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11.0 Commitments and Monitoring

This Section summarizes the commitments made throughout the EA and the monitoring program that will ensure compliance with the EA commitments and measure the performance of the landfill. A list of all commitments made in this EA has been summarized in Section 11.1.

Compliance monitoring will be carried out to ensure that all commitments are met. Environmental monitoring will also be completed to identify any unexpected effects and determine when Adaptive Management may be required. Compliance monitoring and environmental monitoring are described in Sections 11.2.1 and 11.2.2, respectively. An Adaptive Management Plan is described in Section 11.3.

11.1 Summary of Commitments

Throughout this EA, various commitments have been made with respect to the detailed design, construction, operation and closure of the St Marys Landfill expansion. For the purpose of this section:

- Detailed design refers to the period of time between EA approval and the commencement of construction activities;
- Construction refers to the period of time when construction activities are occurring and it should be noted that construction and operations will occur concurrently;
- Operations refers to the operating life of the landfill; and
- Closure refers to the period of time after the landfill has stopped receiving waste but while monitoring and maintenance activities continue. (see Section 6.2).

A full list of EA commitments by project phase is provided in Table 11-1, including where the commitment was made in the EA document or in consultation during the final EA review period. In addition, Table 9.1 details the mitigation measures that will be used to minimize the predicted negative effects to the environment. Not all mitigative measures have been repeated in this section. Section 9.0 summarizes the additional studies or updates to studies that will be undertaken as part of detailed design and the Environmental Protection Act Approvals.; not all of these have been repeated in the Summary of Commitments table.

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Table 11-1: Summary of EA Commitments

Project Phase	EA Report Reference	EA Commitment
Detailed Design	Section 7.4.2	Review and re-model potential odour impacts based on the detailed design plans. From the modelling, the Town will identify and develop plans for additional mitigation, monitoring, and contingency measures for odour as needed.
	Section 9.0	During detailed design, provide an updated Hydrogeological Study to MECP and UTRCA. The updated hydrogeological study will assess the interaction of the expanded waste footprint, with its liner and leachate collection system, and the sand-silt seam. We anticipate the detailed design will prevent such interactions, monitoring will be in place to detect any interaction, and contingency measures will be available should interactions occur.
	Sections 11.2 and 11.3	Update existing Annual Monitoring Program to include additional monitoring stations, parameters, triggers and other changes detailed in Sections 11.2 Monitoring Program and 11.3 Adaptive Management Plan. This updated Annual Monitoring Program will be reviewed and approved by MECP as part of the ECA approval process. Annual Monitoring Reports will continue to be submitted to MECP.
	Section 11.2.1	The Town will submit an annual Compliance Monitoring Report to MECP to document how the commitments in Table 11.1 are being carried out until all of the commitments have been fulfilled.
	Section 8.25 and Section 9.0	During detailed design, develop a detailed Watercourse Realignment Plan for approval by DFO and UTRCA. Design the watercourse realignment in accordance with the principles of Natural Channel Design. Ensure the mitigation measures identified by DFO are incorporated into the design.
	Section 8.2.6 and Section 9.0	Develop a Stormwater Management Plan and submit to MECP and UTRCA for approval prior to construction. Plan will provide additional detail including velocities at the basin outlets for various storm events, cross sections of the stormwater facilities showing flood water surface elevations for the 100 and 250 year storm event as well as pond inlet and outlet details.

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Project Phase	EA Report Reference	EA Commitment
	Section 7.7.1 and Table 9-1	An Erosion and Sediment Control (ESC) Plan/ Dewatering Plan will be developed and submitted to UTRCA and MECP for review.
	Table 9.1	Opportunities for habitat enhancement and increased net environmental benefit for any terrestrial or aquatic habitat removed as part of the landfill expansion works will be further assessed and incorporated during the detailed design phase. These measures will be developed in consultation with the UTRCA.
	Table 7-2 Table 9-1	<p>A Tree Inventory and Landscape Plan will be completed for the landfill property including the following mitigation measures:</p> <ul style="list-style-type: none"> • Complete a Tree Inventory and Landscape Plan for the landfill property. • Tree replacement will be at a 10:1 ratio. For clarity, this means that ten tree seedlings will be planted for each tree that is removed. Replacement seedlings will be located on the landfill property or another Town property, if space does not permit. • Install woody plants adjacent to the realigned watercourse to enhance watercourse shading, fish, and wildlife habitat, as well as improve tree cover within the watershed. • Revegetate disturbed areas including closed landfill cells as soon as possible with native groundcover species to minimize potential for reseeding of non-native and/or invasive species. • Conduct post-construction monitoring of plantings for vegetation success. Replacements may be necessary where vegetation does not survive.
	Section 8.2.5	As part of Watercourse Realignment Plan identify measures for turtle, snake and other habitat enhancement and aquatic habitat enhancements where possible and incorporate into the detailed design. This Plan will be submitted to UTRCA and DFO for review and to secure the relevant permits prior to construction.

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Project Phase	EA Report Reference	EA Commitment
	Consultation Record, Vol IV, Appendix I	<p>Contact all relevant utilities to identify potential effects , with particular attention to:</p> <ul style="list-style-type: none"> • Union Gas: Provide preliminary plans to Union Gas to identify any conflicts with the natural gas main located in the east side of County Road 123/Water Street S., and a station southwest of the existing landfill site.
	Section 8.2.7	Consult with the St. Marys Fire Department during the detailed design to ensure that site access and interior roads meet fire route requirements in accordance with applicable municipal by-law(s).
	Section 8.4	Review and update existing Complaint Response Framework which identifies procedures for documenting, investigating, responding to and reporting on complaints.
	Section 8.5	Review and update existing Emergency Response and Communications Plan which identifies procedures for responding to emergencies and ensuring clear and appropriate public and agency communication.
	Section 8.7.6	Prepare a Closure Plan at least two years prior to closure of the landfill site as per the current ECA governing site operations and obtain MECP approval prior to closure.

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Project Phase	EA Report Reference	EA Commitment
	Section 8.3	<ul style="list-style-type: none"> • During detailed design, an Indigenous Consultation Plan will be developed to direct consultation with Indigenous communities throughout the remainder of the detailed design, operations and closure/post-closure phases. At a minimum it will include: • Opportunities for Indigenous communities to review the detailed design documents and reports required for other approvals; • Meetings between the Town and interested Indigenous communities to discuss opportunities for involvement of community members, accommodations, and mutual benefits including opportunities to participate in field monitoring during construction and operation; • Town led landfill tours offered to interested Indigenous communities; • The Town will notify Indigenous communities if there are changes to the landfill's ECA throughout the operational period and if there are any emergency or spill-related situations that pose a risk to the Thames River; and • The Town will notify interested Indigenous communities of the landfill's closure and post closure monitoring plans.

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Project Phase	EA Report Reference	EA Commitment
	Section 8.3	<p>Work with regulators to acquire all necessary permits and/or approvals pursuant to the:</p> <ul style="list-style-type: none"> • Environmental Protection Act • Ontario Water Resources Act • Conservation Authorities Act • Endangered Species Act • Fisheries Act • Fish and Wildlife Conservation Act • Others, as identified during the design phase • As part of the ECA application pursuant to the Environmental Protection Act the Town will submit an updated Design and Operations Report which addresses the requirements of O.Reg. 232/98 under the Act.
	Table 7-2, Table 9-1	Complete the online project registration to address removal of Eastern Meadowlark Habitat under the conditional exemptions outlined in O. Reg. 830/21 of the Endangered Species Act or pay the species conservation charge to the Species at Risk Conservation Trust.
	Section 8.3	The Town commits to consulting with Hydro One during all stages as the project progresses. Hydro One will be provided with an opportunity to review and comment on the design plan prior to finalization. Future communications about this project will be sent electronically to SecondaryLandUse@HydroOne.com .
	Section 7.7.1 and Table 9.1	Survey the site for Bank Swallow habitat prior to any site alteration. Contact the Permissions and Compliance of Species at Risk Branch (SAROntario@ontario.ca) for guidance under the <i>Endangered Species Act, 2007</i> if Bank Swallow is found to be nesting on site. Should Bank Swallow be found nesting on-site, apply a 50 m buffer around the active nest.”

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Project Phase	EA Report Reference	EA Commitment
	Section 8.3	Contact the Impact Assessment Agency of Canada to confirm if an IAAC review is required, should details or design aspects of the Project change such that the Project may include physical activities that are described in The Physical Activities Regulations under the Impact Assessment Act.
	Section 8.3	Contact the NDMNRF should there be any potential need for a permit under the Petroleum Wells & Oil, Gas and Salt Resource Act, or Public Lands Act & Lakes and Rivers Improvement Act. Obtain approvals as required.
	Section 7.8.2 and Table 9-1	Should the proposed work extend the current study area, then further Stage 1 Archaeological Assessment (and further assessments, if recommended) will be conducted by a licensed archaeologist as early as possible during detailed design and prior to ground disturbing activities.
	Section 7.8.1 and Table 9-1	Construction activities and staging should be suitably planned and undertaken to avoid impacts to identified cultural heritage resources.
	Section 7.8.1 and Table 9-1	Once detailed designs of the proposed work are available, the Cultural Heritage Resources Assessment will be updated with a confirmation of impacts of the undertaking on cultural heritage resources identified within and/or adjacent to the study area and will recommend appropriate mitigation measures. Mitigation measures may include, but are not limited to, completing a heritage report, or employing suitable measures such as landscaping, buffering or other forms of mitigation, where appropriate. In this regard, provincial guidelines should be consulted for advice and further heritage assessment work should be undertaken as necessary.
	Section 7.8.1 and Table 9-1	Should future work require an expansion of the study area, the a qualified heritage consultant should be contacted in order to confirm the impacts of the proposed work on potential heritage resources.
Construction		
Construction	Table 9-1	Carry out construction in accordance with the mitigation measures described in Table 9-1.

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Project Phase	EA Report Reference	EA Commitment
	Section 8.3	Notify the DFO greater than 10 days prior to the construction of the landfill expansion commencing.
	Section 8.3	Keep the DFO letter, dated October 4, 2021 and/or any subsequent letters and approvals, on Site during the construction period to ensure all noted mitigation measures are implemented.
	Table 9-1	Conduct two years of post-construction monitoring of the realigned watercourse and any watercourse monitoring requirements identified by DFO or UTRCA during the permitting process. Monitoring results will be presented in the Annual Monitoring Report prepared for MECP.
	Section 8.3	Engage with HDI to identify opportunities where community representatives may participate in field monitoring during construction.
Operation	Section 3.1.3.6	Review available diversion programs every 10 years and meet any future diversion targets set out in provincial policy.
	Table 9.1	Carry out landfill operations in accordance with the mitigation measures described in Table 9.1.
	Section 8.4 and 8.5	Enact the site's complaint-response procedures and emergency response plans, as required. Document and report on actions taken in Annual Monitoring Reports.
	Section 11.2 and 11.3	Undertake the landfill site's updated Annual Monitoring Program and reporting and enact any adaptive management, as required, in accordance with the Adaptive Management Plan and the approved ECA and in consultation with MECP.
	Table 7-2 and Section 11.2	Maintain existing monitoring wells located within the CKD Stockpile for use in determining groundwater contours and flow direction at the site. Sample these wells as part of Annual Monitoring Program) until sampling results show stable or predictable results to the satisfaction of MECP and then discontinue monitoring.
	Table 7-2 and Section 11.2	Continue to monitor the five private wells which are currently part of the landfill's updated Annual Monitoring Program.
	Section 9.2.1	Review and update dust suppressant procedures should dust concerns become apparent i.e., if complaints rise significantly.

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Project Phase	EA Report Reference	EA Commitment
	Section 8.3	Submit Annual Monitoring Reports to HDI for review.
	Section 8.3	Meet annually with the Walpole Island First Nation to discuss annual monitoring reports, landfill performance and potential benefits and opportunities that the work may present for the Walpole Island First Nation. At each meeting it will be determined if additional meetings are required.
	Section 8.3	Notify Indigenous communities any changes to the landfill's ECA throughout the operational period.
	Section 8.3	Notify Indigenous communities of any emergency or spill-related situations that pose a risk to the Thames River, as required.
Closure and Post-Closure	Table 7-2 and Section 8.7.6	At least 2 years prior to closure of the landfill, a Closure Plan will be prepared in and circulated in accordance with the ECA for site operations and the landfill will be closed in accordance with the approved Closure Plan.
	Table 9.1	Carry out landfill closure and post-closure activities in accordance with the mitigation measures described in Table 9.1.
	Table 7-2 and Section 8.7.6	Maintain the site's surface water and leachate management facilities, plus inspect and repair areas of settlement, erosion, or leachate seeps for the duration of the post-closure period.
	Section 11.2	Complete annual monitoring and submit Post-operational Monitoring Reports for the post-closure period to MECP in accordance with the ECA and this EA.
	Section 8.3	Notifying interested Indigenous communities of the landfill's closure and post-closure monitoring plans.

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11.2 Monitoring Program

A comprehensive updated monitoring program is a critical element of the landfill expansion project informing detailed design, operation and closure. The monitoring program serves several functions, as follows:

- EA compliance monitoring will ensure compliance with EA commitments and approval conditions set out in Table 11.1.
- Environmental conditions monitoring will be on-going and will inform detailed design activities, and confirm effects are as predicted. This information will also be used to inform the Adaptive Management framework to identify where changes to the design or operation may be required to ensure effects are minimized.
- Environmental effects monitoring will measure the effects of landfill operation. This includes the environmental effects monitoring and reporting that will be carried out under subsequent Environmental Compliance Approvals. This monitoring will also inform the Adaptive Management Framework.

Each of these types of monitoring is detailed below.

11.2.1 EA Compliance Monitoring

Compliance monitoring refers to the monitoring carried out to ensure that all project phases are carried out in a manner that is compliant with this EA and that all the commitments listed in Table 11-1 have been carried out.

Some of the commitments will be carried out by the Town, while others will be the responsibility of various engineering and construction contractors. Any contractor responsibilities will be clearly specified in bid and tender documents to ensure they are carried out. The Town will ultimately be responsible for ensuring that contractors complete all required commitments.

The Town will submit an annual Compliance Monitoring Report to MECP to document how the commitments in Table 11.1 are being carried out until all of the commitments have been fulfilled.

11.2.2 Environmental Effects Monitoring

Effects monitoring refers to monitoring used to ensure that the magnitude, frequency and duration of the effects of the construction, operation and closure of the landfill are as expected. The existing and updated monitoring program is on-going and will be carried out for the full operational period of the landfill and will continue into the post-closure period. For the purposes of this EA, the post-closure period is assumed to be 50 years, but the actual length will depend on leachate contaminant levels.

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This program specifically targets identifying effects to groundwater and surface water quality due to landfill operations as a result of the uncertainties identified in the effects assessment and the risks of leachate migration off-site.

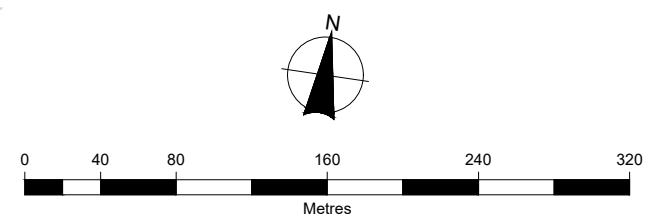
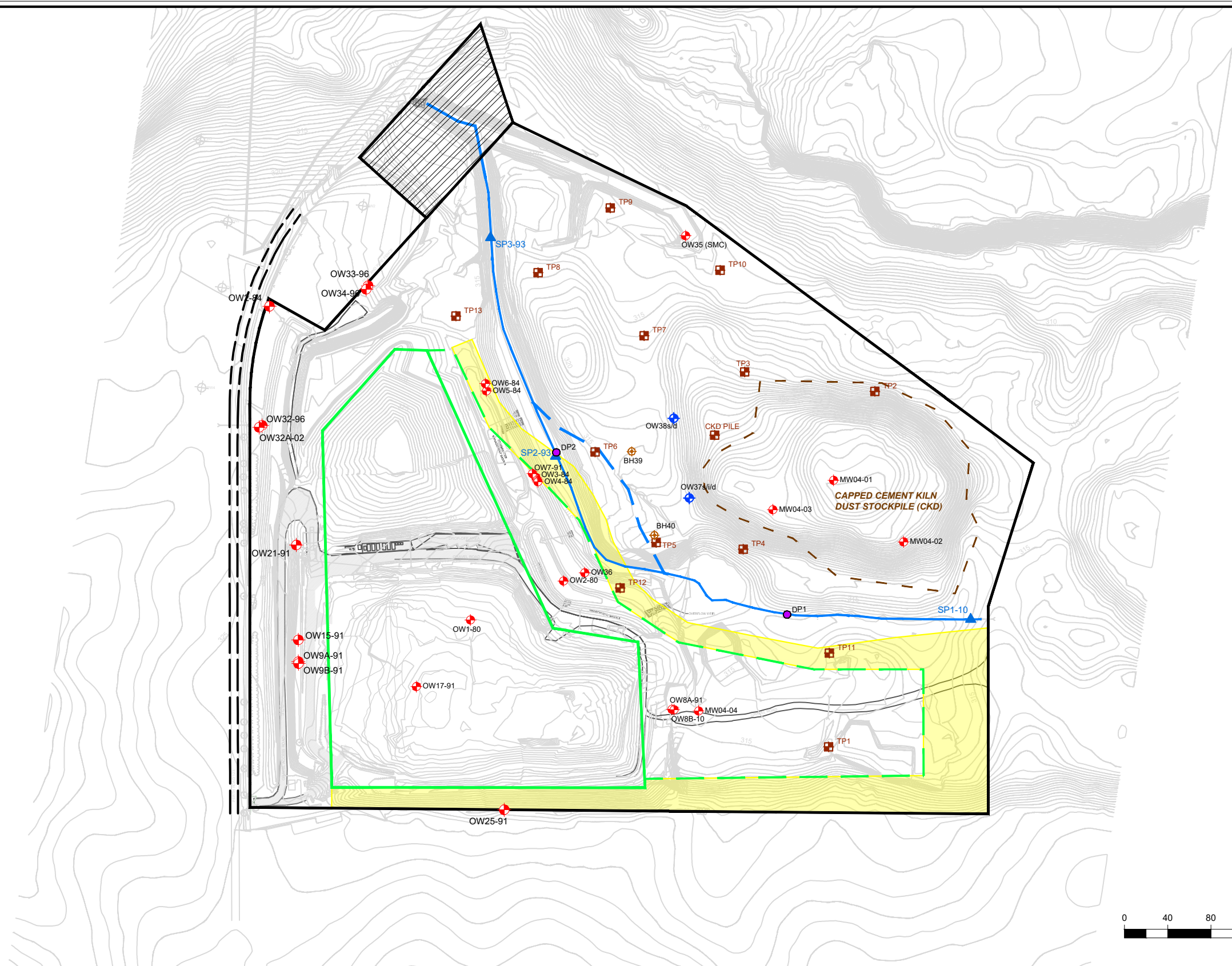
Effects monitoring will be documented in the landfill's Annual Monitoring Reports, submitted to MECP as a requirement under the landfill's ECA. Within the annual monitoring report an 'Opinion' section will be included which discusses, based on the ground and surface water monitoring results, whether additional mitigation or contingency measures are necessary. This opinion will be reviewed each year and updated as required. The Town commits to including in the ECA application a section that discusses how the Town will determine when mitigation measures need to be implemented and the inclusion of an 'Opinion Section' in the annual monitoring report. Furthermore, should the Town's consultant determine that the contingency measures are necessary immediately, the MECP will be notified directly.

Monitoring is carried out through water sampling at a number of monitoring wells and stations, as shown on Figure 11-1.

Annual monitoring is currently carried out at the landfill and updates are proposed to the program as a result of the landfill expansion. The updated Annual Monitoring Program is based on the existing program, and incorporates the changes recommended in Vol I, Appendix D. It is to be implemented as part of both the EA and the ECA approval process. The program also considers the following MECP documents that have come into effect since 1992, when the original monitoring program was developed:

- Landfilling Sites, Ontario Regulation 232/98;
- Landfill Standards: A Guidelines on the Regulatory and Approval Requirements for New or Expanding Landfill Sites, January 2021, Schedule 5: Groundwater, Leachate and Surface Water Monitoring Parameters;
- Monitoring and Reporting for Waste Disposal Sites, Groundwater and Surface water, Technical Guidance Document, MOE, November 2010; and
- Guide on Aspects of Hydrogeological Assessment for New and Expanding Landfilling Sites, DRAFT (V.9), March 2022.

The type of monitoring and water quality parameters to be sampled are summarized in Table 11-2, Table 11-3 and Table 11-4. General site conditions should be documented during each site visit including, but not limited to, condition of landfill cover, erosion, leachate seeps, blown litter, odours, conditions of each monitoring location, and wells needing repair. This updated Annual Monitoring Program will be further refined during the ECA approval process following EA approval.



LEGEND	
	PROPERTY LINE
	APPROXIMATE CKD PILE COVER LIMIT
	EXISTING WATERCOURSE
	PROPOSED WATERCOURSE ALIGNMENT
	EXISTING LIMIT OF WASTE
	EXPANSION REFUSE LIMIT
	EXISTING CONDITIONS CONTOURS
	MONITORING WELL (RJB, 2022)
	MONITORING / OBSERVATION WELL
	TESTPIT
	SURFACE WATER SAMPLING LOCATION
	BOREHOLE (RJB, 2022)
	DRIVE POINT PIEZOMETER
	PERIMETER INFRASTRUCTURE
	RIGHT-OF-WAY AND SEWER EASEMENT



TOWN OF ST. MARYS

Figure Title			
FUTURE SOLID WASTE DISPOSAL EA			
LOCATION OF MONITORING WELLS			
Drawn	Checked	Date	Figure No.
SK	TR	JUNE 2022	
Scale	Project No.		11-1
1:4,000	300032339		

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Table 11-2: Ground & Surface Water Monitoring Program Summary

Groundwater Monitoring Wells		
Station	Water Level	Water Quality
OW2-84 (Background O/B)	WL	GWQ
OW8A-91	WL	GWQ
OW8B-10	WL	GWQ
OW9A-91 ³	WL	GWQ
OW9B-91 ³	WL	GWQ
OW15-91 ³	WL	GWQ
OW21-91 ³	WL	GWQ
OW25-91 (Background O/B)	WL	GWQ
OW32-96	WL	GWQ
OW33-96 (P/L) ⁴	WL	GWQ
OW34-96 (P/L) ⁴	WL	GWQ
OW32A-02 (P/L) ⁴	WL	GWQ
OW37S-22 ¹	WL	GWQ
OW37I-22 ¹	WL	GW
OW37D-22 ¹	WL	GWQ
OW38S-22 ¹	WL	GWQ
OW38D-22 ¹	WL	GWQ
MHB	WL	GWQ
Surface Water Stations		
Station	Flow (F), Water level (WL)	Water Quality
SP1-10 (upstream)	WLF	SWQ
SP2-93 (midstream) ³	WLF	SWQ
SP3-93 (downstream)	WLF	SWQ
West SWM Basin		
Inlet	WLF	SWQ
Outlet	WLF	SWQ
East SWM Basin⁵		
Inlet	WL	SWQ
Outlet	WL	SWQ

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Table 11-3: Groundwater Monitoring Program Summary

Surface Water Stations		
Station	Flow (F), Water level (WL)	Water Quality
Leachate Manholes⁶		
MH1 (Phase I)	WL	LQ
MH3 (Phase II/III)	WL	LQ

Notes:

1. OW3-84, OW4-84, OW5-84, OW6-84, OW7-91, and OW36 will be decommissioned and replaced by OW37S, OW37I-22, OW37D-22, OW38S-22, and OW38D-22. OW37S-22 and OW38D may have insufficient water to collect a sample)
2. Record observations of sedimentation build up in Basin
3. SP2-93, OB9A-91, OW9B-91, OW15-91 and OW21-91 might have to be decommissioned to facilitate site construction. (Replacement wells proposed in Area 6 (Figure D-7).
4. Located along property limit (P/L) for Reasonable Use Assessment
5. SWM Basins A & B will continue to be monitored until they are replaced by the West and East SWM Basins
6. Monitoring of noted leachate manholes will be discontinued and replaced with new monitoring locations when the landfill expansions leachate collection system is constructed and operating.

O/B – Overburden; WL= Water level; WLF= water level and or flow conditions; GWQ = Groundwater Quality – Schedule 5; SWQ = Surface Water Quality; LQ = Leachate Quality; Flow = Flow Measurement
It is recommended that at least two duplicate water quality samples be collected for blind laboratory analysis (Approximately 1 duplicate should be collected for every 10 samples submitted to the Laboratory for analysis).

Table 11-4: Water Quality Parameters

Sample Type	Schedule 5 Parameters	Special considerations
Groundwater Monitoring Wells (GWQ)	Column 2: Indicator List for Groundwater plus: total phosphorus, hardness, manganese, potassium, bicarbonate and carbonate.	Schedule 5: Column 1: Comprehensive list for Groundwater plus hardness, bicarbonate and carbonate at: OW37S, OW37I, OW37D, OW38S, OW38D, MHB, OW2-84 and OW25-91
Surface Water Stations (SWQ)	Column 4: Indicator List for Surface Water plus: boron, hardness, magnesium, manganese, sodium, calcium, potassium, bicarbonate & carbonate.	
Leachate wells and manholes (LQ)	Column 2: Indicator List for Leachate, plus: total phosphorus, hardness, manganese, potassium, bicarbonate, and carbonate	

Notes:

Based on MECP (January 2012) Landfill Standards Schedule 5 groundwater and surface water quality parameters with the following notes:

- potassium was added as an indicator for CKD pile contaminants.

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Sample Type	Schedule 5 Parameters	Special considerations
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- Total Phosphorus, hardness, boron and manganese are current landfill indicators (2021 Monitoring Report, GM BluePlan, 2022).
- Magnesium, sodium, calcium, bicarbonate, and carbonate were added to facilitate analysis using trilinear plots (Piper Plots).

11.3 Adaptive Management Plan

To ensure the landfill expansion and realignment of the watercourse function as anticipated, an approach to ongoing management is required to identify and assess the need for changes to the project to minimize unanticipated effects. Adaptive Management provides a framework to achieve this using monitoring information. Adaptive Management is a systematic process for improving the function or operation of a project throughout the project life. Information obtained from monitoring is used to identify issues and risks before they become undesirable environmental effects such that management or design changes can be implemented promptly.

An Adaptive Management Plan will be in place to address unanticipated effects that may arise. This section provides procedures to follow if site design and environmental control measures do not function as anticipated.

The landfill expansion project is occurring on a complex landscape which includes the existing landfill site, the operations of SMC, the CKD pile and drainage from these industrial activities. This complexity creates some uncertainty with respect to how different activities on the site may interact or have influence on each other. Information obtained from the environmental effects monitoring will be used to identify issues and risks before they become undesirable environmental effects such that management or design changes can be implemented promptly.

Given that the project is an expansion of an existing landfill the site conditions are well known as are the effects of operation. This EA process has identified that there are some uncertainties associated with the potential effects to groundwater quality as the landfill expands to the north east closer to the CKD pile and with the realignment of the watercourse and the potential for impacts to surface water quality from groundwater and site run off. The Adaptive Management Plan is focused on addressing these uncertainties as detailed in the following sections.

11.3.1 Adaptive Management Triggers

Adaptive Management or Contingency plans are emplaced to address potential impacts that may occur but are unlikely to happen. This section provides triggers and procedures, to be incorporated into the updated Design and Operations Report (to be prepared as part of the ECA application), for use during emergencies as well as planned

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responses if site design and environmental control measures do not function as anticipated.

It is recommended that non-emergency measures be implemented only after a review of background information and site performance indicators to provide the best solution to potential effects that may arise. The contingency measures described below are generic and address a wide variety of issues. A situation specific issue may be more suitably addressed by a specific response measure. Therefore, all measures, beyond those of a routine maintenance nature, are to be reviewed by the MECP before implementation to ensure compliance with the ECA. The following sections outline the measures that should be taken if one or more of these situations occur at the site.

Contingency triggers are developed to determine when action is required. The contingency triggers for the site are based on both concentration trigger values for chloride and evaluating concentration trends for site specific indicator parameters while taking into consideration Provincial Water Quality Objectives (PWQO) and Ontario Drinking Water Quality Standards (ODWQS). The indicator parameters for the Site are presented in Table 11.5 and recommended for monitoring to determine if changes in water quality (i.e., trends or trigger exceedances) demonstrate a deterioration in water quality or predict a future landfill or CKD pile effect on groundwater or surface water quality. The trends and triggers for these indicator parameters will be evaluated as part of the updated annual monitoring required by both the EA and the ECA. The monitoring and contingency program might need minor adjustments once detailed design is completed however the overall intent and evaluation process is not expected to change. Triggers are summarized in Table 11-5.

Table 11-5: Points of Compliance and Indicator Parameters

Location	Chloride Trigger	Trend Analysis	Notes
Assessment for Landfill Impacts			
Reasonable Use Boundary/Compliance wells OW32-96, OW32A-02, OW33-96, OW34-96, and OW35	Chloride (100 mg/L)	Alkalinity Conductivity DOC Sulphate Hardness TKN Manganese Boron	Sodium:chloride, sodium:calcium, and chloride:sulphate ratios will be reviewed in the future to determine if they can demonstrate landfill related impacts. Time versus concentration trends to be assessed for all indicator parameters while taking PWQOs and ODWQS and Reasonable Use target concentrations into consideration.
Sentry Wells: OW9A-091, OW9B-91, OW15-91		Chloride Alkalinity Conductivity DOC Sulphate Hardness TKN	

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Location	Chloride Trigger	Trend Analysis	Notes
		Manganese Boron	
Background Wells: OW2-84, OW25-91		Chloride Alkalinity Conductivity DOC Sulphate Hardness TKN Manganese Boron	
Surface water: SP3-93 (downstream)		Potassium Sulphate Alkalinity Conductivity DOC Hardness Manganese TKN Boron	Time versus concentration trends to be assessed for all indicator parameters while taking PWQO concentrations and trends comparing upstream (SP1-10) versus downstream (SP3-93) conditions.
Sentry Wells for Potential CKD Impacts on Watercourse			
OW37S-22 OW37I-22 OW37D-22 OW38S-22 OW38D-22		Potassium Alkalinity Conductivity DOC Sulphate (Establish base line for all indicators (minimum 4 results), assess for increasing trend for 4 consecutive results – evaluate potential for future impact on surface water quality.	Sodium:chloride, sodium:calcium, and chloride:sulphate ratios will be reviewed in the future to determine if they can demonstrate CKD related impacts.
Notes: OW9A-091, OW9B-91, OW15-91 may be decommissioned and replaced to facilitate construction.			

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Chloride Trigger:

Groundwater: The D&O (CRA 1992) identified a trigger of 100 mg/L for chloride at the property limit. Chloride is a good indicator of landfill related impacts but can be influenced by road salting and in this case, the CKD pile. As such, other indicators including conductivity, alkalinity sulphate, DOC, potassium, and a few metals will also be used to assess long term trends even if background concentrations are near the Reasonable Use Guideline (RUG) value (e.g., DOC) or no RUG value exists (e.g., alkalinity).

Surface Water: Surface water impacts have not been detected (GM BluePlan, 2022) and there are currently no site-specific surface water triggers. A PWQO value does not exist for chloride however the Canadian Water Quality Guidelines (CWQG) present a surface water criterion of 128 mg/L for chloride. The historical range for chloride is between 13 mg/L and 887 mg/L at the upstream station SP1-10 (i.e., elevated chloride is attributed to off site upstream contributions) therefore a concentration above 128 mg/L does not necessarily reflect a site related impact on the watercourse. Downstream surface water (SP3-93) quality will be compared to upstream surface water ((SP1-10) quality to assess on site contribution of chloride to the watercourse.

CKD Pile Sentry Wells: It is expected that ground water quality at the sentry wells would have to deteriorate significantly (i.e., assumed to at least double) before a CKD related effect could be detected in surface water. A chloride trigger is not recommended for the sentry wells positioned between the CKD pile and the watercourse based on the following rationale:

- The sentry wells are not a point of compliance yet provide early warning for potential future impacts on the watercourse which will be evaluated based on water quality trends in the sentry wells in conjunction with a comparison of upstream (SP1-10) and downstream (SP3-93) surface water quality in the watercourse as noted above.
- The Ontario Drinking Water Quality Aesthetic Objective (ODWQ – AO) for chloride is 250 mg/L,
- The chloride concentrations at OW37I-22, OW37D-22 and OW38-S are already almost 250 mg/L (244 mg/L at OW38S-22, see Table 7) yet the watercourse is not currently impacted by the CKD Pile (or the landfill), and,
- Groundwater flow contributions from the CKD pile to the watercourse are minimal.

Trend Analysis

If the chloride trigger is activated at a point of compliance, the required action will depend on the nature of the result and concentration trend analysis for the other indicators. If an exceedance of a trigger concentration or an increasing concentration trend emerges during annual monitoring, the next two routine monitoring results

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obtained at that location will be reviewed to confirm the validity of the suspect concentration or trend. If the exceedance or trend is confirmed by the next two routine monitoring results to reflect a potential impact, action will be required.

Assessing water quality impacts on the watercourse will rely on indicator parameter data trends at the sentry wells and a comparison of surface water quality in the watercourse between upstream (SP1-10) and downstream (SP3-93) stations. Once baseline conditions are established (minimum of 4 samples), the following will be considered:

- If an unacceptable increasing trend for an indicator parameter is identified in a sentry well:
 - Other parameter trends will be assessed both in the sentry wells and watercourse monitoring locations to confirm or refute the trend.
 - Water quality between upstream and downstream surface water stations will be compared to determine whether indicator concentrations and trends are similar or different between stations.
- If an unacceptable increasing trend is identified in the watercourse:
 - Concentration trends will be assessed both in the sentry wells and watercourse monitoring locations to confirm or refute the trend.
 - Water quality between upstream (SP1-10) and downstream (SP3-93) surface water stations will be compared to determine whether indicator concentrations and trends are similar or different between stations.

The trends and triggers for indicator parameters outlined above will be evaluated to recommend if adaptive management measures are needed. The recommendation(s) will be included as an “Opinion Section” in both the annual monitoring report and associated cover letter, for submission to the MECP. If immediate action is required, the Town will submit an interim letter report.

The goal is to submit the adaptive management plan outlining the measures to be implemented to the MECP for review and comment within one month of identifying an increasing trend as outlined above. It will be carried out upon approval from the MECP and could include the following depending on the situation.

Adaptive Management Measures - Groundwater:

- Install and test boundary well(s) downgradient of the affected sentry well(s).
- Review current site operations to determine if there is any probable cause for the increase and if any operational changes could reduce the impact through reduction of leachate production.
- Review data to determine the probability of off-site contamination and assess the need develop a contaminant attenuation zone.

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- Review the updated annual monitoring program and recommend changes. Any new boundary wells would become part of the updated annual monitoring program and triggers would be set for these wells. If the trigger levels are exceeded or increasing trends are identified at the new boundary wells, and there is potential for off-site impacts, additional actions will be required. The exact nature of those actions would depend on impacts identified and where they are occurring and could include items outlined in Section 11.3.2.

Adaptive Management Measures - Surface Water:

- Review current site operations to determine if there is any probable cause for the increase and if any operational changes could reduce the impact through surface water controls such as ditches, swales, berms, grading, seeding, cover enhancement.
- Review the updated annual monitoring program and recommend changes. New surface water quality monitoring points would become part of the updated annual monitoring program and triggers would be set for these locations. If the trigger levels are exceeded at the new locations, and there is potential for off-site impacts, additional actions will be required. The exact nature of those actions would depend on impacts identified and where they are occurring and could include items outlined in Section 11.3.2.

11.3.2 Adaptive Management Responses

When the triggers outlined in Section 11.3.1 are exceeded, an Adaptive Management response may be required. The following sections outline potential strategies to provide guidance in the event that effects are detected.

Potential Effect Identified: Landfill Leachate Migration in Groundwater (Overburden)

The leachate collection system installed beneath Phase II/III was a mitigation measure to collect leachate beneath the waste. It reduces the potential for contaminants to migrate into the overburden, more specifically the meltwater deposits.

A deeper collection pipe was also installed in the meltwater deposits beneath the leachate collection system between MHA and MHB (maintenance hole A and B). The deeper pipe has no outlet. It was installed as a contingency to collect leachate entering the meltwater deposits. Water in the deeper pipe can be pumped out from MHB when leachate contaminants are detected (i.e., not meeting Provincial Water Quality Objectives). Otherwise, overflow from MHB is allowed to discharge to the surface water system that flows to Basin B. Water quality samples are collected at MHB to assess changes and potential impacts beneath the Phase II/III leachate collection system the

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waste. This provides a level of protection that contaminants won't exceed the trigger levels at the property boundary.

Other options include:

- Establish an offsite Contaminant Attenuation Zone (CAZ), such as the road allowance or other lands located to the west of the site.
- Install poplars or other hardy trees on completed portions of the site, which tend to stabilize the surface, increase evapotranspiration and uptake leachate impacted groundwater which reduces the leachate generated from the site; and/or,
- Install a cut-off trench, with leachate interception and recirculation back into the landfill. If monitoring beyond the control feature indicates leachate migration, then purge wells would be installed along the landfill side of the cut off feature to dewater the meltwater deposits. The quality of purge water would determine whether the water would be discharged to the leachate collection system or the surface water Basin.

A slurry trench/wall was to have been constructed to cut off leachate migration from the landfill site (pg. 72 of 1992 CRA report). The Slurry wall was to have been placed along the west and south perimeter ditch and keyed into a soil unit with permeability less than 10^{-8} m/s.

Potential Effect Identified: Leachate Migration in the Bedrock Aquifer

If monitoring indicates leachate migration into the bedrock, then purge wells could be installed downgradient of the plume. The quality of contamination in the purge water would determine whether the water would be discharged to the leachate collection system or a surface water Basin.

Potential Effect Identified: Leachate Mounding and Seepage

Leachate seeps would be corrected by excavating the soil cover and waste in the vicinity of the seep and placing a granular material (e.g., clear washed stone) to create a hydraulic connection between the perched layer and the collection system. Leachate seeps due to the failure of the leachate collection system can be corrected by flushing the lines and removing restrictions in the pipe. If flushing is unsuccessful, purge wells could be installed through to the base of the waste. The leachate could be pumped to a holding tank to alleviate pressure and leachate mounding on the landfill side slopes. Alternatively, the leachate could be transferred and held in a clay-lined, temporary dry surface water storage pond to facilitate eventual management and disposal.

The District Manager of the MECP must be notified within 1 week of a leachate breakout.

Potential Effect Identified: Groundwater Impacts from CKD pile

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Groundwater impacts from the CKD pile could be addressed as follows:

- Continued groundwater quality monitoring between the CKD pile and the watercourse realignment will be critical to assessing water quality trends, changes in the subsurface conditions and predicting future CKD impacts on the watercourse.
- The concentration of many parameters in the groundwater within CKD pile have declined since monitoring began in 2004. Resume monitoring of the groundwater quality at MW04-01 and MW04-03 screened within the CKD pile to assess source concentrations.
- Groundwater levels and water quality monitoring at MW04-01 and MW04-03 could be incorporated into the routine monitoring program. A contingency plan and trigger mechanism must be established to determine when confirmation sampling and remedial action are required.

Although not currently required, mitigation measures may be needed as part of the watercourse realignment design and construction, or they may be added later based on monitoring. Potential measures include:

- Adding to or improving the cover materials and vegetation above the CKD Pile.
- Excavating/removing the buried CKD material or sand and silt seam pathway, backfilling with a clayey material (likely available on-Site).
- Over excavating some or the entire realignment and installing a liner – either recompacted clay or a geosynthetic.
- Installing a French drain between the CKD Pile and the watercourse realignment, directing the CKD impacted groundwater to the Site's leachate collection system, a holding tank, or a containment pond (lined, dedicated for this purpose).

Potential Effect Identified: Surface Water Impacts from CKD pile

The monitoring well network, and site drainage systems are designed to prevent and predict impacts to surface water. Should CKD contaminants be detected in the sample collection pond, then mitigation measures can be implemented. These may include or combine:

- Extending or improving the cover materials and vegetation above the CKD Pile.
- Additional local grading.
- Enhancing the swale with vegetation to provide additional treatment.
- Modifying the sampling pond to provide additional treatment.
- Adding an outlet control to the sampling pond, allowing surface water to accumulate but not discharge. The water could then be sampled, and if contaminated, disposed (potentially directed to the leachate collection system) rather than released into the watercourse.

Potential Effect Identified: Presence of High Levels of Landfill Gas

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Historically, there has been no landfill gas monitoring at the Site. Further, there was no monitoring completed as part of this field investigation. We assume landfill gas migration will remain an insignificant issue at the Site, particularly given its predominantly clay/silt till nature. However, contingency measures can be put into place should landfill gas issues arise. These include:

- If low combustible gas levels are suspected or complaints regarding odours are received:
 - A landfill gas monitoring program can be initiated.
 - Consideration will be given to installing a passive gas venting system consisting of perforated gas collection piping in appropriate locations.

If high levels of combustible gas are suspected, then the need to install an active gas collection system will be considered.

11.3.3 Adaptive Management Summary and Flexibility

The Adaptive Management Plan is designed to address unexpected environmental effects. There is potential that an environmental effect could be detected that is not considered in Section 11.3.2. Should this occur, the Town will work under the guidance of MECP to investigate the cause and/or severity of the effect and develop an appropriate management response.