FINAL REPORT

WASTE MANAGEMENT OF CANADA CORPORATION

WATFORD, ONTARIO

TWIN CREEKS ENVIRONMENTAL CENTRE: 2024 FOURTH QUARTER & ANNUAL MONITORING REPORT VOLUME 1 OF 5 – COMPLIANCE MONITORING

RWDI #2402553.01

February 25, 2025

SUBMITTED TO

Angela McLachlan
Environmental Compliance Manager
amclachl@wm.com

Waste Management of Canada Corporation
Twin Creeks Environmental Centre
5768 Nauvoo Road (Watford)
Warwick Township, County of Lambton
N0M 2S0

T: 519.849.5810
F: 519.849.5811

SUBMITTED BY

Brent J. Langille, B.Sc., P.Geo.
Senior Technical Director | Principal
Brent.Langille@rwdi.com | ext. 2618

Khalid Hussein, P.Eng.
Project Manager
Khalid Hussein@rwdi.com | ext. 2055

RWDI AIR Inc.
Consulting Engineers & Scientists
4510 Rhodes Drive | Suite 530
Windsor, Ontario
N8W 5K5

T: 519.974.7384
F: 519.823.1316

February 25, 2025

Ms. Angela McLachlan
Environmental Compliance Manager
Waste Management of Canada Corporation
Twin Creeks Environmental Centre
5678 Nauvoo Road (Watford)
Warwick Township, County of Lambton

Re: Waste Management of Canada Corporation
2024 Fourth Quarter and Annual Monitoring Report
Twin Creeks Environmental Centre, Warwick Township, County of Lambton, Ontario
Volumes 1 and 2 - Text, Figures, Tables, and Appendices

Dear Ms. McLachlan,

RWDI AIR Inc. (RWDI) is pleased to provide the 2024 Fourth Quarter and Annual Monitoring Report, Volumes 1 and 2: Compliance Monitoring and Operations Program, for the Twin Creeks Environmental Centre. Volume 1 includes the text, figures, and tables. Volume 2 includes the appendices, which contain the technical information and supporting documentation for the Compliance Monitoring and Operations Program and is provided in three (3) bound sections. Volume 3 – Poplar System Monitoring Program, Volume 4 – Ambient Air Quality Monitoring Program, and Volume 5 – Noise Monitoring Program, are provided under separate covers.

In November 2010, the Ministry of the Environment (MOE) issued the Technical Guidance Document entitled "*Monitoring and Reporting for Waste Disposal Sites, Groundwater and Surface Water*" (MOE, 2010). Appended to this report is a completed Monitoring and Screening Checklist from the above Technical Guidance Document, which provides certification of the Competent Environmental Practitioner (CEP). The Monitoring and Screening Checklist is provided in Appendix S.

Volumes 1 and 2 of the 2024 Fourth Quarter and Annual Monitoring Report have been prepared in consideration of Conditions 15.4 through 15.7 of Amended Environmental Compliance Approval (ECA) No. A032203 dated December 16, 2023 (Waste ECA), and provides a detailed interpretive analysis of the 2024 findings for the compliance monitoring at the Twin Creeks Environmental Centre and a summary of its operations in 2024.

We trust that this report satisfies your requirements. Please contact us if you have any questions.

Yours truly,

RWDI

Jeff Cleland, B.Eng., P.Eng.
Environmental Engineer | Geosciences

Brent J. Langille, B.Sc., P.Geo.
Senior Technical Director | Principal

JCL/BJL/kta/tmg

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Volume 2C:

1 INTRODUCTION

1.1 Purpose & Scope

The purpose of the 2024 Compliance Monitoring and Operations Program for Waste Management of Canada Corporation's (WM) Twin Creeks Environmental Centre (Site) is as follows.

- To report compliance with the terms and conditions of the relevant Environmental Compliance Approvals (ECAs) (Waste, Sewage, and Air) and regulatory permits (PTTW) for the Site, the landfill gas flare systems, and stormwater management facilities for the reporting period of January 1 to December 31, 2024.
- To satisfy Conditions 5, 6, and 7 of the Environmental Assessment Act approval, dated January 15, 2007.
- To assess potential effects of the landfill on groundwater and surface water quality.
- To evaluate the monitoring program(s) on an annual basis and to recommend improvements as operations at the Site mature.
- To determine the need for the implementation of contingency measures.

Volumes 1 and 2 of the 2024 Fourth Quarter and Annual Monitoring Report (2024 Annual Report) satisfy the reporting requirements for both the fourth quarter (Q4) of 2024 (October 1 to December 31) and the 2024 compliance monitoring and operations calendar year monitoring period. Reporting involves a data collection component and a comprehensive analysis and interpretation component. The 2024 data were collected by WM and RWDI AIR Inc. (RWDI), while the data compiled for Volumes 1 and 2 of the 2024 Annual Report were collated and analyzed by RWDI. The following presents a summary of the data collection responsibilities for the Compliance Monitoring Program in 2024.

Waste Management of Canada Corporation:

- Operations Logs (Dust and Litter)
- Leachate Volume Tracking
- Tonnage Tracking Information (Waste & Recyclables)
- Water Taking Information
- Complaint Logs
- Collection of Daily Liquid Levels from Expansion Landfill Primary Drainage Layer (PDL) Pumping Stations

RWDI AIR Inc.:

- Liquid Level Monitoring (Leachate and Groundwater)
- Groundwater Quality Monitoring
- Surface Water Quality Monitoring
- Contaminated Soil & ASR Quality Monitoring
- Leachate Quality Monitoring
- Monthly Collection of Liquid levels from Expansion Landfill Secondary Drainage Layer (SDL) Pumping Stations
- Monthly Site Inspections
- Overall Data Collation and Reporting

Air quality, noise, total suspended particulate and Poplar System monitoring, and reporting were also completed by RWDI in 2024. The monitoring results, analysis, and interpretation for the Poplar System Monitoring Program are presented in Volume 3 of the 2024 Annual Report. Environmental monitoring of the Poplar Plantation is not required until two (2) months prior to the system becoming operational per the Waste ECA. Therefore, a relevant volume is not included in this Annual Report.

1.2 Site Regulatory Framework

The Site is owned and is operated by WM in conformance with the regulatory approvals noted below. Copies of the relevant ECAs and their amendments, as well as the PTTW, are provided in Appendix A.

- Amended Environmental Compliance Approval (ECA) No. A032203, dated December 16, 2023 (Waste ECA).
- Amended ECA for an Industrial Sewage Works No. 8117-CUSNXX, dated April 29, 2024 (Sewage ECA). It is noted that up to April 28, 2024, WM was required to conform to Amended ECA for Industrial Sewage Works No. 2403-BE6LZ4, dated August 21, 2019.
- Amended ECA for Air No. 6318-CX4NFX, dated December 13, 2023 (Air ECA).
- Permit-To-Take-Water (PTTW) No. 4682-BLJRYJ, dated November 8, 2021, for the removal of surface water from four (4) Sedimentation Ponds and the dewatering of the Secondary Drainage Layer (SDL) for the Expansion Landfill.

Throughout 2024, quarterly monitoring reports were submitted to relevant stakeholders in accordance with Condition 15.4 of the Waste ECA. Volumes 1 and 2 of the 2024 Annual Report have been prepared in consideration of Conditions 15.4 through 15.7 of the Waste ECA and Condition 7.5. of the Sewage ECA. Volumes 1 and 2 provide a detailed analysis of the 2024 findings for the compliance monitoring at the Site and its operation in 2024.

This 2024 Annual Report is also prepared in accordance with Conditions 5, 6, and 7 of the Notice of Approval to Proceed with the Undertaking, dated January 15, 2007, in regard to the Environmental Assessment Act (EAA) approval of the Warwick Landfill Expansion (renamed Twin Creeks Landfill and subsequently to Twin Creeks Environmental Centre).

1.3 Site Description & Background

The Site is a solid, non-hazardous waste landfill site that contains an old landfill (Existing Landfill) and an area approved for expansion (Expansion Landfill). The Site is located on Part of Lots 19 and 20, Concession 3, south of Egremont Road (SER), and part of Lots 20 to 22, Concession 4 SER, in the Township of Warwick, County of Lambton, Ontario. The Site occupies an area of 301 hectares (ha) with 101.8 ha permitted for landfilling. A Site Location Map is presented on Figure 1.

Landfill waste at the Site has two (2) distinct waste disposal areas: 1) the Existing Landfill; and 2) the Expansion Landfill. The Existing Landfill is divided into waste cells as presented on Figure 2. The progression of construction of the Expansion Landfill is summarized below and presented on Figure 2.

Expansion Landfill Cell	Date of First Waste Tonnage Deposited
Cell 1A Stage I	November 16, 2009
Cell 1A Stage II	September 21, 2010
Cell 1B Stage I	August 18, 2011
Cell 1B Stage II	June 20, 2012
Cell 2A	November 18, 2013
Cell 2B	September 25, 2014
Cell 2C	September 10, 2015
Cell 2D	August 19, 2016
Cell 2E	September 8, 2017
Cell 4A Stage 1	September 25, 2019
Cell 4A Stage 2	November 14, 2019
Cell 4B Stage 1	September 22, 2020
Cell 4B Stage 2	November 23, 2020
Cell 4C	August 10, 2021
Cell 6A	September 14, 2022
Cell 6B	October 28, 2024

The South Cell (formerly South Fill Area) of the Existing Landfill consists of historical waste landfilled into trenches of various widths and depths excavated into the clayey soil. There are three (3) finger drains that transect through the trenches to provide gravity drainage toward the perimeter maintenance holes (MH16, MH17, and MH18) for leachate collection. The remainder of the waste footprint of the Existing Landfill contains older waste cells that are completed with waste trenches, but also includes newer waste cells constructed with re-compacted clayey liners with waste underdrains.

Waste within the Expansion Landfill will extend to an average design depth of 15 m below existing grade. Leachate is managed with a liner system that directs leachate toward dedicated leachate pumping stations. The liner system consists of a PDL below the waste to convey leachate, an underlying re-compacted clayey liner (primary liner), then a secondary drainage layer (SDL) for leak detection and contingency use, which is all underlain by a thick natural barrier of clayey soil. Design specifications are provided under Items 66 to 68 in Schedule A of the Waste ECA, namely, the report titled "*Development and Operations Plans – Warwick Landfill Expansion (Volumes 1 to 3)*", as prepared by Henderson Paddon & Associates and dated March 2008 (D&O Report).

Leachate generated at the Site can be managed either on-Site through irrigation for poplar trees to be treated by phytoremediation or by transport for off-Site treatment and disposal. The Poplar System was decommissioned in June 2014 as part of the construction activities to expand the footprint from the previous 3.3 ha to 9.3 ha. Leachate phytoremediation is approved for the expanded Poplar System located within the waste footprint of the Existing Landfill, as shown on Figure 2. In 2024, irrigation liquid was applied to the poplar trees intermittently from May 1 to October 11. It should be noted that the Poplar System pertains to a plot of poplar trees planted on the landfill cap of the Existing Landfill, whereas the Poplar Plantation refers to the plot of trees planted on native soil and is located south of the Existing Landfill. Details pertaining to the Poplar System Monitoring Program completed in 2024, including surface water monitoring in response to precipitation events of ≥ 10 millimetres (mm) in 24 hours, are provided in Volume 3 of the 2024 Annual Report.

Surface water flow is ephemeral, with flow that typically occurs after snowmelt or prolonged periods of precipitation. Details on the surface water quality system are provided in Section 2.4. In summary, surface water is managed through a network of on-Site ditches, a Temporary Water Storage Area, and four (4) on-Site Sedimentation Ponds. Surface water runoff from the Site flows toward: 1) Kersey Drain (Brown Creek) to the east, and 2) to drains and ditches associated with Bear Creek to the west.

Assessments of local groundwater and surface water have continued to achieve acceptable quality at the Site compliance boundaries. A list of historical monitoring reports is provided in Table B-1, Appendix B.

For reference to the Site construction design details, Appendix L contains construction details of the Existing and Expansion Landfills, with the breakdown as outlined below.

Existing Landfill:

The construction details: *"Laidlaw Waste Systems (Warwick) Limited, Warwick Township Landfill Site, Development and Operations Plan"* from the Development & Operations Report, Canadian Waste Services Inc., Warwick Landfill, Warwick Township (Henderson, Paddon Environmental Inc., October 1997), which is Item 37 of Schedule A of the Waste ECA (included as Appendix L-1, Appendix L).

Expansion Landfill:

The construction details: *"Drawings 111 – 120, 125, and 127"* from the Development & Operations Plans, Warwick Landfill Expansion, Volume 1 of 3, which is Item 66 of Schedule A of the Waste ECA (included as Appendix L-2, Appendix L).

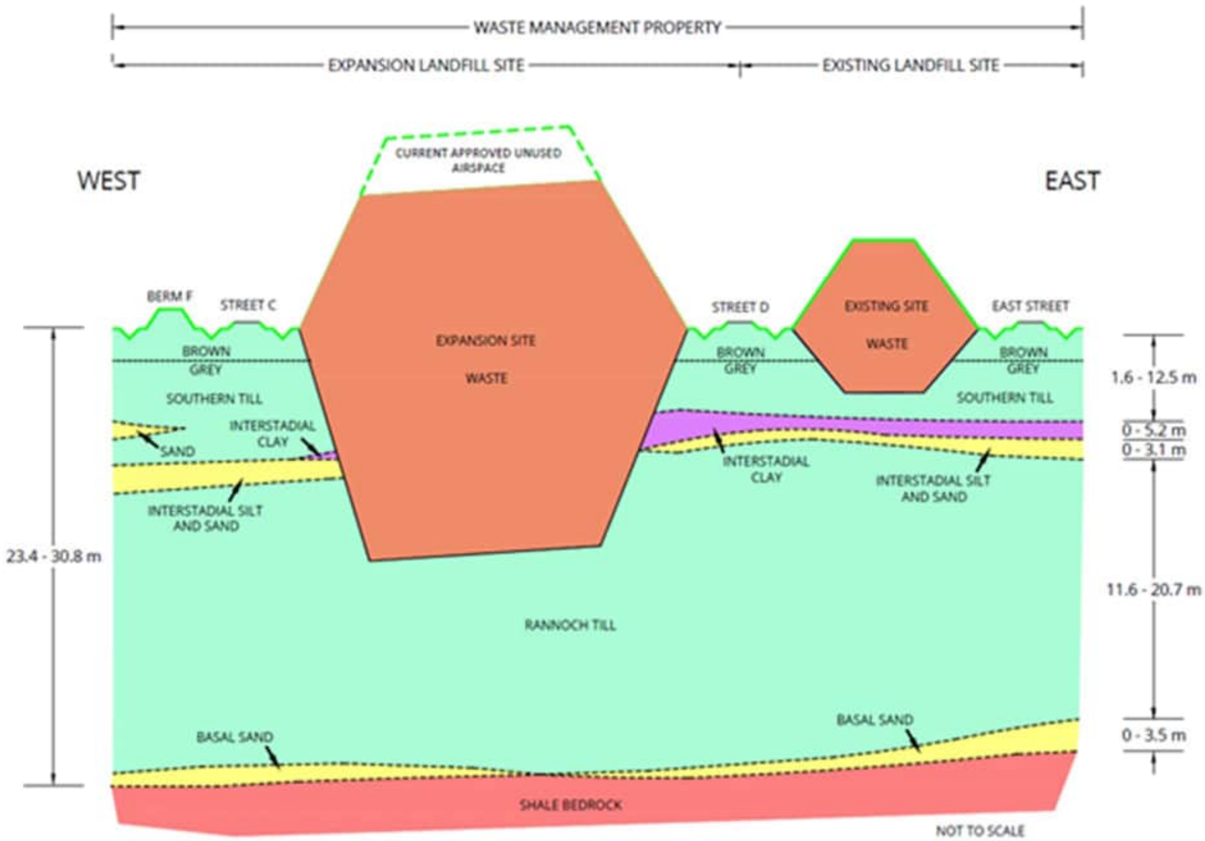
As-built Information for Waste Cells Constructed in 2024:

The CQA/CQC Liner System Summary Report (Cell 6B), as prepared by RWDI, dated October 23, 2024, can be found in Appendix L-3, Appendix L.

1.4 Site Hydrogeologic Setting

The landfill is located in southwestern Ontario within the southeastern portion of the Horseshoe Moraines physiographic region (Chapman and Putnam, 1984). The Horseshoe Moraines consist of a large horseshoe-shaped landform that includes a series of moraines aligned roughly parallel to the Lake Huron shoreline. Bear Creek to the west and Brown Creek to the east provide a slightly rolling topography around the Site. This rolling topography is further enhanced by the local tributaries and drainage swales.

For the purpose of this report, the local stratigraphy is subdivided into the following main units: 1) the Southern Till; 2) interstadial deposits; 3) the Rannoch Till; and 4) bedrock and the overlying basal sand. Each unit is shown in the following cross-section and is briefly discussed below.



The Southern Till unit consists of silty clay to clayey silt with trace amounts of disseminated sand and gravel. Occasional discontinuous layers or lenses of sand were observed within this unit. At the Site, this unit ranges in thickness from approximately 1.6 m to 12.5 m. The upper 1.6 m to 5.0 m of the Southern Till is weathered and is generally identified by a brown colour. Soil fractures are numerous near ground surface and decrease in frequency with depth. The underlying unweathered Southern Till is grey in colour and contains occasional fractures.

The interstadial deposits generally consist of two (2) distinct deposits: 1) an upper deposit of silt and clay, often varved, that is up to 5.2 m in thickness; and 2) a lower deposit of silt to sand that is up to 3.1 m in thickness. At some borehole locations, one or both deposits were not detected which indicates that these deposits are not continuous below the Site. Below the Site, the interstadial silt and sand ranges from 4.0 m to 10.7 m below ground surface where detected.

At about 4.0 m to 10.3 m below ground surface is the Rannoch Till. This till is a gritty to moderately stony clayey silt to silt till, although some textural variations occur. At some borehole locations, layers or lenses of silt to sand were detected within the till. The Rannoch Till was up to about 21.4 m thick below the Site.

Occasional discontinuous layers of sand and gravel between the Rannoch Till and underlying bedrock constitute the basal sand. The bedrock was encountered at a depth of between 23.4 m and 30.8 m below ground surface at the landfill and consists of the black bituminous shale of the Kettle Point Formation. The upper fractured portion of the bedrock and the overlying basal sand form the local bedrock aquifer.

The two (2) creeks that influence the physiography of the regional study area include Bear Creek to the west and Brown Creek to the east. The watershed for Bear Creek includes most of the Site and the area to the west. The Drainage Divide for the Bear Creek watershed cuts through the northeastern corner of the Site. Bear Creek is a tributary of the North Sydenham River and flows southwesterly to join the Sydenham River at Wallaceburg.

Surface water flow is ephemeral, with flow that typically occurs after snowmelt or prolonged periods of precipitation. Runoff from most of the east half of the Existing Landfill flows to Sedimentation Pond 1 (SP1), while runoff from the northern portion of Cell 11 and the west half of the Existing Landfill from north of approximately Cell 8/6 boundary flows to Sedimentation Pond 4 (SP4), drainage from most of Cell 6 flows into a Temporary Water Storage Area, while runoff from the remainder the west half of the Existing Landfill is directed to Sedimentation Pond 2 (SP2).

Sedimentation Ponds 1 through 4 are four (4) on-Site Sedimentation Ponds constructed in 2009 to manage surface water for the Site. Sedimentation Pond 1 discharges onsite and ultimately flows through surface water monitoring station SS1 that in turn discharges into a tributary of Bear Creek on the east side of Lambton Road 79 (Nauvoo Road). Sedimentation Pond 2 discharges through culverts to the western Site boundary and into a tributary of Bear Creek on the east side of Nauvoo Road. It is noted that flow from SS1 and flow from SP2 both discharge to the east side of Nauvoo Road at the box culvert under the road. Sedimentation Pond 3 discharges to the east side of Nauvoo Road near the northwestern portion of the site. Sedimentation Pond 4 discharges onsite and ultimately flows through a culvert that discharges to the southern side of Zion line. The surface water system around the Site is presented on Figure 3.

Surface water runoff is managed through Sedimentation Ponds 1, 2, 3, and 4. Surface water runoff originating from areas south of the Existing Landfill flows toward: 1) Kersey Drain (Brown Creek) to the east; and 2) to the west toward the Van Kessel Drain where it enters a municipal drainage tile at a catch basin (surface water monitoring station SS1), which is situated 60 m east of the western Site boundary. The municipal drainage tile subsequently drains into the discharge ditch of Sedimentation Pond 2, which ultimately flows westward to the Gilliand-Geerts Drain ‘A’, beneath Lambton Road 79.

The Brown Creek watershed drains the area east of the Site, including the northeast corner of the Existing Landfill. Brown Creek is a southwesterly flowing headwater of the Sydenham River, which it intersects about 1.3 kilometres (km) northeast of Alvinston.

1.5 Water Budget

Water budgets are provided in Tables C-1 through C-7, Appendix C, for the 30-year normals (1961-1990, 1971-2000, 1981-2010, and 1991-2020) and the 2022 through 2024 climatic data for the area around the Site. The water budget information is based on the Thornthwaite Analytical Method (1957). A summary of precipitation data for the 30-Year Normal (1961-1990, 1971-2000, 1981-2010, and 1991-2020) and the 1995 through 2024 annual climatic data for the area around the Site is provided in Table C-9, Appendix C. The 30-year normal and data to 1996 were collected at the Strathroy Climatological Station. Data from 1997 onward were collected from the Strathroy-Mullifarry Climatological Station, which is the nearest Environment Canada climatological station to the Site.

Precipitation data collected from the on-Site climatological station from January 1 to December 31, 2024, is also provided in Table C-8, Appendix C. As presented in Table C-9, Appendix C, a total of about 936.4 mm of precipitation was recorded from the on-Site climatological station during 2024, while the Strathroy-Mullifarry Climatological Station recorded about 1,157.2 mm of precipitation in 2024.

Relative to the 30-Year Normal (1991-2020), 2024 was wetter than normal as recorded at the climatological station. The 2002 to 2024 on-Site precipitation data from January 1 to December 31 indicates that the yearly precipitation received at the Site was consistently less than the regional total. For example, the precipitation recorded from the on-Site climatological in 2024 was approximately 19.1 % less than what was measured at the Strathroy-Mullifarry Climatological Station. This pattern of annually less precipitation recorded at the Site than recorded regionally, has typically been observed since on-Site precipitation monitoring began in 2003 (2003 was first full year of monitoring). Notwithstanding this observation, within the last five (5) years, 2024 was noted to have been the wettest year. 2024 experienced two kinds of precipitation occurrences that were of note that occurred multiple times throughout the year. The two different kinds of events were:

1) Multiple short duration, high magnitude events (i.e. July 15, 2024 where the site recorded 79.6 mm in 24 hours); and
2) Prolonged periods of precipitation over multiple weeks (i.e. it rained 20 of the 31 days in December 2024).

Based on the available historical data from the Environment Canada climatological stations year-to-year, there is typically a water deficit (evapotranspiration exceeds precipitation) from May through September. Therefore, there is a low potential for overland flow and an increase in infiltration rates during this period, which is beneficial for the operation of a Poplar System. For the period from October through April, typically there is a water surplus (precipitation exceeds evapotranspiration) results in a greater potential for overland flow and a decrease in infiltration rates.

1.6 Monitoring System & Schedule

The monitoring system and schedule for the site follows the requirements of the site regulatory framework as outlined in Section 1.2, as well as the environmental monitoring plan, as prepared by Jagger Hims Limited, dated December 6, 2007 (EMP).

Table 1 provides a schedule of the monitoring tasks completed in 2024. Also, provided in Table 1 are rationales for monitoring requirements that were not completed in 2024. The annual monitoring program completed for the 2024 calendar year, including the relevant monitoring locations, parameters, and frequency, is outlined in Table B-2, Appendix B. Table B-3, Appendix B, provides a summary of changes to the EMP as approved by the Ministry of the Environment, Conservation and Parks (MECP). Table B-4, Appendix B, provides a summary of Compliance Point trigger concentration exceedances in 2024. Borehole logs and monitoring well information are provided in Appendix D. Monitoring well construction details are also summarized in tabular format as provided in Table F-1, Appendix F.

2 MONITORING METHODS

The 2024 Compliance Monitoring Program for groundwater, surface water, landfill gas, leachate, air quality and noise were completed by RWDI between January 1 and December 31, 2024. Liquid level monitoring of the PDL and SDL of the Expansion Landfill was recorded automatically with pressure transducers and recorded by a SCADA system.

Monitoring locations included in the annual monitoring program are listed in Table 1 and presented on Figure 2.

Copies of the Chain of Custody Forms/Files, as it relates to water, leachate, and soil, for samples submitted to the laboratory in 2024 are provided in Table B-5, Appendix B. It is noted, that beginning early in 2024, the environmental analytical testing laboratory, Bureau Veritas implemented an electronic chain of custody system to create Electronic Chain of Custody submissions, which are not included with the laboratory reports of analysis and are replaced with Custody Tracking Forms. A quality assurance and quality control (QA/QC) program was followed for each of the routine monitoring tasks completed. This program consists of procedures for the sampling of monitoring wells, the collection of samples, and ancillary tasks. A copy of the field sampling protocols is provided in Appendix E.

Monitoring well construction details are provided in Table F-1, Appendix F. Monitoring wells, which were included in the 2024 annual monitoring program, are designated as 'Active'. Other monitoring wells not included in the annual monitoring program are designated as 'Inactive'. Some historical monitoring wells that were recently removed and/or replaced from the monitoring program may be designated as 'Decommissioned'.

2.1 Liquid Level Measurements

Groundwater and leachate levels were manually measured at accessible monitoring wells, leachate wells, and maintenance holes located on the Site on May 1 and November 1, 2024.

On a daily basis, during landfill operations, liquid levels for the leachate within the PDL at PS1, PS3, PS5, and PS7, as well as monthly groundwater levels for the water in the SDL at PS2, PS4, PS6, and PS8. Groundwater and leachate elevations are discussed in Section 4.

2.2 Leachate Sampling

Leachate samples were collected using dedicated disposable bailers for the relevant monitoring locations. Leachate samples were collected from select maintenance holes and pumping stations on May 2 and 6, 2024.

Leachate from the Equalization Tank was conveyed into 20 litre (L) pails, which were rinsed with leachate prior to sample collection. The sampling point for the Equalization Tank is at the truck loading bay for PS10. The Equalization Tank is sampled on a quarterly basis. The leachate within the Equalization Tank represented leachate from: PS1 (Cell 1), PS3 (Cell 2), PS5 (Cell 4), PS7 (Cell 6A) most of the Existing Landfill, as well as partially derived from the condensate from the landfill gas collection systems installed in the Existing and Expansion Landfill. During 2017, each cell with a leachate collection system within the Existing Landfill was automated for leachate transfer to the Equalization Tank, with the exception of the eastern portion of Cell 3S (MH3SA and MH3SB), and the northern portion of Cell 4 (MH4B). In late 2022, MH3SB was automated for leachate transfer to the Equalization Tank. As such, leachate sampled from the Equalization Tank included leachate from the Existing Landfill throughout 2024.

Leachate was collected from PS1 (Cell 1), PS3 (Cell 2), PS5 (Cell 4), and PS7 (Cell 6A) via dedicated Waterra tubing equipped with a manual inertial-lift pump during the required annual sampling event in May. Leachate samples for soluble metals did not require field-filtering, but were preserved as required, while leachate samples for dissolved organic carbon (DOC) were field filtered and preserved.

Leachate chemical results for the aforementioned various sampling locations are discussed in Section 5.1.

2.3 Monitoring Well Sampling

Groundwater samples were collected from May 6 to 10, 2024 for the spring semi-annual monitoring event. During the fall semi-annual monitoring event, groundwater sampling was completed from November 18 to 19, 2024.

Groundwater samples were collected using dedicated low flow bladder pumps.

The cemetery well is sampled annually in the spring by manually purging approximately 100 L using the cemetery well's existing manual inertial-lift pump. Although not required to be evaluated as a drinking water source, as there is no restriction on how the water could be used from the cemetery well, metals sampling did not include field filtering because the water could potentially be utilized as drinking water.

As part of Site operations and to protect groundwater resources, some inactive monitoring wells were retained for potential future use as part of the monitoring program of the Expansion Landfill. This includes monitoring well OW59-10. Although monitoring well OW59-10 is considered an 'inactive' monitoring well, liquid levels are being assessed at OW59-10 to evaluate groundwater conditions near Cell 7 of the Existing Landfill. Idle monitoring wells OW39-6 and OW39-12 were decommissioned in 2017 during replacement activities related to damaged OW39-26. Monitoring locations OW61, OW62, OW75, OW76, OW77, OW78, and OW85 are currently inactive, as these monitoring wells are utilized to assess groundwater quality as it pertains to the operation of the Poplar Plantation. Since the Poplar Plantation has been inactive since its construction in 2009, groundwater quality assessment is not required to be completed in that location, which is also approved under Notice No.1 of the Sewage ECA.

Of note, groundwater monitoring well OW40D-4 was decommissioned on January 30, 2024 as a result of damage from nearby construction activities. The installation of replacement groundwater monitoring well OW40E-4 was completed on March 20, 2024.

Groundwater chemical results for the monitoring wells that were required to be sampled in 2024 are discussed in Section 5.2.

In consultation with the Landfill Engineer and Hydrogeologist Reviewers of the Technical Review Team (TRT), WM had agreed post-2016 to supplement the existing leachate level monitoring. The supplemental leachate level monitoring locations (LW1 through LW6) were installed within the Existing Landfill in late 2017. The locations of the select landfill gas extraction wells from within the Expansion Landfill were determined in 2018 [EV229 in Cell 1A (Stage 1), EV268 in Cell 1A (Stage 2), EV022 in Cell 2B, and EV226 in Cell 2D], as shown on Figure 2. These supplemental leachate level monitoring wells are proposed to be monitored semi-annually together with the already established semi-annual spring and fall monitoring events for the Site to provide further insight toward leachate patterns within select waste cells of the Existing Landfill, as well as the Expansion Landfill.

2.4 Surface Water Sampling

2.4.1 Surface Water Flow

Surface water flow at the monitoring stations is precipitation dependent. Adequate flowing conditions to conduct surface water sampling were noted during Q1, Q2, Q3 and Q4 of 2024. After some precipitation events, some of the sampling stations did not produce the required flow for sampling. The observation of no flowing conditions after rain events ≥ 10mm/24hrs is expected and has been identified since precipitation monitoring began in 2003 at the Site. Verification surface water sampling events were also conducted, where required, in 2024.

As approval to discontinue monitoring the Poplar Plantation was received from the MECP on February 20, 2013, the surface water monitoring program for SS17A/B and SS18A/B remained inactive during the 2024 monitoring period.

2.4.2 Mechanism for Response Routine Monitoring

In general, for the surface water monitoring program, the triggering mechanism for response monitoring is the receipt of ≥ 10 mm of precipitation in a 24-hour period from 08:00 to 08:00 hours. Flowing conditions permitting, the surface water stations are sampled within a 24-hour window following the receipt of ≥ 10 mm at the Site. Surface water is sampled once per quarter as part of the required routine monitoring for the Site. If a compliance monitoring station does not produce sufficient runoff to conduct sampling (or is dry), then the next precipitation event of ≥ 10 mm in a 24-hour period will trigger the assessment of those stations that were dry during the previous assessment. This response monitoring will continue throughout a quarterly monitoring period until the compliance stations have been sampled, or the quarter ends, in which monitoring of all the compliance stations will commence again for the next quarterly monitoring period. It is noted that per the EMP a maximum of one precipitation event is to be monitored in a calendar quarter and events are to be separated by a one (1) month interval.

2.4.3 Mechanism for Response Verification Monitoring

There are two (2) types of surface water monitoring stations at the Site. The first type of station consists of an open ditch where surface water flowing conditions heavily rely on precipitation. The second type of station consists of Sedimentation Ponds. When a Primary Leachate Indicator List (PLIL) parameter exceeds its trigger concentration at a surface water monitoring station, a verification monitoring response is triggered for that monitoring station per the regulatory documents.

For the 'ditch' type monitoring stations (e.g., SS1), verification monitoring can only occur after the receipt of ≥ 10 mm of precipitation in a 24-hour period where the precipitation was sufficient to generate flowing conditions to conduct sampling. Response monitoring continues throughout the quarter until a precipitation event is sufficient to conduct sampling. If insufficient flowing conditions continue at the ditch type station throughout a quarterly monitoring period, the verification event is postponed to the next quarterly monitoring period, and consequently, the postponed, monitoring event will consider both the routine quarterly monitoring event, as well as the verification monitoring event.

Similarly, for the Sedimentation Ponds, a verification monitoring event is triggered when one or more PLIL parameters exceed their relevant trigger concentrations following the routine quarterly sampling event. The verification monitoring for Sedimentation Ponds is completed within one (1) week of receipt of the routine monitoring event's chemical analytical results, independent of precipitation occurrences (Condition 8.4.) of the Sewage ECA).

2.4.4 Precipitation Summary for Monitoring Events

<u>Monitoring Station Locations and Sampling Details:</u>

The surface water monitoring stations that formed part of the 2024 Compliance and Poplar System Monitoring Programs are summarized below.

Task	Monitoring Station Designations	Monitoring Station Description
Surface Water Environmental Monitoring Program	SS1	Downstream of Existing Landfill on WM property, 60 m east of Lambton Road 79 (Nauvoo Road) – Compliance Point
	SS10	Off-Site flow from neighbouring farmland into the East Ditch of the Existing Landfill – Background Surface Water Quality
	SS16	On-site flow onto expansion lands from Township land located south of the Site – Background Surface Water Quality

Task	Monitoring Station Designations	Monitoring Station Description
	SS19	Composting Facility (not yet constructed)
	SP1	Outlet Weir of Sedimentation Pond 1 – Internal assessment location
	SP2	Outlet Weir of Sedimentation Pond 2 – Compliance Point
	SP3	Outlet Weir of Sedimentation Pond 3 – Compliance Point
	SP4	Outlet Weir of Sedimentation Pond 4 – Compliance Point
Surface Water Poplar System Monitoring Program	SS14A (former SS14)	On-Site flow within East Ditch of the Existing Landfill, upstream of Poplar System
	SS14B (former SS15)	On-Site flow within West Ditch of the Existing Landfill, adjacent to Poplar System.
	SS15A	South Ditch of the Existing Landfill and inlet point to Sedimentation Pond 1. Downstream of Poplar System.

Note: Former surface water monitoring stations SS14 and SS15, and revised/new surface water stations SS14A, SS14B, and SS15A as noted above, are required under the Waste and Sewage ECA's as part of the Poplar System Monitoring Program.

Details of the findings for the 2024 Poplar System surface water monitoring stations (SS14A, SS14B, and SS15A) can be found in Volume 3 of the 2024 Annual Report.

A summary of the precipitation that triggered the surface water monitoring events is provided below. The precipitation amounts for the five days preceding the monitoring event are also provided. The data presented in the summary reflects that collected from the on-Site climatological station in 2024.

Quarter	Previous 5 Days of Precipitation (mm)	Sampling Events
1	0, 0, 0.2, 0, 18.4	January 10, 2024 – Routine monitoring event for the January 9, 2024 precipitation event (SP3 unable to be sampled due to no flow).
	0.2, 1.0, 5.4, 6.6, 8.2	January 25, 2024 – SP2 verification monitoring event for the January 10, 2024 routine monitoring event from Q1.
	1.0, 5.4, 6.6, 8.2, 22.2	January 26, 2024 – Routine monitoring event for the January 25, 2024 precipitation event (for SP3).
	1.0, 5.4, 6.6, 8.2, 22.2	January 26, 2024 – SS1 verification monitoring event for the January 10, 2024 routine monitoring event from Q1.
2	1.4, 0, 0, 8.8, 15.6	April 12, 2024 – Routine monitoring event for the April 11, 2024 precipitation event.
	0, 0, 0, 0, 0	April 24, 2024 – SP2 verification monitoring event for the April 12, 2024 routine monitoring event from Q2.
	0, 1.0, 2.8, 4.6, 11.6	April 30, 2024 – SS1 Verification monitoring event for the April 12, 2024 routine monitoring event from Q2.
3	2.2, 0, 0, 0, 25.8	July 10, 2024 – Routine monitoring event for the July 9, 2024 precipitation event.
	0, 0, 0, 0, 1.8	July 24, 2024 – SP2 verification monitoring event for the July 10, 2024 routine monitoring event from Q3.
	0, 0, 0, 0, 18.6	July 30, 2024 – SS1 verification monitoring event for the July 10, 2024 routine monitoring event from Q3.
4	0, 0, 0, 2.4, 21.0	October 14, 2024 – Routine monitoring event for the October 13, 2024 precipitation event.
	1.2, 0, 0, 0, 0	October 28, 2024 – SP2 verification monitoring event for the October 14, 2024 routine monitoring event from Q4.
	0.2, 0, 0, 1.0, 13.4	November 11, 2024 – SS1 verification monitoring event for the October 14, 2024 routine monitoring event from Q4.

Summary of Stations Monitored:

A summary of the surface water stations that were sampled in 2024, including a brief explanation as to why a station was not sampled, is provided below.

Surface Water Monitoring Station	Routine Monitoring	Verification Monitoring	Rationale for No Samples Being Collected
SS1	Q1, Q2, Q3, Q4	Q1, Q2, Q2, Q3	
SS10	Q1, Q2, Q4		No flow in Q3
SS16	Q1, Q2, Q3, Q4		
SP1	Q1, Q2, Q3, Q4		
SP2	Q1, Q2, Q3, Q4	Q1, Q2, Q3, Q4	
SP3	Q1, Q2, Q3, Q4		
SP4	Q1, Q2, Q3, Q4		

Surface water chemical results for the aforementioned various sampling locations are discussed in Section 5.3.

Biological Monitoring:

The annual biomonitoring program was completed for the April 12, 2024, spring surface water monitoring event per the EMP. Surface water samples were collected at stations SS1, SS10, SS16, SP1, SP2, SP3, and SP4 for the annual biomonitoring program.

Verification biomonitoring was also conducted at monitoring stations SS1 on January 26 (for Q1), April 30 (for Q2), July 30 (for Q3), and November 11 (for Q4) 2024, as well as at SP2 on January 25 (for Q1), April 24 (for Q2), July 24 (for Q3), and October 28 (for Q4) 2024, in accordance with conditions approved in the 2014 MECP Letter.

Details of the biological monitoring completed during the 2024 year are discussed in Section 5.3.3 and 5.3.4.

2.5 Landfill Gas Monitoring

Landfill gas monitoring was completed at gas probes GP1 to GP10 in January, February, March, April, July, November, and December 2024 per the EMP.

Methane gas monitoring findings are discussed in Section 5.4.

2.6 Automobile Shredder Residue Monitoring

Automobile Shredder Residue (ASR) may be used at the Site as daily cover in accordance with Condition 6.51 of the Waste ECA. ASR samples, when this material is utilized, are collected on a semi-annual basis during the spring and fall and submitted for analysis of Ontario Regulation 347 (O.Reg. 347) Schedule IV criteria in accordance with Condition 6.52 of the Waste ECA. Composite samples of stockpiled ASR material were collected on April 9 and October 3, 2024.

ASR monitoring findings are discussed in Section 6.3.

2.7 Contaminated Soil Monitoring

Contaminated soil may be managed on-Site in accordance with Conditions 6.53 to 6.61 of the Waste ECA. Quarterly sampling is completed for contaminated soil that is utilized as daily and/or intermediate cover for the Expansion Landfill per Conditions 6.56 and 6.57 of the Waste ECA, and is submitted for analysis of O.Reg. 347 Schedule IV. Composite samples of contaminated soil material were collected on January 24 (for Q1), April 9 (for Q2), July 19 (for Q3), and October 3 (for Q4) in 2024.

Contaminated soil monitoring findings are discussed in Section 6.4.

2.8 Field Sampling Parameters

Groundwater, leachate, and surface water field testing included the measurement of pH, electrical conductivity (EC), temperature, and turbidity (groundwater, surface water, and leachate), as well as dissolved oxygen (DO) (for surface water and leachate only). Surface water field parameters, including flow rates, were measured at each monitoring station, when water was present, during each monitoring event.

2.9 Laboratory Analytical Parameters

Analytical parameters are listed in Table B-2, Appendix B. In general, analyses were completed by Bureau Veritas Laboratories, a Canadian Association of Laboratory Accreditation (CALA) accredited laboratory.

2.10 Field QA/QC Sampling

The field sampling QA/QC program is outlined in the following table. No equipment rinse blanks were collected due to the use of dedicated sampling equipment.

Media	Monitoring Event	Field-prepared Duplicate (Original Sample)
Leachate	May 6, 2024	LDUP (MH18)
Groundwater	May 6 to 10, 2024	OW73-6 (GWDUP1)
		OW16-6 (GWDUP2)
		OW40A-7 (GWDUP3)
		OW80-3 (GWDUP4)
	November 18 to 19, 2024	OW16-6 (GWDUP1)
		OW16-7 (GWDUP2)
		OW72-6 (GWDUP3)
Surface Water	January 10, 2024	SSDUP1 (SS1)
		SPDUP (SP4)
	April 12, 2024	SSDUP1 (SS1)
		SPDUP (SP2)
	July 10, 2024	SSDUP1 (SS1)
		SPDUP (SP2)
	October 14, 2024	SSDUP1 (SS1)
		SPDUP (SP2)

Notes: 1) Field and trip blanks were analyzed as part of the groundwater monitoring events during May and November. Parameters are outlined in Table B-2, Appendix B.
2) Field prepared duplicate samples are not required for verification monitoring events.

3 QUALITY ASSURANCE & QUALITY CONTROL EVALUATION

The QA/QC program included field-prepared duplicate samples, field-prepared blanks, trip blanks, comparisons with field-determined analytical results, laboratory-prepared blanks, matrix spikes, duplicates, percent recoveries of analyses, and data review. Additionally, the QA/QC program consists of verifying that the correct parameters were assessed by the laboratory for each sampling event, and that they were assessed within their respective hold times (not beyond the sample expiration date). During 2024 the correct parameters were assessed within the allotted hold times.

The laboratory analyzed several control samples to verify that the analytical equipment was functioning properly and reporting results accurately at the time of analysis for the samples collected at the Site. The control samples had an expected target value, which was compared against pre-determined data quality objectives. For the laboratory control samples, the results were within acceptable laboratory data quality criteria.

For the field-prepared duplicate samples, the analytical results for the required parameters of analysis, completed as detailed in Section 2.9, were evaluated for the relative percent difference (RPD) of parameter concentrations using the United States Environmental Protection Agency (USEPA) National Functional Guidelines (US EPA 542-R-20-006 and US EPA 540-R-20-005) as a general QA/QC RPD screening mechanism. The RPD screening mechanism is such that for concentrations greater than five (5) times the laboratory reportable detection limit (RDL), a concentration difference of less than or equal to 20% is deemed acceptable. For concentrations less than or equal to five (5) times the RDL, a concentration difference of equal to or less than the RDL is deemed acceptable. Where an exceedance of the general QA/QC RPD screening mechanism is identified, the results for the required parameters of analysis are evaluated against the applicable performance standards for sample duplicates noted in Tables 5-1 to 5-15 of the *Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act*, as prepared by the Ministry of the Environment, Conservation, and Parks (MECP), dated March 9, 2004, and amended on February 19, 2021. For the results found to exceed the criteria of each QA/QC evaluation, a laboratory data quality review (DQR) of the results is completed by the laboratory to verify that the concentrations are accurate as presented and are within acceptable laboratory data quality criteria.

Laboratory chemical results for the leachate, groundwater, and surface water are provided in Appendices G, H, and I, respectively.

3.1 Leachate

For leachate samples collected for the 2024 Compliance Monitoring Program, the RPD were acceptable between original and duplicate samples, with the exception of select parameters as summarized below.

Sampling Date	Original Sample (Duplicate)	Parameter with QA/QC Exception
May 6, 2024	MH18 (LDUP)	Ethylbenzene Toluene

A laboratory DQR for each of the aforementioned results indicated that the concentrations for the above noted parameters were accurate as presented and within acceptable laboratory data quality criteria. Therefore, the results for the leachate samples collected during the 2024 monitoring event were considered representative of actual leachate quality at the time of sample collection and were acceptable for inclusion into the database for interpretation.

The leachate field analytical results for temperature, pH, EC, turbidity, and DO, are provided for the Existing Landfill (CFA-Comp, Sump, and MH18), as well as the Expansion Landfill (PS1, PS3, PS5, PS7, and Equalization Tank) in Table G-1, Appendix G. Field leachate temperatures showed some variability reflective of the location the leachate is being stored/generated and the time of year the leachate was assessed. For example, generally the quarterly field temperature results for the Equalization Tank showed expected variability based on the time of year sampled with relatively slightly lower temperatures for January and October, and relatively higher temperatures for May and July.

The field analytical values recorded for pH across the Site varied between 7.2 and 8.2 pH units. EC values also varied, with a range of 1,110 to 6,250 micro-Siemens per centimetre (µS/cm) at the Existing Landfill, and 9,170 to >20,000 µS/cm for the Expansion Landfill. Turbidity values also expectedly varied with values between 92.2 and 166 nephelometric turbidity units (NTU) for the Existing Landfill, and values between 132 and >999 NTU for the Expansion Landfill.

Ion balances were also calculated as a QA/QC procedure for the leachate. Considering major anions and cations, an ion balance difference of greater than 10% would initiate a more thorough review of the chemical results and laboratory procedures. The leachate chemical results obtained during the 2024 annual monitoring program satisfied the 10% ion balance target, except as noted in the summary below. The cause of the ion balance exceedances summarized below are reasonable for the noted parameters and the respective concentrations detected in the relevant samples.

Media	Station/Monitoring Well ID	Ion Balance Percentage and Date	Comments
Leachate	MH18	10.8 – May 2024	High anion concentrations
	CFA-COMP	28.6 – May 2024	High anion concentrations
	Equalization Tank	22.3 – May 2024	High anion concentrations
		15.2 – October 2024	High anion concentrations
	PS1	26.0 – May 2024	High anion concentrations
	PS3	14.4 – May 2024	High anion concentrations
	PS7	10.2 – May 2024	High anion concentrations

3.2 Groundwater

For the groundwater samples collected for the 2024 Compliance Monitoring Program, the RPD were acceptable between original and duplicate samples, with the exception of select parameters as summarized below.

Sampling Date	Original Sample (Duplicate)	Parameter with QA/QC Exception
November 1 to 3, 2024	OW16-6 (GWDUP-1)	Dissolved Organic Carbon Alkalinity (Total as $CaCO_3$)
	OW16-7 (GWDUP-2)	Dissolved Organic Carbon
	OW72-6 (GWDUP-3)	Dissolved Organic Carbon

A laboratory DQR for each of the aforementioned results indicated that the concentrations for the above noted parameters were accurate as presented and within acceptable laboratory data quality criteria. Therefore, the results for the groundwater samples collected during the 2024 monitoring events were considered representative of actual groundwater at the time of sample collection and were acceptable for inclusion into the database for interpretation.

The groundwater field analytical results for temperature, pH, EC, and turbidity are provided for the active aquitard, the interstadial silt and sand, as well as the interface aquifer in Tables H-1 to H-3, Appendix H, respectively. Shallow groundwater generally showed greater temperatures than the deeper groundwater during May and cooler temperatures compared to the deeper groundwater during November, indicative of seasonal influences on the shallower groundwater. The field analytical values recorded for pH varied between 6.5 and 8.1 pH units. As expected in clayey soil, both conductivity and turbidity values varied, with a range of 900 to 7,180 µS/cm for conductivity and 3.20 to >999 NTU for turbidity.

Ion balances were also calculated as a QA/QC procedure for the groundwater. Considering major anions and cations, an ion balance difference of greater than 10% would initiate a more thorough review of the chemical results and laboratory procedures. The groundwater chemical results obtained during the 2024 annual monitoring program satisfied the 10% ion balance target, except as noted in the summary below. The cause of the ion balance exceedances summarized below are reasonable for the noted parameters and the respective concentrations detected in the relevant samples.

Media	Station/Monitoring Well ID	Ion Balance Percentage and Date	Comments
Groundwater	OW16-6	18.3 – November 2024	High cation concentrations
	OW60-4	10.2 – May 2024	High cation concentrations
	OW68-5	11.5 – May 2024	High cation concentrations
	OW79-5	11.1 – May 2024	High cation concentrations
	OW80-3	29.9 – May 2024	High cation concentrations
	OW80-27	10.1 – May 2024	High cation concentrations
	OW83-5	14.2 – May 2024	High cation concentrations
	OW83-9	11.8 – May 2024	High cation concentrations
	OW84-6	16.4 – May 2024	High cation concentrations
		12.2 – November 2024	High cation concentrations
	Cemetery Well	10.8 – May 2024	High cation concentrations

3.3 Surface Water

For the surface water samples collected for the 2024 Compliance Monitoring Program, the RPDs were acceptable between original and duplicate samples, with the exception of select parameters as summarized below.

Sampling Date	Original Sample (Duplicate)	Parameter with QA/QC Exception
January 10, 2024	SS1 (SSDUP1)	Total Suspended Solids
	SP4 (SPDUP)	Total Suspended Solids Total Iron
April 12, 2024	SS1 (SSDUP1)	Total BOD
July 10, 2024	SS1 (SSDUP1)	Nitrite
October 14, 2024	SS1 (SPDUP1)	Total Suspended Solids
	SP2 (SPDUP)	Total BOD Total Phosphorous Total Suspended Solids

A laboratory DQR for each of the aforementioned results indicated that the concentrations for the above noted parameters with RPDs were accurate as presented and within acceptable laboratory data quality criteria. Therefore, results for the surface water samples collected during the 2024 monitoring events were considered representative of actual groundwater quality at the time of sample collection and were acceptable for inclusion into the database for interpretation.

Surface water field analytical results are provided in Table I-1, Appendix I. During the 2024 monitoring events, the surface water temperatures reflected the ambient air temperature during sampling. Field pH, EC, turbidity, and DO values fluctuated with no notable anomalies.

Ion balances were also calculated as a QA/QC procedure for surface water. Considering major anions and cations, an ion balance difference of greater than 10% would initiate a thorough review of the chemical results and laboratory procedures. The surface water chemical results obtained during the 2024 annual monitoring program satisfied the 10% ion balance target, except as noted in the summary below. The cause of the ion balance exceedances summarized below are reasonable for the noted parameters and the respective concentrations detected in the relevant samples.

Media	Surface Water Monitoring Station	Ion Balance Percentage and Date	Comments
Surface Water	SS1	16.3 – January 10, 2024	Low anion concentrations
		22.1 – January 26, 2024	Low anion concentrations
		21.1 – July 10, 2024	Low anion concentrations
		37.0 – July 30, 2024	Low anion concentrations
	SS16	15.2 – January 10, 2024	Low anion concentrations
	SP2	13.0 – October 14, 2024	Low anion concentrations

In summary, the 2024 field and laboratory QA/QC results indicated that the chemical results were representative of actual conditions at the time of sample collection.

4 GROUNDWATER & LEACHATE ELEVATION RESULTS

To define the local groundwater setting below the landfill, the stratigraphic sequence described in Section 1.4 can be associated with hydrostratigraphic units, as summarized below.

Stratigraphic Unit	Hydrostratigraphic Unit	Approximate Depth to top of Unit (m)
Brown Zone in the Southern Till	Active Aquitard	0.0
Grey Zone in the Southern Till Interstadial Clay and Silt	Upper Aquitard	1.6 to 7.9
Interstadial Silt and Sand	Interstadial Sand	4.0 to 10.7
Rannoch Till	Lower Aquitard	4.5 to 12.5
Fractured Bedrock and Basal Sand	Interface Aquifer	22.8 to 29.3

Although each stratigraphic unit is identified as part of a hydrostratigraphic unit, each unit has a hydraulic influence on the others. Groundwater monitoring wells developed within each hydrostratigraphic unit are summarized below and monitoring well construction details provided in Table F-1, Appendix F.

Hydrostratigraphic Unit	Monitoring Wells

Hydrostratigraphic Unit	Monitoring Wells
Active Aquitard	OW16-6, OW17-4, OW40E-4, OW54A-4, OW56-4, OW57-4, OW58-6, OW59-6, OW60-4, *OW61-4, OW62-5*, OW67-4, OW68-5, OW69-5, OW70B-5, OW71A-5, OW72-6, OW73-6, *OW75-3, OW76-5, OW77-4, OW78-4,* OW79-5, OW80-3, OW81-5, OW82-5, OW83-5, OW84-6, *OW85-5*
Interstadial Silt and Sand	OW16-7, OW40A-7, OW46-7, OW47-6, OW54-10, OW57-15, OW58-17, OW60-8, *OW61-6, OW62-7*, OW67-11, OW72-10, OW73-9, *OW75-7, OW78-6,* OW79-7, OW80-6, OW81-7, OW82-14, OW83-9, OW84-11, *OW85-8*
Interface Aquifer	OW17-30, OW19-29, OW39A-26, OW40A-28, OW49-29, OW60-25, *OW61-26, OW62-30*, OW79-26, OW80-27, OW81-27, OW82-28, OW83-29, OW84-31, Cemetery Well

Note: *Italicized* denotes monitoring well is inactive as the monitoring well is to be used to evaluate the Poplar Plantation two (2) months prior to activation of the system.

4.1 Leachate Elevations

Leachate elevations measured at the Existing Landfill during the 2024 annual monitoring program are presented with historical data in Tables F-2 and F-3, Appendix F. Leachate elevation data from the pumping stations of the Expansion Landfill are presented with historical data in Table F-6, Appendix F.

4.1.1 Leachate Elevation Assessment - Existing Landfill

Based on discussions below, no improvements to the Existing Landfill leachate elevation monitoring were proposed or identified in 2024.

Monitoring Details:

Leachate elevations are plotted on Figure 4. Flow valves between maintenance holes for each cell of the Existing Landfill are left in a normally open position to facilitate the automated pumping of leachate to the Equalization Tank, as necessary to keep leachate levels at an acceptable elevation.

Collection System(s) Background:

To provide background for the understanding of the design of the waste cells within the Existing Landfill, Cells 3S, 4, 5, 6, 7, 8, 9, 10, and 11, as well as Cell 12 (only the southern third is constructed) contain waste underdrains that direct leachate to a perimeter collector system. Cells 10 and 12 are hydraulically connected, with leachate extraction typically occurring from MH12. The South Cell is completed with finger drains that direct leachate to a perimeter collection system. The West Cell is completed with a collection "Sump" to collect leachate for extraction purposes. Cell 3 does not have a leachate collection system, however, based on historical liquid levels the leachate in this cell is understood to be managed by the adjacent cells. For cells with waste underdrains, when the valve is open and leachate flows freely between a cell's maintenance holes, the leachate elevation in the maintenance holes of that cell is expected to be similar, typically within 0.15 m.

Two (2) exceptions to this pattern can occur for cells with waste underdrains, which are for Cells 3S and 4. For Cell 3S, the leachate levels can be notably different in each maintenance hole.

By the original design of the collection system MH3SA and MH3SB were not hydraulically connected with a pipe and are the upper end of the system, which drain to the low end at MH3SC. As of October 2022, for operational efficiencies, MH3SB was converted into a pumping station and MH3SA and MH3SB were hydraulically connected with a pipe. As such the leachate elevations in MH3SA and MH3SB will be expected to be similar, typically within

0.15 m. MH3SC is connected with a pipe to MH3SD but is constructed with a sump ~2m deeper than the base of MH3SD. For Cell 4, there are two distinct (north third and south two-thirds) waste underdrain systems, which independently gravitationally drain to their respective low ends, MH4A (south system) and MH4B (north system). MH4B gravity drains through a toe drain to MH4A.

By the fall of 2017 each of the downstream maintenance holes for the Existing Landfill were updated to be operated as pumping stations (MH3SB updated to be operated as a pumping station late in 2022). This pumping station conversion enables the leachate level in the maintenance hole to be automatically managed, year-round, via pumping leachate to either the equalization tank or to the Poplar System irrigation tanks.

Leachate Management:

As a general leachate best management practice, the extraction of leachate within the Existing Landfill is prioritized based on the leachate elevations for each individual waste cell to facilitate inward hydraulic gradients (as calculated considering the previous year's seasonally relevant groundwater elevations). Exceptions occur since 2019 for leachate management practices where leachate is stored in the waste during late winter to spring, for volume availability for irrigation application to the Poplar System in the subsequent growing season. From an environmental stewardship perspective, the leachate generated from within the waste mound of the Existing Landfill was determined to generally be of more suitable use as irrigation liquid during the growing season as opposed to dedicating efforts for off-Site disposal and treatment between late winter 2023 and spring 2024. It is noted that storing leachate in this manner is suitable as acceptable groundwater quality is observed around the Existing Landfill.

Leachate Level Assessment Details:

The hydraulic assessment of leachate compared to nearby shallow groundwater is utilized as an additional guidance tool toward managing leachate volumes in the waste cells and preventing the potential for releases to local water resources, such as surface water and groundwater. The leachate target elevations updated in 2023 were used to assist in lowering the liquid elevation within the maintenance holes and Sump during 2024. Most of the waste cells of the Existing Landfill are completed with waste underdrains such that leachate will percolate vertically downward through the waste and into the collection lines and be directed gravitationally toward the perimeter maintenance holes. As the waste mound is not likely uniform in nature, some leachate could be perched within the waste mound. As such, the potential for leachate seeps exists. In 2024, RWDI did not observe any seeps on the landfill cap during their respective Site inspections, with the exception of a couple of seeps as noted in Section 4.1.4.

4.1.1.1 Leachate Elevation Patterns – Existing Landfill

It is apparent that leachate elevations varied across the Site. A comparison of the May and November 2024 leachate elevations with ground surface and inferred groundwater elevations outside the waste footprint is provided in Table 2. Overall, leachate elevations at the Existing Landfill generally increased from November 2023 to May 2024 and/or then decreased from May 2024 to November 2024. One (1) exception to the generalized pattern was noted in Cell 3 (at OW51A-15), where leachate elevations slightly increased from May 2024 to November 2024.

Based on 2024 leachate elevations, the hydraulically connected maintenance holes in the Existing Landfill generally showed an elevation difference that was equal within the same cell or that differed by less than 0.15 m. Exceptions to this occurred during one or both monitoring events for Cell 3S (at MH3SC and MH3SD, and at MH3SE and MH3SF), Cell 6, Cell 8, and Cell 12 in 2024. The below summary outlines the noted differences, which are not a concern as the differences are either based on design or generally consistent with historical observations.

- Within Cell 3S, the leachate elevation at MH3SC for the May and November monitoring event was greater than the elevation at MH3SD by 1.28 m and 1.33 m respectively, which is generally consistent with historical observations.
- Within Cell 3S, the leachate elevation at MH3SE for the November monitoring event was greater than the elevation at MH3SF by 0.83 m, which has been observed occasionally based on historical observations.
- Within Cell 6, the leachate elevations at MH6A for the May and November monitoring events were less than the elevations at MH6B by 0.47 and 2.14 m, respectively, which has been observed occasionally based on historical observations.
- Within Cell 8, the leachate elevation at MH8A for the May monitoring event was less than the elevation at MH8B by 0.16 m, which has been occasionally observed historically.
- Within Cell 12, the leachate elevation at MH12A for the November monitoring event was less than the elevation at MH12B by 0.16 m.

4.1.1.2 Leachate Levels Assessed Against Ground Surface

Leachate elevations/pressures that would have the potential to affect the groundwater systems are reflected by the leachate elevations within the associated maintenance holes of a given waste cell. As presented in Table 2, leachate elevations within the eastern and western waste cells were generally lower than the surrounding ground surface in May and November 2024.

One (1) exception occurred in the West Cell (Sump) both during the May and November 2024 monitoring events. Since the November 2015 monitoring event, the leachate elevation within the Sump has generally exhibited an increasing trend until November 2019, which then showed a significant decrease of 2.6 m as a result of leachate extraction. The leachate elevation within the Sump showed a further decrease from November 2019 to November 2020 of 1.51 m, also as a result of leachate extraction. Since 2020, the leachate elevation within the Sump generally exhibited an increasing trend, of which is interpreted to be a result of a combination of significant precipitation totals (in 2021, 2023 and 2024) and mechanical issues with the Sump's pump. In mid-June of 2023, the Sump's pump and level sensor were assessed to be faulty and were repaired in late August 2023. Since August 2023 leachate levels within the Sump generally reflect periodic dewatering. During 2024 the pump in the Sump failed from June through October which limited de-watering during the 2024 calendar year. Ongoing leachate level monitoring will continue, specifically with a focus of reducing leachate levels in this cell in the long-term.

Overall, however, based on the findings from the regulatory monitoring, acceptable groundwater and surface water quality was noted around the Existing Landfill in 2024.

Additionally, leachate seeps were generally not observed along the waste side slopes of the Existing Landfill in 2024, with the exception of a couple of seeps as noted below in Section 4.1.4. Therefore, the noted leachate elevation within the West Cell does not represent an immediate concern. Continued leachate extraction from the West Cell as well as the South Cell via automated pumping is expected to reduce the leachate mound in these cells. Ongoing monitoring will evaluate these locations over time.

4.1.1.3 Leachate Levels Assessed Against the Shallow Groundwater Table

<u>Spring 2024:</u>

In May 2024, leachate elevations were lower than the local and inferred shallow groundwater table for Cells 3S, 3, 4 (northern portion) 5, 7, 9, 11, and 12. This comparison shows that the groundwater was being induced toward the waste and that leachate was hydraulically contained within the waste at these locations. Exceptions to this are discussed below.

- Within Cell 4 (at MH4A), the leachate elevation was higher than the local shallow groundwater elevations to the east by 0.58 m. It is noted that the May 2024 leachate elevation within MH4A is within the historical range for this location.
- Within Cell 6 (at MH6A), the leachate elevation was higher than the historical (pre-2008) local shallow groundwater elevation by 2.71 m. It is noted that the May 2024 leachate elevation within MH6A was slightly above its historical range, however, the May 2024 leachate elevation within MH6B was within the historical range for this location, with both locations being notably lower in November 2024.
- Within Cell 8 (MH8B), the leachate elevation was higher than the historical (pre-2008) local shallow groundwater elevation by 1.63 m. It is noted that the May 2024 leachate elevation within MH8B is within the historical range for this location.
- Within Cell 10 (MH10), the leachate elevation was higher than the historical (pre-2008) local shallow groundwater elevation by 1.58 m. It is noted that the May 2024 leachate elevation within MH10 is within the historical range for this location.
- Within the West Cell (Sump), the leachate elevation was higher than the historical (pre-2008) local shallow groundwater elevations by 8.44 m. The May 2024 leachate elevation within the SUMP was 0.13 m higher than the peak elevation observed in May 2023, however, a decrease of 0.87 m was observed between May and November 2024, as a result of gradually lowering the leachate level as discussed in Section 4.1.1.2.
- Within the South Cell (at MH16, OW22A-10, and OW53-10) the leachate elevations were higher than the historical (pre-2008) local shallow groundwater elevation by 0.27 m, 0.59 m, and 1.97 m, respectively. It is noted that the May 2024 leachate elevation within MH16 was slightly above its historical range, however, the May 2024 leachate elevations within OW22A-10 and OW53-10 are within their respective historical ranges for each location.

<u>Fall 2024:</u>

In November 2024, the leachate elevations throughout select cells of the Existing Landfill expectedly showed a decrease since May 2024, dominantly as a result of leachate extraction for irrigation onto the Poplar System. For a few waste cells, the leachate elevations remained elevated with respect to the historical shallow groundwater elevations to the west and south of the Existing Landfill. However, leachate elevations were lower than the local and inferred shallow groundwater table for Cells 3S, 3, 4, 5, 7, 8, 9, 10, 11, and 12. Exceptions to this are discussed below.

- The leachate elevation within Cell 6 (at MH6A) was higher than the historical (pre-2008) shallow groundwater elevation by 1.21 m. However, the November 2024 leachate elevation within MH6A is within the historical range for this location.
- Within the West Cell (Sump), the leachate elevation was higher than the historical (pre-2008) local shallow groundwater elevations by 7.47 m. The November 2024 leachate elevation within the West Cell (Sump) is within the historical range for this location. Efforts to further lower the leachate level within the West Cell will continue in 2025.
- Within the South Cell (at MH16, OW22A-10, and OW53-10) the leachate elevations were higher than the historical (pre-2008) local shallow groundwater elevation by 0.15 m, 0.22 m, and 3.26 m, respectfully. The November 2024 leachate elevation within MH16 was slightly above its historical range, however, the November 2024 leachate elevations with OW22A-10 and OW53-10 are within the historical ranges for each respective location. Efforts to further lower the leachate level within the South Cell will continue in 2025.

Overall, as discussed herein, based on the findings from the regulatory monitoring, acceptable groundwater and surface water quality was demonstrated at the compliance points during 2024. Also, leachate seeps were generally not observed along the waste side slopes of the Existing Landfill in 2024, with the exception of a couple of seeps as noted below in Section 4.1.4. Therefore, the noted leachate elevations that were higher in 2024 than the local groundwater elevations within select leachate monitoring wells and maintenance holes of the Existing Landfill did not represent a concern.

4.1.1.4 Leachate Elevation Trends – Existing Landfill

Hydrographs of leachate elevations are presented on Figures F-1 through F-12, Appendix F. Long-term trends are summarized in Table 3. For the purpose of assessing elevation trends, a constant elevation trend is defined as having 0.1 m or less of seasonal variation.

Over past years, leachate elevations have mostly fluctuated with some exceptions, as noted in Table 3. The historically increasing leachate elevation trends that were noted in 2019 for Cell 3S (at MH3SC and MH3SD), Cell 6 (at MH6A and MH6B), and the West Cell (Sump) are noted to have generally been fluctuating below their historical highs. Efforts to further lower the leachate level within the West Cell and the South Cell will continue in 2025.

Over the long-term, leachate elevations are expected to continue to decrease and eventually stabilize since the Existing Landfill is capped and leachate is extracted from cells within the Existing Landfill for the operation of the Poplar System and for off-Site disposal. It should be noted that over time, the amount of leachate removed from storage will likely increase with the operation of the expanded Poplar System, as the system matures. The volume of leachate managed from the Site in 2024 is summarized in Section 4.1.3.1.

4.1.1.5 Supplemental Leachate Level Assessment

As discussed in Section 2.3, supplemental leachate level monitoring wells were installed in 2017 and were monitored semi-annually in 2024 together with the already established semi-annual spring and fall monitoring events at the Site. The leachate elevations for the leachate level monitoring wells (LW1 to LW6) are presented in Table F-3, Appendix F.

<u>Existing Landfill:</u>

The May and November 2024 data indicates that select waste cells have leachate stored within the waste that may not be directed to, or captured by, the cell's leachate collection system. As such, this leachate does not represent a hydraulic loading to the respective cell's floor/liner and therefore, does not have a direct influence on the groundwater system (i.e. potentiometric influences).

During 2024, the leachate elevations within select maintenance holes were generally drawn down throughout the majority of the application period and fluctuated significantly as a result of leachate extraction for irrigation to the Poplar System. With respect to draw down as a result of leachate extraction, the liquid elevations in leachate monitoring wells LW1 to LW6 did not definitively correlate to the elevations in their counterpart maintenance hole (within the same waste cell).

This observation indicates that leachate within the waste mound that may not be directed to, or captured by the leachate underdrain collection system (i.e. perched, low hydraulic conductivity, or some other cause) is therefore, not having an effect to the groundwater system (i.e. potentiometric pressures). This effect is observed in waste cells that are both positioned under and not under the Poplar System, indicating that the operation of the Poplar System is not the cause of this leachate elevation differential effect.

Although the exact cause of the leachate differential is unknown, it is not causing a detrimental effect and is generally not causing visible stress to the landfill cap. As such, it does not represent an immediate concern. Overall in 2024, there was no observable negative affect observed to the sideslope of the Existing Landfill, such as leachate seeps, soil staining, stress vegetation, soil slumping or erosion, as a result of this leachate elevation differential. Exceptions (leachate seeps) to this occurred on two (2) separate dates as discussed below in in Section 4.1.4.

Ongoing leachate level monitoring will enable an evaluation if this leachate differential is a long-term (i.e. over 5 years) situation, or has the potential to represent a concern (i.e. increasing trends with time, or stress to the landfill cap, etc.).

In summary, the Existing Landfill requires the ongoing leachate level monitoring program to continue to enable input such that the leachate is managed environmentally effective in consideration of the destination target (e.g. off-Site vs. on-Site treatment).

4.1.1.6 Leachate Storage Volume – Existing Landfill

Overall, between May 2023 and May 2024 there was an increase in the calculated theoretical total leachate volume stored above the local groundwater table (11,162 m^3) and within the waste (21,818 m^3) of the Existing Landfill, as summarized in Table 5. Between November 2023 and November 2024 there was a decrease in the calculated theoretical total leachate volume stored above the local groundwater table (7,404 m^3) and within the waste (12,380 m^3) of the Existing Landfill. It is noted that these volumes are only theoretical in nature and are used as guidance information for year over year overall performance evaluation.

For example, the total leachate storage in the Existing Landfill decreased from May to November 2024 (a period of time approximately 2 weeks longer than the 24-week long irrigation season) by 189,821 m^3, however, during that time approximately 12,705 m^3 was measured to have been extracted from the Existing Landfill. During this timeframe, the pumping stations in many of the weaker strength leachate waste cells were routinely drawn down to elevations where further drawdown would be too low to safely operate the pumps without damage to the pumps. Therefore, the reliance on these theoretical leachate volumes as actual empirical volumes should not be completed, and that tracking of these volumes be only used as a year over year performance evaluation with respect to leachate management.

As discussed, and as presented on Figures F-1 to F-12, after the 2024 irrigation season in November 2024, the leachate elevations in only one (1) of the cells (Cell 3) of the Existing Landfill was determined to be slightly higher than the May 2024 elevations whereas, the leachate elevations in the majority of the cells were determined to be lower.

Over the long-term, leachate volumes within cells of the Existing Landfill are expected to continue to decrease as more leachate is extracted for the operation of the expanded Poplar System and off-Site disposal.

4.1.2 Leachate Elevation Assessment – Expansion Landfill

Leachate level monitoring within the Expansion Landfill is completed to assess leachate pressures on the liner and the effectiveness of the leachate management system. Leachate levels for PS1, PS3, PS5, and PS7, are tabulated in Table F-6 and graphically represented on Figures F-26 to F-29.

Based on discussions below, no improvements to the Expansion Landfill leachate elevation monitoring were proposed or identified in 2024.

<u>Collection System Background:</u>

Leachate within each cell is directed to a sump where it is managed by pumping stations PS1, PS3, PS5, and PS7, (Cell 1, Cell 2, Cell 4, and Cell 6, respectfully) for conveyance to the Equalization Tank. The operation of the pumps in the aforementioned pumping stations is SCADA-controlled (automated) with liquid level sensors that control pump 'on' and 'off' depending on the leachate level within the relevant sump. Leachate retrieval from the

Equalization Tank is controlled by pump station PS10. Pumping station PS1 began operation on November 16, 2009. PS3 began operation on November 21, 2013. PS5 began operation on October 1, 2019. PS7 operation began on September 14, 2022.

Trigger Mechanism Assessment Process:

The trigger mechanism for implementation of groundwater contingency measures for the Expansion Landfill is the loss of hydraulic containment of the landfill waste footprint. The loss of hydraulic containment occurs when leachate levels within the PDL are higher than the surrounding groundwater elevation for the active aquitard and the groundwater pressures for the interface aquifer.

Leachate liquid levels for the pumping stations for the Expansion Landfill are evaluated against the Waste ECA Conditions 7.18 and 14.1.

- Condition 7.18 of the Waste ECA requires that a leachate head of 300 mm (or 0.30 metres (m)) on the landfill liner is not exceeded.
- Condition 14.1 of the Waste ECA requires that, for PS1, PS3, PS5, and PS7, the trigger leachate elevations for hydraulic containment for the protection of groundwater are 232.7 metres above sea level (m ASL), 232.6 m ASL, 232.8 m ASL, and 233.4 m ASL, respectively. These elevations represent a maximum leachate head of 6 m above the landfill liner of each respective cell.

Occasionally, after major storm events when a part of the active waste disposal area within the Expansion Landfill is not final capped, a large percentage of precipitation will move to the cell floor and the leachate pumping rates for PS1, PS3, PS5, and PS7 would be less than the incoming volume of liquid.

It is noted that periodic elevated leachate liquid level occurrences are described in the MECP-approved Development and Operations Report (D&O Report) (Henderson Paddon, 2008). A temporary increase of the leachate head under such circumstances is not considered a non-compliance issue with the Waste ECA.

Notwithstanding this consideration, WM has implemented an Expansion Landfill Leachate Level Contingency Plan (RWDI, April 30, 2021). The aforementioned plan was implemented so that WM is aware of a leachate level elevation that could be indicative of a pending operating scenario that could cause the leachate head to exceed 300 mm. This notification process enables WM to be aware of a level of possible concern and enable WM to evaluate if the leachate level is a concern or not. If the level is of concern, then WM will be able to evaluate the leachate level operational system to identify the cause and implement the relevant remedial measure(s) to address the leachate level. The notifications are denoted below.

- Electronic issuance (email and/or text) to relevant WM operations personnel that a leachate level for a given waste cell of the Expansion Landfill is at 80% (240 mm) of the 300 mm leachate head limit.
- A visual notification (i.e., light) on the leachate pumping stations when the leachate level for the respective waste cell of the Expansion Landfill is at 80% (240 mm) of the 300 mm leachate head limit.

Condition 7.18

PS1

During 2024, the leachate elevations at PS1 satisfied condition 7.18 of the Waste ECA, which targets a leachate head less than 300 mm (or 0.3 m).

PS3

The leachate elevations at PS3 in Cell 2 during the time periods of January 1, 6 to 7, 13 to 15, 20 to 21, 27 to 28, February 3 to 4, 10 to 11, 17 to 18, 24 to 25, 27, March 1 to 5, 9 to 13, 16 to 19, 23 to 26, 29 to 31, April 1 to 3, 7 to 8, 12 to 16, 20 to 23, 27 to 28, 30, May 4 to 5, 7, 11 to 12, 18 to 19, 22, 25 to 26, June 1 to 2, 8 to 9, 15 to 30, July 1 to 31, August 1, 4 to 5, 10 to 11, 16 to 19, 25, 31, September 1 to 6, 8 to 30, October 1 to 22, 24 to 31, as well as November 1 to December 31, 2024 exceeded the 0.3 m of head target values ranging from 0.01 to 1.96 m.

As noted above, periodic elevated leachate occurrences are described in the D&O Report. Temporary increases of the leachate head under such circumstances are not considered a non-compliance issue with the Waste ECA. Of note, within the last five (5) years, 2024 was noted to have been the wettest year, with a significant amount of the precipitation occurring in Q2, Q3 and Q4 .

PS5

During 2024, the leachate elevations at PS5 satisfied the leachate head of less than 0.3 m.

PS7

Of note, beginning on April 12, 2024, PS7 stopped recording liquid levels as a result of an electrical communications failure. Repairs were completed on August 28, 2024 which restored the liquid level recording. Again, PS7 stopped recording liquid levels on November 9, 2024, as a result of an electrical communications failure, but was repaired by November 26, 2024.

When PS7 was recording leachate liquid levels, the leachate elevations at PS7 in Cell 6 during the time periods of January 1 to April 11, August 28 to November 8, and November 26 to December 31, 2024 exceeded the 0.3 m of head target by values ranging from 0.07 m to 1.35 m.

Specific to Cell 6, the duration of 0.3 m head target exceedance during 2024 was caused by two dominant factors:

1) infiltration potential (e.g. large flat top area relate to sloped cap area; and 2) precipitation volume in 2024.

Infiltration Potential:

Throughout 2024, the waste mound in Cell 6A was still lower in elevation than, or near, the surrounding ground surface. Similarly, Cell 6B construction was completed late October 2024 and with waste beginning to be landfilled in Cell 6B on October 28th. The clay covered portions of the Cells 1, 2, and 4 waste mound has a large flat top surface area compared to sideslope area (note WM routinely slopes the 'flat top areas of large cell tops) that is completed with the required 0.3 m thick interim clayey soil cover. The sideslopes area compared to the flat top area would preferentially shed stormwater away from the waste mound. The sideslopes and top of the waste mounds of Cells 1, 2, and 4 are clay capped with greater than the minimum 0.3 m thick interim cap, except where WM has an open landfill workface. Thus, Cell 6A and 6B are exposed to a greater volume of precipitation infiltration potential to the PDL of Cell 6 than the PDLs of Cell 1, Cell 2, and Cell 4.

Precipitation Volume:

As discussed in Section 1.5, 2024 experienced both numerous short duration/high magnitude events (i.e. July 15, 2024 where the site recorded 79.6 mm in 24 hours) as well as prolonged periods of precipitation (i.e. it rained 20 of the 31 days in December 2024). It is noted that the Site received approximately 328 mm of precipitation within Q3 and approximately 218 mm in Q4, which is a significant amount of precipitation for the summer and fall/early winter seasons, respectively.

It is expected that as landfilling of waste in Cell 6 progresses above ground surface level, the exposure to precipitation infiltrating will decrease as the large flat top will be reduced with increased height as sideslopes are developed.

Condition 14.1

During 2024, the leachate elevations at PS1, PS3, PS5, and PS7 remained well below their respective trigger leachate elevations, as outlined in Condition 14.1 in the Waste ECA.

In addition, the leachate elevations at PS1, PS3, PS5, and PS7 were below the historical groundwater elevation in the active aquitard and the interstadial silt and sand flow systems. Therefore, the leachate in Cells 1, 2, 4, and 6 was hydraulically contained from the afore-mentioned groundwater flow systems.

Further details are included in Appendix Q.

4.1.2.1 Leachate Elevation trends – Expansion Landfill

Leachate levels for PS1, PS3, PS5, and PS7, are presented in Table F-6 and on Figure F-26 to F-29, Appendix F. As expected, leachate levels vary with time as a result of the gradual accumulation of leachate and pumping activities to maintain acceptable leachate levels at each pumping station.

4.1.2.2 Supplemental Leachate Level Assessment

Expansion Landfill:

The leachate elevations for the Expansion Landfill were collected from landfill gas extraction wells, otherwise known as early vertical gas wells (EVGW) [EV229 in Cell 1A (Stage 1), EV268 in Cell 1A (Stage 2), EV022 in Cell 2B, and EV226 in Cell 2D] are presented in Table F-8, Appendix F. The locations of these EVGWs are shown on the attached Figure 2.

Leachate elevations for the EV229, EV268, EV022, and EV226 were unable to be measured during 2024 semi-annual monitoring events. For the EVGW's that could not be measured for liquid levels, similar to the semi-annual monitoring events since May 2019, debris was encountered at elevations that were higher than the EVGW base, thus precluding access to deeper portions of the EVGW's. The obstructing debris could not be identified in the field. It is noted that in 2018 these same EVGWs were assessed to be dry to each of their respective bottom elevations (approximately 1.0 to 1.5 m above the liner floor). Also, up to the 2021 semi-annual monitoring events, EVGW EV268 was determined to be dry to its depth extent, which is within 1 m above the liner floor.

4.1.3 Leachate Management

4.1.3.1 Leachate Volume

Leachate Generation:

The primary leachate source is from precipitation infiltrating into and percolating through the waste. The groundwater contribution is negligible. Between January 1 and December 31, 2024, a total of 78,533.71 m^3 of leachate was managed, of which 68,159.16 m^3 of leachate was removed and transported off-Site for treatment and disposal at the Chatham Water Pollution Control Plant and the Valicor Environmental Services plant in Michigan, while 10,374.55 m^3 was irrigated onto the Poplar system during the 2024 growing season. Details regarding the 2024 Poplar System irrigation activities are discussed in Volume 3 of the 2024 Annual Report.

A breakdown of the leachate volumes treated in 2024 is presented below.

Area of Leachate Extraction	Treatment (m^3)
Off-Site Treatment Management	
Existing Landfill MHs	0
Pumping Station PS10 – From Expansion Landfill	60,767.42
Pumping Station PS10 – From Existing Landfill	7,391.74
Sub-Total	*68,159.16*

Area of Leachate Extraction	Treatment (m^3)
On-Site Treatment Management	
Poplar System – From Expansion Landfill	0
Poplar System – From Existing Landfill	10,374.55
Sub-Total	*10,374.55*
TOTAL	78,533.71

Note: 1) m^3 denotes cubic metre. 1 m^3 is equivalent to 1,000 L (litres).
2) Existing Landfill denotes leachate extracted by tanker truck directly from one of, or a combination of, Cell 3S, 4, 5, 6, 7, 8, 9, 10/12, 11, South Cell, &/or West Cell (Sump).
3) The source cell leachate make-up in the Equalizations Tank, as sampled from PS10, changes over time, as outlined in Section 2.2.

Of the 78,533.71 m^3 noted above, the approximate breakdown of leachate source location between the Existing Landfill and the Expansion Landfill is 23% (17,766.29 m^3) and 77% (60,767.42 m^3), respectively. This breakdown is based on the leachate source distribution which incorporates the separate approximate volumes of leachate extracted from the Existing Landfill (37.5% of area) and Expansion Landfill (62.5% of area).

Leachate treatment management considered either off-site disposal of stronger strength leachate (i.e. Expansion Landfill leachate) or storage of weaker strength leachate (i.e. Existing Landfill leachate) for use as irrigation liquid to the Poplar System during the 2024 growing season.

No improvements to the leachate management were proposed or identified in 2024.

4.1.4 Leachate Seeps & Stains

Generally, no significant leachate seeps or stains were noted by the MECP, RWDI, or WM for the Expansion Landfill throughout the 2024 calendar period. Based upon available Site inspections completed by the aforementioned, exceptions to this occurred on two (2) separate dates. One (1) leachate seep was observed by WM and MECP on May 2, 2024 and another seep was observed by the MECP on June 12, 2024. Both seeps occurred on the western sideslope of the Existing Landfill. On the day of detection, WM immediately repaired the landfill cap at these locations and no additional seeping was observed during subsequent WM and MECP Site inspections. Of note, there was no negative impact observed to the surface water drainage ditch at the bottom of slope.

4.2 Secondary Drainage Layer Hydraulic Containment

Liquid levels were recorded monthly for the SDL of Cell 1, Cell 2, Cell 4, and Cell 6 in 2024. Liquid elevations from the SDL are provided in Table F-7 and graphically represented on Figure F-25, Appendix F.

<u>Hydraulic Containment Assessment:</u>

Water levels within the SDL of Cell 1, Cell 2, Cell 4, and Cell 6 continued to be below surrounding shallow groundwater levels and pressures (provided in Table 2 and Table F-4) and therefore, groundwater was induced to flow toward the SDL of Cell 1, Cell 2, Cell 4, and Cell 6. As the water elevations in the SDL for Cell 1, Cell 2, Cell 4, and Cell 6, (PS2, PS4, PS6, and PS8, respectively) are typically greater than the leachate elevations within the PDL of Cell 1, Cell 2, Cell 4, and Cell 6, the leachate in the PDLs are hydraulically contained within the PDLs from the SDLs.

Historical SDL Elevation Trends of Note:

The initial slow increase over time in the SDL elevation within Cell 1 since its installation is a result of the large pore volume for water to accumulate within the 0.3 m thick granular layer that comprises the SDL within the western half of Cell 1. The rapid increases in SDL elevation within Cell 2, Cell 4, and Cell 6 are reflective of the very small pore volume within the 0.01 m thick Geonet that is installed as the SDL for Cell 2, Cell 4, and Cell 6 (and the eastern portion of Cell 1). It is noted that the historical periodic short duration decreasing pattern in the SDL for Cell 1, Cell 2, Cell 4, and Cell 6 represents water taking activities for cell-to-cell connection activities and/or soil moisture conditioning of the clayey soil liner material used in the construction of the cell liner system. These periodic SDL level decreases are expected during the Expansion Landfill construction and as discussed, do not represent a concern as once a cell is excavated, groundwater movement is toward the cell excavation, thereby hydraulically containing any liquid (both in SDL and PDL) in the cell.

It is noted that beginning late September 2024 the level sensor in PS6 was observed to begin to show abnormal fluctuations in liquid levels, of which continued to be observed throughout the remainder of 2024. The exact cause of the liquid level sensor malfunction is not understood at this time, however, continued routine monitoring is expected to provide an understanding as to if the liquid level sensor in PS6 will need to be replaced.

4.3 Active Aquitard Groundwater Movement

The active aquitard represents a shallow groundwater flow system whereby precipitation infiltrates into soil fractures, root casts, and other weathering features and moves in a dominantly lateral direction. The low permeability of the surrounding silty clay to clayey silt matrix reduces the volume of groundwater movement through the active aquitard. The low volume of water within the active aquitard is also evident by the slow recovery of monitoring wells after purging and sampling.

Groundwater elevations measured during the 2024 annual monitoring program are presented with historical data in Table F-4, Appendix F.

4.3.1 Groundwater Elevation Patterns

Groundwater elevations measured for the Active Aquitard on May 1, 2024, are presented on Figure 4. Considering the north-south flow divide through the Poplar Plantation and historical patterns of groundwater movement, an easterly and westerly direction of groundwater movement is inferred. Surficial features such as ditches, waste cells, excavations, ponds, berms, and the leachate management systems, as well as precipitation amounts, will locally influence the groundwater flow direction.

4.3.2 Groundwater Elevation Trends

Groundwater elevation hydrographs for the active aquitard are presented on Figures F-13 through F-18, Appendix F. Long-term trends are summarized in Table 4. For the purpose of assessing elevation trends, a constant elevation trend is defined as having 0.1 m or less seasonal variation.

In the long-term within the active aquitard, groundwater elevations have continued to fluctuate. Overall, fluctuating patterns in groundwater elevation were noted across the Site in the Active Aquitard, which are attributed to seasonal effects from precipitation and snowmelt. Overall, groundwater elevations were generally noted to be within their historical ranges. The groundwater elevations at OW16-6, OW54A-4, OW57-4, OW59-6, OW69-5, OW73-6, OW81-5, were noted to have increased to new highs in May 2024. The groundwater elevations at OW72-6 and OW83-5 were noted to have increased to a new high in November 2024. These elevated groundwater elevations are attributable to the wetter than normal climatic period during 2024.

No improvements to the monitoring of the active aquitard groundwater movement was proposed or identified in 2024.

4.4 Interstadial Silt & Sand Groundwater Movement

The interstadial silt and sand hydrostratigraphic unit consists of silt and sand layers or lenses within the interstadial deposit that overlies the Rannoch Till. Groundwater movement within the interstadial silt and sand will be controlled by hydraulic gradients and the soil texture. For the purpose of the landfill compliance assessment, it is assumed that the silt and sand layers or lenses are hydraulically connected and that groundwater movement is in the direction of the inferred hydraulic gradient.

Groundwater elevations measured during the 2024 annual monitoring program are presented with historical data in Table F-4, Appendix F. Hydrographs for the interstadial silt and sand are provided on Figures F-19 through F-22, Appendix F.

4.4.1 Groundwater Elevation Patterns

Groundwater elevations measured for the Interstadial Silt and Sand on May 1, 2024 are presented on Figure 5. Groundwater pressures suggest a consistent pattern to the historical interpretation of an easterly and westerly groundwater flow direction from a north-south groundwater divide that extends from Confederation Line to Zion Line (Jagger Hims Limited, 2005). However, the excavation of Cell 1, Cell 2, Cell 4, and Cell 6A/6B has reduced the groundwater potentiometric pressures within the interstadial silt in these areas and locally induces groundwater to move toward and into the SDL of the cells. These lowered groundwater pressures are expected to return to pre-existing conditions as the soil mass is replaced with waste mass. Higher groundwater pressure elevations relative to other areas may occur below the Central Fill Area (defined as waste cells: Cell 3S, Cell 3 through Cell 7, as well as Cell 9 and Cell 11) of the Existing Landfill due to the mass of the overlying waste and leachate, thereby hydraulic gradients are expected to be upward toward the waste.

4.4.2 Groundwater Elevation Trends

Long-term elevation trends are summarized in Table 4. For the purpose of assessing elevation trends, a constant elevation trend is defined as having 0.1 m or less seasonal variation.

Groundwater elevations within the interstadial silt and sand have generally fluctuated in the long-term, with the elevations at OW54-10, OW67-11, OW72-10, and OW73-9 exhibiting generally decreasing and fluctuating trends over time. As of recent years, it is noted that the groundwater elevations at the aforementioned monitoring wells appear to be stabilizing and beginning to slightly increase. The groundwater elevations at OW16-7, OW46-7, OW57-15, OW60-8, OW81-7, OW83-9 and OW84-11 were noted to have increased to new highs in May 2024. Ongoing monitoring will evaluate the noted trends over time.

For the monitoring wells where seasonal fluctuations in the groundwater elevation have historically been observed, this trend generally continued in 2024. For these wells, the November 2024 groundwater elevations within the interstadial silt and sand were generally lower or similar compared to those observed in May 2024. Within the interstadial silt and sand flow system, the overlying waste and leachate levels, as well as the Cell 1, Cell 2, Cell 4, and Cell 6A/6B excavations, induced localized potentiometric pressure increases and decreases, which also resulted in variations in the local flow direction. Overall, with the exception of where decreasing trends continued to be observed in 2024, groundwater elevations were generally noted to be within their historical ranges.

4.4.3 Vertical Hydraulic Gradients

Vertical hydraulic gradients below the Site in the active aquitard to the interstadial silt and sand hydrostratigraphic unit were calculated for the May 1 and November 1, 2024, data.

The hydraulic gradients that were calculated are presented in Table F-5, Appendix F. In summary, vertical hydraulic gradients continued to be dominantly downward toward the interface aquifer around the waste footprints and below the Existing Landfill. However, localized upward hydraulic gradients occurred from the active aquitard to the interstadial silt and sand at the monitoring well locations summarized in the table below. Ongoing monitoring will continue to evaluate these trends over time.

May 2024	November 2024
OW40E-4/OW40A-7 OW60-4/OW60-8 OW80-3/OW80-6 OW81-5/OW81-7	OW40E-4/OW40A-7 OW79-5/OW79-7 OW80-3/OW80-6

No improvements to the monitoring of the interstadial silt and sand groundwater movement were proposed or identified in 2024.

4.5 Interface Aquifer Groundwater Movement

Occasional discontinuous layers of sand and gravel between the Rannoch Till and underlying bedrock constitute the basal sand. For the purpose of the landfill compliance assessment, it is assumed that groundwater movement is in the direction of the inferred hydraulic gradient. The upper fractured portion of the bedrock and the overlying basal sand form the local bedrock aquifer and are generally referred to as the interface aquifer.

Groundwater elevations measured during the 2024 annual monitoring program are presented with historical data in Table F-4, Appendix F. Hydrographs are provided on Figures F-23 to F-24, Appendix F.

4.5.1 Groundwater Elevation Patterns

Groundwater elevations measured for the Interface Aquifer on May 1, 2024, are presented on Figure 6. Overall, a southwesterly groundwater flow direction was apparent below the Existing Landfill and the Expansion Landfill. This flow direction is consistent with the historical inferred direction of groundwater movement within the interface aquifer (Jagger Hims Limited, 2005). Of note, as more overburden soil is removed during landfill cell construction, interface aquifer pressures are expected to decrease temporarily. As more waste is deposited within the waste cells of the Expansion Landfill, the increase in overlying mass will increase the groundwater pressures of the bedrock aquifer.

4.5.2 Groundwater Elevation Trends

Long-term elevation trends are summarized in Table 4. For the purpose of assessing elevation trends, a constant elevation trend is defined as having 0.1 m or less seasonal variation.

Groundwater pressure elevation trends and patterns for the interface aquifer continue to be generally consistent with historical findings with a fluctuating trend with time. Additionally, the majority of monitoring wells in the interface aquifer were showing a fluctuating and decreasing trend from about 2010 to 2018. This pattern at these locations was expected as it indicates a response to depressurization from the removal of overlying soil within the Expansion Landfill waste footprint. It is anticipated that these decreasing elevation trends will be temporary, and pressures will begin to increase once a sufficient waste mass is landfilled to replace the excavated clayey soil mass. As expected, monitoring wells OW39A-26, OW79-26, OW80-27, and OW81-27 are showing a fluctuating and increasing trend since about 2018 as a significant waste mass has been progressively landfilled into the southern half of the Expansion Landfill.

The groundwater elevations at OW82-28, were noted to have increased to new highs in May 2024. Overall, with the exception of where a more dominant fluctuating trend continued to be observed in 2024, groundwater liquid levels were generally noted to be within their historical ranges.

4.5.3 Vertical Hydraulic Gradients

Vertical hydraulic gradients below the Site in the interstadial silt and sand to the interface aquifer hydrostratigraphic unit were calculated for the May 1 and November 1, 2024 data. The hydraulic gradients that were calculated are presented in Table F-5, Appendix F. In summary, vertical hydraulic gradients were noted to be downward during both the May and November 2024 monitoring events from the Interstadial Silt and Sand layer to the Interface Aquifer owing to the low leachate and groundwater levels within Cells 1, 2, 4 and 6A/6B. Ongoing monitoring will continue to evaluate these trends over time.

No improvements to the monitoring of the interface aquifer groundwater movement were proposed or identified in 2024.

5 CHEMICAL & GAS MONITORING RESULTS

5.1 Leachate

In accordance with the landfill EMP, leachate sampling from within select maintenance holes across the Existing Landfill was completed on May 6, 2024, as part of the annual monitoring requirement. A leachate sample was obtained from the Sump that is located within the West Cell. A second leachate sample designated CFA-Comp consisted of the collection of a composite sample obtained from MH4, MH5, MH6, MH7, MH9, and MH11 to represent leachate within the Central Fill Area. Leachate is also sampled from MH18 to represent leachate from the South Cell.

Samples were also collected from PS1, PS3, PS5, and PS7 during the spring monitoring event on May 2, 2024. PS1, PS3, PS5, and PS7 samples were collected directly from the pumping station sump. Chemical results are summarized in Appendix G.

Table 6 provides a chemical summary of the long-term leachate characteristics for the Existing Landfill and the Expansion Landfill to November 2024. The 2024 leachate chemical results were generally within the respective historical ranges for the parameters analyzed.

As shown on Figure G-1, Appendix G, the chloride concentrations in leachate from the Equalization Tank show a fluctuating trend since 2013. Concentration fluctuations over time are expected due to the nature of leachate, as well as to the variations in the relative contribution of weaker leachate from new waste (i.e., new waste in Cell 6A) or from the monofill cells (i.e., Cells 10/12) of the Existing Landfill to stronger leachate from the aging waste (i.e., waste in Cell 1) or from the West Cell (Sump) of the Existing Landfill. Chloride concentrations in leachate from the Equalization Tank will continue to be monitored during future sampling events.

5.1.1 Leachate Indicator List

In general, leachate concentrations vary across the Site, with stronger leachate within Cell 6 and the West Cell compared to other cells of the Existing Landfill. Leachate constituent concentrations for the Expansion Landfill are generally within the low range for concentrations detected in the Existing Landfill. This difference is attributed to the relatively young age of the waste (compared to waste in the Existing Landfill) and the onset of waste decomposition. The 2024 and historical ranges in chemical concentrations for the leachate, as well as the background groundwater and surface water, are presented in Table 6.

Based on a comparison of the leachate concentrations to the background groundwater and surface water concentrations, the following parameters have had notably elevated concentrations within the leachate.

- EC
- Alkalinity
- Calcium
- Magnesium
- Sodium
- Potassium
- Chloride
- Dissolved Organic Carbon
- Ammonia
- Total Kjeldahl Nitrogen
- Boron
- BTEX Compounds (Benzene, Toluene, Ethylbenzene, and Xylenes)

A landfill leachate effect on groundwater or surface water quality is defined as leachate mixing with the water and migrating in the direction of water movement beyond the Site boundary. To differentiate landfill leachate effects from natural water quality variability, a group of parameters indicative of landfill leachate was selected based on the following items.

- Elevated concentrations in leachate.
- Mobility and stability in groundwater and surface water.
- Representative of a larger chemical group (e.g., boron for metals).
- Applicable Ontario Drinking Water Standard (ODWS) or PWQO.

A group of indicator parameters selected for this landfill, termed the Primary Leachate Indicator List (PLIL), are summarized below.

Primary Leachate Indicator List (PLIL)	
PLIL – Groundwater	PLIL – Surface Water
Chloride, Nitrate (as N), Boron	Chloride, Ammonia (unionized), Phenols, Boron, Nickel, Chromium (total), Zinc

A supplemental group of parameters, termed the Secondary Leachate Indicator List (SLIL), is selected based on elevated concentrations within the leachate. The SLIL is used for quality assurance of the chemical database, for input to establish trigger concentrations, and for further data analyses in the event of trigger concentration exceedances. The SLIL parameters are summarized below.

Secondary Leachate Indicator List (SLIL)			
SLIL – Groundwater		SLIL – Surface Water	
Alkalinity, Sulphate, Calcium Magnesium, Potassium, Sodium, Barium, Iron, DOC, TDS	Ammonia (total), TKN, pH, Conductivity, Cadmium, Lead, Benzene, Toluene, Ethylbenzene, Xylenes	Alkalinity, Sulphate, Calcium, Magnesium, Potassium, Sodium, Iron, Nitrate, TKN, Phosphorus (total)	TDS, pH, Conductivity, Turbidity, Dissolved Oxygen

The concentrations of leachate constituents will vary with time. Leachate quality monitoring will continue at the Existing Landfill and the Expansion Landfill to assess the changing leachate characteristics for a landfill impact assessment and for leachate management.

No improvements to the leachate monitoring were proposed or identified in 2024.

5.2 Groundwater

Field groundwater chemical results for the May, November, and supplemental monitoring events are presented in Tables H-1 to H-3, Appendix H. The 2024 laboratory chemical results are presented in Tables H-4 and H-5, Appendix H. Historical data are provided for comparison. Laboratory reports of analysis and QA/QC documentation are included as Table H-6, Appendix H.

Groundwater quality monitoring occurred at the required monitoring locations in consideration of the groundwater monitoring schedule within the approved landfill EMP. An updated monitoring schedule is presented within Table B-2, Appendix B, which shows the monitoring wells required for sampling, the sampling frequency, and the parameters for analytical testing. Monitoring well designations and locations are presented on Figure 2. Monitoring well nests OW82, OW83, and OW84 were installed in June 2022, with monitoring of groundwater quality beginning in May 2023.

Based on discussions below, no improvements to the groundwater monitoring were proposed or identified in 2024.

5.2.1 General Chemical Trends

To assess long-term chemical trends with time, time-concentration graphs for chloride, nitrate, and boron were prepared. Based on the background concentrations presented in Table 6, concentrations were considered constant where results varied by less than 15 milligrams per litre (mg/L) for chloride, 0.5 mg/L for nitrate, and 0.2 mg/L for boron. Concentration trends that varied by greater than these concentration ranges were interpreted as increasing, decreasing, or fluctuating.

Concentration trends for the time-concentration graphs on Figures H-1 to H-14, Appendix H, are summarized in Table 7. Typically, the long-term concentration trends indicate constant or fluctuating concentrations with time, with some exceptions, which are discussed below. It is noted that the below observations do not represent immediate concerns, but as a matter of diligence will be evaluated over time to verify that a trend of concern does not develop or corrective measures, if required can be implemented.

Active Aquitard:

- At monitoring well OW16-6, the chloride concentrations have been generally stable after the short-term historical high concentration of 77 mg/L noted in May 2015, which subsequently decreased to an approximate average of 47 mg/L since then. It is noted that the chloride concentrations discussed are notably less than the trigger concentration of 106 mg/L.
- At monitoring well OW17-4, the chloride concentrations have been generally stable after the short-term historical high concentration of 71 mg/L noted in May 2016, which subsequently decreased to an approximate average of 30 mg/L since then. It is noted that the chloride concentrations discussed are notably less than the trigger concentration of 106 mg/L.
- At monitoring well OW54A-4, chloride concentrations have been increasing and fluctuating since late 2014. It is noted that the aforementioned chloride concentrations have shown an approximate stabilization around 25 mg/L since 2018 and are notably less than the trigger concentration of 106 mg/L.

- At monitoring well OW56-4, the boron concentrations have generally been fluctuating below 0.5 mg/L. In November 2023, a new historical high of 0.99 mg/L was noted at monitoring well OW56-4, but has since returned to concentrations more inline with the historical range. It is noted that the aforementioned boron concentration is well below the trigger concentration of 2.1 mg/L. The noted boron concentrations are not a concern as it would be expected that the more mobile PLIL parameter chloride would also be present at elevated concentrations if the boron concentrations were landfill leachate related. Ongoing monitoring will evaluate whether boron concentrations necessitate corrective measures (i.e. monitoring well replacement as a result of well seal moving into the sand filter pack for the well's screened interval).
- At monitoring well OW56-4, nitrate concentrations have generally been low and constant, however, isolated elevated concentrations have been detected over time; with the most recent event occurring in 2018. It is likely that the nitrate concentrations are a result of effects resulting from fertilizer application to the adjacent field. Nitrate concentrations have continued to be low and constant since 2018.
- At monitoring well OW58-6, nitrate concentrations have been low and constant, however, an isolated event with a concentration that was a new historic high was detected in May 2022. It is noted that the aforementioned nitrate concentration of 0.47 mg/L is well below the trigger concentration of 2.3 mg/L. It is likely that the nitrate concentration detected in May 2022, was a result of effects resulting from fertilizer application to the adjacent field. The May 2022 nitrate concentration is not a concern as concentrations subsequently decreased back to historically low and constant values.
- At monitoring well OW67-4, the concentrations of chloride, nitrate, and boron have exhibited generally decreasing and fluctuating trends over time. Periodic increases in concentrations for each parameter have occurred over time, including chloride in November 2022. However, the overall trend for each parameter has generally been decreasing and fluctuating since monitoring began at OW67-4. It is noted that the concentrations of chloride, nitrate, and boron were below their respective trigger concentrations in 2024.
- At monitoring well OW68-5, a historical high boron concentration of 0.99 mg/L was observed in November 2024. With the exception of a previously observed elevated boron concentration in May 2011 of 0.53 mg/L, concentrations of boron have been generally constant with an approximate average of 0.08 mg/L. It is noted that the aforementioned boron concentration of 0.99 mg/L is below the trigger concentration of 1.1 mg/L. Similarly at monitoring well OW68-5, a historical high nitrate concentration of 0.32 mg/L was observed in November 2024, however, it is noted that the concentration is well below the trigger concentration of 2.3 mg/L. Further monitoring events will determine if any potential trends of concern are developing at OW68-5.
- At monitoring well OW69-5, boron concentrations continue to show a generally constant but slightly fluctuating trend with concentrations hovering around the shallow groundwater trigger concentration of 1.1 mg/L. At this time the boron concentrations at OW69-5 are not a concern as it is expected the more mobile parameter chloride would be observed first if the source of the boron were leachate. It is likely that, similar to observations for monitoring well OW58-14, that was decommissioned in 2016, the monitoring well's bentonite seal is moving into the filter screen material of the monitoring well, and as such may require decommissioning and replacement in the future depending on chemical results.
- At monitoring well OW71A-5, the chloride concentrations are showing an increasing trend to a historical high of 32 mg/L in November 2022. In 2024, chloride concentrations were lower than the historical high observed in November 2022. The chloride concentrations are notably less than the Active Aquitard trigger concentration of 106 mg/L. It is noted that monitoring well OW71A-5 is not a compliance monitoring well for the Site but was added to supplement historically dry conditions at OW67-4. The recent chloride concentrations at OW71A-5 and OW67-4 are generally similar and the concentrations of the other PLIL parameters are not showing a similar trend. Also at monitoring well OW71A-5, a historical high nitrate concentration of 0.56 mg/L was observed in November 2024, however, it is noted that the concentration is well below the trigger concentration of 2.3 mg/L. Further monitoring events will determine if a potential trend of concern is developing at OW71A-5.

Interstadial Silt and Sand:

- At monitoring well OW46-7, the concentration of boron has been observed to have been fluctuating and increasing since November 2019, which is similar to the short-term increase in 2015. However, the boron concentrations are notably less than the historical concentrations prior to 2003. The boron concentrations remain below the trigger concentration of 2.1 mg/L. The other PLIL parameters are not elevated or showing an increasing trend. It is likely that the observed periodic increases in boron concentrations is an effect from the bentonite seal moving into the filter pack of the monitoring well. At historical monitoring well OW58-14, the observed boron concentrations were proven to be related to bentonite seal impacts from the monitoring well seal moving into the sand filter pack. Consequently, per MECP approval, OW58-14 was decommissioned and replaced as OW58-17, which has shown constant and acceptable concentrations of boron since its installation in 2014.
- At monitoring well OW47-6, the concentrations of chloride have been constant and low since data has been recorded. During the May 2022 monitoring event, a new historical high was recorded at monitoring well OW47-6, of which the chloride concentration (14 mg/L) was well below the trigger concentration of 116 mg/L. The May 2022 nitrate concentration is not a concern as concentrations subsequently decreased back to historically low and constant values.
- At monitoring well OW67-11, chloride concentrations showed an increasing trend between about 2009 and 2013 and have since showed a generally fluctuating trend. Nitrate concentrations have continued to fluctuate since monitoring began. Boron concentrations have fluctuated and decreased since about 2011. The chloride concentrations are notably below the trigger concentration of 116 mg/L for the interstadial silt and sand hydrostratigraphic unit.
- At monitoring well OW80-6, the concentrations of chloride, nitrate, and boron detected in May 2022 were noted to be anomalous due to overall groundwater quality showing significant deviations (typically lesser) from historical concentrations. Further monitoring will evaluate these parameter concentrations over time. In 2023, the relevant parameters returned to their historical ranges.

5.2.2 Organic Chemistry

The 2024 and historical organic chemical results are provided in Table H-5, Appendix H. Tested organic chemical constituents at each monitoring location were generally not detected at concentrations greater than their respective laboratory RDL during 2024, with one (1) exception.

During the spring, volatile organic compound (VOC) vinyl chloride tested within the groundwater at the monitoring well OW17-4 was detected at 0.0012 mg/L. As vinyl chloride is a SLIL parameter, and that there were no PLIL parameters detected above their trigger concentration at this location, and that there is no trend of concern occurring for vinyl chloride at OW17-4, the noted concentration is interpreted to be insignificant.

5.2.3 Trigger Mechanisms

Groundwater compliance is assessed based on criteria calculated with respect to the Ministry of the Environment and Energy's (MOEE) Guideline B-7 Reasonable Use Concept (Guideline B-7) and evaluated at the Site boundaries (Points of Compliance). Trigger concentrations are used to assess potential sources of concentration changes. The groundwater trigger concentrations are based on 80% of the calculated Guideline B-7 criteria for the reasonable use of groundwater (MOE, 1994), in accordance with Condition 14.2 of the Waste ECA. When background groundwater quality satisfies the ODWS, background groundwater quality cannot be degraded by more than 25% of the ODWS for health-related parameters (e.g., nitrate) or by more than 50% of the ODWS for aesthetic-related parameters (e.g., sodium). Where background concentrations naturally exceed the ODWS, background groundwater quality becomes the criteria.

Historical background groundwater quality for local monitoring wells was used to calculate the trigger concentrations at the Site. As a screening process, trigger concentrations for the PLIL were calculated and assessed as provided in Table 3 of the landfill EMP.

5.2.3.1 Points of Compliance

An assessment of potential landfill leachate effects on groundwater quality is completed at the Site boundary to encompass the Expansion Landfill footprint and operations, as well as to consider potential effects of the Existing Landfill on groundwater quality. Monitoring wells are used at strategic locations around the Site to obtain an acceptable representation of groundwater quality moving beyond the Site boundary. These strategic locations are called the Points of Compliance and are assessed in accordance with Guideline B-7.

To account for the natural groundwater quality variability, the trigger concentrations consider the PLIL parameters discussed in Section 5.1.1. Exceedance of the trigger concentrations at the monitoring wells initiates the assessment process, which is detailed within Figure 3 of the landfill EMP. Tables 8 to 10 provide the groundwater trigger concentration comparison and the 2024 chemical concentrations for the PLIL parameters.

Verification groundwater monitoring at the Site adheres to Condition 14.4 of the Waste ECA, which references the landfill EMP. Groundwater verification is required to be completed for two (2) subsequent events separated by six months with the first verification monitoring event taking place within one month of the initial sampling event.

5.2.3.2 Trigger Concentration Assessment

Primary Leachate Indicator List Assessment:

Based on the chemical analytical results for the 2024 monitoring events, the concentrations of the PLIL parameters at the groundwater monitoring wells, including the Points of Compliance, within the active aquitard, the interstadial silt and sand, as well as the interface aquifer generally satisfied the relevant trigger concentrations. Where exceptions were noted, a summary of the trigger concentration evaluation is presented in the following table.

Sample ID	Parameter	Trigger Concentration (mg/L)	May 2024 Analytical Result (mg/L)	Comments
OW84-6	Nitrate	2.3	4.25	The nitrate concentration at monitoring well OW84-6 is not a concern as the other Primary Leachate Indicator List (PLIL) parameters (chloride and boron) were not detected at elevated concentrations. Verification monitoring was completed on May 28, 2024 per the EMP.

Assessment Monitoring OW84-6

The nitrate concentration detected at monitoring well OW84-6 is interpreted to not be attributable to a landfill leachate effect as groundwater movement within the active aquitard is in a southwesterly direction for the northern portion of the site where OW84-6 is located. Therefore, OW84-6 is positioned upgradient (background) to the landfill waste mounds at the Site. In addition, neither chloride nor boron were detected at elevated concentrations which would be more indicative of a landfill leachate effect. Of note, monitoring well OW84-6 was sampled for the first time during the Spring 2023 monitoring event and had a nitrate concentration well below that of the trigger concentration of 2.3 mg/L.

Verification Monitoring OW84-6

Based on the noted nitrate concentration at monitoring well OW84-6, per Figure 3 of the EMP, a verification monitoring event for the primary and secondary leachate indicator list parameters was required as outlined below along with the associated findings. A verification sample was collected at monitoring well OW84-6 on May 28, 2024, which indicated acceptable results (nitrate concentration of 2.18 mg/L).

Per Figure 3 of the EMP, a second verification sample was collected at monitoring well OW84-6 on November 19 2024. Results for the second verification sampling confirmed acceptable results (nitrate concentration of 1.12 mg/L).

On going monitoring at this background groundwater monitoring well will continue.

Secondary Leachate Indicator List Assessment:

Based on the chemical analytical results for the 2024 monitoring events, the concentrations of the SLIL parameters at the groundwater monitoring wells, including the Points of Compliance, within the active aquitard, the interstadial silt and sand, as well as the interface aquifer generally satisfied the relevant trigger concentrations. Where exceptions were noted, a summary of the trigger concentration evaluation is presented in the following table.

Sample ID	Parameter	Trigger Concentration (mg/L)	May 2024 Analytical Result (mg/L)	Comments
OW17-4	Vinyl Chloride	0.0004	0.0012	The detected vinyl chloride concentration at monitoring well OW17-4 is not a concern as vinyl chloride is a Secondary Leachate Indicator List (SLIL) parameter, and the PLIL parameters (chloride, boron, and nitrate) were not detected at elevated concentrations. Per the EMP verification monitoring for this occurrence is not required.

The detected vinyl chloride concentration monitoring well OW17-4 is not a concern as vinyl chloride is a SLIL parameter, and the PLIL parameters (chloride, boron, and nitrate) were not detected at elevated concentrations. As such the vinyl chloride concentration is interpreted to not be leachate related.

Per the EMP, an exceedance of SLIL parameter trigger concentrations does not initiate a verification monitoring event. The evaluation of SLIL concentrations is done in conjunction with PLIL parameter evaluations, or where there is an exceedance of a PLIL parameter trigger concentration at a given location, the SLIL parameter concentrations are evaluated in greater detail to the overall water quality at that location.

Future monitoring events will evaluate if there is a trend of concern, or not, in the concentrations of vinyl chloride.

In summary, based on the chemical analytical results for the 2024 monitoring events, the concentrations of the PLIL and SLIL parameters at the groundwater monitoring wells, including the Points of Compliance, within the active aquitard, the interstadial silt and sand, as well as the interface aquifer generally satisfied the relevant trigger concentrations.

5.3 Surface Water

Surface water chemical results are summarized in Tables I-1 to I-4, Appendix I. Laboratory reports and documentation of quality control are provided in Table I-5, Appendix I.

5.3.1 General Chemical Trends

As discussed in Section 5.1.1, there are seven (7) surface water PLIL parameters that represent effective indicators of landfill leachate effects on surface water quality for the Site. To assess chemical trends with time, time-concentration graphs for chloride, un-ionized ammonia, boron, and zinc were prepared.

Data were analyzed for long-term trends, which considered the historical data. Concentrations were considered constant where results varied by less than 15 mg/L for chloride, 0.02 mg/L for un-ionized ammonia, 0.2 mg/L for boron, and 0.02 mg/L for zinc.

Concentration trends that varied by greater than these concentration ranges were interpreted as increasing, decreasing, or fluctuating. A minimum of three (3) to five (5) data points are required to determine a chemical trend with time. Concentration trends are summarized in Table 11. Time-concentration graphs are presented on Figures I-1 to I-4, Appendix I.

Long-term concentration trends indicate both constant and fluctuating concentrations with time. Fluctuating concentrations generally showed a seasonal pattern for boron and chloride concentrations at stations SS1 and SP1. Chloride concentrations at SP2 and SP4 appear to have a fluctuating pattern in the long-term. Additionally, in the long-term, unionized ammonia concentrations generally continued a constant trend of being below their respective laboratory RDL and/or less than the respective PWQO (0.02 mg/L), with occasional historical exceedances at SS1, SP1, and SP2.

In 2024, concentrations of the PLIL parameters in surface water within the Sedimentation Ponds and at compliance point SS1 were typically similar to each other, with some exceptions where elevated and fluctuating concentrations of boron, nickel, chromium, and zinc have generally been noted at SS1 and boron at SP2. Further details pertaining to individual surface water monitoring events conducted in 2024 are provided in Section 5.3.5.

5.3.2 Organic Chemistry

Organic chemical results are provided in Table I-3, Appendix I. Tested organic chemical constituents at the downstream compliance monitoring stations SS1, SP2, SP3, and SP4, as well as the internal compliance monitoring station SP1, were generally not detected at concentrations greater than their respective laboratory RDL.

Volatile organic compound (VOC) and semi-volatile organic compound (SVOC) concentrations for the Q3 routine and verification surface water samples were generally below their respective laboratory reportable detection limits (RDLs), with one (1) exception. For the July 30, 2024 verification monitoring event, the VOC parameter toluene was detected at compliance surface water monitoring station SS1 (0.20 µg/L), however, it was well below the interim Provincial Water Quality Objectives (PWQO) value (0.8 µg/L). Additionally, toluene has not been detected at SS1 during previous monitoring events. As such, a concentration trend of concern does not appear to be occurring for toluene. The concentration of toluene will continue to be evaluated to verify that a concentration trend of concern is not occurring.

5.3.3 Biomonitoring Program – Annual Spring Routine Event

The laboratory results for the biomonitoring monitoring events completed in 2024 are provided within Table I-6, Appendix I. The sample aliquots collected to assess biological conditions were assessed for surface water quality toxicity to *daphnia magna* and rainbow trout. The biological testing results showed that there was not a potential for detrimental effects to aquatic life in the discharge water.

5.3.4 Biomonitoring Program – Verification Events

Surface water verification sampling included the collection of a grab sample for analysis of the toxicity to rainbow trout and *daphnia magna* associated with verification surface water monitoring events for compliance monitoring discussed in Section 2.4.3.

During the verification sampling events, the verification biological results indicated that the surface water was of acceptable quality for continued discharge.

5.3.5 Trigger Concentration Assessment

Table 12 provides the Post 2023 trigger concentrations utilized to assess surface water quality during 2024, as well as the Post 2024 trigger concentrations that will be utilized in 2025 to assess the chemical quality of surface water.

A comparison of the 2024 surface water quality with the Post 2023 trigger concentrations is provided in Table I–4, Appendix I.

Outlined below is a summary of the detailed discussion of the trigger concentration assessments that are provided within the 2024 surface water quality assessment letter of notifications as well as the 2024 Q1 through Q3 quarterly monitoring reports, as well as the data contained in Appendix I. A quality comparison for background stations SS10 and SS16 is also provided where applicable.

General Chemical Assessment Findings

The surface water quality at the required monitoring stations satisfied the relevant trigger concentrations, with some exceptions at monitoring stations SS1 and SP2, as discussed below.

SS1

For the routine quarterly surface water samples collected at compliance monitoring station SS1, the concentrations of total boron (in Q1 and Q2), as well as the concentrations of nickel, chromium, and zinc (in Q1, Q3, and Q4) were greater than their respective trigger concentrations of 0.20 mg/L, 0.026 mg/L, 0.021 mg/L and 0.05 mg/L, respectively.

Q1

The total boron, nickel, chromium, and zinc concentrations noted at SS1 were interpreted to be a result of background water quality from an off-site source(s) as noted at SS16 (upstream of SS1). The visually identified turbid water for the surface water at SS16 and SS1 was confirmed through field measurements for turbidity (>999 nephelometric turbidity units (NTU)). Though elevated, the total boron, nickel, chromium, and zinc concentrations at compliance monitoring station SS1 were noted to be within the historical range.

Q2

The total boron concentration noted at SS1 is interpreted to not be landfill leachate related as neither chloride, un-ionized ammonia, or phenols were detected at elevated concentrations which would be more indicative of a landfill leachate effect. Though elevated, the total boron concentration at compliance monitoring station SS1, was noted to be within the historical range.

Q3 and Q4

The total nickel, chromium, and zinc concentrations noted at SS1 in Q3 and Q4 are interpreted to be a result of soil erosional effects with flow in the ditch upstream of SS1. The erosional effects observed at SS1 are, in part, due to rainfall ranging from 20 to 30 millimeters (mm), within 24 hours prior to sample collection. The visually identified turbid water for the surface water at SS1 was confirmed through field measurements for turbidity (>999 nephelometric turbidity units (NTU)).

Of note, the increased erosional effects that were observed upstream of SS1 were dominantly from the ongoing construction activities associated with the earth works for the Renewable Natural Gas (RNG) Facility located southwest of the area of the flare facility (shown on Figure 3). As some of the newly established surface water drainage ditches, adjacent to new roadways for the RNG Facility, either do not have topsoil and seeding or application occurred recently (e.g. within the prior couple of months), these surface water drainage ditches were more susceptible to erosion than seasonally mature vegetated ditches.

In addition, a portion of the length of ditch on-site between SP1 and SS1 was removed of sediment build-up late June into early July 2024. Following the removal of the sediment build-up, multiple straw bale check dams had to be re-installed along the noted length of ditch (re-installation began in mid-July 2024). More straw bale check dams were also recommended for installation in the RNG Facility area drainage network that flow towards SS1.

SP2

For the routine quarterly surface water samples collected at compliance monitoring station SP2, the concentration of total boron (in Q1, Q2, Q3, and Q4) was greater than its respective trigger concentration of 0.20 mg/L.

Q1, Q2, Q3, and Q4

The total boron concentrations noted at SP2 are interpreted to not be landfill leachate related as neither chloride, un-ionized ammonia, or phenols were detected at elevated concentrations which would be more indicative of a landfill leachate effect.

Though elevated, the total boron concentrations at SP2, were noted to be within the historical range and were not showing an increasing concentration trend over time.

Additionally, observations will continue to be made to determine if there are possible sources of boron nearby/upstream of SP2.

Verification Monitoring Assessment Findings

Verification monitoring for SS1 and SP2 was required in Q1, Q2, Q3, and Q4.

As shown in Table I–4, Appendix I, in comparison to the routine quarterly surface water monitoring results, the verification monitoring results for some of the monitoring events indicated acceptable chemical analytical results, whereas some again indicated exceedances of the trigger concentrations.

However, the biological results indicated that the surface water quality at SS1 and SP2 in 2024 did not pose a detrimental effect to aquatic life and that the surface water was of acceptable quality for continued discharge, and that no further verification monitoring was required (refer to Section 5.3.4).

5.3.6 Surface Water Drainage Network Evaluation

The surface water that discharged from the Sedimentation (Stormwater Management) Ponds 1 to 4 was generally of acceptable quality during 2024 based on the assessment and verification monitoring completed.

During the 2024 calendar year, maintenance was completed on portions of the surface water drainage ditches listed below (upstream of SS1, SP2, and SP3), as listed below.

Expansion Landfill

- Landfill side ditches along Street C (adjacent to the western limit of Cells 1, 2, and 4, as well as the southern limit of Cell 1).
- Landfill side ditch along Street D (adjacent to the eastern limit of Cells 1, 2, and 4).
- Landfill side ditch along Street D (adjacent to the northern limit of Cell 6A).

Existing Landfill

- Landfill side ditch along Street D (western side of the Existing Landfill).

Other

- Ditch leading from the outflow of Sedimentation Pond 1, along the southern side of Street C (south of the Expansion Landfill) almost to the eastern boundary of Sedimentation Pond 2.

The above-noted ditch maintenance included the removal of sediment build-up within the surface water drainage ditches as well as the repair/install of straw bale check dams. Additional straw bale check dams are installed or replaced at various locations in the surface water drainage network in an effort to reduce sediment loading of runoff water into the sedimentation ponds at the Site.

Ongoing efforts will continue to be undertaken by WM to reduce sediment loading, due to erosional effects, to the ditches and sedimentation ponds at the Site.

At surface water monitoring station SS1, TSS was elevated with concentrations ranging from 160 mg/L to 1,400 mg/L, during the routine and verification monitoring events in 2024. As discussed in Section 5.3.5 , the TSS concentrations during 2024 were a result of the erosional effects that were observed upstream of SS1, primarily from the ongoing construction activities associated with the earth works for the RNG Facility.

Also, in conformance with Condition 8.7. of the Sewage ECA, the sedimentation ponds were inspected in 2024 for the presence of excessive sediment/vegetation build-up. Based on the 2024 inspection, it was assessed that the primary and secondary forebays in Sedimentation Pond 1 and the primary forebays in Sedimentation Ponds 2 and 4 required sediment removal. This work was completed in December 2024. It is noted, despite the presence of sediment build-up assessed by RWDI to be required to be removed, the water quality discharge from Sedimentation Ponds 1, 2, and 4 during 2024 was of acceptable quality per the surface water evaluation criteria. Additionally, the total suspended solids were low, and less than 120 mg/L, which indicates that the ponds still effectively worked to reduce sediment loading in discharge water despite the aforementioned sediment build-up.

5.4 Landfill Gas Monitoring

Consistent with historical observations, methane gas was not detected within the gas probes in 2024. This observation indicates that landfill gas is not migrating in the subsurface beyond the waste footprint and is therefore, being effectively captured by the landfill gas collection system. Therefore, mitigation measures that would address a potential landfill gas migration in the shallow subsurface beyond the waste footprint are not required. The 2024 landfill gas monitoring results are presented in Table J-1, Appendix J.

Gas monitoring probes GP1A to GP10 were noted to be in acceptable condition for the monitoring of LFG and therefore, no additional monitoring or corrective actions were required. In addition, no improvements to the landfill gas monitoring were proposed or identified in 2024.

6 SITE OPERATIONS SUPPLEMENTAL TESTING & MONITORING

6.1 Construction Activities

6.1.1 Existing Landfill

From June 12 to 13, and July 4, 2024, seven (7) landfill cap repairs were completed on the Existing Landfill to address Total Hydrocarbon (THC) survey findings from the spring monitoring event. On October 16, 2024, four (4) landfill cap repairs were completed on the Existing Landfill to address THC survey findings from the fall monitoring event. Six (6) of the repairs were located along the eastern side slope; two (2) of the repairs were located on the top of the eastern portion of waste mound; and three (3) of the repairs were located centrally on the northern portion of the waste mound. These repairs were completed with a geosynthetic bentonite composite layer placed approximately 0.3 m below final cap surface that was then hydrated, and subsequently the clayey soil cap material was replaced and re-compacted.

Validation of the ground level THC (as methane) level was completed for the repair locations following the spring and fall monitoring events on July 4 and 5, as well as November 2, 2024, respectively.

The ground level THC concentrations were less than 500 ppm indicating that the repairs were successful. Refer to Volume 4 of the 2024 Annual Report for details regarding the THC Survey monitoring.

6.1.2 Expansion Landfill

The Site was formally approved for expansion on August 5, 2008. Cell 6C pre-excavation activities related to the future construction of the Cell 6C landfill liner system of the Expansion Site commenced in 2024.

Interim cover was placed on portions of the southern, eastern, western side slopes of Cell 3 as well as on portions of the northern, eastern, and western side slopes of Cell 5 during 2024. Portions of Cells 3 and 5 also had interim cover placed on the relative “flat-top”.

6.1.3 Groundwater Monitoring Wells

In 2024, there were no new groundwater monitoring wells or gas probes installed at the Site. Groundwater monitoring well OW40D-4 was decommissioned as a result of damage from nearby construction activities and replacement groundwater monitoring well OW40E-4 was installed at the Site in 2024.

The 2024 monitoring well and gas probe installation/decommissioning status summary is provided in Appendix M.

6.1.4 On-Site Surface Water Management

Upon completion of cell construction and filling in the Expansion Landfill, surface water runoff will be continue to be managed through Sedimentation Ponds 1, 2, 3, and 4. Surface water runoff originating from areas south of the Existing Landfill flows toward: 1) Kersey Drain (Brown Creek) to the east; and 2) to the west toward the Van Kessel Drain and enters a municipal drainage tile at a catch basin (SS1), which is situated 60 m east of the western Site boundary. The municipal drainage tile subsequently drains into the discharge ditch for SP2, which ultimately flows to the Gilliand-Geerts Drain ‘A’, beneath Lambton Road 79.

During the 2024 operating period, maintenance to the on-Site surface water flow system was required, which is detailed in Section 5.3.6.

Only water that satisfied the Criteria for On-Site Surface Water Management (D&O, 2008) was used on-Site for dust control and road cleaning purposes in 2024.

6.2 MECP Site Inspection Reports

The MECP Site inspections are conducted to assess Site operation compliance with the applicable approval documentation.

The MECP’s Fiscal Year is from October 1 to September 30. The MECP Inspector provided inspection summary reports on a semi-annual basis through till the end of February 2024. Following February 2024, the MECP switched to providing inspection summary reports on a monthly basis. Findings from the MECP semi-annual Inspection Report from October 1, 2023 to February 29, 2024, and the monthly Inspection Reports for March through November 2024, are summarized in Appendix N of Volume 2 of the 2024 Annual Report. Where action items were required, they were addressed by WM. It is noted that the monthly MECP inspection summary reports are scheduled to be provided by the MECP to WM the following end of each month when possible.

6.3 Automobile Shredder Residue

Composite samples of stockpiled ASR material were collected in the spring and fall of 2024, for the TCLP parameters listed in Condition 6.52 of the Waste ECA. Testing results indicated that the ASR was classified as non-hazardous and could be either disposed of in the landfill or utilized as daily cover in accordance with the stipulations of the Waste ECA. Historical analytical data, as well as analytical data related to the 2024 semi-annual (spring and fall) assessments that were completed per Condition 6.52 of the Waste ECA, is presented in Table K-1, Appendix K. The relevant laboratory Certificates of Analysis, which detail the chemical analytical results for the ASR samples collected in 2024, are included in Appendix K-2.

WM works to contain the use of ASR within the workface to areas away from where the waste hauling trucks drive. This reduces the likelihood of ASR getting stuck between the truck tires as the trucks leave the workface. Aside from a few occurrences (May, June and October) identified by the MECP during 2024 of ASR trackout, ASR was contained within the workface. Following the identification of the occurrences of ASR trackout, WM promptly cleaned up the ASR that was observed outside the site entrance. In addition, in August 2024, WM temporarily discontinued receiving ASR for a 60-day period. Following the end of the 60-day period the reuse of ASR began, which was not causing trackout conditions through the remainder of 2024.

6.4 Contaminated Soil

Composite samples of stockpiled contaminated soil were collected during each quarter of 2024 and were submitted for analytical testing of the TCLP parameters listed in Condition 6.57 of the Waste ECA. Testing results indicated that the contaminated soil was classified as non-hazardous and could be either disposed of in the landfill or utilized as daily cover in accordance with the stipulations of the Waste ECA. Historical analytical data, as well as analytical data related to the quarterly contaminated soil assessments that were completed per Condition 6.57 of the Waste ECA, is presented in Table O-1, Appendix O. The relevant laboratory Certificates of Analysis, which detail the chemical analytical results for the contaminated soil samples collected in 2024, are included in Appendix O-2.

No improvements to the contaminated soil monitoring were proposed or identified in 2024.

7 AMBIENT AIR QUALITY MONITORING PLAN

7.1 Total Suspended Particulate (TSP) Monitoring

Monitoring of Total Suspended Particulate (TSP) for the 2024 monitoring period was completed as required. Findings of the TSP monitoring program is detailed within Volume 4 of the 2024 Annual Report.

7.2 Volatile Organic Compounds (VOCs) Monitoring

The ambient air volatile organic compound (VOC) monitoring is to be completed during the summer period, which begins on June 21 and ends September 21 of every year in accordance with the Ambient Air Quality Monitoring Plan. Findings of the VOC monitoring program, completed during the 2024 monitoring period, are detailed within Volume 4 of the 2024 Annual Report.

7.3 Total Hydrocarbon (THC) Landfill Cap Surveys

The landfill final cap surface of the Existing Landfill is surveyed for Total Hydrocarbon (THC) vapour releases as part of the Ambient Air Quality Monitoring Plan twice annually in the spring and the fall. The landfill final cap surface of the Existing Landfill was surveyed by RWDI in the spring and fall of 2024 for Total Hydrocarbon (THC) vapour releases, as required. The THC Landfill Cap survey and associated details are presented within Volume 4 of the 2024 Annual Report.

8 NOISE MONITORING PLAN

The Environmental Noise Monitoring Program (Aercoustics, 2007) was implemented in 2009. The survey is required under Condition 13.10 of the Waste ECA. The Noise Monitoring Plan (NMP) report as it relates to the 2024 monitoring period is presented within Volume 5 of the 2024 Annual Report.

9 BEST MANAGEMENT PRACTICES

9.1 Dust

The Best Management Practices Plan (Dust) for the Site was utilized by WM for its operations during 2024. The Dust Inspection and Dispatch Log for each event as filled out by WM are maintained on file.

Complaints related to dust were not received by WM during the 2024 monitoring period.

Details of the Ambient Air Quality Monitoring Program for the Site are presented within Volume 4 of the 2024 Annual Report.

9.2 Litter

WM operated the Site in accordance with its Best Management Practices Plan (Litter) during 2024. The Litter Inspection and Dispatch Logs for each event, as filled out by WM, are maintained on file.

Complaints related to litter were not received by WM during 2024.

9.3 Odour

Odour control is achieved through the Best Management Practices Plan (Odour). The Odour Control Plan was implemented at the Site during 2024. Additionally, an odour suppression system is available to manage refuse odours during normal operating procedures as identified by WM.

Details related to odour complaints received during the 2024 monitoring period are outlined in Section 10, Appendix P, and Appendix Q.

Further explanation of odour as it relates to the Ambient Air Quality Monitoring Program for the Site is presented within Volume 4 of the 2024 Annual Report.

10 COMPLAINTS

In 2024, WM received a total of 16 odour complaints. Of the complaints received, they represented a total of 15 complaint driven odour events which occurred on 14 separate days. Of these odour events, 12 were documented from discrete physical locations such as a residence or commercial building. The other three (3) odour events represented transient (driving or walking) occurrences in which the complainant observed an odour while driving or walking in different areas (e.g. in town in Watford or near Highway 402). Two (2) of the odour complaints were observed to not be downwind of the Site, and therefore were likely a result of off-site source(s). Further details on these complaints driven odour events are discussed in Section Q1.17, Appendix Q, Volume 2.

A summary of the complaints and the associated response action for each complaint is presented in Appendix P.

11 WATER TAKINGS

Reporting of 2024 water takings is required to be completed for Sedimentation Ponds 1 to 4 and the SDL per Ontario Regulation 387/04: Water Taking and Transfer (O. Reg. 387/04), and the Site's PTTW No. 4682-BLJRYJ, dated November 8, 2021. A report indicating water takings during 2024 from the Sedimentation Ponds and the SDL will be submitted to the MECP by March 31, 2025, in accordance with O. Reg. 387/04, and is provided under separate cover, and/or submitted using the online Water Taking Reporting System (WTRS).

In 2024, water was taken from Sedimentation Ponds 2 and 3. Water that was taken from the aforementioned ponds was used mainly for dust control for landfill operations. Water was also taken from the aforementioned pumping stations for use as recompacted clayey liner soil conditioning. During 2024, the water taking activities were in compliance with the PTTW limits for the Site, as summarized next.

Pond 2		
PTTW Regulatory Components	PTTW Value Limits	2024 Water Taking Values
Max. Taken per Minute (L/min)	4,921	2,809
Max. Hours Taken per Day	24	2.9
Max. Litres Taken Per Day	7,085,520	363,396
Max. Days Taken per Year	105	42
Total Litres Taken in 2024	N/A	2,700,357
Pond 3		
PTTW Regulatory Components	PTTW Value Limits	2024 Water Taking Values
Max. Taken per Minute (L/min)	4,921	2,089
Max. Hours Taken per Day	24	0.5
Max. Litres Taken Per Day	7,085,520	60,566
Max. Days Taken per Year	105	1
Total Litres Taken in 2024	N/A	60,566

12 WASTE DISPOSAL INFORMATION

Waste disposal in 2024 occurred in Cells 3 and 5 (above Cells 1, 2, and 4) as well as in Cell 6A/6B of the Expansion Landfill. In 2025, it is anticipated that landfilling of waste will continue to occur in in Cells 3 and 5 as well as Cell 6A/6B. Upon completion of the landfill liner system of Cell 6C, it is also anticipated that landfilling of waste will occur in this cell in 2025.

For reference, design drawings for the Existing and Expansion Landfills are presented in Appendix L.

13 EAA MONITORING & ANNUAL REPORTING

13.1 Mitigation Measures

No mitigation measures related to hydrogeology were required beyond the mitigation built into the Site design.

13.2 Monitoring Measures

Monitoring requirements at the landfill evolved in accordance with the EMP as construction progressed in 2024. No changes occurred in 2024 from the previous monitoring period.

13.3 Contingency Measures

Based on the groundwater and surface water quality results presented in Sections 5.2 and 5.3, the detailed development and implementation of contingency plans is not required.

13.4 Annual Reporting

Reporting requirements for the Site are addressed and detailed in Appendix Q and R, per the Waste and Sewage ECAs, as well as the amended PTTW.

14 2025 MONITORING PROGRAM

The 2025 Monitoring Program reflects the EMP approved for the Site and incorporates the requirements of the Waste ECA, Sewage ECA, Air ECA, as well as the PTTW. Details of the proposed 2025 Monitoring Program are presented in Table 13.

15 CONCLUSIONS

Based on the findings presented in this report, the following conclusions are provided.

- Overall, leachate elevations at the Existing Landfill generally increased from November 2023 into May 2024 and then decreased from May 2024 to November 2024. This generalized pattern was expected for 2024 with the short-term increase of leachate levels in May 2024 resulting from utilizing the leachate volumes within the waste for irrigation application to the Poplar System beginning in May.

From an environmental stewardship perspective, the leachate generated from within the waste mound of the Existing Landfill was determined to be of more suitable use as irrigation liquid during the growing season as opposed to dedicating efforts for off-Site disposal and treatment between late winter and spring. This storage practice began in 2019 and will continue into the future such that there is sufficient weak-strength leachate volume for irrigation purposes during the growing season. There was a short-term slight increase in leachate elevation noted at one (1) of the landfill cells (Cell 3, at OW51A-15) from May 2024 to November 2024.

- Environmental compliance at the Site as it relates to the Existing Landfill relies on groundwater and surface water quality monitoring, which once again was verified at the Site in 2024. As an additional guidance tool toward managing leachate volumes in the waste cells a hydraulic gradient assessment of leachate compared to nearby shallow groundwater is utilized to further protect local water resources. May 2024 leachate levels were reflective of leachate storage for utilization onto the Poplar System. However, by November 2024, the leachate elevation data within the waste of the Existing Landfill indicated that groundwater flow was inward toward the waste at Cells 3S, 3, 4, 5, 7, 8, 9, 10, 11, and 12.
- In 2024, leachate elevations within the southern portion of Cell 4 (at MH4A), Cell 6, Cell 8, Cell 10, and the eastern and western portions of the South Cell (at MH16, OW22A-10 and OW53-10), and the West Cell (Sump) were higher in elevation compared to groundwater during the May monitoring event. Leachate elevations within Cell 6, the eastern and western portions of the South Cell (at MH16, OW22A-10 and OW53-10), and the West Cell (Sump) were higher in elevation compared to groundwater during the November monitoring event. However, acceptable water quality was demonstrated at the Site during 2024 and therefore, the elevated leachate elevations that showed the potential for outward migration were not negatively affecting the water resources at the Site. Also, generally leachate seeps were not observed along the waste side slopes of the Existing Landfill in 2024, with a couple of exceptions as noted in Section 4.1.4. Continued leachate management of the leachate via automated pumping is expected to continue to reduce the leachate mound in these cells over time.
- During May and November 2024, leachate elevation in the West Cell (Sump) was greater than the surrounding natural ground surface elevation. As discussed in detail in Section 4.1.1.2, since the November 2015 monitoring event, the leachate elevation within the Sump has generally exhibited an increasing/fluctuating trend, of which in part is interpreted to be a result of a combination of significant precipitation totals received at the Site the past few years, as well as various mechanical issues with the Sump's pump. The noted leachate elevation within the Sump does not represent an immediate concern based on acceptable surface water quality at compliance stations and generally no visible leachate seeps on the sideslope, with a couple of exceptions as noted in Section 4.1.4. Continued leachate extraction from the West Cell over time is expected to further reduce the potential for outward leachate seepage in this area. Efforts to further lower the leachate level within the West Cell will continue in 2025.
- Overall, between May 2023 and May 2024 there was an increase in the calculated theoretical total leachate volume stored above the local groundwater table (11,162 m^3) and within the waste (21,818 m^3) of the Existing Landfill. Between November 2023 and November 2024 there was a decrease in the calculated theoretical total leachate volume stored above the local groundwater table (7,404 m^3) and within the waste (12,380 m^3) of the Existing Landfill. It is noted that these volumes are only theoretical in nature and are used as guidance information for year over year overall performance evaluation. For example, the total leachate storage in the Existing Landfill decreased from May to November 2024 (a period of time approximately 2 weeks longer than the 24-week long irrigation season) by 189,821 m^3, however, during that time approximately 12,705 m^3 was measured to have been extracted from the Existing Landfill. During this timeframe, the pumping stations in many of the weaker strength leachate waste cells were routinely drawn down to elevations where the leachate elevation was too low to safely operate the pumps without damage to the pumps.
- The trigger mechanism for implementation of groundwater contingency measures for the Expansion Landfill is the loss of hydraulic containment of the landfill waste footprint. During 2024, the leachate target level for each pumping station of the Expansion Landfill as noted in Condition 14.1 of the Waste ECA was satisfied.

- The operation of the primary leachate collection system is designed to maintain a liquid level below a leachate head target of 300 mm (or 0.3 m) above the primary clay liner (bottom of the landfill). The leachate elevation in Cell 1 and Cell 4, as represented by PS1 and PS5 respectively, satisfied the 0.3 m head target, while there were occurrences at PS3 and PS7, which represent Cell 2 and Cell 6 respectively, that had periods where the 0.3 m head target was exceeded. It is noted that periodic elevated leachate occurrences are described in the D&O Report after precipitation or snow melt events generate more leachate than the pumps can extract and a temporary increase of the leachate head under such circumstances is not considered a non-compliance issue with the Waste ECA. Where there were durations of the 0.3 m head target that were exceeded during 2024, a discussion is provided in Section 4.1.2.
- Between January 1 and December 31, 2024, a total of 78,533.71 m^3 of leachate was managed, of which 68,159.16 m^3 of leachate was removed and transported off-Site for treatment and disposal at the Chatham Water Pollution Control Plant and the Valicor Environmental Services plant in Michigan, while 10,374.55 m^3 was irrigated onto the Poplar System during the 2024 growing season.
- Of the 78,533.71 m^3 noted above, the approximate breakdown of leachate source location between the Existing Landfill and the Expansion Landfill is 23% (17,766.29 m^3) and 77% (60,767.42 m^3), respectively. This breakdown is based on the leachate source distribution which incorporates the separate approximate volumes of leachate extracted from the Existing Landfill (37.5% of area) and Expansion Landfill (62.5% of area). Leachate treatment management considered either off-site disposal of stronger strength leachate (i.e. Expansion Landfill leachate) or storage of weaker strength leachate (i.e. Existing Landfill leachate) for use as irrigation liquid to the Poplar System during the 2024 growing season.
- Considering a general north-south groundwater drainage divide at the Site, shallow groundwater movement within the active aquitard was generally in an easterly and westerly direction away from the divide with local variations as a result of surficial feature influences, such as ditches, waste cells, excavations, ponds, berms, and the leachate management systems.
- Groundwater movement within the interstadial silt and sand also typically moves toward the east and west, away from the drainage divide. Influences from the excavation of the Expansion Landfill as well as landfilling of waste in the Expansion Landfill were noted to the south (at monitoring well nest OW79) where the groundwater in the active aquitard, as well as the interstadial silt and sand was induced toward the north.
- The groundwater pressures within the interface aquifer have also appeared to be affected by the removal of the overlying soil mass, whereby pressures were observed to be slightly decreasing in recent years, and are expected to return to pre-existing conditions as the soil mass is replaced with waste mass. As expected, monitoring wells OW39A-26, OW79-26, OW80-27, and OW81-27 are showing a fluctuating and increasing trend since about 2018 as a significant waste mass has been progressively landfilled into the southern half of the Expansion Landfill. Groundwater movement within the interface aquifer is in a southwesterly direction.
- The groundwater monitoring results for the active aquitard, the interstadial silt and sand, as well as the interface aquifer satisfied the relevant PLIL and SLIL trigger concentrations. Two (2) exceptions occurred during the spring monitoring event for the PLIL parameter nitrate at OW84-6 and the SLIL parameter vinyl chloride at OW17-4, which as discussed in Section 5.2.3.2 are not landfill related.
- At monitoring wells OW69-5 (Active Aquitard), and OW46-7 (Interstadial Silt and Sand), the concentrations of boron show infrequent spikes, but concentrations are less than the respective trigger concentration at each location. At this time the boron concentrations are not a concern as it is expected the more mobile parameter chloride would be observed first if the source of the boron were leachate. It is likely that, similar to observations for monitoring well OW58-14, the bentonite seal for these locations is likely moving into the filter screen material of the monitoring well, and as such may require decommissioning and replacement in the future depending on chemical results. Overall, groundwater quality did not show an unacceptable landfill leachate or operations effect in 2024.
- The routine quarterly surface water monitoring results satisfied the relevant trigger concentrations, with eight (8) exceptions, where a compliance monitoring station was observed to have at least one PLIL parameter trigger exceedance. The exceptions are discussed in detail in Section 5, with verification biological results indicating acceptable results and no further verification monitoring was required.

Overall, surface water quality did not pose a detrimental effect to aquatic life in the discharge water and was of acceptable quality for continued discharge in 2024.

- The annual spring biomonitoring also showed that there was not a potential for detrimental effects to aquatic life in the discharge water and was acceptable for continued discharge.
- Water takings at the Site from the Sedimentation Ponds were used as a dust suppressant related to landfill operations and construction activities. The water taking activities in 2024 satisfied the requirements of the Site's PTTW. Documentation will be submitted to the MECP, as required by the PTTW, under separate cover.
- No methane gas was detected within the gas probes in 2024. Therefore, mitigation measures that would address a potential landfill gas migration in the shallow subsurface beyond the waste footprint are not required.
- In 2024, WM received a total of 16 odour complaints. Of the complaints received, they represented a total of 15 complaint driven odour events which occurred on 14 separate days. Of these odour events, 12 were documented from discrete physical locations such as a residence or commercial building. The other three (3) odour events represented transient (driving or walking) occurrences in which the complainant observed an odour while driving or walking in different areas (e.g. in town in Watford or near Highway 402). Two (2) of the odour complaints were observed to not be downwind of the Site, and therefore were likely a result of off-site source(s).

16 CLOSURE

We trust that this 2024 Fourth Quarter and Annual Monitoring Report for the Twin Creeks Environmental Centre is satisfactory. Should there be any questions or comments, please contact us.

Yours very truly,

RWDI

Eric Wilson, B.Sc.
Scientist | Geoscience

Jeff Cleland, B.Eng., P.Eng.
Environmental Engineer | Geoscience

Brent J. Langille, B.Sc., P.Geo.
Senior Technical Director | Principal

EW/JCL/BJL/kta/tmg

Attach.

17 STATEMENT OF QUALIFICATIONS AND LIMITATIONS

This Report has been prepared for a specific purpose and use, as outlined within the Report. The scope of the undertaking was initially provided in a proposal submitted by RWDI AIR, Inc. (RWDI) to Waste Management of Canada Corporation. The proposal (subject to any documented scope changes requested by Waste Management of Canada Corporation) constitutes an agreement between RWDI and Waste Management of Canada Corporation.

RWDI relied in part, upon the data, information, specifications, and documentation (Data) provided by Waste Management of Canada Corporation as well as third parties. It is assumed by RWDI that the Data provided are complete and accurate. RWDI was not retained to, nor has it conducted any independent verification of the accuracy, completeness or suitability of the Data. As such, RWDI assumes no liability for losses, damages, or claims of any nature arising from inaccurate, incomplete or unsuitable Data provided on this project. Waste Management of Canada Corporation by receipt of this Report agrees to indemnify and hold harmless RWDI with respect thereto.

It is important that the reader of this Report, recognize that subsurface, environmental and/or geotechnical conditions may vary geographically and temporally. This is a natural phenomenon, which is not fully accommodated in the limited testing conducted by RWDI. In addition, the analysis of the collected data, by necessity, incorporates simplifying assumptions of site conditions and analytical solutions that assume uniformity in site conditions. The opinions, conclusions, and recommendations contained within the Report therefore represent RWDI's professional judgment in-light of these limitations.

This Report is to be considered confidential and is for the sole use of Waste Management of Canada Corporation. As such, the Report shall not be relied upon by third parties, except where agreed in writing between RWDI and Waste Management of Canada Corporation; where required by law; or where used for governmental review. RWDI accepts no responsibility, and denies any liability whatsoever, to parties other than Waste Management of Canada Corporation who may obtain access to the Report, for any injury, loss, or damage suffered by such parties arising from their use of, reliance upon, decisions or actions based on the Report or any of its contents, except to the extent where those parties have obtained prior written consent of RWDI to use and rely upon the Report and its contents. Any damages arising from improper use of the Report or parts thereof shall be borne by the party making such use.

This statement of Qualifications and Limitations is attached to and forms part of the Report and any use of the Report are subject to the terms thereof.

TABLES

Table 1
Monitoring Schedule - 2024
Twin Creeks Environmental Centre - 2024 Annual Monitoring Report

Task	Monitoring Locations	Monitoring Dates	Notes
First Quarter Monitoring Period (January 1 to March 31, 2024)			
Compliance Monitoring System			
Precipitation Event Surface Water Monitoring/Sampling	SS1, SS10, SS16, SS19 (new), SP1, SP2, SP3, SP4	January 10, 2024 - Routine monitoring for January 9, 2024 precipitation event	SS19 not monitored since the compost facility is not yet constructed. SP3 not monitored due to no flow conditions.
	SP3	January 26, 2024 - Routine monitoring for January 25, 2024 precipitation event	
	SP2	January 25, 2024 - Verification monitoring event based on the results for the January 10, 2024 routine monitoring event	
	SS1	January 26, 2024 - Verification monitoring event based on the results for the January 10, 2024 routine monitoring event	
Biomonitoring	SP2	January 25, 2024 - Verification monitoring event based on the results for the January 10, 2024 routine monitoring event	
	SS1	January 26, 2024 - Verification monitoring event based on the results for the January 10, 2024 routine monitoring event	
Leachate Liquid Level Measurements	PS1, PS3, PS5, PS7, MH3S, MH4, MH5, MH6, MH7, MH8, MH9, MH10, MH11, MH12, MH16, MH17, MH18, OW22A-10, OW51A-15, OW53-10, Sump	Semi-annually in May and November. Daily during operation for PS1, PS3, PS5, and PS7	
Leachate Sampling	Equalization Tank	Quarterly, and Semi-Annually in May and November. A quarterly sample was collected on January 24, 2024	
Secondary Drainage Layer (SDL) Liquid Levels	PS2, PS4, PS6, PS8	Monthly - January 18, February 7, March 5, 2024	
Gas Monitoring	GP1A, GP2, GP3, GP4, GP5, GP6, GP7, GP8, GP9, GP10	Monthly gas monitoring from November to April and in July. Perimeter gas probes were monitored on January 24, February 7, and March 6, 2024.	
Poplar System Monitoring Program			
Precipitation Event Surface Water Monitoring/Sampling	SS14A, SS14B, and SS15A	January 10, 2024 - Routine monitoring for January 9, 2024, precipitation event	
Ambient Air Quality Monitoring Program			
Total Suspended Particulate - Dust	Stations West, Northeast, and Southeast	Every sixth day - NAPS Schedule (October 1 to May 31) Every third day - NAPS Schedule (June 1 to September 30)	
Noise Monitoring System			
Noise monitoring	Stations - M1, M2, M3, and M4	Ongoing - Quarterly Reporting	
Operational Monitoring			
Automobile Shredder Residue (ASR)	Landfill Daily Cover/Disposed Material	Semi-Annually (Spring and Fall) if utilized.	Monitoring not completed during the Q1 calendar period.
Contaminated Soil	Landfill Daily Cover/Disposed Material	Quarterly, if utilized: January 24, 2024	

NOTES:
1) (new) denotes monitoring station/wells to be installed per the Environmental Monitoring Plan (EMP) dated December 20, 2007.
2) OW71A-5* denotes groundwater well monitored at the request of the Public Liaison Committee.

Table 1
Monitoring Schedule - 2024
Twin Creeks Environmental Centre - 2024 Annual Monitoring Report

Task	Monitoring Locations	Monitoring Dates	Notes
Second Quarter Monitoring Period (April 1 to June 30, 2024)			
Compliance Monitoring System			
Precipitation Event Surface Water Monitoring/Sampling	SS1, SS10, SS16, SS19 (new), SP1, SP2, SP3, SP4	April 12, 2024 - Routine monitoring for April 11, 2024 precipitation event	SS19 not monitored since the compost facility is not yet constructed.
	SP2	April 24, 2024 - Verification monitoring event based on the results for the April 12, 2024 routine monitoring event	
	SS1	April 30, 2024 - Verification monitoring event based on the results for the April, 12, 2024 routine monitoring event	
Biomonitoring	SS1, SS10, SS16, SS19 (new), SP1, SP2, SP3, SP4	April 12, 2024 - Routine monitoring for April 11, 2024 precipitation event	SS19 not monitored since the compost facility is not yet constructed.
	SP2	April 24, 2024 - Verification monitoring event based on the results for the April 12, 2024 routine monitoring event	
	SS1	April 30, 2024 - Verification monitoring event based on the results for the April, 12, 2024 routine monitoring event	
Leachate Liquid Level Measurements	PS1, PS3, PS5, PS7, MH3S, MH4, MH5, MH6, MH7, MH8, MH9, MH10, MH11, MH12, MH16, MH17, MH18, OW22A-10, OW51A-15, OW53-10, Sump	Semi-annually in May and November: May 1, 2024. Daily during operation for PS1, PS3, PS5, and PS7	
Leachate Sampling	PS1, PS3, PS5, PS7, South Fill Area (MH18), West Central Fill Area (Sump), Central Fill Area (Composite of MH4, MH5, MH6, MH7, MH9, MH11)	Annually in May: May 2 and 6, 2024	
	Equalization Tank	Semi-Annually sampled in May and November: May 2, 2024	
Secondary Drainage Layer (SDL) Liquid Levels	PS2, PS4, PS6, PS8	Monthly - April 2, May 1, June 5, 2024 - PS2, PS4, PS6, and PS8	
Groundwater Liquid Level Measurements	ACTIVE AQUITARD OW16-6, OW17-4, OW40E-4, OW54A-4, OW56-4, OW57-4, OW58-6, OW59-6, OW60-4, OW67-4, OW68-5, OW69-5, OW70B-5, OW71A-5*, OW72-6, OW73-6, OW79-5, OW80-3, OW81-5, OW82-5, OW83-5, OW84-6 INTERSTADIAL SILT AND SAND OW16-7, OW40A-7, OW46-7, OW47-6, OW54-10, OW57-15, OW58-17, OW60-8, OW67-11, OW72-10, OW73-9, OW79-7, OW80-6, OW81-7, OW82-14, OW83-9, OW84-11 INTERFACE AQUIFER OW17-30, OW19-29, OW39A-26, OW40A-28, OW49-29, OW60-25, OW79-26, OW80-27, OW81-27, OW82-28, OW83-29, OW84-31	Semi-annually in May and November: May 6 - May 10, 2024	
Piezometer Liquid Level Measurements	P1, P2, P3	Semi-annually in May and November: May 6, 2024	
Groundwater Sampling	ACTIVE AQUITARD OW16-6, OW17-4, OW40E-4, OW54A-4, OW56-4, OW57-4, OW58-6, OW59-6, OW60-4, OW67-4, OW68-5, OW69-5, OW70B-5, OW71A-5*, OW72-6, OW73-6, OW79-5, OW80-3, OW81-5, OW82-5, OW83-5, OW84-6 INTERSTADIAL SILT AND SAND OW16-7, OW40A-7, OW46-7, OW47-6, OW54-10, OW57-15, OW58-17, OW60-8, OW67-11, OW72-10, OW73-9, OW79-7, OW80-6, OW81-7, OW82-14, OW83-9, OW84-11 INTERFACE AQUIFER OW19-29, OW39A-26, OW49-29, OW79-26, OW80-27, OW81-27, OW82-28, OW83-29, OW84-31, Cemetery Well	Semi-annually in May and November: May 6 - May 10, 2024 OW84-6 verification monitoring - May 28, 2024	
Gas Monitoring	GP1A, GP2, GP3, GP4, GP5, GP6, GP7, GP8, GP9, GP10	Monthly gas monitoring from November to April and in July. Perimeter gas probes were monitored on April 1, 2024.	
Poplar System Monitoring Program			
Precipitation Event Surface Water Monitoring/Sampling	SS14A, SS14B, and SS15A	April 12, 2024 - Routine monitoring for April 11, 2024 precipitation event	
Ambient Air Quality Monitoring Program			
Total Suspended Particulate - Dust	Stations West, Northeast, and Southeast	Every sixth day - NAPS Schedule (October 1 to May 31) Every third day - NAPS Schedule (June 1 to September 30)	
Volatile Organic Compounds	Upwind/downwind Monitoring	June 21 to September (5 sets): Not required	Ambient VOC monitoring could not be completed within the 9-day window of June 21 to 30, 2024 in the second quarter monitoring period as climatic conditions were unfavourable to conduct the survey.
Total Hydrocarbon Landfill Cap Survey	Final Capped Areas	Between the Spring and Fall: May 16, 2024	
Noise Monitoring Program			
Noise Monitoring	Stations - M1, M2, M3, and M4	Ongoing - Quarterly Reporting.	
Operational Monitoring			
Automobile Shredder Residue	Landfill Daily Cover/Disposed Material	Semi-Annually (Spring and Fall), if utilized: April, 9 2024	
Contaminated Soil	Landfill Daily Cover/Disposed Material	Quarterly, if utilized: April 9, 2024	

NOTES:
1) (new) denotes monitoring station/wells to be installed per the Environmental Monitoring Plan (EMP) dated December 20, 2007.
2) OW71A-5* denotes groundwater well monitored at the request of the Public Liaison Committee.

Table 1
Monitoring Schedule - 2024
Twin Creeks Environmental Centre - 2024 Annual Monitoring Report

Task	Monitoring Locations	Monitoring Dates	Notes
Third Quarter Monitoring Period (July 1 to September 30, 2024)			
Compliance Monitoring System			
Precipitation Event Surface Water Monitoring/Sampling	SS1, SS10, SS16, SS19(new), SP1, SP2, SP3, SP4	July 10, 2024 - Routine monitoring for July 9, 2024 precipitation event	SS19 not monitored since the compost facility is not yet constructed. SS10 not monitored due to no flow conditions.
	SP2	July 24, 2024 - Verification monitoring for July 10, 2024 routine monitoring event	
	SS1	July 30, 2024 - Verification monitoring for July 10, 2024 routine monitoring event	
Biomonitoring	SP2	July 24, 2024 - Verification monitoring event based on the results for the July 10, 2024 routine monitoring event	
	SS1	July 30, 2024 - Verification monitoring event based on the results for the July 10, 2024 routine monitoring event	
Leachate Level Measurements	PS1, PS3, PS5, PS7, MH3S, MH4, MH5, MH6, MH7, MH8, MH9, MH10, MH11, MH12, MH16, MH17, MH18, OW22A-10, OW51A-15, OW53-10, Sump	Semi-annually in May and November. Daily during operation for PS1, PS3, PS5, and PS7.	
Leachate Sampling	Equalization Tank	Quarterly, and semi-annually in May and November. A quarterly sample was collected on July 23, 2024	
Secondary Drainage Layer (SDL) Liquid Levels	PS2, PS4, PS6, PS8	Monthly - July 18, August 15, September 12, 2024	
Gas Monitoring	GP1A, GP2, GP3, GP4, GP5, GP6, GP7, GP8, GP9, GP10	Monthly gas monitoring from November to April and in July. Perimeter gas probes were monitored on July 4, 2024.	
Poplar System Monitoring Program			
Precipitation Event Surface Water Monitoring/Sampling	SS14A, SS14B, and SS15A	July 10, 2024 - Combined Routine and Storm monitoring for July 9, 2024 precipitation event	
Storm Event Surface Water Monitoring	SS14A, SS14B, and SS15A	Two (2) events during the irrigation season and after a storm event (>25 mm in 24 hrs): July 10, 2024 - Storm event monitoring for July 9, 2024 precipitation event.	
Ambient Air Quality Monitoring Program			
Total Suspended Particulate - Dust	Stations West, Northeast, and Southeast	Every sixth day - NAPS Schedule (October 1 to May 31) Every third day - NAPS Schedule (June 1 to September 30)	
Volatile Organic Compounds	Upwind/downwind Monitoring	June 21 to October (5 sets): July 5, July 22, August 13, August 22, and September 12, 2024	
Total Hydrocarbon Landfill Cap Survey	Final Capped Areas	Between the Spring and Fall:	Monitoring not completed during the 2024 third quarter monitoring period.
Noise Monitoring System			
Noise Monitoring	Stations - M1, M2, M3, and M4	Ongoing - Quarterly Reporting	
Operational Monitoring			
Automobile Shredder Residue	Landfill Daily Cover/Disposed Material	Semi-Annually (Spring and Fall), if utilized:	Monitoring not completed during the 2024 third quarter monitoring period.
Contaminated Soil	Landfill Daily Cover/Disposed Material	Quarterly, if utilized: July 19, 2024	

NOTES:
1) (new) denotes monitoring station/wells to be installed per the Environmental Monitoring Plan (EMP) dated December 20, 2007.
2) OW71A-5* denotes groundwater well monitored at the request of the Public Liaison Committee.

Table 1
Monitoring Schedule - 2024
Twin Creeks Environmental Centre - 2024 Annual Monitoring Report

Task	Monitoring Locations	Monitoring Dates	Notes
Fourth Quarter Monitoring Period (October 1 to December 31, 2024)			
Compliance Monitoring System			
Precipitation Event Surface Water Monitoring/Sampling	SS1, SS10, SS16, SS19(new), SP1, SP2, SP3, SP4	October 14, 2024 - Routine monitoring for October 13, 2024 precipitation event	SS19 not monitored since the compost facility is not yet constructed.
	SP2	October 28, 2024 - Verification monitoring for October 14, 2024 routine monitoring event	
	SS1	November 11, 2024 - Verification monitoring for October 14, 2024 routine monitoring event	
Leachate Liquid Level Measurements	PS1, PS3, PS5, PS7, MH3S, MH4, MH5, MH6, MH7, MH8, MH9, MH10, MH11, MH12, MH16, MH17, MH18, OW22A-10, OW51A-15, OW53-10, Sump	Semi-annually in May and November: November 1, 2024. Daily during operation for PS1, PS3, PS5 and PS7.	
Leachate Sampling	Equalization Tank	Quarterly, and semi-annually in May and October. A quarterly sample was collected on October 9, 2024.	
Secondary Drainage Layer (SDL) Liquid Levels	PS2, PS4, PS6, PS8	Monthly - October 10, November 11, and December 10, 2024	
Groundwater Liquid Level Measurements	ACTIVE AQUITARD OW16-6, OW17-4, OW40E-4, OW54A-4, OW56-4, OW57-4, OW58-6, OW59-6, OW60-4, OW67-4, OW68-5, OW69-5, OW70B-5, OW71A-5*, OW72-6, OW73-6, OW79-5, OW80-3, OW81-5, OW82-5, OW83-5, OW84-6 INTERSTADIAL SILT AND SAND OW16-7, OW40A-7, OW46-7, OW47-6, OW54-10, OW57-15, OW58-17, OW60-8, OW67-11, OW72-10, OW73-9, OW79-7, OW80-6, OW81-7, OW82-14, OW83-9, OW84-11 INTERFACE AQUIFER OW17-30, OW19-29, OW39A-26, OW40A-28, OW49-29, OW60-25, OW79-26, OW80-27, OW81-27, OW82-28, OW83-29, OW84-31	Semi-annually in May and November: November 1, 2024	
		OW84-6 second verification monitoring - November 19, 2024	
Piezometer Liquid Level Measurements	P1, P2, P3	Semi-annually in May and November: November 1, 2024	
Groundwater Sampling	ACTIVE AQUITARD OW16-6, OW17-4, OW54A-4, OW56-4, OW57-4, OW58-6, OW59-6, OW67-4, OW68-5, OW69-5, OW70B-5, OW71A-5*, OW72-6, OW73-6 INTERSTADIAL SILT AND SAND OW16-7, OW46-7, OW47-6, OW54-10, OW57-15, OW58-14, OW67-11, OW72-10, OW73-9	Semi-annually in May and November: November 18 and 19, 2024	
Gas Monitoring	GP1A, GP2, GP3, GP4, GP5, GP6, GP7, GP8, GP9, GP10	Perimeter gas probes monitored on November 25 and December 9, 2024	
Poplar System Monitoring Program			
Precipitation Event Surface Water Monitoring/Sampling	SS14A, SS14B, and SS15A	October 14, 2024 - Routine monitoring for October 13, 2024 precipitation event	
Ambient Air Quality Monitoring Program			
Total Suspended Particulate - Dust	Stations West, Northeast, and Southeast	Every sixth day - NAPS Schedule (October 1 to May 31) Every third day - NAPS Schedule (June 1 to September 30)	
Noise Monitoring Program			
Noise Monitoring	Stations - M1, M2, M3, and M4	Ongoing - Quarterly Reporting	
Operational Monitoring			
Automobile Shredder Residue	Landfill Daily Cover/Disposed Material	Semi-Annually (Spring and Fall), if utilized: October 3, 2024	
Contaminated Soil	Landfill Daily Cover/Disposed Material	Quarterly (if utilized), October 3, 2024	

NOTES:
1) (new) denotes monitoring station/wells to be installed per the Environmental Monitoring Plan (EMP) dated December 20, 2007.
2) OW71A-5* denotes groundwater well monitored at the request of the Public Liaison Committee.

Table 2
Leachate Elevation Comparison
Twin Creeks Environmental Centre - 2024 Annual Monitoring Report

Monitoring Location	Groundwater Monitoring Wells Compared	Existing Ground Surface Elevation (m ASL)	Exisiting Bottom of Ditch Elevation (m ASL)	Current Local Groundwater Elevation (m ASL)	Leachate Elevation (m ASL)	Leachate Elevation Compared to Ground Surface Elevation	Leachate Elevation Compared to Groundwater Elevation
May 1, 2024							
Cell 3S							
MH3SA	OW17-4 and OW56-4	240.71	240.68	239.66	239.05	LOWER	LOWER
MH3SB	OW17-4 and OW56-4	240.46	240.31	239.66	239.04	LOWER	LOWER
MH3SC	*OW7-5*	239.66	239.42	*236.85*	234.50	LOWER	LOWER
MH3SD	*OW7-5*	239.87	239.93	*236.85*	235.78	LOWER	LOWER
Central Fill Area							
Sump	*OW7-5 and OW8-5*	240.81	240.28	*237.14*	245.58	HIGHER	HIGHER
OW51A-15	OW17-4	240.24	239.68	239.71	238.05	LOWER	LOWER
MH4A	OW17-4 and OW69-5	240.33	239.71	239.60	240.18	LOWER	HIGHER
MH4B	OW57-4	240.95	240.17	240.37	240.18	LOWER	LOWER
MH5A	OW58-6	241.51	240.78	240.71	240.17	LOWER	LOWER
MH6A	*OW65-4/OW65A-4*	241.90	241.20	*237.34*	240.05	LOWER	HIGHER
MH7A	OW73-6	242.07	241.34	241.41	238.66	LOWER	LOWER
MH8B	*OW74-6*	242.54	242.46	*239.33*	240.96	LOWER	HIGHER
MH9A	OW72-6	242.33	241.89	241.09	239.91	LOWER	LOWER
MH10	*OW74-6*	241.80	241.43	*239.33*	240.91	LOWER	HIGHER
MH11A	OW54A-4	242.34	241.94	242.00	241.00	LOWER	LOWER
MH12A	*OW66-4*	241.90	241.37	*241.79*	240.88	LOWER	LOWER
MH12B	*OW66-4*	241.90	241.37	*241.79*	240.90	LOWER	LOWER
South Cell							
MH16	*OW63A-6*	239.53	238.49	*238.12*	238.39	LOWER	HIGHER
MH17	*OW63A-6*	239.12	238.07	*238.12*	238.06	LOWER	LOWER
MH18	*OW63A-6*	238.84	238.18	*238.12*	238.09	LOWER	LOWER
OW22A-10	*OW6-4*	239.38	238.76	*238.11*	238.70	LOWER	HIGHER
OW53-10	*OW44-5 and OW64-4/OW64A-4*	239.47	238.45	*236.77*	238.74	LOWER	HIGHER
Expansion Site Cell 1							
PS1	*OW38-6*	240.88		*236.73*	227.16	LOWER	LOWER
Expansion Site Cell 2							
PS3	*OW38-6*	240.18		*236.73*	228.54	LOWER	LOWER
Expansion Site Cell 4							
PS5	*OW38-6*	240.73		*236.73*	228.00	LOWER	LOWER
Expansion Site Cell 6							
PS7	*OW38-6*	239.41		*236.73*	229.41	LOWER	LOWER

Notes: 1) Leachate elevations from May 1, 2024
2) m ASL denotes meters above sea level.
3) *Italics* denotes historic information used to calculate data.
4) ***Bold and italics*** denotes elevation presented is the maintenance hole bottom elevation as it was dry at the time of monitoring.
5) For waste cells with two maintenance holes, the maintenance hole farthest into the waste cell was utilized for comparison.
6) Revised measuring point elevations for Existing Site manholes and leachate wells, as well as updated ground surface elevations reflect the findings of an updated survey (2016).
7) Existing Ground Surface Elevation and Existing Bottom of Ditch Elevation for MH16, MH17, and MH18 resurveyed on November 3, 2022.

Table 2
Leachate Elevation Comparison
Twin Creeks Environmental Centre - 2024 Annual Monitoring Report

Monitoring Location	Groundwater Monitoring Wells Compared	Existing Ground Surface Elevation (m ASL)	Exisiting Bottom of Ditch Elevation (m ASL)	Current Local Groundwater Elevation (m ASL)	Leachate Elevation (m ASL)	Leachate Elevation Compared to Ground Surface Elevation	Leachate Elevation Compared to Groundwater Elevation
November 1, 2024							
Cell 3S							
MH3SA	OW17-4 and OW56-4	240.71	240.68	239.23	238.74	LOWER	LOWER
MH3SB	OW17-4 and OW56-4	240.46	240.31	239.23	238.73	LOWER	LOWER
MH3SC	*OW7-5*	239.66	239.42	*236.85*	234.43	LOWER	LOWER
MH3SD	*OW7-5*	239.87	239.93	*236.85*	235.76	LOWER	LOWER
Central Fill Area							
Sump	*OW7-5 and OW8-5*	240.81	240.28	*237.14*	244.61	HIGHER	HIGHER
OW51A-15	OW17-4	240.24	239.68	239.38	238.47	LOWER	LOWER
MH4A	OW17-4 and OW69-5	240.33	239.71	239.30	237.32	LOWER	LOWER
MH4B	OW57-4	240.95	240.17	239.59	239.28	LOWER	LOWER
MH5A	OW58-6	241.51	240.78	240.01	236.66	LOWER	LOWER
MH6A	*OW65-4/OW65A-4*	241.90	241.20	*237.34*	238.55	LOWER	HIGHER
MH7A	OW73-6	242.07	241.34	240.39	236.43	LOWER	LOWER
MH8B	*OW74-6*	242.54	242.46	*239.33*	237.86	LOWER	LOWER
MH9A	OW72-6	242.33	241.89	240.78	238.10	LOWER	LOWER
MH10	*OW74-6*	241.80	241.43	*239.33*	236.37	LOWER	LOWER
MH11A	OW54A-4	242.34	241.94	241.48	238.92	LOWER	LOWER
MH12A	*OW66-4*	241.90	241.37	*241.79*	236.34	LOWER	LOWER
MH12B	*OW66-4*	241.90	241.37	*241.79*	236.50	LOWER	LOWER
South Cell							
MH16	*OW63A-6*	239.53	238.49	*238.12*	238.27	LOWER	HIGHER
MH17	*OW63A-6*	239.12	238.07	*238.12*	237.96	LOWER	LOWER
MH18	*OW63A-6*	238.84	238.18	*238.12*	237.99	LOWER	LOWER
OW22A-10	*OW6-4*	239.38	238.76	*238.24*	238.46	LOWER	HIGHER
OW53-10	*OW44-5 and OW64-4/OW64A-4*	239.47	238.45	*235.30*	238.56	LOWER	HIGHER
Expansion Site Cell 1							
PS1	*OW38-6*	240.88		*236.73*	228.16	LOWER	LOWER
Expansion Site Cell 2							
PS3	*OW38-6*	240.18		*236.73*	229.66	LOWER	LOWER
Expansion Site Cell 4							
PS5	*OW38-6*	240.73		*236.73*	228.08	LOWER	LOWER
Expansion Site Cell 6							
PS7	*OW38-6*	239.41		*236.73*	228.58	LOWER	LOWER

Notes: 1) Leachate elevations from November 1, 2024.
2) m ASL denotes meters above sea level.
3) *Italics* denotes historic information used to calculate data.
4) ***Bold and italics*** denotes elevation presented is the maintenance hole bottom elevation as it was dry at the time of utilized for monitoring.
5) For waste cells with two maintenance holes, the maintenance hole farthest into the waste cell was monitored.
6) Revised measuring point elevations for Existing Site manholes and leachate wells, as well as updated ground surface elevations reflect the findings of an updated survey (2016).
7) Existing Ground Surface Elevation and Existing Bottom of Ditch Elevation for MH16, MH17, and MH18 resurveyed on November 3, 2022.

Table 3
Leachate Elevation Trends
Twin Creeks Environmental Centre - 2024 Annual Monitoring Report

Monitor Designation	Long-Term Trend (Includes Historical Data)				
	Constant	Decreasing	Increasing	Fluctuating	Comments
Cell 3S					
MH3SA				X	Increasing to 2018 and since fluctuating.
MH3SB				X	Decreasing to 2017 and since fluctuating.
MH3SC				X	Fluctuating since 2017.
MH3SD				X	Fluctuating since 2017.
MH3SE	X			X	Increasing to 2017 and since constant to fluctuating.
MH3SF				X	Decreasing to 2017 and since constant to fluctuating.
Central Fill Area					
OW51A-15			X	X	Constant to fluctuating to 2022 and since increasing.
MH4A			X	X	Fluctuating to increasing since 2011.
MH4B			X	X	Fluctuating to increasing since 2011.
MH5				X	Fluctuating since 2007.
MH6			X	X	Decreasing to 2017 and since fluctuating/increasing.
MH7		X		X	Fluctuating to decreasing since 2009.
MH8				X	Fluctuating since 2005.
MH9				X	Decreasing to 2012 and since fluctuating.
MH10				X	Fluctuating since 2010.
MH11		X		X	Decreasing to 2011 and since fluctuating.
MH12				X	Fluctuating since 2010.
SUMP			X	X	Fluctuating to 2016 and since increasing to fluctuating.
South Fill Area					
OW22A-10				X	Fluctuating since 2005.
OW53-10				X	Increasing to 2014 and since fluctuating.
MH16				X	Increasing to 2010 and since fluctuating.
MH17	X			X	Increasing to 2010. Fluctuating to 2020. Constant since 2021.
MH18	X			X	Increasing to 2010. Fluctuating to 2020. Constant since 2021.

NOTES:

1) Elevations can show more than one trend.

2) For waste cells with two maintenance holes, the maintenance hole furthest within the waste was utilized for comparison.

Table 4
Groundwater Elevation Trends
Twin Creeks Environmental Centre - 2024 Annual Monitoring Report

Monitor Designation	Long-Term Trend (Includes Historical Data)				
	Constant	Decreasing	Increasing	Fluctuating	Comments
Active Aquitard					
OW16-6*				X	Seasonal
OW17-4				X	Seasonal
OW40E-4*				X	Seasonal
OW54A-4*			X	X	Seasonal
OW56-4			X	X	Seasonal
OW57-4			X	X	Seasonal
OW58-6*			X	X	Seasonal
OW59-6*				X	Seasonal
OW60-4				X	
OW67-4				X	
OW68-5				X	Seasonal
OW69-5			X	X	
OW70B-5*				X	Seasonal
OW71A-5*				X	Seasonal
OW72-6			X	X	Seasonal
OW73-6			X	X	Seasonal
OW79-5				X	Seasonal
OW80-3				X	
OW81-5				X	
OW82-5				X	
OW83-5				X	
OW84-6				X	Seasonal
Interstadial Silt and Sand					
OW16-7				X	Seasonal
OW40A-7*				X	Seasonal
OW46-7			X	X	
OW47-6				X	
OW54-10				X	Fluctuating since 2017
OW57-15				X	
OW58-14				X	Decommissioned 2016
OW58-17				X	Fluctuating since 2015
OW60-8				X	Seasonal
OW67-11				X	Fluctuating since 2018
OW72-10				X	Fluctuating since 2018
OW73-9				X	Fluctuating since 2018
OW79-7				X	Seasonal
OW80-6				X	Seasonal
OW81-7				X	
OW82-14				X	
OW83-9				X	
OW84-11				X	
Interface Aquifier					
OW17-30		X		X	Decreasing since 2005
OW19-29		X		X	Decreasing since 2009
OW39A-26			X	X	Fluctuating since 2021
OW40A-28*		X		X	Decreasing since 2015
OW49-29		X		X	Decreasing since 2009
OW60-25		X		X	Decreasing since 2009
OW79-26			X	X	Increasing since 2018
OW80-27			X	X	Increasing since 2018
OW81-27			X	X	Increasing since 2020
OW82-28			X	X	Decreasing since 2022
OW83-29			X	X	Decreasing since 2022
OW84-31			X	X	Decreasing since 2022

Notes:

1) Seasonal - denotes a seasonal trend with elevated elevations during prolonged periods of precipitation, typically in the spring and summer months, and lower elevations during drier periods, typically the fall and winter months.
2) Water elevations can show more than one trend.
3) Ins - denotes insufficient data. At least three data points are required to establish a trend.
4) * denotes trends consider historical data from former monitoring wells at that location.
5) Monitoring well OW58-14 was decomissioned prior to the fall 2016 monitoring event.
6) Monitoring well OW39-26 was noted to have been damaged during the fall 2016 monitoring event and decomissioned April 2017.
7) OW82-5, OW82-14, OW82-28, OW83-5, OW83-9, OW83-29, OW84-6, OW84-11, and OW84-31 installed in June 2022.
8) OW40D-4 noted to have been damaged in January 2024. OW40D-4 decomissioned in January 2024. Replacement OW40E-4 installed in March 2024.

Table 5
Estimated Leachate Storage Volumes
Twin Creeks Environmental Centre - 2024 Annual Monitoring Report

Fill Area	Approximate Area (ha)	Approximate Original Ground Surface Elevation (m asl)	Groundwater Reference Elevation (m asl)	Estimated Average Base of Waste (m asl)	May 2024 Average Leachate Elevation (m asl)	Estimated Volume in Waste Cells (Measured from Cell Base) (m^3)															Change in Volume Within the Waste Cells From May 2023 to May 2024 (m^3)
						MAY 2010	MAY 2011	MAY 2012	MAY 2013	MAY 2014	MAY 2015	MAY 2016	MAY 2017	MAY 2018	MAY 2019	MAY 2020	MAY 2021	MAY 2022	MAY 2023	MAY 2024	
West Cell (Sump)	6.3	238.3	237.1	235.5	245.6	103,320	118,440	110,628	136,332	87,948	71,568	148,680	164,052	195,552	242,928	122,724	161,784	174,636	250,740	254,016	3,276
Cell 3 (OW51A-15)	1.5	239.9	239.2	235.2	238.1	4,200	4,980	5,220	5,100	7,800	6,180	4,800	4,920	5,100	6,360	5,640	7,620	6,600	14,820	17,100	2,280
Cell 4 (MH4B)	2.1	240.8	238.5	234.1	240.2	52,080	62,664	29,148	36,120	30,492	37,212	46,200	46,452	40,404	46,368	43,848	44,856	45,024	51,240	51,072	-168
Cell 5 (MH5A)	2.2	241.2	237.0	236.5	240.2	7,040	0	7,832	28,776	22,264	0	14,520	28,160	0	28,512	27,984	17,600	28,424	32,736	32,296	-440
Cell 6 (MH6A)	2.0	240.0	237.3	236.5	240.1	4,000	8,080	5,280	9,680	10,880	1,600	0	0	3,840	28,880	16,720	16,000	29,280	29,360	28,400	-960
Cell 7 (MH7A)	1.9	240.7	238.8	236.5	238.7	15,960	10,564	19,076	2,736	5,548	17,784	9,576	18,848	12,920	23,484	13,984	10,792	4,940	11,400	16,416	5,016
Cell 8 (MH8B)	1.9	240.0	239.3	237.0	241.0	760	10,108	19,380	17,480	3,496	1,672	9,880	18,392	17,252	27,968	29,868	22,572	16,872	32,148	30,096	-2,052
Cell 9 (MH9A)	1.9	241.2	239.0	237.5	239.9	15,200	17,936	8,816	7,296	7,296	8,968	5,700	13,072	1,064	19,456	14,440	12,692	13,224	13,908	18,316	4,408
Cell 10 (MH10)	1.9	241.5	239.3	236.5	240.9	7,600	22,496	21,280	5,320	5,092	8,588	28,500	34,200	28,120	34,276	4,636	4,788	1,368	25,992	33,516	7,524
Cell 11 (MH11A)	1.9	244.3	240.8	237.8	241.0	20,520	7,068	15,884	14,516	15,352	19,076	23,560	21,584	20,292	25,156	11,324	17,860	7,068	24,472	24,320	-152
Cell 12 (MH12A)	0.6	242.5	241.8	236.5	240.9	2,400	7,152	6,768	4,008	1,512	2,640	8,880	10,800	8,856	11,016	1,488	1,488	456	8,304	10,512	2,208
Cell 3S (MH3SA/B/C/D/E/F)	1.1	238.6	238.3	235.2	239.4	7,964	16,060	13,640	16,588	5,412	10,340	14,520	4,752	16,368	21,831	17,431	21,120	20,460	20,321	18,319	-2,002
South Cell (MH16/17/18)	5.4	239.4	238.1	235.0	238.2	54,000	62,640	62,640	67,176	55,296	60,912	49,680	46,224	55,296	70,992	65,304	60,912	65,016	65,808	68,688	2,880
					Total	**295,044**	**348,188**	**325,592**	**351,128**	**258,388**	**246,540**	**364,496**	**411,456**	**405,064**	**587,227**	**375,391**	**400,084**	**413,368**	**581,249**	**603,067**	21,818

Fill Area	Approximate Area (ha)	Approximate Original Ground Surface Elevation (m asl)	Groundwater Reference Elevation (m asl)	Estimated Average Base of Waste (m asl)	May 2024 Average Leachate Elevation (m asl)	Volume Above Groundwater Reference Level (m^3)															Change in Volume Above Groundwater Reference Level From May 2023 to May 2024 (m^3)
						MAY 2010	MAY 2011	MAY 2012	MAY 2013	MAY 2014	MAY 2015	MAY 2016	MAY 2017	MAY 2018	MAY 2019	MAY 2020	MAY 2021	MAY 2022	MAY 2023	MAY 2024	
West Cell (Sump)	6.3	238.3	237.1	235.5	245.6	63,000	78,120	70,308	96,012	47,628	31,248	108,360	123,732	155,232	202,608	82,404	121,464	134,316	210,420	213,696	3,276
Cell 3 (OW51A-15)	1.5	239.9	239.2	235.2	238.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cell 4 (MH4B)	2.1	240.8	238.5	234.1	240.2	11,760	25,704	0	0	0	252	9,240	9,492	3,444	9,408	6,888	7,896	8,064	14,280	14,112	-168
Cell 5 (MH5A)	2.2	241.2	237.0	236.5	240.2	0	0	3,432	24,376	17,864	0	10,120	23,760	0	24,112	23,584	13,200	24,024	28,336	27,896	-440
Cell 6 (MH6A)	2.0	240.0	237.3	236.5	240.1	0	1,680	0	3,280	4,480	0	0	0	0	22,480	10,320	9,600	22,880	22,960	22,000	-960
Cell 7 (MH7A)	1.9	240.7	238.8	236.5	238.7	1,520	0	1,596	0	0	304	0	1,368	0	6,004	0	0	0	0	0	0
Cell 8 (MH8B)	1.9	240.0	239.3	237.0	241.0	0	0	1,900	0	0	0	0	912	0	10,488	12,388	5,092	0	14,668	12,616	-2,052
Cell 9 (MH9A)	1.9	241.2	239.0	237.5	239.9	6,080	6,536	0	0	0	0	0	1,672	0	8,056	3,040	1,292	1,824	2,508	6,916	4,408
Cell 10 (MH10)	1.9	241.5	239.3	236.5	240.9	0	1,216	0	0	0	0	7,220	12,920	6,840	12,996	0	0	0	4,712	12,236	7,524
Cell 11 (MH11A)	1.9	244.3	240.8	237.8	241.0	9,120	0	0	0	0	0	760	0	0	2,356	0	0	0	1,672	1,520	-152
Cell 12 (MH12A)	0.6	242.5	241.8	236.5	240.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cell 3S (MH3SA/B/C/D/E/F)	1.1	238.6	238.3	235.2	239.4	0	2,420	0	2,948	0	0	880	0	2,728	8,191	3,791	7,480	6,820	6,681	4,679	-2,002
South Cell (MH16/17/18)	5.4	239.4	238.1	235.0	238.2	0	0	0	0	0	0	0	0	0	4,032	0	0	0	0	1,728	1,728
					Total	**91,480**	**115,676**	**77,236**	**126,616**	**69,972**	**31,804**	**136,580**	**173,856**	**168,244**	**310,731**	**142,415**	**166,024**	**197,928**	**306,237**	**317,399**	11,162

Notes:

1) Average leachate elevations are from May 1, 2024.

2) Assumes a waste porosity of 40%.

3) NA indicates data not available, owing to date of manhole installation.

4) Revised original ground surface elevations reflect the findings of an updated survey in 2016.

5) Estimated Leachate Storage Volume (m^3) for Total in Waste Cell = Average Leachate Elevation (m) - (Estimated Average Base of Waste (ha) * 10,000 (m^2)) * 0.4 (assumed porosity).

6) Groundwater Reference Elevation is a fixed value as of 2011 based on historic (2003-2007) data.

7) Volume Above Groundwater Reference Level based on similar reference level for post-2010 volumes. Pre-2010 volumes based on spring average level.

Table 5
Estimated Leachate Storage Volumes
Twin Creeks Environmental Centre - 2024 Annual Monitoring Report

Fill Area	Approximate Area (ha)	Approximate Original Ground Surface Elevation (m asl)	Groundwater Reference Elevation (m asl)	Estimated Average Base of Waste (m asl)	Nov 2024 Average Leachate Elevation (m asl)	Estimated Volume in Waste Cells (Measured from Cell Base) (m3)							Change in Volume Within the Waste Cells From Nov 2023 to Nov 2024 (m^3)
						NOV 2018	NOV 2019	NOV 2020	NOV 2021	NOV 2022	NOV 2023	NOV 2024	
West Cell (Sump)	6.3	238.3	237.1	235.5	244.6	217,224	177,408	139,356	180,432	177,912	216,216	229,572	13,356
Cell 3 (OW51A-15)	1.5	239.9	239.2	235.2	238.5	5,040	6,000	6,840	6,540	8,280	10,440	19,620	9,180
Cell 4 (MH4B)	2.1	240.8	238.5	234.1	239.3	47,376	40,572	44,772	49,140	44,268	52,164	43,512	-8,652
Cell 5 (MH5A)	2.2	241.2	237.0	236.5	236.7	26,136	0	0	30,360	2,552	0	1,320	1,320
Cell 6 (MH6A)	2.0	240.0	237.3	236.5	238.6	2,560	30,640	11,360	31,520	29,840	26,000	16,400	-9,600
Cell 7 (MH7A)	1.9	240.7	238.8	236.5	236.4	10,412	3,952	456	4,408	760	1,216	0	-1,216
Cell 8 (MH8B)	1.9	240.0	239.3	237.0	237.9	17,556	6,992	6,308	15,580	14,440	8,664	6,536	-2,128
Cell 9 (MH9A)	1.9	241.2	239.0	237.5	238.1	4,712	7,752	1,596	9,728	1,900	5,700	4,560	-1,140
Cell 10 (MH10)	1.9	241.5	239.3	236.5	236.4	33,668	0	0	1,900	2,356	10,564	0	-10,564
Cell 11 (MH11A)	1.9	244.3	240.8	237.8	238.9	22,952	7,296	4,484	7,372	15,276	5,700	8,512	2,812
Cell 12 (MH12A)	0.6	242.5	241.8	236.5	236.3	10,632	0	0	576	792	3,024	0	-3,024
Cell 3S (MH3SA/B/C/D/E/F)	1.1	238.6	238.3	235.2	239.0	19,323	21,685	11,730	19,351	20,108	19,338	16,830	-2,508
South Cell (MH16/17/18)	5.4	239.4	238.1	235.0	238.1	59,760	58,608	58,248	64,800	66,312	66,600	66,384	-216
					Total	**477,351**	**360,905**	**285,150**	**421,707**	**384,796**	**425,626**	**413,246**	-12,380

Fill Area	Approximate Area (ha)	Approximate Original Ground Surface Elevation (m asl)	Groundwater Reference Elevation (m asl)	Estimated Average Base of Waste (m asl)	Nov 2024 Average Leachate Elevation (m asl)	Volume Above Groundwater Reference Level (m3)							Change in Volume Above Groundwater Reference Level From Nov 2023 to Nov 2024 (m^3)
						NOV 2018	NOV 2019	NOV 2020	NOV 2021	NOV 2022	NOV 2023	NOV 2024	
West Cell (Sump)	6.3	238.3	237.1	235.5	244.6	176,904	137,088	99,036	140,112	137,592	175,896	189,252	13,356
Cell 3 (OW51A-15)	1.5	239.9	239.2	235.2	238.5	0	0	0	0	0	0	0	0
Cell 4 (MH4B)	2.1	240.8	238.5	234.1	239.3	10,416	3,612	7,812	12,180	7,308	15,204	6,552	-8,652
Cell 5 (MH5A)	2.2	241.2	237.0	236.5	236.7	21,736	0	0	25,960	0	0	0	0
Cell 6 (MH6A)	2.0	240.0	237.3	236.5	238.6	0	24,240	4,960	25,120	23,440	19,600	10,000	-9,600
Cell 7 (MH7A)	1.9	240.7	238.8	236.5	236.4	0	0	0	0	0	0	0	0
Cell 8 (MH8B)	1.9	240.0	239.3	237.0	237.9	76	0	0	0	0	0	0	0
Cell 9 (MH9A)	1.9	241.2	239.0	237.5	238.1	0	0	0	0	0	0	0	0
Cell 10 (MH10)	1.9	241.5	239.3	236.5	236.4	12,388	0	0	0	0	0	0	0
Cell 11 (MH11A)	1.9	244.3	240.8	237.8	238.9	152	0	0	0	0	0	0	0
Cell 12 (MH12A)	0.6	242.5	241.8	236.5	236.3	0	0	0	0	0	0	0	0
Cell 3S (MH3SA/B/C/D/E/F)	1.1	238.6	238.3	235.2	239.0	5,683	8,045	0	5,711	6,468	5,698	3,190	-2,508
South Cell (MH16/17/18)	5.4	239.4	238.1	235.0	238.1	0	0	0	0	0	0	0	0
					Total	**227,355**	**172,985**	**111,808**	**209,083**	**174,808**	**216,398**	**208,994**	-7,404

Notes:

1) Average leachate elevations are from November 1, 2024.

2) Assumes a waste porosity of 40%.

3) NA indicates data not available, owing to date of manhole installation.

4) Revised original ground surface elevations reflect the findings of an updated survey in 2016.

5) Estimated Leachate Storage Volume (m^3) for Total in Waste Cell = Average Leachate Elevation (m) - (Estimated Average Base of Waste (ha) * 10,000 (m^2)) * 0.4 (assumed porosity).

6) Groundwater Reference Elevation is a fixed value as of 2011 based on historic (2003-2007) data.

7) Volume Above Groundwater Reference Level based on similar reference level for post-2010 volumes. Pre-2010 volumes based on spring average level.

Table 6
Leachate Chemical Summary
Twin Creeks Environmental Centre – 2024 Annual Monitoring Report

Parameter	Leachate Concentrations			Background Concentrations		
	West Central Fill Area (Existing Site) (2008-2024)	Typical Waste Areas (Existing Site) (2008-2024)	Equalization Tank (Expansion Site) (2010-2024)	Groundwater (1984-2001)	Surface Water (2001-2024) SS10	Surface Water (2008-2024) SS16
pH (pH units)	**7.3 - 8.1**	**7.4 - 8.2**	**7.0 - 8.1**	7.0 – 8.3	6.7 - 8.7	7.4 - 8.4
Conductivity (µS/cm)	**880 - 16,400**	**501 – 31,100**	**2,000 - 26,000**	443 – 2,550	62 - 1,200	109 - 626
Alkalinity	**280 - 7,060**	**160 - 18,300**	**1,820 - 10,000**	100 - 581	22 - 203	45 - 230
Calcium	**49 - 150**	**19 - 380**	**79 - 1,400**	19 - 250	5.4 - 170	15 - 1,300
Magnesium	**20 - 390**	**19 - 450**	**130 - 530**	9 - 261	1.6 - 33	3.3 - 88
Sodium	**57 - 2,100**	**19 - 6,300**	**270 - 2,700**	48 - 199	0.49 - 20	1.4 - 21
Potassium	**12 - 620**	**6.7 - 1,100**	**81 - 900**	1 - 9	1 - 17	3.1 - 60
Chloride	**68 - 2,600**	**11 - 1,000**	**330 - 3,400**	1 - 15	1 - 46	1.2 - 27
Sulphate	**0.5 - 81**	**10 - 410**	**10 - 220**	100 – 1,330	0.5 - 290	<1 - 220
Iron	**2.2 - 54**	**<0.05 - 33**	**<1 - 120**	<0.1 - 3.3	0.1 - 79	0.3 - 540
DOC	**22 - 462**	**8.3 - 1,480**	**170 - 4,500**	0.7 - 9.8	<0.02 - 0.26	
Ammonia (total)	**1.41 - 857**	**8 - 3,540**	**57 - 2,000**	<0.05 – 7.1	<0.02 - 18.4	0.05 - 0.3
TKN	**3.1 - 930**	**11 - 3,500**	**26 - 2,700**	<0.1 – 10.9	0.41 - 33	<0.7 - 7.2
Nitrate	**<0.1 - <2.0**	**<0.1 - 6.7**	**<0.1 - <5.0**	<0.1 – 2.7	<0.01 - 102	<0.01 - 1.5
Boron	**1.3 - 70**	**0.67 - 560**	**1.3 - 41**	0.09 – 0.99	0.02 - 0.48	<0.02 - 0.4
Benzene (µg/L)	**<0.2 - 361**	**<0.1 - 12.0**	**<1 - <10**	<1.3		
Toluene (µg/L)	**<0.2 - 782**	**<0.2 - 550**	**4.2 - 2,400**	<1.5		
Ethylbenzene (µg/L)	**<0.2 - 318**	**<0.1 - 891**	**<0.5 - 30**	<1.6		
m/p - xylenes (µg/L)	**<0.2 - 1,990**	**<0.1 - 200**	**2.5 - 64**	<3.4		
o - xylene (µg/L)	**<0.2 - 1,140**	**<0.1 - 97.4**	**<0.5 - 28**	<2.7		

Notes:

1) Background concentrations for groundwater are established from 1984 to 2001 for monitoring wells 250 metres or greater to the west of the Existing Site: OW1-5, OW5-6, OW38-6, OW38-10, OW39-6, OW39-12, OW42-6, OW42-9.

2) Background concentrations for surface water (SS10 and SS16) are established for 2001-2024 data, where available.

3) All data are mg/L unless otherwise specified.

4) Blank denotes parameter not tested.

Table 7
Indicator Parameter Concentration Trend Summary - Groundwater
Twin Creeks Environmental Centre - 2024 Annual Monitoring Report

Monitor Designation	Long-Term Trend (Includes Historic Data)		
	Chloride	Nitrate	Boron
Active Aquitard			
OW16-6*	C	C	C
OW17-4	F	C	C
OW40E-4*	C	C	D/F
OW54A-4*	F	C	C
OW56-4	C	F	F
OW57-4	C	C	C
OW58-6	C	C	F
OW59-6	C	C	F
OW60-4	C	C	C
OW67-4	F	F	F/D
OW68-5	F	C	F
OW69-5	C	C	F
OW70B-5*	C	C	C
OW71A-5*	I/F	F	C
OW72-6	C	C	F
OW73-6	C	C	F
OW79-5	C	C	C
OW80-3	D/F	C	C
OW81-5	C	C	C
OW82-5	ID	ID	ID
OW83-5	ID	ID	ID
OW84-6	ID	ID	ID
Interstadial Silt and Sand			
OW16-7	C	C	C
OW40A-7	C	C	C
OW46-7	C	C	F/I
OW47-6	C	F	F
OW54-10	C	F	C
OW57-15	C	F	C
OW58-17*	C	C	C
OW60-8	C	C	F
OW67-11	F	F	F
OW72-10	C	C	C
OW73-9	C	C	F
OW79-7	F	C	C
OW80-6	F	C	C
OW81-7	F	C	C
OW82-14	ID	ID	ID
OW83-9	ID	ID	ID
OW84-11	ID	ID	ID
Interface Aquifer			
OW19-29	C	C	F
OW39A-26*	F	C	F
OW49-29	C	C	F
OW79-26	C	C	F
OW80-27	C	C	F
OW81-27	F	C	F
OW82-28	ID	ID	ID
OW83-29	ID	ID	ID
OW84-31	ID	ID	ID
Cemetery Well	C	F	C

Notes:
1) C denotes constant trend.
2) D denotes decreasing trend.
3) I denotes increasing trend.
4) F denotes fluctuating trend.
5) S denotes seasonal pattern.
6) ID denotes insufficient data for interpretation.
7) Data are presented in Table H-4 Appendix H .
8) Historic data trends assume nitrate+nitrite represents nitrate.
9) Concentrations can show more than one trend.
10) * denotes considers historic data from decommissioned monitoring well.

Table 8
Groundwater Trigger Concentration / Comparison Summary - Active Aquitard
Twin Creeks Environmental Centre - 2024 Annual Monitoring Report

Monitor Designation		Chloride	Nitrate	Boron
Active Aquitard				
	Trigger Concentration (mg/L)	**106**	**2.3**	**1.1**
OW16-6	May-24	51	<0.10	0.14
	Nov-24	47	0.15	0.14
OW17-4	May-24	24	0.17	0.20
	Nov-24	23	0.14	0.31
OW40E-4	May-24	2.5	<0.10	0.30
OW54A-4	May-24	28	0.16	0.20
	Nov-24	23	<0.10	0.21
OW56-4	May-24	6.8	<0.10	0.42
	Nov-24	6.4	<0.10	0.45
OW57-4	May-24	5.0	<0.10	0.36
	Nov-24	3.7	<0.10	0.41
OW58-6	May-24	4.1	0.15	0.61
	Nov-24	3.3	<0.10	0.62
OW59-6	May-24	5.4	<0.10	0.8
	Nov-24	4.6	<0.10	0.73
OW60-4	May-24	6.0	<0.10	0.05
OW67-4	May-24	22	0.16	0.05
	Nov-24	13	0.30	0.16
OW68-5	May-24	9.0	<0.10	0.08
	Nov-24	4.0	0.32	0.99
OW69-5	May-24	9.7	<0.10	0.93
	Nov-24	8.1	<0.10	0.99
OW70B-5	May-24	9.4	<0.10	0.43
	Nov-24	4.8	<0.10	0.50
OW71A-5	May-24	31	<0.10	0.13
	Nov-24	28	0.56	0.15
OW72-6	May-24	4.9	<0.10	0.74
	Nov-24	3.2	<0.10	0.66
OW73-6	May-24	8.0	<0.10	0.7
	Nov-24	7.5	<0.10	0.67
OW79-5	May-24	14	<0.10	0.05
OW80-3	May-24	54	<0.10	0.03
OW81-5	May-24	19	<0.10	0.57
OW82-5	May-24	8.1	<0.10	0.58
OW83-5	May-24	81	<0.10	0.12
OW84-6	May-24	9.1	**4.25**	0.14
	May-24 - Verification	10	2.18	0.21
	Nov-24 - Second Verification	21	1.12	0.27

NOTES:

1) Trigger Concentrations based on Table 4 of the 2007 Landfill EMP.

2) Bolded text and shading denotes concentration exceeds trigger concentration.

3) Italics denotes parameter concentration was below the laboratory reportable detection limit (RDL), where the RDL exceeds the relevant trigger concentration.

Table 9
Groundwater Trigger Concentration Comparison Summary - Interstadial Silt and Sand
Twin Creeks Environmental Centre - 2024 Annual Monitoring Report

Monitor Designation		Chloride	Nitrate	Boron
Interstadial Silt and Sand				
	Trigger Concentration (mg/L)	**116**	**2.3**	**2.1**
OW16-7	May-24	5.3	0.14	0.29
	Nov-24	5.2	<0.10	0.28
OW40A-7	May-24	6.2	0.37	0.65
OW46-7	May-24	11	0.17	0.49
	Nov-24	10	0.17	0.7
OW47-6	May-24	5.2	0.37	1.0
	Nov-24	3.7	0.28	1.0
OW54-10	May-24	8.0	0.37	1.1
	Nov-24	8.1	<0.10	1.1
OW57-15	May-24	7.1	0.55	1.2
	Nov-24	6.1	0.49	1.3
OW58-17	May-24	7.6	0.33	1.5
	Nov-24	6.4	0.2	1.5
OW60-8	May-24	7.0	<0.10	0.83
OW67-11	May-24	23	0.11	0.44
	Nov-24	22	<0.10	0.47
OW72-10	May-24	4.9	0.32	1.1
	Nov-24	3.4	0.26	1.1
OW73-9	May-24	7.1	0.63	1.2
	Nov-24	5.6	0.55	1.3
OW79-7	May-24	*150*	<0.10	0.19
OW80-6	May-24	*200*	<0.10	0.21
OW81-7	May-24	*190*	0.18	0.58
OW82-14	May-24	31	1.00	1.1
OW83-9	May-24	29	0.18	0.37
OW84-11	May-24	26	0.11	0.82
Cemetery Wel	May-24	3.8	0.23	0.03

Notes:

1) Trigger Concentrations based on Table 4 of the 2007 Landfill EMP.

2) Bolded text and shading denotes concentration exceeds trigger concentration.

3) Italics denotes that per MECP approval the parameter's concentration is not evaluated against the trigger concertation.

4) Chloride trigger concentration of 116mg/L is not applicable to OW79-7, OW80-6, and OW81-7

Table 10
Groundwater Trigger Concentration Comparison Summary - Interface Aquifer
Twin Creeks Environmental Centre - 2024 Annual Monitoring Report

Monitor Designation		Chloride	Nitrate	Boron
Interface Aquifer				
	Trigger Concentration (mg/L)	**134**	**2.3**	**2.6**
OW19-29	May-24	25	<0.10	2.1
OW39A-26	May-24	39	<0.10	1.7
OW49-29	May-24	32	0.19	1.6
OW79-26	May-24	24	0.18	1.6
OW80-27	May-24	46	<0.10	1.8
OW81-27	May-24	21	<0.10	0.49
OW82-28	May-24	43	0.12	2.0
OW83-29	May-24	33	<0.10	1.2
OW84-31	May-24	36	0.15	1.5

Notes:

1) Trigger Concentrations based on Table 4 of the 2007 Landfill EMP.

2) Bolded text and shading denotes concentration exceeds trigger concentration.

Table 11
Indicator Parameter Concentration Trend Summary - Surface Water
Twin Creeks Environmental Centre - 2024 Annual Monitoring Report

Monitoring Station	Long-Term Trend (Includes Historic Data)			
	Chloride	Ammonia	Boron	Zinc
SS1	F	C	F	F
SS10	F	C	C	C
SS16	F	C	F	C
SP1	F	F	F	C
SP2	F	F	F	C
SP3	F	F	C	C
SP4	F	F	C	C

Notes:

1) C denotes constant trend.
2) D denotes decreasing trend.
3) I denotes increasing trend.
4) F denotes fluctuating trend.
5) S denotes seasonal pattern.
6) Data are presented in Table I-2, Appendix I.
7) INS - denotes there is insufficient data available for interpretation.
8) NC denotes sampling station not yet constructed.

Table 12
Surface Water Trigger Concentrations
Twin Creeks Environmental Centre - 2024 Annual Monitoring Report

Parameter	Units	PWQO	Background Station SS10 and SS16 90% Trigger Concentration	Number of Samples for Background Station SS10	Number of Samples for Background Station SS16	Post 2023 Trigger Concentration	Post 2024 Trigger Concentration
Trigger Concentrations/Levels for Compliance Points							
Chloride	mg/L	210*	20.0	71	54	210	210
Ammonia (unionized)	mg/L	0.020	0.010	71	54	0.020	0.020
Phenols	mg/L	0.001	0.003	71	54	0.003	0.003
Boron	mg/L	0.20	0.17	71	54	0.20**	0.20**
Nickel	mg/L	0.025	0.026	71	54	0.026	0.026
Chromium (total)	mg/L	0.0089	0.021	71	54	0.021	0.022
Zinc	mg/L	0.02	0.05	71	54	0.05	0.06

Notes:

1) PWQO denotes Provincial Water Quality Objectives (1994) with updates.

2) * denotes recommended concentration by Environment Canada.

3) ** It is noted that the boron trigger concentration for SP1 is 0.39 mg/L, per the MOECC letter dated May 18, 2012.

4) Trigger concentrations are calculated annually from SS10 and SS16, per MOECC letter dated February 27, 2014.

Table 13
2025 Monitoring Program
Twin Creeks Environmental Centre - 2024 Annual Monitoring Report

Monitoring Locations	Parameters	Frequency
Leachate		
PS1, PS3, PS5, PS7, MH3S, MH4, MH5, MH6, MH7, MH8, MH9, MH10, MH11, MH12, MH16, MH17, MH18, OW22A-10, OW51A-15, OW53-10, Sump, LW1, LW2, LW3, LW4, LW5, LW6	Leachate Levels	May and November
PS1, PS3, PS5, PS7	Leachate Levels	Daily
PS1, PS3, PS5, PS7, South Fill Area (MH18), West Central Fill Area (Sump), Central Fill Area (Composite of MH4, MH5, MH6, MH7, MH9, MH11)	PLIL-GW, SLIL-GW, PLIL-SW, SLIL-SW, LS	May
Equalization Tank	BOD_5, DOC, phosphorus (total), TKN, BTEX, pH	Quarterly
	PLIL-SW, SLIL-SW, LS	May and November
Treated Leachate Effluent		
Treatment Plant Effluent	Discharge Rates, COD, pH, turbidity	Daily
	Chloride, $CBOD_5$, BOD_5, DOC, BTEX, ammonia, pH	Weekly
	PLIL-GW, SLIL-GW, PLIL-SW, SLIL-SW, LS	Monthly
	PCB, organochlorines	May and November
Treated Leachate Temporary Storage Cells : Cells 1 and 2	Discharge Rates	Daily
Cell 1 Inlet, Cells 1 and 2	Chloride, $CBOD_5$, BOD_5, DOC, BTEX, ammonia, pH	Weekly
Cells 1 and 2	DO, pH, alkalinity, DOC	Weekly
Cells 1 and 2	PLIL-GW, SLIL-GW, PLIL-SW, SLIL-SW, LS	Monthly
Cell 1	Biomonitoring	May and November
Secondary Drainage Layer		
PS2, PS4, PS6, PS8	Groundwater Levels	Monthly
Active Aquitard		
OW16-6, OW17-4, OW40E-4, OW54A-4, OW56-4, OW57-4, OW58-6, OW59-6, OW60-4**, OW61-4, OW62-5**, OW67-4, OW68-5, OW69-5, OW70B-5, OW71A-5[†], OW72-6, OW73-6, **OW75-3, OW76-5, OW77-4, OW78-4**, OW79-5, OW80-3, OW81-5, OW82-5, OW83-5, OW84-6, **OW85-5,** P1, P2, P3	Groundwater Levels	May and November
OW16-6, OW17-4, OW54A-4, OW56-4, OW57-4, OW58-6, OW59-6, **OW61-4, OW62-5**, OW67-4, OW68-5, OW69-5, OW70B-5, OW71A-5*, OW72-6, OW73-6, **OW75-3, OW76-5, OW77-4, OW78-4**	PLIL-GW, SLIL-GW	May and November
OW40E-4, OW60-4, OW79-5, OW80-3, OW81-5, OW82-5, OW83-5, OW84-6, **OW85-5**	PLIL-GW, SLIL-GW	May
OW16-6, **OW61-4, OW62-5, OW75-3, OW78-4**	Volatiles	May and November
OW17-4, OW40E-4, OW54A-4, OW56-4, OW57-4, OW58-6, OW59-6, OW60-4, OW67-4, OW68-5, OW69-5, OW70B-5, OW71A-5*, OW72-6, OW73-6, **OW76-5, OW77-4**, OW79-5, OW80-3, OW81-5, OW82-5, OW83-5, OW84-6, **OW85-5**	Volatiles	May
Interstadial Silt and Sand		
OW16-7, OW40A-7, OW46-7, OW47-6, OW54-10, OW57-15, OW58-17, OW60-8, **OW61-6, OW62-7**, OW67-11, OW72-10, OW73-9, **OW75-7, OW78-6**, OW79-7, OW80-6, OW81-7, OW82-14, OW83-9, OW84-11, **OW85-8**	Groundwater Levels	May and November
OW46-7, OW47-6, OW54-10, OW57-15, OW58-17, OW67-11, OW72-10, OW73-9	PLIL-GW, SLIL-GW	May and November
OW16-7, **OW61-6, OW62-7, OW75-7, OW78-6**	PLIL-GW, SLIL-GW, volatiles	May and November
OW40A-7 OW60-8, OW79-7, OW80-6, OW81-7, OW82-14, OW83-9, OW84-11, **OW85-8**	PLIL-GW, SLIL-GW	May
OW40A-7, OW46-7, OW47-6, OW54-10, OW57-15, OW58-17, OW60-8, OW67-11, OW72-10, OW73-9, OW79-7, OW80-6, OW81-7, OW82-14, OW83-9, OW84-11, **OW85-8**	Volatiles	May
Interface Aquifer		
OW17-30, OW19-29, OW39A-26, OW40A-28, OW49-29, OW60-25, **OW61-26, OW62-30**, OW79-26, OW80-27, OW81-27, OW82-28, OW83-29, OW84-31	Groundwater Levels	May and November
OW19-29, OW39A-26, OW49-29, OW79-26, OW80-27, OW81-27, OW82-28, OW83-29, OW84-31, Cemetery Well	PLIL-GW, SLIL-GW	May
OW19-29, OW39A-26, OW49-29, OW79-26, OW80-27, OW81-27, OW82-28, OW83-29, OW84-31, Cemetery Well	Volatiles	Biennial - May 2026
Background Station		
SS10, SS16	Flow Rates	Quarterly after 10 mm precipitation events. Greater than 1 month intervals between sampling.
	PLIL-SW, SLIL-SW, nitrite	
	LS-SW	Spring Precipitation Event
	Biomonitoring	Spring Precipitation Event
Sedimentation Ponds (Discharge Points)		
SP1, SP2, SP3, SP4	Flow Rates	Quarterly after 10 mm precipitation events. Greater than 1 month intervals between sampling.
	PLIL-SW, SLIL-SW, nitrite	
	LS-SW, volatiles, semi-volatiles	Quarterly after 10 mm precipitation events. Greater than 1 month intervals between sampling.
	Biomonitoring	Spring Precipitation Event
Western Site Boundary Compliance Point		
SS1	Flow Rates	Quarterly after 10 mm precipitation events. Greater than 1 month intervals between sampling.
	PLIL-SW, SLIL-SW, nitrite	
	LS-SW, volatiles, semi-volatiles	Quarterly after 10 mm precipitation events. Greater than 1 month intervals between sampling.
	Biomonitoring	Spring Precipitation Event
Poplar Tree Plantation Land Application Area		
SS17A, SS17B, SS18A, SS18B	Flow Rates	Quarterly after 10 mm precipitation events. Greater than 1 month intervals between sampling.
	PLIL-SW, SLIL-SW, nitrite	
	LS-SW, volatiles, semi-volatiles	Quarterly after 10 mm precipitation events. Greater than 1 month intervals between sampling.
	Biomonitoring	Spring Precipitation Event
Compost Facility (if constructed)		
SS19	PLIL-SW, SLIL-SW, nitrite, BOD_5, TSS, Total Coliform, Fecal Coliform, E. Coli	Prior to water use

Table 13
2025 Monitoring Program
Twin Creeks Environmental Centre - 2024 Annual Monitoring Report

Monitoring Locations	Parameters	Frequency
Landfill Gas Monitoring		
Landfill Cap	Inspections	Monthly (April to November)
GP1A, GP2, GP3, GP4, GP5, GP6, GP7, GP8, GP9, GP10	Methane Gas	January, February, March, April, July, November, December

Notes:
1) PLIL-GW indicates: chloride, nitrate, boron.

2) SLIL-GW indicates: alkalinity, sulphate, calcium, magnesium, potassium, sodium, barium, cadmium, iron, lead, DOC, TDS, ammonia (total), TKN, pH, conductivity. Field parameters of pH, conductivity, temperature, turbidity.

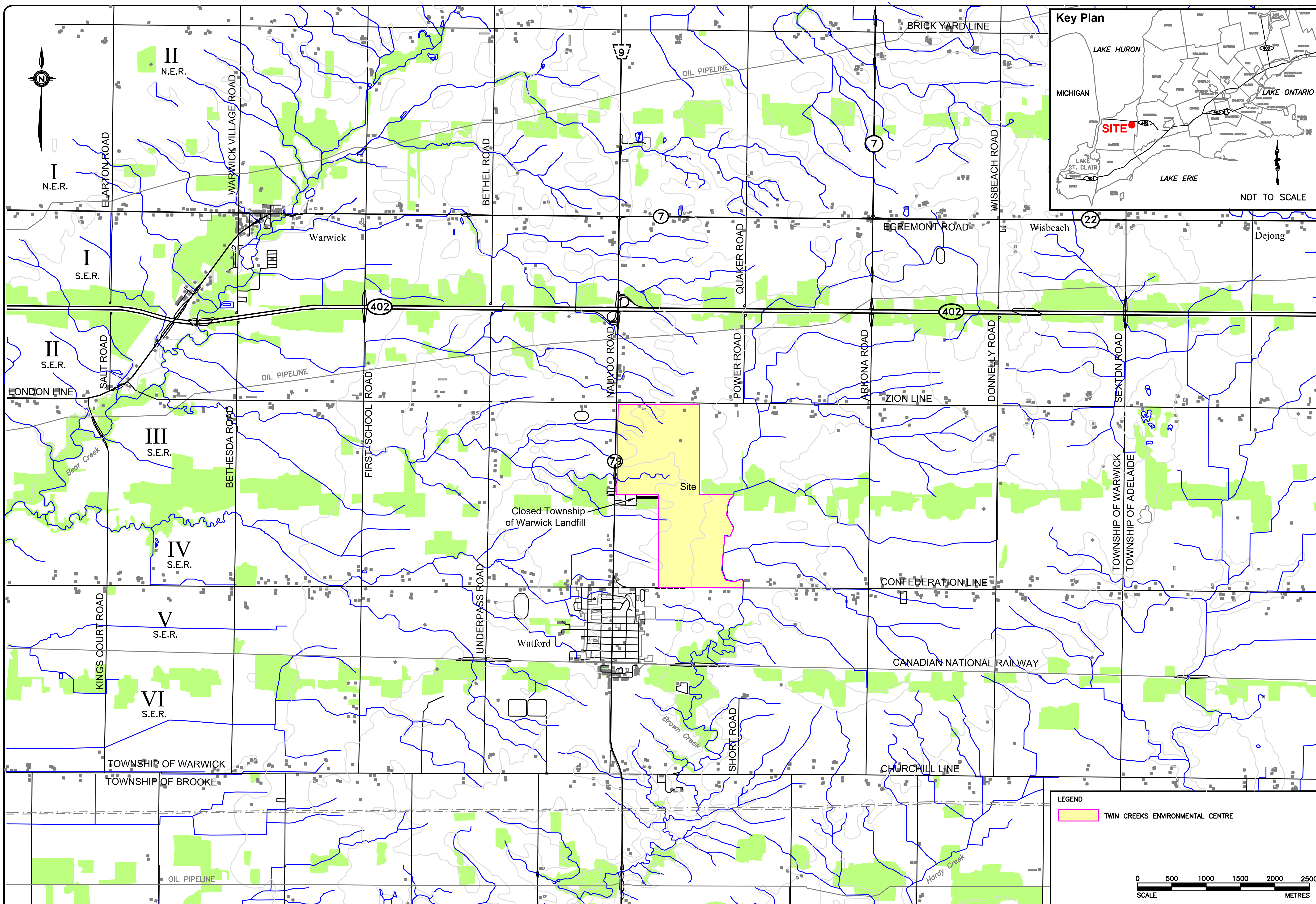
3) PLIL-SW indicates: chloride, ammonia (total and unionized), phenols, boron, nickel, chromium (total), zinc.
4) SLIL-SW indicates: alkalinity, sulphate, calcium, magnesium, potassium, sodium, total phosphorus, iron, nitrate, TKN, TDS, pH, conductivity. Field parameters of temperature, pH, conductivity, turbidity, DO.
5) LS indicates: arsenic, barium, cadmium, copper, lead, manganese, mercury, nitrite, TSS, volatiles, semi-volatiles, BOD_5, COD.
6) LS-SW indicates: arsenic, barium, cadmium, copper, lead, mercury, nitrite, TSS, BOD_5, COD.
7) Volatiles should include the following at a minimum: benzene, 1,4-dichlorobenzene, dichloromethane, toluene, ethylbenzene, xylenes, and vinyl chloride.
8) Semi-volatiles should include the following at a minimum: 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, hexachlorobenzene, diethylphthalate, dimethylphthalate, di-n-butyl phthalate, phenol, benzo(a)pyrene, 2,4,6-trichlorophenol, 2,4-dichlorophenol, pentachlorophenol.
9) Organochlorines include herbicide and pesticide scan.
10) Biomonitoring indicates toxicity testing for Rainbow Trout and Daphnia Magna.
11) Biennial indicates every second year.
12) QA/QC includes one (1) blind duplicate for each 15 samples or once per event, whichever is greater.
13) Surface water samples shall be collected in a downstream to upstream sequence.
14) OW84(new) denotes monitoring wells to be installed per EMP dated December 20, 2007.
15) Spring denotes: April, May, and June.
16) † indicates that OW71A-5 is not required as part of the monitoring program, however, obtained data is interpolated for the monitoring well OW67-4, which used to show dry conditions.

17) Since the Poplar Plantation is not required to be utilized until a few months prior to the initiation of the treatment plant as operational, monitoring per the EMP and ECA, as well as the Waste and Sewage ECA's that is completed to evaluate the vigour of the Poplar Plantation, is not required. It is recognized that once the Poplar Plantation is initialized, then the required monitoring to evaluate the Poplar Plantation would be reinitiated.

18) Monitoring stations that are currently idle until 2 months prior to the leachate treatment plant being operational, include the following: 1) Surface water stations **SS17A, SS17B, SS18A, SS18B**; and 2) Groundwater monitoring locations **OW61, OW62, OW75, OW76, OW77, OW78, AND OW85.**

FIGURES

FIGURES



MAP SOURCE:
FIGURE PROVIDED BY GENIVAR INC., FIGURE 1, FILE REF NO. 111-53111-00-F1-LM 12CM Q4, DATED FEBRUARY 2013.

WM WASTE MANAGEMENT

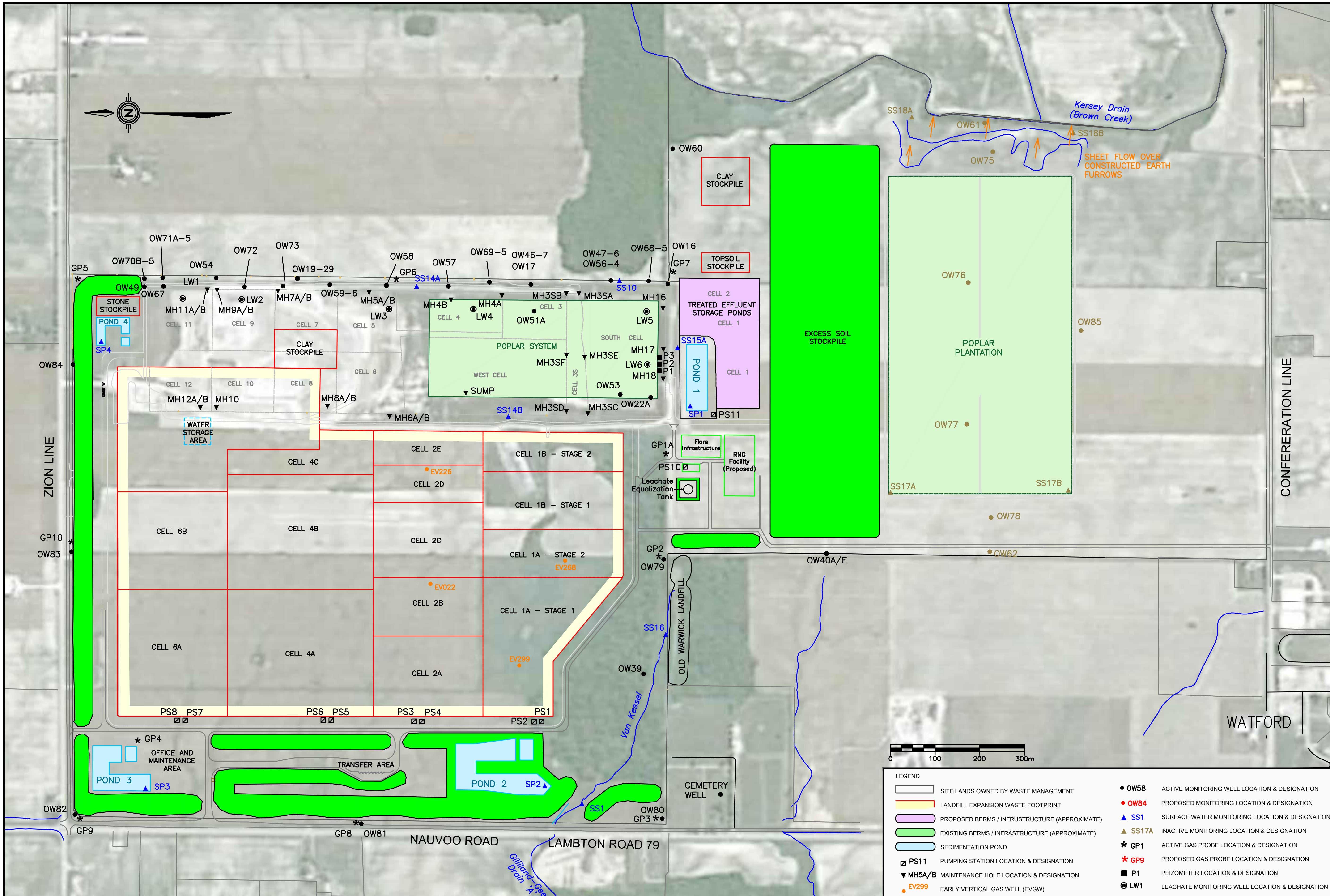
SITE LOCATION MAP
2024 COMPLIANCE MONITORING PROGRAM
TWIN CREEKS ENVIRONMENTAL CENTRE
TOWNSHIP OF WARWICK, ONTARIO

DWN BY: EW
CHK BY: PEJ
DATE: JANUARY 2024
SCALE: 1:50,000

WASTE MANAGEMENT OF CANADA CORP.

PROJECT FILE REF. NO.
2402553

FIGURE
1



LEGEND

	SITE LANDS OWNED BY WASTE MANAGEMENT
	LANDFILL EXPANSION WASTE FOOTPRINT
	PROPOSED BERMS / INFRUSTRUCTURE (APPROXIMATE)
	EXISTING BERMS / INFRUSTRUCTURE (APPROXIMATE)
	SEDIMENTATION POND
PS11	PUMPING STATION LOCATION & DESIGNATION
MH5A/B	MAINTENANCE HOLE LOCATION & DESIGNATION
EV299	EARLY VERTICAL GAS WELL (EVGW)
OW58	ACTIVE MONITORING WELL LOCATION & DESIGNATION
OW84	PROPOSED MONITORING LOCATION & DESIGNATION
SS1	SURFACE WATER MONITORING LOCATION & DESIGNATION
SS17A	INACTIVE MONITORING LOCATION & DESIGNATION
GP1	ACTIVE GAS PROBE LOCATION & DESIGNATION
GP9	PROPOSED GAS PROBE LOCATION & DESIGNATION
P1	PEIZOMETER LOCATION & DESIGNATION
LW1	LEACHATE MONITORING WELL LOCATION & DESIGNATION

NOTE: LOCATION OF CONSTRUCTION SEDIMENTATION PONDS, BERMS, POPLAR PLANTATION, TREATMENT PLANT, & EFFLUENT LAGOONS FROM NOVEMBER 2010 SURVEY PLAN.

MAP SOURCE:
AERIAL PHOTO PROVIDED BY GOOGLE EARTH (2011), ACCESSED ON JANUARY 2014.
FIGURE PROVIDED BY GENIVAR INC., FIGURE 2, FILE REF NO. 111–53111–00–F2–SP 12CM Q4, DATED FEBRUARY 2013.

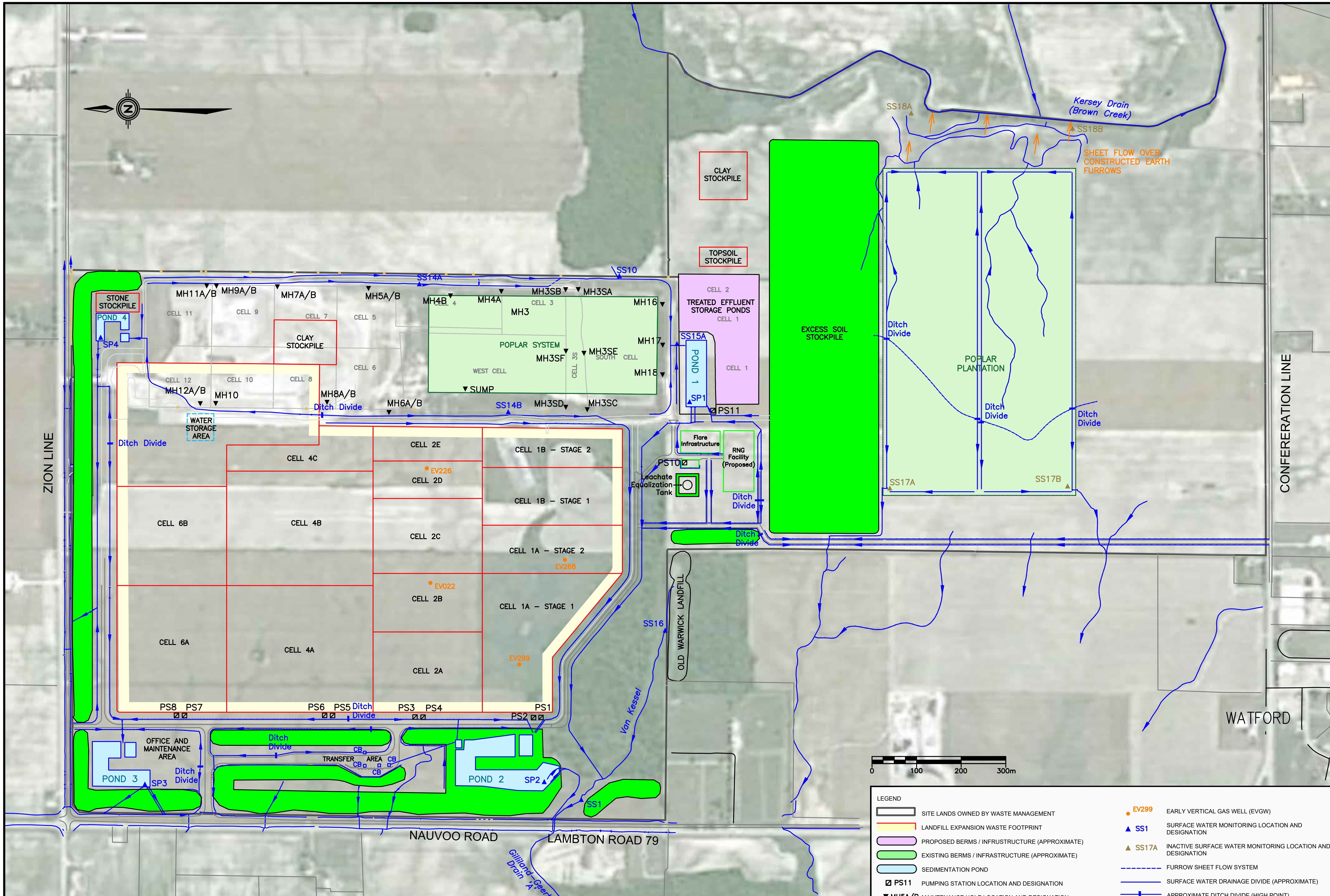
WM WASTE MANAGEMENT

SITE PLAN

2024 COMPLIANCE MONITORING PROGRAM
TWIN CREEKS ENVIRONMENTAL CENTRE
TOWNSHIP OF WARWICK, ONTARIO

DWN BY: EW
CHK BY: JCL
DATE: December 2024
SCALE: 1:8,000
WASTE MANAGEMENT OF CANADA CORP.
PROJECT FILE REF. NO. 2402553

FIGURE 2



NOTE:
LOCATION OF CONSTRUCTION SEDIMENTATION PONDS, BERMS, POPLAR PLANTATION, TREATMENT PLANT, & EFFLUENT LAGOONS FROM NOVEMBER 2010 SURVEY PLAN.

MAP SOURCE:
AERIAL PHOTO PROVIDED BY GOOGLE EARTH (2011), ACCESSED ON JANUARY 2014.
FIGURE PROVIDED BY GENIVAR INC., FIGURE 3, FILE REF NO. 111-53111-00-F3-SP 12CM Q4, DATED JANUARY 2013.

RWDI

WM WASTE MANAGEMENT

SURFACE WATER SYSTEM
2024 COMPLIANCE MONITORING PROGRAM

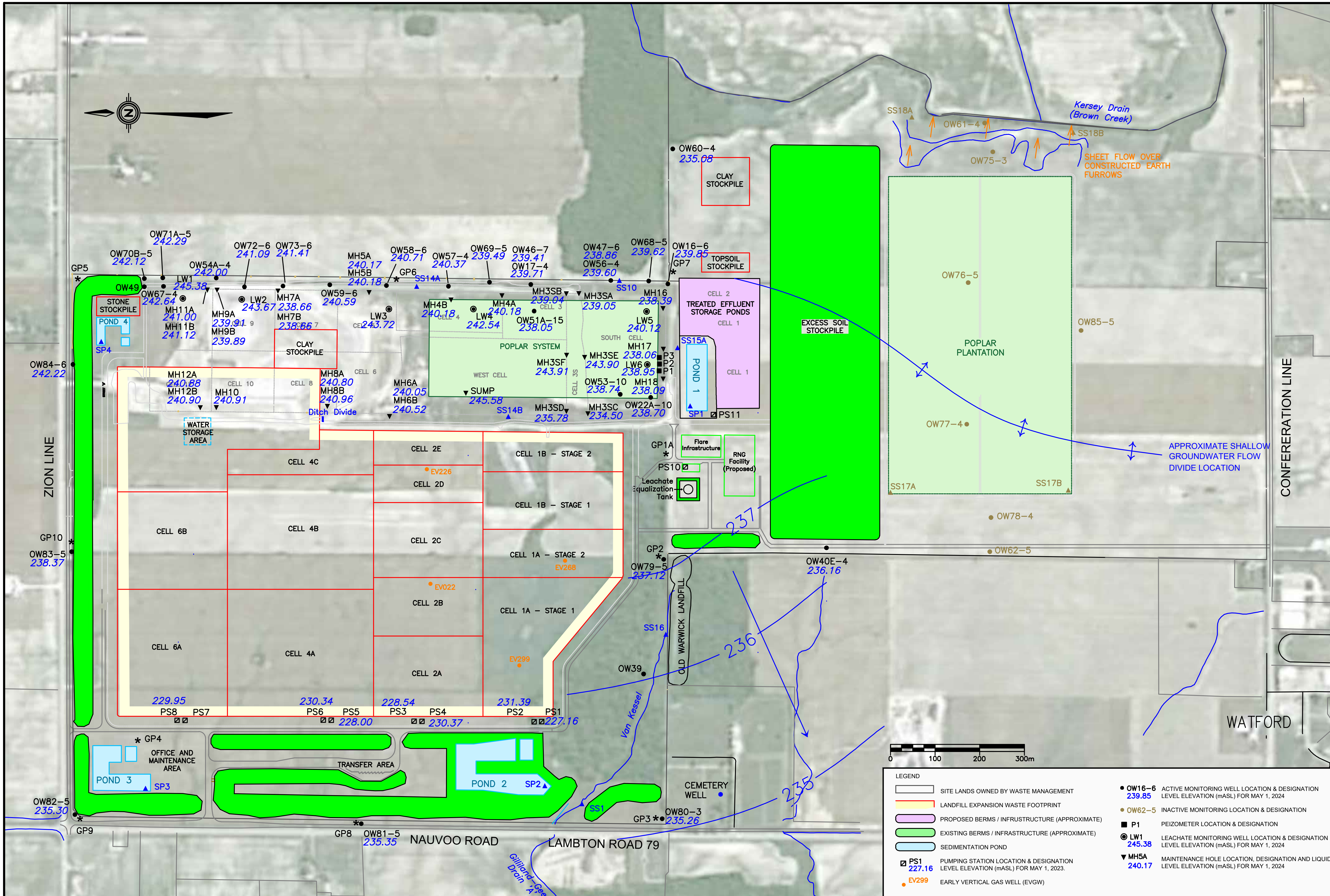
TWIN CREEKS ENVIRONMENTAL CENTRE
TOWNSHIP OF WARWICK, ONTARIO

DWN BY: EW DATE: November 2024
CHK BY: JCL SCALE: 1:8,000

WASTE MANAGEMENT OF CANADA CORP.

PROJECT FILE REF. NO. 2402553

FIGURE 3



MAP SOURCE:
AERIAL PHOTO PROVIDED BY GOOGLE EARTH (2011), ACCESSED ON JANUARY 2014.
FIGURE PROVIDED BY GENIVAR INC., FIGURE 2, FILE REF NO. 111-53111-00-F2-SP 12CM Q4, DATED FEBRUARY 2013.

NOTE: LOCATION OF CONSTRUCTION SEDIMENTATION PONDS, BERMS, POPLAR PLANTATION, TREATMENT PLANT, & EFFLUENT LAGOONS FROM NOVEMBER 2010 SURVEY PLAN.

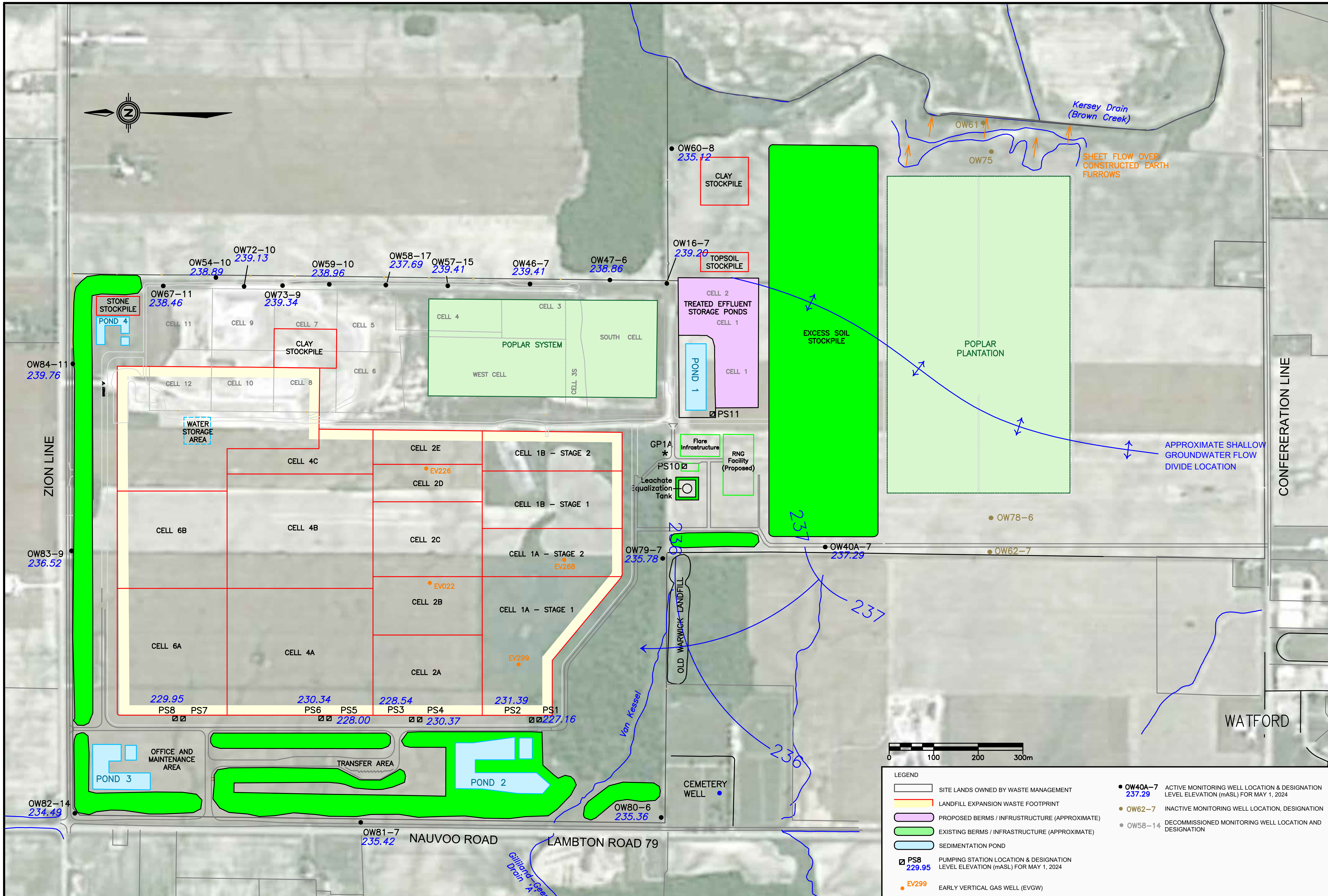
RWDI

WM WASTE MANAGEMENT

LEACHATE & SHALLOW GROUNDWATER ELEVATIONS
2024 COMPLIANCE MONITORING PROGRAM
TWIN CREEKS ENVIRONMENTAL CENTRE
TOWNSHIP OF WARWICK, ONTARIO

DWN BY: EW
CHK BY: JCL
DATE: January 2025
SCALE: 1:8,000
WASTE MANAGEMENT OF CANADA CORP.
PROJECT FILE REF. NO. 2402553

FIGURE 4



MAP SOURCE:
AERIAL PHOTO PROVIDED BY GOOGLE EARTH (2011), ACCESSED ON JANUARY 2014.
FIGURE PROVIDED BY GENIVAR INC., FIGURE 2, FILE REF NO. 111-53111-00-F2-SP 12CM Q4, DATED FEBRUARY 2013.

NOTE: LOCATION OF CONSTRUCTION SEDIMENTATION PONDS, BERMS, POPLAR PLANTATION, TREATMENT PLANT, & EFFLUENT LAGOONS FROM NOVEMBER 2010 SURVEY PLAN.

RWDI

WM WASTE MANAGEMENT

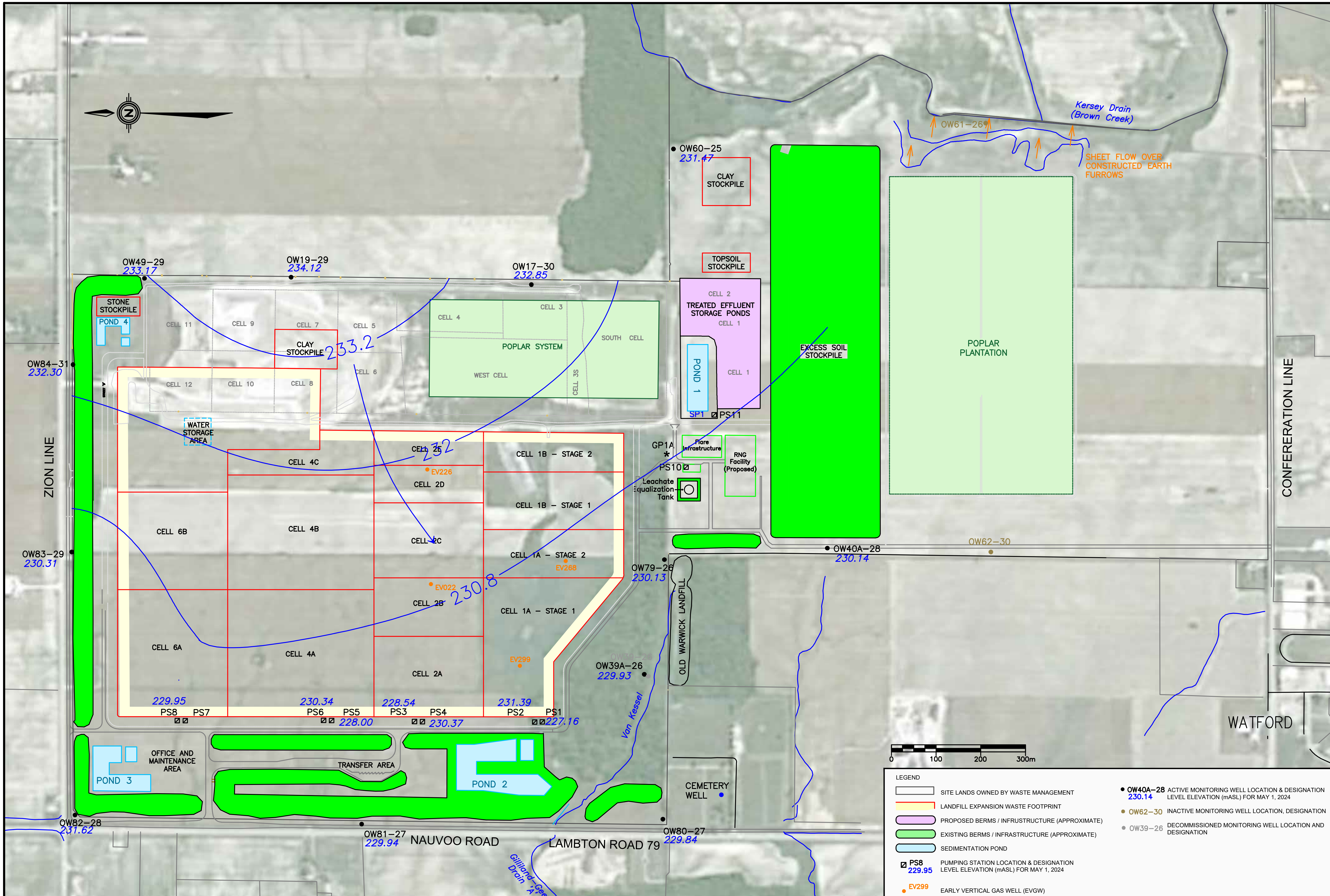
INTERSTADIAL SILT AND SAND GROUNDWATER ELEVATIONS
2024 COMPLIANCE MONITORING PROGRAM
TWIN CREEKS ENVIRONMENTAL CENTRE
TOWNSHIP OF WARWICK, ONTARIO

DWN BY: EW
CHK BY: JCL
DATE: December 2024
SCALE: 1:8,000

WASTE MANAGEMENT OF CANADA CORP.

PROJECT FILE REF. NO. 2402553

FIGURE 5



MAP SOURCE:
AERIAL PHOTO PROVIDED BY GOOGLE EARTH (2011), ACCESSED ON JANUARY 2014.
FIGURE PROVIDED BY GENIVAR INC., FIGURE 2, FILE REF NO. 111-53111-00-F2-SP 12CM Q4, DATED FEBRUARY 2013.

NOTE: LOCATION OF CONSTRUCTION SEDIMENTATION PONDS, BERMS, POPLAR PLANTATION, TREATMENT PLANT, & EFFLUENT LAGOONS FROM NOVEMBER 2010 SURVEY PLAN.

RWDI

WM WASTE MANAGEMENT

INTERFACE AQUIFER GROUNDWATER ELEVATIONS
2024 COMPLIANCE MONITORING PROGRAM
TWIN CREEKS ENVIRONMENTAL CENTRE
TOWNSHIP OF WARWICK, ONTARIO

DWN BY: EW
CHK BY: JCL
DATE: December 2024
SCALE: 1:8,000
WASTE MANAGEMENT OF CANADA CORP.
PROJECT FILE REF. NO. 2402553

FIGURE 6