MUNICIPALITY OF WAWA

Expansion of the Municipal Waste Disposal Site
Environmental Screening Process

Environmental Screening Report

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EXECUTIVE SUMMARY

The Municipality of Wawa's municipal waste disposal site is located approximately 1.7 kilometers east of Highway 17, on High Falls Road in Rabazo Township, District of Algoma (about 8km south of the built-up community of Wawa). The waste disposal site currently receives non-hazardous solid municipal waste from approximately 2,900 permanent residents as well as from Hawk Junction and the Village of Michipicoten (which makes up part of the Municipality of Wawa). Waste is also accepted seasonally from area Provincial Parks (Lake Superior Park).

Based on the estimated volume of in-place material at the Municipality's waste disposal site, the current site is nearing capacity.

Considering the above as well as the Municipality's preferred option to expand the existing waste disposal site, the Municipality initiated the Environmental Screening Process under the Province's Environmental Assessment Act to address the site's declining waste disposal capacity. The Environmental Assessment Act is a provincial statute that lays out a planning and decision-making process to evaluate the potential environmental effects that may result following the implementation of a proposed undertaking. The Act ensures that points of consultation are made with all parties interested in a project throughout its planning and implementation process.

As part of the process, screening for potential negative environmental effects was conducted. Potential environmental effects of the project identified through the application of the Screening Criteria Checklist include:

1. Potential Surface Water and Groundwater Effects;
2. Potential Land Effects;
3. Potential Air and Noise Effects;
4. Potential Natural Environment Effects;
5. Potential Socio-Economic Effects;
6. Potential Effects on Heritage and Culture; and,
7. Potential for the production of non-hazardous or hazardous wastes.

Following the completion of the Screening Criteria Checklist, studies and/or assessments were conducted to understand the extent of the identified potential environmental effects. Impact management measures/mitigation measures were also developed for the predictable environmental effects associated with the expansion of the municipal waste disposal site.

The following conclusions were developed:

1. Best management practices currently in place and proposed as part of the expansion are expected to mitigate any potential impacts that may be introduced by the expansion;

2. The undeveloped land surrounding the proposed expansion area is expected to provide a sufficient buffer to prevent any negative aesthetic impacts to the surrounding land uses (e.g. High Falls Road);

3. In comparison to identifying and establishing a new site, an expansion to the existing site will help minimize the overall costs to the Municipality as existing features will be maintained as part of the expansion (i.e. monitoring network, access road, landfill gate, etc.); and,

4. The Environmental Screening Process did not identify any significant negative effects. A proposed expansion to the Wawa municipal waste disposal site is therefore considered a feasible option for addressing the Municipality's future waste management needs.

This Environmental Screening Report has been prepared in accordance with Ontario Regulation 101/07 made under the Province's Environmental Assessment and documents the Environmental Screening Process followed and the conclusions reached.

1.0 INTRODUCTION AND BACKGROUND

In 2016, the Municipality of Wawa (Municipality) initiated the Environmental Screening Process (ESP) to investigate the preferred method to expand waste disposal site capacity. Considering the site volume identified in the current ECA, it is expected that the remaining approved capacity will be filled during the 2021 operating year. Expansion will provide an additional disposal capacity of 100,000 m^3 (estimated 25-year lifespan).

Kresin Engineering Corporation (KEC) was retained by the Municipality to assist in the completion of the ESP as required by Ontario Regulation (O. Reg.) 101/07, made under the Province's Environmental Assessment (EA) Act.

A Municipality-owned parcel of property, the site is approximately 22 hectares in size, of which 2.6 hectares are approved for use and operation as a fill area. The Municipality's waste disposal site (Site) has been serving area residents since 1980. The Site is located approximately 1.7 kilometers east of Highway 17, on High Falls Road in Rabazo Township, District of Algoma (about 8km south of the built-up community of Wawa). The Site location is depicted on Drawing A1 of Appendix A.

1.1 Background

The Site currently receives non-hazardous solid municipal waste from approximately 2,900 permanent residents as well as from Hawk Junction and the Village of Michipicoten (which makes up part of the Municipality of Wawa). Waste is also accepted seasonally from area Provincial Parks (Lake Superior Park). Residential (curbside) and commercial waste is collected and hauled to the waste disposal site on a weekly basis.

The Site currently operates under Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Approval (ECA) No. A7266501, dated November 2, 2005. The ECA was amended (Notice 1) on February 1, 2011 to allow the continued use of the site to accept an additional 34,000m^3 of waste above the contours established in December 2007, or until May 2012. This corresponded to a total site volume of 208,383m^3.

Subsequent amendments (Notices 2, 3, 4, and 5) ultimately extended this date to April 16, 2016 and introduced the following requirements (in addition to other operational requirements):

1. The preparation and submission of a trigger mechanisms plan and a contingency plan;
2. The provision of updates on the status of the Environmental Assessment ("EA") process to secure additional waste disposal capacity; and,
3. The provision of details of the contaminant attenuation zone ("CAZ") and status of the process for acquiring the CAZ.

The ECA was again amended (Notice 6) on April 14, 2016 to allow the continued use of the site to accept an additional 22,000m^3 of waste, or until April 18, 2017. This corresponds to a total site volume of 230,383m^3. Subsequent amendments (Notices 7, 8 and 9), allowed the continued use of the site until May 31, 2021. Copies of the ECA and Notices are included in Appendix B.

As shown on the Municipality's Official Plan, surrounding properties are identified as Crown Land. A utility corridor is located approximately 0.34 kilometers north of the site and two abandoned mine sites are located approximately 0.5 kilometers northeast of the site.

A groundwater monitoring network consisting of ten (10) monitoring wells is in-place at the current waste disposal site. Monitoring well locations are shown on Drawing A2 of Appendix A. Analytical data is available for groundwater monitoring wells as well as upstream and downstream surface water samples for more than the past 10 years.

Review of the topographic surveys completed at the Municipality's waste disposal site, reveals that the in-place volume of waste and cover material is nearing capacity. To address the declining waste disposal capacity, the Municipality has confirmed its preference to expand the existing waste disposal site.

2.0 ENVIRONMENTAL SCREENING PROCESS

The Environmental Assessment Act (EAA) is a provincial statute that lays out a planning and decision-making process to evaluate potential environmental effects that may result following the implementation of a proposed undertaking. The EAA ensures that points of consultation are made with all parties interested in a project throughout its planning and implementation process.

In March of 2007, the Waste Management Projects Regulation was filed by the MECP under the EAA. The regulation established the Environmental Screening Process for Waste Management Projects, which streamlined the assessment process for certain waste disposal projects in Ontario. Rather than completing a full EA, the process is intended to provide a quick and predictable assessment for those projects that have expected environmental effects that can be readily mitigated.

As described in the MECP's *Guide to Environmental Assessment Requirements for Waste Management Projects* (Guide), the Environmental Screening Process is a proponent driven, self-assessment process for certain waste management projects where the proponent is responsible for determining if the process applies to a particular project. As part of the process, screening for potential negative environmental effects must occur, studies must be conducted and mitigation measures for predictable environmental effects associated with the implementation of a proposed project must be developed.

As the expansion of an existing waste disposal site by a capacity of between 40,000 m^3 – 100,000m^3 is considered a project listed under Part III of the Waste Management Projects Regulation, the Municipality is required to follow the steps to complete the Environmental Screening Process as outlined in the Guide. A process flowchart is shown in Figure 1. In accordance with the Guide, the tasks included as part of the Environmental Screening Process are listed below and will be carried out in two phases.

<u>Phase 1:</u>

1. Prepare and Publish Notice of Commencement of a Screening Project;
2. Identify Problem or Opportunity and Provide Project Description;
3. Apply Screening Criteria Checklist to Identify Potential Environmental Effects;
4. Describe Potential Environmental Effects, Concerns and Issues to be Addressed;
5. Consult with Interested Persons to Identify Issues/Concerns;

<u>Phase 2:</u>

6. Conduct Detailed Site Assessment of Potential Environmental Effects;
7. Develop Impact Mitigation Measures;
8. Consult with Interested Persons and Government Agencies to Identify Any Issues or Concerns;
9. Identify Significant Net Effects and Reporting;
10. Conduct Additional Studies and Assessments;
11. Prepare Environmental Screening Report;
12. Publish Notice of Study Completion of Environmental Screening Process;
13. Address Elevation Requests; and
14. Submit Statement of Completion.

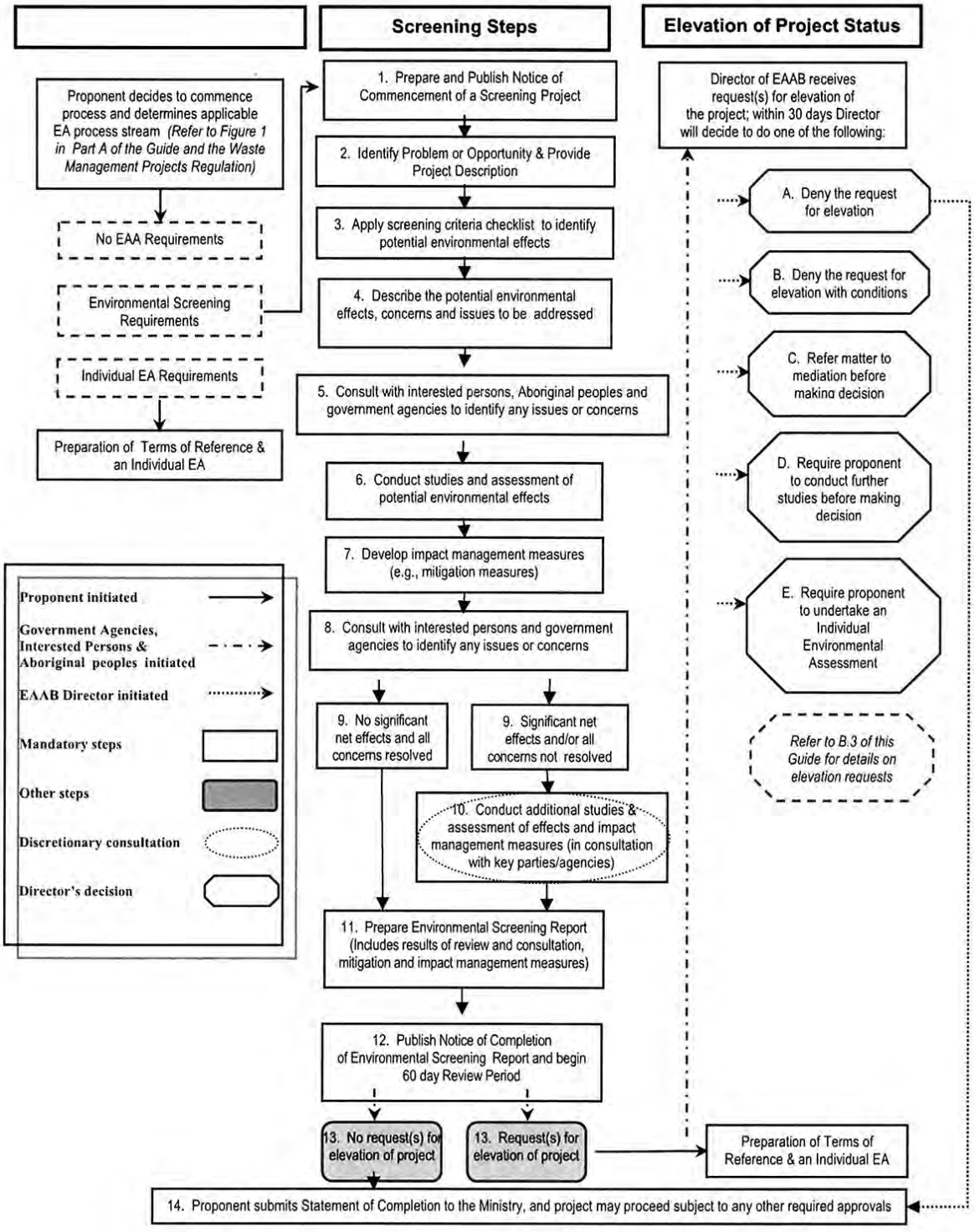


Figure 1. Environmental Screening Process
(Source: Guide to Environmental Assessment Requirements for Waste Management Projects)

3.0 FIRST POINT OF CONSULTATION (STEP 1 OF THE SCREENING PROCESS)

A Notice of Commencement of the Environmental Screening Process (copy in Appendix C) was prepared and circulated to applicable government ministries/departments/agencies, Indigenous communities and residents in September of 2016 for the purpose of introducing them to the proposed undertaking and informing them of upcoming consultation sessions. The notice was also posted on the Consultant's website, local news websites and submitted to applicable government ministries/departments/agencies and Indigenous communities. The consultation list for the project is located in Appendix D.

Government ministries/departments/agencies and Indigenous communities contacted are also listed below.

1. Ministry of Energy, Northern Development and Mines;
2. Algoma Public Health;
3. Ministry of the Environment, Conservation and Parks;
4. Ministry of Tourism, Culture and Sport;
5. Ministry of Natural Resources and Forestry;
6. Canadian Environmental Assessment Agency;
7. Métis Nation of Ontario;
8. Michipicoten First Nation;
9. Batchewana First Nation;
10. Garden River First Nation;
11. Evolugen by Brookfield Renewable.;
12. Algoma Power Inc.; and
13. Hydro One (formerly Great Lakes Power Transmission).

An Open House was held on July 26th, 2017 to provide the opportunity for residents to discuss the undertaking and provide public input. Government ministries/departments/agencies, Indigenous communities were also invited to review and provide comments on the display boards presented at the July 2017 Open House. Open House material is presented in Appendix E.

There were no comments received following the circulation of the Notice of Commencement and the Open House.

4.0 IDENTIFICATION OF PROBLEM/OPPORTUNITY AND PROJECT DESCRIPTION (STEP 2 OF THE SCREENING PROCESS)

4.1 Problem/Opportunity

The problem being addressed is the need for additional waste disposal capacity to service the Municipality of Wawa. It has been estimated that the existing approved capacity at the Site will be filled during the 2021 operating year.

It is anticipated that the Municipality will continue with the separation of white metals, tires and household electronics so that they may be stored for future removal by an appropriate recycling contractor. Cans (steel and aluminum) are collected from the local school and arena by a local scrap yard operator, providing a degree of waste diversion and extending the life of the Site.

4.2 Existing Waste Disposal Site

The Site is located in an area underlain with well drained sandy soil and is bound to the east, west and south by a meander of the Michipicoten River. Entry to the site is from the north and fill activities in 2020 took place in the middle of the existing fill area as the height of fill had been reached, or nearly reached in the remaining portions of the fill area. An attendant's shelter and areas to dispose of materials to be diverted are situated just within the site entry gate. Forested Crowns lands abut the east, west and south boundaries and a hydro corridor the north.

The Site operates as a natural attenuation site, relying on naturally occurring physical, chemical and biological processes to reduce concentrations of contaminants below MECP limits prior to reaching the property boundaries.

Current Municipal staff is unable to confirm; however, considering site topography and historical test-pitting, it seems likely that the site developed using both trench and area fill methods. Currently, site operations are proceedings using the area method of disposal.

4.3 Current Waste Management Program

The Site receives non-hazardous solid municipal waste from approximately 2,900 permanent residents of Wawa as well as Hawk Junction, and the Village of Michipicoten (which makes-up part of the Municipality of Wawa). Waste is also accepted seasonally from area Provincial Parks (Lake Superior Park). Residential (curbside) and commercial waste is collected and hauled to the site on a weekly basis.

The Municipality hosts a Municipal Hazardous and Special Waste Collection Day at a frequency determined by Council. There are a number of hazardous or special waste items (e.g. paints and solvents) that can be accepted by way of this program. Household batteries may be deposited in designated boxes at Town Hall for eventual shipping to a recycling centre.

The Municipality participates in a program to divert hazardous waste, electronics waste and tires. White goods such as large appliances and steel/metals are stored on site until sufficient in quantity to be removed by recycling contractors.

4.4 Screening of Alternatives

An initial screening of alternatives to the undertaking was completed to determine whether or not the alternatives considered address the stated purpose and are within the Municipality's ability to implement.

The alternatives considered were:

1. Do Nothing;
2. Construct and operate a thermal destruction facility;
3. Export waste outside the Municipality;
4. Establish a new waste disposal site; and
5. Expand the existing waste disposal site.

From the initial screening exercise, it was determined that Alternative 5 – expand the existing waste disposal site is the preferred alternative to the undertaking. Descriptions of each alternative and a summary of screening results are provided in Appendix F.

The screening assessment was completed and presented to the public at the July 2017 Open House conducted in the Municipality. A copy of the Open House boards is included in Appendix E. Screening considered the following criteria, eleven (11) of which are identified in the MECP Code of Practice for "*Preparing and Reviewing Terms of Reference for Environmental Assessments in Ontario*".

1. Does the alternative provide a viable solution to the need?
2. Does the alternative use proven technologies?
3. Is the alternative technically feasible?
4. Is the alternative consistent with applicable official plans?
5. Is the alternative consistent with provincial government priority initiatives such as waste diversion, energy efficiency, source water protection and reduction of greenhouse gases?
6. Will the alternative protect sensitive environmental features?
7. Is the alternative practical, financially realistic and economically viable?
8. Is the alternative within the ability of the proponent to implement?
9. Can the alternative be implemented within the defined study area?
10. Can the alternative be implemented within the Municipality's time frame needed for more disposal capacity?
11. Is the alternative appropriate to the proponent doing the study?
12. Is the alternative able to meet the purpose of the EAA?
13. Is the alternative compatible with the precautionary approach to decision making in the MECP's Statement of Environmental Values?

Four of the criteria were undifferentiating (there was no preference for any alternative) namely:

1. Use of proven technologies (Screening Criterion #2);
2. Technical feasibility (Screening Criterion #3);

3. Able to meet the purpose of the EAA (Screening Criterion #12); and,
4. Compliance with MECP's Statement of Environmental Values (Screening Criterion #13).

For successful implementation while achieving the Municipality's goals, it is important to first consider Screening Criteria related to the environment, society and culture, specifically:

1. Technically feasibility (Screening Criterion #3);
2. Consistency with waste diversion, energy efficiency, source water protection and reduction of greenhouse gases (Screening Criterion #5);
3. Protect sensitive environmental features (Screening Criterion #6); and
4. Compliance with MECP's Statement of Environmental Values (Screening Criteria #13).

All of the identified Alternatives answered "Yes" to Screening Criterion #3, #5 and #13 therefore not giving any preference to one Alternative over another. However, Alternative #3 is undesirable because of its uncertainty regarding its ability to protect sensitive environmental features.

After environmental, social and cultural criteria were considered, the next most relevant criteria were Screening Criterion #1 and #7. The "No" answer to Screening Criterion #1 (Does the alternative provide a viable solution to the need?) and Screening Criterion #7 (Is the alternative practical, financially realistic and economically viable?) provided a strong reason for eliminating Alternative 1 (Do Nothing) and Alternative 2 (Construct a Thermal Processing Facility) from further consideration. Similarly, "No" answers to Screening Criteria #7 (is the alternative practical, financially realistic and economically viable?) influenced the decision to eliminate Alternative 3 (Export Waste) and Alternative 4 (Establish a New Landfill). Alternative 5 (Establish a New Waste Disposal Site) was the only alternative to answer "Yes" to both Screening Criterion #1 and #7.

Alternative 5 (Expand Existing Waste Disposal Site) received the least number of "No" responses (1) and was therefore determined to be the preferred alternative to address the Municipality's declining waste disposal capacity. The Do Nothing alternative received 3 "No" responses, "Establish a New Waste Disposal Site" 3, "Construct a Thermal Processing Facility" 6.5, and "Export Waste" 5.5. Alternatives were assigned a score of 0.5 "No's" if the response was "uncertain" or "Possibly".

4.5 Screening of Alternative Locations

Expansion at the current site location presents challenges with respect to compliance requirements governing acceptable downgradient leachate impacts. Offsite groundwater impacts have been identified and are being addressed by the establishment of a Contamination Attenuation Zone (CAZ) and monitoring will be continued/expanded to investigate the potential for offsite impacts (including potential for surface water impact). In order to further investigate the preference to expand the current site as opposed to establishing a new site, an additional screening exercise was conducted to identify potentially more suitable locations for a new landfill site. The screening for potential site locations included the application of screening criteria considering: accessibility/transportation; natural environment constraints; terrains; and geology. Within the screening boundaries established, 5 potential locations were identified, including the current site location.

The current site has been developed as a natural attenuation site. A review of the 5 locations confirms the preference to expand at the current site location as none of the remaining sites were felt to present a more practical or environmentally beneficial option.

A summary of this screening assessment is presented in Appendix G.

4.6 Project Description

The project involves a 100,000 cubic meter (m^3) volume expansion adjacent to the southwest boundary of the existing fill area. In February of 2021, a site topographic survey was completed to assess the waste volume at the site. Comparing the topography of the site as determined in February 2021 to that established in December 2007, a total of 54,106m^3 of material had been deposited at the Site over the approximately 13-year period. The corresponding average annual fill rate was determined to be 4,162m^3. The total volume in-place was estimated to be 228,489m^3, less than the approved capacity of 230,383m^3. Considering this, an expansion of 100,000m^3 will accommodate the Municipality's waste disposal requirements for the next 25 years.

As the proposed undertaking involves the expansion of the current site by more than 40,000m^3 but by no more than 100,000m^3, it is exempt from Schedule ll of the EA Act (Individual Environmental Assessment). However, the Municipality must first complete the Environmental Screening Process as described under Part lll of the Waste Management Projects Regulation (Ontario Regulation 101/07) prior to submitting an application for an amendment to the existing ECA.

The proposed expansion area to the southwest would possess a footprint similar to the existing fill area and would be utilized for future landfilling operations. It is proposed that on approval of the waste disposal site expansion, the required area will be cleared of any brush and merchantable timber will be harvested appropriately. Top soil from the expansion area will be stripped and stockpiled onsite to be used during future final cover construction and a perimeter ditch to divert surface water from entering the disposal area would be constructed. The proposed surface water works will require that a separate application be submitted for an ECA under the Ontario Water Resources Act (OWRA). It is proposed that excavated material will be stockpiled onsite and used for daily cover. Once site preparations are complete, wastes will be deposited within the designated active area via the trench and fill method of disposal. The footprint will be progressively covered and capped as desired contours are met. Additional details will be incorporated in a Design and Operations Plan for the site.

Following the opening of the expanded site, the current site will be closed, capped and graded to restrict infiltration, mitigating leachate generation/contaminant loading on the subsurface.

5.0 EXISTING SITE CONDITIONS

5.1 Site Description

A Municipality-owned parcel of property, the Site is approximately 22 hectares in size, of which 2.6 hectares are approved for use and operation as the fill area. The Municipality's waste disposal site has been serving area residents since 1980 and currently operates under MECP Environmental Compliance Approval (ECA) No. A7266501, dated November 2, 2005.

As shown on the Municipality's Official Plan, surrounding properties are identified as Crown Land. A utility corridor is located approximately 0.34 kilometers north of the site and two abandoned mine sites are located approximately 0.5 kilometers northeast of the site.

5.2 Existing Landfill Design

The Site operates as a natural attenuation site, relying on naturally occurring physical, chemical and biological processes to reduce concentrations of contaminants below MECP limits prior to reaching the property boundaries.

The Municipality has used trench and area methods of landfilling at the site, gradually increasing the height of the waste disposal site throughout its operating life. The site ranges in elevation from a high of approximately 237 meters above sea level at the center of the active fill area, to a low of approximately 229 meters above sea level at the base of the north side of the fill area.

5.3 Natural Environment

Soils

In general, soils within the area of and at the Site are found to be sand and gravel in nature with occasional layers of silt, silty sand and silty clay. The soil is generally highly porous and drainage is classified as dry. Bedrock is approximately 40-60m below ground surface but is undulating with local topography.

Physiography

The Site is situated in the Michipicoten Valley which once acted as a spillway and major melt water channel during the glaciation period. This channel created thick deposits of sands, gravels and silts over the pre-Cambrian metamorphic rock sequence. Through time, the water levels in the channel fluctuated which formed series of terraces along the valley. This created step like sequences of sand deposits that are present along the valley walls today. The dominant landforms are classified as outwash plain and valley terrain.

The topography of the extended region is typical of the Canadian Shield. The region is part of some of the most rugged terrain comprised of dissected uplands with ridges, escarpments and vistas as high as 200m above the adjacent terrain as a result of glacial processes.

Water Resources

There are two primary surface water features near the Site. The Michipicoten River and Trout Creek (a tributary of the Michipicoten River). The Michipicoten River flows within the steep walled Michipicoten Valley and meanders in a granular floodplain that traverses westerly towards Lake Superior. The river is located south and west of the Site and is within approximately 200m of the Site at its closest point (west). Trout Creeks flows southeast into the Michipicoten River and is located 250m northwest of the Site.

Vegetation

The region is situated in the transition zone between the Boreal (to the north) and the Great Lakes St. Lawrence (to the south) Forest Regions.

Northward, evergreen elements are more dominant characterized by stands of pine, white cedar, larch and black spruce. The Boreal Forest region is mostly coniferous, but includes a mix of deciduous trees such as white birch and trembling aspen. Successional forests are also frequent as forest disturbances (e.g., fire and timber harvest) allow single species to dominate a stand.

The Great Lakes St. Lawrence Forest Region extends southward from the Site and does not include the area north of Lake Superior. This region characterized by mixed coniferous-deciduous trees which include eastern white cedar and large tooth aspen in addition to tree species including red oak, beech, paper birch, trembling aspen and hemlock.

The vegetation located within the vicinity of the Site is characterized generally as being wooded, with a mix of coniferous and deciduous trees and brush that surrounds the site.

Biology

The biological environmental component comprises terrestrial and aquatic ecosystems. The area supports large terrestrial animals such as black bear, moose and deer as well as other smaller animals including grouse, raccoons, rabbits, etc. The South Michipicoten River-Superior Shoreline Conservation Reserve (directly south of the Michipicoten River) and The Lake Superior Provincial Park (approximately 4 km south of the Site), consists of forested lands, lakes and streams that provides suitable habitat for a variety of wildlife.

No known rare, threatened or endangered species have been identified within the Site and no protected areas such as Areas of Natural and Scientific Interest (ANSIs), Environmentally Sensitive Areas (ESAs) or other significant natural areas have been identified within the Study Area.

5.4 Air and Noise

The Site operates without the use of gas management features, with the exception of the application of cover material. As the Site receives relatively small quantities of waste and is located in a remote location, odour control measures have not been considered necessary. There have not been any odour complaints received and based on previous visits to the Site, odours seem to be limited to the area directly adjacent to the Site.

Although small amounts of landfill gas are produced at the Site, the relatively permeable cover surrounding the Site is conducive to natural venting. This assumption has been supported through previous assessments which did not detect landfill gas within any of the onsite monitoring wells.

Noise originating from the Site is typical of a small site. Emissions are a result of the use of on-site equipment to manage incoming wastes as well as traffic generated by the Municipality's waste collection vehicles. Residents direct hauling their wastes also contribute to noise emissions at the Site.

Present operations taking place at the existing fill area have not required the need for dust control measures. The treed buffer that surrounds the Site acts as a natural barrier to minimize dust emissions between the fill area and adjacent properties while reducing wind speeds across the Site.

5.5 Socio-economic

The Site is located approximately 1.7km off Highway 17, on High Falls Road in Rabazo Township, District of Algoma. The Community of Wawa is located approximately 8 km north off High Falls Road and is primarily a residential community with industrial, commercial, and institutional developments that provide basic services to the permanent residents and visitors to the community. Michipicoten River Village is a small residential community located west of Highway 17 North via High Falls Road.

The Site is owned by the Municipality while most of the land surrounding the site is Crown land which the Municipality plans on acquiring a portion thereof. The main activities that take place within the surrounding areas are forest management, mineral explorations, mining, hydroelectric power generation, tourism and recreation. The South Michipicoten River-Superior Shoreline Conservation Reserve is located south of the Site and abuts the southern shoreline of the Michipicoten River. There have not been any complaints made from the adjacent properties regarding its use.

As the Site functions as a natural attenuation site, it does not rely on community services or infrastructure for operation.

5.6 Site Geology

The Site is located on terraced lands up to 30 meters above the Michipicoten River within the Precambrian Shield. Thick deposits of sands, gravels and silts overlay Precambrian metamorphic bedrock. Bedrock is approximately 40–60 meters below ground surface but undulates with local topography with an outcropping east of the fill area. Soils within the area and at the Site are sand and gravel with occasional layers of silt, silty sand and silty clay.

The Site is located within a glaciofluvial deposit, having low local relief and dry drainage conditions as well as some areas to the north and east that are characterized by bedrock outcrops, organic terrain (peaty) with low local relief and wet and dry drainage conditions exist closer to the Michipicoten River. Topographically, the land surface gradually slopes south and south-westward across the Site and, ultimately, down an embankment to the Michipicoten River as shown on Drawing 3 in the Ground and Surface Water Assessment Report (Appendix H).

Stratigraphic sections were prepared from borehole information to interpret the distribution of overburden formations beneath the study area as shown on Drawings 4 and 5 in the Ground and Surface Water Assessment Report (Appendix H). The boreholes were constructed in Pleistocene-Age

glaciofluvial sediments. Beneath the upper coarser sand-gravel sediments, the formation generally comprises a thick interval of sand with traces of silt, which in turn is underlain by silty clay sand upgradient of the fill area. The overburden thickness ranges from about 42-48 meters.

5.7 Site Hydrogeology

Based on a review of recorded water-level elevations obtained from the groundwater monitors, the potentiometric surface was interpreted to slope west/southwestward toward the Michipicoten River as shown on Drawing A6 in Appendix A. Infiltrating precipitation will eventually discharge to the River.

Considering water table elevations recorded in the fall of 2020, the lateral groundwater gradient at the site was estimated to be about 0.015m/m prior to ultimately discharging at the River. Vertically, groundwater is interpreted to move downward beneath the existing and proposed fill areas as well as in areas downgradient at a gradient in the range of 0.39m/m.

Groundwater movement within the underlying bedrock will be controlled by the fracture density/distribution, which cannot be thoroughly assembled without extensive testing. Considering the setting, the overburden formations are interpreted to be capable of transmitting and infiltrating precipitation, and the bedrock flux is expected to be low and likely in the direction of the overburden flux.

Based on the above, precipitation infiltrating the proposed fill and catchment areas is expected to move downward through surficial formations to the groundwater transmissions zone, being the underlying fine-medium silty sand. As groundwater travels laterally west/southwestward, it is expected to eventually discharge into the Michipicoten River (some 230m downgradient from the Site boundary).

5.8 Surface Water Features

Distinct watercourses are not evident on the site. This, coupled with no obvious indication of overland sheet flow, suggests that the bulk of surface water runoff infiltrates into the granular surficial sediments.

Michipicoten River

The Michipicoten River is located near the site to the east, west and south and meanders in a granular floodplain. The River flows in a westerly direction and, after its confluence with the Magpie River, outlets to Lake Superior.

Trout Creek

Trout Creek drains a sub watershed north of the Michipicoten River and outlets into the River at a location northwest of the Site.

5.9 Groundwater Movement

Based on a review of recorded water-level elevations obtained from available groundwater monitors, the potentiometric surface was interpreted to slope west/southwestward toward the Michipicoten River as shown on Drawing A6 in Appendix A. Infiltrating precipitation will eventually discharge to the River.

6.0 SCREENING CRITERIA AND POTENTIAL ENVIRONMENTAL EFFECTS (STEPS 3 AND 4 OF THE SCREENING PROCESS)

As part of the screening process, the MECP requires that potential adverse environmental effects resulting from the project be identified. This was accomplished through the completion of the MECP's screening criteria checklist, which incorporates a series of "yes" and "no" questions to identify any potential negative effects to the environment. Mitigation measures were not considered when determining whether or not potential negative environmental effects existed. A completed Screening Criteria Checklist is provided in Appendix I.

Potential environmental effects of the project identified through the application of the Screening Criteria Checklist include:

1. Potential Surface Water and Groundwater Effects;
2. Potential Air and Noise Effects;
3. Potential Natural Environmental Effects;
4. Potential Socio-Economic Effects;
5. Potential Heritage and Cultural Effects; and,
6. Potential for the production of non-hazardous or hazardous wastes.

The identified potential effects and associated screening checklist item number are summarized below. Rationale for those screening criteria that had a "no effects" conclusion is located in Appendix I.

6.1 Surface and Groundwater

The evaluation of potential negative environmental effects on surface and groundwater considered whether or not the proposed project would impact water quality and quantity or potentially cause significant soil or sediment erosion adjacent to surface water features on or off-site. Potential surface and groundwater effects which may result from the proposed expansion are described below.

Screening Criteria Checklist Item 1.1: Might the project cause negative effects on surface water quality, quantities or flow?

Yes. Michipicoten River and Trout Creek are located approximately 200m west of the site.

Screening Criteria Checklist Item 1.2: Might the project cause negative effect in groundwater quality, quantity or movement?

Proposed expansion for landfilling may result in leachate negatively effecting groundwater.

While no significant trends are evident in data from individual monitoring wells, concentrations of the selected parameters (e.g. Alkalinity, Hardness, TDS, Iron and Manganese) are typically greatest in MW1, followed by MW2. With respect to the surface water sample results, no trends indicating a change in conditions are evident.

Groundwater samples are collected twice annually and are compared to MECP's Ontario Drinking Water Quality Standards (ODWS) and Reasonable Use Concept. Analytical data is available for groundwater monitoring wells for more than the past 10 years.

As the proposed expansion is expected to generate landfill leachate, groundwater impacts are expected.

Screening Criteria Checklist 1.4: Might the project cause negative effects on surface or groundwater from accidental spills or releases (e.g. leachate) to the environment?

Negative effects on groundwater as a result of leachate from the landfill area is possible. As an expansion of the existing Site will create additional source material and continued leachate generation, negative effects on surface water and groundwater quality are possible. A possible increase in parameter concentrations, including those outlined in Screening Criteria Checklist Items 1.1 and 1.2, may result.

No other potential environmental effects on surface water or groundwater were identified as a result of the proposed undertaking.

6.2 Land

This criterion group considered the potential environmental impacts of the proposed waste disposal Site on land uses both on-site and on adjacent lands. No potential environmental effects on land as a result of the proposed undertaking have been identified as the proposed expansion area is on Municipality-owned land that is currently approved for municipal waste disposal. Acquisition of a small area of Crown land abutting the existing Site will be required to establish the required buffer and a portion of the fil area. Clearing of vegetation will be conducted in accordance with requirements identified and permits issued by the MNDMNRF.

6.3 Air and Noise

Air and noise impacts related to the expansion of the waste disposal site were evaluated as part of the completion of the environmental screening checklist. Potential air and nose effects which may result from the proposed undertaking are described below.

Screening Criteria Checklist Item 3.2: Might the project cause negative effects from the emission of greenhouse gases (e.g. carbon dioxide, carbon monoxide, methane)?

The decomposition of waste material produces greenhouse gases, primarily methane which can be potentially hazardous if produced in significant amounts. Gases are expected to be generated as a result of the proposed expansion; however, as the waste disposal Site is expected to operate as a small site, it is not expected to generate gases at levels that are considered hazardous or recoverable.

Screening Criteria Checklist Item 3.3: Might the project cause negative effects from the emission of dust or odour?

Odour emissions resulting from the decomposition of waste material are anticipated with the proposed expansion. As the Site is expected to receive small quantities of waste annually, it is expected that odours will generally be limited to the area directly adjacent to the waste disposal Site.

Site characteristics and operational activities may lead to dust emissions resulting in negative air impacts. As the access road for the site is not paved, dust may be generated by waste collection vehicles and residents direct hauling their wastes. Equipment used on-site to handle incoming wastes may be a

potential source of emissions as bulldozing, compaction and contouring activities may lead to the generation of dust. Stockpiles of cover material and exposed areas lacking vegetation may also contribute to dust emissions as they are susceptible to wind erosion.

Screening Criteria Checklist Item 3.4: Might the project cause negative effects from the emission of noise?

The proposed undertaking may lead to noise emissions as a result of the use of on-site equipment to manage incoming wastes and recyclables. Traffic generated by the Municipality's waste collection vehicles and residents direct hauling their wastes to the site may also create negative noise emissions.

Screening Criteria Checklist Item 3.5: Might the project cause light pollution from trucks or other operational activities at the site?

Light pollution generated from vehicles depositing wastes and equipment used for the maintenance and operation of the site may impact air quality.

No other potential environmental effect on air/noise have been identified.

6.4 Natural Environment

Potential impacts to the natural environment resulting from the proposed expansion are described below.

Screening Criteria Checklist Item 4.7: Might the project increase bird hazards within the area that could impact surrounding land uses (e.g. airports)?

The proposed expansion of the waste disposal Site will have an active working face, potentially resulting in an increase in the number of birds, bears and other wildlife attracted to the Site. Birds attracted to the Site are not expected to have an effect on the surrounding land uses, however, they may lead to a hazard for the Wawa Aerodome located approximately 4 kilometers northwest of the proposed expansion.

No other potential environmental impacts to the natural environment have been identified.

6.5 Socio-economic

The establishment of a waste disposal Site can have negative impacts on surrounding residential, institutional, commercial or recreational land uses as related activities may adversely affect community character, surrounding aesthetics and business operations.

Screening Criteria Checklist Item 6.9: Might the project be located within 8 km of an aerodome/airport reference point?

The Wawa Aerodome is located approximately 4.0 kilometers northwest of the proposed Site. As the area proposed for the expansion is expected to be generally horizontal it has the potential to attract birds.

No other socio-economic effects have been identified.

6.6 Heritage and Culture

Screening Criteria Checklist Item 7.1: Might the project cause negative effects on heritage buildings, structures or sites, archaeological sites or areas of archaeological importance, or cultural heritage landscapes?

Completion of the Ministry of Heritage, Sport, Tourism and Culture (MHSTC) checklist "*Criteria for Evaluating Archaeological Potential"* determined the project area may have archaeological potential because of close proximity to a waterbody. Therefore, there is a need for an archaeological study to be carried out by a licensed person.

Completion of the MHSTC checklist "*Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes*" determined the project area is not a recognized heritage property and is not a cultural heritage value.

6.7 Other

This factor addresses the potential of non-hazardous or hazardous wastes being produced as a result of an expansion to the existing waste disposal site.

Screening Checklist Criteria 9.1: Might the project result in the creation of non-hazardous waste material requiring disposal?

It is expected that the proposed expansion area would require the clearing of undeveloped land of the existing site. Wood resulting from clearing can be sold. No hazardous wastes requiring disposal are expected to be created as a result of the proposed expansion.

7.0 SECOND POINT OF CONSULTATION (STEP 5 OF THE SCREENING PROCESS)

Steps 1 – 4 of the MECP's ESP were completed and summarized in a December 2017 report titled "Expansion of Municipal Waste Disposal Site Environmental Screening Process Phase 1 Report: Steps 1-4". The report identified the project's problem/opportunity statement and provided a project description. The report also summarized the results of the application of the environmental screening criteria checklist, identified the potential effects of the project on the environment and briefly outlined the next steps in the Environmental Screening Process.

The Phase 1 report was circulated to government ministries/departments/agencies and Indigenous communities that expressed an interest in the project. They were asked to review the report and provide any comments or suggestions relative to the agency's mandate or jurisdiction. Government ministries/departments/agencies and Indigenous communities consulted are listed below as well as in Appendix D.

1. Ministry of Energy, Northern Development and Mines;
2. Algoma Public Health;
3. Ministry of the Environment, Conservation and Parks;
4. Ministry of Tourism, Culture and Sport;
5. Ministry of Natural Resources and Forestry;
6. Canadian Environmental Assessment Agency;
7. Métis Nation of Ontario;
8. Michipicoten First Nation;
9. Batchewana First Nation;
10. Garden River First Nation;
11. Evolugen by Brookfield Renewable.;
12. Algoma Power Inc.; and
13. Hydro One (formerly Great Lakes Power Transmission).

Table 1 below summarized the responses received following the circulation of the Phase 1: Steps 1 to 4 Report (a copy of the responses are provided in Appendix J).

TABLE 1:
Responses Received Following Second Point of Consultation

Agency	Date	Comments	Response
Ministry of the Environment, Conservation and Parks	May 22, 2018	1. Include final version of the detailed project description in the Environmental Screening Report (ESR). 2. Proponent is encouraged to ensure that the principles of land use compatibility are considered during the screening process and reflected in the	Completed. A detailed project description is included in section 4.6 of this ESR. Completed. Land use is addressed in section 6.2 of this ESR.

TABLE 1:
Responses Received Following Second Point of Consultation

Agency	Date	Comments	Response
		Environmental Screening Report (ESR).	
		3. Names and email addresses from the July 2017 Open House Sign in Sheet (Appendix B) may be redacted.	Completed. Last names and phone numbers have been redacted from Open House sign-in sheets
		4. Reference to the Terms of Reference (TofR) in the Screening Assessment of Alternatives To (Appendix C) should be updated to reflect the new direction of a Class EA under the Waste Regulation.	Completed. TofR references removed from Appendix C (Now Appendix F).
		5. It is suggested to include overall document page numbers and updating table of contents accordingly for increased readability.	Completed.
		6. Remove next steps section dealing with TofR in Appendix C.	Completed.
		7. Include reference for the need to amend the existing ECA in order to permit the proposed expansion in EA document. Include list of all subsequent permits or other approvals that may be required for the implementation of the preferred alternative.	Completed. References are provided in section 4.6 of this ESR.
		8. It is recommended that the proponent engage in consultation with the MECP Environmental Approvals and Permissions Branch with respect to any ECA	Noted.

TABLE 1:
Responses Received Following Second Point of Consultation

Agency	Date	Comments	Response
		requirements for the proposed works.	
Ministry of the Environment, Conservation and Parks	May 1, 2018	1. Include background information, along with rationale, on project initially going through an Individual EA and then subsequently withdrew in latest proposal's cover letter or email sent along with ESP document.	Noted. Previously the project initiated the EA TofR process, withdrawing before TofR was approved by MECP.
Metis Nation of Ontario	April 5, 2018	1. We are not intending to present comments. 2. Please keep us on the contact list in the future for this project.	Noted.
Algoma Public Health	April 4, 2018	3. Will the project include corrective/preventative engineering techniques such as utilizing a liner to capture leachate and then properly dispose to protect the groundwater? 4. Is there a process going to be considered to capture the methane to reduce greenhouse gases? 5. Are there plans to expand the Municipal Hazardous and Special Waste collection day? Could the Municipality increase the availability/days to redirect hazardous waste? 6. Is there a recycling program in the Municipality? Will the	Leachate attenuation and dilution as well as mitigation measures are discussed in the Groundwater and Surface Water Assessment Report. Landfill gases/odour are addressed in the Groundwater and Surface Water Assessment Report. There are no plans to expand at this time. The Municipality currently diverts hazardous waste, electronic waste and tires.

TABLE 1:
Responses Received Following Second Point of Consultation

Agency	Date	Comments	Response
		Municipality consider having a recycling plan as part of the approval process for the expansion?	Similarly, white goods and steel/metals are on-site until sufficient in quantity to be removed by a recycler. Cans (steel and aluminum) are collected from the local school and arena by a local scrap yard operator on occasion.
		7. Is there a program to encourage composting? Will the Municipality consider having a promotion of composting plan?	There are no current plans for a composting program.
Evolugen by Brookfield Renewable	April 3, 2018	1. We do not intend to provide comments on this report. 2. Please keep us on contact list for this project.	Noted.
Ministry of Heritage, Sport, Tourism and Culture Industries	March 23, 2018	1. It is recommended to complete the Archaeological Assessment as soon as possible as its results have the potential to impact the project footprint.	Completed. See the Archaeological Assessment Report in Appendix K.
Algoma Power Inc.	March 22, 2018	1. We have no issues or concerns with regards to the identified potential environmental effects.	Noted.
Canadian Environmental Assessment Agency	February 6, 2018	1. The CEAA focuses on federal environmental reviews of projects that have the potential to cause adverse environmental effects in areas of federal jurisdiction and applies	Does not appear that project is subject to a federal environmental assessment. CEAA removed from consultation list.

TABLE 1: **Responses Received Following Second Point of Consultation**			
Agency	**Date**	**Comments**	**Response**
		to physical activities described in the *Regulations Designating Physical Activities* (the Regulations). Based on the information provided, the project does not appear to be described in the Regulations. 2. Review requirements of CEAA 2012 including the Regulations. If project is not subject to a federal environmental assessment, please remove from distribution list.	
Ministry of the Environment, Conservation and Parks	February 5, 2018	1. Please forward like information to Lilian Keen, as she is now the Senior Environmental Officer for this area.	Noted.

8.0 STUDIES AND ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS (STEP 6 OF THE SCREENING PROCESS)

8.1 Ground and Surface Water Assessment

The Municipality submitted a Groundwater and Surface Water Assessment Report to MECP for review and comment to MECP in July 2018. A revised (Rev. 1) assessment report was submitted in April 2019 in response to comments and recommendations presented by the MECP in their letter dated February 5, 2019. Further correspondence continued between the Municipality and MECP with additional information provided to the groundwater reviewer in August 2020 regarding the direction of groundwater flow. In September 2020, the MECP surface water technical reviewer provided comments that supported the proposed expansion.

In email correspondence from April 2021, the MECP confirmed that, following their review, no hydrogeological reason that might disqualify the described site expansion from further consideration were identified. The email further requires that a detailed site Design and Operations plan be developed and must address the groundwater quality monitoring infrastructure in the west, southwest and south flow directions from the expansion fill area. The Design and Operations plan will need to include an effective contingency plan and trigger mechanisms to prevent impacts to the Michipicoten River.

Copies of the Ground and Surface Water Assessment report as well as the September 2020 and April 2021 correspondence from the MECP are provided in Appendix H.

8.2 Potential Archaeological Sites

Following the completion of the MHSTC "*Screening for Impacts to Built Heritage and Cultural Heritage Landscapes*" and its submission to the Ministry, it appeared that the existing and proposed waste disposal site would not affect any known or potential cultural heritage resources. However, following the completion of MHSTC "*Criteria for Evaluating Archaeological Potential*" checklist, the site was identified as having archaeological potential and as a result a Stage 1 Archaeological Assessment was completed.

8.2.1 Stage 1 Archaeological Assessment

A Stage 1 Archaeological Assessment Report was completed by Woodland Heritage Services in May of 2021 for the proposed expansion area at the Wawa municipal waste disposal site (a copy of the report is located in Appendix K). The report summarized historical and archaeological considerations relating to the area and described observations made during the May 19, 2021 site visit.

The report states that as a result of the Stage 1 archaeological assessment, no areas of archaeological potential were identified and as such, no further archaeological assessment was required.

The Stage 1 Archaeological Assessment Report was submitted to the MHSTC and was entered into the Ontario Public Register of Archaeological Reports. The MHSTC confirmed that the province's concerns had been addressed for the subject property and that no further archaeological work was required.

9.0 DEVELOPMENT OF MITIGATION MEASURES/IMPACT MANAGEMENT (STEP 7 OF THE SCREENING PROCESS)

As summarized in Section 6, potential environmental effects resulting from the expansion of the existing Site were identified through the application of the Screening Checklist. Mitigation measures/impact management for the identified potential environmental are included in this section along with their related net effects.

9.1 Effect on Surface and Groundwater

Negative impacts to surface water in the vicinity of the proposed Site are possible as an expansion of the existing waste disposal Site will continue to generate leachate.

Surface Water Mitigation Measures/Impact Management

Both short and long-term operation and maintenance of the Site will require that close attention be paid to the surface drainage patterns within the fill area. As it is essential that surface water ponding on the fill area be eliminated wherever possible, and otherwise minimized, the placement of waste material will be positioned and properly sloped so that leachate generation through surface water percolation is minimized. Efforts shall be made at all times during site operations to avoid surface water contact with waste material, through the application of cover material and the construction of small berms, as required, to direct surface water flow away from and around the active disposal operations. Drainage to surface water is to be directed to areas within the buffer zone to be naturally attenuated. To minimize possible effects to the lands surrounding the expanded site, it is proposed that surface water management ditches be constructed around the perimeter of the fill area to intercept surface drainage and convey flow around the perimeter of the fill area. Exposed areas such as final cover and ditch side slopes shall be seeded/vegetated to help prevent soil erosion while re-directing a portion of the infiltration precipitation back to the atmosphere by evapotranspiration.

It is proposed that progressive capping will be carried out at the Site to reduce infiltration of precipitation thereby limiting leachate production, to control odours and to progressively rehabilitate the Site throughout its operation.

To assess the effects of surface water runoff on receiving watercourses within the vicinity of the Site, the existing surface water monitoring program will continue throughout the life and following closure of the Site. Currently surface water is collected twice annually from both Michipicoten River and Trout Creek. Analytical results are compared to the MECP's PWQO to determine the impacts from landfilling activities. Surface water analytical results have concluded that there is no measurable impact to Michipicoten River water quality as a result of the landfilling activities. As the current surface water monitoring program will continue throughout the life of the proposed site, modifications to the program may be required to properly assess the effects of the proposed expansion.

Two (2) near shore sample locations will be introduced to assess for potential impact(s) as groundwater is interpreted to discharge into the Michipicoten River.

Net Effects

It is anticipated that the proposed expansion will likely not impact surface waters in the vicinity of the site. As the soils surrounding the Site are comprised of permeable coarse-grained material including sand and gravel, it is expected that surface water from the Site would infiltrate the soil strata and contaminants be attenuated prior to leaving the Site. The vegetative buffer surrounding the waste disposal Site would also promote filtration of suspended contaminants and infiltration of surface run-off prior to reaching adjacent surface waters.

Groundwater Mitigation Measures/Impact Management

To comply with MECP requirements, acceptable groundwater quality is typically assessed by applying the Reasonable Use (RU) concept. The RU concept requires that the concentration of specific constituents at the downgradient site boundary must be less than their maximum permissible RU concentration. In this case, however, leachate impacted groundwater discharges into the Michipicoten River after some level of attenuation.

A Contaminant Attenuation Zone (CAZ) is normally established in the area hydrogeologically downgradient from the waste disposal site to provide attenuation of contaminants to acceptable levels. A CAZ in this case will provide a level of attenuation prior to discharge to the Michipicoten River.

RU concentrations are calculated using the equation described in Section 5.9.5 from the MECP's Reasonable Use Guideline B-7.

$$Cm = Cb + x(Cr - Cb)$$

where: Cm = Reasonable Use concentration (mg/L)
Cb = background concentration (mg/L)
Cr = maximum drinking-water concentration of a particular parameter (mg/L)
x = factor, 0.5 for aesthetic and 0.25 for health-related parameters

Using a background concentration of 0.37mg/L (the median of 17 sample results at the background monitoring well) and x = 0.5 for chloride, the RU maximum allowable chloride concentration at the downgradient boundary of the CAZ is calculated to be 125mg/L.

In order to meet the maximum RU concentration of 125mg/L, the following equation was used to determine the required CAZ area at the existing Wawa waste disposal site:

$$CAZ = \frac{A * (C - Cm)}{(Cm - Cb)}$$

where: A is the refuse area;
C is the average concentration of a particular leachate constituent (chloride in this case);
C_m is the maximum allowable concentration at the property boundary; and
C_b is the background concentration.

At a leachate chloride concentration of 750mg/L and a fill area of 2.6ha, the area of the required CAZ for the expansion fill area is 13ha. A CAZ of this area would extend toward the Michipicoten River in the interpreted direction of groundwater flow. Leachate that would be generated within the expansion area is expected to travel south and south-westerly through an available CAZ of approximately 27.2ha in area. Although the expansion fill area is situated approximately 300m from the Michipicoten River at its closest point, it is expected that a high level of attenuation would be provided due to an interpreted average width of flow of about 643m (about 1,000m along the riverbank). A CAZ of these dimensions is calculated to result in compliance with RU criteria for a 2.6ha fill area, considering a leachate chloride concentration of 750mg/L. As a precaution should there be radial leachate flow, the CAZ will extend upgradient and coincide with the existing and proposed site property limits.

To monitor the effects of leachate, a groundwater monitoring program has been in-place at the operating Site for more than 10 years. It is proposed that additional groundwater wells be positioned downgradient of the proposed expansion area in the direction of the interpreted south/southwestward groundwater flow. For the purpose of preventing adverse effects on groundwater and surface water resources, a trigger mechanism plan as well as a contingency plan will continue to be applied for the site. The existing groundwater monitoring program, including data from future monitoring locations, will continue throughout the life of the Site and following closure.

Potential impacts of waste disposal activities on the neighboring properties have previously been assessed in accordance with the MECP's Reasonable Use Concept. Groundwater assessments have determined that RU concentrations have been exceeded for both aesthetic and health-related parameters for monitoring wells at the Site. For the purpose of providing sufficient area for the expansion and natural attenuation of landfill contaminants, the Municipality has been in contact with the MNRF regarding the acquisition and use of Crown land.

In addition to natural attenuation within the proposed CAZ, best management practices such as maintaining a small working face, proper site grading and the placement of daily cover material will be implemented to mitigate leachate formation.

Net Effects

It is expected that through the application of the mitigation measures noted, groundwater quality will be attenuated to levels below MECP standards before discharging beyond the CAZ.

Accidental Spills/Releases Mitigation Measure/Impact Management

As mentioned in Section 6.1, the placement of waste at the Site is expected to generate leachate, possibly resulting in negative effects on surface and groundwater. The application of daily cover material as well as the progressive capping of the site will help to minimize leachate production.

In the event of a spill, efforts shall be made to safely contain the material so as to allow for its appropriate handling and disposal. All spills must be reported to the MECP's Spills Action Centre. A spill response plan shall be developed to address both accidental spills from vehicles, waste hauling trucks, etc. as well as possible leachate releases from the site.

Net Effects

The proposed undertaking is expected to result in leachate generation on-site. However, through the application of the best management practices as well as the surface and groundwater mitigation measures mentioned, off-site groundwater and surface water concentrations are anticipated to be below MECP allowable concentrations.

9.2 Effect on Air and Noise

As the expanded site is to operate similarly to the current waste disposal site, negative effects relating to the emission of greenhouse gases, dust, odour and noise as well as the production of light pollution are possible but are expected to be similar to current levels at the existing site.

Emission of Greenhouse Gas Mitigation Measures/Impact Management

It is likely that the gases produced as part of the natural biodegradation process will passively vent though the waste material deposited or be readily released to the air through the relatively permeable cover material that is present at the Site.

Currently, the small volumes of landfill gas produced at the existing waste disposal Site have not warranted the use of a gas control system. Similarly, it is anticipated that the amount of methane produced during the operation of the expansion will likely not require the use of a landfill gas control system.

Net Effects

It is anticipated that the small quantities of methane gas produced at the expanded waste disposal site would be concentrated at the fill area in amounts not likely to cause negative impacts on residents and adjacent properties.

Dust and Odour Mitigation Measures/Impact Management

Considering the present operations taking place at the existing waste disposal Site, the need for dust control measures is currently not considered necessary. The treed buffer that surrounds the existing fill area and expansion area will continue to act as a natural barrier to minimize dust emissions between the fill area and adjacent properties while reducing wind speeds across the Site. Progressive capping and seeding of inactive areas will also help to minimize wind erosion across the Site. Although not expected, should complaints be received regarding dust levels at the Site, the need for control measures will be re-evaluated.

As the Site is expected to receive small quantities of waste annually, it is expected that odours will generally be limited to the areas adjacent to the waste disposal Site. Similar to current procedures, odour emissions will be controlled through the operation of a small working face and the application of cover material. The Municipality will limit the area of exposed wastes at the Site and priority landfilling will be given to highly odourous wastes.

Net Effects

Although the potential for the generation of dust and odour exists on-site, it is expected that proper site operations will result in minimal impacts of the surrounding environment. Negative net effects are not expected.

Noise Mitigation Measures/Impact Management

The proposed expansion will be located southwest of the existing waste disposal site (about 8km south of the built-up community of Wawa. As shown on the Municipality's Official Plan, surrounding properties are identified as Crown Land. As there have been no historical noise complaints received from adjacent or surrounding properties, noise emissions from the proposed site are not expected to affect the use of adjacent properties.

As it is proposed that the expanded Site will be accessed using the existing access road, a change in the haul routes is not expected and the level of noise related to the transportation of materials to the waste disposal Site is anticipated to be similar to what currently exists.

The proposed waste disposal Site is expected to receive small volumes of waste and should not require the regular operation of equipment to manage the waste. Equipment operation for the compaction and contouring of wastes as well as the application of cover material will occur as needed during days of the week when the Site is closed to the public. Landfill maintenance will also take place during day time periods to minimize off-site impacts.

The site attendant and equipment operators shall observe activities at the landfill to minimize noise levels. Generally, equipment being used at the Site shall be equipped with appropriate functional muffling devices at all times. If noise emissions are felt to be excessive, or public complaints are received, remedial efforts shall be initiated immediately. The level of noise at the Site is not expected to increase over the life of the landfill Site.

Net Effects

The proposed expansion is not expected to result in negative net effects relating to noise emissions as the Site is to be located adjacent to the existing site and no changes in Site operations are expected.

Light Pollution Mitigation Measures/Impact Management

As the proposed expansion of the Wawa waste disposal Site will continue to serve a small service area that receives a relatively small amount of waste, with no increase in hauling distance, changes in the amount of pollution generated is not anticipated. It is expected that any air pollution resulting from vehicle emissions would be similar to those currently generated at the existing waste disposal Site.

Net Effects

As there are no proposed changes in haul route or operational activities, an increase in negative impacts from light pollution is not expected as a result of the proposed expansion.

9.3 Effect on the Natural Environment

The proposed expansion of the Wawa waste disposal Site will involve the minimal removal of forest cover, potentially impacting wildlife and vegetative species. The proposed expansion may also potentially increase the number of wildlife, specifically birds that are attracted to the Site.

Bird Hazard Mitigation Measures/Impact Management

As a horizontal expansion of the Wawa waste disposal Site will increase the area of the waste footprint, the potential for an increase in birds as well as insects, rodents and other wildlife is possible. However, it is anticipated that the proper management of a small working face and the progressive application of cover material would minimize the presence of birds and other nuisance wildlife.

The application of daily cover will likely discourage foraging birds as well as other wildlife from visiting the Site while the use of a small working face is expected to reduce the size of the foraging opportunity and correspondingly may reduce the carrying capacity of the Site for species like gulls. Although specific bird control measures above and beyond daily operational practices have not been considered necessary at the current Site, due to the proximity to the Wawa Aerodome, a bird control plan may be developed during the EPA approval stage.

Net Effects

It is anticipated that, with the application of the mentioned mitigation measures, that surrounding land uses would not be negatively impacted by increased bird hazards as a result of the proposed expansion.

9.4 Effect on Socio-economic Environment

In general, the establishment of a waste disposal site can have negative impacts on surrounding residential, institutional, commercial or recreational land uses as activities associated with a waste disposal site have the potential to adversely affect community character, surrounding aesthetics and business operations. As identified in Section 6.5, the proposed expansion of the waste disposal Site is located within 4 kilometers of the Wawa Aerodome and as a result of landfilling activities, has the potential to attract birds, possibly affecting flight paths.

Mitigation Measures/Impact Management

It is expected that similarly to the current Site, effective on-site management measures, including maintaining a small working face and placement of cover material will help minimize the number of birds present at the waste disposal Site. Although there have not been any complaints reported, should on-site bird populations be observed to be a potential hazard to flight paths, alternative bird control methods will be investigated. As mentioned in Section 9.4, specific bird control measures above and beyond those mentioned have not been considered necessary at the current site, however, due to the proximity to Wawa Aerodome, a bird control plan may be developed.

Net Effects

As the Site will be operated similarly to the existing Site which includes minimizing the exposed waste and deterring the number of birds attracted to the Site, no negative net effects are expected.

9.5 Effect on Heritage and Culture

As an expansion of the waste disposal Site is expected to involve the disturbance of undeveloped lands outside the current boundary of the Site, there is a possibility of encountering items of cultural heritage interest.

Mitigation Measures/Impact Management

During the preparation of this report, a Stage 1 Archaeological Assessment was completed for the proposed waste disposal Site. Findings of the report concluded that as a result of the Stage 1 archaeological assessment, no areas of archaeological potential were identified and as such, no further archaeological assessment was required.

Net Effects

As the proposed Site is not likely to have an effect on heritage or culture, mitigation measures and impact management is not considered necessary. However, should any objects be uncovered or encountered during Site development work, activities will cease until direction is obtained from Woodland Heritage Services and MHSTC identifying requirements to proceed.

9.6 Other

In addition to the effects identified throughout this section, the clearing of undeveloped land southwest of the Site is expected to produce wood waste that would be managed in accordance with MNDMNRF requirements.

Mitigation Measures/Impact Management

During Site preparations for the proposed site, any merchantable timber will be harvested appropriately. Remaining wood waste will be collected and stockpiled onsite for future burning. Burning activities will be conducted in accordance with MECP procedures, including the burning of clean wood waste during daylight hours and under controlled, segregated and supervised conditions.

It is proposed that burning will not be carried out during times of high Air Quality Index or during times of rain or fog as smoke may become concentrated in one location. To minimize the chance of the fire quickly changing course, burning will not take place during times of high wind speeds or when wind direction is unpredictable.

Clean wood waste and brush shall be segregated from other waste materials in a designated area of the Site and burned under the supervision of the site operator. Planned burning shall be supervised continuously until the fire is extinguished and cold ashes will be landfilled as usual. Non-combustible cover material will also be kept onsite to assist in the extinguishing of fire, if needed.

Net Effects

As clean wood waste is the only waste expected to be produced as a result of the proposed expansion, and given that it can be properly managed onsite, no negative net effects are expected.

10.0 THIRD POINT OF CONSULTATION (STEP 8 OF THE SCREENING PROCESS)

Steps 5 – 7 of the MECP's screening process were completed and presented during Open House No. 2 held on August 19, 2021 to identify any issues or concerns relating to the assessment of anticipated environmental effects and to discuss recommended mitigation measures.

There were no comments received at Open House No. 2.

The display boards presented at Open House No. 2 will be posted on the project website, which includes a document repository, at www.kresinengineering.ca. Government ministries/departments/agencies, Indigenous communities that expressed interest in the project are encouraged to visit the project website to review and provide comments on the display boards. Open House No. 2 material is presented in Appendix L.

Government ministries/departments/agencies and Indigenous communities consulted are listed below as well as in Appendix D.

1. Ministry of the Environment, Conservation and Parks;
2. Ministry of Heritage, Sport, Tourism and Culture Industries;
3. Ministry of Northern Development, Mines, Natural Resources and Forestry;
4. Algoma Public Health;
5. Métis Nation of Ontario;
6. Michipicoten First Nation;
7. Batchewana First Nation;
8. Garden River First Nation;
9. Red Sky Metis Independent Nation;
10. Missanabie Cree First Nation
11. Evolugen by Brookfield Renewable.;
12. Algoma Power Inc.; and,
13. Hydro One (formerly Great Lakes Power Transmission).

11.0 ASSESSMENT OF THE NET EFFECTS (STEP 9 OF THE SCREENING PROCESS)

As stated in the *Guide to Environmental Assessment Requirements for Waste Management Projects: Part B – Environmental Screening Process*, net effects are those potential negative environmental effects caused by the project and related activities that will remain after impact management measures have been applied. Following the identification of potential environmental effects and review of comments received as a result of the consultation activities carried-out, the net environmental effects were reviewed and are summarized below.

Impacts to surface and groundwater are expected to be minimal. Following completion of the Ground and Surface Water Assessment Report, the proposed size and location of the CAZ has been confirmed and the surface and groundwater monitoring programs currently in place at the Site shall be modified to adequately monitor the potential effects of landfilling activities in the proposed expansion area. Although an increase in waste volume is expected to result in an increase in groundwater impacts associated with the Site, impacts are expected to be mitigated prior to any discharges beyond the CAZ boundary. In the event that monitoring shows that mitigation measures are ineffective, contingency plans shall be implemented.

The small size of the proposed Site, the treed buffer surrounding the expansion fill area and the application of best management practices will help to ensure that no negative effects are encountered as a result of greenhouse gas, odour, dust or noise emissions. Similar to the existing Site, minimal effects are expected in this regard.

As the proposed expansion is located in an area that is not preferred by those species identified as being rare, threatened or endangered, net effects were not identified. Potential disruption to species residing adjacent to the Site shall be monitored through visual observations made in conjunction with environmental monitoring at the Site.

Although the expansion of the existing Site has the potential to lead to an increase in the number of birds attracted to the area, it is expected that the application of best management practices as well as the progressive capping will minimize any related potential hazards that could impact surrounding land uses. A bird control plan may be developed during the EPA approval stage.

Following the initial preparations for the expansion, no significant effects are expected as the creation of additional non-hazardous waste material is not expected as part of the daily disposal operations.

As a result of the review of the mitigation measures and net effects summarized in Section 9, there are no significant net effects identified.

12.0 OVERALL ENVIRONMENTAL ADVANTAGES AND DISADVANTAGES OF THE PROPOSED UNDERTAKING

The proposed landfill expansion is expected to provide a solution to the inadequate capacity at the Municipality's municipal waste disposal site and address the Municipality's waste management needs for the next 25 years. Drawings A7.1 and A7.2 in Appendix A present conceptual arrangements for a Site expansion.

Although the expansion has the potential to produce leachate that may possibly impact surface and groundwater, it is expected that the effects will be minimal, similar to the existing Site. The existing surface and groundwater monitoring programs currently in place shall be revised to adequately monitor the potential effects of landfilling activities within the expanded Site and proposed CAZ.

Site expansion is not expected to displace or disrupt residential, institutional, community or recreational features as a portion of the expansion is to take place on undeveloped Crown land directly adjacent to the southwestern boundary of the existing fill area. An expansion of the existing Site prevents the need to find and establish a new site and associated monitoring programs, access roads, access gates, etc. thereby minimizing the overall cost for the Municipality. As access to the proposed Site will remain at the same location, residents will not be required to travel a greater distance when hauling their own waste.

As there are no operational changes expected with the proposed expansion, it is anticipated that any air or noise impacts will be similar to those associated with the existing Site, minimally affecting those properties in the vicinity of the Site. Impacts related to increased traffic are not anticipated as there are no changes in haul routes proposed as part of the expansion.

As the area proposed for the expansion is located in an area that is surrounded by an abundance of undisturbed habitat, it is anticipated that any species potentially affected by the expansion will be displaced to these areas of similar habitat. The proposed expansion is also located in an area where there are no designated wetlands, areas of significance or valued ecosystems.

The proposed Site is not expected to have any negative impacts related to the Municipality's resources and is not expected to cause any negative effects on residents and businesses with respect to availability as the location and hours of operation of the Site are not expected to change.

The expansion is not expected to have any significant socio-economic impacts as the proposed Site is to be located at a distance far enough from the Municipality's core as to not cause any negative effects on neighborhood or community character. As the distance between the Site and public areas (i.e. High Falls Road) is to be increased as part of the expansion, aesthetic impacts are not anticipated. Although the operation of the expanded Site has the potential to increase the number of birds attracted to the area, it is anticipated that ongoing best management practices will prevent any related hazards. Minimal impacts, similar to the current condition, are expected.

Areas of heritage and cultural importance have not been identified in the area of the proposed expansion and as a result, negative impacts are not anticipated.

Negative effects on land, resources, traditional activities or other interest of Indigenous communities have not been identified and are not anticipated. The closest community is located approximately 4

kilometers northwest of the proposed site and the Municipality will continue to consult with Indigenous communities throughout the project to address any concerns or comments regarding the proposed expansion. Environmental monitoring throughout the life of the waste disposal site will ensure that any off-site impacts are addressed.

With the exception of the generation of clean wood waste during site preparations, it is anticipated that non-hazardous waste materials requiring disposal will not be created as a result of the expansion. It is anticipated that the wood waste would minimally contribute to the Site's total fill volume as it proposed that any merchantable timber will be harvested appropriately and the remaining wood waste would be collected, chipped and/or burned prior to disposal.

13.0 PUBLIC LIAISON COMMITTEE

A Public Liaison Committee will be established for the Site for the purpose of identifying and resolving any operational problems such as litter, odour, noise, etc. that affect local residents. Committee meetings will be held at a frequency determined by the Committee and will be open to members of the public.

14.0 CONCLUSIONS

This Environmental Screening Report has been prepared to support a proposed expansion of the Municipality of Wawa municipal waste disposal Site to address the Municipality's waste management needs for the next 25 years.

Based on the information presented in the preceding sections of this report, including the supporting documentation, the following conclusions are provided:

1. Best management practices currently in place and proposed as part of the expansion are expected to mitigate any potential impacts that may be introduced by the expansion;

2. The undeveloped land surrounding the proposed expansion area is expected to provide a sufficient buffer to prevent any negative aesthetic impacts to the surrounding land uses (i.e. High Falls Road);

3. In comparison to identifying and establishing a new site, an expansion to the existing Site will help minimize the overall costs to the Municipality as existing features will be maintained as part of the expansion (i.e. monitoring network, access road, landfill gate, etc.); and,

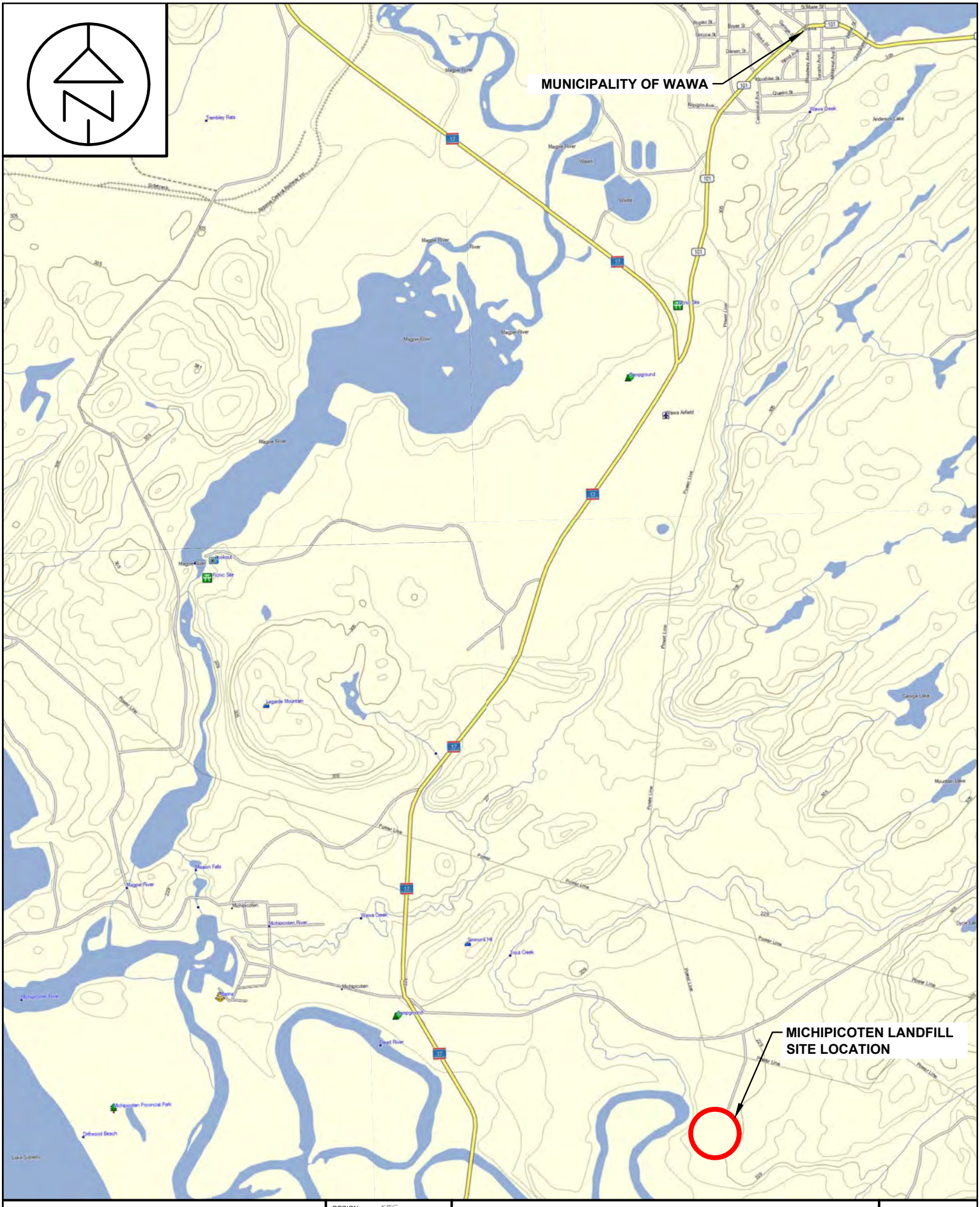
4. The Environmental Screening Process did not identify any significant negative net effects. A proposed expansion to the Wawa municipal waste disposal Site is therefore considered a feasible option for addressing the Municipality's future waste management needs.

Respectfully submitted by:
Kresin Engineering Corporation

Chris Kresin, M.Sc.(Eng.), P.Eng.
Consulting Engineer

Ryan Wilson, P. Eng.
Project Engineer

Appendix A
Referenced Drawings



KRESIN Engineering Corporation

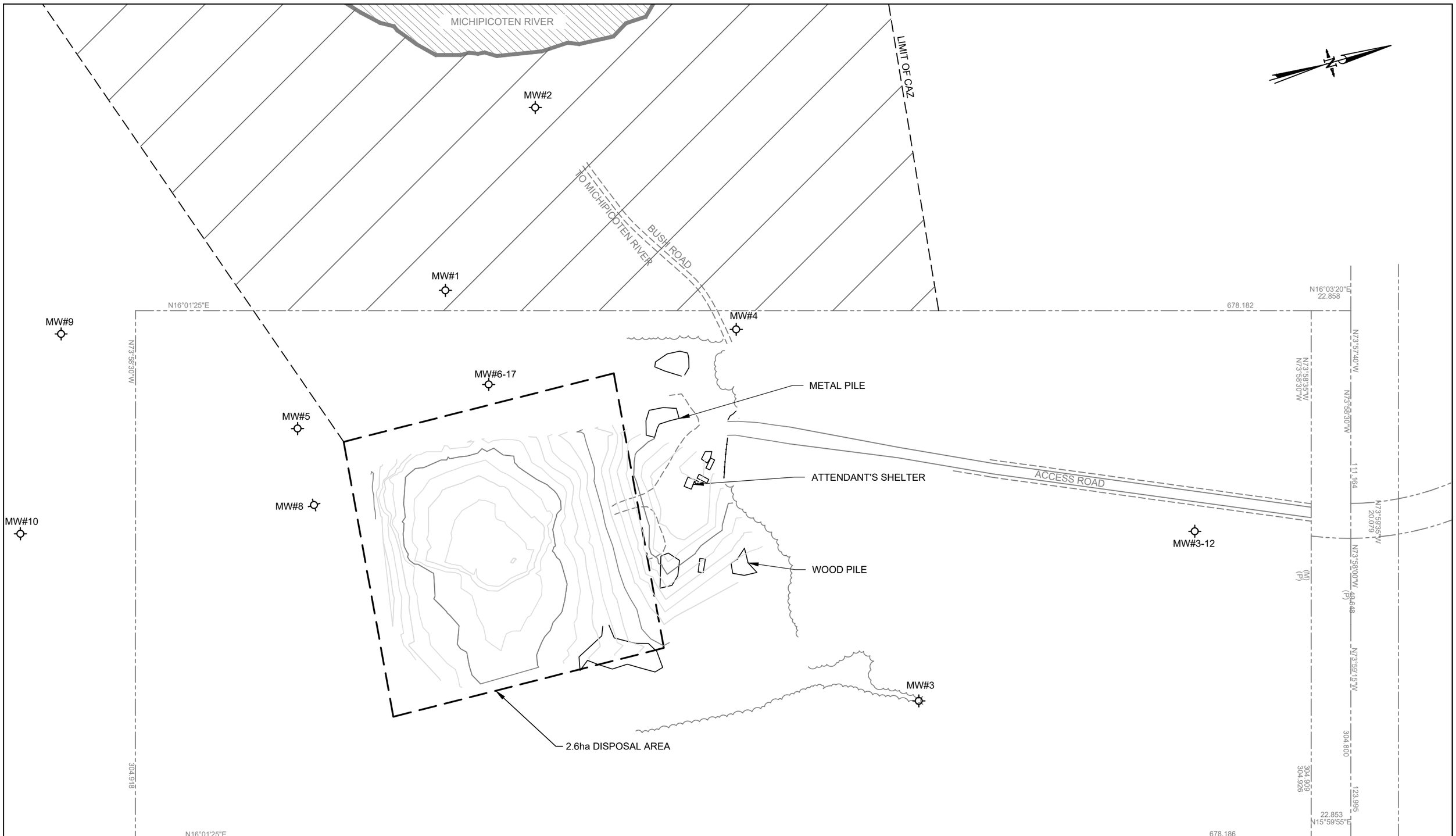
DESIGN:	KEC
DRAWN:	S. MACKENZIE
PROJECT:	1140.09
FILENAME:	1140.09 A1
SCALE:	1:33,333

THE CORPORATION OF THE MUNICIPALITY OF WAWA

MICHIPICOTEN LANDFILL SITE LOCATION PLAN

A1

Rev 0



KRESIN Engineering Corporation
Sault Ste. Marie, Ontario
(705) 949-4900

NOTES

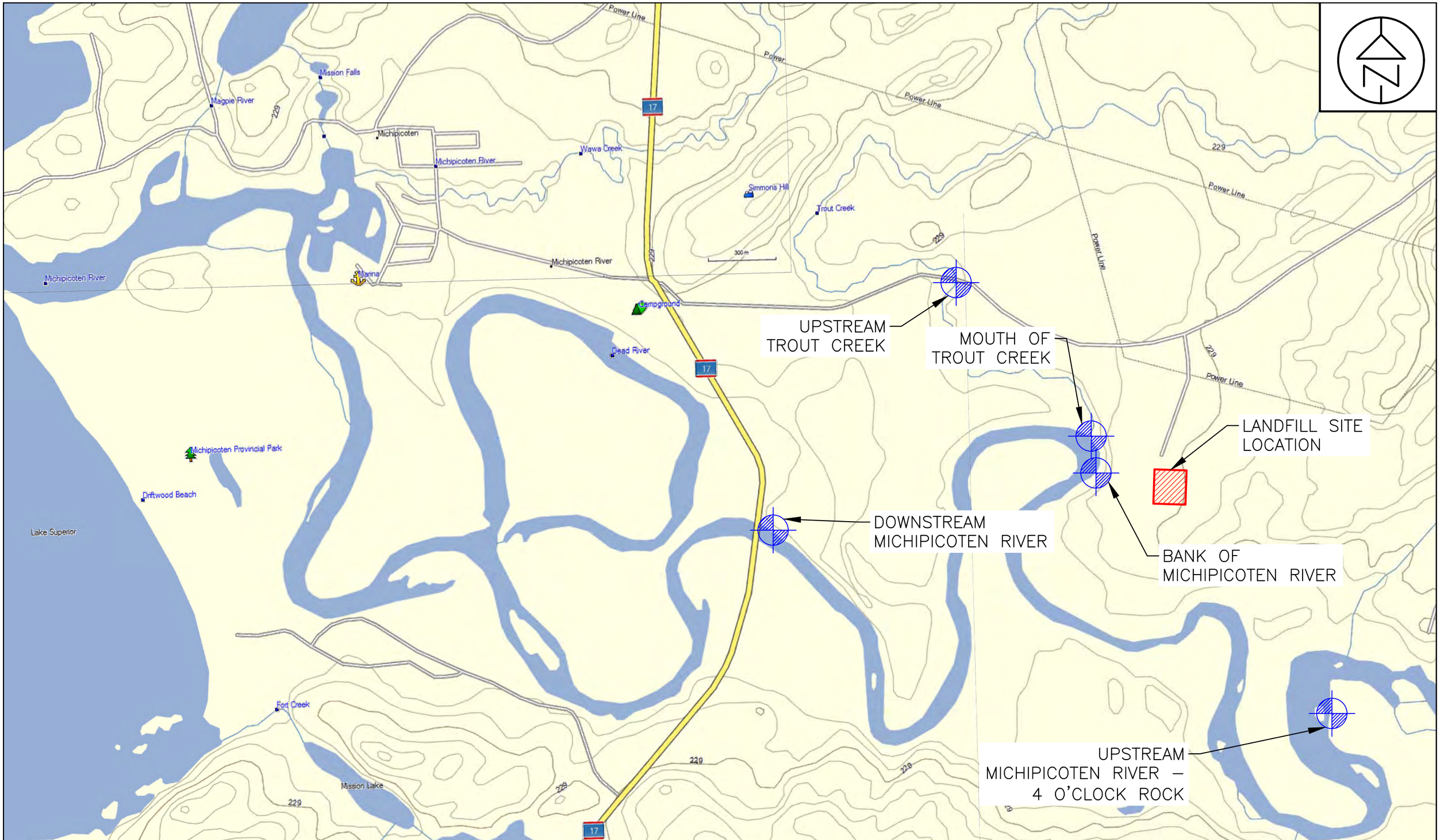
DESIGN		
DRAWN	S. MACKENZIE	05/2021
CHECKED	R. WILSON	05/2021
PROJECT	1140.09	
FILENAME	1140.09 A2	
SCALE	1:2000	

THE CORPORATION OF THE MUNICIPALITY OF WAWA
MICHIPICOTEN LANDFILL SITE

MONITORING WELL LOCATIONS

A2

Rev 0



KRESIN Engineering Corporation
Sault Ste. Marie, Ontario
(705) 949-4900

NOTES

DESIGN		KFC
DRAWN	S. MACKENZIE	05/2021
CHECKED	R. WILSON	05/2021
PROJECT	1140.09	
FILENAME	1140.09 A3	
SCALE	1:15,000	

THE CORPORATION OF THE MUNICIPALITY OF WAWA
MICHIPICOTEN LANDFILL SITE
SURFACE WATER SAMPLING LOCATIONS

A3

Rev 0

LEGEND

INTERPRETED DIRECTION OF GROUNDWATER FLOW

MICHIPICOTEN RIVER

189

189

189

MW#2
(188.842m)

CAZ

LOCATION OF SUSPECTED GW DIVIDE

190

191

192

TO MICHIPICOTEN RIVER

BUSH ROAD

MW#1
(189.589m)

MW#4
(192.131m)

MW#9
(217.553m)

MW#7
(195.720m)

MW#5
(189.475m)

MW#8
(192.399m)

ACCESS ROAD

195

MW#6
(195.443m)

MW#10
(219.694m)

190
195
200
210
220

2.6ha DISPOSAL AREA

GPR PATH (TYP.)

REFUSAL

REFUSAL

200

MW#3
(198.389m)

N16°01'25"E

678.182

N16°03'20"E
22.858

N73°57'40"W

N73°58'35"W

N73°58'30"W

111.164

N73°58'35"W
20.079

N73°58'00"W
18.648

(M)
(P)

N73°58'15"W

304.800

304.909
304.926

123.996

22.853
N15°59'55"E

678.186

304.918

N16°01'25"E

DESIGN	KEC
DRAWN	S. MACKENZIE 05/2021
CHECKED	R. WILSON 05/2021
PROJECT	1140.09
FILENAME	1140.09 A4
SCALE	1:2500

KRESIN Engineering Corporation
Sault Ste. Marie, Ontario
(705) 949-4900

NOTES

THE CORPORATION OF THE MUNICIPALITY OF WAWA
MICHIPICOTEN LANDFILL SITE

GROUNDWATER CONTOURS - FALL 2020

A4

Rev 0

RELOCATED SIGN.

±6m

RELOCATE GATE.

EXISTING SIGN.

EXISTING GATE.

EXISTING HYDRO POLE. (TYP.)

MW 4

RELOCATED ATTENDANT SHELTER.

PROPOSED CONCRETE BLOCKS AT 2m SPACING PAINTED FLUORESCENT ORANGE.

PROPOSED SIGN #11 "MERGE"

PROPOSED SIGN #1 "DO NOT ENTER".

EXISTING FENCE (TYP.).

PROPOSED 10mx10m COMPACTOR SHELTER.

PROPOSED ISLAND. CONSTRUCTION BASED ON MATERIAL AVAILABILITY.

PROPOSED 1.8m HIGH DIVERTABLES & RECYCLABLES CONCRETE BLOCK BUNKER.

PROPOSED SIGN #2" AUTHORIZED VEHICLES ONLY".

PROPOSED SIGN #3 "YIELD".

SIGN

LEGEND

1 - ELECTRONICS
2 - TIRES
3 - RECYCLABLES

PROPOSED SIGN #10 "BRUSH AND CLEAN WOOD WASTE ONLY".

PROPOSED SIGN #9 "SCRAP METAL ONLY".

PROPOSED EDGE OF GRANULAR OR ASPHALT.

PROPOSED SIGN #4 "DIVERTABLES & RECYCLABLES ONLY - KEEP LEFT DOMESTIC WASTE - KEEP RIGHT".

RAMP

±9.5m

±6m

PROPOSED SIGN #8 "WHITE GOODS ONLY".

EXISTING LANDFILL SITE 2.6ha DISPOSAL AREA.

±13m

EXISTING ATTENDANT SHELTER.

PROPOSED SIGN #7 "CONCRETE ONLY".

RAMP

±10m

PROPOSED SIGN #6 "SHINGLES ONLY".

CONCRETE PADS FOR ROLL OFF BINS.

PROPOSED RETAINING WALL FOR WASTE DROPOFF.

PROPOSED SIGN #5 "YIELD".

TO EXPANSION FILL AREA

EXISTING GRAVEL (TYP.)

NOTES
1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED.
2. DO NOT SCALE DRAWING.
3. DRAWING SHOWS PROPOSED CONSTRUCTION EMPHASIZED.
4. EXISTING CONDITIONS APPEAR SCREENED IN BACKGROUND.
5. LOCATION OF EXISTING UNDERGROUND UTILITIES ARE APPROXIMATE ONLY AND MUST BE VERIFIED BY CONTRACTOR.

No	DESCRIPTION	DATE	INITIAL
	REVISIONS		

KRESIN Engineering Corporation
Sault Ste. Marie, Ontario
(705) 949-4900

DESIGN	RW	05/2021
DRAWN	RW	05/2021
CHECKED	CK	08/2021
PROJECT	1140	
FILENAME	1140.09 A5.1	
SCALE	1:500	

THE CORPORATION OF THE MUNICIPALITY OF WAWA MUNICIPAL WASTE DISPOSAL SITE

WASTE, DIVERTABLES AND RECYCLABLES RECEIVING LAYOUT

A5.1

Rev 0

NOTES

1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED.
2. DO NOT SCALE DRAWING.
3. DRAWING SHOWS PROPOSED CONSTRUCTION EMPHASIZED.
4. EXISTING CONDITIONS APPEAR SCREENED IN BACKGROUND.
5. LOCATION OF EXISTING UNDERGROUND UTILITIES ARE APPROXIMATE ONLY AND MUST BE VERIFIED BY CONTRACTOR.

No	DESCRIPTION	DATE	INITIAL

REVISIONS

KRESIN Engineering Corporation
Sault Ste. Marie, Ontario
(705) 949-4900

DESIGN	RW	05/21
DRAWN	RW	05/21
CHECKED	CK	08/21
PROJECT	1140.09	
FILENAME	1140.09 A5.2	
SCALE	1:4000	

THE CORPORATION OF THE MUNICIPALITY OF WAWA
MUNICIPAL WASTE DISPOSAL SITE

CONCEPTUAL EXPANSION ARRANGEMENT

A5.2

Rev 0

Appendix B
MECP Environmental Compliance Approval & Notices

Ontario

Ministry of the Environment, Conservation and Parks
Ministère de l'Environnement, de la Protection de la nature et des Parcs

AMENDMENT TO ENVIRONMENTAL COMPLIANCE APPROVAL
NUMBER A7266501
Notice No. 9
Issue Date: May 9, 2019

The Corporation of the Municipality of Wawa
40 Broadway Ave
Post Office Box, No. 500
Wawa, Ontario
P0S 1K0

Site Location: 161 High Falls Road
161 High Falls Rd
Rabazo Unorganized Township, District of Algoma
P0S 1K0

You are hereby notified that I have amended Approval No. A7266501 issued on November 2, 2005 and amended on February 1, 2011, August 1, 2012, September 26, 2013, April 16, 2015, July 15, 2015, April 14, 2016, June 1, 2017 and May 15, 2018 for the use and operation of a 2.6 hectare landfilling site within a total of 22 hectares , as follows:

Condition 11 (b) is hereby revoked and replaced with the following:

11. (b) Notwithstanding Condition 11(a), the *Owner* shall cease accepting and depositing waste at the *Site* by **May 30, 2021**.

Item 15 is added to the Schedule "A".

Schedule "A"

15. Environmental Compliance Approval Application received February 1, 2019 and signed Corey Stainthorpe, Director of Infrastucture Services, The Corporation of the Municipality of Wawa, including all submitted supporting documentation.

The reason for this amendment to the Approval is as follows:

Condition 11 (b) is amended to allow the Owner to continue depositing waste to protect the health and safety of the public and the environment while the Owner is completing the Environmental Screening process to acquire required disposal capacity for the residents in the service area for the waste disposal site.

This Notice shall constitute part of the approval issued under Approval No. A7266501 dated November 2, 2005

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:

a. 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;
b. 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:

1. The name of the appellant;
2. The address of the appellant;
3. The environmental compliance approval number;
4. The date of the environmental compliance approval;
5. The name of the Director, and;
6. 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, Conservation and Parks
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 9th day of May, 2019

Mohsen Keyvani, P.Eng.
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

CM/
c: Area Manager, MECP Sault Ste. Marie
c: District Manager, MECP Sudbury
Chris Kresin, Kresin Engineering Corporation

1819.01

Ontario

Ministry of the Environment and Climate Change
Ministère de l'Environnement et de l'Action en matière de changement climatique

AMENDMENT TO ENVIRONMENTAL COMPLIANCE APPROVAL
NUMBER A7266501
Notice No. 8
Issue Date: May 15, 2018

The Corporation of the Municipality of Wawa
40 Broadway Ave PO Box 500
Wawa, Ontario
P0S 1K0

RECEIVED
JUL 24 2018
KRESIN Engineering Corporation

Site Location: 161 High Falls Road
Lot MS54
Part 1 & 2, Plan IR-4972/IR-7885
Rabazo Unorganized Township, District of Algoma

You are hereby notified that I have amended Approval No. A7266501 issued on November 2, 2005 and amended on February 1, 2011, August 1, 2012, September 26, 2013, April 16, 2015, July 15, 2015, April 14, 2016, and June 1, 2017 for the use and operation of a 2.6 hectare landfilling site within a total of 22 hectares , as follows:

Condition 11 (b) is hereby revoked and replaced with the following:

11. (b) Notwithstanding Condition 11(a), the *Owner* shall cease accepting and depositing waste at the *Site* by **May 30, 2019**.

Item 14 is added to the Schedule "A".

Schedule "A"

14. Environmental Compliance Approval Application received April 3, 2018 and signed Chris Wray, CAO/Clerk-Treasurer, The Corporation of the Municipality of Wawa, including all submitted supporting documentation.

The reason for this amendment to the Approval is as follows:

Condition 11 (b) is amended to allow the Owner to continue depositing waste to protect the health and safety of the public and the environment while the Owner is completing the Environmental Screening process to acquire required disposal capacity for the residents in the service area for the waste disposal

site.

This Notice shall constitute part of the approval issued under Approval No. A7266501 dated November 2, 2005.

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:

a. 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;
b. 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:

1. The name of the appellant;
2. The address of the appellant;
3. The environmental compliance approval number;
4. The date of the environmental compliance approval;
5. The name of the Director, and;
6. 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 15th day of May, 2018

Dale Gable, P.Eng.
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

THIS NOTICE WAS MAILED
ON JUL 19 2018
(Signed)

CM/

c: Area Manager, MOECC Sault Ste. Marie
c: District Manager, MOECC Sudbury
Chris Kresin, Kresin Engineering Corporation ✓

Content Copy Of Original

Ontario

Ministry of the Environment and Climate Change
Ministère de l'Environnement et de l'Action en matière de changement climatique

AMENDMENT TO ENVIRONMENTAL COMPLIANCE APPROVAL
NUMBER A7266501
Notice No. 7
Issue Date: June 1, 2017

The Corporation of the Municipality of Wawa
40 Broadway Ave PO Box 500
Wawa, Ontario
P0S 1K0

Site Location: 161 High Falls Road
Lot MS54
Part 1 & 2, Plan IR-4972/IR-7885
Rabazo Unorganized Township, District of Algoma

You are hereby notified that I have amended Approval No. A7266501 issued on November 2, 2005 and amended on February 1, 2011, August 1, 2012, September 26, 2013, April 16, 2015, July 15, 2015, and April 14, 2016 for the use and operation of a 2.6 hectare landfilling site within a total of 22 hectares , as follows:

Condition 11 (b) is hereby revoked and replaced with the following:

11. (b) Notwithstanding Condition 11(a), the *Owner* shall cease accepting and depositing waste at the *Site* by May 30, 2018.

Item 13 is added to the Schedule "A".

Schedule "A"

13. Environmental Compliance Approval Application received April 4, 2017 and signed Chris Wray, CAO/Clerk-Treasurer, The Corporation of the Municipality of Wawa, including all submitted supporting documentation.

The reasons for this amendment to the Approval are as follows :

Condition 11 (b) is amended to allow the Owner to continue depositing waste to protect the health and safety of the public and the environment while the Owner is completing the Environmental Assessment and Environmental Protection Act approval process to acquire required disposal capacity for the residents in the service area for the waste disposal site.

This Notice shall constitute part of the approval issued under Approval No. A7266501 dated November 2, 2005

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:

a. 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;
b. 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:

1. The name of the appellant;
2. The address of the appellant;
3. The environmental compliance approval number;
4. The date of the environmental compliance approval;
5. The name of the Director, and;
6. 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 1st day of June, 2017

Dale Gable, P.Eng.
Director
appointed for the purposes of Part II.1 of the *Environmental Protection Act*

BH/
c: Area Manager, MOECC Sault Ste. Marie
c: District Manager, MOECC Sudbury
Chris Kresin, Kresin Engineering Corporation

Ontario

Ministry of the Environment and Climate Change
Ministère de l'Environnement et de l'Action en matière de changement climatique

AMENDMENT TO ENVIRONMENTAL COMPLIANCE APPROVAL
NUMBER A7266501
Notice No. 6
Issue Date: April 14, 2016

The Corporation of the Municipality of Wawa
40 Broadway Ave P.O. Box 500
Wawa, Ontario
P0S 1K0

Site Location: 161 High Falls Road
Lot MS54
Part 1 & 2, Plan IR-4972/IR-7885
Rabazo Unorganized Township, District of Algoma

You are hereby notified that I have amended Approval No. A7266501 issued on November 2, 2005 and amended on February 1, 2011, August 1, 2012, September 26, 2013, April 16, 2015, and July 15, 2015 forthe use and operation of a 2.6 hectare landfilling site within a total of 22 hectares, as follows:

Condition 11 (a) & (b) is hereby revoked and replaced with the following:

11. (a) The *Owner* is permitted to continue to use the site for waste disposal. The Owner is only permitted to deposit a waste volume amount no greater than 22,000 cubic meters.

11. (b) Notwithstanding Condition 11(a), the *Owner* shall cease accepting and depositing waste at the *Site* by April 18, 2017.

The reason(s) for this amendment to the Approval is (are) as follows:

Item 12 is added to the Schedule "A".

Schedule "A"

12. Environmental Compliance Approval Application dated April 11, 2016 and signed Chris Wray, CAO/Clerk-Treasurer, The Corporation of the Municipality of Wawa, including all submitted supporting documentation.

The reasons for this amendment to the Approval are as follows:

Condition 11 (b) is amended to allow the *Owner* to continue depositing waste to protect the health and safety of the public and the environment while the *Owner* is completing the Environmental Assessment and Environmental Protection Act approval process to acquire required disposal capacity for the residents in the service area for the waste disposal site.

This Notice shall constitute part of the approval issued under Approval No. A7266501 dated November 2, 2005 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 14th day of April, 2016

Dale Gable, P.Eng.
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

BH/
c: Area Manager, MOECC Sault Ste. Marie
c: District Manager, MOECC Sudbury
Chris Kresin, Kresin Engineering Corporation

Ontario

Ministry of the Environment and Climate Change
Ministère de l'Environnement et de l'Action en matière de changement climatique

AMENDMENT TO ENVIRONMENTAL COMPLIANCE APPROVAL
NUMBER A7266501
Notice No. 5
Issue Date: July 15, 2015

The Corporation of the Municipality of Wawa
40 Broadway Ave P.O. Box 500
Wawa, Ontario
P0S 1K0

Site Location: 161 High Falls Road
Lot MS54
Part 1 & 2, Plan IR-4972/IR-7885
Rabazo Unorganized Township, District of Algoma

You are hereby notified that I have amended Approval No. A7266501 issued on November 2, 2005 and amended on February 1, 2011, August 1, 2012, September 26, 2013 and April 16, 2015 forthe use and operation of a 2.6 hectare landfilling site within a total of 22 hectares, as follows:

Condition 11 (b) is hereby revoked and replaced with the following:

11. (b) Notwithstanding Condition 11(a), the *Owner* shall cease accepting and depositing waste at the *Site* by April 16, 2016.

The reason for this amendment to the *Approval* is to reflect the Settlement Agreement between the Corporation of the Municipality of Wawa and The Director, Ministry of the Environment and Climate Change dated July 9, 2015.

This Notice shall constitute part of the approval issued under Approval No. A7266501 dated November 2, 2005 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) 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 15th day of July, 2015

Dale Gable, P.Eng.
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

RM/
c: Area Manager, MOECC Sault Ste. Marie
c: District Manager, MOECC Sudbury
Jim Harmar, Shelby Environmental Services Inc.

Ontario

Ministry of the Environment and Climate Change
Ministère de l'Environnement et de l'Action en matière de changement climatique

AMENDMENT TO ENVIRONMENTAL COMPLIANCE APPROVAL
NUMBER A7266501
Notice No. 4
Issue Date: April 16, 2015

The Corporation of the Municipality of Wawa
40 Broadway Ave P.O. Box 500
Wawa, Ontario
P0S 1K0

Site Location: 161 High Falls Road
Lot MS54
Part 1 & 2, Plan IR-4972/IR-7885
Rabazo Unorganized Township, District of Algoma

You are hereby notified that I have amended Approval No. A7266501 issued on November 2, 2005 and amended on February 1, 2011, August 1, 2012 and September 26, 2013 for the use and operation of a 2.6 hectare landfilling site within a total of 22 hectares , as follows:

Condition 11 (b) is hereby revoked and replaced with the following:

11. (b) Notwithstanding Condition 11(a), the *Owner* shall cease accepting and depositing waste at the *Site* by December 2015.

Condition 11 (c) is hereby added to this *Approval:*

11. (c) The *Owner* shall submit to the *Director* with copies to the *District Manager* the following within six (6) months from the date of this *Approval:*

(i) Status of the Approval for Environmental Assessment Act. for securing waste disposal capacity for the residents in the service area of this *Approval;*
(ii) Revised trigger mechanism and contingency plan for the *Site;* and
(iii) Details of the Contaminant Attenuation Zone (CAZ) and the status of the process for acquiring the CAZ.

Item 11 is added to the Schedule "A".

Schedule "A"

11. Environmental Compliance Approval Application dated May 15, 2014 and signed Brian Sheridan, Director, Infrastructure Services, The Corporation of the Municipality of Wawa, including the attached supporting documentation.

The reasons for this amendment to the Approval are as follows:

Condition 11 (b) is amended to allow the *Owner* to continue depositing waste to protect the health and safety of the public and the environment while the *Owner* is completing the Environmental Assessment and Environmental Protection Act. approval process to acquire required disposal capacity for the residents in the service area for the waste disposal site.

Condition 11(c) is added to the Approval to ensure the *Owner* submit the documents required under the Emergency Approval in a timely manner.

This Notice shall constitute part of the approval issued under Approval No. A7266501 dated November 2, 2005 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
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 16th day of April, 2015

THIS NOTICE WAS MAILED
ON April 21, 2015
2C
(Signed)

Dale Gable, P.Eng.
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

RM/
c: Area Manager, MOECC Sault Ste. Marie
c: District Manager, MOECC Sudbury
Jim Harmar, Shelby Environmental Services Inc. ✓

Ontario

Ministry of the Environment
Ministère de l'Environnement

AMENDMENT TO ENVIRONMENTAL COMPLIANCE APPROVAL
NUMBER A7266501
Notice No. 3
Issue Date: September 26, 2013

The Corporation of the Municipality of Wawa
40 Broadway Ave
Wawa, Ontario
P0S 1K0

Site Location: 161 High Falls Road
Lot MS54
Part 1 & 2, Plan IR-4972/IR-7885
Rabazo Unorganized Township, District of Algoma

You are hereby notified that I have amended Approval No. A7266501 issued on November 2, 2005 and amended on February 1, 2011 and August 1, 2012 for the use and operation of a 2.6 hectare landfilling site within a total site area of 22 hectares , as follows:

Conditions 7.7 is hereby revoked and replaced with the following:

7.7 (a) By May 31, 2014, 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.

(b) By May 31, 2014, 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 any trigger mechanism.

The reason for this amendment to the Approval is to reflect the decision dated June 27, 2013 by the Environmental Review Tribunal.

This Notice shall constitute part of the approval issued under Approval No. A7266501 dated November 2, 2005 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 26th day of September, 2013

Tesfaye Gebrezghi, P.Eng.
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

RM/
c: Area Manager, MOE Sault Ste. Marie
c: District Manager, MOE Sudbury

Ontario

Ministry of the Environment
Ministère de l'Environnement

AMENDMENT TO ENVIRONMENTAL COMPLIANCE APPROVAL
NUMBER A7266501
Notice No. 2
Issue Date: August 1, 2012

The Corporation of the Municipality of Wawa
40 Broadway Ave
Post Office Box, No. 500
Wawa, Ontario
P0S 1K0

Site Location: 161 High Falls Road
Lot MS54
Part 1 & 2, Plan IR-4972/IR-7885
Rabazo Unorganized Township, District of Algoma

You are hereby notified that I have amended Approval No. A7266501 issued on November 2, 2005 and amended on February 1, 2011 forthe use and operation of a 2.6 hectare landfilling site within a total of 22 hectares, as follows:

The definition of "Approval" is hereby added.

"*Approval*" means this Environmental Compliance Approval and any Schedules to it, including the application and supporting documentation listed in Schedule "A".

Conditions 7.7 and 11 (b) are hereby revoked and replaced with the following:

7.7 (a) Within one (1) year from the date of this *Approval,* 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.

(b) Within one (1) year from the date of this *Approval,* 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 any trigger mechanism.

11. (b) Notwithstanding Condition 11(a), the *Owner* shall cease accepting and depositing waste at the *Site* by May 2014.

The following conditions are added to this *Approval:*

7.8 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, 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.

7.9 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:

(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.*

7.10 The *Owner* shall ensure that any proposed changes to the site-specific trigger levels for leachate impacts to the surface water or groundwater, are approved in advance by the *Director* via an amendment to this *Approval.*

11. (c) The *Owner* shall include the volume of waste approved in condition 11 (a) in the emergency approval (Notice Number 1) issued on February 1, 2011 and the volume of 41,184 cubic meters of fill beyond approved limits (by 2008) in the total capacity for the Environmental Assessment for the future expansion of the landfill site if the Environmental Assessment concludes that this *Site* is the preferred option for waste management and is suitable for further landfilling.

(d) An update on the status of Environmental Assessment process on obtaining future waste disposal capacity shall be included in the Annual Monitoring Report to the *District Manager* with a copy to the *Director.*

The following items are added to the Schedule "A":

Schedule "A"

7. Application for a Certificate of Approval dated April 16, 2012 signed by Brian Sheridan, Director of Infrastructure, the Corporation of the Municipality of Wawa.

8. Letter dated April 16, 2012 to the Director, Section 39, Environmental Protection Act, Ministry of the Environment from Brian Sheridan, Director of Infrastructure, the Corporation of the Municipality of Wawa.

9. Letter report addressed to Ms. Doreen Pavlic, the Corporation of the Municipality of Wawa, Re:Landfill Liability Reporting - 2011 (Revised) prepared by Conestoga Rovers & Associates.

10. Electronic mail dated May 16, 2012 from Brian Sheridan, the Corporation of the Municipality of Wawa to Ranjani Munasinghe, Ministry of the Environment.

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 11 (b) is amended to allow the *Owner* to continue depositing waste to protect the health and safety of the public and the environment while the *Owner* is completing the Environmental Assessment and Environmental Protection Act. approval process to acquire required disposal capacity for the residents in the service area for the waste disposal site.

2. Conditions 7.7 to 7.10 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 at the *Site's* compliance point.

3. Conditions 11 (c) and (d) are included to ensure the *Owner* obtain necessary approvals for the capacity of the landfill since it is in the interest of the health and safety of the public and the environment.

This Notice shall constitute part of the approval issued under Approval No. A7266501 dated November 2, 2005 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) 314-4506 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 1st day of August, 2012

Tesfaye Gebrezghi, P.Eng.
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

RM/
c: District Manager, MOE Sault Ste. Marie
Jim Harmar, Shelby Environmental Services Ltd.

Ontario

Ministry of the Environment
Ministère de l'Environnement

AMENDMENT TO PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A7266501
Notice No. 1
Issue Date: February 1, 2011

The Corporation of the Municipality of Wawa
Post Office Box, No. 500
Wawa, Ontario
P0S 1K0

Site Location: 161 High Falls Road
Lot MS54
Part 1 & 2, Plan IR-4972/IR-7885
Rabazo Unorganized Township, District of Algoma

You are hereby notified that I have amended Provisional Certificate of Approval No. A7266501 issued on November 2, 2005 for the use and operation of a 2.6 hectare landfilling site within a total of 22 hectares, as follows:

Condition 3.3 is hereby revoked and replaced with the following:

Capacity

3.3 The Owner shall assess the total volume of waste that is deposited in the landfill. This assessment shall be included in the Annual Report for the year 2012.

Cover

3.7 Alternative materials to soil may be used as weekly 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.

3.8 Following alternative cover material may be used as daily cover material:

(a) Non-hazardous contaminated soil; and
(b) Wood chips.

11. the emergency expansion of the waste disposal site for additional capacity of 34,000 cubic metres (from the contours of December 2007 topographical survey) is hereby approved subject to the following conditions:

(a) The *Owner* shall cease accepting and depositing waste at the *Site* when the additional approved capacity of 34,000 cubic meters has been reached.

(b) Notwithstanding Condition 11(a) above, the *Owner* shall cease accepting and depositing waste at the *Site* by May 2012.

The following items are added to the Schedule "A":

Schedule "A"

4. Application for a Certificate of Approval dated April 30, 2010 signed by Dennis Berard, Director of Infrastructure, The Corporation of the Municipality of Wawa.

5. Report titled "Short-Term Landfill Capacity Increase, Provisional Certificate of Approval A7266501" dated February 2010 prepared by Conestoga-Rovers & Associates.

6. Electronic mail dated January 16, 2011, from Dennis Berard, The Corporation of the Municipality of Wawa to Ranjani Munasinghe, Ministry of the Environment.

The reasons for this amendment to the Certificate of Approval are as follows:

1. Condition 3.7 is to provide the *Owner* the process for getting the approval for alternative daily and intermediate cover material.

2. The reasons for Conditions 11 are to approve the emergency capacity increase for the Site as requested by the *Owner.*

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A7266501 dated November 2, 2005 as amended

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 1st day of February, 2011

Tesfaye Gebrezghi, P.Eng.
Director
Section 39, *Environmental Protection Act*

RM/
c: District Manager, MOE Sault Ste. Marie
Jim Harmar, Shelby Environmental Services Ltd.

Ontario

Ministry of the Environment **Ministère de l'Environnement**

AMENDED PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A7266501
Issue Date: November 2, 2005

The Corporation of the Township of Michipicoten
40 Broadway Avenue, PO Box 500
Wawa, Ontario
P0S 1K0

Site Location: Michipicoten Landfill Site
High Falls Road
Michipicoten Township, District of Algoma

You have applied in accordance with Section 27 of the Environmental Protection Act for approval of:

a waste disposal site

For the purpose of this Certificate of Approval and the terms and conditions specified below, the following definitions apply:

1. DEFINITIONS

"*Buffer*" means those lands between the limit of fill and the boundaries of the property owned by The Corporation of the Township of Michipicoten, that shall in no instance be less than 30 meters;

"*Crown*" means Her Majesty the Queen in the Right of Ontario;

"*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;

"*Engineer*" means a professional engineer licensed under the Ontario Professional Engineers Act;

"*EPA*" means *Environmental Protection Act*, R.S.O. 1990, c. E. 19, as amended;

"*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 The Corporation of the Township of Michipicoten, 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 Corporation of the Township of Michipicoten**,** its successors and assigns;

"*OWRA*" means the *Ontario Water Resources Act*, R.S.O. 1990, c.0.40, 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*.

"*Regional Director*" means the Regional Director of the local Regional Office of the Ministry in which the Site is located.

"*Regulation 232*" or "*Reg. 232*" means Ontario Regulation 232/98 (New Landfill Standards) made under the *EPA*, as amended from time to time;

"*Regulation 347*" or "*Reg. 347*" means Regulation 347, R.R.O. 1990, made under the *EPA*, as amended from time to time;

"*Site*" means the entire waste disposal site, including the buffer lands and contaminant attenuation zone approved by this *Certificate*.

"*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;
h. the requirements of this *Certificate*.

You are hereby notified that this approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

2. GENERAL

Compliance

2.1 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.

2.2 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

2.3 Except as otherwise provided for in this *Certificate*, the Site shall be designed, developed, built, operated and maintained in accordance with supporting documentations listed in Schedule "A".

Interpretation

2.4 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.

2.5 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.

2.6 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.

2.7 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.

Other Legal Obligations

2.8 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

2.9 The Owner and Operator shall take steps to minimize and ameliorate any adverse effect (as defined under the *EPA*), 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.

2.10 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 Owner

2.11 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*;
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;

2.12 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.

2.13 In the event of any change in *Ownership* of the works, other than change to a successor municipality, 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

2.14 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.

2.15 Two copies of a completed Certificate of Requirement, containing a registerable description of the *Site*, shall be submitted to the Director for the Director's signature within 60 calendar days of the date of this *Certificate.*

2.16 The Certificate of Requirement shall be registered in the appropriate land registry office on title to the *Site* by the *Owner* within 10 calendar days of receiving the Certificate of Requirement signed by the *Director,* and a duplicate registered copy shall be submitted to the *Director*.

Inspections

2.17 No person shall hinder or obstruct a *Provincial Officer* from carrying out any and all inspections authorized by the *OWRA*, the *EPA*, or the *PA*, 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* or the *PA*.

Information and Record Retention

2.18 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.*

2.19 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.

3. SITE OPERATION AND DEVELOPMENT

3.1 Only the following type of waste shall be accepted at the *Site*: solid municipal waste including wood ash from a nearby Weyerhaeuser Plant.

3.2 The *Owner* shall develop and implement a program to inspect waste to ensure that the waste is of a type approved for acceptance under this *Certificate*.

Capacity

3.3 The Owner shall only accept and deposit waste at the Site as long as there is available capacity as described in the report in Item 1, Schedule "A".

3.4 The remaining waste capacity of the landfill site is 17,000 m3.

Service Area

3.5 The service area for the site shall be the geographic boundaries of the Corporation of the Township of Michipicoten.

Cover

3.6 Cover material shall be applied as follows:
a. Fill areas shall be progressively completed and rehabilitated as landfill development reaches final contours.
b. Final Cover - In areas where landfilling has been completed to final contours, a final cover consisting of 0.6 metres of clay and 0.15 metres of top soil shall be placed on the waste.

4. SITE DESIGN

4.1 Following the closure of the *Site*, the final cover of the top portion of the landfill shall be built with a gradient of 20 horizontal to 1 vertical.

4.2 Following the closure of the *Site*, the final side slopes of the landfill shall be built with a gradient of 4 horizontal to 1 vertical.

5. SITE OPERATION

5.1 The *Site* shall be operated and maintained at all time including management and disposal of all waste in accordance with the *EPA*, *Regulation 347, Regulation 232*, 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.

5.2 The *Site* shall be operated and maintained such that vermin, vectors, dust, litter, odour, noise and traffic do not create a nuisance.

Burning Waste Prohibited

5.3 Burning of waste at the *Site* is prohibited, except for the burning of clean wood and brush in accordance with the Ministry Guideline "Burning at Landfill Sites", [Reg. 232] and in a supervised and controlled manner.

Signs

5.4 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 normal hours of operation;
d. the allowable and prohibited waste types;
e. the telephone number to which complaints may be directed;
f. a twenty-four (24) hour emergency telephone number (if different from above); and
g. a warning against dumping outside the *Site*.

Hours of Operation

5.5 Unless the Director or the District Manager ordered otherwise, the *Site* shall operate Tuesday to Saturday 9:00 am to 5:00 pm.

Site Security

5.6 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.

5.7 The Site shall be operated and maintained in a secure manner**.** During non-operating hours, the *Site* shall be secured against access by unauthorized persons.

Site Access

5.8 Access to and exit from the *Site* shall only be permitted from the gravel road off High Falls Road.

SITE PERSONNEL AND INSPECTION

Daily Inspections and Log Book

Inspection

6.1 A monthly inspection, at a minimum, of the approved fill area (and its immediate vicinity) and all equipment on the *Site,* and a semi-annual inspection of the entire *Site* shall be conducted 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.*

6.2 Any deficiencies discovered as a result of the inspection shall be remedied immediately, including temporarily ceasing operations at the *Site* if needed**.**

6.3 A record of the inspections shall be kept in a log book that includes:

b. the name and signature of person that conducted the inspection;
c. the date and time of the inspection;
d. the list of any deficiencies discovered;
e. The recommendations for remedial action; and
f. the date, time and description of actions taken.

6.4 A log shall be maintained in written format and maintained at the *Site*.

7. MONITORING PROGRAM

7.1 Monitoring programs shall be carried out for groundwater and surface water in accordance with the Monitoring Program outlined in Item 1, Schedule "A", attached to this Certificate, and as per Conditions 7.2 to 7.7 outlined below.

7.2 Groundwater shall be sampled on a semi-annual basis from 2 monitoring wells located downgradient of the landfill site.

7.3 Surface water samples shall be collected on a semi-annual basis from downstream and upstream locations of both the Trout Creek and Michipicoten River.

7.4 For each sampling event, analytical parameters shall include: pH, total dissolved solids (TDS), conductivity, hardness, alkalinity, chloride, sulphate, nitrate, nitrite, calcium, magnesium, sodium, potassium, dissolved organic carbon (DOC), ICAP metal scan (barium, boron, cadmium, chromium, copper, iron, lead, manganese, zinc), ion balance calculation, 5-day biological oxygen demand (BOD5), chemical oxygen demand (COD), total Kjeldahl nitrogen (TKN), ammonia, and total phosphorous.

7.5 Once each year, sampling shall include volatile organic compounds (VOC).

7.6 Reasonable Use Policy assessment shall be completed and reported for all tested parameters for which there is an Ontario Drinking Water Standard.

7.7 In the event a result of a monitoring test carried out under a monitoring program does not comply with the Reasonable Use Policy criteria, the *Owner* shall:

a. conduct an investigation into the cause of the adverse result and submit a report to the *District Manager* that includes an assessment of whether contingency measures need to be carried out; and
b. if contingency measures are needed, submit detailed plans, specifications and descriptions for the design, operation and maintenance of the contingency measures, and a schedule as to when these measures will be implemented, to the *Director* and notify *District Manager*; and
c. implement the required contingency measures upon approval by the *Director*.

8. COMPLAINTS PROCEDURE

8.1 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 managerial or operational changes to reasonably avoid the recurrence of similar incidents.

9. ANNUAL REPORT

9.1 A written report on the development, operation and monitoring of the *Site*, shall be completed annually (the "Annual Report") and submitted to the *District Manager* by April 30th of each year.

9.2 The Annual Report shall include, but not limited to, the following:

a. the results and an interpretive analysis of the results of all groundwater and surface water monitoring, and for leachate and landfill gas monitoring if required at some future date, including an assessment of the need to amend the monitoring programs;
b. A site plan or plans which accurately show the monitoring well locations, distances to local surface water features or other receptors, topography, predicted direction of ground water flow, ground water contours, and buffer zones and/or the contaminant attenuation zone (CAZ);
c. an assessment of the operation and performance of all facilities, the need to amend the design or operation of the *Site*, and the adequacy of and need to implement the contingency plans;
d. 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;
e. calculations of the volume of waste 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;
f. a calculation of the remaining capacity of the *Site* and an estimate of the remaining *Site* life;
g. a summary of the estimated monthly and total annual quantity (tonnes) of waste received at the Site.
h. a summary of any complaints received and the responses made;
i. a discussion of any operational problems encountered at the *Site* and corrective action taken;
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.

10. CLOSURE PLAN

10.1 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; and
vi. final construction of any control, treatment, disposal and monitoring facilities for leachate, groundwater, surface water and landfill gas;
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

The reasons for the imposition of these terms and conditions are as follows:

1. The reason for Condition 1 is to define the specific meaning of terms and simplify the wording of conditions in this Certificate of Approval.

2. The reason for Conditions 2.1, 2.2, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.18 and 2.19 is to clarify the legal rights and responsibilities of the Owner and Operator under this Certificate of Approval.

3. The reasons for Conditions 2.3 and 4.1 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.

4. The reasons for Conditions 2.11 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.

5. The reasons for Condition 2.12 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.

6. The reason for Condition 2.13 is to ensure that the successor is aware of its legal responsibilities as detailed in the Certificate.

7. Conditions 2.14, 2.15 and 2.16 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.

8. The reason for Condition 2.17 is to ensure that appropriate Ministry staff have 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 EPA and OWRA.

9. The reasons for Conditions 3.1, 3.3, 3.4 and 3.5 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.

10. The reasons for Conditions 3.2, 5.1, and 5.2 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.

11. The reason for Condition 3.6 is to specify the approval requirements for capping the Site. 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.

12. The reason for Condition 4 is to ensure that final slopes of the landfill site are stable and do not pose stability hazard to people and animals.

13. The reason for Condition 5.3 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.

14. The reason for Condition 5.4 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 of Approval.

15. The reasons for Condition 5.5 is to specify the hours of operation for the landfill Site and a mechanism for amendment of the hours of operation, as required.

16. The reasons for Conditions 5.6, 5.7 and 5.8 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.

17. The reasons for Conditions 6.1, 6.2, 6.3 and 6.4 are to ensure that detailed records of Site inspections are recorded and maintained for inspection and information purposes and to ensure that deficiency corrective measures are taken in a timely manner.

18. The reasons for Condition 7 are to demonstrate that the landfill 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.

19. The reason for Condition 8 is to ensure that any complaints regarding landfill operations at this Site are responded to in a timely and efficient manner.

20. The reason for Condition 9.1 is to ensure the submission of an Annual Report on time for necessary reviews of past operations of the Site.

21. The reasons for Condition 10 are to ensure that appropriate closure plan is in place for the *Site*. It is also 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.

Schedule "A"

1. A report titled "Township of Michipicoten Sanitary Landfill Site Study", Proctor and Redfern Group, dated February 1979;

2. A report titled "Hydrogeological Investigation, Proposed Solid Waste Disposal Site", Gartner Lee Associates Limited, dated January 1979;

3. 2003 Annual Monitoring Report, Michipicoten Landfill Site, Township of Michipicoten, Rabazo Township, Ontario, by Conestoga-Rovers & Associates, dated August 2004.

This Provisional Certificate of Approval revokes and replaces Certificate(s) of Approval No. A7266501 issued on June 10, 1980, as amended

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
2300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

AND

The Director
Section 39, *Environmental Protection Act*
Ministry of Environment and Energy
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 2nd day of November, 2005

Ian Parrott, P.Eng.
Director
Section 39, *Environmental Protection Act*

TG/
c: District Manager, MOE Sault Ste. Marie

Appendix C
Notice of Commencement

The Corporation of the Municipality of Wawa
Municipal Waste Disposal Site Expansion

NOTICE OF COMMENCEMENT OF ENVIRONMENTAL SCREENING PROCESS

The Municipality's waste disposal site, located approximately 1.7km east of Highway 17 on High Falls Road (see Figure 1), has been serving area residents since 1980. The site is approximately 22 hectares in size, of which 2.6 hectares are approved for use and operation as a fill area and operates under an Environmental Compliance Approval issued by the Ministry of the Environment and Climate Change. The municipal waste disposal site accepts post-diversion waste generated within the communities of Wawa and Hawk Junction as well as the Village of Michipicoten River. Waste is also accepted seasonally from Lake Superior Provincial Park. Approximately five (5) years of disposal capacity remains at the site.

The purpose of this notice is to inform those interested that the Municipality of Wawa is intends to initiate the Environmental Screening Process for Waste Management Projects under the Environmental Protection Act to address the need for additional capacity at the waste disposal site. Expansion will provide an additional disposal capacity of 100,000 m^3 (estimated 25 year lifespan) and allow the Municipality to continue to operate at the current location.

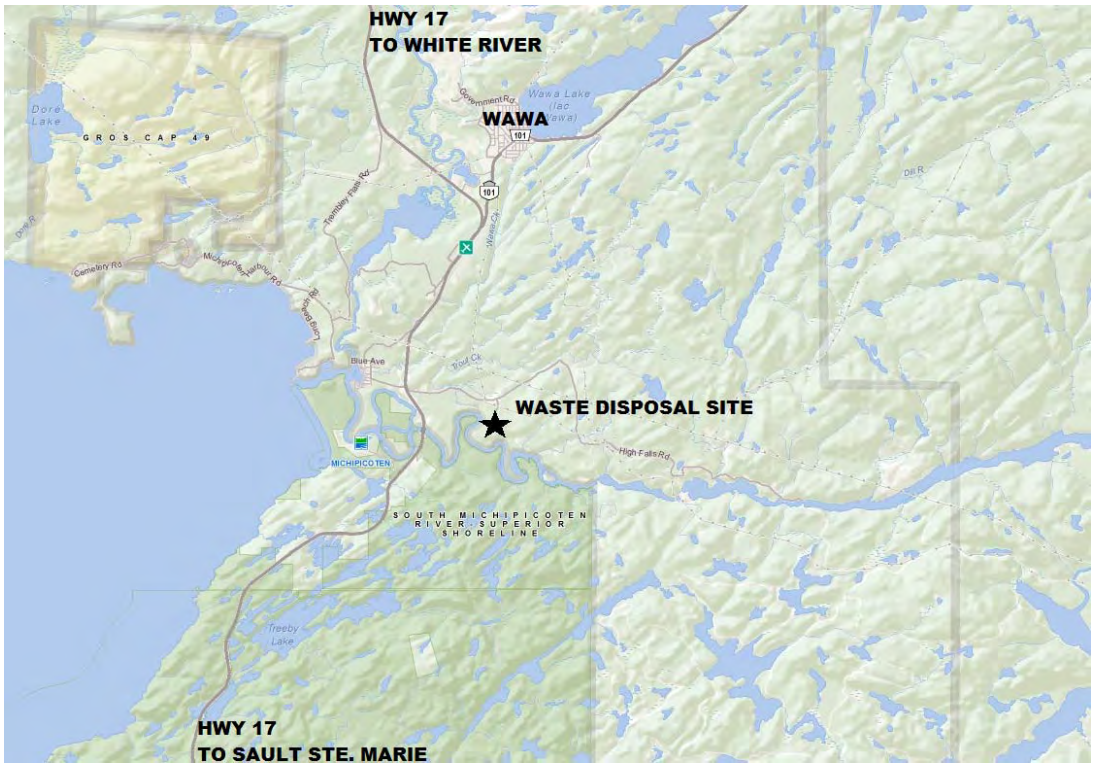


FIGURE 1: LOCATION MAP

For further information, or to comment, please contact a representative at either of the addresses below:

1. **Chris Wray**
   The Municipality of Wawa
   40 Broadway Avenue
   P.O. Box 500
   Wawa, ON P0S 1K0
   Tel: 705-856-2244

2. **Chris Kresin, P.Eng.**
   Kresin Engineering Corporation
   536 Fourth Line East
   Sault Ste. Marie, ON P6A 6J8
   Tel: 705-949-4900
   Email: chris@kresinengineering.ca

KRESIN
Engineering Corporation

536 Fourth Line East
Sault Ste. Marie, ON P6A 6J8
tel: 705-949-4900
fax: 705-949-9965
email: info@kresinengineering.ca

sustainable, practical solutions

September 14, 2016.
KEC Ref. 1140.09
By Email

Attention: To Whom It May Concern

Dear Sir/Madam:

Re: Municipality of Wawa
Municipal Waste Disposal Site Expansion
Notice of Commencement of Environmental Screening Process

The purpose of this letter is to introduce you to the referenced undertaking, and to confirm with you if you or your agency should be included in the consultation activities that will take place as part of the Environmental Screening Process.

Background

The Municipality's waste disposal site, located approximately 1.7km east of Highway 17 on High Falls Road, has been serving area residents since 1980. The site is approximately 22 hectares in size, of which 2.6 hectares are approved for use and operation as a fill area, and operates under an Environmental Compliance Approval issued by the Ministry of the Environment and Climate Change. The municipal waste disposal site accepts post-diversion waste generated within the communities of Wawa and Hawk Junction as well as the Village of Michipicoten River. Waste is also accepted seasonally from Lake Superior Provincial Park. Approximately five (5) years of disposal capacity remains at the site.

The purpose of this notice is to inform those interested that the Municipality of Wawa intends to initiate the Environmental Screening Process for Waste Management Projects under the Environmental Protection Act to address the need for additional capacity at the waste disposal site. Expansion will provide an additional disposal capacity of 100,000 m^3 (estimated 25 year lifespan) and allow the Municipality to continue to operate at the current location.

Conclusion

Please find attached the Notice of Commencement. This Notice can also be found on our website (www.kresinengineering.ca) and the Municipality of Wawa's website (www.wawa.cc). It was advertised locally in My Algoma, and Algoma News in early September 2016.

Should you or your agency wish to be consulted throughout the Environmental Screening Process for the expansion of the Municipality of Wawa's municipal waste disposal site, please

KRESIN
Engineering Corporation

536 Fourth Line East
Sault Ste. Marie, ON P6A 6J8
tel: 705-949-4900
fax: 705-949-9965
email: info@kresinengineering.ca

sustainable, practical solutions

respond either by email (kristen@kresinengineering.ca) telephone (705-949-4900) or mail. Similarly, please indicate if you have no comments and/or if you would like to be removed from our consultation list.

Thank you in advance for your response to the above, we look forward to working with you throughout this process. If you have any questions or require clarification regarding the contents of this letter, or the undertaking in general, please call.

Yours very truly,
Kresin Engineering Corporation

Kristen Sherlock, B.E.Sc.
EIT
Encl.

14 Sept 2016 let to agencies re initiation.doc

Appendix D
Consultation List

The Corporation of the Municipality of Wawa
Municipal Waste Disposal Site Expansion
ENVIRONMENTAL SCREENING PROCESS
KEC Project Ref. No. 1140.09
Consultation List - Updated August 2021

KRESIN Engineering Corporation

Ministry/Agency	Contact Name	Contact Title	Street Address	City	Province
Ministry of the Environment, Conservation and Parks	Ms. Mira Majerovich	EA Coordinator/Planner (A)		Thunder Bay	ON
Ministry of the Environment, Conservation and Parks	Ms. Lilian Keen	Senior Environmental Officer	70 Foster Drive	Sault Ste. Marie	ON
Ministry of the Environment, Conservation and Parks	Ms. Gillianne Marshall	EA Coordinator/Planner	435 James Street South, Floor 3	Thunder Bay	ON
Ministry of Heritgae, Sport, Tourism and Culture Industries	Ms. Karla Barboza	Team Lead, Heritage	401 Bay Street, Suite 1700	Toronto ON	ON
Ministry of Heritgae, Sport, Tourism and Culture Industries	Mr.Jeff Elkow	Heritage Planner	401 Bay Street, Suite 1700	Toronto ON	ON
Ministry of Northern Development, Mines, Natural Resources and Forestry	Mr. John Hall	Regional Initiatives Coordinator	Willet Green Miller Centre 6th Flr., 933 Ramsey Lake Rd.	Sudbury	ON
Ministry of Northern Development, Mines, Natural Resources and Forestry - Wawa	Mr. Shawn Fortin	Lands and Water Technical Specialist	48 Mission Rd.	Wawa	ON
Ministry of Northern Development, Mines, Natural Resources and Forestry - Northeast Region	Ms. Jill Entwistle		5520 Hwy. 101 E. Postal Bag 3020	South Porcupine	ON
Algoma Public Health	Mr. Jon Bouma	Manager, Environmental Health and Communicable Disease Control	18 Ganley St.	Wawa	ON
Algoma Public Health	Mr. Chris Spooney	District Manager for Wawa	18 Ganley St.	Wawa	ON
Métis Nation of Ontario	Mr. Jesse Fieldwebster	Consultation Assessment Coordinator	355 Cranston Crescent PO Box 4	Midland	ON
Michipicoten First Nation	Chief Patricia Tangie	Chief	PO Box 1, Site 8, RR#1	Wawa	ON
Batchewana First Nation	Chief Dean Sayers	Chief	236 Frontenac Street	Sault Ste. Marie	ON
Garden River First Nation	Chief Andy Rickard	Chief	7 Shingwauk Street, RR 4	Garden River	ON
Red Sky Metis Independent Nation	Dean Whellan	Community Consultation, GIS Specialist	406 East Victoria Avenue	Thunder Bay	ON
Missanabie Cree First Nation	Chief Jason Gauthier	Chief	174B, Highway 17 East Bell's Point	Garden River	ON
Evolugen by Brookfield Renewable	Ms. Kelly Withers	License and Compliance Manager	243 Industrial Park Crescent	Sault Ste. Marie	ON
Algoma Power Inc.	Mr. Michael Degilio	Distribution Engineer	2 Sackville Road, Suite A	Sault Ste. Marie	ON
Hydro One	To Whom It May Concern		2 Sackville Road, Suite B	Sault Ste. Marie	ON
Public Contact	Mr. Chris Mortimer			Wawa	ON
Municipality of Wawa	Mr. Dan Beach	Director of Infrastructure Services	40 Broadway Avenue	Wawa	ON

Appendix E
July 2017 Open House Materials

Invitation to Public Open House
Environmental Screening Process

Wawa Waste Disposal Site Capacity Expansion
The Corporation of the Municipality of Wawa

The Municipality of Wawa has initiated the Environmental Screening Process for Waste Management Projects under the *Environmental Assessment Act* to identify the preferred method to provide additional domestic non-hazardous waste disposal capacity.

This study will be carried out in accordance with the requirements of the *Environmental Assessment Act*. Since publishing the Notice of Commencement in September 2016, the Municipality has been working toward completion of the Screening steps, prescribed under the *Environmental Assessment Act,* and is conducting the first of several consultations with those interested and affected.

The project web site, which includes a document repository, may be viewed at: www.kresinengineering.ca

Public Open House

A public open house will be held at the Michipicoten Memorial Community Centre on July 26, 2017 from 3:30pm to 6:00pm. All are welcome and encouraged to attend.

For further information or if you have any questions regarding the proposed study please contact:

Chris Kresin, P.Eng.
Kresin Engineering Corporation
536 Fourth Line East
Sault Ste. Marie, ON, P6A 5K8
info@kresinengineering.ca

1140.09

ATTENDANCE RECORD
PUBLIC OPEN HOUSE – ENVIRONMENTAL SCREENING

Project Name: Municipality of Wawa – Waste Disposal Site Expansion
Meeting Description: Review Steps 1 to 4 of the ESP **Location:** Community Centre

Date: July 26, 2017
Time: 3:30 pm to 6:00 pm

NAME (please print)	ADDRESS	TELEPHONE
Shawn [redacted]	96 Broadway ave, wawa	705-[redacted]
NANCY [redacted]	127 BROADWAY AVE WAWA	[redacted]
BARB [redacted]	62 MAGPIE RD WAWA	[redacted]
Lynn [redacted]	8 Superior Ave Wawa	[redacted]
Deb [redacted]		
David [redacted]	13 Carroll Ave Wawa	[redacted]
Mark [redacted]	20 Queen St. Wawa	[redacted]
Daniel [redacted]	96 Broadway Ave., Wawa	705 [redacted]

Date:_____

Municipality of Wawa Waste Disposal Site
Environmental Screening – Waste Disposal Site Expansion

PUBLIC OPEN HOUSE
COMMENT SHEET

I/We have reviewed the project material and have the following comments:

_____

_____

_____

_____

_____

_____

_____

_____

_____

Thank you for your comment(s). Please complete the following if you would like to be contacted for clarification, or if you wish to be added to the project Mailing List.

_____ _____
Name (print) Address

_____ _____
Phone No. Email Address

Please leave the completed form with a representative of the Municipality or the Consultant or deliver or mail to:

Kresin Engineering Corporation
536 Fourth Line East
Sault Ste. Marie, Ontario
P6A 6J8
info@kresinengineering.ca

PUBLIC OPEN HOUSE INFORMATION SESSION

WEDNESDAY, JULY 26, 2017
FROM 3:30pm TO 6:00pm

ENVIRONMENTAL SCREENING PROCESS

TO SUPPORT THE

EXPANSION OF THE MUNICIPAL WASTE DISPOSAL SITE

BACKGROUND

1. The Municipality's waste disposal site located on High Falls Road has been actively receiving waste since 1980 and currently operates under Ministry of the Environment and Climate Change (MOECC) Environmental Compliance Approval (ECA) Number A7266501, dated November 2, 2005.

2. Located within a Municipality-owned parcel of property, the site is approved to accept solid municipal waste within a fill area of 2.6 hectares.

3. Considering the site volume identified in the current ECA, it is expected that the remaining approved capacity will be filled by the year 2021.

4. Following consultation with MOECC, the Municipality has initiated the Screening Process under the Province's Environmental Assessment (EA) Act to investigate the preferred method to expand site capacity.

PURPOSE OF THE PROPOSED UNDERTAKING

The purpose of the proposed undertaking is to address the Municipality's solid municipal waste disposal requirements by expanding the capacity of the existing waste disposal site.

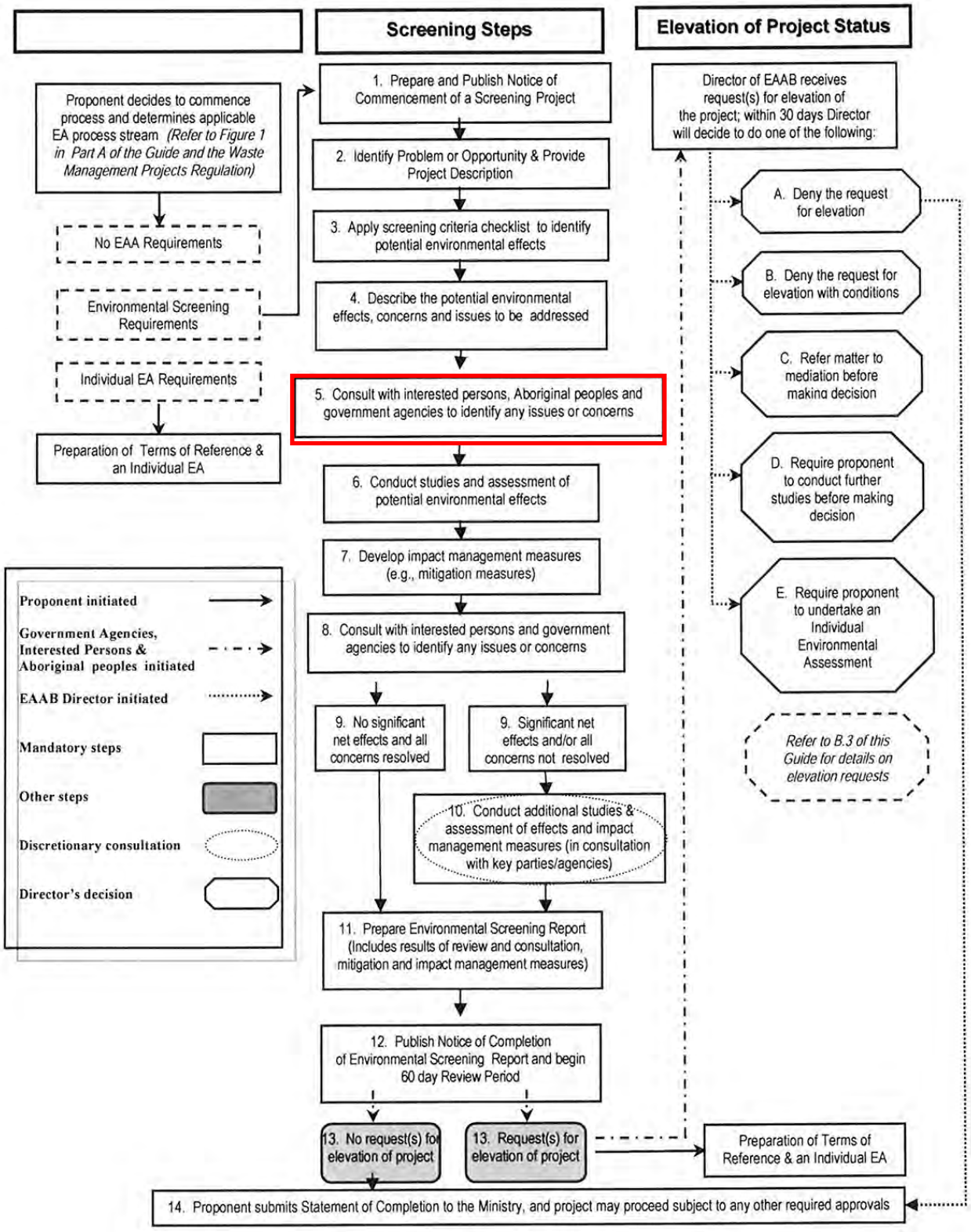
DESCRIPTION OF THE PROPOSED UNDERTAKING

1. The undertaking being considered is the expansion of the waste disposal site capacity by 100,000 cubic metres.
2. The proposed undertaking is exempt from Schedule II of the EA Act (Individual Environmental Assessment); however, the Municipality must first complete the Environmental Screening Process as described under Ontario Regulation (O.Reg.) 101/07 (*Waste Management* Projects).
3. The undertaking will consider the solid municipal waste generated within the Municipality's service area.

ENVIRONMENTAL SCREENING PROCESS

1. The Environmental Screening Process is a proponent driven self-assessment process.
2. The Process is directed at small, rural waste disposal sites (≤ 100,000 cubic metres).
3. The Process assesses how the environment will be directly or indirectly affected by the project and what actions, if any, are required to prevent or mitigate these impacts.
4. Reasonable and practical mitigation measures will be considered to avoid or reduce impacts from the project.

ENVIRONMENTAL SCREENING PROCESS



STEP 1: NOTICE OF COMMENCEMENT

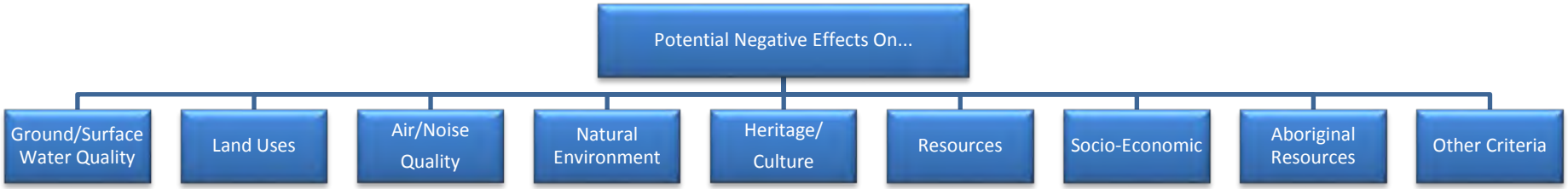
The Notice of Commencement was published in September 2016 on several local web sites and was forwarded by mail and email to Government Review Team members and other interested parties.

STEP 2: IDENTIFY AND DESCRIBE THE PROBLEM

The problem being address is the need for additional waste disposal capacity to service the Municipality of Wawa. It has been estimated that the existing approved capacity at the waste disposal site will be filled by the year 2021.

STEP 3: SCREENING CRITERIA CHECKLIST

The Environmental Screening Criteria checklist considers criteria in the following groups (defined by MOECCC):



STEP 3: SCREENING CRITERIA CHECKLIST

1. An initial screening of alternatives to the undertaking was completed to determine whether or not the alternatives considered address the stated purpose and are within the Municipality's ability to implement.

2. The alternatives considered were:

    1. Do Nothing;
    2. Construct and operate a thermal destruction facility;
    3. Export waste outside the Municipality;
    4. Establish a new waste disposal site; and
    5. Expand the existing waste disposal site.

3. From the initial screening exercise, it was determined that Alternative 5 – expand the existing waste disposal site is the preferred alternative to the undertaking.

4. The MOECC Environmental Screening Criteria Checklist was subsequently applied to Alternative 5 to identify the potential for negative environmental effects and, thus, the potential need for mitigating measures.

STEP 3: INITIAL SCREENING OF ALTERNATIVES

Table 1: Initial Screening of Alternatives to the Undertaking

Screening Criteria	Alternative				
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1. Does the alternative provide a viable solution to the need?	NO	NO	YES	YES	YES
2. Does the alternative use proven technologies?	YES	YES	YES	YES	YES
3. Is the alternative technically feasible?	YES	YES	YES	YES	YES
4. Is the alternative consistent with the Official Plan?	YES	NO	YES	NO	YES
5. Is the alternative consistent with provincial government priority initiatives such as waste diversion, energy efficiencies, source water protection, and reduction of greenhouse gases?	YES	YES	YES	YES	YES
6. Will the alternative protect sensitive environmental features?	YES	YES	UNCERTAIN	YES	YES
7. Is the alternative practical, financially realistic and economically viable?	NO	NO	NO	NO	YES
8. Is the alternative within the ability of the proponent to implement?	YES	POSSIBLY	YES	YES	YES
9. Can the alternative be implemented within the defined study area?	YES	NO	NO	YES	YES
10. Can the alternative be implemented within the Municipality's time frame needed for more disposal capacity?	YES	NO	NO	NO	NO
11. Is the alternative appropriate to the proponent doing the study?	NO	NO	NO	YES	YES
12. Is the alternative able to meet the purpose of the EAA?	YES	YES	YES	YES	YES
13. Is the alternative compatible with the precautionary approach to decision making in the MOE's Statement of Environmental Values?	YES	YES	YES	YES	YES
NUMBER OF "NO'S"	**3**	**6.5**	**5.5**	**3**	**1**

STEP 4: POTENTIAL ENVIRONMENTAL IMPACTS

- Application of the Environmental Screening Criteria Checklist identified the following potential environmental impacts (i.e. these are issues potentially requiring mitigation):

Surface/Groundwater Quality	Air/Noise Quality	Natural Environment
• Surface water quality may be impacted • Leachate may negatively affect groundwater quality	• Natural biodegradation of organic material at waste disposal site may produce landfill gas • Emissions of dust due to unpaved access road • Possible negative noise effects due to landfilling operations • Light pollution from public vehicles as well as operation/maintenance vehicles	• Expansion of site may potentially increase the number of birds attracted to the site, potentially creating a hazard

Socio-Economic	Heritage and Culture	Other Criteria
• As an aerodrome is located within 8 kilometres of the waste disposal site, a possible bird hazard relating to flight paths may exist	• As the site is within 300m of surface water a Stage 1 archaeological assessment is required.	• Clean wood waste requiring disposal will be produced during clearing for the proposed expansion

NEXT STEPS IN THE PROCESS

1. The purpose of this Open House is to introduce the project and Environmental Screening Process to the residents of the Municipality of Wawa and provide the opportunity for early input into the process.

2. Considering feed-back from this Open House, Government Ministries and Indigenous communities, an assessment of the potential environmental effects related to the project will be conducted and mitigation measures will be developed (if/as required).

3. A second Open House will be held to identify any issues or concerns relating to the assessment of anticipated environmental effects and to discuss recommended mitigation measures.

4. Comments will be incorporated into an Environmental Screening Report that will include the results of review and consultation activities as well as mitigation and impact management measures.

5. Following its completion, the Environmental Screening Report will be available for review and comment by interested Government Ministries, Indigenous communities and members of the public for a period of 60 days prior to implementing the project.

Appendix F
Screening Alternatives

Table A Screening Assessment of Alternatives to the Undertaking

Screening Criteria	Alternative 1 – Do Nothing	Alternative 2 – Thermal Processing Facility	Alternative 3 – Export Wastes	Alternative 4 – Establish a New Landfill	Alternative 5 – Expand Existing Site
1. Does the alternative provide a viable solution to the need?	No. The Municipality would have no disposal capacity within its boundaries.	No. Capacity would still be needed to dispose of residual wastes.	Yes.	Yes.	Yes.
2. Does the alternative use proven technologies?	Yes.	Yes. Few Ontario approvals.	Yes.	Yes.	Yes.
3. Is the alternative technically feasible?	Yes.	Yes.	Yes.	Yes.	Yes.
4. Is the alternative consistent with the Official Plan?	Yes.	No. Approval under the Planning Act and amendment to the Official Plan required.	Yes.	No. Approval under the Planning Act and amendment to the Official Plan required.	Yes.
5. Is the alternative consistent with provincial government priority initiatives such as waste diversion, energy efficiencies, source water protection, and reduction of greenhouse gases?	Yes. To the extent feasible at a small site.	Yes.	No.	Yes. To the extent feasible at a small site.	Yes. To the extent feasible at a small site.
6. Will the alternative protect sensitive environmental features?	Yes. Mitigating techniques required.	Yes. Mitigating techniques required.	Uncertain.	Yes. Mitigating techniques required.	Yes. Mitigating techniques required.
7. Is the alternative practical, financially realistic and economically viable?	No. Would increase cost to Municipal tax payers and other users.	No. Approvals, construction and operation of a thermal processing facility would be costly in comparison to other alternatives.	No. Would increase cost to Municipal tax payers and other users.	No. Approvals, construction and operation of a new landfill would be costly in comparison to other alternatives (except for alternative 5).	Yes.

Table A Screening Assessment of Alternatives to the Undertaking

Screening Criteria	Alternative 1 – Do Nothing	Alternative 2 – Thermal Processing Facility	Alternative 3 – Export Wastes	Alternative 4 – Establish a New Landfill	Alternative 5 – Expand Existing Site
8. Is the alternative within the ability of the proponent to implement?	Yes.	Possibly. Training of staff to operate and maintain or hiring outside expertise is required.	Yes.	Yes.	Yes.
9. Can the alternative be implemented within the defined study area?	Yes.	No. A method to accommodate residual waste is required.	No. Exporting wastes would require a disposal site/option beyond the study area.	Yes. It may be possible to find a suitable site within the study area.	Yes. Site expansion may occur to the north of the existing site.
10. Can the alternative be implemented within the Municipality's time frame needed for more disposal capacity?	Yes.	No.	No. It is unclear where exported waste would be disposed of. It may take several months for site selection and assessments to grant approval to export municipal waste.	No. Site selection, approval, and construction would require an extended timeframe.	No.
11. Is the alternative appropriate to the proponent doing the study?	No.	No.	No.	Yes.	Yes.
12. Is the alternative able to meet the purpose of the EAA?	Yes.	Yes.	Yes.	Yes.	Yes.
13. Is the alternative compatible with the precautionary approach to decision making in the MOE's Statement of Environmental Values?	Yes.	Yes.	Yes.	Yes.	Yes.
NUMBER OF "NO'S"	**3**	**6.5**	**5.5**	**3**	**1**

NOTES: 1. "Possibly" and "Uncertain" received "NO" scores of 0.5.
2. The alternative(s) with the lowest score(s) is preferred.

THE MUNICIPALITY OF WAWA

WASTE DISPOSAL SITE EXPANSION

ALTERNATIVE 1: DO NOTHING

- The 'do nothing' alternative would mean that the current waste disposal site would close and there would be no waste disposal capacity available within the Municipality.

- A closure plan for the existing waste disposal site would need to be prepared and approved by the MOE and then the Municipality would close the waste disposal site according to the approved plan.

- The Municipality would continue to care for the Site (e.g., monitoring, leachate collection and treatment) on an ongoing basis. This includes remedial measures over the contaminating life span of the closed site.

- The Municipality would be without a means of waste disposal.

THE MUNICIPALITY OF WAWA
WASTE DISPOSAL SITE EXPANSION

ALTERNATIVE 2: THERMAL DESTRUCTION

- Thermal destruction of wastes to achieve a reduction in the volume prior to disposal in a residual wastes disposal site.
- Available technologies include incineration, pyrolysis, gasification, refuse-derived fuel, plasma gasification and depolymerisation. Some technologies, such as incineration, are proven at full scale while others such as plasma gasification or pyrolysis are in the demonstration phase.
- Considerable uncertainty and expense is expected in the approvals process for this alternatve, which is expected to take a number of years.
- A thermal destruction facility requires a long operational life to justify the investment.
- Waste disposal capacity is still required to dispose of residual wastes.
- The cost for approval, construction and operation of a thermal destruction facility is expected to be significantly greater than other alternatives.

THE MUNICIPALITY OF WAWA

WASTE DISPOSAL SITE EXPANSION

ALTERNATIVE 3: EXPORT WASTE

- One or more transfer stations would be established within the Municipal boundaries.

- Waste received and processed at these facilities would have to be exported to waste disposal sites or waste management facilities beyond the Municipal boundaries. This would result in increased disposal costs to the Municipality and its residents.

- A location(s) must be identified to accept waste generated within the Municipality. This requires MOE approvals and C of A amendments prior to acceptance of wastes.

- The Municipality would continue to care for the existing site (e.g., monitoring, leachate collection and treatment) on an ongoing basis.

- If off-site contamination occurs at the existing site it would become non-compliant with MOE requirements and the Municipality would need to implement remedial measures to bring the site into compliance (despite it being closed).

THE MUNICIPALITY OF WAWA

WASTE DISPOSAL SITE EXPANSION

ALTERNATIVE 4: ESTABLISH NEW WASTE DISPOSAL SITE

- Under this scenario the Municipality would initiate EA and other approval processes to locate, construct and operate a new (greenfield) site.

- These approval processes would involve assessment of alternative technologies and alternative sites in addition to other factors.

- If approvals were to be obtained and a new waste disposal site was to be constructed, the Municipality would be able to meet its disposal needs.

- It is doubtful that a new waste disposal site could be approved and operational to satisfy the Municipality's immediate need for waste disposal capacity.

- The cost for approval, construction and operation of a new facility would be significant. Less than Alternative 2 but greater than the other alternatives.

THE MUNICIPALITY OF WAWA

WASTE DISPOSAL SITE EXPANSION

ALTERNATIVE 5: EXPAND EXISTING WASTE DISPOSAL SITE

- In 1979, the existing site was identified as the preferred location following an evaluation of the merits and detractors associated with 6 alternative sites, including the then existing site.

- Preliminary assessment suggests that an additional capacity of 150,000m^3 could be provided by expanding the existing site, estimated to provide 25 years of service.

- The potential expansion of the site is constrained to the east and possibly south by groundwater divides and to the west by proximity to the Michipicoten River.

- For this screening assessment, it was assumed that expansion would occur in an area north of the existing disposal area.

- As part of the expansion, improvements may be required at the existing site to meet regulatory requirements.

Appendix G
Alternative Location Screening

MUNICIPALITY OF WAWA
TECHNICAL MEMORANDUM

SCREENING REVIEW:
POTENTIAL LOCATIONS FOR A NEW WASTE DISPOSAL SITE

February 2016
KEC Ref: 1140.01

Prepared by:

KRESIN
Engineering Corporation

1.0 IDENTIFICATION OF POTENTIAL SITE LOCATIONS

The Municipality of Wawa requires additional waste disposal capacity to continue to serve its residents, the residents of Hawk Junction and other users (eg. Lake Superior Provincial Park). Previous screening of alternative approaches to provide this additional capacity identified expansion of the current waste disposal site as being preferred. This preference has been vetted with the public at Open House sessions and has been accepted by Council by way of Resolution (No. RC15220 dated August 11, 2015).

During review of the Environmental Assessment Terms of Reference, the Ministry of the Environment and Climate Change requested that additional rationale be provided to support expansion of the current site over establishing a green field site. This memo describes the results of a screening exercise implemented to identify potential locations for a new (green field) waste disposal site (WDS) to service the Municipality of Wawa.

1.1 Screening Criteria

Criteria applied to identify suitable locations take into consideration: accessibility/transportation; various environmental considerations; terrain and area geology. The following WDS screening criteria were identified:

1. 200m buffers around lakes, streams, rivers, wetland areas;
2. 500m buffers around built up areas of the community, parks, and conservation areas;
3. 50m buffers from roadways;
4. Consideration of primary and secondary bird hazard zones (municipal airport);
5. Terrain should be relatively flat; and,
6. Geology (eg. soil type and expected conditions) should be appropriate for WDS development and operation.

1.1.1 Screening Boundaries

A key consideration when identifying potential site locations is proximity to where the majority of waste is being produced. This waste centroid concept resulted in screening out lands beyond an eight kilometer radius from the centre of the built-up community. An eight kilometer radius was established as this includes the existing site, which is felt to be an acceptable haul distance from the built-up community.

Transport Canada guidelines establish a Primary and Secondary Bird Hazard Zones. Under these guidelines, municipal waste disposal sites that accept putrescible waste, are not to be established within either the Primary or Secondary Bird Hazard Zones. However, considering that the existing site is located within the Secondary Bird Hazard Zone, potential sites located within this zone were included for further consideration during this screening exercise.

Finally, a 2 kilometre buffer was applied to the boundary of the Michipicoten First Nation lands.

Figure 1 depicts the screening boundaries established for the screening exercise and the resulting search areas.

Once the search areas were established, the buffers identified in Section 1.1 were applied, as depicted on **Figure 2** (buffer areas are outlined in light blue). Figure 2 was then overlain with the "*Ontario Geological Survey Data Base Map*" (**Figure 3**) to identify areas with morainal and/or glaciofacluvial landforms (represented as green and yellow areas). These geological landforms are preferred because of their tendency to contain favourable granular materials for WDS development and operation. Other landforms such as organic and bedrock were excluded as being unsatisfactory for a WDS.

1.2 Area Required for New WDS

Considering a WDS design recently completed by KEC, it is anticipated that a new WDS to service Wawa would require a land area in the range of 40 hectares to provide 40 years of service. To provide 20 years of service, a site approximately 25 hectares in size would be required.

Locations providing a minimum land area of 25 hectares must also be appropriately shaped to provide a fill area, buffer area and contaminant attenuation zone hydrogeologically downgradient from the fill area. Considering this, a site should be shaped to accommodate a rectangle roughly 500m by 800m. The actual area and shape is, ultimately, developed considering location specific characteristics.

1.3 Review of Potential Site Locations

The five (5) potential WDS locations identified on **Figure 4** "*Potential Site Locations*" are situated beyond the established buffers, within the 8km search radius and in areas with morainal and/or glaciofacluvial landforms.

1.3.1 Land Use Conflicts

The next step in review of the five (5) potential locations was to overlay the locations on satellite imagery to identify any potential land use conflicts. In relation to this consideration, location 3, which is located adjacent to the Highway 17 right-of-way and a parcel of private property, was identified as being less suitable.

1.3.2 Summary

Table 1 presents a summary of the potential locations depicted on Figure 4 as well as comments concerning each location.

Table 1: Summary of Potential WDS Locations

Location No.	Distance from Centroid (km)	Available Area (ha)	Comments
1	7.3	34	• Currently no access to the location. • Remote, would expand the municipal road network beyond what which would be reasonably capable of maintaining.
2	5.0	47	• Accessible via private road only that would require upgrading to municipal standards. • Remote, would expand the municipal road network beyond what which would be reasonably capable of maintaining.

Table 1: Summary of Potential WDS Locations			
Location No.	**Distance from Centroid (km)**	**Available Area (ha)**	**Comments**
3	3.1	69	• Located immediately adjacent to and upgradient from Highway 17. • A parcel of private property lies within this location. • Considering topography, there may be a groundwater divide within this location.
4	3.7	36	• Considering topography, site may be bisected by a groundwater divide. • Watercourse along westerly boundary, Trembley Flats Road along east boundary.
5	7.3	104	• Located upgradient from Michipicoten River. • Considering topography a groundwater divide likely lies within this location. • Access road in-place. • Monitoring wells in-place. • Current WDS lies within this location. • Apparent available expansion area to the north and east of the current WDS

1.4 Preferred Location

Locations that would require the construction and/or upgrading of roadways (locations 1 and 2) thereby expanding the municipal road network are not desirable. Location 3 is located such that the associated leachate plume migration pathway would intersect Highway 17, private property and/or the Magpie River, which is also not desirable. The likely existence of a groundwater divide bisecting location 4, results in at least 2 parcels of property of inadequate land area to effectively manage (attenuate) leachate produced.

Although challenges exist with respect to proximity to the Michipicoten River, as a result of the screening exercise conducted, location 5 is identified as being the preferred location for development of new disposal capacity. This confirms previously conducted screening, which has been vetted at Open House sessions held in the Municipality of Wawa and accepted by Council in the form of a Resolution.

1.5 Next Steps

During completion of the Environmental Assessment required to expand the current site, location-specific information will be collected to further assess the preferred location, to confirm its acceptability and to identify development specific requirements. This may include site visits, surveys, the completion of a hydrogeological assessment, and/or discussion with the MNR and MOECC, etc.

Respectfully Submitted by:
Kresin Engineering Corporation

Chris Kresin, M.Sc(Eng.), P.Eng.
Consulting Engineer

BOUNDARIES AND BUFFERS IDENTIFIED:

1. MUNICIPAL BOUNDARY
2. FIRST NATION BUFFER
3. AIRPORT: BIRD HAZARD ZONES
4. 8km CENTROID

SEARCH AREAS

KRESIN Engineering Corporation

DESIGN	
DRAWN	K.Sherlock JAN 2016
CHECKED	
PROJECT	1140.01
FILENAME	1140 screening.dwg
SCALE	1:200,000

DISPOSAL SITE EXPANSION
MUNICIPALITY OF WAWA

SCREENING: BOUNDARIES

Fig. 1

Rev 0

LEGEND

- LAKE, STREAM, WETLAND
- 200m BUFFER FROM WATER
- 500m COMMUNITY BUFFER
- 50m ROADWAY BUFFER
- WOODLANDS
- MUNICIPAL BOUNDARY

KRESIN Engineering Corporation

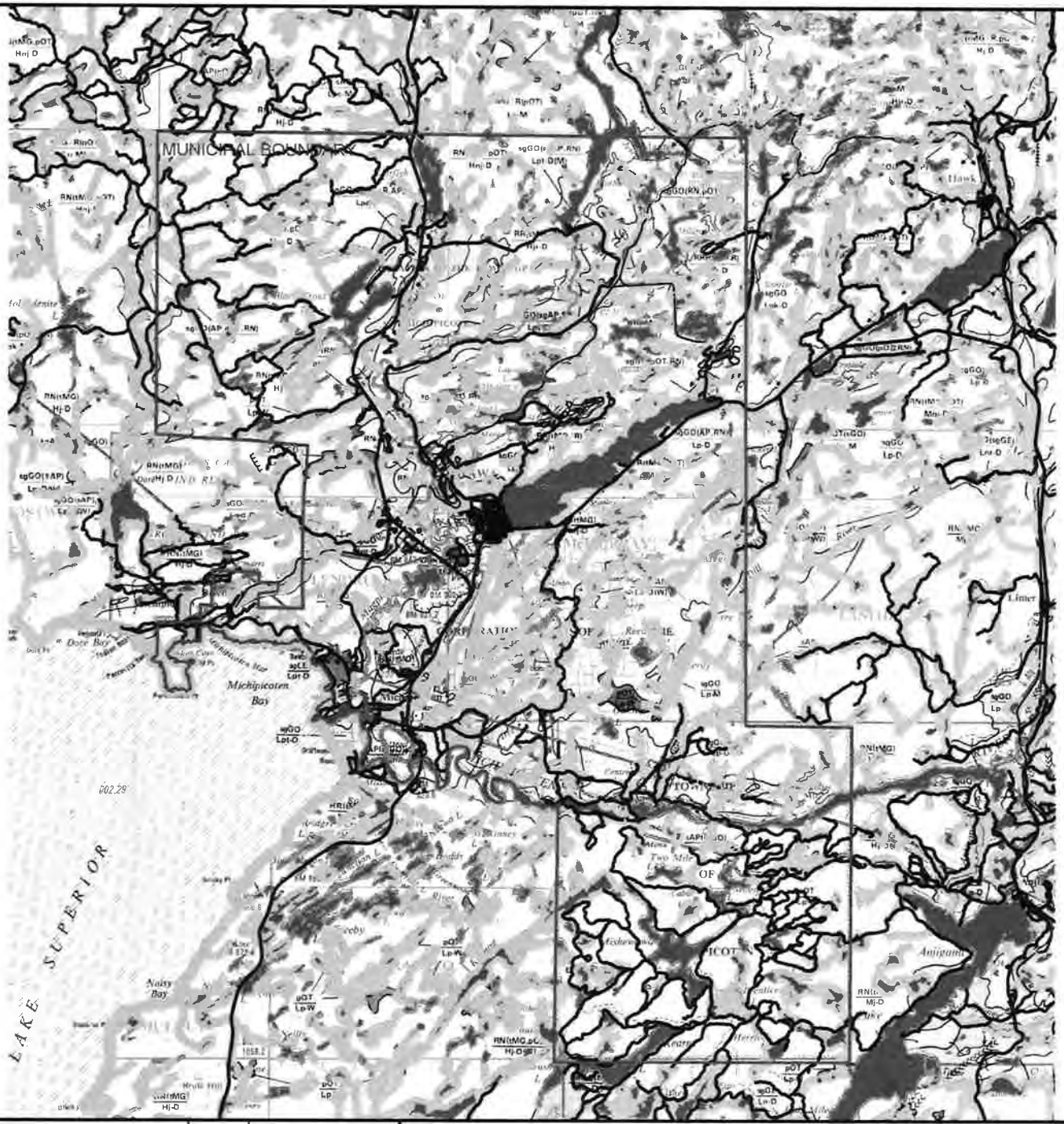
DESIGN	
DRAWN	K.Sherlock Jan 2016
CHECKED	
PROJECT	1140.01
FILENAME	1140 screening.dwg
SCALE	1:200,000

DISPOSAL SITE EXPANSION
MUNICIPALITY OF WAWA

SCREENING - BUFFERS

Fig 2

Rev 0



KRESIN Engineering Corporation

DESIGN	
DRAWN	K.Sherlock Jan 2016
CHECKED	
PROJECT	1140 01
FILENAME	1140 screening dwg
SCALE	1:200,000

DISPOSAL SITE EXPANSION
MUNICIPALITY OF WAWA

SCREENING - DATA BASE MAP

Fig 3

Rev 0

POTENTIAL WDS LOCATIONS

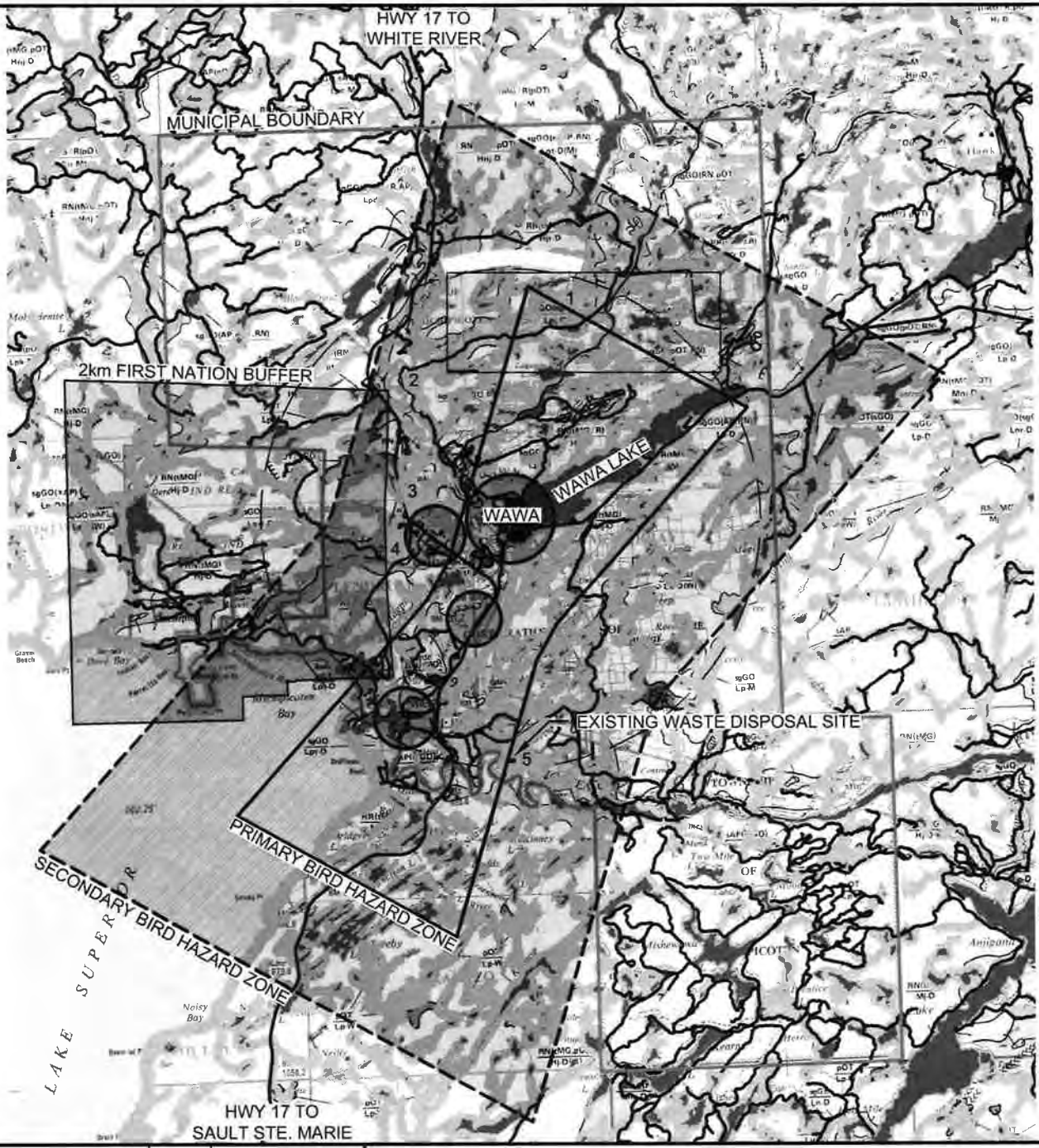
1 - 34.4 ha

2 - 46.7 ha

3 - 68.6 ha

4 - 35.7 ha

5 - 104.4 ha



LEGEND

- LAKE, STREAM, WETLAND
- 200m BUFFER FROM WATER
- 500m BUFFER OUTSIDE A COMMUNITY
- 50m ROADWAY BUFFER
- WOODLANDS
- POTENTIAL WDS LOCATIONS

KRESIN Engineering Corporation

DESIGN	
DRAWN	K.Sherlock Jan 2016
CHECKED	
PROJECT	1140.01
FILENAME	1140 screening dwg
SCALE	1:200,000

DISPOSAL SITE EXPANSION
MUNICIPALITY OF WAWA

SCREENING SUMMARY

Fig 4

Rev 0

Appendix H
Ground and Surface Water Assessment Report

Ryan Wilson

Subject: RE: Wawa WDS Expansion EA Hydrogeology Review

From: Majerovich, Mira (MECP) [mailto:Mira.Majerovich@ontario.ca]
Sent: Wednesday, April 14, 2021 3:49 PM
To: Chris Kresin <Chris@kresinengineering.ca>
Subject: Wawa WDS Expansion EA Hydrogeology Review

Good afternoon Chris—

First off, I want to thank you again for your patience with receiving this response, the second, from our technical support group (surface water comments were forwarded earlier in the year and are attached again here for your information). In the interest of time, I have forwarded along our hydrogeologist's comments in this email. If you prefer to have these on letterhead, please let me know.

MECP examined the hydrogeological aspects of the following documents, entitled:

·Item 1: "RE: Municipality of Wawa, Michipicoten Landfill Site Groundwater and Surface Water Assessment Report – response to review comments." Memorandum from Scott Parker (MECP) to Mira Majerovich (MECP) 22 October 2019.

· Item 2: "RE: Municipality of Wawa, Michipicoten WDS Expansion Environmental Screening Process" Memorandum from Archana Uprety (MECP) to Mira Majerovich (MECP) 28 October 2019.

· Item 3: "Re: Municipality of Wawa, Michipicoten Landfill Site, Groundwater and Surface Water Assessment Report" Kresin Engineering Corporation, 30 January 2020.

· Item 4 "Drawing A: The Corporation of The Municipality of Wawa, GW And SW Assessment Report, Interpreted Groundwater Contours" Kresin Engineering Corporation, 30 January 2020.

· Item 5: "Re: Municipality of Wawa, Michipicoten Landfill Site, Groundwater and Surface Water Assessment Report" Kresin Engineering Corporation, 4 August 2020.

The reviewer's site knowledge is further informed by a document previously reviewed by A. Uprety entitled:

· Item 6: "Summaries of Historical Analytical Results", Appendix B of "Municipality of Wawa, Michipicoten Landfill Site, Groundwater and Surface Water Assessment Report" Kresin Engineering Corporation, 23 April 2019.

The reviewer had no previous involvment with this site and the ongoing EA process. Based upon the provided information, the reviewer submits the following comments for your consideration.

1. The reviewer has not identified hydrogeological reasons that might disqualify the described site expansion from further consideration.

2. There is negligible potential for domestic water well impacts. Groundwater will ultimately discharge to the Michipicoten River, which surrounds the fill area on three sides. Figure A of Item 5 depicts the existence of a Contaminant Attenuation Zone (CAZ) extending to the river to the west of the existing fill area.

3. The site owners propose expanding the CAZ to the river on the south and west of the existing and proposed fill areas. Figure 7 of Item 5 depicts the proposed extent of the expanded CAZ.

4. Substantiated legal care and control of the proposed CAZ lands should be established as a pre-condition prior to any waste disposal within a proposed expansion area.

5. Once the site owners' legal care and control of the proposed CAZ to the river boundary becomes an established fact, there is a high probability that this will prevent leachate impacts to groundwater on adjacent properties. This would satisfy the intent of Reasonable Use Guideline B-7 indefinitely. This is satisfactory.

6. No permanent structures appear to exist within a kilometer of the fill area. Passive methane management is likely to be effective.

7. Under Reasonable Use Guideline B-7, the reasonable use of groundwater is determined on a case-by-case basis. Once the CAZ extends to the Michipicoten River, the highest reasonable use of groundwater within the CAZ is unlikely to be human consumption. There is no obvious rationale for development of reasonable use criteria based upon the Ontario Drinking Water Standards / Objectives.

8. The next highest reasonable use of groundwater will be baseflow recharge to the Michipicoten River. Groundwater quality should be compared to criteria for the protection of the natural functions of the river (i.e. PWQO's, CWQS's, etc.). The Hydrogeologist will defer to the opinions of the Regional Surface Water Scientist on which criteria are most appropriate.

9. The proposed size of the fill area exceeds 40,000 m3. Ontario Regulation 232/98 applies. During an approval pre-submission process the proponents will be required to develop a detailed site Design and Operations plan that complies with the Regulation.

10. The Design and Operations Plan should include a groundwater monitoring and reporting program consistent with (but not limited to) the MECP Technical Guidance Document entitled, "Monitoring and Reporting for Waste Disposal Sites, Groundwater and Surface Water" (Ministry of the Environment Operations Division, November 2010).

11. Figures A and 7 of Item 5 clearly infer that groundwater will flow west, southwest and south from the proposed "Alternative Two" landfill expansion area toward the Michipicoten River. The groundwater reviewer notes that no groundwater quality monitoring infrastructure exists in these downgradient flow directions. The Design and Operations (D & O) plan must address this.

12. The D & O plan will need to include an effective contingency plan and trigger mechanism to prevent impacts to the Michipicoten River. Typical contingency actions for naturally attenuating waste disposal sites include CAZ expansion, engineered leachate controls, or site cover and closure. In this case, further CAZ expansion appears unlikely. The contingency plan concepts should therefore focus upon engineered leachate controls, early site closure, or both.

Statement of Limitations

The purpose of the preceding review is to provide advice to the Ministry of the Environment, Conservation and Parks regarding subsurface conditions based on a review of the information provided in the above-referenced documents. The conclusions, opinions and recommendations of the reviewer are based on information provided by others, except where otherwise noted.

The Ministry cannot guarantee that the information that is provided by others is accurate or complete. A lack of specific comment by the reviewer is not to be construed as endorsing the content or views expressed in the reviewed material.

Please let me know if you want to discuss these comments further.

Thank you,

Mira Majerovich
A/ Environmental Assessment Coordinator/Resource Planner
Project Review Unit | Environmental Assessment Branch | MECP
☎ 807.707.5052 | ✉ **Mira.Majerovich@ontario.ca** |

Ryan Wilson

From: Majerovich, Mira (MECP) <Mira.Majerovich@ontario.ca>
Sent: September 25, 2020 3:22 PM
To: Chris Kresin
Subject: RE: Wawa Landfill Expansion EA

Good afternoon Chris—

Unfortunately our groundwater unit does not have the capacity to review the additional material at this time, and I have not been given a timeline for review comments. I do however have comments from surface water—I was waiting to send one ministry response back to you, but will opt to forward these in this email, and send groundwater when it is completed:

From Surface Water:
I have reviewed the additional information provided in the email for the Wawa WDS proposed expansion. The August 4th, 2020 memorandum states that ground penetrating radar was used to interpret groundwater flow direction at both the existing WDS and proposed expansion area and was correlated with existing boreholes and monitoring wells. The memorandum indicates that there is a groundwater divide coincident with a bedrock high shown on Drawing A (Rev. 1). Considering the direction of interpreted groundwater flow and the shape and orientation of the proposed expansion area, it is predicted that leachate from the existing fill area will not flow into the proposed expansion area (or existing attenuation area).

Based on the calculations provided in the Municipality of Wawa, Michipicoten Landfill Site, Groundwater and Surface Water Assessment Report – Expansion of the Municipal Waste Disposal Site, dated July 27, 2018, the available contaminant attenuation zone (CAZ) area (revised to 27.2 ha in the August 4th memorandum) to the south/southwest of the proposed expansion area (Alternative 2) should provide sufficient attenuation area for the proposed expansion (based on the reports calculation of a required CAZ of 13 ha). However, the Michipicoten River will still limit the size of the available CAZ for the existing site (approximately 6.5 ha) since the proposed expansion does not alter the leachate flow path of the existing site.

I apologize the groundwater piece is missing, but it will be reviewed as soon as our unit can manage. I hope this helps somewhat.

Regards,
Mira

From: Chris Kresin
Sent: September 25, 2020 8:44 AM
To: Majerovich, Mira (MECP)
Subject: RE: Wawa Landfill Expansion EA

Hi Mira,

I'm just following-up your note below.

Does the tech support team have any questions or require additional information?

Thanks,

Chris

Chris Kresin, M.Sc.(Eng.), P.Eng.
Consulting Engineer

Kresin Engineering Corporation - 536 Fourth Line East, Sault Ste. Marie, ON, P6A 6J8 - tel: 705-949-4900, fax: 705-949-9965

From: Majerovich, Mira (MECP) [mailto:Mira.Majerovich@ontario.ca]
Sent: Wednesday, August 05, 2020 8:59 AM
To: Chris Kresin <Chris@kresinengineering.ca>
Cc: 'Cory Stainthorpe' <cstainthorpe@wawa.cc>
Subject: RE: Wawa Landfill Expansion EA

Good morning Chris—

Thanks for the additional information regarding the Wawa expansion project. I will forward this along to the technical support team that reviewed this and will respond once they have provided comment.

Cheers,
Mira

From: Chris Kresin <Chris@kresinengineering.ca>
Sent: August 4, 2020 8:26 AM
To: Majerovich, Mira (MECP) <Mira.Majerovich@ontario.ca>
Cc: 'Cory Stainthorpe' <cstainthorpe@wawa.cc>
Subject: Wawa Landfill Expansion EA

Hi Mira,

I hope that you are well.

Attached with this email is a letter providing MECP with additional information to assist with the review of the proposed expansion of the Wawa municipal landfill.

We hope that this additional information will be sufficient to support the completion of MECP's review allowing the Municipality to complete the EA screening process and proceed with obtaining the required EPA approvals to allow construction and operation of the expanded site.

If you have any questions or wish to discuss this letter, please let me know.

Thank you,

Chris

Chris Kresin, M.Sc.(Eng.), P.Eng.
Consulting Engineer

Kresin Engineering Corporation - 536 Fourth Line East, Sault Ste. Marie, ON, P6A 6J8 - tel: 705-949-4900, fax: 705-949-9965

KRESIN
Engineering Corporation

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email: info@kresinengineering.ca

sustainable, practical solutions

August 4, 2020
KEC Ref. 1140.11

By Email (Mira.Majerovich@ontario.ca)

Attention: Mira Majerovich, EA Coordinator/Environmental Resource Planner
Ministry of the Environment Conservation and Parks
435 James Street South, Suite 331
Thunder Bay, ON, P7E 6S7

Re: Municipality of Wawa, Michipicoten Landfill Site
Groundwater and Surface Water Assessment Report

Dear Ms. Majerovich,

Following-up to our letter dated January 30, 2020, the purpose of this letter is to provide additional information in response to Ministry of Environment, Conservation and Parks (MECP) groundwater review comments.

In our January 30 letter, we note that the Municipality of Wawa would investigate the bedrock profile using geophysical methods, rather than advancing test holes, to support an interpretation of the direction of groundwater flow.

Geophysical Investigation

In May 2020, Canadian Exploration Services Ltd. (CXS) carried out a ground penetrating radar (GPR) survey at the Wawa landfill site to aid in the interpretation of groundwater flow directions at the existing fill area and proposed expansion area. Results from the GPR survey were presented in a CXS report dated June 2, 2020. Referencing the attached Drawing B, CXS surveyed 3 lines (A-A, B-B, and C-C) the results from which were utilized to produce 3 bedrock profiles. Depths to bedrock were correlated where the GPR survey lines corresponded with boreholes and monitoring wells.

The GPR survey revealed a bedrock high along survey line B-B that is confirmed by observation of a localized bedrock outcropping. This bedrock high generally corresponds with a topographic ridge and surface water divide. Depths to bedrock along survey line A-A range from roughly 6m to 15m and from roughly 20m to 40m along line C-C.

Interpreted Groundwater Flow Direction

Measured depths to groundwater in monitoring wells, coupled with the bedrock profiles developed from the GPR survey, were utilized to interpret groundwater flow direction. This is depicted on Drawing A (Rev. 1), attached, along with the interpreted location and orientation of a groundwater divide, coinciding with the bedrock high.

Proposed Expansion Area

Considering the interpreted direction of groundwater flow, the shape and orientation of the proposed expansion area has been modified from that shown in the Groundwater and Surface Water Assessment Report (Rev. 1, April 23, 2019). These revisions are incorporated into Drawings A (Rev. 1) and B.

Referencing Drawing A (Rev. 1), it is expected that leachate from the existing fill area will not flow into the proposed expansion area. The interpreted direction of groundwater flow also indicates that the arrangement of the CAZ for the originally proposed expansion area (Alternative 2), depicted on Drawing 7 of the Groundwater and Surface Water Assessment Report, would generally coincide with the CAZ for the revised proposed expansion footprint. Drawing 7 has been revised (copy attached) to show the re-oriented Alternative 2 and associated CAZ of 27.2ha.

Closure

We trust that this additional information, coupled with that in our original response on January 30, 2020, will further assist MECP complete their review of the proposed expansion of the Wawa municipal landfill site.

If you have any questions or wish to discuss the contents of this letter, please contact the undersigned.

Yours Very Truly,
Kresin Engineering Corporation

Chris Kresin, M.Sc.(Eng.), P. Eng.
Consulting Engineer

Copy: Cory Stainthorpe, Municipality of Wawa

1140.11 ltr follow up mecp re gw review comments.docx

LEGEND

- INTERPRETED DIRECTION OF GROUNDWATER FLOW
- MW#1 — MONITORING WELL AND NUMBER AND FALL 2019 WATER TABLE ELEVATION
- LIMITS OF CURRENT CAZ
- 190 — GROUNDWATER CONTOUR
- 210 — TOPOGRAPHIC CONTOUR

MICHIPICOTEN RIVER

MICHIPICOTEN RIVER

200
210
220
230
240
250

189
189
190
190.5
192
195
199

MW#2
189.102

MW#1
189.979

MW#4
192.661

MW#7
190.459

MW#5
190.495

MW#8
199.539

MW#3
199.490

MW#9
216.996

MW#10
220.950

LOCATION OF SUSPECTED GW DIVIDE

PROPOSED LANDFILL EXPANSION

TO MICHIPICOTEN RIVER

BUSH ROAD

METAL PILE

ACCESS ROAD

ATTENDANT'S SHELTER

WOOD PILE

GPR PATH (TYP.)

REFUSAL @ 23.77m
(205.23m)

REFUSAL @ 21.18m
(207.82m)

EXISTING 2.6ha DISPOSAL AREA

LIMITS OF MUNICIPAL PROPERTY

N16°01'25"E

304.918

0 50 100 Meters

KRESIN Engineering Corporation
Sault Ste. Marie, Ontario
(705) 949-4900

NOTES

REV. 1 REVISED CONSIDERING LOCATION OF SUSPECTED GW DIVIDE FROM GPR SURVEY

DESIGN	KEC	
DRAWN	KSHERLOCK	31 JULY 2020
CHECKED	C.KRESIN	31 JULY 2020
PROJECT	1140.11	
FILENAME	1140.11 DRAWING A.DWG	
SCALE	AS SHOWN	

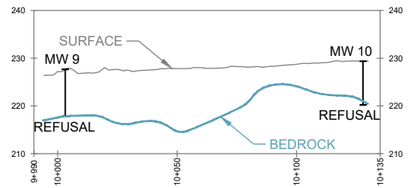
THE CORPORATION OF THE MUNICIPALITY OF WAWA
GW AND SW ASSESSMENT REPORT
INTERPRETED GROUNDWATER CONTOURS

A

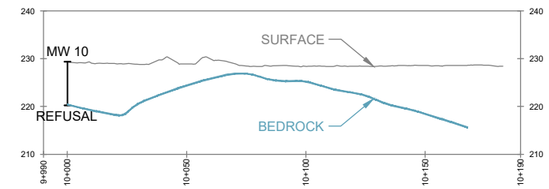
Rev 1

BEDROCK PROFILES

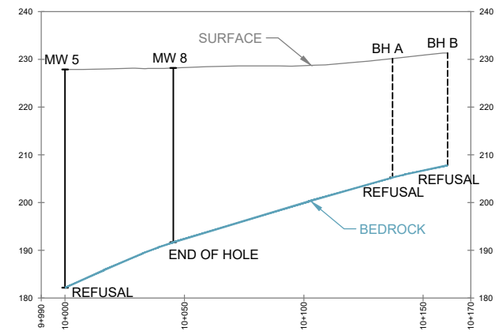
PROFILE A-A

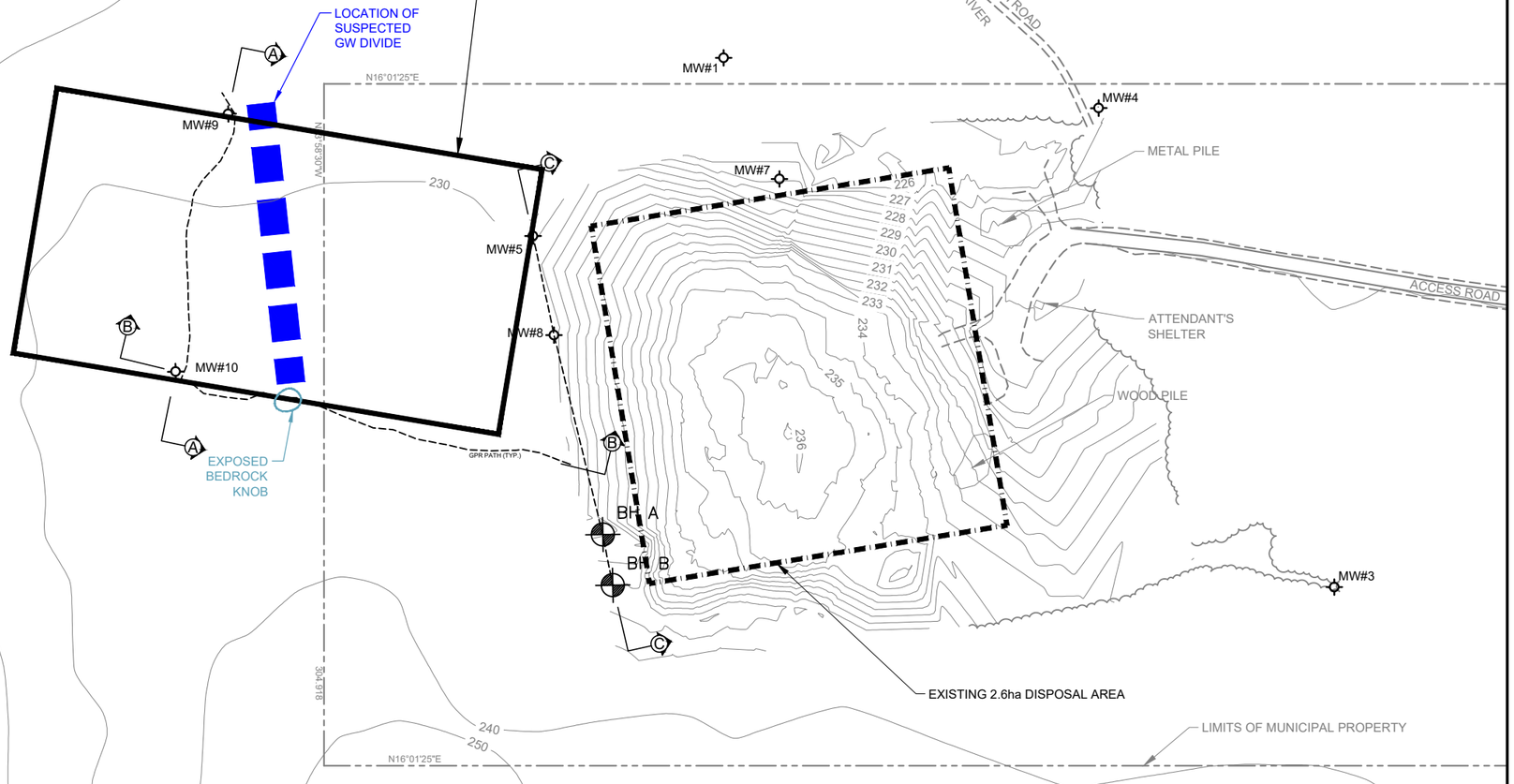


PROFILE B-B



PROFILE C-C





0 50 100 Meters

KRESIN Engineering Corporation
Sault Ste. Marie, Ontario
(705) 949-4900

NOTES

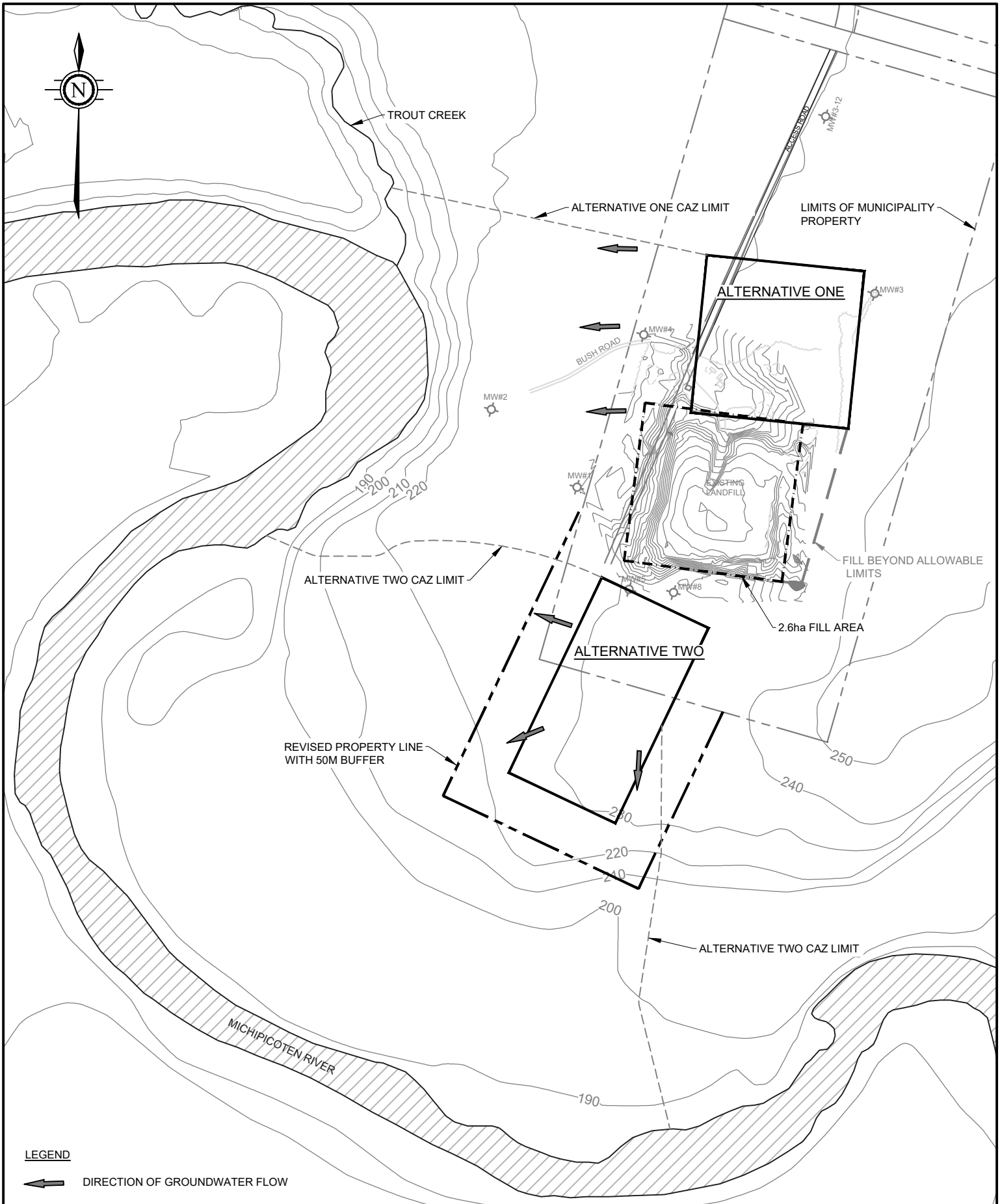
DESIGN	KEC
DRAWN	KSHERLOCK 07/2020
CHECKED	CKRESIN
PROJECT	1140.11
FILENAME	1140.11 DRAWING B.dwg
SCALE	AS SHOWN

THE CORPORATION OF THE MUNICIPALITY OF WAWA
GW AND SW ASSESSMENT REPORT

GPR BEDROCK PLAN AND PROFILE

B

Rev 0



KRESIN Engineering Corporation

DESIGN	KEC	
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CHECKED	C.KRESIN	07/20
PROJECT	1140.11	
FILENAME	1140.11 drawing 7.dwg	
SCALE	1:5000	

The Corporation of the Municipality of Wawa
GW AND SW ASSESSMENT REPORT

CONTAMINANT ATTENUATION ZONES

7

Rev 1

KRESIN
Engineering Corporation

536 Fourth Line East
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email: info@kresinengineering.ca

sustainable, practical solutions

January 30, 2020
KEC Ref. 1140.11

By Email (Mira.Majerovich@ontario.ca)

Attention: Mira Majerovich, EA Coordinator/Environmental Resource Planner
Ministry of the Environment Conservation and Parks
435 James Street South, Suite 331
Thunder Bay, ON, P7E 6S7

Re: Municipality of Wawa, Michipicoten Landfill Site
Groundwater and Surface Water Assessment Report

Dear Ms. Majerovich,

Thank you very much for your letter dated November 1, 2019 conveying comments from the groundwater review of the revised "Groundwater and Surface Water Assessment Report". It is also indicated in your letter that the previous surface water review comments had been adequately addressed.

The purpose of this letter is to provide additional information and responses to the latest Ministry of Environment, Conservation and Parks (MECP) groundwater review comments, where required.

Responses to MECP Groundwater Review Comments

Responses and additional information are presented below following the numbering convention established in the November 1, 2019 letter. Where numbers are skipped, the MECP comment was either "Acceptable" or direction to an earlier MECP comment was provided.

MECP Comment 1

"The groundwater trigger limit for manganese exceeded at MW1 and MW2 on more than two consecutive sampling events. There have been exceedances of manganese since 2001. Tier II monitoring and or/ contingency measures should be initiated to mitigate the impacts."

The Municipality proposes to undertake a program in the late spring of 2020 to begin final grading and capping of portions of the approved fill area that have reached final contour elevations, including side slopes. It is anticipated that, with this work completed, surface water infiltration into the underlying waste will be limited thereby reducing leachate production. Results from continued monitoring will be utilized to assess the effectiveness of these measures.

MECP Comment 2

"The groundwater results table needs to be updated to include assessment of all historical analytical results to the RUG criteria, as well as the PWQO, APV and CWQO where applicable. This assessment is only provided for the 2018 results. In addition, the historical tables should be expanded as it is difficult to review the small font in the current tables."

Table 7 of the revised Groundwater and Surface Water Assessment Report presents an assessment considering the 75th percentile concentrations using data from 2010 to 2019. To aid in their review, copies of the summary tables presented in Appendix B of the Report ("Summaries of Historical Analytical Results) accompany this letter in electronic form (.pdf).

MECP Comment 3

"...it would be more appropriate to use a calculation such as the Zaltsberg method to calculate the CAZ rather than the dilution calculation. The Zaltsberg method considers the various attenuation processes which occur in the groundwater flow system between two wells. Therefore, it is recommended that the Zaltsberg method, or another similar method be used to calculate the CAZ required for the other leachate indicator parameters."

The Zaltsberg method was applied for iron, manganese, alkalinity, hardness, DOC and TDS using median values from historical MW 7 and MW 2 analytical data, up to the year 2018. MW 2 is hydrogeologically downgradient from MW7 and, following the establishment of the Contaminant Attenuation Zone (CAZ), MW 2 is now used to assess compliance with Reasonable Use Criteria. Table 1 presents a summary of values utilized and results from applying the Zaltsberg method.

Table 1: Summary of Application of the Zaltsberg Method

Parameter	Concentration (mg/L)			Concentration Gradient	Attenuation Distance (m)
	MW 7	MW 2	RU		
Iron	2.65	0.11	0.16	0.0157	168.8
Manganese	1.741	0.115	0.025	0.0100	181.0
Alkalinity	313.5	192.5	511	0.7469	-254.4
Hardness	322	182.5	118	0.8644	247.0
DOC	4.81	2.5	3.1	0.0143	130.0
TDS	339.5	205	331	0.8302	20.2

The "Attenuation Distance" is measured as the distance from the limit of fill to a location where the parameter is expected to be equivalent to the reasonable use concentration (RU). Referencing Table 1, all parameters with the exception of manganese and hardness are below the RU value at MW 2. Considering that the distance from the limit of fill to MW 2 is roughly 172m, manganese requires an additional 9m of travel through CAZ before it meets the RU value (0.025 mg/L) and hardness another 75m. As MW 2 is approximately 30m from the Michipicoten River, adequate attenuation would be provided for manganese but not for hardness prior to groundwater discharging into the River.

RU concentrations in Table 1 are based on the Ontario Drinking Water Quality Standards (ODWS) for each parameter. The ODWS for Hardness (80 – 100mg/L) is presented as an Operational Guideline (OG), as opposed to a maximum acceptable concentration or aesthetic objective, and is non-health related. It is noted that median hardness value in the background monitoring well (MW 6) is 136mg/L. OG's are

established in the ODWS for parameters that, if not controlled, may negatively affect the efficient and effective treatment, disinfection and distribution of the water. Considering the potential to cause incrustation in water system components, waters with harness values greater than 200mg/L are considered poor but tolerable and in excess of 500mg/L unacceptable for most domestic purposes. No measurable impact to the Michipicoten River is expected should groundwater with hardness values exceeding the RU concentration discharge to the River.

MECP Comment 3a

"It should be demonstrated with supporting information whether leachate from the existing landfill will flow into the expansion area."

Referencing the attached Drawing A, leachate from the existing landfill is not expected to flow into the expansion area.

MECP Comment 4

"The groundwater flow directions in the expansion area must be established based on groundwater elevation data. This is fundamental to determining the available downgradient CAZ. An updated groundwater contour should be provided which shows the groundwater flow directions in the expansion area."

The attached Drawing A presents groundwater contours and interpreted direction of groundwater flow considering water table elevations determined in the fall of 2019, including from 2 new monitoring wells constructed in the summer of 2019 (MW 9 and MW 10). The wells constructed in 2019 encountered refusal at depths of approximately 10m, establishing the likely existence of a groundwater divide beneath the proposed expansion area and it is anticipated that groundwater will flow in a southerly direction south of MW 9 and MW 10. The Municipality intends to confirm the bedrock profile to support the interpretation of the direction of groundwater flow using geophysical methods rather than advancing test holes.

MECP Comment 6

"This will be assessed following review of the updated groundwater contour, and updated CAZ calculations."

Refer to responses to MECP Comment 3 and Comment 4 for updated CAZ calculations and groundwater contours.

MECP Comment 8

"Figure 11 only shows two additional wells (MW-P3 and MW- P4), which are downgradient of MW-P1 and MW-P2, respectively. MW-P3 and MW-P4 should be more upgradient then the proposed location in order to provide enough warning of unacceptable changes in groundwater quality before discharging to surface water. Two additional monitoring wells should be installed. One well downgradient/southwest of MW1 (to monitor the extents of the plume from the existing landfill), and a second a leachate characterization well should be installed adjacent to the expansion area."

Agreed. The 2 noted additional wells will be constructed in conjunction with the eventual expansion works.

MECP Comment 11

"Zaltsberg method is acceptable method to identify trigger parameters. This method should be used to identify all leachate indicator parameters by calculating the pollution index ratio (leachate/background). This needs to be evaluated following establishment of a statistically valid database at the source well (MW7). Currently there are only two years of groundwater data at the source well."

This comment is acknowledged.

MECP Comment 14

"Considering the site accepts wood ash, it should be determined (by providing supporting information) what are wood ash indicator parameters and whether additional parameters need to be analyzed in groundwater? Will wood ash be accepted in the expansion area?"

It is not anticipated that the site will accept wood ash from commercial waste producers (eg. co-generation) as no such activity currently takes place in the Wawa area.

MECP Comment 15

"Groundwater sampling results from MW8 should be provided for review, as well are missing borehole logs for MW1 and MW2."

MW 8 has not contained sufficient volumes of water to draw samples for analysis. Alternative methods to draw samples are being evaluated. It is understood that MW1 and MW2 were constructed in the early 1980's and the Municipality is unable to located copies of the related borehole logs.

Closure

We trust that the responses and additional information provided will further assist MECP with their review of the proposed expansion of the Wawa municipal landfill site. The Municipality is working to expand the existing landfill site under a project funded by the Build Canada Fund which has a complete-by date of December 31, 2020 (including construction).

If you have any questions or wish to discuss the contents of this letter, please contact the undersigned.

Yours Very Truly,
Kresin Engineering Corporation

Chris Kresin, M.Sc.(Eng.), P. Eng.
Consulting Engineer
Copy: Cory Stainthorpe, Municipality of Wawa

1140.11 ltr mecp re gw review comments.docx

Ministry of the Environment, Conservation and Parks
435 James Street South
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Ministère de l'Environnement, de la Protection de la nature et des Parcs
435, rue James sud
Bureau 331
Thunder Bay ON P7E 6S7
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Téléc: (807) 475-1754

Ontario

November 1st, 2019

Chris Kresin, Consulting Engineer
Kresin Engineering Corp
536 Fourth Line East
Sault Ste Marie, ON

Dear Chris,

RE: Municipality of Wawa, Michipicoten Landfill Site Groundwater and Surface Water Assessment Report – MECP response to review comments prepared by Kresin Engineering Corporation, dated April 14, 2019

The Municipality of Wawa and the Ministry of the Environment, Conservation and Parks (MECP) have determined that the approved capacity of the Michipicoten Waste Disposal Site (WDS) has been exceeded and in September 2016 initiated the Environmental Screening Process for the proposed WDS expansion.

Groundwater and surface water staff have responded to Kresin review comments dated April 24, 2019 which are shared below.

Surface water review comments:
In response to MECP surface water recommendations identified in the January 28, 2019 memorandum (February 5, 2019 letter), Kresin indicated that:

- A table summarizing historical analytical results for surface water and groundwater monitoring with comparisons to PWQO, APVs and CWQGs has been added to Section 5.6.1 of the revised report;
- Sample locations will be sited to intercept the interpreted leachate plume direction and any identified exfiltration areas down-gradient of the proposed fill area;
- A background river water quality sampling location was established historically with samples collected from this location since 2009.
- Additional surface water monitoring locations will be established down-gradient of the predicted leachate plume from the proposed fill area. Down-gradient groundwater monitoring wells, including near the Michipicoten River, will also be constructed following development of the proposed site.

The information provided in the letter from Kresin dated April 24, 2019 re: Municipality of Wawa, Michipicoten Landfill Site Groundwater and Surface Water Assessment Report and revisions therein adequately address the aforementioned MECP surface water review comments and recommendations.

Groundwater review comments:

#	MECP GW Comments	Consultant Comments	MECP GW Response
1	The 2017 annual monitoring report concludes that the trigger criteria for manganese were exceeded at MW1 and MW2 during the spring and fall sampling events. There was also exceedance of a number of trigger parameters (aluminum, chromium, copper, iron, lead, manganese, and nickel) at surface water trigger locations. In addition to acquiring the CAZ downgradient of the landfill, tier II trigger mechanism should be initiated, and if necessary, remedial/contingency measures should be implemented to mitigate the impacts.	- The Municipality of Wawa is in the process of acquiring CAZ lands downgradient of the existing fill area from the Ministry of Natural Resources and Forestry. - Regarding the conclusion in the 2017 Monitoring and Operations Report that surface water trigger criteria were exceeded for aluminum, chromium, copper, iron, lead, manganese, and nickel) it is noted in the conclusion that, despite the exceedances, levels are within historical ranges of upstream surface water concentrations. These exceedances have also not occurred in 2 consecutive sampling events. The Wawa trigger mechanisms and contingency plans indicate that Tier II level monitoring will be initiated where this occurs. This will be addressed further in the 2018 Monitoring and Operations Report. - Although not a formal implementation of the contingency plan, in 2019, the Municipality will initiate the process of grading and capping fill side slopes in an effort to reduce the amount of infiltration and related leachate production.	The groundwater trigger limit for manganese exceeded at MW1 and MW2 on more than two consecutive sampling events. There have been exceedances of manganese since 2001. Tier II monitoring and or/ contingency measures should be initiated to mitigate the impacts.

#	MECP GW Comments	Consultant Comments	MECP GW Response
2	The groundwater results tables provided in the Groundwater and Surface Water Assessment Report should be updated to include an assessment of the site-specific RUC criteria. In addition, considering leachate from the site will discharge (after some attenuation) to the Michipicoten River, monitoring wells located near the River (i.e. MW2) should be compared to the PWQO, APV and CWQO.	Assessment of site specific RUC for the existing fill area and comparison of groundwater quality in wells located near the Michipicoten River (MW1 and MW2) to PWQO, APV and CWQO are included in Section 3.8 and 5.6.1 of the revised report.	The groundwater results table need to be updated to include assessment of all historical analytical results to the RUG criteria, as well as the PWQO, APV and CWQO where applicable. This assessment is only provided for the 2018 results. In addition, the historical tables should be expanded as it is difficult to review the small font in the current tables.
3	The consultant has calculated a required CAZ of 26 ha using a dilution model based on an estimated maximum chloride concentration. The calculations for the attenuation zone area consider only chloride as the contaminant of concern. I recommend that the calculations need to be carried out for other leachate indicator parameters – iron, manganese, alkalinity, DOC, hardness and TDS. Some of which are higher in magnitude compared to chloride. Subsequently, an appropriately sized attenuation zone should be established to reflect the maximum	The CAZ calculations were undertaken utilizing chloride as a leachate indicator parameter due to its higher mobility and relative non-reactivity in groundwater and assuming that its concentration in leachate is 750 mg/L. CAZ calculations were also undertaken for iron, manganese, alkalinity, DOC, hardness and TDS and are discussed in Sections 4.2.1 and 4.3.3 of the revised report.	I agree with the Consultant that the dilution calculation is appropriate to calculate the CAZ by incorporating the estimated maximum chloride concentration. However, for the other leachate indicator parameters (i.e. iron, manganese, alkalinity, DOC, hardness and TDS) since they undergo other forms of degradation in addition to dilution it would be more appropriate to use a calculation such as the Zaltsberg method[1] to calculate the CAZ rather then the dilution calculation. The Zaltsberg method considers the various attenuation processes which occur in the groundwater flow system between two wells. Therefore, it is recommended that the Zaltsberg

#	MECP GW Comments	Consultant Comments	MECP GW Response
	area required based on these leachate indicator parameters (including chloride).		method, or another similar method be used to calculate the CAZ required for the other leachate indicator parameters. An additional concern I have is if there is potential for leachate to flow from the existing landfill to the expansion area towards the south/southwest. Since the existing landfill has a total volume well over the approved volume of 133,200m^3, this could create more leachate which will affect the downgradient CAZ available for the expansion. It should be demonstrated with supporting information whether leachate from the existing landfill will flow into the expansion area.

[1] E. Zaltsberg (1995) Determination of Groundwater Attenuation Distances for Municipal Landfill Sites in Ontario, Canadian Water Resources Journal / Revue canadienne des resources hydriques, 20:1, 39-47, DOI: 10.4296/cwrj2001039

#	MECP GW Comments	Consultant Comments	MECP GW Response
4	In section 4.3.2 of the report it is indicated that "leachate that would be generated within the Alt. 2 expansion area is expected to travel south and south-westerly through an available CAZ of approximately 23.4 ha in area." Based on the groundwater contour, groundwater flows west and southwest. The available CAZ area in the correct downgradient direction of the expansion should be re-evaluated to ensure it meets the required CAZ area.	The landfill site is located within a meander of the Michipicoten River and the interpreted direction of groundwater flow developed utilizing water table elevation data obtained from monitoring wells associated with the existing disposal area is west and southwest. It is noted that this matches the surface contours, which is typical and expected within the Precambrian Shield setting. Noting this, and that the surface contours south of the existing fill area introduce a southerly shift, the direction of groundwater flow is also expected to shift southerly in this area. Sections 3.5 and 4.3.2 of the revised report has been modified to describe this in more detail. The Municipality intends to investigate this further in the Spring of 2019 by installing an additional monitoring well (s).	The groundwater flow directions in the expansion area must be established based on groundwater elevation data. This is fundamental to determining the available downgradient CAZ. An updated groundwater contour should be provided which shows the groundwater flow directions in the expansion area.

#	MECP GW Comments	Consultant Comments	MECP GW Response
5	The CAZ should extend slightly upgradient of the expansion area, and existing fill area as a precaution should there be radial leachate flow	As a precaution should there be radial leachate flow, the upgradient limit of the CAZ will coincide with the current and proposed revised property limits as shown on revised Drawing 7.	Acceptable.
6	Considering groundwater flows west and southwest, the location and shape of the expansion should be situated at an optimum location to maximize the available CAZ.	Considering the interpreted and expected direction of groundwater flow and site constraints including topography, distance to the Michipicoten River and the location of the existing fill area, the proposed expansion area footprint is felt to be located optimally. Section 4.3.2 of the revised report discussed this in more detail.	This will be assessed following review of the updated groundwater contour, and updated CAZ calculations.

#	MECP GW Comments	Consultant Comments	MECP GW Response
7	The original permitted waste volume for the existing landfill was 133, 200 m^3. The landfill exceeded this volume in April 2008 by 41,183 m^3. The site is currently operating with an emergency environmental compliance approval which allows continued operation of the landfill until May 2019. With the approval of the emergency additional volume of 34,000 m^3 in February 2011, and 22,000 m^3 in April 2016, this brought the total waste volume to 230,383 m^3, which is 97,183 m^3 over the original permitted volume. It is required that the proponent demonstrate that the total volume of waste from the existing landfill and the expansion are likely to meet the PWQO, APV and CWQO at the CAZ boundary by modelling or predictive impact calculations. The assessment should be based on site specific characteristics including leachate generation rate, hydraulic conductivity, total volume of waste, fill area, etc.	The CAZ calculations presented reveal that there is limited land area hydrogeologically downgradient from the existing fill area (particularly to the west of the fill area) to attenuate expected leachate contaminants to meet PWQO, APV and CWQG. While the CAZ associated with the proposed expansion area is adequate to attenuate a greater number of contaminants, the required CAZ area to attenuate iron and manganese are orders of magnitude greater then the land area available. Contaminants such as iron and manganese are attenuated by mechanisms in addition to dilution such as oxidation, sorption, and biodegradation, and therefore would not require a CAZ sized based on dilution alone. The effects of other attenuation mechanisms may be apparent when noting their apparently attenuated levels as determine from water sampled collected at MW2, which are significantly lower than would be expected through only dilution. Additional information in this regard is presented in Sections 3.7, 4.2.2, 4.3.2, 4.3.3 and 5.6 of the revised report.	Refer to comment 3.

#	MECP GW Comments	Consultant Comments	MECP GW Response
8	A monitoring well should be installed downgradient of MW1 to delineate RUC exceedances.	A MW will be constructed downgradient of MW1.	Figure 11 only shows two additional wells (MW-P3 and MW-P4), which are downgradient of MW-P1 and MW-P2, respectively. MW-P3 and MW-P4 should be more upgradient then the proposed location in order to provide enough warning of unacceptable changes in groundwater quality before discharging to surface water. Two additional monitoring wells should be installed. One well downgradient/southwest of MW1 (to monitor the extents of the plume from the existing landfill), and a second a leachate characterization well should be installed adjacent to the expansion area.
9	As part of the expansion, additional monitoring wells need to be proposed. Monitoring wells should be installed west and southwest of the expansion area to monitor groundwater quality downgradient of the expansion. A monitoring well should also be installed further downgradient of the proposed MW-P1, near the CAZ boundary to assess groundwater quality leaving the site. This well should be added to the trigger mechanism program.	Referring to Drawing 11, MWs will be constructed west and southwest of the expansion area as well as downgradient of proposed MW-P1 and will be added to the trigger mechanism program. Proposed new wells will be constructed when the proposed expansion is constructed.	See comment 8.

#	MECP GW Comments	Consultant Comments	MECP GW Response
10	Concentrations of leachate indicator parameters are required to meet PWQO, APV, CWQO or established background values at the discharge point of groundwater to surface water. Trigger criteria, based on the 75th percentile of PWQO, APV, CWQO or background values should be established at the trigger monitoring wells in order to ensure that groundwater discharging to surface water is meeting the above-mentioned criteria.	Section 5.6.1 of the reviewed report presents an assessment of leachate indicator parameter values at MW2 with respect to PWQO, APV, CWQG and considering the 75th percentile background values. Similar assessments will be undertaken in Annual Monitoring and operations Reports.	Acceptable.
11	The Tier I trigger parameters should be broader and include additional leachate indicator parameters such as iron, alkalinity, DOC, hardness and TDS, etc. which are elevated at MW1. This should be re-evaluated following establishment of a statistically valid database (a minimum of 8 to 10 samples collected over a two year period) at the leachate characterization well.	The method used to establish Tier 1 trigger parameters (we assume this MECP comment relates to the 2017 Annual Monitoring and Operations Report) is a method presented by Zaltsberg that compares average concentrations in leachate and ambient (background) water samples. As Zaltsberg suggests, a ratio of not less than 10 is "reasonable in identifying trigger constituents" with preference given to those parameters for which ODWS exist. Can MECP suggest an alternative acceptable method to identify trigger parameters?	Zaltsberg method is acceptable method to identify trigger parameters. This method should be used to identify all leachate indicator parameters by calculating the pollution index ratio (leachate/background). This needs to be evaluated following establishment of a statistically valid database at the source well (MW7). Currently there are only two years of groundwater data at the source well.

#	MECP GW Comments	Consultant Comments	MECP GW Response
12	In section 2.0 of the report MW3-12 is referred to as MW6, and MW6-12 as MW7. This discrepancy should be corrected.	Discrepancy in MW naming will be corrected.	Acceptable.
13	It was previously recommended in the June 5, 2015 and November 10, 2015 MECP memorandums that the proponent needed to have at least one sampling event each year carried out by experienced professionals. It appears this has not been occurring and should be conducted during future sampling events.	One sampling event will be carried out by or in presence of experienced professionals.	Acceptable. As recommended in the June 5, 2015 MECP memorandum "all data in future reports need to be clearly identified and labelled as having been collected by municipal staff or the experienced professional."

#	MECP GW Comments	Consultant Comments	MECP GW Response
14 (New)	Considering the site accepts wood ash, it should be determined (by providing supporting information) what are wood ash indicator parameters and whether additional parameters need to be analyzed in groundwater? Will wood ash be accepted in the expansion area?		
15 (New)	Groundwater sampling results from MW8 should be provided for review, as well are missing borehole logs for MW1 and MW2.		

That concludes MECP's response to Kresin Engineering comments.

If you require further information or clarification, please let me know.

Regards,

Mira Majerovich
Environmental Assessment Coordinator, MECP
Northern Region

KRESIN
Engineering Corporation

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sustainable, practical solutions

April 24, 2019
KEC Ref. 1140.11

By Email (Mira.Majerovich@ontario.ca)

Attention: Mira Majerovich, EA Coordinator/Environmental Resource Planner
Ministry of the Environment Conservation and Parks
435 James Street South
Suite 331
Thunder Bay ON
P7E 6S7

Re: Municipality of Wawa, Michipicoten Landfill Site
Groundwater and Surface Water Assessment Report

Dear Mira,

The purpose of this letter is to present responses to comments and recommendations presented by the Ministry of the Environment, Conservation and Parks (MECP) following their review of the July 2019, Groundwater and Surface Water Assessment Report. Items below are numbered according to the convention established in MECP's letter dated February 5, 2019.

A copy of a revised Groundwater and Surface Water Assessment Report is enclosed with this letter.

Groundwater Recommendations

1. The Municipality of Wawa is in the process of acquiring CAZ lands downgradient of the existing fill area. Ministry of Natural Resources and Forestry (MNRF) has been provided with a plan prepared by an Ontario Land Surveyor as well as a plan depicting the proposed site arrangement including expansion. On March 29, 2019 MNRF informed the Municipality that MNRF "*...is ready to proceed with finalizing the easement for the contamination attenuation zone...*" and requested that the Municipality pay the required administration fee.

Regarding the conclusion in the 2017 Monitoring and Operations Report that surface water trigger criteria were exceeded for aluminum, chromium, copper, iron, lead, manganese and nickel) it is noted in the conclusion that, despite the exceedances, levels are within historical ranges of upstream surface water concentrations. These exceedances had also not occurred in 2 consecutive sampling events. The Wawa trigger mechanisms and contingency plans indicate that Tier II level monitoring will be initiated where this occurs. This will be addressed further in the 2018 Monitoring and Operations Report.

Although not a formal implementation of the contingency plan, in 2019, the Municipality will initiate the process of grading and capping fill side slopes in an effort to reduce the amount of infiltration and related leachate production.

2. Assessment of site specific RUC for the existing fill area and comparison of groundwater quality in wells located near the Michipicoten River (MW1 and MW2) to PWQO, APV and CWQO are included in Section 3.8 and 5.6.1 of the revised Report.

3. The CAZ calculations were undertaken utilizing chloride as a leachate indicator parameter due to its higher mobility and relative non-reactivity in groundwater and assuming that its concentration in leachate is 750mg/L. CAZ calculations were also undertaken for iron, manganese, alkalinity, DOC, hardness and TDS and are discussed in Sections 4.2.1 and 4.3.3 of the revised Report.

4. The landfill site is located within a meander of the Michipicoten River and the interpreted direction of groundwater flow developed utilizing water table elevation data obtained from monitoring wells associated with the existing disposal area is west and southwest. It is noted that this matches the surface contours, which is typical and expected within the Precambrian Shield setting. Noting this, and that the surface contours south of the existing fill area introduce a southerly shift, the direction of groundwater flow is also expected to shift southerly in this area. Sections 3.5 and 4.3.2 of the revised Report has been modified to describe this in more detail. The Municipality intends to investigate this further in the Spring of 2019 by installing an additional monitoring well(s).

5. As a precaution should there be radial leachate flow, the upgradient limit of the CAZ will coincide with the current and proposed revised property limits as shown on revised Drawing 7.

6. Considering the interpreted and expected direction of groundwater flow and site constraints including topography, distance to the Michipicoten River and the location of the existing fill area, the proposed expansion area footprint is felt to be located optimally. Section 4.3.2 of the revised Report discusses this in more detail.

7. The CAZ calculations presented reveal that there is limited land area hydrogeologically downgradient from the existing fill area (particularly to the west of the fill area) to attenuate expected leachate contaminants to meet PWQO, APV and CWQG. While the CAZ associated with the proposed expansion area is adequate to attenuate a greater number of contaminants, the required CAZ area to attenuate iron and manganese are orders of magnitude greater than the land area available. Contaminants such iron and manganese are attenuated by mechanisms in addition to dilution such as oxidation, sorption and biodegradation, and therefore would not require a CAZ sized based on dilution alone. The effects of other attenuation mechanisms may be apparent when noting their apparently attenuated levels as determined from water samples collected at MW2, which are significantly lower than would be expected through only dilution. Additional information in this regard is presented in Sections 3.7, 4.2.2, 4.3.2, 4.3.3 and 5.6 of the revised Report.

8. A MW will be constructed downgradient of MW1.

9. Referring to Drawing 11, MWs will be constructed west and southwest of the expansion area as well as downgradient of proposed MW-P1 and will be added to the trigger mechanism program. Proposed new wells will be constructed when the proposed expansion is constructed.

10. Section 5.6.1 of the revised Report presents an assessment of leachate indicator parameter values at MW2 with respect to PWQO, APV and CWQG and considering the 75th percentile background values. Similar assessments will be undertaken in Annual Monitoring and Operations Reports.

11. The method used to establish Tier 1 trigger parameters (we assume this MECP comment relates to the 2017 Annual Monitoring and Operations Report) is a method presented by Zaltsberg [1] that compares average concentrations in leachate and ambient (background) water samples. As Zaltsberg suggests, a ratio of not less than 10 is "*reasonable in identifying trigger constituents*" with preference given to those parameters for which ODWS exist. Can MECP suggest an alternative acceptable method to identify trigger parameters?

12. Discrepancy in MW naming will be corrected.

13. One sampling event will be carried out by or in the presence of experienced professionals.

Surface Water Recommendations

As the understanding of groundwater flow has developed for the Michipicoten landfill site, it is believed that the direction of groundwater flow impacted by the existing fill area is more prevalent in the south-westerly than the westerly direction. Referencing Drawing 2 and Section 3.5 of the revised Report, the fall 2018 gradient between MW7 and MW2 is 0.007 (westerly) and between MW7 and MW5 is 0.03 (southerly). Based on this, the statement was made that the total CAZ area provided exceeds the total CAZ area required, considering chloride attenuation calculations. This may in-part explain what appears to be low contaminant levels in groundwater samples drawn from MW2 when compared to samples from MW7 (source) and MW1 (intermediate). Although this may ultimately result in adequate contaminant attenuation prior to groundwater discharge into the Michipicoten River, the comparatively shorter distance from the existing fill area to the River in a westerly direction may act as a controlling or limiting CAZ constraint. This will be investigated further with the installation of additional downgradient monitoring wells.

Section 5.6 of the revised Report presents an assessment of groundwater quality at boundary wells considering PWQO, APV and CWQG. The assessment includes results from the analysis of surface water samples collected at a location in the River directly down-gradient of the predicted leachate plume path for the existing fill area. Although not a formal implementation of the contingency plan, in 2019 the Municipality will initiate the process of grading and capping fill side slopes in an effort to reduce the amount of infiltration and related leachate production to help mitigate leachate contaminant concentrations. The Municipality has also recently begun utilizing a landfill compactor at the existing fill area to increase waste density, a result of which is the mitigation of leachate contaminant concentrations.

An assessment of the potential impact of leachate indicator parameter concentrations on surface water is presented in Section 5.6.1 of the revised Report. A surface water monitoring location "Michipicoten River Bank" was established historically and 75th percentile parameter concentrations are summarized in Section 5.4.2 of the revised Report. Additional surface water monitoring locations will be established downgradient of a predicted leachate plume from the proposed fill area when the expansion is constructed. Downgradient groundwater monitoring wells, including near the Michipicoten River, will also be constructed at that time, as shown on Drawings 11 and 12 of the revised Report

In response to the bulleted MECP recommendations identified in the February 5, 2019 letter:

[1] Zatlsberg, E. 1994. A Statistically Based Trigger Mechanism for Evaluation of Groundwater Quality in Landfill Monitoring Wells. Canadian Water Resources Journal, 19:3, pp. 267-274.

- A table summarizing historical analytical results for surface water and groundwater monitoring with comparison to PWQO, APV and CWQGs has been added to Section 5.6.1 of the revised Report.
- Sample locations will be sited to intercept the interpreted leachate plume direction and any identified exfiltration areas downgradient of the proposed fill area.
- A background River water quality sampling location was established historically and samples have been collected from this location since 2009.

General Comments

The general comments presented at the conclusion of the MECP letter were responded to via email on February 13, 2019.

Closure

The Municipality is working to expand the existing landfill site under a project funded by the Build Canada Fund which has a complete-by date of December 31, 2020 (including construction). MECP acceptance of the Groundwater and Surface Water Assessment Report will allow the Municipality to complete the Environmental Screening Process. This subsequently will allow the Municipality to pursue securing the required land from MNRF to expand the fill area (including buffer) and establish an expanded CAZ as well as to develop and submit the required applications to MECP for Environmental Compliance Approvals under the Ontario Water Resources Act and the Environmental Protection Act.

If you have any questions or wish to discuss the contents of this letter, please contact the undersigned.

Thank you.

Yours Very Truly,
Kresin Engineering Corporation

Chris Kresin, M.Sc.(Eng.), P. Eng.
Consulting Engineer

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MUNICIPALITY OF WAWA

MICHIPICOTEN LANDFILL SITE

GROUNDWATER AND SURFACE WATER ASSESSMENT REPORT

Revision 1: April 23, 2019
July 27, 2018
KEC Ref: 1140.11

Prepared by:

KRESIN Engineering Corporation

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1.0 Introduction

The 2.6 hectare Michipicoten landfill site is situated on a 22 hectare parcel of property owned by the Municipality of Wawa (Municipality). Accessed from High Falls Road, the site is situated near the southerly boundary of the Municipality, just north of the Michipicoten River (Drawing 1).

In September 2016, the Municipality initiated the Environmental Screening Process for Waste Management Projects established under Ontario Regulation 101/07. The process exempts certain projects from Schedule II of the Environmental Assessment Act, in this case a proposed landfill site expansion of 100,000 cubic metres. The initial screening assessment has identified that the proposed undertaking (i.e. expansion) has the potential to impact ground and surface water quality associated with the natural attenuation of landfill leachate. In this context, the purpose and scope of the assessment described in this report are to present:

1. An assessment of the conditions at the site and immediate vicinity;
2. A description of the existing hydrogeological conditions below and down gradient of the facility;
3. An outline of soil composition, stratigraphy, groundwater flow and the depth to the water table;
4. An estimate of the quality of leachate generated and the leachate attenuation capability of the soils;
5. A determination of possible exceedances of the Ministry's document entitled, "Incorporation of the Reasonable Use Concept Into MOE Groundwater Management Activities" Guideline B-7 (Formerly 15-08)", PIBS 430e;
6. A description of the surface water features in the area (watershed) and near the site;
7. Estimates of the quantities of surface water flows generated at and upgradient from the site and within the watershed;
8. A discussion on water quality in the receiving water body (Michipicoten River);
9. Discussion on the impacts of waste disposal on the ground and surface water at the site and along property boundaries; and
10. A proposal for a monitoring program to capture the chemical and physical parameters of concern for both ground and surface water.

2.0 Field and Laboratory Work

Field work was initiated in 1980 (by others) with the installation of 2 monitoring wells downgradient (westerly) from the waste disposal site (MW-1 and MW-2). In 2010, three (3) additional monitoring wells were constructed: MW-3 (background), MW-4 and MW-5 (cross / downgradient). A second background monitoring well was constructed in 2012 (MW-6), a source monitoring well in 2017 (MW-7) and a downgradient well was constructed to the south east of the fill area (MW-8) in 2018.

All (8) monitoring wells (MW-1 to MW-8) were extended to depths below the water table and at least 2 monitors (MW-3 and MW-5) were extended to refusal at bedrock. Each borehole was equipped with a single standpipe assembly, comprising a 50 mm diameter, flush-jointed PVC riser pipe and varying lengths of PVC screen, with the annulus opposite the screened interval backfilled with silica filter sand. Copies of well logs for MW-3 to MW-8 inclusive are presented in Appendix A and well locations are denoted on Drawing 2. Well logs for MW-1 and MW-2 are not available; however, information was sourced from the well construction records and is also included in Appendix A.

Soil samples were collected during construction of monitoring wells to examine surficial sediments and to verify if saturated conditions occurred near the ground surface. The shallow overburden in the area largely comprises medium sand with gravel interspersed. Saturated conditions were encountered at depths of roughly 35 to 40 metres within the fine to medium sand formation.

Water-levels have been measured in and water samples collected from the groundwater monitors twice annually and reported on in annual operations reports. Water samples have also been collected twice annually from locations in the Michipicoten River and Trout Creek. Water samples are sent to an accredited laboratory for analysis.

3.0 Site Specific Conditions

The Northern Ontario Engineering Geology Terrain Study for the Michipicoten Area (NTS 41N/NE, 1980) was referenced to develop descriptions of site specific conditions, supplemented by observation. From the Study, the site is situated in an outwash plain of sand and gravel in a terraced area with mainly low local relief. South of the site (north of the River), the area is described as a glaciofluvial delta.

3.1 Drainage

The site is located within a glaciofluvial deposit, having low local relief and dry drainage conditions as well as some areas to the north and east that are characterized by bedrock outcrops, organic terrain (peaty) with low local relief and wet and dry drainage conditions exist closer to the Michipicoten River. Topographically, the land surface gradually slopes south and south-westward across the site and, ultimately, down an embankment to the Michipicoten River (Drawing 3).

Distinct watercourses are not evident on the site. This, coupled with no obvious indication of overland sheet flow, suggests that the bulk of surface water runoff infiltrates into the granular surficial sediments.

3.2 Overburden

Stratigraphic sections were prepared from the borehole information to interpret the distribution of overburden formations beneath the study area. These sections are shown on Drawings 4 and 5.

The boreholes were constructed in Pleistocene-Age glaciofluvial sediments. Beneath the upper coarser sand-gravel sediments, the formation generally comprises a thick interval of sand with traces of silt, which in turn is underlain by silty clay sand upgradient of the fill area. The overburden thickness ranges from about 42 metres to about 48 metres.

3.2.1 Hydraulic Conductivity

Referencing the well logs, shallow overburden units are medium grained sand with traces of gravel and the wells are screened in a layer of fine sand containing traces of silt.

The overburden aquifer has not been tested to estimate hydraulic conductivity. Considering the nature of the soils and referencing published values for soil types, it is assumed that the hydraulic conductivity of the shallow overburden is in the range of 10^{-3}cm/s and the deep overburden in the range of 10^{-4}cm/s.

Vertical hydraulic conductivity is estimated to be one order of magnitude lower, as has been typically reported for stratified granular sediments.

3.3 Bedrock

The area is underlain by early Precambrian-age bedrock, near the southerly edge of a metavolcanic-metasedimentary belt containing mineral occurrences.

MW-3 and MW-5 both encountered refusal at bedrock ranging in depths from 42.7m to 45.7m, sloping to the west / southwest, similar to observations of surface topography. Further, an attempt to advance a borehole east of MW-8 encountered refusal at suspected bedrock at a depth of approximately 22m.

3.4 Groundwater Recharge

Long-term streamflow data assembled by Environment Canada for the Michipicoten River is collected at the Scott Falls generating station, which regulates the flow. Although an estimate of the annual water surplus can be developed using streamflow for the area, the assessments herein were completed using a recharge value of 250mm/year (as suggested in Ministry of the Environment, Conservation and Parks guidance documentation).

3.5 Groundwater Movement

Based on a review of recorded water-level elevations obtained from the groundwater monitors, the potentiometric surface was interpreted to slope west to south-west (Drawing 6) toward the Michipicoten River. In general, the interpreted direction of flow follows the ground topography (Drawing 7). The landfill location lies within a River meander and, south of the existing fill area, topography begins to slope to the south also toward the Michipicoten River. Referencing Drawing 2, the gradient between MW7 and MW2 is 0.007m/m (westerly) and between MW7 and MW5 is 0.03 (southerly). From a groundwater flow perspective, then, the location is interpreted to lie on or near a divide with infiltrating precipitation eventually discharging to the River.

Considering water table elevations recorded in the spring of 2018, the lateral groundwater gradient at the site was estimated to be about 0.03m/m prior to ultimately discharging at the River. Vertically, groundwater is interpreted to move downward beneath the existing and proposed fill areas as well as in areas downgradient at a gradient in the range of 0.39m/m.

Groundwater movement within the underlying bedrock will be controlled by the fracture density/distribution, which cannot be thoroughly assessed without extensive testing. Considering the setting, the overburden formations are interpreted to be capable of transmitting the infiltrating precipitation, and the bedrock flux is expected to be low and likely in the direction of the overburden flux.

Based on the above, precipitation infiltrating the proposed fill and catchment areas is expected to move downward through surficial formations to the groundwater transmission zone, being the underlying fine-medium silty sand. As groundwater travels laterally south to southwestward, it is expected to eventually discharge into the Michipicoten River (some 230m downgradient from the site boundary).

3.6 Groundwater Velocity

Groundwater movement is influenced by the hydraulic conductivity and the prevailing hydraulic gradients of the transmitting formations and may be estimated by the following Darcy flow equation:

$$v = \frac{ki}{Sy}$$

where: v = groundwater velocity (L/t)
k = hydraulic conductivity (L/t)
i = hydraulic gradient, dimensionless
Sy = specific yield, dimensionless (estimated to be 0.3)

At the estimated lateral gradient of 0.03m/m and hydraulic conductivity of 10^{-3}cm/s, the groundwater may move at a rate of 31.5 metres per year within the fine-medium sand/silty sand formation. Consequently, the travel time for a leachate plume originating at the existing fill area to reach the downgradient boundary at the Michipicoten River, depending on the continuity of formations encountered, is estimated to be in the range of about 7 years in a westerly direction and may exceed 20 years in a south-westerly direction.

At a vertical gradient of about 0.39m/m, the groundwater velocity would be in the range of about 40 metres per year at the estimated hydraulic conductivities of the fine to medium silty sand formations. Using an overburden thickness of 35m above the observed water table elevations, groundwater would require about 1 year to reach the saturated formation.

At the calculated horizontal and vertical groundwater velocities, precipitation (or leachate) reaching the underlying groundwater system will travel for less than 10 years before eventually discharge to where the fill area is nearest the Michipicoten River.

3.7 Groundwater Flux

Within the landfill area, CAZ and upland areas, groundwater recharge occurs throughout as a downward gradient prevails and groundwater discharge occurs laterally through the overburden sequence toward the Michipicoten River. Historically, the direction of flow has been interpreted to be westerly and south-westerly from the existing fill area. As the landfill site is located within a meander of the Michipicoten River, the direction of flow is also interpreted to have a southerly component at locations south of the existing fill area. Groundwater flux is determined by applying the flux equation:

$$Q = k\ i\ A$$

where: Q = groundwater flux (m^3/d)
k = hydraulic conductivity (m/d)
i = hydraulic gradient, dimensionless
A = area through which flux occurs (m^2)

Within the overburden, the thickness of the water transmitting zone was determined to be the difference between average water table elevation (considering MW3 and MW2) and the assumed elevation of the bottom of the Michipicoten River (2m deeper than the lowest water table elevation in MW2). This, coupled with a width of flow equivalent to the width of the CAZ, results in a cross-sectional area of flow equivalent to 4,520m^2. Applying the flux equation, the lateral groundwater flow is calculated to be about 120m^3/day.

3.8 Groundwater Quality

Groundwater samples have been collected and analyzed twice annually for more than the past 10 years. Tables E.1 to E.14 (Appendix B) present summaries of the analytical results from samples obtained at each monitoring well location. Certificates of Analysis for the 2017 sampling events are presented in Appendix C and plots showing water quality trends in Appendix D.

Groundwater obtained from MW6 (background well) generally displays the lowest levels for typical leachate indicator parameters. Considering this, naturally occurring levels of water quality parameters are not elevated, judged by whether or not concentrations exceed the Ontario Drinking Water Quality Standards (ODWQS).

Parameter concentrations are elevated compared to background conditions at each downgradient well, MW1 displaying the greatest frequency and number of such occurrences. Water quality in samples collected from the source well and downgradient wells suggests that the landfill is producing weak leachate. This may in-part be due to the interpreted lack of groundwater mounding conditions and/or a result of monitoring well placement. Comparing data from samples collected at MW1 (intermediate) and MW2 (boundary) in 2018 to Reasonable Use Criteria, exceedances for iron, manganese, alkalinity, DOC, pH and TDS were identified, as presented on Table 1.

Table 1: Summary of RU Criteria and Analytical Results – 2018

Parameter	ODWS (Cr)	MW6 (Cb)	R.U. Criteria (Cm)	Spring 2018		Fall 2018	
				MW1	MW2	MW1	MW2
VOCs							
1,4 Dichlorobenzene - H	0.005	0.0005	0.0016	ND	ND	NT	NT
Benzene - H	0.005	0.0005	0.0016	ND	ND	NT	NT
Dichloromethane – H	0.05	0.002	0.014	ND	ND	NT	NT
Toluene – A	0.024	0.0005	0.012	ND	ND	NT	NT
Vinyl Chloride – H	0.002	0.0005	0.00088	ND	ND	NT	NT
Dissolved Metals							
Arsenic –H	0.01	0.00099	0.0032	0.00031	0.00013	0.00041	0.00016
Barium – H	1	0.016	0.26	0.066	0.024	0.071	0.027
Boron – H	5	0.01	1.26	0.23	0.015	0.24	0.016

Table 1: Summary of RU Criteria and Analytical Results – 2018

Parameter	ODWS (Cr)	MW6 (Cb)	R.U. Criteria (Cm)	Spring 2018		Fall 2018	
				MW1	MW2	MW1	MW2
Cadmium – H	0.005	0.000011	0.0013	0.000045	ND	ND	ND
Chromium – H	0.05	0.00032	0.013	0.00035	ND	0.00035	ND
Copper – A	1	0.00095	0.5	0.0018	ND	0.00021	ND
Iron – A	0.3	0.01	0.16	0.053	ND	**0.294**	0.045
Lead – H	0.01	0.00005	0.0025	ND	ND	ND	ND
Mercury – H	0.001	0.00001	0.00025	ND	ND	ND	ND
Magnesium	-	9.18	-	25.3	9.99	29.5	10.7
Manganese – A	0.05	0.00036	0.025	**2.25**	**0.11**	**2.62**	**0.12**
Nickel	-	0.0005	-	0.0044	ND	0.006	ND
Potassium	-	2.14	-	6.91	2.33	7.15	2.5
Sodium – A	200	1.73	100.86	15	2.46	14.8	2.53
Zinc - A	5	0.003	2.5	0.02	0.014	0.0016	0.14
General Chemistry							
Alkalinity – OG	30-500	142	86-321	**511**	168	**549**	213
Ammonia	-	0.049	-	0.7	0.058	0.91	0.22
BOD5	-	2	-	ND	ND	ND	2.2
Chloride – A	250	0.37	125.18	8.74	0.64	10.5	0.69
COD	-	22.75	-	127	ND	38	28
Cond. (us/cm)	-	274.5	-	953	329	968	324
DOC – A	5	1.2	3.1	**6.5**	**6.5**	**7.71**	1.97
Nitrate – H	10	0.035	2.53	ND	ND	ND	0.022
Nitrite – H	1	0.01	0.26	0.01	ND	ND	ND
pH – OG	6.5-8.5	7.95	7.23-8.23	**7.05**	7.47	**7.12**	7.62
Sulphate – A	500	11.9	256	23.9	1.12	28.1	2.18
TDS – A	500	162	331	**557**	177	**576**	189
TKN	-	0.45	-	3.88	0.18	1.43	0.32
TP	-	0.9	-	0.024	0.011	0.0063	0.015

Notes: *A – aesthetic, H – health related, OG – op. guideline, Bolded/shaded values exceed R.U. Criteria, ND – below DL*
Cb - median values of all previous sampling events. Laboratory detection limits used where concentrations were ND

Although groundwater concentrations of certain parameters exceed Reasonable Use Criteria, considering that groundwater ultimately discharges to the Michipicoten River an assessment of the potential impact to the Michipicoten River referencing the Provincial Water Quality Objectives (PWQO), Canadian Water Quality Guidelines (CWQG) and Aquatic Protection Values (APV) is required. Section 5.0 of this report presents such an assessment.

Water levels in the Michipicoten River downgradient from the landfill site fluctuate depending on the flow allowed through the Scott generating station (GS). It is believed that the water level fluctuation varies higher and lower than the water table elevation adjacent to the River, as determined in MW-2. It is also believed that the fluctuations cause changing water quality conditions in monitoring well 2. When the River stage is high, the monitoring well is likely impacted by River water. It is therefore important to determine the elevation of the River stage concurrent with the collection of water samples from MW-2 and that the potential for surface water influence is assessed.

4.0 Landfill Impact

The landfill site has been developed as a natural attenuation landfill where the gases and leachate produced by the refuse are discharged to the natural environment without engineered controls and/or treatment facilities.

4.1 Landfill Gases/Odour

No monitoring for landfill gases has been undertaken at the existing site and no public concerns have been received by the Municipality regarding odour.

Similar to the existing fill area, the proposed expansion incorporates shallow (3m deep) excavated trenches followed by area fill to a final height of 7m above original ground elevation. Refuse-derived gases should be readily attenuated by natural venting through the refuse capping and within the adjacent buffer zone. Odours may be an occasional nuisance for distances of a few hundred metres, but should be manageable by adherence to proper landfilling procedures. The nearest residence is located more than 8.5 kilometres from the site and should not be adversely impact by landfill odours.

4.2 Leachate Generation

Noting that the shallow trenches are well above the observed water table elevation, the existing and proposed fills area are/will be founded in unsaturated sediments. As a result, landfill leachate would most significantly be generated during the seasonal water-surplus periods when precipitation and/or snow melt infiltrate into the landfill. With the expected lack of groundwater mounding within the waste material, leachate strength is expected to be mitigated. With an annual depth of infiltration of 250mm and a fill area of 2.6ha, about 18m^3/day of leachate may be produced at the existing fill area.

Several processes are locally available to attenuate leachate including:

1. Dilution by groundwater underflow;
2. Dilution by infiltrating precipitation on the adjacent downgradient lands;
3. Adsorption onto the soils beneath and downgradient from the landfill; and,
4. Chemical and biological transformations in the underlying groundwater system.

As adsorption and bio-chemical attenuation cannot be reliably quantified, dilution is relied on as the attenuation mechanism when assessing what water quality impacts may occur within the groundwater system downgradient of the proposed landfill. The assessment herein considers only the dilution provided by precipitation infiltrating the downgradient lands.

Natural attenuation landfill assessments are typically focussed on demonstrating that adequate dilution is perennially available to decrease the surrogate landfill contaminant. The assessment described herein considers the fate of chloride as a non-reacting, mobile leachate constituent to identify requirements to ensure its effective attenuation. By meeting requirements for chloride, it is assumed that other less mobile and/or more reactive leachate constituents would be attenuated to acceptable levels. Historically, such assessments have been accepted by the Province, provided that routine water quality

monitoring is undertaken to promptly detect adverse quality variations resulting from the landfilling operation.

4.2.1 Other Leachate Indicators

Other leachate indicator parameters considered in this case are iron, manganese, alkalinity, dissolved organic carbon (DOC), hardness and TDS. Although the concentrations of some of these parameters in leachate (MW7) are greater in magnitude than the concentration of chloride (see Table 2), the required degrees of attenuation (dilution) to meet the allowable concentrations at a CAZ boundary are less in many cases. This is discussed further in sub-section 4.3.3.

Table 2: Fall 2018 Concentrations of Selected Leachate Indicators (mg/L)

Parameter	Well 7 (source)	Well 6 (background)	R.U. Criteria (Cm)	Well 2 (boundary)
Iron	2.65	ND	0.16	0.045
Manganese	2.81	ND	0.025	0.12
Alkalinity	468	142	86-321	213
Dissolved Organic Carbon	4.81	1.1	3.1	2.0
Hardness	463	145	107.8	181
Total Dissolved Solids	500	163	331	189
Chloride	462	0.34	125.18	0.69

4.2.2 Chloride Strength to Calculate CAZ

Chloride strength varies according to several factors, including the method and rate of disposal, infiltration of precipitation, degree of groundwater mounding and the specific composition of refuse. Long term quality sampling of moderate-sized Ontario landfills suggests that the chloride concentration may range from about 100 mg/l to over 1000 mg/l. Over the past several years of groundwater quality monitoring at the existing waste disposal site, the maximum chloride concentration was determined to be 462mg/L at MW7.

A chloride concentration of about 700mg/L is estimated by applying the wet density of 1.8mg of chloride per tonne of waste presented in Table 1 of O. Reg. 232/98 to the expanded site volume (330,383m^3) and expected leachate volume (13,000m^3/yr) over 40 years. The leachate chloride strength used in the attenuation calculations below is 750mg/L.

4.3 Leachate Attenuation

To comply with Ministry of the Environment, Conservation and Parks (MECP) requirements, acceptable groundwater quality is typically assessed by applying the Reasonable Use (RU) concept. The RU concept requires that the concentration of specific constituents at the downgradient site boundary must be less than their maximum permissible Reasonable Use concentration. In this case, however, leachate impacted groundwater discharges into the Michipicoten River after some level of attenuation. Accordingly, potential impact(s) from the discharge of potentially leachate impacted groundwater to the River must also be assessed.

A Contaminant Attenuation Zone (CAZ) is normally established in the area hydrogeologically downgradient from the waste disposal site to provide attenuation of contaminants to acceptable levels. A CAZ in this case will provide a level of attenuation prior to discharge to the Michipicoten River.

4.3.1 CAZ - Existing Site

For the purpose of identifying the maximum allowable concentration of a particular parameter at a site boundary, the MECP RU Policy is used. The Policy is applied to groundwater at property boundaries and to parameters with aesthetic and health-related concentrations in the ODWQS. The calculation of RU concentrations is based on one-half of the ODWS concentrations for aesthetic parameters, and one-quarter of the ODWQS concentrations for health-related parameters.

The RU calculation is based on the relationship: $C_m = C_b + x(C_r - C_b)$

where: C_m is the maximum allowable concentration at the property boundary,
C_b is the background concentration (MW7),
C_r is the ODWS concentrations, and
x is 0.5 for non-health related parameters and 0.25 for health-related parameters.

Using a background concentration of 0.37mg/L (the median of 12 sample results at the background monitoring well) and x = 0.5 for chloride, the RU maximum allowable chloride concentration at the downgradient boundary of the CAZ is calculated to be 125mg/L.

In order to meet the maximum RU concentration of 125mg/L, the following equation was used to determine the required CAZ area at the existing Wawa WDS:

$$CAZ = \frac{A[C - C_m]}{C_m - C_b}$$

where: A is the refuse area;
C is the average concentration of a particular leachate constituent (chloride in this case);
C_m is the maximum allowable concentration at the property boundary; and
C_b is the background concentration.

At a leachate chloride concentration of 750mg/L and a fill area of 2.6ha, the area of the required CAZ is 13ha. A CAZ of this area would extend toward and beyond the Michipicoten River in the interpreted direction of groundwater flow (see attached Drawing 7). The available land area downgradient from the existing fill area is 6.5ha and extends roughly 230m to the Michipicoten River. Though this would provide a degree of contaminant attenuation, the potential impact(s) to the River associated with the discharge of potentially leachate impacted groundwater requires assessment.

4.3.2 CAZ - Proposed Expansion

Expanded fill areas are typically offset from an existing fill area in an alignment that is perpendicular to the direction of groundwater flow so as to introduce underflow from up-gradient groundwater of a quality that has not been impacted by landfilling activities. In this case; however, consideration is also given to maximizing both the available downgradient CAZ area and the separation distance to the Michipicoten River. Two alternative expansion areas were developed and evaluated considering the potential to attenuate contaminants. Both alternative areas, one being off-set to the north-east (Alt. 1) and the other to the south (Alt. 2), abut the existing fill area and are situated at similar topographic elevations as the existing fill area. Soil and groundwater conditions are also interpreted to be similar to those at the existing fill area. Drawing 8 depicts the alternative expansion areas.

Alt. 1 is aligned to increase distance to the Michipicoten River, though marginally, when compared to the existing fill area. The separation distance can be increased further by shifting Alt. 1 further east; however, this would increase the lateral distance that the south-westerly component of groundwater flow would travel beneath the fill areas. In order to provide a CAZ of adequate area, the distance that Alt. 1 would need to be from the River is roughly twice that shown on Drawing 7. Regardless of east-west orientation, the alignment of Alt. 1 would be situated such that the expanded fill area would cause leachate impacted groundwater to discharge to the lower reach of Trout Creek. It is preferred to not expose Trout Creek to the potential impacts of this discharge.

Alt. 2 is aligned near what is suspected to be a groundwater divide where a portion of the flow is expected to flow in a southerly direction. It is also believed that groundwater flow from the east would contribute to underflow beneath the expanded fill area, supplementing the south-westerly groundwater flow. If the location of Alt. 2 were to be moved easterly to align perpendicular to a south-westerly direction of groundwater flow, the expanded fill area would be situated in an adjacent catchment area where groundwater is expected to flow in a southerly and south-easterly direction, with a separation distance from the Michipicoten River less than the current fill area. This would decrease the available CAZ land area and is not preferred.

Applying the equation introduced in sub-section 4.3.1, the proposed expansion area would also require a CAZ of 13ha, regardless of which alternative expansion area is developed. As is the case with the CAZ associated with the existing fill area, the Michipicoten River would limit the CAZ available for either alternative expansion area.

Leachate that would be generated within the Alt. 1 expansion area is expected to travel westerly through a CAZ of approximately 7.2ha in area, roughly half of the required CAZ area. Though contaminant attenuation mechanisms will reduce the concentration of contaminants somewhat, potentially leachate impacted groundwater would be expected to discharge into the Michipicoten River and Trout Creek, as indicated on Drawing 7.

Leachate that would be generated within the Alt. 2 expansion area is expected to travel south and south-westerly through an available CAZ of approximately 28.5ha in area, shown on Drawing 7, The Alt 2. expansion area provides significantly greater opportunity for contaminant attenuation prior to discharge of groundwater to the Michipicoten River. Although the fill area would be situated approximately 300m from the River at its closest point, it is expected that a high level of attenuation

would be provided due to an interpreted average width of flow of about 643m (about 1,000m along the riverbank). A CAZ of these dimensions is calculated to result in compliance with RU criteria for a 2.6ha fill area, considering a leachate chloride concentration of 750mg/L. Alt. 2 is therefore the preferred expansion scenario. As a precaution should there be radial leachate flow, the CAZ will extend upgradient and coincide with the existing and proposed site property limits (see Drawing 7).

4.3.3 CAZ Considering Other Leachate Indicators

CAZ area requirements were also determined for other leachate indicator parameters and, considering dilution alone, were in cases found to be greater than that required to attenuate chloride. Of the parameters evaluated, the CAZ to dilute iron and manganese ranges from 2.8 to 11.3 times greater than that required to dilute chloride (see Table 3).

Table 3: CAZ Areas Considering Other Leachate Indicators – Existing and Expanded Site

Parameter	Well 7 (source)	R.U. Criteria (Cm)	Required Dilution Factor	Required CAZ Area (ha)	
				Existing Site	Expanded Site^
Iron	2.65	0.16	16.6	35.9	71.8
Manganese	1.7	0.025	68.0	147.5	295
Alkalinity	313.5	86	3.6	7.9	15.8
Dissolved Organic Carbon	4.81	3.1	1.6	3.4	6.8
Hardness	322	107.8	3.0	6.5	13
Total Dissolved Solids	339.5	162	2.1	4.5	9
Chloride	750*	125.18	6.0	13	26

* the highest recorded source well concentration of chloride is 231mg/L, 750mg/L is used in sizing the CAZ
^ "Expanded Site" includes the existing plus proposed fill areas

The RUC values presented in Table 3 are developed assuming that the downgradient water use is drinking water and are thus based on ODWS values. However, as the ultimate receiver is the Michipicoten River, surface water quality objectives and guidelines should be considered. In the case of iron, the PWQO and CWQG are both equivalent to the ODWS value (0.3mg/L), there is no APV. No PWQO, CWQG or APV has been established for manganese.

In addition to this, iron and manganese are also attenuated by mechanisms other than dilution, such as oxidation, sorption and biodegradation and therefore would not require a CAZ sized based on dilution alone. The effects of other attenuation mechanisms may be apparent when noting the attenuated levels as determined from water samples collected at MW2 (see Table 1), which are significantly lower than would be expected if only attenuated by dilution through the existing CAZ. Improved performance would be expected through the expanded CAZ due to its land area and increased distance to the River.

4.4 Conclusion

Considering the results of the assessment of available CAZ areas provided by Alt. 1 and Alt. 2, it is preferred that a WDS expansion would occur abutting the existing fill area offset to the south and over a footprint matching the size of the existing fill area (i.e. Alt. 2). Developed to provide for a 25 year planning period, the volume of waste and fill material to be placed is 100,000m^3. The proposed expansion would include disposal by trench method with trenches to a depth of 3m, this would allow for

potential future expansion using the area method (i.e. above grade fill). Final contours would be developed to ensure positive drainage away from the fill area with top slopes of 20:1.

By constructing an expansion area south of the existing fill area, a total CAZ of approximately 35ha in area would be provided downgradient from the existing and proposed fill areas prior to the Michipicoten River. The CAZ calculations presented in the sub-sections above suggest that this is adequate area to attenuate chloride (a mobile and non-reactive leachate indicator) to below RU criteria. When considering iron and manganese, though, a larger CAZ would be required when the ODWS are used as the basis for RU calculations and considering dilution alone. Due to proximity of the site and CAZ to the River, it is necessary to consider the potential impact(s) to surface water. To do so, reference to the PWQO, CWQG and APV is made as is discussed further in Section 5.0.

5.0 Surface Water Assessment

The analysis presented in Section 4.0 indicates that potentially leachate impacted groundwater may discharge to the Michipicoten River. Accordingly, appropriate landfill operations and maintenance tasks will be required to help effectively control the potential for adverse impact. These include (but are not necessarily limited to): appropriate site grading so as to not direct surface water onto the fill area; and, progressive capping of completed portions of the fill area. The goal of these tasks is to reduce the potential for leachate generation.

5.1 Watershed

The Michipicoten River watershed lies within the Lake Superior drainage basin. The watershed area upstream from the landfill site and upstream of the mouth of Trout Creek, is approximately 529,000ha according to the Ontario Flow Assessment Tool (OFAT). Following its confluence with the Magpie River, the Michipicoten River discharges into Lake Superior. The watershed is characterised by numerous natural lakes and wetland areas interconnected by systems of short river reaches. The Michipicoten River is flow controlled by hydroelectric generating stations located upstream of the site (first developed at High Falls in 1908) and operated by Brookfield Power.

Located within a meander of the Michipicoten River, the existing fill area is located within 230m of the River and within 250m from the mouth of Trout Creek where it discharges into the River. The elevation of the Michipicoten River is approximately 186m above sea level (asl) whereas the original ground elevation at the disposal site is approximately 230m asl. The ground elevation is relatively flat from the edge of the fill area for a distance of 150m prior to a steep embankment to the River. Similar topography exists between the existing fill area and Trout Creek.

5.2 On and Near Site Surface Water Conditions

There are no surface water features located on or flowing through the site (either existing or proposed fill areas). The existing fill area is graded to avoid ponding of water thereby mitigating the leachate formation potential; however, no surface water management infrastructure is provided (eg. infiltration swales/ponds).

Locally, surface water flows generally in a westerly direction. The 17.6ha surface water drainage area upgradient from the existing fill area has a slope of approximately 0.04m/m and is forested. These characteristics remain in the area downgradient of the site (6.5ha) for approximately 150m before a steep embankment leads to the Michipicoten River. The catchment area upgradient from the proposed fill area is approximately 2.4ha in size, has a slope of about 0.05m/m (steeper toward the east) and is also forested. The downgradient catchment area (28.5ha) is similar to that downgradient from the existing fill area. Drawing 9 depicts these catchment areas.

5.3 Surface Water Quantity

The Michipicoten River is flow controlled by a series of hydroelectric generating stations, the last of which is the Scott generating station (GS) located nearly 7km upstream from a location in the River west of the landfill site. As stated in Brookfield Power's March 2007 Michipicoten River Water Management Plan (MRWMP), the minimum flow to be maintained downstream of the Scott GS is 17m^3/s, increasing annually to 26.3m^3/s from April 15 to June 15. Downstream from the landfill site flow is not controlled.

Flow through the GS is monitored and is calculated through the spill gates. During the 2017 calendar year, the average flow through the GS was roughly 80m^3/s and ranged from roughly 17m^3/s to 250m^3/s. The watershed area upstream from the GS location is approximately 528,000ha, about 1,000ha less than that upstream from the landfill site. Mean annual flows generated using OFAT for these 2 watershed areas were marginally different at 79.6m^3/s and 79.8m^3/s. For the purpose of flow analysis, then, flow data from the Scott GS is felt to be sufficiently similar to the flow expected in the River west of the landfill site to support assessment of potential impacts.

The drainage areas immediately upgradient from the existing and proposed sites are not expected to generated measureable surface runoff and the Municipality has reported no instances where overland flow from this drainage area has impacted site operations. Provisions would, however, be provided to intercept any potential runoff prior to it potentially coming into contact with waste and becoming contaminated. This can perhaps most effectively be done by constructing a system of intercepting swales to collect runoff and allow it to infiltrate into the ground.

The peak rate of surface water runoff from the existing and proposed fill areas, when fully developed, is estimated to be 1.37m^3/s. Similarly to runoff generated upgradient from the site, a system of intercepting swales constructed near the toe of fill material and discharging to an infiltration pond would provide for the collection and infiltration of potentially contaminated runoff. Maintaining an effectively graded fill area to encourage surface water runoff, rather than infiltration through the fill material, is an important consideration to managing surface water on-site.

5.4 Surface Water Quality

The Municipality has carried out a surface water quality monitoring program in the Michipicoten River and Trout Creek reportedly since at least the mid-late 1990's. Data is readily available for most of the current sample collection locations starting in 2001, generally twice annually, from the locations shown on Drawing 10. The program was developed and implemented by the Municipality to assess for potential impacts to the River and Creek from the discharge of potentially leachate impacted groundwater and/or surface water. Due to site topography, and the topography and forested nature of

the land between the fill area and the Michipicoten River, any surface water runoff that may be generated at the fill area is not expected to discharge directly into the River.

5.4.1 Water Quality Objectives and Receiver Policy

MECP uses the goals and policies described in the 1994 publication "*Water Management: Policies, Guidelines, Provincial Water Quality Objectives*" and Procedure B-1-5 "*Deriving Receiving Water Based Point Source Effluent Requirements for Ontario Waters*" (updated March 22, 2019) to ensure that the quality of surface waters are satisfactory for aquatic life and recreation. The Guidelines define Policy 1 and Policy 2 receiving water courses as:

- **Policy 1:** "In areas which have water quality better than the Provincial Water Quality Objectives, water quality shall be maintained at or above the Objectives." (i.e. better than the objective).

- **Policy 2:** "Water quality which presently does not meet the Provincial Water Quality Objectives shall not be degraded further and all practical measures shall be taken to upgrade the water quality to the Objectives."

Historical upstream water quality concentrations are assessed using the 75th percentile concentration to determine which policy is applied. From the data presented in Table 4, the Michipicoten River is classified as a Policy 1 receiver.

Table 4: Selected Surface Water Quality Data – 75th Percentile Values from Historical Data

Parameter	Units	Sampling Location and Concentration					
		PWQO	Michipicoten River Upstream	Michipicoten River Bank	Upstream Trout Creek	Downstream Trout Creek	Michipicoten River Downstream
Chloride	mg/L	-	0.94	0.94	0.71	0.69	1.03
Manganese	mg/L	-	0.011	0.010	0.018	0.015	0.009
Sulphate	mg/L	-	3.25	3.46	3.66	3.98	2.29
Phosphorus	mg/L	0.03	0.0068	0.0089	0.012	0.011	0.008
Un-ionized Ammonia	mg/L	0.02	0.001	0.001	0.001	0.001	0.001
pH	-	6.5-8.5	7.61	7.58	7.73	7.72	7.59
Arsenic	µg/L	5*	0.38	1.0	9.1	8.3	0.37
Barium	µg/L	-	10.0	10.0	26.4	23.9	8.2
Boron	µg/L	200	ND	ND	ND	ND	ND
Cadmium	µg/L	0.1*	0.02	0.02	0.02	0.02	ND
Chromium	µg/L	1^	0.45	0.4	0.67	0.52	0.84
Iron	µg/L	300	118	131	255	209	111
Lead	µg/L	3*	ND	0.073	0.15	0.1	0.06
Zinc	µg/L	20*	ND	ND	ND	ND	ND
Copper	µg/L	5*	1.0	1.12	1.55	1.31	0.78
Nitrate	µg/L	-	92	91	101	104	103
Nitrite	µg/L	-	ND	ND	ND	ND	ND

Table 4: Selected Surface Water Quality Data – 75th Percentile Values from Historical Data							
			Sampling Location and Concentration				
Parameter	Units	PWQO	Michipicoten River Upstream	Michipicoten River Bank	Upstream Trout Creek	Downstream Trout Creek	Michipicoten River Downstream
Conductivity	(uS/cm)	-	72	73	115	116	55

NOTE: data set 2010 to 2018.
* interim PWQO, current PWQO for arsenic is 100ug/L, cadmium 0.2ug/L, copper 5ug/L, lead 10ug/L and zinc 30ug/L.
^ Cr VI

5.4.2 Historical Water Quality

Table 4 presents a summary of the 75th percentile values from analysis of the historical surface water sampling events. A summary of all historical results is presented in Tables E.8 to E.13 of Appendix B and copies of laboratory certificates of analysis for the 2017 events are provided in Appendix C. Plots depicting trends in selected surface water quality parameters are included in Appendix D. Historical reviews of surface water quality data have concluded that water quality upstream in Trout Creek and the Michipicoten River is similar to water quality in downstream locations and that there is no measurable landfill-related influence on water quality.

5.4.3 PWQMN Data

A Provincial Water Quality Monitoring Network (PWQMN) sample station was established on the Michipicoten River at Highway 17, approximately 3.3km downstream from the landfill site. The station, number 01002900102, is currently inactive and water quality samples were first collected in 1969 and last collected in 2005 from this location. Data from 2000 to 2005 is available for download from the Province of Ontario in Microsoft Excel format and data from 1964 to 1999 in data base format (*.mdb and *.odb).

Data is available from 2003 to 2005 for parameters including (but not limited to): alkalinity; chloride; pH; sodium; manganese; and, nickel. Only data from 1969 to 1990 was capable of being retrieved by KEC for the following parameters: nitrite; nitrate; total nitrates; ammonium; total kjeldahl nitrogen; phosphate; and, turbidity. A summary of results from analyses conducted in 2003 to 2005 is presented in Table 5.

Table 5: Summary of Selected Parameters from PWQMN Station 01002900102							
Parameter	PWQO	Units	Sample Size	Min	Max	Ave	75th Percentile
Alkalinity	*	mg/L	21	15.8	33.1	27.5	30.3
Chloride	-	mg/L	21	0.7	1.3	0.9	0.9
Manganese	-		19	4.95	30	9.3	8.4
Nickel	25	ug/L	19	0	2.86	0.5	0.75
pH	6.5-8.5	-	21	7	10	8.0	8.09
Sodium	-	mg/L	21	0.84	1.28	1.1	1.1

* Alkalinity should not be decreased by more than 25% of the natural concentration.

Plots of the laboratory results from the analyses summarized in Table 5 are presented in Appendix E. While there is an apparent seasonal trend in River water alkalinity, no other trends are obvious. It is noted, though, that the data set is limited to a period of 3 years.

5.5 Surface Water Habitat Conditions

As presented in the MRWMP, Table 6 summarizes Ministry of Natural Resources and Forestry (MNRF) fisheries management and habitat objectives for the Michipicoten River reach downstream of the Scott GS. As stated in the MRWMP, the objectives for this reach are supported by Brookfield Power to the extent possible within the flow regime that is available from hydropower operations and through the provision of a continuous baseflow as outlined in the MRWMP.

Table 6: MNRF Fisheries Management and Habitat Objectives for the Michipicoten River

Location	MNRF Targeted Fish Species/Habitat	MNRF Sport Fishing Target Quality	MNRF Habitat Target Quality
Scott GS to Lake Superior	Non-native Rainbow Trout, Chinook Salmon, Coho Salmon	Medium	Medium
	Native Walleye, Brook Trout, Sturgeon, Lake Trout	Viable population	Medium

In Table 3, "Medium Quality Habitat" are habitat conditions that may be moderately different from a non-manipulated system but provide good habitat for all life stages.

5.6 Potential Surface Water Impact

There are no surface water features on, passing through or discharging from the existing or proposed fill areas. As it is proposed to collect surface water runoff that may be generated at the existing and proposed fill areas and allow it to infiltrate, rather than discharge directly to surface water, no impact to temperature or average annual sediment loading to the Michipicoten River or Trout Creek will result. Collecting potential surface water runoff and allowing it to infiltrate at the site will also result in no substantive changes to the site water budget. Due to the relative sizes of drainage areas, no measureable impact to the hydrologic characteristics of the Michipicoten River drainage area will occur as a result of developing the existing and proposed fill areas.

5.6.1 Potential Impact of Landfill Related Groundwater Contaminants

The potential leachate plume migration path and locations of potential discharge to the Michipicoten River coincide with the delineated CAZ for the existing and proposed fill areas, as show on Drawing 7. It is expected that potentially leachate impacted groundwater will discharge to the Michipicoten River along its bank within the limits of the CAZ, perhaps more significantly along reaches of the River adjacent to the discharge location associated with the existing fill area.

A point of discharge mixing analysis is used to evaluate resulting concentrations of leachate indicator parameters that were determined to exceed the RUC, PWQO, CWQG or APV in water samples collected from MW2, as indicated in Table 7. MW2 is the closest monitoring well to the bank of the Michipicoten River and is located downgradient from the existing fill area. This approach provides an estimate of mixed concentrations at the point of discharge under the low flow condition and assuming complete mixing. The low flow in the River is maintained through the Scott GS at roughly 1.47 million m^3/day (17m^3/s).

Table 7: Summary of Surface Water Guidance and Background Values, Reasonable Use and Boundary Concentrations

Parameter	Guideline (mg/L)				Background (mg/L)		R.U. Criteria (Cm, mg/L)	MW2 (mg/L)
	ODWQS (Cr)	PWQO	CWQG - LT	APV	River BG	MW6 (Cb)		
VOCs								
1,4 Dichlorobenzene - H	0.005	0.004	0.026	0.763	ND	0.0005	0.0016	ND
Benzene - H	0.005	0.01	0.37	0.46	NT	0.0005	0.0016	ND
Dichloromethane – H	0.05	-	0.0981	-	NT	0.002	0.014	ND
Toluene – A	0.024	0.0008	0.002	1.4	NT	0.0005	0.012	ND
Vinyl Chloride – H	0.002	0.6	-	35.6	NT	0.0005	0.00088	ND
Dissolved Metals								
Arsenic –H	0.025	0.005~	0.005	0.15	0.00038	0.00099	0.0032	0.00016
Barium – H	5.0	-	-	2.3	0.1	0.016	0.26	0.027
Boron – H	5	0.2	1.5	3.55	ND	0.01	1.26	0.028
Cadmium – H	0.005	0.0001~	0.00009	0.00021	0.00002	0.00001	0.0013	0.00003
Chromium – H	0.05	0.001*	0.001*	0.064 total	0.00045	0.00032	0.013	ND
Copper – A	1	0.005	0.002	0.0069	0.001	0.00095	0.5	0.0011
Iron – A	0.3	0.3	0.3	-	0.118	0.01	0.16	0.046
Lead – H	0.01	0.003~	0.001	0.002	ND	0.00005	0.0025	ND
Mercury – H	0.001	0.0002	0.000026	0.00077	NT	0.00001	0.00025	ND
Magnesium	-	-	-	-	1.98	9.18	-	11.4
Manganese – A	0.05	-	-	-	0.011	0.00036	0.025	0.117
Nickel	-	0.025	0.025	0.039	ND	0.0005	-	ND
Potassium	-	-	-	-	0.62	2.14	-	2.54
Sodium – A	200	-	-	180	1.32	1.73	100.86	3.29
Zinc - A	5	0.02~	0.007^	0.089	ND	0.003	2.5	0.021
General Chemistry								
Alkalinity – OG	30-500	#	-	-	31	142	86-321	243
Ammonia**	-	0.02	0.019	-	0.001	0.001	-	0.001
BOD5	-	-	-	-	ND	2	-	2.95
Chloride – A	250	-	120	180	0.94	0.37	125.18	1.98
COD	-	-	-	-	24	22.75	-	19
Cond. (us/cm)	-	-	-	-	72	274.5	-	398
DOC – A	5	-	-	-	8.9	1.2	3.1	3.4
Nitrate – H	10	-	13	-	0.092	0.035	2.53	0.046
Nitrite – H	1	-	0.06	-	ND	0.01	0.26	0.02

Table 7: Summary of Surface Water Guidance and Background Values, Reasonable Use and Boundary Concentrations								
Parameter	Guideline (mg/L)				Background (mg/L)		R.U. Criteria (Cm, mg/L)	MW2 (mg/L)
	ODWQS (Cr)	PWQO	CWQG - LT	APV	River BG	MW6 (Cb)		
pH – OG	6.5-8.5	6.5-8.5	6.5-9.0	-	7.61	7.95	7.23-8.23	7.6
Sulphate – A	500	-	-	-	3.25	11.9	256	4.92
TDS – A	500	-	-	-	53	162	331	236
TKN	-	-	-	-	0.41	0.45	-	0.385
TP	-	0.03	0.004^^	-	0.0068	0.9	-	0.014

Notes: *A – aesthetic, H – health related, OG – op. guideline, ND – below DL, Cb - median values of all previous sampling events. Laboratory detection limits used where concentrations were ND; *Cr VI, 0.0089ug/L for CrIII; **unionized ammonia; # do not decrease by more than 25% of the natural concentration; ## CWQG for copper is based on hardness; ^ for dissolved zinc; ^^varies by waterbody trophic state; ~interim PWQO. Background river and MW2 are 75th percentile values using data from 2010 to 2019.*

Mixing calculations were completed using the lateral groundwater flow rate (120m^3/d) determined in sub-section 3.7 and the 75th percentile River background and MW2 contaminant concentrations in Table 7. Table 8 presents a summary of the results of the mixing analysis for the existing fill area and CAZ. It is noted that, although the resulting in-stream concentrations of zinc and TP exceed the CWQG for long term exposure, they are equivalent to background concentrations (in the case of zinc, the laboratory detection limit). The results indicate that the Michipicoten River has available assimilative capacity as a Policy 1 receiver.

Mixing calculations completed for the proposed fill area and CAZ incorporate reduced contaminant levels (due to increased dilution of more the 4 times) and a similar lateral groundwater flow rate. The results of the calculations are similar to those presented in Table 8 in that the calculated in-stream concentrations are either consistent with background concentrations and/or below surface water objectives and guidelines.

As the groundwater discharge is subsurface along the bank of the Michipicoten River, in-stream mixing zone or plume modeling was not undertaken.

Table 8: Summary of Assimilative Capacity Mixing Analysis – Existing Fill Area and CAZ								
Parameter	Guideline (mg/L)				R.U. Criteria (Cm, mg/L)	MW2 (mg/L)	River Background Concentration (mg/L)	Calculated In-Stream Concentration (mg/L)
	ODWQS (Cr)	PWQO	CWQG - LT	APV				
Manganese	0.05	-	-	-	0.025	0.117	0.011	0.011
Zinc	5	0.02~	0.007	0.089	2.5	0.0201	ND*	0.003*
DOC	5	-	-	-	3.1	3.4	8.9	8.9
TP	-	0.03	0.004^^	-	-	0.014	0.0068	0.0068

* river background concentration is not detected, use laboratory detection limit of 0.003 for calculation; *^^varies by waterbody trophic state; ~interim PWQO.*

5.7 Suitability of the Site

The suitability of the site for waste disposal purposes is judged to be adequate considering the low potential for negative impact to surface water, due to attenuation provided through the CAZ and the comparatively small volume of discharge expected when compared to flow rates in the Michipicoten River.

Site design elements that intercept surface water allowing it to infiltrate the ground, as described above, combined with operational considerations such as proper capping and grading are expected to limit the generation of leachate from the site. Surface water runoff is not expected. Development and implementation of an appropriate ground and surface water monitoring program is also critical to assess the effectiveness of the available CAZ and the quality of groundwater discharging to the River. Future leachate contingency planning may include the development of a collection and treatment system, the need for which is to be judged based on results from the monitoring program and consultation with MECP.

6.0 Monitoring and Mitigation

Given complexities inherent to interpreting groundwater systems, once operating, a natural attenuation landfill may function differently than anticipated and/or a constituent other than chloride may be identified as the critical contaminant. Accordingly, it is essential to develop and implement a comprehensive groundwater monitoring program to monitor site performance.

Similarly, a surface water monitoring program is required to identify any potential impact(s) on surface water. In this case, from the discharge of potentially leachate impacted groundwater to the Michipicoten River.

6.1 Groundwater Monitoring

Groundwater monitoring will continue to comprise an integral component of site operations, with the objectives being to monitor the groundwater quality in the overburden aquifer to:

1. identify and characterize the landfill derived contaminants moving through the overburden aquifer;
2. evaluate the effectiveness of the defined CAZ;
3. monitor the quality of groundwater discharging to the Michipicoten River; and,
4. assess the need for implementation of a contingency measure(s).

During construction of the proposed expansion, the monitoring well network will be expanded to provide for adequate monitoring of downgradient groundwater quality, as shown on Drawing 11. Water levels and groundwater samples will be collected from the entire monitoring well network twice a year, in April-May and August-September. It is proposed that the analyses required by Condition 7. of the current Environmental Compliance Approval (ECA) will remain:

> *7.4 For each sampling event, analytical parameters shall include: pH, Total Dissolved Solids (TDS), Conductivity, Hardness, Alkalinity, Chloride, Sulphate, Nitrate, Nitrite, Calcium, Magnesium,*

Sodium, Potassium, Dissolved Organic Carbon (DOC), ICAP metal scan (Barium, Boron, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Zinc), Ion balance calculation, 5-day biological oxygen demand (BOD5), chemical oxygen demand (COD), Total Kjeldahl Nitrogen (TKN), Ammonia, and Total Phosphorous.

7.5 *Once each year, sampling shall include volatile organic compounds (VOC).*

During each monitoring event, field pH, temperature and conductivity will be recorded prior to sampling.

6.2 Surface Water Monitoring

The established surface water monitoring program will also be maintained. However, two (2) near shore sample locations will be introduced to assess for potential impact(s) where groundwater is interpreted to discharge into the River. Drawing 12 shows the current and proposed surface water sampling locations. Samples will be collected twice annually concurrently with groundwater samples and analyzed for the parameters identified in section 6.1.

6.3 Monitoring Procedures, Methods and Record Keeping

Sample collection will continue to be by Municipal staff in accordance with the current "Groundwater Monitoring and Sampling Protocol" and "Surface Water Monitoring and Sampling Protocol" and as required under Section 24 & 25 of Ontario Regulation 232/98.

Monitoring well record sheets as well as surface water record sheets will continue to be kept in a logbook stored at the Municipal office while laboratory sample results are kept at the water treatment plant located in Wawa, ON.

6.4 Trigger Mechanisms

The trigger mechanisms plan considers the assessment of results from the analysis of groundwater and surface water samples. In order to implement the trigger mechanism plan, the following are established for both groundwater and surface water:

1. trigger parameters;
2. trigger concentrations; and,
3. trigger monitoring points.

The groundwater trigger mechanism plan would continue to be applied as an early warning mechanism to help ensure that contingency measures are implemented prior to the occurrence of an unacceptable impact on the Michipicoten River.

6.4.1 Groundwater Triggers

Trigger Parameters

As suggested by Zaltsberg[1], in order to develop a list of trigger parameters, average concentrations in leachate and ambient (background) groundwater should be compared. Zaltsberg further suggests that a ratio between average concentrations in leachate and background results of not less than 10 is "reasonable in identifying trigger constituents" with preference given to those parameters for which ODWQS exist. Parameters with no ODWQS may also be included as leachate indicators.

This assessment will be completed on an annual basis during preparation of the required annual report. Specific trigger parameters are expected to remain consistent; however, they may change from year to year as the assessment is based on ratios of averages of analytical results that are, by their nature, variable.

Trigger Concentrations

Trigger concentrations for the trigger parameters identified will be calculated as the 75th percentile RU criteria values using the 10 most recent sampling results, for each trigger parameter. Acknowledging that the downgradient boundary of the CAZ is the Michipicoten River, additional trigger parameters and concentrations will also be established as described in sub-section 6.4.1.

Trigger Monitoring Points

Trigger monitoring points are the MWs constructed upgradient from the Michipicoten River.

6.4.2 Surface Water Triggers

Trigger Parameters

Trigger parameters are the leachate indicator parameters identified in Schedule 5, Column 3 of the MOE Landfill Standards.

Trigger Concentrations

Trigger concentrations are equivalent to the 75th percentile values calculated using the 10 most recent historical background surface water quality sample results from each of the two (2) upstream sampling locations.

Trigger Monitoring Points

The trigger monitoring points are locations upstream and downstream of the Site within both the Michipicoten River and Trout Creek as well as near shore locations on the River, as shown on Drawing 12.

[1] Zatlsberg, E. 1994. A Statistically Based Trigger Mechanism for Evaluation of Groundwater Quality in Landfill Monitoring Wells. Canadian Water Resources Journal, 19:3, pp. 267-274.

6.5 Trigger Mechanisms Plan

The objective of the trigger mechanisms plan is to monitor the potential impact(s) to ground and surface water and to establish a structured approach to verifying potential impact(s) and confirming the need to implement the contingency plan to mitigate such impact(s).

The trigger mechanisms plan is comprised of the following 3 tiers:

- Tier I – Annual routine monitoring program;
- Tier II – Intensive monitoring program; and,
- Tier III – Compliance monitoring program.

Tier I – Annual Routine (Alert) Monitoring Program

Sampling will continue to occur twice annually, once in the spring and once in the fall. If a trigger parameter exceeds its trigger concentration (groundwater and/or surface water) on two (2) consecutive sampling events, Tier II level monitoring will be initiated and the MECP will be informed.

Tier II – Intensive (Confirmation) Monitoring Program

Tier II is confirmatory monitoring which includes: an increased sampling frequency; a review of supplemental analytical results to confirm the degree and nature of the exceedance; and, discussions with concerned parties.

When Tier II is activated, the collection and analysis of samples would be required on a monthly basis, for a period of six (6) months (subject to ice conditions on the Michipicoten River), from both the background monitoring location and the location where the Tier I exceedance(s) occurred. Tier II monitoring is conducted to facilitate an assessment of whether an observed exceedance is due solely to landfill impact or is partly or wholly caused by other influences.

If Tier II monitoring confirms that the exceedance is related to landfill operations discussions will be held between the Municipality, the Municipality's consultant, and the MECP to determine whether implementation of the Contingency Plan is warranted. The discussions will define the optimum course of action and review contingency measures available to the Municipality (e.g. progressive closure and capping, leachate recirculation, leachate treatment, etc.). Should it be necessary to implement the Contingency Plan it will occur in concert with the Tier III monitoring program.

Tier III – Compliance Monitoring

Tier III monitoring is initiated following implementation of the Contingency Plan to monitor performance and assess effectiveness. The scope of the Tier III monitoring will be established during development of the proposed mitigating measure(s).

6.6 Contingency Plan

The Contingency plan is a 3 step process to be employed in the event that water quality trigger levels are exceeded in order to develop and implement the appropriate contingency measure.

Step 1 – Assessment

Undertake an assessment of whether an observed exceedance of a trigger is in fact due to landfill leachate, or whether the exceedance is partly or wholly attributable to other factors/sources. This will be achieved by considering trends in trigger parameter concentrations in the context of:

a) trigger parameter concentrations at other monitoring wells; and,
b) non-trigger leachate indicator parameter concentrations.

The trends will be considered using statistical analysis for the various cases to determine whether there is an overall trend of increased impact due to leachate, or whether the observed exceedance is anomalous or due to a source other than the landfill.

Step 2 – Determine Need for Contingency Measure

The results from Step 1 will be discussed the Municipality and the MECP in order to decide whether implementation of a contingency measure(s) is warranted. It is anticipated that if the exceedance of the trigger is due to leachate impact and off-site water resources may be impacted, then contingency measures will be implemented. If the exceedance is determined to be anomalous or not due to leachate, the contingency measures will not be implemented and monitoring (either the regular program or possibly an appropriately modified program) will continue.

Step 3 – Develop and Implement Contingency Measure

If the determination at Step 2 is that implementation is required, Step 3 constitutes the design (if required) and implementation of an appropriate contingency measure(s).

6.6.1 Potential Contingency Measures

One or more of the potential contingency measures below, or other measure, may be implemented based on the results of the contingency plan assessments:

1. Develop and implement a revised monitoring program;
2. Improvement/ repair of interim or final cover over landfilled areas;
3. Improvement/repair of surface water management facilities; and,
4. Construct leachate control facilities such as pump and treat and/or containment barriers.

One or more of the above measures may be implemented based on the degree, nature, and source(s) of an exceedance requiring mitigation. Specific details for the above contingencies, including capital, operation and maintenance costs, will be developed for consideration prior to implementation.

7.0 Conclusions and Recommendations

The following conclusions are derived from the groundwater and surface water assessment:

1. The existing and proposed fill areas are situated in a glaciofluvial deposit that largely comprises moderately permeable, fine to medium sand/silty sand and ranges in thickness from about 43m metres to 46 metres locally.

2. The underlying Precambrian bedrock is interpreted to slope to the south, southwest and west beneath the site.

3. Lateral groundwater and leachate movement is interpreted to advance to the south, southwest and west within the saturated overburden interval, based on the recorded elevations within the established monitoring well network. Vertical gradients are expected to be downward throughout the local area.

4. Considering the calculated hydraulic gradients and the interpreted hydraulic conductivities of the predominant formation, the groundwater (and ultimately the leachate) velocity may be about 30 to 40 metres per year whether moving laterally or vertically within the underlying formations. Quantifiable groundwater quality impact may be realized within 10 years after commencement of landfilling operations at the proposed fill area.

5. The assessment described in this report identifies that a 26 hectare CAZ is required to attenuate the design chloride concentration to a concentration meeting the RU requirement. Although a CAZ area of roughly 35ha is available downgradient from the existing and proposed fill areas, the proximity to the Michipicoten River requires that the potential impact to this water course be considered.

6. Previous assessments of surface water quality monitoring have concluded that there is no measurable impact to River water quality as a result of the landfilling activities. Additional monitoring and assessment should be carried out after initiation of a site expansion to determine if any related near shore impact(s) may occur.

7. A point of discharge mixing analysis to assess the assimilative capacity of the Michipicoten River (Policy 1 receiver) reveals that River has available capacity to accommodate potentially leachate impacted groundwater without resulting in exceedances of PWQO, CWQG or APV.

8. The fill area should be expanded as shown on Drawing 7, Alternative 2.

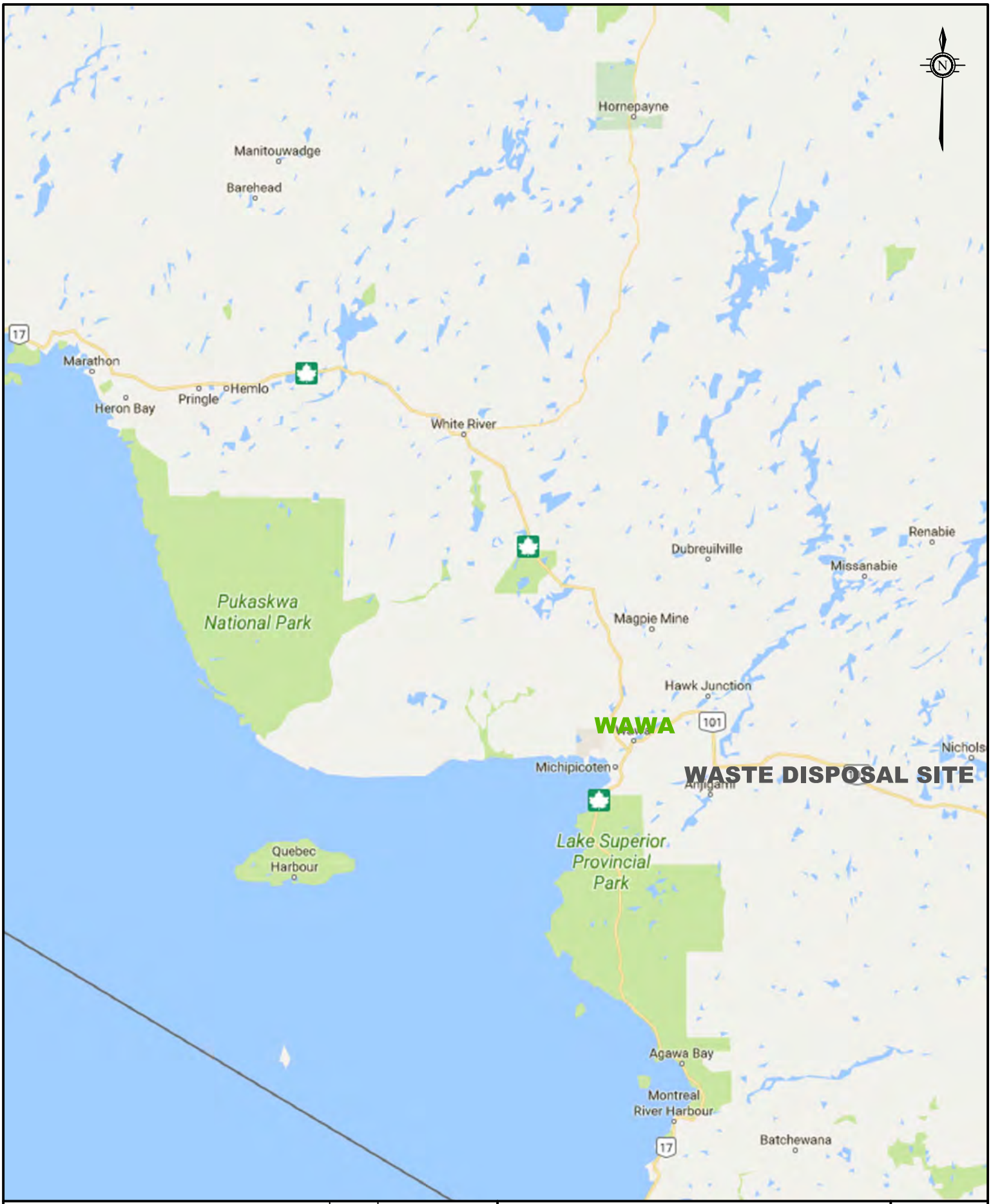
9. Routine groundwater and surface water level and water quality monitoring will be required to demonstrate compliance downgradient from the site. Findings from the monitoring program should continue to be documented in an annual report for submission to the MECP.

10. Four (4) new monitoring wells should be constructed and 2 new surface water monitoring locations established at the time the proposed expansion is developed as indicated on Drawing 11 and 12.

11. Should water quality exceedances be verified by the trigger mechanisms plan, implementation of contingency measures may be required.

This report prepared and respectfully submitted by:
Kresin Engineering Corporation

Chris Kresin, M.Sc.(Eng.), P.Eng.
Consulting Engineer



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Engineering Corporation

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CHECKED	C.KRESIN	08/18
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FILENAME	1140.11 drawing 1.dwg	
SCALE	NTS	

The Corporation of the Municipality of Wawa
GW AND SW ASSESSMENT REPORT

Waste Disposal Site: Location

1

Rev 0

MICHIPICOTEN RIVER

MW#2

MW#1

TO MICHIPICOTEN RIVER

BUSH ROAD

MW#4

MW#7

MW#5

MW#8

MW#6

MW#3

ACCESS ROAD

2.6ha DISPOSAL AREA

N16°01'25"E

678.182

N16°03'20"E
22.858

N73°58'30"W

N73°57'40"W

N73°58'35"W

111.164

N73°59'35"W
20.079

N73°58'00"W
(M)
(P)
40.648

N73°59'15"W

304.800

304.909
304.926

123.995

22.853
N15°59'55"E

678.186

304.918

GRADIENTS

MW 7 - MW 2 → 190.58m - 189.76m = 0.007
125m

MW 7 - MW 5 → 190.58m - 187.73m = 0.030
90m

*CONSIDERS FALL 2018 WATER TABLE ELEVATIONS

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NOTES

0 40 80 Meters

DESIGN		
DRAWN	K.SHERLOCK	04/2019
CHECKED	C.KRESIN	04/2019
PROJECT	1140.11	
FILENAME	1140.11 drawing 2.dwg	
SCALE	1:2000	

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GW AND SW ASSESSMENT REPORT

MONITORING WELL LOCATIONS

2

Rev 0

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NOTES

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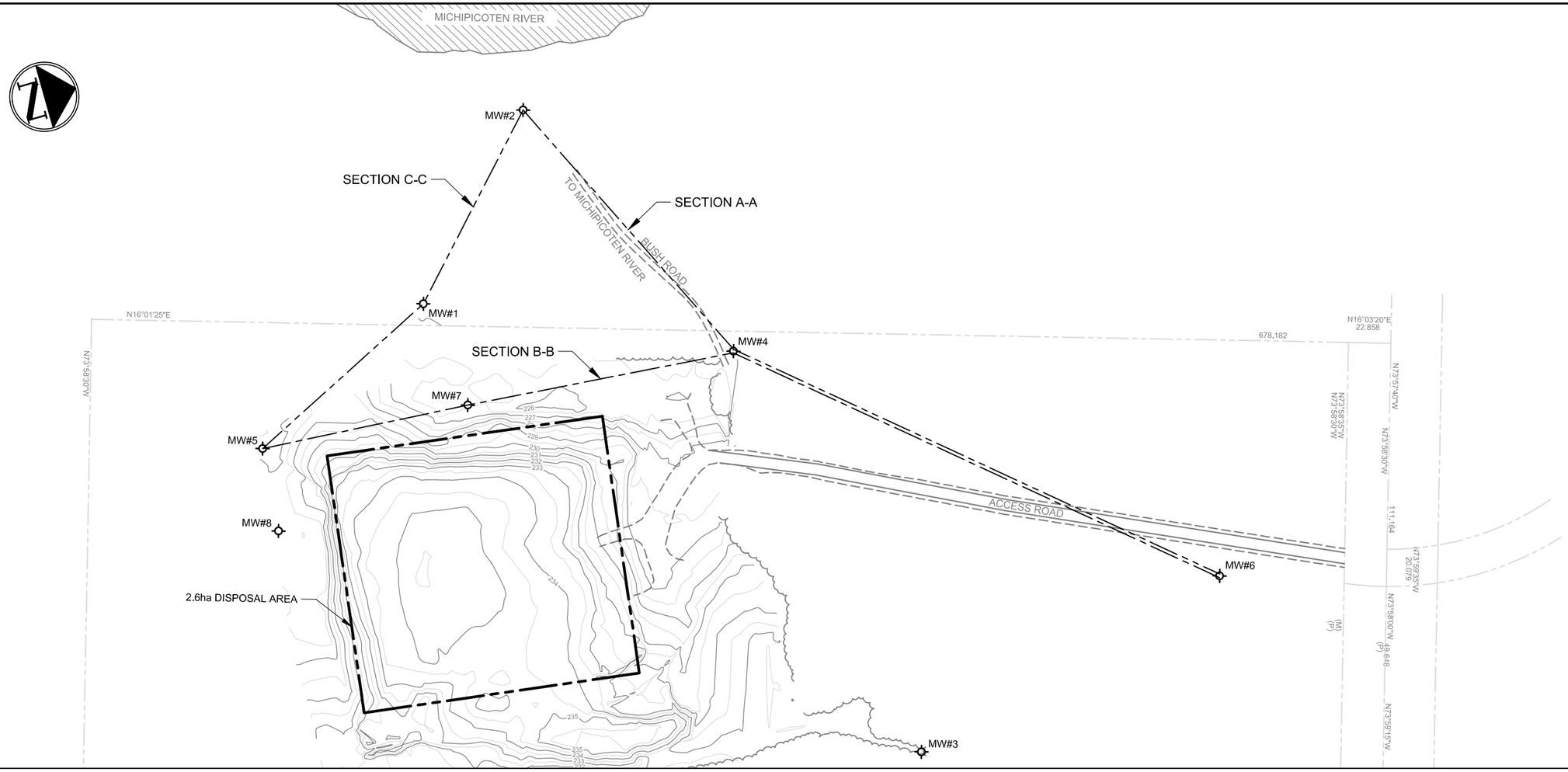
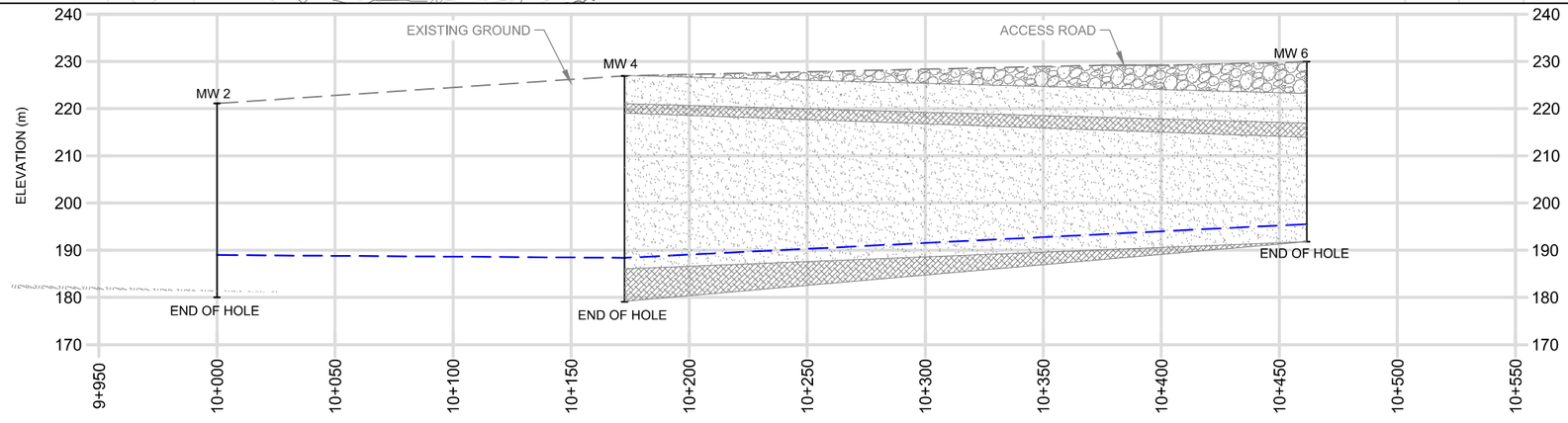
GW AND SW ASSESSMENT REPORT

LOCAL TOPOGRAPHY

3

Rev 0





LEGEND

- SAND WITH TRACES OF GRAVEL
- SAND
- SILTY SAND
- SILTY CLAY

SECTION A-A

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NOTES

DESIGN	CK	JULY 2018
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PROJECT	1140.11	
FILENAME	1140.11 drawing 4 and 5.dwg	
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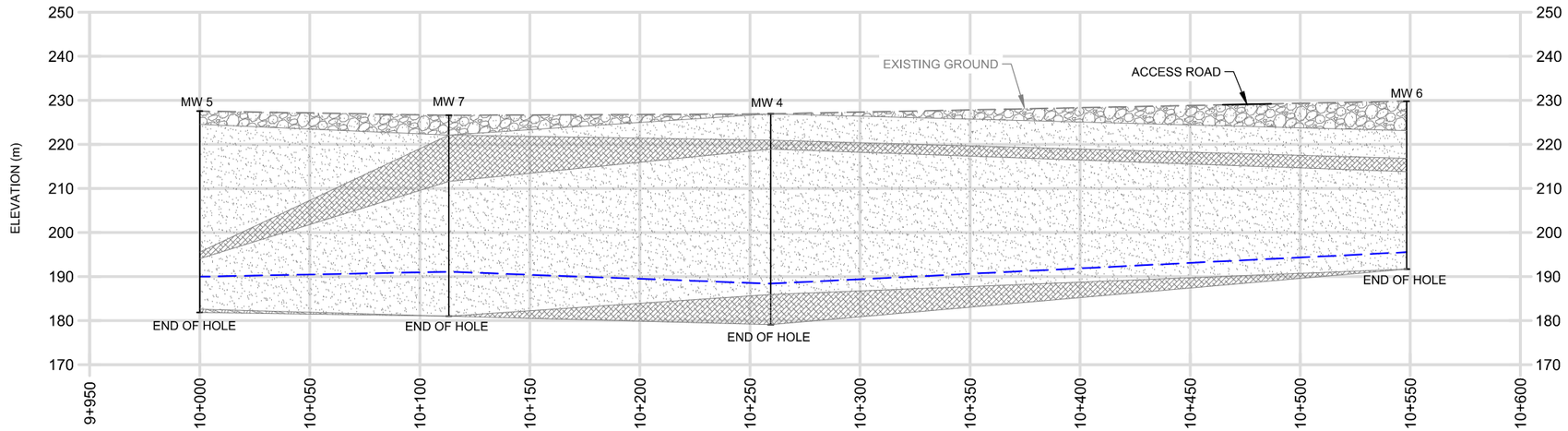
GW AND SW ASSESSMENT REPORT

STRATIGRAPHIC SECTIONS

4

Rev 0



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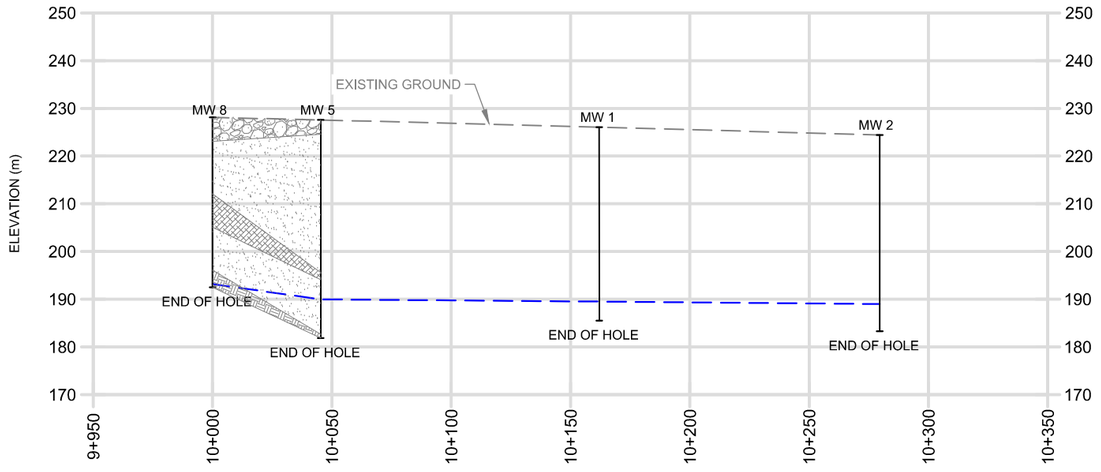

SECTION C-C

LEGEND

- SAND WITH TRACES OF GRAVEL
- SAND
- SILTY SAND
- SILTY CLAY

SPRING 2018 WATER TABLE

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NOTES

0 50 100 Meters

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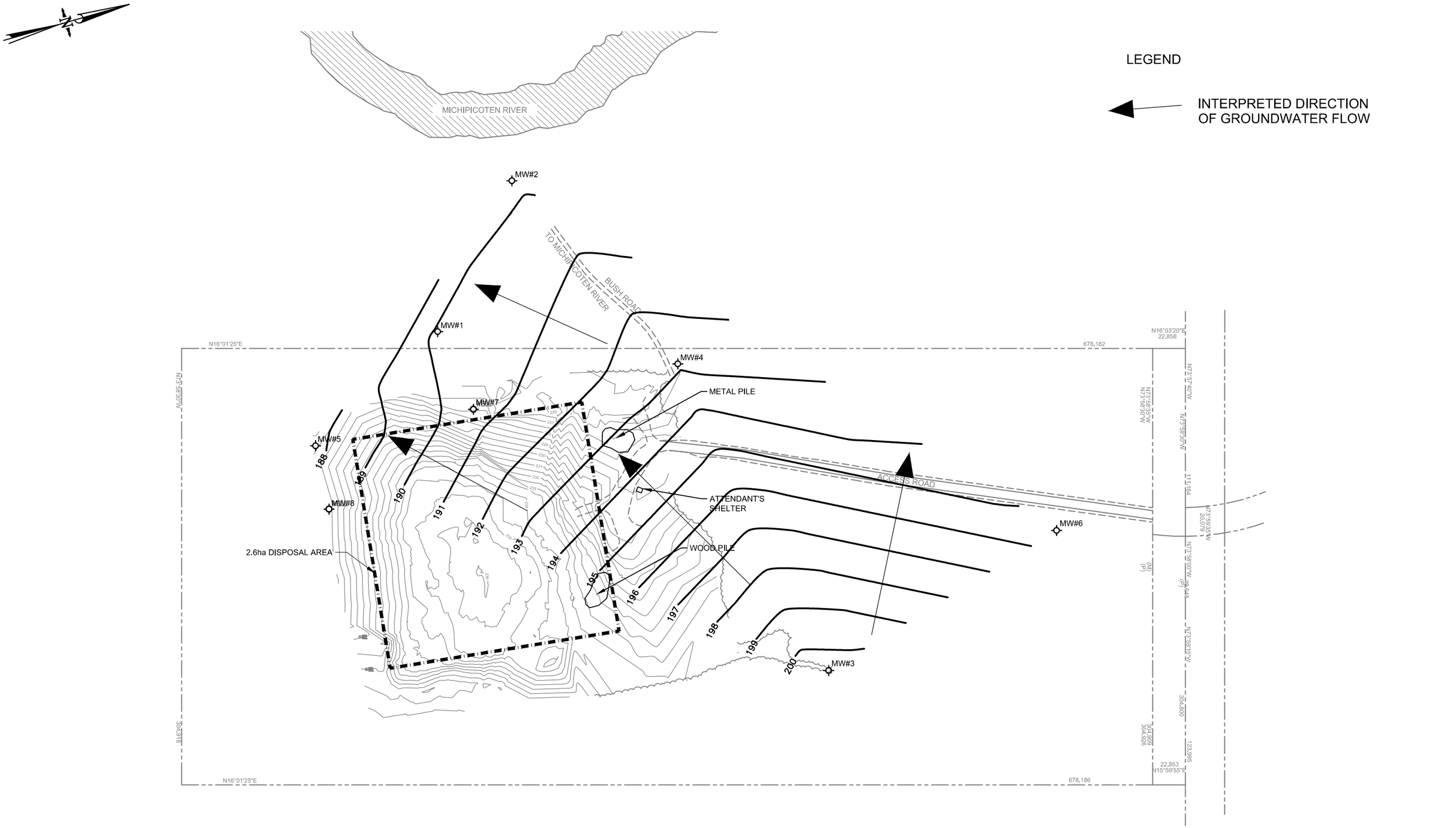
CHECKED	CK JULY 2018
PROJECT	1140.11
FILENAME	1140.11 drawing 4 and 5.dwg
SCALE	H 1: 5000 V 1:1250

THE CORPORATION OF THE MUNICIPALITY OF WAWA
GW AND SW ASSESSMENT REPORT

STRATIGRAPHIC SECTIONS

5

Rev 0



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NOTES

0 40 80 Meters

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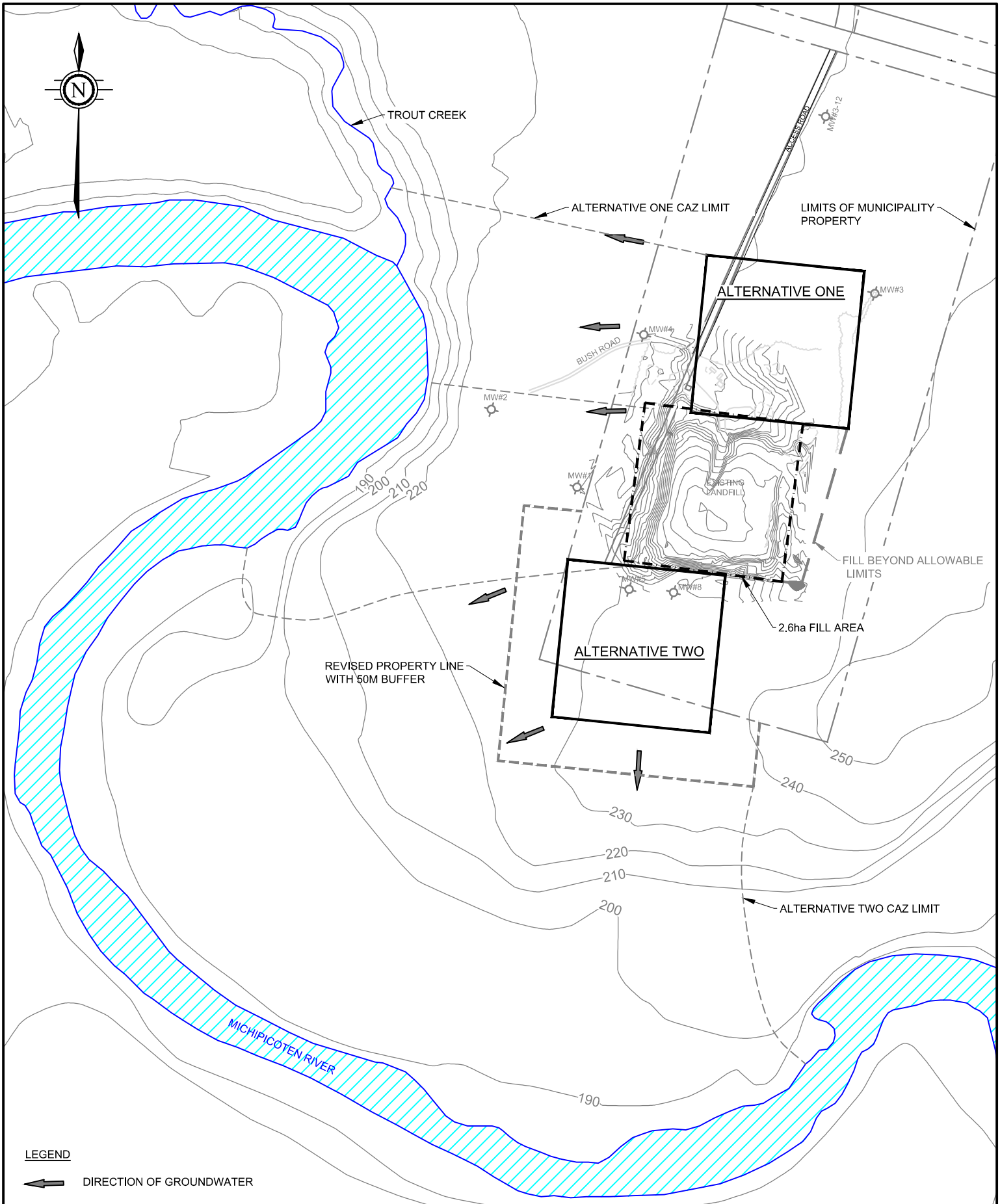
CHECKED	CKRESIN 04/2019
PROJECT	1140.11
FILENAME	1140.11 drawing 6.dwg
SCALE	AS SHOWN

THE CORPORATION OF THE MUNICIPALITY OF WAWA
GW AND SW ASSESSMENT REPORT

INTERPRETED GROUNDWATER CONTOURS

6

Rev 0



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PROJECT	1140.11
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SCALE	1:5000

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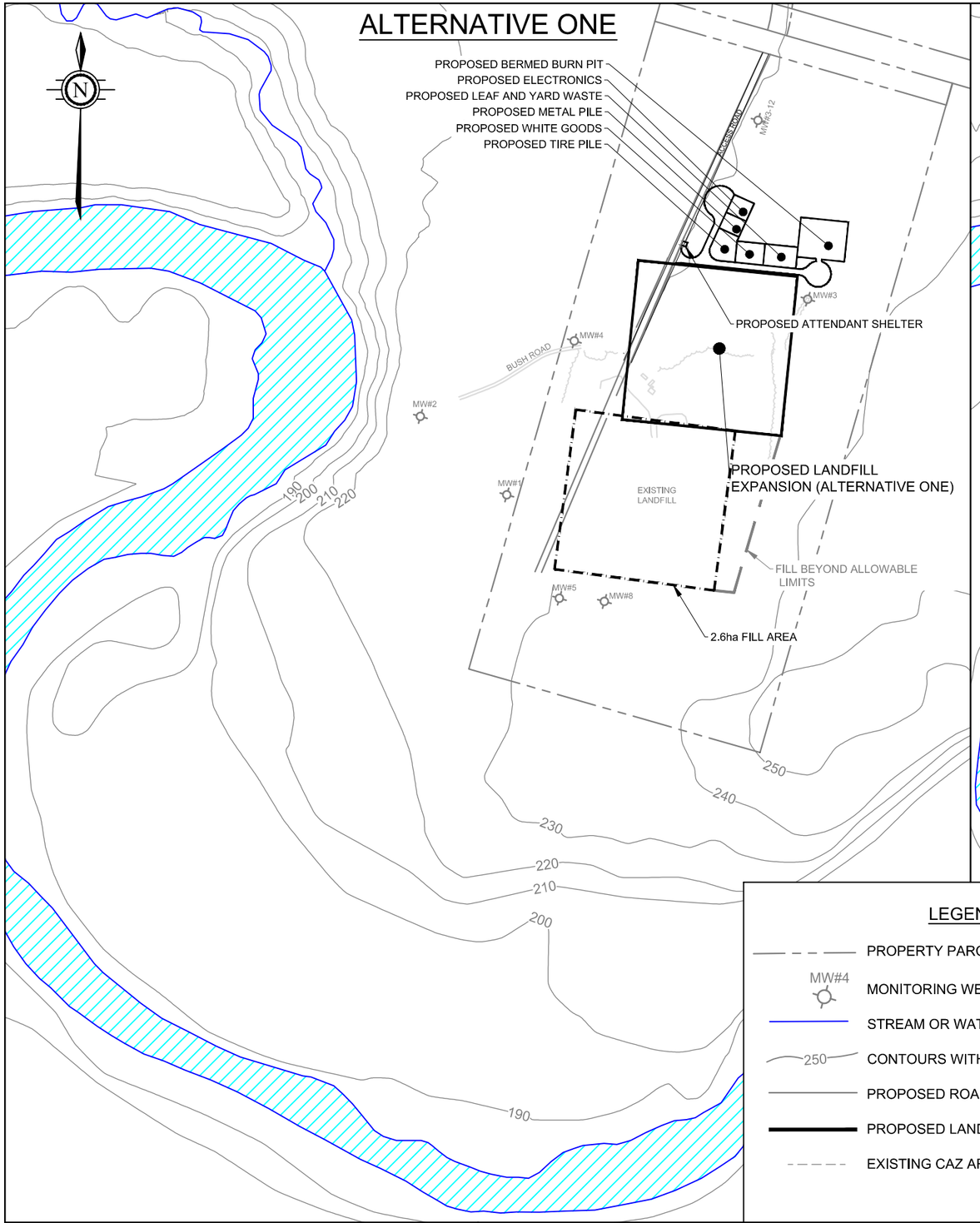
GW AND SW ASSESSMENT REPORT

CONTAMINANT ATTENUATION ZONES

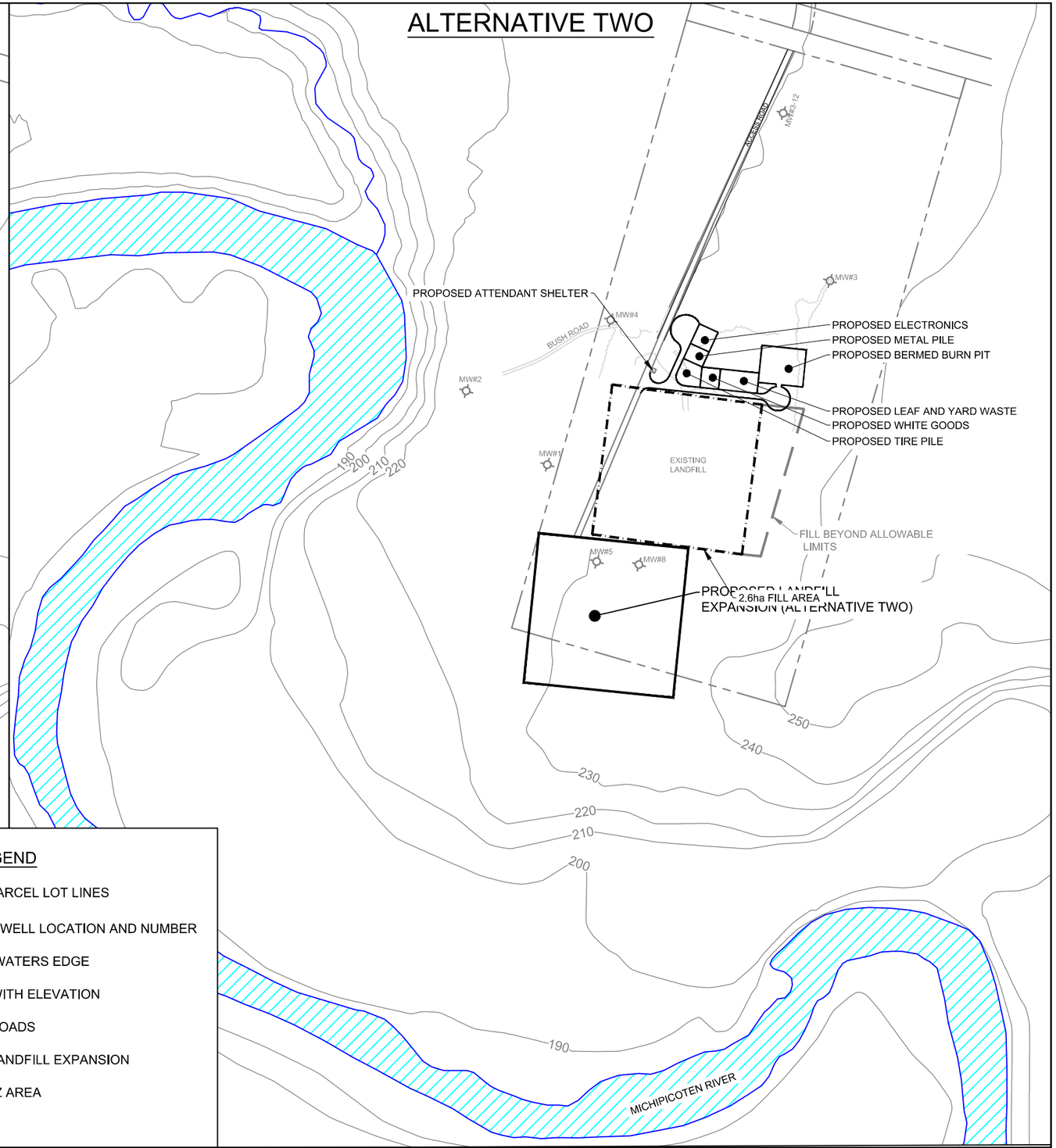
7

Rev 0

ALTERNATIVE ONE



ALTERNATIVE TWO



LEGEND

- PROPERTY PARCEL LOT LINES
- MW#4 — MONITORING WELL LOCATION AND NUMBER
- STREAM OR WATERS EDGE
- 250 — CONTOURS WITH ELEVATION
- PROPOSED ROADS
- PROPOSED LANDFILL EXPANSION
- EXISTING CAZ AREA

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NOTES

DESIGN		
DRAWN	K.SHERLOCK	JULY 2018
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PROJECT	1140.11	
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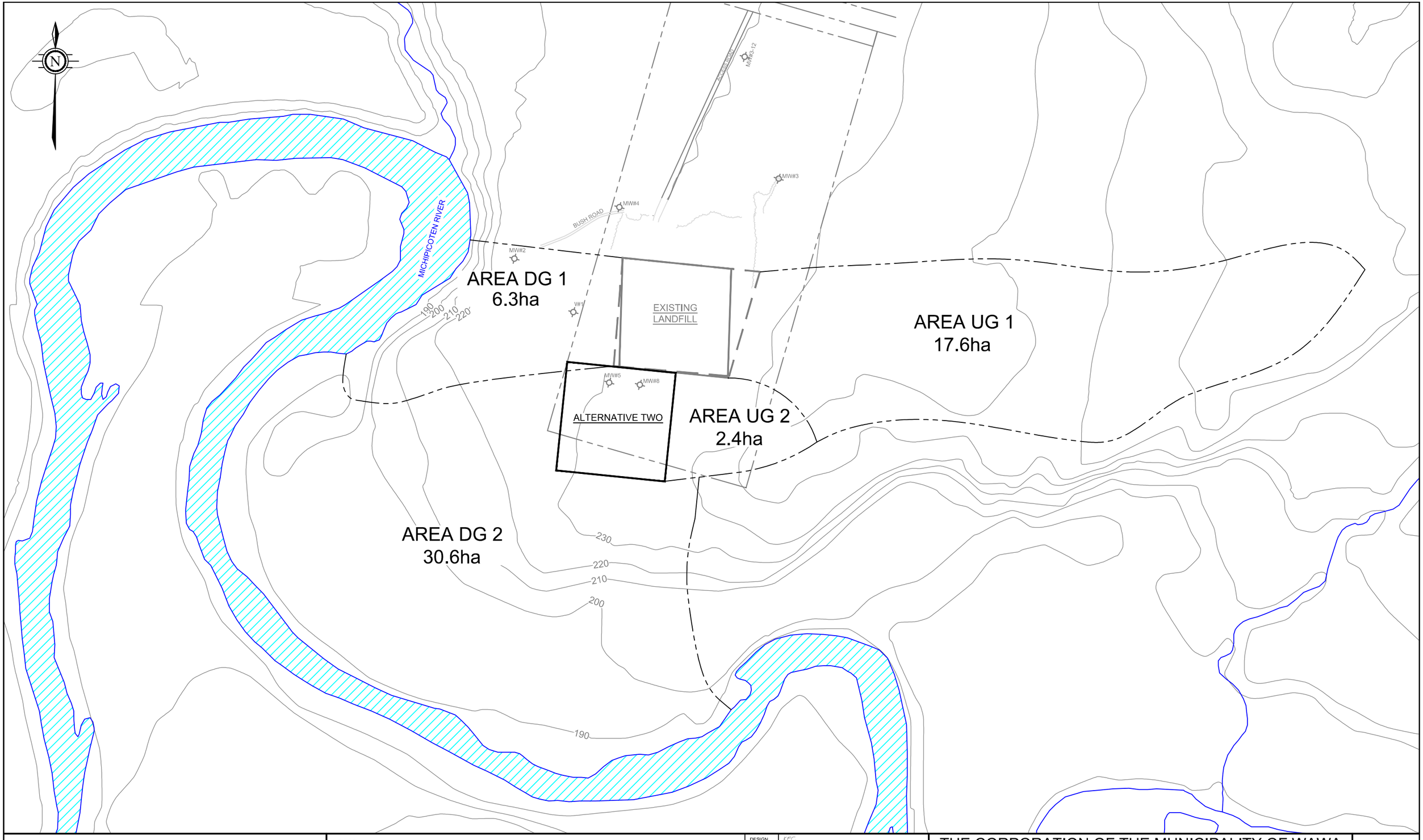
THE CORPORATION OF THE MUNICIPALITY OF WAWA
GW AND SW ASSESSMENT REPORT

ALTERNATIVE EXPANSION AREAS

8

Rev 0



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PROJECT	1140.11	
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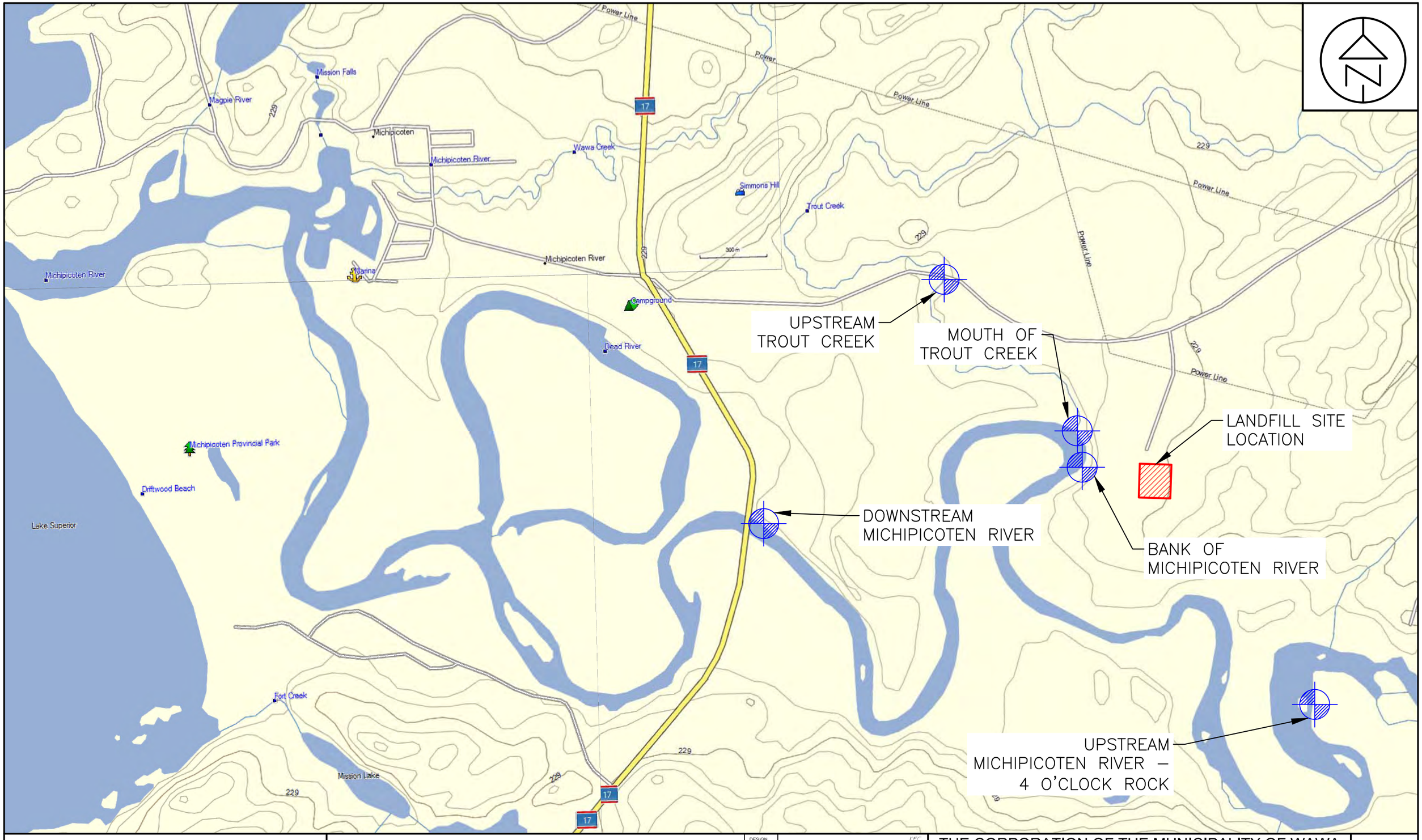
THE CORPORATION OF THE MUNICIPALITY OF WAWA
GW AND SW ASSESSMENT REPORT

SURFACE WATER CATCHMENT AREAS

9

Rev 0



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NOTES

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CHECKED	C.Kresin	JANUARY 2018
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SCALE	1:15,000	

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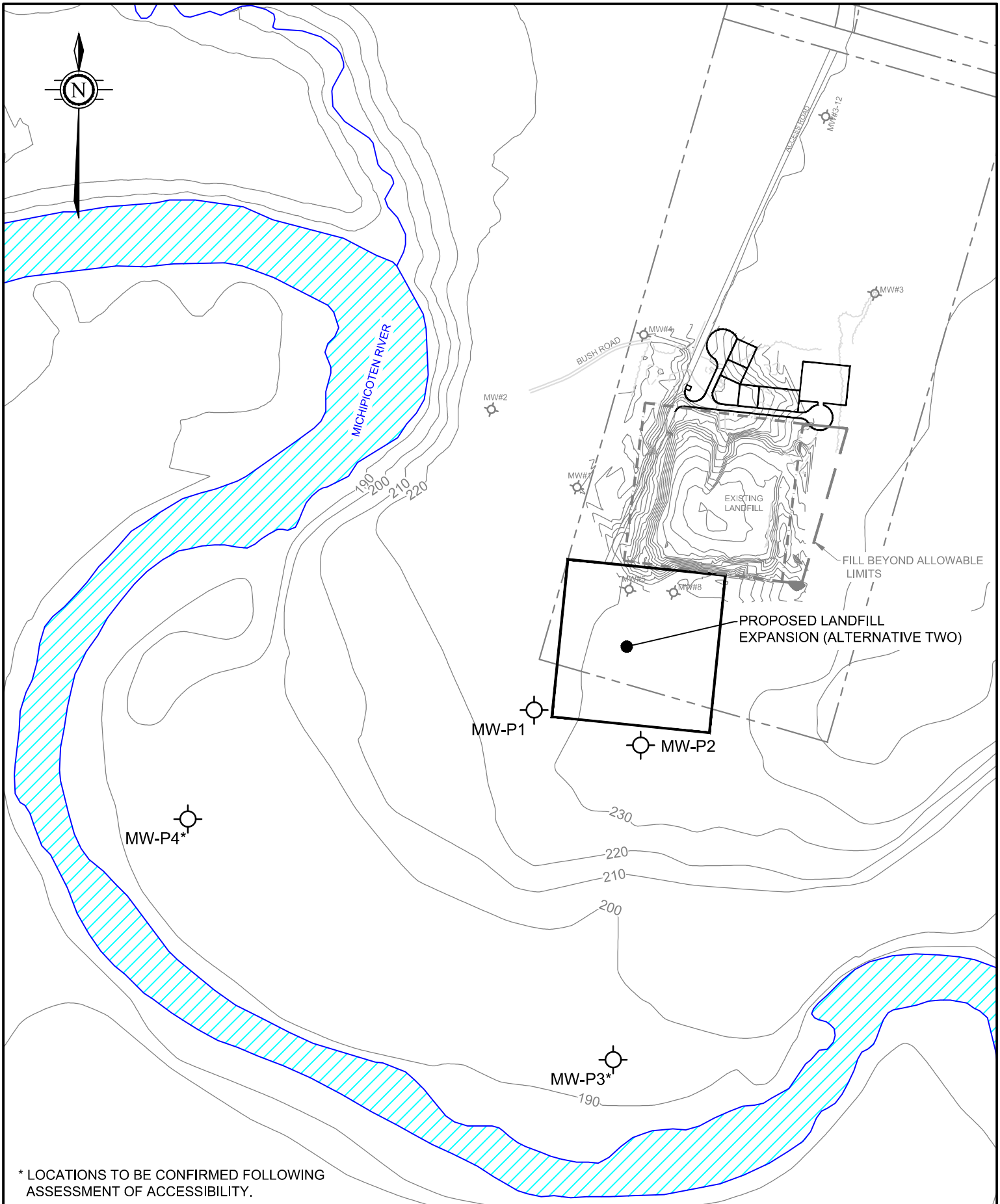
GW AND SW ASSESSMENT REPORT

SURFACE WATER SAMPLING LOCATIONS

10

Rev 0



* LOCATIONS TO BE CONFIRMED FOLLOWING ASSESSMENT OF ACCESSIBILITY.

KRESIN Engineering Corporation

DESIGN	KEC	04/19
DRAWN	K.SHERLOCK	04/19
CHECKED	C.KRESIN	04/19
PROJECT	1140.11	
FILENAME	1140.11 drawing 11.dwg	
SCALE	1:5000	

The Corporation of the Municipality of Wawa
GW AND SW ASSESSMENT REPORT

PROPOSED MONITORING WELL NETWORK

11

Rev 0

Power Line
Power
Power Line
Mission Falls
Magpie River
229
Michipicoten
Michipicoten River
Wawa Creek
17
Simmons Hill
Trout Creek
229
Power Line
300 m
Michipicoten River
Michipicoten River
Wawa
Campground
Dead River
17
UPSTREAM
TROUT CREEK
MOUTH OF
TROUT CREEK
229
Power Line
Power Line
LANDFILL SITE
LOCATION
Michipicoten Provincial Park
Driftwood Beach
Lake Superior
DOWNSTREAM
MICHIPICOTEN RIVER
BANK OF
MICHIPICOTEN RIVER
SWP2
SWP1
Fort Creek
229
Mission Lake
229
17
17
UPSTREAM
MICHIPICOTEN RIVER –
4 O'CLOCK ROCK

KRESIN Engineering Corporation
Sault Ste. Marie, Ontario
(705) 949-4900

NOTES

DESIGN		KEC
DRAWN	K.Shellock	JULY 2018
CHECKED	C.Kresin	JULY 2018
PROJECT	1140.11	
FILENAME	1140.11 drawing 12.dwg	
SCALE	1:15,000	

THE CORPORATION OF THE MUNICIPALITY OF WAWA
GW AND SW ASSESSMENT REPORT

PROPOSED SURFACE WATER SAMPLING LOCATIONS

12

Rev 0

Appendix A

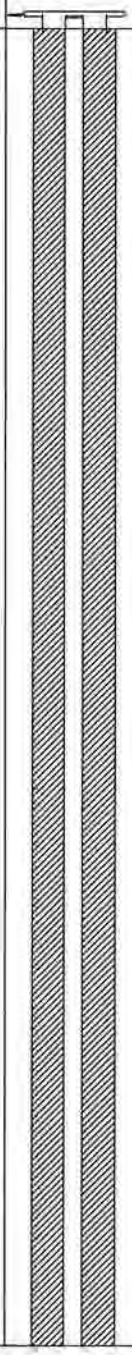
Monitoring Well Logs

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-3
DATE COMPLETED: April 16, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
	SAND, trace gravel, medium grained, brown, moist						
4.5	SAND, fine grained, trace silt, grey, moist	4.57					



0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-3
DATE COMPLETED: April 16, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
7.5							
8.0							
8.5							
9.0							
	SAND, medium grained, trace silt, grey, moist	9.14					
9.5							
10.0							
10.5							
11.0							
11.5							
12.0							
12.5							
13.0							
13.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-3
DATE COMPLETED: April 16, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
14.5							
15.0							
15.5							
16.0							
16.5							
17.0			BENTONITE				
17.5							
18.0							
18.5							
19.0							
19.5							
20.0	- silty clay, grey at 20.12m BGS						
20.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 35181.GPJ CRA_CORP.GDT 5/20/10

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-3
DATE COMPLETED: April 16, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
21.5							
22.0							
22.5							
23.0							
23.5							
24.0							
24.5							
25.0							
25 5							
26.0							
26.5							
27.0							
27.5	- slight sulfur odour, some rust staining at 27.43m BGS						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 35181.GPJ CRA_CORP.GDT 5/20/10

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-3
DATE COMPLETED: April 16, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	
28.5								
29.0								
29.5								
30.0								
30.5								
31.0								
31.5								
32.0								
32.5								
33.0								
33.5								
34.0								
34.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 35181.GPJ CRA_CORP.GDT 5/20/10

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-3
DATE COMPLETED: April 16, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
35.5			SAND PACK WELL SCREEN				
36.0							
36.5							
37.0							
37.5							
38.0							
38.5							
39.0							
39.5							
40.0							
40.5							
41.0							
41.5			WELL DETAILS Screened interval: 35.20 to 41.30m BGS Length: 6.1m				

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 35181.GPJ CRA_CORP.GDT 5/20/10

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-3
DATE COMPLETED: April 16, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
42.5	SILTY CLAY, grey, wet	42.37	Diameter: 51mm Slot Size: #10 Material: PVC Sand Pack: 34.14 to 41.45m BGS Material: #2 SILICA				
	BEDROCK	42.67					
43.0	END OF BOREHOLE @ 42.98m BGS	42.98					
43.5							
44.0							
44.5							
45.0							
45.5							
46.0							
46.5							
47.0							
47.5							
48.0							
48.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-4
DATE COMPLETED: April 22, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
	SAND, red, organic odour						
1.5	SAND, brown, moist	1.52					
	- gravel layer at 3 66m BGS						
6.0	SAND, trace silt, brown/grey, moist	6.10					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 35181.GPJ CRA_CORP.GDT 5/20/10

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-4
DATE COMPLETED: April 22, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
7.5							
8.0							
8.5	- layered silt and sand at 8.53m BGS						
9.0							
9.5							
10.0							
10.5							
11.0							
11.5							
12.0							
12.5							
13.0							
13.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-4
DATE COMPLETED: April 22, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
14.5							
15.0							
15.5							
16.0							
16.5							
17.0							
17.5							
18.0							
18.5							
19.0							
19.5							
20.0							
20.5			BENTONITE				

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-4
DATE COMPLETED: April 22, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
21.5							
22.0							
22.5							
23.0							
23.5							
24.0							
24.5							
25.0							
25.5							
26.0							
26.5	- silt layer at 26.82m BGS						
27.0							
27.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-4
DATE COMPLETED: April 22, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
28.5							
29.0							
29.5							
30.0							
30.5							
31.0							
31.5							
32.0							
32.5							
33.0							
33.5							
34.0							
34.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-4
DATE COMPLETED: April 22, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
35.5							
36.0							
36.5							
37.0							
37.5							
38.0							
38.5							
39.0							
39.5							
40.0							
40.5							
41.0	SILTY SAND, grey, wet, slight sulfur odour	41.15					
41.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-4
DATE COMPLETED: April 22, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
42.5	- strong sulfur odour at 42.67m BGS		SAND PACK; WELL SCREEN				
43.0							
43.5							
44.0							
44.5							
45.0							
45.5							
46.0							
46.5							
47.0							
47.5							
48.0	END OF BOREHOLE @ 47.85m BGS	47.85	WELL DETAILS Screened interval: 41.76 to 47.85m BGS Length: 6.1m Diameter: 51mm Slot Size: #10 Material: PVC Sand Pack: 41.07 to 47.85m BGS				
48.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 35181.GPJ CRA_CORP.GDT 5/20/10

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-4
DATE COMPLETED: April 22, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	
49.5			Material: SILICA					
50.0								
50.5								
51.0								
51.5								
52.0								
52.5								
53.0								
53.5								
54.0								
54.5								
55.0								
55.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 35181.GPJ CRA_CORP.GDT 5/20/10

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-5
DATE COMPLETED: April 19, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
	SAND, trace gravel, brown/red						
	SAND, trace gravel, medium grained, light brown/grey, moist	3.05					

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 35181.GPJ CRA_CORP.GDT 5/20/10

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-5
DATE COMPLETED: April 19, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
7.5							
8.0							
8.5							
9.0							
9.5							
10.0							
10.5	- silty layer at 10.36m BGS						
11.0							
11.5							
12.0							
12.5							
13.0							
13.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-5
DATE COMPLETED: April 19, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
14.5							
15.0							
15.5							
16.0							
16.5							
17.0							
17.5							
18.0	- silty layer at 18.29m BGS						
18.5							
19.0							
19.5			BENTONITE				
20.0							
20.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-5
DATE COMPLETED: April 19, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
21.5							
22.0							
22.5							
23.0							
23.5							
24.0							
24.5							
25.0							
25.5							
26.0							
26.5							
27.0							
27.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-5
DATE COMPLETED: April 19, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
28.5							
29.0							
29.5							
30.0							
30.5							
31.0							
31.5							
32.0	SILTY SAND, wet, slight sulfur odour	32.00					
32.5							
33.0	- rusty coloured sand, wet at 32.92m BGS						
33.5							
34.0	SAND, fine grained, trace silt, brown/grey, wet, slight odour	33.83					
34.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-5
DATE COMPLETED: April 19, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
35.5							
36.0							
36.5							
37.0							
37.5							
38.0							
38.5							
39.0							
39.5							
40.0							
40.5							
41.0							
41.5	- silt layer at 41.45m BGS						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 35181.GPJ CRA_CORP.GDT 5/20/10

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WAWA LANDFILL
PROJECT NUMBER: 35181-27
CLIENT: MUNICIPALITY OF WAWA
LOCATION: LANDFILL SITE, WAWA, ONTARIO

HOLE DESIGNATION: MW-5
DATE COMPLETED: April 19, 2010
DRILLING METHOD: AUGER/PQ
FIELD PERSONNEL: J. TIMMERMANS

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
42.5			SAND PACK; WELL SCREEN				
43.0							
43.5	- strong sulfur odour at 43.59m BGS						
44.0							
44.5							
45.0							
	SILTY CLAY, dense, no odour	45.11					
45.5							
	- BEDROCK, refusal at 45.72m BGS	45.72					
46.0	END OF BOREHOLE @ 45.72m BGS						
46.5							
47.0							
47.5							
48.0							
48.5							

WELL DETAILS
Screened interval:
39.62 to 45.72m BGS
Length: 6.1m
Diameter: 51mm
Slot Size: #10
Material: PVC
Sand Pack:
39.01 to 45.72m BGS
Material: SILICA

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 35181.GPJ CRA_CORP.GDT 5/20/10

MW6

PROJECT NAME	WAWA WASTE DISPOSAL SITE – NEW BACKGROUND WELL	PROJECT NO.	1140.08
CLIENT	MUNICIPALITY OF WAWA	DATE	OCTOBER 24–26, 2012
BOREHOLE TYPE	203 mm (8 inch) DIAMETER AUGER	FIELD SUPERVISOR	Jennifer Sharpe
GROUND ELEVATION	229.816	ENGINEER	

DEPTH (m)	STRATIGRAPHY	SAMPLE			MONITORING WELL DETAILS	DEPTH (m)
		STRATIGRAPHIC DESCRIPTION	SAMPLE DEPTH	BLOW COUNT		
0.0		ORGANICS			BACKFILL/BENTONITE HOLEPLUG	0.0
1.0						1.0
2.0						2.0
3.0		COARSE SAND/FINE GRAVEL/DRY		4,6,19,20		3.0
4.0						4.0
5.0						5.0
6.0				6,9,10,9		6.0
7.0		FINE SAND/WET				7.0
8.0						8.0
9.0				3,2,1,2		9.0
10.0		SAND/WET			BACKFILL	10.0
11.0						11.0
12.0		FINE SAND/WET		3,1,0,5		12.0
13.0		SILTY SAND/WET				13.0
14.0						14.0
15.0		SAND/DRY		5,12,14,18		15.0
16.0		COARSE SAND/SMALL GRAVEL/DRY				16.0
17.0						17.0
18.0				14,15,18,21		18.0
19.0		FINE SAND/DRY				19.0
20.0						20.0
21.0		FINE SAND/DAMP		7,13,24,24		21.0
22.0					BENTONITE HOLEPLUG	22.0
23.0		SAND/WET				23.0
24.0				4,6,8,13		24.0
25.0						25.0
26.0						26.0
27.0				12,22,22,21		27.0
28.0		SILTY SAND/WET				28.0
29.0					BACKFILL	29.0
30.0		SILTY SAND/DRY		9,27,31,30		30.0
31.0						31.0
32.0		FINE SAND/DRY				32.0
33.0						33.0
34.0				12,21,24,24	WATER TABLE ELEV. 194.316 m	34.0
35.0						35.0
36.0		FINE SAND/WET				36.0
37.0				4,10,25,41	WELL SCREEN	37.0
38.0					BOTTOM OF MONITOR WELL	38.0
39.0						39.0
40.0						40.0

KRESIN Engineering Corporation

DESIGN:	
DRAWN:	
PROJECT:	1140.08
FILENAME:	1140.08 well log
SCALE:	NTS

MUNICIPALITY OF WAWA
MUNICIPAL WASTE DISPOSAL SITE
MONITORING WELL RECORD - MW6

1

Rev 0

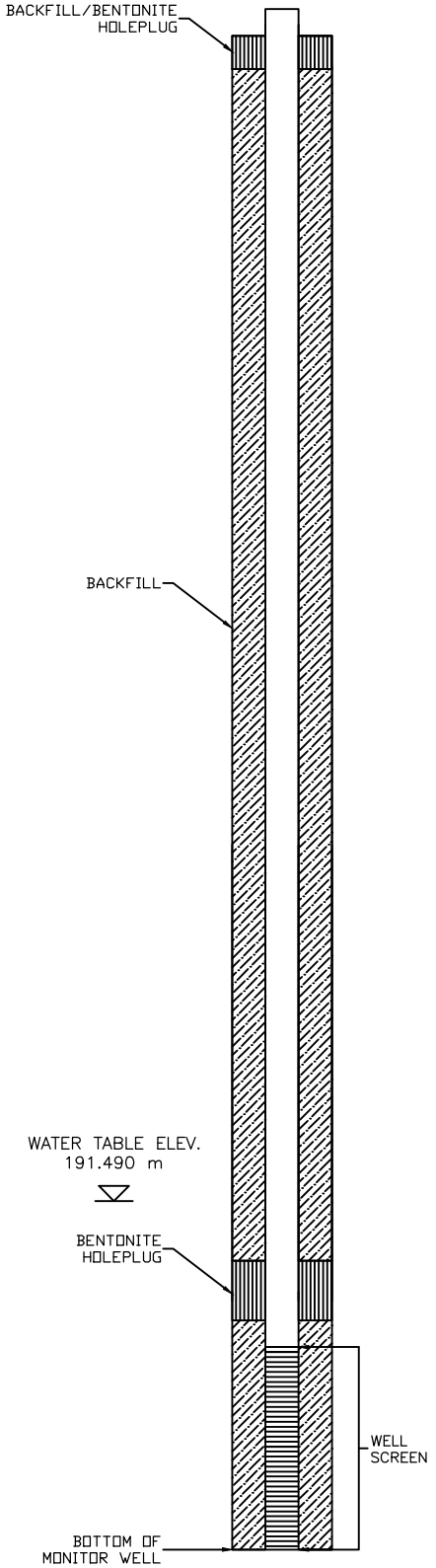
MW7

PROJECT NAME: WAWA WASTE DISPOSAL SITE – NEW SOURCE WELL
CLIENT: MUNICIPALITY OF WAWA
BOREHOLE TYPE: 150 mm (6 inch) DIAMETER DRILL BIT (MUD DRILLING)
GROUND ELEVATION: 226.600

PROJECT NO.: 1140.12
DATE: OCTOBER 16–17, 2017
FIELD SUPERVISOR: BRANDON MAAHS
ENGINEER:

DEPTH (m)	STRATIGRAPHY	SAMPLE: STRATIGRAPHIC DESCRIPTION	SAMPLE: SAMPLE DEPTH	SAMPLE: BLOW COUNT
0.0 – 1.0		DARK BROWN SAND W/TRACES OF GRAVEL		
1.0 – 2.0		DARK BROWN GRAVEL		
2.0 – 4.0		DARK BROWN GRAVEL W/±1" STONES		
5.0 – 6.0		FINE BROWN SAND		
6.0 – 9.0		BROWNISH GREY SAND W/TRACES OF SILT		
9.0 – 14.0		DARK GREY SILTY SAND		
14.0 – 15.0		DARK GREY SILTY SAND W/TRACES OF STONES		
15.0 – 45.0		LIGHT BROWN SAND		
45.0 – 46.0		LIGHT GREY SILT		19,21,22,28

MONITORING WELL DETAILS



DEPTH (m): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0 40.0 41.0 42.0 43.0 44.0 45.0 46.0

KRESIN Engineering Corporation

DESIGN:	KEC
DRAWN:	KEC
PROJECT:	1140.12
FILENAME:	1140.12 well log
SCALE:	NTS

MUNICIPALITY OF WAWA
MUNICIPAL WASTE DISPOSAL SITE
MONITORING WELL RECORD - MW7

1

Rev 0

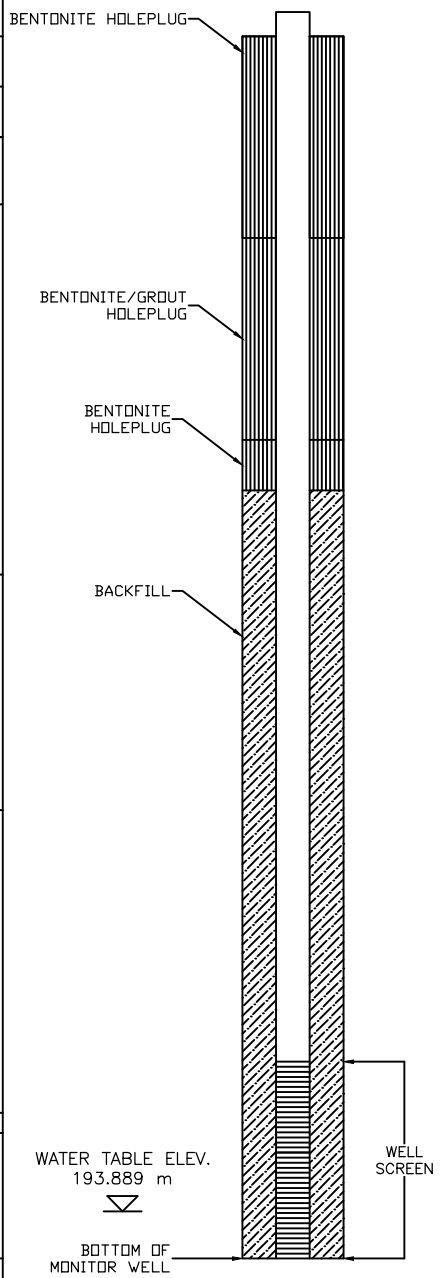
MW8

PROJECT NAME: WAWA WASTE DISPOSAL SITE
CLIENT: MUNICIPALITY OF WAWA
BOREHOLE TYPE: 150 mm (6 inch) DIAMETER DRILL BIT (MUD DRILLING)
GROUND ELEVATION: 228.099

PROJECT NO.: 1140.13
DATE: MAY 30 – JUNE 1, 2018
FIELD SUPERVISOR: KRISTEN SHERLOCK
ENGINEER:

DEPTH (m)	STRATIGRAPHY	SAMPLE: STRATIGRAPHIC DESCRIPTION	SAMPLE: SAMPLE DEPTH	SAMPLE: BLOW COUNT
0.0 – 1.0		DARK BROWN SAND W/TRACES OF GRAVEL		
1.0 – 2.0		MULTI–COLORED GRAVEL AND COARSE SAND		
2.0 – 5.0		FINE BROWN GRAVEL		
5.0 – 16.0		FINE BROWN SAND		
16.0 – 23.0		FINE GREY SAND WITH GREY SILT		
23.0 – 32.0		FINE GREY SAND		
32.0		GREY SILTY SAND WITH TRACES OF STONES		
32.0 – 36.0		GREY SILTY SAND WITH TRACES OF STONES		

MONITORING WELL DETAILS



DEPTH (m): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0 40.0 41.0

NOTES: SAND POINT USED FOR INSTALLATION OF MONITORING WELL.

WELL STICK UP 0.72 m; STEEL PROTECTIVE CASING 0.8m; BOTTOM OF MONITOR WELL INSTALLED AT 156.868m.

KRESIN Engineering Corporation

DESIGN:	KEC
DRAWN:	KS
PROJECT:	1140.13
FILENAME:	1140.13 well log
SCALE:	NTS

MUNICIPALITY OF WAWA
MUNICIPAL WASTE DISPOSAL SITE
MONITORING WELL RECORD - MW8

1

Rev 0

Appendix B

Summaries of Historical Analytical Results

Municipality of Wawa - Michipicoten Landfill Site
Ground and Surface Water Monitorine Results

KEC Project Ref. No. 1772

Table E.1: Sampling Location MW1

Parameter	ODWS	Units	H/A	11/20/2001	6/4/2002	10/28/2002	02-Jul-03 (1)	12/2/2003	6/2/2004	11/17/2004	13/23-Jun-05	10/27/2005	5/23/2006	10/30/2006	6/13/2007	6-Nov-07 (3)	6/25/2008	23-Oct-08 (3)	6/25/2009	10/20/2009	4/24/2010	9/22/2010	6/22/2011	10/14/2011	6/14/2012	9/26/2012	5/22/2013	9/25/2013	6/10/2014	10/15/2014	5/26/2015	11/19/2015	5/11/2016	9/27/2016	5/16/2017	5/16/2017	11/1/2017
																																				Duplicate	
VOCs																																			Sample	
Acetone				-	-	-	-	-	-	-	<0.02	-	<0.02	-	-	<0.02	<0.02		<0.02	-	<0.02	-	<20	-	<0.02	-	<0.02	-	<0.02	-	<0.02	-	<0.02	-	<0.02	<0.02	-
1,4 Dichlorobenzene	0.005	mg/L	H	-	-	-	-	-	-	-	<0.0005	-	0.0007	-	-	0.0006	<0.0005		<0.0005	-	<0.0005	-	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	<0.0005	-
Benzene	0.005	mg/L	H	-	-	-	-	-	-	-	<0.0005	-	<0.0005	-	-	<0.0005	<0.0005	-	<0.0005	-	<0.0005	-	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	<0.0005	-
cis-1,2 Dichloroethylene	-	mg/L	-	-	-	-	-	-	-	-	<0.0005	-	0.0035	-	-	0.0023	0.0018	-	0.00136	-	0.00232	-	1.42	-	0.00168	-	0.00156	-	0.00145	-	0.00142	-	0.00103	-	0.00076	0.00084	-
Dichloromethane	0.05	mg/L	H	-	-	-	-	-	-	-	<0.0005	-	0.0014	-	-	<0.0005	<0.0005	-	<0.0005	-	<0.0005	-	<0.50	-	<0.0005	-	0.001	-	<0.0005	-	<0.002	-	<0.002	-	<0.002	<0.002	-
Chlorobenzene	-	mg/L	-	-	-	-	-	-	-	-	-	-	0.0007	-	-	<0.0005	<0.0005	-	<0.0005	-	<0.0005	-	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	0.00069	-	0.00076	-	0.00071	0.00076	-
Chloroethane		mg/L	-	-	-	-	-	-	-	-	-	-	0.001	-	-	<0.001	<0.001	-	<0.001	-	<0.001	-	<1.0	-	<0.001	-	<0.001	-	<0.001	-	<0.001	-	<0.001	-	<0.001	<0.001	-
Ethyl Benzene	0.0024	mg/L	-	-	-	-	-	-	-	-	0.0011	-	<0.0005	-	-	0.0006	0.0013	-	<0.0005	-	<0.0005	-	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	0.00051	-	<0.0005	-	<0.0005	<0.0005	-
Styrene	-	mg/L	-	-	-	-	-	-	-	-	-	-	0.0007	-	-	<0.0005	0.0006	-	<0.0005	-	0.00171	-	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	0.00105	-	<0.0005	-	<0.0005	<0.0005	-
Toluene	0.024	mg/L	A	-	-	-	-	-	-	-	<0.0005	-	<0.0005	-	-	<0.0005	<0.0005	-	<0.0005	-	0.0007	-	2.71	-	0.002	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	<0.0005	-
Vinyl Chloride	0.002	mg/L	H	-	-	-	-	-	-	-	0.0008	-	0.0008	-	-	<0.0005	0.0005	-	0.00057	-	0.00068	-	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	<0.0005	-
DISSOLVED METALS																																				
Aluminum	0.1	mg/L		-	-	-	-	-	-	-	<0.01	0.12	<0.01	0.05	0.04	<0.01	<0.1	0.08	0.28	<0.1	<0.1	<0.010	<0.010	<0.01	<0.005	<0.005	<0.05	0.0028	<0.005	<0.0050	0.0028	<0.0020	0.0025	0.0021	<0.0020	<0.0020	<0.0020
Antimony	0.006	mg/L		-	-	-	-	-	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	<0.0050	<0.0006	<0.0006	<0.0006	<0.0006	<0.006	0.00011	<0.0006	<0.0006	0.00014	<0.0001	0.00014	<0.0001	0.0002	0.00017	<0.00010
Arsenic	0.025	mg/L	H	-	-	-	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.010	<0.0010	<0.010	<0.010	<0.01	<0.0010	<0.001	<0.001	<0.0010	<0.001	<0.01	0.00032	<0.001	<0.0010	0.0004	0.00032	0.00039	0.0003	0.00038	0.00038
Barium	1	mg/L	H	-	-	-	-	-	-	-	0.01	0.08	0.06	0.05	0.05	0.05	<0.1	0.07	<0.10	0.12	<0.10	0.021	0.49	0.045	0.047	0.051	<0.1	0.058	0.077	0.076	0.0756	0.0693	0.0703	0.0781	0.0797	0.0647	0.058
Boron	5	mg/L	H	-	-	-	-	-	-	-	0.18	0.53	0.2	0.2	0.09	0.08	<0.5	0.07	<0.50	<0.50	<0.50	<0.050	0.06	<0.001	<0.050	0.07	<0.5	0.1	0.25	0.34	0.385	0.36	0.384	0.322	0.299	0.282	0.206
Cadmium	0.005	mg/L	H	-	-	-	-	-	-	-	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0010	<0.0010	<0.001	<0.00010	<0.0000090	<0.000090	<0.000017	0.000027	<0.00017	0.000012	<0.000017	<0.000017	<0.00005	<0.000005	<0.000005	0.00001	<0.000005	0.0000039	0.0000063
Calcium		mg/L		144	157	145	207	209	179	163	172	197	169	162	154	141	136	152	157	177	187	54.3	160	140	166	154	175	176	203	211	186	186	176	163	161	159	135
Chromium	0.05	mg/L	H	-	-	-	-	-	-	-	0.001	0.014	<0.001	0.014	0.004	0.005	<0.01	0.003	<0.010	<0.010	<0.01	0.0011	<0.0010	<0.0010	<0.0010	<0.001	<0.01	0.00013	<0.001	<0.0010	0.00029	0.0003	0.00023	0.00017	0.00021	0.00018	0.00018
Cooper	1	mg/L	A	0.0089	0.0432	0.0026	0.0087	<0.0005	0.0035	0.001	0.002	0.003	<0.001	0.007	0.003	<0.001	0.01	0.75	0.02	<0.010	<0.01	0.0022	<0.0010	<0.0010	0.0013	<0.001	<0.01	0.00092	<0.0010	<0.0010	0.0004	<0.0002	0.00026	0.00428	0.00025	0.0004	0.00039
Iron	0.3	mg/L	A	0.008	3.83	1.8	16.5	4.54	1.17	0.518	0.89	17.5	2.88	6.94	11.1	1.38	16.4	9.18	12.1	2.15	12.3	<0.050	0.996	0.116	<0.020	0.817	1.94	3.24	2.01	2.38	0.336	1.62	0.345	<0.010	0.075	0.057	0.035
Lead	0.01	mg/L	H	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.001	0.002	0.001	0.003	0.003	<0.001	<0.01	0.024	<0.010	<0.010	<0.01	<0.0010	<0.0010	<0.0010	<0.0010	<0.001	<0.01	<0.00005	<0.001	<0.0010	<0.000005	<0.00005	<0.000005	0.000142	<0.00005	<0.00005	<0.00005
Mercury	0.001	mg/L	H	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.0001	<0.0001	<0.00010	<0.00010	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00001	<0.00001	<0.00010	<0.00001	<0.00001	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Magnesium	-	mg/L	-	21.6	23.6	20.3	26.9	27.7	23.6	22.6	22.1	28	22.3	21.1	20.8	19.3	18.7	18.6	19.5	21.1	25	11.8	20.1	12.7	17.4	17.7	18.6	17.8	22	21.7	22.1	23.7	23.1	24.1	23.5	22	22.3
Manganese	0.05	mg/L	A	1.33	1.68	1.59	2.28	2.7	2.01	1.92	2.04	2.94	1.95	1.82	1.91	1.73	1.9	1.8	1.73	2.25	2.59	<0.0010	1.99	1.29	2.07	1.94	2.09	2.12	2.36	2.67	2.42	2.46	2.39	2.08	2.1	2.19	2.16
Nickel	-	mg/L	-	0.015	0.01	0.007	0.014	0.013	0.008	0.002	0.004	0.007	0.002	0.006	0.006	0.005	<0.02	0.008	<0.020	<0.020	<0.02	<0.0020	0.0047	0.004	0.0039	0.0021	<0.02	0.00273	0.005	0.0048	0.00515	0.00422	0.00656	0.0217	0.00514	0.0054	0.00549
Potassium	-	mg/L	-	3.18	3.88	3.45	4.64	5.26	5.02	5.08	5.3	5.81	5.42	5.6	5.5	5.47	6.26	4.97	5.79	<10	<10	2.5	4.9	3.8	4.01	5.06	<5	4.45	5.27	5.72	5.99	6.56	6.51	6.45	6.16	5.95	5.92
Selenium	0.01	mg/L	H	-	-	-	-	-	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	<0.0050	<0.0020	<0.0020	<0.0010	<0.001	<0.01	<0.00010	<0.001	<0.0010	0.000079	0.000077	0.000068	0.000061	0.000082	0.000066	0.000094
Sodium	200	mg/L	A	32.6	19.5	16.6	30.6	38	32.3	30.2	23.9	31.9	17.5	21.4	11	8.91	14.1	7.64	7.48	7.9	18.3	2.24	8.07	5.64	5.03	6.16	6.6	7.3	17.1	21.6	23.5	30.8	22.5	21.7	18.1	16.6	15.8
Uranium	0.02	mg/L	H	-	-	-	-	-	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	<0.0050	<0.0050	<0.0050	<0.0050	<0.005	<0.05	0.00336	<0.005	<0.0050	0.00418	0.00285	0.00293	0.00385	0.00382	0.0031	0.00277
Zinc	5	mg/L	A	0.079	0.127	0.02	0.217	0.027	0.029	0.008	0.014	0.023	0.012	0.031	0.02	0.012	<0.03	0.033	<0.030	0.074	0.533	0.003	0.0073	0.0073	0.0049	0.0172	<0.03	0.0061	<0.003	<0.0030	0.0013	<0.0010	0.0026	0.0018	0.0011	0.003	0.0028
GENERAL CHEMISTRY																																				
Alkalinity, Total	30-500	mg/L	A	473	502	503	640	682	562	541	557	642	538	493	484	468	482	455	466	514	572	178	435	441	456	441	483	505	569	619	592	604	556	580	567	503	465
Ammonia-N	-	mg/L	-	-	0.44	0.23	0.31	0.26	0.37	0.37	0.32	0.46	0.5	0.46	0.4	0.38	0.44	0.38	0.36	0.445	0.489	<0.020	0.235	0.26	0.22	0.285	0.269	0.232	0.263	0.285	0.329	0.438	0.429	0.524	0.563	0.596	0.65
BOD5	-	mg/L	-	-	-	-	-	-	-	-	2	5	4	-	-	9	9	7	6	7.1	2.2	<2.0	<2.0	<2.0	<2.0	2.2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Chloride	250	mg/L	A	22.8	17.6	17.2	59.1	67.6	35.4	23	24.6	39.4	23.8	15.3	8.1	4.6	5.8	6	7.18	13.8	20	2.39	1.34	3	3.92	3.55	9.03	12.4	16.4	19.2	15.9	16.2	13.1	12	9.84	8.37	7.83
COD	-	mg/L	-	-	-	-	-	-	-	-	18	52	31	27	76	56	75	30	30.7	55.1	29.5	17.1	14	13.7	8.6	79.5	46.9	133	19	27	57	36	28	21	24	25	27
Conductivity (µs/cm)	-	-	-	903	966	954	1200	1460	1100	1040	994	1140	993	753	722	696	878	770	869	811	994	343	822	782	858	852	898	921	1100	1140	1130	1110	1020	1010	965	905	870
Dissolved Organic Carbon	5	mg/L	A	-	-	-	-	-	-	2	8	8	17	-	-	7	4	5	6.7	9	8.7	3.1	4.5	3.4	2.6	4.6	4.6	7.2	7.3	12.8	9.2	7.2	8.4	6.4	6.7	6.2	6.4
Hardness	80-100	mg/L	A	450	490	448	628	635	543	163	522	608	513	166	470	432	417	456	472	489	570	184	482	401	485	457	514	513	597	617	557	562	533	506	500	488	429
Ion Balance Calculation (%)	-	-	-	-	-	-	-	-	-	-	3.2	-3.4	-2.7	0.8	0.3	-2.4	-4.5	0.9	1	2.6	0.6	-	5.9	-4	3.2	3.12	2.8	10.9	1.9	-0.4	-2.7	-1.1	-0.8	-5.2	-4.8	-0.1	-2.5
Nitrate	10	mg/L	H	0.14	0.16	<0.03	0.03	<0.15	<0.03	<0.03	0.63	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.030	<0.030	<0.030	<0.030	<0.030	<0.03	<0.030	<0.030	<0.03	<0.030	<0.030	<0.030	<0.040	<0.040	<0.040	<0.020	<0.020	<0.020	<0.020
Nitrite	1	mg/L	H	<0.03	<0.02	<0.03	<0.02	<0.1	<0.02	<0.02	<0.02	0.16	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.020	<0.020	<0.020	<0.020	<0.20	<0.02	<0.020	<0.020	<0.02	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.010	<0.010	<0.010	<0.010
pH (standard units)	6.5-8.5	-	A	7.2	7.2	7.4	7	6.9	7.2	7.2	6.9	7.6	7.2	7.3	7.3	7	7.3	7.26	7.3	7.82	7.08	7.73	7.04	7.11	7.29	7.29	7.46	7.86	6.74	7.23	6.93	7.05	6.99	6.88	7.06	7.08	7.15
Sulphate	500	mg/L	A	23	18.8	9.3	27.6	41.1	35.9	26.1	23.6	36.9	20.5	15.9	10.6	7.9	10.1	9.5	11	12.6	19.4	5.91	10.9	9.57	9.65	8.38	11.2	24.6	34.1	41.2	38.6	33	30.8	30.1	26.9	21.6	24.8
TDS	500	mg/L	A	-	-	-	-	-	-	-	650	680	610	610	490	460	480	472	540	580	613	192	495	468	480	459	510	562	654	706	644	654	637	605	579	523	530
TKN	-	mg/L	-	1.13	2.91	0.75	5.22	1.09	1.41	1.17	0.85	1.59	0.92	1.25	2.33	1.17	1.49	1	0.967	2.68	0.931	0.39	0.417	0.51	0.425	2.16	1.36	3.81	0.714	0.85	1.34	0.88	0.77	0.85	1.12	0.96	1.15
TP	-	mg/L	-	-	-	-	-	-	-	-	0.19	0.065	0.007	0.008	0.045	0.042	0.043	0.12	0.0291	0.187	0.0097	0.0538	<0.030	0.0056	<0.0050	0.032	0.0133	0.0189	0.0049	0.0071	0.0037	0.0063	0.0068	0.0045	0.0069	0.0062	<0.0030

Shaded values exceed ODWS

Municipality of Wawa - Michipicoten Landfill Site
Ground and Surface Water Monitoring Results

KEC Project Ref. No. 1772

Table E.2: Sampling Location MW2

Parameter	ODWS	Units	H/A	20-Nov-01	4-Jun-02	28-Oct-02	02-Jul-03 (1)	2-Dec-03	2-Jun-04	17-Nov-04	13/23-Jun-	27-Oct-05	23-May-06	30-Oct-06	13-Jun-07	6-Nov-07 (3)	25-Jun-08	23-Oct-08	25-Jun-09	20-Oct-09	24-Apr-10	22-Sep-10	22-Jun-11	14-Oct-11	14-Jun-12	26-Sep-12	22-May-13	25-Sep-13	10-Jun-14	15-Oct-14	26-May-15	19-Nov-15	11-May-16	27-Sep-16	16-May-17	1-Nov-17
VOCs																																			
Acetone	-	-	-	-	-	-	-	-	-	-	<0.02	-	<0.02	-	-	<0.02	<0.02	-	<0.02	-	<0.02	-	<20	-	<0.02	-	<0.02	-	<0.02	-	<0.02	-	<0.02	-	<0.02	-
1,4 Dichlorobenzene	0.005	me/L	H	-	-	-	-	-	-	-	<0.0005	-	<0.0005	-	-	<0.0005	<0.0005	-	<0.0005	-	<0.0005	-	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
Benzene	0.005	mg/L	H	-	-	-	-	-	-	-	<0.0005	-	<0.0005	-	-	<0.0005	<0.0005	-	<0.0005	-	<0.0005	-	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
cis-1,2 Dichloroethylene	-	mg/L	-	-	-	-	-	-	-	-	<0.0005	-	<0.0005	-	-	0.0008	<0.0005	-	<0.0005	-	<0.0005	-	<0.50	-	<0.0005	-	<0.0005	-	0.00056	-	0.00066	-	<0.0005	-	<0.0005	-
Dichloromethane	0.05	mg/L	H	-	-	-	-	-	-	-	<0.0005	-	0.0011	-	-	<0.0005	<0.0005	-	<0.0005	-	<0.0005	-	<0.50	-	<0.0005	-	0.00097	-	<0.0005	-	<0.0005	-	<0.002	-	<0.002	-
Chlorobenzene	-	mg/L		-	-	-	-	-	-	-	<0.0005	-	<0.0005	-	-	<0.0005	<0.0005	-	<0.0005	-	<0.0005	-	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
Chloroethane	-	mg/L		-	-	-	-	-	-	-	<0.001	-	<0.001	-	-	<0.001	<0.001	-	<0.001	-	<0.001	-	<1.0	-	<0.0001	-	<0.0001	-	<0.001	-	<0.001	-	<0.001	-	<0.001	-
Ethyl Benzene	0.0024	ma/L		-	-	-	-	-	-	-	<0.0005	-	<0.0005	-	-	<0.0005	<0.0005	-	<0.0005	-	<0.0005	-	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
Styrene	-	mg/L		-	-	-	-	-	-	-	<0.0005	-	<0.0005	-	-	<0.0005	<0.0005	-	<0.0005	-	<0.0005	-	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
Toluene	0.024	mg/L	A	-	-	-	-	-	-	-	<0.0005	-	<0.0005	-	-	0.0008	<0.0005	-	<0.0005	-	<0.0005	-	1.51	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
Vinyl Chloride	0.002	mg/L	H	-	-	-	-	-	-	-	<0.0006	-	<0.0005	-	-	<0.0005	<0.0005	-	<0.0005	-	<0.0005	-	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
DISSOLVED METALS																																			
Aluminum	0.1	mg/L		-	-	-	-	-	-	-	<0.01	0.03	<0.01	0.04	0.08	<0.01	<0.1	0.06	0.5	<0.01	<0.01	<0.01	<0.010	<0.010	<0.005	<0.0050	<0.0050	<0.0010	<0.005	<0.0050	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Antimony	0.006	me/L		-	-	-	-	-	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.005	0.008	<0.05	<0.005	<0.005	<0.005	<0.00060	<0.00060	<0.0006	<0.00060	<0.00060	<0.00010	<0.0006	<0.00060	<0.0001	<0.00015	<0.0001	<0.0001	<0.0001	0.00019
Arsenic	0.025	mg/L	H	-	-	-	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.010	<0.0010	<0.010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.001	<0.0010	<0.0010	0.0002	<0.001	<0.0010	0.00022	0.00017	0.00015	0.00016	0.00016	0.00014
Barium	1	mg/L	H	-	-	-	-	-	-	-	0.13	0.03	0.05	0.03	0.03	0.02	<0.1	0.03	<0.10	0.138	0.022	0.027	0.021	0.021	0.02	0.02	0.02	0.0241	0.029	0.032	0.0288	0.0276	0.027	0.0243	0.0234	0.0245
Boron	5	mg/L	H	-	-	-	-	-	-	-	<0.05	0.07	<0.05	<0.05	<0.05	<0.05	<0.5	<0.05	<0.50	<0.050	<0.050	0.128	<0.050	<0.050	<0.050	<0.050	<0.050	0.011	<0.050	<0.050	0.027	0.028	0.039	0.02	0.025	0.028
Cadmium	0.005	mg/L	H	-	-	-	-	-	-	-	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.001	0.0004	<0.0010	<0.00010	<0.00010	<0.00010	<0.000090	<0.000090	<0.000017	<0.000017	<0.000017	<0.000010	<0.000017	<0.000017	0.0000054	0.0000456	0.0000057	<0.000005	<0.000005	<0.000005
Calcium	-	mg/L	-	7.9	7.3	6.7	9.8	62.3	65.8	57.9	55.6	53.9	64.2	68.9	66.6	52.8	45.3	64.2	59.4	59.4	51.2	78.5	58.5	39.9	55.1	48.5	54.1	62.9	83.9	89.3	67.7	67.9	62.2	53.2	52.9	48.4
Chromium	0.05	mg/L	H	-	-	-	-	-	-	-	<0.001	0.003	<0.001	0.0002	0.001	<0.001	<0.01	0.002	<0.010	<0.0010	<0.0010	0.0016	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00010	<0.0010	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	1	mg/L	A	0.178	0.333	0.243	0.193	0.0144	0.0115	0.0249	0.002	0.035	<0.001	0.009	0.061	<0.001	0.02	0.411	0.181	0.0028	<0.001	0.003	0.0012	0.0012	0.0014	<0.0010	<0.0010	0.00019	<0.001	<0.0010	0.00058	0.00204	0.00068	<0.0002	0.00095	0.00025
Iron	0.3	mg/L	A	0.177	0.632	0.639	3.22	0.207	0.712	5.46	0.48	3.7	0.36	4.41	7.79	0.65	7.9	4.25	11.4	0.351	0.427	<0.05	<0.050	<0.050	<0.020	<0.020	<0.020	<0.010	<0.020	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	0.013
Lead	0.01	me/L	H	0.046	0.125	0.085	0.112	<0.006	<0.006	<0.006	<0.001	0.005	<0.001	0.001	0.005	<0.001	<0.01	0.016	0.012	<0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.000050	<0.001	<0.0010	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Mercury	0.001	mg/L	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.0000310	<0.00010	<0.00001	<0.000010	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Magnesium	-	mg/L	-	1.79	1.5	1.42	1.9	9.8	11	10.4	10.3	10.1	11.8	12.5	12.5	10.2	9.35	10.9	11.2	11	10.4	18.2	10.6	7.73	9.9	9.7	9.66	10.7	14.4	14.6	12.2	11.3	11.4	10.3	10.6	9.82
Manganese	0.05	mg/L	A	0.163	0.18	0.085	0.178	0.238	0.13	0.0871	0.086	0.084	0.088	0.105	0.151	0.13	0.14	0.125	0.188	0.158	0.123	0.129	0.134	0.0585	0.12	0.115	0.0877	0.0812	0.105	0.118	0.0987	0.102	0.106	0.0902	0.102	0.104
Nickel	-	mg/L	-	0.006	0.004	0.147	0.004	0.007	<0.002	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.02	0.003	<0.020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.00035	<0.002	<0.0020	<0.0005	0.00063	<0.0005	<0.0005	<0.0005	<0.0005
Potassium	-	mg/L	-	1.22	1.61	1.42	2.71	1.92	2.46	2.31	2.06	1.9	2.57	2.23	2.54	2.47	2.81	1.82	2.42	2.7	2.7	6	2.3	2.1	2.34	2.4	2.48	2.37	2.46	2.68	2.69	2.41	2.55	2.36	2.41	2.23
Selenium	0.01	mg/L	H	-	-	-	-	-	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.0050	<0.0050	<0.0020	<0.0020	<0.0010	<0.0010	<0.0010	<0.00010	<0.0001	<0.0010	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Sodium	200	me/L	A	4.14	1.08	0.849	2.71	4.48	2.76	2.53	5.86	4.2	2.52	4.22	2.56	2.1	7.9	4.12	3.37	2.71	2.05	13.2	1.92	1.56	2.04	1.7	2	2.33	3.61	4.82	3.97	3.35	3.22	2.74	2.76	2.65
Uranium	0.02	mg/L	H	-	-	-	-	-	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.000372	<0.005	<0.0050	0.000369	0.000263	0.000139	0.000219	0.000252	0.000222
Zinc	5	ma/L	A	0.54	0.694	0.82	0.769	0.08	0.087	0.032	0.037	0.057	0.039	0.017	0.078	0.029	0.06	0.06	0.162	0.0767	0.0151	0.0632	0.0081	0.012	0.0074	<0.0030	0.0046	<0.0050	0.006	0.0063	0.0046	0.0203	0.0218	0.0092	0.0226	0.146
GENERAL CHEMISTRY																																			
Alkalinity, Total	30-500	mg/L	A	28	30	28	35	207	205	198	181	178	209	217	214	172	175	192	188	193	185	447	176	158	147	151	162	198	260	292	277	230	206	205	256	191
Ammonia-N	-	mg/L	-	-	1.39	1.32	1.53	0.35	0.17	0.09	0.02	0.03	0.04	<0.02	0.03	0.04	0.09	0.06	0.36	0.043	<0.020	0.44	<0.20	<0.020	<0.020	0.034	<0.020	0.034	0.031	0.046	0.027	0.065	0.058	0.023	0.062	<0.020
BOD5		mg/L	-	-	-	-	-	-	-	-	<2	3	<2	-	-	<2	5	7	9.6	11.2	5.6	9.2	2.3	<2.0	3.1	2.3	2.8	<2.0	2.5	<2.0	2.3	<2.0	3.7	<2.0	3.1	<2.0
Chloride	250	me/L	A	3	3.2	2.2	2.6	4.3	2.6	2.6	3.4	2.6	3.1	2.2	2.3	1	1.6	2.1	2.11	2.19	2.52	11.3	1.85	1.19	0.77	0.72	0.88	1.99	3.02	3.12	1.88	1.96	1.59	1.13	0.97	0.81
COD	-	mg/L	-	-	-	-	-	-	-	-	11	9	14	12	6	12	28	12	42.2	40	17.3	77.6	13.7	7.6	9	5.2	5.2	12.8	<10	<10	11	18	<10	<10	<10	<20
Conductivity (µs/cm)	-	-	-	90.2 - 27	92.3	85	91	405	409	381	353	329	407	379	372	296	347	367	374	319	345	776	358	310	306	308	307	383	501	529	458	412	369	355	366	338
Dissolved Organic Carbon	5	mg/L	A	-	-	-	-	-	-	6	2	2	8	-	-	1	3	2	3.5	4.3	3.3	6.7	7.5	1.6	1.6	2.5	1.5	3.7	2	3.5	2.7	1.7	2.6	<1.0	1.3	1.3
Hardness	80-100	mg/L	A	27	25	23	32	196	210	187	181	176	209	223	218	174	152	205	195	194	171	271	190	132	178	161	175	201	269	283	219	216	202	175	175	161
Ion Balance Calculation (%)	-			-	-	-	-	-	-	-	0.7	-0.3	-0.8	1.8	1	0.2	-2.9	3.7	2.6	1.3	-2.8		3.4	-9.5	8.8	4.37	4.6	0.3	1.7	-0.7	-10.2	-1.9	0.8	-6.6	-17.1	-7.1
Nitrate	10	me/L	H	1.63	1.44	1	0.72	0.16	0.06	0.04	0.05	0.06	0.06	0.03	<0.03	<0.03	<0.03	0.05	<0.030	<0.030	<0.030	<0.030	0.091	<0.030	<0.030	<0.030	<0.030	<0.030	0.072	0.08	0.056	0.047	<0.020	0.022	0.045	0.029
Nitrite	1	mg/L	H	<0.03	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.07	<0.02	<0.02	0.04	<0.02	<0.02	<0.02	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH (standard units)	6.5-8.5	-	A	6.8	6.9	6.8	6.8	7.1	7.5	7.6	7.3	8	7.8	7.8	7.6	7.3	7.7	7.63	7.59	7.92	7.61	7.16	7.47	7.57	7.58	7.58	7.73	8.12	6.8	7.83	7.33	7.52	7.44	7.52	7.51	7.48
Sulphate	500	mg/L	A	6.2	2.6	2.2	2.2	4.5	5.1	5.3	7.5	8.1	9.1	8.1	6.3	7.8	5.9	6.8	3.63	3.49	1.54	4.68	5.13	6.96	7.47	1.95	3.21	6.83	5.84	4.7	4.27	2.69	1.35	3.66	4.17	4.07
TDS	500	mg/L	A	-	-	-	-	-	-	-	190	140	230	210	230	160	178	205	219	220	181	470	210	182	166	156	170	234	270	310	249	237	220	204	212	159
TKN	-	mg/L		3.21	3.88	2.85	2.79	1.24	0.51	0.4	0.32	0.26	0.31	0.19	0.27	0.27	0.85	0.39	0.69	0.435	0.426	8.07	0.344	<0.25	0.24	0.179	0.205	0.173	0.254	1.41	0.27	0.55	<0.25	0.85	<0.25	0.18
TP	-	mg/L		-	-	-	-	-	-	-	0.013	0.015	0.004	0.012	0.011	0.012	0.028	0.036	0.0883	0.0316	0.0202	0.209	<0.030	0.0055	0.011	0.0085	0.0087	0.0053	0.0096	0.0087	0.0106	0.0165	0.0133	0.007	0.0107	0.0104

Shaded values exceed ODWS

Municipality of Wawa - Michipicoten Landfill Site
Ground and Surface Water Monitoring Results

KEC Project Ref. No. 1772

Table E.3: Sampling Location MW3

Parameter	ODWS		Units	H/A	4/24/2010	9/22/2010	6/22/2011	10/14/2011	6/14/2012	9/26/2012	2013	2014	2015	5/11/2016	9/27/2016	5/16/2017	11/1/2017
VOCs																	
Acetone	-			-	0.051	-	<20	-	<0.02	-	Not	Not	Not	<0.02	Not	<0.02	-
1,4 Dichlorobenzene	0.005		mg/L	H	<0.0005	-	<0.50	-	<0.0005	-	Sampled	Sampled	Sampled	<0.0005	Sampled	<0.0005	-
Benzene	0.005		mg/L	H	<0.0005	-	<0.50	-	<0.0005	-				<0.0005		<0.0005	-
cis-1,2 Dichloroethylene	-		mg/L	-	<0.0005	-	<0.50	-	<0.0005	-				<0.0005		<0.0005	-
Dichloromethane	0.05		mg/L	H	<0.0005	-	<0.50	-	<0.0005	-				<0.002		<0.002	-
Chlorobenzene	-		mg/L		<0.0005	-	<0.50	-	<0.0005	-				<0.0005		<0.0005	-
Chloroethane	-		mg/L		<0.001	-	<1.0	-	<0.001	-				<0.001		<0.001	-
Ethyl Benzene	0.0024		mg/L		<0.0005	-	<0.50	-	<0.0005	-				<0.0005		<0.0005	-
Styrene	-		mg/L		<0.0005	-	<0.50	-	<0.0005	-				<0.0005		<0.0005	-
Toluene	0.024		mg/L	A	0.0085	-	<0.50	-	<0.0005	-				<0.0005		<0.0005	-
Vinyl Chloride	0.002		mg/L	H	<0.0005	-	<0.50	-	<0.0005	-				<0.0005		<0.0005	-
DISSOLVED METALS																	
Aluminum	0.1		mg/L		4.13	0.03	0.013	0.014	0.0124	0.0145				0.0178		0.047	0.0474
Antimony	0.006		mg/L		<0.005	<0.005	0.00089	0.00087	<0.00060	0.00063				0.00038		0.00013	0.00012
Arsenic	0.025		mg/L	H	0.0022	0.0086	0.0011	0.0014	<0.0010	<0.0010				0.00072		0.00068	0.00066
Barium	1		mg/L	H	0.73	0.018	0.023	0.027	0.021	0.02				0.0161		0.0146	0.0145
Boron	5		mg/L	H	0.571	0.105	0.061	<0.050	<0.050	<0.050				<0.010		<0.010	<0.010
Cadmium	0.005		mg/L	H	0.00034	<0.0001	<0.000090	<0.000090	<0.000017	<0.000017				0.0000138		0.0000163	0.0000195
Calcium	-		mg/L	-	7.6	7.76	18.5	13.7	17.4	17.8				19.3		18.2	15.5
Chromium	0.05		mg/L	H	0.0023	<0.001	<0.0010	<0.0010	<0.0010	<0.0010				0.00024		0.00031	0.0005
Copper	1		mg/L	A	0.0191	0.0139	0.0054	0.0063	0.0089	0.0068				0.00963		0.0064	0.00811
Iron	0.3		mg/L	A	1.45	<0.05	<0.050	<0.050	<0.020	<0.020				0.013		0.021	0.025
Lead	0.01		mg/L	H	0.0014	<0.001	<0.0010	<0.0010	<0.0010	<0.0010				0.000073		0.000053	0.000132
Mercury	0.001		mg/L	H	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010				<0.000005		<0.000005	0.0000051
Magnesium	-		mg/L	-	1.85	2.48	5.29	3.19	4.6	4.83				4.73		3.28	2.9
Manganese	0.05		mg/L	A	0.0319	0.0154	0.0215	0.0071	0.0063	0.0024				0.00094		0.00116	0.00121
Nickel	-		mg/L	-	0.0091	0.0021	<0.0020	<0.0020	<0.0020	<0.0020				0.000094		0.00077	0.00083
Potassium	-		mg/L	-	1.4	<1	<1.0	<1.0	<0.50	<0.50				0.333		0.506	0.472
Selenium	0.01		mg/L	H	0.0057	0.005	<0.0020	<0.0020	<0.0010	<0.0010				0.000121		0.000101	0.000129
Sodium	200		mg/L	A	102	80.3	26.8	15.1	11.8	9.61				2.19		1.17	1.08
Uranium	0.02		mg/L	H	0.0068	0.0073	<0.0050	<0.0050	<0.0050	<0.0050				0.000308		0.000093	0.000086
Zinc	5		mg/L	A	0.0798	<0.003	<0.003	<0.003	<0.0030	<0.0030				0.003		0.0123	0.0112
GENERAL CHEMISTRY																	
Alkalinity, Total	30	500	mg/L	A	111	128	113	77.4	75.8	73.8				66.6		61.1	52.3
Ammonia-N	-		mg/L	-	<0.020	0.045	<0.020	0.032	<0.020	0.03				<0.020		0.057	<0.020
BOD5	-		mg/L	-	<2.0 UJ	2.6	<2.0	<2.0	<2.0	<2.0				<2.0		<2.0	<2.0
Chloride	250		mg/L	A	13.2	0.81	0.7	0.49	0.39	0.34				0.4		0.43	0.24
COD	-		mg/L	-	194	14.8	48.9	7.4	18.1	13.1				19		22	30
Conductivity (µs/cm)	-			-	512	355	253	162	166	162				131		124	107
Dissolved Organic Carbon	5		mg/L	A	24.7	13.1	12	5.2	3.8	4.1				6.4		7.1	7
Hardness	80	100	mg/L	A	27	30	68	47.3	62.3	64.4				67.6		59.1	50.5
Ion Balance Calculation (%)	-						-1.3	-2.1	2.8	3.58				1.5		-2.4	-1.9
Nitrate	10		mg/L	H	0.611	0.267	0.356	0.131	0.217	0.143				0.106		0.137	0.083
Nitrite	1		mg/L	H	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020				<0.010		<0.010	<0.010
pH (standard units)	6.5	8.5	-	A	8.45	8.26	7.75	7.71	7.65	7.54				7.25		7	7.2
Sulphate	500		mg/L	A	113	49.6	14.4	5.29	5.96	4.55				3.2		3.51	2.86
TDS	500		mg/L	A	804	410	230	116	86.6	82				98		93	77
TKN	-		mg/L		1.11	0.726	0.587	<1.3	0.366	0.589				<0.25		<0.25	0.27
TP	-		mg/L		1.08	0.747	0.47	0.285	0.136	0.121				0.131		0.031	0.038

Shaded values exceed ODWS

Municipality of Wawa - Michipicoten Landfill Site
Ground and Surface Water Monitoring Results

KEC Project Ref. No. 1772

Table E.4: Sampling Location MW4

Parameter	ODWS	Units	H/A	4/24/2010	9/22/2010	6/22/2011	10/14/2011	6/14/2012	9/6/2012	5/22/2013	9/25/2013	6/10/2014	10/15/2014	5/26/2015	11/19/2015	5/11/2016	9/27/2016	5/16/2017	11/1/2017
VOCs																			
Acetone	-		-	<0.02	-	<20	-	<0.02	-	<0.02	-	<0.02	-	<0.02	-	<0.02	-	<0.02	-
1,4 Dichlorobenzene	0.005	mg/L	H	<0.0005	-	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
Benzene	0.005	mg/L	H	0.002	-	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
cis-1,2 Dichloroethylene	-	mg/L	-	<0.0005	-	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
Dichloromethane	0.05	mg/L	H	<0.0005	-	<0.50	-	<0.0005	-	0.00082	-	<0.0005	-	<0.002	-	<0.002	-	<0.002	-
Chlorobenzene	-	mg/L		<0.0005	-	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
Chloroethane	-	mg/L		<0.001	-	<1.0	-	<0.001	-	<0.001	-	<0.001	-	<0.001	-	<0.001	-	<0.001	-
Ethyl Benzene	0.0024	mg/L		<0.0005	-	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
Styrene	-	mg/L		<0.0005	-	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
Toluene	0.024	mg/L	A	0.0016	-	2.03	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
Vinyl Chloride	0.002	mg/L	H	<0.0005	-	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
DISSOLVED METALS																			
Aluminum	0.1	mg/L		0.172	0.038	<0.010	<0.010	<0.0050	0.0051	0.0068	0.0052	0.0066	0.0051	0.0065	0.0043	0.0037	0.0173	0.0067	0.0093
Antimony	0.006	mg/L		<0.005	<0.005	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00010	<0.0006	<0.00060	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	0.025	mg/L	H	0.0014	<0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00071	<0.001	<0.0010	0.00071	0.00083	0.0006	0.00074	0.00057	0.00058
Barium	1	mg/L	H	0.042	0.031	0.041	0.039	0.025	0.034	0.032	0.0368	0.035	0.033	0.0417	0.0473	0.0436	0.0478	0.0438	0.0421
Boron	5	mg/L	H	0.091	<0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.010	<0.05	<0.050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	0.005	mg/L	H	<0.0001	<0.0001	<0.000090	<0.000090	<0.000017	<0.000017	<0.000017	<0.000010	<0.000017	<0.000017	<0.000005	0.0000136	<0.000005	<0.000005	<0.000005	0.000057
Calcium	-	mg/L	-	64.8	39.9	43.8	41	43.7	43.6	43.8	42.2	47	43.6	40	43.6	42.4	42.4	42.2	39.9
Chromium	0.05	mg/L	H	<0.001	<0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00010	<0.001	<0.0010	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00022
Copper	1	mg/L	A	0.001	0.0131	<0.0010	<0.0010	0.0015	<0.0010	<0.0010	0.00013	<0.001	0.006	0.0005	0.00166	0.00049	0.00035	0.00037	0.0065
Iron	0.3	mg/L	A	0.084	<0.05	<0.050	<0.050	<0.020	<0.020	<0.020	<0.010	<0.02	<0.020	<0.010	<0.010	<0.010	0.013	<0.010	<0.010
Lead	0.01	mg/L	H	<0.001	<0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.000050	<0.001	<0.0010	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.000059
Mercury	0.001	mg/L	H	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.000010	<0.00010	<0.00001	<0.00001	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Magnesium	-	mg/L	-	10.8	9.12	8.9	7.22	9.33	8.88	8.71	7.76	8.72	8.31	8.41	8.65	8.71	8.48	8.61	8.36
Manganese	0.05	mg/L	A	0.0959	<0.001	0.0292	0.0251	<0.0010	0.0289	0.0124	0.0143	0.0122	0.015	0.0378	0.0159	0.0146	0.0303	0.0351	0.0359
Nickel	-	mg/L	-	<0.002	<0.002	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.00025	<0.002	<0.0020	<0.0005	0.00078	<0.0005	0.00054	<0.0005	0.00074
Potassium	-	mg/L	-	2.6	2.4	2.2	2.1	2.12	2.28	2.34	2.12	2.18	2.23	2.41	2.38	2.38	2.25	2.39	2.2
Selenium	0.01	mg/L	H	<0.005	<0.005	<0.0020	<0.0020	<0.0010	<0.0010	<0.0010	0.00018	<0.001	<0.0010	0.000175	0.000154	0.000149	0.000168	0.000134	0.000192
Sodium	200	mg/L	A	26.3	11	1.32	1.28	1.73	1.45	1.55	1.44	1.39	1.37	1.44	1.51	1.55	1.47	1.43	1.69
Uranium	0.02	mg/L	H	0.0056	<0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.00107	<0.005	<0.0050	0.000992	0.00101	0.00109	0.00153	0.00148	0.00115
Zinc	5	mg/L	A	0.0066	<0.003	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0050	<0.003	0.0041	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0258
GENERAL CHEMISTRY																			
Alkalinity, Total	30-500	mg/L	A	249	154	136	135	146	132	130	135	146	140	154	142	139	146	192	146
Ammonia-N	-	mg/L	-	0.053	0.04	<0.020	<0.020	<0.020	<0.020	<0.020	0.078	0.04	0.084	0.122	0.055	0.065	0.192	0.207	0.051
BOD5		mg/L	-	2.2 J	2.1	<2.0	<2.0	3.8	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Chloride	250	mg/L	A	7.07	1.35	0.44	0.55	0.68	0.32	0.31	0.28	0.32	0.35	0.31	0.41	0.35	0.34	0.36	1.03
COD	-	mg/L	-	34.1	<3.0	8.9	<3.0	3.6	8.2	8.3	17.3	21	22	13	<10	<10	35	67	<20
Conductivity (µs/cm)	-		-	516	304	282	275	300	291	269	274	277	277	285	375	270	275	282	275
Dissolved Organic Carbon	5	mg/L	A	7	5.8	<5.0	1.6	1.5	1.2	1.2	2	1.3	2	1.4	<1.0	1.3	<1.0	<1.0	3.5
Hardness	80-100	mg/L	A	206	137	146	132	148	145	145	137	153	143	134	144	142	141	141	134
Ion Balance Calculation (%)	-					0.9	-3.7	-0.5	1.87	2.8	2.97	-0.1	-1.5	-8.7	-1.4	-1.2	-3.9	-16.6	-6.4
Nitrate	10	mg/L	H	0.355	<0.030	0.133	0.097	0.039	0.063	0.105	0.061	0.077	0.077	0.049	0.08	0.073	0.06	0.073	0.115
Nitrite	1	mg/L	H	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.02	<0.02	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH (standard units)	6.5-8.5	-	A	7.91	7.83	8.02	8.04	8.04	7.97	8.18	8.26	7.19	7.9	7.81	7.99	7.95	7.94	7.88	7.86
Sulphate	500	mg/L	A	32.7	20.9	13	12.7	8.18	12.8	12.1	13.1	12.3	12.6	12.6	12	12.2	13	13.1	12.2
TDS	500	mg/L	A	488	329	176	3	154	149	147	180	192	153	165	180	189	263	299	205
TKN	-	mg/L		0.307	0.813	0.28	<0.25	0.238	0.196	0.307	0.393	1.23	0.42	<0.5	<0.5	<0.25	<2.5	<2.5	0.85
TP	-	mg/L		0.377	0.167	3.22	0.207	0.29	0.361	0.647	1.1	2.15	1.01	1.8	0.58	0.48	5.71	6.98	0.55

Shaded values exceed ODWS

Municipality of Wawa - Michipicoten Landfill Site
Ground and Surface Water Monitoring Results

KEC Project Ref. No. 1772

Table E.5: Sampling Location MW5

Parameter	ODWS	Units	H/A	4/24/2010	9/22/2010	6/22/2011	10/14/2011	6/14/2012	9/26/2012	5/22/2013	9/25/2013	6/10/2014	10/15/2014	5/26/2015	11/19/2015	5/11/2016	9/27/2016	5/16/2017	11/1/2017
VOCs																			
Acetone	-		-	<0.02	- -	<20	-	<0.02	-	<0.02	-	<0.02	-	<0.02	-	<0.02	-	<0.02	-
1,4 Dichlorobenzene	0.005	mg/L	H	<0.0005	- -	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
Benzene	0.005	mg/L	H	<0.0005	- -	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
cis-1,2 Dichloroethylene	-	mg/L	-	<0.0005	- -	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
Dichloromethane	0.05	mg/L	H	<0.0005	- -	<0.50	-	<0.0005	-	0.00098	-	<0.0005	-	<0.002	-	<0.002	-	<0.002	-
Chlorobenzene	-	mg/L		<0.0005	- -	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
Chloroethane	-	mg/L		<0.001	- -	<1.0	-	<0.001	-	<0.001	-	<0.001	-	<0.001	-	<0.001	-	<0.001	-
Ethyl Benzene	0.0024	mg/L		<0.0005	- -	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
Styrene	-	mg/L		<0.0005	- -	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
Toluene	0.024	mg/L	A	0.0006	- -	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
Vinyl Chloride	0.002	mg/L	H	<0.0005	- -	<0.50	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-
DISSOLVED METALS																			
Aluminum	0.1	mg/L		0.14	0.018	<0.010	<0.010	<0.0050	0.007	0.0061	0.0099	0.0103	0.0072	0.0107	0.008	0.0061	0.0134	0.0147	0.0121
Antimony	0.006	mg/L		<0.005	<0.005	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00010	<0.0006	<0.0006	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	0.025	mg/L	H	<0.001	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00033	<0.001	<0.0010	0.00033	0.0003	0.00034	0.00033	0.00031	0.00031
Barium	1	mg/L	H	0.036	0.037	0.063	0.057	0.057	0.059	0.048	0.0414	0.045	0.037	0.0396	0.0353	0.031	0.0309	0.0301	0.0294
Boron	5	mg/L	H	0.414	0.659	0.299	<0.050	<0.050	<0.050	<0.050	<0.010	<0.050	<0.050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	0.005	mg/L	H	<0.0001	<0.0001	<0.000090	<0.000090	<0.000017	0.000023	<0.000017	0.000011	<0.000017	<0.000017	0.0000085	0.0000056	<0.000005	0.0000061	<0.000005	<0.000005
Calcium	-	mg/L	-	48.8	42.8	77.9	62.3	68.7	69.1	66.1	47.5	65.9	55.2	46	53.5	51.5	49.3	43.8	41.5
Chromium	0.05	mg/L	H	<0.001	<0.001		<0.0010	<0.0010	<0.0010	<0.0010	0.00025	<0.0010	<0.0010	0.0003	0.00027	0.00027	0.00035	0.00025	0.00027
Copper	1	mg/L	A	0.0056	0.0263	0.0037	0.0033	0.0085	0.0097	0.0048	0.00403	0.0039	0.0029	0.00316	0.00258	0.00239	0.0036	0.00271	0.00246
Iron	0.3	mg/L	A	<0.05	<0.05	<0.050	<0.050	<0.020	<0.020	<0.020	<0.010	<0.020	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead	0.01	mg/L	H	<0.001	<0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.000050	<0.0010	<0.0010	<0.0005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Mercury	0.001	mg/L	H	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.000010	<0.000010	<0.00010	<0.00001	<0.00001	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Magnesium	-	mg/L	-	60.3	7.52	9.51	7.89	8.25	8.24	7.61	5.37	6.53	5.93	5.64	6.1	6.1	5.99	5.46	5.54
Manganese	0.05	mg/L	A	0.0272	0.0929	0.217	0.0638	0.0227	0.021	0.0045	0.00413	0.0063	<0.0010	0.00154	0.00022	0.00068	0.00026	0.00087	0.00037
Nickel	-	mg/L	-	<0.002	<0.002	0.0024	<0.0020	<0.0020	<0.0020	<0.0020	0.00037	<0.002	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Potassium	-	mg/L	-	2	2.4	2.2	1.4	1.44	1.58	1.46	1.05	1.15	1.17	1.27	1.14	1.14	1.17	1.07	1.03
Selenium	0.01	mg/L	H	<0.005	<0.005	<0.0020	<0.0020	<0.0010	<0.0010	<0.0010	0.00011	<0.0010	<0.0010	0.000102	0.000107	0.000083	0.000118	0.000118	0.000139
Sodium	200	mg/L	A	0.138	0.207	22.7	2.32	2.03	1.78	1.66	1.73	1.5	1.37	1.48	1.34	1.34	1.37	1.29	1.3
Uranium	0.02	mg/L	H	<0.005	<0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.000205	<0.0050	<0.0050	0.000158	0.000173	0.000164	0.000162	0.000137	0.000147
Zinc	5	mg/L	A	0.0032	<0.003	0.0035	<0.0030	<0.0030	0.0036	<0.0030	<0.0050	<0.0030	<0.0030	0.0016	<0.0010	<0.001	0.0057	0.0015	0.0026
GENERAL CHEMISTRY																			
Alkalinity, Total	30-500	mg/L	A	111	128	243	223	186	183	175	91.3	173	157	167	165	152	150	146	130
Ammonia-N	-	mg/L	-	<0.020	0.045	<0.020	<0.020	<0.020	0.042	<0.020	0.071	<0.020	<0.020	<0.020	0.042	0.035	0.033	0.04	<0.020
BOD5		mg/L	-	<2.0 UJ	2.6	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Chloride	250	mg/L	A	13.2	0.81	2.23	1.27	0.81	0.88	0.68	0.59	0.7	0.74	0.63	0.67	0.57	0.7	0.65	0.59
COD	-	mg/L	-	194	14.8	14.4	8.8	7	13.6	17.4	19.3	10	17	11	<10	<10	<10	13	<20
Conductivity (µs/cm)	-		-	512	355	526	425	375	384	342	192	321	300	299	305	288	272	255	253
Dissolved Organic Carbon	5	mg/L	A	24.7	13.1	10.5	2.8	2.2	2.8	2.9	4.9	4.5	3.5	3.2	7	3	4.2	3.1	3.4
Hardness	80-100	mg/L	A	27	30	234	188	206	206	196	141	191	162	138	159	154	148	132	126
Ion Balance Calculation (%)	-					1.6	-8.5	4.3	5.4	5	1.95	4.3	0.9	-9.5	-2.5	0.2	-1.3	-5.7	-2.1
Nitrate	10	mg/L	H	0.611	0.267	0.815	0.587	0.594	0.552	0.683	0.605	0.591	0.696	0.68	0.907	0.657	0.652	0.594	0.688
Nitrite	1	mg/L	H	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH (standard units)	6.5-8.5	-	A	8.45	8.26	7.48	7.74	7.79	7.85	8.11	7.75	6.63	7.81	7.27	7.74	7.86	7.52	7.21	7.55
Sulphate	500	mg/L	A	113	49.6	27.7	5.73	4.55	4.42	4.04	3.31	3.63	3.4	2.78	2.85	2.68	3.22	3.29	3.21
TDS	500	mg/L	A	804	410	351	251	200	198	190	127	183	188	179	186	190	165	154	137
TKN	-	mg/L		1.11	0.726	0.158	<0.25	0.252	0.367	0.303	0.334	0.386	<0.25	<0.25	<0.25	<0.25	0.3	<0.25	0.15
TP	-	mg/L		1.08	0.747	<0.030	0.0776	0.0078	0.0227	0.109	0.058	0.0395	0.0253	0.0036	0.0268	0.0357	0.0103	0.0143	0.0091

Shaded values exceed ODWS

Municipality of Wawa - Michipicoten Landfill Site
Ground and Surface Water Monitoring Results

KEC Project Ref. No. 1772

Table E.6: Sampling Location MW3-12

Parameter	ODWS		Units	H/A	12/5/2012	5/22/2013	9/25/2013	6/10/2014	10/15/2014	5/26/2015	11/19/2015	5/11/2016	9/27/2016	5/16/2017	11/1/2017	11/1/2017
																Duplicate
VOCs																Sample
Acetone	-			-	<0.02	<0.02	-	<0.02	-	<0.02	-	<0.02	-	<0.02	-	-
1,4 Dichlorobenzene	0.005		mg/L	H	<0.0005	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	-
Benzene	0.005		mg/L	H	<0.0005	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	-
cis-1,2 Dichloroethylene	-		mg/L	-	<0.0005	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	-
Dichloromethane	0.05		mg/L	H	0.00102	<0.0005	-	<0.0005	-	<0.002	-	<0.002	-	<0.002	-	-
Chlorobenzene	-		mg/L		<0.0005	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	-
Chloroethane	-		mg/L		<0.001	<0.001	-	<0.001	-	<0.001	-	<0.001	-	<0.001	-	-
Ethyl Benzene	0.0024		mg/L		<0.00050	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	-
Styrene	-		mg/L		<0.00050	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	-
Toluene	0.024		mg/L	A	<0.00050	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	-
Vinyl Chloride	0.002		mg/L	H	<0.00050	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	<0.0005	-	-
DISSOLVED METALS																
Aluminum	0.1		mg/L		0.0267	0.0084	0.0054	0.0059	0.0091	0.0113	0.0035	0.005	0.0071	0.0046	0.0028	0.0028
Antimony	0.006		mg/L		<0.00060	<0.00060	<0.00010	<0.0006	<0.0006	0.00011	0.00014	0.00035	<0.0001	0.00031	<0.0001	<0.0001
Arsenic	0.025		mg/L	H	<0.0010	<0.0010	0.00081	0.001	0.001	0.00101	0.00095	0.00101	0.00099	0.00094	0.00092	0.00095
Barium	1		mg/L	H	0.014	0.017	0.0172	0.017	0.017	0.0186	0.0164	0.0159	0.0152	0.0151	0.0155	0.0152
Boron	5		mg/L	H	<0.050	<0.050	<0.010	<0.05	<0.050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	0.005		mg/L	H	<0.000017	<0.000017	<0.000010	<0.000017	0.00002	0.0000242	<0.000005	0.0000093	<0.000005	0.0000079	0.00001	0.0000168
Calcium	-		mg/L	-	37.9	42.3	41.3	42.6	42.4	37.5	40.7	39.5	36.4	39	37.4	37.8
Chromium	0.05		mg/L	H	<0.0010	<0.0010	0.00018	0.0055	<0.0010	0.00034	0.0003	0.00025	0.00023	0.00028	0.00036	0.00034
Copper	1		mg/L	A	0.0016	<0.0010	0.00056	0.0039	<0.0010	0.00128	0.00123	0.00077	0.00039	0.00089	0.00049	0.00043
Iron	0.3		mg/L	A	<0.020	<0.020	<0.010	<0.020	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead	0.01		mg/L	H	<0.0010	<0.0010	<0.000050	<0.001	<0.0010	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Mercury	0.001		mg/L	H	<0.000010	<0.000010	<0.00010	<0.000010	<0.000010	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Magnesium	-		mg/L	-	8.11	9.54	8.96	9.29	9.17	9.15	9.49	9.03	8.58	8.84	9.19	9.22
Manganese	0.05		mg/L	A	0.035	0.0453	0.00091	0.0015	0.0029	0.0041	0.00019	0.00023	<0.0001	0.00021	0.00014	<0.00010
Nickel	-		mg/L	-	<0.0020	<0.0020	0.00021	<0.0020	<0.0020	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Potassium	-		mg/L	-	2.58	2.58	2.07	2.27	2.15	2.27	2.04	2.13	2.02	2.13	2.12	2.12
Selenium	0.01		mg/L	H	<0.0010	<0.0010	0.00032	<0.001	<0.0010	0.000189	0.000238	0.000086	0.000066	0.000089	0.000312	0.000281
Sodium	200		mg/L	A	1.68	1.93	1.67	2.64	1.73	1.72	1.71	1.69	1.5	1.6	1.77	1.8
Uranium	0.02		mg/L	H	<0.0050	<0.0050	0.000541	<0.005	<0.0050	0.00138	0.00166	0.000982	0.000824	0.00063	0.00148	0.00138
Zinc	5		mg/L	A	0.0054	<0.0030	<0.0050	<0.003	<0.0030	0.0021	<0.0010	0.0023	<0.0010	0.0035	0.0031	0.0025
GENERAL CHEMISTRY																
Alkalinity, Total	30	500	mg/L	A	134	129	136	150	142	149	150	134	138	152	146	143
Ammonia-N	-		mg/L	-	0.247	0.049	0.2	0.14	0.116	0.023	0.034	<0.020	0.024	0.049	<0.020	<0.020
BOD5			mg/L	-	<2.5	<2.0	<2.0	4	<2.0	2.5	<2.0	2.8	<2.0	<2.0	<2.0	<2.0
Chloride	250		mg/L	A	0.52	0.36	0.37	2.59	0.34	0.44	0.31	0.38	0.36	0.41	0.32	0.34
COD	-		mg/L	-	4.4	38.7	25.5	34	32	28	17	31	13	30	<20	<20
Conductivity (µs/cm)	-			-	274	276	276	299	279	275	276	247	252	265	275	270
Dissolved Organic Carbon	5		mg/L	A	2.7	2	1.8	3	2.2	1.6	<1.0	1.1	<1.0	<1.0	<1.0	<1.0
Hardness	80	100	mg/L	A	128	145	140	145	144	131	141	136	126	134	131	132
Ion Balance Calculation (%)	-				4.2	2.51	-1.9	-5.4	-2.4	.8.0	-5.4	-0.7	-5.8	-7.6	-7.2	-5.8
Nitrate	10		mg/L	H	0.062	0.07	<0.030	0.031	<0.030	0.069	0.042	0.042	<0.020	0.052	0.034	0.035
Nitrite	1		mg/L	H	<0.020	<0.020	<0.020	<0.020	<0.02	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH (standard units)	6.5	8.5	-	A	8.1	8.16	8.25	6.7	8.06	7.82	8.06	7.95	7.94	7.85	7.95	7.91
Sulphate	500		mg/L	A	13.4	18.4	15.8	17	14.7	11.2	13.2	9.22	9.68	9.77	11.9	11.9
TDS	500		mg/L	A	145	153	195	183	191	158	168	161	160	168	170	160
TKN	-		mg/L		1.6	2.89	1.4	1.63	<1.3	0.4	<0.5	<0.25	<1.3	<0.25	<0.15	<0.15
TP	-		mg/L		2.41	4.11	1.79	3.59	1.19	0.765	1.16	0.53	1.03	0.21	0.28	0.0842

Shaded values exceed ODWS

Municipality of Wawa - Michipicoten Landfill Site
Ground and Surface Water Monitoring Results

Table E.7: Sampling Location MW6-17

KEC Project Ref. No. 1772

Parameter	ODWS		Units	H/A	11/1/2017
VOCs					
Acetone	-			-	-
1,4 Dichlorobenzene	0.005		mg/L	H	-
Benzene	0.005		mg/L	H	-
cis-1,2 Dichloroethylene	-		mg/L	-	-
Dichloromethane	0.05		mg/L	H	-
Chlorobenzene	-		mg/L		-
Chloroethane	-		mg/L		-
Ethyl Benzene	0.0024		mg/L		-
Styrene	-		mg/L		-
Toluene	0.024		mg/L	A	-
Vinyl Chloride	0.002		mg/L	H	-
DISSOLVED METALS					
Aluminum	0.1		mg/L		<0.0020
Antimony	0.006		mg/L		<0.00010
Arsenic	0.025		mg/L	H	0.00115
Barium	1		mg/L	H	0.0897
Boron	5		mg/L	H	0.076
Cadmium	0.005		mg/L	H	0.0000312
Calcium	-		mg/L	-	54.8
Chromium	0.05		mg/L	H	<0.00010
Copper	1		mg/L	A	0.00175
Iron	0.3		mg/L	A	<0.010
Lead	0.01		mg/L	H	<0.000050
Mercury	0.001		mg/L	H	<0.000005
Magnesium	-		mg/L	-	10.6
Manganese	0.05		mg/L	A	0.672
Nickel	-		mg/L	-	0.00231
Potassium	-		mg/L	-	5.01
Selenium	0.01		mg/L	H	0.000205
Sodium	200		mg/L	A	20.1
Uranium	0.02		mg/L	H	0.00189
Zinc	5		mg/L	A	0.0019
GENERAL CHEMISTRY					
Alkalinity, Total	30	500	mg/L	A	159
Ammonia-N	-		mg/L	-	0.393
BOD5			mg/L	-	<2.0
Chloride	250		mg/L	A	0.33
COD	-		mg/L	-	25
Conductivity (µs/cm)	-			-	277
Dissolved Organic Carbon	5		mg/L	A	<1.0
Hardness	80	100	mg/L	A	181
Ion Balance Calculation (%)	-				14.7
Nitrate	10		mg/L	H	0.057
Nitrite	1		mg/L	H	<0.010
pH (standard units)	6.5	8.5	-	A	7.91
Sulphate	500		mg/L	A	13.4
TDS	500		mg/L	A	179
TKN	-		mg/L		1.16
TP	-		mg/L		2.93

Shaded values exceed ODWS

Municipality of Wawa - Michipicoten Landfill Site
Ground and Surface Water Monitoring Results

KEC Project Ref. No. 1772

Table E.8: Sampling Location Michipicoten River Bank

Parameter	PWQO	Units	20-Nov-01	4-Jun-02	28-Oct-02	02-Jul-03 (1)	2-Dec-03	2-Jun-04	17-Nov-04	13/23-Jun-	27-Oct-05	23-May-06	31-Oct-06	13-Jun-07	14-Nov-07	25-Jun-08	23-Oct-08 (3)	25-Jun-09	20-Oct-09	22-Sep-10	21-Jun-11	11-Oct-11	11-Jun-12	24-Sep-12	13-May-13	25-Sep-13	11-Jun-14	22-Oct-14	21-May-15	17-Nov-15	12-May-16	28-Sep-16	17-May-17	7-Nov-17
VOCs																																	
Acetone		mg/L										<0.02	<0.02			<0.02		<0.02			<20		<20		<20		<20	-	<0.02	-	<0.02	-	<0.02	-
1,4 Dichlorobenzene		mg/L								<0.0005		0.0009	<0.0005			<0.0005		<0.0005			<0.05		<0.5		<0.5		<0.5	-	<0.0005	-	<0.0005	-	<0.0005	-
METALS																																	
Antimony	0.02	mg/L								<0.005	0.055	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0050	<0.0050	<0.0050	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00010	<0.00060	<0.00060	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.1	mg/L										<0.001	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.00274	<0.0010	<0.0010	0.00031	0.00035	0.00031	0.00037	0.00476	0.00036
Barium		mg/L								0.01	0.01	<0.01	0.02	<0.01	0.01	0.03	<0.01	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	0.0122	<0.010	<0.010	0.00663	0.00874	0.00807	0.00773	0.028	0.00732
Boron	0.2	mg/L								<0.05	0.73	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	0.0001	mg/L								0.0004	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.000017	<0.000017	0.000017	<0.000010	<0.000017	<0.000017	0.0000113	<0.000005	0.0000075	<0.000005	<0.000005	0.0000053
Calcium		mg/L	8.4	8.7	8.6	9.5	8.1	13.1	8.1	8.8	14.4	7.8	16.9	9	8.9	9.1	11.2	9.49	10.6	11.7	8.53	8.98	10.4	10.3	4.69	11.1	8.23	7.84	6.29	8.57	6.71	8.57	17.9	8.3
Chromium		mg/L								<0.001	0.002	<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	0.0032	<0.0010	<0.0010	0.00044	0.00026	0.00036	0.00031	0.0005	0.00031
Cobalt	0.0009	mg/L								<0.0005	0.0012	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00010	<0.00050	<0.00050	<0.00010	<0.0001	<0.00010	<0.0001	<0.00010	<0.0001	<0.0001
Copper	0.005	mg/L	0.003	0.001	0.005	0.012	<0.001	0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.0013	<0.0010	<0.0010	<0.0010	0.0011	0.00122	<0.0010	<0.0010	0.00117	0.00074	0.00085	0.00082	0.00132	0.00067
Iron	0.3	mg/L	0.041	0.083	0.1	0.06	0.07	0.12	0.07	0.05	<0.05	0.09	0.17	<0.05	0.14	0.38	0.1	0.11	0.11	0.086	0.073	0.06	0.051	0.044	0.145	0.131	0.092	0.106	0.127	0.082	0.131	0.106	0.199	0.103
Lead	0.01	mg/L	0.0004	<0.0001	<0.001	<0.001	<0.001	<0.001	<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	<0.001	<0.001	<0.001	<0.0010	0.000065	<0.0010	<0.0010	0.000098	<0.00005	0.00008	<0.00005	0.000073	<0.00005
Magnesium		mg/L	1.79	1.77	1.78	1.84	1.63	2.92	1.64	1.75	2.7	1.63	2.9	1.7	1.81	1.83	2.07	1.87	2.03	2.43	1.78	1.94	2.13	1.93	0.991	2.32	1.64	1.75	1.33	2.04	1.34	1.55	4.05	1.64
Manganese	0.05	mg/L	<0.001	0.007	0.012		0.006	0.01	0.006	0.009	0.018	0.006	0.008	0.008	0.009	0.024	0.008	0.0061	0.0111	0.0284	0.0071	0.0093	0.0083	0.0125	0.0137	0.00908	0.0073	0.008	0.00818	0.00866	0.00935	0.011	0.0195	0.00829
Nickel	0.025	mg/L	<0.0002	<0.0002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.00057	<0.0020	<0.0020	0.0005	<0.0005	<0.0005	<0.0005	0.00079	<0.0005
Potassium		mg/L	0.58	0.48	0.52	0.58	0.5	0.7	0.48	0.59	0.61	0.48	0.57	0.32	0.51	0.49	0.39	0.494	<1.0	<1.0	<1.0	<1.0	0.54	0.5	<0.50	0.513	<0.50	<0.50	0.424	0.527	0.43	0.42	0.966	0.387
Sodium	200	mg/L	1.24	1.04	1.12	1.13	1.13	0.886	1.22	1.3	1.54	1.2	1.24	1.32	1.27	1.13	0.71	1.24	1.28	1.44	1.14	1.21	1.36	1.14	0.97	1.02	1.06	1.21	1.1	1.34	1.32	1.18	1.01	1.15
Thallium	0.0003	mg/L								<0.0003	0.0045	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.000010	<0.00030	<0.00030	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Zinc	5	mg/L	0.029	<0.004	0.006	0.005	<0.003	<0.003	<0.003	<0.0003	0.024	<0.0003	<0.0003	<0.003	<0.003	<0.003	<0.003	<0.0030	0.0034	<0.0030	0.004	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
GENERAL CHEMISTRY																																	
Alkalinity, Total		mg/L	24	24	28	25	22	37	23	24.4	40	20	31	25	25	27	30	25.9	30.5	30.9	24.9	32.6	26.8	34.5	14.2	32.9	22.5	27.2	19.6	30.6	17	26.4	60.3	26.9
Ammonia-N		mg/L		<0.07	<0.07	<0.07	<0.07	0.02	0.02	<0.02	<0.02	0.03	<0.02	0.02	0.03	0.03	0.03	<0.020	<0.02	0.025	<0.020	<0.020	<0.020	<0.020	<0.020	0.11	<0.020	<0.020	<0.020	<0.020	<0.020	0.128	0.075	0.093
Ammonia-unionized		mg/L		0.005	0.005	0.005	0.005	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	<0.020	<0.02															
BOD5	0.02	mg/L								<2	<2	<2				<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Chloride		mg/L				1.2	0.6	0.4	0.6	0.7	1.4	1.3	1	1.4	1.1	0.8	0.7	0.73	0.95	1.07	0.59	0.94	0.98	0.92	0.62	0.6	0.68	0.72	0.64	0.86	1	0.75	0.59	0.79
COD		mg/L								6	15	21	12	12	18	17	11	9.6	16.7	13.2	12.5	17.9	17	13.6	24.3	28.7	27	24	18	22	20	20	20	22
Conductivity (µs/cm)			63.4	64.5	68	62	62	88	58	62	96	57	73	65	66	67	75	62.9	74	77.3	63.6	76.7	72	87	37.7	78.6	53.4	58.7	44.6	66.4	48.5	55.4	121	57.1
Dissolved Organic Carbon		mg/L							4	6	4	2				5	4	6.1	3.8	6.2	6.3	6.3	5.7	4.3	12.8	9.8	9.2	9.1	9	27.9	7.3	8.9	6.5	8.5
Hardness		mg/L	28	29	29	31	27	45	27	29	47	26	37	29	29.7	30.2	36.4	31.4	34.8	39	28.6	30.4	34.7	33.6	15.8	37.3	27.3	26.8	21.2	29.8	22.3	27.8	61.4	27.5
Ion Balance Calculation (%)		%								3.02	2.87	4.05	22.4	0.95	2.9	-0.25	3.85	6.05	2.65				9.1	4.1	0.31	4.7	6.3	-2	4	-1.9	10.9	3.2	0.02	-0.8
Nitrate		mg/L	0.09	0.14	0.08	0.12	0.13	0.08	0.08	0.1	0.07	0.11	0.08	0.09	0.1	0.12	0.05	0.109	0.055		0.065	0.044	0.06	0.05	0.11	0.054	0.092	0.073	0.075	0.075	0.091	0.036	0.108	0.067
Nitrite		mg/L	<0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.020	<0.020		<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH (standard units)	6.5 - 8.5		7.4	7.4	7.5	7.4	7.3	7.6	7.3	7	7.5	7.2	7.5	7.3	7.2	7.46	7.57	7.36	7.72	7.49	7.41	7.45	7.55	7.6	7.18	7.59	6.15	7.62	7.3	7.61	7.3	7.33	7.58	7.37
Sulphate		mg/L	7	4.1	3.8	3.8	3.9	3.6	2.9	4.7	5.7	5.1	5.3	5.1	4.6	4.8	4.1	3.77	3.64		3.09	3.67	3.45	3.95	2.59	3.47	2.91	2.73	2.34	2.93	2.6	2.34	4.26	3.18
TDS		mg/L								30	20	80	70	50	50	35	37	62	42	76	62	33	35.2	39.7	18.9	58	40	18	38	62	39	45	56	49
TKN		mg/L	0.73	0.33	0.006	0.3	0.25	0.3	0.27	0.27	0.2	0.33	0.26	0.29	0.31	0.26	0.24	0.265	0.254		0.253	0.335	0.389	0.392	0.432	0.555	0.432	0.49	<0.25	0.38	<0.25	0.28	0.27	0.16
TP	0.03	mg/L								0.005	0.006	0.008	0.0006	0.004	0.027	0.005	0.006	<0.0050	<0.0050		<0.030	<0.0050	<0.0050	0.0072	0.0109	0.0055	0.0063	0.007	0.0053	0.0033	0.0087	0.0055	0.0093	<0.0030

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Table E.9: Sampling Location Michipicoten River Midstream

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Parameter	PWQO	Units	31-Oct-06	13-Jun-07	8-Nov-07 (3)	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
VOCs															
Acetone		mg/L	<0.02	Not	<0.002	Not	Not	Not	Not	Not	Not	Not	Not	Not	Not
1,4 Dichlorobenzene		mg/L	<0.0005	Sampled	<0.0005	Sampled	Sampled	Sampled	Sampled	Sampled	Sampled	Sampled	Sampled	Sampled	Sampled
METALS															
Antimony	0.02	mg/L	<0.005		<0.005										
Arsenic	0.1	mg/L	<0.001		<0.001										
Barium		mg/L	<0.01		<0.01										
Boron	0.2	mg/L	<0.05		<0.05										
Cadmium	0.0001	mg/L	<0.00009		<0.00009										
Calcium		mg/L	10.7		8.9										
Chromium		mg/L	<0.001		<0.001										
Cobalt	0.0009	mg/L	<0.0005		<0.0005										
Copper	0.005	mg/L	0.001		0.001										
Iron	0.3	mg/L	0.08		0.12										
Lead	0.01	mg/L	<0.0001		<0.001										
Magnesium		mg/L	1.5		1.18										
Manganese	0.05	mg/L	0.008		0.011										
Nickel	0.025	mg/L	<0.002		<0.002										
Potassium		mg/L	2		0.51										
Sodium	200	mg/L	1.25		1.19										
Thallium	0.0003	mg/L	<0.0003		<0.0003										
Zinc	5	mg/L	0.008		<0.003										
GENERAL CHEMISTRY															
Alkalinity, Total		mg/L	31		24										
Ammonia-N		mg/L	<0.02		<0.02										
Ammonia-unionized		mg/L	0.002		0.002										
BOD5	0.02	mg/L			<2										
Chloride		mg/L	1.1		1.4										
COD		mg/L	17		14										
Conductivity (µs/cm)			74		65										
Dissolved Organic Carbon		mg/L			4										
Hardness		mg/L	33		29.7										
Ion Balance Calculation (%)		%	0.57		0.3										
Nitrate		mg/L	0.09		0.11										
Nitrite		mg/L	<0.02		<0.02										
pH (standard units)	6.5 - 8.5		7.6		7.3										
Sulphate		mg/L	5.3		5.5										
TDS		mg/L	70		90										
TKN		mg/L	0.25		0.24										
TP	0.03	mg/L	0.004		0.004										

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Table E.10: Sampling Location Michipicoten River Downstream

Parameter	PWQO	Units	31-Oct-06	13-Jun-07	8-Nov-07 (3)	25-Jun-08	23-Oct-08 (3)	25-Jun-09	20-Oct-09	11-May-10	22-Sep-10	2011	2012	2013	2014	2015	2016	17-May-17	7-Nov-17
VOCs																			
Acetone		mg/L	<0.02	Not	<0.002	<0.02		<0.02		<0.02	Not	Not	Not	Not	Not	Not	Not	<0.02	Not
1,4 Dichlorobenzene		mg/L	<0.0005	Sampled	<0.0005	<0.0005		<0.0005		<0.50	Sampled	Sampled	Sampled	Sampled	Sampled	Sampled	Sampled	<0.0005	Sampled
METALS																			
Antimony	0.02	mg/L	<0.005		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005								<0.00010	
Arsenic	0.1	mg/L	<0.001		<0.001	0.009	<0.001	<0.009	<0.001	<0.0010								0.00036	
Barium		mg/L	<0.010		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010								0.00709	
Boron	0.2	mg/L	<0.050		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050								<0.010	
Cadmium	0.0001	mg/L	<0.00009		<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009								<0.000005	
Calcium		mg/L	10.6		8.9	9.1	10.9	8.15	10.9	9.46								6.72	
Chromium		mg/L	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001								0.00036	
Cobalt	0.0009	mg/L	<0.0005		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005								<0.00010	
Copper	0.005	mg/L	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001								0.00074	
Iron	0.3	mg/L	0.09		0.13	0.08	0.1	0.112	0.101	0.062								0.117	
Lead	0.01	mg/L	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001								0.000052	
Magnesium		mg/L	1.6		1.85	1.84	2.04	2.06	2.06	2.23								1.39	
Manganese	0.05	mg/L	0.01		0.011	0.006	0.007	0.0064	0.0095	0.0067								0.00687	
Nickel	0.025	mg/L	<0.002		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002								<0.0005	
Potassium		mg/L	2		0.53	0.49	0.37	0.507	<1.0	<1.0								0.391	
Sodium	200	mg/L	0.997		1.23	1.14	0.687	1.18	1.3	1.11								1.14	
Thallium	0.0003	mg/L	<0.0003		<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003								<0.00001	
Zinc	5	mg/L	<0.003		<0.003	<0.003	<0.003	<0.003	<0.003	<0.003								<0.0030	
GENERAL CHEMISTRY																			
Alkalinity, Total		mg/L	51		24	27	30	25.4	30.8	32								21.7	
Ammonia-N		mg/L	<0.02		<0.02	0.03	0.03	<0.020	<0.020	<0.020								0.063	
Ammonia-unionized		mg/L	0.002		0.002	0.002	0.002	<0.020	<0.020										
BOD5	0.02	mg/L			<2	<2	<2	<2	<2	<2								<2	
Chloride		mg/L	0.9		1.5	0.9	0.7	0.97	0.93	0.96								0.77	
COD		mg/L	24		14	18	15	8.7	19.6	13.2								25	
Conductivity (µs/cm)			113		65	67	74	63.9	74.7	72.8								48.5	
Dissolved Organic Carbon		mg/L			5	5	4	7.9	4	7.6								8.1	
Hardness		mg/L	33		29.9	30.3	35.5	28.8	35.7	32.8								22.5	
Ion Balance Calculation (%)		%	-22.7		1.8	-0.06	2.75	1.32	3.83									1.9	
Nitrate		mg/L	0.08		0.11	0.12	0.05	0.139	0.055	0.078								0.095	
Nitrite		mg/L	<0.02		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02								<0.010	
pH (standard units)	6.5 - 8.5		7.8		7.3	7.48	7.57	7.22	7.72	7.33								7.13	
Sulphate		mg/L	7.3		5.5	4.6	4	3.77	3.68	3.6								2.39	
TDS		mg/L	90		70	35	37	56	53	36.9								45	
TKN		mg/L	0.33		0.25	0.28	0.24	0.275	0.247	0.228								<0.25	
TP	0.03	mg/L	0.009		0.004	0.006	0.007	<0.0050	0.0076	0.006								0.0056	

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Table E.11: Sampling Location Michipicoten River Upstream - 4 O'clock Rock

Parameter	PWQO	Units	25-Jun-09	20-Oct-09	11-May-10	22-Sep-10	21-Jun-11	11-Oct-11	11-Jun-12	24-Sep-12	13-May-13	25-Sep-13	11-Jun-14	22-Oct-14	21-May-15	17-Nov-15	12-May-16	28-Sep-16	17-May-17	17-May-17	7-Nov-17
																				Duplicate	
VOCs																				Sample	
Acetone		ug/L	<0.02		<20		<20		<20		<20		<20	-	<20	-	<20	-	<20	<20	-
1,4 Dichlorobenzene		ug/L	<0.0005		<0.50		<0.50		<0.50		<0.50		<0.50	-	<0.50	-	<0.50	-	<0.50	<0.50	-
METALS																					
Antimony	0.02	mg/L	<0.005	<0.005	<0.005	<0.005	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	0.0001	<0.0006	<0.0006	<0.0001	<0.00010	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.1	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0010	0.00039	0.0068	<0.001	0.00031	0.00034	0.00028	0.00037	0.00033	0.00033	0.00035
Barium		mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	0.008	0.025	<0.010	0.00675	0.00873	0.00809	0.00768	0.0069	0.00671	0.00715
Boron	0.2	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.010	<0.050	<0.050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	0.0001	mg/L	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	0.00003	<0.000017	<0.000017	<0.000010	<0.000017	<0.000017	0.0000072	<0.000005	0.000007	<0.000005	0.0000057	<0.000005	<0.000005
Calcium		mg/L	9.66	10.9	9.34	11.1	9.32	9.13	9.76	10.6	4.46	9.1	18.9	8.12	6.48	9.61	6.59	8.53	6.85	6.60	8.48
Chromium		mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00022	<0.0010	<0.0010	0.00046	0.0005	0.00035	0.00031	0.00036	0.00043	0.00036
Cobalt	0.0009	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.00050	<0.00050	<0.00010	<0.00050	<0.00050	<0.0001	<0.00010	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010
Copper	0.005	mg/L	0.0012	<0.0010	<0.0010	0.00105	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	0.00142	0.0016	<0.0010	0.001	0.00093	0.00075	0.00069	0.00081	0.0012	0.00073
Iron	0.3	mg/L	0.19	0.105	0.072	0.1	0.076	0.083	0.058	0.109	0.135	0.093	0.114	0.096	0.12	0.084	0.103	0.108	0.117	0.124	0.101
Lead	0.01	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.0010	0.000055	<0.0010	<0.0010	0.000083	<0.00005	<0.00005	<0.00005	<0.00005	0.000121	0.000055
Magnesium		mg/L	1.86	2.08	2.19	2.27	1.91	1.97	2.02	1.99	0.927	1.81	3.87	1.7	1.33	1.96	1.33	1.59	1.42	1.35	1.62
Manganese	0.05	mg/L	0.0111	0.009	0.0083	0.0325	0.0075	0.0121	0.0083	0.0291	0.013	0.00855	0.0159	0.0082	0.00795	0.00856	0.00772	0.0109	0.00724	0.00764	0.00841
Nickel	0.025	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.00050	<0.0020	<0.0020	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00071	<0.0005
Potassium		mg/L	0.49	<1.0	<1.0	<1.0	<1.0	<1.0	0.54	0.53	<0.50	0.429	0.85	<0.5	0.394	0.515	0.429	0.433	0.438	0.378	0.39
Sodium	200	mg/L	1.22	1.33	1.12	1.5	1.43	1.27	1.35	1.19	0.94	1.09	0.91	1.2	1.06	1.32	1.34	1.2	1.19	1.15	1.2
Thallium	0.0003	mg/L	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.00030	<0.00030	0.000011	<0.00030	<0.00030	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Zinc	5	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0054	<0.0030	<0.0030	<0.0030	<0.0030	0.0032
GENERAL CHEMISTRY																					
Alkalinity, Total		mg/L	25.8	30.3	30.8	30.7	25	32.5	26.7	34.7	13.4	26	59.3	30.4	19.6	31	17	26.9	24.8	23.5	26.8
Ammonia-N		mg/L	<0.020	<0.020	<0.020	<0.020	0.02	<0.020	<0.02	<0.02	0.022	0.142	<0.020	0.037	<0.020	0.043	<0.020	0.104	0.073	0.068	0.085
Ammonia-unionized		mg/L	<0.020	<0.020					<0.020												
BOD5	0.02	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Chloride		mg/L	0.73	1.03	0.98	0.87	0.59	0.94	0.97	0.94	0.65	0.66	0.55	0.72	0.65	0.88	1.01	0.83	0.85	0.78	0.77
COD		mg/L	9.4	15.7	11.8	11.3	16.5	3.8	18.6	16.1	23.6	26.9	24	24	20	14	20	20	24	24	21
Conductivity (µs/cm)			62.6	73.9	71.5	74.7	63.8	76.2	73.4	86.7	40	65.5	119	58.7	43.6	65.3	46	55.5	48.8	48.3	56.6
Dissolved Organic Carbon		mg/L	6	3.8	7.4	4.7	4.9	5.8	5.1	5.3	13.6	8.7	8.9	9.1	5.9	6.8	7.4	8.4	7.6	7.7	8.9
Hardness		mg/L	31.8	35.8	32.3	37	31.1	30.9	32.7	34.7	15	30.2	63.1	27.3	21.7	32.1	21.9	27.8	22.9	22	27.8
Ion Balance Calculation (%)		%	6.82	3.87					Low EC	5.3	-1.06	5.8	2.4	-6.2	4.5	0.7	10.4	1.2	-3.6	-3.4	0.4
Nitrate		mg/L	0.108	0.058	0.079		0.066	0.043	0.056	0.051	0.112	0.047	0.07	0.072	0.076	0.077	0.096	0.041	0.098	0.099	0.07
Nitrite		mg/L	<0.020	<0.020	<0.020		<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH (standard units)	6.5 - 8.5		7.36	7.71	7.31	7.53	7.41	7.44	7.59	7.6	7.12	7.46	7.72	7.93	7.72	7.78	7.60	7.33	7.65	7.36	7.36
Sulphate		mg/L	3.6	3.64	3.57		3.07	3.69	3.25	3.98	2.62	3.36	3.23	2.73	2.36	2.95	2.44	2.95	2.79	2.95	3.32
TDS		mg/L	65	54	36	46	63	30	34.2	40.3	18.1	43	73	41	41	54	39	49	40	39	40
TKN		mg/L	0.278	0.223	0.255		0.233	0.343	0.378	0.444	0.429	0.569	0.371	0.45	<0.25	0.28	<0.25	0.31	0.29	0.26	0.26
TP	0.03	mg/L	0.0056	<0.0050	0.0055		<0.030	<0.0050	<0.0050	0.0096	0.0116	<0.0050	0.0048	0.0043	0.0055	0.0034	0.0048	0.0039	0.0055	0.0058	0.0048

Municipality of Wawa - Michipicoten Landfill Site
Ground and Surface Water Monitoring Results

KEC Project Ref. No. 1772

Table E.12: Sampling Location Trout Creek Mouth

Parameter	PWQO	Units	20-Nov-01	4-Jun-02	28-Oct-02	02-Jul-03 (1)	2-Dec-03	2-Jun-04	17-Nov-04	13/23-Jun-05	27-Oct-05	23-May-06	31-Oct-06	13-Jun-07	14-Nov-07	25-Jun-08	23-Oct-08 (3)	25-Jun-09	20-Oct-09	11-May-10	22-Sep-10	21-Jun-11	11-Oct-11	11-Jun-12	24-Sep-12	13-May-13	25-Sep-13	11-Jun-14	22-Oct-14	21-May-15	17-Nov-15	12-May-16	28-Sep-16	17-May-17	7-Nov-17
VOCs																																			
Acetone		mg/L								0.02		<0.02	<0.02			<0.02		<0.02		<0.02	Not	Not		<0.02			<0.02		<0.02	-	<0.02	-	<0.02	-	<0.02	-
1,4 Dichlorobenzene		mg/L								<0.0005		0.001	<0.0005			<0.0005		<0.0005		<0.50	Sampled	Sampled		<0.50			<0.50		<0.50	-	<0.00050	-	<0.00050	-	<0.0005	-
METALS																																			
Antimony	0.02	mg/L								<0.005	0.014	<0.005	<0.005	<0.005	<.0.005	<.0.005	<.0.005	<.0.005	<.0.005	<.0.005			<0.00060	<0.00060	<0.00060	<0.00060	<0.00010	<0.00060	<0.0006	<0.0001	<0.00010	<0.0001	<0.00010	<0.00010	<0.00010
Arsenic	0.1	mg/L										0.004	0.005	0.009	0.005	0.008	<0.001	0.0013	0.0048	0.0046			0.0014	0.0096	0.0145	0.0052	0.00036	0.0046	<0.0010	0.0003	0.0103	0.00699	0.0137	0.00476	0.00535
Barium		mg/L								0.03	0.03	0.03	0.005	0.03	0.03	0.03	<0.01	0.012	0.026	0.025			0.013	0.029	0.015	0.019	0.00734	0.019	<0.010	0.00642	0.0218	0.0255	0.0313	0.0269	0.0202
Boron	0.2	mg/L								<0.05	0.37	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05			<0.050	<0.050	<0.050	<0.050	<0.010	<0.050	<0.050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	0.0001	mg/L								<0.0001	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009			<0.000090	0.000019	0.000017	<0.000017	<0.000010	<0.000017	<0.000017	0.0000083	<0.000005	0.0000064	0.0000224	<0.000005	0.0000055
Calcium		mg/L	12.8	15.9	8.6	26	15.7	8.1	17.9	15.4	18.6	18.5	16.4	19.6	14.5	17.6	11.6	10.6	21.6	18.6			13	23.7	12.1	9.75	9.44	15.8	8.1	6.22	14.7	17.2	13.4	17.8	13.5
Chromium		mg/L	<0.001	0.002	<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			<0.0010	<0.0010	<0.0010	<0.0010	0.00027	<0.0010	<0.0010	0.00034	0.00039	0.00037	0.00263	0.00049	0.00047
Cobalt	0.0009	mg/L	<0.0005	0.0007	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005			<0.00050	<0.00050	<0.00050	<0.00050	<0.00010	<0.00050	<0.00050	<0.0001	<0.0001	<0.0001	0.0007	<0.00010	<0.00010
Copper	0.005	mg/L	0.003	0.002	0.002	0.012	0.001	<0.001	0.001	0.001	0.002	<0.001	0.001	0.001	0.002	0.001	0.009	0.0014	0.0014	0.0013			<0.0010	0.0013	<0.0010	0.0019	0.0012	0.0013	<0.0010	0.00086	0.00152	0.00131	0.00313	0.00127	0.00126
Iron	0.3	mg/L	0.234	0.131	0.28	0.09	0.18	0.07	0.15	0.14	0.07	0.09	0.15	0.1	0.29	0.24	0.12	0.163	0.224	0.131			0.086	0.128	0.188	0.31	0.091	0.104	0.098	0.119	0.223	0.165	1.31	0.194	0.295
Lead	0.01	mg/L	0.0004	0.0002	<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	<0.001	<0.001	<0.001			<0.0010	<0.0010	<0.0010	<0.0010	0.000064	<0.0010	<0.0010	0.000067	0.00005	<0.00005	0.000634	0.000065	0.000098
Magnesium		mg/L	3.05	3.61	1.81	5.31	3.62	1.63	4.02	3.43	4.28	4.12	4.1	4.33	3.38	4.02	2.21	2.6	4.61	4.98			2.81	5.27	2.75	2.11	1.78	3	1.62	1.26	3.57	3.87	3.6	3.97	3.23
Manganese	0.05	mg/L	0.005	0.01	0.023	0.013	0.01	0.007	0.007	0.01	0.012	0.009	0.008	0.015	0.012	0.015	0.009	0.009	0.0106	0.013			0.0101	0.019	0.0103	0.0155	0.00853	0.0132	0.0082	0.00765	0.0106	0.0121	0.0661	0.0188	0.0136
Nickel	0.025	mg/L	0.001	0.0005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002			<0.0020	<0.0020	<0.0020	<0.0020	<0.00050	<0.0020	<0.0020	<0.0005	0.00084	0.00066	0.00277	0.00069	0.00097
Potassium		mg/L	0.7	0.84	0.52	1.11	0.87	0.47	0.9	0.81	0.88	0.89	4	0.91	0.79	0.99	0.41	0.64	1	<1.0			<1.0	1.15	0.76	0.52	0.404	0.71	<0.50	0.374	0.859	0.828	0.864	0.949	0.667
Sodium	200	mg/L	0.793	0.862	1.13	1.23	0.974	1.08	1.03	0.865	0.98	0.987	1.03	1.11	0.888	1.03	0.697	1.07	1.13	0.96			1.23	1.18	0.67	0.57	1.08	0.95	1.14	1.01	0.87	0.93	0.681	1.02	0.784
Thallium	0.0003	mg/L								<0.0003	0.0009	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003			<0.00030	<0.00030	<0.00030	<0.00030	<0.000010	<0.00030	<0.00030	<0.00001	<0.00001	<0.00001	0.000015	<0.00001	<0.00001
Zinc	5	mg/L	0.063	<0.004	0.004	0.005	0.003	<0.003	<0.003	<0.003	0.014	<0.003	<0.003	<0.003	<0.003	<0.003	0.005	<0.003	0.0073	<0.003			<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0045	0.0045	<0.0030	<0.0030
GENERAL CHEMISTRY																																			
Alkalinity, Total		mg/L	33	49	26	77	46	21	54	47	46	53	52	58	41	56	33	35.5	66.8	62.1			54.7	66.9	48	28.7	26.5	51.9	27	17.2	48.4	53.9	37.6	60	45
Ammonia-N		mg/L		<0.07	<0.07	<0.07	<0.07	0.07	0.03	<0.02	<0.02	<0.02	<0.02	0.02	0.04	0.04	0.04	<0.02	<0.02	<0.02			<0.020	<0.02	<0.020	0.035	0.037	<0.020	<0.020	<0.020	<0.020	<0.020	0.08	0.142	0.273
Ammonia-unionized		mg/L		0.005	0.005	0.005	0.005	0.005	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003	<0.020	<0.02																
BOD5	0.02	mg/L								<2	<2	<2				<2	<2	<2	<2	<2			<2.0	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Chloride		mg/L				1.2	0.4	0.5	0.6	0.3	0.8	1.1	0.9	1.2	0.7	0.5	0.7	0.57	0.95	0.76			1.02	0.82	0.38	0.22	0.67	0.57	0.71	0.61	0.36	0.45	0.38	0.51	0.31
COD		mg/L								13	21	19	23	13	29	25	12	14.6	23.6	13.3			17.9	20.2	27.3	23.8	26.8	24	23	20	31	21	56	22	32
Conductivity (µ⍵/cm)			88.5	113	69	164	109	58	118	99	126	124	113	124	99	123	78	81.8	140	132			121	154	113	66.3	65	109	58.9	43.9	101	110	73.1	120	88.1
Dissolved Organic Carbon		mg/L							5	6	6	7				6	4	6.8	5.1	8.2			6.2	5.7	7.1	13.2	8.9	8.7	9.4	9.2	35.2	8	18.3	6.6	13.1
Hardness		mg/L	45	55	29	87	54	27	61	53	64	63	63	67	50.2	60.6	38.2	37.2	72.9	67			44	80.9	41.6	33.1	30.9	51.7	26.9	20.7	51.3	58.8	48.3	60.7	47
Ion Balance Calculation (%)		%								2.72	5	3.2	5.1	3.1	4.3	1.6	3.78	-1.41	2.2				-12.7	7.6	-0.6	2.87	5.3	-1.2	-1.8	8.3	1.7	3.5	17.4	0.4	2.8
Nitrate		mg/L	0.23	0.07	0.08	0.09	0.16	0.12	0.1	0.08	0.1	0.08	0.09	0.08	0.17	0.08	0.05	0.092	<0.030	0.058			0.045	0.081	0.119	0.166	0.048	0.08	0.074	0.073	0.1	0.057	0.074	0.103	0.118
Nitrite		mg/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	<0.02	<0.02			<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH (standard units)	6.5 - 8.5		7.5	7.8	7.4	7.8	7.6	7.4	7.7	7.4	7.6	7.8	7.7	7.7	7.4	7.83	7.59	7.54	8.06	7.74			7.67	7.92	7.71	7.42	7.56	6.32	6.99	7.35	7.72	7.79	7.44	7.59	7.5
Sulphate		mg/L	10.1	4.9	3.7	5.7	4.4	3.2	4.1	4.9	13.8	7.7	7.6	6.5	6	5.2	4	3.88	5.34	4.97			4.41	4.45	4.02	3.36	3.41	3.67	2.75	2.22	3.93	3.53	3.63	3.91	3.07
TDS		mg/L								60	40	90	100	100	90	63	40	68	104	67.8			55.5	77.1	50	34.5	43	78	47	44	79	74	77	77	67
TKN		mg/L	1.13	0.41	0.31	0.26	0.31	0.26	0.33	0.35	0.34	0.27	0.33	0.35	0.39	0.33	0.3	0.329	0.292	0.336			0.34	0.411	0.658	0.466	0.431	0.43	0.44	<0.25	0.44	<0.25	0.71	<0.25	0.42
TP	0.03	mg/L								0.01	0.007	<0.003	0.005	0.005	0.032	0.009	0.011	<0.0050	0.008	0.0078			<0.0050	0.0059	0.0137	0.0185	<0.0050	0.0055	0.0091	0.0063	0.0051	0.0086	0.0912	0.088	0.0059

Municipality of Wawa - Michipicoten Landfill Site
Ground and Surface Water Monitoring Results

KEC Project Ref. No. 1772

Table E.13: Sampling Location Trout Creek Upstream

Parameter	PWQO	Units	25-Jun-08	23-Oct-08 (3)	25-Jun-09	20-Oct-09	11-May-10	22-Sep-10	21-Jun-11	11-Oct-11	11-Jun-12	24-Sep-12	13-May-13	25-Sep-13	11-Jun-14	22-Oct-14	21-May-15	17-Nov-15	12-May-16	28-Sep-16	17-May-17	7-Nov-17
VOCs																						
Acetone		mg/L	<0.02		<0.02		<0.02	Not	Not		<0.02		<0.02		<0.02	-	<0.02	-	<0.02	-	<0.02	-
1,4 Dichlorobenzene		mg/L	<0.0005		<0.0005		<0.00050	Sampled	Sampled		<0.00050		<0.00050		<0.00050	-	<0.00050	-	<0.00050	-	<0.0050	-
METALS																						
Antimony	0.02	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005			<0.00060	<0.00060	<0.00060	<0.0006	<0.00010	<0.00060	<0.00060	<0.0001	<0.00010	<0.0001	<0.00010	<0.00010	<0.0001
Arsenic	0.1	mg/L	<0.001	0.004	0.0103	0.0062	0.0044			0.0036	0.0097	0.0154	0.0049	0.0004	0.0067	<0.0010	0.00033	0.0105	0.00843	0.0137	0.00482	0.00545
Barium		mg/L	<0.01	0.03	0.023	0.026	0.024			0.023	0.029	0.017	0.019	0.00747	0.025	<0.010	0.00638	0.0218	0.0278	0.0282	0.0286	0.0206
Boron	0.2	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05			<0.050	<0.050	<0.050	<0.050	<0.010	<0.050	<0.050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	0.0001	mg/L	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009			<0.000017	<0.000017	<0.000017	<0.000017	<0.000010	<0.000017	<0.000017	0.0000086	<0.000005	0.0000064	0.0000174	<0.000005	0.0000051
Calcium		mg/L	15.9	23.8	13.5	17.7	17.6			22.7	23.2	13.4	9.57	9.4	18.2	8.32	6.27	13.2	15.5	12.9	17.9	13.8
Chromium		mg/L	<0.001	<0.001	<0.001	<0.001	<0.001			<0.0010	<0.0010	0.0011	<0.0010	0.00028	<0.0010	<0.0010	0.00043	0.00038	0.00044	0.00213	0.00048	0.00059
Cobalt	0.0009	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005			<0.00050	<0.00050	<0.00050	<0.00050	<0.00010	<0.00050	<0.00050	<0.0001	<0.0001	<0.0001	0.00057	<0.00010	<0.00010
Copper	0.005	mg/L	<0.001	0.009	0.0013	0.0014	0.0015			<0.0010	0.0012	0.0015	0.0016	0.00105	0.0017	<0.0010	0.00088	0.0012	0.00135	0.00296	0.00131	0.00122
Iron	0.3	mg/L	0.07	0.21	0.253	0.262	0.142			0.097	0.135	0.207	0.291	0.095	0.12	0.098	0.123	0.219	0.178	1.13	0.19	0.291
Lead	0.01	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001			<0.0010	<0.0010	<0.0010	<0.0010	0.000076	<0.0010	<0.0010	0.000067	<0.00005	<0.00005	0.000527	0.000067	0.000086
Magnesium		mg/L	3.74	5.46	3.38	4.03	4.68			5.6	5.34	3.05	2.12	1.84	3.83	1.8	1.33	3.71	3.55	3.53	4.11	3.23
Manganese	0.05	mg/L	0.006	0.012	0.0151	0.0123	0.013			0.0061	0.0182	0.0113	0.0148	0.00984	0.0167	0.083	0.00818	0.0113	0.0116	0.0584	0.0187	0.014
Nickel	0.025	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002			<0.0020	<0.002	<0.0020	<0.0020	<0.00050	<0.0020	<0.0020	<0.0005	0.00081	0.00074	0.00249	0.00068	0.001
Potassium		mg/L	0.92	1.2	0.816	<1.0	<1.0			1.2	1.14	0.84	0.52	0.415	0.86	<0.5	0.381	0.868	0.786	0.845	0.969	0.687
Sodium	200	mg/L	0.926	0.807	0.8	1.11	0.94			1.34	1.18	0.76	0.56	1.08	0.94	1.26	1.05	0.844	0.839	0.667	1.04	0.797
Thallium	0.0003	mg/L	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003			<0.00030	<0.00030	<0.00030	<0.00030	<0.000010	<0.00030	<0.00030	<0.00001	<0.00001	<0.00001	0.000012	<0.00001	<0.00001
Zinc	5	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003			<0.0030	<0.0030	<0.0030	<0.0030	0.0036	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0038	<0.0030	<0.0030
GENERAL CHEMISTRY																						
Alkalinity, Total		mg/L	51	73	45.5	54.1	62.3			84.4	67.1	47.7	29	26.7	43.9	26.6	20.2	47.5	48.2	37.6	32.7	43.7
Ammonia-N		mg/L	0.03	0.04	<0.020	<0.020	<0.020			<0.020	0.02	<0.02	0.032	0.121	<0.020	<0.020	<0.020	0.021	<0.020	0.062	0.074	0.13
Ammonia-unionized		mg/L	0.002	0.003	<0.020	<0.020																
BOD5	0.02	mg/L	<2	<2	<2	<2	<2			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Chloride		mg/L	0.4	0.6	0.17	0.39	0.74			1.21	0.79	0.36	0.23	0.66	0.61	0.82	0.64	0.37	0.17	0.19	0.75	0.3
COD		mg/L	25	15	15.3	25.5	13.5			12.5	18.6	34.6	21	25.5	24	23	17	32	20	49	23	34
Conductivity (µs/cm)			112	152	100	114	131			177	153	112	67.4	65.2	96	58.7	44.6	101	97.3	72.6	68	87.3
Dissolved Organic Carbon		mg/L	6	4	8.9	5.7	8.2			6.1	5.3	6.2	14.6	8.8	8.5	9.5	9.3	10.3	8.1	18.7	6.6	12.9
Hardness		mg/L	55.2	81.9	47.6	60.8	63.2			79.8	79.9	46	32.6	31.1	61.2	28.2	21.2	48.3	53.4	46.8	61.6	47.8
Ion Balance Calculation (%)		%	1.5	4.2	0.6	3.8				-3.9	7.1	5.3	1.62	0.62	14.7	1.1	2.2	-0.3	4.4	16.9	28	3.9
Nitrate		mg/L	0.1	<0.03	0.069	<0.030	0.058			0.054	0.076	0.113	0.168	0.047	0.076	0.071	0.075	0.1	0.058	0.064	0.103	0.107
Nitrite		mg/L	<0.02	<0.02	<0.02	<0.02	<0.02			<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH (standard units)	6.5 - 8.5		7.71	7.57	7.62	7.83	7.7			7.78	7.9	7.71	7.41	7.55	6.25	6.91	7.31	7.72	7.74	7.46	7.29	7.52
Sulphate		mg/L	4.7	4.5	4.01	3.72	4.96			5.33	4.22	3.69	3.45	3.36	3.3	2.78	2.35	3.94	3.62	2.19	3.1	3.62
TDS		mg/L	58	80	82	84	66.6			88.3	76.5	51.2	34.6	48	60	33	27	75	68	79	76	59
TKN		mg/L	0.38	0.25	0.411	0.345	0.274			0.303	0.409	0.652	0.484	0.448	0.445	0.44	0.25	0.48	0.27	0.67	<0.25	0.38
TP	0.03	mg/L	0.038	0.005	<0.005	0.0082	0.007			<0.0050	0.005	0.0146	0.018	0.0055	0.005	0.0047	0.0058	0.0076	0.0092	0.0837	0.0086	0.005

Municipality of Wawa - Michipicoten Landfill Site
Ground and Surface Water Monitoring Results

Table E.14: Field Blank

KEC Project Ref. No. 1772

Parameter	ODWS		Units	H/A	5/16/2017	11/1/2017
						NO SAMPLE
VOCs						
Acetone	-			-	<0.020	
1,4 Dichlorobenzene	0.005		mg/L	H	<0.0005	
Benzene	0.005		mg/L	H	<0.0005	
cis-1,2 Dichloroethylene	-		mg/L	-	<0.0005	
Dichloromethane	0.05		mg/L	H	<0.002	
Chlorobenzene	-		mg/L		<0.0005	
Chloroethane	-		mg/L		<0.001	
Ethyl Benzene	0.0024		mg/L		<0.0005	
Styrene	-		mg/L		<0.0005	
Toluene	0.024		mg/L	A	<0.0005	
Vinyl Chloride	0.002		mg/L	H	<0.0005	
DISSOLVED METALS						
Aluminum	0.1		mg/L		<0.0020	
Antimony	0.006		mg/L		<0.00010	
Arsenic	0.025		mg/L	H	<0.00010	
Barium	1		mg/L	H	<0.00005	
Boron	5		mg/L	H	<0.010	
Cadmium	0.005		mg/L	H	<0.000005	
Calcium	-		mg/L	-	<0.050	
Chromium	0.05		mg/L	H	<0.00010	
Copper	1		mg/L	A	<0.00020	
Iron	0.3		mg/L	A	<0.010	
Lead	0.01		mg/L	H	<0.00005	
Mercury	0.001		mg/L	H	<0.000005	
Magnesium	-		mg/L	-	<0.005	
Manganese	0.05		mg/L	A	<0.0001	
Nickel	-		mg/L	-	<0.0005	
Potassium	-		mg/L	-	<0.050	
Selenium	0.01		mg/L	H	<0.00005	
Sodium	200		mg/L	A	<0.050	
Uranium	0.02		mg/L	H	<0.00001	
Zinc	5		mg/L	A	<0.0010	
GENERAL CHEMISTRY						
Alkalinity, Total	30	500	mg/L	A	<2.0	
Ammonia-N	-		mg/L	-	0.055	
BOD5			mg/L	-	<2.0	
Chloride	250		mg/L	A	<0.10	
COD	-		mg/L	-	<10	
Conductivity (µs/cm)	-			-	<3.0	
Dissolved Organic Carbon	5		mg/L	A	<1.0	
Hardness	80	100	mg/L	A	<0.50	
Ion Balance Calculation (%)	-				0	
Nitrate	10		mg/L	H	<0.020	
Nitrite	1		mg/L	H	<0.010	
pH (standard units)	6.5	8.5	-	A	5.63	
Sulphate	500		mg/L	A	<0.30	
TDS	500		mg/L	A	<10	
TKN	-		mg/L		<0.25	
TP	-		mg/L		<0.0030	

Shaded values exceed ODWS

Appendix C

Certificates of Analysis – 2017 Sampling Events

Wawa, Municipality Of
ATTN: MARK MCRAE
MUNCIPALITY OF WAWA
40 BROADWAY AVE, P.O. BOX 500
WAWA ON P0S 1K0

Date Received: 18-MAY-17
Report Date: 29-MAY-17 12:52 (MT)
Version: FINAL

Client Phone: 705-856-4315

Certificate of Analysis

Lab Work Order #: L1928102

Project P.O. #: 28376
Job Reference: SPRING LANDFILL
C of C Numbers:
Legal Site Desc:

Christina Shepherd
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1928102-1 Ground Water 16-MAY-17 09:30 WELL #1 - 5310295.53/665574.89	L1928102-2 Ground Water 16-MAY-17 08:50 WELL #2 - 5310213.87/665662.28	L1928102-3 Ground Water 16-MAY-17 11:00 WELL #3 - 5310376.44/665723.23	L1928102-4 Ground Water 16-MAY-17 08:00 WELL #4 - 5310376.44/665733.23	L1928102-5 Ground Water 16-MAY-17 10:20 WELL #5 - 5310416.16/665966.67
WATER						
Physical Tests	Conductivity (EC) (uS/cm)	965	366	124	282	255
	Hardness (as CaCO3) (mg/L)	500	175	59.1	141	132
	pH (pH)	7.06	7.51	7.00	7.88	7.21
	Total Dissolved Solids (mg/L)	579	212	93	299	154
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	567	256	61.1	192	146
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Total (as CaCO3) (mg/L)	567	256	61.1	192	146
	Ammonia, Total (as N) (mg/L)	0.563	0.062	0.057	0.207	0.040
	Chloride (Cl) (mg/L)	9.84	0.97	0.43	0.36	0.65
	Nitrate (as N) (mg/L)	<0.020	0.045	0.137	0.073	0.594
	Nitrite (as N) (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Total Kjeldahl Nitrogen (mg/L)	1.12	<0.25	<0.25	<2.5 DLM	<0.25
	Phosphorus (P)-Total (mg/L)	0.0069	0.0107	0.031	6.98	0.0143
	Sulfate (SO4) (mg/L)	26.9	4.17	3.51	13.1	3.29
	Anion Sum (meq/L)	12.2	5.22	1.32	4.13	3.05
	Cation Sum (meq/L)	11.1	3.70	1.26	2.95	2.72
	Cation - Anion Balance (%)	-4.8	-17.1	-2.4	-16.6	-5.7
Organic / Inorganic Carbon	Dissolved Carbon Filtration Location	LAB	LAB	LAB	LAB	LAB
	Dissolved Organic Carbon (mg/L)	6.7	1.3	7.1	<1.0	3.1
Dissolved Metals	Dissolved Mercury Filtration Location	LAB	LAB	LAB	LAB	LAB
	Dissolved Metals Filtration Location	LAB	LAB	LAB	LAB	LAB
	Aluminum (Al)-Dissolved (mg/L)	<0.0020	<0.0020	0.0470	0.0067	0.0147
	Antimony (Sb)-Dissolved (mg/L)	0.00020	<0.00010	0.00013	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00038	0.00016	0.00068	0.00057	0.00031
	Barium (Ba)-Dissolved (mg/L)	0.0797	0.0234	0.0146	0.0438	0.0301
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	0.299	0.025	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050	0.0000163	<0.0000050	<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	161	52.9	18.2	42.2	43.8
	Cesium (Cs)-Dissolved (mg/L)	0.000160	<0.000010	<0.000010	0.000014	0.000011
	Chromium (Cr)-Dissolved (mg/L)	0.00021	<0.00010	0.00031	<0.00010	0.00025
	Cobalt (Co)-Dissolved (mg/L)	0.00487	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00025	0.00095	0.00640	0.00037	0.00271
	Iron (Fe)-Dissolved (mg/L)	0.075	<0.010	0.021	<0.010	<0.010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1928102-6	L1928102-7	L1928102-8	L1928102-9	L1928102-10
Description	Ground Water	Water	Water	Water	Water
Sampled Date	16-MAY-17	16-MAY-17	16-MAY-17	16-MAY-17	16-MAY-17
Sampled Time	11:20	00:01	00:01	00:01	00:01
Client ID	WELL #6 - 5310591/665911	DUP	FIELD BLANK	TRAVEL BLANK	TRAVEL SPIKE
Grouping / **Analyte**					
WATER					
Physical Tests Conductivity (EC) (uS/cm)	265	905	<3.0	<3.0	
Hardness (as CaCO3) (mg/L)	134	488	<0.50	<0.50	
pH (pH)	7.85	7.08	5.63	5.88	
Total Dissolved Solids (mg/L)	168	523	<10	<10	
Anions and Nutrients Alkalinity, Bicarbonate (as CaCO3) (mg/L)	152	503	<2.0	<2.0	
Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	
Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	
Alkalinity, Total (as CaCO3) (mg/L)	152	503	<2.0	<2.0	
Ammonia, Total (as N) (mg/L)	0.049	0.596	0.055 RRV	0.023 RRV	
Chloride (Cl) (mg/L)	0.41	8.37	<0.10	<0.10	
Nitrate (as N) (mg/L)	0.052	<0.020	<0.020	<0.020	
Nitrite (as N) (mg/L)	<0.010	<0.010	<0.010	<0.010	
Total Kjeldahl Nitrogen (mg/L)	<0.25	0.96	<0.25	<0.25	
Phosphorus (P)-Total (mg/L)	0.21	0.0062	<0.0030	<0.0030	
Sulfate (SO4) (mg/L)	9.77	21.6	<0.30	<0.30	
Anion Sum (meq/L)	3.26	10.7	<0.10	<0.10	
Cation Sum (meq/L)	2.80	10.7	<0.10	<0.10	
Cation - Anion Balance (%)	-7.6	-0.1	0.0	0.0	
Organic / Inorganic Carbon Dissolved Carbon Filtration Location	LAB	LAB	FIELD	FIELD	
Dissolved Organic Carbon (mg/L)	<1.0	6.2	<1.0	<1.0	
Dissolved Metals Dissolved Mercury Filtration Location	LAB	LAB	FIELD	FIELD	
Dissolved Metals Filtration Location	LAB	LAB	FIELD	FIELD	
Aluminum (Al)-Dissolved (mg/L)	0.0046	<0.0020	<0.0020	<0.0020	
Antimony (Sb)-Dissolved (mg/L)	0.00031	0.00017	<0.00010	<0.00010	
Arsenic (As)-Dissolved (mg/L)	0.00094	0.00036	<0.00010	<0.00010	
Barium (Ba)-Dissolved (mg/L)	0.0151	0.0647	<0.000050	<0.000050	
Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
Boron (B)-Dissolved (mg/L)	<0.010	0.282	<0.010	<0.010	
Cadmium (Cd)-Dissolved (mg/L)	0.0000079	0.0000059	<0.0000050	<0.0000050	
Calcium (Ca)-Dissolved (mg/L)	39.0	159	<0.050	<0.050	
Cesium (Cs)-Dissolved (mg/L)	<0.000010	0.000162	<0.000010	<0.000010	
Chromium (Cr)-Dissolved (mg/L)	0.00028	0.00018	<0.00010	<0.00010	
Cobalt (Co)-Dissolved (mg/L)	<0.00010	0.00574	<0.00010	<0.00010	
Copper (Cu)-Dissolved (mg/L)	0.00089	0.00040	<0.00020	<0.00020	
Iron (Fe)-Dissolved (mg/L)	<0.010	0.057	<0.010	<0.010	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1928102-1	L1928102-2	L1928102-3	L1928102-4	L1928102-5
	Description	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
	Sampled Date	16-MAY-17	16-MAY-17	16-MAY-17	16-MAY-17	16-MAY-17
	Sampled Time	09:30	08:50	11:00	08:00	10:20
	Client ID	WELL #1 - 5310295.53/665574.89	WELL #2 - 5310213.87/665662.28	WELL #3 - 5310376.44/665723.23	WELL #4 - 5310376.44/665733.23	WELL #5 - 5310416.16/665966.67
Grouping	**Analyte**					
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	0.000053	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0052	0.0039	<0.0010	0.0036	<0.0010
	Magnesium (Mg)-Dissolved (mg/L)	23.5	10.6	3.28	8.61	5.46
	Manganese (Mn)-Dissolved (mg/L)	2.10	0.102	0.00116	0.0351	0.00087
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.000346	0.000268	0.000178	0.00128	0.000157
	Nickel (Ni)-Dissolved (mg/L)	0.00514	<0.00050	0.00077	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	6.16	2.41	0.506	2.39	1.07
	Rubidium (Rb)-Dissolved (mg/L)	0.0280	0.00718	0.00077	0.0107	0.00164
	Selenium (Se)-Dissolved (mg/L)	0.000082	<0.000050	0.000101	0.000134	0.000118
	Silicon (Si)-Dissolved (mg/L)	7.58	3.90	4.29	2.99	3.89
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	18.1	2.76	1.17	1.43	1.29
	Strontium (Sr)-Dissolved (mg/L)	0.398	0.0987	0.0416	0.100	0.0805
	Sulfur (S)-Dissolved (mg/L)	9.64	1.27	0.93	4.46	0.93
	Tellurium (Te)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Thallium (Tl)-Dissolved (mg/L)	0.000052	<0.000010	<0.000010	0.000021	0.000011
	Thorium (Th)-Dissolved (mg/L)	<0.00010	<0.00010	0.00011	<0.00010	<0.00010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Tungsten (W)-Dissolved (mg/L)	<0.00010	<0.00010	0.00083	<0.00010	0.00010
	Uranium (U)-Dissolved (mg/L)	0.00382	0.000252	0.000093	0.00148	0.000137
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	0.00052	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	0.0011	0.0226	0.0123	<0.0010	0.0015
	Zirconium (Zr)-Dissolved (mg/L)	0.000571	<0.000060	0.000250	<0.000060	0.000154
Aggregate Organics	Biochemical Oxygen Demand (mg/L)	<2.0	3.1	<2.0	<2.0	<2.0
	Chemical Oxygen Demand (mg/L)	24	<10	22	67	13
Volatile Organic Compounds	Acetone (%)					
	Acetone (ug/L)	<20	<20	<20	<20	<20
	Benzene (%)					
	Benzene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Bromodichloromethane (%)					
	Bromodichloromethane (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Bromoform (%)					
	Bromoform (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1928102-6 Ground Water 16-MAY-17 11:20 WELL #6 - 5310591/665911	L1928102-7 Water 16-MAY-17 00:01 DUP	L1928102-8 Water 16-MAY-17 00:01 FIELD BLANK	L1928102-9 Water 16-MAY-17 00:01 TRAVEL BLANK	L1928102-10 Water 16-MAY-17 00:01 TRAVEL SPIKE
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Lithium (Li)-Dissolved (mg/L)	0.0045	0.0049	<0.0010	<0.0010	
	Magnesium (Mg)-Dissolved (mg/L)	8.84	22.0	<0.0050	<0.0050	
	Manganese (Mn)-Dissolved (mg/L)	0.00021	2.19	<0.00010	<0.00010	
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	
	Molybdenum (Mo)-Dissolved (mg/L)	0.000746	0.000408	<0.000050	<0.000050	
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	0.00540	<0.00050	<0.00050	
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	
	Potassium (K)-Dissolved (mg/L)	2.13	5.95	<0.050	<0.050	
	Rubidium (Rb)-Dissolved (mg/L)	0.00185	0.0261	<0.00020	<0.00020	
	Selenium (Se)-Dissolved (mg/L)	0.000089	0.000066	<0.000050	<0.000050	
	Silicon (Si)-Dissolved (mg/L)	3.21	7.94	<0.050	<0.050	
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Sodium (Na)-Dissolved (mg/L)	1.60	16.6	<0.050	<0.050	
	Strontium (Sr)-Dissolved (mg/L)	0.0739	0.359	<0.00020	<0.00020	
	Sulfur (S)-Dissolved (mg/L)	3.21	7.95	<0.50	<0.50	
	Tellurium (Te)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	0.000048	<0.000010	<0.000010	
	Thorium (Th)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Tin (Sn)-Dissolved (mg/L)	0.00026	<0.00010	<0.00010	<0.00010	
	Titanium (Ti)-Dissolved (mg/L)	0.00036	<0.00030	<0.00030	<0.00030	
	Tungsten (W)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Uranium (U)-Dissolved (mg/L)	0.000630	0.00310	<0.000010	<0.000010	
	Vanadium (V)-Dissolved (mg/L)	0.00228	<0.00050	<0.00050	<0.00050	
	Zinc (Zn)-Dissolved (mg/L)	0.0035	0.0030	<0.0010	<0.0010	
	Zirconium (Zr)-Dissolved (mg/L)	<0.000060	0.000552	<0.000060	<0.000060	
Aggregate Organics	Biochemical Oxygen Demand (mg/L)	<2.0	<2.0	<2.0	<2.0	
	Chemical Oxygen Demand (mg/L)	30	25	<10	<10	
Volatile Organic Compounds	Acetone (%)					177 PEHR
	Acetone (ug/L)	<20	<20	<20	<20	
	Benzene (%)					113 PEHR
	Benzene (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Bromodichloromethane (%)					115 PEHR
	Bromodichloromethane (ug/L)	<1.0	<1.0	<1.0	<1.0	
	Bromoform (%)					114 PEHR
	Bromoform (ug/L)	<1.0	<1.0	<1.0	<1.0	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1928102-1	L1928102-2	L1928102-3	L1928102-4	L1928102-5
	Description	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
	Sampled Date	16-MAY-17	16-MAY-17	16-MAY-17	16-MAY-17	16-MAY-17
	Sampled Time	09:30	08:50	11:00	08:00	10:20
	Client ID	WELL #1 - 5310295.53/665574.89	WELL #2 - 5310213.87/665662.28	WELL #3 - 5310376.44/665723.23	WELL #4 - 5310376.44/665733.23	WELL #5 - 5310416.16/665966.67
Grouping	**Analyte**					
WATER						
Volatile Organic Compounds	Bromomethane (%)					
	Bromomethane (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Carbon Disulfide (%)					
	Carbon Disulfide (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Carbon tetrachloride (%)					
	Carbon tetrachloride (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Chlorobenzene (%)					
	Chlorobenzene (ug/L)	0.71	<0.50	<0.50	<0.50	<0.50
	Dibromochloromethane (%)					
	Dibromochloromethane (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Chloroethane (%)					
	Chloroethane (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Chloroform (%)					
	Chloroform (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Chloromethane (%)					
	Chloromethane (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	1,2-Dibromoethane (%)					
	1,2-Dibromoethane (ug/L)	<0.20	<0.20	<0.20	<0.20	<0.20
	1,2-Dichlorobenzene (%)					
	1,2-Dichlorobenzene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	1,3-Dichlorobenzene (%)					
	1,3-Dichlorobenzene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	1,4-Dichlorobenzene (%)					
	1,4-Dichlorobenzene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Dichlorodifluoromethane (%)					
	Dichlorodifluoromethane (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	1,1-Dichloroethane (%)					
	1,1-Dichloroethane (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	1,2-Dichloroethane (%)					
	1,2-Dichloroethane (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	1,1-Dichloroethylene (%)					
	1,1-Dichloroethylene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	cis-1,2-Dichloroethylene (%)					
	cis-1,2-Dichloroethylene (ug/L)	0.76	<0.50	<0.50	<0.50	<0.50
	trans-1,2-Dichloroethylene (%)					
	trans-1,2-Dichloroethylene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Dichloromethane (%)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1928102-6 Ground Water 16-MAY-17 11:20 WELL #6 - 5310591/665911	L1928102-7 Water 16-MAY-17 00:01 DUP	L1928102-8 Water 16-MAY-17 00:01 FIELD BLANK	L1928102-9 Water 16-MAY-17 00:01 TRAVEL BLANK	L1928102-10 Water 16-MAY-17 00:01 TRAVEL SPIKE
WATER						
Volatile Organic Compounds	Bromomethane (%)					109 PEHR
	Bromomethane (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Carbon Disulfide (%)					90.7 PEHR
	Carbon Disulfide (ug/L)	<1.0	<1.0	<1.0	<1.0	
	Carbon tetrachloride (%)					107 PEHR
	Carbon tetrachloride (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Chlorobenzene (%)					103 PEHR
	Chlorobenzene (ug/L)	<0.50	0.76	<0.50	<0.50	
	Dibromochloromethane (%)					120 PEHR
	Dibromochloromethane (ug/L)	<1.0	<1.0	<1.0	<1.0	
	Chloroethane (%)					115 PEHR
	Chloroethane (ug/L)	<1.0	<1.0	<1.0	<1.0	
	Chloroform (%)					114 PEHR
	Chloroform (ug/L)	<1.0	<1.0	<1.0	<1.0	
	Chloromethane (%)					125 PEHR
	Chloromethane (ug/L)	<1.0	<1.0	<1.0	<1.0	
	1,2-Dibromoethane (%)					116 PEHR
	1,2-Dibromoethane (ug/L)	<0.20	<0.20	<0.20	<0.20	
	1,2-Dichlorobenzene (%)					108 PEHR
	1,2-Dichlorobenzene (ug/L)	<0.50	<0.50	<0.50	<0.50	
	1,3-Dichlorobenzene (%)					99.4 PEHR
	1,3-Dichlorobenzene (ug/L)	<0.50	<0.50	<0.50	<0.50	
	1,4-Dichlorobenzene (%)					103 PEHR
	1,4-Dichlorobenzene (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Dichlorodifluoromethane (%)					115 PEHR
	Dichlorodifluoromethane (ug/L)	<1.0	<1.0	<1.0	<1.0	
	1,1-Dichloroethane (%)					111 PEHR
	1,1-Dichloroethane (ug/L)	<0.50	<0.50	<0.50	<0.50	
	1,2-Dichloroethane (%)					123 PEHR
	1,2-Dichloroethane (ug/L)	<0.50	<0.50	<0.50	<0.50	
	1,1-Dichloroethylene (%)					99.0 PEHR
	1,1-Dichloroethylene (ug/L)	<0.50	<0.50	<0.50	<0.50	
	cis-1,2-Dichloroethylene (%)					111 PEHR
	cis-1,2-Dichloroethylene (ug/L)	<0.50	0.84	<0.50	<0.50	
	trans-1,2-Dichloroethylene (%)					104 PEHR
	trans-1,2-Dichloroethylene (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Dichloromethane (%)					123 PEHR

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1928102-1 Ground Water 16-MAY-17 09:30 WELL #1 - 5310295.53/665574.89	L1928102-2 Ground Water 16-MAY-17 08:50 WELL #2 - 5310213.87/665662.28	L1928102-3 Ground Water 16-MAY-17 11:00 WELL #3 - 5310376.44/665723.23	L1928102-4 Ground Water 16-MAY-17 08:00 WELL #4 - 5310376.44/665733.23	L1928102-5 Ground Water 16-MAY-17 10:20 WELL #5 - 5310416.16/665966.67
WATER						
Volatile Organic Compounds	Dichloromethane (ug/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	1,2-Dichloropropane (%)					
	1,2-Dichloropropane (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	cis-1,3-Dichloropropene (%)					
	cis-1,3-Dichloropropene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	trans-1,3-Dichloropropene (%)					
	trans-1,3-Dichloropropene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Ethylbenzene (%)					
	Ethylbenzene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	n-Hexane (%)					
	n-Hexane (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	2-Hexanone (%)					
	2-Hexanone (ug/L)	<20	<20	<20	<20	<20
	Methyl Ethyl Ketone (%)					
	Methyl Ethyl Ketone (ug/L)	<20	<20	53	<20	<20
	Methyl Isobutyl Ketone (%)					
	Methyl Isobutyl Ketone (ug/L)	<20	<20	<20	<20	<20
	MTBE (%)					
	MTBE (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Styrene (%)					
	Styrene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	1,1,1,2-Tetrachloroethane (%)					
	1,1,1,2-Tetrachloroethane (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	1,1,2,2-Tetrachloroethane (%)					
	1,1,2,2-Tetrachloroethane (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Tetrachloroethylene (%)					
	Tetrachloroethylene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Toluene (%)					
	Toluene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	1,1,1-Trichloroethane (%)					
	1,1,1-Trichloroethane (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	1,1,2-Trichloroethane (%)					
	1,1,2-Trichloroethane (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Trichloroethylene (%)					
	Trichloroethylene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Trichlorofluoromethane (%)					
	Trichlorofluoromethane (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1928102-6	L1928102-7	L1928102-8	L1928102-9	L1928102-10
Description	Ground Water	Water	Water	Water	Water
Sampled Date	16-MAY-17	16-MAY-17	16-MAY-17	16-MAY-17	16-MAY-17
Sampled Time	11:20	00:01	00:01	00:01	00:01
Client ID	WELL #6 - 5310591/665911	DUP	FIELD BLANK	TRAVEL BLANK	TRAVEL SPIKE
Grouping / **Analyte**					
WATER					
Volatile Organic Compounds					
Dichloromethane (ug/L)	<2.0	<2.0	9.0	<2.0	
1,2-Dichloropropane (%)					116 PEHR
1,2-Dichloropropane (ug/L)	<0.50	<0.50	<0.50	<0.50	
cis-1,3-Dichloropropene (%)					72.8 PEHR
cis-1,3-Dichloropropene (ug/L)	<0.50	<0.50	<0.50	<0.50	
trans-1,3-Dichloropropene (%)					71.1 PEHR
trans-1,3-Dichloropropene (ug/L)	<0.50	<0.50	<0.50	<0.50	
Ethylbenzene (%)					88.7 PEHR
Ethylbenzene (ug/L)	<0.50	<0.50	<0.50	<0.50	
n-Hexane (%)					51.2 PEHR
n-Hexane (ug/L)	<0.50	<0.50	<0.50	<0.50	
2-Hexanone (%)					109 PEHR
2-Hexanone (ug/L)	<20	<20	<20	<20	
Methyl Ethyl Ketone (%)					130 PEHR
Methyl Ethyl Ketone (ug/L)	<20	<20	<20	<20	
Methyl Isobutyl Ketone (%)					112 PEHR
Methyl Isobutyl Ketone (ug/L)	<20	<20	<20	<20	
MTBE (%)					108 PEHR
MTBE (ug/L)	<0.50	<0.50	<0.50	<0.50	
Styrene (%)					92.8 PEHR
Styrene (ug/L)	<0.50	<0.50	<0.50	<0.50	
1,1,1,2-Tetrachloroethane (%)					104 PEHR
1,1,1,2-Tetrachloroethane (ug/L)	<0.50	<0.50	<0.50	<0.50	
1,1,2,2-Tetrachloroethane (%)					121 PEHR
1,1,2,2-Tetrachloroethane (ug/L)	<0.50	<0.50	<0.50	<0.50	
Tetrachloroethylene (%)					85.6 PEHR
Tetrachloroethylene (ug/L)	<0.50	<0.50	<0.50	<0.50	
Toluene (%)					93.9 PEHR
Toluene (ug/L)	<0.50	<0.50	<0.50	<0.50	
1,1,1-Trichloroethane (%)					107 PEHR
1,1,1-Trichloroethane (ug/L)	<0.50	<0.50	<0.50	<0.50	
1,1,2-Trichloroethane (%)					111 PEHR
1,1,2-Trichloroethane (ug/L)	<0.50	<0.50	<0.50	<0.50	
Trichloroethylene (%)					103 PEHR
Trichloroethylene (ug/L)	<0.50	<0.50	<0.50	<0.50	
Trichlorofluoromethane (%)					110 PEHR
Trichlorofluoromethane (ug/L)	<1.0	<1.0	<1.0	<1.0	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1928102-1 Ground Water 16-MAY-17 09:30 WELL #1 - 5310295.53/665574.89	L1928102-2 Ground Water 16-MAY-17 08:50 WELL #2 - 5310213.87/665662.28	L1928102-3 Ground Water 16-MAY-17 11:00 WELL #3 - 5310376.44/665723.23	L1928102-4 Ground Water 16-MAY-17 08:00 WELL #4 - 5310376.44/665733.23	L1928102-5 Ground Water 16-MAY-17 10:20 WELL #5 - 5310416.16/665966.67
WATER						
Volatile Organic Compounds	Vinyl chloride (%)					
	Vinyl chloride (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	o-Xylene (%)					
	o-Xylene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	m+p-Xylenes (%)					
	m+p-Xylenes (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Xylenes (Total) (ug/L)	<1.1	<1.1	<1.1	<1.1	<1.1
	Surrogate: 4-Bromofluorobenzene (%)	94.4	90.5	95.8	94.5	94.8
	Surrogate: 1,4-Difluorobenzene (%)	102.4	101.3	102.5	102.3	102.3
Trihalomethanes	Total THMs (ug/L)	<2.0	<2.0	<2.0	<2.0	<2.0

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1928102-6 Ground Water 16-MAY-17 11:20 WELL #6 - 5310591/665911	L1928102-7 Water 16-MAY-17 00:01 DUP	L1928102-8 Water 16-MAY-17 00:01 FIELD BLANK	L1928102-9 Water 16-MAY-17 00:01 TRAVEL BLANK	L1928102-10 Water 16-MAY-17 00:01 TRAVEL SPIKE
WATER						
Volatile Organic Compounds	Vinyl chloride (%)					106 PEHR
	Vinyl chloride (ug/L)	<0.50	<0.50	<0.50	<0.50	
	o-Xylene (%)					93.2 PEHR
	o-Xylene (ug/L)	<0.50	<0.50	<0.50	<0.50	
	m+p-Xylenes (%)					92.9 PEHR
	m+p-Xylenes (ug/L)	<1.0	<1.0	<1.0	<1.0	
	Xylenes (Total) (ug/L)	<1.1	<1.1	<1.1	<1.1	
	Surrogate: 4-Bromofluorobenzene (%)	95.0	95.6	95.0	95.2	95.7
	Surrogate: 1,4-Difluorobenzene (%)	102.7	102.8	101.2	102.5	102.2
Trihalomethanes	Total THMs (ug/L)	<2.0	<2.0	<2.0	<2.0	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Additional Comments for Sample Listed:

Samplenum	Matrix	Report Remarks	Sample Comments
L1928102-10	Water	Note: PEHR-Spike was prepared May1/17 therefore expired May15/17.	

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Dissolved Organic Carbon	MS-B	L1928102-9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1928102-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1928102-9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1928102-8
Matrix Spike	Boron (B)-Dissolved	MS-B	L1928102-9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1928102-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1928102-9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1928102-8
Matrix Spike	Cobalt (Co)-Dissolved	MS-B	L1928102-9
Matrix Spike	Copper (Cu)-Dissolved	MS-B	L1928102-9
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1928102-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1928102-9
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1928102-8
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1928102-9
Matrix Spike	Potassium (K)-Dissolved	MS-B	L1928102-9
Matrix Spike	Rubidium (Rb)-Dissolved	MS-B	L1928102-9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1928102-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1928102-9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1928102-8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1928102-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1928102-9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1928102-8
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1928102-9
Matrix Spike	Uranium (U)-Dissolved	MS-B	L1928102-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Total Kjeldahl Nitrogen	MS-B	L1928102-1, -2, -3, -4, -5, -6, -8, -9
Matrix Spike	Total Kjeldahl Nitrogen	MS-B	L1928102-7

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
PEHR	Parameter Exceeded Recommended Holding Time On Receipt: Proceed With Analysis As Requested.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-CO3-TITR-CALC-TB	Water	Alkalinity, Carbonate (as CaCO3)	CALCULATION
ALK-HCO3TITR-CALC-TB	Water	Alkalinity, Bicarbonate (as CaCO3)	CALCULATION
ALK-OH-TITR-CALC-TB	Water	Alkalinity, Hydroxide (as CaCO3)	CALCULATION
ALK-TITR-TB	Water	Alkalinity	APHA 2320B modified

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

Reference Information

BOD-TB	Water	Biochemical Oxygen Demand (BOD)	APHA 5210 B- BIOCHEMICAL OXYGEN DEMAND

All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.

CL-L-IC-N-TB	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

COD-TB	Water	Chemical Oxygen Demand	APHA 5220D

This analysis is carried out using procedures adapted from APHA Method 5220 "Chemical Oxygen Demand (COD)". Chemical oxygen demand is determined using the closed reflux colourimetric method.

DOC-TB	Water	Dissolved Organic Carbon	APHA 5310 B modified

Water samples are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis. Analyzed by converting all carbonaceous material to carbon dioxide (CO2) by catalytic combustion at 850?C. The CO2 generated is measured by an infrared detector and is directly proportional to concentration of carbonaceous material in the sample

EC-TITR-TB	Water	Conductivity	APHA 2510 B

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

HARDNESS-CALC-TB	Water	Hardness (as CaCO3)	CALCULATION
HG-D-CVAF-TB	Water	Dissolved Mercury in Water by CVAFS	EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAFS.

IONBALANCE-TB	Water	Ion Balance Calculation	APHA 1030 E - CALCULATION

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

MET-D-CCMS-TB	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

NH3-COL-TB	Water	Ammonia by Discrete Analyzer	APHA 4500-NH3 G. (modified)

Ammonia in aqueous matrices is analyzed using discrete analyzer with colourimetric detection.

NO2-IC-N-TB	Water	Nitrite in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-IC-N-TB	Water	Nitrate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-COL-TB	Water	Total Phosphorus by Discrete Analyzer	APHA 4500-P B, F, G (modified)

Phosphorus in aqueous matrices is analyzed using discrete Analyzer with colourimetric detection.

PH-TITR-TB	Water	pH	APHA 4500-H

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

SO4-IC-N-TB	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-TB	Water	Total Dissolved Solids	APHA 2540 C (modified)

Aqueous matrices are analyzed using gravimetry and evaporation

THM-SUM-PPB-CALC-WT	Water	Total Trihalomethanes (THMs)	CALCULATION

Total Trihalomethanes (THMs) represents the sum of bromodichloromethane, bromoform, chlorodibromomethane and chloroform. For the purpose of calculation, results less than the detection limit (DL) are treated as zero.

Reference Information

TKN-COL-TB	Water	Total Kjeldahl Nitrogen	APHA 4500-Norg (modified)

Total Kjeldahl Nitrogen in aqueous matrices is analyzed using a discrete analyzer with colourimetric detection.

VOC-ROU-HS-WT	Water	Volatile Organic Compounds	SW846 8260

Aqueous samples are analyzed by headspace-GC/MS.

XYLENES-SUM-CALC-WT	Water	Sum of Xylene Isomer Concentrations	CALCULATION

Total xylenes represents the sum of o-xylene and m&p-xylene.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
TB	ALS ENVIRONMENTAL - THUNDER BAY, ONTARIO, CANADA
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L1928102-COFC

COC Number: 14 -

Page 1 of 1

Report To		Report Format / Distribution		Turnaround Time (TAT) (Rush TAT is not available for all tests)
Company:	Municipality of Wawa	Select Report Format: ☐ PDF ☐ EXCEL ☐ EDD (DIGITAL)		R ☑ Regular (Standard TAT if received by 3 pm - business days)
Contact:	Mark McRae	Quality Control (QC) Report with Report ☐ Yes ☐ No		P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	40 Braodway Ave. PO Box 500 Wawa ON P0S 1K0	☐ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
		Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX		E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Phone: Fax:	807-856-4315 807-856-1745	Email 1 or Fax: As set up in account		Specify Date Required for E2,E or P:
		Email 2		

Invoice To		Invoice Distribution	
	Same as Report To ☐ Yes ☑ No	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
	Copy of Invoice with Report ☑ Yes ☐ No	Email 1 or Fax: acctspayable@wawa.cc	
Company:		Email 2	
Contact:			

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q61800	Approver ID:	Cost Center:
Job #:	Spring Landfill	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	

ALS Lab Work Order # (lab use only): L1928102 **ALS Contact:** Danielle Drawson **Sampler:** GARY MERCIER

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Dissolved Metals, Hardness	Dissolved Mercury	Speciated Alkalinity, Conductivity	Cl, NO2, NO3, SO4	TDS, pH, Ion Balance	BOD, DOC	COD, Total Phos, TKN, NH4	VOC	Number of Containers
	Well #1 - 5310295.53/665574.89	MAY/16/17	9:30	GW	x	x	x	x	x	x	x	x	
	Well #2 - 5310213.87/665662.28	"	8:50	GW	x	x	x	x	x	x	x	x	
	Well #3 - 5310376.44/665723.23	"	11:00	GW	x	x	x	x	x	x	x	x	
	Well #4 - 5310376.44/665733.23	"	8:00	GW	x	x	x	x	x	x	x	x	
	Well #5 - 5310416.16/665966.67	"	10:20	GW	x	x	x	x	x	x	x	x	
	Well #6 - 5310591/665911	"	11:20	GW	x	x	x	x	x	x	x	x	
	DUP	"		GW	x	x	x	x	x	x	x	x	
	Trip Blank LAND FILL SAMPLES	"		Water	x	x	x	x	x	x	x	x	
	Field Blank P.O# 275716	"		Water	x	x	x	x	x	x	x	x	
	VOC Spike	"		Water								x	

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☑ No	
Are samples for human drinking water use? ☐ Yes ☑ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice packs Yes ☑ No ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☑

INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C		
	8.2			

SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)	
Released by: GARY MERCIER	Date: MAY/16/17 Time: [illegible]	Received By: MM	Date: 18 May 17 Time: 9:46	Received by:	Date: Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

ALS-FM-0328e v20 Front/04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System please submit using an Authorized DW COC form

JRR

Wawa, Municipality Of
ATTN: MARK MCRAE
MUNCIPALITY OF WAWA
40 BROADWAY AVE, P.O. BOX 500
WAWA ON P0S 1K0

Date Received: 19-MAY-17
Report Date: 31-MAY-17 13:15 (MT)
Version: FINAL

Client Phone: 705-856-4315

Certificate of Analysis

Lab Work Order #: L1928714

Project P.O. #: 28376
Job Reference: SPRING LANDFILL
C of C Numbers:
Legal Site Desc:

Christina Shepherd
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1928714-1 Surface Water 17-MAY-17 08:15 MICHIPICOTEN RIVER UPSTREAM - 4 O'CLOCK ROCK	L1928714-2 Surface Water 17-MAY-17 08:30 BANK OF MICHIPICOTEN RIVER	L1928714-3 Surface Water 17-MAY-17 08:40 TROUT CREEK UPSTREAM	L1928714-4 Surface Water 17-MAY-17 08:50 MOUTH OF TROUT CREEK DOWNSTREAM	L1928714-5 Surface Water 17-MAY-17 09:05 DOWNSTREAM MICHIPICOTEN RIVER
WATER						
Physical Tests	Conductivity (EC) (uS/cm)	48.8 HTC	121 HTC	68.0 HTC	120 HTC	48.5 HTC
	Hardness (as CaCO3) (mg/L)	22.9	61.4	61.6	60.7	22.5
	pH (pH)	7.65	7.58	7.29	7.59	7.13
	Total Dissolved Solids (mg/L)	40	56	76	77	45
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	24.8	60.3	32.7	60.0	21.7
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Total (as CaCO3) (mg/L)	24.8	60.3	32.7	60.0	21.7
	Ammonia, Total (as N) (mg/L)	0.073	0.075	0.074	0.142	0.063
	Chloride (Cl) (mg/L)	0.85	0.59	0.75	0.51	0.77
	Nitrate (as N) (mg/L)	0.098	0.108	0.103	0.103	0.095
	Nitrite (as N) (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Total Kjeldahl Nitrogen (mg/L)	0.29	0.27	<0.25	<0.25	<0.25
	Phosphorus (P)-Total (mg/L)	0.0055	0.0093	0.0086	0.0088	0.0056
	Sulfate (SO4) (mg/L)	2.79	4.26	3.10	3.91	2.39
	Anion Sum (meq/L)	0.58	1.32	0.75	1.30	0.51
	Cation Sum (meq/L)	0.54	1.32	1.33	1.31	0.53
	Cation - Anion Balance (%)	-3.6	0.2	28.0 BL:INT	0.4	1.9
Organic / Inorganic Carbon	Dissolved Carbon Filtration Location	LAB	LAB	LAB	LAB	LAB
	Dissolved Organic Carbon (mg/L)	7.6	6.5	6.6	6.6	8.1
Total Metals	Aluminum (Al)-Total (mg/L)	0.0977	0.0943	0.0841	0.0936	0.105
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00033	0.00476	0.00482	0.00476	0.00036
	Barium (Ba)-Total (mg/L)	0.00690	0.0280	0.0286	0.0269	0.00709
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	0.0000057	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Total (mg/L)	6.85	17.9	17.9	17.8	6.72
	Cesium (Cs)-Total (mg/L)	0.000012	0.000017	0.000016	0.000018	0.000011
	Chromium (Cr)-Total (mg/L)	0.00036	0.00050	0.00048	0.00049	0.00036
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	0.00081	0.00132	0.00131	0.00127	0.00074
	Iron (Fe)-Total (mg/L)	0.117	0.199	0.190	0.194	0.117
	Lead (Pb)-Total (mg/L)	<0.000050	0.000073	0.000067	0.000065	0.000052
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1928714-6				
	Description	Surface Water				
	Sampled Date	17-MAY-17				
	Sampled Time	00:01				
	Client ID	DUP				
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (EC) (uS/cm)	48.3				
	Hardness (as CaCO3) (mg/L)	22.0 HTC				
	pH (pH)	7.36				
	Total Dissolved Solids (mg/L)	39				
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	23.5				
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0				
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0				
	Alkalinity, Total (as CaCO3) (mg/L)	23.5				
	Ammonia, Total (as N) (mg/L)	0.068				
	Chloride (Cl) (mg/L)	0.78				
	Nitrate (as N) (mg/L)	0.099				
	Nitrite (as N) (mg/L)	<0.010				
	Total Kjeldahl Nitrogen (mg/L)	0.26				
	Phosphorus (P)-Total (mg/L)	0.0058				
	Sulfate (SO4) (mg/L)	2.95				
	Anion Sum (meq/L)	0.56				
	Cation Sum (meq/L)	0.52				
	Cation - Anion Balance (%)	-3.4				
Organic / Inorganic Carbon	Dissolved Carbon Filtration Location	LAB				
	Dissolved Organic Carbon (mg/L)	7.7				
Total Metals	Aluminum (Al)-Total (mg/L)	0.103				
	Antimony (Sb)-Total (mg/L)	<0.00010				
	Arsenic (As)-Total (mg/L)	0.00033				
	Barium (Ba)-Total (mg/L)	0.00671				
	Beryllium (Be)-Total (mg/L)	<0.00010				
	Bismuth (Bi)-Total (mg/L)	<0.000050				
	Boron (B)-Total (mg/L)	<0.010				
	Cadmium (Cd)-Total (mg/L)	<0.0000050				
	Calcium (Ca)-Total (mg/L)	6.60				
	Cesium (Cs)-Total (mg/L)	0.000012				
	Chromium (Cr)-Total (mg/L)	0.00043				
	Cobalt (Co)-Total (mg/L)	<0.00010				
	Copper (Cu)-Total (mg/L)	0.00120				
	Iron (Fe)-Total (mg/L)	0.124				
	Lead (Pb)-Total (mg/L)	0.000121				
	Lithium (Li)-Total (mg/L)	<0.0010				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1928714-1 Surface Water 17-MAY-17 08:15 MICHIPICOTEN RIVER UPSTREAM - 4 O'CLOCK ROCK	L1928714-2 Surface Water 17-MAY-17 08:30 BANK OF MICHIPICOTEN RIVER	L1928714-3 Surface Water 17-MAY-17 08:40 TROUT CREEK UPSTREAM	L1928714-4 Surface Water 17-MAY-17 08:50 MOUTH OF TROUT CREEK DOWNSTREAM	L1928714-5 Surface Water 17-MAY-17 09:05 DOWNSTREAM MICHIPICOTEN RIVER
WATER						
Total Metals	Magnesium (Mg)-Total (mg/L)	1.42	4.05	4.11	3.97	1.39
	Manganese (Mn)-Total (mg/L)	0.00724	0.0195	0.0187	0.0188	0.00687
	Mercury (Hg)-Total (mg/L)	0.0000218	<0.0000050	0.0000435	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.000063	0.000263	0.000258	0.000251	0.000063
	Nickel (Ni)-Total (mg/L)	<0.00050	0.00079	0.00068	0.00069	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.438	0.966	0.969	0.949	0.391
	Rubidium (Rb)-Total (mg/L)	0.00115	0.00207	0.00204	0.00197	0.00108
	Selenium (Se)-Total (mg/L)	0.000075	0.000082	0.000083	0.000085	0.000071
	Silicon (Si)-Total (mg/L)	2.57	2.25	2.23	2.19	2.57
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	1.19	1.01	1.04	1.02	1.14
	Strontium (Sr)-Total (mg/L)	0.0171	0.0634	0.0652	0.0640	0.0169
	Sulfur (S)-Total (mg/L)	0.72	1.18	1.17	1.16	0.71
	Tellurium (Te)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Thorium (Th)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	0.00115	0.00296	0.00244	0.00283	0.00115
	Tungsten (W)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Uranium (U)-Total (mg/L)	0.000088	0.000155	0.000149	0.000148	0.000085
	Vanadium (V)-Total (mg/L)	0.00055	0.00098	0.00098	0.00097	0.00052
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	0.000064	0.000143	0.000137	0.000137	0.000062
Aggregate Organics	Biochemical Oxygen Demand (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Chemical Oxygen Demand (mg/L)	24	20	23	22	25
Volatile Organic Compounds	Acetone (ug/L)	<20	<20	<20	<20	<20
	Benzene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Bromodichloromethane (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Bromoform (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Bromomethane (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Carbon Disulfide (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Carbon tetrachloride (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Chlorobenzene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Dibromochloromethane (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Chloroethane (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1928714-6				
	Description	Surface Water				
	Sampled Date	17-MAY-17				
	Sampled Time	00:01				
	Client ID	DUP				
Grouping	**Analyte**					
WATER						
Total Metals	Magnesium (Mg)-Total (mg/L)	1.35				
	Manganese (Mn)-Total (mg/L)	0.00764				
	Mercury (Hg)-Total (mg/L)	<0.0000050				
	Molybdenum (Mo)-Total (mg/L)	0.000073				
	Nickel (Ni)-Total (mg/L)	0.00071				
	Phosphorus (P)-Total (mg/L)	<0.050				
	Potassium (K)-Total (mg/L)	0.378				
	Rubidium (Rb)-Total (mg/L)	0.00098				
	Selenium (Se)-Total (mg/L)	0.000055				
	Silicon (Si)-Total (mg/L)	2.53				
	Silver (Ag)-Total (mg/L)	<0.000010				
	Sodium (Na)-Total (mg/L)	1.15				
	Strontium (Sr)-Total (mg/L)	0.0166				
	Sulfur (S)-Total (mg/L)	0.75				
	Tellurium (Te)-Total (mg/L)	<0.00020				
	Thallium (Tl)-Total (mg/L)	<0.000010				
	Thorium (Th)-Total (mg/L)	<0.00010				
	Tin (Sn)-Total (mg/L)	<0.00010				
	Titanium (Ti)-Total (mg/L)	0.00136				
	Tungsten (W)-Total (mg/L)	<0.00010				
	Uranium (U)-Total (mg/L)	0.000087				
	Vanadium (V)-Total (mg/L)	0.00055				
	Zinc (Zn)-Total (mg/L)	<0.0030				
	Zirconium (Zr)-Total (mg/L)	<0.000060				
Aggregate Organics	Biochemical Oxygen Demand (mg/L)	<2.0				
	Chemical Oxygen Demand (mg/L)	24				
Volatile Organic Compounds	Acetone (ug/L)	<20				
	Benzene (ug/L)	<0.50				
	Bromodichloromethane (ug/L)	<1.0				
	Bromoform (ug/L)	<1.0				
	Bromomethane (ug/L)	<0.50				
	Carbon Disulfide (ug/L)	<1.0				
	Carbon tetrachloride (ug/L)	<0.50				
	Chlorobenzene (ug/L)	<0.50				
	Dibromochloromethane (ug/L)	<1.0				
	Chloroethane (ug/L)	<1.0				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1928714-1 Surface Water 17-MAY-17 08:15 MICHIPICOTEN RIVER UPSTREAM - 4 O'CLOCK ROCK	L1928714-2 Surface Water 17-MAY-17 08:30 BANK OF MICHIPICOTEN RIVER	L1928714-3 Surface Water 17-MAY-17 08:40 TROUT CREEK UPSTREAM	L1928714-4 Surface Water 17-MAY-17 08:50 MOUTH OF TROUT CREEK DOWNSTREAM	L1928714-5 Surface Water 17-MAY-17 09:05 DOWNSTREAM MICHIPICOTEN RIVER
WATER						
Volatile Organic Compounds	Chloroform (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Chloromethane (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	1,2-Dibromoethane (ug/L)	<0.20	<0.20	<0.20	<0.20	<0.20
	1,2-Dichlorobenzene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	1,3-Dichlorobenzene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	1,4-Dichlorobenzene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Dichlorodifluoromethane (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	1,1-Dichloroethane (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	1,2-Dichloroethane (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	1,1-Dichloroethylene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	cis-1,2-Dichloroethylene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	trans-1,2-Dichloroethylene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Dichloromethane (ug/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	1,2-Dichloropropane (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	cis-1,3-Dichloropropene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	trans-1,3-Dichloropropene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Ethylbenzene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	n-Hexane (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	2-Hexanone (ug/L)	<20	<20	<20	<20	<20
	Methyl Ethyl Ketone (ug/L)	<20	<20	<20	<20	<20
	Methyl Isobutyl Ketone (ug/L)	<20	<20	<20	<20	<20
	MTBE (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Styrene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	1,1,1,2-Tetrachloroethane (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	1,1,2,2-Tetrachloroethane (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Tetrachloroethylene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Toluene (ug/L)	<0.50	<0.50	<0.50	<0.50	0.54
	1,1,1-Trichloroethane (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	1,1,2-Trichloroethane (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Trichloroethylene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Trichlorofluoromethane (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Vinyl chloride (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	o-Xylene (ug/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	m+p-Xylenes (ug/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Xylenes (Total) (ug/L)	<1.1	<1.1	<1.1	<1.1	<1.1
	Surrogate: 4-Bromofluorobenzene (%)	95.8	91.9	94.1	94.9	92.3
	Surrogate: 1,4-Difluorobenzene (%)	102.7	100.8	99.8	101.0	99.8

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1928714-6				
	Description	Surface Water				
	Sampled Date	17-MAY-17				
	Sampled Time	00:01				
	Client ID	DUP				
Grouping	**Analyte**					
WATER						
Volatile Organic Compounds	Chloroform (ug/L)	<1.0				
	Chloromethane (ug/L)	<1.0				
	1,2-Dibromoethane (ug/L)	<0.20				
	1,2-Dichlorobenzene (ug/L)	<0.50				
	1,3-Dichlorobenzene (ug/L)	<0.50				
	1,4-Dichlorobenzene (ug/L)	<0.50				
	Dichlorodifluoromethane (ug/L)	<1.0				
	1,1-Dichloroethane (ug/L)	<0.50				
	1,2-Dichloroethane (ug/L)	<0.50				
	1,1-Dichloroethylene (ug/L)	<0.50				
	cis-1,2-Dichloroethylene (ug/L)	<0.50				
	trans-1,2-Dichloroethylene (ug/L)	<0.50				
	Dichloromethane (ug/L)	<2.0				
	1,2-Dichloropropane (ug/L)	<0.50				
	cis-1,3-Dichloropropene (ug/L)	<0.50				
	trans-1,3-Dichloropropene (ug/L)	<0.50				
	Ethylbenzene (ug/L)	<0.50				
	n-Hexane (ug/L)	<0.50				
	2-Hexanone (ug/L)	<20				
	Methyl Ethyl Ketone (ug/L)	<20				
	Methyl Isobutyl Ketone (ug/L)	<20				
	MTBE (ug/L)	<0.50				
	Styrene (ug/L)	<0.50				
	1,1,1,2-Tetrachloroethane (ug/L)	<0.50				
	1,1,2,2-Tetrachloroethane (ug/L)	<0.50				
	Tetrachloroethylene (ug/L)	<0.50				
	Toluene (ug/L)	<0.50				
	1,1,1-Trichloroethane (ug/L)	<0.50				
	1,1,2-Trichloroethane (ug/L)	<0.50				
	Trichloroethylene (ug/L)	<0.50				
	Trichlorofluoromethane (ug/L)	<1.0				
	Vinyl chloride (ug/L)	<0.50				
	o-Xylene (ug/L)	<0.50				
	m+p-Xylenes (ug/L)	<1.0				
	Xylenes (Total) (ug/L)	<1.1				
	Surrogate: 4-Bromofluorobenzene (%)	93.2				
	Surrogate: 1,4-Difluorobenzene (%)	100.7				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1928714-1 Surface Water 17-MAY-17 08:15 MICHIPICOTEN RIVER UPSTREAM - 4 O'CLOCK ROCK	L1928714-2 Surface Water 17-MAY-17 08:30 BANK OF MICHIPICOTEN RIVER	L1928714-3 Surface Water 17-MAY-17 08:40 TROUT CREEK UPSTREAM	L1928714-4 Surface Water 17-MAY-17 08:50 MOUTH OF TROUT CREEK DOWNSTREAM	L1928714-5 Surface Water 17-MAY-17 09:05 DOWNSTREAM MICHIPICOTEN RIVER
Sample ID						
Description						
Sampled Date						
Sampled Time						
Client ID						
WATER						
Trihalomethanes	Total THMs (ug/L)	<2.0	<2.0	<2.0	<2.0	<2.0

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1928714-6				
Description	Surface Water				
Sampled Date	17-MAY-17				
Sampled Time	00:01				
Client ID	DUP				
Grouping **Analyte**					
WATER					
Trihalomethanes Total THMs (ug/L)	<2.0				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Chloride (Cl)	MS-B	L1928714-1, -2, -3, -4, -5, -6
Matrix Spike	Dissolved Organic Carbon	MS-B	L1928714-1, -2, -3, -4, -5, -6
Matrix Spike	Calcium (Ca)-Total	MS-B	L1928714-1, -2, -3, -4, -5, -6
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1928714-1, -2, -3, -4, -5, -6
Matrix Spike	Strontium (Sr)-Total	MS-B	L1928714-1, -2, -3, -4, -5, -6
Matrix Spike	Phosphorus (P)-Total	MS-B	L1928714-1, -2, -3, -4, -5, -6
Matrix Spike	Total Kjeldahl Nitrogen	MS-B	L1928714-1, -2, -3, -4, -5, -6

Qualifiers for Individual Parameters Listed:

Qualifier	Description
BL:INT	Balance Reviewed: Interference Or Non-Measured Component
HTC	Hardness was calculated from Total Ca and/or Mg concentrations and may be biased high (dissolved Ca/Mg results unavailable).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-CO3-TITR-CALC-TB	Water	Alkalinity, Carbonate (as CaCO3)	CALCULATION
ALK-HCO3TITR-CALC-TB	Water	Alkalinity, Bicarbonate (as CaCO3)	CALCULATION
ALK-OH-TITR-CALC-TB	Water	Alkalinity, Hydroxide (as CaCO3)	CALCULATION
ALK-TITR-TB	Water	Alkalinity	APHA 2320B modified

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

BOD-TB Water Biochemical Oxygen Demand (BOD) APHA 5210 B- BIOCHEMICAL OXYGEN DEMAND

All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.

CL-L-IC-N-TB Water Chloride in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

COD-TB Water Chemical Oxygen Demand APHA 5220D

This analysis is carried out using procedures adapted from APHA Method 5220 "Chemical Oxygen Demand (COD)". Chemical oxygen demand is determined using the closed reflux colourimetric method.

DOC-TB Water Dissolved Organic Carbon APHA 5310 B modified

Water samples are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis. Analyzed by converting all carbonaceous material to carbon dioxide (CO2) by catalytic combustion at 850?C. The CO2 generated is measured by an infrared detector and is directly proportional to concentration of carbonaceous material in the sample

EC-TITR-TB Water Conductivity APHA 2510 B

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

HARDNESS-CALC-TB Water Hardness (as CaCO3) CALCULATION

HG-T-CVAF-TB Water Total Mercury in Water by CVAFS EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAFS.

IONBALANCE-TB Water Ion Balance Calculation APHA 1030 E - CALCULATION

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Reference Information

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

MET-T-CCMS-TB	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

NH3-COL-TB	Water	Ammonia by Discrete Analyzer	APHA 4500-NH3 G. (modified)

Ammonia in aqueous matrices is analyzed using discrete analyzer with colourimetric detection.

NO2-IC-N-TB	Water	Nitrite in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-IC-N-TB	Water	Nitrate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-COL-TB	Water	Total Phosphorus by Discrete Analyzer	APHA 4500-P B, F, G (modified)

Phosphorus in aqueous matrices is analyzed using discrete Analyzer with colourimetric detection.

PH-TITR-TB	Water	pH	APHA 4500-H

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

SO4-IC-N-TB	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-TB	Water	Total Dissolved Solids	APHA 2540 C (modified)

Aqueous matrices are analyzed using gravimetry and evaporation

THM-SUM-PPB-CALC-WT	Water	Total Trihalomethanes (THMs)	CALCULATION

Total Trihalomethanes (THMs) represents the sum of bromodichloromethane, bromoform, chlorodibromomethane and chloroform. For the purpose of calculation, results less than the detection limit (DL) are treated as zero.

TKN-COL-TB	Water	Total Kjeldahl Nitrogen	APHA 4500-Norg (modified)

Total Kjeldahl Nitrogen in aqueous matrices is analyzed using a discrete analyzer with colourimetric detection.

VOC-ROU-HS-WT	Water	Volatile Organic Compounds	SW846 8260

Aqueous samples are analyzed by headspace-GC/MS.

XYLENES-SUM-CALC-WT	Water	Sum of Xylene Isomer Concentrations	CALCULATION

Total xylenes represents the sum of o-xylene and m&p-xylene.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
TB	ALS ENVIRONMENTAL - THUNDER BAY, ONTARIO, CANADA
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1928714-COFC

COC Number: 14 -

Page ___ of ___

Report To		Report Format / Distribution	
Company:	Municipality of Wawa	Select Report Format:	☐ PDF ☐ EXCEL ☐ EDD (DIGITAL)
Contact:	Mark McRae	Quality Control (QC) Report with Report	☐ Yes ☐ No
Address:	40 Braodway Ave. PO Box 500 Wawa ON P0S 1K0	☐ Criteria on Report - provide details below if box checked	
		Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Phone: Fax:	807-856-4315 807-856-1745	Email 1 or Fax	As set up in account
		Email 2	

Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)

- R ☑ Regular (Standard TAT if received by 3 pm - business days)
- P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
- E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
- E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge

Specify Date Required for E2,E or P:

Invoice To		Invoice Distribution	
Same as Report To	☐ Yes ☑ No	Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Copy of Invoice with Report	☑ Yes ☐ No	Email 1 or Fax	acctspayable@wawa.cc
Company:		Email 2	
Contact:			

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q61800	Approver ID:	Cost Center:
Job #:	Spring Landfill	GL Account:	Routing Code:
PO / AFE:	28376	Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	L1928714	ALS Contact: Danielle Drawson	Sampler: Mike LHARD

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metals, Hardness	Total Mercury	Speciated Alkalinity, Conductivity	Cl, NO2, NO3, SO4	TDS, pH, Ion Balance	BOD, DOC	COD, Total Phos, TKN, NH4	VOC	Number of Containers
	Michipicoten River Upsteam - 4 o'clock Rock	17/05/17	08:15	SW	x	x	x	x	x	x	x	x	
	Bank of Michipicoten River	17/05/17	08:30	SW	x	x	x	x	x	x	x	x	
	Trout Creek Upstream	17/05/17	08:40	SW	x	x	x	x	x	x	x	x	
	Mouth of Trout Creek Downstream	17/05/17	08:50	SW	x	x	x	x	x	x	x	x	
	Downstream Michipicoten River	17/05/17	09:05	SW	x	x	x	x	x	x	x	x	
	DUP	17/05/17		SW	x	x	x	x	x	x	x	x	

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ Yes ☑ No

Are samples for human drinking water use? ☐ Yes ☑ No

Special Instructions / Specify Criteria to add on report (client Use)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☑ No ☐

Ice packs Yes ☑ No ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☑

INITIAL COOLER TEMPERATURES °C: 7.5

FINAL COOLER TEMPERATURES °C:

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: [signature]	Date:	Time:	Received By: S.D.	Date: May 19/17	Time: 8:50	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0326a v09 Front/04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Wawa, Municipality Of
ATTN: MARC LAIRD
MUNCIPALITY OF WAWA
40 BROADWAY AVE, P.O. BOX 500
WAWA ON P0S 1K0

Date Received: 03-NOV-17
Report Date: 14-NOV-17 13:01 (MT)
Version: FINAL

Client Phone: 705-856-4315

Certificate of Analysis

Lab Work Order #: L2017818

Project P.O. #: 28376
Job Reference: FALL LANDFILL
C of C Numbers:
Legal Site Desc:

Christina Shepherd
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L2017818-1 GW 01-NOV-17 08:50 WELL #1 - 5310295.53/6655 74.89	L2017818-2 GW 01-NOV-17 08:30 WELL #2 - 5310213.87/6656 62.28	L2017818-3 GW 01-NOV-17 12:50 WELL #3 - 5310376.44/6657 23.23	L2017818-4 GW 01-NOV-17 10:00 WELL #4 - 5310376.44/6657 33.23	L2017818-5 GW 01-NOV-17 09:40 WELL #5 - 5310416.16/6653 66.67
WATER						
Physical Tests	Conductivity (EC) (uS/cm)	870	338	107	275	253
	Hardness (as CaCO3) (mg/L)	429	161	50.5	134	126
	pH (pH)	7.15	7.48	7.20	7.86	7.55
	Total Dissolved Solids (mg/L)	530	159	77	205	137
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	465	191	52.3	146	130
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Total (as CaCO3) (mg/L)	465	191	52.3	146	130
	Ammonia, Total (as N) (mg/L)	0.650	<0.020	<0.020	0.051	<0.020
	Chloride (Cl) (mg/L)	7.83	0.81	0.24	1.03	0.59
	Nitrate (as N) (mg/L)	<0.020	0.029	0.083	0.115	0.688
	Nitrite (as N) (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Total Kjeldahl Nitrogen (mg/L)	1.15	0.18	0.27	0.85	0.15
	Phosphorus (P)-Total (mg/L)	<0.0030	0.0104	0.038	0.55	0.0091
	Sulfate (SO4) (mg/L)	24.8	4.07	2.86	12.2	3.21
	Anion Sum (meq/L)	10.0	3.92	1.12	3.20	2.72
	Cation Sum (meq/L)	9.54	3.40	1.08	2.82	2.61
	Cation - Anion Balance (%)	-2.5	-7.1	-1.9	-6.4	-2.1
Organic / Inorganic Carbon	Dissolved Carbon Filtration Location	LAB	LAB	LAB	LAB	LAB
	Dissolved Organic Carbon (mg/L)	6.4	1.3	7.0	3.5	3.4
Dissolved Metals	Dissolved Mercury Filtration Location	LAB	LAB	LAB	LAB	LAB
	Dissolved Metals Filtration Location	LAB	LAB	LAB	LAB	LAB
	Aluminum (Al)-Dissolved (mg/L)	<0.0020	<0.0020	0.0474	0.0093	0.0121
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	0.00019	0.00012	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00038	0.00014	0.00066	0.00058	0.00031
	Barium (Ba)-Dissolved (mg/L)	0.0580	0.0245	0.0145	0.0421	0.0294
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	0.206	0.028	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	0.0000063	<0.0000050	0.0000195	0.0000570	<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	135	48.4	15.5	39.9	41.5
	Cesium (Cs)-Dissolved (mg/L)	0.000178	<0.000010	<0.000010	0.000015	<0.000010
	Chromium (Cr)-Dissolved (mg/L)	0.00018	<0.00010	0.00050	0.00022	0.00027
	Cobalt (Co)-Dissolved (mg/L)	0.00494	<0.00010	<0.00010	0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00039	0.00025	0.00811	0.00650	0.00246
	Iron (Fe)-Dissolved (mg/L)	0.035	0.013	0.025	<0.010	<0.010

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2017818-6	L2017818-7	L2017818-8		
	Description	GW	GW	GW		
	Sampled Date	01-NOV-17	01-NOV-17	01-NOV-17		
	Sampled Time	13:30	11:00	00:01		
	Client ID	WELL #6 - 5310591/665911	WELL #7 - MW6-17 A212965	GW DUPLICATE		
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (EC) (uS/cm)	275	277	270		
	Hardness (as CaCO3) (mg/L)	131	181	132		
	pH (pH)	7.95	7.91	7.91		
	Total Dissolved Solids (mg/L)	170	179	160		
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	146	159	143		
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0		
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0		
	Alkalinity, Total (as CaCO3) (mg/L)	146	159	143		
	Ammonia, Total (as N) (mg/L)	<0.020	0.393	<0.020		
	Chloride (Cl) (mg/L)	0.32	0.33	0.34		
	Nitrate (as N) (mg/L)	0.034	0.057	0.035		
	Nitrite (as N) (mg/L)	<0.010	<0.010	<0.010		
	Total Kjeldahl Nitrogen (mg/L)	<0.15	1.16	<0.15		
	Phosphorus (P)-Total (mg/L)	0.28	2.93	0.0842		
	Sulfate (SO4) (mg/L)	11.9	13.4	11.9		
	Anion Sum (meq/L)	3.18	3.47	3.12		
	Cation Sum (meq/L)	2.75	4.66	2.78		
	Cation - Anion Balance (%)	-7.2	14.7	-5.8		
Organic / Inorganic Carbon	Dissolved Carbon Filtration Location	LAB	LAB	LAB		
	Dissolved Organic Carbon (mg/L)	<1.0	<1.0	<1.0		
Dissolved Metals	Dissolved Mercury Filtration Location	LAB	LAB	LAB		
	Dissolved Metals Filtration Location	LAB	LAB	LAB		
	Aluminum (Al)-Dissolved (mg/L)	0.0028	<0.0020	0.0028		
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Arsenic (As)-Dissolved (mg/L)	0.00092	0.00115	0.00095		
	Barium (Ba)-Dissolved (mg/L)	0.0155	0.0897	0.0152		
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		
	Boron (B)-Dissolved (mg/L)	<0.010	0.076	<0.010		
	Cadmium (Cd)-Dissolved (mg/L)	0.0000100	0.0000312	0.0000168		
	Calcium (Ca)-Dissolved (mg/L)	37.4	54.8	37.8		
	Cesium (Cs)-Dissolved (mg/L)	<0.000010	0.000020	<0.000010		
	Chromium (Cr)-Dissolved (mg/L)	0.00036	<0.00010	0.00034		
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	0.00137	<0.00010		
	Copper (Cu)-Dissolved (mg/L)	0.00049	0.00175	0.00043		
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010		

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2017818-1	L2017818-2	L2017818-3	L2017818-4	L2017818-5
	Description	GW	GW	GW	GW	GW
	Sampled Date	01-NOV-17	01-NOV-17	01-NOV-17	01-NOV-17	01-NOV-17
	Sampled Time	08:50	08:30	12:50	10:00	09:40
	Client ID	WELL #1 - 5310295.53/6655 74.89	WELL #2 - 5310213.87/6656 62.28	WELL #3 - 5310376.44/6657 23.23	WELL #4 - 5310376.44/6657 33.23	WELL #5 - 5310416.16/6653 66.67
Grouping	**Analyte**					
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	0.000132	0.000059	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0038	0.0036	<0.0010	0.0031	<0.0010
	Magnesium (Mg)-Dissolved (mg/L)	22.3	9.82	2.90	8.36	5.54
	Manganese (Mn)-Dissolved (mg/L)	2.16	0.104	0.00121	0.0359	0.00037
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	0.0000051	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.000439	0.000217	0.000198	0.00108	0.000177
	Nickel (Ni)-Dissolved (mg/L)	0.00549	<0.00050	0.00083	0.00074	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	5.92	2.23	0.472	2.20	1.03
	Rubidium (Rb)-Dissolved (mg/L)	0.0257	0.00659	0.00061	0.0104	0.00155
	Selenium (Se)-Dissolved (mg/L)	0.000094	<0.000050	0.000129	0.000192	0.000139
	Silicon (Si)-Dissolved (mg/L)	8.21	3.97	4.37	3.14	3.78
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	15.8	2.65	1.08	1.69	1.30
	Strontium (Sr)-Dissolved (mg/L)	0.342	0.0951	0.0367	0.101	0.0769
	Sulfur (S)-Dissolved (mg/L)	9.23	1.62	0.84	5.24	1.17
	Tellurium (Te)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Thallium (Tl)-Dissolved (mg/L)	0.000070	<0.000010	<0.000010	0.000016	<0.000010
	Thorium (Th)-Dissolved (mg/L)	<0.00010	<0.00010	0.00011	<0.00010	<0.00010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	0.00036	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	0.00031	<0.00030	<0.00030
	Tungsten (W)-Dissolved (mg/L)	<0.00010	<0.00010	0.00110	<0.00010	0.00011
	Uranium (U)-Dissolved (mg/L)	0.00277	0.000222	0.000086	0.00115	0.000147
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	0.00051	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	0.0028	0.146	0.0112	0.0258	0.0026
	Zirconium (Zr)-Dissolved (mg/L)	0.000537	<0.000060	0.000531	<0.000060	0.000153
Aggregate Organics	Biochemical Oxygen Demand (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Chemical Oxygen Demand (mg/L)	27	<20	30	<20	<20

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2017818-6	L2017818-7	L2017818-8		
	Description	GW	GW	GW		
	Sampled Date	01-NOV-17	01-NOV-17	01-NOV-17		
	Sampled Time	13:30	11:00	00:01		
	Client ID	WELL #6 - 5310591/665911	WELL #7 - MW6-17 A212965	GW DUPLICATE		
Grouping	**Analyte**					
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		
	Lithium (Li)-Dissolved (mg/L)	0.0037	0.0050	0.0041		
	Magnesium (Mg)-Dissolved (mg/L)	9.19	10.6	9.22		
	Manganese (Mn)-Dissolved (mg/L)	0.00014	0.672	<0.00010		
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050		
	Molybdenum (Mo)-Dissolved (mg/L)	0.00122	0.00221	0.00121		
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	0.00231	<0.00050		
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050		
	Potassium (K)-Dissolved (mg/L)	2.12	5.01	2.12		
	Rubidium (Rb)-Dissolved (mg/L)	0.00185	0.00825	0.00190		
	Selenium (Se)-Dissolved (mg/L)	0.000312	0.000205	0.000281		
	Silicon (Si)-Dissolved (mg/L)	3.39	4.67	3.38		
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		
	Sodium (Na)-Dissolved (mg/L)	1.77	20.1	1.80		
	Strontium (Sr)-Dissolved (mg/L)	0.0782	0.244	0.0786		
	Sulfur (S)-Dissolved (mg/L)	4.44	7.41	4.20		
	Tellurium (Te)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020		
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	0.000044	0.000011		
	Thorium (Th)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030		
	Tungsten (W)-Dissolved (mg/L)	<0.00010	0.00207	<0.00010		
	Uranium (U)-Dissolved (mg/L)	0.00148	0.00189	0.00138		
	Vanadium (V)-Dissolved (mg/L)	0.00223	<0.00050	0.00227		
	Zinc (Zn)-Dissolved (mg/L)	0.0031	0.0019	0.0025		
	Zirconium (Zr)-Dissolved (mg/L)	<0.000060	0.000151	<0.000060		
Aggregate Organics	Biochemical Oxygen Demand (mg/L)	<2.0	<2.0	<2.0		
	Chemical Oxygen Demand (mg/L)	<20	25	<20		

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-CO3-TITR-CALC-TB	Water	Alkalinity, Carbonate (as CaCO3)	CALCULATION
ALK-HCO3TITR-CALC-TB	Water	Alkalinity, Bicarbonate (as CaCO3)	CALCULATION
ALK-OH-TITR-CALC-TB	Water	Alkalinity, Hydroxide (as CaCO3)	CALCULATION
ALK-TITR-TB	Water	Alkalinity	APHA 2320B modified

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

BOD-TB	Water	Biochemical Oxygen Demand (BOD)	APHA 5210 B- BIOCHEMICAL OXYGEN DEMAND

All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.

CL-L-IC-N-TB	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

COD-TB	Water	Chemical Oxygen Demand	APHA 5220D

This analysis is carried out using procedures adapted from APHA Method 5220 "Chemical Oxygen Demand (COD)". Chemical oxygen demand is determined using the closed reflux colourimetric method.

DOC-TB	Water	Dissolved Organic Carbon	APHA 5310 B modified

Water samples are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis. Analyzed by converting all carbonaceous material to carbon dioxide (CO2) by catalytic combustion at 850?C. The CO2 generated is measured by an infrared detector and is directly proportional to concentration of carbonaceous material in the sample

EC-TITR-TB	Water	Conductivity	APHA 2510 B

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

HARDNESS-CALC-TB	Water	Hardness (as CaCO3)	CALCULATION
HG-D-CVAF-TB	Water	Dissolved Mercury in Water by CVAFS	EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAFS.

IONBALANCE-TB	Water	Ion Balance Calculation	APHA 1030 E - CALCULATION

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

MET-D-CCMS-TB	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

NH3-COL-TB	Water	Ammonia by Discrete Analyzer	APHA 4500-NH3 G. (modified)

Ammonia in aqueous matrices is analyzed using discrete analyzer with colourimetric detection.

NO2-IC-N-TB	Water	Nitrite in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-IC-N-TB	Water	Nitrate in Water by IC	EPA 300.1 (mod)

Reference Information

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-COL-TB	Water	Total Phosphorus by Discrete Analyzer	APHA 4500-P B, F, G (modified)

Phosphorus in aqueous matrices is analyzed using discrete Analyzer with colourimetric detection.

PH-TITR-TB	Water	pH	APHA 4500-H

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

SO4-IC-N-TB	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-TB	Water	Total Dissolved Solids	APHA 2540 C (modified)

Aqueous matrices are analyzed using gravimetry and evaporation

TKN-COL-TB	Water	Total Kjeldahl Nitrogen	APHA 4500-Norg (modified)

Total Kjeldahl Nitrogen in aqueous matrices is analyzed using a discrete analyzer with colourimetric detection.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
TB	ALS ENVIRONMENTAL - THUNDER BAY, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L2017818-COFC

COC Number: 14 - Page 1 of 1

Report To		Report Format / Distribution	Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	Municipality of Wawa	Select Report Format: ☐PDF ☐EXCEL ☐EDD (DIGITAL)	R ☑Regular (Standard TAT if received by 3 pm - business days)
Contact:	Marc Laird	Quality Control (QC) Report with Report ☐ Yes ☐ No	P ☐Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	40 Broadway Ave. PO Box 500 Wawa ON P0S 1K0	☐Criteria on Report - provide details below if box checked	E ☐Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
		Select Distribution: ☑EMAIL ☐MAIL ☐FAX	E2 ☐Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Phone: Fax:	807-856-4315 807-856-1745	Email 1 or Fax: As set up in account	Specify Date Required for E2,E or P:
		Email 2	

Invoice To		Invoice Distribution	
	Same as Report To ☐ Yes ☑ No	Select Invoice Distribution: ☑EMAIL ☐MAIL ☐FAX	
	Copy of Invoice with Report ☑ Yes ☐ No	Email 1 or Fax: acctspayable@wawa.cc	
Company:		Email 2	
Contact:			

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q61800	Approver ID:	Cost Center:
Job #:	Fall Landfill	GL Account:	Routing Code:
PO / AFE:	28376	Activity Code:	
LSD:		Location:	

ALS Lab Work Order # (lab use only): L2017819

ALS Contact: Danielle Drawson

Sampler: Dave Lowe

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Dissolved Metals, Hardness	Dissolved Mercury	Specialed Alkalinity, Conductivity	Cl, NO2, NO3, SO4	TDS, pH, Ion Balance	BOD, DOC	COD, Total Phos, TKN, NH4							Number of Containers
	Well #1 - 5310295.53/665574.89	01-11-17	0850	GW	x	x	x	x	x	x	x							
	Well #2 - 5310213.87/665662.28	01-11-17	0830	GW	x	x	x	x	x	x	x							
	Well #3 - 5310376.44/665723.23	01-11-12	1250	GW	x	x	x	x	x	x	x							
	Well #4 - 5310376.44/665733.23	01-11-17	1000	GW	x	x	x	x	x	x	x							
	Well #5 - 5310416.16/665966.67	01-11-17	0940	GW	x	x	x	x	x	x	x							
	Well #6 - 5310591/665911	01-11-17	1330	GW	x	x	x	x	x	x	x							
	Well #7 - MW6-17 A212965	01-11-17	1100	GW	x	x	x	x	x	x	x							
				GW	x	x	x	x	x	x	x							

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☑ No	
Are samples for human drinking water use? ☐ Yes ☑ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐
Ice packs	Yes ☑	No ☐	Custody seal intact	Yes ☐	No ☐
Cooling Initiated	☑			

INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C		
5.4				

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received By: BP	Date: Nov 3	Time: 12:33	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JRae

Wawa, Municipality Of
ATTN: Marc Liard
Municipality of Wawa
40 Broadway Ave, P.O. Box 500
Wawa ON P0S 1K0

Date Received: 09-NOV-17
Report Date: 15-NOV-17 13:57 (MT)
Version: FINAL

Client Phone: 705-856-4315

Certificate of Analysis

Lab Work Order #: L2020194

Project P.O. #: 28376
Job Reference: FALL LANDFILL
C of C Numbers:
Legal Site Desc:

Christina Shepherd
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2020194-1	L2020194-2	L2020194-3	L2020194-4	
	Description	SW	SW	SW	SW	
	Sampled Date	07-NOV-17	07-NOV-17	07-NOV-17	07-NOV-17	
	Sampled Time	11:30	11:45	11:55	12:05	
	Client ID	MICHIPICOTEN RIVER UPSTEAM - 4 OCLOCK ROCK	BANK OF MICHIPICOTEN RIVER	TROUT CREEK UPSTREAM	MOUTH OF TROUT CREEK DOWNSTREAM	
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (EC) (uS/cm)	56.6	57.1	87.3	88.1	
	Hardness (as CaCO3) (mg/L)	27.8 HTC	27.5 HTC	47.8 HTC	47.0 HTC	
	pH (pH)	7.36	7.37	7.52	7.50	
	Total Dissolved Solids (mg/L)	40	49	59	67	
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	26.8	26.9	43.7	45.0	
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Total (as CaCO3) (mg/L)	26.8	26.9	43.7	45.0	
	Ammonia, Total (as N) (mg/L)	0.085	0.093	0.130	0.273	
	Chloride (Cl) (mg/L)	0.77	0.79	0.30	0.31	
	Nitrate (as N) (mg/L)	0.070	0.067	0.107	0.118	
	Nitrite (as N) (mg/L)	<0.010	<0.010	<0.010	<0.010	
	Total Kjeldahl Nitrogen (mg/L)	0.26	0.16	0.38	0.42	
	Phosphorus (P)-Total (mg/L)	0.0048	<0.0030	0.0050	0.0059	
	Sulfate (SO4) (mg/L)	3.32	3.18	3.62	3.07	
	Anion Sum (meq/L)	0.63	0.63	0.96	0.98	
	Cation Sum (meq/L)	0.64	0.62	1.04	1.04	
	Cation - Anion Balance (%)	0.4	-0.8	3.9	2.8	
Organic / Inorganic Carbon	Dissolved Carbon Filtration Location	LAB	LAB	LAB	LAB	
	Dissolved Organic Carbon (mg/L)	8.9	8.5	12.9	13.1	
Total Metals	Aluminum (Al)-Total (mg/L)	0.0530	0.0535	0.0964	0.0978	
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Arsenic (As)-Total (mg/L)	0.00035	0.00036	0.00545	0.00535	
	Barium (Ba)-Total (mg/L)	0.00715	0.00732	0.0206	0.0202	
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	
	Cadmium (Cd)-Total (mg/L)	<0.0000050	0.0000053	0.0000051	0.0000055	
	Calcium (Ca)-Total (mg/L)	8.48	8.30	13.8	13.5	
	Cesium (Cs)-Total (mg/L)	0.000013	0.000012	0.000011	0.000011	
	Chromium (Cr)-Total (mg/L)	0.00036	0.00031	0.00059	0.00047	
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Copper (Cu)-Total (mg/L)	0.00073	0.00067	0.00122	0.00126	
	Iron (Fe)-Total (mg/L)	0.101	0.103	0.291	0.295	
	Lead (Pb)-Total (mg/L)	0.000055	<0.000050	0.000086	0.000098	
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2020194-1	L2020194-2	L2020194-3	L2020194-4	
	Description	SW	SW	SW	SW	
	Sampled Date	07-NOV-17	07-NOV-17	07-NOV-17	07-NOV-17	
	Sampled Time	11:30	11:45	11:55	12:05	
	Client ID	MICHIPICOTEN RIVER UPSTEAM - 4 OCLOCK ROCK	BANK OF MICHIPICOTEN RIVER	TROUT CREEK UPSTREAM	MOUTH OF TROUT CREEK DOWNSTREAM	
Grouping	**Analyte**					
WATER						
Total Metals	Magnesium (Mg)-Total (mg/L)	1.62	1.64	3.23	3.23	
	Manganese (Mn)-Total (mg/L)	0.00841	0.00829	0.0140	0.0136	
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	
	Molybdenum (Mo)-Total (mg/L)	0.000103	0.000075	0.000173	0.000155	
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	0.00100	0.00097	
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	
	Potassium (K)-Total (mg/L)	0.390	0.387	0.687	0.667	
	Rubidium (Rb)-Total (mg/L)	0.00105	0.00109	0.00164	0.00160	
	Selenium (Se)-Total (mg/L)	0.000061	<0.000050	0.000107	0.000091	
	Silicon (Si)-Total (mg/L)	2.28	2.34	2.81	2.83	
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Sodium (Na)-Total (mg/L)	1.20	1.15	0.797	0.784	
	Strontium (Sr)-Total (mg/L)	0.0205	0.0201	0.0535	0.0522	
	Sulfur (S)-Total (mg/L)	1.06	0.76	0.89	0.77	
	Tellurium (Te)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Thorium (Th)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Titanium (Ti)-Total (mg/L)	<0.00090 DLM	<0.0016 DLM	0.00225	<0.0029 DLM	
	Tungsten (W)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Uranium (U)-Total (mg/L)	0.000082	0.000084	0.000084	0.000085	
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	0.00053	0.00052	
	Zinc (Zn)-Total (mg/L)	0.0032	<0.0030	<0.0030	<0.0030	
	Zirconium (Zr)-Total (mg/L)	0.000063	0.000065	0.000184	0.000185	
Aggregate Organics	Biochemical Oxygen Demand (mg/L)	<2.0	<2.0	<2.0	<2.0	
	Chemical Oxygen Demand (mg/L)	21	22	34	32	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Silver (Ag)-Total	B	L2020194-1, -2, -3, -4
Matrix Spike	Dissolved Organic Carbon	MS-B	L2020194-1, -2, -3, -4
Matrix Spike	Calcium (Ca)-Total	MS-B	L2020194-1, -2, -3, -4
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2020194-1, -2, -3, -4
Matrix Spike	Sodium (Na)-Total	MS-B	L2020194-1, -2, -3, -4
Matrix Spike	Strontium (Sr)-Total	MS-B	L2020194-1, -2, -3, -4
Matrix Spike	Phosphorus (P)-Total	MS-B	L2020194-1, -2, -3, -4

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
HTC	Hardness was calculated from Total Ca and/or Mg concentrations and may be biased high (dissolved Ca/Mg results unavailable).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-CO3-TITR-CALC-TB	Water	Alkalinity, Carbonate (as CaCO3)	CALCULATION
ALK-HCO3TITR-CALC-TB	Water	Alkalinity, Bicarbonate (as CaCO3)	CALCULATION
ALK-OH-TITR-CALC-TB	Water	Alkalinity, Hydroxide (as CaCO3)	CALCULATION
ALK-TITR-TB	Water	Alkalinity	APHA 2320B modified

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

BOD-TB	Water	Biochemical Oxygen Demand (BOD)	APHA 5210 B- BIOCHEMICAL OXYGEN DEMAND

All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.

CL-L-IC-N-TB	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

COD-TB	Water	Chemical Oxygen Demand	APHA 5220D

This analysis is carried out using procedures adapted from APHA Method 5220 "Chemical Oxygen Demand (COD)". Chemical oxygen demand is determined using the closed reflux colourimetric method.

DOC-TB	Water	Dissolved Organic Carbon	APHA 5310 B modified

Water samples are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis. Analyzed by converting all carbonaceous material to carbon dioxide (CO2) by catalytic combustion at 850?C. The CO2 generated is measured by an infrared detector and is directly proportional to concentration of carbonaceous material in the sample

EC-TITR-TB	Water	Conductivity	APHA 2510 B

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

HARDNESS-CALC-TB	Water	Hardness (as CaCO3)	CALCULATION
HG-T-CVAF-TB	Water	Total Mercury in Water by CVAFS	EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAFS.

IONBALANCE-TB	Water	Ion Balance Calculation	APHA 1030 E - CALCULATION

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Reference Information

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

MET-T-CCMS-TB	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

NH3-COL-TB	Water	Ammonia by Discrete Analyzer	APHA 4500-NH3 G. (modified)

Ammonia in aqueous matrices is analyzed using discrete analyzer with colourimetric detection.

NO2-IC-N-TB	Water	Nitrite in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-IC-N-TB	Water	Nitrate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-COL-TB	Water	Total Phosphorus by Discrete Analyzer	APHA 4500-P B, F, G (modified)

Phosphorus in aqueous matrices is analyzed using discrete Analyzer with colourimetric detection.

PH-TITR-TB	Water	pH	APHA 4500-H

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

SO4-IC-N-TB	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-TB	Water	Total Dissolved Solids	APHA 2540 C (modified)

Aqueous matrices are analyzed using gravimetry and evaporation

TKN-COL-TB	Water	Total Kjeldahl Nitrogen	APHA 4500-Norg (modified)

Total Kjeldahl Nitrogen in aqueous matrices is analyzed using a discrete analyzer with colourimetric detection.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
TB	ALS ENVIRONMENTAL - THUNDER BAY, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L2020194-COFC

COC Number: 14 -

Page ____ of ____

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	Municipality of Wawa	Select Report Format:	☐ PDF ☐ EXCEL ☐ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3 pm - business days)
Contact:	~~Mark McRae~~ Marie Liams	Quality Control (QC) Report with Report	☐ Yes ☐ No	P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	40 Braodway Ave. PO Box 500 Wawa ON P0S 1K0	☐ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
		Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Phone: Fax:	807-856-4315	Email 1 or Fax	As set up in account	Specify Date Required for E2,E or P:
	807-856-1745	Email 2		

Invoice To		Invoice Distribution	
	Same as Report To ☐ Yes ☑ No	Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
	Copy of Invoice with Report ☑ Yes ☐ No	Email 1 or Fax	acctspayable@wawa.cc
Company:		Email 2	
Contact:			

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q56342	Approver ID:	Cost Center:
Job #:	Fall Landfill	GL Account:	Routing Code:
PO / AFE:	28376	Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	L2020194	ALS Contact: Danielle Drawson	Sampler:

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metals, Hardness	Total Mercury	Speciated Alkalinity, Conductivity	Cl, NO2, NO3, SO4	TDS, pH, Ion Balance	BOD, DOC	COD, Total Phos, TKN, NH4	Number of Containers
	Michipicoten River Upsteam - 4 o'clock Rock	07-11-17	11:30	SW	x	x	x	x	x	x	x	
	Bank of Michipicoten River	07-11-17	11:45	SW	x	x	x	x	x	x	x	
	Trout Creek Upstream	07-11-17	11:55	SW	x	x	x	x	x	x	x	
	Mouth of Trout Creek Downstream	07-11-17	12:05	SW	x	x	x	x	x	x	x	
	SAMPLER: Marie Liams											

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☑ No	
Are samples for human drinking water use? ☐ Yes ☑ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice packs Yes ☐ No ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
4.8					

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received By	Date	Time	Received by:	Date:	Time:
			US	11/09/17	8:50			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION — WHITE - LABORATORY COPY — YELLOW - CLIENT COPY

NA-FM-0326e v09 Front/04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

US

Appendix D

Selected Parameter Trend Plots

Chart I.1
Municipality of Wawa
Waste Disposal Site Groundwater Monitoring
Alkalinity

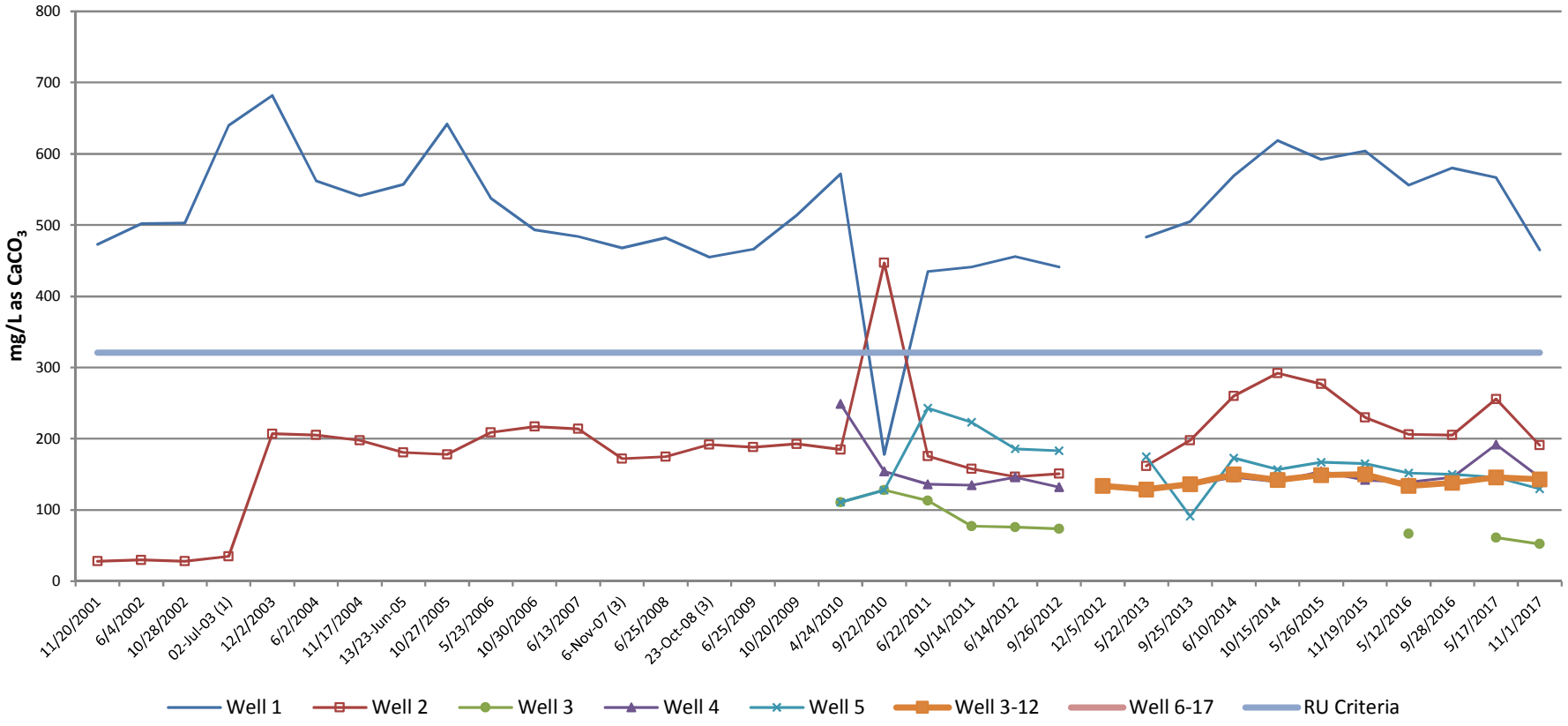


Chart I.2
Municipality of Wawa
Waste Disposal Site Groundwater Monitoring
Chloride

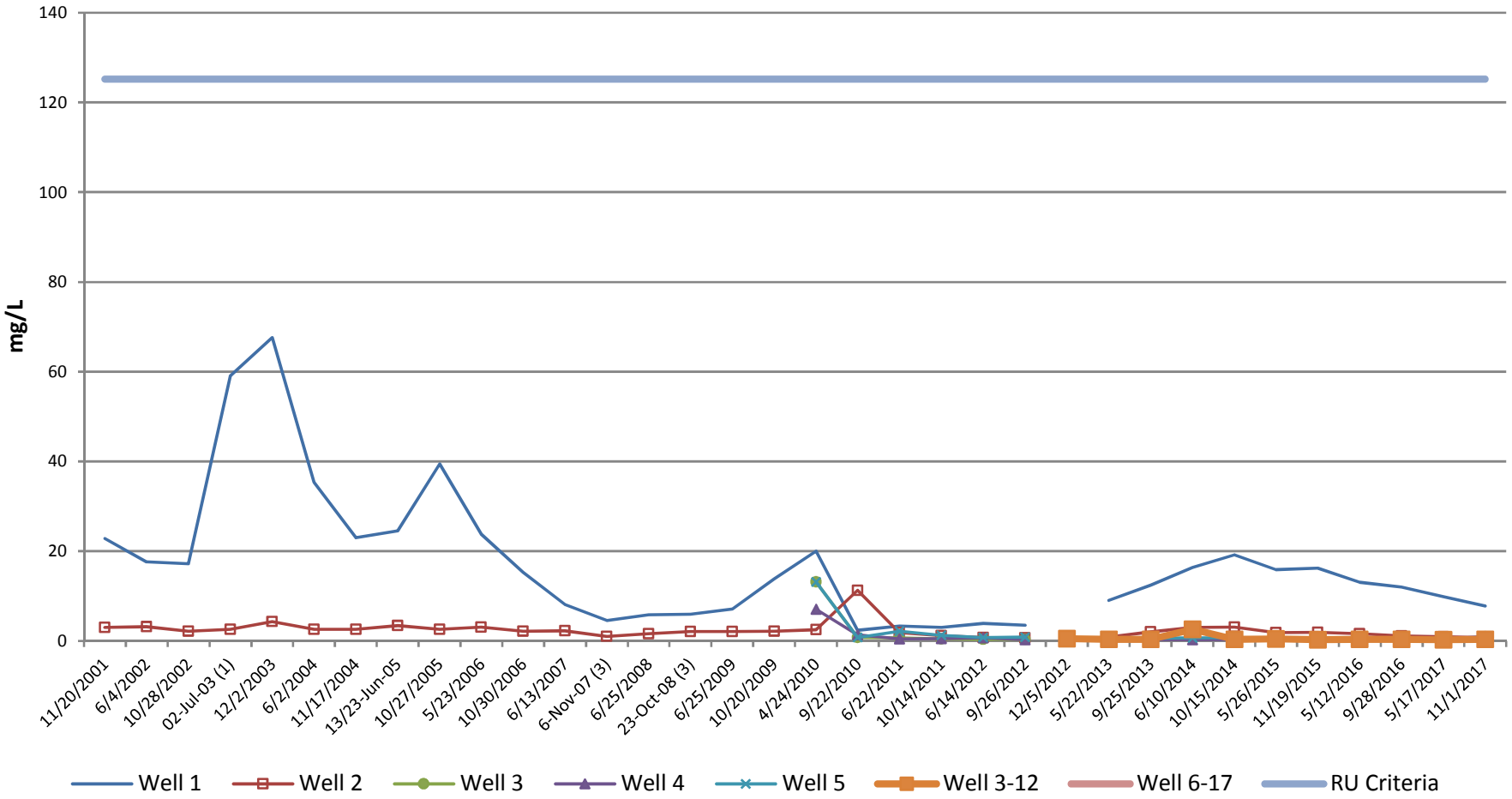


Chart I.3
Municipality of Wawa
Waste Disposal Site Groundwater Monitoring
pH

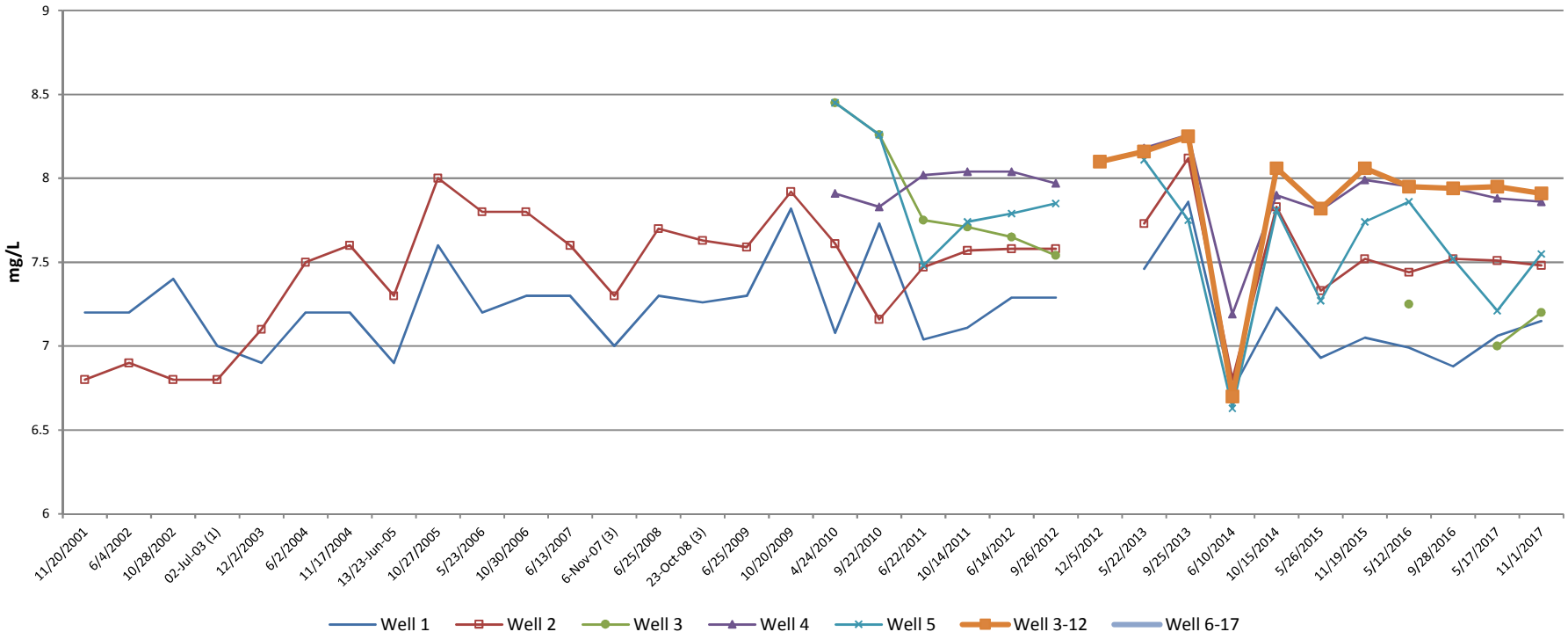


Chart I.4
Municipality of Wawa
Waste Disposal Site Groundwater Monitoring
Hardness

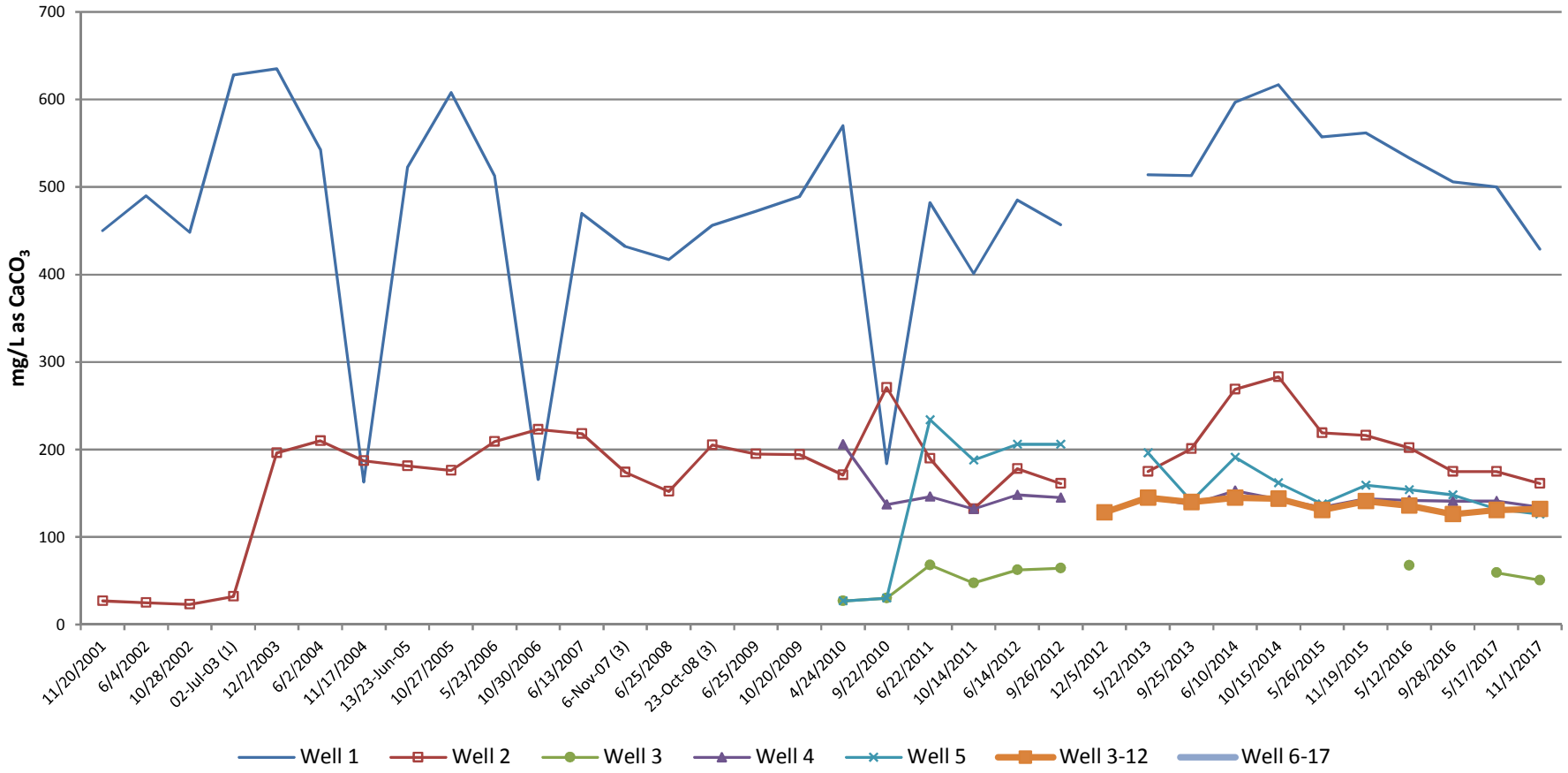


Chart I.6
Municipality of Wawa
Waste Disposal Site Groundwater Monitoring
Iron

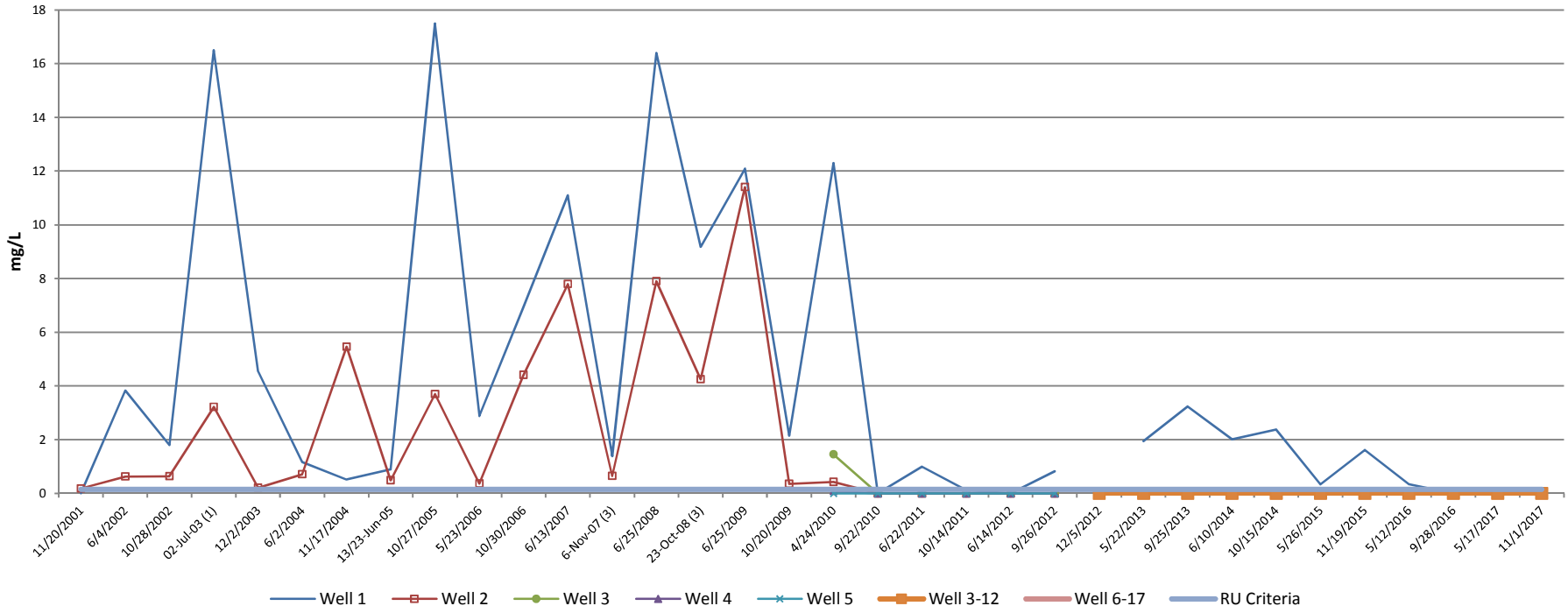


Chart I.7
Municipality of Wawa
Waste Disposal Site Groundwater Monitoring
Manganese

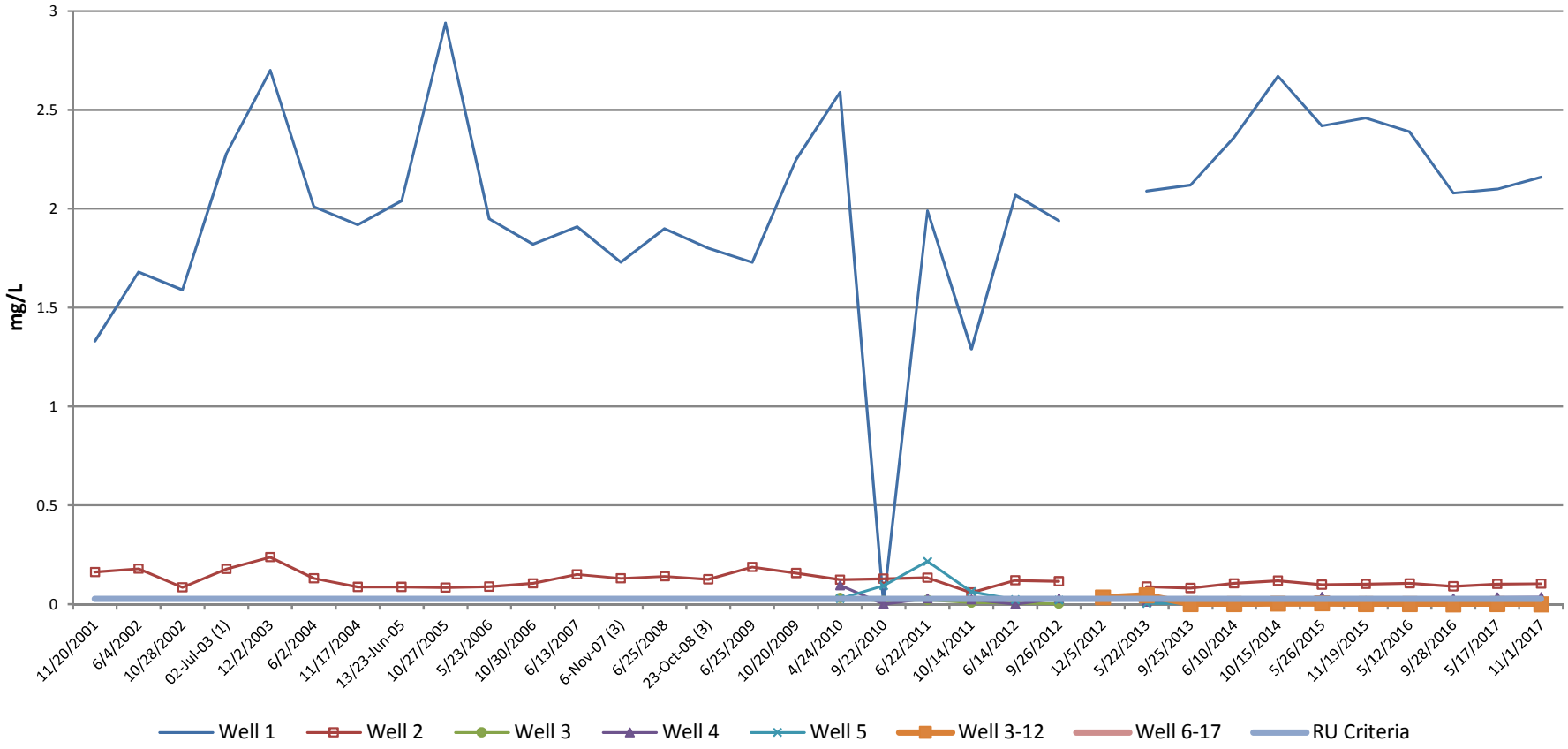


Chart I.8
Municipality of Wawa
Waste Disposal Site Groundwater Monitoring
DOC

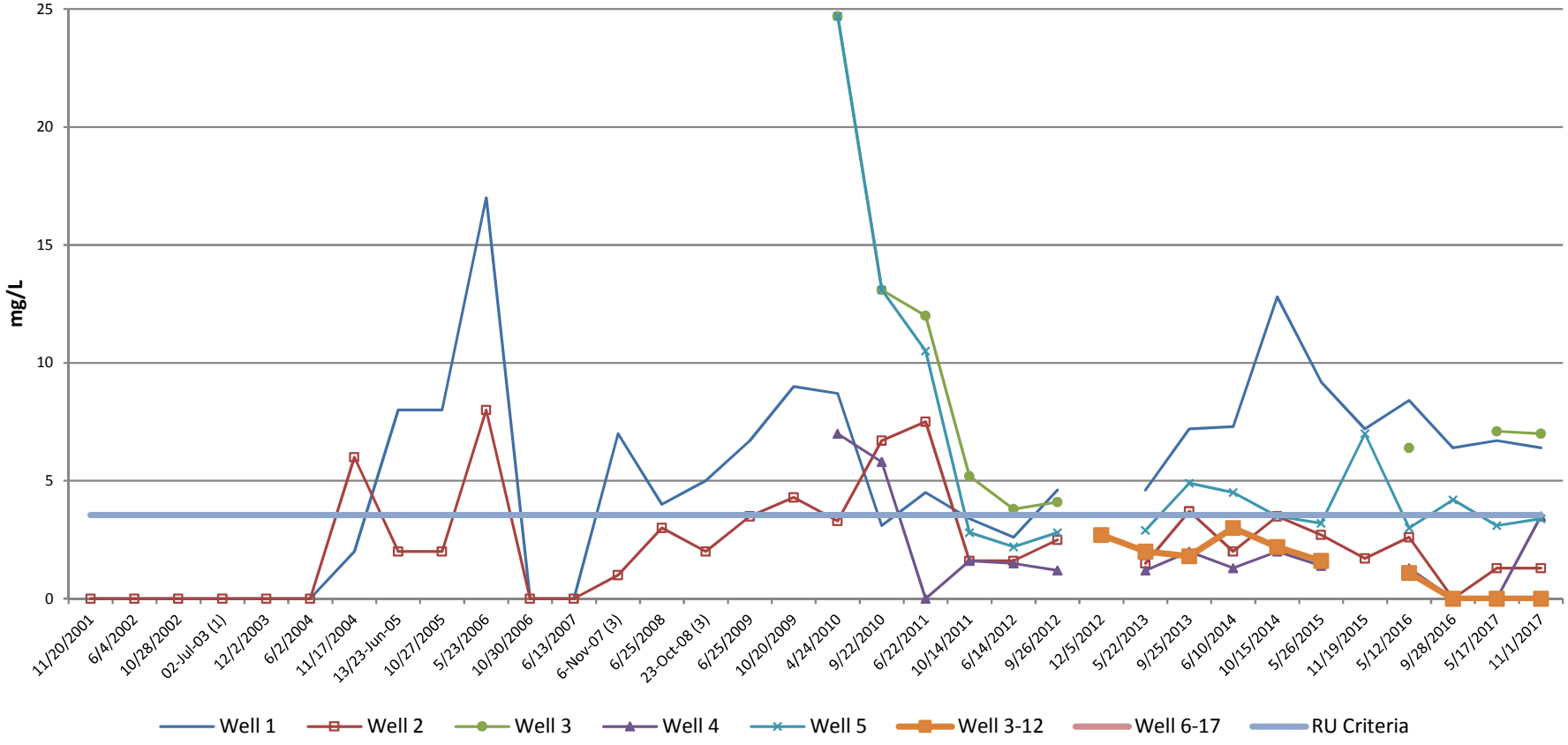
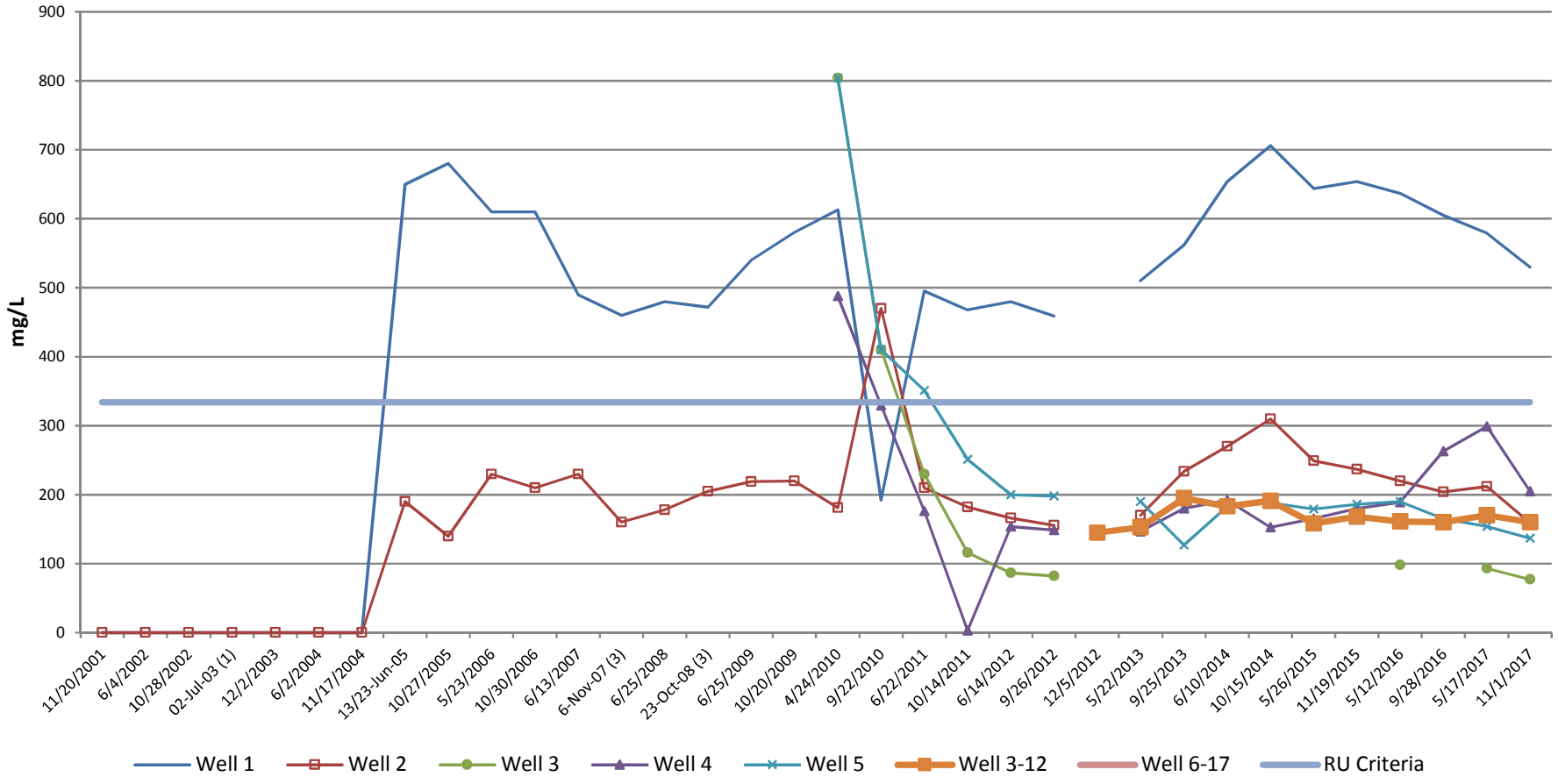
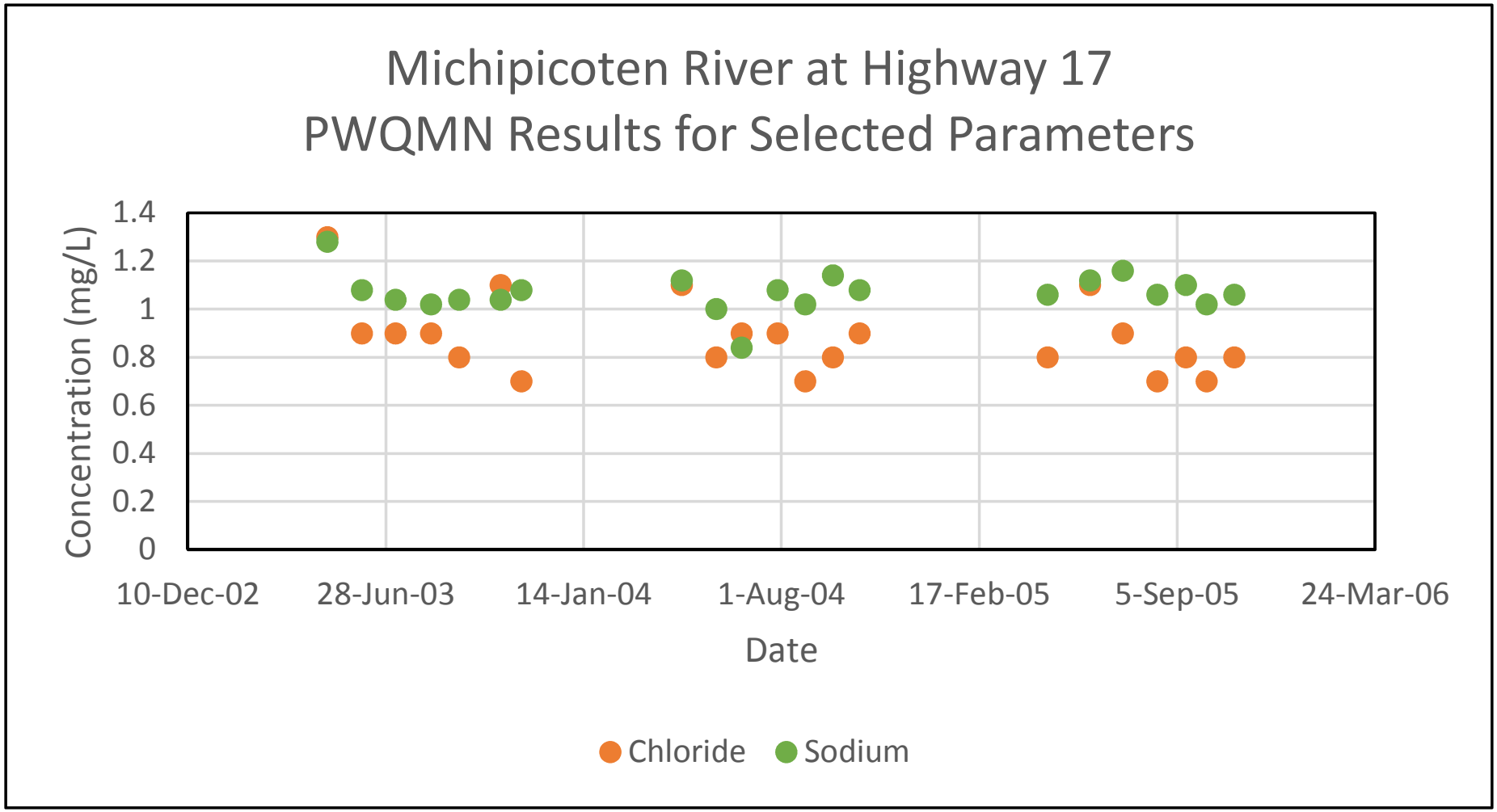


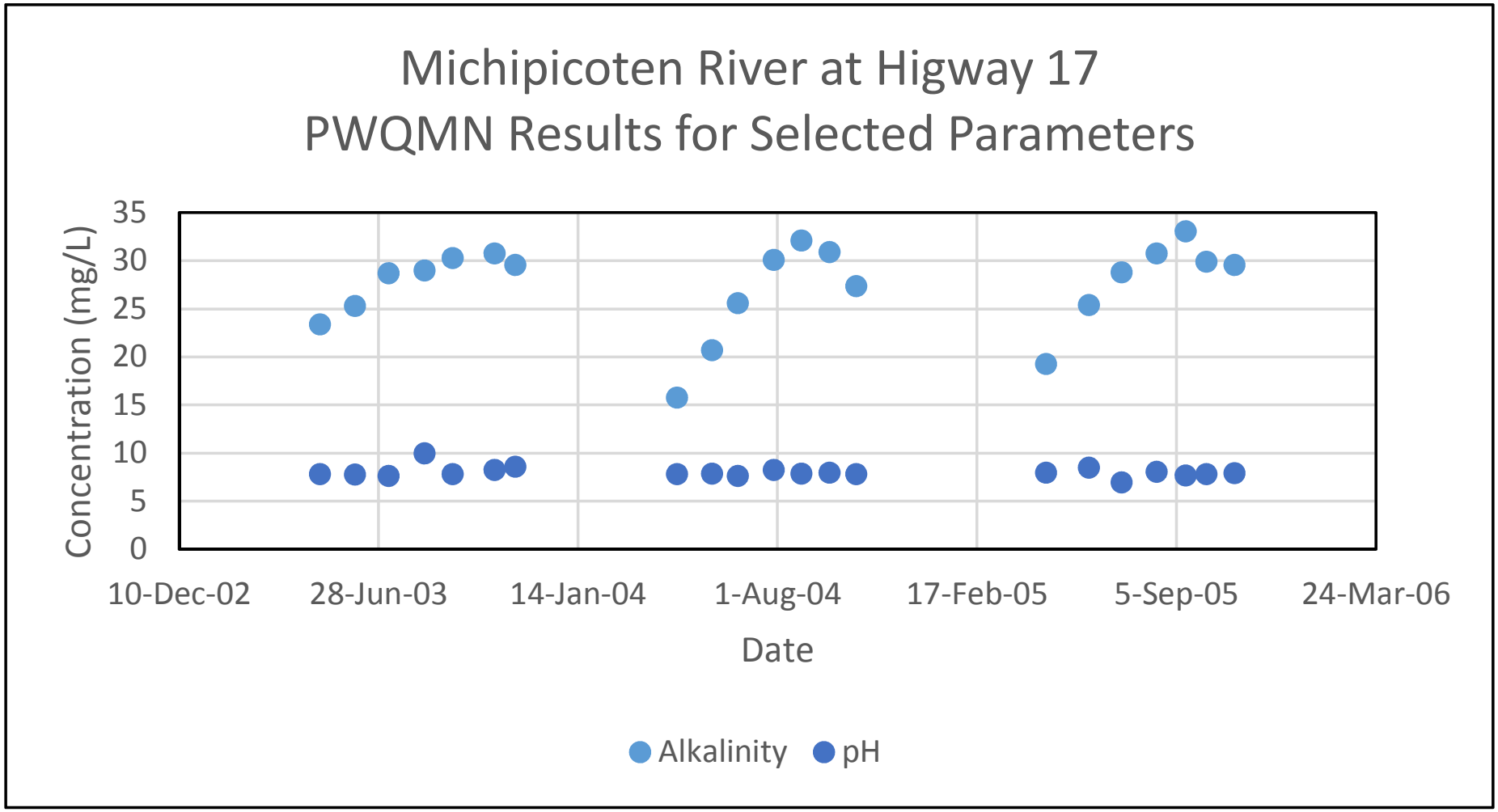
Chart I.5
Municipality of Wawa
Waste Disposal Site Groundwater Monitoring
TDS

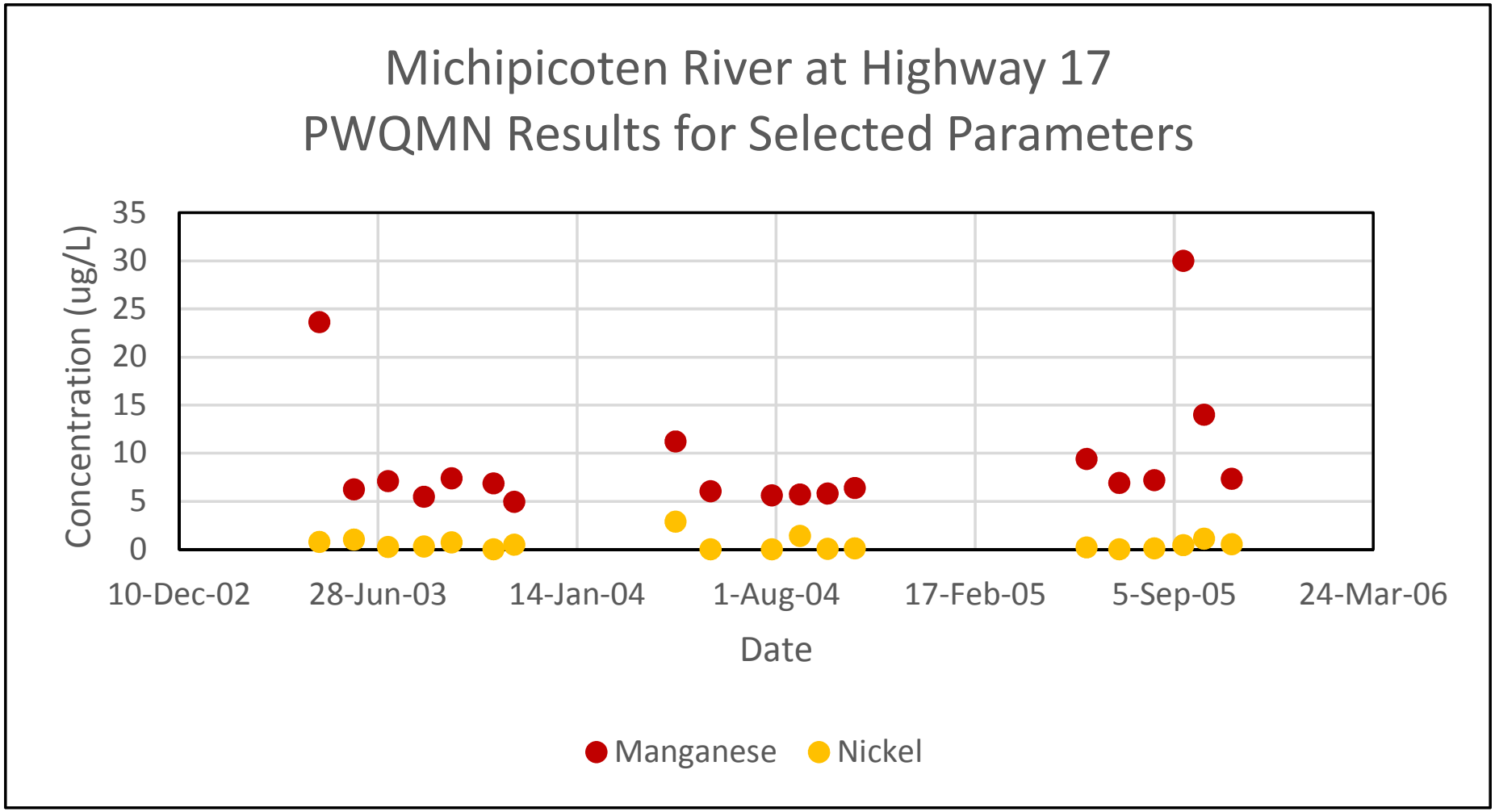


Appendix E

Plots of Selected PWQMN Parameters


Michipicoten River at Highway 17
PWQMN Results for Selected Parameters
Concentration (mg/L)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
10-Dec-02
28-Jun-03
14-Jan-04
1-Aug-04
17-Feb-05
5-Sep-05
24-Mar-06
Date
Chloride
Sodium


Michipicoten River at Higway 17
PWQMN Results for Selected Parameters
Concentration (mg/L)
35
30
25
20
15
10
5
0
10-Dec-02
28-Jun-03
14-Jan-04
1-Aug-04
17-Feb-05
5-Sep-05
24-Mar-06
Date
Alkalinity
pH


Michipicoten River at Highway 17
PWQMN Results for Selected Parameters
Concentration (ug/L)
35
30
25
20
15
10
5
0
10-Dec-02
28-Jun-03
14-Jan-04
1-Aug-04
17-Feb-05
5-Sep-05
24-Mar-06
Date
Manganese
Nickel

Ministry of the Environment Conservation and Parks
435 James Street South
Suite 331
Thunder Bay ON P7E 6S7
Tel.: 807 475-1717
Fax: 807 475-1754

Ministère de l'Environnement, de la Protection de la nature et des Parcs
435, rue James sud
Bureau 331
Thunder Bay ON P7E 6S7
Tél. : 807 475-1717
Téléc. : 807 475-1754

Ontario

February 5th, 2019

TO: Chris Kresin, Kresin Engineering Corp

FROM: Mira Majerovich, EA Coordinator/Environmental Resource Planner

Dear Chris,

Re: Municipality of Wawa, Michipicoten Landfill Site Groundwater and Surface Water Assessment Report – Expansion of the Municipal Waste Disposal Site (July 27, 2018).

As requested, the Ministry of the Environment, Conservation and Parks (MECP) staff have reviewed the Municipality of Wawa, Michipicoten Landfill Site Groundwater and Surface Water Assessment Report, prepared by Kresin Engineering Corporation, dated July 27, 2018, and in support of the Environmental Screening Report for the expansion of the Municipal Waste Disposal Site project under the Environmental Assessment requirements for Waste Management projects (Regulation 101/07).

Groundwater Recommendations
Our groundwater reviewer has the following recommendations to provide:

The expansion of the site has the potential to impact ground and surface water quality. The existing landfill is already 97,183 m^3 over capacity. There are Reasonable Use Concept Guideline (RUC)[1] and/or Ontario Drinking Water Standard (ODWS) exceedances detected at offsite monitoring wells MW1 and MW2. There were trigger criteria exceedances at MW1 and MW2 in spring and fall 2017 sampling events. There were also surface water trigger criteria exceedances for a number of parameters in 2017. Additional information is required to demonstrate that the existing landfill and expansion are likely to meet the Provincial Water Quality Objectives (PWQO), Aquatic Protection Values (APV)[2], and Canadian Water Quality Guidelines (CWQO)[3] at the Contaminant Attenuation Zone (CAZ) boundary. The following specific conclusions and recommendations are provided below that should be addressed prior to approval:

The 2017 annual monitoring report concludes that the trigger criteria for manganese were exceeded at MW1 and MW2 during the spring and fall sampling events. There was also exceedance of a number of trigger parameters (aluminum, chromium, copper, iron, lead, manganese, and nickel) at surface water trigger locations. In addition to acquiring the CAZ downgradient of the landfill, tier II trigger mechanism should be initiated, and if necessary, remedial/contingency measures should be implemented

[1] Guideline B-7, Incorporation of the Reasonable Use Concept into MOEE Groundwater Management Activities, April 1994. [2] APV derived in the Ministry's "Rationale for the Development of Soil and Ground Water Standards for Use at Contaminated Site in Ontario", April 15, 2011. [3] Canadian Water Quality Guidelines for the Protection of Aquatic Life, Canadian Council of Ministers of the Environment, 2007

to mitigate the impacts.

2. The groundwater results tables provided in the Groundwater and Surface Water Assessment Report should be updated to include an assessment of the site-specific RUC criteria. In addition considering leachate from the site will discharge (after some attenuation) to the Michipicoten River, monitoring wells located near the River (i.e. MW2) should be compared to the PWQO, APV and CWQO.

3. The consultant has calculated a required CAZ of 26 ha using a dilution model based on an estimated maximum chloride concentration. The calculations for the attenuation zone area consider only chloride as the contaminant of concern. I recommend that the calculations need to be carried out for other leachate indicator parameters – iron, manganese, alkalinity, DOC, hardness and TDS. Some of which are higher in magnitude compared to chloride. Subsequently, an appropriately sized attenuation zone should be established to reflect the maximum area required based on these leachate indicator parameters (including chloride).

4. In section 4.3.2 of the report it is indicated that "leachate that would be generated within the Alt. 2 expansion area is expected to travel south and south-westerly through an available CAZ of approximately 23.4 ha in area." Based on the groundwater contour, groundwater flows west and southwest. The available CAZ area in the correct downgradient direction of the expansion should be re-evaluated to ensure it meets the required CAZ area.

5. The CAZ should extend slightly upgradient of the expansion area, and existing fill area as a precaution should there be radial leachate flow.

6. Considering groundwater flows west and southwest, the location and shape of the expansion should be situated at an optimum location to maximize the available CAZ.

7. The original permitted waste volume for the existing landfill was 133, 200 m^3. The landfill exceeded this volume in April 2008 by 41,183 m^3. The site is currently operating with an emergency environmental compliance approval which allows continued operation of the landfill until May 2020. With the approval of the emergency additional volume of 34,000 m^3 in February 2011, and 22,000 m^3 in April 2016, this brought the total waste volume to 230,383 m^3, which is 97,183 m^3 over the original permitted volume. It is required that the proponent demonstrate that the total volume of waste from the existing landfill and the expansion are likely to meet the PWQO, APV and CWQO at the CAZ boundary by modelling or predictive impact calculations. The assessment should be based on site specific characteristics including leachate generation rate, hydraulic conductivity, total volume of waste, fill area, etc.

8. A monitoring well should be installed downgradient of MW1 to delineate RUC exceedances.

9. As part of the expansion, additional monitoring wells need to be proposed. Monitoring

wells should be installed west and southwest of the expansion area to monitor groundwater quality downgradient of the expansion. A monitoring well should also be installed further downgradient of the proposed MW-P1, near the CAZ boundary to assess groundwater quality leaving the site. This well should be added to the trigger mechanism program.

10. Concentrations of leachate indicator parameters are required to meet PWQO, APV, CWQO or established background values at the discharge point of groundwater to surface water. Trigger criteria, based on the 75th percentile of PWQO, APV, CWQO or background values should be established at the trigger monitoring wells in order to ensure that groundwater discharging to surface water is meeting the above mentioned criteria.

11. The Tier I trigger parameters should be broader and include additional leachate indicator parameters such as iron, alkalinity, DOC, hardness and TDS, etc. which are elevated at MW1. This should be re-evaluated following establishment of a statistically valid database (a minimum of 8 to 10 samples collected over a two year period) at the leachate characterization well.

12. In section 2.0 of the report MW3-12 is referred to as MW6, and MW6-12 as MW7. This discrepancy should be corrected.

13. It was previously recommended in the June 5, 2015 and November 10, 2015 MECP memorandums that the proponent needed to have at least one sampling event each year carried out by experienced professionals. It appears this has not been occurring and should be conducted during future sampling events.

Surface Water Recommendations
Our surface water reviewer has the following recommendations to provide:

The statement that the resultant CAZ area (the addition of the existing CAZ to the proposed available CAZ) exceeds the required total CAZ area for the entire WDS of 26 ha is misleading. The Michipicoten River will still limit the size of the available CAZ for the existing site (approximately 6.5 ha) since the proposed expansion does not alter the leachate flow path of the existing site. However, based on these calculations, the available CAZ area (23.4 ha) to the south/southwest of the proposed expansion area should provide sufficient attenuation area (based on the reports calculations of a required CAZ of 13 ha) for the proposed expansion.

With regard to the on-going RUC exceedances and limited CAZ for the existing WDS, additional information, including further monitoring, contingency planning and possible mitigation measures is required to ensure that both the existing WDS and proposed expansion will meet the Provincial Water Quality Objectives (PWQO), Aquatic Protection Values (APV)[2] and Canadian Water Quality Guidelines (CWQG)[3] at the CAZ boundary. Mitigation of the off-site contamination may be required prior to, or in conjunction with, the proposed WDS expansion.

As indicated in the MECP review of the Proposed Trigger Mechanisms and Contingency Plan dated February 18th, 2016, groundwater monitoring triggers provide the earliest prediction of potential surface water impacts to the river. Thus, due to the on-going RUC exceedances at the CAZ boundary, PWQOs, APVs and CWQG criteria must be applied at the most down-gradient monitoring well(s) adjacent the Michipicoten River. Also, at least one surface water monitoring location in the river must be directly down-gradient of the predicted leachate plume path for the existing WDS. Dependant on the final location of the proposed WDS expansion (i.e. to the south of the existing fill area), additional surface water monitoring location(s) in the Michipicoten River will be required and must also be directly down-gradient of the *new* leachate plume and attenuation zone. Similarly, a new monitoring well must be constructed down-gradient of the proposed expansion site leachate plume at or near the CAZ boundary and adjacent to the Michipicoten River. In addition to the above recommendations, the following must also be included and/or addressed in the final Environmental Screening Report:

- Tables summarizing all historical and current analytical results for all surface water and groundwater monitoring at the site with comparisons to PWQO, APVs and CWQGs;
- Sample locations need to be sited to intercept stormwater and surface water features, leachate plume direction and potential exfiltration areas in surface waters down-gradient of the proposed expansion site;
- In the event that the most down-gradient monitoring well or surface water monitoring location results indicate any monitored contaminant exceeds the prescribed criteria, a background surface water reference sampling location(s) upstream of the site (in the Michipicoten River) is/are required to be sampled for comparison.

All recommendations outlined in this correspondence are expected to be addressed in the final Environmental Screening Report.

General Comments

The Ministry has previously identified the need to acquire Crown Land between the WDS and the down-gradient Michipicoten River to serve as a Contaminant Attenuation Zone (CAZ) to meet the Ministry's Reasonable Use Concept (RUC)[1] Guidelines. The report states that the required CAZ area for the existing site is 13 ha. The available down gradient area from the existing site is approximately only 6.5 ha and extends 230 m toward and beyond the Michipicoten River. With the addition of the proposed expansion area, the required CAZ doubles in area to 26 ha. Leachate generated within the Alternative 2 expansion area is predicted to travel south and south-westerly, through an available proposed CAZ of approximately 23.4 ha.

MECP remains unaware whether the Municipality of Wawa has acquired the south area of the WDS for the CAZ. The assessment report discusses the CAZ, but does not confirm whether this land has been acquired. Please confirm the status of this land acquisition.

In addition, MECP questions whether the requested capacity for the expansion of the WDS is accurate. As previously mentioned, the original permitted waste volume for the existing landfill was 133, 200 m^3. The landfill exceeded this volume in April 2008 by 41,183 m^3. The site is currently operating with an emergency environmental compliance approval which allows continued operation of the landfill until May 2020. With the approval of the emergency, and additional volume of 34,000 m^3 in 2011, and 22,000 m^3 in 2016, the total waste volume is now 230,383 m^3, which is 97,183 m^3 over the original permitted volume. Can you confirm that the total volume of waste from the existing landfill along with the expansion request of an additional 100,000 m^3 will be sufficient for the projected future of the landfill?

Should you have any questions regarding these comments, please let me know.

Regards,

Mira Majerovich
EA Coordinator/Planner (A), MECP

C: Paula Allen, APEP Supervisor, Sudbury, MECP
Lilian Keen, EO Sault Ste Marie Area, MECP
Scott Parker, Surface Water Scientist, MECP
Archana Uprety, Hydrogeologist, MECP

Appendix I
Environmental Screening Checklist

Municipality of Wawa - Environmental Screening Process
Screening Criteria Checklist
KEC Project No. 1140.09

KRESIN Engineering Corporation

	Criterion	Yes	No	Additional Information
1. Surface and Groundwater				
1.1	Might the project cause negative effects on surface water quality, quantities or flow?	X		Expansion within existing approved horizontal boundaries proposed. Michipicoten River and Trout Creek are located approximately 200m west of the site.
1.2	Might the project cause negative effects in groundwater quality, quantity or movement?	X		Proposed expansion for landfilling may result in leachate negatively effecting groundwater.
1.3	Might the project cause significant sedimentation or soil erosion or shoreline or riverbank erosion on or off site?		X	Expansion is not proposed in the area of lakes/rivers or in area of unstable lands. Erosion is not expected.
1.4	Might the project cause negative effects on surface or groundwater from accidental spills or releases (e.g. leachate) to the environment?	X		Negative effects on groundwater as a result of leachate from the landfill area is possible.
2. Land				
2.1	Might the project cause negative effects on residential, commercial, institutional or other sensitive land uses within 500 meters from the site boundary?		X	No nearby receptors. The proposed expansion to the site will require the Municipality to purchase additional Crown Land for landfilling, contaminant attenuation, buffer or other purposes.
2.2	Might the project not be consistent with the Provincial Policy Statement, provincial land use or resource management plans?		X	The proposed landfill expansion accompanied with a waste diversion program and an approved ECA fulfills S.1.6.8.1 of the Provincial Policy Statement.
2.3	Might the project be inconsistent with municipal land use policies, plans and zoning bylaws (including municipal setbacks)?		X	The proposed expansion area is on Municipally owned land that is currently approved for waste disposal.
2.4	Might the project use lands not zoned as industrial, heavy industrial or waste disposal?		X	The proposed expansion of the landfill site will not require changes to the current Official Plan or Zoning By-laws as the expansion area is approved for waste disposal.
2.5	Might the project use hazard lands or unstable lands subject to erosion?		X	No hazard lands or unstable lands in close vicinity to proposed expansion area.
2.6	Might the project cause negative effects related to the remediation of contaminated land?		X	Expansion is not to take place on contaminated lands underground remediation.
3. Air and Noise				
3.1	Might the project cause negative effects on air quality due to emissions (for parameters such as temperature, thermal treatment exhaust flue gas volume, nitrogen dioxide, sulphur dioxide, residual oxygen, opacity, hydrogen chloride, suspended particulates, or other contaminants)?		X	With the exception of clean wood and brush, there will be no burning of municipal waste at the site as part of the landfilling operation. It's expected that emissions will be limited to methane from organic decomposition within waste.
3.2	Might the project cause negative effects from the emission of greenhouse gases (e.g. carbon dioxide, carbon monoxide, methane)?	X		Natural biodegradation of organic wastes at the site can produce landfill gas that may be emitted to the atmosphere. The major constituents being methane and carbon dioxide. Hydrogen sulphide, mercaptans and non-methane organic compounds may also be present.
3.3	Might the project cause negative effects from the emission of dust or odour?	X		Unpaved access roads to the site may create negative effects due to the emission of dust. Odour emissions are possible onsite as the control of odours is based on the rate of applying cover material.
3.4	Might the project cause negative effects from the emission of noise?	X		Negative effects of noise emissions are possible at the site as current landfilling activities include the use of rubber-tired loader.
3.5	Might the project cause light pollution from trucks or other operational activities at the site?	X		Light pollution from vehicles depositing waste at the site as well as operation/maintenance vehicles.

	Criterion	Yes	No	Additional Information
4. Natural Environment				
4.1	Might the project cause negative effects on rare (vulnerable), threatened or endangered species of flora or fauna or their habitat?		X	It is anticipated that potential construction and operation impacts to flora/fauna or their habitat will be limited. With the advance of undisturbed habitat in the area, it is anticipated that species affected, if any, will be displaced to areas where similar habitat quantities exist.
4.2	Might the project cause negative effects on protected natural areas such as ANSIs, ESAs or other significant natural areas?		X	There are no designated ANSIs, ESAs, or other significant natural areas in proximity of the site.
4.3	Might the project cause negative effects on designated wetlands?		X	There are no designated wetlands in the vicinity of the landfill site.
4.4	Might the project cause negative effects on wildlife habitat, populations, corridors or movement?		X	It is anticipated that potential construction and operation impacts to the environment and associated with the proposed landfill expansion will be limited. The clearing of the expansion area should create little to no disturbance to nearby vegetation and wildlife communities. With the abundance of undisturbed habitat in the area, it is anticipated that affected wildlife, if any, will be displaced to areas where similar habitat quantities exist.
4.5	Might the project cause negative effects on fish or their habitat, spawning, movement or environmental conditions (e.g. water, temperature, turbidity, etc.)?		X	There are no direct fish habitats in proximity to the site.
4.6	Might the project cause negative effects on locally important or valued ecosystems or vegetation?		X	There are no locally valued ecosystems impacted, habitat types in proximity to site common throughout Northern Ontario.
4.7	Might the project increase bird hazards within the area that could impact surrounding land uses (e.g. airports)	X		Proposed horizontal expansion of the landfill site may potentially increase the number of birds attracted to the site.
5. Resources				
5.1	Might the project result in the practices inconsistent with waste studies and/or waste diversion targets (e.g. result in final disposal of materials subject to diversion programs)?		X	The municipality practices waste diversion at the landfill site.
5.2	Might the project result in generation of energy that cannot be captured and utilized?		X	Gases produced are in such small quantity, therefore they are unable to be utilized for energy generation.
5.3	Might the project be located a distance from required infrastructure (such as availability to customers, markets and other factors)?		X	The landfill is nearby the communities it serves: Wawa, Hawk Junction, Village of Michipicoten River and Lake Superior Provincial Park.
5.4	Might the project cause negative effects on the use of Canada Land Inventory Class 1-3, specifically crop or locally significant agricultural lands?		X	The proposed expansion to the site is on and surrounded by undeveloped Crown Land classified zoned as a Natural Resource Area.
5.5	Might the project cause negative effects on existing agricultural production?		X	The proposed expansion to the site is on and surrounded by undeveloped Crown Land classified zoned as a Natural Resource Area.
6. Socio-economic				
6.1	Might the project cause negative effects on neighbourhood or community character?		X	The proposed expansion to the landfill site is on and surrounded by undeveloped Crown Land. The site is located at a distance for enough from the Wawa community to not cause a negative effect on neighbourhood or community character.
6.2	Might the project result in aesthetics impacts (e.g. visual and litter impacts)?		X	The proposed expansion area will be surrounded by a buffer area at least 100m wide at every point unless a written report confirms that a 30m wide buffer is sufficient to satisfy subsection 3 of section 4.2.1 of the MOE Landfill Standards, A guideline on the Regulatory and Approval Requirements for New or Expanding Landfilling Sites (May 1998).
6.3	Might the project cause negative effect on local businesses, institutions or public facilities?		X	The project is not expected to cause negative effects on local businesses, institutions or public facilities.
6.4	Might the project cause negative effects on recreation, cottaging or tourism?		X	No concerns are expected with the proposed expansion. The landfill site will continue to provide waste management to residents and seasonal population.
6.5	Might the project cause negative effects related to increases in the demands on community services and infrastructure?		X	The current (and the proposed expansion) site is a natural attenuation site and does not rely on community services/infrastructure for operation.

	Criterion	Yes	No	Additional Information
6.6	Might the project cause negative effects on the economic base of a municipality or community?		X	No negative effects to the Municipality's economic base are expected.
6.7	Might the project cause negative effects on local employment and labour supply?		X	No negative effects are expected. The expansion of the site may temporarily provide local employment creating a positive local employment effect.
6.8	Might the project cause negative effects related to traffic?		X	No negative effects related to traffic are expected. The landfill will continue to operate as it does now. The population of the Municipality of Wawa and surrounding area is expected to remain relatively stable.
6.9	Might the project be located within 8 km of an aerodrome/airport reference point?	X		The landfill site is located approximately 4.0 km southeast of the Wawa airport.
6.10	Might the project interfere with flight paths due to the construction of facilities with height (i.e. stacks)?		X	The landfill will not interfere with flight paths as expansion will be generally horizontal.
6.11	Might the project cause negative effects on public health and safety?		X	Operation of the landfill site will continue to operate as per the current ECA and in accordance with applicable regulations. Environmental monitoring will continue at the site.
7. Heritage and Culture				
7.1	Might the project cause negative effects on heritage buildings, structures or sites, archaeological sites or areas of archaeological importance, or cultural heritage landscapes?	X		MTCS checklist determined the project area may have archaeological potential beacuse of close proximity to a waterbody. Therefore, there is a need for an archaeological study to be carried out by a licensed person. MTCS checklist determined the project area is not a recognized heritage property and is not of cultural heritage value.
7.2	Might the project cause negative effects on scenic or aesthetically pleasing landscapes or views?		X	The proposed expansion will require the clearing of undeveloped land for the purpose of increasing the landfilling area.
8. Aboriginal				
8.1	Might the project cause negative effects on land, resources, traditional activities or other interests of Aboriginal communities?		X	None anticipated. Consultation will be undertaken to identify any concerns.
9. Other				
9.1	Might the project result in the creation of non-hazardous waste materials requiring disposal?	X		Wood resulting from clearing can be sold.
9.2	Might the project result in the creation of hazardous waste materials requiring disposal?		X	No hazardous waste will be generated as a result of the proposed expansion.
9.3	Might the project cause any other negative environmental effects not covered by the criteria outlined above?		X	No other concerns identified.

Appendix J
Comments Received

Comments Received Following Second Point of Consultation

Michael Kresin

From: Majerovich, Mira (MOECC) <Mira.Majerovich@ontario.ca>
Sent: Wednesday, May 23, 2018 8:56 AM
To: Kristen Sherlock
Cc: Allen, Paula (MOECC); Crosson, Kirk (MOECC); Parker, Scott A. (MOECC); Nelson, Leif (MOECC)
Subject: RE: Wawa WDS MOECC Review of Steps 1-4 in Class EA process
Attachments: MOECC comments Wawa WDS expansion ESP_April 2018.pdf

Hi Kristen,

Apologies for the delay, attached please find MOECC comments on the Phase 1 report: Steps 1-4 of the Waste Management Projects Regulation 101/07. If you have any questions please feel free to contact me to discuss.

AS previously mentioned, MOECC encourages consultation with you and the Municipality of Wawa to discuss steps 6-12 of the Class EA, to ensure your project is proceeding accordingly.

Regards,

Mira

From: Kristen Sherlock [mailto:kristen@kresinengineering.ca]
Sent: May 4, 2018 2:01 PM
To: Majerovich, Mira (MOECC)
Subject: RE: Wawa WDS

Good afternoon Mira,

Thank you for your email. We will include the EA withdrawl info moving forward.

We consulted with the following:

MNO	Métis Nation of Ontario	Mr. Jesse Fieldwebster		355 Cranston Crescent PO Box 4	Midland	ON	L4R 4K6	705-526-6335 ext.220	705-526-7537	je
MFN	Michipicoten First Nation	Chief Patricia Tangie	Chief					705-865-1993 ext. 215		pta
BFN	Batchewana First Nation	Chief Dean Sayers	Chief	236 Frontenac Street	Sault Ste. Marie	ON	P6A 5K9	705-759-0914	705-759-9171	chiefd
GRFN	Garden River First Nation	Chief Paul Syrette	Chief	7 Shingwauk	Garden River	ON	P6A 6Z8	705-949-6300	705-945-1415	ps

I understand the challenge with getting up to speed, I was not involved at the beginning either. I am available if you need anything more.

Thanks,
Kristen

From: Majerovich, Mira (MOECC) [mailto:Mira.Majerovich@ontario.ca]
Sent: Tuesday, May 01, 2018 3:06 PM
To: Kristen Sherlock <kristen@kresinengineering.ca>
Subject: RE: Wawa WDS

Kristen—

After discussing this project with our review team it has come to my attention that this project initially went through an Individual EA and then subsequently withdrew (see attached). It would be good to include this as background information in the latest proposal, either in your cover letter or email sent along with the ESP document, along with the rationale.

Regardless, I see that a letter was sent from this office to you regarding consultation obligations with First Nation and Métis communities (see attached). Could you please let MOECC know of the communities that have been consulted with on this proposal.

I am trying to get up to speed with the history on this file.

Thanks,

Mira

Mira Majerovich | EA Coordinator/Planner (A) | **Northern Region | Ministry of the Environment and Climate Change**
☎807.475.1717 ✉Mira.Majerovich@ontario.ca

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Ministère de l'Environnement et de l'Action en matière de changement climatique
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Tél:(807)475-1717

Ontario

May 22, 2018

MEMORANDUM

TO: Kristen Sherlock
Engineering Intern
Kresin Engineering Corporation

FROM: Mira Majerovich
Environmental Assessment Coordinator/Environmental Planner (A)
Northern Region - Thunder Bay

Dear Ms. Sherlock,

RE: Environmental Screening for Waste Management Projects, Proposed Expansion, Municipality of Wawa – Review of Phase 1 Report: Steps 1-4

The Ministry of the Environment and Climate Change (MOECC) has reviewed the document entitled *"Municipality of Wawa Expansion of the Municipal Waste Disposal Site Environmental Screening Process Phase 1 Report: Steps 1-4" (*December 2017), and prepared by Kresin Engineering Corporation (herein referred to as the "Report").

It is our understanding that the Municipality of Wawa is proposing to increase the current licensed capacity of the Wawa Landfill site by 100,000 cubic metres (m^3), where it currently is approved for 230,383 cubic meters. The landfill site is located 1.7 km east of Highway 17, on High Falls Rd in Rabazo Township, District of Algoma (about 8km south of Wawa) and is approximately 22 hectares in size, of which 2.6 hectares are approved for use and operations as a fill area. The site receives municipal waste from 2900 permanent residents and seasonally from area Provincial Parks. The need for landfill expansion was identified in the current Environmental Compliance Approval (ECA) and is expected that the remaining approved capacity will be filled by the year 2021.

This project is being planned and assessed in accordance with the Environmental Screening Process for Waste Management Projects under *Ontario Regulation 101/07* of the *Environmental Assessment Act* (the Waste Management Projects Regulation). The project description has been prepared to outline the need for the project and to provide a detailed description of all phases and components of the project, including construction, operation, and closure of the landfill. However, as this is Phase 1 of the project, a fulsome review is not possible to provide at this time. The project description will be used throughout the Environmental Screening Process (ESP), and the initial

project description may be fine-tuned during the process as a result of environmental effects and mitigation measures identified during subsequent steps of the process. In accordance with the requirements of the ESP, the final version of the detailed project description must be included in the Environmental Screening Report (ESR).

The Ministry of the Environment and Climate Change (MOECC) has reviewed the portion submitted and has the following to provide at this time:

Potential Groundwater Impacts:
Not discussed within. Phase 2 (steps 6-12) will include the detailed site assessment of potential environmental effects and any mitigation measures to address potential impacts.

Potential Surface water Impacts:
Not discussed within. Phase 2 (steps 6-12) will include the detailed site assessment of potential environmental effects and develop mitigation measures.

Land-Use Compatibility:
MOECC has a mandate under the *Environmental Protection Act* to minimize the exposure of any person, property, plant or animal life to off-site potential negative effects associated with the operation of certain facilities. To address this concern, the principles of land use compatibility should be considered during the Environmental Screening Process.

Potential land use compatibility issues would include land use conflicts that may result from either a new facility location so that an existing sensitive use (ie. Residential development or other sensitive use) is captured within the facility's influence area, or from a new sensitive land use locating within the influence area of the facility. We would encourage the proponents to ensure that the principles of land use compatibility, as summarized above and articulated in MOECC Guidelines, are considered during the screening process and reflected in the Environmental Screening Report.

Further detail is included in the following MOECC Guidelines:

- *Guideline D-1: Land Use Compatibility;*
- *Procedure D-1: Land Use Compatibility; Implementation;*
- *Procedure D-1-3: Land Use Compatibility Definitions;*
- *Guideline D-4: Land Use On or Near Landfills and Dumps.*

The documents listed above are available on the Ontario website at:
https://www.ontario.ca/search/search-results?query=Land%20use%20compatibility

Appendix B July 2017 Open House Material
Names and email addresses from the Sign In Sheet for the Public Information Centre (6th page in appendix of the PDF document) may be redacted.

Appendix C Screening Assessment of Alternatives To
The pages herein contain reference to the Terms of Reference (TofR) that was undertaken in preparation of an Individual EA and no longer has relevance to this document as you are now following the process for a Class EA under the Waste Regulation. Please update the information included to reflect this new direction.

Other
Information regarding the details of your proposal should be presented in the main body of the report and not only presented in supplementary studies. The Environmental Screening Report (ESR) for this project should clearly describe details regarding this portion of your project

MOECC suggests including overall document page numbers and updating the table of contents accordingly for increased readability (specifically for readers utilizing the digital copy only). Appendices do not have associated page numbers, and are confusing to read through—some are remnants from the TofR process. Since this project is no longer going through an Individual EA, the next steps section dealing with TofR should be removed from this document.

Our review did not find any reference for the need to amend the existing ECA in order to permit the proposed expansion. After completion of steps 6-12 and once the 60 day public review period has ended, and should there be no requests for elevation to the Director of EAPB, the Municipality will be in a position to make an application to MOECC to amend the existing Environmental Certificate of Approval A7266501. Please also include in the EA document, a list of all subsequent permits or other approvals that may be required for the implementation of the preferred alternative, including Permits to Take Water, ECAs or other ministerial approvals, and conservation authority permits.

We recommend that the proponent engage in consultation with the MOECC Environmental Approvals and Permissions Branch with respect to any ECA requirements for the proposed works. Any consultation with agencies should then be documented and included in the report. MOECC notes that technical support staff encouraged a consultation meeting initially when this project went through the individual EA process. It would be beneficial for you to meet with MOECC staff to discuss this project as it has changed and is now going through the Class EA process.

This concludes MOECC's comments regarding the submitted material. Should you or any members of your project team have any questions, please feel free to contact me at mira.majerovich@ontario.ca or 807-475-1717.

Sincerely,

Mira Majerovich
Planner/EA Coordinator, MOECC Northern Region, Thunder Bay

cc: Paula Allen, APEP Supervisor MOECC
Kirk Crosson, Senior Environmental Officer, MOECC

File: EA 08 04 Wawa Municipality: Expansion of the Waste Disposal Site

Ministry of the Environment and Climate Change

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Ontario

July 29, 2016

The Corporation of the Municipality of Wawa
Attention: Kristin Sherlock, Kresin Engineering
40 Broadway Avenue
P.O. Box 500
Wawa, ON P0S 1K0

Dear Ms. Sherlock:

Re: **Wawa Landfill**
The Corporation of the Municipality of Wawa
Environmental Screening Process for Waste Management Projects
Response to Notice of Commencement

This letter is our response to the Notice of Commencement for the above noted project. This response acknowledges that the Corporation of the Municipality of Wawa has indicated that its study is following the Environmental Screening Process for Waste Management Projects, under Regulation 101/07.

Thank you for the opportunity to comment on this project.

Based on the information submitted, we have identified the following key project details with respect to the proposed undertaking:

- The Municipality's waste disposal site, located approximately 1.7km east of Highway 17 on High Falls Road has been serving area residents since 1980.
- The site is approximately 22 hectares in size, of which 2.6 hectares are approved for use and operation as a fill area and operates under an Environmental Compliance Approval issued by the Ministry of the Environment and Climate Change.
- The municipal waste disposal site accepts post-diversion waste generated within the communities of Wawa and Hawk Junction as well as the Village of Michipicoten River.
- Waste is also accepted seasonally from Lake Superior Provincial Park.
- Approximately five (5) years of disposal capacity remains at the site.

Consultation with First Nation and Métis Communities

Your proposed project may have the potential to affect Aboriginal communities who hold or claim Aboriginal or treaty rights protected under Section 35 of Canada's *Constitution Act* 1982.

The Crown has a duty to consult First Nation and Métis communities when it knows about established or credibly asserted Aboriginal or treaty rights, and contemplates decisions or actions that may adversely affect them.

Although the Crown remains responsible for ensuring the adequacy of consultation with potentially affected Aboriginal communities, it may delegate procedural aspects of the consultation process to project proponents.

The environmental assessment process requires proponents to consult with interested persons and government agencies, including those potentially affected by the proposed project. This includes a responsibility to conduct adequate consultation with First Nation and Métis communities.
The Ministry relies on consultation conducted by proponents when it assesses the Crown's obligations and directs proponents during the regulatory process.

Where the Crown's duty to consult is triggered in relation to your proposed project, the Ontario Ministry of the Environment is delegating the procedural aspects of rights-based consultation to you through this letter.

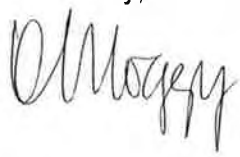
Steps that you may need to take in relation to Aboriginal consultation for your proposed project are outlined in the attached "Aboriginal Consultation Information" document. Please complete the checklist contained there, and keep related notes as part of your consultation record. Doing so will help you assess your project's potential adverse effects on Aboriginal or treaty rights.

You must contact the Director, Environmental Approvals Branch if you have reason to believe that your proposed project may **adversely affect an Aboriginal or treaty right**, **consultation has reached an impasse**, or if an **elevation request** is anticipated. The Ministry will then assess the extent of any Crown duty to consult in the circumstances, and will consider whether additional steps should be taken and what role you will be asked to play in them.

A draft copy of the Environmental Study Report (ESR) at Step 5 and Step 8 should be sent to the appropriate Ministry of Environment and Climate Change regional office prior to the filing of the final report as applicable, allowing a minimum of 30 days for the ministry's technical reviewers to provide comments. Please also forward the Notice of Completion and ESR to the appropriate regional office when completed

Should you or any members of your project team have any questions regarding the material above, please contact me at (705) 564-3254.

Yours truly,



Derrick Moggy
Environmental Assessment Coordinator/Environmental Planner

c. Brian Cameron, MOECC

Attachment

Michael Kresin

From: Jesse Fieldwebster <JesseF@metisnation.org>
Sent: Thursday, April 05, 2018 10:59 AM
To: Kristen Sherlock
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Follow Up Flag: Follow up
Flag Status: Flagged

Yes please.

Jesse Fieldwebster, M. Eng.
Consultation Assessment Coordinator
Métis Nation of Ontario
355 Cranston Crescent PO Box 4
Midland, Ont. L4R-4K6
PH: 705-526-6335 ext.220
FX: 705-526-7537
E: JesseF@metisnation.org
W: www.metisnation.org

From: Kristen Sherlock [mailto:kristen@kresinengineering.ca]
Sent: April-05-18 11:01 AM
To: Jesse Fieldwebster
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Thank you for your response. Are you wanting to remain on our contact list in the future for this project?

From: Jesse Fieldwebster [mailto:JesseF@metisnation.org]
Sent: Thursday, April 05, 2018 10:57 AM
To: Kristen Sherlock <kristen@kresinengineering.ca>
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Hello Kristen,

We are not intending to present comments.

Thank you for reaching out.

Sincerely,

Jesse Fieldwebster, M. Eng.
Consultation Assessment Coordinator
Métis Nation of Ontario
355 Cranston Crescent PO Box 4
Midland, Ont. L4R-4K6
PH: 705-526-6335 ext.220
FX: 705-526-7537
E: JesseF@metisnation.org
W: www.metisnation.org

From: Kristen Sherlock [mailto:kristen@kresinengineering.ca]
Sent: March-22-18 3:55 PM
To: Jesse Fieldwebster
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Good afternoon,

It's been over 6 weeks since the Phase I report was sent to your organization. Is it your intention to provide comments? If so, please let me know when I can expect to receive them.

Regards,
Kristen Sherlock

From: Kristen Sherlock
Sent: Monday, February 05, 2018 10:27 AM
To: 'JesseF@metisnation.org' <JesseF@metisnation.org>
Subject: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

February 5, 2018.
KEC Ref. 1140.09
By Email: JesseF@metisnation.org

Attention: Mr. Jesse Fieldwebster, Métis Nation of Ontario

Dear Mr. Jesse Fieldwebster:

Re: Municipality of Wawa
Municipal Waste Disposal Site Expansion

Environmental Screening Process – Phase I Report: Steps 1-4

Attached for your review is a flow chart outlining the screening steps required as part of the Ministry of the Environment's Environmental Screening Process as well as a report summarizing the completed steps 1 to 4 of the screening process for the Municipality of Wawa municipal waste disposal site expansion. The report identifies the project's problem/opportunity statement and provides a project description. The report also summarizes the results of the application of the environmental screening criteria checklist and identifies the potential effects of the project on the environment.

Should you or your agency have any comments or suggestions following your review of the attached document, please respond either by email (kristen@kresinengineering.ca), telephone (705-949-4900), fax (705-949-9965) or mail so that they can be included in the final Environmental Screening Report.

If you have any questions or require clarification regarding the contents of this letter, or the undertaking in general, please call.

Yours very truly,
Kresin Engineering Corporation

Kristen Sherlock, BESc.
Engineering Intern
Encl.

letter re ESR steps 1-4 report.doc

Michael Kresin

From: Tracy Alexander <TAlexander@algomapublichealth.com>
Sent: Wednesday, April 04, 2018 2:08 PM
To: Kristen Sherlock
Cc: Chris Spooney
Subject: FW: Comments on Municpality of Wawa Expansion of Municipal Waste Disposal Site Environmental Screening Process
Attachments: Scanned from a Xerox Multifunction Device.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Tracy Alexander
ALGOMA PUBLIC HEALTH
294 Willow Ave
Sault Ste. Marie ON P6B 0A9
(705) 759-5286
(705) 541-7346 fax
www.algomapublichealth.com

Algoma
PUBLIC HEALTH
Santé publique Algoma
www.algomapublichealth.com

April 4, 2018

KRISTEN SHERLOCK,
KRESIN ENGINEERING CORPORATION
536 FOURTH LINE EAST
SAULT STE. MARIE, ON, P6A 6JB

VIA EMAIL: Kristen@kresinengineering.ca

Dear Ms. Sherlock:

RE: Comments on Municipality of Wawa Expansion of Municipal Waste Disposal Site Environmental Screening Process

Algoma Public Health has reviewed the above report Phase 1 Steps 1-4 and has a few comments.

1. Currently the site is a natural attenuation site. It was not noted in the report if the proponent is considering including technology in the expansion to decrease the negative impacts of the waste disposal including capturing leachate and emissions.

    a. The report states that the ground water has a high likelihood to be adversely affected by this expansion. Will the project include corrective/preventative engineering techniques such as utilizing a liner to capture leachate and then properly dispose to protect the groundwater?
    Note: The Michipicoten River is only 200m away and meanders on three sides of the site which has well-draining sandy soil.
    b. The report states that the expansion of the site will increase greenhouse gases being emitted. Is there a process going to be considered to capture the methane to reduce greenhouse gases?

2. The report mentions a few waste diversion management programs however it does not indicate if these programs will be expanded.

    a. Are there plans to expand the Municipal Hazardous and Special Waste collection day? Could the municipality increase the availability /days to redirect hazardous waste?
    b. Is there a recycling program in the municipality? Will the municipality consider having a recycling plan as part of the approval process for the expansion?

c. Is there a program to encourage composting? Will the municipality consider having a promotion of composting plan?

If you have any questions or concerns, please contact me at:
cspooney@algomapublichealth.com or 705-356-2551 ext. 5000

For healthier communities,

Chris Spooney, CPHI(C), BHSc
Environmental Health Manager

/ta

Michael Kresin

From: Withers, Kelly <Kelly.Withers@brookfieldrenewable.com>
Sent: Tuesday, April 03, 2018 4:22 PM
To: Kristen Sherlock
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Oh, that's too bad, I have heard similar stories. I hope you find something, that can be a challenge in this area too.

From: Kristen Sherlock [mailto:kristen@kresinengineering.ca]
Sent: Tuesday, April 03, 2018 4:21 PM
To: Withers, Kelly <Kelly.Withers@brookfieldrenewable.com>
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Thank you Kelly for the suggestion but I am no longer affiliated with the club. The current board of directors are something else! So after 3+ years there I have to find a new place to board! Such is life!

From: Withers, Kelly [mailto:Kelly.Withers@brookfieldrenewable.com]
Sent: Tuesday, April 03, 2018 4:18 PM
To: Kristen Sherlock <kristen@kresinengineering.ca>
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Hi Kristen! It is a small town! I hope you guys found a pony. Another person that has a few of them is Lisa Tarum Leclaire, I'm not sure if she will part with any but it doesn't hurt to ask.

From: Kristen Sherlock [mailto:kristen@kresinengineering.ca]
Sent: Tuesday, April 03, 2018 3:38 PM
To: Withers, Kelly <Kelly.Withers@brookfieldrenewable.com>
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Absolutely ☺

Thank you.

FYI, this is the same Kristen that inquired about your cute pony to lease for strathclair (I'm friends with Danielle Punch). Small world!

From: Withers, Kelly [mailto:Kelly.Withers@brookfieldrenewable.com]
Sent: Tuesday, April 03, 2018 3:36 PM
To: Kristen Sherlock <kristen@kresinengineering.ca>
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Hi Kristen,

Can you keep us on the list so that we know what's going on?
Thanks – Kelly

From: Kristen Sherlock [mailto:kristen@kresinengineering.ca]
Sent: Tuesday, April 03, 2018 3:31 PM
To: Withers, Kelly <Kelly.Withers@brookfieldrenewable.com>
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Hi Kelly,

Do you want to remain on the contact list for future reports?

Regards,
Kristen

From: Withers, Kelly [mailto:Kelly.Withers@brookfieldrenewable.com]
Sent: Tuesday, April 03, 2018 3:30 PM
To: Kristen Sherlock <kristen@kresinengineering.ca>
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Hi Kristen,
We do not intend to provide comments on this report. Sorry for the delay in responding.
Thanks,

Kelly

From: Kristen Sherlock [mailto:kristen@kresinengineering.ca]
Sent: Thursday, March 22, 2018 3:54 PM
To: Withers, Kelly <Kelly.Withers@brookfieldrenewable.com>
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Good afternoon,

It's been over 6 weeks since the Phase I report was sent to your organization. Is it your intention to provide comments? If so, please let me know when I can expect to receive them.

Regards,
Kristen Sherlock

From: Kristen Sherlock
Sent: Monday, February 05, 2018 10:28 AM
To: 'kelly.withers@brookfieldrenewable.com' <kelly.withers@brookfieldrenewable.com>
Subject: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

February 5, 2018.
KEC Ref. 1140.09
By Email: kelly.withers@brookfieldrenewable.com

Attention: Ms. Kelly Withers, Brookfield Renewable Power Inc.

Dear Ms. Kelly Withers:

Re: Municipality of Wawa
Municipal Waste Disposal Site Expansion
Environmental Screening Process – Phase I Report: Steps 1-4

Attached for your review is a flow chart outlining the screening steps required as part of the Ministry of the Environment's Environmental Screening Process as well as a report summarizing the completed steps 1 to 4 of the screening process for the Municipality of Wawa municipal waste disposal site expansion. The report identifies the project's problem/opportunity statement and provides a project description. The report also summarizes the results of the application of the environmental screening criteria checklist and identifies the potential effects of the project on the environment.

Should you or your agency have any comments or suggestions following your review of the attached document, please respond either by email (kristen@kresinengineering.ca), telephone (705-949-4900), fax (705-949-9965) or mail so that they can be included in the final Environmental Screening Report.

If you have any questions or require clarification regarding the contents of this letter, or the undertaking in general, please call.

Yours very truly,
Kresin Engineering Corporation

Kristen Sherlock, BESc.
Engineering Intern
Encl.

letter re ESR steps 1-4 report.doc

Michael Kresin

From: Elkow, Jeff (MTCS) <Jeff.Elkow@ontario.ca>
Sent: Friday, March 23, 2018 8:32 AM
To: Kristen Sherlock
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Follow Up Flag: Follow up
Flag Status: Flagged

Kristen,

We have reviewed the Phase 1 Report and have the following comment:

MTCS acknowledges the commitment in Section 5.6 of the Phase 1 Report to undertake an Archaeological Assessment on the subject lands. MTCS recommends completion of the Archaeological Assessment as soon as possible as its results have the potential to impact the project footprint.

Please let me know if you have any questions.

Regards,

Jeff Elkow, M.A.
Heritage Planner
Heritage Program Unit | Programs and Services Branch | Ministry of Tourism, Culture and Sport
401 Bay Street Suite 1700 Toronto ON M7A 0A7
Tel. 416.314.7182 | email: jeff.elkow@ontario.ca

From: Kristen Sherlock [mailto:kristen@kresinengineering.ca]
Sent: Thursday, March 22, 2018 3:53 PM
To: Kirzati, Katherine (MTCS); Elkow, Jeff (MTCS)
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Good afternoon,

It's been over 6 weeks since the Phase I report was sent to your agency. Is it your intention to provide comments? If so, please let me know when I can expect to receive them.

Regards,
Kristen Sherlock

From: Kristen Sherlock
Sent: Monday, February 05, 2018 10:41 AM
To: 'Kirzati, Katherine (MTCS)' <Katherine.Kirzati@ontario.ca>; Elkow, Jeff (MTCS) <Jeff.Elkow@ontario.ca>
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Katherine – Ok. Good luck with your other duties.

Jeff - Could you please email me with your full contact info (position, address etc)?

Regards,
Kristen

From: Kirzati, Katherine (MTCS) [mailto:Katherine.Kirzati@ontario.ca]
Sent: Monday, February 05, 2018 10:38 AM
To: Kristen Sherlock <kristen@kresinengineering.ca>; Elkow, Jeff (MTCS) <Jeff.Elkow@ontario.ca>
Subject: FW: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Thank you Kristen.

I'm forwarding to my colleague Jeff Elkow, who is taking over my files while I temporarily take on other duties.

Regards, Katherine

From: Kristen Sherlock [mailto:kristen@kresinengineering.ca]
Sent: February-05-18 10:26 AM
To: Kirzati, Katherine (MTCS)
Subject: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

February 5, 2018.
KEC Ref. 1140.09
By Email: katherine.kirzati@ontario.ca

Attention: Ms. Katherine Kirzati, Ministry of Tourism, Culture and Sport

Dear Ms. Katherine Kirzati:

Re: Municipality of Wawa
Municipal Waste Disposal Site Expansion
Environmental Screening Process – Phase I Report: Steps 1-4

Attached for your review is a flow chart outlining the screening steps required as part of the Ministry of the Environment's Environmental Screening Process as well as a report summarizing the completed steps 1 to 4 of the screening process for the Municipality of Wawa municipal waste disposal site expansion. The report identifies the project's problem/opportunity statement and provides a project description. The report also summarizes the results of the application of the environmental screening criteria checklist and identifies the potential effects of the project on the environment.

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If you have any questions or require clarification regarding the contents of this letter, or the undertaking in general, please call.

Yours very truly,
Kresin Engineering Corporation

Kristen Sherlock, BESc.
Engineering Intern
Encl.

letter re ESR steps 1-4 report.doc

Michael Kresin

From: Degilio, Michael <michael.degilio@algomapower.com>
Sent: Thursday, March 22, 2018 11:34 PM
To: Kristen Sherlock
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Kristen,

My apologies for not replying to you sooner. I've had the opportunity to review the results of the Phase I report and Algoma Power has no issues or concerns with regards to the identified potential environmental effects.

Thank you and Kind Regards,
Michael

Michael Degilio, EIT
Distribution Engineer in Training
Algoma Power
2 Sackville Road, Suite A | Sault Ste. Marie, ON P6B 6J6
Tel: 705.256.3850 x5841
Email: michael.degilio@algomapower.com

From: Kristen Sherlock <kristen@kresinengineering.ca>
Sent: March-22-18 3:54 PM
To: Degilio, Michael <michael.degilio@algomapower.com>
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Good afternoon,

It's been over 6 weeks since the Phase I report was sent to your organization. Is it your intention to provide comments? If so, please let me know when I can expect to receive them.

Regards,
Kristen Sherlock

From: Kristen Sherlock
Sent: Monday, February 05, 2018 10:28 AM
To: 'michael.degilio@algomapower.com' <michael.degilio@algomapower.com>
Subject: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

February 5, 2018.
KEC Ref. 1140.09
By Email: michael.degilio@algomapower.com

Attention: Mr. Michael Degilio, Algoma Power Inc.

Dear Mr. Michael Degilio:

Re: Municipality of Wawa
Municipal Waste Disposal Site Expansion
Environmental Screening Process – Phase I Report: Steps 1-4

Attached for your review is a flow chart outlining the screening steps required as part of the Ministry of the Environment's Environmental Screening Process as well as a report summarizing the completed steps 1 to 4 of the screening process for the Municipality of Wawa municipal waste disposal site expansion. The report identifies the project's problem/opportunity statement and provides a project description. The report also summarizes the results of the application of the environmental screening criteria checklist and identifies the potential effects of the project on the environment.

Should you or your agency have any comments or suggestions following your review of the attached document, please respond either by email (kristen@kresinengineering.ca), telephone (705-949-4900), fax (705-949-9965) or mail so that they can be included in the final Environmental Screening Report.

If you have any questions or require clarification regarding the contents of this letter, or the undertaking in general, please call.

Yours very truly,
Kresin Engineering Corporation

Kristen Sherlock, BESc.
Engineering Intern
Encl.

letter re ESR steps 1-4 report.doc

Michael Kresin

From: Ontario Region / Region d'Ontario (CEAA/ACEE) <CEAA.ontario.ACEE@ceaa-acee.gc.ca>
Sent: Tuesday, February 06, 2018 10:11 AM
To: Kristen Sherlock
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4
Attachments: Email - Municipality of Wawa Waste Expansion - Letter A - 2015-05-07

Dear Ms. Sherlock,

Please find previous correspondence related to this project.

If the project details have not changed, we kindly request that you remove us from your distribution list.

Kind Regards,
Caitlin

Caitlin Cafaro
Administrative Clerk, Ontario
Canadian Environmental Assessment Agency / Government of Canada
caitlin.cafaro@ceaa-acee.gc.ca/ Tel: 416-952-1576

Caitlin Cafaro
Commis à l'administration, Ontario
Agence canadienne d'évaluation environnementale / Gouvernement du Canada
caitlin.cafaro@ceaa-acee.gc.ca / Tél. : 416-952-1576

From: Kristen Sherlock [mailto:kristen@kresinengineering.ca]
Sent: February 5, 2018 10:27 AM
To: Puvananathan,Anjala [CEAA]
Subject: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

February 5, 2018.
KEC Ref. 1140.09
By Email: anjala.puvananathan@ceaa-acee.gc.ca

Attention: Ms. Anjala Puvananathan, Canadian Environmental Assessment Agency

Dear Ms. Anjala Puvananathan:

Re: Municipality of Wawa
Municipal Waste Disposal Site Expansion

Environmental Screening Process – Phase I Report: Steps 1-4

Attached for your review is a flow chart outlining the screening steps required as part of the Ministry of the Environment's Environmental Screening Process as well as a report summarizing the completed steps 1 to 4 of the screening process for the Municipality of Wawa municipal waste disposal site expansion. The report identifies the project's problem/opportunity statement and provides a project description. The report also summarizes the results of the application of the environmental screening criteria checklist and identifies the potential effects of the project on the environment.

Should you or your agency have any comments or suggestions following your review of the attached document, please respond either by email (kristen@kresinengineering.ca), telephone (705-949-4900), fax (705-949-9965) or mail so that they can be included in the final Environmental Screening Report.

If you have any questions or require clarification regarding the contents of this letter, or the undertaking in general, please call.

Yours very truly,
Kresin Engineering Corporation

Kristen Sherlock, BESc.
Engineering Intern
Encl.

letter re ESR steps 1-4 report.doc

Michael Kresin

From: Cafaro,Caitlin [CEAA] <Caitlin.Cafaro@ceaa-acee.gc.ca>
Sent: Thursday, May 07, 2015 1:05 PM
To: Kristen Sherlock
Subject: Email - Municipality of Wawa Waste Expansion - Letter A - 2015-05-07
Attachments: Letter - Municipality of Wawa Waste Expansion - Letter A - 2015-05-01.pdf

Dear Ms. Sherlock,

Please find letter attached.

Kind Regards,
Caitlin Cafaro

Caitlin Cafaro
Environmental Assessment Officer, Ontario
Canadian Environmental Assessment Agency |
Agence canadienne d'évaluation environnementale
55 St. Clair Avenue East, Suite 907 Toronto ON M4T 1M2 |
55 avenue St. Clair Est pièce 907 Toronto ON M4T 1M2
caitlin.cafaro@ceaa-acee.gc.ca
http://www.ceaa-acee.gc.ca
Telephone | Téléphone 416-954-0734
Facsimile | Télécopieur 416-952-1573
Government of Canada | Gouvernement du Canada

Canadian Environmental Assessment Agency
55 St. Clair Avenue East,
Room 907
Toronto ON M4T 1M2

Agence canadienne d'évaluation environnementale
55, avenue St. Clair Est,
plèce 907
Toronto ON M4T 1M2

May 1, 2015

Sent by email

Kristen Sherlock
Kresin Engineering
536 Fourth Line East
Sault Ste. Marie, ON P6A6J8
Kristen@kresinengineering.ca

Dear Ms. Sherlock:

Re: Information on the *Canadian Environmental Assessment Act, 2012*

Thank you for your correspondence of April 14, 2015 regarding the Municipality of Wawa expansion of waste disposal site capacity.

As part of the Government of Canada's plan for Responsible Resource Development, the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) focuses federal environmental reviews on projects that have the potential to cause significant adverse environmental effects in areas of federal jurisdiction.

The CEAA 2012 applies to projects described in the *Regulations Designating Physical Activities* (the Regulations). Based on the information provided, your project does not appear to be described in the Regulations. **Kindly review the Regulations to confirm applicability to the proposed project.**

If your project is in a federally designated wildlife area or migratory bird sanctuary please check section 1 of the Regulations, which details the designated projects specific to those locations.

For more information on CEAA 2012, please access the following links on the Canadian Environmental Assessment Agency's (the Agency) website:

Overview of CEAA 2012
http://www.ceaa.gc.ca/default.asp?lang=En&n=16254939-1

Regulations Designating Physical Activities, and
Prescribed Information for a Description of a Designated Project Regulations
http://www.ceaa.gc.ca/default.asp?lang=En&n=9EC7CAD2-1

.../2

If it appears that CEAA 2012 may apply to your proposed project, you must provide the Agency with a description of the proposed project. Please see the link below to the Agency's guide to preparing a project description.

Guide to Preparing a Description of a Designated Project
http://www.ceaa.gc.ca/63D3D025-2236-49C9-A169-DD89A36DA0E6/Guide_to_Preparing_a_Description_of_a_Designated_Project_under_CEAA_2012.pdf

If you believe the project is not subject to a federal environmental assessment, and do not submit a project description, **we kindly request that you remove the Agency from your distribution list**. If you have questions, please get in touch with our office through the switchboard at 416-952-1576.

Sincerely,

Anjala Puvananathan
Director, Ontario Region
Canadian Environmental Assessment Agency

Cafaro,Caitlin [CEAA]

From:	Kristen Sherlock <kristen@kresinengineering.ca>
Sent:	April 14, 2015 3:53 PM
To:	Puvananathan,Anjala [CEAA]
Subject:	Draft Terms of Reference; expansion of existing waste disposal site; Municipality of Wawa

KRESIN Engineering Corporation

536 Fourth Line East
Sault Ste. Marie, ON P6A 6J8
tel: 705-949-4900
fax: 705-949-9965
email: kristen@kresinengineering.ca

sustainable, practical solutions

April 14, 2015
KEC Ref. 1140.01
By EMail

Attention: Mr. Anjala Puvananathan
Canadian Environmental Assessment Agency - Ontario Region
55 St. Clair Ave. East, 9th Floor
Toronto, ON M4T 1M2

Dear Mr. Puvananathan:

Re: Municipality of Wawa
Expansion of Waste Disposal Site Capacity
Draft Terms of Reference Review

The Municipality of Wawa has initiated the Environmental Assessment (EA) planning process to address the lack of approved disposal capacity at the existing waste disposal site on High Falls Road. The first key step in the EA planning process is the development of a Terms of Reference (ToR) outlining the scope and approach to be taken during the completion of the EA. Information regarding the project is available on the project website at www.kresinengineering.ca (under Projects/Current Projects).

The general public, Aboriginal peoples and government agencies will be provided a Draft Terms of Reference with Consultation Record as suggested by the Ontario Ministry of the Environment and Climate Change (MOECC) Code of Practice.

The purpose of this letter is to inform you of our intent to send you by email a Draft ToR document with corresponding Consultation Record on April 23, 2015. All interested persons, including your group, have 30 days for review. If you prefer to be provided with printed copies of the available information, please let me know by April 22, 2015.

If you have any questions or require clarification regarding the contents of this letter, or the undertaking in general, please call.

Yours very truly,

Kresin Engineering Corporation

Kristen Sherlock, EIT
Engineer-in-Training
1140.01 draft ToR letter of intent.doc

Michael Kresin

From: Keen, Lilian (MOECC) <Lilian.Keen@ontario.ca>
Sent: Monday, February 05, 2018 1:04 PM
To: Kristen Sherlock
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Hi Kristen,

Please see my signature below for contact information.

Lilian

Lilian Keen, B.Sc. ONTARIO
Senior Environmental Officer / Agente principale de l'environnement

Ministry of the Environment and Climate Change / Ministère de l'environnement et de l'action en matière de changement climatique
Sault Ste. Marie Area Office / Bureau du secteur de Sault-Sainte-Marie
70 Foster Drive/promenade Foster, Suite / bureau 110
Sault Ste. Marie / Sault-Sainte-Marie, ON P6A 6V4
Tél: 705.942.6309 toll free/sans frais: 1.800.965.9990 Fax: 705.942.6327

From: Kristen Sherlock [mailto:kristen@kresinengineering.ca]
Sent: February 05, 2018 1:00 PM
To: Crosson, Kirk (MOECC)
Cc: Keen, Lilian (MOECC)
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Kirk – Ok. Thank you.

Lilian - Could you please email me with your full contact info (position, address etc)?

Regards,
Kristen

From: Crosson, Kirk (MOECC) [mailto:Kirk.Crosson@ontario.ca]
Sent: Monday, February 05, 2018 11:56 AM
To: Kristen Sherlock <kristen@kresinengineering.ca>
Cc: Keen, Lilian (MOECC) <Lilian.Keen@ontario.ca>
Subject: RE: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

Please forward like information to Lilian Keen, as she is now the Senior Environmental Office for this area

Thanks

Kirk

From: Kristen Sherlock [mailto:kristen@kresinengineering.ca]
Sent: February-05-18 10:26 AM
To: Crosson, Kirk (MOECC)
Subject: Municipality of Wawa, Municipal Waste Disposal Site Expansion, Environmental Screening Process - Phase I Report: Steps 1-4

February 5, 2018.
KEC Ref. 1140.09
By Email: kirk.crosson@ontario.ca

Attention: Mr. Kirk Crosson, Ministry of the Environment and Climate Change

Dear Mr. Kirk Crosson:

Re: Municipality of Wawa
Municipal Waste Disposal Site Expansion
Environmental Screening Process – Phase I Report: Steps 1-4

Attached for your review is a flow chart outlining the screening steps required as part of the Ministry of the Environment's Environmental Screening Process as well as a report summarizing the completed steps 1 to 4 of the screening process for the Municipality of Wawa municipal waste disposal site expansion. The report identifies the project's problem/opportunity statement and provides a project description. The report also summarizes the results of the application of the environmental screening criteria checklist and identifies the potential effects of the project on the environment.

Should you or your agency have any comments or suggestions following your review of the attached document, please respond either by email (kristen@kresinengineering.ca), telephone (705-949-4900), fax (705-949-9965) or mail so that they can be included in the final Environmental Screening Report.

If you have any questions or require clarification regarding the contents of this letter, or the undertaking in general, please call.

Yours very truly,
Kresin Engineering Corporation

Kristen Sherlock, BESc.
Engineering Intern
Encl.

letter re ESR steps 1-4 report.doc

Appendix K
Archaeological Assessment

ORIGINAL REPORT

STAGE 1 ARCHAEOLOGICAL ASSESSMENT OF THE PROPOSED LANDFILL EXPANSION SITE FOR THE MUNICIPALITY OF WAWA IN THE DISTRICT OF ALGOMA, ONTARIO

REPORT AUTHOR
Dave Norris
Woodland Heritage Services
140 Strathcona Avenue
Thunder Bay, ON P7A 1S3
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E: dave.norris@woodlandheritage.com

PROJECT INFORMATION
Location: Municipality of Wawa,
District of Algoma
PIF P307-0133-2021

PROPONENT INFORMATION
Kresin Engineering Corporation
536 Fourth Line East
Sault Ste. Marie, ON
P6A 6J8
Attn: Ryan Wilson
T: (705) 949-4900
E: ryan@kresinengineering.ca

Report completed: June 3, 2021
Report Submitted: June 8, 2021

WOODLAND
HERITAGE NORTHWEST

Executive Summary

The Municipality of Wawa is proposing an expansion to an existing landfill situated within the Municipality of Wawa, in an uncategorized area in the District of Algoma, Ontario. On behalf of Kresin Engineering Corporation, Woodland Heritage Northwest was contacted to complete the required Stage 1 Archaeological Assessment to determine both potential and possible presence of unknown archaeological materials prior to development.

The archaeological assessments were undertaken in accordance with the requirements of the *Ontario Heritage Act (R.S.O. 1990)*, *Municipal Planning Act*, and the *Standards and Guidelines for Consulting Archaeologists (2011)*. All archaeological consulting activities were performed under the Professional Archaeological Licence of David Norris (P307).

The Subject property is situated in the Canadian Shield (Section 1.3.3, Standard 1).

During Stage 1 Archaeological Assessment, 100% of the area was inspected for archaeological potential in the form of features indicating past water sources, elevated topography, relic shorelines and distinctive land formations according to Section 1.3 of the Standards and Guidelines for Consulting Archaeologists (MTCS 2011). The Stage 1 Assessment indicated no features of archeological potential existed in the expansion area of the property.

Archaeological recommendations have been made based on the background historic research, property inspection, location of known or registered archaeological sites, previous archaeological assessments, and indicators of archaeological potential. These recommendations are summarized in Section 5 of this report and are as follows:

- No further archaeological assessment is required for the proposed new landfill expansion site situated in the Municipality of Wawa, District of Algoma, Ontario.

The Ontario Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) is asked to review the results presented and to accept this report into the Ontario Public Register of Archaeological Reports. Archaeological sites recommended for further archaeological fieldwork or protection remain subject to Section 48 (1) of the Ontario Heritage Act and may not be altered, or have artifacts removed from them, except by a person holding an archaeological licence with local First Nation community authorization.

Table of Contents

List of Maps

List of Photographs

Project Personnel

Field Director	David Norris (P307)
Field Inspection	David Norris (P307) Leia MacKay
Archival Research	David Norris (P307)
Report Preparation	David Norris (P307)
Report Review	Arlene Lahti M.Sc.

1.0 Project Context

1.1 Objectives of Archaeological Assessments

The objectives of a Stage 1 archaeological assessment, as outlined by the Standards and Guidelines for Consultant Archaeologists (2011 MTCS), are as follows:

- To provide information about the property's geography, history, previous archaeological fieldwork and current land condition;
- To evaluate in detail the property's archaeological potential, which will support recommendations for Stage 2 survey for all or parts of the property if required; and
- To recommend appropriate strategies for Stage 2 survey if necessary

The Stage 1 assessment can include a physical property inspection if possible and is highly recommended to determine the current land condition.

1.2 Development Context

The Municipality of Wawa is proposing the development of a new landfill site situated in the Municipality of Wawa, in the District of Algoma, Ontario. On behalf of Kresin Engineering Corporation, Woodland Heritage Northwest was contacted to complete the required archaeological assessment to determine both potential and possible presence of unknown archaeological materials prior to development.

The landfill site is situated approximately 11 km to the south of the town of Wawa (Map 1). The proposed development is situated north along the Mitchipicoten River that flows from Lake Superior. The site consists of a containment attenuation area that measures 350 m north to south and approximately 300 m east to west (Map 2). This containment attenuation area will not be disturbed or impacted by the development and was not assessed during this survey. Immediately to the west of this area is the landfill site actual which measures 250 m north to south and approximately 75 m east to west (Map 2). There is a 50 m buffer that surrounds the landfill site actual that was inspected as part of the Stage 1 Archaeological Assessment (Map 2).

The assessment was conducted under the management and direction of licence holder David Norris (PIF P307-0093-2018). All activities were completed in accordance with the terms of the Planning Act, R.S.O. 1990 P.13, the Ontario Ministry of Heritage, Sport, Tourism, and Culture Industries (MHSTCI) 2011 *Standards and Guidelines for Consultant Archaeologists,* as required by the *Ontario Heritage Act (R.S.O. 1990).*

1.3 Historical Context

1.3.1 Terminology

The history for northern Ontario has been reconstructed from the documentation of archaeological sites and recovered material remains which has been compiled and categorized to represent several periods of pre-history. Although previous work has been limited, the designation of these periods is also impacted by several issues that are relevant to working within the boreal forest environment. Most notable is the acidity of the soils which obscures

and degrades organic materials (Dawson 1983). This degradation of organic materials prevents adequate and accurate dating of archaeological sites, thus, in the absence of absolute dates, any interpretation of data must be done on a relative scale.

Compounding the issue of a relative time frame of culture history is the lack of stratification and biomechanical processes that affect the soils within the region. Pedoturbation, or the actions upon artifacts, such as the burrowing of animals (faunalturbation), freeze-thaw cycles (cryoturbation), disturbances by living plants (floralturbation), and forest fires play an adverse role in the distribution of artifacts within the archaeological record from any time period (Courchesne et al. 2012; Hinshelwood 1996). These actions, as well as collapsed or relatively thin soil profiles make the interpretation of archaeological context incredibly difficult. None-the-less, archaeological investigative measures have been developed to address these issues and to aid in the development of an acceptable material culture history.

A note on terminology.

The segregation of Ontario's prehistory includes the term "Paleoindian" which is a non-Indigenous label. Indigenous views suggest that they are and were all one people and that this viewpoint is important in understanding their social, economic, and political reproduction (Harris 2005; Million 2005; Nicholas 2005; Hazell 2019). The label "Paleoindian" was meant as a means to designate the first peoples who migrated into the areas of North America, but the culturally laden term "Indian" is a racialized term that has been imposed on a group of people by those who colonized their lands (Hinshelwood 2019:10). It falsely allows the archaeologist to believe that they are being objective when it is used (Hinshelwood 2019:10). Therefore, to decolonize the use of such terminology and adhere to a more culturally appropriate means of identifying those ancestors of whom material culture we study, the term "Paleo Indigenous" will be used. The term "Paleo" can be defined as meaning "early" or "ancient" and in this case the discussion revolves around initial peopling of the area, while "Indigenous" is a term meaning original inhabitants of the land.

It should also be noted that terminology used in the Woodland sections below consist of labels created and used by archaeologists to denote artifacts dated to specific time periods. These labels define the material culture (i.e., artifacts) recovered from archaeological sites and are not intended to label the groups that made them or reflect how the groups identified with each other.

1.3.2 Pre-Contact Period

Traditionally, the history of northern Ontario has been categorized into three main periods: (1) Paleoindigenous (10,000 to 7,000 BP); (2) Archaic 7,000 to 2,500 BP); and (3) Woodland (2500 to 400 BP). A fourth period, the Historic (400 to present) can be assigned to the latter portion of the cultural chronology since it involves the contact and introduction of Europeans and their material culture. The first three periods are based on differences in artifact content that represents technological and cultural changes through time.

1.3.2.1 Paleoindigenous Period (ca. 10,000 – 7,000 years B.P. [Before Present])

Sites that are of a Paleoindigenous cultural affiliation are rare in northern Ontario, and research on them is limited. Fox (1975) assessed the majority of Paleoindigenous sites in the north and

identified a cultural entity known as the “Lakehead Complex”. It is a discrete and temporal cluster of Late Paleoindigenous sites, which are associated with the middle, and late development stages of Lake Minong (Fox 1975). These sites have been found across a broad area extending from east of Lake Nipigon to as far west as the Manitoba border. Many of these sites tend to cluster along the Gunflint formation, which is a broad band of siliceous rock, which extends west from Pass Lake to Gunflint Lake (Adams 1993). It should be noted that since Fox’s (1975) assessment of Paleoindigenous sites in northern Ontario, there has been very little research on Paleoindigenous sites in Northern Ontario.

The current understanding of the Lakehead Complex Paleoindigenous artifact assemblage is limited to non-organic materials, primarily stone tools. Manufactured artifacts from materials such as taconite and silicified sandstone are what remain, offering a limited glimpse into the culture.

Due to the antiquity of the sites and the relative acidic nature of boreal forest soils, wood, bone, skins, bark and other natural materials which were commonly used are rarely preserved on such sites, eliminating valuable evidence that can be used to interpret the early lifeways of the people occupying the sites. This also produces a problem when trying to fit sites into a chronological sequence. With little or no organic materials surviving the taphonomic record, there is little material for radiometric absolute dating and other dating techniques have not been attempted until recently. Therefore, establishing a firm chronology of the occupation of northern Ontario is not possible at the present time. Fortunately, the association of many Paleoindigenous sites with the shorelines of Lake Minong and Lake Agassiz indicates that these sites cannot predate the formation of these features. This is not to say that there are no sites inland, along smaller lakes and rivers. However, beaches, bay mouth bars and spits of post-glacial shorelines permitted easy movement of people and provided access to ample subsistence resources, so sites are most often found on these types of land forms.
It appears that people may have entered the eastern Lake Superior/northern Lake Huron area about 9,000 years ago, while archaeological work farther north in the Hudson’s Bay Lowlands suggests that human occupation there may be limited to about the last 6,000 years.

1.3.2.2 Archaic Period (ca. 7,000 – 2500 years BP)

An environmental transition brought about warmer, drier conditions resulting in a change in the plant and animal communities, which consequently impacted the subsistence patterns of humans living in the region now represented by north-central Ontario. These alterations of subsistence patterns are reflected in the artifact assemblages. For instance, in response to the hunting of smaller game, large spear points were replaced by smaller, notched projectile points and stone knives generally became smaller. A new technology involving the production of stone tools by grinding rather than chipping was also utilized.

About 5,000 B.P., people started to make use of copper, which was cold-hammered to form spear points, knives, gaff hooks and elaborate jewelry. One of the most complete copper assemblages for northwestern Ontario comes from a burial south of Lake Nipigon, dating to about 3,500 B.P.

1.3.2.3 Initial Woodland Period (ca. 2500 – 1150 years B.P.)

Perhaps the most active period in precontact history, the Woodland period represents a vast technological revolution, with the introduction of pottery, the shift from spear points to the bow and arrow and the large-scale use of wild rice as a staple food. The Woodland period is divided into Early, Middle and Late phases and each designation is represented by more advanced technological innovation.

In northern Ontario, there is little to no evidence of Initial Woodland cultures. Either sites haven't been found, or the criteria used to identify Initial Woodland sites are not present in the region. Criteria for establishing Early Woodland sites include the presence of pottery and projectile points which are small, well-shaped and used with bow and arrow hunting rather than as spear points.

The Middle Woodland period is represented in northern Ontario by the appearance of pottery assigned to the Laurel Configuration (after Reid and Rajnovich 1991). Geographically, the distribution of Laurel sites range from northeast central Saskatchewan, through a large portion of central Manitoba and northern Minnesota to northern Michigan and northern Ontario (the central-west appearance in Saskatchewan was identified by Dr. David Meyer (per comm. 2004). The first appearance of Laurel pottery comes from Minnesota (Wilford 1955), thus it appears to represent a migration of peoples or ideas north into Ontario. The broad distribution means that there are many styles of pottery representing regional expressions. Reid and Rajnovich (1991) summarized Laurel pottery into three main complexes: (1) Manitoba Lakes; (2) Boundary Waters; and (3) Superior. Characteristics of Laurel pottery include thick, conoidal vessels (made by coiling) with pseudo-scallop and linear stamping in short vertical motifs around the upper portions and smoothed out bodies on the remaining portions of the vessel (Reid and Rajnovich 1991). Although the chronological time span of Laurel pottery is under contention, a rough estimation beginning approximately 100 B.C. and lasting to 1300 A.D. was proposed by Reid and Rajnovich (1991).

1.3.2.4 Terminal/Late Woodland Period (ca. 1150 to 400 B.P.)

The Late or Terminal Woodland period in northern Ontario represents a wide dispersal of technological traits in terms of pottery styles and manufacturing techniques. The most predominate pottery style is from the Blackduck horizon. The geographical distribution of Blackduck pottery ranges from west-central Saskatchewan, through Manitoba, into Minnesota, northwest Michigan and northern Ontario (Lenius and Olinyk 1990). Blackduck vessels are typically thin-walled globular vessels (made by paddle and anvil technique) with constricted necks, wedge-shaped lips and outflaring rims. They have textile impressed globular bodies with the neck, rim and lip areas often decorated with complex and highly variable patterns of cord wrapped object impressions, punctates and/or bosses that may be found on the exterior, on the lip and sometimes on the interior of the vessel. Some vessels also have vertically oriented combing as the surface finish (Hamilton et al. 2012). Anfinson (1979) suggests that Blackduck first emerges at A.D. 800 and lasts until approximately 1400. However, Lenius and Olinyk (1990) reviewed C14 dates and suggest that an appearance around A.D. 500 to A.D. 1000 is more appropriate.

After the disappearance of Blackduck pottery, there were many different styles which began to appear in the Late Woodland. Although a discussion of these styles is beyond the scope of this report, the taxonomy should be mentioned as these cultures are important to the history of northern Ontario.

Lenius and Olinyk (1990) discuss the designation of the Western Woodland Algonquian Configuration emerging from antecedent cultures Laurel and Blackduck. This configuration includes two composites, Selkirk and Rainy River. The Selkirk composite includes a number of northern regional expressions, while the Rainy River composite includes the Duck Bay, Bird Lake and Winnipeg River types or complexes. Each of these composites consists of shared social, political and religious activities, which were important in the development of the precontact environment in northern Ontario.

1.3.2.5 Historic Period (400 B.P. to present)

This period begins with the arrival of Europeans and settlers to the area, specifically French, then English traders, bringing with them trade goods such as axes, guns, beads and metal products. The Missinaibi River was an important travel route to James Bay and, through its headwaters, provided a heavily traveled connection to Lake Superior (through the Michipicoten River). Trade posts were established at the mouth of the Michipicoten River and also at various places along the length of the Missinaibi River.

1.4 Archaeological Context

1.4.1 Current Conditions

Presently the landscape is undisturbed boreal forest. The landscape consists of slightly undulating with low ridges of glacially deposited sand, gravel and cobbles. Surrounding the proposed development is the Mitchipicoten River a navigable river that flows from Lake Superior. Adjacent to the proposed development is an active landfill site, that has been built up over the duration of its use. Debris from the active landfill is evident on the terrain of the proposed development and there are two water testing areas situated in the southwestern and northwestern corners. The forest has been cleared to allow a vehicle to these testing sources, but no other development is evident.

1.4.2. Physiography

The proposed development is situated in the geological region known as the Canadian Shield. This designation refers to a portion of exposed continental crust underlying North America. The Canadian Shield runs from central Ontario north to the Arctic Archipelago, and from Labrador west to the Northwest Territories. Consisting of various rocks from the Archean and Proterozoic eons, the Canadian Shield yields a tremendous amount of resources such as minerals, coniferous forests and capacity for hydroelectric developments (Historica Canada 2017).

Vegetation within the region is considered to be consistent with boreal forest species. South of the Hudson Bay Lowlands, major vegetation species of trees include black spruce, as well as conifers such as tamarack, balsam fir and jack pine. This area is also considered to be a part of the Northern Coniferous region, a vegetation zone that extends from western Ontario to

western Saskatchewan (Rowe 1972:43). Stands of black spruce form on thin soils of the uplands as well as in poorly drained lowlands with jack pine and tamarack being associated with these areas as well. River valleys around some of the lakes and on south-facing slopes were favourable conditions for soil accumulations. In these areas white spruce, balsam fir, trembling aspen and balsam poplar form mixed stands of vegetation. Glaciation was intense in this region, resulting in irregular relief of the landscape, with rocky parallel ridges separating poorly drained depressions and innumerable narrow lakes (Rowe 1972:43).

1.4.3 Previous Archaeological Assessments

No other recorded archaeological assessments have been conducted within the vicinity of this proposed development.

Despite the lack of previous work, studies that have been carried out in the remote portions of northwestern Ontario outline potential for the discovery of unknown archaeological sites and do prove past peoples did migrate across the landscape of northwestern Ontario. Of importance to this study area is the deglaciation northern Ontario. Late Pleistocene and early Holocene events are of particular relevance to this area. Despite the limited geomorphological studies in the area, a general reconstruction is possible (Dyke and Prest 1987; Bjorck 1985; Dredege and Cowan 1989; Teller 1987; McAndrews et al. 1987). As the Laurentide Ice Sheet continued to move northeast, areas within the study region become both free of ice and water between 9,000 and 8,000 years ago. Between 8,400 and 8,000 years ago, the main mass of the Laurentian glacier rapidly retreats further north, and waters of Glacial Lake Agassiz quickly drain into the Arctic Ocean (Hamilton 2004: 340). During this time, from about 9,000 years ago, northwestern Ontario begins to see a post-glacial vegetative recovery that is reflected in McAndrews (1987) pollen sequence (Hamilton 2004:342). This pollen sequence is divided into four stages and is critical to the interpretation of past land use by peoples of this time. The first stage “Zone 1” is characterized by open tundra, especially on the uplands, with more diverse plant communities developing in sheltered areas (McAndrews 1982). Comparatively brief, this zone disappeared during a rapid development of closed spruce forest – “Zone 2”. Julig et al. (1990:39) note that continued global warming and soil development most likely influenced these larger forest communities (Hamilton 2004:342). “Zone 3” begins about 8,000 years ago and consists of a warmer period of more diverse forest communities. During this time, the Hypsithermal period occurs which produced warmer and drier conditions. “Zone 3” lasts from 8,000 years until contact and subsequently, “Zone 4” coincides with modern climactic and vegetative conditions (Hamilton 2004:342; Julig et al. 1990:39; McAndrews; 1982).

Considering the study region was free of ice and glacial waters and the environment was conducive for habitation of past peoples, it is likely that archaeology sites could be found that could date back to approximately 8,000 years ago.

1.4.4 Registered Archaeological Sites

In Ontario, information concerning archaeological sites is stored in the Ontario Archaeological Sites Database and is maintained by the MHSTCI. A request for site data was made to the

MHSTCI by Woodland Heritage Northwest when filing for the project and no sites have been recorded within 1 km of the proposed locations.

1.4.5 Summary

Due to the diverse cultural and historical background of northern Ontario, there is an increased chance that unknown archaeological sites could be impacted by development. Given that there have been few archaeological investigations, particular attention should be given to the study area so that a complete accurate archaeological history can be developed. A physical inspection of the property is warranted to determine the presence of potential and to determine the likelihood of unknown archaeological resources being disturbed.

2.0 Methodology

Several factors are used to determine archaeological potential. Criteria for pre-contact archaeological potential is focused on physiographic variables that include distance from the nearest source of water, the nature of the nearest source/body of water, distinguishing features in the landscape (eg. ridges, knolls, eskers, wetlands), the types of soils found within the area of assessment and resource availability as outlined in the *Standards and Guidelines for Consultant Archaeologists* (MHSTCI 2011:22). Additionally, previously recorded archaeological sites within or in the vicinity of the study area are also used in determining archaeological potential. Historic and archival research provides the basis for determining historic archaeological potential.

As noted previously, the proposed development occurs in an area with little to no previously areas that have been impacted by any disturbance. This could significantly increase the archaeological potential due to undisturbed nature of the landscape. Additionally, the few archaeological investigations that have occurred in northwestern Ontario suggest that people did in fact utilize the landscape beginning about 8,000 years ago which also increases the potential for unknown sites to lie within the proposed development. Finally, criteria set out by the Ministry of Tourism, Culture and Sport (2011) in *Section 1.3.1 Features indicating archaeological potential* include the following:

- Previously identified archaeological sites
- Water sources such as:
- Primary water sources (lakes, rivers, streams)
- Secondary water sources (intermittent streams and creeks, springs, marshes, swamps)
- Features indicating past water sources (e.g. glacial lake shorelines indicated by the presence of raised sand or gravel beach ridges, relic river or stream channels, shorelines of drained lakes or marshes)
- Accessible or inaccessible shoreline (e.g. high bluffs, swamp or marsh fields by edges of lakes, sandbars stretching into marsh)
- Elevated topography (e.g. eskers, drumlins, large knolls)
- Pockets of well drained sandy soils, especially near areas of soil or rocky ground

For this Stage 1 Archaeological Assessment, the proposed development was plotted on satellite imagery using GIS software. The surrounding area examined for features indicating archaeological potential (as outlined in Section 1.3.1 of the Standards and Guidelines (MHSTCI 2011).

2.1 Physical Inspection

Property inspection was undertaken on May 19, 2021, on a sunny day. Despite being situated in a remote area approximately 330 m from the Mitchipicoten River, the area was accessible by vehicle and thus a physical inspection could be performed. The physical inspection covered 100% of the area to determine archaeological potential. David Norris (P307) acted as field director and all work was conducted under PIF P307-0133-2021. Within the landfill site location, pedestrian transects through the boreal forest were carried out spaced approximately 8 m apart to determine the presence of any archaeological potential. Both the proposed landfill area and 50 m buffer were examined for any archaeological potential.

3.0 Records of Finds

The Stage 1 Archaeological Assessment found no previously unknown archaeological resources nor evidence of archaeological potential in the proposed development or 50 m buffer.

4.0 Analysis and Conclusions

Screening for the proposed development indicated that the landscape could possibly be favourable for past land use given the proximity of the Mitchipicoten River. However, during the physical inspection, no evidence of archaeological potential was observed.

5.0 Recommendations

Archaeological recommendations have been made based on the background historic research, high resolution satellite imagery, location of known or registered archaeological sites, previous archaeological assessments, and indicators of archaeological potential. These recommendations are summarized as follows:

- No further archaeological assessment is required for the proposed new landfill expansion site situated in the Municipality of Wawa, District of Algoma, Ontario.

The Stage 1 Archaeological Assessment was undertaken in accordance with the requirements of the *Ontario Heritage Act (R.S.O. 1990)*, as well as the *Standards and Guidelines for Consulting Archaeologists (MHSTCI 2011)* and were completed to the satisfaction of the First Nations representatives reviewing this report.

6.0 Advice on Compliance with Legislation

This report is submitted to the MHSTCI as a condition of licensing in accordance with Part VI of the Ontario Heritage Act, R.S.O. 1990, c 0.18. The report is reviewed to ensure that it complies with the *Standards and Guidelines for Consultant Archaeologists* (2011) that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the

conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the MHSTCI, a letter will be issued by the Ministry stating that there are no further concerns regarding alterations to archaeological sites by the proposed development.

It is an offence under Sections 48 and 69 of the Ontario Heritage Act for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human us or activity from the site, until such time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeological Reports referred to in Section 65.1 of the Ontario Heritage Act.

Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject Section 48(1) of the Ontario Heritage Act. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48(1) of the Ontario Heritage Act.

The Cemeteries Act, R.S.O. 1990 c.C.4 and the Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33 (when proclaimed in force) require that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Consumer Services.

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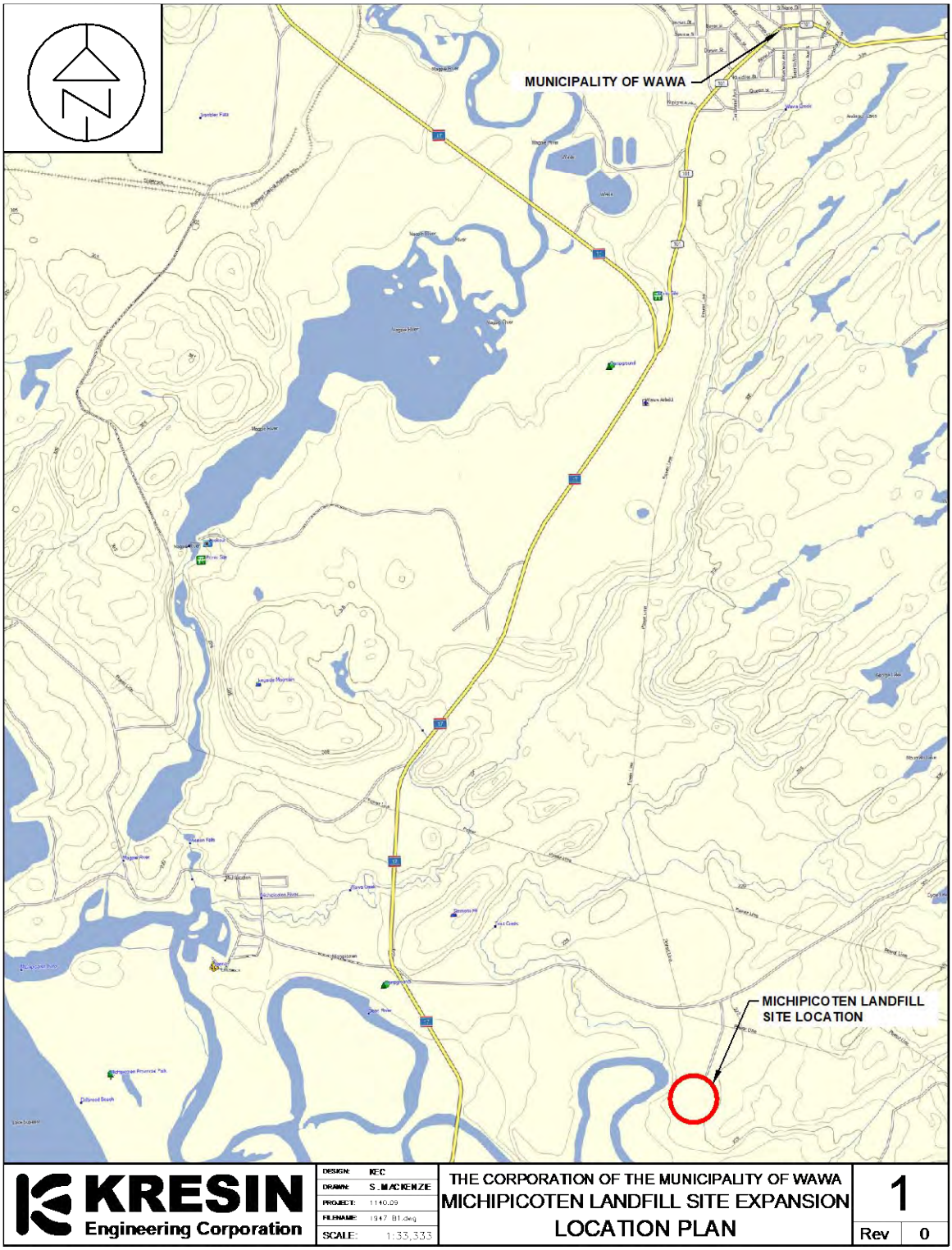
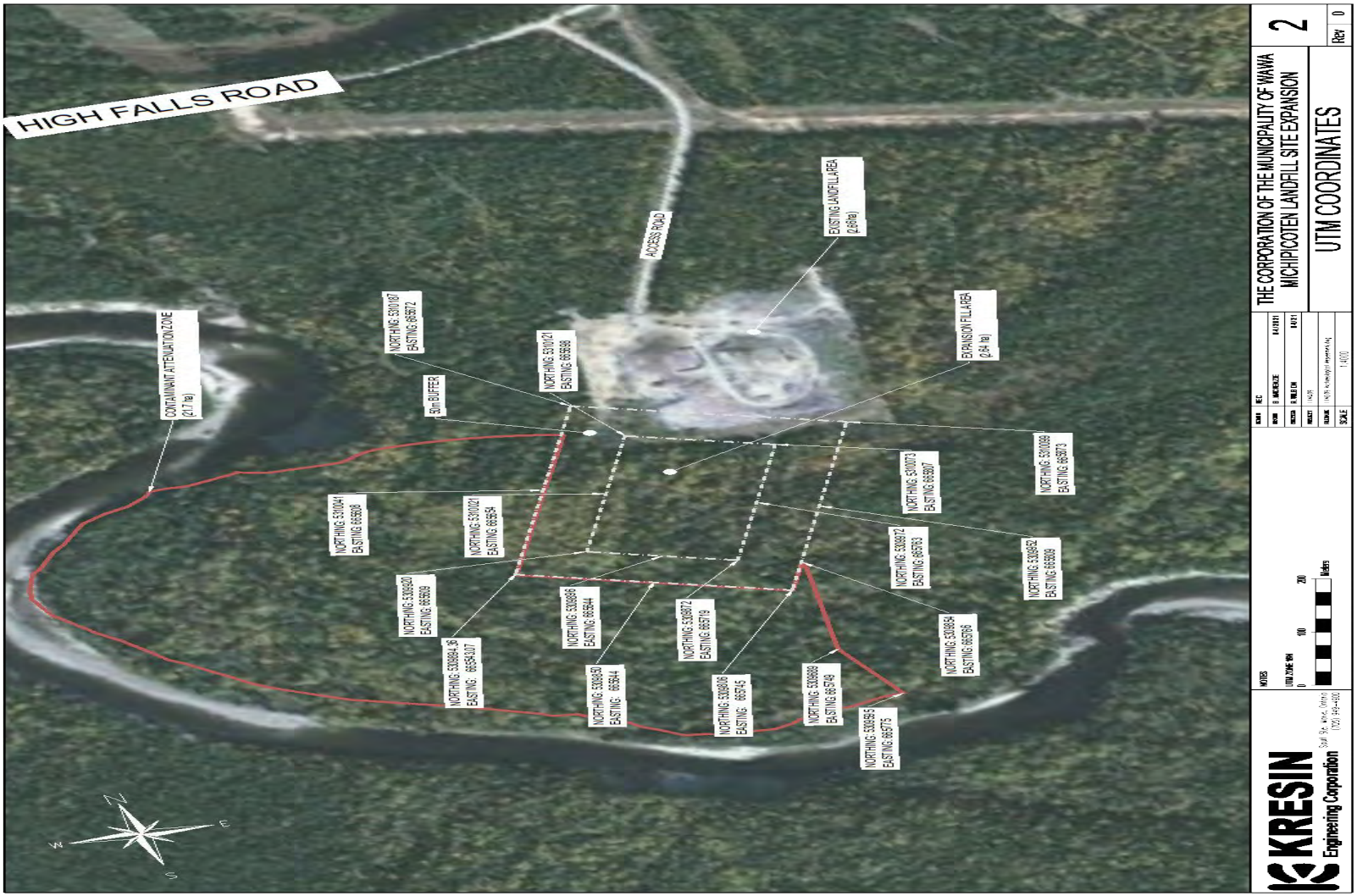
8.0 Maps



Map 1. Location of proposed development in northwestern Ontario.



Map 2. Location and coordinates of proposed development and attenuation zone.

Map 3. Area Surveyed as part of the Stage 1 physical assessment.

Map 4. Direction and Location of photographs taken for this report.

9.0 Photographs

Photograph 1. Example of existing landfill area in the northern section.

Photograph 2. Example of terrain along transition between active area and undeveloped area.

Photograph 3. Example of terrain in the northeastern area.

Photograph 4. Example of transition between active and undeveloped area in the northeastern portion.

Photograph 5. Example of road that had been pushed along the eastern side of the proposed development.

Photograph 6. Example of water testing area in western area of proposed development.

Photograph 7. Example of terrain within the mid-portion of proposed development.

Photograph 8. Example of terrain within mid-portion of development.

Photograph 9. Example of exposed bedrock within proposed development.

Photograph 10. Example of terrain within proposed development.

Photograph 11. Example of terrain within proposed development.

Ryan Wilson

Sent: June 11, 2021 12:02 PM
Subject: FW: FILED: ARCHAEOLOGICAL REPORT for P307-0133-2021 / *

Begin forwarded message:

From: pastport <pastport@ontario.ca>
Subject: FILED: ARCHAEOLOGICAL REPORT for P307-0133-2021 / *
Date: June 9, 2021 at 7:45:00 AM EDT
To: dave.norris@woodlandheritage.com
Cc: <PastPort@ontario.ca>

Dear Dave Norris,
The ministry has screened the project report package for P307-0133-2021 that you submitted on Jun 8, 2021 for completeness.

The package is complete and the report is now considered 'filed' with the ministry.

Next, we will either add it to our queue to be reviewed or enter it into the register without technical review.
Please do not reply to this e-mail. The message will be undeliverable and we are unable to respond from this address.
If you have any questions about this report email us at: Archaeology@ontario.ca
Thank you,
Jessica Marr
Jessica.Marr@ontario.ca

Ministry of Heritage, Sport, Tourism, and Culture Industries

Archaeology Program Unit
Programs and Services Branch
Heritage, Tourism and Culture Division
401 Bay Street, Suite 1700
Toronto ON M7A 0A7
Tel.: (249) 885-1567
Email: Paige.Campbell@ontario.ca

Ministère des Industries du patrimoine, du sport, du tourisme et de la culture

Unité des programme d'archéologie
Direction des programmes et des services
Division du patrimoine, du tourisme et de la culture
401, rue Bay, bureau 1700
Toronto ON M7A 0A7
Tél. : (249) 885-1567
Email: Paige.Campbell@ontario.ca

Ontario

Jul 13, 2021

Dave Norris (P307)
Woodland Heritage Services Northwest
140 Strathcona Thunder Bay ON P7A 1S3

RE: Review and Entry into the Ontario Public Register of Archaeological Reports: Archaeological Assessment Report Entitled, "STAGE 1 ARCHAEOLOGICAL ASSESSMENT OF THE PROPOSED LANDFILL EXPANSION SITE FOR THE MUNICIPALITY OF WAWA IN THE DISTRICT OF ALGOMA, ONTARIO ", Dated Jun 8, 2021, Filed with MHSTCI Toronto Office on Jun 9, 2021, MHSTCI Project Information Form Number P307-0133-2021, MHSTCI File Number 0014262

Dear Mr. Norris:

This office has reviewed the above-mentioned report, which has been submitted to this ministry as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c 0.18.[1] This review has been carried out in order to determine whether the licensed professional consultant archaeologist has met the terms and conditions of their licence, that the licensee assessed the property and documented archaeological resources using a process that accords with the 2011 *Standards and Guidelines for Consultant Archaeologists* set by the ministry, and that the archaeological fieldwork and report recommendations are consistent with the conservation, protection and preservation of the cultural heritage of Ontario.

The report documents the assessment of the study area as depicted in Map 4 of the above titled report and recommends the following:

No further archaeological assessment is required for the proposed new landfill expansion site situated in the Municipality of Wawa, District of Algoma, Ontario.

Based on the information contained in the report, the ministry is satisfied that the fieldwork and reporting for the archaeological assessment are consistent with the ministry's 2011 *Standards and Guidelines for Consultant Archaeologists* and the terms and conditions for archaeological licences. This report has been entered into the Ontario Public Register of Archaeological Reports. Please note that the ministry makes no representation or warranty as to the completeness, accuracy or quality of reports in the register.

Should you require any further information regarding this matter, please feel free to contact me.

Sincerely,

Paige Campbell
Archaeology Review Officer

cc. Archaeology Licensing Officer
Ryan Wilson,Kresin Engineering
Dan Beach,Municipality of Wawa

[1] *In no way will the ministry be liable for any harm, damages, costs, expenses, losses, claims or actions that may result: (a) if the Report(s) or its recommendations are discovered to be inaccurate, incomplete, misleading or fraudulent; or (b) from the issuance of this letter. Further measures may need to be taken in the event that additional artifacts or archaeological sites are identified or the Report(s) is otherwise found to be inaccurate, incomplete, misleading or fraudulent.*

Ontario

Ministry of Tourism, Culture and Sport

Programs & Services Branch
401 Bay Street, Suite 1700
Toronto ON M7A 0A7

Criteria for Evaluating Archaeological Potential

A Checklist for the Non-Specialist

The **purpose of the checklist** is to determine:

- if a property(ies) or project area may contain archaeological resources i.e., have archaeological potential
- it includes all areas that may be impacted by project activities, including – but not limited to:
  - the main project area
  - temporary storage
  - staging and working areas
  - temporary roads and detours

Processes covered under this checklist, such as:

- *Planning Act*
- *Environmental Assessment Act*
- *Aggregates Resources Act*
- *Ontario Heritage Act* – Standards and Guidelines for Conservation of Provincial Heritage Properties

Archaeological assessment

If you are not sure how to answer one or more of the questions on the checklist, you may want to hire a licensed consultant archaeologist (see page 4 for definitions) to undertake an archaeological assessment.

The assessment will help you:

- identify, evaluate and protect archaeological resources on your property or project area
- reduce potential delays and risks to your project

Note: By law, archaeological assessments **must** be done by a licensed consultant archaeologist. Only a licensed archaeologist can assess – or alter – an archaeological site.

What to do if you:

- **find an archaeological resource**

  If you find something you think may be of archaeological value during project work, you must – by law – stop all activities immediately and contact a licensed consultant archaeologist

  The archaeologist will carry out the fieldwork in compliance with the *Ontario Heritage Act* [s.48(1)].

- **unearth a burial site**

  If you find a burial site containing human remains, you must immediately notify the appropriate authorities (i.e., police, coroner's office, and/or Registrar of Cemeteries) and comply with the *Funeral, Burial and Cremation Services Act*.

Other checklists

Please use a separate checklist for your project, if:

- you are seeking a Renewable Energy Approval under Ontario Regulation 359/09 – separate checklist
- your Parent Class EA document has an approved screening criteria (as referenced in Question 1)

Please refer to the Instructions pages when completing this form.

Project or Property Name

Wawa WDS

Project or Property Location (upper and lower or single tier municipality)

Wawa ToR ; ...

Proponent Name

Municipality of Wawa

Proponent Contact Information

Screening Questions

	Yes	No
1. Is there a pre-approved screening checklist, methodology or process in place?	☐	☑

If Yes, please follow the pre-approved screening checklist, methodology or process.

If No, continue to Question 2.

	Yes	No
2. Has an archaeological assessment been prepared for the property (or project area) and been accepted by MTCS?	☐	☑

If Yes, do **not** complete the rest of the checklist. You are expected to follow the recommendations in the archaeological assessment report(s).

The proponent, property owner and/or approval authority will:

- summarize the previous assessment
- add this checklist to the project file, with the appropriate documents that demonstrate an archaeological assessment was undertaken e.g., MTCS letter stating acceptance of archaeological assessment report

The summary and appropriate documentation may be:

- submitted as part of a report requirement e.g., environmental assessment document
- maintained by the property owner, proponent or approval authority

If No, continue to Question 3.

	Yes	No
3. Are there known archaeological sites on or within 300 metres of the property (or the project area)?	☑	☐
4. Is there Aboriginal or local knowledge of archaeological sites on or within 300 metres of the property (or project area)?	☐	☐
5. Is there Aboriginal knowledge or historically documented evidence of past Aboriginal use on or within 300 metres of the property (or project area)?	☐	☐
6. Is there a known burial site or cemetery on the property or adjacent to the property (or project area)?	☐	☑
7. Has the property (or project area) been recognized for its cultural heritage value?	☐	☐

If Yes to any of the above questions (3 to 7), do **not** complete the checklist. Instead, you need to hire a licensed consultant archaeologist to undertake an archaeological assessment of your property or project area.

If No, continue to question 8.

	Yes	No
8. Has the entire property (or project area) been subjected to recent, extensive and intensive disturbance?	☐	☐

If Yes to the preceding question, do **not** complete the checklist. Instead, please keep and maintain a summary of documentation that provides evidence of the recent disturbance.

An archaeological assessment is not required.

If No, continue to question 9.

	Yes	No
9. Are there present or past water sources within 300 metres of the property (or project area)?	☐	☐

If Yes, an archaeological assessment is required.

If No, continue to question 10.

	Yes	No
10. Is there evidence of two or more of the following on the property (or project area)?	☐	☐

- elevated topography
- pockets of well-drained sandy soil
- distinctive land formations
- resource extraction areas
- early historic settlement
- early historic transportation routes

If Yes, an archaeological assessment is required.

If No, there is low potential for archaeological resources at the property (or project area).

The proponent, property owner and/or approval authority will:

- summarize the conclusion
- add this checklist with the appropriate documentation to the project file

The summary and appropriate documentation may be:

- submitted as part of a report requirement e.g., under the *Environmental Assessment Act, Planning Act* processes
- maintained by the property owner, proponent or approval authority

Instructions

Please have the following available, when requesting information related to the screening questions below:

- a clear map showing the location and boundary of the property or project area
  - large scale and small scale showing nearby township names for context purposes
- the municipal addresses of all properties within the project area
- the lot(s), concession(s), and parcel number(s) of all properties within a project area

In this context, the following definitions apply:

- **consultant archaeologist** means, as defined in Ontario regulation as an archaeologist who enters into an agreement with a client to carry out or supervise archaeological fieldwork on behalf of the client, produce reports for or on behalf of the client and provide technical advice to the client. In Ontario, these people also are required to hold a valid professional archaeological licence issued by the Ministry of Tourism, Culture and Sport.
- **proponent** means a person, agency, group or organization that carries out or proposes to carry out an undertaking or is the owner or person having charge, management or control of an undertaking.

1. Is there a pre-approved screening checklist, methodology or process in place?

An existing checklist, methodology or process may be already in place for identifying archaeological potential, including:

- one prepared and adopted by the municipality e.g., archaeological management plan
- an environmental assessment process e.g., screening checklist for municipal bridges
- one that is approved by the Ministry of Tourism, Culture and Sport under the Ontario government's Standards & Guidelines for Conservation of Provincial Heritage Properties [s. B.2.]

2. Has an archaeological assessment been prepared for the property (or project area) and been accepted by MTCS?

Respond 'yes' to this question, if all of the following are true:

- an archaeological assessment report has been prepared and is in compliance with MTCS requirements
  - a letter has been sent by MTCS to the licensed archaeologist confirming that MTCS has added the report to the Ontario Public Register of Archaeological Reports (Register)
- the report states that there are no concerns regarding impacts to archaeological sites

Otherwise, if an assessment has been completed and deemed compliant by the MTCS, and the ministry recommends further archaeological assessment work, this work will need to be completed.

For more information about archaeological assessments, contact:

- approval authority
- proponent
- consultant archaeologist
- Ministry of Tourism, Culture and Sport at archaeology@ontario.ca

3. Are there known archaeological sites on or within 300 metres of the property (or project area)?

MTCS maintains a database of archaeological sites reported to the ministry.

For more information, contact MTCS Archaeological Data Coordinator at archaeology@ontario.ca.

4. Is there Aboriginal or local knowledge of archaeological sites on or within 300 metres of the property?

Check with:

- Aboriginal communities in your area
- local municipal staff

They may have information about archaeological sites that are not included in MTCS' database.

Other sources of local knowledge may include:

- property owner
- local heritage organizations and historical societies
- local museums
- municipal heritage committee
- published local histories

5. Is there Aboriginal knowledge or historically documented evidence of past Aboriginal use on or within 300 metres of the property (or property area)?

Check with:

- Aboriginal communities in your area
- local municipal staff

Other sources of local knowledge may include:

- property owner
- local heritage organizations and historical societies
- local museums
- municipal heritage committee
- published local histories

6. Is there a known burial site or cemetery on the property or adjacent to the property (or project area)?

For more information on known cemeteries and/or burial sites, see:

- Cemeteries Regulation Unit, Ontario Ministry of Consumer Services – for database of registered cemeteries
- Ontario Genealogical Society (OGS) – to locate records of Ontario cemeteries, both currently and no longer in existence; cairns, family plots and burial registers
- Canadian County Atlas Digital Project – to locate early cemeteries

In this context, 'adjacent' means 'contiguous', or as otherwise defined in a municipal official plan.

7. Has the property (or project area) been recognized for its cultural heritage value?

There is a strong chance there may be archaeological resources on your property (or immediate area) if it has been listed, designated or otherwise identified as being of cultural heritage value by:

- your municipality
- Ontario government
- Canadian government

This includes a property that is:

- designated under *Ontario Heritage Act* (the OHA), including:
  - individual designation (Part IV)
  - part of a heritage conservation district (Part V)
  - an archaeological site (Part VI)
- subject to:
  - an agreement, covenant or easement entered into under the OHA (Parts II or IV)
  - a notice of intention to designate (Part IV)
  - a heritage conservation district study area by-law (Part V) of the OHA
- listed on:
  - a municipal register or inventory of heritage properties
  - Ontario government's list of provincial heritage properties
  - Federal government's list of federal heritage buildings
- part of a:
  - National Historic Site
  - UNESCO World Heritage Site
- designated under:
  - *Heritage Railway Station Protection Act*
  - *Heritage Lighthouse Protection Act*
- subject of a municipal, provincial or federal commemorative or interpretive plaque.

To determine if your property or project area is covered by any of the above, see:

- Part A of the MTCS Criteria for Evaluating Potential for Built Heritage and Cultural Heritage Landscapes

Part VI – Archaeological Sites

Includes five sites designated by the Minister under Regulation 875 of the Revised Regulation of Ontario, 1990 (Archaeological Sites) and 3 marine archaeological sites prescribed under Ontario Regulation 11/06.

For more information, check Regulation 875 and Ontario Regulation 11/06.

8. Has the entire property (or project area) been subjected to recent extensive and intensive ground disturbance?

Recent: after-1960

Extensive: over all or most of the area

Intensive: thorough or complete disturbance

Examples of ground disturbance include:

- quarrying
- major landscaping – involving grading below topsoil
- building footprints and associated construction area
  - where the building has deep foundations or a basement
- infrastructure development such as:
  - sewer lines
  - gas lines
  - underground hydro lines
  - roads
  - any associated trenches, ditches, interchanges. **Note**: this applies only to the excavated part of the right-of-way; the remainder of the right-of-way or corridor may not have been impacted.

A ground disturbance does **not** include:

- agricultural cultivation
- gardening
- landscaping

Site visits

You can typically get this information from a site visit. In that case, please document your visit in the process (e.g., report) with:

- photographs
- maps
- detailed descriptions

If a disturbance isn't clear from a site visit or other research, you need to hire a licensed consultant archaeologist to undertake an archaeological assessment.

9. Are there present or past water bodies within 300 metres of the property (or project area)?

Water bodies are associated with past human occupations and use of the land. About 80-90% of archaeological sites are found within 300 metres of water bodies.

Present

- Water bodies:
  - primary - lakes, rivers, streams, creeks
  - secondary - springs, marshes, swamps and intermittent streams and creeks
- accessible or inaccessible shoreline, for example:
  - high bluffs
  - swamps
  - marsh fields by the edge of a lake
  - sandbars stretching into marsh

Water bodies not included:

- man-made water bodies, for example:
  - temporary channels for surface drainage
  - rock chutes and spillways
  - temporarily ponded areas that are normally farmed
  - dugout ponds
- artificial bodies of water intended for storage, treatment or recirculation of:
  - runoff from farm animal yards
  - manure storage facilities
  - sites and outdoor confinement areas

Past

Features indicating past water bodies:

- raised sand or gravel beach ridges – can indicate glacial lake shorelines
- clear dip in the land – can indicate an old river or stream
- shorelines of drained lakes or marshes
- cobble beaches

You can get information about water bodies through:

- a site visit
- aerial photographs
- 1:10,000 scale Ontario Base Maps - or equally detailed and scaled maps.

10. Is there evidence of two or more of the following on the property (or project area)?

- elevated topography
- pockets of well-drained sandy soil
- distinctive land formations
- resource extraction areas
- early historic settlement
- early historic transportation routes

- **Elevated topography**

  Higher ground and elevated positions - surrounded by low or level topography - often indicate past settlement and land use.

  Features such as eskers, drumlins, sizeable knolls, plateaus next to lowlands, or other such features are a strong indication of archaeological potential.

  Find out if your property or project area has elevated topography, through:

  - site inspection
  - aerial photographs
  - topographical maps

- **Pockets of well-drained sandy soil, especially within areas of heavy soil or rocky ground**

  Sandy, well-drained soil - in areas characterized by heavy soil or rocky ground - may indicate archaeological potential

  Find out if your property or project area has sandy soil through:

  - site inspection
  - soil survey reports

- **Distinctive land formations**

  Distinctive land formations include – but are not limited to:

  - waterfalls
  - rock outcrops
  - rock faces
  - caverns
  - mounds, etc.

  They were often important to past inhabitants as special or sacred places. The following sites may be present – or close to – these formations:

  - burials
  - structures
  - offerings
  - rock paintings or carvings

  Find out if your property or project areas has a distinctive land formation through:

  - a site visit
  - aerial photographs
  - 1:10,000 scale Ontario Base Maps - or equally detailed and scaled maps.

- **Resource extraction areas**

  The following resources were collected in these extraction areas:

  - food or medicinal plants e.g., migratory routes, spawning areas, prairie
  - scarce raw materials e.g., quartz, copper, ochre or outcrops of chert
  - resources associated with early historic industry e.g., fur trade, logging, prospecting, mining

  Aboriginal communities may hold traditional knowledge about their past use or resources in the area.

- **Early historic settlement**

  Early Euro-Canadian settlement include – but are not limited to:

  - early military or pioneer settlement e.g., pioneer homesteads, isolated cabins, farmstead complexes
  - early wharf or dock complexes
  - pioneers churches and early cemeteries

  For more information, see below – under the early historic transportation routes.

- **Early historic transportation routes** - such as trails, passes, roads, railways, portage routes, canals.

  For more information, see:

  - historical maps and/or historical atlases
    - for information on early settlement patterns such as trails (including Aboriginal trails), monuments, structures, fences, mills, historic roads, rail corridors, canals, etc.
    - Archives of Ontario holds a large collection of historical maps and historical atlases
    - digital versions of historic atlases are available on the Canadian County Atlas Digital Project
  - commemorative markers or plaques such as local, provincial or federal agencies
  - municipal heritage committee or other local heritage organizations
    - for information on early historic settlements or landscape features (e.g., fences, mill races, etc.)
    - for information on commemorative markers or plaques

Clear Form Print Form

Ontario

Ministry of Tourism, Culture and Sport

Programs & Services Branch
401 Bay Street, Suite 1700
Toronto ON M7A 0A7

Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes

A Checklist for the Non-Specialist

The **purpose of the checklist** is to determine:

- if a property(ies) or project area:
  - is a recognized heritage property
  - may be of cultural heritage value
- it includes all areas that may be impacted by project activities, including – but not limited to:
  - the main project area
  - temporary storage
  - staging and working areas
  - temporary roads and detours

Processes covered under this checklist, such as:

- *Planning Act*
- *Environmental Assessment Act*
- *Aggregates Resources Act*
- *Ontario Heritage Act* – Standards and Guidelines for Conservation of Provincial Heritage Properties

Cultural Heritage Evaluation Report (CHER)

If you are not sure how to answer one or more of the questions on the checklist, you may want to hire a qualified person(s) (see page 5 for definitions) to undertake a cultural heritage evaluation report (CHER).

The CHER will help you:

- identify, evaluate and protect cultural heritage resources on your property or project area
- reduce potential delays and risks to a project

Other checklists

Please use a separate checklist for your project, if:

- you are seeking a Renewable Energy Approval under Ontario Regulation 359/09 – separate checklist
- your Parent Class EA document has an approved screening criteria (as referenced in Question 1)

Please refer to the Instructions pages for more detailed information and when completing this form.

Project or Property Name

Project or Property Location (upper and lower or single tier municipality)

Proponent Name

Proponent Contact Information

Screening Questions

	Yes	No
1. Is there a pre-approved screening checklist, methodology or process in place?	☐	☑

If Yes, please follow the pre-approved screening checklist, methodology or process.

If No, continue to Question 2.

Part A: Screening for known (or recognized) Cultural Heritage Value

	Yes	No
2. Has the property (or project area) been evaluated before and found **not** to be of cultural heritage value?	☐	☑

If Yes, do **not** complete the rest of the checklist.

The proponent, property owner and/or approval authority will:

- summarize the previous evaluation and
- add this checklist to the project file, with the appropriate documents that demonstrate a cultural heritage evaluation was undertaken

The summary and appropriate documentation may be:

- submitted as part of a report requirement
- maintained by the property owner, proponent or approval authority

If No, continue to Question 3.

	Yes	No
3. Is the property (or project area):		
a. identified, designated or otherwise protected under the *Ontario Heritage Act* as being of cultural heritage value?	☐	☑
b. a National Historic Site (or part of)?	☐	☑
c. designated under the *Heritage Railway Stations Protection Act*?	☐	☑
d. designated under the *Heritage Lighthouse Protection Act*?	☐	☑
e. identified as a Federal Heritage Building by the Federal Heritage Buildings Review Office (FHBRO)?	☐	☑
f. located within a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site?	☐	☑

If Yes to any of the above questions, you need to hire a qualified person(s) to undertake:

- a Cultural Heritage Evaluation Report, if a Statement of Cultural Heritage Value has not previously been prepared or the statement needs to be updated

If a Statement of Cultural Heritage Value has been prepared previously and if alterations or development are proposed, you need to hire a qualified person(s) to undertake:

- a Heritage Impact Assessment (HIA) – the report will assess and avoid, eliminate or mitigate impacts

If No, continue to Question 4.

Part B: Screening for Potential Cultural Heritage Value

	Yes	No
4. Does the property (or project area) contain a parcel of land that:		
a. is the subject of a municipal, provincial or federal commemorative or interpretive plaque?	☐	☑
b. has or is adjacent to a known burial site and/or cemetery?	☐	☑
c. is in a Canadian Heritage River watershed?	☐	☑
d. contains buildings or structures that are 40 or more years old?	☐	☑

Part C: Other Considerations

	Yes	No
5. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area):		
a. is considered a landmark in the local community or contains any structures or sites that are important in defining the character of the area?	☐	☑
b. has a special association with a community, person or historical event?	☐	☑
c. contains or is part of a cultural heritage landscape?	☐	☑

If Yes to one or more of the above questions (Part B and C), there is potential for cultural heritage resources on the property or within the project area.

You need to hire a qualified person(s) to undertake:

- a Cultural Heritage Evaluation Report (CHER)

If the property is determined to be of cultural heritage value and alterations or development is proposed, you need to hire a qualified person(s) to undertake:

- a Heritage Impact Assessment (HIA) – the report will assess and avoid, eliminate or mitigate impacts

If No to all of the above questions, there is low potential for built heritage or cultural heritage landscape on the property.

The proponent, property owner and/or approval authority will:

- summarize the conclusion
- add this checklist with the appropriate documentation to the project file

The summary and appropriate documentation may be:

- submitted as part of a report requirement e.g. under the *Environmental Assessment Act, Planning Act* processes
- maintained by the property owner, proponent or approval authority

Instructions

Please have the following available, when requesting information related to the screening questions below:

- a clear map showing the location and boundary of the property or project area
  - large scale and small scale showing nearby township names for context purposes
- the municipal addresses of all properties within the project area
- the lot(s), concession(s), and parcel number(s) of all properties within a project area

For more information, see the Ministry of Tourism, Culture and Sport's Ontario Heritage Toolkit or Standards and Guidelines for Conservation of Provincial Heritage Properties.

In this context, the following definitions apply:

- **qualified person(s)** means individuals – professional engineers, architects, archaeologists, etc. – having relevant, recent experience in the conservation of cultural heritage resources.
- **proponent** means a person, agency, group or organization that carries out or proposes to carry out an undertaking or is the owner or person having charge, management or control of an undertaking.

1. Is there a pre-approved screening checklist, methodology or process in place?

An existing checklist, methodology or process may already be in place for identifying potential cultural heritage resources, including:

- one endorsed by a municipality
- an environmental assessment process e.g. screening checklist for municipal bridges
- one that is approved by the Ministry of Tourism, Culture and Sport (MTCS) under the Ontario government's Standards & Guidelines for Conservation of Provincial Heritage Properties [s.B.2.]

Part A: Screening for known (or recognized) Cultural Heritage Value

2. Has the property (or project area) been evaluated before and found not to be of cultural heritage value?

Respond 'yes' to this question, if all of the following are true:

A property can be considered not to be of cultural heritage value if:

- a Cultural Heritage Evaluation Report (CHER) - or equivalent - has been prepared for the property with the advice of a qualified person and it has been determined not to be of cultural heritage value and/or
- the municipal heritage committee has evaluated the property for its cultural heritage value or interest and determined that the property is not of cultural heritage value or interest

A property may need to be re-evaluated, if:

- there is evidence that its heritage attributes may have changed
- new information is available
- the existing Statement of Cultural Heritage Value does not provide the information necessary to manage the property
- the evaluation took place after 2005 and did not use the criteria in Regulations 9/06 and 10/06

Note: Ontario government ministries and public bodies [prescribed under Regulation 157/10] may continue to use their existing evaluation processes, until the evaluation process required under section B.2 of the Standards & Guidelines for Conservation of Provincial Heritage Properties has been developed and approved by MTCS.

To determine if your property or project area has been evaluated, contact:

- the approval authority
- the proponent
- the Ministry of Tourism, Culture and Sport

3a. Is the property (or project area) identified, designated or otherwise protected under the *Ontario Heritage Act* as being of cultural heritage value e.g.:

i. designated under the *Ontario Heritage Act*

- individual designation (Part IV)
- part of a heritage conservation district (Part V)

Individual Designation – Part IV

A property that is designated:

- by a municipal by-law as being of cultural heritage value or interest [s.29 of the *Ontario Heritage Act*]
- by order of the Minister of Tourism, Culture and Sport as being of cultural heritage value or interest of provincial significance [s.34.5]. **Note**: To date, no properties have been designated by the Minister.

Heritage Conservation District – Part V

A property or project area that is located within an area designated by a municipal by-law as a heritage conservation district [s. 41 of the *Ontario Heritage Act*].

For more information on Parts IV and V, contact:

- municipal clerk
- Ontario Heritage Trust
- local land registry office (for a title search)

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ii. subject of an agreement, covenant or easement entered into under Parts II or IV of the *Ontario Heritage Act*

An agreement, covenant or easement is usually between the owner of a property and a conservation body or level of government. It is usually registered on title.

The primary purpose of the agreement is to:

- preserve, conserve, and maintain a cultural heritage resource
- prevent its destruction, demolition or loss

For more information, contact:

- Ontario Heritage Trust - for an agreement, covenant or easement [clause 10 (1) (c) of the *Ontario Heritage Act*]
- municipal clerk – for a property that is the subject of an easement or a covenant [s.37 of the *Ontario Heritage Act*]
- local land registry office (for a title search)

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iii. listed on a register of heritage properties maintained by the municipality

Municipal registers are the official lists - or record - of cultural heritage properties identified as being important to the community.

Registers include:

- all properties that are designated under the *Ontario Heritage Act* (Part IV or V)
- properties that have not been formally designated, but have been identified as having cultural heritage value or interest to the community

For more information, contact:

- municipal clerk
- municipal heritage planning staff
- municipal heritage committee

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iv. subject to a notice of:

- intention to designate (under Part IV of the *Ontario Heritage Act*)
- a Heritage Conservation District study area bylaw (under Part V of the *Ontario Heritage Act*)

A property that is subject to a **notice of intention to designate** as a property of cultural heritage value or interest and the notice is in accordance with:

- section 29 of the *Ontario Heritage Act*
- section 34.6 of the *Ontario Heritage Act.* **Note**: To date, the only applicable property is Meldrum Bay Inn, Manitoulin Island. [s.34.6]

An area designated by a municipal by-law made under section 40.1 of the *Ontario Heritage Act* as a **heritage conservation district study area.**

For more information, contact:

- municipal clerk – for a property that is the subject of notice of intention [s. 29 and s. 40.1]
- Ontario Heritage Trust

v. included in the Ministry of Tourism, Culture and Sport's list of provincial heritage properties

Provincial heritage properties are properties the Government of Ontario owns or controls that have cultural heritage value or interest.

The Ministry of Tourism, Culture and Sport (MTCS) maintains a list of all provincial heritage properties based on information provided by ministries and prescribed public bodies. As they are identified, MTCS adds properties to the list of provincial heritage properties.

For more information, contact the MTCS Registrar at registrar@mtc.gov.on.ca.

3b. Is the property (or project area) a National Historic Site (or part of)?

National Historic Sites are properties or districts of national historic significance that are designated by the Federal Minister of the Environment, under the *Canada National Parks Act*, based on the advice of the Historic Sites and Monuments Board of Canada.

For more information, see the National Historic Sites website.

3c. Is the property (or project area) designated under the *Heritage Railway Stations Protection Act*?

The *Heritage Railway Stations Protection Act* protects heritage railway stations that are owned by a railway company under federal jurisdiction. Designated railway stations that pass from federal ownership may continue to have cultural heritage value.

For more information, see the Directory of Designated Heritage Railway Stations.

3d. Is the property (or project area) designated under the *Heritage Lighthouse Protection Act*?

The *Heritage Lighthouse Protection Act* helps preserve historically significant Canadian lighthouses. The Act sets up a public nomination process and includes heritage building conservation standards for lighthouses which are officially designated.

For more information, see the Heritage Lighthouses of Canada website.

3e. Is the property (or project area) identified as a Federal Heritage Building by the Federal Heritage Buildings Review Office?

The role of the Federal Heritage Buildings Review Office (FHBRO) is to help the federal government protect the heritage buildings it owns. The policy applies to all federal government departments that administer real property, but not to federal Crown Corporations.

For more information, contact the Federal Heritage Buildings Review Office.

See a directory of all federal heritage designations.

3f. Is the property (or project area) located within a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site?

A UNESCO World Heritage Site is a place listed by UNESCO as having outstanding universal value to humanity under the Convention Concerning the Protection of the World Cultural and Natural Heritage. In order to retain the status of a World Heritage Site, each site must maintain its character defining features.

Currently, the Rideau Canal is the only World Heritage Site in Ontario.

For more information, see Parks Canada – World Heritage Site website.

Part B: Screening for potential Cultural Heritage Value

4a. Does the property (or project area) contain a parcel of land that has a municipal, provincial or federal commemorative or interpretive plaque?

Heritage resources are often recognized with formal plaques or markers.

Plaques are prepared by:

- municipalities
- provincial ministries or agencies
- federal ministries or agencies
- local non-government or non-profit organizations

For more information, contact:

- municipal heritage committees or local heritage organizations – for information on the location of plaques in their community
- Ontario Historical Society's Heritage directory – for a list of historical societies and heritage organizations
- Ontario Heritage Trust – for a list of plaques commemorating Ontario's history
- Historic Sites and Monuments Board of Canada – for a list of plaques commemorating Canada's history

4b. Does the property (or project area) contain a parcel of land that has or is adjacent to a known burial site and/or cemetery?

For more information on known cemeteries and/or burial sites, see:

- Cemeteries Regulations, Ontario Ministry of Consumer Services – for a database of registered cemeteries
- Ontario Genealogical Society (OGS) – to locate records of Ontario cemeteries, both currently and no longer in existence; cairns, family plots and burial registers
- Canadian County Atlas Digital Project – to locate early cemeteries

In this context, adjacent means contiguous or as otherwise defined in a municipal official plan.

4c. Does the property (or project area) contain a parcel of land that is in a Canadian Heritage River watershed?

The Canadian Heritage River System is a national river conservation program that promotes, protects and enhances the best examples of Canada's river heritage.

Canadian Heritage Rivers must have, and maintain, outstanding natural, cultural and/or recreational values, and a high level of public support.

For more information, contact the Canadian Heritage River System.

If you have questions regarding the boundaries of a watershed, please contact:

- your conservation authority
- municipal staff

4d. Does the property (or project area) contain a parcel of land that contains buildings or structures that are 40 or more years old?

A 40 year 'rule of thumb' is typically used to indicate the potential of a site to be of cultural heritage value. The approximate age of buildings and/or structures may be estimated based on:

- history of the development of the area
- fire insurance maps
- architectural style
- building methods

Property owners may have information on the age of any buildings or structures on their property. The municipality, local land registry office or library may also have background information on the property.

Note: 40+ year old buildings or structure do not necessarily hold cultural heritage value or interest; their age simply indicates a higher potential.

A building or structure can include:

- residential structure
- farm building or outbuilding
- industrial, commercial, or institutional building
- remnant or ruin
- engineering work such as a bridge, canal, dams, etc.

For more information on researching the age of buildings or properties, see the Ontario Heritage Tool Kit Guide Heritage Property Evaluation.

Part C: Other Considerations

5a. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) is considered a landmark in the local community or contains any structures or sites that are important to defining the character of the area?

Local or Aboriginal knowledge may reveal that the project location is situated on a parcel of land that has potential landmarks or defining structures and sites, for instance:

- buildings or landscape features accessible to the public or readily noticeable and widely known
- complexes of buildings
- monuments
- ruins

5b. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) has a special association with a community, person or historical event?

Local or Aboriginal knowledge may reveal that the project location is situated on a parcel of land that has a special association with a community, person or event of historic interest, for instance:

- Aboriginal sacred site
- traditional-use area
- battlefield
- birthplace of an individual of importance to the community

5c. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) contains or is part of a cultural heritage landscape?

Landscapes (which may include a combination of archaeological resources, built heritage resources and landscape elements) may be of cultural heritage value or interest to a community.

For example, an Aboriginal trail, historic road or rail corridor may have been established as a key transportation or trade route and may have been important to the early settlement of an area. Parks, designed gardens or unique landforms such as waterfalls, rock faces, caverns, or mounds are areas that may have connections to a particular event, group or belief.

For more information on Questions 5.a., 5.b. and 5.c., contact:

- Elders in Aboriginal Communities or community researchers who may have information on potential cultural heritage resources. Please note that Aboriginal traditional knowledge may be considered sensitive.
- municipal heritage committees or local heritage organizations
- Ontario Historical Society's "Heritage Directory" - for a list of historical societies and heritage organizations in the province

An internet search may find helpful resources, including:

- historical maps
- historical walking tours
- municipal heritage management plans
- cultural heritage landscape studies
- municipal cultural plans

Information specific to trails may be obtained through Ontario Trails.

Appendix L
August 2021 Open House Material

Invitation to Public Open House
Environmental Screening Process

Wawa Waste Disposal Site Capacity Expansion
The Corporation of the Municipality of Wawa

The Municipality of Wawa initiated the Environmental Screening Process for Waste Management Projects under the *Environmental Assessment Act* to identify the preferred method to provide additional domestic non-hazardous waste disposal capacity.

The study was carried out in accordance with the requirements of the *Environmental Assessment Act*. Since publishing the Notice of Commencement in September 2016 and initial public open house in July 2017, the Municipality has completed the Screening steps, prescribed under the *Environmental Assessment Act,* and is conducting final consultation.

The project web site, which includes a document repository, may be viewed at: www.kresinengineering.ca

Public Open House

A public open house presenting the Process results and providing opportunity for input, will be held at the Michipicoten Memorial Community Centre on August 19, 2021 from 3:30pm to 6:00pm. All are welcome and encouraged to attend.

For further information or if you have any questions regarding the proposed study please contact:

Ryan Wilson, P.Eng.
Kresin Engineering Corporation
536 Fourth Line East
Sault Ste. Marie, ON, P6A 5K8
info@kresinengineering.ca

ATTENDANCE RECORD
PUBLIC OPEN HOUSE – ENVIRONMENTAL SCREENING

Project Name: Municipality of Wawa – Waste Disposal Site Expansion
Meeting Description: Review Steps 5 to 7 of the ESP **Location:** Community Centre
Date: August 19, 2021
Time: 3:30 pm to 6:00 pm

NAME (please print)	ADDRESS	TELEPHONE
N [redacted]	127 Broadway Ave.	[redacted]
W + M C [redacted]	Box 591 Wawa	[redacted]

11404

Date:_____

Municipality of Wawa Waste Disposal Site
Environmental Screening – Waste Disposal Site Expansion

PUBLIC OPEN HOUSE
COMMENT SHEET

I/We have reviewed the project material and have the following comments:

_____

_____

_____

_____

_____

_____

_____

_____

_____

Thank you for your comment(s). Please complete the following if you would like to be contacted for clarification.

_____ _____
Name (print) Address

_____ _____
Phone No. Email Address

Please leave the completed form with a representative of the Municipality or the Consultant or deliver or mail to:

Kresin Engineering Corporation
536 Fourth Line East
Sault Ste. Marie, Ontario
P6A 6J8
info@kresinengineering.ca

PUBLIC OPEN HOUSE INFORMATION SESSION

August 19, 2021
FROM 3:30pm TO 6:00pm

ENVIRONMENTAL SCREENING PROCESS

TO SUPPORT THE

EXPANSION OF THE MUNICIPAL WASTE DISPOSAL SITE

BACKGROUND

1. The Municipality's waste disposal site located on High Falls Road has been actively receiving waste since 1980 and currently operates under Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Approval (ECA) Number A7266501, dated November 2, 2005.

2. Located within a Municipality-owned parcel of property, the site is approved to accept solid municipal waste within a fill area of 2.6 hectares.

3. Considering the site volume identified in the current ECA, it is expected that the remaining approved capacity will be filled by the year 2023.

4. Following consultation with MECP, the Municipality initiated the Screening Process under the Province's Environmental Assessment (EA) Act to investigate the preferred method to expand site capacity.

PURPOSE OF THE PROPOSED UNDERTAKING

The purpose of the proposed undertaking is to address the Municipality's solid municipal waste disposal requirements by expanding the capacity of the existing waste disposal site.

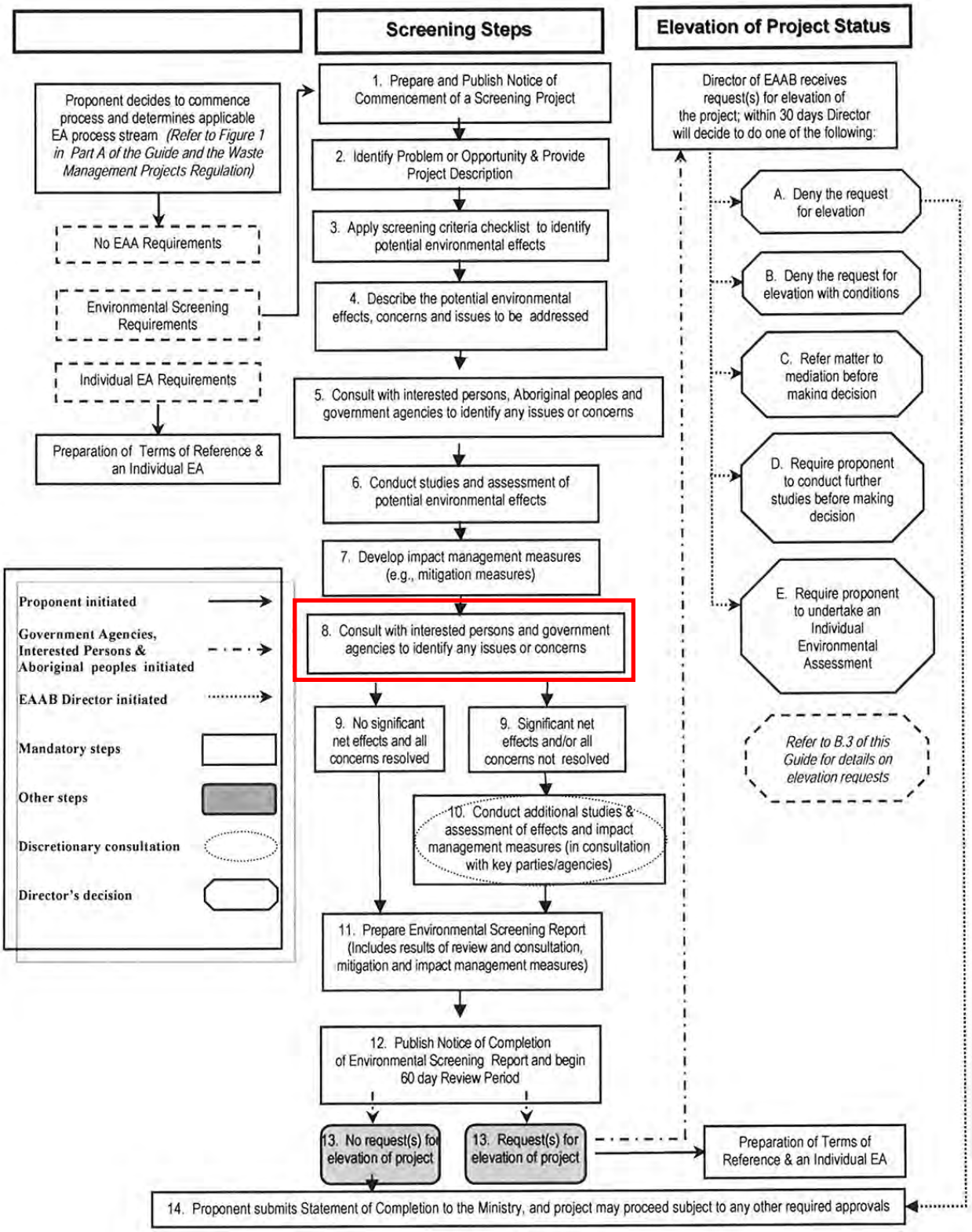
DESCRIPTION OF THE PROPOSED UNDERTAKING

1. The undertaking being considered is the expansion of the waste disposal site capacity by 100,000 cubic metres.
2. The proposed undertaking is exempt from Schedule II of the EA Act (Individual Environmental Assessment); however, the Municipality must first complete the Environmental Screening Process as described under Ontario Regulation (O.Reg.) 101/07 (*Waste Management* Projects).
3. The undertaking will consider the solid municipal waste generated within the Municipality's service area.

ENVIRONMENTAL SCREENING PROCESS

1. The Environmental Screening Process is a proponent driven self-assessment process.
2. The Process is directed at small, rural waste disposal sites (≤ 100,000 cubic metres).
3. The Process assesses how the environment will be directly or indirectly affected by the project and what actions, if any, are required to prevent or mitigate these impacts.
4. Reasonable and practical mitigation measures will be considered to avoid or reduce impacts from the project.

ENVIRONMENTAL SCREENING PROCESS



SUMMARY OF PREVIOUSLY COMPLETED ESP STEPS

STEP 1: NOTICE OF COMMENCEMENT

- The Notice of Commencement was published in September 2016 on several local web sites and was forwarded by mail and email to Government Review Team members and other interested parties.

STEP 2: IDENTIFY AND DESCRIBE THE PROBLEM

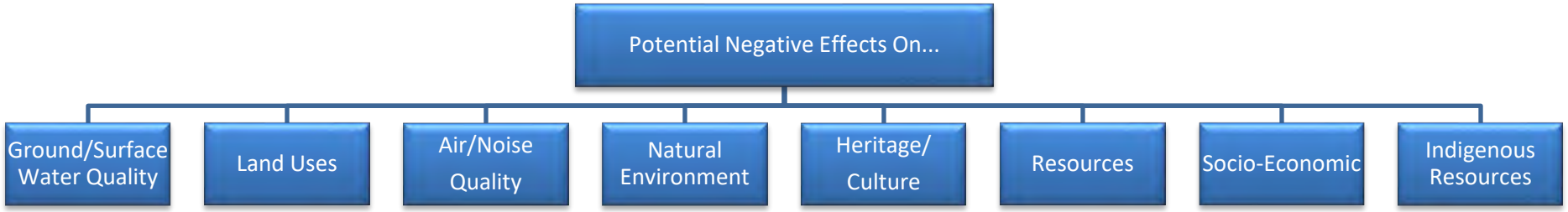
- The problem being address is the need for additional waste disposal capacity to service the Municipality of Wawa. It has been estimated that the existing approved capacity at the waste disposal site will be filled by the year 2023.

STEP 3: SCREENING CRITERIA CHECKLIST

- A screening exercise determined that the preferred alternative to the undertaking is to expand the existing waste disposal site.

STEP 4: POTENTIAL ENVIRONMENTAL IMPACTS

- The Environmental Screening Criteria Checklist was completed in order to identify potential environmental impacts associated with expanding the existing site (i.e. issues potentially requiring mitigation).



STEP 5: CONSULTATION WITH INTERESTED PARTIES

A Public Open House was held at the Michipicoten Community Centre on July 26, 2017 in order to update the residents of the Municipality of Wawa and provide the opportunity for input into the process.

The project website, which includes a document repository, may be viewed at: **www.kresinengineering.ca**

STEP 6: STUDIES AND ASSESSMENT OF POTENTIAL OF ENVIRONMENTAL IMPACTS

The initial screening assessment has identified that the proposed undertaking (i.e. expansion) has the potential to impact ground and surface water quality associated with the natural attenuation of landfill leachate.

Surface/Groundwater Quality

- The Municipality submitted a Groundwater and Surface Water

  Assessment Report to the MECP which presented a comprehensive assessment of hydrogeological conditions and impact mitigation.

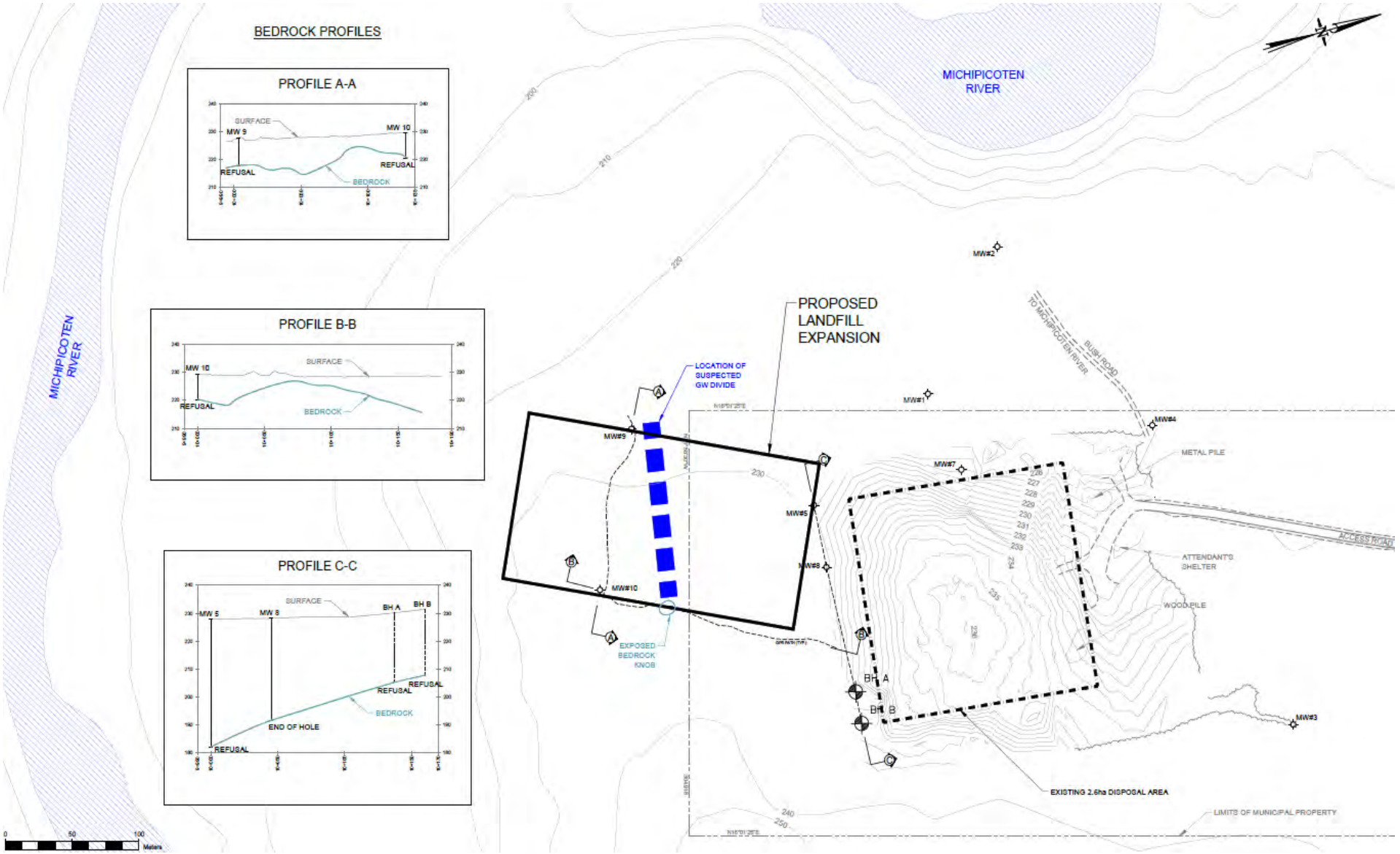
- The MECP has confirmed that no hydrogeological reason that might disqualify the described site expansion from further consideration were identified.

Ministry of Heritage, Sport, Tourism and Culture (MHSTC) checklist determined the project area may have archaeological potential because of the close proximity to a waterbody (Michipicoten River).

Heritage and Culture

- A Stage 1 Archaeological Assessment was completed at the site where it was determined that no features of archaeological potential existed in the expansion area of the property.

- No further archaeological assessment is required for the proposed site.


BEDROCK PROFILES
PROFILE A-A
SURFACE
MW 9
MW 10
REFUSAL
REFUSAL
BEDROCK
PROFILE B-B
MW 10
SURFACE
REFUSAL
BEDROCK
PROFILE C-C
MW 5
MW 8
BH A
BH B
SURFACE
REFUSAL
REFUSAL
BEDROCK
END OF HOLE
REFUSAL
MICHIPICOTEN RIVER
MICHIPICOTEN RIVER
PROPOSED LANDFILL EXPANSION
LOCATION OF SUSPECTED GW DIVIDE
EXPOSED BEDROCK KNOB
BUSH ROAD TO MICHIPICOTEN RIVER
ACCESS ROAD
METAL PILE
ATTENDANT'S SHELTER
WOOD PILE
MW#1
MW#2
MW#3
MW#4
MW#5
MW#7
MW#8
MW#9
MW#10
BH A
BH B
EXISTING 2.6ha DISPOSAL AREA
LIMITS OF MUNICIPAL PROPERTY
0
50
100
Meters

STEP 7: MITIGATION AND IMPACT MANAGEMENT MEASURES

Following the identification of potential environmental impacts in Step 4, the mitigation and impact managements measures below were developed:

Table 1: Development of Mitigation and Impact Management Measures

Screening Criteria	Potential Environmental Impacts	Mitigation Measures	Net Effects
Surface/ Groundwater Quality	• Surface water quality may be impacted	• Position and properly slope waste material • Application of cover material and construction of small berms to direct surface water flow • Construction of surface water management ditches around perimeter of fill area • Seed/vegetate exposed areas such as final cover and ditch side slopes • Continuation of existing surface water monitoring program including addition of near shore locations.	None Expected
	• Leachate may negatively affect groundwater quality	• Establishment of a Contaminant Attenuation Zone (CAZ) in area hydrogeologically downgradient of site • Continuation of existing groundwater monitoring program including addition of monitoring wells downgradient of site • Continue to apply Trigger Mechanism Plan and Contingency Plan	
Air/Noise Quality	• Natural biodegradation of organic material at waste disposal site may produce landfill gas	• Small amounts of gases produced will passively vent through waste material deposited or be readily released to the air through relatively permeable cover material	None Expected
	• Emissions of dust due to unpaved access road	• Treed buffer surrounding site will continue to act as natural barrier while reducing wind speeds across the site • Progressive capping and seeding of inactive areas	
	• Possible negative noise effects due to landfilling operations	• Site attendant and equipment operators shall observe activities at the site to minimize noise levels • Site equipment shall be equipped with appropriate functional muffling devices at all times	
	• Light pollution from public vehicles as well as operation/maintenance vehicles	• Site will continue to serve a small service area with no increase in hauling distance	

STEP 7: MITIGATION AND IMPACT MANAGEMENT MEASURES

Table 1: Development of Mitigation and Impact Management Measures

Screening Criteria	Potential Environmental Impacts	Mitigation Measures	Net Effects
Natural Environment	• Expansion of site may potentially increase the number of birds attracted to the site, potentially creating a hazard	• Proper management of small working face and progressive application of cover material • Develop bird control plan	None Expected
Socio-Economic	• As an aerodrome is located within 8 kilometres of the waste disposal site, a possible bird hazard relating to flight paths may exist	• Proper management of small working face and progressive application of cover material • Develop bird control plan	None Expected
Heritage and Culture	• As the site is within 300m of surface water a Stage 1 archaeological assessment is required.	• Stage 1 Archaeological Assessment completed with no areas of archaeological potential identified	None Expected

NEXT STEPS IN THE PROCESS

1. The purpose of this Open House is to identify any issues or concerns relating to the assessment of anticipated environmental effects and to discuss recommended mitigation measures.

2. Comments will be addressed and incorporated into an Environmental Screening Report that will include the results of review and consultation activities as well as mitigation and impact management measures.

3. Following its completion, the Environmental Screening Report will be available for review and comment by interested Government Ministries, Indigenous communities and members of the public for a period of 60 days.