

Hartland Landfill Operating & Environmental Monitoring

2024/2025 Report

Operational Certificate 12659

Capital Regional District | Parks, Recreation & Environmental Services, Environmental Protection



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**HARTLAND LANDFILL
OPERATING & ENVIRONMENTAL MONITORING
2024/2025 REPORT**

EXECUTIVE SUMMARY

Hartland Landfill is owned and operated by the Capital Regional District (CRD) and is the only municipal solid waste landfill in the capital region. The multi-purpose facility provides recycling, household hazardous waste collection, a salvage area, yard and garden waste collection and processing, controlled waste disposal and landfill services to commercial and residential customers. The facility is also authorized to accept waste asbestos.

The facility operates in accordance with an approved Solid Waste Management Plan and Operational Certificate #12659 issued by the BC Ministry of Environment and Climate Change Strategy (ENV). An annual operations report is required under the current landfill authorization and must detail waste tonnages, landfill lifespan, closure funding, and operational and construction-related activities. This report also summarizes findings from the environmental monitoring and landfill gas reports. Operational activities and landfill gas findings cover the period of January 1 to December 31, 2024. Environmental monitoring data is reported for the period of April 1, 2024 to March 31, 2025, to encompass a full wet season.

The water quality results from 2024/2025 indicate that landfill leachate was contained and controlled within the landfill property. The surface water monitoring program indicated that nearby surface water bodies, including Tod Creek, Durrance Lake, and Killarney Lake are not impacted by landfill leachate. Some metals and total suspended solids exceeded the BC Water Quality Guidelines during the reporting year, though most were likely related to high flow/turbid sampling conditions.

In 2024, off-site and boundary water quality showed elevated nitrate concentrations likely related to on-site aggregate quarrying and stockpiling activities. It has been confirmed by the CRD's qualified professional that nitrate concentrations in groundwater pose no significant risk to human health, aquatic life or livestock and are an exceedance of the drinking water standard that must be applied according to the BC CSR framework, though no drinking water wells reside within 1km. In accordance with the CRD's Aggregate Management Plan, staff continue to implement mitigation measures and engineering controls including additional hydraulic containment systems, and continued stockpile depletion, and nitrate concentrations at previously non-compliant monitoring locations have been improving.

Construction of the Biogas Upgrading Facility was completed in 2024, with full commissioning scheduled for 2025. Design and construction challenges delayed delivery of key components for the gas header extension and associated well connections. As a result, landfill gas collection efficiency declined in 2024 to 43% (ENV model) and 50% (UBCi model). Monthly well-field balancing continues to optimize collection. Header construction and well connections are expected to be completed in Q1 2025, with collection efficiency anticipated to return to 2023 levels (64% and 74%, respectively). In 2024, the Hartland Landfill received 186,525 tonnes of waste which included 161,540 tonnes of general refuse (including biosolids mixed with sand), 22,671 tonnes of controlled waste and 2,314 tonnes of asbestos. Additionally, in 2024, 10,867 tonnes of wood waste, construction and demolition, and bulky wastes were beneficially reused for side and controlled waste cover.

The detailed Phase 2 cell design and filling plan optimization resulted in an estimated remaining capacity of 6,926,635 m³ compared to that reported at the end of 2023 (7,135,047 m³). The estimated landfill capacity will be reached in approximately 25 years (approximately 2050), assuming current rates of waste disposal.

Hartland Landfill has an annual capital budget of approximately \$2.5 million. However, construction of Cells 4, 5 and 6 in 2023-2025 has increased the average annual capital budget to approximately \$20 million annually through 2026 to ensure the cells are ready for filling. This budget also supports many other projects focused on improving landfill operations, health and safety, waste diversion infrastructure, and environmental protection. Operations and capital projects that occurred in 2024 include:

- Capital project completion
 - Cell 4 completion, and design procurement for Cell 5a
 - Biogas upgrading facility

- Hartland north scale
 - Material diversion transfer station and biosolids mixing pad
 - Kitchen scraps transfer station (north)
- Landfill operations and infrastructure
 - Nuisance, litter, vector control
 - Implementation of the Aggregate Management Plan
- Environmental and waste diversion programs
 - Improvements to wood waste, and demolition/renovation waste management programs
 - Engineered water quality controls and mitigation measures (aggregate runoff containment, etc.)
 - Landfill gas infrastructure improvements

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Appendix II	Hartland Landfill – Landfill Gas Monitoring 2024 Report

List of Acronyms and Units of Measurement

CRD	Capital Regional District	km	Kilometer
ANFO	Ammonium Nitrate / Fuel Oil	LFG	Landfill Gas
BC WQG-STA	BC Approved and Working Water Quality Short Term Acute Guidelines for Freshwater Aquatic Life	LIDAR	Light Detection of Ranging
		m	Meter
		m ³	Cubic Meter
BUF	Biogas Upgrading Facility	RNG	Renewable Natural Gas
CSR	BC Contaminated Sites Regulation	RSCP	Regional Source Control Program
		SCADA	Supervisory Control and Data Acquisition
DOCP	Design, Operations and Closure Plan	scfm	Standard cubic feet per minute
ENV	Ministry of Environment and Parks	SWMP	Solid Waste Management Plan
ENV model	Ministry of Environment and Parks landfill gas generation model	TSS	Total Suspended Solids
		UBCi model	University of British Columbia integrated model
		Y&G	Yard and Garden

HARTLAND LANDFILL OPERATING & ENVIRONMENTAL MONITORING 2024/2025 REPORT

1.0 INTRODUCTION

Hartland Landfill (Hartland) is owned and operated by the Capital Regional District (CRD) and is located about 14 km northwest of Victoria. It is the only sanitary landfill in the capital region, serving a population of approximately 450,000 people. The operation is a multi-purpose facility providing recycling, household hazardous waste collection, a salvage area, yard and garden waste collection and processing, controlled waste disposal, and landfill services to commercial and residential customers.

This report represents the consolidation of three documents (Hartland Landfill Operations Annual Report, Hartland Landfill Environmental Programs Annual Report, and Landfill Gas Monitoring Annual Report). The data herein is required to meet CRD operating standards, and provincial regulatory requirements per Section 3.2 of the Operational Certificate. As required by the Operational Certificate, this report includes:

- waste tonnages
- remaining landfill lifespan
- post-closure funding
- 2024 operations activities
- 2024 construction contract-related activities
- 2024/2025 environmental monitoring program results¹
- 2024 annual landfill gas monitoring report summary

2.0 SITE OVERVIEW

Hartland Landfill is located in the Tod Creek watershed, in the bedrock highlands of the Gowlland Range, northwest of Victoria. The terrain is moderately rugged with relief of up to 446 meters in the area. Undeveloped CRD property (about 320 hectares in total) lies to the west and south of the landfill site. Mount Work Regional Park lies to the west. Willis Point Road borders the site to the north, and beyond that is a Department of National Defense rifle range. Private residential properties are located to the east and southeast of the landfill.

The landfill is situated in a north-south trending bedrock saddle with Mount Work to the west and an unnamed bedrock ridge to the east. The crest of the landfill forms a drainage divide between the Heal Creek drainage basin to the north and the Killarney Creek drainage basin to the south.

Filling with waste started at the site in the 1950's under private ownership. The site continued to be owned and operated privately until 1975 when the CRD purchased the property. Hartland Landfill is the primary solid waste disposal site for all areas of the capital region. Landfilling operations and equipment maintenance is conducted by private companies under contract and direction of CRD staff.

The Hartland Landfill site is divided into two distinct areas referred to as Phase 1 and Phase 2. Initially, waste was deposited in Phase 1 which reached capacity in 1996 and was capped in 1997. Phase 2 is currently receiving waste. Filling of Phase 2, Cell 1 was completed in 2004. Subsequently, the filling of Phase 2, Cell 2 was completed in 2016 and its interim closure is in progress. Phase 2, Cell 3 became active in September 2016. Cell 4 construction is currently underway with planned filling to start in January 2025. Cell 5a construction is planned for Q2 2025 with landfilling anticipated to begin in late 2025.

Leachate and surface runoff from the active landfill areas are directed to two leachate lagoons at the north end of the landfill. The leachate is then transported via the centrate return line (shared with the CRD's Residual Treatment Facility) to the McLoughlin Point Wastewater Treatment Plant. Leachate discharge to

¹ Note, operational and landfill gas data/information is presented in a calendar year (January to December), but environmental monitoring data is presented from April 2024 to March 2025 (so it encompasses a full wet season).

sewer is authorized by CRD Regional Source Control Program (RSCP) Waste Discharge Authorization 1978692 and is subject to the CRD Sewer Use Bylaw (Bylaw No. 2922).

The CRD initiated a surface water and groundwater monitoring program for the landfill in 1983. Annual monitoring reports have been prepared and issued by consultants since 1988. The current Hartland monitoring program is required under the Amended Operational Certificate #12659 issued by the Ministry of Environment and Parks (ENV) and last amended on January 21, 2013.

The Residuals Treatment Facility resides in the northwest corner of the Hartland Landfill property. The facility anaerobically digests residual solids from the CRD's McLoughlin Point Wastewater Treatment Plant and produces Class A biosolids for beneficial reuse, in accordance with the CRD's Liquid Waste Management Plan. Operation and annual reporting for the facility is completed under Operational Certificate #109471 issued by ENV.

3.0 REGULATORY SETTING

The Hartland Landfill operates in accordance with an approved Solid Waste Management Plan and an Operational Certificate. The following lists key regulatory approvals for Hartland Landfill:

- Solid Waste Management Plan, 2022 (received approval from ENV on July 13, 2023).
- Amended Operational Certificate (#12659) approved by ENV, last amended on January 21, 2013.
- Authorization to Dispose of Hazardous Waste Asbestos at the Hartland Landfill, approved by ENV on July 23, 2012.
- RSCP Waste Discharge Authorization 1978692, last amended on December 20, 2022, and subject to the CRD Sewer Use Bylaw (Bylaw No. 2922).
- Landfill gas is regulated by the BC *Landfill Gas Management Regulation* and various provincial guidelines and criteria. Hartland continues to operate under an approved Landfill Gas Management Design Plan.

4.0 WASTE VOLUMES AND AIR SPACE CONSUMPTION

In 2024, the Hartland Landfill received 186,525 tonnes of waste which included 161,540 tonnes of general refuse (including biosolids mixed with sand), 22,671 tonnes of controlled waste and 2,314 tonnes of asbestos. Air space consumption also considers wood waste beneficially used as cover (e.g. side cover or controlled waste cover). In 2024, 10,867 tonnes of wood waste, construction and demolition, and bulky wastes were beneficially reused for side and controlled waste cover.

Air space consumption is calculated separately for waste received at the active face and asbestos areas as they have different disposal locations and waste-to-cover ratios. The following section reports annual landfill air space and waste tonnage statistics. The CRD conducts monthly volumetric surveys for all wastes in order to document changes in air space volume and support quality control, design conformance assessments, and assist in ongoing landfill optimization assessments.

4.1 Compaction Data

Localized compaction data is obtained routinely at Hartland Landfill to support the landfill operations and to verify target compaction rates. An average compaction density of 0.85 tonnes/m³ is targeted during landfilling operations. No in-situ compaction tests were conducted in 2024. The CRD has a compaction monitoring system installed in the compactor and bulldozer. This system monitors the deflection of the compactor wheels through the garbage in real-time and provides visual assistance to ensure the operator conducts sufficient passes across each waste lift to achieve the targeted density.

4.2 Air Space Utilization – Consumption and General Refuse Tonnage

The annual air space consumed at the active landfilling location from waste and daily cover, tonnage of waste landfilled, and associated Air Space Utilization Factor is shown below in Table 1. The waste air space utilization is calculated using all refuse and shredded wood.

Table 1 General Refuse Air Space Utilization

2024 Waste Air Space/Density Calculations	Quantity
Air space consumed by landfilling waste (m ³) (includes waste and cover)	258,541
Tonnage of waste landfilled (tonnes) (scale data)	195,078 ¹
Air Space Utilization Factor (tonnes/m ³) ²	0.75

¹ Includes 161,540 tonnes of general refuse, 22,671 tonnes of controlled waste and 10,867 tonnes of beneficially used wood waste

² Air Space Utilization Factor = Total tonnes disposed divided by the volume of air space consumed, including waste and cover

In 2024, it was not possible to accurately track the amount of cover material used for landfilling. Therefore, an Air Space Utilization Factor will be used as a key performance indicator.

4.3 Asbestos Air Space Utilization – Consumption and Asbestos Tonnage

The annual air space consumed at the asbestos location from asbestos and daily cover, tonnage of asbestos deposited, and associated asbestos utilization factor is shown below in Table 2.

Table 2 Asbestos Air Space Utilization

2024 Asbestos Air space/Density Calculations	Quantity
Air space consumed by asbestos (m ³) (includes asbestos and cover)	12,676
Tonnage of asbestos (tonnes)	2,314
Asbestos Air Space Utilization Factor (tonnes/m ³) ¹	0.18

¹ Asbestos Utilization Factor = Total tonnes disposed divided by the volume of air space consumed, including asbestos and cover

4.4 Uncertainties

The waste deposited at Hartland Landfill is constantly compressing and settling. Settlement and air space are assessed by monthly topographic surveys; however, this introduces uncertainty into the tracking data. The settlement factor has not been factored into the air space utilization data above, as reporting monthly landfill tracking data is assumed to be more accurate when calculating an air space utilization factor.

4.5 Design Conformance

Hartland Landfill is currently in Phase 2 of development and is being constructed in a series of cells with each cell divided into a series of lifts that are progressively filled with waste. In 2024, filling within Phase 2, Cell 3 is ongoing until Cell 4 construction is complete in January 2025. as per the Hartland Design, Operations and Closure Plan (DOCP) and Master Filling Plan for the site.

5.0 REMAINING SITE LIFE

In 2021 the use of LIDAR (Light Detection of Ranging) technology was replaced with photogrammetry technology. Each month a drone is used to take top-down, overlapping photos of the landfill. The photos are run through photogrammetry software which produces a three-dimensional point cloud. The point clouds are used to create three-dimensional surfaces that allow for the filling volume calculations to be conducted monthly and assist with landfill lifespan estimates. The remaining landfill life is calculated by dividing the remaining capacity by the previous three-year average yearly landfilling volume.

In 2022 the Hartland DOCP was updated by Sperling Hansens Associates Inc. and a detailed assessment of air space was completed. The remaining capacity of the Phase 2 landfill is summarized in Table 3. It is estimated that Hartland's current capacity will be reached by the year 2050.

Table 3 Summary of Landfill Capacity from the Hartland Landfill DOCP, 2022

/Cell	Gross Cell Capacity m ³	Linear Area m ²	Net Cell Capacity Phase m ³	Filling Timeframe
Phase 2 (Cells 3-6)	7,484,122	141,772	7,292,730	2016-2050 (approx.)

6.0 CLOSURE AND POST-CLOSURE FUND

A requirement of the Operational Certificate is a closure and post-closure liability fund to meet or exceed the estimated closure and post-closure costs with a reasonable contingency. At the end of 2024, the closure/post-closure fund was \$14,271,342.

7.0 2024 COMPLETED STUDIES AND PROJECTS

The annual Hartland capital and operations budget supports many capital projects and studies focused on environmental protection and meeting Solid Waste Management Plan (SWMP) commitments. The following is a summary of work completed in 2024.

- **Construction of Cell 4** was completed in 2024.
- **Procurement of Cell 5A construction** services were completed in summer 2024. Construction of Cell 5A started in Q4 2024.
- **Biogas Upgrading Facility (BUF):** Construction of the BUF was completed in Q4 2024. Commissioning of the BUF began in Q4 2024 and is expected to conclude in Q2 2025. The facility will feed renewable natural gas into the Fortis BC network. More detail is available in the Hartland Landfill Gas Monitoring 2024 Annual Report.
- **Construction upgrades and Automation of the North Scale system:** was completed in 2024 along with various traffic flow, signage and security upgrades to facilitate commercial access accessing from Willis Point Road. Commercial traffic will be routed through the north scales beginning in 2025.
- **Material Diversion Transfer Facility:** Construction, startup and operations of a diversion depot for wood and asphalt shingles was completed in 2024. This facility receives and transports wood waste (clean and dirty) and asphalt roofing off-site for recycling/beneficial reuse.
- **Wood Waste Diversion Pilot Program:** The voluntary wood waste diversion program continued until the new Material Diversion Transfer Facility was operational.
- **A Biosolids Mixing Pad** was completed as part of the material diversion transfer facility in 2024 to allow for blending of biosolids prior to transport off-site.
- **Kitchen Scraps Transfer Station relocation to the north:** Construction and relocation of the kitchen scraps transfer operation was completed in 2024. The south kitchen scraps transfer station was closed.
- **Access Roads:** Construction of a new north commercial access road into Cell 4 and kitchen scraps transfer station was completed in 2024.
- **Landfill operations, mechanical services, security and vector control:** Throughout 2024, contract management continued for mechanical services, on-site security, seasonal bird control, bin haul, stewardship, household hazardous waste, recycling and ozone-depleting substance removal.
- **Asphalt Paving:** Select access roads at the north end of the property were paved in 2024.
- **Annual invasive plant species control:** Invasive species control continued with removal of some species and spraying of others with herbicide.
- **Litter control:** Ongoing litter cleanup and installation of litter fences were prioritized throughout the year.

- **Residential renovation waste management:** The Reno Safe Waste Wise program continued into 2024. This screening process for renovation waste is in place to improve health and safety at the public bins area.
- **Outreach campaigns:** Outreach campaigns were planned and implemented in 2024 including issuance of four Rethink Waste newsletters, delivered 79 3R Programs to 2,053 students and 20 teachers, attended 20 community events with solid waste messaging including Love Food Hate Waste, Household Hazardous waste and Rethink Waste/3R. Partnered with Saanich Fire to produce educational videos on safe disposal of batteries to prevent landfill fires. Participation in the Local Government Waste Reduction Working Group continued in 2024.
- **Yard and Garden (Y&G) Diversion Program:** Diversion of Y&G materials continued in 2024. Y&G is sent off-site to be beneficially used at an external composting facility.
- **Mitigation of Aggregate Run-off:** In 2024, additional engineered water quality controls were installed as part of the ongoing Aggregate Management Plan to mitigate water quality degradation related to quarrying and aggregate production. Measures included construction of a hydraulic containment ditch to convey aggregate-impacted runoff to the leachate system, installation of additional groundwater monitoring wells, reduction and reconfiguration of aggregate stockpiles, and expansion of the monitoring network to improve on-site water quality.
- **Gas and leachate collection infrastructure:** Landfill gas infrastructure was installed per the Hartland Landfill Gas Management Design Plan. Wellheads, valves, condensation traps, monitoring points and piping are installed and commissioned to convey landfill gas to the gas plant, and leachate to the storage lagoons. Installation of a new landfill gas header to increase collection coverage in Phase 2 Cell 3 was completed in 2024.
- **Landfill gas capture optimization:** Pilot projects for automated well head tuning devices and continuous methane surface emission monitoring devices are set to begin in 2024, aiming to improve gas collection efficiency and reduce emissions.

8.0 2025 PLANNED STUDIES AND PROJECTS

- Capital Projects – from 2024 to 2026 \$20 million annual budget has been establish to initiate and/or complete the project below.
 - **Gas and leachate collection infrastructure:** Combined landfill gas and leachate collectors continue to be installed as landfilling progresses and in accordance with the Hartland landfill gas design plan.
 - **Completion of Cell 5A construction:** with filling to begin in Q3.
 - **Procurement of design services for Cell 5B.** This design is for new landfill infrastructure including a sedimentation pond, Cell 5B, commercial truck wheel wash and landfill containment berm for Cell 5 and 6. Following design, procurement for construction services will ensue for this work.
 - **Procurement of design services for relocating the existing contractor workshop** outside of the future Cell 5B filling area.
 - **Commissioning of the new Biogas Upgrading Facility** and generation of renewable natural gas.
 - **Design of electrical enhancements** required to meet the power and backup power requirements of the Hartland North scales, kitchen scrap depot, wheel wash and contractor's shop.
- Landfill Operations and Infrastructure
 - **Fire protection system:** Expansion of the Cell 3 leachate fire suppression system into Cell 4, 5 and 6.
- Environmental and Waste Diversion Programs
 - **Outreach campaigns:** Public outreach campaigns will continue into 2025.
 - Ongoing monitoring and improvements to the environmental monitoring network

- **Landfill gas capture optimization:** Pilot projects for monitoring continuous methane surface emission monitoring devices are set to begin in 2025, aiming to improve monitoring and mitigating emissions.

9.0 2024/2025 ENVIRONMENTAL MONITORING

CRD staff monitor landfill gas, groundwater, surface water and leachate quality to ensure the effectiveness of management activities and confirm regulatory compliance. Environmental data reported herein is compared to the most current and applicable provincial standards.

Based on monitoring conducted in 2024/2025², the program continues to provide data needed to:

- meet Operational Certificate requirements;
- identify potential impacts of landfill operations, if any; and
- evaluate the effectiveness of control measures, and plan for mitigation (if required).

A brief summary of key findings of the landfill gas, groundwater, surface water and leachate monitoring program are presented here. For a detailed discussion of results, recommendations and actions please reference the following reports:

- Hartland Landfill Groundwater, Surface Water, Leachate Monitoring Program Annual Report (April 2024 to March 2025), AECOM Canada Ltd. (AECOM) – Appendix I
- Hartland Landfill – Landfill Gas Monitoring 2024 Report, Parks, Recreation & Environmental Services, Environmental Protection, CRD, November 2025 – Appendix II

9.1 Environmental Monitoring Program

Engineered controls at Hartland Landfill collect and contain leachate to control contaminant migration and, therefore, reduce or eliminate potential impacts to groundwater and surface water quality. Since 1990, the leachate has been captured and discharged via pipeline to the sanitary sewer.

Groundwater and surface water monitoring stations on the Hartland Landfill property and specific off-site locations have been monitored since 1983. Monitoring is mandated through the landfill Operational Certificate and is conducted on a quarterly basis to assess the potential for landfill processes to impact groundwater and surface water resources. Additionally, leachate, generated by the infiltration of precipitation through the waste, is monitored for flow characteristics, quantity and quality. The annual monitoring program has four main components, as listed below:

1. groundwater monitoring at on- and off-site locations
2. private domestic well monitoring off-site
3. surface water monitoring at on- and off-site locations
4. leachate quality and flow monitoring

Hartland Landfill has an extensive network of groundwater wells to monitor conditions immediately adjacent to the Phase 1 and Phase 2 areas, and at points adjacent to the landfill property boundary. Groundwater elevations are routinely monitored to understand the direction of groundwater flow within the landfill property. Groundwater quality is monitored at groundwater well locations to evaluate and identify changes in water chemistry that may be attributed to landfill processes and operations and, specifically, the effect of landfill leachate on groundwater resources.

9.1.1 Groundwater Flow

Groundwater flow throughout the landfill followed previously established patterns. Flow directions in the Phase 1 area were primarily to the north, and this component of flow is captured by the northern leachate containment system. At the south end of Phase 1, a groundwater divide exists where groundwater flows

² Monitoring periods vary such that the landfill gas “year” is January to December, but the groundwater, surface water and leachate “year” is April to March (to enable review of a full ‘wet season’).

towards the north (into the landfill) and south (away from the landfill). The southerly component of flow is intercepted by the south leachate containment system.

In the Phase 2 area, west of Phase 1, groundwater flow is directed inward toward the base of the former Heal Lake. Because the groundwater flow is directed inward toward the basin, it is considered a hydraulic trap. In the basin, the leachate is then conveyed into the leachate lagoons. Leachate and groundwater levels are monitored in Phase 2 to ensure that the hydraulic trap is maintained. The 2024/2025 data indicate that the hydraulic trap functioned effectively throughout the year. Water level and quality monitoring should continue to confirm ongoing effectiveness of leachate containment and identify any changes in the extent or magnitude of potential leachate impacts.

9.1.2 Groundwater Quality Results

Groundwater quality is compared against BC *Contaminated Sites Regulation* (CSR) numerical standards for the protection of drinking water and aquatic life. To account for seasonal variations, groundwater quality is reported between April 1, 2024 and March 31, 2025.

Of the 97 groundwater wells monitored at Hartland, 36 groundwater monitoring wells are considered boundary compliance locations, listed below:

South of the Landfill (10)

- 04-3-1, 04-4-1
- 71-1-1, 71-2-1, 71-3-1
- 72-1-1, 72-3-1
- 73-1-1, 73-2-1, 73-3-1

East of the Landfill (6)

- 17-1-1, 17-1-2, 17-1-3
- 18-1-1, 18-2-1, 18-2-2

North of the Landfill (15)

- 20-1-1, 20-1-2
- 21-1-1, 21-1-2, 21-2-1
- 28-1-0
- 29-1-1, 29-1-2
- 30-1-1, 30-1-2
- 31-1-1, 31-1-2
- 39-1-1, 39-2-1
- 53-1-1
- 111-1-1
- 111-2-1
- 112-1-1
- 112-2-1

North of the Hartland North Pad (5)

- 41-1-1
- 42-1-1
- 55-1-1
- 56-1-1
- 57-1-1

Further results of the 2024/2025 groundwater quality monitoring program are presented by area in the following sections.

Groundwater quality in boundary compliance locations north of the landfill met the applicable BC CSR groundwater standards except for nitrate at GW-31-1-1, GW-31-1-2, GW-111-1-1, GW-111-2-1; and boron at GW-20-1-1. Compliance groundwater quality is summarized in Table 4.

Groundwater quality in proximity to the Phase 2 basin confirms the hydraulic trap leachate collection system is effectively containing leachate north of Phase 2. Groundwater quality 100 m north of Phase 2 continued to show low concentrations of leachate indicator parameters, indicating groundwater quality is not affected by landfill leachate. Operation of the Phase 1 North Purge Well System continued to mitigate leachate impacts north of the landfill.

Table 4 Compliance Groundwater Quality – North of Phase 1 and Phase 2 (2024/2025)

Well	Exceedances	# of Exceedances	Comments
20-1-1	Boron	-	Boron is interpreted to originate from silicate mineral dissolution and/or changes to redox conditions near the bedrock below Phase 1.
31-1-1	Nitrate	2	Nitrate exceedances are associated with aggregate production and stockpiling at Hartland. The nitrate originates from leaching of ammonium nitrate / fuel oil (ANFO) residue left on the aggregate after blasting.
31-1-2	Nitrate	2	
39-1-1	Nitrate	1	Nitrate exceedances are associated with aggregate production and stockpiling at Hartland. The nitrate originates from leaching of ANFO residue left on the aggregate after blasting.
111-1-1	Nitrate	2	
111-2-1	Nitrate	1	

Groundwater quality at all other boundary compliance locations met all applicable regulatory limits. These results, paired with groundwater flow analyses indicate that all leachate is contained and controlled within the landfill property.

9.1.3 Domestic Well Monitoring Program

Since the 1980's, the CRD has performed routine sampling and analysis of domestic wells in the vicinity of the landfill that are used as the primary source of drinking water. Seventeen domestic wells were sampled in 2024 within a two kilometer radius of the landfill.

Analytical results were compared to the *BC Source Drinking Water Guidelines* (updated 2020) and *Guidelines for Canadian Drinking Water Quality* (updated 2022).

The domestic groundwater quality data was consistent with historical results, meeting all applicable federal and provincial drinking water quality guidelines. Overall, the results indicate that off-site domestic water wells continue to remain unimpacted by landfill leachate.

9.1.4 Surface Water Monitoring Program

Hartland Landfill is located within the Tod Creek watershed. Drainage south of the landfill is directed toward Killarney and Prospect lakes, discharging to Tod Creek. Drainage north of the landfill flows northeasterly within Heal Creek to Durrance Creek, discharging to Tod Creek and Tod Inlet. Surface water quality is monitored to assess the potential impacts for various landfill activities, such as road construction, blasting, and aggregate stockpiling, as well as their impact on the downstream environment.

The program consists of approximately 31 monitoring locations, five of which are considered boundary compliance locations, listed below. These locations are concentrated along the southern and northern property boundaries and monitored to assess compliance with the landfill operating permit. Water Quality data is compared to *BC Approved and Working Water Quality Short Term Acute Guidelines* (BC WQG-STA) for Freshwater Aquatic Life:

South of the Landfill

- SW-S-04

North of Phases 1 and 2

- SW-N-05
- SW-N-16

North of the Hartland North Pad

- SW-N-41S1
- SW-N-42S1

9.1.4.1 Results

Surface water quality data collected in 2024/2025 confirmed that nearby surface water bodies, including Tod Creek, Durrance Lake and Killarney Lake are not impacted by landfill leachate. Elevated nitrate concentrations related to aggregate runoff were observed north of the site, in Durrance and Tod Creeks.

Surface water quality exceeded the applicable BC WQG-STA standards at boundary compliance stations in the north (SW-N-05, SW-N-16, SW-N-41S1, SW-N-55), and south (SW-S-04) and is summarized in Table 5. Elevated and non-compliant nitrate concentrations north of the landfill are determined to be related to aggregate management activities and the Northwest Aggregate stockpile. Remedial strategies and options for managing and mitigating run-off from aggregate blasting and stockpiles have been implemented, with additional strategies ongoing as outlined in Aggregate Management Plan. Elevated nitrate and some metals in the south, at SW-S-04, were determined to be related to sump pump failure, now rectified.

Table 5 summarizes BC WQG-STA exceedances observed at Hartland boundary compliance stations in 2024/2025.

Table 5 Compliance Surface Water Quality (2024/2025)

Location	Exceedances of BC Water Quality – Short-Term Acute Guidelines	# of Samples with Exceedances	Comments
SW-N-05	Nitrate	4	The total suspended solids (TSS) and metal concentration exceedances are anticipated to be related to turbid flow conditions following a prolonged dry period. It is unlikely that the elevated TSS and metal concentrations were influenced by landfill activities.
SW-N-16	Nitrate	4	
	Total aluminum	1	
	Dissolved Copper	4	
SW-N-41S1	Dissolved Copper	1	
SW-S-04	Nitrate	1	Nitrate exceedances are associated with aggregate production and stockpiling at Hartland. The nitrate originates from leaching of ANFO residue.
	Total aluminum	1	
	Cobalt	2	
	Iron	2	
	Dissolved Copper	4	
SW-N-55	Nitrate	2	

9.1.5 Leachate Management and Monitoring Program

Leachate is produced from the percolation of precipitation and groundwater through the decomposing refuse in the landfill. At Hartland Landfill, leachate is managed through landfill design, input monitoring, contaminant treatment, if required, and routine monitoring.

During the reporting period, leachate continued to be managed in accordance with the DOCP and its supporting documents.

9.1.5.1 Leachate Monitoring

A routine leachate monitoring program is conducted to:

- document leachate discharge volumes and flow rates to the sanitary sewer,
- characterize the physical and chemical constituents in the leachate, and
- verify compliance with the CRD RSCP Waste Discharge Authorization at the point of discharge.

Automated monitoring of the volume of leachate discharged is maintained on the CRD SCADA (Supervisory Control and Data Acquisition) system and provides a basis for measuring flow rates to the sanitary sewer and leak detection. Monthly leachate samples are collected to verify compliance with the Waste Discharge

Authorization and are analyzed for a variety of chemical parameters (e.g., nutrients, mineral oil and grease, organic compounds, metals and chlorinated compounds).

9.1.5.2 Results

The total volume of leachate discharged during the reporting period was 461,488 m³, which is approximately 13.9% lower than the previous year's volume of 530,735 m³, likely due to several factors including landfill construction activities, lagoon maintenance during the spring of 2024, and an extremely dry January 2025. Leachate generation rates typically vary with annual precipitation and landfill filling/construction-related activities (e.g., interim cover installation, final closures, etc.).

In 2024/2025, the leachate quality observed in the Hartland Valve Chamber met the requirements of the Waste Discharge Authorization. Overall, average annual leachate concentrations in 2024/2025 were comparable with those measured in 2023/2024.

9.2 Landfill Gas Monitoring Program

Landfill gas management is regulated by a number of BC regulations (including the BC *Landfill Gas Management Regulation*), design guidelines, BC Landfill Criteria, Hartland-specific management plans, and WorkSafeBC. The BC *Landfill Gas Management Regulation* requires landfills generating more than 1,000 tonnes per year of methane to develop landfill gas management design plans that targets a 75% collection efficiency in four years. Landfill gas is managed in accordance with a site-specific Landfill Gas Management Design Plan required by the BC *Landfill Gas Management Regulation*.

To assess the effectiveness of the landfill gas collection infrastructure, Hartland Landfill monitors landfill gas collection and utilization, perimeter and foundation probes, ambient air and landfill gas speciation. In 2024, the monitoring program confirmed that landfill gas was contained within the landfill.

9.2.1 Gas Generation

In 2024, Hartland Landfill generated 8,532 tonnes/year of methane, based on ENV's recommended gas generation model. As required, the province's gas generation model is updated annually with waste quantity and composition data to enable the annual calculation of collection efficiency and greenhouse gas emissions.

9.2.2 Gas Collection and Utilization

In 2024, the gas extraction network consisted of 155 wells that captured an average of 748 scfm of landfill gas. Well field balancing was completed at least monthly to optimize collection. Well field monitoring and balancing should continue at least monthly, as recommended by the BC Landfill Gas Management Facilities Design Guidelines.

At the end of 2024, the landfill gas collection efficiency was 43% according to the ENV model. Empirical field data and methane mass balance indicates that an alternative gas generation (UBCi model) more accurately estimates overall gas production for Hartland. Using this model, collection efficiency in 2024 is estimated to be 50%; and according to a recently published model provided by Environmental Climate Change Canada, it was 49%. The decrease in collection efficiency is mainly due to infrastructure and installation challenges, including technical design considerations, delays in acquiring critical equipment, and coordination with other capital projects (Cell 4 construction), which affected the timely connection of multiple gas wells. These wells are planned to be connected in early 2025, and as a result, the collection efficiency is expected to significantly improve.

The construction of the Biogas Upgrading Facility was completed in 2024, with commissioning expected to begin in 2025. During construction and transition, landfill gas was continuously flared. The facility is expected to be fully commissioned in early to mid- 2025. Additional details on Biogas Upgrading Facility and renewable natural gas (RNG) production process can be found in Appendix II.

9.2.3 Gas Monitoring and Compliance Summary

Numerous monitoring programs are in place to evaluate the performance of the landfill gas system. The CRD continues to follow the Landfill Gas Management Design Plan specifications for achieving 75% collection efficiency. Staff continue to monitor and adjust the well field to maximize collection and optimize key gas constituents (methane and nitrogen) in accordance with the BC Landfill Gas Management Facilities Design Guidelines.

10.0 RECOMMENDATIONS

- Air space utilization and compaction rates should continue to be regularly evaluated to accurately assess future air space/landfilling needs. Additional measures/procedures to increase compaction rates should be evaluated.
- Continue to follow and implement the Landfill Gas Management Design Plan and annual amendments. Continue following the landfill gas management design plan.
- Continue implementing the Aggregate Management Plan to mitigate current and future degradation of water quality related to aggregate runoff.
- Monitoring programs for groundwater, surface water, leachate and landfill gas should continue in order to evaluate regulatory compliance and effectiveness of environmental/engineering controls. Detailed recommendations can be found in the appended Hartland Environmental Monitoring, and Landfill Gas Reports.
- Continue to evaluate landfill operations/activities to ensure compliance with the landfill Operational Certificate and SWMP. Findings must be reported annually at minimum.

11.0 CONCLUSIONS

In 2024, Hartland Landfill received approximately 193,000 tonnes of waste (including beneficially used material, blended biosolids, controlled waste and asbestos) and the total air space volume (waste and cover) consumed in 2024 was 271,000 m³. Currently, the estimated airspace utilization factor is 0.75 tonnes/m³. At the current disposal rate, it is estimated that Hartland's current capacity will be reached in approximately 2050.

2024 marked the completion of many significant capital projects in support of SWMP initiatives, including the north scales, Cell 4, the materials diversion transfer station, and construction of the Biogas Upgrading Facility.

In 2025, installation of landfill gas collection infrastructure will continue concurrently with the connection of additional wells that is expected to significantly improve collection efficiency. The Biogas Upgrading Facility will begin commissioning in Q1 of next year.

Environmental Performance

In 2024/2025, 461,488 m³ of leachate was discharge to the sanitary sewer. and landfill gas are being managed in accordance with regulatory requirements and data are reported in Appendices I and II, respectively.

Water quality results indicate that landfill leachate is being effectively contained and controlled on-site. In 2024, off-site groundwater quality showed elevated nitrate concentrations likely related to on-site aggregate quarrying and stockpiling activities. It has been confirmed by the CRD's qualified professional that these levels pose no significant risk to human health, aquatic life or livestock and is an exceedance of the drinking water standard that must be applied according to the BC CSR framework, though no drinking water wells reside within 1km. In accordance with the CRD's Aggregate Management Plan, staff continue to implement mitigation measures and engineering controls including additional hydraulic containment systems, and

continued stockpile depletion, and nitrate concentrations in previously non-compliant groundwater wells have been consistently decreasing and are now in compliance with the BC CSR.

Additional details can be found in Appendix I.



Declaration of Competency

The Ministry of Environment and Climate Change Strategy relies on the work, advice, recommendations and in some cases decision making of qualified professionals¹, under government's professional reliance regime. With this comes an assumption that professionals who undertake work in relation to ministry legislation, regulations and codes of practice have the knowledge, experience and objectivity necessary to fulfill this role.

1. Name of Qualified Professional Kelly Tradewell
Title Supervisor, GeoEnvironmental Programs

2. Are you a registered member of a professional association in B.C.? ☒ Yes ☐ No

Name of Association: BC Institute of Agrologists Registration # 4409

3. Brief description of professional services:
Oversight and senior review of the data analysis, interpretation and compliance summary of the
2024 Hartland Landfill Gas Annual Report

This declaration of competency is collected under section 26(c) of the *Freedom of Information and Protection of Privacy Act* for the purposes of increasing government transparency and ensuring professional ethics and accountability. By signing and submitting this statement you consent to its publication and its disclosure outside of Canada. This consent is valid from the date submitted and cannot be revoked. If you have any questions about the collection, use or disclosure of your personal information please contact the Ministry of Environment and Climate Change Strategy Headquarters Office at 1-800-663-7867.

Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature: 

X Print Name: Kelly Tradewell

Witnessed by: 

X Print Name: LORI NICKERSON

Date signed: November 20, 2025

¹ *Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

- a) *is registered in British Columbia with a professional association, is acting under that organization's code of ethics, and is subject to disciplinary action by that association, and*
- b) *through suitable education, experience, accreditation and knowledge, may reasonably be relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.*

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1. Name of Qualified Professional Ian Wiebenga
Title Manager, Project Engineering

2. Are you a registered member of a professional association in B.C.? ☒ Yes ☐ No

Name of Association: EGBC Registration # _____

3. Brief description of professional services:

Senior review and provision of information related to capital projects, budgets, closure and post-closure funds, and annual airspace calculations

This declaration of competency is collected under section 26(c) of the *Freedom of Information and Protection of Privacy Act* for the purposes of increasing government transparency and ensuring professional ethics and accountability. By signing and submitting this statement you consent to its publication and its disclosure outside of Canada. This consent is valid from the date submitted and cannot be revoked. If you have any questions about the collection, use or disclosure of your personal information please contact the Ministry of Environment and Climate Change Strategy Headquarters Office at 1-800-663-7867.

Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature: 
X _____
Print Name: Ian Wiebenga

Witnessed by: 
X _____
Print Name: Kelly Trudewell

Date signed: November 20, 2025

¹Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who

- a) is registered in British Columbia with a professional association, is acting under that organization's code of ethics, and is subject to disciplinary action by that association, and
- b) through suitable education, experience, accreditation and knowledge, may reasonably be relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.

AUTHOR QUALIFICATIONS

Shelley Donovan, M.Sc., has over 15 years experience in environmental monitoring, data analysis and regulatory reporting. She has been working extensively at Hartland Landfill for the past 4 years completing environmental monitoring of groundwater, surface water and landfill gas in accordance with the landfill Operational Certificate, the BC Environmental Management Act, and applicable regulations and guidelines. For this report, Shelley compiled and summarized existing data from the Hartland Landfill Gas and Environmental Monitoring Reports.

Kelly Tradewell, P.Ag. has over 20 years of professional experience in leading environmental monitoring, assessment, and compliance programs in the solid waste and resource management sector. For the past 17 years, she has worked extensively at the Hartland Landfill, providing professional oversight and assessment of environmental compliance under the landfill Operational Certificate, the Environmental Management Act, and applicable regulations and guidelines, including BC the Landfill Criteria for Municipal Solid Waste. Kelly provided oversight and senior review of the summarized data analysis and interpretation, and regulatory compliance review for this report.

STATEMENT OF LIMITATIONS

This report consolidates operational, financial, engineering, and environmental data prepared and certified by multiple internal and external parties. Environmental monitoring, landfill gas data, and related analyses were compiled by other qualified professionals, as referenced in text and/or appended to this report. Certain design assumptions, capacity estimates, and lifespan calculations were provided by external qualified professionals. The conclusions herein are based on data available at the time of preparation and are subject to the limitations of that data and the scope of work completed by contributing professionals.

Ian Wiebenga's seal and signature on this report certifies that the information related to capital projects, budgets, closure and post-closure funds, and annual airspace calculations have been reviewed and deemed to be accurate. It does not warrant or guarantee, nor accept any responsibility for, the accuracy or completeness of any other information supplied by others contained in this report.

Use of this report or any part thereof is subject to the understanding that professional judgment has been applied within the limits of the available information, applicable regulations, and accepted practice standards at the time of writing.

12.0 REPORT SIGNOFF

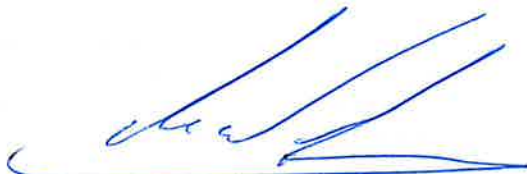
Approved by:



Kelly Tradewell, P.Ag.
Supervisor, GeoEnvironmental Programs



The Undersigned's seal and signature on this report certifies that the information related to capital projects, budgets, closure and post-closure funds, and annual airspace calculations have been reviewed and deemed to be accurate. It does not warrant or guarantee, nor accept any responsibility for, the accuracy or completeness of any other information supplied by others contained in this report.



Ian Wiebenga, P.Eng.
Manager, Project Engineering



Reviewed by:

Luke Novy, P.Eng. Manager, Solid Waste Operations

Ian Wiebenga, P.Eng, Manager, Project Engineering

Russ Smith, Senior Manager, Environmental Resource Management

Glenn Harris, Ph.D., R.P.Bio., Senior Manager, Environmental Protection