Clean Harbors Canada, Inc.
Lambton Facility
4090 Telfer Road, R.R. #1
Corunna, Ontario
N0N 1G0

2017 Annual Landfill Report

Executive Summary

Table of Contents

FIGURES

TABLES

APPENDICES

1. INTRODUCTION

1.1 Background and Scope

Clean Harbors Canada, Inc. operates a hazardous waste management complex on a 140 hectare parcel of land in St. Clair Township, Lambton County, called the Lambton Facility. The location of the Lambton Facility and major site features are shown in **Figure 1.** Site Location Plan and **Figure 2.** Site Works and Development Plan, respectively.

The Lambton Facility encompasses an analytical laboratory, a transportation depot, a high temperature incinerator, associated pretreatment processes, as well as a landfill.

The landfill is operated in accordance with Environmental Compliance Approval (ECA) No. **A031806** dated September 5, 1997, as amended by subsequent Notices up to, and including, Notice 11 dated September 22, 2017. Copies of the ECA and amendment Notices are provided in **Appendix A**.

1.2 Site Inspection, Monitoring and Reporting Requirements

Condition 15 of the ECA requires that the Annual Landfill Report be submitted by April 1st of each year and include the following information.

a. The results and an interpretive analysis of the results of all Site monitoring programs, including an assessment of the need to amend the monitoring programs;
b. A summary of any drilling programs, geotechnical monitoring programs, and the results of any soil testing;
c. An assessment of the operation and performance of all Major Works, the need to amend the design or operation of the Site, and the adequacy of and need to implement the contingency plans;
d. Site plans showing the existing contours of the Site; areas of landfilling operation during the reporting period; areas of intended operation during the next reporting period; areas of excavation during the reporting period; any encountered gravel or sand lenses, the progress of final cover, vegetative cover, and any intermediate cover application; facilities existing, added or removed during the reporting period; and Site preparations and facilities planned for installation during the next reporting period;
e. Calculations of the volume of waste, daily and intermediate cover, and final cover deposited or placed at the Site during the reporting period and a calculation of the total volume of Site capacity used during the reporting period;
f. A calculation of the remaining capacity of the Site and an estimate of the remaining Site life;
g. A summary of the monthly, maximum daily and total annual quantity (tonnes) of waste received at the Site for landfilling and pretreatment, including types and origin;
h. Any Unused Tonnage applied to the current year;
i. A summary of any complaints received and the responses made;
j. A discussion of any operational problems encountered at the Site and corrective action taken;
k. Any changes to the Design and Operations Report and the Closure Plan that have been approved by the Director since the last Annual Report;

l. A report on the status of all monitoring wells and a statement as to compliance with Ontario Regulation 903;
m. Site plan showing the location of the storage for the unacceptable waste;
n. A list of all rejected loads, including reasons for any rejection;
o. A summary of quantities and types of wastes temporarily stored and transferred from the Site; and
p. Any other information with respect to the Site which the District Manager may require from time to time.
q. **For QC Results:** a summary of all quality control sampling in accordance with the quality assurance/quality control plans for the Major Works, including interpretation and discussion of compliance with those plans.
r. **For LDR**: a detailed monthly summary of the type (by waste class and characteristic) and quantity of waste received at the Site for LDR and at the Processing Facility for LDR and landfill pretreatment system, total amount and type of reagents used in the process, and the total amount and destination of all outgoing wastes from the Processing Facility; and
s. **For LDR**: a descriptive summary of upgrades conducted during the previous calendar year.

This annual report, which covers the period from **January 1, 2017 to December 31, 2017,** presents the requested information.

1.3 Report Organization

This report is subdivided into two parts:

- The Executive Summary outlines the various site monitoring activities and reporting requirements, as set out in the ECA.
- The Appendices contain supporting information, reports and technical data submitted by consultants responsible for the various environmental monitoring programs conducted at the Lambton Facility.

Figure 1. Site Location Plan

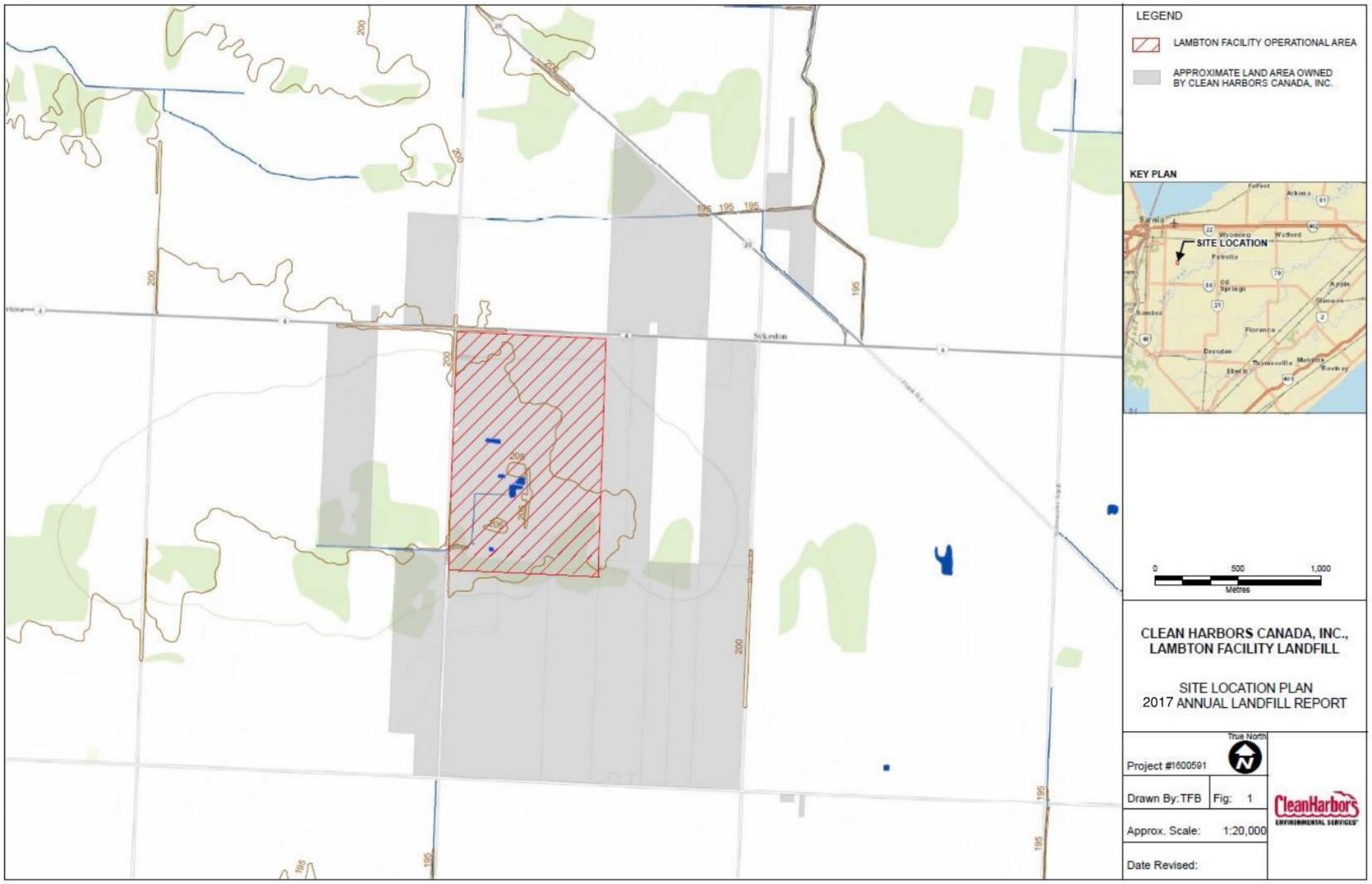
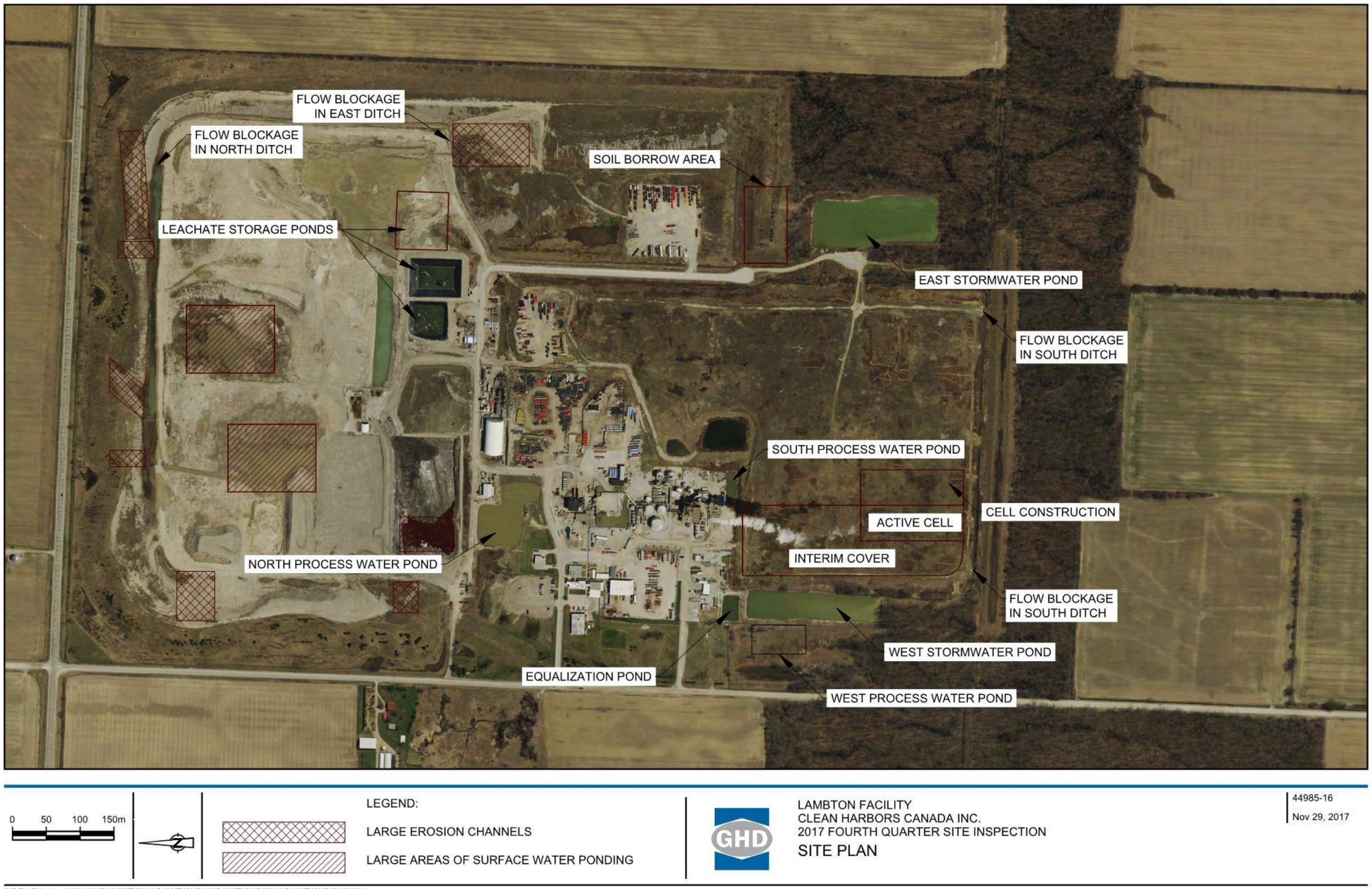


Figure 2. Site Works and Development Plan



Following is a brief description of the contents:

EXECUTIVE SUMMARY	
Section 1: Introduction	Provides background of on-site operations and monitoring activities.
Section 2: Facility Operations	Overview of site operations and description of the waste received.
Section 3: Waste Types and Quantities	Summary of waste types and quantities received, processed and landfilled; remaining landfill capacity.
Section 4: Site Inspection Activities	Summary of quarterly site inspection reports.
Section 5: Environmental Monitoring	Summary of groundwater, surface water, air quality and biomonitoring activities.
Section 6: Recommendations	Summary of recommendations contained within each of the technical reports.
APPENDICES	
Appendix A: Environmental Compliance Approvals	ECA **#A031806** dated September 5, 1997 as amended by subsequent Notices up to, and including, Notice 11 dated September 22, 2017.
Appendix B: Previous Year Annual Landfill Report Correspondence	Review comments concerning Clean Harbors' previous year Annual Landfill Report.
Appendix C: Waste Material Codes and Descriptions	Description of material codes applied by Clean Harbors Canada, Inc. to characterize waste streams.
Appendix D: Waste Load Rejection Summary	List of rejected waste loads and basis for rejection.
Appendix E: Community Liaison & Advisory Committee Meeting Minutes	Copy of the minutes from the scheduled Community Liaison & Advisory Committee meetings.
Appendix F: Summary of Quarterly Site Inspection Reports	Summary of quarterly site inspection results undertaken by GHD.
Appendix G: Groundwater Monitoring Report	Technical report prepared by GHD
Appendix H: Surface Water Quality Monitoring Report	Annual surface water technical report prepared by GHD.
Appendix I: Air Quality Monitoring Report	Technical report prepared by ORTECH Canada Ltd.
Appendix J: Biomonitoring Report	Technical report prepared by Stantec Consulting Limited.

1.4 Review of 2016 Annual Landfill Report

It has been the historic practice for the Ministry of the Environment and Climate Change (MOECC) to provide comments on the facility's annual landfill reports. The comments typically relate to requests for clarification and, on occasion, reflect a difference in opinion on data interpretation. With respect to issues pertaining to environmental monitoring, Clean Harbors Canada, Inc. confers closely with its independent consultants in reviewing the MOECC comments and providing a written response. The responses can include, but are not limited to, modifications of reporting procedures and direct correspondence to the MOECC providing further detailed explanations. No comments were received from the MOECC for the 2016 Annual Landfill Report.

Comments on the 2016 Annual Report were received from Neegan Burnside, retained by Walpole Island First Nation (WIFN) as a technical reviewer.

Comments regarding the 2016 Annual Landfill Report that have been provided to Clean Harbors are enclosed in **Appendix B**. The comments were received in the latter part of 2017 and Clean Harbors has not finalized responses to each comment. A copy of the Clean Harbors responses to the 2016 Annual Report comments received will be provided to WIFN during 2018 and included as part of the next annual report.

2. REVIEW OF SITE DEVELOPMENT AND OPERATIONS

2.1 Landfill Development Activities

The Lambton Landfill expansion was approved in 2015 and involves the vertical expansion of the landfill, mainly over previously filled areas of the existing landfill. Construction of the landfill expansion was initiated in Fall 2015 based on the Design and Operations Plan as approved by MOECC on October 19, 2015. Landfill development activities undertaken in 2017 include the following:

- Construction of Cell 19-1-3.
- Interim cap placement on Cells 19-1-1, 19-1-2A and the western portion of 19-1-2B.

No major development or construction activities are planned for the landfill in 2018. Major features of the site are shown in **Figure 2.** Site Works and Development Plan.

2.2 LDR Pretreatment Activities

No upgrades were conducted to LDR during the reporting period.

2.3 Assessment of Major Works

The following engineered design elements of the Lambton Landfill are considered to be Major Works:

- Interim clay cap
- Hydraulic control layer
- Final cover including HDPE liner, geosynthetic liner and geocomposite
- Perimeter leachate control trench

All Major Works operated as expected in 2017. No issues were identified that require an amendment to the design of the Major Works.

2.4 Summary of Complaints

During the reporting period, one off-site complaint was received by Clean Harbors. A complaint was received from a site neighbour regarding odour. The complaint was investigated by Clean Harbors staff and it was determined that the neighbor was located upwind of the site and that the facility was not the source of any odours that may have been detected. The MOECC Spills Action Centre was notified of the complaint.

2.5 Community Liaison & Advisory Committee (CLAC)

The Community Liaison & Advisory Committee (CLAC) meets regularly during the year to discuss the Lambton Landfill facility operations, updates and potential issues. The Committee is made up of local community members, St. Clair Township Councillors, Walpole Island First Nation, Aamjiwnaang First Nation, a representative of the Ministry of Environment and Climate Change, and Clean Harbors employees. Minutes from the meetings held during the reporting period are included in **Appendix E**.

3. WASTE TYPES AND QUANTITIES

3.1 Pretreatment and Waste Processing

The ECA requires that Clean Harbors provide to the MOECC each year:

a) **For LDR**: a detailed monthly summary of the type (by waste class and characteristic) and quantity of waste received at the Site for LDR and at the Processing Facility for LDR and landfill pretreatment system, total amount and type of reagents used in the process, and the total amount and destination of all outgoing wastes from the Processing Facility; and

b) **For LDR**: a descriptive summary of upgrades conducted during the previous calendar year.

Table 1 provides a summary of the information for the pretreatment process (stabilization).

Table 1. Waste Pre-treatment (Stabilization) - January 2017 – December 2017

Month	Waste Class	Weight (Tonnes)	REAGENT WEIGHTS (Tonnes)								Weight Landfilled (Tonnes)
			CKD	FA	PC	W	F	D	TSP	FCL	
Jan 2017	143H	83.2	43.8	0	8.9	21.0	1.0	0	0	0	157.9
	146T	213.3	0	0	18.1	49.6	0	0	0	0	281.0
	N/A	828.0	70.9	0	0	185.8	27.0	0	0	0	1111.7
Feb 2017	143H	151.7	36.1	0	45.5	42.0	4.0	0	0	0	288.7
	146H	10.4	0	0	2.1	1.5	0	0	0	0	14
	146T	182.5	0	0	18.2	71.2	0	0	0	0	271.9
	N/A	833.0	92.9	0	0	226.3	35.0	0	0	0	1224.0
Mar 2017	131H	8.1	0	0	2.4	2.0	0.1	0	0	0	12.6
	143H	187.2	56.2	0	56.2	46.0	6.0	0	0	0	351.6
	146H	10.7	3.2	0	0	0	0.3	0.3	0	0	14.5
	146T	206.4	0	0	20.7	84.0	0	0	0	0	311.1
	N/A	651.6	71.6	0	23.2	202.0	27.0	0	0	0	975.4
Apr 2017	143H	124.4	28.0	0	37.1	36.2	4.0	0	0	0	229.7
	146T	227.7	0	0	22.8	66.4	0	0	0	0	316.9
	N/A	778.6	141.9	0	28.0	230.5	37.0	0	0	0	1216.0
May 2017	143H	124.5	41.3	0	37.2	34.4	4.0	0	0	0	241.4
	146T	209.4	0	0	20.9	72.2	0	0	0	0	302.5
	N/A	807.0	65.4	0	44.8	288.9	28.0	0	0	0	1234.1
Jun 2017	143H	162.7	64.2	0	48.8	57.0	6.0	0	0	0	338.7
	146T	213.9	0	0	21.5	78.1	0	0	0	0	313.5
	N/A	697.0	86.4	0	14.5	241.5	30.0	0	0	0	1069.4
Jul 2017	146T	229.9	0	0	22.9	85.7	0	0	0	0	338.5
	N/A	993.2	0	0	22.9	259.5	27.0	0	0	0	1302.6
Aug 2017	143H	244.9	0	0	65.3	76.9	10.3	0	0	0	397.4
	146H	2.4	0	0	0.2	2.0	1.0	0	0	0	5.6
	146T	314.3	0	0	38.4	86.5	8.0	0	0	0	447.2
	N/A	796.7	4.8	0	64.3	240.6	17.0	0	0	0	1123.4
Sep 2017	131T	8.5	0	0	1.3	1.0	0	0	0	0	10.8
	143H	174.0	0	0	40.7	50.5	17.0	0	0	0	282.2
	146T	191.9	0	0	24.9	69.5	0	0	0	0	286.3
	N/A	974.2	0	0	65.2	283.7	11.0	0	0	0	1334.1
Oct 2017	122C	25.5	0	0	0	0	14.6	0	0	0	40.1
	131H	17.5	0	0	5.3	1.0	0.2	0	0	0	24.0
	131T	7.3	0	0	1.1	1.0	0	0	0	0	9.4
	143H	210.5	0	0	45.3	49.0	5.0	0	0	0	309.8
	146H	47.9	0	0	4.7	0	2.6	1.3	0	0	56.5
	146T	159.6	0	0	31.6	33.7	4.4	0	0	0	229.3

Month	Waste Class	Weight (Tonnes)	REAGENT WEIGHTS (Tonnes)								Weight Landfilled (Tonnes)
			CKD	FA	PC	W	F	D	TSP	FCL	
	N/A	929.3	0	0	86.9	241.2	12.0	0	0	0	1269.4
Nov 2017	143H	153.7	0	0	43.2	46.5	7	0	0	0	250.4
	131H	10.1	0	0	3	2	.1	0	0	0	15.2
	122C	34.1	0	0	1.5	2	3	0	0	0	40.6
	146H	12.1	0	0	1.2	0	.6	.6	0	0	14.5
	146T	7.7	0	0	4.6	2.0	0	0	0	0	14.3
	146A	34.4	0	0	2.0	2.0	0	0	0	0	38.4
	N/A	694.9	0	0	81.3	185.6	16	0	0	0	977.8
Dec 2017	N/A	854	0	0	77.8	210.6	10	0	0	0	1152.4
	122C	38.2	0	0	0	2	1	0	0	0	41.2
	146A	31.4	0	0	3.1	4.0	0	0	0	0	38.5
	143H	110.2	0	0	26.5	35.5	5	0	0	0	177.2
	146T	10	0	0	6	4	0	0	0	0	20
	148C	13.2	0	0	3.3	2.6	0	0	0	0	19.1

Note: *N/A refers to in-house generated waste which includes the incinerator burner ash and the thermal desorber ash.*

Reagents: *Cement Kiln Dust (CKD), Flyash (FA), Portland Cement (PC), Water (W), Ferrous Sulphate (F), Sodium Sulfide (D), Trisodium Phosphate (TSP), Ferric Chloride (FCL)*

Following the stabilization process (performed in the LDR processing building) or the solidification process (performed in exterior mixing pit), all wastes are loaded into an articulating hauler and transported to the landfill for final disposal.

Table 2 and Table 3 below provide summaries of the quantities of waste processed via solidification and macro-encapsulation pre-treatment processes, respectively, during the reporting period. **Table 4** provides a summary of the quantity of waste processed at the TDU during the reporting period.

Table 2. Waste Pre-treatment (Solidification) – January 2017 – December 2017

Month	Waste Processed (tonnes)	Month	Waste Processed (tonnes)
Jan 2017	278	Jul 2017	203
Feb 2017	42	Aug 2017	207
Mar 2017	5	Sep 2017	0
Apr 2017	19	Oct 2017	4
May 2017	0	Nov 2017	148
Jun 2017	5	Dec 2017	6

Table 3. Waste Pre-treatment (Macro-encapsulation) – January 2017 – December 2017

Month	Waste Processed (tonnes)	Month	Waste Processed (tonnes)
Jan 2017	29	Jul 2017	153
Feb 2017	56	Aug 2017	100
Mar 2017	63	Sep 2017	100
Apr 2017	221	Oct 2017	103
May 2017	203	Nov 2017	47
Jun 2017	178	Dec 2017	118

Table 4. Waste Processed at the TDU – January 2017 – December 2017

Month	Waste Processed (tonnes)	Month	Waste Processed (tonnes)
Jan 2017	1842	Jul 2017	2172
Feb 2017	1629	Aug 2017	1897
Mar 2017	1602	Sep 2017	1720
Apr 2017	1268	Oct 2017	1507
May 2017	2155	Nov 2017	1259
Jun 2017	1338	Dec 2017	1643

3.2 Waste Quantities and Landfill Capacity

3.2.1 Waste Quantities

Conditions 4 and 5 of the ECA identify the waste streams that are acceptable for landfill at the Lambton Facility. A description of the material classification codes used by the facility to describe landfill-destined wastes is provided in **Appendix C**.

The waste classification codes used in this report reflect the implementation of Clean Harbors' corporate computer business platform used internally across North America. The waste codes provide a description of the wastes to be received. As per Condition 8 of the ECA, daily records are maintained at the facility, identifying the quantities and types of wastes received, origin of the waste, results of analyses performed and the location of placement in the cell. Associated information (i.e., description of the quantities of waste received and their origin), and an estimate of the remaining capacity are summarized on an annual basis per Condition 15 (b).

In the period from January 1, 2017 through to December 31, 2017, Clean Harbors Lambton Facility received 86,040.7 tonnes of solid waste, not including 3,634 tonnes of ash generated on-site from the incinerator. A summary of the waste types and quantities received at the facility is provided in **Table 5**. A detailed monthly breakdown for the three categories of generator location is provided in **Table 6**, **Table 7** and **Table 8**.

Table 5. Waste Quantity (tonnes) by Waste Types, January 1, 2017 to December 31, 2017

Clean Harbors Waste Codes	Material Type	Generator Location			Total
		Ontario	Other Provinces	United States	
CA1	Solids contaminated with cyanides	100	0	58	158
CANL	Spent pot liner	0	1460	4770	6230
CATR	Catalyst for reclamation	9	25	231	265
CATRI	Catalyst for reclamation, limited value	1	0	0	1
CBP	Non hazardous	9155	1320	269	10744
CBPR	RCRA solids	2865	810	1605	5280
CBPS	Semi-solids	625	0	66	691
CCRT	Thermal desorber	3585	0	14900	18485
CCS	Inorganic solids	2235	179.7	2484	4898.7
CCSF	F-Listed for stabilization	1	0	70	71
CCSM	Debris for Micro	180	205	682	1067
CCSMA	Debris for Macro	22622	8462	979	32063
CCSS	Characteristic semi-solids	4.2	14	40	58.2
CNIA	Non RCRA asbestos	16.6	33.2	0	49.8
CNO	Non RCRA solids	5472	494	13	5979
	Incinerator ash	3634	0	0	3634
	TOTAL	**50,504.8**	**13,002.9**	**26,167**	**89,674.7**
	Percent of Total	56.3	14.5	29.2	

Table 6. Waste Quantity (tonnes) by Waste Types, Ontario Generators

Clean Harbors Waste Codes	Generator Location: Ontario												Total
	January	February	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	
CA1	20	0	19	0	7	14	0	20	0	20	0	0	**100**
CANL	0	0	0	0	0	0	0	0	0	0	0	0	**0**
CATR	0	0	0	0	9	0	0	0	0	0	0	0	**9**
CATRI	0	0	0	0	0	0	0	0	1	0	0	0	**1**
CBP	278	180	313	484	316	317	295	1497	1172	2667	1277	359	**9155**
CBPR	52	3	0	267	162	277	75	0	0	26	2003	0	**2865**
CBPS	84	29	5	19	31	8	184	181	0	4	74	6	**625**
CCRT	215	71	452	226	171	252	86	277	427	486	536	386	**3585**
CCS	206	109	269	150	203	219	108	249	216	181	183	142	**2235**
CCSF	0	0	1	0	0	0	0	0	0	0	0	0	**1**
CCSM	3	10	6	5	7	63	68	6	2	4	6	0	**180**
CCSMA	1764	1797	1893	1996	2646	2128	1719	1439	2027	1903	1996	1314	**22622**
CCSS	0	0	0	3	0	1	0	0.2	0	0	0	0	**4.2**
CNIA	0	0.2	0	0	3	0	0.4	0	10	0	3	0	**16.6**
CNO	383	436	443	350	560	755	325	400	773	538	272	237	**5472**
TOTAL	**3005**	**2635.2**	**3401**	**3500**	**4115**	**4034**	**2860.4**	**4069.2**	**4628**	**5829**	**6350**	**2444**	**46870.8**

Table 7. Waste Quantity (tonnes) by Waste Types, Other Provinces Generators

Clean Harbors Waste Codes	Generator Location: Other Provinces												Total
	January	February	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	
CA1	0	0	0	0	0	0	0	0	0	0	0	0	**0**
CANL	65	123	296	432	385	159	0	0	0	0	0	0	**1460**
CATR	0	0	0	0	25	0	0	0	0	0	0	0	**25**
CATRI	0	0	0	0	0	0	0	0	0	0	0	0	**0**
CBP	37	17	102	117	266	49	265	28	191	115	98	35	**1320**
CBPR	37	359	7	0	87	9	11	8	0	276	16	0	**810**
CBPS	0	0	0	0	0	0	0	0	0	0	0	0	**0**
CCRT	0	0	0	0	0	0	0	0	0	0	0	0	**0**
CCS	0.4	1	0	0	10	0	16	25	0.3	44	81	2	**179.7**
CCSF	0	0	0	0	0	0	0	0	0	0	0	0	**0**
CCSM	5	9	0	0	19	14	61	51	17	10	17	2	**205**
CCSMA	553	585	493	616	946	1140	742	935	712	793	117	830	**8462**
CCSS	0	0	0	0	0	4	0	0	1	1	6	2	**14**
CNIA	0	0	0	26	0	7	0	0	0.2	0	0	0	**33.2**
CNO	90	56	97	49	0	0	0	97	24	81	0	0	**494**
TOTAL	**787.4**	**1150**	**995**	**1240**	**1738**	**1382**	**1095**	**1144**	**945.5**	**1320**	**335**	**871**	**13002.9**

Table 8. Waste Quantity (tonnes) by Waste Types, United States Generators

Clean Harbors Waste Codes	Generator Location: United States												Total
	January	February	March	April	May	June	July	August	September	October	November	December	
CA1	9	0	0	15	0	8	0	10	0	8	0	8	**58**
CANL	0	0	0	143	961	1395	822	698	635	116	0	0	**4770**
CATR	0	0	0	127	6	59	15	24	0	0	0	0	**231**
CATRI	0	0	0	0	0	0	0	0	0	0	0	0	**0**
CBP	0	0	11	0	18	0	0	9	75	54	88	14	**269**
CBPR	38	53	110	658	409	34	53	64	39	63	84	0	**1605**
CBPS	0	0	0	0	0	0	36	0	30	0	0	0	**66**
CCRT	1117	2205	1873	1193	725	1302	1355	1250	519	905	1255	1201	**14900**
CCS	214	185	384	295	223	212	204	234	451	52	18	12	**2484**
CCSF	1	20	0	3	0	0	2	0	0	44	0	0	**70**
CCSM	8	34	45	52	326	8	31	27	18	38	25	70	**682**
CCSMA	12	45	21	35	511	31	134	20	36	79	42	13	**979**
CCSS	0	0	0	0	0	0	0	0	32	8	0	0	**40**
CNIA	0	0	0	0	0	0	0	0	0	0	0	0	**0**
CNO	0	0	0	0	0	0	0	0	13	0	0	0	**13**
TOTAL	**1399**	**2542**	**2444**	**2521**	**3179**	**3049**	**2652**	**2336**	**1848**	**1367**	**1512**	**1318**	**26167**

For the reporting period, the total quantity of waste received at the Lambton landfill by point of origin is summarized in **Table 9**.

Table 9. Total Waste Receipts by Source (tonnes)

Source	Quantity Received (tonnes)	% Total Quantity
Ontario	46,870.8	54.5
Other Provinces	13,002.9	15.1
United States	26,167	30.4
Total	**86,040.7**	

During the reporting period, the maximum daily quantity of waste received for pretreatment and landfilling was 604 tonnes on November 21, 2017.

No wastes were temporarily stored and then transferred from the site during the reporting period.

Condition 29 (i) of the ECA specifies that the maximum rate at which the Site may accept waste is 200,000 tonnes per calendar year. No Unused Tonnage was applied to the reporting year. As of December 31, 2017, the two year total Unused Tonnage is 179,836.7 tonnes.

3.3 Landfill Capacity

The vertical landfill expansion was approved in 2015 with a permitted capacity of 3,870,000 m^3. Filling within the expansion landfill began in Subcell 19-1 in early 2016. As of December 31, 2017, the remaining capacity of landfill was 3,745,362 m^3 (124,638 m^3 or 3.2% of capacity used). The remaining capacity in Subcell 19-1 was approximately 58,371 m^3, as of December 31, 2017.

Based on current projections using 2017 volumes, the landfill expansion is expected to have a site life of 54 years.

3.4 Waste Load Rejection Summary

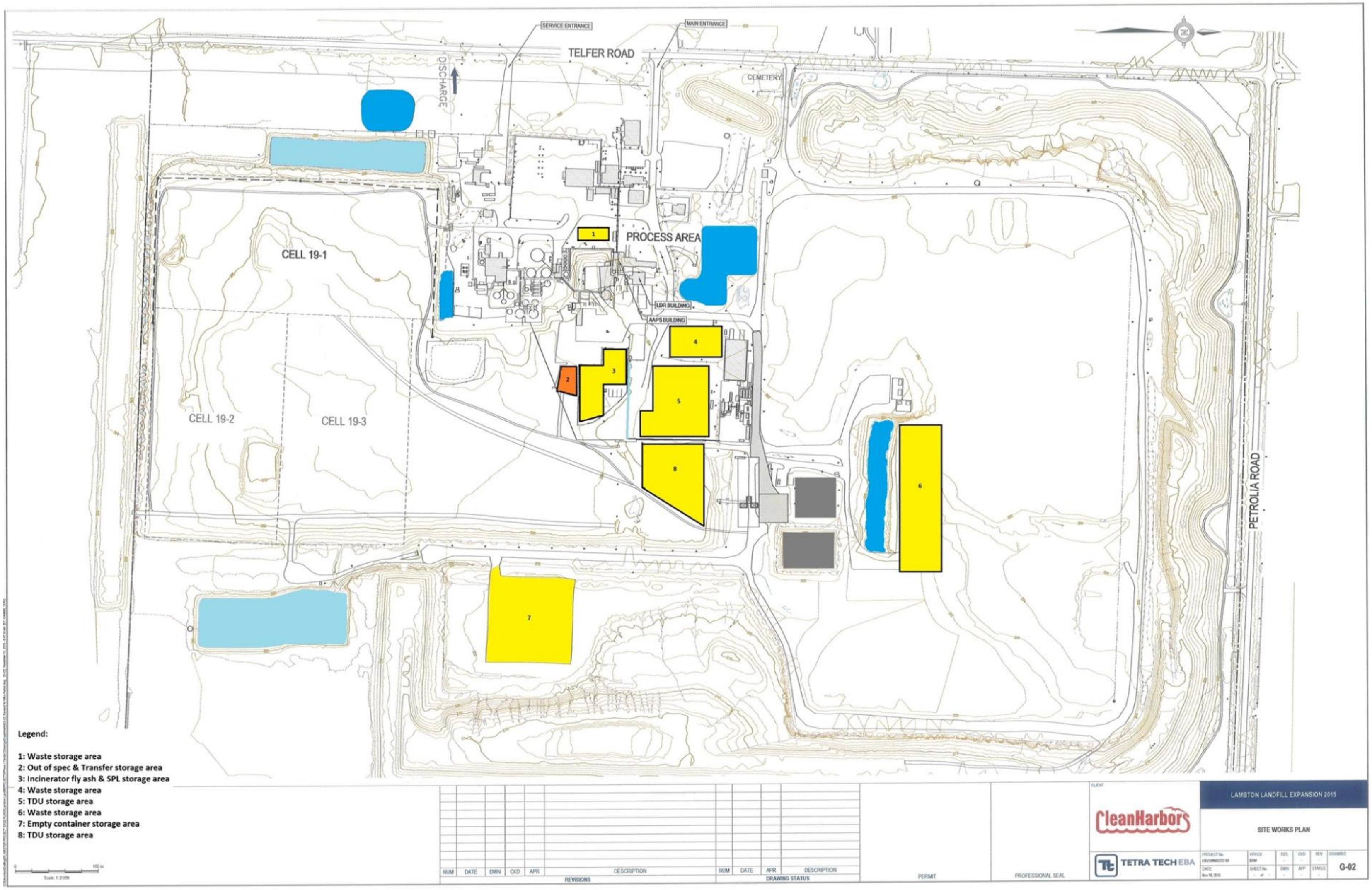
Clean Harbors Canada, Inc. is required under Condition 15 (b) (xiv) of the ECA to provide the MOECC with a list of all rejected waste loads (i.e., vehicle shipments) together with the reasons for rejection.

During the reporting period covered by this report, 11 individual loads of waste were rejected by the Lambton Facility for failing to meet the site's acceptance criteria. The reasons for rejection included:

- Material too thick to pump – one (1) loads
- Non-Conforming – one (1) load
- Not Permitted – two (2) load
- Unable to offload – five (5) load
- Operational wait times – one (1) load
- Tanker included debris – one (1) load

A summary of all waste loads rejected and related reasoning is presented in **Appendix D**. Rejected loads are contained within the Out of Spec and Transfer Storage Area. No processing or co-mingling with other waste will take place – containers will stay in this storage area untouched until it is determined that they will be shipped to another disposal location or returned to the customer. Containers will be shipped out of the site as they have been received. Once moved to the Out of Spec and Transfer Storage Area the container will be marked up in such a way as to make it discernible from the Transfer containers stored within the same area. This will be achieved by the use of marking items such as caution tape. Transfer containers will not have any such markings, which will differentiate them from the Out of Spec containers. **Figure 3.** On-Site Waste Storage Areas provides a site plan showing the various storage areas on site and location of out-of-spec material.

Figure 3. On-Site Waste Storage Areas



4. SITE INSPECTION ACTIVITIES

4.1 Quarterly Site Inspections

Clean Harbors conducts quarterly site inspections of the facility by an independent third party consultant. The inspections provide a review of the landfill operations including landfill cell development, construction and capping, perimeter screening berms, surface water management system, process water management system, leachate management system, and waste processing operations. This summary is compiled from the results of the site inspections conducted during the reporting year. The inspection program provides independent confirmation that the site is being developed in accordance with the provisions set forth in the Design and Operations Report.

The Quarterly Site Inspections were completed on the following dates:

First Quarter 2017 – March 23, 2017
Second Quarter 2017 – June 8, 2017
Third Quarter 2017 – September 13, 2017
Fourth Quarter 2017 – November 7, 2017

The site inspections consisted of a visual assessment of the landfill operations including the active waste fill area, cell development area, the landfill cap, perimeter screening berms and the various water management systems. The site inspections are documented in technical memos included in **Appendix F**.

4.1.1 Cell Development

4.1.1.1 Construction Activities

Construction occurred within the southern portion of Cell 19-1 Subcell 2, referred to as Cell 19-1-2C and was completed by the end of 2017. Construction of Cell 19-1-3 was initiated in Fall 2017. The location of the active Cell (19-1-2) and the under construction Cell (19-1-3) are shown on **Figure 2.** Site Works and Development Plan.

4.1.1.2 Landfill Cell Advancement

Landfilling activities occurred within Cell 19-1 Subcell 2 (19-1-2) during the reporting year. Initially waste was placed within the northern portion of the cell (19-1-2A) and into the central (19-1-2B) portion during the year. By the end of the year waste filling was transitioning into the southern (19-1-2C) portion of the cell. Landfilling progressed from north to south within the subcell. It is anticipated that Subcell 2 will reach capacity during 2018. Landfilling will then proceed to Subcell 3.

4.1.2 Active Waste Fill Area

A description of the active tipping face location and waste placement is presented in the site inspection reports contained in **Appendix F**. The haul route utilized from the unloading area to the active tipping face is also described in each quarterly report.

4.1.3 Landfill Cap Construction and Conditions

As part of each quarterly site inspection, visual observations are made of any cap placement work and the condition of the interim and final already in place.

With the approval of the vertical expansion of the landfill, previously capped areas of the landfill are considered to be interim, since a portion of the cap will be removed and additional waste placed in these areas. Construction of interim cap over Cells 19-1-1, 19-1-2A and the western portion of 19-1-2B was completed in 2017.

The interim cap was observed to be in good condition throughout the reporting period, with some noted minor erosion channels. Minor ponding was identified in several areas requiring minor grading improvements to promote drainage to the perimeter ditches.

No areas of the landfill have received final cover.

4.1.4 Perimeter Screening Berms

The geometry of the perimeter berms surrounding the landfill is unchanged. Erosion of the perimeter screening berm was observed to occur in a number of locations on the interior or landfill side of the berm. This ranged from minor channels to more significant channeling in select areas of the site. The erosion channels are a result of the interior side walls being unvegetated. The erosion has resulted in some sedimentation occurring in the perimeter storm water ditching.

4.1.5 Surface Water Management System

The surface water management system at the Lambton Facility is comprised of a network of drainage ditches, and two surface water ponds located in the East and West portions of the site. Surface water runoff from undeveloped portions of the site, perimeter berms, capped and closed landfill cells is directed through this network of drainage ditches and reservoirs to the on-site surface water treatment facility. Treated effluent from the surface water treatment facility is discharged to, and retained in, the Equalization Reservoir before being discharged via a channel to the municipal drainage swale located along Telfer Sideroad.

Inspection of the perimeter ditches and surface water ponds established that their sideslopes were stable with only minor evidence of erosion. Some ponding on the site and within the ditches at locations was observed throughout the year due to rainfall events, low or impeded flow due to sedimentation, vegetation and limited elevation differences.

During the reporting period, water levels in the surface water ponds were low at the start of the year and then generally remained high for the remainder of the year due to the large amount of precipitation during the year. Water levels within the equalization pond were also generally at normal operating levels during the year although they tended to be low at both the start and end of the year. The Equalization Pond provides for the adequate retention of the treated storm water. The exposed, concrete-lined sideslopes appear to be stable, although cracks and sloughing of the concrete were observed, consistent with previous observations.

Detailed observations of the surface water management system are presented in the site inspections contained in **Appendix F**.

4.1.6 Process Water Management System

The Process Water Management System consists of three ponds and a series of ditches and swales. Impacted and potentially impacted runoff from the operational areas and active landfill sub-cells is directed to the three ponds. The North Process Water Pond is located immediately west of the TDU, the South Process Water Pond is located immediately south of the incinerator, and the West Process Water Pond is located adjacent to the West Storm Water Pond. Water retained in the Process Water Management System is used as quench water for the site incineration operations.

Water levels in the process water ditch adjacent the TDU were generally below normal during the year. The process water ditch feeding the North Process Water Pond was noted to have significant sediment buildup and the west end of the culvert beneath the North Process Water Pond access driveway is partially crushed.

Levels in the South pond increased from the first quarter of the year and remained high. This was partly due to this pond receiving clean runoff from the active landfill area. The West pond had high levels during the second quarter but otherwise levels remained low during the year. The North process water pond had low water levels throughout the year.

Detailed observations of the process water management system are presented in the site inspections contained in **Appendix F**.

4.1.7 Leachate Management System

The leachate reservoirs are designed to receive leachate from the active fill area and process areas. Leachate transferred from the active fill area is detained within the leachate reservoirs prior to transfer to the incinerator for disposal. The East Leachate Reservoir and the adjacent (immediately to the east) New Leachate Reservoir operated throughout the year. The South Leachate Reservoir was not operated during the year and is scheduled to be enlarged.

The Leachate Storage Tank was in operation serving as the feed tank to the incinerator.

Detailed observations of the leachate management system are presented in the site inspections contained in **Appendix F**.

5. ENVIRONMENTAL MONITORING

5.1 Groundwater and Landfill Performance Monitoring Program

The 2017 groundwater monitoring program undertaken at the Lambton Facility was based on the document “Final Draft – Groundwater and Landfill Performance Monitoring Programs” prepared by RWDI (December 2015).

The Groundwater Monitoring Program is subdivided into three programs:

1) Groundwater Monitoring Along Perimeter of Facility
2) Sub-cell 3 Remedial Performance Monitoring
3) Performance Monitoring of Engineered Landfill Systems

The goals of the various monitoring programs are to provide for the early detection of changes in groundwater quality at the site and to demonstrate that engineering systems are functioning as intended. To address this goal, monitoring wells have been installed along the perimeter of the Facility property in the two hydraulically active water-bearing zones, which are the primary pathways along which contaminants could travel. These are referred to as the Active Aquitard and the Interface Aquifer.

The Active Aquitard is the near surface weathered portion of the clay-silt overburden that is present at the Site. Weathering including summer desiccation and winter frost action has fractured the clay materials to a depth on the order of 3 m to 4 m. Groundwater movement through the fractures is potentially rapid in comparison with movement through unfractured overburden materials.

The Interface Aquifer is located at the contact between the overburden and bedrock, and is characterized by a thin, discontinuous layer of granular material overlying fractured bedrock. This aquifer has been capable of satisfying residential water requirements albeit the yield and quality has been problematic.

The 2017 Annual Monitoring Report is appended (**Appendix G**). The reviewer should refer to this report for descriptions of each of the monitoring programs. The following discussion focuses strictly on the major findings of the programs and recommendations that have emerged.

5.2 Monitoring Results

The following is a summary of the key monitoring results for the current monitoring period. Detailed discussions are provided in Sections 3 and 4 of **Appendix G** of this document (2017 Annual Monitoring Report).

5.2.1 Groundwater Monitoring Along Perimeter of Facility

5.2.1.1 Groundwater Levels

The objective of the perimeter groundwater monitoring and sampling program is to assess the vertical and horizontal hydraulic gradients and detect the extent and magnitude of potential contamination to groundwater (if any), in the three hydrostatic units monitored (Active Aquitard, Interface Aquifer, and Shale Aquitard).

The movement of groundwater beneath the Lambton Facility is described for the three hydrostatic units monitored, as follows:

Horizontal Gradient

Active Aquitard: At the Lambton Facility, perimeter screening berms are located along the property boundary. The northern berm surrounds Cells 16 through 18 and is approximately 10 m above original ground surface. Following completion of the vertical expansion, the maximum height of the waste will be equal to height of the northern berm. The southern berm is located off Site to the south of Cell 19 and is approximately 4 m above original ground surface.

The groundwater beneath the northern berm is monitored within the berm fill and the native overburden beneath the northern berm. Conditions are also monitored adjacent to the berm along the property boundary within the native overburden. Groundwater elevations are mounded in the monitoring wells instrumented within the northern berm fill and beneath the northern berm. These groundwater elevations are slowly decreasing towards the groundwater elevations identified outside of the northern berm. Groundwater elevations identified in monitoring wells instrumented along the outside of the northern berm remain stable compared to historical measurements.

The Active Aquitard is monitored beneath the southern berm and to the north of the southern berm near the surface water drainage ditch. The monitoring wells are screened at similar elevations within the Active Aquitard. Groundwater flow along the southern property boundary is influenced by the groundwater recharge through the surface water ditch along the southern Site perimeter, the mounding below the southern berm, and the leachate collection system.

Historically, groundwater was generally mounded below the southern berm in comparison to groundwater elevations along the surface water ditch. In November 2017, groundwater elevations beneath the southern berm and along surface water ditch presented noticeable declines compared to historical groundwater elevations. The groundwater elevations are similar to the leachate collection system standpipes and sump leachate levels. Based on these observations, groundwater elevations along the western and central portions of the southern property boundary are likely being drawn down by the leachate collection system sumps.

Interface Aquifer: Groundwater contours of the Interface Aquifer illustrate a potentiometric high present in the northwest portion of the property and an outward flow. This is consistent with historical groundwater patterns. A potentiometric low is identified at TW45-99D located west of the internal facility. The low groundwater elevations at this location have historically been attributed to slow groundwater recharge.

Hydrographs of the Interface Aquifer demonstrate that the potentiometric head continues to rise at monitoring wells located off Site and along the northern property boundary. Potentiometric head which noticeably declined in September 2012 and September 2014 as a result of pumping activities was stable during 2017.

Shale Aquitard: Two groundwater monitoring wells are currently screened in the Shale Aquitard on Site and are located on the northeast corner of the property and to the south of the property. Groundwater flow directions could not be determined within the Shale Aquitard as there are insufficient monitoring locations to determine flow direction.

Vertical Gradient

The vertical gradient between two hydrostatic units is assessed through nested well clusters (wells located closely together and screened at different depths) and indicates the direction the vertical component of groundwater flow. Vertical gradients within the Site can help predict if landfill impacts have the potential to migrate downwards to adjacent hydrostatic units or for naturally occurring parameters in background groundwater to potentially migrate and influence the geochemistry of the adjacent hydrostatic unit.

Groundwater movement between the Active Aquitard and Interface Aquifer is through unfractured clay with low hydraulic conductivities. The vertical gradients are very low and represent very slow upward or downward flow through these units. The vertical gradient of the Interface Aquifer and the Shale Aquitard were also very low representing very slow upward or downward flow through these units.

5.2.1.2 Groundwater Quality

Observations regarding groundwater quality are summarized in this section. The groundwater is assessed with respect to MOECC criteria listed in the Ontario Drinking Water Standards (ODWS) for comparative reference. The groundwater is also assessed with respect to MOECC criteria listed in the Provincial Water Quality Objectives (PWQO), due to the possibility for shallow groundwater to discharge to surface water. Historically, eight leachate indicator parameters were selected to evaluate the effects of the landfill on surrounding water quality. The indicator parameters include chloride, sodium, sulfate, potassium, fluoride, barium, bromide, and boron. These parameters have historically been useful in determining the source of groundwater or potential impacts from leachate. Many other analytical parameter concentrations can change in leachate impacted water, but not generally at the levels of change noted in the above-listed parameters. The selection of specific indicator parameters may be refined for future reporting periods. For consistency, the same indicator parameters were selected for review of the 2017 analytical data.

- **Active Aquitard – Inorganic Chemistry**

Samples from Active Aquitard monitoring locations had exceedances of the ODWS for total dissolved solids (TDS), alkalinity, chloride, sulfate, and sodium. It should be noted the ODWS for these parameters were developed based on aesthetic or operational guidelines and are not based on risk to human health. Of the parameters with exceedances, chloride, sodium, and sulfate are considered indicator parameters. The majority of ODWS exceedances were within historical ranges.

The PWQO for boron, chromium and nickel were exceeded at locations screened in the Active Aquitard. Of the parameters exceeding the PWQO, boron is considered an indicator parameter. The PWQO concentrations for these parameters are lower than the ODWS concentrations, as the PWQOs were developed for the protection of freshwater aquatic life. These standards are being applied to groundwater samples because shallow groundwater discharges to surface ditches and drainage swales. Detections of boron, chromium, and/or nickel above the PWQO were within historical ranges, with the exception of TW39-99S for boron which was only slightly above the historical range. Concentrations of boron at TW39-99S appear to be stable and do not exhibit significant increasing trends.

Statistical analysis was performed on indicator parameters for all wells in the Active Aquitard to determine if detections exhibited statistically significant trends. The majority of monitoring locations showed no trend or decreasing trends for indicator parameters. The majority of monitoring locations with increasing trends had concentrations below the ODWS and within historical ranges. It is anticipated that elevated concentrations and/or increasing trends of multiple indicator parameters would be evident if groundwater quality was impacted from the landfill. Based on the patterns of groundwater quality observed during 2017, it is unlikely that the increasing trends are the result of landfill impacts.

- **Active Aquitard – Organic Chemistry**

Samples collected for organic chemistry include VOCs which are collected biennially and were collected in spring 2017. All organic compounds were non-detect in samples collected at monitoring wells in the Active Aquitard in spring 2017, with the exception of toluene detected at TW45-99S. Toluene was detected at a concentration below the ODWS and the PWQO. The next monitoring event for organic chemistry is scheduled for spring 2019.

- **Interface Aquifer – Inorganic Chemistry**

Samples from Interface Aquitard monitoring locations had exceedances of the ODWS for TDS, alkalinity, chloride, sodium, iron and barium. It should be noted the ODWS for these parameters were developed based on aesthetic or operational guidelines, with the exception of barium which is based on risks to human health. Of these exceedances, chloride, sodium, and barium are considered indicator parameters. TDS, sodium and chloride were detected above the ODWS consistently across the Site.

Sodium and chloride were detected at high concentrations in baseline samples collected prior to landfilling disturbance. In the baseline samples, sodium and chloride were detected at higher concentrations with depth. This was historically attributed to naturally occurring soluble salts within the Kettle Point Formation shale. Sodium and chloride were detected within historical ranges, except for at OW35-90D and OW45-99D. Sodium and chloride concentrations at OW35-90D and OW45-99D did not show a significantly significant increasing trend.

TDS has historically been detected in exceedance of the ODWS across the Site. TDS was detected within historical ranges in 2017. Detections of TDS are likely attributed to natural conditions, based on pre-landfilling baseline water quality.

Barium was detected at concentrations above the ODWS at TW47-00D but within the historical range. Barium is considered an indicator parameter; however, concentrations of barium in baseline samples were similar to leachate samples. Barium was detected at concentrations below the ODWS in leachate samples. As the leachate at the Site does not have characteristically high barium, the detections of barium at TW47-00D is not likely the result of landfill impacts. No statistically significant increasing trend was identified in historical barium concentrations at TW47-00D.

Iron was detected above the ODWS at monitoring locations located on and off Site. Iron has been regionally detected above the ODWS. The detection of iron at on and off Site monitoring locations indicates the elevated iron concentrations may be the result of regional groundwater quality. Six monitoring locations had sample iron concentrations above the ODWS and the historical range. Since iron is not an indicator parameter, statistical analysis and concentration versus time plots were not developed. Other indicator parameters at these locations were not found to be significantly increasing. It is expected that statistically significant trends or elevated concentrations of other leachate indicator parameters would be apparent if iron was resultant from landfill impacts. Continued monitoring of at these locations will provide additional insight into long-term trends in groundwater quality.

Groundwater chemistry is evaluated in comparison to the PWQO due to the potential for shallow groundwater to discharge to surface water through roadside swales and/or surface water ditches. The Interface Aquifer is located approximately 40 m bgs and it is unlikely groundwater from the Interface Aquifer discharges to surface water resources. The PWQOs were exceeded at a number of Interface Aquifer monitoring locations for boron, chromium, iron, and/or arsenic. The concentrations of the PWQOs are lower than the ODWS for these parameters, with the exception of iron. As mentioned previously, iron has historically been detected regionally above the ODWS due to the Kettle Point Formation shale. Concentrations of iron exceeded the PWQOs, ODWS, and the historical range at monitoring locations TW56-11D, TW59-13D, TW30-99D, TW43-99D, and TW53-03D. The source of iron is interpreted to be from regional groundwater quality.

Statistical analysis was performed on indicator parameters for all wells in the Interface Aquifer to determine if detections exceeding the historical range exhibited statistically significant trends. The majority of monitoring locations showed no trend or decreasing trends for indicator parameters. The monitoring locations with increasing trends had concentrations within historical ranges. It is anticipated elevated concentrations and/or increasing trends of multiple indicator parameters would be evident if groundwater quality was impacted from the landfill. It is unlikely increasing trends observed are resultant of landfill impacts.

- **Interface Aquifer – Organic Chemistry**

Samples collected for organic chemistry include VOCs which are collected biennially. The next monitoring event for organic chemistry is scheduled for spring 2019. Specific monitoring locations exceeded the ODWS for benzene. There were no organic compounds detected above the PWQO.

Samples from the Interface Aquifer have historically had detections of VOCs, including detections of benzene above the ODWS. VOCs from naturally-occurring petroleum hydrocarbons (benzene, toluene, ethylbenzene, and xylenes) are found regionally due to bitumen with the Kettle Point Formation shale. In 2017, benzene and toluene was detected in the Interface Aquifer both on and off Site. Benzene was also detected at wells installed in the Kettle Point Formation shale (TW32-94-I and TW42-99D). The benzene and toluene detections are not interpreted to be landfill related.

Trichloroethene, trans-1,2-dichloroethene, and cis-1,2-dichloroethene have historically been detected at monitoring location TW22-99D and has historically exceeded the ODWS for TCE (5 µg/L). Trans-1,2-dichloroethene and cis-1,2-dichloroethene are degradation products of trichloroethene and do not have standards in accordance with the ODWS. TW22-99D is the only monitoring location where these VOC parameters have been detected. TW60-13D was installed immediately adjacent and has historically not detected VOCs. The VOC compounds detected at TW22-99D in 2017 were detected at the lower end of the respective historical ranges. The VOCs appear to be stable at this location.

Acetone and methyl ethyl ketone (MEK) has not historically been detected at either monitoring locations TW48-00D and TW49-00D. These parameters were detected at relatively high concentrations and may be resultant from cross contamination or external sources. Acetone is often used in analytical laboratories as a solvent and thus it is not uncommon to see acetone detections in VOC samples from laboratory cross-contamination. It is recommended that TW48-00D and TW49-00D are re-sampled for VOCs during 2018 to investigate the source of acetone and MEK detections.

Chloroform has sporadically been detected at monitoring location TW45-99D, most recently in fall 2014 and spring 2015. Chloroform was not detected at TW45-99D in 2017.

- **Shale Aquitard – Inorganic Chemistry**

These sampling locations are screened within the Kettle Point Formation shale, an aquitard unit with groundwater flow limited within fractures that are rare. Hydraulic conductivity and the transmissivity of the unit is low. Monitoring wells are very slow to recover following purging.

The monitoring locations within the Shale Aquitard had exceedances of the ODWS for TDS, alkalinity, chloride, sodium, boron, barium, and iron. Of these parameters, chloride, sodium, boron, and barium are considered indicator parameters. The Kettle Point Formation shale is a unit that is regionally known to have saline pore water due to readily soluble salts in the shale matrix. The exceedances of sodium and chloride at these monitoring locations are likely attributed to natural conditions within the shale. Concentrations of sodium and chloride are significantly less than concentrations detected in the Shale Aquitard as part of the baseline study.

Additionally, elevated concentrations of TDS, iron, sulfate, and constituents of petroleum hydrocarbon are typical of the Kettle Point Formation shale. Historically, concentrations of boron, bromide, chloride, potassium, and sodium are present within the Shale Aquifer wells. The results from 2017 are consistent with historical trends in comparison to water quality in the Interface Aquifer.

Groundwater chemistry is evaluated in comparison to the PWQO due to shallow groundwater discharging to surface water through roadside swales and/or surface water ditches. The top of the Shale Aquitard is located approximately 40 m bgs and it is unlikely groundwater from this unit will discharge to surface water resources. The PWQOs were exceeded at both Shale Aquitard monitoring locations for boron, chromium, and iron and TW32-94-I for arsenic. The concentrations of the PWQOs is lower than the ODWS for these parameters, with the exception of iron.

Iron exceeded the historical range at TW32-94-I and TW42-99D. There were no other parameters at Shale Aquitard monitoring locations with exceedances above the historical range, including samples that did not exceed the ODWS and/or the PWQO.

Statistical analysis was performed on indicator parameters for Shale Aquitard monitoring wells to determine if detections exhibited statistically significant trends. All monitoring locations showed no trend for indicator parameters.

- **Shale Aquitard – Organic Chemistry**

Benzene was the only organic compound detected at a Shale Aquitard monitoring location. Benzene was detected at TW42-99D at a concentration of 16 µg/L, which exceeds the ODWS and the historical range. Benzene was historically detected at this location with a maximum concentration of 11.9 µg/L. Petroleum hydrocarbon constituents (such as benzene) have been detected regionally within the Kettle Point Formation shale. As described in Section 1.2.4, the Kettle Point Formation shale contains bitumen which has historically been attributed to detections of petroleum hydrocarbon constituents in groundwater. The detection of benzene at TW42-99D is likely not attributed to landfilling activities and is likely the result of natural conditions within the shale.

5.2.2 Monitoring Program to Assess Effectiveness of Sub-Cell 3

The Sub-Cell 3 remedial performance monitoring program was developed to determine the performance of the hydraulic and water-quality aspects of the remedial measures in Sub-Cell 3. The purpose of the hydraulic monitoring is to confirm an appropriate head difference between the HCL and Interface Aquifer is being maintained by the extraction wells. Discharge from the HCL extraction wells is treated as surface water at the Site and is sampled semi-annually. The monitoring program conducted in Sub-Cell 3 included the collection of water level measurements and groundwater samples.

Groundwater extraction from wells in the HCL maintained a head pressure that was lower than the Interface Aquifer levels. Based on these observations, an upward vertical gradient from the Interface Aquifer to the HCL was maintained during 2017.

Groundwater concentrations from the HCL and the Interface Aquifer monitoring well locations adjacent to Sub-Cell 3 were identified above the ODWS for TDS, chloride, and sodium. TDS results were lower than the historical range for the spring and fall 2017 monitoring events, with the exception of EW2a-01 and PW1-N. Groundwater concentrations from the HCL and the Interface Aquifer monitoring wells locations adjacent to Sub-Cell 3 were identified above the PWQO for boron and iron.

TDS, chloride and sodium concentrations are elevated in Active Aquitard and Interface Aquifer off Site monitoring wells that are representative of background conditions. Boron and iron concentrations are elevated in the Interface Aquifer off Site monitoring wells that are representative of background conditions. The Sub-Cell 3 remedial system is designed to create an upward vertical gradient from the Interface Aquifer to the HCL and the groundwater quality is likely reflective of contributions to groundwater quality from both the Active Aquitard and Interface Aquifer.

Leachate from the surrounding cells does not appear to be infiltrating the HCL as analysis of historical leachate indicator parameters analytical results identified decreasing trends for chloride, sulfate, potassium, sodium, bromide and fluoride.

5.2.3 Performance Monitoring of Engineered Landfill System

The engineered landfill system performance monitoring consists of comparing the perimeter leachate collection system water level monitoring data with the perimeter monitoring program water level data to determine the horizontal gradient between the leachate collection system and the Site property boundary. A horizontal transect is currently used to evaluate the effectiveness of the leachate collection system along the west side of the leachate collection system.

The groundwater elevations in TW64-16-IV located within the Active Aquitard at the toe of Cell 19 were below the monitored leachate levels identified in leachate collection sumps PTS-01 and PTS-02 and leachate collection trench standpipe LCSOW2-15 from August to the end of December (the end of the reporting period). From mid August to the end of December 2017, an outward gradient from Sub-Cell 19 to the toe of the landfill was present. The groundwater elevations in TW48-16S within the Active Aquitard along the property boundary was above the monitored leachate levels. An inwards gradient was maintained within the Transect throughout 2017 from the Site property boundary to the toe of the Landfill.

5.2.4 Performance Monitoring of the Purge Well System

Performance testing of the Purge Well Pumping System is next scheduled to be completed during the 2018 Monitoring Period.

5.3 Surface Water Monitoring

The surface water management system directs all stormwater generated from non-operational areas via a series of ditches and reservoirs to a water treatment plant located within the main processing area of the Lambton Facility. The surface water treatment plant is operated when the live surface water storage across the site needs to be increased, often due to precipitation events and seasonal periods of high water run off. The plant operates in recirculation mode until the effluent criteria established under the ECA are met. Once the effluent from the treatment plant is in compliance with the ECA criteria, the treated water is discharged to the Equalization Pond. Before discharge is permitted, surface waters from this Equalization Pond are analyzed and verified to meet the discharge criteria. When the conditions are satisfied the Equalization Pond is discharged to a ditch along Telfer Road. A surface water monitoring program for the Facility was approved by the MOECC in March 2016.

During discharge the treated surface water is monitored daily for continual acceptance against the discharge criteria. Samples are collected and analyzed for pH, specific conductivity, phenols, chloride, solvent extractables (oil and grease), and total suspended solids. Monthly discharge monitoring conducted on-site during discharge includes general chemistry, total metals, volatile organic compounds, semi-volatile organic compounds, toxicity, and the presence/absence of fish in the Equalization Pond. Off-site surface water monitoring is conducted seasonally.

In 2017, there were three distinct periods during which daily discharge monitoring was completed. Monthly discharge monitoring, including toxicity and visual observations, were also undertaken for these three time periods. The detailed surface water monitoring program results are included in **Appendix H**.

5.3.1 Daily Discharge Monitoring

Daily discharge monitoring was completed during discharge from the Equalization Pond during three distinct time periods. With the exception of Period 2, no exceedances of monitoring parameters were recorded. The discharge periods are as follows:

- Period 1: January 24 to March 20, 2017
- Period 2: April 11 to June 15, 2017
- Period 3: December 19 to December 22, 2017

During Period 2, an exceedance in total suspended solids (TSS) above the limit of 15.0 mg/L was measured on May 6, 2017 (19.8 mg/L). The surface water treatment plant (SWTP) was placed into recirculation mode so that the treatment process could be adjusted to bring the level of TSS into compliance with the discharge criteria. Discharge from the SWTP resumed May 8, 2017. The sand filters were backwashed on May 5, 2017, which may explain the elevated levels of TSS on May 6, 2017.

The daily discharge monitoring results are provided in **Appendix H**.

5.3.2 Monthly Discharge Monitoring

A monthly monitoring sampling event was during each of the three discharge periods. When compared to the Provincial Water Quality Objectives (PWQO), the analytical results were generally below the PWQO with the following noted exceedances, based on the parameter and number of occurrences.

- Total phenolics – during Periods 1 and 2
- Phosphorus – during Periods 1, 2 and 3
- Unionized ammonia – during Period 1
- Aluminum – during Periods 1, 2 and 3
- Boron – during Period 3
- Iron – during Period 2
- Molybdenum – during Periods 1, 2 and 3

It was noted that a number of sVOC parameters had reporting limits that were above their associated PWQO, with bis(2-Ethylhexyl)phthalate (DEHP) the highest with a reporting limit of 2.0 µg/L and PWQO of 0.6 µg/L.

The off-site up-stream sample location, STN6, provides the general surface water quality in the area. The Lambton Facility has a clayey overburden and as such the surface water is impacted by the natural materials that present within the overburden. Comparison of the background sample results to the monthly discharge monitoring results for the seven parameters noted above for an exceedance of the PWQOs, the background location also has exceedances for total phenolics that are similar. In the case of phosphorus, aluminum, and iron, the background exceedances are higher than the EQ Pond. Molybdenum is slightly elevated over the PWQO for two of the five results. The unionized ammonia results are reported to be above the PWQO during the January 2017 sampling event, but was below the PWQO for the remainder of the year. Boron was reported to be above the PWQO during a single monitoring event, in December 2017.

The monthly discharge monitoring results are provided in **Appendix H**.

5.3.3 Toxicity Testing

Toxicity testing of the Equalization Pond was completed five times during the reporting period, between January 25th and December 22nd, 2017. All samples were within specified limits to characterize the samples as being non-toxic. The toxicity test results are provided in **Appendix H**.

5.3.4 Visual Observation

A visual observation of the presence/absence of fish in the Equalization Pond was completed as part of the quarterly landfill inspections. The presence of live fish in the Equalization Pond was confirmed during the first three quarterly inspections. No fish were observed in the equalization pond during the fourth quarterly inspection. It was noted that the water level was lower than usual, though murky. Also, it is likely that the fish were near the bottom of the pond given the colder temperatures.

5.3.5 Off-Site Monitoring

Supplementary chemical monitoring of the background (STN6) and downstream (STN6A) off-Site monitoring locations for general chemistry, metals, VOCs, and sVOCs were taken on May 8, 2017. When compared to the PWQO, the analytical results for both sampling locations were below the PWQO with the exception of total phenolics, phosphorus, aluminum, and iron. The analytical results for all parameters analyzed are on approximately the same order of magnitude for both sampling locations.

The off-site water quality is representative of a clay overburden environment with regard to the metal components and the phosphorus levels are representative of agricultural impacts.

The off-site monitoring results are provided in **Appendix H**.

5.3.6 Surface Water Characterization

Supplementary monitoring of the East and West Surface Water Ponds for general chemistry, metals, VOCs and sVOCs was undertaken on January 25, February 21, March 20, May 8, and June 5, 2017. Comparison of the on-site surface water data indicates that the surface water quality improves as the water moves from the East Pond to the West Pond and then through the treatment plant and Equalization Pond. Comparison of the on-site data to the off-site background indicates that the water is similar and is generally reflective of clay overburden (surface) water chemistry.

The detailed on-site surface water characterization results are provided in **Appendix H**.

5.4 Air Quality Monitoring

Clean Harbors has been conducting an annual ambient air fenceline monitoring program spanning more than twenty years at the Lambton Facility. The objective of the program is to ensure that potential contaminant releases from the facility's ongoing operations are within accepted regulatory limits. The monitoring program includes a series of measurements for a number of speciated vapor and particulate constituents in accordance with a monitoring plan prepared in 2015.

A total of twelve pairs of simultaneous north/south fixed location speciated VOC measurements were conducted by sampling for 24 hour perios, initiated at midnight (eastern standard time) following the twelve day NAPS cycle adjusted to ensure no samples were taken on days when the Facility was not in operation. Sampling occurred during May through September 2017. Similarly, 24-hour samples were also collected for subsequent analysis of TSP and selected elemental constituents along with the acquisition of local meteorological data for these time frames. Three sample sets of speciated carbonyls and airborne mercury were collected; one in each of June, July and August concurrent with the VOC and TSP measurements. The level of all constituents measured were compared with any applicable O.Reg. 419 Schedule 3 standards, or where no standard exists, the relevant guideline or AAQC.

Meteorological data indicated that four of the twelve monitoring days had significant numbers of hours with winds blowing from the southwest to southeast quadrant where the north and south monitors would be aligned downwind and upwind respectively.

Most measured VOC concentrations were less than 1% of the schedule 3 standards, guidelines or AAQCs. The compound measured at the highest percentage of a standard, guideline or AAQC was benzene, which was found in concentrations up to 88.7% of its 24 hour AAQC. No VOC species were measured in concentrations greater than their respective standard, guideline or AAQC.

Measured concentrations of total particulate and speciated particulates were all less than their respective standard, guideline or AAQC. Total particulate was measured in concentrations of up to 58% of the 24 hour standard. Of the speciated components, iron was measured at the highest percentage of its limit, at 24%.

Of the speciated carbonyl measurements, only formaldehyde was detected on all occasions at both sites, although formaldehyde concentrations were generally low in comparison to the standard, there was one measurement where a concentration of 67.9%of the standard was found.

Particulate mercury was measured in small quantities, while vapour mercury was not detected in any of the samples. Total mercury was measured in concentrations of well below (<0.1%) of its schedule 3 standard in all samples.

Air Quality monitoring data are provided in **Appendix I**.

5.5 Biomonitoring Program

The Biomonitoring Program is one of the Lambton Facility's ongoing monitoring programs, which are required under condition 9 of the Facility's Environmental Compliance Approval No. A031806 dated September 5, 1997 and as amended. The Biomonitoring Program provides an indication of trends, through time, in the concentration of analytes in several environmental media at a network of test sites located within approximately 1.5 km of the Lambton Facility boundary. Each year, samples from up to four environmental media (soil, drainage ditch sediment, natural vegetation and agricultural crops) from each of the test sites are collected and submitted to the analytical laboratory to determine the concentration of selected metals, pesticides, chlorinated phenols, and dioxins and furans. In 2016, 13 test sites were monitored. Site S7 was introduced to the Biomonitoring Program in the 2016 Field Year to replace Site S3 (removed from the Biomonitoring Program in the 2015 Field Year after being disturbed during the expansion of the landfill within the Lambton Facility). Monitoring at Site S7 will begin in the 2017 Field Year.

The review and comparison of the 2016 data relative to the upper control limits (UL15) for each site and on a site-wide basis was completed for inorganic analytes. The concentrations of 22 inorganic analytes (15 Group 1 analytes and seven Group 2 analytes) exceeded their respective site-specific UL15 while four Group 1 analytes and one Group 2 analyte exceeded their site-wide UL15.

Concentrations of a limited number of inorganic chemicals in sediment, natural grasses and soil collected and analyzed in 2016 exceeded the Ontario Typical Ranges for Rural Parkland Soil (rural parkland OTR98) (Ministry of the Environment and Climate Change, MOECC, 2011), the rural Upper Limit of Normal (ULN) (MOECC, 1989), the MOECC O.Reg.153/04 Table 1 Sediment Site Condition Standard (SCS), the MOECC O.Reg.153/04 Table 1 Soil SCS (MOECC, 2011), or the Provincial Sediment Quality Guidelines (PSQG) (MOECC, 2008).

Overall, the majority of exceedances of the UL15 in the 2016 Field Year were identified for Group 1 inorganic analytes (barium, beryllium, calcium, chloride, chromium, iron, magnesium, manganese, molybdenum, nickel, phosphorus, potassium, sodium, strontium and sulfur). The exceedances of the Group 1 analytes do not warrant additional investigation at this time.

A select number of Group 2 analytes were found to have exceeded the site-specific UL15 (aluminum, arsenic, copper, lead, mercury, vanadium and zinc). However, the concentrations of these analytes were below levels associated with potential phytotoxicity. Consequently, continued monitoring is recommended but additional investigation is not justified at this time.

Concentration trend lines using linear regression statistics were updated on a site-wide basis for inorganic analytes. The purpose was to identify trends in the concentration of analytes (i.e., downward, upward, no change) over time. Overall, the regression analyses produced 51 significant trend lines with $p < 0.003$. These 51 trend lines, representing 17 downward trends and 34 upward trends.

Group 3 organic analytes were not detected at concentrations representative of concern for ecological health during the 2016 Field Year. A select number of organochlorine pesticides (OCP) analytes were measured at concentrations above their applicable reporting detection limit (RDL). However, all detected concentrations of OCPs were below the applicable rural parkland OTR98 and MOECC 153/04 Table 1 SCS, where available for comparison.

Polychlorinated biphenyls (PCBs) and pentachlorophenols (PCPs) were not identified at concentrations greater than their respective RDLs. Monitoring should continue but no additional examination is proposed.

Dioxins/furans (PCDD/DF) were not reported at concentrations greater than the rural parkland OTR98. The range of results indicates that the Biomonitoring Program continues to effectively meet its specific objectives of monitoring environmental concentrations and identifying the trends in concentrations over time.

Changes to the Biomonitoring Program have been proposed to the MOECC to streamline the program and to accommodate the Landfill Expansion currently underway. Upon approval by the MOECC, these changes could be implemented during the next cycle of the Biomonitoring Program.

Biomonitoring data are provided in **Appendix J**.

6. RECOMMENDATIONS

The following recommendations are provided with respect to the above observations and conclusions.

6.1 Site Inspections

The following recommendations are provided based on the observations of the most recent site inspection (November 29, 2017):

- Interim cover work has been completed in the northern area of the Site. As such, the former stockpile area and other areas in the north that have ponded water are scheduled to be assessed and re-graded to promote drainage.
- Maintenance of the perimeter ditches is required to remove areas where sediment has accumulated and is restricting flow of water. Maintenance of the perimeter ditches is a key component to minimize ponding of water on the interim cover and transfer of water to stormwater ponds.
- Portions of the interior side of the perimeter screening berms have significant erosion. These areas should be assessed and corrected to minimize erosion into the perimeter ditches. Installation of reinforced ditches from the top of the berm to the perimeter ditches may be a solution for these areas, as well as vegetation of the internal berm slopes.

6.2 Groundwater Monitoring Program

6.2.1 Perimeter Groundwater Monitoring Program

- To properly assess potential changes to leachate conditions over time for the Site, the collection and submission of semi-annual leachate samples from the leachate pumping station for laboratory analysis of select leachate indicator parameters during the 2018 groundwater monitoring event is recommended. The analytical data will be used to reassess the current state of the leachate within Cell 19, identify potential seasonal variability, and reassess the current leachate indicator parameters.
- Inspect monitoring well TW64-16-II to assess the integrity of the surface seal.
- Redevelopment of monitoring well TW45-99D to assess if the screen and sandpack can be rehabilitated and groundwater can reach static in 2018.
- It is recommended that TW48-00D and TW49-00D are re-sampled for VOCs during 2018 to investigate the source of acetone and MEK detections.

6.2.2 Monitoring Program to Assess Effectiveness of Sub-Cell 3 Mitigation

- Development of a Sub-Cell 3 groundwater remedial system operational and maintenance procedure and developing an inspection checklist to be completed in tandem with groundwater monitoring events.

6.2.3 Performance Monitoring of Engineered Landfill System

- Install water level monitoring stations with pressure transducer within the west surface water pond and surface water ditch located within the transect and incorporate the water level data in the transect assessment.
- Lower the operating level of the leachate collection system through a reduction of the pump on set point by 0.2 m per month to assess the influence of the leachate collection system on the groundwater within the Active Aquitard within the transect.
- As part of the overall Site operations, the leachate collection system, groundwater, and surface water interaction should be assessed and operating/monitoring programs amended to ensure an inward gradient is maintained throughout the year from the perimeter groundwater wells to the leachate collection system

6.3 Surface Water Quality Monitoring

The compliance based monitoring programs detailed within the Surface Water Quality Report (**Appendix H**) and completed in accordance with the requirements of the ECA should continue in subsequent years. No additional recommendations have been identified at this time.

6.4 Air Quality Monitoring

The compliance based monitoring programs detailed within the Air Quality Monitoring Report (**Appendix I**) and completed in accordance with the requirements of the ECA should continue in subsequent years. No additional recommendations have been identified at this time.

6.5 Biomonitoring Program

The proposed changes were presented in a letter prepared by Clean Harbors (July 3, 2015). Since that time, conditions at the Lambton Facility have changed, leading to additional proposed revisions to the Biomonitoring Program. A summary of proposed changes to the biomonitoring program was prepared by Clean Harbors (September 6, 2016). The summary of proposed changes was reviewed by the MOECC (March 29, 2017). A response was prepared by Clean Harbors (April 20, 2017). The letter, review and response are provided in Appendix G of the Biomonitoring Report. Further details on the proposed changes, including a figure showing the proposed new sites, are also provided in Appendix G of the Biomonitoring Report (**Appendix J**). Upon approval by the MOECC, these changes could be implemented during the next cycle of the Biomonitoring Program.