking into account adverse wind and meteorological conditions.

The estimation method includes the following:

- Distance attenuation is based on spherical spreading.
- Atmospheric attenuation.
- Ground attenuations, as appropriate.
- Barrier attenuation, as appropriate.

In order to consider cases of worst noise impacts, four operational scenarios have been modeled. In general, the worst impacts are those which occur when all equipment is operating concurrently.

The following four worst case scenarios are presented in this report and form the basis for the recommended mitigation measures and assessment of compliance to MECP criteria:

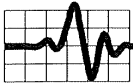
*Scenario 1: Worst Case, Normal Operations – All equipment in operation concurrently with the extraction occurring closest to the subject site, crusher not in operation (Day or Evening) – **Before Mitigation** – Figure 7 and 8.*

*Scenario 2: Worst Case, Normal Operations – All equipment in operation concurrently with the extraction occurring closest to the subject site, crusher not in operation (Day or Evening) – **After Mitigation** – Figure 9 and 10.*

*Scenario 3: Worst Case, Crushing Campaigns - All equipment in operation concurrently with the extraction occurring closest to the subject site, crusher in operation (Day only) – **Before Mitigation** – Figure 11 and 12.*

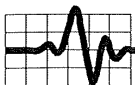
*Scenario 4: Worst Case, Crushing Campaigns - All equipment in operation concurrently with the extraction occurring closest to the subject site, crusher in operation (Day only) – **After Mitigation** – Figure 13 and 14.*

In Table 6.1, 6.2, 6.3 and 6.4, estimated noise levels at the nearest receptors for the worst-case scenarios, during daytime and evening periods of operation, are compared with the applicable sound level limits. More detailed estimates are contained in Appendix 2, Tables A2.6.1 to A2.6.4.



It can be seen that with the recommended mitigation measures detailed in Section 7.0 of this report, the sound level limits are met at the worst-case points of reception at the subject site, POR 1_POW_3 and POR 2, for worst case operating conditions during the daytime, 7 am to 7 pm (07:00 to 19:00), and evening 7 pm to 8 pm (19:00 to 20:00) period of operation.

Details of acoustic modeling are provided in Appendix 2. Figures 8, 10, 12 and 14 show predicted noise contours for each mode of operation analyzed.



7.0 Noise Control Measures

Where noise impact exceeds the applicable sound level limits, mitigation is required in order to ensure the existing Sproule Pit may be operated in compliance with the applicable sound level limits.

As shown in Table 6.1 noise control measures are not required during regular day to day operations of loaders, excavators and haul trucks only at Sproule Pit during the daytime period, 07:00 to 19:00. During the evening and nighttime period, 19:00 to 07:00, however, the sound level limits are exceeded before mitigation, hence, noise control measures are required.

Furthermore, as shown in Table 6.3, before mitigation, the sound level limits are exceeded at all points of reception at the subject site during periods when the mobile crushing and screening plant is in operation at Sproule Pit. This typically occurs for approximately 2 weeks per calendar year.

As such noise control measures, during the evening and nighttime period of regular operations and during periods when the mobile crushing and screening plant is in operation, are required to ensure noise impacts comply with the applicable sound level limits.

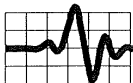
As per NPC-300, "Noise control measures may be implemented on the site of the noise sensitive land use or at the source. For noise impacts from stationary sources, the preferred and normally the most economical and practical option is to implement noise control measures at the source." NPC-300, Part C7.6, page 52.

The following noise control measures are a combination of requirements applicable to the subject site (proposed noise sensitive land use) as well as at the existing licensed Sproule Pit (source).

It is recommended that the implementation and maintenance of these measures be included in an agreement between on the owner of the subject site, the land use planning authority and the owner / operator of the Sproule Pit and be registered on the title of the subject site.

It is noted that the noise control measures specified below for Sproule Pit are presented as a guide only to demonstrate possible compliance. Alternative noise control measures such as locating the portable crushing and screening plant at a greater distance from the subject property and or at a lower elevation may also be suitable. Following approval of the proposed noise sensitive use (residence) it will be the responsibility of the license holder of Sproule Pit to ensure pit operations are in compliance with the applicable sound level limits.

The predicted noise impacts in Tables A2.6.2 and A2.6.4 are based on the implementation of the following mitigation measures:



7.1 **General**

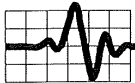
7.1.1 It is recommended that the implementation and maintenance of the noise control measures, noted in 7.2 below, be included in an agreement between the owner of the subject site, the land use planning authority and the owner / operator of the Sproule Pit and be registered on the title of the subject site.

7.2 **Noise Control Measures for the Subject Site (Proposed Noise Sensitive Land Use)**

7.2.1 **Residence and Future Noise Sensitive Buildings**

7.2.1.1 The residence and any future noise sensitive buildings (alterations or additions) on the subject site shall be:

- i. Located such that the rear facade, closest to Sproule Pit, is a minimum distance of 22.1 m (72.5 ft) from the rear property boundary as shown in Figure 15.
- ii. Maximum one storey high i.e. single storey.
- iii. Located below the 295 mASL contour line.
- iv. Constructed to “Face away” from the Sproule Pit, with the “exposed” side of the building/s not containing windows serving indoor noise sensitive spaces such as bedrooms or living rooms, and only containing insensitive spaces such as washrooms, corridors etc.
- v. It is noted the partially constructed residence has a patio door and window serving the kitchen facing towards Sproule Pit, refer POR_1_POW_1. While the kitchen area is not considered a noise sensitive area inside the dwelling, it is recommended that the kitchen be separated from the adjacent living room with an interior partition containing a single leaf door which can be closed during crushing campaigns, such that noise is not transmitted at unacceptable levels into the adjacent living room. It is recommended that the wall be constructed with a minimum of 89 mm thick glass fiber insulation in stud cavity and 1 x layer of 12.7 mm thick gypsum board each side, with a minimum STC 32 rating as per Ontario Building Code Supplementary Standard SB-3. The interior door providing access from the living room to the kitchen is to be of solid core wood door construction.
- vi. It is noted the partially constructed residence has an existing small window associated with the living room facing towards Sproule Pit, refer POR_1_POW_2. This window is to be removed and replaced with solid exterior wall construction matching the existing rear wall construction of the residence.



7.2.2 **Outdoor Areas**

7.2.2.1 No outdoor area amenable for use shall be established above the 295 mASL contour line. It is recommended the primary outdoor amenity area be located on the south side of the building in a “shielded” location.

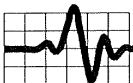
7.2.3 **Warning Clause**

7.2.3.1 It is recommended that the Warning Clause Type “E”, taken from provincial guidelines, be applied.

Warning Clause Type “E”:

“Purchasers/tenants are advised that due to the proximity of the adjacent pit, sound levels from the pit may at times be audible.”

7.2.3.2 This clause should be included in Agreements of Purchase and Sale or Lease Agreements and incorporated into the relevant Development Agreements which are registered on title of the property.



7.3 Noise Control Measures for the Sproule Pit (Existing source of environmental noise)

7.3.1 The noise control measures specified below are presented as a guide only to demonstrate possible compliance. Alternative noise control measures such as locating the portable crushing and screening plant at a greater distance from the subject property and / or at a lower elevation may also be suitable. Following approval of the proposed noise sensitive development it will be the responsibility of the license holder of Sproule Pit to ensure pit operations are in compliance with the applicable sound level limits at all nearby residences including the subject site.

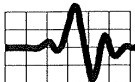
7.3.2 Noise Barriers:

7.3.2.1 A noise barrier could be established extending the full length of the rear property boundary of the subject site and be located in the setback limits or Sproule's Pit, on the boundary with the subject site, or fully within the subject site (of the new noise sensitive development) as shown in Figure 15. The top of the barrier is to be established and maintained at a minimum elevation of 302 mASL. Refer Figure 15.

7.3.2.2 A minimum 12 m high noise barrier such as a stockpile, lift face or berm located at a maximum distance of 15 m from the plant could be established to shield line of sight from the portable crushing and screening plant to the subject site.

7.3.2.3 Noise barriers and berms are to be solid, having no gaps, and are to have a surface density of no less than 20 kg/m². Examples of suitable barriers or berms are as follow:

- i. Lift face or existing terrain;
- ii. Earth, gravel or aggregate berms or stockpiles;
- iii. Concrete or brick walls;
- iv. Commercial noise barriers;
- v. Shipping containers or buildings,
- vi. Wood fence (barrier). Note: A noise barrier constructed of pressure treated spruce or pine with an assumed density of 0.45 kg/m³ would need to be 2" thick (finished) to meet the 20 kg/m² of surface density required for a noise barrier. In addition, the barrier would need to be constructed with no gaps, hence, tongue and groove construction and / or two layers with joints overlapped would be required. Special attention to seal the gap at the base of the wall is required.



8.0 Conclusions

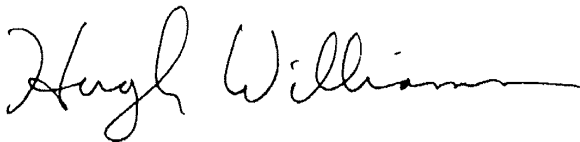
An assessment of noise impacts from Sproule Pit at the partially constructed residence located at 9489C Road 509, Ompah, Ontario (subject site) has been conducted according to MECP noise assessment procedures.

Future worst-case location of pit operations has been assumed, including extraction by loaders, aggregate processing by a crushing and screening plant, loading operations by loaders, stockpiling operations by an excavator or bulldozer, and on-site truck movements used for stockpiling and shipping of product have been considered in this assessment.

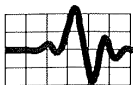
It has been found that noise levels from the assumed worst-case operations pit operations at the subject site are in compliance with MECP sound level limits as set out in publication NPC-300¹, provided that the noise mitigation measures described in Section 7.0 of this report are followed.



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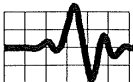


Hugh Williamson, Ph.D., P.Eng.
Member, Canadian Acoustical Association



References

1. Ministry of Environment, Conservation and Parks Publication NPC-300, *Environmental Noise Guideline, Stationary and Transportation Sources – Approval and Planning*, August 2013, adopted by the MECP on 22 October 2013.
2. International Standards Organization, *Acoustics - Attenuation of Sound during Propagation Outdoors, Part 2: General Method of Calculation*, ISO 9613-2: 1996(E).
3. Township of North Frontenac, *Official Plan*, 19 May 2017.
4. Ministry of the Environment, Conservation and Parks Guideline D-6, '*Compatibility Between industrial Facilities and Sensitive Land Uses*'.
5. Tulloch Engineering, *Sproule Pit - Site Plan Category 7, Document Number: 11-2523-02-624220*", 2 November 2011.
6. Freefield Ltd., "*Noise Impact Assessment for Residence within the Influence Area of Licensed Pit, Township of North Frontenac, Ontario*", dated 18th July 2022.
7. McIntosh Perry Surveying Inc., "*Plan of Survey of Part of Lot 28, Concession 1, Geographic Township of Palmerston, Township of North Frontenac, County of Frontenac,*" dated August 25, 2022.



TABLES

Table 1: Points of Reception Summary Table

Table 2: Noise Source Summary Table

Table 3: Exclusion Limit Values for One-Hour Equivalent
Sound Level (Leq, dBA) at Outdoor Points of Reception

Table 4: Exclusion Limit Values for One-Hour Equivalent Sound Level
(Leq, dBA) at Plane of Window of Noise Sensitive Spaces

Table 5: Applicable One Hour Sound Level Limits

Table 6.1: Acoustic Assessment Summary Table, Scenario 1: Worst Case,
Daytime (07:00 - 19:00) and Evening (19:00 - 20:00) Period of
Operation - **Before Mitigation**

Table 6.2: Acoustic Assessment Summary Table, Scenario 1: Worst Case,
Daytime (07:00 - 19:00) and Evening (19:00 - 20:00) Period of
Operation - **After Mitigation**

Table 6.3: Acoustic Assessment Summary Table, Scenario 2: Worst Case,
Daytime (07:00 - 19:00) Period of Operation – **Before Mitigation**

Table 6.4: Acoustic Assessment Summary Table, Scenario 2: Worst Case,
Daytime (07:00 - 19:00) Period of Operation – **After Mitigation**

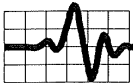


Table 1: Point of Reception Summary Table

Point of Reception	Location*
POR_1_POW_1	Plane of Window – Rear Facade at Kitchen (Rear facade of residence facing Sproule Pit) (1 storey)
POR_1_POW_2	Plane of Window – Rear Facade at Living Room (Set forward rear facade of residence facing Sproule Pit) (1 storey)
POR_1_POW_3	Plane of Window – Side Facade at Living Room (Set forward rear facade of residence facing Sproule Pit) (1 storey)
POR_2_OPR	Outdoor Point of Reception (Outdoor Amenity Area to the south of the residence)

* For assessment purposes, points of reception, (POR), have been taken as upper floor plane of window (POW) locations (2.3 m above grade for single storey) and Outdoor Point of Receptions (1.5 m above grade) in acoustic calculations.

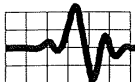


Table 2: Noise Source Summary Table

Name	Source ID	Sound Power (dBA)	Source Location Ht. above ground (m)*	Sound Characteristics	Noise Control Measures
Crusher (includes primary, secondary and tertiary crushing and screening units and an associated diesel generator)	Crusher	117.5	2.5	Steady, non-tonal, non-directional	None
Loaders (Cat 982M or similar)	Loader	103.0	2.5	Steady, moving non-tonal, non-directional	None
Excavators or Bulldozers (CAT345DLME or similar)	Excavator	103.2	2.5	Steady, moving non-tonal, non-directional	None
Aggregate Trucks (Delivery of processed aggregate to stockpiles)	IHR_2_Stockpiling (Aggregate_Truck_Passby)	103.3	2.5	Steady, moving non-tonal, non-directional	As noted in section 7.0
Highway Trucks (Shipping)	IHR_1_Shipping (HWYTruck_Slow58)	110.1	2.5	Steady, moving non-tonal, non-directional	As noted in section 7.0

*Height measured from finished grade at location of equipment operation.

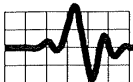


Table 3: MECP Exclusion Limit Values for One-Hour Equivalent Sound Level (Leq, dBA) at Outdoor Points of Reception

Time of Day	Class 1 Area	Class 2 Area	Class 3 Area	Class 4 Area
07:00 – 19:00	50	50	45	55
19:00 – 23:00	50	45	40	55

Table 4: MECP Exclusion Limit Values for One-Hour Equivalent Sound Level (Leq, dBA) at Plane of Window of Noise Sensitive Spaces

Time of Day	Class 1 Area	Class 2 Area	Class 3 Area	Class 4 Area
07:00 – 19:00	50	50	45	60
19:00 – 23:00	50	50	40	60
23:00 – 07:00	45	45	40	55

Table 5: Applicable One Hour Sound Level Limits for the Daytime Period (07:00 – 19:00)

Receptor & Point of Reception POW = Plane of Window OPR = Outdoor Point of Reception	Sound Level Limit 1-hour LAEQ dBA (Daytime Period, 07:00 – 19:00)	Sound Level Limit 1-hour LAEQ dBA (Evening Period, 19:00 – 23:00)	Sound Level Limit 1-hour LAEQ dBA (Nighttime Period, 23:00 – 07:00)
POR_1_POW_1	45	40	40
POR_1_POW_2	45	40	40
POR_1_POW_3	45	40	40
POR_2_OPR	45	40	-

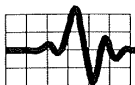


Table 6.1: Acoustic Assessment Summary Table, Scenario 1: Worst Case, Normal Operations, Daytime and Evening (07:00 - 20:00) Period of Operation – Before Mitigation

Point of Reception ID	POR Description	Location	Estimated Sound Level at POR Daytime Period (Worst Case) (dBA)	Performance Limit Daytime Period (dBA)	Estimated Sound Level at POR Evening Period (Worst Case) (dBA)	Performance Limit Evening Period (dBA)	Compliance with Performance Limit (Yes/No)
POR_1_POW_1	Residence (Plane of Window)	POW (at rear of building serving a kitchen)	40.9	45	40.9	40	No ³
POR_1_POW_2	Residence (Plane of Window)	POW (at rear of building serving a living room or bedroom)	39.7	45	39.7	40	Yes ³
POR_1_POW_3	Residence (Plane of Window)	POW (at side of building serving a living room)	40.9	45	40.9	40	No
POR_2_OPR	Outdoor Amenity Area (Outdoor Point of Reception)	OPR	40.5	45	40.5	40	No

Notes:

1. Performance limits are based on 1-hour equivalent sound levels, Leq.
2. Refer to Tables A2.6.1 to A2.6.4 in Appendix 2 for more detailed sound level estimates by source.
3. Results and assessment of compliance at POR 1-1 and POR 1-2 shown for information purposes only. Refer to Section 4.0 and Section 7.0 for further details.

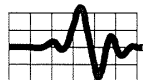


Table 6.2: Acoustic Assessment Summary Table, Scenario 2: Worst Case, Normal Operations, Daytime and Evening (07:00 - 20:00) Period of Operation – After Mitigation

Point of Reception ID	POR Description	Location	Estimated Sound Level at POR Daytime Period (Worst Case) (dBA)	Performance Limit Daytime Period (dBA)	Estimated Sound Level at POR Evening Period (Worst Case) (dBA)	Performance Limit Evening Period (dBA)	Noise Control Measures	Compliance with Performance Limit (Yes/No)
POR_1_POW_1	Residence (Plane of Window)	POW (at rear of building serving a kitchen)	39.4	45	39.4	40	Plane of window location not serving indoor noise sensitive area. Refer to Section 4.0 and 7.0 for further details.	Not applicable ³
POR_1_POW_2	Residence (Plane of Window)	POW (at rear of building serving a living room or bedroom)	38.7	45	38.7	40	Window to be removed. Refer to Section 7.0 for further details.	Not applicable ³
POR_1_POW_3	Residence (Plane of Window)	POW (at side of building serving a living room)	38.7	45	38.7	40	Noise Barriers Refer to Section 7.0 for further details.	Yes
POR_2_OPR	Outdoor Amenity Area (Outdoor Point of Reception)	OPR	39.1	45	39.1	40	Noise Barriers and restricted area Refer to Section 7.0 for further details.	Yes

Notes:

1. Performance limits are based on 1-hour equivalent sound levels, Leq.
2. Refer to Tables A2.6.1 to A2.6.4 in Appendix 2 for more detailed sound level estimates by source.
3. Results and assessment of compliance at POR 1-1 and POR 1-2 shown for information purposes only. Refer to Section 4.0 and Section 7.0 for further details.

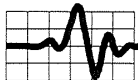


Table 6.3: Acoustic Assessment Summary Table, Scenario 2: Worst Case, During Crushing Campaigns, Daytime (07:00 - 19:00) Period of Operation⁴ – Before Mitigation

Point of Reception ID	POR Description	Location	Estimated Sound Level at POR Daytime Period (Worst Case) (dBA)	Performance Limit Daytime Period (dBA)	Compliance with Performance Limit (Yes/No)
POR_1_POW_1	Residence (Plane of Window)	POW (at rear of building serving a kitchen)	48.6	45	No ³
POR_1_POW_2	Residence (Plane of Window)	POW (at rear of building serving a living room or bedroom)	48.1	45	No ³
POR_1_POW_3	Residence (Plane of Window)	POW (at side of building serving a living room)	48.1	45	No
POR_2_OPR	Outdoor Amenity Area (Outdoor Point of Reception)	OPR	47.5	45	No

Notes:

1. Performance limits are based on 1-hour equivalent sound levels, Leq.
2. Refer to Tables A2.6.1 to A2.6.4 in Appendix 2 for more detailed sound level estimates by source.
3. Results and assessment of compliance at POR 1-1 and POR 1-2 shown for information purposes only. Refer to Section 4.0 and Section 7.0 for further details.
4. It is understood that crushing operations do not occur during the evening period.

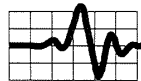
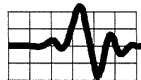


Table 6.4: Acoustic Assessment Summary Table, Scenario 2: Worst Case, During Crushing Campaigns, Daytime (07:00 - 19:00) Period of Operation⁴ – After Mitigation

Point of Reception ID	POR Description	Location	Estimated Sound Level at POR Daytime Period (Worst Case) (dBA)	Performance Limit Daytime Period (dBA)	Noise Control Measures	Compliance with Performance Limit (Yes/No)
POR_1_POW_1	Residence (Plane of Window)	POW (at rear of building serving a kitchen)	45.6	45	Plane of window location not serving indoor noise sensitive area. Refer to Section 4.0 and 7.0 for further details.	Not applicable ³
POR_1_POW_2	Residence (Plane of Window)	POW (at rear of building serving a living room or bedroom)	45.2	45	Window to be removed. Refer to Section 7.0 for further details.	Not applicable ³
POR_1_POW_3	Residence (Plane of Window)	POW (at side of building serving a living room)	44.9	45	Plane of window location not serving indoor noise sensitive area. Refer to Section 4.0 and 7.0 for further details.	Yes
POR_2_OPR	Outdoor Amenity Area (Outdoor Point of Reception)	OPR	44.8	45	Window to be removed. Refer to Section 7.0 for further details.	Yes

Notes:

1. Performance limits are based on 1-hour equivalent sound levels, Leq.
2. Refer to Tables A2.6.1 to A2.6.4 in Appendix 2 for more detailed sound level estimates by source.
3. Results and assessment of compliance at POR 1-1 and POR 1-2 shown for information purposes only. Refer to Section 4.0 and Section 7.0 for further details.
4. It is understood that crushing operations do not occur during the evening period.



FIGURES

- Figure 1: Scaled Location Plan showing Subject Site and Surrounding Area
- Figure 2: Detail Site Layout & Surface Elevation Contours (elevation contours for surrounding area based on LIO, Provincial Digital Elevation Model, shown at 1-meter intervals)
- Figure 3.1: Site Survey showing Existing Partially Constructed Residence and Distance to Rear Property Boundary (Source: McIntosh Perry Surveying Inc.)
- Figure 3.2: Detail Site Plan showing Points of Reception and Elevation Contours at Ridge (Source: McIntosh Perry Surveying Inc.)
- Figure 4: Ground Floor Plan showing Interior Layout of Residence and Plane of Window Point of Reception (Source: Poulin)
- Figure 5: Building Front and Rear Elevations showing Plane of Window Point of Reception (Source: Poulin)
- Figure 6: Building Side Elevations (Source: Poulin)
- Figure 7: Scenario 1: Normal Operations - All equipment in operation concurrently with the extraction occurring closest to the subject site, crusher not in operation (Day or Evening) – **Before Mitigation**
- Figure 8: Prediction Results, Scenario 1: Worst Case, Evening Period, Noise Contours, (Noise levels at 4.5 m) – **Before Mitigation**
- Figure 9: Scenario 2: Normal Operations - All equipment in operation concurrently with the extraction occurring closest to the subject site, crusher not in operation (Day or Evening) – **After Mitigation**
- Figure 10: Prediction Results, Scenario 2: Worst Case, Evening Period, Noise Contours, (Noise levels at 4.5 m) – **After Mitigation**
- Figure 11: Scenario 3: Worst Case, Crushing Campaigns - All equipment in operation concurrently with the extraction occurring closest to the subject site, crusher in operation (Day only) – **Before Mitigation**
- Figure 12: Prediction Results, Scenario 3: Worst Case, Daytime Period, Noise Contours, (Noise levels at 4.5 m) – **Before Mitigation**
- Figure 13: Scenario 4: Worst Case, Crushing Campaigns - All equipment in operation concurrently with the extraction occurring closest to the subject site, crusher in operation (Day only) – **After Mitigation**
- Figure 14: Prediction Results, Scenario 4: Worst Case, Daytime Period, Noise Contours, (Noise levels at 4.5 m) – **After Mitigation**
- Figure 15: Detailed Plan showing Recommended Mitigation Measures and Minimum Setback to Rear Property Boundary

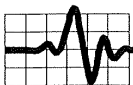


Figure 1: Scaled Location Plan showing Subject Site and Surrounding Area

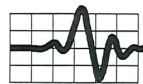
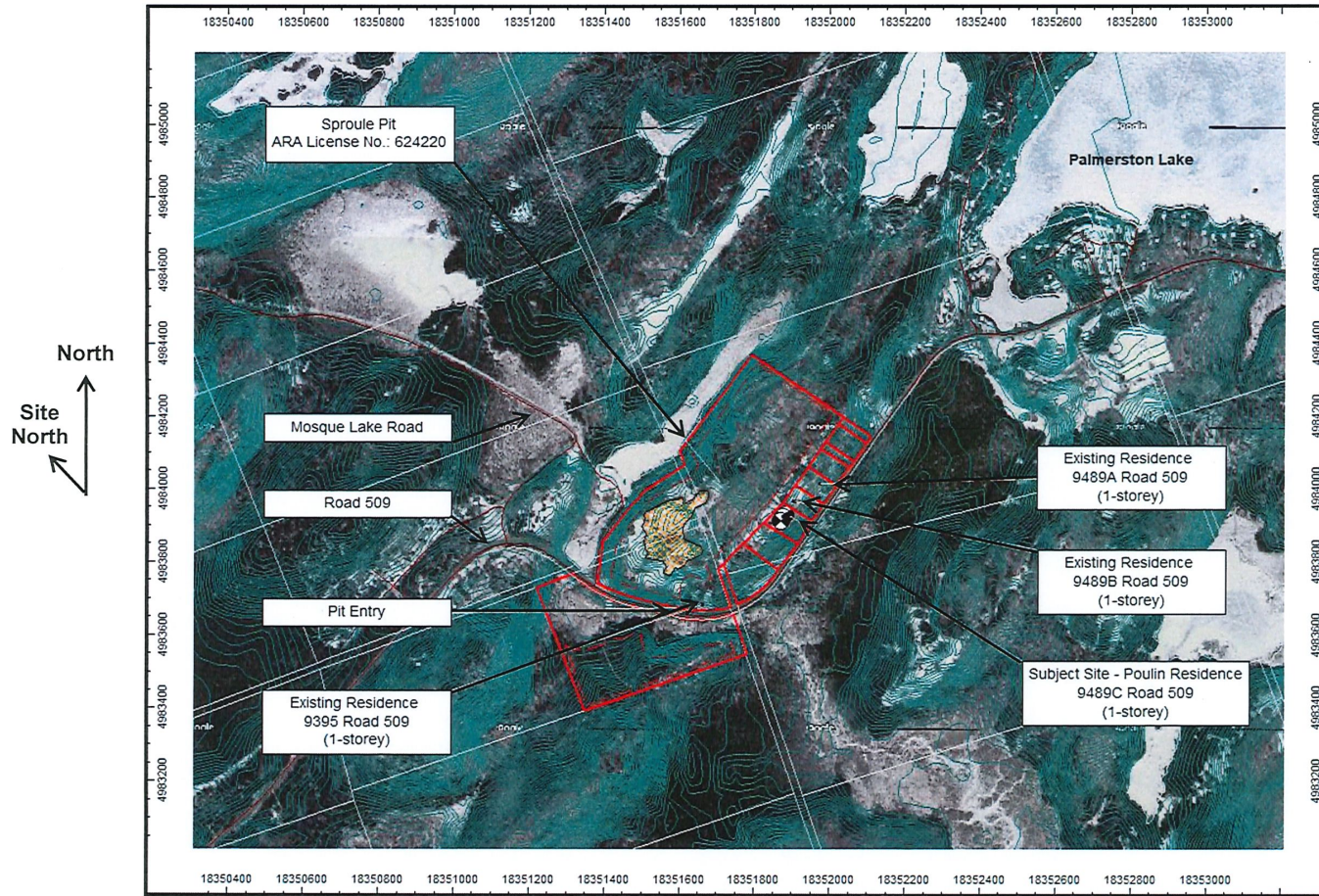
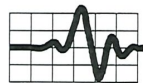
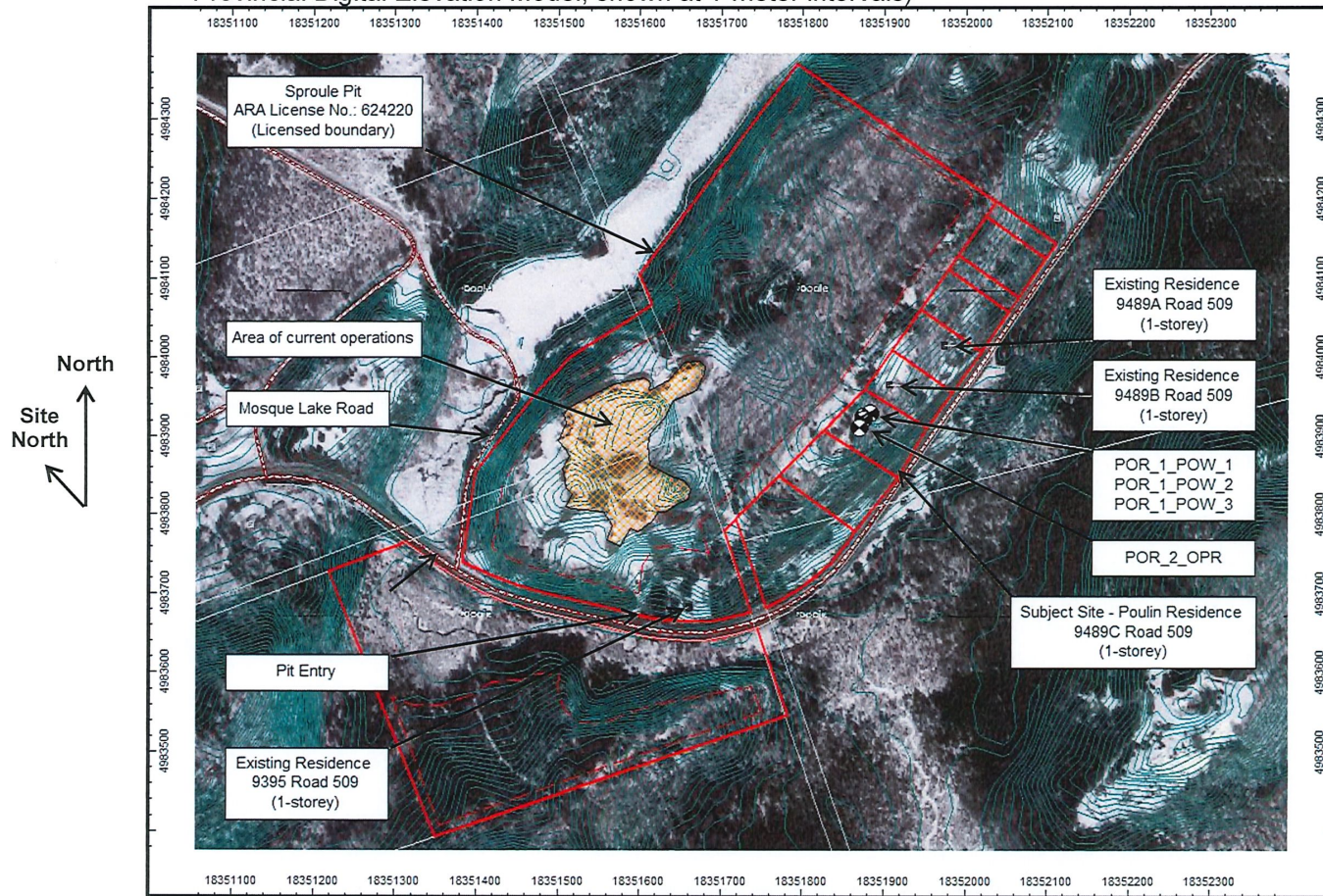


Figure 2: Detail Site Layout & Surface Elevation Contours (elevation contours for surrounding area based on LIO, Provincial Digital Elevation Model, shown at 1-meter intervals)



Noise Impact Assessment for Residence
within the Influence Area of Licensed Pit,
Township of North Frontenac, Ontario

Mr. Joseph Poulin

21st June 2023

Figure 3.1: Site Survey showing Existing Partially Constructed Residence and Distance to Rear Property Boundary (Source: McIntosh Perry Surveying Inc.)

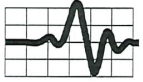
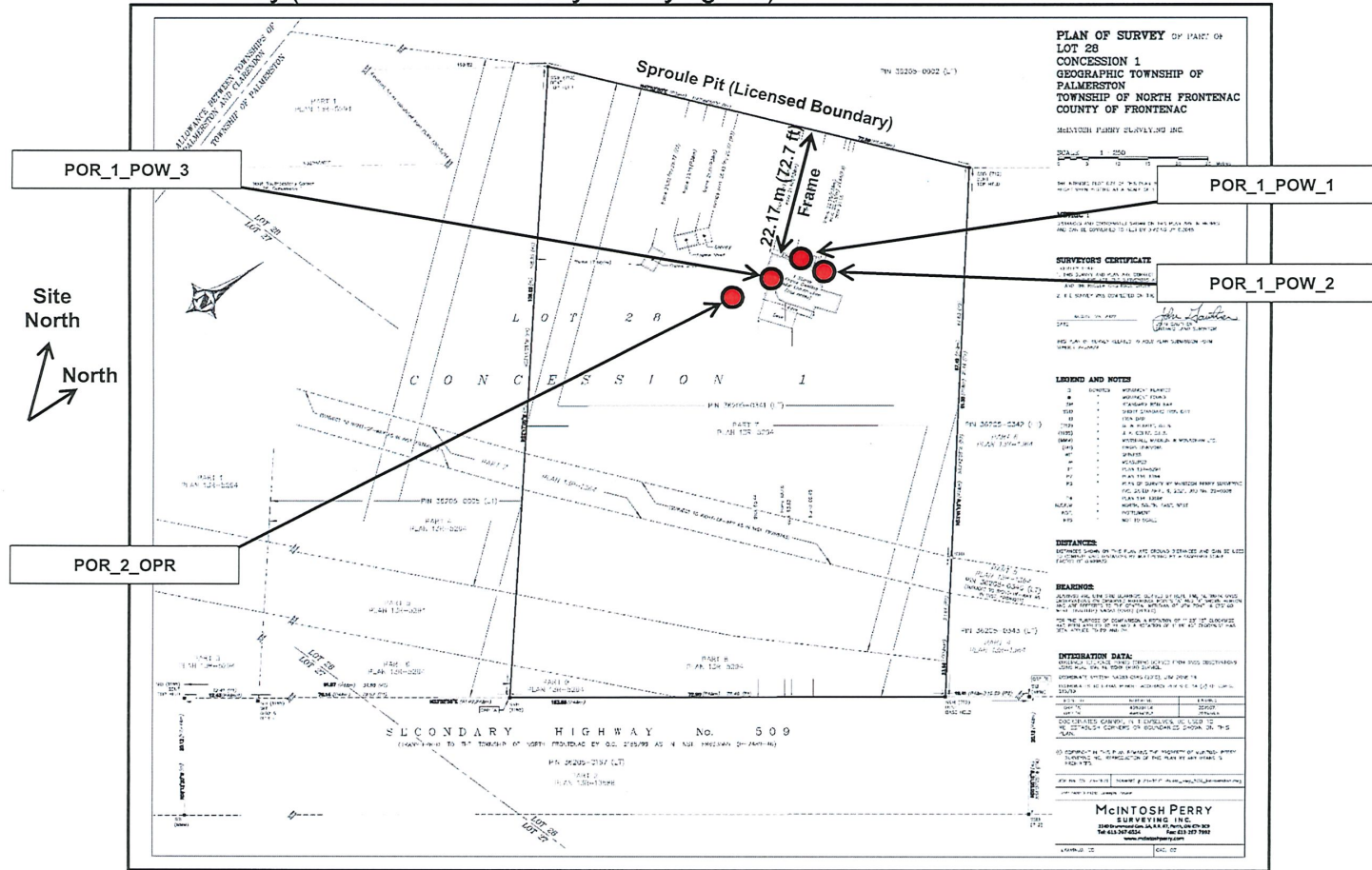


Figure 3.2: Detail Site Plan showing Points of Reception and Elevation Contours at Ridge (Source: McIntosh Perry Surveying Inc.)

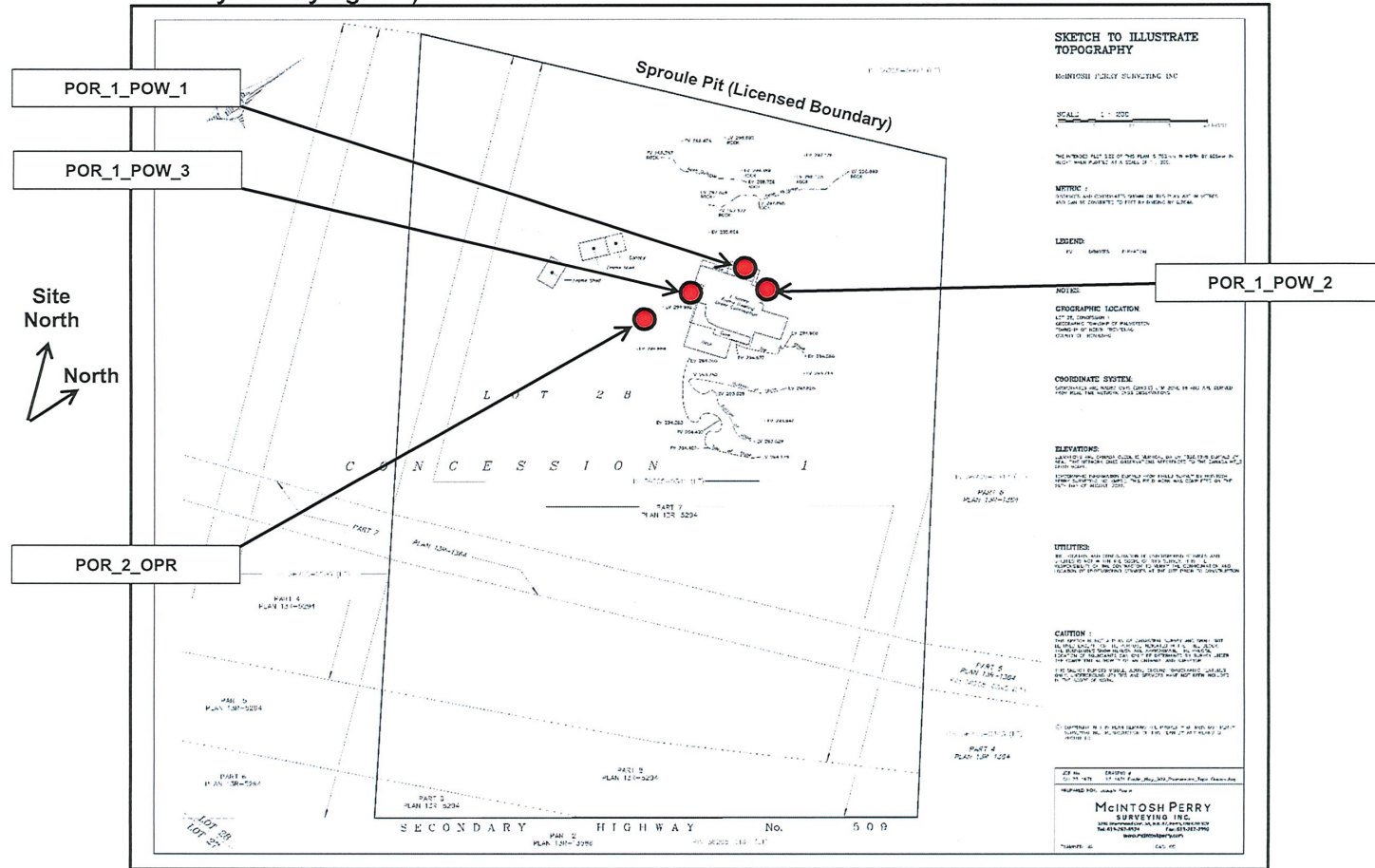


Figure 4: Ground Floor Plan showing Interior Layout of Residence and Plane of Window Point of Reception (Source: Poulin)

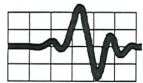
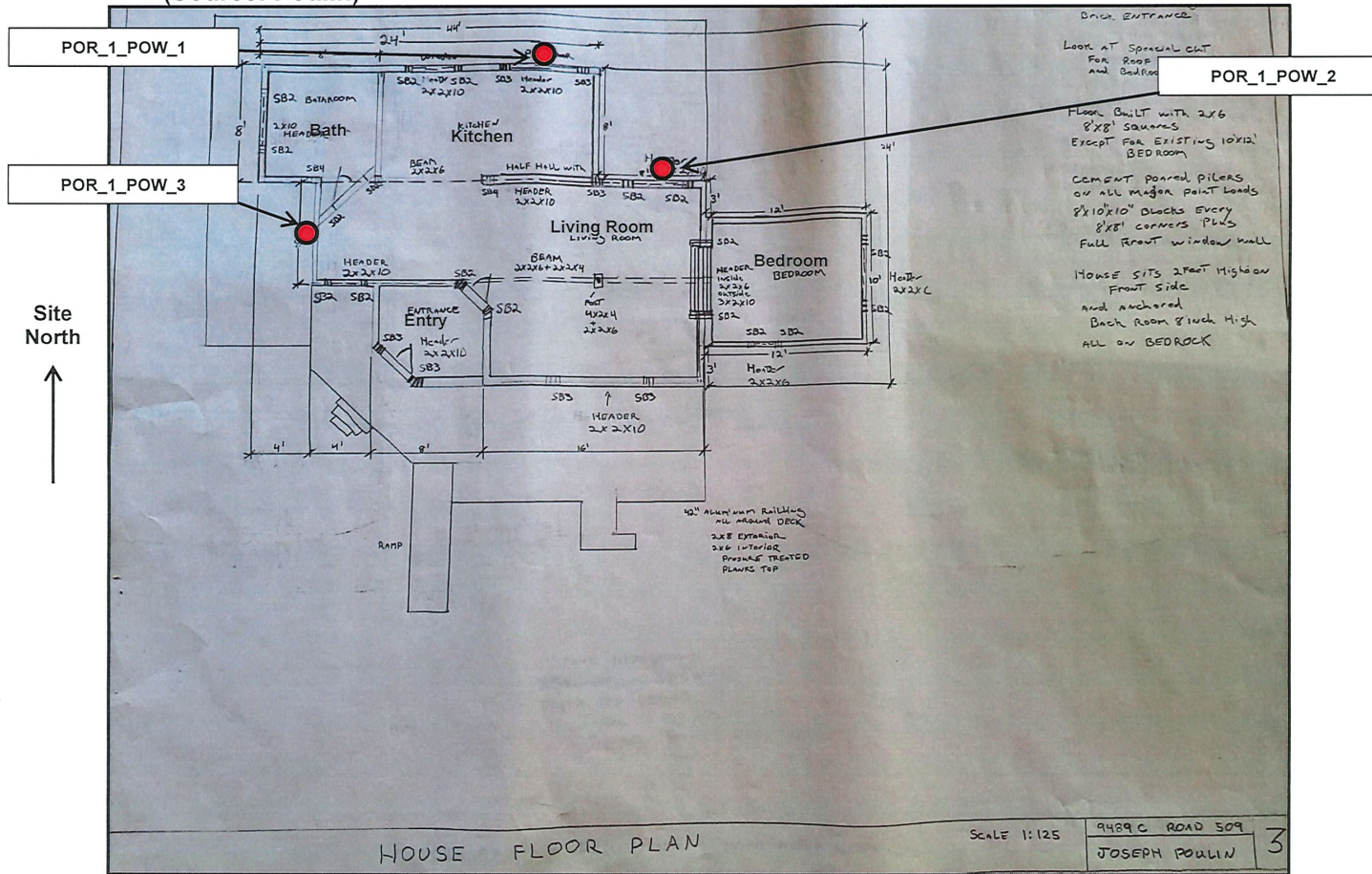


Figure 5: Building Front and Rear Elevations showing Plane of Window Point of Reception (Source: Poulin)

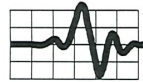
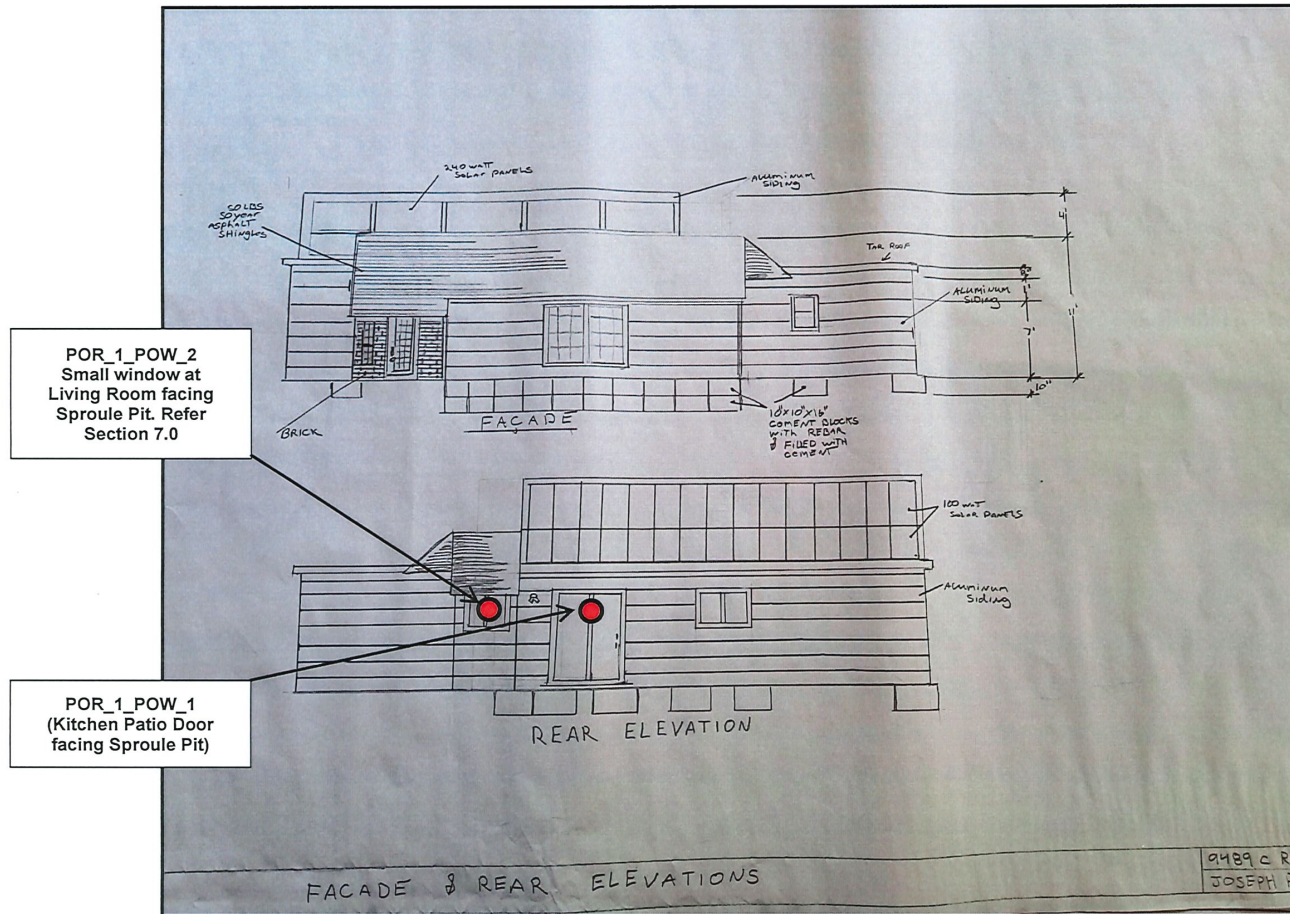


Figure 6: Building Side Elevations (Source: Poulin)

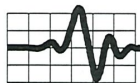
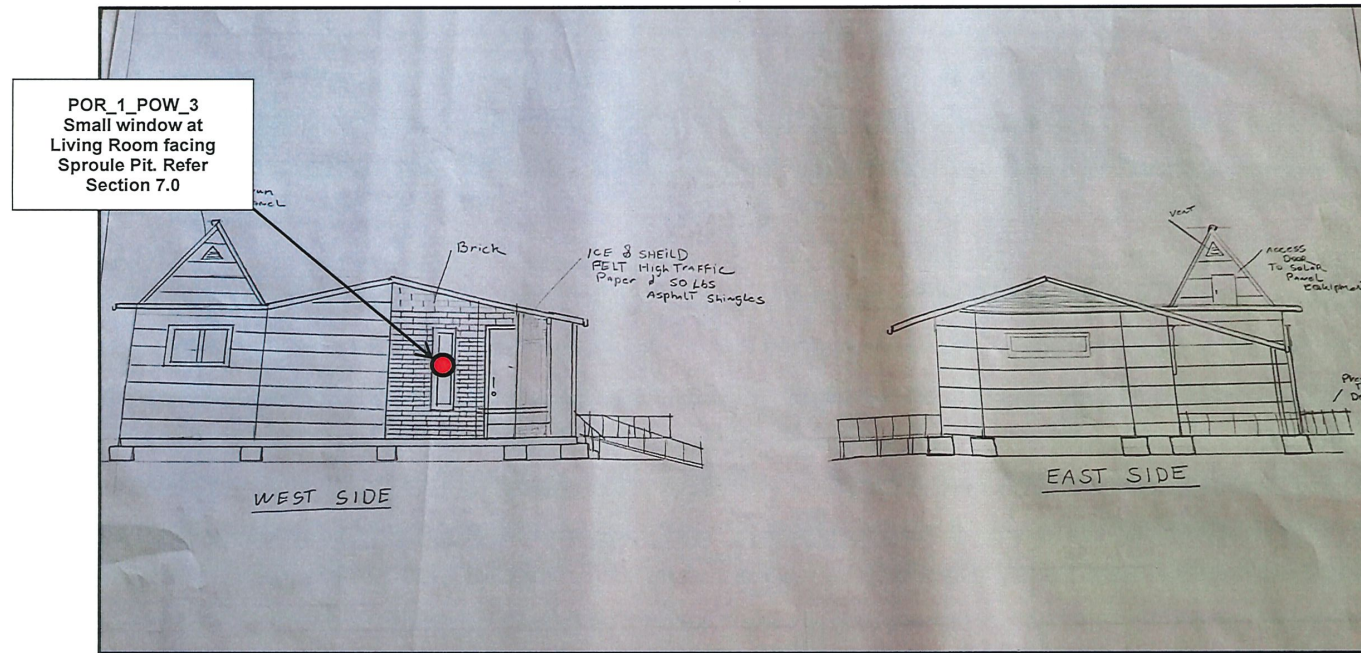


Figure 7: Scenario 1: Normal Operations - All equipment in operation concurrently with extraction occurring closest to the subject site, crusher not in operation (Day or Evening) – Before Mitigation

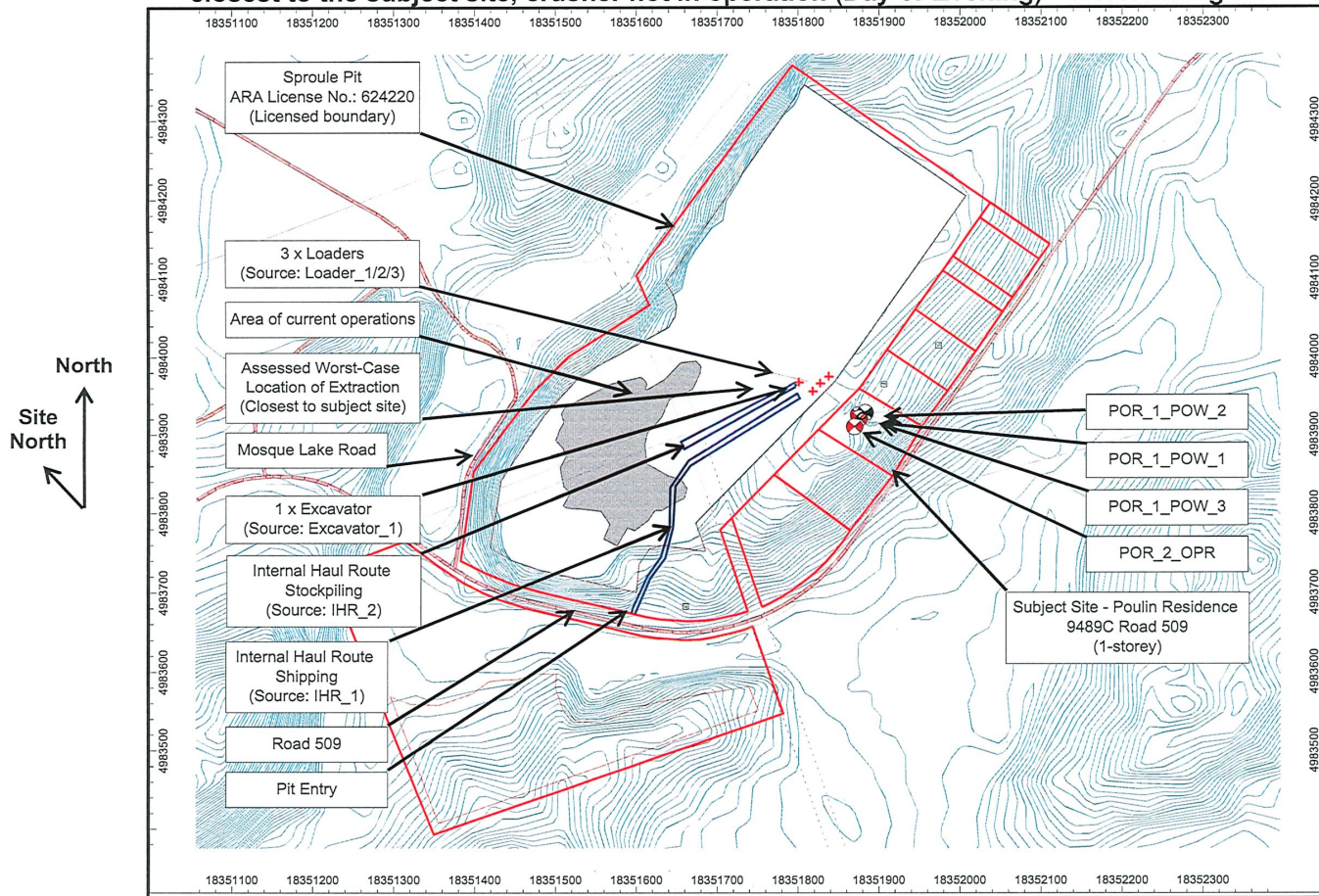


Figure 8: Prediction Results, Scenario 1: Worst Case, Evening Period, Noise Contours, (Noise levels at 4.5 m) – Before Mitigation

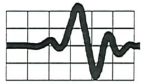
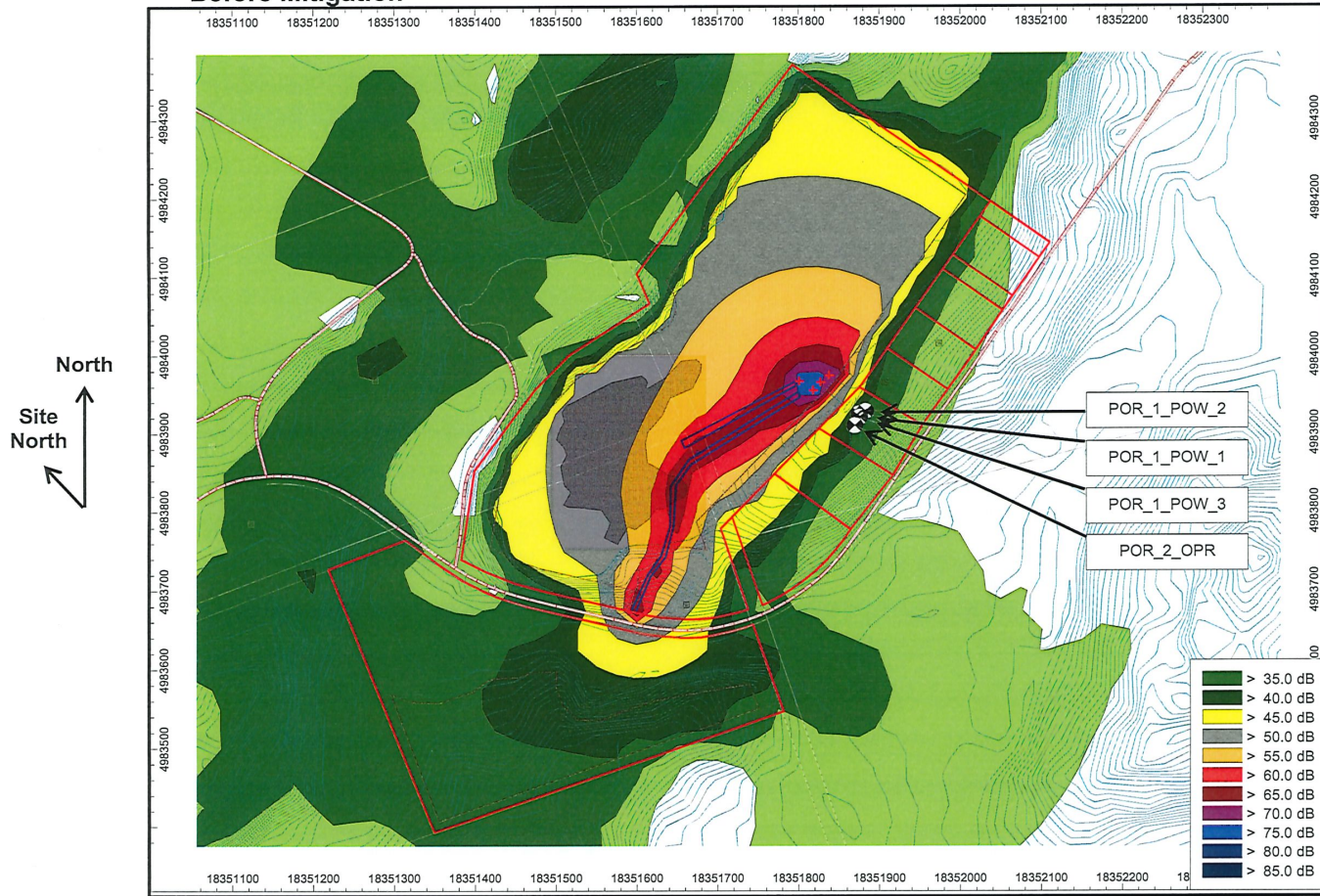


Figure 9: Scenario 2: Normal Operations - All equipment in operation concurrently with extraction occurring closest to the subject site, crusher not in operation (Day or Evening) – After Mitigation

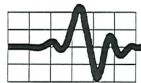
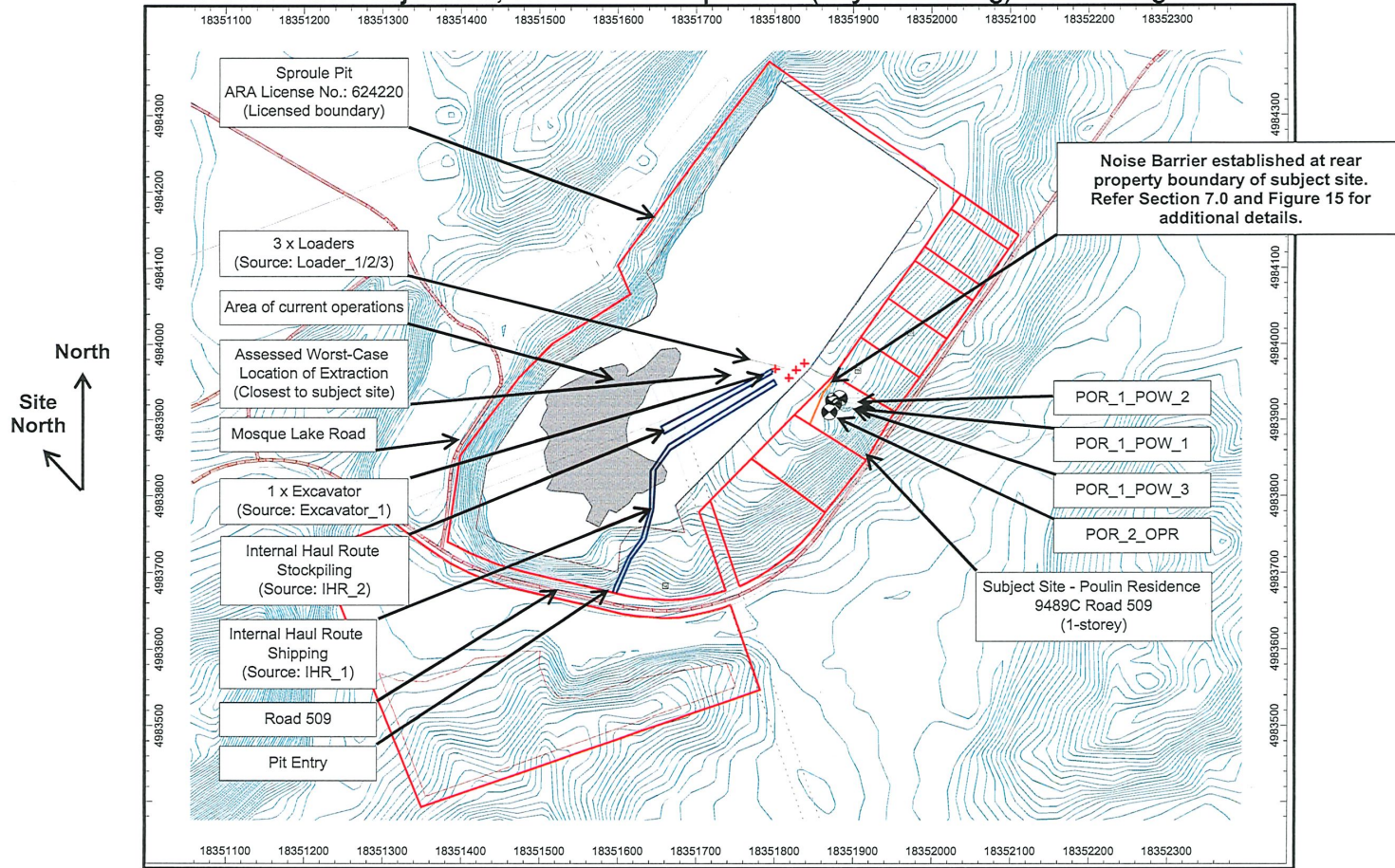


Figure 10: Prediction Results, Scenario 2: Worst Case, Evening Period, Noise Contours, (Noise levels at 4.5 m) – After Mitigation

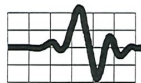
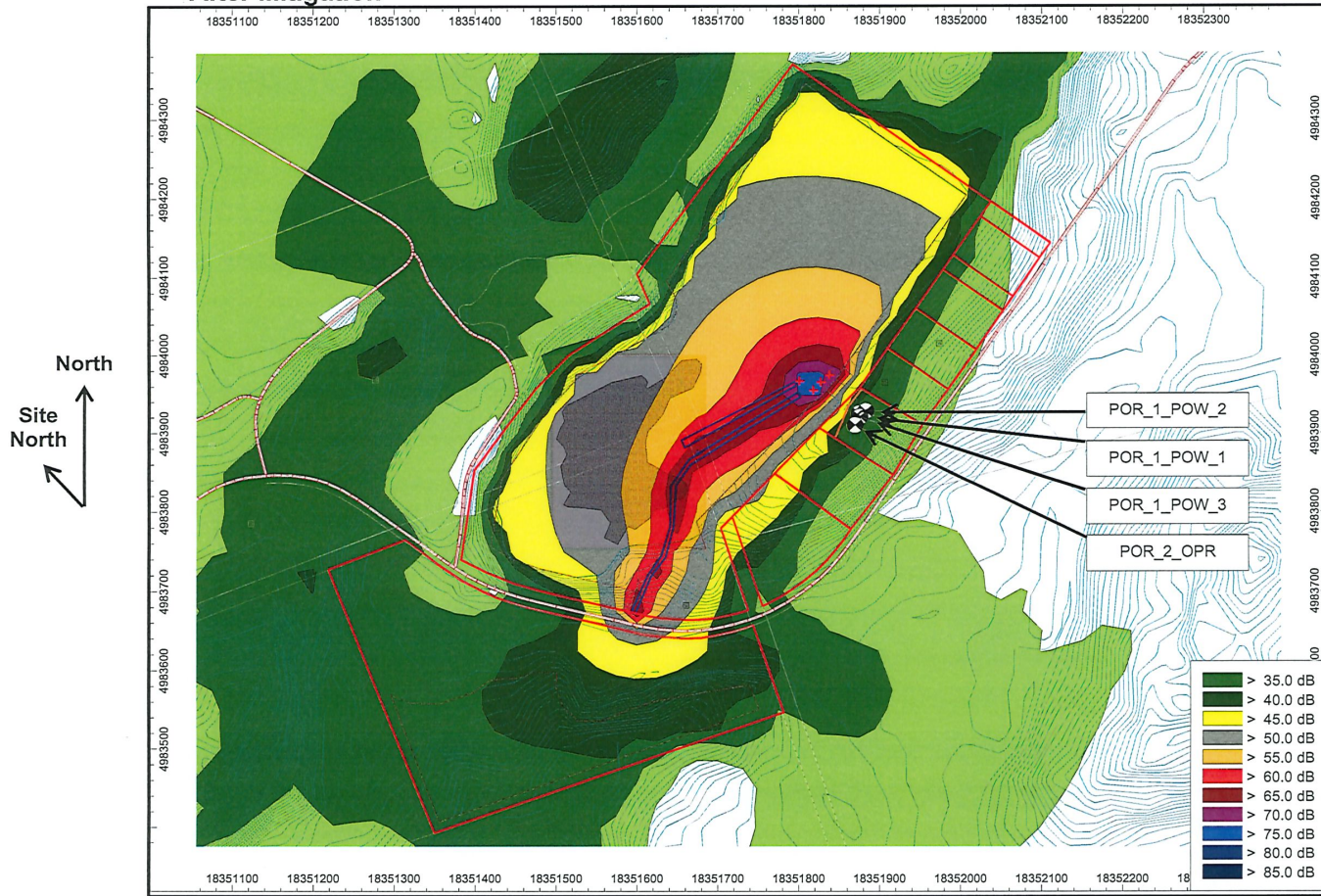


Figure 11: Scenario 3: Worst Case, Crushing Campaigns - All equipment in operation concurrently with extraction occurring closest to the subject site, crusher in operation (Day only) – Before Mitigation

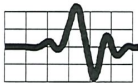
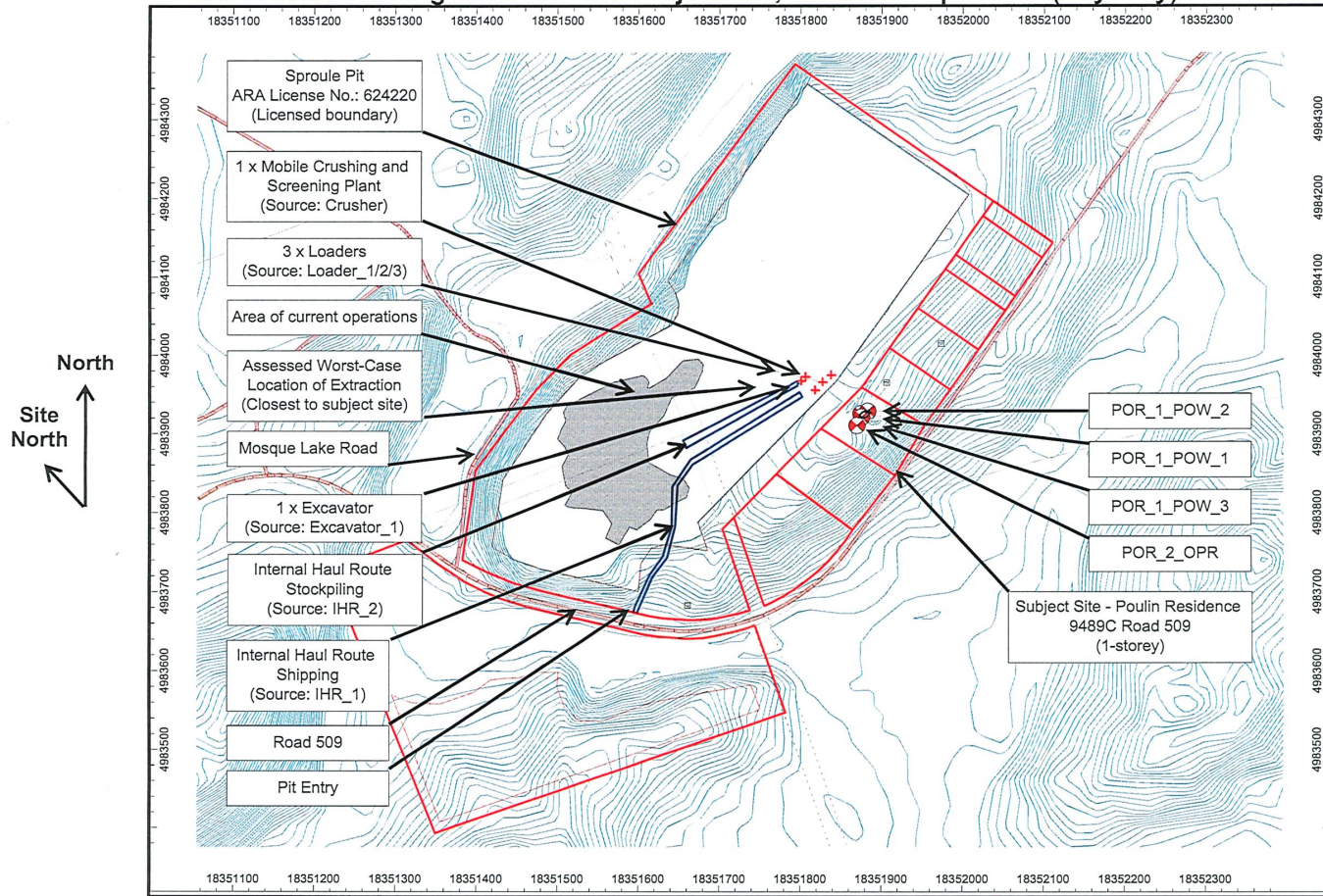


Figure 12: Prediction Results, Scenario 3: Worst Case, Daytime Period, Noise Contours, (Noise levels at 1.5 m) – Before Mitigation

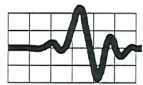
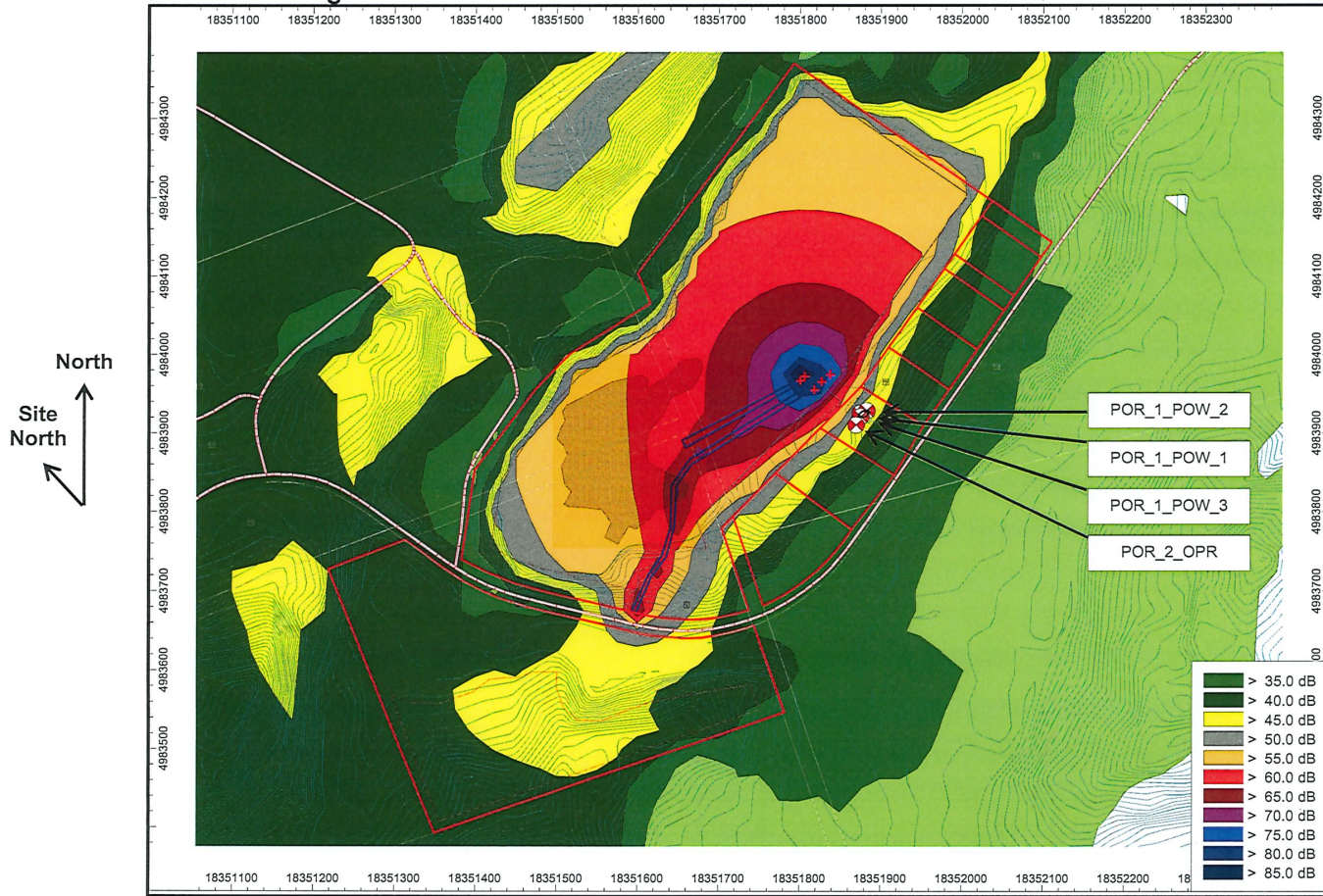


Figure 13: Scenario 4: Worst Case, Crushing Campaigns - All equipment in operation concurrently with extraction occurring closest to the subject site, crusher in operation (Day only) – After Mitigation

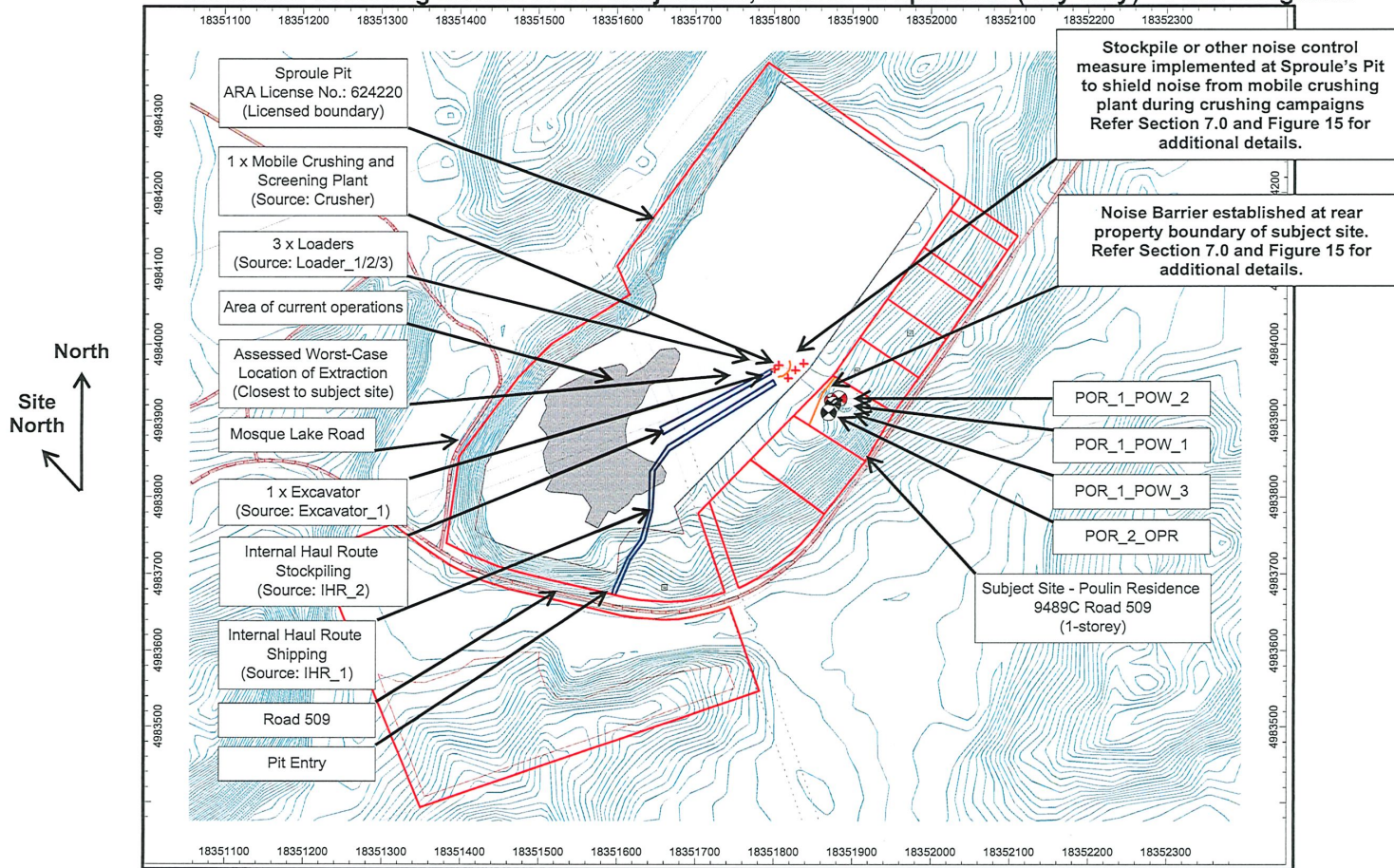


Figure 14: Prediction Results, Scenario 4: Worst Case, Daytime Period, Noise Contours, (Noise levels at 1.5 m) – After Mitigation

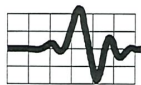
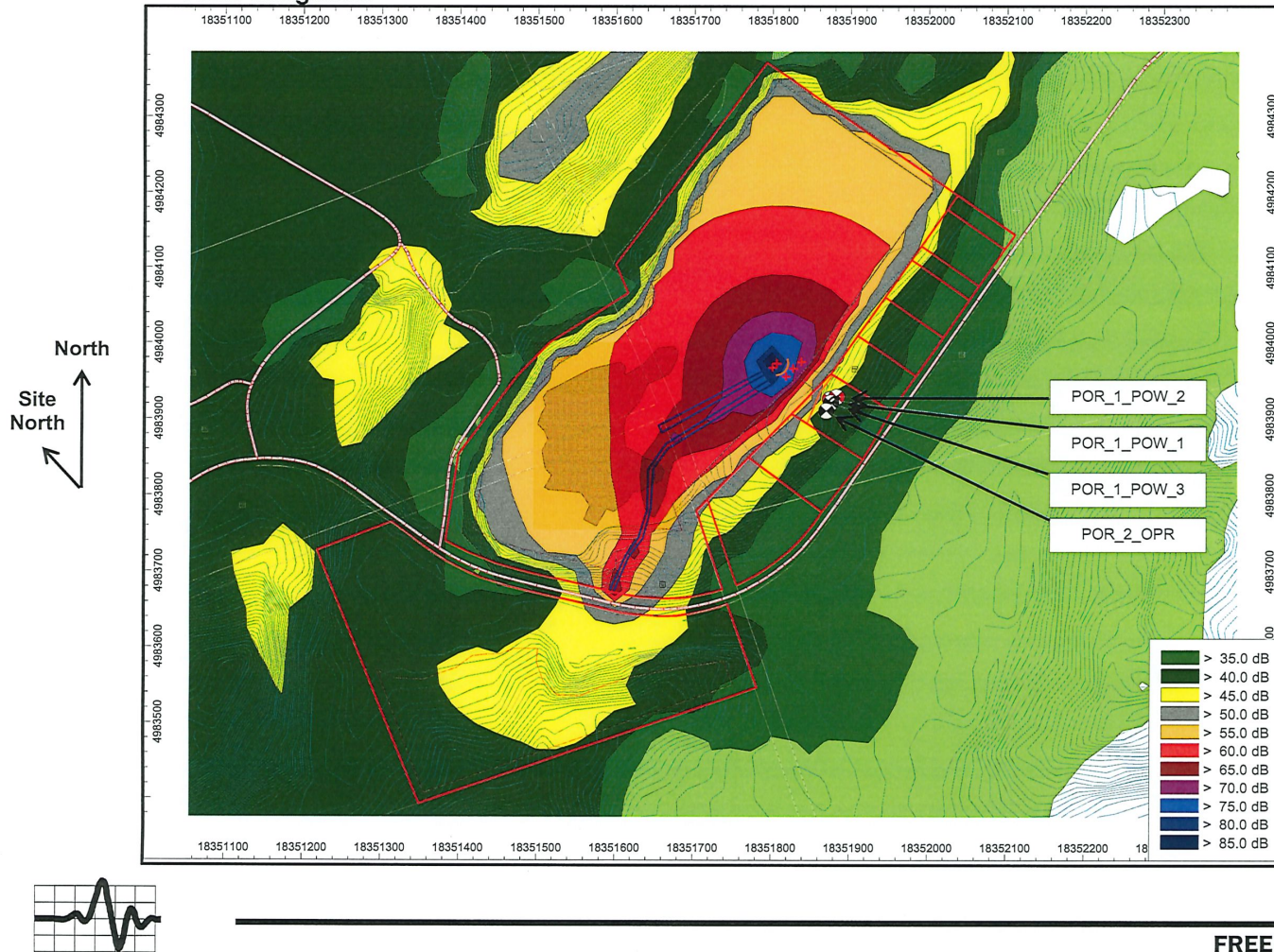
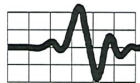
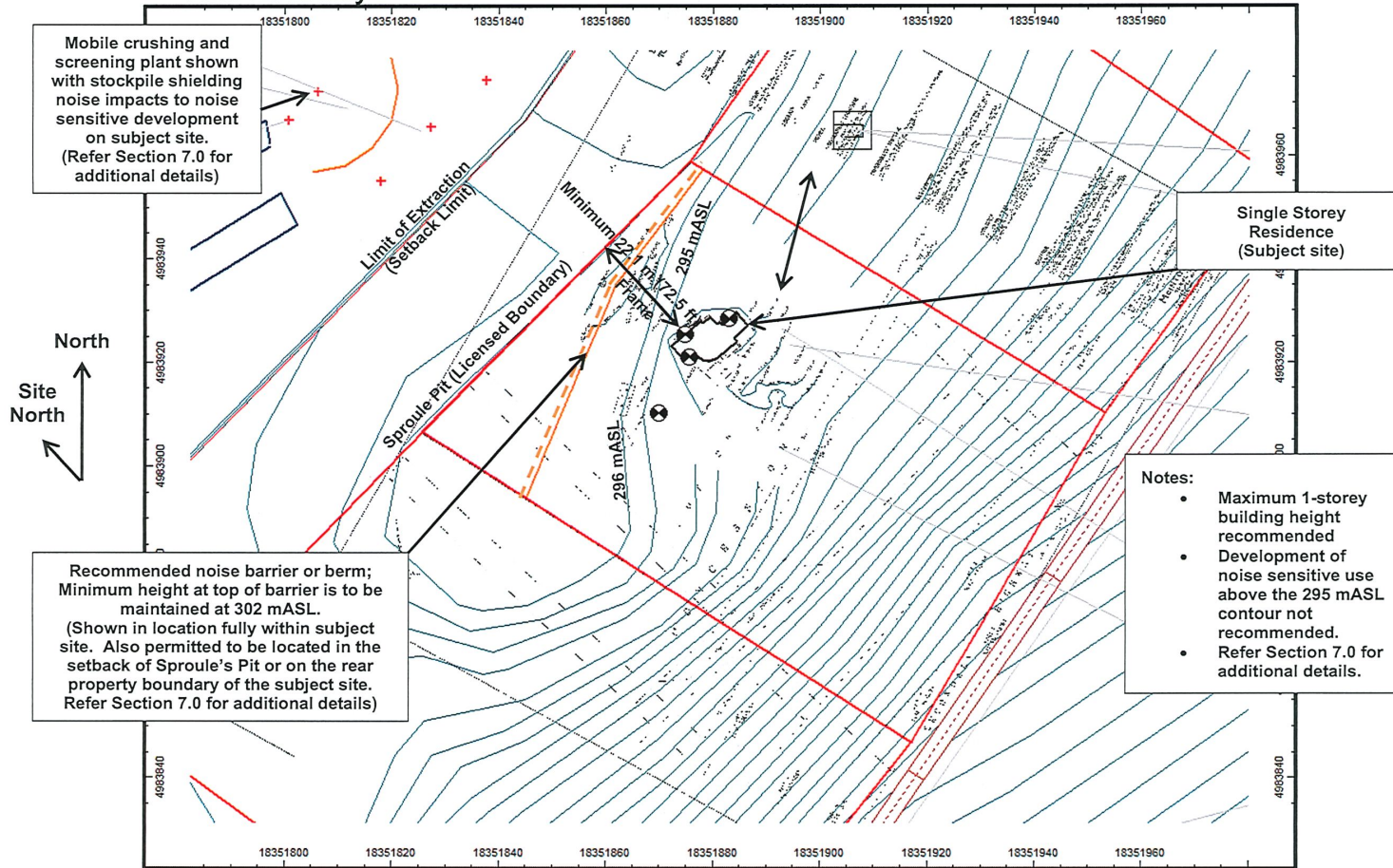


Figure 15: Detailed Plan showing Recommended Noise Control Measures and Minimum Setback Distance from Rear Boundary



Appendix 1

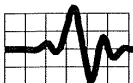
Zoning Plan and Land Use Designations

Contents:

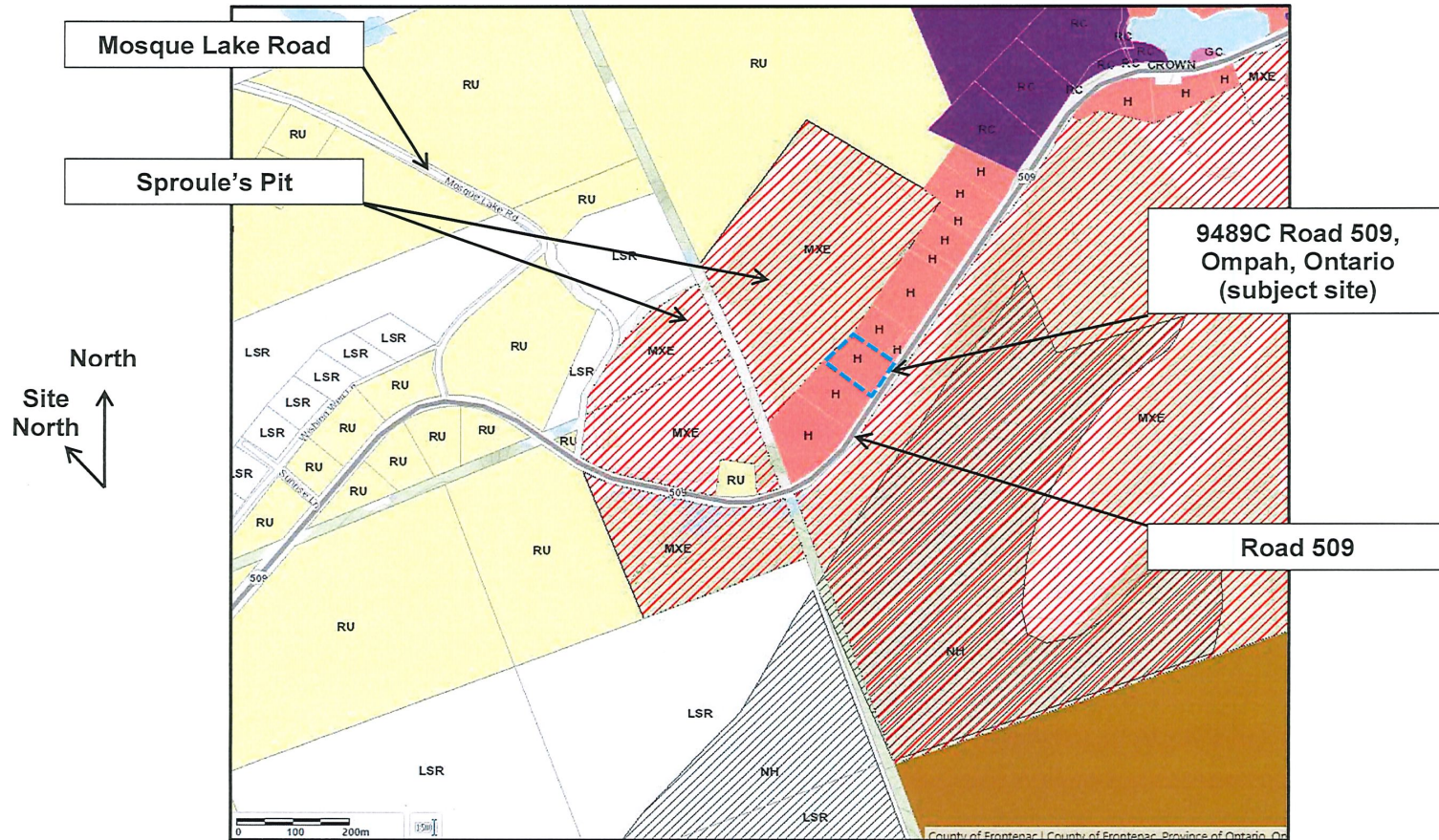
- **Zoning Map: Township of North Frontenac Zoning By-Law** (Source: County of Frontenac Interactive Mapping)

Legend:

- Hamlet (H)
- Mineral Aggregate Extraction (MXE)
- Rural (RU)
- Recreational Commercial (RC)
- Limited Service Rural (LSR)



Zoning Map: Township of North Frontenac Zoning By-Law (Source: County of Frontenac Interactive Mapping)



Appendix 2

Acoustic Modelling Details

Modeling Notes:

1. Acoustic model developed uses Cadna-A software, Version 2022.
2. Sound propagation is modeled according to ISO 9613-2: 1996(E).
3. The whole of the extraction area is modelled with an absorption coefficient of 0.5 representative of exposed earth. The surrounding area is modeled with an absorption coefficient of 1.0 indicative of a Class 3 Area.
4. MECP favoured conservative modelling assumptions are used, that is, 'no subtraction of negative ground attenuation' and 'no negative path differences'.

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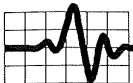


Table A2.1 Point of Reception Location Table

ID	Height	Coordinates		
		X	Y	Z
		(m)	(m)	(m)
POR_1_POW_1	2.3	18351874.8	4983925.3	297.3
POR_1_POW_2	2.3	18351883.1	4983928.5	297.3
POR_1_POW_3	2.3	18351875.6	4983921.0	297.3
POR_2_OPR	1.5	18351869.9	4983910.2	296.4

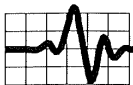


Table A2.2 Point Sources

ID	Result. PWL			Lw / Li	Noise Source Library File	Operating Time			Direct.	Height	Coordinates				
	Day	Evening	Night			Type	Value	Day			Evening	Night	X	Y	Z
	(dBA)	(dBA)	(dBA)					(min/hr)			(min/hr)	(min/hr)	(m)	(m)	(m)
Crusher	117.5	-	-	Lw	Crushing_Plant	60.0	-	-	(none)	2.5	18351825.7	4983964.5	283.5		
Loader_1	103.0	103.0	103.0	Lw	Loader	60.0	60.0	-	(none)	2.5	18351837.7	4983974.3	283.5		
Loader_2	103.0	103.0	103.0	Lw	Loader	60.0	60.0	-	(none)	2.5	18351818.1	4983955.0	283.5		
Loader_3	103.0	103.0	103.0	Lw	Loader	60.0	60.0	-	(none)	2.5	18351814.3	4983965.5	283.5		
Excavator_1	103.2	103.2	103.2	Lw	Excavator	60.0	60.0	-	(none)	2.5	18351800.9	4983966.8	283.5		

Table A2.3 Line Sources

ID	Result. PWL			Lw / Li	Noise Source Library File	Direct.	Moving Pt. Src			Speed		
	Day	Evening	Night				Type	Value	Number/hr			
	(dBA)	(dBA)	(dBA)						Day		Evening	Night
IHR_1_Shipping	105.8	105.8	-	PWL-Pt	HWYTruck_Slow58	(none)	15.0	15.0	-	30.0		
IHR_2_Stockpiling	92.8	92.8	-	PWL-Pt	Aggregate_Truck_Passby	(none)	8.0	8.0	-	30.0		



Table A2.4 Noise Source Library

ID	Type	Spectra (dB)										A	lin	Source
		31.5	63	125	250	500	1000	2000	4000	8000				
Crushing_Plant	Lw	113.1	115.8	117.3	117.3	116.0	111.2	109.1	104.9	99.2	117.5	123.6	Mielke Quarry - Measured 3rd February 2015	
Loader	Lw	107.3	109.5	107.1	101.8	99.4	97.6	95.9	90.1	82.9	103.0	113.6	Meas. Howe-Ross Pit 20-05-13 72dBA at 14m	
Excavator	Lw	100.0	110.2	109.0	100.8	98.5	98.0	95.2	92.6	87.7	103.2	113.5	Meas. OTR 23rd August 2017 at 13.0m	
Aggregate_Truck_Passby	Lw	104.5	103.9	104.1	102.1	99.5	99.5	94.5	91.2	79.6	103.3	110.7	Meas. Howe-Ross Pit 20-05-13 73.7dBA at 12m	
HWYTruck_Slow58	Lw	115.9	112.7	110.2	101.6	101.4	105.0	104.2	97.6	103.5	110.1	119.0	Brockville McDowell Study, 2003	

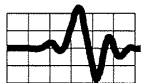


Table A2.5 Noise Measurement Data

ID	Type	Spectra (dB)										A	lin	Source
		31.5	63	125	250	500	1000	2000	4000	8000				
Meas_Crushing_WP286	Li	75.5	82.0	84.7	77.0	77.7	73.8	71.5	68.1	62.9	79.8	88.1	Mielke Quarry - Measured 3rd February 2015	
Meas_Crushing_WP287	Li	74.8	77.5	79.0	79.0	77.7	72.9	70.8	66.6	60.9	79.2	85.3	Mielke Quarry - Measured 3rd February 2015	
Meas_Crushing_WP288	Li	72.3	78.3	77.1	69.9	72.5	71.7	67.5	62.9	57.3	75.6	82.7	Mielke Quarry - Measured 3rd February 2015	
Meas_Crushing_WP289	Li	72.7	77.9	79.6	70.9	73.2	72.2	69.7	64.9	58.5	76.8	83.7	Mielke Quarry - Measured 3rd February 2015	
Meas_Crushing_WP290	Li	76.8	82.7	84.4	78.5	75.3	75.0	71.9	67.0	62.6	79.7	88.2	Mielke Quarry - Measured 3rd February 2015	
Meas_Crushing_WP291	Li	72.6	79.1	82.1	78.2	72.2	75.6	74.2	70.3	70.0	80.5	86.3	Mielke Quarry - Measured 3rd February 2015	
Meas_Crushing_WP292	Li	75.2	80.7	84.8	79.2	80.9	76.5	74.9	70.3	64.3	82.5	88.7	Mielke Quarry - Measured 3rd February 2015	
Meas_Crushing_WP293	Li	68.0	75.5	78.8	73.8	67.5	67.9	64.0	59.3	54.3	72.7	82.0	Mielke Quarry - Measured 3rd February 2015	
Meas_Crushing_WP294	Li	62.5	68.8	72.6	69.3	62.9	59.8	58.8	52.3	48.6	66.8	76.0	Mielke Quarry - Measured 3rd February 2015	
Meas Loader	Li	76.3	78.5	76.1	70.8	68.4	66.6	64.9	59.1	51.9	72.0	82.6	Meas. Howe-Ross Pit 20-05-13 72dBA at 14m	
Meas_Excavator_CAT345DL	Li	69.6	79.8	78.6	70.4	68.1	67.6	64.8	62.2	57.3	72.8	83.1	Meas. OTR 23rd August 2017 at 13.0m	
Meas_Aggregate_Truck_Passby	Li	74.9	74.3	74.5	72.5	69.9	69.9	64.9	61.6	50.0	73.7	81.1	Meas. Howe-Ross Pit 20-05-13 73.7dBA at 12m	
Meas_HWYTruck_Slow58	Li	67.5	64.3	61.8	53.2	53.0	56.6	55.8	49.2	55.1	61.7	70.6	adj. 90m source Brockville McDowell Study, 2003	

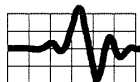


Table A2.6.1 Point of Reception Impacts by Source for Scenario 1* - Daytime and evening Period – Before Mitigation

Source	Daytime and Evening Period (07:00 to 20:00)			
	POR_1_POW_1	POR_1_POW_2	POR_1_POW_3	POR_2_OPR
ID	dBA	dBA	dBA	dBA
Loader_1	32.6	32.2	32	31.1
Loader_2	32.7	32	32.3	31.9
Loader_3	32.9	32.3	32.3	31.7
Excavator_1_S1	34.5	34.1	34.0	33.7
IHR_1	35.5	32.0	36.5	36.2
IHR_2	23.6	22.3	24.5	25.1
Total	40.9	39.7	40.9	40.5

* Values at first floor window height (W) at 2.3 m above grade and Outdoor Point of Reception (OPR) at 1.5 m above grade are given above as these where the most critical points at each receptor.

Table A2.6.2 Point of Reception Impacts by Source for Scenario 2* - Daytime and evening Period – After Mitigation

Source	Daytime and Evening Period (07:00 to 20:00)			
	POR_1_POW_1	POR_1_POW_2	POR_1_POW_3	POR_2_OPR
ID	dBA	dBA	dBA	dBA
Loader_1	32.6	32.2	31.7	31.1
Loader_2	32.6	31.9	31.5	31.8
Loader_3	32.8	32.3	31.7	31.6
Excavator_1_S1	32.9	32.7	31.5	32.1
IHR_1	30.4	27.4	31.6	33.2
IHR_2	20.7	18.2	20.6	19.9
Total	39.4	38.7	38.7	39.1

* Values at first floor window height (W) at 2.3 m above grade and Outdoor Point of Reception (OPR) at 1.5 m above grade are given above as these where the most critical points at each receptor.

Table A2.6.3 Point of Reception Impacts by Source for Scenario 3* - Daytime Period – Before Mitigation

Source	Daytime and Evening Period (07:00 to 20:00)			
	POR_1_POW_1	POR_1_POW_2	POR_1_POW_3	POR_2_OPR
ID	dBA	dBA	dBA	dBA
Loader_1	32.6	32.2	31.7	31.1
Loader_2	32.6	31.9	31.5	31.8
Loader_3	32.8	32.3	31.7	31.6
Excavator_1_S1	32.9	32.7	31.5	32.1
IHR_1	30.4	27.4	31.6	33.2
IHR_2	20.7	18.2	20.6	19.9
Total	39.4	38.7	38.7	39.1

* Values at first floor window height (W) at 2.3 m above grade and Outdoor Point of Reception (OPR) at 1.5 m above grade are given above as these where the most critical points at each receptor.

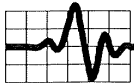


Table A2.6.4 Point of Reception Impacts by Source for Scenario 4* - Daytime Period – After Mitigation

Source ID	Daytime Period (07:00 to 19:00)			
	POR_1_POW_1	POR_1_POW_2	POR_1_POW_3	POR_2_OPR
	dB(A)	dB(A)	dB(A)	dB(A)
Loader_1	32.6	32.2	31.7	31.1
Loader_2	32.6	31.9	31.5	31.8
Loader_3	32.8	32.3	31.7	31.6
Excavator_1	31.2	30.8	30.3	30.3
Crusher_S3	44.5	44.2	43.7	43.5
IHR_1	30.4	27.4	31.6	33.2
IHR_2	20.6	18.1	20.6	19.8
Total	45.6	45.2	44.9	44.8

* Values at first floor window height (W) at 2.3 m above grade and Outdoor Point of Reception (OPR) at 1.5 m above grade are given above as these where the most critical points at each receptor.

Table A2.7 Distance Source to Point of Reception

ID	POR_1_POW_1	POR_1_POW_2	POR_1_POW_3	POR_2_OPR
	(m)	(m)	(m)	(m)
Loader_1	61	64	65	72
Loader_2	64	70	67	69
Loader_3	62	67	66	70
Excavator_1	85	91	88	89
Crusher_S3	83	88	86	89

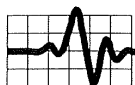


Table A2.8 Sample Calculations – Scenario 1

Receiver
Name: POR_1
ID: POR_1_POW_1
X: 18351874.78 m
Y: 4983925.31 m
Z: 297.30 m

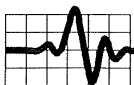
Point Source, ISO 9613, Name: "Loader_1", ID: "Loader_1"																				
Nr.	X	Y	Z	Ref.	DEN	Freq.	Lw	I/a	Oplime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)
1	18351837.74	4983974.33	283.50	0	DEN	32	67.9	0.0	0.0	0.0	0.0	47.0	0.0	-3.0	0.0	0.0	11.1	0.0	0.0	12.8
1	18351837.74	4983974.33	283.50	0	DEN	63	83.3	0.0	0.0	0.0	0.0	47.0	0.0	-3.0	0.0	0.0	14.8	0.0	0.0	24.5
1	18351837.74	4983974.33	283.50	0	DEN	125	91.0	0.0	0.0	0.0	0.0	47.0	0.0	1.5	0.0	0.0	17.4	0.0	0.0	25.1
1	18351837.74	4983974.33	283.50	0	DEN	250	93.2	0.0	0.0	0.0	0.0	47.0	0.1	6.3	0.0	0.0	16.1	0.0	0.0	23.7
1	18351837.74	4983974.33	283.50	0	DEN	500	96.2	0.0	0.0	0.0	0.0	47.0	0.1	1.0	0.0	0.0	24.0	0.0	0.0	24.1
1	18351837.74	4983974.33	283.50	0	DEN	1000	97.6	0.0	0.0	0.0	0.0	47.0	0.2	-0.2	0.0	0.0	25.0	0.0	0.0	25.6
1	18351837.74	4983974.33	283.50	0	DEN	2000	97.1	0.0	0.0	0.0	0.0	47.0	0.6	-0.3	0.0	0.0	25.0	0.0	0.0	24.8
1	18351837.74	4983974.33	283.50	0	DEN	4000	91.1	0.0	0.0	0.0	0.0	47.0	2.1	-0.3	0.0	0.0	25.0	0.0	0.0	17.3
1	18351837.74	4983974.33	283.50	0	DEN	8000	81.8	0.0	0.0	0.0	0.0	47.0	7.4	-0.3	0.0	0.0	25.0	0.0	0.0	2.7

Point Source, ISO 9613, Name: "Loader_3", ID: "Loader_3"																				
Nr.	X	Y	Z	Ref.	DEN	Freq.	Lw	I/a	Oplime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)
2	18351827.37	4983965.48	283.50	0	DEN	32	67.9	0.0	0.0	0.0	0.0	47.1	0.0	-3.0	0.0	0.0	10.5	0.0	0.0	13.3
2	18351827.37	4983965.48	283.50	0	DEN	63	83.3	0.0	0.0	0.0	0.0	47.1	0.0	-3.0	0.0	0.0	14.2	0.0	0.0	25.0
2	18351827.37	4983965.48	283.50	0	DEN	125	91.0	0.0	0.0	0.0	0.0	47.1	0.0	1.5	0.0	0.0	16.7	0.0	0.0	25.7
2	18351827.37	4983965.48	283.50	0	DEN	250	93.2	0.0	0.0	0.0	0.0	47.1	0.1	6.3	0.0	0.0	15.4	0.0	0.0	24.3
2	18351827.37	4983965.48	283.50	0	DEN	500	96.2	0.0	0.0	0.0	0.0	47.1	0.1	1.0	0.0	0.0	23.9	0.0	0.0	24.1
2	18351827.37	4983965.48	283.50	0	DEN	1000	97.6	0.0	0.0	0.0	0.0	47.1	0.2	-0.2	0.0	0.0	25.0	0.0	0.0	25.5
2	18351827.37	4983965.48	283.50	0	DEN	2000	97.1	0.0	0.0	0.0	0.0	47.1	0.6	-0.3	0.0	0.0	25.0	0.0	0.0	24.7
2	18351827.37	4983965.48	283.50	0	DEN	4000	91.1	0.0	0.0	0.0	0.0	47.1	2.1	-0.3	0.0	0.0	25.0	0.0	0.0	17.2
2	18351827.37	4983965.48	283.50	0	DEN	8000	81.8	0.0	0.0	0.0	0.0	47.1	7.4	-0.3	0.0	0.0	25.0	0.0	0.0	2.6

Point Source, ISO 9613, Name: "Loader_2", ID: "Loader_2"																				
Nr.	X	Y	Z	Ref.	DEN	Freq.	Lw	I/a	Oplime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)
3	18351818.07	4983955.01	283.50	0	DEN	32	67.9	0.0	0.0	0.0	0.0	47.3	0.0	-3.0	0.0	0.0	10.5	0.0	0.0	13.1
3	18351818.07	4983955.01	283.50	0	DEN	63	83.3	0.0	0.0	0.0	0.0	47.3	0.0	-3.0	0.0	0.0	14.1	0.0	0.0	24.8
3	18351818.07	4983955.01	283.50	0	DEN	125	91.0	0.0	0.0	0.0	0.0	47.3	0.0	1.5	0.0	0.0	16.5	0.0	0.0	25.6
3	18351818.07	4983955.01	283.50	0	DEN	250	93.2	0.0	0.0	0.0	0.0	47.3	0.1	6.4	0.0	0.0	15.1	0.0	0.0	24.2
3	18351818.07	4983955.01	283.50	0	DEN	500	96.2	0.0	0.0	0.0	0.0	47.3	0.1	1.0	0.0	0.0	23.7	0.0	0.0	24.0
3	18351818.07	4983955.01	283.50	0	DEN	1000	97.6	0.0	0.0	0.0	0.0	47.3	0.2	-0.2	0.0	0.0	25.0	0.0	0.0	25.3
3	18351818.07	4983955.01	283.50	0	DEN	2000	97.1	0.0	0.0	0.0	0.0	47.3	0.6	-0.3	0.0	0.0	25.0	0.0	0.0	24.4
3	18351818.07	4983955.01	283.50	0	DEN	4000	91.1	0.0	0.0	0.0	0.0	47.3	2.1	-0.3	0.0	0.0	25.0	0.0	0.0	16.9
3	18351818.07	4983955.01	283.50	0	DEN	8000	81.8	0.0	0.0	0.0	0.0	47.3	7.7	-0.3	0.0	0.0	25.0	0.0	0.0	2.1

Point Source, ISO 9613, Name: "Excavator_1", ID: "Excavator_1"																				
Nr.	X	Y	Z	Ref.	DEN	Freq.	Lw	I/a	Oplime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)
4	18351800.87	4983966.83	283.50	0	DEN	32	60.6	0.0	0.0	0.0	0.0	49.7	0.0	-3.0	0.0	0.0	7.4	0.0	0.0	6.5
4	18351800.87	4983966.83	283.50	0	DEN	63	84.0	0.0	0.0	0.0	0.0	49.7	0.0	-3.0	0.0	0.0	10.0	0.0	0.0	27.3
4	18351800.87	4983966.83	283.50	0	DEN	125	92.9	0.0	0.0	0.0	0.0	49.7	0.0	1.4	0.0	0.0	12.0	0.0	0.0	29.8
4	18351800.87	4983966.83	283.50	0	DEN	250	92.2	0.0	0.0	0.0	0.0	49.7	0.1	6.4	0.0	0.0	10.2	0.0	0.0	25.8
4	18351800.87	4983966.83	283.50	0	DEN	500	95.3	0.0	0.0	0.0	0.0	49.7	0.2	0.8	0.0	0.0	18.8	0.0	0.0	25.8
4	18351800.87	4983966.83	283.50	0	DEN	1000	98.0	0.0	0.0	0.0	0.0	49.7	0.3	-0.5	0.0	0.0	22.6	0.0	0.0	25.9
4	18351800.87	4983966.83	283.50	0	DEN	2000	96.4	0.0	0.0	0.0	0.0	49.7	0.8	-0.5	0.0	0.0	25.0	0.0	0.0	21.4
4	18351800.87	4983966.83	283.50	0	DEN	4000	93.6	0.0	0.0	0.0	0.0	49.7	2.8	-0.5	0.0	0.0	25.0	0.0	0.0	16.6
4	18351800.87	4983966.83	283.50	0	DEN	8000	86.6	0.0	0.0	0.0	0.0	49.7	10.0	-0.5	0.0	0.0	25.0	0.0	0.0	2.4

Line Source, ISO 9613, Name: "IHR_1 Shipping", ID: "IHR_1"																				
Nr.	X	Y	Z	Ref.	DEN	Freq.	Lw	I/a	Oplime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)
5	18351700.96	4983882.02	283.50	0	DEN	32	43.5	19.0	0.0	0.0	0.0	56.1	0.0	-3.6	0.0	0.0	5.3	0.0	0.0	4.7
5	18351700.96	4983882.02	283.50	0	DEN	63	53.5	19.0	0.0	0.0	0.0	56.1	0.0	-3.6	0.0	0.0	6.1	0.0	0.0	13.9
5	18351700.96	4983882.02	283.50	0	DEN	125	61.1	19.0	0.0	0.0	0.0	56.1	0.1	1.5	0.0	0.0	5.9	0.0	0.0	16.6
5	18351700.96	4983882.02	283.50	0	DEN	250	60.0	19.0	0.0	0.0	0.0	56.1	0.2	6.7	0.0	0.0	2.4	0.0	0.0	13.6
5	18351700.96	4983882.02	283.50	0	DEN	500	65.2	19.0	0.0	0.0	0.0	56.1	0.3	0.7	0.0	0.0	10.6	0.0	0.0	16.5
5	18351700.96	4983882.02	283.50	0	DEN	1000	72.0	19.0	0.0	0.0	0.0	56.1	0.7	-0.8	0.0	0.0	13.8	0.0	0.0	21.3
5	18351700.96	4983882.02	283.50	0	DEN	2000	72.4	19.0	0.0	0.0	0.0	56.1	1.7	-0.8	0.0	0.0	16.5	0.0	0.0	17.9



**RESUMÉ: Dr. HUGH WILLIAMSON, P.Eng.**

QUALIFICATIONS: Ph.D. Mechanical Engineering, University of New South Wales, 1972
B.Sc. Mechanical Engineering, (with Distinction), University of Alberta, 1967
Member, Professional Engineers, Ontario
Member, Canadian Acoustical Association

- KEY COMPETENCIES:**
- Environmental noise and vibration assessments, Environmental Compliance Approval (ECA). Noise assessment for land use planning
 - Architectural and building acoustics, acoustics of office spaces, meeting rooms, auditoriums and studios, noise and vibration control of building mechanical services.
 - Industrial noise and vibration assessment and control.
 - Transportation noise and vibration.

PROFESSIONAL EXPERIENCE:

Hugh Williamson is a professional engineer with many years of experience in the measurement, analysis and control of noise and vibration. Freefield Ltd. was incorporated in 2017 and provides consulting services in architectural, building, industrial, transportation and environmental acoustics and vibration. Clients include architects, engineering firms, industrial firms and government departments. Prior to joining Freefield Ltd. Hugh Williamson founded and directed Hugh Williamson Associates Inc. which specialized in consulting services in architectural, building, industrial, transportation and environmental acoustics and vibration. His career included extensive periods in industry as well as university level research and teaching. He is a former Director of the Acoustics and Vibration Unit at the Australian Defence Force Academy. He has published over 50 engineering and scientific papers and has been an invited speaker on noise and vibration at national and international conferences. He has more than 25 years of experience as a consultant.

CLIENT LIST:

Hugh Williamson has provided consulting services to large and small clients including: National Research Council, J. L. Richards & Associates, Barry Padolsky Associates, Atkinson Schroeter Design Group, R. W. Tomlinson Limited, Geo. Tackaberry Construction, Miller Paving, City of Ottawa.

Postal Address: PO Box 74056, RPO Beechwood, Ottawa, Ontario, K1M 2H9, Canada
Phone: 613-747-0983, Email: hugh@freefieldacoustics.com, <http://www.freefieldacoustics.com>

**RESUMÉ: MICHAEL WELLS****QUALIFICATIONS:** Registered Architect of NSW, Registration Number: 8111

B. Architecture (Hons), University of Sydney, 2002

B.Sc. Architecture, University of Sydney, 1999

Member, Canadian Acoustical Association

Member, Australian Acoustical Society

Associate Member, INCE-USA

KEY**COMPETENCIES:**

- Environmental noise and vibration assessments, Environmental Compliance Approval (ECA). Noise assessment for land use planning.
- Architectural and building acoustics, acoustics of office spaces, meeting rooms, auditoriums and studios, noise and vibration control of building mechanical services.
- Industrial noise and vibration assessment and control.
- Transportation noise and vibration.
- Design services including sketch design, design development (development / permit applications), contract documents, tendering and contract administration.

PROFESSIONAL EXPERIENCE:

Michael Wells is a professional Architect registered in NSW, Australia, with many years of experience in the measurement, analysis and control of noise and vibration. Michael Wells is a founding Director of Freefield Ltd. which was incorporated in 2017, and provides consulting services in architectural, building, industrial, transportation and environmental acoustics and vibration. Clients include architects, engineering firms, industrial firms and government departments. Prior to establishing Freefield Ltd., his career included working for Hugh Williamson Associates Inc. specializing in acoustics, noise and vibration consulting services, and, the founding of Michael Wells Architect in Sydney, Australia, specializing in the design of institutional, commercial and residential projects. He is the former Director of Architectural Workshops Australia and Vision Blue Pty Ltd. He has more than 15 years of experience as a consultant.

CLIENT LIST:

Michael Wells has provided consulting services to large and small clients including: National Research Council, R. W. Tomlinson, G. Tackaberry & Sons Construction, Miller Paving, J. L. Richards & Associates, Barry Padolsky Associates, Atkinson Schroeter Design Group and Industry Canada.

Postal Address: PO Box 74056, RPO Beechwood, Ottawa, Ontario, K1M 2H9, Canada

T/F: 613-747-0983, E: michael@freefieldacoustics.com, W: www.freefieldacoustics.com



NORTHERN Applied Sciences Inc.

August 15, 2023

Brooke Drechsler, Deputy Clerk
Township of North Frontenac
6648 Road 506
Plevna, ON K0H 2M0

RE: Noise Peer Review
9489C Road 509, Ompah - Township of North Frontenac
NAPSCI Ref. 23-053

Dear Ms. Drechsler:

Northern Applied Sciences Inc. (NAPSCI) was retained by the Township of North Frontenac to provide a peer review of a noise impact assessment pertaining to a residential property within the area of influence of an existing licensed gravel pit.

The following technical report was reviewed for this assignment:

- Noise Impact Assessment for Residence Located within the Influence Area of the Existing Licensed Sproules Pit, Township of North Frontenac, Ontario, dated June 21, 2023, and prepared by Freefield Ltd. (herein, *Noise Impact Assessment*).

Peer Review Findings

1. Criteria: The *Noise Impact Assessment* was conducted according to MECP Noise Assessment Guidelines, including NPC-300. We concur that this is the most appropriate noise assessment guidance and criteria to follow.

2. Sound Propagation Model and Noise Receptors: The Cadna-A noise model was used to predict sound level impacts; Canda-A is a model that is well-accepted by the MECP. Worst-case gravel pit impacts were assessed at both plane-of-window (residential building façade) and outdoor living space receptors, which is appropriate.

3. Sound Output from Noise Generating Equipment: Sound power levels for all noise generating equipment were estimated from other representative sites. The values therefore have the potential to underpredict actual sound levels. We note specifically that the Loaders, Excavators/Bulldozers, and Aggregate Trucks are potentially underpredicted based on our own experience with these sources. We would therefore recommend actual site-specific sound level measurements to confirm the equipment sound power levels before any agreed-to noise control measures are implemented.

Northern Applied Sciences Inc.
Yonge Mulock P.O., P.O. Box. 93307, Newmarket, Ontario, L3X 1A3
647-381-3080 (Toronto) | 416-992-4116 (Newmarket) | www.napsci.io

4. Mitigation – the report concludes that noise levels from the assumed worst-case pit operations at the subject site are in compliance with NPC-300 sound level limits provided that the noise mitigation measures described in the report are followed. Importantly, the report recommends a combination of noise controls at receptor-side (residence) and source-side (gravel pit). Any noise controls within the property of the pit would require the appropriate knowledge, consent and agreement of the pit owner.

We thank you for the opportunity to be of service. Should you have any questions or comments, please do not hesitate to contact us.

Respectfully,
Northern Applied Sciences Inc.



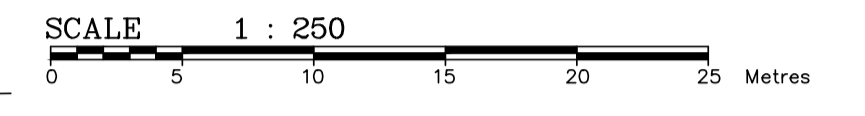
Stephen Kuchma, P.Eng.
Principal
kuchma@napsci.io
416-992-4116



Chris Scullion, B.E.Sc. (Civil Engineering)
Principal
scullion@napsci.io
647-381-3080

PLAN OF SURVEY OF PART OF
LOT 28
CONCESSION 1
GEOGRAPHIC TOWNSHIP OF
PALMERSTON
TOWNSHIP OF NORTH FRONTENAC
COUNTY OF FRONTENAC

McINTOSH PERRY SURVEYING INC.

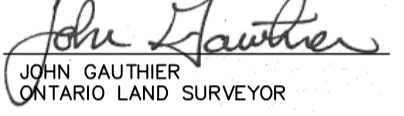


THE INTENDED PLOT SIZE OF THIS PLAN IS 762mm IN WIDTH BY 609mm IN HEIGHT WHEN PLOTTED AT A SCALE OF 1 : 250.

METRIC :
 DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

SURVEYOR'S CERTIFICATE

I CERTIFY THAT:
 1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE LAND TITLES ACT AND THE REGULATIONS MADE UNDER THEM.
 2. THE SURVEY WAS COMPLETED ON THE 11TH DAY OF AUGUST, 2022.

AUGUST 25, 2022
 DATE 
 JOHN GAUTHIER
 ONTARIO LAND SURVEYOR

THIS PLAN OF SURVEY RELATES TO AOLS PLAN SUBMISSION FORM NUMBER V-25829.

LEGEND AND NOTES

- DENOTES MONUMENT PLANTED
- " MONUMENT FOUND
- SIB " STANDARD IRON BAR
- SSIB " SHORT STANDARD IRON BAR
- IB " IRON BAR
- (712) " G. W. ELLIOTT, O.L.S.
- (1185) " J. F. GOLTZ, O.L.S.
- (MMM) " MARSHALL, MACKLIN & MONAGHAN LTD.
- (OU) " ORIGIN UNKNOWN
- WT " WITNESS
- m " MEASURED
- P1 " PLAN 13R-5294
- P2 " PLAN 13R-1364
- P3 " PLAN OF SURVEY BY McINTOSH PERRY SURVEYING INC, DATED APRIL 9, 2021, JOB No. 22-0008
- P4 " PLAN 13R-13586
- N,S,E,W " NORTH, SOUTH, EAST, WEST
- INST. " INSTRUMENT
- NTS " NOT TO SCALE

DISTANCES:
 DISTANCES SHOWN ON THIS PLAN ARE GROUND DISTANCES AND CAN BE USED TO COMPUTE GRID DISTANCES BY MULTIPLYING BY A COMBINED SCALE FACTOR OF 0.999832.

BEARINGS:
 BEARINGS ARE UTM GRID BEARINGS, DERIVED BY REAL TIME NETWORK GNSS OBSERVATIONS ON OBSERVED REFERENCE POINTS 'A' AND 'B' SHOWN HEREON, AND ARE REFERRED TO THE CENTRAL MERIDIAN OF UTM ZONE 18 (75° 00' WEST LONGITUDE) NAD83 (CSRS) (2010.0).

FOR THE PURPOSE OF COMPARISON A ROTATION OF 1° 23' 15" CLOCKWISE HAD BEEN APPLIED TO P1 AND A ROTATION OF 1° 18' 45" CLOCKWISE HAS BEEN APPLIED TO P2 AND P4.

INTEGRATION DATA:
 OBSERVED REFERENCE POINTS (ORPs) DERIVED FROM GNSS OBSERVATIONS USING REAL TIME NETWORK (RTN) SERVICE.

COORDINATE SYSTEM: NAD83 CSRS (2010), UTM ZONE 18.
 COORDINATES TO URBAN REMOTE ACCURACY PER SEC. 14 (2) OF O.REG. 216/10

POINT ID	NORTHING	EASTING
ORP 'A'	4983841.6	351907.1
ORP 'B'	4983918.3	351958.6

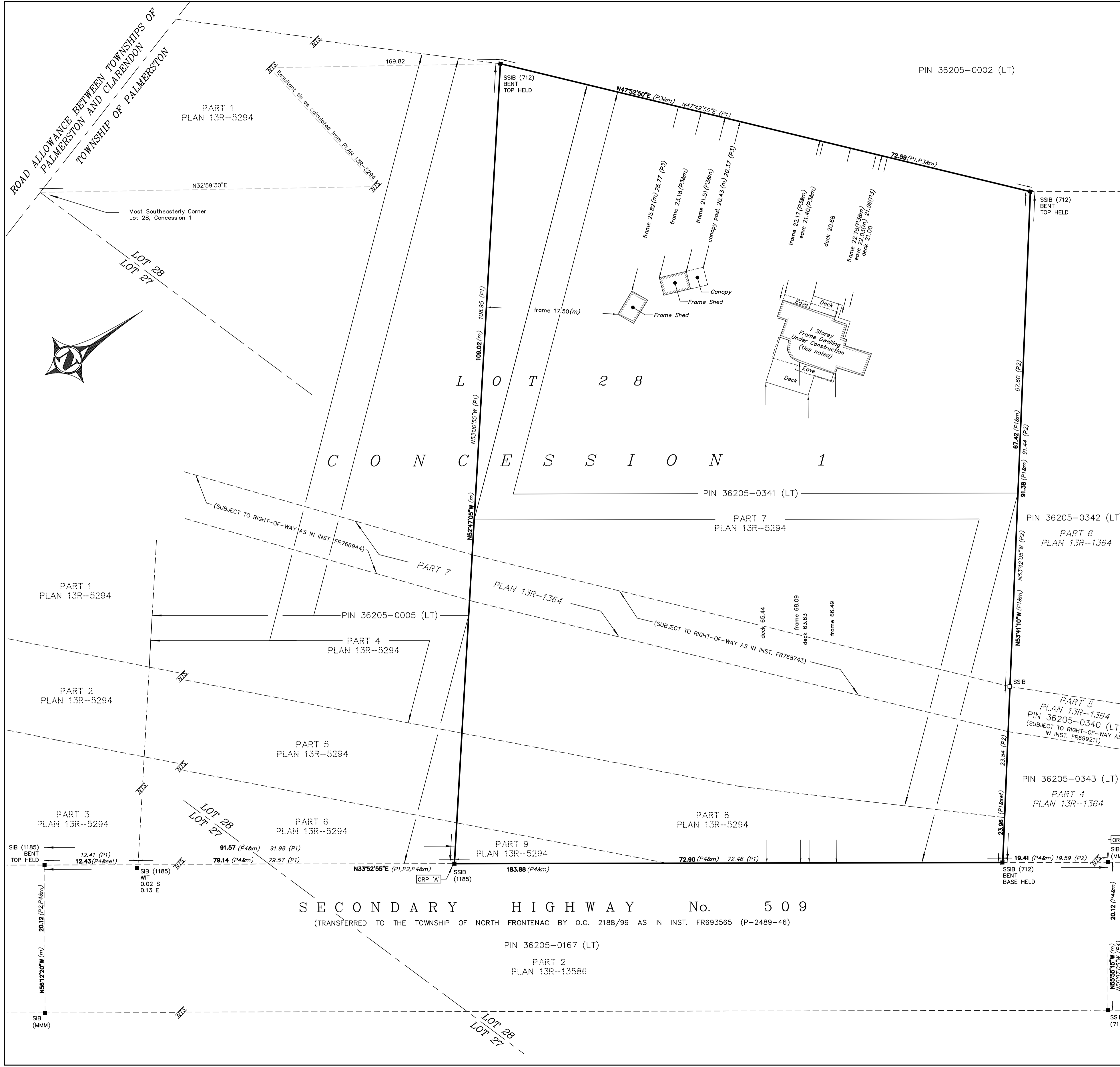
COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.

© COPYRIGHT IN THIS PLAN REMAINS THE PROPERTY OF McINTOSH PERRY SURVEYING INC.. REPRODUCTION OF THIS PLAN BY ANY MEANS IS PROHIBITED.

JOB No. CSI 23-1671 DRAWING # 23-1671 Poulin_Hwy_509_Palmerston.dwg
 PREPARED FOR: Joseph Poulin

McINTOSH PERRY SURVEYING INC.
 3240 Drummond Con. 5A, R.R. #7, Perth, ON K7H 3C9
 Tel: 613-267-6524 Fax: 613-267-7992
 www.mcintoshperry.com

EXAMINED: CC CAD: CC





Planning Report

To: Members of Committee of Adjustment

Prepared By: Jennie Kapusta, Community Planner, County of Frontenac

Reviewed By: Sonya Bolton, Manager of Community Planning, County of Frontenac

Re: **Application for Minor Variance to Permit the Construction of a Dwelling within the Influence Area of a Waste Disposal Site and within 30 Metres (98 feet) of a Waterbody**

Address: 1230D Austris Road

Legal Description: Part Lot 19, Southwest Range, Part Shore Road Allowance 13R 10703 Parts 9 and 10, Geographic Township of Clarendon

File Number: A11/23 (Leptick)

Owner(s): Spencer Leptick

Applicant(s): Same as Owner

Date Prepared: August 18, 2023

Date of Meeting: August 28, 2023

Recommendation:

That the Committee of Adjustment for the Township of North Frontenac hear comments from the public and defer this application until concerns raised by Township Public Works have been addressed and formal comments have been received from Mississippi Valley Conservation Authority.

Proposal:

The proposal is to construct a new dwelling on an existing waterfront residential lot within the 500 metre (1,640 foot) influence area of a waste management facility. The proposed dwelling will be located approximately 120 metres (394 feet) from the edge of

the fill area (approximately 90 metres (295 feet) from the abutting property line) of a currently non-operational, Township-owned, waste management facility, and a minimum of 18.3 metres (60 feet) from the high-water mark of Malcom Lake on a plateau area on the subject property. This dwelling will be a 1.5 storey structure with a footprint of 93.6 square metres (1,008 square feet) including attached decks.



Figure 1: Site plan submitted with the application showing the location of the existing and proposed development.

Existing Development

- A dry boathouse with a footprint of 20 square metres (216 square feet) that is located approximately 14 metres (46 feet) from the shoreline of Malcom Lake.
- A grey water system located approximately 36.6 metres (120 feet) from the high-water mark of Malcom Lake. This application includes a proposed septic system to service the new dwelling. This proposed septic system will be located more than 30 metres from Malcom Lake in vicinity of the existing grey water system.
- A storage shed with a footprint of 8.9 square metres (96 square feet) located approximately 21.3 metres (70 feet) from the shoreline of Malcom Lake.



Figure 2: Map with air photo showing the subject property, proposed development area, and approximate waste disposal site fill area.

The following variances from the Township Zoning By-Law Number 55-19 are required to permit the construction of the proposed dwelling:

Variance 1: Section 3.27(b)(i) of the zoning by-law states that no sensitive land use is to be permitted within the 500-metre influence area from the fill boundary of a waste management facility. Any proposal to construct a sensitive land use within the identified influence area is required to be supported with a compatibility study prepared by a qualified professional to evaluate environmental conditions, and the presence of and impact of any adverse effects or risks to health and safety and to recommend any remedial measures to be taken.

The entirety of the subject property is located within the 500-metre influence area of the non-operational, Township-owned, waste management facility on the abutting property (located at 6648 Road 506). The dwelling (sensitive land use) is proposed to be located a minimum of 120 metres (394 feet) from the edge of the fill area of this waste facility, a variance request of 380 metres (1,247 feet). The applicant has submitted a compatibility study, prepared by McIntosh Perry, in support of this reduction.

Variance 2: Sections 3.27(e)(i) and 4.4.3(a) of the zoning by-law requires all structures to be setback from the high-water mark of all waterbodies a minimum of 30 metres. The dwelling proposed through this application will be located a minimum of 18.3 metres (60 feet) from the high-water mark of Malcom Lake, a variance request of 11.7 metres (38.4 feet).

Background Information

Information Category	Response
Official Plan designation	Waterfront Area
Zoning	Residential Waterfront (RW)
Current size (area) of subject property	1.11 hectares (2.74 acres)
Existing road frontage and access	Accessed by Austris Road
Waterfront	Approximately 102 metres (335 feet) on Malcolm Lake
Natural heritage features	Malcom Lake
Surrounding land uses	Temporarily closed Ardoch waste disposal site to the east, Malcom Lake to the northwest, many similarly sized Residential Waterfront zoned properties along the shoreline of Malcom Lake, with a large portion contain existing residential development.

The entirety of the subject property is located within the 500-metre area of influence surrounding a waste site that is identified on both the Township Official Plan and Zoning By-law land use schedules. Within this area of influence the construction of sensitive land uses such as dwellings is prohibited without additional planning approval.

The applicant retained the services of McIntosh Perry (MP) to undertake the compatibility study (Landfill Impact Assessment [LIA]) required to evaluate environmental conditions, and the presence of and impact of any adverse effects or risks to health and safety and to recommend any remedial measures to be taken as a result of the subject property being located within the influence area of a waste disposal facility.

The subject property abuts the Ardoch Waste Disposal Site (WDS), municipally addressed as 1114 Austris Road. This waste facility was operational until 2014 when it was temporarily closed. No waste has been accepted at this site since 2014 and the site's Environmental Compliance Approval (ECA) was amended in 2015 to reflect this closure.

The WDS was temporarily closed before reaching its final capacity and it is MP's understanding that the WDS is to remain closed for at least 15 years (per the 2021 annual monitoring report, completed by Cambium). Based on Cambium's assessments made in the 2021 annual monitoring program, the approximate remaining site life is 38 years if the WDS is reopened for disposal.

The Ardoch WDS operated as a naturally attenuating waste disposal site between 1976 and 2014 and received solid, non-hazardous municipal waste. The Ardoch WDS was covered and vegetated in 2014, following its closure. Information in the 2021 annual monitoring report for the WDS suggests that the cover was in good condition and vegetation had established itself in the covered area. No complaints had been made concerning the landfill in 2021. Land use in the area surrounding the WDS is primarily vacant forested lands and lake area, although residential waterfront properties are scattered along the lakeside. A tree buffer separates the WDS and the development property. Ground settlement is expected to occur at the WDS.

MP stated that the Landfill Impact Assessment (LIA) report was completed in accordance with the Ontario Ministry of the Environment, Conservation and Parks (MECP) Guideline D-4 (revised 1990) and D-1 (revised 1990) in the documents entitled "D-4 Land Use On or Near Landfills and Dumps" and "D-1 Land Use and Compatibility".

Per the requirements of Guideline D-4, the potential impacts of the Ardoch WDS on the subject property were evaluated with respect to the following:

- Groundwater and surface water contamination by leachate
- Surface runoff
- Landfill gases
- Litter

- Odours
- Contaminant discharges from vehicular traffic
- Dust
- Noise
- Other air emissions
- Fires
- Vectors and vermin

The Landfill Impact Assessment (LIA) report stated that the subject property is located less than 30 metres (98.4 feet) from the Ardoch Waste Disposal Site's (WDS) western boundary and inferred to be hydraulically down-gradient. Groundwater flow diagrams provided to MP by Cambium (who manages and monitors the Ardoch WDS) suggest that groundwater from the WDS flows to the southwest. Similarly, surface water is interpreted to flow via surrounding watercourses and the WDS towards the subject property. The applicant has indicated that they do not intend to install a drinking water well on the subject property and as such, health-related impacts are not anticipated from development of the subject property. MP recommended that if the property owner intends to install a drinking water well in the future that the well is advanced into bedrock and cased at least six metres into the bedrock, similar to other existing wells in the area. Since the deeper bedrock aquifer is considered to be isolated, contamination is not expected.

It is MP's opinion that there are no concerns related to landfill gas impacts on the subject property. The Ardoch WDS has been covered by vegetation since 2014 and concentration of gases were measured well below limits of concerns. Migration of gases is not expected to impact the subject property.

MP noted that the proposed dwelling will be located approximately 90 metres (295 feet) from the property line abutting the Ardoch WDS, and that the land between the WDS and the proposed dwelling is heavily treed, which serves to mitigate noise, dust, and odour concerns.

In the opinion of MP, vermin at the Ardoch WDS are expected to be limited and similar to that of natural populations in the surrounding area. Solid waste has not been deposited at the WDS since 2014, and the cover present overtop of the waste mound acts as a protective layer from vermin. Cambium did not identify issues with vermin in their 2021 annual monitoring report, nor did they note any complaints submitted to the Township of North Frontenac concerning vermin at the WDS. MP is not aware of any historic complaints regarding vermin at the WDS.

Pre-application Consultation:

The property owner consulted with Township and County planning staff prior to the submission of this application.

Public Notice

Notice of the public meeting before the Committee of Adjustment was given in accordance with the requirements of the Planning Act. A notice was placed on the subject property and mailed to all property owners within 60 metres of subject property, 10 days in advance of the meeting.

Comments

Cambium Inc. – Consulting and Engineering

The Landfill Impact Assessment (LIA) prepared by McIntosh Perry (MP) was peer reviewed by Cambium at the expense of the applicant. Comments dated August 2, 2023, stated that under current conditions, Cambium agrees with MP's interpretation that the risk to the development on the subject property is minimal.

However, Cambium went on to say that the Ardoch WDS has the potential to re-open, with the possibility to recommence operations as early as 2028. Development of the subject property could be impacted by the Ardoch WDS if it were an open landfill and/or transfer station (e.g., surface water impacts, litter, odour, traffic etc.) and the Township should consider future plans for the Ardoch WDS when reviewing this development application. Specifically, that if the proposed development is approved, the Township may not receive approval to reopen the Ardoch WDS, either as a landfill and/or a transfer station from MECP. The Township should consider the future operations of the WDS and possible associated negative impacts/complaints when considering approval of this application.

Township of North Frontenac Public Works

Township staff have reviewed the submitted McIntosh Perry assessment report, along with the peer review completed by Cambium. The notes by Cambium that approval of this development could potentially impact the ability of the Township to resume operations at the Ardoch WDS in the future raised serious concerns. It is the intent of the Township to resume operations at the Ardoch WDS, though the exact timeline for this reopening has yet to be determined. Township staff would like a decision on this application to be deferred until these concerns can be appropriately addressed.

Mississippi Valley Conservation Authority (MVCA)

This application was circulated to MVCA, but formal comments have yet to be received. Email correspondence dated August 9, 2023, indicated potential concerns with slope stability on the subject property with regards to the proposed development.

Septic Approval Authority (Township of South Frontenac)

This application was not circulated for a review of septic suitability as the subject property contains an existing approved grey water system that was installed in 2010

(permit number CLM 20-10). The minor variance application indicates the intent to install a Class 4 sewage disposal system on the property greater than 30 metres from Malcom Lake in the vicinity of the existing grey water system, and the installation of this new system will require the issuance of a building permit.

Public Comments

County planning staff are not aware of any public comments received at the time of drafting this report.

Conclusion

Staff are recommending that the Committee of Adjustment defer the decision on application number A11/23, until the concerns raised by Township Public Works have been addressed and comments have been received from the Mississippi Valley Conservation Authority.



Township of North Frontenac



Application under Section 45 of the Planning Act

Section 45 (1) Minor Variance Section 45 (2) Request for Permission

Applicant Information – Please include all registered owners listed on the deed.

Name(s) of All Registered Property Owner(s)

Spencer Leptick

Mailing Address of Applicant:

5770 Philip Street, Osgoode, ON, K0A2W0

Primary Contact Number: 613.619.5194

Email Address: sleptickeunifor34.ca

Subject Property Information

Assessment Roll Number: 1042 070 020 38730 0000

Civic Address: 12300 Austins Road (Malcolm Lake), Pleung, ON

Date Subject Land was acquired by Current Owner: February 2004

Legal Description:

Lot Concession Subdivision Lot Plan #

Geographic Township:

Barrie Clarendon Miller Palmerston

N. Canonto _____ S. Canonto _____

Existing Use of Subject Land(s): Recreational

Length of time Existing Use has continued: 19 years

Proposed Use of Subject Land(s) if different from existing use: seasonal cottage

Current Use(s) of Adjacent Properties: recreational cottage,
township landfill

Lot Area 2.65 acres Lot Depth 282.24'

Frontage (Water) ~~172'~~ 172' Frontage (Road) _____

Are there any easements/covenants on the subject property? Yes _____ No

If yes, please describe: _____

How is the subject property accessed?

Provincial Highway _____ Township Maintained Road _____

Private Lane Legal Deeded Right-of-Way _____

Is the subject property Water Access Only? Yes _____ No

If yes, please provide the following information:

Location of Parking and Docking Facilities: _____

Distance of Docking from Subject Property: _____

Nearest Public Road: _____

Property Features (Select all applicable features)

Name of Waterbody: Malcolm Lake

Is the subject property within 300 metres of a lake trout lake (either at-capacity or not at-capacity)? Yes _____ No

Are there existing structures within 30 metres of the water? Yes No _____

Is there a Wetland area or Marsh on the property? Yes _____ No

Is there a steep slope (greater than 3:1) on the property? Yes _____ No

Are there drainage concerns on the property? Yes _____ No

Please identify any other property features: _____

Property Servicing – Water

Privately Owned and Operated Well _____ Privately Owned and Operated Cistern _____

Lake Water Other proposed lake water

None of these apply:

Property Servicing – Septic System

Privately Owned and Operated Individual Septic System

(Proposed) Leaching Bed (Class 4) Grey Water Pit (Class 2) (Approval # CLM-20-10)

Holding Tank (Class 5) _____ Privy/Outhouse (Class 1)

Other: _____

None of these apply: _____

Property Servicing – Storm Drainage

Ditches Swales _____ Other _____

Land Use Designations

Official Plan Designation(s): Waterfront Area
recreational / seasonal cottage ~~vacant land~~
Zoning Designation(s): vacant land (lot) ~~Residential Waterfront~~
within influence area of WMF.

Clarendon SW Range PT Lot 19
PT Shore Rd Allowance
RP 13R10 703 Parts 9 and 10
IRREG

Reason for Request for Minor Variance/Request for Permission

Provide a detailed reasoning as to why the proposed development is requested, including details such as size of structure, number of storeys, lot coverage, etc. Include reasons why development cannot comply with Zoning Provisions.

There is only 1 suitable location to build a cottage on the property. It is on a rock ledge/bench parallel to the water front but <100' from the shoreline. Every other location on the lot is either a gully or low ground just above the water table and behind/below the rocky area with no view of the lake. Estimated footprint of proposed 1.5 storey cottage is 36' x 28' (1008 sq. ft.). Front of proposed cottage would be ~60' - 65' from shoreline.

Nature and Extent of Relief from Zoning By-law

Section(s) of Zoning By-law:

[3.27 (b) and 3.27 (e)]
↳ D4 study completed → minor variance

Zoning Requirement/Provision:

30m setback from high-water mark to structures

Proposed:

~20m setback

Relief Required:

~10m

Existing Buildings/Structures on Subject Property (including septic systems and all accessory structures)

#1 Type of Building/Structure boat house
Building Area (Footprint) 12'x18' Building Height/No. of storeys 14'/1
Front Yard Setback (Water) 14m Rear Yard Setback (Road) 100+m
Side Yard Setback 3m Side Yard Setback 18 55m

#2 Type of Building/Structure Greywater pit
Building Area (Footprint) 6'x8' Building Height/No. of storeys Na
Front Yard Setback (Water) 120' Rear Yard Setback (Road) 100+m
Side Yard Setback 120' Side Yard Setback 90'

#3 Type of Building/Structure Tool shed
Building Area (Footprint) 8'x12' Building Height/No. of storeys 10'
Front Yard Setback (Water) 70' Rear Yard Setback (Road) 100m+
Side Yard Setback 110' Side Yard Setback 110'

#4 Type of Building/Structure _____
Building Area (Footprint) _____ Building Height/No. of storeys _____
Front Yard Setback (Water) _____ Rear Yard Setback (Road) _____
Side Yard Setback _____ Side Yard Setback _____

Proposed Building/Structure or Addition to Building/Structure on Subject Property (Include covered/uncovered decks, porches, and additions)

#1 Type of Building/Structure Cottage

Building Area (Footprint) ~ 36' x 28' (1008 sq. ft.) Building Height/No. of storeys 1-5

Front Yard Setback (Water) ~ 2.0m Rear Yard Setback (Road) ~ 300'

Side Yard Setback ~ 10m Side Yard Setback ~ 140'

#2 Type of Building/Structure _____

Building Area (Footprint) _____ Building Height/No. of storeys _____

Front Yard Setback (Water) _____ Rear Yard Setback (Road) _____

Side Yard Setback _____ Side Yard Setback _____

#3 Type of Building/Structure _____

Building Area (Footprint) _____ Building Height/No. of storeys _____

Front Yard Setback (Water) _____ Rear Yard Setback (Road) _____

Side Yard Setback _____ Side Yard Setback _____

#4 Type of Building/Structure _____

Building Area (Footprint) _____ Building Height/No. of storeys _____

Front Yard Setback (Water) _____ Rear Yard Setback (Road) _____

Side Yard Setback _____ Side Yard Setback _____

Development Increase or Change

Will the proposed development increase the number of bedrooms?

Yes No

Will the proposed development increase the number of plumbing fixtures?

Yes No

Will the proposed development increase the area of living space?

Yes No

Will the proposed development change the current setback from the existing septic system?

Yes No

If yes, please provide the proposed setback to the existing septic system _____

Previous Planning Applications

If known, has the subject land ever been, or is currently, the subject of an application for:

Consent (Planning Act – Section 53) Yes No Unknown

Minor Variance (Planning Act – Section 45) Yes No Unknown

Site Plan Control Agreement Yes No Unknown

Plan of Subdivision (Planning Act - Section 51) Yes No Unknown

Zoning By-law/Official Plan Amendment Yes No Unknown

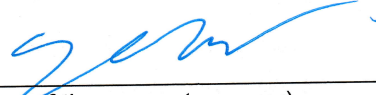
If yes, please provide application File Number, Date of Decision and any other details:

If the subject land is covered by a Minister's Zoning Order, what is the Ontario Regulation Number? _____

Permission to Enter Subject Lands

Permission is hereby granted to the relevant staff and necessary commenting agencies to enter the premises subject to this development application for the purposes of making inspections associated with this application, during normal and reasonable working hours.

Dated this 27th day of May, 2023.



(Signature of the property owner)

(Signature of the property owner)

Declaration of Prescribed Information

I/We, Spencer Leptick
(Name of Applicants)

of Ottawa
(Municipality)

do solemnly declare that the information contained in this application is true and that the information contained in the documents that accompany this application is true, and acknowledge that personal information and all other material collected on this form and provided to the municipality as part of this application, including all names, addresses, opinions and comments, is collected under the authority of the Planning Act, R.S.O. 1990, as amended, will be used to assist in making a decision on this matter and will be made available for public disclosure. Please be aware the information collected in this application will be provided in the applicable agenda and posted on the Township's website.

Sworn (or declared) before me in the Municipality of _____
this _____ day of _____ 20_____.

Commissioner of Oaths

Signature of Applicant(s) or Authorized Agent

Note: Do not sign until in the presence of the Commissioner of Oaths. You will be required to provide photo identification (i.e. driver's license).

Notice of Collection – Personal information collected as a result of this application is collected under the authority of the Municipal Act, the Municipal Freedom of Information and Protection of Privacy Act (MFIPPA), the Planning Act, and all other relevant legislation, and will be used to assist in making a decision on this matter. All personal information (as defined by MFIPPA), including (but not limited to) names, addresses, opinions and comments collected will be made available for public disclosure to members of the public, at a meeting, through requests, and through the Township website. Questions regarding the collection, use, and disclosure of this personal information should be forwarded to the Clerk's Department.

Acknowledgment of Additional Requirements

I/ We, the undersigned, being the registered property owner(s)

Spencer Leptik of
(Property owner's name(s))

1230D Austris Road
(Legal description and/or municipal address)

Hereby acknowledge additional studies and/or legal review may be required by the Township as a part of the review of my/our application. Should the need arise, I/we are responsible for completing the studies as requested in order for the application to be deemed complete.

Dated this 27th day of May, 20 23.

[Signature]
(Signature of the property owner)

(Signature of the property owner)

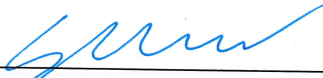
Agreement to Indemnify

The applicant hereby agrees to indemnify and save harmless The Corporation of the Township of North Frontenac ("the Municipality") from all costs and expenses that the Municipality may incur in connection with the processing of the applicant's application for approval under the Planning Act.

Without limiting the foregoing, such costs and expenses will include all legal, engineering, planning, advertising and consulting fees and charges incurred or payable by the Municipality to process the application together with all costs and expenses arising from or incurred in connection with the Municipality being required, or requested by the applicant, to appear at the hearing of any appeal to the Ontario Land Tribunal from any decision of the Council or Committee of Adjustments, as the case may be, approving the applicant's application.

The applicant acknowledges and agrees that if any amount owing to the Municipality in respect of the application is not paid when due, the Municipality will not be required to process or to continue processing the application, or to appear before the Ontario Land Tribunal in support of a decision approving the application until the amount has been paid in full.

The applicant further acknowledges and agrees that any amount owing by the applicant to the Municipality is, when due, a debt of the applicant and the Municipality may, in addition to any other remedies available to it at law, recover the amount owing together with interest from the applicant by action.



Signature of Property Owner

Spencer Leptick

Owner's Name (Print)

Mayor

Clerk

Date





ATTENTION

The sticky label enclosed with your Final Inspection Report is to be affixed to your home's electrical panel or fuse box.

The number of the label should be used when requesting information about your septic system from your area Public Health office. It will also be valuable in the event your house is sold, as it will make search for documents easier.

Please help by affixing your sticker to your panel.

Thank you.

Environmental Health Department
KFLA Public Health

SEWAGE SYSTEM CERTIFICATE OF APPROVAL

The Approval number for the sewage disposal system at this building is:

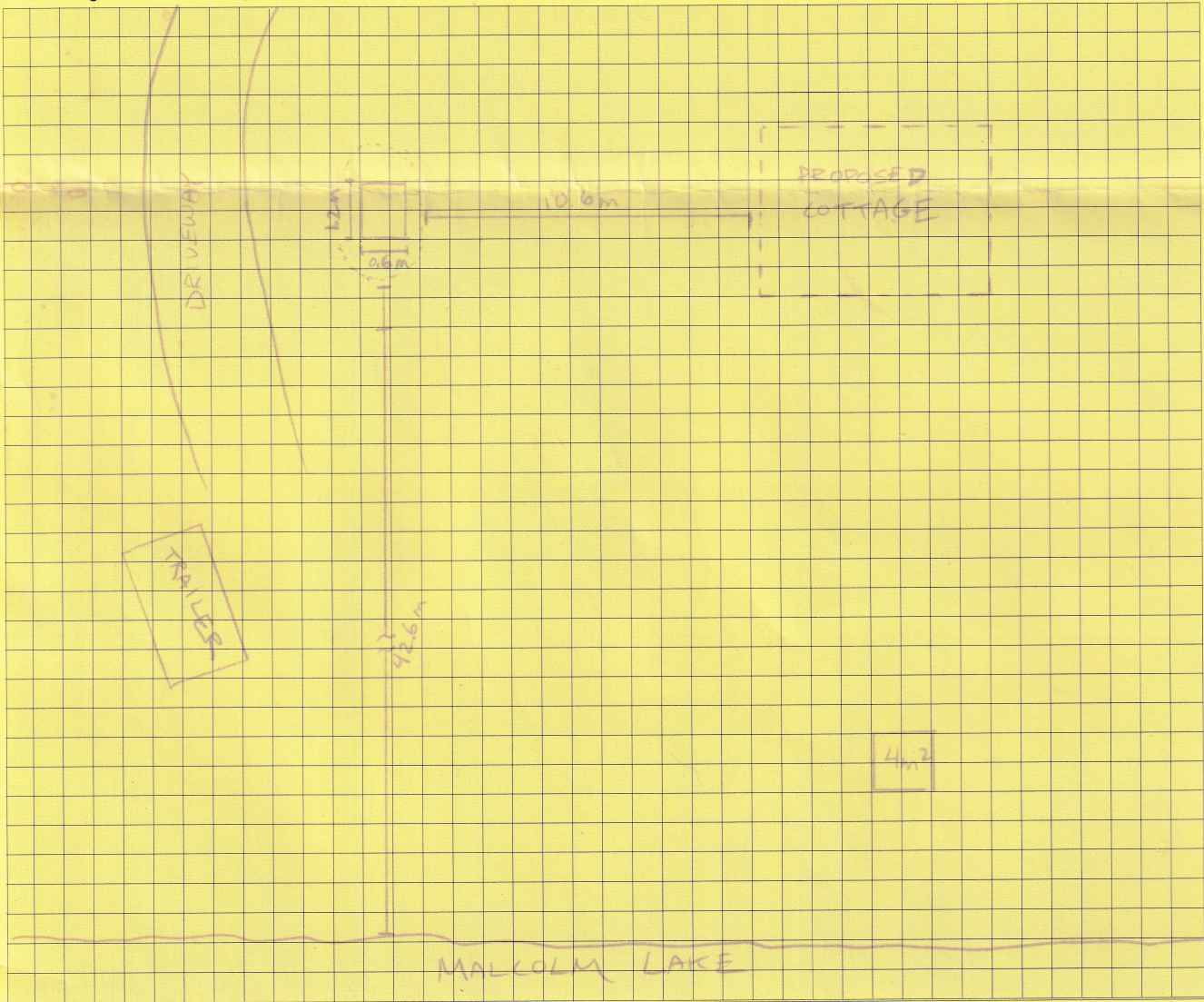
CLM - 20 - 10
district - number - year

Please refer to this number when requesting any information from the KFL&A Public Health.

e) Septic tank GPS Coordinates: Longitude _____ Latitude _____

2. Location:

The sketch below indicates the location of all components of the Sewage System and separation distances as required under the Ontario Building Code.



Final Inspection Compliance: _____ Date: _____ Label attached to Electrical Panel Yes No

The following work has been completed:

- System has been backfilled with suitable granular fill
- Grading to shed run-off and divert water around leaching bed has been completed
- Sloped surfaces are stabilized
- Topsoil has been put on the leaching bed to establish grass cover
- Other

The Sewage System was inspected and it has been determined that the installation complies with the requirements of Regulation 350/06

made under the Building Code Act, for the following property located on Lot _____ Concession SW RANGE Municipality NORTH FRONTENAC

District/Ward CLARENDON/MILBER Municipal address 1230 D'AUSTREIS ROAD Plan No. 13R10703

Part(s) _____ Subdivision Plan No. _____ Sublot _____

Inspector D. Clegg Report Issued Yes No Date Oct 25/2010

LANDFILL IMPACT ASSESSMENT (GUIDELINE D-4 STUDY)

1230D AUSTRIS ROAD, TOWNSHIP OF NORTH FRONTENAC, ONTARIO



Project No.: CCO-23-3909

Prepared for:

Mr. Spencer Leptick
5770 Phillip Street
Osgoode, Ontario
K0A 2W0

Prepared by:

McIntosh Perry
115 Walgreen Road, RR3
Carp, ON
K0A 1L0

April 04, 2023

McINTOSH PERRY

Executive Summary

McIntosh Perry (MP) was retained by Mr. Spencer Leptick (Client) to conduct a Landfill Impact Assessment (Guideline D-4 Study) for the recreational property located at 1230D Austris Road, Township of Frontenac, Ontario ("the Site"). The Site is currently undeveloped, with the exception of a shared unpaved driveway leading to the property, and it is our understanding that the client intends to develop the property with a cottage. The Site is located in close proximity to the Ardoch Waste Disposal Site (WDS), operated by the Township of North Frontenac. Based on correspondence with the Township, MP understands that a D-4 Study/Landfill Impact Assessment, completed in accordance with the Ministry of the Environment, Conservation and Parks' (MECP) Guideline D-4 and Guideline D-1 is required to permit the development of the property, due to the Site being within 500 m of the Ardoch waste disposal site (WDS). McIntosh Perry has been provided with a copy of the most recent (2021) annual landfill monitoring report for the Ardoch WDS, completed by Cambium Inc. (Cambium).

The Site is located less than 30 m from the Ardoch WDS's western boundary and inferred to be hydraulically down-gradient. Groundwater flow diagrams provided by Cambium suggest that groundwater from the WDS flows to the southwest. Similarly, surface water is interpreted to flow via surrounding watercourses and the WDS towards the Site. The proposed Site building footprint and height are currently unknown. The Client has informed MP that they do not intend to install a drinking water well at the Site.

The Ardoch WDS is located at 1114 Austris Road, approximately 0.39 km west of Ardoch Road. The Ardoch WDS has a 4.02 ha total area, and in accordance with the most recent Environmental Compliance Approval (ECA) No. A3880405, the WDS was designated a 0.81 ha licensed fill area. No additional waste has been accepted at the Ardoch WDS since 2014 when the WDS was temporarily closed. The WDS's ECA was amended in 2015 to reflect this temporary closure.

Results from MW14-4R, located immediately adjacent the Site, showed Provincial Water Quality Objective (PWQO) exceedances of boron (leachate indicator parameter, or LIP), copper (non-LIP) and dissolved organic carbon (DOC) (LIP), although DOC was also seen in the background well results and is not considered related to WDS impacts. Surface water data collected at SW1 (considered to be representative of Site conditions) showed total phosphorus, zinc and phenols (all non-LIP) concentrations above PWQO and were considered generally characteristic of natural surface waters in the vicinity of the Site.

It is MP's opinion that there are no concerns related to landfill gas impacts at the Site. The Ardoch WDS has been covered by vegetation since 2014 and concentrations of gases were measured well below limits of concern. Migration of gasses is not expected to impact the Site.

The proposed cottage is located approximately 90 m from the WDS boundary and MW14-4R in a cross-gradient direction, and the land between the WDS and proposed cottage is heavily treed, which serves to mitigate noise, dust, and odour concerns. It is MP's understanding that the Client does not intend to install a drinking water well at the Site, and as a result, health-related impacts are not anticipated from development at the Site. If the event that the Client does intend to install a drinking water well, MP recommends that the well is advanced into bedrock and cased at least six metres into the bedrock, similar to other wells in the area. Since the deeper bedrock aquifer is considered to be isolated, and contamination is not expected in this case. Any well installed at the Site would be subject to the requirements of O.Reg. 903 (Wells), and water quality and quantity at any new well should be confirmed by hydrogeological testing.

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- Table 3 Ardoch WDS – Hours of Operation (prior to 2014) (in-text)

APPENDICES

- Appendix A 2021 Annual Report, Ardoch WDS

1.0 INTRODUCTION

McIntosh Perry (MP) was retained by Mr. Spencer Leptick (Client) to conduct a Landfill Impact Assessment (Guideline D-4 Study) for the recreational property located at 1230D Austris Road, Township of Frontenac, Ontario (“the Site”). The Site is currently undeveloped, with the exception of a shared unpaved driveway leading to the property, and it is our understanding that the client intends to develop the property with a cottage. The Site is located in close proximity to the Ardoch Waste Disposal Site (WDS), operated by the Township of North Frontenac. Based on correspondence with the Township, MP understands that a D-4 Study/Landfill Impact Assessment, completed in accordance with the Ministry of the Environment, Conservation and Parks’ (MECP) Guideline D-4 and Guideline D-1 is required to permit the development of the property, due to the Site being within 500m of the Ardoch WDS. McIntosh Perry has been provided with a copy of the most recent (2021) annual landfill monitoring report for the Ardoch WDS, completed by Cambium Inc. (Cambium).

The Site location is shown on Figure 1 (Site Location). The Site layout and features, including on-Site land use, monitoring wells, and surface water monitoring locations at the Ardoch WDS, are shown on Figure 2 (Site Layout).

1.1 Scope of Work

This report was prepared by McIntosh Perry for the Client. The work was carried out in general accordance with the Ontario Ministry of the Environment, Conservation and Parks’ (MECP) Guideline D-4 (revised 1990) and D-1 (revised 1990) in the documents entitled “D-4 Land Use On or Near Landfills and Dumps” and “D-1 Land Use and Compatibility”.

The scope of work included a review of applicable planning documents (official plan, zoning bylaw), aerial photographs, topographical and geological mapping, water well records, and other available documentation to establish the physical setting of the Site and the Ardoch WDS. A detailed review of the 2021 Ardoch WDS annual monitoring report was also completed by McIntosh Perry. Per the requirements of Guideline D-4, the potential impacts of the Ardoch WDS on the Site were evaluated with respect to the following:

- Groundwater and surface water contamination by leachate
- Surface runoff
- Landfill gases
- Litter
- Odours
- Contaminant discharges from vehicular traffic
- Dust
- Noise
- Other air emissions
- Fires
- Vectors and vermin

2.0 BACKGROUND

2.1 Site Description and Intended Future Use

The Site is currently undeveloped (apart from a shared driveway that leads to the Site's southwestern boundary) and is covered by trees and vegetation. The site is zoned as Waterfront Residential (WR) property per the Township of North Frontenac's Schedule "A2" – Ward II by-law No. 15-04. The Site is less than 30 m from the Ardoch WDS's property boundary at its closest point.

It is MP's understanding that the Client intends to construct a cottage at the centre of the property nearby Malcom Lake (see Figure 2 for details). The proposed cottage is approximately 90 m from the boundary of the WDS in an inferred cross-gradient direction, with heavy tree cover between the WDS and the proposed building site. The Client has informed MP that they do not intend to install a drinking water well at the Site.

The Site holds the municipal address of 1230D Austris Road, Township of Frontenac, Ontario and is approximately 0.94 hectares in area. The legal description of the Site is as follows:

**PT LT 19 CON SOUTHWEST RANGE CLARENDON; PT RDAL ON S END OF MALCOLM LAKE CLARENDON
CLOSED BY FR612255, PT 9, 10 13R10703 T/W FR741412; NORTH FRONTENAC**

PIN 361870081

2.2 Ardoch Waste Disposal Site

The Ardoch WDS is located at 1114 Austris Road, approximately 0.39 km west of Ardoch Road. The WDS consists of one parcel legally described as Lot 19, Southwest Range, geographic Township of Clarendon, Township of North Frontenac Ontario; see Figure 2 for a Site Layout plan.

The Ardoch WDS has a 4.02 ha total area, and in accordance with the most recent Environmental Compliance Approval (ECA) No. A3880405, the WDS was designated a 0.81 ha licensed fill area. It should be noted that the fill area has not reached its licensed limits. As suggested in Cambium's 2021 annual monitoring report for the WDS, the existing limits of the waste mound were measured at 0.46 ha. No additional waste has been accepted at the Ardoch WDS since 2014 when the WDS was temporarily closed. The WDS's ECA was amended in 2015 to reflect this temporary closure.

The WDS was closed before reaching its final capacity and it is MP's understanding that the WDS is to remain closed for at least 15 years (per the 2021 annual monitoring report). Based on Cambium's assessments made in the 2021 annual monitoring program, the approximate remaining site life is 38 years if the WDS is reopened for disposal.

The Ardoch WDS operated as a naturally attenuating waste disposal site between 1976 and 2014 and received solid, non-hazardous municipal waste. The Ardoch WDS was covered and vegetated in 2014, following its closure. Information in the 2021 annual monitoring report for the WDS suggests that the cover was in good condition and vegetation had established itself in the covered area. No complaints had been made concerning the landfill in 2021. Land use in the area surrounding the WDS is primarily vacant forested lands and lake area,

although residential waterfront properties are scattered along the lakeside. A tree buffer separates the WDS and the development property. Ground settlement is expected to occur at the WDS.

2.3 Physiography, Topography and Hydrostratigraphy

Site

Elevation at the Site is approximately 257-262 m above sea level (m asl). The site and surrounding area slope downwards to the west towards Malcolm Lake.

The Site occurs within the Mississippi River watershed. On a local scale groundwater is expected to flow northwest towards Malcolm Lake.

Geological maps of the area classify the overburden at the southern half of the Site as organic deposits consisting of peat, muck and marl, and overburden at the northern half of the Site is classified as bedrock-drift complex in Precambrian terrain (OGS, 2010).

Geological maps of the area classify the bedrock under the Site as early felsic plutonic rock granodiorite, tonalite, monzogranite and syenogranite derived from gneisses and migmatites (OGS, 2010).

Ardoch Waste Development Site

Elevation at the Ardoch WDS was approximately 262 to 265 m asl. The property slopes steeply from the top of the waste mound.

The Ardoch WDS occurs within the Mississippi River watershed. The surface water drainage at the Ardoch WDS was noted in the 2021 annual monitoring report to flow westward from the waste mound, following shallow swales along the waste footprint and ultimately flowing through watercourses to Malcolm Lake.

Overburden at the Ardoch WDS is generally composed of ice-contact stratified deposits consisting of sand and gravel, minor silt, clay and till (OGS, 2010). Overburden at the southwestern boundary of the Ardoch WDS is noted as bedrock-drift complex in Precambrian terrain, and organic deposits consisting of peat, muck and marl at the southwestern and northeastern boundaries of the WDS (OGS, 2010). This is consistent with the overburden observations made by Cambium in their 2021 annual monitoring program report.

Geological maps of the area classify the bedrock under the Site and Ardoch WDS as early felsic plutonic rock granodiorite, tonalite, monzogranite and syenogranite derived from gneisses and migmatites (OGS, 2010). This is also consistent with the bedrock observations made by Cambium in their 2021 annual monitoring program report.

A well record search completed by Cambium showed limited overburden within 500 m of the Ardoch WDS, with an average depth of less than one metre and maximum depth of three metres. Well depths ranged from 13.7 to 121.9 mbgs and static water levels ranged from 1.5 to 7.6 mbgs.

3.0 LANDFILL IMPACTS BY LEACHATE

3.1 Groundwater Contamination by Leachate

Groundwater at the Ardoch WDS is currently monitored twice per annum, once in the spring and once in the fall. Groundwater is collected from seven monitoring wells at the WDS, which are spread radially around the waste mound (see Figure 2 for details). The Ardoch WDS's ECA states that, where groundwater discharges to surface water, the groundwater quality objectives should be applied. As a result, all groundwater quality results are compared to the Ministry of the Environment Conservation and Parks' (MECP) Provincial Water Quality Objectives (PWQO), outlined in the document entitled "Water management: policies, guidelines, provincial water quality objectives" in Cambium's 2021 annual monitoring report for the WDS. Groundwater impacts are assessed each year at the WDS, and groundwater contamination is characterized through the analysis of several leachate indicator parameters (LIPs) outlined by the WDS' ECA.

The leachate indicator parameters identified for the Ardoch WDS are as follows:

- Alkalinity
- Conductivity
- Total Dissolved Solids (TDS)
- Boron (MW14-3R only)
- Chloride
- Sodium
- Hardness
- Calcium
- Barium
- Iron
- Magnesium
- Sulphate
- COD
- Manganese
- Dissolved Organic Carbon

Ardoch WDS - 2021 Groundwater Quality

Overburden monitoring well MW14-7R is installed up-gradient from the waste mound and is used as the background monitoring well for the WDS. Since its installation, MW14-7R was reported as having low/moderate concentrations of most parameters. In the 2021 annual monitoring report, Cambium reported that concentrations of alkalinity, calcium, conductivity, hardness and magnesium have generally increased since 2016 but remain within historical ranges. Concentrations of all parameters remained within PWQO limits, with the exception of dissolved oxygen in the spring. It was also concluded that elevated concentrations of dissolved organic carbon (DOC) and manganese found in samples taken at downgradient wells might not be related to the WDS, as samples taken at MW14-7R also showed elevated concentrations of these parameters.

Monitoring wells MW14-2R and MW14-3R are used as leachate monitors at the Ardoch WDS. Concentrations of iron exceeded the PWQO at MW14-2R in the fall of 2021, and the dissolved oxygen (DO) concentration was lower than the minimum PWQO value. DO also did not meet its PWQO at the background location.

Monitoring well MW14-4R is located downgradient of the waste mound on its western boundary and is the closest monitoring well relative to the Site. 2021 concentrations of tested parameters were similar, or at lower concentrations, than in the leachate indicator wells, with the exception of boron, sulphate, nitrate (non-LIP)

and potassium (non-LIP). PWQO limits were not met for boron, copper (spring only) and DO (spring only) in 2021.

All groundwater exceedances reported in the 2021 annual report for the Ardoch WDS are summarized below:

Table 1: Ardoch WDS – Summary of 2021 Groundwater Exceedances

Location	Parameters Exceeding PWQO (SPRING)	Parameters Exceeding PWQO (FALL)
MW14-7R (Background)	DO (below acceptable limit)	Dry (no sample collected)
MW14-1R	Zinc, DO (below acceptable limit)	Zinc
MW14-2R (Leachate indicator)	n/a	Iron, DO (below acceptable limit)
MW14-3R	DO (below acceptable limit)	DO (below acceptable limit)
MW14-4R	Boron, copper, DO (below acceptable limit)	Boron
MW12-5B	Boron, iron, phosphorus, zinc, DO (below acceptable limit)	Boron, DO (below acceptable limit)
MW14-6R	n/a	Iron

From these results, Cambium concluded that a weak leachate plume was present in the overburden layer at the WDS. This leachate plume was suggested to flow radially from the waste mound towards monitoring wells MW14-2R, MW14-3R, MW12-5B and MW14-4R. However, it was also indicated that the radial impacts to the west and east of the waste mound are minor and decreasing. The elevated concentrations of parameters in wells cross-gradient to the waste mound were attributed to effects of road de-icing. No adverse impacts were anticipated from groundwater discharging to the surface.

On-Site Contamination

Groundwater flow at the Ardoch WDS is suggested by Cambium in their “shallow groundwater configuration” figure to generally flow southwest through permeable sand and gravel, ultimately discharging to surface water downstream into Malcolm Lake. There is not expected to be significant connectivity between the shallow overburden aquifer and deeper bedrock aquifer, due to poorly fractured bedrock at the WDS. Groundwater at the waste mound is expected to flow radially.

The Site is located less than 30 m from the Ardoch WDS’s western boundary (building location would be xx m from the WDS) and inferred to be hydraulically cross-gradient, based on a southwesterly groundwater flow direction observed at the WDS. Results from MW14-4R showed PWQO exceedances of boron (LIP), copper (non-LIP) and DOC (LIP), although DOC was seen in the background well results. It is MP’s understanding that the Client does not intend to install a drinking water well at the Site, and as a result, health-related impacts are

not anticipated from development at the Site. If excavation expected to occur sub-grade, dewatering may be required during construction activities.

If the event that the Client does intend to install a drinking water well, MP recommends that the well is advanced into bedrock and cased at least six metres into the rock, similar to other wells in the area. Since the deeper bedrock aquifer is considered to be isolated, and contamination is not expected in this case. Any well installed at the Site would be subject to the requirements of O.Reg. 903 (Wells), and water quality and quantity at any new well should be confirmed by hydrogeological testing.

3.2 Surface Water Contamination by Leachate/Surface Runoff

Ardoch WDS - 2021 Surface Water Quality

Surface water at the Ardoch WDS is monitored three times per annum, once during the spring, summer and fall. Two surface water monitors exist at the WDS, SW2 and SW1. SW2 is used as the background surface water monitoring location and is located southeast and up-gradient of the waste mound. SW1 is used as the downstream surface water quality monitoring location and is located northwest of the waste mound at the outlet of the watercourse that flows into Malcolm Lake.

All surface water quality results were compared to the Ministry of the Environment Conservation and Parks' (MECP) Provincial Water Quality Objectives (PWQO), outlined in the document entitled "Water management: policies, guidelines, provincial water quality objectives" in Cambium's 2021 annual monitoring report.

Historic results from SW2 show sporadic exceedances of metals, suggesting naturally elevated concentrations in the area. Total phosphorus, iron and pH exceeded the PWQO at SW2 in 2021, and all concentrations of parameters were within their historic ranges.

Surface water quality results from SW1 showed minor impacts downstream of the waste mound, although similar impacts were observed at the background monitoring location. Concentrations of all parameters were under PWQO limits, with the exception of total phosphorus, zinc and phenols (all non-LIP). Cambium reported that elevated concentrations of LIPs have historically been observed at SW1 and were similarly observed in 2021. Given the resemblances between results from SW1 and background conditions, Cambium noted that the concentrations of parameters observed at SW1 were generally characteristic of natural surface waters and the Site was considered in compliance with trigger mechanisms.

All surface water exceedances reported in the 2021 annual report for the Ardoch WDS are summarized below:

Table 2: Ardoch WDS – Summary of 2021 Surface Water Exceedances

Location	Parameters Exceeding PWQO (SPRING)	Parameters Exceeding PWQO (Summer)	Parameters Exceeding PWQO (FALL)
SW2 (Background)	Iron, total phosphorus, pH	Dry (no sample collected)	Dry (no sample collected)
SW1	zinc	Total phosphorus, zinc	Total phosphorus, phenols

On-Site Contamination

The ground surface of the Site is primarily comprised of permeable areas of grass and vegetation. Impermeable surfaces are very limited. Permeable sand and gravel overburden was noted at the WDS and is also expected at the Site.

Surface water from the WDS follows shallow swales along the waste footprint and travels west. It is expected to flow through or directly adjacent to the Site, following the watercourse that runs from east of the waste mound to the outlet at Malcom Lake. It is MP’s opinion that results from SW1 likely reflect surface water at the Site.

The 2021 exceedances of PWQO at SW1 are considered representative of surface water conditions at the Site. Cambium concludes that surface water quality at SW1 is similar to background conditions, and PWQO exceedances are not directly attributed to the WDS.

3.3 Landfill Gasses

Landfill gases are monitored at the Ardoch WDS three times per annum, once during warm conditions and twice during frozen ground conditions. Landfill gases are measured at four probes at the WDS, which are located south, north and at the centre of the waste mound. There are no landfill gas monitors located between the WDS and the Site, although due to the presence of a gas probe at the centre of the waste mound, MP considers the distribution of landfill gas monitors sufficient to characterize landfill gas impacts at the Site.

All concentrations of landfill gas at the WDS were measured by Cambium below 1% methane by volume in each of the three 2021 sampling events. Cambium has reported that concentrations of landfill gas at the WDS have consistently been measured below concentrations of concern. It is MP’s opinion that there are no concerns related to landfill gas impacts at the Site. The WDS has been covered by vegetation since 2014, likely mitigating off-gassing of waste, and concentrations of gases were measured well below limits of concern. Migration of gasses is not expected to impact the Site, due to their low measured concentrations.

4.0 ADDITIONAL LANDFILL IMPACTS AND CONSIDERATIONS

4.1 Litter

No exposed litter is anticipated at the Ardoch WDS. The WDS has been closed since 2014 when the waste within the landfill area was covered by material approved by the MECP, although cover depth and material were not listed in Cambium's 2021 annual monitoring report. The cover was subsequently vegetated and has since established according to Cambium staff. Site inspections which assess cover integrity are performed regularly, and exposed waste and/or litter has not been noted by Cambium. Cambium also did not note any complaints to the municipality regarding litter from the Ardoch WDS in their 2021 report. MP is not aware of any historic complaints regarding litter at the WDS.

MP conducted a review of prevailing wind directions in the Municipality of North Frontenac and found that wind generally travelled in a northeast direction. Any litter blown from the WDS is expected to blow off-Site to the northeast towards Austris Road.

Given the good condition of the cover at the Ardoch WDS, prevailing wind direction, and distance and tree cover between the WDS boundary and the building site, litter migration from the WDS is not expected to impact the Site.

4.2 Odours

Odours have not been identified as having discernable impacts at the Ardoch WDS. The WDS is covered by MECP-approved materials and vegetation, likely aiding in mitigating the odours produced from the decomposition of waste materials. Cambium did not note any complaints regarding odour from the WDS in their 2021 report and MP is not aware of any historic complaints regarding odour at the WDS.

The proposed Site building is anticipated to be a residence where people sleep. The Site is therefore considered a sensitive land use site per the MECP document entitled "D-1-3 Land Use Compatibility: Definitions" and as such, is classified as susceptible to adverse effects from contaminant discharge at nearby facilities. However, odour migration is not anticipated to affect the Site. Prevailing wind directions in the Municipality of North Frontenac are to the northeast, suggesting that wind passing overtop the WDS will travel away from the Site. A tree buffer also exists between the Site and the WDS, potentially intercepting migrating odours.

4.3 Contaminant Discharges from Vehicular Traffic

Access routes at the WDS are limited to a single lockable gate to the northeast of the waste mound, accessible from Austris Road. Austris Road is a rural gravel road that runs north-northwest-south-southeast. No other routes that lead to the WDS were identified in Cambium's 2021 annual monitoring report or communicated to MP by other means.

Due to the Site's closure, contaminant discharges from vehicular traffic related to the Ardoch WDS are not anticipated. Heavy equipment and vehicles which would typically discharge exhaust emissions into the air are expected to not be present or in use at the WDS at this time. Traffic along Austris Road is expected to be

unrelated to the Ardoch WDS. Cambium did not note any complaints regarding traffic at or nearby the WDS in their 2021 report. A traffic impact study is beyond the scope of this report.

4.4 Dust

Dust has not been identified as having perceptible impacts at the Ardoch WDS. The WDS's cover material is expected to aid in mitigating any dust originating from the waste mound. There is the potential for dust to be created along Austris Road and at the entrance of the WDS, due to the gravel material of the roads, although the WDS is temporarily closed and does not experience significant vehicular traffic. Cambium did not note any complaints regarding dust from the WDS in their 2021 report and MP is not aware of any historic complaints regarding dust at the WDS.

Given the Site's designation as a sensitive land use property, it is classified as being susceptible to adverse effects from dust resulting from nearby facilities, although dust migration is not anticipated to affect the Site. Prevailing wind directions in the Municipality of North Frontenac are to the northeast and are expected to carry dust produced at the WDS away from the Site. The distance and tree cover between the WDS boundary and the building site will also serve to mitigate dust impacts.

4.5 Noise

Due to the Site's closure, noise is not anticipated to be generated at a level that is detectable beyond the WDS. Upon reopening, noise is expected to be limited to that related to the operation of heavy equipment. Cambium did not note any complaints regarding noise at or nearby the WDS in their 2021 report. MP is not aware of any historic complaints regarding noise at or nearby the WDS.

It is MP's opinion that the noise produced at the WDS does not represent a concern to the Site. The WDS' operating hours are limited to 10:00 am to 6:00 pm, and the WDS's closure suggest that no nuisance-level noise will be produced at the Site for approximately the next 15 years. A tree buffer also exists between the WDS and the Site, helping to mitigate noise produced from daily operations.

4.6 Other Air Emissions

No other air emissions are anticipated to be produced at the WDS. Cambium did not indicate any incineration activities at the WDS, and landfill gas concentrations were noted as low throughout 2021 and historic monitoring results.

4.7 Fires

It is MP's opinion that there is little potential for fires at the WDS. The waste at the Ardoch WDS was covered and vegetated following its temporary closure in 2014 and no fuel sources or accelerants are anticipated to be present at the WDS.

Should a fire occur at the WDS, the northeastern direction of the prevailing winds is likely to mitigate risks to health and safety and air quality on-Site.

4.8 Vectors and Vermin

Vermin at the Ardoch WDS are expected to be limited and similar to that of natural populations in the surrounding area. Solid waste has not been deposited at the WDS since 2014, and the cover present on top of the waste mound acts as a protective layer from vermin. Cambium did not identify issues with vermin in their 2021 annual monitoring report, nor did they note any complaints submitted to the Municipality of North Frontenac concerning vermin at WDS. MP is not aware of any historic complaints regarding vermin at the WDS.

MP recommends that hygiene best practices be adhered to during and following the development of the Site building in order to limit the risk of vermin-related impacts.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on our review of the available information for the Site and on current monitoring results from the Ardoch WDS, it is our opinion that the Site may be developed without adverse impacts from the Ardoch WDS as long as monitoring continues at the Ardoch WDS. The proposed building location on the Site is located approximately 90 m from the WDS in an inferred hydrogeologically cross-gradient direction, with heavy tree cover between the building location and the WDS.

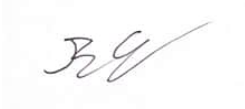
It is MP's understanding that the Client does not intend to install a drinking water well at the Site, and as a result, health-related impacts are not anticipated from development at the Site. If the event that the Client does intend to install a drinking water well, MP recommends that the well is advanced into bedrock and cased at least six metres into the rock, similar to other wells in the area. Since the deeper bedrock aquifer is considered to be isolated, and contamination is not expected in this case. Any well installed at the Site would be subject to the requirements of O.Reg. 903 (Wells), and water quality and quantity at any new well should be confirmed by hydrogeological testing.

6.0 CLOSURE

We trust that this information is satisfactory for your present requirements. Should you have any questions or require additional information, please do not hesitate to contact the undersigned.

Respectfully submitted,

McIntosh Perry,



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LANDFILL IMPACT ASSESSMENT (GUIDELINE D-4 STUDY) 1230D AUSTRIS ROAD, TOWNSHIP OF NORTH FRONTENAC, ONTARIO



FIGURES

McINTOSH PERRY



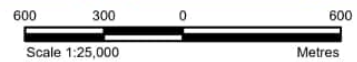
C:\Users\james.mcc@mcintoshperry.com\Documents\Projects\CCO-23-3909 Landfill - B-4 Study - Assets\B-4 Assets\Environmental\CCO-23-3909 Landfill Impact Assessment.mxd

LEGEND

- Site Location
- Local Road
- Major Road
- ~ Watercourse
- ▭ Waterbody
- + Wooded Area

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2023.



CLIENT:		MR. SPENCER LEPTICK	
PROJECT:		LANDFILL IMPACT ASSESSMENT	
TITLE:		SITE LOCATION	
McINTOSH PERRY <small>115 Walgreen Road, RR3, Carp, ON K0A1L0 Tel: 613-836-2194 Fax: 613-836-3142 www.mcintoshperry.com</small>		PROJECT NO: CCO-23-3909	1
		Date: Mar., 13, 2023	
		Checked By: BE	

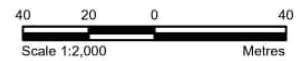


LEGEND

- Proposed Building Location
- Proposed Development Property
- ▲ Surface Water Sampling Locations
- ⊗ Monitoring Well Locations
- Site Boundary

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2023.



CLIENT:		MR. SPENCER LEPTICK	
PROJECT:		LANDFILL IMPACT ASSESSMENT	
TITLE:		SITE LAYOUT	
McINTOSH PERRY <small>115 Walgreen Road, RR3, Carp, ON K0A1L0 Tel: 613-836-2184 Fax: 613-836-3742 www.mcintoshperry.com</small>	PROJECT NO.:	CCO-23-3909	2
	Date	Mar., 29, 2023	
	Checked By	BE	

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**LANDFILL IMPACT ASSESSMENT (GUIDELINE D-4
STUDY) 1230D AUSTRIS ROAD, TOWNSHIP OF
NORTH FRONTENAC, ONTARIO**



APPENDIX A – 2021 ANNUAL MONITORING REPORT, ARDOCH WDS

McINTOSH PERRY

2021 Annual Report, Ardoch Waste Disposal Site

Environmental Compliance Approval No. A380405

April 13, 2022

Prepared for:
The Corporation of the Township of North
Frontenac



Cambium Reference: 10530-003

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Executive Summary

The Ardoch waste disposal site operates under Ministry of the Environment, Conservation and Parks Environmental Compliance Approval No. A380405. The site is on Lot 19, Southwest Range, geographic Township of Clarendon, Township of North Frontenac. The site is at 1114 Austris Road, 4 km southeast of Township Road 506 and is owned and operated by the Township of North Frontenac. The site consists of an approved fill area of 0.81 ha within a total site area of 4.02 ha and an approved waste disposal capacity of 30,320 m³. This report presents the results of the 2021 activities that were completed at the Ardoch Waste Disposal Site. The report and activities have been completed and reported on in general conformance with the November 2010 Ministry of the Environment Technical Guidance Document entitled **Monitoring and Reporting for Waste Disposal Sites – Groundwater and Surface Water**. The Monitoring and Screening Checklist is provided in Appendix A.

Leachate generated at the site is expected to flow vertically through the highly permeable sand, gravel, and stone overburden until reaching the shallow water table and/or bedrock surface and then flow horizontally generally following topography. There is expected to be no connectivity between the shallow overburden aquifer and the deeper supply aquifer in the bedrock. Due to the presence of organic deposits and the (intermittently) wet area on-site, it is expected the shallow water table discharges to surface west of the waste mound. This area drains northwest away from the site and ultimately discharges to Malcolm Lake.

The water level measurements from 2021 indicated that shallow overburden groundwater continued to flow to the west-southwest, consistent with historical results. Typical of this site, hydraulic gradients calculated for the east portion of the waste mound on the north flank of the esker between MW14-1R, MW14-4R, and MW14-2R were more significant and decreased as the water table flattened between MW14-4R, MW14-2R, and MW12-5B in the wet area west of the waste mound.

A dilute landfill leachate plume emanated radially in the direction of monitoring wells MW14-2R, MW14-3R, MW12-5B, and MW14-4R. Concentrations east and west of the mound have stabilized or began decreasing in recent years. Concentrations at MW12-5B have



increased since landfilling ceased in 2014; however, concentrations appeared to be stabilizing for many leachate indicator parameters in 2021.

The Ardoch waste disposal site demonstrated compliance with Condition 8 (2) of the Environmental Compliance Approval and an assessment of the potential impact of the discharging groundwater quality on the receiving wetland and/or surface water was not warranted in 2021.

Despite surface water trigger exceedances for some parameters in 2021, the concentrations were within historical ranges in the background water quality and the range characteristic of natural surface waters, the Ardoch waste disposal site complied with the surface water trigger mechanism. Given that the surface water down-gradient of the waste mound is the recognized reasonable use of the groundwater, the site was also in compliance with the Ministry of the Environment, Conservation and Parks Reasonable Use Concept.

Measured concentrations were less than 0.05% methane by volume during all landfill gas monitoring events.

The Township of North Frontenac managed the Ardoch waste disposal site in compliance with the Environmental Compliance Approval in 2021.

Recommendations have been made regarding the future operation of the Ardoch waste disposal site and work to be completed in 2022 including changes to the environmental monitoring programs for the site.

Respectfully submitted,

Cambium Inc.

Meaghan Haligowski, M.Env.Sc
Technologist

Stephanie Reeder, P.Geol.
Senior Project Manager/Hydrogeologist





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1.0 Introduction

The Corporation of the Township of North Frontenac (Township) retained Cambium Inc. (Cambium) to complete the 2021 annual monitoring program for the Ardoch waste disposal site (Site). The Site operates under Ontario Ministry of the Environment, Conservation and Parks (Ministry) Environmental Compliance Approval (ECA) No. A380405, most recently amended December 2, 2015 (Appendix B).

To aid in the understanding of the history and development of the Site, the following information is included digitally in the report package:

- **Temporary Closure Plan for Ardoch Waste Disposal Site, Addendum to Design, Operation and Closure Plan** (AECOM, 2013)
- Survey Plan 13R-19081, Plan of Survey of Part of Lot 19, Southwest Range, Geographic Township of Clarendon, Township of North Frontenac (McIntosh Perry, 2008)
- Historical water quality from 2005 to 2013

1.1 Site Location

The Site is on Lot 19, Southwest Range, geographic Township of Clarendon, Township of North Frontenac. The municipal address for the Site is 1114 Austris Road, North Frontenac, approximately 4 km southeast of Township Road 506 (formerly Highway 506) (Figure 1). The Universal Transverse Mercator (UTM) coordinates of the site entrance are zone 18T, 351300m east, 4974573m north.

1.2 Site Description

The Site is a natural attenuation landfill and is owned by the Township. The Site was approved as a landfill for the disposal of solid, non-hazardous municipal waste in accordance with ECA No. A380405, servicing the Township of North Frontenac. As of May 2014, the Site was temporarily closed for a period lasting at least 15 years. Site details are in Embedded Table 1.



Figure 2 illustrates the site layout and the approved waste disposal footprint, as well as the property boundary. Existing site conditions are on Figure 3.

Embedded Table 1 Site Details

Total Site Area	4.02 ha
Approved Area of Refuse Placement	0.81 ha
Total Site Capacity, not including Final Cover	30,325 m ³

The Site was temporarily closed in May 2014 before reaching its approved final capacity. Section 5.2 provides a summary of the capacity status for the Site as of November 2015. As per ECA Condition 2.1, at least six months prior to resumption of waste disposal operation at the landfill site, the Township is required to submit an updated Site Development and Operations Report to the Ministry for review and approval. At the time of closure, it was estimated that the Site would remain closed for at least 15 years (AECOM, 2013).

1.3 Scope of Work

The scope of the 2021 work program was based on the results of the 2020 monitoring program (Cambium, 2021), requirements outlined in the ECA, and included:

- Groundwater monitoring in the spring and autumn of 2021
- Surface water monitoring in the spring, summer, and autumn of 2021
- Evaluation of groundwater quality at select monitoring wells against the Provincial Water Quality Objectives (PWQO) and Reasonable Use Concept (RUC) values developed in accordance with Ministry Guideline B-7
- Evaluation of surface water quality against the PWQO and calculated surface water trigger values
- Preparation of this annual monitoring report

This report presents the results of the 2021 work program, provides an assessment of the current landfill impact of the Site on the surrounding groundwater and surface water environments, and a summary of the operational activities at the Site. Cambium has provided



recommendations for the 2022 monitoring program and site operations based on the 2021 results and assessment. Furthermore, this report addresses comments and recommendations provided by Shawn Trimper, Hydrogeologist, Technical Support Section, Eastern Region, dated January 26, 2022, following their review of the **2020 Annual Report** (Cambium, 2021) (Appendix C). Specifically, the following comments have been addressed:

- Additional information is required with respect to the geological and hydrogeological conditions on and surrounding the site to support the conceptual understanding of leachate migration. (Section 3.0)
- In future reports, the most significantly impacted monitoring well should be used to assess leachate quality at the site (this is currently MW12-5B). (Section 4.2.2)
- Cambium has identified eight (8) LIPS that are associated with the site; however, based on the existing data I conclude that this list is incomplete. (Section 4.2.2)
- Cambium indicates that elevated zinc identified in groundwater is not related to the landfill; however, no discussion as to the source of the zinc is provided. (Section 4.2.3)
- Details related to the water supplies used at surrounding properties should be confirmed and provided. (Section 3.2)
- An assessment should be completed to ensure that all monitoring wells are constructed of appropriate inert materials. (Section 3.2)
- I recommend that VOCs be added to the groundwater sampling program at a frequency of once every five (5) years at the leachate monitoring well(s) only (currently MW12-5B). (Section 4.5)



2.0 Methodology

The 2021 work program was completed to maintain compliance with the ECA and Ministry requirements. As such, the environmental monitoring work program was completed consistent with **Guidance Manual for Landfill Sites Receiving Municipal Waste** (MOEE, 1993) and **Monitoring and Reporting for Waste Disposal Sites, Groundwater and Surface Water, Technical Guidance Document** (MOE, 2010).

Field tasks were completed following Cambium's Standard Operating Procedures developed from recognized standard procedures such as those listed above and the Ministry document **Guidance on Sampling and Analytical Methods for use at Contaminated Sites in Ontario** (MOEE, 1996). A health and safety program was developed for site-specific conditions and all Cambium personnel working on the project were familiarized and required to follow the identified protocol.

Surface water and groundwater samples were stored in coolers with freezer packs and maintained at less than 10°C during transport to Caduceon Environmental Laboratories (Caduceon) in Kingston, Ontario. Caduceon is accredited by the Canadian Association for Laboratory Accreditation Inc. for specific environmental tests listed in the scope of accreditation. Groundwater and surface water samples were submitted for analysis of the parameters outlined in Table 1.

2.1 Groundwater Monitoring Program

The following tasks were completed as part of the groundwater monitoring program:

- Prior to sampling, water levels were measured at each monitoring well using an electronic water level tape.
- The purge volume was calculated on-site during each monitoring event using the measured water level, well depth, and the borehole diameter. Each groundwater monitoring well to be sampled was purged of approximately three well bore volumes. For wells with low recovery, at least one saturated borehole volume was purged prior to sampling. Purged water was disposed on-site, down-gradient of each respective well.



- Low flow sampling techniques were used at all monitoring wells.
- Groundwater samples for metals and dissolved organic carbon (DOC) analysis were field filtered.
- Field measurements were recorded for pH, conductivity, temperature, dissolved oxygen (DO), and oxygen reduction potential (ORP).

Groundwater samples were collected on May 18 and September 22, 2021 from the on-site monitoring wells listed below, with the following exception of MW14-7R which was dry in September.

- MW14-1R
- MW14-2R
- MW14-3R
- MW14-4R
- MW12-5B
- MW14-6R
- MW14-7R

Locations of all monitors are shown on Figure 3 and Figure 4; a groundwater elevation graph is provided as Figure 5. The UTM coordinates for the monitoring locations are on Table 2. The results of the groundwater monitoring program are in Sections 3.2.1 and 4.2. The groundwater field data sheets completed during the 2021 monitoring program are in Appendix D. Laboratory Certificates of Analysis as provided by Caduceon are in Appendix E. Photographs of the groundwater monitoring wells are in Appendix F.

Blind duplicate groundwater samples were collected from MW14-1R in May and September as part of the Quality Assurance/Quality Control (QA/QC) program. As these field duplicates equate to at least 10% of the total samples collected, this is an adequate QA/QC program for groundwater. In addition to these samples, the laboratory completes internal QA/QC. The results of the QA/QC program are presented in Section 4.1.

2.2 Surface Water Monitoring Program

The following tasks were completed as part of the surface water monitoring program:

- Weather conditions prior to and during the field events were recorded.



- Surface water samples were collected by immersing the sample container into the water body.
- When sample bottles were prefilled with preservatives, a clean bottle was used to collect and decant the water directly into the sample bottle.
- Surface water samples for mercury (0.45 µm) analysis were filtered by the laboratory.
- Field measurements were recorded for pH, conductivity, temperature, DO, and ORP.
- Where possible, depth, width, and flow velocity measurements were collected at each surface water location.

The surface water monitoring program included collection of samples from surface water sample stations SW1 and SW2 on May 18, July 19, and September 22, 2021, with the following exceptions:

- SW2 had insufficient volume for sample collection in May and was dry in September

Surface water sampling locations are shown on Figure 2. The UTM coordinate for the monitoring locations are in Embedded Table 2. Surface water results are presented in Section 4.3. Field data sheets are in Appendix D. Laboratory Certificates of Analysis provided by Caduceon are in Appendix E. Photographs of each surface water sample location are in Appendix F.

Blind duplicate surface water samples were collected from station SW1 in May, July, and September as part of the QA/QC program. As these field duplicates equate to at least 10% of the total samples obtained, this is an adequate QA/QC program for surface water. The results of the QA/QC program are presented in Section 4.1.

2.3 Landfill Gas Monitoring Program

Landfill gas (LFG) monitoring was implemented at the Site in August 2016. The purpose of the monitoring is to assess compliance with Section 4.10 of **Landfill Standards, A Guideline on the Regulatory and Approval Requirements for New and Expanding Landfilling Sites**



(MOEE, 1998), which states the concentration of methane gas in the subsurface may not exceed 2.5% by volume at the property boundary.

In accordance with Condition 4.2 of the ECA and recommendations made in the **2015 Annual Report** (Cambium, 2016), four gas probes were installed at the Site on August 26, 2016.

- Gas probe GP101 is south of the site entrance
- Gas probe GP102 is south of the waste mound
- Gas probe GP103 is north of the waste mound
- Gas probe GP104 is in the waste mound

All probes were installed such that they were screened in the shallow overburden, above the water table, and sealed at the surface. All gas probes are equipped with a sampling port which allows pressure and gas measurements to be taken without the loss methane to the atmosphere. Prior to taking gas measurements, a Dwyer Digital Manometer was used to measure gas pressure in the probe. Peak level recordings, a stable five-minute average concentration, and an ambient reading was recorded. Following the gas measurements, water levels measurements were taken at all gas probes.

Landfill gas (LFG) monitoring on January 19, February 17, and July 17, 2021. The completed LFG program meets the requirements of Condition 4.2 of which requires LFG monitoring to be completed at dedicated gas probes at least once during warm conditions (i.e., May 1 through November 30) and twice during frozen ground conditions (i.e., December 1 through April 30).

Locations of the gas probes are on Figure 3. The results from monitoring are in Section 4.4. Photographs of the probes are in Appendix F and installation logs are in Appendix G.

2.4 Site Inspection and Operations Overview

Site operations were observed during site visits completed in May, July, and September 2021. During these visits, the items listed below were inspected on accessed areas of the Site and observations noted in the field file. In January 2022, the Township provided additional 2021 site inspection information. Site inspection results are presented in Section 5.0.



- Status of monitoring well security
- Condition and layout of access roads, access gates
- Cover material integrity



3.0 Geological and Hydrogeological Context

3.1 Topography and Drainage

The Site is in the Upper Mississippi sub watershed, which is in the Mississippi River watershed. The Mississippi River watershed is in southeastern Ontario and is composed of a complex network of rivers, streams, rapids, and over 250 lakes. The Mississippi River has a drainage area of 3,740 km² from its headwaters in Kilpecker Creek, in the Township of Addington Highlands, to its outlet at the Ottawa River in the City of Ottawa (MNR, 2006).

The Site is on the north flank of an east-west trending bedrock ridge that forms the surface water divide between Malcolm Lake and Pine Lake (Figure 2). The surface water drainage in the vicinity of the waste mound is westward by means of shallow swales along both sides of the waste footprint toward a wetland/watercourse draining northward to Malcolm Lake. Malcolm Lake is 40 m north of the Site boundary at its closest point and drains north to Mud Lake (Mississippi River). Mud Lake Provincially Significant Wetland and Mud Lake are approximately 2.7 km north of the Site; no other significant wetlands have been identified in the vicinity of the Site. Drainage on the south side of Austris Road drains south to Pine Lake which is 420 m south of the Site. Pine Lake discharges to the east and ultimately drains to Crotch Lake to the southeast.

Two surface water sampling stations are currently monitored at the Site.

- Surface water station SW1 is on the downstream watercourse that drains to Malcolm Lake, 120 m northwest of the waste mound and 5 m from the discharge point to the lake.
- Surface water station SW2 is on the upstream intermittent watercourse at the inlet of a culvert southeast of the Site.

When water is at the surface water locations, which is infrequent, it is usually described as ponded with no observable flows. The geospatial coordinates (NAD 83) for the surface water monitoring stations are in Embedded Table 2. Flow and discharge rates measured during the monitoring events are in Appendix D. There was no staining observed at any of the surface water monitoring stations that would be indicative of leachate impacted groundwater



discharging to surface. Photographs of surface water monitoring stations are provided in Appendix F.

Embedded Table 2 Coordinates of Surface Water Stations

Surface Water Station	Northing	Easting
SW1	4974622	351138
SW2	4974471	351320

Notes:
Zone 18.

3.1.1 Precipitation Data

A review of the 2021 precipitation data (Government of Canada, 2021) in comparison to the average precipitation (Government of Canada, 2015) for the Drummond Centre station (1981 to 2010 climate normals) indicated that the annual precipitation was normal; however, varied month to month. July, September, and October received more precipitation than normal, while January, May, August, and November received less. The monthly precipitation, as well as the amount of precipitation during and in the three days prior to the sampling events is summarized in Embedded Table 3. Refer to Appendix D for field sheets and climate data.

Embedded Table 3 Historical and 2021 Precipitation Data

Sampling Date	Average Monthly Precipitation (mm) (1981 – 2010)	2021 Precipitation (mm)	Precipitation During and Prior to Sampling (mm)
May 18	77	35.4	0.0
July 19	83.5	88.2	0.0
September 22	91.8	157.8	50.4

3.2 Hydrogeology

The Site is on the northern flank of the east-west trending ridge (esker) described as a relatively thick deposit of ice contact, stratified sand and gravel (Chapman & Putnam, 2007; OGS, 2010). These sediments have been mined within an extensive pit 300 m east of the Site



(AECOM, 2015). The remainder of the Site and areas to the north, west, and south are described as shallow till and bare rock ridges (Chapman & Putnam, 2007).

The wetland area on-site, to the west of the waste mound, is described on surficial geology mapping as an organic deposit. The remaining area of the Site and lands to the north are described as bedrock-drift complex in Precambrian terrain (Malcolm Lake). The lands west and south of the Site are described as Precambrian bedrock. (OGS, 2010)

Bedrock in and around the Site is identified as early felsic plutonic rock of the Central Metasedimentary Belt and mafic to felsic metavolcanic rocks of the Grenville Supergroup and Flinton Group. North of Malcolm Lake there are also areas of carbonate and clastic metasedimentary rocks of the Grenville Supergroup and Flinton Group. (OGS, 2011)

AECOM (2015) reported groundwater transport is primarily through the permeable sand/gravel deposits toward the on-site watercourse and ultimately Malcolm Lake. Given that the Precambrian bedrock is poorly fractured with a low water transmitting capacity, groundwater flow derived from the landfill is restricted to the shallow overburden where it is interpreted to discharge to the surface water features northwest of the waste mound within the Township-owned property. There are no potable water supply wells in the immediate vicinity of the Site.

A well record search completed by Cambium indicated that there are six wells within about 500 m of the Site (Figure 2) that ranged in depth from 13.7 to 121.9 mbgs (MECP, 2021). In all cases there was limited overburden, described as stone and gravel when present (the maximum thickness being 3 m). Six of the wells described the bedrock as granite. The well about 500 m south of the Site on Lakeside Lane was reported as limestone bedrock. Static water levels ranged from 1.5 to 7.6 mbgs.

The average depth of wells along the shores Malcolm and Pine Lakes, north, west, and south of the Site was 32 mbgs. All wells were reported to be in bedrock, most described as granite or limestone and reported limited to no overburden. Where overburden was present, it was described as gravel and/or stones and was typically less than 1.0 m. Relevant logs are included in Appendix H.



The well records generally confirmed the reported geological conditions in the vicinity of the Site. Given the depth to the supply aquifer and observed potentiometric surface, the deep bedrock supply aquifer is a confined aquifer.

Leachate generated at the Site is expected to flow vertically through the highly permeable sand, gravel, and stone overburden until reaching the shallow water table and/or bedrock surface and then flow horizontally generally following topography. There is expected to be no connectivity between the shallow overburden aquifer and the deeper supply aquifer in the bedrock. Due to the presence of organic deposits and the (intermittently) wet area on-site, it is expected the shallow water table discharges to surface west of the waste mound. This area drains northwest away from the Site and ultimately discharges to Malcolm Lake.

Six groundwater monitoring wells were installed at the Site in 2005. All the original drive-point piezometers were constructed of 19 mm black galvanized steel risers and a 0.35 m long wire wrapped screen (monitors MW05-1 through MW05-6). Monitor MW09-7 was installed in 2009 up-gradient of MW05-1 to serve as a background monitoring location. This well was subsequently replaced with 14-7R due to persistent dryness. Monitor MW12-5B was installed in 2012 to replace MW05-05 to serve as a down-gradient monitoring location. The original wells were replaced with stainless steel wells in 2014 in response to Ministry concerns regarding the construction of these monitors and resultant water quality (AECOM, 2015). MW12-5B is a stainless-steel monitor; however, the drive point was made with cast iron material (AECOM, 2014).

Refer to Embedded Table 4 for a summary of the current monitoring well names. The depth of each monitoring well is in Table 2; however, borehole logs are not available for any of monitors installed on-site currently or historically. All monitoring wells on-site are believed to be constructed in the shallow overburden.



Embedded Table 4 Summary of Monitoring Well Replacements and Nomenclature

2005	2007	2009	2012	2014 (stainless steel drive-points)
MW05-1	MW07-1			MW14-1R
MW05-2		MW09-2B		MW14-2R
MW05-3		MW09-3B		MW14-3R
MW05-4	MW07-4			MW14-4R
MW05-5			MW12-5B	
MW05-6				MW14-6R
		MW09-7		MW14-7R

Notes:

1. Bold wells are the current wells. All other wells have been destroyed or decommissioned and replaced.

Monitoring well locations are on Figure 3 and Figure 4 and where available, well information is in Table 2. The wells are located as follows:

- MW14-1R is up-gradient and 20 m east of the waste mound, down-gradient from an adjacent road and cross-gradient to the primary leachate flow path
- MW14-2R is adjacent to the waste mound and monitors leachate indicator parameters
- MW14-3R is adjacent to the waste mound and monitors leachate indicator parameters
- MW14-4R is down-gradient and 15 m west of the waste mound
- MW12-5B is down gradient and 15 m southwest of the waste mound
- MW14-6R is down-gradient and 10 m south of the waste mound
- MW14-7R is down-gradient and northwest of the waste mound, and is representative of natural background groundwater quality



3.2.1 Groundwater Flow Direction

The general direction of groundwater has been reported to be west from the waste disposal area toward the low-lying area and watercourse that drains into Malcolm Lake. A radial component has been present to the southwest due to mounding below the waste mound.

The water level data collected in 2021 are in Table 2 and Figure 5. Water elevations at the Site have been reported to fluctuate seasonally and annually. This indicates the shallow overburden water table is sensitive to seasonal variations; years and seasons that receive more precipitation, tend to raise the water table. When seasons are drier (e.g., autumn), water levels drop. Water elevations in 2021 were generally consistent with historical results. The water table was elevated at MW12-5B in September, attributed to the significant precipitation received before the sampling event and the higher water level in the ponded area west-southwest of the waste mound, surrounding MW12-5B.

The groundwater elevation contours and flow directions are on Figure 4. The water level measurements from 2021 indicated that shallow overburden groundwater continued to flow to the southwest, consistent with historical results. Typical of this Site, hydraulic gradients calculated for the east portion of the waste mound on the north flank of the esker between MW14-1R, MW14-4R, and MW14-2R were more significant and decreased as the water table flattened between MW14-4R, MW14-2R, and MW12-5B in the wet area west of the waste mound. The average horizontal hydraulic gradients in 2021 were as follows:

Waste mound (MW14-1R, MW14-4R, and MW14-2R)

- Spring – 0.082 m/m
- Autumn – 0.111 m/m

West portion of waste mound (MW14-4R, MW14-2R, and MW12-5B)

- Spring – 0.013 m/m
- Autumn – 0.008 m/m



3.3 Conceptual Site Model

AECOM (2015) reported groundwater transport is primarily through the permeable sand/gravel deposits toward the on-site watercourse and ultimately Malcolm Lake.

Available geological mapping indicates the area to the east and northeast of the Site is dominated by an east-west trending esker described as a relatively thick deposit of ice contact, stratified sand and gravel (OGS, 2010; Chapman & Putnam, 2007). There is an organic deposit on-site, west of the waste mound. The remaining area of the Site and lands to the north, west, and south are described as shallow till, bare rock ridges, Precambrian terrain/bedrock (OGS, 2010).

The water supply aquifer in the vicinity of the Site is at an average depth of 30 mbgs, in the deep granitic and metasedimentary bedrock. Where overburden is present, other than on the identified esker, the overburden is described as gravel and/or stones in limited thickness, typically less than 1.0 m. Given the depth to the supply aquifer and observed potentiometric surface, the deep bedrock supply aquifer is a confined aquifer.

Based on available on-site well data, there is a limited shallow overburden water table only 1.5 to 2.5 m in thickness. The water table is typically within 1.0 m of the ground surface. The water table is sensitive to seasonal changes and often fluctuates with precipitation events. Hydraulic gradients calculated for the east portion of the waste mound on the north flank of the esker are more significant and decrease as the water table flattens in the wet area west of the waste mound.

Leachate generated at the Site is expected to flow vertically through the highly permeable sand, gravel, and stone overburden until reaching the shallow water table and/or bedrock surface and then flow horizontally generally following topography. There is expected to be no connectivity between the shallow overburden aquifer and the deeper supply aquifer in the bedrock. Due to the presence of organic deposits and the (intermittently) wet area on-site, it is expected the shallow water table discharges to surface west of the waste mound. This area drains northwest away from the Site and ultimately discharges to Malcolm Lake.



4.0 Results and Discussion

Water quality results from the monitoring program are used to assess the existence, extent, and degree of impacts to the groundwater and surface water environments related to waste disposal site activities at the Site.

To ensure appropriate actions are in place to respond to degradation in surface water or groundwater quality beyond an acceptable level, site-specific trigger levels and contingency measures aid in the assessment of impacts from leachate contamination and help to prevent adverse impacts to the environments surrounding the waste disposal site.

This section presents the results of the 2021 monitoring program completed at the Site as compared to available historical data and discusses observed trends in the groundwater and surface water quality.

4.1 Quality Assurance / Quality Control

Results from the analyses completed on the blind duplicate samples obtained as part of the 2021 QA/QC program were evaluated. Parameter concentrations were considered significantly different if the relative percent difference (RPD) between the duplicate and the parent samples was greater than 30% when at least one result was greater than five times the reported detection limit (RDL).

The duplicate groundwater and surface water analyses were compared to the originals. Overall, the duplicate samples correlated well with the parent samples and met the data quality objective of 30%. Exceptions noted included:

- MW14-R (May): copper, lead, total suspended solids (TSS)
- MW14-1R (September): copper, chemical oxygen demand (COD), ammonia, total Kjeldahl nitrogen (TKN)
- SW1 (May): zinc
- SW1 (July): manganese, ammonia



Where variations were noted, the concentration in the duplicate and original sample were within concentration ranges typical of the location. The groundwater and surface water data for these sampling events were considered suitable for their intended use, which was to identify changes in water quality and analyzed parameters present at concentrations greater than the applicable standards.

4.2 Groundwater Quality

The groundwater chemistry data obtained from the analysis of groundwater samples collected from the monitoring wells at the Site from 2014 to 2021 are in Table 3. Historical water quality data (2005 to 2013) are included digitally in the report package.

To assess water quality impacts related to landfill site operations, the analytical results for groundwater samples collected on-site were compared to background water quality and historical data, and Site compliance was assessed using the Ministry RUC for groundwater (Guideline B-7) (MOEE, 1994a). Furthermore, as shallow groundwater discharges to surface on-site, the results for groundwater samples collected from down-gradient monitoring wells were also compared against the PWQO (MOEE, 1994b).

4.2.1 Background Groundwater Quality

When evaluating the impact of any waste disposal site on a groundwater resource, a reference point or value must be established to assist in determining the magnitude of the impact. In this respect, the quality of the groundwater that is not impacted by the waste disposal site operation (background water quality) should be used for comparison purposes. Given the location of monitoring well MW14-7R (Figure 3), this well has represented natural background water quality at the Site. Notably, this monitor is seasonally dry whereas the remaining monitoring wells on-site are typically saturated year-round.

Since installation, this location has had low to moderate concentrations of most parameters; this continued in 2021. Many concentrations have increased since 2016 but have generally remained within historical ranges (e.g., alkalinity, calcium, conductivity, hardness, magnesium).



Concentrations of chromium, phosphorus, and DO (low) have not the PWQO. Only DO (low) did not meet the PWQO in (September) 2021.

4.2.2 Leachate Characteristics

Most analyzed parameters have been considered to be leachate indicator parameters (LIPs) (AECOM, 2015). With the installation of the replacement monitors in 2014, water quality from MW14-2R and MW14-3R adjacent the waste mound was compared to the replacement background monitor MW14-7R to reassess the leachate characteristics for the Site.

Furthermore, following comments received from Shawn Trimper following his review the **2020 Annual Report** (Cambium, 2021), MW12-5B was also incorporated into the LIP assessment in 2021. Embedded Table 5 summarizes the LIPs determined using the data from the MW14 series of monitors, as well as comments received from Ministry reviewers. Some of the LIPs previously identified such as DOC and manganese were elevated in background monitor MW14-7R, indicating these elevated parameter concentrations may not be related to the Site. DOC and manganese will continue to be monitored as LIPs at the Site to assess any changes in these parameters. Furthermore, the improved water quality of the down-gradient monitors compared to the background monitors indicates the monitoring well replacements were warranted, and the new monitors more clearly demonstrate impact from the Site versus from the monitoring well materials.

Embedded Table 5 Leachate Indicator Parameters

alkalinity	conductivity	total dissolved solids (TDS)	boron (MW14-3R only)
chloride	sodium	hardness	calcium
barium	iron	magnesium	sulphate
COD	manganese	DOC	

The LIPs identified are characteristic of leachate at the Site and are examined closely when assessing waste related impacts at the down-gradient monitoring wells.

Water quality results from monitors MW14-2R and MW14-3R were generally within expected concentration ranges in 2021. Seasonal variations continued at MW14-2R. Ammonia was



elevated at MW14-3R in September. DO (low) and iron did not meet the PWQO at monitor MW14-2R in September, consistent with historical results. DO (low) did not meet the PWQO at monitor MW14-3R in May and September. DO concentrations in the leachate wells have been consistent with ranges reported in the background water quality at MW14-7R historically. Concentration trends were generally stable or exhibited minor decreasing trends since site closure except for iron at MW14-2R.

MW12-5B was installed in 2012 to replace MW05-5 as a down-gradient monitor. Many concentrations have increased at MW12-5B since closure including: alkalinity, barium, boron, calcium, chloride, conductivity, hardness, iron, magnesium, potassium, sodium, sulphate, TDS, and zinc. Of these parameters, boron, iron, zinc, and DO (low) did not meet PWQO in May and boron and DO (low) did not meet PWQO in September. Most increasing trends have been stabilizing. MW12-5B is a stainless steel monitor; however, the drive point was made with cast iron material, which can explain the elevated iron concentrations at this monitor (AECOM, 2014). Regardless, increasing leachate strength in the years following closure adjacent the waste mound, in the direction of groundwater flow at MW12-5B is not unexpected. It is expected the concentrations will peak, then stabilize or decrease with time.

The leachate concentration at monitors MW14-2R and MW14-3R have historically indicated low leachate parameters at the Site, with most parameter concentrations meeting the PWQO; however, increasing trends at MW12-5B should continue to be monitored to confirm the leachate strength is stabilizing.

4.2.3 Down-Gradient Groundwater Quality

Monitoring wells MW14-4R and MW14-6R are down-gradient and radially around the waste mound. Monitor MW14-1R is east of the waste mound, south of the site entrance. Water quality results were generally within expected concentrations at all down-gradient monitors in 2021. The following observations were made:

- Water quality data at monitor MW14-6R has had slightly elevated concentrations of most parameters compared to MW14-7R. Similar to previous years, MW14-6R had elevated



alkalinity, barium, calcium, chloride, conductivity, hardness, magnesium, manganese, potassium, sodium, sulphate, and TDS compared to monitor MW14-7R in 2021.

- Monitor MW14-4R had LIPs concentrations similar to or less than MW14-2R and MW14-3R with the exception of boron and sulphate. Boron, sulphate, and non-LIPs nitrate and potassium were elevated at MW14-4R compared to MW14-2R and MW14-3R demonstrating variation in the water quality confirming that water quality varies east and west of the waste mound.
- Water quality at monitor MW14-1R has had water quality similar to leachate monitors MW14-2R and MW14-3R except elevated concentrations of cadmium, sodium, and zinc indicating radial impacts from the waste mound and some variation in water quality signature. Copper and lead were greater than historical ranges in 2021. As this monitor is cross-gradient of the waste mound and down-gradient from an adjacent road, the variation in water quality at this location was attributed to road salt impacts. It is speculated that elevated metals concentrations (i.e., barium) may also be partially related to salt use on the adjacent road. Salt influences the chemistry of the soil in which it infiltrates and increasing the solubility of metals (e.g., zinc) and releases base cations (e.g., calcium, magnesium) (Health Canada, 2001).
- Zinc concentrations at this location continued to decrease but continued to exceed the PWQO criteria. The source of the elevated zinc concentrations is unknown. Given the concentrations at this location are the greatest on-site and there are otherwise only marginal impacts from leachate at this location, the elevated zinc concentrations are not expected to be site related.

Based on the water quality results from 2021, a weak leachate plume emanates radially from the waste mound in the direction of monitoring wells MW14-2R, MW14-3R, MW12-5B, and MW14-4R. There were some elevated concentrations east and cross-gradient of the waste mound at monitor MW14-1R; however, these were at least partially attributed to impacts from road de-icing activities on Austris Road. Regardless, the radial impacts to the east and west of the waste mound are minor and stable or decreasing. There have been increasing LIP



concentrations at MW12-5B since the temporary closure of the Site in 2014 that appeared to be stabilizing in 2021. Refer to time concentration graphs provided for all LIPs at all monitoring well locations (Figure 6 to Figure 20). Continued monitoring to confirm the leachate strength is stabilizing is recommended.

4.2.4 Groundwater Trigger Mechanism

As dictated by the Reasonable Use Concept (Guideline B-7), where groundwater provides baseflow to a surface water feature, this is the recognized reasonable use of the groundwater and management approaches should be focused on the receiving surface water feature. At the Ardoch site, surface water is interpreted to receive the groundwater through baseflow and this is a recognized reasonable use of the groundwater. The surface water assessment should therefore be used to ensure adverse impact does not occur to the natural environment down-gradient of the Site; refer to Section 4.3.

Regardless of the foregoing, Condition 8 (2) of the ECA sets the Compliance Limits for the Site. Condition 8 (2) (c) states: where groundwater discharges to surface water or wetland, the groundwater quality shall comply with the PWQO. If test results confirm non-compliance of groundwater quality with the PWQO, or any other monitored parameter found to be present at concentrations deemed to be unacceptable, due to landfill leachate, an assessment of the potential impact of the discharging groundwater quality on the receiving wetland and/or surface water, along with mitigation action, as necessary, shall be carried.

As such, the following trigger assessment outlined in the report entitled *2014 Annual Report* (AECOM, 2015) was used to assess the compliance of the Site with the required limits (PWQO). The comparison of the groundwater quality to PWQO is included as Table 3.

If the water quality from the drive-point monitors report an elevated metal concentration (with the exception of iron or zinc) which exceeds the PWQO, on three consecutive occasions, and is deemed to be caused by the waste disposal site, an environmental study should be undertaken. The purpose of the environmental study is to determine whether the vegetation surrounding the landfill and the function of this vegetation is affected by leachate discharge.



4.2.4.1 Groundwater Compliance Assessment

Reviewing the water quality at MW14-4R, MW14-6R, and MW12-5B, those wells in closest proximity to where groundwater discharges to surface, only boron and DO (low) did not meet the PWQO for three consecutive exceedances (other than iron and zinc). The elevated boron concentrations reported since 2019 are only slightly greater than the PWQO and significantly less than the objective of 1,500 µg/L set out in the **Canadian Water Quality Guidelines (CWQG) for the Protection of Aquatic Life** (CCME, 2011) which were developed using more current toxicological information.

Due to the nature of DO in groundwater, low DO measurements are not unexpected and are not considered significant for groundwater quality comparisons. Furthermore, DO concentrations are known to fluctuate throughout the year as DO is directly related to environmental conditions and more specifically seasonal impacts. In summer months, cold groundwater discharging into warm surface water will reduce the temperature of the receiving body, thus reducing the surface water's ability to hold oxygen.

As concentrations generally met the PWQO for most other parameters, no adverse impacts were expected from groundwater discharging to surface. An assessment of the potential impact of the discharging groundwater quality on the receiving wetland and/or surface water was not warranted in 2021.

4.3 Surface Water Quality

The 2006 to 2021 surface water quality data are in Table 4. The surface water data have been compared with background water quality and historical data and compliance was assessed using the PWQO (MOEE, 1994b).

4.3.1 Background Surface Water Quality

Surface water station SW2 is on the upstream intermittent watercourse at the inlet of a culvert southeast of the Site. The water quality at this location is representative of background conditions.



Historically, un-ionized ammonia, pH (low), arsenic, cadmium, iron, total phosphorus, and zinc have sporadically not met the PWQO at station SW2. This confirms elevated metals (e.g., iron, zinc) are common in the vicinity of the Site and may contribute to some of the elevated metal concentrations in the shallow groundwater. Total phosphorus, iron, and pH (low) concentrations did not meet PWQO at SW2 in 2021. All concentrations in 2021 were within historical ranges for this location.

4.3.2 Downstream Surface Water Quality

Surface water station SW1 is on the downstream watercourse that drains to Malcolm Lake, about 120 m northwest of the waste disposal area and 5 m from the outlet to the lake. The water quality at this location has been characterized by slightly elevated concentrations of most of the LIPs (alkalinity, barium, boron, calcium, chloride, conductivity, hardness, magnesium, sodium, TDS) compared to the background station SW2. Historically, several metals have periodically exceeded the PWQO at SW1, similar to SW2. Although marginal impacts have been evident at SW1, all parameter concentrations have been within the range characteristic of natural surface waters and no adverse impacts are expected.

All parameter concentration at surface water station SW1 were within their historical ranges in 2021. All concentrations met the PWQO criteria except for total phosphorus, zinc, and phenols during one or more event.

4.3.3 Surface Water Compliance Assessment

The surface water trigger mechanism was described in the **2014 Annual Report** (AECOM, 2015) for the Site and is outlined in the following sections.

4.3.3.1 Trigger Locations

Surface water trigger points are generally at any point where surface water impacts, as a result of landfilling operations, are likely to occur. Water quality at surface water station SW1 has been identified as the trigger sampling point to monitor potential impacts to the surface water migrating downstream of the landfill (Figure 3). The water quality data obtained from surface



water station SW1 are used in the surface water trigger assessment completed annually. The water quality at this location will be compared to the trigger parameter concentrations outlined in Section 4.3.3.2.

4.3.3.2 Trigger Parameters

The recommended trigger parameters are the parameters listed in Column 3 of Schedule 5 of the **Landfill Standards** (MOECC, 2012). Ideally, sample collection should only be undertaken when there is observable flow in the water since stagnant, ponded water may not be representative of the surface water impact. It is noted that surface water station SW1 is rarely flowing and is generally ponded.

4.3.3.3 Trigger Parameter Concentrations

A trigger exceedance for the surface water regime for the Site is defined as the numerical elevation of an analytical parameter (except DO) greater than the trigger concentration (PWQO limit) or greater than the background concentration at station SW2 if greater than the trigger concentration.

4.3.3.4 Sampling and Re-sampling Frequencies

The surface water sampling frequency of the established annual monitoring program will dictate sampling frequency. The current surface water monitoring takes place in the spring, summer, and autumn of each year.

4.3.3.5 Compliance Assessment

At surface water location SW1, the following trigger criteria exceedances were observed:

- total phosphorus exceeded the trigger criteria in July and September
- zinc exceeded the trigger in May and July;
- phenols exceeded the trigger criteria in September



As the concentrations were generally within historical ranges at SW1 and the range characteristic of natural surface waters, the Site complied with the surface water trigger mechanism.

4.4 Landfill Gas Monitoring

According to Condition 4.2 of the ECA, landfill gas shall be monitored from appropriate dedicated gas monitoring probes installed at the Site, at least once during warm conditions (i.e., May 1 through November 30) and twice during frozen ground conditions (i.e., December 1 through April 30).

LFG, specifically methane and carbon dioxide, is derived from the decomposition of organic wastes. Production of LFG from landfilled wastes normally reaches a maximum rate approximately two years after placement and may continue at this rate for many years. The biological decomposition process results in the generation of LFG until some period, likely decades, after the landfilling of that waste ceases. Methane is explosive at volumes of 5% methane by volume to 17% methane by volume (50,000 ppm to 170,000 ppm) in air (Werner Sölken, 2021).

Landfill gas (LFG) was monitored at all gas probes in January, February, and July 2021. All measured concentrations were less than 1% methane by volume during all monitoring events in 2021 (Table 5).

4.5 Adequacy of Monitoring Program

To have a refined and concise monitoring program at the Site, the existing monitoring program is reviewed annually to determine if it sufficiently monitors impacts at the Site.

Recommendations were made following the 2016 (Cambium, 2017) and 2019 monitoring programs (Cambium, 2020). These recommendations have been modified following receipt of comments from Shawn Trimper, Hydrogeologist, following his review of the 2020 Annual Report (Cambium, 2021).



Groundwater

Given the similarity between the water quality at monitors MW14-2R and MW14-3R, it was recommended that monitor MW14-2R be removed from the sampling program. As the Site may be re-opened, this monitor should be maintained in compliance with R.R.O. 1990 Regulation 903: Wells (Reg. 903) and water levels should be collected from this monitor during sampling events. The groundwater reviewer supported this recommendation in their comments dated January 26, 2022 (Appendix B).

Only about 12,000 m³ of waste and cover has been landfilled at the Site. Landfill operations ceased in 2014 and the waste mound was covered and vegetated. The leachate strength is weak. Some increasing concentrations trends have been at MW12-5B since landfilling operations ceased in 2014 attributed to reduced infiltration through the waste mound, but these have begun to stabilize in recent years and very little seasonal variation has been present. Concentrations at all down-gradient monitors have generally met compliance criteria and no adverse impacts are expected to the primary down-gradient receptor, Malcolm Lake. As such, Cambium continues to support that monitoring once per year is sufficient to document trends and provide an assessment on site compliance and potential adverse impacts down-gradient of the waste mound. The groundwater reviewer was not supportive of this recommendation in comments dated January 26, 2022. Cambium has provided additional details throughout this report on the geological and hydrogeological conditions at the Site, provided information on well construction materials, and outlined additional trend analysis and rationale for a reduction in reporting, as requested by the reviewer.

As requested by the groundwater reviewer, volatile organic compound (VOC) analysis should be added to the monitoring program. It is recommended that VOCs be tested once every five years at the leachate monitoring well (currently only MW12-5B) and should include a comprehensive list of VOCs. This should be implemented in the spring of 2022.

Surface Water

As a suitable surface water database has been collected, Cambium recommended that the surface water sampling program be reduced to twice per year, to be completed in the spring



and autumn. Sampling twice per year is sufficient to capture water quality down-gradient and downstream of the waste mound during wet and dry periods.

Ministry Surface Water Reviewer, Sarah Baxter, concurred with this recommendation in her comments dated January 19, 2018 and January 6, 2020 following her review of the 2016 and 2018 annual reports, respectively (Cambium, 2020).

Reporting

Given the closed status of the Site, the number of sampling points, and the recommended reductions to the sampling frequency, the reporting frequency should be reduced to once every three years, the next report to be submitted to the Ministry prior to March 31, 2025 and should cover the monitoring years 2022 to 2024.

Ministry Surface Water Reviewer, Sarah Baxter, concurred with this recommendation in her comments dated January 6, 2020 following her review of the 2018 annual report (Cambium, 2020).

Landfill Gas

Consideration should be given to reducing landfill gas monitoring to once during the winter as concentrations of gas have been stable and not at concentrations of concern. LFG measurements should still be collected once during warm conditions.

The Ministry reviewer concurred with the proposed reduction in LFG monitoring in recent comments (Appendix C); however, recommended review from the regional air analyst or engineer prior to any changes being implemented.

As per Condition 8 of the ECA, these recommended changes will not be implemented until District Manger approval is received and the Director issues an amended ECA.



5.0 Site Operations

This section presents a summary of the 2021 Site inspections. The Site is currently closed to waste operations and the ECA was amended on December 2, 2015, to reflect temporary closure.

5.1 Site Access and Security

A lockable gate at the entrance and fencing prohibits access to the Site. Access is only permitted by permission of the Township.

5.2 Site Inspections

ECA Condition 3.1 requires that the landfill site, including the intermediate cover and general Site features, be inspected and cleaned-up regularly. Interim cover shall be inspected more frequently (i.e., quarterly) until the vegetation is established and stabilized.

A logbook is kept for the Site which records the results of inspections and incidents by the Township, as required by the ECA.

During the 2021 site visits, Cambium field staff noted that the vegetative cover was well established with no leachate seeps or exposed waste observed from the areas visited. As the vegetative cover is now established, the cover integrity is not expected to deteriorate. No post-closure repairs or maintenance was completed by the Township in 2021.

5.1 Monitoring Well Security

All monitoring wells listed in Table 1 were inspected by Cambium personnel in 2021 for compliance with R.R.O. 1990 Regulation 903 – Wells (Reg.903). A new lock was installed on MW12-5B in 2021. As such, all wells complied with Reg. 903. Refer to Appendix F for photographs of the inspected wells.



5.2 Remaining Site Capacity

As discussed in Section 1.2, the Site was closed before reaching its approved final capacity. Embedded Table 6 provides a summary of capacity status for the Site as of the last survey in November 2015.

Embedded Table 6 Ardoch Waste Disposal Site Remaining Capacity

Approved waste disposal capacity	30,325 m ³
Existing volume of capacity used	11,895 m ³
Remaining volume of capacity	18,430 m ³
Average annual waste placement	490 m ³
Remaining site life	38 years

To assist the Township with their long-term waste management planning, Embedded Table 7 provides an update on the current municipal wide available capacity.

Embedded Table 7 Summary of Township Wide Capacities

	506	Kashwakamak	Mississippi	Plevna	Municipality
Approved waste disposal capacity (m ³)	40,000	26,200	28,825	39,500	134,525
Existing volume of capacity used (m ³)	20,485	9,085	8,680	16,560	54,810
Annual Volume Used in 2020 (m ³)	40	140	415	845	1,440
Remaining volume of capacity (m ³)	19,200	16,920	20,115	22,475	78,710
Average annual waste placement (m ³)	470	195	320	710	1,691
Remaining site life (years)	41	87	63	32	47

5.3 Compliance with Ministry Approval

The Township managed the Site in compliance with the ECA in 2021.



6.0 Conclusions and Recommendations

Based on the 2021 monitoring program, Cambium offers the following conclusions regarding the Ardoch waste disposal site.

- The water level measurements from 2021 indicated that shallow overburden groundwater continued to flow to the west-southwest, consistent with historical results. Typical of this Site, hydraulic gradients calculated for the east portion of the waste mound on the north flank of the esker between MW14-1R, MW14-4R, and MW14-2R were more significant and decreased as the water table flattened between MW14-4R, MW14-2R, and MW12-5B in the wet area west of the waste mound.
- A dilute landfill leachate plume emanated radially in the direction of monitoring wells MW14-2R, MW14-3R, MW12-5B, and MW14-4R. Concentrations east and west of the mound have stabilized or began decreasing in recent years. Concentrations at MW12-5B have increased since landfilling ceased in 2014; however, concentrations appeared to be stabilizing for many LIPs in 2021.
- Given that the surface water down-gradient of the waste mound is the recognized reasonable use of the groundwater, the Site complied with the Reasonable Use Concept (MOEE, 1994a).
- The Site complied with Condition 8 (2) of the ECA and an assessment of the potential impact of the discharging groundwater quality on the receiving wetland and/or surface water was not warranted.
- Despite surface water trigger exceedances for some parameters in 2021, as the concentrations were within historical ranges in the background water quality and the range characteristic of natural surface waters, the Site complied with the surface water trigger mechanism.
- All measured LFG concentrations were less than 0.05% methane by volume during all monitoring events.



- Waste disposal operations ceased at the Site in May 2014. The Site was temporarily closed to waste operations and the ECA was amended on December 2, 2015 to reflect the closure of the Site for a period of at least 15 years.
- The Township managed the Site in compliance with the ECA in 2021.

Based on the results of the 2021 monitoring program, Cambium recommends the following:

- Volatile organic compound (VOC) analysis should be added to the monitoring program. It is recommended that VOCs be tested once every five years at the leachate monitoring well (currently only MW12-5B) and should include a comprehensive list of VOCs. This should be implemented in the spring of 2022.
- A number of reductions were made for the environmental monitoring program for the Site. Until written approval from the District Manager is received approving the recommended reductions to the monitoring program (Section 4.5) and the Director issues an amended ECA, the monitoring programs should continue as approved by the ECA, as outlined in Table 1, with the inclusion of VOC analysis at MW12-5B in the spring.



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Glossary of Terms

Active Face/Area

The portion of the landfill facility where waste is currently being deposited, spread and/or, compacted prior to the placement of cover material.

Adverse Environmental Impact

Any direct or indirect undesirable effect on the environment resulting from an emission or discharge that is caused or likely to be caused by human activity.

Annual Report

Report documenting the results of water quality, environmental quality, and operations monitoring for the year, or for a period as prescribed in the Certificate of Approval.

Approved Design and Operations Plan

The design of a landfill site and its facilities which have been submitted along with the application documents for which formal Ministry approval has been issued through the Certificate of Approval.

Approved Site or Facility

A landfill site/facility for which there is an existing and current Certificate of Approval.

Aquifer

A geologic unit (soil or rock) that contains sufficient saturated permeable material to yield measurable quantities of water to wells and springs.

Attenuation

Natural process through which the concentrations of landfill generated contaminants are reduced to safe levels.

Borehole

A hole drilled for soil sampling purposes.

Buffer Area

An area of land situated within the peripheral area surrounding an active filling area, but limited in extent to the property boundary, assigned to provide space for remedial measures, contaminant control measures, and for the reduction or elimination of adverse environmental impact caused by migrating contaminants.

Certificate of Approval

The license or permit issued by the Ministry for the operation of a landfill site. Issued to the owner of the site with conditions of compliance stated therein.

Contaminant

A compound, element, or physical parameter, usually resulting from human activity, or found at elevated concentrations that have or may have a harmful effect on public health or the environment.

Contaminant Migration Path

Route by which a contaminant will move from the site into adjacent properties or the natural environment. Usually a route that offers the least resistance to movement.

Contamination Attenuation Zone

The zone beneath the surface, located beyond the landfill site boundary, where contaminants will be naturally attenuated to predetermined levels. Also, see Reasonable Use Policy.

Contingency Plan

A documented plan detailing a co-ordinated course of action to be followed to control and remediate occurrences such as a fire, explosion, or release of contaminants in an uncontrolled manner that could threaten the environment and public health.

Cover Material

Material approved by the Ministry that is used to cover compacted solid waste. Usually, a soil with suitable characteristics for specific end-use.

Site Development Plan and Operations Report

Development and Operations Plan or Report is a document detailing the planned sequence of activities through the landfill site's active life, the control systems, site facilities and monitoring systems that are necessary. This document is required for obtaining a Certificate of Approval.

Design Capacity

The maximum amount of waste that is planned to be disposed of at a landfill site.

Detection Limit

Concentration under which a parameter cannot be quantitatively measured.



EAA or EA Act

Environmental Assessment Act, Revised Statutes of Ontario, 1990. One of the primary acts of legislation intended to protect, conserve, and wisely manage Ontario's environment through regulating planning and development.

Environmental Compliance Approval

The license or permit issued by the Ministry for the operation of a landfill site. Issued to the owner of the site with conditions of compliance stated therein.

EPA

Environmental Protection Act, Revised Status of Ontario, 1990. EPA is another of the primary pieces of Provincial legislation governing the protection of the natural environment of the Province.

Evapotranspiration

The evaporation of all water from soil, snow, ice, vegetation and other surfaces, including the water absorbed by plants, that is released to the atmosphere as vapour.

Fill Area

The area of a landfill site designed and designated for the disposal of waste.

Final Cover

Soil material or soil in combination with synthetic membranes, overlain by vegetation in a planned landscape, placed over a waste cell that has reached the end of its active life.

Groundwater

Subsurface water that occurs beneath the water table in soils and rocks that are fully saturated.

Hydraulic Conductivity

The rate of flow of water through a cross-section under a specific hydraulic gradient. It is a property of the geologic formation and the fluid, in hydrogeologic applications where the fluid is water (Units of m/day or cm/s).

Hydraulic Gradient

The head drop per unit distance in the direction of flow, the driving force for groundwater flow.

Hydrogeology

The study of subsurface waters and related geologic aspects of surface waters.

Impermeable Fill

Soil material that is placed as filling material that is sufficiently cohesive and fine grained to impede and restrict the flow of water through it.

In situ Testing

Testing done on-site, in the field, of material or naturally occurring substances in their original state.

Landfill Gas

Combustible gas (primarily methane and carbon dioxide) generated by the decomposition of organic waste materials.

Landfill Site

A parcel of land where solid waste is disposed of in or on land for the purposes of waste management.

Leachate

Water or other liquid that has been contaminated by dissolved or suspended particles due to contact with solid waste.

Leachate Breakout

Location where leachate comes to the ground surfaces; a seep or spring.

Limit of Filling

The outermost limit at which waste has been disposed of, or approved or proposed for disposal at a landfill.

Ministry

Ontario Ministry of the Environment, Conservation and Parks.

Monitoring

Regular or spontaneous procedures used to methodically inspect and collect data on the performance of a landfill site relating to environmental quality (i.e., air, leachate, gas, ground or surface water, unsaturated soils, etc.).

Monitoring Well

The constructed unit of casing (riser and screen) installed in a borehole.

Multi-Level Monitoring Well

More than one monitoring well installed at a given test well location.

Native Soil

Soil material occurring naturally in the ground at a location.



Natural Attenuation

Where contaminants are reduced to acceptable concentration levels by natural mechanisms (dilution, absorption onto the soil matrix, etc.), biological action, and chemical interaction.

Occupational Health and Safety Act

The primary act of legislation enacted by Ontario Ministry of Labour to regulate and control the safety in the workplace; also Occupational Health and Safety Act, Revised Statutes of Ontario, 1990.

Odour Control

Minimizing or eliminating the nuisance and undesirable impact of objectionable or unpleasant odours arising from waste disposal operations.

Open Burning

Burning any matter whereby the resultant combustion products are emitted directly to the atmosphere without passing through an adequate stack, duct, or chimney.

Operations Plan

A document detailing the waste disposal operations in a planned, and if necessary, a staged manner, that ensure compliance with regulatory provisions concerning the operations of a landfill site.

Operator (Site Operator)/Attendant

The individual or organization who, through ownership or under contract, manages and operates a landfill site for the purpose of waste disposal.

Owner

A person, persons, organization, or municipal authority who own a landfill facility or part of a landfill facility, and in whose name the Certificate of Approval for the site is issued.

Percolation

The movement of infiltrating water through soil.

Permeability

Often used interchangeable with hydraulic conductivity, but not strictly correct. Permeability is a property of the porous media only. Dependent upon media properties that affect flow, diameter, sphericity, roundness, and packing of the grains.

Piezometer

A well that intersects a confined aquifer.

Provisional Certificate of Approval (Provisional C of A)

Same as Certificate of Approval.

Reasonable Use Policy

A policy developed by the Ministry to stipulate limits to the level of groundwater quality impairment that may be permitted to occur at site property boundaries, to allow the reasonable use of adjacent properties or land without adversely affecting public health and the environment.

Recharge Zone

An area where precipitation or surface run-off infiltrates into the ground and then, through natural percolation enters an aquifer.

Recycling

Sorting, collecting or processing waste materials that can be used as a substitute for the raw materials in a process or activity for the production of (the same or other) goods. For example, the "Blue Box" system, in-plant scrap handling, or raw material recovery systems. Recycling is also the marketing of products made from recycled or recycled materials.

Reduction (of waste or component of 3Rs program)

Those actions, practices, or processes that result in the production or generation of less waste.

Remedial Action

Corrective action taken to clean-up or remedy a spill, an uncontrolled discharge of a contaminant, or a breach in a facility or its operations, in order to minimize the consequent threat to public health and the environment.

Representative Sample

A small portion of soil, water, etc. which can be subjected to testing and analysis, that is expected to yield results that will reliably represent the identical characteristics of the source of the material or of a larger body of material.

Reuse (component of 3Rs program)

The use of an item again in its original form, for a similar purpose as originally intended, or to fulfil a different function.

Run-off

The part of precipitation (rainwater, snowmelt) that flows overland and does not infiltrate the surface material (soil or rock).

Saturated Zone

The zone of a subsurface soil where all voids are filled with water.



Sedimentation

The deposition of fine grained soil in an undesirable location, caused by the scouring, erosion and transportation of earth materials by surface run-off.

Sensitive Land Use

A land use where humans or the natural environment may experience an adverse environmental impact.

Settlement

The subsidence of the top surface and underlying waste of a landfill or waste cell as a result of densification under its own weight.

Site Capacity

The maximum amount of waste that is planned to be disposed (design capacity) or that has been disposed of at a landfill site.

Site Closure

The planned and approved cessation or termination of landfilling activities at a landfill site upon reaching its site capacity.

Site Life

The period from its inception through active period of waste disposal, to the time when a landfill site reaches its' site capacity, when it ceases to receive any further waste, including and up to closure.

Solid Waste

Any waste matter that cannot be characterized by its physical properties as a liquid waste product.

Solid Waste Disposal Site or Facility

A site or facility such as a landfill site where solid waste is disposed of.

Source Separation

The separation of various wastes at their point of generation for the purposes of recycling or further processing.

Standpipe

A monitoring well that intersects the water table aquifer.

Storm water

Run-off that occurs as a direct result of a storm event or thaw.

Storm water Detention

Control of storm water by the construction of impoundments of structures for the purpose of regulating storm water flows during high intensity rainfall events that would otherwise transport excessive amounts of sediment, cause soil erosion or cause flooding.

Stratigraphy

The geologic sub-structuring, usually layered with different distribution, deposition and age.

Surface Run-off (Drainage)

See Run-off.

Surface Water

Water that occurs at the earth's surface (ponds, streams, rivers, lakes, oceans).

Sub-Soil

Soil horizons below the topsoil.

Test hole

A hole drilled for soil sampling purposes.

Topsoil

The uppermost layer of the soil containing appreciable organic materials in mineral soils. Adequate fertility to support plant growth.

Unsaturated Zone

The zone (also vadose zone) in a porous sub-soil, where the voids are not completely water-filled, but contain some air-filled voids. Limited above by the land surface and below by the water table.

Vector

A disease carrier and transmitter; usually an insect or rodent.

VOC

Volatile organic compounds are those compounds that will readily volatilize (convert from liquid to gas phase) at conditions normally found in the environment.

Waste

Ashes, garbage, refuse, domestic waste, industrial waste, or municipal refuse and other used products as are designated or interpreted by the provisions of the Environmental Protection Act.



Waste Disposal Site (Facility)

Any land or land covered by water upon, into, in or through which, or building or structure in which, waste is deposited or processed and any machinery or equipment or operation required for the treatment or disposal of waste.

Waste Management System

All facilities, equipment and operations for the complete management of waste, including the collection, handling, transportation, storage, processing and disposal thereof, and may include one or more waste disposal sites.

Water Table

The water level attained in a monitoring well, which screens the surficial unconfined aquifer.

Water Balance

Amounts of water to various components in a system so that water entering the system equals the amount of water contained within and discharged out of a system.

Water Level

The level of water in a well.

Well Casing

The pipe that is used to construct a well.

Well Screen

A filtering device used to keep sediment from entering a well.

Wetlands

Areas where water is at, near or above the land surface long enough to be capable of supporting aquatic or hydrolytic vegetation, and which have soils indicative of wet conditions.



Abbreviations

RFP	Request For Proposal	BTU	British Thermal Unit
ha	hectare	µg	microgram
Ministry	Ontario Ministry of the Environment, Conservation and Parks	°C	temperature in degrees Celsius
tonne	metric ton	g	gram
MNRF	Ontario Ministry of Natural Resources and Forestry	N/A	not available
t	metric tonne	kg	kilogram
ECA	Environmental Compliance Approval	%	percent
µS	microSiemens	L	Litre
EPA	Environmental Protection Act	cfm	cubic feet per minute
ODWQS	Ontario Drinking Water Quality Standards	mg/L	milligrams per litre
EAA	Environmental Assessment Act	ppmdv	part per million by dry volume
PC of A	Provisional Certificate of Approval	mm	millimetre
MW	monitoring well	ppmv	part per million by volume
PWQO	Provincial Water Quality Objectives	m	metre
masl	metres above sea level	ppm	part per million
TOC	Total Organic Carbon	km	kilometre
pg	picogram	min	minimum
VOC	Volatile Organic Compound	m ³	cubic metre
ng	nanogram	max	maximum
		m ²	square metre



Standard Limitations

Limited Warranty

In performing work on behalf of a client, Cambium relies on its client to provide instructions on the scope of its retainer and, on that basis, Cambium determines the precise nature of the work to be performed. Cambium undertakes all work in accordance with applicable accepted industry practices and standards. Unless required under local laws, other than as expressly stated herein, no other warranties or conditions, either expressed or implied, are made regarding the services, work or reports provided.

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Site Assessments

A site assessment is created using data and information collected during the investigation of a site and based on conditions encountered at the time and particular locations at which fieldwork is conducted. The information, sample results and data collected represent the conditions only at the specific times at which and at those specific locations from which the information, samples and data were obtained and the information, sample results and data may vary at other locations and times. To the extent that Cambium's work or report considers any locations or times other than those from which information, sample results and data was specifically received, the work or report is based on a reasonable extrapolation from such information, sample results and data but the actual conditions encountered may vary from those extrapolations.

Only conditions at the site and locations chosen for study by the client are evaluated; no adjacent or other properties are evaluated unless specifically requested by the client. Any physical or other aspects of the site chosen for study by the client, or any other matter not specifically addressed in a report prepared by Cambium, are beyond the scope of the work performed by Cambium and such matters have not been investigated or addressed.

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Limitation of Liability

Potential liability to the client arising out of the report is limited to the amount of Cambium's professional liability insurance coverage. Cambium shall only be liable for direct damages to the extent caused by Cambium's negligence and/or breach of contract. Cambium shall not be liable for consequential damages.

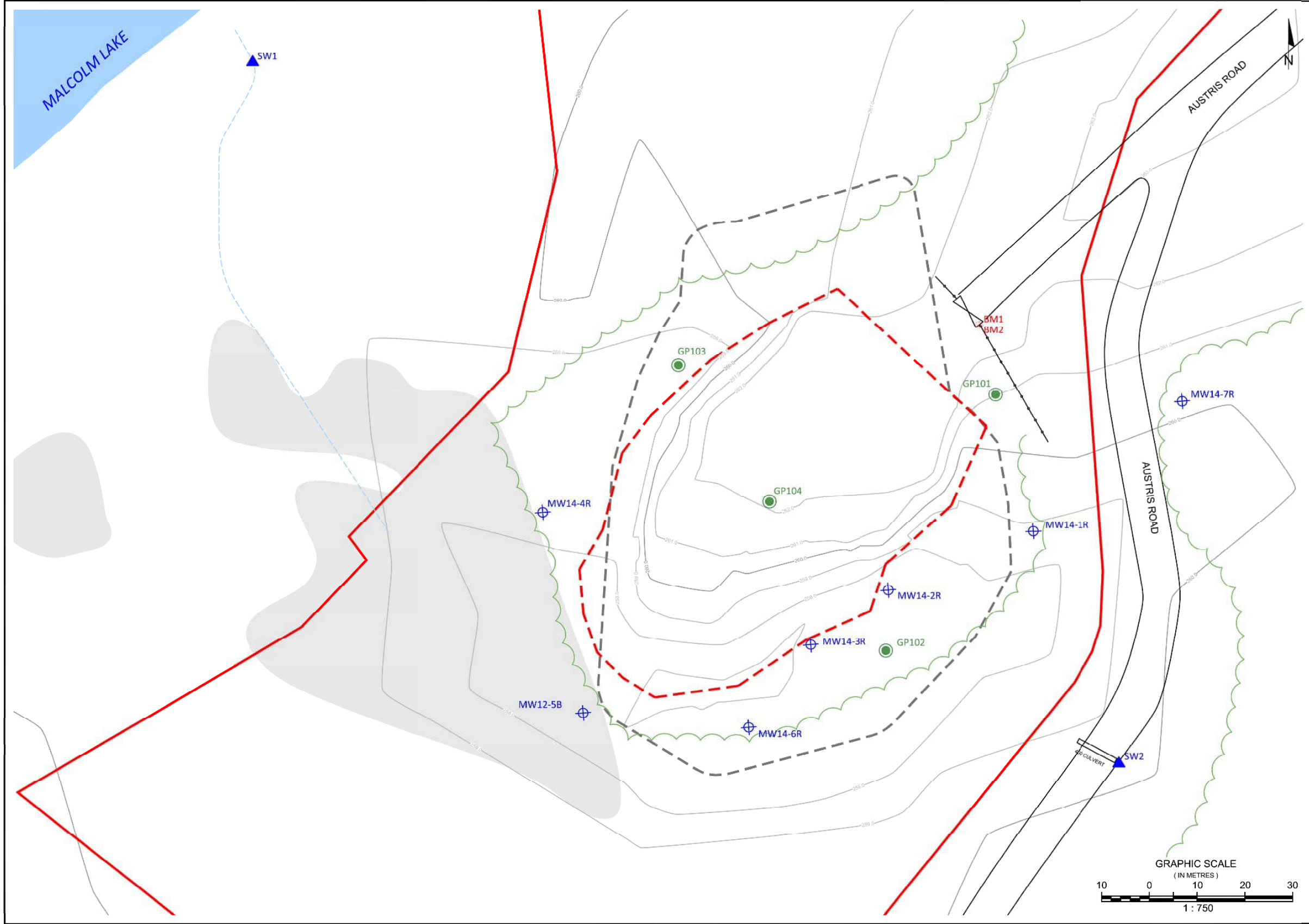
Personal Liability

The client expressly agrees that Cambium employees shall have no personal liability to the client with respect to a claim, whether in contract, tort and/or other cause of action in law. Furthermore, the client agrees that it will bring no proceedings nor take any action in any court of law against Cambium employees in their personal capacity.



Appended Figures

Fully accessible appended figures are available upon request.



**ARDOCH
WASTE DISPOSAL SITE**
1114 AUSTRIS ROAD
North Frontenac, Ontario
Township of North Frontenac

- LEGEND**
- Monitoring Well
 - Surface Water Sample Location
 - Gas Probe
 - Benchmark
 - Primary Topographic Contour Line
 - Secondary Topographic Contour Line
 - Property Boundary (4.02 ha.)
 - Existing Limit of Waste (0.46 ha.)
 - Approved Waste Disposal Area (0.81 ha.)
 - Watercourse
 - Fence
 - Gate
 - Approximate Tree Line
 - Low Lying Area

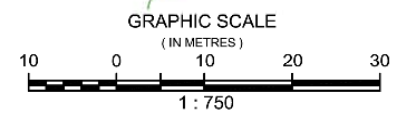
- Notes:**
1. Survey completed by Cambium Inc. November 30, 2015.
 2. Base mapping features are derived from Aecom 2014 Annual Report.
 3. Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
 4. Cambium Inc. makes every effort to ensure this map is free from errors or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.
- Benchmarks:**
1. Very top cap of south gatepost. Northing: 4974565.5532m
Easting: 351290.2902m Elevation: 254.416 m.
 2. Bottom nut on south gatepost. Northing: 4974565.5542m
Easting: 351290.1701m Elevation: 247.048.



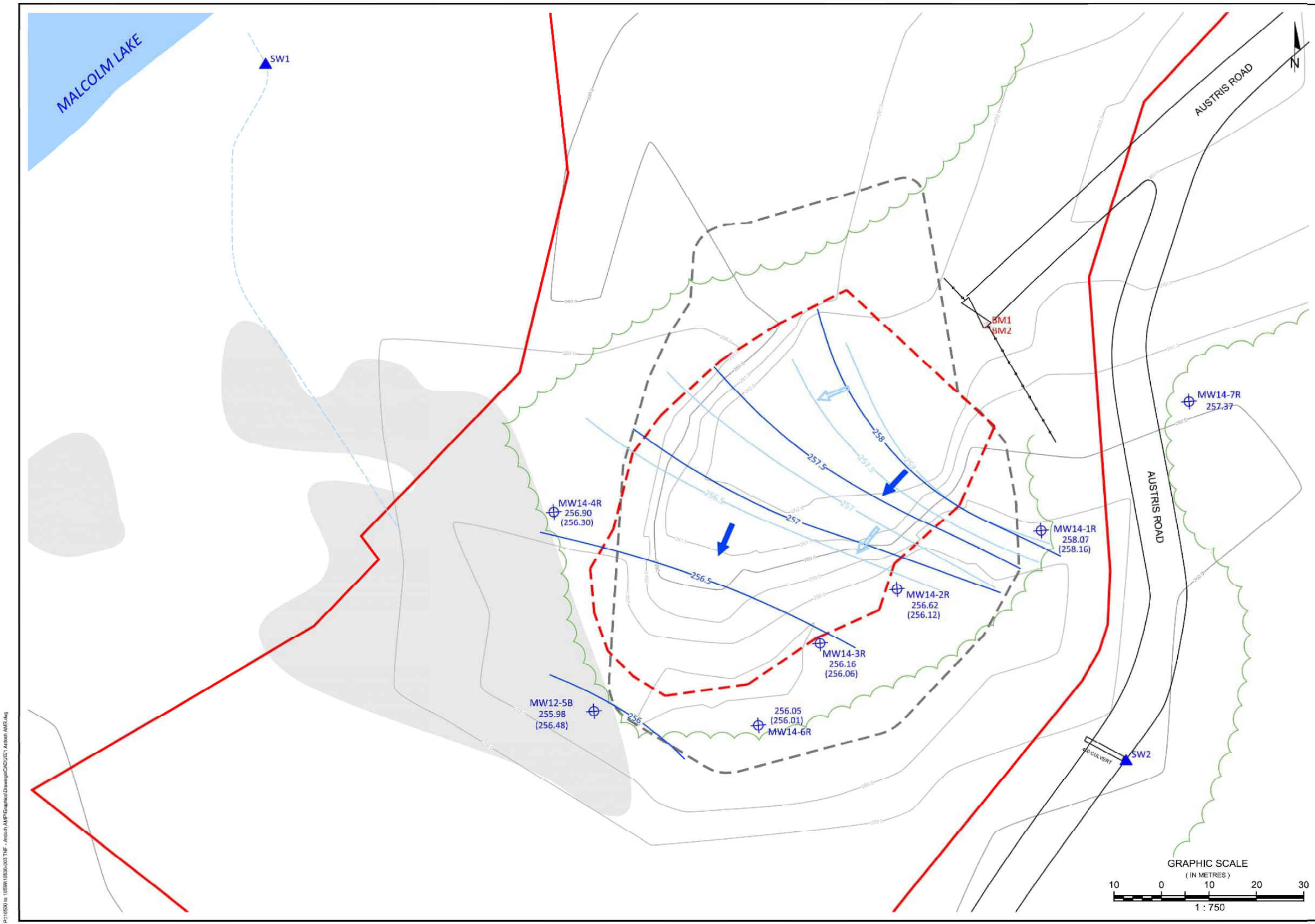
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EXISTING CONDITIONS

Project No.: 10530-003	Date: March 2022
Horizontal Scale: 1:750	Rev.: 3
Projection: NAD 1983 UTM Zone 18N	Figure: 3
Drawn By: TLC	Checked By: SNR



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**ARDOCH
WASTE DISPOSAL SITE**
1114 AUSTRIS ROAD
North Frontenac, Ontario
Township of North Frontenac

LEGEND

- Monitoring Well
- Surface Water Sample Location
- Benchmark
- 257.96** Groundwater Elevation
May 18, 2021
- (257.84)** Groundwater Elevation
September 22, 2021
- Primary Topographic Contour Line
- Secondary Topographic Contour Line
- Groundwater Contour
May 18, 2021
- Groundwater Contour
September 22, 2021
- Property Boundary (4.02 ha.)
- Existing Limit of Waste (0.46 ha.)
- Approved Waste Disposal Area
(0.81 ha.)
- Watercourse
- Fence
- Gate
- Approximate Tree Line
- Low Lying Area
- Groundwater Flow Direction
May 18, 2021
- Groundwater Flow Direction
September 22, 2021

Notes:

1. Survey completed by Cambium Inc. November 30, 2015.
2. Base mapping features are derived from Aconon 2014 Annual Report.
3. Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
4. Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to errors or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

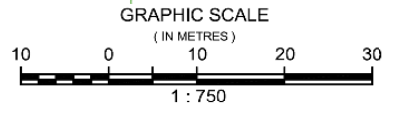
Benchmarks:

1. Very top east of south gatepost. Northing: 4974565.5532m
Easting: 351290.2902m Elevation 264.416 m.
2. Bottom nut on south gatepost. Northing: 4974565.5542m
Easting: 351300.1350m Elevation: 262.846m

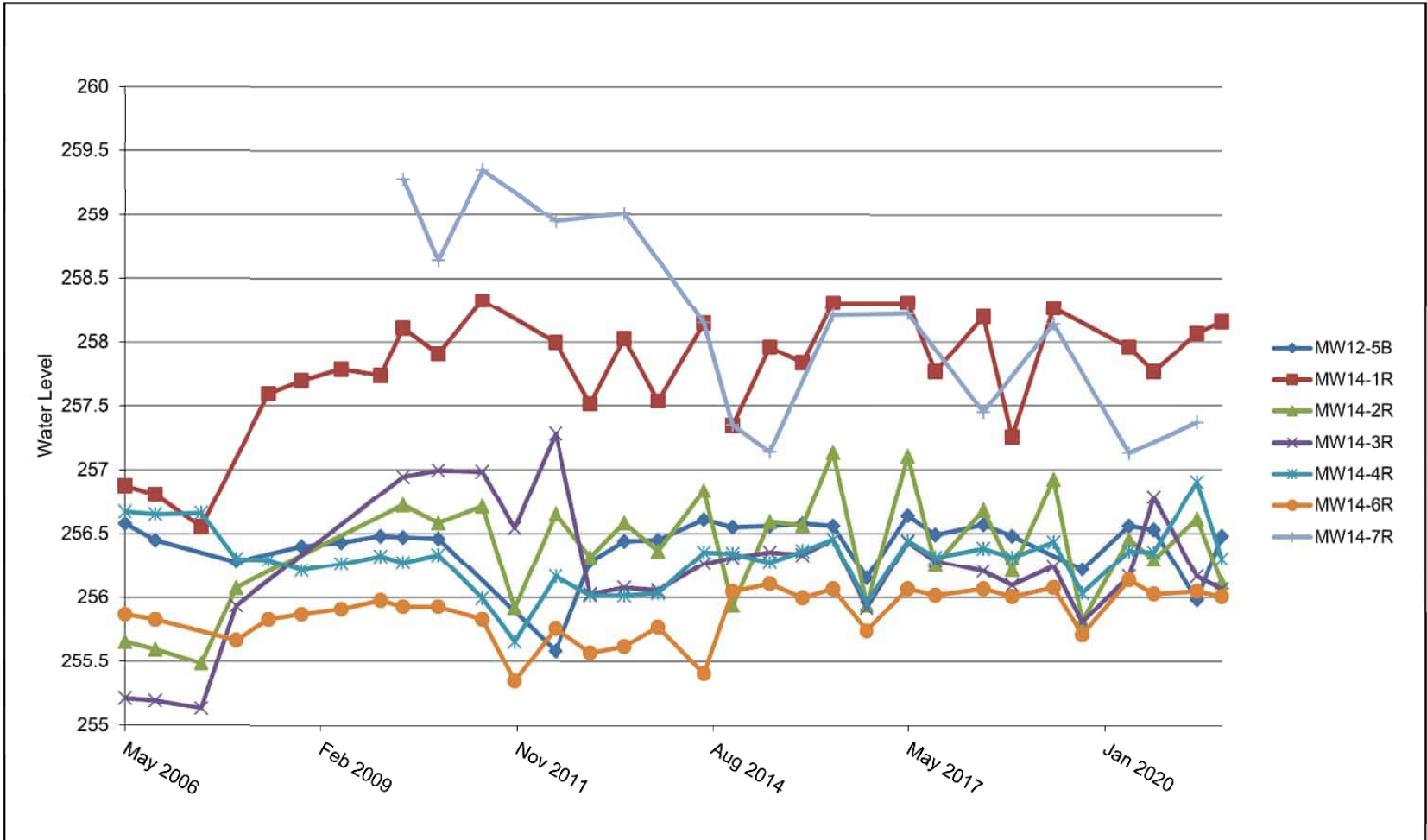


**SHALLOW GROUNDWATER
CONFIGURATION**

Project No.: 10530-003	Date: March 2022
Horizontal Scale: 1:750	Projection: NAD 1983 UTM Zone 18N
Drawn By: TLC	Checked By: SNR
Figure: 4	



PROJECTED TO 10530-003 TIF - Ardoch AMP/Gravel/Chang/CAD/2022 Ardoch AMP.dwg

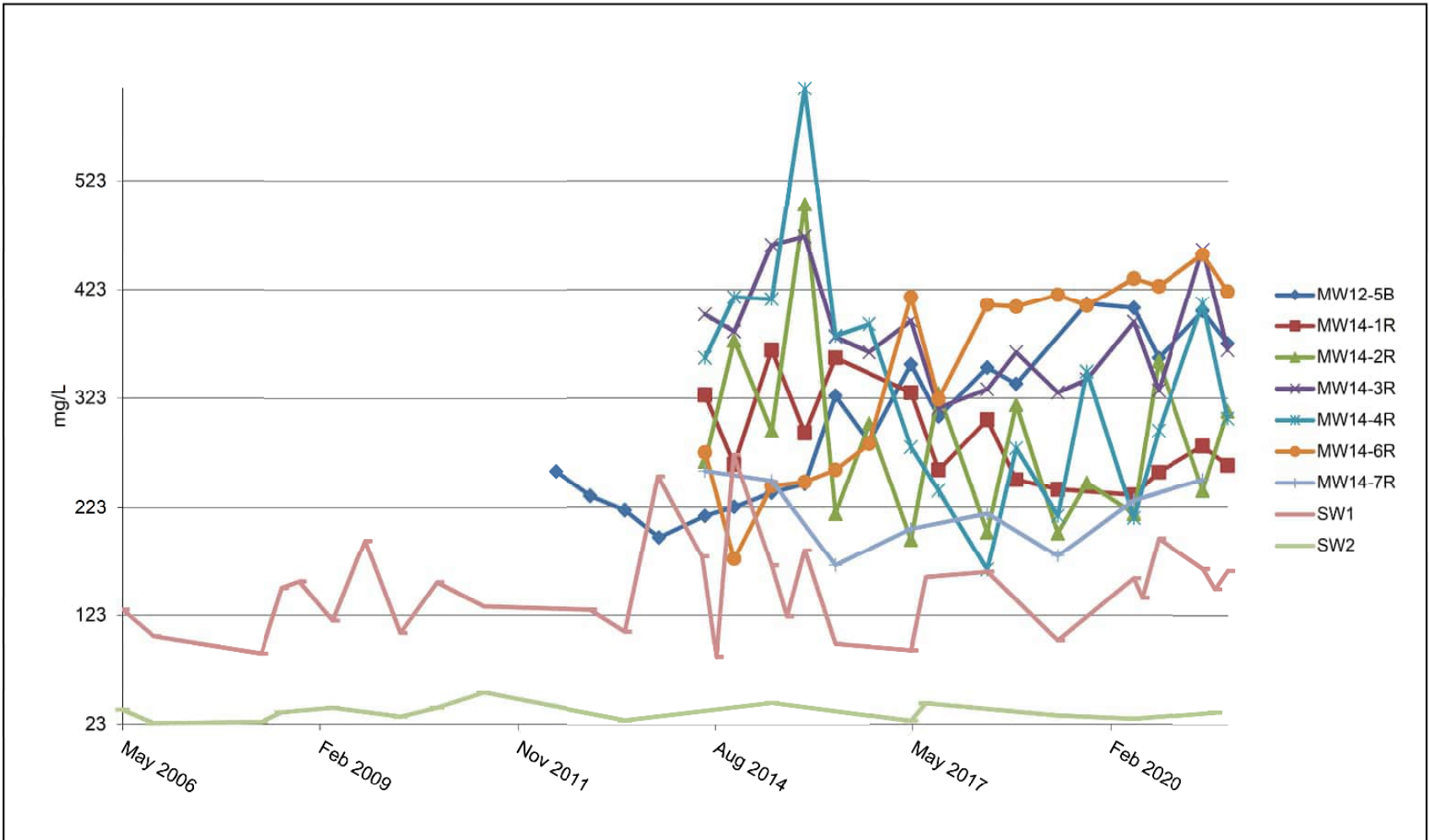


Groundwater Elevations

2021 Annual Report, Ardoch Waste Disposal Site
 1114 Austris Road, North Frontenac
 The Corporation of the Township of North Frontenac

Figure:	5
Date:	11-Mar-22
Project Manager:	Stephanie Reeder
Project No.:	10530-003



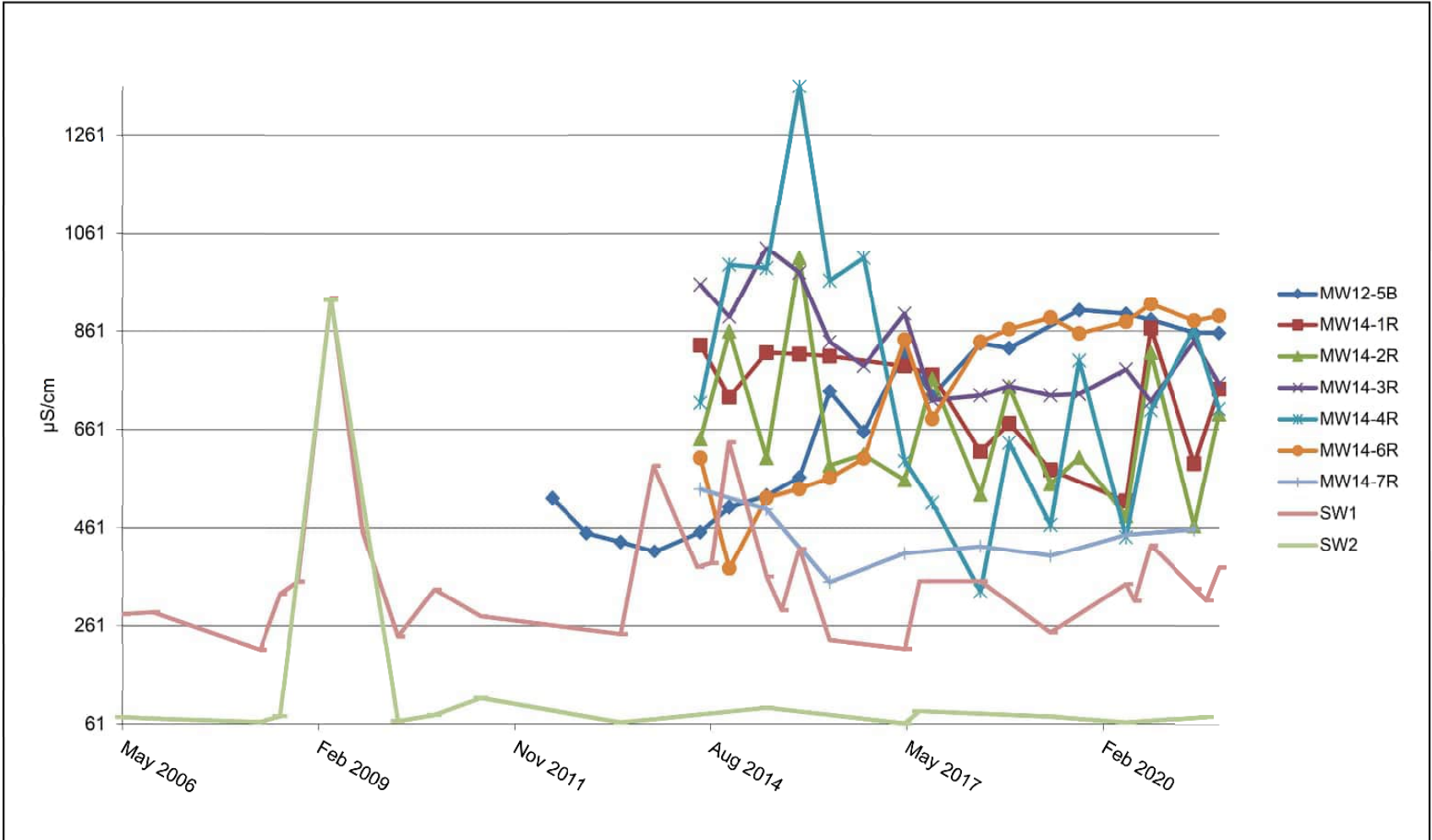


Alkalinity Concentrations

2021 Annual Report, Ardoch Waste Disposal Site
 1114 Austris Road, North Frontenac
 The Corporation of the Township of North Frontenac

Figure:	6
Date:	24-Mar-22
Project Manager:	Stephanie Reeder
Project No.:	10530-003



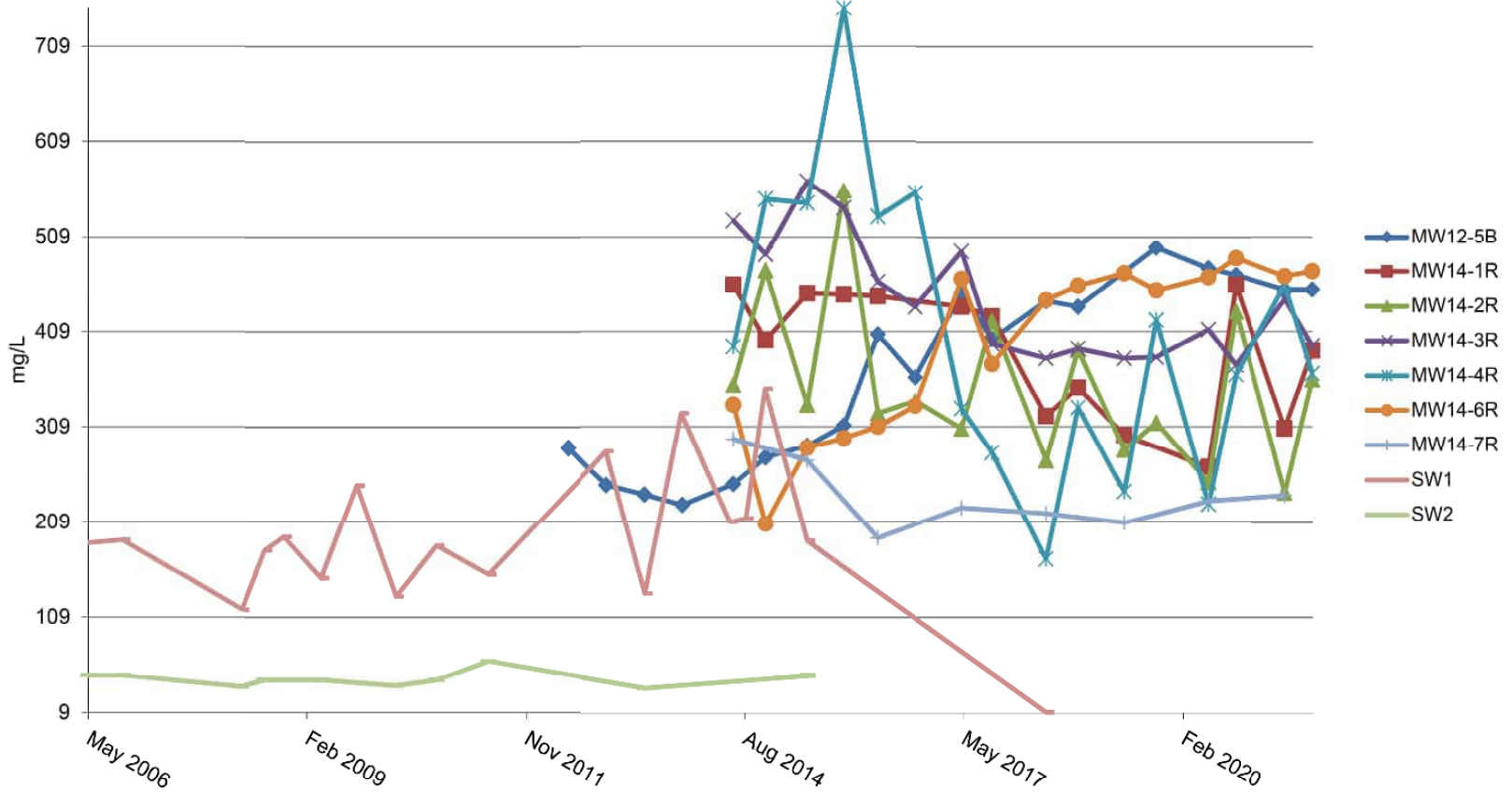


Conductivity Concentrations

2021 Annual Report, Ardoch Waste Disposal Site
 1114 Austris Road, North Frontenac
 The Corporation of the Township of North Frontenac

Figure:	7
Date:	24-Mar-22
Project Manager:	Stephanie Reeder
Project No.:	10530-003



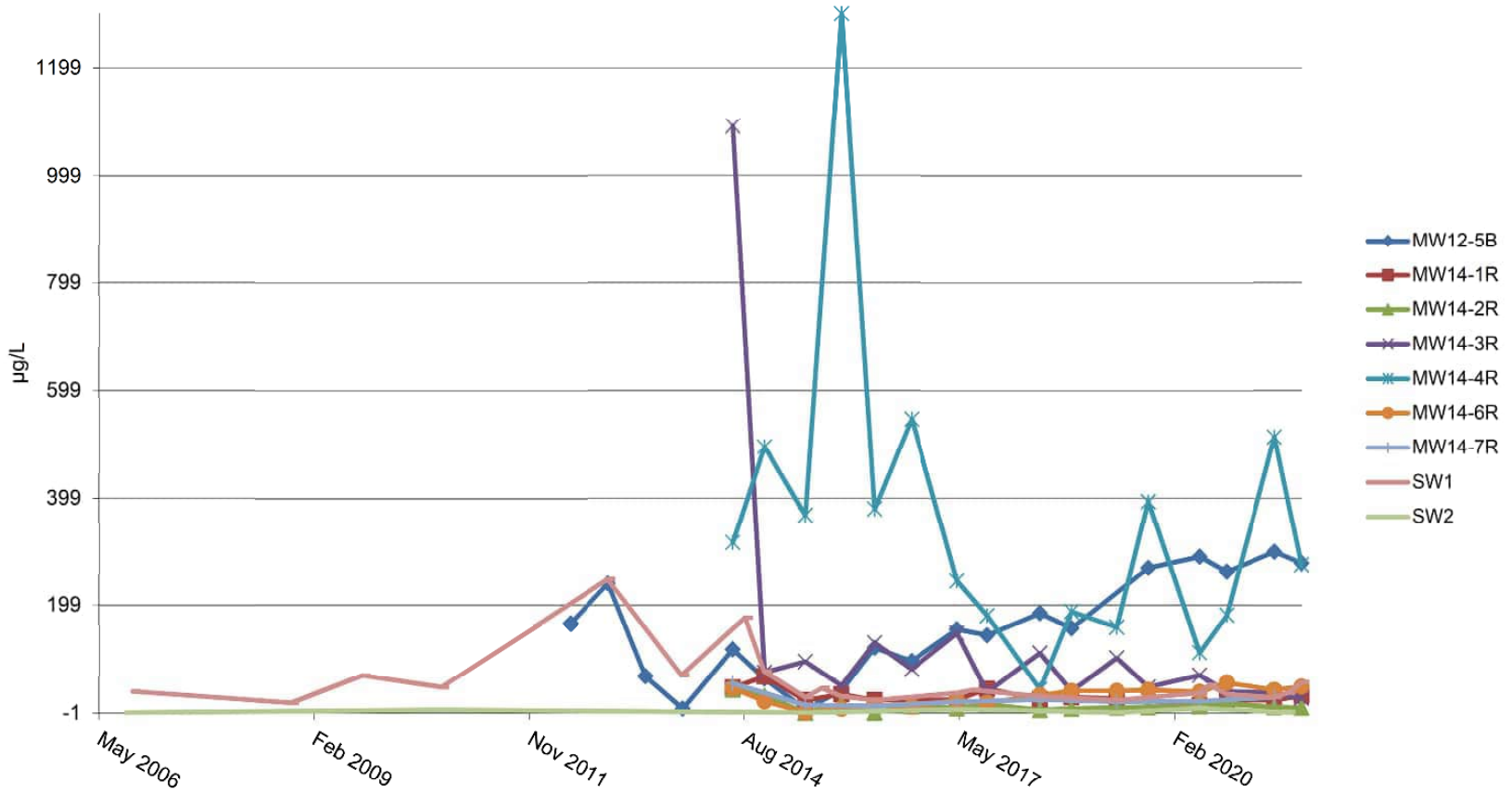


Total Dissolved Solids (TDS) Concentrations

2021 Annual Report, Ardoch Waste Disposal Site
 1114 Austris Road, North Frontenac
 The Corporation of the Township of North Frontenac

Figure:	8
Date:	24-Mar-22
Project Manager:	Stephanie Reeder
Project No.:	10530-003



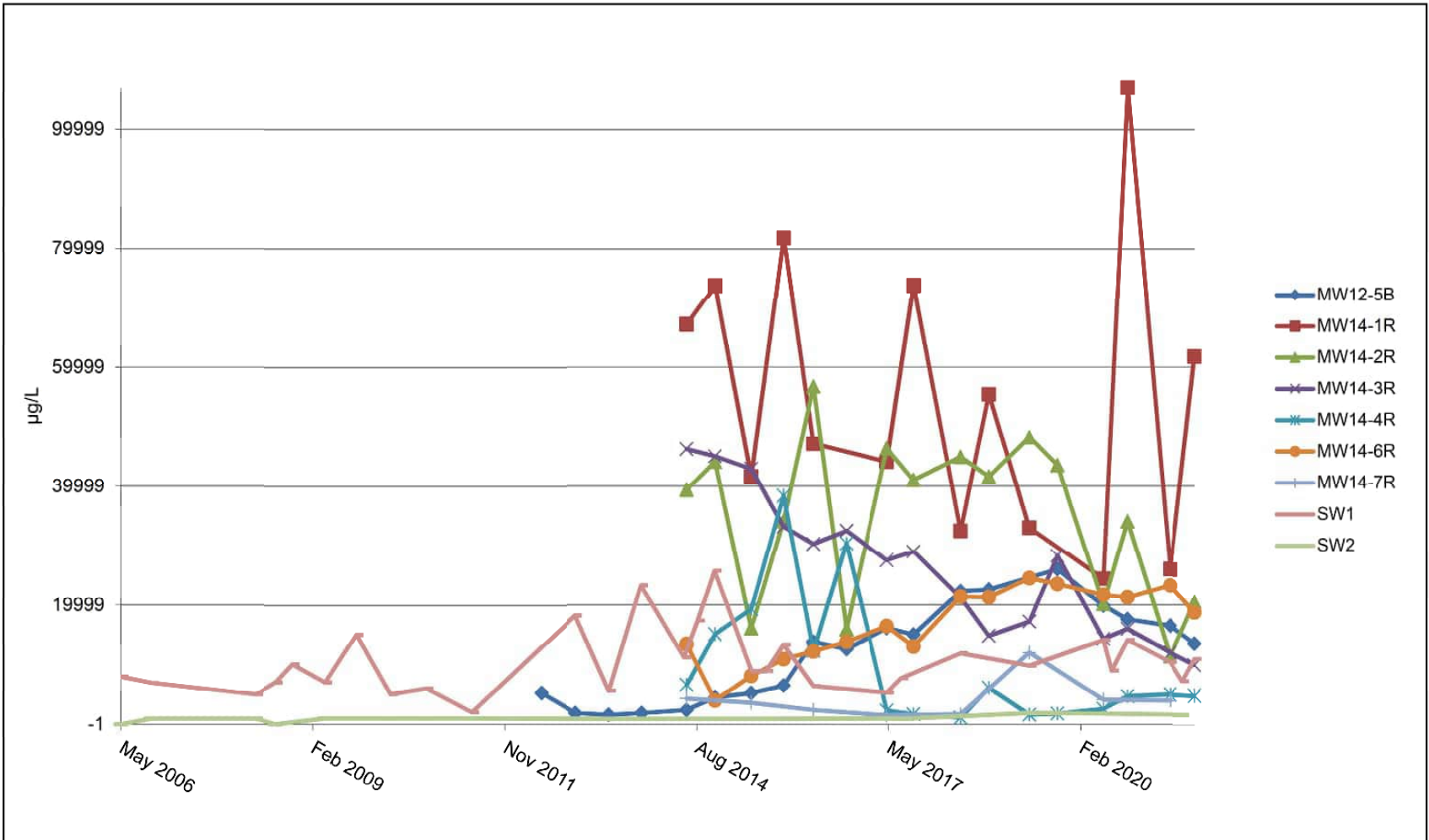


Boron Concentrations

2021 Annual Report, Ardoch Waste Disposal Site
 1114 Austris Road, North Frontenac
 The Corporation of the Township of North Frontenac

Figure:	9
Date:	24-Mar-22
Project Manager:	Stephanie Reeder
Project No.:	10530-003



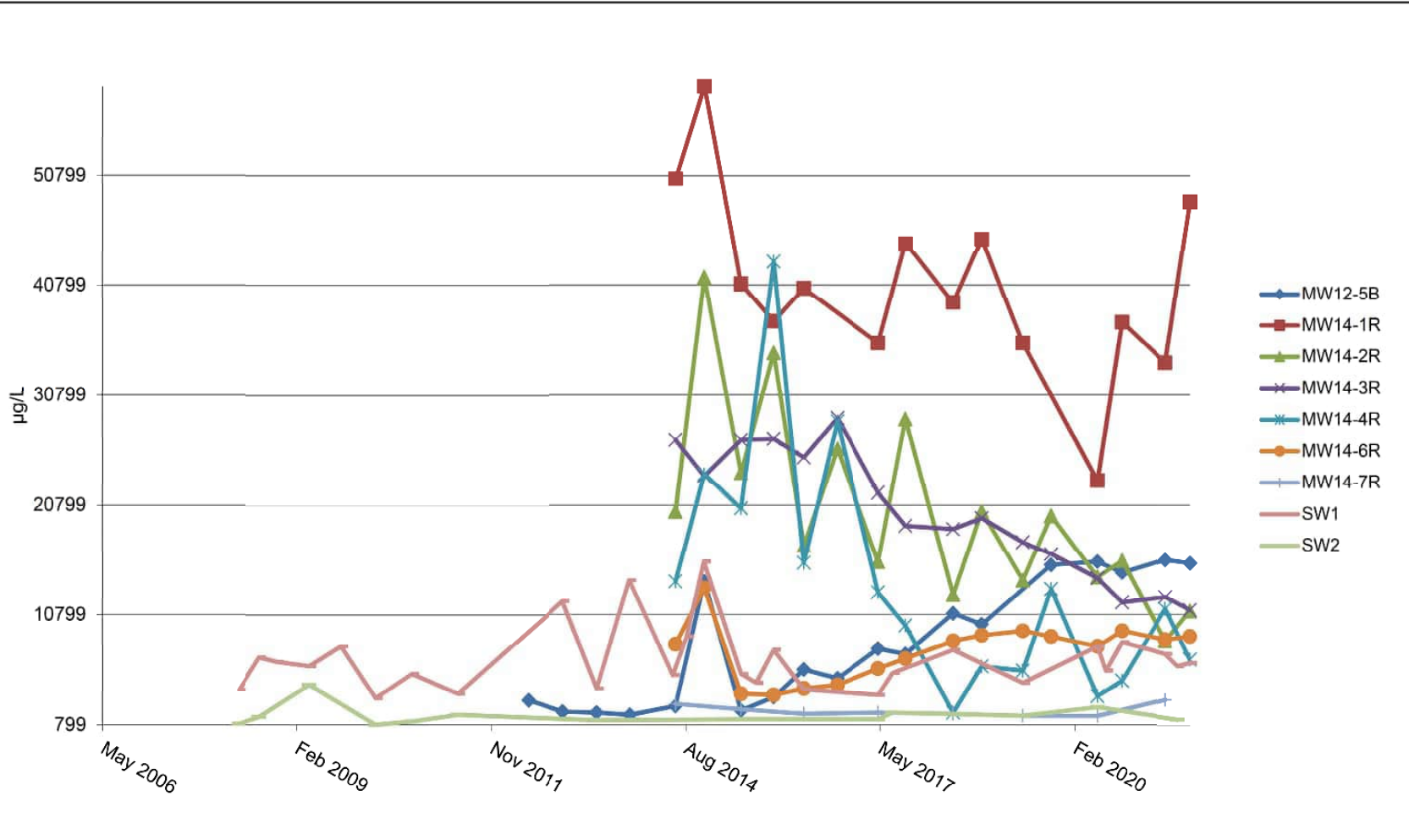


Chloride Concentrations

2021 Annual Report, Ardoch Waste Disposal Site
 1114 Austris Road, North Frontenac
 The Corporation of the Township of North Frontenac

Figure:	10
Date:	24-Mar-22
Project Manager:	Stephanie Reeder
Project No.:	10530-003



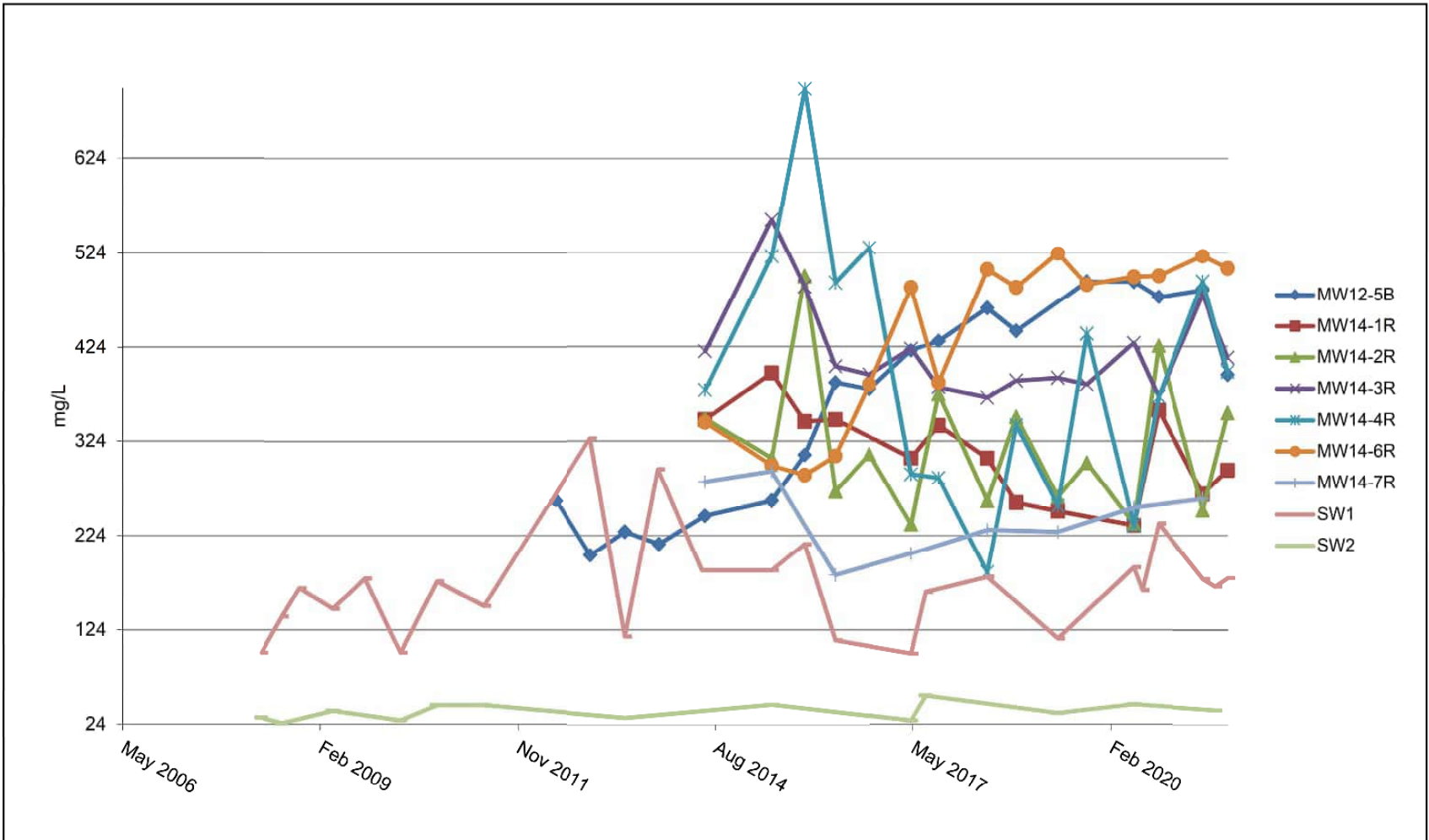


Sodium Concentrations

2021 Annual Report, Ardoch Waste Disposal Site
 1114 Austris Road, North Frontenac
 The Corporation of the Township of North Frontenac

Figure:	11
Date:	24-Mar-22
Project Manager:	Stephanie Reeder
Project No.:	10530-003



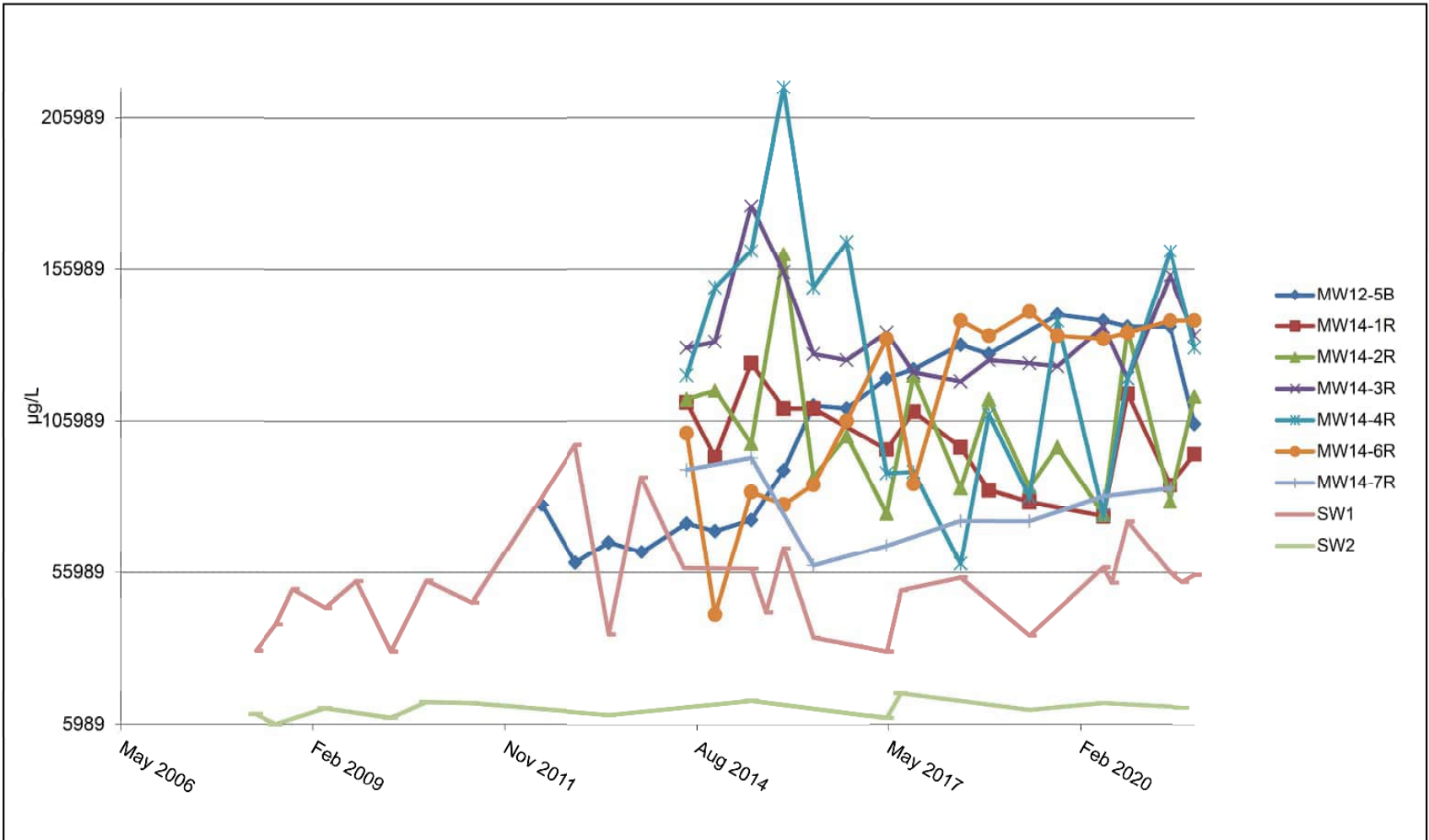


Hardness Concentrations

2021 Annual Report, Ardoch Waste Disposal Site
 1114 Austris Road, North Frontenac
 The Corporation of the Township of North Frontenac

Figure:	12
Date:	24-Mar-22
Project Manager:	Stephanie Reeder
Project No.:	10530-003



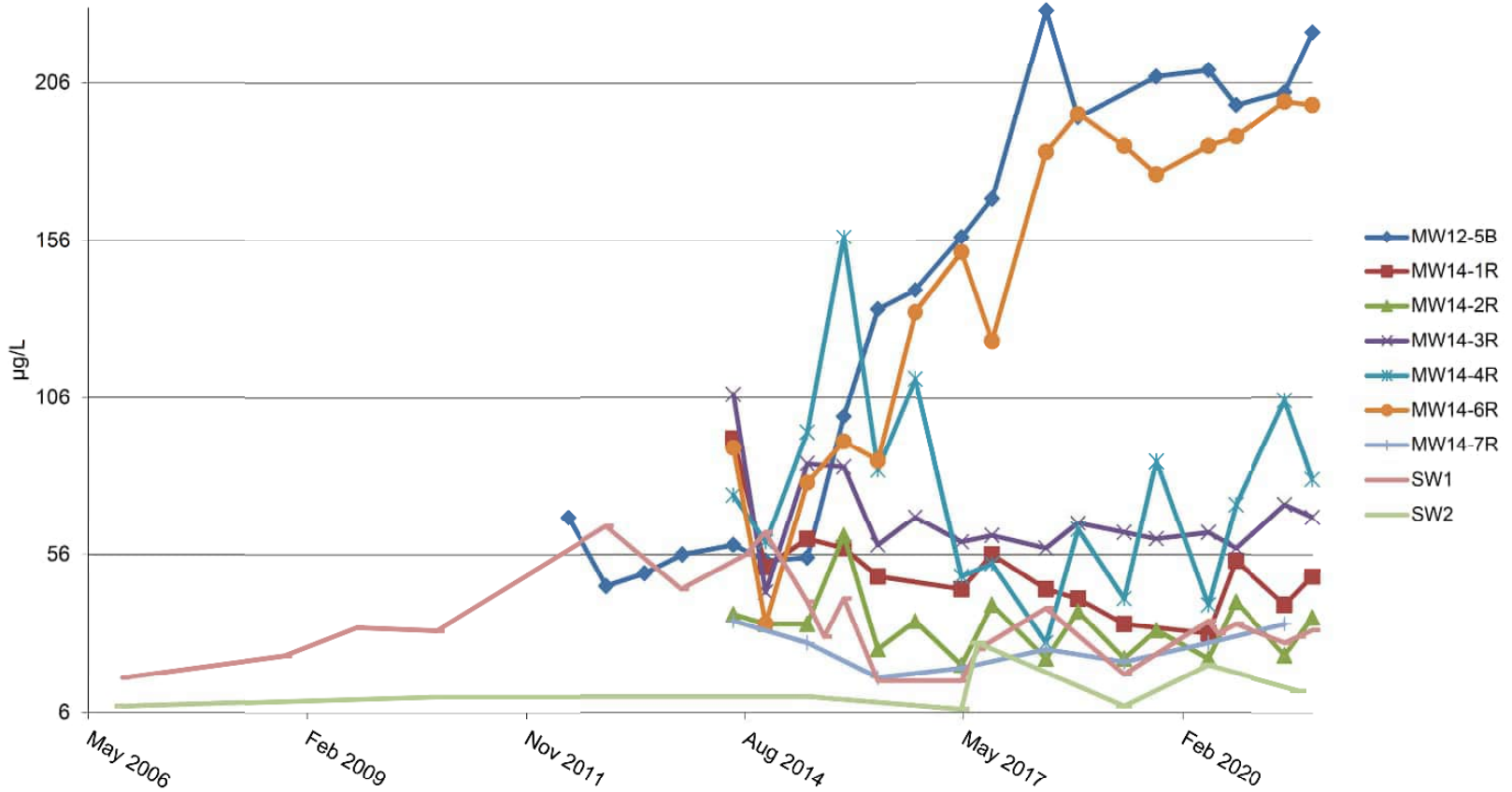


Calcium Concentrations

2021 Annual Report, Ardoch Waste Disposal Site
 1114 Austris Road, North Frontenac
 The Corporation of the Township of North Frontenac

Figure:	13
Date:	24-Mar-22
Project Manager:	Stephanie Reeder
Project No.:	10530-003



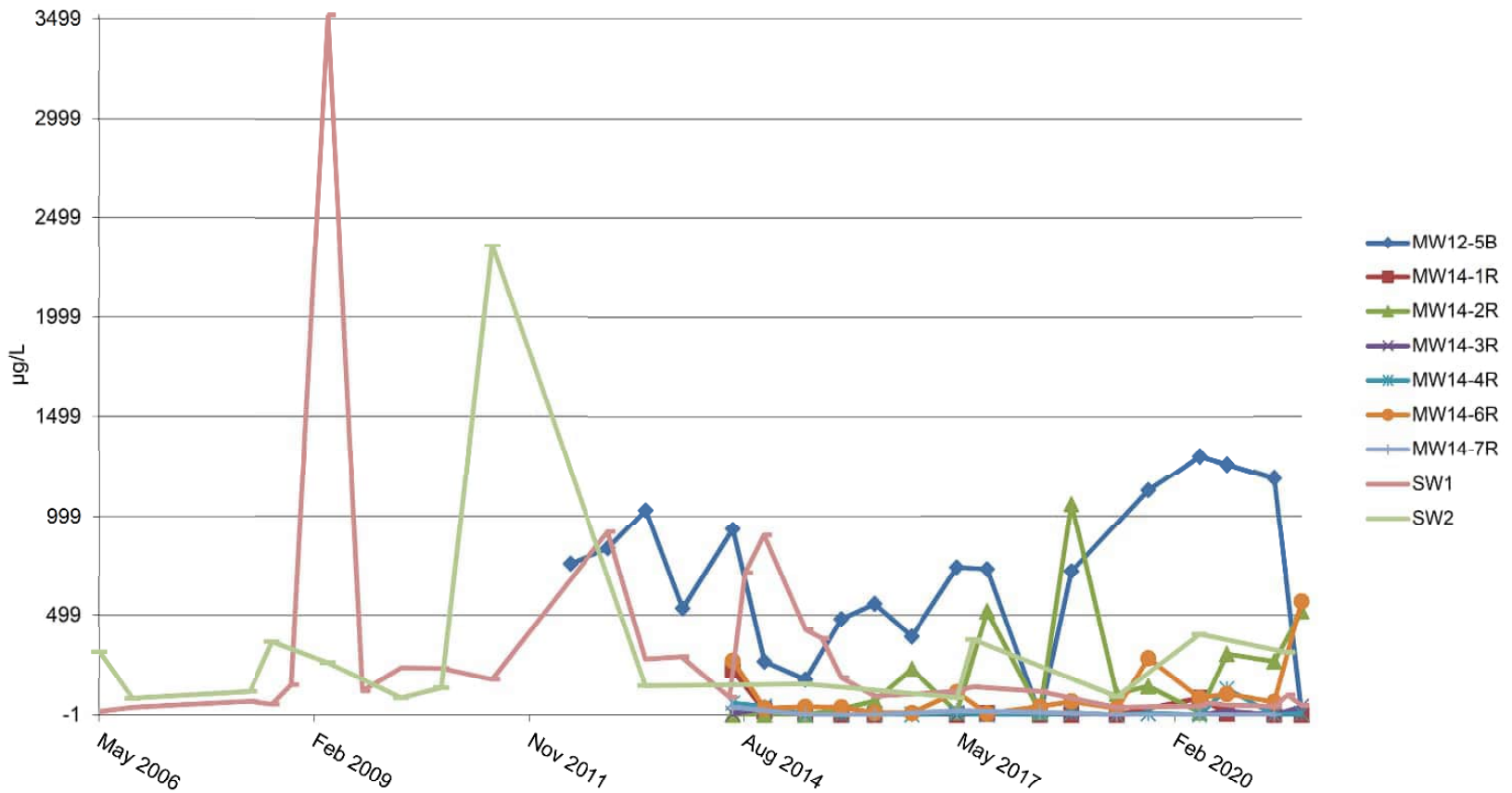


Barium Concentrations

2021 Annual Report, Ardoch Waste Disposal Site
 1114 Austris Road, North Frontenac
 The Corporation of the Township of North Frontenac

Figure:	14
Date:	24-Mar-22
Project Manager:	Stephanie Reeder
Project No.:	10530-003



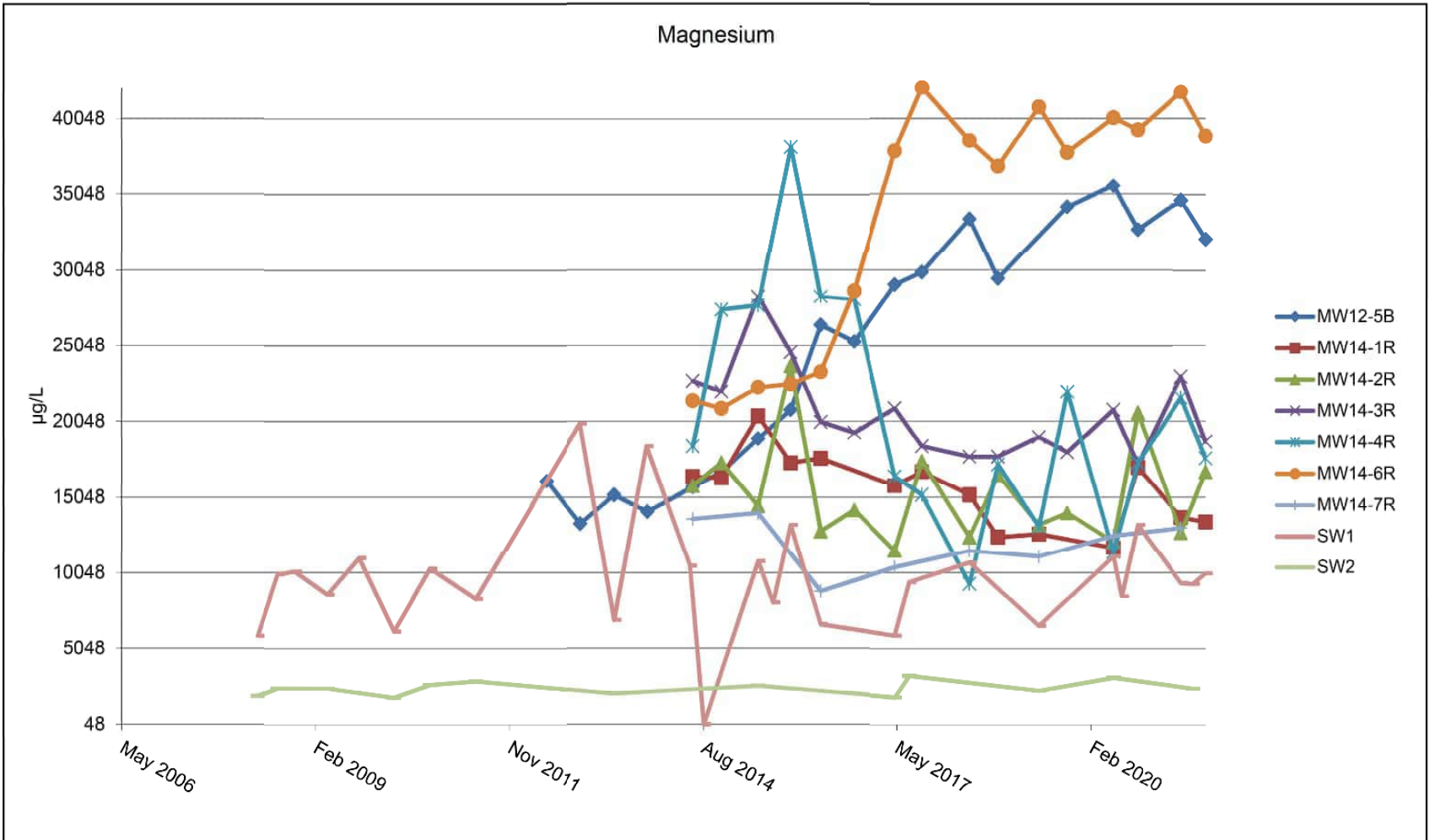


Iron Concentrations

2021 Annual Report, Ardoch Waste Disposal Site
 1114 Austris Road, North Frontenac
 The Corporation of the Township of North Frontenac

Figure:	15
Date:	24-Mar-22
Project Manager:	Stephanie Reeder
Project No.:	10530-003



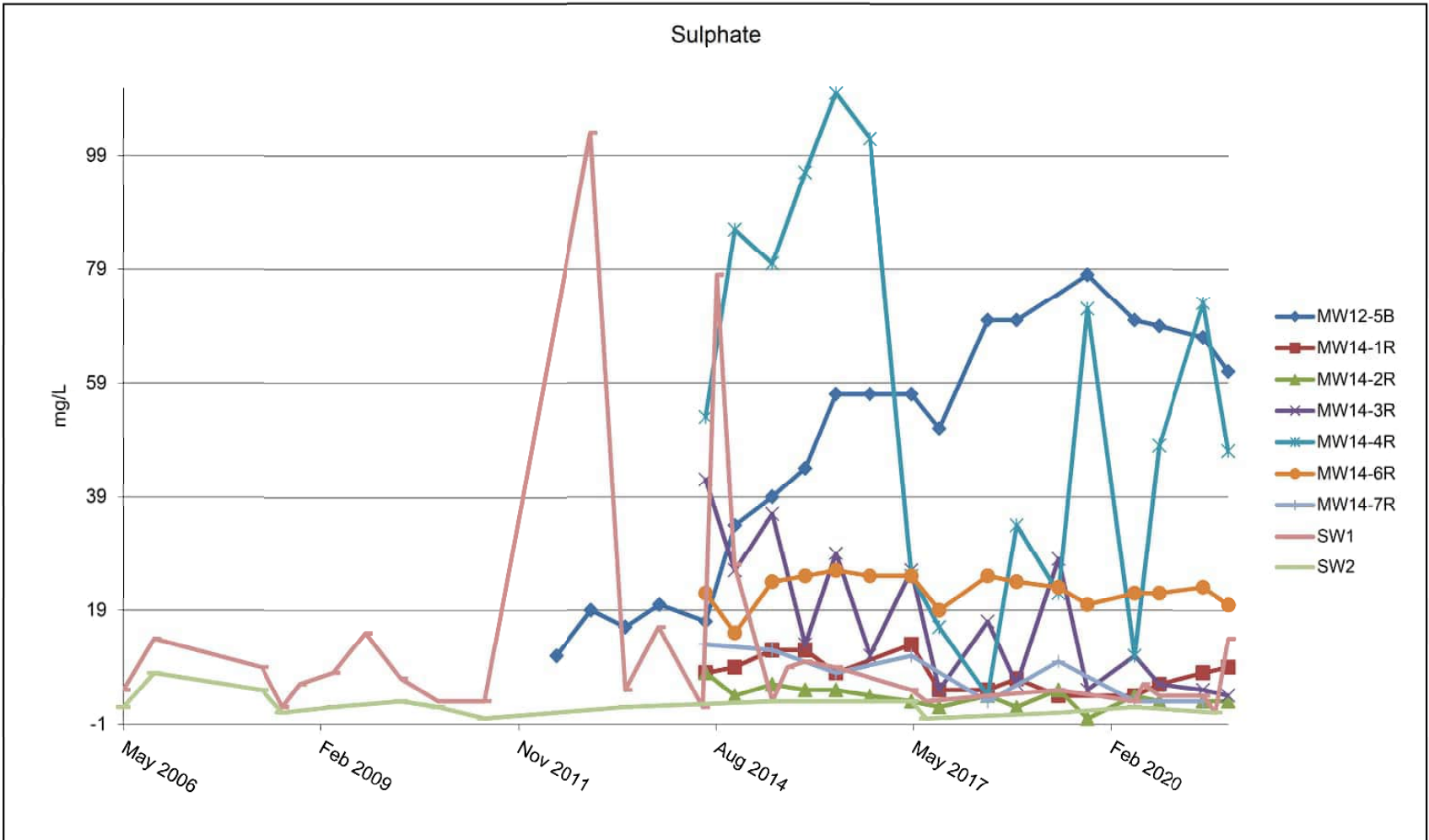


Magnesium Concentrations

2021 Annual Report, Ardoch Waste Disposal Site
 1114 Austris Road, North Frontenac
 The Corporation of the Township of North Frontenac

Figure:	16
Date:	24-Mar-22
Project Manager:	Stephanie Reeder
Project No.:	10530-003



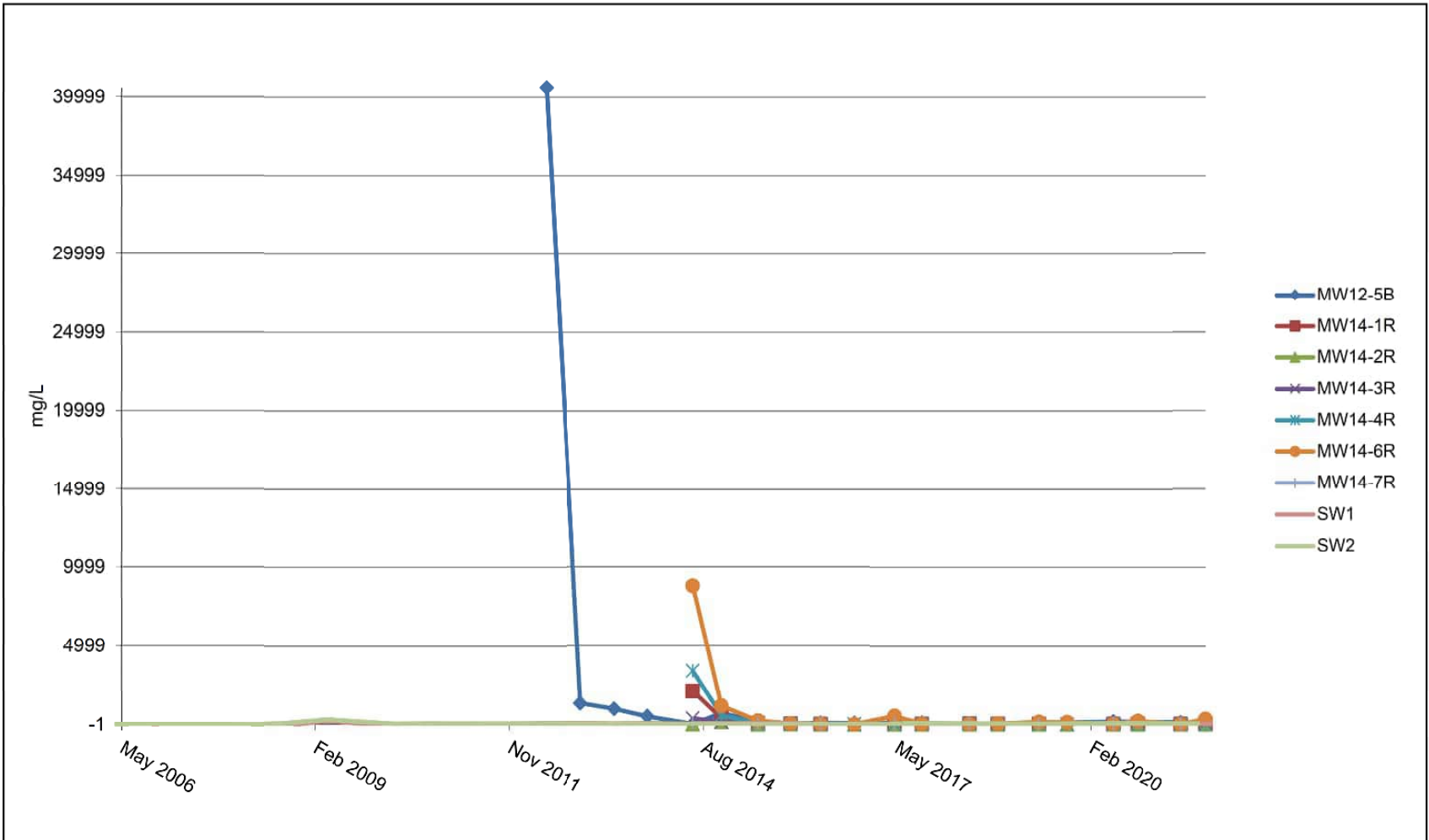


Sulphate Concentrations

2021 Annual Report, Ardoch Waste Disposal Site
 1114 Austris Road, North Frontenac
 The Corporation of the Township of North Frontenac

Figure:	17
Date:	24-Mar-22
Project Manager:	Stephanie Reeder
Project No.:	10530-003



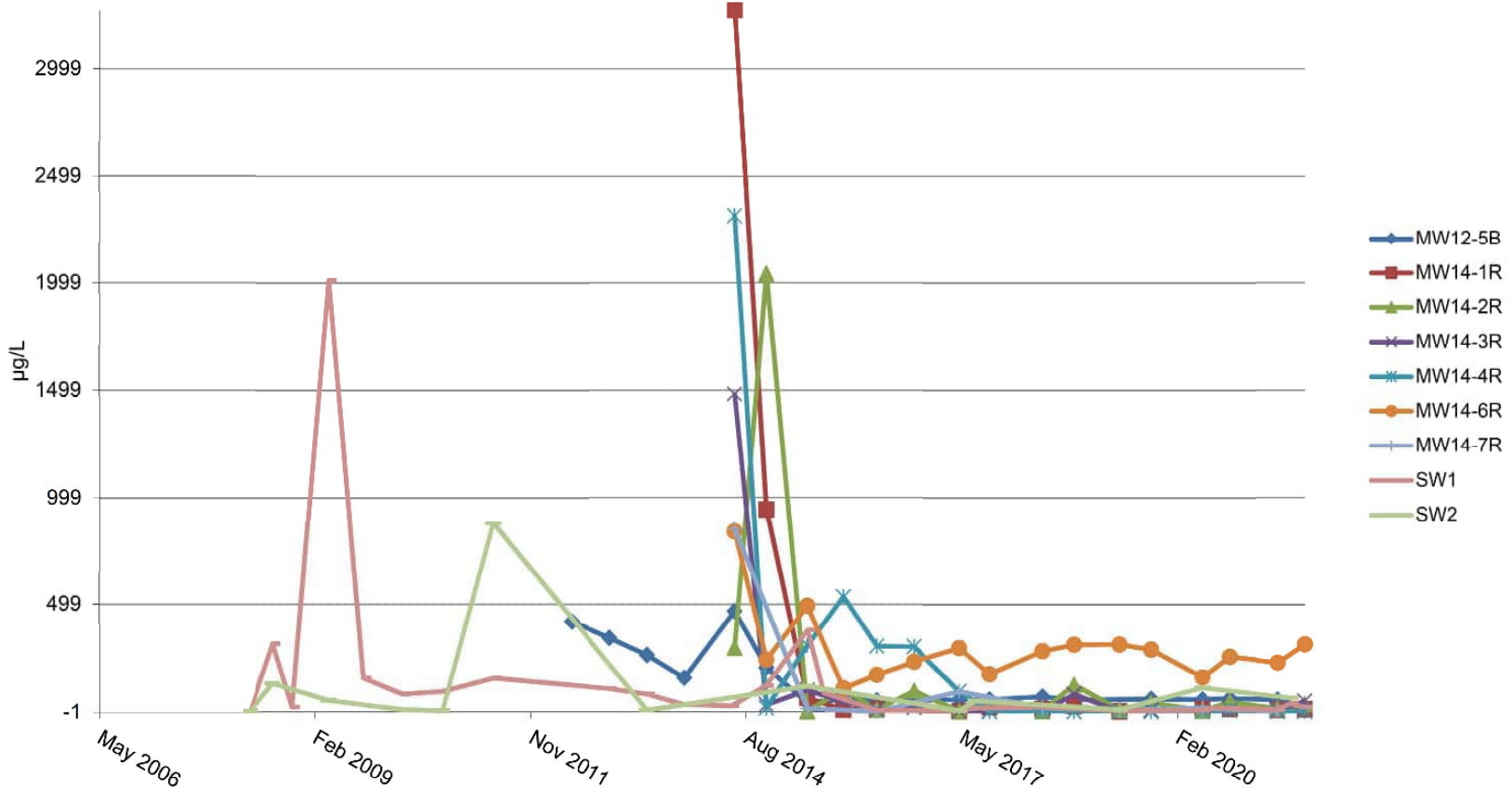


Chemical Oxygen Demand (COD) Concentrations

2021 Annual Report, Ardoch Waste Disposal Site
 1114 Austris Road, North Frontenac
 The Corporation of the Township of North Frontenac

Figure:	18
Date:	24-Mar-22
Project Manager:	Stephanie Reeder
Project No.:	10530-003





Manganese Concentrations

2021 Annual Report, Ardoch Waste Disposal Site
 1114 Austris Road, North Frontenac
 The Corporation of the Township of North Frontenac

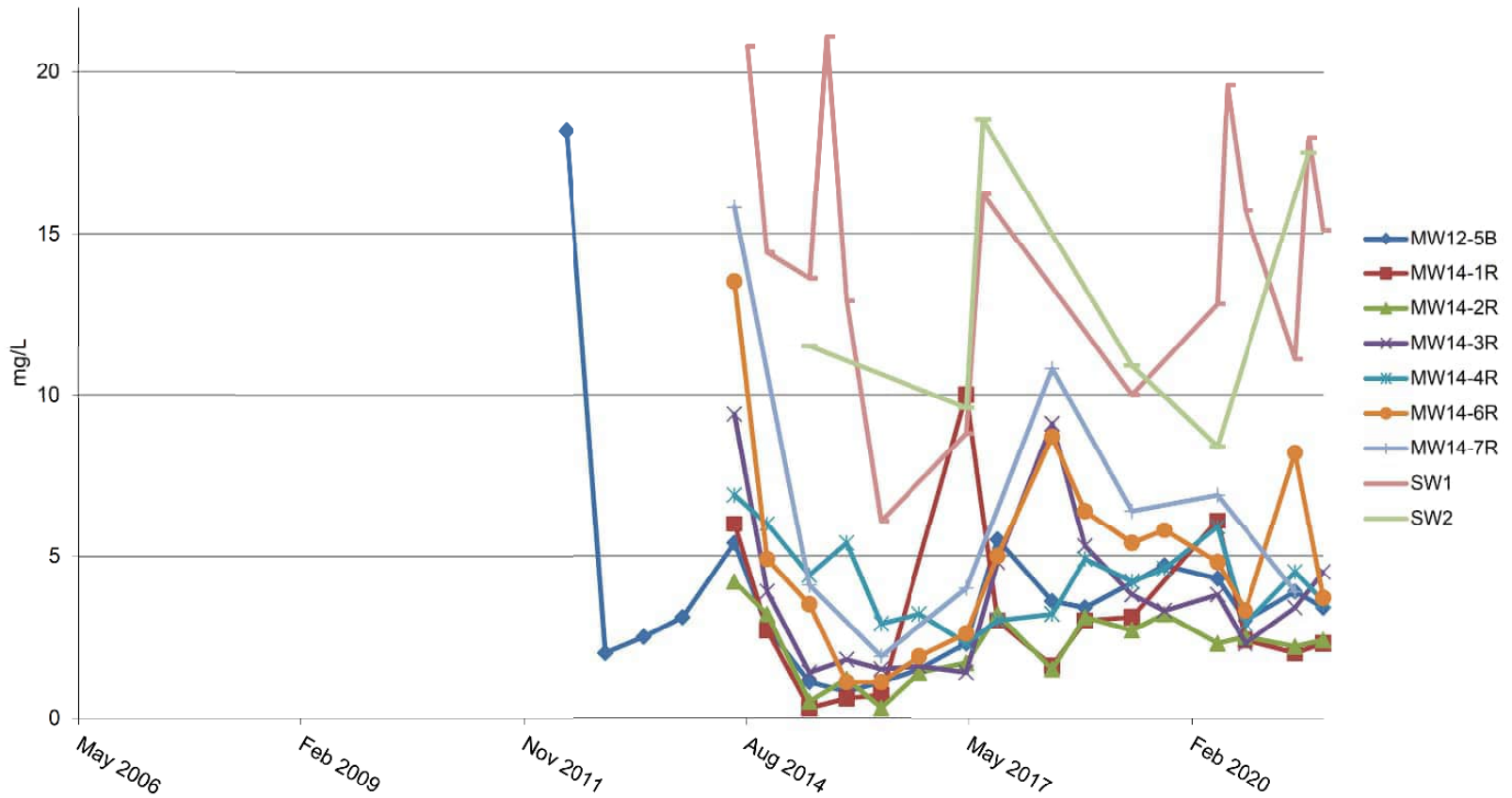
Figure: 19

Date: 24-Mar-22

Project Manager:
Stephanie Reeder

Project No.:
10530-003





Dissolved Organic Carbon (DOC) Concentrations

2021 Annual Report, Ardoch Waste Disposal Site
 1114 Austris Road, North Frontenac
 The Corporation of the Township of North Frontenac

Figure:	20
Date:	24-Mar-22
Project Manager:	Stephanie Reeder
Project No.:	10530-003





Appended Tables

Fully accessible appended tables are available upon request.



Table Notes

RDL - reported detection limit for the current year

RUC - Reasonable Use Criteria

CWQG - Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME, 2011)

ODWQS - Ontario Drinking Water Quality Standards, O.Reg. 169/03

PWQO - Water Management, Policies, Guidelines, Provincial Water Quality Objectives
(MOEE, 1994b)

PWQO for beryllium, cadmium, copper, and lead depend on hardness

PWQO for aluminum depends on pH and background concentration

NV - No Value

"-" Parameter not analyzed or measured

Unionized ammonia calculated using total ammonia and field data for pH and conductivity



Table 1 - Environmental Monitoring Program

Location	Task	Frequency	Parameters
<u>Groundwater</u>			
MW14-1R, MW14-2R, MW14-3R, MW14-4R, MW12-5B, MW14-6R MW14-7R 1 QA/QC	<ul style="list-style-type: none"> Groundwater Elevations Field measurements (pH, temperature, conductivity, dissolved oxygen, and oxygen reduction potential (ORP)) 	Twice annually (spring and autumn)	ammonia, TKN, nitrite, nitrate, BOD, COD, conductivity, pH, TDS, DCC, phosphorous by ICP, TSS, alkalinity, chloride, sodium, calcium, magnesium, potassium, sulphate, arsenic, barium, boron, cadmium, chromium, copper, iron, lead, manganese, mercury, zinc, hardness
GP101, GP102, GP103, GP104	<ul style="list-style-type: none"> Measure combustible gas % by volume methane Groundwater Elevations 	Once between May 1 and November 30) Twice during frozen ground conditions (i.e. December 1 through April 30)	% methane by volume
<u>Surface Water</u>			
SW1, SW2 1 QA/QC	<ul style="list-style-type: none"> Surface water sampling Flow estimates Staff gauge elevations Field measurements (pH, temperature, conductivity, dissolved oxygen, and oxygen reduction potential (ORP)) 	Three times annually (spring, summer, autumn)	ammonia, unionized ammonia (field), TKN, nitrite, nitrate, BOD, COD, conductivity, pH, TSS, DOC, phenols, total phosphorous, alkalinity, chloride, sodium, calcium, magnesium, potassium, sulphate, arsenic, barium, boron, cadmium, chromium, copper, iron, lead, manganese, dissolved mercury, zinc, hardness

**Dissolved mercury to be lab filtered with a 0.45 micron filter for all surface water samples.*



Table 2 - Groundwater Elevation Data

Monitor	MW14-1R	MW14-2R	MW14-3R	MW14-4R	MW12-5B	MW14-6R	MW14-7R
Northing Easting¹	4974521 351301	4974509 351271	4974497 351255	4974525 351199	4974482 351207	4974479 351242	4974549 351333
Original Ground Elevation (masl)	258.40	257.95	257.12	256.58	256.28	256.51	258.29
Stick Up (m)	0.95	0.94	0.85	0.90	0.83	0.75	1.06
Depth (m)	2.59	3.35	3.27	2.60	3.10	3.13	2.64
Measuring Point After 2013 (masl)	259.35	258.89	257.97	257.48	257.11	257.26	259.35
23-May-06	256.88	255.66	255.21	256.67	256.58	255.87	-
24-Oct-06	256.81	255.60	255.19	256.65	256.45	255.83	-
15-Jun-07	256.56	255.49	255.13	256.66	-	-	-
10-Dec-07	-	256.08	255.93	256.30	256.28	255.67	-
27-May-08	257.60	-	-	256.29	-	255.83	-
11-Nov-08	257.70	-	-	256.21	256.40	255.87	-
1-Jun-09	257.79	-	-	256.26	256.43	255.91	-
18-Dec-09	257.74	-	-	256.32	256.48	255.98	-
12-Apr-10	258.11	256.73	256.94	256.27	256.47	255.93	259.28
8-Oct-10	257.91	256.59	256.99	256.33	256.46	255.93	258.64
20-May-11	258.33	256.72	256.98	255.99	-	255.83	259.35
1-Nov-11	-	255.92	256.54	255.65	-	255.35	-
30-May-12	258.00	256.66	257.28	256.16	255.58	255.76	258.95
23-Nov-12	257.52	256.32	256.02	256.01	256.28	255.57	-
16-May-13	258.03	256.59	256.07	256.01	256.44	255.62	259.01
4-Nov-13	257.54	256.37	256.05	256.03	256.45	255.77	-
25-Jun-14	258.15	256.84	256.26	256.35	256.61	255.41	258.15
19-Nov-14	257.35	255.94	256.31	256.34	256.55	256.05	257.35
27-May-15	257.96	256.60	256.35	256.27	256.56	256.11	257.14
10-Nov-15	257.84	256.57	256.33	256.36	256.58	256.00	-
13-Apr-16	258.31	257.14	256.45	256.45	256.56	256.07	258.21
3-Oct-16	-	255.94	255.91	255.95	256.15	255.74	-
3-May-17	258.31	257.11	256.43	256.44	256.64	256.07	258.22
20-Sep-17	257.77	256.26	256.28	256.31	256.49	256.02	-
23-May-18	258.20	256.69	256.20	256.38	256.57	256.07	257.45
16-Oct-18	257.26	256.22	256.09	256.31	256.48	256.01	-
15-May-19	258.27	256.93	256.24	256.43	-	256.08	258.14
8-Oct-19	-	255.82	255.80	256.03	256.22	255.71	-
2-Jun-20	257.96	256.46	256.16	256.36	256.56	256.14	257.13
6-Oct-20	257.77	256.30	256.78	256.35	256.53	256.03	-
18-May-21	258.07	256.62	256.16	256.90	255.98	256.05	257.37
22-Sep-21	258.16	256.12	256.06	256.30	256.48	256.01	-

1. Zone 18, accurate to +/- 5.0 metres.



Table 3 - Groundwater Quality

Unit	RDL	PWQC	MW12-5B	MW12-5B	MW12-5B	MW12-5B	MW12-5B	MW12-5B	MW12-5B	MW12-5B	MW12-5B	MW12-5B	MW12-5B	MW12-5B	MW12-5B	MW12-5B	MW12-5B	MW12-5B	MW12-5B	MW12-5B	MW12-5B
			2012-05-30	2012-11-23	2013-05-16	2013-11-04	2014-06-25	2014-11-19	2015-05-27	2015-11-10	2016-04-13	2016-10-03	2017-05-03	2017-09-20	2018-05-23	2018-10-16	2019-10-08	2020-06-02	2020-10-06	2021-05-18	2021-09-22
Metals																					
Arsenic (Filtered)	µg/L	5	-	1.1	-	0.9	-	0.7	0.9	0.8	0.8	0.6	1	0.8	0.7	1	0.9	0.8	0.9	0.8	1.2
Barium (Filtered)	µg/L	1	68	46	50	56	59	54	55	100	134	140	157	169	229	195	208	210	199	203	222
Boron (Filtered)	µg/L	200	165	239	67	7	117	63	6	41	120	95	154	143	184	156	269	289	261	298	277
Calcium (Filtered)	µg/L	20	78,500	59,100	66,000	62,700	72,200	69,700	73,400	89,600	111,000	110,000	120,000	123,000	131,000	128,000	141,000	139,000	137,000	137,000	105,000
Cadmium (Filtered)	µg/L	0.02	-	<0.02	-	<0.02	-	<0.02	0.02	<0.02	<0.02	0.02	<0.014	<0.014	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.016
Chloride	µg/L	500	5,200	1,900	1,600	1,900	2,400	4,500	5,200	6,500	13,800	12,600	16,100	15,000	22,300	22,600	26,000	19,900	17,600	16,500	13,500
Chromium (III+VI) (Filtered)	µg/L	1	-	<2	-	<2	-	<2	<2	<2	<2	<2	5	<1	<1	<1	<1	<1	<1	<1	1
Copper (Filtered)	µg/L	0.1	-	<2	-	<2	-	<2	<2	<2	<0.1	<0.1	0.2	<0.1	<0.1	0.1	<0.1	0.1	4.1	0.6	0.4
Iron (Filtered)	µg/L	5	756	835	1,030	533	931	266	175	479	555	391	738	729	<5	719	1,130	1,300	1,260	1,190	<5
Lead (Filtered)	µg/L	0.02	-	0.02	-	0.02	-	0.02	<0.02	<0.02	<0.02	0.03	<0.02	0.03	<0.02	0.03	0.03	0.11	0.07	0.05	0.05
Manganese (Filtered)	µg/L	1	417	342	262	156	466	204	40	58	52	52	56	56	69	54	58	56	60	56	21
Magnesium (Filtered)	µg/L	20	16,100	13,300	15,200	14,100	15,700	16,700	18,900	20,800	26,400	25,300	29,100	29,900	33,400	29,500	34,200	35,600	32,700	34,700	32,100
Mercury (Filtered)	µg/L	0.02	-	<0.02	-	<0.02	-	<0.02	<0.02	<0.02	0.04	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phosphorus total (P2O5)	µg/L	30	-	9,740	-	6,420	-	30,700	4,890	2,440	8,030	5,770	9,850	30,800	6,520	11,300	-	-	-	-	-
Phosphorus (Filtered)	µg/L	100	30	-	-	-	-	-	-	-	-	-	-	-	<100	<100	<100	<100	<100	<100	<100
Potassium (Filtered)	µg/L	100	1,700	1,900	1,900	2,000	2,300	4,000	2,000	2,400	2,400	2,700	2,400	3,400	3,600	3,300	3,800	3,400	3,500	3,300	4,700
Sodium (Filtered)	µg/L	200	3,000	2,000	1,900	1,700	2,500	13,800	2,100	3,300	5,800	7,700	7,200	10,800	9,900	15,300	16,600	15,600	14,600	15,800	15,500
Zinc (Filtered)	µg/L	5	20	18	-	9	-	9	9	22	37	48	51	43	33	46	60	44	49	59	<5
Inorganics																					
Alkalinity (as CaCO3)	mg/L	5	256	233	220	195	215	223	236	244	325	282	354	306	351	336	410	406	360	403	373
Hardness (as CaCO3) (Filtered)	mg/L	1	262	203	228	215	245	-	261	309	386	379	420	430	465	441	493	493	477	484	394
Solids - Total Dissolved (TDS)	mg/L	1	287	248	238	227	249	277	289	310	406	381	449	401	441	435	497	475	468	453	453
Oxygen Demand - Chemical (COD)	mg/L	5	40,600	1,330	979	505	12	712	162	34	84	81	94	72	27	<5	112	160	158	123	56
Solids - Total Suspended (TSS)	mg/L	3	127,000	62,000	47,700	10,900	3,060	47,800	15,400	9,600	9,700	21,000	10,600	8,800	47,000	35,000	19,800	9,700	22,500	19,600	13,500
Organic Carbon - Dissolved (DOC) (Filtered)	mg/L	0.2	16.2	2	2.5	3.1	5.4	2.8	1.1	0.8	1.1	1.5	2.3	5.5	3.6	3.4	4.7	4.3	3	3.9	3.4
Oxygen Demand - Biological (BOD)	mg/L	2	30	16	9	2	2	5	2	2	2	2	2	2	2	2	2	2	2	2	2
Sulphate (Filtered)	mg/L	1	11	19	16	20	17	34	39	44	57	57	57	51	70	70	78	70	69	67	61
Ammonia, Unionized (Field)	mg/L	0.02	0.261	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Ammonia	mg/L	0.01	0.57	0.125	0.168	0.026	0.22	0.07	0.09	0.04	0.15	0.1	0.02	0.03	<0.01	0.07	0.09	0.1	0.04	<0.01	0.17
Nitrate (as N)	mg/L	0.05	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Nitrite (as N)	mg/L	0.05	-	<0.1	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen (TKN)	mg/L	0.1	-	2.1	-	0.1	-	9.8	0.4	0.3	0.3	0.4	0.5	0.3	0.4	0.4	0.3	0.2	0.4	5.9	<0.5
Conductivity (lab)	µS/cm	1	521	450	432	412	452	503	526	563	738	656	816	729	836	826	904	896	884	858	857
pH (Lab)	-	6.5-8.5	7.36	7.79	7.82	8.06	7.92	8.02	7.94	8.08	7.99	7.87	7.93	8.04	8	7.92	7.76	7.86	7.98	7.98	7.98
Field																					
DO (Field)	mg/L	5	-	-	-	-	-	2.45	8.4	-	7.97	0.94	1.03	2.8	0.7	2.1	0.71	2.35	2.23	0.93	-
Redox Potential (Field)	mV	-	-	-	-	-	-	88	119	45	-22	128	151	121	52	189	125	171	68	190	-
Temp (Field)	°C	-	19	10.9	1.95	8.2	12.2	4.6	7.82	11.4	8.8	13	10.3	13.1	12.6	10.9	11.4	7.7	13.1	9.7	12.2
Conductivity (field)	µS/cm	-	443	860	253	262	351	267	530	520	710	720	740	750	860	820	770	560	690	744	814
pH (Field)	-	6.5-8.5	9.36	8.02	7.68	8.64	7.74	7.13	7.78	7.79	7.61	7.47	7.41	7.25	7.39	7.4	7.32	7.19	7.06	7.31	7.01



Table 3 - Groundwater Quality

Metals	Unit	RWQO	MW14-1R	MW14-1R	MW14-1R	MW14-1R	MW14-1R	MW14-1R	MW14-1R	MW14-1R	MW14-1R	MW14-1R	MW14-1R	MW14-1R	MW14-1R
			2014-06-25	2014-11-19	2015-05-27	2015-11-10	2016-04-13	2017-05-03	2017-08-20	2018-05-23	2018-10-16	2019-05-15	2020-06-02	2020-10-06	2021-05-18
Arsenic (Filtered)	µg/L	0.1	-	0.9	0.2	0.1	<0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Barium (Filtered)	µg/L	1	93	52	61	58	49	45	56	45	42	34	31	54	40
Boron (Filtered)	µg/L	5	200	46	67	23	34	23	24	25	26	26	14	23	23
Calcium (Filtered)	µg/L	20	112,000	94,000	125,000	110,000	110,000	96,600	109,000	97,300	83,100	79,300	74,600	115,000	84,700
Cadmium (Filtered)	µg/L	0.02	-	0.29	0.29	0.39	0.25	0.401	0.574	0.426	0.454	0.32	0.189	0.373	0.224
Chloride	µg/L	500	67,200	73,700	41,600	81,800	47,100	44,100	73,800	32,500	55,400	33,000	24,400	107,000	26,000
Chromium (III+VI) (Filtered)	µg/L	1	-	<2	<2	<2	<2	<1	<1	<1	<1	<1	<1	<1	<1
Copper (Filtered)	µg/L	0.1	-	<2	0.4	0.5	0.6	0.8	0.5	0.4	0.3	0.4	0.5	0.4	1.1
Iron (Filtered)	µg/L	5	300	223	19	<5	<5	<5	6	<5	<5	<5	61	7	
Lead (Filtered)	µg/L	0.02	-	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.11	
Manganese (Filtered)	µg/L	1	3,270	943	62	9	10	<1	21	13	26	1	10	13	
Magnesium (Filtered)	µg/L	20	16,400	16,300	20,400	17,300	17,600	15,800	16,700	15,200	12,400	12,600	11,700	17,900	
Mercury (Filtered)	µg/L	0.02	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Phosphorus total (P2O5)	µg/L	30	-	29,000	600	318	220	80	190	69	190	10	-	-	
Phosphorus (Filtered)	µg/L	100	30	-	-	-	-	-	-	-	-	-	<100	<100	
Potassium (Filtered)	µg/L	100	2,800	5,700	1,400	1,400	1,200	1,100	1,700	1,300	1,400	1,200	1,200	1,600	
Sodium (Filtered)	µg/L	200	50,500	58,900	40,900	37,500	40,500	35,500	44,600	39,200	45,000	35,500	22,900	37,400	
Zinc (Filtered)	µg/L	5	20	-	101	206	192	163	131	147	126	90	94	55	
Inorganics															
Alkalinity (as CaCO3)	mg/L	5	326	262	367	291	360	328	257	303	248	239	228	255	
Hardness (as CaCO3) (Filtered)	mg/L	1	347	-	396	345	347	306	341	306	259	250	235	357	
Solids - Total Dissolved (TDS)	mg/L	1	458	400	449	448	446	435	425	320	350	300	267	458	
Oxygen Demand - Chemical (COD)	mg/L	5	2,110	386	60	37	<5	<5	<5	5	7	5	7	<5	
Solids - Total Suspended (TSS)	mg/L	3	1,490	85,800	1,660	6,700	130	67	244	31	366	30	7	25	
Organic Carbon - Dissolved (DOC) (Filtered)	mg/L	0.2	6	2.7	0.3	0.6	0.7	10	3	1.6	3	3.1	6.1	2.4	
Oxygen Demand - Biological (BOD)	mg/L	3	3	<2	<2	<2	3	<2	<2	2	<3	<3	<3	<3	
Sulphate (Filtered)	mg/L	1	8	9	12	12	8	13	5	5	7	4	4	6	
Ammonia, Unionized (Field)	mg/L	0.02	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
Ammonia	mg/L	0.01	0.24	0.12	0.03	<0.01	0.05	<0.01	0.01	0.02	0.03	<0.01	<0.01	<0.01	
Nitrate (as N)	mg/L	0.05	0.1	0.1	0.1	<0.1	<0.1	<0.05	0.07	<0.05	0.18	<0.05	<0.05	0.05	
Nitrite (as N)	mg/L	0.05	-	<0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
Total Kjeldahl Nitrogen (TKN)	mg/L	0.1	-	43.9	0.9	0.2	0.1	<0.1	0.2	0.1	0.2	<0.1	<0.1	<0.1	
Conductivity (lab)	µS/cm	1	832	727	817	814	810	790	772	616	673	579	515	867	
pH (Lab)	-	6.5-8.5	7.84	7.88	7.84	8.04	7.87	7.81	7.94	7.84	8.09	7.8	7.74	7.8	
Field															
DO (Field)	mg/L	5	-	-	5.83	7.04	9.78	4.15	5.92	12.0	2.78	2.06	2.33	3.17	
Redox Potential (Field)	mV	-	-	-	99	125	81	122	157	119	109	142	171	128	
Temp (Field)	°C	-	14.7	4.4	14.8	10.8	8	7.2	16.6	10.8	12	8	9.4	12.9	
Conductivity (field)	µS/cm	-	680	17	800	780	800	760	750	700	690	620	550	620	
pH (Field)	-	6.5-8.5	7.71	6.53	7.55	7.64	7.58	7.39	7.31	7.24	7.58	7.84	7.53	6.98	



Table 3 - Groundwater Quality

Unit	RDL	PWQC	MW14-2R	MW14-2R	MW14-2R	MW14-2R	MW14-2R	MW14-2R	MW14-2R	MW14-2R	MW14-2R	MW14-2R	MW14-2R	MW14-2R	MW14-2R	MW14-2R	MW14-2R
			2014-06-25	2014-11-19	2015-05-27	2015-11-10	2016-04-13	2016-10-03	2017-05-03	2017-09-20	2018-05-23	2018-10-16	2019-05-15	2019-10-08	2020-06-02	2020-10-06	2021-05-18
Metals																	
Arsenic (Filtered)	µg/L	0.1	-	0.5	0.2	0.4	0.2	<0.1	0.3	0.2	<0.1	0.1	<0.1	0.1	<0.1	0.1	0.1
Barium (Filtered)	µg/L	1	37	34	34	62	26	35	21	40	23	36	23	32	23	39	24
Boron (Filtered)	µg/L	5	200	43	31	<5	16	<5	12	8	15	5	7	9	10	12	9
Calcium (Filtered)	µg/L	20	113,000	118,000	68,600	161,000	87,500	101,000	76,800	121,000	83,600	113,000	84,200	67,400	75,200	124,000	79,600
Cadmium (Filtered)	µg/L	0.02	-	0.04	0.02	0.03	<0.02	<0.02	<0.014	<0.014	<0.015	0.016	<0.015	<0.015	<0.015	<0.015	<0.015
Chloride	µg/L	500	39,400	44,100	16,100	34,200	56,700	15,900	46,300	41,000	44,900	41,600	48,200	43,500	20,200	32,500	11,400
Chromium (III+VI) (Filtered)	µg/L	1	-	<2	<2	<2	8	<2	<1	1	<1	1	<1	<1	<1	2	<1
Copper (Filtered)	µg/L	0.1	-	2	2.5	0.9	0.8	0.7	0.2	3	0.3	0.5	0.3	1.5	2.7	1.1	2.6
Iron (Filtered)	µg/L	5	300	<5	<5	28	69	229	13	517	15	1,060	104	142	12	304	267
Lead (Filtered)	µg/L	0.02	-	<0.02	0.03	<0.02	0.05	<0.02	<0.02	0.43	<0.02	<0.02	<0.02	0.03	0.04	<0.02	0.02
Manganese (Filtered)	µg/L	1	295	2,040	2	101	9	96	2	40	3	124	8	41	4	41	14
Magnesium (Filtered)	µg/L	20	15,800	17,300	14,500	23,700	12,800	14,200	11,500	17,400	12,400	16,500	13,200	14,000	12,100	19,400	12,700
Mercury (Filtered)	µg/L	0.02	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phosphorus total (P2O5)	µg/L	30	-	16,600	20	29	30	90	19	20	<10	30	10	-	-	-	-
Phosphorus (Filtered)	µg/L	100	30	-	-	-	-	-	-	-	-	-	-	<100	<100	<100	<100
Potassium (Filtered)	µg/L	100	1,900	4,900	1,200	1,500	800	900	500	1,100	600	900	600	900	700	900	700
Sodium (Filtered)	µg/L	200	20,200	41,500	23,700	34,600	17,100	25,900	15,600	28,600	12,600	20,200	13,900	19,800	14,200	15,700	6,400
Zinc (Filtered)	µg/L	5	20	-	12	<5	<5	19	<5	<5	9	<5	<5	<5	<5	<5	<5
Inorganics																	
Alkalinity (as CaCO3)	mg/L	5	265	376	293	502	217	300	193	327	200	317	199	245	217	344	238
Hardness (as CaCO3) (Filtered)	mg/L	1	348	-	306	499	271	310	236	374	261	350	265	301	237	390	251
Solids - Total Dissolved (TDS)	mg/L	1	353	473	332	557	323	336	307	420	274	390	285	313	251	411	240
Oxygen Demand - Chemical (COD)	mg/L	5	11	166	<5	36	<5	<5	<5	9	<5	5	<5	<5	<5	<5	<5
Solids - Total Suspended (TSS)	mg/L	3	16,600	62,600	24	20	-3	444	10	26	-3	24	4	9	-3	4	11
Organic Carbon - Dissolved (DOC) (Filtered)	mg/L	0.2	4.2	3.2	0.5	1.2	0.3	1.4	1.7	3.2	1.5	3.1	2.7	3.2	2.3	2	2.2
Oxygen Demand - Biological (BOD)	mg/L	3	5	<2	<2	<2	2	<2	<2	<2	<2	3	<3	<3	<3	<3	<3
Sulphate (Filtered)	mg/L	1	8	4	6	5	5	4	3	2	4	2	5	<1	4	3	3
Ammonia, Unionized (Field)	mg/L	0.02	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Ammonia	mg/L	0.01	0.14	0.09	<0.01	<0.01	0.03	0.03	<0.01	<0.01	<0.01	0.02	0.04	<0.01	0.04	<0.01	<0.01
Nitrate (as N)	mg/L	0.05	0.7	0.1	0.2	0.2	0.3	<0.1	0.2	<0.05	0.11	<0.05	0.34	<0.05	0.07	0.09	0.08
Nitrite (as N)	mg/L	0.05	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen (TKN)	mg/L	0.1	-	12.5	0.1	<0.1	0.2	0.4	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Conductivity (lab)	µS/cm	1	642	860	603	1,010	588	610	558	764	529	747	550	604	485	784	465
pH (Lab)	-	6.5-8.5	7.66	7.75	7.75	7.99	7.96	8.13	7.88	7.85	8.02	7.96	7.8	8.03	7.77	7.84	7.96
Field																	
DO (Field)	mg/L	5	-	-	7.65	9.75	10.62	7.77	10.16	4.37	10.19	2.91	6.96	4.06	6.95	4.34	8.5
Redox Potential (Field)	mV	-	-	-	90	136	67	82	104	149	101	87	123	215	134	72	75
Temp (Field)	°C	-	13.3	8	14.4	11.9	8.8	15.1	6.9	16.3	9.8	12.3	7	13	8.3	11.9	8.3
Conductivity (field)	µS/cm	-	556	285	630	950	600	670	590	670	540	720	580	610	430	760	422
pH (Field)	-	6.5-8.5	7.76	6.78	7.88	7.41	7.64	7.44	7.31	7.2	7.78	7.33	7.56	7.37	7.38	7.22	7.26



Table 3 - Groundwater Quality

	Unit	RDI	PW00	MW14-3R 2014-06-25	MW14-3R 2014-11-19	MW14-3R 2015-05-27	MW14-3R 2015-11-10	MW14-3R 2016-04-13	MW14-3R 2016-10-03	MW14-3R 2017-05-03	MW14-3R 2017-09-20	MW14-3R 2018-05-23	MW14-3R 2018-10-16	MW14-3R 2019-05-15	MW14-3R 2019-10-08	MW14-3R 2020-06-02	MW14-3R 2020-10-06	MW14-3R 2021-05-18	MW14-3R 2021-09-22
Metals																			
Arsenic (Filtered)	µg/L	0.1	5	-	1.1	0.5	0.4	0.2	<0.1	0.3	0.2	0.1	0.2	0.1	0.2	0.1	0.2	0.2	0.3
Barium (Filtered)	µg/L	1		107	44	85	84	59	66	60	62	58	66	63	61	63	58	72	88
Boron (Filtered)	µg/L	5	200	1,090	74	94	50	129	80	147	38	110	40	101	47	69	39	36	26
Calcium (Filtered)	µg/L	20		130,000	132,000	177,000	165,000	128,000	126,000	135,000	122,000	119,000	126,000	125,000	124,000	137,000	120,000	164,000	134,000
Cadmium (Filtered)	µg/L	0.02	0.1 ² to 0.5 ¹¹	-	0.05	0.05	<0.02	<0.02	<0.02	0.014	<0.014	<0.015	0.016	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Chloride	µg/L	500		46,200	45,000	42,900	33,200	30,300	32,500	27,500	29,000	21,200	14,800	17,200	26,300	14,300	16,000	12,000	9,900
Chromium (III+VI) (Filtered)	µg/L	1	8.9	-	<2	<2	<2	<2	2	<1	<1	<1	<1.1	1	<1	<1	<1	<1	<1
Copper (Filtered)	µg/L	0.1	1 ¹ to 5 ¹¹	-	<2	2.7	1.3	16.8	1.2	1.1	0.8	2.9	0.7	0.8	0.7	1.4	1.9	1.7	2.1
Iron (Filtered)	µg/L	5	300	6	30	<5	<5	<5	<5	<5	<5	<5	6	<5	6	<5	17	<5	40
Lead (Filtered)	µg/L	0.02	1 ¹ to 1 ¹ to 5 ¹¹	-	<0.02	0.03	<0.02	0.14	0.03	<0.02	<0.02	0.14	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	0.04
Manganese (Filtered)	µg/L	1		1,480	31	99	46	6	19	2	3	1	79	<1	6	1	9	6	48
Magnesium (Filtered)	µg/L	20		22,700	22,000	28,300	24,600	20,500	19,300	20,900	18,400	17,700	17,700	19,000	16,000	20,800	17,200	23,000	16,700
Mercury (Filtered)	µg/L	0.02	0.2	-	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phosphorus total (P2O5)	µg/L	30		-	16,000	2,180	140	60	50	40	10	1,380	10,800	<10	-	-	-	-	-
Phosphorus (Filtered)	µg/L	100	30	-	-	-	-	-	-	-	-	-	-	<100	<100	<100	<100	<100	<100
Potassium (Filtered)	µg/L	100		2,500	2,100	1,700	1,900	1,300	1,700	1,100	1,600	1,200	1,600	1,300	1,500	1,400	1,400	1,400	1,500
Sodium (Filtered)	µg/L	200		26,700	23,400	26,700	26,800	25,100	28,700	21,900	18,900	18,600	18,600	17,400	16,300	14,100	11,900	12,400	11,200
Zinc (Filtered)	µg/L	5	20	-	<5	5	<5	6	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	5
Inorganics																			
Alkalinity (as CaCO3)	mg/L	5		400	384	464	472	379	365	394	314	331	365	328	340	393	330	460	367
Hardness (as CaCO3) (Filtered)	mg/L	1		419	-	559	488	403	394	422	381	370	388	391	384	428	371	479	412
Solids - Total Dissolved (TDS)	mg/L	1		526	490	567	539	461	435	493	396	381	391	381	382	411	374	443	394
Oxygen Demand - Chemical (COD)	mg/L	5		374	145	53	39	<5	<5	7	5	57	<5	7	<5	14	<5	<5	32
Solids - Total Suspended (TSS)	mg/L	3		66,900	19,600	6,100	242	52	34	58	16	5,000	16,200	4	<0	<3	209	7	<3
Organic Carbon - Dissolved (DOC) (Filtered)	mg/L	0.2		9.4	3.9	1.4	1.8	1.5	1.6	1.4	4.8	9.1	5.3	3.8	3.3	3.8	2.3	3.4	4.5
Oxygen Demand - Biological (BOD)	mg/L	3		5	<2	<2	<2	2	<2	<2	<2	<2	2	<3	<3	<3	<3	<3	<3
Sulphate (Filtered)	mg/L	1		42	26	36	13	29	11	28	5	17	6	28	5	11	6	5	4
Ammonia, Unionized (Field)	mg/L	0.02		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Ammonia	mg/L	0.01		0.09	0.06	0.04	<0.01	0.03	0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.05	<0.01	<0.01	<0.01	0.3
Nitrate (as N)	mg/L	0.05		0.4	0.1	0.2	<0.1	0.4	0.3	2.79	0.11	0.48	<0.05	0.79	0.09	0.17	<0.05	0.09	<0.05
Nitrite (as N)	mg/L	0.05		-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen (TKN)	mg/L	0.1		-	10.1	0.7	0.2	0.7	0.2	0.2	0.1	0.3	1.4	0.2	<0.1	0.2	<0.1	0.1	1
Conductivity (lab)	µS/cm	1		956	890	1,030	980	839	790	896	720	730	749	730	733	783	718	840	754
pH (Lab)	-		6.5-8.5	7.51	7.54	7.41	7.73	7.63	7.98	7.55	7.71	7.85	7.93	7.46	7.82	7.55	7.74	7.77	7.6
Field																			
DO (Field)	mg/L	5		-	-	1.96	6.2	5.45	2.98	5.54	1.77	4.24	2.3	4.7	2.9	2.37	3.27	1.39	2.07
Redox Potential (Field)	mV			-	-	109	128	69	83	121	152	117	82	134	211	124	66	125	82
Temp (Field)	°C			13	7.9	11.7	13.1	11.8	14.7	7.7	14.9	19.7	12	8	13.5	9	11.9	10.4	12.7
Conductivity (field)	µS/cm			935	560	920	910	810	810	900	730	740	770	750	670	560	750	391	681
pH (Field)	-		6.5-8.5	7.14	6.59	7.02	7.28	7.14	7.07	7.13	7.09	7.08	7.14	7.08	6.97	6.92	-	6.89	7.21



Table 3 - Groundwater Quality

Unit	RWQO	MW14-4R	MW14-4R	MW14-4R	MW14-4R	MW14-4R	MW14-4R	MW14-4R	MW14-4R	MW14-4R	MW14-4R	MW14-4R	MW14-4R	MW14-4R	MW14-4R	MW14-4R	MW14-4R		
		2014-06-25	2014-11-19	2015-05-27	2015-11-10	2016-04-13	2016-10-03	2017-05-03	2017-09-20	2018-05-23	2018-10-16	2019-05-15	2019-10-08	2020-06-02	2020-10-06	2021-05-18	2021-09-22		
Metals																			
Arsenic (Filtered)	µg/L	0.1	-	0.4	0.4	0.3	<0.1	0.2	0.1	<0.1	0.1	0.1	<0.1	0.2	0.1	0.1	0.1		
Barium (Filtered)	µg/L	1	75	60	95	157	83	112	49	53	28	64	42	86	40	72	105	80	
Boron (Filtered)	µg/L	5	200	315	494	367	1,300	379	545	244	179	43	187	158	392	111	180	512	274
Calcium (Filtered)	µg/L	20	121,000	150,000	162,000	216,000	150,000	165,000	88,700	89,200	58,800	108,000	80,900	139,000	75,100	120,000	162,000	136,000	
Cadmium (Filtered)	µg/L	0.02	-	0.04	0.04	0.06	<0.02	<0.02	<0.014	<0.014	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	
Chloride	µg/L	500	6,600	15,100	19,300	38,400	12,300	30,400	2,300	1,700	1,100	6,100	1,600	1,800	2,600	4,700	5,000	4,300	
Chromium (III+VI) (Filtered)	µg/L	1	-	3	<2	<2	<2	<2	<1	2	2	<1	2	<1	<1	1	<1	<1	
Copper (Filtered)	µg/L	0.1	-	<2	3.7	4	4.9	2.1	1.1	0.9	0.6	1.2	0.7	2.2	1.8	2.2	5.5	5.1	
Iron (Filtered)	µg/L	5	300	58	40	<5	<5	<5	10	<5	<5	9	<5	7	<5	128	<5	7	
Lead (Filtered)	µg/L	0.02	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.04	0.03	0.11	<0.02	0.05	
Manganese (Filtered)	µg/L	1	2,310	17	307	533	304	301	93	<1	<1	<1	<1	1	<1	7	<1	1	
Magnesium (Filtered)	µg/L	20	18,400	27,400	27,700	38,200	28,300	28,100	16,400	15,200	9,310	17,200	13,100	22,000	11,400	17,300	21,600	17,600	
Mercury (Filtered)	µg/L	0.02	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Phosphorus total (P2O5)	µg/L	30	-	11,300	1,216	316	276	120	180	180	1,290	580	10	-	-	-	-	-	
Phosphorus (Filtered)	µg/L	100	30	-	-	-	-	-	-	-	-	-	<100	<100	<100	<100	<100		
Potassium (Filtered)	µg/L	100	3,000	2,900	2,900	3,900	2,700	3,600	1,900	2,900	1,600	3,100	2,500	4,100	2,700	3,800	4,400	4,100	
Sodium (Filtered)	µg/L	200	13,800	23,600	20,500	42,900	15,500	28,400	12,800	9,800	1,900	6,100	5,700	13,100	3,400	4,800	11,300	6,700	
Zinc (Filtered)	µg/L	5	20	<5	<5	20	<5	<5	7	<5	<5	5	<5	<5	<5	<5	<5	<5	
Inorganics																			
Alkalinity (as CaCO3)	mg/L	5	360	416	414	608	380	391	278	238	165	277	215	347	213	293	410	304	
Hardness (as CaCO3) (Filtered)	mg/L	1	378	-	520	698	492	529	289	285	185	341	256	438	235	371	493	397	
Solids - Total Dissolved (TDS)	mg/L	1	393	548	544	749	530	555	328	282	170	329	241	421	228	364	458	365	
Oxygen Demand - Chemical (COD)	mg/L	5	3,390	559	52	22	17	14	14	15	46	9	9	7	13	<5	<5	<5	
Solids - Total Suspended (TSS)	mg/L	3	42,700	39,800	2,600	760	380	236	176	300	280	21,900	34	30	8	24	33	32	
Organic Carbon - Dissolved (DOC) (Filtered)	mg/L	0.2	6.9	6	4.4	5.4	2.9	3.2	2.3	3	3.2	4.9	4.2	4.6	5.9	2.9	4.5	5.6	
Oxygen Demand - Biological (BOD)	mg/L	3	5	<2	3	<2	8	<2	<2	<2	<2	2	<3	<3	<3	<3	<3	<3	
Sulphate (Filtered)	mg/L	1	53	86	80	96	110	102	25	16	4	34	22	72	11	48	73	47	
Ammonia, Unionized (Field)	mg/L	0.02	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
Ammonia	mg/L	0.01	0.34	0.06	0.04	0.02	0.04	<0.01	<0.01	0.02	0.03	0.02	0.05	0.01	<0.01	0.01	0.01	0.01	
Nitrate (as N)	mg/L	0.05	2.7	5.1	5.8	2.2	6.8	5.5	1.32	0.79	0.23	1.6	0.65	2.34	0.73	1.25	2.71	1.29	
Nitrite (as N)	mg/L	0.05	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
Total Kjeldahl Nitrogen (TKN)	mg/L	0.1	-	12.5	1.2	1	6.8	0.6	0.4	0.4	1.9	0.6	<0.1	0.3	0.1	0.1	0.3	0.3	
Conductivity (lab)	µS/cm	1	715	996	989	1,360	964	1,010	597	512	330	634	467	801	442	700	866	702	
pH (Lab)	-	6.5-8.5	7.58	7.6	7.55	7.46	7.7	7.95	7.76	7.86	8.13	8.04	7.76	7.86	7.83	7.81	7.9	7.8	
Field																			
DO (Field)	mg/L	5	-	-	2.39	4.49	3.35	1.59	1.98	2.92	7.37	5.12	3.41	1.94	6.53	0.45	2.64	5.1	
Redox Potential (Field)	mV	-	-	-	101	145	42	51	126	150	115	54	128	209	147	125	102	186	
Temp (Field)	°C	-	11.2	2.9	10	12.4	6.7	13.7	7.5	14.4	9.3	12	7	13.6	8.5	13	11.9	11.3	
Conductivity (field)	µS/cm	-	551	116	970	1,270	960	1,040	540	490	360	800	520	710	500	750	395	681	
pH (Field)	-	6.5-8.5	7.78	7.28	7.04	7.13	7.18	7.02	7.33	7.19	7.78	7.68	7.58	7.04	7.8	8.02	7.13	7.02	



Table 3 - Groundwater Quality

Unit	RWQO	MW14-6R	MW14-6R	MW14-6R	MW14-6R	MW14-6R	MW14-6R	MW14-6R	MW14-6R	MW14-6R	MW14-6R	MW14-6R	MW14-6R	MW14-6R	MW14-6R	MW14-6R	MW14-6R
		2014-06-25	2014-11-19	2015-05-27	2015-11-10	2016-04-13	2016-10-03	2017-05-03	2017-09-20	2018-05-23	2018-10-16	2019-05-15	2019-10-08	2020-06-02	2020-10-06	2021-05-18	2021-09-22
Metals																	
Arsenic (Filtered)	µg/L	0.1	5	0.8	0.8	0.5	0.6	0.4	0.6	0.6	0.4	0.4	0.3	0.5	0.3	0.3	0.5
Barium (Filtered)	µg/L	1	90	34	79	92	86	133	152	124	184	196	186	177	186	189	200
Boron (Filtered)	µg/L	5	200	45	21	<5	7	14	11	23	18	32	40	42	38	55	42
Calcium (Filtered)	µg/L	20	102,000	42,000	82,500	78,400	84,900	106,000	133,000	85,200	139,000	134,000	142,000	134,000	133,000	135,000	139,000
Cadmium (Filtered)	µg/L	0.02	0.1*	0.03	0.03	<0.02	<0.02	<0.02	<0.014	<0.014	0.031	<0.015	0.017	<0.015	<0.015	0.028	0.017
Chloride	µg/L	500	13,400	4,000	8,100	10,900	12,200	13,800	15,400	13,000	21,400	21,300	24,500	23,500	21,700	21,300	23,300
Chromium (III+VI) (Filtered)	µg/L	1	8.9	2	2	<2	<2	<2	<1	<1	<1	<1	2	<1	<1	<1	<1
Copper (Filtered)	µg/L	0.1	1*	3	2	0.6	3.1	4.2	0.6	0.4	6.3	0.7	0.7	1.7	4.4	1.6	1.1
Iron (Filtered)	µg/L	5	300	269	31	39	36	10	8	112	6	40	66	32	282	83	104
Lead (Filtered)	µg/L	0.02	1*	<0.02	0.06	<0.02	<0.02	0.1	<0.02	<0.02	0.28	<0.02	0.03	0.05	0.07	<0.02	0.13
Manganese (Filtered)	µg/L	1	838	240	491	107	170	231	294	173	280	310	311	287	158	254	229
Magnesium (Filtered)	µg/L	20	21,400	20,900	22,300	22,500	23,300	28,700	37,900	42,100	38,600	39,900	40,800	37,800	40,100	39,300	41,800
Mercury (Filtered)	µg/L	0.02	0.2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phosphorus total (P2O5)	µg/L	30	-	50,500	140	290	90	40	10,300	160	50	3,260	20	-	-	-	-
Phosphorus (Filtered)	µg/L	100	30	-	-	-	-	-	-	-	-	-	-	<100	<100	<100	<100
Potassium (Filtered)	µg/L	100	2,900	4,400	2,100	2,100	1,900	2,500	2,100	4,000	2,500	3,000	2,600	3,000	2,800	2,900	2,700
Sodium (Filtered)	µg/L	200	8,100	13,200	3,600	3,500	4,100	4,400	5,900	6,800	8,400	6,900	9,300	8,800	7,900	9,300	6,500
Zinc (Filtered)	µg/L	5	20	51	77	19	12	7	18	8	18	12	22	8	<5	6	5
Inorganics																	
Alkalinity (as CaCO3)	mg/L	5	273	175	242	246	257	281	418	322	409	407	418	408	433	426	455
Hardness (as CaCO3) (Filtered)	mg/L	1	344	-	296	288	308	384	487	386	506	487	523	490	498	499	520
Solids - Total Dissolved (TDS)	mg/L	1	332	207	287	297	309	331	464	375	442	457	470	452	466	486	467
Oxygen Demand - Chemical (COD)	mg/L	5	8,810	1,170	230	42	12	5	519	16	13	46	136	119	10	192	<5
Solids - Total Suspended (TSS)	mg/L	3	12,000	17,800	3,000	128	126	-	2,340	16,600	81	13,600	1,740	11,100	43	50	3,410
Organic Carbon - Dissolved (DOC) (Filtered)	mg/L	0.2	13.5	4.9	3.5	1.1	1.1	1.9	2.6	5	8.7	6.4	5.4	5.8	4.8	3.3	8.2
Oxygen Demand - Biological (BOD)	mg/L	3	16	7	7	<2	<2	-	<2	3	<2	3	<2	<2	<2	<2	<2
Sulphate (Filtered)	mg/L	1	22	15	24	25	26	25	25	19	25	24	23	20	22	22	23
Ammonia, Ionized (Field)	mg/L	0.02	0.009	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006
Ammonia	mg/L	0.01	1.19	0.35	0.16	0.04	0.02	0.06	0.09	0.05	<0.01	0.08	0.05	0.15	0.07	0.08	<0.01
Nitrate (as N)	mg/L	0.05	0.4	0.3	0.6	0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	0.17	<0.05	0.05	<0.05	0.03
Nitrite (as N)	mg/L	0.05	-	<0.1	0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen (TKN)	mg/L	0.1	-	1.98	<0.1	0.8	0.4	0.3	10	0.5	0.2	2.6	0.11	0.2	1.6	2.7	0.2
Conductivity (lab)	µS/cm	1	603	377	522	540	562	602	843	682	839	865	888	856	880	916	882
pH (Lab)	-	6.5-8.5	7.57	8.14	8.03	8.1	8.25	8.25	8.16	7.98	8.27	8.1	7.62	8.12	7.96	7.96	8.05
Field																	
DO (Field)	mg/L	5	-	-	4.45	5.43	7.03	-	-	-	7.55	4.21	3.98	5.34	6.41	6.77	6.92
Redox Potential (Field)	mV	-	-	-	111	116	53	-	-	-	114	54	124	216	163	80	68
Temp (Field)	°C	-	13.1	7.2	11.3	12.7	8.8	-	-	-	17.2	12.1	12	12.7	11.8	11.5	21.1
Conductivity (field)	µS/cm	-	489	577	500	640	540	-	-	-	685	850	710	850	810	780	665
pH (Field)	-	6.5-8.5	7.53	6.72	7.61	7.91	7.59	-	-	-	7.98	7.49	7.64	7.42	7.58	7.22	7.62



Table 3 - Groundwater Quality

	Unit	RDL	PWQC	MW14-7R 2014-06-25	MW14-7R 2015-05-27	MW14-7R 2016-04-13	MW14-7R 2017-06-03	MW14-7R 2018-05-23	MW14-7R 2019-05-15	MW14-7R 2020-06-02	MW14-7R 2021-05-16
Metals											
Arsenic (Filtered)	µg/L	0.1	5	-	0.2	<0.1	0.3	0.2	0.1	0.1	0.1
Barium (Filtered)	µg/L	1		35	28	17	20	26	22	28	34
Boron (Filtered)	µg/L	5	200	54	14	12	20	24	20	21	28
Calcium (Filtered)	µg/L	20		89 900	83 800	58 200	64 900	73 100	73 000	81 100	83 700
Cadmium (Filtered)	µg/L	0.02	0.1**/0.5**	-	0.03	<0.02	<0.014	<0.015	<0.015	<0.015	<0.015
Chloride	µg/L	500		4 300	3 600	2 400	1 500	1 700	12 000	4 100	4 000
Chromium (III+VI) (Filtered)	µg/L	1	8.9	-	<2	<2	15	<1	1	<1	<1
Copper (Filtered)	µg/L	0.1	1**/5**	-	1.3	0.9	<0.1	2.3	0.5	1.3	1.4
Iron (Filtered)	µg/L	5	300	38	<5	<5	20	12	<5	<5	<5
Lead (Filtered)	µg/L	0.02	1**/1**/5**	-	<0.02	<0.02	<0.02	0.13	<0.02	0.04	<0.02
Manganese (Filtered)	µg/L	1		846	14	<1	93	18	5	16	2
Magnesium (Filtered)	µg/L	20		13 600	14 000	8 830	10 400	11 500	11 100	12 500	13 000
Mercury (Filtered)	µg/L	0.02	0.2	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phosphorus total (P2O5)	µg/L	30		-	1 660	20	30	30	10	-	-
Phosphorus (Filtered)	µg/L	100	30	-	-	-	-	-	-	<100	<100
Potassium (Filtered)	µg/L	100		1 800	800	600	500	700	800	1 100	1 100
Sodium (Filtered)	µg/L	200		2 700	2 200	1 800	1 900	1 800	1 600	1 600	3 100
Zinc (Filtered)	µg/L	5	20	-	<5	<5	<5	<5	<5	<5	<5
Inorganics											
Alkalinity (as CaCO3)	mg/L	5		256	247	169	203	217	178	229	248
Hardness (as CaCO3) (Filtered)	mg/L	1		281	292	182	205	230	228	254	263
Solids - Total Dissolved (TDS)	mg/L	1		296	274	192	224	218	208	231	237
Oxygen Demand - Chemical (COD)	mg/L	5		57	61	<5	7	13	<5	5	<5
Solids - Total Suspended (TSS)	mg/L	3		16 300	20 900	5	6	6	<3	<3	6
Organic Carbon - Dissolved (DOC) (Filtered)	mg/L	0.2		15.8	4.1	1.9	4	10.8	6.4	6.9	3.9
Oxygen Demand - Biological (BOD)	mg/L	3		3	4	<2	<2	<2	<3	<3	<3
Sulphate (Filtered)	mg/L	1		13	12	8	11	3	10	3	3
Ammonia, Unionized (Field)	mg/L	0.02		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Ammonia	mg/L	0.01		0.19	0.03	<0.01	<0.01	<0.01	0.06	<0.01	<0.01
Nitrate (as N)	mg/L	0.05		<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	0.07	<0.05
Nitrite (as N)	mg/L	0.05		-	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen (TKN)	mg/L	0.1		-	1.2	0.2	0.1	0.2	<0.1	0.3	0.1
Conductivity (lab)	µS/cm	1		539	499	349	408	423	403	447	458
pH (Lab)	-		6.5-8.5	7.78	7.92	7.81	7.82	7.78	7.62	7.52	7.87
Field											
DO (Field)	mg/L	5		-	8.17	5.12	4.92	3.07	1.47	6.68	2.44
Redox Potential (Field)	mV			-	84	58	135	116	122	162	117
Temp (Field)	°C			10.8	12.0	8.4	8.9	9	9	8.5	9.4
Conductivity (field)	µS/cm			301	470	370	370	430	460	500	203
pH (Field)	-		6.5-8.5	7.77	7.71	7.45	7.46	7.1	7.24	7.38	7.26



Table 4 - Surface Water Quality

Unit	RDL	Ardoch SW 75th	Ardoch SW Trigger	PWGO	SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1
					2006-05-31	2006-11-03	2008-05-01	2008-08-14	2008-11-11	2009-04-29	2009-10-08	2010-04-05	2010-10-08	2011-08-01	2012-11-20	2013-05-16	2013-10-30	2014-06-10	2014-08-21
Metals																			
Arsenic	µg/L	0.1	0.55	5	-	42	-	-	<0.5	-	<0.5	-	<0.5	-	1.3	-	0.8	-	1.4
Barium	µg/L	1	16	200	-	17	-	-	24	-	33	-	32	-	65	-	45	-	56
Boron	µg/L	5	6	200	-	39	-	-	18	-	69	-	47	-	247	-	69	-	176
Calcium	µg/L	20	12975		-	-	99,300	39,000	50,500	44,300	53,100	30,000	53,200	46,600	98,100	35,600	67,300	57,400	-
Cadmium	µg/L	0.02	0.1	0.1	0.1*	0.5*	-	-	<0.1	-	<0.1	-	-	-	0.21	-	0.06	-	0.06
Chloride	µg/L	500	1000		8,000	7,000	5,000	7,000	10,000	7,000	15,000	5,000	6,000	2,000	18,200	5,600	23,300	11,200	17,400
Chromium (III+VI)	µg/L	1	2	8.9	-	<2	-	-	<1	-	<2	-	<2	-	<2	-	<2	-	<2
Copper	µg/L	0.1	2	2	1*	5*	-	-	<2	-	<2	-	<2	-	3	-	<2	-	2.9
Iron	µg/L	5	354	354	300	16	36	68	52	150	3,520	119	235	232	177	917	278	290	87
Lead	µg/L	0.02	0.45	0.45	1*	1*	5*	-	0.5	-	0.5	-	0.2	-	0.6	-	0.4	-	0.99
Manganese	µg/L	1	111		-	-	6	314	-	21	2,010	155	81	92	154	105	81	34	26
Magnesium	µg/L	20	2717		-	-	5,890	8,900	10,100	8,590	11,000	6,180	10,300	8,310	19,900	6,910	18,400	10,500	49
Mercury	µg/L		0.02	0.2	-	<0.1	-	-	<0.02	-	<0.02	-	<0.02	-	<0.02	-	<0.02	-	<0.02
Mercury (Filtered)	µg/L	0.02	0.02	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus total (P2O5)	µg/L	10	50	50	30	40	10	110	40	320	260	50	180	140	400	80	210	150	340
Potassium	µg/L	100	425		-	-	900	500	800	1,300	1,400	900	2,100	1,500	1,700	600	2,300	300	4,800
Sodium	µg/L	200	1750		-	-	4,000	6,900	6,500	6,100	7,900	3,200	5,400	3,600	12,000	4,100	13,900	5,300	8,600
Zinc	µg/L	5	7.5	20	20	-	<5	-	-	<5	-	-	14	-	26	-	6	-	15
Inorganics																			
Alkalinity (as CaCO3)	mg/L	5	38		128	104	88	148	154	118	192	107	153	131	128	108	251	177	85
Hardness (as CaCO3)	mg/L	1	44		-	-	100	136	168	146	178	100	175	149	327	117	294	187	-
Solids - Total Dissolved (TDS)	mg/L		48		187	190	117	179	193	150	248	131	184	154	283	134	323	209	213
Oxygen Demand - Chemical (COD)	mg/L	5	41.5		35	34	14	44	~5	166	50	27	45	30	73	43	50	30	52
Solids - Total Suspended (TSS)	mg/L	3	23		17	32	<2	28	3	40	128	16	28	2	50	10	24	168	28
Organic Carbon - Dissolved (DOC) (Filtered)	mg/L	0.2	11.5		-	-	-	-	-	-	-	-	-	-	-	-	-	-	20.8
Oxygen Demand - Biological (BOD)	mg/L	3	4		7	<2	<2	5	-	<2	<2	<2	<2	<2	2	<2	<2	<2	5
Phenols (AAP)	mg/L	0	0.001	0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sulphate (Filtered)	mg/L	1	3		5	14	9	2	6	8	15	7	3	3	103	5	16	2	78
Ammonia Unionized (Field)	mg/L	0.01		0.02	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ammonia	mg/L	0.01	0.05		<0.05	<0.05	0.19	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.005	0.029	0.011	0.06	0.06
Nitrate (as N)	mg/L	0.05	0.1		0.2	<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	0.3
Nitrite (as N)	mg/L	0.05	0.1		<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Kjeldahl Nitrogen (TKN)	mg/L	0.1	0.6		0.5	0.3	0.5	0.9	0.4	0.8	1.2	0.5	0.8	0.8	1.5	0.7	1	0.9	1.6
Conductivity (lab)	µS/cm		85		284	288	212	325	350	930	452	239	334	280	-	244	567	380	388
pH (Lab)	-		7.27	6.5-8.5	6.5-8.5	6.92	7.1	7.64	7.66	7.94	6.76	7.46	7.77	7.83	7.79	7.57	7.79	8.1	8.17
Field																			
DO (Field)	mg/L			5	6	10	10	-	7	7	15	8	5	5	4	7	11	6.2	8.63
Redox Potential (Field)	mV				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Temp (Field)	°C				21.5	5.4	12.3	15.8	5.1	17.7	11.7	11.3	-	27.3	4.8	9.9	5.6	17.8	16.8
Conductivity (field)	µS/cm				286	267	205	295	310	268	425	228	153	272	467	169	3.63	314	322
pH (Field)	-				6.3	8.12	7.18	7.09	7.66	7.16	7.84	8.3	6.88	6.89	7.06	7.3	7.53	7.49	7.37



Table 4 - Surface Water Quality

Unit	RDL	Ardoch SW 75th	Ardoch SW Trigger	PWGO	SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1
					2014-11-17	2015-05-28	2015-08-12	2015-11-10	2016-04-13	2017-05-03	2017-07-17	2018-05-23	2019-05-15	2020-06-02	2020-07-15	2020-10-06	2021-05-18	2021-07-19	2021-09-22
Metals																			
Arsenic	µg/L	0.1	0.55	5	0.5	0.9	0.6	0.3	0.1	0.3	0.8	0.6	0.3	0.5	0.7	0.3	0.3	0.6	0.7
Barium	µg/L	1	16		63	41	30	42	16	16	26	39	18	35	30	34	28	30	32
Boron	µg/L	5	6	200	76	28	45	30	23	36	42	30	23	36	51	33	29	34	56
Calcium	µg/L	20	12975		-	57,100	42,700	64,100	34,500	30,000	50,100	54,200	35,300	57,600	50,700	71,500	55,600	52,900	55,300
Cadmium	µg/L	0.02	0.1	0.1	0.07	0.16	<0.02	<0.02	<0.02	<0.02	0.254	0.048	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Chloride	µg/L	500	1000		25,700	8,900	8,900	13,300	6,400	5,300	7,700	11,900	9,800	14,000	9,000	14,100	10,100	7,200	10,400
Chromium (III+VI)	µg/L	1	2	8.9	2	<2	<2	<2	<2	3	<1	1	1	<1	<1	<1	<1	<1	<1
Copper	µg/L	0.1	2	2	11	1.2	<2	0.3	0.5	0.7	6	5.8	1	0.6	0.8	0.3	0.4	0.3	1
Iron	µg/L	5	354	354	901	428	383	186	92	116	139	116	38	43	42	42	96	45	45
Lead	µg/L	0.02	0.45	0.45	0.9	1.6	0.3	0.06	0.14	0.07	0.62	0.74	0.08	0.03	0.04	<0.02	<0.02	0.04	0.04
Manganese	µg/L	1	111		119	379	87	57	6	5	18	21	4	7	10	14	9	38	19
Magnesium	µg/L	20	2717		-	10,800	8,070	13,200	6,630	5,890	9,420	10,700	6,530	11,100	8,460	13,000	9,350	9,270	10,000
Mercury	µg/L		0.02	0.2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	-	-	-	-	-	-
Mercury (Filtered)	µg/L	0.02	0.02	0.2	-	-	-	-	-	-	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phosphorus total (P2O5)	µg/L	10	50	50	270	150	140	50	50	50	150	90	30	30	70	50	20	70	70
Potassium	µg/L	100	425		1,800	900	800	1,000	600	600	900	800	500	400	1,300	200	600	1,600	1,600
Sodium	µg/L	200	1750		15,600	5,400	4,600	7,800	4,000	3,500	5,500	7,600	4,600	7,900	5,300	8,100	7,200	6,100	8,400
Zinc	µg/L	5	7.5	20	47	14	9	69	<5	<5	<5	17	6	10	18	<5	46	64	15
Inorganics																			
Alkalinity (as CaCO3)	mg/L	5	38		271	169	122	183	97	91	158	163	100	157	139	193	166	147	164
Hardness (as CaCO3)	mg/L	1	44		-	187	-	215	113	99	164	180	115	190	162	232	178	170	179
Solids - Total Dissolved (TDS)	mg/L		48		349	189	-	-	-	-	9.6	-	-	-	-	-	-	-	-
Oxygen Demand - Chemical (COD)	mg/L	5	41.5		42	80	55	79	19	30	41	29	19	33	46	35	25	35	31
Solids - Total Suspended (TSS)	mg/L	3	23		28	170	22	8	4	<3	80	3	6	16	3	5	5	<3	<3
Organic Carbon - Dissolved (DOC) (Filtered)	mg/L	0.2	11.5		14.4	13.6	21.1	12.9	6.1	8.6	16.2	-	10	12.3	19.6	15.6	11	18	15.1
Oxygen Demand - Biological (BOD)	mg/L	3	4		<2	3	4	<2	3	<2	<2	<2	<3	<3	<3	<3	<3	<3	<3
Phenols (4AAP)	mg/L	0	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	0.002	<0.002	<0.001	<0.002	0.005	0.005
Sulphate (Filtered)	mg/L	1	3		27	3	9	10	9	5	3	4	5	3	6	4	1	1	14
Ammonia (Un-ionized) (Field)	mg/L	0.01			<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.01
Ammonia	mg/L	0.01	0.05		<0.01	0.03	<0.01	0.01	<0.01	<0.01	0.03	0.02	0.04	0.02	0.02	0.02	0.02	0.08	0.05
Nitrate (as N)	mg/L	0.05	0.1		0.1	0.1	<0.1	0.1	<0.1	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	0.07	0.1
Nitrite (as N)	mg/L	0.05	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen (TKN)	mg/L	0.1	0.6		1.1	1.2	1.2	0.5	0.4	0.4	0.7	0.4	0.5	0.5	0.7	0.5	0.4	0.6	0.6
Conductivity (lab)	µS/cm	1	85		635	360	292	418	232	214	351	351	247	345	311	420	336	311	360
pH (Lab)	-		7.27	6.5-8.5	6.5-8.5	8.06	8.01	7.86	6.04	7.65	8.03	8.17	8.02	7.83	7.92	8	8.07	7.53	7.87
Field																			
DO (Field)	mg/L			5	-	6.16	6.45	10.98	9.8	9.63	7.16	8.17	8.41	8.14	6.57	8.87	8.64	7.45	7.26
Redox Potential (Field)	mV				-	124	87	121	25	110	218	105	115	117	131	79	137	179	205
Temp (Field)	°C				40.3	15.7	15.9	9.6	6.5	10	18.5	21.4	10.8	13.2	19.8	10.8	18.5	20.6	15.6
Conductivity (field)	µS/cm				701	370	260	360	240	190	360	370	320	340	310	520	186	316	373
pH (Field)	-				7.1	7.73	8.29	6.03	7.63	7.65	7.58	7.84	7.6	7.58	7.23	7.23	7.73	7.32	6.75



Table 4 - Surface Water Quality

Unit	RDL	Ardoch SW 75th	Ardoch SW Trigger	PWQO	SW2	SW2	SW2	SW2	SW2	SW2	SW2	SW2	SW2	SW2	SW2	SW2	SW2	SW2	SW2
					2006-05-31	2006-11-03	2008-05-01	2008-08-14	2009-04-29	2010-04-05	2010-10-08	2011-06-01	2013-05-16	2015-05-28	2017-05-03	2017-07-17	2019-05-15	2020-06-02	2021-07-19
Metals																			
Arsenic	µg/L	0.1	0.55	5	-	35.3	-	-	-	-	<0.5	-	-	0.4	0.2	0.6	0.2	0.3	0.8
Barium	µg/L	1	16	200	-	8	-	-	-	-	11	-	-	11	7	28	8	21	13
Boron	µg/L	5	6	200	-	<5	-	-	-	-	9	-	-	<5	-	6	<5	8	<5
Calcium	µg/L	20	12975		-	-	9,200	5,990	11,200	6,990	13,200	12,900	9,150	13,600	6,110	16,100	10,700	12,900	11,500
Cadmium	µg/L	0.02	0.1	0.1	0.1	<0.1	-	-	-	-	<0.1	-	-	<0.02	<0.014	0.117	<0.015	0.037	0.047
Chloride	µg/L	500	1000		<1,000	1,000	1,000	<1,000	1,000	1,000	1,000	1,000	900	900	1,000	900	1,900	1,800	1,600
Chromium (III+VI)	µg/L	1	2	8.9	8.9	<2	-	-	-	-	<2	-	-	<2	<1	<1	1	<1	<1
Copper	µg/L	0.1	2	2	1	<2	-	-	-	-	<2	-	-	0.2	0.8	4.2	0.9	1	1.2
Iron	µg/L	5	354	354	300	318	82	116	366	260	84	134	2,360	144	154	85	379	91	403
Lead	µg/L	0.02	0.45	0.45	1	0.5	-	-	-	-	0.3	-	-	0.02	0.13	0.87	0.1	0.39	0.72
Manganese	µg/L	1	111		-	-	4	129	52	9	4	876	7	117	4	50	9	109	82
Magnesium	µg/L	20	2717		-	-	1,900	2,430	2,410	1,810	2,660	2,890	2,060	2,600	1,830	3,260	2,280	3,140	2,410
Mercury	µg/L		0.02	0.2	-	<0.1	-	-	-	-	<0.02	-	-	<0.02	<0.02	<0.02	<0.02	-	-
Mercury (Filtered)	µg/L	0.02	0.02	0.2	0.2	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02
Phosphorus total (P2O5)	µg/L	10	50	50	50	40	10	30	60	30	20	260	40	40	20	56	30	170	100
Potassium	µg/L	100	425		-	-	200	300	300	200	500	800	300	400	300	600	400	400	500
Sodium	µg/L	200	1750		-	-	900	1,500	4,400	800	1,100	1,700	1,200	1,300	1,300	1,900	1,600	2,400	1,300
Zinc	µg/L	5	7.5	20	-	<5	-	-	-	-	<5	-	-	<5	<5	39	7	8	<5
Inorganics																			
Alkalinity (as CaCO3)	mg/L	5	38		36	24	25	34	38	30	38	52	27	43	26	42	31	26	34
Hardness (as CaCO3)	mg/L	1	44		-	-	31	25	38	28	44	44	31	45	28	54	36	45	39
Solids - Total Dissolved (TDS)	mg/L		48		48	48	36	43	43	37	43	63	35	48.1	-	-	-	-	-
Oxygen Demand - Chemical (COD)	mg/L	5	41.5		37	40	13	33	290	33	34	42	31	19	32	64	25	66	53
Solids - Total Suspended (TSS)	mg/L	3	23		10	19	2	18	24	14	2	8,100	20	36	<3	3	9	50	14
Organic Carbon - Dissolved (DOC) (Filtered)	mg/L	0.2	11.5		-	-	-	-	-	-	-	-	-	11.5	9.6	18.5	10.9	8.4	17.5
Oxygen Demand - Biological (BOD)	mg/L	3	4		7	4	<2	4	<2	<2	<2	20	<2	4	<2	<2	<3	<3	<3
Phenols (4AAP)	mg/L	0	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002
Sulphate (Filtered)	mg/L	1	3		2	8	5	1	2	3	2	<1	2	3	3	<1	1	2	1
Ammonia Unionized (Field)	mg/L	0.01		0.02	0.005	0.001	<0.001	<0.001	<0.001	0.05	0.05	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Ammonia	mg/L	0.01	0.05		<0.05	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.025	0.03	<0.01	0.03	0.04	0.02	0.04
Nitrate (as N)	mg/L	0.05	0.1		<0.1	<0.1	<0.1	0.2	0.2	<0.1	<0.1	0.1	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	0.09
Nitrite (as N)	mg/L	0.05	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.05	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen (TKN)	mg/L	0.1	0.6		0.7	0.2	0.3	0.5	0.5	0.5	1.8	0.6	0.5	0.5	0.5	0.9	0.3	1	0.8
Conductivity (lab)	µS/cm	1	85		75	72	85	77	924	67	79	114	84	94	82	87	76	64	76
pH (Lab)	-		7.27	6.5-8.5	6.43	6.61	6.99	7.09	6.82	7.27	7.27	7.2	7.25	7.35	7.43	7.25	7.52	6.81	6.74
Field																			
DO (Field)	mg/L			5	5	9	10	-	7	11	12.5	6	11	6.1	9.73	7.82	8.71	7.88	6.17
Redox Potential (Field)	mV				-	-	-	-	-	-	-	-	-	103	100	200	107	107	176
Temp (Field)	°C				19.6	7.8	12.1	16	12.7	9.03	-	20.5	3.5	14.8	7.1	19.6	10.2	11.8	16.5
Conductivity (field)	µS/cm				65	60	56	77	69	30	75	89	42	100	80	100	110	90	87
pH (Field)	-				6.5-8.5	8.49	8.06	7.03	7.19	7.01	8	6	7.06	7.64	7.16	7.26	7.14	7.96	7.68



Table 5 - Landfill Gas Monitoring Data

Date	MW14-1R	MW14-2R	MW14-3R	MW14-4R	MW12-5B	MW14-6R	MW14-7R	GP101	GP102	GP103	GP104
Top of Screen Elevation (m)	258.26	257.04	256.20	256.38	255.51	255.63	258.21	-	-	-	-
Water Level (m)¹	257.87	256.51	256.23	256.23	256.48	255.85	258.01	-	-	-	-
Screen Saturated	no	no	yes	no	yes	yes	no	no	no	no	no
13-Apr-16	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
03-Oct-16	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.00	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
13-Jan-17	-	-	-	-	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05
03-Feb-17	-	-	-	-	-	-	-	< 0.05	0.08	< 0.05	< 0.05
03-May-17	<0.05	<0.05	0.24	<0.05	<0.05	<0.05	<0.05	<0.05	0.24	<0.05	<0.05
16-Jan-18	-	-	-	-	-	-	-	<0.05	0.05	<0.05	<0.05
06-Feb-18	-	-	-	-	-	-	-	<0.05	0.22	<0.05	<0.05
23-May-18	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.09	<0.05	<0.05
16-Jan-19	-	-	-	-	-	-	-	<0.05	0.32	<0.05	<0.05
14-Feb-19	-	-	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05
08-Aug-19	-	-	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05
07-Jan-20	-	-	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05
12-Feb-20	-	-	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05
15-Jul-20	-	-	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05
19-Jan-21	-	-	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05
17-Feb-21	-	-	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05
17-Jul-21	-	-	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05
13-Apr-16	-	-	-	-	-	-	-	-	-	-	-
03-Oct-16	-	-	-	-	-	-	-	-	-	-	-
13-Jan-17	-	-	-	-	-	-	-	-	-	-	-
03-Feb-17	-	-	-	-	-	-	-	-	-	-	-
03-May-17	-	-	-	-	-	-	-	-	-	-	-
16-Jan-18	-	-	-	-	-	-	-	-	-	-	-
06-Feb-18	-	-	-	-	-	-	-	-	-	-	-
23-May-18	-	-	-	-	-	-	-	-	-	-	-
16-Jan-19	-	-	-	-	-	-	-	0.00	0.00	-0.17	-0.12
14-Feb-19	-	-	-	-	-	-	-	0.00	-0.21	0.00	-0.12
08-Aug-19	-	-	-	-	-	-	-	0.00	-0.47	0.00	0.00
07-Jan-20	-	-	-	-	-	-	-	-	-0.18	-0.52	-0.06
12-Feb-20	-	-	-	-	-	-	-	gas ports were replaced during this event			
15-Jul-20	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00
19-Jan-21	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00
17-Feb-21	-	-	-	-	-	-	-	0.02	0.02	0.00	0.02
17-Jul-21	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00

Notes:

1. Water elevation data from September 30, 2015.



Appendix A

Monitoring and Screening Checklist

Fully accessible appended items are available upon request.

Appendix D-Monitoring and Screening Checklist General Information and Instructions

General Information: The checklist is to be completed, and submitted with the Monitoring Report.

Instructions: A complete checklist consists of:

- (a) a completed and signed checklist, including any additional pages of information which can be attached as needed to provide further details where indicated.
- (b) completed contact information for the Competent Environmental Practitioner (CEP)
- (c) self-declaration that CEP(s) meet(s) the qualifications as set out below and in Section 1.2 of the Technical Guidance Document.

Definition of Groundwater CEP:

For groundwater, the CEP must have expertise in hydrogeology and meet one of the following:

- (a) the person holds a licence, limited licence or temporary licence under the *Professional Engineers Act*; or
- (b) the person holds a certificate of registration under the *Professional Geoscientists Act, 2000* and is a practicing member, temporary, member or limited member of the Association of Professional Geoscientists of Ontario. O. Reg. 66/08, s. 2..

Definition of Surface water CEP:

A CEP for surface water assessments is a scientist, professional engineer or professional geoscientist as described in (a) and (b) above with demonstrated experience and post-secondary education, either a diploma or degree, in hydrology, aquatic ecology, limnology, aquatic biology, physical geography with specialization in surface water, and/or water resource management.

The type of scientific work that a CEP performs must be consistent with that person's education and experience. If an individual has appropriate training and credentials in both groundwater and surface water and is responsible for both areas of expertise, the CEP may then complete and validate both sections of the checklist.

Monitoring Report and Site Information	
Waste Disposal Site (WDS) Name	Ardoch Waste Disposal Site
Location (e.g. street address, lot, concession)	Part of Lot 19, Southwest Range, geographic Township of Clarendon, Township of North Frontenac, 1114 Austris Road
GPS Location (taken within the property boundary at front gate/ front entry)	4974573, 351300
Municipality	Township of North Frontenac
Client and/or Site Owner	The Corporation of the Township of North Frontenac
Monitoring Period (Year)	2021
This Monitoring Report is being submitted under the following:	
Environmental Compliance Approval (ECA) Number (formerly "Certificate of Approval" (C of A)):	A380405
Director's Order No.:	
Provincial Officer's Order No.:	

Other:			
Report Submission Frequency	<input checked="" type="radio"/> Annual <input type="radio"/> Other		
The site is: (Operation Status)	<input type="radio"/> Open <input checked="" type="radio"/> Inactive <input type="radio"/> Closed		
Is there an active waste transfer station at the site?	<input type="radio"/> Yes <input checked="" type="radio"/> No		
Does this WDS have a Closure Plan?	<input type="radio"/> Not yet submitted <input type="radio"/> Submitted and under review <input checked="" type="radio"/> Submitted and approved		
Total Approved Capacity	30325	Units	Cubic Metres
Maximum Approved Fill Rate		Units	
Total Waste Received within Monitoring Period (Year)	0	Units	Cubic Metres
Total Waste Received within Monitoring Period (Year) <i>Describe the methodology used to determine this quantity</i>	Survey		
Estimated Remaining Capacity	18,430	Units	Cubic Metres
Estimated Remaining Capacity <i>Describe the methodology used to determine this quantity</i>	Direct Survey (GPS/Total Station)		
Estimated Remaining Capacity <i>Date Last Determined</i>	30-Nov-2015		
Non-Hazardous Approved Waste Types	<input type="checkbox"/> Domestic <input type="checkbox"/> Industrial, Commercial & Institutional (IC&I) <input type="checkbox"/> Source Separated Organics (Green Bin) <input type="checkbox"/> Tires	<input type="checkbox"/> Contaminated Soil <input type="checkbox"/> Wood Waste <input type="checkbox"/> Blue Box Material <input type="checkbox"/> Processed Organics <input type="checkbox"/> Leaf and Yard Waste	<input type="checkbox"/> Food Processing/Preparation Operations Waste <input type="checkbox"/> Hauled Sewage Other: <input type="text"/>
Subject Waste Approved Waste Classes: Hazardous & Liquid Industrial <i>(separate waste classes by comma)</i>			

Year Site Opened <i>(enter the Calendar Year only)</i>	1972	Current ECA Issue Date	2-Dec-2015
Is your Site required to submit Financial Assurance?		<input type="radio"/> Yes <input checked="" type="radio"/> No	
Describe how your WDS is designed.		<input checked="" type="radio"/> Natural Attenuation only <input type="radio"/> Fully engineered Facility <input type="radio"/> Partially engineered Facility	
Does your Site have an approved Contaminant Attenuation Zone?		<input checked="" type="radio"/> Yes <input type="radio"/> No	
If closed, specify ECA, control or authorizing document closure date:			
Has the nature of the operations at the site changed during this monitoring period?	<input type="radio"/> Yes <input checked="" type="radio"/> No		
If yes, provide details:			

<p>Have any measurements been taken since the last reporting period that indicate landfill gas volumes have exceeded the MOE limits for subsurface or adjacent buildings? (i.e. exceeded the LEL for methane)</p>	<p><input type="radio"/> Yes</p> <p><input checked="" type="radio"/> No</p>
---	---

Groundwater WDS Verification:

Based on all available information about the site and site knowledge, it is my opinion that:

Sampling and Monitoring Program Status:

<p>1) The monitoring program continues to effectively characterize site conditions and any groundwater discharges from the site. All monitoring wells are confirmed to be in good condition and are secure:</p>	<p><input checked="" type="radio"/> Yes</p> <p><input type="radio"/> No</p>	
---	---	--

<p>2) All groundwater, leachate and landfill gas sampling and monitoring for the monitoring period being reported on was successfully completed as required by ECA or other relevant authorizing/control document(s):</p>	<p><input checked="" type="radio"/> Yes</p> <p><input type="radio"/> No</p> <p><input type="radio"/> Not Applicable</p>	<p>If no, list exceptions below or attach information.</p>
---	---	--

Groundwater Sampling Location	Description/Explanation for change (change in name or location, additions, deletions)	Date

3) a) Some or all groundwater, leachate and landfill gas sampling and monitoring requirements have been established or defined outside of a ministry ECA, authorizing, or control document.	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> Not Applicable	
b) If yes, the sampling and monitoring identified under 3(a) for the monitoring period being reported on was successfully completed in accordance with established protocols, frequencies, locations, and parameters developed as per the Technical Guidance Document:	<input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> Not Applicable	If no, list exceptions below or attach additional information.
Groundwater Sampling Location	Description/Explanation for change (change in name or location, additions, deletions)	Date

<p>4) All field work for groundwater investigations was done in accordance with Standard Operating Procedures (SOP) as established/outlined per the Technical Guidance Document (including internal/external QA/QC requirements) (Note: A SOP can be from a published source, developed internally by the site owner's consultant, or adopted by the consultant from another organization):</p>	<p><input checked="" type="radio"/> Yes <input type="radio"/> No</p>	
<p>Sampling and Monitoring Program Results/WDS Conditions and Assessment:</p>		
<p>5) The site has an adequate buffer, Contaminant Attenuation Zone (CAZ) and/or contingency plan in place. Design and operational measures, including the size and configuration of any CAZ, are adequate to prevent potential human health impacts and impairment of the environment.</p>	<p><input checked="" type="radio"/> Yes <input type="radio"/> No</p>	
<p>6) The site meets compliance and assessment criteria.</p>	<p><input type="radio"/> Yes <input checked="" type="radio"/> No</p>	<p>Refer to Section 4.2 and Table 3 of the report.</p>
<p>7) The site continues to perform as anticipated. There have been no unusual trends/changes in measured leachate and groundwater levels or concentrations.</p>	<p><input checked="" type="radio"/> Yes <input type="radio"/> No</p>	

<p>1) Is one or more of the following risk reduction practices in place at the site:</p> <p>(a) There is minimal reliance on natural attenuation of leachate due to the presence of an effective waste liner and active leachate collection/ treatment; or</p> <p>(b) There is a predictive monitoring program in-place (modeled indicator concentrations projected over time for key locations); or</p> <p>(c) The site meets the following two conditions (typically achieved after 15 years or longer of site operation):</p> <p><i>i.</i> The site has developed stable leachate mound(s) and stable leachate plume geometry/ concentrations; and</p> <p><i>ii.</i> Seasonal and annual water levels and water quality fluctuations are well understood.</p>	<p><input checked="" type="radio"/> Yes</p> <p><input type="radio"/> No</p>	<p>Note which practice(s):</p>	<p><input type="checkbox"/> (a)</p> <p><input type="checkbox"/> (b)</p> <p><input checked="" type="checkbox"/> (c)</p>
<p>9) Have trigger values for contingency plans or site remedial actions been exceeded (where they exist):</p>	<p><input type="radio"/> Yes</p> <p><input checked="" type="radio"/> No</p> <p><input type="radio"/> Not Applicable</p>		

Groundwater CEP Declaration:

I am a licensed professional Engineer or a registered professional geoscientist in Ontario with expertise in hydrogeology, as defined in Appendix D under Instructions. Where additional expertise was needed to evaluate the site monitoring data, I have relied on individuals who I believe to be experts in the relevant discipline, who have co-signed the compliance monitoring report or monitoring program status report, and who have provided evidence to me of their credentials.


I have examined the applicable Environmental Compliance Approval and any other environmental authorizing or control documents that apply to the site. I have read and followed the Monitoring and Reporting for Waste Disposal Sites Groundwater and Surface Water Technical Guidance Document (MOE, 2010, or as amended), and associated monitoring and sampling guidance documents, as amended from time to time. I have reviewed all of the data collected for the above-referenced site for the monitoring period(s) identified in this checklist. Except as otherwise agreed with the ministry for certain parameters, all of the analytical work has been undertaken by a laboratory which is accredited for the parameters analysed to *ISO/IEC 17025:2005 (E)- General requirements for the competence of testing and calibration laboratories*, or as amended from time to time by the ministry.


If any exceptions or potential concerns have been noted in the questions in the checklist attached to this declaration, it is my opinion that these exceptions and concerns are minor in nature and will be rectified for the next monitoring/reporting period. Where this is not the case, the circumstances concerning the exception or potential concern and my client's proposed action have been documented in writing to the Ministry of the Environment District Manager in a letter from me dated:

25-Mar-2021

Recommendations:

Based on my technical review of the monitoring results for the waste disposal site:

<p><input type="radio"/> No changes to the monitoring program are recommended</p> <p><input checked="" type="radio"/> The following change(s) to the monitoring program is/are recommended:</p>	<p>Cambium has made recommendations for reductions to the monitoring programs at the Ardoch site, including: reducing the groundwater sampling frequency to annual, and reducing the reporting frequency to once every three (3) years.</p> <p>Refer to Section 4.5 of the report.</p>
<p><input checked="" type="radio"/> No Changes to site design and operation are recommended</p> <p><input type="radio"/> The following change(s) to the site design and operation is/are recommended:</p>	
<p>Name:</p>	<p>Stephanie Reeder, P.Geo, C.E.T.</p>
<p>Seal:</p>	<p>Add Image</p> 

Signature:		Date:	Apr 13/22
CEP Contact Information:	Stephanie Reeder, P.Geo, C.E.T.		
Company:	Cambium Inc.		
Address:	194 Sophia Street Peterborough, Ontario K9H 1E5		
Telephone No.:	705-872-8797	Fax No.:	705-742-7907
E-mail Address:	stephanie.reeder@cambium-inc.com		
Co-signers for additional expertise provided:			
Signature:		Date:	
Signature:		Date:	
Surface Water WDS Verification:			
Provide the name of surface water body/bodies potentially receiving the WDS effluent and the approximate distance to the waterbody (including the nearest surface water body/bodies to the site):			
Name (s)	Malcolm Lake		

Distance(s)	Approximately 125 m northwest of the existing limit of waste	
Based on all available information and site knowledge, it is my opinion that:		
Sampling and Monitoring Program Status:		
1) The current surface water monitoring program continues to effectively characterize the surface water conditions, and includes data that relates upstream/background and downstream receiving water conditions:	<input checked="" type="radio"/> Yes <input type="radio"/> No	
2) All surface water sampling for the monitoring period being reported was successfully completed in accordance with the ECA or relevant authorizing/control document(s) (if applicable):	<input checked="" type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Not applicable	If no, specify below or provide details in an attachment.
Surface Water Sampling Location	Description/Explanation for change (change in name or location, additions, deletions)	Date
3) a) Some or all surface water sampling and monitoring program requirements for the monitoring period have been established outside of a ministry ECA or authorizing/control document.	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> Not Applicable	
b) If yes, all surface water sampling and monitoring identified under 3 (a) was successfully completed in accordance with the established program from the site, including sampling protocols, frequencies, locations and parameters) as developed per the Technical Guidance Document:	<input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> Not Applicable	If no, specify below or provide details in an attachment.

Surface Water Sampling Location	Description/Explanation for change (change in name or location, additions, deletions)		Date
<p>4) All field work for surface water investigations was done in accordance with SOP, including internal/external QA/QC requirements, as established/outlined as per the Technical Guidance Document, MOE 2010, or as amended. (Note: A SOP can be from a published source, developed internally by the site owner's consultant, or adopted by the consultant from another organization):</p>	<p><input checked="" type="radio"/> Yes</p> <p><input type="radio"/> No</p>		
<p>Sampling and Monitoring Program Results/WDS Conditions and Assessment:</p>			
<p>5) The receiving water body meets surface water-related compliance criteria and assessment criteria: i.e., there are no exceedances of criteria, based on MOE legislation, regulations, Water Management Policies, Guidelines and Provincial Water Quality Objectives and other assessment criteria (e.g., CWQGs, APVs), as noted in Table A or Table B in the Technical Guidance Document (Section 4.6):</p>			<p><input checked="" type="radio"/> Yes</p> <p><input type="radio"/> No</p>
<p>If no, list parameters that exceed criteria outlined above and the amount/percentage of the exceedance as per the table on the following page or provide details in an attachment:</p>			

Parameter	Compliance or Assessment Criteria or Background	Amount by which Compliance or Assessment Criteria or Background Exceeded
e.g. Nickel	e.g. ECA limit, PWQO, background	e.g. X% above PWQO
Phenols	PWQO	Refer to Table 4
Total Phosphorus	PWQO	Refer to Table 4
Zinc	PWQO	Refer to Table 4
Iron	PWQO	Refer to Table 4
<p>6) In my opinion, any exceedances listed in Question 5 are the result of non-WDS related influences (such as background, road salting, sampling site conditions)?</p>	<p><input checked="" type="radio"/> Yes</p> <p><input type="radio"/> No</p>	<p>Refer to Report Section 4.3 for further details.</p>

<p>7) All monitoring program surface water parameter concentrations fall within a stable or decreasing trend. The site is not characterized by historical ranges of concentrations above assessment and compliance criteria.</p>	<p><input checked="" type="radio"/> Yes</p> <p><input type="radio"/> No</p>	
<p>8) For the monitoring program parameters, does the water quality in the groundwater zones adjacent to surface water receivers exceed assessment or compliance criteria (e.g., PWQOs, CWQGs, or toxicity values for aquatic biota (APVs)):</p>	<p><input checked="" type="radio"/> Yes</p> <p><input type="radio"/> No</p> <p><input type="radio"/> Not Known</p> <p><input type="radio"/> Not Applicable</p>	<p>Refer to Table 3 and Section 4.2.4 of the report.</p>
<p>9) Have trigger values for contingency plans or site remedial actions been exceeded (where they exist):</p>	<p><input checked="" type="radio"/> Yes</p> <p><input type="radio"/> No</p> <p><input type="radio"/> Not Applicable</p>	<p>Refer to Report Section 4.3.3 for further details.</p>

Surface Water CEP Declaration:

I, the undersigned hereby declare that I am a Competent Environmental Practitioner as defined in Appendix D under Instructions, holding the necessary level of experience and education to design surface water monitoring and sampling programs, conduct appropriate surface water investigations and interpret the related data as it pertains to the site for this monitoring period.

I have examined the applicable Environmental Compliance Approval and any other environmental authorizing or control documents that apply to the site. I have read and followed the Monitoring and Reporting for Waste Disposal Sites Groundwater and Surface Water Technical Guidance Document (MOE, 2010, or as amended) and associated monitoring and sampling guidance documents, as amended from time to time. I have reviewed all of the data collected for the above-referenced site for the monitoring period(s) identified in this checklist. Except as otherwise agreed with the ministry for certain parameters, all of the analytical work has been undertaken by a laboratory which is accredited for the parameters analysed to ISO/IEC 17025:2005 (E)- General requirements for the competence of testing and calibration laboratories, or as amended from time to time by the ministry.

If any exceptions or potential concerns have been noted in the questions in the checklist attached to this declaration, it is my opinion that these exceptions and concerns are minor in nature or will be rectified for future monitoring events. Where this is not the case, the circumstances concerning the exception or potential concern and my client's proposed action have been documented in writing to the Ministry of the Environment District Manager in a letter from me dated:

25-Mar-2022

Recommendations:

Based on my technical review of the monitoring results for the waste disposal site:

<p><input type="radio"/> No Changes to the monitoring program are recommended</p> <p><input checked="" type="radio"/> The following change(s) to the monitoring program is/are recommended:</p>	<p>Cambium recommended reducing the surface water sampling frequency to semi-annually (spring and autumn) and reducing the reporting frequency to once every three (3) years.</p> <p>Refer to Section 4.5 of the report.</p>
<p><input checked="" type="radio"/> No changes to the site design and operation are recommended</p> <p><input type="radio"/> The following change(s) to the site design and operation is/are recommended:</p>	

CEP Signature	
Relevant Discipline	Physical Geography
Date:	
CEP Contact Information:	Stephanie Reeder, P.Geo, C.E.T.
Company:	Cambium Inc.
Address:	194 Sophia Street Peterborough, Ontario K9H 1E5
Telephone No.:	705-872-8797
Fax No. :	705-742-7900
E-mail Address:	stephanie.reeder@cambium-inc.com
Save As	Print Form



Appendix B

Environmental Compliance Approval A380405

Fully accessible appended items are available upon request.

AMENDMENT TO ENVIRONMENTAL COMPLIANCE APPROVAL

NUMBER A380405

Notice No. 3

Issue Date: December 2, 2015

The Corporation of the Township of North Frontenac
6648 Road 506
Plevna, Ontario
K0H 2M0

Site Location: Ardoch Waste Disposal Site
1114 Austris Rd (Lot 19, SW Range)
North Frontenac Township, County of Frontenac

You are hereby notified that I have amended Approval No. A380405 issued on November 17, 1976, as subsequently amended for use and operation of a 0.81 hectare waste fill area within a total Site area of 4.02 hectares , as follows:

TEMPORARY SITE CLOSURE

Pursuant to Section 20.2 of Part II.1 of the Environmental Protection Act, approval is hereby granted for a temporary closure of the Ardoch Waste Disposal Site for a period lasting fifteen (15) years or longer,

all in accordance with a temporary closure plan listed as Item 8 in Schedule "A" of the Certificate and subject to the terms and conditions outlined herein:

Documentation

The following documentation is hereby added to Schedule "A" and forms part of the Environmental Compliance Approval No. A380405:

7. Environmental Compliance Approval Application dated December 10, 2013, signed by Jim Phillips, Public Works Manager, Township of North Frontenac
8. Report entitled "Temporary Closure Plan for Ardoch Waste Disposal Site, (Addendum to Design, Operation and Closure Plan)", dated November 2013, prepared by AECOM Canada Ltd.

You are hereby notified that this approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

Condition 8(2) of the Certificate is hereby amended by adding new Condition 8(2)(c), as follows:

Compliance Limits

- 8(2) (c) Notwithstanding Sub-condition 8(2)(a) in the Certificate, where groundwater discharges to surface water or wetland, the groundwater quality shall comply with the Provincial Water Quality Objectives. If test results confirm non-compliance of groundwater quality with the **Provincial Water Quality Objectives, or any other monitored parameter found to be present at concentrations deemed to be unacceptable**, due to landfill leachate, an assessment of the potential impact of the discharging groundwater quality on the receiving wetland and/or surface water, along with mitigation action, as necessary, shall be carried out.

1.0 Temporary Site Closure

- 1.1 The Site is hereby acknowledged to be mothballed/temporary closed for a period lasting fifteen (15) years, for the deposition of waste into the waste fill area for final disposal, as of Labour Day, 2013, and no waste management activities shall be carried out at the Site without approval of the Director.

Interim/Final Cover

- 1.2 During the period of temporary site closure, an interim/final cover shall be installed to ensure that a minimum 600 mm thickness of clay or silty clay soil, overlain by a minimum 150 mm topsoil and vegetative cover, is maintained over the waste, as described in sections 4.6 and 4.7 in Item 8 of Schedule "A", attached to this Certificate.
- 1.3 Once mothballed no waste shall be accepted at the Landfill Site for disposal, and on waste shall be deposited beyond the limits of the approved 0.81 ha. waste fill area, unless a report referred to in Condition 2.1, below is submitted and approved by the Director.

2.0 Resumption of Waste Disposal Operation

- 2.1 At least six (6) months prior to resumption of waste disposal operation at the landfill site, the Owner/Operator shall submit, for the approval of the Director, an updated Site Development and Operations Report, prepared and signed by a Professional Engineer or Geo-Scientist, qualified within the jurisdiction of the subject Report, to utilize the Site volume remaining.
- 2.2 The updated Site Development and Operations Report referred in Condition 2.1 above, shall include, as a minimum, a calculation confirming the remaining capacity of the site, and the remaining site life based on the approved fill rate; a legal survey of the Site, including the waste fill area and all buffer/contaminant attenuation lands approved by this Certificate; a full-scale site

plan showing the footprint of the waste fill area, buffer/contaminant attenuation lands and the entire site boundary; existing contour plan at the time of interim closure, final contours; a hydrogeological and surface water studies which address the utilization of the site volume remaining; proposed monitoring program for landfill gas, leachate, groundwater, and surface water, including any proposed changes in the monitoring requirements; trigger mechanisms and contingency plans, detailed information on the Site utilization and maintenance; and final closure plans.

3.0 Post-Closure Inspection and Maintenance

- 3.1 The landfill site, including the interim/final cover and general site features, shall be inspected and cleaned-up regularly, including litter pick-up, as described in section 4.4 in Item 8 of Schedule "A", attached to this Certificate. Newly installed or repaired interim/final cover shall be inspected more frequently (i.e. quarterly) until the vegetation is established and stabilized.
- 3.2 Where deficiencies and/or non-compliance conditions exist, or if groundwater and surface water impacts are found to be unacceptable, or the integrity of the interim/final cover, access roads, fence, groundwater/leachate and surface water management/monitoring facilities, and the like, is impaired, the Township shall engage in discussions with the District Manager on acceptable remedial action to address the deficiencies and/or the non-compliance conditions at the Site. The remedial action carried out shall be reported in the subsequent Post-Closure Monitoring Report.

4.0 Post-Closure Monitoring Programs

Condition 8(3) of the Certificate is hereby revoked and replaced with new Conditions 4.1 and 4.2, such that the new Conditions read as follows:

- 4.1 Monitoring programs for groundwater/leachate, surface water and landfill gas, as described in section 3.4 and summarized in Table 3.1 in Item 8 of Schedule "A", attached to this Certificate, and in accordance with this Approval and any other applicable legislation, shall be carried out at the Site.

Landfill Gas

- 4.2 Landfill gas (methane concentration and pressure) shall be monitored from appropriate dedicated gas monitoring probes installed at the Site, at least once during warm conditions (i.e. May 1 through November 30), and twice during frozen ground conditions (i.e. December 1 through April 30).

REASONS

The reasons for this amendment to the Environmental Compliance Approval are as follows:

1. The reason for adding **Condition 8(2)(c)** is to ensure that groundwater quality deterioration due to landfill leachate, shall not impact on surface water quality degradation above the provincial

surface water quality standards (The Provincial Water Quality Objectives)

2. The reasons for this approval and **Conditions 1.0, 3.0 and 4.0** are to acknowledge that the landfill site is mothballed/temporary closed, and to ensure that appropriate closure processes, including adequate waste capping, are in order, and that the closed landfill site is inspected, monitored and maintained in an environmentally acceptable manner for the protection of the natural environment and public health and safety.
3. **Condition 2.0** is included to ensure that the Site is developed, operated and maintained in accordance with satisfactory design and operations plan consistent with or an improvement to the approved design and operation of the Site.

This Notice shall constitute part of the approval issued under Approval No. A380405 dated November 17, 1976, as amended.

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

1. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

Pursuant to subsection 139(3) of the Environmental Protection Act, a hearing may not be required with respect to any terms and conditions in this environmental compliance approval, if the terms and conditions are substantially the same as those contained in an approval that is amended or revoked by this environmental compliance approval.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The environmental compliance approval number;
6. The date of the environmental compliance approval;
7. The name of the Director, and;
8. The municipality or municipalities within which the project is to be engaged in.

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
655 Bay Street, Suite 1500
Toronto, Ontario
M5G 1E5

AND

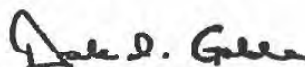
The Director appointed for the purposes of Part II.1 of
the Environmental Protection Act
Ministry of the Environment and Climate Change
135 St. Clair Avenue West, 1st Floor
Toronto, Ontario
M4V 1P5

* Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 326-5370 or www.ert.gov.on.ca

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 2nd day of December, 2015

THIS NOTICE WAS MAILED
ON <u>Dec 17, 2015</u>
<u>DC</u>
(Signed)



Dale Gable, P.Eng.
Director

appointed for the purposes of Part II.1 of the
Environmental Protection Act

DO/

c: District Manager, MOECC Kingston - District
David Bucholtz, CAMBIUM. ✓

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Ministry of the Environment
Ministère de l'Environnement

AMENDMENT TO ENVIRONMENTAL COMPLIANCE APPROVAL

NUMBER A380405

Notice No. 2

Issue Date: November 22, 2013

The Corporation of the Township of North Frontenac
6648 Road 506
Plevna, Ontario
K0H 2M0

Site Location: Ardoch Waste Disposal Site
Lot 19, Southwest Range
Geographic Township of Clarendon,
North Frontenac Township, County of Frontenac

*You are hereby notified that I have amended Approval No. A380405 issued on November 17, 1976, as subsequently amended for use and operation of a **0.81 hectare** waste fill area within a total Site area of **4.02 hectares**, as follows:*

1. UPDATED DESIGN AND OPERATIONS PLAN

Pursuant to Section 20.3 of Part II.1 of the Environmental Protection Act, you have applied for approval of an updated Design and Operations Plan, to reflect the corrected site area and address.

2. ERRATA - SITE AREA AND SITE ADDRESS

Pursuant to Section 20.3 of Part II.1 of the Environmental Protection Act, you have applied for approval to correct errors as they appear in the Certificate as follows:

A. *The Total Site Area, including Waste Fill Area and Buffer is corrected:*

FROM: 40 hectares Total Site Area of which **0.81 hectare** is used for landfilling.

TO: 4.02 hectares Total Site Area of which **0.81 hectare** is used for landfilling.

B. *Legal description of the Site Location is corrected:*

FROM: Lot 19, Concession 4, Geographic Township of Clarendon, North Frontenac Township, County of Frontenac.

TO: Lot 19, Southwest Range, Geographic Township of Clarendon, North Frontenac Township, County of Frontenac.

all as verified in the supporting documentation listed below.

Documentation

The following documentation is hereby added to Schedule "A" and forms part of the Environmental Compliance Approval No. A380405:

4. Application for a Provisional Certificate of Approval for a Waste Disposal site dated March 12, 2009, signed by Brenda Defosse, Clerk and Ron Maguire, Mayor, Township of North Frontenac

5. Report titled "Design, Operation and Closure Plan" Ardoch Waste Disposal Site, dated July 2009, prepared by AECOM Canada Ltd.

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6. Letter dated October 4, 2012 from Guy Laport, AECOM Canada Ltd. to Dickson Odame-Osafo, Environmental Assessment and Approvals Branch, Ministry of the environment, with attached drawing 1 dated March 2012, Figure 3.2 dated February 2012, and Legal Survey Plans 13R-10703 and 13R-19081, respectively received and deposited February 4, 1992 and January 28, 2008.

You are hereby notified that this approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

Conditions 1(3), 1(14) and 1(15) in the Approval dated May 13, 2008, are hereby revoked and replaced by new Conditions 1(3), 1(14) and 1(15), such that the new Conditions read as follows:

1. GENERAL

In Accordance

(3) Except as otherwise provided for in this *Certificate*, as amended from time-to-time, the *Site* shall be designed, developed, built, operated and maintained in accordance with the applications for *Certificate of Approval*, dated July 20, 1972, and subsequent amendment dated March 12, 2009 and the supporting documentation listed in Schedule "A".

Certificate of Requirement

(14) Pursuant to Section 197 of the *EPA*, no person having an interest in the Site shall deal in any way with the Site without first giving a copy of this Certificate to each person acquiring an interest in the Site as a result of the dealing.

(15). The Owner shall:

(a) within sixty (60) calendar days from the date of issuance of this Certificate, submit to the Director.

- (i) a plan of survey of the revised area of the Site prepared, signed and sealed by a licensed Ontario Land Surveyor;
- (ii) proof of ownership;
- (iii) legal abstract of the property; and
- (iv) a completed Certificate of Requirement, and its supporting documents, containing a registerable description of the property.

(b) within fifteen (15) calendar days of receiving a Certificate of Requirement authorized by the Director, the Owner shall:

- (i) register the Certificate of Requirement in the appropriate Land Registry Office on the title to the property, and
- (ii) submit to the Director, copy to the District Manager, a written verification that the Certificate of Requirement has been duly registered on title.

2. SITE OPERATION

Condition 2(7) in the Approval dated May 13, 2008, is hereby revoked and replaced by new Condition 2(7), such that the new Condition reads as follows:

Hours of Operation

(7) The operating hours for the Site for receipt of waste for disposal are as follows:

Summer Hours (May 15th to October 14th):

Mondays and Thursdays (except statutory holidays) 1:00 pm to 6:00 pm

Saturday 10:00 am to 6:00 pm

Holiday Mondays 10:00 am to 3:00 pm

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Winter Hours (October 15th to May 14th):

Thursday and Saturday 10:00 am to 3:00 pm

7. LANDFILL DESIGN AND DEVELOPMENT

Conditions 7(5) and 7(10)(a) in the Approval dated May 13, 2008, are hereby revoked and replaced by new Condition 7(5) and 7(10)(a), and sub-condition 7(9)(e) added, such that the new Conditions read as follows:

Capacity

(5) The calculated theoretical maximum volumetric capacity of the Site, consisting of waste, daily cover and intermediate cover, but excluding final cover is **30,325 cubic metres**.

(9) Alternative Cover Material

(e) Prior to the use of crushed glass or materials other than wood chips, compost or foundry sand, as an alternative cover material or as a component of cover soil, the Owner shall submit an application together with applicable fees and supporting information, for the approval of the Director, as required by Condition 7(9) of the Certificate. The supporting information must demonstrate that the alternative cover material is non-hazardous and shall not pose physical hazard or unsafe characteristics to people and the natural environment, and must demonstrate its performance of cover as required by Sub-condition 7(9)(a to d) of the Certificate.

(10) Cover material shall be applied as follows:

(a) Daily Cover - Weather permitting, deposited waste shall be covered with soil monthly in the summer, and bimonthly in winter, or more frequently in a manner acceptable to the District Manager, when nuisance impact due to waste cover deficiency is identified.

8. LANDFILL MONITORING

Conditions 8(2), 8(5) in the Approval dated May 13, 2008, is hereby revoked and replaced by new Conditions 8(2), 8(5) such that the new Condition reads as follows:

Compliance Limits

(2) The *Site* shall be operated in such a way as to ensure compliance with the following:

(a) Reasonable Use Guideline B-7 for the protection of groundwater at the *Site*. and

(b) Provincial Water Quality Objectives included in the July 1994 publication entitled *Water Management Policies, Guidelines, Provincial Water Quality Objectives*, as amended from time to time or limits set by the *Regional Director*, for the protection of the surface water at and off the *Site*.

(c) Notwithstanding Sub-condition 2(a) above, where groundwater discharges to surface water or wetland, the groundwater quality shall comply with the Provincial Water Quality Objectives. If test results confirm non-compliance of groundwater quality with the **Provincial Water Quality Objectives, or any other monitored parameter found to be present at concentrations deemed to be unacceptable**, due to landfill leachate, an assessment of the potential impact of the discharging groundwater quality on the receiving wetland and/or surface water, along with mitigation action, as necessary, shall be carried out.

Groundwater Wells and Monitors

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(5) (a) The *Owner* shall ensure that all groundwater monitoring wells which form part of the monitoring program are properly capped, locked and protected from damage.

(b) The *Owner* shall install and include in the monitoring program, a new monitoring well at a location between west of the site and the Malcolm Lake, as described in Section 3.3 in Item 5 of Schedule "A" attached to this Certificate, to provide an indication on the groundwater quality discharging into the lake.

(c) All off-site private wells which are used as source of portable water supply and have the potential to be impacted by the landfill, shall be included in the water monitoring program for the Site.

9. CLOSURE PLAN

Condition 9(2) in the Approval dated May 13, 2008, is hereby revoked and replaced by new Condition 9(2) such that the new Condition reads as follows:

(2) (a) Upon reaching the approved capacity or upon decision by the Owner/Operator to cease operation permanently, or upon instructions by the District Manager to terminate the operations permanently, the Site shall be closed for deposition of waste into the waste fill area for final disposal, and closure works, including final capping, post-closure care and monitoring of the Site, shall be completed in accordance with the Closure Plan, (Section 4.27) in Item 5 of Schedule "A", attached to this Approval. Updates to the Closure Plan as appropriate, may be carried out and implemented, subject to a prior written concurrence in advance, by the District Manager.

(b) Within fifteen (15) days after closure of the Site, the Owner/Operator shall notify the Director, in writing, that the Site is closed in accordance with Condition 9(2)(a), above.

REASONS

The reason(s) for this amendment to the Approval is (are) as follows:

1. The reason for this amendment to the Approval is to correct errors in the area and the legal description of the Site as they appeared in the Certificate, and to approve a Design and Operations Plan to reflect the corrected Site area and address.
2. The reason for **Condition 1(3)** is to ensure that the Site is designed, operated, monitored and maintained in accordance with the application and supporting documentation submitted by the Owner, and not in a manner which the Director has not been asked to consider.
3. **Conditions 1(14)** and **1(15)** are included, pursuant to subsection 197(1) of the EPA, to provide that any persons having an interest in the Site are aware that the land has been approved and used for the purposes of waste disposal.
4. The reason for **Condition 2(7)** is to specify the hours of operation for the landfill Site.
5. The reason for **Condition 7(5)** is to specify restrictions on the extent of landfilling at this Site based on the Owner's application and supporting documentation. This defines the approved volumetric capacity of the site.
6. The reason for **Condition 7(9)(e)** is to specify the approval requirements and mechanism for amendment for use of alternative cover material to soil as cover at the Site.
7. The reason for **Condition 7(10)** is to ensure that cover material is applied over the waste to control potential nuisance effects, to facilitate vehicle access at the site, and to ensure an acceptable site appearance is maintained.
8. The reasons for **Conditions 8(2) and 8(5)** are to demonstrate that the landfill site is performing as designed in respect of the management of surface water and groundwater, and that the impacts on the natural environment are acceptable. Regular monitoring allows for the analysis of trends over time and ensures that there is an early warning of potential problems so that any necessary remedial/contingency action can be taken.

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9. The reason for **Condition 9(2)** is to ensure that appropriate closure processes, including final capping, are followed, and the closed landfill site is inspected, maintained and monitored in an environmentally acceptable manner for the protection of the natural environment and public health and safety.

This Notice shall constitute part of the approval issued under Approval No. A380405 dated November 17, 1976, as amended.

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

1. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

Pursuant to subsection 139(3) of the Environmental Protection Act, a hearing may not be required with respect to any terms and conditions in this environmental compliance approval, if the terms and conditions are substantially the same as those contained in an approval that is amended or revoked by this environmental compliance approval.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The environmental compliance approval number;
6. The date of the environmental compliance approval;
7. The name of the Director, and;
8. The municipality or municipalities within which the project is to be engaged in.

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
655 Bay Street, Suite 1500
Toronto, Ontario
M5G 1E5

AND

The Director appointed for the purposes of Part II.1 of
the Environmental Protection Act
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at:
Tel: (416) 212-6349, Fax: (416) 314-3717 or www.ert.gov.on.ca**

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 22nd day of November, 2013

Dale Gable, P.Eng.
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

DO/
c: District Manager, MOE Kingston - District
Guy Laporte, P. Eng., AECOM Canada Ltd.

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Ministry of the Environment
Ministère de l'Environnement

AMENDMENT TO PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A380405
Notice No. 1
Issue Date: May 13, 2008

The Corporation of the Township of North Frontenac
6648 Road 506, P.O. Box 97
Plevna, Ontario K0H 2M0

Site Location: Ardoch Waste Disposal Site
1114 Austris Road
North Frontenac Township, County of Frontenac

You are hereby notified that I have amended Provisional Certificate of Approval No. A380405 issued on November 17, 1976 for the use and operation of a 0.81 hectare landfill site within a total area of 40 hectares, as follows:

For the purpose of this Certificate of Approval and the terms and conditions specified below, the following definitions apply:

"Certificate" means this entire provisional Certificate of Approval document, issued in accordance with section 39 of the EPA, and includes any schedules to it, the application and the supporting documentation listed in Schedule "A";

"Director" means any Ministry employee appointed in writing by the Minister pursuant to section 5 of the EPA as a Director for the purposes of Part V of the EPA;

"District Manager" means the District Manager of the local district office of the Ministry in which the Site is geographically located;

"EPA" means *Environmental Protection Act*, R.S.O. 1990, c. E. 19, as amended;

"NMA" means *Nutrient Management Act*, 2002, S.O. 2002, c. 4, as amended from time to time;

"Operator" means any person, other than the Owner's employees, authorized by the Owner as having the charge, management or control of any aspect of the Site and includes its successors or assigns;

"Owner" means any person that is responsible for the establishment or operation of the Site being approved by this Certificate, and includes the Township of North Frontenac, its successors and assigns;

"OWRA" means the *Ontario Water Resources Act*, R.S.O. 1990, c. O.40, as amended;

"PA" means the *Pesticides Act*, R.S.O. 1990, c. P-11, as amended from time to time;

"Provincial Officer" means any person designated in writing by the Minister as a provincial officer pursuant to Section 5 of the OWRA or Section 5 of the EPA or Section 17 of PA or Section 4 of NMA or Section 8 of SDWA.

"Refrigerant Appliances" means household appliances which use, or may use refrigerants, and which include, but is not restricted to, refrigerators, freezers and air-conditioning systems;

"Regional Director" means the Regional Director of the local Regional Office of the Ministry in which the Site is located.

"Regulation 347" or "Reg. 347" means Regulation 347, R.R.O. 1990, made under the EPA, as amended from time to time;

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"SDWA" means *Safe Drinking Water Act*, 2002, S.O. 2002, c. 32, as amended from time to time;

"Site" means the entire waste disposal site, including the buffer lands, and contaminant attenuation zone located at 1114 Austris Road (Part of Lot 19, Concession 4) North Frontenac Township, County of Frontenac;

"Trained personnel" means knowledgeable in the following through instruction and/or practice:

- a. relevant waste management legislation, regulations and guidelines;
- b. major environmental concerns pertaining to the waste to be handled;
- c. occupational health and safety concerns pertaining to the processes and wastes to be handled;
- d. management procedures including the use and operation of equipment for the processes and wastes to be handled;
- e. emergency response procedures;
- f. specific written procedures for the control of nuisance conditions;
- g. specific written procedures for refusal of unacceptable waste loads; and
- h. the requirements of this *Certificate*; and

"White Goods" means household appliances which did not use refrigerants

You are hereby notified that this approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL

Compliance

(1) The *Owner* and *Operator* shall ensure compliance with all the conditions of this *Certificate* and shall ensure that any person authorized to carry out work on or operate any aspect of the *Site* is notified of this *Certificate* and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.

(2) Any person authorized to carry out work on or operate any aspect of the *Site* shall comply with the conditions of this *Certificate*.

In Accordance

(3) Except as otherwise provided for in this *Certificate*, the *Site* shall be designed, developed, built, operated and maintained in accordance with the applications for *Certificates* of Approval, dated July 20, 1972 and the supporting documentation listed in Schedule "A".

Interpretation

(4) Where there is a conflict between a provision of any document, including the application, referred to in this *Certificate*, and the conditions of this *Certificate*, the conditions in this *Certificate* shall take precedence.

(5) Where there is a conflict between the application and a provision in any documents listed in Schedule "A", the application shall take precedence, unless it is clear that the purpose of the document was to amend the application and that the *Ministry* approved the amendment.

(6) Where there is a conflict between any two documents listed in Schedule "A", other than the application, the document bearing the most recent date shall take precedence.

(7) The conditions of this *Certificate* are severable. If any condition of this *Certificate*, or the application of any condition of this *Certificate* to any circumstance, is held invalid or unenforceable, the application of such condition to other circumstances and the remainder of this *Certificate* shall not be affected thereby.

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Other Legal Obligations

(8) The issuance of, and compliance with, this *Certificate* does not:

- (a) relieve any person of any obligation to comply with any provision of any applicable statute, regulation or other legal requirement; or
- (b) limit in any way the authority of the *Ministry* to require certain steps be taken or to require the *Owner* and *Operator* to furnish any further information related to compliance with this *Certificate*.

Adverse Effect

(9) The *Owner* and *Operator* shall take steps to minimize and ameliorate any adverse effect on the natural environment or impairment of water quality resulting from the *Site*, including such accelerated or additional monitoring as may be necessary to determine the nature and extent of the effect or impairment.

(10) Despite an *Owner*, *Operator* or any other person fulfilling any obligations imposed by this *Certificate* the person remains responsible for any contravention of any other condition of this *Certificate* or any applicable statute, regulation, or other legal requirement resulting from any act or omission that caused the adverse effect to the natural environment or impairment of water quality.

Change of Ownership

(11) The *Owner* shall notify the *Director*, in writing, and forward a copy of the notification to the *District Manager*, within 30 days of the occurrence of any changes in the following information:

- (a) the ownership of the *Site*;
- (b) the *Operator* of the *Site*;
- (c) the address of the *Owner* or *Operator*; and
- (d) the partners, where the *Owner* or *Operator* is or at any time becomes a partnership and a copy of the most recent declaration filed under the *Business Names Act*, R. S. O. 1990, c. B.17, shall be included in the notification.

(12) No portion of this *Site* shall be transferred or encumbered prior to or after closing of the *Site* unless the *Director* is notified in advance and sufficient financial assurance is deposited with the *Ministry* to ensure that these conditions will be carried out.

(13) In the event of any change in *Ownership* of the works, other than change to a successor *Owner*, the *Owner* shall notify the successor of and provide the successor with a copy of this *Certificate*, and the *Owner* shall provide a copy of the notification to the *District Manager* and the *Director*.

Certificate of Requirement/Registration on Title

(14) The *Owner* shall:

- (a) Within 60 days of the date of the issuance of this *Certificate*, submit to the *Director* for review, two copies of a completed *Certificate of Requirement* with a registerable description of the *Property*; and
- (b) Within 10 calendar days of receiving the *Certificate of Requirement* authorized by the *Director*, register the *Certificate of Requirement* in the appropriate *Land Registry Office* on title to the *Site* and submit to the *Director* the duplicate registered copy immediately following registration.

(15) Pursuant to Section 197 of the *Environmental Protection Act*, neither the *Owner* nor any person having an interest in

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the Site shall deal with the Site in any way without first giving a copy of this Certificate to each person acquiring an interest in the Site as a result of the dealing.

Inspections by the Ministry

(16) No person shall hinder or obstruct a *Provincial Officer* from carrying out any and all inspections authorized by the *OWRA*, the *EPA*, the *PA*, the *SDWA* or the *NMA*, of any place to which this *Certificate* relates, and without limiting the foregoing:

- (a) to enter upon the premises where the approved works are located, or the location where the records required by the conditions of this *Certificate* are kept;
- (b) to have access to, inspect, and copy any records required to be kept by the conditions of this *Certificate*;
- (c) to inspect the *Site*, related equipment and appurtenances;
- (d) to inspect the practices, procedures, or operations required by the conditions of this *Certificate*; and
- (e) to sample and monitor for the purposes of assessing compliance with the terms and conditions of this *Certificate* or the *EPA*, the *OWRA*, the *PA*, the *SDWA* or the *NMA*.

Information and Record Retention

(17) Any information requested, by the *Ministry*, concerning the *Site* and its operation under this *Certificate*, including but not limited to any records required to be kept by this *Certificate* shall be provided to the *Ministry*, upon request, in a timely manner. Records shall be retained for contaminating life span of the *Site* except for as otherwise authorized in writing by the *Director*.

(18) The receipt of any information by the *Ministry* or the failure of the *Ministry* to prosecute any person or to require any person to take any action, under this *Certificate* or under any statute, regulation or other legal requirement, in relation to the information, shall not be construed as:

- (a) an approval, waiver, or justification by the *Ministry* of any act or omission of any person that contravenes any term or condition of this *Certificate* or any statute, regulation or other legal requirement; or
- (b) acceptance by the *Ministry* of the information's completeness or accuracy.

(19) The Owner shall ensure that a copy of this Certificate, in its entirety and including all its Notices of Amendment, and documentation listed in Schedule "A", are retained at the Site at all times.

2. SITE OPERATION

Operation

(1) The *Site* shall be operated and maintained at all time including management and disposal of all waste in accordance with the *EPA*, *Regulation 347*, and the conditions of this *Certificate*. At no time shall the discharge of a contaminant that causes or is likely to cause an adverse effect be permitted

Signs

(2) A sign shall be installed and maintained at the main entrance/exit to the *Site* on which is legibly displayed the following information:

- (a) the name of the *Site* and *Owner*;
- (b) the number of the *Certificate*;
- (c) the name of the *Operator*;
- (d) the normal hours of operation;
- (e) the allowable and prohibited waste types;
- (f) the telephone number to which complaints may be directed;

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- (g) a warning against unauthorized access;
- (h) a twenty-four (24) hour emergency telephone number (if different from above); and
- (i) a warning against dumping outside the *Site*.

(3) The Owner shall install and maintain signs to direct vehicles to working face and recycling areas.

(4) The Owner shall provide signs at recycling depot informing users what materials are acceptable and directing users to appropriate storage area.

Vermin, Vectors, Dust, Litter, Odour, Noise and Traffic

(5) The *Site* shall be operated and maintained such that the vermin, vectors, dust, litter, odour, noise and traffic do not create a nuisance.

Burning Waste Prohibited

(6) Burning of waste at the *Site* is prohibited.

Site Access

(7) Waste shall only be accepted at the *Site* from 6:00 am to 8:00 p.m.

(8) On-site equipment used for daily site preparation and closing activities shall be operated one (1) hour before and one (1) hour after the hours of operation approved by this *Certificate*.

(9) With the prior written approval from the *District Manager*, the time periods may be extended to accommodate seasonal or unusual quantities of waste.

Site Security

(10) No waste shall be received, landfilled or removed from the *Site* unless a site supervisor or attendant is present and supervises the operations during operating hours. The *Site* shall be closed when a site attendant is not present to supervise landfilling operations.

(11) The *Site* shall be operated and maintained in a safe and secure manner. During non-operating hours, the *Site* entrance and exit gates shall be locked and the *Site* shall be secured against access by unauthorized persons.

3. EMPLOYEE TRAINING

(1) A training plan for all employees that operate any aspect of the *Site* shall be developed and implemented by the *Operator*. Only *Trained Personnel* shall operate any aspect of the *Site* or carry out any activity required under this *Certificate*.

4. COMPLAINTS RESPONSE PROCEDURE

(1) If at any time the *Owner* receives complaints regarding the operation of the *Site*, the *Owner* shall respond to these complaints according to the following procedure:

(a) The *Owner* shall record and number each complaint, either electronically or in a log book, and shall include the following information: the nature of the complaint, the name, address and the telephone number of the complainant if the complainant will provide this information and the time and date of the complaint;

(b) The *Owner*, upon notification of the complaint, shall initiate appropriate steps to determine all possible causes of the complaint, proceed to take the necessary actions to eliminate the cause of the complaint and forward a formal reply to the complainant; and

(c) The *Owner* shall complete and retain on-site a report written within one (1) week of the complaint date, listing the actions taken to resolve the complaint and any recommendations for remedial measures, and

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managerial or operational changes to reasonably avoid the recurrence of similar incidents.

5. EMERGENCY RESPONSE

(1) Any spills, fires or other emergency situations shall be forthwith reported directly to the *Ministry's* Spills Action Centre (1-800-268-6060) and shall be cleaned up immediately.

(2) In addition, the *Owner* shall submit, to the *District Manager* a written report within three (3) business days of the emergency situation, outlining the nature of the incident, remedial measures taken, handling of waste generated as a result of the emergency situation and the measures taken to prevent future occurrences at the *Site*.

(3) All wastes resulting from an emergency situation shall be managed and disposed of in accordance with *O.Reg. 347*.

(4) All equipment and materials required to handle the emergency situations shall be:

- (a) kept on hand at all times that waste landfilling and/or handling is undertaken at the *Site*; and
- (b) adequately maintained and kept in good repair.

(5) The *Owner* shall ensure that the emergency response personnel are familiar with the use of such equipment and its location(s).

6. RECORD KEEPING AND REPORTING

Daily Log Book

(1) A daily log shall be maintained in written format and shall include the following information:

- (a) the type, date and time of arrival, hauler, and quantity (tonnes) of all industrial and commercial waste and cover material received at the *Site*;
- (b) the area of the *Site* in which waste disposal operations are taking place;
- (c) a record of litter collection activities and the application of any dust suppressants;
- (d) a record of the daily inspections; and
- (e) a description of any out-of-service period of any control, treatment, disposal or monitoring facilities, the reasons for the loss of service, and action taken to restore and maintain service.

(2) Any information requested, by the *Director* or a *Provincial Officer*, concerning the *Site* and its operation under this *Certificate*, including but not limited to any records required to be kept by this *Certificate* shall be provided to the *Ministry*, upon request.

Daily Inspections and Log Book

(3) An inspection of the entire *Site* and all equipment on the *Site* shall be conducted each day the *Site* is in operation to ensure that: the *Site* is secure; that the operation of the *Site* is not causing any nuisances; that the operation of the *Site* is not causing any adverse effects on the environment and that the *Site* is being operated in compliance with this *Certificate*. Any deficiencies discovered as a result of the inspection shall be remedied immediately, including temporarily ceasing operations at the *Site* if needed.

(4) A record of the inspections shall be kept in a daily log book that includes:

- (a) the name and signature of person that conducted the inspection;
- (b) the date and time of the inspection;
- (c) the list of any deficiencies discovered;
- (d) the recommendations for remedial action; and
- (e) the date, time and description of actions taken.

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(5) A record shall be kept in the daily log book of all refusals of waste shipments, the reason(s) for refusal, and the origin of the waste, if known.

Annual Report

(6) A written report on the development, operation and monitoring of the *Site*, shall be completed annually (the "Annual Report"). The Annual Report shall be submitted to the *District Manager*, by March 31st of the year following the period being reported upon.

(7) The Annual Report shall include the following:

- (a) the results and an interpretive analysis of the results of all leachate, groundwater surface water and landfill gas monitoring, including an assessment of the need to amend the monitoring programs;
- (b) an assessment of the operation and performance of all engineered facilities, the need to amend the design or operation of the *Site*, and the adequacy of and need to implement the contingency plans;
- (c) site plans showing the existing contours of the *Site*; areas of landfilling operation during the reporting period; areas of intended operation during the next reporting period; areas of excavation during the reporting period; the progress of final cover, vegetative cover, and any intermediate cover application; previously existing site facilities; facilities installed during the reporting period; and site preparations and facilities planned for installation during the next reporting period;
- (d) calculations of the volume of waste, daily and intermediate cover, and final cover deposited or placed at the *Site* during the reporting period and a calculation of the total volume of *Site* capacity used during the reporting period;
- (e) a calculation of the remaining capacity of the *Site* and an estimate of the remaining *Site* life;
- (f) a summary of the weekly, maximum daily and total annual quantity (tonnes) of waste received at the *Site*;
- (g) a summary of any complaints received and the responses made;
- (h) a discussion of any operational problems encountered at the *Site* and corrective action taken;
- (i) any changes to the Design and Operations Report and the Closure Plan that have been approved by the *Director* since the last *Annual Report*;
- (j) a report on the status of all monitoring wells and a statement as to compliance with *Ontario Regulation 903*; and
- (k) any other information with respect to the *Site* which the *Regional Director* may require from time to time.

7. LANDFILL DESIGN AND DEVELOPMENT

Approved Waste Types

(1) Only solid non-hazardous municipal waste as defined under *Reg. 347* shall be accepted at the *Site* for landfilling.

(2) No liquid industrial waste or hazardous wastes as defined under *Reg. 347* shall be received at the *Site*.

(3) The *Owner* shall develop and implement a program to inspect waste to ensure that the waste received at the *Site* is of a type approved for acceptance under this *Certificate*.

(4) The *Owner* shall ensure that all loads of waste are properly inspected by trained site personnel prior to acceptance at the *Site* and that the waste vehicles are directed to the appropriate areas for disposal or transfer of the waste. The *Owner* shall notify the *District Manager*, in writing, of load rejections at the *Site* within one (1) business day from their occurrence.

Capacity

CONTENT COPY OF ORIGINAL

(5) The calculated theoretical maximum volumetric capacity of the Site, consisting of the waste, daily cover and intermediate cover, but excluding the final cover is 48,770 cubic metres.

(6) This approval is for the design, operation and use of 24,670 cubic meters of the calculated theoretical maximum volumetric capacity of the Site as described in Item 2 of Schedule "A".

(7) At least two (2) years prior to utilizing the remaining calculated theoretical maximum volumetric capacity of the Site, the Owner shall submit to the Director for Director's approval, a design and operation plan with up to date engineering and environmental standards and a detailed hydrogeological assessment for proper and safe development of the remainder of the Site.

Service Area

(8) Only waste that is generated within the boundaries of the Township of North Frontenac shall be accepted at the *Site*.

Cover

(9) Alternative materials to soil may be used as daily and interim cover material, based on an application with supporting information and applicable fee for a trial use or permanent use, submitted by the *Owner* to the *Director*, copied to the *District Manager* and as approved by the *Director* via an amendment to this *Certificate*. The alternative material shall be non-hazardous according to *Reg. 347* and will be expected to perform at least as well as soil in relation to the following functions:

- (a) Control of blowing litter, odours, dust, landfill gas, gulls, vectors, vermin and fires;
- (b) Provision for an aesthetic condition of the landfill during the active life of the *Site*;
- (c) Provision for vehicle access to the active tipping face; and
- (d) Compatibility with the design of the *Site* for groundwater protection, leachate management and landfill gas management.

(10) Cover material shall be applied as follows:

- (a) Daily Cover - Weather permitting, deposited waste shall be covered monthly in the summer and bimonthly in winter in a manner acceptable to the District Manager so that no waste is exposed to the atmosphere;
- (b) Intermediate Cover - In areas where landfilling has been temporarily discontinued for six (6) months or more, a minimum thickness of 300 millimetre of soil cover or an approved thickness of alternative cover material shall be placed; and
- (c) Final Cover - In areas where landfilling has been completed to final contours, a minimum 600 millimetre thick layer of clay and 150 millimetres of top soil (final cover) shall be placed. Fill areas shall be progressively completed and rehabilitated as landfill development reaches final contours.

8. LANDFILL MONITORING

Landfill Gas

(1) The *Owner* shall ensure that any buildings or structures at the *Site* contain adequate ventilation systems to relieve any possible landfill gas accumulation. Routine monitoring for explosive methane gas levels shall be conducted in all buildings or structures at the *Site*, especially enclosed structures which at times are occupied by people.

Compliance Limits

(2) The *Site* shall be operated in such a way as to ensure compliance with the following:

CONTENT COPY OF ORIGINAL

- (a) Reasonable Use Guideline B-7 for the protection of the groundwater at the *Site*; and
- (b) Provincial Water Quality Objectives included in the July 1994 publication entitled *Water Management Policies, Guidelines, Provincial Water Quality Objectives*, as amended from time to time or limits set by the *Regional Director*, for the protection of the surface water at and off the *Site*.

Surface Water and Ground Water

- (3) The *Owner* shall monitor surface water and ground water in accordance with Items 2 and 3 in Schedule "A".
- (4) A certified Professional Geoscientist or Engineer possessing appropriate hydrogeologic training and experience shall execute or directly supervise the execution of the groundwater monitoring and reporting program.

Groundwater Wells and Monitors

- (5) The *Owner* shall ensure that all groundwater monitoring wells which form part of the monitoring program are properly capped, locked and protected from damage.
- (6) Where landfilling is to proceed around monitoring wells, suitable extensions shall be added to the wells and the wells shall be properly re-secured.
- (7) Any groundwater monitoring wells included in the on-going monitoring program that are damaged shall be assessed, repaired, replaced or decommissioned by the *Owner*, as required.
 - (a) The *Owner* shall repair or replace any monitoring well which is destroyed or in any way made to be inoperable for sampling such that no more than one regular sampling event is missed.
 - (b) All monitoring wells which are no longer required as part of the groundwater monitoring program, and have been approved by the *District Manager* for abandonment, shall be decommissioned by the *Owner*, as required, in accordance with *O.Reg. 903*, that will prevent contamination through the abandoned well. A report on the decommissioning of the well shall be included in the Annual Report for the period during which the well was decommissioned.

Trigger Mechanisms and Contingency Plans

- (8) Within one (1) year from the date of this *Certificate*, the *Owner* shall submit to the *Director*, for approval, and copies to the *District Manager*, details of a trigger mechanisms plan for surface water and groundwater quality monitoring for the purpose of initiating investigative activities into the cause of increased contaminant concentrations at the Contaminant Attenuation Zone (*CAZ*) limit.
- (9) Within one (1) year from the date of this *Certificate*, the *Owner* shall submit to the *Director* for approval, and copies to the *District Manager*, details of a contingency plan to be implemented in the event that the surface water or groundwater quality exceeds the a trigger mechanism at the *CAZ* limit.
- (10) In the event of a confirmed exceedence of a site-specific trigger level relating to leachate mounding or groundwater or surface water impacts due to leachate at the site's *CAZ* limit, the *Owner* shall immediately notify the *District Manager*, and an investigation into the cause and the need for implementation of remedial or contingency actions shall be carried out by the *Owner* in accordance with the approved trigger mechanisms and associated contingency plans.
- (11) If monitoring results, investigative activities and/or trigger mechanisms indicate the need to implement contingency measures, the *Owner* shall ensure that the following steps are taken:

CONTENT COPY OF ORIGINAL

- (a) The *Owner* shall notify the *District Manager*, in writing of the need to implement contingency measures, no later than 30 days after confirmation of the exceedences;
- (b) Detailed plans, specifications and descriptions for the design, operation and maintenance of the contingency measures shall be prepared and submitted by the *Owner* to the *District Manager* for approval; and
- (c) The contingency measures shall be implemented by the *Owner* upon approval by the *District Manager*.

(12) The *Owner* shall ensure that any proposed changes to the site-specific trigger levels for leachate impacts to the surface water or groundwater, shall be approved in advance by the *Director* via an amendment to this *Certificate*.

Changes to the Monitoring Plan

(13) The *Owner* may request to make changes to the monitoring program(s) to the *District Manager* in accordance with the recommendations of the annual report. The *Owner* shall make clear reference to the proposed changes in separate letter that shall accompany the annual report.

(14) Within fourteen (14) days of receiving the written correspondence from the *District Manager* confirming that the *District Manager* is in agreement with the proposed changes to the environmental monitoring program, the *Owner* shall forward a letter identifying the proposed changes and a copy of the correspondences from the *District Manager* and all other correspondences and responses related to the changes to the monitoring program, to the *Director* requesting the *Certificate* be amended to approve the proposed changes to the environmental monitoring plan prior to implementation.

(15) In the event any other changes to the environmental monitoring program are proposed outside of the recommendation of the annual report, the *Owner* shall follow current ministry procedures for seeking approval for amending the *Certificate of Approval*.

9. CLOSURE PLAN

(1) At least 2 years prior to the anticipated date of closure of this *Site*, the *Owner* shall submit to the *Director* for approval, with copies to the *District Manager*, a detailed *Site* closure plan pertaining to the termination of landfilling operations at this *Site*, post-closure inspection, maintenance and monitoring, and end use. The plan shall include the following:

- (a) a plan showing *Site* appearance after closure;
- (b) a description of the proposed end use of the *Site*;
- (c) a descriptions of the procedures for closure of the *Site*, including:
 - (i) advance notification of the public of the landfill closure;
 - (ii) posting of a sign at the *Site* entrance indicating the landfill is closed and identifying any alternative waste disposal arrangements;
 - (iii) completion, inspection and maintenance of the final cover and landscaping;
 - (iv) *Site* security;
 - (v) removal of unnecessary landfill-related structures, buildings and facilities;
 - (vi) final construction of any control, treatment, disposal and monitoring facilities for leachate, groundwater, surface water and landfill gas; and
 - (vii) a schedule indicating the time-period for implementing sub-conditions (i) to (vi) above;
- (d) descriptions of the procedures for post-closure care of the *Site*, including:
 - (i) operation, inspection and maintenance of the control, treatment, disposal and monitoring facilities for leachate, groundwater, surface water and landfill gas;
 - (ii) record keeping and reporting; and
 - (iii) complaint contact and response procedures;
- (e) an assessment of the adequacy of and need to implement the contingency plans for leachate

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and methane gas; and

(f) an updated estimate of the contaminating life span of the *Site*, based on the results of the monitoring programs to date.

(2) The *Site* shall be closed in accordance with the closure plan as approved by the *Director*.

10. WASTE DIVERSION

(2) The Owner shall ensure that:

- (a) all bins and waste storage areas are clearly labelled;
- (b) all lids or doors on bins shall be kept closed during non-operating hours and during the high wind events; and
- (c) if necessary to prevent litter, waste storage areas shall be covered during the high winds events.

(3) The Owner shall provide a segregated area for the storage of *Refrigerant Appliances* so that the following are ensured:

- (a) all *Refrigerant Appliances* have been tagged to indicate that the refrigerant has been removed by a licensed technician. The tag number shall be recorded in the log book and shall remain affixed to the appliance until transferred from the *Site*; **or**
- (b) all *Refrigerant Appliances* accepted at the *Site*, which have not been tagged by a licensed technician to verify that the equipment no longer contains refrigerants, are stored segregated, in a clearly marked area, in an upright position and in a manner which allows for the safe handling and transfer from the *Site* for removal of refrigerants as required by O.Reg. 189; and
- (c) all *Refrigerant Appliances* received on-site shall either have the refrigerant removed prior to being transferred from the *Site* or shall be shipped off-site only to facilities where the refrigerants can be removed by a licensed technician in accordance with O.Reg. 189.

(4) Propane cylinders shall be stored in a segregated area in a manner which prevents cylinders from being knocked over or cylinder valves from breaking.

(5) The Owner shall transfer waste and recyclable materials from the *Site* as follows:

- (a) recyclable materials shall be transferred off-site once their storage bins are full;
- (b) scrap metal shall be transferred off-site at least twice a year;
- (c) tires shall be transferred off-site as soon as a load for the contractor hired by the Owner has accumulated or as soon as the accumulated volume exceeds the storage capacity of its bunker; and
- (d) immediately, in the event that waste is creating an odour or vector problem.

(6) The Owner shall notify the appropriate contractors that waste and recyclable wastes that are to be transferred off the *Site* are ready for removal. Appropriate notice time, as determined by the contract shall be accommodated in the notification procedure.

SCHEDULE "A"

1. Application for a Certificate of Approval for a Waste Disposal Site dated July 20, 1972 and all the supporting information associated with the application.
2. Report titled "Township of North Frontenac, Development and Closure Plan" dated February 28, 2006, prepared by Totten Sims Hubicki Associates.
3. Letter dated January 4, 2008 from Guy Laporte, P.Eng., Totten Sims Hubicki Associates to Ranjani Munasinghe, Ministry of the Environment.

The reason(s) for this amendment to the Certificate of Approval is (are) as follows:

CONTENT COPY OF ORIGINAL

GENERAL

1. The reason for Conditions 1(1), (2), (4), (5), (6), (7), (8), (9), (10), (17), (18) and (19) is to clarify the legal rights and responsibilities of the *Owner* and *Operator* under this Certificate of Approval.
2. The reasons for Condition 1(3) is to ensure that the *Site* is designed, operated, monitored and maintained in accordance with the application and supporting documentation submitted by the *Owner*, and not in a manner which the *Director* has not been asked to consider.
3. The reasons for Condition 1(11) are to ensure that the *Site* is operated under the corporate name which appears on the application form submitted for this approval and to ensure that the *Director* is informed of any changes.
4. The reasons for Condition 1(12) are to restrict potential transfer or encumbrance of the *Site* without the approval of the *Director* and to ensure that any transfer of encumbrance can be made only on the basis that it will not endanger compliance with this Certificate of Approval.
5. The reason for Condition 1(13) is to ensure that the successor is aware of its legal responsibilities.
6. Conditions 1 (14) and (15) are included, pursuant to subsection 197(1) of the *EPA*, to provide that any persons having an interest in the *Site* are aware that the land has been approved and used for the purposes of waste disposal.
7. The reason for Condition 1(16) is to ensure that appropriate Ministry staff has ready access to the Site for inspection of facilities, equipment, practices and operations required by the conditions in this Certificate of Approval. This Condition is supplementary to the powers of entry afforded a Provincial Officer pursuant to the *Act*, the *OWRA*, the *PA*, the *NMA* and the *SDWA*.

SITE OPERATION

8. The reasons for Conditions 2(1), 2(5) and 6(3) are to ensure that the *Site* is operated, inspected and maintained in an environmentally acceptable manner and does not result in a hazard or nuisance to the natural environment or any person.
9. The reason for Conditions 2 (2), 2(3) and 2(4) is to ensure that users of the *Site* are fully aware of important information and restrictions related to *Site* operations and access under this *Certificate*.
10. The reason for Condition 2(6) is that open burning of municipal waste is unacceptable because of concerns with air emissions, smoke and other nuisance affects, and the potential fire hazard.
11. The reasons for Condition 2(7), 2(8) and 2(9) are to specify the hours of operation for the landfill site and a mechanism for amendment of the hours of operation, as required.
12. The reasons for Condition 2(10) and 2(11) are to ensure that the *Site* is supervised by properly trained staff in a manner which does not result in a hazard or nuisance to the natural environment or any person and to ensure the controlled access and integrity of the *Site* by preventing unauthorized access when the Site is closed and no site attendant is on duty.

EMPLOYEE TRAINING

13. The reason for Condition 3(1) is to ensure that the *Site* is supervised and operated by properly trained staff in a manner which does not result in a hazard or nuisance to the natural environment or any person.

COMPLAINTS RESPONSE PROCEDURE

14. The reason for Condition 4(1) is to ensure that any complaints regarding landfill operations at this *Site* are responded to in a timely and efficient manner.

EMERGENCY RESPONSE

15. Conditions 5(1) and 5(2) are included to ensure that emergency situations are reported to the Ministry to ensure public

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health and safety and environmental protection.

16. Conditions 5(3), 5(4) and 5(5) are included to ensure that emergency situations are handled in a manner to minimize the likelihood of an adverse effect and to ensure public health and safety and environmental protection.

RECORD KEEPING AND REPORTING

17. The reason for Conditions 6(1) and 6(2) is to ensure that accurate waste records are maintained to ensure compliance with the conditions in this Certificate of Approval (such as fill rate, site capacity, record keeping, annual reporting, and financial assurance requirements), the *EPA* and its regulations.

18. The reason for Conditions 6(4) and 6(5) is to ensure that detailed records of *Site* inspections are recorded and maintained for inspection and information purposes.

19. The reasons for Conditions 6(6) and 6(7) are to ensure that regular review of site development, operations and monitoring data is documented and any possible improvements to site design, operations or monitoring programs are identified. An annual report is an important tool used in reviewing site activities and for determining the effectiveness of site design.

LANDFILL DESIGN AND DEVELOPMENT

20. The reason for Conditions 7(1) to 7(8) inclusive is to specify the approved areas from which waste may be accepted at the *Site* and the types and amounts of waste that may be accepted for disposal at the *Site*, based on the *Owner's* application and supporting documentation.

21. The reason for Condition 7 (9) is to specify the approved alternative cover material and to specify requirements for use of alternative cover material at the *Site*.

22. The reasons for Condition 7(10) are to ensure that daily and intermediate cover is used to control potential nuisance effects, to facilitate vehicle access on the *Site*, and to ensure an acceptable site appearance is maintained. The proper closure of a landfill site requires the application of a final cover which is aesthetically pleasing, controls infiltration, and is suitable for the end use planned for the *Site*.

LANDFILL MONITORING

23. Reasons for Condition 8(1) are to ensure that off site migration of landfill gas is monitored and all buildings at the *Site* are free of any landfill gas accumulation, which due to a methane gas component may be explosive and thus create a danger to any persons at the *Site*.

24. Condition 8(2) is included to provide the groundwater and surface water limits to prevent water pollution at the *Site*.

23. Conditions 8(3) and 8(4) are included to require the *Owner* to demonstrate that the *Site* is performing as designed and the impacts on the natural environment are acceptable. Regular monitoring allows for the analysis of trends over time and ensures that there is an early warning of potential problems so that any necessary remedial/contingency action can be taken.

24. Conditions 8(5), 8(6) and 8(7) are included to ensure the integrity of the groundwater monitoring network so that accurate monitoring results are achieved and the natural environment is protected.

25. Conditions 8(8) to 8(12) inclusive are added to ensure the *Owner* has a plan with an organized set of procedures for identifying and responding to potential issues relating to groundwater and surface water contamination near or at the *Site's* compliance point.

26. Reasons for conditions 8(13), 8(14) and 8(15) are included to streamline the approval of the changes to the monitoring plan.

CLOSURE PLAN

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27. The reasons for Condition 9 are to ensure that final closure of the *Site* is completed in an aesthetically pleasing manner, in accordance with Ministry standards, and to ensure the long-term protection of the health and safety of the public and the environment.

WASTE DIVERSION

28. Condition 10 is included to ensure that the recyclable materials are stored in their temporary storage location in a manner as to minimize a likelihood of an adverse effect or a hazard the natural environment or any person.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A380405 dated November 17, 1976

In accordance with Section 139 of the Environmental Protection Act, R.S.O. 1990, Chapter E-19, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the waste disposal site is located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
655 Bay Street, 15th Floor
Toronto, Ontario
M5G 1E5

AND

The Director
Section 39, *Environmental Protection Act*
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted waste disposal site is approved under Section 39 of the Environmental Protection Act.

DATED AT TORONTO this 13th day of May, 2008

Tesfaye Gebrezghi, P.Eng.
Director
Section 39, *Environmental Protection Act*

RM/
c: District Manager, MOE Kingston - District
Guy Laporte, P. Eng., Totten Sims Hubicki Associates



Appendix C Correspondence

Fully accessible appended items are available upon request.

**Ministry of the
Environment,
Conservation and Parks**
Eastern Region
1259 Gardiners Road, Unit 3
Kingston ON K7P 3J6
Phone: 613.549.4000
or 1.800.267.0974

**Ministère de l'Environnement,
de la Protection de la nature
et des Parcs**
Région de l'Est
1259, rue Gardiners, unité 3
Kingston (Ontario) K7P 3J6
Tél: 613 549-4000
ou 1 800 267-0974



MEMORANDUM

January 26, 2022

TO: Craig Dobiech
Senior Environmental Officer
Kingston District Office
Eastern Region

FROM: Shawn Trimper
Hydrogeologist
Technical Support Section
Eastern Region

RE: 2020 Annual Monitoring Report
Ardoch Waste Disposal Site
1114 Austris Road
Lot 19, Concession Southwesterly Range
Geographic Township of Clarendon
Township of North Frontenac
Environmental Compliance Approval No. A380405

I have reviewed the 2020 Annual Monitoring Report (AMR) for the Ardoch Waste Disposal Site (WDS) prepared by Cambium and dated March 25, 2021. The following sections provide a summary of factual information related to the site as well as details and interpretations provided in the 2020 AMR. My conclusions and recommendations are provided in the final section of this memorandum.

Environmental Compliance Approval (ECA)

The Ardoch WDS is located on Lot 19, Concession Southwesterly Range, Geographic Township of Clarendon, Township of North Frontenac. The site is owned and operated by the Corporation of the Township of North Frontenac (the township). Waste management activities on the site are authorised by ECA No. A380405. Cambium reports that the site is licensed for the operation of a 0.8 hectare (ha) landfilling area within a total site area of 4.02 ha. The site is approved for the disposal of solid non-hazardous domestic waste and has an approved volumetric capacity of 30,320 cubic metres (m³). Waste disposal activities commenced at the site prior to 1972. The site is a natural attenuating waste disposal site and the landfilling method is "area fill".

In an effort to reduce costs the municipality temporarily ceased landfilling operations at the site in 2014 and the ECA was amended in 2015 recognising temporary closure of the site. The site is to remain closed for at least 15 years and an updated Design and Operations Report is required to be prepared and approved prior to the reopening of the site. This amendment also addressed errors in the site address and size (previously indicated to be 40 ha).

The site has an estimated remaining capacity of 18,430 m³. Based on the historical waste disposal rates the site has an estimated life span of approximately 38 years.

Site Description

The Ardoch WDS is located at 1114 Austris Road and is approximately 3 kilometres southeast of the village of Ardoch. The site is bordered to the east by Austris Road, a small number of residential lots (a mix of vacant and developed) to the west, and forested lands to the north and west. A low-lying wetland area is located onsite immediately west of the waste mound. Channelized flow is reported to occur within the wetland toward the north and discharges to Malcolm Lake approximately 100 metres northwest of the site.

Geology

The site is reported to be located on the northern flank of an east-west trending bedrock ridge composed of undulating Precambrian bedrock. The site is reported to be covered by a relatively thick deposit of ice contact stratified sand and gravel. Bedrock outcrops in the area are generally of limited extent but are prominent along Austris Road.

Hydrogeology

It is reported that groundwater transport is primarily through the permeable sand/gravel overburden. The Precambrian bedrock is reported to be poorly fractured with low water transmitting capacity, restricting flow to the shallow overburden where it is interpreted to discharge to the wetland area northwest of the waste mound.

Groundwater flow is interpreted to be toward the west with slight radial components detected toward the southwest attributed to mounding below the waste mound. The groundwater elevations and interpretation from 2020 are consistent with previous years.

Existing Groundwater Monitoring Program

The groundwater monitoring network currently consists of seven (7) shallow overburden monitoring wells that range in depth from 2.6 to 3.4 metres in depth. No bedrock monitoring wells are present at the site. Due to concerns related to the materials used and the integrity of the monitoring wells present at the site, all previously installed monitoring wells with the exception of MW12-5B were abandoned and reinstalled using appropriate methods and materials in 2014.

The currently approved groundwater monitoring program requires groundwater elevation monitoring and water quality sampling to be completed twice per year (spring and fall) at all seven (7) existing monitoring wells.

Background Groundwater Quality

Monitoring well MW14-7R is interpreted to be located upgradient of the site and to be representative of background groundwater quality at the site. It is noted that this

monitoring well is seasonally dry. It is reported that most groundwater parameters have low to moderate concentrations.

Leachate

Cambium has assessed leachate quality at the site using monitoring wells MW14-2R and MW14-3R which are adjacent/south of the waste mound. Cambium identifies the following parameters are the leachate indicator parameters (LIPs) associated with the site: alkalinity, boron, calcium, chloride, conductivity, hardness, total dissolved solids (TDS), and sodium.

Cambium indicates that iron and manganese are elevated at background monitoring well MW09-7 and are therefore not leachate indicator parameters.

Downgradient Groundwater Quality

Monitoring wells MW12-5B, MW14-4R, MW14-6R are located to the southwest, west, and south of the waste mound, respectively, and are interpreted to be located downgradient of the waste mound. Cambium indicates that a dilute leachate plume is emanating from the waste mound and is identified at these three monitoring wells.

Monitoring well MW14-1R is located east of the waste mound and is interpreted by Cambium to be located upgradient of the waste mound. Elevated concentrations of chloride, sodium, and TDS are identified in groundwater at this location but are interpreted to be the result of road salting activities. Zinc is also elevated at this location, but Cambium indicates that it is not attributed to the site.

Regulatory Evaluation

Reasonable Use Guideline B-7 applies to all operating WDS and those WDS closed after 1986; therefore, Guideline B-7 applies to the Ardoch WDS. Given that groundwater is interpreted to discharge to surface water onsite the intent of Guideline B-7 is interpreted to be met.

Trigger Mechanisms and Contingency Action Plan

Given that leachate impacted groundwater is interpreted to discharge to surface water onsite, the sites groundwater triggers and associated contingency action plan is based on surface water protection.

Condition 8(2) of the ECA requires groundwater quality to be compared to and comply with the Provincial Water Quality Objectives (PWQO) in areas where groundwater is interpreted to discharge to surface water or wetlands. Contingency actions are required to be taken if PWQO exceedances (with the exception of iron and zinc) are identified and confirmed and are interpreted to be landfill related. The required contingency action consists of the completion of an assessment of the potential impact of the discharging groundwater quality on the receiving wetland and/or surface water, along with mitigation action as necessary.

Groundwater – Surface Water Interaction

Cambium indicates that groundwater on the site is interpreted to discharge to surface water features northwest of the waste mound within the limits of the township owned property. As such, leachate impacted groundwater has the potential to impact surface water on and surrounding the site.

Potable Supply Wells

It is reported that no potable water supply wells are located in the immediate vicinity of the site. No potable water supply wells are included in the groundwater sampling program.

Landfill Gas

Condition 4.2 of the ECA requires that landfill gas be monitored from appropriate dedicated landfill gas sampling probes installed at the site, at least once during warm conditions and twice during frozen ground conditions. Four (4) landfill gas probes were installed at the site in 2016.

Landfill gas monitoring was completed in the existing landfill gas probes in January, February, and July of 2020 in accordance with the ECA requirements. The concentration of methane was less than 1% methane by volume at all locations during all monitoring events, consistent with previous years. The Landfill Standards (MOE, 2011) require that methane concentrations not exceed 2.5% methane gas at the property boundary. Based on the 2020 monitoring results landfill gas is not currently interpreted to be a concern.

Given that landfill gas concentrations have been stable and are not at concentrations of concern, Cambium is recommending that landfill gas monitoring be reduced to twice per year (once during frozen conditions and once during warm conditions).

Ongoing Groundwater Monitoring and Reporting

Cambium has recommended the following changes to the groundwater monitoring program:

- Groundwater monitoring and sampling be reduced from twice per year (spring and fall) to once per year (spring). Cambium indicates that this reduction is warranted given that groundwater quality is stable with little seasonal variation and is expected to improve with time given that the site is temporarily closed.
- Monitoring well MW14-2R be removed from the groundwater sampling program. Cambium indicates that this monitoring well is redundant given its close proximity and similar water quality to monitoring well MW14-3R.

Cambium has also recommended that the reporting frequency be reduced to once every three (3) years. Cambium indicates that the reduced reporting frequency is supportable given that the site is temporarily closed and given the proposed reduction in the monitoring frequency.

Conclusions and Recommendations

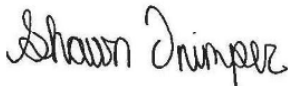
I provide the following conclusions and recommendations for your consideration:

- The Ardoch WDS is a naturally attenuating landfill site that has been temporarily closed since 2014.
- The level of understanding related to the geological and hydrogeological conditions at this site appear to be insufficient to support the conceptual understanding of leachate migration at site. This comment has been raised by previous ministry reviewers but remains unaddressed. To date it has been assumed that groundwater discharges to surface water onsite and the bedrock at the site is relatively impermeable; however, based on my review of the available information these processes appear to be poorly supported. Additional information is required with respect to the geological and hydrogeological conditions on and surrounding the site to support the conceptual understanding of leachate migration.
- The assessment of background groundwater quality is currently adequate.
- A true leachate monitor does not exist at the site and Cambium has used monitoring wells MW14-3R and MW14-2R to assess leachate quality. Based on my assessment of the existing data it is apparent that monitoring well MW12-5B is the most significantly impacted monitoring well at the site. In future reports, the most significantly impacted monitoring well should be used to assess leachate quality at the site (this is currently MW12-5B).
- The presence of increasing trends at monitoring well MW12-5B indicates that the leachate strength is increasing. Increased leachate strength is not uncommon following site closure due to reduced infiltration. Leachate quality should be closely watched in future years and concentration trends discussed in future reports.
- Cambium has identified eight (8) LIPS that are associated with the site; however, based on the existing data I conclude that this list is incomplete and should include the following additional parameters: barium, chemical oxygen demand (COD), iron, magnesium, and sulphate. Manganese and Dissolved Organic Carbon (DOC) are also commonly accepted LIPs associated with waste disposal but are more difficult to interpret due to redox interactions and background conditions but should not be disregarded.
- Cambium indicates that elevated zinc identified in groundwater is not related to the landfill; however, no discussion as to the source of the zinc is provided.

- A relatively weak leachate plume is present to the south (MW14-2R, MW14-3R, MW14-6R), southwest (MW12-5B), and west (MW14-4R) as indicated by Cambium. Leachate impacts appear to be decreasing at monitoring wells MW14-4R, MW14-2R and MW14-3R; however, a relatively significant increasing trend is occurring at MW12-5B indicating that the leachate plume is expanding toward the southwest. Cambium indicates that monitoring well MW14-1R is impacted by road salting activities only; however, I note that numerous LIPs are decreasing at this location indicating that this monitoring well has been impacted by leachate but is improving.
- The site is currently interpreted to be in compliance with Guideline B-7 based on the assumption that leachate impacted groundwater discharges to surface water onsite. So long as this can be demonstrated/confirmed (as discussed above) this is a valid conclusion.
- It is reported that no potable supply wells are in use surrounding the site; however, I note that a number of cottages are located in close proximity to and potentially downgradient of the site. Details related to the water supplies used at surrounding properties should be confirmed and provided.
- A ministry surface water specialist should continue to be consulted with respect to surface water protection and management on and surrounding the site.
- The groundwater monitoring and sampling program completed in 2020 was in compliance with the ECA.
- Landfill gas monitoring was completed in 2020 in accordance with the requirements of the ECA. The results indicate that landfill gas does not currently pose a concern at the site and is consistent with previous years.
- I provide the following comments with respect to the adequacy of the existing monitoring and reporting programs and the proposed reductions recommended by Cambium:
 - I have no objection to removing monitoring well MW14-2R from the groundwater sampling program as proposed by Cambium. This monitoring well is redundant as indicated by Cambium.
 - I cannot currently support a reduction in the frequency of groundwater monitoring/sampling or reporting at the site. Cambium indicates that the plume is stable and expected to decrease over time; however, the magnitude and extent of impacts are actually increasing toward the southwest.
 - I have concerns with the suitability of the materials (likely galvanized steel) used to construct monitoring well MW12-5B and potentially other monitoring wells. An assessment should be completed to ensure that all monitoring wells are constructed of appropriate inert materials. Any

monitoring wells not constructed of appropriate materials should be abandoned and replaced using appropriate methods and materials.

- Volatile organic compounds (VOCs) are not currently included in the groundwater sampling program. I recommend that VOCs be added to the groundwater sampling program at a frequency of once every five (5) years at the leachate monitoring well(s) only (currently MW12-5B). The sampling should include a comprehensive list of VOCs. This requirement is consistent with typical groundwater monitoring requirements at similarly sized sites.
- I expect to have additional comments related to the adequacy of the monitoring program once I have received additional information to support the conceptual understanding of leachate migration and have had the opportunity to complete a site visit.
- The proposed reduction in landfill gas monitoring seems reasonable; however, the regional air analyst or engineer should be consulted with respect to this proposed change.



Shawn Trimper, P.Eng.
SAT

ec: Victor Castro
Roberto Sacilotto
Sarah Baxter

c: File GW FR NF 01 02 AU (Ardoch WDS; ECA No. A380405)
ECHO Review No. 1-94344865



Appendix D

Field and Precipitation Data

Fully accessible appended items are available upon request.

LOCATION: Ardoch WDSDATE: May 18, 2021WEATHER (SAMPLE DAY): 8°C Sun 25°CPROJECT NUMBER: 10530-003SAMPLED BY: M. Pion and N. MorinWEATHER (PREVIOUS DAY): 22°C Sun

FIELD SHEET – GROUNDWATER DEVELOPMENT & SAMPLING

Sample Location	Water Level	B.H. Depth (m)	B.H. Dia. (mm)	Stick - Up (m)	Purge Volumes (L)		Temp (°C)	pH (units)	Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Observations				
					Needed	Actual						Clarity	Colour	Odour	Sheen	Other
MW14-1R	1.28	2.59	25.4	0.95	2.00	2.00	9.3	7.28	517	1.90	74	Clear	None	None	None	QA/QC
MW14-2R	2.27	3.35	25.4	0.94	1.75	1.75	8.3	7.28	422	8.50	75	Clear	None	None	None	
MW14-3R	1.81	3.27	25.4	0.85	2.23	2.25	10.4	6.89	391	1.39	125	Clear	None	None	None	
MW12-5B	0.58	3.10	25.4	0.83	4.00	4.00	9.7	7.31	744	2.23	68	Cloudy	Grey	None	None	
MW14-4R	1.13	3.13	25.4	0.90	3.00	Dry x 1 3.00	11.9	7.13	385	2.64	102	Clear	None	None	None	
MW14-6R	1.21	2.60	25.4	0.75	2.25	Dry x 1 1.75	21.1	7.62	665	6.92	68	Clear	None	None	None	
MW14-7R	1.98	2.64	25.4	1.06	1.00	Dry x 1 1.00	9.4	7.26	203	2.44	117	Clear	None	None	None	



LOCATION: Ardoch WDS

DATE: September 22, 2021

WEATHER (SAMPLE DAY): 17°C Rain 21°C

PROJECT NUMBER: 10530-003

SAMPLED BY: N. Morin and M. Pion

WEATHER (PREVIOUS DAY): 25°C Sun

FIELD SHEET – GROUNDWATER DEVELOPMENT & SAMPLING

Sample Location	Water Level	B.H. Depth (m)	B.H. Dia. (mm)	Stick - Up (m)	Purge Volumes (L)		Temp (°C)	pH (units)	Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Observations				
					Needed	Actual						Clarity	Colour	Odour	Sheen	Other
MW14-1R	1.19	2.59	25.4	0.95	2.00	2.00	17.2	7.97	642	8.26	94	Cloudy	Red-brown	None	None	QA/QC
MW14-2R	2.77	3.35	25.4	0.94	1.00	1.00	14.2	6.90	578	2.75	197	Clear	None	None	None	
MW14-3R	1.91	3.27	25.4	0.85	2.00	2.00	12.7	7.21	681	2.07	82	Clear	None	None	None	
MW14-4R	1.18	3.13	25.4	0.90	3.00	3.00	14.3	7.02	681	5.10	186	Clear	None	None	None	
MW12-5B	0.63	3.10	25.4	0.83	4.00	4.00	12.2	7.01	814	0.93	190	Opaque	Grey	None	None	
MW14-6R	1.25	2.60	25.4	0.75	2.25	Dry x 1 1.50	13.3	7.53	624	5.58	78	Clear	None	None	None	
MW14-7R	-	2.64	25.4	1.06	-	-	-	-	-	-	-	-	-	-	-	Dry



LOCATION: Ardoch WDS

DATE: May 18, 2021

WEATHER (SAMPLE DAY): 8°C Sun 25°C

PROJECT NUMBER: 10530-003

SAMPLED BY: M. Pion and N. Morin

WEATHER (PREVIOUS DAY): 22°C Sun

FIELD SHEET – SURFACE WATER SAMPLING

Sample Location	Depth (m)	Width (m)	Velocity (m/s)	Discharge (m ³ /s)	Temp (°C)	pH (units)	Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Observations				
										Clarity	Colour	Odour	Sheen	Other
SW1	0.10	Ponded - No Observable Flow			18.5	7.73	186	8.64	137	Clear	Yellow	None	None	QA/QC
SW2	-	-	-	-	-	-	-	-	-	-	-	-	-	Insufficient Volume



LOCATION: Ardoch WDS

DATE: July 19, 2021

WEATHER (SAMPLE DAY): 19°C Sun 27°C

PROJECT NUMBER: 10530-003

SAMPLED BY: M. Pion

WEATHER (PREVIOUS DAY): 30°C Sun

FIELD SHEET – SURFACE WATER SAMPLING

Sample Location	Depth (m)	Width (m)	Velocity (m/s)	Discharge (m ³ /s)	Temp (°C)	pH (units)	Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Observations				
										Clarity	Colour	Odour	Sheen	Other
SW1	0.08	0.65	< 0.10	< 0.005	20.6	7.32	316	7.45	179	Clear	Yellow	None	None	QA/QC
SW2	0.05	Ponded - No Observable Flow			18.5	6.40	87	6.17	176	Clear	Yellow	None	None	



LOCATION: Ardoch WDS

DATE: September 22, 2021

WEATHER (SAMPLE DAY): 17°C Rain 21°C

PROJECT NUMBER: 10530-003

SAMPLED BY: M. Pion and N. Morin

WEATHER (PREVIOUS DAY): 25°C Sun

FIELD SHEET – SURFACE WATER SAMPLING

Sample Location	Depth (m)	Width (m)	Velocity (m/s)	Discharge (m ³ /s)	Temp (°C)	pH (units)	Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Observations				
										Clarity	Colour	Odour	Sheen	Other
SW1	0.05	Ponded - No Observable Flow			15.6	6.75	373	7.26	205	Clear	None	Sulphur	None	QA/QC
SW2	-	-	-	-	-	-	-	-	-	-	-	-	-	Dry



LOCATION: Ardoch WDS

DATE: January 19, 2021

WEATHER (SAMPLE DAY): -12°C Overcast, flurries

PROJECT NUMBER: 10530-003

SAMPLED BY: N. Morin

BAROMETRIC PRESSURE: 101.6 ↑ kPa

FIELD SHEET – Landfill Gas Monitoring

Sample Location	Water Level	B.H. Depth (m)	B.H. Dia. (mm)	Stick - Up (m)	Purge Volumes (L)		Temp (°C)	pH (units)	Cond. (µS/cm)	DO (mg/L)	ORP (mV)	LFG (ppm)	Observations				
					Needed	Actual							Clarity	Colour	Odour	Sheen	Other
GP101	Dry	1.82	38.1	1.20	-	-	-	-	-	-	-	<5	-	-	-	-	Gas Pressure: 0.00 kPa Ambient Air: <5 ppm Stable: <5 ppm
GP102	1.82	2.14	38.1	1.39	-	-	-	-	-	-	-	75	-	-	-	-	Gas Pressure: 0.00 kPa Ambient Air: <5 ppm Stable: 55 ppm
GP103	Dry	1.85	38.1	1.29	-	-	-	-	-	-	-	<5	-	-	-	-	Gas Pressure: 0.00 kPa Ambient Air: <5 ppm Stable: <5 ppm
GP104	Dry	2.00	38.1	1.37	-	-	-	-	-	-	-	<5	-	-	-	-	Gas Pressure: 0.00 kPa Ambient Air: <5 ppm Stable: <5 ppm



LOCATION: Ardoch WDS

DATE: February 17, 2021

WEATHER (SAMPLE DAY): -18°C Sun

PROJECT NUMBER: 10530-003

SAMPLED BY: N. Morin

BAROMETRIC PRESSURE: 102.8 ↑ kPa

FIELD SHEET – Landfill Gas Monitoring

Sample Location	Water Level	B.H. Depth (m)	B.H. Dia. (mm)	Stick - Up (m)	Purge Volumes (L)		Temp (°C)	pH (units)	Cond. (µS/cm)	DO (mg/L)	ORP (mV)	LFG (ppm)	Observations				
					Needed	Actual							Clarity	Colour	Odour	Sheen	Other
GP101	Dry	1.82	38.1	1.20	-	-	-	-	-	-	-	30	-	-	-	-	Gas Pressure: 0.022 kPa Ambient Air: 25 ppm Stable: 10 ppm
GP102	1.90	2.14	38.1	1.39	-	-	-	-	-	-	-	55	-	-	-	-	Gas Pressure: 0.018 kPa Ambient Air: <5 ppm Stable: 15 ppm
GP103	Dry	1.85	38.1	1.29	-	-	-	-	-	-	-	60	-	-	-	-	Gas Pressure: 0.013 kPa Ambient Air: 35 ppm Stable: 55 ppm
GP104	Dry	2.00	38.1	1.37	-	-	-	-	-	-	-	115	-	-	-	-	Gas Pressure: 0.016 kPa Ambient Air: 15 ppm Stable: 40 ppm

LOCATION: Ardoch WDSDATE: July 17, 2021WEATHER (SAMPLE DAY): 19°C Sun 27°CPROJECT NUMBER: 10530-003SAMPLED BY: N. Morin and M. PionBAROMETRIC PRESSURE: 101.6 ↑ kPa

FIELD SHEET – Landfill Gas Monitoring

Sample Location	Water Level	B.H. Depth (m)	B.H. Dia. (mm)	Stick – Up (m)	Purge Volumes (L)		CH4 (% lcl)		O2 (% vol)		CO2 (ppm)		Observations				
					Needed	Actual	Peak	Stable	Peak	Stable	Peak	Stable	Clarity	Colour	Odour	Sheen	Other
GP101 ¹	Dry	1.82	38.1	1.20	-	-	<0.05	-	18.7	-	3250	-		-	-	-	Gas Pressure: 0.00 kPa O2 Alarm
GP102 ¹	1.77	2.14	38.1	1.39	-	-	<0.05	-	19.0	-	10,000	-		-	-	-	Gas Pressure: 0.00 kPa O2 and CO2 Alarm
GP103	Dry	1.85	38.1	1.29	-	-	<0.05	<0.05	20.2	20.0	4200	4150		-	-	-	Gas Pressure: 0.00 kPa
GP104 ¹	Dry	2.00	38.1	1.37	-	-	<0.05	-	19.4	-	10,000	-		-	-	-	Gas Pressure: 0.00 kPa O2 and CO2 Alarm

Notes:

1. Stable readings not recorded due to alarm



Daily Data Report for May 2021

**DRUMMOND CENTRE
ONTARIO**
Current Station Operator: CCN

Latitude: 45°01'56.082" N **Longitude:** 76°15'10.098" W **Elevation:** 145.00 m
Climate ID: 6102J13 **WMO ID:** **TC ID:**

DAY	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days	Cool Deg Days	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's deg	Spd of Max Gust km/h
01 †	12.0	-1.5	5.3	12.7	0.0	3.0	0.0	3.0	I		
02 †	17.0	1.5	9.3	8.7	0.0	0.0	0.0	0.0	0		
03 †	9.0	7.5	8.3	9.7	0.0	0.2	0.0	0.2	0		
04 †	15.0	7.0	11.0	7.0	0.0	1.4	0.0	1.4	0		
05 †	11.5	8.5	10.0	8.0	0.0	0.0	0.0	0.0	0		
06 †	14.0	3.0	8.5	9.5	0.0	0.0	0.0	0.0	0		
07 †	12.5	2.5	7.5	10.5	0.0	12.4	0.0	12.4	0		
08 †	9.0	6.0	7.5	10.5	0.0	7.4	0.0	7.4	0		
09 †	14.0	0.0	7.0	11.0	0.0	0.6	0.0	0.6	0		
10 †	17.0	3.0	10.0	8.0	0.0	4.2	0.0	4.2	0		
11 †	12.5	2.0	7.3	10.7	0.0	3.6	0.0	3.6	0		
12 †	17.5	5.0	11.3	6.7	0.0	0.0	0.0	0.0	0		
13 †	22.0	3.0	12.5	5.5	0.0	0.0	0.0	0.0	0		
14 †	24.5	5.0	14.8	3.2	0.0	0.0	0.0	0.0	0		
15 †	24.5	8.0	16.3	1.7	0.0	0.0	0.0	0.0	0		
16 †	24.5	6.0	15.3	2.7	0.0	0.0	0.0	0.0	0		
17 †	26.0	5.5	15.8	2.2	0.0	0.0	0.0	0.0	0		
18 †	27.0	10.5	18.8	0.0	0.8	0.0	0.0	0.0	0		
19 †	30.0	9.0	19.5	0.0	1.5	0.0	0.0	0.0	0		
20 †	31.5	13.5	22.5	0.0	4.5	0.0	0.0	0.0	0		
21 †	32.5	16.0	24.3	0.0	6.3	0.0	0.0	0.0	0		
22 †	28.5	17.5	23.0	0.0	5.0	0.0	0.0	0.0	0		
23 †	21.5	16.5	19.0	0.0	1.0	0.0	0.0	0.0	0		
24 †	23.0	3.0	13.0	5.0	0.0	0.0	0.0	0.0	0		
25 †	26.5	8.5	17.5	0.5	0.0	2.6	0.0	2.6	0		
26 †	28.5	17.5	23.0	0.0	5.0	0.0	0.0	0.0	0		
27 †	15.0	7.0	11.0	7.0	0.0	0.0	0.0	0.0	0		
28 †	12.5	1.5	7.0	11.0	0.0	0.0	0.0	0.0	0		
29 †	19.0	0.5	9.8	8.2	0.0	0.0	0.0	0.0	0		
30 †	21.5	0.5	11.0	7.0	0.0	0.0	0.0	0.0	0		
31 †	24.5	3.0	13.8	4.2	0.0	0.0	0.0	0.0	0		
Sum				171.2	24.1	35.4	0.0	35.4			



Daily Data Report for July 2021

**DRUMMOND CENTRE
ONTARIO**
Current Station Operator: CCN

Latitude: 45°01'56.082" N **Longitude:** 76°15'10.098" W **Elevation:** 145.00 m
Climate ID: 6102J13 **WMO ID:** **TC ID:**

DAY	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days	Cool Deg Days	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's deg	Spd of Max Gust km/h
01 †	24.0	13.0	18.5	0.0	0.5	1.0	0.0	1.0	0		
02 †	23.0	15.5	19.3	0.0	1.3	0.0	0.0	0.0	0		
03 †	23.5	10.5	17.0	1.0	0.0	0.0	0.0	0.0	0		
04 †	25.0	9.5	17.3	0.7	0.0	0.0	0.0	0.0	0		
05 †	28.0	11.0	19.5	0.0	1.5	4.0	0.0	4.0	0		
06 †	30.5	19.0	24.8	0.0	6.8	0.4	0.0	0.4	0		
07 †	17.0	12.0	14.5	3.5	0.0	1.0	0.0	1.0	0		
08 †	17.0	11.5	14.3	3.7	0.0	31.4	0.0	31.4	0		
09 †	19.5	13.0	16.3	1.7	0.0	0.0	0.0	0.0	0		
10 †	27.0	9.0	18.0	0.0	0.0	0.0	0.0	0.0	0		
11 †	26.5	11.0	18.8	0.0	0.8	0.0	0.0	0.0	0		
12 †	29.5	14.5	22.0	0.0	4.0	0.0	0.0	0.0	0		
13 †	29.5	18.0	23.8	0.0	5.8	6.0	0.0	6.0	0		
14 †	30.0	19.0	24.5	0.0	6.5	0.0	0.0	0.0	0		
15 †	28.0	15.0	21.5	0.0	3.5	8.8	0.0	8.8	0		
16 †	25.0	17.0	21.0	0.0	3.0	0.0	0.0	0.0	0		
17 †	24.5	15.0	19.8	0.0	1.8	0.0	0.0	0.0	0		
18 †	28.5	14.5	21.5	0.0	3.5	0.0	0.0	0.0	0		
19 †	28.5	16.0	22.3	0.0	4.3	0.0	0.0	0.0	0		
20 †	27.0	16.0	21.5	0.0	3.5	16.6	0.0	16.6	0		
21 †	25.0	13.5	19.3	0.0	1.3	0.0	0.0	0.0	0		
22 †	25.0	12.0	18.5	0.0	0.5	0.6	0.0	0.6	0		
23 †	26.5	12.0	19.3	0.0	1.3	0.0	0.0	0.0	0		
24 †	26.5	11.0	18.8	0.0	0.8	5.4	0.0	5.4	0		
25 †	28.5	18.0	23.3	0.0	5.3	0.0	0.0	0.0	0		
26 †	30.0	14.5	22.3	0.0	4.3	1.2	0.0	1.2	0		
27 †	18.5	12.5	15.5	2.5	0.0	6.6	0.0	6.6	0		
28 †	24.5	10.0	17.3	0.7	0.0	0.0	0.0	0.0	0		
29 †	22.5	11.0	16.8	1.2	0.0	2.2	0.0	2.2	0		
30 †	19.5	12.0	15.8	2.2	0.0	0.0	0.0	0.0	0		
31 †	23.0	7.5	15.3	2.7	0.0	3.0	0.0	3.0	0		
Sum				19.9	60.3	88.2	0.0	88.2			



Daily Data Report for September 2021

**DRUMMOND CENTRE
ONTARIO**
Current Station Operator: CCN

Latitude: 45°01'56.082" N **Longitude:** 76°15'10.098" W **Elevation:** 145.00 m
Climate ID: 6102J13 **WMO ID:** **TC ID:**

DAY	Max	Min	Mean	Heat Deg	Cool Deg	Total	Total	Total	Snow on	Dir of Max	Spd of Max
	Temp	Temp	Temp	Days	Days	Rain	Snow	Precip	Grnd	Gust	Gust
	°C	°C	°C			mm	cm	mm	cm	10's deg	km/h
01 †	23.0	8.0	15.5	2.5	0.0	0.0	0.0	0.0	0		
02 †	18.0	8.0	13.0	5.0	0.0	0.0	0.0	0.0	0		
03 †	21.0	13.0	17.0	1.0	0.0	0.0	0.0	0.0	0		
04 †	23.0	8.0	15.5	2.5	0.0	2.6	0.0	2.6	0		
05 †	25.0	14.5	19.8	0.0	1.8	2.2	0.0	2.2	0		
06 †	21.5	12.0	16.8	1.2	0.0	4.4	0.0	4.4	0		
07 †	24.5	8.0	16.3	1.7	0.0	30.6	0.0	30.6	0		
08 †	24.5	14.0	19.3	0.0	1.3	0.4	0.0	0.4	0		
09 †	23.0	8.5	15.8	2.2	0.0	1.8	0.0	1.8	0		
10 †	23.0	9.5	16.3	1.7	0.0	0.0	0.0	0.0	0		
11 †	24.0	8.0	16.0	2.0	0.0	1.8	0.0	1.8	0		
12 †	22.5	15.5	19.0	0.0	1.0	0.0	0.0	0.0	0		
13 †	22.0	9.0	15.5	2.5	0.0	0.0	0.0	0.0	0		
14 †	21.5	6.0	13.8	4.2	0.0	37.0	0.0	37.0	0		
15 †	22.0	15.5	18.8	0.0	0.8	0.0	0.0	0.0	0		
16 †	23.0	7.0	15.0	3.0	0.0	0.0	0.0	0.0	0		
17 †	26.0	7.0	16.5	1.5	0.0	0.0	0.0	0.0	0		
18 †	22.0	15.5	18.8	0.0	0.8	0.0	0.0	0.0	0		
19 †	21.0	5.0	13.0	5.0	0.0	0.0	0.0	0.0	0		
20 †	25.0	4.0	14.5	3.5	0.0	0.0	0.0	0.0	0		
21 †	21.0	13.0	17.0	1.0	0.0	2.6	0.0	2.6	0		
22 †	20.0	15.0	17.5	0.5	0.0	47.8	0.0	47.8	0		
23 †	20.5	11.5	16.0	2.0	0.0	23.0	0.0	23.0	0		
24 †	18.0	9.5	13.8	4.2	0.0	0.4	0.0	0.4	0		
25 †	22.0	5.0	13.5	4.5	0.0	0.0	0.0	0.0	0		
26 †	19.0	7.0	13.0	5.0	0.0	1.6	0.0	1.6	0		
27 †	16.5	7.5	12.0	6.0	0.0	1.6	0.0	1.6	0		
28 †	16.5	3.5	10.0	8.0	0.0	0.0	0.0	0.0	0		
29 †	15.0	4.5	9.8	8.2	0.0	0.0	0.0	0.0	0		
30 †	16.0	5.0	10.5	7.5	0.0	0.0	0.0	0.0	0		
Sum				86.4	5.7	157.8	0.0	157.8			



Appendix E

Laboratory Certificates of Analysis

Fully accessible appended items are available upon request.

C.O.C.: G103539

REPORT No. B21-15182

Report To:

Cambium Environmental
194 Sophia St.,
Peterborough ON K9H 1E5 Canada
Attention: Stephanie Reeder

Caduceon Environmental Laboratories

285 Dalton Ave
Kingston Ontario K7K 6Z1
Tel: 613-544-2001
Fax: 613-544-2770

DATE RECEIVED: 20-May-21

JOB/PROJECT NO.: Ardoch WDS

DATE REPORTED: 10-Jun-21

P.O. NUMBER: 10530-003

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed	Client I.D.			
					MW14-1R	MW14-2R	MW14-3R	MW14-6R
Sample I.D.					B21-15182-1	B21-15182-2	B21-15182-3	B21-15182-4
Date Collected					18-May-21	18-May-21	18-May-21	18-May-21
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	02-Jun-21/O	279	238	460	455
Conductivity @25°C	µmho/cm	1	SM 2510B	02-Jun-21/O	581	465	840	882
pH @25°C	pH Units		SM 4500H	02-Jun-21/O	7.99	7.96	7.77	8.06
TDS (Calc. from Cond.)	mg/L	1	Calc.	03-Jun-21	301	240	443	467
Total Suspended Solids	mg/L	3	SM2540D	25-May-21/K	19	11	7	3410
Dissolved Organic Carbon	mg/L	0.2	EPA 415.2	27-May-21/O	2.0	2.2	3.4	8.2
BOD(5 day)	mg/L	3	SM 5210B	21-May-21/K	< 3	< 3	< 3	< 3
COD	mg/L	5	SM5220C	25-May-21/K	< 5	< 5	< 5	< 5
Chloride	mg/L	0.5	SM4110C	28-May-21/O	26.0	11.4	12.0	23.3
Ammonia (N)-Total	mg/L	0.01	SM4500-NH3-H	08-Jun-21/K	< 0.01	< 0.01	< 0.01	< 0.01
Sulphate	mg/L	1	SM4110C	28-May-21/O	6	3	5	23
Nitrite (N)	mg/L	0.05	SM4110C	28-May-21/O	< 0.05	< 0.05	< 0.05	< 0.05
Nitrate (N)	mg/L	0.05	SM4110C	28-May-21/O	0.05	0.08	0.09	0.08
Total Kjeldahl Nitrogen	mg/L	0.1	E3199A.1	07-Jun-21/K	< 0.1	< 0.1	0.1	0.2
Mercury	mg/L	0.00002	SM 3112 B	27-May-21/O	< 0.00002	< 0.00002	< 0.00002	
Hardness (as CaCO3)	mg/L	1	SM 3120	26-May-21/O	268	251	479	520
Arsenic	mg/L	0.0001	EPA 200.8	07-Jun-21/O	< 0.0001	0.0001	0.0002	0.0003
Barium	mg/L	0.001	SM 3120	26-May-21/O	0.040	0.024	0.072	0.200
Boron	mg/L	0.005	SM 3120	26-May-21/O	0.023	0.010	0.036	0.042
Cadmium	mg/L	0.00015	EPA 200.8	07-Jun-21/O	0.000224	< 0.00015	< 0.00015	0.00017
Calcium	mg/L	0.02	SM 3120	26-May-21/O	84.7	79.6	154	139
Chromium	mg/L	0.001	EPA 200.8	07-Jun-21/O	< 0.001	< 0.001	< 0.001	< 0.001
Copper	mg/L	0.0001	EPA 200.8	07-Jun-21/O	0.0011	0.0011	0.0017	0.0011
Iron	mg/L	0.005	SM 3120	26-May-21/O	< 0.005	0.267	< 0.005	0.064
Lead	mg/L	0.00002	EPA 200.8	07-Jun-21/O	0.00011	0.00002	0.00003	0.00013
Magnesium	mg/L	0.02	SM 3120	26-May-21/O	13.7	12.7	23.0	41.8
Manganese	mg/L	0.001	SM 3120	26-May-21/O	0.008	0.014	0.006	0.229



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Michelle Dubien
Lab Manager

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C.O.C.: G103539

REPORT No. B21-15182

Report To:

Cambium Environmental
 194 Sophia St.,
 Peterborough ON K9H 1E5 Canada
Attention: Stephanie Reeder

Caduceon Environmental Laboratories

285 Dalton Ave
 Kingston Ontario K7K 6Z1
 Tel: 613-544-2001
 Fax: 613-544-2770

DATE RECEIVED: 20-May-21
 DATE REPORTED: 10-Jun-21
 SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: Ardoch WDS
 P.O. NUMBER: 10530-003
 WATERWORKS NO.

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed	Client I.D.			
					MW14-1R	MW14-2R	MW14-3R	MW14-6R
					Sample I.D.			
					B21-15182-1	B21-15182-2	B21-15182-3	B21-15182-4
					Date Collected			
					18-May-21	18-May-21	18-May-21	18-May-21
Phosphorus	mg/L	0.1	SM 3120	26-May-21/O	< 0.1	< 0.1	< 0.1	< 0.1
Potassium	mg/L	0.1	SM 3120	26-May-21/O	1.4	0.7	1.4	2.7
Sodium	mg/L	0.2	SM 3120	26-May-21/O	33.7	8.4	12.4	8.5
Zinc	mg/L	0.005	SM 3120	26-May-21/O	0.062	< 0.005	< 0.005	0.005

1. Results unavailable for certain requested parameters due to low sample volumes



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SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: Ardoch WDS
P.O. NUMBER: 10530-003
WATERWORKS NO.

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed	Client I.D.	GW_QAQC	MW12-5B	MW14-4R	MW14-7R
					Sample I.D.	B21-15182-5	B21-15182-6	B21-15182-7	B21-15182-8
Date Collected					18-May-21	18-May-21	18-May-21	18-May-21	18-May-21
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	02-Jun-21/O	279	403	410	248	
Conductivity @25°C	µmho/cm	1	SM 2510B	02-Jun-21/O	591	858	866	458	
pH @25°C	pH Units		SM 4500H	02-Jun-21/O	7.95	7.98	7.90	7.87	
TDS (Calc. from Cond.)	mg/L	1	Calc.	03-Jun-21	307	453	458	237	
Total Suspended Solids	mg/L	3	SM2540D	25-May-21/K	33	19600	33	6	
Dissolved Organic Carbon	mg/L	0.2	EPA 415.2	27-May-21/O	1.7	3.9	4.5	3.9	
BOD(5 day)	mg/L	3	SM 5210B	21-May-21/K	< 3	< 3	< 3	< 3	
COD	mg/L	5	SM5220C	25-May-21/K	< 5	123	< 5	< 5	
Chloride	mg/L	0.5	SM4110C	28-May-21/O	24.0	16.5	5.0	4.0	
Ammonia (N)-Total	mg/L	0.01	SM4500-NH3-H	08-Jun-21/K	< 0.01	< 0.01	0.01	< 0.01	
Sulphate	mg/L	1	SM4110C	28-May-21/O	8	67	73	3	
Nitrite (N)	mg/L	0.05	SM4110C	28-May-21/O	< 0.05	< 0.05	< 0.05	< 0.05	
Nitrate (N)	mg/L	0.05	SM4110C	28-May-21/O	0.06	< 0.05	2.71	< 0.05	
Total Kjeldahl Nitrogen	mg/L	0.1	E3199A.1	07-Jun-21/K	< 0.1	5.9	0.3	0.1	
Mercury	mg/L	0.00002	SM 3112 B	27-May-21/O	< 0.00002	< 0.00002	< 0.00002	< 0.00002	
Hardness (as CaCO3)	mg/L	1	SM 3120	26-May-21/O	266	484	493	263	
Arsenic	mg/L	0.0001	EPA 200.8	07-Jun-21/O	< 0.0001	0.0008	0.0001	0.0001	
Barium	mg/L	0.001	SM 3120	26-May-21/O	0.038	0.203	0.105	0.034	
Boron	mg/L	0.005	SM 3120	26-May-21/O	0.023	0.298	0.512	0.028	
Cadmium	mg/L	0.000015	EPA 200.8	07-Jun-21/O	0.000215	< 0.000015	< 0.000015	< 0.000015	
Calcium	mg/L	0.02	SM 3120	26-May-21/O	84.8	137	162	83.7	
Chromium	mg/L	0.001	EPA 200.8	07-Jun-21/O	< 0.001	< 0.001	< 0.001	< 0.001	
Copper	mg/L	0.0001	EPA 200.8	07-Jun-21/O	0.0003	0.0004	0.0055	0.0014	
Iron	mg/L	0.005	SM 3120	26-May-21/O	< 0.005	1.19	< 0.005	< 0.005	
Lead	mg/L	0.00002	EPA 200.8	07-Jun-21/O	< 0.00002	0.00005	< 0.00002	< 0.00002	
Magnesium	mg/L	0.02	SM 3120	26-May-21/O	13.3	34.7	21.6	13.0	
Manganese	mg/L	0.001	SM 3120	26-May-21/O	0.007	0.056	< 0.001	0.002	

M. Dubien

R.L. = Reporting Limit

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Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Michelle Dubien
Lab Manager

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C.O.C.: G103539

REPORT No. B21-15182

Report To:

Cambium Environmental
 194 Sophia St.,
 Peterborough ON K9H 1E5 Canada
Attention: Stephanie Reeder

Caduceon Environmental Laboratories

285 Dalton Ave
 Kingston Ontario K7K 6Z1
 Tel: 613-544-2001
 Fax: 613-544-2770

DATE RECEIVED: 20-May-21
 DATE REPORTED: 10-Jun-21
 SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: Ardoch WDS
 P.O. NUMBER: 10530-003
 WATERWORKS NO.

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed	Client I.D.	GW_QAQC	MW12-5B	MW14-4R	MW14-7R
					Sample I.D.	B21-15182-5	B21-15182-6	B21-15182-7	B21-15182-8
					Date Collected	18-May-21	18-May-21	18-May-21	18-May-21
Phosphorus	mg/L	0.1	SM 3120	26-May-21/O	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Potassium	mg/L	0.1	SM 3120	26-May-21/O	1.4	3.3	4.4	1.1	
Sodium	mg/L	0.2	SM 3120	26-May-21/O	33.3	15.8	11.3	3.1	
Zinc	mg/L	0.005	SM 3120	26-May-21/O	0.074	0.059	< 0.005	< 0.005	

1. Results unavailable for certain requested parameters due to low sample volumes



R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Michelle Dubien
 Lab Manager

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from

C.O.C.: G101748

REPORT No. B21-30786

Report To:

Cambium Environmental
 194 Sophia St.,
 Peterborough ON K9H 1E5 Canada
Attention: Stephanie Reeder

Caduceon Environmental Laboratories

285 Dalton Ave
 Kingston Ontario K7K 6Z1
 Tel: 613-544-2001
 Fax: 613-544-2770

DATE RECEIVED: 24-Sep-21

JOB/PROJECT NO.: Ardoch WDS

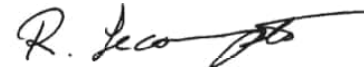
DATE REPORTED: 04-Oct-21

P.O. NUMBER: 10530-003

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed	Client I.D.	MW14-1R	MW14-2R	GW_QAQC	MW14-6R
					Sample I.D.	B21-30786-1	B21-30786-2	B21-30786-3	B21-30786-4
					Date Collected	22-Sep-21	22-Sep-21	22-Sep-21	22-Sep-21
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	27-Sep-21/O		261	311	260	421
Conductivity @25°C	µmho/cm	1	SM 2510B	27-Sep-21/O		729	692	743	892
pH @25°C	pH Units		SM 4500H	27-Sep-21/O		7.87	7.76	7.81	7.94
TDS (Calc. from Cond.)	mg/L	1	Calc.	28-Sep-21		389	359	388	472
Total Suspended Solids	mg/L	3	SM2540D	24-Sep-21/K		3900	4	5200	5850
BOD(5 day)	mg/L	3	SM 5210B	24-Sep-21/K		< 3	< 3	< 3	< 3
COD	mg/L	5	SM5220C	28-Sep-21/K		< 5	< 5	50	329
Dissolved Organic Carbon	mg/L	0.2	EPA 415.2	27-Sep-21/O		2.3	2.4	2.0	3.7
Chloride	mg/L	0.5	SM4110C	28-Sep-21/O		60.7	20.5	61.7	18.7
Ammonia (N)-Total	mg/L	0.01	SM4500-NH3-H	27-Sep-21/K		0.01	< 0.01	0.24	0.32
Sulphate	mg/L	1	SM4110C	28-Sep-21/O		7	3	9	20
Nitrite (N)	mg/L	0.05	SM4110C	28-Sep-21/O		< 0.05	< 0.05	< 0.05	< 0.05
Nitrate (N)	mg/L	0.05	SM4110C	28-Sep-21/O		< 0.05	< 0.05	< 0.05	< 0.05
Total Kjeldahl Nitrogen	mg/L	0.1	E3199A.1	27-Sep-21/K		0.1	< 0.1	1.4	4.2
Mercury	mg/L	0.00002	SM 3112 B	30-Sep-21/O		< 0.00002	< 0.00002	< 0.00002	< 0.00002
Hardness (as CaCO3)	mg/L	1	SM 3120	27-Sep-21/O		291	354	293	507
Arsenic	mg/L	0.0001	EPA 200.8	29-Sep-21/O		< 0.0001	0.0002	< 0.0001	0.0005
Calcium	mg/L	0.02	SM 3120	27-Sep-21/O		94.5	114	95.0	139
Magnesium	mg/L	0.02	SM 3120	27-Sep-21/O		13.4	16.7	13.4	38.9
Sodium	mg/L	0.2	SM 3120	27-Sep-21/O		48.3	11.1	48.4	8.8
Potassium	mg/L	0.1	SM 3120	27-Sep-21/O		1.7	0.9	1.7	3.0
Barium	mg/L	0.001	SM 3120	27-Sep-21/O		0.049	0.036	0.048	0.199
Boron	mg/L	0.005	SM 3120	27-Sep-21/O		0.031	0.009	0.031	0.048
Cadmium	mg/L	0.000015	EPA 200.8	29-Sep-21/O		0.000271	< 0.000015	0.000318	< 0.000015
Chromium	mg/L	0.001	EPA 200.8	29-Sep-21/O		< 0.001	0.001	0.003	< 0.001
Copper	mg/L	0.0001	EPA 200.8	29-Sep-21/O		0.0019	0.0026	0.0003	0.0027
Iron	mg/L	0.005	SM 3120	27-Sep-21/O		< 0.005	0.519	< 0.005	0.568



Richard Lecompte
 Laboratory Supervisor

R.L. = Reporting Limit

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C.O.C.: G101748

REPORT No. B21-30786

Report To:

Cambium Environmental
 194 Sophia St.,
 Peterborough ON K9H 1E5 Canada
Attention: Stephanie Reeder

Caduceon Environmental Laboratories

285 Dalton Ave
 Kingston Ontario K7K 6Z1
 Tel: 613-544-2001
 Fax: 613-544-2770

DATE RECEIVED: 24-Sep-21

JOB/PROJECT NO.: Ardoch WDS

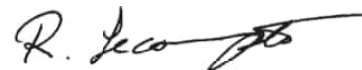
DATE REPORTED: 04-Oct-21

P.O. NUMBER: 10530-003

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Parameter	Units	R.L.	Client I.D.		MW14-1R	MW14-2R	GW_QAQC	MW14-6R
			Reference Method	Date/Site Analyzed	B21-30786-1	B21-30786-2	B21-30786-3	B21-30786-4
Lead	mg/L	0.00002	EPA 200.8	29-Sep-21/O	0.00007	0.00006	< 0.00002	0.00006
Manganese	mg/L	0.001	SM 3120	27-Sep-21/O	0.009	0.034	0.010	0.314
Phosphorus	mg/L	0.1	SM 3120	27-Sep-21/O	< 0.1	< 0.1	< 0.1	< 0.1
Zinc	mg/L	0.005	SM 3120	27-Sep-21/O	0.083	< 0.005	0.093	0.007



Richard Lecompte
 Laboratory Supervisor

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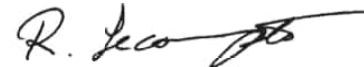
DATE REPORTED: 04-Oct-21

P.O. NUMBER: 10530-003

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed	Client I.D.	MW14-4R	MW12-5B	MW14-3R
					Sample I.D.	B21-30786-5	B21-30786-6	B21-30786-7
Date Collected					22-Sep-21	22-Sep-21	22-Sep-21	
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	27-Sep-21/O	304	373	367	
Conductivity @25°C	µmho/cm	1	SM 2510B	27-Sep-21/O	702	857	754	
pH @25°C	pH Units		SM 4500H	27-Sep-21/O	7.80	7.98	7.60	
TDS (Calc. from Cond.)	mg/L	1	Calc.	28-Sep-21	365	453	394	
Total Suspended Solids	mg/L	3	SM2540D	24-Sep-21/K	12	13500	13	
BOD(5 day)	mg/L	3	SM 5210B	24-Sep-21/K	< 3	< 3	< 3	
COD	mg/L	5	SM5220C	28-Sep-21/K	< 5	56	32	
Dissolved Organic Carbon	mg/L	0.2	EPA 415.2	27-Sep-21/O	3.6	3.4	4.5	
Chloride	mg/L	0.5	SM4110C	28-Sep-21/O	4.8	13.5	9.9	
Ammonia (N)-Total	mg/L	0.01	SM4500-NH3-H	27-Sep-21/K	0.01	0.17	0.30	
Sulphate	mg/L	1	SM4110C	28-Sep-21/O	47	61	4	
Nitrite (N)	mg/L	0.05	SM4110C	28-Sep-21/O	< 0.05	< 0.05	< 0.05	
Nitrate (N)	mg/L	0.05	SM4110C	28-Sep-21/O	1.29	< 0.05	< 0.05	
Total Kjeldahl Nitrogen	mg/L	0.1	E3199A.1	27-Sep-21/K	0.3	< 0.5	1.0	
Mercury	mg/L	0.00002	SM 3112 B	30-Sep-21/O	< 0.00002	< 0.00002	< 0.00002	
Hardness (as CaCO3)	mg/L	1	SM 3120	27-Sep-21/O	397	394	412	
Arsenic	mg/L	0.0001	EPA 200.8	29-Sep-21/O	0.0001	0.0012	0.0003	
Calcium	mg/L	0.02	SM 3120	27-Sep-21/O	130	105	134	
Magnesium	mg/L	0.02	SM 3120	27-Sep-21/O	17.6	32.1	18.7	
Sodium	mg/L	0.2	SM 3120	27-Sep-21/O	6.7	15.5	11.2	
Potassium	mg/L	0.1	SM 3120	27-Sep-21/O	4.1	4.7	1.5	
Barium	mg/L	0.001	SM 3120	27-Sep-21/O	0.080	0.222	0.068	
Boron	mg/L	0.005	SM 3120	27-Sep-21/O	0.274	0.277	0.026	
Cadmium	mg/L	0.000015	EPA 200.8	29-Sep-21/O	< 0.000015	0.000016	< 0.000015	
Chromium	mg/L	0.001	EPA 200.8	29-Sep-21/O	< 0.001	0.001	< 0.001	
Copper	mg/L	0.0001	EPA 200.8	29-Sep-21/O	0.0031	0.0020	0.0021	
Iron	mg/L	0.005	SM 3120	27-Sep-21/O	0.007	< 0.005	0.040	



R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Richard Lecompte
 Laboratory Supervisor

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C.O.C.: G101748

REPORT No. B21-30786

Report To:

Cambium Environmental
 194 Sophia St.,
 Peterborough ON K9H 1E5 Canada

Attention: Stephanie Reeder

Caduceon Environmental Laboratories

285 Dalton Ave
 Kingston Ontario K7K 6Z1
 Tel: 613-544-2001
 Fax: 613-544-2770

DATE RECEIVED: 24-Sep-21

JOB/PROJECT NO.: Ardoch WDS

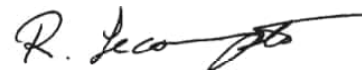
DATE REPORTED: 04-Oct-21

P.O. NUMBER: 10530-003

SAMPLE MATRIX: Groundwater

WATERWORKS NO.

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed	Client I.D.		
					MW14-4R	MW12-5B	MW14-3R
					Sample I.D.		
					B21-30786-5	B21-30786-6	B21-30786-7
					Date Collected		
					22-Sep-21	22-Sep-21	22-Sep-21
Lead	mg/L	0.00002	EPA 200.8	29-Sep-21/O	0.00005	0.00055	0.00004
Manganese	mg/L	0.001	SM 3120	27-Sep-21/O	0.001	0.021	0.048
Phosphorus	mg/L	0.1	SM 3120	27-Sep-21/O	< 0.1	< 0.1	< 0.1
Zinc	mg/L	0.005	SM 3120	27-Sep-21/O	< 0.005	< 0.005	0.005



Richard Lecompte
 Laboratory Supervisor

R.L. = Reporting Limit

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Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

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C.O.C.: G103534

REPORT No. B21-15184

Rev. 1

Report To:

Cambium Environmental
 194 Sophia St.,
 Peterborough ON K9H 1E5 Canada
Attention: Stephanie Reeder

Caduceon Environmental Laboratories

285 Dalton Ave
 Kingston Ontario K7K 6Z1
 Tel: 613-544-2001
 Fax: 613-544-2770

DATE RECEIVED: 20-May-21

JOB/PROJECT NO.: Ardoch WDS

DATE REPORTED: 19-Jan-22

P.O. NUMBER: 10530-003

SAMPLE MATRIX: Surface Water

WATERWORKS NO.

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed	Client I.D.		SW1		SW_QAQC	
					Sample I.D.	Date Collected	B21-15184-1	18-May-21	B21-15184-2	18-May-21
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	01-Jun-21/O			166		166	
Conductivity @25°C	µmho/cm	1	SM 2510B	01-Jun-21/O			336		336	
pH @25°C	pH Units		SM 4500H	01-Jun-21/O			8.07		7.99	
Total Suspended Solids	mg/L	3	SM2540D	25-May-21/K			3		12	
Dissolved Organic Carbon	mg/L	0.2	EPA 415.2	26-May-21/O			11.0		11.1	
BOD(5 day)	mg/L	3	SM 5210B	21-May-21/K			< 3		< 3	
COD	mg/L	5	SM5220C	21-May-21/K			25		27	
Phenolics	mg/L	0.001	MOEE 3179	31-May-21/K			< 0.001		< 0.001	
Chloride	mg/L	0.5	SM4110C	27-May-21/O			10.1		10.4	
Ammonia (N)-Total	mg/L	0.01	SM4500-NH3-H	08-Jun-21/K			0.02		0.02	
Ammonia (N)-unionized	mg/L	0.01	CALC	15-Jun-21/K			< 0.01		< 0.01	
Sulphate	mg/L	1	SM4110C	27-May-21/O			4		4	
Nitrite (N)	mg/L	0.05	SM4110C	27-May-21/O			< 0.05		< 0.05	
Nitrate (N)	mg/L	0.05	SM4110C	27-May-21/O			< 0.05		< 0.05	
Total Kjeldahl Nitrogen	mg/L	0.1	E3199A.1	15-Jun-21/K			0.4		0.4	
Mercury	mg/L	0.00002	SM 3112 B	26-May-21/O			< 0.00002		< 0.00002	
Hardness (as CaCO3)	mg/L	1	SM 3120	26-May-21/O			178		174	
Arsenic	mg/L	0.0001	EPA 200.8	03-Jun-21/O			0.0003		0.0003	
Barium	mg/L	0.001	SM 3120	26-May-21/O			0.028		0.027	
Boron	mg/L	0.005	SM 3120	26-May-21/O			0.028		0.027	
Cadmium	mg/L	0.000015	EPA 200.8	03-Jun-21/O			< 0.000015		< 0.000015	
Calcium	mg/L	0.02	SM 3120	26-May-21/O			55.8		54.6	
Chromium	mg/L	0.001	EPA 200.8	03-Jun-21/O			< 0.001		< 0.001	
Copper	mg/L	0.0001	EPA 200.8	03-Jun-21/O			0.0004		0.0004	
Iron	mg/L	0.005	SM 3120	26-May-21/O			0.042		0.042	
Lead	mg/L	0.00002	EPA 200.8	03-Jun-21/O			< 0.00002		0.00002	
Magnesium	mg/L	0.02	SM 3120	26-May-21/O			9.35		9.16	



R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Michelle Dubien
 Lab Manager

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C.O.C.: G103534

REPORT No. B21-15184

Rev. 1

Report To:

Cambium Environmental
 194 Sophia St.,
 Peterborough ON K9H 1E5 Canada
Attention: Stephanie Reeder

Caduceon Environmental Laboratories

285 Dalton Ave
 Kingston Ontario K7K 6Z1
 Tel: 613-544-2001
 Fax: 613-544-2770

DATE RECEIVED: 20-May-21
 DATE REPORTED: 19-Jan-22
 SAMPLE MATRIX: Surface Water

JOB/PROJECT NO.: Ardoch WDS
 P.O. NUMBER: 10530-003
 WATERWORKS NO.

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed	Client I.D.		Date Collected	
					SW1	SW_QAQC	18-May-21	18-May-21
Manganese	mg/L	0.001	SM 3120	26-May-21/O	0.009	0.009		
Phosphorus-Total	mg/L	0.01	E3199A.1	15-Jun-21/K	0.02	0.02		
Potassium	mg/L	0.1	SM 3120	26-May-21/O	0.2	0.3		
Sodium	mg/L	0.2	SM 3120	26-May-21/O	7.2	7.1		
Zinc	mg/L	0.005	SM 3120	26-May-21/O	0.046	0.022		

1. Revised to include U-NH3



Michelle Dubien
 Lab Manager

R.L. = Reporting Limit

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Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

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C.O.C.: G100059

REPORT No. B21-22767

Rev. 1

Report To:

Cambium Environmental
194 Sophia St.,
Peterborough ON K9H 1E5 Canada
Attention: Stephanie Reeder

Caduceon Environmental Laboratories

285 Dalton Ave
Kingston Ontario K7K 6Z1
Tel: 613-544-2001
Fax: 613-544-2770

DATE RECEIVED: 21-Jul-21

JOB/PROJECT NO.: Ardoch WDS

DATE REPORTED: 25-Jan-22

P.O. NUMBER: 10530-003

SAMPLE MATRIX: Surface Water

WATERWORKS NO.

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed	Client I.D.		
					SW2	SW1	SW_QAQC
					B21-22767-1	B21-22767-2	B21-22767-3
					19-Jul-21	19-Jul-21	19-Jul-21
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	22-Jul-21/O	34	147	146
Conductivity @25°C	µmho/cm	1	SM 2510B	22-Jul-21/O	76	311	313
pH @25°C	pH Units		SM 4500H	22-Jul-21/O	6.74	7.53	7.58
Total Suspended Solids	mg/L	3	SM2540D	22-Jul-21/K	14	5	11
Dissolved Organic Carbon	mg/L	0.2	EPA 415.2	22-Jul-21/O	17.5	18.0	17.7
BOD(5 day)	mg/L	3	SM 5210B	21-Jul-21/K	< 6	< 3	< 6
COD	mg/L	5	SM5220C	26-Jul-21/K	53	35	36
Phenolics	mg/L	0.001	MOEE 3179	26-Jul-21/K	0.001	< 0.001	< 0.001
Chloride	mg/L	0.5	SM4110C	23-Jul-21/O	1.6	7.2	7.2
Ammonia (N)-Total	mg/L	0.01	SM4500-NH3-H	22-Jul-21/K	0.04	0.08	0.03
Ammonia (N)-unionized	mg/L	0.01	CALC	22-Jul-21/K	< 0.01	< 0.01	< 0.01
Sulphate	mg/L	1	SM4110C	23-Jul-21/O	1	1	1
Nitrite (N)	mg/L	0.05	SM4110C	23-Jul-21/O	< 0.05	< 0.05	< 0.05
Nitrate (N)	mg/L	0.05	SM4110C	23-Jul-21/O	0.09	0.07	0.07
Total Kjeldahl Nitrogen	mg/L	0.1	E3199A.1	26-Jul-21/K	0.8	0.6	0.6
Mercury	mg/L	0.00002	SM 3112 B	27-Jul-21/O	< 0.00002	< 0.00002	< 0.00002
Hardness (as CaCO3)	mg/L	1	SM 3120	23-Jul-21/O	39	170	167
Arsenic	mg/L	0.0001	EPA 200.8	23-Jul-21/O	0.0008	0.0006	0.0006
Barium	mg/L	0.001	SM 3120	23-Jul-21/O	0.013	0.030	0.029
Boron	mg/L	0.005	SM 3120	23-Jul-21/O	< 0.005	0.034	0.036
Cadmium	mg/L	0.000015	EPA 200.8	23-Jul-21/O	0.000047	< 0.000015	< 0.000015
Calcium	mg/L	0.02	SM 3120	23-Jul-21/O	11.5	52.9	51.5
Chromium	mg/L	0.001	EPA 200.8	23-Jul-21/O	< 0.001	< 0.001	< 0.001
Copper	mg/L	0.0001	EPA 200.8	23-Jul-21/O	0.0012	0.0003	0.0004
Iron	mg/L	0.005	SM 3120	23-Jul-21/O	0.312	0.098	0.082
Lead	mg/L	0.00002	EPA 200.8	23-Jul-21/O	0.00072	< 0.00002	0.00003
Magnesium	mg/L	0.02	SM 3120	23-Jul-21/O	2.41	9.27	9.29



R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Michelle Dubien
Lab Manager

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C.O.C.: G100059

REPORT No. B21-22767

Rev. 1

Report To:

Cambium Environmental
 194 Sophia St.,
 Peterborough ON K9H 1E5 Canada
Attention: Stephanie Reeder

Caduceon Environmental Laboratories

285 Dalton Ave
 Kingston Ontario K7K 6Z1
 Tel: 613-544-2001
 Fax: 613-544-2770

DATE RECEIVED: 21-Jul-21
 DATE REPORTED: 25-Jan-22
 SAMPLE MATRIX: Surface Water

JOB/PROJECT NO.: Ardoch WDS
 P.O. NUMBER: 10530-003
 WATERWORKS NO.

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed	Client I.D.	SW2	SW1	SW_QAQC
					Sample I.D.	Date Collected		
Manganese	mg/L	0.001	SM 3120	23-Jul-21/O	B21-22767-1	0.062	0.038	0.019
Phosphorus-Total	mg/L	0.01	E3199A.1	26-Jul-21/K	B21-22767-2	0.10	0.07	0.07
Potassium	mg/L	0.1	SM 3120	23-Jul-21/O	B21-22767-3	0.5	0.6	0.6
Sodium	mg/L	0.2	SM 3120	23-Jul-21/O	19-Jul-21	1.3	6.1	6.0
Zinc	mg/L	0.005	SM 3120	23-Jul-21/O	19-Jul-21	< 0.005	0.054	0.040

1. Revised to include U-NH3



Michelle Dubien
 Lab Manager

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

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C.O.C.: G100076

REPORT No. B21-30796

Rev. 1

Report To:

Cambium Environmental
194 Sophia St.,
Peterborough ON K9H 1E5 Canada
Attention: Stephanie Reeder

Caduceon Environmental Laboratories

285 Dalton Ave
Kingston Ontario K7K 6Z1
Tel: 613-544-2001
Fax: 613-544-2770

DATE RECEIVED: 24-Sep-21

JOB/PROJECT NO.: Ardoch WDS

DATE REPORTED: 20-Jan-22

P.O. NUMBER: 10530-003

SAMPLE MATRIX: Surface Water

WATERWORKS NO.

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed	Client I.D.		SW1		SW_QAQC	
					Sample I.D.	Date Collected	B21-30796-1	22-Sep-21	B21-30796-2	22-Sep-21
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	27-Sep-21/O			164		163	
Conductivity @25°C	µmho/cm	1	SM 2510B	27-Sep-21/O			380		379	
pH @25°C	pH Units		SM 4500H	27-Sep-21/O			7.87		7.92	
Total Suspended Solids	mg/L	3	SM2540D	24-Sep-21/K			< 3		5	
Dissolved Organic Carbon	mg/L	0.2	EPA 415.2	27-Sep-21/O			15.1		14.8	
BOD(5 day)	mg/L	3	SM 5210B	24-Sep-21/K			< 3		< 3	
COD	mg/L	5	SM5220C	28-Sep-21/K			31		32	
Phenolics	mg/L	0.001	MOEE 3179	27-Sep-21/K			0.005		< 0.001	
Chloride	mg/L	0.5	SM4110C	28-Sep-21/O			10.4		10.9	
Ammonia (N)-Total	mg/L	0.01	SM4500-NH3-H	28-Sep-21/K			0.05		0.05	
Ammonia (N)-unionized	mg/L	0.01	CALC	28-Sep-21/K			< 0.01		< 0.01	
Sulphate	mg/L	1	SM4110C	28-Sep-21/O			14		14	
Nitrite (N)	mg/L	0.05	SM4110C	28-Sep-21/O			< 0.05		< 0.05	
Nitrate (N)	mg/L	0.05	SM4110C	28-Sep-21/O			0.10		< 0.05	
Total Kjeldahl Nitrogen	mg/L	0.1	E3199A.1	27-Sep-21/K			0.6		0.6	
Mercury	mg/L	0.00002	SM 3112 B	30-Sep-21/O			< 0.00002		< 0.00002	
Hardness (as CaCO3)	mg/L	1	SM 3120	27-Sep-21/O			179		174	
Arsenic	mg/L	0.0001	EPA 200.8	29-Sep-21/O			0.0007		0.0006	
Barium	mg/L	0.001	SM 3120	27-Sep-21/O			0.032		0.031	
Boron	mg/L	0.005	SM 3120	27-Sep-21/O			0.056		0.054	
Cadmium	mg/L	0.000015	EPA 200.8	29-Sep-21/O			< 0.000015		< 0.000015	
Calcium	mg/L	0.02	SM 3120	27-Sep-21/O			55.3		53.7	
Chromium	mg/L	0.001	EPA 200.8	29-Sep-21/O			< 0.001		< 0.001	
Copper	mg/L	0.0001	EPA 200.8	29-Sep-21/O			0.0010		0.0009	
Iron	mg/L	0.005	SM 3120	27-Sep-21/O			0.045		0.039	
Lead	mg/L	0.00002	EPA 200.8	29-Sep-21/O			0.00004		0.00004	
Magnesium	mg/L	0.02	SM 3120	27-Sep-21/O			10.0		9.79	

M. Dubien

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Michelle Dubien
Lab Manager

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C.O.C.: G100076

REPORT No. B21-30796

Rev. 1

Report To:

Cambium Environmental
 194 Sophia St.,
 Peterborough ON K9H 1E5 Canada
Attention: Stephanie Reeder

Caduceon Environmental Laboratories

285 Dalton Ave
 Kingston Ontario K7K 6Z1
 Tel: 613-544-2001
 Fax: 613-544-2770

DATE RECEIVED: 24-Sep-21
 DATE REPORTED: 20-Jan-22
 SAMPLE MATRIX: Surface Water

JOB/PROJECT NO.: Ardoch WDS
 P.O. NUMBER: 10530-003
 WATERWORKS NO.

Parameter	Units	R.L.	Reference Method	Date/Site Analyzed	Client I.D.		
					SW1	SW_QAQC	
Manganese	mg/L	0.001	SM 3120	27-Sep-21/O	0.019	0.018	
Phosphorus-Total	mg/L	0.01	E3199A.1	27-Sep-21/K	0.07	0.07	
Potassium	mg/L	0.1	SM 3120	27-Sep-21/O	1.6	1.5	
Sodium	mg/L	0.2	SM 3120	27-Sep-21/O	6.4	6.2	
Zinc	mg/L	0.005	SM 3120	27-Sep-21/O	0.015	0.013	

1. Revised to include U-NH3



Michelle Dubien
 Lab Manager

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

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Appendix F Photographs

Fully accessible appended items are available upon request.



Photograph 1: Monitoring well MW14-1R, June 2020



Photograph 2: Monitoring well MW14-2R, June 2020



Photograph 3: Monitoring well MW14-3R, June 2020



*Photograph 4: Monitoring well MW14-4R,
September 2021*



Photograph 5: Monitoring well MW12-5B, June 2020



Photograph 6: Monitoring well MW14-6R, May 2021



Photograph 7: Monitoring Well MW14-7R, June 2020



*Photograph 8: Surface water monitoring station SW1,
May 2021*



**Photograph 9: Surface water monitoring station SW1,
July 2021**



**Photograph 10: Surface water monitoring station SW1,
September 2021**



**Photograph 11: Insufficient volumes - Surface water
monitoring station SW2, May 2021**



**Photograph 12: Surface water monitoring station SW2,
July 2021**



Photograph 13: Dry - Surface water monitoring station SW2, September 2021



Photograph 14: Gas Probe GP101, July 2021



Photograph 15: Gas Probe GP102, July 2021



Photograph 16: Gas Probe GP103, February 2021



Photograph 17: Gas Probe GP104, February 2021



Appendix G

Gas Probe Installation Logs

Fully accessible appended items are available upon request.



Appendix H

Water Well Records

Fully accessible appended items are available upon request.

Well Number (Place sticker and print number below)
A 006555
A006555

Instructions for Completing Form

- For use in the **Province of Ontario** only. This document is a permanent **legal** document. Please retain for future reference.
- All Sections **must** be completed in full to avoid delays in processing. Further instructions and explanations are available on the back of this form.
- Questions regarding completing this application can be directed to the Water Well Management Coordinator at 416-235-6203.
- **All metre measurements shall be reported to 1/10th of a metre.**
- Please print clearly in blue or black ink only.

Ministry Use Only

Address of Well Location (County/District/Municipality) **1077 Hermer Lane** Township **Clarendon** Lot **20** Concession **SW Range**
 RR#/Street Number/Name City/Town/Village Site/Compartment/Block/Tract etc.
 GPS Reading NAD **83** Zone **18** Easting **351116** Northing **4974850** Unit Make/Model **Magellan** Mode of Operation: Undifferentiated Averaged
 Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Metres To
red	sand/gravel/stones			0.	0.91
black/pink	granite			0.91	9.14
black/brown	granite			9.14	9.75
black/pink	granite			9.75	16.46
black/brown	(mica) granite			16.46	16.76
black	granite			16.76	18.29

R Plan 13 R 15054 Parts 4-6
 60' 10 gpm

Hole Diameter			Construction Record				Test of Well Yield					
Depth From	Metres To	Diameter Centimetres	Inside diam centimetres	Material	Wall thickness centimetres	Depth From	Metres To	Pumping test method	Draw Down Time min	Water Level Metres	Recovery Time min	Water Level Metres
0	6.70	25.4	15.24	Steel	1.48	0.61	6.70	Pump	1	4.23	1	5.10
Water Record			Casing				Final water level end of pumping					
Water found at Metres	Kind of Water		Material	Wall thickness centimetres	Depth From	Metres To						
9.4 m	Fresh	Sulphur	Steel	1.48	0.61	6.70	2.09 metres	Recommended pump type	4	5.05	4	4.25
Gas	Salty	Minerals	Plastic	Concrete			Recommended pump depth	5	5.20	5	4.15	
Other: not tested			Galvanized				Recommended pump rate	10	5.58	10	3.84	
16.46 m	Fresh	Sulphur	Steel	Fibreglass			15	5.76	15	3.67		
Gas	Salty	Minerals	Plastic	Concrete			20	5.85	20	3.54		
Other: not tested			Galvanized				25	5.91	25	3.46		
m	Fresh	Sulphur	Steel	Fibreglass			30	5.96	30	3.42		
Gas	Salty	Minerals	Plastic	Concrete			40	6.03	40	3.36		
Other:			Galvanized				50	6.12	50	3.32		
After test of well yield, water was	Screen											
<input type="checkbox"/> Clear and sediment free	Outside diam <input type="checkbox"/> Steel <input type="checkbox"/> Fibreglass <input type="checkbox"/> Slot No											
<input checked="" type="checkbox"/> Other, specify cloudy	<input type="checkbox"/> Plastic <input type="checkbox"/> Concrete											
Chlorinated <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Galvanized											
	No Casing or Screen											
	<input type="checkbox"/> Open hole											

Plugging and Sealing Record Annular space Abandonment

Depth set at - Metres From **6.70** To **0.** Material and type (bentonite slurry, neat cement slurry) etc. **Quick grout** Volume Placed (cubic metres) **0.066**

Method of Construction

Cable Tool Rotary (air) Diamond Digging
 Rotary (conventional) Air percussion Jetting Other
 Rotary (reverse) Boring Driving

Water Use

Domestic Industrial Public Supply Other
 Stock Commercial Not used
 Irrigation Municipal Cooling & air conditioning

Final Status of Well

Water Supply Recharge well Unfinished Abandoned, (Other)
 Observation well Abandoned, insufficient supply Dewatering
 Test Hole Abandoned, poor quality Replacement well

Location of Well

In diagram below show distances of well from road, lot line, and building. Indicate north by arrow.

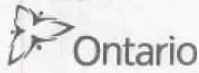
Audit No. **Z 06667** Date Well Completed **2004 05 03**
 Was the well owner's information package delivered? Yes No Date Delivered **2004 05 03**

Well Contractor/Technician Information

Name of Well Contractor **WLF Hall Ltd.** Well Contractor's Licence No. **2558**
 Business Address (street name, number, city etc.) **RR, 260 Hall Shore Rd, McDonald's Corners Ont K0G1M0**
 Name of Well Technician (last name, first name) **Mark Hall** Well Technician's Licence No. **T2228**
 Signature of Technician/Contractor **x Mark Hall** Date Submitted **2004 05 03**

Ministry Use Only

Data Source Contractor **2558**
 Date Received **JUN 03 2004** Date of Inspection **2004 05 03**
 Remarks **CSS 555** Well Record Number **2218237**



Ministry of the Environment

Measurements recorded in: Metric Imperial

Well Tag No. (Place Sticker and/or Print Below)

A109541

A109541

Well Record Regulation 903 Ontario Water Resources Act

Page 1 of 1

Address of Well Location (Street Number/Name) **1083 Hermer Lane** Township **Clarendon** Lot SW Range **Part Lot 20** Precinct

County/District/Municipality **Frontenac** City/Town/Village Province **Ontario** Postal Code

UTM Coordinates Zone Easting Northing Municipal Plan and Sublot Number Other

NAD 83 **1835110674974910** **RP 13R12519** **Parts 3 & 4**

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft)	
				From	To
	Gravel + Stones			0'	10'
grey	granite			10'	38'
grey/brown	granite		Course gravel seam	38'	45'

Annular Space

Depth Set at (m/ft)	Type of Sealant Used (Material and Type)	Volume Placed (m ³ /ft ³)
0' 22'	2 Bags cement	0.044
	3 Bags quick grout	0.044

Method of Construction

Cable Tool Diamond Public Commercial Not used

Rotary (Conventional) Jetting Domestic Municipal Dewatering

Rotary (Reverse) Driving Livestock Test Hole Monitoring

Boring Digging Irrigation Cooling & Air Conditioning

Air percussion Industrial Other, specify

Results of Well Yield Testing

After test of well yield, water was:

Clear and sand free

Other, specify **Cloudy**

If pumping discontinued, give reason:

Pump intake set at (m/ft) **35'**

Pumping rate (l/min / GPM) **15 gpm**

Duration of pumping **1** hrs + min

Final water level end of pumping (m/ft) **6.75'**

If flowing give rate (l/min / GPM)

Recommended pump depth (m/ft) **38'**

Recommended pump rate (l/min / GPM) **15 gpm**

Well production (l/min / GPM) **60 gpm**

Disinfected? Yes No

Time (min)	Draw Down (m/ft)		Recovery (m/ft)	
	Water Level	Time	Water Level	Time
1	7.6'	1	7.1'	
2	7.7'	2	7.0'	
3	7.8'	3	6.93'	
4	7.85'	4	6.88'	
5	7.9'	5	6.84'	
10	8.0'	10	6.79'	
15	8.05'	15	6.75'	
20	8.05'	20	6.75'	
25	8.05'	25	6.75'	
30	8.05'	30	6.75'	
40	8.07'	40	6.75'	
50	8.08'	50	6.75'	
60	8.08'	60	6.75'	

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)	
			From	To
6"	Steel	480m	0'	22'

Status of Well

Water Supply

Replacement Well

Test Hole

Recharge Well

Dewatering Well

Observation and/or Monitoring Hole

Alteration (Construction)

Abandoned, Insufficient Supply

Abandoned, Poor Water Quality

Abandoned, other, specify

Other, specify

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)	
			From	To

Water Details

Water found at Depth **38** (m/ft) Gas Other, specify

Kind of Water: Fresh Untested

Water found at Depth **45** (m/ft) Gas Other, specify

Kind of Water: Fresh Untested

Water found at Depth (m/ft) Gas Other, specify

Kind of Water: Fresh Untested

Hole Diameter

Depth (m/ft)	Diameter (cm/in)
0' 22'	25.4cm

Well Contractor and Well Technician Information

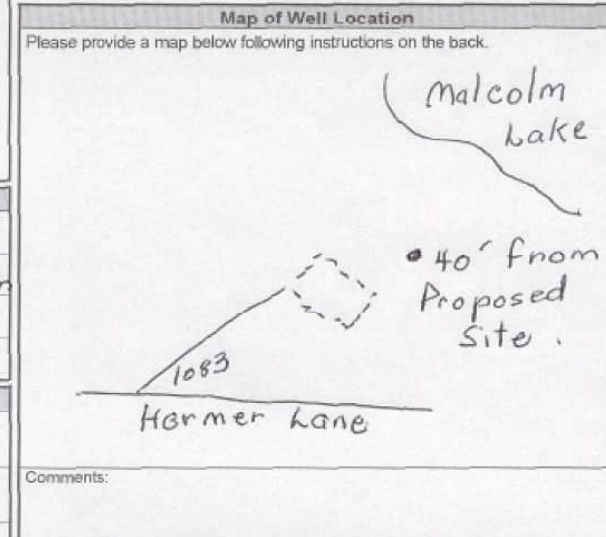
Business Name of Well Contractor **WILF HALL & Sons WELL DRILLING** Well Contractor's Licence No. **2558**

Business Address (Street Number/Name) **RR1 256 Hall Shore Rd McDonald's Corners** Municipality

Province **Ont** Postal Code **K0G1M0** Business E-mail Address **wilphall1tda@bell.net.ca**

Bus. Telephone No. (inc. area code) **6132782933** Name of Well Technician (Last Name, First Name) **Hall Mark**

Well Technician's Licence No. **T2228** Signature of Technician and/or Contractor **Mark Hall** Date Submitted **2011 05 06**



Comments:

Well owner's information package delivered Yes No

Date Package Delivered **2011 05 06**

Date Work Completed **2011 05 06**

Ministry Use Only

Audit No. **z123757**

Received **JUL 06 2011**



Ministry of the Environment

Well Tag No. (Place Sticker and/or Print Below)

A139316

Tag#: A139316

Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 1

Measurements recorded in: Metric Imperial

Address of Well Location (Street Number/Name) 1089 Hermer Lane Township Clarendon Lot 20 Concession SW Range
 County/District/Municipality Frontenac City/Town/Village Ardoch Province Ontario Postal Code _____
 UTM Coordinates Zone 18 Easting 35110724974940 Northing _____ Municipal Plan and Sublot Number _____ Other _____

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft)
				From To
	Gravel / stones			0' 5'
grey	granite			5' 34'
grey/brown	granite			34' 39'
grey	granite			39' 160'

Annular Space

Depth Set at (m/ft)	Type of Sealant Used (Material and Type)	Volume Placed (m ³ /ft ³)
From To		
0 22'	2 Bags cement	0.044
	2 Bags quick grout	0.044

Method of Construction

Cable Tool Diamond Public Commercial Not used
 Rotary (Conventional) Jetting Domestic Municipal Dewatering
 Rotary (Reverse) Driving Livestock Test Hole Monitoring
 Boring Digging Irrigation Cooling & Air Conditioning
 Air percussion Industrial Other, specify _____
 Other, specify _____

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Well Thickness (cm/in)	Depth (m/ft)	Status of Well
			From To	
6"	steel	48cm	0' 22'	<input checked="" type="checkbox"/> Water Supply <input type="checkbox"/> Replacement Well <input type="checkbox"/> Test Hole <input type="checkbox"/> Recharge Well <input type="checkbox"/> Dewatering Well <input type="checkbox"/> Observation and/or Monitoring Hole <input type="checkbox"/> Alteration (Construction) <input type="checkbox"/> Abandoned, Insufficient Supply <input type="checkbox"/> Abandoned, Poor Water Quality <input type="checkbox"/> Abandoned, other, specify _____ <input type="checkbox"/> Other, specify _____

Water Details

Water found at Depth (m/ft)	Kind of Water: <input type="checkbox"/> Fresh <input checked="" type="checkbox"/> Untested	Hole Diameter
	<input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	Depth (m/ft) From To Diameter (cm/in)
35'	<input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	0' 22' 25.4cm
52'	<input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	
	<input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	

Well Contractor and Well Technician Information

Business Name of Well Contractor WLF HALL & SONS WELL DRILLING Well Contractor's Licence No. 25158
 Business Address (Street Number/Name) 156 Hall Shore Rd. RR, McDonald's Corners Municipality _____
 Province ON Postal Code K0G1M0 Business E-mail Address wilfhalltda@bellnet.ca
 us. Telephone No. (inc. area code) 6132782933 Name of Well Technician (Last Name, First Name) Hall Mark
 Well Technician's Licence No. 22218 Signature of Technician and/or Contractor Mark Hall Date Submitted 20130523

Results of Well Yield Testing

After test of well yield, water was:
 Clear and sand free
 Other, specify Cloudy

If pumping discontinued, give reason: _____

Pump intake set at (m/ft) 150'

Pumping rate (l/min / GPM) 4 gpm

Duration of pumping 1 hrs + min

Final water level end of pumping (m/ft) 25.6'

If flowing give rate (l/min / GPM) 2

Time (min)	Draw Down		Recovery	
	Water Level (m/ft)	Time (min)	Water Level (m/ft)	Time (min)
1	25.2'	1	70.9'	
2	25.6'	2	68.8'	
3	26.05'	3	66.8'	
4	26.4'	4	64.8'	
5	26.7'	5	62.75'	
10	28.15'	10	52.7'	
15	29.85'	15	42.9'	
20	31.6'	20	35.4'	
25	33.25'	25	34.15'	
30	34.65'	30	33.1'	
40	41.1'	40	31.4'	
50	55.8'	50	30.0'	
60	72.7'	60	28.9'	

Recommended pump depth (m/ft) 140'

Recommended pump rate (l/min / GPM) 4 gpm

Well production (l/min / GPM) 4 gpm

Disinfected? Yes No

Map of Well Location

Please provide a map below following instructions on the back.

1089 Hermer Lane

• 20' from house

Malcolm lake

Well owner's information package delivered Yes No

Date Package Delivered 2013 05 23

Date Work Completed 2013 05 23

Ministry Use Only

Audit No. 2159779

Received JUN 10 2013



The Ontario Water Resources Act WATER WELL RECORD

Print only in spaces provided. Mark correct box with a checkmark, where applicable.

2215564

Municipality 22005 Con South Range

County or District, Township/Borough/City/Town/Village, Address, Date completed

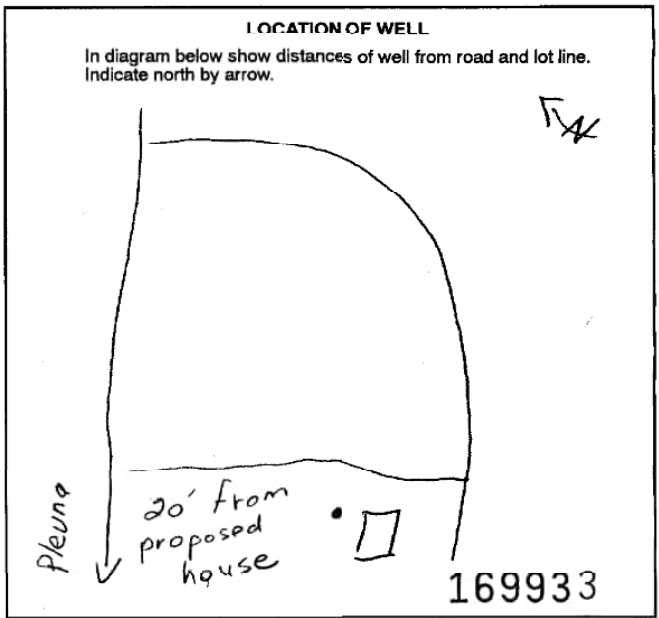
LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions) Table with columns: General colour, Most common material, Other materials, General description, Depth - feet

WATER RECORD Table with columns: Water found at - feet, Kind of water

CASING & OPEN HOLE RECORD Table with columns: Inside diam inches, Material, Wall thickness inches, Depth - feet

PLUGGING & SEALING RECORD Table with columns: Depth set at - feet, Material and type

PUMPING TEST Table with columns: Pumping test method, Pumping rate, Duration of pumping, Water level end of pumping, Water levels during pumping, Pump intake set at, Recommended pump type, Recommended pump setting, Recommended pump rate



FINAL STATUS OF WELL, WATER USE, METHOD OF CONSTRUCTION sections with checkboxes for various well types and construction methods.

Name of Well Contractor, Well Contractor's Licence No, Address, Name of Well Technician, Well Technician's Licence No, Signature of Technician/Contractor, Submission date

MINISTRY USE ONLY. Data source, Contractor, Date received, Date of inspection, Inspector, Remarks



MINISTRY OF THE ENVIRONMENT
The Ontario Water Resources Act
WATER WELL RECORD

31c/15west

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK CORRECT BOX WHERE APPLICABLE

11 2206574-22005 R SW
MUNICIPALITY 22005 CON. BLOCK, TRACT, SURVEY, ETC. R SW
COUNTY OR DISTRICT FRONETAC TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE CLARENDON
SOUTH WEST RANGE 019
DATE COMPLETED DAY 31 MO 08 YR 73
ELEVATION 747.50 BASIN CODE 5 26

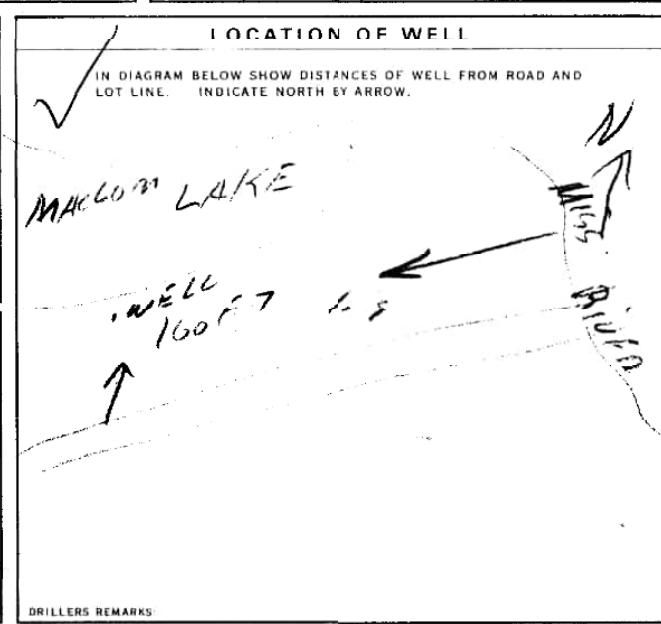
LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET	
				FROM	TO
			BLACK GRANITE	0	65
			RED & BLACK GRANITE	65	68
			BLACK GRANITE	68	75
			RED GRANITE	75	75

31 006582 006872 007582 009572
32

41 WATER RECORD WATER POUND 0061 KIND OF WATER 1 <input checked="" type="checkbox"/> FRESH 3 <input type="checkbox"/> SULPHUR 2 <input type="checkbox"/> SALTY 4 <input type="checkbox"/> MINERAL		51 CASING & OPEN HOLE RECORD INSIDE DIAM INCHES 6.4 MATERIAL 1 STEEL WALL THICKNESS INCHES 1.88 DEPTH - FEET FROM 0 TO 12 2 GALVANIZED 3 CONCRETE 4 OPEN HOLE 17-18 06 20-23 002 24-25 1 STEEL 2 GALVANIZED 3 CONCRETE 4 OPEN HOLE 27-30		61 PLUGGING & SEALING RECORD DEPTH SET AT - FEET FROM TO MATERIAL AND TYPE CEMENT GROUT LEAD PACKER, ETC. 10-13 14-17 18-21 22-25 26-29 30-33 80	
--	--	--	--	---	--

7 PUMPING TEST METHOD
 PUMP BAILER
 PUMPING RATE 0003 GPM
 DURATION OF PUMPING 01 HOURS 30 MINS
8 PUMPING TEST
 STATIC LEVEL 014 FEET
 WATER LEVEL END OF PUMPING 095 FEET
 WATER LEVELS DURING PUMPING
 15 MINUTES 075 FEET
 30 MINUTES 075 FEET
 45 MINUTES 035 FEET
 60 MINUTES 00 FEET
 IF FLOWING GIVE RATE 30-41
 PUMP INTAKE SET AT 43-45 FEET 027
 WATER AT END OF TEST 42 FEET 1 CLEAR 2 CLOUDY
 RECOMMENDED PUMP TYPE SHALLOW DEEP
 RECOMMENDED PUMP SETTING 027 FEET
 RECOMMENDED PUMPING RATE 0002 GPM



FINAL STATUS OF WELL
 1 WATER SUPPLY
 2 OBSERVATION WELL
 3 ABANDONED, INSUFFICIENT SUPPLY
 4 ABANDONED, POOR QUALITY
 5 UNFINISHED
WATER USE
 01
 1 DOMESTIC
 2 INDUSTRIAL
 3 COMMERCIAL
 4 MUNICIPAL
 5 PUBLIC SUPPLY
 6 COOLING OR AIR CONDITIONING
 7 NOT USED
METHOD OF DRILLING
 4
 1 AIR PERCUSSION
 2 ROTARY (NORMAL)
 3 ROTARY (REVERSE)
 4 ROTARY (AIR)
 5 BOREING
 6 DIAMOND
 7 JETTING
 8 DRIVING

CONTRACTOR
 NAME OF WELL CONTRACTOR THOMPSON BROS
 LICENCE NUMBER 4904
 ADDRESS LANARK #3
 NAME OF DRILLER OR BORER C. H. THOMPSON
 LICENCE NUMBER
 SIGNATURE OF CONTRACTOR [Signature]
 SUBMISSION DATE DAY 31 MO 8 YR 73

OFFICE USE ONLY
 DATA SOURCE 1
 CONTRACTOR 4904
 DATE RECEIVED 10 04 74
 DATE OF INSPECTION
 INSPECTOR
 REMARKS: P 82 WI
 CSS. 82



MINISTRY OF THE ENVIRONMENT 31 C/15 West
The Ontario Water Resources Act
WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK CORRECT BOX WHERE APPLICABLE

11 | 2206575 | 22005 R SW
 COUNTY OR DISTRICT: FRANKFURT
 TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: CLARENDON
 CON. BLOCK, TRACT, SURVEY, ETC: SOUTH WEST RANGE 019
 DATE COMPLETED: DAY 28, MO 08, YR 73
 ELEVATION: 74750 | 5 | 0860 | 5 | 26

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET	
				FROM	TO
			BLACK GRANITE	0	65
			BLACK & RED GRANITE	65	156

31 | 0065821 | 0156821
 32

41 WATER RECORD

WATER FOUND	KIND OF WATER
10-13 15-18 20-23 25-28 30-33	1 <input checked="" type="checkbox"/> FRESH 2 <input type="checkbox"/> SALTY 3 <input checked="" type="checkbox"/> SULPHUR 4 <input type="checkbox"/> MINERAL

51 CASING & OPEN HOLE RECORD

HOLE DIA. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET	
			FROM	TO
10-11 17-10 24-25	1 <input checked="" type="checkbox"/> STEEL 2 <input type="checkbox"/> GALVANIZED 3 <input type="checkbox"/> CONCRETE 4 <input type="checkbox"/> OPEN HOLE	1.79	0	156

SCREEN

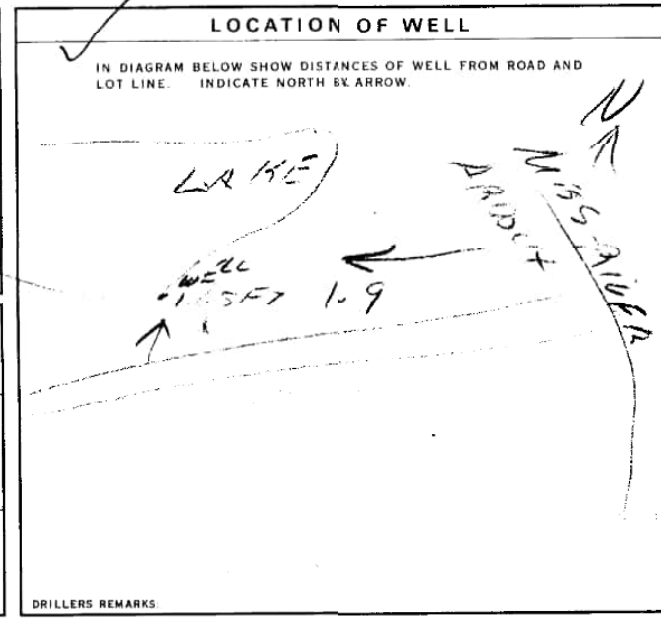
SIZE(S) OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET
	34-38	39-40
MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN	41-44
		80

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET	MATERIAL AND TYPE	CEMENT GROUT, HEAD PACKER, ETC.
FROM TO		
10-13	14-17	
18-21	22-25	
26-29	30-33	80

71 PUMPING TEST

PUMPING TEST METHOD	PUMPING RATE	DURATION OF PUMPING
1 <input checked="" type="checkbox"/> PUMP 2 <input type="checkbox"/> BAILER	0002 GPM	01 HOURS 30 MINS
STATIC LEVEL	WATER LEVEL	WATER LEVELS DURING
013 FEET	156 FEET	15 MINUTES: 145 FEET 30 MINUTES: 145 FEET 45 MINUTES: 96 FEET 90 MINUTES: 96 FEET
IF FLOWING GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST
	145 FEET	1 <input checked="" type="checkbox"/> CLEAR 2 <input type="checkbox"/> CLOUDY
RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
<input type="checkbox"/> SHALLOW <input checked="" type="checkbox"/> DEEP	145 FEET	0002 GPM



STATUS OF WELL

1 WATER SUPPLY 5 ABANDONED - INSUFFICIENT SUPPLY
 2 OBSERVATION WELL 6 ABANDONED - POOR QUALITY
 3 TEST HOLE 7 UNFINISHED
 4 RECHARGE WELL

WATER USE

1 DOMESTIC 2 COMMERCIAL
 3 STOCK 4 MUNICIPAL
 5 IRRIGATION 6 PUBL. SUPPLY
 7 INDUSTRIAL 8 COOLING OR AIR CONDITIONING
 9 OTHER 10 NOT USED

METHOD OF DRILLING

1 CASE 2 BORE
 3 ROTARY (CONVENTIONAL) 4 DIAMOND
 5 ROTARY (AIR) 6 JETTING
 7 AIR PERCUSSION 8 DRIVING

CONTRACTOR

NAME OF WELL CONTRACTOR: THOMPSON BROS
 LICENCE NUMBER: 4904
 ADDRESS: LANARK RA#3
 NAME OF DRILLER OR BORER: THOMPSON
 SIGNATURE OF CONTRACTOR: Cornell Thompson
 SUBMISSION DATE: DAY 31, MO 8, YR 73

OFFICE USE ONLY

DATA SOURCE: 1 | 4904 | 200474
 DATE OF INSPECTION: _____
 REMARKS: _____
 P 82
 WI
 CSE 58



Environmental

Geotechnical

Building Sciences

Construction Quality
Verification

Telephone

(866) 217.7900
(705) 742.7900

Facsimile

(705) 742.7907

Website

cambium-inc.com

Mailing Address

P.O. Box 325,
Peterborough, Ontario
Canada, K9J 6Z3

Locations

Peterborough
Kingston
Barrie
Oshawa
Ottawa

Laboratory

Peterborough



August 4, 2023

Township of North Frontenac
6648 Road 506, Plevna, ON
K0H 2M0

Attn: Brooke Drechsler

**Re: Peer Review – Ministry Guideline D4 – Landfill Site Assessment
1230D Austris Road, North Frontenac, Ontario
Cambium Reference: 10530-001**

Dear Ms. Drechsler,

McIntosh Perry (MP) submitted a Ministry Guideline D4 Study to the Township of North Frontenac (TNF) titled "*Landfill Impact Assessment (Guideline D-4 Study) – 1230D Austris Road, Township of North Frontenac, Ontario*" dated April 4, 2023.

The subject property is at 1230D Austris Road, North Frontenac, Ontario (Site), it is understood that the Site is about 0.94 ha. The legal description for the Site is: PT LOT 19 CON SOUTHWEST RANGE CLARENDON; PT RDAL, ON S END OF MALCOLM LAKE CLARENDON CLOSED BY FR612255, PT 9, 10 13R10703 T/W FR741412, NORTH FRONTENAC.

The Site is undeveloped woodland other than a shared unpaved driveway permitting access to southwest boundary. The proposed development is for a cottage to be built at the centre of the property near Malcolm Lake. There are no current plans for the cottage to be supplied by a drinking water supply well. The Site is less than 30 m from the western property boundary of the temporarily closed Ardoch waste disposal site (WDS). The cottage is intended to be built on the northeast corner of the property.

A D4 study is required for the land use within the 500 m buffer to ensure that there is no impacts or potential impacts to the Site that are associated with the operating or closed landfill site, including: landfill gases, groundwater and surface water contamination, odour, litter, visual impact, dust, noise, vectors and vermin,

10530-001

Page 1



Environmental

Geotechnical

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Locations

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Kingston
Barrie
Oshawa
Ottawa

Laboratory

Peterborough



August 4, 2023

and air emission associated with vehicular traffic and the burning of clean wood and brush.

AS CAMBIUM UNDERSTANDS

The D4 Study scope of work was completed by reviewing the following documents:

- 2021 Annual Monitoring Report (AMR) for the Ardoch WDS (Cambium, 2022)
- Geological and topographic mapping for the area
- Water Well Records
- Aerial Photographs
- Municipal planning documents (i.e., Official Plan, and Zoning Bylaws)
- Other documents pertaining to the physical setting of the Site and the WDS

The finding of the scope of work were as followed:

- The conceptual site model for the Ardoch WDS indicated that leachate impacted groundwater flowed southwest through the permeable sand and gravel overburden unit where is it expected to discharge to surface. From here surface water drainage is northwest (toward the Site), ultimately discharging into Malcolm Lake. There is a component of radial flow, in the overburden, away from the waste mound. MP concluded that the Site was hydrogeologically cross-gradient from the WDS.
- The connectivity between the shallow overburden aquifer and deeper bedrock aquifer (i.e., supply well aquifer) is minimal due to the poorly fractured bedrock within the area.
- Since groundwater is interpreted to discharge to the down-gradient surface water systems, analytical results were compared to the Provincial Water Quality Objectives (PWQO). The only leachate indicator parameters (LIP) to exceed the PWQO criteria at the groundwater monitoring well closest to the Site were boron and dissolved organic carbon (DOC).



Environmental

Geotechnical

Building Sciences

Construction Quality
Verification

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Canada, K9J 6Z3

Locations

Peterborough
Kingston
Barrie
Oshawa
Ottawa

Laboratory

Peterborough



August 4, 2023

- Although there were some exceedances of the PWQO criteria at the farthest downstream surface water monitoring location impacts were not attributed to the WDS.
- Landfill gas (LFG) is monitored at the WDS three times annually. Results in 2021 were consistent with historical measurements and indicated concentrations less than 1% methane by volume. MP concluded that based on the low concentrations measured, impacts related to LFG were not expected to impact the Site.
- MP concluded that the tree and vegetation cover between the Site and WDS should be adequate to reduce any visual impairments, prevent the migration of windblown litter, and any nuisance-level noise.
- MP completed an assessment on the prevailing wind direction which was determined to be to the northeast (away from the Site) which will aid in reducing any nuisance odours, contaminant discharges from vehicles, dust, fires, or other air emissions.
- MP concluded that the Site may be developed without adverse impacts as long as groundwater monitoring continues at the WDS.
- Given that the property owners do not intend on installing a drinking water supply well, health related impacts from WDS operations are not anticipated. However, if they do decide to install a supply well – MP recommended that the well be advanced and cased at least six metres into the bedrock, similar to other well installations in the area. Drinking water wells should be installed to the requirements of R.R.O 1990 Regulation 903 - Wells, and water quality and quantity should be confirmed with appropriate testing.

CAMBIUM'S COMMENTS AND RECOMMENDATIONS

Following a review of the D4 Study prepared by MP and the 2021 Ardoch AMR, Cambium offers the following comments:

- The domestic water supply aquifer in the vicinity of the WDS and Site is at an average depth of 30 m below ground surface (m bgs) in the deep granitic and



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metasedimentary bedrock. To the east and northeast of the WDS is an east-west trending esker which is described as having a relatively thick deposit of ice contact, stratified sand and gravel. Other than the areas where the esker has been identified, where the overburden is present the thickness is limited – typically less than 1 m. Given the depth to the supply well aquifer and potentiometric surface, the deep bedrock supply aquifer is considered to be confined. As such, impacts from the WDS to the supply well aquifer is considered to be negligible, if any.

- Groundwater impacts from historical waste disposal operations would be limited to the overburden aquifer. Given the competency of the bedrock unit, shallow overburden groundwater will discharge to surface. Given that there is a component of radial groundwater flow from the waste mound, there is potential for groundwater discharge to be at or near the Site's southeastern boundary. Leachate concentrations have reported to be stable or decreasing at all monitoring wells except for down-gradient well MW12-5B. Concentrations reported in 2021 indicated that leachate parameters appeared to be stabilizing.
- Cambium agrees with the approach MP suggested for any supply well to be installed. Groundwater samples should be collected and analyzed for the parameters listed in Schedule 5 (Comprehensive List) of the Landfill Standards – including hardness and VOCs.
- Cambium agrees with MP interpretation that LFG impacts are not anticipated to occur at the Site based on current site conditions.
- MP completed the D4 assessment based on current site conditions, that is a closed landfill. Environment Compliance Approval Condition 1.1 indicates that the WDS is temporarily closed for a period of at least 15 years as of Labour Day 2013.
- The WDS has a remaining capacity of 18,430 m³, or about 38 years based on historical filling rates. Furthermore, the existing limit of waste is currently only 0.46 ha of the approved 0.81 ha.



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- The recommencement of waste disposal operations has a potential to impact the surrounding surface water features (which flow toward the Site), and cause nuisance affects (e.g., windblown and animal removed litter, air and noise, odours, etc.).
- Further, if development of the Site were approved, the Township may not receive approval to reopen the Ardoch WDS, either as a landfill and/or a Transfer Station from the MECP.
- The Township should consider the future operation of the WDS and possible associated negative impacts/complaints when considering the approval for site development.

CLOSING

A D4 assessment is required to determine the influence area for a waste disposal site. These assessments are required for any development within a 500 m radius of waste disposal areas. The property boundary of the proposed development is less than 30 m from the currently closed WDS. Under current conditions, Cambium agrees with MPs interpretation that the risk of impact to the Site is minimal. That said, the Ardoch WDS has potential to re-open with the possibility to recommence operations as early as 2028. Development of the Site could be impacted by the Ardoch WDS if it were an open landfill and/or transfer station (e.g., surface water impacts, litter, odour, traffic, etc.). The Township should consider the future plans for the Ardoch site when reviewing this development application.

We trust this meets your expectations, please feel free to contact the undersigned at your convenience to discuss or clarify any of our comments.



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Best regards,

Cambium Inc.

Michael Pion, C.E.T.
Environmental Specialist

Stephanie Reeder, P.Geo., C.E.T.
Senior Project Manager

SNR/map

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A site assessment is created using data and information collected during the investigation of a site and based on conditions encountered at the time and particular locations at which fieldwork is conducted. The information, sample results and data collected represent the conditions only at the specific times at which and at those specific locations from which the information, samples and data were obtained and the information, sample results and data may vary at other locations and times. To the extent that Cambium's work or report considers any locations or times other than those from which information, sample results and data was specifically received, the work or report is based on a reasonable extrapolation from such information, sample results and data but the actual conditions encountered may vary from those extrapolations.

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