COMBINED REPORTS

2023 Groundwater and Surface Water Monitoring and Operations Reports

McNab Waste Disposal Site

Township of McNab/Braeside, Ontario

Submitted to:

Township of McNab/Braeside

2473 Russett Road
Arnprior, Ontario
K7S 3G8

Submitted by:

WSP Canada Inc.
1931 Robertson Road Ottawa, ON K2H 5B7 Canada

613-592-9600

22578713

March 2024



Distribution List

3 copies - Township of McNab/Braeside

1 copy - Ministry of Environment, Conservation and Parks

E-copy - Stantec Consulting Ltd.

E-copy - WSP Canada Inc.

Combined Report Contents

Ministry of Environment, Conservation and Parks Monitoring and Screening Checklist

PART A

2023 Groundwater and Surface Water Monitoring Report, WSP Canada Inc.

PART B

B-1: 2022 Annual Landfill Operations Report, Stantec Consulting Ltd.

B-2: 2023 Annual Landfill Operations Report, Stantec Consulting Ltd.

Appendix D-Monitoring and Screening Checklist
General Information and Instructions

General Information: The checklist is to be completed, and submitted with the Monitoring Report.
Instructions: A complete checklist consists of:
(a) a completed and signed checklist, including any additional pages of information which can be attached as needed to provide further details where indicated.
(b) completed contact information for the Competent Environmental Practitioner (CEP)
(c) self-declaration that CEP(s) meet(s) the qualifications as set out below and in Section 1.2 of the Technical Guidance Document.

Definition of Groundwater CEP:
For groundwater, the CEP must have expertise in hydrogeology and meet one of the following:
(a) the person holds a licence, limited licence or temporary licence under the *Professional Engineers Act*; or
(b) the person holds a certificate of registration under the *Professional Geoscientists Act, 2000* and is a practicing member, temporary, member or limited member of the Association of Professional Geoscientists of Ontario. O. Reg. 66/08, s. 2..
Definition of Surface water CEP:
A CEP for surface water assessments is a scientist, professional engineer or professional geoscientist as described in (a) and (b) above with demonstrated experience and post-secondary education, either a diploma or degree, in hydrology, aquatic ecology, limnology, aquatic biology, physical geography with specialization in surface water, and/or water resource management.

The type of scientific work that a CEP performs must be consistent with that person's education and experience. If an individual has appropriate training and credentials in both groundwater and surface water and is responsible for both areas of expertise, the CEP may then complete and validate both sections of the checklist.

Monitoring Report and Site Information	
Waste Disposal Site (WDS) Name	McNab-Braeside Waste Disposal Site
Location (e.g. street address, lot, concession)	Part Lots 18 and 19, Concession 6; Part Lot 19, Concession 5
GPS Location (taken within the property boundary at front gate/ front entry)	379730 m E, 5031575 m N (UTM 18)
Municipality	Township of McNab/Braeside
Client and/or Site Owner	Township of McNab/Braeside
Monitoring Period (Year)	2023
This Monitoring Report is being submitted under the following:	
Environmental Compliance Approval (ECA) Number (formerly "Certificate of Approval" (C of A)) :	A412605
Director's Order No.:	
Provincial Officer's Order No.:	

Other:			
Report Submission Frequency	○ **Annual** ◉ **Other**	Full monitoring report every second year; summary letter in intervening years.	
The site is: **(Operation Status)**	◉ **Open** ○ **Inactive** ○ **Closed**		
Is there an active waste transfer station at the site?	◉ **Yes** ○ **No**		
Does this WDS have a Closure Plan?	◉ **Not yet submitted** ○ **Submitted and under review** ○ **Submitted and approved**		
Total Approved Capacity	1,000,000	*Units*	Cubic Metres
Maximum Approved Fill Rate		*Units*	
Total Waste Received within Monitoring Period (Year)	9,426	*Units*	Cubic Metres
Total Waste Received within Monitoring Period (Year) *Describe the methodology used to determine this quantity*	Physical survey with waste volume calculated using Civil 3D		
Estimated Remaining Capacity	550,898	*Units*	Cubic Metres
Estimated Remaining Capacity *Describe the methodology used to determine this quantity*	Calculation of remaining volumetric air space.		
Estimated Remaining Capacity *Date Last Determined*	December 2023		
Non-Hazardous Approved Waste Types	☒ Domestic ☒ Industrial, Commercial & Institutional (IC&I) ☐ Source Separated Organics (Green Bin) ☒ Tires	☒ Contaminated Soil ☒ Wood Waste ☒ Blue Box Material ☐ Processed Organics ☒ Leaf and Yard Waste	☐ Food Processing/Preparation Operations Waste ☐ Hauled Sewage Other: Waste Oil
Subject Waste Approved Waste Classes: Hazardous & Liquid Industrial *(separate waste classes by comma)*			

Year Site Opened *(enter the Calendar Year only)*		**Current ECA Issue Date**	September 30, 1998
Is your Site required to submit Financial Assurance?		○ **Yes** ◉ **No**	
Describe how your WDS is designed.		◉ Natural Attenuation only ○ Fully engineered Facility ○ Partially engineered Facility	
Does your Site have an approved Contaminant Attenuation Zone?		○ **Yes** ◉ **No**	
If closed, specify ECA, control or authorizing document closure date:			
Has the nature of the operations at the site changed during this monitoring period?	○ **Yes** ◉ **No**		
If yes, provide details:			

Have any measurements been taken since the last reporting period that indicate landfill gas volumes have exceeded the MOE limits for subsurface or adjacent buildings? (i.e. exceeded the LEL for methane)	○ Yes ◉ No

Groundwater WDS Verification:

Based on all available information about the site and site knowledge, it is my opinion that:

Sampling and Monitoring Program Status:

1) The monitoring program continues to effectively characterize site conditions and any groundwater discharges from the site. All monitoring wells are confirmed to be in good condition and are secure:	○ **Yes** ◉ **No**	Groundwater sample could not be collected at monitoring location BH15-2A in 2023 due to a blockage in the monitoring well.
2) All groundwater, leachate and landfill gas sampling and monitoring for the monitoring period being reported on was successfully completed as required by ECA or other relevant authorizing/ control document(s):	○ **Yes** ◉ **No** ○ **Not Applicable**	If no, list exceptions below or attach information.

Groundwater Sampling Location	**Description/Explanation for change (change in name or location, additions, deletions)**	**Date**
BH15-2A	Groundwater sample could not be collected at monitoring location due to blockage in the monitoring well.	Spring and Fall 2023
BH99-1, BH20-2, BH20-3	Monitors contained insufficient water volume for sampling.	Fall 2023

3) a) Some or all groundwater, leachate and landfill gas sampling and monitoring requirements have been established or defined outside of a ministry ECA, authorizing, or control document *, or Ministry concurrence.*	◯ **Yes** ◉ **No** ◯ **Not Applicable**	
b) If yes, the sampling and monitoring identified under 3(a) for the monitoring period being reported on was successfully completed in accordance with established protocols, frequencies, locations, and parameters developed as per the Technical Guidance Document:	◯ **Yes** ◯ **No** ◉ **Not Applicable**	If no, list exceptions below or attach additional information.

Groundwater Sampling Location	**Description/Explanation for change (change in name or location, additions, deletions)**	**Date**

4) All field work for groundwater investigations was done in accordance with Standard Operating Procedures (SOP) as established/outlined per the Technical Guidance Document (including internal/external QA/QC requirements) (Note: A SOP can be from a published source, developed internally by the site owner's consultant, or adopted by the consultant from another organization):	◉ **Yes** ○ **No**	
Sampling and Monitoring Program Results/WDS Conditions and Assessment:		
5) The site has an adequate buffer, Contaminant Attenuation Zone (CAZ) and/ or contingency plan in place. Design and operational measures, including the size and configuration of any CAZ, are adequate to prevent potential human health impacts and impairment of the environment.	◉ **Yes** ○ **No**	If no, the potential design and operational concerns/exceptions are as follows
6) The site meets compliance and assessment criteria.	◉ **Yes** ○ **No**	If no, list and explain exceptions (Type Here):
7) The site continues to perform as anticipated. There have been no unusual trends/ changes in measured leachate and groundwater levels or concentrations.	◉ **Yes** ○ **No**	If no, list exceptions and explain reason for increase/change

1) Is one or more of the following risk reduction practices in place at the site: ***(a)*** **There is minimal reliance on natural attenuation of leachate due to the presence of an effective waste liner and active leachate collection/ treatment; or** ***(b)*** **There is a predictive monitoring program in-place (modeled indicator concentrations projected over time for key locations); or** ***(c)*** **The site meets the following two conditions (typically achieved after 15 years or longer of site operation):** ***i.*** **The site has developed stable leachate mound(s) and stable leachate plume geometry/ concentrations; and** ***ii.*** **Seasonal and annual water levels and water quality fluctuations are well understood.**	○ **Yes** ● **No**	**Note which practice(s):**	☐ **(a)** ☐ **(b)** ☐ **(c)**
9) Have trigger values for contingency plans or site remedial actions been exceeded (where they exist):	○ **Yes** ● **No** ○ **Not Applicable**	If yes, list value(s) that are/have been exceeded and follow-up action taken:	

Groundwater CEP Declaration:

I am a licensed professional Engineer or a registered professional geoscientist in Ontario with expertise in hydrogeology, as defined in Appendix D under Instructions. Where additional expertise was needed to evaluate the site monitoring data, I have relied on individuals who I believe to be experts in the relevant discipline, who have co-signed the compliance monitoring report or monitoring program status report, and who have provided evidence to me of their credentials.

I have examined the applicable Environmental Compliance Approval and any other environmental authorizing or control documents that apply to the site. I have read and followed, *as deemed appropriate for this site in my professional judgement,* the Monitoring and Reporting for Waste Disposal Sites Groundwater and Surface Water Technical Guidance Document (MOE, 2010, or as amended), and associated monitoring and sampling guidance documents, as amended from time to time. I have reviewed all of the data collected for the above-referenced site for the monitoring period(s) identified in this checklist. Except as otherwise agreed with the ministry for certain parameters, all of the analytical work has been undertaken by a laboratory which is accredited for the parameters analysed to *ISO/IEC 17025-2005 (E)- General requirements for the competence of testing and calibration laboratories*, or as amended from time to time by the ministry.

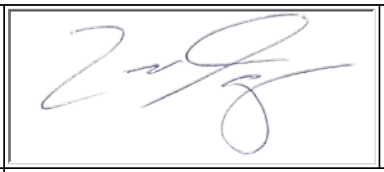
If any exceptions or potential concerns have been noted in the questions in the checklist attached to this declaration, it is my opinion that these exceptions and concerns are minor in nature and will be rectified for the next monitoring/reporting period. Where this is not the case, the circumstances concerning the exception or potential concern and my client's proposed action have been documented in writing to the Ministry of the Environment District Manager in a letter from me dated:

Select Date

Recommendations:

Based on my technical review of the monitoring results for the waste disposal site:

○ **No changes to the monitoring program are recommended**	WSP proposes that monitor BH15-2A is removed from the monitoring program, as discussed in Section 6 of the 2023 monitoring report.
◉ **The following change(s) to the monitoring program is/ are recommended:**	
◉ **No Changes to site design and operation are recommended**	
○ **The following change(s) to the site design and operation is/are recommended:**	
Name:	Cameron W. Toy, M.Sc., P.Geo.
Seal:	Add Image 

Signature:		**Date:**	March 26, 2024
CEP Contact Information:			
Company:	WSP Canada Inc.		
Address:	1931 Robertson Road, Ottawa, ON, K2H 5B7		
Telephone No.:	613-592-9600 x 3234	Fax No. :	613-592-9601
E-mail Address:	cameron.toy@wsp.com		
Co-signers for additional expertise provided:			
Signature:		**Date:**	
Signature:		**Date:**	

Surface Water WDS Verification:

Provide the name of surface water body/bodies potentially receiving the WDS effluent and the approximate distance to the waterbody (including the nearest surface water body/bodies to the site):	
Name (s)	1) Dochart Creek; 2) Poorly-Drained Area

Distance(s)	1) 450 m from mound; 2) 10 m from mound

Based on all available information and site knowledge, it is my opinion that:

Sampling and Monitoring Program Status:

1) The current surface water monitoring program continues to effectively characterize the surface water conditions, and includes data that relates upstream/background and downstream receiving water conditions:	(●) **Yes** ( ) **No**	If no, identify issues (Type Here):
2) All surface water sampling for the monitoring period being reported was successfully completed in accordance with the ECA or relevant authorizing/control document(s) (if applicable):	( ) **Yes** (●) **No** ( ) **Not applicable**	If no, specify below or provide details in an attachment.

Surface Water Sampling Location	**Description/Explanation for change (change in name or location, additions, deletions)**	**Date**
SW6	Station SW6 was dry during the 2023 fall monitoring event.	December 1, 2023

3) a) Some or all surface water sampling and monitoring program requirements for the monitoring period have been established outside of a ministry ECA or authorizing/control document, *or Ministry concurrence.*	( ) **Yes** (●) **No** ( ) **Not Applicable**	
b) If yes, all surface water sampling and monitoring identified under 3 (a) was successfully completed in accordance with the established program from the site, including sampling protocols, frequencies, locations and parameters) as developed per the Technical Guidance Document:	( ) **Yes** ( ) **No** (●) **Not Applicable**	If no, specify below or provide details in an attachment.

Surface Water Sampling Location	Description/Explanation for change (change in name or location, additions, deletions)	Date

4) All field work for surface water investigations was done in accordance with SOP, including internal/external QA/QC requirements, as established/outlined as per the Technical Guidance Document, MOE 2010, or as amended. (Note: A SOP can be from a published source, developed internally by the site owner's consultant, or adopted by the consultant from another organization):	(◉) Yes ( ) No	

Sampling and Monitoring Program Results/WDS Conditions and Assessment:

5) The receiving water body meets surface water-related compliance criteria and assessment criteria: i.e., there are no exceedances of criteria, based on MOE legislation, regulations, Water Management Policies, Guidelines and Provincial Water Quality Objectives and other assessment criteria (e.g., CWQGs, APVs), as noted in Table A or Table B in the Technical Guidance Document (Section 4.6):	( ) Yes (◉) No

If no, list parameters that exceed criteria outlined above and the amount/percentage of the exceedance as per the table on the following page or provide details in an attachment:

Parameter	Compliance or Assessment Criteria or Background	Amount by which Compliance or Assessment Criteria or Background Exceeded
e.g. Nickel	e.g. ECA limit, PWQO, background	e.g. X% above PWQO
Total Phosphorus Total Iron	PWQO - SW2 PWQO - SW2	67% above PWQO during spring 13% above PWQO during summer
Total Iron Dissolved Iron	Total: Policy 2 - SW7, SW9 Dissolved: PWQO - SW9	Total Iron: 695% above Policy 2 at SW7 (fall) Total Iron: 3,740% (spring) and 2,209% (fall) above Policy 2 at SW9 Dissolved Iron: 773% (spring) and 2,500% (fall) above PWQO at SW9
Cobalt	PWQO - SW6, SW7, SW9	Cobalt: 11% above PWQO at SW6 (spring) Cobalt: 167% above PWQO at SW7 (fall) Cobalt: 56% (spring) and 33% (fall) above PWQO at SW9
Boron	PWQO - SW4, SW6, SW7, SW9	40% (spring) and 30% (fall) above PWQO at SW4 15% above PWQO at SW6 (spring) 90% (spring) and 85% (fall) above PWQO at SW7 435% (spring) and 150% (fall) above PWQO at SW9
6) In my opinion, any exceedances listed in Question 5 are the result of non-WDS related influences (such as background, road salting, sampling site conditions)?	○ **Yes** ◉ **No**	It is interpreted that there is impact from landfill leachate on the surface water quality at SW9, at the edge of the waste mound. Station SW9 is located within 50 metres of the waste disposal fill area. This interpretation has remained unchanged during more than 20 years of monitoring. There is also likely impact of landfill leachate at stations in the poorly-drained area further from the waste mound (SW4, SW6, SW7) that is less significant than at SW9. The elevated total phosphorus and total iron concentrations at SW2 in 2023 are interpreted to be due to natural variations in surface water quality and mixing rather than landfill leachate-related impacts.

7) All monitoring program surface water parameter concentrations fall within a stable or decreasing trend. The site is not characterized by historical ranges of concentrations above assessment and compliance criteria.	○ **Yes** ◉ **No**	SW4, SW6, SW8, SW9 (poorly-drained area): consistent non-compliance with PWQO for dissolved oxygen, total phosphorus and iron
8) For the monitoring program parameters, does the water quality in the groundwater zones adjacent to surface water receivers exceed assessment or compliance criteria (e.g. , PWQOs, CWQGs, or toxicity values for aquatic biota (APVs)):	◉ Yes ○ No ○ Not Known ○ Not Applicable	Total phosphorus exceeded PWQO at BH99-1, BH99-5 and BH20-3 during the spring monitoring session in 2023. pH was outside of the PWQO range at BH99-1 during the spring monitoring session in 2023. Iron exceeded PWQO at BH99-1 and BH99-5 during at least one monitoring session in 2023.
9) Have trigger values for contingency plans or site remedial actions been exceeded (where they exist):	○ **Yes** ◉ **No** ○ **Not Applicable**	If yes, list value(s) that are/have been exceeded and follow-up action taken

Surface Water CEP Declaration:

I, the undersigned hereby declare that I am a Competent Environmental Practitioner as defined in Appendix D under Instructions, holding the necessary level of experience and education to design surface water monitoring and sampling programs, conduct appropriate surface water investigations and interpret the related data as it pertains to the site for this monitoring period.

I have examined the applicable Environmental Compliance Approval and any other environmental authorizing or control documents that apply to the site. I have read and followed, *as deemed appropriate for this site in my professional judgement,* the Monitoring and Reporting for Waste Disposal Sites Groundwater and Surface Water Technical Guidance Document (MOE, 2010, or as amended), and associated monitoring and sampling guidance documents, as amended from time to time. I have reviewed all of the data collected for the above-referenced site for the monitoring period(s) identified in this checklist. Except as otherwise agreed with the ministry for certain parameters, all of the analytical work has been undertaken by a laboratory which is accredited for the parameters analysed to *ISO/IEC 17025-2005 (E)- General requirements for the competence of testing and calibration laboratories,* or as amended from time to time by the ministry.

If any exceptions or potential concerns have been noted in the questions in the checklist attached to this declaration, it is my opinion that these exceptions and concerns are minor in nature or will be rectified for future monitoring events. Where this is not the case, the circumstances concerning the exception or potential concern and my client's proposed action have been documented in writing to the Ministry of the Environment District Manager in a letter from me dated:

Recommendations:

Based on my technical review of the monitoring results for the waste disposal site:

◉ **No Changes to the monitoring program are recommended** ○ **The following change(s) to the monitoring program is/are recommended:**	
◉ **No changes to the site design and operation are recommended** ○ **The following change(s) to the site design and operation is/ are recommended:**	

CEP Signature	
Relevant Discipline	P.Geo. with demonstrated relevant experience
Date:	March 26, 2024
CEP Contact Information:	Cameron W. Toy, M.Sc., P.Geo.
Company:	WSP Canada Inc.
Address:	1931 Robertson Road, Ottawa, ON, K2H 5B7
Telephone No.:	**613-592-9600**
Fax No. :	
E-mail Address:	**cameron.toy@wsp.com**
Save As	

PART A

2023 Groundwater and Surface Water Monitoring Report WSP Canada Inc.

REPORT

2023 Groundwater and Surface Water Monitoring Report

McNab Waste Disposal Site

Township of McNab/Braeside, Ontario

Submitted to:

Township of McNab/Braeside

2473 Russett Drive
Arnprior, Ontario
K7S 3G8

Submitted by:

WSP Canada Inc.

1931 Robertson Road Ottawa, ON K2H 5B7 Canada

+1 613 592 9600

22578713

March 2024



Distribution List

3 copies - Township of McNab/Braeside

1 copy - Ministry of Environment, Conservation and Parks

1 e-copy - Stantec Consulting Ltd.

1 e-copy - WSP Canada Inc.

Table of Contents

1.0 INTRODUCTION 1

1.1 MECP Correspondence 1

1.1.1 MECP Comments on Recent Reports 2

2.0 PROCEDURES 3

2.1 Groundwater Monitoring Program 3

2.1.1 Monitoring Locations 3

2.1.2 Method 4

2.2 Surface Water Monitoring Program 5

2.3 Data Quality 6

3.0 CONCEPTUAL HYDROGEOLOGICAL MODEL 7

3.1 Physical Setting 7

3.2 Physical Hydrogeology 7

3.3 Groundwater Levels and Flow Directions 7

3.4 Hydraulic Gradients 8

3.5 Horizontal Hydraulic Conductivity 8

3.6 Average Linear Groundwater Velocity 8

3.7 Leachate Migration 9

4.0 GROUNDWATER QUALITY 9

4.1 Physical and Chemical Analyses 9

4.1.1 Background Groundwater Quality 9

4.1.2 Leachate Quality 10

4.1.2.1 Leachate Indicator Parameters 10

4.1.3 North Property Boundary 11

4.1.4 Northwest of Waste Mound 13

4.2 Compliance Assessment 13

5.0 SURFACE WATER 16
5.1 Physical and Chemical Analyses 16
5.1.1 Poorly-Drained Area 16
5.1.2 Dochart Creek 17
5.2 Compliance Assessment 17
5.2.1 Poorly-Drained Area 17
5.2.2 Dochart Creek 19
6.0 PROPOSED 2024 GROUNDWATER AND SURFACE WATER MONITORING PROGRAM 20
7.0 CONCLUSIONS 21
8.0 LIMITATIONS AND USE OF REPORT 22
9.0 SIGNATURE PAGE 24
10.0 REFERENCES 25

TABLES

Table 1 – 2023 Stream Flow Observations

Table 2 – Groundwater Elevation Data and Results of Monitoring Well Conditions Survey

Table 3 – Interpretation of 2023 Groundwater Quality Data

Table 4 – Interpretation of 2023 Surface Water Quality Data

Table 5 – Proposed 2024 Groundwater Monitoring Program

Table 6 – Proposed 2024 Surface Water Monitoring Program

FIGURES

Figure 1 – Key Plan

Figure 2 – Site Plan

APPENDICES

APPENDIX A
Ministry of Environment, Conservation and Parks Correspondence

APPENDIX B
Borehole and Augerhole Records from Previous Investigations

APPENDIX C
Groundwater and Surface Water Quality

1.0 INTRODUCTION

WSP Canada Inc. (WSP) was retained by the Township of McNab/Braeside (the Township) to prepare this report, which summarizes the results of the 2023 groundwater and surface water monitoring program carried out at the McNab Waste Disposal Site in accordance with Certificate of Approval No. A412605. The McNab Waste Disposal Site (the Site) is located on Part of Lots 18 and 19, Concession VI and Part of Lot 19, Concession V in the Township of McNab/Braeside, Ontario in Renfrew County approximately 2.5 kilometres southwest of Glasgow Station (Figure 1).

The objectives of the 2023 groundwater and surface water monitoring program were to monitor water quality at the Site, including locations upgradient and downgradient of the landfilling area, for the purpose of characterizing the extent of the leachate-impacted areas of the Site and assessing compliance. Figure 2 presents a plan of the Site including the locations of the monitoring wells and surface water monitoring stations.

The scope of the 2023 groundwater and surface water monitoring programs were consistent with the programs proposed in Tables 4 and 5, respectively, of the 2022 monitoring program letter report (WSP, 2023). The groundwater monitoring program is consistent with the Certificate of Approval (C of A) No. A412605, with the changes recommended by the Ministry of Environment, Conservation and Parks (MECP) groundwater reviewer in 2010, 2015 and 2019 (Appendix A) and the decommissioning of the monitoring wells in borehole BH4 (Golder, 2020). The surface water monitoring program is consistent with the C of A, as amended by the MECP District Manager on September 19, 2003 and with the changes recommended by the MECP surface water reviewer in 2010, 2011 and 2019 (Appendix A).

In regard to Condition 45.11 of the C of A, this groundwater and surface water monitoring program report combined with the 2023 operations report prepared by Stantec Consulting Ltd. (Part B of this combined report) satisfies all the conditions with respect to the inspection and reporting requirements as indicated in the C of A.

1.1 MECP Correspondence

The most recent groundwater and surface water monitoring report for the Site was submitted to the MECP in March 2022 following the completion of the 2021 monitoring program (Golder, 2022). The following recent submissions are also relevant to the groundwater and surface water monitoring program for the Site:

- A groundwater and surface water monitoring program summary letter was submitted to the MECP in March 2023 following the completion of the 2022 monitoring program (WSP, 2023).
- In addition to the annual monitoring program, WSP (formerly Golder Associates Ltd. (Golder)) has been retained by the Township in support of updating the Development and Operations Plan (D&O Plan) for the Site. With respect to this scope, WSP completed a hydrogeological impact assessment that was submitted to the MECP in February 2021 (Golder, 2021A) and has proposed a revised groundwater and surface water monitoring program that could be adopted as part of the updated D&O Plan (i.e., along with an ECA amendment recognizing the updated D&O Plan). The Township, represented by WSP, continues to engage in correspondence with the MECP with respect to updating the D&O Plan. The following correspondence between the Township and the MECP occurred during 2023 with respect to updating the D&O Plan:
  - The Township received memoranda from the MECP Eastern Region Technical Support Section (TSS) groundwater and surface water reviewers dated January 12, 2023 and January 25, 2023, respectively. These memoranda are included in Appendix A1. The memoranda provide technical review comments on the hydrogeological impact assessment and clarifications made by WSP during earlier correspondence.

- WSP responded to the January 2023 MECP comments in a letter dated April 21, 2023. The April 21, 2023 letter is included in Appendix A2.
- The Township received memoranda from the MECP TSS groundwater and surface water reviewers dated September 12, 2023 and October 23, 2023, respectively. These memoranda are included in Appendix A3. The memoranda provide technical review comments on the April 21, 2023 letter submitted by WSP.
- WSP responded to the September/October 2023 MECP comments in a letter dated February 2, 2024. The February 2024 letter is included in Appendix A4.

1.1.1 MECP Comments on Recent Reports

At the time of the preparation of this report, no review comments have been received from the MECP on the 2021 monitoring report; however, the MECP TSS reviewers indicated in their September/October 2023 memoranda (Appendix A3) that the summary letter on the 2022 monitoring program has been reviewed. The MECP TSS groundwater reviewer provided one comment in the September 2023 memorandum related to an interpretation provided in the 2022 summary letter. The comment from the groundwater reviewer has been reproduced below along with a response by WSP.

MECP Comment: *Increasing trends were noted in the area north of the waste disposal area; however, it was stated that the Site remains in compliance with respect to Guideline B-7 under the current program. I noted that the nitrate concentration at 99-1 was 13.8 mg/L in the fall (ODWQS is 10 mg/L); it was also noted to be elevated in the spring (8.87 mg/L). Guideline B-7 should be applied to all potential landfill parameters, so this indicates the Site is not in compliance with respect to Guideline B-7. Further assessment of nitrate should be undertaken by the consultant, in addition to a re-evaluation of Landfill Indicator Parameters (LIPs).*

WSP Response: WSP agrees that the concentration of nitrate is occasionally elevated at monitoring well BH99-1, including an exceedance of the ODWQS in fall of 2022 and spring of 2023. The table below presents concentrations of nitrate at this monitor for the period of 2012 to 2023 (additional data is available in Appendix C). As presented in the table, the concentration of nitrate at this monitor is variable between monitoring events as opposed to consistently elevated or following an increasing trend over time. The highest nitrate concentration in December 2022 is only marginally higher than those measured in May 2012 and November 2014.

Sample Date	Concentration of Nitrate as N (mg/L)
15-May-2012	9.00
03-Dec-2012	NOTE 1
29-Apr-2013	6.40
27-Nov-2013	NOTE 1
01-May-2014	4.52
25-Nov-2014	9.68
25-Apr-2015	4.63
11-Nov-2015	NOTE 1
27-May-2016	6.66

Sample Date	Concentration of Nitrate as N (mg/L)
26-Apr-2018	0.79
30-Nov-2018	5.24
09-May-2019	3.09
20-Nov-2019	3.92
21-Apr-2020	3.41
30-Nov-2020	NOTE 1
19-Apr-2021	5.69
25-Nov-2021	NOTE 1
01-Jun-2022	8.87

Sample Date	Concentration of Nitrate as N (mg/L)
08-Nov-2016	NOTE 1
04-May-2017	2.75
23-Nov-2017	7.65

Sample Date	Concentration of Nitrate as N (mg/L)
01-Dec-2022	13.8
27-Apr-2023	11.1
30-Nov-2023	NOTE 1

NOTE 1 – Groundwater level within monitor was too low to collect sample.

While the nitrate concentrations observed at monitor BH99-1 are elevated, WSP interprets the elevated nitrate to be unrelated to landfill operations. The following is noted:

- As discussed in Section 4.1.3, the current interpretation of Site conditions is that the leachate plume has not yet reached the location of monitor BH99-1. This interpretation is supported by the concentrations of Leachate Indicator Parameters at this monitoring location that have been generally stable over time and are generally not elevated compared to background conditions. This assessment specifically considers the concentration of chloride, which is a reliable tracer for the extent of leachate impacts in the groundwater at the Site and continues to be within the background range at this monitor with no increasing trend.
- Monitoring well BH99-1 is located at the edge of the Site, which is adjacent to an agricultural field. As such, the elevated nitrate concentrations may be due to agricultural activities.

WSP continues to interpret that landfill (i.e., leachate) impacts are not causing the Site to be out of compliance with respect to Guideline B-7.

The Reasonable Use compliance assessment presented in this report (Section 4.2) has considered all analytical parameters included in the groundwater monitoring program for which a Reasonable Use Performance Objective can be calculated (i.e., all analytical parameters included in the groundwater monitoring program with ODWQS criteria).

2.0 PROCEDURES

The groundwater and surface water components of the monitoring program are described in the following sections.

2.1 Groundwater Monitoring Program

2.1.1 Monitoring Locations

The 2023 groundwater monitoring program was carried out at the Site by a WSP environmental field technician on April 27 and 28, 2023 (“spring monitoring event”) and November 30 and December 1, 2023 (“fall monitoring event”).

During the 2023 spring monitoring event, groundwater levels were measured in all existing operational monitoring wells and an assessment was completed of the condition of each monitoring well. During the 2023 fall monitoring event, groundwater levels were measured in the monitoring wells that were sampled. During both monitoring events, groundwater sample collection was attempted at each of the monitoring wells summarized in the following table. Installation details for each of the monitoring wells are provided on the borehole logs in Appendix B.

Site Area Monitored	Monitoring Wells
Background Groundwater Conditions	BH3B, BH92-5
Leachate Quality Near Waste	BH6
North Boundary Area	BH8A, BH8B, BH9B, BH91-1B, BH92-1A, BH92-1B, BH92-1C, BH99-1, BH99-2, BH99-3, BH99-4, BH99-5
Northwest of Waste Mound	BH10A, BH15-1, BH15-2A, BH15-2B, BH20-1, BH20-2, BH20-3

Groundwater samples were successfully collected from each of the monitoring wells presented above during both 2023 monitoring events with the following exceptions:

- A groundwater sample could not be collected from BH15-2A during either of the 2023 monitoring events due to an excessive amount of sediment in the well preventing the purging and sampling of the well. Monitoring well BH15-2A was last successfully sampled in November 2019. Attempts made during 2022 and 2023 to clear the blockage have been unsuccessful.
- Monitoring wells BH99-1, BH20-2 and BH20-3 contained insufficient water to yield a groundwater sample during the 2023 fall monitoring event. Each of these monitoring wells were successfully sampled during the 2023 spring monitoring event.

2.1.2 Method

Prior to the collection of a groundwater sample, each monitoring well was purged through the removal of at least three standing volumes of water using dedicated samplers. Generally, sampling of groundwater was performed immediately after purging.

The temperature, pH and conductivity of the groundwater samples were measured in the field at the time of sample collection using equipment that was calibrated prior to use. All samples were logged on a chain of custody form and placed in coolers with ice packs until they were delivered in person to Eurofins Environment Testing Canada Inc. (Eurofins) in Ottawa, Ontario. The groundwater samples were collected, prepared and preserved in the field using the protocols summarized in the following table.

Analytical Parameters	Preparation and Preservation Protocols
arsenic, barium, boron, cadmium, chromium, copper, iron, lead, manganese, potassium, sodium, zinc	plastic bottle, field filtered to 0.45 microns, preserved to pH<2 with nitric acid
mercury	clear glass bottle, field filtered to 0.45 microns, preserved to pH<2 with potassium chromate
chloride, alkalinity, nitrate, nitrite, hardness (calcium and magnesium), sulphate, total dissolved solids (TDS), biochemical oxygen demand (BOD), dissolved organic carbon (DOC) and total suspended solids (TSS)	plastic bottle, unfiltered, no preservative
total Kjeldahl nitrogen (TKN), ammonia, total phosphorus and chemical oxygen demand (COD)	plastic bottle, unfiltered and preserved to pH<2 with sulphuric acid
phenols	amber glass, unfiltered and preserved to pH<2 with sulphuric acid
volatile organic compounds (VOCs)	clear glass vials, unfiltered and preserved to pH<2 with hydrochloric acid

All groundwater samples were submitted for analysis of the parameters listed in the above table, excluding TSS, BOD and VOCs. Samples collected from monitoring well BH6 (leachate well) were submitted for analysis of BOD and TSS during both monitoring events. Samples collected from monitoring wells BH6, BH9B, BH99-4 and BH15-1 were submitted for analysis of VOCs during the fall monitoring event.

Two groundwater field duplicates were prepared during each of the spring and fall monitoring events.

Eurofins performed all laboratory chemical and physical analyses on the submitted groundwater samples. The reports of analysis from Eurofins are provided on the data drive included in Appendix C of this report.

2.2 Surface Water Monitoring Program

The 2023 surface water monitoring program was carried out at the Site by a WSP environmental field technician on April 28, 2023 (“spring monitoring event”), August 24, 2023 (“summer monitoring event”) and December 1, 2023 (“fall monitoring event”).

The surface water monitoring stations included in the surface water monitoring program were stations SW4, SW6, SW7, SW8 and SW9 located in the poorly-drained eastern portion of the Site, and SW1 and SW2 located in Dochart Creek (see Figure 2). The stations in the poorly-drained eastern portion of the Site were sampled during the spring and fall monitoring events, while the stations in Dochart Creek were sampled in the spring, summer and fall monitoring events, with the following exception:

- Surface water station SW6 was dry during the 2023 fall monitoring event. This station was successfully sampled during the 2023 spring monitoring event.

The temperature, pH, conductivity and dissolved oxygen content of the surface water samples were measured in the field at the time of sample collection using equipment that was calibrated prior to use. All samples were logged on a chain of custody form and placed in coolers with ice packs until they were delivered in person to Eurofins in Ottawa, Ontario. The surface water samples were collected, prepared and preserved in the field using the protocols summarized in the following table.

Analytical Parameters	Preparation and Preservation Protocols
barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, nickel, silicon, silver, sodium, potassium, strontium, thallium, titanium, vanadium, zinc	plastic bottle, unfiltered and preserved to pH<2 with nitric acid
dissolved aluminum, dissolved iron	plastic bottle, filtered and preserved to pH<2 with nitric acid
alkalinity, chloride, hardness (calcium and magnesium), nitrate, TDS, TSS, turbidity, DOC and BOD	plastic bottle, unfiltered and unpreserved
ammonia, COD and total phosphorus	plastic bottle, unfiltered and preserved to pH<2 with sulphuric acid
phenols	amber glass, unfiltered, preserved to pH<2 with sulphuric acid

One surface water field duplicate was prepared during each of the spring and fall monitoring events.

Eurofins performed all laboratory chemical and physical analyses on the surface water samples submitted. The reports of analysis from Eurofins are provided on the data drive provided with this report.

Estimates of surface water flow were completed at each surface water station during each of the 2023 monitoring sessions. Surface water flow estimates made in 2023 are presented in Table 1.

2.3 Data Quality

The quality of the laboratory data used in this report (i.e., groundwater and surface water quality analytical results) was evaluated based on laboratory quality assurance/quality control (QA/QC) results and field duplicate results. All laboratory chemical and physical analyses on groundwater and surface water samples were performed by Eurofins in Ottawa, Ontario, which is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation. The laboratory performs internal QA/QC checks including matrix spikes, spiked blanks, method blanks and laboratory duplicates. WSP has reviewed the laboratory QA/QC results provided in the certificates of analysis (included in the data drive accompanying this document) and found them to be acceptable.

WSP's QA/QC program included the collection of the following duplicate samples:

- Collection of duplicate groundwater samples at monitoring wells BH10A and BH3B during the spring monitoring session.
- Collection of duplicate groundwater samples at monitoring wells BH10A and BH6 during the fall monitoring session.
- Collection of a duplicate surface water sample at station SW-1 during the spring monitoring session.
- Collection of a duplicate surface water sample at station SW-2 during the fall monitoring session.

The duplicate samples were submitted to the laboratory using a coded sample name and analyzed for the same suite of parameters as the primary samples. All groundwater and surface water duplicate results were considered acceptable.

The quality of the field data collected for this report was ensured by using calibrated equipment. The field equipment used to measure temperature, pH, conductivity and dissolved oxygen was calibrated each day prior to use.

Based on the laboratory and field QA/QC protocols, the 2023 laboratory and field data presented in this report are determined to be of acceptable quality and reliable for use.

3.0 CONCEPTUAL HYDROGEOLOGICAL MODEL

A conceptual hydrogeological model for the Site was first established during early site development (Golder, 1991; Golder 1993) and has continued to be refined as part of the on-going annual groundwater and surface water monitoring program.

3.1 Physical Setting

The landfill is situated on an area that is topographically highest in the south and gradually slopes towards the north. Dochart Creek flows from west to east through the northern portion of the Site. A low-lying area with no distinct drainage channels (the “poorly-drained area”) exists to the east of the active disposal area. Trees have been cleared in the vicinity of the active disposal area and along the access road while the rest of the Site is covered by heavy bush and trees.

3.2 Physical Hydrogeology

Logs for the boreholes and augerholes advanced at the Site during previous investigations are presented in Appendix B.

Across most of the Site, a thin layer of topsoil or fill is underlain by a fine to coarse sand unit typically measuring 1.8 metres to 4.6 metres thick. The sand is underlain by a silty clay unit that has been proven to extend to depths of up to 8.2 metres below ground surface (mbgs). The shallowest portion of the silty clay deposit (i.e., up to approximately 3 metres thick) is a grey-brown weathered crust containing sand layers with a thickness up to 0.2 metres. To the north of the Site, adjacent to Dochart Creek, the surficial sand layer is discontinuous and the silty clay is present near ground surface immediately below the topsoil. In the poorly-drained area on the eastern part of the Site, a surficial peat layer is present and is underlain by the silty clay deposit.

Carbonate metasedimentary bedrock was encountered at approximately 2.8 mbgs at one borehole at the southern limit of the Site (BH1), but was not encountered in the other boreholes that extended to 9.1 mbgs. Published bedrock geology maps indicate that the bedrock at the Site consists of Precambrian rock (carbonate metasedimentary and mafic to ultramafic plutonic rocks) that is present at depths ranging from less than 1 mbgs to 20 mbgs, with bedrock depth increasing towards the northeast (OGS, 2006). A layer of sand and gravel was observed beneath the silty clay at two boreholes. The sand and gravel layer is likely a glacial till layer that is inferred to exist between the silty clay and bedrock across the Site.

3.3 Groundwater Levels and Flow Directions

The groundwater elevation data obtained during the 2022 and 2023 monitoring programs are presented in Table 2. Results of the well condition survey completed in 2023 are also included in Table 2.

The horizontal groundwater flow direction in the shallow overburden (i.e., surficial granular layer and/or weathered silty clay) is interpreted to generally follow topography, from the topographic highs on the south of the Site towards the north and northeast. The inferred horizontal groundwater flow direction based on the groundwater elevation measurements from the 2023 monitoring program are consistent with historical interpretations.

3.4 Hydraulic Gradients

Based on groundwater elevations measured in monitoring wells in April 2023, the horizontal hydraulic gradient across the Site ranges from approximately 0.015 metres per metre (m/m) in the vicinity of the waste mound up to approximately 0.074 m/m near Dochart Creek.

In April 2023, upward vertical hydraulic gradients were measured between the silty clay layer and the overlying surficial granular layer at BH2, BH3, BH8 and BH91-1, and through the silty clay at BH5. Downward vertical hydraulic gradients were measured within the silty clay layer at BH92-1. Negligible vertical hydraulic gradients were observed at BH9 and BH10A/BH15-1.

These results are consistent with historical interpretations of groundwater horizontal and vertical hydraulic gradients.

3.5 Horizontal Hydraulic Conductivity

The horizontal hydraulic conductivity of the geological units encountered at the Site have previously been estimated based on the results of single-well response tests (Golder, 1991). The results from the single well response tests are summarized in the table below.

Geological Unit Group	Monitoring Well Intervals Tested	Hydraulic Conductivity Range (m/s)	Geometric Mean Hydraulic Conductivity (m/s)
Surficial granular layer and weathered silty clay	BH3B, BH8A, BH9	6×10^{-7} to 4×10^{-6}	2×10^{-6}
Unweathered silty clay	BH4A, BH5B, BH9A	4×10^{-8} to 8×10^{-8}	6×10^{-8}

3.6 Average Linear Groundwater Velocity

The average linear groundwater velocity, v is calculated using the equation:

$$v = Ki/n$$

Where:
v = average linear groundwater velocity in units of length per time
n = dimensionless formation porosity
K = horizontal hydraulic conductivity in units of length per time
i = dimensionless horizontal hydraulic gradient in direction of v

For unconsolidated deposits such as silts and sands, typical porosity values range from 25 to 50 percent (Freeze and Cherry, 1979). An average porosity of 35 percent is assumed for the surficial sand and weathered crust in the area of the landfill Site.

Using the average horizontal hydraulic gradients (Section 3.4) and the geometric mean hydraulic conductivity for the surficial granular layer and weathered silty clay (Section 3.5), the average linear velocity for shallow groundwater was calculated to range from approximately 2.4 m/year in the vicinity of the waste mound up to approximately 13.5 m/year near Dochart Creek. These results are consistent with historical interpretations of shallow groundwater velocity.

3.7 Leachate Migration

The flow of leachate-impacted groundwater is interpreted to primarily occur in the surficial granular and weathered silty clay layers. As presented in Section 3.3, the groundwater in the shallow overburden is interpreted to flow generally from south to north. This is also the direction through which leachate-impacted groundwater will migrate. As such, leachate-impacted groundwater from the Site is expected to eventually discharge to Dochart Creek (i.e., where Dochart Creek exists within the property limits or makes up the property boundary) or migrate past the north property line.

A number of poorly defined surface water features are present in the poorly-drained area during wet periods of the year (i.e., spring and fall). These ephemeral surface water features could potentially intermittently convey discharging groundwater through the poorly-drained area off-site to the east, eventually contributing to flow in Dochart Creek; however, limited flow has been observed between these disconnected surface water features during on-going surface water monitoring in this area and no permanent off-site surface drainage has been observed to the east or northeast of the landfilling area.

4.0 GROUNDWATER QUALITY

4.1 Physical and Chemical Analyses

The results of the field and laboratory chemical and physical analyses conducted on groundwater samples during the 2023 monitoring program, along with the relevant Ontario Drinking Water Quality Standards, Objectives and Guidelines (MECP, 2003), are provided in Appendix C. Historic results from 1991 through 2023 are included on the data drive accompanying this document.

This section discusses the groundwater quality at the monitoring wells sampled during the 2023 monitoring program and, where appropriate, provides a discussion of the apparent trends in groundwater quality over time at each of the monitoring well locations. Discussions relating to compliance with the Ontario Drinking Water Quality Standards, Objectives and Guidelines (ODWQS) relate specifically to parameters for which an Aesthetic Objective (AO), Maximum Acceptable Concentration (MAC) or Interim Maximum Acceptable Concentration (IMAC) has been established.

4.1.1 Background Groundwater Quality

As presented in Section 3.2, the geology between the waste mound and the north property boundary is generally characterized by a surficial granular layer that is underlain by a silty clay unit.

The background groundwater quality in the surficial granular layer is interpreted to be represented by the groundwater quality at monitoring well BH3B that is screened within the surficial granular layer and has been part of the groundwater monitoring program since 1991. Although this monitoring well is situated in close proximity to the waste disposal area, the groundwater quality in this monitor is characterized by low concentrations of chloride (<1 to 7.4 milligrams per litre (mg/L)) and thus is interpreted to not be impacted by landfill leachate. The groundwater quality in monitoring well BH3B met the ODWQS during the 2023 monitoring program with respect to all parameters analyzed. The groundwater quality at this location has been fairly consistent over time.

The background groundwater quality within the silty clay unit is interpreted to be represented by the groundwater quality at monitoring well BH92-5 which is screened within the silty clay layer and has been sampled as part of the groundwater monitoring program since 1993. The groundwater quality in this monitor is characterized by low concentrations of chloride (<1 to 8 mg/L) and thus is interpreted to not be impacted by landfill leachate. The

groundwater quality at BH92-5 has been interpreted to contain naturally elevated concentrations of manganese that occasionally exceed the ODWQS. The groundwater quality met the ODWQS during the 2023 monitoring program with respect to all parameters analyzed with the exception of manganese during the 2023 spring monitoring event.

In comparison to the background conditions in the granular layer, the background conditions in the silty clay are typically characterized by somewhat higher ammonia, boron, COD, manganese, magnesium, potassium and sodium concentrations and slightly lower TDS and calcium concentrations.

The suitability of the selected background monitoring wells will continue to be assessed as a component of the groundwater monitoring program for the Site.

4.1.2 Leachate Quality

Leachate quality at the Site has been characterized by the quality of the groundwater within existing monitor BH6 (part of the groundwater monitoring program from since 1991) and the historical monitoring well BH4B (included in the groundwater monitoring program from 1991 until decommissioning in 2020). Groundwater from these monitoring wells has been considered indicative of the leachate quality at the Site due to the monitors being located a short distance downgradient from the waste disposal area.

The groundwater quality at monitoring well BH6 exceeded the ODWQS for DOC, TDS, iron and manganese during both 2023 sampling events. In addition, the ODWQS for benzene was exceeded during the VOC sampling program conducted at monitoring well BH6 as part of the 2023 fall monitoring event.

4.1.2.1 Leachate Indicator Parameters

Leachate Indicator Parameters are analytical parameters which are useful in: 1) determining the presence/absence of landfill leachate impact on water resources; 2) assessing the magnitude of leachate impact on water resources; and, 3) determining the spatial extent of leachate impact near a landfill Site.

Ideal Leachate Indicator Parameters have the following characteristics:

- present in relatively low concentrations in background
- present in relatively high concentrations in the landfill leachate
- background concentrations are temporally consistent
- trends in leachate concentrations are temporally consistent
- mobile in groundwater flow system as they are not subject to significant attenuation mechanisms (e.g., adsorption, biological uptake, precipitation, etc.)
- concentrations exhibit spatial variations relative to the distance from the fill area (i.e., relatively high concentrations proximal to the fill area, relatively low concentrations distal to the fill area)

Based on the above criteria, fifteen parameters have been selected as Leachate Indicator Parameters for the Site. The following table summarizes the historical concentration ranges of the Leachate Indicator Parameters in the monitoring wells representative of leachate quality, as well as in background monitoring wells for both the granular unit and the silty clay unit.

Parameter	Granular Background Range[1]	Silty Clay Background Range[2]	Leachate-Impacted Groundwater Range[3]
Alkalinity	180 – 338	186 – 223	490 – 1120
Ammonia	<0.01 – 0.14	<0.01 – 0.56	0.12 – 34
Boron	<0.01 – 0.08	0.02 – 0.06[4]	0.02 – 1.08
Calcium	47 – 120	33 – 157	110 – 347
Chloride	<1 – 7.4	<1 – 8	8 – 136
COD	<4 – 131	<3 – 310	<5 – 282
DOC	1.1 – 5.6	0.9 – 3.2[5]	4.8 – 36
Hardness	154 – 448	160 – 503	380 – 1132
Iron	<0.01 – 0.46	<0.01 – 0.65[6]	<0.01 – 100
Magnesium	9 – 21	20 – 30	23 – 74
Manganese	<0.002 – 0.019	<0.01 – 0.5	1.7 – 17.6
Potassium	<1 – 4	3 – 10	8 – 62
Sodium	<1 – 9	5 – 46	20 – 103
TDS	184 – 436	196 – 290	416 – 1442
TKN	<0.1 – 4	0.26 – 4.5	3 – 29

Notes:
[1] Based on 1991-2021 data at groundwater monitor BH 3B
[2] Based on 1993-2019 data at groundwater monitor BH 92-5
[3] Based on 1991-2021 data at groundwater monitors BH 4B and BH 6
[4] Excludes anomalous value of 0.41 mg/L reported in October 1994
[5] Excludes anomalous value of 44 mg/L reported in November 2013
[6] Excludes anomalous value of 10.8 mg/L reported in April 2021
All concentrations reported in milligrams per litre

4.1.3 North Property Boundary

The groundwater monitoring wells located near the north property boundary include BH8A, BH8B, BH9B, BH91-1B, BH92-1A, BH92-1B, BH92-1C, BH99-1, BH99-2, BH99-3, BH99-4 and BH99-5. It should be noted that all of the monitoring wells near the north property boundary are located within the property boundary (refer to Figure 2).

Table 3 presents a summary of the parameters with reported levels exceeding their respective ODWQS, trends in groundwater quality, a comparison of the groundwater quality to background conditions (in the surficial granular layer or silty clay layer), vertical variations in groundwater quality at each borehole location (where applicable), and an interpretation of the groundwater quality data for the monitoring wells sampled in 2023.

Each of the monitoring wells located near the north property boundary did not meet the ODWQS with respect to DOC, iron, manganese and/or TDS during at least one of the monitoring events. In addition, monitor BH99-1 did not meet the ODWQS with respect to nitrate during the spring monitoring event.

As shown in Table 3, among the monitoring wells located near the north property boundary, those interpreted to be impacted by landfill leachate are BH8A, BH8B, BH91-1B and BH99-3, which are located along the old north property boundary. Monitoring wells BH9B, BH92-1A, BH92-1B, BH92-1C and BH99-4, located farther downgradient, are interpreted to be marginally impacted by landfill leachate (i.e., concentrations of Leachate Indicator Parameters at these wells are elevated compared to background concentrations but remain low compared to those at impacted wells BH8A, BH8B and BH91-1B). Monitoring well BH99-5 is interpreted to be potentially impacted by landfill leachate, but the impact is considered to be inconsistent and/or minor. Monitoring wells BH99-1 and BH99-2, located along the current northern property boundary, are interpreted to be not impacted by landfill leachate.

The parameter concentrations recorded at the monitored wells in 2023 were generally within their respective historical ranges and did not exhibit any marked increasing or decreasing trends, with the following noted exceptions:

- A generally increasing trend in chloride concentration has been observed at monitor BH8A since 2014. Concentrations of chloride measured in 2023 (i.e., 43 mg/L in both spring and fall 2023) are the highest concentrations of chloride measured at this monitor to-date. Monitor BH8A is interpreted to be impacted by landfill leachate and elevated chloride concentrations are consistent with this interpretation.
- A generally increasing trend in chloride concentration has been observed at monitor BH8B since 2011. The November 2023 concentration of 51 mg/L is the highest concentration of chloride measured at this monitor to-date. Monitor BH8B is interpreted to be impacted by landfill leachate and elevated chloride concentrations are consistent with this interpretation.
- A generally increasing trend in chloride concentration has been observed at monitor BH9B since 2010. The November 2023 concentration of 61 mg/L is the highest concentration of chloride measured at this monitor to date. Monitor BH9B is interpreted to be marginally impacted by landfill leachate and the increasing chloride concentrations are expected as leachate continues to migrate into the vicinity of the monitor.
- A generally increasing trend in manganese has been observed at monitor BH91-1; however, the concentrations of manganese measured at monitor BH91-1 in 2023 were within the historical limits for this parameter at this location. Monitor BH8B is interpreted to be impacted by landfill leachate and elevated manganese concentrations are consistent with this interpretation.

The following overall interpretations are provided based on the 2023 data for the groundwater monitoring wells located near the north property boundary:

- The potential that the landfill leachate plume is affecting water quality in Dochart Creek to the north of the waste mound is considered low. Monitoring well BH99-5 near the creek is considered to be potentially impacted by leachate, while monitoring well BH99-1 near the creek is not.
- The landfill leachate plume has not reached the north property boundary. Monitoring wells BH99-1 and BH99-2 (located at the north property boundary) are interpreted to not be impacted by landfill leachate.

4.1.4 Northwest of Waste Mound

The groundwater monitoring wells located northwest of the waste mound include BH10A, BH15-1, BH15-2A, BH15-2B, BH20-1, BH20-2 and BH20-3. The locations of these monitors are presented on Figure 2.

As shown in Table 3, among the monitoring wells located northwest of the waste mound, those interpreted to be impacted by landfill leachate are BH10A, BH15-1, BH15-2A and BH15-2B, which are all located within 180 metres from the waste mound and consistently report elevated concentrations of Leachate Indicator Parameters compared to background concentrations. Monitoring well BH20-1, located approximately 50 metres downgradient of BH15-2, is interpreted to be marginally impacted by landfill leachate due to elevated concentrations of chloride; however, concentrations of other Leachate Indicator Parameters at monitor BH20-1 remain comparable to background concentrations or marginally exceed background concentrations. Monitors BH20-2 and BH20-3, located furthest downgradient and within 100 metres of Dochart Creek, are interpreted to not be impacted by landfill leachate as Leachate Indicator Parameters are comparable to background concentrations.

The parameter concentrations recorded at the monitored wells in 2023 were generally within their respective historical ranges and did not exhibit any marked increasing or decreasing trends, with the following noted exceptions:

- A generally decreasing trend in chloride concentration has been observed at monitor BH10A since 2017. The chloride concentration measured at this monitor in 2017 was 110 mg/L while the chloride concentrations measured at this monitor in 2023 were 67 mg/L and 64 mg/L for the spring and fall monitoring events, respectively. Groundwater at monitor BH10A is interpreted to be impacted by landfill leachate and the chloride concentrations measured in 2023 remain within the range expected for leachate-impacted groundwater (see Section 4.1.2.1).
- The iron concentration measured at monitor BH15-1 during the 2023 fall monitoring event (64.7 mg/L) is the highest iron concentration recorded at this monitor to-date. Iron concentrations at monitor BH15-1 have been observed to vary over a large range between monitoring events, without following a generally increasing or decreasing trend. Prior to 2023, iron concentrations at BH15-1 ranged from 0.54 mg/L to 59.0 mg/L. Groundwater at monitor BH15-1 is interpreted to be impacted by landfill leachate and the iron concentration measured during the 2023 fall monitoring event is within the range expected for leachate-impacted groundwater (see Section 4.1.2.1).

As stated above, groundwater in the vicinity of BH20-2 and BH20-3 (both located within 100 metres of the Dochart Creek) is considered to not be impacted by landfill leachate; as such, the landfill leachate is interpreted to not be affecting water quality in Dochart Creek to the northwest of the waste mound.

4.2 Compliance Assessment

This section provides a groundwater compliance assessment under MECP Guideline B-7 (MECP, 1994b).

MECP Guideline B-7 (the “Reasonable Use Concept”) addresses the levels of off-site leachate impact on groundwater considered acceptable by the MECP and defines the level of impact on groundwater beyond which some form of mitigation measure(s) would be warranted. Under MECP Guideline B-7, a change in the quality of groundwater on adjacent properties will only be acceptable if the quality is not degraded in excess of fifty percent of the difference between background concentrations and established water quality criteria for aesthetic related parameters, and twenty-five percent of the difference between background conditions and established water

quality criteria for health-related parameters. The standards described in the ODWQS (MECP, 2003) are used to represent the established water quality criteria.

MECP Guideline B-7 applies to groundwater quality at the Site boundary. As per the conceptual hydrogeological model established for the Site (Section 3.0), leachate-impacted groundwater is interpreted to flow from the waste mound towards the north. As such, the compliance assessment under MECP Guideline B-7 was applied to boundary monitors BH99-2 and BH99-1 which are located along the current north property boundary. The property boundary monitors BH99-2 and BH99-1 represent the groundwater quality within the granular and silty clay layers, respectively. Prior to the acquisition of additional property in 2000 (i.e., along with amendments to the Certificate of Approval), several additional monitors were used to evaluate Reasonable Use compliance at the former northern property boundary. The property acquisition of 2000 extended sections of the property boundary for the Site to Dochart Creek; as such, leachate-impacted groundwater is expected to eventually discharge to Dochart Creek in these areas (see Section 5.2 for assessment of surface water compliance).

For the purpose of this compliance evaluation under MECP Guideline B-7, the historical groundwater quality reported at monitor BH3B is assumed to represent background groundwater quality within the granular overburden. The historical groundwater quality reported at monitor BH92-5 is assumed to represent background conditions within the silty clay unit.

The range in natural groundwater quality at background monitors BH3B and BH92-5 with respect to analytical parameters included in the groundwater monitoring program (see Section 2.1.2) for which an ODWQS Maximum Acceptable Concentration (MAC), Interim Maximum Acceptable Concentration (IMAC) or Aesthetic Objective (AO) has been established is provided in the following table along with the Reasonable Use performance objectives under MECP Guideline B-7.

Parameters	ODWQS (MECP, 2003)	Range in Background Concentration at Monitor		Reasonable Use Performance Objectives (MECP, 1994b)	
		BH3B (Granular Layer)	BH92-5 (Silty Clay Layer)	Granular Layer	Silty Clay Layer
Arsenic	0.01 (MAC)	<0.001	<0.001	0.003	0.003
Barium	1 (MAC)	0.01 – 0.05	0.027 – 0.1	0.29	0.33
Boron*	5 (MAC)	<0.01 – 0.08	0.02 – 0.06[1]	1.31	1.30
Chloride*	250 (AO)	<1 – 7.4	<1 – 8	129	129
Chromium	0.05 (MAC)	<0.001 – 0.02	<0.001	0.03	0.01
Copper	1 (AO)	<0.001 – 0.005	<0.001 – 0.02	0.5	0.5
DOC*	5 (AO)	1.1 – 5.6	0.9 – 3.2[2]	5.6	4.1
Iron*	0.3 (AO)	<0.01 – 0.46	<0.01 – 0.65[3]	0.46	0.65
Lead	0.01 (MAC)	<0.002	<0.002[4]	0.004	0.004
Manganese*	0.05 (AO)	<0.002 – 0.019	<0.01 – 0.5	0.035	0.50
Mercury	0.001 (MAC)	<0.0001	<0.0001	0.0003	0.001

Parameters	ODWQS (MECP, 2003)	Range in Background Concentration at Monitor		Reasonable Use Performance Objectives (MECP, 1994b)	
		BH3B (Granular Layer)	BH92-5 (Silty Clay Layer)	Granular Layer	Silty Clay Layer
Nitrate	10 (MAC)	<0.1 – 1.84	<0.1 – 0.18	3.9	2.6
Nitrite	1 (MAC)	<0.01 – 0.015	<0.01 – 0.031	0.26	0.27
Sodium*	200 (AO)	<1 – 9	5 – 46	105	123
Sulphate	500 (AO)	14 – 43	<1 – 125	272	313
TDS*	500 (AO)	184 – 436	196 – 290	468	395
Zinc	5 (AO)	<0.005 – 0.05	<0.005 – 0.013	2.5	2.5

Notes:
All concentrations reported in milligrams per litre
* Indicates Leachate Indicator Parameter (see Section 4.1.2.1)
[1] Excludes anomalous value of 0.41 mg/L reported in October 1994
[2] Excludes anomalous value of 44 mg/L reported in November 2013
[3] Excludes anomalous value of 10.8 mg/L reported in April 2021
[4] Excludes anomalous value of 0.03 mg/L reported in April 2021

All parameters evaluated at the compliance locations during the 2023 fall monitoring event met the Reasonable Use Performance Objectives; however, iron, nitrate and manganese did not meet the Reasonable Use Performance Objectives at one of the two compliance locations during the 2023 spring monitoring event as shown in the table below.

Compliance Location (Monitoring Well)	Monitoring Event	Parameter	Reasonable Use Performance Objective (MECP, 1994b) (mg/L)	Measured Concentration (mg/L)
BH99-1	Spring 2023	Iron	0.65	0.85
BH99-1	Spring 2023	Nitrate	2.6	11.1
BH99-2	Spring 2023	Manganese	0.035	0.09

The identified exceedances are interpreted to not be the result of leachate impacts based on the following reasons:

- As discussed in Section 4.1.3, the current interpretation of Site conditions is that the leachate plume has not yet reached the location of monitors BH99-1 and BH99-2. This interpretation is supported by the concentrations of Leachate Indicator Parameters at these monitoring locations that have been generally stable over time and are generally not elevated compared to background conditions. This assessment specifically considers the concentration of chloride, which is a reliable tracer for the extent of leachate impacts in the groundwater at the Site and continues to be within the background range at these monitors with no increasing trends.

- The values of iron and manganese identified exceeding Reasonable Use criteria are only slightly elevated compared to background groundwater quality at the Site. Iron and manganese concentrations measured at the background sampling locations occasionally exceed the ODWQS. In addition, the measured concentrations are significantly lower than the concentrations observed for these parameters in leachate-impacted groundwater (see Section 4.1.2.1).
- The concentration of nitrate is occasionally elevated at monitoring well BH99-1, including past Reasonable Use and ODWQS exceedances. The concentration of nitrate at this monitor is variable between monitoring events as opposed to consistently elevated or following an increasing trend over time. Monitoring well BH99-1 is located at the edge of the Site, which is adjacent to an agricultural field. As such, the elevated nitrate concentrations may be due to agricultural activities.

The landfill is interpreted to be operating in compliance with the MECP Guideline B-7 with respect to landfill leachate-related impacts.

5.0 SURFACE WATER

5.1 Physical and Chemical Analyses

The results of the field and laboratory chemical and physical analyses conducted on surface water samples during the 2023 monitoring program, along with the relevant Provincial Water Quality Objectives (PWQO) (MECP, 1994a (Reprint 1999)), are provided in Appendix C. Historic results from 1991 through 2023 are included on the data drive accompanying this report.

Section 5.1.1 and Section 5.1.2 discuss the surface water quality at the stations sampled during the 2023 monitoring program and, where appropriate, provide discussions on the apparent trends in surface water quality over time at each of the locations.

The parameters with reported levels exceeding their respective PWQO, trends in surface water quality, a comparison of the surface water quality to background conditions, and an interpretation of the surface water quality data are summarized in Table 4 for each of the monitoring stations sampled during the 2023 surface water monitoring program.

5.1.1 Poorly-Drained Area

The locations of all existing surface water sampling stations in the poorly-drained area are shown on Figure 2. No surface water features are present upgradient of the waste mound; as such, there is no suitable upgradient background sampling location for the poorly-drained area. Sampling station SW8 located along the east property boundary has been selected as the best available location to represent background surface water conditions in the poorly-drained area. Surface water station SW8 has been sampled since 1993 and appears to be unaffected by the landfill as the chloride levels measured are typically below 8 mg/L, which is similar to the concentration reported for the background groundwater monitoring well BH3B (i.e., <1 mg/L to 7.4 mg/L). However, in December 2012 and November 2013, the chloride concentration at SW8 (21 mg/L on both dates) was elevated compared to the historical range. Since 2014, chloride concentration has been observed to be within the historical range at SW8. In addition, total iron concentrations at SW8 have historically varied over a wide range (<0.03 mg/L to 0.94 mg/L); however, the total iron concentrations measured at SW8 since 2017 have been low (<0.03 mg/L and 0.17 mg/L). Concentrations of Leachate Indicator Parameters will be closely monitored at this location to assess whether there are any sustained increasing trends suggesting landfill leachate impacts. For the comparison to background surface water quality in Table 4, the elevated chloride and sodium concentrations in

2012 and 2013 at SW8 have been identified as potentially anomalous and excluded from the historical background range.

The parameter concentrations recorded in 2023 at the surface water stations in the poorly-drained area were generally within their respective historical ranges with the exception of station SW6, where increasing trends in chloride and boron have been observed since 2013.

Based on the results of the analysis presented in Table 4, sampling stations SW4, SW6, SW7 and SW9 are interpreted to be impacted by landfill leachate based on a comparison to the background conditions at station SW8. The greatest landfill leachate impacts are reported at sampling station SW9 which is located within 50 metres of the waste disposal fill area. This interpretation is consistent with the interpretations made during previous assessments.

5.1.2 Dochart Creek

Surface water monitoring stations SW1 and SW2, in Dochart Creek, were sampled three times in 2023. In general, the surface water quality at station SW2 downstream of the fill area was similar to surface water quality at upstream station SW1. As presented in Table 4, all Leachate Indicator Parameter concentrations at SW2 were within the background range during the 2023 monitoring program with the exception of ammonia, total iron and manganese during the spring monitoring session and chemical oxygen demand during the fall monitoring session. The remaining Leachate Indicator Parameter concentrations were either unchanged or decreased between SW1 and SW2. The limited and inconsistent increases in parameter concentrations noted above are interpreted to be due to natural variations in surface water quality and mixing. Based on this analysis, it is interpreted that landfill leachate is not impacting surface water quality at SW2. This interpretation is consistent with the interpretations made during previous assessments.

5.2 Compliance Assessment

For the purpose of this surface water quality compliance assessment, the PWQO are being applied to the surface water sampling stations in the poorly-drained area to the east of the fill area, and to downstream surface station SW2 in Dochart Creek. As discussed previously, the background surface water quality is assumed to be represented by the data available from station SW8 for the poorly-drained area and from SW1 for Dochart Creek.

For this compliance assessment, Policy 1 and Policy 2 of the PWQO (MECP, 1994a (Reprint 1999)) were considered. Policy 1 indicates that "in areas which have water quality better than the Provincial Water Quality Objectives, water quality shall be maintained at or above the Objectives". Policy 2 indicates that "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".

5.2.1 Poorly-Drained Area

During the 2023 monitoring program, surface water quality at background station SW8 was in compliance with the PWQO for all parameters tested. Based on the historical surface water quality data collected at station SW8, background surface water quality in the poorly-drained area is generally in compliance with the PWQO with the exception of dissolved oxygen, total phosphorus and iron which are occasionally out of compliance with PWQO. The presence of organic peat soils within the poorly-drained area and the low flow conditions may contribute to the low dissolved oxygen content of the surface water in this area. For the purpose of this compliance assessment, the surface water quality within the poorly-drained area is considered to not naturally meet the PWQO for dissolved oxygen, total phosphorus, and iron. As a result, it is considered at this time that

Policy 2 would apply to these parameters in the poorly-drained area and that Policy 1 would apply to the remaining parameters in the poorly-drained area.

The following table summarizes the 2023 parameter concentrations which exceeded their respective PWQO values:

Sampling Location	Parameters Not in Compliance with PWQO in 2023	2023 Parameter Concentration (µg/L)	Background Concentrations at SW8 (1993 – 2023) (µg/L)	
			Range	75th Percentile
SW8 (Background)	none	-	-	-
SW4 (420 m from fill area)	**Spring:** boron total phosphorus **Fall:** boron total phosphorus total iron	 280 66 260 82 500	 <10 – 60 5 – 190 <10 – 60 5 – 190 <30 – 940	 36 60 36 60 253
SW6 (350 m from fill area)	**Spring:** unionized ammonia total phosphorus boron cobalt *SW6 was dry during the 2023 fall monitoring event*	 70 38 230 1.0	 <20 5 – 190 <10 – 60 <0.5	 never detected 60 36 never detected
SW7 (250 m from fill area)	**Spring:** boron dissolved oxygen **Fall:** boron total phosphorus cobalt total iron dissolved oxygen	 380 6,270 370 506 2.4 7,470 3,800	 <10 – 60 1,150 – 11,630 <10 – 60 5 – 190 <0.5 <30 – 940 1,150 – 11,630	 36 5,100 36 60 never detected 253 5,100
SW9 (50 m from fill area)	**Spring:** boron total phosphorus cobalt total iron dissolved iron **Fall:** boron total phosphorus cobalt total iron dissolved iron dissolved oxygen	 1,070 49 1.4 36,100 2,620 500 34 1.2 21,700 7,800 2,400	 <10 – 60 5 – 190 <0.5 <30 – 940 <30 – 100 <10 – 60 5 – 190 <0.5 <30 – 940 <30 – 100 1,150 – 11,630	 36 60 never detected 253 62 36 60 never detected 253 62 5,100

At station SW4, boron and total phosphorus were not in compliance with the PWQO during both 2023 monitoring events and total iron was not in compliance with the PWQO during the 2023 fall monitoring event. The total phosphorus and total iron concentrations do comply with MECP Policy 2 because the concentrations fall within the background concentration range for these parameters. Boron concentrations at station SW4 have been variable over time, ranging from <10 µg/L to 380 µg/L. Boron is considered a Leachate Indicator Parameter and the elevated concentrations present at SW4 are likely due to leachate impacts in the surface water at this monitoring location.

At station SW6, unionized ammonia, total phosphorus, boron and cobalt did not comply with the PWQO during the 2023 spring monitoring event (i.e., the only time a sample was collected at station SW6 during 2023 due to the station being dry during the fall monitoring event). The total phosphorus concentration from the spring monitoring event did comply with MECP Policy 2 because the concentration falls within the background concentration range for total phosphorus. Cobalt and unionized ammonia concentrations exceeding the PWQO have not been recorded at SW6 prior to the 2023 monitoring event. Boron concentrations at station SW6 have followed a generally increasing trend since approximately 2013. Boron is considered a Leachate Indicator Parameter and the elevated concentrations present at SW6 are likely due to leachate impacts in the surface water at this monitoring location.

At station SW7, boron and dissolved oxygen did not comply with the PWQO during the 2023 spring monitoring event and boron, total phosphorus, cobalt, total iron and dissolved oxygen did not comply with the PWQO during the 2023 fall monitoring event. The dissolved oxygen concentrations out of compliance with the PWQO do comply with MECP Policy 2 because the concentrations fall within the background concentration range for this parameter. The concentrations of each of the parameters not in compliance with the PWQO during 2023 have been variable over time including historical non-compliance with PWQO. Boron is considered a Leachate Indicator Parameter and the elevated concentrations present at SW7 likely indicate leachate impacts in the surface water at this monitoring location.

At station SW9, boron, total phosphorus, cobalt, total iron and dissolved iron did not comply with PWQO during both monitoring events in 2023. In addition, dissolved oxygen did not comply with PWQO during the 2023 fall monitoring event; however, the dissolved oxygen did comply with MECP Policy 2 because the concentration falls within the range of historic background levels at SW8. Station SW9 is located approximately 50 metres from the waste mound and is interpreted to be impacted by landfill leachate due to consistently elevated concentrations of Leachate Indicator Parameters compared to background conditions.

5.2.2 Dochart Creek

Background surface water quality in Dochart Creek (SW1) has historically been in compliance with the PWQO except for occasional exceedances of iron and total phosphorus. During the 2023 monitoring program, SW1 was in compliance with the PWQO for all parameters tested with the exception of total iron during the summer and fall monitoring events.

During the 2023 monitoring program, SW2 was in compliance with the PWQO for all parameters tested with the exception of total iron during the spring monitoring event and total phosphorus during the summer monitoring event. The elevated total iron and total phosphorus concentrations at SW2 are interpreted to be due to natural variations in surface water quality and mixing rather than landfill leachate-related impacts, based on the following:

- The concentration of total iron measured at station SW2 during the spring monitoring event (500 ug/L) fell within the range of historic concentrations for total iron at station SW2 (40 µg/L to 530 µg/L).

- The concentration of total phosphorus measured at station SW2 during the summer monitoring event (34 µg/L) fell within the range of historic concentrations for total phosphorus at station SW2 (8 µg/L to 70 µg/L).
- There is no evidence of increasing concentrations of total phosphorus or total iron over time at station SW2.
- Total phosphorus and total iron parameters are occasionally found in concentrations exceeding the PWQO at the background surface water station in Dochart Creek (SW1).

6.0 PROPOSED 2024 GROUNDWATER AND SURFACE WATER MONITORING PROGRAM

A groundwater and surface water monitoring program forms an integral part of the management of a landfill during both the operational period and post-closure. Routine monitoring allows the determination of contaminant egress from the landfill, if any, and alerts the owner/operator to environmental problems. Potential problems of the future may be recognized from the analysis of the trends of the monitoring data collected over the years. The early warning of developing problems will allow for corrective measures to be taken thus avoiding or lessening any potential environmental damage. Corrective actions may mean modifications to the Site design or operations, or the implementation of a contingency plan.

A monitoring program also serves the purpose of providing the general public directly, or through regulatory authorities such as the MECP, with information on the performance of the landfill and the protection it affords to the environment as a result of sound planning, design and operations.

The objectives of the 2024 groundwater and surface water monitoring program are to continue to monitor water quality at the Site, including locations upgradient and downgradient of the landfilling area, for the purpose of characterizing the extent of the leachate-impacted areas of the Site and assessing compliance.

The proposed groundwater monitoring program for 2024 is summarized in Table 5. The proposed groundwater monitoring program is consistent with the 2023 groundwater monitoring program with the following exception:

- It is proposed that monitor BH15-2A be removed from the groundwater monitoring program. Excessive sediment has built up within the well (i.e., screened interval and riser) resulting in a blockage that prevents the collection of a groundwater sample from this location. This location has not been successfully sampled since November 2019. Two attempts to rehabilitate the monitoring well have been undertaken since the blockage was identified but the efforts did not result in the ability to collect a groundwater sample from the well. Observations made during the rehabilitation attempts suggest issues exist with the well screen and/or filter media. This monitor was installed in 2015 to assess the extent of leachate migration in the groundwater northwest of the waste mound. Data collected at this monitor since 2015 have allowed for the interpretation that leachate-impacted groundwater has migrated past this location (Section 4.1.4); as such, additional monitors were installed downgradient of this location in 2020 (i.e., BH20-1, BH20-1 and BH20-3). It is WSP's opinion that BH15-2A is no longer needed to characterize the extent of leachate-impacted groundwater to the northwest of the waste mound given the location of the leachate plume (i.e., interpreted to already have migrated beyond this location) and the existence of downgradient monitors; therefore, it is proposed that monitor BH15-2A can be removed from the monitoring program and does not need to be replaced. It is noted that no issues have been identified with monitor BH15-2B (i.e., the monitoring well targeting the granular layer within the same well nest as BH15-2A); as such, monitor BH15-2B will remain part of the groundwater monitoring program.

The proposed groundwater monitoring program is consistent with the requirements of the Site's Certificate of Approval No. A412605, with the changes to the parameter list recommended by the MECP groundwater reviewer in 2010 and 2019, the addition of monitoring wells to the northwest of the mound area recommended by the MECP groundwater reviewer in 2015 and 2019 and the removal of monitor BH4B from the monitoring program in 2020. The groundwater monitoring program also includes a monitoring well condition survey.

The proposed surface water monitoring program for 2024 is summarized in Table 6. The proposed surface water monitoring program remains unchanged from the 2023 surface water monitoring program and is consistent with the Site's Certificate of Approval No. A412605, as amended by the MECP District Manager on September 19, 2003 and with the changes recommended by the MECP surface water reviewer in 2010, 2011 and 2019.

It should be noted that the Township is currently undertaking steps towards updating the D&O Plan for the Site (as discussed in Section 1.1). Based on the current correspondence between the Township and the MECP, it is expected that the updated D&O Plan will include groundwater and surface water monitoring programs with a larger scope than the monitoring programs currently conducted at the Site. It is not expected that an updated D&O Plan and amendment to the Certificate of Approval would be in place prior to the start of the 2024 monitoring programs; as such, at this time, it is assumed that the 2024 monitoring programs would be conducted based on the requirements of the current Certificate of Approval (as presented above).

The results of the groundwater and surface water monitoring program are formally reported to the MECP on a biennial basis (i.e., every two years). In place of a formal technical report, a summary letter report for the 2024 monitoring program will be prepared and submitted to the MECP prior to March 31, 2025. The next formal monitoring report will be prepared for the 2025 monitoring program and will be submitted to the MECP prior to March 31, 2026.

7.0 CONCLUSIONS

The main conclusions derived from the 2021 monitoring program carried out at the Site are summarized below:

- Based on the results of the 2023 monitoring program, the groundwater along the north property boundary of the Site complies with MECP Guideline B-7 (the "Reasonable Use Concept") with respect to landfill leachate-related impacts.
- The parameter concentrations exceeding the PWQO values at sampling station SW9 are related to landfill leachate-related impacts and this interpretation is consistent with previous years. This sampling station is located within 50 metres of the waste disposal fill area.
- The impacts from landfill leachate on the surface water quality in the poorly-drained area east of the waste disposal fill area result in concentrations of several Leachate Indicator Parameters beyond the values considered acceptable under MECP Policy 1 (PWQO); however, less significantly than at SW9.
- Surface water quality in Dochart Creek in the vicinity of the Site does not significantly vary along the length of the Site and does not appear to be impacted by landfill leachate.
- Groundwater and surface water monitoring programs will continue at the Site to evaluate Site compliance on an ongoing basis. The groundwater monitoring program proposed for 2024 is the same as the program conducted in 2023 with the exception of the removal of monitor BH15-2A from the monitoring program. The surface water monitoring program proposed for 2024 is unchanged from the 2023 monitoring program.

8.0 LIMITATIONS AND USE OF REPORT

WSP Canada Inc. (“WSP”) prepared this report solely for the use of the intended recipient, the Township of McNab/Braeside, in accordance with the professional services agreement between the parties. The report is intended to be used in its entirety. No excerpts may be taken to be representative of the findings in the assessment.

The conclusions presented in this report are based on work performed by trained, professional and technical staff, in accordance with their reasonable interpretation of current and accepted engineering and scientific practices at the time the work was performed.

The content and opinions contained in the present report are based on the observations and/or information available to WSP at the time of preparation, using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by WSP and other engineering/scientific practitioners working under similar conditions, and subject to the same time, financial and physical constraints applicable to this project.

WSP disclaims any obligation to update this report if, after the date of this report, any conditions appear to differ significantly from those presented in this report; however, WSP reserves the right to amend or supplement this report based on additional information, documentation or evidence.

WSP makes no other representations whatsoever concerning the legal significance of its findings.

The intended recipient is solely responsible for the disclosure of any information contained in this report. If a third party makes use of, relies on, or makes decisions in accordance with this report, said third party is solely responsible for such use, reliance or decisions. WSP does not accept responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken by said third party based on this report.

WSP has provided services to the intended recipient in accordance with the professional services agreement between the parties and in a manner consistent with that degree of care, skill and diligence normally provided by members of the same profession performing the same or comparable services in respect of projects of a similar nature in similar circumstances. It is understood and agreed by WSP and the recipient of this report that WSP provides no warranty, express or implied, of any kind. Without limiting the generality of the foregoing, it is agreed and understood by WSP and the recipient of this report that WSP makes no representation or warranty whatsoever as to the sufficiency of its scope of work for the purpose sought by the recipient of this report.

In preparing this report, WSP has relied in good faith on information provided by others, as noted in the report. WSP has reasonably assumed that the information provided is correct and WSP is not responsible for the accuracy or completeness of such information.

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

WSP disclaims any responsibility for consequential financial effects on transactions or property values, or requirements for follow-up actions /or costs.

Overall conditions can only be extrapolated to an undefined limited area around these testing and sampling locations. The conditions that WSP interprets to exist between testing and sampling points may differ from those that actually exist. The accuracy of any extrapolation and interpretation beyond the sampling locations will depend on natural conditions, the history of Site development and changes through construction and other activities. In

addition, analysis has been carried out for the identified chemical and physical parameters only, and it should not be inferred that other chemical species or physical conditions are not present. WSP cannot warrant against undiscovered environmental liabilities or adverse impacts off-Site.

This limitations statement is considered an integral part of this report.

9.0 SIGNATURE PAGE

We trust this report meets your current needs. If you have any questions regarding this report, please contact the undersigned.

WSP Canada Inc.



Cameron W. Toy, M.Sc., P.Geo.
Hydrogeologist

Kris A. Marentette, M.Sc., P.Geo.
Senior Hydrogeologist

CWT/KAM/rk

https://golderassociates.sharepoint.com/sites/169612/project files/6 deliverables/1. 2023 monitoring report/22578713-r-rev0-mcnab_braeside 2023 monitoring report_20mar2024.docx

10.0 REFERENCES

Freeze, A.R., and J.A. Cherry. 1979. Groundwater. Prentice Hall, New Jersey.

Golder, 2022. 2021 Groundwater and Surface Water Monitoring Program and Annual Operations Report, Waste Disposal Site, Township of McNab/Braeside, Ontario. Golder Associates Ltd. and Stantec Consulting Ltd., Report No. 20443041, March 2022.

Golder, 2021A. Hydrogeological Impact Assessment, McNab Waste Disposal Site, Township of McNab/Braeside, Ontario. Golder Associates Ltd. Report No. 19130748-001, February 2021.

Golder, 2021B. 2020 Groundwater and Surface Water Monitoring Program Summary Letter, McNab Waste Disposal Site, Township of McNab/Braeside, Ontario. Golder Associates Ltd. Letter No. 19135012, March 2021.

Golder, 2020. 2019 Groundwater and Surface Water Monitoring Program and Annual Operations Report, Waste Disposal Site, Township of McNab/Braeside, Ontario: Golder Associates Ltd. and Stantec Consulting Ltd., Report No. 18112938, March 2020.

Golder, 1993. Hydrogeological Investigation and 1992 Monitoring Program, McNab Township Waste Disposal Site, Renfrew County, Ontario, Golder Associates Ltd. Report No. 921-2795, February 1993.

Golder, 1991. Hydrogeological Investigation, McNab Township Waste Disposal Site, Renfrew County, Ontario, Golder Associates Ltd. Report No. 901-2851, April 1991.

Ministry of the Environment, 2010. Landfill Standards: A Guideline on the Regulatory and Approval Requirement for New or Expanding Landfill Sites, June 2010.

Ministry of the Environment, 2001. Ontario Drinking Water Standards, Revised 2001.

Ministry of the Environment, 1994a. Water Management - Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of the Environment and Energy: Ontario Ministry of the Environment and Energy, July 1994 (Reprint 1999).

Ministry of the Environment, 1994b. Guideline B-7: Incorporation of the Reasonable Use Concept into MOEE Groundwater Management: MOEE Program Development Branch: Ontario Ministry of the Environment and Energy, April 1994, 8 p.

Ministry of the Environment, 1998. Landfill Standards: A Guideline on the Regulatory and Approval Requirements for New or Expanding Landfilling Sites: Ontario Ministry of the Environment, May 1998 (Last Revision June 2010).

Ontario Geological Survey, 2006. Bedrock topography and overburden thickness mapping, Southern Ontario; Ontario Geological Survey, Miscellaneous Release – Data 207.

WSP, 2023. 2022 Groundwater and Surface Water Monitoring Program Summary Letter, McNab Waste Disposal Site, Township of McNab/Braeside, Ontario. WSP Canada Inc. Letter No. 21506553, March 2023.

Table 1: 2023 Stream Flow Observations

Surface Water Station	Surface Water Flow Estimate (litres/second)		
	Spring 2023	Summer 2023	Fall 2023
SW1	60	40	30
SW2	60	40	20
SW4	No measurable flow	Not included in the summer monitoring program	No measurable flow
SW6	4		Dry
SW7	No measurable flow		No measurable flow
SW8	10		No measurable flow
SW9	No measurable flow		No measurable flow

Notes:
1. No measurable flow – No flow was observed at the surface water station during site visit
2. Dry – Surface water station was dry during the site visit

Table 2: Groundwater Elevation Data and Results of Monitoring Well Condition Survey

Monitoring Well	Well Coordinates[1]		Current Top of Casing (masl)	Groundwater Elevation (masl)				Monitoring Well Condition on April 27, 2023
	Easting (m)	Northing (m)		31-May-22	01-Dec-22	27-Apr-23	30-Nov-23	STATUS / COMMENTS
BH 1	302320	5031563	152.73	149.33	NA	149.79	NA	Operational
BH 2A	302415	5031867	145.94	NM	NA	144.64	NA	Operational
BH 2B	302415	5031867	145.88	NM	NA	144.42	NA	Operational
BH 3A	302523	5031534	146.96	145.52	NA	145.88	NA	Operational
BH 3B	302523	5031534	146.96	145.51	144.89	145.74	144.30	Operational
BH 5A	302614	5031989	143.47	141.74	NA	142.13	NA	Operational
BH 5B	302614	5031989	143.05	141.32	NA	141.73	NA	Operational
BH 6	302505	5031647	145.31	144.35	144.24	144.40	144.11	Operational
BH 7	302569	5032019	144.68	141.86	NA	142.20	NA	Operational
BH 8A	302497	5031967	144.38	142.86	142.71	142.98	142.36	Operational
BH 8B	302497	5031968	144.31	142.69	142.54	142.82	142.21	Operational
BH 9A	302466	5032000	144.41	142.48	NA	142.74	NA	Operational
BH 9B	302466	5031999	144.36	142.50	142.31	142.76	142.00	Operational
BH 10A	302283	5031770	147.93	145.32	144.51	145.94	144.28	Operational
BH 91-1A	302515	5031975	144.10	142.98	NA	143.12	NA	Operational
BH 91-1B	302516	5031976	143.42	142.31	142.14	142.41	141.74	Operational
BH 91-1C	302516	5031975	143.07	141.85	NA	141.89	NA	Operational
BH 92-1A	302522	5032056	141.29	138.31	138.15	138.58	137.93	Operational
BH 92-1B	302524	5032056	141.36	139.00	138.91	139.17	138.59	Operational
BH 92-1C	302524	5032056	141.36	139.34	139.33	139.51	138.96	Operational
BH 92-2	302890	5031692	142.08	140.71	NA	140.74	NA	Operational
BH 92-3	302804	5031659	142.14	141.23	NA	141.26	NA	Operational
BH 92-4	302689	5031690	144.09	143.12	NA	143.15	NA	Operational
BH 92-5	302702	5031577	142.96	141.98	141.94	141.99	141.82	Operational
BH 99-1	302628	5032087	140.99	138.20	137.33	138.43	dry	Operational
BH 99-2	302612	5032031	143.29	141.54	140.88	141.90	140.40	Operational
BH 99-3	302433	5031907	145.68	143.83	143.66	144.08	143.43	Operational
BH 99-4	302380	5031963	145.00	143.31	143.32	143.35	143.06	Operational
BH 99-5	302385	5032067	140.34	137.58	138.44	137.92	137.04	Operational
BH 15-1	302284	5031780	147.82	145.29	144.45	145.98	144.22	Operational
BH 15-2A	302230	5031887	145.54	144.35	blockage	blockage	blockage	Sediment buildup is preventing groundwater sample collection.
BH 15-2B	302230	5031887	145.56	144.44	144.25	144.40	144.02	Operational
BH 20-1	380047	5031556	145.09	143.58	143.47	143.83	143.16	Operational
BH 20-2	380040	5031605	143.68	141.72	141.31	141.94	140.76	Operational
BH 20-3	380013	5031666	140.55	138.66	138.46	138.88	137.98	Operational

Notes:

[1] Survey accurate to approximately 2 m; MTM Zone 9, NAD 1983 datum.

NM: not measured, monitors BH2A and BH2B were inaccessible during May 2022 due to site operations.

NA: measurement of groundwater elevation at this monitoring well is not included in the fall monitoring program

dry: no groundwater was present in this monitor at the time of measurement

blockage: sediment buildup prevented the measurement of the groundwater level in this monitor

Prepared by: AS

Checked by: CWT

Table 3: Interpretation of 2023 Groundwater Quality Data, Waste Disposal Site, Township of McNab/Braeside, Ontario

Borehole Location	Monitoring Well	Parameters Exceeding ODWQS in 2023	Trend(s)	Indicator Parameters Elevated Compared to Background Conditions	Vertical Variation in Groundwater Quality at Borehole Location	Interpretation
BH3	BH3B Sand[1]	none	▪ Groundwater quality generally consistent over time	BH3B is a background monitoring well for the sand unit	NA	▪ Borehole 3B is interpreted to represent **background** groundwater quality in the surficial sand layer
BH6	BH6 Sand, Silty Clay[1]	DOC TDS iron manganese benzene (fall)	▪ Groundwater quality generally consistent over time	alkalinity boron ammonia calcium chloride DOC hardness (spring) iron magnesium manganese potassium sodium TDS TKN	NA	▪ Borehole BH6 is hydrogeologically downgradient and located immediately adjacent to the current waste disposal area ▪ Groundwater quality at the borehole is interpreted to be **indicative of the leachate** quality at the site, based on proximity to the downgradient side of the current waste disposal area

Borehole Location	Monitoring Well	Parameters Exceeding ODWQS in 2023	Trend(s)	Indicator Parameters Elevated Compared to Background Conditions	Vertical Variation in Groundwater Quality at Borehole Location	Interpretation
BH8	BH8A Silty Clay/ Clayey Silt[1]	DOC iron manganese TDS	▪ Increasing trend in chloride concentration since 2014	alkalinity boron chloride DOC iron magnesium manganese TDS	▪ Concentrations of most monitored parameters have historically been higher in monitoring well BH8A than in BH8B	▪ Borehole BH8 is hydrogeologically downgradient from the old waste disposal area along the old north property boundary ▪ Groundwater quality in the area of the borehole is interpreted to **be impacted by landfill leachate** based on the elevated concentrations of several leachate indicator parameters relative to background ▪ The significantly elevated iron and manganese levels in the groundwater may be related to the metal component of the previously landfilled material along the north property boundary
	BH8B Sand[1]	DOC iron manganese TDS (fall)	▪ Increasing trend in chloride concentration since 2011	alkalinity (fall) ammonia (fall) boron chloride DOC iron magnesium (fall) manganese potassium (fall) sodium TDS (fall)		
BH9	BH9B Sand, Clayey Silt[1]	DOC (fall)	▪ Increasing trend in chloride concentrations since 2010	boron chloride DOC (fall) magnesium sodium	NA	▪ Borehole BH9 is hydrogeologically downgradient from the old waste disposal area 50 metres beyond the old north property boundary ▪ Groundwater quality in the area of the borehole is interpreted to **be marginally impacted by landfill leachate** based on the elevated chloride concentrations relative to the background

Borehole Location	Monitoring Well	Parameters Exceeding ODWQS in 2023	Trend(s)	Indicator Parameters Elevated Compared to Background Conditions	Vertical Variation in Groundwater Quality at Borehole Location	Interpretation
BH10 / BH15-1[3]	BH10A Silty Clay[1]	DOC TDS iron manganese	▪ Decreasing trend in chloride concentrations since 2017	alkalinity boron calcium chloride DOC hardness iron magnesium manganese sodium (spring) TDS	▪ Generally, BH15-1 exhibits higher parameter concentrations than BH10A	▪ Boreholes BH10 and BH15-1 are located to the northwest of the current waste disposal area ▪ Groundwater quality in the area of the borehole is interpreted to **be impacted by landfill leachate** based on elevated concentrations of the leachate indicator parameters relative to background
	BH10B / BH15-1 Sand[1]	DOC TDS iron manganese	▪ Variable parameter concentrations between sampling events with no clear increasing or decreasing trends	alkalinity ammonia boron calcium COD (fall) chloride DOC hardness iron magnesium manganese potassium sodium TDS TKN		

Borehole Location	Monitoring Well	Parameters Exceeding ODWQS in 2023	Trend(s)	Indicator Parameters Elevated Compared to Background Conditions	Vertical Variation in Groundwater Quality at Borehole Location	Interpretation
BH91-1	BH91-1B Silty Clay[1]	DOC TDS iron manganese	▪ Long-term increasing trend in manganese concentration	alkalinity boron chloride DOC iron magnesium manganese TDS	NA	▪ Borehole BH91-1 is hydrogeologically downgradient from the old waste disposal area adjacent to the old north property boundary ▪ Groundwater quality in the area of the borehole is interpreted to **be impacted by landfill leachate** based on elevated concentrations of several leachate indicator parameters relative to background
BH92-1	BH92-1A Silty Clay[1]	DOC (fall)	▪ Groundwater quality generally consistent over time	chloride DOC (fall)	▪ No overall trend between depth and the concentrations of indicator parameters is observed at this location	▪ Borehole BH92-1 is hydrogeologically downgradient from the old waste disposal area 50 metres beyond the old north property boundary ▪ Groundwater quality in the area of the borehole is interpreted to **be marginally impacted by landfill leachate** based on occasionally elevated concentrations of chloride, manganese and other indicator parameters
	BH92-1B Silty Clay[1]	DOC (fall) manganese	▪ Groundwater quality generally consistent over time	alkalinity chloride DOC (fall) manganese TDS		
	BH92-1C Silty Clay[1]	DOC	▪ Groundwater quality generally consistent over time	chloride DOC		

Borehole Location	Monitoring Well	Parameters Exceeding ODWQS in 2023	Trend(s)	Indicator Parameters Elevated Compared to Background Conditions	Vertical Variation in Groundwater Quality at Borehole Location	Interpretation
BH92-5	BH92-5 Silty Clay[1]	manganese (spring)	▪ Groundwater quality generally consistent over time	BH92-5 is a background monitoring well for the silty clay unit	NA	▪ Borehole 92-5 is interpreted to represent **background** groundwater quality in the silty clay layer
BH99-1	BH99-1 Silty Clay[1]	nitrate (spring) iron (spring)	▪ Groundwater quality generally consistent over time	chloride (spring) iron (spring)	NA	▪ Borehole BH99-1 is hydrogeologically downgradient from the old waste disposal area on a part of the north property boundary ▪ Elevated nitrate concentrations may be related to the location of the borehole adjacent to an agricultural field ▪ Groundwater quality at this location is interpreted to **not be impacted by landfill leachate** based on the lack of indicator parameters with concentrations elevated compared to the background
		BH99-1 could not be sampled during fall 2023 due to insufficient groundwater volume in the monitoring well.				
BH99-2	BH99-2 Sand, Silty Clay[1]	DOC (fall)	▪ Groundwater quality generally consistent over time	manganese (spring)	NA	▪ Borehole BH99-2 is hydrogeologically downgradient from the old waste disposal area on the north property boundary ▪ Groundwater quality in area of borehole interpreted to **not be impacted by landfill leachate** based on the lack of indicator parameters with concentrations elevated compared to the background including concentrations of chloride that are consistently within the range of concentrations observed at the background monitor

Borehole Location	Monitoring Well	Parameters Exceeding ODWQS in 2023	Trend(s)	Indicator Parameters Elevated Compared to Background Conditions	Vertical Variation in Groundwater Quality at Borehole Location	Interpretation
BH99-3	BH99-3 Sand, Silty Clay[1]	DOC (spring) TDS (spring) iron (spring) manganese	▪ Variable parameter concentrations between sampling events with no clear increasing or decreasing trends	alkalinity (spring) boron calcium (spring) chloride DOC (spring) hardness (spring) iron (spring) magnesium manganese sodium TDS (spring)	NA	▪ Borehole BH99-3 is hydrogeologically downgradient from the old waste disposal area on the old north-west property boundary ▪ Groundwater quality in area of borehole is interpreted to **be impacted by landfill leachate** based on the elevated concentrations of several leachate indicator parameters relative to background
BH99-4	BH99-4 Sand, Silty Clay[1]	DOC	▪ Chloride concentrations have been stable since 2019 following period of increasing concentrations between 2011 and 2019 ▪ Variable concenrations of DOC, ammonia, TDS and TKN	boron chloride DOC sodium	NA	▪ Borehole BH99-4 is hydrogeologically downgradient from the old waste disposal area 75 metres beyond the old north property boundary ▪ Groundwater quality in area of borehole interpreted to **be marginally impacted by landfill leachate** based on the elevated chloride concentrations relative to background
BH99-5	BH99-5 Silty Clay[1]	DOC iron manganese (spring)	▪ Variable parameter concentrations between sampling events with no clear increasing or decreasing trends	ammonia COD (spring) DOC iron manganese sodium	NA	▪ Borehole BH99-5 is hydrogeologically downgradient from the old waste disposal area 150 metres beyond the old north property boundary ▪ Groundwater quality in area of borehole interpreted to **be potentially impacted by landfill leachate** based primarily on slightly elevated DOC concentrations and occasionally elevated iron and manganese concentrations

Borehole Location	Monitoring Well	Parameters Exceeding ODWQS in 2023	Trend(s)	Indicator Parameters Elevated Compared to Background Conditions	Vertical Variation in Groundwater Quality at Borehole Location	Interpretation
BH15-2	BH15-2A Silty Clay[1]	NA	▪ Groundwater quality generally consistent over time	NA	▪ Concentrations of some indicator parameters including chloride, manganese and TDS are generally higher in monitoring well BH15-2B than in BH15-2A	▪ Borehole BH15-2 is located to the northwest of the current waste disposal area ▪ The groundwater quality in the area of the borehole is interpreted **to be impacted by landfill leachate** based on elevated concentrations of the leachate indicator parameters relative to background
		BH15-2A could not be sampled in spring or fall 2023 due to a blockage within the monitoring well.				
	BH15-2B Sand[1]	DOC TDS (spring) manganese	▪ Variable parameter concentrations between sampling events with no clear increasing or decreasing trends	alkalinity boron calcium (spring) chloride DOC hardness (spring) magnesium (spring) manganese sodium TDS		
BH20-1	BH20-1 Sand[1]	DOC TDS (fall)	▪ Groundwater quality generally consistent over time	alkalinity boron calcium (fall) chloride DOC (fall) magnesium (fall) manganese sodium TDS	NA	▪ Borehole BH20-1 is located to the northwest of the current waste disposal area ▪ Monitoring at this borehole began in 2020. At this time, the groundwater quality in the area of the borehole is interpreted **to be marginally impacted by landfill leachate** based primarily on the elevated chloride concentrations
BH20-2	BH20-2 Silty Clay[1]	none	▪ Groundwater quality generally consistent over time	DOC (spring)	NA	▪ Borehole BH20-2 is located to the northwest of the current waste disposal area ▪ The groundwater quality in area of the borehole is interpreted to **not be impacted by landfill leachate** based on the generally low leachate indicator parameter concentrations relative to background
		BH20-2 could not be sampled during fall 2023 due to insufficient groundwater volume in the monitoring well.				

Borehole Location	Monitoring Well	Parameters Exceeding ODWQS in 2023	Trend(s)	Indicator Parameters Elevated Compared to Background Conditions	Vertical Variation in Groundwater Quality at Borehole Location	Interpretation
BH20-3	BH20-3 Silty Clay[1]	DOC (spring)	▪ Groundwater quality generally consistent over time ▪ Monitoring well is typically dry during the fall	DOC (spring)	NA	▪ Borehole BH20-3 is located to the northwest of the current waste disposal area ▪ Monitoring at this borehole began in 2020. At this time, the groundwater quality in area of the borehole is interpreted to **not be impacted by landfill leachate** based on the generally low leachate indicator parameter concentrations relative to background
		BH20-3 could not be sampled during fall 2023 due to insufficient groundwater volume in the monitoring well.				

Notes:
ODWQS - Ontario Drinking Water Quality Standards, Objectives and Guidelines (MECP, 2003)
[1] Geological unit(s) adjacent to monitoring well screened interval
[2] Background conditions defined within the silty clay/clayey silt as data from 1993 to 2023 at monitoring well BH92-5 and within the sand as data from 1991 to 2023 at monitoring well BH3B (background groundwater quality represented by data available from monitor BH3B for monitors BH6, BH9B, BH99-2, BH99-3, BH99-4)
[3] BH15-1 replaced BH10B in November 2015
(spring) – Concentration of parameter exceeded ODWQS or background in 2023 during the spring monitoring session only
(fall) – Concentration of parameter exceeded ODWQS or background in 2023 during the fall monitoring session only
NA – Not Applicable

Table 4: Interpretation of 2023 Surface Water Quality Data, Waste Disposal Site, Township of McNab/Braeside, Ontario

Surface Water Sampling Station	Parameters Not in Compliance with PWQO in 2023	Trend(s)	Indicator Parameters Elevated Compared to Background Conditions[1]	Interpretation
SW1 Dochart Creek	**Spring:** none **Summer:** total iron **Fall:** total iron	▪ Surface water quality generally consistent over time	SW1 is the background station for Dochart Creek	▪ Sampling station located in Dochart Creek west (upgradient) from fill area ▪ Surface water quality is representative of **background** water quality in the creek
SW2 Dochart Creek	**Spring:** total iron **Summer:** total phosphorus **Fall:** none	▪ Surface water quality generally consistent over time	**Spring:** ammonia, total iron, manganese **Summer:** none **Fall:** COD	▪ Sampling station located in Dochart Creek north (downgradient) from fill area ▪ Surface water quality interpreted to **not be impacted by landfill leachate**
SW4 Poorly-drained area	**Spring:** boron, total phosphorus **Fall:** boron, total phosphorus, total iron	▪ Surface water quality generally consistent over time ▪ Historically variable iron and boron concentrations occasionally exceeding PWQO	**Spring:** alkalinity, ammonia, boron, calcium, chloride, hardness, magnesium, potassium, sodium, TDS **Fall:** alkalinity, boron, calcium, COD, chloride, hardness, magnesium, potassium, sodium, TDS	▪ Sampling station located approximately 420 metres downgradient from fill area ▪ Surface water quality interpreted to **be impacted by landfill leachate** due to consistently elevated concentrations of indicator parameters compared to background
SW6 Poorly-drained area	**Spring:** unionized ammonia, total phosphorus, boron, cobalt *SW6 was dry during the 2023 fall monitoring event*	▪ Increasing trend in chloride and boron concentrations since 2013 ▪ Variable total phosphorous concentrations occasionally exceeding PWQO	**Spring:** alkalinity, ammonia, boron, calcium, chloride, hardness, magnesium, potassium, sodium, TDS *SW6 was dry during the 2023 fall monitoring event*	▪ Sampling station located approximately 350 metres downgradient from fill area ▪ Surface water quality interpreted to **be impacted by landfill leachate** due to consistently elevated concentrations of indicator parameters compared to background

Surface Water Sampling Station	Parameters Not in Compliance with PWQO in 2023	Trend(s)	Indicator Parameters Elevated Compared to Background Conditions[1]	Interpretation
SW7 Poorly-drained area	**Spring:** boron, dissolved oxygen **Fall:** boron, total phosphorus, cobalt, total iron, dissolved oxygen	▪ Monitoring station is often dry during the fall monitoring session ▪ Concentrations of total phosphorus and various metals are variable between monitoring events	**Spring:** alkalinity, boron, calcium, chloride, hardness, magnesium, potassium, sodium, TDS **Fall:** alkalinity, boron, calcium, chloride, COD, hardness, total iron, magnesium, manganese, potassium, sodium, TDS	▪ Sampling station located approximately 250 metres downgradient from fill area ▪ Surface water quality historically interpreted to **be impacted by landfill leachate** due to consistently elevated concentrations of indicator parameters compared to background
SW8 Poorly-drained area	**Spring:** none **Fall:** none	▪ Surface water quality generally consistent over time	SW8 is the background station for the poorly-drained area	▪ Sampling station located approximately 450 metres downgradient from fill area along eastern property boundary ▪ Surface water quality interpreted to represent **background** water quality for the poorly-drained area
SW9 Poorly-drained area	**Spring:** total phosphorus, boron, cobalt, iron (total and dissolved) **Fall:** total phosphorus, boron, cobalt, iron (total and dissolved), dissolved oxygen	▪ Ammonia and iron concentrations are highly variable over time	**Spring:** alkalinity, ammonia, boron, calcium, chloride, hardness, iron (total and dissolved), magnesium, manganese, potassium, sodium, TDS **Fall:** alkalinity, ammonia, boron, calcium, COD, chloride, hardness, iron (total and dissolved), magnesium, manganese, potassium, sodium, TDS	▪ Sampling station located within 50 metres of fill area ▪ Surface water quality interpreted to **be impacted by landfill leachate** due to consistently elevated concentrations of indicator parameters compared to background

Notes:

PWQO – Provincial Water Quality Objective (MECP, 1994a (Reprint 1999))

TDS – Total Dissolved Solids

COD – Chemical Oxygen Demand

[1] Surface water concentrations at SW2 are considered elevated compared to background concentrations when they are at least 10% higher than the concentrations at SW1 during the same monitoring session and at least twice the method detection limit. Surface water concentrations for the poorly-drained area are considered elevated compared to background conditions when they exceed the historical (1993-2023) maximum concentrations available for each parameter at station SW8.

Table 5: Proposed 2024 Groundwater Monitoring Program

1.0 MONITORING SESSIONS

1.1 Water Level and Quality Monitoring
Spring (April/May)
Fall (October/November)

1.2 Groundwater Monitoring Well Condition Survey
Spring (April/May)

2.0 GROUNDWATER SAMPLING LOCATIONS

2.1 Background Monitors
BH3B, BH92-5

2.2 Leachate Monitors
BH6

2.3 North Boundary Monitors
BH8A, BH8B, BH9B, BH91-1B, BH92-1A, BH92-1B, BH92-1C
BH99-1, BH99-2, BH99-3, BH99-4, BH99-5

2.4 Northwest Monitors
BH10A, BH15-1, BH15-2B, BH20-1, BH20-2, BH20-3

2.5 Quality Assurance/Quality Control
Two field duplicates per monitoring session

3.0 FIELD MEASURED PARAMETERS

3.1 **Groundwater Levels**
All monitoring wells (Spring)
Sampled monitoring wells (Fall)

3.2 **All Sampled Monitors**
temperature, conductivity, pH

4.0 LABORATORY MEASURED PARAMETERS

4.1 **All Monitors**
alkalinity, chloride, COD, DOC, mercury, arsenic, barium, boron, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, potassium, sodium, zinc, ammonia, nitrite, nitrate, phenols, sulphate, TDS, TKN, total phosphorus.

4.2 **Leachate Monitor BH6**
BOD, TSS

4.3 **Monitors BH6, BH9B, BH99-4, BH15-1, BH15-2B**
volatile organic compounds (VOCs) in fall monitoring session only

Table 6: Proposed 2024 Surface Water Monitoring Program

1.0 MONITORING SESSIONS

1.1 Water Quality Monitoring
Spring (April/May)
Summer (July/August) – **at SW1 and SW2 only**
Fall (October/November)

2.0 SURFACE WATER SAMPLING LOCATIONS

2.1 **Surface Water Sampling Stations – Poorly-drained Area**
SW4, SW6, SW7, SW8, SW9

2.2 **Surface Water Sampling Stations – Dochart Creek**
SW1, SW2

2.2 **Quality Assurance/Quality Control**
One field duplicate during spring and fall monitoring sessions

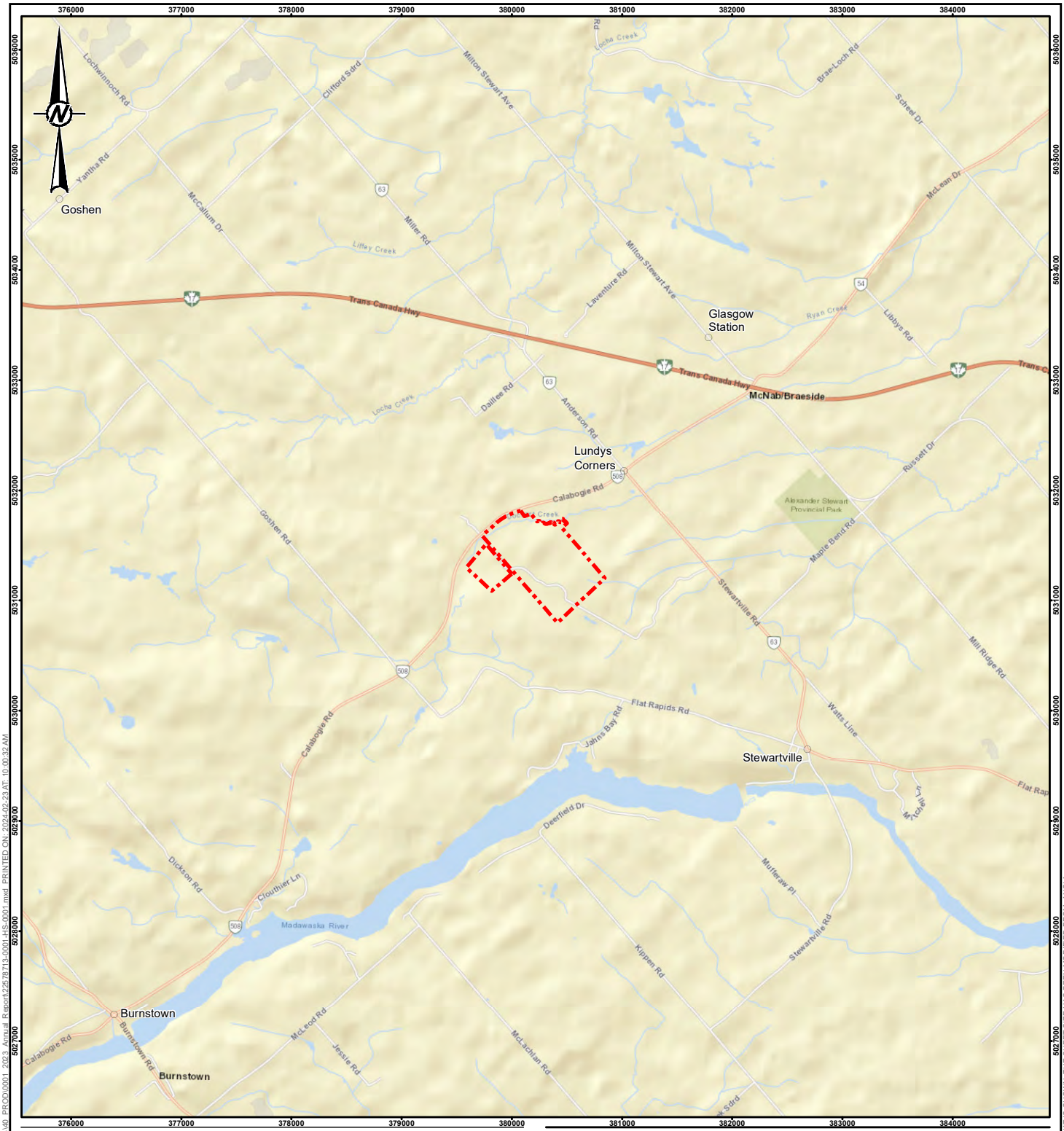
3.0 FIELD MEASURED PARAMETERS

3.1 **With Each Water Quality Sample**
temperature, conductivity, pH, dissolved oxygen
stream flow rate estimate

4.0 LABORATORY MEASURED PARAMETERS

4.1 **Chemical and Physical Parameters (Poorly-drained Area)**
chloride, sodium, potassium, boron, manganese, strontium, hardness, alkalinity, COD, TDS, DOC, iron (total and dissolved), total phosphorus, BOD, total suspended solids, turbidity, nitrate, phenols, aluminum, barium, beryllium, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, silicon, silver, thallium, titanium, vanadium, zinc, unionized ammonia.

4.2 **Chemical and Physical Parameters (Dochart Creek)**
chloride, sodium, potassium, boron, manganese, strontium, hardness, alkalinity, COD, TDS, DOC, iron, total phosphorus, BOD, total suspended solids, turbidity, nitrate, phenols, aluminum, barium, beryllium, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, silicon, silver, thallium, titanium, vanadium, zinc, unionized ammonia.



LEGEND

SITE BOUNDARY

0 1,000 2,000

1:50,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. IMAGERY CREDITS: SOURCES: ESRI, HERE, GARMIN, USGS, INTERMAP, INCREMENT P, NRCAN, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), ESRI KOREA, ESRI (THAILAND), NGCC, (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 18N

CLIENT

TOWNSHIP OF MCNAB / BRAESIDE

PROJECT

2023 ANNUAL REPORT MCNAB/BRAESIDE WASTE DISPOSAL SITE

TITLE

KEY PLAN

CONSULTANT

wsp

YYYY-MM-DD	2024-02-23
DESIGNED	---
PREPARED	BR
REVIEWED	CWT
APPROVED	KAM

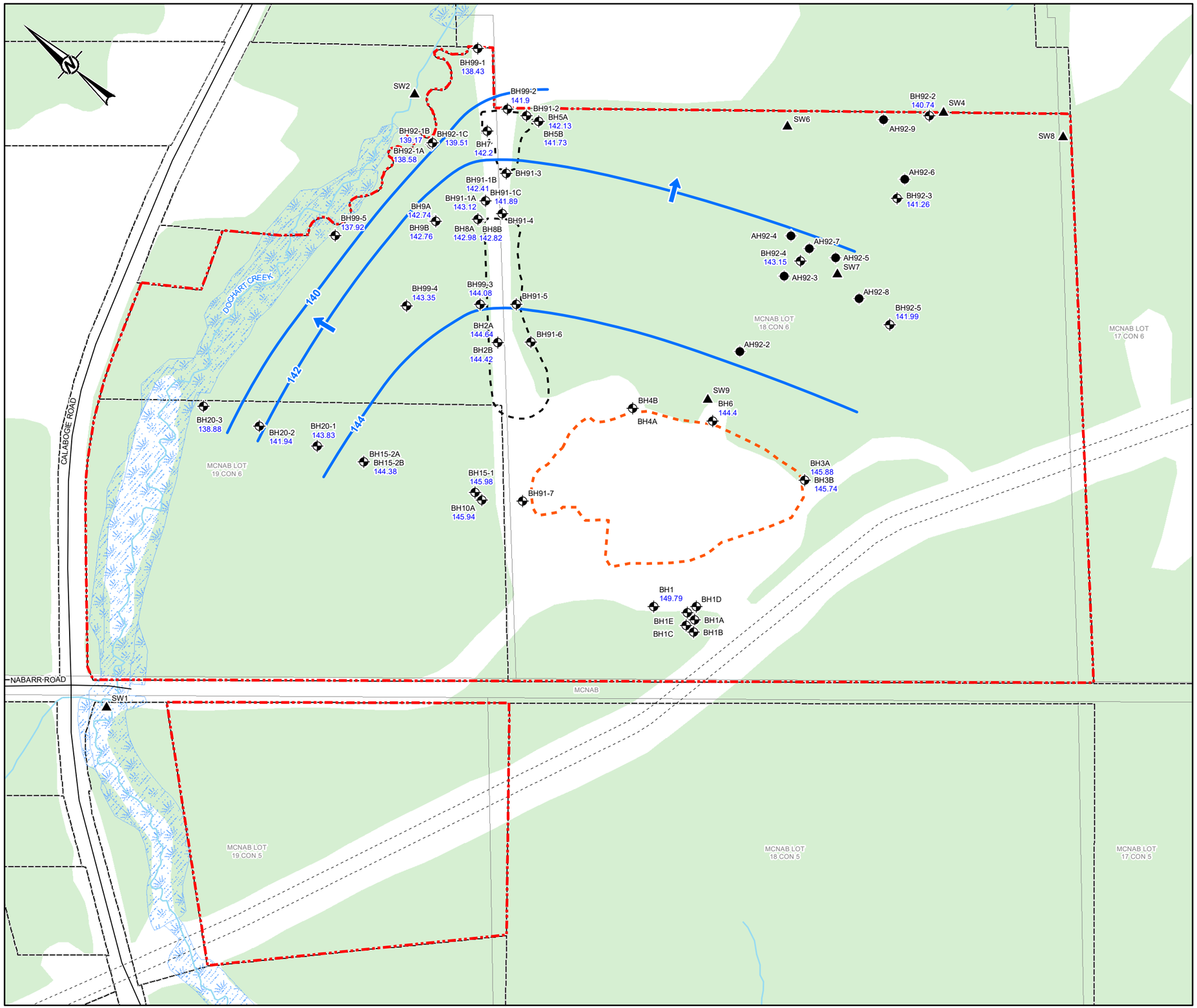
PROJECT NO.	CONTROL	REV.	FIGURE
22578713	0001	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25mm

0

PATH: S:\Clients\Township_of_McNab_Braeside\McNab_Braeside_Landfill\99_PRO\22578713\40_PRO\0001_2023_Annual_Report\22578713-0001HLS-0001.mxd PRINTED ON: 2024-02-23 AT: 10:09:32 AM



LEGEND

- BOREHOLE LOCATION IN PLAN, PREVIOUS INVESTIGATIONS BY GOLDER ASSOCIATIONS LTD.
- AUGERHOLE LOCATION IN PLAN, PREVIOUS INVESTIGATION BY GOLDER ASSOCIATES LTD.
- SURFACE WATER MONITORING STATION IN
- SITE BOUNDARY (65.1 hectares)
- ROAD
- UTILITY
- WATERCOURSE
- WATERBODY
- WETLAND
- APPROXIMATE LOCATION OF EXISTING WASTE
- APPROXIMATE LIMITS OF HISTORICAL METAL WASTE DISPOSAL AREA (NOW CLOSED)
- PROPERTY FABRIC
- TOWNSHIP, LOT AND
- WOODED
- INTERPRETED DIRECTION OF SHALLOW GROUNDWATER FLOW
- SHALLOW GROUNDWATER ELEVATION CONTOUR (GEODETIC), metres
- 143.01 GROUNDWATER ELEVATION (GEODETIC), metres (April 27, 2023)

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. SITE BOUNDARY DOWNLOADED FROM COUNTY OF RENFREW MAPPING WEBSITE, COUNTY OF RENFREW, ONTARIO, CANADA.
2. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
3. IMAGERY CREDITS:
4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 18N

0 80 160

1:4,000 METRES

CLIENT
TOWNSHIP OF MCNAB / BRAESIDE

PROJECT
2023 ANNUAL REPORT MCNAB/BRAESIDE WASTE DISPOSAL SITE

TITLE
SITE PLAN

CONSULTANT

YYYY-MM-DD	2024-02-23
DESIGNED	---
PREPARED	BR
REVIEWED	CWT
APPROVED	KAM

PROJECT NO.	CONTROL	REV.	FIGURE
22578713	0001	0	2

PATH: S:\Clients\Township_of_Mcnab\Braeside\McNab_Braeside_Landfill\09_PROJ\22578713\40_PROD\0001_2023_Annual_Report\22578713-0001-HS-0002.mxd PRINTED ON: 2024-02-23 AT: 10:00:03 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm

APPENDIX A

Ministry of Environment, Conservation and Parks Correspondence

APPENDIX A1

MECP Memoranda - January 2023

Ministry of the Environment, Conservation and Parks
Eastern Region
1259 Gardiners Road, Unit 3
Kingston ON K7P 3J6
Phone: 613.549.4000
or 1.800.267.0974

Ministère de l'Environnement, de la Protection de la nature et des Parcs
Région de l'Est
1259, rue Gardiners, unité 3
Kingston (Ontario) K7P 3J6
Tél: 613 549-4000
ou 1 800 267-0974

Ontario

M E M O R A N D U M

January 12, 2023

TO: Thandeka Ponalo
Senior Environmental Officer
Ottawa District Office
Eastern Region

FROM: Nick Battye
Hydrogeologist
Technical Support Section
Eastern Region

RE: WSP Golder Responses to MECP Memorandum, McNab WDS

I have reviewed WSP Golder's "Response to MECP groundwater and surface water technical support comments regarding the hydrogeological impact assessment for the McNab waste disposal site", dated June 21, 2022. My comment responses are provided below.

Response to Comment 1: It was noted in WSP Golder's response that the weathered silty clay unit has permeabilities that sharply differentiate it from the underlying, unweathered silty clay. Thus, they conclude that there is sufficient transmissivity for this unit to act as a pathway for leachate migration, and that the wells screened in this unit are appropriate for use in model calibration. I am satisfied with this response.

Response to Comment 2: While it's not clear to me how the location of BH92-1 is any different than BH99-1 in terms of B-7 compliance, I agree that the intent of B-7 in this area is generally met with groundwater discharge to surface water occurring in relatively short order. The crux of my comment pertained to possible biases originating from monitoring wells screened in the silty clay unit, but this aspect was discussed to my satisfaction in their response to Comment 1, so I consider this comment resolved.

Response to Comment 3: In response to my comment regarding leachate impacts on the eastern side of the waste mound, WSP Golder highlighted that on Figure 4, for the current (2020) landfilling area, the groundwater flow model does not predict leachate migration in the direction of BH92-4 and BH92-3. This is my point of concern as leachate impacts clearly already affect this area as evidenced by the chloride concentrations (visually depicted in Figure 2) and the available surface water sample concentrations. Presumably, groundwater would also be affected but there is currently a lack of monitoring wells (and/or data) in this area to prove this. I request WSP Golder's opinion on whether this data gap may have had a significant impact on the resulting

model outputs for all three scenarios examined: current (2020), full footprint, open and closed. Regardless, I endorse the suggestion that BH92-3 and BH92-4 be put back into the annual monitoring program moving forward. BH92-5, located in this area, is currently considered a background well; given that the area seems to be impacted, I request WSP Golder comment on the suitability of this well for background purposes, now and in the future, as model results for the full footprint show that this area is expected to eventually become impacted. An alternate background location will eventually be needed and should be selected and/or installed sooner rather than later to build a sufficiently sized dataset for B-7 RUC development.

Response to Comment 4: The potential pathways for leachate migration and the ultimate receiving bodies in this area are understood. The comment was meant to pertain to possible biases in the modelling using data from wells from the weathered silty clay; however, taking the discussion surrounding the functional permeability of this unit at face value, I am satisfied with the response.

Response to Comment 5: WSP Golder's response explained the reasons for selecting chloride, boron, and ammonia for the predictive modelling and the challenges that would be encountered in attempting to model DOC, Fe, Mn, and TDS. I am satisfied with the response and agree that no further work is necessary.

Response to Comment 6: I endorse the statement made in the reply that additional monitoring wells be installed between the full landfill footprint and current northeast property line, as well as the reinstatement of BH92-3 and BH92-4 back into the program. Data therefrom may also help determine the appropriateness of currently using BH92-5 as a background well (discussed under Comment 3).

Should you have any questions regarding these comments, I would be happy to discuss them further.



Nick Battye, MSc, PGeo

ec: Emily Tieu
Victor Castro
Christina Klein
Lauren Forrester

c: File GW RE MC 01-02 (McNab/Braeside WDS A412605)
ECHO Ref # 1-112265172

Ministry of the Environment, Conservation and Parks
Eastern Region
1259 Gardiners Road, Unit 3
Kingston ON K7P 3J6
Phone: 613.549.4000
or 1.800.267.0974

Ministère de l'Environnement, de la Protection de la nature et des Parcs
Région de l'Est
1259, rue Gardiners, unité 3
Kingston (Ontario) K7P 3J6
Tél: 613 549-4000
ou 1 800 267-0974

Ontario

M E M O R A N D U M

January 25, 2023

TO: Thandeka Ponalo
Senior Environmental Officer
Ottawa District Office
Eastern Region

FROM: Lauren Forrester
Surface Water Specialist
Technical Support Section
Eastern Region

RE: Response to June 21, 2022 submission
Hydrogeological Impact Assessment
McNab Waste Disposal Site
Lots 18 and 19, Concession 6, Geographic Township of McNab
ECA No. A412605

As requested, I have reviewed the subject response, prepared by Golder Associates Ltd. and dated June 21, 2022. The responses pertain to MECP surface water and groundwater memoranda dated April 19, 2022 and April 21, 2022, respectively, which provided reviews of the Hydrogeological Impact Assessment for the McNab Waste Disposal Site (WDS). Golder's responses to groundwater comments are addressed by the groundwater reviewer under separate cover. I offer the following comments in relation to surface water concerns only.

Responses to surface water comments:

Responses provided below refer to the numbering in the Golder memorandum. See my memorandum dated April 19, 2022 and the responses provided by Golder dated June 21, 2022 for fulsome context for the comments provided below. Please note that, in some cases, the consultant's response appears to be limited to the summarized Conclusions and Recommendations and does not address the detailed review comments provided throughout the memorandum, upon which those summary statements are based. A lack of specific comment herein is not to be construed as endorsement or acceptance.

1. MECP does not limit the evaluation of surface water impacts based on property lines. Despite the likely seasonal nature of some of the watercourses identified, leachate will be conveyed towards Dochart Creek and its tributaries in pulses during wet weather events, as has also been noted by the groundwater reviewer. Leachate impacts to both on-site and off-site surface water features continue to be a concern under the proposed development conditions.

With respect to the drainage features to the east, as described in my memorandum, two streams are depicted on Ministry mapping and indicate a sustained intermittent (verified) and permanent flow. One of these drainage features is depicted on Figure 2 of Golder's 2021 Monitoring and Operations Report (the other is out of frame). These features drain towards a tributary to Dochart Creek, downstream of the WDS, from a location just beyond the east property boundary (SW4). SW4 is within the poorly drained area and understood to be impacted by leachate. The response does not speak to these watercourses or specify the boundaries of the 2019 site evaluation area. I continue to recommend additional evaluation of water quality in those coldwater tributaries.

In addition, as noted in my review, the model results presented by Golder in Figure 4 of the report appear to indicate that SW2 may be upstream of a substantial part of expected leachate plume under current (2020) and future conditions. If SW2 is not expected to capture all expected leachate effects in Dochart Creek, additional sampling location(s) should be established farther downstream.

In the absence of evidence that the watercourses east of the property boundary have been assessed, I recommend surface water monitoring be established in these locations prior to development of Stage 3 of the WDS (if approved, and regardless of the implementation of engineered leachate controls). Additional downstream monitoring should also be established in Dochart Creek prior to development of Stage 3 of the landfill. That monitoring location must be immediately downstream of the area over which the leachate plume is expected to intersect with the Creek.

2. I am not satisfied that the current surface water monitoring program adequately characterizes the risk to Dochart Creek or would serve as a reliable basis for a trigger mechanism. Please see the response provided above.

3. The response is generally acceptable; however, it should be recognized that the WSC dataset for this station contains numerous qualifiers that speak to the data quality. The WSC daily flow data for the referenced station, accessed April 4, 2022, contains the following annotation for the time period in question: "Extensive beaver activity June – December 2016. Discharges estimated for this period. Min inst. Discharge not valid – occurs during period of estimation" and "Estimated discharges November 23 – December 8, 2017 due to construction". Other periods of estimation and notes relating to ice conditions affecting measurements and/or days where data represent partial days are also identified throughout the dataset.

4. The discussion provided by the consultant is reasonable given the limitations of the available data and site conditions.

5. Response acknowledged.

6. Response is reasonable. It is acknowledged that iron concentrations will be used to monitor leachate plume progression (with respect to groundwater). Please

note that iron must also be considered as a potential leachate indicator in on-site surface water and wetland receivers (see Response 1), regardless of its inclusion in the models.

7. Generally, the response does not address the concerns cited in my memorandum particularly with respect to on-site receivers, which are acknowledged to be leachate impacted under current conditions.

   The compliance criteria for ammonia must be selected considering temperature and pH (75th percentile, not average, median or typical), in order to meet Provincial Water Quality Objectives (PWQO) within the downgradient receiving stream. PWQO are the accepted long term exposure criteria, applicable to surface water receivers. In this case, the receiver is a cold-water stream (considered highly sensitive habitat). Golder's suggested relaxation of surface water criteria is not appropriate. As stated in my memo:

   "To establish a surrogate for the PWQO [for unionized ammonia], the consultant has used 'typical' temperature and pH (15ºC and 7.5, respectively), producing a compliance criteria of 2.3 mg/L total ammonia. Because the amount of ammonia in the unionized fraction increases sharply with increases in either pH or temperature, the proposed compliance criteria may not be protective.

   Temperature in Dochart Creek ranges from 0.5 to 25.1 ºC (median 11.1 ºC; 75th percentile 17.5 ºC) over the period of record and pH ranges from 6.8 to 8.43 (median 7.73; 75th percentile 8.04). Temperature in small streams east of the fill area ranges from 0ºC to 23.3ºC. Considering the likelihood that higher temperatures will correspond to lower flows and that the 'typical' pH cited is less than the median and average values in Dochart Creek, it is likely that unionized ammonia will grossly exceed the concentrations presumed in the surface water impact assessment in the late summer low flow period, which is typically the critical period for leachate assimilation".

   If the PWQO for unionized ammonia is not expected to be met, measures must be taken to prevent the migration of leachate to surface water receivers (on- and off-site).

   Also as identified in my review, a compliance criterion for iron is justified considering the on-site impacts present under current conditions.

8. Please see Response 1, specifically as related to the information presented in Figure 4 (groundwater plume intersection with the Creek). SW2 may not be an appropriate compliance boundary.

9. See Response 1, above. The evaluation of surface water impacts is not dictated by property boundaries.

10. The consultant acknowledges that "modelling demonstrates that at some time in the future… engineering control of leachate impacted groundwater migration towards Dochart Creek will be required to achieve surface water compliance". The response considers only the downstream, off-site receiver at SW2 (see

notes above questioning the ongoing suitability of that station as a compliance boundary) and not on-site wetlands and ephemeral streams. Impacts between the landfill and the Creek are largely ignored in the proposed approach. The reactive, rather than proactive approach to leachate control continues to be a concern.

If you have any questions about these comments, I would be happy to discuss them with you.



Lauren Forrester, M.Sc.
LF

ec: Victor Castro, Water Resources Unit Supervisor
Nicholas Battye, Regional Hydrogeologist

c: LF/ECHO 1-112265203

APPENDIX A2

WSP Letter - April 2023

April 21, 2023 Reference No. 19130748-003

Thandeka Ponalo
Ministry of the Environment, Conservation and Parks
Ottawa District Office
2430 Don Reid Drive
Ottawa ON K1H 1E1

RESPONSE TO MECP GROUNDWATER AND SURFACE WATER JANUARY 2023 TECHNICAL COMMENTS MCNAB WASTE DISPOSAL SITE

Dear Ms. Ponalo,

Golder Associates Ltd. (Golder), now WSP Canada Inc. (WSP), has been retained by the Township of McNab/Braeside (the Township) in support of updates to the Development and Operations Plan (D&O Plan) for the McNab Waste Disposal Site. The following have previously been completed in support of the updates to the D&O Plan:

- Golder completed a hydrogeological impact assessment with the objective of forecasting site compliance (i.e., groundwater and surface water compliance) throughout the life of the McNab Waste Disposal Site assuming full development of the landfill to provide 1 million cubic metres of airspace (i.e., Stages 1 through 3), as described in the existing approved D&O Plan. A report on the hydrogeological impact assessment (Golder 2021) was submitted to the Ministry of the Environment, Conservation and Parks (MECP) in February 2021. The MECP submitted the report to their Eastern Region Technical Support Section resulting in review comments provided by the MECP surface water and groundwater reviewers in memoranda dated April 19, 2022 (MECP 2022a) and April 21, 2022 (MECP 2022b), respectively.
- Golder was further retained by the Township to review the April 2022 memoranda and prepare a letter providing responses to both the groundwater and surface water review comments. The response letter (Golder 2022) was submitted to the MECP on June 21, 2022. The MECP subsequently forwarded the response letter to the Eastern Region Technical Support Section for further review.

Comments on the June 2022 response letter were received by the Township from the MECP groundwater reviewer and surface water reviewer on January 12, 2023 (MECP 2023a) and January 25, 2023 (MECP 2023b), respectively. The Township has further retained WSP to review the January 2023 comments and prepare a response.

Responses to the January 2023 groundwater reviewer comments and surface water reviewer comments are provided in Table 1 and Table 2, respectively. As discussed in the responses provided in the tables, it is WSP's opinion that the remaining concerns expressed by the MECP technical reviewers can be satisfactorily addressed by modifying the groundwater and surface water monitoring programs conducted at the site. As such, this letter

also includes proposed groundwater and surface water monitoring programs that would be included in the updated D&O Plan and, once approved by MECP, included in an ECA amendment. The proposed monitoring programs are presented in the sections below. It is noted that these sections are meant to outline the details of the monitoring programs and do not include discussion of potential corrective measures that would be undertaken if monitoring indicates such measures are necessary. The specific corrective measures that would be taken along with the associated triggers would be proposed in the updated D&O Plan included in the future ECA amendment application.

Proposed Groundwater and Surface Water Monitoring Programs

A groundwater and surface water monitoring program forms an integral part of the management of a landfill during both the operational period and post-closure. Routine monitoring allows the determination of contaminant egress from the landfill, if any, and provides advance alert to the owner/operator of potential environmental problems. Potential problems of the future may be recognized from the analysis of the trends of the monitoring data collected over the years. The early warning of developing problems will allow for corrective measures to be taken prior to the site going out of regulatory compliance, and thereby avoiding or lessening any potential environmental damage. Corrective actions may mean modifications to the site design or operations, or the implementation of a contingency plan.

A monitoring program also serves the purpose of providing the general public directly, or through regulatory authorities such as the MECP, with information on the performance of the landfill and the protection it affords to the environment as a result of sound planning, design and operations.

The objectives of the proposed groundwater and surface water monitoring program are to continue to monitor water quality at the site for the purpose of characterizing the extent of the leachate-impacted areas and assessing compliance.

Existing groundwater and surface water monitoring programs are conducted at the site as required by the current Certificate of Approval (No. A412605). The proposed groundwater and surface water monitoring programs described below build on the existing programs such that the overall objectives of the programs (i.e., characterizing the extent of leachate impacts and assessing both groundwater and surface water compliance) will be achieved during the full development of Stages 1 through 3 and post-closure. The proposed monitoring programs were designed with consideration given to the comments provided by the MECP technical reviewers (MECP 2022a, 2022b, 2023a, 2023b).

Groundwater Monitoring Program

As presented in the conceptual hydrogeological model for the site described by Golder (2021), the overburden at the site generally consists of a sandy surficial layer underlain by silty clay. The shallowest portion of the silty clay deposit (i.e., up to approximately 3 metres thick) is a grey-brown weathered crust containing sand layers with a thickness up to 0.2 metres; as such, this shallow portion of the silty clay deposit is considerably more transmissive than the deeper grey silty clay. The horizontal groundwater flow direction in the shallow overburden (i.e., sandy surficial layer and/or weathered silty clay) is interpreted to generally follow topography, from the topographic highs on the south of the site towards the topographically lower north and northeast. Leachate-impacted groundwater will migrate through the sandy surficial layer and weathered silty clay along this groundwater flow direction, eventually discharging to Dochart Creek or migrating beyond the north property boundary.

As described in Golder (2021) and previous responses to MECP comments, the groundwater monitoring program will 1) track the advancement of the leachate plume towards Dochart Creek and allow for implementation of engineered controls prior to the leachate effects exceeding surface water quality objectives in the Creek and 2) track the advancement of the plume towards the north property line such that the proposed contaminant attenuation zone (CAZ) can be in place and the site can continue to be in compliance with the Reasonable Use Performance Objectives (RUPO) established by MECP Guideline B-7 (MECP 1994).

The groundwater monitoring wells included in the existing monitoring program as well as the proposed groundwater monitoring locations for the revised monitoring program are presented on Figure 1. Borehole logs for the existing monitoring wells are included in Golder (2021).

The sections below provide details on the various components of the proposed groundwater monitoring program. Attachment A provides a summarized version of the proposed groundwater monitoring program.

Background Monitors

The purpose of the background monitors is to provide locations to collect groundwater samples that allow for characterization of groundwater upgradient of the landfilling area. Leachate from the landfilling area is expected to migrate through the sandy surficial unit as well as the silty clay unit; as such, background groundwater quality within both hydrostratigraphic units must be understood.

Currently, the background groundwater quality in the sandy surficial unit is interpreted to be represented by the groundwater quality at monitoring well BH3B that is screened within the sandy surficial unit and has been part of the groundwater monitoring program since 1991. Although this monitoring well is situated in close proximity to the existing waste disposal area, the groundwater quality in this monitor is characterized by low concentrations of leachate indicator parameters and the groundwater quality at this location has been generally consistent over time (Golder 2021).

The background groundwater quality within the silty clay unit is interpreted to be represented by the groundwater quality at monitoring well BH92-5, which is screened within the weathered crust zone of the silty clay unit and has been sampled as part of the groundwater monitoring program since 1993. The groundwater quality in this monitor is characterized by low concentrations of leachate indicator parameters and has been generally consistent over time (Golder 2021).

It is noted that neither monitor BH3B or BH92-5 are located directly upgradient of the landfilling area and that monitor BH3B is located inside of the planned footprint of the landfilling area under full development. As presented in the conceptual hydrogeological model for the site described by Golder (2021), bedrock is located at or near the ground surface on the upgradient (i.e., approximately south) side of the landfilling area. Depth to bedrock increases northward across the site resulting in increased overburden thickness beneath the landfilling area and to the north of the landfilling areas. As such, there is no sandy or silty clay unit hydraulically upgradient of the landfilling area where a representative background groundwater quality sample could be collected. As with any background monitor, it will be important to routinely assess the suitability of these monitors as background monitors (i.e., as part of the annual interpretation of groundwater quality for the site). If interpretation of groundwater quality data concludes that either of these wells are no longer representative of background quality, then background groundwater quality for the associated hydrostratigraphic unit would be defined by the data

collected from these wells over an appropriate historical period. As noted above, groundwater quality at these locations to date over a period of approximately 30 years have been generally consistent.

Leachate Monitors

The purpose of the leachate monitors is to provide locations to collect groundwater samples that allow for characterization of the leachate quality.

Currently, leachate quality at the site is characterized by the quality of the groundwater within existing monitor BH6 and the historical monitor BH4B. Monitor BH6 has been part of the groundwater monitoring program since 1991 and continues to be sampled twice per year as part of the existing groundwater monitoring program, while historical monitor BH4B was part of the groundwater monitoring program from 1991 until decommissioning in 2020. These monitoring locations had been selected due to their close proximity to the landfilling area (Figure 1).

In 2015, monitor BH15-1 was installed with a screen in the surficial sandy unit approximately 50 metres to the northwest of the landfilling area. Monitor BH15-1 has been sampled twice per year since installation. The concentrations of parameters typically associated with leachate at the site are generally higher at monitor BH15-1 than at monitors BH6 or BH4B. As such, groundwater quality at monitor BH15-1 is also useful for characterizing leachate at the site and it is proposed that monitor BH15-1 is included as a leachate monitor for the revised monitoring program.

It is noted that monitor BH6 is located within the footprint of the fully developed landfilling area. If it can be accommodated by site operations, it would be preferable for monitor BH6 to be maintained throughout the life of the site (i.e., protecting the monitor from landfilling activities and extending the riser upward, as necessary, as the waste mound rises). If site operations cannot accommodate maintaining monitor BH6, this monitor could be decommissioned leaving monitor BH15-1 as the leachate monitor. Monitor BH15-1 is located outside of the existing and future landfill footprint.

Downgradient Monitors

The purpose of the downgradient monitors is to allow for the tracking of the migration of leachate as the plume migrates towards Dochart Creek and the north property boundary. The downgradient monitors include monitors located along the north property boundary, which have the additional purpose of assessing site compliance with respect to RUPO established by MECP Guideline B-7 (MECP 1994).

The existing groundwater monitoring program includes 18 downgradient monitors (i.e., not including the leachate monitors described above). The monitors are screened in the sandy surficial unit or silty clay unit as presented on Figure 1. It is proposed that each of the monitors included in the existing program are maintained in the revised program. In addition, it is proposed that the revised groundwater monitoring program include the following:

- Existing monitoring wells BH92-2, BH92-3 and BH92-4 should be sampled as part of the revised groundwater monitoring program. These monitors were sampled in 1993 and 1994 but are not sampled as part of the existing groundwater monitoring program. Monitoring well condition surveys conducted annually across the site indicate that these monitors are still in good condition. As shown on Figure 1, these monitors are located within the poorly-drained area to the northeast of the landfilling area. Each of these monitors are screened in the weathered zone of the silty clay unit. Monitor BH92-2 is located at the property boundary; as such,

groundwater quality obtained from monitor BH92-2 would serve as an additional assessment point with respect to the RUPO compliance of the site.

- An additional monitoring well should be installed along the north property boundary midway between existing monitors BH99-2 and BH92-2, approximately at the location identified on Figure 1 as NEW-BH. Two monitoring intervals should be added at this location if both the sandy surficial unit and the underlying silty clay unit are present; however, it is possible that the silty clay unit is present at the ground surface at this location (i.e., the overlying sandy unit is not present). The proposed monitor would serve as an additional assessment point with respect to the RUPO compliance of the site.

Groundwater Sampling Parameters

It is proposed that the following parameters are analyzed in the groundwater samples collected from all monitoring wells:

- chloride, alkalinity, nitrate, nitrite, hardness (calcium and magnesium), sulphate, total dissolved solids (TDS), dissolved organic carbon (DOC) and, total Kjeldahl nitrogen (TKN), ammonia, total phosphorus and chemical oxygen demand (COD), total recoverable phenolics, dissolved metals (arsenic, barium, boron, cadmium, chromium, copper, iron, lead, manganese, mercury, potassium, sodium, zinc)

In addition to the above, biochemical oxygen demand (BOD) and total suspended solids (TSS) would be analyzed in the groundwater samples collected from the leachate monitors (i.e., monitors BH6 and BH15-1).

Further, as per the existing groundwater monitoring program, a suite of volatile organic compounds (VOCs) would be analyzed in the groundwater samples collected at monitors BH6, BH9B, BH99-4, BH15-1 and BH15-2B.

In addition to the samples collected for laboratory analysis, the temperature, pH and conductivity of the groundwater samples at each station would be measured in the field at the time of sample collection. Furthermore, the groundwater elevation at each monitoring well prior to sampling would be recorded and notes would be made of all visual and olfactory observations of the collected groundwater samples. The physical condition of each monitoring well would also be noted during each sampling event.

It is noted that the analytical parameters proposed above are consistent with the existing groundwater monitoring program.

Groundwater Sampling Frequency

Under the existing groundwater monitoring program, all monitoring wells included in the program are sampled twice per year (i.e., once during the spring and fall).

It is proposed that the sampling frequency from the existing groundwater monitoring program is maintained for the revised groundwater monitoring program.

Surface Water Monitoring Program

The existing surface water monitoring program includes sampling within Dochart Creek, which flows from west to east across the north side of the site, as well as from a number of ephemeral surface water features located in the poorly-drained eastern portion of the site.

The sections below describe the proposed stations for the revised surface water monitoring program. The surface water sampling stations included in the existing monitoring program as well as the proposed surface water sampling stations for the revised monitoring program are presented on Figure 1. Attachment B provides a summarized version of the proposed surface water monitoring program.

Dochart Creek

The purpose of the monitoring stations within Dochart Creek is to allow for identification of changes in surface water quality along the stretch of the Creek that is expected to one day receive leachate-impacted groundwater discharge.

The existing surface water monitoring program includes two sampling locations that have been sampled since 1991 (i.e., stations SW1 and SW2). The existing sampling locations are presented on Figure 1. Sampling station SW1 is located upgradient of the area expected to one day receive leachate-impacted groundwater and is therefore considered representative of background conditions within Dochart Creek. Station SW2 is located downstream of SW1 at approximately the north property boundary.

Groundwater flow modelling completed by Golder (2021) indicated that leachate-impacted groundwater is expected to discharge to Dochart Creek both on-site as well as downstream of station SW2; as such, impacts to Dochart Creek could occur downstream of where sampling occurs under the existing monitoring program. Historically, surface water station SW3 existed downstream of station SW2. Station SW3 was located within Dochart Creek to the southwest of the culvert beneath Stewartville Road. The location of station SW3 is illustrated on Figure 1. Surface water samples had been collected at station SW3 between 1991 and 2003. It is proposed that station SW3 is reinstated in the revised surface water monitoring program.

It is acknowledged that establishing an additional monitoring location within Dochart Creek between existing station SW2 and proposed station SW3 could be beneficial to characterizing potential future leachate impacts to Dochart Creek; however, an additional monitoring station between SW2 and SW3 is not being proposed at this time since the establishment of such a station would be contingent on receiving permission from the property owner to access this stretch of Dochart Creek. If access to this location could be arranged (e.g., through an independent access agreement or in association with future discussions to establish a groundwater easement for the proposed CAZ), then it would be recommended that a sampling station be established at a point in Dochart Creek midway between stations SW2 and SW3. At this time, since existing groundwater monitoring has indicated that leachate-impacted groundwater has not yet migrated beyond the property boundary or reached the Creek, sampling at stations SW2 and SW3 is considered satisfactory.

Poorly-Drained Area (On-Site)

The purpose of the on-site surface water sampling stations within the poorly-drained area is to characterize the quality of the water that accumulates in topographic lows in this area and identify if flow from this area of the site is occurring to other on-site or off-site locations.

The existing surface water monitoring program includes five sampling locations that have been sampled since 1993 (i.e., stations SW4, SW6, SW7, SW8 and SW9). The existing sampling locations are presented on Figure 1. The stations were selected as they are the locations within the poorly-drained area where surface water has been found to reliably accumulate during wet conditions.

Surface water at station SW8 is considered to be representative of the background conditions in the poorly-drained area. As illustrated on Figure 1, background sampling station SW8 is located within the poorly-drained area at the farthest on-site location from the landfilling area. It is noted that this location is topographically downgradient from the landfilling area. The poorly-drained area does not receive surface water flow from the area upgradient (i.e., south) of the landfilling area; as such, there is no more suitable upgradient background sampling location for this area. It will be important to continue to assess the suitability of this location as a background sampling station. If there comes a time when station SW8 is considered no longer appropriate for obtaining a background water quality sample, background conditions for the poorly-drained area could be defined using historical data obtained at station SW8.

It is noted that station SW9 is located within the planned footprint of the landfilling area under full development. Station SW9 would be removed from the sampling program once the landfill base has been prepared in this area.

During the sampling of each of the surface water stations within the poorly-drained area, observations would be made of any flow observed (i.e., direction and estimated rate) as well as the general size and extent of the water feature at each sampling station.

East of Poorly-Drained Area (Off-Site)

Feedback received from the MECP surface water reviewer (MECP 2022a, 2023b) has underscored concern for the potential of impacted surface water within the poorly-drained area flowing off-site towards the east and entering the tributaries that eventually drain into Dochart Creek. No permanent off-site drainage channels exist that convey surface water over the east or northeast site boundary and no permanent surface water features are located immediately adjacent to the east of the landfill property; as such, there are no suitable locations immediately east of the site to establish sampling stations. To address the concerns raised by the MECP reviewer, it is proposed that surface water sampling stations are established within the two tributaries to Dochart Creek located off the landfill property east of the poorly-drained area at the locations where these watercourses pass beneath Stewartville Road. These locations are expected to reliably contain enough water to collect a sample and would be downgradient of any off-site flow towards the east. These locations are identified on Figure 1 as stations NEW-SW-A and NEW-SW-B.

Surface Water Sampling Parameters

It is proposed that the following parameters are analyzed in the surface water samples collected from all surface water monitoring stations:

- dissolved aluminum, alkalinity, chloride, hardness (calcium and magnesium), nitrate, TDS, TSS, turbidity, DOC, BOD, ammonia, COD, total phosphorus, total recoverable phenolics, total metals (barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, nickel, silicon, silver, sodium, potassium, strontium, thallium, titanium, vanadium, zinc)

Due to the historically elevated iron concentration and the potential for leachate-impacts in samples from the poorly-drained area, samples collected from the poorly-drained area would be analyzed for dissolved iron in addition to total iron.

In addition to the samples collected for laboratory analysis, the temperature, pH, conductivity and dissolved oxygen content of the surface water samples at each station would be measured in the field at the time of sample collection and notes would be made of all visual and olfactory observations of the collected surface water samples.

It is noted that the analytical parameters proposed above are consistent with the existing surface water monitoring program.

Surface Water Sampling Frequency

Under the existing surface water monitoring program, stations within Dochart Creek are sampled three times per year (i.e., once each during the spring, summer and fall) while stations within he poorly-drained area are sampled twice per year (i.e., once each during the spring and fall). It is noted that surface water is not typically present within the poorly-drained area during summer months; as such, sampling within the poorly-drained area must take place during wetter months.

It is proposed that the sampling frequency from the existing surface water monitoring program is maintained for the revised surface water monitoring program. It is proposed that the re-instated station SW3 would be monitored three times per year (coinciding with the monitoring at the on-site Dochart Creek stations) and that proposed stations NEW-SW-A and NEW-SW-B would be monitored twice per year (coinciding with the monitoring at the on-site stations in the poorly-drained area).

Limitations and Use of this Letter

This letter was prepared for the exclusive use of The Township of McNab/Braeside. Any use which a third party makes of this report, or any reliance on, or decisions to be made based on it, are the responsibilities of such third parties. WSP Canada Inc. (WSP) accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

This letter is based on data and information collected by WSP and is based solely on the conditions of the property at the time of the work, supplemented by historical information and data obtained by WSP as described in this letter and referenced reports. WSP has relied in good faith on all information provided and does not accept responsibility for any deficiency, misstatements, or inaccuracies contained in the report as a result of omissions, misinterpretation, or fraudulent acts of the persons contacted or errors or omissions in the reviewed documentation.

The services performed, as described in this letter, were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

The findings and conclusions of this letter are valid only as of the date of this letter. If new information is discovered in future work, including excavations, borings, or other studies, WSP should be requested to re-evaluate the conclusions of this letter, and to provide amendments as required.

Closure

We trust the contents of this letter meet your current needs. If you have any questions regarding this letter, please contact the undersigned.

Sincerely,

WSP CANADA INC.





Cameron W. Toy, M.Sc., P.Geo.
Hydrogeologist

Paul Smolkin, P.Eng.
Senior Geo-environmental Engineer

CWT/PAS/rk

CC: Ryan Frew, Township of McNab/Braeside

Attachments: Figure 1 – Groundwater and Surface Water Monitoring Locations
Table 1 – Cumulative Responses to MECP Groundwater Technical Reviewer Comments
Table 2 – Cumulative Responses to MECP Surface Water Technical Reviewer Comments
Attachment A – Summary of Proposed Groundwater Monitoring Program
Attachment B – Summary of Proposed Surface Water Monitoring Program

https://golderassociates.sharepoint.com/sites/115688/project files/6 deliverables/003 2nd response to mecp/19130748-003-l-rev0_mcnab 2ndresponseletter_21apr2023.docx

References

Golder, 2021. Hydrogeological Impact Assessment, McNab Waste Disposal Site, Township of McNab/Braeside, Ontario. Golder Associates Ltd. Report No. 19130748-001, February 2021.

Golder, 2022. Response to MECP Groundwater and Surface Water Technical Support Comments Regarding the Hydrogeological Impact Assessment for the McNab Waste Disposal Site. Reference No. 19130748-002, June 21, 2022.

MECP, 2022a. Hydrogeological Impact Assessment and 2020 Annual Report, McNab-Braeside Waste Disposal Site, Lots 18 and 19, Concession 6, Geographic Township of McNab, ECA No. A412605. Reference No. 1-97847882, April 19, 2022.

MECP, 2022b. McNab/Braeside Waste Disposal Site A412605, Hydrogeological Impact Assessment, Lots 18 & 19, Concessions 6, part of Lot 19, Concession 5, Township of McNab/Braeside, Renfrew County, Ontario. Reference No. 1-93456530, April 21, 2022.

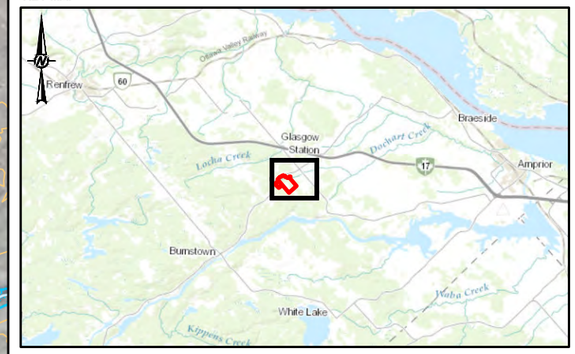
MECP, 2023a. WSP Golder Responses to MECP Memorandum, McNab WDS. Reference No. 1-112265172, January 12, 2023.

MECP, 2023b. Response to June 21, 2022 submission, Hydrogeological Impact Assessment, McNab Waste Disposal Site, Lots 18 and 19, Concession 6, Geographic Township of McNab, ECA No. A412605. Reference No. 1-112265203, January 25, 2023.

Figure



KEY MAP



SCALE 1:350,000

LEGEND

- EXISTING MONITORING WELL INCLUDED IN CURRENT GROUNDWATER MONITORING PROGRAM
- EXISTING MONITORING WELL NOT INCLUDED IN CURRENT GROUNDWATER MONITORING PROGRAM
- PROPOSED MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- SURFACE WATER MONITORING STATION INCLUDED IN CURRENT SURFACE WATER MONITORING PROGRAM
- PROPOSED SURFACE WATER MONITORING STATION
- MCNAB WASTE DISPOSAL SITE PROPERTY BOUNDARY
- FULL DEVELOPMENT WASTE FOOTPRINT (STAGES 1-3)
- 2020 WASTE FOOTPRINT
- ROADWAY
- UTILITY LINE
- TOPOGRAPHIC CONTOUR, metres
- WATERCOURSE
- WATERBODY
- WETLAND

0 100 200 400
1:8,500 METRES

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. IMAGERY CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
COUNTY OF RENFREW, SPRING, 2020.
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 18N

CLIENT
TOWNSHIP OF MCNAB / BRAESIDE

PROJECT
PROPOSED GROUNDWATER AND SURFACE WATER MONITORING PROGRAMS
FOR UPDATED DEVELOPMENT AND OPERATIONS PLAN
MCNAB WASTE DISPOSAL SITE

TITLE
GROUNDWATER AND SURFACE WATER MONITORING LOCATIONS

CONSULTANT

YYYY-MM-DD	2023-04-20
DESIGNED	CT
PREPARED	BR
REVIEWED	CT
APPROVED	PS

PROJECT NO.	CONTROL	REV.	FIGURE
19130748	0002	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

PATH: S:\Clients\Township_of_Mcnab\Braeside\McNab_Braeside_Landfill\99_PROJ\19130748\40_PROD\002_Updated_D_O_Plan\19130748-0002-CH-0001.mxd PRINTED ON: 2023-04-20 AT: 8:34:12 AM

Tables

TABLE 1 – CUMULATIVE RESPONSES TO MECP GROUNDWATER TECHNICAL REVIEWER COMMENTS

Comment Number	MECP Comment (MECP 2022b)	Golder Response (Golder 2022)	MECP Response (MECP 2023a)	Current Response
Groundwater Comment 1	*Golder concludes that an additional CAZ to the northeast would satisfy Condition 39 of the ECA and keep the waste disposal site in compliance with B-7 right up to full landfill capacity. I am in general agreement with the Guideline B-7 assessment completed by Golder, and I support the recommendation to purchase additional CAZ to provide for further landfill development; however, while Guideline B-7 may be satisfied from the groundwater perspective, this approach may not adequately consider potential surface water impacts resulting from groundwater discharge to Dochart Creek and the poorly drained area to the northeast. Due to the thinning of the sand layer towards the north, and the complete pinch out of this unit towards the northeast, most monitoring wells located along the periphery of the site were screened in the silty clay layer, which has hydraulic conductivity one to four orders of magnitude lower and vertical flow in the upward direction. Thus, existing groundwater monitoring results for wells screened in the silty clay unit may be an underrepresentation of leachate concentrations / migration in the more permeable sand unit. Where the sand thins, e.g., to 0.1 m at BH99-5 in the north, the unit may no longer be perennially saturated, but could still convey leachate at higher concentrations and at faster rates towards Dochart Creek in pulses during wet events. A similar fate and transport mechanism could be present in the poorly drained area to the northeast, where the sand unit completely pinches out and it is topsoil / peat down to 0.2 m (BH92-2) that overlies the silty clay layer. If correct, given that existing results (largely from groundwater pulled from the underlying silty clay layer) were used to calibrate the model, the model may be biased low. Additional insight and/or investigation from Golder on this is requested. However, with groundwater presenting very close to, if not at, the surface in many of the periphery areas on-site, potential surface water impacts are seen to be the driving concern in these areas; therefore, the case for the McNab/Braeside WDS ECA amendment must ultimately satisfy any concerns raised by the MECP Surface Water Specialist.*	Silty clay is present across the site beneath the shallow sand layer and/or peat deposits. The upper portion of the silty clay deposit is a weathered crust, which has been observed in all boreholes that have encountered the silty clay deposit and has been observed to have a thickness up to 3 metres. This upper weathered crust zone is typical of the marine clay deposits that underlie areas of eastern Ontario. The weathered crust at the McNab Landfill site is characterized by a red-brown to grey-brown colour and occasional seams of sand (with observed thickness up to 0.2 metres). The weathered crust has secondary permeability features in the form of an interconnected network of fractures caused by geologic weathering and freeze-thaw cycles. This contrasts notably with the underlying intact portion of the unweathered silty clay deposit that is grey in colour, is not fractured, and has a low hydraulic conductivity that is on the order of 10^{-10} to 10^{-8} metres per second. We agree that the leachate plume is not expected to extend down into the grey silty clay; however, due to fracturing the weathered crust unit is moderately transmissive (i.e., with hydraulic conductivity on the order of 10^{-7} to 10^{-6} metres per second) and is interpreted to be a pathway for leachate migration in the shallow groundwater, especially where the overlying sand layer has pinched out. The monitoring well referenced in the comment, BH99-5 in the north, is screened entirely within the weathered crust since the weathered crust is the shallowest unit present at this location (i.e., beneath the topsoil); as such, this monitoring well is considered to be appropriately screened to encounter the shallow groundwater flow that is expected, based on the modelling, to one day contain the leachate plume. It is for the same reason that the monitoring wells installed in BH20-1, 20-2 and 20-3 for the purpose of determining the location of and parameter concentrations at the advancing plume front towards the northeast were installed specifically within the shallow sand and/or weathered crust zone. As such, it is groundwater information from the shallow sands or weathered crust zone that was used to calibrate the model, which is considered to be appropriate for and representative of the site conditions related to leachate plume migration from the disposal area.	*It was noted in WSP Golder's response that the weathered silty clay unit has permeabilities that sharply differentiate it from the underlying, unweathered silty clay. Thus, they conclude that there is sufficient transmissivity for this unit to act as a pathway for leachate migration, and that the wells screened in this unit are appropriate for use in model calibration. I am satisfied with this response.*	Acknowledged. No further response required.

TABLE 1 – CUMULATIVE RESPONSES TO MECP GROUNDWATER TECHNICAL REVIEWER COMMENTS

Comment Number	MECP Comment (MECP 2022b)	Golder Response (Golder 2022)	MECP Response (MECP 2023a)	Current Response
Groundwater Comment 2	*Golder has been evaluating compliance with Guideline B-7 based on the concentrations measured in wells BH99-1 and BH99-2. It was noted that well BH99-1 is screened in the silty clay unit and therefore, may not be appropriate as an accurate indicator of leachate migration (see point 1). Boundary wells BH92-1 and BH99-5, located to the west, are also screened in the silty clay layer, but have measured exceedances, at times, related to DOC, Fe, and/or Mn. While BH99-2 (Guideline B-7 well) is appropriately screened in the sand, and does not show any signs of leachate, the nearest wells that are screened in the sand (with results) include the well clusters at BH91-1 and BH8; these wells have reported exceedances, at times, for DOC, TDS, Fe, and/or Mn. Given these facts, an explanation from Golder is needed on why they think B-7 is being met.*	Monitor BH99-1 is screened in the weathered crust zone of the silty clay unit. As noted in our response to Groundwater Comment #1, the weathered crust is a potential pathway for leachate plume migration in the shallow groundwater. The screen depth at monitor BH99-1 was selected for the screen to be beneath the water table to allow for the collection of a groundwater sample. It is noted that even at this screen depth this monitoring well has contained a water level too low to sample during four monitoring events since 2015. Monitors BH99-1 and BH99-2 (both located at the north property line) are properly screened (in the weathered crust zone and sand/weathered crust, respectively) to encounter shallow groundwater that is expected, based on the understanding of the hydrogeological setting and reflected in the modelling, to one day be affected by the leachate plume. The groundwater quality of these two monitoring wells consistently meets RUPO; as such, the site is interpreted to operate in compliance within Guideline B-7. BH92-1 and BH99-5 are not “boundary wells” since they are not positioned at a groundwater compliance boundary. These two wells are on-site wells that allow for monitoring of the leachate plume migration. As such, the calculated Guideline B-7 compliance values for Fe, Mn and DOC are not relevant to these monitoring locations and the quality of the groundwater at these monitoring wells does not represent exceedances of the allowable Guideline B-7 values or affect landfill site compliance with Guideline B-7. It is noted that Dochart Creek is hydraulically downgradient of these two wells and that along this portion of the property boundary the shallow groundwater discharges to Dochart Creek; site compliance in this part of the site is related to surface water compliance criteria.	*While it’s not clear to me how the location of BH92-1 is any different than BH99-1 in terms of B-7 compliance, I agree that the intent of B-7 in this area is generally met with groundwater discharge to surface water occurring in relatively short order. The crux of my comment pertained to possible biases originating from monitoring wells screened in the silty clay unit, but this aspect was discussed to my satisfaction in their response to Comment 1, so I consider this comment resolved.*	No further response required.

TABLE 1 – CUMULATIVE RESPONSES TO MECP GROUNDWATER TECHNICAL REVIEWER COMMENTS

Comment Number	MECP Comment (MECP 2022b)	Golder Response (Golder 2022)	MECP Response (MECP 2023a)	Current Response
Groundwater Comment 3	*Leachate effects have been observed in monitoring well BH6, located further south on the existing waste footprint, and in surface water samples from the poorly drained area east / northeast of the landfill; specifically, at SW4, SW6, SW7, SW8, and SW9, which have consistently recorded elevated alkalinity, ammonia, boron, cobalt, COD, calcium, chloride, DO, hardness, iron, manganese, magnesium, phenols, potassium, sodium, TDS, and total phosphorus. In some cases, the concentrations exceeded the PWQO. Given the known exceedances in surface water here, the lack of groundwater data in this area is concerning and may be a source of error for model prediction; for example, groundwater data is not available for locations in the vicinity of monitoring wells BH-4, BH92-4, and BH92-3, despite that fact that the 'full footprint' modelling predictions show that groundwater flow in this direction becomes a dominant flow pathway. Coupled with that, it is not clear to me why there is little to no contaminant movement predicted in this direction under the '2020 conditions' modelling predictions. To me, this raises questions about the accuracy of model predictions. I recommend that Golder provide additional information to clarify these items.*	Of the locations noted in the comment, the surface water quality at SW8 has not been interpreted to have been affected by landfill leachate. As shown on Figure 4 of the Hydrogeological Impact Assessment report, for the current (2020) landfilling area the groundwater flow model does not predict leachate migration in groundwater in the direction north of the 2020 fill area, i.e., in the direction of BH92-4 and 92-3. Note that the location of BH4 was adjacent to the limit of the more recent enlargement of the disposal area; this monitoring well was sampled until 2019 when it was accidently destroyed, and it was then decommissioned. However, as also shown on Figure 4 of the Hydrogeological Impact Assessment report, the groundwater flow model predicts increased leachate migration in the groundwater towards the northeast property line only under full development conditions due to the extension of the full development waste footprint in this northward direction. It is the location of the landfill footprint (leachate source) in relation to the shallow groundwater flow system that determines the presence and direction of leachate plume migration. Based on the modelling result shown on Figure 4 and the density of the flowpath lines, the new area of flow paths resulting from the enlarged disposal footprint becomes a flowpath but not a 'dominant' flowpath. The monitoring wells at BH92-3 and BH92-4 are still available, and monitoring of these locations could be added back into the annual program in future. It is noted that in Section 9.0 of the Impact Assessment report it is recommended to 1) install an additional monitoring location(s) between the full landfill footprint and the northeast portion of the property line and 2) add additional CAZ lands.	*In response to my comment regarding leachate impacts on the eastern side of the waste mound, WSP Golder highlighted that on Figure 4, for the current (2020) landfilling area, the groundwater flow model does not predict leachate migration in the direction of BH92-4 and BH92-3. This is my point of concern as leachate impacts clearly already affect this area as evidenced by the chloride concentrations (visually depicted in Figure 2) and the available surface water sample concentrations. Presumably, groundwater would also be affected but there is currently a lack of monitoring wells (and/or data) in this area to prove this. I request WSP Golder's opinion on whether this data gap may have had a significant impact on the resulting model outputs for all three scenarios examined: current (2020), full footprint, open and closed. Regardless, I endorse the suggestion that BH92-3 and BH92-4 be put back into the annual monitoring program moving forward. BH92-5, located in this area, is currently considered a background well; given that the area seems to be impacted, I request WSP Golder comment on the suitability of this well for background purposes, now and in the future, as model results for the full footprint show that this area is expected to eventually become impacted. An alternate background location will eventually be needed and should be selected and/or installed sooner rather than later to build a sufficiently sized dataset for B-7 RUC development.*	Concerns regarding the lack of groundwater quality monitoring to the northeast in the existing groundwater monitoring program were considered during the design of the revised monitoring program proposed in the accompanying letter. With respect to monitor BH92-5, it is noted that the location of the monitor (i.e., potentially downgradient of the landfill area) is not ideal for a background well and that under full development of the landfilling area the monitor would be immediately adjacent to the landfilling area. As presented in the conceptual hydrogeological model for the site described by Golder (2021), bedrock is located at or near the ground surface on the upgradient (i.e., approximately south) side of the landfilling area. As such, there is no silty clay unit hydraulically upgradient of the landfilling area where a representative background groundwater quality sample could be collected. Please refer to the discussion on background monitors in the proposed groundwater monitoring program in the accompanying letter.
Groundwater Comment 4	*Care needs to be taken when considering monitoring results from wells screened in the underlying silty clay, as they may not be representative of the maximum amount of leachate migrating from the source (discussed earlier in point 1). Where the sand and peat units overlying the silty clay thin (down to 0.1 m in places), installation of additional monitoring wells is recognized as being an impractical solution. Alternative methods are needed in these areas to confirm the fate and transport of leachate in the sand unit, or where it discharges therefrom.*	As per our response to Groundwater Comment #1, we agree that the leachate plume is not expected to extend down into the grey silty clay; however, the weathered crust portion of the silty clay deposit is moderately transmissive and is interpreted to be an important leachate migration pathway, especially where overlying sand and/or peat units thin and pinch out. It is considered that the placement of the monitoring well screens is appropriate to track plume development and migration. It is known that the sand unit pinches out before Dochart Creek; in the area between where the sand pinches out and the Creek, either 1) the leachate-impacted groundwater will discharge to surface (which possibly could be observed) and travel overland in which case impacts to surface water will be monitored in the Creek, or 2) it will continue as groundwater in the weathered clay zone and will be tracked through groundwater monitoring before the plume reaches the Creek. It is not considered that 'alternative methods' of monitoring are required.	*The potential pathways for leachate migration and the ultimate receiving bodies in this area are understood. The comment was meant to pertain to possible biases in the modelling using data from wells from the weathered silty clay; however, taking the discussion surrounding the functional permeability of this unit at face value, I am satisfied with the response.*	No further response required.

TABLE 1 – CUMULATIVE RESPONSES TO MECP GROUNDWATER TECHNICAL REVIEWER COMMENTS

Comment Number	MECP Comment (MECP 2022b)	Golder Response (Golder 2022)	MECP Response (MECP 2023a)	Current Response
Groundwater Comment 5	*While contaminant concentration projections were performed for boron, chloride, and ammonia, and in most cases represent conservative tracers, none of these represent the current contaminants of concern in groundwater at the site, which are DOC, Fe, Mn, and TDS. These should be modelled as well and may be useful as an extra source of data for calibration.*	The rationale for selection of chloride, boron and ammonia for predictive modelling is provided in Section 1.3 of the Impact Assessment report. These are characteristic of municipal landfill leachate and are considered to be contaminants of concern at this landfill site. Based on our experience, they are contaminants of concern at many municipal landfill sites as related to tracking the advancement of a groundwater plume, the identification of trigger parameters and trigger concentrations and assessing groundwater and/or surface water compliance. The monitoring at this site shows that chloride is the key parameter for tracking the presence and advance of the groundwater plume towards the surface water and groundwater compliance boundaries. Iron and manganese naturally occur in soil, groundwater and surface water and their concentrations are often naturally elevated in excess of the ODWQS or PWQO; they are also commonly elevated in areas underlain by organic soils such as the peat soils that underlie an area of the McNab Landfill site. Elevated DOC is also often encountered in areas underlain by organic soils. In the absence of the typical leading leachate indicators chloride, boron and ammonia, elevated concentrations of other parameters such as iron, manganese, DOC and TDS are not considered to be associated with leachate impacts. Because of their natural occurrence and geochemical reactivity that typically results in highly varying concentrations over time in leachate and both naturally occurring and leachate-impacted groundwater or surface water, it is problematic to model iron or manganese for modelling calibration or predictive effects. DOC is an unconservative parameter in terms of leachate impacts and is not considered to be a critical parameter for groundwater compliance assessment and it does not have a surface water PWQO for assessment purposes. TDS is a measure of total ionic strength of the various dissolved constituents in the groundwater, and it is well known that the concentration of the various constituents that result in the TDS concentration vary over time due to natural reactions in the subsurface such as ion exchange. Chloride (as a constituent of TDS) is a recognized parameter in terms of assessing leachate effects and compliance under Guideline B-7. Efforts could be made to try and model the suggested parameters, but selection of the source strength of these parameters in leachate as well as factors for retardation and geochemical reaction has a high degree of uncertainty. However, such modelling attempts are not expected to improve upon what is already a well calibrated model or assist in predicting future compliance based on this calibrated model. As such, it is not considered necessary or beneficial for the purpose of assessing the expected performance of the McNab Landfill under full development to carry out the additional modelling suggested by the reviewer.	*WSP Golder's response explained the reasons for selecting chloride, boron, and ammonia for the predictive modelling and the challenges that would be encountered in attempting to model DOC, Fe, Mn, and TDS. I am satisfied with the response and agree that no further work is necessary.*	No further response required.

TABLE 1 – CUMULATIVE RESPONSES TO MECP GROUNDWATER TECHNICAL REVIEWER COMMENTS

Comment Number	MECP Comment (MECP 2022b)	Golder Response (Golder 2022)	MECP Response (MECP 2023a)	Current Response
Groundwater Comment 6	*It was stated that on-going monitoring remains critical to continue validating model accuracy. Additional well installations were also recommended by Golder between the full landfill footprint and the current northeast property line for better understanding and tracking of leachate in this area. I agree with this and stress that the screened intervals need to be appropriately placed to capture leachate migration in all applicable stratigraphic units. This may require some exploratory work to determine the best placement location and further consideration of the degree of hydraulic connection between units.*	On-going monitoring will be important to verify the results of the modelling completed and to assess future site compliance and the need for and timing of implementation of contingency measures. As stated in the Hydrogeological Impact Assessment report, the existing groundwater monitoring program is generally considered appropriate to monitor leachate migration; however, an additional monitoring well(s) between the full landfill footprint and the current northeast property line (as well as bringing BH92-3 and BH92-4 back into the groundwater quality monitoring program) could be considered to provide better understanding and tracking of leachate migration in this area. As outlined in the response to Groundwater Comment #1, the weathered crust, which comprises the upper silty clay zone across the site, is interpreted to convey leachate-impacted groundwater and is the primary pathway for leachate migration in the groundwater in areas where the sand deposit is not present. As such, in areas of the site where the silty clay is located near the surface, monitoring wells should be screened in the weathered crust zone so that they can encounter the leachate plume when the plume reaches those monitoring locations.	*I endorse the statement made in the reply that additional monitoring wells be installed between the full landfill footprint and current northeast property line, as well as the reinstatement of BH92-3 and BH92-4 back into the program. Data therefrom may also help determine the appropriateness of currently using BH92-5 as a background well (discussed under Comment 3).*	This comment was considered during the design of the revised groundwater monitoring program presented in the accompanying letter.

TABLE 2 – CUMULATIVE RESPONSES TO MECP SURFACE WATER TECHNICAL REVIEWER COMMENTS

Comment Number	MECP Comment (MECP 2022a)	Golder Response (Golder 2022)	MECP Response (MECP 2023b)	Current Response
Surface Water Comment 1	*Leachate effects are evident at all monitoring locations in the poorly drained area northeast and east of the current waste mound, including background. While significant impairment is unlikely at this time, intensification of leachate effects in that area reasonably predictable with continued development of Stage 3, without additional measures to control leachate migration. Additional monitoring in the tributaries to Dochart Creek draining from the east property line may be required.* *There are no appreciable leachate impacts to Dochart Creek immediately north of the Site at this time, but leachate impacted groundwater is expected to eventually discharge to Dochart as the primary pathway for leachate migration. Additional information is needed to determine whether additional downstream monitoring is justified, as discussed above.*	A number of disconnected surface water features are present to the east and northeast of the waste mound (i.e., the "poorly-drained area"). These surface water features have been documented and sampled for approximately 30 years as a component of the annual surface water monitoring program. While these features are generally present during monitoring events conducted in the spring and fall, the surface water features in the poorly-drained area may be dry depending on seasonal conditions and negligible to limited flow has been observed within each of the isolated surface water features. As reported in the Hydrogeological Impact Assessment report, a site visit was conducted by Golder in 2019 that included an extensive walk over of the site area, with the intent of identifying surface drainage channels at the site including within the poorly-drained area. No distinct drainage channels to the east and northeast of the waste mound were identified during the 2019 site visit. As such, the conceptual model for the site is that no permanent off-site drainage channels exist that convey surface water over the northeast property boundary. The reasoning for the reviewer's differing interpretation and description of the surface water system is not apparent. As noted by the surface water reviewer's comments, there was a historical monitoring station (i.e., SW3) located in Dochart Creek located further downstream from the existing SW2 monitoring location. Monitoring location SW3 was removed from the sampling program in 2003. From review of historical correspondence in our files, the removal of SW3 from the program was discussed with and agreed to by the MECP District Office in 2003, with the reasoning being that the groundwater plume had not yet reached Dochart Creek and downstream surface water quality was being adequately monitored at SW2. As recommended in the Hydrogeological Impact Assessment report, the updated Development & Operations Plan would include a revised surface water and groundwater trigger mechanism, that would use on-going groundwater and surface water monitoring to track plume migration and surface water quality and set triggers at parameter concentrations below the compliance values such that contingency measures could be implemented prior to the site going out of compliance. Additional surface water stations could be added to the existing monitoring program, such as the reinstatement of sampling within Dochart Creek in the vicinity of SW3.	*MECP does not limit the evaluation of surface water impacts based on property lines. Despite the likely seasonal nature of some of the watercourses identified, leachate will be conveyed towards Dochart Creek and its tributaries in pulses during wet weather events, as has also been noted by the groundwater reviewer. Leachate impacts to both on-site and off-site surface water features continue to be a concern under the proposed development conditions.* *With respect to the drainage features to the east, as described in my memorandum, two streams are depicted on Ministry mapping and indicate a sustained intermittent (verified) and permanent flow. One of these drainage features is depicted on Figure 2 of Golder's 2021 Monitoring and Operations Report (the other is out of frame). These features drain towards a tributary to Dochart Creek, downstream of the WDS, from a location just beyond the east property boundary (SW4). SW4 is within the poorly drained area and understood to be impacted by leachate. The response does not speak to these watercourses or specify the boundaries of the 2019 site evaluation area. I continue to recommend additional evaluation of water quality in those coldwater tributaries.* *In addition, as noted in my review, the model results presented by Golder in Figure 4 of the report appear to indicate that SW2 may be upstream of a substantial part of expected leachate plume under current (2020) and future conditions. If SW2 is not expected to capture all expected leachate effects in Dochart Creek, additional sampling location(s) should be established farther downstream.* *In the absence of evidence that the watercourses east of the property boundary have been assessed, I recommend surface water monitoring be established in these locations prior to development of Stage 3 of the WDS (if approved, and regardless of the implementation of engineered leachate controls). Additional downstream monitoring should also be established in Dochart Creek prior to development of Stage 3 of the landfill. That monitoring location must be immediately downstream of the area over which the leachate plume is expected to intersect with the Creek.*	This comment was considered during the design of the revised surface water monitoring program presented in the accompanying letter. Specifically, it is being proposed to reinstate station SW3 as a sampling location (i.e., downstream of station SW2) and to establish new sampling stations within the seasonally variable tributaries to Dochart Creek located off-site to the east of the site. For clarification, the 2019 site evaluation included a thorough walkover of the poorly-drained area to the northeast of the disposal area between the disposal area and the northeast property boundary and along the northeast property boundary. One purpose of the walkover was to check for the presence of possible surface water connections between the poorly drained area on-site and the off-site tributaries (in terms of the latter, none were observed).

TABLE 2 – CUMULATIVE RESPONSES TO MECP SURFACE WATER TECHNICAL REVIEWER COMMENTS

Comment Number	MECP Comment (MECP 2022a)	Golder Response (Golder 2022)	MECP Response (MECP 2023b)	Current Response
Surface Water Comment 2	*Monitoring data collected in 2020 suggests that Dochart Creek, which contains highly sensitive cold water habitat, may have very low flows in the mid-to-late summer. As such, there is likely limited capacity for dilution or assimilation at those times. This is problematic for a naturally attenuating site, which will ultimately discharge leachate impacted groundwater to area surface waters without controls over the timing, quantity or quality. It is also notable that no flow or water quality information is available for the cold water tributaries to Dochart Creek east of the Site. These tributaries are slightly downgradient of current leachate impacted surface water monitoring locations and appear to originate within the projected pathway for leachate migration.*	While the McNab Landfill site currently operates in compliance as a natural attenuation site, it is recognized that a robust monitoring program is necessary to verify if compliance can be maintained over the life of the site and post-closure and that contingency measures, including engineered controls, would have to be implemented in advance of any non-compliance. As recommended in the Hydrogeological Impact Assessment, the updated Development & Operations Plan would include a revised surface water and groundwater trigger mechanism, that would use on-going groundwater and surface water monitoring to track plume migration and surface water quality and set triggers at parameter concentrations below the compliance values such that contingency measures could be implemented prior to the site going out of compliance. The contingency measures would be provided in the updated Development & Operations Plan and are expected to be similar to the current contingency plan and consist of a collection trench constructed to intercept shallow leachate-impacted groundwater upstream of Dochart Creek and removal of the collected groundwater for treatment. This approach, which will change the site from one relying on natural attenuation to one using engineering controls to achieve compliance, will provide the control on potential leachate impacts on surface water. Regarding Dochart Creek providing cold water habitat, the proposed approach assesses surface water compliance relative to the generic PWQO that was developed to be protective; as such, use of the PWQO for compliance assessment is not affected by the specific habitat or aquatic species within Dochart Creek. Regarding “cold water tributaries to Dochart Creek east of the site”, please refer to the response to Surface Water Comment #1.	*I am not satisfied that the current surface water monitoring program adequately characterizes the risk to Dochart Creek or would serve as a reliable basis for a trigger mechanism. Please see the response provided above.*	This comment was considered during the design of the revised surface water monitoring program presented in the accompanying letter.

TABLE 2 – CUMULATIVE RESPONSES TO MECP SURFACE WATER TECHNICAL REVIEWER COMMENTS

Comment Number	MECP Comment (MECP 2022a)	Golder Response (Golder 2022)	MECP Response (MECP 2023b)	Current Response
Surface Water Comment 3	*The method used to estimate low flows in Dochart Creek may be overly simplistic (i.e. may over- or under-estimate available assimilative capacity), as discussed above. The flow statistics presented, both measured and estimated, should be used with caution and may not be appropriate for the extrapolations made in the surface water impact assessment.*	To provide a comprehensive answer to Surface Water Comment #3, we have reproduced additional statements made throughout the surface water review letter on the topic of low flow estimation below. *"Flow would typically be expected to increase with distance downstream. Measured flows at SW2 were often lower than at SW1 (upstream) in the data presented. The reason for this is not discussed in the report (i.e., Were transect locations appropriate? Is the study site within a losing reach? What equipment / method were used to measure flows?)."* The surface water monitoring locations (SW1 and SW2) were chosen to represent the streamflow regime of Dochart Creek within the vicinity of the McNab Site. This included establishing transect locations to capture the manual flow data directly upstream and downstream of the Site. Manual flow measurements at both locations were completed using the following methodology. ▪ A measuring tape was strung across two wooden stakes at each surface water monitoring location to establish a consistent transects for each of the nine monitoring visits. ▪ Using a streamflow meter and rod setup, depths and streamflow velocities (measured at 60% of the depth) were measured at 10 cm intervals across each transect. ▪ Using the flow velocities, depths, and distance of each interval, the streamflow was calculated by multiplying the flow area by the flow velocity. Out of the nine site visits conducted, higher upstream flow measurements were recorded during a total of six visits from April 20th – September 22nd in 2020 at SW1, as seen below in [*Table of 1 of the Golder (2022)*]. During these monitoring visits, no abnormalities were witnessed or recorded by the field technicians at SW1 or SW2. We believe that this watercourse is a potential losing reach as the consistent higher upstream flow values show a pattern of lost flow that would not be expected to be caused by field measurement error. It is likely that when frozen conditions ended (i.e., March), the flow regime changed within the reach between SW1 and SW2 causing a potential losing reach. This could be attributed to groundwater / surface water interactions or interflow that occurs when sediment and soils are not frozen. *"Nine monthly measurements of flow are available for SW1 and SW2 in Dochart Creek, collected October 2019 through September 2020. While it is not unusual to have limited flow information, it is unclear how representative these data and the calculated average flows are for use in the extrapolations presented."* We agree that an extensive yearly record would be preferred; however, the flows were taken monthly to establish a seasonal record of conditions for Dochart Creek directly upstream and	*The response is generally acceptable; however, it should be recognized that the WSC dataset for this station contains numerous qualifiers that speak to the data quality. The WSC daily flow data for the referenced station, accessed April 4, 2022, contains the following annotation for the time period in question: "Extensive beaver activity June – December 2016. Discharges estimated for this period. Min inst. Discharge not valid – occurs during period of estimation" and "Estimated discharges November 23 – December 8, 2017 due to construction". Other periods of estimation and notes relating to ice conditions affecting measurements and/or days where data represent partial days are also identified throughout the dataset.*	It is common for gauging stations to have imperfections in their flow records for a wide variety of reasons. That said, it is considered that Buckshot Creek provides the best reference water course for predicting flows in Dochart Creek.

TABLE 2 – CUMULATIVE RESPONSES TO MECP SURFACE WATER TECHNICAL REVIEWER COMMENTS

Comment Number	MECP Comment (MECP 2022a)	Golder Response (Golder 2022)	MECP Response (MECP 2023b)	Current Response
		downstream of the site. Also, the daily continuous flow data obtained from the Water Survey of Canada for 2020 for Buckshot Creek showed an average annual flow of 2.41 m^3/s which is slightly above the station average annual flow of 2.13 m^3/s. Note that this average annual flow for Buckshot Creek (2.13 m^3/s) only includes the flows recorded after 2005, as the flows recorded before were seasonal and not fully representative of an annual average. This shows that any extrapolated flows from Buckshot Creek would likely be an overestimate of potential flows in Dochart Creek. Further comparison between Dochart Creek, Buckshot Creek, and other nearby watercourses with gauging stations is provided in the sections below. *"No justification is provided for the use of the ratio of average flows over other methods for estimating the 7Q20 flow in Dochart Creek (i.e., area reduction method with calibration using measured flows). Support for the choice of extrapolation technique is needed."* The ratio of average flow extrapolation method was chosen to estimate the 7Q20 flow in Dochart Creek so that the flow estimate would be considerate of the specific yields from the site. It was suspected that Dochart Creek possibly behaved as a headwaters of a smaller catchment area, compared to a yield of a gauged river with a larger catchment. Since we had seasonal measured flows at the site, we wanted to utilize these. If we had tried to compare the catchment areas between Dochart Creek and Buckshot Creek there was a possibility that the area reduction would result in a ratio not representative of the Dochart Creek yield and therefore an unrepresentative 7Q20. *"Insufficient information is provided to corroborate the calculated 7Q20 in Buckshot Creek (i.e., Why was the selected calculation used? Within the available dataset, how were estimated flows or flows affected by beaver activity treated? Were there gaps in the dataset?)."* The 7Q20 was estimated using continuous daily flow data from the Water Survey of Canada hydrometric station at Buckshot Creek near Plevna, Ontario (02KF017) over the period of 1993 – 2019. Flow ratios were established by pairing the manual flow measurements to an average daily flow measurement from Buckshot Creek for each specific date. Using the continuous daily averaged data, a rolling 7-day average over the entire period of record was established and then the minimum flow for each year was placed into a Pearson curve fitting model. The Pearson curve fitting model we used compared the 3 Parameter Log-Normal, Extreme value, Log Pearson III, and Weibull distribution fitting curves and selected the best option based on the inputted data. A 3 Parameter Log-Normal analysis was therefore selected as the best option and the 7Q20 was estimated and the ratio was applied to the estimate the Dochart Creek 7Q20. Within the available data set, there was no mention of beaver activity. The only gaps in data occurred prior to 2005 as the		

TABLE 2 – CUMULATIVE RESPONSES TO MECP SURFACE WATER TECHNICAL REVIEWER COMMENTS

Comment Number	MECP Comment (MECP 2022a)	Golder Response (Golder 2022)	MECP Response (MECP 2023b)	Current Response
		continuous flow data was recorded seasonally (i.e., between April and September). Only the flows within those months were considered for 7Q20 analysis. *"No information is provided on the comparability of Buckshot Creek to the study site (e.g., characteristics of the streams, drainage areas, physiography, stream order, groundwater regime), nor is justification provided for the choice of reference watershed. Buckshot Creek is located approximately 65 km southwest of the waste disposal site, with notable differences in watershed characteristics, including main channel slope, percent wetlands, percent agricultural/rural area and percent open waters indicated in OFAT. In addition, Buckshot Creek has been classified as warm water creek (with a small portion designated as cool water habitat downstream of the gauging site), while Dochart Creek and its tributaries are classified as having a cold-water thermal regime. These differences suggest that these systems may differ in their responses to high and low water conditions."* The 7Q20 estimate requires the evaluation of publicly available river gauge data. These gauging stations are typically established on larger river systems, often to monitor flooding and potential for water usage. These larger river systems differ from creeks with much smaller catchment areas (including the headwaters of the same system). For that reason, the estimate of the 7Q20 of Dochart Creek using a comparison with Buckshot Creek is a modelled approximation based on typical industry practice. A comparison of the characteristics of similar watercourses in the general vicinity of the Site with an extensive gauging record are detailed below in [Table 2 of the Letter]. As detailed in Table 2 above, all the gauging stations with 20+ years of flow data within the vicinity of the Site had notable differences in watershed characteristics in comparison to Dochart Creek. All but one of these gauging stations were placed on a watercourse with a warm thermal regime; however, Bear Brook still has a relatively high thermal regime and is classified as a cool-warm watercourse. In comparison to Dochart Creek, Buckshot Creek is more comparable by slope of the main channel and percentage of lakes/wetlands within the catchment, when compared to the other unregulated flow watercourses. While Buckshot Creek is located 65 km northwest of the site, it is the closest natural watercourse with a gauging station; therefore, it was predicted that Buckshot Creek and Dochart Creek would experience similar responses to draughts and local precipitation than the other more distant watercourses with gauging stations.		

Comment Number	MECP Comment (MECP 2022a)	Golder Response (Golder 2022)	MECP Response (MECP 2023b)	Current Response
Surface Water Comment 4	*Given the limited supporting information provided, I cannot confirm that the surface water model is sufficiently calibrated or reliable. Agreement between measured and predicted conditions cannot be confirmed for the estimated 7Q20 condition for any of the parameters evaluated.*	To provide a comprehensive answer to Surface Water Comment #4, we have reproduced below additional statements made throughout the surface water review letter on the topic of model calibration. *"It is unclear how (or if) background surface water quality in Dochart Creek was incorporated into this assessment (i.e., Are the concentrations reported intended to represent the additional concentrations of the subject parameters or the final concentration after mixing? If it is the latter, what values were used to represent background water quality?)."* The forecasted concentrations represent the final concentrations following mixing with the background quality of Dochart Creek. As described in Section 7.1. page 13 of the Hydrogeological Impact Assessment report, the background concentrations were taken as the average observed concentrations at the Dochart Creek background station from the surface water monitoring program. *"Based on current monitoring data, leachate does not yet appear to have reached SW2 in Dochart Creek in any appreciable quantity, which may limit the value of the comparisons between model predictions and current water quality."* It is agreed that leachate-impacted groundwater is interpreted to have not yet reached Dochart Creek; as such, the comparison of simulated and measured parameter concentrations in Dochart Creek cannot form the only line of evidence to support the calibration of the model. Additional lines of evidence supporting the model calibration are presented in the Hydrogeological Impact Assessment report, including: ▪ The comparison between simulated and measured groundwater elevations at monitoring wells (Section 6.3 and Figure 4); ▪ The comparison between simulated groundwater flow pathways and the conceptual hydrogeological model (Section 6.3 and Figure 4); and, ▪ The comparison between simulated and measured parameter concentrations at on-site monitoring wells (Section 7.2.2). The model is considered to be satisfactorily calibrated based on the assessment of each of the above comparisons. On-going monitoring will be important to verify the results of the modelling and keep abreast of leachate-impacts on groundwater and surface water. *"In addition to the poor correlation for boron under the estimated 7Q20 conditions, noted above, predicted 7Q20 ammonia concentration is an order of magnitude higher than both the 2018-2020 (<0.01-0.09 mg/L) and historical range in Dochart Creek (<0.01-0.11 mg/L)."* No sampling events have occurred during 7Q20 flow conditions in Dochart Creek; as such, at this time, parameter	*The discussion provided by the consultant is reasonable given the limitations of the available data and site conditions.*	No further response required.

TABLE 2 – CUMULATIVE RESPONSES TO MECP SURFACE WATER TECHNICAL REVIEWER COMMENTS

Comment Number	MECP Comment (MECP 2022a)	Golder Response (Golder 2022)	MECP Response (MECP 2023b)	Current Response
		concentrations in Dochart Creek during extreme low flow conditions cannot be known. While the leachate plume is interpreted to not have reached Dochart Creek, it is considered conservative that the model simulates a minor contribution of leachate discharge to the Creek that results in elevated parameter concentrations during the low flow event. *"While the peak chloride concentration does initially appear to correlate well with model predictions for the estimated 7Q20 conditions, that measured value (reported in 2018) appears to be an outlier, more than double the next highest concentration on record for Dochart Creek and reflecting background effects, apparently unrelated to the landfill. This is not noted by the consultant and should not be considered to support predicted landfill impacts. Agreement with the model cannot be confirmed for the estimated 7Q20 condition for any of the parameters evaluated."* If the elevated chloride concentrations measured at both SW1 and SW2 are removed from consideration, the observed concentration range (2018 to 2020) for chloride in Dochart Creek becomes 9 mg/L to 38 mg/L. The concentration of chloride simulated for 2020 for the minimum, 25th percentile and median flow rates of Dochart Creek are 33 mg/L, 29 mg/L and 27 mg/L, respectively, which all fall within this range. Only the simulated concentration of chloride for the 7Q20 flow rate (93 mg/L) exceeds this range. As stated above, no sampling events have occurred during 7Q20 flow conditions in Dochart Creek; as such, at this time, parameter concentrations in Dochart Creek during extreme low flow conditions cannot be known. While the leachate plume is interpreted to not have reached Dochart Creek, it is considered conservative that the model simulates a minor contribution of leachate discharge to the Creek that results in elevated parameter concentrations during the low flow event. As shown, the model calibrates well when parameter concentrations forecasted for observed flow rates in Dochart Creek are compared to the measured results. *If only 2020 conditions are considered, there is a lack of agreement between measured and predicted ammonia concentrations for all model scenarios (<0.01 mg/L vs 0.01-0.9 mg/L), including August 20, which corresponds directly to one of the flow conditions modeled. While the model appears to over-estimate ammonia concentrations for the measured flows (which would be protective), I have concerns over the meaningfulness of these flow statistics (min, 25th percentile, median) for long term predictions, as discussed above. As noted above, the measured flow at SW2 on August 20, 2020 was equal to the minimum flow value cited in the model validation and corresponds to the mid- summer sampling event. Direct comparison of predicted and measured water quality results reveals that the chloride*		

Comment Number	MECP Comment (MECP 2022a)	Golder Response (Golder 2022)	MECP Response (MECP 2023b)	Current Response
		concentration was slightly overestimated (114%), while boron and ammonia were more dramatically overestimated (2x and >9x the measured values, respectively), demonstrating the potential lack of agreement between monitoring data and model predictions. While the concentration of ammonia measured in Dochart Creek throughout 2020 was <0.01 mg/L at both monitoring locations SW1 and SW2, the concentrations of ammonia measured in 2018 and 2019 (<0.01 mg/L – 0.09 mg/L) are not outliers and represent the natural variability in ammonia within Dochart Creek. Due to the variability expected when sampling surface water, Golder considers it reasonable to compare these forecasted model results to samples collected over a period of time (such as the 3-year window used in this assessment); it is beyond the ability or expectation of a model to predict parameter concentrations that correspond to specific days. *The consultant's conclusion presumes that all flow conditions encountered 2018 - 2020 were within the lower distribution of flows (median, 25th percentile, or minimum, but not reaching the estimated 7Q20). While flows may have been low over a portion of the selected date range, supporting data have not been provided.* The model calibration was presented for the 7Q20 flow rate and minimum, 25th percentile and median of the observed flow rates for Dochart Creek, as these values were considered more useful to present than higher flow rates (such as the 75th percentile or maximum observed flow rates) that result in the forecasted concentration in Dochart Creek closer to the background concentration for each parameter. In addition, the flow rates selected for the assessment of the calibration are the same as those selected for the forecasting. Because it is the lower end of flow rates that will be considered for assessing future surface water compliance, the lower flow rates were selected for the forecast assessment as these provide a more conservative assessment of whether surface water quality can be expected, under natural attenuation conditions, to comply with PWQO than using higher flow rates in Dochart Creek.		

TABLE 2 – CUMULATIVE RESPONSES TO MECP SURFACE WATER TECHNICAL REVIEWER COMMENTS

Comment Number	MECP Comment (MECP 2022a)	Golder Response (Golder 2022)	MECP Response (MECP 2023b)	Current Response
Surface Water Comment 5	*It is not clear if the leachate source strength determinations consider the potential changes in waste stream (i.e., diversion of recyclables and protrusible wastes), changes in leachate composition/concentration following cover placement, and/or with aging of waste. I defer to the groundwater reviewer and review engineer for comment on these matters.*	The leachate source strength does not consider potential changes in the waste stream associated with waste diversion (in particular the diversion of organics) that can, over time, significantly reduce the decomposable portion of the waste stream) and the resultant changes in leachate strength. Diversion is expected to improve (reduce) the concentration of various parameters in the leachate, which would then reduce the concentration in groundwater or surface water affected by leachate. The peak concentrations of the parameters selected for modelling conservatively correspond to typical municipal solid waste leachate for a site with the physical characteristics of the McNab Landfill site, as described in Section 5.1 of the Impact Assessment report. Also, as described in Sections 5.1 and 7.1, appropriate reductions over time in the peak leachate source strength as the waste ages and contaminants are flushed out of the waste by infiltrating precipitation or are otherwise removed were modelled and incorporated into the hydrogeologic model.	*Response acknowledged.*	No further response required.
Surface Water Comment 6	*Boron, chloride and ammonia were selected as parameters of concern for groundwater and surface water impact assessments. Iron is also present at high concentration in leachate and should be considered with respect to potential surface water impacts in both on-site streams / wetlands and in Dochart Creek.*	Please see response to Groundwater Comment #5. Note that iron will be part of the site's ongoing groundwater and surface water monitoring program and will be used in conjunction with leading leachate indicator parameters to assess and characterize groundwater plume migration, the future onset of leachate impacts in Dochart Creek and site compliance in terms of surface water.	*Response is reasonable. It is acknowledged that iron concentrations will be used to monitor leachate plume progression (with respect to groundwater). Please note that iron must also be considered as a potential leachate indicator in on-site surface water and wetland receivers (see Response 1), regardless of its inclusion in the models.*	Iron is sampled in both groundwater and surface water as part of the existing monitoring programs and would continue to be included in the proposed parameter lists for the revised monitoring programs. Iron is considered a leachate indicator parameter at this site, noting that elevated iron on its own in the absence of other leachate indicator parameters is likely to be naturally occurring.

TABLE 2 – CUMULATIVE RESPONSES TO MECP SURFACE WATER TECHNICAL REVIEWER COMMENTS

Comment Number	MECP Comment (MECP 2022a)	Golder Response (Golder 2022)	MECP Response (MECP 2023b)	Current Response
Surface Water Comment 7	*The compliance criteria selected for boron and chloride are appropriate. I cannot confirm that the selected compliance criteria for ammonia will be protective, particularly during the late summer period. The effect of fluctuations in temperature, pH and flow must be considered more thoroughly, with consideration for the precautionary principle.*	For the assessment, the compliance value for ammonia of 2.3 mg/L was calculated using the median values of pH and temperature measured in Dochart Creek, which is considered to be a reasonable approach for this modelling. In response to the comment, the ammonia concentration corresponding to a unionized ammonia concentration of 0.02 mg/L was determined for each sampling event from 1991 through 2021 using the field measured pH and temperature values. The median calculated ammonia concentration from this data set is 2.3 mg/L, the same value as presented in the assessment. From this data set, the minimum calculated ammonia concentration is 0.23 mg/L, the 5th percentile concentration is 0.41 mg/L and the 25th percentile is 1.02 mg/L. The modelling incorporates conservatism into various aspects of the model. Also, the PWQO value for unionized ammonia includes a factor of safety of 10 based on toxicity testing for the most sensitive aquatic species. For these reasons, the values of pH and temperature that result in the most conservative calculated compliance value for ammonia were not considered necessary to be used in the assessment. Rather, the approach taken was to assess the resultant concentrations that could reasonably occur under typical conditions of both surface water quality and creek flow. Considering the simulated surface water presented on Figures 5 and 6 of the Impact Assessment report, the effect of a lower ammonia compliance value (say the 25th percentile value) would be that the compliance value would not be met at the minimum observed flow rate but would be met at the 25th percentile and median observed flow rates. This assessment predicts an outcome based on the McNab Landfill site continuing to operate as a natural attenuation landfill. The modelling demonstrates that at some time in the future, based on a robust monitoring program coupled with a trigger mechanism, it can be expected that engineered control of leachate-impacted groundwater migration towards Dochart Creek will be required to achieve surface water compliance at the McNab Landfill site. This is further discussed in the response to Surface Water Comment #10.	*Generally, the response does not address the concerns cited in my memorandum particularly with respect to on-site receivers, which are acknowledged to be leachate impacted under current conditions. The compliance criteria for ammonia must be selected considering temperature and pH (75th percentile, not average, median or typical), in order to meet Provincial Water Quality Objectives (PWQO) within the downgradient receiving stream. PWQO are the accepted long term exposure criteria, applicable to surface water receivers. In this case, the receiver is a cold-water stream (considered highly sensitive habitat). Golder's suggested relaxation of surface water criteria is not appropriate. As stated in my memo: "To establish a surrogate for the PWQO [for unionized ammonia], the consultant has used 'typical' temperature and pH (15ºC and 7.5, respectively), producing a compliance criteria of 2.3 mg/L total ammonia. Because the amount of ammonia in the unionized fraction increases sharply with increases in either pH or temperature, the proposed compliance criteria may not be protective.* *Temperature in Dochart Creek ranges from 0.5 to 25.1 ºC (median 11.1 ºC; 75th percentile 17.5 ºC) over the period of record and pH ranges from 6.8 to 8.43 (median 7.73; 75th percentile 8.04). Temperature in small streams east of the fill area ranges from 0ºC to 23.3ºC. Considering the likelihood that higher temperatures will correspond to lower flows and that the 'typical' pH cited is less than the median and average values in Dochart Creek, it is likely that unionized ammonia will grossly exceed the concentrations presumed in the surface water impact assessment in the late summer low flow period, which is typically the critical period for leachate assimilation".* *If the PWQO for unionized ammonia is not expected to be met, measures must be taken to prevent the migration of leachate to surface water receivers (on- and off-site).* *Also as identified in my review, a compliance criterion for iron is justified considering the on-site impacts present under current conditions.*	This comment was considered during the design of the revised surface water monitoring program presented in the accompanying letter. For modelling purposes, it was necessary to select a representative set of Creek temperature and pH conditions to assess potential ammonia impacts from leachate impacts. The ongoing monitoring program will use the measured temperature and pH to calculate the unionized ammonia concentration for comparison to the PWQO. There was no intent to suggest a relaxation of the surface water criterion. As stated in our previous response, the modelling demonstrates that at some time in the future, based on a robust monitoring program coupled with a trigger mechanism, it can be expected that engineered control of leachate-impacted groundwater migration towards Dochart Creek will be required to achieve long term surface water compliance at the McNab Landfill site. With respect to the comment regarding low-flow summer conditions, it is noted that both the existing and proposed surface water monitoring programs include a summer sampling event for the Dochart Creek sampling stations.

TABLE 2 – CUMULATIVE RESPONSES TO MECP SURFACE WATER TECHNICAL REVIEWER COMMENTS

Comment Number	MECP Comment (MECP 2022a)	Golder Response (Golder 2022)	MECP Response (MECP 2023b)	Current Response
Surface Water Comment 8	*Clarification is needed on the compliance boundary for surface water considered in the Hydrogeological Assessment. Compliance boundaries for surface water are not dictated by property boundaries.*	The "surface water compliance boundary" presented on Figure 5 of the Hydrogeological Impact Assessment report specifically refers to the furthest downgradient intersection of Dochart Creek and the McNab WDS property boundary. This is in the vicinity of the SW2 monitoring station. The "surface water compliance boundary" presented on Figure 6 of the Hydrogeological Impact Assessment report (i.e., forecasted compliance with additional CAZ) refers to the furthest downgradient intersection of Dochart Creek and the proposed additional CAZ. It is acknowledged that the McNab Landfill site would become non-compliant regarding surface water compliance if leachate from the site causes parameter concentrations to exceed the applicable criteria anywhere along Dochart Creek. It is noted that the peak surface water impacts forecasted on Figure 5 and Figure 6 are comparable; as such, it is expected that the model would forecast a comparable level of impact regardless of the compliance point selected for analysis. It is proposed that the surface water compliance location remains at SW2.	*Please see Response 1, specifically as related to the information presented in Figure 4 (groundwater plume intersection with the Creek). SW2 may not be an appropriate compliance boundary.*	This comment was considered during the design of the revised surface water monitoring program presented in the accompanying letter. Specifically, an additional sampling location is being proposed downstream of station SW2 (i.e., station SW3).
Surface Water Comment 9	*The assessment does not appear to consider potential impacts to surface water from discharge of leachate impacted groundwater to streams and wetland areas upgradient of Dochart Creek, east and northeast of the current fill area. Evaluation of potential impacts to those receivers is also required to support and inform the proposed development of Stage 3 of the landfill.*	Please refer to our response to Surface Water Comment #1. As described in that response, based on our understanding of the surface water setting in the area of the McNab Landfill site, Dochart Creek is the eventual receiver of leachate-impacted groundwater discharge and the appropriate watercourse to assess for landfill site compliance.	*See Response 1, above. The evaluation of surface water impacts is not dictated by property boundaries.*	Acknowledged and agreed. As per above, this comment was considered during the design of the revised surface water monitoring program presented in the accompanying letter.

TABLE 2 – CUMULATIVE RESPONSES TO MECP SURFACE WATER TECHNICAL REVIEWER COMMENTS

Comment Number	MECP Comment (MECP 2022a)	Golder Response (Golder 2022)	MECP Response (MECP 2023b)	Current Response
Surface Water Comment 10	*Given the uncertainties described here, I cannot support the development of Stage 3 of the McNab-Braeside WDS as a naturally attenuating site, pending the submission of the additional information and assessment requested above.*	The purpose of the modelling assessment is to provide an understanding of current and future leachate migration to assist in the refinement of the groundwater and surface water monitoring programs and the development of contingency measures to ensure ongoing compliance of the site. It is our opinion that the modelling work completed to-date has been beneficial by providing the understanding of leachate migration and potential effects on groundwater and surface water quality and associated site compliance required to update the Development & Operations Plan for the site. The updated Development & Operations Plan will include a surface water and groundwater trigger mechanism, that would use on-going groundwater and surface water monitoring to track plume migration and surface water quality and set triggers at parameter concentrations below the compliance values such that contingency measures could be implemented prior to the site going out of compliance. The contingency measures would be provided in the updated Development & Operations Plan and have been briefly described in the response to Surface Water Comment #2. The McNab Landfill has been and is currently operating as a natural attenuation landfill, which is also the condition assumed in the modeling assessment. It is important to understand it is not proposed that the site continue to operate indefinitely as a natural attenuation landfill. When it is necessary to implement the contingency plan (based on ongoing monitoring and the approved trigger mechanism), it will no longer rely on natural attenuation but on an engineered collection and control system to manage the impacts of leachate generated by the landfill and continue to achieve compliance for surface water. The hydrogeologic setting at this site, where leachate-impacted groundwater migrates in the shallow subsurface through the surface sand layer and/or weathered clay crust zone and does not extend deeper because of the underlying low permeability unweathered grey silty clay, is very suitable for the installation and operation of a groundwater interceptor trench. This contingency measure can be expected to be highly effective in this setting to capture the leachate-impacted groundwater plume. It is noted that the proposed approach is not affected by the volume of approved disposal capacity, the main effect of which is on the strength of the intercepted leachate-impacted groundwater. In terms of the modeling predictions under natural attenuation, since the 7Q20 flow is so low, the predicted concentrations of parameters in Dochart Creek during this extreme low flow event essentially reflect that the surface water is mostly leachate-impacted groundwater discharge.	*The consultant acknowledges that "modelling demonstrates that at some time in the future… engineering control of leachate impacted groundwater migration towards Dochart Creek will be required to achieve surface water compliance". The response considers only the downstream, off-site receiver at SW2 (see notes above questioning the ongoing suitability of that station as a compliance boundary) and not on-site wetlands and ephemeral streams. Impacts between the landfill and the Creek are largely ignored in the proposed approach. The reactive, rather than proactive approach to leachate control continues to be a concern.*	This comment was considered during the design of the revised surface water monitoring program presented in the accompanying letter. In addition, it is noted that some of the on-site poorly-drained area to the northeast will be covered by Stage 3 of the landfill. Also, the Stage 3 area will be underlain by a sand base pad of higher hydraulic conductivity than the native soils in this area, which is expected to provide a preferred pathway for leachate towards the north/northwest and away from the remaining poorly-drained area, the northeast property boundary and the off-site tributaries.

APPENDIX A

Summary of Proposed Groundwater Monitoring Program

Attachment A: Summary of Proposed Groundwater Monitoring Program

1.0 SAMPLING FREQUENCY

1.1 **Monitoring Sessions**
Spring (April/May)
Fall (October/November)

2.0 GROUNDWATER SAMPLING LOCATIONS

2.1 **Background Monitors**
BH3B, BH92-5

2.2 **Leachate Monitors**
BH6, BH15-1

2.3 **Downgradient Monitors**
BH8A, BH8B, BH9B, BH10A, BH15-2A, BH15-2B, BH20-1, BH20-2, BH20-3, BH91-1B, BH92-1A, BH92-1B, BH92-1C, BH92-2, BH92-3, BH92-4, BH99-1, BH99-2, BH99-3, BH99-4, BH99-5
Plus one new monitoring well at the location identified on Figure 1 as NEW-BH.

2.4 **Quality Assurance/Quality Control**
Two field duplicates per monitoring session

3.0 FIELD MEASURED PARAMETERS AND OBSERVATIONS

3.1 **With Each Groundwater Quality Sample**
temperature, conductivity, pH
groundwater elevation
sample observations
observations of monitoring well condition

4.0 LABORATORY MEASURED PARAMETERS

4.1 **All Monitors**
alkalinity, chloride, COD, DOC, mercury, arsenic, barium, boron, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, potassium, sodium, zinc, ammonia, nitrite, nitrate, phenols, sulphate, TDS, TKN, total phosphorus.

4.2 **Leachate Monitors BH6 and BH15-1**
BOD, TSS

4.3 **Monitors BH6, BH9B, BH99-4, BH15-1, BH15-2B**
volatile organic compounds (VOCs) in fall monitoring session only

APPENDIX B

Summary of Proposed Surface Water Monitoring Program

Attachment B: Summary of Proposed Surface Water Monitoring Program

1.0 SAMPLING FREQUENCY

1.1 **Monitoring Sessions**
Spring (April/May)
Summer (July/August) – **at Dochart Creek locations only**
Fall (October/November)

2.0 SURFACE WATER SAMPLING LOCATIONS

2.1 **Surface Water Sampling Stations – Dochart Creek**
SW1, SW2, SW3

2.2 **Surface Water Sampling Stations – Poorly-Drained Area (On-Site)**
SW4, SW6, SW7, SW8, SW9

2.3 **Surface Water Sampling Stations – East of Poorly-Drained Area (Off-Site)**
Two new sampling stations established where tributaries to Dochart Creek pass beneath Stewartville Road. Identified on Figure 1 as NEW-SW-A and NEW-SW-B.

2.2 **Quality Assurance/Quality Control**
One field duplicate during spring and fall monitoring sessions

3.0 FIELD MEASURED PARAMETERS AND OBSERVATIONS

3.1 **With Each Surface Water Quality Sample**
temperature, conductivity, pH, dissolved oxygen
observations of flowing conditions (direction and estimation of rate)
size and extent of water features at sampling stations
sample observations

4.0 LABORATORY MEASURED PARAMETERS

4.1 **Chemical and Physical Parameters (Dochart Creek)**
chloride, sodium, potassium, boron, manganese, strontium, hardness, alkalinity, COD, TDS, DOC, iron, total phosphorus, BOD, total suspended solids, turbidity, nitrate, phenols, aluminum, barium, beryllium, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, silicon, silver, thallium, titanium, vanadium, zinc, ammonia.

4.2 **Chemical and Physical Parameters – Poorly Drained Area (On-Site and East of Site)**
chloride, sodium, potassium, boron, manganese, strontium, hardness, alkalinity, COD, TDS, DOC, iron (total and dissolved), total phosphorus, BOD, total suspended solids, turbidity, nitrate, phenols, aluminum, barium, beryllium, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, silicon, silver, thallium, titanium, vanadium, zinc, ammonia.

APPENDIX A3

MECP Memoranda - September/October 2023

Ministry of the Environment, Conservation and Parks
Eastern Region
1259 Gardiners Road, Unit 3
Kingston ON K7P 3J6
Phone: 613.549.4000
or 1.800.267.0974

Ministère de l'Environnement, de la Protection de la nature et des Parcs
Région de l'Est
1259, rue Gardiners, unité 3
Kingston (Ontario) K7P 3J6
Tél: 613 549-4000
ou 1 800 267-0974

Ontario

M E M O R A N D U M

September 12, 2023

TO: Thandeka Ponalo
Senior Environmental Officer
Ottawa District Office
Eastern Region

FROM: Nick Battye
Hydrogeologist
Technical Support Section
Eastern Region

RE: 2022 AMR and Comment Responses, McNab/Braeside Waste Disposal Site, Township of McNab/Braeside

I have reviewed the following WSP reports:

- 2022 Groundwater and Surface Water Monitoring Program Summary Letter and Annual Operations Report (dated March 22, 2023); and,
- Response to MECP groundwater and surface water January 2023 technical comments McNab waste disposal site (dated April 21, 2023).

A summary of the pertinent information from each report is provided below, along with my comments and recommendations.

Background

The Township of McNab/Braeside operates the McNab/Braeside Waste Disposal Site (WDS), which is located on part of Lots 18 and 19, Concession VI, and part of Lot 19, Concession V, in the Township of McNab/Braeside, Renfrew County, approximately 2.5 km southwest of Glasgow Station, Ontario. The Site has been operating under Environmental Compliance Approval (ECA) A412605, which permits the development of a landfill up to 10 ha with a total capacity for waste and daily cover of 1,000,000 m^3 as part of a three-stage approach. Stage 1 relies on natural attenuation, which was achieved through the acquisition of Contaminant Attenuation Zone (CAZ) land to the north and northeast of the landfill. For landfill enlargement to proceed in association with Stage 2 and 3, the ECA requires additional studies to assess the potential requirement for engineered leachate management controls, or an increased CAZ, such that the landfill remains compliant with respect to leachate impacts on groundwater and surface water. Despite this requirement, landfilling has already moved well into Stage 2, and a limited amount into Stage 3. A Hydrogeological Impact Assessment was completed by

Golder Associates Limited (Golder 2021), which sought to satisfy these requirements by determining the need for engineered or other design controls. This report was previously reviewed by the Ministry (memorandums dated April 19 and 21, 2022). WSP's response document here is a continuation of this discussion.

2022 Groundwater and Surface Water Monitoring Program Summary Letter

This letter report was submitted to comply with the reporting requirements associated with Conditions 45.3, 45.4, 45.6, 45.7, and 45.14 of the ECA. Submission of a full monitoring report is required every two years, with a summary letter being prepared in the year when a full monitoring report is not submitted.

The 2022 groundwater monitoring program was completed on May 31, June 1, and June 2, 2022, and again on December 1 and December 2, 2022. Deviations from the accepted program included the following:

- Insufficient water in BH20-3 prevented a sample being collected during the fall monitoring event (was successfully sampled in the spring).
- A blockage in BH15-2A prevented the collection of a sample during the spring and fall monitoring events.

Noteworthy trends and changes in groundwater quality observed in 2022 were reported to be:

- A generally increasing trend in chloride concentrations has been observed at BH8A since 2014, and in 2022, results were 38 mg/L for both events, which represent the highest concentrations measured at that location to date.
- A generally increasing trend in chloride concentrations has been observed at BH8B since 2011; in the fall, 51 mg/L was measured, which represents the highest value at that location to date.
- A generally increasing trend in chloride concentrations has been observed in BH9B since 2010; in the fall, a value of 50 mg/L was recorded, which represents the highest concentration at that location to date.
- A generally decreasing trend in chloride concentrations has been observed in BH10A since 2017; while the chloride concentration in 2017 was 110 mg/L, in the fall of 2022 it was recorded to be 67 mg/L.
- Iron concentrations at BH15-1 have been observed to vary over a large range between monitoring events, without following a generally increasing or decreasing trend. Since 2015, iron concentrations at BH15-1 have ranged from 0.54 mg/L to 59.0 mg/L. Iron concentrations in the spring and fall of 2022 were 13.1 and 47.4 mg/L, respectively.

It was stated that the significance of these observations will be discussed in the next full monitoring report, which will include both 2022 and 2023 data, due March 31, 2024.

However, compliance assessment under Guideline B-7, applied to boundary monitors BH99-1 (silty clay unit) and BH99-2 (sand unit), located along the north property boundary, was concluded to meet the Reasonable Use Performance Objectives (RUPO) for all evaluated parameters. As such, the Site was interpreted to be operating in compliance with Guideline B-7. Groundwater quality at all other monitoring locations was said to have remained relatively consistent in 2022.

Responses to MECP Groundwater Technical Comments

It is WSP's opinion that the remaining concerns expressed by the MECP can be satisfactorily addressed by modifying the groundwater and surface water monitoring programs for the Site. It was noted that corrective measures would still be undertaken if future monitoring indicates such measures to be necessary. Such measures, along with associated triggers, would be proposed in the updated D&O plan that will be put into the future ECA amendment application. A summary of the proposed changes related to groundwater are provided below. An MECP surface water specialist will be providing comment on aspects related to surface water.

Background groundwater quality in the sandy surficial unit is currently interpreted to be represented by BH3B and has been sampled since 1991. Although BH3B is situated close to the existing waste disposal area, the groundwater quality here is characterized by low concentrations of leachate indicator parameters and has been generally consistent over time. The background groundwater quality within the silty clay unit is interpreted to be represented by BH92-5 and has been sampled since 1993; groundwater quality here is also characterized by low concentrations of leachate indicator parameters and has generally been consistent over time. While neither of these monitors is located directly upgradient of the landfilling area, no suitable location is available in that area due to surficial bedrock being present. It was proposed that these wells remain as background monitors, but that they are routinely assessed to determine their ongoing suitability. If future interpretation of the groundwater quality data concludes that impacts are beginning to occur, background for the associated hydrostratigraphic unit would be defined by the data collected over an appropriate historical period.

Leachate quality at the Site is currently characterized by the ongoing data being collected at BH6 and historical data for BH4B. WSP considers BH15-1 to be useful for this purpose and since BH6 may be lost with further landfill development it was proposed that it be included as a leachate monitor under the revised program.

There are 18 downgradient monitors currently included in the monitoring program (not including the monitors discussed above). It was proposed that each of these monitors remain in the revised program, with the following additions:

- BH92-2, BH92-3, and BH92-4. While BH92-3 and BH92-4 will be standard downgradient assessment wells, 92-2 is located at the property boundary and will also serve as an additional assessment / compliance point with respect to Guideline B-7.

- An additional monitoring well will be installed along the north property boundary midway between BH99-2 and BH92-2. Two monitoring intervals will be added at this location if both the sandy surficial unit and the underlying silty clay unit are present. This monitor would also serve as an additional groundwater assessment / compliance point with respect to the Guideline B-7.

The analytical parameters and frequency of sampling under the revised groundwater monitoring program would be consistent with the existing program.

Conclusions and Recommendations

I offer the following conclusions and recommendations:

1. Increasing trends were noted in the area north of the waste disposal area; however, it was stated that the Site remains in compliance with respect to Guideline B-7 under the current program. I noted that the nitrate concentration at 99-1 was 13.8 mg/L in the fall (ODWQS is 10 mg/L); it was also noted to be elevated in the spring (8.87 mg/L). Guideline B-7 should be applied to all potential landfill parameters, so this indicates the Site is not in compliance with respect to Guideline B-7. Further assessment of nitrate should be undertaken by the consultant, in addition to a re-evaluation of Landfill Indicator Parameters (LIPs).
2. To address ministry concerns, WSP has proposed changes to the monitoring program. Specifically, these include:
    a. For background, no real change, but an acknowledgement that BH3B and BH92-5 will need to be assessed diligently for impacts as expansion proceeds.
    b. BH15-1 will become a leachate monitor given that BH6 may be lost as expansion proceeds.
    c. BH92-2, BH92-3, and BH92-4 will be added to the program, with BH92-2 and another location (to be developed between BH99-2 and BH92-2) functioning as Guideline B-7 compliance monitors.

    These proposed changes satisfy my concerns for the Site from a groundwater perspective. Notably, however, is that BH92-5 had exceedances of the ODWQS for manganese in both the spring and fall. A response / assessment of this is requested.
3. Updated triggers / continencies may need to be prepared now if the D&O report is not forecast to be updated in a timely manner.
4. The proposed changes to the surface water monitoring program will need to be addressed by a MECP surface water specialist.

Should you have any questions regarding these comments, I would be happy to discuss them further.



Nick Battye, MSc, PGeo

ec: Emily Tieu
Victor Castro
Christina Klein
Brigitte Simmatis

c: ECHO Ref # 1-208396500

Ministry of the Environment, Conservation and Parks
Eastern Region
1259 Gardiners Road, Unit 3
Kingston ON K7P 3J6
Phone: 613.549.4000
or 1.800.267.0974

Ministère de l'Environnement, de la Protection de la nature et des Parcs
Région de l'Est
1259, rue Gardiners, unité 3
Kingston (Ontario) K7P 3J6
Tél: 613 549-4000
ou 1 800 267-0974

Ontario

M E M O R A N D U M

October 23, 2023

TO: Thandeka Ponalo
Senior Environmental Officer
Ottawa District Office
Eastern Region

FROM: Brigitte Simmatis
Surface Water Specialist
Technical Support Section
Eastern Region

RE: McNab Waste Disposal Site
Lots 18 and 19, Concession 6, Geographic Township of McNab
ECHO #1-208396801

As requested, I have reviewed the following and offer comments in relation to surface water quality for your consideration:

- "2022 Groundwater and Surface Water Monitoring Program Summary Letter and Annual Operations Report", prepared by WSP Canada Inc. ("WSP"), formerly Golder Associates ("Golder"), and dated March 2023.
- "Response to MECP Groundwater and Surface Water January 2023 technical comments – McNab waste disposal site", prepared by WSP Canada Inc. ("WSP") and dated April 21, 2023.

I have also examined the following for additional information and context:

- "Response to June 21, 2022 Submission – Hydrogeological Impact Assessment", memorandum from L. Forrester to T. Ponalo and dated January 25, 2023.
- "WSP Golder Responses to MECP Memorandum, McNab WDS", memorandum from N. Battye to T. Ponalo and dated January 12, 2023.
- "Hydrogeological impact assessment and 2020 annual report – McNab-Braeside Waste Disposal Site", memorandum from L. Forrester to T. Ponalo and dated April 19, 2022.
- "2021 Groundwater and Surface Water monitoring program and operations reports – McNab Waste Disposal Site", prepared by WSP and dated March 2022.

This memorandum is divided into two parts: a review of the 2022 Surface Water Monitoring program and comments on the consultant responses to previous MECP surface water correspondence (detailed responses in Appendix A; a very brief summary is given in the body of this memorandum).

Background

The McNab Waste Disposal Site is a 10 ha landfilling area within a total site area of 64.3 ha. The Site is located on West ½ lots 18 and 19, Concession 6, and East ½ lot 19, Concession 5, in the Township of McNab/Braeside. The Site currently operates as a natural attenuation site and is subject to ECA No. A412605. The approval was first issued in 1971 and has since been amended from time to time, most recently on May 11, 2016.

The site has been landfilled in three Stages/Cells. The total approved landfill capacity was identified as 1,000,000 m^3. In 2019, filling began in Stage 3 of the site. In 2022, 10,745 m^3 of waste and daily cover were deposited within the boundaries of Stage 3A.

Due to exposed bedrock outcrops in the area, Stages 1 and 2 will be filled after filling in Stage 3 is complete. The remaining capacity in Stages 1 and 2 is 125,417 m^3. The remaining capacity in Stage 3 is 560,325 m^3. The total capacity of the site is approximately 51 years amongst all Stages.

2022 Monitoring Program and Results

The results of the 2022 groundwater and surface water monitoring program were provided in letter form to comply with the requirements of C of A No. A412605.

Surface water was collected on May 31, 2022 (“spring”), August 26, 2022 (“summer”), and December 2, 2022 (“fall”). The following stations were monitored in 2022:

- SW8, in the southeastern corner of the property, was viewed by WSP to be representative of background conditions in the poorly-drained area;
- SW1, in Dochart Creek at the northwestern corner of the property, was viewed by WSP to be representative of background conditions in the Creek;
- SW2, in Dochart Creek at the northeastern property boundary approximately 800 m downstream of SW1;
- SW4, adjacent to BH92-2 (not currently monitored) along the southeastern property boundary in the poorly-drained area;
- SW6, approximately 200 m northwest of SW4 along the eastern property boundary in the poorly-drained area;
- SW7, at the southeastern toe of the proposed Stage 3 waste footprint nearest to BH92-5 in the poorly-drained area;
- SW9, within the proposed Stage 3 footprint and currently along the eastern boundary of the waste mound in the poorly-drained area.

WSP noted that most parameter concentrations in 2022 were within known historical ranges with two exceptions that will be further explained in the next full monitoring report:

- In Dochart Creek, pH at SW1 and SW2 was low (pH <6) in the summer.
- Boron concentrations have been increasing at SW4 (southeastern property boundary) since 2003.

Poorly-drained area water quality

WSP reported that background water quality (SW8) was generally compliant with PWQO, except for low dissolved oxygen (DO), elevated total phosphorus (TP) and sporadically elevated iron concentrations. The following parameters exceeded PWQO in the poorly-drained area in 2022:

- SW4 and SW6 – boron, TP and DO in spring; TP in fall. WSP noted that concentrations of TP and DO were within historical background ranges at SW8 and were therefore viewed to comply with Policy 2.
- SW7 – DO, TP, boron and total iron in the spring and fall. Dissolved iron concentrations did not conform to PWQO in spring nor were they within historical ranges at SW8. Concentrations of DO, TP and total iron were within historical background ranges at SW8 and were therefore viewed to comply with Policy 2.
- SW9 – DO, TP, boron, cobalt, total iron and dissolved iron in the spring and fall. In addition, concentrations of phenolics were elevated in spring and pH was low in fall. The observed iron concentrations were not within the range of historical concentrations at SW8.

WSP interpreted that water quality at SW4, SW6, SW7 and SW9 were impacted by landfill leachate, primarily boron. The impact of landfill leachate decreased with increasing distance from the waste mound.

I agree that landfill impacts are evident at the above-listed sites. SW8 (background) may also be impacted by leachate based on recent water quality data. This concern was also raised by the previous surface water reviewer in a memorandum dated April 19, 2022. The alternative proposed by WSP was to continue use of SW8 as a background station until it is “no longer considered appropriate” and to use historical water quality from SW8 after that time. The proposed solution does not address whether the station is currently suitable as background.

To determine whether leachate is influencing water quality at SW8, I recommend measuring and comparing the composition/concentration of PFAS at a subset of groundwater and surface water sites. Weather conditions, water depth and flow at the time of sampling should be reported. I recommend that a PFAS suite be included with regular monitoring at the following sites for at least three sampling events:

- Groundwater: The groundwater reviewer should provide comment under separate cover to determine which wells would be best suited to PFAS monitoring.
- Surface water: SW4 to characterize PFAS at an impacted surface water station; SW8 to determine if leachate impacts are evident in the background samples.

If the composition of PFAS is similar among the surface water and groundwater stations, then SW8 and its historical data should not be considered representative of background. A new background station should be selected.

Dochart Creek water quality

WSP reported that background water quality in Dochart Creek (SW1) was generally compliant with PWQO except for sporadic exceedances of TP and total iron concentrations.

The downstream location (SW2) had concentrations of TP above PWQO but within the historical range. WSP does not interpret the exceedance of TP as landfill impact. The pH value during summer was lower than typical in Dochart Creek at both SW1 and SW2; this was viewed to be unrelated to landfill impacts. The pH levels were within PWQO during the fall monitoring event.

I concur that elevated TP and low pH were likely unrelated to landfill impacts during the 2022 monitoring events. If low pH occurs again in the future, careful consideration should be given to the proportion of unionized ammonia in the reach running through the Site. Further investigation into the cause of low pH events may be appropriate and informative in future if acidic conditions reoccur.

Responses to Previous Memoranda

I have reviewed the relevant correspondence between MECP and the consultants, in addition to the commentary tables provided by WSP. The previous surface water reviewer made a series of comments and recommendations regarding surface water quality monitoring that were to be addressed by WSP. In Appendix A, I summarize the pre-existing correspondence to my understanding and provide specific comment-by-comment responses in a table format.

To summarize briefly, my primary outstanding concerns are as follows:

- Based on Comments 1, 2, 8 and 9: The monitoring plan requires additional adjustment and clarification, depending on the cooperation of adjacent landowner(s). Specifically, new monitoring locations should be located upstream in their respective waterways of the proposed locations for SW3, NEW-SW-A and NEW-SW-B. Sampling sites in the eastern tributaries should be as close to the property boundary as possible. A sampling location on Dochart Creek should be located between SW2 and SW3, and immediately downstream of the intersection with the projected leachate plume as possible.
- Based on Comment 7: The unionized ammonia projections and modelling should be revised using the 75^{th} percentile for temperature and pH.

Conclusions

To summarize the 2022 monitoring letter:

- Surface water quality in Dochart Creek did not appear to be notably impacted by leachate in 2022. Elevated TP and total iron concentrations were detected; TP was likely naturally occurring. Elevated total iron concentrations were observed at SW1 but not discussed further by WSP. Low pH occurred at both SW1 and SW2 in summer, which should be carefully monitored going forward.
- All monitoring stations located in the poorly-drained area appear to be impacted by leachate. SW8 also appears to have been impacted by leachate.
- WSP proposes to complete monitoring without additional changes. I recommend that PFAS sampling (as described above) should occur to determine if SW8 is an appropriate background station for this portion of the site. If SW8 is impacted by leachate, a new background station should be selected.

To summarize my response to the most recent correspondence with WSP:

- I am not wholly satisfied by the response of WSP to numerous comments that were also raised by the previous reviewer regarding the surface water monitoring regime. I have made further specific comments in Appendix A and summarized my remaining concerns in the previous section. A lack of reply to specific comments or points does not imply endorsement or acceptance.

Please let me know if you have any questions about these comments.



Brigitte Simmatis, Ph.D.

BS/bs

ec: Victor Castro

Nicholas Battye

Appendix A: Response Table

Initial MECP Concern	Summary of Correspondence	Recommendations
Comment 1: The concern of the previous reviewer was, from my understanding, that leachate effects in the poorly drained area to the east of the site were not characterized or assessed.	The previous reviewer recommended monitoring the tributaries east of the site. Golder noted that the tributaries were ephemeral with negligible flow and do no represent permanent drainage channels. The previous reviewer identified one permanent and one intermittent watercourse in the vicinity, the potential for leachate discharge to the tributaries in pulses of wet weather and recommended monitoring. WSP recommended the reinstatement of SW3 on Dochart Creek and two new stations to monitor the tributaries east of the site.	**I am not wholly satisfied by these responses.** **The watercourses east of the Site are designated cold-water streams and represent sensitive habitat. The previous reviewer noted that these watercourses potentially intersect with the predicted leachate plume. The previous reviewer also noted that leachate impacts in the poorly drained area decrease with distance from the mound. The proposed monitoring stations are along Stewartville Road, each roughly 1 km from the nearest site boundary.** **The primary pathway for leachate migration appears to be through groundwater discharge to surface water. A lack of visible surface connectivity does not imply that watercourses to the east of the site are unaffected by landfill leachate.** **Further, as indicated by the previous reviewer, data to model the leachate plume in the northeast of the Site is informed only by BH92-5, which may contribute to uncertainty regarding the location and extent of intersection between the plume and surface water features in the east/northeast. A monitoring location between SW2 and SW3 would be beneficial and should be as immediately downstream as possible of the area over which the plume is expected to intersect with the Creek.** **If permission is provided by the adjacent**
Comment 2: The concern of the previous reviewer, to my understanding, was that summer low-flows in Dochart Creek would limit the assimilative capacity of the creek and therefore be problematic for a natural attenuation site. Further, no flow information was available for the tributaries east of the waste mound; those tributaries are expected to originate within the projected pathway for leachate migration.	Golder indicated that a robust monitoring program would be necessary to verify compliance over the operational and post-closure lifespan of the site. The consultants indicated that an updated Development & Operations Plan would include revised surface water and groundwater trigger mechanisms to track plume migration. The contingency mechanisms were expected to consist of a collection trench constructed to intercept leachate-impacted shallow groundwater and removal of groundwater for treatment. This approach would change the nature of the site from natural attenuation to engineered controls for compliance. The previous reviewer noted that SW2 was too far upstream of the predicted leachate plume to	

Initial MECP Concern	Summary of Correspondence	Recommendations
	characterize the risk to Dochart Creek or be a reliable trigger. WSP proposed new monitoring stations in the eastern tributaries, as described in Comment 1. The consultants acknowledged that an additional monitoring station between SW2 and SW3 would be beneficial to characterize leachate impacts on Dochart Creek, but permission from the adjacent property owner(s) is required to access that area.	**landowner(s), I would recommend surveilling potential monitoring stations further upstream (closer to the Site property boundary) to allow for leachate impacts, rather than road-related or cumulative impacts, to be appropriately assessed. The landowner(s) should be provided enough context to make an informed decision about allowing access for water quality assessment and monitoring of the tributaries on their property.**
Comment 3: The concern of the previous reviewer, to my understanding, was that the method used to estimate low-flow conditions in Dochart Creek were overly simplistic and may not have been appropriate for extrapolations made in the surface water impact assessment.	WSP ultimately responded that Buckshot Creek remains the best reference watercourse to predict flows in Dochart Creek.	**I am satisfied with this response.** **I note that qualified data should be used and interpreted with caution.**
Comment 4: The concern of the previous reviewer, to my understanding, was that inadequate data were provided to assess the surface water model.	Golder provided a discussion of methods, which the previous reviewer found reasonable.	**I have no further comment.**
Comment 5: The concern of the previous reviewer, to my understanding, was that altered leachate source strength as a result of changes in waste stream, leachate composition or waste aging were not considered in the assessment.	The previous reviewer deferred comment to the groundwater reviewer and review engineer.	**I have no further comment.**
Comment 6: The concern of the previous reviewer, to my understanding, was that iron was not included in the list of parameters of concern for groundwater and surface water impact assessments.	WSP will now include iron in the proposed parameter lists and as a leachate indicator parameter. WSP noted that elevated iron in the absence of other leachate parameters is likely to be naturally occurring.	**I am satisfied with this response.** **I note that elevated iron concentrations need to be viewed in light of background conditions and other chemical parameters (e.g., TSS) to**

Initial MECP Concern	Summary of Correspondence	Recommendations
		determine whether it occurs naturally.
Comment 7: The concern of the previous reviewer, to my understanding, was that the compliance criteria selected for ammonia may not be protective due to assumptions made about typical temperature, pH and flow during modeling.	Golder proposed a compliance value of 2.3 mg/L, calculated based on median values of pH and temperature in Dochart Creek. Golder asserted that the model incorporated conservatism. The consultants described that the PWQO for unionized ammonia included a safety factor of 10 based on toxicity testing and, therefore, the most conservative pH and temperature values were not considered necessary. The previous reviewer noted that the typical temperature and pH are not protective and, if the PWQO are not expected to be met, measures must be taken to prevent the migration of leachate to on-site and off-site surface water receivers. Currently, WSP proposes that the revised surface water monitoring plan addresses the previous reviewer's comments. The consultants note that a representative set of Creek temperature and pH values were used for modelling without intent of relaxing the surface water criterion.	**I am not satisfied with this response.** **Appropriate modeling is vital to assessing potential impacts to surface water and the underlying assumptions should be sound.** **The CCME guideline for ammonia, very similar in value to the PWQO, is based on a statistically robust species-sensitivity distribution (SSD) approach, rather than the lowest-endpoint approach as described by the consultants (lowest toxicity value in the literature multiplied by a safety factor, often 10 or 20). The SSD approach does not use a safety factor, but rather uses available toxicity data from a variety of species to derive a protective guideline. The most sensitive species included in the CCME derivation was a salmonid, a taxon which could be reasonably encountered in a cold-water system.** **Further, PWQOs are intended to protect aquatic life and recreational uses, but water uses that may require more stringent water quality are to be protected on a site-specific basis.** **A cold-water creek is particularly sensitive to environmental perturbation. Un-ionized ammonia is the most toxic form of nitrogen to aquatic biota; in an already sensitive system, due consideration for the ecological functioning Dochart Creek and its tributaries should be given.** **In light of my above comments, I agree with the previous reviewer in that the 75th percentile**

Initial MECP Concern	Summary of Correspondence	Recommendations
		would be more protective as un-ionized ammonia concentrations would likely far exceed typical/average values in the surface water impact assessment during low-flow periods. **If PWQO are not met for ammonia, steps should be taken to limit or prevent the migration of leachate to surface water receivers. I do not see where WSP provided information regarding how far into the future engineered measures would be required based on their current model, but this information – in addition to a revised model that incorporates the 75th percentile for temperature and pH – would be informative for the assessment of future surface water impacts.**
Comment 8: The concern of the previous reviewer, to my understanding, was that the proposed compliance boundary required clarification.	Golder proposed that SW2 represent the compliance point, where the property boundary intersected Dochart Creek. Based on their models, Golder forecasted comparable levels of impact regardless of the compliance point selected for analysis. The previous reviewer was unsatisfied. WSP currently proposes the reinstatement of SW3.	**I am not wholly satisfied by these responses.** **As mentioned in a previous response to Comments 1 and 2, I would prefer to see a monitoring station further upstream that is closer to the intersection of the leachate plume and Creek (between SW2 and SW3), if the adjacent property owner(s) are amenable. I would also prefer to see monitoring occur further upstream in the eastern tributaries.**
Comment 9: The concern of the previous reviewer, to my understanding, was that the assessment was not holistic of all potential leachate pathways nor of all watercourses that may be influenced.	Golder responded that Dochart Creek is the eventual receiver of leachate-impacted groundwater and is therefore the appropriate watercourse to monitor. The previous reviewer was not satisfied with the response. WSP currently proposes the modified sampling	

Initial MECP Concern	Summary of Correspondence	Recommendations
	plan to address this comment.	
Comment 10: The previous reviewer concluded that the development of Stage 3 could not be supported without additional information and assessment.	Golder asserted that the existing modeling was beneficial by providing the understanding of leachate migration and effects on surface water quality as it related to site compliance. The consultants indicate that the McNab Landfill has been and is currently operating as a natural attenuation site but will require a contingency plan (based on ongoing monitoring and the approved trigger mechanism) such that an engineered leachate collection and control system can be used in future to achieve compliance. The previous reviewer was not satisfied with the response, noting that the proponents were proposing a reactive rather than proactive approach. WSP describes that the on-site poorly drained area will be covered by the Stage 3 landfill, underlain by a sand base that is purported to move leachate from the east to the north/northwest as a preferred hydraulic pathway.	**I have no further comment at this time aside from recommending additional sampling program modifications and continued monitoring. Changing site conditions in the future may warrant revisiting this line of commentary.**

APPENDIX A4

WSP Letter - February 2024

February 2, 2024 Reference No. 19130748-004

Thandeka Ponalo
Ministry of the Environment, Conservation and Parks
Ottawa District Office
2430 Don Reid Drive
Ottawa ON K1H 1E1

RESPONSE TO MECP GROUNDWATER AND SURFACE WATER SEPTEMBER/OCTOBER 2023 TECHNICAL COMMENTS, MCNAB WASTE DISPOSAL SITE

Dear Ms. Ponalo,

WSP Canada Inc. (WSP), formerly Golder Associates Ltd. (Golder), has been retained by the Township of McNab/Braeside (the Township) in support of updates to the Development and Operations Plan (D&O) for the McNab Waste Disposal Site. The following have previously been completed in support of the updates to the D&O Plan:

- Golder completed a hydrogeological impact assessment with the objective of forecasting site compliance (i.e., groundwater and surface water compliance) throughout the life of the McNab Waste Disposal Site assuming full development of the landfill to provide 1 million cubic metres of airspace (i.e., Stages 1 through 3), as described in the existing approved D&O Plan. A report on the hydrogeological impact assessment (Golder, 2021) was submitted to the Ministry of the Environment, Conservation and Parks (MECP) in February 2021. The MECP submitted the report to their Eastern Region Technical Support Section resulting in review comments provided by the MECP surface water and groundwater reviewers in memoranda dated April 19, 2022 (MECP, 2022a) and April 21, 2022 (MECP, 2022b), respectively.
- Golder was retained by the Township to review the April 2022 memoranda and prepare a letter providing responses to both the groundwater and surface water review comments. The response letter (Golder, 2022) was submitted to the MECP on June 21, 2022. The MECP subsequently forwarded the response letter to the Eastern Region Technical Support Section for further review. Comments on the June response letter were received by the Township from the MECP groundwater and surface water reviewers in memoranda dated January 12, 2023 (MECP, 2023a) and January 25, 2023 (MECP, 2023b), respectively.
- WSP was then retained by the Township to review the January 2023 memoranda and prepare a letter providing responses to both the groundwater and surface water review comments. It was WSP's opinion that the remaining concerns expressed by the MECP technical reviewers in the January 2023 memoranda could be satisfactorily addressed by presenting the proposed groundwater and surface water monitoring programs that would be included in the updated D&O Plan. The response letter including the proposed monitoring programs was submitted to the MECP on April 21, 2023 (WSP, 2023a). The MECP subsequently forwarded the response letter to the Eastern Region Technical Support Section for further review.

Comments on the April 2023 response letter were received by the Township from the MECP groundwater and surface water reviewers in memoranda dated September 12, 2023 (MECP, 2023c) and October 23, 2023 (MECP, 2023d), respectively. WSP has been retained by the Township to review the September/October 2023 comments and prepare a response.

It is WSP's understanding that the MECP groundwater reviewer is generally satisfied with the information provided within the hydrogeological impact assessment (Golder, 2021) along with the additional information provided by WSP in follow-up communications (Golder, 2022; WSP, 2023a). The groundwater reviewer provided four "conclusions and recommendations" within the September 2023 memorandum. As further discussed in Section 1 of this letter, these conclusions and recommendations provided by the groundwater reviewer either do not require a response from the Township or are minor in nature. As such, with respect to groundwater concerns, it is WSP's understanding that the Township can proceed with the preparation of the updated D&O Plan and ECA amendment application to permit full development of the landfill as planned (i.e., Stages 1 through 3).

The October 2023 memorandum provided by the MECP surface water reviewer identified a number of concerns. Section 2 below provides responses to specific comments provided in the October 2023 memorandum received from the MECP. With respect to surface water concerns, it is WSP's understanding that further review from the MECP Eastern Regional Technical Support Section will be necessary prior to preparation of the updated D&O Plan.

A summary of the proposed groundwater and surface water monitoring programs that would be included in the updated D&O Plan are provided in Attachment A and Attachment B, respectively. The proposed surface water monitoring program has been adjusted from the program previously proposed by WSP in the April 2023 response letter (WSP, 2023a). The proposed changes to the surface water monitoring program are described in Section 2 of this letter. The proposed groundwater monitoring program has not been changed since the April 2023 response letter.

1.0 RESPONSE TO GROUNDWATER REVIEWER COMMENTS

The numbered comments from the "Conclusions and Recommendations" section of the memorandum from the MECP groundwater reviewer dated September 12, 2023 are reproduced below along with responses provided by WSP.

Groundwater Comment #1

MECP Comment: *Increasing trends were noted in the area north of the waste disposal area; however, it was stated that the Site remains in compliance with respect to Guideline B-7 under the current program. I noted that the nitrate concentration at 99-1 was 13.8 mg/L in the fall (ODWQS is 10 mg/L); it was also noted to be elevated in the spring (8.87 mg/L). Guideline B-7 should be applied to all potential landfill parameters, so this indicates the Site is not in compliance with respect to Guideline B-7. Further assessment of nitrate should be undertaken by the consultant, in addition to a re-evaluation of Landfill Indicator Parameters (LIPs).*

WSP Response: WSP agrees that the concentration of nitrate is occasionally elevated at monitoring well BH99-1, including an exceedance of the ODWQS in fall of 2022. The concentration of nitrate at this monitor is variable between monitoring events as opposed to consistently elevated or following an increasing trend over time. For reference, the table below presents concentrations of nitrate at this monitor for the period of 2012 to 2022. The highest nitrate concentration in December 2022 is only marginally higher than those measured in May 2012 and November 2014.

Sample Date	Concentration of Nitrate as N (mg/L)	Sample Date	Concentration of Nitrate as N (mg/L)
15-May-2012	9.00	23-Nov-2017	7.65
03-Dec-2012	NOTE 1	26-Apr-2018	0.79
29-Apr-2013	6.40	30-Nov-2018	5.24
27-Nov-2013	NOTE 1	09-May-2019	3.09
01-May-2014	4.52	20-Nov-2019	3.92
25-Nov-2014	9.68	21-Apr-2020	3.41
25-Apr-2015	4.63	30-Nov-2020	NOTE 1
11-Nov-2015	NOTE 1	19-Apr-2021	5.69
27-May-2016	6.66	25-Nov-2021	NOTE 1
08-Nov-2016	NOTE 1	01-Jun-2022	8.87
04-May-2017	2.75	01-Dec-2022	13.8

NOTE 1 – Groundwater level within monitor was too low to collect sample.

While the nitrate concentrations observed at monitor BH99-1 are elevated, WSP interprets the elevated nitrate to be unrelated to landfill operations. WSP has previously made the following observations and interpretations relevant to monitoring well BH99-1:

- Concentrations of leachate indicator parameters at monitoring well BH99-1 are not elevated compared to background concentrations and have been generally stable over time. Monitoring well BH99-1 is interpreted to not be impacted by landfill leachate. (WSP, 2023b).
- Leachate-impacted groundwater is expected to eventually discharge to Dochart Creek or migrate past the northeast property line. Due to the limited natural concentration of chloride in the background groundwater at the site and the conservative properties of chloride during migration in groundwater, chloride

concentrations provide a reliable tracer for the extent of leachate impacts in the groundwater at the site. Based on measured chloride concentrations, leachate-impacted groundwater has not yet reached Dochart Creek or the northeast properly line (including the vicinity of monitoring well BH99-1) (Golder, 2021).

- Monitoring well BH99-1 is located at the edge of the landfill property, which is adjacent to an agricultural field. As such, the elevated nitrate concentrations may be due to agricultural activities (WSP, 2023b).

Interpretations of leachate migration and site compliance are assessed annually. The next assessment will be provided as part of the 2023 annual report. The 2023 annual report will also provide additional commentary on whether the elevated nitrate concentrations at monitoring well BH99-1 continued to be observed throughout 2023. The 2023 annual report is required to be submitted to the MECP by March 31, 2024.

Groundwater Comment #2

MECP Comment: *To address ministry concerns, WSP has proposed changes to the monitoring program. Specifically, these include:*

> *a. For background, no real change, but an acknowledgement that BH3B and BH92-5 will need to be assessed diligently for impacts as expansion proceeds.*
>
> *b. BH15-1 will become a leachate monitor given that BH6 may be lost as expansion proceeds.*
>
> *c. BH92-2, BH92-3, and BH92-4 will be added to the program, with BH92-2 and another location (to be developed between BH99-2 and BH92-2) functioning as Guideline B-7 compliance monitors.*

These proposed changes satisfy my concerns for the Site from a groundwater perspective. Notably, however, is that BH92-5 had exceedances of the ODWQS for manganese in both the spring and fall. A response / assessment of this is requested.

WSP Response: WSP has previously interpreted the groundwater quality at BH92-5 to contain naturally elevated concentrations of manganese that occasionally exceeds the ODWQS (WSP, 2023b). Manganese has been identified as a leachate indicator parameter at this site; however, the observed manganese concentrations at monitoring well BH92-5 are low (i.e., <0.08 mg/L) compared to the concentrations of manganese in leachate impacted groundwater (i.e., 1.7 mg/L to 17.6 mg/L). In addition, the groundwater quality at this monitor is characterized by low concentrations of chloride (i.e., <1 mg/L to 8 mg/L) compared to leachate impacted groundwater (i.e., 8 mg/L to 136 mg/L).

WSP interprets monitoring well BH92-5 to not be impacted by landfill leachate. As noted during previous communications, the suitability of BH92-5 as a background monitoring well will continue to be assessed as a component of the groundwater monitoring program.

Groundwater Comment #3

MECP Comment: *Updated triggers / contingencies may need to be prepared now if the D&O report is not forecast to be updated in a timely manner.*

WSP Response: The updated D&O report will be prepared in a timely manner following concurrence from the MECP groundwater and surface water reviewers indicating that it is appropriate to complete the updated D&O report and submit the associated ECA amendment application.

Groundwater Comment #4

MECP Comment: *The proposed changes to the surface water monitoring program will need to be addressed by a MECP surface water specialist.*

WSP Response: Correspondence with the MECP surface water specialist is ongoing, as documented in Section 2 of this letter.

2.0 RESPONSE TO SURFACE WATER REVIEW COMMENTS

The numbered comments from Appendix A of the memorandum from the MECP surface water reviewer dated October 23, 2023 are reproduced below along with responses provided by WSP. The surface water reviewer was satisfied with WSP's previous response to Comments 3 and 6 and provided no further comment for Comments 4, 5 and 10; as such, those comments have not been reproduced below.

In addition, WSP has provided a response below for an additional comment appearing in the text of the October 2023 memorandum that did not appear in Appendix A.

Surface Water Comments #1 & #2

MECP Comment: *I am not wholly satisfied by these responses.*

The watercourses east of the Site are designated cold-water streams and represent sensitive habitat. The previous reviewer noted that these watercourses potentially intersect with the predicted leachate plume. The previous reviewer also noted that leachate impacts in the poorly drained area decrease with distance from the mound. The proposed monitoring stations are along Stewartville Road, each roughly 1 km from the nearest site boundary.

The primary pathway for leachate migration appears to be through groundwater discharge to surface water. A lack of visible surface connectivity does not imply that watercourses to the east of the site are unaffected by landfill leachate.

Further, as indicated by the previous reviewer, data to model the leachate plume in the northeast of the Site is informed only by BH92-5, which may contribute to uncertainty regarding the location and extent of intersection between the plume and surface water features in the east/northeast. A monitoring location between SW2 and SW3 would be beneficial and should be as immediately downstream as possible of the area over which the plume is expected to intersect with the Creek.

If permission is provided by the adjacent landowner(s), I would recommend surveilling potential monitoring stations further upstream (closer to the Site property boundary) to allow for leachate impacts, rather than road-related or cumulative impacts, to be appropriately assessed. The landowner(s) should be provided enough context to make an informed decision about allowing access for water quality assessment and monitoring of the tributaries on their property.

WSP Response:

Dochart Creek

To address the concerns raised by the MECP reviewer with respect to potential impacts to Dochart Creek downgradient of existing surface water station SW2, WSP has previously proposed resuming surface water sampling at former station SW3. Surface water sampling location SW3 is located in Dochart Creek at Stewartville Road (refer to attached Figure 1).

To address the additional concerns raised by the MECP reviewer, an additional surface water monitoring station is proposed in Dochart Creek between the surface water stations SW2 and SW3. The proposed additional monitoring location is identified as NEW-SW-C on Figure 1.

Permission from the landowner would be required to establish and monitor NEW-SW-C. As recommended by the MECP reviewer, the landowner would be provided enough context to make an informed decision regarding the monitoring of Dochart Creek on their property. The proposed location as shown on Figure 1 may be adjusted based on discussions with the landowner and field reconnaissance.

East of Poorly-Drained Area (Off-Site)

To address the concerns raised by the MECP reviewer with respect to potential impacts to off-site surface water features east of the poorly-drained area, WSP has previously proposed that surface water sampling stations are established within the two tributaries to Dochart Creek at the locations where the watercourses pass beneath Stewartville Road. These locations are identified as NEW-SW-A and NEW-SW-B on Figure 1. The selected locations are expected to reliably contain enough water to collect a sample and are accessible (i.e., public property).

To address the additional concerns raised by the MECP reviewer, WSP proposes four additional surface water monitoring stations in the tributaries to Dochart Creek located between the Waste Disposal Site property and Stewartville Road, which have seasonally variable to intermittent flow. It is anticipated that the four proposed stations could be established at approximately the locations identified as NEW-SW-D, NEW-SW-E, NEW-SW-F and NEW-SW-G on Figure 1.

Permission from the landowner would be required to establish and monitor these four stations. As recommended by the MECP reviewer, the landowner would be provided enough context to make an informed decision regarding the monitoring of the tributaries on their property. The proposed locations for these four stations as illustrated on Figure 1 may be adjusted based on discussions with the landowner. If permission cannot be obtained from the landowner, only proposed stations NEW-SW-A and NEW-SW-B will be established in the off-site area east of the poorly-drained area.

Additionally, the proposed locations may need to be adjusted following field reconnaissance. Based on WSP's previous observations, it is anticipated that surface water is not present year-round along the full length of the watercourses illustrated on Figure 1 between the Waste Disposal Site property and Stewartville Road. As such, the proposed sampling stations identified as NEW-SW-D and NEW-SW-E would be established as far upgradient as possible such that surface water may be reasonably expected to be present at the sampling location during monitoring events. It is proposed that sampling at these locations would occur during spring and fall to increase the likelihood of surface water at these sampling locations.

Surface Water Comment #7

MECP Comment: *I am not satisfied with this response.*

Appropriate modelling is vital to assessing potential impacts to surface water and the underlying assumptions should be sound.

The CCME guideline for ammonia, very similar in value to the PWQO, is based on a statistically robust species-sensitivity distribution (SSD) approach, rather than the lowest-endpoint approach as described by the consultants (lowest toxicity value in the literature multiplied by a safety factor, often 10 or 20). The SSD approach does not use a safety factor, but rather uses available toxicity data from a variety of species to derive a protective guideline. The most sensitive species included in the CCME derivation was a salmonid, a taxon which could be reasonably encountered in a cold-water system.

Further, PWQOs are intended to protect aquatic life and recreational uses, but water uses that may require more stringent water quality are to be protected on a site-specific basis.

A cold-water creek is particularly sensitive to environmental perturbation. Un-ionized ammonia is the most toxic form of nitrogen to aquatic biota; in an already sensitive system, due consideration for the ecological functioning Dochart Creek and its tributaries should be given.

In light of my above comments, I agree with the previous reviewer in that the 75th percentile would be more protective as un-ionized ammonia concentrations would likely far exceed typical/average values in the surface water impact assessment during low-flow periods.

If PWQO are not met for ammonia, steps should be taken to limit or prevent the migration of leachate to surface water receivers. I do not see where WSP provided information regarding how far into the future engineered measures would be required based on their current model, but this information – in addition to a revised model that incorporates the 75th percentile for temperature and pH – would be informative for the assessment of future surface water impacts.

WSP Response:

As previously noted, the model presented in the hydrogeological impact assessment (Golder, 2021) was used to simulate total ammonia (i.e., the parameter measured directly from laboratory analysis of surface water samples); however, PWQO guidelines only provide surface water compliance criteria for unionized ammonia (i.e., 0.02 mg/L). During field investigations, the temperature and pH of the surface water are measured at the time of sample collection to calculate the unionized ammonia present within the water sample. For modelling purposes, temperature and pH values of 15^{o}C and 7.5, respectively, were assumed (described as “typical conditions”), resulting in the approximation of 2.3 mg/L as the surface water compliance criteria for ammonia. It is noted that the assumed conditions impact only the concentration used to assess compliance for the modelling work (i.e., the simulated concentration of total ammonia in Dochart Creek is not affected by the assumed temperature and pH) and does not imply that this value will be used to assess surface water compliance during future monitoring programs (i.e., unionized ammonia concentrations during site investigations will continue to be calculated based on temperature and pH values measured during sample collection).

The 2021 assessment for ammonia concentrations in Dochart Creek has been revisited based on the comments provided by the surface water reviewer. The 25th percentile, median and 75th percentile from the 110 measurements of temperature and pH made in Dochart Creek between 1991 and 2022 are presented in the attached Attachment C. These statistics were used to expand the 2021 assessment by considering a range of possible compliance criteria for ammonia in surface water. The revised assessment ranges from consideration of 25th percentile conditions (i.e., temperature and pH of 3.5^{o}C and 7.3, respectively) to 75th percentile conditions (i.e., temperature and pH of 18.0^{o}C and 8.0, respectively) resulting in compliance concentrations of ammonia ranging from 0.61 mg/L to 9.1 mg/L. Attachment C contains a revised version of the plot of simulated ammonia concentrations in Dochart Creek, modified from the plot presented on Figure 5 of the hydrogeological impact assessment (Golder, 2021).

As illustrated in Attachment C, the lower ammonia compliance value (i.e., using the 75th percentile conditions) may be exceeded during 7Q20 flow conditions, the minimum observed flow conditions and the 25th percentile flow conditions observed for Dochart Creek. Surface water compliance with respect to the lower ammonia compliance value is expected to be consistently achievable under median flow rate conditions.

The modelling assessment assumed that the McNab Waste Disposal Site continues to operate as a natural attenuation landfill. The modelling demonstrates that at some time, based on robust groundwater and surface water monitoring programs coupled with a trigger mechanism, engineered control of leachate-impacted

groundwater migrating towards Dochart Creek may be required to maintain surface water compliance. This is consistent with the previous interpretations and proposed operational approach provided by WSP.

Surface Water Comments # 8 & 9

MECP Comment: *I am not wholly satisfied by these responses.*

As mentioned in a previous response to Comments 1 and 2, I would prefer to see a monitoring station further upstream that is closer to the intersection of the leachate plume and Creek (between SW2 and SW3), if the adjacent property owner(s) are amenable. I would also prefer to see monitoring occur further upstream in the eastern tributaries.

WSP Response:

See above response to Surface Water Comments #1 and #2.

Additional Surface Water Comment Regarding Background Monitoring Station SW8

MECP Comment: *SW8 (background) may also be impacted by leachate based on recent water quality data. This concern was also raised by the previous surface water reviewer in a memorandum dated April 19, 2022. The alternative proposed by WSP was to continue use of SW8 as a background station until it is "no longer considered appropriate" and to use historical water quality from SW8 after that time. The proposed solution does not address whether the station is currently suitable as background. To determine whether leachate is influencing water quality at SW8, I recommend measuring and comparing the composition/concentration of PFAS at a subset of groundwater and surface water sites. Weather conditions, water depth and flow at the time of sampling should be reported. I recommend that a PFAS suite be included with regular monitoring at the following sites for at least three sampling events:*

- *Groundwater: The groundwater reviewer should provide comment under separate cover to determine which wells would be best suited to PFAS monitoring.*
- *Surface water: SW4 to characterize PFAS at an impacted surface water station; SW8 to determine if leachate impacts are evident in the background samples.*

If the composition of PFAS is similar among the surface water and groundwater stations, then SW8 and its historical data should not be considered representative of background. A new background station should be selected.

WSP Response:

As noted by WSP in previous responses, the poorly-drained area does not receive surface water flow from the area upgradient (i.e., south) of the landfill area; as such, there is no suitable upgradient background sampling location for the poorly-drained area. Surface water station SW8 was selected approximately 30 years ago during the initial hydrogeological and surface water studies at the site as the best available location to characterize surface water for the poorly-drained area. WSP acknowledges that the location of SW8 is not an ideal location to establish background conditions; however, a suitable alternative location to establish a new background station does not exist. WSP has previously recommended that if there comes a time when station SW8 is considered no longer appropriate for obtaining a background water quality sample, background conditions for the poorly-drained area could be defined using historical data at station SW8. Sampling at station SW8 has been undertaken since 1993.

It is our understanding that the surface water reviewer remains concerned that leachate is already impacting water quality at station SW8. Based on these concerns and the size of the dataset available at SW8, WSP

proposes that recent and future data from SW8 no longer be used to characterize background conditions in the poorly-drained area. Station SW8 would remain in the sampling program but the water quality observed at SW8 would no longer be considered representative of background conditions. It is proposed that historical data collected at station SW8 between 1993 and 2010 be used to characterize background conditions in the poorly-drained area. The PFAS sampling recommended by the surface water reviewer would not be required if the proposed approach is accepted.

Limitations and Use of this Letter

This letter was prepared for the exclusive use of The Township of McNab/Braeside. Any use which a third party makes of this report, or any reliance on, or decisions to be made based on it, are the responsibility of such third parties. WSP Canada Inc. (WSP) accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

This letter is based on data and information collected by WSP and is based solely on the conditions of the property at the time of the work, supplemented by historical information and data obtained by WSP as described in this letter and referenced reports. WSP has relied in good faith on all information provided and does not accept responsibility for any deficiency, misstatements, or inaccuracies contained in the report as a result of omissions, misinterpretations, or fraudulent acts of the persons contacted or error or omissions in the reviewed documentation.

The services performed, as described in this letter, were conducted in a manner consistent with that level of care and skills normally exercised by other members of the engineering and science professions currently practicing under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

The findings and conclusions of this letter are valid only as of the date of this letter. If new information is discovered in future work, including excavations, borings, or other studies, WSP should be requested to re-evaluate the conclusions of this letter, and to provide amendments as required.

Closure

We trust the contents of this letter meet your needs. If you have any questions regarding this letter, please contact the undersigned.

Sincerely,

WSP Canada Inc.



Cameron W. Toy, M.Sc., P.Geo.
Hydrogeologist
AS/CWT/PAS/rk



Paul Smolkin, P.Eng.
Senior Geo-environmental Engineer

CC: Ryan Frew, Township of McNab/Braeside

Attachments: Figure 1 – Proposed Groundwater and Surface Water Monitoring Locations
Attachment A – Summary of Proposed Groundwater Monitoring Program
Attachment B – Summary of Proposed Surface Water Monitoring Program
Attachment C – Simulated Ammonia Concentration in Dochart Creek over Time (Revised from Golder 2021)

References

Golder, 2021. Hydrogeological Impact Assessment, McNab Waste Disposal Site, Township of McNab/Braeside, Ontario. Golder Associates Ltd. Report No. 19130748-001, February 2021.

Golder, 2022. Response to MECP Groundwater and Surface Water Technical Support Comments Regarding the Hydrogeological Impact Assessment for the McNab Waste Disposal Site. Reference No. 19130748-002, June 21, 2022

MECP, 2022a. Hydrogeological Impact Assessment and 2020 Annual Report, McNab-Braeside Waste Disposal Site, Lots 18 and 19, Concession 6, Geographic Township of McNab, ECA No. A412605. Reference No. 1-97847882, April 19, 2022.

MECP, 2022b. McNab/Braeside Waste Disposal Site A412605, Hydrogeological Impact Assessment, Lots 18 & 19, Concession 6, part of Lot 19, Concession 5, Township of McNab/Braeside, Renfrew County, Ontario. Reference No. 1-93456530, April 21, 2022.

MECP, 2023a. WSP Golder Responses to MECP Memorandum, McNab WDS. Reference No. 1-112265172, January 12, 2023.

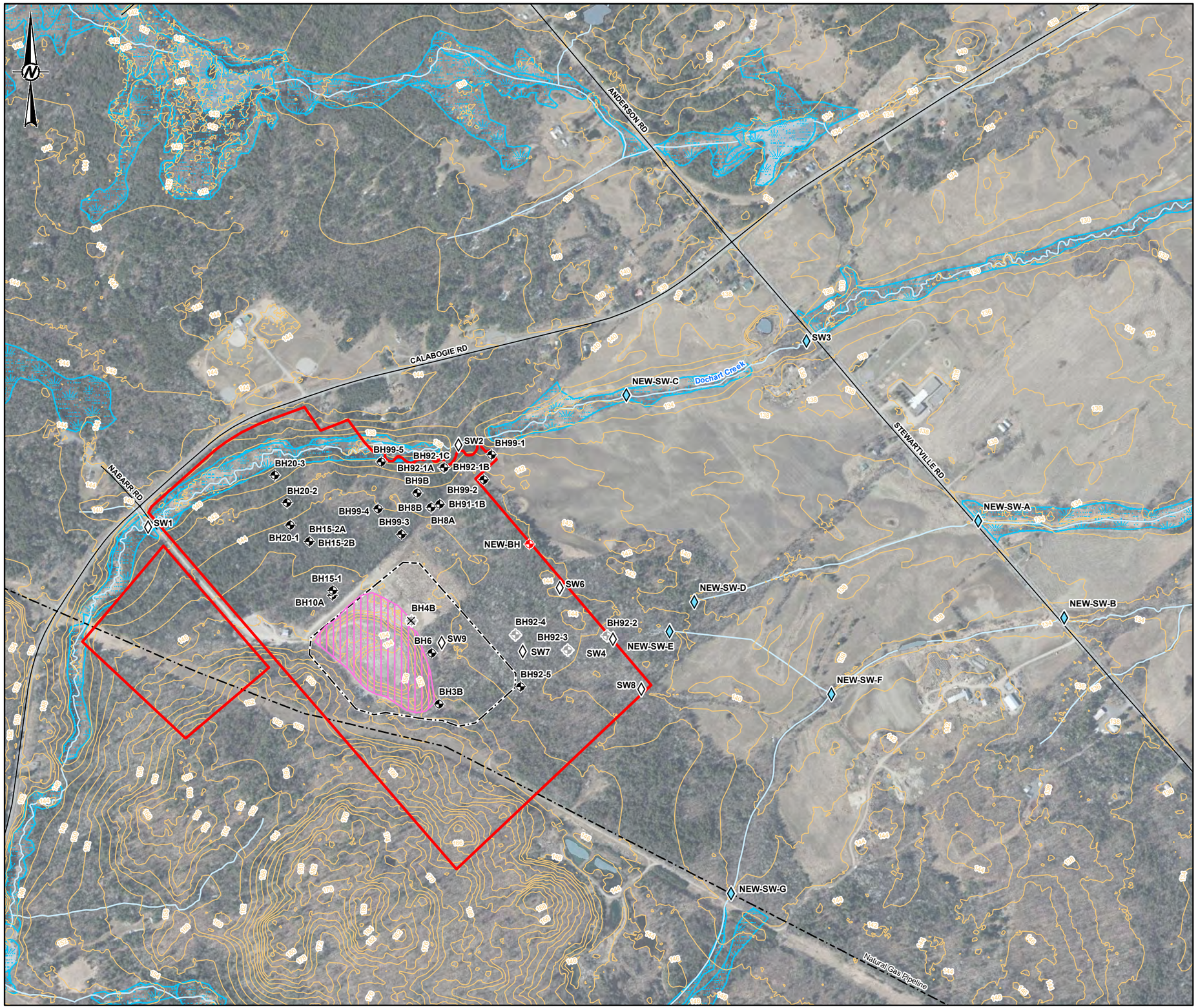
MECP, 2023b. Response to June 21, 2022 submission, Hydrogeological Impact Assessment, McNab Waste Disposal Site, Lots 18 and 19, Concession 6, Geographic Township of McNab, ECA No.A412605. Reference No. 1-112265203, January 25, 2023.

MECP, 2023c. 2022 AMR and Comment Responses, McNab/Braeside Waste Disposal Site, Township of McNab/Braeside. Reference No. 1-208396500, September 12, 2023.

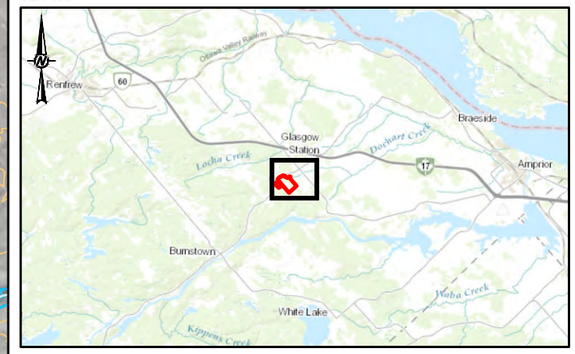
MECP, 2023d. McNab Waste Disposal Site Lots 18 and 19, Concession 6, Geographic Township of McNab. Reference No. 1-208396801. October 23, 2023.

WSP, 2023a. Response to MECP Groundwater and Surface Water January 2023 Technical Comments McNab Waste Disposal Site. Reference No. 19130748-003, April 21, 2023.

WSP, 2023b. 2022 Groundwater and Surface Water Monitoring Program Summary Letter and Annual Operations Report, McNab Waste Dispoal Site, Township of McNab/Braeside, Ontario. Reference No. 21506553, March 2023.



KEY MAP



SCALE 1:350,000

LEGEND

- EXISTING MONITORING WELL INCLUDED IN CURRENT GROUNDWATER MONITORING PROGRAM
- EXISTING MONITORING WELL NOT INCLUDED IN CURRENT GROUNDWATER MONITORING PROGRAM
- PROPOSED MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- SURFACE WATER MONITORING STATION INCLUDED IN CURRENT SURFACE WATER MONITORING PROGRAM
- PROPOSED SURFACE WATER MONITORING STATION
- MCNAB WASTE DISPOSAL SITE PROPERTY BOUNDARY
- FULL DEVELOPMENT WASTE FOOTPRINT (STAGES 1-3)
- 2020 WASTE FOOTPRINT
- ROADWAY
- UTILITY LINE
- TOPOGRAPHIC CONTOUR, metres
- WATERCOURSE
- WATERBODY
- WETLAND

0 100 200 400
1:8,500 METRES

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. IMAGERY CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
COUNTY OF RENFREW, SPRING, 2020.
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 18N

CLIENT
TOWNSHIP OF MCNAB / BRAESIDE

PROJECT
PROPOSED GROUNDWATER AND SURFACE WATER MONITORING PROGRAMS
FOR UPDATED DEVELOPMENT AND OPERATIONS PLAN
MCNAB WASTE DISPOSAL SITE

TITLE
EXISTING AND PROPOSED GROUNDWATER AND SURFACE WATER MONITORING LOCATIONS

CONSULTANT

YYYY-MM-DD	2024-01-31
DESIGNED	CWT
PREPARED	BR
REVIEWED	CWT
APPROVED	PAS

PROJECT NO.	CONTROL	REV.	FIGURE
19130748	0002	1	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

25mm

0

PATH: S:\Clients\Township_of_Mcnab\Braeside\McNab_Braeside_Landfill\99_PROJ\19130748\40_PROD\002_Updated_D_O_Plan\19130748-0002-CH-0001.mxd PRINTED ON: 2023-12-21 AT: 2:02:47 PM

ATTACHMENT A

Summary of Proposed Groundwater Monitoring Program

Attachment A: Summary of Proposed Groundwater Monitoring Program

1.0 SAMPLING FREQUENCY

1.1 **Monitoring Sessions**
Spring (April/May)
Fall (October/November)

2.0 GROUNDWATER SAMPLING LOCATIONS

2.1 **Background Monitors**
BH3B, BH92-5

2.2 **Leachate Monitors**
BH6, BH15-1

2.3 **Downgradient Monitors**
BH8A, BH8B, BH9B, BH10A, BH15-2A, BH15-2B, BH20-1, BH20-2, BH20-3, BH91-1B, BH92-1A, BH92-1B, BH92-1C, BH92-2, BH92-3, BH92-4, BH99-1, BH99-2, BH99-3, BH99-4, BH99-5
Plus one new monitoring well at the location identified on Figure 1 as NEW-BH.

2.4 **Quality Assurance/Quality Control**
Two field duplicates per monitoring session

3.0 FIELD MEASURED PARAMETERS AND OBSERVATIONS

3.1 **With Each Groundwater Quality Sample**
temperature, conductivity, pH
groundwater elevation
sample observations
observations of monitoring well condition

4.0 LABORATORY MEASURED PARAMETERS

4.1 **All Monitors**
alkalinity, chloride, COD, DOC, mercury, arsenic, barium, boron, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, potassium, sodium, zinc, ammonia, nitrite, nitrate, phenols, sulphate, TDS, TKN, total phosphorus.

4.2 **Leachate Monitors BH6 and BH15-1**
BOD, TSS

4.3 **Monitors BH6, BH9B, BH99-4, BH15-1, BH15-2B**
volatile organic compounds (VOCs) in fall monitoring session only

ATTACHMENT B

Summary of Proposed Surface Water Monitoring Program

Attachment B: Summary of Proposed Surface Water Monitoring Program

1.0 SAMPLING FREQUENCY

1.1 **Monitoring Sessions**
Spring (April/May)
Summer (July/August) – **at Dochart Creek locations only**
Fall (October/November)

2.0 SURFACE WATER SAMPLING LOCATIONS

2.1 **Surface Water Sampling Stations – Dochart Creek**
SW1, SW2, SW3
One new sampling station identified as NEW-SW-C on Figure 1.

2.2 **Surface Water Sampling Stations – Poorly-Drained Area (On-Site)**
SW4, SW6, SW7, SW8, SW9

2.3 **Surface Water Sampling Stations – East of Poorly-Drained Area (Off-Site)**
Two new sampling stations established where tributaries to Dochart Creek pass beneath Stewartville Road. Identified on Figure 1 as NEW-SW-A and NEW-SW-B.
Four new sampling stations established within off-site poorly drained area between property boundary and Stewartville Road. Identified on Figure 1 as NEW-SW-D, NEW-SW-E, NEW-SW-F and NEW-SW-G.

2.2 **Quality Assurance/Quality Control**
One field duplicate during spring and fall monitoring sessions

3.0 FIELD MEASURED PARAMETERS AND OBSERVATIONS

3.1 **With Each Surface Water Quality Sample**
temperature, conductivity, pH, dissolved oxygen
observations of flowing conditions (direction and estimation of rate)
size and extent of water features at sampling stations
sample observations

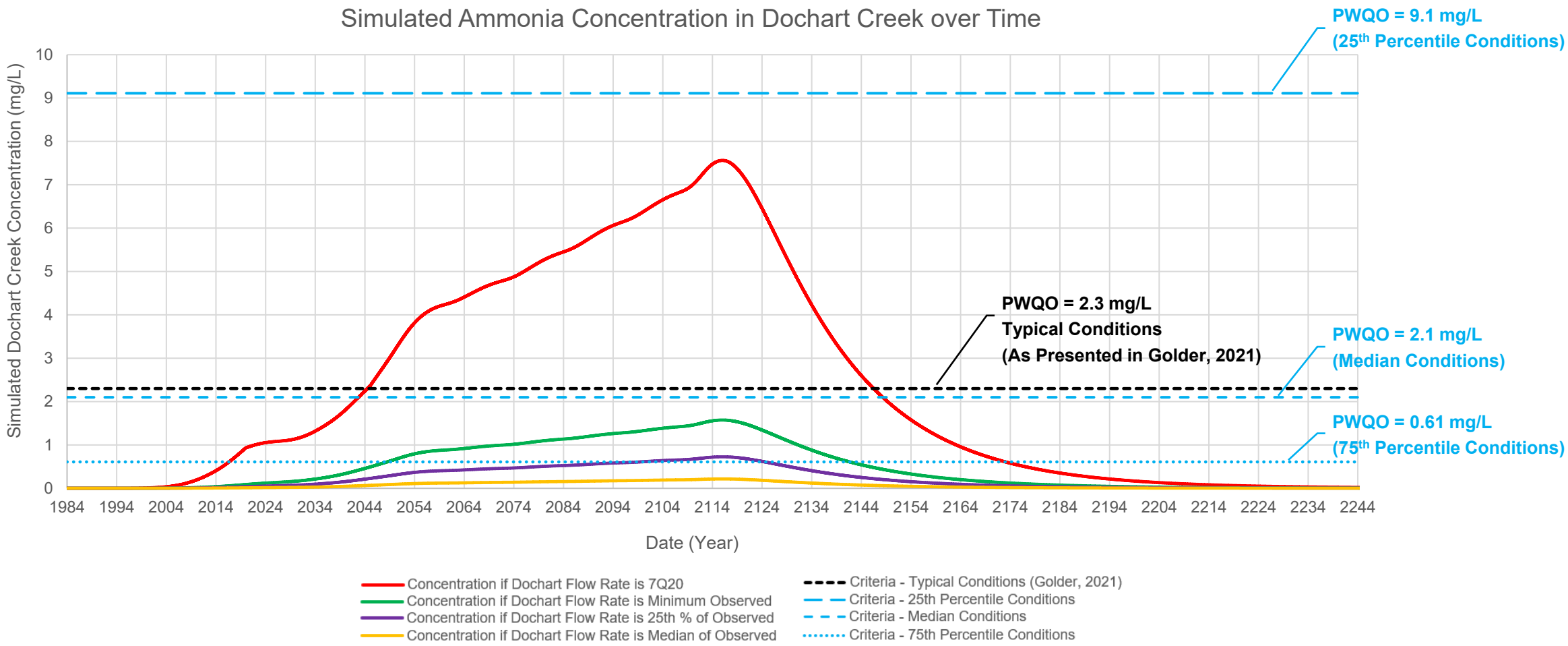
4.0 LABORATORY MEASURED PARAMETERS

4.1 **Chemical and Physical Parameters (Dochart Creek)**
chloride, sodium, potassium, boron, manganese, strontium, hardness, alkalinity, COD, TDS, DOC, iron, total phosphorus, BOD, total suspended solids, turbidity, nitrate, phenols, aluminum, barium, beryllium, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, silicon, silver, thallium, titanium, vanadium, zinc, ammonia.

4.2 **Chemical and Physical Parameters – Poorly Drained Area (On-Site and East of Site)**
chloride, sodium, potassium, boron, manganese, strontium, hardness, alkalinity, COD, TDS, DOC, iron (total and dissolved), total phosphorus, BOD, total suspended solids, turbidity, nitrate, phenols, aluminum, barium, beryllium, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, silicon, silver, thallium, titanium, vanadium, zinc, ammonia.

ATTACHMENT C

Simulated Ammonia Concentration in Dochart Creek over Time (Revised from Golder 2021)



Available pH and Temperature Data: 110 measurements from Dochart Creek (SW1, SW2 and SW3) from 1991 to 2022
25th Percentile Conditions: pH = 7.3, temperature = 3.5°C
Median Conditions: pH = 7.7, temperature = 10.2°C
75th Percentile Conditions: pH = 8.0, temperature = 18.0°C

"Typical Conditions" assumed for Golder (2021) Assessment: pH = 7.5, temperature = 15°C



wsp.com

APPENDIX B

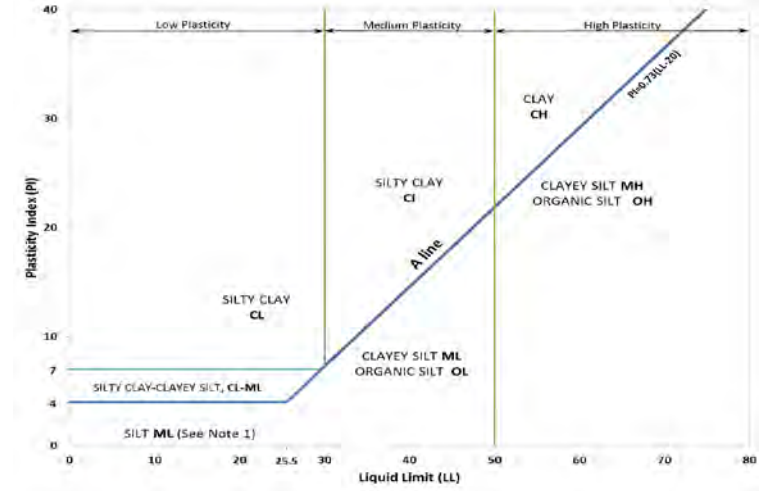
Borehole and Augerhole Records from Previous Investigations

METHOD OF SOIL CLASSIFICATION

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{(D_{30})^2}{D_{10} x D_{60}}$	Organic Content	USCS Group Symbol	Group Name
INORGANIC (Organic Content ≤30% by mass)	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Gravels with ≤12% fines (by mass)	Poorly Graded	<4	≤1 or ≥3	≤30%	GP	GRAVEL
				Well Graded	≥4	1 to 3		GW	GRAVEL
			Gravels with >12% fines (by mass)	Below A Line	n/a			GM	SILTY GRAVEL
				Above A Line	n/a			GC	CLAYEY GRAVEL
		SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm)	Sands with ≤12% fines (by mass)	Poorly Graded	<6	≤1 or ≥3		SP	SAND
				Well Graded	≥6	1 to 3		SW	SAND
			Sands with >12% fines (by mass)	Below A Line	n/a			SM	SILTY SAND
				Above A Line	n/a			SC	CLAYEY SAND

Organic or Inorganic	Soil Group	Type of Soil	Laboratory Tests	Field Indicators					Organic Content	USCS Group Symbol	Primary Name
				Dilatancy	Dry Strength	Shine Test	Thread Diameter	Toughness (of 3 mm thread)			
INORGANIC (Organic Content ≤30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below)	Liquid Limit <50	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT
				Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
				Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
			Liquid Limit ≥50	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT
				None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	OH	ORGANIC SILT
		CLAYS (PI and LL plot above A-Line on Plasticity Chart below)	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to 30% **(see Note 2)**	CL	SILTY CLAY
			Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium		CI	SILTY CLAY
			Liquid Limit ≥50	None	High	Shiny	<1 mm	High		CH	CLAY
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures							30% to 75%	PT	SILTY PEAT, SANDY PEAT
		Predominantly peat, may contain some mineral soil, fibrous or amorphous peat							75% to 100%		PEAT



Note 1 – Fine grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are non-plastic (i.e. a PL cannot be measured) are named SILT.
Note 2 – For soils with <5% organic content, include the descriptor "trace organics" for soils with between 5% and 30% organic content include the prefix "organic" before the Primary name.

Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC and CL-ML.
For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between "clean" and "dirty" sand or gravel.
For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see Plasticity Chart at left).

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML.
A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to indicate a range of similar soil types within a stratum.

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (*i.e.,* SAND and GRAVEL)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
GS	Grab Sample
MC	Modified California Samples
MS	Modified Shelby (for frozen soil)
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample

SOIL TESTS

w	water content
PL , w_p	plastic limit
LL , w_L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

NON-COHESIVE (COHESIONLESS) SOILS

Compactness[2]

Term	SPT 'N' (blows/0.3m)[1]
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. SPT 'N' in accordance with ASTM D1586, uncorrected for the effects of overburden pressure.
2. Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic trip hammers), overburden pressure, groundwater conditions, and grainsize. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N'[1,2] (blows/0.3m)
Very Soft	<12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.
2. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations.

Water Content

Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
ln x	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
υ	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ. Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index = $(w_l - w_p)$
NP	non-plastic
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
c_v	coefficient of consolidation (vertical direction)
c_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = tan δ
c′	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p′	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1 $\tau = c' + \sigma' \tan \phi'$

2 shear strength = (compressive strength)/2

OJECT: 901-2851

RECORD OF BOREHOLE 1

SHEET 1 OF 1

LOCATION: See Figure 2

BORING DATE: Sept.24&25,1990

DATUM: Geodetic

DIP:

SAMPLER HAMMER, 63.5kg; DROP, 760mm

METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION ● / % LEL □	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp — W — Wl (20 40 60 80)	INSTALLATIONS (A B C)
0		Ground Surface		151.66								
		TOPSOIL		0.00								
				0.12								
	Power Auger 200mm Diam (Hollow Stem)	Very loose brown fine to medium SAND										Bentonite Seal
				149.83	1	SS	3					
				1.83								
		Probably brown SAND and GRAVEL, occasional cobble										
				148.98								
				2.68								
3		Completely weathered grey brown massive coarse grained CARBONATE METASEDIMENT			2	SS	>50					
				147.70								
				3.96								
		Moderately weathered grey massive coarse grained CARBONATE METASEDIMENT with brown stained fracture surfaces coated with calcium carbonate deposits; pyrite mineralization			3	NX RC				T.C.R. 92% S.C.R. 37% R.Q.D. 8%		
				148.54								
				5.12								Granular Filter
	Rotary Drilling NX Core				4	NX RC				T.C.R. 100% S.C.R. 100% R.Q.D. 100%		
7		Faintly weathered to fresh massive coarse grained CARBONATE METASEDIMENT, occasional fracture; prominent fracture zone between 7.47 and 7.56m.			5	NX RC				T.C.R. 94% S.C.R. 77% R.Q.D. 71%		
				143.34								32mm PVC #6 Slot Screen
				8.32								
		End of Hole										W.L. in Screen at elev. 148.28m Jan. 9, 1991

DEPTH SCALE (ALONG HOLE)

LOGGED: S.L

PROJECT: 901-2851

RECORD OF BOREHOLE 1A

SHEET 1 OF 1

LOCATION: See Figure 2

BORING DATE: Sept.25.1990

DATUM: Geodetic

DIP:

SAMPLER HAMMER: 63.5kg; DROP: 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION ● / % LEL □	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp ⊢ O W ⊣ Wl (20 40 60 80)	INSTALLATIONS A B C
0	Power Auger 200mm Diam (Hollow Stem)	Ground Surface		151.41								
		TOPSOIL		0.00								
				0.12								
1		Loose brown fine to medium SAND			1	AS				Strong hydrocarbon odour		
				149.70								
		Dark brown fine to coarse SAND		1.69	2	SS	21			Strong hydrocarbon odour		
2		Compact brown SILTY SAND, some gravel		1.83								
				149.03								
		End of Hole Auger Refusal		2.50								
3												
4												
5												
6												
7												
8												
9												
10												

DEPTH SCALE (ALONG HOLE)

LOGGED: S.L

PROJECT: 901-2851

LOCATION: See Figure 2

DIP:

RECORD OF BOREHOLE 1B

BORING DATE: Sept.25,1990

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 63.5 kg; DROP, 760mm

DEPTH SCALE METRE	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION ● / % LEL □	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp Wl Wi	INSTALLATIONS A B C
		Ground Surface		150.76								
0	Power Auger 200mm Diam (Hollow Stem)	TOPSOIL		0.00								
				0.15								
		Brown SAND and GRAVEL, occasional cobble and boulder								Faint hydrocarbon odour		
				148.93								
2		End of Hole Auger Refusal		1.83								
1												
4												
5												
6												
7												
8												
9												
10												

LOGGED: S.L

PROJECT: 901-2651

LOCATION: See Figure 2

DIP:

RECORD OF BOREHOLE 1C

BORING DATE: Dec.7,1990

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 63.5 kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION ● / % LEL □	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp — W — Wl (20 40 60 80)	INSTALLATIONS A B C
0		Ground Surface		151.98 / 0.00								
0	Power Auger 200mm Diam (Hollow Stem)	Loose brown fine to medium SAND, trace silt, some coarse sand and gravel with depth			1	AS						
1					2	AS						
2				149.55 / 2.43	3	SS DO	8			No hydrocarbon odour		
		End of Hole Auger Refusal										
3												
4												
5												
6												
7												
8												
9												
10												

DEPTH SCALE (ALONG HOLE)

LOGGED: S.L.

RECORD OF BOREHOLE 1D

PROJECT: 901-2651
LOCATION: See Figure 2
DIP:
BORING DATE: Dec.7.1990
SAMPLER HAMMER: 63.5kg; DROP: 760mm
SHEET 1 OF 1
DATUM: Geodetic

BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION ● / % LEL □	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp W Wl	INSTALLATIONS A B C
	Ground Surface		151.60 0.00								
Power Auger 200mm Diam (Hollow Stem)	Loose brown fine to medium SAND, trace silt			1	AS						
				2	SS DO	8			No hydrocarbon odour		
			149.09 2.51								
	End of Hole Auger Refusal										

LOGGED: S.L

PROJECT: 901-2651

RECORD OF BOREHOLE 1E

SHEET 1 OF 1

LOCATION: See Figure 2

BORING DATE: Dec.7,1990

DATUM: Geodetic

DIP:

SAMPLER HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION ● / % LEL □	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp — W — Wl (20 40 60 80)	INSTALLATIONS A B C
0	Power Auger 200mm Diam (Hollow Stem)	Ground Surface		151.64								
				0.00								
1		Dark brown silty sand with glass fragments (FILL)			1	AS						
				150.12								
				1.52								
2		Loose brown fine to medium SAND, trace silt			2	SS DO	8			No hydrocarbon odour		
				149.15								
		End of Hole Auger Refusal		2.49								
3												
4												
5												
6												
7												
8												
9												
10												

PROJECT: 901-2851

RECORD OF BOREHOLE 2

SHEET 1 OF 1

LOCATION: See Figure 2

BORING DATE: Sept.25,1990

DATUM: Geodetic

DIP:

SAMPLER HAMMER, 63.5kg; DROP, 760mm

DEPTH METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION ● / % LEL □	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp W Wl (20 40 60 80)	INSTALLATIONS (A B C)
0		Ground Surface		144.69								
		Brown fine sand (FILL)		0.00 / 144.29								Bentonite Seal
		Yellow brown SILTY SAND		0.40 / 144.28								
		Brown fine to medium SAND		0.61 / 143.98								
1		Compact grey fine SAND, with occasional 25-50mm silty clay layer		1.01	1	SS DO	19					38mm PVC #10 Slot Screen B
2				142.40								Frozen
		Very stiff grey SILTY CLAY with occasional sand seam		2.29	2	SS DO	2					Bentonite Seal
4												
					3	SS DO	1					Granular Filter
6												32mm PVC #10 Slot Screen A
					4	SS DO	1					Bentonite Seal
				138.28								
7		End of Hole Refusal to Auger		6.71								W.L. in Screen A at elev. 144.11m Screen B frozen Jan. 9, 1991
8												
9												

Power Auger 200mm Diam (Hollow Stem)

LOGGED: SJ

PROJECT: 901-2851

RECORD OF BOREHOLE 2A

SHEET 1 OF 1

LOCATION: See Figure 2

BORING DATE: Sept.25,1990

DATUM: Geodetic

DIP:

SAMPLER HAMMER: 63.5kg; DROP: 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION (% LEL)	HYDRAULIC CONDUCTIVITY, k, cm/s	WATER CONTENT, PERCENT (Wp, W, Wl; 20 40 60 80)	INSTALLATIONS A	B	C
0	Power Auger 200mm Diam (Hollow Stem)	Ground Surface		145.33											
		Brown fine to medium sand (FILL)		0.00 / 144.55											
1		Paper, rags and plastic (GARBAGE FILL)		0.78 / 143.80											
		End of Hole		1.53											
2															
3															
4															
5															
6															
7															
8															
9															
10															

PROJECT: 901-2851

LOCATION: See Figure 2

DIP:

RECORD OF BOREHOLE 3

BORING DATE: Sept.26,1990

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING
	Ground Surface		146.09					
	TOPSOIL		0.00 / 145.82					
	Brown fine to medium SAND		0.27 / 145.09					
	Brown fine to coarse SAND, some gravel		1.01 / 144.57					
	Loose brown fine SAND, some silt		1.52 / 143.65	1	SS	8	50	
	Very stiff grey brown SILTY CLAY to CLAYEY SILT, trace gravel between 3.96 and 4.27m (Weathered Crust)		2.44 / 141.82	2	SS	10	50	
	Very stiff grey SILTY CLAY		4.27 / 140.82	3	SS	3	50	
	Dense to very dense brown SAND and GRAVEL, occasional cobble		5.27 / 139.29	4	SS	58	50	M
	End of Hole Auger Refusal		6.80					

Power Auger 200mm Diam. (Hollow Stem)

GAS CONCENTRATION ●
% LEL □

HYDRAULIC CONDUCTIVITY, k, cm/s

WATER CONTENT, PERCENT
Wp — W — Wl
20 40 60 80

INSTALLATIONS

A B C



W.L. in Screen A at elev. 145.38m
W.L. in Screen B at elev. 145.48m
Jan. 8, 1991

LOGGED: S.I

PROJECT: 901-2851

RECORD OF BOREHOLE 4

SHEET 1 OF 1

LOCATION: See Figure 2

BORING DATE: Sept.27,1990

DATUM: Geodetic

DIP:

SAMPLER HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION (% LEL)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT, PERCENT (Wp — W — Wl)	INSTALLATIONS
0		Ground Surface		144.46								
		TOPSOIL		0.00 / 144.16								Bentonite Seal
		Brown fine SAND, some silt		0.30 / 143.72								
1		Compact brown fine to medium SAND, trace to some silt		0.76								Native Backfill
2					1	SS DO	16					32mm PVC #6 Slot Screen B
				142.19 / 2.29								
3		Compact brown fine SAND, trace to some silt										
				141.19 / 3.29	2	SS DO	13					
		Grey brown SILTY CLAY (Weathered Crust)		140.88 / 3.60								
4	Power Auger 200mm Diam (Hollow Stem)											Bentonite Seal
5					3	SS DO	5					
6		Very stiff grey SILTY CLAY			4	SS DO	2					Granular Filter
												50mm PVC #10 Slot Screen A
7												
8					5	SS DO	3					
				136.23 / 8.23								
		End of Hole										W.L. in Screen A at elev. 144.52m W.L. in Screen B at elev. 144.46m Jan. 8, 1991
9												
10												

DEPTH SCALE (ALONG HOLE)

LOGGED: AJ

PROJECT: 901-2851

RECORD OF BOREHOLE 5

SHEET 1 OF 1

LOCATION: See Figure 2

BORING DATE: Sept.27,28,1991

DATUM: Geodetic

DIP:

SAMPLER HAMMER: 63.5 kg; DROP: 760mm

DEPTH METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION ● / % LEL □	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp W Wl (20 40 60 80)	INSTALLATIONS A B C
0	Power Auger 200mm Diam (Hollow Stem)	Ground Surface		142.54								
		TOPSOIL		0.00 / 142.30								Bentonite Seal
		Red brown SILTY fine to medium SAND		0.24 / 142.06								
				0.48								
1		Brown fine to medium SAND		141.17								Native Backfill
				1.37								
		Very stiff grey brown SILTY CLAY to CLAYEY SILT (Weathered Crust)			1	SS	9		MH			Bentonite Seal
2				139.95 / 2.59								Native Backfill
												32mm PVC #6 Slot Screen B
3					2	SS	7					
4												Bentonite Seal
					3	SS	4					
5		Very stiff grey SILTY CLAY										
6					4	SS	9					
7												
					5	SS	4		MH			Granular Filter
8												32mm PVC #6 Slot Screen A
		Probably Sand and Gravel		133.59 / 8.99 / 133.40								
9		End of Hole Auger Refusal		9.14								W.L. in Screen A at elev. 141.47m W.L. in Screen B at elev. 141.48m Jan. 8, 1991
10												

DEPTH SCALE (ALONG HOLE)

LOGGED: S.I.

PROJECT: 901-2851

LOCATION: See Figure 2

DIP:

RECORD OF BOREHOLE 6

BORING DATE: Dec.5,1990

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER: 63.5kg; DROP: 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION ● / % LEL □	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp — W — Wl (20 40 60 80)	INSTALLATIONS A B C
0	Power Auger 200mm Diam (Hollow Stem)	Ground Surface		144.72								
		TOPSOIL		0.00 144.45								
				0.27								Bentonite Seal
1		Compact brown fine to coarse SAND, trace gravel and silt, occasional silty clay seam below 1.98m			1	SS	50 DO 14		M			Granular Filter
2												50mm PVC #10 Slot Screen M
				141.95								
		Grey brown SILTY CLAY (Weathered Crust)		2.74 141.67								
3				3.05								
		Grey SILTY CLAY, occasional sand seam			2	SS	50 DO 7					
				141.07								
		End of Hole		3.65								W.L. in Screen at elev. 144.35m Jan. 8, 1991
4												
5												
6												
7												
8												
9												
10												

LOGGED: S.L.

RECORD OF BOREHOLE 7

PROJECT: 901-2651
LOCATION: See Figure 2
DIP:
BORING DATE: Dec.5,1990
SHEET 1 OF 1
DATUM: Geodetic
SAMPLER HAMMER: 63.5kg; DROP: 760mm

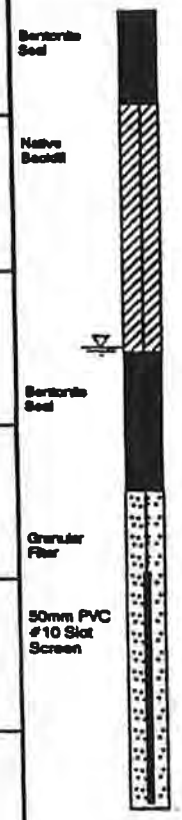
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING
		Ground Surface		143.67					
0	Power Auger 200mm Diam (Hollow Stem)	TOPSOIL		0.00					
				0.15					
		Brown fine to medium SAND, trace gravel, metal debris (FILL)			1	AS			
1				142.15					
		Brown fine stratified SAND		1.52					
		Grey brown SILTY CLAY to CLAYEY SILT with occasional sand seam (Weathered Crust)		1.68	2	SS	50 DO 11		
2				141.80					
		Brown fine to medium SAND, trace silt		1.99					
				2.13					
		Grey brown SILTY CLAY (Weathered Crust)							
3				140.62					
		Grey fine SAND, some silt, occasional silty clay seam		3.05					
				3.20	3	SS	50 DO 18		
		Grey brown SILTY CLAY, occasional sand seam (Weathered Crust)							
4									
					4	SS	50 DO 7		
5				138.48					
		End of Hole		5.19					
6									
7									
8									
9									
10									

GAS CONCENTRATION ●
% LEL □

HYDRAULIC CONDUCTIVITY, k, cm/s

WATER CONTENT, PERCENT
Wp — W — Wl
20 40 60 80

INSTALLATIONS
A B C



W.L. in Screen at elev. 141.52m Jan. 9, 1991

LOGGED: S.L

PROJECT: 901-2851

RECORD OF BOREHOLE 8

SHEET 1 OF 1

LOCATION: See Figure 2

BORING DATE: Dec. 6, 1990

DATUM: Geodetic

DIP:

SAMPLER HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION ● / % LEL □	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp — W — Wl (20 40 60 80)	INSTALLATIONS: A / B / C
0	Power Auger 200mm Diam (Hollow Stem)	Ground Surface		143.45								
		TOPSOIL		0.03								Bentonite Seal
1		Red brown fine to medium SAND, some silt			1	AS						Native Backfill
				142.06								
		Grey fine to medium SAND, trace silt		1.37								
				141.62	2	SS DO	14					
2		Grey brown SILTY CLAY to CLAYEY SILT, occasional sand seam (Weathered Crust)		1.83								Bentonite Seal
3					3	SS DO	4					Granular Filter
				139.82								
				3.63								
4												50mm PVC #10 Slot Screen
5					4	SS DO	7					
6		Grey SILTY CLAY, occasional thin sand seam										
					5	SS DO	5					Native Backfill
7												
					6	SS DO	8					
8				135.23								
		End of Hole		8.22								W.L. in Screen A at elev. 142.78m W.L. in Screen B at elev. 142.75m Jan. 9, 1991
9												
10												

DEPTH SCALE (ALONG HOLE)

LOGGED: S.L

PROJECT: 901-2851

RECORD OF BOREHOLE 9

SHEET 1 OF 1

LOCATION: See Figure 2

BORING DATE: Dec.7,1990

DATUM: Geodetic

DIP:

SAMPLER HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE (METRES)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	SAMPLES: RECOVERY %	SAMPLES: LAB. TESTING	GAS CONCENTRATION ● / % LEL □	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp W Wl (20 40 60 80)	INSTALLATIONS
0	Power Auger 200mm Diam (Hollow Stem)	Ground Surface		143.44								A B C
		TOPSOIL		0.00 / 143.19								Bentonite Seal
				0.25								
1		Red brown fine to medium SAND, trace to some silt			1	AS						Native Backfill
				141.92								
		Grey brown CLAYEY SILT, occasional sand seam (Weathered Crust)		1.52 / 141.81	2	SS	10					
2				1.83								
		Brown fine SAND, some silt, occasional silty clay seams										
				140.39								
3				3.05	3	SS	4					Bentonite Seal
		Grey SILTY CLAY, occasional sand seam			4	SS	11					Granular Filter
												50mm PVC #10 Slot Screen
				137.34								
		End of Hole		6.10								

W.L. in Screen A at elev. 142.52m
W.L. in Screen B at elev. 142.55m
Jan. 9, 1991

DEPTH SCALE (ALONG HOLE)

LOGGED: S.L

RECORD OF BOREHOLE 10

PROJECT: 901-2851
LOCATION: See Figure 2
DIP:

BORING DATE: Dec.5,1990

SHEET 1 OF 1
DATUM: Geodetic

SAMPLER HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING
0	Power Auger 200mm Diam (Hollow Stem)	Ground Surface		147.19					
		TOPSOIL		147.01 / 0.00					
				0.18					
1		Red brown fine to medium SAND, trace silt			1	SS	50 DO		
2				144.75 / 2.44					
3		Grey fine SAND, some silt, scattered trace gravel			2	SS	50 DO		M
4				142.62 / 4.57					
5		Grey brown SILTY CLAY, occasional sand seam (Weathered Crust)			3	SS	50 DO		
6					4	SS	50 DO		
7		End of Hole Auger Refusal		140.33 / 6.86					
8									
9									
10									

GAS CONCENTRATION ●
% LEL □

HYDRAULIC CONDUCTIVITY, k, cm/s

WATER CONTENT, PERCENT
Wp ⊢ W ⊣ Wl
20 40 60 80

INSTALLATIONS

A B C

Bentonite Seal
Native Backfill
Bentonite Seal
Granular Filter
50mm PVC #10 Slot Screen

M

W.L. in Screen A at elev. 144.68m
W.L. in Screen B at elev. 144.68m
Jan. 9, 1991

DEPTH SCALE (ALONG HOLE)

LOGGED: S.L.

PROJECT: 1521951

RECORD OF BOREHOLE: 15-1

SHEET 1 OF 1

LOCATION: N 5031411.5 ;E 380141.2

BORING DATE: November 5, 2015

DATUM: Geodetic

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		147.05							
0	Geoprobe 90 mm Diam. (Direct Push)	TOPSOIL		0.00 / 146.75							
		SAND, fine to medium, trace silt and gravel; red brown; moist		0.30 / 144.51	1	53 DT	-				Bentonite Seal
1											
2					2	53 DT	-				Silica Sand
		SAND, fine to medium, trace silt and gravel; grey; moist to wet		2.54 / 143.09							42 mm Diam. PVC #10 Slot Screen
3					3	53 DT	-				
		SILTY CLAY; grey brown (Weathered Crust)		3.96 / 142.48							Silica Sand
4		End of Borehole		4.57							W.L. in Screen at Elev. 144.12 m on November 12, 2015
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: CWT

CHECKED: KAM

MIS-BHS 001 1521951.GPJ GAL-MIS.GDT 03/18/16 JEM

PROJECT: 1521951

RECORD OF BOREHOLE: 15-2

SHEET 1 OF 1

LOCATION: N 5031519.5 ;E 380089.2

BORING DATE: November 5, 2015

DATUM: Geodetic

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		144.77							
0	Geoprobe 90 mm Diam. (Direct Push)	TOPSOIL		0.00 / 144.47							Bentonite Seal
		SAND, fine to medium, trace silt; red brown; moist to wet		0.30 / 143.73	1	53 DT	-				
1		SAND, fine, trace silt; grey; wet		1.04 / 142.61							42 mm Diam. PVC #10 Slot Screen 'B'
2		SILTY CLAY; grey brown (Weathered Crust); wet		2.16 / 140.20	2	53 DT	-				Silica Sand
3					3	53 DT	-				Bentonite Seal
4		SILTY CLAY; grey		4.57 / 137.15	4	53 DT	-				Silica Sand
5											42 mm Diam. PVC #10 Slot Screen 'A'
6					5	53 DT	-				
7		End of Borehole		7.62							Bentonite Seal
8											W.L. in Screen 'B' at Elev. 143.96 m on November 12, 2015
9											W.L. in Screen 'A' at Elev. 142.67 m on November 12, 2015
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: CWT

CHECKED: KAM

MIS-BHS 001 1521951.GPJ GAL-MIS.GDT 03/18/16 JEM

RECORD OF BOREHOLE 91-1

PROJECT: 913-2860
LOCATION: See Figure 2
DIP:
BORING DATE: Dec. 4 & 5, 1991
SHEET 1 OF 1
DATUM: Local
SAMPLER HAMMER, 63.5kg; DROP, 760 mm

METRE	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION (ppm) 50 100 150 200 / % LEL 50 100 150 200	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp W Wl 20 40 60 80	INSTALLATIONS A B C
0		Ground Surface		142.83								
		Dark brown sandy TOPSOIL		0.00 / 142.37								
		Brown to grey fine to medium SAND		0.46 / 141.46								
		Compact grey fine SAND, trace to some silt, occasional thin silty clay seam		1.37 / 140.79	1	SS	50/00	19				
		Very stiff grey brown SILTY CLAY, occasional sand seam (Weathered Crust)		2.04 / 138.67	2	SS	50/00	4				
	Power Auger 200mm Diam. (Hollow Stem)	Very stiff grey SILTY CLAY		3.96 / 134.60	3	SS	50/00	2				
					4	SS	50/00	3				
					5	SS	50/00	3				
		End of Hole		8.23								

Bentonite Seal
Native Backfill
Bentonite Seal
Filter Sand Backfill

W.L. in Screen A at 1.80m depth
W.L. in Screen B at 1.39m depth
W.L. in Screen C at 1.38m depth
Jan. 13, 1992

LOGGED: M.A.S.

PROJECT: 911-2860

RECORD OF BOREHOLE 92-1

SHEET 1 OF 1

LOCATION: See Figure 2

BORING DATE: Feb. 19, 1992

DATUM: Local

DIP:

SAMPLER HAMMER, 63.5kg; DROP, 760 mm

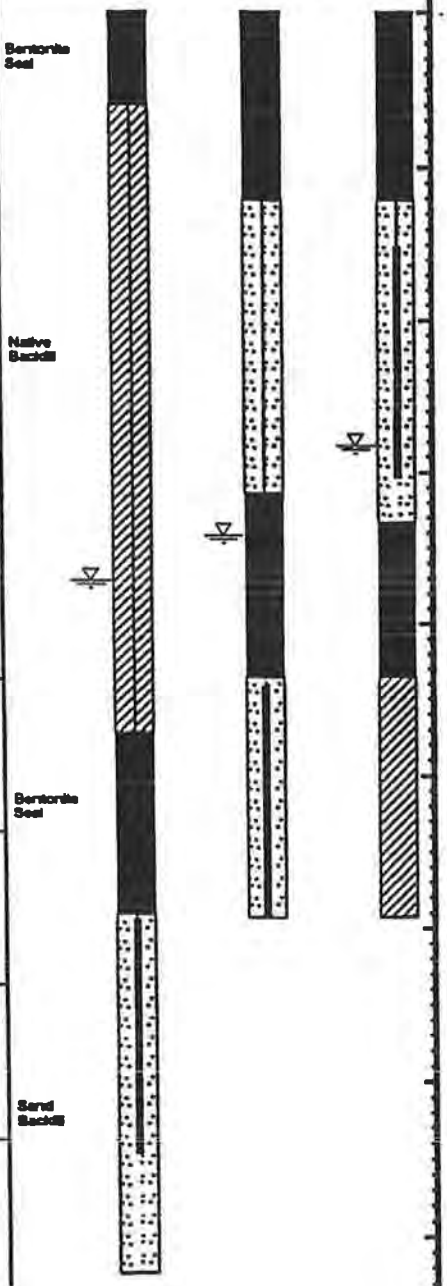
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING
0	Power Auger 200mm Diam. (Hollow Stem)	Ground Surface		140.37					
		Dark brown clayey TOPSOIL		140.13 / 0.00					
				0.24					
1		Very stiff grey brown SILTY CLAY (Weathered Crust)			1	SS	11		
2					2	SS	6		
3									
4					3	SS	4		
5				135.49 / 4.88					
		Stiff grey SILTY CLAY			4	SS	2		
7									
8					5	SS	2		
				132.14					
		End of Hole		8.23					
9									
10									

GAS CONCENTRATION ( ) ● — 20 40 60 80 — % LEL □

HYDRAULIC CONDUCTIVITY, k, cm/s

WATER CONTENT, PERCENT — Wp ⊢ W ⊣ Wl — 20 40 60 80

INSTALLATIONS



W.L. in Screen A at 3.70m depth
W.L. in Screen B at 3.41m depth
W.L. in Screen C at 2.82m depth
March 3, 1992

DEPTH SCALE (ALONG HOLE)

LOGGED: M.A.S.

PROJECT: 921-2795

LOCATION: See Plan

DIP:

RECORD OF BOREHOLE 92-2

BORING DATE: Dec. 14, 1992

SHEET 1 OF 1

DATUM: Local

SAMPLER HAMMER: 63.5kg; DROP: 760 mm

DEPTH SCALE	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION ( ) 20 40 60 80 / %LEL 20 40 60 80	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp W Wl 20 40 60 80	INSTALLATIONS A B C
		Ground Surface		140.89								
		TOPSOIL		0.00 / 140.68								
	Power Auger 200mm Dia. (Hollow Stem)	Very stiff red brown to grey brown SILTY CLAY (Weathered Crust)		0.21	1	SS	DO 3					
					2	SS	DO 2					
				138.00								
		End of Hole		2.89								

INSTALLATIONS:
- Native Backfill
- Bentonite Seal
- Silica Sand Backfill
- 38mm PVC #10 Slot Screen

Water frozen at Elev. 140.73m Jan. 25, 1993

DEPTH SCALE (ALONG HOLE)

LOGGED: L.D.L

PROJECT: 921-2795

LOCATION: See Plan

DIP:

RECORD OF BOREHOLE 92-3

BORING DATE: Dec. 14, 1992

SAMPLER HAMMER: 63.5kg; DROP: 760 mm

SHEET 1 OF 1

DATUM: Local

METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION ( ) ● %LEL □	HYDRAULIC CONDUCTIVITY, k, cm/s	WATER CONTENT, PERCENT Wp W Wl	INSTALLATIONS
0		Ground Surface		142.14									
		PEAT		0.00									Native Backfill
				141.84									
				0.30									Bentonite Seal
1	Power Auger 200mm Dia. (Hollow Stem)	Very stiff grey brown SILTY CLAY (Weathered Crust)											Silica Sand Backfill
					1	SS DO	4						38mm PVC #10 Slot Screen
2				140.01									
		Grey SILTY SAND, some gravel		2.13									
				139.70	2	SS DO	>100						
		End of Hole Auger Refusal		2.44									Water frozen at Elev. 141.46m Jan. 23, 1993
3													
4													
5													

DEPTH SCALE (ALONG HOLE)

LOGGED: L.D.L.

PROJECT: 921-2795

LOCATION: See Plan

DIP:

RECORD OF BOREHOLE 92-4

BORING DATE: Dec. 14, 1992

SHEET 1 OF 1

DATUM: Local

SAMPLER HAMMER, 63.5kg; DROP, 760 mm

DEPTH SCALE	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION (%LEL)	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT (Wp, W, Wl)	INSTALLATIONS
		Ground Surface		143.10 / 0.00								
		PEAT		142.60 / 0.50								Native Backfill
		Brown medium to fine SAND		142.40 / 0.70								Bentonite Seal
	Power Auger 200mm Dia. (Hollow Stem)	Very stiff to stiff grey brown SILTY CLAY (Weathered Crust)			1	SS	50 DO	12				Silica Sand Backfill
				140.81 / 2.29								
		Stiff grey SILTY CLAY			2	SS	50 DO	6				38mm PVC #10 Slot Screen
					3	SS	50 DO	8				
				139.44 / 3.66								
		End of Hole										Water frozen at Elev. 142.43m Jan. 25, 1993

DEPTH SCALE (ALONG HOLE)

LOGGED: L.D.L.

PROJECT: 921-2785

LOCATION: See Plan

DIP:

RECORD OF BOREHOLE 92-5

BORING DATE: Dec. 14, 1992

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 63.5 kg; DROP, 760 mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING
0	Power Auger 200mm Dia. (Hollow Stem)	Ground Surface		142.98					
		PEAT		0.00					
				142.13					
		Grey SILTY SAND, trace gravel		0.85 142.01					
1				0.97					
		Very stiff grey brown SILTY CLAY (Weathered Crust)			1	SS	50 DO	7	
2					2	SS	50 DO	8	
				139.93					
				3.05					
3		Very stiff grey SILTY CLAY			3	SS	50 DO	3	
				139.32					
				3.66					
		End of Hole							
4									
5									

GAS CONCENTRATION ( ) ●
20 40 60 80
%LEL □
20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s

WATER CONTENT, PERCENT
Wp ⊢ O W ⊣ Wl
20 40 60 80

INSTALLATIONS

A B C

Native Backfill

Bentonite Seal

Silica Sand Backfill

38mm PVC #10 Slot Screen

Water frozen at Elev. 142.18m Jan. 25, 1993

DEPTH SCALE (ALONG HOLE)

LOGGED: L.D.L.

PROJECT: 991-2631

RECORD OF BOREHOLE 99-1

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Apr. 22, 1999

DATUM: Geodetic

DIP:

SAMPLER HAMMER, 63.5 kg; DROP, 760 mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	COMBUSTIBLE VAPOUR (100 200 300 400) / Micro-Tip ppm (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp W Wl	INSTALLATIONS A B C
0	75mm Hand Auger Open Hole	GROUND SURFACE		140.14								
		Dark brown SANDY TOPSOIL		0.00 / 139.90								
		Brown fine SAND.		0.24 / 139.07								Bentonite Seal
1		Grey brown SILTY CLAY. (Weathered Crust)		1.07	1	SS DO	22					Sand
2					2	SS DO	14					
3												38mm PVC #10 Slot Screen
4					3	SS DO	9					Native Backfill
				135.87								
		END OF BOREHOLE		4.27								
5												

DEPTH SCALE (ALONG HOLE)

1 to 25

Golder Associates

LOGGED: DJS

CHECKED: MPD

PROJECT: 991-2831

RECORD OF BOREHOLE 99-2

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Apr. 22, 1999

DATUM: Geodetic

DIP:

SAMPLER HAMMER, 63.5 kg; DROP, 760 mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	COMBUSTIBLE VAPOUR (ppm) / Micro-Tip ppm	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp, w, Wl	INSTALLATIONS
0	SW Casing	GROUND SURFACE		142.35								
		Dark brown SANDY TOPSOIL		142.20 / 0.00								
		Brown fine SAND.		0.15								Bentonite Seal
1	75mm Hard Auger			141.44 / 0.91								
		Brown fine to medium SAND, scattered trace gravel.			1	SS DO	22					
	Open Hole			140.83 / 1.52								
2		Grey brown SILTY CLAY, occasional sand seam. (Weathered Crust)										Sand
					2	SS DO	16					38mm PVC #10 Slot Screen
				139.61 / 2.74								
		Grey SILTY CLAY.										
3				139.30 / 3.05								
		END OF BOREHOLE										
4												
5												

DEPTH SCALE (ALONG HOLE)

LOGGED: DJS

CHECKED:

Golder Associates

PROJECT: 991-2631

LOCATION: See Site Plan

DIP:

RECORD OF BOREHOLE 99-3

BORING DATE: Apr. 23, 1999

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 63.5kg; DROP, 760 mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	COMBUSTIBLE VAPOUR (100 200 300 400) / Micro-Tip ppm (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp — W — Wl	INSTALLATIONS A B C
		GROUND SURFACE		144.66								
0	75mm Hand Auger Open Hole	Dark brown SANDY TOPSOIL.		0.00 / 144.50								Bentonite Seal
		Brown SILTY fine SAND.		0.16 / 144.22								
		Brown fine SAND.		0.44 / 143.46								
1		Brown fine to coarse SAND.		1.22 / 143.16	1	SS	50 DO 21					
		Grey brown SILTY CLAY, occasional sand seam. (Weathered Crust)		1.52 / 142.39								Sand
2		Grey SILTY CLAY.		2.29 / 141.76	2	SS	50 DO 12					38mm PVC #10 Slot Screen
		END OF BOREHOLE		2.90								
3												
4												
5												

DEPTH SCALE (ALONG HOLE)

Golder Associates

LOGGED: DJS

CHECKED: KMM

PROJECT: 991-2831

LOCATION: See Site Plan

DIP:

RECORD OF BOREHOLE 99-4

BORING DATE: Apr. 23, 1999

SAMPLER HAMMER, 63.5kg; DROP, 760 mm

SHEET 1 OF 1

DATUM: Geodetic

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	COMBUSTIBLE VAPOUR (100 200 300 400) / Micro-Tip ppm (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp — W — Wl	INSTALLATIONS A B C
0	75mm Hand Auger / Open Hole	GROUND SURFACE		143.97								
		Dark brown SANDY TOPSOIL.		0.00 / 143.73								Bentonite Seal
		Dark brown SILTY fine SAND.		0.24 / 143.36								
1		Brown fine to medium SAND.		0.61 / 142.45	1	SS	DO 18					
		Grey brown SILTY CLAY. (Weathered Crust)		1.52 / 141.23	2	SS	DO 12					Sand
		Grey SILTY CLAY.		2.74 / 140.92								38mm PVC #10 Slot Screen
3		END OF BOREHOLE		3.05								
4												
5												

DEPTH SCALE (ALONG HOLE)

1 to 25

Golder Associates

LOGGED: DJS

CHECKED: KTM

PROJECT: 991-2831

RECORD OF BOREHOLE 99-5

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Apr. 23, 1999

DATUM: Geodetic

DIP:

SAMPLER HAMMER, 63.5 kg; DROP, 760 mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	SAMPLES: RECOVERY %	SAMPLES: LAB. TESTING	COMBUSTIBLE VAPOUR (Micro-Tip ppm)	HYDRAULIC CONDUCTIVITY, k, cm/s	WATER CONTENT, PERCENT (Wp, W, Wl)	INSTALLATIONS
0	75mm Hand Auger Open Hole	GROUND SURFACE		139.41									
		Dark brown SANDY TOPSOIL		0.00 / 139.29									
				0.12									Bentonite Seal
1													
		Grey brown SILTY CLAY. (Weathered Crust)			1	SS DO	14						
2													Sand
													38mm PVC #10 Slot Screen
3													
				135.79									
		END OF BOREHOLE		3.66									
4													
5													

INSTALLATIONS: A B C

DEPTH SCALE (ALONG HOLE)

1 to 25

Golder Associates

LOGGED: DJS

CHECKED: KMM

PROJECT: 19135012

RECORD OF BOREHOLE: 20-1

SHEET 1 OF 1

LOCATION: N 5031556.1 ;E 380046.9

BORING DATE: May 22, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		144.16							
	Portable Rig, 50 mm Sampler	TOPSOIL - SILTY SAND; brown; moist		0.00							
		SAND, fine to medium, trace silt; red brown; moist		0.10							
		SILTY CLAY and SAND; grey brown; moist		0.25	1	SS	-				Native Backfill
				143.25	2	SS	-				Silica Sand
1		SAND, fine, trace silt; grey; wet		0.91	3	SS	-				
2					4	SS	-				32 mm Diam. PVC #10 Slot Screen
					5	SS	-				
3				141.11							
		End of Borehole		3.05							WL in Screen at Elev. 143.659 m on May 26, 2020
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE
1 : 50

GOLDER

LOGGED: SPS

CHECKED: CWT

MIS-BHS 001 19135012.GPJ GAL-MIS.GDT 2-16-21 JEM

PROJECT: 19135012

RECORD OF BOREHOLE: 20-2

SHEET 1 OF 1

LOCATION: N 5031605.3 ;E 380040.0

BORING DATE: May 22, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		142.73							
0	Portable Rig, 50 mm Sampler	TOPSOIL - SILTY SAND; brown; moist		0.00							
		SAND, fine to medium, trace silt; grey brown; moist		0.10	1	SS	-				Native Backfill
				142.12							
		SAND, fine, trace silt; grey; moist		0.61	2	SS	-				Silica Sand
1				141.61							
		SILTY CLAY; grey brown (WEATHERED CRUST); wet		1.12	3	SS	-				
2					4	SS	-				32 mm Diam. PVC #10 Slot Screen
					5	SS	-				
3				139.68							
		End of Borehole		3.05							WL in Screen at Elev. 141.577 m on May 26, 2020
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: SPS

CHECKED: CWT

MIS-BHS 001 19135012.GPJ GAL-MIS.GDT 2-16-21 JEM

PROJECT: 19135012

RECORD OF BOREHOLE: 20-3

SHEET 1 OF 1

LOCATION: N 5031666.0 ;E 380013.1

BORING DATE: May 22, 2020

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		139.71							
0	Portable Rig, 50 mm Sampler	TOPSOIL - SILTY SAND; brown; moist		0.00							
		SILTY CLAY; grey brown (WEATHERED CRUST); moist to wet		0.10	1	SS	-				Native Backfill
1					2	SS	-				Silica Sand
					3	SS	-				32 mm Diam. PVC #10 Slot Screen
2					4	SS	-				
					5	SS	-				
3				136.66							
		End of Borehole		3.05							WL in Screen at Elev. 138.746 m on May 26, 2020
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: SPS

CHECKED: CWT

MIS-BHS 001 19135012.GPJ GAL-MIS.GDT 2-16-21 JEM

APPENDIX C

Groundwater and Surface Water Quality

Parameter	Unit	ODWQS(169/03)-Health [1]	ODWQS-AO [2]	BH 3B 27-Apr-2023 BH-3B	BH 3B 30-Nov-2023 [5] BH3-B	BH 6 28-Apr-2023 [7] BH-6	BH 6 01-Dec-2023 BH-6
General Chemistry							
Alkalinity (Total as CaCO3)	mg/l	--	--	202	262	605	662
Ammonia Nitrogen	mg/l	--	--	<0.020	0.067	14.3	23.2
Biochemical Oxygen Demand, 5 Day	mg/l	--	--	--	--	8	18
Chemical Oxygen Demand	mg/l	--	--	15	45	50	92
Chloride	mg/l	--	250	1	1	32	47
Conductivity	uS/cm	--	--	289	490	1120	1200
Conductivity (Field)	uS/cm	--	--	369	493	1219	1404
Dissolved Organic Carbon	mg/l	--	5	2.4	2.4	11.0	18.0
Hardness, Calcium Carbonate	mg/l	--	--	203	266	487	447
Nitrate as N	mg/l	10.0	--	<0.10	0.25	<0.10	<0.10
Nitrite as N	mg/l	1.0	--	<0.10	<0.10	<0.10	<0.10
Nitrogen, Total Kjeldahl	mg/l	--	--	<0.100	0.185	14.4	26.1
pH (Field)	-	--	--	7.26	7.24	6.31	6.41
Phosphorus	mg/l	--	--	0.004	<0.002	0.014	0.334
Sulphate	mg/l	--	500 [9]	15	25	2	<1
Temperature (Field)	deg c	--	15	7.8	7	8.3	7.2
Total Dissolved Solids	mg/l	--	500	188	318	728	780
Total Suspended Solids	mg/l	--	--	--	--	242	314
Metals							
Arsenic, dissolved	mg/l	0.01	--	<0.001	<0.001	0.002	0.002
Barium, dissolved	mg/l	1	--	0.03	0.02	0.31	0.38
Boron, dissolved	mg/l	5	--	0.01	0.01	0.43	0.95
Cadmium, dissolved	mg/l	0.005	--	<0.0001	<0.0001	<0.0001	<0.0001
Calcium, dissolved	mg/l	--	--	63	80	149	141
Chromium, dissolved	mg/l	0.05	--	<0.001	<0.001	<0.001	0.002
Copper, dissolved	mg/l	--	1	0.001	0.002	0.002	<0.001
Iron, dissolved	mg/l	--	0.3	<0.03	<0.03	56.5	79.1
Lead, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.001
Magnesium, dissolved	mg/l	--	--	11	16	28	23
Manganese, dissolved	mg/l	--	0.05	<0.01	<0.01	2.06	2.18
Mercury, dissolved	mg/l	0.001	--	<0.0001	<0.0001	<0.0001	<0.0001
Potassium, dissolved	mg/l	--	--	3	<1	23	27
Sodium, dissolved	mg/l	--	200 [10]	2	2	32	58
Zinc, dissolved	mg/l	--	5	<0.01	<0.01	<0.01	<0.01
Phenols							
Phenolics, Total Recoverable	mg/l	--	--	<0.001	<0.001	<0.001	<0.001

Parameter	Unit	ODWQS(169/03)-Health [1]	ODWQS-AO [2]	BH 8A 27-Apr-2023 [5] BH-8A	BH 8A 30-Nov-2023 [5] BH-8A	BH 8B 27-Apr-2023 BH-8B	BH 8B 30-Nov-2023 [5] BH-8B	BH 9B 27-Apr-2023 [5] BH-9B
General Chemistry								
Alkalinity (Total as CaCO3)	mg/l	--	--	423	433	265	408	272
Ammonia Nitrogen	mg/l	--	--	0.273	0.364	0.076	0.352	<0.020
Biochemical Oxygen Demand, 5 Day	mg/l	--	--	--	--	--	--	--
Chemical Oxygen Demand	mg/l	--	--	20	57	14	65	29
Chloride	mg/l	--	250	43	43	28	51	63
Conductivity	uS/cm	--	--	807	826	530	793	650
Conductivity (Field)	uS/cm	--	--	817	846	451	833	633
Dissolved Organic Carbon	mg/l	--	5	5.5	6.4	5.8	11.9	3.8
Hardness, Calcium Carbonate	mg/l	--	--	418	425	246	385	315
Nitrate as N	mg/l	10.0	--	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrite as N	mg/l	1.0	--	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrogen, Total Kjeldahl	mg/l	--	--	0.550	0.792	0.267	1.18	<0.100
pH (Field)	-	--	--	6.92	6.66	6.96	6.73	6.98
Phosphorus	mg/l	--	--	0.006	0.011	0.006	0.006	0.010
Sulphate	mg/l	--	500 [9]	<1	<1	1	<1	5
Temperature (Field)	deg c	--	15	6.3	8.4	5.9	7.6	5.5
Total Dissolved Solids	mg/l	--	500	525	537	344	515	422
Total Suspended Solids	mg/l	--	--	--	--	--	--	--
Metals								
Arsenic, dissolved	mg/l	0.01	--	0.002	0.002	<0.001	0.001	<0.001
Barium, dissolved	mg/l	1	--	0.05	0.04	0.03	0.05	0.02
Boron, dissolved	mg/l	5	--	0.11	0.14	0.07	0.19	0.07
Cadmium, dissolved	mg/l	0.005	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcium, dissolved	mg/l	--	--	108	109	69	108	80
Chromium, dissolved	mg/l	0.05	--	<0.001	<0.001	<0.001	<0.001	<0.001
Copper, dissolved	mg/l	--	1	0.002	<0.001	0.004	0.001	0.002
Iron, dissolved	mg/l	--	0.3	6.80	5.96	1.60	5.24	<0.03
Lead, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.001	<0.001
Magnesium, dissolved	mg/l	--	--	36	37	18	28	28
Manganese, dissolved	mg/l	--	0.05	3.80	3.81	0.52	3.28	<0.01
Mercury, dissolved	mg/l	0.001	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Potassium, dissolved	mg/l	--	--	4	4	3	6	<1
Sodium, dissolved	mg/l	--	200 [10]	12	14	15	22	14
Zinc, dissolved	mg/l	--	5	<0.01	<0.01	<0.01	<0.01	<0.01
Phenols								
Phenolics, Total Recoverable	mg/l	--	--	<0.001	<0.001	<0.001	<0.001	<0.001

Parameter	Unit	ODWQS(169/03)-Health [1]	ODWQS-AO [2]	BH 9B 30-Nov-2023 [5] BH-9B	BH 10A 27-Apr-2023 10-A	BH 10A 30-Nov-2023 BH10-A	BH 15-1 27-Apr-2023 15-1	BH 15-1 30-Nov-2023 [3] BH15-1
General Chemistry								
Alkalinity (Total as CaCO3)	mg/l	--	--	242	711	714	721	712
Ammonia Nitrogen	mg/l	--	--	<0.020	0.154	0.102	10.3	13.8
Biochemical Oxygen Demand, 5 Day	mg/l	--	--	--	--	--	--	--
Chemical Oxygen Demand	mg/l	--	--	38	34	27	59	150
Chloride	mg/l	--	250	61	67	64	67	127
Conductivity	uS/cm	--	--	593	1320	1300	1350	1510
Conductivity (Field)	uS/cm	--	--	601	1347	1321	1504	1658
Dissolved Organic Carbon	mg/l	--	5	6.0	24.1	8.6	17	37.3
Hardness, Calcium Carbonate	mg/l	--	--	266	685	703	546	535
Nitrate as N	mg/l	10.0	--	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrite as N	mg/l	1.0	--	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrogen, Total Kjeldahl	mg/l	--	--	0.266	0.725	0.598	12.4	19.9
pH (Field)	-	--	--	6.91	6.68	6.7	6.6	6.57
Phosphorus	mg/l	--	--	0.005	0.011	0.009	0.013	0.018
Sulphate	mg/l	--	500 [9]	5	18	21	16	3
Temperature (Field)	deg c	--	15	7.2	9.3	8.1	7.8	8.4
Total Dissolved Solids	mg/l	--	500	385	858	845	878	982
Total Suspended Solids	mg/l	--	--	--	--	--	--	--
Metals								
Arsenic, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.001	0.001
Barium, dissolved	mg/l	1	--	0.01	0.09	0.09	0.48	0.63
Boron, dissolved	mg/l	5	--	0.10	0.51	0.45	0.93	1.5
Cadmium, dissolved	mg/l	0.005	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcium, dissolved	mg/l	--	--	67	220	227	169	168
Chromium, dissolved	mg/l	0.05	--	<0.001	<0.001	<0.001	<0.001	0.001
Copper, dissolved	mg/l	--	1	0.004	<0.001	0.001	0.004	<0.001
Iron, dissolved	mg/l	--	0.3	<0.03	1.77	0.66	58.6	64.7
Lead, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.001	<0.001
Magnesium, dissolved	mg/l	--	--	24	33	33	30	28
Manganese, dissolved	mg/l	--	0.05	<0.01	5.00	3.63	11.4	4.44
Mercury, dissolved	mg/l	0.001	--	<0.0001	<0.0001	<0.0001	<0.0001	0.0001
Potassium, dissolved	mg/l	--	--	<1	4	4	22	25
Sodium, dissolved	mg/l	--	200 [10]	16	53	45	81	112
Zinc, dissolved	mg/l	--	5	<0.01	<0.01	<0.01	<0.01	<0.01
Phenols								
Phenolics, Total Recoverable	mg/l	--	--	<0.001	<0.001	<0.001	0.001	<0.001

Parameter	Unit	ODWQS(169/03)-Health [1]	ODWQS-AO [2]	BH 15-2A 28-Apr-2023 [4] BH15-2A	BH 15-2A 01-Dec-2023 [4] BH15-2A	BH 15-2B 28-Apr-2023 BH15 - 2A	BH 15-2B 01-Dec-2023 [5] 15-2B	BH 20-1 28-Apr-2023 BH20 - 1
General Chemistry								
Alkalinity (Total as CaCO3)	mg/l	--	--	--	--	615	357	343
Ammonia Nitrogen	mg/l	--	--	--	--	0.042	0.035	0.022
Biochemical Oxygen Demand, 5 Day	mg/l	--	--	--	--	--	--	--
Chemical Oxygen Demand	mg/l	--	--	--	--	43	77	41
Chloride	mg/l	--	250	--	--	65	53	42
Conductivity	uS/cm	--	--	--	--	1220	759	759
Conductivity (Field)	uS/cm	--	--	--	--	1186	790	832
Dissolved Organic Carbon	mg/l	--	5	--	--	9.4	6.8	5.4
Hardness, Calcium Carbonate	mg/l	--	--	--	--	595	331	346
Nitrate as N	mg/l	10.0	--	--	--	<0.10	<0.10	<0.10
Nitrite as N	mg/l	1.0	--	--	--	0.13	<0.10	<0.10
Nitrogen, Total Kjeldahl	mg/l	--	--	--	--	0.432	0.429	0.220
pH (Field)	-	--	--	--	--	6.54	6.49	7.23
Phosphorus	mg/l	--	--	--	--	0.054	0.435	0.009
Sulphate	mg/l	--	500 [9]	--	--	29	18	29
Temperature (Field)	deg c	--	15	--	--	6.6	7.2	8.3
Total Dissolved Solids	mg/l	--	500	--	--	793	493	493
Total Suspended Solids	mg/l	--	--	--	--	--	--	--
Metals								
Arsenic, dissolved	mg/l	0.01	--	--	--	<0.001	<0.001	<0.001
Barium, dissolved	mg/l	1	--	--	--	0.09	0.05	0.03
Boron, dissolved	mg/l	5	--	--	--	0.38	0.35	0.15
Cadmium, dissolved	mg/l	0.005	--	--	--	<0.0001	<0.0001	<0.0001
Calcium, dissolved	mg/l	--	--	--	--	187	103	104
Chromium, dissolved	mg/l	0.05	--	--	--	<0.001	<0.001	<0.001
Copper, dissolved	mg/l	--	1	--	--	0.007	0.003	0.002
Iron, dissolved	mg/l	--	0.3	--	--	0.07	0.04	0.05
Lead, dissolved	mg/l	0.01	--	--	--	<0.001	<0.001	<0.001
Magnesium, dissolved	mg/l	--	--	--	--	31	18	21
Manganese, dissolved	mg/l	--	0.05	--	--	6.10	0.14	0.04
Mercury, dissolved	mg/l	0.001	--	--	--	<0.0001	<0.0001	<0.0001
Potassium, dissolved	mg/l	--	--	--	--	3	1	<1
Sodium, dissolved	mg/l	--	200 [10]	--	--	50	36	31
Zinc, dissolved	mg/l	--	5	--	--	<0.01	<0.01	<0.01
Phenols								
Phenolics, Total Recoverable	mg/l	--	--	--	--	<0.001	<0.001	<0.001

Parameter	Unit	ODWQS(169/03)-Health [1]	ODWQS-AO [2]	BH 20-1 01-Dec-2023 BH20-1	BH 20-2 28-Apr-2023 BH20 - 2	BH 20-2 01-Dec-2023 [6] 20-2	BH 20-3 28-Apr-2023 BH20 - 3	BH 20-3 01-Dec-2023 [6] 20-3
General Chemistry								
Alkalinity (Total as CaCO3)	mg/l	--	--	433	27	--	29	--
Ammonia Nitrogen	mg/l	--	--	0.034	0.045	--	0.104	--
Biochemical Oxygen Demand, 5 Day	mg/l	--	--	--	--	--	--	--
Chemical Oxygen Demand	mg/l	--	--	109	54	--	93	--
Chloride	mg/l	--	250	51	4	--	5	--
Conductivity	uS/cm	--	--	903	68	--	68	--
Conductivity (Field)	uS/cm	--	--	1018	72	--	96	--
Dissolved Organic Carbon	mg/l	--	5	6.7	4.6	--	11.0	--
Hardness, Calcium Carbonate	mg/l	--	--	424	21	--	21	--
Nitrate as N	mg/l	10.0	--	<0.10	<0.10	--	<0.10	--
Nitrite as N	mg/l	1.0	--	<0.10	<0.10	--	<0.10	--
Nitrogen, Total Kjeldahl	mg/l	--	--	0.452	0.398	--	0.458	--
pH (Field)	-	--	--	7.34	6.71	--	7.06	--
Phosphorus	mg/l	--	--	0.415	0.373	--	0.905	--
Sulphate	mg/l	--	500 [9]	33	6	--	6	--
Temperature (Field)	deg c	--	15	7.5	5.2	--	11.4	--
Total Dissolved Solids	mg/l	--	500	587	44	--	44	--
Total Suspended Solids	mg/l	--	--	--	--	--	--	--
Metals								
Arsenic, dissolved	mg/l	0.01	--	<0.001	<0.001	--	<0.001	--
Barium, dissolved	mg/l	1	--	0.03	0.01	--	0.02	--
Boron, dissolved	mg/l	5	--	0.22	<0.01	--	<0.01	--
Cadmium, dissolved	mg/l	0.005	--	<0.0001	<0.0001	--	<0.0001	--
Calcium, dissolved	mg/l	--	--	127	5	--	5	--
Chromium, dissolved	mg/l	0.05	--	<0.001	<0.001	--	<0.001	--
Copper, dissolved	mg/l	--	1	0.002	0.002	--	0.005	--
Iron, dissolved	mg/l	--	0.3	0.06	0.08	--	0.12	--
Lead, dissolved	mg/l	0.01	--	<0.001	<0.001	--	<0.001	--
Magnesium, dissolved	mg/l	--	--	26	2	--	2	--
Manganese, dissolved	mg/l	--	0.05	0.05	<0.01	--	<0.01	--
Mercury, dissolved	mg/l	0.001	--	<0.0001	<0.0001	--	<0.0001	--
Potassium, dissolved	mg/l	--	--	<1	<1	--	<1	--
Sodium, dissolved	mg/l	--	200 [10]	41	17	--	20	--
Zinc, dissolved	mg/l	--	5	<0.01	<0.01	--	<0.01	--
Phenols								
Phenolics, Total Recoverable	mg/l	--	--	<0.001	<0.001	--	<0.001	--

Parameter	Unit	ODWQS(169/03)-Health [1]	ODWQS-AO [2]	BH 91-1B 27-Apr-2023 [5] 91-1B	BH 91-1B 30-Nov-2023 [5] 91-1B	BH 92-1A 27-Apr-2023 [5] BH92-1A	BH 92-1A 30-Nov-2023 [3] 92-1A	BH 92-1B 27-Apr-2023 BH92-1B
General Chemistry								
Alkalinity (Total as CaCO3)	mg/l	--	--	462	477	220	211	257
Ammonia Nitrogen	mg/l	--	--	0.035	0.044	<0.020	<0.020	<0.020
Biochemical Oxygen Demand, 5 Day	mg/l	--	--	--	--	--	--	--
Chemical Oxygen Demand	mg/l	--	--	24	65	28	40	20
Chloride	mg/l	--	250	25	29	10	9	10
Conductivity	uS/cm	--	--	808	821	415	309	473
Conductivity (Field)	uS/cm	--	--	811	840	413	419	463
Dissolved Organic Carbon	mg/l	--	5	5.3	6.3	2.5	8.7	3.0
Hardness, Calcium Carbonate	mg/l	--	--	449	445	148	132	216
Nitrate as N	mg/l	10.0	--	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrite as N	mg/l	1.0	--	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrogen, Total Kjeldahl	mg/l	--	--	0.262	0.460	1.06	0.400	<0.100
pH (Field)	-	--	--	7.07	6.85	7.78	7.72	7.7
Phosphorus	mg/l	--	--	0.006	0.012	0.018	0.020	0.006
Sulphate	mg/l	--	500 [9]	6	4	12	12	10
Temperature (Field)	deg c	--	15	7.4	8.2	7.2	6.6	6.9
Total Dissolved Solids	mg/l	--	500	525	534	270	201	307
Total Suspended Solids	mg/l	--	--	--	--	--	--	--
Metals								
Arsenic, dissolved	mg/l	0.01	--	0.001	0.002	<0.001	<0.001	<0.001
Barium, dissolved	mg/l	1	--	0.05	0.04	0.03	0.01	0.02
Boron, dissolved	mg/l	5	--	0.08	0.10	0.01	0.01	<0.01
Cadmium, dissolved	mg/l	0.005	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcium, dissolved	mg/l	--	--	109	109	38	33	57
Chromium, dissolved	mg/l	0.05	--	<0.001	<0.001	<0.001	<0.001	<0.001
Copper, dissolved	mg/l	--	1	0.002	<0.001	0.002	<0.001	0.001
Iron, dissolved	mg/l	--	0.3	2.08	1.92	<0.03	<0.03	<0.03
Lead, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.001	<0.001
Magnesium, dissolved	mg/l	--	--	43	42	13	12	18
Manganese, dissolved	mg/l	--	0.05	1.60	1.69	<0.01	<0.01	0.10
Mercury, dissolved	mg/l	0.001	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Potassium, dissolved	mg/l	--	--	3	3	3	2	1
Sodium, dissolved	mg/l	--	200 [10]	12	12	35	36	21
Zinc, dissolved	mg/l	--	5	<0.01	<0.01	<0.01	<0.01	<0.01
Phenols								
Phenolics, Total Recoverable	mg/l	--	--	0.001	<0.001	<0.001	<0.001	<0.001

Parameter	Unit	ODWQS(169/03)-Health [1]	ODWQS-AO [2]	BH 92-1B 30-Nov-2023 92-1B	BH 92-1C 27-Apr-2023 [5] BH92-1C	BH 92-1C 30-Nov-2023 [5] 92-1C	BH 92-5 27-Apr-2023 [3] BH92-5	BH 92-5 30-Nov-2023 [3] 92-5
General Chemistry								
Alkalinity (Total as CaCO3)	mg/l	--	--	252	113	176	211	223
Ammonia Nitrogen	mg/l	--	--	0.021	<0.020	<0.020	0.294	0.235
Biochemical Oxygen Demand, 5 Day	mg/l	--	--	--	--	--	--	--
Chemical Oxygen Demand	mg/l	--	--	19	34	32	13	7
Chloride	mg/l	--	250	9	10	9	2	1
Conductivity	uS/cm	--	--	463	200	269	302	307
Conductivity (Field)	uS/cm	--	--	477	244	341	403	407
Dissolved Organic Carbon	mg/l	--	5	5.9	8.4	5.8	2.0	2.4
Hardness, Calcium Carbonate	mg/l	--	--	202	116	148	197	192
Nitrate as N	mg/l	10.0	--	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrite as N	mg/l	1.0	--	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrogen, Total Kjeldahl	mg/l	--	--	0.354	0.126	0.255	0.438	0.445
pH (Field)	-	--	--	7.41	7.01	6.78	7.63	7.62
Phosphorus	mg/l	--	--	0.008	0.020	0.004	0.034	0.026
Sulphate	mg/l	--	500 [9]	11	6	6	20	22
Temperature (Field)	deg c	--	15	7.4	5.4	7.7	6.2	8
Total Dissolved Solids	mg/l	--	500	301	130	175	196	200
Total Suspended Solids	mg/l	--	--	--	--	--	--	--
Metals								
Arsenic, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.001	<0.001
Barium, dissolved	mg/l	1	--	<0.01	0.02	0.01	0.04	0.03
Boron, dissolved	mg/l	5	--	<0.01	<0.01	0.02	0.04	0.04
Cadmium, dissolved	mg/l	0.005	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcium, dissolved	mg/l	--	--	53	30	41	41	39
Chromium, dissolved	mg/l	0.05	--	<0.001	<0.001	<0.001	<0.001	<0.001
Copper, dissolved	mg/l	--	1	0.001	0.005	0.001	0.002	0.001
Iron, dissolved	mg/l	--	0.3	<0.03	0.05	<0.03	0.07	<0.03
Lead, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.001	<0.001
Magnesium, dissolved	mg/l	--	--	17	10	14	23	23
Manganese, dissolved	mg/l	--	0.05	0.22	<0.01	<0.01	0.07	0.05
Mercury, dissolved	mg/l	0.001	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Potassium, dissolved	mg/l	--	--	1	<1	<1	5	5
Sodium, dissolved	mg/l	--	200 [10]	21	5	7	7	7
Zinc, dissolved	mg/l	--	5	<0.01	<0.01	<0.01	<0.01	<0.01
Phenols								
Phenolics, Total Recoverable	mg/l	--	--	<0.001	<0.001	<0.001	<0.001	<0.001

Parameter	Unit	ODWQS(169/03)-Health [1]	ODWQS-AO [2]	BH 99-1 27-Apr-2023 [3] BH99-1	BH 99-1 30-Nov-2023 [6] 99-1	BH 99-2 27-Apr-2023 [5] BH99-2	BH 99-2 30-Nov-2023 [3] 99-2	BH 99-3 27-Apr-2023 [8] 99-3
General Chemistry								
Alkalinity (Total as CaCO3)	mg/l	--	--	42	--	174	229	645
Ammonia Nitrogen	mg/l	--	--	<0.020	--	<0.020	0.033	0.036
Biochemical Oxygen Demand, 5 Day	mg/l	--	--	--	--	--	--	--
Chemical Oxygen Demand	mg/l	--	--	11	--	42	35	44
Chloride	mg/l	--	250	10	--	6	5	98
Conductivity	uS/cm	--	--	181	--	283	453	1260
Conductivity (Field)	uS/cm	--	--	223	--	371	456	1250
Dissolved Organic Carbon	mg/l	--	5	1.5	--	4.2	5.5	10.8
Hardness, Calcium Carbonate	mg/l	--	--	83	--	185	227	642
Nitrate as N	mg/l	10.0	--	**11.1**	--	<0.10	0.18	<0.50
Nitrite as N	mg/l	1.0	--	<0.10	--	<0.10	<0.10	<0.50
Nitrogen, Total Kjeldahl	mg/l	--	--	0.189	--	<0.100	0.150	0.627
pH (Field)	-	--	--	6.23	--	7.09	7.44	6.99
Phosphorus	mg/l	--	--	0.042	--	0.005	0.004	0.013
Sulphate	mg/l	--	500 [9]	5	--	26	26	<5
Temperature (Field)	deg c	--	15	7.1	--	7.3	7.6	5.3
Total Dissolved Solids	mg/l	--	500	118	--	184	294	819
Total Suspended Solids	mg/l	--	--	--	--	--	--	--
Metals								
Arsenic, dissolved	mg/l	0.01	--	<0.001	--	<0.001	<0.001	<0.001
Barium, dissolved	mg/l	1	--	0.03	--	0.02	0.01	0.06
Boron, dissolved	mg/l	5	--	<0.01	--	0.03	0.03	0.36
Cadmium, dissolved	mg/l	0.005	--	<0.0001	--	<0.0001	<0.0001	<0.0001
Calcium, dissolved	mg/l	--	--	20	--	51	63	186
Chromium, dissolved	mg/l	0.05	--	0.001	--	<0.001	<0.001	<0.001
Copper, dissolved	mg/l	--	1	0.003	--	0.003	0.001	0.002
Iron, dissolved	mg/l	--	0.3	0.85	--	<0.03	<0.03	1.05
Lead, dissolved	mg/l	0.01	--	<0.001	--	<0.001	<0.001	<0.001
Magnesium, dissolved	mg/l	--	--	8	--	14	17	43
Manganese, dissolved	mg/l	--	0.05	0.02	--	0.09	<0.01	0.45
Mercury, dissolved	mg/l	0.001	--	<0.0001	--	<0.0001	<0.0001	<0.0001
Potassium, dissolved	mg/l	--	--	1	--	<1	<1	3
Sodium, dissolved	mg/l	--	200 [10]	7	--	6	7	46
Zinc, dissolved	mg/l	--	5	<0.01	--	<0.01	<0.01	<0.01
Phenols								
Phenolics, Total Recoverable	mg/l	--	--	<0.001	--	<0.001	<0.001	<0.001

Parameter	Unit	ODWQS(169/03)-Health [1]	ODWQS-AO [2]	BH 99-3 30-Nov-2023 99-3	BH 99-4 27-Apr-2023 [5] 99-4	BH 99-4 30-Nov-2023 [5] 99-4	BH 99-5 27-Apr-2023 [5] 99-5	BH 99-5 30-Nov-2023 [3] 99-5
General Chemistry								
Alkalinity (Total as CaCO3)	mg/l	--	--	329	219	220	126	168
Ammonia Nitrogen	mg/l	--	--	<0.020	0.027	<0.020	0.150	0.151
Biochemical Oxygen Demand, 5 Day	mg/l	--	--	--	--	--	--	--
Chemical Oxygen Demand	mg/l	--	--	43	39	59	178	123
Chloride	mg/l	--	250	29	35	33	1	2
Conductivity	uS/cm	--	--	624	501	510	197	243
Conductivity (Field)	uS/cm	--	--	680	518	557	232	372
Dissolved Organic Carbon	mg/l	--	5	4.7	7.8	6.5	31.7	25.4
Hardness, Calcium Carbonate	mg/l	--	--	311	231	229	106	134
Nitrate as N	mg/l	10.0	--	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrite as N	mg/l	1.0	--	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrogen, Total Kjeldahl	mg/l	--	--	0.510	0.269	0.302	0.272	0.422
pH (Field)	-	--	--	6.76	7.01	6.77	7.03	6.86
Phosphorus	mg/l	--	--	0.016	0.010	0.003	0.249	0.012
Sulphate	mg/l	--	500 [9]	2	10	15	2	3
Temperature (Field)	deg c	--	15	7.8	4.8	7.3	6.1	7.3
Total Dissolved Solids	mg/l	--	500	406	326	332	128	158
Total Suspended Solids	mg/l	--	--	--	--	--	--	--
Metals								
Arsenic, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.001	<0.001
Barium, dissolved	mg/l	1	--	0.02	0.03	0.02	0.02	0.01
Boron, dissolved	mg/l	5	--	0.07	0.08	0.10	0.01	0.02
Cadmium, dissolved	mg/l	0.005	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcium, dissolved	mg/l	--	--	80	63	62	26	34
Chromium, dissolved	mg/l	0.05	--	<0.001	<0.001	<0.001	<0.001	<0.001
Copper, dissolved	mg/l	--	1	0.001	0.003	<0.001	0.002	0.003
Iron, dissolved	mg/l	--	0.3	0.08	0.03	<0.03	2.93	0.52
Lead, dissolved	mg/l	0.01	--	<0.001	<0.001	<0.001	<0.001	<0.001
Magnesium, dissolved	mg/l	--	--	27	18	18	10	12
Manganese, dissolved	mg/l	--	0.05	0.08	<0.01	<0.01	0.16	0.02
Mercury, dissolved	mg/l	0.001	--	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Potassium, dissolved	mg/l	--	--	3	<1	<1	<1	1
Sodium, dissolved	mg/l	--	200 [10]	14	15	17	15	11
Zinc, dissolved	mg/l	--	5	<0.01	<0.01	<0.01	<0.01	<0.01
Phenols								
Phenolics, Total Recoverable	mg/l	--	--	<0.001	<0.001	<0.001	<0.001	<0.001

Footnotes:

	Tables should be read in conjunction with the accompanying document.
<	Indicates parameter not detected above laboratory method detection limit.
>	Indicates parameter detected above equipment analytical range.
--	Chemical not analyzed or criteria not defined.
Value	Parameter is greater than ODWQS(169/03)-Health
Value	Parameter is greater than ODWQS-AO
(1)	Ontario Drinking Water Quality Standards - Health Based Standards (June 2003, revised January 2020).
(2)	Ontario Drinking Water Quality Standards - Aesthetic Objectives. Aesthetic Objectives are established for parameters that may impair the taste, odour or colour of water or which may interfere with good water quality control practices. For certain parameters, both aesthetic objectives and health-related MACs have been derived (June 2003, revised July 2017).
(3)	Sediment not included in TKN & COD analysis.
(4)	Water sample could not be collected due to a blockage within the monitoring well.
(5)	Sediment not included in TKN analysis.
(6)	Not enough water to collect a sample.
(7)	Sediment not included in COD or TKN analysis for this report.
(8)	Sediment not included in TKN analysis. Total P bottles not provided for this report; Phosphorous results are from unpreserved bottles.
(9)	There may be a laxative effect in some individuals when sulphate levels exceed 500 mg/L.
(10)	The aesthetic objective for sodium in drinking water is 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.

APPENDIX C - REPORT OF MONITORING RESULTS
2023 GROUNDWATER QUALITY
VOLATILE ORGANIC COMPOUNDS
MCNAB WASTE DISPOSAL SITE

Parameter	Unit	ODWQS(169/03)-Health (1)	ODWQS-AO (2)	BH 6 01-Dec-2023 BH-6	BH 9B 30-Nov-2023 BH-9B	BH 15-1 30-Nov-2023 BH15-1	BH 99-4 30-Nov-2023 99-4
VOCs							
1,1,1,2-Tetrachloroethane	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0005
1,1,1-Trichloroethane	mg/l	--	--	<0.0004	<0.0004	<0.0004	<0.0004
1,1,2,2-Tetrachloroethane	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0005
1,1,2-Trichloroethane	mg/l	--	--	<0.0004	<0.0004	<0.0004	<0.0004
1,1-Dichloroethane	mg/l	--	--	0.0006	<0.0004	0.0004	<0.0004
1,1-Dichloroethylene	mg/l	0.014	--	<0.0005	<0.0005	<0.0005	<0.0005
1,2-Dibromoethane	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0005
1,2-Dichlorobenzene	mg/l	0.2	0.003	0.0014	<0.0004	<0.0004	<0.0004
1,2-Dichloroethane	mg/l	0.005	--	<0.0005	<0.0005	<0.0005	<0.0005
1,2-Dichloropropane	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0005
1,3,5-Trimethylbenzene	mg/l	--	--	<0.0003	<0.0003	<0.0003	<0.0003
1,3-Dichlorobenzene	mg/l	--	--	<0.0004	<0.0004	<0.0004	<0.0004
1,4-Dichlorobenzene	mg/l	0.005	0.001	<0.0004	<0.0004	<0.0004	<0.0004
Benzene	mg/l	0.001	--	**0.0038**	<0.0005	0.0010	<0.0005
Bromodichloromethane	mg/l	--	--	<0.0003	<0.0003	<0.0003	<0.0003
Bromoform	mg/l	--	--	<0.0004	<0.0004	<0.0004	<0.0004
Bromomethane	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0005
Carbon Tetrachloride	mg/l	0.002	--	<0.0002	<0.0002	<0.0002	<0.0002
Chlorobenzene	mg/l	0.08	0.03	0.0015	<0.0005	0.0012	<0.0005
Chloroethane	mg/l	--	--	0.0036	<0.0005	<0.0005	<0.0005
Chloroform	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0005
Chloromethane	mg/l	--	--	<0.0002	<0.0002	<0.0002	<0.0002
cis-1,2-Dichloroethene	mg/l	--	--	<0.0004	<0.0004	<0.0004	<0.0004
cis-1,3-Dichloropropene	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0005
Dibromochloromethane	mg/l	--	--	<0.0003	<0.0003	<0.0003	<0.0003
Dichlorodifluoromethane	mg/l	--	--	0.0016	<0.0005	<0.0005	<0.0005
Ethylbenzene	mg/l	0.14	0.0016	<0.0005	<0.0005	<0.0005	<0.0005
m,p-Xylenes	mg/l	--	--	<0.0004	<0.0004	<0.0004	<0.0004
Methylene Chloride	mg/l	0.05	--	<0.0040	<0.0040	<0.0040	<0.0040
o-Xylene	mg/l	--	--	<0.0004	<0.0004	<0.0004	<0.0004
Styrene	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0005
Tetrachloroethylene	mg/l	0.01	--	<0.0003	<0.0003	<0.0003	<0.0003
Toluene	mg/l	0.06	0.024	<0.0004	<0.0004	<0.0004	<0.0004
trans-1,2-Dichloroethene	mg/l	--	--	<0.0004	<0.0004	<0.0004	<0.0004
trans-1,3-Dichloropropene	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0005
Trichloroethene	mg/l	0.005	--	<0.0003	<0.0003	<0.0003	<0.0003
Trichlorofluoromethane	mg/l	--	--	<0.0005	<0.0005	<0.0005	<0.0005
Vinyl Chloride	mg/l	0.001	--	<0.0002	<0.0002	<0.0002	<0.0002
Xylenes, Total	mg/l	0.09	0.02	<0.0005	<0.0005	<0.0005	<0.0005

Created by: AS
Checked by: CWT

2023 GROUNDWATER QUALITY
VOLATILE ORGANIC COMPOUNDS
MCNAB WASTE DISPOSAL SITE

Footnotes:

	Tables should be read in conjunction with the accompanying document.
<	Indicates parameter not detected above laboratory method detection limit.
>	Indicates parameter detected above equipment analytical range.
--	Chemical not analyzed or criteria not defined.
Value	Parameter is greater than ODWQS(169/03)-Health
Value	Parameter is greater than ODWQS-AO
(1)	Ontario Drinking Water Quality Standards - Health Based Standards (June 2003, revised January 2020).
(2)	Ontario Drinking Water Quality Standards - Aesthetic Objectives. Aesthetic Objectives are established for parameters that may impair the taste, odour or colour of water or which may interfere with good water quality control practices. For certain parameters, both aesthetic objectives and health-related MACs have been derived (June 2003, revised July 2017).

APPENDIX C - REPORT OF MONITORING RESULTS
2023 SURFACE WATER QUALITY
MCNAB WASTE DISPOSAL SITE

Parameter	Unit	PWQO [1]	SW1 28-Apr-2023 SW-1	SW1 24-Aug-2023 SW-1	SW1 01-Dec-2023 SW-1	SW2 28-Apr-2023 SW-2	SW2 24-Aug-2023 SW-2	SW2 01-Dec-2023 SW-2	SW4 28-Apr-2023 SW-4	SW4 01-Dec-2023 [2] SW-4
General Chemistry										
Alkalinity (Total as CaCO3)	mg/l	-- [6]	142	192	176	141	191	160	350	398
Ammonia, unionized (Field)	ug/l	20	<20	<20	<20	<20	<20	<20	<20	<20
Ammonia Nitrogen	ug/l	--	147	23	52	198	25	22	197	<20
Biochemical Oxygen Demand, 5 Day	ug/l	--	<1000	<1000	5000	<1000	<1000	4000	2000	5000
Chemical Oxygen Demand	ug/l	--	5000	31000	24000	7000	32000	63000	30000	84000
Chloride	ug/l	--	19000	22000	22000	20000	24000	20000	30000	42000
Conductivity	uS/cm	--	258	311	288	265	313	275	706	789
Conductivity (Field)	uS/cm	--	313	314	374	322	321	369	670	836
Dissolved Organic Carbon	ug/l	--	5200	8300	6600	5100	7700	6200	15600	14500
Dissolved Oxygen (Field)	mg/l	-- [7]	14.38	8.52	15.21	15.09	8.41	15.68	11.84	9.05
Hardness, Calcium Carbonate	ug/l	--	137000	165000	160000	137000	163000	146000	295000	351000
Nitrate as N	ug/l	--	<100	<100	<100	<100	<100	<100	<100	<100
pH (Field)	-	6.5 - 8.5	7.64	7.28	7.77	7.78	7.31	7.7	7.94	7.34
Phosphorus	ug/l	-- [8]	7	29	21	21	**34**	12	**66**	**82**
Temperature (Field)	deg c	-- [9]	13.8	12.8	2.1	10.9	12.1	1.8	10.2	1.6
Total Dissolved Solids	ug/l	--	168000	202000	187000	172000	203000	179000	459000	513000
Total Suspended Solids	ug/l	--	<2000	2000	5000	4000	50000	<2000	41000	35000
Turbidity	NTU	-- [10]	1.0	4.0	3.7	3.3	8.4	2.5	3.0	8.1
Metals										
Aluminum, dissolved	ug/l	-- [11]	<10	<10	<10	<10	<10	<10	<10	<10
Barium	ug/l	--	20	20	20	20	20	20	50	70
Beryllium	ug/l	-- [12]	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Boron	ug/l	200 [13]	<10	<10	<10	20	10	<10	**280**	**260**
Cadmium	ug/l	0.2 [14]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
Calcium	ug/l	--	40000	48000	46000	40000	47000	42000	82000	96000
Chromium	ug/l	-- [15]	<1	<1	<1	<1	<1	<1	<1	<1
Cobalt	ug/l	0.9	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.4	0.7
Copper	ug/l	5	<1	<1	<1	<1	<1	<1	<1	1
Iron	ug/l	300	140	**420**	**460**	**500**	230	250	130	**500**
Iron, dissolved	ug/l	300	--	--	--	--	--	--	60	30
Lead	ug/l	-- [16]	<1	<1	<1	<1	<1	<1	<1	<1
Magnesium	ug/l	--	9000	11000	11000	9000	11000	10000	22000	27000
Manganese	ug/l	--	20	120	150	50	60	40	70	390
Molybdenum	ug/l	40	<5	<5	<5	<5	<5	<5	<5	<5
Nickel	ug/l	25	<5	<5	<5	<5	<5	<5	<5	<5
Potassium	ug/l	--	<1000	<1000	<1000	<1000	<1000	<1000	18000	15000
Silicon	ug/l	--	3900	7100	6500	4000	7600	7000	4700	7100
Silver	ug/l	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sodium	ug/l	--	14000	17000	13000	14000	18000	14000	31000	35000
Strontium	ug/l	--	98	130	133	101	149	128	354	435
Thallium	ug/l	0.3 [17]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	ug/l	6	<1	<1	<1	<1	<1	<1	<1	1
Zinc	ug/l	30 [14]	<10	<10	<10	<10	<10	<10	<10	<10
Phenols										
Phenolics, Total Recoverable	ug/l	1 [18]	<1	<1	<1	<1	<1	<1	<1	<1

APPENDIX C - REPORT OF MONITORING RESULTS
2023 SURFACE WATER QUALITY
MCNAB WASTE DISPOSAL SITE

Parameter	Unit	PWQO [1]	SW6 28-Apr-2023 [3] SW-6	SW6 01-Dec-2023 [4] SW-6	SW7 28-Apr-2023 SW-7	SW7 01-Dec-2023 [5] SW-7	SW8 28-Apr-2023 SW-8	SW8 01-Dec-2023 SW-8	SW9 28-Apr-2023 [2] SW-9	SW9 01-Dec-2023 SW-9
General Chemistry										
Alkalinity (Total as CaCO3)	mg/l	-- [6]	571	--	382	495	174	253	599	508
Ammonia, unionized (Field)	ug/l	20	**70**	--	<20	<20	<20	<20	<20	<20
Ammonia Nitrogen	ug/l	--	5850	--	39	20	28	24	8100	12700
Biochemical Oxygen Demand, 5 Day	ug/l	--	<1000	--	<1000	8000	<1000	4000	4000	16000
Chemical Oxygen Demand	ug/l	--	61000	--	36000	119000	11000	39000	78000	189000
Chloride	ug/l	--	121000	--	42000	51000	2000	6000	36000	41000
Conductivity	uS/cm	--	1310	--	808	912	263	484	1120	957
Conductivity (Field)	uS/cm	--	1266	--	771	965	312	504	1059	992
Dissolved Organic Carbon	ug/l	--	25600	--	17800	21800	10000	13300	13200	12200
Dissolved Oxygen (Field)	mg/l	-- [7]	9.67	--	**6.27**	**3.8**	8.53	10.82	6.09	**2.4**
Hardness, Calcium Carbonate	ug/l	--	468000	--	330000	393000	167000	252000	460000	378000
Nitrate as N	ug/l	--	360	--	220	<100	<100	<100	690	<100
pH (Field)	-	6.5 - 8.5	7.84	--	7.75	6.9	7.61	7.29	6.78	6.6
Phosphorus	ug/l	-- [8]	**38**	--	11	**506**	19	14	**49**	**34**
Temperature (Field)	deg c	-- [9]	9.8	--	8.4	2.1	11.6	2.2	17.1	2.4
Total Dissolved Solids	ug/l	--	852000	--	525000	593000	171000	315000	728000	622000
Total Suspended Solids	ug/l	--	2000	--	<2000	236000	<2000	<2000	33000	442000
Turbidity	NTU	-- [10]	0.3	--	0.8	>100	0.4	0.5	29.2	>100
Metals										
Aluminum, dissolved	ug/l	-- [11]	<10	--	<10	<10	10	<10	<10	<10
Barium	ug/l	--	80	--	40	130	20	30	310	450
Beryllium	ug/l	-- [12]	<0.5	--	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Boron	ug/l	200 [13]	**230**	--	**380**	**370**	40	30	**1070**	**500**
Cadmium	ug/l	0.2 [14]	<0.1	--	<0.1	0.2	<0.1	<0.1	<0.1	<0.1
Calcium	ug/l	--	123000	--	91000	108000	52000	76000	138000	115000
Chromium	ug/l	-- [15]	<1	--	<1	1	<1	<1	<1	1
Cobalt	ug/l	0.9	**1.0**	--	0.5	**2.4**	<0.2	<0.2	**1.4**	**1.2**
Copper	ug/l	5	<1	--	<1	3	<1	1	<1	<1
Iron	ug/l	300	40	--	100	**7470**	40	<30	**36100**	**21700**
Iron, dissolved	ug/l	300	30	--	80	100	<30	30	**2620**	**7800**
Lead	ug/l	-- [16]	<1	--	<1	4	<1	<1	<1	<1
Magnesium	ug/l	--	39000	--	25000	30000	9000	15000	28000	22000
Manganese	ug/l	--	70	--	40	2060	<10	20	1450	2190
Molybdenum	ug/l	40	13	--	<5	<5	<5	<5	<5	<5
Nickel	ug/l	25	<5	--	<5	<5	<5	<5	<5	<5
Potassium	ug/l	--	29000	--	24000	23000	2000	3000	29000	21000
Silicon	ug/l	--	7400	--	7000	9900	2900	5100	10800	4000
Silver	ug/l	0.1	<0.1	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sodium	ug/l	--	94000	--	41000	46000	3000	6000	47000	38000
Strontium	ug/l	--	711	--	373	500	162	276	593	506
Thallium	ug/l	0.3 [17]	<0.1	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	ug/l	6	<1	--	<1	5	<1	<1	<1	3
Zinc	ug/l	30 [14]	<10	--	<10	30	<10	<10	<10	<10
Phenols										
Phenolics, Total Recoverable	ug/l	1 [18]	1	--	<1	<1	<1	<1	<1	<1

APPENDIX C - REPORT OF MONITORING RESULTS
2023 SURFACE WATER QUALITY
MCNAB WASTE DISPOSAL SITE

Footnotes:

	Tables should be read in conjunction with the accompanying document.
<	Indicates parameter not detected above laboratory method detection limit.
>	Indicates parameter detected above equipment analytical range.
--	Chemical not analyzed or criteria not defined.
Value	Parameter is greater than PWQO
(1)	Provincial Water Quality Objectives (July 1994, reprinted February 1999)
(2)	Sediments not included for COD analysis.
(3)	Holding time for turbidity analysis was exceeded for every sample on this report.
(4)	Monitoring location was dry during this sampling event. No sample was collected.
(5)	Metals analysis performed on weak acid digest of sample material due to solids present in sample. Total P MRL elevated due to matrix interference.
(6)	Alkalinity should not be decreased by more than 25% of the natural concentration.
(7)	Objective depends on water temperature and biota. Dissolved oxygen concentrations should not be less than the values specified in the PWQO document for cold water biota (e.g. salmonid fish communities) and warm water biota (e.g. centrarchid fish communities).
(8)	Current scientific evidence is insufficient to develop a firm Objective at this time. Accordingly, the following phosphorus concentrations should be considered as general guidelines which should be supplemented by site-specific studies: To avoid nuisance concentrations of algae in lakes, average total phosphorus concentrations for the ice-free period should not exceed 20 ug/L; A high level of protection against aesthetic deterioration will be provided by a total phosphorus concentration for the ice-free period of 10 ug/L or less. This should apply to all lakes naturally below this value; Excessive plant growth in rivers and streams should be eliminated at a total phosphorus concentration below 30 ug/L.
(9)	(1) General: The natural thermal regime of any body of water shall not be altered so as to impair the quality of the natural environment. In particular, the diversity, distribution and abundance of plant and animal life shall not be significantly changed. (2) Waste Heat Discharge: (a) Ambient Temperature Changes: The temperature at the edge of a mixing zone shall not exceed the natural ambient water temperature at a representative control location by more than 10°C (18°F). However, in special circumstances, local conditions may require a significantly lower temperature difference than 10°C (18°F). Potential dischargers are to apply to the MOEE for guidance as to the allowable temperature rise for each thermal discharge. This ministry will also specify the nature of the mixing zone and the procedure for the establishment of a representative control location for temperature recording on a case-by-case basis. (b) Discharge Temperature Permitted: The maximum temperature of the receiving body of water, at any point in the thermal plume outside a mixing zone, shall not exceed 30°C (86°F) or the temperature of a representative control location plus 10°C (18°F) or the allowed temperature difference, which ever is the lesser temperature. These maximum temperatures are to be measured on a mean daily basis from continuous records. (c) Taking and Discharging of Cooling Water: Users of cooling water shall meet both the Objectives for temperature outlined above and the "Procedures for the Taking and Discharge of Cooling Water" as outlined in the MOEE publication Deriving Receiving-Water Based, Point-Source Effluent Requirements for Ontario Waters(1994).
(10)	Suspended matter should not be added to surface water in concentrations that will change the natural Secchi disc reading by more than 10 percent.
(11)	At pH 4.5 to 5.5 the Interim PWQO is 15 µg/L based on inorganic monomeric aluminum measure in clay-free samples; At pH > 5.5 to 6.5, no condition should be permitted which would increase the acid soluble inorganic aluminum concentration in clay-free samples to more than 10% above natural background concentrations for waters representative of that geological area of the Province that are unaffected by man-made inputs. At pH > 6.5 to 9.0, the Interim PWQO is 75 µg/L based on total aluminum measured in clay-free samples. If natural background aluminum concentrations in water bodies unaffected by man-made inputs are greater than the numerical Interim PWQO (above), no condition is permitted that would increase the aluminum concentration in clay-free samples by more than 10% of the natural background level. Note: pH values of < 6.5 and > 8.5 are outside the range considered acceptable by the PWQO for pH. See the Scientific Criteria Document for Development of Provincial Water Quality Objectives and Guidelines - Aluminum for a discussion of analytical procedures.
(12)	If hardness as CaCO3 < 75 mg/L, PWQO = 11 µg/L; if hardness as CaCO3 > 75 mg/L, PWQO = 1100 µg/L.
(13)	See Section 1.2.3. of PWQO. This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.
(14)	An Interim PWQO also exists for this parameter. See Section 1.10 of the PWQO - Where both a PWQO and an Interim PWQO exist.
(15)	PWQO values exist for Cr(III) and Cr(VI)
(16)	If alkalinity as CaCO3 < 20 mg/L, PWQO = 5 µg/L; if alkalinity as CaCO3 from 20 to 40 mg/L, PWQO = 10 µg/L; if alkalinity as CaCO3 from 40 to 80 mg/L, PWQO = 20 µg/L; if alkalinity as CaCO3 > 80 mg/L, PWQO = 25 ug/L. An Interim PWQO also exists for this parameter. See Section 1.10 of the PWQO - Where both a PWQO and an Interim PWQO exist.
(17)	MOEE.
(18)	Determined by the total reactive phenols test - the 4-AAP (4-amino-antipyrine) test. This objective should be used primarily as a screening tool. The isomer specific PWQOs for various phenolics should be employed where possible.



wsp.com

PART B-1

2022 Annual Landfill Operations Report
Stantec Consulting Ltd.

2022 Annual Operations Monitoring Report

Prepared for:
Township of McNab/Braeside
2473 Russett Drive
Arnprior ON K7S 3G8

Prepared by:
Stantec Consulting Ltd.
300-1331 Clyde Avenue
Ottawa, ON K2C 3G4

1634-01671

Distribution:
Township of McNab/Braeside, 3 copies
MECP, 2 copies
Golder Ltd., **1** copy
Stantec Consulting Ltd., **1** copy

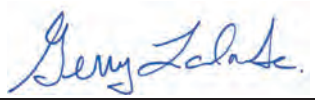
March 31, 2023

2022 ANNUAL OPERATIONS MONITORING REPORT

Revision	Description	Author		Quality Check		Independent Review	
0	Report	G. Lalonde	3/15/2023	A. Moran	3/20/2023	C. Zheng	3/20/2023

Sign-off Sheet

This document entitled 2022 Annual Operations Monitoring Report was prepared by Stantec Consulting Ltd. for the account of the Township of McNab/Braeside. The material in it reflects Stantec's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Stantec Consulting Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Prepared by 

(signature)

Gerry Lalonde, P. Eng.

Reviewed by 

(signature)

Chuyi Zheng, EIT

Table of Contents

EXECUTIVE SUMMARY ..... **i**

1 INTRODUCTION **1.1**

2 PURPOSE OF ANNUAL REPORT **2.1**

3 SUMMARY OF SITE CONDITIONS **3.1**
3.1 GUIDELINES FOR OPERATIONS (ENVIRONMENTAL COMPLIANCE APPROVAL) 3.1
3.2 WASTE DEPOSITED DURING 2022 ..... 3.12
3.2.1 Waste Deposited in 2022 ..... 3.12
3.2.2 Waste Deposited in 2021 ..... 3.13
3.3 SITE CAPACITY AND LANDFILL LAYOUT 3.14
3.4 REMAINING SITE CAPACITY AND SITE LIFE 3.15
3.5 SUMMARY OF LANDFILL OPERATIONS DURING 2022 ..... 3.17
3.5.1 Disposal Operations During 2022 ..... 3.17
3.5.2 Equipment 3.18
3.5.3 Materials and Compaction 3.18
3.5.4 Users 3.19
3.5.5 Inspections 3.20
3.6 PROPOSED CHANGES TO LANDFILL OPERATIONS FOR 2023 ..... 3.20
3.7 COSTS 3.21

4 HYDROGEOLOGICAL MONITORING IMPACTS ON OPERATIONS **4.1**

5 WASTE DIVERSION INITIATIVES **5.1**
5.1 WASTE REDUCTION TARGETS 5.1
5.2 WASTE DIVERSION/RECYCLING PROGRAM 5.1
5.2.1 Curbside Recycling Program 5.1
5.2.2 Segregation of Products at the Landfill 5.2
5.2.3 Household Hazardous Waste 5.2
5.2.4 Waste Oil Transfer Station 5.2
5.2.5 Waste Recycling Strategy 5.2
5.3 STATUS OF WASTE DIVERSION INITIATIVES 5.3
5.3.1 Net Unit Cost for Waste Diversion 5.4
5.3.2 Administrative 5.4

6 OTHER ISSUES **6.1**
6.1 PLANNING FOR WASTE DISPOSAL 6.1
6.2 MINISTRY INSPECTIONS AND CORRESPONDENCE 6.1
6.3 REVIEW OF COMPLAINTS 6.1

7 CONCLUSIONS AND RECOMMENDATIONS **7.1**

8 LIMITATIONS AND USE OF REPORT **8.1**

LIST OF TABLES

Table 1: Monthly Breakdown by Waste Source (2022) 3.13
Table 2: Monthly Breakdown by Waste Source (2021) 3.14
Table 3: Remaining Service Life 3.16
Table 4: Compaction Equipment Hours.....3.18
Table 5: Material Usage - Tonnes.....3.18
Table 6: Monthly Site Users 3.19
Table 7: Annual Costs for Waste Management 3.21
Table 8: Annual Cost Breakdown for Disposal Components 3.22
Table 9: Curbside Collection Recycling Program - Tonnes 5.1
Table 10: Waste Oil Transfer Station.....5.2
Table 11: Waste Diversion Initiatives 5.3
Table 12: Waste Diversion Costs – 2022.....5.4

LIST OF APPENDICES

APPENDIX A FIGURES AND PHOTOS A.1

APPENDIX B ENVIRONMENTAL COMPLIANCE APPROVAL, AND BY-LAW 2022-96 ..... B.1

APPENDIX C SITE OBSERVATION FORMS, CORRESPONDENCE, OTHER SUPPORTING INFORMATION C.1

Executive Summary

The Township of McNab/Braeside is a rural Township located in Renfrew County near the Town of Arnprior. The Township has a projected population of 7,591 (based on 2021 Census). The Township of McNab/Braeside owns a 10-hectare landfilling area and an oil transfer station (not operational since 2020) within a total site area of 64.3 hectares on West ½ Lots 18 and 19, Concession 6, East ½ Lot 19, Concession 5 within the same Township under the Ministry of the Environment, Conservation & Parks (MECP) Environmental Compliance Approval (ECA - formerly Certificate of Approval) No. A412605.

The landfill development plan is to provide one million m^3 of capacity using an area method of fill in three Cells/Stages: Cells 1, 2 and 3. During 2018, disposal operations were within Stages 1 & 2. In January 2019, disposal operations were shifted to Stage 3. During 2022, the Township deposited approximately 10,745 cubic metres of waste and daily cover within the approved contours of Stage 3A. The 2022 annual volume is within the historical range from the previous five years (shown in **Table 3).** The remaining site capacity for all Stages is calculated using a population growth shown in **Table 3** and historical waste generation rates using a 5-year rolling average of 1.24 cubic metres/capita. Before 2021, the 2020 rolling average was 1.2 m^3/cap/yr. but that increased significantly to 1.46 m^3/cap/yr. in 2021 due to the 2021 annual per capita waste generation of 2.5 m^3/cap/yr. With the 2022 annual waste volume returning to previous levels, the 5-year rolling average has decreased to 1.24 cubic metres/capita (excluding the outlier from 2021).

The Township operates a successful waste diversion program through curbside collection of recyclables and its depot program at its landfill. The program diverted 1253 tonnes or approximately 26.6% (by weight) of its waste stream from disposal in 2022. The curbside collection and depot programs for WEEE, scrap metal, grinding brush, tires and other diversion programs represent a significant diversion and should be continued.

The remaining capacity in Stages 1 and 2 was 125,417 m^3 as disposal operations moved into Stage 3A at year end 2018. Future volumes forecasted in **Table 3** using the most recent 5-year rolling average per capita generation (1.24 m^3/c/yr.) show an additional 51 years of disposal capacity in all Stages.

During 2022, the 10,745 cubic metres of capacity used in Stage 3A has reduced the remaining capacity in Stage 3 to 560,325 cubic metres (excludes remaining capacity in Stages 1 & 2) and represents several decades of remaining service life. During 2023, the Township should continue disposal operations in Stage 3A. The remaining capacity at the top of Stages 1 & 2 can be developed once all of Stage 3 has developed and reached the same height at Stages 1 & 2.

Golder Associates installed three new monitoring wells between the waste footprint and Dochart Creek during 2020 and completed groundwater modelling to address concerns that the MECP has raised with the future development of Stage 3. During 2019, MECP correspondence has requested that the Township submit additional documentation to demonstrate that Stage/Cell 3 can be developed to provide the above capacity while maintaining compliance with applicable legislation (chiefly groundwater and surface water



regimes). Golder Associates conducted groundwater modeling to quantity impacts to groundwater from Stage 3 development and submitted the reports to MECP in February 2021. The Township received copies of the MECP's technical reviews for groundwater (Nick Battye) and surface water (Lauren Forrester) specialists in Memorandums dated April 21st, 2022, and April 19th,2022 respectively which are reproduced in **Appendix C**. Golder Associates responded to MECP comments in letter prepared by P. Smolkin dated June 21st, 2022, which is reproduced in **Appendix C**. Discussion on topics raised by MECP reviewers are discussed in the Golder Associates' portion of the collated Annual Monitoring Report.

Depending on the outcome of future discussions with MECP during 2023, it is anticipated that a revised Development & Operation Plan will have to be prepared and an application for an amendment to the Environmental Compliance Approval sought.

1 INTRODUCTION

The Township of McNab/Braeside is a rural Township located in Renfrew County near the Town of Arnprior. The Township has a projected population of 7,591 (based on 2021 Census). The Township of McNab/Braeside owns and operates a 10-hectare landfilling area and oil transfer station (not operational since 2020) within a total site area of 64.3 hectares on West ½ Lots 18 and 19, Concession 6, East ½ Lot 19, Concession 5 within the same Township under the Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Approval (formerly Certificate of Approval) No. A412605.

2 PURPOSE OF ANNUAL REPORT

The purpose of this annual report is to satisfy Condition 45 of the September 30, 1998 Environmental Compliance Approval (formerly Certificate of Approval), which states that the owner shall prepare and submit an annual report to the director by March 31st of the year following the calendar year covered by the report.

In email correspondence dated February 9, 2005, from Andrew Polley (MECP Ottawa), the District Manager amended condition 45 to permit the submission of biennial reports and letter style reports in alternate years to continue unless otherwise advised.

This annual report (although not letter style), prepared by Stantec Consulting Ltd. for the 2022 calendar year, addresses all the activities that relate to site operations. All activities relating to hydrogeology, groundwater and surface water monitoring are addressed by Golder Associates (Golder) in a separate report.

Except for the physical measurement of the waste volume which is calculated from a Stantec survey done in late November/early December each year, the interpretation of all other activities is based on data supplied by the Township.

3 SUMMARY OF SITE CONDITIONS

3.1 GUIDELINES FOR OPERATIONS (ENVIRONMENTAL COMPLIANCE APPROVAL)

The Township must operate their landfill according to the general principles outlined in the MECP manual "Guidance Manual for Landfill Sites Receiving Municipal Waste, November 1993." More particular, the conditions listed in the April 7, 1993 and September 30, 1998 Environmental Compliance Approval (reproduced in **Appendix B**) and subsequent notices dated April 14, 2000; December 4, 2000; and March 2010 give clear direction on duties imposed by the MECP on the Township for operating its landfill.

The April 14, 2000, Notice was issued to incorporate the newly acquired 8.2 ha parcel of land into the total site area of the landfill and the December 4, 2000 Notice was issued to ensure the issuance of a Certificate of Prohibition for that newly acquired parcel of land.

The March 2010 Notice was issued to incorporate site changes which would improve the flow of traffic around the material storage area and reduce interference with future disposal operations.

The following section describes the conditions listed in the Certificate of Approval (ECA) that were relevant to the operations of the landfill during the current reporting period.

Conditions 1 through 8, 15, 16, 46 and 47 – are administrative in nature and have no impact on site operations. Conditions 9 through 14 are from the April 1993 Environmental Compliance Approval and Conditions 17 through 45 are from the September 1998 ECA.

9. (1) The operation of the waste transfer site is limited to the collection, temporary storage and transfer of waste oil, Class 252, as defined in the Ministry of the Environment "New Ontario Waste Classes" dated January 1986, collected from residential and family farm sources in the municipalities of McNab, Renfrew, Arnprior, Horton, Bagot and Blythfield.

(2) No wastes other than those listed in sub condition (1) shall be collected and stored at the transfer site without amendment to the Certificate.

(3) No municipalities other than those listed in sub condition (1) shall use the transfer site without amendment to the Certificate.

(4) All waste shall be delivered to the site by the householder or the family farm operator responsible for the waste or by an approved waste management system. Each delivery is limited to 50 litres.

(5) The operation of the waste transfer site is limited to the operation and 1500 litres tank facility described in the supporting information for this Certificate and no other transfer facility shall be constructed or operated at the site without written approval from the District Manager.

(6) Storage of waste at the transfer facility shall not exceed 1500 litres without amendment to this Certificate.

Discussion: The Township advises their residents to take waste oil to the Renfrew HHW depot. No waste oil was removed from the site during 2022.

10. (1) The waste transfer shall be supervised at all times when open. Access to the transfer site shall be limited to the hours of operation for the landfill site on which this facility is located.

(2) All personnel supervising the transfer site shall be aware of the waste types which may be collected at the transfer site and shall be knowledgeable about all aspects of the transfer site operation including the requirements under this Notice and the Certificate.

(3) Signs shall be posted at the entrance of the landfill site showing the hours of operation and giving notice of the types of waste permitted at the landfill and transfer sites.

(4) The storage tank shall be maintained under lock and key when site personnel are not in attendance.

(5) The storage tank shall be inspected daily during operating hours, by site personnel trained in contingency measures, and all inspections shall be recorded, and these records shall be maintained by owner/operator as described under condition 5(3).

(6) The operator shall ensure that site personnel trained in contingency measures are on duty to receive waste oil and during unloading operations at the site.

(7) The operator shall prepare Generator Registration Reports as required under Regulation 347 of the Ontario Environmental Protection Act.

Discussion: The waste transfer storage shed is locked and not being used.

11. (1) The operator shall establish separate record systems for the waste received at the transfer site which shall include, but not necessarily be limited to, the documentation of quantities of waste received at the transfer site; shipping dates and volumes of waste delivered to approved transfer and processing sites and the documentation of environmental and other problems experienced in operating transfer.

(2) The information collected under section (1) shall be submitted in a report to the District Manager on or before March 31 of each year, with the first report due in 1994, and for each year of operation or until the Director or the District Manager has given notice, in writing, that these submissions are no longer required.

Discussion: Section 5.2.4 of this report satisfies this condition. The waste transfer storage shed is locked and not being used.

12. (1) The operator shall ensure that the landfill site and the transfer site are operated in a safe and secure manner, that the operation of the transfer site does not impede or is, impeded by the

landfill operation on which the transfer site is located, that the wastes are properly handled, contained and stored; and that the general public, site personnel and the environment are protected.

(2) Within 30 days of the issuance of this Notice the operator shall prepare an operation manual for the transfer site for use by site personnel which shall contain, but not necessarily be limited to the following:

1. an outline of the responsibilities of site personnel,
2. personnel training protocols;
3. proper receiving, screening and recording procedures;
4. proper handling, storage and shipping procedures;
5. contingency procedures to be followed by site personnel in the event of fires or other emergencies.

A copy of the operation manual shall be submitted to the District Manager.

(3) The operator shall maintain a safe storage capacity for the transfer site which is consistent with the application for this Certificate and shall ensure that this capacity does the 1500 litre limit of the tank by providing regular movement of the wastes to approved transfer and processing facilities and sites.

(4) Notwithstanding Condition 2 the owner/operator shall ensure that adequate fire-fighting equipment is available at the transfer site and that personnel are familiar with the use of such equipment and its location(s) on the transfer site.

(5) The local fire department shall be advised of the wastes collected at the waste transfer site and this Notice for the Certificate.

Discussion: '*The Operation and Management Plan for the Waste Oil Transfer Station*' dated August 1992 was prepared by Cari Forteath for the Township of McNab/Braeside. The waste transfer storage shed is locked and has not been used since 2020. The transfer site does not interfere with the operation of the landfill site. A fire extinguisher is stored in the custodian shelter and the custodian has a telephone to contact the local fire department, should a fire erupt.

13. All waste shall be transported from the transfer site by an approved waste management system and shall be disposed of at waste landfill, transfer and processing sites certified to accept these types of wastes.

Discussion: The waste transfer storage shed is locked and was not used in 2022. In former years (2019 and prior to that), waste oil from the transfer site was collected by Safety Kleen Canada and copies of the manifests included in the annual monitoring reports**.**

14. The approval for the transfer site on the landfill site expires with the termination of the transfer site; when all the wastes have been removed from this site; and the restoration of this site has been,

approved, in writing by the District Manager; or if closure of the landfill site prohibits or prevents further use of the transfer site.

Discussion: The transfer site was not operational in 2022.

Conditions 17 through 45 – relate to landfill operations.

17. The Site service area shall include the Corporation of the Township of McNab and the Village of Braeside.

Discussion: The site only accepts waste from the Township of McNab/Braeside.

18. The Owner shall place a sign at the main entrance to the Site on which is displayed, in prominent letters, the following information:

18.1 the name of the Site and the Certificate of Approval number for the Site;

18.2 the operating authority, telephone number and mailing address;

18.3 the hours the Site is open to accept waste from the public;

18.4 the telephone number for reporting emergency situations occurring at the Site during non-operating hours;

18.5 the waste acceptable for disposal at the Site; and tipping fee rates; and

18.6 The Site shall be permitted to operate daily 8:00 a.m. to 5:00 p.m. throughout the year. An approval to amend the time of operation can be granted from time to time by writing to the Director or the District Manager.

Discussion: The signs at the entrance include all the information required by condition 18. An MECP inspection report of the site dated 6 July 2015 confirmed that signage is adequate.

19. The Owner shall maintain daily records with monthly summary of the quantity and types of waste disposed of at the Site.

Discussion: The site custodian maintains daily records of the number of users and quantities and types of waste received at the site. Section 3.2 discusses the distribution of users monthly for 2022.

20. The following information shall be recorded on loads refused access to the Site for disposal purposes:

20.1 date;

20.2 name of persons;

20.3 company name on vehicle;

20.4 vehicle description of waste refused; and

20.5 reasons for refusals.

Discussion: The Township uses a specific form to document the above information when recording the number of loads refused. No loads were refused during 2022.

21. During non-operating hours of the Site, the entrance shall be locked.

Discussion: The site entrance has a gate that is locked during non-operating hours.

22. No waste shall be received at the Site or removed from the Site unless a Site Supervisor or his/her alternate (s) and/or designated person (s) are present to supervise the operation.

Discussion: No waste is accepted at the site without a representative of the Township being on site.

23. The Owner shall ensure that the Site Supervisor and/or designated alternative person(s) have been adequately trained with respect to the following procedures without limitations:

23.1 conditions and Schedules of this Certificate;

23.2 the operation and maintenance of this Site;

23.3 relevant waste management regulations and legislation;

23.4 environmental conditions and concerns related to waste handling operations at the Site; and

23.5 occupational health and safety activities pertaining to the workplace and waste handling operations at the Site.

Discussion: The Township has prepared a draft Training Manual for its operators that documents the guidance provided in Memos to staff and operation and maintenance procedures for the site. The Training Manual is an ongoing development and will contain procedures for waste handling, WHMIS, equipment maintenance, weigh scale operations, health and safety and relevant waste management legislation – a copy of which is maintained at the scale house. The Township's Director meets with landfill staff annually to review the Manual.

24. Owner shall keep a copy of this Certificate and Schedule "A" at the Site.

Discussion: A copy of the Environmental Compliance Approval is included in each Annual Monitoring Report (**Appendix B** of the AMR) and a copy of the Annual Monitoring Report is maintained in the site custodian shelter/scale house.

SITE INSPECTION

Litter Control

25. Litter Control shall be carried out by the Owner in accordance with procedures described in Schedule "A".

Discussion: The current approach at the site is to apply adequate daily and interim cover to limit windblown litter. Litter is occasionally picked up around the landfill footprint as deemed necessary. As described in the Operations and Development Plan, if litter becomes a nuisance, a litter fence could be installed near the active face to control windblown litter – this is to supplement regular litter collection at the site. The litter fence would be moved as the location of the active face changes with the development of the site.

With the shift in disposal into Stage 3A (January 2019), the waste is deposited at a lower elevation and sheltered from the wind by the Stage 2 waste and trees along the east side. We anticipate less nuisance issues with wind blown litter in Stage 3A due to better shelter.

Dust Control

26. The owner shall take all necessary mitigative actions for dust control.

27. A dust suppressant shall be applied to the on-site roads when dust becomes a problem during the dry periods of the year.

Discussion: The access route into the landfill is gravel surfaced and when required during the summer months, the Township applies a dust suppressant or water. Based on the three site inspections undertaken by Stantec during 2022, dust has not been a problem.

Pest Control

28. The Owner shall ensure that there are no pests that shall pose a hazard to the health and safety of persons.

Discussion: During 2003, the Township installed an electric fence surrounding the waste footprint to prohibit bears from rummaging thru the waste. The fence was partially dismantled in 2017 to allow for tree clearing for Stage 3 development. Rodents and pests are controlled through the application of daily cover. If additional measures become necessary, the Township would investigate the use of a licensed exterminator and a bait program for rodent control.

Birds have at times been a problem at the site as they dig through the daily cover to get to the waste underneath. The application of interim cover over Stage 2 during 2019 reduced the size of the active face (compared to current active face in Stage 3) and is anticipated to minimize nuisance effects created from the presence of birds. The Township will investigate measures to deter birds if additional issues develop.

Scavenging

29. The Owner shall ensure that there is no scavenging of waste at the Site.

Discussion: The landfill site is fenced, and the site custodian is responsible for ensuring that the entrance gate is locked during non-operating hours to prevent access and scavenging.

Odour Control

30. The Owner shall operate the Site in such a manner to minimize off-Site impact of odours at all times.

Discussion: Applying adequate daily cover minimizes the odours at the site. From the site inspections (3 times per year by Stantec), odours have not been detectable at the site entrance.

Noise Control

31. The Owner shall operate the Site in such a manner to minimize noise impact from haulage trucks and operating equipment on the natural environment and persons.

Discussion: Given the site's natural setting and buffering provided by the existing trees, noise is not an operational concern.

Burning of Waste

32. The owner shall ensure that there is no burning of waste at the Site.

33. The burning of brush, trees and clean wood piles can be conducted at Site and shall be confined to the area as indicated in Figure 7, Item No.1, Schedule "A" and Section 4.21, of the Ministry of the Environment Guidance Manual For Landfill Site Receiving municipal Waste, dated November, 1993.

Discussion: The Township indicated that clean brush has not been burned for several years, including 2022. The Township uses a Contractor to chip the brush on an as needed basis (twice in 2022) with the chipped product being mixed with sand and used for daily cover. Over the last 5 years, chipping/grinding has usually been done twice per year, except for 2020 which did not have any grinding.

Daily Cover

34. The minimum thickness of daily cover shall be 150 millimetres indicated in Figures 10 and 11, Item No.1, Schedule "A";

34.1 The use of petroleum hydrocarbon contaminated soils as daily cover shall be subject to the Generator demonstrating to the owner that the petroleum hydrocarbon contaminated soils are non-hazardous and meets Regulation 347 of the Ontario Environmental Protection Act.

Discussion: The Township is using a combination of sand and wood chips as daily cover. The wood chips are more resistant to wind erosion and have decreased the amount of sand used. All clean wood and brush that is brought to site is chipped and most of it used in the daily cover mixture.



The Township does not accept hydrocarbon contaminated soil unless analytical testing has been done and identifies the soils as being non-hazardous and in accordance with O. Reg. 347/558. No contaminated soil was accepted in 2022.

34.2 The volume of petroleum hydrocarbon contaminated soils received at the Site shall be subject to the approval of the District Manager. The volume of contaminated soils stored at the Site shall not exceed the limitation of the annual daily cover material requirements as determined by the previous annual report.

Discussion: The Township indicated that no hydrocarbon contaminated soil was accepted at the site during 2022. Normal procedure for accepting contaminated soil (once an analysis of specified parameters has been analyzed and reviewed by the Township) is for the soil to be spread at the top of waste in Stage 2 so it can be aerated and then used for daily cover.

35. A suitable stockpile of clean granular cover material, which shall be equivalent to 50% of the quantity of the required annual daily cover material as outlined in condition 34, shall be maintained at the Site as a contingency measure.

Discussion: Sand imported for daily cover usage is now weighed so that the volume can be tracked. While the ECA allows the stockpiling of up to 50% of total annual daily cover usage, other uses for sand exist (such as road maintenance) and sand may be stockpiled temporarily on site for these uses. Monthly tonnages of sand for 2022 are shown in **Table 5**. When woodchips are available at the site, they are mixed in with the sand at approximate 1:1 ratio. The site observations made during the last two years did not indicate that the sand stockpiles were excessive.

Intermediate Cover

36. The minimum thickness for the intermediate soil cover shall be 300 millimetres as indicated in Figures 10 and 11, Item no.1, Schedule “A”.

Discussion: Areas that have not been landfilled for more than 12 consecutive months have intermediate cover. Interim cover was applied to top of Stage 2 during 2019.

Final Cover

37. The maximum height for the refuse and final cover shall not exceed 16.9 metres above the assumed elevation datum which gives a total capacity of 1,000,000 cubic metres for the Site as indicated in Figures 5 and 6 of Item No.1, Schedule "A".

Discussion: The waste height has not exceeded the 16.9 metre maximum height (refer to **Figures 5 to 11** for cross-sections of the waste pile for 2022).

38. No waste shall be deposited at the Site after the final contours have been attained as shown on Figures 5, and 6 of Item No.1, Schedule "A". The final completed contours as noted in Condition 36 shall include 0.7 metres of final cover. The cover material shall include 600-millimetre-thick layer of general clean earth material and a 150-millimetre layer of topsoil, which is seeded.

Discussion: The final site contours have not been reached; therefore, final cover is not required at this time.

Site Capacity

39. The total Site capacity of 1,000,000 cubic metres (air space calculation is based on an area of 10 hectares with a waste mound maximum height of 16.9 metres as indicated in Figures 5 and 6, No.1, Schedule "A". This total site capacity shall be contingent on the owner implementing a leachate collection system or by gaining control over the leachate by acquiring buffer lands to service as leachate attenuation zone such as the privately owned parcel of land, Part of Plan 49R-8277, that is situated in the west part of Lot 19, Concession 6, Township of McNab. This land parcel which comprises the conceptual leachate attenuation zone is shown in Figure 7, Item No. 1 Schedule "A".

Discussion: The Township has purchased buffer lands to provide a larger leachate attenuation zone. Notice No. 1 dated April 14, 2000, incorporates this parcel of land into the site ECA (former CofA).

40. The Owner shall purchase a minimum 30 metre buffer zone and gain control over the remaining conceptual leachate attenuation zone as described in condition 39. The owner shall bring the site into compliance with 2 years of the issuance of this Notice with the RUPO and 30 metre buffer zone requirements.

Discussion: The amended Certificate of Approval dated 4 December 2000 incorporates the 8.2 ha parcel of land to fulfill the requirements of this condition.

Groundwater Monitoring

41. The groundwater monitoring program shall be undertaken by the Owner accordance with Item No. 2 in Schedule "A ". The Owner shall provide with the annual report an evaluation of the groundwater condition for long term monitoring purposes and the number of wells required on site to provide an accurate configuration of the hydrogeochemical condition at the Site. The 1997 monitoring program indicates that RUPO exceeded at the Site. The owner in consultation with the Ministry of the Environment, Eastern Region Hydrogeologist shall amend monitoring program to better assess the RUPO exceedance at the Site and provide recommendations to bring the Site into compliance. The proposed changes to the monitoring program shall be subject to the approval the Director.

Discussion: Groundwater for the site is conducted by Golder Associates and is addressed in a separate report (separate letter style report or Part A of the biennial report).

42. Groundwater geochemical quality exceeds RUPO at the east and north boundaries of the Site. The groundwater contamination is attributable to contamination originating from the Site at locations that were previously landfilled with metal waste and burnt garbage. The Owner shall provide to the Director a contingency and remediation implementation Schedule plan to address the off-Site contamination and to bring the Site into compliance. The financial cost for implementing the remedial action plan and abatement program shall be responsibility of the Owner. The Contingency plan shall be implemented upon approval of the Director and within 2 years of the issuance of this Notice.

Discussion: Groundwater for the site is conducted by Golder Associates and is addressed in a separate report (separate letter style report or Part A of the biennial report).

Surface Water Monitoring

43. The surface water sampling program shall be conducted a minimum of two times a year. The Water samples shall be collected on Dochart Creek at locations SW1, SW2 and SW3 which are situated up gradient and down gradient from the Site. The other surface water sampling locations indicated in Items no.1, Schedule "A". All proposed changes to monitoring program shall be subject to the approval of the Director.

Discussion: Surface water for the site is conducted by Golder Associates and is addressed in a separate report (separate letter style report or Part A of the biennial report).

Closure Plan Landfill Site

44. One year before the Site is expected to close and stop receiving waste, as determined by Conditions 36, 37 and 38, the Owner shall develop and submit an updated Closure Plan. The Closure Plan shall be submitted for the Director's approval and should outline post-closure maintenance and monitoring program. The plan shall include, but not be limited to the following:

44.1 Changes to the final contour plan that have occurred and have been previously identified in the annual reports or recommended in the development of the detailed closure plan;

44.2 fencing and access control;

44.3 details of any vegetative planting planned;

44.4 the sequence and schedules for the final cover installation;

44.5 post-closure and end-use plans;

44.6 plans and schedules for the management and continued monitoring of the surface water and groundwater;

44.7 plans and schedules for routine monitoring and maintenance of stormwater facilities; and

44.8 plans and schedules for the routine monitoring of leachate seeps, the final cover and Site settlement.

Discussion: An updated Closure Plan was not required during 2022 since the Township has significant capacity (approximately 125,417 cubic metres) remaining in Stages 1 and 2. Remaining capacity for waste placement in Stage 3 is 560,325 cubic metres. Disposal operations began in Cell 3A in January 2019.

Annual Report

45. The Owner shall prepare and submit an annual report to the Director by March 31st, of the year following the calendar year covered by the report which shall include as a minimum, but not limited to the following:

45.1 a survey of the Landfill Site waste disposal area conducted every three years and a map illustrating existing contours. The frequency of the surveys can be changed from time to time by writing to District Manager for approval;

45.2 a summary of the total annual quantities of waste received on a quarterly basis for the Site;

45.3 a drawing(s) indicating all groundwater and surface water monitoring locations;

45.4 tables outlining monitoring locations, analytical parameter sampled and the frequency of sampling;

45.5 an interpretation of the surface water, groundwater and leachate monitoring data; a review of the adequacy of the monitoring programs; provide conclusions and recommendations for changes made in the monitoring programs;

45.6 an assessment of the groundwater quality as it relates to the RUPO and ODWO;

45.7 an assessment of the surface water quality with respect to the PWQO/Guidelines;

45.8 an update of any changes made in the operations, equipment or procedures at the Site and Facility and operating difficulties encountered;

45.9 drawings showing the areas of fill, buffer areas, current landfill contours, percentages of available space utilized, and an estimate of the remaining disposal capacity and the landfill life span;

45 .10 a summary discussion of landfill daily cover requirements and erosion protection;

45.11 a statement of compliance with all the conditions with respect to the inspection and reporting requirements as indicated in the Certificate;

45.12 a summary of any complaints made regarding the landfill Site operations and response from the Owner/Operator and the necessary actions taken to address these complaints;

45.13 recommendations with respect to any proposed changes made the operation programs for the Site; and

45.14 proposed changes made in the monitoring program for the Site shall be subject to the approval of the Director.

Discussion: This 2022 annual monitoring report by Stantec Consulting Ltd. (which will be incorporated into the 2023 biennial report, Part B) and Golder Associates (Part A) satisfy the



requirements of this condition. In email correspondence dated February 9, 2005 from Andrew Polley, the MECP District Manager amended condition 45 to permit the submission of a biennial report (2021, next year 2023), with letter style reports to be submitted in alternate years (2022), to continue unless otherwise advised.

3.2 WASTE DEPOSITED DURING 2022

3.2.1 Waste Deposited in 2022

Stantec Consulting Ltd. completed a survey of the waste stockpile on December 6th 2022, to measure the net volume of waste, daily cover and interim cover deposited at the site since the last survey conducted on December 7th, 2021.

Figure 1 (Appendix A) identifies the location of the landfill**. Figure 2A** shows the approved design contours for waste for Stages 1 & 2. **Figure 2B** identifies the design waste contours for Stages 2 and 3. **Figure 4** identifies the 2022 waste placement footprint (which is slightly larger than the 2021 waste footprint shown in **Figure 3**). As shown on these figures, waste placement in 2022 was in the northwest portion of Stage 3A, more particularly extending the 2021 footprint further north. From the survey, we calculated the volume of waste, daily cover, and interim cover volume placed between December 7th 2021 and December 6th 2022 to be 10,745 m^3. **Table 3** identifies the annual quantities measured since 2003.

Figures 5 to 11 show the cross-sections of annual waste placement in comparison to the approved design cross-sections. All waste was deposited within the approved footprint during 2022.

Table 1 identifies the tonnage from various waste sources for 2022 and **Table 2** identifies the 2021 waste sources (for comparison purposed). The 2022 tonnage (3,465) is about 11% higher than the 2021 tonnage (3,121), the increase attributed to construction and organic waste types.

Table 1: Monthly Breakdown by Waste Source (2022)

Month	Household Waste delivered to Site (tonnes) Note 1	Curbside Collection (tonnes)	Construction (tonnes)	Organics (tonnes) Note 2	Total (tonnes)
January	11.19	102.58	48.08	8.7	170.5
February	9.14	96.54	52.21	1.3	159.2
March	11.34	108.61	79.73	2.3	201.9
April	20.73	102.58	112.52	232	467.8
May	25.00	108.61	134.38	57.9	325.9
June	12.81	108.61	109.33	37.3	268.1
July	16.31	96.54	118.17	34.1	265.1
August	20.98	108.61	118.70	29.3	277.6
September	15.49	108.61	138.39	34.1	296.6
October	16.22	102.58	260.27	221.0	600.1
November	11.90	102.58	100.38	20.3	235.1
December	7.63	108.61	73.58	7.1	196.9
Total 2022	178.74	1255.07	1345.74	685.4	3465.0

Note 1: Waste from 7524 users – 1036 used vouchers.
Note 2: Each organic load was taken to be 1.08 cubic metres with density of 298kg/m^3.

3.2.2 Waste Deposited in 2021

With Covid-19 health restrictions in place during 2021, access to many public places was prohibited, including restrictions at the Township's landfill. This annual report includes the breakdown of waste from 2021 for comparison purposes. **Table 2** identifies the tonnage from various waste sources for 2021. The total tonnage for 2021 (3,121 t) is only slightly more than the previous 2020 total (2,992 t). As noted in Section 3.2.1, we suspect that people being told to stay at home during 2021 resulted in many renovation projects and a larger curbside pickup and construction tonnages.

Table 2: Monthly Breakdown by Waste Source (2021)

Month	Household Waste delivered to Site (tonnes) Note 1	Curbside Collection (tonnes)	Construction (tonnes)	Organics (tonnes) Note 2	Total (tonnes)
January	0.4	96.54	43.62	3.54	144.11
February	0.9	96.54	80.39	1.93	179.75
March	4.1	114.65	51.78	19.95	190.45
April	4.7	102.58	93.68	89.15	290.11
May	13.2	102.58	89.5	71.13	276.38
June	16.0	108.61	187.17	50.21	361.97
July	17.7	102.58	85.41	53.43	259.13
August	18.8	108.61	84.38	35.08	246.83
September	23.0	102.58	284.7	40.87	451.18
October	28.6	102.58	104.33	64.05	299.58
November	28.5	108.61	67.12	37.98	242.20
December	9.1	108.61	49.03	12.55	179.30
Total 2021	165.0	1255.0	1221.1	479.9	3121.0

Note 1: Waste from 7389 users – 984 used vouchers.
Note 2: Each organic load was taken to be 1.08 cubic metres with density of 298kg/m^3.

3.3 SITE CAPACITY AND LANDFILL LAYOUT

Historically, the landfill site was developed by the trench method of landfilling. More recently, the June 1997 Site Operations and Development Plan prepared by Golder Associates provided guidance regarding the development of the landfill site in three Stages/Cells by the area method. Waste volume, including daily cover, for each Stage/Cell of landfill development is as follows;

Cell 1	257,500 cubic metres
Cell 2	132,500 cubic metres
Cell 3	610,000 cubic metres
Total	1,000,000 cubic metres

During 2019, MECP correspondence has requested that the Township submit additional documentation to demonstrate that Stage/Cell 3 can be developed to provide the above capacity while maintaining compliance with applicable legislation (chiefly groundwater and surface water regimes). Golder Associates conducted groundwater modeling to quantity impacts to groundwater from Stage 3 development and submitted the reports to MECP in February 2021. The Township received copies of the MECP's technical reviews for groundwater (Nick Battye) and surface water (Lauren Forrester) specialists in Memorandums dated April 21st, 2022 and April 19th,2022 respectively which are reproduced in

Appendix C. Golder Associates responded to MECP comments in letter prepared by P. Smolkin dated June 21st, 2022 which is reproduced in **Appendix C**. Discussion on topics raised by MECP reviewers are discussed in the Golder Associates' portion of the collated Annual Monitoring Report.

3.4 REMAINING SITE CAPACITY AND SITE LIFE

The approved landfill capacity (excluding final cover) for all three Stages of the landfill site was identified as one million m^3 (June 1997 Site Development and Operation Plan). With the December 2018 survey, Stantec calculated the remaining capacity in Stages 1 and 2 to be 125,417 m^3 (as operations moved into Stage 3). Most of the remaining Stage 1 & 2 capacity involves depositing waste to the south and west of the Stage 2 footprint. Due to exposure to bedrock outcrops in the south limit of Stage 2, the Operational strategy is to use the remaining capacity only once Stage 3 is filled.

The remaining site capacity for all Stages is calculated using a population growth shown in **Table 3** and historical waste generation rates using a 5-year rolling average of 1.24 cubic metres/capita (excluding the outlier of 2.51 from 2021). The 2022 annual generation rate of 1.44 m^3/cap/yr. is within the historical range (0.96 to 1.48 for 2018 and 2020 respectively) and a significantly reduced from the 2021 per capita waste generation of 2.5m^3/cap/yr. The 2021 report had raised concerns that the large 2021 increase in per capita generation would result in removal of 30 years of service life from that reported in 2020. With the anticipated end to the pandemic and return to normal life in 2023, the per capita waste generation has returned to previous averages (2021 will be considered an anomaly).

Table 3: Remaining Service Life

Year	Population (Note 3)	Actual Waste Volume	Projected Waste Volume (Note 1)	Remaining Capacity: (Notes 2 & 6)	
		(m^3)	(m^3)	(m^3)	
2003	6,355	**10,830**			
2004	6,463	**7,298**			
2005	6,573	**4,500**			
2006	**7,222**	**6,196**			
2007	7,252	**7,002**			
2008	7,281	**6,250**			
2009	7,311	**9,200**			
2010	7,341	**8,080**		**185,526**	
2011	**7,371**	**9,150**		**176,376**	
2012	7,371	**8,040**		**168,336**	
2013	7,371	**7,980**		**160,356**	
2014	7,371	**7,136**		**153,220**	
2015	7,371	**7,293**		**145,927**	
2016	7,371	**5,648**		**140,279**	
2017	7,371	**7,766**		**132,514**	
2018	7,371	**7,096**		**125,417**	
				Cell 2	**Cell 3**
2019	7,371	**9,500**		125,417	600,500
2020	7,371	**10,892**			589,608
2021	7,371	**18,538**			571,070
2022	7,459	**10,745**			560,325
2030	8,206	Note 5	10,214		470,151
2040	9,246	Note 5	11,508		344,165
2050	10,417	Note 5	12,966		221,208
2060	11,737	Note 5	14,609		82,674
2065	12,459	Note 5	15,507	125,417	6,958
2070	13,224	Note 5	16,460	45,048	
2073	13,706	Note 5	17,059	-5,526	

Note 1: Projected waste generation rate based on 5 year rolling average = 1.24m^3/cap.
Note 2: Based on Stage 1& 2 volume of 390,000 m^3 and Stage 3 volume of 610,000 m^3.
Note 3: Annual population growth rate is assumed to be zero between 2011 and 2019 since it was negative between 2011 and 2016.
For 2020 -2100, use annual rate increase of 1.2 %/year – immigration anticipated beyond 2021.
Note 4: Bold denotes actual survey measurements.
Note 5: Stage 3 Development total capacity of 610,000 m^3.
Note 6: Start date for deposit of waste in Stage 3 was January 2019.

3.5 SUMMARY OF LANDFILL OPERATIONS DURING 2022

3.5.1 Disposal Operations During 2022

A summary of operational issues involving equipment, materials and compaction, site users, and inspections is provided in the following section.

During 2022, the Township main activities included the continuation of the waste diversion (depot) programs (scrap metal, Waste Electronics and Electrical Equipment (WEEE), tires, organics, and blue bin type products. The WEEE products and tires are collected under the Individual Producer Responsibility model operated by Electronics Products Recycling Association (EPRA) and eTracks Tire Management Systems (eTracks) respectively.

As shown in **Figure 4**, waste was deposited mainly in the northwest section of Stage 3A. An access road that was constructed in 2015 along the north slope of Stage 2 to gain access to the top of Cell 2 continued to be used in 2022 for material storage and a dump pad (since top of waste in Phase 3A is now at the height). With the top of waste in Stage 3 at approximately the same height of waste in Stage 2, many users drive to the top of Stage 2 and end dump their load into Stage 3 from that edge. This is useful when site conditions are poor due to weather or too much congestion at the active face.

During 2022, as waste placement proceeded in a northerly direction in Stage 3A, the Township removed the organic material beneath the base of the footprint and used imported sand to raise grade to design elevations. The organics were stockpiled in a windrow along the north side of the regraded footprint. The next paragraph provides a brief summary of activities relating to the preparation of Stage 3 base (reference to Figures reproduced in **Appendix C**).

Cell 3 Development - *during late 2016 and early 2017, the Township had the trees in the west 1/3 of Cell 3 removed to prepare for the Cell 3 base development. In 2017, the Township undertook an investigation of the organic material thickness in Cell 3 and the development of bottom of waste contours for Cell 3. Investigations conducted in 2017 consisted of digging test pits to define surficial soils, groundwater level and thickness of the organic layer. Design contours for the bottom of waste in Cell 3 were generated that provide a minimum vertical separation of approximately 1m between groundwater and the bottom of the future waste.* ***Figure C-01*** *provides the proposed contours for the Cell 3 bottom.*

Starting in 2019, waste will be deposited in the west corner of Cell 3 and abut against the existing Cell 2 slope. The ground level (base) is slightly higher in this area and only minor grading is required to make it acceptable for receipt of waste. The open area further east will require fill to raise the grade before waste can be deposited there. Interim cover will be applied over Cell 2 and this area reserved for treatment of any contaminated soil. The soil cover in Cell 2 should be monitored to ensure that it is not impacted from wind erosion.

The proposed overall strategy for future waste placement is to use all off the Stage 3 capacity before returning to Stage 2 (estimated to occur around 2065 once the top of waste in all of Stage 3 reaches the

same height as the existing Stage 2. Until then, the top of Stage 2 will be used to receive any hydrocarbon contaminated soil and its treatment.

3.5.2 Equipment

The Township uses a Caterpillar 816F2 compactor and crawler loader Deere 655K to spread and compact the waste, as well as other material handling activities.

As shown in **Table 4**, during 2022 the Township expended total hours on compaction and material handling that are comparable to previous years.

These two pieces of equipment continued to be used in 2022.

Table 4: Compaction Equipment Hours

Year	Total Hours Compactor Cat 816F2	Total Hours Track Loader Deere 655K
2022	44	1151
2021	50	1105
2020	225	836

3.5.3 Materials and Compaction

During 2022, as shown in **Table 5**, the annual use of sand imported for daily and interim cover and other usage was 6,494 tonnes (average of 541 tonnes/month), which is more than previous years. The higher monthly tonnage in December 2022 is for stockpiling/storage for use in the following months.

While only a minimal amount of sand was used for base construction during 2022, a significant tonnage of approximately 3,600 tonnes of fine sand (equivalent to 2,181 cubic metres using conversion density of 1,650 kg/m^3) was imported during 2021 to construct the bottom grade of the waste footprint in Stage 3A. It is anticipated that the base will need to be expanded during 2023 to allow filling to continue in Stage 3A.

Table 5: Material Usage - Tonnes

Month	2022 Tonnage	2021 Tonnage	2020 Tonnage	2019 Tonnage
January	827	0	50.2	0
February	233	0	0.0	0
March	1015	0	0.0	0
April	0	0	0.0	0
May	0	0	0.0	1002.7
June	0	0	817.0	0
July	0	1522	600.4	0
August	2295	1273	438.0	699.4
September	0	0	1117.8	548.0

Month	2022 Tonnage	2021 Tonnage	2020 Tonnage	2019 Tonnage
October	0	1458	1165.2	1373.8
November	0	0	376.5	809.1
December	2124	0	896.6	269.0
Total	6494	4253	5461.7	4702
Average per month	541	354	455.1	391.8
Sand imported for base construction – not included in above Total	0	3,600 tonnes 2181 m^3	2,000 tonnes 1211 m^3	
Note: A large portion of sand for December 2022 is stockpiled for use in 2023.				

3.5.4 Users

As shown in **Table 6** the total number of landfill users for 2022 was 7,524 with the highest number of users in October (874) and the lowest in February (242). The number of users is consistent with previous years, except for 2019 where debris from flooding was brought into the site.

Table 6: Monthly Site Users

Month	2022 Users	2021 Users	2020 Users	2019 Users
January	321	256	278	251
February	242	206	258	242
March	336	479	174	380
April	732	884	43	686
May	806	809	1205	1390
June	762	627	997	1295
July	801	777	788	1453
August	758	610	852	1126
September	779	694	883	943
October	874	904	1092	1152
November	643	695	726	829
December	470	448	429	427
Total	**7,524**	**7,389**	**7,725**	**10,174**
				Note 1
Note 1 – increase in users due to flooding that year that created more waste than is usual.				

3.5.5 Inspections

Stantec conducted three site inspection in 2022 (same frequency as previous years). Usually, the site inspections to review operations are done during the spring, summer and fall of each year. Stantec staff completed the inspections using a pre-established form/checklist and submitted their observations to the Township's Director of Public Works within one week of each inspection. The observations are mainly regarding requirements for compliance with operational conditions of the ECA. Copies of the forms for 2022 are reproduced in **Appendix C**. No significant issues were identified during 2022. Due to Covid-19, our inspections did not include entry into the weigh scale building during the spring 2022 inspection.

3.6 PROPOSED CHANGES TO LANDFILL OPERATIONS FOR 2023

With disposal operations now in Stage 3A, the Township should continue with the removal of organics and grading and import of granular fill to raise the ground level to those specified for the bottom of waste (**Figure C-01** – refer to **Appendix C**) for the northern half of Stage 3A.

As shown in **Figure 4**, during 2022, the footprint of the new waste was advanced to the north and east within Stage 3A. During 2023, the toe of the waste should be extended further north, and the platform widened to accommodate the base preparation using imported sand.

It is recommended that a platform width (N-S) of 80m be maintained to accommodate a waste footprint width of 50m and 30m width for user traffic. The platform should extend east to the limit of clearing and an area reserved for a turnaround (trucks with trailers, snow removal equipment). As the first row of waste placement (which overlies Stage 2 slope) is nearing completion, the process should be repeated by advancing the platform northward.

With disposal operations in Stage 3A, the chipped wood can be stockpiled along the northwest limit of Stage 3, between the toe of waste and the tree line. Limited use of the area south of Stage 2 for the segregation of other products can be continued (organics).

The Township is advising its residents that the waste oil should be brought to the Town of Renfrew's household hazardous waste depot. This should continue in 2023.

During 2021, Golder Associates completed groundwater modeling to predict impacts from Stage 3 development on the CAZ and submitted this information to the Ministry for review in February 2021. The Township received copies of the MECP's technical reviews for groundwater (Nick Battye) and surface water (Lauren Forrester) specialists in Memorandums dated April 21st, 2022 and April 19th,2022 respectively which are reproduced in **Appendix C**. Golder Associates responded to MECP comments in letter prepared by P. Smolkin dated June 21st, 2022 which is reproduced in **Appendix C**. Depending on the results of further discussions in 2023, it is anticipated that a revised Development and Operation (D&O) Plan may need to be prepared during 2023.

In 2019, the recycling collection and processing contractor (Beaumen Waste Management) became insolvent and stopped providing these services to the Township of McNab Braeside, as well as other

surrounding municipalities. During 2022, Topps Environmental Solutions (TES) provided the recycling collection for blue box and fibres which are delivered to a processing facility, Emterra Environmental Group in Renfrew. The existing contract with TES ends in July 2023.

All diversion programs are to be continued in 2023. As noted previously, the WEEE products and tires are collected under the Individual Producer Responsibility model operated by Electronics Products Recycling Association (EPRA) and eTracks Tire Management Systems (eTracks) respectively.

With the spring 2017 and spring 2019 flooding issues, the Township should continue to maintain an open space along the properties north/west limit for temporary stockpiling of construction related debris.

3.7 COSTS

Table 7 below summarizes the cost breakdown for waste management services during 2022, as well as previous years for comparison.

Table 7: Annual Costs for Waste Management

Description	2022	2021	2020	2019	2018
Waste collection	$225,987	$200,973	$187,591	$187,571	$180,569
Recycling collection and processing	$ 240,549	$ 217,441	$ 316,500	$ 239,716	$144,032
Disposal operations	$ 247,464	$ 226,670	$ 173,911	$ 201,790	$231,951
Monitoring and Reporting	$ 65,287	$ 57,917	$ 87,589	$ 55,599	$42,056
Household Hazardous Waste Processing (Note 1)	$ N/A	$ N/A	$ 5,783	$ 1,699	$3,146
Equipment & Structures (fuel, maintenance, depreciation)	$ 58,149	$ 29,315	$ 64,952	$ 37,066	$39,664
Transfer to Reserve / Capital Funds	$ 106,022	$ 108,182	$ 0	$ 169,088	$146,129
Total Expenditure	***$ 943,460***	***$ 840,498***	***$ 836,326***	***$ 892,529***	***$784,404***
Revenues (taxes, tipping fees, recycling)	***$ 1,040,442***	***$ 993,752***	***$ 1,020,562***	***$ 892,529***	***$784,404***
Net $	***$ 96,981***	***$153,254***	***$184,236***	***0***	***0***
Note 1: Information not provided by the Town of Renfrew at time of report writing.					

Based on the information in **Table 7,** the Total Expenditure for 2022 is approximately 12% higher than 2021 and the previous three years. The increase is attributed to higher collection costs for garbage and equipment repair costs.

Gross Unit Cost for Waste Disposal

Based on the information in **Table 8**, the unit cost for waste disposal was calculated to be approximately $ 83.75/tonne ($ 290,203 / 3,465 tonnes of waste) for 2022. The 2022 unit cost for disposal is approximately the same as previous years.

Table 8: Annual Cost Breakdown for Disposal Components

Description	2022	2021	2020	2019	2018
Labour & Benefits	$ 90,000	$ 92,266	$ 84,913	$ 85,511	$ 90,269
Equipment & Fuel	$ 33,615	$ 18,191	$ 25,403	$ 38,512	$ 61,080
Monitoring/Reporting	$ 65,287	$ 57,917	$ 87,589	$ 55,600	$ 42,056
Structures (Note 3)	$ 10,300	$ 11,123	$ 0	$ 7,128	$ 13,887
Sand (i.e., Daily Cover)	$ 48,262	$ 26,747	$ 33,461	$ 29,378	$ 58,047
Other (grinding/Stage 3 work)	$ 42,739	$ 20,426	$ 30,134	$ 78,029	$ 48,333
Total $	$ 290,203	$ 226,670	$ 261,500	$ 294,158	$ 313,672
Annual Volume (m^3) (Note 1)	10,745	18,538	10,892	7,600	5,656
Cost / volume waste ($/$m^3$)	$ 27.00	$ 12.28	$ 24.00	$ 38.70	$ 55.45
Waste (tonnes) (Note 2)	3,465	3,121	2,992	3,103	3,164
Cost / mass waste ($/t)	$ 83.75	$ 72.63	$ 87.40	$ 95	$ 99

Note 1: For years prior to 2019, assumes 20% of survey volume is daily cover
*Note 2: Refer to **Table 2** for tonnage.*
Note 3: includes the landfill scale house, equipment shed, and scale.

4 HYDROGEOLOGICAL MONITORING IMPACTS ON OPERATIONS

The Golder Associates report, Part A, presents the results of the 2022 groundwater monitoring.

The landfill's capacity and remaining waste volumes are based on the design contours presented in the 1997 Development & Operation Plan prepared by Golder Associates. During 2019, the Ministry's technical reviewer expressed some concerns with the ability of the contamination attenuation zone to mitigate impacts on groundwater and surface water from the Stage 3 development. During 2020, Golder Associates installed three additional monitoring wells between the waste footprint and Dochart Creek. The results of the monitoring are presented in Part A of the main report.

During 2021, Golder Associates completed groundwater modeling to predict impacts from Stage 3 development on the CAZ and submitted this information to the Ministry for review in February 2021. The Township received copies of the MECP's technical reviews for groundwater (Nick Battye) and surface water (Lauren Forrester) specialists in Memorandums dated April 21st, 2022 and April 19th,2022 respectively which are reproduced in **Appendix C**. Golder Associates responded to MECP comments in letter prepared by P. Smolkin dated June 21st, 2022 which is reproduced in **Appendix C**. Discussion on topics raised by MECP reviewers are discussed in the Golder Associates' portion of the collated Annual Monitoring Report.

Additional comments were received from the Ministry in early 2023 and are discussed in the Golder report. Based on the Ministry's review comments, a new Development & Operation Plan is likely to be required to provide clarification on the Stage 3 construction.

5 WASTE DIVERSION INITIATIVES

5.1 WASTE REDUCTION TARGETS

The provincial strategy for waste reduction is to focus on the idea of Zero Waste. As part of that initiative, the province is focussing the creation of waste diversion programs that make producers responsible for the organization and management of collection, processing and reuse of their products. During 2021, individual producers were responsible for management of electronics (WEEE) and tires at the McNab-Braeside landfill. By 2023, new programs are anticipated for the recycling (Blue box and Black box materials) and where populations warrant it, for organics (green bin) collection and processing.

The Township of McNab/Braeside has implemented the following programs to promote diversion:

- Promotes backyard composting
- Operates a curbside collection recycling program
- Segregates scrap metal, tires and white goods at the landfill
- Diverts clean brush from burial through chipping and its use as daily cover
- Participates in a HHW depot at the Town of Renfrew landfill
- Segregates electronic waste

5.2 WASTE DIVERSION/RECYCLING PROGRAM

5.2.1 Curbside Recycling Program

The Township operates a curbside collection recycling program. The Township of McNab/Braeside (as well as other surrounding municipalities) retained the services of Topps Environmental Services (TES) to provide curbside collection and processing of recyclables. Recyclables through curbside dual stream collection are sent to Emterra Environmental Group facility in Renfrew for processing. **Table 9** identifies the type and volume of recyclable material collected in 2022.

Table 9: Curbside Collection Recycling Program - Tonnes

Material	2022	2021	2020	2019	2018
	Metric Tonnes	Metric Tonnes	Metric Tonnes	Metric Tonnes	Metric Tonnes
ONP/OCC/ Boxboard	202.4	230	97.24	N/A	244.79
Aluminum/Tin/ Plastic/Glass	181.5	190.5	70.14	N/A	164.04
Polystyrene	0	0	0	0	0
Single stream mixed	0	0	315.17	N/A	N/A
TOTAL	383.9	420.5	482	499	440.47

The 2022 tonnage of curbside recyclable products collected has remained relatively constant over the last four years, with less than a 10% variance from the 2021 total.

5.2.2 Segregation of Products at the Landfill

The Township segregates certain materials (such as scrap metal, white goods, tires and electronic waste) from the waste stream and stores these products at the landfill until sufficient quantities warrant collection of the products by private contractors or thru individual producer responsibility model programs. Clean wood and brush that is brought in by residents is stockpiled until a wood-chipping contractor is brought in to chip it. The woodchips are mixed with imported sand for daily and interim cover use. **Table 11** identifies that approximately 685 tonnes of brush/organics was brought to the landfill for grinding on two separate occasions (April and October).

5.2.3 Household Hazardous Waste

The Township of McNab/Braeside, along with other surrounding municipalities, participated in the depot program at the Town of Renfrew landfill. Records of the total volume/weight of HHW collected at the Renfrew depot was not available for 2022.

In prior years, the McNab/Braeside contribution represented 20.59% of the total cost of operation (based on Census population) and reported HHW tonnages for the Township were 16 tonnes (2019) and 9.7 tonnes (2018).

5.2.4 Waste Oil Transfer Station

In 1993, the Township began operating a waste oil transfer station that collects, temporarily stores and transfers waste oil from the landfill site. Historically, Safety Kleen Canada would pick up waste oil on two or three occasions during the year. As shown in **Table 10,** no waste oil has been removed from the site since 2020. Users are advised to drop off any waste oil at the Renfrew HHW depot.

Table 10: Waste Oil Transfer Station

Year Collected	Quantity (Litres)
2018	1700
2019	1227
2020	0
2021	0
2022	0

5.2.5 Waste Recycling Strategy

In 2011, the Township retained Stantec Consulting to develop a Waste Recycling Strategy to support diversion initiatives and guidance on monitoring and measuring of diversion success for its waste management program. The Strategy was completed in November and adopted by Council on December 20, 2011.

Recommendations in the Strategy included reuse, reduction and diversion initiatives, such as incorporating green procurement policies, setting reduction and diversion targets, reviewing collection frequencies and utilizing larger blue boxes for curbside collection. These initiatives would be further evaluated and incorporated into the Township's waste diversion program over the short, medium and long-term planning periods. The Strategy should be reviewed with regard to the province's new and future initiatives involving Extended Producers Responsibility (such as those currently in place for tires and electronic waste).

5.3 STATUS OF WASTE DIVERSION INITIATIVES

The results of the 2022 waste diversion programs are summarized in **Table 11.** We observe that the waste diversion programs achieved a diversion of 26.6% by weight for 2022, a diversion that is consistent with prior years.

The diversion rate above should not be compared to the diversion rate calculated by Waste Diversion Ontario (WDO) since the latter reflects only the residential portion of the waste stream and the blue box recycling program.

Table 11: Waste Diversion Initiatives

Description	2022	2021	2020	2019	2018
	tonnes	tonnes	tonnes	tonnes	tonnes
Recycling Program (blue box + bins at landfill	383	420	490	499	440.47
Polystyrene (Note 1)	0	0	0	0	0
Segregation – tires (Note 3))	19.55	21.4	12.72	15	22.38
Segregation – scrap metal	148	161	161	154	152.31
Segregation – wood (Note 6)	685	596	0	625	775
Electronics	18.18	21.3	23.42	22.9	22.96
Waste Oil (Note 4)	0	0	1	1.034	1.43
Household Hazardous Waste (Notes 2, 8)	0	0	10	16	9.7
Subtotal waste diverted	**1253**	**1219**	**698**	**1333**	**1424**
Contaminated Soil	0	0	0	0	0
Household Waste (Note 5)	3465	3121	2992	3103	3164
Total Waste Stream	**4718**	**4340**	**3690**	**4435**	**4588**
Waste Diversion	**26.6%**	**28.0%**	**19%**	**30%**	**31%**

Note 1: Program not in operation during 2020.

Note 2: Hazardous waste collection thru the Town of Renfrew depot.

Note 3: Where weight is not provided – use 22 lbs/car tire, 25lbs/truck tire and 100lbs per commercial tire.

Note 4: Use 0.843 tonnes per cubic metre and Town of Renfrew data – not available for 2022.

Note 5: Compare to 2021 survey volume assuming 20% cover and a dry waste density of 0.450 tonnes per cubic metre.

Note 6: Woodchips used for cover, density of 298kg/m^3.

Note 7: Agreement with eTracks (IPR supplier) entered in 2019 – tonnage calculated using 22lbs/tire.

Note 8: Not available at the time of report writing.

5.3.1 Net Unit Cost for Waste Diversion

Based on the information in **Table 11** and **Table 12,** the net unit cost for the waste diversion initiatives was calculated to be approximately **$ 65.91/tonne** ($ 82,592/1,253 tonnes) for 2022, and is significantly lower than previous years due to the increase in recycling revenue.

Table 12: Waste Diversion Costs – 2022

Description	2022	2021	2020	2019
Blue Box Pickup	$ 240,549	$ 217,441	$ 315,098	$239,176
Corrugated Cardboard	0	0	0	0
Waste Oil Shipping & Fees	$ 0	$ 0	$ 49	$ 120
Household Hazardous Waste	Note 1	$ 0	$ 5,783	$ 296
Blueboxes / Composter Purchases	0	0	0	$ 650
Recycling Promotion	$ 0	$ 0	$ 1,352	$ 527
Total Costs	**$ 240,549**	**$ 217,441**	**$ 322,283**	**$ 240,769**
Garbage bag tags	$6,042	0	0	0
Tire Revenue	0	0	0	0
Composter / Blue Box Sales	$ 431	$ 389	$ 417	$650
Scrap Metal Revenue	$ 7,399	$ 9,213	$ 9,226	$ 8,022
Bluebox Funding	$ 141,356	$ 78,851	$ 68,850	$ 70,896
E-waste Revenue	$ 2,727	$ 3,360	$ 3,880	$ 3,355
Total Revenue	**$ 157,956**	**$ 91,813**	**$ 82,375**	**$ 82,923**
Net Total Cost	**$ 82,592**	**$ 125,628**	**$ 239,908**	**$ 157,846**
Note 1: HHW cost from Town of Renfrew depot not available but $ 8000 has been budgeted for this service				

5.3.2 Administrative

The Township passed By-Law 2022-96 on December 20th, 2022, which is a by-law to establish fees and charges for services or use of municipal property. Tipping fees for landfill users are established in this by-law within Schedule F, Waste Management fees. Tipping fees for waste was listed at $ 90/tonne (2022).

A copy of the By-Law is provided in **Appendix B**.

6 OTHER ISSUES

6.1 PLANNING FOR WASTE DISPOSAL

Table 3 identifies the remaining capacity of the landfill to be reached by 2073. This is similar to previous projections, assuming that the 2021 rolling 5-year average can be considered an outlier. The per capita generation was doubled in 2021 from the previous years and resulted in increasing the previous rolling five-year average from 1.2 to 1.46 m^3/cap/yr. In addition, with the pandemic and a shift to more people moving to rural areas and the Federal commitment to increase immigration, the Township's population projection was revised to show a 1.2% annual increase starting in 2022.

During 2019, in response to concerns expressed by MECP, the Township committed to undertaking the investigations and modelling to demonstrate that it can develop the full capacity of Stage 3. Submission of this work by Golder Associates was submitted to the Ministry in February 2021. We anticipate that the Ministry's review comments will result in a revised Development & Operation Plan being prepared and submitted to MECP during 2023.

During 2023, the Township will be considering the establishment of a Waste Diversion Sub-Committee to investigate and promote initiatives for the improvement of waste diversion.

6.2 MINISTRY INSPECTIONS AND CORRESPONDENCE

The last inspection was conducted by MECP (Emily Tieu) during 2018. The MECP did not conduct any inspections during 2022.

Based on a Memo from Lauren Forrester (MECP Kingston), the MECP Ottawa office forwarded a letter dated September 24th, 2019, to the Township requesting that a workplan and implementation schedule be submitted. The requested documentation was submitted to the MECP Ottawa office on October 22nd, 2019, by the Township. The workplan and schedule was prepared by Golder Associates in a letter to the Township dated October 3rd, 2019. Upon review of the documentation by MECP (Thandeka Ponalo), a November 6th, 2019 letter was forwarded to the Township providing comments on additional info that the Township should consider in undertaking the work.

During 2020, the Township authorized their Consultant Golder Associates to complete the investigations and modelling of groundwater and surface water to define potential impacts from landfill operations. This information was submitted to the Ministry in February 2021. Based on future comments from the Ministry reviewers, the Township is likely to have to prepare and submit a revised Development & Operation Plan for Ministry review during 2023.

6.3 REVIEW OF COMPLAINTS

The Township did not receive any written public complaints during 2022.

7 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions are reached for 2022 and recommendations are made for 2023 operations at the site, these are:

1. The landfill development plan is to provide one million m^3 of capacity using an area method of fill in three Stages/Cells: Stages 1, 2 and 3. The remaining capacity (125,417 m^3) in Stage 2 should be developed only after Stage 3 is full. During 2022, the Township consumed 10,745 cubic metres of capacity within Stage 3 and has a remaining capacity of 560,325 cubic metres (representing several decades of service life).
2. The remaining capacity of 560,325 cubic metres could decrease/change depending on the Ministry review comments of the Golder modelling report on groundwater impacts, as well as a consideration to not develop all of the remaining capacity of the south side of Stage 2 (where the access road is currently).
3. An interim cover was placed over Cell 2 in 2019/2020 and this area will be used for the management of contaminated soil while Stage 3 is being developed.
4. The Township operates a successful waste diversion program through curbside collection of recyclables and its depot program at its landfill. The program diverted 1253 tonnes or approximately 26.6% (by weight) of its waste stream from disposal in 2022. The curbside collection and depot programs for WEEE, scrap metal, grinding brush, waste oil (Renfrew), tires and other diversion programs represent a significant diversion and should be continued.
5. The Township entered into an agreement with eTrac – an extended producer responsibility (EPR) supplier, for the removal of tires. Additional agreements will become necessary as more products move to the new system for blue box material.
6. The Township should continue with its dual stream curbside collection of recyclables using Topps Environmental Solution and processing at the Emterra Group facility in Renfrew.
7. The agreement with the Town of Renfrew for household hazardous waste offers a valuable service at a reasonable cost and should be continued.
8. Granular fill needs to be imported to extend the base of Stage 3 northward to allow for continued development. Base preparation should continue in 2023 so that a platform width of approximately 80m is developed over the current cleared area of Stage 3 (refer to **Figure C-03** in Appendix C for clearing limits for initial development).
9. Perform an annual inspection of the weigh scale and maintain a record of the inspection and calibration (if necessary).
10. The Township should continue with the environmental monitoring program, as per Golder recommendation, and operations monitoring program as per Stantec recommendation. To respond to MECP concerns with the development of Stage 3, the Township should continue consultation with Ministry reviewers regarding the investigations, modelling and other activities described in the Golder Associates report. As Stage 3 remaining volume represents a significant

investment value in the million of dollars, implementing any additional measures that may be required to increase the level of protection for groundwater and surface water from Stage 3 operations is warranted.

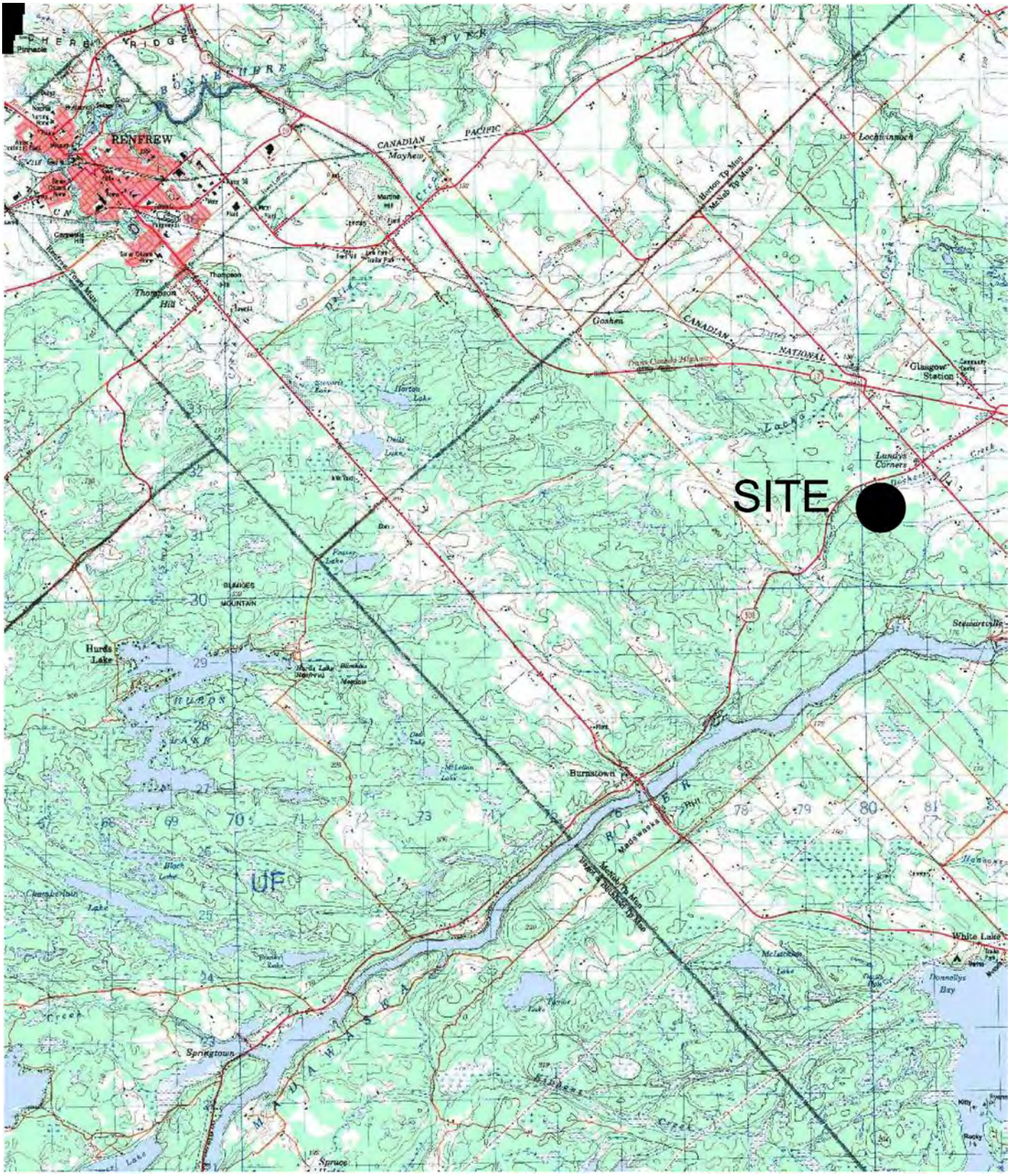
11. The Township's management did review the training manual with its staff during 2022. Township should continue to review the Training Manual with its staff annually and make any amendments, as necessary. A record of this review should be documented. Also verify that personnel safety requirements remain current (WHMIS, first aid, CPR, tetanus vaccination).

8 LIMITATIONS AND USE OF REPORT

In the preparation of this report, Stantec provides the benefit of its professional judgment based on its experience and in accordance with generally accepted professional standards for this type of project.

This report has been prepared for the exclusive use of the Township of McNab/Braeside for the purpose of annual operations monitoring and reporting at the subject property. Any use that a third party makes of this report, or any reliance on or decisions to be made on it, are the responsibility of such third parties. Stantec accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Appendix A FIGURES AND PHOTOS



\\ca0218-ppfss01\01-634\active\1634_01671\planning\drawing\2019 drawings\figures-06-02-01 - 2022

2023.01.23 1:53:10 PM

Stantec

Stantec Consulting Ltd.
300-1331 Clyde Ave.
Ottawa, ON K2C 3G4
Tel: (613) 722-4420
www.stantec.com

Client/Project
McNAB/BRAESIDE TOWNSHIP
McNAB/BRAESIDE WASTE DISPOSAL REPORT

Project No.
163401671

Title
LOCATION PLAN

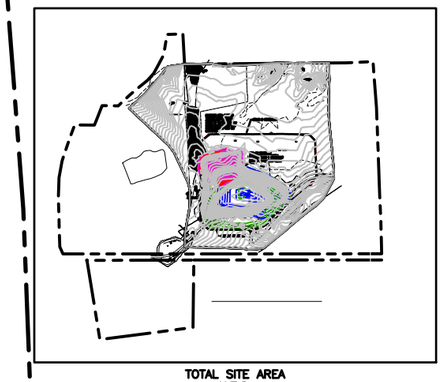
Date
2022.01.13

Drawing No.
FIG-1

BENCHMARK No.1 ELEV.152.494
NAIL IN NORTH FACE OF 0.80 MAPLE ABOUT 1.0m FROM GROUND. MAPLE IS LOCATED ON SOUTH EDGE OF BUSH OF WASTE SITE AND LEFT OF TRAIL TO GAS PIPE LINE.

BENCHMARK No.2 ELEV.143.932
NAIL AND WASHER IN NORTH EAST ROOT OF 0.2m HEMLOCK TREE. TREE IS LOCATED ON RIGHT OF TRAIL ON MOST WESTERLY EDGE OF BUSH TO WASTE SITE.

BENCHMARK No.5 ELEV.148.843
PAINT SPOT ON SLAB OF GARAGE DOOR



TOTAL SITE AREA
N.T.S.

DOCHART CREEK
LOT 19
LOT 18
LOT 17
BM#2
BM#1
BM#5
STAGE 3 FOOTPRINT
STAGE 1 FOOTPRINT
STAGE 2 FOOTPRINT
WET AREA
300ø CSP
CLEAN FILL HERE
POST & SECURITY
GATE
TRANS CANADA PIPELINE R.O.W.
GARAGE
OLD RAD ACCESS
TRAIL
TOTAL SITE AREA OF 64.3ha EXTENDS WESTWARD TO THE HIGHWAY
CONC. VI
ROAD ALLOWANCE BETWEEN CONCESSIONS V AND VI (UNOPENED)
CONC. V

Notes
1. SITE BOUNDARIES ARE DERIVED FROM REG. PLAN 48R-12786.
2. EXISTING CONDITIONS ARE BASED ON TOPOGRAPHIC SITE SURVEY BY Jp2g CONSULTANTS INC. DATED NOV. 19, 1990, SEPT. 15, 1999, JAN. 5, 2001, DEC. 6, 2001 AND DEC. 9, 2002.

Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved
The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend
- HISTORICAL METAL WASTE DISPOSAL AREA (NOW CLOSED)
- ROCK OUTCROP
- STAGE 1 FOOTPRINT
- STAGE 1 DESIGN WASTE CONTOURS
- STAGE 2 FOOTPRINT
- STAGE 2 DESIGN WASTE CONTOURS
- STAGE 3 FOOTPRINT

Client/Project
TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title
DESIGN WASTE CONTOURS
STAGE 1 AND STAGE 2

Project No. 163401671
Scale 0 15 45 75m
Drawing No. FIG-2A
Sheet of
Revision 0

\\cd2219-pproject\01-ESA\active\163A_01671\planning\drawing\2019 Drawings\FIGURES-06-02-01 - 2022.dwg
2022 January 25, 11:53 AM

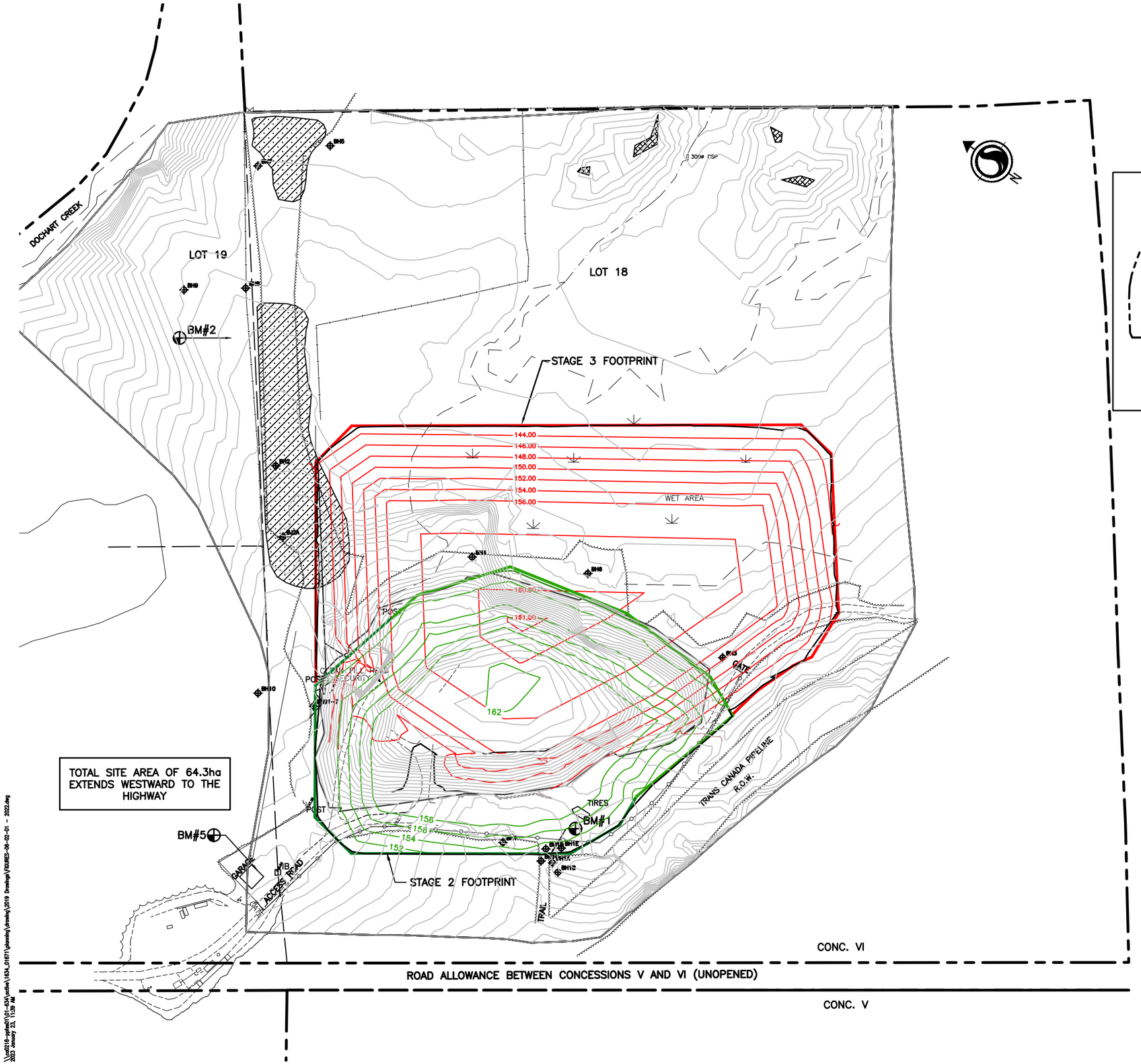
BENCHMARK No.1 ELEV.152.494
NAIL IN NORTH FACE OF 0.80 MAPLE ABOUT 1.0m FROM GROUND. MAPLE IS LOCATED ON SOUTH EDGE OF BUSH OF WASTE SITE AND LEFT OF TRAIL TO GAS PIPE LINE.

BENCHMARK No.2 ELEV.143.932
NAIL AND WASHER IN NORTH EAST ROOT OF 0.2m HEMLOCK TREE. TREE IS LOCATED ON RIGHT OF TRAIL ON MOST WESTERLY EDGE OF BUSH TO WASTE SITE.

BENCHMARK No.5 ELEV.148.843
PAINT SPOT ON SLAB OF GARAGE DOOR



TOTAL SITE AREA
N.T.S.



\\ca0218-pnfs01\01-KSA\active\163A_01671\planning\planning\2019 Drawings\FIGURES-06-02-01 - 2022.dwg
2022, January 21, 11:59 AM

Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved
The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend
- HISTORICAL METAL WASTE DISPOSAL AREA (NOW CLOSED)
- ROCK OUTCROP
- STAGE 2 FOOTPRINT
- STAGE 2 DESIGN WASTE CONTOURS
- STAGE 3 FOOTPRINT
- STAGE 3 DESIGN WASTE CONTOURS

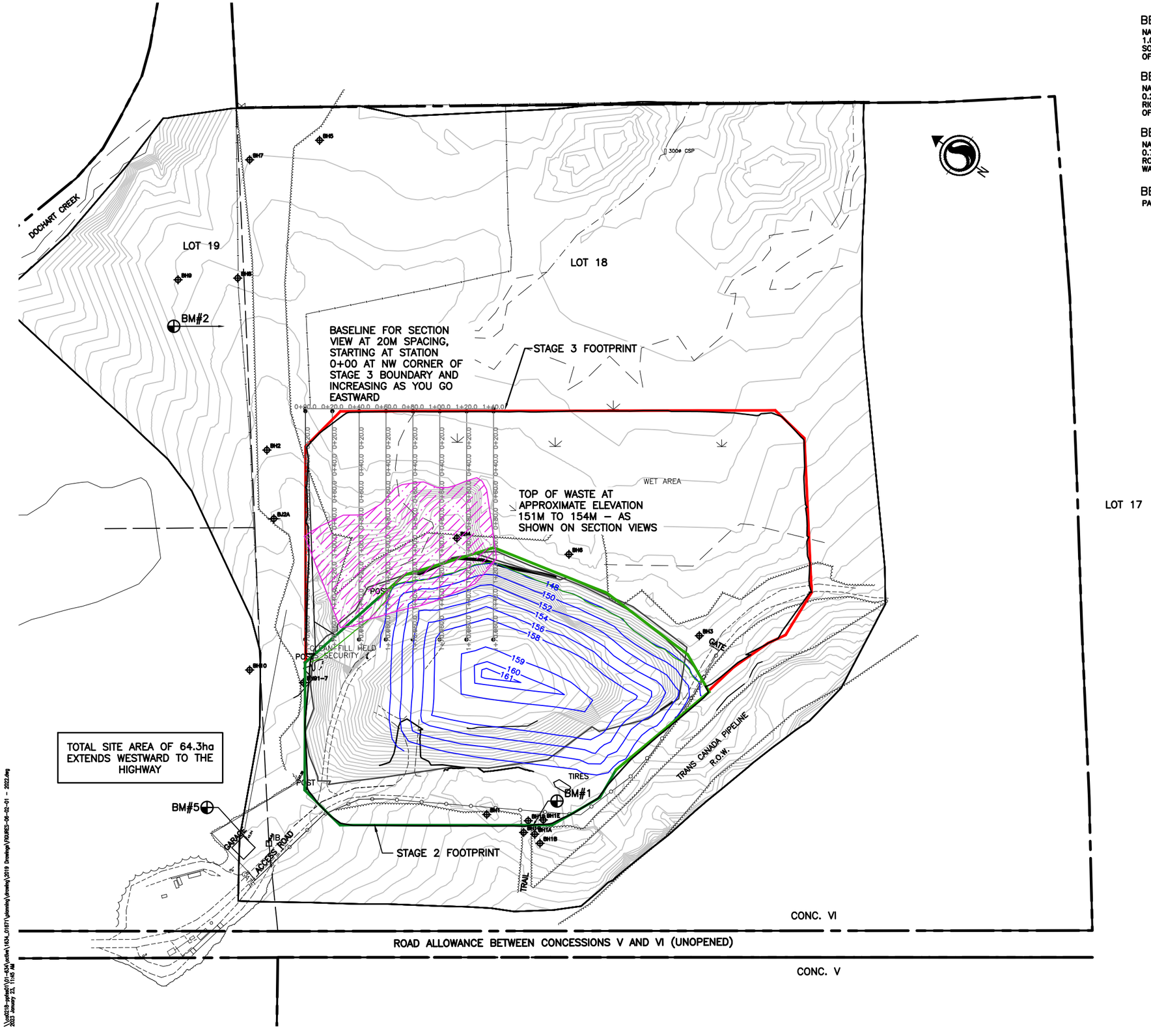
Notes
1. SITE BOUNDARIES ARE DERIVED FROM REG. PLAN 48R–12786.
2. EXISTING CONDITIONS ARE BASED ON TOPOGRAPHIC SITE SURVEY BY Jp2g CONSULTANTS INC. DATED NOV. 19, 1990, SEPT. 15, 1999, JAN. 5, 2001, DEC. 6, 2001 AND DEC. 9, 2002.

Client/Project
TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title
DESIGN WASTE CONTOURS
STAGE 2 AND STAGE 3

Project No. 163401671
Scale 0 15 45 75m
Drawing No. FIG-2B
Sheet of
Revision 0



BENCHMARK No.1 ELEV.152.494
NAIL IN NORTH FACE OF 0.80 MAPLE ABOUT 1.0m FROM GROUND. MAPLE IS LOCATED ON SOUTH EDGE OF BUSH OF WASTE SITE AND LEFT OF TRAIL TO GAS PIPE LINE.

BENCHMARK No.2 ELEV.143.932
NAIL AND WASHER IN NORTH EAST ROOT OF 0.2m HEMLOCK TREE. TREE IS LOCATED ON RIGHT OF TRAIL ON MOST WESTERLY EDGE OF BUSH TO WASTE SITE.

BENCHMARK No.3 ELEV.149.509
NAIL AND WASHER IN SOUTH WEST ROOT OF A 0.7m HEMLOCK TREE. FIRST TREE ON RIGHT OF ROAD APPROXIMATELY 5m PAST MAIN GATE TO WASTE SITE.

BENCHMARK No.5 ELEV.148.843
PAINT SPOT ON SLAB OF GARAGE FLOOR

Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved
The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

- CONTOURS
- STAGE 1 DESIGN WASTE CONTOURS
- STAGE 2 FOOTPRINT
- 2021 WASTE SURVEY
- EXISTING WASTE FOOTPRINT (pre 2014)

Notes
1. SITE BOUNDARIES ARE DERIVED FROM REG. PLAN 48R–12786.

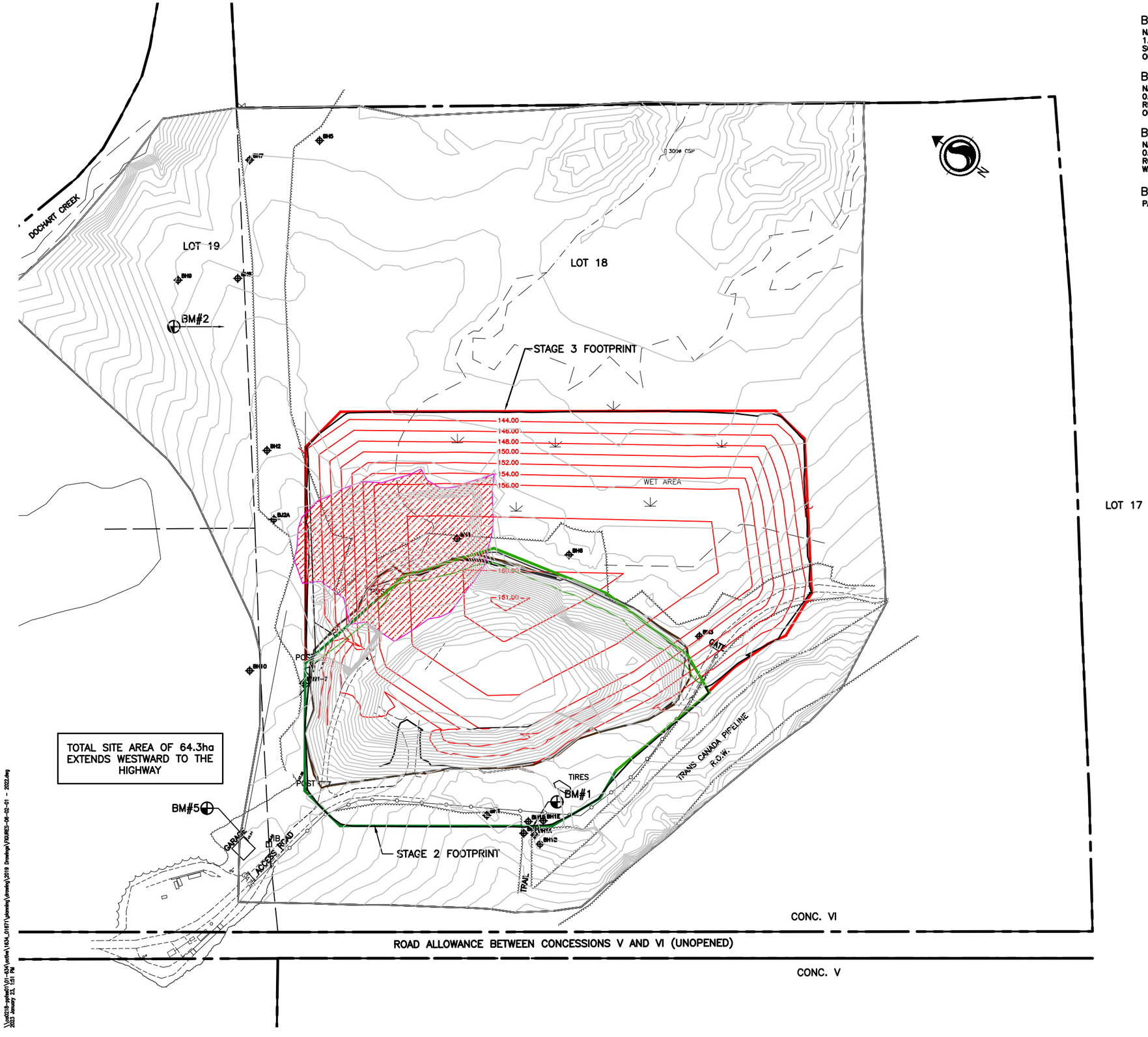
Client/Project
TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title
2021 WASTE CONTOURS

Project No. 163401671
Scale 0 15 45 75m
Drawing No. FIG-3
Sheet of
Revision 0

\\cd2165-pprfs01\01-ISA\active\163A_01671\planning\drawing\2019 Drawings\FIGURES-06-02-01 - 2022.dwg
2022 January 25, 11:45 AM



BENCHMARK No.1 ELEV.152.494
NAIL IN NORTH FACE OF 0.80 MAPLE ABOUT 1.0m FROM GROUND. MAPLE IS LOCATED ON SOUTH EDGE OF BUSH OF WASTE SITE AND LEFT OF TRAIL TO GAS PIPE LINE.

BENCHMARK No.2 ELEV.143.932
NAIL AND WASHER IN NORTH EAST ROOT OF 0.2m HEMLOCK TREE. TREE IS LOCATED ON RIGHT OF TRAIL ON MOST WESTERLY EDGE OF BUSH TO WASTE SITE.

BENCHMARK No.3 ELEV.149.509
NAIL AND WASHER IN SOUTH WEST ROOT OF A 0.7m HEMLOCK TREE. FIRST TREE ON RIGHT OF ROAD APPROXIMATELY 5m PAST MAIN GATE TO WASTE SITE.

BENCHMARK No.5 ELEV.148.843
PAINT SPOT ON SLAB OF GARAGE FLOOR

Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved
The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

- CONTOURS
- STAGE 2 FOOTPRINT
- STAGE 3 DESIGN WASTE CONTOURS
- 2022 WASTE SURVEY
- EXISTING WASTE FOOTPRINT (pre 2014)

Notes
1. SITE BOUNDARIES ARE DERIVED FROM REG. PLAN 48R-12786.

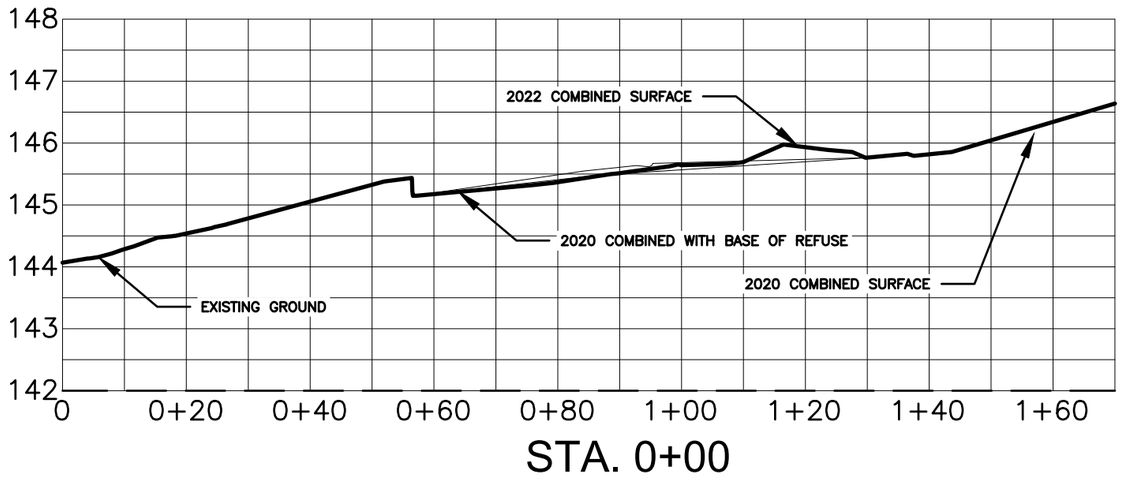
Client/Project
TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

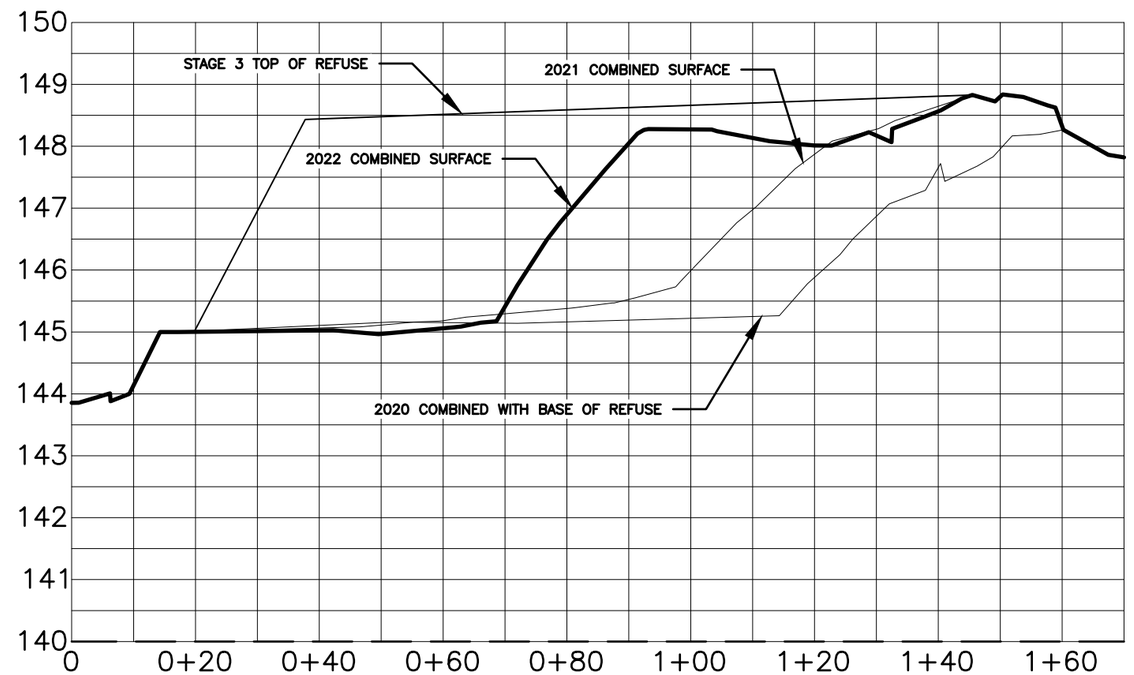
Title
2022 WASTE CONTOURS

Project No.	Scale	
163401671	0 15 45 75m	
Drawing No.	Sheet	Revision
FIG-4	of	0

\\cd2215-pgmad1\01-EA\active\163401671\planning\drawing\2019 Drawings\FIGURES-06-02-01 - 2022.dwg
2023 January 23, 1:51 PM



STA. 0+00



STA. 0+20

Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

Notes

2020 COMBINED SURFACE IS 2020 TOP OF WASTE OVERLYING EXISTING GROUND AND WASTE, 2020 COMBINED WITH BASE OF REFUSE IS 2020 THE TOP OF WASTE OVERLYING PROPOSED STAGE 3 DESIGN BASE CONTOURS, 2021 COMBINED SURFACE IS 2021 TOP OF WASTE OVERLYING 2020 TOP OF WASTE

SURVEY COMPLETED DECEMBER 6, 2022.

Client/Project

TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title

2022 SECTIONS
Sta. 0+00, Sta. 0+20

Project No. 163401671

Scale H 0 5 15 25m; V 0 0.5 1.5 2.5m

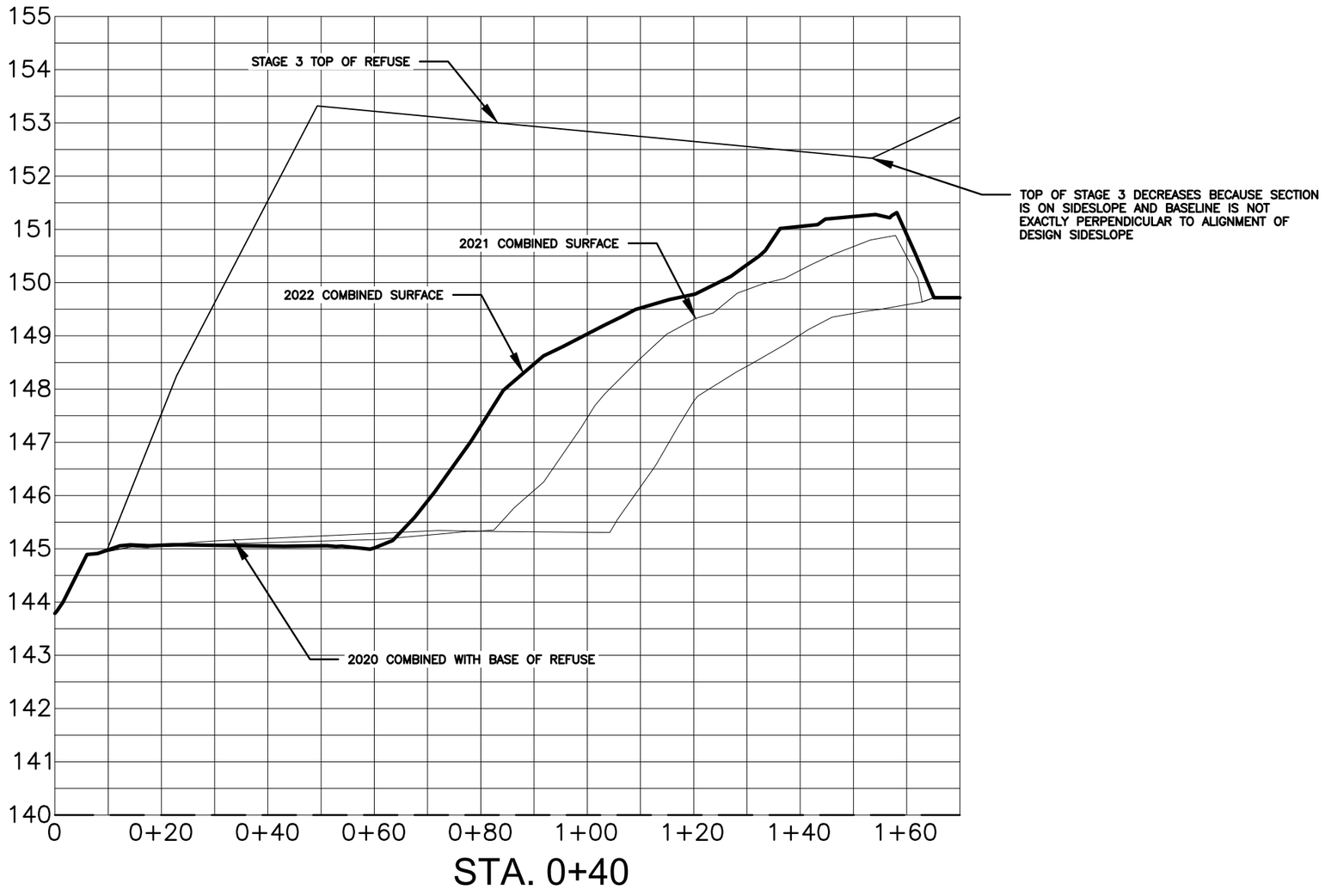
Drawing No. FIG-5

Sheet

of

Revision 0

\\cd2218-pfpa01\01-ASW\active\163401671\planning\drawing\2019 Drawings\FIGURES-06-02-01 - 2022.dwg
2023 January 23, 1:59 PM



STA. 0+40

Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

Notes

2020 COMBINED SURFACE IS 2020 TOP OF WASTE OVERLYING EXISTING GROUND AND WASTE, 2020 COMBINED WITH BASE OF REFUSE IS 2020 THE TOP OF WASTE OVERLYING PROPOSED STAGE 3 DESIGN BASE CONTOURS, 2021 COMBINED SURFACE IS 2021 TOP OF WASTE OVERLYING 2020 TOP OF WASTE

SURVEY COMPLETED DECEMBER 6, 2022.

Client/Project
TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title
2022 SECTIONS
Sta. 0+40

Project No.
163401671

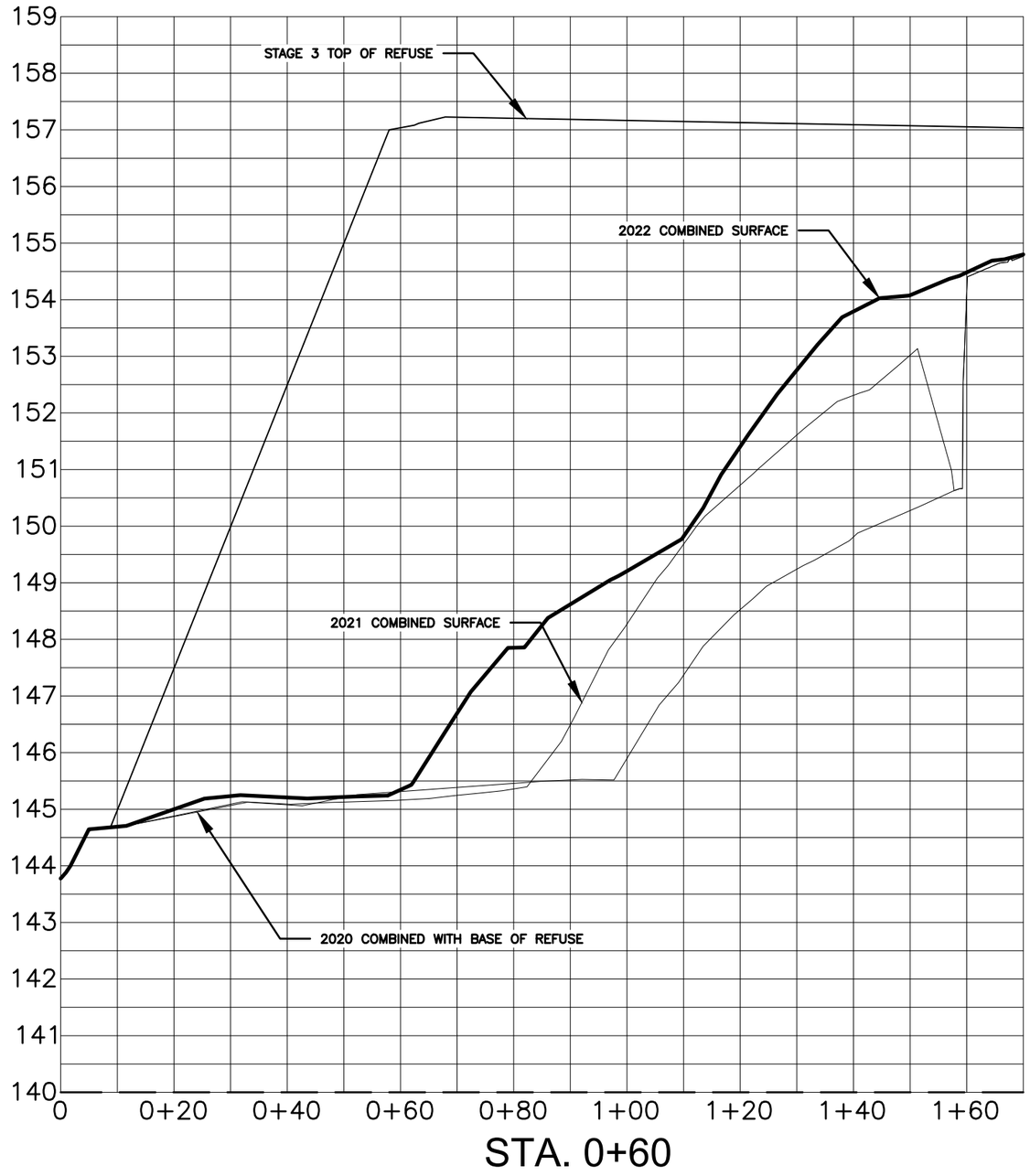
Scale H 0 5 15 25m
V 0 0.5 1.5 2.5m

Drawing No.
FIG-6

Sheet
of

Revision
0

\\ca0218-pfss01\01-KSA\active\163401671\planning\drawing\2019 Drawings\FIGURES-06-02-01 - 2022.dwg
2023 January 25, 10:17 AM



Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

Notes

2020 COMBINED SURFACE IS 2020 TOP OF WASTE OVERLYING EXISTING GROUND AND WASTE, 2020 COMBINED WITH BASE OF REFUSE IS 2020 THE TOP OF WASTE OVERLYING PROPOSED STAGE 3 DESIGN BASE CONTOURS, 2021 COMBINED SURFACE IS 2021 TOP OF WASTE OVERLYING 2020 TOP OF WASTE

SURVEY COMPLETED DECEMBER 6, 2022.

Client/Project

TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title

2022 SECTIONS
Sta. 0+60

Project No. 163401671

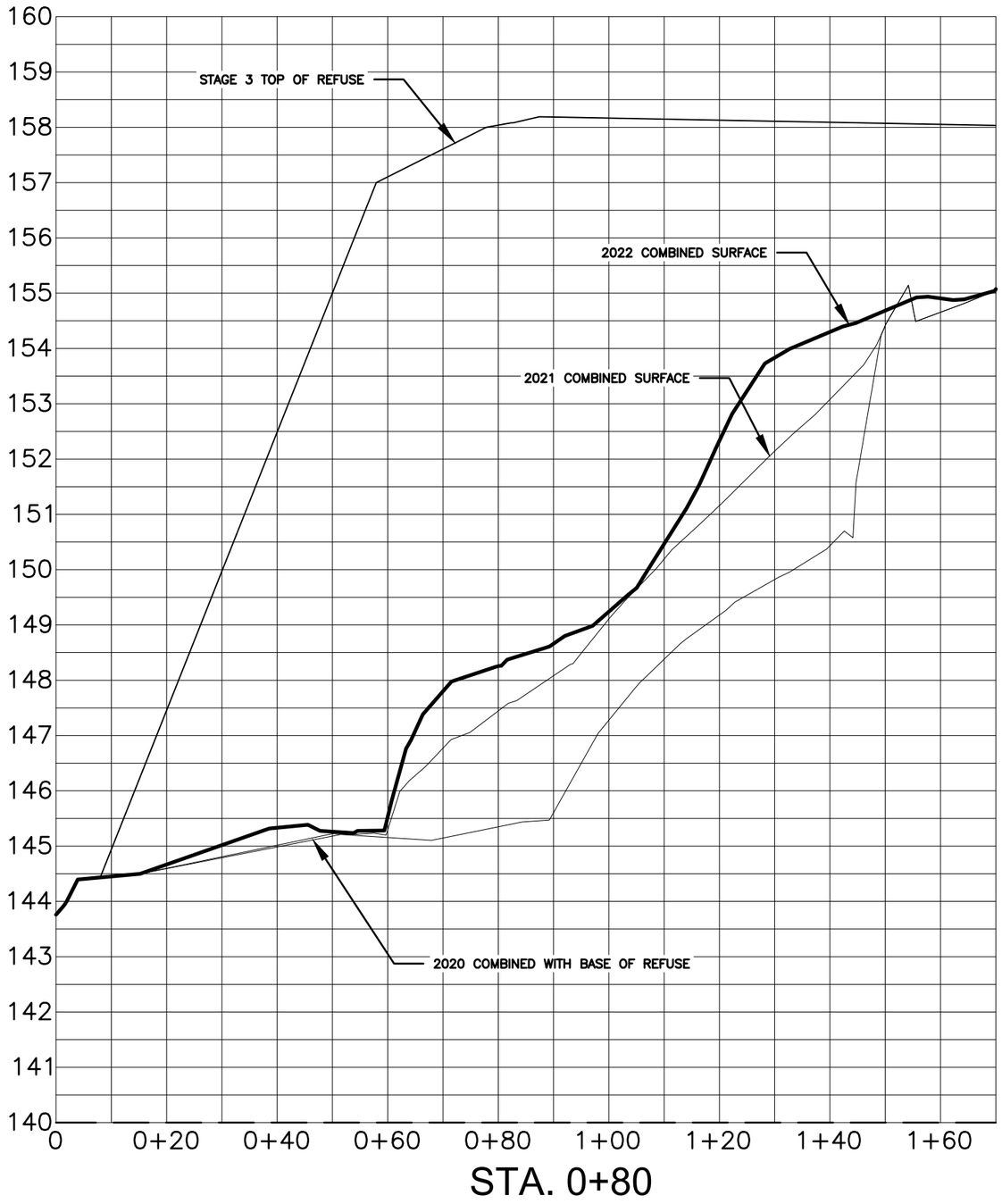
Scale H 0 5 15 25m
V 0 0.5 1.5 2.5m

Drawing No. FIG-7

Sheet of

Revision 0

\\ca0218-pnpst01\01-ESA\active\163X_01671\planning\drawing\2019 Drawings\FIGURES-06-02-01 - 2022.dwg
2022 January 23, 1:44 PM



Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

Notes

2020 COMBINED SURFACE IS 2020 TOP OF WASTE OVERLYING EXISTING GROUND AND WASTE, 2020 COMBINED WITH BASE OF REFUSE IS 2020 THE TOP OF WASTE OVERLYING PROPOSED STAGE 3 DESIGN BASE CONTOURS, 2021 COMBINED SURFACE IS 2021 TOP OF WASTE OVERLYING 2020 TOP OF WASTE

SURVEY COMPLETED DECEMBER 6, 2022.

Client/Project

TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title

2022 SECTIONS
Sta. 0+80

Project No.
163401671

Scale H 0 5 15 25m
V 0 0.5 1.5 2.5m

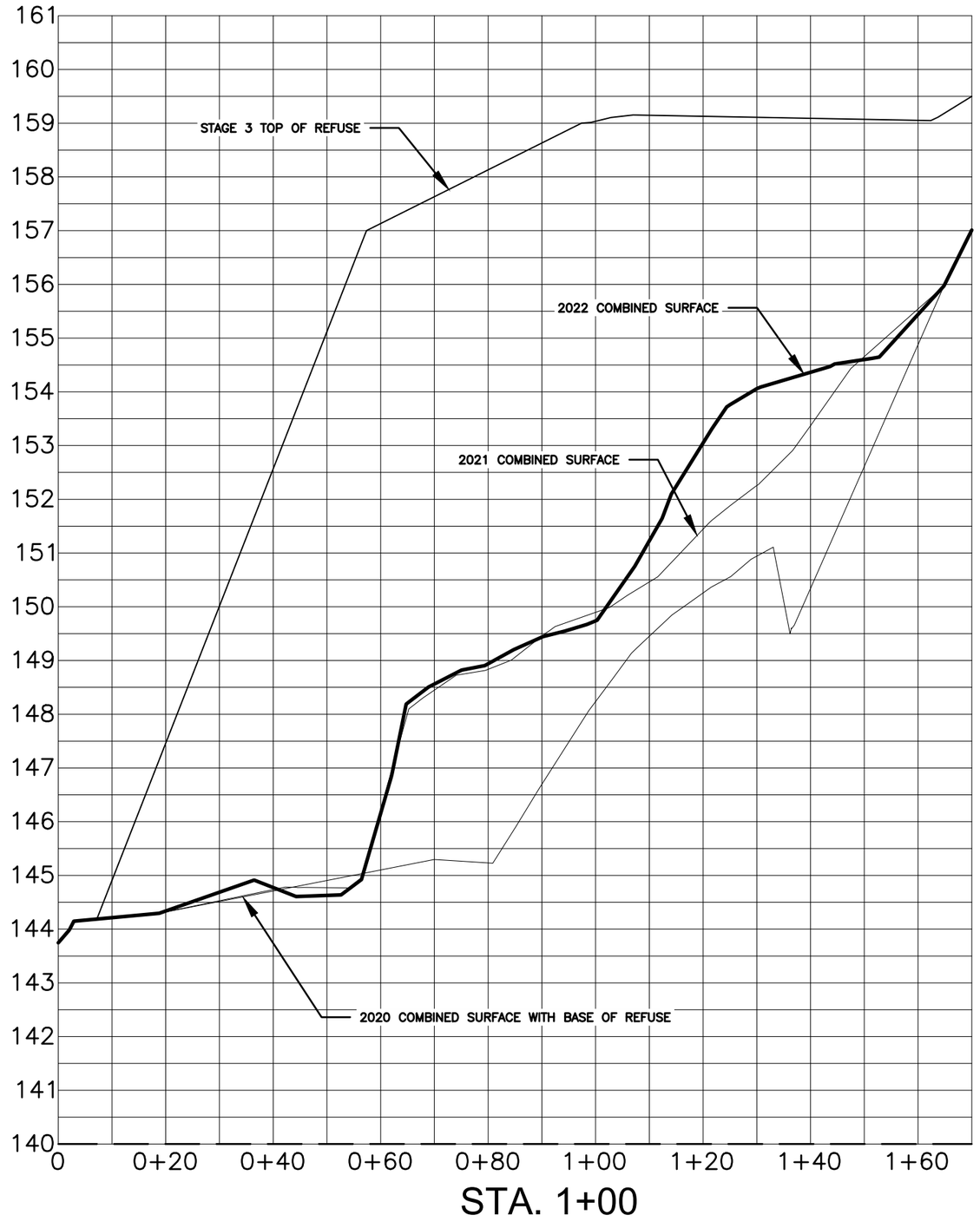
Drawing No.
FIG-8

Sheet

of

Revision
0

\\ca2219-pgfas01\01-ESA\active\1654_01671\planning\drawing\2019 Drawings\YEARLY\2022-06-02-01 - 2022.dwg
2023 January 25, 10:15 AM



Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

Notes

2020 COMBINED SURFACE IS 2020 TOP OF WASTE OVERLYING EXISTING GROUND AND WASTE, 2020 COMBINED WITH BASE OF REFUSE IS 2020 THE TOP OF WASTE OVERLYING PROPOSED STAGE 3 DESIGN BASE CONTOURS, 2021 COMBINED SURFACE IS 2021 TOP OF WASTE OVERLYING 2020 TOP OF WASTE

SURVEY COMPLETED DECEMBER 6, 2022.

Client/Project

TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title

2022 SECTIONS
Sta. 1+00

Project No. 163401671

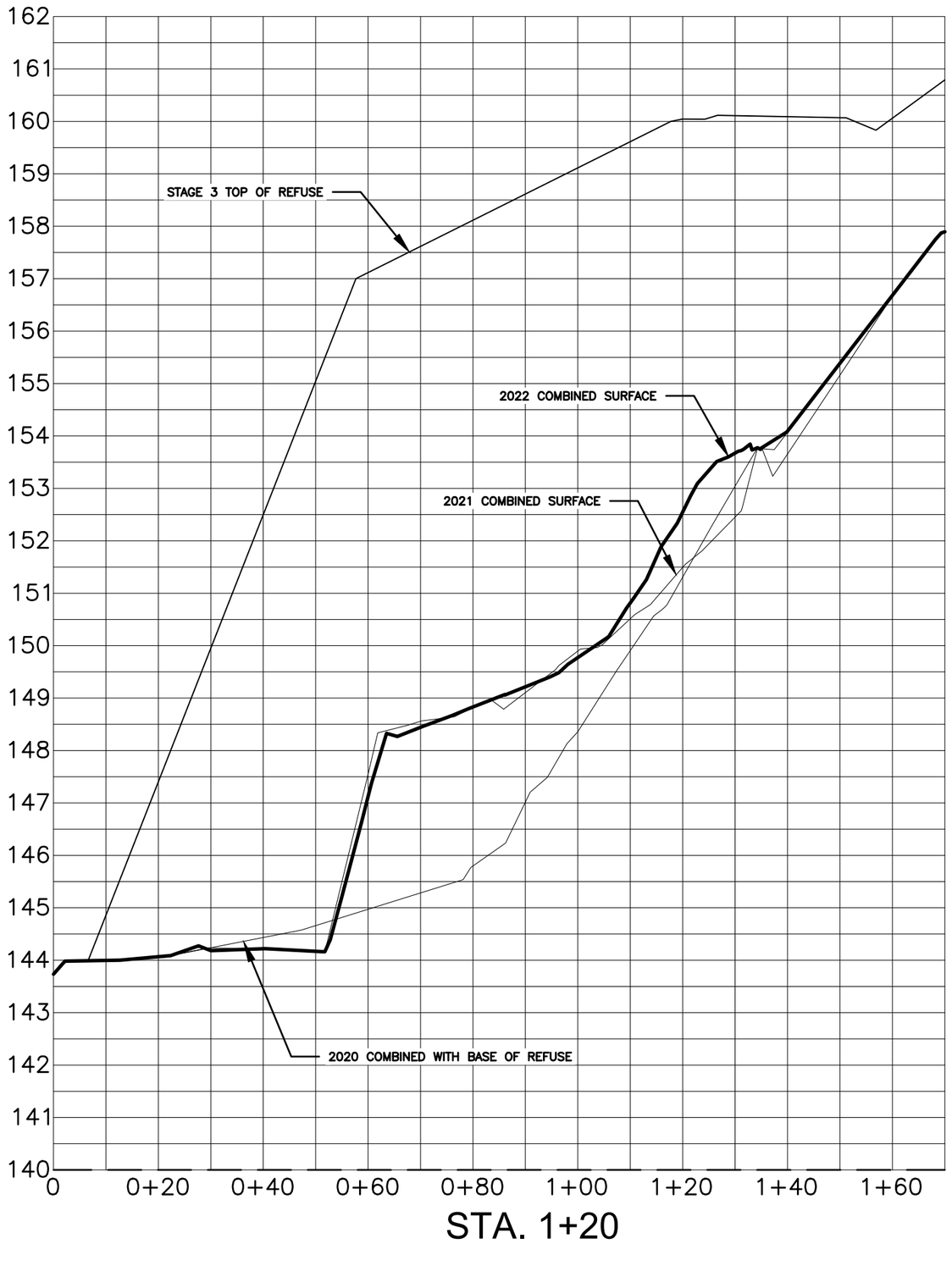
Scale H 0 5 15 25m
V 0 0.5 1.5 2.5m

Drawing No. FIG-9

Sheet of

Revision 0

\\ca0219-pgfpa01\VI-EA\active\163A_01671\planning\drawing\2019 Drawings\FIGURES-06-02-01 - 2022.dwg
2023 January 23, 1:45 PM



Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

Notes

2020 COMBINED SURFACE IS 2020 TOP OF WASTE OVERLYING EXISTING GROUND AND WASTE, 2020 COMBINED WITH BASE OF REFUSE IS 2020 THE TOP OF WASTE OVERLYING PROPOSED STAGE 3 DESIGN BASE CONTOURS, 2021 COMBINED SURFACE IS 2021 TOP OF WASTE OVERLYING 2020 TOP OF WASTE

SURVEY COMPLETED DECEMBER 6, 2022.

Client/Project

TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title

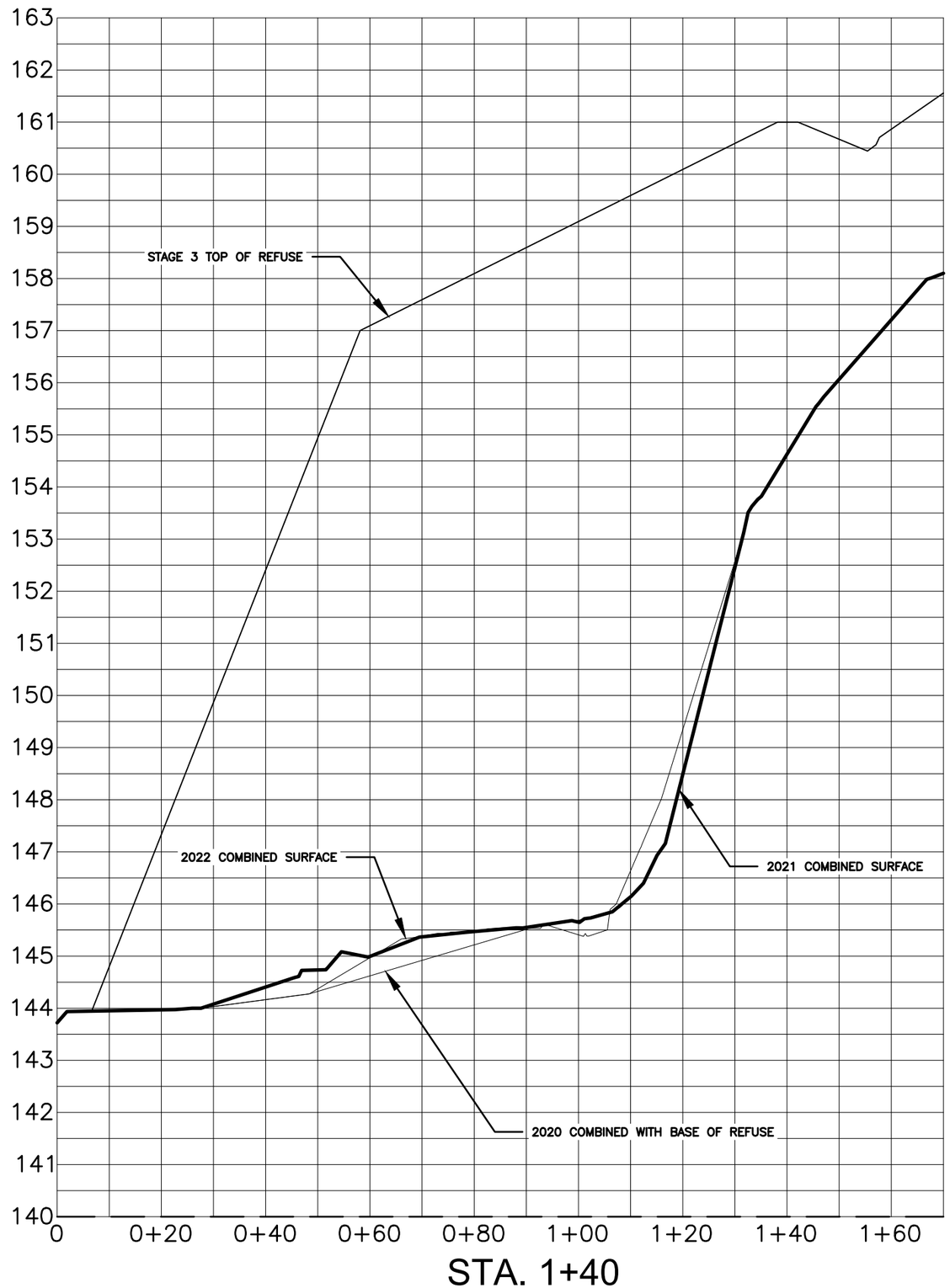
2022 SECTIONS
Sta. 1+20

Project No. 163401671

Scale H 0 5 15 25m
V 0 0.5 1.5 2.5m

Drawing No. FIG-10 of Sheet Revision 0

\\ca0218-pfpa01\01-ISM\active\163401671\planning\planning\2019 Drawings\FIGURES-06-02-01 - 2022.dwg
2023 January 23, 1:46 PM



STA. 1+40

Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

Notes

2020 COMBINED SURFACE IS 2020 TOP OF WASTE OVERLYING EXISTING GROUND AND WASTE, 2020 COMBINED WITH BASE OF REFUSE IS 2020 THE TOP OF WASTE OVERLYING PROPOSED STAGE 3 DESIGN BASE CONTOURS, 2021 COMBINED SURFACE IS 2021 TOP OF WASTE OVERLYING 2020 TOP OF WASTE

SURVEY COMPLETED DECEMBER 6, 2022.

Client/Project

TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title

2022 SECTIONS
Sta. 1+40

Project No.
163401671

Scale H 0 5 15 25m
V 0 0.5 1.5 2.5m

Drawing No.
FIG-11

Sheet

of

Revision
0

\\cd2218-pprod01\01-ESA\active\163401671\planning\planning\2019 Drawings\FIGURES-06-02-01 - 2022.dwg
2023 January 23, 1:56 PM



Photo 1 – Scrap metal and WEEE area



Photo 2 – Weigh Scale



Photo 3 – Waste Oil (not in operation)



Photo 4 – Active face of Stage 3A (May 2022)

Stantec

Client:	Township McNab Braeside
Project:	2022 Annual Operation Report
Date:	May 2022
File:	163401671



Photo 5 – Brush area south of Stage 2



Photo 6 – Looking north/easterly along access road to active face



Photo 7 – Looking east at active face in Stage 3A



Photo 4 – Looking north/west at active face in Stage 3A

Stantec

Client:	Township McNab Braeside
Project:	2022 Annual Operation Report
Date:	September 2022
File:	163401671

Appendix B ENVIRONMENTAL COMPLIANCE APPROVAL, AND BY-LAW 2022-96

CORPORATION OF THE TOWNSHIP OF McNAB/BRAESIDE
By-Law No. 2022-96

Being a By-Law to Establish Fees and Charges for services or use of municipal property.

WHEREAS Section 391(1) of the Municipal Act, 2001 provides that a municipality may impose fees or charges on any person, municipality, local board and the crown.

(1) for services or activities provided or done by or on behalf of it;
(2) for costs payable by it for services or activities provided or done by or on behalf of any other municipality or local board; and
(3) for the use of its property including property under its control.

NOW THEREFORE the Council of the Corporation of the Township of McNab/Braeside enacts as follows:

1. The fees and charges set out on the attached Schedules are hereby imposed as follows:

Schedule "A" – Administration
Schedule "B" – Building
Schedule "C" – Septic
Schedule "D" – Development Charges
Schedule "E" - Planning
Schedule "F"- Waste Management
Schedule "G"- Recreation
Schedule "H" -Museum
Schedule "I" - Animal Control
Schedule "J" – Fire Department
Schedule "K" - Roads Dept.
Schedule "L" – Market Fees
Schedule "M" – Clay Bank Park

2. All fees and charges set out in this by-law shall be payable prior to the provision of the service unless an agreement in writing is made to the contrary and approved by the CAO/Clerk and/or Council.

3. In the event any fee or charge imposed herein remains unpaid after provision of the service or is otherwise in arrears, such fees or charges may be added to the Tax Roll for any real property in the municipality, the owner of which is responsible for paying the fee or charge and shall be collected in like manner as municipal taxes.

4. Council does hereby delegate to the CAO/Clerk, the authority to administer such fees and charges and approve such forms and procedures as may be required for the efficient administration of the fees and charges.

5. The fees set out in this By-Law shall be increased at the rate of inflation, based upon the Consumer Price Index for Ontario, when Council deems it appropriate.

6. The fees set out in the By-Law shall exclude Harmonized Sales Tax (HST) as applicable unless otherwise noted.

BE IT FURTHER ENACTED, that all By-Laws or parts thereof, and all or any resolutions of Council contrary thereto, or inconsistent herewith, be and the same are hereby repealed

READ a first time this **20th day of December, 2022.**

READ a second time this **20th day of December, 2022.**

READ a third and final time and passed this **20th day of December, 2022.**

MAYOR

CAO/CLERK

By-Law No. 2022-96
Schedule "F" - Waste Management

Tipping Fees at the Landfill Site - 573 Calabogie Rd.

Garbage Bag	$2.00
Mixed Waste (Household and Construction/Demolition	
Material Flat Rate (200 kg & under)	$ 15.00
Per Tonne	$ 90.00 per metric tonne*
Hydrocarbon Contaminated Soils (Pre-approved)	$ 90.00 per metric tonne*
Stumps and Contaminated Wood	$ 90.00 per metric tonne*
All refrigerated appliances	no charge
Sorted, flattened and recycled corrugated cardboard	no charge
Scrap metal including white goods	no charge
All recycling items listed in the recycling contract	no charge
Clean wood, free of paint or stain	no charge
Garden waste and leaves (free of household garbage)	no charge
E-waste - Computers, Monitors and other Electronics (Do not accept parts or incomplete or broken screens)	no charge

Open September to April Uncontaminated** Motor/Engine oil

(up to 25 litres)	$3.50
(25 - 50 litres)	$7.00

Open May-August Household Hazardous Waste Depot (376 Bruce Street, Renfrew) – Free drop off of household waste for Township Residents.

All Tires - Cars, trucks, tractors	No Charge
Blue Boxes - available at the Municipal Office	$8.00 incl. HST

Tipping Fee at the curbside, the maximum limit is two bags per week each additional bag must be tagged with yellow tag for pickup.

Yellow Tag	$2.00

*If the scales at the landfill site are not operational due to a power outage or maintenance, the following tipping fees shall apply:

Car, single axle trailer, towed by car, half ton truck or van	$15.00
Half ton and single axle trailer	$30.00
Tandem axle trailers, farm wagons	$65.00
Single axle truck	$150.00
Single axle packer truck, tandem truck	$300.00
Tandem packer truck	$400.00
Tractor trailers	$700.00
Un-compacted waste, roll off bins and tri-axle truck	$15.00/ cu. yd.
Stumps	$15.00/ cu. yd.

**not mixed with other types of oil

Environmental Compliance Approval

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

The Corporation of the Township of McNab/Braeside
2508 Russett Dr R.R. 2
Arnprior, Ontario
K7S 3G8

Site Location: McNab Braeside Township Landfill
573 Calabogie Road
Lot West half of Lots 18 19, Concession 6
McNab-Braeside Township, County of Renfrew

You are hereby notified that I have amended Approval No. A412605 issued on June 10, 1980 and amended on April 7, 1993, September 30, 1998, April 14, 2000, December 4, 2000, 22nd February 2003, and March 12 2010 forWaste Disposal Site, as follows:

Following conditions are hereby added as follows:

49. Waste Storage and Processing

49.1 Following solid non hazardous waste received at the site can be processed once or twice in a year by contractor who have mobile waste management system certificate to process these types of wastes.

a) Yard waste (brush)

b) Construction and Demolition waste

c) Bulky items

49.2 Tires which are not accepted by Ontario Tire Stewardship can be stored at the site and disposed off at the tire recycling station by licensed hauler.

49.3 The maximum number of tires stored at any one time shall not exceed 3000 tire units

50. Alternate Daily Cover

50.1 The following processed solid non hazardous waste can be used as an alternate daily cover with minimum thickness of 150 mm.

1) Yard waste (Brush)

2) Construction and Demolition Waste

3) Bulky Items

50.2 The maximum volume of material stockpiled for processing at any time shall not exceed the annual requirement of daily cover.

50.3 The processed waste used as a daily cover referred in Condition 50.1 and petroleum hydrocarbon contaminated soil used as a daily cover as approved in condition 34 can be mixed such that the final mix of the various material does not exceed 2/3 of the final product mix.

50.4 Synthetic HDPE membrane may be used as an alternate daily cover.

The reasons for this amendment to the Approval are as follows

The reason for Condition 49 is to approve the processing of various waste material by contractor.

The reason for Condition 50 is to approve the various waste material to use as an alternate daily cover

The following item is hereby added to Schedule "A":

8. Application for a Provisional Certificate of Approval for a Waste Disposal Site dated December 16, 2015, and signed by Gerry Lalonde, P.Eng.and all attached supporting documentation

9. Letter dated April 12, 2016 from Gerry Lalonde, P.Eng., Stantec to Hirva Vyas, P.Eng.,regarding the revised information as per requested information

10. Email dated April 20, 2016 from Gerry Lalonde, P.Eng., Stantec to Hirva Vyas, P.Eng., MoECC

This Notice shall constitute part of the approval issued under Approval No. A412605 dated June 10, 1980

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 .....

Signature
....., P.Eng.
Director
Section .....

HV/
c: District Manager, MOECC Ottawa
Gerry Lalonde, Stantec Consulting Ltd., Stantec Consulting

6340041U

Ontario

Ministry of the Environment
Ministère de l'Environnement

AMENDMENT TO PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A412605
Notice No. 3
Issue Date: March 12, 2010

The Corporation of the Township of McNab Braeside
2508 Russett Dr., R.R. 2
Arnprior, Ontario
K7S 3G8

Site Location: McNab Braeside Township Landfill
573 Calabogie Road
Lot West half of Lots 18 & 19, Concession 6
Township of McNab Braeside, Renfrew County

You are hereby notified that I have amended Provisional Certificate of Approval No. A412605 issued on June 10, 1980 and all subsequent Notices for the McNab Braeside Township Landfill Site , as follows:

CONDITIONS

The following Condition is hereby added:

48. The waste diversion / storage bins shall be relocated, to a new area closer to the entrance, as per Figure No. 3 entitled Onsite Facilities, in the application dated September 15, 2009.

The following documents are hereby added to **Schedule "A"**:

7. Application for an Amendment to Provisional Certificate of Approval for a Waste Disposal Site, dated September 15, 2009 from The Corporation of the Township of McNab Braeside.

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

The relocation will improve the flow of traffic around the material storage area and reduce interference with future disposal operations.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A412605 dated June 10, 1980, as amended.

RECEIVED
MAR - 3 2003
TWP OF MCNAB/BRAESIDE

Ontario

Ministry of the Environment | Ministère de l'Environnement

AMENDMENT TO PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A412605
Notice No. 2

The Corporation of the Township of McNab/Braeside
2508 Russett Drive, R.R. #2
Arnprior, Ontario
K7S 3G8

Site Location: West 1/2 of Lots 18 & 19, Concession 6
McNab-Braeside Township, County of Renfrew

You are hereby notified that I have amended Provisional Certificate of Approval No. A412605 issued on June 10, 1980 and amended on April 7, 1993, September 30, 1998, April 14, 2000 and December 4, 2000 for a Waste Disposal Site, as follows:

I. Condition 18.6 is hereby revoked and replaced with:

18.6. The Site shall be permitted to operate during daylight hours, seven (7) days a week. All proposed changes to the hours of operation shall be subject to the written approval of the District Manager.

Condition 43 is hereby revoked and replaced with:

43. The surface water sampling program shall be conducted a minimum of two times a year. The water samples shall be collected on Dochart Creek at locations SW1, SW2 and SW3 which are situated up gradient and down gradient from the Site. The other surface water sampling locations are indicated in Item (1) of Schedule "A". All proposed changes to the monitoring program shall be subject to the written approval of the District Manager.

Condition 45.14 is hereby revoked and replaced with:

45.14 Proposed changes made in the monitoring program for the Site shall be subject to the written approval of the District Manager.

II. The following item is hereby added to Schedule "A":

7. Application for a Provisional Certificate of Approval for a Waste Disposal Site dated October 25, 2002 and signed by Noreen Mellema, CAO/Clerk, Township of McNab/Braeside.

8. Letter dated October 25, 2002 from Noreen Mellema, CAO/Clerk, Township of McNab/Braeside to Ian Parrott, MOE, Supervisor of Waste Unit, EAAB. Re: Amendment to Certificate of Approval No. A412605.

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

The reason for this amendment is to provide the MOE District Office with the ability to approve requests for changes in hours of operation, groundwater and surface water sampling and monitoring programs.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A412605 dated June 10, 1980

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 22nd day of February, 2003

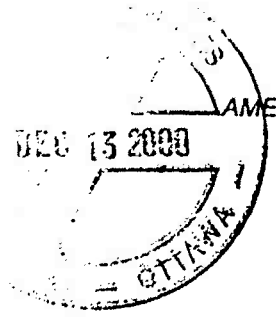
Ian Parrott, P.Eng.
Director
Section 39, *Environmental Protection Act*

DL/

c: District Manager, MOE Ottawa
Lauree Armstrong, Jp2g Consultants Inc.

Ontario

Ministry of the Environment | Ministère de l'Environnement



AMENDMENT TO CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A412605
Notice No. 1

Corporation of the Township of McNab/Braeside
2508 Russett Drive, R.R. #2
Arnprior, Ontario
K7S 3G8

Site Location: Waste Oil Transfer Station
W. 1/2 Lts. 18&19, Con. 6, E. 1/2 Lot 19, Con. 5
McNab-Braeside Township, County of Renfrew

You are hereby notified that I have amended Provisional Certificate of Approval No. A412605 issued on June 10, 1980 and amended on April 7, 1993, September 28, 1998 and April 14, 2000 for the McNab-Braeside Township Landfill Site, as follows:

1. The first paragraph on the front page should read as: "for the use and operation of 10.0 hectare landfilling area and the oil transfer station within a total site area of 64.3 hectares."

2. Condition 47 is added:

   47. The Township shall obtain the Certificate of Prohibition for the newly acquired 8.2 hectare parcel of land in accordance with the procedure described in Condition 46.

3. The following items are added to Schedule "A":

   5. A Letter from K.A. Marentette of Golder Associates to A.Dominsky of the MOE dated September 14, 2000 re: Notification on fulfillment of Condition 40 requirements of the Certificate of Approval No A412605 for the Township of McNab-Braeside Landfill Site; and

   6. Figure 7 (Rev.3), Stage 1 Development & Operations Plan prepared by Golder Associates and dated November, 2000.

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

The reason for Amendment 1 is to incorporate the newly acquired 8.2 hectare parcel of land into the total Site area.

The reason for Amendment 2 is to ensure the issuance of the Certificate of Prohibition for the newly acquired

8.2 hectare parcel of land.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A412605 dated June 10, 1980.

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 Appeal Board within 15 days after receipt of this Notice, require a hearing by the Board. 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 Appeal Board
2300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

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 Appeal Board's requirements for an appeal can be obtained directly from the Board 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 4th day of December, 2000

THIS IS A TRUE COPY OF THE ORIGINAL NOTICE MAILED
ON Dec. 7, 2000
I.C.

Andrzej Dominski, P.Eng.
Director
Section 39, *Environmental Protection Act*

991-2831

Post-it® Fax Note 7671	Date May 10/2000	# of pages ▶ 2
To Kris	From Jennifer M. Barr	
Co./Dept. Golder Assoc.	Co. McNab/Braeside	
Phone #	Phone # 623-5758 #2	
Fax # 613-224-9928	Fax # 623-9138	

AMENDMENT TO CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A412605
Notice No. 1

RECEIVED
APR 27 2000
TWP OF McNAB/BRAESIDE

Township of McNab/Braeside
2508 Russett Drive, R.R. #2
Arnprior, Ontario
K7S 3G8

Site Location: W. 1/2 Lts. 18&19, Con. 6, E. 1/2 Lot 19, Con. 5
McNab-Braeside Township, County of Renfrew

You are hereby notified that I have amended Provisional Certificate of Approval No. A412605 issued on June 10,1980 and amended on April 7,1993 and September 28,1998 for the McNab-Braeside Township Landfill Site, as follows:

1. The first paragraph on the front page should read as: "for the use and operation of 10.0 hectare landfilling area and the oil transfer station within a total site area of 56.1 hectares."

2 Condition 46 is added:

46. (a) The Township shall:

i) Within 60 days of the date of this Certificate, submit to the Director, for the Director's signature, two copies of a completed Certificate of Prohibition containing a registrable description of the Property, in accordance with Forms 4 & 5 of O. Reg. 14/92; and

ii) Within 10 calendar days of receiving the Certificates of Prohibition signed by the Director, register the Certificate of Prohibition in the appropriate Land Registry Office on title to the Property and submit to the Director the duplicate registered copy immediately following registration; and

(b) Pursuant to Section 197 of the Environmental Protection Act, neither the Township nor any person having an interest in the Property shall deal with the Property in any way without first giving a copy of this Certificate to each person acquiring an interest in the Property as a result of the dealing.

3. The following items are added to Schedule "A":

3. Application for approval of a Waste Disposal Site dated December 13,1999; and

4. Figure 7 (Rev.1), Stage 1 Development & Operations Plan prepared by Golder Associates dated February 15, 2000.

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

1 The reason for Amendment 1 is to incorporate the newly acquired 8.1 hectare parcel of land into a total Site area.

2. The reason for Condition (46) requiring registration of the Provisional Certificate of Approval is that Section 46 of the Environmental Protection Act, R.S.O. 1990, prohibits any use being made of the lands after they cease to be used for waste disposal purposes within a period of twenty-five years from the year in which such land ceased to be used for waste disposal, unless the approval of the Minister for the proposed use has been given. The purpose of this prohibition is to protect future users of the Site and the environment from any hazards which might occur as a result of waste being disposed of on the Site. This prohibition and potential hazard should be drawn to the attention of future owners and users of the Site by the Provisional Certificate of Approval being registered on title.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A412605 dated September 28, 1998.

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 Appeal Board within 15 days after receipt of this Notice, require a hearing by the Board. Section 142 of the Environmental Protection Act, provides that the Notice requiring the hearing shall state:

- The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
- The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

- The name of the appellant;
- The address of the appellant;
- The Certificate of Approval number;
- The date of the Certificate of Approval;
- The name of the Director;
- 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 Appeal Board
300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

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 Appeal Board's requirements for an appeal can be obtained directly from the Board 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 14th day of April, 2000

THIS IS A TRUE COPY OF THE ORIGINAL NOTICE MAILED

ON Apr 20 2000

SIGNED

Andrzej Dominski, P.Eng.
Director
Section 39, *Environmental Protection Act*

EZ/

c: District Manager, MOE Ottawa
Murray Yantha, Clerk-Treasurer, Township of McNab/Braeside

Under the Environmental Protection Act and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:

The Corporation of the Township of McNab/Braeside
R.R. No. 2
Arnprior, Ontario
K7S 3G8

You are hereby notified that the terms and conditions of the Provisional Certificate of Approval No. A 412605 *dated* June 10, 1980 and April 7, 1993, *issued to you, are amended by Notice and approval is granted.*

for the use and operation of 10.0 hectares landfilling area and oil transfer station within a total site are of 48.0 hectares.

all in accordance with the following plans and specifications: as listed in Schedule "A"

Located: Part of West ½ of Lots 18 and 19, Concession 6
Township of McNab
County of Renfrew

which includes the use of the site for an oil transfer station and only for the disposal of waste from the Township of McNab/Braeside *of the following categories of waste (Note: Use of the site for additional categories of wastes requires a new application and amendments to the Provisional Certificate of Approval)* domestic, commercial and non-hazardous solid industrial.

and subject to the following conditions:

The following revoke and replace the definitions contained in the Provisional Certificate of Approval dated April 7, 1993.

1.0 DEFINITIONS

For the purpose of this Provisional Certificate of Approval:

1.1 "Director" means any Ministry employee appointed by the Minister pursuant to Section 5 of the Environmental Protection Act;
1.2 "MOE" means the Ministry of Environment;
1.3 "District Manager" means the District Manager of the Ottawa District Office, Eastern Region of the Ministry of Environment;

1.4 "This Certificate " means Provisional Certificate of Approval No. A 412605, dated May 11,1998;
1.5 "Owner" means the Corporation of the Township of McNab/Braeside
1.6. "Site" means 10.0 hectares landfilling area within a total Site area of 48.0 hectares as shown on Plan 49R-12786 and Figure No. 2 Item 1, Schedule "A";
1.7 "Transfer Site" means the oil transfer station described in items 2, 3 and 4 on page 1 of the Provisional Certificate of Approval dated April 7, 1993;
1.8 "ODWO" means the Ontario Drinking Water Objectives dated February, 1994 (and as amended);
1.9 "RUPO" means the Ministry of the Environment Reasonable Use Policy Objectives (Policy no. B-7); and
1.10 "PWQO" means the Provincial Water Quality Objectives dated July, 1994 (and as amended).

GENERAL CONDITIONS

The terms and conditions listed in the Provisional Certificate of Approval dated June 10, 1980, and April 7, 1993 are continued in this Notice by the following new conditions listed below.

15. The Owner shall be bound by the conditions of this Certificate. The conditions of this Certificate shall extend to and bind any successor and/or subsequent Owner(s)/Operator(s) of this Site subject to the approval of the Ministry of the Environment (MOE).

16. The Site shall be operated and maintained by the Owner in accordance with all documents listed in the Schedule "A" of this Certificate.

17. The Site service area shall include the Corporation of the Township of McNab and the Village of Braeside.

18. The Owner shall place a sign at the main entrance to the Site on which is displayed, in prominent letters, the following information:

18.1 the name of the Site and the Certificate of Approval number for the Site;
18.2 the operating authority, telephone number and mailing address;
18.3 the hours the Site is open to accept waste from the public;
18.4 the telephone number for reporting emergency situations occurring at the Site during non-operating hours;

18.5 the waste acceptable for disposal at the Site; and tipping fee rates; and

18.6 The Site shall be permitted to operate daily 8:00 a.m. to 5:00 p.m. throughout the year. An approval to amend the time of operation can be granted from time to time by writing to the Director or the District Manager.

19. The Owner shall maintain daily records with monthly summary of the quantity and types of waste disposed of at the Site.

20. The following information shall be recorded on loads refused access to the Site for disposal purposes:

20.1 date;
20.2 name of persons;
20.3 company name on vehicle;
20.4 vehicle description of waste refused; and
20.5 reasons for refusals.

21. During non-operating hours of the Site, the entrance shall be locked.

22. No waste shall be received at the Site or removed from the Site, unless a Site Supervisor or his/her alternate (s) and/or designated person (s) are present to supervise the operation.

23. The Owner shall ensure that the Site Supervisor and/or designated alternative person(s) have been adequately trained with respect to the following procedures without limitations:

23.1 conditions and Schedules of this Certificate;
23.2 the operation and maintenance of this Site;
23.3 relevant waste management regulations and legislation;
23.4 environmental conditions and concerns related to waste handling operations at the Site; and
23.5 occupational health and safety activities pertaining to the workplace and waste handling operations at the Site.

24. Owner shall keep a copy of this Certificate and Schedule "A" at the Site.

SITE INSPECTION

Litter Control

25. Litter Control shall be carried out by the Owner in accordance with procedures described in Schedule "A".

Dust Control

26. The Owner shall take all necessary mitigative actions for dust control.

27. A dust suppressant shall be applied to the on-site roads, when dust becomes a problem during the dry periods of the year.

Pest Control

28. The Owner shall ensure that there are no pests that shall pose a hazard to the health and safety of persons.

Scavenging

29. The Owner shall ensure that there is no scavenging of waste at the Site.

Odour Control

30. The Owner shall operate the Site in such a manner to minimize off-Site impact of odours at all time.

Noise Control

31. The Owner shall operate the Site in such a manner to minimize noise impact from haulage trucks and operating equipment on the natural environment and persons.

Burning of Waste

32. The Owner shall ensure that there is no burning of waste at the Site.

33. The burning of brush, trees and clean wood piles can be conducted at the Site and shall be confined to the area as indicated in Figure 7, Item No.1, Schedule "A" and Section 4.21,of the Ministry of the Environment Guidance Manual For Landfill Site Receiving Municipal Waste, dated November, 1993.

Daily Cover

34. The minimum thickness of daily cover shall be 150 millimetres as indicated in Figures 10 and 11, Item no.1, Schedule "A";

34.1 The use of petroleum hydrocarbon contaminated soils as daily cover shall be subject to the Generator demonstrating to the Owner that the petroleum hydrocarbon contaminated soils is non-hazardous and meets Regulation 347 of the Ontario Environmental Protection Act.

34.2 The volume of petroleum hydrocarbon contaminated soils (was received at the Site shall be subject to the approval of District Manager. The volume of contaminated soils stored at Site shall not exceed the limitation of the annual daily co material requirements as determined by the previous annual repo

35. A suitable stock pile of clean granular cover material, which shall equivalent to 50% of the quantity of the required annual daily co material as outlined in condition 34, shall be maintained at the Site a contingency measure.

Intermediate Cover

36. The minimum thickness for the intermediate soil cover shall be millimetres as indicated in Figures 10 and 11, Item no.1, Schedule "A

Final Cover

37. The maximum height for the refuse ~~and final cover~~ shall not exceed 163 metres above the assumed elevation datum which gives a total Si capacity of 1,000,000 cubic metres for the Site as indicated in Figu No's. 5 and 6 of Item no.1, Schedule "A".

38. No waste shall be deposited at the Site after the final contours ha been attained as shown on Figure No's. 5, and 6 of Item No.1, Schedu "A". The final completed contours as noted in Condition 36, sha include 0.7 metre of final cover. The cover material shall include 600 millimetre thick layer of general clean earth material and a 1 millimetre layer of top soil, which is seeded.

Site Capacity

39. The total Site capacity of 1,000,000 cubic metres (air space calculation is based on an area of 10 hectares with a waste mou maximum height of 16.9 metres as indicated in Figures 5 and 6, Ite No.1, Schedule "A". This total site capacity shall be contingent on th Owner implementing a leachate collection system or by gaining contro over the leachate by acquiring buffer lands to service as leachat attenuation zone such as the privately owned parcel of land, Part 1 Plan 49R-8277, that is situated in the west part of Lot 19, Concessio 6, Township of McNab. This land parcel ~~land~~ which comprises th conceptual leachate actenuation zone is shown in Figure 7, Item No.1 Schedule "A".

40. The Owner shall purchase a minimum 30 metre buffer zone and gain control over the remaining conceptual leachate attenuation zone as described in condition 39. The Owner shall bring the Site into compliance within 2 years of the issuance of this Notice with the RUPO and 30 metre buffer zone requirement.

Groundwater Monitoring

41. The groundwater monitoring program shall be undertaken by the Owner in accordance with Item No. 2 in Schedule "A ". The Owner shall provide with the annual report an evaluation of the groundwater condition for long term monitoring purposes and the number of wells required on site to provide an accurate configuration of the hydrogeochemical conditions at the Site. The 1997 monitoring program indicates that RUPO are exceeded at the Site. The Owner in consultation with the Ministry of the Environment, Eastern Region Hydrogeologist shall amend the monitoring program to better assess the RUPO exceedance at the Site and provide recommendations to bring the Site into compliance. The proposed changes to the monitoring program shall be subject to the approval of the Director.

42. Groundwater geochemical quality exceeds RUPO at the east and north boundaries of the Site. The groundwater contamination is attributable to contamination originating from the Site at locations that were previously landfilled with metal waste and burnt garbage. The Owner shall provide to the Director a contingency and remediation implementation Schedule plan to address the off-Site contamination and to bring the Site into compliance. The financial cost for implementing the remedial action plan and abatement program shall be the responsibility of the Owner. The Contingency plan shall be implemented upon approval of the Director and within 2 years of the issuance of this Notice.

Surface Water Monitoring

43. The surface water sampling program shall be conducted a minimum of two times a year. The Water samples shall be collected on Dochart Creek at locations SW1, SW2 and SW3 which are situated up gradient and down gradient from the Site. The other surface water sampling locations are indicated in Items no.1, Schedule "A". All proposed changes to the monitoring program shall be subject to the approval of the Director.

Closure Plan Landfill Site

44. One year before the Site is expected to close and stop receiving waste, as determined by Conditions 36, 37 and 38, the Owner shall develop and submit an updated Closure Plan. The Closure Plan shall be submitted for the Director's approval and should outline post-closure maintenance and monitoring program. The plan shall include, but not be limited to the following:

44..1 Changes to the final contour plan that have occurred and have been previously identified in the annual reports or recommended in the development of the detailed closure plan;
44.2 fencing and access control;
44.3 details of any vegetative planting planned;
44.4 the sequence and schedules for the final cover installation;
44.5 post-closure and end-use plans;
44.6 plans and schedules for the management and continued monitoring of the surface water and groundwater;
44.7 plans and schedules for routine monitoring and maintenance of stormwater facilities; and
44.8 plans and schedules for the routine monitoring of leachate seeps, the final cover and Site settlement.

Annual Report

45. The Owner shall prepare and submit an annual report to the Director by March 31st, of the year following the calendar year covered by the report which shall include as a minimum, but not limited to the following:

45.1 a survey of the Landfill Site waste disposal area conducted every three years and a map illustrating existing contours. The frequency of the surveys can be changed from time to time by writing to District Manager for approval;
45.2 a summary of the total annual quantities of waste received on a quarterly basis for the Site;
45.3 a drawing(s) indicating all groundwater and surface water monitoring locations;
45.4 tables outlining monitoring locations, analytical parameters sampled and the frequency of sampling;
45.5 an interpretation of the surface water, groundwater and leachate monitoring data; a review of the adequacy of the monitoring programs; provide conclusions and recommendations for changes made in the monitoring programs;
45.6 an assessment of the groundwater quality as it relates to the RUPO and ODWO;

45.7 an assessment of the surface water quality with respect to the PWQO/Guidelines;

45.8 an update of any changes made in the operations, equipment, or procedures at the Site and Facility and operating difficulties encountered;

45.9 drawings showing the areas of fill, buffer areas, current landfill contours, percentages of available space utilized, and an estimate of the remaining disposal capacity and the landfill life span;

45.10 a summary discussion of landfill daily cover requirements and erosion protection;

45.11 a statement of compliance with all the conditions with respect to the inspection and reporting requirements as indicated in the Certificate;

45.12 a summary of any complaints made regarding the landfill Site operations and response from the Owner/Operator and the necessary actions taken to address these complaints;

45.13 recommendations with respect to any proposed changes made in the operation programs for the Site; and

45.14 proposed changes made in the monitoring program for the Site shall be subject to the approval of the Director.

SCHEDULE "A"

This Schedule "A" forms part of Provisional Certificate of Approval No. A 462605 and contains an application along with documentation submitted in support to this application:

1. "Report on Development, Operations and Closure Plan Waste Disposal Site, Township of McNab, Ontario," submitted to the Township of McNab by Golder Associates Ltd., dated June, 1997.

2. "Report on 1997 Groundwater and Surface water Monitoring Program, Waste Disposal Site Township of McNab, Ontario," prepared by Golder Associates Ltd., dated June, 1997.

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

1. Conditions 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33 34, 35 and 36 are to ensure the Site is operated in compliance and in accordance with the Provisional Certificate of Approval, EPA and other supporting documents submitted in Schedule "A".

2. Conditions 37, 38, and 39 are to ensure that Site capacity is not exceeded beyond final contours and adequate final cover is installed at the Site.

3. Condition 40 is included to ensure the Site is in compliance with Regulation 347, Section 11, of the EPA, because waste was deposited within the 30 metres buffer zone along the north property boundary. The Site is in non- Compliance with RUPO at the north property boundary.

4. Conditions 41, 42, and 43 are to ensure that the surface water and groundwater monitoring programs are conducted so that the Site is operated in compliance with the Ontario Water Resources Act, Environmental Protection Act and the conditions in this Certificate.

5. Condition 44 provides guidance to ensure that the Site is closed in accordance with the Certificate. The Site shall be maintained and inspected so that it causes no impact on the natural environment does not create a nuisance and poses no threat to the health and safety of persons. The long term maintenance of the Site shall be such that, it at all times be in compliance with the Ontario Water Resources Act, Environmental Protection Act and Conditions in this Certificate.

6. Condition 45 provides and outlines the requirements for the annual report that must be submitted to the Ministry. The annual report shall provide an update of all surface water and groundwater monitoring programs, waste placements, site plans and all other operational development activities on the Site as set out in the Certificate.

Ontario

In accordance with Section 139 of the Environmental Protection Act, R.S.O. 1990 c. E-19, you may by written notice served upon me and the Environmental Appeal Board within 15 days after receipt of this Notice, require a hearing by the Board. Section 142 of the Environmental Protection Act, as amended provides that the Notice requiring a 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 <u>each</u> portion appealed.*

In addition to these legal requirements, 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 Appeal Board,
2300 Yonge St., 12th Floor,
P.O. Box 2382
Toronto, Ontario.
M4P 1E4

<u>AND</u>

The Director,
Section 39, Environmental Protection Act,
Ministry of the Environment,
250 Davisville Avenue, 3rd Floor.
Toronto, Ontario.
M4S 1H2

DATED AT TORONTO this 30th *day of* September, 1998.

A. Dominski, P. Eng.,
Director,
Section 39,
Environmental Protection Act

SE/lf
cc: A.Polley, Ottawa District Office

Ministry of the Environment / Ministère de l'Environnement

Ontario

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

Under the Environmental Protection Act and Regulations, and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:
Aux termes de la Loi sur la protection de l'environnement et des règlements y afférents et sous réserve des restrictions qui s'y appliquent, ce Certificat provisoire d'autorisation est délivré à:

To: The Township of McNab
R.R. #2
Arnprior, Ontario
K7S 3G8

You are hereby notified that Provisional Certificate of Approval No. A412605 dated December 14, 1971 which was issued to you, is being amended as follows:

A. a) for the use and operation "of a 36 hectare landfilling site and oil transfer station".

b) all in accordance with the following plans and specifications:

1. Application for a Certificate of Approval for a Waste Disposal Site dated January 05, 1971.

2. Application for a Certificate of Approval for a Waste Disposal Site (Transfer) dated July 10, 1992.

3. Letter from the Township of McNab to the Ministry of the Environment dated July 10, 1992 containing the "Application for a Certificate of Approval for a Waste Disposal Site (Transfer)", and supporting information outlining an operational and management plan for the proposed waste oil transfer station.

4. Letter from the Township of McNab to the Ministry of the Environment dated March 10, 1993 outlining the revised plans for the waste oil storage tank.

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

Definitions:

"Certificate" means the entire certificate of approval including its schedules, if any, issued in accordance with Section 27, Part V of the Environmental Protection Act;

"Director" means Director of the Southeastern Region of the Ministry or his appointee;

"District Manager" means the District Manager of Ottawa District Office, Southeastern Region of the Ministry;

"Ministry" means the Ontario Ministry of Environment and Energy;

"Owner" means the Township of McNab;

"Operator" means the Township of McNab; its officers, employees, agents or contractors;

"Site" means the landfilling site described in this Notice and the Certificate;

"Transfer Site" means the oil transfer station described in items 2, 3 and 4 on page 1 of this Notice;

Addition of the following General Conditions:

The requirements of this Certificate are imposed pursuant to Part V of the Environmental Protection Act. The issuance of this Certificate in no way abrogates the operator's legal obligations to take all reasonable steps to avoid violating other applicable provisions of this legislation and the other legislation and regulations.

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

2. (1) The requirements of this Certificate are severable. If any requirement of this Certificate, or the application of any requirement of this Certificate to any circumstance, is held invalid, the application of such requirement to other circumstances and the remainder of this Certificate shall not be affected thereby.

(2) In all matters requiring the interpretation and implementation of the Certificate, the conditions of the certificate shall take precedence, followed in descending order by the operator's application and the documentation, referred to in this Certificate, which is submitted in support of the application.

3. The operator must ensure compliance with all the terms and conditions of the Certificate. Non-compliance constitutes a violation of the Environmental Protection Act and is grounds for enforcement.

4. (1) The operator shall, forthwith upon the request of the Director or District Manager, furnish any information requested concerning compliance with the Certificate including any records required to be kept by the Certificate.

(2) In the event the operator provides to the Ministry information, records, documentation of notification in accordance with the Certificate,

(a) the receipt of said information by the Ministry;

(b) the acceptance by the Ministry of the information's completeness or accuracy; or,

(c) the failure of the Ministry to prosecute the operator, or to require the operator to take any action, under the Certificate of any statute or regulation in relation to said information;

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

shall not be construed as the approving, excusing or justifying by the Ministry of any act or omission of the operator relating to said information, amounting to non- compliance with the Certificate or any statute or regulation.

(3) All records referred to in the Certificate shall be retained on file in a secure manner for a period not less than two years.

5. The operator/owner shall allow Ministry personnel, or a Ministry authorized representative(s), upon presentation of credentials, to carry out any and all inspections authorized by section 156, 157 or 158 of the Environmental Protection Act, as amended from time to time, of any place to which the Certificate relates; and, without restricting the generality of the foregoing, to:

(a) enter at reasonable times upon the premises, or the location where the records required by the conditions of the Certificate are kept:

(b) have access to and copy, at reasonable times, any records required by the conditions of the Certificate;

(c) inspect at reasonable times any facilities, equipment, practices, or operations required by the conditions of the Certificate; and

(d) sample and monitor at reasonable times for the purpose of assuring compliance with the conditions of the Certificate.

For the purposes of the Condition, "presentation of credentials" means:

(i) in the case of a provincial officer, production of a copy of his or her designation;

(ii) in the case of Ministry personnel, production of his or her Ministry Identification Card;

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

(iii) in the case of a Ministry authorized representative, production of a letter from the Director or District Manager authorizing entry and inspection in accordance with this condition.

6. (1) The operator shall notify the District Manager in writing of any of a change in ownership, the operator or termination of the transfer site within 30 days of the change occurring:

(2) The operator/owner shall ensure that all communications made pursuant to this Condition shall refer to the Certificate number for this site.

7. (1) In accordance with Section 19(4) of the Environmental Protection Act the Certificate, the application filed to obtain it and documentation referred to in the Certificate which may be reasonable necessary for a proper reading and understanding of it, shall be made available for public inspection at the request of any person.

(2) Additional information to that set out in subcondition (1) relating to the Certificate and contained in Ministry files may be made available to the public in accordance with the provisions of the Freedom of Information and Protection of Privacy Act.

8. Except as otherwise specified by the conditions in this Notice and the Certificate the transfer site shall be operated in accordance with the application dated July 10, 1992 and its supporting information described in items 2 to 4 on page 1 of this Notice.

9. (1) The operation of the waste transfer site is limited to the collection, temporary storage and transfer of waste oil, Class 252, as defined in the Ministry of the Environment "New Ontario Waste Classes" dated January, 1986, collected from residential and family farm sources in the municipalities of McNab, Renfrew, Arnprior, Horton, Bagot and Blythfield.

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

(2) No wastes other than those listed in subcondition (1) shall be collected and stored at the transfer site without amendment to the Certificate.

(3) No municipalities other than those listed in subcondition (1) shall use the transfer site without amendment to the Certificate.

(4) All waste shall be delivered to the site by the householder or the family farm operator responsible for the waste or by an approved waste management system. Each delivery is limited to 50 litres.

(5) The operation of the waste transfer site is limited to the operation and 1500 litres tank facility described in the supporting information for this Certificate and no other transfer facility shall be constructed or operated at the site without written approval from the District Manager.

(6) Storage of waste at the transfer facility shall not exceed 1500 litres without amendment to this Certificate.

10. (1) The waste transfer shall be supervised at all times when open. Access to the transfer site shall be limited to the hours of operation for the landfill site on which this facility is located.

(2) All personnel supervising the transfer site shall be aware of the waste types which may be collected at the transfer site and shall be knowledgeable about all aspects of the transfer site operation including the requirements under this Notice and the Certificate.

(3) Signs shall be posted at the entrance of the landfill site showing the hours of operation and giving notice of the types of waste permitted at the landfill and transfer sites.

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

(4) The storage tank shall be maintained under lock and key when site personnel are not in attendance.

(5) The storage tank shall be inspected daily during operating hours, by site personnel trained in contingency measures and all inspections shall be recorded and these records shall be maintained by owner/operator as described under Condition 5(3).

(6) The operator shall ensure that site personnel trained in contingency measures are on duty to receive waste oil and during unloading operations at the site.

(7) The operator shall prepare Generator Registration Reports as required under Regulation 347 of the Ontario Environmental Protection Act.

11. (1) The operator shall establish separate record systems for the waste received at the transfer site which shall include, but not necessarily be limited to, the documentation of quantities of waste received at the transfer site; shipping dates and volumes of waste delivered to approved transfer and processing sites; and the documentation of environmental and other problems experienced in operating transfer.

(2) The information collected under section (1) shall be submitted in a report to the District Manager on or before March 31 of each year, with the first report due in 1994, and for each year of operation or until the Director or the District Manager has given notice, in writing, that these submissions are no longer required.

12. (1) The operator shall ensure that the landfill site and the transfer site are operated in a safe and secure manner; that the operation of the transfer site does not impede or is impeded by the landfill operation on which the transfer site is located; that the wastes are properly handled, contained and stored; and that the general public, site personnel and the environment are protected.

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

(2) Within 30 days of the issuance of this Notice the operator shall prepare a operation manual for the transfer site for use by site personnel which shall contain, but not necessarily be limited to the following:

a) a outline of the responsibilities of site personnel;

b) personnel training protocols;

c) proper receiving, screening and recording procedures;

d) proper handling, storage and shipping procedures;

e) contingency procedures to be followed by site personnel in the event of fires or other emergencies.

A copy of the operation manual shall be submitted to the District Manager.

(3) The operator shall maintain a safe storage capacity for the transfer site which is consistent with the application for this Certificate and shall ensure that this capacity does the 1500 litre limit of the tank by providing regular movement of the wastes to approved transfer and processing facilities and sites.

(4) Notwithstanding Condition 2 the owner/operator shall ensure that adequate fire fighting equipment is available at the transfer site and that personnel are familiar with the use of such equipment and its location(s) on the transfer site.

(5) The local fire department shall be advised of the wastes collected at the waste transfer site and this Notice for the Certificate.

13. All waste shall be transported from the transfer site by an approved waste management system and shall be disposed of at waste landfill, transfer and processing sites certified to accept these types of wastes.

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

14. The approval for the transfer site on the landfill site expires with the termination of the transfer site; when all the wastes have been removed from this site; and the restoration of this site has been approved, in writing, by the District Manager; or if closure of the landfill site prohibits or prevents further use of the transfer site.

The reason for the imposition of Conditions 10 to 15 is to accommodate the waste Transfer Station amendment requested by the Township of McNab to the Ministry of the Environment in their application dated July 10, 1992.

The specific reason(s) for each condition is:

- Conditions 9 and 10 are to ensure that the transfer site is used only to collect, handle and transport waste approved under this Notice and the Certificate.
- Conditions 11 and 13 are to ensure that the waste transfer site is properly managed in an organized manner by adequately trained persons, in order to prevent environmental detriment; and to ensure the safety of the general public and site personnel.
- Condition 12 is to provide both the owner/operator and the Ministry of the Environment with an assessment of the waste transfer site.
- Condition 14 is to ensure that the collection, handling, reuse and transportation of all waste materials are conducted in an environmentally acceptable manner in accordance with provincial regulations.
- Condition 15 is to ensure the transfer area is cleaned up and restored to the satisfaction of the Ministry prior to closure.

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

Conditions 2 to 8 are standard conditions which are now incorporated in most waste site applications. Their purpose is to ensure that the applicant is aware of his rights and responsibilities under the Certificate.

The specific reason(s) for each condition is:

- Conditions 2, 3, 4, 5 and 8 are to clarify the legal rights and obligations of this Provisional Certificate of Approval.
- Condition 7 is to ensure that the transfer site is operated in accordance with the information submitted and not in any way which the Director has not been asked to consider;
- Condition 6 is to ensure that the appropriate Ministry staff have ready access to the waste disposal site to inspect the operations that are approved under this Provisional Certificate of Approval. The condition is supplementary to the powers of entry afforded a Provincial Officer pursuant the Environmental Protection Act, as amended.

You may, by written notice served upon me and the Environmental Appeal Board within 15 days after receipt of this Certificate, require a hearing by the Board. Section 142 of the Environmental Protection Act, R.S.O. 1990 c. E-19, as amended, provides that the notice requiring the hearing shall state:

1. **The portions of 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 <u>each</u> portion appealed.**

In addition to these statutory requirements, the notice should include:

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

l. The name of the appellant;
l. The address of the appellant;
. The Certificate of Approval number;
. The date of the Certificate of Appeal;
. The name of the Director;
. The municipality within which the works are located;

nd the notice should be signed and dated by the appellant.

his notice should be served upon:

he Secretary
nvironmental Appeal Board
12 St. Clair Avenue West
th Floor
ORONTO, Ontario
14V 1N3

AND

The Director
Section 39, E.P.A.
Ministry of the Environment
133 Dalton Avenue, Box 820
KINGSTON, Ontario
K7L 4X6

ated at Kingston this 7th day of April, 1993.

Director
Section 39, E.P.A.
Ministry of the Environment.

Pour obtenir une copie du present avis en francais, communiquer le Ministère de Environnement 613 549-4000.)

tes

Ministry of the Environment
Ontario

Provisional Certificate No. A 412605

PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE

Under The Environmental Protection Act, 1971 and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:

Township of McNab
R.R. # 2
Arnprior, Ontario

for the use and operation **of a 36 hectare landfilling site**

all in accordance with the following plans and specifications:

Located: **Part W.1/2 Lot 18, Concession VI**
Township of McNab
County of Renfrew

which includes the use of the site only for the **disposal** of the following categories of waste (NOTE: Use of the site for additional categories of wastes requires a new application and amendments to the Provisional Certificate of Approval) **Domestic, commercial, 5% non-hazardous solid industrial and 10% other, limited to brush, demolition debris and construction debris.**

and subject to the following conditions:

1. **No operation shall be carried out at the site after sixty days from this condition becoming enforceable unless this Certificate including the reasons for this condition has been registered by the applicant as an instrument in the appropriate Land Registry Office against title to the site and a duplicate registered copy thereof has been returned by the applicant to the Director.**

THIS IS A TRUE COPY OF THE ORIGINAL CERTIFICATE MAILED

ON JUN 12 1980

(Signed)

Dated this 10th day of June, 1980.

Director, Section 39,
The Environmental Protection Act, 1971

MOE 1408 (10/79)

Appendix C SITE OBSERVATION FORMS, CORRESPONDENCE, OTHER SUPPORTING INFORMATION

Stantec Consulting Ltd.
400-1331 Clyde Avenue
Ottawa Ontario, Canada
K2C 3G4
Tel: (613) 722-4420
Fax: (613) 722-2799

McNAB / BRAESIDE LANDFILL
OBSERVATION REPORT

Environmental Compliance Approval Number A412605

Authorized Operations – Landfill and Oil Transfer Station

Total Site Area – 64.3ha, Part of West ½ Lots 18, 19 Concession 6 Plan 49R - 12786

Service Area – Township of McNab/Braeside

Project Name: McNab/Braeside Landfill Observation Report

Project Number: 163401671 Task 200.101

Observation Date: May 17th 2022

Weather: Cloudy & rain +12^{0}C

Observations by: Gerry Lalonde

Site Supervisor: Ryan Frew

Reviewed by: Gerry Lalonde Date: May 17th, 2022

Submitted to: Ryan Frew Date: May 17th, 2022

Township Contact Number (613) 623-5756 (227)
Cell: 613-808-3748

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Entrance	Site locked during non-operating hours.	1	Inspection was done when site was open. Entrance road in good condition. New CSP installed at entrance in 2019.	None.	
Gate	Gate condition	2	Entrance gate is in reasonable condition. Access restricted through padlock.	None	
Main Entrance Sign	Sign to display; Name of Site; CofA number, Operating authority and their telephone number and mailing address; Hours of operation; Emergency telephone number; Waste types accepted; Tipping fees.	1	New entrance sign erected in 2014 with all information required by ECA, including tipping fees and operating authority mailing address. Sign is in good condition and legible.	None	Two new signs at entrance to advise users to maintain 2m separation distance and not accepting cash for payment
Hours of Operation	8:30 am to 4:00 pm unless amended by District Manager.	1	Hours posted on entrance sign shows 8:30am to 4:00pm.	None	
Screening	On site vegetation provides adequate screening.	2	Trees provide adequate screening.	None	
Supervision	Custodian on site when site open. Site is open on Tuesday, Thursday and Saturday.	2	Site was open on Tuesday. Township staff was present at scale house and on equipment (loader).	None.	Compactor was not operating during inspection.
Fence	Condition of fence.	2	Bear fence and page wire fences along the north and west limits have been removed due to the clearing of trees for Stage 3 development.	Reinstall page wire fence & bear fence along north & west limits once base preparation in Stage 3 is completed or bears become a nuisance, whichever comes first.	
Transportation	Condition of all season access roads. Signs to control speed on roads.	2	Speed sign (50km/h) posted at entrance and site access road is in good condition. Access to active face is in good condition.	None	
Dust Control	Control dust from traffic using an application of dust suppressant.	1, 2	Site access road is well graded and granulars recently applied for traction.	None.	
Custodian Shelter	Condition of structure. Information/signs provided for safety and emergency procedures, telephone locations and emergency contact names & numbers; fire extinguisher locations; spill response procedures.	3 1	New custodian shelter was constructed in 2011. Building exterior is in good condition. Weigh scale is operational.	Custodian shelter was not inspected as a precaution measure for Covid-19.	

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Electronics	Building and surrounding area are in a safe environment.		Electronics are stored in a steel bin container in diversion area near scale. Bin is full/slightly overflowing.	Contractor to empty bin as soon as possible	
On Site Signs	Conditions of signs at disposal areas, segregated products, waste oil.	2	Sign advises all users to report to weigh scale. Additional signage has been erected in 2014 for blue box materials. In 2019, new signs were installed at segregated material stockpiles. Signs direct users to designated areas. All signs are in good condition and legible.	None	New sign installed along access road to Stage 3A advising users to maintain 2m separation as a precaution for Covid-19
Equipment	What equipment is used to compact waste?		Caterpillar 816F is used for compaction. Crawler loader being used to spread waste.	Daily cover (sand) and chipped wood are being used for cover in Stage 3. Dozer and Bomag being used to shape waste.	Current disposal operations are within Stage 3A.
Noise	Can noise from on-site operations be detected at nearest sensitive receptor?	3	Equipment was operating during inspection. Separation distance to nearest receptors is deemed adequate to attenuate the noise.	None	
Surface Drainage	Grading to prevent s/w from flowing through waste. Grading to prevent ponding near toe.	3 3	Grading and CSPs have been installed along new road to Stage 3A with drainage directed towards bush along west limit.	None	
Surface Monitoring	Has any sampling been done since last inspection on Dochart Creek at locations SW1, SW2 and SW3?	2	Golder Associates does the sampling.	None	
Groundwater Monitoring	Any damage to any of 27 monitoring wells at 35 locations. Are monitoring wells in area of operations and protected?	2	Golder Associates does the sampling. Monitor BH4A/B within Stage 3 has been decommissioned by Golder Associates.	None.	
Landfill Gas	On site facilities are vented and no smoking signs posted at any enclosed facility.	3	Structures are above ground so natural ventilation is adequate to avoid potential for gas accumulation. Doors to maintenance shed left open so ventilation is available.	None	
Burning	Any evidence of waste being burnt? Can burn brush, trees and clean wood piles in designated locations. Is there a 30m fire break around piles.	1 2 3	Brush is stockpiled in Stage 3A. Stockpile is moderate in size.	Chip brush/wood pile and use woodchips for alternate cover.	
Odours	Are odours noticeable at nearest sensitive receptor or at property limit.	2	Odours are not noticeable at the weigh scale, at the site entrance or from Stage 3 area.	None	
Scavenging	No scavenging allowed. Any evidence of trespassers.	3	None observed.	None	
Pest Control	Any evidence of pests that can pose a hazard to the health and safety of site users.	2	No evidence of rodents.	None	
Vectors	Are birds or other animals a nuisance?		About 100 gulls and a few crows were observed at the top of the waste in Stage 3A at time of inspection.	None	Continue monitoring and review options for wildlife management if birds become a nuisance.
Litter Control	Is litter evident beyond waste pile? Is there a litter fence?	1 2	Wind-blown debris evidenced for most of the site and along the tree line of Stage 3A. More cover material needs to be applied to top of Stage 3A.	Organize general litter cleanup before vegetation growth makes it difficult to collect.	Install temporary snow fence to capture wind-blown debris along the east & west sides of Stage 3A.
Metal	Segregated and placed in containers for removal by scrap metal dealer.	2	Scrap metal bin is almost full. White goods stockpile along Cell 1 is small.to moderate.	Contractor responsible for scrap metal to empty containers within the next month or so.	

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Rubber Tires	Segregated and stored in a fenced area adjacent to the reuse building.	2	Tire stockpile along the south/west limit of Stage 1 has more than one full trailer load. Bin to accept tires has been placed near electronics bin – tire bin is currently full/overflowing.	Contractor responsible for tire removal to be advised to remove tires. Discuss potential for additional bin to get rid of excess tires in Stage 1.	Tire Collection Network is responsible for tire collection.
Other Diversion materials	Starting in August 2003, shingles were segregated and stockpiled for removal by recycler. Segregation was stopped around 2010 because of poor market conditions.		A sea container near the weigh scale accepts cardboard. Container is full. Blue box material can be deposited in plastic bins aligned along weigh scale.	Diversion area near weigh scale was mostly tidy. Contractor that handles cardboard to be advised to pick up cardboard.	
White Goods	Metal - in designated containers. Refrigerated Appliances – must have CFC refrigerant removed and stickers attached.	2	Small quantity of white goods is stockpiled next to the tire stockpile.		Minor amount of various waste on approach (by foot) to scrap metal bin. Use track loader to make one pass to collect waste and dispose in Stage 3A
Waste Oil Transfer Station	Storage of waste oil in a neat and safe environment. Ensure oil building is locked at the end of the day. Waste oil should only be stored in waste oil tank or in waste oil shed.	1	Since the spring 2019 inspection, waste oil is no longer accepted and sign on building advises users to bring their used oil to the Renfrew depot. Sign on fence advises that oil transfer station and platform are closed.	Waste oil containers from previous inspections have been removed from platform and surrounding area. Except for some wind-blown behind at rear of building, general area looks relatively clean.	
Footprint	Is footprint delineated by stakes/posts?	2	Stakes were placed to delineate the Stage 3 footprint in 2018. Stakes have been offset in vegetation so they are not clearly visible.	Marker stakes delimiting the edge of the waste footprint are mostly destroyed. As the waste placement in Stage 3A progresses towards the west, the toe of slope should be delineated.	
Waste Type	Domestic, commercial and non-hazardous solid industrial.	1	Only municipal waste observed.	None.	
Capacity • Stage 1 • Stage 2 • Stage 3	Maximum capacity of 1 million m^3 within a 10ha footprint as per Golder figure 7, revision 3. Capacity of 257,500 cm to height of 9.9m and area of 3ha. Capacity of 285,000 m^3 to height of 12.4m over 4.6ha. Capacity of 357,500 m^3 to height of 16.9m over area of 10ha.	2	Waste is being deposited in Stage 3A. Stantec/Golder discussed with Ryan Frew on where to locate disposal during 2020 within Stage 3A. Disposal to continue pushing eastward and close to toe of Stage 2. Stantec advised that a 40m wide (N-S) footprint following Stage 2 would provide in excess of 20,000 cubic metres of capacity – top of waste to match existing top of Stage 2.	Since early 2019, the Township has shifted disposal operations into Stage 3A. Ministry (MECP) staff have requested that an updated Development & Operation Plan be submitted for Stage 3. Township has deposited a lift of sand to extend the base for waste placement in Stage 3A. Active face in Stage 3A has reached height of Stage 2 for all of Stage 3A.	Once the current lift in Stage 3A reaches its west limit, the Townhip intends to shift the active face to the top of Stage 2 so users can dump their waste over the north facing side slope of Stage 2. Loader will then push the waste into Stage 3A to create a new lift within the existing pad.
Buffer	Maintain 30m minimum buffer around Stage 3 waste area.	2	Buffer distances to edge of property from proposed Stage 3A limits are acceptable.	None.	
Leachate	Any evidence/sign of leachate breakout on slopes or ponding near toe.	3	No evidence of leachate seeping observed along south slope of Stage 1.	None	
Daily Cover	Minimum thickness of 150 mm to be applied at the end of each working day.	1	Sand and woodchips are used as daily cover.	Use sand and chipped wood for cover material.	All chipped wood piles should be measured for reporting as waste diversion.
Daily Cover Stockpile	Keep clean granular material stockpile equal to 50 % of the quantity of the annual daily cover material.	1	Small stockpiles of sand observed in Stage 3A. Continue to use chipped wood mixed with sand as cover material for Stage 3A operations.		

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Intermediate Cover	Minimum thickness of 300 mm to be applied in areas not worked for 30 days. Remove cover before starting new lift.	1	Township has placed an interim cap over most of Stage 2. Minor changes observed to top of Stage 2 as decomposition/settlement occurs.	Few birds (gulls, crows) were observed during this inspection.	Once the first lift of Stage 3A is completed, Township intends to reopen the road to the top of Stage2 so that users can dump their waste over the Stage 2 side slope.
Closure	Has any areas reached final contours? Condition of closed areas (if any), 600mm of earth material and 100mm of topsoil and seeded.		Waste has not reached final approved contours.	None	Township awaiting comments from the Ministry (MECP) on a Golder report regarding the groundwater modeling done to support the lateral expansion in Stage 3.
Contaminated Soil	Petroleum hydrocarbon contaminated soils (non-hazardous and meet Reg. 347) can be used as daily cover provided the volume stored does not exceed the annual daily cover requirements and it is spread within the footprint, turned periodically for 7 days and then stockpiled for use.	1 2	Waste has now been deposited over former area designated for hydrocarbon impacted soil (Stage 2).	None	
Training	Has any training been provided to site custodian? Training of CofA, operation and maintenance.	3 1	Training is provided annually on safety issues.	Provide training once an updated Development & Operation Plan is approved.	
Records	Maintain daily records; Monthly summary of quantity and types of waste disposed; Copy of CofA at site.	1 1 1	All waste and sand (used for daily cover) coming onto site should be weighed and recorded.	Volume of wood chips after chipping (stockpile dimensions) to be measured so that some of the volume can count towards diversion.	
Loads Refused	Date; Name of person; Company name on vehicle and vehicle description; Waste refused; Reason for refusal.	1	Procedure in place for load refusal.	Municipal hazardous waste to be directed to the Renfrew hazardous waste depot.	
Instructions to Site Supervisor:					
Additional Comments: (1) (2)					

* Reference:

1 - Certificate of Approval Number A412605 dated September 30, 1998 and Notice 1 dated December 4, 2000.

2 - Golder Associates. June 1997. Site Development, Operations and Closure Plan, Township of McNab Waste Disposal Site.

3 - Ministry of the Environment. November 1993. Guidance Manual for Landfill Sites Receiving Municipal Waste.

Stantec Consulting Ltd.
400-1331 Clyde Avenue
Ottawa Ontario, Canada
K2C 3G4
Tel: (613) 722-4420
Fax: (613) 722-2799

McNAB / BRAESIDE LANDFILL
OBSERVATION REPORT

Environmental Compliance Approval Number A412605

Authorized Operations – Landfill and Oil Transfer Station

Total Site Area – 64.3ha, Part of West ½ Lots 18, 19 Concession 6 Plan 49R - 12786

Service Area – Township of McNab/Braeside

Project Name:	McNab/Braeside Landfill Observation Report	Observation Date:	September 1st, 2022
Project Number:	163401671 Task 200.101	Weather:	Sunny +20^{0}C

Observations by:	Gerry Lalonde		
Site Supervisor:	Ryan Frew		
Reviewed by:	Gerry Lalonde	Date:	Sept. 2, 2022
Submitted to:	Ryan Frew	Date:	Sept.2, 2022
Township Contact Number	(613) 623-5756 (227) Cell: 613-808-3748		

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Entrance	Site locked during non-operating hours.	1	Inspection was done when site was open. Entrance road was in good condition. New CSP installed at entrance in 2019.	None.	
Gate	Gate condition	2	Entrance gate is in reasonable condition. Access restricted through padlock.	None	
Main Entrance Sign	Sign to display; Name of Site; CofA number, Operating authority and their telephone number and mailing address; Hours of operation; Emergency telephone number; Waste types accepted; Tipping fees.	1	New entrance sign erected in 2014 with all information required by ECA, including tipping fees and operating authority mailing address. Sign is in good condition and legible. Two signs at entrance to advise users to maintain 2m separation distance and not accepting cash for payment.	None	
Hours of Operation	8:30 am to 4:00 pm unless amended by District Manager.	1	Hours posted on entrance sign shows 8:30am to 4:00pm.	None	
Screening	On site vegetation provides adequate screening.	2	Trees provide adequate screening.	None	
Supervision	Custodian on site when site open. Site is open on Tuesday, Thursday and Saturday.	2	Site was open on day of inspection. Township staff was present at scale house and on equipment (loader).	None.	Compactor was not operating during inspection.
Fence	Condition of fence.	2	Bear fence and page wire fences along the north and west limits have been removed due to the clearing of trees for Stage 3 development.	None	Reinstall page wire fence & bear fence along property limits if bears re-establish a presence..
Transportation	Condition of all season access roads. Signs to control speed on roads.	2	Speed sign (50km/h) posted at entrance. Site access road is in good condition with no dust. Access to Stage 3 is in good condition.	None	
Dust Control	Control dust from traffic using an application of dust suppressant.	1, 2	Site access road is well graded and with recent rain, no dust was observed.	None.	

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Custodian Shelter	Condition of structure. Information/signs provided for safety and emergency procedures, telephone locations and emergency contact names & numbers; fire extinguisher locations; spill response procedures.	3 1	Custodian shelter was constructed in 2011. Building exterior is in good condition. Weigh scale is operational.	None.	
Electronics	Building and surrounding area are in a safe environment.		Electronics are stored in a steel bin container in diversion area near scale. Except for one item, bin was empty.	None	
On Site Signs	Conditions of signs at disposal areas, segregated products, waste oil.	2	Sign advises all users to report to weigh scale. Additional signage has been erected in 2014 for blue box materials. In 2019, new signs were installed at segregated material stockpiles. Signs direct users to designated areas. All signs are in good condition and legible.	None	Sign installed along access road to Stage 3A advising users to maintain 2m separation as a precaution for Covid-19
Equipment	What equipment is used to compact waste?		Caterpillar 816F is used for compaction. Crawler loader being used to spread waste. Waste from compactor truck is being dumped from top of Stage 2 on to Stage 3A (north west corner of footprint).	Daily cover (sand) is being used for cover in Stage 3. Loader being used to shape waste.	
Noise	Can noise from on-site operations be detected at nearest sensitive receptor?	3	Equipment was operating during inspection. Separation distance to nearest receptors is deemed adequate to attenuate the noise.	None	
Surface Drainage	Grading to prevent s/w from flowing through waste. Grading to prevent ponding near toe.	3 3	Grading and CSPs have been installed along new road to Stage 3A with drainage directed towards bush along west limit.	None	
Surface Monitoring	Has any sampling been done since last inspection on Dochart Creek at locations SW1, SW2 and SW3?	2	Golder Associates does the sampling.	None	
Groundwater Monitoring	Any damage to any of 27 monitoring wells at 35 locations. Are monitoring wells in area of operations and protected?	2	Golder Associates does the sampling.	None.	
Landfill Gas	On site facilities are vented and no smoking signs posted at any enclosed facility.	3	Structures are above ground so natural ventilation is adequate to avoid potential for gas accumulation. Doors to maintenance shed left open so ventilation is available.	None	
Burning	Any evidence of waste being burnt? Can burn brush, trees and clean wood piles in designated locations. Is there a 30m fire break around piles.	1 2 3	Brush is stockpiled in Stage 3A. Brush stockpile is large in size.	Chip brush/wood pile and use woodchips for alternate cover.	
Odours	Are odours noticeable at nearest sensitive receptor or at property limit.	2	Odours are not noticeable at the weigh scale, at the site entrance or from Stage 3 area.	None	
Scavenging	No scavenging allowed. Any evidence of trespassers.	3	None observed.	None	
Pest Control	Any evidence of pests that can pose a hazard to the health and safety of site users.	2	No evidence of rodents.	None	

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Vectors	Are birds or other animals a nuisance?		About a dozen gulls and a few crows were observed at the top of the waste in Stage 3A at time of inspection.	None	Thick vegetative cover growing on Stage 2 is deterring gulls from this part of the footprint. Continue monitoring and review options for wildlife management if birds become a nuisance.
Litter Control	Is litter evident beyond waste pile? Is there a litter fence?	1 2	Wind-blown debris evidenced for most of the site and along the tree line and access road to Stage 3A..	Organize general litter cleanup before vegetation growth makes it difficult to collect. More cover material needs to be applied to top of Stage 3A	
Metal	Segregated and placed in containers for removal by scrap metal dealer.	2	Scrap metal bin is almost full. White goods stockpile along Cell 1 is of moderate size.	Contractor responsible for scrap metal to empty container within the next few weeks.	
Rubber Tires	Segregated and stored in a fenced area adjacent to the reuse building.	2	Tire stockpile along the south/west limit of Stage 1 has more than one full trailer load. Bin to accept tires has been placed near electronics bin – tire bin is currently full/overflowing.	Contractor responsible for tire removal to be advised to remove tires. Discuss potential for additional bin to get rid of excess tires in Stage 1.	Tire Collection Network is responsible for tire collection.
Other Diversion materials	Starting in August 2003, shingles were segregated and stockpiled for removal by recycler. Segregation was stopped around 2010 because of poor market conditions.		A sea container near the weigh scale accepts cardboard. Container is full. Blue box material can be deposited in plastic bins aligned along weigh scale.	Diversion area near weigh scale was mostly tidy. Contractor that handles cardboard to be advised to pick up cardboard.	
White Goods	Metal - in designated containers. Refrigerated Appliances – must have CFC refrigerant removed and stickers attached.	2	Small to moderate quantity of white goods is stockpiled next to the tire stockpile.	None	
Waste Oil Transfer Station	Storage of waste oil in a neat and safe environment. Ensure oil building is locked at the end of the day. Waste oil should only be stored in waste oil tank or in waste oil shed.	1	Since the spring 2019 inspection, waste oil is no longer accepted and sign on building advises users to bring their used oil to the Renfrew depot. Sign on fence advises that oil transfer station and platform are closed.	None.	
Footprint	Is footprint delineated by stakes/posts?	2	Stakes were placed to delineate the Stage 3 footprint in 2018. Stakes have been offset in vegetation so they are not clearly visible.	Marker stakes delimiting the edge of the waste footprint are mostly destroyed. As the waste placement in Stage 3A is near its west limit, the toe of slope should be delineated.	
Waste Type	Domestic, commercial and non-hazardous solid industrial.	1	Only municipal waste observed.	None.	
Capacity • Stage 1 • Stage 2 • Stage 3	Maximum capacity of 1 million m^3 within a 10ha footprint as per Golder figure 7, revision 3. Capacity of 257,500 cm to height of 9.9m and area of 3ha. Capacity of 285,000 m^3 to height of 12.4m over 4.6ha. Capacity of 357,500 m^3 to height of 16.9m over area of 10ha.	2	Waste is being deposited in Stage 3A.	Since early 2019, the Township has shifted disposal operations into Stage 3A. Ministry (MECP) staff have requested that an updated Development & Operation Plan be submitted for Stage 3. Active face in Stage 3A has reached height of Stage 2 for most of Stage 3A. Compactor truck now dumping waste from top of Stage 2 into Stage 3A.	
Buffer	Maintain 30m minimum buffer around Stage 3 waste area.	2	Buffer distances to edge of property from proposed Stage 3A limits are acceptable.	None.	

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Leachate	Any evidence/sign of leachate breakout on slopes or ponding near toe.	3	No evidence of leachate seeping observed along south slope of Stage 1.	None	
Daily Cover	Minimum thickness of 150 mm to be applied at the end of each working day.	1	Sand and woodchips are used as daily cover.	Use sand and/or chipped wood for cover material. Two stockpiles of sand observed.	
Daily Cover Stockpile	Keep clean granular material stockpile equal to 50 % of the quantity of the annual daily cover material.	1	Two stockpiles of sand observed in Stage 3A. Continue to use chipped wood mixed with sand as cover material for Stage 3A operations.	None	
Intermediate Cover	Minimum thickness of 300 mm to be applied in areas not worked for 30 days. Remove cover before starting new lift.	1	Township has placed an interim cap over most of Stage 2. Vegetative growth is robust.	Vegetative growth over Stage 2 is a deterrent to birds. Only a few gulls were observed during this inspection.	
Closure	Has any areas reached final contours? Condition of closed areas (if any), 600mm of earth material and 100mm of topsoil and seeded.		Waste has not reached final approved contours.	None	Township awaiting comments from the Ministry (MECP) on a Golder report regarding the groundwater modeling done to support the lateral expansion in Stage 3.
Contaminated Soil	Petroleum hydrocarbon contaminated soils (non-hazardous and meet Reg. 347) can be used as daily cover provided the volume stored does not exceed the annual daily cover requirements and it is spread within the footprint, turned periodically for 7 days and then stockpiled for use.	1 2	Waste has now been deposited over former area designated for hydrocarbon impacted soil (Stage 2).	None	
Training	Has any training been provided to site custodian? Training of CofA, operation and maintenance.	3 1	Training is provided annually on safety issues.	Provide training once an updated Development & Operation Plan is approved.	
Records	Maintain daily records; Monthly summary of quantity and types of waste disposed; Copy of CofA at site.	1 1 1	All waste and sand (used for daily cover) coming onto site should be weighed and recorded.	Volume of wood chips after chipping (stockpile dimensions) to be measured so that some of the volume can count towards diversion.	
Loads Refused	Date; Name of person; Company name on vehicle and vehicle description; Waste refused; Reason for refusal.	1	Procedure in place for load refusal.	Municipal hazardous waste to be directed to the Renfrew hazardous waste depot.	
Instructions to Site Supervisor:					
Additional Comments: (1) (2)					

* Reference:

1 - Certificate of Approval Number A412605 dated September 30, 1998 and Notice 1 dated December 4, 2000.
2 - Golder Associates. June 1997. Site Development, Operations and Closure Plan, Township of McNab Waste Disposal Site.
3 - Ministry of the Environment. November 1993. Guidance Manual for Landfill Sites Receiving Municipal Waste.

Stantec Consulting Ltd.
400-1331 Clyde Avenue
Ottawa Ontario, Canada
K2C 3G4
Tel: (613) 722-4420
Fax: (613) 722-2799

McNAB / BRAESIDE LANDFILL
OBSERVATION REPORT

Environmental Compliance Approval Number A412605

Authorized Operations – Landfill and Oil Transfer Station

Total Site Area – 64.3ha, Part of West ½ Lots 18, 19 Concession 6 Plan 49R - 12786

Service Area – Township of McNab/Braeside

Project Name: McNab/Braeside Landfill Observation Report

Project Number: 163401671 Task 200.101

Observation Date: December 6th, 2022 (no snow cover)

Weather: Cloudy, rain +4^{0}C

Observations by: Gerry Lalonde

Site Supervisor: Ryan Frew

Reviewed by: Gerry Lalonde Date: Dec.6th, 2022

Submitted to: Ryan Frew Date: Dec.6th, 2022

Township Contact Number (613) 623-5756 (227)
Cell: 613-808-3748

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Entrance	Site locked during non-operating hours.	1	Inspection was done when site was open. Entrance road was in good condition. New CSP installed at entrance in 2019.	None.	Roadtop wet due to rain. CSP culverts flowing half full.
Gate	Gate condition	2	Entrance gate is in reasonable condition. Access restricted through padlock.	None	
Main Entrance Sign	Sign to display; Name of Site; CofA number, Operating authority and their telephone number and mailing address; Hours of operation; Emergency telephone number; Waste types accepted; Tipping fees.	1	New entrance sign erected in 2014 with all information required by ECA, including tipping fees and operating authority mailing address. Sign is in good condition and legible. Two signs at entrance to advise users to maintain 2m separation distance and not accepting cash for payment.	None	
Hours of Operation	8:30 am to 4:00 pm unless amended by District Manager.	1	Hours posted on entrance sign for 8:30am to 4:00pm.	None	
Screening	On site vegetation provides adequate screening.	2	Trees provide adequate screening.	None	
Supervision	Custodian on site when site open. Site is open on Tuesday, Thursday and Saturday.	2	Site was open on day of inspection. Township staff was present at scale house and on equipment (track and wheel loaders).	None.	Compactor was not operating during inspection.
Fence	Condition of fence.	2	Bear fence and page wire fences along the north and west limits have been removed due to the clearing of trees for Stage 3 development.	None	Reinstall page wire fence & bear fence along property limits if bears re-establish a presence.
Transportation	Condition of all season access roads. Signs to control speed on roads.	2	Speed sign (50km/h) posted at entrance. Site access road is in good condition with no dust. Access to Stage 3 is in good condition.	None	Users are now unloading their waste from the top of Phase 2. Two tandem trucks hauling chipped wood from Stage 3 to the top of Stage 2 – due to rain, some rutting of base in north west corner of Stage 3.
Dust Control	Control dust from traffic using an application of dust suppressant.	1, 2	Site access road is well graded and no dust was observed.	None.	Rain today is making surface muddy.

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Custodian Shelter	Condition of structure. Information/signs provided for safety and emergency procedures, telephone locations and emergency contact names & numbers; fire extinguisher locations; spill response procedures.	3 1	Custodian shelter was constructed in 2011. Building exterior is in good condition. Weigh scale is operational.	None.	New site custodian operating weigh scale. Safety kit and fire extinguisher shown in full view.
Electronics	Building and surrounding area are in a safe environment.		Electronics are stored in a steel bin container in diversion area near scale. Except for a few items, bin was nearly empty.	None	
On Site Signs	Conditions of signs at disposal areas, segregated products, waste oil.	2	Sign advises all users to report to weigh scale. Additional signage has been erected in 2014 for blue box materials. In 2019, new signs were installed at segregated material stockpiles. Signs direct users to designated areas. All signs are in good condition and legible.	None	Sign installed along access road to Stage 3A advising users to maintain 2m separation as a precaution for Covid-19
Equipment	What equipment is used to compact waste?		Caterpillar 816F is used for compaction. Crawler loader being used to spread waste. Waste from compactor truck is being dumped from top of Stage 2 on to Stage 3A (north west corner of footprint).	Daily cover (sand and chipped wood) is being used for cover in Stage 3. Loader being used to shape waste and stockpiling of chipped wood.	
Noise	Can noise from on-site operations be detected at nearest sensitive receptor?	3	Equipment was operating during inspection. Separation distance to nearest receptors is deemed adequate to attenuate the noise.	None	
Surface Drainage	Grading to prevent s/w from flowing through waste. Grading to prevent ponding near toe.	3 3	Grading and CSPs have been installed along new road to Stage 3A with drainage directed towards bush along west limit.	None	No evidence of leachate seeps or odours emanating from Stage 2 sideslope. Dense vegetation on sideslopes prevents soil erosion.
Surface Monitoring	Has any sampling been done since last inspection on Dochart Creek at locations SW1, SW2 and SW3?	2	Golder Associates does the sampling.	None	
Groundwater Monitoring	Any damage to any of 27 monitoring wells at 35 locations. Are monitoring wells in area of operations and protected?	2	Golder Associates does the sampling.	None.	
Landfill Gas	On site facilities are vented and no smoking signs posted at any enclosed facility.	3	Structures are above ground so natural ventilation is adequate to avoid potential for gas accumulation. During warmer conditions, doors to maintenance shed left open so ventilation is available.	None	
Burning	Any evidence of waste being burnt? Can burn brush, trees and clean wood piles in designated locations. Is there a 30m fire break around piles.	1 2 3	Brush is stockpiled in Stage 3A. Brush stockpile is being transported to top of Stage 2 for use in daily cover.	Chip brush/wood pile and use woodchips for alternate cover.	
Odours	Are odours noticeable at nearest sensitive receptor or at property limit.	2	Odours are not noticeable at the weigh scale, at the site entrance or from Stage 3 area.	None	
Scavenging	No scavenging allowed. Any evidence of trespassers.	3	None observed.	None	
Pest Control	Any evidence of pests that can pose a hazard to the health and safety of site users.	2	No evidence of rodents.	None	

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Vectors	Are birds or other animals a nuisance?		More than 100 gulls and a few crows were observed at the top of the waste in Stage 3A at time of inspection. Gulls were puncturing garbage bags and creating opportunity for wind blown debris.	None	Thick vegetative cover growing on Stage 2 is deterring gulls from this part of the footprint. Continue monitoring and review options for wildlife management if birds become a nuisance.
Litter Control	Is litter evident beyond waste pile? Is there a litter fence?	1 2	Wind-blown debris evidenced for most of the site, along the east and west tree lines, along access road to Stage 3A, and near recycling bins near custodian shelter.	Organize general litter cleanup before vegetation growth makes it difficult to collect. Increase cover material application over Stage 3A in areas where waste will not be placed within the next few weeks to deter birds.	Custodian advised that area around recycling bins had been cleaned up the previous week but the strong winds have created a new mess.
Metal	Segregated and placed in containers for removal by scrap metal dealer.	2	Scrap metal bin is about 3/4 full. White goods stockpile along Cell 1 is of moderate size.	Contractor responsible for scrap metal to empty container within the next few weeks.	
Rubber Tires	Segregated and stored in a fenced area adjacent to the reuse building.	2	Tire stockpile along the south/west limit of Stage 1 has one full trailer load. Bin to accept tires has been placed near electronics bin and bin has only a few tires (nearly empty).	Continue to reduce tire stockpile in Stage 1 when opportunity arises.	Tire Collection Network is responsible for tire collection.
Other Diversion materials	Starting in August 2003, shingles were segregated and stockpiled for removal by recycler. Segregation was stopped around 2010 because of poor market conditions.		A sea container near the weigh scale accepts cardboard. Container is nearly empty. Blue box material can be deposited in plastic bins aligned along weigh scale.	Diversion area near weigh scale was messy from wind blown debris.	Custodian advised that area around recycling bins had been cleaned up the previous week but the strong winds have created a new mess.
White Goods	Metal - in designated containers. Refrigerated Appliances – must have CFC refrigerant removed and stickers attached.	2	Small to moderate quantity of white goods is stockpiled next to the tire stockpile.	None	
Waste Oil Transfer Station	Storage of waste oil in a neat and safe environment. Ensure oil building is locked at the end of the day. Waste oil should only be stored in waste oil tank or in waste oil shed.	1	Since the spring 2019 inspection, waste oil is no longer accepted and sign on building advises users to bring their used oil to the Renfrew depot. Sign on fence advises that oil transfer station and platform are closed.	None.	
Footprint	Is footprint delineated by stakes/posts?	2	Stakes were placed to delineate the Stage 3 footprint in 2018. Stakes have been offset in vegetation so they are not clearly visible.	Marker stakes delimiting the edge of the waste footprint have been destroyed. As the waste placement in Stage 3A is near its west limit, the toe of slope should be delineated.	Following today's assessment of the waste survey, new stakes to be installed in 2023 to guide waste placement along this limit.
Waste Type	Domestic, commercial and non-hazardous solid industrial.	1	Only municipal waste observed.	None.	
Capacity • Stage 1 • Stage 2 • Stage 3	Maximum capacity of 1 million m^3 within a 10ha footprint as per Golder figure 7, revision 3. Capacity of 257,500 cm to height of 9.9m and area of 3ha. Capacity of 285,000 m^3 to height of 12.4m over 4.6ha. Capacity of 357,500 m^3 to height of 16.9m over area of 10ha.	2	Waste is being deposited in Stage 3A.	Since early 2019, the Township has shifted disposal operations into Stage 3A. Ministry (MECP) staff have requested that an updated Development & Operation Plan be submitted for Stage 3. Active face in Stage 3A has reached height of Stage 2 for most of Stage 3A. Compactor truck/users now dumping waste from top of Stage 2 into Stage 3A.	
Buffer	Maintain 30m minimum buffer around Stage 3 waste area.	2	Buffer distances to edge of property from proposed Stage 3A limits are acceptable.	None.	

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Leachate	Any evidence/sign of leachate breakout on slopes or ponding near toe.	3	No evidence of leachate seeping observed along south slope of Stage 1.	None	
Daily Cover	Minimum thickness of 150 mm to be applied at the end of each working day.	1	Sand and woodchips are used as daily cover.	Use sand and/or chipped wood for cover material. Two stockpiles of sand observed.	
Daily Cover Stockpile	Keep clean granular material stockpile equal to 50 % of the quantity of the annual daily cover material.	1	Two stockpiles of sand observed in Stage 3A. Continue to use chipped wood mixed with sand as cover material for Stage 3A operations.	None	Two tandem trucks hauling wood chips from Stage 3 to top of Stage 2 during inspection.
Intermediate Cover	Minimum thickness of 300 mm to be applied in areas not worked for 30 days. Remove cover before starting new lift.	1	Township has placed an interim cap over most of Stage 2. Vegetative growth is robust.	Vegetative growth over Stage 2 is a deterrent to birds. While several hundred gulls were observed during this inspection, their presence was observed in Stage 3 where waste was exposed.	
Closure	Has any areas reached final contours? Condition of closed areas (if any), 600mm of earth material and 100mm of topsoil and seeded.		Waste has not reached final approved contours.	None	Township awaiting comments from the Ministry (MECP) on a Golder report regarding the groundwater modeling done to support the lateral expansion in Stage 3.
Contaminated Soil	Petroleum hydrocarbon contaminated soils (non-hazardous and meet Reg. 347) can be used as daily cover provided the volume stored does not exceed the annual daily cover requirements and it is spread within the footprint, turned periodically for 7 days and then stockpiled for use.	1 2	Waste has now been deposited over former area designated for hydrocarbon impacted soil (Stage 2).	None	
Training	Has any training been provided to site custodian? Training of CofA, operation and maintenance.	3 1	Training is provided annually on safety issues.	Provide training once an updated Development & Operation Plan is approved.	
Records	Maintain daily records; Monthly summary of quantity and types of waste disposed; Copy of CofA at site.	1 1 1	All waste and sand (used for daily cover) coming onto site should be weighed and recorded.	Volume of wood chips after chipping (stockpile dimensions) to be measured so that some of the volume can count towards diversion.	
Loads Refused	Date; Name of person; Company name on vehicle and vehicle description; Waste refused; Reason for refusal.	1	Procedure in place for load refusal.	Municipal hazardous waste to be directed to the Renfrew hazardous waste depot.	
Instructions to Site Supervisor:					
Additional Comments: (1) (2)					

* Reference:

1 - Certificate of Approval Number A412605 dated September 30, 1998 and Notice 1 dated December 4, 2000.
2 - Golder Associates. June 1997. Site Development, Operations and Closure Plan, Township of McNab Waste Disposal Site.
3 - Ministry of the Environment. November 1993. Guidance Manual for Landfill Sites Receiving Municipal Waste.

June 21, 2022 Reference No. 19130748-002

Thandeka Ponalo
Ministry of the Environment, Conservation and Parks
Ottawa District Office
2430 Don Reid Drive
Ottawa ON K1H 1E1

RESPONSE TO MECP GROUNDWATER AND SURFACE WATER TECHNICAL SUPPORT COMMENTS REGARDING THE HYDROGEOLOGICAL IMPACT ASSESSMENT FOR THE MCNAB WASTE DISPOSAL SITE

Dear Ms. Ponalo,

Golder Associates Ltd. (Golder) was retained by the Township of McNab/Braeside (the Township) to complete a hydrogeological impact assessment in support of updates to the Development and Operations plan for the McNab Waste Disposal Site. The objective of the hydrogeological impact assessment was to forecast site compliance (i.e., groundwater and surface water compliance) throughout the life of the McNab Waste Disposal Site assuming full development of the landfill to provide 1 million cubic metres of airspace (including Stages 2 and 3), as described in the existing approved Development & Operations plan. A report on the hydrogeological impact assessment was submitted to the Ministry of the Environment, Conservation and Parks (MECP) in February 2021[1]. The MECP submitted the report to their Eastern Region Technical Support Section resulting in review comments provided by the MECP surface water and groundwater reviewers in letters dated April 19, 2022 and April 21, 2022, respectively.

Golder has been further retained by the Township to respond to the comments presented in the MECP review letters. The sections below provide responses to the comments presented by the groundwater and surface water reviewers.

Response to Groundwater Review Comments

The numbered comments from the Conclusions and Recommendations section of the letter dated April 21, 2022 from the MECP groundwater reviewer are reproduced along with responses below.

Groundwater Comment #1

Comment: *Golder concludes that an additional CAZ to the northeast would satisfy Condition 39 of the ECA and keep the waste disposal site in compliance with B-7 right up to full landfill capacity. I am in general agreement with the Guideline B-7 assessment completed by Golder, and I support the recommendation to purchase additional CAZ to provide for further landfill development; however, while Guideline B-7 may be satisfied from the groundwater perspective, this approach may not adequately consider potential surface water impacts resulting from groundwater discharge to Dochart Creek and the poorly drained area to the northeast. Due to the thinning of the sand layer towards the north, and the complete pinch out of this unit towards the northeast, most monitoring wells located along the periphery of the site were screened in the silty clay layer, which has hydraulic conductivity one to four orders of magnitude lower and vertical flow in the upward direction. Thus, existing groundwater monitoring results for wells screened in the silty clay unit may be an underrepresentation of leachate*

[1] Golder, 2021. Hydrogeological Impact Assessment, McNab Waste Disposal Site, Township of McNab/Braeside, Ontario. Golder Associates Ltd. Report No. 19130748-001, February 2021.

concentrations / migration in the more permeable sand unit. Where the sand thins, e.g., to 0.1 m at BH99-5 in the north, the unit may no longer be perennially saturated, but could still convey leachate at higher concentrations and at faster rates towards Dochart Creek in pulses during wet events. A similar fate and transport mechanism could be present in the poorly drained area to the northeast, where the sand unit completely pinches out and it is topsoil / peat down to 0.2 m (BH92-2) that overlies the silty clay layer. If correct, given that existing results (largely from groundwater pulled from the underlying silty clay layer) were used to calibrate the model, the model may be biased low. Additional insight and/or investigation from Golder on this is requested. However, with groundwater presenting very close to, if not at, the surface in many of the periphery areas on-site, potential surface water impacts are seen to be the driving concern in these areas; therefore, the case for the McNab/Braeside WDS ECA amendment must ultimately satisfy any concerns raised by the MECP Surface Water Specialist.

Response:

Silty clay is present across the site beneath the shallow sand layer and/or peat deposits. The upper portion of the silty clay deposit is a weathered crust, which has been observed in all boreholes that have encountered the silty clay deposit and has been observed to have a thickness up to 3 metres. This upper weathered crust zone is typical of the marine clay deposits that underlie areas of eastern Ontario. The weathered crust at the McNab Landfill site is characterized by a red-brown to grey-brown colour and occasional seams of sand (with observed thickness up to 0.2 metres). The weathered crust has secondary permeability features in the form of an interconnected network of fractures caused by geologic weathering and freeze-thaw cycles. This contrasts notably with the underlying intact portion of the unweathered silty clay deposit that is grey in colour, is not fractured, and has a low hydraulic conductivity that is on the order of 10^{-10} to 10^{-8} metres per second. We agree that the leachate plume is not expected to extend down into the grey silty clay; however, due to fracturing the weathered crust unit is moderately transmissive (i.e., with hydraulic conductivity on the order of 10^{-7} to 10^{-6} metres per second) and is interpreted to be a pathway for leachate migration in the shallow groundwater, especially where the overlying sand layer has pinched out. The monitoring well referenced in the comment, BH99-5 in the north, is screened entirely within the weathered crust since the weathered crust is the shallowest unit present at this location (i.e., beneath the topsoil); as such, this monitoring well is considered to be appropriately screened to encounter the shallow groundwater flow that is expected, based on the modelling, to one day contain the leachate plume. It is for the same reason that the monitoring wells installed in BH20-1, 20-2 and 20-3 for the purpose of determining the location of and parameter concentrations at the advancing plume front towards the northeast were installed specifically within the shallow sand and/or weathered crust zone. As such, it is groundwater information from the shallow sands or weathered crust zone that was used to calibrate the model, which is considered to be appropriate for and representative of the site conditions related to leachate plume migration from the disposal area.

Groundwater Comment #2

Comment: *Golder has been evaluating compliance with Guideline B-7 based on the concentrations measured in wells BH99-1 and BH99-2. It was noted that well BH99-1 is screened in the silty clay unit and therefore, may not be appropriate as an accurate indicator of leachate migration (see point 1). Boundary wells BH92-1 and BH99-5, located to the west, are also screened in the silty clay layer, but have measured exceedances, at times, related to DOC, Fe, and/or Mn. While BH99-2 (Guideline B-7 well) is appropriately screened in the sand, and does not show any signs of leachate, the nearest wells that are screened in the sand (with results) include the well clusters at BH91-1 and BH8; these wells have reported exceedances, at times, for DOC, TDS, Fe, and/or Mn. Given these facts, an explanation from Golder is needed on why they think B-7 is being met.*

Response:

Monitor BH99-1 is screened in the weathered crust zone of the silty clay unit. As noted in our response to Groundwater Comment #1, the weathered crust is a potential pathway for leachate plume migration in the shallow groundwater. The screen depth at monitor BH99-1 was selected for the screen to be beneath the water table to allow for the collection of a groundwater sample. It is noted that even at this screen depth this monitoring well has contained a water level too low to sample during four monitoring events since 2015. Monitors BH99-1 and BH99-2

(both located at the north property line) are properly screened (in the weathered crust zone and sand/weathered crust, respectively) to encounter shallow groundwater that is expected, based on the understanding of the hydrogeological setting and reflected in the modelling, to one day be affected by the leachate plume. The groundwater quality of these two monitoring wells consistently meets RUPO; as such, the site is interpreted to operate in compliance within Guideline B-7.

BH92-1 and BH99-5 are not “boundary wells” since they are not positioned at a groundwater compliance boundary. These two wells are on-site wells that allow for monitoring of the leachate plume migration. As such, the calculated Guideline B-7 compliance values for Fe, Mn and DOC are not relevant to these monitoring locations and the quality of the groundwater at these monitoring wells does not represent exceedances of the allowable Guideline B-7 values or affect landfill site compliance with Guideline B-7. It is noted that Dochart Creek is hydraulically downgradient of these two wells and that along this portion of the property boundary the shallow groundwater discharges to Dochart Creek; site compliance in this part of the site is related to surface water compliance criteria.

Groundwater Comment #3

Comment: *Leachate effects have been observed in monitoring well BH6, located further south on the existing waste footprint, and in surface water samples from the poorly drained area east / northeast of the landfill; specifically, at SW4, SW6, SW7, SW8, and SW9, which have consistently recorded elevated alkalinity, ammonia, boron, cobalt, COD, calcium, chloride, DO, hardness, iron, manganese, magnesium, phenols, potassium, sodium, TDS, and total phosphorus. In some cases, the concentrations exceeded the PWQO. Given the known exceedances in surface water here, the lack of groundwater data in this area is concerning and may be a source of error for model prediction; for example, groundwater data is not available for locations in the vicinity of monitoring wells BH-4, BH92-4, and BH92-3, despite that fact that the ‘full footprint’ modelling predictions show that groundwater flow in this direction becomes a dominant flow pathway. Coupled with that, it is not clear to me why there is little to no contaminant movement predicted in this direction under the ‘2020 conditions’ modelling predictions. To me, this raises questions about the accuracy of model predictions. I recommend that Golder provide additional information to clarify these items.*

Response:

Of the locations noted in the comment, the surface water quality at SW8 has not been interpreted to have been affected by landfill leachate.

As shown on Figure 4 of the Hydrogeological Impact Assessment report, for the current (2020) landfilling area the groundwater flow model does not predict leachate migration in groundwater in the direction north of the 2020 fill area, i.e., in the direction of BH92-4 and 92-3. Note that the location of BH4 was adjacent to the limit of the more recent enlargement of the disposal area; this monitoring well was sampled until 2019 when it was accidently destroyed, and it was then decommissioned.

However, as also shown on Figure 4 of the Hydrogeological Impact Assessment report, the groundwater flow model predicts increased leachate migration in the groundwater towards the northeast property line only under full development conditions due to the extension of the full development waste footprint in this northward direction. It is the location of the landfill footprint (leachate source) in relation to the shallow groundwater flow system that determines the presence and direction of leachate plume migration. Based on the modelling result shown on Figure 4 and the density of the flowpath lines, the new area of flow paths resulting from the enlarged disposal footprint becomes a flowpath but not a ‘dominant’ flowpath.

The monitoring wells at BH92-3 and BH92-4 are still available, and monitoring of these locations could be added back into the annual program in future. It is noted that in Section 9.0 of the Impact Assessment report it is recommended to 1) install an additional monitoring location(s) between the full landfill footprint and the northeast portion of the property line and 2) add additional CAZ lands.

Groundwater Comment #4

Comment: *Care needs to be taken when considering monitoring results from wells screened in the underlying silty clay, as they may not be representative of the maximum amount of leachate migrating from the source (discussed earlier in point 1). Where the sand and peat units overlying the silty clay thin (down to 0.1 m in places), installation of additional monitoring wells is recognized as being an impractical solution. Alternative methods are needed in these areas to confirm the fate and transport of leachate in the sand unit, or where it discharges therefrom.*

Response:

As per our response to Groundwater Comment #1, we agree that the leachate plume is not expected to extend down into the grey silty clay; however, the weathered crust portion of the silty clay deposit is moderately transmissive and is interpreted to be an important leachate migration pathway, especially where overlying sand and/or peat units thin and pinch out. It is considered that the placement of the monitoring well screens is appropriate to track plume development and migration. It is known that the sand unit pinches out before Dochart Creek; in the area between where the sand pinches out and the Creek, either 1) the leachate-impacted groundwater will discharge to surface (which possibly could be observed) and travel overland in which case impacts to surface water will be monitored in the Creek, or 2) it will continue as groundwater in the weathered clay zone and will be tracked through groundwater monitoring before the plume reaches the Creek. It is not considered that ‘alternative methods’ of monitoring are required.

Groundwater Comment #5

Comment: *While contaminant concentration projections were performed for boron, chloride, and ammonia, and in most cases represent conservative tracers, none of these represent the current contaminants of concern in groundwater at the site, which are DOC, Fe, Mn, and TDS. These should be modelled as well and may be useful as an extra source of data for calibration.*

Response:

The rationale for selection of chloride, boron and ammonia for predictive modelling is provided in Section 1.3 of the Impact Assessment report. These are characteristic of municipal landfill leachate and are considered to be contaminants of concern at this landfill site. Based on our experience, they are contaminants of concern at many municipal landfill sites as related to tracking the advancement of a groundwater plume, the identification of trigger parameters and trigger concentrations and assessing groundwater and/or surface water compliance. The monitoring at this site shows that chloride is the key parameter for tracking the presence and advance of the groundwater plume towards the surface water and groundwater compliance boundaries.

Iron and manganese naturally occur in soil, groundwater and surface water and their concentrations are often naturally elevated in excess of the ODWQS or PWQO; they are also commonly elevated in areas underlain by organic soils such as the peat soils that underlie an area of the McNab Landfill site. Elevated DOC is also often encountered in areas underlain by organic soils. In the absence of the typical leading leachate indicators chloride, boron and ammonia, elevated concentrations of other parameters such as iron, manganese, DOC and TDS are not considered to be associated with leachate impacts.

Because of their natural occurrence and geochemical reactivity that typically results in highly varying concentrations over time in leachate and both naturally occurring and leachate-impacted groundwater or surface water, it is problematic to model iron or manganese for modelling calibration or predictive effects. DOC is an unconservative parameter in terms of leachate impacts and is not considered to be a critical parameter for groundwater compliance assessment and it does not have a surface water PWQO for assessment purposes. TDS is a measure of total ionic strength of the various dissolved constituents in the groundwater, and it is well known that the concentration of the various constituents that result in the TDS concentration vary over time due to natural reactions in the subsurface such as ion exchange. Chloride (as a constituent of TDS) is a recognized parameter in terms of assessing leachate effects and compliance under Guideline B-7. Efforts could be made to try and model the suggested parameters, but selection of the source strength of these parameters in leachate as well as factors

for retardation and geochemical reaction has a high degree of uncertainty. However, such modelling attempts are not expected to improve upon what is already a well calibrated model or assist in predicting future compliance based on this calibrated model. As such, it is not considered necessary or beneficial for the purpose of assessing the expected performance of the McNab Landfill under full development to carry out the additional modelling suggested by the reviewer.

Groundwater Comment #6

Comment: *It was stated that on-going monitoring remains critical to continue validating model accuracy. Additional well installations were also recommended by Golder between the full landfill footprint and the current northeast property line for better understanding and tracking of leachate in this area. I agree with this and stress that the screened intervals need to be appropriately placed to capture leachate migration in all applicable stratigraphic units. This may require some exploratory work to determine the best placement location and further consideration of the degree of hydraulic connection between units.*

Response:

On-going monitoring will be important to verify the results of the modelling completed and to assess future site compliance and the need for and timing of implementation of contingency measures. As stated in the Hydrogeological Impact Assessment report, the existing groundwater monitoring program is generally considered appropriate to monitor leachate migration; however, an additional monitoring well(s) between the full landfill footprint and the current northeast property line (as well as bringing BH92-3 and BH92-4 back into the groundwater quality monitoring program) could be considered to provide better understanding and tracking of leachate migration in this area. As outlined in the response to Groundwater Comment #1, the weathered crust, which comprises the upper silty clay zone across the site, is interpreted to convey leachate-impacted groundwater and is the primary pathway for leachate migration in the groundwater in areas where the sand deposit is not present. As such, in areas of the site where the silty clay is located near the surface, monitoring wells should be screened in the weathered crust zone so that they can encounter the leachate plume when the plume reaches those monitoring locations.

Response to Surface Water Review Comments

The numbered comments from the Conclusions and Recommendations section of the letter dated April 19, 2022 from the MECP surface water reviewer are reproduced along with responses below.

Surface Water Comment #1

Comment: *Leachate effects are evident at all monitoring locations in the poorly drained area northeast and east of the current waste mound, including background. While significant impairment is unlikely at this time, intensification of leachate effects in that area reasonably predictable with continued development of Stage 3, without additional measures to control leachate migration. Additional monitoring in the tributaries to Dochart Creek draining from the east property line may be required.*

There are no appreciable leachate impacts to Dochart Creek immediately north of the Site at this time, but leachate impacted groundwater is expected to eventually discharge to Dochart as the primary pathway for leachate migration. Additional information is needed to determine whether additional downstream monitoring is justified, as discussed above.

Response:

A number of disconnected surface water features are present to the east and northeast of the waste mound (i.e., the “poorly-drained area”). These surface water features have been documented and sampled for approximately 30 years as a component of the annual surface water monitoring program. While these features are generally present during monitoring events conducted in the spring and fall, the surface water features in the poorly-drained area may be dry depending on seasonal conditions and negligible to limited flow has been observed within each of the isolated surface water features. As reported in the Hydrogeological Impact

Assessment report, a site visit was conducted by Golder in 2019 that included an extensive walk over of the site area, with the intent of identifying surface drainage channels at the site including within the poorly-drained area. No distinct drainage channels to the east and northeast of the waste mound were identified during the 2019 site visit. As such, the conceptual model for the site is that no permanent off-site drainage channels exist that convey surface water over the northeast property boundary. The reasoning for the reviewer's differing interpretation and description of the surface water system is not apparent.

As noted by the surface water reviewer's comments, there was a historical monitoring station (i.e., SW3) located in Dochart Creek located further downstream from the existing SW2 monitoring location. Monitoring location SW3 was removed from the sampling program in 2003. From review of historical correspondence in our files, the removal of SW3 from the program was discussed with and agreed to by the MECP District Office in 2003, with the reasoning being that the groundwater plume had not yet reached Dochart Creek and downstream surface water quality was being adequately monitored at SW2.

As recommended in the Hydrogeological Impact Assessment report, the updated Development & Operations Plan would include a revised surface water and groundwater trigger mechanism, that would use on-going groundwater and surface water monitoring to track plume migration and surface water quality and set triggers at parameter concentrations below the compliance values such that contingency measures could be implemented prior to the site going out of compliance. Additional surface water stations could be added to the existing monitoring program, such as the reinstatement of sampling within Dochart Creek in the vicinity of SW3.

Surface Water Comment #2

Comment: *Monitoring data collected in 2020 suggests that Dochart Creek, which contains highly sensitive cold water habitat, may have very low flows in the mid-to-late summer. As such, there is likely limited capacity for dilution or assimilation at those times. This is problematic for a naturally attenuating site, which will ultimately discharge leachate impacted groundwater to area surface waters without controls over the timing, quantity or quality. It is also notable that no flow or water quality information is available for the cold water tributaries to Dochart Creek east of the Site. These tributaries are slightly downgradient of current leachate impacted surface water monitoring locations and appear to originate within the projected pathway for leachate migration.*

Response:

While the McNab Landfill site currently operates in compliance as a natural attenuation site, it is recognized that a robust monitoring program is necessary to verify if compliance can be maintained over the life of the site and post-closure and that contingency measures, including engineered controls, would have to be implemented in advance of any non-compliance. As recommended in the Hydrogeological Impact Assessment, the updated Development & Operations Plan would include a revised surface water and groundwater trigger mechanism, that would use on-going groundwater and surface water monitoring to track plume migration and surface water quality and set triggers at parameter concentrations below the compliance values such that contingency measures could be implemented prior to the site going out of compliance. The contingency measures would be provided in the updated Development & Operations Plan and are expected to be similar to the current contingency plan and consist of a collection trench constructed to intercept shallow leachate-impacted groundwater upstream of Dochart Creek and removal of the collected groundwater for treatment. This approach, which will change the site from one relying on natural attenuation to one using engineering controls to achieve compliance, will provide the control on potential leachate impacts on surface water.

Regarding Dochart Creek providing cold water habitat, the proposed approach assesses surface water compliance relative to the generic PWQO that was developed to be protective; as such, use of the PWQO for compliance assessment is not affected by the specific habitat or aquatic species within Dochart Creek.

Regarding "cold water tributaries to Dochart Creek east of the site", please refer to the response to Surface Water Comment #1.

Surface Water Comment #3

Comment: *The method used to estimate low flows in Dochart Creek may be overly simplistic (i.e. may over- or under-estimate available assimilative capacity), as discussed above. The flow statistics presented, both measured and estimated, should be used with caution and may not be appropriate for the extrapolations made in the surface water impact assessment.*

Response:

To provide a comprehensive answer to Surface Water Comment #3, we have reproduced additional statements made throughout the surface water review letter on the topic of low flow estimation below.

> *"Flow would typically be expected to increase with distance downstream. Measured flows at SW2 were often lower than at SW1 (upstream) in the data presented. The reason for this is not discussed in the report (i.e., Were transect locations appropriate? Is the study site within a losing reach? What equipment / method were used to measure flows?)."*

The surface water monitoring locations (SW1 and SW2) were chosen to represent the streamflow regime of Dochart Creek within the vicinity of the McNab Site. This included establishing transect locations to capture the manual flow data directly upstream and downstream of the Site. Manual flow measurements at both locations were completed using the following methodology.

- A measuring tape was strung across two wooden stakes at each surface water monitoring location to establish a consistent transects for each of the nine monitoring visits.
- Using a streamflow meter and rod setup, depths and streamflow velocities (measured at 60% of the depth) were measured at 10 cm intervals across each transect.
- Using the flow velocities, depths, and distance of each interval, the streamflow was calculated by multiplying the flow area by the flow velocity.

Out of the nine site visits conducted, higher upstream flow measurements were recorded during a total of six visits from April 20th – September 22nd in 2020 at SW1, as seen below in Table 1.

Table 1: Manual Flow Measurements at SW1 and SW2

Date	Flow Rate	
	SW1	SW2
April 20, 2020	333.3	232.9
May 22, 2020	43.5	28.3
June 23, 2020	22.2	13.0
July 28, 2020	7.0	5.6
August 20, 2020	5.0	3.6
September 22, 2020	11.6	5.0

Notes: All flow rates reported in litres per second

During these monitoring visits, no abnormalities were witnessed or recorded by the field technicians at SW1 or SW2. We believe that this watercourse is a potential losing reach as the consistent higher upstream flow values show a pattern of lost flow that would not be expected to be caused by field measurement error. It is likely that when frozen conditions ended (i.e., March), the flow regime changed within the reach between SW1 and SW2 causing a potential losing reach. This could be attributed to groundwater / surface water interactions or interflow that occurs when sediment and soils are not frozen.

> *"Nine monthly measurements of flow are available for SW1 and SW2 in Dochart Creek, collected October 2019 through September 2020. While it is not unusual to have limited flow information, it is unclear how representative these data and the calculated average flows are for use in the extrapolations presented."*

We agree that an extensive yearly record would be preferred; however, the flows were taken monthly to establish a seasonal record of conditions for Dochart Creek directly upstream and downstream of the site. Also, the daily continuous flow data obtained from the Water Survey of Canada for 2020 for Buckshot Creek showed an average annual flow of 2.41 m^3/s which is slightly above the station average annual flow of 2.13 m^3/s. Note that this average annual flow for Buckshot Creek (2.13 m^3/s) only includes the flows recorded after 2005, as the flows recorded before were seasonal and not fully representative of an annual average. This shows that any extrapolated flows from Buckshot Creek would likely be an overestimate of potential flows in Dochart Creek. Further comparison between Dochart Creek, Buckshot Creek, and other nearby watercourses with gauging stations is provided in the sections below.

> *"No justification is provided for the use of the ratio of average flows over other methods for estimating the 7Q20 flow in Dochart Creek (i.e., area reduction method with calibration using measured flows). Support for the choice of extrapolation technique is needed."*

The ratio of average flow extrapolation method was chosen to estimate the 7Q20 flow in Dochart Creek so that the flow estimate would be considerate of the specific yields from the site. It was suspected that Dochart Creek possibly behaved as a headwaters of a smaller catchment area, compared to a yield of a gauged river with a larger catchment. Since we had seasonal measured flows at the site, we wanted to utilize these. If we had tried to compare the catchment areas between Dochart Creek and Buckshot Creek there was a possibility that the area reduction would result in a ratio not representative of the Dochart Creek yield and therefore an unrepresentative 7Q20.

> *"Insufficient information is provided to corroborate the calculated 7Q20 in Buckshot Creek (i.e., Why was the selected calculation used? Within the available dataset, how were estimated flows or flows affected by beaver activity treated? Were there gaps in the dataset?)."*

The 7Q20 was estimated using continuous daily flow data from the Water Survey of Canada hydrometric station at Buckshot Creek near Plevna, Ontario (02KF017) over the period of 1993 – 2019. Flow ratios were established by pairing the manual flow measurements to an average daily flow measurement from Buckshot Creek for each specific date. Using the continuous daily averaged data, a rolling 7-day average over the entire period of record was established and then the minimum flow for each year was placed into a Pearson curve fitting model. The Pearson curve fitting model we used compared the 3 Parameter Log-Normal, Extreme value, Log Pearson III, and Weibull distribution fitting curves and selected the best option based on the inputted data. A 3 Parameter Log-Normal analysis was therefore selected as the best option and the 7Q20 was estimated and the ratio was applied to the estimate the Dochart Creek 7Q20.

Within the available data set, there was no mention of beaver activity. The only gaps in data occurred prior to 2005 as the continuous flow data was recorded seasonally (i.e., between April and September). Only the flows within those months were considered for 7Q20 analysis.

> *"No information is provided on the comparability of Buckshot Creek to the study site (e.g., characteristics of the streams, drainage areas, physiography, stream order, groundwater regime), nor is justification provided for the choice of reference watershed. Buckshot Creek is located approximately 65 km southwest of the waste disposal site, with notable differences in watershed characteristics, including main channel slope, percent wetlands, percent agricultural/rural area and percent open waters indicated in OFAT. In addition, Buckshot Creek has been classified as warm water creek (with a small portion designated as cool water habitat downstream of the gauging site), while Dochart Creek and its tributaries are classified as having a cold-water thermal regime. These differences suggest that these systems may differ in their responses to high and low water conditions."*

The 7Q20 estimate requires the evaluation of publicly available river gauge data. These gauging stations are typically established on larger river systems, often to monitor flooding and potential for water usage. These larger river systems differ from creeks with much smaller catchment areas (including the headwaters of the same system). For that reason, the estimate of the 7Q20 of Dochart Creek using a comparison with Buckshot Creek is a modelled approximation based on typical industry practice.

A comparison of the characteristics of similar watercourses in the general vicinity of the Site with an extensive gauging record are detailed below in Table 2.

Table 2: Water Survey of Canada Gauging Station Comparison

Watercourse Stations	Drainage Area (km^2)	Slope of Main Channel (m/km)	Area – Lakes/ Wetlands (%)	Proximity to Site	Continuous Data Record	Thermal Regime (Cold/Cool/Warm) [1]
Dochart Creek at Study Site [3]	6.4	10.12	8	n/a	n/a	Cold
Bonnechere River near Castleford [2]	2,364.8	2.10	16	8.5 km NW	1962 - 2022	Warm (BRWP, n.d.)
Indian River near Blakeney [2]	212.4	4.25	16	29 km SE	2002 - 2022	Warm (MVC, 2019)
Clyde River at Gordon Rapids [2]	291.4	4.66	15	33 km NW	1971 - 2022	Warm (MVC, 2019)
Jock River near Richmond [3]	539.2	0.75	30	61 km SE	1969 - 2022	Warm (with Cool – Warm water reaches) (RVCA, 2016)
Buckshot Creek at Plevna [3]	150.6	4.02	13	65 km SW	1993 - 2022	Warm
Kemptville Creek near Kemptville [2]	412.4	0.51	35	83 km SE	1969 - 2022	Warm (RVCA, 2013)
South Castor River at Kenmore [3]	183.4	0.90	20	90 km SE	1978 - 1997, 2003 - 2022	Cool – Warm (City of Ottawa, 2011)
Bear Brook near Bourget [3]	447.6	0.85	19	108 km SE	1971 - 2022	Cool – Warm (City of Ottawa, 2011)
Riviere Beaudette Near Glen Nevis [3]	132.9	1.13	28	160 km SE	1983 - 2022	Warm (RRCA, 2006)

Notes:

[1] Refers to the thermal regime in the vicinity of the gauging station.

[2] Refers to a gauging station on a regulated watercourse.

[3] Refers to a gauging station on a natural (unregulated) watercourse.

As detailed in Table 2 above, all the gauging stations with 20+ years of flow data within the vicinity of the Site had notable differences in watershed characteristics in comparison to Dochart Creek. All but one of these gauging stations were placed on a watercourse with a warm thermal regime; however, Bear Brook still has a relatively high thermal regime and is classified as a cool-warm watercourse.

In comparison to Dochart Creek, Buckshot Creek is more comparable by slope of the main channel and percentage of lakes/wetlands within the catchment, when compared to the other unregulated flow watercourses. While Buckshot Creek is located 65 km northwest of the site, it is the closest natural watercourse with a gauging station; therefore, it was predicted that Buckshot Creek and Dochart Creek would experience similar responses to draughts and local precipitation than the other more distant watercourses with gauging stations.

Surface Water Comment #4

Comment: *Given the limited supporting information provided, I cannot confirm that the surface water model is sufficiently calibrated or reliable. Agreement between measured and predicted conditions cannot be confirmed for the estimated 7Q20 condition for any of the parameters evaluated.*

Response:

To provide a comprehensive answer to Surface Water Comment #4, we have reproduced below additional statements made throughout the surface water review letter on the topic of model calibration.

> *"It is unclear how (or if) background surface water quality in Dochart Creek was incorporated into this assessment (i.e., Are the concentrations reported intended to represent the additional concentrations of the subject parameters or the final concentration after mixing? If it is the latter, what values were used to represent background water quality?)."*

The forecasted concentrations represent the final concentrations following mixing with the background quality of Dochart Creek. As described in Section 7.1. page 13 of the Hydrogeological Impact Assessment report, the background concentrations were taken as the average observed concentrations at the Dochart Creek background station from the surface water monitoring program.

> *"Based on current monitoring data, leachate does not yet appear to have reached SW2 in Dochart Creek in any appreciable quantity, which may limit the value of the comparisons between model predictions and current water quality."*

It is agreed that leachate-impacted groundwater is interpreted to have not yet reached Dochart Creek; as such, the comparison of simulated and measured parameter concentrations in Dochart Creek cannot form the only line of evidence to support the calibration of the model. Additional lines of evidence supporting the model calibration are presented in the Hydrogeological Impact Assessment report, including:

- The comparison between simulated and measured groundwater elevations at monitoring wells (Section 6.3 and Figure 4);
- The comparison between simulated groundwater flow pathways and the conceptual hydrogeological model (Section 6.3 and Figure 4); and,
- The comparison between simulated and measured parameter concentrations at on-site monitoring wells (Section 7.2.2).

The model is considered to be satisfactorily calibrated based on the assessment of each of the above comparisons. On-going monitoring will be important to verify the results of the modelling and keep abreast of leachate-impacts on groundwater and surface water.

> *"In addition to the poor correlation for boron under the estimated 7Q20 conditions, noted above, predicted 7Q20 ammonia concentration is an order of magnitude higher than both the 2018-2020 (<0.01-0.09 mg/L) and historical range in Dochart Creek (<0.01-0.11 mg/L)."*

No sampling events have occurred during 7Q20 flow conditions in Dochart Creek; as such, at this time, parameter concentrations in Dochart Creek during extreme low flow conditions cannot be known. While the leachate plume is interpreted to not have reached Dochart Creek, it is considered conservative that the model simulates a minor contribution of leachate discharge to the Creek that results in elevated parameter concentrations during the low flow event.

> *"While the peak chloride concentration does initially appear to correlate well with model predictions for the estimated 7Q20 conditions, that measured value (reported in 2018) appears to be an outlier, more than double the next highest concentration on record for Dochart Creek and reflecting background effects, apparently unrelated to the landfill. This is not noted by the consultant and should not be considered to support predicted landfill impacts. Agreement with the model cannot be confirmed for the estimated 7Q20 condition for any of the parameters evaluated."*

If the elevated chloride concentrations measured at both SW1 and SW2 are removed from consideration, the observed concentration range (2018 to 2020) for chloride in Dochart Creek becomes 9 mg/L to 38 mg/L. The concentration of chloride simulated for 2020 for the minimum, 25th percentile and median flow rates of Dochart Creek are 33 mg/L, 29 mg/L and 27 mg/L, respectively, which all fall within this range. Only the simulated concentration of chloride for the 7Q20 flow rate (93 mg/L) exceeds this range. As stated above, no sampling events have occurred during 7Q20 flow conditions in Dochart Creek; as such, at this time, parameter concentrations in Dochart Creek during extreme low flow conditions cannot be known. While the leachate plume is interpreted to not have reached Dochart Creek, it is considered conservative that the model simulates a minor contribution of leachate discharge to the Creek that results in elevated parameter concentrations during the low flow event. As shown, the model calibrates well when parameter concentrations forecasted for observed flow rates in Dochart Creek are compared to the measured results.

> *If only 2020 conditions are considered, there is a lack of agreement between measured and predicted ammonia concentrations for all model scenarios (<0.01 mg/L vs 0.01-0.9 mg/L), including August 20, which corresponds directly to one of the flow conditions modeled. While the model appears to over-estimate ammonia concentrations for the measured flows (which would be protective), I have concerns over the meaningfulness of these flow statistics (min, 25th percentile, median) for long term predictions, as discussed above. As noted above, the measured flow at SW2 on August 20, 2020 was equal to the minimum flow value cited in the model validation and corresponds to the mid- summer sampling event. Direct comparison of predicted and measured water quality results reveals that the chloride concentration was slightly overestimated (114%), while boron and ammonia were more dramatically overestimated (2x and >9x the measured values, respectively), demonstrating the potential lack of agreement between monitoring data and model predictions.*

While the concentration of ammonia measured in Dochart Creek throughout 2020 was <0.01 mg/L at both monitoring locations SW1 and SW2, the concentrations of ammonia measured in 2018 and 2019 (<0.01 mg/L – 0.09 mg/L) are not outliers and represent the natural variability in ammonia within Dochart Creek. Due to the variability expected when sampling surface water, Golder considers it reasonable to compare these forecasted model results to samples collected over a period of time (such as the 3-year window used in this assessment); it is beyond the ability or expectation of a model to predict parameter concentrations that correspond to specific days.

> *The consultant's conclusion presumes that all flow conditions encountered 2018 - 2020 were within the lower distribution of flows (median, 25th percentile, or minimum, but not reaching the estimated 7Q20). While flows may have been low over a portion of the selected date range, supporting data have not been provided.*

The model calibration was presented for the 7Q20 flow rate and minimum, 25th percentile and median of the observed flow rates for Dochart Creek, as these values were considered more useful to present than higher flow rates (such as the 75th percentile or maximum observed flow rates) that result in the forecasted concentration in Dochart Creek closer to the background concentration for each parameter. In addition, the flow rates selected for the assessment of the calibration are the same as those selected for the forecasting. Because it is the lower end of flow rates that will be considered for assessing future surface water compliance, the lower flow rates were selected for the forecast assessment as these provide a more conservative assessment of whether surface water quality can be expected, under natural attenuation conditions, to comply with PWQO than using higher flow rates in Dochart Creek.

Surface Water Comment #5

Comment: *It is not clear if the leachate source strength determinations consider the potential changes in waste stream (i.e., diversion of recyclables and protrusible wastes), changes in leachate composition/concentration following cover placement, and/or with aging of waste. I defer to the groundwater reviewer and review engineer for comment on these matters.*

Response:

The leachate source strength does not consider potential changes in the waste stream associated with waste diversion (in particular the diversion of organics) that can, over time, significantly reduce the decomposable portion of the waste stream) and the resultant changes in leachate strength. Diversion is expected to improve (reduce) the concentration of various parameters in the leachate, which would then reduce the concentration in groundwater or surface water affected by leachate. The peak concentrations of the parameters selected for modelling conservatively correspond to typical municipal solid waste leachate for a site with the physical characteristics of the McNab Landfill site, as described in Section 5.1 of the Impact Assessment report. Also, as described in Sections 5.1 and 7.1, appropriate reductions over time in the peak leachate source strength as the waste ages and contaminants are flushed out of the waste by infiltrating precipitation or are otherwise removed were modelled and incorporated into the hydrogeologic model.

Surface Water Comment #6

Comment: *Boron, chloride and ammonia were selected as parameters of concern for groundwater and surface water impact assessments. Iron is also present at high concentration in leachate and should be considered with respect to potential surface water impacts in both on-site streams / wetlands and in Dochart Creek.*

Response:

Please see response to Groundwater Comment #5. Note that iron will be part of the site's ongoing groundwater and surface water monitoring program and will be used in conjunction with leading leachate indicator parameters to assess and characterize groundwater plume migration, the future onset of leachate impacts in Dochart Creek and site compliance in terms of surface water.

Surface Water Comment #7

Comment: *The compliance criteria selected for boron and chloride are appropriate. I cannot confirm that the selected compliance criteria for ammonia will be protective, particularly during the late summer period. The effect of fluctuations in temperature, pH and flow must be considered more thoroughly, with consideration for the precautionary principle.*

Response:

For the assessment, the compliance value for ammonia of 2.3 mg/L was calculated using the median values of pH and temperature measured in Dochart Creek, which is considered to be a reasonable approach for this modelling. In response to the comment, the ammonia concentration corresponding to a unionized ammonia concentration of 0.02 mg/L was determined for each sampling event from 1991 through 2021 using the field measured pH and temperature values. The median calculated ammonia concentration from this data set is 2.3 mg/L, the same value as presented in the assessment. From this data set, the minimum calculated ammonia concentration is 0.23 mg/L, the 5^{th} percentile concentration is 0.41 mg/L and the 25^{th} percentile is 1.02 mg/L.

The modelling incorporates conservatism into various aspects of the model. Also, the PWQO value for unionized ammonia includes a factor of safety of 10 based on toxicity testing for the most sensitive aquatic species. For these reasons, the values of pH and temperature that result in the most conservative calculated compliance value for ammonia were not considered necessary to be used in the assessment. Rather, the approach taken was to assess the resultant concentrations that could reasonably occur under typical conditions of both surface water quality and creek flow.

Considering the simulated surface water presented on Figures 5 and 6 of the Impact Assessment report, the effect of a lower ammonia compliance value (say the 25th percentile value) would be that the compliance value would not be met at the minimum observed flow rate but would be met at the 25th percentile and median observed flow rates.

This assessment predicts an outcome based on the McNab Landfill site continuing to operate as a natural attenuation landfill. The modelling demonstrates that at some time in the future, based on a robust monitoring program coupled with a trigger mechanism, it can be expected that engineered control of leachate-impacted groundwater migration towards Dochart Creek will be required to achieve surface water compliance at the McNab Landfill site. This is further discussed in the response to Surface Water Comment #10.

Surface Water Comment #8

Comment: *Clarification is needed on the compliance boundary for surface water considered in the Hydrogeological Assessment. Compliance boundaries for surface water are not dictated by property boundaries.*

Response:

The “surface water compliance boundary” presented on Figure 5 of the Hydrogeological Impact Assessment report specifically refers to the furthest downgradient intersection of Dochart Creek and the McNab WDS property boundary. This is in the vicinity of the SW2 monitoring station.

The “surface water compliance boundary” presented on Figure 6 of the Hydrogeological Impact Assessment report (i.e., forecasted compliance with additional CAZ) refers to the furthest downgradient intersection of Dochart Creek and the proposed additional CAZ.

It is acknowledged that the McNab Landfill site would become non-compliant regarding surface water compliance if leachate from the site causes parameter concentrations to exceed the applicable criteria anywhere along Dochart Creek. It is noted that the peak surface water impacts forecasted on Figure 5 and Figure 6 are comparable; as such, it is expected that the model would forecast a comparable level of impact regardless of the compliance point selected for analysis. It is proposed that the surface water compliance location remains at SW2.

Surface Water Comment #9

Comment: *The assessment does not appear to consider potential impacts to surface water from discharge of leachate impacted groundwater to streams and wetland areas upgradient of Dochart Creek, east and northeast of the current fill area. Evaluation of potential impacts to those receivers is also required to support and inform the proposed development of Stage 3 of the landfill.*

Response:

Please refer to our response to Surface Water Comment #1. As described in that response, based on our understanding of the surface water setting in the area of the McNab Landfill site, Dochart Creek is the eventual receiver of leachate-impacted groundwater discharge and the appropriate watercourse to assess for landfill site compliance.

Surface Water Comment #10

Comment: *Given the uncertainties described here, I cannot support the development of Stage 3 of the McNab-Braeside WDS as a naturally attenuating site, pending the submission of the additional information and assessment requested above.*

Response:

The purpose of the modelling assessment is to provide an understanding of current and future leachate migration to assist in the refinement of the groundwater and surface water monitoring programs and the development of contingency measures to ensure ongoing compliance of the site. It is our opinion that the modelling work

completed to-date has been beneficial by providing the understanding of leachate migration and potential effects on groundwater and surface water quality and associated site compliance required to update the Development & Operations Plan for the site. The updated Development & Operations Plan will include a surface water and groundwater trigger mechanism, that would use on-going groundwater and surface water monitoring to track plume migration and surface water quality and set triggers at parameter concentrations below the compliance values such that contingency measures could be implemented prior to the site going out of compliance. The contingency measures would be provided in the updated Development & Operations Plan and have been briefly described in the response to Surface Water Comment #2.

The McNab Landfill has been and is currently operating as a natural attenuation landfill, which is also the condition assumed in the modeling assessment. It is important to understand it is not proposed that the site continue to operate indefinitely as a natural attenuation landfill. When it is necessary to implement the contingency plan (based on ongoing monitoring and the approved trigger mechanism), it will no longer rely on natural attenuation but on an engineered collection and control system to manage the impacts of leachate generated by the landfill and continue to achieve compliance for surface water. The hydrogeologic setting at this site, where leachate-impacted groundwater migrates in the shallow subsurface through the surface sand layer and/or weathered clay crust zone and does not extend deeper because of the underlying low permeability unweathered grey silty clay, is very suitable for the installation and operation of a groundwater interceptor trench. This contingency measure can be expected to be highly effective in this setting to capture the leachate-impacted groundwater plume.

It is noted that the proposed approach is not affected by the volume of approved disposal capacity, the main effect of which is on the strength of the intercepted leachate-impacted groundwater. In terms of the modeling predictions under natural attenuation, since the 7Q20 flow is so low, the predicted concentrations of parameters in Dochart Creek during this extreme low flow event essentially reflect that the surface water is mostly leachate-impacted groundwater discharge.

Concluding Statements

It is considered that the predictive modelling of expected effects of continued landfilling as proposed at the McNab Landfill on groundwater and surface water quality and compliance is technically appropriate and includes degrees of conservatism, and it demonstrates that the site can be expected to operate and remain in compliance (incorporating the proposed monitoring, trigger mechanism and at some point in the future engineered contingency measure control on migration of leachate-impacted groundwater, as well as additional CAZ lands) from a surface water and groundwater perspective.

We hope that the clarifications and additional information provided in these responses to groundwater and surface water review comments assist with your assessment and will result in MECP’s support of the development of Stage 3 of the McNab Township landfill as proposed in the Hydrogeological Impact Assessment report.

Limitations and Use of this Letter

This letter was prepared for the exclusive use of The Township of McNab/Braeside. Any use which a third party makes of this report, or any reliance on, or decisions to be made based on it, are the responsibilities of such third parties. Golder Associates Ltd. (Golder) accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

This letter is based on data and information collected by Golder and is based solely on the conditions of the property at the time of the work, supplemented by historical information and data obtained by Golder as described in this letter and referenced reports. Golder has relied in good faith on all information provided and does not accept responsibility for any deficiency, misstatements, or inaccuracies contained in the report as a result of omissions, misinterpretation, or fraudulent acts of the persons contacted or errors or omissions in the reviewed documentation.

The services performed, as described in this letter, were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

The findings and conclusions of this letter are valid only as of the date of this letter. If new information is discovered in future work, including excavations, borings, or other studies, Golder should be requested to re-evaluate the conclusions of this letter, and to provide amendments as required.

Closure

We trust the contents of this letter meets your current needs. If you have further questions regarding the Hydrogeological Impact Assessment or the contents of this letter, please contact the undersigned.

Golder Associates Ltd.



Paul Smolkin, P.Eng.
Principal, Senior Geo-environmental Engineer

CWT/PAS/KAM/sg
https://golderassociates.sharepoint.com/sites/115688/project files/6 deliverables/002 response to mecp on hia/19130748 l response to mecp comments 2022june21.docx

CC: Ryan Frew, Township of McNab-Braeside

Ministry of the Environment, Conservation and Parks
Eastern Region
1259 Gardiners Road, Unit 3
Kingston ON K7P 3J6
Phone: 613.549.4000
or 1.800.267.0974

Ministère de l'Environnement, de la Protection de la nature et des Parcs
Région de l'Est
1259, rue Gardiners, unité 3
Kingston (Ontario) K7P 3J6
Tél: 613 549-4000
ou 1 800 267-0974

Ontario

M E M O R A N D U M

April 21, 2022

TO: Thandeka Ponalo
Senior Environmental Officer
Ottawa District Office
Eastern Region

FROM: Nick Battye
Hydrogeologist
Technical Support Section
Eastern Region

RE: McNab/Braeside Waste Disposal Site A412605
Hydrogeological Impact Assessment
Lots 18 & 19, Concessions 6, part of Lot 19, Concession 5
Township of McNab/Braeside, Renfrew County, Ontario

I have reviewed the report titled "Hydrogeological Impact Assessment, McNab Waste Disposal Site, Township of McNab/Braeside, Ontario" by Golder Associates Limited, dated February, 2021 (Golder 2021), which seeks to forecast site compliance with respect to surface water and groundwater leachate impacts originating from the McNab waste disposal facility at a time of full landfill development (1 million cubic metres of airspace) as described in the Development and Operations (D&O) plan for Stages 1, 2 and 3 (Golder 1997). My review notes and comments are included below.

Certificate of Approval

The McNab/Braeside Waste Disposal Site has been operating under Environmental Compliance Approval (ECA) A412605 since its issuance on June 10, 1980. The ECA permits the development of a landfill up to 10 hectares with a total capacity for waste and daily cover of 1 million cubic metres as part of a three-stage approach. Stage 1 relies on natural attenuation, which was achieved through the acquisition of land by the Township to the north and northeast of the landfill, referred to as the Contaminant Attenuation Zone (CAZ).

For landfill enlargement to proceed in association with Stage 2 and 3, the ECA requires additional studies to assess the potential requirement for engineered leachate management controls, or an increased CAZ, such that the landfill remains compliant with respect to leachate impacts on groundwater and surface water. Despite this requirement, landfilling has already moved well into Stage 2, and a limited amount into Stage 3. The present report (Golder 2021) seeks to satisfy the requirements of the ECA by assessing the hydrogeological characteristics of the site and the potential impacts of leachate generated from full Stage 1 to Stage 3 landfilling activities to determine the need for engineered or other design controls.

Physical Setting

The site is located on parts of Lots 18 and 19, Concession VI and part of Lot 19, Concession V in the Township of McNab/Braeside, Renfrew County, approximately 2.5 km southwest of Glasgow Station, Ontario.

Topography at the site generally slopes the north. Dochart Creek flows from west to east through the northern portion of the site, and a low-lying area with no distinct drainage channels is present to the northeast and east that is referred to as the “poorly drained area”.

Aspects of the hydrogeological impact assessment (Golder 2021) related to surface water will be reviewed separately by a MECP Surface Water Specialist.

Geology

The overburden at the site consists of a thin layer of topsoil or fill, underlain by a fine to coarse grained sand (measured between 1.8 and 4.6 m in thickness), which is underlain by a silty clay that extends up to 8.2 m below ground surface (bgs). The shallowest portion of the silty clay deposit (up to approximately 3 m thick) is a grey-brown weathered crust containing sand layers with thicknesses up to 0.2 m. The sand unit is discontinuous, thinning to the north and northeast. Adjacent to Dochart Creek and the poorly drained area, it is not found, and the silty clay is present immediately below the topsoil and peat in those areas, respectively. A sand and gravel layer was observed beneath the silty clay at two boreholes; it is inferred to be a till layer that exists between the silty clay and bedrock.

Bedrock consists of carbonate metasedimentary and mafic to ultramafic plutonic rocks; it was found at a depth of 2.8 m bgs in the southern part of the site but was not encountered in other boreholes that extended to 9.1 m bgs elsewhere on the site.

Hydrogeology

Groundwater flow has been interpreted to generally follow topography, flowing north and northeast. Upward hydraulic gradients were observed between the silty clay and the overlying sand layer. A number of poorly defined ephemeral surface water features in the poorly drained area have been identified that could potentially intermittently convey discharging groundwater through the poorly-drained area off-site to the northeast that could eventually contribute to flow in Dochart Creek; however, limited flow has been observed between these disconnected surface water features or via these features to the northeast property boundary during Golder’s ongoing surface water monitoring in this area.

Hydraulic conductivities recorded in specific units are as follows:

1. Sand and weathered crust: $1x10^{-4}$ to $6.4x10^{-7}$ m/s
2. Silty clay: $4x10^{-8}$ to $8x10^{-8}$ m/s
3. Till: $5x10^{-7}$ m/s
4. Bedrock: $3x10^{-8}$ m/s

Based on the hydrogeology and hydrology, two compliance boundaries have been highlighted by Golder:

1. Dochart Creek, and,
2. The northeast property boundary.

Guideline B-7

This is a landfill site operating under an ECA. As such, Reasonable Use Guideline B-7 applies. Golder has been evaluating compliance with Guideline B-7 based on the concentrations measured in wells BH99-1 (silty clay) and BH99-2 (sand) (boundary wells to the northeast). It was reported that as of 2019, the Reasonable Use Performance Objectives were met at these two wells.

Expansion Feasibility Study

Golder developed a numerical model to forecast site compliance with respect to surface water and groundwater leachate impacts originating from the McNab waste disposal facility at a time of full landfill development (1 million cubic metres of airspace) as described in the Development and Operations (D&O) plan for Stages 1, 2 and 3 (Golder 1997).

Steps and assumptions used in model development appear below:

- The infiltration rate of atmospheric water through the cover system and waste profile was estimated using the Hydrologic Evaluation of Landfill Performance (HELP) Model (USEPA 2020).
    - Current and final conditions modelled.
    - Climatic normal values over past 30 years, factoring in cover systems materials, layer thicknesses, final over slope, drainage length, present and effect of vegetation, and evaporative zone depth.
    - Calculated average annual infiltration rates through the bottom of the waste layer were 326 mm/yr under open conditions and 247 mm/yr under closed conditions.
- Leachate source strength was conducted using contaminant transport model POLLUTE (Rowe et al 1994), which is a one-dimensional analytical contaminant transport model that can simulate vertical contaminant migrations from a landfill situated on a multi-layer soil deposit.
    - Two cross-sections were considered.
    - Model inputs included current peak concentrations, peak concentrations at closure, contaminant mass as a proportion of total mass of waste, and half life in the landfill.
- A three-dimensional numerical model representing the landfill property and surrounding area was constructed using FEFLOW (Diersch 2016), a commercial finite element modelling program.
    - Boundary conditions were set up using local surface water features to the west and north (i.e., Dochart Creek), and to the southeast; an assumed groundwater flow divide corresponding to the topographical highs to the south and southwest; and the eastern flow boundary was selected to position the landfill at the centre of the model domain.

  - Total extents of the model are 2,100 m west-east, and 1,050 m north-south.
  - Constant head boundaries were set as follows: at the topographic elevation along the west, north, southeast boundaries to simulate the surface water features there; along the eastern edge of the model for all layers to simulate downgradient flow beyond the model; and no-flow boundaries were specified at the south and southwest boundaries as well as along the bottom of the model.
  - The horizontal finite element mesh was 50,877 finite elements per layer, with a discretization of 6 m in the vicinity of the landfilling area, and up to 30 m at the model periphery.
  - Vertically, the model is made up of 16 layers (more layers were used in areas of higher gradients).
  - The entire model domain corresponds to 814,032 finite elements.
- Hydraulic conductivities were applied per field measurements discussed above, but the till and bedrock values were combined for simplicity as the higher (i.e., more conservative) value. Areas within the waste footprint were given a value of $1x10^{-5}$ m/s.
- Recharge rates were used as follows:
  - Sand: 50 mm/a
  - Weathered crust: 5 mm/a
  - Waste footprint: 326 mm/a
- The model was run and calibrated based on the observed 2020 site conditions, and was considered satisfactorily calibrated based on the following:
  - simulated vs observed hydraulic heads for each on-site observation well within 5% normalized root mean square error.
  - simulated groundwater flow direction was consistent with measured readings.
  - forward particle tracking indicated leachate migration that was consistent with measured results.
- Two scenarios were examined:
  - full footprint, open (recharge rate 326 mm/a)
  - full footprint, closed (recharge rate 247 mm/a – includes final cover).
- An analytical solute transport model (GoldSim (GTG) 2018) was used to forecast the concentrations of select parameters at compliance boundaries throughout the life of a site.
  - Designed to develop an understanding of the factors that control the performance of an engineered or natural system and to predict the future behavior (performance) of the defined system.
  - Assumptions:
    - maximum landfilling footprint reached in 2045 (assumed to be conservative)
    - full capacity reached in 2100 (at which point final cover placed, which affects model infiltration rates)
    - dispersivity of 10% of the pathway length
    - tortuosity of 0.65
    - Partitioning coefficient of 0.19 mL/g for boron.
    - Pathway specific scaling factors for ammonia to simulate ammonia degradation during migration in groundwater

- Model performance was evaluated using actual data from well BH99-2 from 2015 to 2020 against simulated 2020 concentrations.
    - Simulated results for each parameter fell within the upper limit of the observed concentration ranges or slightly exceeded.
    - Indicates the model may be slightly conservative, but otherwise considered satisfactorily calibrated with respect to the groundwater compliance boundaries.

Future groundwater compliance was assessed by comparing forecasted groundwater quality for boron and chloride to the Reasonable Use Performance Objectives (RUPOs). Ammonia was modelled but does not have a groundwater guideline (or RUPO) for comparison. The model forecast that boron will exceed the RUPO (1.3 mg/L) in 2131, with a peak of 1.5 mg/L in 2159, and that chloride would exceed the RUPO (129 mg/L) in 2074, with a peak of 260 mg/L in 2131. Because the simulation results did not meet the RUPOs for the full development of the waste disposal site, an additional scenario was considered where an additional 500 m CAZ was present to the northeast; in this scenario, the site remained in compliance. Therefore, to achieve future groundwater compliance without reducing landfill capacity or implementing other engineered solutions, it was recommended by Golder (2021) that the Township enlarge their CAZ to the northeast, either through a groundwater easement or property purchase. The required timing for acquisition would be dependent on on-going monitoring results.

Conclusions and Recommendations

1. Golder concludes that an additional CAZ to the northeast would satisfy Condition 39 of the ECA and keep the waste disposal site in compliance with B-7 right up to full landfill capacity. I am in general agreement with the Guideline B-7 assessment completed by Golder, and I support the recommendation to purchase additional CAZ to provide for further landfill development; however, while Guideline B-7 may be satisfied from the groundwater perspective, this approach may not adequately consider potential surface water impacts resulting from groundwater discharge to Dochart Creek and the poorly drained area to the northeast. Due to the thinning of the sand layer towards the north, and the complete pinch out of this unit towards the northeast, most monitoring wells located along the periphery of the site were screened in the silty clay layer, which has hydraulic conductivity one to four orders of magnitude lower and vertical flow in the upward direction. Thus, existing groundwater monitoring results for wells screened in the silty clay unit may be an underrepresentation of leachate concentrations / migration in the more permeable sand unit. Where the sand thins, e.g., to 0.1 m at BH99-5 in the north, the unit may no longer be perennially saturated, but could still convey leachate at higher concentrations and at faster rates towards Dochart Creek in pulses during wet events. A similar fate and transport mechanism could be present in the poorly drained area to the northeast, where the sand unit completely pinches out and it is topsoil / peat down to 0.2 m (BH92-2) that overlies the silty clay layer. If correct, given that existing results (largely from groundwater pulled from the underlying silty clay layer) were used to calibrate the model, the model may be biased low. Additional insight and/or investigation from Golder on this is requested. However, with groundwater presenting very close to, if not at, the surface in many of the periphery areas on-site, potential surface water impacts are seen to be the

driving concern in these areas; therefore, the case for the McNab/Braeside WDS ECA amendment must ultimately satisfy any concerns raised by the MECP Surface Water Specialist.

2. Golder has been evaluating compliance with Guideline B-7 based on the concentrations measured in wells BH99-1 and BH99-2. It was noted that well BH99-1 is screened in the silty clay unit and therefore, may not be appropriate as an accurate indicator of leachate migration (see point 1). Boundary wells BH92-1 and BH99-5, located to the west, are also screened in the silty clay layer, but have measured exceedances, at times, related to DOC, Fe, and/or Mn. While BH99-2 (Guideline B-7 well) is appropriately screened in the sand, and does not show any signs of leachate, the nearest wells that are screened in the sand (with results) include the well clusters at BH91-1 and BH8; these wells have reported exceedances, at times, for DOC, TDS, Fe, and/or Mn. Given these facts, an explanation from Golder is needed on why they think B-7 is being met.
3. Leachate effects have been observed in monitoring well BH6, located further south on the existing waste footprint, and in surface water samples from the poorly drained area east / northeast of the landfill; specifically, at SW4, SW6, SW7, SW8, and SW9, which have consistently recorded elevated alkalinity, ammonia, boron, cobalt, COD, calcium, chloride, DO, hardness, iron, manganese, magnesium, phenols, potassium, sodium, TDS, and total phosphorus. In some cases, the concentrations exceeded the PWQO. Given the known exceedances in surface water here, the lack of groundwater data in this area is concerning and may be a source of error for model prediction; for example, groundwater data is not available for locations in the vicinity of monitoring wells BH-4, BH92-4, and BH92-3, despite that fact that the ‘full footprint’ modelling predictions show that groundwater flow in this direction becomes a dominant flow pathway. Coupled with that, it is not clear to me why there is little to no contaminant movement predicted in this direction under the ‘2020 conditions’ modelling predictions. To me, this raises questions about the accuracy of model predictions. I recommend that Golder provide additional information to clarify these items.
4. Care needs to be taken when considering monitoring results from wells screened in the underlying silty clay, as they may not be representative of the maximum amount of leachate migrating from the source (discussed earlier in point 1). Where the sand and peat units overlying the silty clay thin (down to 0.1 m in places), installation of additional monitoring wells is recognized as being an impractical solution. Alternative methods are needed in these areas to confirm the fate and transport of leachate in the sand unit, or where it discharges therefrom.
5. While contaminant concentration projections were performed for boron, chloride, and ammonia, and in most cases represent conservative tracers, none of these represent the current contaminants of concern in groundwater at the site, which are DOC, Fe, Mn, and TDS. These should be modelled as well and may be useful as an extra source of data for calibration.
6. It was stated that on-going monitoring remains critical to continue validating model accuracy. Additional well installations were also recommended by Golder between the full landfill footprint and the current northeast property line for better understanding and tracking of leachate in this area. I agree with this and stress that the screened intervals need to be appropriately placed to capture leachate migration in all applicable stratigraphic units. This may require some exploratory

work to determine the best placement location and further consideration of the degree of hydraulic connection between units.

Should you have any questions regarding these comments, I would be happy to discuss them further.



Nick Battye, MSc, PGeo

ec: Emily Tieu
Lauren Forrester
Victor Castro
James Mahoney

c: File GW RE MC 01-02 (McNab/Braeside WDS A412605)
ECHO Ref # 1-93456530

Ministry of the Environment, Conservation and Parks
Eastern Region
1259 Gardiners Road, Unit 3
Kingston ON K7P 3J6
Phone: 613.549.4000
or 1.800.267.0974

Ministère de l'Environnement, de la Protection de la nature et des Parcs
Région de l'Est
1259, rue Gardiners, unité 3
Kingston (Ontario) K7P 3J6
Tél: 613 549-4000
ou 1 800 267-0974

Ontario

M E M O R A N D U M

April 19, 2022

TO: Thandeka Ponalo
Senior Environmental Officer
Ottawa District Office
Eastern Region

FROM: Lauren Forrester
Surface Water Specialist
Technical Support Section
Eastern Region

RE: Hydrogeological Impact Assessment and 2020 Annual Report
McNab-Braeside Waste Disposal Site
Lots 18 and 19, Concession 6, Geographic Township of McNab
ECA No. A412605

As requested, I have reviewed the report titled "Hydrogeological Impact Assessment, McNab Waste Disposal Site, Township of McNab/Braeside, Ontario", prepared by Golder Associates Limited (GAL) and dated February 2021. I have also consulted the summary letter titled "2020 Groundwater and Surface Water Monitoring Program and Annual Operations Report", prepared by GAL, dated March 2021. I offer the following comments with respect to surface water matters.

Background

The McNab/Braeside Waste Disposal Site (WDS) is currently operated as a naturally attenuating waste disposal site under Environmental compliance Approval No. A412605. The WDS has an approved 10-hectare (ha) landfill footprint within a 64.3 ha site and a total capacity of 1,000,000 cubic metres between three Stages. The Approval for this site was first issued in 1971 and has been repeatedly amended since that time, most recently on May 11, 2016 (Notice No. 4). The existing Design and Operations (D & O) Plan was adopted under the September 30, 1998 Approval, with an amendment to Figure 7 incorporated as part of Notice 1 to the ECA (April 14, 2000). The D & O Plan sets out details for the development and operation of Stage 1 of the WDS and conceptual development plans for Stages 2 and 3. Development plans for Stages 2 and 3 have not yet been reviewed by the Ministry.

To date, filling has occurred in Stages 1, 2 and 3, as described below. Operations shifted to Cell 3 in 2019. Residual capacity in Stage 2 is estimated to be 125,417 m^3 at the end of 2020. The annual operations report indicates that, due to exposed bedrock outcrops in the area, the residual capacity in Stages 1 and 2 will be filled only after filling in Stage 3 is complete. Interim cover placed over Stage 2 in 2019 and 2020 and the

area is intended to be used for management of contaminated soil while Stage 3 is developed.

The footprint of Stage 3 extends north, east, and slightly south of the existing footprint. Trees were cleared from the north section of the Stage 3 footprint in 2016-2017. Final design contours for Stage 3 are reported to have been developed in 2017 and are intended to provide a minimum vertical separation of 1 metre between groundwater and deposited waste through import of granular fill. More extensive fill placement is expected to be required for the 'open area' farther east (identified as 'wet area' on Stantec's Design Waste Contours map). In 2019 and 2020 granular fill was imported to prepare portions of the base of Cell 3 to accept waste. In 2020, 10,892 cubic metres of waste and daily cover were deposited in Cell 3A, leaving a remaining capacity 589,608 m^3 in Stage 3 at the end of that year. Development of Stage 3 is projected to provide for continued operation at the Site through to approximately 2100.

The approved D&O plan for this Site states that the development of Stage 3 is expected to "incorporate engineered containment features (liners / collection systems, etc.)" and "require additional geotechnical and hydrogeological studies for the purpose of assessing the need and finalizing the design of the engineered components… site development under Stage 3 would require an approval process for the engineered system" (GAL, 1997). No rationale for the change in conceptual plan has been provided. The subject report is intended to lay out the groundwork for the required updates to the D&O Plan and amendments to the Approval for the continued development of Stages 2 and 3.

Surface Water Regime

The Site is located within a poorly drained area south of Dochart Creek. The site slopes gradually to the north, with Dochart Creek flowing west to east through the northern portion of the Site. Dochart Creek and its tributaries east of the landfill are designated as cold water streams based on the presence indicator fish species. As such, these waterbodies should be considered highly sensitive. Shallow groundwater is interpreted by GAL to flow towards Dochart Creek in the northern portion of the site and to the northeast on the eastern side, following site topography. Small drainage courses are apparent near the eastern property line, some originating near the waste mound and flowing through the poorly-drained wetland area east/northeast of the mound, potentially intersecting with the predicted leachate plume. These small streams eventually flow to the unnamed tributaries to Dochart Creek east of the Site.

Overburden generally consists of a surficial sand layer underlain by silty clay, which is understood to limit infiltration in the area northeast of the fill area (corresponding to the footprint of Stage 3 of the approved landfill). Bedrock outcrops are noted within the landfill footprint. The depth of the silty clay deposit is described by the consultant to vary across the site. Clay is present near the ground surface in the northern portion, near the Creek. In the wetland area / poorly drained area, the silty clay is overlain by a surficial peat layer. Leachate impacted groundwater is expected to eventually discharge to the Creek and ephemeral watercourse / wet areas east and northeast of the waste due to upward hydraulic gradients between the sand and clay layers. As

such, the primary pathway for leachate migration is understood to be through discharge to surface water.

In his October 3, 2019 memorandum, S. Kinney recommended the installation of additional monitoring wells north, northwest and west of impacted monitoring locations BH 15-1 and BH 15-2 to fully delineate the horizontal and vertical extent of leachate impacts in groundwater. Three new groundwater monitoring wells were established between the waste footprint and Dochart Creek in 2020 (BH20-1, BH20-2, BH20-3, north/northwest of BH15-2A/B). There continues to be limited active groundwater monitoring east of the landfill footprint.

The surface water monitoring program includes monitoring in Dochart Creek (SW1 and SW2) and at several locations through the poorly drained area (SW4, SW6, SW7, SW8 and SW9). Stantec's operations report refers to an additional station in Dochart Creek (SW3), which was last monitored in 2003. I have not been able to locate documentation showing the location of that station or supporting the cessation of monitoring there.

Results and Discussion

2020 Surface Water Monitoring Summary

Leachate effects are evident in the poorly drained area east/northeast of the mound, including potential indications of leachate affecting the background station (SW8) as described below. As reported for groundwater, leachate impacts in the poorly drained area decrease with distance from the mound. Dochart Creek does not appear to be discernibly impacted by landfill operations at this time.

- SW2 in Dochart Creek is not definitively impacted by leachate. COD, iron and sodium were slightly elevated compared to background on some dates but were generally consistent with background and below the 75th percentile concentration from SW1.

- SW4, 420 m from fill area in the poorly drained area, is impacted by leachate. The station exhibits consistently elevated concentrations of leachate parameters, including alkalinity, boron, calcium, chloride, hardness, magnesium, potassium, sodium, and TDS compared to background. Boron exceeded PWQO in April (below CWQG). Total phosphorus and phenols also exceeded the PWQO in December. A long-term increasing trend in the concentration of boron is noted by Golder. Surface water is otherwise consistent over time.

- SW6, 350 m from fill area in the poorly drained area, is impacted by leachate. The station exhibits consistently elevated concentrations of leachate parameters, including alkalinity, boron, calcium, chloride, hardness, magnesium, potassium, sodium, and TDS compared to background (not exceeding guideline values, where applicable). Dissolved oxygen was below the PWQO in April. Total phosphorus and phenols exceeded the PWQO in December. Golder reports that water quality is generally consistent over time at this station, but following independent review, there appears to be increasing trends in several leachate indicator parameters (sodium and boron, and to a lesser extent chloride).

- SW7, 250 m from fill area in the poorly drained area, is impacted by leachate as above, including alkalinity, boron, COD, calcium, chloride, hardness, magnesium, potassium, sodium, and TDS compared to background. Boron, DO, iron, and phenols failed to comply with PWQO. Golder reports surface water quality to be consistent over time. I disagree, noting marked increasing trends in the concentrations of boron and sodium, and more subtle upward trends in COD, potassium, manganese, and alkalinity. Iron is variable at this station but may also be trending upward.

- SW8, in the poorly drained area, is intended to represent background for the wetland area. Only PWQO non-compliance is phenol in December. Golder reports that surface water quality is generally consistent over time; however, there appears to be noticeable increasing trends in the concentrations of several leachate indicator parameters (boron and chloride, and possibly alkalinity, manganese, sodium, and potassium), which may indicate potential leachate effects in this area. The potential for flow from the mound to that area is supported by the drainage areas predicted in OFAT, but should be confirmed.

- SW9, 50 m from fill area, is impacted by leachate, with elevated alkalinity, ammonia, boron, calcium, chloride, calcium, hardness, iron, magnesium, manganese, potassium, sodium, and TDS compared to background. PWQO exceedances include boron, cobalt, DO, iron, phenols, unionized ammonia, and TP. Ammonia and iron concentrations have been noted to be variable over time as this location may be affected by leachate seeps. This station is within the landfill footprint and will eventually be entombed by waste.

<u>Hydrogeological Impact Assessment:</u>

Streamflow in Dochart Creek:

Streamflow monitoring is outlined in S.3.0 of the report and consisted of nine (9) single transect measurements at each SW1 and SW2, which were averaged through the non-frozen season (October and November 2019, March through September 2020). SW1 / SW2 averaged streamflow ranged from 4.3 L/s to 528.8 L/s.

Average flows in Buckshot and Dochart Creeks were used to produce a ratio of average flows in the two watersheds. That flow ratio was applied to the calculated $7Q_{20}$ for Buckshot Creek (6 L/s) to estimate the $7Q_{20}$ for Dochart Creek (0.3 L/s) (less than a typical garden hose). Other flow statistics presented (minimum, 25^{th} percentile, median, 75^{th} percentile and maximum) were represent data collected October 2019 through September 2020 only. Together with the estimated $7Q_{20}$, these flow statistics were used to estimate future concentrations of parameters of concern in Dochart Creek and form the basis for the surface water impact assessment.

I have several concerns with the streamflow estimates for Dochart Creek, summarized below:

- Flow would typically be expected to increase with distance downstream. Measured flows at SW2 were often lower than at SW1 (upstream) in the data presented. The reason for this is not discussed in the report (i.e., Were transect locations

appropriate? Is the study site within a losing reach? What equipment / method were used to measure flows?).

- Nine monthly measurements of flow are available for SW1 and SW2 in Dochart Creek, collected October 2019 through September 2020. While it is not unusual to have limited flow information, it is unclear how representative these data and the calculated average flows are for use in the extrapolations presented.

- No justification is provided for the use of the ratio of average flows over other methods for estimating the $7Q_{20}$ flow in Dochart Creek (i.e., area reduction method with calibration using measured flows). Support for the choice of extrapolation technique is needed.

- Insufficient information is provided to corroborate the calculated $7Q_{20}$ in Buckshot Creek (i.e., Why was the selected calculation used? Within the available dataset, how were estimated flows or flows affected by beaver activity treated? Were there gaps in the dataset?).

- No information is provided on the comparability of Buckshot Creek to the study site (e.g., characteristics of the streams, drainage areas, physiography, stream order, groundwater regime), nor is justification provided for the choice of reference watershed. Buckshot Creek is located approximately 65 km southwest of the waste disposal site, with notable differences in watershed characteristics, including main channel slope, percent wetlands, percent agricultural/rural area and percent open waters indicated in OFAT. In addition, Buckshot Creek has been classified as warm water creek (with a small portion designated as cool water habitat downstream of the gauging site), while Dochart Creek and its tributaries are classified as having a cold water thermal regime. These differences suggest that these systems may differ in their responses to high and low water conditions.

  I cannot confirm that the selected watershed is appropriate for prorating flows in Dochart Creek based on the information provided.

Leachate Indicators and Source Strength Determination:

Leachate indicator parameters for this Site have been previously identified as alkalinity, ammonia, boron, calcium, chloride, COD, DOC, hardness, iron, magnesium, manganese, potassium, sodium, TDS, and TKN. From these, GAL identifies parameters of concern as chloride, boron, and ammonia because these parameters were at low concentration in groundwater compared to leachate, conservative (B and Cl), are important to surface water impact assessment (NH3) and have surface water compliance criteria.

Leachate strength determination (s. 5.0) was done based on POLLUTE model, with two cross-sections of the landfill to assess the Site's two compliance boundaries (surface / groundwater). Projected peak concentrations of chloride, boron and ammonia in leachate were estimated as 500 mg/L, 3.2 mg/L and 200 mg/L, respectively. Current leachate strength is understood to be relatively dilute under current conditions. From the details provided, it is not clear if potential changes in waste stream (i.e., diversion of recyclables and protrusible wastes), changes in leachate composition following cover

placement, and/or with aging of waste were considered. I defer to the expertise of the review engineer and groundwater reviewer for comment on the predicted leachate strengths.

While the identification of boron, chloride and ammonia as parameters of concern is reasonable with respect to surface water receivers, iron is also present at high concentrations in leachate (dissolved iron up to 100 mg/L in BH4B/BH6) and has relevant surface water criteria. Monitoring data from SW9 suggests that ephemeral streams receiving leachate impacted groundwater may be significantly impacted by iron, with total iron up to 280 mg/L and dissolved iron up to 37.3 mg/L, over 100-times the guideline value at that location (tested in 2020 only). Iron (dissolved and total) should be considered in the assessment of potential leachate impacts. The British Columbia Ministry of the Environment Water Quality Guideline for iron is appropriate for this assessment and states that iron should not exceed 0.35 mg/L dissolved or 1.0 mg/L total to protect freshwater aquatic life from adverse effects of iron.

Surface Water Model and Validation:

Surface modelling work presented in the report incorporates information from the leachate source strength determinations (described above), solute transport modelling described in Section 7.0 of the report, and flow measurements / estimates for Dochart Creek (described above).

In an effort to validate the model, model outputs representing simulated 2020 conditions under various flow conditions were compared to the range of measured water quality for parameters of concern reported 2018 though 2020. The consultant concludes that, because predicted concentrations fell within the measured concentration range 2018-2020 (except boron, which exceeded measured values under simulated $7Q_{20}$ conditions), the model is satisfactorily calibrated. I offer the following observations and comments with respect to these findings:

- Leachate impacted groundwater is expected to discharge to Dochart Creek where leachate plume reaches Dochart Creek (with leachate-impacted groundwater discharging from the surficial sand layer). The specific compliance point evaluated in the model is not identified (i.e., What section of the creek is expected to intersect the plume? How far downstream of the plume intersection are these results intended to represent? Where is the plume and compliance locations in relation to SW2?).

- It is unclear how (or if) background surface water quality in Dochart Creek was incorporated into this assessment (i.e., Are the concentrations reported intended to represent the additional concentrations of the subject parameters or the final concentration after mixing? If it is the latter, what values were used to represent background water quality?).

- Based on current monitoring data, leachate does not yet appear to have reached SW2 in Dochart Creek in any appreciable quantity, which may limit the value of the comparisons between model predictions and current water quality.

- In addition to the poor correlation for boron under the estimated 7Q20 conditions, noted above, predicted 7Q20 ammonia concentration is an order of magnitude higher than both the 2018-2020 (<0.01-0.09 mg/L) and historical range in Dochart Creek (<0.01-0.11 mg/L).

  While the peak chloride concentration does initially appear to correlate well with model predictions for the estimated $7Q_{20}$ conditions, that measured value (reported in 2018) appears to be an outlier, more than double the next highest concentration on record for Dochart Creek and reflecting background effects, apparently unrelated to the landfill. This is not noted by the consultant and should not be considered to support predicted landfill impacts.

  Agreement with the model cannot be confirmed for the estimated $7Q_{20}$ condition for any of the parameters evaluated.

- If only 2020 conditions are considered, there is a lack of agreement between measured and predicted ammonia concentrations for all model scenarios (<0.01 mg/L vs 0.01-0.9 mg/L), including August 20, which corresponds directly to one of the flow conditions modeled. While the model appears to over-estimate ammonia concentrations for the measured flows (which would be protective), I have concerns over the meaningfulness of these flow statistics (min, 25th percentile, median) for long term predictions, as discussed above.

  As noted above, the measured flow at SW2 on August 20, 2020 was equal to the minimum flow value cited in the model validation and corresponds to the mid-summer sampling event. Direct comparison of predicted and measured water quality results reveals that the chloride concentration was slightly overestimated (114%), while boron and ammonia were more dramatically overestimated (2x and >9x the measured values, respectively), demonstrating the potential lack of agreement between monitoring data and model predictions.

- The consultant's conclusion presumes that all flow conditions encountered 2018 - 2020 were within the lower distribution of flows (median, 25th percentile, or minimum, but not reaching the estimated $7Q_{20}$). While flows may have been low over a portion of the selected date range, supporting data have not been provided.

Comments on the groundwater model are provided under separate cover from the groundwater reviewer. In summary, Reasonable Use Performance Objectives were exceeded for each of the selected parameters of concern, necessitating additional the purchase of additional CAZ to the northeast, reduction of landfill capacity or implementation of other engineered solutions. With respect to potential groundwater-surface water interactions, I note the following:

- Surface water monitoring data shows current leachate impacts east / northeast of the existing mound (described above). The 'Simulated Hydraulic Head and Leachate-Impacted Groundwater Flow Path – 2020 Conditions' (Figure 4) do not depict flow of leachate impacted water to those areas. It is unclear if the simulation agrees with the current understanding of shallow groundwater flow and demonstrated leachate effects in surface waters east of the mound. This may

reflect a lack of current groundwater monitoring in that area, as only active groundwater monitoring location (other than leachate monitors) appears to be BH92-5, which is a background station.

Discharge of leachate impacted groundwater to surface is expected to be the predominant pathway for leachate migration. I am not confident that the model adequately characterizes current conditions to the east/northeast of the current fill area, which limits the capacity to predict potential intensification of leachate impacts to surface water in that area between current and full footprint scenarios.

Surface Water Compliance Criteria:

CWQG for chloride and boron (120 mg/L and 1.5 mg/L, respectively) were selected as compliance criteria, which is acceptable. As described above, additional surface water compliance criteria are justified for iron and should be based on the BC MOE water quality guideline for iron. For ammonia, the applicable guideline is the PWQO for unionized ammonia. The proportion of ammonia present in the unionized form varies with water temperature and pH. To establish a surrogate for the PWQO, the consultant has used 'typical' temperature and pH (15ºC and 7.5, respectively), producing a compliance criteria of 2.3 mg/L total ammonia. Because the amount of ammonia in the unionized fraction increases sharply with increases in either pH or temperature, the proposed compliance criteria may not be protective.

Temperature in Dochart Creek ranges from 0.5 to 25.1 ºC (median 11.1 ºC; 75th percentile 17.5 ºC) over the period of record and pH ranges from 6.8 to 8.43 (median 7.73; 75th percentile 8.04). Temperature in small streams east of the fill area ranges from 0ºC to 23.3ºC. Considering the likelihood that higher temperatures will correspond to lower flows and that the 'typical' pH cited is less than the median and average values in Dochart Creek, it is likely that unionized ammonia will grossly exceed the concentrations presumed in the surface water impact assessment in the late summer low flow period, which is typically the critical period for leachate assimilation.

Surface Water Compliance Location:

The specific compliance location in Dochart Creek is not identified in relation to the results presented in the report. For the purpose of this discussion, the compliance location is assumed to be SW2.

Based on the model results presented in Figure 4, it appears that SW2 may be upstream of a substantial part of expected leachate plume under current (2020) and future conditions. The area of expected leachate discharge and SW2 should be clearly depicted on subsequent figures. If SW2 is not expected to capture all expected leachate effects in Dochart Creek, an additional sampling location should be established farther downstream.

A number of ephemeral and unnamed streams occur both within the site and adjacent to it. An area previously described as wetland, now referred to as 'poorly drained area', also exists within and adjacent to the proposed Stage 3 footprint. The extent of the potential impacts to these streams, including cold water tributaries to Dochart Creek, and to the undeveloped portions of the wetland are not discussed (i.e., what

concentrations of leachate indicator parameters should be expected where groundwater discharges to small streams? Will wildlife be exposed to higher concentrations of undiluted leachate discharging to surface upgradient of Dochart Creek?). More information is required.

Surface Water Compliance Assessment:

Concentrations of boron, chloride and ammonia were all forecast to exceed the compliance criteria under the $7Q_{20}$ flow rate scenario, while only chloride was expected to exceed under the 'minimum flow' condition. Compliance criteria were not expected to be exceeded under the median or 25th percentile flow conditions. For reference, the current range for parameters of concern in Dochart Creek are <0.01-0.03 mg/L boron; 12-50 mg/L chloride (outlier excluded); and <0.02-0.02 mg/L ammonia) (75th percentile values 0.05 mg/L, 28 mg/L and 0.016 mg/L, respectively).

While the compliance criteria are noted to be exceeded, the magnitude of the expected exceedance is not discussed. Based on a review of Figures 5 and 6, peak parameter concentrations occurring under the estimated $7Q_{20}$ conditions are approximately 3.0 mg/L boron, 500 mg/L chloride, and 7.5 mg/L ammonia. Chloride only slightly exceeds the CQWG (120 mg/L) under the 'minimum observed flow' condition. Slight differences in surface water predictions are noted between Figures 5 (existing groundwater compliance boundary) and Figure 6 (with additional CAZ). The reason for these differences is not discussed. Surface water compliance boundaries are not dictated by property lines and would not be affected by the establishment of additional CAZ.

- As noted above, the location that these predictions are intended to represent is not clearly defined, additional information is needed with respect to flow modeling, and it is unclear how background water quality was defined or if it was considered in the subject assessment.

- Anticipated impacts to on-site ephemeral streams and wetlands or to cold water tributaries to Dochart Creek immediately east of the Site do not appear to be considered in the current assessment and more information is required.

With respect to the projected concentrations of parameters of concern in excess of compliance criteria, the consultant notes that the low flow conditions in Dochart Creek are not expected to be consistent and represent worst-case scenario, emphasizing that under typical conditions compliance will be achieved. While I do not disagree, low flow conditions are used in evaluating the expected impacts of long-term projects to ensure environmental protection under statistically likely worst-case scenarios (i.e., $7Q_{20}$). Low flow conditions, when they occur, are unlikely to be so transient that long term exposure criteria would not apply. Published guidelines must be met unless supported by site-specific toxicological assessments (reviewed and approved by MECP's Standards Development Branch) or where assimilation occurs within an approved Mixing Zone. A mixing zone, if proposed, must be supported by relevant assessments and comply with the MECP Policies for Water Management (MECP 1994).

Summary of Golder's Recommendations:

- GAL recommend establishment of additional CAZ northeast of the existing landfill to achieve groundwater compliance without reduction of landfill capacity or implementation of engineering solutions.

  Establishment of additional CAZ does not address surface water concerns. Compliance criteria for surface waters (including ephemeral and wetland areas) are applicable on- and off-site. The subject report does not provide enough information to be confident that development of Stage 3 of the landfill (without reduction of landfill capacity or implementation of engineering controls) will not result in impairment of surface waters receivers. Additional source controls may be required to prevent impairment of area surface water.

  Within the 2020 Annual Operations Monitoring Report, Stantec recommends that, in recognition of the significant financial interest in Cell 3, implementation of any additional measures to increase protection of groundwater and surface water from Cell 3 Operations are warranted.

- Existing monitoring program is considered by GAL to be appropriate. Ongoing monitoring is required to verify modelling predictions. Additional monitoring wells between fill area and northeast property line may be considered.

  Please see comments from the groundwater reviewer with respect to the relevant monitoring program. With respect to surface water, additional downstream monitoring may be required, pending clarification of the location of SW2 relative to the expected intersection of the leachate plume and the creek. Establishment of a new background monitoring location and downgradient monitoring locations east of the mound may also be required.

- Development sequence for the landfill is to be set out in an updated D&O plan. The updated D&O plan is to include revised surface water and groundwater trigger mechanism and contingency plan. The subject report will form the basis of the updated D&O Plan and ECA amendment application in support of the proposed development of Stages 2 and 3.

  In addition to the above, the updated plan should include details of any on-site drainage features, as previously requested. Surface water review of any updated D&O is recommended.

Conclusions and Recommendations

1. Leachate effects are evident at all monitoring locations in the poorly drained area northeast and east of the current waste mound, including background. While significant impairment is unlikely at this time, intensification of leachate effects in that area reasonably predictable with continued development of Stage 3, without additional measures to control leachate migration. Additional monitoring in the tributaries to Dochart Creek draining from the east property line may be required.

There are no appreciable leachate impacts to Dochart Creek immediately north of the Site at this time, but leachate impacted groundwater is expected to eventually discharge to Dochart as the primary pathway for leachate migration. Additional information is needed to determine whether additional downstream monitoring is justified, as discussed above.

2. Monitoring data collected in 2020 suggests that Dochart Creek, which contains highly sensitive cold water habitat, may have very low flows in the mid-to-late summer. As such, there is likely limited capacity for dilution or assimilation at those times. This is problematic for a naturally attenuating site, which will ultimately discharge leachate impacted groundwater to area surface waters without controls over the timing, quantity or quality. It is also notable that no flow or water quality information is available for the cold water tributaries to Dochart Creek east of the Site. These tributaries are slightly downgradient of current leachate impacted surface water monitoring locations and appear to originate within the projected pathway for leachate migration.

3. The method used to estimate low flows in Dochart Creek may be overly simplistic (i.e. may over- or under-estimate available assimilative capacity), as discussed above. The flow statistics presented, both measured and estimated, should be used with caution and may not be appropriate for the extrapolations made in the surface water impact assessment.

4. Given the limited supporting information provided, I cannot confirm that the surface water model is sufficiently calibrated or reliable. Agreement between measured and predicted conditions cannot be confirmed for the estimated $7Q_{20}$ condition for any of the parameters evaluated.

5. It is not clear if the leachate source strength determinations consider the potential changes in waste stream (i.e., diversion of recyclables and protrusible wastes), changes in leachate composition/concentration following cover placement, and/or with aging of waste. I defer to the groundwater reviewer and review engineer for comment on these matters.

6. Boron, chloride and ammonia were selected as parameters of concern for groundwater and surface water impact assessments. Iron is also present at high concentration in leachate and should be considered with respect to potential surface water impacts in both on-site streams / wetlands and in Dochart Creek.

7. The compliance criteria selected for boron and chloride are appropriate. I cannot confirm that the selected compliance criteria for ammonia will be protective, particularly during the late summer period. The effect of fluctuations in temperature, pH and flow must be considered more thoroughly, with consideration for the precautionary principle.

8. Clarification is needed on the *compliance boundary* for surface water considered in the Hydrogeological Assessment. Compliance boundaries for surface water are not dictated by property boundaries.

9. The assessment does not appear to consider potential impacts to surface water from discharge of leachate impacted groundwater to streams and wetland areas upgradient of Dochart Creek, east and northeast of the current fill area. Evaluation of potential impacts to those receivers is also required to support and inform the proposed development of Stage 3 of the landfill.

10. Given the uncertainties described here, I cannot support the development of Stage 3 of the McNab-Braeside WDS as a naturally attenuating site, pending the submission of the additional information and assessment requested above.

If you have any questions about these comments, I would be happy to discuss them with you.



Lauren Forrester, M.Sc.
LF

ec: Victor Castro, Water Resources Unit Supervisor
Nick Battye, Regional Hydrogeologist
Emily Tieu, Ottawa District Supervisor

c: LF/ECHO 1-97847882

Stantec

Memo

To:	Ryan Frew, P. Eng. Township of McNab Braeside	From:	Gerry Lalonde 1331 Clyde Avenue, Ottawa
File:	163401232	Date:	December 7, 2015

Reference: McNab Braeside Landfill – Stage 3 Development

The Township retained Stantec to develop contours for the bottom of the waste for Stage 3 of the approved landfill development plan. Stantec proposal scope of work was defined in email dated June 4th to Ryan Frew and authorization to proceed received via email to Gerry Lalonde (GL) dated July 31, 2015. The outline of the Stage 3 waste development plan was prepared by Golder Associates (GA) in 1997 and is incorporated into the Environmental Compliance Approval (ECA) #A 412605, more particularly Conditions 37, 38 and 39. The final waste contours approved for the landfill development incorporate an air space of approximately 1 million cubic metres. In 1997, GA had identified the potential for the site development having to include a leachate collection system (LCS) to manage groundwater contamination from Stage 3. Since then, the Township has purchased additional land for a contaminant attenuation zone (CAZ – refer to Condition 39 and 40 of ECA) which should negate the need for a LCS. Groundwater monitoring of the CAZ is required to assess compliance and the need for any additional measures.

The areal extent of Stage 3 is shown in Figure C01. As this area is covered in bush, a walk through by a Stantec biologist was conducted on October 27 (2015) to investigate the potential presence of butternut trees. A Memo dated November 10th 2015 from Josh Mansell (Stantec) describes the walk-through and the finding of one butternut tree in the south east segment of Stage 3. No work should be conducted within 50m of this tree. Further work (butternut health assessment) should be completed 3 years prior to the planned development of Stage 3B such that if a permit (under the Endangered Species Act or ESA) by the Ministry of Natural Resources is required, it can be done and not delay tree clearing and the Stage 3B base preparation. The location/coordinates (UTM NAD 83) of the butternut tree are shown in the Table on drawing C-01. As Stage 3B is still many years away, the condition of the tree may be significantly different than today and thus this work should not be done till required.

Stantec completed 5 section lines of shallow auger holes (AH) to define the thickness of peat within Stage 3. The auger holes were done manually due to the thick vegetation and their location and elevation determined from a GPS unit. Drawing C01 shows the AH locations and includes a table identifying the peat thickness encountered. The AH were extended to a maximum depth of 1.2m and terminated earlier if a sand or clay unit was encountered. Several AH along the north limit (Stage 3A) encountered waste beneath the thin organic layer. In Stage 3A, topsoil/peat thickness was generally less than 300mm (and less than 100mm in the most west section line). In Stage 3B, the topsoil/peat thickness was generally between 600 and 900mm while in Stage 3C it extended to 1200mm depth. The water table was generally close to ground surface in Stages 3B and 3C.

Drawing C01 also includes the proposed contours for the bottom of the waste. The bottom of the waste is above the water table. All topsoil/peat needs to be excavated and filled to grade with silty sand. The selection of backfill material needs to be reviewed by a geotechnical engineer. If backfill material is too coarse, the hydraulic conductivity is too high and does not provide sufficient retention for biological treatment – the same effect as using clay where runoff occurs instead of

infiltration. A grade of approximately 1% to1.5% has been applied to most of the base in Stage 3B and 3C so as to match the existing grade and avoid excessive fill.

The landfill development should proceed in the sequence 3A, 3B and 3C. In Stage 3B, the buffer along the south side is increased to provide sufficient separation from the bedrock outcrop along the south side of the access road. We recommend that the buffer area near the bedrock outcrop in Stage 3B should not be filled until after Stage 3C. The Township may want to do further investigation and review landfill performance with regards to groundwater compliance to see if any additional precautionary measures are needed before waste is deposited there. The volume (air space contained in all three Stages is shown below and amounts to 527,000 cubic metres. This is less that the GA plan which identified Stage 3 as containing 600,000 cubic metres.

The volume for waste provided by each Stage is as follows;

Stage #	Volume – cubic metres	Comments
3A	102,000	Develop this Stage following Stage 2. Maintain existing evergreens along east side to provide wind screen. Only a minor thickness of topsoil to remove.
3B	90,500 + 73000 (to be developed after Stage 3C)	The east limit of the waste placement does not extend to the east limit of the approved footprint shown in Figure 5 of the Golder plan. This change is recommended to maintain a separation from the bedrock outcrop observed along the access road. The difference in volumes between these two plans is approximately 73,000 m3 (600,000-527000). This buffer could be developed after Stage 3C and may warrant additional investigation to determine if additional precautionary measures to minimize groundwater impacts are necessary.
3C	334,500	
1	Stage 1, 2A and 2B combined have a capacity of 390,000 m3 and a remaining capacity of 159,500 m3 (December 2014)	Stage 1 and 2A will be fully developed once waste placement is moved to Stage 3.
2A	As above	Will be fully developed once waste placement is moved to Stage 3.
2B	As above	Area to the south of the current waste slope where the compost, tires are currently stockpiled – this area could be developed after Stage 3C is full.
Total	1,000,000	

Reference: McNab Braeside Landfill – Stage 3 Development

The east extent of Stage 3A finishes at the tall evergreens separating 3A and 3C – we recommend leaving as much of the existing tall evergreens in place until Stage 3C to reduce the effects of the wind during waste placement. All of Stage 3A should be completed before moving to Stage 3B. A road ending in a turning circle will need to be constructed at the base of Stage 3A along the fenceline. As the height of waste extends in Stage 3A, a connection to the existing road in Stage 2 could be done to improve traffic flow and accessibility.

The access road into Stage 3B and 3C would be advanced along the existing edge of waste in Stage 2. The waste would be advanced from Stage 2 and pushed towards the east for each Stage. To minimize leachate generation, a final cover would be placed over each Stage (3A, 3B) once final contours are reached.

We calculate the volume of soil (silty sand)required to replace the excavated peat to be approximately 30,000 cubic metres (most of it in Stage 3B and 3C).

Please review this proposed development scheme and advise if any changes are required. We would recommend that the waste bottom contours be included in the 2015 Annual Monitoring Report.

STANTEC CONSULTING LTD.

Gerry Lalonde, P. Eng.
Associate, Water
Phone: (613) 724-4389
Fax: (613) 722-2799
gerry.lalonde@stantec.com

Attachment: Figures C-01, C-02, C-03

c.

Stantec

Memo

To:	Gerry Lalonde Ottawa (Clyde Ave) ON Office	From:	Josh Mansell Ottawa (Clyde Ave) ON Office
File:	163401232	Date:	November 10, 2015

Reference: McNab/Braeside Landfill Phase 3 Expansion – Butternut Search

INTRODUCTION

On October 27, 2015 the Environmental Services Group (BC1225) was retained to complete a butternut (*Juglans cinerea*) search within the proposed phase 3 expansion area of the McNab/Braeside Landfill located at 573 Calabogie Rd., McNab/Braeside, ON.

In the province of Ontario Butternut is listed as an endangered species and is afforded protection under Section 23.7, O. Reg. 242/08 of the *Endangered Species Act, 2007 (ESA, 2007)*.

METHODS

The butternut search was completed on foot by conducting parallel transects at 20m intervals throughout the area outlined in red on the attached figure with the use of binoculars, a hand-held global positioning system (GPS) and a GPS camera.

RESULTS

A single large diameter (58cm DBH) butternut tree was observed (18T 380441E, 5031174N) within the upland forest community at southeastern extent of the search area. Though heavy canker was noted on this tree a butternut health assessment was not completed, as per the *Butternut Assessment Guidelines* (MNRF 2014), due to the timing of the search. This butternut tree was marked with a single wrap of orange flagging tape with the words "Stantec – Oct. 27/2015".



Photo 1 - *Butternut tree within the McNab/Braeside landfill search area*

Reference: McNab/Braeside Landfill Phase 3 Expansion – Butternut Search

MITIGATION

In Ontario, the butternut tree receives general habitat protection under the *ESA, 2007*. The MNRF considers activities within 25m as constituting harm to the tree and more recently activities (depending on type) within 50m may be considered harm to habitat (pers. comm. Erin Seabert, MNRF Kemptville District).

If activities associated with the phase 3 expansion of the McNab/Braeside landfill are anticipated to result in killing, taking or harming the butternut tree (i.e., activities within 50m of the tree), as described above, then a butternut health assessment must be completed. The butternut health assessment must follow the provincial *Butternut Assessment Guidelines: Assessment of Butternut Tree Health for the Purposes of the Endangered Species Act, 2007* (MNRF 2014).

REFERENCES

MNRF (Ministry of Natural Resources and Forestry). 2011. *Butternut Assessment Guidelines – Assessment of Butternut Tree Health for the Purposes of the Endangered Species Act, 2007*. Ministry of Natural Resources and Forestry. V2. Peterborough. ii +18 pp.

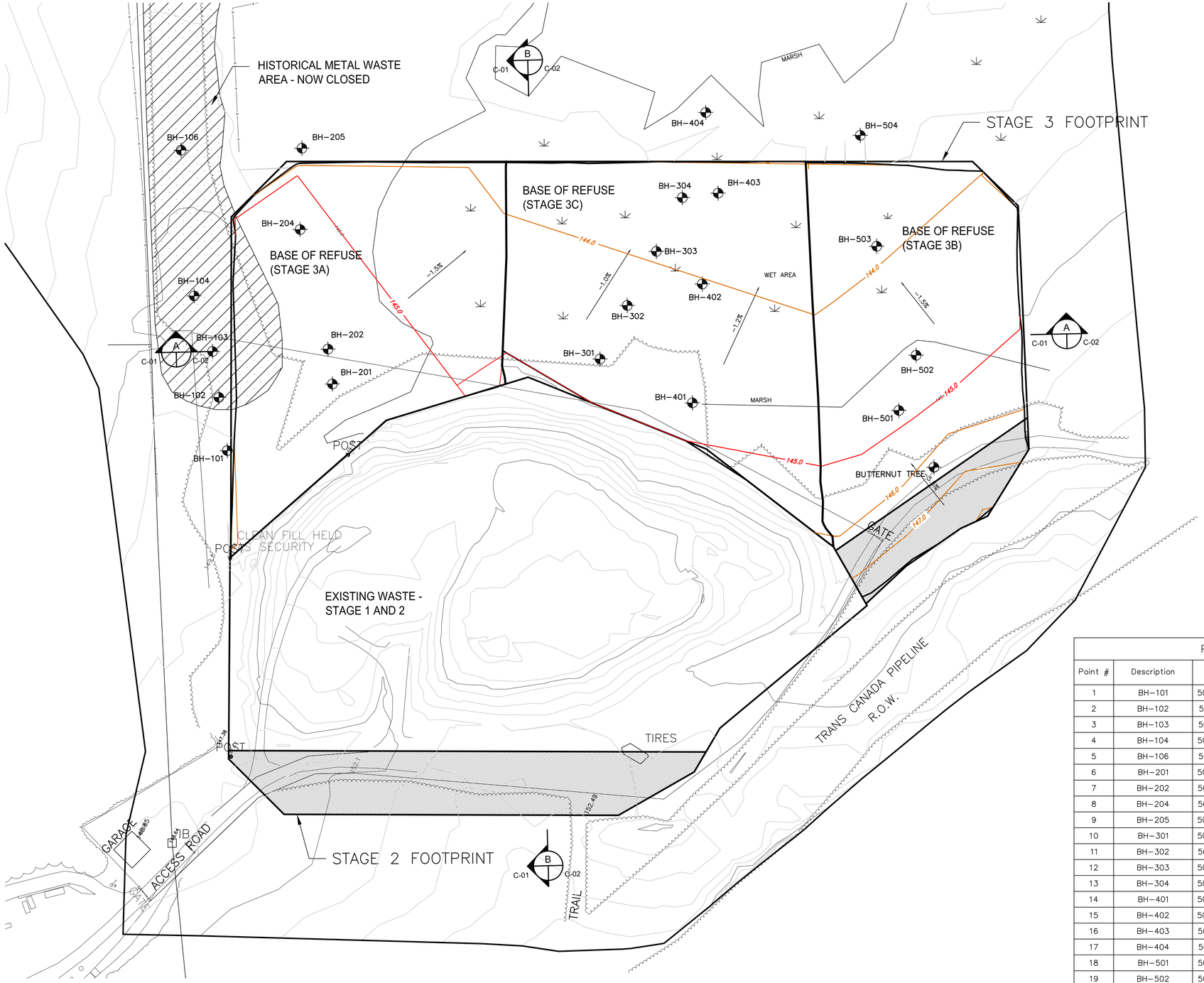
Seabert, E. 2015. Fish and Wildlife Technical Specialist. Ministry of Natural Resources and Forestry. Kemptville, Ontario. E-mail. October 14 2015.

Stantec Consulting Ltd.



Josh Mansell
Biologist
Phone: 613-355-5493
Fax: 613-722-2799
Josh.mansell@stantec.com

Attachment: Figure – McNab/Braeside Landfill Search Area



Point Table					
Point #	Description	Northing	Easting	Elevation	Peat Thickness
1	BH-101	5031775.52	302352.06	146.04	0.0m
2	BH-102	5031795.11	302368.31	145.86	0.0m
3	BH-103	5031811.67	302382.57	145.69	0.0m
4	BH-104	5031835.49	302396.52	145.53	0.0m
5	BH-106	5031885.61	302444.08	144.38	0.0m
6	BH-201	5031759.08	302408.44	145.35	0.1m
7	BH-202	5031771.54	302419.44	145.34	0.1m
8	BH-204	5031818.67	302453.09	143.85	0.3m
9	BH-205	5031843.40	302482.44	143.46	0.1m
10	BH-301	5031672.08	302500.75	144.32	0.3m
11	BH-302	5031679.12	302528.20	144.05	0.6m
12	BH-303	5031685.67	302556.44	143.47	0.6m
13	BH-304	5031693.25	302583.57	143.26	1.2m
14	BH-401	5031625.67	302514.01	144.30	0.4m
15	BH-402	5031659.24	302559.19	143.56	1.2m
16	BH-403	5031681.97	302596.33	143.14	0.9m
17	BH-404	5031711.52	302621.04	142.61	0.1m
18	BH-501	5031550.17	302575.71	144.75	0.1m
19	BH-502	5031561.27	302600.68	144.04	0.5m
20	BH-503	5031609.23	302626.98	143.32	0.9m
21	BH-504	5031649.63	302661.16	142.42	0.4m
	BUTTERNUT TREE	5031520.03	302566.54		

Stantec
1331 Clyde Avenue
Ottawa, ON. K2C 3G4
Tel. 613-722-4420
www.stantec.com

Copyright Reserved
The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

140.0 EXISTING CONTOURS

150.0 PROPOSED CONTOURS

Notes

1. BH'S 101 TO 106 HAVE LESS THAN 100MM OF TOPSOIL
2. STAGE 3 FOOTPRINT AS PER GOLDER ASSOCIATES FIGURE 5 REPORT ON DEVELOPMENT OPERATIONS AND CLOSURE PLAN WASTE DISPOSAL SITE. JUNE 1997.
3. ELEVATIONS ARE GEODETIC AND COORDINATES ARE IN UTM SYSTEM
4. SHADED AREA IN STAGE 3B TO BE FILLED WITH WASTE FOLLOWING STAGE 3C
5. SHADED AREA FOR STAGE 2B BASE TO BE FILLED WITH WASTE ONCE ALL OF STAGE 3 IS FULLY DEVELOPED

Revision	By	Appd.	YY.MM.DD
ISSUED FOR REVIEW	G.L.	G.L.	15.12.09
Issued	By	Appd.	YY.MM.DD

File Name: Dwn. Chkd. Dsgn. YY.MM.DD

Permit-Seal

Client/Project
MC NAB / BRAESIDE
WASTE DISPOSAL SITE

STAGE 3 DEVELOPMENT

Ottawa, ON.

Title
PROPOSED BASE GRADING AND BOREHOLE LOCATIONS

Project No. 163401232

Scale 0 7.5 22.5 37.5

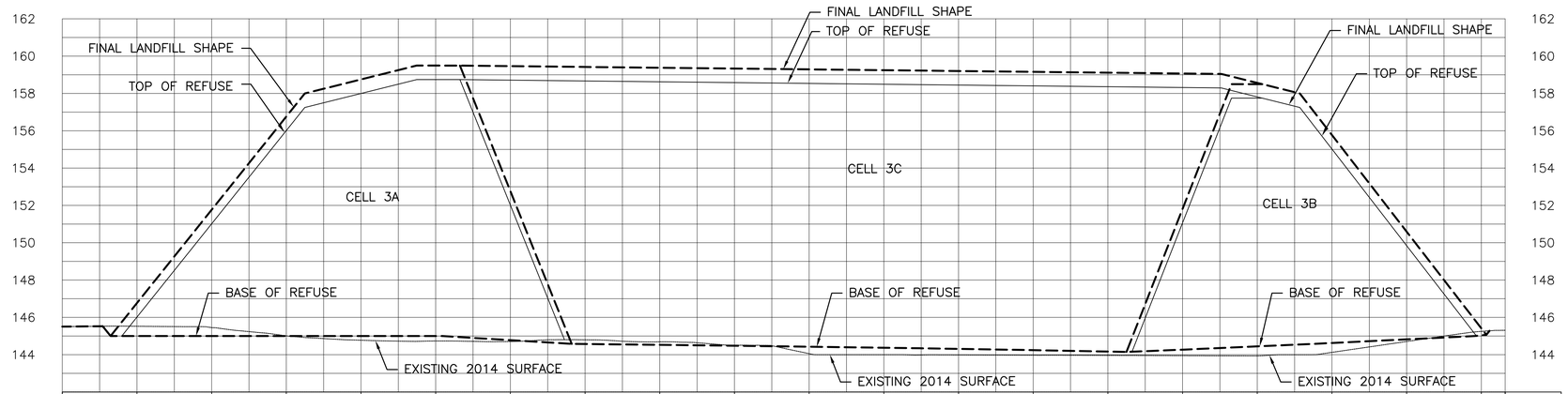
Drawing No. C-01

Sheet 1 of 3

Revision 0

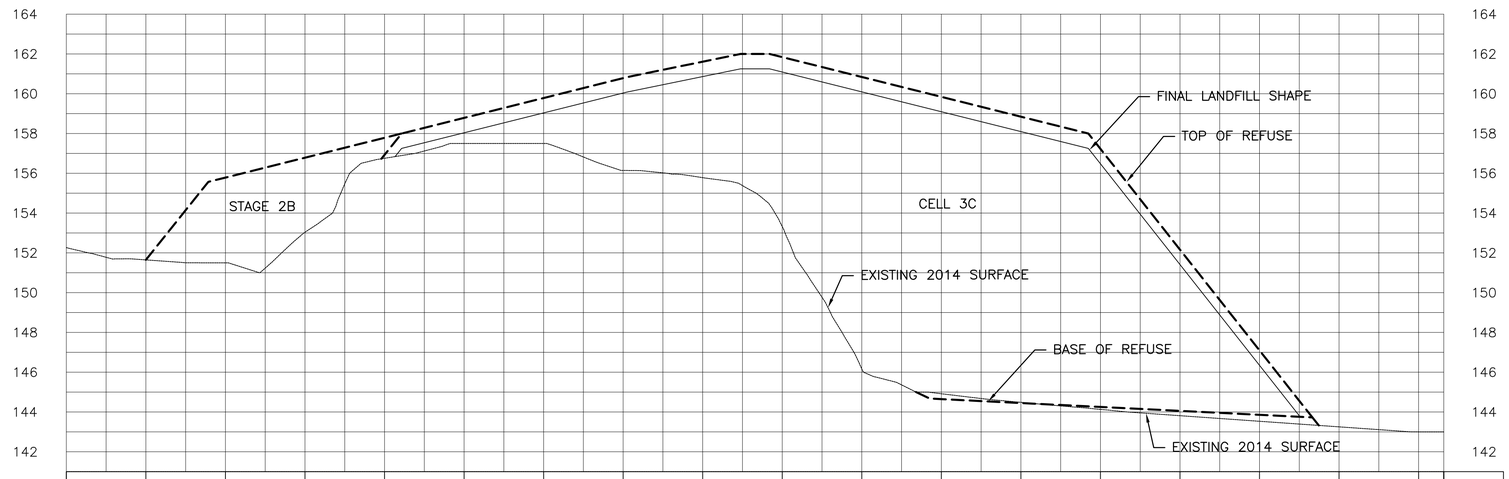
W:\cc-ltwn\163401232\planning\drawing\163401232 Drawings.dwg
2015/12/09 9:21 AM By: Taylor, Stephen

ORIGINAL SHEET - ANSI D



STATION	0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180	0+200	0+220	0+240	0+260	0+280	0+300	0+320	0+340	0+360	0+380	0+386.38
BASE PAD DESIGN LEVEL	145.51	145.00	145.00	145.00	145.00	145.00	144.78	144.57	144.53	144.48	144.43	144.37	144.31	144.24	144.17	144.27	144.44	144.63	144.82	145.04	145.31
FINAL GRADE	145.51	146.77	151.77	156.76	158.75	159.49	159.47	159.43	159.38	159.34	159.29	159.25	159.20	159.16	159.11	159.07	158.57	155.77	150.59	145.41	145.31

SECTION AA



STATION	0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180	0+200	0+220	0+240	0+260	0+280	0+300	0+320	0+340	0+346.33
BASE PAD DESIGN LEVEL												144.64	144.43	144.24	144.06	143.86			
FINAL GRADE					156.93	158.79	159.79	160.79	161.61	161.84	160.84	159.84	158.84	157.23	152.16	147.10			

SECTION BB

Stantec
1331 Clyde Avenue
Ottawa, ON, K2C 3G4
Tel. 613-722-4420
www.stantec.com

Copyright Reserved
The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

Notes

Revision	By	Appd.	YY.MM.DD
ISSUED FOR REVIEW	G.L.	G.L.	15.12.09
Issued	By	Appd.	YY.MM.DD

File Name:

Dwn. Chkd. Dsgn. YY.MM.DD

Permit-Seal

Client/Project
MC NAB / BRAESIDE
WASTE DISPOSAL SITE

STAGE 3 DEVELOPMENT

Ottawa, ON.

Title
PROPOSED SECTIONS

Project No. 163401232

Scale 0 7.5 22.5 37.5

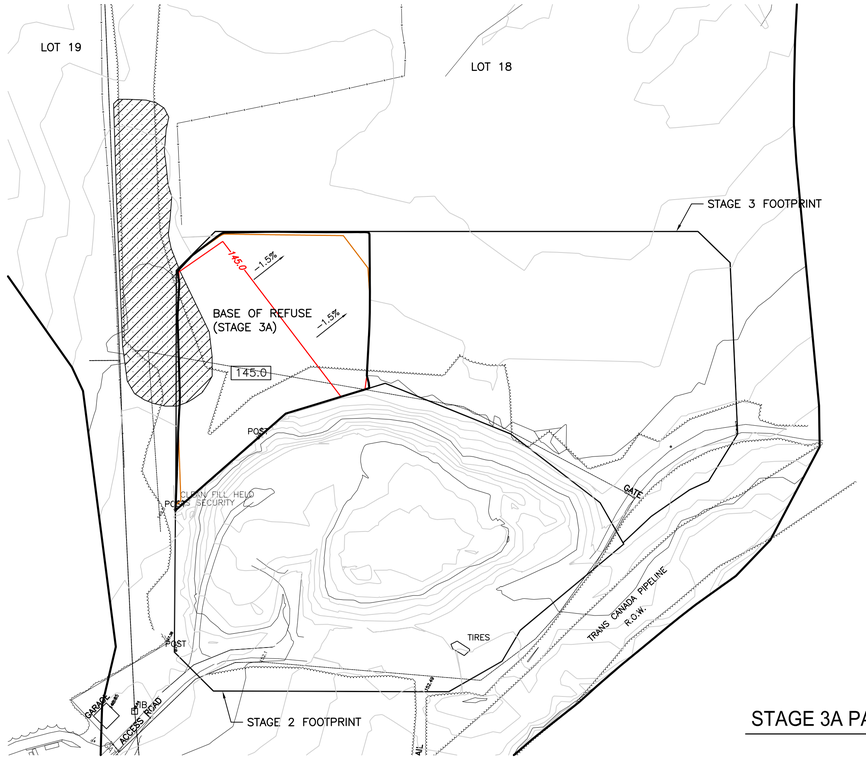
Drawing No. C-02

Sheet 2 of 3

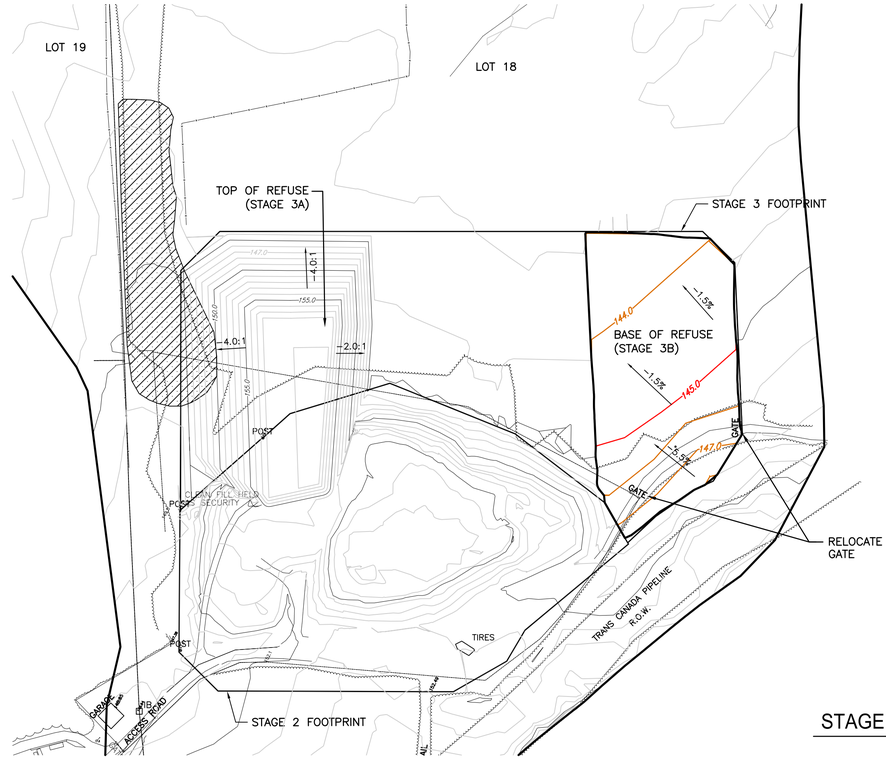
Revision 0

W:\active\163401232\planning\drawing\13401232 Drawings.dwg
2015/12/09 9:21 AM By: Taylor, Stephen

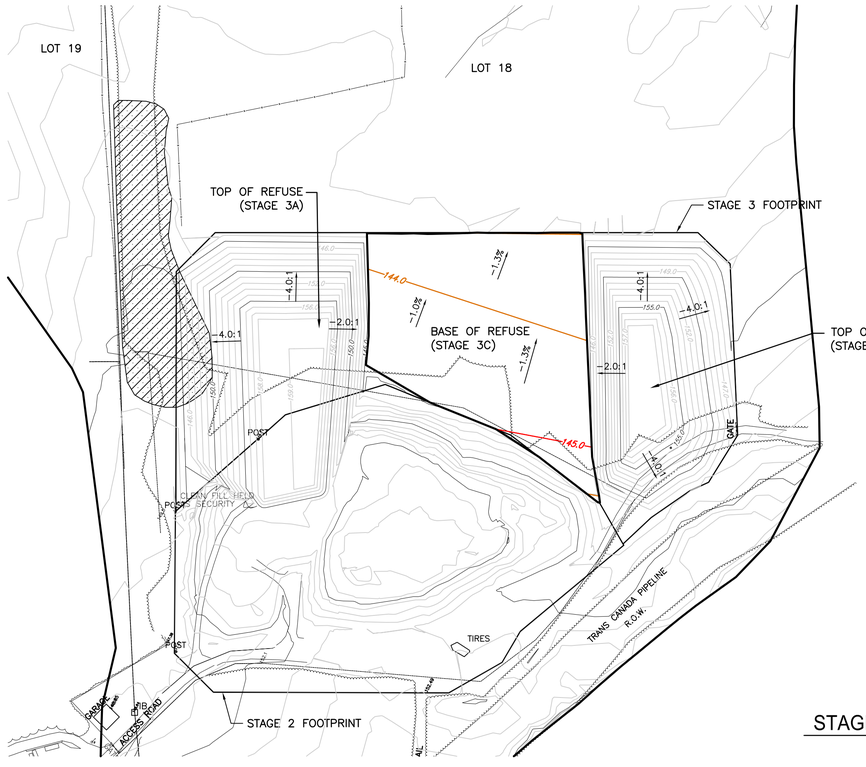
ORIGINAL SHEET - ANSI D



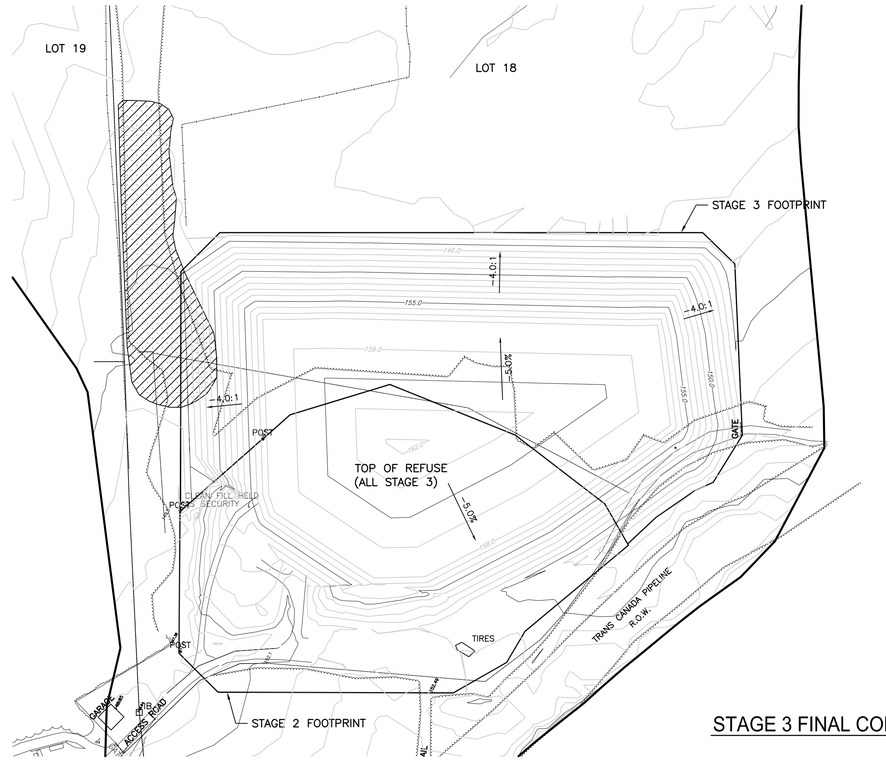
STAGE 3A PAD



STAGE 3B PAD



STAGE 3C PAD



STAGE 3 FINAL CONTOURS

Stantec

1331 Clyde Avenue
Ottawa, ON, K2C 3G4
Tel. 613-722-4420
www.stantec.com

Copyright Reserved

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

140.0 EXISTING CONTOURS

150.0 PROPOSED CONTOURS

Notes

1. RELOCATE BEAR FENCE AROUND STAGE 3 DEVELOPMENT
2. RELOCATE GATE FOR STAGE 3B DEVELOPMENT AND BEAR FENCE AROUND STAGE 3B AND 3C

Revision	By	Appd.	YY.MM.DD
ISSUED FOR REVIEW	G.L.	G.L.	15.12.09

Issued

File Name:	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project

MC NAB / BRAESIDE
WASTE DISPOSAL SITE

STAGE 3 DEVELOPMENT

Ottawa, ON.

Title

STAGING PLAN

Project No.	Scale	
163401232	0 20 60 100	
Drawing No.	Sheet	Revision
C-03	3 of 3	0

W:\archive\1634_01232\planning\drawings\134401232 Drawings.dwg
2015/12/09 9:22 AM By: Taylor, Stephen

ORIGINAL SHEET - ANSI D

PART B-2

2023 Annual Landfill Operations Report
Stantec Consulting Ltd.

2023 Annual Landfill Operations Monitoring Report - McNab Braeside Landfill

Prepared for:
Township of McNab/Braeside
2473 Russett Drive
Arnprior ON K7S 3G8

Prepared by:
Stantec Consulting Ltd.
300-1331 Clyde Avenue
Ottawa, ON K2C 3G4

1634-01671

Distribution:
Township of McNab/Braeside, 3 copies
MECP, 2 copies
Golder Ltd (electronic)., **1** copy
Stantec Consulting Ltd (electronic)., **1** copy

March 31, 2024

Revision	Description	Author		Quality Check		Independent Review	
0	Final	G. Lalonde	3/15/2024	A. Moran	3/20/2024	W. Bogaart	3/20/2024

Sign-off Sheet

This document entitled **2023 Annual Landfill Operations Monitoring Report** was prepared by Stantec Consulting International Ltd. (“Stantec”) for the account of Township of McNab/Braeside (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by 

(signature)

Gerry Lalonde, P. Eng.

Reviewed by 

(signature)

William Bogaart, P. Eng.

Table of Contents

EXECUTIVE SUMMARY ..... EX-i

1 INTRODUCTION 1.1

2 PURPOSE OF ANNUAL REPORT 2.1

3 SUMMARY OF SITE CONDITIONS 3.1
3.1 GUIDELINES FOR OPERATIONS (ENVIRONMENTAL COMPLIANCE APPROVAL) 3.1
3.2 WASTE DEPOSITED DURING 2023 AND 2022 ..... 3.12
3.2.1 Waste Deposited in 2023 ..... 3.12
3.2.2 Waste Deposited in 2022 ..... 3.13
3.3 SITE CAPACITY AND LANDFILL LAYOUT 3.14
3.4 REMAINING SITE CAPACITY AND SITE LIFE 3.15
3.5 SUMMARY OF LANDFILL OPERATIONS DURING 2023 ..... 3.16
3.5.1 Disposal Operations During 2023 ..... 3.16
3.5.2 Equipment 3.17
3.5.3 Materials and Compaction 3.18
3.5.4 Users 3.18
3.5.5 Inspections 3.19
3.6 PROPOSED CHANGES TO LANDFILL OPERATIONS FOR 2024 ..... 3.19
3.7 COSTS 3.20

4 HYDROGEOLOGICAL MONITORING IMPACTS ON OPERATIONS 4.1

5 WASTE DIVERSION INITIATIVES 5.1
5.1 WASTE REDUCTION TARGETS 5.1
5.2 WASTE DIVERSION/RECYCLING PROGRAM 5.1
5.2.1 Curbside Recycling Program 5.1
5.2.2 Segregation of Products at the Landfill 5.2
5.2.3 Household Hazardous Waste 5.3
5.2.4 Waste Oil Transfer Station 5.3
5.2.5 Waste Recycling Strategy 5.5
5.3 STATUS OF WASTE DIVERSION INITIATIVES 5.5
5.3.1 Net Unit Cost for Waste Diversion 5.7
5.3.2 Administrative 5.8

6 OTHER ISSUES 6.1
6.1 PLANNING FOR WASTE DISPOSAL 6.1
6.2 MINISTRY INSPECTIONS AND CORRESPONDENCE 6.1
6.3 REVIEW OF COMPLAINTS 6.2

7 CONCLUSIONS AND RECOMMENDATIONS 7.1

8 LIMITATIONS AND USE OF REPORT 8.1



LIST OF TABLES

Table 1: Monthly Breakdown by Waste Source (2023) 3.13
Table 2: Monthly Breakdown by Waste Source (2022) 3.14
Table 3: Remaining Service Life 3.15
Table 4: Compaction Equipment Hours.....3.17
Table 5: Material Usage - Tonnes.....3.18
Table 6: Monthly Site Users 3.18
Table 7: Annual Costs for Waste Management 3.21
Table 8: Annual Cost Breakdown for Disposal Components 3.23
Table 9: Curbside Collection Recycling Program - Tonnes 5.2
Table 10: Waste Oil Transfer Station.....5.5
Table 11: Waste Diversion Initiatives 5.7
Table 12: Waste Diversion Costs – 2023.....5.8

LIST OF APPENDICES

APPENDIX A FIGURES AND PHOTOS A.1

APPENDIX B ENVIRONMENTAL COMPLIANCE APPROVAL, AND BY-LAW 2023-59 ..... B.1

APPENDIX C SITE OBSERVATION FORMS, CORRESPONDENCE, OTHER SUPPORTING INFORMATION C.1

Executive Summary

The Township of McNab/Braeside is a rural Township located in Renfrew County near the Town of Arnprior. The Township has a projected population of 7,602 (based on 2021 Census). The Township of McNab/Braeside owns a 10-hectare landfilling area and an oil transfer station (not operational since 2020) within a total site area of 64.3 hectares on West ½ Lots 18 and 19, Concession 6, East ½ Lot 19, Concession 5 within the same Township under the Ministry of the Environment, Conservation & Parks (MECP) Environmental Compliance Approval (ECA - formerly Certificate of Approval) No. A412605.

The landfill development plan is to provide one million m^3 of capacity using an area method of fill in three Cells/Stages: Cells 1, 2 and 3. During 2018, disposal operations were within Stages 1 & 2. In January 2019, disposal operations were transitioned to Stage 3. During 2023, the Township deposited approximately 9,426 cubic metres of waste and daily cover within the approved contours of Stage 3A. The 2023 annual volume is within the historical range from the previous five years (shown in **Table 3).** The remaining site capacity for all Stages is calculated using a population growth shown in **Table 3** and historical waste generation rates using a 5-year rolling average of 1.24 cubic metres/capita. Before 2021, the 2020 rolling average was 1.2 m^3/cap/yr. but that increased significantly to 1.46 m^3/cap/yr. in 2021 (due to the 2021 annual per capita waste generation of 2.5 m^3/cap/yr.). With the 2023 annual waste volume returning to previous levels, the 5-year rolling average has remained at 1.24 cubic metres/capita (excluding the outlier from 2021).

During the period January to July 29th, 2023, the Township operated a successful waste diversion program through curbside collection of recyclables and recycling of products from its depot program at its landfill. The program diverted 211 tonnes of its waste stream from disposal in 2023. When other waste diversion programs are considered, such as WEEE, scrap metal and white goods, grinding brush, tires, the diversion increased to 1025 tonnes and indicate the importance of the continuity of these programs.

The remaining capacity in Stages 1 and 2 was 125,417 m^3 as disposal operations moved into Stage 3A at year end 2018. Future volumes forecasted in **Table 3** using the most recent 5-year rolling average per capita generation (1.24 m^3/c/yr.) show an additional 50 years of disposal capacity in all Stages.

During 2023, the 9,426 cubic metres of capacity used in Stage 3A has reduced the remaining capacity in Stage 3 to 550,898 cubic metres (excludes remaining capacity in Stages 1 & 2) and represents several decades of remaining service life. During 2024, the Township should continue disposal operations in Stage 3A. The remaining capacity at the top of Stages 1 & 2 can be developed once all of Stage 3 capacity has been consumed and the waste has reached the same height as Stages 1 & 2.

Golder Associates (now WSP) installed three new monitoring wells between the waste footprint and Dochart Creek during 2020 and completed groundwater modelling to address concerns that the MECP has raised with the future development of Stage 3. During 2019, MECP correspondence has requested that the Township submit additional documentation to demonstrate that Stage/Cell 3 can be developed to provide the above capacity while maintaining compliance with applicable legislation (chiefly groundwater



and surface water regimes). Golder Associates conducted groundwater modeling to quantify impacts to groundwater from Stage 3 development and submitted the reports to MECP in February 2021. The Township received copies of the MECP's technical reviews for groundwater (Nick Battye) and surface water (Lauren Forrester) specialists in Memorandums dated April 21st, 2022, and April 19th,2022 respectively which are reproduced in **Appendix C**. Golder Associates responded to MECP comments in letter prepared by P. Smolkin dated June 21st, 2022, which is reproduced in **Appendix C**. Discussion on topics raised by MECP reviewers are discussed in the Golder Associates' portion of the collated Annual Monitoring Report.

Depending on the outcome of future discussions with MECP during 2024, it is anticipated that a revised Development & Operation Plan will have to be prepared and an application for an amendment to the Environmental Compliance Approval sought.

1 INTRODUCTION

The Township of McNab/Braeside (Township) is a rural Township located in Renfrew County near the Town of Arnprior. The Township has a projected population of 7,602 (based on 2021 Census and annual growth projection of 0.56%). The Township of McNab/Braeside owns and operates a 10-hectare landfilling area and oil transfer station (not operational since 2020) within a total site area of 64.3 hectares on West ½ Lots 18 and 19, Concession 6, East ½ Lot 19, Concession 5 within the same Township under the Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Approval (formerly Certificate of Approval) No. A412605.

2 PURPOSE OF ANNUAL REPORT

The purpose of this annual report is to satisfy Condition 45 of the September 30, 1998 Environmental Compliance Approval (formerly Certificate of Approval), which states that the owner shall prepare and submit an annual report to the director by March 31st of the year following the calendar year covered by the report.

In email correspondence dated February 9, 2005, from Andrew Polley (MECP Ottawa), the District Manager amended condition 45 to permit the submission of biennial reports and letter style reports in alternate years to continue unless otherwise advised. This 2023 report is a biennual style report.

This annual report prepared by Stantec Consulting Ltd. for the 2023 calendar year, addresses all the activities that relate to site operations. All activities relating to hydrogeology, groundwater and surface water monitoring are addressed by Golder Associates (now part of WSP) in a separate report.

Except for the physical measurement of the waste volume which is calculated from a Stantec survey done in late November/early December each year, the interpretation of all other activities is based on data supplied by the Township.

3 SUMMARY OF SITE CONDITIONS

3.1 GUIDELINES FOR OPERATIONS (ENVIRONMENTAL COMPLIANCE APPROVAL)

The Township must operate their landfill according to the general principles outlined in the MECP manual "Guidance Manual for Landfill Sites Receiving Municipal Waste, November 1993." More particular, the conditions listed in the April 7, 1993 and September 30, 1998 Environmental Compliance Approval (ECA) (reproduced in **Appendix B**) and subsequent notices dated April 14, 2000; December 4, 2000; and March 2010 give clear direction on duties imposed by the MECP on the Township for operating its landfill.

The April 14, 2000, Notice was issued to incorporate the newly acquired 8.2 ha parcel of land into the total site area of the landfill and the December 4, 2000 Notice was issued to ensure the issuance of a Certificate of Prohibition (registration of purchase at the land registry office) for the newly acquired parcel of land.

The March 2010 Notice was issued to incorporate site changes which would improve the flow of traffic around the material storage area and reduce interference with future disposal operations.

The following section describes the conditions listed in the Certificate of Approval (now ECA) that were relevant to the operations of the landfill during the current reporting period.

Conditions 1 through 8, 15, 16, 46 and 47 – are administrative in nature and have no impact on site operations. Conditions 9 through 14 are from the April 1993 Environmental Compliance Approval and Conditions 17 through 45 are from the September 1998 ECA.

9. (1) The operation of the waste transfer site is limited to the collection, temporary storage and transfer of waste oil, Class 252, as defined in the Ministry of the Environment "New Ontario Waste Classes" dated January 1986, collected from residential and family farm sources in the municipalities of McNab, Renfrew, Arnprior, Horton, Bagot and Blythfield.

(2) No wastes other than those listed in sub condition (1) shall be collected and stored at the transfer site without amendment to the Certificate.

(3) No municipalities other than those listed in sub condition (1) shall use the transfer site without amendment to the Certificate.

(4) All waste shall be delivered to the site by the householder or the family farm operator responsible for the waste or by an approved waste management system. Each delivery is limited to 50 litres.

(5) The operation of the waste transfer site is limited to the operation and 1500 litres tank facility described in the supporting information for this Certificate and no other transfer facility shall be constructed or operated at the site without written approval from the District Manager.

(6) Storage of waste at the transfer facility shall not exceed 1500 litres without amendment to this Certificate.

Discussion: The Township advises their residents to take waste oil to the Renfrew HHW depot. No waste oil was removed from the site during 2023.

10. (1) The waste transfer shall be supervised at all times when open. Access to the transfer site shall be limited to the hours of operation for the landfill site on which this facility is located.

(2) All personnel supervising the transfer site shall be aware of the waste types which may be collected at the transfer site and shall be knowledgeable about all aspects of the transfer site operation including the requirements under this Notice and the Certificate.

(3) Signs shall be posted at the entrance of the landfill site showing the hours of operation and giving notice of the types of waste permitted at the landfill and transfer sites.

(4) The storage tank shall be maintained under lock and key when site personnel are not in attendance.

(5) The storage tank shall be inspected daily during operating hours, by site personnel trained in contingency measures, and all inspections shall be recorded, and these records shall be maintained by owner/operator as described under condition 5(3).

(6) The operator shall ensure that site personnel trained in contingency measures are on duty to receive waste oil and during unloading operations at the site.

(7) The operator shall prepare Generator Registration Reports as required under Regulation 347 of the Ontario Environmental Protection Act.

Discussion: The waste transfer storage shed is locked and not being used. Consideration should be given to its removal when the Township's updates their Operation and Development Plan for the landfill.

11. (1) The operator shall establish separate record systems for the waste received at the transfer site which shall include, but not necessarily be limited to, the documentation of quantities of waste received at the transfer site; shipping dates and volumes of waste delivered to approved transfer and processing sites and the documentation of environmental and other problems experienced in operating transfer.

(2) The information collected under section (1) shall be submitted in a report to the District Manager on or before March 31 of each year, with the first report due in 1994, and for each year of operation or until the Director or the District Manager has given notice, in writing, that these submissions are no longer required.

Discussion: Section 5.2.4 of this report satisfies this condition. The waste transfer storage shed (used oil) is locked and closed to public use.

12. (1) The operator shall ensure that the landfill site and the transfer site are operated in a safe and secure manner, that the operation of the transfer site does not impede or is, impeded by the landfill operation on which the transfer site is located, that the wastes are properly handled, contained and stored; and that the general public, site personnel and the environment are protected.

(2) Within 30 days of the issuance of this Notice the operator shall prepare an operation manual for the transfer site for use by site personnel which shall contain, but not necessarily be limited to the following:

1. an outline of the responsibilities of site personnel,
2. personnel training protocols;
3. proper receiving, screening and recording procedures;
4. proper handling, storage and shipping procedures;
5. contingency procedures to be followed by site personnel in the event of fires or other emergencies.

A copy of the operation manual shall be submitted to the District Manager.

(3) The operator shall maintain a safe storage capacity for the transfer site which is consistent with the application for this Certificate and shall ensure that this capacity does the 1500 litre limit of the tank by providing regular movement of the wastes to approved transfer and processing facilities and sites.

(4) Notwithstanding Condition 2 the owner/operator shall ensure that adequate fire-fighting equipment is available at the transfer site and that personnel are familiar with the use of such equipment and its location(s) on the transfer site.

(5) The local fire department shall be advised of the wastes collected at the waste transfer site and this Notice for the Certificate.

Discussion: '*The Operation and Management Plan for the Waste Oil Transfer Station*' dated August 1992 was prepared by Cari Forteath for the Township of McNab/Braeside. The waste transfer storage shed is locked and has not been used since 2020. The transfer site does not interfere with the operation of the landfill site. A fire extinguisher is stored in the custodian shelter and the custodian has a telephone to contact the local fire department, in case of an emergency.

13. All waste shall be transported from the transfer site by an approved waste management system and shall be disposed of at waste landfill, transfer and processing sites certified to accept these types of wastes.

Discussion: The waste transfer storage shed is locked and was not used in 2023. In former years (2019 and prior to that), waste oil from the transfer site was collected by Safety Kleen Canada with copies of the manifests included in the annual monitoring reports**.**

14. The approval for the transfer site on the landfill site expires with the termination of the transfer site; when all the wastes have been removed from this site; and the restoration of this site has been, approved, in writing by the District Manager; or if closure of the landfill site prohibits or prevents further use of the transfer site.

Discussion: The transfer site was not operational in 2023 and waste oil is being directed to the Renfrew HHW depot.

Conditions 17 through 45 – relate to landfill operations.

17. The Site service area shall include the Corporation of the Township of McNab and the Village of Braeside.

Discussion: The site only accepts waste from the Township of McNab/Braeside.

18. The Owner shall place a sign at the main entrance to the Site on which is displayed, in prominent letters, the following information:

18.1 the name of the Site and the Certificate of Approval number for the Site;

18.2 the operating authority, telephone number and mailing address;

18.3 the hours the Site is open to accept waste from the public;

18.4 the telephone number for reporting emergency situations occurring at the Site during non-operating hours;

18.5 the waste acceptable for disposal at the Site; and tipping fee rates; and

18.6 The Site shall be permitted to operate daily 8:00 a.m. to 5:00 p.m. throughout the year. An approval to amend the time of operation can be granted from time to time by writing to the Director or the District Manager.

Discussion: The signs at the entrance include all the information required by condition 18. An MECP inspection report of the site dated 6 July 2015 confirmed that signage is adequate. Stantec's inspections of the landfill on three occasions during 2023 show the signs to be in good condition.

19. The Owner shall maintain daily records with monthly summary of the quantity and types of waste disposed of at the Site.

Discussion: The site custodian maintains daily records of the number of users and quantities and types of waste received at the site. Section 3.2 discusses the monthly distribution of users for 2023.

20. The following information shall be recorded on loads refused access to the Site for disposal purposes:

20.1 date;

20.2 name of persons;

20.3 company name on vehicle;

20.4 vehicle description of waste refused; and

20.5 reasons for refusals.

Discussion: The Township uses a specific form to document the above information when recording the number of loads refused. No loads were refused during 2023.

21. During non-operating hours of the Site, the entrance shall be locked.

Discussion: The site entrance has a gate that is locked during non-operating hours.

22. No waste shall be received at the Site or removed from the Site unless a Site Supervisor or his/her alternate (s) and/or designated person (s) are present to supervise the operation.

Discussion: No waste is accepted at the site without a representative of the Township being on site.

23. The Owner shall ensure that the Site Supervisor and/or designated alternative person(s) have been adequately trained with respect to the following procedures without limitations:

23.1 conditions and Schedules of this Certificate;

23.2 the operation and maintenance of this Site;

23.3 relevant waste management regulations and legislation;

23.4 environmental conditions and concerns related to waste handling operations at the Site; and

23.5 occupational health and safety activities pertaining to the workplace and waste handling operations at the Site.

Discussion: The Township has prepared a draft Training Manual for its operators that documents the guidance provided to staff and operation and maintenance procedures for the site. The Training Manual is an ongoing development and will contain procedures for waste handling, WHMIS, equipment maintenance, weigh scale operations, health and safety and relevant waste management legislation – a copy of which is maintained at the scale house. The Township's Director meets with landfill staff annually to review the Manual.

24. Owner shall keep a copy of this Certificate and Schedule "A" at the Site.

Discussion: A copy of the Environmental Compliance Approval is included in each Annual Monitoring Report (**Appendix B** of the AMR) and a copy of the Annual Monitoring Report is to be maintained in the site custodian shelter/scale house.

SITE INSPECTION

Litter Control

25. Litter Control shall be carried out by the Owner in accordance with procedures described in Schedule "A".

Discussion: The current approach at the site is to apply adequate daily and interim cover to limit windblown litter. Litter is occasionally picked up around the landfill footprint as deemed necessary. As described in the Operations and Development Plan, if litter becomes a nuisance, a litter fence could be installed near the active face to control windblown litter – this is to supplement regular litter collection at the site. The litter fence would be moved as the location of the active face changes with the development of the site.

With the shift in disposal into Stage 3A (January 2019), the waste is deposited at a lower elevation and sheltered from the wind by the Stage 2 waste and trees along the east side. We anticipate less nuisance issues with wind blown litter in Stage 3A due to better shelter.

Dust Control

26. The owner shall take all necessary mitigative actions for dust control.

27. A dust suppressant shall be applied to the on-site roads when dust becomes a problem during the dry periods of the year.

Discussion: The access route into the landfill is gravel surfaced and when required during the summer months, the Township applies a dust suppressant or water. Based on the three site inspections undertaken by Stantec during 2023, dust has not been a problem.

Pest Control

28. The Owner shall ensure that there are no pests that shall pose a hazard to the health and safety of persons.

Discussion: During 2003, the Township installed an electric fence surrounding the waste footprint to prohibit bears from rummaging thru the waste. The fence was partially dismantled in 2017 to allow for tree clearing for Stage 3 development. Rodents and pests are controlled through the application of daily cover. If additional measures become necessary, the Township would investigate the use of a licensed exterminator and a bait program for rodent control.

Birds have at times been a problem at the site as they dig through the daily cover to get to the waste underneath. The application of interim cover over Stage 2 during 2019 reduced the size of the active face (compared to current active face in Stage 3) and is anticipated to minimize nuisance effects created from the presence of birds. The Township will investigate measures to deter birds if additional issues develop. Birds not observed to be a significant nuisance during the three landfill observations completed in 2023.

Scavenging

29. The Owner shall ensure that there is no scavenging of waste at the Site.

Discussion: The landfill site is fenced, and the site custodian is responsible for ensuring that the entrance gate is locked during non-operating hours to prevent access and scavenging.

Odour Control

30. The Owner shall operate the Site in such a manner to minimize off-Site impact of odours at all times.

Discussion: Applying adequate daily cover minimizes the odours at the site. From the site inspections (3 times per year by Stantec), odours have not been detectable at the site entrance.

Noise Control

31. The Owner shall operate the Site in such a manner to minimize noise impact from haulage trucks and operating equipment on the natural environment and persons.

Discussion: Given the site's natural setting and buffering provided by the existing trees, noise is not an operational concern.

Burning of Waste

32. The owner shall ensure that there is no burning of waste at the Site.

33. The burning of brush, trees and clean wood piles can be conducted at Site and shall be confined to the area as indicated in Figure 7, Item No.1, Schedule "A" and Section 4.21, of the Ministry of the Environment Guidance Manual For Landfill Site Receiving municipal Waste, dated November, 1993.

Discussion: The Township indicated that clean brush had not been burned for several years, including 2023. The Township uses a Contractor to chip the brush on an as needed basis with the chipped product being mixed with sand and used for daily cover. Over the last 5 years, chipping/grinding has usually been done twice per year (including 2023), except for 2020 which did not have any grinding.

Daily Cover

34. The minimum thickness of daily cover shall be 150 millimetres indicated in Figures 10 and 11, Item No.1, Schedule "A";

34.1 The use of petroleum hydrocarbon contaminated soils as daily cover shall be subject to the Generator demonstrating to the owner that the petroleum hydrocarbon contaminated soils are non-hazardous and meets Regulation 347 of the Ontario Environmental Protection Act.

Discussion: The Township is using a combination of sand and wood chips as daily cover. The wood chips are more resistant to wind erosion and have decreased the amount of sand used. All clean wood and brush that is brought to site is chipped and most of it used in the daily cover mixture.

The Township does not accept hydrocarbon contaminated soil unless analytical testing has been done and identifies the soils as being non-hazardous and in accordance with O. Reg. 347/558. No contaminated soil was accepted in 2023.

34.2 The volume of petroleum hydrocarbon contaminated soils received at the Site shall be subject to the approval of the District Manager. The volume of contaminated soils stored at the Site shall not exceed the limitation of the annual daily cover material requirements as determined by the previous annual report.

Discussion: The Township indicated that no hydrocarbon contaminated soil was accepted at the site during 2023. Normal procedure for accepting contaminated soil (once an analysis of specified parameters has been analyzed and reviewed by the Township) is for the soil to be spread at the top of waste in Stage 2 so it can be aerated and then used for daily cover.

35. A suitable stockpile of clean granular cover material, which shall be equivalent to 50% of the quantity of the required annual daily cover material as outlined in condition 34, shall be maintained at the Site as a contingency measure.

Discussion: Sand imported for daily cover usage is now weighed so that the volume can be tracked. While the ECA allows the stockpiling of up to 50% of total annual daily cover usage, other uses for sand exist (such as road maintenance) and sand may be stockpiled temporarily on site for these uses. Monthly tonnages of sand for 2023 are shown in **Table 5**. When woodchips are available at the site, they are mixed in with the sand at approximate 1:1 ratio. The site observations made during the last two years did not indicate that the sand stockpiles were excessive.

Intermediate Cover

36. The minimum thickness for the intermediate soil cover shall be 300 millimetres as indicated in Figures 10 and 11, Item no.1, Schedule “A”.

Discussion: Areas that have not been landfilled for more than 12 consecutive months have intermediate cover. Interim cover was applied to top of Stage 2 during 2019.

Final Cover

37. The maximum height for the refuse and final cover shall not exceed 16.9 metres above the assumed elevation datum which gives a total capacity of 1,000,000 cubic metres for the Site as indicated in Figures 5 and 6 of Item No.1, Schedule "A".

Discussion: The waste height has not exceeded the 16.9 metre maximum height (refer to **Figures 5 to 11** for Stage 3A cross-sections of the waste pile for 2023).

38. No waste shall be deposited at the Site after the final contours have been attained as shown on Figures 5, and 6 of Item No.1, Schedule "A". The final completed contours as noted in Condition 36 shall include 0.7 metres of final cover. The cover material shall include 600-millimetre-thick layer of general clean earth material and a 150-millimetre layer of topsoil, which is seeded.

Discussion: The final site contours have not been reached; therefore, final cover is not required at this time.

Site Capacity

39. The total Site capacity of 1,000,000 cubic metres (air space calculation is based on an area of 10 hectares with a waste mound maximum height of 16.9 metres as indicated in Figures 5 and 6, No.1, Schedule "A". This total site capacity shall be contingent on the owner implementing a leachate collection system or by gaining control over the leachate by acquiring buffer lands to service as leachate attenuation zone such as the privately owned parcel of land, Part of Plan 49R-8277, that is situated in the west part of Lot 19, Concession 6, Township of McNab. This land parcel which comprises the conceptual leachate attenuation zone is shown in Figure 7, Item No. 1 Schedule "A".

Discussion: The Township has purchased 8.2ha of buffer lands to provide a larger leachate contamination attenuation zone (CAZ). Notice No. 1 dated April 14, 2000, incorporates this parcel of land into the site ECA (former CofA).

40. The Owner shall purchase a minimum 30 metre buffer zone and gain control over the remaining conceptual leachate attenuation zone as described in condition 39. The owner shall bring the site into compliance with 2 years of the issuance of this Notice with the RUPO and 30 metre buffer zone requirements.

Discussion: The amended Certificate of Approval dated 4 December 2000 incorporates the 8.2 ha parcel of land to fulfill the requirements of this condition.

Groundwater Monitoring

41. The groundwater monitoring program shall be undertaken by the Owner accordance with Item No. 2 in Schedule "A ". The Owner shall provide with the annual report an evaluation of the groundwater condition for long term monitoring purposes and the number of wells required on site to provide an accurate configuration of the hydrogeochemical condition at the Site. The 1997 monitoring program indicates that RUPO exceeded at the Site. The owner in consultation with the Ministry of the Environment, Eastern Region Hydrogeologist shall amend monitoring program to better assess the RUPO exceedance at the Site and provide recommendations to bring the Site into compliance. The proposed changes to the monitoring program shall be subject to the approval the Director.

Discussion: Groundwater for the site is conducted by WSP/GA (Golder Associates) and is addressed in a separate report (separate letter style report or Part A of the biennial report).

42. Groundwater geochemical quality exceeds RUPO at the east and north boundaries of the Site. The groundwater contamination is attributable to contamination originating from the Site at locations that were previously landfilled with metal waste and burnt garbage. The Owner shall provide to the Director a contingency and remediation implementation Schedule plan to address the off-Site contamination and to bring the Site into compliance. The financial cost for implementing the remedial action plan and abatement program shall be responsibility of the Owner. The Contingency plan shall be implemented upon approval of the Director and within 2 years of the issuance of this Notice.

Discussion: Groundwater for the site is conducted by WSP/GA and is addressed in a separate report (Part A of the biennial report or separate letter report in alternate years).

Surface Water Monitoring

43. The surface water sampling program shall be conducted a minimum of two times a year. The Water samples shall be collected on Dochart Creek at locations SW1, SW2 and SW3 which are situated up gradient and down gradient from the Site. The other surface water sampling locations indicated in Items no.1, Schedule "A". All proposed changes to monitoring program shall be subject to the approval of the Director.

Discussion: Surface water for the site is conducted by WSP/GA (Golder Associates) and is addressed in a separate report (Part A of the biennial report or separate letter report in alternate years).

Closure Plan Landfill Site

44. One year before the Site is expected to close and stop receiving waste, as determined by Conditions 36, 37 and 38, the Owner shall develop and submit an updated Closure Plan. The Closure Plan shall be submitted for the Director's approval and should outline post-closure maintenance and monitoring program. The plan shall include, but not be limited to the following:

44.1 Changes to the final contour plan that have occurred and have been previously identified in the annual reports or recommended in the development of the detailed closure plan;

44.2 fencing and access control;

44.3 details of any vegetative planting planned;

44.4 the sequence and schedules for the final cover installation;

44.5 post-closure and end-use plans;

44.6 plans and schedules for the management and continued monitoring of the surface water and groundwater;

44.7 plans and schedules for routine monitoring and maintenance of stormwater facilities; and

44.8 plans and schedules for the routine monitoring of leachate seeps, the final cover and Site settlement.

Discussion: An updated Closure Plan was not required during 2023 since the Township has significant capacity (approximately 125,417 cubic metres) remaining in Stages 1 and 2. From the December 2023 survey, the remaining capacity for waste placement in Stage 3 is calculated to be 550,898 cubic metres. Disposal operations began in Cell 3A in January 2019.

Annual Report

45. The Owner shall prepare and submit an annual report to the Director by March 31st, of the year following the calendar year covered by the report which shall include as a minimum, but not limited to the following:

45.1 a survey of the Landfill Site waste disposal area conducted every three years and a map illustrating existing contours. The frequency of the surveys can be changed from time to time by writing to District Manager for approval;

45.2 a summary of the total annual quantities of waste received on a quarterly basis for the Site;

45.3 a drawing(s) indicating all groundwater and surface water monitoring locations;

45.4 tables outlining monitoring locations, analytical parameter sampled and the frequency of sampling;

45.5 an interpretation of the surface water, groundwater and leachate monitoring data; a review of the adequacy of the monitoring programs; provide conclusions and recommendations for changes made in the monitoring programs;

45.6 an assessment of the groundwater quality as it relates to the RUPO and ODWO;

45.7 an assessment of the surface water quality with respect to the PWQO/Guidelines;

45.8 an update of any changes made in the operations, equipment or procedures at the Site and Facility and operating difficulties encountered;

45.9 drawings showing the areas of fill, buffer areas, current landfill contours, percentages of available space utilized, and an estimate of the remaining disposal capacity and the landfill life span;

45 .10 a summary discussion of landfill daily cover requirements and erosion protection;

45.11 a statement of compliance with all the conditions with respect to the inspection and reporting requirements as indicated in the Certificate;

45.12 a summary of any complaints made regarding the landfill Site operations and response from the Owner/Operator and the necessary actions taken to address these complaints;

45.13 recommendations with respect to any proposed changes made the operation programs for the Site; and

45.14 proposed changes made in the monitoring program for the Site shall be subject to the approval of the Director.

Discussion: This 2023 annual monitoring report by Stantec Consulting Ltd. (which will be incorporated into the 2023 biennial report, Part B) and WSP/GA (Part A) satisfy the requirements of



this condition. In email correspondence dated February 9, 2005 from Andrew Polley, the MECP District Manager amended condition 45 to permit the submission of a biennial report (2023) with letter style reports to be submitted in alternate years (2024), to continue unless otherwise advised.

3.2 WASTE DEPOSITED DURING 2023 AND 2022

3.2.1 Waste Deposited in 2023

Stantec Consulting Ltd. completed a survey of the waste stockpile on December 7th 2023, to measure the net volume of waste, daily cover and interim cover deposited at the site since the last survey conducted on December 6th, 2022.

Figure 1 (Appendix A) identifies the location of the landfill**. Figure 2A** shows the approved design contours for waste for Stages 1 & 2. **Figure 2B** identifies the design waste contours for Stages 2 and 3. **Figure 4** identifies the 2023 waste placement footprint (which is slightly larger than the 2022 waste footprint shown in **Figure 3**). As shown on these figures, waste placement in 2023 was in the northwest portion of Stage 3A, more particularly extending the 2022 footprint further north, east (toe of waste) and west (overlying Stage 2). From the survey, we calculated the volume of waste, daily cover, and interim cover volume placed between December 6th 2022 and December 7th 2023 to be 9,426 m^3. **Table 3** identifies the annual quantities measured since 2003.

Figures 5 to 11 show the cross-sections of annual waste placement in comparison to the approved design cross-sections. All waste was deposited within the approved footprint during 2023.

Table 1 identifies the tonnage from various waste sources for 2023 and **Table 2** identifies the 2022 waste tonnage for these same sources (for comparison purposes). The 2023 tonnage (2,948) is about 15% lower than the 2022 tonnage (3,465), the decrease attributed to household waste delivered to site and organic waste types.

Table 1: Monthly Breakdown by Waste Source (2023)

Month	Household Waste delivered to Site (tonnes) Note 1	Curbside Collection (tonnes)	Construction (tonnes)	Organics (tonnes) Note 2	Total (tonnes)
January	4.31	108.61	71.49	5.36	189.78
February	4.58	96.54	63.37	2.09	166.58
March	3.84	108.61	66.99	1.19	180.63
April	15.10	96.54	203.1	18.77	333.52
May	11.63	108.61	170.22	27.12	317.58
June	6.32	108.61	161.33	25.03	301.29
July	6.70	102.58	104.15	27.42	240.84
August	10.20	114.65	132.42	22.95	280.21
September	52.09	102.58	135.74	19.37	262.90
October	9.97	108.61	130.09	18.48	267.15
November	4.62	102.58	108.84	19.37	235.41
December	4.03	102.58	60.6	5.07	172.27
Total 2023	86.51	1261.11	1408.34	192.21	2948.16

Note 1: Waste from 7503 users – 952 used vouchers.
Note 2: Each organic load was taken to be 1.08 cubic metres with density of 298kg/m^3.

3.2.2 Waste Deposited in 2022

Error! Reference source not found. identifies the tonnage from various waste sources for 2022 and is provided for comparison with Table 1 for 2023. The total tonnage for 2022 (3,465 t) is between 15 and 20% more than 2023 and previous years. The source responsible for the 2022 increase was from household waste delivered to site and organics – the increase was distributed over the entire year and not just a one-month occurrence.

Table 2: Monthly Breakdown by Waste Source (2022)

Month	Household Waste delivered to Site (tonnes) Note 1	Curbside Collection (tonnes)	Construction (tonnes)	Organics (tonnes) Note 2	Total (tonnes)
January	11.19	102.58	48.08	8.7	170.5
February	9.14	96.54	52.21	1.3	159.2
March	11.34	108.61	79.73	2.3	201.9
April	20.73	102.58	112.52	232	467.8
May	25.00	108.61	134.38	57.9	325.9
June	12.81	108.61	109.33	37.3	268.1
July	16.31	96.54	118.17	34.1	265.1
August	20.98	108.61	118.70	29.3	277.6
September	15.49	108.61	138.39	34.1	296.6
October	16.22	102.58	260.27	221.0	600.1
November	11.90	102.58	100.38	20.3	235.1
December	7.63	108.61	73.58	7.1	196.9
Total 2021	178.74	1255.07	1345.74	685.4	3465.0

Note 1: Waste from 7524 users – 1036 used vouchers.
Note 2: Each organic load was taken to be 1.08 cubic metres with density of 298kg/m^3.

3.3 SITE CAPACITY AND LANDFILL LAYOUT

Historically, the landfill site was developed by the trench method of landfilling. More recently, the June 1997 Site Operations and Development Plan prepared by Golder Associates provided guidance regarding the development of the landfill site in three Stages/Cells by the area method. Waste volume, including daily cover, for each Stage/Cell of landfill development is as follows;

Cell 1	257,500 cubic metres
Cell 2	132,500 cubic metres
Cell 3	610,000 cubic metres
Total	1,000,000 cubic metres

During 2019, MECP correspondence has requested that the Township submit additional documentation to demonstrate that Stage/Cell 3 can be developed to provide the above capacity while maintaining compliance with applicable legislation (chiefly groundwater and surface water regimes). Golder Associates conducted groundwater modeling to quantity impacts to groundwater from Stage 3 development and submitted the reports to MECP in February 2021. The Township received copies of the MECP's technical reviews for groundwater (Nick Battye) and surface water (Lauren Forrester) specialists in Memorandums dated April 21st, 2022, and April 19th, 2022 respectively which are reproduced in

Appendix C. Golder Associates responded to MECP comments in letter prepared by P. Smolkin dated June 21st, 2022, which is reproduced in **Appendix C**. Discussion on topics raised by MECP reviewers are discussed in the Golder Associates' portion of the collated Annual Monitoring Report.

3.4 REMAINING SITE CAPACITY AND SITE LIFE

The approved landfill capacity (excluding final cover) for all three Stages of the landfill site was identified as one million m^3 (June 1997 Site Operation and Development Plan). With the December 2018 survey, Stantec calculated the remaining capacity in Stages 1 and 2 to be 125,417 m^3 (as operations moved into Stage 3 in January 2019). Most of the remaining Stage 1 & 2 capacity involves depositing waste to the south and west of the Stage 2 footprint. Due to exposure to bedrock outcrops in the south limit of Stage 2, the waste placement strategy is to use the remaining Stage 2 capacity only once Stage 3 is filled.

The remaining site capacity for all Stages is calculated using a population growth shown in **Table 3** and historical waste generation rates using a 5-year rolling average of 1.24 cubic metres/capita (excluding the outlier of 2.51 from 2021).

Table 3: Remaining Service Life

Year	Population (Note 3)	Actual Waste Volume	Projected Waste Volume (Note 1)	Remaining Capacity: (Notes 2 & 6)	
		(m^3)	(m^3)	(m^3)	
2010	7,341	**8,080**		**185,526**	
2011	**7,371**	**9,150**		**176,376**	
2012	7,371	**8,040**		**168,336**	
2013	7,371	**7,980**		**160,356**	
2014	7,371	**7,136**		**153,220**	
2015	7,371	**7,293**		**145,927**	
2016	7,371	**5,648**		**140,279**	
2017	7,371	**7,766**		**132,514**	
2018	7,371	**7,096**		**125,417**	
				Cell 2	**Cell 3**
2019	7,371	**9,500**		125,417	600,500
2020	7,371	**10,892**			589,608
2021	7,371	**18,538**			571,070
2022	7,591	**10,745**			560,325
2023	7,602	**9,426**			550,898
2030	8,206	Note 5	10,214		470,151
2040	9,246	Note 5	11,508		344,165
2050	10,417	Note 5	12,966		221,208
2060	11,737	Note 5	14,609		82,674
2065	12,459	Note 5	15,507	125,417	6,958

Year	Population (Note 3)	Actual Waste Volume	Projected Waste Volume (Note 1)	Remaining Capacity: (Notes 2 & 6)	
		(m^3)	(m^3)	(m^3)	
2070	13,224	Note 5	16,460	45,048	
2073	13,706	Note 5	17,059	-5,526	

Note 1: Projected waste generation rate based on 2023 5 year rolling average = 1.24m^3/cap.
Note 2: Based on Stage 1& 2 volume of 390,000 m^3 and Stage 3 volume of 610,000 m^3.
Note 3: Annual population growth rate is assumed to be zero between 2011 and 2021 since it was negative between 2011 and 2016.
For 2023 - 2100, use annual rate increase of 1.2 %/year to account for immigration anticipated beyond 2021.
Note 4: Bold denotes actual survey measurements.
Note 5: Stage 3 Development total capacity of 610,000 m^3.
Note 6: Start date for deposit of waste in Stage 3 was January 2019.

3.5 SUMMARY OF LANDFILL OPERATIONS DURING 2023

3.5.1 Disposal Operations During 2023

A summary of operational issues involving equipment, materials and compaction, site users, and inspections is provided in the following sections.

During 2023, the Township main activities included the continuation of the waste diversion (depot) programs involving scrap metal, Waste Electronics and Electrical Equipment (WEEE), tires, organics, and blue bin type products. The WEEE products and tires are collected under the Individual Producer Responsibility model operated by Electronics Products Recycling Association (EPRA) and eTracks Tire Management Systems (eTracks) respectively. During 2023, operation of the blue box program curbside collection and processing was transferred from the Township to Circular Materials Ontario (Producer Responsibility Organization) and resulted in Topps Environmental Solutions becoming the Contractor responsible for collection and transport of curbside recyclables to a processing centre in Renfrew operated by Emterra Environmental.

As shown in **Figure 4 in Appendix A**, waste was deposited mainly in the northwest section of Stage 3A. An access road that was constructed in 2015 along the north slope of Stage 2 to gain access to the top of Stage 2 which continued to be used in 2023 for material storage and a dump pad. With the top of waste in Stage 3A at approximately the same height of the waste in Stage 2, users drive to the top of Stage 2 and end dump their load into Stage 3A from that edge. This is useful when site conditions are poor due to weather or access to the toe of the waste is restricted or too much congestion at the active face.

The next paragraph provides a brief summary of activities relating to the preparation of Stage 3 base. As Stage 3A waste is now overtopping Stage 2 waste, increasing the width of the base in Stage 3A in an

easterly direction will be required during 2024 (or shortly thereafter) if the waste footprint is to be expanded to meet future waste demands.

Cell 3 Development - *during late 2016 and early 2017, the Township had the trees in the west 1/3 of Cell 3 removed to prepare for the Cell 3 base development. In 2017, the Township undertook an investigation of the organic material thickness in Cell 3 and the development of bottom of waste contours for Cell 3. Investigations conducted in 2017 consisted of digging test pits to define surficial soils, groundwater level and thickness of the organic layer. Design contours for the bottom of waste in Cell 3 were generated that provide a minimum vertical separation of approximately 1m between groundwater and the bottom of the future waste.* ***Figure C-01*** (Figure included in Stantec Memo dated December 7th 2015 reproduced in Appendix C) *provides the proposed contours for the Cell 3 bottom.*

Starting in 2019, waste will be deposited in the west corner of Cell 3 and abut against the existing Cell 2 slope. The ground level (base) is slightly higher in this area and only minor grading is required to make it acceptable for receipt of waste. The open area further east will require fill to raise the grade before waste can be deposited there. Interim cover will be applied over Cell 2 and this area reserved for treatment of any contaminated soil. The soil cover in Cell 2 should be monitored to ensure that it is not impacted from wind erosion.

The proposed overall strategy for future waste placement is to use all off the Stage 3 capacity before returning to Stage 2 (estimated to occur around 2065, once the top of waste in all of Stage 3 reaches the same height as the existing Stage 2. Until then, the top of Stage 2 will be used to receive any hydrocarbon contaminated soil and its treatment.

3.5.2 Equipment

The Township uses a Caterpillar 816F2 compactor and crawler loader Deere 655K to spread and compact the waste, as well as other material handling activities.

As shown in **Table 4**, during 2023 the Township expended total hours on compaction and material handling that are comparable to previous years (range of 1100 to 1200 hours).

These two pieces of equipment continued to be used in 2023.

Table 4: Compaction Equipment Hours

Year	Total Hours Compactor Cat 816F2	Total Hours Track Loader Deere 655K
2023	211	900
2022	44	1151
2021	50	1105
2020	225	836

3.5.3 Materials and Compaction

During 2023, as shown in **Table 5**, the amount of sand imported for daily and interim cover and other usage was 1,589 tonnes. This is much less than the 6,494 tonnes (average of 541 tonnes/month) that was imported in 2022. The sand used for cover during 2023 was chiefly from the 2022 stockpile. While only a minimal amount of sand was used for base construction during 2023, this will change if the waste footprint is to be expanded easterly.

Table 5: Material Usage - Tonnes

Month	2023 Tonnage	2022 Tonnage	2021 Tonnage	2020 Tonnage
January	0	827	0	50.2
February	0	233	0	0.0
March	0	1015	0	0.0
April	0	0	0	0.0
May	0	0	0	0.0
June	0	0	0	817.0
July	0	0	1522	600.4
August	0	2295	1273	438.0
September	0	0	0	1117.8
October	0	0	1458	1165.2
November	0	0	0	376.5
December	1589	2124	0	896.6
Total	1589	6494	4253	5461.7
Average per month		541	354	455.1
Sand imported for base construction – not included in above Total	0	0	3,600 tonnes 2181 m^3	2,000 tonnes 1211 m^3
Note: A large portion of sand imported in December 2022 was used during 2023.				

3.5.4 Users

As shown in **Table 6** the total number of landfill users for 2023 was 7,503 with the highest number of users in May (849) and the lowest in February (263). The total number of users is consistent with previous years, except for 2019 when heavier usage was recorded due to debris from a flooding occurrence along the Ottawa River (in May) that users brought into the site.

Table 6: Monthly Site Users

Month	2023 Users	2022 Users	2021 Users	2020 Users	2019 Users
January	359	321	256	278	251
February	263	242	206	258	242

Month	2023 Users	2022 Users	2021 Users	2020 Users	2019 Users
March	304	336	479	174	380
April	734	732	884	43	686
May	849	806	809	1205	1390
June	752	762	627	997	1295
July	750	801	777	788	1453
August	841	758	610	852	1126
September	738	779	694	883	943
October	770	874	904	1092	1152
November	661	643	695	726	829
December	482	470	448	429	427
Total	**7,503**	**7,524**	**7,389**	**7,725**	**10,174**
					Note 1
Note 1 – increase in users due to flooding that year that created more waste than is usual.					

3.5.5 Inspections

Stantec conducted three site inspection in 2023 (same frequency as previous years). Typically, the site inspections to review operations are done during the spring, summer and fall of each year. Stantec staff completed the inspections using a pre-established form/checklist and submitted their observations to the Township's Director of Public Works within one week of each inspection. The observations are mainly regarding requirements for compliance with operational conditions of the ECA. Copies of the forms for 2023 are reproduced in **Appendix C**. No significant issues were identified during 2023.

3.6 PROPOSED CHANGES TO LANDFILL OPERATIONS FOR 2024

To continue with disposal operations in Stage 3A during 2024, the Township's current disposal operations at the top of Stage 3A are becoming constrained and the Township will need to consider the expansion of the Stage 3A base in an easterly direction. This would include the removal of peat/organics and grading and import of granular fill to raise the ground level to that specified for the bottom of waste (**Figure C-01** – refer to **Appendix C** for the eastern half of Stage 3A). Review of anticipated comments from MECP on the WSP/Golder submission is to be considered in making that decision.

As shown in **Figure 4 in Appendix A**, during 2023, the footprint of the new waste was advanced along the east (toe of waste extended) and west (overlie Stage 2) directions within Stage 3A. As noted above, during 2024, the toe of the waste should be extended further east, and the platform widened to accommodate the base preparation using imported sand.

It is recommended that a platform length (N-S) of 80m be maintained to accommodate a waste footprint of 50m length and an additional 30m left for a pad to accommodate a turnaround for user traffic. The platform should extend east to the limit of waste placement and an area reserved for a turnaround (trucks with trailers, snow removal equipment). As the first row of waste placement (which overlies Stage 2 slope) is nearing completion, the process should be repeated by advancing the platform eastward.

With disposal operations in Stage 3A, the chipped wood can be stockpiled along the northern limit of Stage 3, between the toe of waste and the tree line. A buffer width of 10m should be maintained between the trees and the stockpile for fire protection.

Limited use of the area south of Stage 2 for the segregation of other products can be continued (organics).

The Township is advising its residents that the waste oil should be brought to the Town of Renfrew's household hazardous waste depot. This should continue in 2024.

During 2021, Golder Associates completed groundwater modeling to predict impacts from Stage 3 development on the CAZ and submitted this information to the Ministry for review in February 2021. The Township received copies of the MECP's technical reviews for groundwater (Nick Battye) and surface water (Lauren Forrester) specialists in Memorandums dated April 21st, 2022 and April 19th,2022 respectively which are reproduced in **Appendix C**. Golder Associates responded to MECP comments in letter prepared by P. Smolkin dated June 21st, 2022 which is reproduced in **Appendix C**. Depending on the results of further discussions expected in 2024, it is anticipated that a revised Development and Operation (D&O) Plan may need to be prepared during 2024.

In 2019, the recycling collection and processing contractor (Beaumen Waste Management) became insolvent and stopped providing these services to the Township of McNab Braeside, as well as other surrounding municipalities. During the 7 month period, January to July 2023, Topps Environmental Solutions (TES) provided the recycling collection for blue box and fibres which are delivered to a processing facility, Emterra Environmental Group in Renfrew. On July 29th, 2023, responsibility for the curbside collection and processing of blue bin type materials (including the material collected at the landfill) was transferred to Circular Materials Ontario (CMO), a Producer Responsibility Organization that is responsible for the full management of the program.

All waste diversion programs are to be continued in 2024. As noted previously, the WEEE products and tires are collected under the Individual Producer Responsibility model operated by Electronics Products Recycling Association (EPRA) and eTracks Tire Management Systems (eTracks) respectively.

With the spring 2017 and spring 2019 flooding issues, the Township should continue to maintain an open space along the properties north and east limits for temporary stockpiling of construction related debris.

3.7 COSTS

Table 7 below summarizes the cost breakdown for waste management services during 2023, as well as previous years for comparison.

Table 7: Annual Costs for Waste Management

Description	2023	2022	2021	2020	2019
Waste collection	$ 216,012	$225,987	$200,973	$187,591	$187,571
Recycling collection and processing	$ 162,538	$ 240,549	$ 217,441	$ 316,500	$ 239,716
Disposal operations	$ 182,397	$ 247,464	$ 226,670	$ 173,911	$ 201,790
Monitoring and Reporting	$ 60,514	$ 65,287	$ 57,917	$ 87,589	$ 55,599
Household Hazardous Waste Processing (Note 1)	$ 9,821	$ N/A	$ N/A	$ 5,783	$ 1,699
Equipment & Structures (fuel, maintenance, depreciation)	$ 71,211	$ 58,149	$ 29,315	$ 64,952	$ 37,066
Transfer to Reserve / Capital Funds	$ 155,943	$ 106,022	$ 108,182	$ 0	$ 169,088
Total Expenditure	***$ 858,436***	***$ 943,460***	***$ 840,498***	***$ 836,326***	***$ 892,529***
Revenues (taxes, tipping fees, recycling)	***$ 1,054,486***	***$ 1,040,442***	***$ 993,752***	***$ 1,020,562***	***$ 892,529***
Net $	***$ 196,050***	***$ 96,981***	***$153,254***	***$184,236***	***0***
Note 1: Information not provided by the Town of Renfrew at time of report writing for some years.					

Based on the information in

Table 7**,** the Total Expenditure for 2023 is approximately the same as previous years.

Gross Unit Cost for Waste Disposal

Based on the information in

Table 8, the unit cost for waste disposal was calculated to be approximately $ 103.95/tonne ($ 306,439/ 2,948 tonnes of waste) for 2023. The 2023 unit cost for disposal is higher than previous years due mainly for increased equipment costs (repairs), fuel and inclusion of administrative expenses.

Table 8: Annual Cost Breakdown for Disposal Components

Description	2023	2022	2021	2020	2019
Labour & Benefits	$ 95,334	$ 90,000	$ 92,266	$ 84,913	$ 85,511
Equipment & Fuel	$ 61,205	$ 33,615	$ 18,191	$ 25,403	$ 38,512
Monitoring/Reporting	$ 60,514	$ 65,287	$ 57,917	$ 87,589	$ 55,600
Structures (Note 3)	$ 10,006	$ 10,300	$ 11,123	$ 0	$ 7,128
Sand (i.e., Daily Cover)	$ 15,147	$ 48,262	$ 26,747	$ 33,461	$ 29,378
Other (grinding/Stage 3 work)	$ 37,142	$ 42,739	$ 20,426	$ 30,134	$ 78,029
Administrative (expenses, insurance, equipment rentals) Note 1	$ 27,091				
Total $	$ 306,439	$ 290,203	$ 226,670	$ 261,500	$ 294,158
Annual Volume (m^3)	9,426	10,745	18,538	10,892	7,600
Cost / volume waste ($/$m^3$)	$ 32.51	$ 27.00	$ 12.28	$ 24.00	$ 38.70
Waste (tonnes) (Note 2)	2,948	3,465	3,121	2,992	3,103
Cost / mass waste ($/t)	$ 103.95	$ 83.75	$ 72.63	$ 87.40	$ 95

Note 1: Administrative includes insurance, PIL, safety gear, signs, supplies, printing, memberships, other office supplies

Note 2: Refer to Error! Reference source not found. for tonnage.

Note 3: includes the maintenance and operating expenses for landfill scale house, equipment shed, and scale.

4 HYDROGEOLOGICAL MONITORING IMPACTS ON OPERATIONS

The Golder Associates report, Part A, presents the results of the 2022 and 2023 groundwater monitoring.

The landfill's capacity and remaining waste volumes are based on the design contours presented in the 1997 Development & Operation Plan prepared by Golder Associates. During 2019, the Ministry's (MECP) technical reviewer expressed some concerns with the ability of the contamination attenuation zone to mitigate impacts on groundwater and surface water from the Stage 3 development. During 2020, Golder Associates installed three additional monitoring wells between the waste footprint and Dochart Creek. The results of the monitoring are presented in Part A of the main report.

During 2021, Golder Associates completed groundwater modeling to predict impacts from Stage 3 development on the CAZ and submitted this information to the Ministry for review in February 2021. The Township received copies of the MECP's technical reviews for groundwater (Nick Battye) and surface water (Lauren Forrester) specialists in Memorandums dated April 21st, 2022 and April 19th,2022 respectively which are reproduced in **Appendix C**. Golder Associates responded to MECP comments in letter prepared by P. Smolkin dated June 21st, 2022 which is reproduced in **Appendix C**. Discussion on topics raised by MECP reviewers are discussed in the Golder Associates' portion of the collated Annual Monitoring Report.

No comments on Site Operations were received from the MECP during 2023. Any verbal or other correspondence concerning groundwater and surface water are discussed in the WSP/Golder report. Based on the MECP's review comments, a new Operation and development Plan is likely to be required to provide clarification on the Stage 3 construction.

5 WASTE DIVERSION INITIATIVES

5.1 WASTE REDUCTION TARGETS

The provincial strategy for waste reduction is to focus on the goal of Zero Waste. As part of that initiative, the province is focussing the creation of waste diversion programs that make producers responsible for the organization and management of collection, processing and reuse of their products. During 2023, individual producers were responsible for management of electronics (WEEE) and tires at the McNab-Braeside landfill. On July 29th 2023, the Township transitioned its curbside blue box recycling collection and collection of the same products at its landfill depot, and material processing (Blue box and Black box materials) to Circular Materials Ontario, a Producer Responsibility Organization that will manage the program.

The Township of McNab/Braeside has implemented the following programs to promote diversion:

- Promotes backyard composting and accepts Leaf & Yard waste at its landfill
- Operates a curbside recycling collection and material processing program, which on July 29th 2023 was transitioned to Circular Materials Ontario
- Segregates scrap metal and white goods at the landfill
- Diverts clean brush from burial through chipping and its use as daily cover
- Participates in a household HHW depot at the Town of Renfrew landfill
- Segregates electronic waste and electrical equipment, and tires through Producer Responsibility Organizations.

5.2 WASTE DIVERSION/RECYCLING PROGRAM

5.2.1 Curbside Recycling Program

Between January 1st and July 29th, 2023, the Township operated a curbside collection recycling program. The Township of McNab/Braeside (as well as other surrounding municipalities) retained the services of Topps Environmental Services (TES) to provide curbside collection and processing of recyclables. Recyclables collected from a curbside dual stream collection are sent to Emterra Environmental Group facility in Renfrew for processing.

Beginning July 29th 2023 responsibility of curbside and landfill depot collection and processing of blue and black box recyclables was transferred to CMO. **Table 9** identifies the type and volume of recyclable material collected in 2023.

Table 9: Curbside Collection Recycling Program - Tonnes

Material	2023	2022	2021	2020	2019
	Metric Tonnes	Metric Tonnes	Metric Tonnes	Metric Tonnes	Metric Tonnes
ONP/OCC/ Boxboard	115.0	202.4	230	97.24	N/A
Aluminum/Tin/ Plastic/Glass	96.68	181.5	190.5	70.14	N/A
Polystyrene	0	0	0	0	0
Single stream mixed	0	0	0	315.17	N/A
TOTAL (7 months only for 2023)	211.68	383.9	420.5	482	499

Data for the months of August to December (inclusive) 2023 is not available – thus comparison to previous years is not feasible. Our previous report for 2022, had remarked that the tonnage of curbside recyclable products collected had remained relatively constant over the last four years, with less than a 10% variance from the 2021 total.

5.2.2 Segregation of Products at the Landfill

The Township segregates certain materials (such as scrap metal, white goods, tires and electronic waste) from the waste stream and stores these products at the landfill until sufficient quantities warrant collection of the products by private contractors or thru individual producer responsibility model programs. Clean wood and brush that is brought in by residents is stockpiled until a wood-chipping contractor is brought in to chip it. The woodchips are mixed with imported sand for daily and interim cover use.

Table 11 identifies that approximately 625 tonnes of brush/organics was brought to the landfill for grinding on two separate occasions (July and November 2023).

5.2.3 Household Hazardous Waste

The Township of McNab/Braeside, along with other surrounding municipalities, participated in the depot program at the Town of Renfrew landfill. Records of the total volume/weight of HHW collected at the Renfrew depot account for 62,200 Litres of liquid (mostly paint and oil) and 23,546 Kg of solids (miscellaneous items). McNab/Braeside contribution represented 17.17% of the total cost of operation (based on Census population).

5.2.4 Waste Oil Transfer Station

In 1993, the Township began operating a waste oil transfer station that collects, temporarily stores and transfers waste oil from the landfill site. Historically, Safety Kleen Canada would pick up waste oil on two or three occasions during the year. As shown in

Table 10**,** no waste oil has been removed from the site since 2020. Users are advised to drop off any waste oil at the Renfrew HHW depot.

Table 10: Waste Oil Transfer Station

Year Collected	Quantity (Litres)
2018	1700
2019	1227
2020 - 2023	0

5.2.5 Waste Recycling Strategy

In 2011, the Township retained Stantec Consulting to develop a Waste Recycling Strategy to support diversion initiatives and guidance on monitoring and measuring of diversion success for its waste management program. The Strategy was completed in November and adopted by Council on December 20, 2011.

Beginning July 29th, 2023, all future changes to the recycling program for blue box type materials (curbside and landfill depot) will be initiated and implemented by Circular Materials Ontario.

5.3 STATUS OF WASTE DIVERSION INITIATIVES

The results of the 2023 waste diversion programs are summarized in

Table 11**.** We observe that the waste diversion programs achieved a diversion of 25.8% by weight for 2023, a diversion that is below prior years because it does not include recycling tonnage collected between August and December 2023.

The diversion rate above should not be compared to the diversion rate calculated by Waste Diversion Ontario (WDO) since the latter reflects only the residential portion of the waste stream and the blue box recycling program.

Table 11: Waste Diversion Initiatives

Description	2023	2022	2021	2020	2019
	tonnes	tonnes	tonnes	tonnes	tonnes
Recycling Program (blue box + bins at landfill	211.67	383	420	490	499
Polystyrene (Note 1)	0	0	0	0	0
Segregation – tires (Note 3)	12.31	19.55	21.4	12.72	15
Segregation – scrap metal	143	148	161	161	154
Segregation–wood (Note 5)	625.8	685	596	0	625
Electronics	17.48	18.18	21.3	23.42	22.9
Waste Oil (Note 4)	0	0	0	1	1.034
Household Hazardous Waste (Notes 2, 7)	14.72	0	0	10	16
Subtotal waste diverted	**1025**	**1253**	**1219**	**698**	**1333**
Contaminated Soil	0	0	0	0	0
Household Waste	2948	3465	3121	2992	3103
Total Waste Stream	**3973**	**4340**	**3690**	**4435**	**4588**
Waste Diversion (recycling for 7 months only in 2023 – actual diversion should be higher	**25.8%**	**28.0%**	**19%**	**30%**	**31%**

Note 1: Program not in operation since 2019.

Note 2: Hazardous waste collection thru the Town of Renfrew depot.

Note 3: Where weight is not provided – use 22 lbs/car tire, 25lbs/truck tire and 100lbs per commercial tire.

Note 4: Use waste oil density of 0.843 tonnes per cubic metre and Town of Renfrew data – not available for 2022.

Note 5: Woodchips used for cover, density of 298kg/m^3..

Note 6: Agreement with eTracks (IPR supplier) entered in 2019 – tonnage calculated using 22lbs/tire.

Note 7: Calculated using 1 kg/litre for liquid (62,200 L), + total solid of 23,546 KG – McNab contribution of 17.17 % contribution

5.3.1 Net Unit Cost for Waste Diversion

The net unit cost for the waste diversion initiatives was not calculated because the tonnage of the former blue box and black box (fibres) was not available for the period August to December 2023 due to the transition to Circular Materials Ontario.

Table 12: Waste Diversion Costs – 2023

Description	2023	2022	2021	2020
Blue Box Pickup (7 months only)	$ 152,717 + PRO	$ 240,549	$ 217,441	$ 315,098
Corrugated Cardboard	PRO	0	0	0
Waste Oil Shipping & Fees	$ 0	$ 0	$ 0	$ 49
Household Hazardous Waste	9,821	Note 1	$ 0	$ 5,783
Blueboxes / Composter Purchases	0	0	0	0
Recycling Promotion	$ 0	$ 0	$ 0	$ 1,352
Total Costs	**$**	**$ 240,549**	**$ 217,441**	**$ 322,283**
Garbage bag tags	$ 7,052	$6,042	0	0
Tire Revenue	PRO	0	0	0
Composter / Blue Box Sales	$ 609	$ 431	$ 389	$ 417
Scrap Metal Revenue	$ 8,195	$ 7,399	$ 9,213	$ 9,226
Bluebox Funding	$ 115,267	$ 141,356	$ 78,851	$ 68,850
E-waste Revenue	$ 2,430	$ 2,727	$ 3,360	$ 3,880
Total Revenue	**$**	**$ 157,956**	**$ 91,813**	**$ 82,375**
Net Total Cost	**$**	**$ 82,592**	**$ 125,628**	**$ 239,908**

Note 1: HHW cost for Town of Renfrew depot for 2022 was not available.
PRO – Producer Responsibility Organization – organization that manages programs for the handling of selected products – such as tires, blue box recycling, and WEEE

5.3.2 Administrative

The Township passed By-Law 2023-59 on October 03rd, 2023, which is a by-law to establish fees and charges for services or use of municipal property. Tipping fees for landfill users are established in this by-law within Schedule F, Waste Management fees. Tipping fees for waste was listed at $ 90/tonne (2023).

A copy of the By-Law is provided in **Appendix B**.

6 OTHER ISSUES

6.1 PLANNING FOR WASTE DISPOSAL

Table 3 identifies the remaining capacity of the landfill to be reached by approximately 2073. This is similar to previous projections prior to 2021. In prior reports, we reported that the per capita generation was doubled in 2021 from the previous years and increased the rolling five-year average from 1.2 to 1.46 m^3/cap/yr. – with the impact of reducing the remaining years of service. In 2023, the 5 yr. rolling average has returned to pre 2021 levels.

In addition, with the pandemic and a shift to more people moving to rural areas and the Federal commitment to increase immigration, the Township's population projection was revised to show a 1.2% annual increase starting in 2022.

During 2019, in response to concerns expressed by MECP, the Township committed to undertaking the investigations and modelling to demonstrate that it can develop the full capacity of Stage 3. Submission of this work by Golder Associates was submitted to the Ministry in February 2021. We anticipate that the Ministry's review comments (if received in 2024) will result in a revised Operation and development Plan being prepared and submitted to MECP during 2024.

During 2023, the Township was considering the establishment of a Waste Diversion Sub-Committee to investigate and promote initiatives for the improvement of waste diversion. One improvement is a pilot program that provides incentives to residents to purchase (at a reduced cost) a FoodCycler – product that will compost household organics on your kitchen countertop by chopping/slicing organics and heating the mixture for a period of several hours to decompose it. The resulting compost can be used by the users to enhance soil composition.

6.2 MINISTRY INSPECTIONS AND CORRESPONDENCE

The last inspection was conducted by MECP (Emily Tieu) during 2018. The MECP did not conduct any inspections during 2022 or 2023.

Based on a Memo from Lauren Forrester (MECP Kingston), the MECP Ottawa office forwarded a letter dated September 24th, 2019, to the Township requesting that a workplan and implementation schedule be submitted to address site development. The requested documentation was submitted to the MECP Ottawa office on October 22nd, 2019, by the Township. The workplan and schedule was prepared by Golder Associates in a letter to the Township dated October 3rd, 2019. Upon review of the documentation by MECP (Thandeka Ponalo), a November 6th, 2019 letter was forwarded to the Township providing comments on additional info that the Township should consider in undertaking the work.

During 2020, the Township authorized their Consultant Golder Associates to complete the investigations and modelling of groundwater and surface water to define potential impacts from landfill operations. During 2021, Golder Associates completed groundwater modeling to predict impacts from Stage 3

development on the CAZ and submitted this information to the Ministry for review in February 2021. The Township received copies of the MECP's technical reviews for groundwater (Nick Battye) and surface water (Lauren Forrester) specialists in Memorandums dated April 21st, 2022 and April 19th,2022 respectively which are reproduced in **Appendix C**. Golder Associates responded to MECP comments in letter prepared by P. Smolkin dated June 21st, 2022 which is reproduced in **Appendix C**. Discussion on topics raised by MECP reviewers are discussed in the Golder Associates' portion of the collated Annual Monitoring Report.

Based on future comments from the Ministry reviewers, the Township is likely to have to prepare and submit a revised Operation and Development Plan for Ministry review during 2024.

6.3 REVIEW OF COMPLAINTS

The Township did not receive any written public complaints during 2023.

7 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions are reached for 2023 and recommendations are made for 2024 operations at the site, these are:

1. The landfill development plan is to provide one million m^3 of capacity using an area method of fill in three Stages/Cells: Stages 1, 2 and 3. The remaining capacity (125,417 m^3) in Stage 2 should be developed only after Stage 3 is full. During 2023, the Township consumed 9,426 cubic metres of capacity within Stage 3A and has a remaining capacity of 550,898 cubic metres (representing several decades of service life).
2. The remaining capacity of 550,898 cubic metres could decrease/change depending on the Ministry review comments of the Golder modelling report on groundwater impacts, as well as potential for MECP to request that not all of the remaining capacity be developed.
3. An interim cover was placed over Cell 2 in 2019/2020 and this area will be used for the management of contaminated soil while Stage 3 is being developed.
4. During the period January to July 29th, 2023, the Township operated a successful waste diversion program through curbside collection of recyclables and removal of products from its depot program at the landfill. The recycling program diverted 211 tonnes from its waste stream in 2023. During the 7 months of operation, the Township contracted the curbside collection of recyclables using Topps Environmental Solution and processing at the Emterra Group facility in Renfrew.

   On July 29th, 2023 the Township transitioned) its curbside blue box recycling program to Circular Materials Ontario (collection and processing) of blue box type materials and fibres. No data is available for the August to December 31st period that was operated by Circular Materials Ontario.
5. The curbside recycling collection and other depot programs for WEEE, scrap metal, grinding brush, waste oil (Renfrew HHW depot), tires and other diversion programs represent a significant diversion and should be continued. The Township entered into an agreement with eTrac – an extended producer responsibility (EPR) supplier, for the management/removal of tires. Additional agreements will become necessary as more products move to the new system approach.
6. The agreement with the Town of Renfrew for household hazardous waste offers a valuable service at a reasonable cost and should be continued.
7. Granular fill needs to be imported to extend the base of Stage 3A eastward to allow for continued development. Base preparation should continue in 2024 so that a platform of approximately 80m length (N-S) is developed over the current tree cleared area of Stage 3A (refer to **Figure C-03** in Appendix C for clearing limits for initial development).
8. Continue to perform an annual inspection of the weigh scale and maintain a record of the inspection and calibration (if necessary).
9. The Township should continue with the environmental monitoring program, as per Golder recommendation, and operations monitoring program as per Stantec recommendation. To respond to MECP concerns with the development of Stage 3, the Township should continue



consultation with Ministry reviewers regarding the investigations, modelling and other activities described in the Golder Associates report. As Stage 3 remaining volume represents a significant investment value in the million of dollars, implementing any additional measures that may be required to increase the level of protection for groundwater and surface water from Stage 3 operations is warranted.

10. The Township's management did review the training manual with its staff during 2023. Township should continue to review the Training Manual with its staff annually and make any amendments, as necessary. A record of this review should be documented. Also verify that personnel safety requirements remain current (WHMIS, first aid, CPR, tetanus vaccination). A copy of the Training manual and a copy of the Annual Monitoring Reports should be stored at the weigh scale building.

8 LIMITATIONS AND USE OF REPORT

In the preparation of this report, Stantec provides the benefit of its professional judgment based on its experience and in accordance with generally accepted professional standards for this type of project.

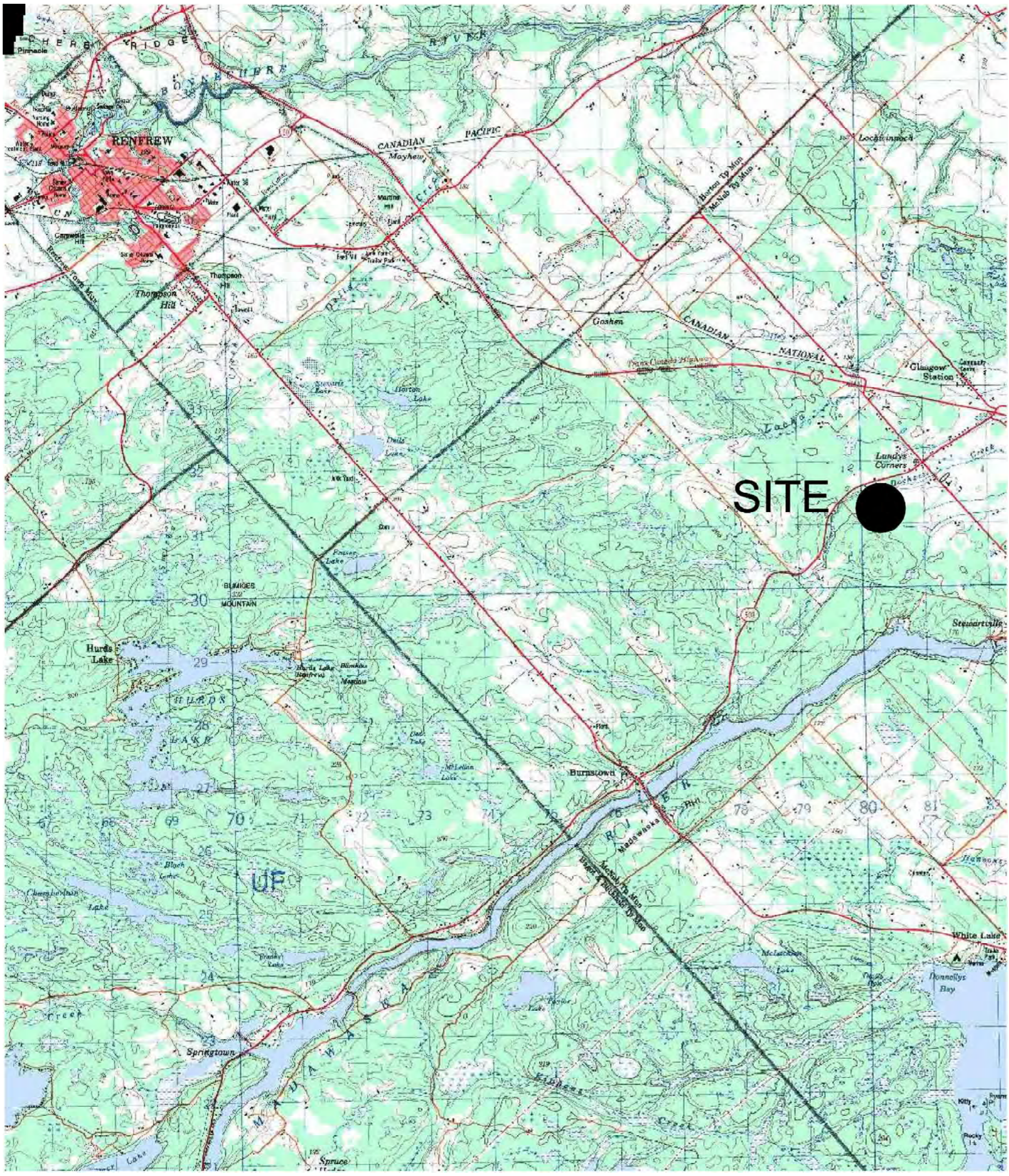
This report has been prepared for the exclusive use of the Township of McNab/Braeside for the purpose of annual operations monitoring and reporting at the subject property. Any use that a third party makes of this report, or any reliance on or decisions to be made on it, are the responsibility of such third parties. Stantec accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Appendix A FIGURES AND PHOTOS

	
Photo 1 – Stage 3A – North West corner	Photo 2 – Stage 3A – South west
	
Photo 3 – Scrap metal bin, tires and WEEE	Photo 4 – Weigh Scale and building

Stantec

Client:	Township McNab Braeside
Project:	2023 Annual Monitoring Report
Date:	March 31th 2024
File:	163401671



\\ca0218-ppfss01\01-634\active\1634_01671\planning\drawing\2019 drawings\figures-06-02-01 - 2023

2024.03.11 8:01:25 PM

Stantec

Stantec Consulting Ltd.
300-1331 Clyde Ave.
Ottawa, ON K2C 3G4
Tel: (613) 722-4420
www.stantec.com

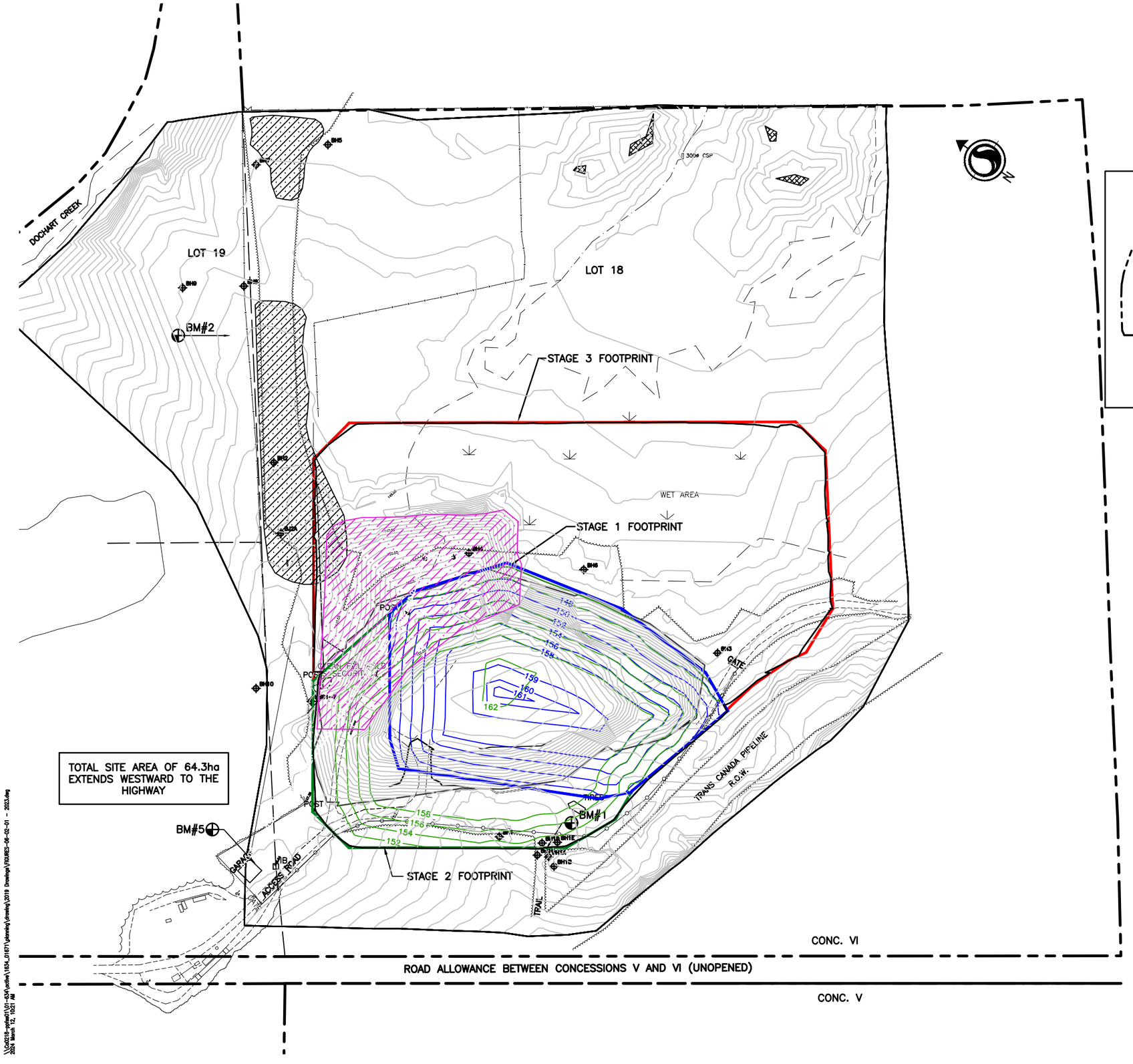
Client/Project
McNAB/BRAESIDE TOWNSHIP
McNAB/BRAESIDE WASTE DISPOSAL REPORT

Project No.
163401671

Title
LOCATION PLAN

Date
2023.03.31

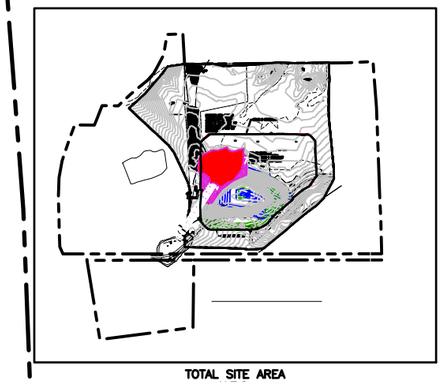
Drawing No.
FIG-1



BENCHMARK No.1 ELEV.152.494
NAIL IN NORTH FACE OF 0.80 MAPLE ABOUT 1.0m FROM GROUND. MAPLE IS LOCATED ON SOUTH EDGE OF BUSH OF WASTE SITE AND LEFT OF TRAIL TO GAS PIPE LINE.

BENCHMARK No.2 ELEV.143.932
NAIL AND WASHER IN NORTH EAST ROOT OF 0.2m HEMLOCK TREE. TREE IS LOCATED ON RIGHT OF TRAIL ON MOST WESTERLY EDGE OF BUSH TO WASTE SITE.

BENCHMARK No.5 ELEV.148.843
PAINT SPOT ON SLAB OF GARAGE DOOR



TOTAL SITE AREA
N.T.S.

Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved
The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend
- HISTORICAL METAL WASTE DISPOSAL AREA (NOW CLOSED)
- ROCK OUTCROP
- STAGE 1 FOOTPRINT
- STAGE 1 DESIGN WASTE CONTOURS
- STAGE 2 FOOTPRINT
- STAGE 2 DESIGN WASTE CONTOURS
- STAGE 3 FOOTPRINT

Notes
1. SITE BOUNDARIES ARE DERIVED FROM REG. PLAN 48R–12786.
2. EXISTING CONDITIONS ARE BASED ON TOPOGRAPHIC SITE SURVEY BY Jp2g CONSULTANTS INC. DATED NOV. 19, 1990, SEPT. 15, 1999, JAN. 5, 2001, DEC. 6, 2001 AND DEC. 9, 2002.

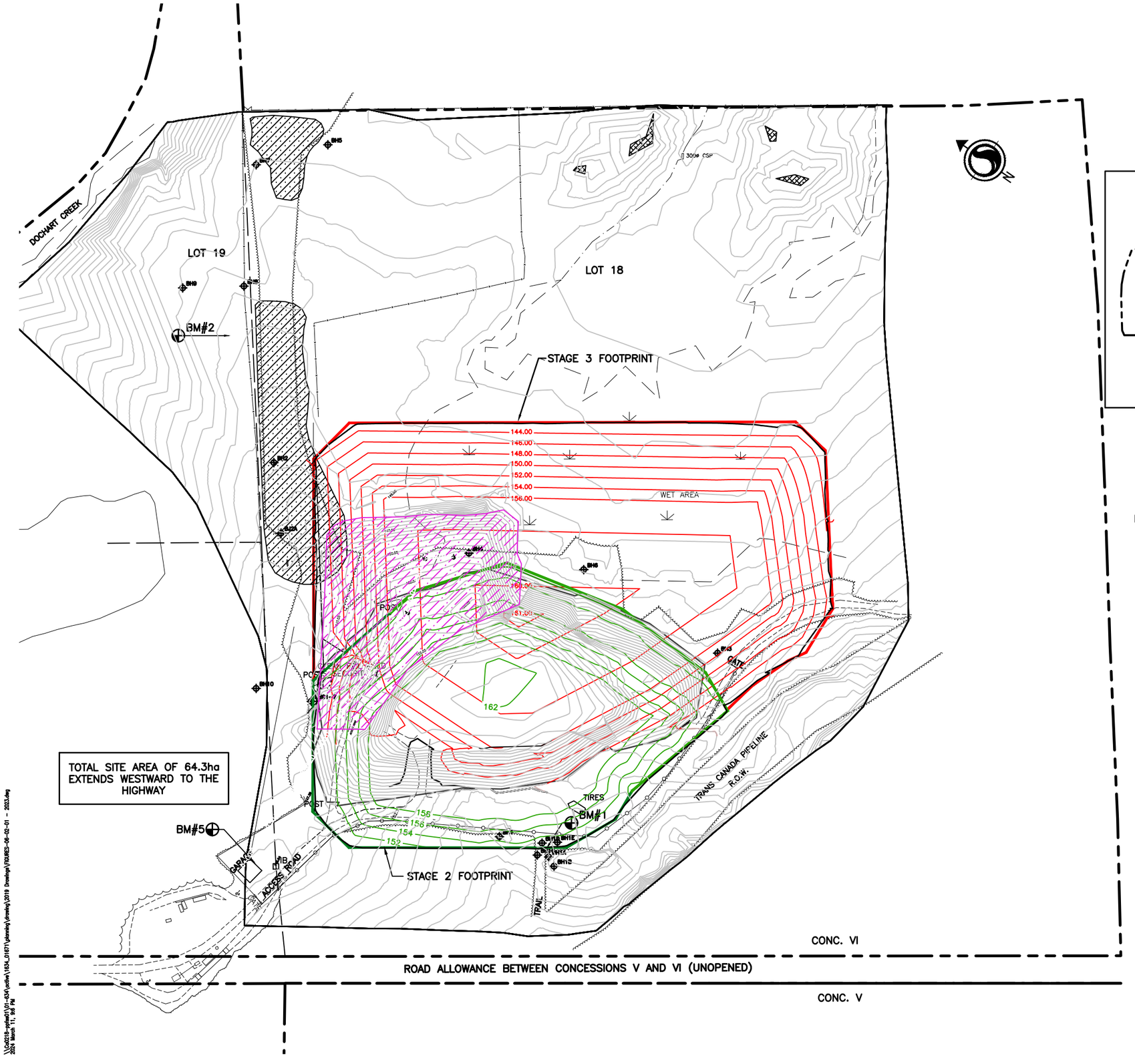
Client/Project
TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title
DESIGN WASTE CONTOURS
STAGE 1 AND STAGE 2

Project No. 163401671
Scale 0 15 45 75m
Drawing No. FIG-2A
Sheet of
Revision 0

\\Ca0215-pafprint\V01-02\Active\163X_01671\planning\drawing\2019 Drawings\FIGURES-06-02-01 - 2023.dwg
2024 March 12, 10:21 AM

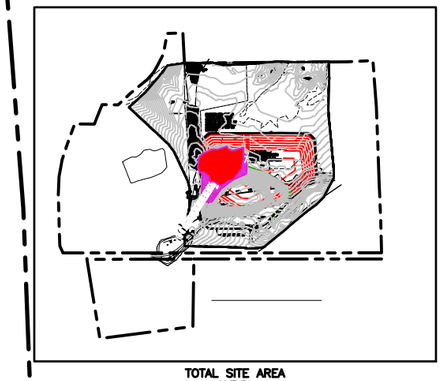


TOTAL SITE AREA OF 64.3ha EXTENDS WESTWARD TO THE HIGHWAY

BENCHMARK No.1 ELEV.152.494
NAIL IN NORTH FACE OF 0.80 MAPLE ABOUT 1.0m FROM GROUND. MAPLE IS LOCATED ON SOUTH EDGE OF BUSH OF WASTE SITE AND LEFT OF TRAIL TO GAS PIPE LINE.

BENCHMARK No.2 ELEV.143.932
NAIL AND WASHER IN NORTH EAST ROOT OF 0.2m HEMLOCK TREE. TREE IS LOCATED ON RIGHT OF TRAIL ON MOST WESTERLY EDGE OF BUSH TO WASTE SITE.

BENCHMARK No.5 ELEV.148.843
PAINT SPOT ON SLAB OF GARAGE DOOR



TOTAL SITE AREA
N.T.S.

Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved
The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend
- HISTORICAL METAL WASTE DISPOSAL AREA (NOW CLOSED)
- ROCK OUTCROP
- STAGE 2 FOOTPRINT
- STAGE 2 DESIGN WASTE CONTOURS
- STAGE 3 FOOTPRINT
- STAGE 3 DESIGN WASTE CONTOURS

Notes
1. SITE BOUNDARIES ARE DERIVED FROM REG. PLAN 48R–12786.
2. EXISTING CONDITIONS ARE BASED ON TOPOGRAPHIC SITE SURVEY BY Jp2g CONSULTANTS INC. DATED NOV. 19, 1990, SEPT. 15, 1999, JAN. 5, 2001, DEC. 6, 2001 AND DEC. 9, 2002.

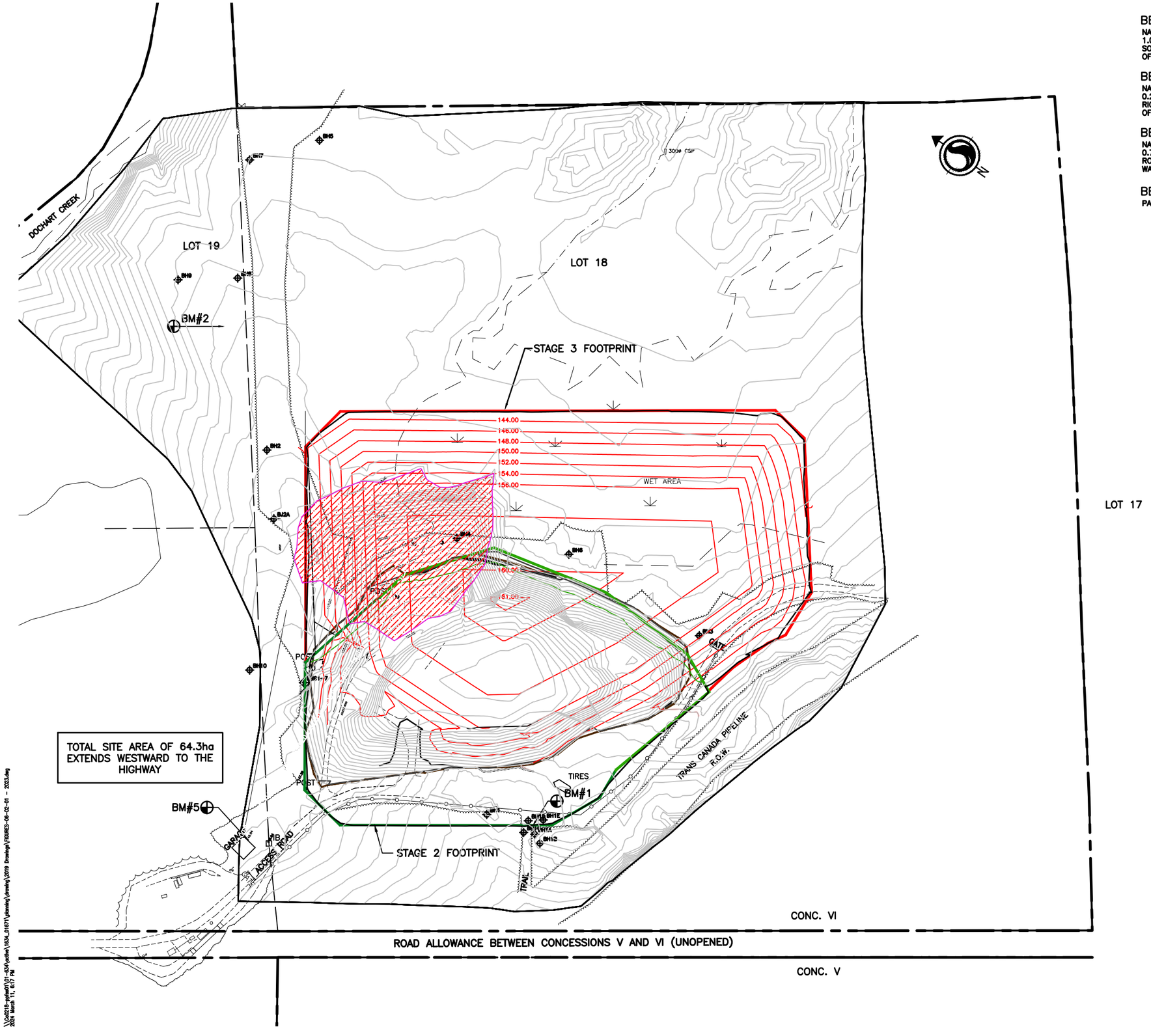
Client/Project
TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title
DESIGN WASTE CONTOURS
STAGE 2 AND STAGE 3

Project No. 163401671
Scale 0 15 45 75m
Drawing No. FIG-2B
Sheet of
Revision 0

\\Cd2215-pdfss01\VI-RS4\active\163401671\planning\drawing\2019 Drawings\FIGURES-06-02-01 - 2023.dwg
2024 March 11, 8:58 PM



BENCHMARK No.1 ELEV.152.494
NAIL IN NORTH FACE OF 0.80 MAPLE ABOUT 1.0m FROM GROUND. MAPLE IS LOCATED ON SOUTH EDGE OF BUSH OF WASTE SITE AND LEFT OF TRAIL TO GAS PIPE LINE.

BENCHMARK No.2 ELEV.143.932
NAIL AND WASHER IN NORTH EAST ROOT OF 0.2m HEMLOCK TREE. TREE IS LOCATED ON RIGHT OF TRAIL ON MOST WESTERLY EDGE OF BUSH TO WASTE SITE.

BENCHMARK No.3 ELEV.149.509
NAIL AND WASHER IN SOUTH WEST ROOT OF A 0.7m HEMLOCK TREE. FIRST TREE ON RIGHT OF ROAD APPROXIMATELY 5m PAST MAIN GATE TO WASTE SITE.

BENCHMARK No.5 ELEV.148.843
PAINT SPOT ON SLAB OF GARAGE FLOOR

Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved
The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

- CONTOURS
- STAGE 2 FOOTPRINT
- STAGE 3 DESIGN WASTE CONTOURS
- 2022 WASTE SURVEY
- EXISTING WASTE FOOTPRINT (pre 2014)

Notes
1. SITE BOUNDARIES ARE DERIVED FROM REG. PLAN 48R-12786.

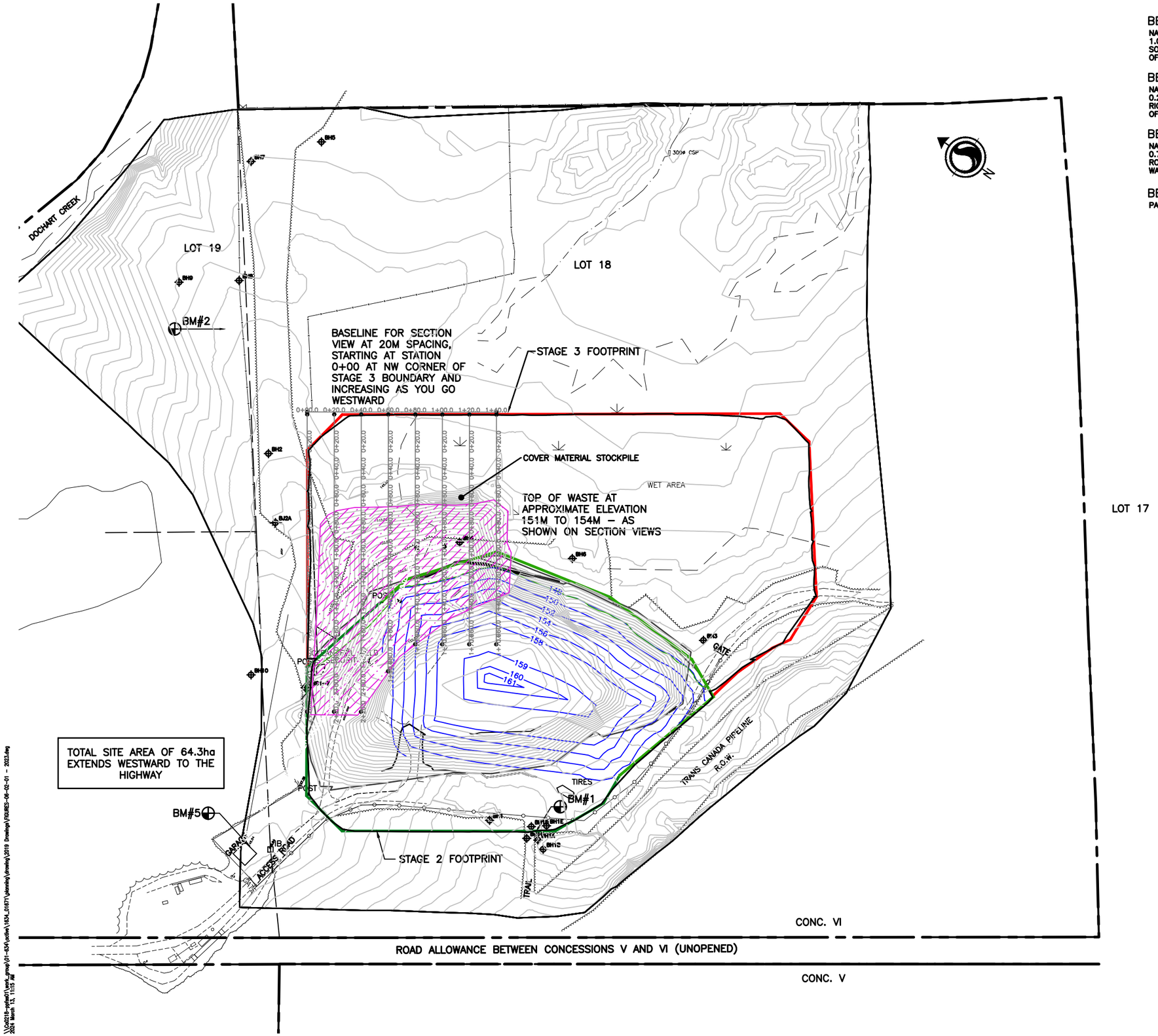
Client/Project
TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title
2022 WASTE CONTOURS

Project No. 163401671
Scale 0 15 45 75m
Drawing No. FIG-3
Sheet of
Revision 0

\\Cd2215-pdfs01\01-ISA\active\163A_01671\planning\drawing\2019 Drawings\FIGURES-06-02-01 - 2023.dwg
2024 March 11, 8:17 PM



BENCHMARK No.1 ELEV.152.494
NAIL IN NORTH FACE OF 0.80 MAPLE ABOUT 1.0m FROM GROUND. MAPLE IS LOCATED ON SOUTH EDGE OF BUSH OF WASTE SITE AND LEFT OF TRAIL TO GAS PIPE LINE.

BENCHMARK No.2 ELEV.143.932
NAIL AND WASHER IN NORTH EAST ROOT OF 0.2m HEMLOCK TREE. TREE IS LOCATED ON RIGHT OF TRAIL ON MOST WESTERLY EDGE OF BUSH TO WASTE SITE.

BENCHMARK No.3 ELEV.149.509
NAIL AND WASHER IN SOUTH WEST ROOT OF A 0.7m HEMLOCK TREE. FIRST TREE ON RIGHT OF ROAD APPROXIMATELY 5m PAST MAIN GATE TO WASTE SITE.

BENCHMARK No.5 ELEV.148.843
PAINT SPOT ON SLAB OF GARAGE FLOOR

Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved
The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

- CONTOURS
- STAGE 1 DESIGN WASTE CONTOURS
- STAGE 2 FOOTPRINT
- 2023 WASTE SURVEY
- EXISTING WASTE FOOTPRINT (pre 2014)

Notes
1. SITE BOUNDARIES ARE DERIVED FROM REG. PLAN 48R–12786.

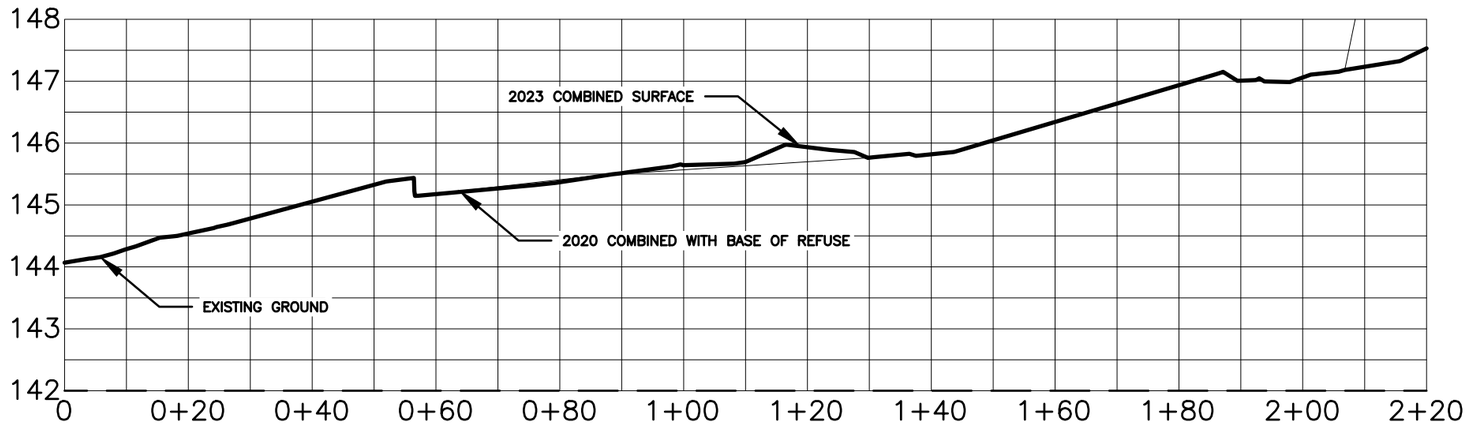
Client/Project
TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

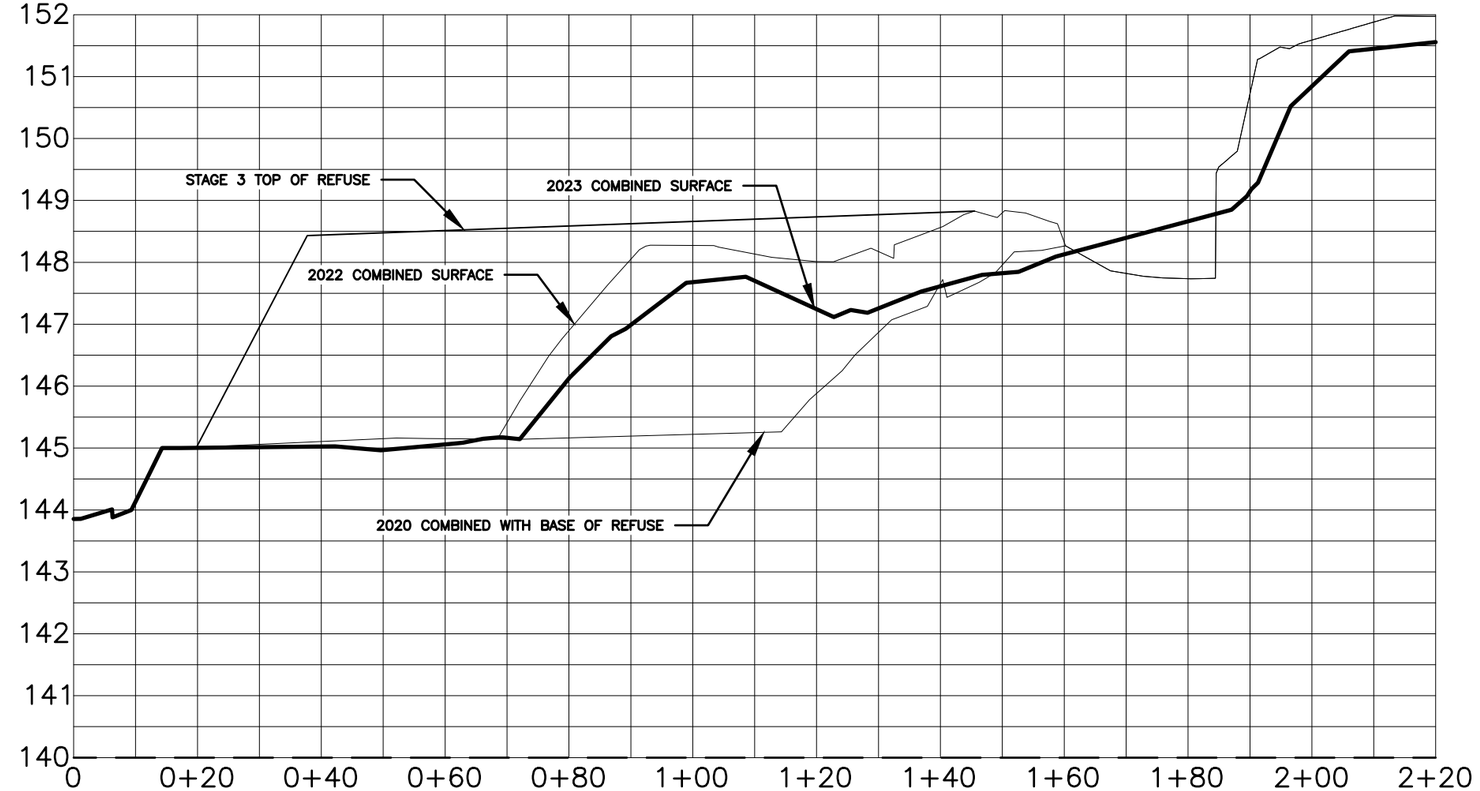
Title
2023 WASTE CONTOURS

Project No. 163401671
Scale 0 15 45 75m
Drawing No. FIG-4
Sheet of
Revision 0

\\Cd2218-pritst01\ven_a\group\01-434\active\1634_01671\planning\cmeiley\2019 Drawings\FIGURES-06-02-01 – 2023.dwg
2024 March 13, 11:15 AM



STA. 0+00



STA. 0+20

Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

Notes

SURVEY COMPLETED DECEMBER 7, 2023.

Client/Project

TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title

2023 SECTIONS
Sta. 0+00, Sta. 0+20

Project No. 163401671

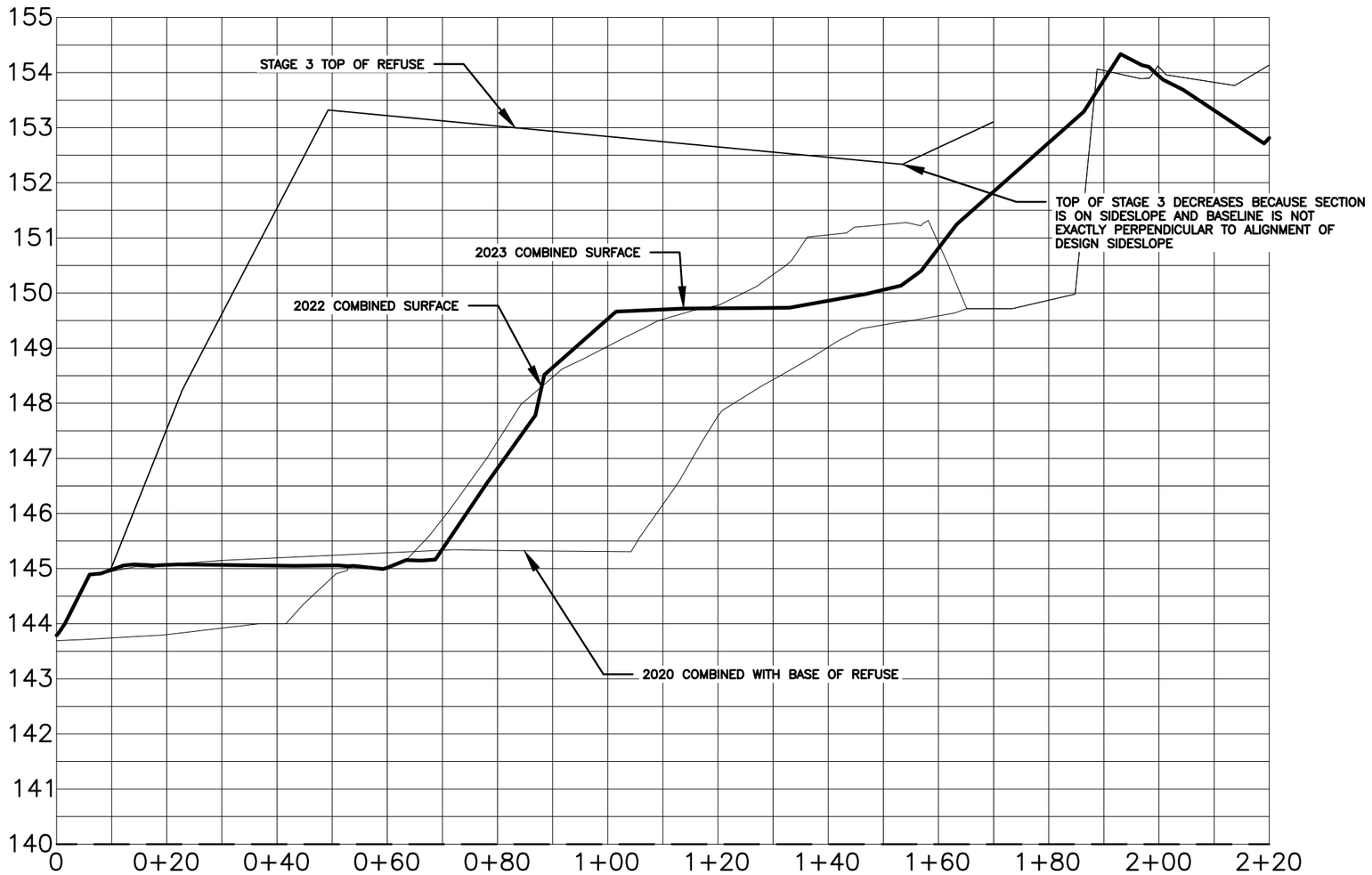
Scale H 0 5 15 25m
V 0 0.5 1.5 2.5m

Drawing No. FIG-5

Sheet of

Revision 0

\\Ca0215-pafast01\work_group\01-634\active\163401671\planning\drawing\2019 Drawings\FIGURES-06-02-01 - 2023.dwg
2024, March 13, 11:11 AM



STA. 0+40

Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

Notes

SURVEY COMPLETED DECEMBER 7, 2023.

Client/Project

TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title

2023 SECTIONS
Sta. 0+40

Project No.
163401671

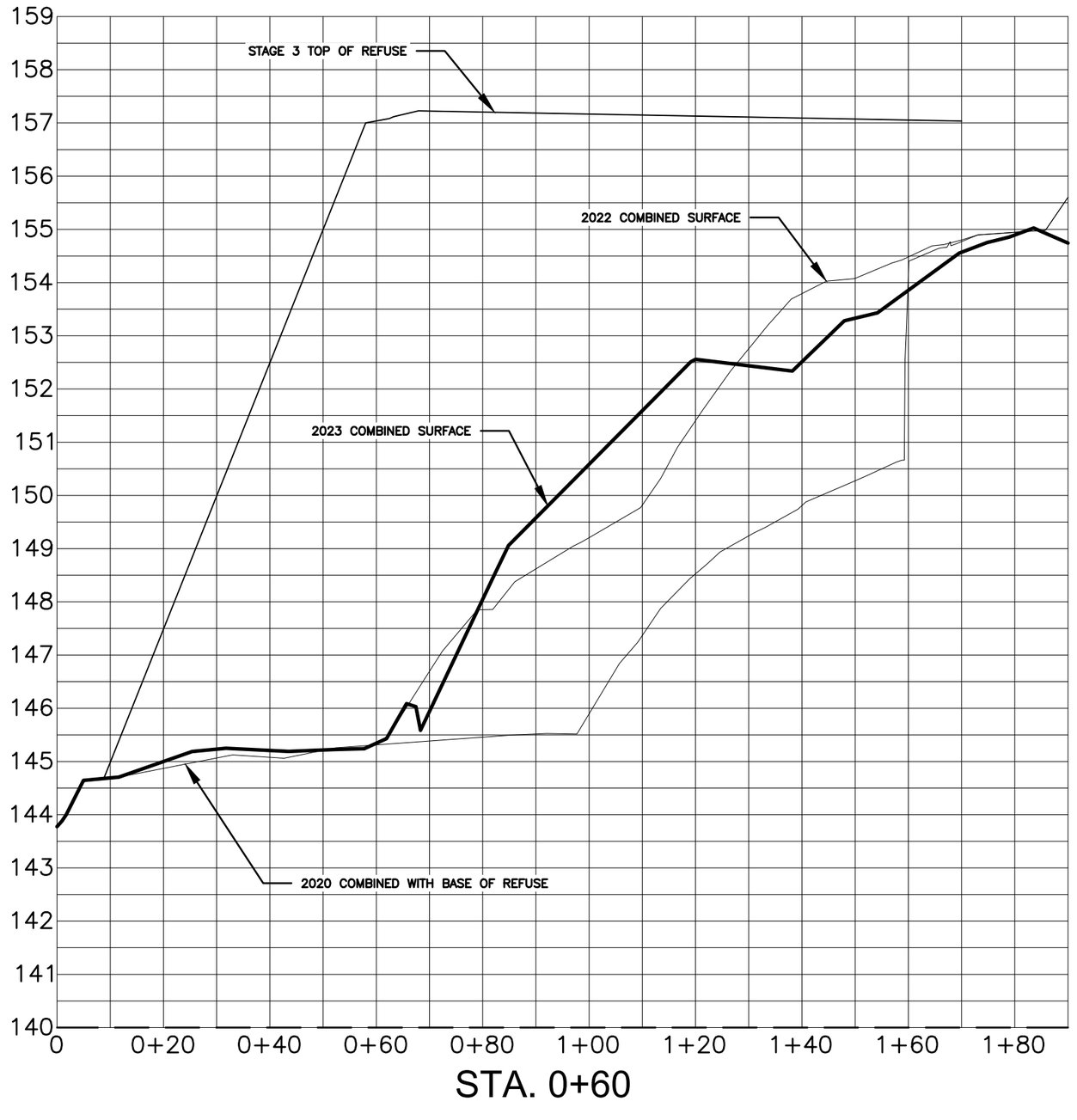
Scale H 0 5 15 25m
V 0 0.5 1.5 2.5m

Drawing No.
FIG-6

Sheet
of

Revision
0

\\Cd2215-pstfil01\Work_Agroup\01-634\active\634_D1671\planning\drawing\2019 Drawings\FIGURES-06-02-01 - 2023.dwg
2024 March 13, 10:26 AM



STA. 0+60

Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

Notes

SURVEY COMPLETED DECEMBER 7, 2023.

Client/Project

TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title

2023 SECTIONS
Sta. 0+60

Project No.
163401671

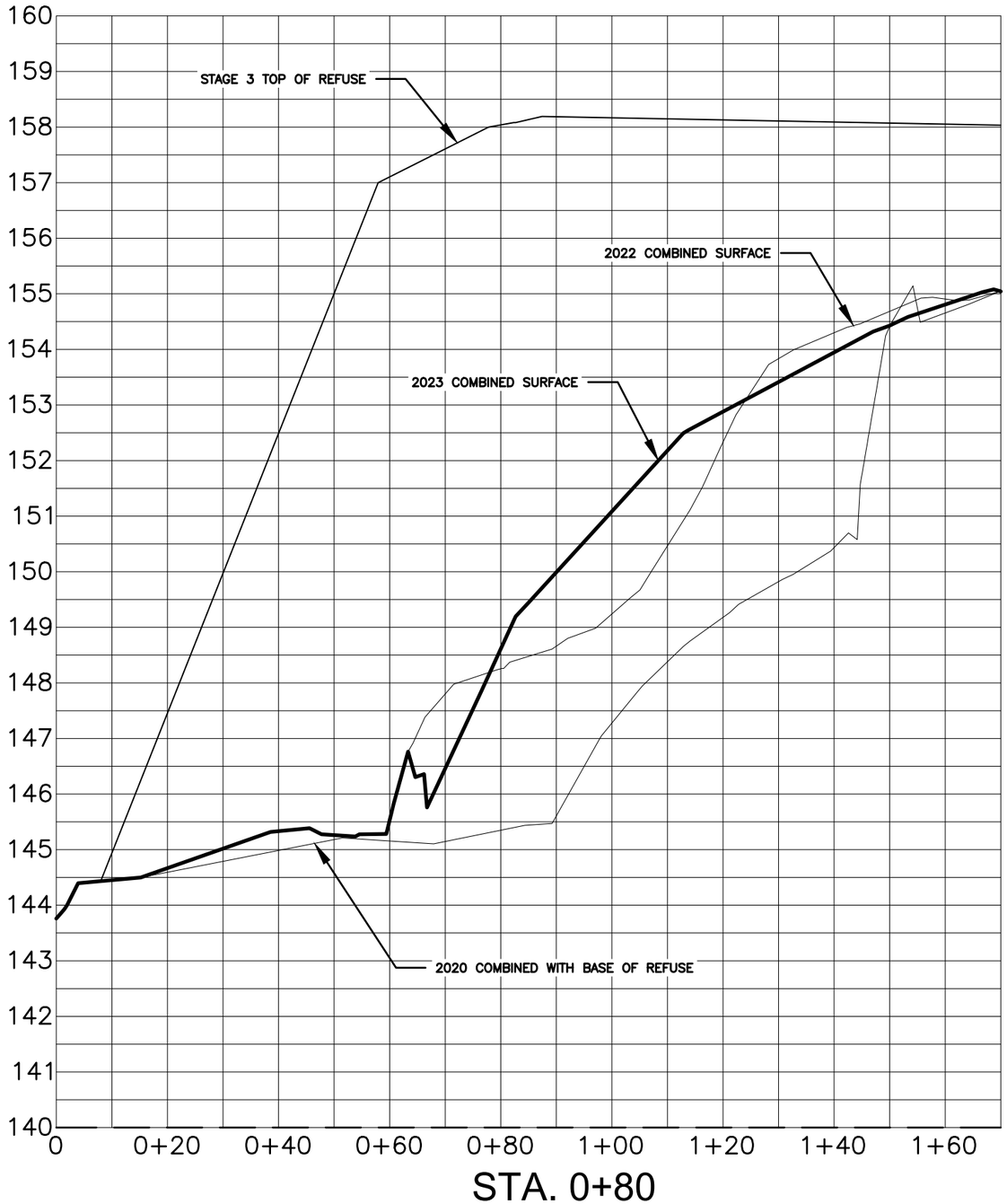
Scale H 0 5 15 25m
V 0 0.5 1.5 2.5m

Drawing No.
FIG-7

Sheet
of

Revision
0

\\CA0218-prfsn01\corp_group\01-634\active\163401671\planning\planning\2019 Drawings\FIGURES-06-02-01 - 2023.dwg
2024 March 14, 10:22 AM



Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

Notes

SURVEY COMPLETED DECEMBER 7, 2023.

Client/Project

TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title

2023 SECTIONS
Sta. 0+80

Project No.
163401671

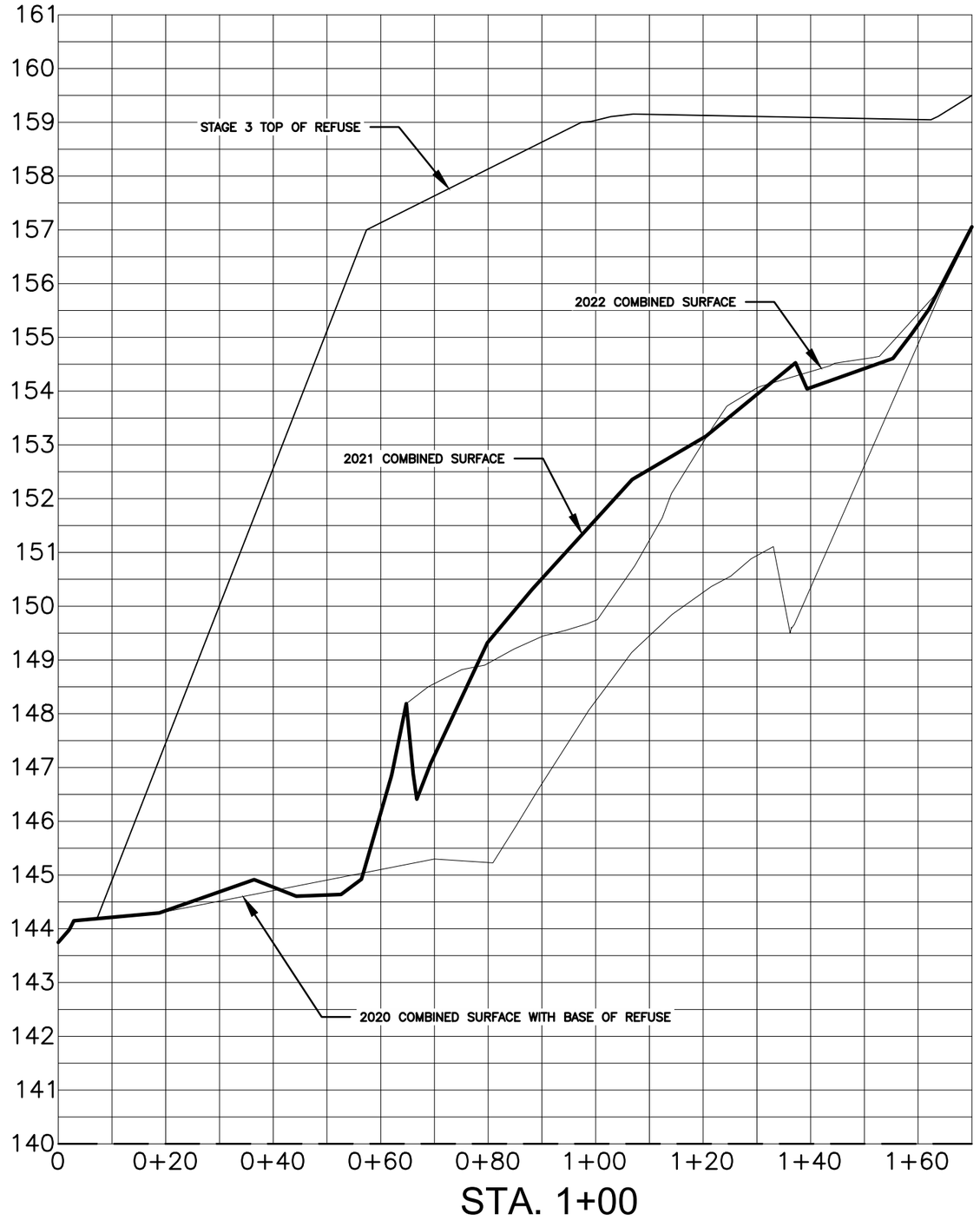
Scale H 0 5 15 25m
V 0 0.5 1.5 2.5m

Drawing No.
FIG-8

Sheet
of

Revision
0

\\Cd2219-pstan01\work_group\01-634\active\163A_01671\planning\drawing\2019 Drawings\FIGURES-06-02-01 - 2023.dwg
2024, March 13, 10:04 AM



Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

Notes

SURVEY COMPLETED DECEMBER 7, 2023.

Client/Project

TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title

2023 SECTIONS
Sta. 1+00

Project No.
163401671

Scale H 0 5 15 25m
V 0 0.5 1.5 2.5m

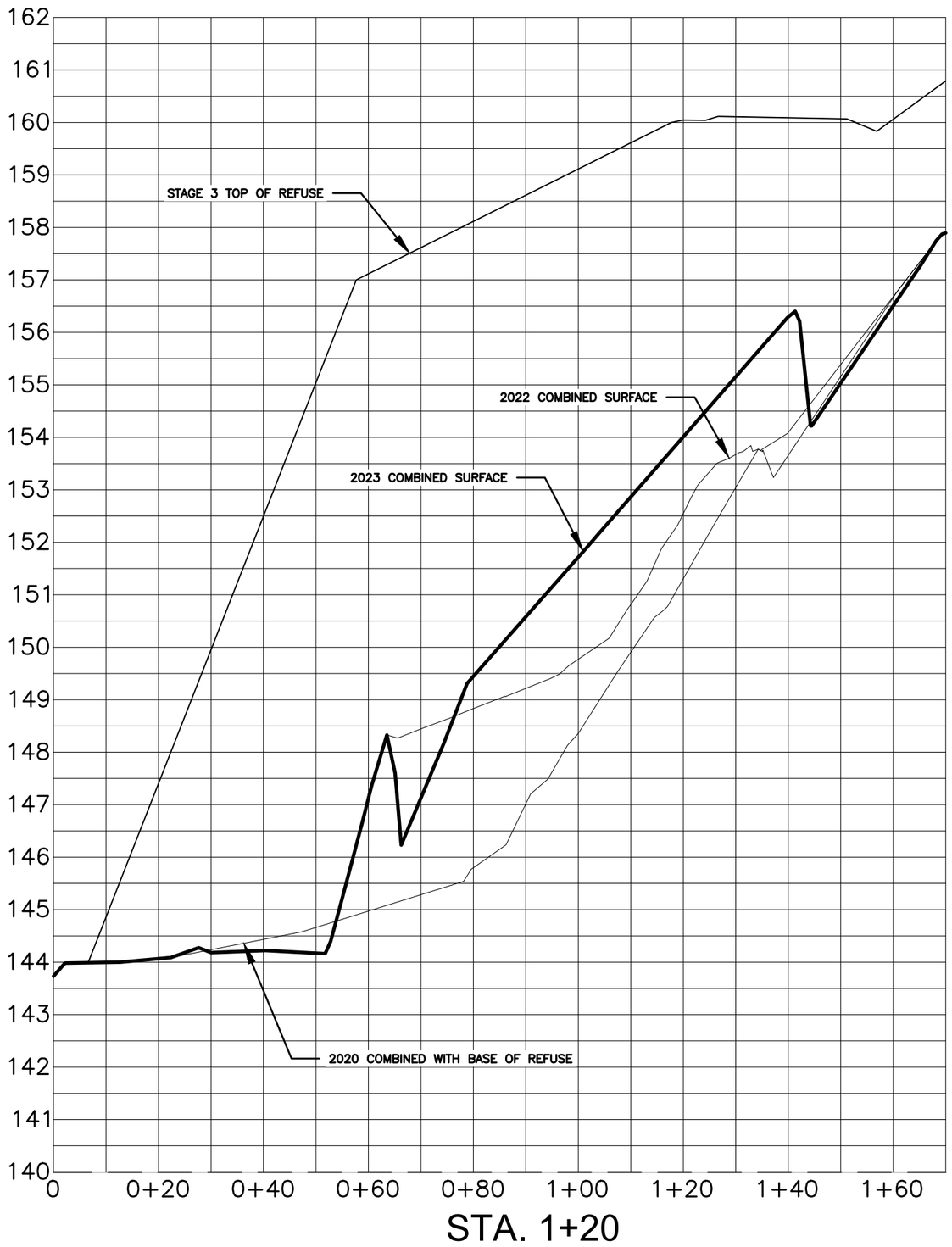
Drawing No.
FIG-9

Sheet

of

Revision
0

\\Cd2218-pstan01\work_group\01-ckfk\active\163kfk_01671\planning\drawing\2019 Drawings\FIGURES-06-02-01 – 2023.dwg
2024, March 13, 10:00 AM



Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

Notes

SURVEY COMPLETED DECEMBER 7, 2023.

Client/Project

TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title

2023 SECTIONS
Sta. 1+20

Project No. 163401671

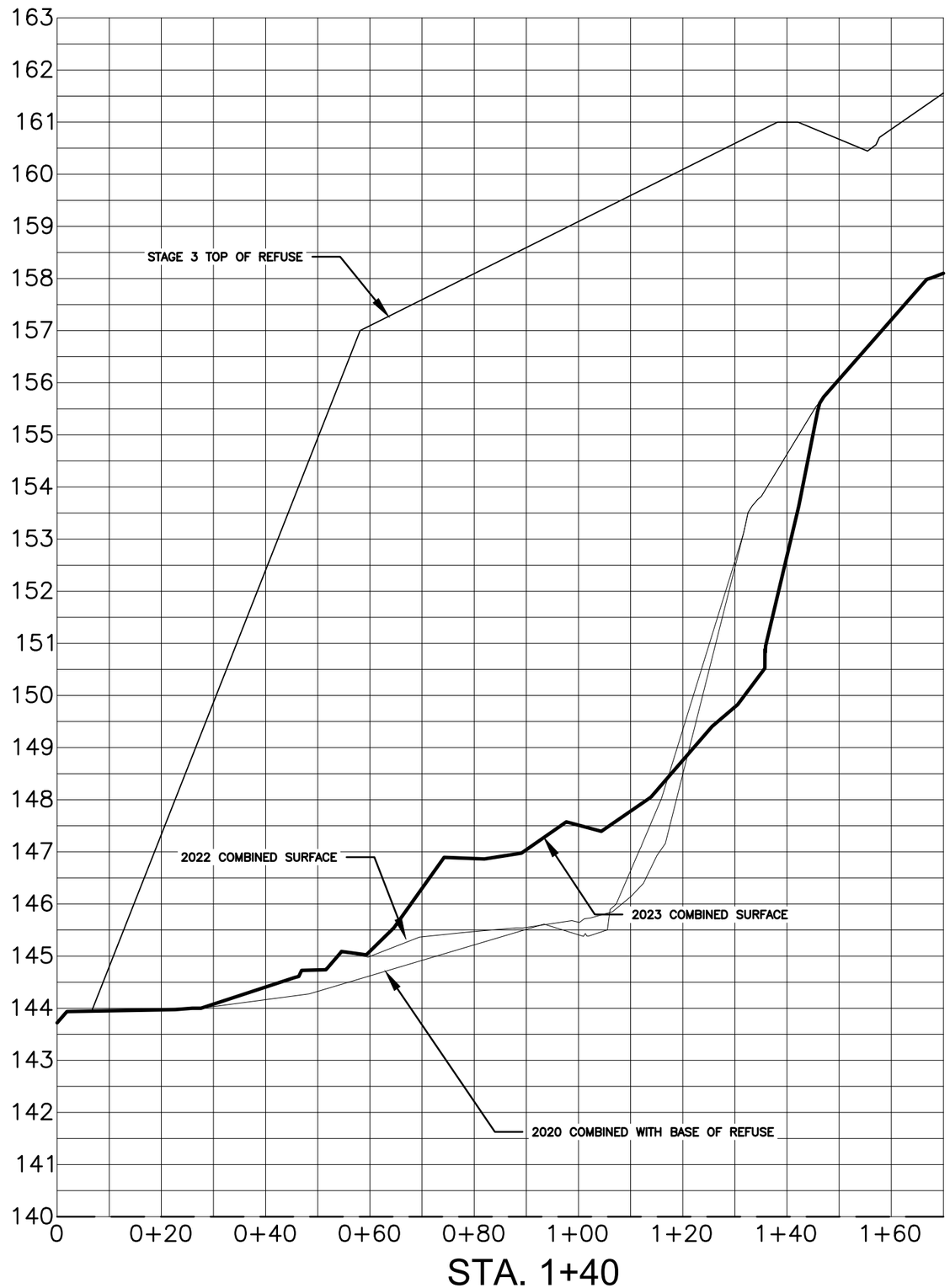
Scale H 0 5 15 25m; V 0 0.5 1.5 2.5m

Drawing No. FIG-10

Sheet of

Revision 0

\\Cd2218-pstfs01\Work_Agroup\01-454\active\163401671\planning\drawing\2019 Drawings\FIGURES-06-02-01 - 2023.dwg
2024 March 15, 10:07 AM



Stantec
1331 Clyde Avenue,
Ottawa ON Canada
K2C 3G4
www.stantec.com

Copyright Reserved

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing – any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

Notes

SURVEY COMPLETED DECEMBER 7, 2023.

Client/Project

TOWNSHIP OF McNAB / BRAESIDE

McNAB / BRAESIDE WASTE DISPOSAL REPORT

Title

2023 SECTIONS
Sta. 1+40

Project No.	Scale	
163401671	H 0 5 15 25m V 0 0.5 1.5 2.5m	
Drawing No.	Sheet	Revision
FIG-11	of	0

\\Cd2215-pstfs01\Work_group\01-634\active\634_01671\planning\drawing\2019 Drawings\FIGURES-06-02-01 - 2023.dwg
2024 March 13, 10:20 AM

Appendix B ENVIRONMENTAL COMPLIANCE APPROVAL, AND BY-LAW 2023-59

CORPORATION OF THE TOWNSHIP OF McNAB/BRAESIDE
By-Law No. 2023-59

Being a By-Law to Establish Fees and Charges for services or use of municipal property.

WHEREAS Section 391(1) of the Municipal Act, 2001 provides that a municipality may impose fees or charges on any person, municipality, local board and the crown.

(1) for services or activities provided or done by or on behalf of it;
(2) for costs payable by it for services or activities provided or done by or on behalf of any other municipality or local board; and
(3) for the use of its property including property under its control.

NOW THEREFORE the Council of the Corporation of the Township of McNab/Braeside enacts as follows:

1. The fees and charges set out on the attached Schedules are hereby imposed as follows:

Schedule "A" – Administration
Schedule "B" – Building
Schedule "C" – Septic
Schedule "D" – Development Charges
Schedule "E" - Planning
Schedule "F"- Waste Management
Schedule "G"- Recreation
Schedule "H" -Museum
Schedule "I" - Animal Control
Schedule "J" – Fire Department
Schedule "K" - Roads Dept.
Schedule "L" – Market Fees
Schedule "M" – Clay Bank Park

2. All fees and charges set out in this by-law shall be payable prior to the provision of the service unless an agreement in writing is made to the contrary and approved by the CAO/Clerk and/or Council.

3. In the event any fee or charge imposed herein remains unpaid after provision of the service or is otherwise in arrears, such fees or charges may be added to the Tax Roll for any real property in the municipality, the owner of which is responsible for paying the fee or charge and shall be collected in like manner as municipal taxes.

4. Council does hereby delegate to the CAO/Clerk, the authority to administer such fees and charges and approve such forms and procedures as may be required for the efficient administration of the fees and charges.

5. The fees set out in this By-Law shall be increased at the rate of inflation, based upon the Consumer Price Index for Ontario, when Council deems it appropriate.

6. The fees set out in the By-Law shall exclude Harmonized Sales Tax (HST) as applicable unless otherwise noted.

BE IT FURTHER ENACTED, that all By-Laws or parts thereof, and all or any resolutions of Council contrary thereto, or inconsistent herewith, be and the same are hereby repealed

READ a first time this **3rd day of October, 2023.**

READ a second time this **3rd day of October, 2023.**

READ a third and final time and passed this **3rd day of October, 2023.**

MAYOR

CAO/CLERK

By-Law No. 2023-59
Schedule "A"- Administration

General Information:

Photocopying	$0.25/page 8 ½ x11	
	$0.30/page 8 ½ x14	
	$0.50/page 11 x 17	

Fee Requests for General & Personal Information under MFIPPA:

Application Fee	$5.00	to be paid when you submit your request
Search Time	$7.50 per ¼ hour	required to search and retrieve records
Record Preparation	$7.50 per ¼ hour	required to prepare records for release
Photocopying	$0.20/page 8 ½ x11, $0.30/page 8 ½ x14, $0.50/page 11 x	
Facsimile Transmit	$5.00	Receive $2.00

Administrative Fee under the Line Fences Act, 2006 (s17)	$350.00 plus costs
Property Standards Appeal	$200.00
Archive Record Retrieval/Research	$10.00 per ¼ hour
N.S.F. charge $25.00 per payment	
Late payment fees on all overdue accounts (excluding taxes)	1.25% per month after 30 days

Commissioner of Oaths & Certified True Copy (by appointment)	$5.00 (includes HST)	(residents/ratepayers)
	$30.00 (includes HST)	(non-residents/non-ratepayers)
Marriage License	$125.00	

Civic Marriage/Union Service	
Normal working hours: 10:00 a.m. - 3:00 p.m.	$300.00 (in Council Chambers)
Other times and locations (mileage may be charged)	$350.00*
Officiant to attend Rehearsal (mileage may be charged)	$75.00*
**Payable to marriage officiant*	
Refreshment Vehicle License	$175.00
Mobile Canteen License	$75.00
Special Event Permit	$100.00
Tax Certificates	$50.00 (per roll number)
Zoning Compliance Report	$50.00 (per roll number)
Subdivision Compliance Report	$60.00
Fire Compliance Report	$50.00 (per roll number)
Special Cleaning Fee	$250.00 per clean
Lottery License, Break Open Tickets, Bingos, Raffles, etc.	3% of total prize value.
Request Change of Street Name	$500.00
Replacement Gate Key (Canaan Road)	$15.00
Township Pin	(cost recovery)
Township Flag	(cost recovery)
Township Map	(cost recovery)
County of Renfrew Map	(cost recovery)
Promotional items, hats, T-shirts, etc.	(cost recovery)
Copy of Zoning By-Law	(cost recovery)
Copy of Official Plan	(cost recovery)
Removal of Election Sign	$20.00/sign

By-Law No. 2023-59
Schedule "B" - Building

Building

Building Bond - Actual Costs plus $5,000.00 refundable deposit + $200 Admin Fee		
Minimum Permit Fee		$100.00
Residential Building Permit	G.F.A.	x 0.70
Occupancy Inspection Fee		$100.00
Comm/Industrial/Institutional Building Permit	G.F.A. x	1.10
Building Accessory or Attached Accessory to a Residential Unit		$187.50
Over 375 sq. ft.	G.F.A.	x .50
Demolition Permit		$50.00
Plumbing Permit		$20.00 per fixture
Min. for new construction		$200.00
Min. for additions/repairs		$100.00
Alterations/Renovations Permit		$150.00
Including an outdoor wood burning furnace		
Conditional Permit.		$100.00
HVAC Permit		$100.00
Change of Use Permit.		$300.00
Revision or Renewal of permit		$100.00
Administration Fee for 2 dwellings on 1 Lot Agreement		$200.00
Porch/Carport		$100.00
Pool Permit		$100.00
McNab/Braeside Municipal Buildings		No Fee
Other Buildings, farm buildings, storage buildings, greenhouses, fabric covered buildings		.18/sq. ft.

Permit to Install an Interior Wood Burning Application/Chimney No Fee
(Inspection and Certification arranged by Property owner and submitted to CBO)

Building without a Permit

Anyone commencing construction prior to the assignment of a permit shall be subject to double fee ie: 2 x the rate as set out in the above fees.

By-Law No. 2023-59

Schedule "C" Septic

Septic Application Fees

Class 2 system (grey-water)	$350.00
Class 3 system (cesspool)	$350.00
Class 4 system (leaching bed, filter bed)	$500.00
Class 5 system (holding tank) ***	$500.00
An engineered designed system	$500.00
Replacement of tank and/or up to 100 ft of weepers	$200.00
Outdoor Washrooms (Class 1)	$250.00
For approval of condominium - for each site that is proposed or installed up to 10,000 L	$500.00

(*** Class 5 system - a signed agreement with licensed pumper will be required.)

Comments requested from Sewage System Inspector

Plan of Subdivision review	$100.00
Minimum Distance Separation Calculations	County of Renfrew Fee
Request for Septic records	$50.00 for each record

By-Law No. 2023-59
Schedule "D" Lot Development Charges

Lot Development Fees	General	Jedd Creek/Campbell Dr.	Dochart Creek
Single Detached Dwelling	$3,954.00	add $230.00	add $298.00
Single Attached Dwelling/unit	$3,784.00	add $219.00	add $286.00
Apartment/unit	$3,143.00	add $182.00	add $237.00
Mobile Home/unit	$2,982.00	add $173.00	add $225.00
Commercial/Industrial (per m² of g.f.a.)	$9.00/m²	add $0.38/m²	add $0.43/ m²

By-Law No. 2023-59
Schedule "E" Planning

Planning

Consent Application (per severance)	$300.00 + Additional Fee as determined by County
Minor Variance Application	$1,100.00 + $3,000.00 deposit
Exemption (Con 12, West Pt. Lot 5 - Pine Grove Mobile Park) exempt from Minor Variance Application fees if setbacks are met.	
Zoning By-law Amendment	$1,800.00 + $3,000.00 deposit
Temporary Use Zoning By-Law Extension	$125.00
Official Plan Amendment	Fee Determined by the County of Renfrew
Amended Planning Applications (Minor Variance, Zoning Amendment)	$250.00
Duplicate Planning Proposals	$200.00
LPAT Proceedings	Actual cost + $1,000.00 deposit
Other Planning Matter & Development Agreements	$325.00 + $3,000.00 deposit
Development Agreement for a Lot in a Plan Of Subdivision	$200.00 + $3,000.00 deposit
Subdivision Proposal (Peer Review)	Actual cost + $15,000.00 deposit
Business Proposals	Actual cost + $1,000.00 deposit
Plan of Subdivision Application	County of Renfrew - Planning
Site Agreement	$950.00 + $5,000.00 deposit
Encroachment Agreement	$325.00 + $1,000.00 deposit
Lifting Holding Symbol	$1,000.00 + $3,000.00 deposit
Lifting a 0.3m Reserve	$325.00 + $1,000.00 deposit
Request for Closure of Road Allowance	$325.00 + $3,000.00 deposit
Land Purchase Requests	$325.00 + $1,000.00 deposit
Pre-servicing Agreement	$2,500.00 + $3,000.00 deposit
Amending Pre-servicing Agreement	$1,000.00 + $3,000.00 deposit
Planning Application Review (internal)	$130.00/hour
Pre-Consultation (General Inquiry)	$200.00

Deposit to be used for Professional Fees (i.e. legal, engineering, peer review etc.) to cover all actual costs associated with the application, when required.

By-Law No. 2023-59
Schedule "F" - Waste Management

Tipping Fees at the Landfill Site - 573 Calabogie Rd.

Garbage Bag	$2.00
Mixed Waste (Household and Construction/Demolition	
Material Flat Rate (200 kg & under)	$ 15.00
Per Tonne	$ 90.00 per metric tonne*
Hydrocarbon Contaminated Soils (Pre-approved)	$ 90.00 per metric tonne*
Stumps and Contaminated Wood	$ 90.00 per metric tonne*
All refrigerated appliances	no charge
Sorted, flattened and recycled corrugated cardboard	no charge
Scrap metal including white goods	no charge
All recycling items listed in the recycling contract	no charge
Clean wood, free of paint or stain	no charge
Garden waste and leaves (free of household garbage)	no charge
E-waste - Computers, Monitors and other Electronics (Do not accept parts or incomplete or broken screens)	no charge

Open September to April Uncontaminated** Motor/Engine oil

(up to 25 litres)	$3.50
(25 - 50 litres)	$7.00

Open May-August Household Hazardous Waste Depot (376 Bruce Street, Renfrew) – Free drop off of household waste for Township Residents/Ratepayers.

All Tires - Cars, trucks, tractors	No Charge
Blue Boxes - available at the Municipal Office	$8.00 incl. HST

Tipping Fee at the curbside, the maximum limit is two bags per week
each additional bag must be tagged with yellow tag for pickup.

Yellow Tag	$2.00

*If the scales at the landfill site are not operational due to a power outage or maintenance, the following tipping fees shall apply:

Car, single axle trailer, towed by car, half ton truck or van	$15.00
Half ton and single axle trailer	$30.00
Tandem axle trailers, farm wagons	$65.00
Single axle truck	$150.00
Single axle packer truck, tandem truck	$300.00
Tandem packer truck	$400.00
Tractor trailers	$700.00
Un-compacted waste, roll off bins and tri-axle truck	$15.00/ cu. yd.
Stumps	$15.00/ cu. yd.

**not mixed with other types of oil

By-Law No. 2023-59
Schedule "G" - Recreation

Boat Launch Parking (fees include HST)

	Residents/Ratepayers	Non-Residents/Ratepayers
Day Pass	$10.00	$20.00
Season Pass	$50.00	$100.00
Second Season Pass (same address)	$5.00	$25.00

Ball Diamond Rental

Single Games
$33.00+HST per game / per diamond + $50.00 security deposit

Tournaments
$160.00+HST Lit Diamond/ per day + $100.00 security deposit
$100.00+HST Unlit diamond/per day + $100.00 security deposit
$400.00+HST 4 diamonds/per day + $100.00 security deposit
$800.00+HST weekend (Fri-Sun) all 4 diamonds + $200.00 security deposit
$700.00+HST weekend (Sat-Sun) all 4 diamonds + $200.00 security deposit

Clean up deposits will be returned if applicable following an inspection of the field(s)

Outdoor Rink Rental $33.00+HST/hour -Group Skating + $100.00 security deposit

Dochart Park Field Rental $28.00+HST/hour/field + $100.00 security deposit
Dochart Park Field Rental – Lit $53.00+HST/hour/field + $100.00 security deposit

Recreation Program Fees – These fees are variable and set by the Recreation Director based on forecasted revenues/expenses.

Paddle Sport Rentals (fees include HST)

	Hourly Rate	**Daily Rate**
Stand Up Paddleboard*	$10.00	$40.00
Kayak*	$10.00	$40.00
Canoe*	$10.00	$40.00

*Please note, a $50.00 deposit is required for each item rented.

Snowshoe Rentals (Fees include HST)

Snowshoes – up to 48 hour rental	Resident/Ratepayer	No charge
	Non-Resident/Ratepayer	$7.00/set

*Please note, a $50.00 deposit is required for non-residents/ratepayers per reservation.

HerbFest (fees include HST)

General Vendor	$70.00 (10x10)
	$100.00 (20x20)
	$130.00 (40x40)
Food Vendor	$120.00

Hall Rental

Your date is confirmed, and your rental is considered secure only once full payment is received. **Payment is due no later than 14 days prior to your event**.

The Security Deposit will be returned after the event, following the inspection of a clean and undamaged facility.

Facility Rental Fees are non-refundable if notice of the cancellation is not given at least 14 days prior to the event date.

John A. Gillies Recreation Centre	Price
Hourly Rate (up to 2 Hours Maximum)	$35 per hour plus HST
Half Day Rate (up to 4 hours)	$100 plus HST
Day Rate (5 or more hours)	$225 plus HST
Decoration Rental (evening before event after 6 pm)	$100 plus HST
Kitchen Rental – Half Day	$25 plus HST
Kitchen Rental – Full Day	$50 plus HST
Security Deposit (returned if applicable, following inspection)	$200.00
Bartender Fee (4 hours if minimum bar sales aren't met)	$18/hour/bartender

Murray Yantha Community Centre	Price
Hourly Rate (up to 2 Hours Maximum)	$40 per hour plus HST
Half Day Rate (up to 4 hours)	$125 plus HST
Day Rate (5 or more hours)	$250 plus HST
Decoration Rental (evening before event after 6 pm)	$100 plus HST
Kitchen Rental – Half Day	$35 plus HST
Kitchen Rental – Full Day	$60 plus HST
Security Deposit (returned if applicable, following inspection)	$200.00
Bartender Fee (4 hours if minimum bar sales aren't met)	$18/hour/bartender
Popcorn Machine Rental (includes 1 package of kernels)	$10.00 $5.00 for additional packages

Facility User Liability Insurance Program
Non Sporting Events or Occasions *

Number of People Attending Event	No Alcohol			Alcohol		
	Hourly Rate**	1-2 Day Event	3-5 Day Event	Hourly Rate**	1-2 Day Event	3-5 Day Event
1-50	$3.00	$25	$50	$12.00	$85	$150
51-100	$4.00	$50	$85	$20.00	$130	$260
101-200	$6.00	$75	$125	$30.00	$200	$400

** If hourly rate exceeds the 1 Day rate, charge the 1 day rate

Sporting Events or Occasions *

Individuals or groups wishing to rent a field or facility to hold a sporting event and / or activity are required to provide proof of $2,000,000 liability insurance. The Township must be named as insured on that policy. If you require insurance, the township offers a range of insurance dependent on the type of event being held. Please contact the Recreation Director for pricing.

*all rates are subject to PST only

By-Law No. 2023-59
Schedule "H" - Museum

Waba Cottage Museum

Museum Entry:

General Day Admission (8 and up)	$3.00 incl. HST
Family Day Admission	$7.00 incl. HST
Children under 8	No charge
Season Pass General	$26.00 incl. HST
Season Family	$66.00 incl. HST

Special Functions:

Your date is confirmed, and your rental is considered secure only once full payment is received. **Payment is due no later than 14 days prior to your event**.

The Security Deposit will be returned after the event, following the inspection of a clean and undamaged facility.

Facility Rental Fees are non-refundable if notice of the cancellation is not given at least 14 days prior to the event date.

Wedding Ceremony 1 - $300.00 +HST + $200 Security Deposit *Use of grounds, sound system (if available), & washroom facility during regular hours*
Wedding Ceremony 2 - $500.00 +HST + $200 Security deposit U*se of grounds, sound system (if available), set up + tear down of up to 100 folding chairs & washroom facility including after-hours*
Picnic - $200+HST+$200 Security Deposit U*se of up to 8 reserved picnic tables & washroom facility, including after-hours* **Reserved Photography Session** - $120.00 +HST For Professional photo sessions wherein areas of the property are reserved.

Facility User Liability Insurance Program
Non Sporting Events or Occasions *

Number of People Attending Event	No Alcohol			Alcohol		
	Hourly Rate**	1-2 Day Event	3-5 Day Event	Hourly Rate**	1-2 Day Event	3-5 Day Event
1-50	$3.00	$25	$50	$12.00	$85	$150
51-100	$4.00	$50	$85	$20.00	$130	$260
101-200	$6.00	$75	$125	$30.00	$200	$400

** If hourly rate exceeds the 1 Day rate, charge the 1 day rate

Sporting Events or Occasions *

Individuals or groups wishing to rent a field or facility to hold a sporting event and / or activity are required to provide proof of $2,000,000 liability insurance. The Township must be named as insured on that policy. If you require insurance, the township offers a range of insurance dependent on the type of event being held. Please contact the Recreation Director for pricing.

*all rates are subject to PST only

Waba Cottage T-Shirt	$18.00 adult incl. HST $15.00 youth incl. HST
Laird of McNab Post Card	$1.00 incl. HST
McNab - The Township (Book)	$30.00 incl. HST
The Last Laird of McNab (Book)	$10.00 incl. HST

By-Law No. 2023-59
Schedule "I" - Animal Control

	On or Before April 30th	
Dog Tags	$15.00	(One Dog)
	$15.00	(2nd Dog)
	$15.00	(3rd Dog)
Kennel Licence	$150.00	
	After April 30th	
Dog Tags	$30.00	(One Dog)
	$30.00	(2nd Dog)
	$30.00	(3rd Dog)
Kennel Licence	$250.00	
Replacement Tag	$7.00	

By-Law No. 2023-59
Schedule "J" - Fire Department

Inspection of Refreshment Vehicle	$50.00
Inspection of Private Home Daycare	$35.00
Inspection of Licensed Day Care	$80.00
Inspection of Rooming/Boarding House	$80.00
Inspection of Multiple Residential Building	$120.00
Inspection of Commercial/Industrial Building (up to 4 visits)	$200.00
Inspection of Commercial/Industrial Buildings (5 or more)	$100.00
Seniors Homes	$200.00
Group Homes/Not for Profit	N/C
Smoke & CO Alarms	Cost Recovery
False Alarm/Owner does not attend**	$410.00
False Alarm (System on test)***	$1,000.00

White Lake Fire Hall

Hall Rental per hour.	$25.00/hr $50.00 max
Security and Clean up Deposit	$100.00 *(refundable if applicable)*

Cost of Fire Suppression Services

1. The cost of Fire Department services charged shall be in accordance with Ministry of Transportation rates as set out in the Ministry of Transportation Memorandum to Fire Chiefs and available through the Claims Office of the Ministry of Transportation.

2. Additional equipment and /or services required by the Fire Department to extinguish the fire shall be charged at actual invoiced cost plus 15% (fifteen per cent) administration fee.

Staff Charge out rates	
Fire manpower charge out rate (per person assigned)	$30.00/hour or part thereof
FIRE	
Contravention of open air burning	As per rates set by MTO
Burn Permit (valid 2 days)	$5.00
Burn Permit (valid for 30 days)	$25.00
Burn Permit (valid for calendar year)	$100.00
Incinerator Permit – valid for the calendar year	$50.00
Camp Fire – Valid for the Calendar year	N/C
Fire watch required due to owner no-show notification	$50.00 per hour, or part there of
MNR Crown Protection Area (CPA)	As per agreement

** **"False Alarm"** means a Security Alarm Occurrence where there is no evidence that a fire is present in a building, structure or premises and includes, but is not limited to:

i) the activation of an alarm during its testing without prior authorization;
ii) an alarm activated by mechanical failure, malfunction or faulty equipment;
iii) an alarm activated by atmospheric conditions, vibrations or power failure;
iv) an alarm activated by user error;
v) an alarm activated with malicious intent;

*** **"System on Test"** means an alarm system that is being tested, or having work done on the alarm system by a technician.

By-Law No. 2023-59
Schedule “K” - Roads Department

Civic Address Sign	$64.50 post and installation included
Entrance Permit	Recovery cost of installation
Tile Drain/Road Crossing Permit	$150.00
Sale of Used Culverts	invoiced on a cost recovery basis
Requested works	invoiced on a cost recovery basis
Installation of a private sign	invoiced on a cost recovery basis
Subdivision Road not assumed into the Township Road System	$5,300.00/km each year

Cost Recovery Rates:	
Tandem axle truck:	$80.00/hr.
Backhoe:	$55.00/hr.
Motor Grader:	$112.00/hr.
Plus: Labour and Materials	cost recovery basis

By-Law No. 2023-59
Schedule “L” – McNab/Braeside Market

Vendor Permit Fees

Full-time Seasonal Space Single Stall 10’ X 10’	$130/Season
Full-time Seasonal Space Double Stall 20’ X 10’	$260/Season
4 Week Block*	$40.00
Weekly Space 10’ x 10’	$20.00/week

(a four week minimum to a maximum of $140.00/stall per season applies to weekly space)

*If the vendor pays for a 4 week block and then commits for the rest of the season, the price for the space will be at a discounted price of $7.00 per day per stall.

By-Law No. 2023-59
Schedule “M”- Clay Bank Park

Community Garden

4’ x 8’ x 19” raised bed	$20.00 (inclusive of HST)
4’ x 4’ x 19” raised bed	$10.00 (Inclusive of HST)

Availability of raised beds will vary and may be limited to 1 bed per family

Appendix B Environmental Compliance Approval and By-Law 2023-59

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

The Corporation of the Township of McNab/Braeside
2508 Russett Dr R.R. 2
Arnprior, Ontario
K7S 3G8

Site Location: McNab Braeside Township Landfill
573 Calabogie Road
Lot West half of Lots 18 19, Concession 6
McNab-Braeside Township, County of Renfrew

You are hereby notified that I have amended Approval No. A412605 issued on June 10, 1980 and amended on April 7, 1993, September 30, 1998, April 14, 2000, December 4, 2000, 22nd February 2003, and March 12 2010 forWaste Disposal Site, as follows:

Following conditions are hereby added as follows:

49. Waste Storage and Processing

49.1 Following solid non hazardous waste received at the site can be processed once or twice in a year by contractor who have mobile waste management system certificate to process these types of wastes.

a) Yard waste (brush)

b) Construction and Demolition waste

c) Bulky items

49.2 Tires which are not accepted by Ontario Tire Stewardship can be stored at the site and disposed off at the tire recycling station by licensed hauler.

49.3 The maximum number of tires stored at any one time shall not exceed 3000 tire units

50. Alternate Daily Cover

50.1 The following processed solid non hazardous waste can be used as an alternate daily cover with minimum thickness of 150 mm.

1) Yard waste (Brush)

2) Construction and Demolition Waste

3) Bulky Items

50.2 The maximum volume of material stockpiled for processing at any time shall not exceed the annual requirement of daily cover.

50.3 The processed waste used as a daily cover referred in Condition 50.1 and petroleum hydrocarbon contaminated soil used as a daily cover as approved in condition 34 can be mixed such that the final mix of the various material does not exceed 2/3 of the final product mix.

50.4 Synthetic HDPE membrane may be used as an alternate daily cover.

The reasons for this amendment to the Approval are as follows

The reason for Condition 49 is to approve the processing of various waste material by contractor.

The reason for Condition 50 is to approve the various waste material to use as an alternate daily cover

The following item is hereby added to Schedule "A":

8. Application for a Provisional Certificate of Approval for a Waste Disposal Site dated December 16, 2015, and signed by Gerry Lalonde, P.Eng.and all attached supporting documentation

9. Letter dated April 12, 2016 from Gerry Lalonde, P.Eng., Stantec to Hirva Vyas, P.Eng.,regarding the revised information as per requested information

10. Email dated April 20, 2016 from Gerry Lalonde, P.Eng., Stantec to Hirva Vyas, P.Eng., MoECC

This Notice shall constitute part of the approval issued under Approval No. A412605 dated June 10, 1980

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 .....

Signature
....., P.Eng.
Director
Section .....

HV/
c: District Manager, MOECC Ottawa
Gerry Lalonde, Stantec Consulting Ltd., Stantec Consulting

6340041U

Ontario

Ministry of the Environment
Ministère de l'Environnement

AMENDMENT TO PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A412605
Notice No. 3
Issue Date: March 12, 2010

The Corporation of the Township of McNab Braeside
2508 Russett Dr., R.R. 2
Arnprior, Ontario
K7S 3G8

Site Location: McNab Braeside Township Landfill
573 Calabogie Road
Lot West half of Lots 18 & 19, Concession 6
Township of McNab Braeside, Renfrew County

You are hereby notified that I have amended Provisional Certificate of Approval No. A412605 issued on June 10, 1980 and all subsequent Notices for the McNab Braeside Township Landfill Site , as follows:

CONDITIONS

The following Condition is hereby added:

48. The waste diversion / storage bins shall be relocated, to a new area closer to the entrance, as per Figure No. 3 entitled Onsite Facilities, in the application dated September 15, 2009.

The following documents are hereby added to **Schedule "A"**:

7. Application for an Amendment to Provisional Certificate of Approval for a Waste Disposal Site, dated September 15, 2009 from The Corporation of the Township of McNab Braeside.

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

The relocation will improve the flow of traffic around the material storage area and reduce interference with future disposal operations.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A412605 dated June 10, 1980, as amended.

RECEIVED
MAR - 3 2003
TWP OF MCNAB/BRAESIDE

Ontario

Ministry of the Environment | Ministère de l'Environnement

AMENDMENT TO PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A412605
Notice No. 2

The Corporation of the Township of McNab/Braeside
2508 Russett Drive, R.R. #2
Arnprior, Ontario
K7S 3G8

Site Location: West 1/2 of Lots 18 & 19, Concession 6
McNab-Braeside Township, County of Renfrew

You are hereby notified that I have amended Provisional Certificate of Approval No. A412605 issued on June 10, 1980 and amended on April 7, 1993, September 30, 1998, April 14, 2000 and December 4, 2000 for a Waste Disposal Site, as follows:

I. Condition 18.6 is hereby revoked and replaced with:

18.6. The Site shall be permitted to operate during daylight hours, seven (7) days a week. All proposed changes to the hours of operation shall be subject to the written approval of the District Manager.

Condition 43 is hereby revoked and replaced with:

43. The surface water sampling program shall be conducted a minimum of two times a year. The water samples shall be collected on Dochart Creek at locations SW1, SW2 and SW3 which are situated up gradient and down gradient from the Site. The other surface water sampling locations are indicated in Item (1) of Schedule "A". All proposed changes to the monitoring program shall be subject to the written approval of the District Manager.

Condition 45.14 is hereby revoked and replaced with:

45.14 Proposed changes made in the monitoring program for the Site shall be subject to the written approval of the District Manager.

II. The following item is hereby added to Schedule "A":

7. Application for a Provisional Certificate of Approval for a Waste Disposal Site dated October 25, 2002 and signed by Noreen Mellema, CAO/Clerk, Township of McNab/Braeside.

8. Letter dated October 25, 2002 from Noreen Mellema, CAO/Clerk, Township of McNab/Braeside to Ian Parrott, MOE, Supervisor of Waste Unit, EAAB. Re: Amendment to Certificate of Approval No. A412605.

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

The reason for this amendment is to provide the MOE District Office with the ability to approve requests for changes in hours of operation, groundwater and surface water sampling and monitoring programs.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A412605 dated June 10, 1980

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 22nd day of February, 2003

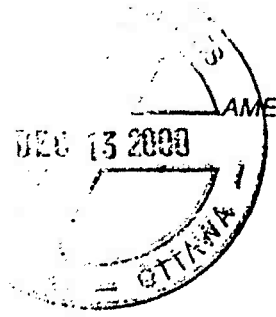
Ian Parrott, P.Eng.
Director
Section 39, *Environmental Protection Act*

DL/

c: District Manager, MOE Ottawa
Lauree Armstrong, Jp2g Consultants Inc.

Ontario

Ministry of the Environment | Ministère de l'Environnement



AMENDMENT TO CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A412605
Notice No. 1

Corporation of the Township of McNab/Braeside
2508 Russett Drive, R.R. #2
Arnprior, Ontario
K7S 3G8

Site Location: Waste Oil Transfer Station
W. 1/2 Lts. 18&19, Con. 6, E. 1/2 Lot 19, Con. 5
McNab-Braeside Township, County of Renfrew

You are hereby notified that I have amended Provisional Certificate of Approval No. A412605 issued on June 10, 1980 and amended on April 7, 1993, September 28, 1998 and April 14, 2000 for the McNab-Braeside Township Landfill Site, as follows:

1. The first paragraph on the front page should read as: "for the use and operation of 10.0 hectare landfilling area and the oil transfer station within a total site area of 64.3 hectares."

2. Condition 47 is added:

   47. The Township shall obtain the Certificate of Prohibition for the newly acquired 8.2 hectare parcel of land in accordance with the procedure described in Condition 46.

3. The following items are added to Schedule "A":

   5. A Letter from K.A. Marentette of Golder Associates to A.Dominsky of the MOE dated September 14, 2000 re: Notification on fulfillment of Condition 40 requirements of the Certificate of Approval No A412605 for the Township of McNab-Braeside Landfill Site; and

   6. Figure 7 (Rev.3), Stage 1 Development & Operations Plan prepared by Golder Associates and dated November, 2000.

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

The reason for Amendment 1 is to incorporate the newly acquired 8.2 hectare parcel of land into the total Site area.

The reason for Amendment 2 is to ensure the issuance of the Certificate of Prohibition for the newly acquired

8.2 hectare parcel of land.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A412605 dated June 10, 1980.

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 Appeal Board within 15 days after receipt of this Notice, require a hearing by the Board. 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 Appeal Board
2300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

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 Appeal Board's requirements for an appeal can be obtained directly from the Board 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 4th day of December, 2000

THIS IS A TRUE COPY OF THE ORIGINAL NOTICE MAILED
ON Dec. 7, 2000
I.C.

Andrzej Dominski, P.Eng.
Director
Section 39, *Environmental Protection Act*

991-2831

Post-it® Fax Note 7671	Date May 10/2000	# of pages ▶ 2
To Kris	From Jennifer M. Barr	
Co./Dept. Golder Assoc.	Co. McNab/Braeside	
Phone #	Phone # 623-5758 #2	
Fax # 613-224-9928	Fax # 623-9138	

AMENDMENT TO CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A412605
Notice No. 1

RECEIVED
APR 27 2000
TWP OF McNAB/BRAESIDE

Township of McNab/Braeside
2508 Russett Drive, R.R. #2
Arnprior, Ontario
K7S 3G8

Site Location: W. 1/2 Lts. 18&19, Con. 6, E. 1/2 Lot 19, Con. 5
McNab-Braeside Township, County of Renfrew

You are hereby notified that I have amended Provisional Certificate of Approval No. A412605 issued on June 10,1980 and amended on April 7,1993 and September 28,1998 for the McNab-Braeside Township Landfill Site, as follows:

1. The first paragraph on the front page should read as: "for the use and operation of 10.0 hectare landfilling area and the oil transfer station within a total site area of 56.1 hectares."

2 Condition 46 is added:

46. (a) The Township shall:

i) Within 60 days of the date of this Certificate, submit to the Director, for the Director's signature, two copies of a completed Certificate of Prohibition containing a registrable description of the Property, in accordance with Forms 4 & 5 of O. Reg. 14/92; and

ii) Within 10 calendar days of receiving the Certificates of Prohibition signed by the Director, register the Certificate of Prohibition in the appropriate Land Registry Office on title to the Property and submit to the Director the duplicate registered copy immediately following registration; and

(b) Pursuant to Section 197 of the Environmental Protection Act, neither the Township nor any person having an interest in the Property shall deal with the Property in any way without first giving a copy of this Certificate to each person acquiring an interest in the Property as a result of the dealing.

3. The following items are added to Schedule "A":

3. Application for approval of a Waste Disposal Site dated December 13,1999; and

4. Figure 7 (Rev.1), Stage 1 Development & Operations Plan prepared by Golder Associates dated February 15, 2000.

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

1 The reason for Amendment 1 is to incorporate the newly acquired 8.1 hectare parcel of land into a total Site area.

2. The reason for Condition (46) requiring registration of the Provisional Certificate of Approval is that Section 46 of the Environmental Protection Act, R.S.O. 1990, prohibits any use being made of the lands after they cease to be used for waste disposal purposes within a period of twenty-five years from the year in which such land ceased to be used for waste disposal, unless the approval of the Minister for the proposed use has been given. The purpose of this prohibition is to protect future users of the Site and the environment from any hazards which might occur as a result of waste being disposed of on the Site. This prohibition and potential hazard should be drawn to the attention of future owners and users of the Site by the Provisional Certificate of Approval being registered on title.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A412605 dated September 28, 1998.

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 Appeal Board within 15 days after receipt of this Notice, require a hearing by the Board. Section 142 of the Environmental Protection Act, provides that the Notice requiring the hearing shall state:

- The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
- The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

- The name of the appellant;
- The address of the appellant;
- The Certificate of Approval number;
- The date of the Certificate of Approval;
- The name of the Director;
- 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 Appeal Board
300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

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 Appeal Board's requirements for an appeal can be obtained directly from the Board 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 14th day of April, 2000

THIS IS A TRUE COPY OF THE ORIGINAL NOTICE MAILED

ON Apr 20 2000

SIGNED

Andrzej Dominski, P.Eng.
Director
Section 39, *Environmental Protection Act*

EZ/

c: District Manager, MOE Ottawa
Murray Yantha, Clerk-Treasurer, Township of McNab/Braeside

Under the Environmental Protection Act and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:

The Corporation of the Township of McNab/Braeside
R.R. No. 2
Arnprior, Ontario
K7S 3G8

You are hereby notified that the terms and conditions of the Provisional Certificate of Approval No. A 412605 *dated* June 10, 1980 and April 7, 1993, *issued to you, are amended by Notice and approval is granted.*

for the use and operation of 10.0 hectares landfilling area and oil transfer station within a total site are of 48.0 hectares.

all in accordance with the following plans and specifications: as listed in Schedule "A"

Located: Part of West ½ of Lots 18 and 19, Concession 6
Township of McNab
County of Renfrew

which includes the use of the site for an oil transfer station and only for the disposal of waste from the Township of McNab/Braeside *of the following categories of waste (Note: Use of the site for additional categories of wastes requires a new application and amendments to the Provisional Certificate of Approval)* domestic, commercial and non-hazardous solid industrial.

and subject to the following conditions:

The following revoke and replace the definitions contained in the Provisional Certificate of Approval dated April 7, 1993.

1.0 DEFINITIONS

For the purpose of this Provisional Certificate of Approval:

1.1 "Director" means any Ministry employee appointed by the Minister pursuant to Section 5 of the Environmental Protection Act;
1.2 "MOE" means the Ministry of Environment;
1.3 "District Manager" means the District Manager of the Ottawa District Office, Eastern Region of the Ministry of Environment;

1.4 "This Certificate " means Provisional Certificate of Approval No. A 412605, dated May 11,1998;
1.5 "Owner" means the Corporation of the Township of McNab/Braeside
1.6. "Site" means 10.0 hectares landfilling area within a total Site area of 48.0 hectares as shown on Plan 49R-12786 and Figure No. 2 Item 1, Schedule "A";
1.7 "Transfer Site" means the oil transfer station described in items 2, 3 and 4 on page 1 of the Provisional Certificate of Approval dated April 7, 1993;
1.8 "ODWO" means the Ontario Drinking Water Objectives dated February, 1994 (and as amended);
1.9 "RUPO" means the Ministry of the Environment Reasonable Use Policy Objectives (Policy no. B-7); and
1.10 "PWQO" means the Provincial Water Quality Objectives dated July, 1994 (and as amended).

GENERAL CONDITIONS

The terms and conditions listed in the Provisional Certificate of Approval dated June 10, 1980, and April 7, 1993 are continued in this Notice by the following new conditions listed below.

15. The Owner shall be bound by the conditions of this Certificate. The conditions of this Certificate shall extend to and bind any successor and/or subsequent Owner(s)/Operator(s) of this Site subject to the approval of the Ministry of the Environment (MOE).

16. The Site shall be operated and maintained by the Owner in accordance with all documents listed in the Schedule "A" of this Certificate.

17. The Site service area shall include the Corporation of the Township of McNab and the Village of Braeside.

18. The Owner shall place a sign at the main entrance to the Site on which is displayed, in prominent letters, the following information:

18.1 the name of the Site and the Certificate of Approval number for the Site;
18.2 the operating authority, telephone number and mailing address;
18.3 the hours the Site is open to accept waste from the public;
18.4 the telephone number for reporting emergency situations occurring at the Site during non-operating hours;

18.5 the waste acceptable for disposal at the Site; and tipping fee rates; and

18.6 The Site shall be permitted to operate daily 8:00 a.m. to 5:00 p.m. throughout the year. An approval to amend the time of operation can be granted from time to time by writing to the Director or the District Manager.

19. The Owner shall maintain daily records with monthly summary of the quantity and types of waste disposed of at the Site.

20. The following information shall be recorded on loads refused access to the Site for disposal purposes:

20.1 date;
20.2 name of persons;
20.3 company name on vehicle;
20.4 vehicle description of waste refused; and
20.5 reasons for refusals.

21. During non-operating hours of the Site, the entrance shall be locked.

22. No waste shall be received at the Site or removed from the Site, unless a Site Supervisor or his/her alternate (s) and/or designated person (s) are present to supervise the operation.

23. The Owner shall ensure that the Site Supervisor and/or designated alternative person(s) have been adequately trained with respect to the following procedures without limitations:

23.1 conditions and Schedules of this Certificate;
23.2 the operation and maintenance of this Site;
23.3 relevant waste management regulations and legislation;
23.4 environmental conditions and concerns related to waste handling operations at the Site; and
23.5 occupational health and safety activities pertaining to the workplace and waste handling operations at the Site.

24. Owner shall keep a copy of this Certificate and Schedule "A" at the Site.

SITE INSPECTION

Litter Control

25. Litter Control shall be carried out by the Owner in accordance with procedures described in Schedule "A".

Dust Control

26. The Owner shall take all necessary mitigative actions for dust control.

27. A dust suppressant shall be applied to the on-site roads, when dust becomes a problem during the dry periods of the year.

Pest Control

28. The Owner shall ensure that there are no pests that shall pose a hazard to the health and safety of persons.

Scavenging

29. The Owner shall ensure that there is no scavenging of waste at the Site.

Odour Control

30. The Owner shall operate the Site in such a manner to minimize off-Site impact of odours at all time.

Noise Control

31. The Owner shall operate the Site in such a manner to minimize noise impact from haulage trucks and operating equipment on the natural environment and persons.

Burning of Waste

32. The Owner shall ensure that there is no burning of waste at the Site.

33. The burning of brush, trees and clean wood piles can be conducted at the Site and shall be confined to the area as indicated in Figure 7, Item No.1, Schedule "A" and Section 4.21,of the Ministry of the Environment Guidance Manual For Landfill Site Receiving Municipal Waste, dated November, 1993.

Daily Cover

34. The minimum thickness of daily cover shall be 150 millimetres as indicated in Figures 10 and 11, Item no.1, Schedule "A";

34.1 The use of petroleum hydrocarbon contaminated soils as daily cover shall be subject to the Generator demonstrating to the Owner that the petroleum hydrocarbon contaminated soils is non-hazardous and meets Regulation 347 of the Ontario Environmental Protection Act.

34.2 The volume of petroleum hydrocarbon contaminated soils (was received at the Site shall be subject to the approval of District Manager. The volume of contaminated soils stored at Site shall not exceed the limitation of the annual daily co material requirements as determined by the previous annual repo

35. A suitable stock pile of clean granular cover material, which shall equivalent to 50% of the quantity of the required annual daily co material as outlined in condition 34, shall be maintained at the Site a contingency measure.

Intermediate Cover

36. The minimum thickness for the intermediate soil cover shall be millimetres as indicated in Figures 10 and 11, Item no.1, Schedule "A

Final Cover

37. The maximum height for the refuse ~~and final cover~~ shall not exceed 163 metres above the assumed elevation datum which gives a total Si capacity of 1,000,000 cubic metres for the Site as indicated in Figu No's. 5 and 6 of Item no.1, Schedule "A".

38. No waste shall be deposited at the Site after the final contours ha been attained as shown on Figure No's. 5, and 6 of Item No.1, Schedu "A". The final completed contours as noted in Condition 36, sha include 0.7 metre of final cover. The cover material shall include 600 millimetre thick layer of general clean earth material and a 1 millimetre layer of top soil, which is seeded.

Site Capacity

39. The total Site capacity of 1,000,000 cubic metres (air space calculation is based on an area of 10 hectares with a waste mou maximum height of 16.9 metres as indicated in Figures 5 and 6, Ite No.1, Schedule "A". This total site capacity shall be contingent on th Owner implementing a leachate collection system or by gaining contro over the leachate by acquiring buffer lands to service as leachat attenuation zone such as the privately owned parcel of land, Part 1 Plan 49R-8277, that is situated in the west part of Lot 19, Concessio 6, Township of McNab. This land parcel ~~land~~ which comprises th conceptual leachate actenuation zone is shown in Figure 7, Item No.1 Schedule "A".

40. The Owner shall purchase a minimum 30 metre buffer zone and gain control over the remaining conceptual leachate attenuation zone as described in condition 39. The Owner shall bring the Site into compliance within 2 years of the issuance of this Notice with the RUPO and 30 metre buffer zone requirement.

Groundwater Monitoring

41. The groundwater monitoring program shall be undertaken by the Owner in accordance with Item No. 2 in Schedule "A ". The Owner shall provide with the annual report an evaluation of the groundwater condition for long term monitoring purposes and the number of wells required on site to provide an accurate configuration of the hydrogeochemical conditions at the Site. The 1997 monitoring program indicates that RUPO are exceeded at the Site. The Owner in consultation with the Ministry of the Environment, Eastern Region Hydrogeologist shall amend the monitoring program to better assess the RUPO exceedance at the Site and provide recommendations to bring the Site into compliance. The proposed changes to the monitoring program shall be subject to the approval of the Director.

42. Groundwater geochemical quality exceeds RUPO at the east and north boundaries of the Site. The groundwater contamination is attributable to contamination originating from the Site at locations that were previously landfilled with metal waste and burnt garbage. The Owner shall provide to the Director a contingency and remediation implementation Schedule plan to address the off-Site contamination and to bring the Site into compliance. The financial cost for implementing the remedial action plan and abatement program shall be the responsibility of the Owner. The Contingency plan shall be implemented upon approval of the Director and within 2 years of the issuance of this Notice.

Surface Water Monitoring

43. The surface water sampling program shall be conducted a minimum of two times a year. The Water samples shall be collected on Dochart Creek at locations SW1, SW2 and SW3 which are situated up gradient and down gradient from the Site. The other surface water sampling locations are indicated in Items no.1, Schedule "A". All proposed changes to the monitoring program shall be subject to the approval of the Director.

Closure Plan Landfill Site

44. One year before the Site is expected to close and stop receiving waste, as determined by Conditions 36, 37 and 38, the Owner shall develop and submit an updated Closure Plan. The Closure Plan shall be submitted for the Director's approval and should outline post-closure maintenance and monitoring program. The plan shall include, but not be limited to the following:

44..1 Changes to the final contour plan that have occurred and have been previously identified in the annual reports or recommended in the development of the detailed closure plan;
44.2 fencing and access control;
44.3 details of any vegetative planting planned;
44.4 the sequence and schedules for the final cover installation;
44.5 post-closure and end-use plans;
44.6 plans and schedules for the management and continued monitoring of the surface water and groundwater;
44.7 plans and schedules for routine monitoring and maintenance of stormwater facilities; and
44.8 plans and schedules for the routine monitoring of leachate seeps, the final cover and Site settlement.

Annual Report

45. The Owner shall prepare and submit an annual report to the Director by March 31st, of the year following the calendar year covered by the report which shall include as a minimum, but not limited to the following:

45.1 a survey of the Landfill Site waste disposal area conducted every three years and a map illustrating existing contours. The frequency of the surveys can be changed from time to time by writing to District Manager for approval;
45.2 a summary of the total annual quantities of waste received on a quarterly basis for the Site;
45.3 a drawing(s) indicating all groundwater and surface water monitoring locations;
45.4 tables outlining monitoring locations, analytical parameters sampled and the frequency of sampling;
45.5 an interpretation of the surface water, groundwater and leachate monitoring data; a review of the adequacy of the monitoring programs; provide conclusions and recommendations for changes made in the monitoring programs;
45.6 an assessment of the groundwater quality as it relates to the RUPO and ODWO;

45.7 an assessment of the surface water quality with respect to the PWQO/Guidelines;

45.8 an update of any changes made in the operations, equipment, or procedures at the Site and Facility and operating difficulties encountered;

45.9 drawings showing the areas of fill, buffer areas, current landfill contours, percentages of available space utilized, and an estimate of the remaining disposal capacity and the landfill life span;

45.10 a summary discussion of landfill daily cover requirements and erosion protection;

45.11 a statement of compliance with all the conditions with respect to the inspection and reporting requirements as indicated in the Certificate;

45.12 a summary of any complaints made regarding the landfill Site operations and response from the Owner/Operator and the necessary actions taken to address these complaints;

45.13 recommendations with respect to any proposed changes made in the operation programs for the Site; and

45.14 proposed changes made in the monitoring program for the Site shall be subject to the approval of the Director.

SCHEDULE "A"

This Schedule "A" forms part of Provisional Certificate of Approval No. A 462605 and contains an application along with documentation submitted in support to this application:

1. "Report on Development, Operations and Closure Plan Waste Disposal Site, Township of McNab, Ontario," submitted to the Township of McNab by Golder Associates Ltd., dated June, 1997.

2. "Report on 1997 Groundwater and Surface water Monitoring Program, Waste Disposal Site Township of McNab, Ontario," prepared by Golder Associates Ltd., dated June, 1997.

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

1. Conditions 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33 34, 35 and 36 are to ensure the Site is operated in compliance and in accordance with the Provisional Certificate of Approval, EPA and other supporting documents submitted in Schedule "A".

2. Conditions 37, 38, and 39 are to ensure that Site capacity is not exceeded beyond final contours and adequate final cover is installed at the Site.

3. Condition 40 is included to ensure the Site is in compliance with Regulation 347, Section 11, of the EPA, because waste was deposited within the 30 metres buffer zone along the north property boundary. The Site is in non- Compliance with RUPO at the north property boundary.

4. Conditions 41, 42, and 43 are to ensure that the surface water and groundwater monitoring programs are conducted so that the Site is operated in compliance with the Ontario Water Resources Act, Environmental Protection Act and the conditions in this Certificate.

5. Condition 44 provides guidance to ensure that the Site is closed in accordance with the Certificate. The Site shall be maintained and inspected so that it causes no impact on the natural environment does not create a nuisance and poses no threat to the health and safety of persons. The long term maintenance of the Site shall be such that, it at all times be in compliance with the Ontario Water Resources Act, Environmental Protection Act and Conditions in this Certificate.

6. Condition 45 provides and outlines the requirements for the annual report that must be submitted to the Ministry. The annual report shall provide an update of all surface water and groundwater monitoring programs, waste placements, site plans and all other operational development activities on the Site as set out in the Certificate.

Ontario

In accordance with Section 139 of the Environmental Protection Act, R.S.O. 1990 c. E-19, you may by written notice served upon me and the Environmental Appeal Board within 15 days after receipt of this Notice, require a hearing by the Board. Section 142 of the Environmental Protection Act, as amended provides that the Notice requiring a 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 <u>each</u> portion appealed.*

In addition to these legal requirements, 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 Appeal Board,
2300 Yonge St., 12th Floor,
P.O. Box 2382
Toronto, Ontario.
M4P 1E4

<u>AND</u>

The Director,
Section 39, Environmental Protection Act,
Ministry of the Environment,
250 Davisville Avenue, 3rd Floor.
Toronto, Ontario.
M4S 1H2

DATED AT TORONTO this 30th *day of* September, 1998.

A. Dominski, P. Eng.,
Director,
Section 39,
Environmental Protection Act

SE/lf
cc: A.Polley, Ottawa District Office

Ministry of the Environment / Ministère de l'Environnement

Ontario

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

Under the Environmental Protection Act and Regulations, and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:
Aux termes de la Loi sur la protection de l'environnement et des règlements y afférents et sous réserve des restrictions qui s'y appliquent, ce Certificat provisoire d'autorisation est délivré à:

To: The Township of McNab
R.R. #2
Arnprior, Ontario
K7S 3G8

You are hereby notified that Provisional Certificate of Approval No. A412605 dated December 14, 1971 which was issued to you, is being amended as follows:

A. a) for the use and operation "of a 36 hectare landfilling site and oil transfer station".

b) all in accordance with the following plans and specifications:

1. Application for a Certificate of Approval for a Waste Disposal Site dated January 05, 1971.

2. Application for a Certificate of Approval for a Waste Disposal Site (Transfer) dated July 10, 1992.

3. Letter from the Township of McNab to the Ministry of the Environment dated July 10, 1992 containing the "Application for a Certificate of Approval for a Waste Disposal Site (Transfer)", and supporting information outlining an operational and management plan for the proposed waste oil transfer station.

4. Letter from the Township of McNab to the Ministry of the Environment dated March 10, 1993 outlining the revised plans for the waste oil storage tank.

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

Definitions:

"Certificate" means the entire certificate of approval including its schedules, if any, issued in accordance with Section 27, Part V of the Environmental Protection Act;

"Director" means Director of the Southeastern Region of the Ministry or his appointee;

"District Manager" means the District Manager of Ottawa District Office, Southeastern Region of the Ministry;

"Ministry" means the Ontario Ministry of Environment and Energy;

"Owner" means the Township of McNab;

"Operator" means the Township of McNab; its officers, employees, agents or contractors;

"Site" means the landfilling site described in this Notice and the Certificate;

"Transfer Site" means the oil transfer station described in items 2, 3 and 4 on page 1 of this Notice;

Addition of the following General Conditions:

The requirements of this Certificate are imposed pursuant to Part V of the Environmental Protection Act. The issuance of this Certificate in no way abrogates the operator's legal obligations to take all reasonable steps to avoid violating other applicable provisions of this legislation and the other legislation and regulations.

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

2. (1) The requirements of this Certificate are severable. If any requirement of this Certificate, or the application of any requirement of this Certificate to any circumstance, is held invalid, the application of such requirement to other circumstances and the remainder of this Certificate shall not be affected thereby.

(2) In all matters requiring the interpretation and implementation of the Certificate, the conditions of the certificate shall take precedence, followed in descending order by the operator's application and the documentation, referred to in this Certificate, which is submitted in support of the application.

3. The operator must ensure compliance with all the terms and conditions of the Certificate. Non-compliance constitutes a violation of the Environmental Protection Act and is grounds for enforcement.

4. (1) The operator shall, forthwith upon the request of the Director or District Manager, furnish any information requested concerning compliance with the Certificate including any records required to be kept by the Certificate.

(2) In the event the operator provides to the Ministry information, records, documentation of notification in accordance with the Certificate,

(a) the receipt of said information by the Ministry;

(b) the acceptance by the Ministry of the information's completeness or accuracy; or,

(c) the failure of the Ministry to prosecute the operator, or to require the operator to take any action, under the Certificate of any statute or regulation in relation to said information;

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

shall not be construed as the approving, excusing or justifying by the Ministry of any act or omission of the operator relating to said information, amounting to non- compliance with the Certificate or any statute or regulation.

(3) All records referred to in the Certificate shall be retained on file in a secure manner for a period not less than two years.

5. The operator/owner shall allow Ministry personnel, or a Ministry authorized representative(s), upon presentation of credentials, to carry out any and all inspections authorized by section 156, 157 or 158 of the Environmental Protection Act, as amended from time to time, of any place to which the Certificate relates; and, without restricting the generality of the foregoing, to:

(a) enter at reasonable times upon the premises, or the location where the records required by the conditions of the Certificate are kept:

(b) have access to and copy, at reasonable times, any records required by the conditions of the Certificate;

(c) inspect at reasonable times any facilities, equipment, practices, or operations required by the conditions of the Certificate; and

(d) sample and monitor at reasonable times for the purpose of assuring compliance with the conditions of the Certificate.

For the purposes of the Condition, "presentation of credentials" means:

(i) in the case of a provincial officer, production of a copy of his or her designation;

(ii) in the case of Ministry personnel, production of his or her Ministry Identification Card;

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

(iii) in the case of a Ministry authorized representative, production of a letter from the Director or District Manager authorizing entry and inspection in accordance with this condition.

6. (1) The operator shall notify the District Manager in writing of any of a change in ownership, the operator or termination of the transfer site within 30 days of the change occurring:

(2) The operator/owner shall ensure that all communications made pursuant to this Condition shall refer to the Certificate number for this site.

7. (1) In accordance with Section 19(4) of the Environmental Protection Act the Certificate, the application filed to obtain it and documentation referred to in the Certificate which may be reasonable necessary for a proper reading and understanding of it, shall be made available for public inspection at the request of any person.

(2) Additional information to that set out in subcondition (1) relating to the Certificate and contained in Ministry files may be made available to the public in accordance with the provisions of the Freedom of Information and Protection of Privacy Act.

8. Except as otherwise specified by the conditions in this Notice and the Certificate the transfer site shall be operated in accordance with the application dated July 10, 1992 and its supporting information described in items 2 to 4 on page 1 of this Notice.

9. (1) The operation of the waste transfer site is limited to the collection, temporary storage and transfer of waste oil, Class 252, as defined in the Ministry of the Environment "New Ontario Waste Classes" dated January, 1986, collected from residential and family farm sources in the municipalities of McNab, Renfrew, Arnprior, Horton, Bagot and Blythfield.

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

(2) No wastes other than those listed in subcondition (1) shall be collected and stored at the transfer site without amendment to the Certificate.

(3) No municipalities other than those listed in subcondition (1) shall use the transfer site without amendment to the Certificate.

(4) All waste shall be delivered to the site by the householder or the family farm operator responsible for the waste or by an approved waste management system. Each delivery is limited to 50 litres.

(5) The operation of the waste transfer site is limited to the operation and 1500 litres tank facility described in the supporting information for this Certificate and no other transfer facility shall be constructed or operated at the site without written approval from the District Manager.

(6) Storage of waste at the transfer facility shall not exceed 1500 litres without amendment to this Certificate.

10. (1) The waste transfer shall be supervised at all times when open. Access to the transfer site shall be limited to the hours of operation for the landfill site on which this facility is located.

(2) All personnel supervising the transfer site shall be aware of the waste types which may be collected at the transfer site and shall be knowledgeable about all aspects of the transfer site operation including the requirements under this Notice and the Certificate.

(3) Signs shall be posted at the entrance of the landfill site showing the hours of operation and giving notice of the types of waste permitted at the landfill and transfer sites.

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

(4) The storage tank shall be maintained under lock and key when site personnel are not in attendance.

(5) The storage tank shall be inspected daily during operating hours, by site personnel trained in contingency measures and all inspections shall be recorded and these records shall be maintained by owner/operator as described under Condition 5(3).

(6) The operator shall ensure that site personnel trained in contingency measures are on duty to receive waste oil and during unloading operations at the site.

(7) The operator shall prepare Generator Registration Reports as required under Regulation 347 of the Ontario Environmental Protection Act.

11. (1) The operator shall establish separate record systems for the waste received at the transfer site which shall include, but not necessarily be limited to, the documentation of quantities of waste received at the transfer site; shipping dates and volumes of waste delivered to approved transfer and processing sites; and the documentation of environmental and other problems experienced in operating transfer.

(2) The information collected under section (1) shall be submitted in a report to the District Manager on or before March 31 of each year, with the first report due in 1994, and for each year of operation or until the Director or the District Manager has given notice, in writing, that these submissions are no longer required.

12. (1) The operator shall ensure that the landfill site and the transfer site are operated in a safe and secure manner; that the operation of the transfer site does not impede or is impeded by the landfill operation on which the transfer site is located; that the wastes are properly handled, contained and stored; and that the general public, site personnel and the environment are protected.

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

(2) Within 30 days of the issuance of this Notice the operator shall prepare a operation manual for the transfer site for use by site personnel which shall contain, but not necessarily be limited to the following:

a) a outline of the responsibilities of site personnel;

b) personnel training protocols;

c) proper receiving, screening and recording procedures;

d) proper handling, storage and shipping procedures;

e) contingency procedures to be followed by site personnel in the event of fires or other emergencies.

A copy of the operation manual shall be submitted to the District Manager.

(3) The operator shall maintain a safe storage capacity for the transfer site which is consistent with the application for this Certificate and shall ensure that this capacity does the 1500 litre limit of the tank by providing regular movement of the wastes to approved transfer and processing facilities and sites.

(4) Notwithstanding Condition 2 the owner/operator shall ensure that adequate fire fighting equipment is available at the transfer site and that personnel are familiar with the use of such equipment and its location(s) on the transfer site.

(5) The local fire department shall be advised of the wastes collected at the waste transfer site and this Notice for the Certificate.

13. All waste shall be transported from the transfer site by an approved waste management system and shall be disposed of at waste landfill, transfer and processing sites certified to accept these types of wastes.

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

14. The approval for the transfer site on the landfill site expires with the termination of the transfer site; when all the wastes have been removed from this site; and the restoration of this site has been approved, in writing, by the District Manager; or if closure of the landfill site prohibits or prevents further use of the transfer site.

The reason for the imposition of Conditions 10 to 15 is to accommodate the waste Transfer Station amendment requested by the Township of McNab to the Ministry of the Environment in their application dated July 10, 1992.

The specific reason(s) for each condition is:

- Conditions 9 and 10 are to ensure that the transfer site is used only to collect, handle and transport waste approved under this Notice and the Certificate.
- Conditions 11 and 13 are to ensure that the waste transfer site is properly managed in an organized manner by adequately trained persons, in order to prevent environmental detriment; and to ensure the safety of the general public and site personnel.
- Condition 12 is to provide both the owner/operator and the Ministry of the Environment with an assessment of the waste transfer site.
- Condition 14 is to ensure that the collection, handling, reuse and transportation of all waste materials are conducted in an environmentally acceptable manner in accordance with provincial regulations.
- Condition 15 is to ensure the transfer area is cleaned up and restored to the satisfaction of the Ministry prior to closure.

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

Conditions 2 to 8 are standard conditions which are now incorporated in most waste site applications. Their purpose is to ensure that the applicant is aware of his rights and responsibilities under the Certificate.

The specific reason(s) for each condition is:

- Conditions 2, 3, 4, 5 and 8 are to clarify the legal rights and obligations of this Provisional Certificate of Approval.
- Condition 7 is to ensure that the transfer site is operated in accordance with the information submitted and not in any way which the Director has not been asked to consider;
- Condition 6 is to ensure that the appropriate Ministry staff have ready access to the waste disposal site to inspect the operations that are approved under this Provisional Certificate of Approval. The condition is supplementary to the powers of entry afforded a Provincial Officer pursuant the Environmental Protection Act, as amended.

You may, by written notice served upon me and the Environmental Appeal Board within 15 days after receipt of this Certificate, require a hearing by the Board. Section 142 of the Environmental Protection Act, R.S.O. 1990 c. E-19, as amended, provides that the notice requiring the hearing shall state:

1. **The portions of 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 <u>each</u> portion appealed.**

In addition to these statutory requirements, the notice should include:

PROVISIONAL CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

CERTIFICAT D'AUTORISATION PROVISOIRE DE DÉCHARGE

Provisional Certificate Number A412605
Certificat d'autorisation provisoire no.

l. The name of the appellant;
l. The address of the appellant;
. The Certificate of Approval number;
. The date of the Certificate of Appeal;
. The name of the Director;
. The municipality within which the works are located;

nd the notice should be signed and dated by the appellant.

his notice should be served upon:

he Secretary
nvironmental Appeal Board
12 St. Clair Avenue West
th Floor
ORONTO, Ontario
14V 1N3

AND

The Director
Section 39, E.P.A.
Ministry of the Environment
133 Dalton Avenue, Box 820
KINGSTON, Ontario
K7L 4X6

ated at Kingston this 7th day of April, 1993.

Director
Section 39, E.P.A.
Ministry of the Environment.

Pour obtenir une copie du present avis en francais, communiquer le Ministère de Environnement 613 549-4000.)

tes

Ministry of the Environment
Ontario

Provisional Certificate No. A 412605

PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE

Under The Environmental Protection Act, 1971 and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:

Township of McNab
R.R. # 2
Arnprior, Ontario

for the use and operation **of a 36 hectare landfilling site**

all in accordance with the following plans and specifications:

Located: **Part W.1/2 Lot 18, Concession VI**
Township of McNab
County of Renfrew

which includes the use of the site only for the **disposal** of the following categories of waste (NOTE: Use of the site for additional categories of wastes requires a new application and amendments to the Provisional Certificate of Approval) **Domestic, commercial, 5% non-hazardous solid industrial and 10% other, limited to brush, demolition debris and construction debris.**

and subject to the following conditions:

1. **No operation shall be carried out at the site after sixty days from this condition becoming enforceable unless this Certificate including the reasons for this condition has been registered by the applicant as an instrument in the appropriate Land Registry Office against title to the site and a duplicate registered copy thereof has been returned by the applicant to the Director.**

THIS IS A TRUE COPY OF THE ORIGINAL CERTIFICATE MAILED

ON JUN 12 1980

(Signed)

Dated this 10th day of June, 1980.

Director, Section 39,
The Environmental Protection Act, 1971

MOE 1408 (10/79)

Appendix C SITE OBSERVATION FORMS, CORRESPONDENCE, OTHER SUPPORTING INFORMATION

FoodCycler™

THE IN-HOME FOOD WASTE DIVERSION SOLUTION

Join your municipality in tackling food waste by piloting FoodCycler™ technology in your home. Support your municipality by testing this innovative technology!

Why should I participate?

Did you know that up to 50% of household waste is composed of food waste? By helping your municipality address food waste, you are supporting your community's environmental initiatives, while reducing your carbon footprint.

What is required of me?

Not much! Purchase a FoodCycler™ from your municipality at a subsidized cost, track your use once a week for a period of 12 weeks and then answer a brief exit survey.

Pilot Project Timeline

MARCH - JUNE 2024 (12 WEEKS)

PURCHASE YOUR UNIT

FoodCycler™ FC-30: $150 CAD (+ tax)
FoodCycler™ Eco 5: $300 CAD (+ tax)

PILOT DURATION

Divert your food waste using the FoodCycler™ for a period of 12 weeks. Track the amount of waste you divert with a tracking sheet (to be provided to you by the municipality).

END DATE

Fill out a closing survey (to be provided by the municipality) about your experience using the FoodCycler™. Once complete, the FoodCycler™ is yours to keep!

Only 100 spots available! Join today!

TO LEARN MORE:

Ryan Frew | Rfrew@mcnabbraeside.com | 613-623-5756 ext. 227

FOODCYCLER OFFERS:

90% Reduction in food waste volume

95% Reduction in greenhouse gas emissions from food waste

FOODCYCLER IS:

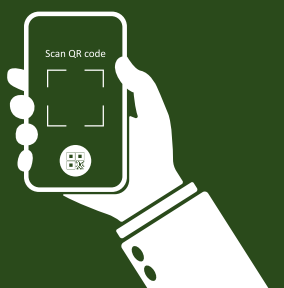
ENERGY EFFICIENT
Only ~$2 in energy costs every month!

ODOURLESS
Carbon filtration controls odours!

EASY TO USE
Just press Start!

SIGN UP HERE:

https://bit.ly/FCMcNabBraeside



Stantec Consulting Ltd.
400-1331 Clyde Avenue
Ottawa Ontario, Canada
K2C 3G4
Tel: (613) 722-4420
Fax: (613) 722-2799

McNAB / BRAESIDE LANDFILL
OBSERVATION REPORT

Environmental Compliance Approval Number A412605

Authorized Operations – Landfill and Oil Transfer Station

Total Site Area – 64.3ha, Part of West ½ Lots 18, 19 Concession 6 Plan 49R - 12786

Service Area – Township of McNab/Braeside

Project Name: McNab/Braeside Landfill Observation Report

Project Number: 163401671 Task 300.101

Observation Date: May 20th 2023

Weather: Rain +12^{0}C

Observations by: Gerry Lalonde

Site Supervisor: Ryan Frew

Reviewed by: Gerry Lalonde Date: May 20th, 2023

Submitted to: Ryan Frew Date: May 23rd, 2023

Township Contact Number (613) 623-5756 (227)
Cell: 613-808-3748

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Entrance	Site locked during non-operating hours.	1	Inspection was done when site was open. Entrance road in good condition. New CSP installed at entrance in 2019.	None.	
Gate	Gate condition	2	Entrance gate is in reasonable condition. Access restricted through padlock.	None	
Main Entrance Sign	Sign to display; Name of Site; CofA number, Operating authority and their telephone number and mailing address; Hours of operation; Emergency telephone number; Waste types accepted; Tipping fees.	1	New entrance sign erected in 2014 with all information required by ECA, including tipping fees and operating authority mailing address. Sign is in good condition and legible.	None	
Hours of Operation	8:30 am to 4:00 pm unless amended by District Manager.	1	Hours posted on entrance sign shows 8:30am to 4:00pm.	None	
Screening	On site vegetation provides adequate screening.	2	Trees provide adequate screening.	None	
Supervision	Custodian on site when site open. Site is open on Tuesday, Thursday and Saturday.	2	Site was open on Saturday. Township staff was present at scale house and on equipment (loader).	None.	Compactor was not operating during inspection.
Fence	Condition of fence.	2	Bear fence and page wire fences along the north and west limits have been removed due to the clearing of trees for Stage 3 development.	Reinstall page wire fence & bear fence along north & west limits once base preparation in Stage 3 is completed or bears become a nuisance, whichever comes first.	
Transportation	Condition of all season access roads. Signs to control speed on roads.	2	Speed sign (50km/h) posted at entrance and site access road is in good condition. Access road to active face is in good condition.	None	Users dump load from top of Phase 2. Access to bottom of waste in Phase 3A is muddy due to rain.
Dust Control	Control dust from traffic using an application of dust suppressant.	1, 2	Site access road is well graded but a few potholes will need regrading. No dust due to rain.	Local spot about halfway between entrance and weigh scale needs to be graded.	

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Custodian Shelter	Condition of structure. Information/signs provided for safety and emergency procedures, telephone locations and emergency contact names & numbers; fire extinguisher locations; spill response procedures.	3 1	New custodian shelter was constructed in 2011. Building exterior is in good condition. Weigh scale is operational.	Interior of custodian shelter was not inspected as a precaution measure for Covid-19. Spoke with weigh scale operator and no new developments since last inspection.	
Electronics	Building and surrounding area are in a safe environment.		Electronics are stored in a steel bin/container in diversion area near scale. Bin is empty.	None	
On Site Signs	Conditions of signs at disposal areas, segregated products, waste oil.	2	Sign advises all users to report to weigh scale. Additional signage has been erected in 2014 for blue box materials. Signs direct users to designated areas. All signs are in good condition and legible.	None	New sign installed along access road to Stage 3A advising users to maintain 2m separation as a precaution for Covid-19.
Equipment	What equipment is used to compact waste?		Caterpillar 816F is used for compaction. Crawler loader being used to spread waste.	Daily cover (sand) and chipped wood are being used for cover in Stage 3. Dozer and Bomag being used to shape waste.	Current disposal operations are within Stage 3A.
Noise	Can noise from on-site operations be detected at nearest sensitive receptor?	3	Equipment (loader) was operating during inspection. Separation distance to nearest receptors is deemed adequate to attenuate the noise.	None	
Surface Drainage	Grading to prevent s/w from flowing through waste. Grading to prevent ponding near toe.	3 3	Grading and CSPs have been installed along new road to Stage 3A with drainage directed towards bush along west limit.	None	
Surface Monitoring	Has any sampling been done since last inspection on Dochart Creek at locations SW1, SW2 and SW3?	2	Golder Associates does the sampling.	None	
Groundwater Monitoring	Any damage to any of 27 monitoring wells at 35 locations. Are monitoring wells in area of operations and protected?	2	Golder Associates does the sampling. Monitor BH4A/B within Stage 3 has been decommissioned by Golder Associates.	None.	
Landfill Gas	On site facilities are vented and no smoking signs posted at any enclosed facility.	3	Structures are above ground so natural ventilation is adequate to avoid potential for gas accumulation. Doors to maintenance shed left open so ventilation is available.	None	
Burning	Any evidence of waste being burnt? Can burn brush, trees and clean wood piles in designated locations. Is there a 30m fire break around piles.	1 2 3	Brush is stockpiled in Stage 3A. Stockpile is moderate/large in size.	Chip brush/wood pile and use woodchips for alternate cover.	
Odours	Are odours noticeable at nearest sensitive receptor or at property limit.	2	Odours are not noticeable at the weigh scale, at the site entrance or from Stage 3 area.	None	
Scavenging	No scavenging allowed. Any evidence of trespassers.	3	None observed.	None	
Pest Control	Any evidence of pests that can pose a hazard to the health and safety of site users.	2	No evidence of rodents.	None	
Vectors	Are birds or other animals a nuisance?		About 50 gulls and a few crows were observed at the top of the waste in Stage 3A at time of inspection.	None	Continue monitoring and review options for wildlife management if birds become a nuisance.

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Litter Control	Is litter evident beyond waste pile? Is there a litter fence?	1 2	Wind-blown debris evidenced for most of the site and along the tree line of Stage 3A. More cover material needs to be applied to top of Stage 3A.	Organize general litter cleanup before vegetation growth makes it difficult to collect.	
Metal	Segregated and placed in containers for removal by scrap metal dealer.	2	Scrap metal bin is overflowing. White goods stockpile size along Cell 1 is moderate.	Contractor responsible for scrap metal to empty container asap.	
Rubber Tires	Segregated and stored in a fenced area adjacent to the reuse building.	2	Tire stockpile along the south/west limit of Stage 1 has approximately one full trailer load. Bin to accept tires has been placed near electronics bin – tire bin is currently full/overflowing.	Contractor responsible for tire removal to be advised to remove tires. Discuss potential for additional bin to get rid of excess tires in Stage 1.	Tire Collection Network is responsible for tire collection.
Other Diversion materials	Starting in August 2003, shingles were segregated and stockpiled for removal by recycler. Segregation was stopped around 2010 because of poor market conditions.		A sea container near the weigh scale accepts cardboard. Container is full. Blue box material can be deposited in plastic bins aligned along weigh scale.	Diversion area near weigh scale was mostly tidy. Contractor that handles cardboard to be advised to pick up cardboard.	
White Goods	Metal - in designated containers. Refrigerated Appliances – must have CFC refrigerant removed and stickers attached.	2	Moderate quantity of white goods is stockpiled next to the tire stockpile.	Sufficient space remains for acceptance of this waste.	
Waste Oil Transfer Station	Storage of waste oil in a neat and safe environment. Ensure oil building is locked at the end of the day. Waste oil should only be stored in waste oil tank or in waste oil shed.	1	Since the spring 2019 inspection, waste oil is no longer accepted and sign on building advises users to bring their used oil to the Renfrew depot. Sign on fence advises that oil transfer station and platform are closed.	Waste oil containers from previous inspections have been removed from platform and surrounding area. Except for some wind-blown behind at rear of building, general area looks relatively clean.	
Footprint	Is footprint delineated by stakes/posts?	2	Stakes were placed to delineate the Stage 3 footprint in 2018. Stakes have been offset in vegetation so they are not clearly visible.	Marker stakes delimiting the edge of the waste footprint are mostly destroyed. As the waste placement in Stage 3A progresses towards the west, the toe of slope should be more clearly defined.	Visually extending the alignment of the sideslope of Phase 2 confirms that western edge of waste in Phase 3 appears to be within limits.
Waste Type	Domestic, commercial and non-hazardous solid industrial.	1	Only municipal waste observed.	None.	
Capacity • Stage 1 • Stage 2 • Stage 3	Maximum capacity of 1 million m^3 within a 10ha footprint as per Golder figure 7, revision 3. Capacity of 257,500 cm to height of 9.9m and area of 3ha. Capacity of 285,000 m^3 to height of 12.4m over 4.6ha. Capacity of 357,500 m^3 to height of 16.9m over area of 10ha.	2	Waste is being deposited in Stage 3A. Stantec/Golder discussed with Ryan Frew on where to locate disposal during 2020 within Stage 3A. Disposal to continue pushing eastward and close to toe of Stage 2. Stantec advised that a 40m wide (N-S) footprint following Stage 2 would provide in excess of 20,000 cubic metres of capacity – top of waste to match existing top of Stage 2.	Since early 2019, the Township has shifted disposal operations into Stage 3A. Ministry (MECP) staff have requested that an updated Development & Operation Plan be submitted for Stage 3. Township has deposited a lift of sand to extend the base for waste placement in Stage 3A. Active face in Stage 3A has reached height of Stage 2 for all of Stage 3A.	
Buffer	Maintain 30m minimum buffer around Stage 3 waste area.	2	Buffer distances to edge of property from proposed Stage 3A limits are acceptable.	Western edge of brush pile is located only several metres from treeline. An adequate buffer should be maintained to minimize potential for fire spread and to provide access to equipment to reach the opposite side of the pile if needed.	
Leachate	Any evidence/sign of leachate breakout on slopes or ponding near toe.	3	No evidence of leachate seeping observed along south slope of Stage 1.	None	

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Daily Cover	Minimum thickness of 150 mm to be applied at the end of each working day.	1	Sand and woodchips are used as daily cover. Fine sand stockpiles observed at top of Stage 2 and adjacent to bottom of waste in stage 3A	Use sand and chipped wood for cover material.	All chipped wood piles should be measured for reporting as waste diversion.
Daily Cover Stockpile	Keep clean granular material stockpile equal to 50 % of the quantity of the annual daily cover material.	1	Stockpiles of sand observed on top of Stage 2 and in Stage 3A. Continue to use chipped wood mixed with sand for cover material for Stage 3A operations.		
Intermediate Cover	Minimum thickness of 300 mm to be applied in areas not worked for 30 days. Remove cover before starting new lift.	1	Township has placed an interim cap over most of Stage 2. Minor changes observed to top of Stage 2 as decomposition/settlement occurs.	Few birds (gulls, crows) were observed during this inspection.	
Closure	Has any areas reached final contours? Condition of closed areas (if any), 600mm of earth material and 100mm of topsoil and seeded.		Waste has not reached final approved contours.	None	Township awaiting comments from the Ministry (MECP) on a Golder report regarding the groundwater modeling done to support the lateral expansion in Stage 3.
Contaminated Soil	Petroleum hydrocarbon contaminated soils (non-hazardous and meet Reg. 347) can be used as daily cover provided the volume stored does not exceed the annual daily cover requirements and it is spread within the footprint, turned periodically for 7 days and then stockpiled for use.	1 2	Waste has now been deposited over former area designated for hydrocarbon impacted soil (Stage 2).	None	
Training	Has any training been provided to site custodian? Training of CofA, operation and maintenance.	3 1	Training is provided annually on safety issues.	Provide training once an updated Development & Operation Plan is approved. Provide a digital copy of latest Annual Monitoring Report to weigh scale operator.	Township to consider providing weigh scale operator with a used laptop equipped with a USB port. All documentation that the Ministry requires to be available at the weigh scale can be stored on the USB so Twp. remains compliant with ECA requirements.
Records	Maintain daily records; Monthly summary of quantity and types of waste disposed; Copy of CofA at site.	1 1 1	All waste and sand (used for daily cover) coming onto site should be weighed and recorded.	Volume of wood chips after chipping (stockpile dimensions) to be measured so that some of the volume can count towards diversion.	
Loads Refused	Date; Name of person; Company name on vehicle and vehicle description; Waste refused; Reason for refusal.	1	Procedure in place for load refusal.	Municipal hazardous waste to be directed to the Renfrew hazardous waste depot.	
Instructions to Site Supervisor:					
Additional Comments: (1) (2)					

* Reference:

1 - Certificate of Approval Number A412605 dated September 30, 1998 and Notice 1 dated December 4, 2000.
2 - Golder Associates. June 1997. Site Development, Operations and Closure Plan, Township of McNab Waste Disposal Site.
3 - Ministry of the Environment. November 1993. Guidance Manual for Landfill Sites Receiving Municipal Waste.

Stantec Consulting Ltd.
400-1331 Clyde Avenue
Ottawa Ontario, Canada
K2C 3G4
Tel: (613) 722-4420
Fax: (613) 722-2799

McNAB / BRAESIDE LANDFILL
OBSERVATION REPORT

Environmental Compliance Approval Number A412605

Authorized Operations – Landfill and Oil Transfer Station

Total Site Area – 64.3ha, Part of West ½ Lots 18, 19 Concession 6 Plan 49R - 12786

Service Area – Township of McNab/Braeside

Project Name: McNab/Braeside Landfill Observation Report

Project Number: 163401671 Task 300.101

Observation Date: August 24th 2023

Weather: Sunny +25^{0}C

Observations by: William Bogaart / Gerry Lalonde

Site Supervisor: Ryan Frew

Reviewed by: Gerry Lalonde Date: August 29th, 2023

Submitted to: Ryan Frew Date: August 29th, 2023

Township Contact Number (613) 623-5756 (227)
Cell: 613-808-3748

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Entrance	Site locked during non-operating hours. Landfill address is 573 Calabogie Road, Arnprior ON	1	Inspection was done when site was open. Entrance road in good condition. New CSP installed at entrance in 2019 is in good condition.	None.	
Gate	Gate condition	2	Entrance gate is in reasonable condition. Access restricted through padlock.	None	
Main Entrance Sign	Sign to display; Name of Site; CofA number, Operating authority and their telephone number and mailing address; Hours of operation; Emergency telephone number; Waste types accepted; Tipping fees.	1	New entrance sign erected in 2014 with all information required by ECA, including tipping fees and operating authority mailing address. Signs (entrance, speed limit) are in good condition and legible.	Minor trimming of vegetation below sign	
Hours of Operation	8:30 am to 4:00 pm unless amended by District Manager.	1	Hours posted on entrance sign shows 8:30am to 4:00pm on Tuesday, Thursday and Saturday.	None	
Screening	On site vegetation provides adequate screening.	2	Trees provide adequate screening.	None	
Supervision	Custodian on site when site open. Site is open on Tuesday, Thursday and Saturday.	2	Site was open on Thursday. Township staff was present at scale house (George) and on equipment (Glen on loader).	None.	Compactor was not operating during inspection.
Fence	Condition of fence.	2	Bear fence and page wire fences along the north and west limits have been removed due to the clearing of trees for Stage 3 development.	Reinstall page wire fence & bear fence along north & west limits if the presence of bears at the site is observed.	
Transportation	Condition of all season access roads. Signs to control speed on roads.	2	Speed sign (50km/h) posted at entrance and site access road is in good condition. West side access road to active face at top of Stage 2 is in good condition.	None	Users dump load from top of Stage 2. Toe of Stage 3A being used to stockpile sand.
Dust Control	Control dust from traffic using an application of dust suppressant.	1, 2	Site access road is well graded. No dust observed due to recent rain.		

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Custodian Shelter	Condition of structure. Information/signs provided for safety and emergency procedures, telephone locations and emergency contact names & numbers; fire extinguisher locations; spill response procedures.	3 1	New custodian shelter was constructed in 2011. Building exterior is in good condition and interior is tidy and clean. Weigh scale is operational. Weigh scale operator advised that there were no new developments since last inspection. Fire extinguisher, eye wash station and first aid kit in full view.	Small tree along weigh scale approach ramp adjacent to scale house needs to be cut to minimize potential for doing damage to building.	
Electronics	Building and surrounding area are in a safe environment.		Electronics are deposited in an open steel bin/container in diversion area near scale. Bin is ¾ full.	None	Electronics are removed by Contractor as part of a provincial Producer Responsibility Program.
On Site Signs	Conditions of signs at disposal areas, segregated products, waste oil.	2	Sign advises all users to report to weigh scale. Signs direct users to designated areas. All signs are in good condition. Some vegetation growth starting to obstruct signs near the diversion bins.	Trim vegetation near signs.	New sign installed along access road to Stage 3A advising users to maintain 2m separation as a precaution for Covid-19.
Equipment	What equipment is used to compact waste?		Caterpillar 816F is used for compaction. John Deere 655K crawler loader being used to spread waste.	Daily cover (sand) and chipped wood are being used for cover in Stage 3A. Dozer and Bomag being used to shape waste – although only loader was operational at time of inspection.	Current disposal operations are within Stage 3A.
Noise	Can noise from on-site operations be detected at nearest sensitive receptor?	3	Equipment (loader) was operating during inspection. Separation distance to nearest receptors is deemed adequate to attenuate the noise.	None	
Surface Drainage	Grading to prevent s/w from flowing through waste. Grading to prevent ponding near toe.	3 3	Grading and CSPs have been installed along new road to Stage 3A with drainage directed towards bush along west limit. Ditches dry at time of inspection.	None	
Surface Monitoring	Has any sampling been done since last inspection on Dochart Creek at locations SW1, SW2 and SW3?	2	Golder Associates does the sampling.	None	Significant flow in Dochart Creek as observed in CSP at entrance.
Groundwater Monitoring	Any damage to any of 27 monitoring wells at 35 locations. Are monitoring wells in area of operations and protected?	2	Golder Associates does the sampling. Monitor BH4A/B within Stage 3 has been decommissioned by Golder Associates.	None.	Golder Associates (Cameron) on site at same time as Stantec inspection.
Landfill Gas	On site facilities are vented and no smoking signs posted at any enclosed facility.	3	Structures are above ground so natural ventilation is adequate to avoid potential for gas accumulation. Doors to maintenance shed left open so ventilation is available.	None	
Burning	Any evidence of waste being burnt? Can burn brush, trees and clean wood piles in designated locations. Is there a 30m fire break around piles.	1 2 3	Brush is typically stockpiled in Stage 3A. Several stockpiles of grinded material observed that are moderate to large in size.	Large stockpiles of brush observed in May have now been grinded.	Chip brush/wood pile and use woodchips for alternate cover.
Odours	Are odours noticeable at nearest sensitive receptor or at property limit.	2	Odours are not noticeable at the weigh scale or at the site entrance. Odours noticeable at toe of Stage 3 area.	None	
Scavenging	No scavenging allowed. Any evidence of trespassers.	3	None observed.	None	

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Pest Control	Any evidence of pests that can pose a hazard to the health and safety of site users.	2	No evidence of rodents observed in Stage 2.	None	
Vectors	Are birds or other animals a nuisance?		About 30 to 50 gulls and a few crows were observed at the top of the waste in Stage 3A at time of inspection.	None	Continue monitoring and review options for wildlife management if birds become a nuisance.
Litter Control	Is litter evident beyond waste pile? Is there a litter fence?	1 2	Minimal wind-blown debris evidenced along tree line and access road to Stage 3A. Some waste exposed in east side of active face.	More cover material needs to be applied to active face of Stage 3A (more notably along the east side).	
Metal	Segregated and placed in containers for removal by scrap metal dealer.	2	Scrap metal bin is less than ¼ full. White goods stockpile size along Stage 2 is small to moderate. About a dozen empty propane tanks (20 lbs size) deposited along bin.	Continue to use the diversion area along the Stage 2 as overflow when scrap metal bin becomes full.	
Rubber Tires	Segregated and stored in a fenced area adjacent to the reuse building.	2	Tire stockpile along the south/west limit of Stage 2 has enough to fill one full trailer load. Bin to accept tires has been placed near electronics bin – tire bin is currently full/overflowing.	Contractor responsible for tire removal to be advised to remove tires. Contractor having difficulty in keeping up with need. Discuss potential for additional bin to get rid of excess tires in Stage 1.	Tire Collection Network (E-Trac) is responsible for tire collection, as part of a provincial Producer Responsibility Program.
Other Diversion materials	Starting in August 2003, shingles were segregated and stockpiled for removal by recycler. Segregation was stopped around 2010 because of poor market conditions.		The sea container near the weigh scale that accepted cardboard has been removed from site and replaced by three smaller roll off containers. Two of the three containers are full. Blue box material can be deposited in plastic bins aligned along weigh scale.	Diversion area near weigh scale was mostly tidy. Contractor that handles cardboard to be advised to pick up cardboard.	Carboard/fibres collection is the responsibility of Topps Environmental Solutions (TES), as part of a provincial Producer Responsibility Program.
White Goods	Metal - in designated containers. Refrigerated Appliances – must have CFC refrigerant removed and stickers attached.	2	Moderate quantity of white goods is stockpiled next to the tire stockpile along east end of Stage 2.	Sufficient space remains for acceptance of this waste.	
Waste Oil Transfer Station	Storage of waste oil in a neat and safe environment. Ensure oil building is locked at the end of the day. Waste oil should only be stored in waste oil tank or in waste oil shed.	1	Since the spring 2019 inspection, waste oil is no longer accepted and sign on building advises users to bring their used oil to the Renfrew depot. Sign on fence advises that oil transfer station and platform are closed.	Several waste oil containers (assumed empty) remain on platform and should be removed to improve the general appearance of the surrounding area. Door to the waste oil shed is falling off and should be reattached so it can be locked to prevent users from placing containers inside.	
Footprint	Is footprint delineated by stakes/posts?	2	Stakes were placed to delineate the Stage 3 footprint in 2018. Stakes have been offset in vegetation so they are not clearly visible.	Marker stakes delimiting the edge of the waste footprint are mostly destroyed. As the waste placement in Stage 3A progresses towards the northwest, the toe of slope should be more clearly defined.	Staking of the north and west limits of Stage 3A to be done during the early December survey.
Waste Type	Domestic, commercial and non-hazardous solid industrial.	1	Only municipal waste observed.	None.	
Capacity • Stage 1 • Stage 2 • Stage 3	Maximum capacity of 1 million m^3 within a 10ha footprint as per Golder figure 7, revision 3. Capacity of 257,500 cm to height of 9.9m and area of 3ha. Capacity of 285,000 m^3 to height of 12.4m over 4.6ha. Capacity of 357,500 m^3 to height of 16.9m over area of 10ha.	2	Waste is being deposited in Stage 3A and has reached the elevation of Stage 2. Consider starting another lift over Stage 3A instead of extending the Stage 3A base or another Stage. Upgrading of the road to the top of Stage 2 along the east side would need to be done.	Since early 2019, the Township has shifted disposal operations into Stage 3A. Ministry (MECP) staff have indicated that an updated Development & Operation Plan is requested for Stage 3 development. Twp. waiting for comments.	Maintain waste placement over the existing lifts in Stage 3A to delay the development of Stage 3B. Decision can be made once the MECP has provided a response to the Golder report.

Item	Objective	Reference*	Observations	Action Required	Additional Comments (See page 3 of 3)
Buffer	Maintain 30m minimum buffer around Stage 3 waste area.	2	Buffer distances to edge of property from proposed Stage 3A limits are acceptable. An adequate buffer should be maintained to minimize potential for fire spread and to provide access to equipment if needed.	The grinding/removal of the brush piles since the last inspection has re-established buffers.	
Leachate	Any evidence/sign of leachate breakout on slopes or ponding near toe.	3	No evidence of leachate seeping observed along south slope of Stage 1. Some surface water observed at toe of Stage 3A.	None	
Daily Cover	Minimum thickness of 150 mm to be applied at the end of each working day.	1	Sand and woodchips are used as daily cover. A large fine sand stockpile observed adjacent to bottom of waste in stage 3A	Use sand and chipped wood for cover material. Large shredded brush stockpiles observed at northwest toe of Stage 3A.	All chipped wood piles should be measured for reporting as waste diversion.
Daily Cover Stockpile	Keep clean granular material stockpile equal to 50 % of the quantity of the annual daily cover material.	1	Stockpiles of sand observed near toe of Stage 3A. Continue to use chipped wood mixed with sand for cover material for Stage 3A operations.	None	
Intermediate Cover	Minimum thickness of 300 mm to be applied in areas not worked for 30 days. Remove cover before starting new lift.	1	Township has placed an interim cap over most of Stage 2. Minor changes observed to top of Stage 2 as decomposition/settlement occurs.	Few birds (gulls, crows) were observed during this inspection.	Heavy vegetation growth on Stage 2 is minimizing erosion and wind blown debris.
Closure	Has any areas reached final contours? Condition of closed areas (if any), 600mm of earth material and 100mm of topsoil and seeded.		Waste has not reached final approved contours.	None	Township awaiting comments from the Ministry (MECP) on a Golder report regarding the groundwater modeling done to support the lateral expansion in Stage 3.
Contaminated Soil	Petroleum hydrocarbon contaminated soils (non-hazardous and meet Reg. 347) can be used as daily cover provided the volume stored does not exceed the annual daily cover requirements and it is spread within the footprint, turned periodically for 7 days and then stockpiled for use.	1 2	No contaminated soil observed in Stage 2.	None	
Training	Has any training been provided to site custodian? Training of CofA, operation and maintenance.	3 1	Training is provided annually on safety issues.	Provide training once an updated Development & Operation Plan is approved. Provide a digital copy of latest Annual Monitoring Report to weigh scale operator.	Township to consider providing weigh scale operator with a used laptop equipped with a USB port so documentation required by ECA can be provided.
Records	Maintain daily records; Monthly summary of quantity and types of waste disposed; Copy of CofA at site.	1 1 1	All waste and sand (used for daily cover) coming onto site should be weighed and recorded.	Volume of wood chips after chipping (stockpile dimensions) to be measured so volume can count towards diversion.	
Loads Refused	Date; Name of person; Company name on vehicle and vehicle description; Waste refused; Reason for refusal.	1	Procedure in place for load refusal.	Municipal hazardous waste to be directed to the Renfrew hazardous waste depot.	
Instructions to Site Supervisor:					
Additional Comments: (1) (2)					

* Reference:

1 - Certificate of Approval Number A412605 dated September 30, 1998 and Notice 1 dated December 4, 2000.

2 - Golder Associates. June 1997. Site Development, Operations and Closure Plan, Township of McNab Waste Disposal Site.

3 - Ministry of the Environment. November 1993. Guidance Manual for Landfill Sites Receiving Municipal Waste.

Stantec Consulting Ltd.
400-1331 Clyde Avenue
Ottawa Ontario, Canada
K2C 3G4
Tel: (613) 722-4420
Fax: (613) 722-2799

McNAB / BRAESIDE LANDFILL
OBSERVATION REPORT

Environmental Compliance Approval Number A412605

Authorized Operations – Landfill and Oil Transfer Station

Total Site Area – 64.3ha, Part of West ½ Lots 18, 19 Concession 6 Plan 49R - 12786

Service Area – Township of McNab/Braeside

Project Name:	McNab/Braeside Landfill Observation Report	Observation Date:	**December 7, 2023**	Observations by:	William Bogaart
Project Number:	163401671 Task 300.101	Weather:	-7°C, light snowfall	Site Supervisor:	Ryan Frew
Landfill Address:	573 Calabogie Road, Arnprior, ON			Reviewed by:	Gerry Lalonde — Date: December 18, 2023
				Submitted to:	Ryan Frew — Date: December 19, 2023
Landfill Address:	573 Calabogie Road Arnprior, ON K7S 3G8			Township Contact Number	(613) 623-5756 (227) Cell: 613-808-3748

Item	Objective	Reference * (page 4)	Observations	Action Required	Additional Comments
Entrance	Site locked during non-operating hours.	1	Inspection carried out during normal site operation hours: Thursday. Landfill entrance road in good condition, including snow removal and sanding. CSP culvert crossing of access road near Calabogie road installed 2019: no issues observed. Dochart Creek ice and snow covered at both ends of CSP.	None	Arrived at 08:15 and access gate was closed. Site was opened by scalehouse operator at 08:30.
Gate	Gate condition	2	Entrance gate in good condition Padlocked after hours.	None	
Main Entrance Sign	Sign to display; Name of Site; CofA number, Operating authority and their telephone number and mailing address; Hours of operation; Emergency telephone number; Waste types accepted; Tipping fees.	1	Entrance sign erected in 2014: good condition and legible. All required information is on the sign.	Trimming of vegetation below sign will be required in spring.	
Hours of Operation	8:30 am to 4:00 pm unless amended by District Manager.	1	Hours posted on entrance sign: 8:30am – 4:00pm Tuesday, Thursday, Saturday Closed statutory holidays.	None	
Screening	On site vegetation provides adequate screening.	2	Trees provide adequate screening.	None	
Supervision	Custodian on site when site open. Site is open on Tuesday, Thursday and Saturday.	2	Site was open on Thursday. Operations staff on duty: Scale house: Jen Loader and compactor: Glen	None	Compactor operation: Minimum once daily and as needed throughout day, depends on volume of waste each day.
Fence	Condition of fence.	2	Bear fence and page wire fences along the north and west limits have been removed due to the clearing of trees for Stage 3 development.	Reinstall page wire fence & bear fence along north & west limits if presence of bears at the site is observed.	No change to fence conditions since previous inspection.

Item	Objective	Reference * (page 4)	Observations	Action Required	Additional Comments
Transportation	Condition of all season access roads. Signs to control speed on roads.	2	Speed limit sign (50km/hr) posted at the main gate entry and at entry to the scalehouse area from the waste unloading areas. All public access roads are in good condition, including snow removal and sanding. 10k/hr sign posted at weigh scale entry. Weigh scale traffic signal lights in good condition.	None	Access road to garbage unloading area (top Stage 3A) in good condition. North access road to yard waste and wood chipping area at toe of Stage 3A and to south access road to large metal/white goods unloading area are in good condition.
Dust Control	Control dust from traffic using an application of dust suppressant.	1, 2	Site access road is well graded. No dust observed due to recent snow.		
Custodian Shelter	Condition of structure. Information/signs provided for safety and emergency procedures, telephone locations and emergency contact names & numbers; fire extinguisher locations; spill response procedures.	3 1	Landfill custodian shelter constructed 2011. Building exterior is in good condition. Building is heated. Weigh scale is operational including traffic lights. Annual inspection and calibration reports for the scale were found in the scalehouse office. Weigh scale operator advised that there were no new developments since last inspection. Fire extinguisher, eye wash station, first aid kit and AED in full view and in good condition.	Small tree adjacent to east side of scale house should be removed before it damages building siding or roof.	Scalehouse waste receipt and transfer records are manually written. There is risk of data loss with only written records. Electronic data recording would facilitate efficient data transfer and analysis. Recommend adding laptop to scalehouse operations for daily record keeping. Written record can become backup method.
Electronics	Building and surrounding area are in a safe environment.		Electronics are deposited in an open steel bin/container in diversion area near tire receiving area. Waste bin is approximately half full.	None	Electronics are removed by Contractor as part of the Individual Producer Responsibility Program.
On Site Signs	Conditions of signs at disposal areas, segregated products, waste oil.	2	All signs are in good condition. Sign at entrance to scalehouse area advises that everyone must report to scalehouse. Sign at crossroads near maintenance garage direct users to the designated waste unloading areas: Large Scape Steel, Brush, Leaf and Yard Waste, Household and Construction. Sign directs to follow road up face of Stage 2 for household and construction waste unloading.	Arrow for “Large Scrap Steel Items” points in same direction as “Household and Construction Waste”. Change arrow direction to point to the right, to follow the south access road. ‘No Dumping’ sign along south access road (adjacent to Stage 2) appears to be falling over – was struck by traffic?	Sign along access road near main gate advises users to maintain 2m separation as a precaution for COVID-19. Sign in same location advises that only debit/credit is accepted for payment.

Item	Objective	Reference * (page 4)	Observations	Action Required	Additional Comments
Equipment	What equipment is used to compact waste?		Caterpillar 816F is used for compaction as needed on daily basis and depending on waste volume received. John Deere 655K crawler loader used throughout the day to spread, shape and break up waste and to place daily cover material. Sand and chipped wood/yard waste mix are used for daily cover in Stage 3A.	Only 1 stockpile of daily cover sand was observed. Recommend at least doubling the current stockpiled sand volume. Measure and record chipped wood and yard waste volumes used as daily cover for annual waste diversion reporting.	Chipped wood/yard waste mix being used for daily cover at time of inspection. There is presently ample chipped wood/yard waste available for daily cover needs for the near future.
Noise	Can noise from on-site operations be detected at nearest sensitive receptor?	3	Track loader was operating during inspection, and it was not unusually loud. Separation distance to nearest receptors and thick forest is deemed adequate to attenuate landfill operation noise.	None.	The closest neighbour to the landfill may be able to hear heavy equipment or wood chipping equipment at Stage 3A, but the noise would not be very loud and not be heard inside the house.
Surface Drainage	Grading to prevent s/w from flowing through waste. Grading to prevent ponding near toe.	3 3	Grading and CSPs have been installed along access road to Stage 3A, drainage directed towards forest along the west boundary. Ditches were snow filled at time of inspection. No evidence of erosion or sedimentation of ditches or access roads.	Monitor condition (location, size, odour) of damp spot at base of Stage 3A throughout the year; suggest once a month.	There is a small damp area at toe of Stage 3A. Assume this to be collection point of surface runoff and leachate discharge from Sage 3A. The liquid does not appear to be collecting so it must pass through and/or over the sand at base of Stage 3A northwest slope and drain to the natural attenuation zone (marsh) immediately adjacent to Stage 3A.
Surface Monitoring	Has any sampling been done since last inspection on Dochart Creek at locations SW1, SW2 and SW3?	2	Golder Associates does the sampling.		Dochart Creek was snow covered at both ends of the CSP crossing of the landfill main entrance road.
Groundwater Monitoring	Any damage to any of 27 monitoring wells at 35 locations. Are monitoring wells in area of operations and protected?	2	Golder Associates does the sampling. Monitor BH4A/B within Stage 3 has been decommissioned by Golder Associates.		Golder Associates was not on site at time of inspection.
Landfill Gas	On site facilities are vented and no smoking signs posted at any enclosed facility.	3	Structures do not have basements so natural ventilation is adequate to avoid potential for gas accumulation. Doors to maintenance shed were closed at time of inspection.	Ensure continuous ventilation of the garage during the winter season. Keep garage door(s) open when able to promote continuous ventilation.	
Burning	Any evidence of waste being burnt? Can burn brush, trees and clean wood piles in designated locations. Is there a 30m fire break around piles.	1 2 3	No evidence of waste burning anywhere. Brush stockpile and chipped wood/yard waste stockpiles at toe of Stage 3A. There is a wood/yard waste stockpile near tipping face at top of Stage 3A for use as daily cover.	Stockpile of brush is moderately sized and wood chipping should be planned for early Spring or late Winter.	Chip brush/wood pile and use woodchips for alternate cover.
Odours	Are odours noticeable at nearest sensitive receptor or at property limit.	2	Odours were not noticeable at the weigh scale or at the site entrance. Odours noticeable at the damp area located at toe of Stage 3A northwest slope.	None	
Scavenging	No scavenging allowed. Any evidence of trespassers.	3	None observed.	None	

Item	Objective	Reference * (page 4)	Observations	Action Required	Additional Comments
Pest Control	Any evidence of pests that can pose a hazard to the health and safety of site users.	2	No evidence of rodents observed on site.	None	
Vectors	Are birds or other animals a nuisance?		Small flock of starlings, and deer tracks in snow across top of Stage 2 were observed. No nuisance wildlife observed or reported by Operations staff.	None	
Litter Control	Is litter evident beyond waste pile? Is there a litter fence?	1 2	Minimal wind-blown debris evidenced along tree line and access road to Stage 3A. Some waste exposed in east side of active face.	More cover material needs to be applied to east side of active face of Stage 3A.	
Metal	Segregated and placed in containers for removal by scrap metal dealer.	2	Scrap metal bin is full and about a dozen empty propane tanks (20 lbs size) and paint cans have been deposited beside the bin. White goods and large metals stockpile beside Stage 2 is nearly full and is extending west along the south access road.	Schedule scrap metal pickup. Secure propane tanks and paint cans for transport to Renfrew landfill when it opens May-2024.	
Rubber Tires	Segregated and stored in a fenced area adjacent to the reuse building.	2	Bin to accept tires is located near electronics collection bin, in the scalehouse area. Tire bin is currently full and there are more tires piled neatly beside the bin. There is another tire stockpile at the south limit of Stage 2 beside the white goods/large metals stockpile.	Schedule tire removal. Between the 2 storage areas estimate there are enough tires to fill 3 to 4 trailers. Discuss potential for additional bin to manage excess tires in Stage 1.	Tire Collection Network (E-Trac) is responsible for tire collection, as part of the Individual Producer Responsibility Program. Tire collection Contractor is having difficulty keeping up with demand.
Other Diversion materials	Starting in August 2003, shingles were segregated and stockpiled for removal by recycler. Segregation was stopped around 2010 because of poor market conditions.		The small household recycling bins that were lined up beside the weigh scale in August have been replaced with 4 steel skip bins. 3 bins are for cardboard (fibre) and 1 is for metal and plastic (containers). The bins range from about ¼ to ¾ full.	Diversion area near weigh scale was tidy. 1 sign indicates which bin is for Containers and which is for Fibres; stickers on each bin also indicate their intended collection material.	Fibres and Containers collection is the responsibility of Topps Environmental Solutions (TES), as part of the Individual Producer Responsibility Program.
White Goods	Metal - in designated containers. Refrigerated Appliances – must have CFC refrigerant removed and stickers attached.	2	Moderate quantity of white goods is stockpiled with large scrap metal next to the tire stockpile adjacent to south side of Stage 2.	The space is nearly full and scrap metal pickup should be scheduled.	
Waste Oil Transfer Station	Storage of waste oil in a neat and safe environment. Ensure oil building is locked at the end of the day. Waste oil should only be stored in waste oil tank or in waste oil shed.	1	Since the spring 2019 inspection, waste oil is no longer accepted. Sign on the waste oil collection shed advises users to bring their used oil to the Renfrew depot.	Lower hinge of waste oil Door to the waste oil shed needs replacement; door nearly falling off and can't be securely locked.	Several waste oil containers (assumed empty) and paint cans remain stored in building. These are deposited by public despite signage that is not allowed. Platform beside used oil shed new storage location of recycle bins.
Footprint	Is footprint delineated by stakes/posts?	2	Stakes were placed to delineate the Stage 3A footprint during the site inspection. Stakes were also set within the landfilling area of Stage 3A to indicate to Landfill Operations the available waste height remaining.		Stakes placed along north, west and south limits of Stage 3A. A 3m offset stake was also placed at each location.
Waste Type	Domestic, commercial and non-hazardous solid industrial.	1	Only municipal waste observed.	None.	

Item	Objective	Reference * (page 4)	Observations	Action Required	Additional Comments
Capacity • Stage 1 • Stage 2 • Stage 3	Maximum capacity of 1 million m^3 within a 10ha footprint as per Golder figure 7, revision 3. Capacity of 257,500 cm to height of 9.9m and area of 3ha. Capacity of 285,000 m^3 to height of 12.4m over 4.6ha. Capacity of 357,500 m^3 to height of 16.9m over area of 10ha.	2	Waste is being deposited on the north face of Stage 3A. The south edge of Stage 3A has nearly reached the current elevation of Stage 2.	Since early 2019 waste disposal has been in Stage 3A. Ministry (MECP) staff have indicated that an updated Development & Operation Plan will be requested for Stage 3 development once decision is taken regarding groundwater modeling and recommendations by Golder/WSP.	Maintain waste placement over the existing lifts in Stage 3A to delay the development of Stage 3B. Decision can be made once the MECP has provided a response to the Golder/WSP report.
Buffer	Maintain 30m minimum buffer around Stage 3 waste area.	2	Buffer distances to edge of property from proposed Stage 3A limits are acceptable.		An adequate buffer should be maintained to minimize potential for fire spread and to provide access to equipment if needed.
Leachate	Any evidence/sign of leachate breakout on slopes or ponding near toe.	3	Some surface water observed beneath the snow at toe of active landfilling face of Stage 3A. Landfill odours detected at this location.	Daily cover on the active face should reduce landfill odours.	Surface water can drain to the immediately adjacent low area which is on the landfill property.
Daily Cover	Minimum thickness of 150 mm to be applied at the end of each working day.	1	Sand and woodchips are used as daily cover. A large fine sand stockpile observed adjacent to bottom of waste in stage 3A	Use sand and chipped wood for cover material. Shredded brush stockpiled at northwest toe of Stage 3A and at top of Stage 3A for ready use as daily cover.	All chipped wood piles should be measured for reporting as waste diversion.
Daily Cover Stockpile	Keep clean granular material stockpile equal to 50 % of the quantity of the annual daily cover material.	1	Only 1 stockpile of sand observed near toe of Stage 3A.	Import more sand for mixing with chipped wood for daily cover.	Currently using just chipped wood for daily cover for Stage 3A.
Intermediate Cover	Minimum thickness of 300 mm to be applied in areas not worked for 30 days. Remove cover before starting new lift.	1	Township has placed an interim cap on Stage 2. Snow cover on Stage 2 did not allow for inspection of intermediate cover condition.	Top and sides of Stage 2 should be inspected for settlement and erosion of intermediate cover next Spring.	Heavy vegetation growth on south face of Stage 2 is minimizing erosion and windblown debris.
Closure	Have any areas reached final contours? Condition of closed areas (if any), 600mm of earth material and 100mm of topsoil and seeded.		Waste has not reached final approved contours. Stage 2 has intermediate cover and has not reached final approved waste elevation.	None	Township awaiting comments from the Ministry (MECP) on a Golder report regarding groundwater modeling that was done to support lateral expansion of waste filling in Stage 3.
Contaminated Soil	Petroleum hydrocarbon contaminated soils (non-hazardous and meet Reg. 347) can be used as daily cover provided the volume stored does not exceed the annual daily cover requirements and it is spread within the footprint, turned periodically for 7 days and then stockpiled for use.	1 2	No contaminated soil observed in Stage 2 or elsewhere on site.	None	Landfill operation staff do not recall receiving contaminated soil in 2023.
Training	Has any training been provided to site custodian? Training of CofA, operation and maintenance.	3 1	Training is provided annually on safety issues.	Provide training once an updated Development & Operation Plan is approved. Provide a digital copy of latest Annual Monitoring Report to weigh scale operator.	Township to consider providing weigh scale operator with a used laptop equipped with a USB port so documentation required by ECA can be provided.
Records	Maintain daily records. Monthly summary of quantity and types of waste disposed. Copy of CofA at site.	1 1 1	All waste (for landfilling or diversion) and sand (for daily cover) received at the site should be weighed and recorded.	Volume of wood chips after chipping (stockpile dimensions) to be measured so volume can count towards diversion.	

Item	Objective	Reference * (page 4)	Observations	Action Required	Additional Comments
Loads Refused	Date; Name of person; Company name on vehicle and vehicle description; Waste refused; Reason for refusal.	1	Procedure in place for load refusal.	Municipal hazardous waste to be directed to the Renfrew hazardous waste depot.	Landfill operation staff do not recall refusing hazardous waste in 2023.

Instructions to Site Supervisor:

(1) Schedule pickup of tires and scrap metal.
(2) Import more clean sand for daily cover.
(3) Review with Landfill Operations the stakes placed in Stage 3A waste filling area for approximate remaining vertical air space.

Additional Comments:

(1) Stockpiled soil and chipped wood observed at top of Stage 2. Soil is not suitable for daily cover but could be used for other purpose: intermediate cover, final cover. Chipped wood likely suitable for daily cover.
(2) Small derelict motorboat located beside the tire storage adjacent to Stage 2. Recommend disposal at appropriate facility.
(3) Recommend adding “NO SMOKING” sign at diesel storage tank near garage.

*** Reference:**

1 - Certificate of Approval Number A412605 dated September 30, 1998, and Notice 1 dated December 4, 2000.
2 - Golder Associates. June 1997. Site Development, Operations and Closure Plan, Township of McNab Waste Disposal Site.
3 - Ministry of the Environment. November 1993. Guidance Manual for Landfill Sites Receiving Municipal Waste.a

June 21, 2022 Reference No. 19130748-002

Thandeka Ponalo
Ministry of the Environment, Conservation and Parks
Ottawa District Office
2430 Don Reid Drive
Ottawa ON K1H 1E1

RESPONSE TO MECP GROUNDWATER AND SURFACE WATER TECHNICAL SUPPORT COMMENTS REGARDING THE HYDROGEOLOGICAL IMPACT ASSESSMENT FOR THE MCNAB WASTE DISPOSAL SITE

Dear Ms. Ponalo,

Golder Associates Ltd. (Golder) was retained by the Township of McNab/Braeside (the Township) to complete a hydrogeological impact assessment in support of updates to the Development and Operations plan for the McNab Waste Disposal Site. The objective of the hydrogeological impact assessment was to forecast site compliance (i.e., groundwater and surface water compliance) throughout the life of the McNab Waste Disposal Site assuming full development of the landfill to provide 1 million cubic metres of airspace (including Stages 2 and 3), as described in the existing approved Development & Operations plan. A report on the hydrogeological impact assessment was submitted to the Ministry of the Environment, Conservation and Parks (MECP) in February 2021[1]. The MECP submitted the report to their Eastern Region Technical Support Section resulting in review comments provided by the MECP surface water and groundwater reviewers in letters dated April 19, 2022 and April 21, 2022, respectively.

Golder has been further retained by the Township to respond to the comments presented in the MECP review letters. The sections below provide responses to the comments presented by the groundwater and surface water reviewers.

Response to Groundwater Review Comments

The numbered comments from the Conclusions and Recommendations section of the letter dated April 21, 2022 from the MECP groundwater reviewer are reproduced along with responses below.

Groundwater Comment #1

Comment: *Golder concludes that an additional CAZ to the northeast would satisfy Condition 39 of the ECA and keep the waste disposal site in compliance with B-7 right up to full landfill capacity. I am in general agreement with the Guideline B-7 assessment completed by Golder, and I support the recommendation to purchase additional CAZ to provide for further landfill development; however, while Guideline B-7 may be satisfied from the groundwater perspective, this approach may not adequately consider potential surface water impacts resulting from groundwater discharge to Dochart Creek and the poorly drained area to the northeast. Due to the thinning of the sand layer towards the north, and the complete pinch out of this unit towards the northeast, most monitoring wells located along the periphery of the site were screened in the silty clay layer, which has hydraulic conductivity one to four orders of magnitude lower and vertical flow in the upward direction. Thus, existing groundwater monitoring results for wells screened in the silty clay unit may be an underrepresentation of leachate*

[1] Golder, 2021. Hydrogeological Impact Assessment, McNab Waste Disposal Site, Township of McNab/Braeside, Ontario. Golder Associates Ltd. Report No. 19130748-001, February 2021.

concentrations / migration in the more permeable sand unit. Where the sand thins, e.g., to 0.1 m at BH99-5 in the north, the unit may no longer be perennially saturated, but could still convey leachate at higher concentrations and at faster rates towards Dochart Creek in pulses during wet events. A similar fate and transport mechanism could be present in the poorly drained area to the northeast, where the sand unit completely pinches out and it is topsoil / peat down to 0.2 m (BH92-2) that overlies the silty clay layer. If correct, given that existing results (largely from groundwater pulled from the underlying silty clay layer) were used to calibrate the model, the model may be biased low. Additional insight and/or investigation from Golder on this is requested. However, with groundwater presenting very close to, if not at, the surface in many of the periphery areas on-site, potential surface water impacts are seen to be the driving concern in these areas; therefore, the case for the McNab/Braeside WDS ECA amendment must ultimately satisfy any concerns raised by the MECP Surface Water Specialist.

Response:

Silty clay is present across the site beneath the shallow sand layer and/or peat deposits. The upper portion of the silty clay deposit is a weathered crust, which has been observed in all boreholes that have encountered the silty clay deposit and has been observed to have a thickness up to 3 metres. This upper weathered crust zone is typical of the marine clay deposits that underlie areas of eastern Ontario. The weathered crust at the McNab Landfill site is characterized by a red-brown to grey-brown colour and occasional seams of sand (with observed thickness up to 0.2 metres). The weathered crust has secondary permeability features in the form of an interconnected network of fractures caused by geologic weathering and freeze-thaw cycles. This contrasts notably with the underlying intact portion of the unweathered silty clay deposit that is grey in colour, is not fractured, and has a low hydraulic conductivity that is on the order of 10^{-10} to 10^{-8} metres per second. We agree that the leachate plume is not expected to extend down into the grey silty clay; however, due to fracturing the weathered crust unit is moderately transmissive (i.e., with hydraulic conductivity on the order of 10^{-7} to 10^{-6} metres per second) and is interpreted to be a pathway for leachate migration in the shallow groundwater, especially where the overlying sand layer has pinched out. The monitoring well referenced in the comment, BH99-5 in the north, is screened entirely within the weathered crust since the weathered crust is the shallowest unit present at this location (i.e., beneath the topsoil); as such, this monitoring well is considered to be appropriately screened to encounter the shallow groundwater flow that is expected, based on the modelling, to one day contain the leachate plume. It is for the same reason that the monitoring wells installed in BH20-1, 20-2 and 20-3 for the purpose of determining the location of and parameter concentrations at the advancing plume front towards the northeast were installed specifically within the shallow sand and/or weathered crust zone. As such, it is groundwater information from the shallow sands or weathered crust zone that was used to calibrate the model, which is considered to be appropriate for and representative of the site conditions related to leachate plume migration from the disposal area.

Groundwater Comment #2

Comment: *Golder has been evaluating compliance with Guideline B-7 based on the concentrations measured in wells BH99-1 and BH99-2. It was noted that well BH99-1 is screened in the silty clay unit and therefore, may not be appropriate as an accurate indicator of leachate migration (see point 1). Boundary wells BH92-1 and BH99-5, located to the west, are also screened in the silty clay layer, but have measured exceedances, at times, related to DOC, Fe, and/or Mn. While BH99-2 (Guideline B-7 well) is appropriately screened in the sand, and does not show any signs of leachate, the nearest wells that are screened in the sand (with results) include the well clusters at BH91-1 and BH8; these wells have reported exceedances, at times, for DOC, TDS, Fe, and/or Mn. Given these facts, an explanation from Golder is needed on why they think B-7 is being met.*

Response:

Monitor BH99-1 is screened in the weathered crust zone of the silty clay unit. As noted in our response to Groundwater Comment #1, the weathered crust is a potential pathway for leachate plume migration in the shallow groundwater. The screen depth at monitor BH99-1 was selected for the screen to be beneath the water table to allow for the collection of a groundwater sample. It is noted that even at this screen depth this monitoring well has contained a water level too low to sample during four monitoring events since 2015. Monitors BH99-1 and BH99-2

(both located at the north property line) are properly screened (in the weathered crust zone and sand/weathered crust, respectively) to encounter shallow groundwater that is expected, based on the understanding of the hydrogeological setting and reflected in the modelling, to one day be affected by the leachate plume. The groundwater quality of these two monitoring wells consistently meets RUPO; as such, the site is interpreted to operate in compliance within Guideline B-7.

BH92-1 and BH99-5 are not “boundary wells” since they are not positioned at a groundwater compliance boundary. These two wells are on-site wells that allow for monitoring of the leachate plume migration. As such, the calculated Guideline B-7 compliance values for Fe, Mn and DOC are not relevant to these monitoring locations and the quality of the groundwater at these monitoring wells does not represent exceedances of the allowable Guideline B-7 values or affect landfill site compliance with Guideline B-7. It is noted that Dochart Creek is hydraulically downgradient of these two wells and that along this portion of the property boundary the shallow groundwater discharges to Dochart Creek; site compliance in this part of the site is related to surface water compliance criteria.

Groundwater Comment #3

Comment: *Leachate effects have been observed in monitoring well BH6, located further south on the existing waste footprint, and in surface water samples from the poorly drained area east / northeast of the landfill; specifically, at SW4, SW6, SW7, SW8, and SW9, which have consistently recorded elevated alkalinity, ammonia, boron, cobalt, COD, calcium, chloride, DO, hardness, iron, manganese, magnesium, phenols, potassium, sodium, TDS, and total phosphorus. In some cases, the concentrations exceeded the PWQO. Given the known exceedances in surface water here, the lack of groundwater data in this area is concerning and may be a source of error for model prediction; for example, groundwater data is not available for locations in the vicinity of monitoring wells BH-4, BH92-4, and BH92-3, despite that fact that the ‘full footprint’ modelling predictions show that groundwater flow in this direction becomes a dominant flow pathway. Coupled with that, it is not clear to me why there is little to no contaminant movement predicted in this direction under the ‘2020 conditions’ modelling predictions. To me, this raises questions about the accuracy of model predictions. I recommend that Golder provide additional information to clarify these items.*

Response:

Of the locations noted in the comment, the surface water quality at SW8 has not been interpreted to have been affected by landfill leachate.

As shown on Figure 4 of the Hydrogeological Impact Assessment report, for the current (2020) landfilling area the groundwater flow model does not predict leachate migration in groundwater in the direction north of the 2020 fill area, i.e., in the direction of BH92-4 and 92-3. Note that the location of BH4 was adjacent to the limit of the more recent enlargement of the disposal area; this monitoring well was sampled until 2019 when it was accidently destroyed, and it was then decommissioned.

However, as also shown on Figure 4 of the Hydrogeological Impact Assessment report, the groundwater flow model predicts increased leachate migration in the groundwater towards the northeast property line only under full development conditions due to the extension of the full development waste footprint in this northward direction. It is the location of the landfill footprint (leachate source) in relation to the shallow groundwater flow system that determines the presence and direction of leachate plume migration. Based on the modelling result shown on Figure 4 and the density of the flowpath lines, the new area of flow paths resulting from the enlarged disposal footprint becomes a flowpath but not a ‘dominant’ flowpath.

The monitoring wells at BH92-3 and BH92-4 are still available, and monitoring of these locations could be added back into the annual program in future. It is noted that in Section 9.0 of the Impact Assessment report it is recommended to 1) install an additional monitoring location(s) between the full landfill footprint and the northeast portion of the property line and 2) add additional CAZ lands.

Groundwater Comment #4

Comment: *Care needs to be taken when considering monitoring results from wells screened in the underlying silty clay, as they may not be representative of the maximum amount of leachate migrating from the source (discussed earlier in point 1). Where the sand and peat units overlying the silty clay thin (down to 0.1 m in places), installation of additional monitoring wells is recognized as being an impractical solution. Alternative methods are needed in these areas to confirm the fate and transport of leachate in the sand unit, or where it discharges therefrom.*

Response:

As per our response to Groundwater Comment #1, we agree that the leachate plume is not expected to extend down into the grey silty clay; however, the weathered crust portion of the silty clay deposit is moderately transmissive and is interpreted to be an important leachate migration pathway, especially where overlying sand and/or peat units thin and pinch out. It is considered that the placement of the monitoring well screens is appropriate to track plume development and migration. It is known that the sand unit pinches out before Dochart Creek; in the area between where the sand pinches out and the Creek, either 1) the leachate-impacted groundwater will discharge to surface (which possibly could be observed) and travel overland in which case impacts to surface water will be monitored in the Creek, or 2) it will continue as groundwater in the weathered clay zone and will be tracked through groundwater monitoring before the plume reaches the Creek. It is not considered that ‘alternative methods’ of monitoring are required.

Groundwater Comment #5

Comment: *While contaminant concentration projections were performed for boron, chloride, and ammonia, and in most cases represent conservative tracers, none of these represent the current contaminants of concern in groundwater at the site, which are DOC, Fe, Mn, and TDS. These should be modelled as well and may be useful as an extra source of data for calibration.*

Response:

The rationale for selection of chloride, boron and ammonia for predictive modelling is provided in Section 1.3 of the Impact Assessment report. These are characteristic of municipal landfill leachate and are considered to be contaminants of concern at this landfill site. Based on our experience, they are contaminants of concern at many municipal landfill sites as related to tracking the advancement of a groundwater plume, the identification of trigger parameters and trigger concentrations and assessing groundwater and/or surface water compliance. The monitoring at this site shows that chloride is the key parameter for tracking the presence and advance of the groundwater plume towards the surface water and groundwater compliance boundaries.

Iron and manganese naturally occur in soil, groundwater and surface water and their concentrations are often naturally elevated in excess of the ODWQS or PWQO; they are also commonly elevated in areas underlain by organic soils such as the peat soils that underlie an area of the McNab Landfill site. Elevated DOC is also often encountered in areas underlain by organic soils. In the absence of the typical leading leachate indicators chloride, boron and ammonia, elevated concentrations of other parameters such as iron, manganese, DOC and TDS are not considered to be associated with leachate impacts.

Because of their natural occurrence and geochemical reactivity that typically results in highly varying concentrations over time in leachate and both naturally occurring and leachate-impacted groundwater or surface water, it is problematic to model iron or manganese for modelling calibration or predictive effects. DOC is an unconservative parameter in terms of leachate impacts and is not considered to be a critical parameter for groundwater compliance assessment and it does not have a surface water PWQO for assessment purposes. TDS is a measure of total ionic strength of the various dissolved constituents in the groundwater, and it is well known that the concentration of the various constituents that result in the TDS concentration vary over time due to natural reactions in the subsurface such as ion exchange. Chloride (as a constituent of TDS) is a recognized parameter in terms of assessing leachate effects and compliance under Guideline B-7. Efforts could be made to try and model the suggested parameters, but selection of the source strength of these parameters in leachate as well as factors

for retardation and geochemical reaction has a high degree of uncertainty. However, such modelling attempts are not expected to improve upon what is already a well calibrated model or assist in predicting future compliance based on this calibrated model. As such, it is not considered necessary or beneficial for the purpose of assessing the expected performance of the McNab Landfill under full development to carry out the additional modelling suggested by the reviewer.

Groundwater Comment #6

Comment: *It was stated that on-going monitoring remains critical to continue validating model accuracy. Additional well installations were also recommended by Golder between the full landfill footprint and the current northeast property line for better understanding and tracking of leachate in this area. I agree with this and stress that the screened intervals need to be appropriately placed to capture leachate migration in all applicable stratigraphic units. This may require some exploratory work to determine the best placement location and further consideration of the degree of hydraulic connection between units.*

Response:

On-going monitoring will be important to verify the results of the modelling completed and to assess future site compliance and the need for and timing of implementation of contingency measures. As stated in the Hydrogeological Impact Assessment report, the existing groundwater monitoring program is generally considered appropriate to monitor leachate migration; however, an additional monitoring well(s) between the full landfill footprint and the current northeast property line (as well as bringing BH92-3 and BH92-4 back into the groundwater quality monitoring program) could be considered to provide better understanding and tracking of leachate migration in this area. As outlined in the response to Groundwater Comment #1, the weathered crust, which comprises the upper silty clay zone across the site, is interpreted to convey leachate-impacted groundwater and is the primary pathway for leachate migration in the groundwater in areas where the sand deposit is not present. As such, in areas of the site where the silty clay is located near the surface, monitoring wells should be screened in the weathered crust zone so that they can encounter the leachate plume when the plume reaches those monitoring locations.

Response to Surface Water Review Comments

The numbered comments from the Conclusions and Recommendations section of the letter dated April 19, 2022 from the MECP surface water reviewer are reproduced along with responses below.

Surface Water Comment #1

Comment: *Leachate effects are evident at all monitoring locations in the poorly drained area northeast and east of the current waste mound, including background. While significant impairment is unlikely at this time, intensification of leachate effects in that area reasonably predictable with continued development of Stage 3, without additional measures to control leachate migration. Additional monitoring in the tributaries to Dochart Creek draining from the east property line may be required.*

There are no appreciable leachate impacts to Dochart Creek immediately north of the Site at this time, but leachate impacted groundwater is expected to eventually discharge to Dochart as the primary pathway for leachate migration. Additional information is needed to determine whether additional downstream monitoring is justified, as discussed above.

Response:

A number of disconnected surface water features are present to the east and northeast of the waste mound (i.e., the “poorly-drained area”). These surface water features have been documented and sampled for approximately 30 years as a component of the annual surface water monitoring program. While these features are generally present during monitoring events conducted in the spring and fall, the surface water features in the poorly-drained area may be dry depending on seasonal conditions and negligible to limited flow has been observed within each of the isolated surface water features. As reported in the Hydrogeological Impact

Assessment report, a site visit was conducted by Golder in 2019 that included an extensive walk over of the site area, with the intent of identifying surface drainage channels at the site including within the poorly-drained area. No distinct drainage channels to the east and northeast of the waste mound were identified during the 2019 site visit. As such, the conceptual model for the site is that no permanent off-site drainage channels exist that convey surface water over the northeast property boundary. The reasoning for the reviewer's differing interpretation and description of the surface water system is not apparent.

As noted by the surface water reviewer's comments, there was a historical monitoring station (i.e., SW3) located in Dochart Creek located further downstream from the existing SW2 monitoring location. Monitoring location SW3 was removed from the sampling program in 2003. From review of historical correspondence in our files, the removal of SW3 from the program was discussed with and agreed to by the MECP District Office in 2003, with the reasoning being that the groundwater plume had not yet reached Dochart Creek and downstream surface water quality was being adequately monitored at SW2.

As recommended in the Hydrogeological Impact Assessment report, the updated Development & Operations Plan would include a revised surface water and groundwater trigger mechanism, that would use on-going groundwater and surface water monitoring to track plume migration and surface water quality and set triggers at parameter concentrations below the compliance values such that contingency measures could be implemented prior to the site going out of compliance. Additional surface water stations could be added to the existing monitoring program, such as the reinstatement of sampling within Dochart Creek in the vicinity of SW3.

Surface Water Comment #2

Comment: *Monitoring data collected in 2020 suggests that Dochart Creek, which contains highly sensitive cold water habitat, may have very low flows in the mid-to-late summer. As such, there is likely limited capacity for dilution or assimilation at those times. This is problematic for a naturally attenuating site, which will ultimately discharge leachate impacted groundwater to area surface waters without controls over the timing, quantity or quality. It is also notable that no flow or water quality information is available for the cold water tributaries to Dochart Creek east of the Site. These tributaries are slightly downgradient of current leachate impacted surface water monitoring locations and appear to originate within the projected pathway for leachate migration.*

Response:

While the McNab Landfill site currently operates in compliance as a natural attenuation site, it is recognized that a robust monitoring program is necessary to verify if compliance can be maintained over the life of the site and post-closure and that contingency measures, including engineered controls, would have to be implemented in advance of any non-compliance. As recommended in the Hydrogeological Impact Assessment, the updated Development & Operations Plan would include a revised surface water and groundwater trigger mechanism, that would use on-going groundwater and surface water monitoring to track plume migration and surface water quality and set triggers at parameter concentrations below the compliance values such that contingency measures could be implemented prior to the site going out of compliance. The contingency measures would be provided in the updated Development & Operations Plan and are expected to be similar to the current contingency plan and consist of a collection trench constructed to intercept shallow leachate-impacted groundwater upstream of Dochart Creek and removal of the collected groundwater for treatment. This approach, which will change the site from one relying on natural attenuation to one using engineering controls to achieve compliance, will provide the control on potential leachate impacts on surface water.

Regarding Dochart Creek providing cold water habitat, the proposed approach assesses surface water compliance relative to the generic PWQO that was developed to be protective; as such, use of the PWQO for compliance assessment is not affected by the specific habitat or aquatic species within Dochart Creek.

Regarding "cold water tributaries to Dochart Creek east of the site", please refer to the response to Surface Water Comment #1.

Surface Water Comment #3

Comment: *The method used to estimate low flows in Dochart Creek may be overly simplistic (i.e. may over- or under-estimate available assimilative capacity), as discussed above. The flow statistics presented, both measured and estimated, should be used with caution and may not be appropriate for the extrapolations made in the surface water impact assessment.*

Response:

To provide a comprehensive answer to Surface Water Comment #3, we have reproduced additional statements made throughout the surface water review letter on the topic of low flow estimation below.

> *"Flow would typically be expected to increase with distance downstream. Measured flows at SW2 were often lower than at SW1 (upstream) in the data presented. The reason for this is not discussed in the report (i.e., Were transect locations appropriate? Is the study site within a losing reach? What equipment / method were used to measure flows?)."*

The surface water monitoring locations (SW1 and SW2) were chosen to represent the streamflow regime of Dochart Creek within the vicinity of the McNab Site. This included establishing transect locations to capture the manual flow data directly upstream and downstream of the Site. Manual flow measurements at both locations were completed using the following methodology.

- A measuring tape was strung across two wooden stakes at each surface water monitoring location to establish a consistent transects for each of the nine monitoring visits.
- Using a streamflow meter and rod setup, depths and streamflow velocities (measured at 60% of the depth) were measured at 10 cm intervals across each transect.
- Using the flow velocities, depths, and distance of each interval, the streamflow was calculated by multiplying the flow area by the flow velocity.

Out of the nine site visits conducted, higher upstream flow measurements were recorded during a total of six visits from April 20th – September 22nd in 2020 at SW1, as seen below in Table 1.

Table 1: Manual Flow Measurements at SW1 and SW2

Date	Flow Rate	
	SW1	SW2
April 20, 2020	333.3	232.9
May 22, 2020	43.5	28.3
June 23, 2020	22.2	13.0
July 28, 2020	7.0	5.6
August 20, 2020	5.0	3.6
September 22, 2020	11.6	5.0

Notes: All flow rates reported in litres per second

During these monitoring visits, no abnormalities were witnessed or recorded by the field technicians at SW1 or SW2. We believe that this watercourse is a potential losing reach as the consistent higher upstream flow values show a pattern of lost flow that would not be expected to be caused by field measurement error. It is likely that when frozen conditions ended (i.e., March), the flow regime changed within the reach between SW1 and SW2 causing a potential losing reach. This could be attributed to groundwater / surface water interactions or interflow that occurs when sediment and soils are not frozen.

> *"Nine monthly measurements of flow are available for SW1 and SW2 in Dochart Creek, collected October 2019 through September 2020. While it is not unusual to have limited flow information, it is unclear how representative these data and the calculated average flows are for use in the extrapolations presented."*

We agree that an extensive yearly record would be preferred; however, the flows were taken monthly to establish a seasonal record of conditions for Dochart Creek directly upstream and downstream of the site. Also, the daily continuous flow data obtained from the Water Survey of Canada for 2020 for Buckshot Creek showed an average annual flow of 2.41 m^3/s which is slightly above the station average annual flow of 2.13 m^3/s. Note that this average annual flow for Buckshot Creek (2.13 m^3/s) only includes the flows recorded after 2005, as the flows recorded before were seasonal and not fully representative of an annual average. This shows that any extrapolated flows from Buckshot Creek would likely be an overestimate of potential flows in Dochart Creek. Further comparison between Dochart Creek, Buckshot Creek, and other nearby watercourses with gauging stations is provided in the sections below.

> *"No justification is provided for the use of the ratio of average flows over other methods for estimating the 7Q20 flow in Dochart Creek (i.e., area reduction method with calibration using measured flows). Support for the choice of extrapolation technique is needed."*

The ratio of average flow extrapolation method was chosen to estimate the 7Q20 flow in Dochart Creek so that the flow estimate would be considerate of the specific yields from the site. It was suspected that Dochart Creek possibly behaved as a headwaters of a smaller catchment area, compared to a yield of a gauged river with a larger catchment. Since we had seasonal measured flows at the site, we wanted to utilize these. If we had tried to compare the catchment areas between Dochart Creek and Buckshot Creek there was a possibility that the area reduction would result in a ratio not representative of the Dochart Creek yield and therefore an unrepresentative 7Q20.

> *"Insufficient information is provided to corroborate the calculated 7Q20 in Buckshot Creek (i.e., Why was the selected calculation used? Within the available dataset, how were estimated flows or flows affected by beaver activity treated? Were there gaps in the dataset?)."*

The 7Q20 was estimated using continuous daily flow data from the Water Survey of Canada hydrometric station at Buckshot Creek near Plevna, Ontario (02KF017) over the period of 1993 – 2019. Flow ratios were established by pairing the manual flow measurements to an average daily flow measurement from Buckshot Creek for each specific date. Using the continuous daily averaged data, a rolling 7-day average over the entire period of record was established and then the minimum flow for each year was placed into a Pearson curve fitting model. The Pearson curve fitting model we used compared the 3 Parameter Log-Normal, Extreme value, Log Pearson III, and Weibull distribution fitting curves and selected the best option based on the inputted data. A 3 Parameter Log-Normal analysis was therefore selected as the best option and the 7Q20 was estimated and the ratio was applied to the estimate the Dochart Creek 7Q20.

Within the available data set, there was no mention of beaver activity. The only gaps in data occurred prior to 2005 as the continuous flow data was recorded seasonally (i.e., between April and September). Only the flows within those months were considered for 7Q20 analysis.

> *"No information is provided on the comparability of Buckshot Creek to the study site (e.g., characteristics of the streams, drainage areas, physiography, stream order, groundwater regime), nor is justification provided for the choice of reference watershed. Buckshot Creek is located approximately 65 km southwest of the waste disposal site, with notable differences in watershed characteristics, including main channel slope, percent wetlands, percent agricultural/rural area and percent open waters indicated in OFAT. In addition, Buckshot Creek has been classified as warm water creek (with a small portion designated as cool water habitat downstream of the gauging site), while Dochart Creek and its tributaries are classified as having a cold-water thermal regime. These differences suggest that these systems may differ in their responses to high and low water conditions."*

The 7Q20 estimate requires the evaluation of publicly available river gauge data. These gauging stations are typically established on larger river systems, often to monitor flooding and potential for water usage. These larger river systems differ from creeks with much smaller catchment areas (including the headwaters of the same system). For that reason, the estimate of the 7Q20 of Dochart Creek using a comparison with Buckshot Creek is a modelled approximation based on typical industry practice.

A comparison of the characteristics of similar watercourses in the general vicinity of the Site with an extensive gauging record are detailed below in Table 2.

Table 2: Water Survey of Canada Gauging Station Comparison

Watercourse Stations	Drainage Area (km^2)	Slope of Main Channel (m/km)	Area – Lakes/ Wetlands (%)	Proximity to Site	Continuous Data Record	Thermal Regime (Cold/Cool/Warm) [1]
Dochart Creek at Study Site [3]	6.4	10.12	8	n/a	n/a	Cold
Bonnechere River near Castleford [2]	2,364.8	2.10	16	8.5 km NW	1962 - 2022	Warm (BRWP, n.d.)
Indian River near Blakeney [2]	212.4	4.25	16	29 km SE	2002 - 2022	Warm (MVC, 2019)
Clyde River at Gordon Rapids [2]	291.4	4.66	15	33 km NW	1971 - 2022	Warm (MVC, 2019)
Jock River near Richmond [3]	539.2	0.75	30	61 km SE	1969 - 2022	Warm (with Cool – Warm water reaches) (RVCA, 2016)
Buckshot Creek at Plevna [3]	150.6	4.02	13	65 km SW	1993 - 2022	Warm
Kemptville Creek near Kemptville [2]	412.4	0.51	35	83 km SE	1969 - 2022	Warm (RVCA, 2013)
South Castor River at Kenmore [3]	183.4	0.90	20	90 km SE	1978 - 1997, 2003 - 2022	Cool – Warm (City of Ottawa, 2011)
Bear Brook near Bourget [3]	447.6	0.85	19	108 km SE	1971 - 2022	Cool – Warm (City of Ottawa, 2011)
Riviere Beaudette Near Glen Nevis [3]	132.9	1.13	28	160 km SE	1983 - 2022	Warm (RRCA, 2006)

Notes:

[1] Refers to the thermal regime in the vicinity of the gauging station.

[2] Refers to a gauging station on a regulated watercourse.

[3] Refers to a gauging station on a natural (unregulated) watercourse.

As detailed in Table 2 above, all the gauging stations with 20+ years of flow data within the vicinity of the Site had notable differences in watershed characteristics in comparison to Dochart Creek. All but one of these gauging stations were placed on a watercourse with a warm thermal regime; however, Bear Brook still has a relatively high thermal regime and is classified as a cool-warm watercourse.

In comparison to Dochart Creek, Buckshot Creek is more comparable by slope of the main channel and percentage of lakes/wetlands within the catchment, when compared to the other unregulated flow watercourses. While Buckshot Creek is located 65 km northwest of the site, it is the closest natural watercourse with a gauging station; therefore, it was predicted that Buckshot Creek and Dochart Creek would experience similar responses to draughts and local precipitation than the other more distant watercourses with gauging stations.

Surface Water Comment #4

Comment: *Given the limited supporting information provided, I cannot confirm that the surface water model is sufficiently calibrated or reliable. Agreement between measured and predicted conditions cannot be confirmed for the estimated 7Q20 condition for any of the parameters evaluated.*

Response:

To provide a comprehensive answer to Surface Water Comment #4, we have reproduced below additional statements made throughout the surface water review letter on the topic of model calibration.

> *"It is unclear how (or if) background surface water quality in Dochart Creek was incorporated into this assessment (i.e., Are the concentrations reported intended to represent the additional concentrations of the subject parameters or the final concentration after mixing? If it is the latter, what values were used to represent background water quality?)."*

The forecasted concentrations represent the final concentrations following mixing with the background quality of Dochart Creek. As described in Section 7.1. page 13 of the Hydrogeological Impact Assessment report, the background concentrations were taken as the average observed concentrations at the Dochart Creek background station from the surface water monitoring program.

> *"Based on current monitoring data, leachate does not yet appear to have reached SW2 in Dochart Creek in any appreciable quantity, which may limit the value of the comparisons between model predictions and current water quality."*

It is agreed that leachate-impacted groundwater is interpreted to have not yet reached Dochart Creek; as such, the comparison of simulated and measured parameter concentrations in Dochart Creek cannot form the only line of evidence to support the calibration of the model. Additional lines of evidence supporting the model calibration are presented in the Hydrogeological Impact Assessment report, including:

- The comparison between simulated and measured groundwater elevations at monitoring wells (Section 6.3 and Figure 4);
- The comparison between simulated groundwater flow pathways and the conceptual hydrogeological model (Section 6.3 and Figure 4); and,
- The comparison between simulated and measured parameter concentrations at on-site monitoring wells (Section 7.2.2).

The model is considered to be satisfactorily calibrated based on the assessment of each of the above comparisons. On-going monitoring will be important to verify the results of the modelling and keep abreast of leachate-impacts on groundwater and surface water.

> *"In addition to the poor correlation for boron under the estimated 7Q20 conditions, noted above, predicted 7Q20 ammonia concentration is an order of magnitude higher than both the 2018-2020 (<0.01-0.09 mg/L) and historical range in Dochart Creek (<0.01-0.11 mg/L)."*

No sampling events have occurred during 7Q20 flow conditions in Dochart Creek; as such, at this time, parameter concentrations in Dochart Creek during extreme low flow conditions cannot be known. While the leachate plume is interpreted to not have reached Dochart Creek, it is considered conservative that the model simulates a minor contribution of leachate discharge to the Creek that results in elevated parameter concentrations during the low flow event.

> *"While the peak chloride concentration does initially appear to correlate well with model predictions for the estimated 7Q20 conditions, that measured value (reported in 2018) appears to be an outlier, more than double the next highest concentration on record for Dochart Creek and reflecting background effects, apparently unrelated to the landfill. This is not noted by the consultant and should not be considered to support predicted landfill impacts. Agreement with the model cannot be confirmed for the estimated 7Q20 condition for any of the parameters evaluated."*

If the elevated chloride concentrations measured at both SW1 and SW2 are removed from consideration, the observed concentration range (2018 to 2020) for chloride in Dochart Creek becomes 9 mg/L to 38 mg/L. The concentration of chloride simulated for 2020 for the minimum, 25th percentile and median flow rates of Dochart Creek are 33 mg/L, 29 mg/L and 27 mg/L, respectively, which all fall within this range. Only the simulated concentration of chloride for the 7Q20 flow rate (93 mg/L) exceeds this range. As stated above, no sampling events have occurred during 7Q20 flow conditions in Dochart Creek; as such, at this time, parameter concentrations in Dochart Creek during extreme low flow conditions cannot be known. While the leachate plume is interpreted to not have reached Dochart Creek, it is considered conservative that the model simulates a minor contribution of leachate discharge to the Creek that results in elevated parameter concentrations during the low flow event. As shown, the model calibrates well when parameter concentrations forecasted for observed flow rates in Dochart Creek are compared to the measured results.

> *If only 2020 conditions are considered, there is a lack of agreement between measured and predicted ammonia concentrations for all model scenarios (<0.01 mg/L vs 0.01-0.9 mg/L), including August 20, which corresponds directly to one of the flow conditions modeled. While the model appears to over-estimate ammonia concentrations for the measured flows (which would be protective), I have concerns over the meaningfulness of these flow statistics (min, 25th percentile, median) for long term predictions, as discussed above. As noted above, the measured flow at SW2 on August 20, 2020 was equal to the minimum flow value cited in the model validation and corresponds to the mid- summer sampling event. Direct comparison of predicted and measured water quality results reveals that the chloride concentration was slightly overestimated (114%), while boron and ammonia were more dramatically overestimated (2x and >9x the measured values, respectively), demonstrating the potential lack of agreement between monitoring data and model predictions.*

While the concentration of ammonia measured in Dochart Creek throughout 2020 was <0.01 mg/L at both monitoring locations SW1 and SW2, the concentrations of ammonia measured in 2018 and 2019 (<0.01 mg/L – 0.09 mg/L) are not outliers and represent the natural variability in ammonia within Dochart Creek. Due to the variability expected when sampling surface water, Golder considers it reasonable to compare these forecasted model results to samples collected over a period of time (such as the 3-year window used in this assessment); it is beyond the ability or expectation of a model to predict parameter concentrations that correspond to specific days.

> *The consultant's conclusion presumes that all flow conditions encountered 2018 - 2020 were within the lower distribution of flows (median, 25th percentile, or minimum, but not reaching the estimated 7Q20). While flows may have been low over a portion of the selected date range, supporting data have not been provided.*

The model calibration was presented for the 7Q20 flow rate and minimum, 25th percentile and median of the observed flow rates for Dochart Creek, as these values were considered more useful to present than higher flow rates (such as the 75th percentile or maximum observed flow rates) that result in the forecasted concentration in Dochart Creek closer to the background concentration for each parameter. In addition, the flow rates selected for the assessment of the calibration are the same as those selected for the forecasting. Because it is the lower end of flow rates that will be considered for assessing future surface water compliance, the lower flow rates were selected for the forecast assessment as these provide a more conservative assessment of whether surface water quality can be expected, under natural attenuation conditions, to comply with PWQO than using higher flow rates in Dochart Creek.

Surface Water Comment #5

Comment: *It is not clear if the leachate source strength determinations consider the potential changes in waste stream (i.e., diversion of recyclables and protrusible wastes), changes in leachate composition/concentration following cover placement, and/or with aging of waste. I defer to the groundwater reviewer and review engineer for comment on these matters.*

Response:

The leachate source strength does not consider potential changes in the waste stream associated with waste diversion (in particular the diversion of organics) that can, over time, significantly reduce the decomposable portion of the waste stream) and the resultant changes in leachate strength. Diversion is expected to improve (reduce) the concentration of various parameters in the leachate, which would then reduce the concentration in groundwater or surface water affected by leachate. The peak concentrations of the parameters selected for modelling conservatively correspond to typical municipal solid waste leachate for a site with the physical characteristics of the McNab Landfill site, as described in Section 5.1 of the Impact Assessment report. Also, as described in Sections 5.1 and 7.1, appropriate reductions over time in the peak leachate source strength as the waste ages and contaminants are flushed out of the waste by infiltrating precipitation or are otherwise removed were modelled and incorporated into the hydrogeologic model.

Surface Water Comment #6

Comment: *Boron, chloride and ammonia were selected as parameters of concern for groundwater and surface water impact assessments. Iron is also present at high concentration in leachate and should be considered with respect to potential surface water impacts in both on-site streams / wetlands and in Dochart Creek.*

Response:

Please see response to Groundwater Comment #5. Note that iron will be part of the site's ongoing groundwater and surface water monitoring program and will be used in conjunction with leading leachate indicator parameters to assess and characterize groundwater plume migration, the future onset of leachate impacts in Dochart Creek and site compliance in terms of surface water.

Surface Water Comment #7

Comment: *The compliance criteria selected for boron and chloride are appropriate. I cannot confirm that the selected compliance criteria for ammonia will be protective, particularly during the late summer period. The effect of fluctuations in temperature, pH and flow must be considered more thoroughly, with consideration for the precautionary principle.*

Response:

For the assessment, the compliance value for ammonia of 2.3 mg/L was calculated using the median values of pH and temperature measured in Dochart Creek, which is considered to be a reasonable approach for this modelling. In response to the comment, the ammonia concentration corresponding to a unionized ammonia concentration of 0.02 mg/L was determined for each sampling event from 1991 through 2021 using the field measured pH and temperature values. The median calculated ammonia concentration from this data set is 2.3 mg/L, the same value as presented in the assessment. From this data set, the minimum calculated ammonia concentration is 0.23 mg/L, the 5^{th} percentile concentration is 0.41 mg/L and the 25^{th} percentile is 1.02 mg/L.

The modelling incorporates conservatism into various aspects of the model. Also, the PWQO value for unionized ammonia includes a factor of safety of 10 based on toxicity testing for the most sensitive aquatic species. For these reasons, the values of pH and temperature that result in the most conservative calculated compliance value for ammonia were not considered necessary to be used in the assessment. Rather, the approach taken was to assess the resultant concentrations that could reasonably occur under typical conditions of both surface water quality and creek flow.

Considering the simulated surface water presented on Figures 5 and 6 of the Impact Assessment report, the effect of a lower ammonia compliance value (say the 25th percentile value) would be that the compliance value would not be met at the minimum observed flow rate but would be met at the 25th percentile and median observed flow rates.

This assessment predicts an outcome based on the McNab Landfill site continuing to operate as a natural attenuation landfill. The modelling demonstrates that at some time in the future, based on a robust monitoring program coupled with a trigger mechanism, it can be expected that engineered control of leachate-impacted groundwater migration towards Dochart Creek will be required to achieve surface water compliance at the McNab Landfill site. This is further discussed in the response to Surface Water Comment #10.

Surface Water Comment #8

Comment: *Clarification is needed on the compliance boundary for surface water considered in the Hydrogeological Assessment. Compliance boundaries for surface water are not dictated by property boundaries.*

Response:

The “surface water compliance boundary” presented on Figure 5 of the Hydrogeological Impact Assessment report specifically refers to the furthest downgradient intersection of Dochart Creek and the McNab WDS property boundary. This is in the vicinity of the SW2 monitoring station.

The “surface water compliance boundary” presented on Figure 6 of the Hydrogeological Impact Assessment report (i.e., forecasted compliance with additional CAZ) refers to the furthest downgradient intersection of Dochart Creek and the proposed additional CAZ.

It is acknowledged that the McNab Landfill site would become non-compliant regarding surface water compliance if leachate from the site causes parameter concentrations to exceed the applicable criteria anywhere along Dochart Creek. It is noted that the peak surface water impacts forecasted on Figure 5 and Figure 6 are comparable; as such, it is expected that the model would forecast a comparable level of impact regardless of the compliance point selected for analysis. It is proposed that the surface water compliance location remains at SW2.

Surface Water Comment #9

Comment: *The assessment does not appear to consider potential impacts to surface water from discharge of leachate impacted groundwater to streams and wetland areas upgradient of Dochart Creek, east and northeast of the current fill area. Evaluation of potential impacts to those receivers is also required to support and inform the proposed development of Stage 3 of the landfill.*

Response:

Please refer to our response to Surface Water Comment #1. As described in that response, based on our understanding of the surface water setting in the area of the McNab Landfill site, Dochart Creek is the eventual receiver of leachate-impacted groundwater discharge and the appropriate watercourse to assess for landfill site compliance.

Surface Water Comment #10

Comment: *Given the uncertainties described here, I cannot support the development of Stage 3 of the McNab-Braeside WDS as a naturally attenuating site, pending the submission of the additional information and assessment requested above.*

Response:

The purpose of the modelling assessment is to provide an understanding of current and future leachate migration to assist in the refinement of the groundwater and surface water monitoring programs and the development of contingency measures to ensure ongoing compliance of the site. It is our opinion that the modelling work

completed to-date has been beneficial by providing the understanding of leachate migration and potential effects on groundwater and surface water quality and associated site compliance required to update the Development & Operations Plan for the site. The updated Development & Operations Plan will include a surface water and groundwater trigger mechanism, that would use on-going groundwater and surface water monitoring to track plume migration and surface water quality and set triggers at parameter concentrations below the compliance values such that contingency measures could be implemented prior to the site going out of compliance. The contingency measures would be provided in the updated Development & Operations Plan and have been briefly described in the response to Surface Water Comment #2.

The McNab Landfill has been and is currently operating as a natural attenuation landfill, which is also the condition assumed in the modeling assessment. It is important to understand it is not proposed that the site continue to operate indefinitely as a natural attenuation landfill. When it is necessary to implement the contingency plan (based on ongoing monitoring and the approved trigger mechanism), it will no longer rely on natural attenuation but on an engineered collection and control system to manage the impacts of leachate generated by the landfill and continue to achieve compliance for surface water. The hydrogeologic setting at this site, where leachate-impacted groundwater migrates in the shallow subsurface through the surface sand layer and/or weathered clay crust zone and does not extend deeper because of the underlying low permeability unweathered grey silty clay, is very suitable for the installation and operation of a groundwater interceptor trench. This contingency measure can be expected to be highly effective in this setting to capture the leachate-impacted groundwater plume.

It is noted that the proposed approach is not affected by the volume of approved disposal capacity, the main effect of which is on the strength of the intercepted leachate-impacted groundwater. In terms of the modeling predictions under natural attenuation, since the 7Q20 flow is so low, the predicted concentrations of parameters in Dochart Creek during this extreme low flow event essentially reflect that the surface water is mostly leachate-impacted groundwater discharge.

Concluding Statements

It is considered that the predictive modelling of expected effects of continued landfilling as proposed at the McNab Landfill on groundwater and surface water quality and compliance is technically appropriate and includes degrees of conservatism, and it demonstrates that the site can be expected to operate and remain in compliance (incorporating the proposed monitoring, trigger mechanism and at some point in the future engineered contingency measure control on migration of leachate-impacted groundwater, as well as additional CAZ lands) from a surface water and groundwater perspective.

We hope that the clarifications and additional information provided in these responses to groundwater and surface water review comments assist with your assessment and will result in MECP’s support of the development of Stage 3 of the McNab Township landfill as proposed in the Hydrogeological Impact Assessment report.

Limitations and Use of this Letter

This letter was prepared for the exclusive use of The Township of McNab/Braeside. Any use which a third party makes of this report, or any reliance on, or decisions to be made based on it, are the responsibilities of such third parties. Golder Associates Ltd. (Golder) accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

This letter is based on data and information collected by Golder and is based solely on the conditions of the property at the time of the work, supplemented by historical information and data obtained by Golder as described in this letter and referenced reports. Golder has relied in good faith on all information provided and does not accept responsibility for any deficiency, misstatements, or inaccuracies contained in the report as a result of omissions, misinterpretation, or fraudulent acts of the persons contacted or errors or omissions in the reviewed documentation.

The services performed, as described in this letter, were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

The findings and conclusions of this letter are valid only as of the date of this letter. If new information is discovered in future work, including excavations, borings, or other studies, Golder should be requested to re-evaluate the conclusions of this letter, and to provide amendments as required.

Closure

We trust the contents of this letter meets your current needs. If you have further questions regarding the Hydrogeological Impact Assessment or the contents of this letter, please contact the undersigned.

Golder Associates Ltd.



Paul Smolkin, P.Eng.
Principal, Senior Geo-environmental Engineer

CWT/PAS/KAM/sg
https://golderassociates.sharepoint.com/sites/115688/project files/6 deliverables/002 response to mecp on hia/19130748 l response to mecp comments 2022june21.docx

CC: Ryan Frew, Township of McNab-Braeside

Ministry of the Environment, Conservation and Parks
Eastern Region
1259 Gardiners Road, Unit 3
Kingston ON K7P 3J6
Phone: 613.549.4000
or 1.800.267.0974

Ministère de l'Environnement, de la Protection de la nature et des Parcs
Région de l'Est
1259, rue Gardiners, unité 3
Kingston (Ontario) K7P 3J6
Tél: 613 549-4000
ou 1 800 267-0974

Ontario

M E M O R A N D U M

April 21, 2022

TO: Thandeka Ponalo
Senior Environmental Officer
Ottawa District Office
Eastern Region

FROM: Nick Battye
Hydrogeologist
Technical Support Section
Eastern Region

RE: McNab/Braeside Waste Disposal Site A412605
Hydrogeological Impact Assessment
Lots 18 & 19, Concessions 6, part of Lot 19, Concession 5
Township of McNab/Braeside, Renfrew County, Ontario

I have reviewed the report titled "Hydrogeological Impact Assessment, McNab Waste Disposal Site, Township of McNab/Braeside, Ontario" by Golder Associates Limited, dated February, 2021 (Golder 2021), which seeks to forecast site compliance with respect to surface water and groundwater leachate impacts originating from the McNab waste disposal facility at a time of full landfill development (1 million cubic metres of airspace) as described in the Development and Operations (D&O) plan for Stages 1, 2 and 3 (Golder 1997). My review notes and comments are included below.

Certificate of Approval

The McNab/Braeside Waste Disposal Site has been operating under Environmental Compliance Approval (ECA) A412605 since its issuance on June 10, 1980. The ECA permits the development of a landfill up to 10 hectares with a total capacity for waste and daily cover of 1 million cubic metres as part of a three-stage approach. Stage 1 relies on natural attenuation, which was achieved through the acquisition of land by the Township to the north and northeast of the landfill, referred to as the Contaminant Attenuation Zone (CAZ).

For landfill enlargement to proceed in association with Stage 2 and 3, the ECA requires additional studies to assess the potential requirement for engineered leachate management controls, or an increased CAZ, such that the landfill remains compliant with respect to leachate impacts on groundwater and surface water. Despite this requirement, landfilling has already moved well into Stage 2, and a limited amount into Stage 3. The present report (Golder 2021) seeks to satisfy the requirements of the ECA by assessing the hydrogeological characteristics of the site and the potential impacts of leachate generated from full Stage 1 to Stage 3 landfilling activities to determine the need for engineered or other design controls.

Physical Setting

The site is located on parts of Lots 18 and 19, Concession VI and part of Lot 19, Concession V in the Township of McNab/Braeside, Renfrew County, approximately 2.5 km southwest of Glasgow Station, Ontario.

Topography at the site generally slopes the north. Dochart Creek flows from west to east through the northern portion of the site, and a low-lying area with no distinct drainage channels is present to the northeast and east that is referred to as the “poorly drained area”.

Aspects of the hydrogeological impact assessment (Golder 2021) related to surface water will be reviewed separately by a MECP Surface Water Specialist.

Geology

The overburden at the site consists of a thin layer of topsoil or fill, underlain by a fine to coarse grained sand (measured between 1.8 and 4.6 m in thickness), which is underlain by a silty clay that extends up to 8.2 m below ground surface (bgs). The shallowest portion of the silty clay deposit (up to approximately 3 m thick) is a grey-brown weathered crust containing sand layers with thicknesses up to 0.2 m. The sand unit is discontinuous, thinning to the north and northeast. Adjacent to Dochart Creek and the poorly drained area, it is not found, and the silty clay is present immediately below the topsoil and peat in those areas, respectively. A sand and gravel layer was observed beneath the silty clay at two boreholes; it is inferred to be a till layer that exists between the silty clay and bedrock.

Bedrock consists of carbonate metasedimentary and mafic to ultramafic plutonic rocks; it was found at a depth of 2.8 m bgs in the southern part of the site but was not encountered in other boreholes that extended to 9.1 m bgs elsewhere on the site.

Hydrogeology

Groundwater flow has been interpreted to generally follow topography, flowing north and northeast. Upward hydraulic gradients were observed between the silty clay and the overlying sand layer. A number of poorly defined ephemeral surface water features in the poorly drained area have been identified that could potentially intermittently convey discharging groundwater through the poorly-drained area off-site to the northeast that could eventually contribute to flow in Dochart Creek; however, limited flow has been observed between these disconnected surface water features or via these features to the northeast property boundary during Golder’s ongoing surface water monitoring in this area.

Hydraulic conductivities recorded in specific units are as follows:

1. Sand and weathered crust: $1x10^{-4}$ to $6.4x10^{-7}$ m/s
2. Silty clay: $4x10^{-8}$ to $8x10^{-8}$ m/s
3. Till: $5x10^{-7}$ m/s
4. Bedrock: $3x10^{-8}$ m/s

Based on the hydrogeology and hydrology, two compliance boundaries have been highlighted by Golder:

1. Dochart Creek, and,
2. The northeast property boundary.

Guideline B-7

This is a landfill site operating under an ECA. As such, Reasonable Use Guideline B-7 applies. Golder has been evaluating compliance with Guideline B-7 based on the concentrations measured in wells BH99-1 (silty clay) and BH99-2 (sand) (boundary wells to the northeast). It was reported that as of 2019, the Reasonable Use Performance Objectives were met at these two wells.

Expansion Feasibility Study

Golder developed a numerical model to forecast site compliance with respect to surface water and groundwater leachate impacts originating from the McNab waste disposal facility at a time of full landfill development (1 million cubic metres of airspace) as described in the Development and Operations (D&O) plan for Stages 1, 2 and 3 (Golder 1997).

Steps and assumptions used in model development appear below:

- The infiltration rate of atmospheric water through the cover system and waste profile was estimated using the Hydrologic Evaluation of Landfill Performance (HELP) Model (USEPA 2020).
    - Current and final conditions modelled.
    - Climatic normal values over past 30 years, factoring in cover systems materials, layer thicknesses, final over slope, drainage length, present and effect of vegetation, and evaporative zone depth.
    - Calculated average annual infiltration rates through the bottom of the waste layer were 326 mm/yr under open conditions and 247 mm/yr under closed conditions.
- Leachate source strength was conducted using contaminant transport model POLLUTE (Rowe et al 1994), which is a one-dimensional analytical contaminant transport model that can simulate vertical contaminant migrations from a landfill situated on a multi-layer soil deposit.
    - Two cross-sections were considered.
    - Model inputs included current peak concentrations, peak concentrations at closure, contaminant mass as a proportion of total mass of waste, and half life in the landfill.
- A three-dimensional numerical model representing the landfill property and surrounding area was constructed using FEFLOW (Diersch 2016), a commercial finite element modelling program.
    - Boundary conditions were set up using local surface water features to the west and north (i.e., Dochart Creek), and to the southeast; an assumed groundwater flow divide corresponding to the topographical highs to the south and southwest; and the eastern flow boundary was selected to position the landfill at the centre of the model domain.

  - Total extents of the model are 2,100 m west-east, and 1,050 m north-south.
  - Constant head boundaries were set as follows: at the topographic elevation along the west, north, southeast boundaries to simulate the surface water features there; along the eastern edge of the model for all layers to simulate downgradient flow beyond the model; and no-flow boundaries were specified at the south and southwest boundaries as well as along the bottom of the model.
  - The horizontal finite element mesh was 50,877 finite elements per layer, with a discretization of 6 m in the vicinity of the landfilling area, and up to 30 m at the model periphery.
  - Vertically, the model is made up of 16 layers (more layers were used in areas of higher gradients).
  - The entire model domain corresponds to 814,032 finite elements.
- Hydraulic conductivities were applied per field measurements discussed above, but the till and bedrock values were combined for simplicity as the higher (i.e., more conservative) value. Areas within the waste footprint were given a value of $1x10^{-5}$ m/s.
- Recharge rates were used as follows:
  - Sand: 50 mm/a
  - Weathered crust: 5 mm/a
  - Waste footprint: 326 mm/a
- The model was run and calibrated based on the observed 2020 site conditions, and was considered satisfactorily calibrated based on the following:
  - simulated vs observed hydraulic heads for each on-site observation well within 5% normalized root mean square error.
  - simulated groundwater flow direction was consistent with measured readings.
  - forward particle tracking indicated leachate migration that was consistent with measured results.
- Two scenarios were examined:
  - full footprint, open (recharge rate 326 mm/a)
  - full footprint, closed (recharge rate 247 mm/a – includes final cover).
- An analytical solute transport model (GoldSim (GTG) 2018) was used to forecast the concentrations of select parameters at compliance boundaries throughout the life of a site.
  - Designed to develop an understanding of the factors that control the performance of an engineered or natural system and to predict the future behavior (performance) of the defined system.
  - Assumptions:
    - maximum landfilling footprint reached in 2045 (assumed to be conservative)
    - full capacity reached in 2100 (at which point final cover placed, which affects model infiltration rates)
    - dispersivity of 10% of the pathway length
    - tortuosity of 0.65
    - Partitioning coefficient of 0.19 mL/g for boron.
    - Pathway specific scaling factors for ammonia to simulate ammonia degradation during migration in groundwater

- Model performance was evaluated using actual data from well BH99-2 from 2015 to 2020 against simulated 2020 concentrations.
    - Simulated results for each parameter fell within the upper limit of the observed concentration ranges or slightly exceeded.
    - Indicates the model may be slightly conservative, but otherwise considered satisfactorily calibrated with respect to the groundwater compliance boundaries.

Future groundwater compliance was assessed by comparing forecasted groundwater quality for boron and chloride to the Reasonable Use Performance Objectives (RUPOs). Ammonia was modelled but does not have a groundwater guideline (or RUPO) for comparison. The model forecast that boron will exceed the RUPO (1.3 mg/L) in 2131, with a peak of 1.5 mg/L in 2159, and that chloride would exceed the RUPO (129 mg/L) in 2074, with a peak of 260 mg/L in 2131. Because the simulation results did not meet the RUPOs for the full development of the waste disposal site, an additional scenario was considered where an additional 500 m CAZ was present to the northeast; in this scenario, the site remained in compliance. Therefore, to achieve future groundwater compliance without reducing landfill capacity or implementing other engineered solutions, it was recommended by Golder (2021) that the Township enlarge their CAZ to the northeast, either through a groundwater easement or property purchase. The required timing for acquisition would be dependent on on-going monitoring results.

Conclusions and Recommendations

1. Golder concludes that an additional CAZ to the northeast would satisfy Condition 39 of the ECA and keep the waste disposal site in compliance with B-7 right up to full landfill capacity. I am in general agreement with the Guideline B-7 assessment completed by Golder, and I support the recommendation to purchase additional CAZ to provide for further landfill development; however, while Guideline B-7 may be satisfied from the groundwater perspective, this approach may not adequately consider potential surface water impacts resulting from groundwater discharge to Dochart Creek and the poorly drained area to the northeast. Due to the thinning of the sand layer towards the north, and the complete pinch out of this unit towards the northeast, most monitoring wells located along the periphery of the site were screened in the silty clay layer, which has hydraulic conductivity one to four orders of magnitude lower and vertical flow in the upward direction. Thus, existing groundwater monitoring results for wells screened in the silty clay unit may be an underrepresentation of leachate concentrations / migration in the more permeable sand unit. Where the sand thins, e.g., to 0.1 m at BH99-5 in the north, the unit may no longer be perennially saturated, but could still convey leachate at higher concentrations and at faster rates towards Dochart Creek in pulses during wet events. A similar fate and transport mechanism could be present in the poorly drained area to the northeast, where the sand unit completely pinches out and it is topsoil / peat down to 0.2 m (BH92-2) that overlies the silty clay layer. If correct, given that existing results (largely from groundwater pulled from the underlying silty clay layer) were used to calibrate the model, the model may be biased low. Additional insight and/or investigation from Golder on this is requested. However, with groundwater presenting very close to, if not at, the surface in many of the periphery areas on-site, potential surface water impacts are seen to be the

driving concern in these areas; therefore, the case for the McNab/Braeside WDS ECA amendment must ultimately satisfy any concerns raised by the MECP Surface Water Specialist.

2. Golder has been evaluating compliance with Guideline B-7 based on the concentrations measured in wells BH99-1 and BH99-2. It was noted that well BH99-1 is screened in the silty clay unit and therefore, may not be appropriate as an accurate indicator of leachate migration (see point 1). Boundary wells BH92-1 and BH99-5, located to the west, are also screened in the silty clay layer, but have measured exceedances, at times, related to DOC, Fe, and/or Mn. While BH99-2 (Guideline B-7 well) is appropriately screened in the sand, and does not show any signs of leachate, the nearest wells that are screened in the sand (with results) include the well clusters at BH91-1 and BH8; these wells have reported exceedances, at times, for DOC, TDS, Fe, and/or Mn. Given these facts, an explanation from Golder is needed on why they think B-7 is being met.
3. Leachate effects have been observed in monitoring well BH6, located further south on the existing waste footprint, and in surface water samples from the poorly drained area east / northeast of the landfill; specifically, at SW4, SW6, SW7, SW8, and SW9, which have consistently recorded elevated alkalinity, ammonia, boron, cobalt, COD, calcium, chloride, DO, hardness, iron, manganese, magnesium, phenols, potassium, sodium, TDS, and total phosphorus. In some cases, the concentrations exceeded the PWQO. Given the known exceedances in surface water here, the lack of groundwater data in this area is concerning and may be a source of error for model prediction; for example, groundwater data is not available for locations in the vicinity of monitoring wells BH-4, BH92-4, and BH92-3, despite that fact that the ‘full footprint’ modelling predictions show that groundwater flow in this direction becomes a dominant flow pathway. Coupled with that, it is not clear to me why there is little to no contaminant movement predicted in this direction under the ‘2020 conditions’ modelling predictions. To me, this raises questions about the accuracy of model predictions. I recommend that Golder provide additional information to clarify these items.
4. Care needs to be taken when considering monitoring results from wells screened in the underlying silty clay, as they may not be representative of the maximum amount of leachate migrating from the source (discussed earlier in point 1). Where the sand and peat units overlying the silty clay thin (down to 0.1 m in places), installation of additional monitoring wells is recognized as being an impractical solution. Alternative methods are needed in these areas to confirm the fate and transport of leachate in the sand unit, or where it discharges therefrom.
5. While contaminant concentration projections were performed for boron, chloride, and ammonia, and in most cases represent conservative tracers, none of these represent the current contaminants of concern in groundwater at the site, which are DOC, Fe, Mn, and TDS. These should be modelled as well and may be useful as an extra source of data for calibration.
6. It was stated that on-going monitoring remains critical to continue validating model accuracy. Additional well installations were also recommended by Golder between the full landfill footprint and the current northeast property line for better understanding and tracking of leachate in this area. I agree with this and stress that the screened intervals need to be appropriately placed to capture leachate migration in all applicable stratigraphic units. This may require some exploratory

work to determine the best placement location and further consideration of the degree of hydraulic connection between units.

Should you have any questions regarding these comments, I would be happy to discuss them further.



Nick Battye, MSc, PGeo

ec: Emily Tieu
Lauren Forrester
Victor Castro
James Mahoney

c: File GW RE MC 01-02 (McNab/Braeside WDS A412605)
ECHO Ref # 1-93456530

Ministry of the Environment, Conservation and Parks
Eastern Region
1259 Gardiners Road, Unit 3
Kingston ON K7P 3J6
Phone: 613.549.4000
or 1.800.267.0974

Ministère de l'Environnement, de la Protection de la nature et des Parcs
Région de l'Est
1259, rue Gardiners, unité 3
Kingston (Ontario) K7P 3J6
Tél: 613 549-4000
ou 1 800 267-0974

Ontario

M E M O R A N D U M

April 19, 2022

TO: Thandeka Ponalo
Senior Environmental Officer
Ottawa District Office
Eastern Region

FROM: Lauren Forrester
Surface Water Specialist
Technical Support Section
Eastern Region

RE: Hydrogeological Impact Assessment and 2020 Annual Report
McNab-Braeside Waste Disposal Site
Lots 18 and 19, Concession 6, Geographic Township of McNab
ECA No. A412605

As requested, I have reviewed the report titled "Hydrogeological Impact Assessment, McNab Waste Disposal Site, Township of McNab/Braeside, Ontario", prepared by Golder Associates Limited (GAL) and dated February 2021. I have also consulted the summary letter titled "2020 Groundwater and Surface Water Monitoring Program and Annual Operations Report", prepared by GAL, dated March 2021. I offer the following comments with respect to surface water matters.

Background

The McNab/Braeside Waste Disposal Site (WDS) is currently operated as a naturally attenuating waste disposal site under Environmental compliance Approval No. A412605. The WDS has an approved 10-hectare (ha) landfill footprint within a 64.3 ha site and a total capacity of 1,000,000 cubic metres between three Stages. The Approval for this site was first issued in 1971 and has been repeatedly amended since that time, most recently on May 11, 2016 (Notice No. 4). The existing Design and Operations (D & O) Plan was adopted under the September 30, 1998 Approval, with an amendment to Figure 7 incorporated as part of Notice 1 to the ECA (April 14, 2000). The D & O Plan sets out details for the development and operation of Stage 1 of the WDS and conceptual development plans for Stages 2 and 3. Development plans for Stages 2 and 3 have not yet been reviewed by the Ministry.

To date, filling has occurred in Stages 1, 2 and 3, as described below. Operations shifted to Cell 3 in 2019. Residual capacity in Stage 2 is estimated to be 125,417 m^3 at the end of 2020. The annual operations report indicates that, due to exposed bedrock outcrops in the area, the residual capacity in Stages 1 and 2 will be filled only after filling in Stage 3 is complete. Interim cover placed over Stage 2 in 2019 and 2020 and the

area is intended to be used for management of contaminated soil while Stage 3 is developed.

The footprint of Stage 3 extends north, east, and slightly south of the existing footprint. Trees were cleared from the north section of the Stage 3 footprint in 2016-2017. Final design contours for Stage 3 are reported to have been developed in 2017 and are intended to provide a minimum vertical separation of 1 metre between groundwater and deposited waste through import of granular fill. More extensive fill placement is expected to be required for the 'open area' farther east (identified as 'wet area' on Stantec's Design Waste Contours map). In 2019 and 2020 granular fill was imported to prepare portions of the base of Cell 3 to accept waste. In 2020, 10,892 cubic metres of waste and daily cover were deposited in Cell 3A, leaving a remaining capacity 589,608 m^3 in Stage 3 at the end of that year. Development of Stage 3 is projected to provide for continued operation at the Site through to approximately 2100.

The approved D&O plan for this Site states that the development of Stage 3 is expected to "incorporate engineered containment features (liners / collection systems, etc.)" and "require additional geotechnical and hydrogeological studies for the purpose of assessing the need and finalizing the design of the engineered components… site development under Stage 3 would require an approval process for the engineered system" (GAL, 1997). No rationale for the change in conceptual plan has been provided. The subject report is intended to lay out the groundwork for the required updates to the D&O Plan and amendments to the Approval for the continued development of Stages 2 and 3.

Surface Water Regime

The Site is located within a poorly drained area south of Dochart Creek. The site slopes gradually to the north, with Dochart Creek flowing west to east through the northern portion of the Site. Dochart Creek and its tributaries east of the landfill are designated as cold water streams based on the presence indicator fish species. As such, these waterbodies should be considered highly sensitive. Shallow groundwater is interpreted by GAL to flow towards Dochart Creek in the northern portion of the site and to the northeast on the eastern side, following site topography. Small drainage courses are apparent near the eastern property line, some originating near the waste mound and flowing through the poorly-drained wetland area east/northeast of the mound, potentially intersecting with the predicted leachate plume. These small streams eventually flow to the unnamed tributaries to Dochart Creek east of the Site.

Overburden generally consists of a surficial sand layer underlain by silty clay, which is understood to limit infiltration in the area northeast of the fill area (corresponding to the footprint of Stage 3 of the approved landfill). Bedrock outcrops are noted within the landfill footprint. The depth of the silty clay deposit is described by the consultant to vary across the site. Clay is present near the ground surface in the northern portion, near the Creek. In the wetland area / poorly drained area, the silty clay is overlain by a surficial peat layer. Leachate impacted groundwater is expected to eventually discharge to the Creek and ephemeral watercourse / wet areas east and northeast of the waste due to upward hydraulic gradients between the sand and clay layers. As

such, the primary pathway for leachate migration is understood to be through discharge to surface water.

In his October 3, 2019 memorandum, S. Kinney recommended the installation of additional monitoring wells north, northwest and west of impacted monitoring locations BH 15-1 and BH 15-2 to fully delineate the horizontal and vertical extent of leachate impacts in groundwater. Three new groundwater monitoring wells were established between the waste footprint and Dochart Creek in 2020 (BH20-1, BH20-2, BH20-3, north/northwest of BH15-2A/B). There continues to be limited active groundwater monitoring east of the landfill footprint.

The surface water monitoring program includes monitoring in Dochart Creek (SW1 and SW2) and at several locations through the poorly drained area (SW4, SW6, SW7, SW8 and SW9). Stantec's operations report refers to an additional station in Dochart Creek (SW3), which was last monitored in 2003. I have not been able to locate documentation showing the location of that station or supporting the cessation of monitoring there.

Results and Discussion

2020 Surface Water Monitoring Summary

Leachate effects are evident in the poorly drained area east/northeast of the mound, including potential indications of leachate affecting the background station (SW8) as described below. As reported for groundwater, leachate impacts in the poorly drained area decrease with distance from the mound. Dochart Creek does not appear to be discernibly impacted by landfill operations at this time.

- SW2 in Dochart Creek is not definitively impacted by leachate. COD, iron and sodium were slightly elevated compared to background on some dates but were generally consistent with background and below the 75th percentile concentration from SW1.

- SW4, 420 m from fill area in the poorly drained area, is impacted by leachate. The station exhibits consistently elevated concentrations of leachate parameters, including alkalinity, boron, calcium, chloride, hardness, magnesium, potassium, sodium, and TDS compared to background. Boron exceeded PWQO in April (below CWQG). Total phosphorus and phenols also exceeded the PWQO in December. A long-term increasing trend in the concentration of boron is noted by Golder. Surface water is otherwise consistent over time.

- SW6, 350 m from fill area in the poorly drained area, is impacted by leachate. The station exhibits consistently elevated concentrations of leachate parameters, including alkalinity, boron, calcium, chloride, hardness, magnesium, potassium, sodium, and TDS compared to background (not exceeding guideline values, where applicable). Dissolved oxygen was below the PWQO in April. Total phosphorus and phenols exceeded the PWQO in December. Golder reports that water quality is generally consistent over time at this station, but following independent review, there appears to be increasing trends in several leachate indicator parameters (sodium and boron, and to a lesser extent chloride).

- SW7, 250 m from fill area in the poorly drained area, is impacted by leachate as above, including alkalinity, boron, COD, calcium, chloride, hardness, magnesium, potassium, sodium, and TDS compared to background. Boron, DO, iron, and phenols failed to comply with PWQO. Golder reports surface water quality to be consistent over time. I disagree, noting marked increasing trends in the concentrations of boron and sodium, and more subtle upward trends in COD, potassium, manganese, and alkalinity. Iron is variable at this station but may also be trending upward.

- SW8, in the poorly drained area, is intended to represent background for the wetland area. Only PWQO non-compliance is phenol in December. Golder reports that surface water quality is generally consistent over time; however, there appears to be noticeable increasing trends in the concentrations of several leachate indicator parameters (boron and chloride, and possibly alkalinity, manganese, sodium, and potassium), which may indicate potential leachate effects in this area. The potential for flow from the mound to that area is supported by the drainage areas predicted in OFAT, but should be confirmed.

- SW9, 50 m from fill area, is impacted by leachate, with elevated alkalinity, ammonia, boron, calcium, chloride, calcium, hardness, iron, magnesium, manganese, potassium, sodium, and TDS compared to background. PWQO exceedances include boron, cobalt, DO, iron, phenols, unionized ammonia, and TP. Ammonia and iron concentrations have been noted to be variable over time as this location may be affected by leachate seeps. This station is within the landfill footprint and will eventually be entombed by waste.

<u>Hydrogeological Impact Assessment:</u>

Streamflow in Dochart Creek:

Streamflow monitoring is outlined in S.3.0 of the report and consisted of nine (9) single transect measurements at each SW1 and SW2, which were averaged through the non-frozen season (October and November 2019, March through September 2020). SW1 / SW2 averaged streamflow ranged from 4.3 L/s to 528.8 L/s.

Average flows in Buckshot and Dochart Creeks were used to produce a ratio of average flows in the two watersheds. That flow ratio was applied to the calculated $7Q_{20}$ for Buckshot Creek (6 L/s) to estimate the $7Q_{20}$ for Dochart Creek (0.3 L/s) (less than a typical garden hose). Other flow statistics presented (minimum, 25^{th} percentile, median, 75^{th} percentile and maximum) were represent data collected October 2019 through September 2020 only. Together with the estimated $7Q_{20}$, these flow statistics were used to estimate future concentrations of parameters of concern in Dochart Creek and form the basis for the surface water impact assessment.

I have several concerns with the streamflow estimates for Dochart Creek, summarized below:

- Flow would typically be expected to increase with distance downstream. Measured flows at SW2 were often lower than at SW1 (upstream) in the data presented. The reason for this is not discussed in the report (i.e., Were transect locations

appropriate? Is the study site within a losing reach? What equipment / method were used to measure flows?).

- Nine monthly measurements of flow are available for SW1 and SW2 in Dochart Creek, collected October 2019 through September 2020. While it is not unusual to have limited flow information, it is unclear how representative these data and the calculated average flows are for use in the extrapolations presented.

- No justification is provided for the use of the ratio of average flows over other methods for estimating the $7Q_{20}$ flow in Dochart Creek (i.e., area reduction method with calibration using measured flows). Support for the choice of extrapolation technique is needed.

- Insufficient information is provided to corroborate the calculated $7Q_{20}$ in Buckshot Creek (i.e., Why was the selected calculation used? Within the available dataset, how were estimated flows or flows affected by beaver activity treated? Were there gaps in the dataset?).

- No information is provided on the comparability of Buckshot Creek to the study site (e.g., characteristics of the streams, drainage areas, physiography, stream order, groundwater regime), nor is justification provided for the choice of reference watershed. Buckshot Creek is located approximately 65 km southwest of the waste disposal site, with notable differences in watershed characteristics, including main channel slope, percent wetlands, percent agricultural/rural area and percent open waters indicated in OFAT. In addition, Buckshot Creek has been classified as warm water creek (with a small portion designated as cool water habitat downstream of the gauging site), while Dochart Creek and its tributaries are classified as having a cold water thermal regime. These differences suggest that these systems may differ in their responses to high and low water conditions.

  I cannot confirm that the selected watershed is appropriate for prorating flows in Dochart Creek based on the information provided.

Leachate Indicators and Source Strength Determination:

Leachate indicator parameters for this Site have been previously identified as alkalinity, ammonia, boron, calcium, chloride, COD, DOC, hardness, iron, magnesium, manganese, potassium, sodium, TDS, and TKN. From these, GAL identifies parameters of concern as chloride, boron, and ammonia because these parameters were at low concentration in groundwater compared to leachate, conservative (B and Cl), are important to surface water impact assessment (NH3) and have surface water compliance criteria.

Leachate strength determination (s. 5.0) was done based on POLLUTE model, with two cross-sections of the landfill to assess the Site's two compliance boundaries (surface / groundwater). Projected peak concentrations of chloride, boron and ammonia in leachate were estimated as 500 mg/L, 3.2 mg/L and 200 mg/L, respectively. Current leachate strength is understood to be relatively dilute under current conditions. From the details provided, it is not clear if potential changes in waste stream (i.e., diversion of recyclables and protrusible wastes), changes in leachate composition following cover

placement, and/or with aging of waste were considered. I defer to the expertise of the review engineer and groundwater reviewer for comment on the predicted leachate strengths.

While the identification of boron, chloride and ammonia as parameters of concern is reasonable with respect to surface water receivers, iron is also present at high concentrations in leachate (dissolved iron up to 100 mg/L in BH4B/BH6) and has relevant surface water criteria. Monitoring data from SW9 suggests that ephemeral streams receiving leachate impacted groundwater may be significantly impacted by iron, with total iron up to 280 mg/L and dissolved iron up to 37.3 mg/L, over 100-times the guideline value at that location (tested in 2020 only). Iron (dissolved and total) should be considered in the assessment of potential leachate impacts. The British Columbia Ministry of the Environment Water Quality Guideline for iron is appropriate for this assessment and states that iron should not exceed 0.35 mg/L dissolved or 1.0 mg/L total to protect freshwater aquatic life from adverse effects of iron.

Surface Water Model and Validation:

Surface modelling work presented in the report incorporates information from the leachate source strength determinations (described above), solute transport modelling described in Section 7.0 of the report, and flow measurements / estimates for Dochart Creek (described above).

In an effort to validate the model, model outputs representing simulated 2020 conditions under various flow conditions were compared to the range of measured water quality for parameters of concern reported 2018 though 2020. The consultant concludes that, because predicted concentrations fell within the measured concentration range 2018-2020 (except boron, which exceeded measured values under simulated $7Q_{20}$ conditions), the model is satisfactorily calibrated. I offer the following observations and comments with respect to these findings:

- Leachate impacted groundwater is expected to discharge to Dochart Creek where leachate plume reaches Dochart Creek (with leachate-impacted groundwater discharging from the surficial sand layer). The specific compliance point evaluated in the model is not identified (i.e., What section of the creek is expected to intersect the plume? How far downstream of the plume intersection are these results intended to represent? Where is the plume and compliance locations in relation to SW2?).

- It is unclear how (or if) background surface water quality in Dochart Creek was incorporated into this assessment (i.e., Are the concentrations reported intended to represent the additional concentrations of the subject parameters or the final concentration after mixing? If it is the latter, what values were used to represent background water quality?).

- Based on current monitoring data, leachate does not yet appear to have reached SW2 in Dochart Creek in any appreciable quantity, which may limit the value of the comparisons between model predictions and current water quality.

- In addition to the poor correlation for boron under the estimated 7Q20 conditions, noted above, predicted 7Q20 ammonia concentration is an order of magnitude higher than both the 2018-2020 (<0.01-0.09 mg/L) and historical range in Dochart Creek (<0.01-0.11 mg/L).

  While the peak chloride concentration does initially appear to correlate well with model predictions for the estimated $7Q_{20}$ conditions, that measured value (reported in 2018) appears to be an outlier, more than double the next highest concentration on record for Dochart Creek and reflecting background effects, apparently unrelated to the landfill. This is not noted by the consultant and should not be considered to support predicted landfill impacts.

  Agreement with the model cannot be confirmed for the estimated $7Q_{20}$ condition for any of the parameters evaluated.

- If only 2020 conditions are considered, there is a lack of agreement between measured and predicted ammonia concentrations for all model scenarios (<0.01 mg/L vs 0.01-0.9 mg/L), including August 20, which corresponds directly to one of the flow conditions modeled. While the model appears to over-estimate ammonia concentrations for the measured flows (which would be protective), I have concerns over the meaningfulness of these flow statistics (min, 25th percentile, median) for long term predictions, as discussed above.

  As noted above, the measured flow at SW2 on August 20, 2020 was equal to the minimum flow value cited in the model validation and corresponds to the mid-summer sampling event. Direct comparison of predicted and measured water quality results reveals that the chloride concentration was slightly overestimated (114%), while boron and ammonia were more dramatically overestimated (2x and >9x the measured values, respectively), demonstrating the potential lack of agreement between monitoring data and model predictions.

- The consultant's conclusion presumes that all flow conditions encountered 2018 - 2020 were within the lower distribution of flows (median, 25th percentile, or minimum, but not reaching the estimated $7Q_{20}$). While flows may have been low over a portion of the selected date range, supporting data have not been provided.

Comments on the groundwater model are provided under separate cover from the groundwater reviewer. In summary, Reasonable Use Performance Objectives were exceeded for each of the selected parameters of concern, necessitating additional the purchase of additional CAZ to the northeast, reduction of landfill capacity or implementation of other engineered solutions. With respect to potential groundwater-surface water interactions, I note the following:

- Surface water monitoring data shows current leachate impacts east / northeast of the existing mound (described above). The 'Simulated Hydraulic Head and Leachate-Impacted Groundwater Flow Path – 2020 Conditions' (Figure 4) do not depict flow of leachate impacted water to those areas. It is unclear if the simulation agrees with the current understanding of shallow groundwater flow and demonstrated leachate effects in surface waters east of the mound. This may

reflect a lack of current groundwater monitoring in that area, as only active groundwater monitoring location (other than leachate monitors) appears to be BH92-5, which is a background station.

Discharge of leachate impacted groundwater to surface is expected to be the predominant pathway for leachate migration. I am not confident that the model adequately characterizes current conditions to the east/northeast of the current fill area, which limits the capacity to predict potential intensification of leachate impacts to surface water in that area between current and full footprint scenarios.

Surface Water Compliance Criteria:

CWQG for chloride and boron (120 mg/L and 1.5 mg/L, respectively) were selected as compliance criteria, which is acceptable. As described above, additional surface water compliance criteria are justified for iron and should be based on the BC MOE water quality guideline for iron. For ammonia, the applicable guideline is the PWQO for unionized ammonia. The proportion of ammonia present in the unionized form varies with water temperature and pH. To establish a surrogate for the PWQO, the consultant has used 'typical' temperature and pH (15ºC and 7.5, respectively), producing a compliance criteria of 2.3 mg/L total ammonia. Because the amount of ammonia in the unionized fraction increases sharply with increases in either pH or temperature, the proposed compliance criteria may not be protective.

Temperature in Dochart Creek ranges from 0.5 to 25.1 ºC (median 11.1 ºC; 75th percentile 17.5 ºC) over the period of record and pH ranges from 6.8 to 8.43 (median 7.73; 75th percentile 8.04). Temperature in small streams east of the fill area ranges from 0ºC to 23.3ºC. Considering the likelihood that higher temperatures will correspond to lower flows and that the 'typical' pH cited is less than the median and average values in Dochart Creek, it is likely that unionized ammonia will grossly exceed the concentrations presumed in the surface water impact assessment in the late summer low flow period, which is typically the critical period for leachate assimilation.

Surface Water Compliance Location:

The specific compliance location in Dochart Creek is not identified in relation to the results presented in the report. For the purpose of this discussion, the compliance location is assumed to be SW2.

Based on the model results presented in Figure 4, it appears that SW2 may be upstream of a substantial part of expected leachate plume under current (2020) and future conditions. The area of expected leachate discharge and SW2 should be clearly depicted on subsequent figures. If SW2 is not expected to capture all expected leachate effects in Dochart Creek, an additional sampling location should be established farther downstream.

A number of ephemeral and unnamed streams occur both within the site and adjacent to it. An area previously described as wetland, now referred to as 'poorly drained area', also exists within and adjacent to the proposed Stage 3 footprint. The extent of the potential impacts to these streams, including cold water tributaries to Dochart Creek, and to the undeveloped portions of the wetland are not discussed (i.e., what

concentrations of leachate indicator parameters should be expected where groundwater discharges to small streams? Will wildlife be exposed to higher concentrations of undiluted leachate discharging to surface upgradient of Dochart Creek?). More information is required.

Surface Water Compliance Assessment:

Concentrations of boron, chloride and ammonia were all forecast to exceed the compliance criteria under the $7Q_{20}$ flow rate scenario, while only chloride was expected to exceed under the 'minimum flow' condition. Compliance criteria were not expected to be exceeded under the median or 25th percentile flow conditions. For reference, the current range for parameters of concern in Dochart Creek are <0.01-0.03 mg/L boron; 12-50 mg/L chloride (outlier excluded); and <0.02-0.02 mg/L ammonia) (75th percentile values 0.05 mg/L, 28 mg/L and 0.016 mg/L, respectively).

While the compliance criteria are noted to be exceeded, the magnitude of the expected exceedance is not discussed. Based on a review of Figures 5 and 6, peak parameter concentrations occurring under the estimated $7Q_{20}$ conditions are approximately 3.0 mg/L boron, 500 mg/L chloride, and 7.5 mg/L ammonia. Chloride only slightly exceeds the CQWG (120 mg/L) under the 'minimum observed flow' condition. Slight differences in surface water predictions are noted between Figures 5 (existing groundwater compliance boundary) and Figure 6 (with additional CAZ). The reason for these differences is not discussed. Surface water compliance boundaries are not dictated by property lines and would not be affected by the establishment of additional CAZ.

- As noted above, the location that these predictions are intended to represent is not clearly defined, additional information is needed with respect to flow modeling, and it is unclear how background water quality was defined or if it was considered in the subject assessment.

- Anticipated impacts to on-site ephemeral streams and wetlands or to cold water tributaries to Dochart Creek immediately east of the Site do not appear to be considered in the current assessment and more information is required.

With respect to the projected concentrations of parameters of concern in excess of compliance criteria, the consultant notes that the low flow conditions in Dochart Creek are not expected to be consistent and represent worst-case scenario, emphasizing that under typical conditions compliance will be achieved. While I do not disagree, low flow conditions are used in evaluating the expected impacts of long-term projects to ensure environmental protection under statistically likely worst-case scenarios (i.e., $7Q_{20}$). Low flow conditions, when they occur, are unlikely to be so transient that long term exposure criteria would not apply. Published guidelines must be met unless supported by site-specific toxicological assessments (reviewed and approved by MECP's Standards Development Branch) or where assimilation occurs within an approved Mixing Zone. A mixing zone, if proposed, must be supported by relevant assessments and comply with the MECP Policies for Water Management (MECP 1994).

Summary of Golder's Recommendations:

- GAL recommend establishment of additional CAZ northeast of the existing landfill to achieve groundwater compliance without reduction of landfill capacity or implementation of engineering solutions.

  Establishment of additional CAZ does not address surface water concerns. Compliance criteria for surface waters (including ephemeral and wetland areas) are applicable on- and off-site. The subject report does not provide enough information to be confident that development of Stage 3 of the landfill (without reduction of landfill capacity or implementation of engineering controls) will not result in impairment of surface waters receivers. Additional source controls may be required to prevent impairment of area surface water.

  Within the 2020 Annual Operations Monitoring Report, Stantec recommends that, in recognition of the significant financial interest in Cell 3, implementation of any additional measures to increase protection of groundwater and surface water from Cell 3 Operations are warranted.

- Existing monitoring program is considered by GAL to be appropriate. Ongoing monitoring is required to verify modelling predictions. Additional monitoring wells between fill area and northeast property line may be considered.

  Please see comments from the groundwater reviewer with respect to the relevant monitoring program. With respect to surface water, additional downstream monitoring may be required, pending clarification of the location of SW2 relative to the expected intersection of the leachate plume and the creek. Establishment of a new background monitoring location and downgradient monitoring locations east of the mound may also be required.

- Development sequence for the landfill is to be set out in an updated D&O plan. The updated D&O plan is to include revised surface water and groundwater trigger mechanism and contingency plan. The subject report will form the basis of the updated D&O Plan and ECA amendment application in support of the proposed development of Stages 2 and 3.

  In addition to the above, the updated plan should include details of any on-site drainage features, as previously requested. Surface water review of any updated D&O is recommended.

Conclusions and Recommendations

1. Leachate effects are evident at all monitoring locations in the poorly drained area northeast and east of the current waste mound, including background. While significant impairment is unlikely at this time, intensification of leachate effects in that area reasonably predictable with continued development of Stage 3, without additional measures to control leachate migration. Additional monitoring in the tributaries to Dochart Creek draining from the east property line may be required.

There are no appreciable leachate impacts to Dochart Creek immediately north of the Site at this time, but leachate impacted groundwater is expected to eventually discharge to Dochart as the primary pathway for leachate migration. Additional information is needed to determine whether additional downstream monitoring is justified, as discussed above.

2. Monitoring data collected in 2020 suggests that Dochart Creek, which contains highly sensitive cold water habitat, may have very low flows in the mid-to-late summer. As such, there is likely limited capacity for dilution or assimilation at those times. This is problematic for a naturally attenuating site, which will ultimately discharge leachate impacted groundwater to area surface waters without controls over the timing, quantity or quality. It is also notable that no flow or water quality information is available for the cold water tributaries to Dochart Creek east of the Site. These tributaries are slightly downgradient of current leachate impacted surface water monitoring locations and appear to originate within the projected pathway for leachate migration.

3. The method used to estimate low flows in Dochart Creek may be overly simplistic (i.e. may over- or under-estimate available assimilative capacity), as discussed above. The flow statistics presented, both measured and estimated, should be used with caution and may not be appropriate for the extrapolations made in the surface water impact assessment.

4. Given the limited supporting information provided, I cannot confirm that the surface water model is sufficiently calibrated or reliable. Agreement between measured and predicted conditions cannot be confirmed for the estimated $7Q_{20}$ condition for any of the parameters evaluated.

5. It is not clear if the leachate source strength determinations consider the potential changes in waste stream (i.e., diversion of recyclables and protrusible wastes), changes in leachate composition/concentration following cover placement, and/or with aging of waste. I defer to the groundwater reviewer and review engineer for comment on these matters.

6. Boron, chloride and ammonia were selected as parameters of concern for groundwater and surface water impact assessments. Iron is also present at high concentration in leachate and should be considered with respect to potential surface water impacts in both on-site streams / wetlands and in Dochart Creek.

7. The compliance criteria selected for boron and chloride are appropriate. I cannot confirm that the selected compliance criteria for ammonia will be protective, particularly during the late summer period. The effect of fluctuations in temperature, pH and flow must be considered more thoroughly, with consideration for the precautionary principle.

8. Clarification is needed on the *compliance boundary* for surface water considered in the Hydrogeological Assessment. Compliance boundaries for surface water are not dictated by property boundaries.

9. The assessment does not appear to consider potential impacts to surface water from discharge of leachate impacted groundwater to streams and wetland areas upgradient of Dochart Creek, east and northeast of the current fill area. Evaluation of potential impacts to those receivers is also required to support and inform the proposed development of Stage 3 of the landfill.

10. Given the uncertainties described here, I cannot support the development of Stage 3 of the McNab-Braeside WDS as a naturally attenuating site, pending the submission of the additional information and assessment requested above.

If you have any questions about these comments, I would be happy to discuss them with you.



Lauren Forrester, M.Sc.
LF

ec: Victor Castro, Water Resources Unit Supervisor
Nick Battye, Regional Hydrogeologist
Emily Tieu, Ottawa District Supervisor

c: LF/ECHO 1-97847882

Stantec

Memo

To:	Ryan Frew, P. Eng. Township of McNab Braeside	From:	Gerry Lalonde 1331 Clyde Avenue, Ottawa
File:	163401232	Date:	December 7, 2015

Reference: McNab Braeside Landfill – Stage 3 Development

The Township retained Stantec to develop contours for the bottom of the waste for Stage 3 of the approved landfill development plan. Stantec proposal scope of work was defined in email dated June 4th to Ryan Frew and authorization to proceed received via email to Gerry Lalonde (GL) dated July 31, 2015. The outline of the Stage 3 waste development plan was prepared by Golder Associates (GA) in 1997 and is incorporated into the Environmental Compliance Approval (ECA) #A 412605, more particularly Conditions 37, 38 and 39. The final waste contours approved for the landfill development incorporate an air space of approximately 1 million cubic metres. In 1997, GA had identified the potential for the site development having to include a leachate collection system (LCS) to manage groundwater contamination from Stage 3. Since then, the Township has purchased additional land for a contaminant attenuation zone (CAZ – refer to Condition 39 and 40 of ECA) which should negate the need for a LCS. Groundwater monitoring of the CAZ is required to assess compliance and the need for any additional measures.

The areal extent of Stage 3 is shown in Figure C01. As this area is covered in bush, a walk through by a Stantec biologist was conducted on October 27 (2015) to investigate the potential presence of butternut trees. A Memo dated November 10th 2015 from Josh Mansell (Stantec) describes the walk-through and the finding of one butternut tree in the south east segment of Stage 3. No work should be conducted within 50m of this tree. Further work (butternut health assessment) should be completed 3 years prior to the planned development of Stage 3B such that if a permit (under the Endangered Species Act or ESA) by the Ministry of Natural Resources is required, it can be done and not delay tree clearing and the Stage 3B base preparation. The location/coordinates (UTM NAD 83) of the butternut tree are shown in the Table on drawing C-01. As Stage 3B is still many years away, the condition of the tree may be significantly different than today and thus this work should not be done till required.

Stantec completed 5 section lines of shallow auger holes (AH) to define the thickness of peat within Stage 3. The auger holes were done manually due to the thick vegetation and their location and elevation determined from a GPS unit. Drawing C01 shows the AH locations and includes a table identifying the peat thickness encountered. The AH were extended to a maximum depth of 1.2m and terminated earlier if a sand or clay unit was encountered. Several AH along the north limit (Stage 3A) encountered waste beneath the thin organic layer. In Stage 3A, topsoil/peat thickness was generally less than 300mm (and less than 100mm in the most west section line). In Stage 3B, the topsoil/peat thickness was generally between 600 and 900mm while in Stage 3C it extended to 1200mm depth. The water table was generally close to ground surface in Stages 3B and 3C.

Drawing C01 also includes the proposed contours for the bottom of the waste. The bottom of the waste is above the water table. All topsoil/peat needs to be excavated and filled to grade with silty sand. The selection of backfill material needs to be reviewed by a geotechnical engineer. If backfill material is too coarse, the hydraulic conductivity is too high and does not provide sufficient retention for biological treatment – the same effect as using clay where runoff occurs instead of

infiltration. A grade of approximately 1% to1.5% has been applied to most of the base in Stage 3B and 3C so as to match the existing grade and avoid excessive fill.

The landfill development should proceed in the sequence 3A, 3B and 3C. In Stage 3B, the buffer along the south side is increased to provide sufficient separation from the bedrock outcrop along the south side of the access road. We recommend that the buffer area near the bedrock outcrop in Stage 3B should not be filled until after Stage 3C. The Township may want to do further investigation and review landfill performance with regards to groundwater compliance to see if any additional precautionary measures are needed before waste is deposited there. The volume (air space contained in all three Stages is shown below and amounts to 527,000 cubic metres. This is less that the GA plan which identified Stage 3 as containing 600,000 cubic metres.

The volume for waste provided by each Stage is as follows;

Stage #	Volume – cubic metres	Comments
3A	102,000	Develop this Stage following Stage 2. Maintain existing evergreens along east side to provide wind screen. Only a minor thickness of topsoil to remove.
3B	90,500 + 73000 (to be developed after Stage 3C)	The east limit of the waste placement does not extend to the east limit of the approved footprint shown in Figure 5 of the Golder plan. This change is recommended to maintain a separation from the bedrock outcrop observed along the access road. The difference in volumes between these two plans is approximately 73,000 m3 (600,000-527000). This buffer could be developed after Stage 3C and may warrant additional investigation to determine if additional precautionary measures to minimize groundwater impacts are necessary.
3C	334,500	
1	Stage 1, 2A and 2B combined have a capacity of 390,000 m3 and a remaining capacity of 159,500 m3 (December 2014)	Stage 1 and 2A will be fully developed once waste placement is moved to Stage 3.
2A	As above	Will be fully developed once waste placement is moved to Stage 3.
2B	As above	Area to the south of the current waste slope where the compost, tires are currently stockpiled – this area could be developed after Stage 3C is full.
Total	1,000,000	

Reference: McNab Braeside Landfill – Stage 3 Development

The east extent of Stage 3A finishes at the tall evergreens separating 3A and 3C – we recommend leaving as much of the existing tall evergreens in place until Stage 3C to reduce the effects of the wind during waste placement. All of Stage 3A should be completed before moving to Stage 3B. A road ending in a turning circle will need to be constructed at the base of Stage 3A along the fenceline. As the height of waste extends in Stage 3A, a connection to the existing road in Stage 2 could be done to improve traffic flow and accessibility.

The access road into Stage 3B and 3C would be advanced along the existing edge of waste in Stage 2. The waste would be advanced from Stage 2 and pushed towards the east for each Stage. To minimize leachate generation, a final cover would be placed over each Stage (3A, 3B) once final contours are reached.

We calculate the volume of soil (silty sand)required to replace the excavated peat to be approximately 30,000 cubic metres (most of it in Stage 3B and 3C).

Please review this proposed development scheme and advise if any changes are required. We would recommend that the waste bottom contours be included in the 2015 Annual Monitoring Report.

STANTEC CONSULTING LTD.

Gerry Lalonde, P. Eng.
Associate, Water
Phone: (613) 724-4389
Fax: (613) 722-2799
gerry.lalonde@stantec.com

Attachment: Figures C-01, C-02, C-03

c.

Stantec

Memo

To:	Gerry Lalonde Ottawa (Clyde Ave) ON Office	From:	Josh Mansell Ottawa (Clyde Ave) ON Office
File:	163401232	Date:	November 10, 2015

Reference: McNab/Braeside Landfill Phase 3 Expansion – Butternut Search

INTRODUCTION

On October 27, 2015 the Environmental Services Group (BC1225) was retained to complete a butternut (*Juglans cinerea*) search within the proposed phase 3 expansion area of the McNab/Braeside Landfill located at 573 Calabogie Rd., McNab/Braeside, ON.

In the province of Ontario Butternut is listed as an endangered species and is afforded protection under Section 23.7, O. Reg. 242/08 of the *Endangered Species Act, 2007 (ESA, 2007)*.

METHODS

The butternut search was completed on foot by conducting parallel transects at 20m intervals throughout the area outlined in red on the attached figure with the use of binoculars, a hand-held global positioning system (GPS) and a GPS camera.

RESULTS

A single large diameter (58cm DBH) butternut tree was observed (18T 380441E, 5031174N) within the upland forest community at southeastern extent of the search area. Though heavy canker was noted on this tree a butternut health assessment was not completed, as per the *Butternut Assessment Guidelines* (MNRF 2014), due to the timing of the search. This butternut tree was marked with a single wrap of orange flagging tape with the words "Stantec – Oct. 27/2015".



Photo 1 - *Butternut tree within the McNab/Braeside landfill search area*

Reference: McNab/Braeside Landfill Phase 3 Expansion – Butternut Search

MITIGATION

In Ontario, the butternut tree receives general habitat protection under the *ESA, 2007*. The MNRF considers activities within 25m as constituting harm to the tree and more recently activities (depending on type) within 50m may be considered harm to habitat (pers. comm. Erin Seabert, MNRF Kemptville District).

If activities associated with the phase 3 expansion of the McNab/Braeside landfill are anticipated to result in killing, taking or harming the butternut tree (i.e., activities within 50m of the tree), as described above, then a butternut health assessment must be completed. The butternut health assessment must follow the provincial *Butternut Assessment Guidelines: Assessment of Butternut Tree Health for the Purposes of the Endangered Species Act, 2007* (MNRF 2014).

REFERENCES

MNRF (Ministry of Natural Resources and Forestry). 2011. *Butternut Assessment Guidelines – Assessment of Butternut Tree Health for the Purposes of the Endangered Species Act, 2007*. Ministry of Natural Resources and Forestry. V2. Peterborough. ii +18 pp.

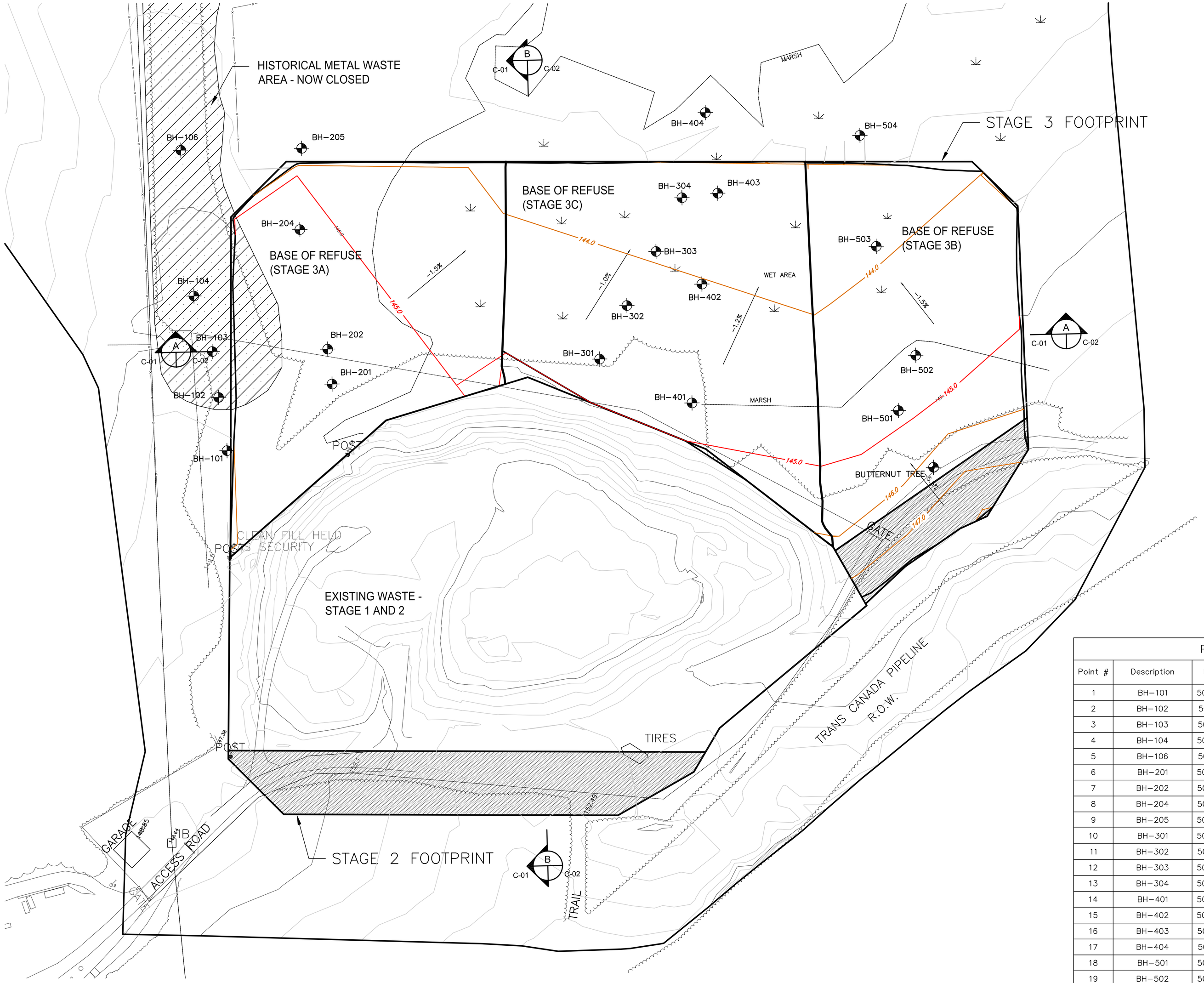
Seabert, E. 2015. Fish and Wildlife Technical Specialist. Ministry of Natural Resources and Forestry. Kemptville, Ontario. E-mail. October 14 2015.

Stantec Consulting Ltd.



Josh Mansell
Biologist
Phone: 613-355-5493
Fax: 613-722-2799
Josh.mansell@stantec.com

Attachment: Figure – McNab/Braeside Landfill Search Area



Point Table					
Point #	Description	Northing	Easting	Elevation	Peat Thickness
1	BH-101	5031775.52	302352.06	146.04	0.0m
2	BH-102	5031795.11	302368.31	145.86	0.0m
3	BH-103	5031811.67	302382.57	145.69	0.0m
4	BH-104	5031835.49	302396.52	145.53	0.0m
5	BH-106	5031885.61	302444.08	144.38	0.0m
6	BH-201	5031759.08	302408.44	145.35	0.1m
7	BH-202	5031771.54	302419.44	145.34	0.1m
8	BH-204	5031818.67	302453.09	143.85	0.3m
9	BH-205	5031843.40	302482.44	143.46	0.1m
10	BH-301	5031672.08	302500.75	144.32	0.3m
11	BH-302	5031679.12	302528.20	144.05	0.6m
12	BH-303	5031685.67	302556.44	143.47	0.6m
13	BH-304	5031693.25	302583.57	143.26	1.2m
14	BH-401	5031625.67	302514.01	144.30	0.4m
15	BH-402	5031659.24	302559.19	143.56	1.2m
16	BH-403	5031681.97	302596.33	143.14	0.9m
17	BH-404	5031711.52	302621.04	142.61	0.1m
18	BH-501	5031550.17	302575.71	144.75	0.1m
19	BH-502	5031561.27	302600.68	144.04	0.5m
20	BH-503	5031609.23	302626.98	143.32	0.9m
21	BH-504	5031649.63	302661.16	142.42	0.4m
	BUTTERNUT TREE	5031520.03	302566.54		

Stantec
1331 Clyde Avenue
Ottawa, ON. K2C 3G4
Tel. 613-722-4420
www.stantec.com

Copyright Reserved
The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

140.0 EXISTING CONTOURS

150.0 PROPOSED CONTOURS

Notes

1. BH'S 101 TO 106 HAVE LESS THAN 100MM OF TOPSOIL
2. STAGE 3 FOOTPRINT AS PER GOLDER ASSOCIATES FIGURE 5 REPORT ON DEVELOPMENT OPERATIONS AND CLOSURE PLAN WASTE DISPOSAL SITE. JUNE 1997.
3. ELEVATIONS ARE GEODETIC AND COORDINATES ARE IN UTM SYSTEM
4. SHADED AREA IN STAGE 3B TO BE FILLED WITH WASTE FOLLOWING STAGE 3C
5. SHADED AREA FOR STAGE 2B BASE TO BE FILLED WITH WASTE ONCE ALL OF STAGE 3 IS FULLY DEVELOPED

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD
ISSUED FOR REVIEW	G.L.	G.L.	15.12.09

File Name: Dwn. Chkd. Dsgn. YY.MM.DD

Permit-Seal

Client/Project
MC NAB / BRAESIDE
WASTE DISPOSAL SITE

STAGE 3 DEVELOPMENT

Ottawa, ON.

Title
PROPOSED BASE GRADING AND BOREHOLE LOCATIONS

Project No. 163401232

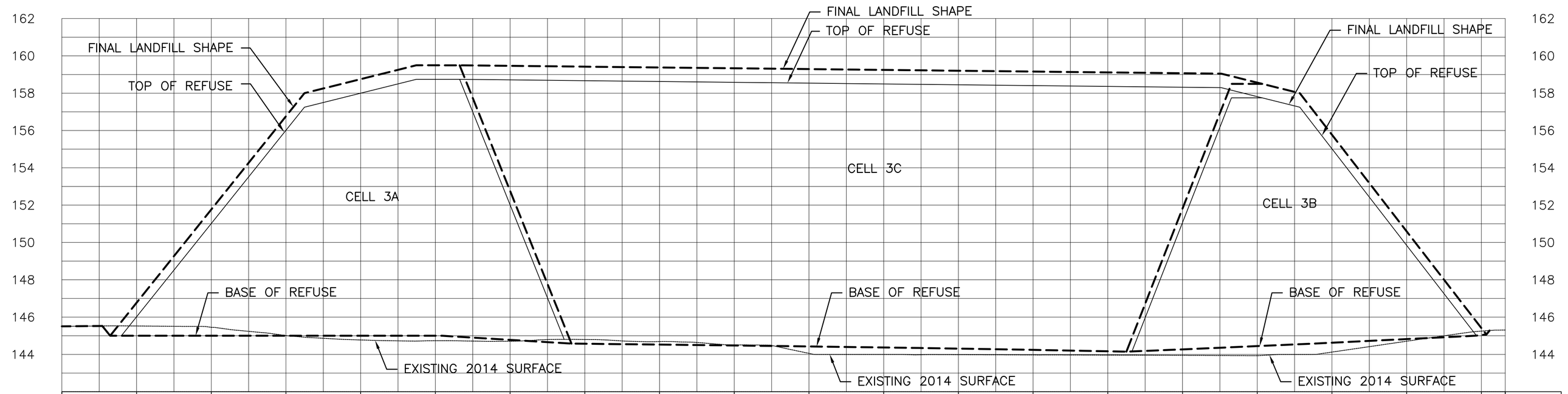
Scale 0 7.5 22.5 37.5

Drawing No. C-01

Sheet 1 of 3

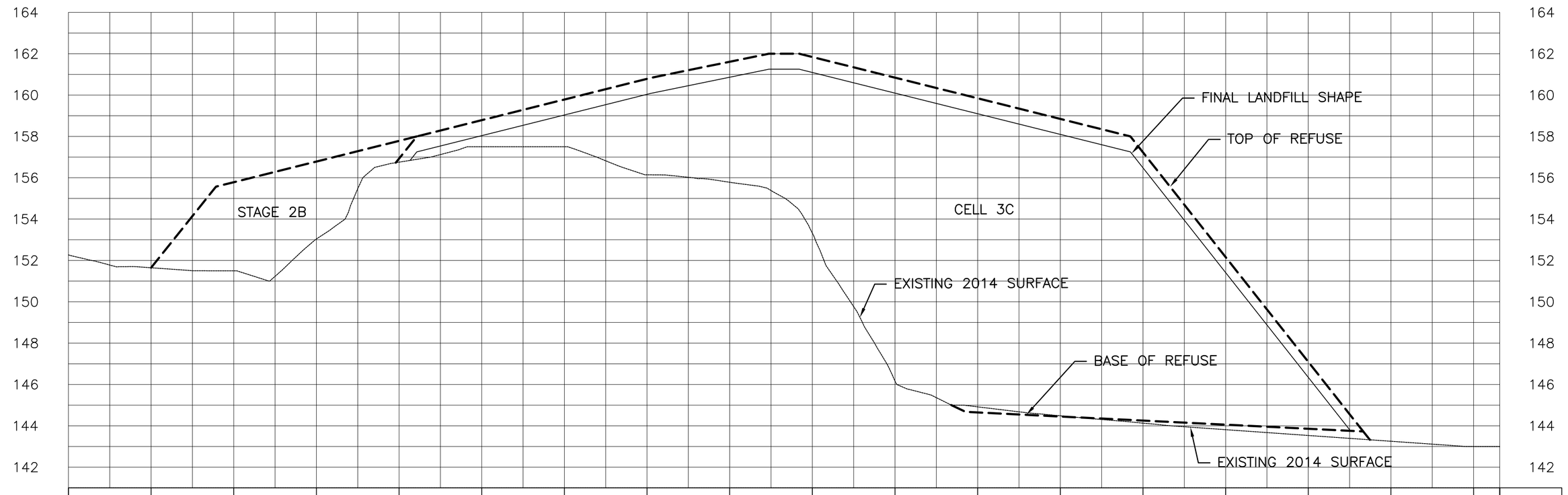
Revision 0

W:\active\163401232\planning\drawing\163401232 Drawings.dwg
2015/12/09 9:21 AM By: Taylor, Stephen
ORIGINAL SHEET - ANSI D



STATION	0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180	0+200	0+220	0+240	0+260	0+280	0+300	0+320	0+340	0+380	0+386.38
BASE PAD DESIGN LEVEL	145.51	145.00	145.00	145.00	145.00	145.00	144.78	144.57	144.53	144.48	144.43	144.37	144.31	144.24	144.17	144.27	144.44	144.63	144.82	145.04	145.31
FINAL GRADE	145.51	146.77	151.77	156.76	158.75	159.49	159.47	159.43	159.38	159.34	159.29	159.25	159.20	159.16	159.11	159.07	158.57	155.77	150.59	145.41	145.31

SECTION AA



STATION	0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180	0+200	0+220	0+240	0+260	0+280	0+300	0+320	0+340	0+346.33
BASE PAD DESIGN LEVEL												144.64	144.43	144.24	144.06	143.86			
FINAL GRADE					156.93	158.79	159.79	160.79	161.61	161.84	160.84	159.84	158.84	157.23	152.16	147.10			

SECTION BB

Stantec

1331 Clyde Avenue
Ottawa, ON, K2C 3G4
Tel. 613-722-4420
www.stantec.com

Copyright Reserved

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

Notes

Revision	By	Appd.	YY.MM.DD
ISSUED FOR REVIEW	G.L.	G.L.	15.12.09
Issued	By	Appd.	YY.MM.DD

File Name:

Dwn. Chkd. Dsgn. YY.MM.DD

Permit-Seal

Client/Project

MC NAB / BRAESIDE
WASTE DISPOSAL SITE

STAGE 3 DEVELOPMENT

Ottawa, ON.

Title

PROPOSED SECTIONS

Project No. 163401232

Scale 0 7.5 22.5 37.5

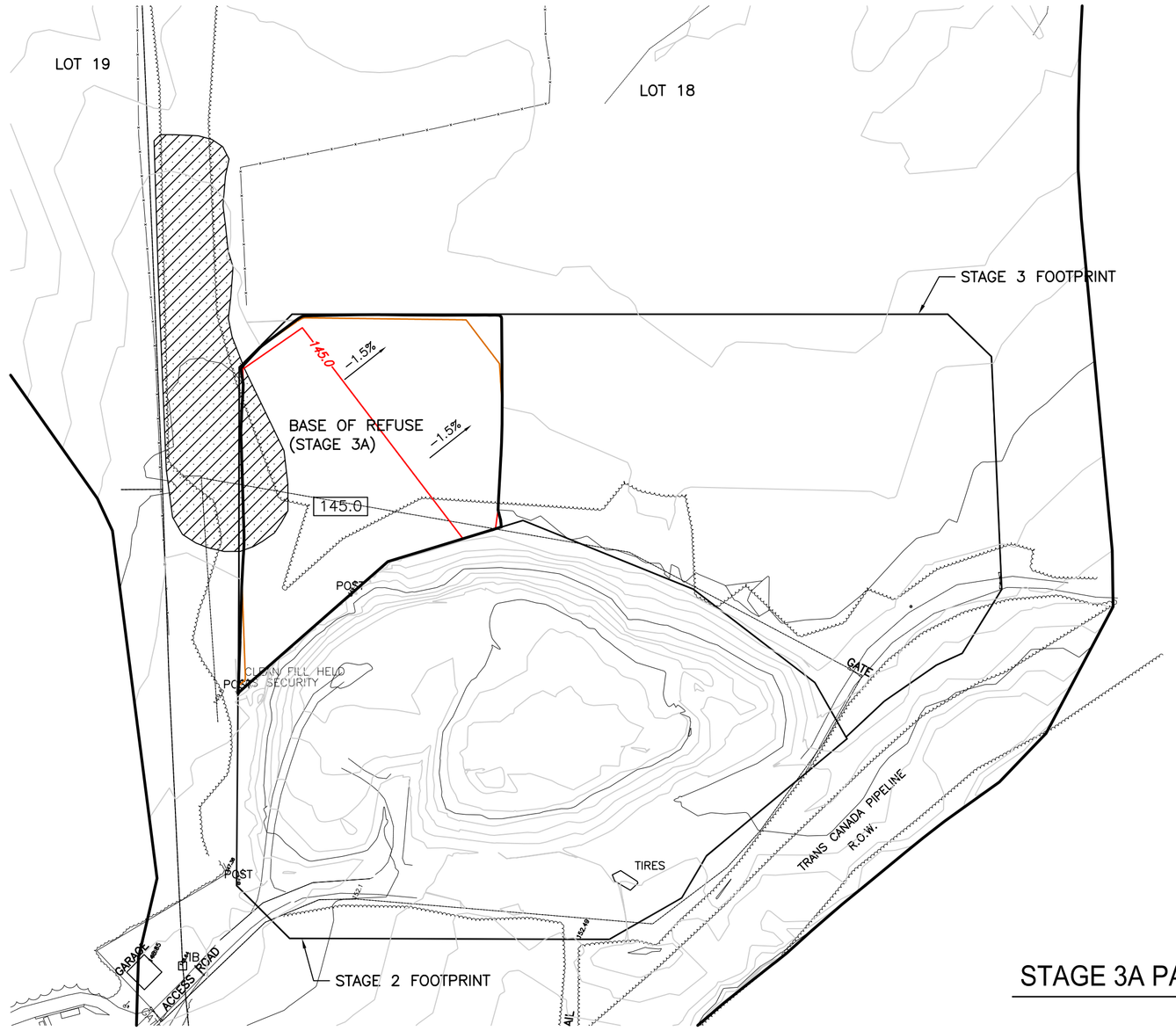
Drawing No. C-02

Sheet 2 of 3

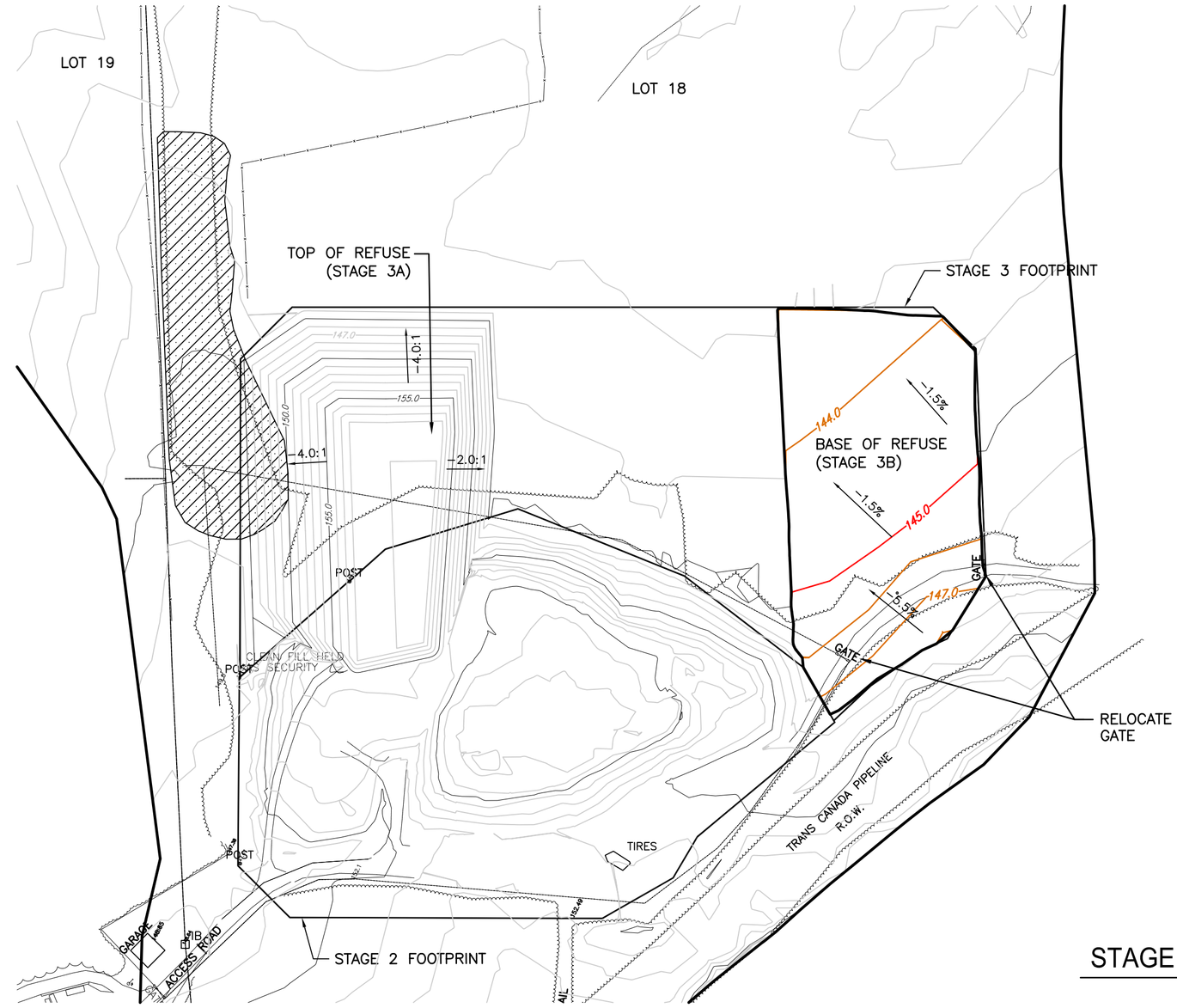
Revision 0

W:\active\163401232\planning\drawing\134401232 Drawings.dwg
2015/12/09 9:21 AM By: Taylor, Stephen

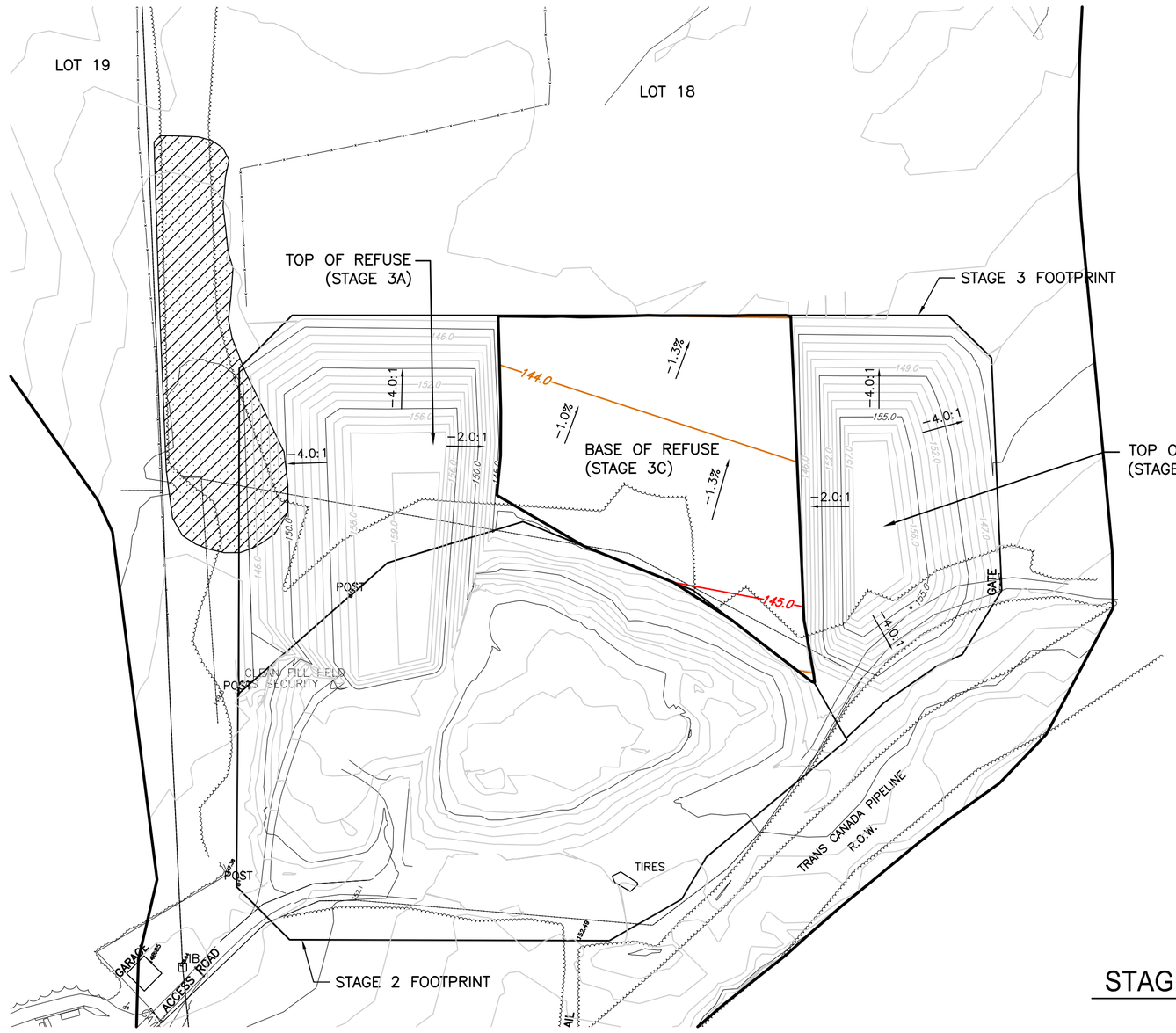
ORIGINAL SHEET - ANSI D



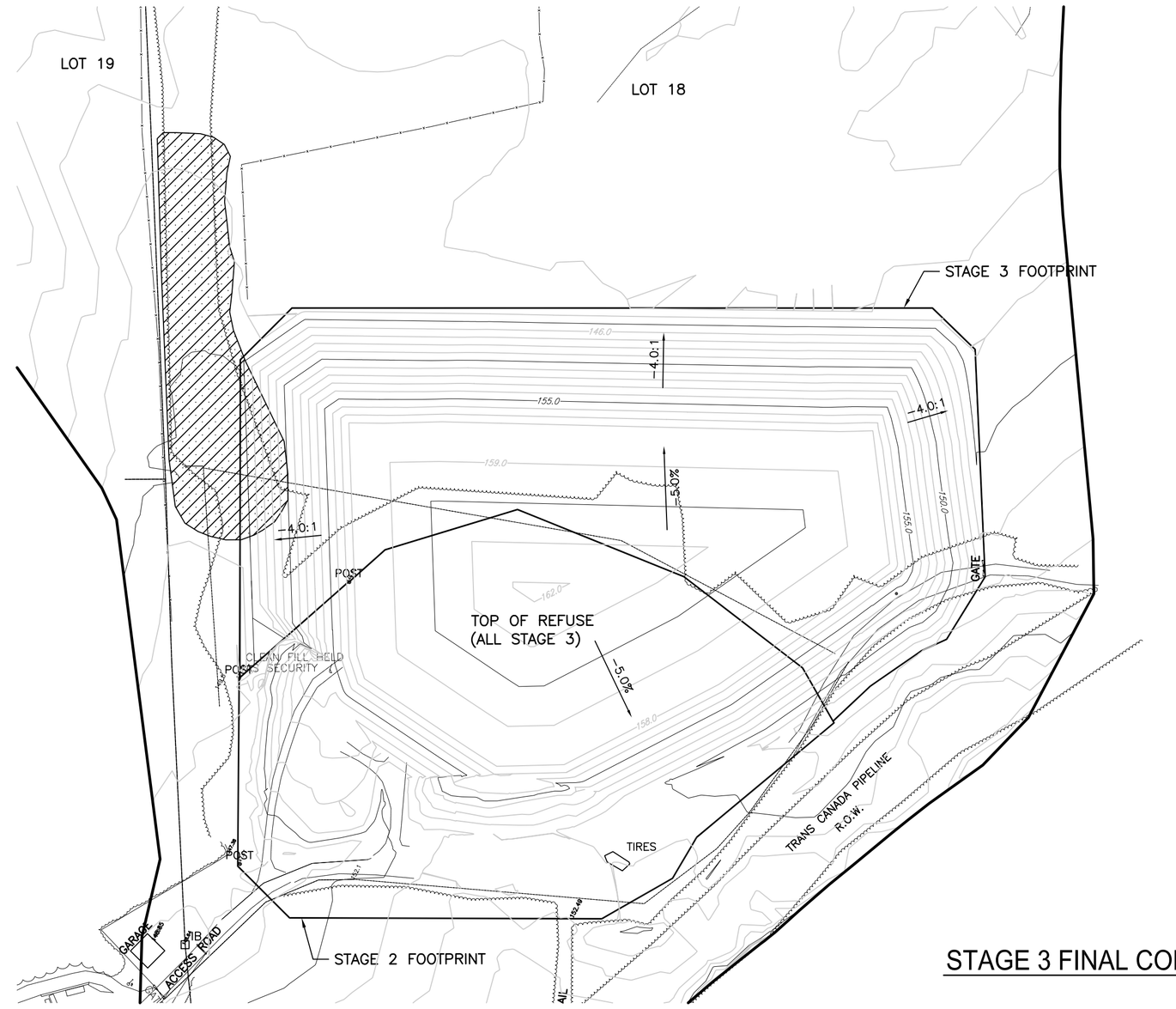
STAGE 3A PAD



STAGE 3B PAD



STAGE 3C PAD



STAGE 3 FINAL CONTOURS

Stantec

1331 Clyde Avenue
Ottawa, ON. K2C 3G4
Tel. 613-722-4420
www.stantec.com

Copyright Reserved

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay.
The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Consultants

Legend

140.0 EXISTING CONTOURS

150.0 PROPOSED CONTOURS

Notes

1. RELOCATE BEAR FENCE AROUND STAGE 3 DEVELOPMENT
2. RELOCATE GATE FOR STAGE 3B DEVELOPMENT AND BEAR FENCE AROUND STAGE 3B AND 3C

Revision	By	Appd.	YY.MM.DD
ISSUED FOR REVIEW	G.L.	G.L.	15.12.09

Issued

	By	Appd.	YY.MM.DD

File Name:

Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project
MC NAB / BRAESIDE
WASTE DISPOSAL SITE

STAGE 3 DEVELOPMENT

Ottawa, ON.

Title
STAGING PLAN

Project No. 163401232

Scale 0 20 60 100

Drawing No. C-03

Sheet 3 of 3

Revision 0

W:\Gw\ltwin\163401222\planning\drawing\136401222 Drawings.dwg
2015/12/09 9:22 AM By: Taylor, Stephen

ORIGINAL SHEET - ANSI D



wsp.com