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Hartland Landfill Groundwater, Surface Water and Leachate Monitoring Program Annual Report

(April 2022 to March 2023)

Capital Regional District

Project number: 60631284

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Executive Summary

Based on our review of historical data and interpretation of the groundwater, surface water, and leachate quality data collected at Hartland between April 2022 and March 2023, the Annual Monitoring Program provided an effective assessment of landfill performance and compliance with respect to groundwater, surface water, and leachate flow and quality. Based on historical data and review of the 2022/23 data, AECOM made the following interpretations:

Leachate Flow

Leachate elevation data collected in 2022/23 indicate that leachate mounding persisted in the Phase 1 landfill, and leachate elevations in Phase 1 were generally stable and exhibited minor seasonal variations. The leachate mound in the upper portion of the refuse is interpreted as being 'perched' above the regional bedrock groundwater flow system, with relatively high water levels and strong downward hydraulic gradients.

Like in 2021/22, leachate elevations in the Phase 2 Basin exceeded the elevation of the Lower Leachate Lagoon in November and remained above the elevation of the lagoon for the rest of the monitoring period. Historically, the leachate elevation in Phase 2 was approximately 1 to 2 m lower than the elevation of the Lower Leachate Lagoon. CRD confirmed that this trend was likely due to calibration/ instrument drift, and were not indicative of a change in operations. . The leachate elevation in Phase 2 was well-below the groundwater elevations observed at locations GW-36-1-1 and GW-37-1-1, indicating that the hydraulic trap was preserved throughout the monitoring year.

In 2022/23, leachate discharge volumes were lower than those observed in 2021/22. The total volume of leachate discharged in 2022/23 was 520,740 m^3, approximately 7.5% less than in 2021/22. The contrast in leachate discharge volumes likely reflects a lower volume of precipitation in 2022/23 compared to 2021/22. It is also possible the lower volume of leachate may be due to biofouling of the North Purge Wells and a resultant decrease in the volume of leachate extracted from these wells over the past year.

In 2022/23, a total of 30,580 m^3 of leachate was collected from the South Purge Wells, approximately 13.3% less than in the previous monitoring year. A total of 14,277 m^3 of leachate was collected from the North Purge Wells, approximately 21.3% less than in the previous monitoring year. Groundwater levels measured in and around the purge well systems were consistent with historical values. The leachate discharge volumes and consistent groundwater elevations suggest that both purge well systems functioned effectively in 2022/23.

Groundwater Flow

In 2022/23, groundwater flow patterns observed at Hartland were consistent with historical interpretations, with some variations in the North Ridge area. Regional groundwater flows from Mount Work northeast to the north-south trending valley that underlies the northern portions of the Phase 1 and Phase 2 landfills. Most of the northward groundwater flow in the bedrock below the landfill is captured by the Toutle Valley Underdrain, Phase 2 Heal basin leachate collection system, springs discharging to the lower lagoon, and the north and south purge well systems. Groundwater monitors east of Phase 1 confirm flow from east to west toward the landfill, preventing off-site migration to the east. Groundwater elevations in the North Ridge area still exhibited strong seasonal fluctuations, and the Highland Fault continued to function as a barrier to groundwater, impeding groundwater flow to the east.

Around the North Ridge and Hartland North Pad, located northwest of Phase 2, groundwater flows radially from a topographic high situated north of Phase 2. Throughout 2022/23, continued blasting operations along the North Ridge resulted in reductions in both the topography and the groundwater potentiometric surface. Although groundwater elevations in the North Ridge area continued to exhibit seasonal fluctuations, the intensity of the fluctuations was less pronounced.

Groundwater Quality

The groundwater quality results from 2022/23 indicate that leachate impacted groundwater was contained within the landfill property. At the north end of the landfill, leachate impacted groundwater extended just north of the unlined Lower Leachate Lagoon and through the middle of the lined Upper Leachate Lagoon but did not extend off-site. Leachate impacts were observed in well GW-106-1-1, but were limited to an area less than 20 meters northwest of the Phase 2 Basin. South of the landfill, leachate impacted groundwater did not extend off-site. Leachate related exceedances were confined to the landfill footprint on the east side of Phase 1 and are inferred to extend to the western extent of the waste footprint within the Phase 2 landfill. These results indicate that the leachate collection system continued to function as intended, minimizing surface water and groundwater quality impacts.

In 2022/23, Boundary Compliance wells and off-site monitoring wells met CSR AW and DW standards, except for an anomalous copper concentration exceedance at GW-21-1-1 in May 2022. However, this recorded exceedance may not accurately represent true conditions as indicated by the high RPD discrepancy between parent and duplicate samples. Dissolved copper in the parent sample was not detected but highly elevated in the duplicate sample. Similar to previous years, most exceedances were present in groundwater wells near leachate purge wells and known leachate sources. However, nitrate concentrations in several groundwater wells located downgradient of aggregate stockpiles exceeded applicable CSR DW standards on one or more sampling event.

In 2022/23, groundwater in many areas of the landfill exhibited elevated conductivity, nitrate, and sulphate concentrations, reflecting the impacts of aggregate production, transport, stockpiling and use for construction at Hartland. These elevated aggregate runoff parameters were observed around the Northwest Stockpile, North of phases 1 and 2, around the Northeast Stockpile, south of Phase 1, and throughout the surface water system. AECOM is currently updating the Groundwater, Surface Water and Leachate Monitoring Plan to capture the cumulative impact of various activities, including aggregate production, stockpiling, leachate discharge and on-going construction. The following paragraphs summarize groundwater quality observations from different areas of the landfill:

North of the Landfill

- In 2022/23, annual average conductivity values in the North Purge Wells were generally higher than those in 2021/22, reflecting more concentrated leachate. Changes in leachate quality in the North Purge Wells may reflect more concentrated leachate due to lower precipitation in 2022/23 than 2021/22, or mixing of leachate from Phase 1 and the Lower Leachate Lagoon.
- Operation of the Phase 1 North Purge Well System continued to mitigate leachate impacts north of the landfill, as indicated by long-term stable or decreasing concentrations of leachate indicator parameters at locations GW-40-1-1, GW-20-1-1 and GW-21-1-1. However, nitrate concentrations at location 40 increased considerably from the previous monitoring year.
- 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. The increase in nitrate and sulphate concentrations in groundwater is interpreted to be due to runoff from aggregate stockpiles and roads constructed with aggregate.
- Along the northern edge of the Phase 2 Basin, groundwater quality is primarily impacted by runoff from aggregate stockpiles. GW-105-1-1 and GW-106-1-1 showed evidence of leachate impacted groundwater, although this is thought to be limited to an area less than 20 meters northwest of the Phase 2 Basin.
- Groundwater quality at Boundary Compliance Station GW-31-1-1 met all applicable CSR standards in 2022/23. Elevated sulphate and nitrate concentrations observed at this location are attributed to aggregate runoff.

Hartland North Pad

- Groundwater quality at the Hartland North Pad was slightly deteriorated, with elevated conductivity, nitrate, and sulphate concentrations observed in some wells (e.g., wells GW-44-1-1, GW-62-1-1, GW-77-1-1, GW-78-1-1, GW-87-1-1, GW-88-1-1). The concurrent increase in conductivity, sulphate, and nitrate concentrations suggests widespread impacts of aggregate runoff on shallow groundwater quality.
- Groundwater quality in GW-91-1-1 and GW-92-1-1 was generally consistent with background conditions, except for elevated conductivity and sulphate concentrations. Nitrate concentrations remained low at both sites. The elevated sulphate may be associated with natural sulphide oxidation. Groundwater at location GW-94-1-1 was clearly impacted by aggregate runoff, indicating it cannot be considered a background station.

South of the Landfill

- Groundwater quality south of the landfill met all applicable CSR standards. Although ammonia concentrations in some wells south of the landfill were slightly elevated, they were within historical ranges and well below the applicable CSR standards.
- Groundwater quality at several locations (e.g., GW-85-1-1, GW-60-1-1, and GW-71-1-1) showed no evidence of landfill leachate impacts. However, elevated nitrate and moderate sulphate concentrations reflect impacts from aggregate stockpiling and use, which may be related to runoff from the paved area and wind-blown or transported aggregate dust. Since 2020, chloride concentrations have been occasionally elevated at some monitoring stations (e.g., GW-85-1-1 and GW-60-1-1), but the elevated chloride concentrations have not correlated with elevated ammonia concentrations. High Cl/Na molar ratios (>1) suggest there is an additional source of chloride other than road salt, but the source of chloride is currently unknown.

East of the Landfill

- Water quality along the east boundary of the Phase 1 landfill was consistent with previous years, and concentrations of all parameters were below applicable CSR standards. However, elevated sulphate and nitrate concentrations were observed at Site 16 reflecting the influence of aggregate runoff from the Northeast Stockpile.

Domestic Well Water Quality

As part of the CRD's groundwater quality monitoring program, sixteen (16) domestic wells within a 2 km radius of the landfill were sampled in 2022/23. The groundwater quality data was consistent with historic results, meeting all applicable federal and provincial drinking water quality guidelines (CDWQ and SDWQG). This indicates that offsite domestic water wells continue to remain unimpacted by landfill leachate.

Surface Water Quality

Surface water quality data collected in 2022/23 confirmed that nearby surface water bodies, including Tod Creek, Durrance Lake and Durrance Creek and Killarney Lake continue to be unimpacted by landfill leachate. However, surface water quality monitoring stations at the landfill continued to show signs of water quality degradation, especially in the area northwest of Phase 2.

In 2021/22, dissolved copper concentrations exceeded BCWQG-STA values at 8 stations. In 2022/23, dissolved copper concentrations exceeded the BCWQG-STA once in January at SW-S-12.

North of the Landfill and Downstream of the North Pad

- Surface water at boundary compliance location Sw-N-05 continued to exhibit elevated nutrient concentrations in 2022/23, resulting in non-compliant conditions. Nitrate concentrations at Sw-N-05 exceeded BCWQG-STA during November 2022 sampling event, suggesting an impact on surface water from quarrying, aggregate production, stockpiling and use. The absence of concurrent elevated ammonia and chloride concentrations indicates surface water was not impacted by leachate. The occasionally elevated ammonia concentrations may be associated with nitrate reduction via denitrification under reducing conditions.
- Surface water quality at boundary compliance station Sw-N-16 met BCWQG-STA, except for one total iron exceedance during the February 2023 sampling event. The iron exceedance observed at Sw-N-16 was likely due to the disturbance of sediment during sampling, as indicated by the reported higher that historic TSS concentration. Surface water quality at Sw-N-16 was not impacted by leachate, but continued to exhibit minor influence from nearby construction activities involving blasting, aggregate production, transport and placement, and excavation of organic soils. Similar aggregate impacts were observed downstream at stations Sw-N-17 and Sw-N-45.
- Surface water at Sw-N-18 reflected dilute landfill leachate impacts and may also have been impacted by aggregate runoff. In November 2022, the plug and diversion measures at surface water station SW-N-18 were removed, and a diversion pipe with valve was constructed in late 2022/early 2023 with the option to direct surface water either to the NWSP or the upper leachate lagoon dependant on water quality.
- In the Hartland North Pad area, surface water quality at boundary compliance stations (Sw-N-41s1 and Sw-N-42s1) met BCWQG-STA in 2022/232, except for TSS. Leachate indicator parameters remained low in 2022/23, indicating

surface water was not impacted by landfill leachate. The slightly elevated sulphate, nitrate and conductivity concentrations indicate continued minor impacts from aggregate production, stockpiling and use.

- Historically, surface water stations Sw-N-14 and Sw-N-CS2 were used to monitor background conditions north of the landfill, but elevated conductivity and nitrate concentrations were observed in 2022/23, and sulphate concentrations were elevated in Sw-N-14. It indicated that surface water quality at these stations has been impacted by aggregate runoff and they are no longer suitable for use as background monitoring locations.
- Sw-S-52 consistently showed no signs of impacts related to the landfill, confirming that the water quality remains representative of the background conditions south of the landfill.
- Surface water quality downgradient of the North Pad (Sw-N-41s3) exhibited slightly elevated nitrate concentrations (1.28 to 1.57 mg/L) corresponding to low to moderate sulphate concentrations (17.0 to 20.0 mg/L). In the absence of elevated sulphate concentrations, it is difficult to interpret whether the elevated nitrate concentrations reflect a background process, , or dilute runoff from aggregate stockpiles originating at Hartland landfill. Historically, nitrate concentrations have generally been below 0.2 mg/L, but they occasionally elevated to a peak level of 10 mg/L in 2007. Further downstream of Sw-N-41s3, water quality at Sw-N-41s4 was consistent with background conditions, and showed no signs of aggregate or leachate impacts.
- Further downstream to the north of the landfill, at the confluence of Durrance Creek and Tod Creek (Sw-N-64 and Sw-N-65), surface water quality showed no impacts from landfill leachate or aggregate runoff. The slightly elevated nitrate (<1.5 mg/L) and sulphate (<20 mg/L) concentrations at Sw-N-63 may have originated from the on-site aggregate runoff, or may be associated with nutrients derived from the surrounding agricultural lands.

South of the Landfill

- Water quality at the boundary compliance location (Sw-S-04) met the BCWQG-STA values for all analytes in all samples collected during 2022/23, except for one total iron concentration observed in May 2022. Surface water quality along the south boundary was not impacted by leachate but may be influenced by dilute aggregate runoff.
- Water quality at Sw-S-52 (not a compliance location) was representative of background water quality. In 2022/23, concentrations of all parameters were below the BCWQG-STA. Concentrations of leachate indicator parameters were consistent with previously reported values.
- Like in 2021/22, surface water quality south of the recycling area (Sw-S-03, Sw-S-12) exhibited several BCWQG-STA exceedances, including TSS, dissolved and total iron, copper, and chloride during one or more sampling dates. Elevated ammonia, nitrate, conductivity and sulphate concentrations at these stations may be related to aggregate dust from the south face of Phase 1 and runoff from paved areas surrounding the bin facility that experiences heavy traffic and several industrial activities.

Leachate Quality

In 2022/23, the leachate quality observed in the Hartland Valve Chamber followed the requirements of the Waste Discharge Authorization, except for COD exceedances on multiple sampling dates. Based on discussions with the analytical laboratory, CRD confirmed that the noted COD exceedances were due to the use of compromised/expired preservatives that were provided to CRD by the laboratory, and the exceedances do not likely reflect in-situ leachate quality. Overall, average annual leachate concentrations in 2022/23 were comparable with those measured in 2021/22.

Quality Assurance and Quality Control

Upon review of the quality assurance and quality control data collected in 2022/23, groundwater, surface water and leachate sampling and laboratory analysis have produced reliable results that are acceptable for the purposes of this monitoring report.

Compliance with Operational Certificate and Waste Discharge Authorization

Groundwater quality, surface water quality, and leachate quality data were used to assess compliance with the Amended Operational Certificate and Waste Discharge Authorization and are discussed individually below.

Groundwater

A total of 36 groundwater monitoring wells were identified as Boundary Compliance Monitoring Wells. Water quality data collected from these wells were compared to the CSR standards for the protection of freshwater aquatic life and drinking water to assess compliance with the landfill Operating Certificate and protect both current and future uses of the groundwater resource.

With respect to groundwater quality, Hartland Landfill remained in compliance with the Operational Certificate in 2022/23 except for one (1) copper exceedance at Boundary Compliance Station GW-21-1-1. However, this recorded exceedance may not be representative of in-situ groundwater quality due to high RPD discrepancy. Dissolved copper was not detected in the parent sample but was highly elevated in the duplicate sample. Overall, the copper exceedance is unrelated to landfill activities, as indicated by low concentrations of parameters associated with aggregate runoff and leachate.

Surface Water

A total of five (5) surface water monitoring stations have been identified as Boundary Compliance stations surrounding Hartland Landfill. These stations are concentrated along the southern and northern property boundaries, downgradient of areas that have the potential to be impacted by leachate or landfill runoff. Water quality data collected from the Boundary Compliance stations were compared to the BCWQG-STA criteria to assess compliance with the Landfill Operational Certificate.

Some water quality impacts observed at the Boundary Compliance stations were caused by sources other than landfill leachate or aggregate runoff, including turbid samples collected under low-flow conditions and ongoing construction activities. In 2022/23, surface water quality was slightly deteriorated, exhibiting widespread impacts related to aggregate production and stockpiling. Throughout the monitoring year, highly elevated conductivity, sulphate, nitrate and/or ammonia concentrations consistent with aggregate runoff were observed at Boundary Compliance stations Sw-N-05, and Sw-N-16. Nitrate concentrations exceeded the BCWQG-STA at Sw-N-05 during the May and November 2022 sampling events. Additionally, moderately elevated conductivity, sulphate, and nitrate concentrations at Sw-N-41s1 and Sw-N-42s1 indicate minor impacts from aggregate production, stockpiling and use. Ultimately, in 2022/23, surface water quality at Sw-N-05 was not compliant with the Landfill Operational Certificate. Table 9-1 summarizes BCWQG-STA exceedances observed at Hartland in 2022/23.

Table ES-1. Surface Water Quality Compliance at Property Boundary Stations

Station	General Parameters	Nutrients	Metals	Comments
North of the Landfill				
Sw-N-05	None	Nitrate (1)	None	• 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.
Sw-N-16	None	None	Total Iron (1)	• Exceedances are anticipated to be related to turbid flow conditions following a prolonged dry period. Continued monitoring to assess these anomalous results.
SW-S-04	None	None	Total Iron (1)	• Exceedances are anticipated to be related to turbid flow conditions following a prolonged dry period. Continued monitoring to assess these anomalous results.

Leachate

The Hartland Valve Chamber is the Compliance Monitoring Station for the Waste Discharge Authorization under the CRD Sewer Use Bylaw, Bylaw 2922. During the monitoring period, leachate discharges at the Hartland Valve Chamber were in compliance with the Waste Discharge Authorization requirements.

Recommendations

Based on the findings of this report, our recommendations are summarized in Table ES-2:

Table ES-2. Summary of Recommendations

	Leachate Collection System	**Status**
1	Closely monitor water levels and leachate quality in the north purge wells to verify the effectiveness of the leachate collection system. Water levels in well 52-3-0, adjacent to 52-4-0-P7 have slowly increased since 2021/22 and may indicate diminished drawdown and leachate collection in this area. A step test should be conducted on each north purge well to measure the specific capacity which is an indicator of well performance. The measurements should be compared to historical assessments to determine the need for well rehabilitation. Options for maintaining lower leachate levels in P7 and P9 should be further investigated to continue improving groundwater quality west of the lower leachate lagoon.	New/Ongoing
2	Closely monitor water levels and leachate quality in the south purge wells to verify the effectiveness of the leachate collection system and identify opportunities for improvements. Several pump failures were reported for south purge wells P3 and P10. Increased water levels above operational targets were observed in P1, reaching a peak of 150.6m. Pumping elevations in the south purge wells (P2, P3, P4 and P10) should be maintained at elevations below 140 m asl. Pumping elevations in P1 should be maintained near the bottom of the screened interval around 146 m asl.	New/Ongoing
3	Periodically validate the pumping levels and the extent of the drawdown cones surrounding the north and south purge well systems (next assessment in 2024) to confirm the proper functioning of the purge wells. All procedures should follow the Standard Operating Procedure (SOP) – North Purge Well Drawdown Cone Verification (AECOM 2016), with interpretation of results by a qualified professional. Water levels in purge wells and pump maintenance should be conducted regularly to confirm the efficiency of the purge wells.	Ongoing
4	Conduct a detailed assessment of the effectiveness of the hydraulic trap and leachate collection systems including the north purge wells and south purge wells based on the design of the Phase 4/5/6 quarry and liner system. This is required to confirm the landfill will perform as intended as the landfill extends further north and west, and as additional lifts are constructed. Recent groundwater and surface water characterization between the Phase 2 Basin and the Northwest Sedimentation Pond suggests additional leachate containment or groundwater management measures need to be implemented to mitigate the potential for off-site leachate migration and non-compliant water quality at Sw-N-05.	Ongoing
	Runoff and Infiltration Associated with Aggregate Stockpiles	
5	Update the aggregate impact indicator parameters and thresholds based on recent geochemical testing results for aggregate samples and recommendations of the Aggregate Management Plan that is presently being developed.	New
6	Minimize the spatial extent and volume of aggregate stockpiles outside of the leachate collection system. Where this is not feasible, stockpiles should be covered with low permeability temporary tarps as soon as practical to minimize sulphate, ammonia, nitrate and TSS impacts on downgradient groundwater and surface water quality. Direct runoff from aggregate stockpiles should be diverted away from natural water courses as it is known to exceed BCWQ guidelines for sulphate and some nitrogenous compounds. This approach proved to be effective for mitigation of historical aggregate impacts at the Hartland North Pad.	Ongoing
	Groundwater Monitoring Program	
7	Advance a network of boreholes into the bedrock slope west of the Phase 2 landfill to characterize the geology, hydrogeology and groundwater quality. This will also allow for establishment of a long-term groundwater monitoring network west and upslope of the Phase 2 landfill to support continued evaluations of hydraulic trap performance and monitor groundwater quality.	New/Ongoing
8	Groundwater monitoring wells in proximity to the Phase 2 Basin and Northwest Sedimentation Pond should be closely monitored to confirm the hydraulic trap leachate collection system is effectively containing leachate north of Phase 2. Continued quarrying may result in greater connection between the groundwater flow system on the west side of the Highland Fault and the Phase 2 hydraulic trap, resulting in lowering of the surrounding groundwater levels and increased leachate generation.	New/Ongoing
9	Decommission any monitoring wells that will be affected by quarrying, aggregate stockpiling, landfill development in advance of any damage to satisfy the requirements of the British Columbia Groundwater Protection Regulation. Based on near term construction activities, it is anticipated that monitoring wells 27-1-1, 78-1-1, and 78-2-1 will be inevitably impacted. Monitoring wells 27-1-2 and 93-1-1 should also be decommissioned.	New
10	Establish a new background groundwater monitoring well further upgradient of the Northwest Stockpile to replace 94-1-1. Water quality in well 94-1-1 is no longer considered representative of	New

	background groundwater quality. It is possible that this monitoring well could be coordinated with investigation of the bedrock hydrogeology west of the Phase 2 landfill.	
11	The existing Groundwater, Surface Water and Leachate Monitoring Plan should be updated to ensure that it remains effective in monitoring the impacts current and future of landfill operations, including aggregate production, stockpiling, leachate discharge and on-going construction. This work is currently underway.	Ongoing
12	Groundwater wells should be surveyed once every five years to verify well condition and ensure geodetic well elevations are accurate (i.e., next survey in 2025).	Ongoing
13	The elevation of the leachate mound in Phase 1 and 2 should be determined at least once every five years (i.e. next assessment in 2025).	Ongoing
14	Conduct a review of the landfill development plan and filling plan every two years to ensure the existing monitoring network and monitoring program remain sufficient and interpretation of the data benefits from a complete understanding of the landfill design and operations over the next five years. The next review should be conducted in 2024 following completion of the Phase 4/5/6 quarry and liner design.	Ongoing
15	As required by the Amended Operational Certificate, the results of the annual monitoring program should continue to be reviewed and interpreted by a Qualified Professional experienced in assessing the impacts of landfill leachate at large municipal landfills similar to Hartland.	Ongoing
Surface Water and Leachate Monitoring Program		
16	Add sodium to the surface water analytical packages. Analyzing sodium alongside chloride can help determine if elevated chloride concentrations originate from road salt application.	New
17	Establish a new background surface water station upgradient of the Phase 2 landfill to replace background water quality monitoring locations Sw-N-14 and Sw-N-C52 which are no longer representative of background conditions.	New
18	Surface water quality at locations Sw-N41s4, Sw-N-63, Sw-N-64, and Sw-N-65 should be sampled on quarterly basis to delineate the impact of aggregate runoff and assess its effect on the receiving environment.	New
19	Improve surface water flow monitoring upstream of Sw-N-05 in Heal Creek to ensure it provides an accurate measurement of surface water discharge from the landfill. Accurate flow measurements are important for evaluating environmental impacts and ensuring adequate collection and conveyance capacity.	New
20	Improve surface water management north of the Phase 2 landfill to minimize impacts of aggregate runoff on groundwater and surface water that is not captured by the leachate collection system. This may require lining of the NWSP and installation of an underdrain to allow for management of groundwater separately from surface water in the area. Additional sediment control measures and efforts to reduce the quantity of blasting residuals contained in aggregate stockpiles may help reduce impacts on water quality as quarry development becomes increasingly close to the northern property boundary and the water quality boundary compliance monitoring stations.	New
21	Characterize the chemistry of residual wastewater solids and stabilized biosolids (solids and leachate) to allow for future evaluation of any impacts to leachate chemistry. This information may be available from pilot studies or operational monitoring programs.	Ongoing
22	Determine the source of chloride, ammonia, dissolved copper and nitrate observed in surface water south of the Phase 1 landfill. Additional waste has been placed on the western and southern portions of Phase 2 over recent years and occasional leachate seeps and runoff from the truck wash facility have been noted in the past. Changes in activities at the south end of the landfill and management of impacted surface runoff may play a role. A multilevel monitoring well cluster should be established west of the bin facility and well 85-1-1 to resolve whether the source of impacts to surface water are due to runoff or discharge of leachate impacted groundwater.	New/Ongoing
23	Resume leachate sampling from the Phase 2 Cleanout as soon as the sampling pump is replaced. This information will be important for tracking changes in leachate chemistry as Phase 2 Cell 4/5/6 are developed.	Ongoing
24	In addition to the Sewer Use Criteria, leachate quality results for trace organic compounds should be compared to CSR standards for the protection of drinking water and aquatic life to allow for screening of data to identify parameters in leachate that exceed CSR standards and guide any refinements to the monitoring program in future years. Additionally, an updated list of emerging contaminants will be integrated into the monitoring program for the 2023/2024.	Ongoing
Construction Management		
25	Blasting and quarrying activities should continue be to be conducted under the direction of a qualified blasting professional to minimize the potential for blast-enhanced fracturing, with possible negative impacts on hydraulic properties. This has been demonstrated to have important implications on groundwater elevations west of the Highland Fault and the volume of seepage reporting to the Phase 2 Basin as the base of the quarry has been lowered In circumstances where blasting might induce substantial topographic alterations or changes to the elevation of the	New

	base of the Phase 2 quarry, consultation with a hydrogeologist is recommended to evaluate potential implications on the performance of the hydraulic trap and the leachate collection system.	
26	The placement of aggregate, road salt, dust suppressant and herbicides should be carefully considered and documented to help understand the causes of potential future concentrations of conductivity, ammonia, chloride, nitrate, sulphate and select metals at groundwater and surface water monitoring locations.	Ongoing
	Quality Assurance and Quality Control	
27	Quality assurance for laboratory analyses should continue to be evaluated quarterly, and any discrepancies should be resolved with the laboratory and CRD sampling personnel within one month of receiving the laboratory results. The appropriate notation should be added to the data files to explain the reason for the low precision and the steps taken, if any, to improve the sampling or laboratory procedures.	Ongoing

Table of Contents

Figures

Tables

Appendices

1. Introduction

Hartland Landfill is located at the end of Hartland Avenue approximately 14 kilometres (km) north of Victoria (Figure 1-1). Filling with waste commenced at the site in the 1950s. The site was owned and operated by a private company until 1975 when the property was purchased by the Capital Regional District (CRD). The landfill is currently owned and operated by the CRD and is the primary solid waste disposal site for the 13 member municipalities and three electoral areas of the Capital Region.

The CRD initiated a surface water and groundwater monitoring program at the landfill in 1983. Since 1988, annual monitoring reports have been prepared and issued by Gartner Lee and AECOM. The present Hartland Monitoring Program is part of an Amended Operational Certificate (#12659) that is required and approved by the BC Ministry of Environment and Climate Change Strategy (ENV) and was last amended January 27, 2010.

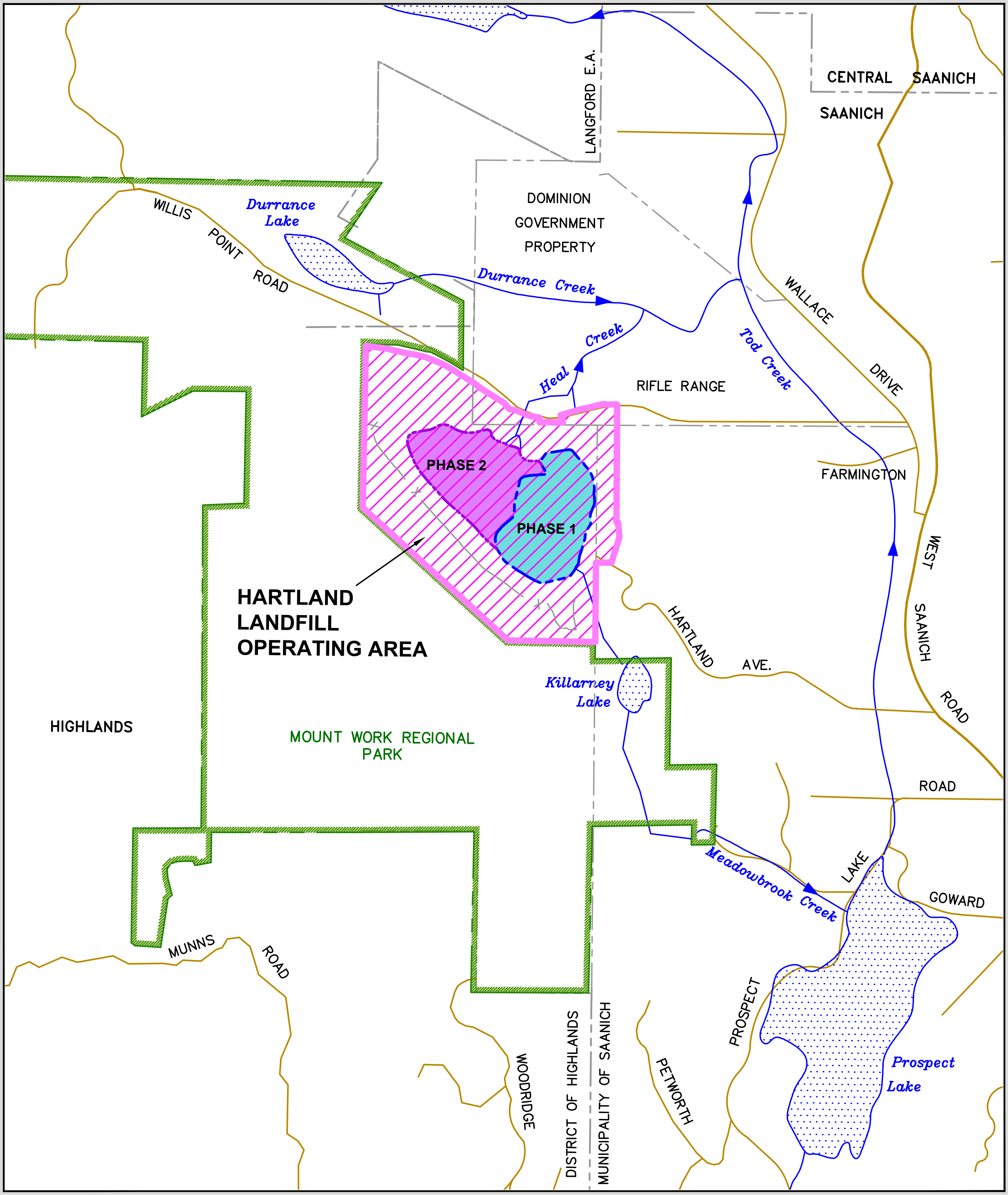
The Hartland Landfill is divided into two distinct areas referred to as Phase 1 and Phase 2. Initially, waste was deposited in Phase 1, which reached capacity in 1996 and was capped in 1997. Phase 2 actively receives waste and is engineered and operated as a ‘hydraulic trap” landfill with the maintenance of upward groundwater gradients below the base of the Phase 2 landfill providing leachate containment. Filling of Phase 2 Cell 1 was completed in 2004, and Cell 1 was capped in 2011. During the summer of 2004, the west face of Phase 2 Cell 1 was capped with a geomembrane to reduce passive gas venting and provide an internal leachate collection system for future development of Phase 2 Cell 2. This area is referred to as the West Face closure. In 2016, Phase 2 Cell 3 was developed on the west side of Phase 2 along with new leachate collection infrastructure.

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 transported by a pipeline through the northwest trunk sewer system and ultimately to the McLoughlin Point Wastewater Treatment Plant. Leachate discharge to sewer is authorized by CRD Regional Source Control Program Waste Discharge Authorization SC97.001, last amended on March 1, 2011, and is subject to the CRD Sewer Use Bylaw (Bylaw No. 2922).

This report presents our interpretation of water quantity and quality data collected between April 2022 and March 2023 to meet the following objectives:

1. Evaluate the effectiveness of the leachate containment and collection systems.
2. Assess the potential impact of landfill leachate and operational activities on groundwater and surface water quality.
3. Assess temporal trends in leachate, groundwater and surface water flow and quality.

Leachate, surface water and groundwater data collected beyond the monitoring timeframe was not considered in this report.



N
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0 100 200 400 600 800 1000 m

1 : 25,000
UTM Zone 10N, NAD83

Legend

- ROAD
- MUNICIPAL BOUNDARIES
- SURFACE DRAINAGE
- PHASE 1
- PHASE 2
- HARTLAND LANDFILL OPERATIONAL BOUNDARY

Reviewed by: KJ
Date Issued: JULY 2023

Prepared by: SP
Project Number: 60631284

Project: Hartland Landfill Monitoring
Location: Saanich, BC

Site Location Map

AECOM

Figure 1-1

Date Plotted: 2023-08-15 File Location: C:\Users\susan.a.powell\Desktop\Desktop_WFH\60631284Hartland Landfill 2022-2023\900-CAD_GIS\910-CAD\20-SHEETS\C\FIG1.1-Site Location-60631284-2022.dwg

2. Site Description

2.1 Physiography

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 metres (m) in the area. Undeveloped CRD property (about 320 hectares (ha) in total) lies to the west and south of the landfill site. Mount Work Regional Park lies to the west and the Department of National Defence rifle range is situated north of the landfill. Durrance Lake Regional Park is located northwest of the landfill, and Killarney Lake Regional Park is located to the southeast. Private residential properties are located to the east and southeast of the landfill.

Durrance Lake and Killarney Lake are two major surface water bodies located within one kilometre of the landfill footprint. A lined perimeter ditch collects and diverts natural runoff from upslope areas around the landfill footprint. The water is discharged into ephemeral surface water features that report to Durrance Lake to the northwest and Killarney Lake to the southeast.

A Residuals Treatment Facility (RTF) was constructed at Hartland North to treat effluent from the McLoughlin Point Wastewater Treatment Plant. The RTF became operational in September 2020. Although the RTF is located within the Hartland Landfill Operating Area Boundary, it is managed by CRD as a separate site.

The Centrate Return Line (CRL) is used to return centrate from the RTF and leachate from the Hartland Landfill to the McLoughlin Point Wastewater Treatment Plant. The CRL was activated on December 30, 2020, and the formal switch from the leachate pipeline to the CRL occurred in March 2021.

A water main was installed along the East Perimeter Road with a water service installed between leachate lagoons in the northeast corner of the Hartland property. The new water main connects the RTF with Saanich's new water reservoir built on Hartland's eastern boundary. The new water service also supplies water to the newly built Pump Station No. 4, which is part of the Wastewater Treatment Project's Residual Solids Conveyance Line (RSCL). The RSCL conveys processed wastewater from the McLoughlin Point Wastewater Treatment Plant to the RTF. Construction of the RSCL was completed in the summer of 2020.

2.2 Geology

2.2.1 Surficial Geology

A thin veneer of glacial till composed of silty, gravelly sand, with interspersed cobbles and boulders mantles the bedrock in areas of gentle slopes and in valley bottoms. Locally surrounding the landfill, fluvial deposits consisting of well-sorted sands and gravels are observed in bedrock depressions and channels, including the channel that drained Heal Lake prior to development of the Phase 2 landfill. At the landfill, the bedrock is mantled by a thin, discontinuous veneer of glacial till (Vashon Drift) composed of silty, gravelly sand, with interspersed cobbles and boulders. Vashon Till is generally absent from the North Ridge and the Hartland North area.

In 2022, AECOM supervised a drilling program at Hartland. During the drill program, a gully infilled with unconsolidated material was identified north of the Phase 2 landfill, between Phase 2 and the Northwest Sedimentation Pond (NWSP) (AECOM 2023). The subsurface materials consisted of dense, sandy, silty diamicton and till, with interspersed cobbles.

2.2.2 Bedrock Geology

The bedrock geology in the area surrounding the landfill mainly comprises Wark Diorite Gneiss with Colquitz Gneiss outcropping in the northern and eastern margins of the landfill site with a thin overlying veneer of glacial till. The Wark Diorite Gneiss is dark green to black in colour. It is competent, except locally in shear zones, where it has been chloritized and weathered into soft, sand-size particles and clay. Discontinuities, including joints, shear zones and altered veins have been observed on the bedrock outcrops and noted in borehole logs. Geologic mapping of an exposed bedrock outcrop north of the Phase 2 landfill (AECOM 2018) characterized the undulating bedrock surface and confirmed the presence a complex network of lithologic contacts, faults and fractures observed in exposed bedrock excavations (sub-vertical quarry walls) including the Highland Fault and other faults that were previously inferred based on lineaments identified on aerial photographs (Thurber 1987). Evidence supporting the identification of a major oblique slip fault proximal to the trace of the Highland Fault was identified in this study and further validated by a drill investigation in the fall of 2019 (AECOM 2019a). Permeability testing and water level measurements have determined that faults and shear zones locally behave as conduits and/or barriers to groundwater flow which imparts a degree of anisotropy in the hydrogeological properties of the bedrock (AECOM 2018).

2.3 Climate

The climate of this area is classified as “cool Mediterranean”. Long-term (1981–2010) average climatic data is available for the Victoria International Airport Climatological Station (Victoria International Airport CS) located approximately 9 km from the landfill. Average annual temperature is 10.0ºC and mean monthly values range from a low of 4.0ºC in December to a high of 16.9ºC in July. Mean annual precipitation is 882.9 mm.

In 1994, the CRD established a climate station (Victoria Hartland CS) at the landfill office. The original Hartland climate station was replaced in 2009/10 with new equipment at a location on top of Phase 1. The new weather station records temperature, precipitation, wind direction, wind speed, barometric pressure, and relative humidity directly to CRD's SCADA system.

Hartland daily precipitation measurements for 2022/23 are provided in Appendix C. The precipitation measured at Hartland Landfill from April 2022 to March 2023 was 837.4 mm, approximately 5% lower than the 30-year average reported for Victoria International Airport CS (882.9 mm/year), and 33% lower than the total precipitation recorded in 2021/22 at Victoria Hartland CS (1279.5 mm). Precipitation during the 2022/23 wet season (i.e., October to February) was 528.0 mm, contributing over 63% of the total annual precipitation.

Climate change projections for the CRD were developed by the Pacific Climate Impacts Consortium to better understand the details of how climate may change in the Capital Region (CRD 2017). Overall, the results indicate that the region can expect warmer winter temperatures, fewer days below freezing, more extreme hot days in the summer, longer dry spells in summer months, more precipitation in fall, winter and spring, and more intense, extreme weather events. A water surplus occurs primarily in the cool, wet winter months (November, December, and January) with water deficit conditions occurring in the warm, dry summer months (July, August, and September).

2.4 Significant Site Activities in 2022/23

CRD staff maintain a log of activities at the landfill that are relevant to landfill operations, leachate containment, and compliance monitoring activities. Activities that are considered important from a compliance monitoring perspective are paraphrased below:

- Preparation of Leachate Line Decommissioning: The leachate pipeline was deactivated in March 2021 and plugged in April 2021 to prepare for decommissioning. The leachate line has been filled with super-chlorinated water since March 2021. In June 2021, the Regional Source Control program (RSCP) discharge permit (SC97.001) was amended to reflect construction of the CRL and decommissioning of the Markham Valve Chamber. In March 2023, to facilitate the Fortis construction near its alignment, the super-chlorinated water in the leachate line was permitted to drain into the Upper Lagoon.
- Deposition of Wastewater Treatment Residuals (WWTR) in Hartland Landfill: Between April 2022 and March 2023, approximately 11,596 tonnes of dried products (95% solid content) were received from the RTF. These biosolids are mixed volumetrically 1:1 prior to landfilling to prevent combustion. As of November 4, 2022, the practice of utilizing a blend of biosolids and overburden as a cover material for controlled waste and asbestos has been discontinued, and a landfilling approach has been adopted.
- Aggregate Storage Development: Aggregate production and blasting for air space, road building, and construction in the north area of Hartland continued in 2022/23. Several major storage areas were established to support aggregate storage and management, including the Northwest Stockpile, the Northeast Stockpile, the Triangle Stockpile, and the South Toe Stockpile. As of March 6, 2023, the current stockpile volume was estimated to be 691,252 m^3, with a maximum capacity of 978,128 m^3.
- Surface Water Quality at Compliance Location SW-N-05: Since November 2021, surface water at compliance monitoring station SW-N-05 has exhibited elevated and non-compliant nutrient concentrations. AECOM was retained by CRD to implement a multiphase assessment to determine the cause of elevated nutrient concentrations within and downstream of the Northwest Sedimentation Pond (NWSP) and Heal Creek. Between February 2022 and September 2022, three (3) drive-point piezometers, two (2) purge wells (P11 and P12), and 16 groundwater monitoring wells (GW-95-1-1 to GW-110-1-1) were installed north of the Phase 2 landfill. The new wells and drive points were monitored for

groundwater levels and groundwater quality, and then used to identify contaminant sources and migration pathways. AECOM determined that water quality north of Phase 2 was being impacted by dilute leachate and nitrate-rich contact water emanating from the Northwest Stockpile (AECOM 2023). The report identified several remedial strategies and options for managing aggregate stockpiles and leachate discharge, which are being implemented by CRD to manage aggregate stockpiling and leachate discharge, including development of an Aggregate Management Plan and updates to the existing groundwater and surface water monitoring plan. Additional design upgrades have also been incorporated into the Phase 4/5/6 landfill design.

- Establishment of New Surface Water Monitoring Stations: Between December 2022 and February 2023, a total of nine (9) surface water stations (SW-N-57, SW-N-58, SW-N-59, SW-N-60, SW-N-61, SW-N-62, SW-N-63, SW-N-64, and SW-N-65) were established north of the landfill. These stations aim to monitor the effects on surface water quality due to various landfill activities, such as road construction, blasting, and aggregate stockpiling. The data they generate supports evaluation of impacts on the downstream environment.
- Installation of Leachate Sump and French Drain System: Between June and October 2022, a French drain and a leachate sump were installed to mitigate the impact of leachate on surface water in the Phase 2 area. This system was strategically designed to reduce the perched, localized leachate mounding observed near the northern boundary of the area.
- Maintenance/Verification of North and South Purge Well Systems: Flow tests were regularly conducted at P1, P7 and P8 to monitor pump efficiency. Pumps installed in several leachate collection wells (P3 and P10) were replaced in response to pump failure.

2.5 Applicable Regulatory Criteria

The Hartland Landfill is required to operate in accordance with the monitoring requirements outlined in the following:

- Amended Operational Certificate (#12659) approved by ENV, last amended on January 27, 2010.
- Waste Discharge Authorization SC97.001 issued by the CRD Regional Source Control Program, last amended on March 1, 2011, and subject to the CRD Sewer Use Bylaw.
- Legally enforceable standards defined by the British Columbia Contaminated Sites Regulation (CSR).

The Stage 10 (Omnibus) and Stage 11 (Housekeeping) amendments to the CSR became effective on November 1, 2017. Stage 12 amendments to the CSR were issued January 24, 2019, and included clerical errors related to the Stage 10 and 11 amendments. The Stage 13 amendments came into force on February 1, 2021, and Stage 14 amendments came into effect on March 1, 2023. References to CSR standards in this report consider the latest amendments up to March 1, 2023.

As part of the update of Stage 10 (Omnibus) and Stage 11 (Housekeeping) amendments, a number of emerging contaminants were added to the water and soil schedules due to their persistence in the environment, toxicity, and relevance to contaminated sites in BC. In April 2017, AECOM conducted a focused review on the applicability of emerging contaminants at the Hartland Landfill based on Schedule 2 activities in the CSR. In 2018, AECOM conducted a detailed emerging contaminant review, to confirm regulatory compliance and to recommend an approach for future monitoring (AECOM 2018). It was recommended to continue sampling and analyzing of emerging contaminants of concern (CECs) at the Hartland Valve Chamber on a quarterly basis in conjunction with the trace organics sampling program, and the review should be conducted every five years to ensure effectiveness and relevance. The review of 2018 to 2022 data is currently on-going. In consideration of the five-year review process, quarterly sample collection in 2022/23 for CEC was momentarily paused, and only one sample was collected in May 2023 for selected CECs.

2.5.1 Groundwater

In February 2016, CSR Protocol 21 (P21), Water Use Determination, became legally enforceable. For the purposes of this report, Protocol 21 (Version 2.0, effective October 31, 2017) is considered when determining applicable water use standards at Hartland Landfill.

Groundwater quality data were compared to CSR Schedule 3.2 Generic Numerical Water Standards Column 3 Aquatic Life Use (AW) and Column 6 Drinking Water Use (DW), as required by P21.

Freshwater AW standards apply to groundwater because the landfill is “within 500 m of a surface water body containing aquatic life” (i.e., Heal Creek, Durrance Creek, Durrance Lake, Killarney Creek and Killarney Lake).

Future DW standards apply because the aquifer underlying the landfill has:

- A hydraulic conductivity greater than 10^{-6} m/s and a yield greater than 1.3 L/min.
- Groundwater with natural total dissolved solids (TDS) concentrations of less than 4,000 mg/L.
- An average confined aquifer saturated thickness greater than 1 m.
- An overlying silt or clay aquitard that is less than 5 m thick.

DW standards for iron and manganese do not apply to municipal landfills based on the Stage 8 Amendments to the CSR that came into effect on January 24, 2013, as presented on CSR Schedule 3.2.

The Stage 13 amendments to the BC CSR were effective as of February 1, 2021. As part of the Stage 13 amendments, Protocol 9, which includes the list of regional groundwater background concentrations, was updated. Regional background concentrations are provided in Table 1 of Protocol 9. Regional background concentrations for the Southern Vancouver Island have been considered when assessing groundwater quality data collected at the Hartland Landfill. In several instances, regional background concentrations are greater than the applicable CSR Drinking Water Use standard and/or the most stringent CSR Freshwater Aquatic Life Use standard. Groundwater that contains a substance concentration above the applicable CSR standard but below the regional background concentration for that substance is not considered contaminated under the CSR. All reference to CSR standards in this report consider Stage 14 amendments and included amendments up to March 1, 2023.

2.5.2 Surface Water

Surface water quality data are compared to the *British Columbia Approved and Working Water Quality Guidelines* (BCWQG) for the protection of AW and DW, because CSR Technical Guidance 15 (April 2013) indicates that groundwater in receiving environments (i.e., within 10 m of the high water mark of a surface water body) should be compared to the BCWQG. The approved and working BCWQGs were last updated in August 2023 and February 2021, respectively and the updated guidelines were considered when assessing data compliance in this report. Furthermore, there are two sets of BCWQG criteria for AW use:

- long-term chronic (LTC)
- Short-term acute (STA)

The purpose of the long-term chronic (LTC) guideline is to protect the most sensitive species and life stages against chronic exposure. To properly compare data against LTC guidelines, the LTC concentration is typically calculated by averaging the results of five or more samples collected within a 30-day period.

Short-term acute (STA) WQGs are established to protect the most sensitive species and life stages against short-term exposure (i.e., < 96 hours). BCWQGs for STAs are typically used to assess risks associated with short-term exposures.

The dissolved copper data evaluation has been updated to reflect the revised BCWQG AW criteria. The dissolved copper BCWQG varies with hardness, pH, dissolved organic carbon (DOC) and temperature, and is calculated using the Biotic Ligand Model (BLM). BLM is a series of linked equations that predict the toxicity of dissolved copper to aquatic life under specific conditions. In this report, only dissolved copper concentrations with paired DOC, pH and temperature data were compared to BCWQG AW criteria.

The approved BCWQG AW criteria for total aluminum, total arsenic and dissolved zinc were also updated in August 2023 version, and the changes have been considered in this report.

The BCWQGs apply to surface water on site and on adjacent sites under provincial jurisdiction. The Federal Water Quality Guidelines (CCME) apply on the property owned by the federal government located north of the site. Both the BCWQG and CCME criteria are guidelines and do not have the same regulatory force as the CSR Omnibus standards.

2.5.3 Leachate

Discharges from the leachate pipeline are subject to the CRD Regional Source Control Program (RSCP Waste Discharge Authorization (SC97.001) authorizing the discharge of non-domestic waste to the sanitary sewer in accordance with the CRD's

Sewer Use Bylaw 2922. In June 2021, the discharge authorization was amended to reflect operation of the CRL and decommissioning of the Markham Valve Chamber. Sampling is conducted on monthly basis.

The Hartland Landfill leachate compliance monitoring location is the Hartland Valve Chamber (flow detection chamber) located near the Lower Lagoon. Discharge limits are identified within the authorization.

3. Methods and Quality Assurance

3.1 Field Techniques

Sampling locations are shown on Figure 4-1. Boreholes and monitoring wells are identified using a standard system adopted by the CRD, consisting of three numbers (e.g., GW-02-02-01). The first number refers to the monitoring site, the second to the borehole at that site (there may be more than one) and the third number refers to the monitoring well in that borehole (there may be two or three at different depths in older installations). If the third number is a zero, it indicates an open borehole where no PVC monitoring well has been installed. Additionally, several leachate purge wells have been installed at the site. Purge wells are denoted with a "P" in front of the purge well number (e.g., P1).

Monitoring well construction details including location coordinates and elevations are summarized in Appendix A.1. Appendix A.1 also lists the status of all the groundwater monitoring wells at the site together with comments describing any problems associated with each monitoring well. Monitoring wells are categorized as active (fully functioning) or inactive (non-functioning or destroyed). In 2022/23, there were 148 active groundwater monitoring wells at 94 locations in the vicinity of Hartland Landfill, of which ten (10) are active purge wells and 13 are landfill gas wells that were regularly used to measure leachate levels in Phase 1. South purge well P1 was replaced and recommissioned in November 2018.

The methods used to develop and sample each monitoring well are indicated in Appendix A.2. The Standard Operating Practice (SOP) for groundwater sampling is periodically updated. A variety of techniques are used depending on the depth of the monitoring well, the groundwater level in the monitoring well, and the permeability of the surrounding geologic formation. A number of dedicated submersible pumps have been installed by CRD in the deeper monitoring wells and open boreholes at the landfill to facilitate more efficient sampling and have resulted in improved data quality. Sampling events were scheduled to avoid heavy rainfall events to avoid sample dilution.

In 2022/23, the monitoring program consisted of the following:

- Groundwater level measurements four times per year.
- Continuous water level monitoring with pressure transducers at north end of the Phase 2 landfill.
- Continuous water level monitoring with pressure transducers at the north and south purge well systems.
- Continuous water level monitoring with pressure transducers east of Phase 1 landfill and Hartland North.
- Quarterly monitoring of wells near the property boundary and key locations to assess the effectiveness of leachate containment.
- Semi-annual monitoring stations with relatively stable long-term historical data.
- Annual sampling of 19 residential wells, including 14 wells within a 2 km radius of the landfill and five (5) domestic wells located north of the Hartland North Pad.
- Quarterly sampling of surface water stations at property boundary points and other selected monitoring locations.
- Quarterly testing of leachate discharge for trace organic compounds.
- Monthly testing of leachate for conventional parameters and metals at the point of discharge and select locations within the leachate collection system.
- One sampling event (May 2022) for select emerging contaminants at the Hartland Valve Chamber.

As in previous years, CRD staff carried out surface water, groundwater and leachate sampling and groundwater level measurements at the locations shown in tables in Appendix B and on figures in Appendix E. Further information on the monitoring program field procedures is contained in the CRD Monitoring Procedure Manual.

The CRD has adopted a continuous improvement and quality assurance program. The existing Leachate, Groundwater, and Surface Water Monitoring Plan for Hartland was established in 2016. Following a review, modifications were made to the groundwater, surface water, and leachate monitoring program, and these changes were implemented in the 2019/20 monitoring year. AECOM is in the process of updating the program to ensure that it remains effective in monitoring the impacts of various landfill operations, including aggregate production, stockpiling, leachate discharge and on-going construction.

3.2 Quality Assurance

In 2022/23, routine surface water, groundwater and domestic well water laboratory analyses were performed by Bureau Veritas Laboratory (BV) in Victoria and Burnaby, British Columbia. BV also analyzed leachate chemistry samples, which included analysis of trace organic compounds.

A quality assurance program is in place assess the validity of the chemical analysis results. This has involved the submission of randomly selected field replicate, trip blank and "reference" Victoria municipal water samples to the laboratory for analysis. Table 3-1 and Table 3-2 presents quality assurance of groundwater and surface water, respectively. There were 25 surface water and 42 groundwater samples submitted in duplicate between May 2022 and April 2023. Table 3-3 presents quality assurance results for the Hartland Valve Chamber. In this report, each set of replicates were taken from the same source and/or site, and under the same conditions. In all cases, the field replicates were submitted ‘blind’ to the laboratory. This resulted in duplicate sampling frequencies of 13% (42/330 samples) for groundwater, 29% (25/87 samples) for surface water, 42% (5/12 samples) for the Hartland Valve Chamber compliance point, and 14% (9/64 samples) for the overall leachate sampling program. Overall, duplicate samples were collected at a frequency of approximately 16% (81/493), which exceeded the targeted duplicate sampling rate of 10%.

Submission of duplicate samples provides an estimate of total uncertainty associated with the data. Typically, one duplicate sample is collected for every ten samples (10%) as part of quality control measures. Total uncertainty is the variability (precision plus bias) associated with the sample collection and sample analyses. In addition, the Limit of Quantification (LOQ) should be considered because the precision of analytical results just above the Method Detection Limit (MDL) are known to be poor. The LOQ is the range of concentrations between the MDL and five times the MDL for each parameter, as outlined in Part E of the 2013 British Columbia Field Sampling Manual.

The CRD has used several different statistical methods for checking the precision and accuracy of its monitoring program. The CRD uses the relative percent difference (RPD) method, as recommended by ENV, which uses duplicate analyses to determine precision of the analytical results. This method expresses percent of difference between two values as the ratio of their absolute difference to the average value of the sample and the duplicate, as shown in the equation below:

$$RPD= [(|x_1-x_2|)/((x_1+x_2)/2)]$$

Where:

x_1 is the initial sample concentration (mg/L)
x_2 is the duplicate sample concentration (mg/L)

Parameters with RPD values exceeding the RPD criteria should be interpreted with caution. Alarm limits were set as per the BC Ministry of Environment Environmental Laboratory Manual. Duplicate samples with RPD values within 30% for general inorganics and metals and within 45% for organic compounds are considered to meet the Data Quality Objectives (DQOs).

3.2.1 Groundwater and Surface Water

Table 3-1 and Table 3-2 present calculated RPD values for replicate groundwater and surface water samples collected near the landfill. In both tables, RPD values were highlighted with an “a” if they were above 30% and it was noted with a “b” if one or more of the parameter concentrations were below the LOQ.

Table 3-1 indicates the following for groundwater samples collected at the landfill in 2022/23:

- A total of 42 duplicate samples were collected and analyzed for 57 parameters. Thirty-nine (39) samples had RPD values greater than 30% when all concentrations were above the LOQ.
- RPD values for pH (1 sample), ammonia (2 samples), dissolved aluminum (30 samples), antimony (2 samples), arsenic (1 sample), barium (2 samples), beryllium (1 sample), bismuth (1 sample), cadmium (11 samples), chloride (2 samples), copper (14 samples), iron (10 samples), lead (14 samples), magnesium (1 sample), manganese (2 sample),

molybdenum (1 sample), nickel (13 samples), phosphorus (6 samples), potassium (1 sample), selenium (1 sample), sodium (1 sample), sulphur (1 sample), thallium (5 samples), titanium (1 sample), uranium (4 samples), vanadium (5 samples), and zinc (23 samples), were greater than the 30% target when all concentrations were above the LOQ.

- Groundwater field replicates showed good precision for most parameters and the majority of RPD values for the 2022/23 monitoring year were within the acceptable range, except for dissolved aluminum, cadmium, copper, iron, lead, nickel, and zinc. These seven (7) dissolved metal concentrations had over 20% of the duplicate samples above the alarm limit of 30%.
- Overall, groundwater quality data is acceptably precise for the purpose of this report. However, dissolved aluminum, cadmium, copper, iron, lead, nickel, and zinc concentrations should be interpreted with caution. Field blanks should be collected to further investigate/evaluate if the filters are the source of metal contamination. It is recommended that in-line filters be flushed with sample water for at least 30 seconds (or 500 mL) to remove any trace metal particulate in advance of sampling where possible.

Table 3-2 indicates the following for surface water samples collected at the landfill in 2022/23:

- A total of 25 duplicate samples were collected and analyzed for 52 parameters. Twenty-three (23) samples had parameters with RPD values greater than 30% when all concentrations were above the LOQ.
- RPD values for pH (1 sample), conductivity (9 samples), temperature (1 sample), TSS (3 sample), dissolved organic carbon (6 samples), total ammonia (1 sample), total aluminum (6 samples), total arsenic (2 samples), total cadmium (9 samples), total cobalt (3 samples), total copper (3 samples), total iron (9 samples), total lead (7 samples), total manganese (7 samples), total nickel (5 samples), total selenium (1 sample), total zinc (4 samples), dissolved aluminum (3 samples), dissolved cadmium (7 samples), dissolved copper (3 samples), dissolved iron (9 samples), dissolved lead (6 samples), dissolved manganese (3 samples), dissolved molybdenum (1 sample), dissolved nickel (1 sample), and dissolved zinc (4 samples) were greater than 30% on at least one occasion when all concentrations were above the LOQ.
- Overall, surface water field replicates showed good precision for most parameters and the majority of RPD values for the 2022/23 monitoring year were within the acceptable range. Some of the high RPD values (i.e., iron, aluminum, etc.) may be due to disturbance of sediments while sampling under low flow conditions in the drier months.

3.2.2 Leachate

Five (5) duplicate leachate samples were collected during April 2022, August, November, and February events and analyzed for various parameters. As shown in Table 3-3, four (4) samples and twenty-four (24) parameters had calculated RPD values that exceeded alarm limits when concentrations in both replicates were above the LOQ. Duplicate sample collected in February 2023 had most of parameters exceeded alarm limits with most total metals above the alarm limit (30%) possibly due to issues with the filtration and collection process during sampling.

Because landfill leachate is a complex analytical matrix, leachate field replicates showed good precision for most parameters and the majority of RPD values for the 2022/23 monitoring year were within the acceptable range. Leachate quality data is acceptably precise for the purposes of this report.

3.3 Statistical Assessment of Temporal Trends

Seasonal variability in water quality parameters can mask the overall trend of parameters in groundwater, surface water and leachate quality data. To better understand long-term trends in water quality, a non-parametric statistical analysis has been employed to evaluate trends in water quality data at Hartland Landfill since 2005. This test, known as the Mann-Kendall test, was used to evaluate temporal trends in contaminant concentrations. The analysis of trends is intended to promote early detection of statistically significant trends (at the 95% confidence level) in groundwater chemistry at each sampling location. This method does not require normally distributed data and allows for missing data (non-detects) and irregularly spaced measurement periods in the dataset. Non-detect measurements are assigned the value of the detection limit for the purposes of the statistical analysis. Water and leachate quality data at Hartland Landfill often includes concentrations below detection limits and samples are not always collected at regularly spaced intervals. The hypothesis of both increasing and decreasing trends are tested at the same time. The Mann-Kendall test can be used for virtually any water quality or leachate parameter and provides a quantitative means of determining if a given parameter is changing (increasing or decreasing) in a statistically significant manner over time.

A statistical analysis was conducted utilizing data collected between February 2018 and March 2023. A five-year time frame is consistent with the time interval over which most water quality data is plotted within this report and is anticipated to provide a good balance between seasonal variation and the detection of long-term trends in water quality. This analysis is used to identify areas of the landfill where water quality is degrading and/or improving. The time frame over which trend analysis is conducted should be carefully evaluated in conjunction with management and operational changes.

All field and lab replicates were removed from the data set prior to the analysis. Conductivity, ammonia, and chloride concentrations were tested for trends using the Mann-Kendall test as they are considered indicators of leachate at Hartland Landfill. Trends in sulphate and nitrate concentrations were also evaluated because high concentrations have been observed in relation to aggregate generated and used at the site.

The analysis was conducted using data collected from a total of 80 groundwater monitoring wells (36 compliance and 44 routine), 8 leachate purge wells, 21 surface water monitoring stations (5 compliance and 16 routine), and the leachate compliance monitoring station (Hartland Valve Chamber). The rest of the locations are either inactive or do not have sufficient data for Mann-Kendall analysis. The results of the statistical trend analysis for groundwater, surface water and leachate are provided in Appendices G-1, G-2, and G-3, respectively, and are discussed in relevant sections of this report.

Table 3-1. Groundwater Quality QA/QC - Relative Percent Difference 2022-2023

				MAX Acceptable RPD	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
				Method Detection Limit (MDL)	1	0.5	0.02	0.02	0.02	0.01	0.005	10	0.005	0.05	1	0.1	0.005	0.05	0.5	1	0.005	0.5	0.05	0.05	0.05	0.02	0.005
				Limit of Quantitation (5 x MDL)	5	2.5	0.1	0.1	0.1	0.05	0.025	50	0.025	0.25	5	0.5	0.025	0.25	2.5	5	0.025	2.5	0.25	0.25	0.25	0.075	0.025
				Parameter	Alkalinity - Total	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chloride	Chromium	Cobalt	Copper	ardness (As Caco	Iron	Lead	Lithium	Magnesium	Manganese	Molybdenum	Ammonia	Nitrite
				Fraction	TOT	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	mg/L	mg/L
Station	Sample Type	Complance Well (Y/N)?	Date Sampled	Comments																							
18-1-1	FR1	Y	2022-05-13	Clear and colourless	150.	3.03	0.471	2.39	12.7	< 0.01	< 0.005	27.	0.016 4	57.3	3.9	< 0.1	0.368	0.139	173.	14.	0.011 2	0.89	7.28	78.6	0.519	< 0.015	< 0.005
18-1-1	FR2	Y	2022-05-13		150.	5.36	0.469	2.37	12.2	< 0.01	< 0.005	25.	0.012 3	57.	3.8	< 0.1	0.383	0.143	173.	14.5	0.010 6	0.92	7.36	78.7	0.527	< 0.015	< 0.005
18-1-1	FRM		2022-05-13	Mean of duplicates	150.	4.195	0.47	2.38	12.45	< 0.01	< 0.005	26.	0.014 35	57.15	3.85	< 0.1	0.375 5	0.141	173.	14.25	0.010 9	0.905	7.32	78.65	0.523	< 0.015	< 0.005
18-1-1	RPD		2022-05-13	RPD of duplicates	0.0%	55.5% a	0.4%	0.8%	4.0%			7.7%	28.6%	0.5%	2.6%		4.0%	2.8%	0.0%	3.5%	5.5%	3.3%	1.1%	0.1%	1.5%		
18-1-1	FR1	Y	2023-01-25	Clear and colourless	150.	2.14	0.348	2.67	13.3	< 0.01	< 0.005	28.	0.072	58.2	2.9	< 0.1	0.29	0.123	175.	2.2	0.005 8	1.61	7.23	72.9	0.736	< 0.015	0.005 2
18-1-1	FR2	Y	2023-01-25		150.	2.5	0.348	2.66	13.2	< 0.01	< 0.005	28.	0.071 4	57.3	3.2	< 0.1	0.281	0.189	172.	2.6	0.016 9	1.6	7.12	72.9	0.71	< 0.015	< 0.005
18-1-1	FRM		2023-01-25	Mean of duplicates	150.	2.32	0.348	2.665	13.25	< 0.01	< 0.005	28.	0.071 7	57.75	3.05	< 0.1	0.285 5	0.156	173.5	2.4	0.011 35	1.605	7.175	72.9	0.723	< 0.015	0.005 1
18-1-1	RPD		2023-01-25	RPD of duplicates	0.0%	15.5%	0.0%	0.4%	0.8%			0.0%	0.8%	1.6%	9.8%		3.2%	42.3% a	1.7%	16.7%	97.8% a	0.6%	1.5%	0.0%	3.6%		
18-1-1	FR1	Y	2023-03-07	Clear and colourless	150.	30.8	0.551	2.42	13.6	< 0.01	< 0.005	28.	0.023 7	54.	2.7	0.4	0.228	0.224	165.	76.3	0.013 8	0.97	7.39	64.3	0.609	< 0.015	< 0.005
18-1-1	FR2	Y	2023-03-07		150.	2.74	0.531	2.4	13.8	< 0.01	< 0.005	26.	< 0.005	55.9	2.7	< 0.1	0.183	0.076	169.	15.8	< 0.005	0.93	7.12	57.6	0.571	< 0.015	< 0.005
18-1-1	FRM		2023-03-07	Mean of duplicates	150.	16.77	0.541	2.41	13.7	< 0.01	< 0.005	27.	0.014 35	54.95	2.7	0.25	0.205 5	0.15	167.	46.05	0.009 4	0.95	7.255	60.95	0.59	< 0.015	< 0.005
18-1-1	RPD		2023-03-07	RPD of duplicates	0.0%	167.3% a	3.7%	0.8%	1.5%			7.4%		3.5%	0.0%		21.9%	98.7% a	2.4%	131.4% a		4.2%	3.7%	11.0%	6.4%		
21-1-1	FR1	Y	2022-05-20		71.	< 2.5	< 0.1	1.22	1.93	< 0.05	< 0.025	3 860.	< 0.025	19.5	3.9	< 0.5	< 0.025	82.8	63.4	35.7	< 0.025	< 2.5	3.57	6.48	0.51	< 0.015	< 0.005
21-1-1	FR2	Y	2022-05-20		70.	< 2.5	< 0.1	1.21	1.56	< 0.05	< 0.025	4 030.	< 0.025	19.8	3.9	< 0.5	< 0.025	< 0.25	65.	< 5.	< 0.025	< 2.5	3.75	6.59	0.46	< 0.015	< 0.005
21-1-1	FRM		2022-05-20	Mean of duplicates	70.5	< 2.5	< 0.1	1.215	1.745	< 0.05	< 0.025	3 945.	< 0.025	19.65	3.9	< 0.5	< 0.025	41.525	64.2	20.35	< 0.025	< 2.5	3.66	6.535	0.485	< 0.015	< 0.005
21-1-1	RPD		2022-05-20	RPD of duplicates	1.4%			0.8%	21.2%			4.3%		1.5%	0.0%				2.5%				4.9%	1.7%	10.3%		
21-1-1	FR1	Y	2022-09-21		69.	9.82	< 0.02	3.71	2.75	< 0.01	< 0.005	3 770.	< 0.005	21.3	3.	< 0.1	0.010 6	0.352	67.9	22.3	0.015 8	0.98	3.57	4.91	0.504	< 0.015	< 0.005
21-1-1	FR2	Y	2022-09-21		68.	3.04	< 0.02	3.72	2.48	< 0.01	< 0.005	3 910.	< 0.005	21.	3.3	< 0.1	< 0.005	0.102	67.2	4.5	< 0.005	0.98	3.59	4.51	0.509	< 0.015	< 0.005
21-1-1	FRM		2022-09-21	Mean of duplicates	68.5	6.43	< 0.02	3.715	2.615	< 0.01	< 0.005	3 840.	< 0.005	21.15	3.15	< 0.1	0.007 8	0.227	67.55	13.4	0.010 4	0.98	3.58	4.71	0.506 5	< 0.015	< 0.005
21-1-1	RPD		2022-09-21	RPD of duplicates	1.5%	105.4% a		0.3%	10.3%			3.6%		1.4%	9.5%		71.8% a	110.1% a	1.0%	132.8% a			0.6%	8.5%	1.0%		
21-1-1	FR1	Y	2022-12-15		70.	4.3	0.041	1.46	2.62	0.042	0.01	4 140.	0.048	21.1	2.8	0.25	0.05	0.18	67.5	9.5	0.045	1.2	3.57	6.85	0.51	< 0.015	< 0.005
21-1-1	FR2	Y	2022-12-15		72.	11.5	< 0.1	1.73	3.55	0.17	0.047	4 470.	0.229	20.9	2.9	< 0.5	0.248	0.39	66.7	33.1	0.228	< 2.5	3.55	10.	0.54	< 0.015	< 0.005
21-1-1	FRM		2022-12-15	Mean of duplicates	71.	7.9	0.070 5	1.595	3.085	0.106	0.028 5	4 305.	0.138 5	21.	2.85	0.375	0.149	0.285	67.1	21.3	0.136 5	1.85	3.56	8.425	0.525	< 0.015	< 0.005
21-1-1	RPD		2022-12-15	RPD of duplicates	2.8%	91.1% a		16.9%	30.1% a	120.8%	129.8% a	7.7%	130.7% a	1.0%	3.5%		132.9% a	73.7% a	1.2%	110.8% a	134.1% a		0.6%	37.4% a	5.7%		
21-1-1	FR1	Y	2023-03-10		70.	2.8	< 0.1	1.14	2.4	< 0.05	< 0.025	4 100.	< 0.025	19.4	3.5	< 0.5	< 0.025	0.25	62.5	7.1	0.033	< 2.5	3.42	9.63	0.44	< 0.015	< 0.005
21-1-1	FR2	Y	2023-03-10		70.	3.3	< 0.1	1.21	2.3	< 0.05	< 0.025	4 100.	< 0.025	18.9	3.7	< 0.5	< 0.025	0.3	61.2	6.7	0.088	< 2.5	3.36	9.17	0.43	< 0.015	< 0.005
21-1-1	FRM		2023-03-10	Mean of duplicates	70.	3.05	< 0.1	1.175	2.35	< 0.05	< 0.025	4 100.	< 0.025	19.15	3.6	< 0.5	< 0.025	0.275	61.85	6.9	0.060 5	< 2.5	3.39	9.4	0.435	< 0.015	< 0.005
21-1-1	RPD		2023-03-10	RPD of duplicates	0.0%	16.4%		6.0%	4.3%			0.0%		2.6%	5.6%			18.2%	2.1%	5.8%	90.9% a		1.8%	4.9%	2.3%		
21-1-2	FR1	Y	2022-05-19	Clear and colourless	170.	2.08	< 0.02	1.24	15.1	< 0.01	< 0.005	691.	< 0.005	40.8	20.	2.7	0.997	0.642	139.	878.	< 0.005	< 0.5	9.12	1 690.	0.848	5.4	< 0.005
21-1-2	FR2	Y	2022-05-19		170.	0.64	< 0.02	1.26	15.7	< 0.01	< 0.005	720.	< 0.005	41.2	30.	0.19	0.973	0.293	141.	865.	< 0.005	< 0.5	9.16	1 690.	0.819	5.3	< 0.005
21-1-2	FRM		2022-05-19	Mean of duplicates	170.	1.36	< 0.02	1.25	15.4	< 0.01	< 0.005	705.5	< 0.005	41.	25.	1.445	0.985	0.467 5	140.	871.5	< 0.005	< 0.5	9.14	1 690.	0.833 5	5.35	< 0.005
21-1-2	RPD		2022-05-19	RPD of duplicates	0.0%	105.9% a		1.6%	3.9%			4.1%		1.0%	40.0% a	173.7% a	2.4%	74.7% a	1.4%	1.5%			0.4%	0.0%	3.5%	1.9%	
21-1-2	FR1	Y	2022-09-20	Clear and colourless	180.	7.24	0.02	1.31	19.3	< 0.01	< 0.005	628.	0.010 4	51.	44.	0.24	1.03	0.376	170.	1 070.	0.006 8	< 0.5	10.3	1 990.	0.749	5.8	< 0.005
21-1-2	FR2	Y	2022-09-20		190.	1.41	< 0.02	1.26	19.	< 0.01	< 0.005	618.	< 0.005	52.1	48.	0.25	1.1	0.206	173.	1 160.	< 0.005	< 0.5	10.4	2 080.	0.833	5.9	< 0.005
21-1-2	FRM		2022-09-20	Mean of duplicates	185.	4.325	0.02	1.285	19.15	< 0.01	< 0.005	623.	0.007 7	51.55	46.	0.245	1.065	0.291	171.5	1 115.	0.005 9	< 0.5	10.35	2 035.	0.791	5.85	< 0.005
21-1-2	RPD		2022-09-20	RPD of duplicates	5.4%	134.8% a		3.9%	1.6%			1.6%		2.1%	8.7%	4.1%	6.6%	58.4% a	1.7%	8.1%			1.0%	4.4%	10.6%	1.7%	
21-1-2	FR1	Y	2022-12-14	Clear and colourless	190.	40.8	0.04	1.38	19.7	< 0.01	< 0.005	869.	0.014 6	55.3	44.	0.37	1.26	0.445	183.	1 290.	0.021 4	< 0.5	11.	2 200.	0.692	5.5	< 0.005
21-1-2	FR2	Y	2022-12-14		190.	6.32	0.021	1.39	19.9	< 0.01	< 0.005	863.	0.016 1	54.1	45.	0.32	1.21	0.289	180.	1 170.	0.012 2	< 0.5	11.	2 190.	0.743	5.5	< 0.005
21-1-2	FRM		2022-12-14	Mean of duplicates	190.	23.56	0.030 5	1.385	19.8	< 0.01	< 0.005	866.	0.015 35	54.7	44.5	0.345	1.235	0.367	181.5	1 230.	0.016 8	< 0.5	11.	2 195.	0.717 5	5.5	< 0.005
21-1-2	RPD		2022-12-14	RPD of duplicates	0.0%	146.3% a	62.3% a	0.7%	1.0%			0.7%	9.8%	2.2%	2.2%	14.5%	4.0%	42.5% a	1.7%	9.8%	54.8% a		0.0%	0.5%	7.1%	0.0%	
21-1-2	FR1	Y	2023-03-10	Clear and colourless	160.	10.5	< 0.02	1.26	15.6	< 0.01	< 0.005	691.	0.006 7	39.9	23.	0.2	0.907	0.268	133.	831.	0.006 5	< 0.5	8.08	1 480.	0.814	4.9	< 0.005
21-1-2	FR2	Y	2023-03-10		160.	104.	< 0.02	1.28	15.7	< 0.01	< 0.005	701.	0.010 7	38.5	23.	0.45	1.	0.419	129.	1 010.	0.017 3	< 0.5	7.88	1 430.	0.786	4.9	< 0.005
21-1-2	FRM		2023-03-10	Mean of duplicates	160.	57.25	< 0.02	1.27	15.65	< 0.01	< 0.005	696.	0.008 7	39.2	23.	0.325	0.953 5	0.343 5	131.	920.5	0.011 9	< 0.5	7.98	1 455.	0.8	4.9	< 0.005
21-1-2	RPD		2023-03-10	RPD of duplicates	0.0%	163.3% a		1.6%	0.6%			1.4%	46.0% a	3.6%	0.0%	76.9% a	9.8%	44.0% a	3.1%	19.4%	90.8% a		2.5%	3.4%	3.5%	0.0%	
21-2-1	FR1	Y	2022-05-19	Silty and orange	170.	1.29	< 0.02	1.7	13.6	< 0.01	< 0.005	610.	0.006 7	41.3	31.	0.13	1.07	0.337	141.	1 000.	< 0.005	< 0.5	9.19	1 830.	0.743	5.2	< 0.005
21-2-1	FR2	Y	2022-05-19		170.	2.42	0.023	1.7	13.7	< 0.01	< 0.005	608.	0.007 5	41.8	32.	0.13	1.05	0.383	143.	1 010.	0.006 1	< 0.5	9.27	1 850.	0.708	5.1	< 0.005
21-2-1	FRM		2022-05-19	Mean of duplicates	170.	1.855	0.021 5	1.7	13.65	< 0.01	< 0.005	609.	0.007 1	41.55	31.5	0.13	1.06	0.36	142.	1 005.	0.005 55	< 0.5	9.23	1 840.	0.725 5	5.15	< 0.005
21-2-1	RPD		2022-05-19	RPD of duplicates	0.0%	60.9% a		0.0%	0.7%			0.3%	11.3%	1.2%	3.2%	0.0%	1.9%	12.8%	1.4%	1.0%			0.9%	1.1%	4.8%	1.9%	
21-2-1	FR1	Y	2022-09-20	Clear and colourless	200.	2.94	0.028	1.58	17.5	< 0.01	< 0.005	589.	0.010 1	54.1	53.	0.16	1.19	0.214	180.	943.	< 0.005	< 0.5	10.9	2 260.	0.586	6.2	< 0.005
21-2-1	FR2	Y	2022-09-20		200.	6.15	0.033	1.64	17.9	< 0.01	< 0.005	590.	0.013	54.8	54.	0.16	1.23	0.275	183.	958.	0.009 6	< 0.5	11.2	2 300.	0.598	0.9	< 0.005
21-2-1	FRM		2022-09-20	Mean of duplicates	200.	4.545	0.030 5	1.61	17.7	< 0.01	< 0.005	589.5	0.011 55	54.45	53.5	0.16	1.21	0.244 5	181.5	950.5	0.007 3	< 0.5	11.05	2 280.	0.592	3.55	< 0.005
21-2-1	RPD		2022-09-20	RPD of duplicates	0.0%	70.6% a	16.4%	3.7%	2.3%			0.2%	25.1%	1.3%	1.9%	0.0%	3.3%	24.9%	1.7%	1.6%			2.7%	1.8%	2.0%	149.3% a	
21-2-1	FR1	Y	2022-12-15	Clear and colourless	190.	1.5	< 0.02	1.5	16.9	0.033	< 0.005	778.	0.025 8	51.1	45.	0.33	1.32	0.423	170.	1 060.	0.029 4	< 0.5	10.2	2 250.	0.704	5.5	< 0.005
21-2-1	FR2	Y	2022-12-15		190.	2.44	< 0.02	1.49	17.4	< 0.01	< 0.005	793.	0.017 9	50.9	45.	0.24	1.31	0.398	170.	1 060.	0.018 8	< 0.5	10.3	2 230.	0.729	5.6	0.005
21-2-1	FRM		2022-12-15	Mean of duplicates	190.	1.97	< 0.02	1.495	17.15	0.021 5	< 0.005	785.5	0.021 85	51.	45.	0.285	1.315	0.410 5	170.	1 060.	0.024 1	< 0.5	10.25	2 240.	0.716 5	5.55	0.005
21-2-1	RPD		2022-12-15	RPD of duplicates	0.0%	47.7% a		0.7%	2.9%			1.9%	36.2% a	0.4%	0.0%	31.6% a	0.8%	6.1%	0.0%	0.0%	44.0% a		1.0%	0.9%	3.5%	1.8%	

Table 3-1. Groundwater Quality QA/QC - Relative Percent Difference 2022-2023

				Fraction	TOT	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	mg/L	mg/L
Station	Sample Type	Complance Well (Y/N)?	Date Sampled	Comments																							
21-2-1	FR1	Y	2023-03-10	Yellow, low turbidity	160.	46.7	< 0.02	1.82	12.7	< 0.01	< 0.005	587.	0.007 9	38.2	27.	0.2	1.04	0.334	127.	846.	0.013 3	< 0.5	7.81	1 600.	0.716	4.9	< 0.005
21-2-1	FR2	Y	2023-03-10		160.	1.97	< 0.02	1.67	13.1	< 0.01	< 0.005	577.	0.007 6	38.3	28.	0.22	0.966	0.307	128.	694.	0.011 4	< 0.5	7.9	1 600.	0.752	5.	< 0.005
21-2-1	FRM		2023-03-10	Mean of duplicates	160.	24.335	< 0.02	1.745	12.9	< 0.01	< 0.005	582.	0.007 75	38.25	27.5	0.21	1.003	0.320 5	127.5	770.	0.012 35	< 0.5	7.855	1 600.	0.734	4.95	< 0.005
21-2-1	RPD		2023-03-10	RPD of duplicates	0.0%	183.8% a		8.6%	3.1%			1.7%	3.9%	0.3%	3.6%	9.5%	7.4%	8.4%	0.8%	19.7%	15.4%		1.1%	0.0%	4.9%	2.0%	
29-1-1	FR1	Y	2022-09-21	Clear and colourless	100.	6.73	< 0.02	0.335	2.29	< 0.01	< 0.005	305.	0.008	45.6	33.	0.16	0.039 1	0.17	137.	74.5	0.005 7	< 0.5	5.53	10.3	0.202	0.019	< 0.005
29-1-1	FR2	Y	2022-09-21		110.	2.14	0.02	0.336	2.26	< 0.01	< 0.005	315.	0.010 7	45.8	33.	0.15	0.040 8	0.178	137.	72.	0.009 8	< 0.5	5.47	10.	0.208	0.021	< 0.005
29-1-1	FRM		2022-09-21	Mean of duplicates	105.	4.435	0.02	0.335 5	2.275	< 0.01	< 0.005	310.	0.009 35	45.7	33.	0.155	0.039 95	0.174	137.	73.25	0.007 75	< 0.5	5.5	10.15	0.205	0.02	< 0.005
29-1-1	RPD		2022-09-21	RPD of duplicates	9.5%	103.5% a		0.3%	1.3%			3.2%	28.9%	0.4%	0.0%	6.5%	4.3%	4.6%	0.0%	3.4%	52.9% a		1.1%	3.0%	2.9%	10.0%	
31-1-1	FR1	Y	2022-05-16	Clear and colourless	140.	2.45	0.064	0.16	3.92	< 0.01	< 0.005	44.	0.035 5	116.	4.	< 0.1	0.189	0.712	329.	4.6	< 0.005	< 0.5	9.33	41.5	0.777	< 0.015	< 0.005
31-1-1	FR2	Y	2022-05-16		140.	1.45	0.056	0.163	3.73	< 0.01	< 0.005	44.	0.034	113.	3.9	< 0.1	0.186	0.628	321.	2.2	< 0.005	< 0.5	9.11	40.8	0.758	< 0.015	< 0.005
31-1-1	FRM		2022-05-16	Mean of duplicates	140.	1.95	0.06	0.161 5	3.825	< 0.01	< 0.005	44.	0.034 75	114.5	3.95	< 0.1	0.187 5	0.67	325.	3.4	< 0.005	< 0.5	9.22	41.15	0.767 5	< 0.015	< 0.005
31-1-1	RPD		2022-05-16	RPD of duplicates	0.0%	51.3% a	13.3%	1.9%	5.0%			0.0%	4.3%	2.6%	2.5%		1.6%	12.5%	2.5%	70.6% a			2.4%	1.7%	2.5%		
31-1-1	FR1	Y	2022-09-21	Clear and colourless	150.	1.38	0.056	0.201	4.66	< 0.01	< 0.005	61.	0.032 2	117.	4.	< 0.1	0.188	1.63	330.	39.8	< 0.005	< 0.5	8.87	39.3	1.12	< 0.015	< 0.005
31-1-1	FR2	Y	2022-09-21		150.	0.88	0.055	0.195	4.87	< 0.01	< 0.005	51.	0.030 5	118.	3.6	< 0.1	0.178	0.386	331.	7.4	< 0.005	< 0.5	8.85	38.5	0.831	< 0.015	< 0.005
31-1-1	FRM		2022-09-21	Mean of duplicates	150.	1.13	0.055 5	0.198	4.765	< 0.01	< 0.005	56.	0.031 35	117.5	3.8	< 0.1	0.183	1.008	330.5	23.6	< 0.005	< 0.5	8.86	38.9	0.975 5	< 0.015	< 0.005
31-1-1	RPD		2022-09-21	RPD of duplicates	0.0%	44.2% a	1.8%	3.0%	4.4%			17.9%	5.4%	0.9%	10.5%		5.5%	123.4% a	0.3%	137.3% a			0.2%	2.1%	29.6%		
31-1-1	FR1	Y	2022-12-15	Clear and colourless	160.	1.29	0.059	0.207	5.71	< 0.01	< 0.005	51.	0.031 6	137.	2.8	0.1	0.187	0.45	388.	2.3	< 0.005	< 0.5	11.2	43.2	0.851	< 0.015	< 0.005
31-1-1	FR2	Y	2022-12-15		160.	3.79	0.063	0.202	5.73	< 0.01	< 0.005	52.	0.033 8	138.	2.9	< 0.1	0.203	0.446	390.	5.6	< 0.005	< 0.5	11.	42.6	0.859	< 0.015	< 0.005
31-1-1	FRM		2022-12-15	Mean of duplicates	160.	2.54	0.061	0.204 5	5.72	< 0.01	< 0.005	51.5	0.032 7	137.5	2.85	0.1	0.195	0.448	389.	3.95	< 0.005	< 0.5	11.1	42.9	0.855	< 0.015	< 0.005
31-1-1	RPD		2022-12-15	RPD of duplicates	0.0%	98.4% a	6.6%	2.4%	0.3%			1.9%	6.7%	0.7%	3.5%		8.2%	0.9%	0.5%	83.5% a	0.0%		1.8%	1.4%	0.9%		
37-3-1	FR1	Y	2022-12-08	Clear and colourless	180.	11.5	0.036	0.243	22.4	< 0.01	< 0.005	312.	0.027 7	135.	11.	0.16	1.27	0.177	393.	377.	0.035 1	< 0.5	13.3	500.	0.695	0.44	< 0.005
37-3-1	FR2	Y	2022-12-08	Clear and colourless	180.	5.03	0.039	0.242	22.1	< 0.01	< 0.005	320.	0.025 1	134.	10.	0.19	1.24	0.167	389.	358.	0.017 8	< 0.5	13.2	490.	0.682	0.44	< 0.005
37-3-1	FRM		2022-12-08	Mean of duplicates	180.	8.265	0.037 5	0.242 5	22.25	< 0.01	< 0.005	316.	0.026 4	134.5	10.5	0.175	1.255	0.172	391.	367.5	0.026 45	< 0.5	13.25	495.	0.688 5	0.44	< 0.005
37-3-1	RPD		2022-12-08	RPD of duplicates	0.0%	78.3% a	8.0%	0.4%	1.3%			2.5%	9.8%	0.7%	9.5%	17.1%	2.4%	5.8%	1.0%	5.2%	65.4% a		0.8%	2.0%	1.9%	0.0%	
39-1-1	FR1	Y	2022-05-17	Clear and colourless	100.	2.28	0.119	0.362	6.14	< 0.01	< 0.005	17.	0.009 3	40.2	2.7	< 0.1	0.013 9	0.313	115.	2.9	< 0.005	< 0.5	3.52	< 0.05	2.16	< 0.015	< 0.005
39-1-1	FR2	Y	2022-05-17		99.	3.	0.116	0.31	6.17	< 0.01	< 0.005	17.	0.015 5	41.2	2.7	< 0.1	0.016 1	0.311	118.	< 1.	0.006 4	< 0.5	3.6	< 0.05	2.32	< 0.015	< 0.005
39-1-1	FRM		2022-05-17	Mean of duplicates	99.5	2.64	0.117 5	0.336	6.155	< 0.01	< 0.005	17.	0.012 4	40.7	2.7	< 0.1	0.015	0.312	116.5	1.95	0.005 7	< 0.5	3.56	< 0.05	2.24	< 0.015	< 0.005
39-1-1	RPD		2022-05-17	RPD of duplicates	1.0%	27.3%	2.6%	15.5%	0.5%			0.0%	50.0% a	2.5%	0.0%		14.7%	0.6%	2.6%				2.2%		7.1%		
39-1-1	SS	Y	2023-03-09	Clear and colourless	98.	3.05	0.685	0.299	7.51	< 0.01	< 0.005	16.	0.024 5	49.4	4.5	0.13	0.033 8	0.214	142.	3.8	0.006 9	< 0.5	4.45	0.198	2.24	< 0.015	0.038 1
39-1-1	FR2	Y	2023-03-09		98.	2.03	0.698	0.318	7.78	< 0.01	< 0.005	19.	0.025 7	49.3	4.2	< 0.1	0.034 9	0.203	140.	3.8	0.005 2	< 0.5	4.24	0.14	2.26	< 0.015	0.037 2
39-1-1	FRM		2023-03-09	Mean of duplicates	98.	2.54	0.691 5	0.308 5	7.645	< 0.01	< 0.005	17.5	0.025 1	49.35	4.35	0.115	0.034 35	0.208 5	141.	3.8	0.006 05	< 0.5	4.345	0.169	2.25	< 0.015	0.037 65
39-1-1	RPD		2023-03-09	RPD of duplicates	0.0%	40.2% a	1.9%	6.2%	3.5%			17.1%	4.8%	0.2%	6.9%		3.2%	5.3%	1.4%	0.0%	28.1%		4.8%	34.3% a	0.9%		2.4%
41-1-1	FR1	Y	2022-05-13	Clear and colourless	150.	2.38	0.031	4.45	1.93	< 0.01	< 0.005	29.	< 0.005	67.3	5.4	< 0.1	0.054 2	0.313	198.	39.6	< 0.005	< 0.5	7.17	117.	1.97	0.03	< 0.005
41-1-1	FR2	Y	2022-05-13		150.	8.41	0.03	4.39	1.26	< 0.01	< 0.005	28.	0.020 1	69.1	5.5	< 0.1	0.057 5	0.323	202.	51.2	0.012 4	< 0.5	7.21	117.	1.99	0.03	< 0.005
41-1-1	FRM		2022-05-13	Mean of duplicates	150.	5.395	0.030 5	4.42	1.595	< 0.01	< 0.005	28.5	0.012 55	68.2	5.45	< 0.1	0.055 85	0.318	200.	45.4	0.008 7	< 0.5	7.19	117.	1.98	0.03	< 0.005
41-1-1	RPD		2022-05-13	RPD of duplicates	0.0%	111.8% a	3.3%	1.4%	42.0% a			3.5%		2.6%	1.8%		5.9%	3.1%	2.0%	25.6%			0.6%	0.0%	1.0%	0.0%	
41-1-1	FR1	Y	2022-09-22	Clear and colourless	160.	5.08	0.043	2.58	2.74	< 0.01	< 0.005	28.	0.029	68.6	5.9	< 0.1	0.115	0.342	201.	12.	< 0.005	< 0.5	7.09	328.	1.99	0.054	< 0.005
41-1-1	FR2	Y	2022-09-22		160.	1.33	0.038	2.5	2.92	< 0.01	< 0.005	28.	0.128	69.2	5.9	< 0.1	0.108	0.277	202.	6.2	< 0.005	< 0.5	7.1	330.	2.01	0.051	< 0.005
41-1-1	FRM		2022-09-22	Mean of duplicates	160.	3.205	0.040 5	2.54	2.83	< 0.01	< 0.005	28.	0.078 5	68.9	5.9	< 0.1	0.111 5	0.309 5	201.5	9.1	< 0.005	< 0.5	7.095	329.	2.	0.052 5	< 0.005
41-1-1	RPD		2022-09-22	RPD of duplicates	0.0%	117.0% a	12.3%	3.1%	6.4%			0.0%	126.1% a	0.9%	0.0%		6.3%	21.0%	0.5%	63.7% a			0.1%	0.6%	1.0%	5.7%	
41-1-1	FR1	Y	2022-12-15	Clear and colourless	160.	1.12	0.034	4.14	2.66	< 0.01	< 0.005	56.	0.010 4	73.9	6.7	< 0.1	0.117	0.224	216.	12.3	0.006 1	< 0.5	7.63	473.	2.42	0.024	< 0.005
41-1-1	FR2	Y	2022-12-15		160.	1.39	0.034	4.2	2.88	0.034	< 0.005	51.	0.024	74.	6.6	0.12	0.118	0.219	216.	11.6	0.010 5	< 0.5	7.49	480.	2.41	0.023	< 0.005
41-1-1	FRM		2022-12-15	Mean of duplicates	160.	1.255	0.034	4.17	2.77	0.022	< 0.005	53.5	0.017 2	73.95	6.65	0.11	0.117 5	0.221 5	216.	11.95	0.008 3	< 0.5	7.56	476.5	2.415	0.023 5	< 0.005
41-1-1	RPD		2022-12-15	RPD of duplicates	0.0%	21.5%	0.0%	1.4%	7.9%			9.3%	79.1% a	0.1%	1.5%		0.9%	2.3%	0.0%	5.9%	53.0% a		1.9%	1.5%	0.4%	4.3%	
41-1-1	FR1	Y	2023-02-27	Very slight yellow	150.	3.19	0.05	2.06	2.75	< 0.01	< 0.005	31.	0.005 2	70.7	9.6	< 0.1	0.023 5	0.16	205.	11.2	0.005 8	< 0.5	6.89	21.4	1.28	0.024	0.006 2
41-1-1	FR2	Y	2023-02-27		150.	8.2	0.052	2.04	2.7	< 0.01	< 0.005	28.	0.082 9	70.7	8.9	0.12	0.039 4	0.259	205.	27.6	0.018 1	< 0.5	6.83	21.4	1.31	0.019	0.005 7
41-1-1	FRM		2023-02-27	Mean of duplicates	150.	5.695	0.051	2.05	2.725	< 0.01	< 0.005	29.5	0.044 05	70.7	9.25	0.11	0.031 45	0.209 5	205.	19.4	0.011 95	< 0.5	6.86	21.4	1.295	0.021 5	0.005 95
41-1-1	RPD		2023-02-27	RPD of duplicates	0.0%	88.0% a	3.9%	1.0%	1.8%			10.2%	176.4% a	0.0%	7.6%		50.6% a	47.3% a	0.0%	84.5% a	102.9% a		0.9%	0.0%	2.3%	23.3%	8.4%
42-1-1	FR1	Y	2022-05-13	Clear and colourless	190.	6.07	< 0.02	0.169	13.9	< 0.01	< 0.005	76.	< 0.005	93.6	13.	0.18	0.052 3	0.052	257.	647.	< 0.005	< 0.5	5.74	159.	0.186	0.057	< 0.005
42-1-1	FR2	Y	2022-05-13		190.	4.85	< 0.02	0.155	13.8	0.011	< 0.005	77.	< 0.005	95.2	14.	0.15	0.048 2	0.055	261.	678.	< 0.005	< 0.5	5.61	158.	0.19	0.057	< 0.005
42-1-1	FRM		2022-05-13	Mean of duplicates	190.	5.46	< 0.02	0.162	13.85	0.010 5	< 0.005	76.5	< 0.005	94.4	13.5	0.165	0.050 25	0.053 5	259.	662.5	< 0.005	< 0.5	5.675	158.5	0.188	0.057	< 0.005
42-1-1	RPD		2022-05-13	RPD of duplicates	0.0%	22.3%		8.6%	0.7%			1.3%		1.7%	7.4%	18.2%	8.2%	5.6%	1.5%	4.7%			2.3%	0.6%	2.1%	0.0%	
42-1-1	FR1	Y	2022-12-15	Clear and colourless	220.	44.7	< 0.02	0.167	16.	0.031	< 0.005	116.	0.006 5	109.	15.	0.34	0.125	0.234	297.	808.	0.015 9	< 0.5	6.15	174.	0.25	0.075	< 0.005
42-1-1	FR2	Y	2022-12-15		220.	5.05	< 0.02	0.159	15.9	0.013	< 0.005	111.	0.005 3	108.	15.	0.44	0.051 4	0.064	295.	727.	0.006 8	< 0.5	6.16	172.	0.262	0.074	< 0.005
42-1-1	FRM		2022-12-15	Mean of duplicates	220.	24.875	< 0.02	0.163	15.95	0.022	< 0.005	113.5	0.005 9	108.5	15.	0.39	0.088 2	0.149	296.	767.5	0.011 35	< 0.5	6.155	173.	0.256	0.074 5	< 0.005
42-1-1	RPD		2022-12-15	RPD of duplicates	0.0%	159.4% a		4.9%	0.6%	81.8% a		4.4%	20.3%	0.9%	0.0%	25.6%	83.4% a	114.1% a	0.7%	10.6%	80.2% a		0.2%	1.2%	4.7%	1.3%	
42-1-1	FR1	Y	2023-02-27	Clear and colourless	190.	4.01	< 0.02	0.164	14.1	< 0.01	< 0.005	82.	< 0.005	100.	15.	0.24	0.036 7	< 0.05	274.	701.	< 0.005	< 0.5	5.58	154.	0.211	0.079	0.006 4
42-1-1	FR2	Y	2023-02-27		190.	5.76	< 0.02	0.161	14.2	< 0.01	< 0.005	75.	0.021 4	99.3	16.	0.16	0.039 5	0.052	271.	708.	0.008 1	< 0.5	5.51	152.	0.173	0.072	< 0.005
42-1-1	FRM		2023-02-27	Mean of duplicates	190.	4.885	< 0.02	0.162 5	14.15	< 0.01	< 0.005	78.5	0.013 2	99.65	15.5	0.2	0.038 1	0.051	272.5	704.5	0.006 55	< 0.5	5.545	153.	0.192	0.075 5	0.005 7
42-1-1	RPD		2023-02-27	RPD of duplicates	0.0%	35.8% a		1.8%	0.7%			8.9%		0.7%	6.5%	40.0% a	7.3%		1.1%	1.0%			1.3%	1.3%	19.8%	9.3%	24.6%
58-1-0	FR1	Y	2022-09-22	Clear, very orange	1 900.	15.6	0.4	1.21	32.4	< 0.05	< 0.025	3 070.	0.067	415.	990.	9.89	55.7	8.9	1 600.	858.	0.174	< 2.5	137.	6 470.	6.46	100.	0.179
58-1-0	FR2	Y	2022-09-22	Clear and colourless	1 700.	11.6	0.4	1.19	32.8	< 0.05	< 0.025	3 230.	0.124	421.	1 000.	9.81	55.5	8.67	1 620.	884.	0.162	< 2.5	137.	6 500.	6.5	100.	0.218
58-1-0	FRM		2022-09-22	Mean of duplicates	1 800.	13.6	0.4	1.2	32.6	< 0.05	< 0.025	3 150.	0.095 5	418.	995.	9.85	55.6	8.785	1 610.	871.	0.168	< 2.5	137.	6 485.	6.48	100.	0.198 5
58-1-0	RPD		2022-09-22	RPD of duplicates	11.1%	29.4%	0.0%	1.7%	1.2%			5.1%	59.7% a	1.4%	1.0%	0.8%	0.4%	2.6%	1.2%	3.0%	7.1%		0.0%	0.5%	0.6%	0.0%	19.6%

Table 3-1. Groundwater Quality QA/QC - Relative Percent Difference 2022-2023

				Fraction	TOT	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	mg/L	mg/L
Station	**Sample Type**	**Complance Well (Y/N)?**	**Date Sampled**	**Comments**																							
71-1-1	FR1	Y	2022-05-27	Clear and colourless	140.	1.38	0.044	0.434	6.61	< 0.01	< 0.005	512.	0.063 8	49.2	7.6	< 0.1	0.079 1	0.323	150.	15.6	< 0.005	< 0.5	6.57	92.4	0.522	< 0.015	< 0.005
71-1-1	FR2	Y	2022-05-27		140.	1.62	0.049	0.415	6.71	< 0.01	< 0.005	519.	0.063 8	49.1	7.6	< 0.1	0.074 7	0.08	149.	16.	0.006 3	< 0.5	6.47	92.5	0.516	< 0.015	< 0.005
71-1-1	FRM		2022-05-27	Mean of duplicates	140.	1.5	0.046 5	0.424 5	6.66	< 0.01	< 0.005	515.5	0.063 8	49.15	7.6	< 0.1	0.076 9	0.201 5	149.5	15.8	0.005 65	< 0.5	6.52	92.45	0.519	< 0.015	< 0.005
71-1-1	RPD		2022-05-27	RPD of duplicates	0.0%	16.0%	10.8%	4.5%	1.5%			1.4%	0.0%	0.2%	0.0%		5.7%	120.6% a	0.7%	2.5%			1.5%	0.1%	1.2%		
71-1-1	FR1	Y	2022-09-27	Clear and colourless	150.	1.11	0.088	0.342	7.55	< 0.01	< 0.005	433.	0.005 7	55.	8.3	0.11	0.092 4	0.105	168.	38.3	0.005 3	< 0.5	7.3	93.2	0.442	< 0.015	< 0.005
71-1-1	FR2	Y	2022-09-27		150.	2.63	0.092	0.354	7.71	< 0.01	< 0.005	447.	0.007 3	55.	8.1	< 0.1	0.094 6	0.11	168.	31.1	0.007 7	< 0.5	7.34	95.	0.451	0.027	< 0.005
71-1-1	FRM		2022-09-27	Mean of duplicates	150.	1.87	0.09	0.348	7.63	< 0.01	< 0.005	440.	0.006 5	55.	8.2	0.105	0.093 5	0.107 5	168.	34.7	0.006 5	< 0.5	7.32	94.1	0.446 5	0.021	< 0.005
71-1-1	RPD		2022-09-27	RPD of duplicates	0.0%	81.3% a	4.4%	3.4%	2.1%			3.2%	24.6%	0.0%	2.4%		2.4%	4.7%	0.0%	20.7%	36.9% a		0.5%	1.9%	2.0%		
71-1-1	FR1	Y	2023-01-12	Clear and colourless	150.	2.81	0.1	0.416	8.35	< 0.01	< 0.005	467.	0.018 1	56.6	8.7	< 0.1	0.127	0.054	173.	37.5	0.005 8	< 0.5	7.74	148.	0.527	1.5	< 0.005
71-1-1	FR2	Y	2023-01-12		160.	3.21	0.11	0.423	8.6	< 0.01	< 0.005	489.	0.023 4	57.4	8.9	0.16	0.128	< 0.05	175.	39.8	< 0.005	< 0.5	7.77	146.	0.523	0.97	< 0.005
71-1-1	FRM		2023-01-12	Mean of duplicates	155.	3.01	0.105	0.419 5	8.475	< 0.01	< 0.005	478.	0.020 75	57.	8.8	0.13	0.127 5	0.052	174.	38.65	0.005 4	< 0.5	7.755	147.	0.525	1.235	< 0.005
71-1-1	RPD		2023-01-12	RPD of duplicates	6.5%	13.3%	9.5%	1.7%	2.9%			4.6%	25.5%	1.4%	2.3%		0.8%		1.1%	6.0%			0.4%	1.4%	0.8%	42.9% a	
71-1-1	FR1	Y	2023-03-07	Clear and colourless	140.	5.67	0.056	0.419	7.74	< 0.01	< 0.005	479.	0.009 6	47.9	6.9	< 0.1	0.114	0.078	148.	35.2	0.007 4	0.53	6.93	117.	0.495	< 0.015	< 0.005
71-1-1	FR2	Y	2023-03-07		140.	15.4	0.114	0.401	8.06	< 0.01	< 0.005	483.	0.462	48.4	6.8	< 0.1	0.144	0.531	150.	46.6	0.034 7	0.55	7.02	120.	0.492	< 0.015	< 0.005
71-1-1	FRM		2023-03-07	Mean of duplicates	140.	10.535	0.085	0.41	7.9	< 0.01	< 0.005	481.	0.235 8	48.15	6.85	< 0.1	0.129	0.304 5	149.	40.9	0.021 05	0.54	6.975	118.5	0.493 5	< 0.015	< 0.005
71-1-1	RPD		2023-03-07	RPD of duplicates	0.0%	92.4% a	68.2% a	4.4%	4.1%			0.8%	191.9% a	1.0%	1.5%		23.3%	148.8% a	1.3%	27.9%	129.7% a	3.7%	1.3%	2.5%	0.6%		
72-1-1	FR1	Y	2022-05-27	Clear and colourless	160.	3.1	< 0.04	0.129	12.3	< 0.02	< 0.01	1 700.	< 0.01	86.3	71.	< 0.2	0.033	< 0.1	269.	381.	< 0.01	< 1.	13.1	117.	0.61	0.022	< 0.005
72-1-1	FR2	Y	2022-05-27		160.	1.6	< 0.04	0.144	11.7	< 0.02	< 0.01	1 690.	< 0.01	85.3	77.	< 0.2	0.039	< 0.1	267.	372.	< 0.01	< 1.	13.1	117.	0.66	< 0.015	< 0.005
72-1-1	FRM		2022-05-27	Mean of duplicates	160.	2.35	< 0.04	0.136 5	12.	< 0.02	< 0.01	1 695.	< 0.01	85.8	74.	< 0.2	0.036	< 0.1	268.	376.5	< 0.01	< 1.	13.1	117.	0.635	0.018 5	< 0.005
72-1-1	RPD		2022-05-27	RPD of duplicates	0.0%	63.8% a		11.0%	5.0%			0.6%		1.2%	8.1%		16.7%		0.7%	2.4%			0.0%	0.0%	7.9%		
72-1-1	FR1	Y	2022-10-03	Clear and colourless	150.	1.28	< 0.02	0.138	12.8	< 0.01	< 0.005	1 540.	< 0.005	83.9	68.	< 0.1	0.048 2	< 0.05	262.	362.	< 0.005	< 0.5	12.8	113.	0.678	< 0.015	< 0.005
72-1-1	FR2	Y	2022-10-03		150.	1.38	< 0.02	0.134	12.8	< 0.01	< 0.005	1 590.	< 0.005	84.2	67.	< 0.1	0.049 6	< 0.05	263.	364.	< 0.005	< 0.5	12.8	115.	0.69	0.016	< 0.005
72-1-1	FRM		2022-10-03	Mean of duplicates	150.	1.33	< 0.02	0.136	12.8	< 0.01	< 0.005	1 565.	< 0.005	84.05	67.5	< 0.1	0.048 9	< 0.05	262.5	363.	< 0.005	< 0.5	12.8	114.	0.684	0.015 5	< 0.005
72-1-1	RPD		2022-10-03	RPD of duplicates	0.0%	7.5%		2.9%	0.0%			3.2%		0.4%	1.5%		2.9%		0.4%	0.6%			0.0%	1.8%	1.8%		
72-1-1	FR1	Y	2023-01-11	Clear and colourless	150.	1.2	< 0.04	0.087	12.9	< 0.02	< 0.01	1 550.	< 0.01	81.5	65.	< 0.2	0.088	< 0.1	259.	350.	< 0.01	< 1.	13.4	108.	0.64	< 0.015	< 0.005
72-1-1	FR2	Y	2023-01-11		150.	2.86	< 0.02	0.094	13.	< 0.01	< 0.005	1 500.	< 0.005	82.5	66.	0.12	0.070 8	< 0.05	261.	352.	< 0.005	< 0.5	13.4	113.	0.701	< 0.015	< 0.005
72-1-1	FRM		2023-01-11	Mean of duplicates	150.	2.03	< 0.03	0.090 5	12.95	< 0.015	< 0.007 5	1 525.	< 0.007 5	82.	65.5	0.16	0.079 4	< 0.075	260.	351.	< 0.007 5	< 0.75	13.4	110.5	0.670 5	< 0.015	< 0.005
72-1-1	RPD		2023-01-11	RPD of duplicates	0.0%	81.8% a		7.7%	0.8%			3.3%		1.2%	1.5%		21.7%		0.8%	0.6%			0.0%	4.5%	9.1%		
72-1-1	FR1	Y	2023-03-06	Clear and colourless	150.	5.55	< 0.02	0.142	12.8	< 0.01	< 0.005	1 600.	< 0.005	83.8	66.	0.12	0.062 6	0.077	264.	372.	0.006	0.56	13.4	112.	0.652	< 0.015	< 0.005
72-1-1	FR2	Y	2023-03-06		150.	1.7	< 0.04	0.142	13.	< 0.02	< 0.01	1 690.	< 0.01	82.9	66.	< 0.2	0.063	< 0.1	263.	369.	< 0.01	< 1.	13.7	113.	0.63	< 0.015	< 0.005
72-1-1	FRM		2023-03-06	Mean of duplicates	150.	3.625	< 0.03	0.142	12.9	< 0.015	< 0.007 5	1 645.	< 0.007 5	83.35	66.	0.16	0.062 8	0.088 5	263.5	370.5	0.008	0.78	13.55	112.5	0.641	< 0.015	< 0.005
72-1-1	RPD		2023-03-06	RPD of duplicates	0.0%	106.2% a		0.0%	1.6%			5.5%		1.1%	0.0%		0.6%		0.4%	0.8%			2.2%	0.9%	3.4%		
73-1-1	FR1	Y	2022-05-25	Slightly silty and clear	170.	0.7	0.024	0.198	13.6	< 0.01	< 0.005	110.	0.023 7	64.7	19.	0.11	0.365	0.411	209.	< 1.	0.014 4	< 0.5	11.6	112.	0.94	< 0.015	< 0.005
73-1-1	FR2	Y	2022-05-25		170.	< 0.5	0.025	0.212	14.	< 0.01	< 0.005	111.	0.025 3	65.1	19.	< 0.1	0.361	0.4	210.	1.5	0.013 8	< 0.5	11.5	112.	0.946	0.022	< 0.005
73-1-1	FRM		2022-05-25	Mean of duplicates	170.	0.6	0.024 5	0.205	13.8	< 0.01	< 0.005	110.5	0.024 5	64.9	19.	0.105	0.363	0.405 5	209.5	1.25	0.014 1	< 0.5	11.55	112.	0.943	0.018 5	< 0.005
73-1-1	RPD		2022-05-25	RPD of duplicates	0.0%	33.3% b	4.1%	6.8%	2.9%			0.9%	6.5%	0.6%	0.0%		1.1%	2.7%	0.5%		4.3%		0.9%	0.0%	0.6%		
73-1-1	FR1	Y	2022-09-27	Slightly turbid, grey	160.	3.23	0.045	0.233	15.	< 0.01	< 0.005	123.	0.509	65.5	20.	0.12	0.41	0.692	210.	8.8	0.027 9	< 0.5	11.3	88.1	0.985	< 0.015	< 0.005
73-1-1	FR2	Y	2022-09-27		160.	1.71	0.042	0.228	15.8	< 0.01	< 0.005	118.	0.048 4	65.8	20.	0.12	0.427	0.632	212.	5.2	0.021 1	< 0.5	11.5	88.7	0.986	< 0.015	< 0.005
73-1-1	FRM		2022-09-27	Mean of duplicates	160.	2.47	0.043 5	0.230 5	15.4	< 0.01	< 0.005	120.5	0.278 7	65.65	20.	0.12	0.418 5	0.662	211.	7.	0.024 5	< 0.5	11.4	88.4	0.985 5	< 0.015	< 0.005
73-1-1	RPD		2022-09-27	RPD of duplicates	0.0%	61.5% a	6.9%	2.2%	5.2%			4.1%	165.3% a	0.5%	0.0%	0.0%	4.1%	9.1%	0.9%	51.4% a	27.8%		1.8%	0.7%	0.1%		
73-1-1	FR1	Y	2023-01-12	Clear and colourless	160.	1.06	0.034	0.204	14.5	< 0.01	< 0.005	119.	0.026 5	71.3	21.	< 0.1	0.355	0.458	230.	4.	0.014 6	< 0.5	12.5	71.5	0.904	< 0.015	< 0.005
73-1-1	FR2	Y	2023-01-12		160.	1.12	0.033	0.211	14.3	< 0.01	< 0.005	122.	0.030 2	71.8	21.	0.12	0.354	0.441	230.	6.5	0.013	< 0.5	12.3	71.1	0.955	< 0.015	< 0.005
73-1-1	FRM		2023-01-12	Mean of duplicates	160.	1.09	0.033 5	0.207 5	14.4	< 0.01	< 0.005	120.5	0.028 35	71.55	21.	0.11	0.354 5	0.449 5	230.	5.25	0.013 8	< 0.5	12.4	71.3	0.929 5	< 0.015	< 0.005
73-1-1	RPD		2023-01-12	RPD of duplicates	0.0%	5.5%	3.0%	3.4%	1.4%			2.5%	13.1%	0.7%	0.0%		0.3%	3.8%	0.0%	47.6% a	11.6%		1.6%	0.6%	5.5%		
73-1-1	FR1	Y	2023-03-07	Clear and colourless	190.	4.26	0.029	0.375	15.1	< 0.01	< 0.005	450.	0.018 1	79.8	39.	0.11	0.128	0.328	227.	21.7	0.011 9	0.54	6.76	78.1	0.657	< 0.015	< 0.005
73-1-1	FR2	Y	2023-03-07		170.	14.	0.037	0.203	13.8	< 0.01	< 0.005	111.	1.03	65.2	21.	< 0.1	0.265	0.619	213.	17.	0.027 4	< 0.5	12.1	87.5	0.958	< 0.015	0.008 2
73-1-1	FRM		2023-03-07	Mean of duplicates	180.	9.13	0.033	0.289	14.45	< 0.01	< 0.005	280.5	0.524 05	72.5	30.	0.105	0.196 5	0.473 5	220.	19.35	0.019 65	0.52	9.43	82.8	0.807 5	< 0.015	0.006 6
73-1-1	RPD		2023-03-07	RPD of duplicates	11.1%	106.7% a	24.2%	59.5% a	9.0%			120.9%	193.1% a	20.1%	60.0% a		69.7% a	61.5% a	6.4%	24.3%	78.9% a	7.69%	56.6% a	11.4%	37.3% a		48.5% b

Notes:

SS	Single sample
FR1	Field replicate 1
FR2	Field replicate 2
FRM	Average of field replicates
RPD	Relative percent difference of field replicates

- Not applicable, some replicates less than the detection limit.

a *- Coefficient of variation greater than 30% and all replicates greater than the limit of quantitation.*

b *- Coefficient of variation greater than 30% with some replicates less than the limit of quantitation.*

Table 3-1. Groundwater Quality QA/QC - Relative Percent Difference 2022-2023

				MAX Acceptable RPD	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
				Method Detection Limit (MDL)	0.02	0.02	0.02	2	0.05	0.04	50	0.005	0.05	0.05	1	3	0.002	0.2	0.5	0.002	0.2	0.1	0.1	0.1	1	0.1
				Limit of Quantitation (5 x MDL)	0.1	0.1	0.1	10	0.25	0.2	250	0.025	0.25	0.25	5	15	0.01	1	2.5	0.01	1	0.5	0.5	0.5	5	0.5
				Parameter	Nitrate	Nitrite + Nitrate	Nickel	Phosphorus	Potassium	Selenium	Silicon	Silver	Sodium	Strontium	Sulphate	Sulfur	Thallium	Tin	Titanium	Uranium	Vadium	Zinc	Zirconium	pH	Conductivity	Temperature
				Fraction	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	TOT	TOT	TOT
				Unit	mg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pH	µS/cm	°C
Station	Sample Type	Complance Well (Y/N)?	Date Sampled	Comments																						
18-1-1	FR1	Y	2022-05-13	Clear and colourless	< 0.02	< 0.02	0.379	5.7	0.25	< 0.04	8 000.	< 0.005	4.79	90.7	26.	8.3	< 0.002	< 0.2	< 0.5	0.135	0.61	1.16	< 0.1	7.43	350.	10.2
18-1-1	FR2	Y	2022-05-13		< 0.02	< 0.02	0.381	6.	0.234	< 0.04	7 670.	< 0.005	4.83	90.1	27.	7.5	< 0.002	< 0.2	< 0.5	0.147	0.63	0.34	< 0.1	7.43	350.	10.2
18-1-1	FRM		2022-05-13	Mean of duplicates	< 0.02	< 0.02	0.38	5.85	0.242	< 0.04	7 835.	< 0.005	4.81	90.4	26.5	7.9	< 0.002	< 0.2	< 0.5	0.141	0.62	0.75	< 0.1	7.43	350.	10.2
18-1-1	RPD		2022-05-13	RPD of duplicates			0.5%	5.1%	6.6%		4.2%		0.8%	0.7%	3.8%	10.1%				8.5%	3.2%	109.3% a		0.0%	0.0%	0.0%
18-1-1	FR1	Y	2023-01-25	Clear and colourless	< 0.02	< 0.02	0.427	5.	0.314	< 0.04	8 280.	< 0.005	5.69	91.8	25.	7.7	< 0.002	< 0.2	< 0.5	0.146	0.49	1.33	< 0.1	7.76	245.	9.8
18-1-1	FR2	Y	2023-01-25		< 0.02	< 0.02	0.394	5.1	0.316	< 0.04	8 420.	< 0.005	5.71	89.1	25.	6.8	< 0.002	< 0.2	< 0.5	0.146	0.47	1.35	< 0.1	7.76	245.	9.8
18-1-1	FRM		2023-01-25	Mean of duplicates	< 0.02	< 0.02	0.410 5	5.05	0.315	< 0.04	8 350.	< 0.005	5.7	90.45	25.	7.25	< 0.002	< 0.2	< 0.5	0.146	0.48	1.34	< 0.1	7.76	245.	9.8
18-1-1	RPD		2023-01-25	RPD of duplicates			8.0%	2.0%	0.6%		1.7%		0.4%	3.0%	0.0%	12.4%				0.0%	4.2%	1.5%		0.0%	0.0%	0.0%
18-1-1	FR1	Y	2023-03-07	Clear and colourless	< 0.02	< 0.02	0.406	8.2	0.255	< 0.04	8 000.	< 0.005	5.22	91.3	25.	6.9	0.002 6	< 0.2	0.87	0.154	0.51	1.34	< 0.1	7.76	250.	10.
18-1-1	FR2	Y	2023-03-07		< 0.02	< 0.02	0.258	7.3	0.244	< 0.04	8 440.	< 0.005	5.04	91.6	25.	6.4	< 0.002	< 0.2	< 0.5	0.154	0.36	0.42	< 0.1	7.76	250.	10.
18-1-1	FRM		2023-03-07	Mean of duplicates	< 0.02	< 0.02	0.332	7.75	0.249 5	< 0.04	8 220.	< 0.005	5.13	91.45	25.	6.65	0.002 3	< 0.2	0.685	0.154	0.435	0.88	< 0.1	7.76	250.	10.
18-1-1	RPD		2023-03-07	RPD of duplicates			44.6% a	11.6%	4.4%		5.4%		3.5%	0.3%	0.0%	7.5%				0.0%	34.5% a	104.5% a		0.0%	0.0%	0.0%
21-1-1	FR1	Y	2022-05-20		< 0.02	< 0.02	< 0.1	< 10.	< 0.25	< 0.2	19 500.	< 0.025	8.31	425.	12.	< 15.	< 0.01	< 1.	< 2.5	0.021	< 1.	19.8	< 0.5	8.32	127.	11.4
21-1-1	FR2	Y	2022-05-20		< 0.02	< 0.02	< 0.1	10.	< 0.25	< 0.2	19 800.	< 0.025	8.73	416.	12.	< 15.	< 0.01	< 1.	< 2.5	0.015	< 1.	< 0.5	< 0.5	8.32	127.	11.4
21-1-1	FRM		2022-05-20	Mean of duplicates	< 0.02	< 0.02	< 0.1	10.	< 0.25	< 0.2	19 650.	< 0.025	8.52	420.5	12.	< 15.	< 0.01	< 1.	< 2.5	0.018	< 1.	10.15	< 0.5	8.32	127.	11.4
21-1-1	RPD		2022-05-20	RPD of duplicates							1.5%		4.9%	2.1%	0.0%					33.3% a				0.0%	0.0%	0.0%
21-1-1	FR1	Y	2022-09-21		< 0.02	< 0.02	0.063	3.1	0.219	< 0.04	19 400.	< 0.005	8.97	458.	11.	3.4	< 0.002	< 0.2	< 0.5	0.021 4	0.25	0.53	< 0.1	8.11	139.	12.8
21-1-1	FR2	Y	2022-09-21		< 0.02	< 0.02	0.032	2.5	0.215	< 0.04	19 400.	< 0.005	8.87	453.	11.	3.6	< 0.002	< 0.2	< 0.5	0.021 7	0.22	0.32	< 0.1	7.08	139.	12.8
21-1-1	FRM		2022-09-21	Mean of duplicates	< 0.02	< 0.02	0.047 5	2.8	0.217	< 0.04	19 400.	< 0.005	8.92	455.5	11.	3.5	< 0.002	< 0.2	< 0.5	0.021 55	0.235	0.425	< 0.1	7.595	139.	12.8
21-1-1	RPD		2022-09-21	RPD of duplicates			65.3% a	21.4%	1.8%		0.0%		1.1%	1.1%	0.0%	5.7%				1.4%	12.8%	49.4% a		13.6%	0.0%	0.0%
21-1-1	FR1	Y	2022-12-15		< 0.02	< 0.02	0.147	16.2	0.23	< 0.08	20 800.	< 0.01	8.58	491.	11.	< 6.	0.010 8	< 0.4	< 1.	0.058 6	< 0.4	0.55	< 0.2	8.51	131.	10.2
21-1-1	FR2	Y	2022-12-15		0.021	0.021	0.4	47.	< 0.25	< 0.2	20 400.	< 0.025	8.79	443.	11.	< 15.	0.046	< 1.	< 2.5	0.245	< 1.	3.71	< 0.5	8.51	131.	10.2
21-1-1	FRM		2022-12-15	Mean of duplicates	0.020 5	0.020 5	0.273 5	31.6	0.24	< 0.14	20 600.	< 0.017 5	8.685	467.	11.	< 10.5	0.028 4	< 0.7	< 1.75	0.151 8	< 0.7	2.13	< 0.35	8.51	131.	10.2
21-1-1	RPD		2022-12-15	RPD of duplicates		4.9%	92.5% a	97.5% a			1.9%		2.4%	10.3%	0.0%		123.9% a			122.8% a		148.4% a		0.0%	0.0%	0.0%
21-1-1	FR1	Y	2023-03-10		0.02	0.02	< 0.1	31.	< 0.25	< 0.2	19 000.	< 0.025	8.27	416.	10.	< 15.	< 0.01	< 1.	< 2.5	0.018	< 1.	0.79	< 0.5	8.53	125.	10.7
21-1-1	FR2	Y	2023-03-10		0.025	0.025	< 0.1	25.	< 0.25	< 0.2	18 700.	< 0.025	8.22	417.	10.	< 15.	< 0.01	< 1.	< 2.5	0.013	< 1.	1.09	< 0.5	8.53	125.	10.7
21-1-1	FRM		2023-03-10	Mean of duplicates	0.022 5	0.022 5	< 0.1	28.	< 0.25	< 0.2	18 850.	< 0.025	8.245	416.5	10.	< 15.	< 0.01	< 1.	< 2.5	0.015 5	< 1.	0.94	< 0.5	8.53	125.	10.7
21-1-1	RPD		2023-03-10	RPD of duplicates	22.2%	22.2%		21.4%			1.6%		0.6%	0.2%	0.0%					32.3% a		31.9% a		0.0%	0.0%	0.0%
21-1-2	FR1	Y	2022-05-19	Clear and colourless	< 0.02	< 0.02	2.52	6.	5.89	< 0.04	12 800.	< 0.005	25.	391.	18.	6.	0.003 7	< 0.2	< 0.5	0.056 1	0.35	0.22	< 0.1	7.17	316.	11.3
21-1-2	FR2	Y	2022-05-19		< 0.02	< 0.02	1.45	6.3	5.76	< 0.04	13 400.	< 0.005	25.	388.	24.	6.4	0.003	< 0.2	< 0.5	0.058 3	0.3	0.22	< 0.1	7.17	316.	11.3
21-1-2	FRM		2022-05-19	Mean of duplicates	< 0.02	< 0.02	1.985	6.15	5.825	< 0.04	13 100.	< 0.005	25.	389.5	21.	6.2	0.003 35	< 0.2	< 0.5	0.057 2	0.325	0.22	< 0.1	7.17	316.	11.3
21-1-2	RPD		2022-05-19	RPD of duplicates			53.9% a	4.9%	2.2%	0.0%	4.6%		0.0%	0.8%	28.6%	6.5%	20.9%			3.8%	15.4%	0.0%		0.0%	0.0%	0.0%
21-1-2	FR1	Y	2022-09-20	Clear and colourless	< 0.02	< 0.02	1.96	7.	6.17	0.065	13 100.	< 0.005	24.9	489.	17.	5.3	0.002 7	< 0.2	< 0.5	0.073 2	0.24	1.18	< 0.1	7.58	489.	14.9
21-1-2	FR2	Y	2022-09-20		< 0.02	< 0.02	3.09	5.9	6.23	0.056	12 900.	< 0.005	25.8	486.	16.	5.4	0.002 3	< 0.2	< 0.5	0.071 9	0.25	0.46	< 0.1	7.48	489.	14.9
21-1-2	FRM		2022-09-20	Mean of duplicates	< 0.02	< 0.02	2.525	6.45	6.2	0.060 5	13 000.	< 0.005	25.35	487.5	16.5	5.35	0.002 5	< 0.2	< 0.5	0.072 55	0.245	0.82	< 0.1	7.53	489.	14.9
21-1-2	RPD		2022-09-20	RPD of duplicates			44.8% a	17.1%	1.0%	14.9%	1.5%		3.6%	0.6%	6.1%	1.9%	16.0%			1.8%	4.1%	87.8% a		1.3%	0.0%	0.0%
21-1-2	FR1	Y	2022-12-14	Clear and colourless	< 0.02	< 0.02	3.85	9.8	6.26	< 0.04	14 900.	< 0.005	26.9	549.	17.	5.9	0.004 3	< 0.2	0.63	0.080 1	0.54	1.75	< 0.1	6.9	410.	10.9
21-1-2	FR2	Y	2022-12-14		< 0.02	< 0.02	2.3	8.1	6.22	< 0.04	14 700.	< 0.005	26.4	552.	17.	6.	0.005 8	< 0.2	< 0.5	0.087 3	0.38	0.56	< 0.1	6.9	410.	10.9
21-1-2	FRM		2022-12-14	Mean of duplicates	< 0.02	< 0.02	3.075	8.95	6.24	< 0.04	14 800.	< 0.005	26.65	550.5	17.	5.95	0.005 05	< 0.2	0.565	0.083 7	0.46	1.155	< 0.1	6.9	410.	10.9
21-1-2	RPD		2022-12-14	RPD of duplicates			50.4% a	19.0%	0.6%	0.0%	1.4%		1.9%	0.5%	0.0%	1.7%	29.7%			8.6%	34.8% a	103.0% a		0.0%	0.0%	0.0%
21-1-2	FR1	Y	2023-03-10	Clear and colourless	< 0.02	< 0.02	1.46	7.1	5.29	< 0.04	12 500.	< 0.005	23.6	389.	18.	5.8	0.036 7	< 0.2	0.56	0.049 5	0.33	0.5	< 0.1	7.14	318.	11.1
21-1-2	FR2	Y	2023-03-10		< 0.02	< 0.02	1.52	9.2	5.06	< 0.04	12 300.	< 0.005	22.8	372.	18.	4.6	0.019 7	< 0.2	2.55	0.049 3	0.85	0.8	< 0.1	7.14	318.	11.1
21-1-2	FRM		2023-03-10	Mean of duplicates	< 0.02	< 0.02	1.49	8.15	5.175	< 0.04	12 400.	< 0.005	23.2	380.5	18.	5.2	0.028 2	< 0.2	1.555	0.049 4	0.59	0.65	< 0.1	7.14	318.	11.1
21-1-2	RPD		2023-03-10	RPD of duplicates			4.0%	25.8%	4.4%		1.6%		3.4%	4.5%	0.0%	23.1%	60.3% a		128.0% a	0.4%	88.1% a	46.2% a		0.0%	0.0%	0.0%
21-2-1	FR1	Y	2022-05-19	Silty and orange	< 0.02	< 0.02	1.43	7.6	5.67	< 0.04	12 700.	< 0.005	24.3	379.	24.	6.3	0.002 6	< 0.2	< 0.5	0.056 7	0.29	0.32	< 0.1	6.83	344.	10.9
21-2-1	FR2	Y	2022-05-19		< 0.02	< 0.02	1.46	6.2	5.68	< 0.04	12 800.	< 0.005	25.	382.	24.	6.5	0.003 2	< 0.2	< 0.5	0.058 3	0.3	0.8	< 0.1	6.83	344.	10.9
21-2-1	FRM		2022-05-19	Mean of duplicates	< 0.02	< 0.02	1.445	6.9	5.675	< 0.04	12 750.	< 0.005	24.65	380.5	24.	6.4	0.002 9	< 0.2	< 0.5	0.057 5	0.295	0.56	< 0.1	6.83	344.	10.9
21-2-1	RPD		2022-05-19	RPD of duplicates			2.1%	20.3%	0.2%		0.8%		2.8%	0.8%	0.0%	3.1%	20.7%			2.8%	3.4%	85.7% a		0.0%	0.0%	0.0%
21-2-1	FR1	Y	2022-09-20	Clear and colourless	0.023	0.023	2.18	5.1	6.18	0.051	12 800.	< 0.005	27.5	488.	13.	4.3	0.002 1	< 0.2	< 0.5	0.1	0.23	0.42	< 0.1	7.54	483.	14.2
21-2-1	FR2	Y	2022-09-20		0.021	0.021	2.24	6.2	6.36	0.046	12 900.	< 0.005	28.2	493.	14.	4.5	0.002 3	< 0.2	< 0.5	0.101	0.26	1.14	< 0.1	6.1	483.	14.2
21-2-1	FRM		2022-09-20	Mean of duplicates	0.022	0.022	2.21	5.65	6.27	0.048 5	12 850.	< 0.005	27.85	490.5	13.5	4.4	0.002 2	< 0.2	< 0.5	0.100 5	0.245	0.78	< 0.1	6.82	483.	14.2
21-2-1	RPD		2022-09-20	RPD of duplicates	9.1%	9.1%	2.7%	19.5%	2.9%	10.3%	0.8%		2.5%	1.0%	7.4%	4.5%	9.1%			1.0%	12.2%	92.3% a		21.1%	0.0%	0.0%
21-2-1	FR1	Y	2022-12-15	Clear and colourless	< 0.02	< 0.02	2.26	7.8	6.32	0.064	13 900.	< 0.005	31.3	483.	17.	5.8	0.007 7	< 0.2	< 0.5	0.1	0.42	0.42	< 0.1	6.88	404.	10.7
21-2-1	FR2	Y	2022-12-15		< 0.02	< 0.02	2.26	7.	6.4	< 0.04	13 800.	< 0.005	31.6	500.	18.	5.9	0.006 2	< 0.2	< 0.5	0.082 5	0.37	0.56	< 0.1	6.88	404.	10.7
21-2-1	FRM		2022-12-15	Mean of duplicates	< 0.02	< 0.02	2.26	7.4	6.36	0.052	13 850.	< 0.005	31.45	491.5	17.5	5.85	0.006 95	< 0.2	< 0.5	0.091 25	0.395	0.49	< 0.1	6.88	404.	10.7
21-2-1	RPD		2022-12-15	RPD of duplicates			0.0%	10.8%	1.3%		0.7%		1.0%	3.5%	5.7%	1.7%	21.6%			19.2%	12.7%	28.6%		0.0%	0.0%	0.0%

Table 3-1. Groundwater Quality QA/QC - Relative Percent Difference 2022-2023

				Fraction	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	TOT	TOT	TOT
				Unit	mg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pH	µS/cm	°C
Station	Sample Type	Complance Well (Y/N)?	Date Sampled	Comments																						
21-2-1	FR1	Y	2023-03-10	Yellow, low turbidity	< 0.02	< 0.02	1.43	6.1	5.02	< 0.04	12 400.	< 0.005	22.4	355.	19.	5.6	0.011 4	< 0.2	0.72	0.054 2	0.63	0.66	< 0.1	7.04	309.	10.
21-2-1	FR2	Y	2023-03-10		< 0.02	< 0.02	1.36	5.6	5.1	< 0.04	12 100.	< 0.005	22.7	359.	19.	5.5	0.007 5	< 0.2	< 0.5	0.052 6	0.26	0.56	< 0.1	7.04	309.	10.
21-2-1	FRM		2023-03-10	Mean of duplicates	< 0.02	< 0.02	1.395	5.85	5.06	< 0.04	12 250.	< 0.005	22.55	357.	19.	5.55	0.009 45	< 0.2	0.61	0.053 4	0.445	0.61	< 0.1	7.04	309.	10.
21-2-1	RPD		2023-03-10	RPD of duplicates	0.0%	0.0%	5.0%	8.5%	1.6%		2.4%		1.3%	1.1%	0.0%	1.8%	41.3% a			3.0%	83.1% a	16.4%		0.0%	0.0%	0.0%
29-1-1	FR1	Y	2022-09-21	Clear and colourless	2.34	2.34	0.521	85.8	0.366	8.45	5 900.	< 0.005	23.5	190.	51.	24.	< 0.002	0.25	< 0.5	0.056 1	0.46	0.32	< 0.1	6.49	430.	12.7
29-1-1	FR2	Y	2022-09-21		2.38	2.38	0.503	85.1	0.358	7.32	5 920.	< 0.005	22.9	187.	52.	24.	< 0.002	0.26	< 0.5	0.055 8	0.46	0.34	< 0.1	7.48	353.	12.7
29-1-1	FRM		2022-09-21	Mean of duplicates	2.36	2.36	0.512	85.45	0.362	7.885	5 910.	< 0.005	23.2	188.5	51.5	24.	< 0.002	0.255	< 0.5	0.055 95	0.46	0.33	< 0.1	6.985	391.5	12.7
29-1-1	RPD		2022-09-21	RPD of duplicates	1.7%	1.7%	3.5%	0.8%	2.2%	14.3%	0.3%		2.6%	1.6%	1.9%	0.0%		3.9%		0.5%	0.0%	6.1%		14.2%	19.7%	0.0%
31-1-1	FR1	Y	2022-05-16	Clear and colourless	0.337	0.337	0.233	5.7	0.655	< 0.04	5 650.	< 0.005	6.72	361.	200.	65.7	< 0.002	< 0.2	< 0.5	0.305	0.25	0.33	< 0.1	7.08	504.	10.6
31-1-1	FR2	Y	2022-05-16		0.333	0.333	0.187	5.2	0.639	0.043	5 490.	< 0.005	6.54	364.	170.	64.	< 0.002	< 0.2	< 0.5	0.278	0.25	0.24	< 0.1	7.08	504.	10.6
31-1-1	FRM		2022-05-16	Mean of duplicates	0.335	0.335	0.21	5.45	0.647	0.041 5	5 570.	< 0.005	6.63	362.5	185.	64.85	< 0.002	< 0.2	< 0.5	0.291 5	0.25	0.285	< 0.1	7.08	504.	10.6
31-1-1	RPD		2022-05-16	RPD of duplicates	1.2%	1.2%	21.9%	9.2%	2.5%		2.9%		2.7%	0.8%	16.2%	2.6%				9.3%	0.0%	31.6% a		0.0%	0.0%	0.0%
31-1-1	FR1	Y	2022-09-21	Clear and colourless	0.236	0.236	0.257	4.2	0.681	< 0.04	5 230.	< 0.005	6.26	354.	200.	63.6	< 0.002	< 0.2	< 0.5	0.331	< 0.2	0.39	< 0.1	6.96	508.	10.9
31-1-1	FR2	Y	2022-09-21		0.233	0.233	0.209	3.9	0.664	< 0.04	5 320.	< 0.005	6.28	360.	190.	63.4	< 0.002	< 0.2	< 0.5	0.321	< 0.2	0.35	< 0.1	6.96	670.	10.9
31-1-1	FRM		2022-09-21	Mean of duplicates	0.234 5	0.234 5	0.233	4.05	0.672 5	< 0.04	5 275.	< 0.005	6.27	357.	195.	63.5	< 0.002	< 0.2	< 0.5	0.326	< 0.2	0.37	< 0.1	6.96	589.	10.9
31-1-1	RPD		2022-09-21	RPD of duplicates	1.3%	1.3%	20.6%	7.4%	2.5%		1.7%		0.3%	1.7%	5.1%	0.3%				3.1%		10.8%		0.0%	27.5%	0.0%
31-1-1	FR1	Y	2022-12-15	Clear and colourless	1.39	1.39	0.425	4.5	0.682	0.122	6 190.	< 0.005	7.15	432.	210.	78.8	< 0.002	< 0.2	< 0.5	0.382	0.3	0.47	< 0.1	7.02	480.	9.7
31-1-1	FR2	Y	2022-12-15		1.4	1.4	0.248	4.5	0.674	0.11	6 190.	< 0.005	7.06	440.	210.	77.7	< 0.002	< 0.2	< 0.5	0.383	0.33	0.88	< 0.1	7.02	480.	9.7
31-1-1	FRM		2022-12-15	Mean of duplicates	1.395	1.395	0.336 5	4.5	0.678	0.116	6 190.	< 0.005	7.105	436.	210.	78.25	< 0.002	< 0.2	< 0.5	0.382 5	0.315	0.675	< 0.1	7.02	480.	9.7
31-1-1	RPD		2022-12-15	RPD of duplicates	0.7%	0.7%	52.6% a	0.0%	1.2%	10.3%	0.0%		1.3%	1.8%	0.0%	1.4%				0.3%	9.5%	60.7% a		0.0%	0.0%	0.0%
37-3-1	FR1	Y	2022-12-08	Clear and colourless	0.039	0.039	3.41	4.2	0.524	< 0.04	11 500.	< 0.005	6.95	293.	200.	64.2	0.012 1	< 0.2	< 0.5	0.521	0.36	1.05	< 0.1	6.92	486.	10.2
37-3-1	FR2	Y	2022-12-08	Clear and colourless	0.042	0.042	3.31	4.6	0.521	< 0.04	11 200.	< 0.005	6.87	293.	210.	62.5	0.014 2	< 0.2	< 0.5	0.513	0.29	0.94	< 0.1	6.92	486.	10.2
37-3-1	FRM		2022-12-08	Mean of duplicates	0.040 5	0.040 5	3.36	4.4	0.522 5	< 0.04	11 350.	< 0.005	6.91	293.	205.	63.35	0.013 15	< 0.2	< 0.5	0.517	0.325	0.995	< 0.1	6.92	486.	10.2
37-3-1	RPD		2022-12-08	RPD of duplicates	7.4%	7.4%	3.0%	9.1%	0.6%		2.6%		1.2%	0.0%	4.9%	2.7%	16.0%			1.5%	21.5%	11.1%		0.0%	0.0%	0.0%
39-1-1	FR1	Y	2022-05-17	Clear and colourless	0.196	0.196	0.096	2.5	0.27	0.172	5 750.	< 0.005	4.19	241.	25.	7.8	< 0.002	< 0.2	< 0.5	0.137	1.91	0.44	< 0.1	8.21	195.	11.4
39-1-1	FR2	Y	2022-05-17		0.195	0.195	0.096	3.7	0.271	0.175	6 000.	< 0.005	4.28	247.	25.	8.9	< 0.002	< 0.2	< 0.5	0.137	1.88	0.7	< 0.1	8.21	195.	11.4
39-1-1	FRM		2022-05-17	Mean of duplicates	0.195 5	0.195 5	0.096	3.1	0.270 5	0.173 5	5 875.	< 0.005	4.235	244.	25.	8.35	< 0.002	< 0.2	< 0.5	0.137	1.895	0.57	< 0.1	8.21	195.	11.4
39-1-1	RPD		2022-05-17	RPD of duplicates	0.5%	0.5%	0.0%	38.7% a	0.4%	1.7%	4.3%		2.1%	2.5%	0.0%	13.2%				0.0%	1.6%	45.6% a		0.0%	0.0%	0.0%
39-1-1	SS	Y	2023-03-09	Clear and colourless	7.65	7.69	0.181	3.1	0.287	0.194	5 180.	< 0.005	4.64	302.	24.	7.	< 0.002	< 0.2	< 0.5	0.162	1.63	1.29	< 0.1	7.95	224.	10.7
39-1-1	FR2	Y	2023-03-09		7.32	7.36	0.164	2.1	0.284	0.205	5 070.	0.006 7	4.39	300.	24.	7.1	0.019 8	< 0.2	< 0.5	0.17	1.6	1.14	< 0.1	7.95	224.	10.7
39-1-1	FRM		2023-03-09	Mean of duplicates	7.485	7.525	0.172 5	2.6	0.285 5	0.199 5	5 125.	0.005 85	4.515	301.	24.	7.05	0.010 9	< 0.2	< 0.5	0.166	1.615	1.215	< 0.1	7.95	224.	10.7
39-1-1	RPD		2023-03-09	RPD of duplicates	4.4%	4.4%	9.9%	38.5% a	1.1%	5.5%	2.1%		5.5%	0.7%	0.0%	1.4%				4.8%	1.9%	12.3%		0.0%	0.0%	0.0%
41-1-1	FR1	Y	2022-05-13	Clear and colourless	0.043	0.043	0.078	2.9	0.713	< 0.04	7 330.	< 0.005	4.75	206.	49.	14.3	< 0.002	< 0.2	< 0.5	0.176	< 0.2	0.16	< 0.1	7.25	286.	9.9
41-1-1	FR2	Y	2022-05-13		0.043	0.043	0.12	2.6	0.924	< 0.04	7 420.	< 0.005	4.79	206.	46.	13.5	< 0.002	< 0.2	< 0.5	0.17	< 0.2	0.62	< 0.1	7.25	286.	9.9
41-1-1	FRM		2022-05-13	Mean of duplicates	0.043	0.043	0.099	2.75	0.818 5	< 0.04	7 375.	< 0.005	4.77	206.	47.5	13.9	< 0.002	< 0.2	< 0.5	0.173	< 0.2	0.39	< 0.1	7.25	286.	9.9
41-1-1	RPD		2022-05-13	RPD of duplicates	0.0%	0.0%	42.4% a	10.9%	25.8%		1.2%		0.8%	0.0%	6.3%	5.8%				3.5%		117.9% a		0.0%	0.0%	0.0%
41-1-1	FR1	Y	2022-09-22	Clear and colourless	0.043	0.043	0.223	2.4	1.2	0.06	7 170.	< 0.005	5.	190.	56.	17.6	< 0.002	< 0.2	< 0.5	0.259	< 0.2	0.49	< 0.1	6.76	338.	12.3
41-1-1	FR2	Y	2022-09-22		0.046	0.046	0.293	< 2.	1.18	0.061	7 290.	< 0.005	4.99	192.	56.	17.9	< 0.002	< 0.2	< 0.5	0.263	< 0.2	0.33	< 0.1	6.76	430.	12.3
41-1-1	FRM		2022-09-22	Mean of duplicates	0.044 5	0.044 5	0.258	2.2	1.19	0.060 5	7 230.	< 0.005	4.995	191.	56.	17.75	< 0.002	< 0.2	< 0.5	0.261	< 0.2	0.41	< 0.1	6.76	384.	12.3
41-1-1	RPD		2022-09-22	RPD of duplicates	6.7%	6.7%	27.1%		1.7%	1.7%	1.7%		0.2%	1.0%	0.0%	1.7%				1.5%		39.0% a		0.0%	24.0%	0.0%
41-1-1	FR1	Y	2022-12-15	Clear and colourless	0.038	0.038	0.177	2.5	0.952	0.057	8 460.	< 0.005	5.16	223.	49.	18.3	0.003 4	< 0.2	< 0.5	0.269	< 0.2	0.3	< 0.1	7.36	315.	10.
41-1-1	FR2	Y	2022-12-15		0.039	0.039	0.18	2.8	0.95	0.077	8 470.	< 0.005	5.1	220.	49.	17.6	0.004 7	< 0.2	< 0.5	0.267	< 0.2	0.35	< 0.1	7.36	315.	10.
41-1-1	FRM		2022-12-15	Mean of duplicates	0.038 5	0.038 5	0.178 5	2.65	0.951	0.067	8 465.	< 0.005	5.13	221.5	49.	17.95	0.004 05	< 0.2	< 0.5	0.268	< 0.2	0.325	< 0.1	7.36	315.	10.
41-1-1	RPD		2022-12-15	RPD of duplicates	2.6%	2.6%	1.7%	11.3%	0.2%	29.9%	0.1%		1.2%	1.4%	0.0%	3.9%	32.1% a			0.7%		15.4%		0.0%	0.0%	0.0%
41-1-1	FR1	Y	2023-02-27	Very slight yellow	0.38	0.386	0.093	3.3	0.866	0.067	8 120.	< 0.005	5.	190.	60.	16.7	< 0.002	< 0.2	< 0.5	0.177	< 0.2	0.31	< 0.1	7.41	301.	9.
41-1-1	FR2	Y	2023-02-27		0.347	0.352	0.126	< 2.	0.854	0.058	8 200.	< 0.005	4.95	189.	58.	16.3	< 0.002	< 0.2	< 0.5	0.185	< 0.2	0.67	< 0.1	7.41	301.	9.
41-1-1	FRM		2023-02-27	Mean of duplicates	0.363 5	0.369	0.109 5	2.65	0.86	0.062 5	8 160.	< 0.005	4.975	189.5	59.	16.5	< 0.002	< 0.2	< 0.5	0.181	< 0.2	0.49	< 0.1	7.41	301.	9.
41-1-1	RPD		2023-02-27	RPD of duplicates	9.1%	9.2%	30.1% a		1.4%	14.4%	1.0%		1.0%	0.5%	3.4%	2.4%				4.4%		73.5% a		0.0%	4.7%	0.0%
42-1-1	FR1	Y	2022-05-13	Clear and colourless	< 0.02	< 0.02	0.134	5.4	0.911	< 0.04	5 900.	< 0.005	9.11	366.	73.	22.3	< 0.002	< 0.2	< 0.5	0.044 7	0.79	0.35	< 0.1	7.01	370.	9.2
42-1-1	FR2	Y	2022-05-13		< 0.02	< 0.02	0.127	5.2	0.901	< 0.04	6 040.	< 0.005	9.	366.	75.	21.5	< 0.002	< 0.2	< 0.5	0.047 1	0.75	< 0.1	< 0.1	7.01	370.	9.2
42-1-1	FRM		2022-05-13	Mean of duplicates	< 0.02	< 0.02	0.130 5	5.3	0.906	< 0.04	5 970.	< 0.005	9.055	366.	74.	21.9	< 0.002	< 0.2	< 0.5	0.045 9	0.77	0.225	< 0.1	7.01	370.	9.2
42-1-1	RPD		2022-05-13	RPD of duplicates			5.4%	3.8%	1.1%		2.3%		1.2%	0.0%	2.7%	3.7%				5.2%	5.2%			0.0%	0.0%	0.0%
42-1-1	FR1	Y	2022-12-15	Clear and colourless	< 0.02	< 0.02	0.175	10.5	0.899	< 0.04	7 800.	< 0.005	9.56	433.	78.	28.8	< 0.002	< 0.2	1.07	0.065 9	1.17	0.54	< 0.1	7.04	423.	9.4
42-1-1	FR2	Y	2022-12-15		< 0.02	< 0.02	0.112	7.8	0.895	< 0.04	7 750.	< 0.005	9.59	437.	79.	29.3	< 0.002	< 0.2	< 0.5	0.070 7	1.04	0.22	< 0.1	7.04	423.	9.4
42-1-1	FRM		2022-12-15	Mean of duplicates	< 0.02	< 0.02	0.143 5	9.15	0.897	< 0.04	7 775.	< 0.005	9.575	435.	78.5	29.05	< 0.002	< 0.2	0.785	0.068 3	1.105	0.38	< 0.1	7.04	423.	9.4
42-1-1	RPD		2022-12-15	RPD of duplicates	0.0%	0.0%	43.9% a	29.5%	0.4%		0.6%		0.3%	0.9%	1.3%	1.7%				7.0%	11.8%	84.2% a	0.0%	0.0%	0.0%	0.0%
42-1-1	FR1	Y	2023-02-27	Clear and colourless	< 0.02	0.021	0.093	5.1	0.824	< 0.04	7 120.	< 0.005	8.72	394.	80.	26.7	< 0.002	< 0.2	< 0.5	0.050 4	0.74	0.11	< 0.1	7.1	387.	8.3
42-1-1	FR2	Y	2023-02-27		< 0.02	< 0.02	0.767	4.9	0.811	< 0.04	6 990.	< 0.005	8.57	389.	81.	26.1	< 0.002	< 0.2	< 0.5	0.048	0.78	0.25	< 0.1	4.1	387.	8.3
42-1-1	FRM		2023-02-27	Mean of duplicates	< 0.02	0.020 5	0.43	5.	0.817 5	< 0.04	7 055.	< 0.005	8.645	391.5	80.5	26.4	< 0.002	< 0.2	< 0.5	0.049 2	0.76	0.18	< 0.1	5.6	387.	8.3
42-1-1	RPD		2023-02-27	RPD of duplicates			156.7% a	4.0%	1.6%		1.8%		1.7%	1.3%	1.2%	2.3%				4.9%	5.3%	77.8% a		53.6% a	0.0%	0.0%
58-1-0	FR1	Y	2022-09-22	Clear, very orange	0.457	0.636	86.7	92.	53.5	0.46	18 100.	< 0.025	522.	3 890.	99.	28.	< 0.01	< 1.	< 2.5	0.388	20.9	5.23	2.28	7.33	6 200.	19.3
58-1-0	FR2	Y	2022-09-22	Clear and colourless	0.41	0.628	86.8	92.	54.2	0.44	18 300.	< 0.025	522.	3 900.	100.	29.	< 0.01	< 1.	< 2.5	0.375	20.7	5.1	2.33	6.64	6 100.	19.3
58-1-0	FRM		2022-09-22	Mean of duplicates	0.433 5	0.632	86.75	92.	53.85	0.45	18 200.	< 0.025	522.	3 895.	99.5	28.5	< 0.01	< 1.	< 2.5	0.381 5	20.8	5.165	2.305	6.985	6 150.	19.3
58-1-0	RPD		2022-09-22	RPD of duplicates	10.8%	1.3%	0.1%	0.0%	1.3%	4.4%	1.1%		0.0%	0.3%	1.0%	3.5%				3.4%	1.0%	2.5%	2.2%	9.9%	1.6%	0.0%

Table 3-1. Groundwater Quality QA/QC - Relative Percent Difference 2022-2023

				Fraction	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	TOT	TOT	TOT
				Unit	mg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pH	µS/cm	°C
Station	Sample Type	Complance Well (Y/N)?	Date Sampled	Comments																						
71-1-1	FR1	Y	2022-05-27	Clear and colourless	< 0.02	< 0.02	0.372	11.8	0.285	< 0.04	13 300.	< 0.005	8.49	129.	24.	7.7	0.008 6	< 0.2	< 0.5	0.289	0.33	0.83	< 0.1	7.73	216.	10.
71-1-1	FR2	Y	2022-05-27		< 0.02	< 0.02	0.379	12.1	0.275	< 0.04	13 600.	< 0.005	8.26	129.	24.	6.6	0.008 3	< 0.2	< 0.5	0.281	0.32	0.99	< 0.1	7.73	216.	10.
71-1-1	FRM		2022-05-27	Mean of duplicates	< 0.02	< 0.02	0.375 5	11.95	0.28	< 0.04	13 450.	< 0.005	8.375	129.	24.	7.15	0.008 45	< 0.2	< 0.5	0.285	0.325	0.91	< 0.1	7.73	216.	10.
71-1-1	RPD		2022-05-27	RPD of duplicates			1.9%	2.5%	3.6%		2.2%		2.7%	0.0%	0.0%	15.4%	3.6%			2.8%	3.1%	17.6%		0.0%	0.0%	0.0%
71-1-1	FR1	Y	2022-09-27	Clear and colourless	< 0.02	< 0.02	0.429	16.	0.268	< 0.04	11 900.	< 0.005	7.28	151.	23.	6.7	0.006 5	< 0.2	< 0.5	0.286	0.36	0.38	< 0.1	7.53	360.	11.3
71-1-1	FR2	Y	2022-09-27		< 0.02	< 0.02	0.453	14.6	0.27	< 0.04	12 000.	< 0.005	7.29	153.	23.	6.5	0.007	< 0.2	< 0.5	0.291	0.33	0.45	< 0.1	7.88	288.	11.3
71-1-1	FRM		2022-09-27	Mean of duplicates	< 0.02	< 0.02	0.441	15.3	0.269	< 0.04	11 950.	< 0.005	7.285	152.	23.	6.6	0.006 75	< 0.2	< 0.5	0.288 5	0.345	0.415	< 0.1	7.705	324.	11.3
71-1-1	RPD		2022-09-27	RPD of duplicates			5.4%	9.2%	0.7%		0.8%		0.1%	1.3%	0.0%	3.0%	7.4%			1.7%	8.7%	16.9%		4.5%	22.2%	0.0%
71-1-1	FR1	Y	2023-01-12	Clear and colourless	< 0.02	< 0.02	0.465	14.6	0.281	< 0.04	12 400.	< 0.005	8.19	142.	21.	6.5	0.006	< 0.2	< 0.5	0.301	0.4	0.65	< 0.1	7.66	258.	10.1
71-1-1	FR2	Y	2023-01-12		< 0.02	< 0.02	0.52	15.	0.283	< 0.04	12 600.	< 0.005	8.2	144.	22.	6.7	0.006 3	< 0.2	< 0.5	0.3	0.42	0.7	< 0.1	7.66	258.	10.1
71-1-1	FRM		2023-01-12	Mean of duplicates	< 0.02	< 0.02	0.492 5	14.8	0.282	< 0.04	12 500.	< 0.005	8.195	143.	21.5	6.6	0.006 15	< 0.2	< 0.5	0.300 5	0.41	0.675	< 0.1	7.66	258.	10.1
71-1-1	RPD		2023-01-12	RPD of duplicates			11.2%	2.7%	0.7%		1.6%		0.1%	1.4%	4.7%	3.0%	4.9%			0.3%	4.9%	7.4%		0.0%	0.0%	0.0%
71-1-1	FR1	Y	2023-03-07	Clear and colourless	< 0.02	< 0.02	0.46	13.6	0.283	< 0.04	11 900.	< 0.005	8.	140.	23.	6.8	0.005 6	< 0.2	< 0.5	0.273	0.43	0.56	< 0.1	7.73	242.	8.9
71-1-1	FR2	Y	2023-03-07		< 0.02	< 0.02	0.731	17.7	0.293	< 0.04	12 000.	< 0.005	8.04	136.	22.	6.2	0.006 3	< 0.2	< 0.5	0.28	0.44	4.22	< 0.1	7.73	242.	8.9
71-1-1	FRM		2023-03-07	Mean of duplicates	< 0.02	< 0.02	0.595 5	15.65	0.288	< 0.04	11 950.	< 0.005	8.02	138.	22.5	6.5	0.005 95	< 0.2	< 0.5	0.276 5	0.435	2.39	< 0.1	7.73	242.	8.9
71-1-1	RPD		2023-03-07	RPD of duplicates			45.5% a	26.2%	3.5%		0.8%		0.5%	2.9%	4.4%	9.2%	11.8%			2.5%	2.3%	153.1% a		0.0%	0.0%	0.0%
72-1-1	FR1	Y	2022-05-27	Clear and colourless	< 0.02	< 0.02	1.79	14.8	0.23	< 0.08	21 300.	< 0.01	8.36	265.	49.	14.6	< 0.004	< 0.4	< 1.	0.017 7	< 0.4	< 0.2	< 0.2	7.75	438.	10.5
72-1-1	FR2	Y	2022-05-27		< 0.02	< 0.02	1.8	10.2	0.22	< 0.08	21 100.	< 0.01	8.36	265.	49.	15.1	< 0.004	< 0.4	< 1.	0.018 7	< 0.4	< 0.2	< 0.2	7.75	438.	10.5
72-1-1	FRM		2022-05-27	Mean of duplicates	< 0.02	< 0.02	1.795	12.5	0.225	< 0.08	21 200.	< 0.01	8.36	265.	49.	14.85	< 0.004	< 0.4	< 1.	0.018 2	< 0.4	< 0.2	< 0.2	7.75	438.	10.5
72-1-1	RPD		2022-05-27	RPD of duplicates			0.6%	36.8% a	4.4%		0.9%		0.0%	0.0%	0.0%	3.4%				5.5%				0.0%	0.0%	0.0%
72-1-1	FR1	Y	2022-10-03	Clear and colourless	< 0.02	< 0.02	1.61	8.3	0.246	< 0.04	20 000.	< 0.005	8.34	283.	45.	14.9	< 0.002	< 0.2	< 0.5	0.016 5	< 0.2	0.21	< 0.1	8.17	610.	11.2
72-1-1	FR2	Y	2022-10-03		< 0.02	< 0.02	1.57	8.5	0.243	< 0.04	20 000.	< 0.005	8.22	280.	45.	14.8	< 0.002	< 0.2	< 0.5	0.016 9	< 0.2	0.28	< 0.1	8.17	610.	11.2
72-1-1	FRM		2022-10-03	Mean of duplicates	< 0.02	< 0.02	1.59	8.4	0.244 5	< 0.04	20 000.	< 0.005	8.28	281.5	45.	14.85	< 0.002	< 0.2	< 0.5	0.016 7	< 0.2	0.245	< 0.1	8.17	610.	11.2
72-1-1	RPD		2022-10-03	RPD of duplicates			2.5%	2.4%	1.2%		0.0%		1.4%	1.1%	0.0%	0.7%				2.4%		28.6%		0.0%	0.0%	0.0%
72-1-1	FR1	Y	2023-01-11	Clear and colourless	< 0.02	< 0.02	1.69	24.6	0.24	0.386	20 000.	< 0.01	8.68	271.	45.	14.5	< 0.004	< 0.4	< 1.	0.020 2	< 0.4	0.29	< 0.2	7.64	431.	10.5
72-1-1	FR2	Y	2023-01-11		< 0.02	< 0.02	1.68	10.9	0.241	0.208	20 500.	0.006 7	8.53	288.	45.	13.6	< 0.002	< 0.2	< 0.5	0.018 4	< 0.2	0.19	< 0.1	7.64	431.	10.5
72-1-1	FRM		2023-01-11	Mean of duplicates	< 0.02	< 0.02	1.685	17.75	0.240 5	0.297	20 250.	0.008 35	8.605	279.5	45.	14.05	< 0.003	< 0.3	< 0.75	0.019 3	< 0.3	0.24	< 0.15	7.64	431.	10.5
72-1-1	RPD		2023-01-11	RPD of duplicates			0.6%	77.2% a	0.4%	59.9% a	2.5%		1.7%	6.1%	0.0%	6.4%				9.3%		41.7% a		0.0%	0.0%	0.0%
72-1-1	FR1	Y	2023-03-06	Clear and colourless	< 0.02	< 0.02	1.59	8.	0.239	< 0.04	19 800.	< 0.005	8.35	283.	44.	13.6	< 0.002	< 0.2	< 0.5	0.018 6	< 0.2	0.22	< 0.1	7.81	392.	10.3
72-1-1	FR2	Y	2023-03-06		< 0.02	< 0.02	1.74	20.5	0.23	< 0.08	19 600.	< 0.01	8.48	277.	44.	13.3	< 0.004	< 0.4	< 1.	0.017 1	< 0.4	0.31	< 0.2	7.81	392.	10.3
72-1-1	FRM		2023-03-06	Mean of duplicates	< 0.02	< 0.02	1.665	14.25	0.234 5	< 0.06	19 700.	< 0.007 5	8.415	280.	44.	13.45	< 0.003	< 0.3	< 0.75	0.017 85	< 0.3	0.265	< 0.15	7.81	392.	10.3
72-1-1	RPD		2023-03-06	RPD of duplicates			9.0%	87.7% a	3.8%		1.0%	66.7% b	1.5%	2.1%	0.0%	2.2%				8.4%		34.0% a		0.0%	0.0%	0.0%
73-1-1	FR1	Y	2022-05-25	Slightly silty and clear	0.13	0.13	0.892	13.	0.461	< 0.04	10 100.	< 0.005	6.5	193.	44.	12.2	0.005 4	< 0.2	< 0.5	0.25	0.63	0.54	< 0.1	7.5	326.	10.3
73-1-1	FR2	Y	2022-05-25		0.131	0.131	0.897	12.3	0.454	< 0.04	10 100.	< 0.005	6.39	193.	41.	13.1	0.005 9	< 0.2	< 0.5	0.245	0.64	0.61	< 0.1	7.5	326.	10.3
73-1-1	FRM		2022-05-25	Mean of duplicates	0.130 5	0.130 5	0.894 5	12.65	0.457 5	< 0.04	10 100.	< 0.005	6.445	193.	42.5	12.65	0.005 65	< 0.2	< 0.5	0.247 5	0.635	0.575	< 0.1	7.5	326.	10.3
73-1-1	RPD		2022-05-25	RPD of duplicates	0.8%	0.8%	0.6%	5.5%	1.5%		0.0%		1.7%	0.0%	7.1%	7.1%	8.8%			2.0%	1.6%	12.2%		0.0%	0.0%	0.0%
73-1-1	FR1	Y	2022-09-27	Slightly turbid, grey	0.075	0.075	1.27	14.1	0.465	< 0.04	9 700.	< 0.005	6.41	200.	47.	14.7	0.005 9	< 0.2	< 0.5	0.252	0.72	1.94	< 0.1	7.04	343.	10.6
73-1-1	FR2	Y	2022-09-27		0.074	0.074	1.13	13.6	0.464	< 0.04	9 720.	< 0.005	6.42	199.	45.	14.7	0.005 7	< 0.2	< 0.5	0.25	0.75	1.22	< 0.1	7.85	450.	10.6
73-1-1	FRM		2022-09-27	Mean of duplicates	0.074 5	0.074 5	1.2	13.85	0.464 5	< 0.04	9 710.	< 0.005	6.415	199.5	46.	14.7	0.005 8	< 0.2	< 0.5	0.251	0.735	1.58	< 0.1	7.445	396.5	10.6
73-1-1	RPD		2022-09-27	RPD of duplicates	1.3%	1.3%	11.7%	3.6%	0.2%		0.2%		0.2%	0.5%	4.3%	0.0%	3.4%			0.8%	4.1%	45.6% a		10.9%	27.0%	0.0%
73-1-1	FR1	Y	2023-01-12	Clear and colourless	0.068	0.068	1.03	13.1	0.462	< 0.04	9 990.	< 0.005	6.8	194.	43.	13.7	0.003 5	< 0.2	< 0.5	0.242	0.74	0.99	< 0.1	7.47	329.	9.9
73-1-1	FR2	Y	2023-01-12		0.069	0.069	1.05	13.1	0.458	< 0.04	10 100.	< 0.005	6.78	200.	43.	13.6	0.004 2	< 0.2	< 0.5	0.245	0.74	0.84	< 0.1	7.47	329.	9.9
73-1-1	FRM		2023-01-12	Mean of duplicates	0.068 5	0.068 5	1.04	13.1	0.46	< 0.04	10 045.	< 0.005	6.79	197.	43.	13.65	0.003 85	< 0.2	< 0.5	0.243 5	0.74	0.915	< 0.1	7.47	329.	9.9
73-1-1	RPD		2023-01-12	RPD of duplicates	1.5%	1.5%	1.9%	0.0%	0.9%		1.1%		0.3%	3.0%	0.0%	0.7%	18.2%			1.2%	0.0%	16.4%		0.0%	0.0%	0.0%
73-1-1	FR1	Y	2023-03-07	Clear and colourless	< 0.02	< 0.02	0.594	10.1	0.868	0.047	8 210.	< 0.005	25.5	167.	57.	17.7	0.007 5	< 0.2	< 0.5	0.169	0.24	0.35	< 0.1	7.49	330.	9.8
73-1-1	FR2	Y	2023-03-07		0.104	0.112	0.893	13.6	0.465	< 0.04	9 650.	< 0.005	6.83	203.	45.	12.8	0.004 5	< 0.2	< 0.5	0.249	0.62	2.75	< 0.1	7.47	330.	9.8
73-1-1	FRM		2023-03-07	Mean of duplicates	0.062	0.066	0.743 5	11.85	0.666 5	0.043 5	8 930.	< 0.005	16.165	185.	51.	15.25	0.006	< 0.2	< 0.5	0.209	0.43	1.55	< 0.1	7.48	330.	9.8
73-1-1	RPD		2023-03-07	RPD of duplicates		139.4% b	40.2% a	29.5%	60.5% a		16.1%		115.5% a	19.5%	23.5%	32.1% a	50.0% a			38.3% a	88.4% a	154.8% a		0.3%	0.0%	0.0%

Notes:

SS	Single sample
FR1	Field replicate 1
FR2	Field replicate 2
FRM	Average of field replicates
RPD	Relative percent difference of field replicates

- Not applicable, some replicates less than the detection limit.

a *- Coefficient of variation greater than 30% and all replicates greater than the limit of quantitati*

b *- Coefficient of variation greater than 30% with some replicates less than the limit of quantitat*

Table 3-2. Surface Water Quality QA/QC - Relative Percent Difference 2022-2023

				MAX Acceptable RPD	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
				Method Detection Limit (MDL)	3	0.02	10	0.005	1	0.005	0.05	0.5	5	0.02	0.1	0.05	0.03	0.005	0.02	0.02	0.04	0.005	1	1
				Limit of Quantification (5x MDL)	15	0.1	50	0.025	5	0.025	0.25	2.5	25	0.1	0.5	0.25	0.15	0.025	0.1	0.1	0.2	0.025	5	5
				Parameter	**Aluminum**	**Arsenic**	**Boron**	**Cadmium**	**Chloride**	**Cobalt**	**Copper**	**Hardness (As Caco3)**	**Iron**	**Lead**	**Manganese**	**Molybdenum**	**N - Nh3 (As N)**	**N - No2 (As N)**	**N - No3 (As N)**	**Nickel**	**Selenium**	**Silver**	**Sulphate**	**TSS**
				Fraction	TOT	TOT	TOT	TOT	DIS	TOT	TOT	TOT	TOT	TOT	TOT	TOT	TOT	DIS	DIS	TOT	TOT	TOT	DIS	TOT
				Unit	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	mg/L	mg/L
Station	**Sample Type**	**Complance Well (Y/N)?**	**Date Sampled**	**Comments**																				
SW-N-05	FR1	Y	2022-05-04		45.1	0.198	233.	0.077 9	16.	0.784	12.8	423.	38.1	0.007 1	161.	2.95	6.5	0.389	32.5	5.18	0.593	< 0.005	240.	2.0
SW-N-05	FR2	Y	2022-05-04		45.	0.182	235.	0.077	16.	0.794	12.7	425.	37.8	0.006 6	158.	2.95	6.5	0.39	32.9 STA	5.05	0.589	0.005 6	260.	1.6
SW-N-05	FRM		2022-05-04	Mean of duplicates	45.05	0.19	234.	0.077 45	16.	0.789	12.75	424.	37.95	0.006 85	159.5	2.95	6.5	0.389 5	32.7	5.115	0.591	< 0.005 3	250.	1.8
SW-N-05	RPD		2022-05-04		0.2%	8.4%	0.9%	1.2%	0.0%	1.3%	0.8%	0.5%	0.8%	7.3%	1.9%	0.0%	0.0%	0.3%	1.2%	2.5%	0.7%	11.3%	8.0%	22.2%
SW-N-05	FR1	Y	2023-01-05	Clear, colourless.	104.	0.193	104.	0.039 4	8.7	0.165	5.28	618.	100.	0.017	5.26	2.82	< 0.015	< 0.005	27.4	2.51	1.64	< 0.005	470.	1.6
SW-N-05	FR2	Y	2023-01-05	Clear, colourless.	105.	0.206	101.	0.081 7	8.7	0.168	5.35	623.	98.	0.027	5.09	2.82	< 0.015	< 0.005	27.6	2.51	1.61	< 0.005	470.	3.2
SW-N-05	FRM		2023-01-05	Mean of duplicates	104.5	0.199 5	102.5	0.060 55	8.7	0.166 5	5.315	620.5	99.	0.022	5.175	2.82	< 0.015	< 0.005	27.5	2.51	1.625	< 0.005	470.	2.4
SW-N-05	RPD		2023-01-05		1.0%	6.5%	2.9%	69.9% **a**	0.0%	1.8%	1.3%	0.8%	2.0%	45.5% **a**	3.3%	0.0%	0.0%	0.0%	0.7%	0.0%	1.8%	0.0%	0.0%	66.7% **a**
SW-N-05	FR1	Y	2023-02-07	Moderate flow, clear & colourless.	217.	0.204	90.	0.088 4	29.	0.277	6.75	271.	304.	0.037	7.61	2.84	< 0.015	< 0.005	13.4	1.81	0.313	< 0.01	150.	4.8
SW-N-05	FR2	Y	2023-02-07	Moderate flow, clear & colourless.	221.	0.221	94.	0.020 8	30.	0.298	7.26	302.	306.	0.038	8.88	3.05	< 0.015	< 0.005	13.8	1.98	0.339	< 0.01	150.	3.2
SW-N-05	FRM		2023-02-07	Mean of duplicates	219.	0.212 5	92.	0.054 6	29.5	0.287 5	7.005	286.5	305.	0.037 5	8.245	2.945	< 0.015	< 0.005	13.6	1.895	0.326	< 0.01	150.	4.0
SW-N-05	RPD		2023-02-07		1.8%	8.0%	4.3%	123.8% **a**	3.4%	7.3%	7.3%	10.8%	0.7%	2.7%	15.4%	7.1%	0.0%	0.0%	2.9%	9.0%	8.0%	0.0%	0.0%	40.0% **a**
SW-N-05	FR1	Y	2023-02-21	Very low flow, clear and colourless.	95.9	0.204	137.	0.017 1	18.	0.15	5.93	237.	117.	0.019 2	3.62	3.28	< 0.015	< 0.005	13.3	1.62	0.3	< 0.005	97.	< 1.0
SW-N-05	FR2	Y	2023-02-21	Very low flow, clear and colourless.	114.	0.198	140.	0.011 3	19.	0.172	6.07	238.	173.	0.015 3	3.32	3.25	< 0.015	< 0.005	13.9	1.58	0.302	< 0.005	96.	< 1.0
SW-N-05	FRM		2023-02-21	Mean of duplicates	104.95	0.201	138.5	0.014 2	18.5	0.161	6.	237.5	145.	0.017 25	3.47	3.265	< 0.015	< 0.005	13.6	1.6	0.301	< 0.005	96.5	< 1.0
SW-N-05	RPD		2023-02-21		17.2%	3.0%	2.2%	40.8% **a**	5.4%	13.7%	2.3%	0.4%	38.6% **a**	22.6%	8.6%	0.9%	0.0%	0.0%	4.4%	2.5%	0.7%	0.0%	1.0%	0.0%
SW-N-05	FR1	Y	2023-03-20	Low flow, clear and colourless.	53.6	0.158	144.	0.013 9	34.	0.105	4.44	212.	44.4	< 0.02	1.78	3.37	< 0.015	< 0.005	12.6	1.24	0.261	< 0.01	89.	< 1.0
SW-N-05	FR2	Y	2023-03-20	Low flow, clear and colourless.	56.4	0.168	139.	0.013 2	34.	0.106	4.54	208.	49.3	< 0.02	1.93	3.25	< 0.015	< 0.005	12.6	1.28	0.265	< 0.01	89.	< 1.0
SW-N-05	FRM		2023-03-20	Mean of duplicates	55.	0.163	141.5	0.013 55	34.	0.105 5	4.49	210.	46.85	< 0.02	1.855	3.31	< 0.015	< 0.005	12.6	1.26	0.263	< 0.01	89.	< 1.0
SW-N-05	RPD		2023-03-20		5.1%	6.1%	3.5%	5.2%	0.0%	0.9%	2.2%	1.9%	10.5%	0.0%	8.1%	3.6%	0.0%	0.0%	0.0%	3.2%	1.5%	0.0%	0.0%	0.0%
SW-N-15	FR1		13/02/2023	Moderate flow, clear & colourless.	7.9	0.085	32.	< 0.005	6.9	0.015	0.29	72.3	8.5	< 0.02	0.72	0.486	< 0.015	< 0.005	0.205	1.18	0.04	< 0.01	11.	< 1.0
SW-N-15	FR2		13/02/2023	Moderate flow, clear & colourless.	7.	0.08	30.	< 0.005	7.2	0.015	0.31	74.4	8.1	< 0.02	0.86	0.607	< 0.015	< 0.005	0.226	1.81	0.046	< 0.01	11.	< 1.0
SW-N-15	FRM		13/02/2023	Mean of duplicates	7.45	0.082 5	31.	< 0.005	7.05	0.015	0.3	73.35	8.3	< 0.02	0.79	0.546 5	< 0.015	< 0.005	0.215 5	1.495	< 0.043	< 0.01	11.	< 1.0
SW-N-15	RPD		13/02/2023		12.1%	6.1%	6.5%	0.0%	4.3%	0.0%	6.7%	2.9%	4.8%	0.0%	17.7%	22.1%	0.0%	0.0%	9.7%	42.1% **a**	14.0%	0.0%	0.0%	0.0%
SW-N-16	FR1	Y	2022-05-04		14.8	0.229	66.	0.010 5	6.1	0.363	7.53	146.	367.	0.011 4	126.	0.823	0.028	0.01	0.505	1.43	0.097	< 0.005	36.	< 1.7
SW-N-16	FR2	Y	2022-05-04		13.9	0.236	66.	0.008 4	6.2	0.352	7.44	147.	366.	0.009 1	129.	0.806	0.034	0.01	0.514	1.42	0.108	< 0.005	36.	3.6
SW-N-16	FRM		2022-05-04	Mean of duplicates	14.35	0.232 5	66.	0.009 45	6.15	0.357 5	7.485	146.5	366.5	0.010 25	127.5	0.814 5	0.031	0.01	0.509 5	1.425	0.102 5	< 0.005	36.	< 2.65
SW-N-16	RPD		2022-05-04		6.3%	3.0%	0.0%	22.2%	1.6%	3.1%	1.2%	0.7%	0.3%	22.4%	2.4%	2.1%	19.4%	0.0%	1.8%	0.7%	10.7%	0.0%	0.0%	71.7% **b**
SW-N-16	FR1	Y	2022-11-09		47.	0.198	53.	0.028 3	6.1	0.244	5.94	180.	165.	0.071	33.2	0.891	0.049	0.018 2	6.73	1.16	0.144	< 0.01	110.	3.2
SW-N-16	FR2	Y	2022-11-09		48.7	0.235	63.	0.030 5	6.5	0.278	6.91	212.	181.	0.077	39.9	1.09	0.048	0.017 5	6.87	1.36	0.163	< 0.01	110.	< 1.0
SW-N-16	FRM		2022-11-09	Mean of duplicates	47.85	0.216 5	58.	0.029 4	6.3	0.261	6.425	196.	173.	0.074	36.55	0.990 5	0.048 5	0.017 85	6.8	1.26	0.153 5	< 0.01	110.	< 2.1
SW-N-16	RPD		2022-11-09		3.6%	17.1%	17.2%	7.5%	6.3%	13.0%	15.1%	16.3%	9.2%	8.1%	18.3%	20.1%	2.1%	3.9%	2.1%	15.9%	12.4%	0.0%	0.0%	104.8% **b**
SW-N-16	FR1	Y	2023-01-05	Clear, colourless.	34.8	0.194	50.	0.019 7	12.	0.207	6.47	181.	108.	0.014 5	39.	0.813	0.039	0.018 8	8.18	1.03	0.114	< 0.005	68.	< 1.0
SW-N-16	FR2	Y	2023-01-05	Clear, colourless.	32.7	0.207	49.	0.016 1	11.	0.203	6.63	182.	111.	0.015 3	37.4	0.819	0.041	0.018 5	8.48	1.05	0.101	< 0.005	69.	< 1.0
SW-N-16	FRM		2023-01-05	Mean of duplicates	33.75	0.200 5	49.5	0.017 9	11.5	0.205	6.55	181.5	109.5	0.014 9	38.2	0.816	0.04	0.018 65	8.33	1.04	0.107 5	< 0.005	68.5	< 1.0
SW-N-16	RPD		2023-01-05		6.2%	6.5%	2.0%	20.1%	8.7%	2.0%	2.4%	0.6%	2.7%	5.4%	4.2%	0.7%	5.0%	1.6%	3.6%	1.9%	12.1%	0.0%	1.5%	0.0%
SW-N-16	FR1	Y	2023-02-07	High flow, moderately turbid, brown.	636.	0.255	45.	0.222	16.	1.12	11.7	187.	1 250.	0.095	56.5	0.862	< 0.075	0.021 7	8.03	2.85	0.116	< 0.01	59.	15.0
SW-N-16	FR2	Y	2023-02-07	High flow, moderately turbid, brown.	606.	0.213	40.	0.064 4	15.	1.05	10.1	164.	1 210.	0.083	50.5	0.739	0.044	0.018 2	8.53	2.47	0.109	< 0.01	60.	18.0
SW-N-16	FRM	Y	2023-02-07	Mean of duplicates	621.	0.234	42.5	0.143 2	15.5	1.085	10.9	175.5	1 230.	0.089	53.5	0.800 5	< 0.059 5	0.019 95	8.28	2.66	0.112 5	< 0.01	59.5	16.5
SW-N-16	RPD	Y	2023-02-07		4.8%	17.9%	11.8%	110.1% **a**	6.5%	6.5%	14.7%	13.1%	3.3%	13.5%	11.2%	15.4%	52.1% **a**	17.5%	6.0%	14.3%	6.2%	0.0%	1.7%	18.2%
SW-N-16	FR1	Y	2023-02-21	Moderate flow, clear and colourless.	90.	0.235	56.	0.338	18.	0.277	6.48	201.	248.	0.017 5	42.9	0.806	0.03	0.016 1	8.31	1.63	0.102	< 0.005	64.	2.0
SW-N-16	FR2	Y	2023-02-21	Moderate flow, clear and colourless.	93.	0.228	53.	0.069 8	18.	0.282	6.49	201.	252.	0.016 2	43.1	0.768	0.032	0.015 7	8.29	1.41	0.086	< 0.005	64.	1.6
SW-N-16	FRM		2023-02-21	Mean of duplicates	91.5	0.231 5	54.5	0.203 9	18.	0.279 5	6.485	201.	250.	0.016 85	43.	0.787	0.031	0.015 9	8.3	1.52	0.094	< 0.005	64.	1.8
SW-N-16	RPD		2023-02-21		3.3%	3.0%	5.5%	131.5% **a**	0.0%	1.8%	0.2%	0.0%	1.6%	7.7%	0.5%	4.8%	6.5%	2.5%	0.2%	14.5%	17.0%	0.0%	0.0%	22.2%
SW-N-18	FR1		2023-02-07	High flow, slightly turbid, grey.	1 660.	0.199	45.	0.012 8	6.5	2.77	4.17	325.	3 290.	0.174	72.6	1.6	6.3	0.496 STA	32.1	4.06	0.905	< 0.01	160.	250.
SW-N-18	FR2		2023-02-07	High flow, slightly turbid, grey.	1 540.	0.211	46.	0.067	7.1	2.61	5.65	326.	3 080.	0.216	71.6	1.65	6.3	0.492 STA	32.1	3.99	0.947	< 0.01	160.	240.
SW-N-18	FRM		2023-02-07	Mean of duplicates	1 600.	0.205	45.5	0.039 9	6.8	2.69	4.91	325.5	3 185.	0.195	72.1	1.625	6.3	0.494 STA	32.1	4.025	0.926	< 0.01	160.	245.
SW-N-18	RPD		2023-02-07		7.5%	5.9%	2.2%	135.8% **a**	8.8%	5.9%	30.1% **a**	0.3%	6.6%	21.5%	1.4%	3.1%	0.0%	0.8%	0.0%	1.7%	4.5%	0.0%	0.0%	4.1%
SW-N-41S1	FR1	Y	2022-05-04		48.6	0.252	23.	0.005	5.3	0.111	0.33	151.	138.	0.035	119.	0.284	< 0.015	< 0.005	0.168	0.15	0.082	< 0.01	48.	2.4
SW-N-41S1	FR2	Y	2022-05-04		71.3	0.287	23.	0.005	5.3	0.141	0.41	150.	219.	0.098	137.	0.341	< 0.015	< 0.005	0.172	0.19	0.213	< 0.01	48.	1.6
SW-N-41S1	FRM		2022-05-04	Mean of duplicates	59.95	0.269 5	23.	0.005	5.3	0.126	0.37	150.5	178.5	0.066 5	128.	0.312 5	< 0.015	< 0.005	0.17	0.17	0.147 5	< 0.01	48.	2.0
SW-N-41S1	RPD		2022-05-04		37.9% **a**	13.0%	0.0%	0.0%	0.0%	23.8%	21.6%	0.7%	45.4% **a**	94.7% **a**	14.1%	18.2%	0.0%	0.0%	2.4%	23.5%	88.8% **a**	0.0%	0.0%	40.0% **a**
SW-N-41S1	FR1	Y	2022-11-09		27.8	0.302	19.	0.005	6.2	0.154	0.23	201.	171.	0.025	152.	0.297	0.018	< 0.005	0.42	0.16	0.168	< 0.01	68.	2.8
SW-N-41S1	FR2	Y	2022-11-09		33.2	0.303	19.	0.005	6.3	0.17	0.26	204.	185.	0.029	158.	0.289	0.016	< 0.005	0.423	0.19	0.171	< 0.01	69.	2.4
SW-N-41S1	FRM		2022-11-09	Mean of duplicates	30.5	0.302 5	19.	0.005	6.25	0.162	0.245	202.5	178.	0.027	155.	0.293	0.017	< 0.005	0.421 5	0.175	0.169 5	< 0.01	68.5	2.6
SW-N-41S1	RPD		2022-11-09		17.7%	0.3%	0.0%	0.0%	1.6%	9.9%	12.2%	1.5%	7.9%	14.8%	3.9%	2.7%	11.8%	0.0%	0.7%	17.1%	1.8%	0.0%	1.5%	15.4%

Table 3-2. Surface Water Quality QA/QC - Relative Percent Difference 2022-2023

MAX Acceptable RPD					30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
Method Detection Limit (MDL)					3	0.02	10	0.005	1	0.005	0.05	0.5	5	0.02	0.1	0.05	0.03	0.005	0.02	0.02	0.04	0.005	1	1
Limit of Quantification (5x MDL)					15	0.1	50	0.025	5	0.025	0.25	2.5	25	0.1	0.5	0.25	0.15	0.025	0.1	0.1	0.2	0.025	5	5
Parameter					**Aluminum**	**Arsenic**	**Boron**	**Cadmium**	**Chloride**	**Cobalt**	**Copper**	**Hardness (As Caco3)**	**Iron**	**Lead**	**Manganese**	**Molybdenum**	**N - Nh3 (As N)**	**N - No2 (As N)**	**N - No3 (As N)**	**Nickel**	**Selenium**	**Silver**	**Sulphate**	**TSS**
Fraction					TOT	TOT	TOT	TOT	DIS	TOT	TOT	TOT	TOT	TOT	TOT	TOT	TOT	DIS	DIS	TOT	TOT	TOT	DIS	TOT
Unit					µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	mg/L	mg/L
Station	**Sample Type**	**Complance Well (Y/N)?**	**Date Sampled**	**Comments**																				
SW-N-41S1	FR1	Y	2023-01-05	Clear, colourless.	85.1	0.264	19.	0.005	5.6	0.115	0.43	170.	200.	0.062	72.5	0.31	< 0.015	< 0.005	0.74	0.19	0.121	< 0.01	63.	8.4
SW-N-41S1	FR2	Y	2023-01-05	Clear, colourless.	77.4	0.251	17.	0.005	5.7	0.103	0.4	160.	179.	0.059	66.	0.256	< 0.015	< 0.005	0.732	0.15	0.109	< 0.01	61.	7.2
SW-N-41S1	FRM		2023-01-05	Mean of duplicates	81.25	0.257 5	18.	0.005	5.65	0.109	0.415	165.	189.5	0.060 5	69.25	0.283	< 0.015	< 0.005	0.736	0.17	0.115	< 0.01	62.	7.8
SW-N-41S1	RPD		2023-01-05		9.5%	5.0%	11.1%	0.0%	1.8%	11.0%	7.2%	6.1%	11.1%	5.0%	9.4%	19.1%	0.0%	0.0%	1.1%	23.5%	10.4%	0.0%	3.2%	15.4%
SW-N-41S1	FR1	Y	2023-02-21	Low flow, clear and colourless.	7.89	0.162	19.	0.005	5.6	0.029 6	0.155	173.	20.2	0.006 6	14.6	0.299	< 0.015	< 0.005	0.686	0.082	0.094	< 0.005	59.	< 1.0
SW-N-41S1	FR2	Y	2023-02-21	Low flow, clear and colourless.	159.	0.319	20.	0.009 1	4.9	0.19	0.56	175.	343.	0.12	106.	0.326	< 0.015	< 0.005	0.733	0.39	0.089	< 0.01	64.	5.2
SW-N-41S1	FRM		2023-02-21	Mean of duplicates	83.445	0.240 5	19.5	0.007 05	5.25	0.109 8	0.357 5	174.	181.6	0.063 3	60.3	0.312 5	< 0.015	< 0.005	0.709 5	0.236	0.091 5	< 0.007 5	61.5	< 3.1
SW-N-41S1	RPD		2023-02-21		181.1% **a**	65.3% **a**	5.1%	58.2% **a**	13.3%	146.1% **a**	113.3% **a**	1.1%	177.8% **a**	179.1% **a**	151.6% **a**	8.6%	0.0%	0.0%	6.6%	130.5% **a**	5.5%	66.7% **b**	8.1%	135.5% **b**
SW-N-42S1	FR1	Y	2022-05-04		42.2	0.087	48.	0.005	12.	0.103	0.52	168.	75.6	0.187	39.2	0.529	< 0.015	< 0.005	0.024	0.16	0.051	< 0.01	66.	13.
SW-N-42S1	FR2	Y	2022-05-04		46.	0.083	50.	0.007 2	12.	0.137	0.57	174.	116.	0.073	69.8	0.681	< 0.015	< 0.005	0.023	0.24	0.06	< 0.01	69.	16.
SW-N-42S1	FRM		2022-05-04	Mean of duplicates	44.1	0.085	49.	0.006 1	12.	0.12	0.545	171.	95.8	0.13	54.5	0.605	< 0.015	< 0.005	0.023 5	0.2	0.055 5	< 0.01	67.5	14.5
SW-N-42S1	RPD		2022-05-04		8.6%	4.7%	4.1%	36.1% **a**	0.0%	28.3%	9.2%	3.5%	42.2% **a**	87.7% **a**	56.1% **a**	25.1%	0.0%	0.0%	4.3%	40.0% **a**	16.2%	0.0%	4.4%	20.7%
SW-N-42S1	FR1	Y	2022-11-09		455.	0.364	60.	0.029 1	15.	0.842	2.	262.	799.	0.573	529.	0.755	0.042	< 0.005	0.036	0.74	0.123	< 0.01	120.	7.6
SW-N-42S1	FR2	Y	2022-11-09		272.	0.254	60.	0.021 9	14.	0.501	1.43	250.	477.	0.32	287.	0.7	< 0.015	< 0.005	0.041	0.52	0.095	< 0.01	120.	6.8
SW-N-42S1	FRM		2022-11-09	Mean of duplicates	363.5	0.309	60.	0.025 5	14.5	0.671 5	1.715	256.	638.	0.446 5	408.	0.727 5	< 0.028 5	< 0.005	0.038 5	0.63	0.109	< 0.01	120.	7.2
SW-N-42S1	RPD		2022-11-09		50.3% **a**	35.6% **a**	0.0%	28.2%	6.9%	50.8% **a**	33.2% **a**	4.7%	50.5% **a**	56.7% **a**	59.3% **a**	7.6%	94.7% **b**	0.0%	13.0%	34.9% **a**	25.7%	0.0%	0.0%	11.1%
SW-N-42S1	FR1	Y	2023-01-05	Clear, colourless.	25.5	0.089	62.	0.005	27.	0.067	0.66	182.	39.8	0.038	15.7	0.479	< 0.015	< 0.005	0.399	0.16	0.06	< 0.01	81.	3.6
SW-N-42S1	FR2	Y	2023-01-05	Clear, colourless.	43.7	0.092	64.	< 0.005	27.	0.089	0.77	184.	68.9	0.055	25.1	0.483	< 0.015	< 0.005	0.398	0.15	0.066	< 0.01	80.	3.2
SW-N-42S1	FRM		2023-01-05	Mean of duplicates	34.6	0.090 5	63.	< 0.005	27.	0.078	0.715	183.	54.35	0.046 5	20.4	0.481	< 0.015	< 0.005	0.398 5	0.155	0.063	< 0.01	80.5	3.4
SW-N-42S1	RPD		2023-01-05		52.6% **a**	3.3%	3.2%	0.0%	0.0%	28.2%	15.4%	1.1%	53.5% **a**	36.6%	46.1% **a**	0.8%	0.0%	0.0%	0.3%	6.5%	9.5%	0.0%	1.2%	11.8%
SW-N-42S1	FR1	Y	2023-02-21	Low flow, clear and colourless.	62.5	0.09	60.	0.005 5	22.	0.122	0.67	198.	109.	0.098	36.2	0.572	< 0.015	< 0.005	0.239	0.27	0.062	< 0.01	82.	6.0
SW-N-42S1	FR2	Y	2023-02-21	Low flow, clear and colourless.	109.	0.104	59.	0.009 4	22.	0.173	0.89	197.	183.	0.189	56.1	0.57	< 0.015	< 0.005	0.239	0.33	0.065	< 0.01	83.	< 1.0
SW-N-42S1	FRM		2023-02-21	Mean of duplicates	85.75	0.097	59.5	0.007 45	22.	0.147 5	0.78	197.5	146.	0.143 5	46.15	0.571	< 0.015	< 0.005	0.239	0.3	0.063 5	< 0.01	82.5	< 3.5
SW-N-42S1	RPD		2023-02-21		54.2% **a**	14.4%	1.7%	52.3% **a**	0.0%	34.6% **a**	28.2%	0.5%	50.7% **a**	63.4% **a**	43.1% **a**	0.4%	0.0%	0.0%	0.0%	20.0%	4.7%	0.0%	1.2%	142.9% **b**
SW-N-57	FR1		2023-02-07	Field characteristics not recorded.	1 370.	0.214	39.	0.008 6	6.4	2.47	4.2	287.	2 650.	0.157	62.4	1.69	6.5	0.49	31.8	3.28	0.917	< 0.01	130.	48.
SW-N-57	FR2		2023-02-07	Field characteristics not recorded.	1 920.	0.225	40.	0.01	7.1	3.02	4.79	287.	3 810.	0.163	71.1	1.69	6.6	0.495	32.5	4.19	0.94	< 0.01	130.	45.
SW-N-57	FRM		2023-02-07	Mean of duplicates	1 645.	0.219 5	39.5	0.009 3	6.75	2.745	4.495	287.	3 230.	0.16	66.75	1.69	6.55	0.492 5	32.15	3.735	0.928 5	< 0.01	130.	46.5
SW-N-57	RPD		2023-02-07		33.4% **a**	5.0%	2.5%	15.1%	10.4%	20.0%	13.1%	0.0%	35.9% **a**	3.8%	13.0%	0.0%	1.5%	1.0%	2.2%	24.4%	2.5%	0.0%	0.0%	6.5%
SW-S-04	FR1	Y	2022-05-05		1 310.	0.322	72.	0.038 5	18.	1.45	9.03	78.1	2 310.	1.86	104.	0.28	< 0.015	0.008 6	1.02	2.36	0.055	0.014	16.	26.
SW-S-04	FR2	Y	2022-05-05		1 210.	0.31	71.	0.051 1	18.	1.4	9.08	78.3	2 190.	1.89	102.	0.257	< 0.015	0.009 1	1.02	2.43	0.067	0.014	16.	20.
SW-S-04	FRM		2022-05-05	Mean of duplicates	1 260.	0.316	71.5	0.044 8	18.	1.425	9.055	78.2	2 250.	1.875	103.	0.268 5	< 0.015	0.008 85	1.02	2.395	0.061	0.014	16.	23.
SW-S-04	RPD		2022-05-05	RPD Calculation	7.9%	3.8%	1.4%	28.1%	0.0%	3.5%	0.6%	0.3%	5.3%	1.6%	1.9%	8.6%	0.0%	5.6%	0.0%	2.9%	19.7%	0.0%	0.0%	26.1%
SW-S-04	FR1	Y	2022-11-08		14.	0.117	63.	0.014 3	30.	0.075 5	1.56	125.	7.9	0.013 4	0.852	0.119	< 0.015	< 0.005	2.33	0.327	0.067	< 0.005	60.	1.2
SW-S-04	FR2	Y	2022-11-08		12.5	0.111	64.	0.015 8	29.	0.071 5	1.55	126.	6.5	0.010 8	0.584	0.114	< 0.015	< 0.005	2.33	0.324	0.073	< 0.005	60.	< 1.0
SW-S-04	FRM		2022-11-08	Mean of duplicates	13.25	0.114	63.5	0.015 05	29.5	0.073 5	1.555	125.5	7.2	0.012 1	0.718	0.116 5	< 0.015	< 0.005	2.33	0.325 5	0.07	< 0.005	60.	< 1.1
SW-S-04	RPD		2022-11-08	RPD Calculation	11.3%	5.3%	1.6%	10.0%	3.4%	5.4%	0.6%	0.8%	19.4%	21.5%	37.3% **a**	4.3%	0.0%	0.0%	0.0%	0.9%	8.6%	0.0%	0.0%	18.2%
SW-S-04	FR1	Y	04/01/2023	Clear, colourless.	25.5	0.099	56.	0.005 7	30.	0.062 3	1.68	92.4	35.5	0.022 5	1.76	0.127	0.021	0.007 8	1.43	0.297	0.05	< 0.005	27.	< 1.0
SW-S-04	FR2	Y	04/01/2023	Clear, colourless.	26.	0.1	57.	< 0.005	30.	0.064 1	1.67	92.6	26.2	0.030 1	1.82	0.119	0.02	0.007 8	1.44	0.283	0.053	< 0.005	27.	1.2
SW-S-04	FRM		04/01/2023	Mean of duplicates	25.75	0.099 5	56.5	< 0.005 35	30.	0.063 2	1.675	92.5	30.85	0.026 3	1.79	0.123	0.020 5	0.007 8	1.435	0.29	0.051 5	< 0.005	27.	< 1.1
SW-S-04	RPD		2023-01-04	RPD Calculation	1.9%	1.0%	1.8%	13.1%	0.0%	2.8%	0.6%	0.2%	30.1% **a**	28.9%	3.4%	6.5%	4.9%	0.0%	0.7%	4.8%	5.8%	0.0%	0.0%	18.2%
SW-S-04	FR1	Y	2023-02-06	Moderate flow, clear and colourless.	55.4	0.105	65.	0.011 5	31.	0.122	1.97	102.	106.	0.069 4	5.	0.203	< 0.015	< 0.005	1.92	0.771	0.053	< 0.005	28.	< 1.0
SW-S-04	FR2	Y	2023-02-06	Very low flow. Clear, colourless.	87.2	0.119	68.	0.013	31.	0.141	2.01	99.9	99.6	0.157	10.3	0.151	< 0.015	< 0.005	1.93	0.409	0.058	< 0.005	28.	2.4
SW-S-04	FRM	Y	2023-02-06	Mean of duplicates	71.3	0.112	66.5	0.012 25	31.	0.131 5	1.99	100.95	102.8	0.113 2	7.65	0.177	< 0.015	< 0.005	1.925	0.59	0.055 5	< 0.005	28.	< 1.7
SW-S-04	RPD	Y	2023-02-06	RPD Calculation	44.6%	12.5%	4.5%	12.2%	0.0%	14.4%	2.0%	2.1%	6.2%	77.4% **a**	69.3% **a**	29.4%	0.0%	0.0%	0.5%	61.4% **a**	9.0%	0.0%	0.0%	82.4% **b**

Notes:

SS	*Single sample*
FR1	*Field replicate 1*
FR2	*Field replicate 2*
FRM	*Average of field replicates*
RPD	Relative percent difference of field replicates

na - Not applicable, some replicates less than the detection limit.

a - Coefficient of variation greater than 30% and all replicates greater than the limit of quantitation.

b - Coefficient of variation greater than 30% with some replicates less than the limit of quantitation.

Table 3-2. Surface Water Quality QA/QC - Relative Percent Difference 2022-2023

				MAX Acceptable RPD	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	45%
				Method Detection Limit (MDL)	0.1	0	0	0	0.5	0.02	10	0.005	0.005	0.05	0.5	1	0.005	0.05	0.05	0.02	0.04	0.005	0.1	0.5
				Limit of Quantification (5x MDL)	0.5	0	0	0	2.5	0.1	50	0.025	0.025	0.25	2.5	5	0.025	0.25	0.25	0.1	0.2	0.025	0.5	2.5
				Parameter	**Zinc**	**pH**	**Conductivity**	**Temperature**	**Aluminum**	**Arsenic**	**Boron**	**Cadmium**	**Cobalt**	**Copper**	**ardness (As Caco**	**Iron**	**Lead**	**Manganese**	**Molybdenum**	**Nickel**	**Selenium**	**Silver**	**Zinc**	**Dissolved Organic Carbon**
				Fraction	TOT	TOT	TOT	TOT	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	Dissolved
				Unit	µg/L	pH	µS/cm	°C	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
Station	**Sample Type**	**Complance Well (Y/N)?**	**Date Sampled**	**Comments**																				
SW-N-05	FR1	Y	2022-05-04		6.93				29.	0.187	229.	0.078 2	0.768	12.2	434.	37.8	< 0.005	159.	2.96	5.26	0.567	< 0.005	6.68	1 400.
SW-N-05	FR2	Y	2022-05-04		7.66				32.	0.2	233.	0.084 2	0.774	12.5	423.	27.	0.008 6	159.	2.97	5.15	0.575	< 0.005	7.16	1 700.
SW-N-05	FRM		2022-05-04	Mean of duplicates	7.295	6.68	691.	9.2	30.5	0.193 5	231.	0.081 2	0.771	12.35	428.5	32.4	< 0.006 8	159.	2.965	5.205	0.571	< 0.005	6.92	1 550.
SW-N-05	RPD		2022-05-04		10.0%				9.8%	6.7%	1.7%	7.4%	0.8%	2.4%	2.6%	33.3% a	52.9% b	0.0%	0.3%	2.1%	1.4%	0.0%	6.9%	19.4%
SW-N-05	FR1	Y	2023-01-05	Clear, colourless.	7.17	7.02	1 200.	8.6	58.7	0.196	103.	0.032 3	0.132	4.81	617.	42.8	0.008 6	3.8	2.82	2.43	1.65	< 0.005	6.67	8.6
SW-N-05	FR2	Y	2023-01-05	Clear, colourless.	7.99	6.56	521.	8.6	54.7	0.186	102.	0.031 7	0.128	4.81	622.	33.	0.005 1	3.64	2.83	2.39	1.73	< 0.005	6.54	1 900.
SW-N-05	FRM		2023-01-05	Mean of duplicates	7.58	6.79	860.5	8.6	56.7	0.191	102.5	0.032	0.13	4.81	619.5	37.9	0.006 85	3.72	2.825	2.41	1.69	< 0.005	6.605	954.3
SW-N-05	RPD		2023-01-05		10.8%	6.8%	78.9% a	0.0%	7.1%	5.2%	1.0%	1.9%	3.1%	0.0%	0.8%	25.9%	51.1% a	4.3%	0.4%	1.7%	4.7%	0.0%	2.0%	198.2% a
SW-N-05	FR1	Y	2023-02-07	Moderate flow, clear & colourless.	3.7	6.57	460.	8.7	53.3	0.189	89.	0.041 4	0.134	5.87	280.	33.	0.007 1	2.76	2.82	1.56	0.324	< 0.005	2.77	300.
SW-N-05	FR2	Y	2023-02-07	Moderate flow, clear & colourless.	3.5	6.57	460.	8.7	56.	0.19	91.	0.181	0.14	6.09	282.	31.8	0.009 6	2.95	2.94	1.65	0.306	< 0.005	3.49	94.
SW-N-05	FRM		2023-02-07	Mean of duplicates	3.6	6.57	460.	8.7	54.65	0.189 5	90.	0.111 2	0.137	5.98	281.	32.4	0.008 35	2.855	2.88	1.605	0.315	< 0.005	3.13	197.
SW-N-05	RPD		2023-02-07		5.6%	0.0%	0.0%	0.0%	4.9%	0.5%	2.2%	125.5% a	4.4%	3.7%	0.7%	3.7%	29.9%	6.7%	4.2%	5.6%	5.7%	0.0%	23.0%	104.6% a
SW-N-05	FR1	Y	2023-02-21	Very low flow, clear and colourless.	3.78	7.9	352.	7.9	48.2	0.179	132.	0.024 5	0.102	5.38	240.	75.4	0.009 9	1.27	3.27	1.37	0.328	< 0.005	3.33	6.9
SW-N-05	FR2	Y	2023-02-21	Very low flow, clear and colourless.	3.86	7.9	530.	7.9	36.5	0.189	135.	0.016 6	0.094 7	5.3	240.	20.6	0.007 2	0.92	3.3	1.32	0.309	< 0.005	3.11	7.
SW-N-05	FRM		2023-02-21	Mean of duplicates	3.82	7.9	441.	7.9	42.35	0.184	133.5	0.020 55	0.098 35	5.34	240.	48.	0.008 55	1.095	3.285	1.345	0.318 5	< 0.005	3.22	6.95
SW-N-05	RPD		2023-02-21		2.1%	0.0%	40.4% a	0.0%	27.6%	5.4%	2.2%	38.4% a	7.4%	1.5%	0.0%	114.2% a	31.6% a	32.0% a	0.9%	3.7%	6.0%	0.0%	6.8%	1.4%
SW-N-05	FR1	Y	2023-03-20	Low flow, clear and colourless.	3.1	6.52	331.3	8.2	32.9	0.182	151.	0.012 9	0.096 4	4.41	217.	17.6	< 0.005	0.869	3.4	1.16	0.265	< 0.005	3.27	5.5
SW-N-05	FR2	Y	2023-03-20	Low flow, clear and colourless.	3.3	6.52	331.3	8.2	34.7	0.173	157.	0.018	0.103	4.52	222.	18.5	0.014 8	0.924	3.49	1.22	0.278	< 0.005	3.55	5.3
SW-N-05	FRM		2023-03-20	Mean of duplicates	3.2	6.52	331.3	8.2	33.8	0.177 5	154.	0.015 45	0.099 7	4.465	219.5	18.05	< 0.009 9	0.896 5	3.445	1.19	0.271 5	< 0.005	3.41	5.4
SW-N-05	RPD		2023-03-20		6.2%	0.0%	0.0%	0.0%	5.3%	5.1%	3.9%	33.0% a	6.6%	2.5%	2.3%	5.0%	99.0% b	6.1%	2.6%	5.0%	4.8%	0.0%	8.2%	3.7%
SW-N-15	FR1		13/02/2023	Moderate flow, clear & colourless.	< 1.0	7.5	111.	5.4	2.68	0.081	31.	< 0.005	0.013 7	0.263	75.4	3.8	< 0.005	0.23	0.227	0.065	0.046	< 0.005	0.28	200.
SW-N-15	FR2		13/02/2023	Moderate flow, clear & colourless.	< 1.0	7.5	111.	5.4	2.49	0.079	29.	< 0.005	0.011 5	0.265	75.5	1.8	< 0.005	0.197	0.224	0.062	0.042	< 0.005	0.32	210.
SW-N-15	FRM		13/02/2023	Mean of duplicates	< 1.0	7.5	111.	5.4	2.585	0.08	30.	< 0.005	0.012 6	0.264	75.45	2.8	< 0.005	0.213 5	0.225 5	0.063 5	0.044	< 0.005	0.3	205.
SW-N-15	RPD		13/02/2023		0.0%	0.0%	0.0%	0.0%	7.4%	2.5%	6.7%	0.0%	17.5%	0.8%	0.1%	71.4% a	0.0%	15.5%	1.3%	4.7%	9.1%	0.0%	13.3%	4.9%
SW-N-16	FR1	Y	2022-05-04		6.25				11.1	0.24	63.	0.011 6	0.361	6.63	144.	290.	0.007 1	152.	0.793	1.52	0.102	< 0.005	5.98	1 500.
SW-N-16	FR2	Y	2022-05-04		6.3				15.8	0.215	61.	0.007 2	0.374	6.77	150.	211.	0.005	155.	0.806	1.48	0.095	< 0.005	5.89	1 600.
SW-N-16	FRM		2022-05-04	Mean of duplicates	6.275	7.67	237.	10.	13.45	0.227 5	62.	0.009 4	0.367 5	6.7	147.	250.5	0.006 05	153.5	0.799 5	1.5	0.098 5	< 0.005	5.935	1 550.
SW-N-16	RPD		2022-05-04		0.8%				34.9% a	11.0%	3.2%	46.8% a	3.5%	2.1%	4.1%	31.5% a	34.7% a	2.0%	1.6%	2.7%	7.1%	0.0%	1.5%	6.5%
SW-N-16	FR1	Y	2022-11-09		17.2	7.61	480.	5.8	12.5	0.218	60.	0.025 7	0.232	5.86	210.	40.1	0.010 8	36.8	1.02	1.28	0.152	< 0.005	16.7	1 600.
SW-N-16	FR2	Y	2022-11-09		19.6	6.8	293.	4.3	12.	0.222	59.	0.024 5	0.223	5.95	210.	39.9	0.009 8	37.	1.03	1.23	0.168	< 0.005	16.8	990.
SW-N-16	FRM		2022-11-09	Mean of duplicates	18.4	7.205	386.5	5.05	12.25	0.22	59.5	0.025 1	0.227 5	5.905	210.	40.	0.010 3	36.9	1.025	1.255	0.16	< 0.005	16.75	1 295.
SW-N-16	RPD		2022-11-09		13.0%	11.2%	48.4% a	29.7%	4.1%	1.8%	1.7%	4.8%	4.0%	1.5%	0.0%	0.5%	9.7%	0.5%	1.0%	4.0%	10.0%	0.0%	0.6%	47.1% a
SW-N-16	FR1	Y	2023-01-05	Clear, colourless.	11.5	6.98	261.	6.2	13.6	0.196	49.	0.016 8	0.181	6.22	179.	48.5	0.007 3	36.5	0.828	1.01	0.109	< 0.005	10.9	7.
SW-N-16	FR2	Y	2023-01-05	Clear, colourless.	11.5	6.98	261.	6.2	15.1	0.196	49.	0.017	0.184	6.19	177.	50.2	0.007 5	36.6	0.809	0.993	0.1	< 0.005	11.	7.1
SW-N-16	FRM		2023-01-05	Mean of duplicates	11.5	6.98	261.	6.2	14.35	0.196	49.	0.016 9	0.182 5	6.205	178.	49.35	0.007 4	36.55	0.818 5	1.001 5	0.104 5	< 0.005	10.95	7.05
SW-N-16	RPD		2023-01-05		0.0%	0.0%	0.0%	0.0%	10.5%	0.0%	0.0%	1.2%	1.6%	0.5%	1.1%	3.4%	2.7%	0.3%	2.3%	1.7%	8.6%	0.0%	0.9%	1.4%
SW-N-16	FR1	Y	2023-02-07	High flow, moderately turbid, brown.	25.1	6.72	290.	7.5	12.7	0.191	43.	0.024 1	0.295	8.07	172.	54.6	0.006 5	38.2	0.721	1.43	0.115	< 0.005	16.4	220.
SW-N-16	FR2	Y	2023-02-07	High flow, moderately turbid, brown.	22.4	6.72	290.	7.5	14.2	0.191	43.	0.035 6	0.298	8.23	175.	59.9	0.006 2	38.2	0.776	1.42	0.113	< 0.005	16.2	710.
SW-N-16	FRM	Y	2023-02-07	Mean of duplicates	23.75	6.72	290.	7.5	13.45	0.191	43.	0.029 85	0.296 5	8.15	173.5	57.25	0.006 35	38.2	0.748 5	1.425	0.114	< 0.005	16.3	465.
SW-N-16	RPD	Y	2023-02-07		11.4%	0.0%	0.0%	0.0%	11.2%	0.0%	0.0%	38.5% a	1.0%	2.0%	1.7%	9.3%	4.7%	0.0%	7.3%	0.7%	1.8%	0.0%	1.2%	105.4% a
SW-N-16	FR1	Y	2023-02-21	Moderate flow, clear and colourless.	9.35	7.02	430.	6.2	12.2	0.196	52.	0.042 9	0.208	5.81	198.	59.3	0.008 3	43.3	0.719	1.1	0.089	< 0.005	9.12	7.6
SW-N-16	FR2	Y	2023-02-21	Moderate flow, clear and colourless.	9.01	7.02	284.	6.2	11.9	0.194	51.	0.084 6	0.197	5.9	198.	58.6	0.005 6	43.4	0.711	1.06	0.083	< 0.005	8.87	7.7
SW-N-16	FRM		2023-02-21	Mean of duplicates	9.18	7.02	357.	6.2	12.05	0.195	51.5	0.063 75	0.202 5	5.855	198.	58.95	0.006 95	43.35	0.715	1.08	0.086	< 0.005	8.995	7.65
SW-N-16	RPD		2023-02-21		3.7%	0.0%	40.9% a	0.0%	2.5%	1.0%	1.9%	65.4% a	5.4%	1.5%	0.0%	1.2%	38.8% a	0.2%	1.1%	3.7%	7.0%	0.0%	2.8%	1.3%
SW-N-18	FR1		2023-02-07	High flow, slightly turbid, grey.	6.2	7.23	537.	8.5	68.8	0.165	43.	1.29	0.738	2.7	329.	171.	0.087 5	40.2	1.68	2.71	1.01	< 0.005	46.3	240.
SW-N-18	FR2		2023-02-07	High flow, slightly turbid, grey.	21.8	7.23	537.	8.5	16.6	0.159	43.	0.010 4	0.634	1.12	328.	40.5	0.026 5	38.2	1.72	1.54	1.01	< 0.005	1.7	230.
SW-N-18	FRM		2023-02-07	Mean of duplicates	14.	7.23	537.	8.5	42.7	0.162	43.	0.650 2	0.686	1.91	328.5	105.75	0.057	39.2	1.7	2.125	1.01	< 0.005	24.	235.
SW-N-18	RPD		2023-02-07		111.4% a	0.0%	0.0%	0.0%	122.2% a	3.7%	0.0%	196.8% a	15.2%	82.7% a	0.3%	123.4% a	107.0% a	5.1%	2.4%	55.1% a	0.0%	0.0%	185.8% a	4.3%
SW-N-41S1	FR1	Y	2022-05-04		< 1.0				3.61	0.182	17.	< 0.005	0.076 8	0.201	156.	34.4	< 0.005	94.1	0.286	0.101	0.065	< 0.005	0.41	1 500.
SW-N-41S1	FR2	Y	2022-05-04		1.3				3.87	0.168	16.	< 0.005	0.076 4	0.195	158.	28.	< 0.005	93.1	0.29	0.103	0.068	< 0.005	0.36	1 600.
SW-N-41S1	FRM		2022-05-04	Mean of duplicates	< 1.15	8.14	229.	9.3	3.74	0.175	16.5	< 0.005	0.076 6	0.198	157.	31.2	< 0.005	93.6	0.288	0.102	0.066 5	< 0.005	0.385	1 550.
SW-N-41S1	RPD		2022-05-04		26.1%				7.0% a	8.0%	6.1%	0.0%	0.5%	3.0%	1.3%	20.5%	0.0%	1.1%	1.4%	2.0%	4.5%	0.0%	13.0%	6.5%
SW-N-41S1	FR1	Y	2022-11-09		1.4	8.19	283.	7.1	3.78	0.255	19.	< 0.005	0.135	0.148	210.	76.9	< 0.005	147.	0.304	0.11	0.162	< 0.005	0.68	1 800.
SW-N-41S1	FR2	Y	2022-11-09		1.5	8.2	283.	7.1	4.96	0.241	19.	< 0.005	0.137	0.229	206.	78.6	0.011 9	142.	0.297	0.13	0.165	< 0.005	1.88	1 700.
SW-N-41S1	FRM		2022-11-09	Mean of duplicates	1.45	8.195	283.	7.1	4.37	0.248	19.	< 0.005	0.136	0.188 5	208.	77.75	< 0.008 45	144.5	0.300 5	0.12	0.163 5	< 0.005	1.28	1 750.
SW-N-41S1	RPD		2022-11-09		6.9%	0.1%	0.0%	0.0%	27.0%	5.6%	0.0%	0.0%	1.5%	43.0% a	1.9%	2.2%	81.7%	3.5%	2.3%	16.7%	1.8%	0.0%	93.8% a	5.7%

Table 3-2. Surface Water Quality QA/QC - Relative Percent Difference 2022-2023

				MAX Acceptable RPD	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	45%
				Method Detection Limit (MDL)	0.1	0	0	0	0.5	0.02	10	0.005	0.005	0.05	0.5	1	0.005	0.05	0.05	0.02	0.04	0.005	0.1	0.5
				Limit of Quantification (5x MDL)	0.5	0	0	0	2.5	0.1	50	0.025	0.025	0.25	2.5	5	0.025	0.25	0.25	0.1	0.2	0.025	0.5	2.5
				Parameter	Zinc	pH	Conductivity	Temperature	Aluminum	Arsenic	Boron	Cadmium	Cobalt	Copper	ardness (As Caco	Iron	Lead	Manganese	Molybdenum	Nickel	Selenium	Silver	Zinc	Dissolved Organic Carbon
				Fraction	TOT	TOT	TOT	TOT	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	Dissolved
				Unit	µg/L	pH	µS/cm	°C	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
Station	Sample Type	Complance Well (Y/N)?	Date Sampled	Comments																				
SW-N-41S1	FR1	Y	2023-01-05	Clear, colourless.	1.2	7.67	360.	8.4	5.14	0.161	17.	< 0.005	0.046 3	0.263	167.	26.1	< 0.005	33.5	0.26	0.083	0.134	< 0.005	0.54	2.
SW-N-41S1	FR2	Y	2023-01-05	Clear, colourless.	1.1	7.67	360.	8.4	5.44	0.166	17.	< 0.005	0.046 5	0.257	165.	27.7	< 0.005	33.2	0.259	0.087	0.124	< 0.005	0.54	1.9
SW-N-41S1	FRM		2023-01-05	Mean of duplicates	1.15	7.67	360.	8.4	5.29	0.163 5	17.	< 0.005	0.046 4	0.26	166.	26.9	< 0.005	33.35	0.259 5	0.085	0.129	< 0.005	0.54	1.95
SW-N-41S1	RPD		2023-01-05		8.7%	0.0%	0.0%	0.0%	5.7%	3.1%	0.0%	0.0%	0.4%	2.3%	1.2%	5.9%	0.0%	0.9%	0.4%	4.7%	7.8%	0.0%	0.0%	5.1%
SW-N-41S1	FR1	Y	2023-02-21	Low flow, clear and colourless.	0.15	7.99	360.	7.2	4.04	0.17	19.	< 0.005	0.041 5	0.246	176.	23.1	< 0.005	32.8	0.276	0.093	0.091	< 0.005	0.37	1.6
SW-N-41S1	FR2	Y	2023-02-21	Low flow, clear and colourless.	1.8	7.99	236.	7.2	4.33	0.18	20.	< 0.005	0.041 8	0.444	174.	24.3	0.012 4	33.2	0.261	0.098	0.085	< 0.005	0.66	1.8
SW-N-41S1	FRM		2023-02-21	Mean of duplicates	0.975	7.99	298.	7.2	4.185	0.175	19.5	< 0.005	0.041 65	0.345	175.	23.7	< 0.008 7	33.	0.268 5	0.095 5	0.088	< 0.005	0.515	1.7
SW-N-41S1	RPD		2023-02-21		169.2% a	0.0%	41.6% a	0.0%	6.9%	5.7%	5.1%	0.0%	0.7%	57.4% a	1.1%	5.1%	85.1% b	1.2%	5.6%	5.2%	6.8%	0.0%	56.3% a	11.8%
SW-N-42S1	FR1	Y	2022-05-04		< 1.0	7.91			6.99	0.072	43.	< 0.005	0.051 1	0.358	166.	16.4	< 0.005	19.3	0.508	0.108	0.044	< 0.005	0.4	1 900.
SW-N-42S1	FR2	Y	2022-05-04		< 1.0	7.89			5.75	0.063	45.	< 0.005	0.054 4	0.373	167.	13.2	< 0.005	19.1	0.527	0.113	< 0.04	< 0.005	0.44	2 200.
SW-N-42S1	FRM		2022-05-04	Mean of duplicates	< 1.0	7.9	276.	9.8	6.37	0.067 5	44.	< 0.005	0.052 75	0.365 5	166.5	14.8	< 0.005	19.2	0.517 5	0.110 5	< 0.042	< 0.005	0.42	2 050.
SW-N-42S1	RPD		2022-05-04		0.0%				19.5%	13.3%	4.5%	0.0%	6.3%	4.1%	0.6%	21.6%	0.0%	1.0%	3.7%	4.5%	9.5%	0.0%	9.5%	14.6%
SW-N-42S1	FR1	Y	2022-11-09		5.7	8.	305.	4.3	5.63	0.147	59.	0.005 7	0.042 7	0.421	251.	9.4	0.011 5	7.08	0.628	0.159	0.079	< 0.005	1.34	310.
SW-N-42S1	FR2	Y	2022-11-09		4.1	7.07	305.	4.3	6.19	0.148	60.	< 0.005	0.044 5	0.448	250.	8.5	0.010 1	6.74	0.654	0.164	0.069	< 0.005	1.65	1 700.
SW-N-42S1	FRM		2022-11-09	Mean of duplicates	4.9	7.535	305.	4.3	5.91	0.147 5	59.5	< 0.005 35	0.043 6	0.434 5	250.5	8.95	0.010 8	6.91	0.641	0.161 5	0.074	< 0.005	1.495	1 005.
SW-N-42S1	RPD		2022-11-09		32.7% a	12.3%	0.0%	0.0%	9.5%	0.7%	1.7%	13.1%	4.1%	6.2%	0.4%	10.1%	13.0%	4.9%	4.1%	3.1%	13.5%	0.0%	20.7%	138.3% a
SW-N-42S1	FR1	Y	2023-01-05	Clear, colourless.	2.5	7.24	293.	7.2	4.87	0.088	60.	< 0.005	0.047 7	0.508	188.	8.3	0.006 2	6.75	0.489	0.11	0.072	< 0.005	0.61	240.
SW-N-42S1	FR2	Y	2023-01-05	Clear, colourless.	1.1	7.05	450.	7.2	4.43	0.083	62.	< 0.005	0.048 1	0.509	187.	8.2	0.006 4	6.79	0.492	0.133	0.072	< 0.005	0.57	250.
SW-N-42S1	FRM		2023-01-05	Mean of duplicates	1.8	7.145	371.5	7.2	4.65	0.085 5	61.	< 0.005	0.047 9	0.508 5	187.5	8.25	0.006 3	6.77	0.490 5	0.121 5	0.072	< 0.005	0.59	245.
SW-N-42S1	RPD		2023-01-05		77.8% a	2.7%	42.3% a	0.0%	9.5%	5.8%	3.3%	0.0%	0.8%	0.2%	0.5%	1.2%	3.2%	0.6%	0.6%	18.9%	0.0%	0.0%	6.8%	4.1%
SW-N-42S1	FR1	Y	2023-02-21	Low flow, clear and colourless.	1.2	7.33	292.	6.3	4.08	0.085	61.	< 0.005	0.042 1	0.36	203.	9.6	0.005 7	7.34	0.533	0.122	0.054	< 0.005	0.47	2.7
SW-N-42S1	FR2	Y	2023-02-21	Low flow, clear and colourless.	1.3	7.33	450.	6.3	4.1	0.084	56.	< 0.005	0.041 9	0.396	205.	8.8	0.005 8	7.57	0.549	0.115	0.057	< 0.005	0.65	2.8
SW-N-42S1	FRM		2023-02-21	Mean of duplicates	1.25	7.33	371.	6.3	4.09	0.084 5	58.5	< 0.005	0.042	0.378	204.	9.2	0.005 75	7.455	0.541	0.118 5	0.055 5	< 0.005	0.56	2.75
SW-N-42S1	RPD		2023-02-21		8.0%	0.0%	42.6% a	0.0%	0.5%	1.2%	8.5%	0.0%	0.5%	9.5%	1.0%	8.7%	1.7%	3.1%	3.0%	5.9%	5.4%	0.0%	32.1% a	3.6%
SW-N-57	FR1		2023-02-07	Field characteristics not recorded.	5.5	7.94	423.	8.3	18.1	0.158	36.	0.006	0.64	1.12	290.	17.2	0.005	29.4	1.74	1.23	1.03	< 0.005	1.28	280.
SW-N-57	FR2		2023-02-07	Field characteristics not recorded.	6.6	0.	0.	0.	18.2	0.177	40.	0.005 7	0.652	1.04	292.	16.2	0.006 1	30.4	1.79	1.31	1.04	< 0.005	1.1	330.
SW-N-57	FRM		2023-02-07	Mean of duplicates	6.05	3.97	211.5	4.15	18.15	0.167 5	38.	0.005 85	0.646	1.08	291.	16.7	0.005 55	29.9	1.765	1.27	1.035	< 0.005	1.19	305.
SW-N-57	RPD		2023-02-07		18.2%	200.0% a	200.0% a	200.0% a	0.6%	11.3%	10.5%	5.1%	1.9%	7.4%	0.7%	6.0%	19.8%	3.3%	2.8%	6.3%	1.0%	0.0%	15.1%	16.4%
SW-S-04	FR1	Y	2022-05-05		22.				21.3	0.128	60.	< 0.005	0.097 9	2.78	76.7	70.3	0.045 9	2.15	0.264	0.529	0.041	< 0.005	2.55	1 700.
SW-S-04	FR2	Y	2022-05-05		25.				25.5	0.138	61.	0.005 2	0.096 4	2.75	76.4	51.	0.050 7	2.17	0.272	0.473	0.044	< 0.005	2.48	1 900.
SW-S-04	FRM		2022-05-05	Mean of duplicates	23.5	7.42	157.	9.5	23.4	0.133	60.5	< 0.005 1	0.097 15	2.765	76.55	60.65	0.048 3	2.16	0.268	0.501	0.042 5	< 0.005	2.515	1 800.
SW-S-04	RPD		2022-05-05	RPD Calculation	12.8%				17.9%	7.5%	1.7%	3.9%	1.5%	1.1%	0.4%	31.8% a	9.9%	0.9%	3.0%	11.2%	7.1%	0.0%	2.8%	11.1%
SW-S-04	FR1	Y	2022-11-08		2.01	7.24	253.	9.6	10.5	0.123	74.	0.012 8	0.066 3	1.61	120.	15.1	0.006 3	0.34	0.758	0.359	0.077	< 0.005	1.77	1 100.
SW-S-04	FR2	Y	2022-11-08		1.86	6.83	253.	9.6	9.62	0.112	72.	0.011 7	0.067 3	1.55	121.	3.	0.006 3	0.263	0.71	0.34	0.084	< 0.005	1.78	890.
SW-S-04	FRM		2022-11-08	Mean of duplicates	1.935	7.035	253.	9.6	10.06	0.117 5	73.	0.012 25	0.066 8	1.58	120.5	9.05	0.006 3	0.301 5	0.734	0.349 5	0.080 5	< 0.005	1.775	995.
SW-S-04	RPD		2022-11-08	RPD Calculation	7.8%	5.8%	0.0%	0.0%	8.7%	9.4%	2.7%	9.0%	1.5%	3.8%	0.8%	133.7% a	0.0%	25.5%	6.5%	5.4%	8.7%	0.0%	0.6%	21.1%
SW-S-04	FR1	Y	04/01/2023	Clear, colourless.	3.76	6.83	174.	7.1	16.1	0.102	54.	< 0.005	0.050 4	1.61	89.7	13.3	< 0.005	0.186	0.127	0.3	0.077	< 0.005	3.26	3.7
SW-S-04	FR2	Y	04/01/2023	Clear, colourless.	3.74	6.85	280.	7.1	17.3	0.113	56.	0.005 9	0.050 7	1.61	89.5	18.3	0.009 5	0.353	0.131	0.313	0.076	< 0.005	3.17	3.8
SW-S-04	FRM		04/01/2023	Mean of duplicates	3.75	6.84	227.	7.1	16.7	0.107 5	55.	< 0.005 45	0.050 55	1.61	89.6	15.8	< 0.007 25	0.269 5	0.129	0.306 5	0.076 5	< 0.005	3.215	3.75
SW-S-04	RPD		2023-01-04	RPD Calculation	0.5%	0.3%	46.7% a	0.0%	7.2%	10.2%	3.6%	16.5%	0.6%	0.0%	0.2%	31.6% a	62.1% b	62.0% a	3.1%	4.2%	1.3%	0.0%	2.8%	2.7%
SW-S-04	FR1	Y	2023-02-06	Moderate flow, clear and colourless.	2.93	7.37	202.	7.5	12.9	0.101	68.	0.010 6	0.079 3	1.75	102.	206.	0.011 8	1.15	0.438	0.369	0.055	< 0.005	1.76	7.3
SW-S-04	FR2	Y	2023-02-06	Very low flow. Clear, colourless.	2.96	7.37	202.	7.5	11.2	0.101	63.	0.009 8	0.072 3	1.68	103.	7.3	0.007 8	0.398	0.163	0.338	0.052	< 0.005	1.82	190.
SW-S-04	FRM	Y	2023-02-06	Mean of duplicates	2.945	7.37	202.	7.5	12.05	0.101	65.5	0.010 2	0.075 8	1.715	102.5	106.65	0.009 8	0.774	0.300 5	0.353 5	0.053 5	< 0.005	1.79	98.65
SW-S-04	RPD	Y	2023-02-06	RPD Calculation	1.0%	0.0%	0.0%	0.0%	14.1%	0.0%	7.6%	7.8%	9.2%	4.1%	1.0%	186.3% a	40.8% a	97.2% a	91.5% a	8.8%	5.6%	0.0%	3.4%	185.2% a

Notes:

SS	*Single sample*
FR1	*Field replicate 1*
FR2	*Field replicate 2*
FRM	*Average of field replicates*
RPD	*Relative percent difference of field replicates*

na - Not applicable, some replicates less than the detection limit.

a - Coefficient of variation greater than 30% and all replicates greater than the limit of quantitation.

b - Coefficient of variation greater than 30% with some replicates less than the limit of quantitation.

Table 3-3. Hartland Valve Chamber Leachate Chemistry QA/QC - Relative Percent Difference 2022-2023

State	Parameter	MDL	LOQ	Lab Units	Maximum Acceptable RPD		Hartland Valve Chamber		Hartland Valve Chamber	RPD %			Hartland Valve Chamber		Hartland Valve Chamber	RPD %			Hartland Valve Chamber
							FR1		FR2				FR1		FR2				FR1
							SAT00110-FR1		SAT00110-FR2				SAT00110-FR1		SAT00110-FR2				SAT00110-FR1
							26-Apr-2022		26-Apr-2022				05-Aug-2022		05-Aug-2022				22-Aug-2022
Conventionals																			
TOT	Total Sulphide	0.001 8	0.009	mg/L	30%	<	0.045	<	0.045				0.085		0.06	34.5%	a		0.067
DISS	Dissolved Sulphide	0.009	0.045	mg/L	30%	<	0.045	<	0.045				0.075		0.065	14.3%			0.005 7
TOT	TSS	1.	5.	mg/L	30%		19.		19.				20.		22.	9.5%			12.
TOT	BOD	2.	10.	mg/L	30%	<	20.	<	20.				30.		34.	12.5%			27.
TOT	COD	10.	50.	mg/L	30%		9 420.		8 610.	9.0%			561.		560.	0.2%			127.
DISS	Chloride	1.	5.	mg/L	30%		330.		320.	3.1%			520.		520.				410.
DISS	Sulphate	1.	5.	mg/L	30%		130.	<	100.	26.1%			17.		20.	16.2%		<	1.
TOT	Oil & Grease, Total	1.	5.	mg/L	30%	<	1.	<	1.			<	1.	<	1.			<	1.
TOT	Oil & Grease, Mineral	2.	10.	mg/L	45%	<	2.	<	2.			<	2.	<	2.			<	2.
TOT	Cyanide - SAD (total)	0.000 5	0.002 5	mg/L	30%		0.013		0.013				0.012		0.010 6	12.4%		<	0.01
TOT	Cyanide - WAD	0.000 5	0.002 5	mg/L	30%		0.01		0.012	18.2%			0.008 1		0.003 6	76.9%	a	<	0.01
TOT	Phenols	0.015	0.075	mg/L	45%	<	0.03	<	0.03				0.007 6		0.008 2	7.6%		<	0.015
TOT	Ammonia	1.5	7.5	mg/L	30%		250.		250.				280.		290.	3.5%			310.
TOT	Nitrite	0.005	0.025	mg/L	30%		1.17		1.21	3.4%		<	0.5	<	0.5				0.115
TOT	Nitrate	0.02	0.1	mg/L	30%		13.9		15.3	9.6%		<	2.	<	2.				0.683
TOT	pH	0.01	0.05	pH	30%		7.1		7.1				8.14		8.14				8.43
TOT	Conductivity	0.1	0.5	µS/cm	30%		3 569.		3 569.				3 633.		3 633.				4 994.
TOT	Temperature	0.1	0.5	°C	30%		16.4		16.4				24.6		24.6				22.5
TOT	Dissolved Oxygen	0.01	0.05	mg/L	30%		1.37		1.37				1.57		1.57				
TOT	ORP	1.	5.	mV	30%		113.		113.				49.		49.				- 43.
Total Metals																			
TOT	Arsenic	0.04	0.2	µg/L	30%		6.8		6.74	0.9%			9.34		9.45	1.2%			8.48
TOT	Cadmium	0.01	0.05	µg/L	30%		0.04		0.052	26.1%			0.053		0.06	12.4%			0.034
TOT	Chromium	0.2	1.	µg/L	30%		44.		49.8	12.4%			57.4		59.2	3.1%			63.7
TOT	Cobalt	0.02	0.1	µg/L	30%		13.3		13.	2.3%			18.8		19.7	4.7%			17.6
TOT	Copper	0.2	1.	µg/L	30%		10.2		10.5	2.9%			11.8		12.3	4.1%			9.08
TOT	Iron	10.	50.	µg/L	30%		2 140.		2 120.	0.9%			3 010.		3 100.	2.9%			3 040.
TOT	Lead	0.04	0.2	µg/L	30%		0.667		0.664	0.5%			0.72		0.87	18.9%			0.65
TOT	Manganese	0.2	1.	µg/L	30%		674.		656.	2.7%			751.		753.	0.3%			839.
TOT	Mercury	0.019	0.095	µg/L	30%	<	0.019	<	0.019			<	0.038	<	0.038			<	0.019
TOT	Molybdenum	0.1	0.5	µg/L	30%		1.98		2.35	17.1%			4.04		4.24	4.8%			3.36
TOT	Nickel	0.2	1.	µg/L	30%		39.8		38.4	3.6%			53.1		54.6	2.8%			51.6
TOT	Selenium	0.08	0.4	µg/L	30%		0.42		0.46	9.1%			0.48		0.56	15.4%			0.49
TOT	Silver	0.02	0.1	µg/L	30%	<	0.02	<	0.02			<	0.05	<	0.05			<	0.05
TOT	Zinc	2.	10.	µg/L	30%		16.8		15.5	8.0%			15.2		15.1	0.7%			13.1
BTEX																			
DISS	Benzene	0.4	2.	µg/L	45%		0.6		0.51	16.2%			0.48	<	0.4	18.2%		<	0.4
DISS	Toluene	0.4	2.	µg/L	45%		1.5		1.1	30.8%		<	0.4	<	0.4			<	0.4
DISS	Ethylbenzene	0.4	2.	µg/L	45%	<	0.4	<	0.4				0.85		0.48	55.6%	a	<	0.4
DISS	Xylenes	0.4	2.	µg/L	45%		1.2		1.	18.2%			1.6		1.3	20.7%			0.78
PAH																			
TOT	Total PAH	0.01	0.05	µg/L	45%		6.6		7.3	10.1%			3.7		4.6	21.7%			1.2
TOT	Acenaphthene	0.01	0.05	µg/L	45%		2.9		3.1	6.7%			0.86		0.91	5.6%			0.3
TOT	Acenaphthylene	0.01	0.05	µg/L	45%		0.055		0.056	1.8%			0.024		0.021	13.3%			0.016
TOT	Anthracene	0.01	0.05	µg/L	45%		0.17		0.18	5.7%			0.047		0.056	17.5%			0.035
TOT	Benzo(a)anthracene	0.01	0.05	µg/L	45%		0.042		0.047	11.2%			0.013		0.019	37.5%			0.022
TOT	Benzo(a)pyrene	0.005	0.025	µg/L	45%		0.007 8		0.008 1	3.8%		<	0.005		0.007 2	36.1%			0.006 6
TOT	Benzo(b,j)fluoranthene	0.01	0.05	µg/L	45%		0.011		0.012	8.7%		<	0.01		0.013	26.1%		<	0.01
TOT	Benzo(g,h,i)perylene	0.02	0.1	µg/L	45%	<	0.02	<	0.02			<	0.02	<	0.02			<	0.02
TOT	Benzo(k)fluoranthene	0.01	0.05	µg/L	45%	<	0.01	<	0.01			<	0.01	<	0.01			<	0.01
TOT	Chrysene	0.01	0.05	µg/L	45%		0.037		0.042	12.7%			0.017		0.023	30.0%			0.021
TOT	Dibenzo(a,h)anthracene	0.02	0.1	µg/L	45%	<	0.02	<	0.02			<	0.02	<	0.02			<	0.02
TOT	Fluoranthene	0.01	0.05	µg/L	45%		0.56		0.62	10.2%			0.16		0.19	17.1%			0.17
TOT	Fluorene	0.01	0.05	µg/L	45%		1.8		2.	10.5%			0.41		0.45	9.3%			0.32
TOT	Indeno(1,2,3-c,d)pyrene	0.02	0.1	µg/L	45%	<	0.02	<	0.02			<	0.02	<	0.02			<	0.02
TOT	Naphthalene	0.01	0.05	µg/L	45%		0.059		0.076	25.2%			0.8		1.5	60.9%	a		0.12
TOT	Phenanthrene	0.01	0.05	µg/L	45%		0.3		0.32	6.5%			0.14		0.16	13.3%			0.038
TOT	Pyrene	0.01	0.05	µg/L	45%		0.31		0.39	22.9%			0.12		0.14	15.4%			0.14

Table 3-3. Hartland Valve Chamber Leachate Chemistry QA/QC - Relative Percent Difference 2022-2023

State	Parameter	MDL	LOQ	Lab Units	Maximum Acceptable RPD		Hartland Valve Chamber		Hartland Valve Chamber	RPD %			Hartland Valve Chamber		Hartland Valve Chamber	RPD %			Hartland Valve Chamber
							FR1		FR2				FR1		FR2				FR1
							SAT00110-FR1		SAT00110-FR2				SAT00110-FR1		SAT00110-FR2				SAT00110-FR1
Chlorinated Phenols																			
TOT	Chlorinated phenols (total)	0.41	2.05	µg/L	45%	<	0.41		0.41										
TOT	Total Dichlorophenols	0.22	1.1	µg/L	45%	<	0.22	<	0.22										
TOT	Total Monochlorophenols	0.09	0.45	µg/L	45%	<	0.09	<	0.09										
TOT	Total Nonchlorinated phenols	1.6	8.	µg/L	45%		7.3		11.	40.4%									
TOT	Total Phenolic Compounds	0.17	0.85	#N/A	45%		0.21		0.21										
TOT	Total Tetrachlorophenols	0.17	0.85	µg/L	45%	<	0.24	<	0.24										
TOT	Total Trichlorophenols	0.24	1.2	µg/L	45%	<	0.05	<	0.05										
TOT	2-Chlorophenol	0.05	0.25	µg/L	45%	<	0.05	<	0.05										
TOT	2,4 + 2,5 Dichlorophenol	0.1	0.5	µg/L	45%	<	0.1	<	0.1										
TOT	2,4,6-Trichlorophenol	0.1	0.5	µg/L	45%	<	0.1	<	0.1										
TOT	Pentachlorophenol	0.1	0.5	µg/L	45%	<	0.1	<	0.1										
TOT	2,3,4,5-Tetrachlorophenol	0.1	0.5	µg/L	45%	<	0.1	<	0.1										
TOT	2,3,4,6-Tetrachlorophenol	0.1	0.5	µg/L	45%	<	0.1	<	0.1										

Notes:

FR1, FR2 - Field replicates 1 and 2.

FRM - Mean of field replicates.

MDL - Method detection limit.

COV - Coefficient of Variation

LOQ - Limit of quantification.

RPD - Relative percent difference.

na - Not applicable, some replicates less than the detection limit.

***a** - Relative Standard Difference greater than 30% for general inorganic parameters/metals and 45% for organic parameters and all replicates greater than the limit of quantitation.*

***b** - Relative Standard Difference greater than 30% for general inorganic parameters/metals and 45% for organic parameters, with some replicates less than the limit of quantitation.*

Table 3-3. Hartland Valve Chamber Leachate Chemistry QA/QC - Relative Percent Difference 2022-2023

State	Parameter	MDL	LOQ	Lab Units		Hartland Valve Chamber	RPD %			Hartland Valve Chamber		Hartland Valve Chamber	RPD %			Hartland Valve Chamber		Hartland Valve Chamber	RPD %	
						FR2				FR1		FR2				FR1		FR2		
						SAT00110-FR2				SAT00110-FR1		SAT00110-FR2				SAT00110-FR1		SAT00110-FR2		
						22-Aug-2022				30-Nov-2022		30-Nov-2022				14-Feb-2023		14-Feb-2023		
Conventionals																				
TOT	Total Sulphide	0.001 8	0.009	mg/L		0.038	55.2%	**a**	<	0.036	<	0.036				0.045		0.03	40.0%	**a**
DISS	Dissolved Sulphide	0.009	0.045	mg/L		0.01	54.8%	**a**		0.014		0.024	52.6%	**a**		0.042		0.034	21.1%	
TOT	TSS	1.	5.	mg/L		22.	58.8%	**a**		73.		36.	67.9%	**a**		13.		10.	26.1%	
TOT	BOD	2.	10.	mg/L		29.	7.1%			16.		19.	17.1%			17.		18.	5.7%	
TOT	COD	10.	50.	mg/L		759.	142.7%	**a**		364.		339.	7.1%			331.		346.	4.4%	
DISS	Chloride	1.	5.	mg/L		410.				270.		270.				250.		250.		
DISS	Sulphate	1.	5.	mg/L	<	1.				220.		220.				100.		110.	9.5%	
TOT	Oil & Grease, Total	1.	5.	mg/L		1.				1.2	<	1.	18.2%			3.8	<	1.	116.7%	**b**
TOT	Oil & Grease, Mineral	2.	10.	mg/L	<	2.			<	2.	<	2.			<	2.	<	2.		
TOT	Cyanide - SAD (total)	0.000 5	0.002 5	mg/L	<	0.01				0.014 4		0.015 4	6.7%			0.013 3		0.008 4	45.2%	**a**
TOT	Cyanide - WAD	0.000 5	0.002 5	mg/L	<	0.01				0.005 2		0.005 4	3.8%			0.007 1	<	0.005	34.7%	**b**
TOT	Phenols	0.015	0.075	mg/L	<	0.015			<	0.007 5	<	0.007 5			<	0.001 5	<	0.001 5		
TOT	Ammonia	1.5	7.5	mg/L		310.				210.		200.	4.9%			210.		210.		
TOT	Nitrite	0.005	0.025	mg/L		0.145	23.1%			3.22		3.23	0.3%			1.84		1.84		
TOT	Nitrate	0.02	0.1	mg/L		1.15	51.0%	**a**		24.9		24.5	1.6%			13.7		13.7		
TOT	pH	0.01	0.05	pH		8.43				7.45		7.45				7.82		7.82		
TOT	Conductivity	0.1	0.5	µS/cm		4 994.				2 614.		2 614.				2 783.		2 783.		
TOT	Temperature	0.1	0.5	°C		22.5				9.1		9.1				13.4		13.4		
TOT	Dissolved Oxygen	0.01	0.05	mg/L						1.09		1.09				0.81		0.81		
TOT	ORP	1.	5.	mV		- 43.				- 14.		- 14.				80.8		80.8		
Total Metals																				
TOT	Arsenic	0.04	0.2	µg/L		8.18	3.6%			5.51		5.48	0.5%			7.6		4.99	41.5%	**a**
TOT	Cadmium	0.01	0.05	µg/L		0.048	34.1%	**a**		0.084 8		0.076 1	10.8%			0.079		0.05	45.0%	**a**
TOT	Chromium	0.2	1.	µg/L		61.6	3.4%			35.4		33.8	4.6%			55.3		37.	39.7%	**a**
TOT	Cobalt	0.02	0.1	µg/L		16.8	4.7%			13.4		13.	3.0%			15.5		10.5	38.5%	**a**
TOT	Copper	0.2	1.	µg/L		9.18	1.1%			23.6		22.3	5.7%			21.4		14.	41.8%	**a**
TOT	Iron	10.	50.	µg/L		3 070.	1.0%			3 670.		3 070.	17.8%			2 610.		1 690.	42.8%	**a**
TOT	Lead	0.04	0.2	µg/L		0.92	34.4%	**a**		1.41		1.27	10.4%			0.765		1.03	29.5%	
TOT	Manganese	0.2	1.	µg/L		818.	2.5%			650.		640.	1.6%			855.		569.	40.2%	**a**
TOT	Mercury	0.019	0.095	µg/L	<	0.019			<	0.019	<	0.019			<	0.038	<	0.038		
TOT	Molybdenum	0.1	0.5	µg/L		3.43	2.1%			5.23		5.29	1.1%			3.86		2.52	42.0%	**a**
TOT	Nickel	0.2	1.	µg/L		50.2	2.8%			38.1		36.8	3.5%			45.7		30.3	40.5%	**a**
TOT	Selenium	0.08	0.4	µg/L		0.5	2.0%			0.578		0.575	0.5%			0.74		0.495	39.7%	**a**
TOT	Silver	0.02	0.1	µg/L	<	0.05				0.018		0.018			<	0.02	<	0.02		
TOT	Zinc	2.	10.	µg/L		17.2	27.1%			32.9		26.4	21.9%			19.6		11.8	49.7%	**a**
BTEX																				
DISS	Benzene	0.4	2.	µg/L	<	0.4			<	0.4	<	0.4			<	0.4		0.44	9.5%	
DISS	Toluene	0.4	2.	µg/L	<	0.4				0.61		0.52	15.9%		<	0.4		1.	85.7%	**b**
DISS	Ethylbenzene	0.4	2.	µg/L	<	0.4			<	0.4	<	0.4			<	0.4	<	0.4		
DISS	Xylenes	0.4	2.	µg/L		0.71	9.4%		<	0.4	<	0.4				0.41		0.55	29.2%	
PAH																				
TOT	Total PAH	0.01	0.05	µg/L		1.2				2.8		2.3	19.6%			8.3		8.	3.7%	
TOT	Acenaphthene	0.01	0.05	µg/L		0.33	9.5%			0.89		0.63	34.2%			3.3		3.2	3.1%	
TOT	Acenaphthylene	0.01	0.05	µg/L		0.015	6.5%			0.015		0.02	28.6%			0.086		0.08	7.2%	
TOT	Anthracene	0.01	0.05	µg/L		0.032	9.0%			0.072		0.075	4.1%			0.16		0.17	6.1%	
TOT	Benzo(a)anthracene	0.01	0.05	µg/L		0.026	16.7%			0.022		0.043	64.6%	**a**		0.057		0.055	3.6%	
TOT	Benzo(a)pyrene	0.005	0.025	µg/L	<	0.005	27.6%		<	0.005		0.006 2	21.4%			0.012		0.013	8.0%	
TOT	Benzo(b,j)fluoranthene	0.01	0.05	µg/L	<	0.01			<	0.01	<	0.01				0.013		0.012	8.0%	
TOT	Benzo(g,h,i)perylene	0.02	0.1	µg/L	<	0.02			<	0.02	<	0.02			<	0.02	<	0.02		
TOT	Benzo(k)fluoranthene	0.01	0.05	µg/L	<	0.01			<	0.01	<	0.01			<	0.01	<	0.01		
TOT	Chrysene	0.01	0.05	µg/L	<	0.01	71.0%	**b**		0.024		0.046	62.9%	**a**		0.055		0.052	5.6%	
TOT	Dibenzo(a,h)anthracene	0.02	0.1	µg/L	<	0.02			<	0.02	<	0.02			<	0.02	<	0.02		
TOT	Fluoranthene	0.01	0.05	µg/L		0.13	26.7%			0.36		0.45	22.2%			0.66		0.62	6.3%	
TOT	Fluorene	0.01	0.05	µg/L		0.32				0.61		0.48	23.9%			2.		2.		
TOT	Indeno(1,2,3-c,d)pyrene	0.02	0.1	µg/L	<	0.02			<	0.02	<	0.02			<	0.02	<	0.02		
TOT	Naphthalene	0.01	0.05	µg/L		0.12				0.25		0.086	97.6%	**a**		0.46		0.32	35.9%	
TOT	Phenanthrene	0.01	0.05	µg/L		0.041	7.6%			0.12		0.072	50.0%	**a**		0.35		0.38	8.2%	
TOT	Pyrene	0.01	0.05	µg/L		0.11	24.0%			0.25		0.33	27.6%			0.45		0.42	6.9%	

Table 3-3. Hartland Valve Chamber Leachate Chemistry QA/QC - Relative Percent Difference 2022-2023

State	Parameter	MDL	LOQ	Lab Units	Hartland Valve Chamber	RPD %	Hartland Valve Chamber	Hartland Valve Chamber	RPD %	Hartland Valve Chamber	Hartland Valve Chamber	RPD %
					FR2		FR1	FR2		FR1	FR2	
					SAT00110-FR2		SAT00110-FR1	SAT00110-FR2		SAT00110-FR1	SAT00110-FR2	
Chlorinated Phenols												
TOT	Chlorinated phenols (total)	0.41	2.05	µg/L								
TOT	Total Dichlorophenols	0.22	1.1	µg/L								
TOT	Total Monochlorophenols	0.09	0.45	µg/L								
TOT	Total Nonchlorinated phenols	1.6	8.	µg/L								
TOT	Total Phenolic Compounds	0.17	0.85	#N/A								
TOT	Total Tetrachlorophenols	0.17	0.85	µg/L								
TOT	Total Trichlorophenols	0.24	1.2	µg/L								
TOT	2-Chlorophenol	0.05	0.25	µg/L								
TOT	2,4 + 2,5 Dichlorophenol	0.1	0.5	µg/L								
TOT	2,4,6-Trichlorophenol	0.1	0.5	µg/L								
TOT	Pentachlorophenol	0.1	0.5	µg/L								
TOT	2,3,4,5-Tetrachlorophenol	0.1	0.5	µg/L								
TOT	2,3,4,6-Tetrachlorophenol	0.1	0.5	µg/L								

Notes:

FR1, FR2 - Field replicates 1 and 2.

FRM - Mean of field replicates.

MDL - Method detection limit.

COV - Coefficient of Variation

LOQ - Limit of quantification.

RPD - Relative percent difference.

na - Not applicable, some replicates less than the detection limit.

a *- Relative Standard Difference greater than 30% for general inorganic param*

b *- Relative Standard Difference greater than 30% for general inorganic param*

3.4 Summary

In summary, the 2022/23 quality assurance (QA) analysis indicates the following:

- Duplicate sampling frequencies of 13% (42/330 samples) for groundwater, 29% (25/87 samples) for surface water, 42% (5/12 samples) for the Hartland Valve Chamber compliance point, and 14% (9/64 samples) for the overall leachate sampling program. Overall, duplicate samples were collected at a frequency of approximately 16% (81/493), which exceeded the targeted duplicate sampling rate of 10%.
- Groundwater sampling and laboratory analysis have produced reliable results. The QA results indicated a total of 42 samples, and 39 analytical results exceeded the RPD alert limits when all parameter concentrations were above the LOQ. Dissolved aluminum, cadmium, copper, iron, lead, nickel, and zinc concentrations should be interpreted with caution, as these seven (7) dissolved metal concentrations had over 20% of the duplicate samples above the alarm limit where all parameter concentrations were above the LOQ, indicating potential contamination during the sample handling or filtration process.
- Surface water sampling and laboratory analysis have produced reliable results. The QA results indicated a total of 23 samples and 26 analytical results exceeded the RPD alert limits where all parameter concentrations were above the LOQ.
- Leachate sampling and laboratory analysis have produced reliable results. A total of four (4) samples and twenty-four (24) parameters had calculated RPD values that exceeded RPD alert limits when concentrations in both replicates were above the LOQ.
- A Mann-Kendall statistical trend analyses was conducted on water quality data collected from 80 groundwater monitoring wells, 8 leachate purge wells, 21 surface water stations and 1 leachate monitoring point for parameters that are known indicators of leachate and aggregate influences to evaluate temporal trends in water quality at the landfill. The results of trend analyses are discussed in the groundwater and surface water quality sections of this report.

4. Groundwater Flow

4.1 Data

A review of the sampling program was undertaken in early 2016 (AECOM 2016), and recommendations for modifications to the number, location, and sampling frequency of compliance monitoring stations were implemented throughout the 2020/21 monitoring year. Groundwater elevations at the landfill were measured on a quarterly basis. The groundwater flow interpretation presented in this section is based on the following data:

- Continuous water level and leachate elevation monitoring using the SCADA system for the lower leachate lagoon, upper leachate lagoon, Phase 2 basin, wells GW-36-1-1 and GW-37-1-1., and one monitoring well located north of Phase 1 (GW-40-1-1).
- Continuous water level monitoring in five purge wells south of Phase 1 (P1, P2, P3, P4 and P10).
- Continuous water level monitoring in four monitoring wells east of Phase 1 (GW-17-1-1, GW-18-1-1, GW-54-1-1 and GW-76-1-1).
- Continuous water level and flow monitoring in or near three north purge wells (GW-80-1-0-P8, GW-81-1-0-P9 and GW-52-4-0-P7) and two monitoring wells (GW-52-3-0 and GW-52-1-1) located north of Phase 1.
- Continuous water level monitoring in 10 wells north of Phase 2 (GW-41-1-1, GW-43-1-1, GW-44-1-1, GW-62-1-1, GW-77-1-1, GW-78-1-1, GW-87-1-1, GW-87-2-1, GW-88-1-1 and GW-88-2-1).
- Continuous water level monitoring in four wells in the Hartland North Ridge area (GW-91-1-1, GW-92-1-1, GW-93-1-1 and GW-94-1-1).
- Presence and elevation of topography, refuse, engineered covers, temporary tarps, ditches, and surface water features.
- Daily precipitation data.

Manually measured groundwater elevations for 2022/23 are presented in Appendix A.3. Groundwater flow patterns were interpreted based on groundwater elevations measured in September 2022. The data indicate that there are two separate groundwater flow systems at the Landfill. One is a regional groundwater flow system in the bedrock surrounding and underlying the landfill. The second is a perched system contained within Phase 1. A similar system has not been observed within the Phase 2 landfill thus far, although low permeability liners, tarps, and other barriers to vertical percolation may promote development of localized perched leachate systems during wet weather and over time. Although the two flow systems are separate, the presence of the leachate mound within the waste influences groundwater flow in the bedrock underlying the waste. Understanding these two flow systems is important for evaluating the effectiveness of leachate control and containment measures.

Monitoring wells GW-79-1-1, GW-79-2-1, GW-74-1-1, and GW-74-2-1 were decommissioned in June 2018 to accommodate blasting and site preparation for aggregate storage. The pressure transducer installed in GW-79-1-1 was removed from the well prior to decommissioning. Four (4) new leachate monitoring wells (GW-89-1-1, GW-89-2-1, GW-90-1-1 and GW-90-2-1) were installed in Phase 1 and Phase 2 in 2018/19 to verify leachate capture and support management decisions. In April 2020, four (4) pressure transducers were installed at locations GW-91-1-1, GW-92-1-1, GW-93-1-1 and GW-94-1-1 to continuously monitor water levels in the Hartland North Ridge area.

In 2022/23, monitoring well GW-93-1-1 was destroyed due to blasting activities, and pressure transducers installed in these wells could not be retrieved. All these wells will need to be decommissioned to meet the well abandonment requirements of the British Columbia Groundwater Protection Regulation.

4.2 Regional Groundwater Flow in the Bedrock

Figure 4-1 presents an interpretation of regional groundwater flow patterns based on groundwater elevations in bedrock wells and deep wells completed in refuse, as observed in September 2022. Within the landfill footprint, several wells (GW-75-1-1, GW-82-1-1, VLGW-02-D, VLGW-03-D, VLGW-08-D, VLGW-15-D, VLGW-16-D and VLGW-17-D) are screened at or near the bottom of the waste and their water levels are interpreted as being representative of the regional groundwater flow system within bedrock underlying the landfill. Geological structures including the Highland Fault and another inferred fault near monitoring well GW-77-1-1 are shown in plan on Figure 4-1 and in cross section in Figure 4-2 and Figure 4-3. Measured groundwater elevations and hydrogeologic testing indicates that these structures influence local-scale groundwater flow patterns. Figure 4-2 is a cross-section that extends from north of the leachate lagoons to the south of Phase 1 and depicts groundwater flow in a north-south direction. Figure 4-3 shows groundwater flow in an east-west cross-section extending from the bedrock ridge northwest of Phase 2 to the eastern property boundary.

Groundwater flow patterns were consistent with previous years, with some differences in the North Ridge area. Regional groundwater flow near the landfill is influenced by bedrock structures, topographic relief, and the presence of surface water features. The regional groundwater flow direction is from southwest to northeast from Mount Work toward the north-south trending valley that underlies the northern portions of the Phase 1 and Phase 2 landfills. Groundwater flow in the bedrock valley underlying the landfill is predominantly northward, as shown in Figure 4-1. Most of the leachate-impacted groundwater in the bedrock below the landfill flows northward to the lower leachate lagoon via the Phase 2 basin leachate collection system, micro-tunnel, leachate springs and purge wells (GW-52-4-0-P7, GW-80-1-0-P8, and GW-81-1-0-P9) located north of Phase 1.

As shown on Figure 4-1, there is an inferred groundwater flow divide located near the south end of the landfill and a small portion of groundwater below the south portion Phase 1 flows towards the southeast. This flow divide trends roughly with a bedrock high in the valley floor beneath the landfill. Southeastward groundwater flow below the landfill is constrained by a constructed clay berm/bedrock grout curtain that was installed at the south end of the landfill in the 1980s, and by five purge wells (P1, P2, P3, P4 and P10) that commenced pumping leachate in 2001. Leachate collected by the south purge well network is pumped from the south pumping station northward to the lower leachate lagoon.

Near the North Ridge and Hartland North Pad, located northwest of Phase 2, groundwater flows radially from a topographic high situated north of Phase 2. The water predominantly flows northeast towards Heal Creek and northwards in the direction of Durrance Lake. Throughout 2022/23, continued blasting operations along the North Ridge led to notable topographic and hydraulic alterations, particularly to the north and west of Phase 2. Notably, groundwater elevations in wells 87 and 88, situated south of the Northwest Stockpile, declined by approximately 4 -10 m compared to previous years. Although this reduced the magnitude of groundwater gradients, inward hydraulic gradients were maintained, and the Phase 2 hydraulic trap remained intact.

Groundwater elevations associated with the Highland Fault have changed. Groundwater elevations typically increase during wet fall, winter, and spring months when precipitation inputs increase infiltration and raise groundwater elevations. Historically, groundwater elevations during the wet season have been several metres higher west of the Highland Fault than they are immediately east, implying that the Highland Fault is a barrier to west-east groundwater flow. In 2022/23, seasonal fluctuations in groundwater elevations were observed in this area, but they have become less pronounced. Groundwater elevations should be continuously monitored to observe any changes during the drier months, and consideration should be given to characterizing the hydrogeology of the bedrock mass upslope (west) of the Phase 2 landfill to confirm the impact of ongoing quarrying on leachate containment and the surrounding groundwater flow system.

Along the bedrock ridge (trending roughly north-south between the Hartland Landfill and Kiowa Place Road) east of the landfill boundary, groundwater flows inwards toward the northern portion of the Phase 1 landfill. Further east of the landfill boundary, the topography begins to slope eastward towards Tod Creek valley and the groundwater flow direction is likely eastward towards Tod Creek.

4.3 Leachate Elevations in Phase 1 and Phase 2

4.3.1 Phase 1

Groundwater monitoring wells installed at varying depths in Phase 1 allow for measurement of leachate levels and interpretation of flow directions within the refuse. In addition to the monitoring wells, water level data is collected manually from selected landfill gas wells in Phase 1.

The leachate mound in the Phase 1 landfill is depicted along a north-south cross section in Figure 4-2**,** based on groundwater and leachate level measurements collected in September 2022. During the operating years of the Phase 1 landfill, the leachate mound within Phase 1 reached an elevation of approximately 160 m asl (above mean sea level). Final cover that incorporated a geomembrane liner was installed on Phase 1 in 1997 to limit infiltration. As shown on Figure 4-2, the leachate mound in the refuse is above the regional bedrock groundwater flow system, and the hydraulic gradient is downward. The downward gradient in the central portion of the landfill reverse to upward gradients due to pumping at the leachate collection purge wells in the north and south areas of the landfill. In 2022/23, leachate elevations within Phase 1 were generally below 155 m asl, reflecting an approximate 5 m decrease in the elevation of the leachate mound since capping of the Phase 1 landfill.

Figure 4-5 presents leachate levels in 13 landfill gas monitors in the Phase 1 landfill. Although it is difficult to accurately measure leachate levels in landfill gas wells, they provide additional landfill leachate level information. Like previous years, leachate levels in the shallow landfill gas monitors typically show minor (i.e., ±1 m) variations, as the refuse has a relatively high porosity and exhibits relatively consistent recharge and discharge patterns. The relatively high leachate elevations in shallow gas wells screened in refuse (e.g., VLGW-21-D and VLGW-26-D) indicate downward vertical gradients from refuse to the underlying bedrock aquifer. In March 2019, a pressure transducer was installed in GW-89-2-1 to record leachate levels continuously. As shown on Figure 4-5, leachate elevations in the shallow well GW-89-2-1 were generally stable over time, ranging from 149.4 to 151.2 m asl. In April 2023, the pressure transducer from well GW-89-2-1 was damaged and data could not be retrieved. Manual leachate elevation data from well GW-89-2-1 indicates that leachates levels have remained below 152.4 m asl.

Like previous years, leachate elevations in the deep gas monitors (VLGW-02-D, VLGW-03-D, VLGW-08-D, VLGW-15-D, VLGW-16-D and VLGW-17-D) continued to fluctuate in response to seasonal variability in groundwater recharge, indicating that the lower portions of the Phase 1 landfill are in hydraulic connection with the regional groundwater flow system. Leachate monitoring well GW-89-1-1 was installed in November 2018 to replace the decommissioned well GW-74-1-1. Well GW-89-1-1 was screened at the bottom of the refuse to facilitate monitoring of the leachate mound. In April 2023, the pressure transducer from well GW-89-1-1 was damaged, and data from 2022/23 could not be retrieved. Manual leachate elevation measurements from well GW-89-1-1 indicate that the leachate elevation was 152.7 m asl on February 3, 2023.

Well GW-75-1-1 is located further downgradient near the north end of Phase 1 and it monitors the deep regional water table. Like previous years, groundwater elevations in well GW-75-1-1 ranged from approximately 128 to 130 m asl in 2022/23 (Figure 4-5). The relatively high leachate elevations in shallow monitors VLGW-21-D (142.7 m asl) and VLGW-26-D (144.7 m asl), both located within 50 m of well GW-75-1-1 and screened in refuse, indicate that strong downward vertical gradients are present in this area of the landfill.

4.3.2 Phase 2 Basin

The Phase 2 landfill is in a large bedrock basin situated immediately west of the north end of the Phase 1 landfill. The Phase 2 landfill is segregated into multiple cells. Cell 1 and Cell 2 are complete, and Cell 3 is active. Quarrying is underway to lower the existing bedrock surface to form the base of Cells 4, 5 and 6. Leachate from Cell 1 and Cell 2 is captured in a 350 mm diameter micro-tunnel by gravity and transported to the Lower Leachate Lagoon. After reporting to the Lower Leachate Lagoon, all leachate is discharged to the sanitary sewer via the leachate pipeline. A geomembrane liner separates Cell 2 and Cell 3. Leachate from Cell 3 is captured via the Toutle Drain, which reports to the Upper Leachate Lagoon prior to discharge into the leachate pipeline and sanitary sewer.

Figure 4-8 presents hydrographs for the groundwater monitoring wells and leachate wells located north of the Phase 2 basin. Groundwater levels north of Phase 2 need to be higher than leachate levels inside the Phase 2 basin for the hydraulic trap to operate. Leachate levels within the Phase 2 basin are typically around 113-114 m asl, or 8 to 10 m lower than groundwater elevations outside the basin (AECOM 2020b). In 2022/23, groundwater elevations at groundwater monitoring locations, 38, 39, 62, 77, and 78 were higher than leachate levels in the Phase 2 basin, indicating that the leachate collection system functioned effectively.

Leachate monitoring wells (GW-82-1-1, GW-83-1-1, GW-84-1-1, GW-86-1-1, and GW-90-1-1) were installed to investigate potential leachate mounding within the Phase 2 refuse. Wells GW-84-1-1 and GW-86-1-1 were damaged and subsequently decommissioned. New leachate monitoring wells (GW-90-1-1 and GW-90-2-1) were installed in 2018/19 to verify leachate capture and monitor leachate elevations. Drilling observations and subsequent monitoring indicated that the waste mass was moist but largely unsaturated. Although higher (i.e., >125 m asl) leachate levels in GW-82-1-1 and GW-83-1-1 were observed in the north area of Phase 2 (Figure 4-8), leachate levels were typically within or below the well screens, and well GW-82-1-1 was dry in September and November 2022. Higher leachate levels may be related to the presence of condensate, historical tarping, or low-permeability strata within the refuse. Wells GW-90-1-1 and GW-90-2-1 were dry in 2022/23.

Historically, leachate elevations in Phase 2 were typically about 0.8 m below the leachate elevation in the Lower Leachate Lagoon. However, since January 2022, leachate elevations in Phase 2 have increased, exceeding the leachate level in the Lower Leachate Lagoon in the spring. In 2022/23, the leachate level in the Lower Leachate Lagoon was lower than normal operating levels, which CRD confirmed that it was likely due to calibration/ instrument drift, and were not indicative of a change in operations. In November 2022, leachate in Phase 2 reached a maximum elevation of approximately 116 m asl (0.5 m higher than the leachate elevation in the Lower Leachate Lagoon) in response to heavy precipitation.

Figure 4-8 shows a hydrograph of leachate levels in the lined Upper Leachate Lagoon and the unlined Lower Leachate Lagoon, based on pressure transducer readings recorded by the SCADA system. In 2022/23, leachate levels in the Upper Leachate Lagoon were generally around 124 m asl, reaching a peak elevation of 127.87 m asl (77% full) in December 2022, in response to heavy precipitation. Due to the relatively high flow rate of the CRL, water levels gradually decreased and returned to a normal operating level of 124 m asl by January 5, 2023. Leachate levels in the Lower Leachate Lagoon fluctuated around 114.5 m asl throughout the year.

In October and November 2022, the SCADA system in the Lower Leachate Lagoon recorded considerable fluctuations (Figure 4-8). The CRD informed AECOM that the Upper Leachate Lagoon underwent maintenance, so the leachate level trends observed in October and November reflect the lagoon being drained periodically. Ultimately, throughout 2022/23, the Lower Leachate Lagoon assumed a substantial role as a leachate storage facility, and the available leachate storage capacity was sufficient.

As landfill development continues, it is imperative that leachate levels in each phase of the landfill are closely monitored to verify seismic stability, confirm that the Leachate Collection System and the Phase 2 hydraulic trap are functioning, and determine if additional leachate containment measures should be implemented. AECOM previously recommended investigating leachate mounding in Phase 2 on a five-year basis, with the next investigation scheduled for 2025.

4.4 Groundwater Flow in the Bedrock Aquifer Near the Landfill

4.4.1 East of Phase 1

Figure 4-4 shows groundwater elevations at monitoring locations 17, 18, 54, and 76, which are located on the bedrock ridge east of Phase 1. Dramatic changes in water levels at Site 18 have occurred occasionally since 2001. In 2016/17, groundwater elevations in the deepest wells at Site 18 increased by approximately 8 m relative to years prior, resulting in lower westward hydraulic gradients. As per the 2018/19 annual monitoring report recommendations (AECOM 2019a), pressure transducers were installed in wells GW-18-1-1, GW-76-1-1, GW-17-1-1, and GW-54-1-1 to continue monitoring the groundwater elevations and confirm groundwater flow is toward the landfill.

As shown on Figure 4-4, groundwater levels in GW-18-1-1 have returned to historical levels since 2018, indicating that westward hydraulic gradients restabilized. In 2022/23, groundwater levels in GW-18-1-1 remained approximately 6 to 7 m lower than those in GW-76-1-1. Similarly, groundwater elevations at GW-54-1-1 are consistently higher than those in GW-17-1-1, indicating a westward component of groundwater flow at these locations. Like previous years, groundwater elevations at monitoring station 76 indicate strong downward hydraulic gradients. However, groundwater elevations at station 18 in 2022/23 indicate low, downward to neutral gradients. Groundwater levels should continue to be monitored in these locations to verify groundwater gradients are directed inward toward the landfill.

4.4.2 North of Phase 1

Groundwater quality data collected from wells downgradient of the North Purge Wells indicate that the purge well system has a mitigating effect on the northward migration of leachate. In July 2016, monitoring well GW-81-1-0-P9 became operational in an ongoing effort to increase leachate collection capacity upgradient of well 40-1-1. The influence of pumping the North Purge Wells (GW-80-1-0-P8, GW-52-4-0-P7, and GW-81-1-0-P9) on groundwater flow is illustrated in plan on Figure 4-1, with the 115 m and 120 m water table contours deflecting southward due to the drawdown of the water table surrounding the North Purge Wells. In 2022/23, a total of 14,277 m^3 of leachate was removed by the North Purge Wells, which was lower than in 2021/22 (18,140 m^3) and 2020/21 (24,790 m^3). The highest leachate discharge rate was observed in late March 2023, with a peak flow of 102 m^3/day.

Figure 4-6 presents precipitation and groundwater elevation data for monitoring wells located near the Phase 1 North Purge Well System (GW-40-1-1, GW-52-1-1, GW-52-3-0, GW-52-4-0-P7, GW-80-1-0-P8, and GW-81-1-0-P9). Leachate discharge rates from the North Purge Wells (GW-52-4-0-P7, GW-80-1-0-P8 and GW-81-1-0-P9) are presented to illustrate the volume of leachate extracted in response to precipitation events. Monitoring well GW-52-3-0 is the original purge well that operated between 1995 and 1998 and is located within 2 m of well GW-52-4-0-P7. Water levels in well GW-52-3-0 are affected by the pumping rate in GW-52-4-0-P7 and seasonal variations in groundwater recharge. Pressure transducers connected to SCADA are installed in wells GW-40-1-1, GW-52-3-0, GW-52-4-0-P7, GW-80-1-0-P8, and GW-81-1-0-P9 to provide long-term monitoring of purge well performance north of Phase 1.

As shown on Figure 4-6, leachate discharge from the North Purge Wells increased in February/March 2023 in response to considerable precipitation. A total of 3,007 m^3 of leachate was discharged during that period, and the daily average leachate flow was approximately 51.9 m^3/day.

The pressure transducer in well GW-52-1-1 was damaged in March 2022, so no timeseries data was recorded in 2022/23. Groundwater levels in GW-52-3-0 increased substantially in 2021/22 and remained elevated in 2022/23. In 2022/23, the average water level in GW-52-3-0 was 116.5 m asl, which was about 2-2.5 m higher than levels seen before 2021. This may indicate a reduction in the extent of the drawdown cone surrounding GW-52-4-0-P7 and/or GW-80-1-0-P8 due to formation of a biofilm on the inside of the well bore. This should be further investigated by conducting specific capacity tests on each well and comparing it to historical results to determine if well performance has degraded. If deemed to significantly impact well performance, the biofilm should be removed by rehabilitating the purge wells.

Water levels in P7, P8, and P9 also exhibited some variability, and were likely influenced by fluctuations in precipitation and pumping rates. However, the average water levels in P7, P8 and P9 were 112.0 m asl, 113.99 m asl and 118.32 m asl, respectively, where were consistent with their 2021/22 average results. Groundwater elevations in the wells surrounding the North Purge Well System should continue to be monitored to confirm that the North Purge Wells are functioning properly. Regular pump and well maintenance is required to maintain leachate capture and therefore minimize potential future leachate impacts around the lower leachate lagoon.

In August 2022, two new purge wells (P11 and P12) were installed near the edge of the ridge just south of the NWSP. P11 was installed in bedrock, and P12 was completed in overburden or across the overburden-bedrock contact. Groundwater elevations in P11 and P12 ranged from 125.3 to 128.6 m asl, and from 120.3 to 123.6 m asl, respectively. The bedrock high near P11 may direct groundwater in overburden sediments to the east-southeast before it flows north toward the NWSP. In early 2023, P11 was equipped with a pneumatic pump and has been operating intermittently. P12 is dry consistently and will likely not be equipped with a pump.

4.4.3 South of Phase 1

The CRD installed six leachate collection purge wells at the south end of the Phase 1 landfill in August 2000 to intercept leachate migrating south of the Phase 1 groundwater divide. Pneumatic pumps were installed in four of these wells (P1, P2, P3, and P4) and they have been in operation since September 2001 (continuously since May 2002). The remaining two wells (P5 and P6) were not outfitted with pumps due to low well yield. An additional well (P10) was installed in 2010 and outfitted with a pneumatic pump to augment pumping capacity south of the landfill. P1 has subsequently been altered and outfitted with an electric submersible pump.

Groundwater elevations measured using pressure transducers in each of the five operational south purge wells are plotted on Figure 4-7. The on/off cycling of the pumps is evident as water levels generally ranged from approximately 133 to 151 m asl. In 2022/23, water levels in all south purge wells remained within their normal ranges, except for P1, P2, and P10. A pump failure may have occurred at P10 in December 2022, when groundwater elevations in the well rapidly increased by approximately 13.6 m to 148.6 m asl. Between January and February 2023, the SCADA System recorded a gradual decline in water elevations to approximately 120 m asl at P2, followed by a rapid increase back to typical levels. The CRD determined this recording resulted from an error in the SCADA System. Generally, large and rapid changes in water levels imply the subsurface materials have a low transmissivity and bulk porosity, and the cone of depression associated with each purge well may be limited in lateral extent. Some fluctuations are related to pump maintenance events and short-term power disruptions.

Groundwater elevations in the south purge wells have fluctuated since 2007. Although elevations have remained somewhat higher than the target pumping elevations, the installation of P10 in September 2010 and the pump upgrades to P1 between 2015 and 2017 resulted in significantly improved drawdown. Unfortunately, P1 required significant maintenance due to well fouling by leachate due to the well/pump design. In November 2018, P1 was re-installed and produces approximately of 1.01 L/s of leachate. The replacement well is screened in refuse only from 6.10 to 12.19 m below ground surface. Despite the shallower installation depth, the well removes a similar volume of leachate. In November 2020, the pump in P1 was rebuilt and the pressure transducer was re-installed. The lower set point was changed to 147.3 m asl, which is the lowest possible depth without burning out the pump.

In 2022/23, groundwater levels in P1 were approximately 147 m asl and remained consistent for most of the monitoring year. However, in November 2023, groundwater levels began to rise and have continued to increase, reaching a peak of approximately 150.6 m asl in April 2023 where the data set ends. The increase in groundwater levels in P1 likely reflects a decline in pump performance or increased infiltration following prolonged heavy precipitation events. In response to the observed elevation in water levels at P1, the pump has undergone maintenance and is now fully operational. Water levels have subsequently been restored to 147.3 m asl. Water levels in the adjacent purge well P4 remained below 136 m asl throughout the 2022/23 monitoring year.

In 2022/23, a total of 30,580 m^3 of leachate was collected from the South Purge Wells, approximately 13.3% less than in the previous monitoring year. The average daily flow in 2022/23 was 83.8 m^3/day. Overall, consistent leachate discharge volumes and groundwater levels observed in the South Purge Wells suggest the purge well system functioned effectively in 2022/23.

4.4.4 North of Phase 2

A detailed assessment of hydrogeologic conditions below the North Ridge was conducted in 2016, culminating in a hydrogeological conceptual model of the ridge (AECOM 2016). The report stated that subvertical strike-slip faults (e.g., the Highland Fault) near groundwater monitoring stations 87 and 88 and an inferred fault near station 77 behave as barriers to west-east groundwater flow, creating a compartmentalized groundwater flow system in the North Ridge area. Conversely, sub-horizontal tensile fractures behave as preferential conduits for groundwater flow. It is likely that bedrock discontinuities contribute to the large fluctuations in groundwater elevations beneath the North Ridge in response to seasonal precipitation and infiltration events. Geologic mapping of exposed bedrock on the North Ridge (AECOM 2018a) revealed an undulating bedrock surface with several closed depressions that allow for surface water pooling and enhanced recharge during wet weather, which is important for maintaining the Phase 2 hydraulic trap.

Figure 4-9 presents groundwater elevations in North Ridge area. The location of the groundwater divergence below the North Ridge has important implications for maintaining the hydraulic trap as the landfill is expanding northward. Since 2006, ten (10) new wells have been installed at five separate locations (groundwater monitoring stations 77, 78, 79, 87, and 88) north of the High Level Road to investigate the groundwater divergence and direction of groundwater flow north of Phase 2. Continuous water levels have been recorded at monitoring locations GW-77-1-1, GW-78-1-1, GW-87-1-1, GW-87-2-1, GW-88-1-1, and GW-88-2-1 to better understand the temporal and spatial variability in groundwater elevations over time. In November 2019, four new groundwater monitoring wells (GW-91-1-1, GW-92-1-1, GW-93-1-1, and GW-94-1-1) were installed in the North Ridge area to increase the spatial coverage of the groundwater monitoring network and investigate the groundwater divergence. Well GW-94-1-1 is located along the inferred groundwater divergence. In 2022/23, well GW-93-1-1 was damaged due to the blasting activities and subsequently decommissioned.

In 2022, a total of 17 monitoring wells were installed north of Phase 2. Wells GW-96-1-1, GW-97-1-1, GW-98-1-1, GW-99-1-1, GW-103-1-1, GW-104-1-1, GW-105-1-1, GW-106-1-1, GW-107-1-1, GW-108-1-1, GW-109-1-1 and GW-110-1-1 were installed in bedrock, whereas monitoring wells GW-95-1-1, GW-100-1-1, GW-101-1-1, GW-102-1-1 and GW-107-1-2 were installed in overburden or across the overburden-bedrock contact. Well GW-102-1-1 was decommissioned shortly after installation.

In 2022/23, blasting performed in the western portion of Phase 2 resulted in substantive lowering of the bedrock surface of quarry and the Toutle Valley. Groundwater elevations along the North Ridge continued to exhibit seasonal fluctuations, but their intensity was less prominent as seen in Figure 4-9. Historically, groundwater levels have been notably higher to the west of the Highland Fault compared to the immediate east, particularly during the winter. However, in 2022/23, this difference in groundwater levels became less distinct during the winter months. In the summer, measurements beneath the North Ridge (from wells GW-62-1-1, GW-87-1-1, and GW-88-1-1) depicted a moderately sloping piezometric surface ranging between 160 to 165 m asl—roughly 4 m lower than the previous year's readings. It is suspected that the quarry cut through the Highland Fault, potentially facilitating the drainage of eastward flowing groundwater that was previously impeded by the fault. This is consistent with the extensive groundwater seepage observed at the base of the Cell 4/5/6 quarries and generally lower groundwater elevations in the North Ridge area. Groundwater well GW-27-1-1 was an artesian well, but water levels decreased to 4-5m below ground surface in 2022/23. Even with the weakened eastward groundwater hydraulic gradient, the Phase 2 hydraulic trap remained effective.

In 2022/23, upward groundwater gradients continued to present at monitoring stations 77, 87, 88, indicating that groundwater discharges to surface over the footprint of the bedrock quarry and within Toutle Valley. Seepage faces were also observed near the base of the quarry highwall. Well GW-27-1-2 was destroyed, so the hydraulic gradient could not be assessed in this location. However, the upward hydraulic gradients at well location 27 diminished during the October 2021 and February 2022 monitoring events, which may be related to active quarrying in the Toutle Valley. Due to ongoing quarry and blasting activities, well GW-27-1-1 is no longer sustainable and needs to be decommissioned. The well should be decommissioned and sealed properly in accordance with the Groundwater Protection Regulation, B.C. Reg. 75/2021 (last updated March 11, 2021).

Given the importance of maintaining the groundwater divergence for leachate containment, future quarrying in the Toutle Valley and the North Ridge should continue to be conducted under the direction of a qualified blasting professional to minimize the potential for blast-enhanced fracturing, with possible negative impacts on hydraulic properties, groundwater elevations, groundwater flow rates, and leachate containment north of the Phase 2 landfill. Ultimately, if blasting programs are not properly designed and implemented, the integrity of the hydraulic trap may be compromised. In circumstances where blasting might induce substantial topographic alterations or changes to the Toutle Valley's elevation, consultation with a hydrogeologist is recommended. This is because the ground surface within the quarry serves as the primary control mechanism for groundwater tables. Any major modifications to the site's topography or valley floor elevation will directly influence the potentiometric structure of the hydraulic trap.

4.5 Summary

4.5.1 Leachate Flow

In 2022/23 leachate flow patterns at Hartland were consistent with historic interpretations. Leachate mounding persisted in Phase 1, and leachate elevations were generally stable, exhibiting minor seasonal variations. The leachate mound in the upper portion of the refuse is interpreted as being ‘perched’ above the regional bedrock groundwater flow system, with relatively high water levels and strong downward hydraulic gradients. Between 2016 and 2023, leachate elevations in the upper portion of the refuse were generally below 155 m asl, reflecting an approximate 5 m decrease in elevation since closure of the Phase 1 landfill in 1997. Based historical data and the 2022/23 leachate flow data, AECOM made the following interpretations:

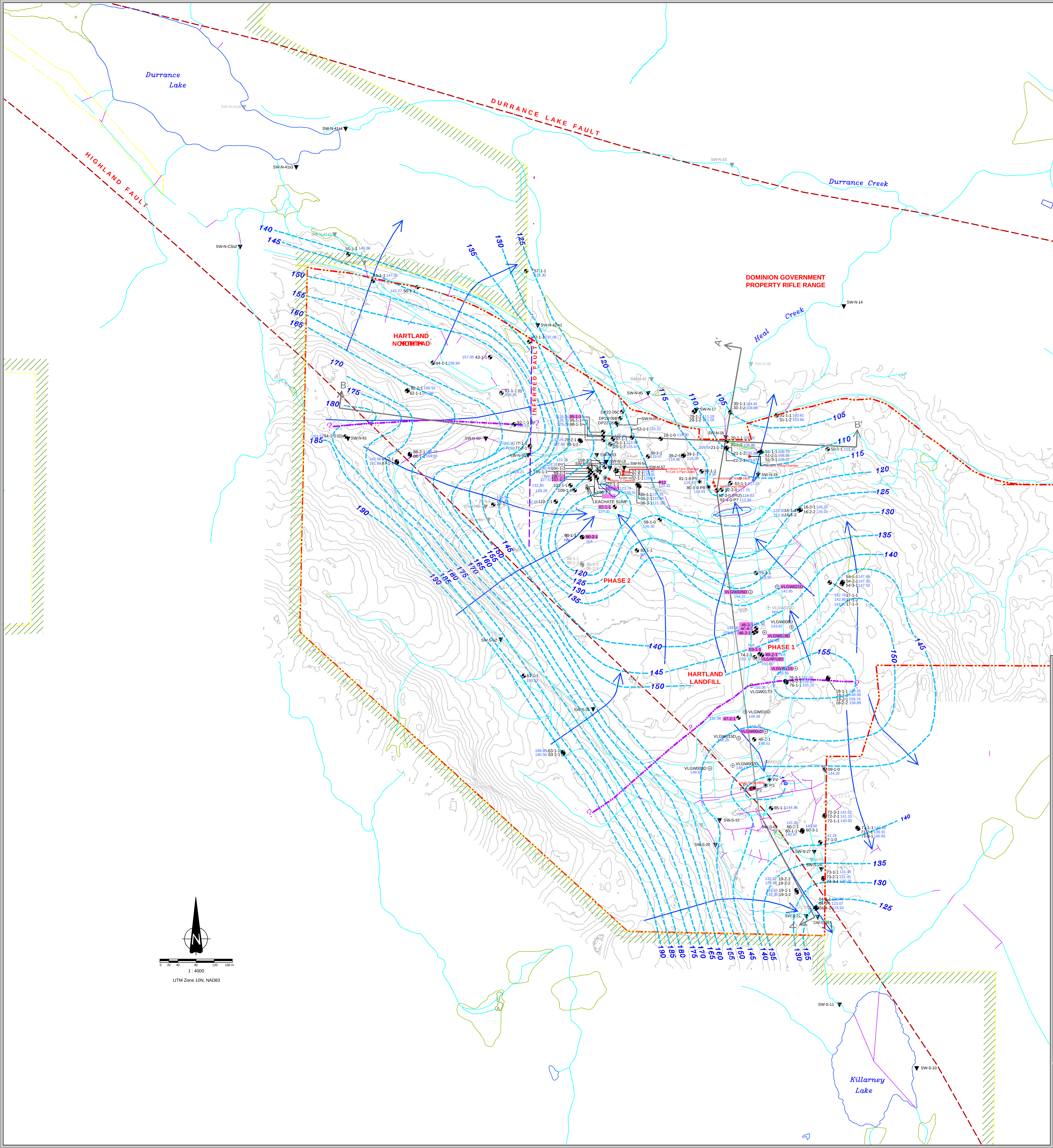
- In April 2023, the pressure transducers in wells GW-89-1-1 and GW-89-2-1 (completed in Phase 1) were damaged, so the data recorded in 2022/23 could not be retrieved. Manual leachate elevation measurements from wells GW-89-1-1 and GW-89-2-1 were consistent with values observed last monitoring year.
- The highest leachate elevations (155 to 157 m asl) were typically observed in the east/southeast area of the Phase 1 (GW-46-2-1, VLGW-004D and VLGW-011S), an area with elevated topography and refuse heights.
- Historically, leachate elevations in Phase 2 were typically about 0.8 m below the leachate elevation in the Lower Leachate Lagoon. However, since November 2021, leachate elevations in Phase 2 have increased, and were above the elevations of the Lower Leachate Lagoon in the wet season. CRD confirmed that this trend was likely due to calibration/ instrument drift, and were not indicative of a change in operations.
- Leachate levels observed at monitoring stations GW-82-1-1 and GW-83-1-1 (completed in Phase 2) were consistent with historical values, and well GW-82-1-1 was dry in September and November 2022.
- In 2022/23, a total of 30,580 m^3 of leachate was collected from the South Purge Wells, approximately 13.3% less than in the previous monitoring year. Standard leachate discharge volumes and consistent groundwater levels observed in the South Purge Wells suggest the purge well system functioned effectively in 2022/23.
- In 2022/23, a total of 14,277 m^3 of leachate was collected from the North Purge Wells, approximately 21.3% lower than in the previous monitoring year. Water levels in GW-40-1-1, GW-52-4-0-P7, GW-80-1-0-P8, and GW-81-1-0-P9 were generally variable but consistent with historical ranges. Standard leachate discharge volumes and consistent groundwater levels observed in the North Purge Wells suggest the purge well system functioned effectively in 2022/23.

4.5.2 Groundwater Flow

In 2022/23, groundwater flow patterns observed at Hartland were consistent with historical interpretations, with some variability in the North Ridge area. Regional groundwater flows from Mount Work northeast to the north-south trending valley that underlies the northern portions of the Phase 1 and Phase 2 landfill. Most of the northward groundwater flow in the bedrock below the landfill is captured by the Toutle Valley Underdrain, Phase 2 Basin Leachate Collection System, springs discharging to the lower lagoon, and the north and south purge well systems (wells P1, P2, P3, P4, P7, P8, P9, and P10). Based on the 2022/23 groundwater flow data, AECOM made the following interpretations:

- Groundwater monitors east of Phase 1 (e.g., GW-54-1-1, GW-76-1-1, GW-17-1-1, and GW-18-1-1) confirmed east-west flow toward the landfill, preventing off-site migration to the east.
- Groundwater levels in GW-52-3-0 increased substantially in 2021/22 and remained elevated during 2022/23. The increase in groundwater elevations at GW-52-3-0 may be related to overall lower leachate discharge rates in North Purge Wells or reduced well efficiency because of biofilm formation in wells GW-52-4-0-P7 or GW-80-1-0-P8. This should be investigated further to confirm the purge wells remain effective.
- Leachate indicator concentrations in wells near GW-81-1-0-P9 have stabilized or decreased slowly under the current pumping configuration/settings. The CRD may consider increasing the pumping rates or adjusting set points to achieve the groundwater elevations required to maintain pumping levels below the Lower Leachate Lagoon and collect more leachate migrating from the area around the landfill gas plant.
- Closure of Phase 2 Cell 1 and the application of tarps to restrict infiltration and leachate generation appears to be slowly improving leachate containment north of the landfill.
- A small amount of groundwater flows southeastward from the south end of Phase 1 in the direction of Killarney Lake. Southeastward groundwater flow below the landfill is constrained by a constructed clay berm and bedrock grout curtain installed at the south end of the landfill and by drawdown cones associated with the South Purge Wells. In 2022/23, water levels all south purge wells remained within their normal ranges, except for P1, P2 P10. Water levels in P1 gradually increased from November 2022 reaching a peak of approximately 150.6 m asl in March 2023. In response to the observed elevation in water levels at P1, the pump has undergone maintenance and is now fully operational. Water levels have subsequently been restored to 147.3 m asl.
- In 2022/23, quarry and blasting activities carried out west of Phase 2 resulted in substantive changes to the topography and lowering of the Toutle Valley ground surface. Subsequently, groundwater levels in several wells situated south of the Northwest Stockpile, notably wells GW-87-1-1 and GW-88-1-1, declined by approximately 4 -10 m compared to previous years. This decline also led to diminished eastward hydraulic gradients. Seasonal fluctuations can still be observed along the Highland Faults, but they have become less pronounced. Despite this impact on the local groundwater flow pattern and hydraulic gradients, the Phase 2 hydraulic trap remained effective. However, groundwater elevations require close monitoring as they establish a new dynamic equilibrium to confirm the performance of the hydraulic trap and inform the design of the Phase 4/5/6 landfill and its associated underdrain system.

File Location: C:\USERS\SUSAN.A.POWELL\DESKTOP\ WFH\60631284\HARTLAND LANDFILL 2022-2023\900-CAD_GIS\910-CAD\20-SHEETS\C1434 - 2022-23 ANNUAL REPORT\FIG4.1_GW PLAN_60631284-2022_.DWG Date Plotted: August 22, 2023 Saved By: susan.a.powell



Legend

▭	BUILDING / STRUCTURE
	ROAD
	FENCE
	LEGAL LOT BOUNDARY
	INDEX CONTOUR (5m)
	INTERMEDIATE CONTOUR (1m)
	TREES/SHRUB/VEGETATION
	DITCH
	DRAINAGE
	PIPE
	FAULT (MULLER, 2020)
	INFERRED FAULT (AECOM, 2020)
	HARTLAND LANDFILL OPERATING AREA BOUNDARY
SW-S-21 ▼	SURFACE WATER SAMPLING LOCATION
SW-S-21 ▼	INACTIVE SURFACE WATER SAMPI
P3 ◈	LEACHATE COLLECTION WELLS
95-1-1 ◕	ACTIVE GROUNDWATER WELL
VLGW001D ⊕	GAS WELL
86-1-1 ◕	DECOMMISSIONED WELL
A A'	CROSS SECTION LINE
158.90	GROUNDWATER LEVEL (m ASL) MEASURED ON SEPTEMBER 202
(D)	D= DEEP MONITOR (~30m)
(I)	I= INTERMEDIATE MONITOR (~20m)
(S)	S= SHALLOW MONITOR (~10m)
N/A	NO GROUNDWATER LEVEL DATA AVAILABLE
LG-11-S	HIGHLIGHTED DATA INDICATES DATA WAS NOT USED IN BEDROCI GROUNDWATER FLOW ANALYSIS
?	INFERRED GROUND WATER DIVIDE
150	INFERRED WATER TABLE CONTOUR
←	INFERRED GROUNDWATER FLOW DIRECTION

Map Sources / Notes:
- Contour interval 1.0 m
- Groundwater elevation data collected by CRD, September 2022.
- Contours based on 24-W542_2022 base.dwg Capital Regional District, April 2023.
- Drainage information for years 2018-2019 obtained from Parks & Env. Services GIS technicians and have layers with the prefix "CRD19_GIS DRAINAGE" & "CRD19_GIS streams_Ditches".
- GPS pickup has been conducted by CRD Staff of creeks, wetlands, culverts located under tree canopied areas. This information (considered more accurate) has been added to the base (superceding some planimetric information) and is placed on layers indicating GPS pickup. An example of that layering system would be 'CRD19-wat-culvert_GPS pickup'.
- Surveyed points for monitoring sites (groundwater, gas wells, leachate, purge wells) were updated for 2019.
- The map is to NAD83 UTM coordinates. Vertical datum is to CGVD28.

Reviewed by:	KJ	Prepared by:	SP
Date Issued:	August 2023	Project Number:	60631284

CRD
Making a difference...together

Project: Hartland Landfill Monitoring
Location: Saanich, BC

Groundwater Elevations and Flow Directions in Bedrock (September 2022)

AECOM

Figure 4-1

Legend

85-1-1 (6.5m)	MONITORING WELL (NUMBER) INDICATES DISTANCE WELL IS FROM PLANE OF SECTION. WHERE NOT INDICATED, DISTANCE IS LESS THAN 2 m.
┿	SCREENED INTERVAL
85-1-1 (6.5m)	MONITORING WELL WATER LEVEL WAS NOT USED IN THE BEDROCK GROUNDWATER FLOW ANALYSIS
⚡	WATER BEARING FRACTURES
──	GROUND SURFACE
- - -	LOCATION OF BEDROCK DERIVED FROM 1954 GROUND CONTOUR OR BEDROCK INTERSECTIONS IN BOREHOLES
▨	REFUSE
▨	CLAY BERM
▒	UNCONSOLIDATED SOIL AND FILL
- -▼- -	INTERPRETED GROUNDWATER POTENTIOMETRIC SURFACE IN BEDROCK
↓	INFERRED VERTICAL LEACHATE FLOW
-·-▽-·-	INTERPRETED LEACHATE MOUND
- - -	INFERRED GROUNDWATER POTENTIOMETRIC CONTOUR
←	INFERRED GROUNDWATER FLOW DIRECTION IN BEDROCK
103.75	GROUNDWATER ELEVATION (mASL) SEPTEMBER 2022
▭	FAULT (MULLER, 1980)

Map Sources / Notes:
- Contours based on 24W542_2022 base.dwg, provided by the Capital Regional District, April 2023.
- Stratigraphy between boreholes is inferred and may vary from that shown

0 10 20 40 60 80 m
1 : 2000
Section Looking West

Reviewed by: KJ
Date Issued: August 2023
Prepared by: SP
Project Number: 60631248

Project: Hartland Landfill Monitoring
Location: Saanich, BC

Groundwater Flow in Cross Section A-A'
(September 2022)

AECOM

Figure 4-2

Legend

85-1-1 (6.5m)	MONITORING WELL (NUMBER) INDICATES DISTANCE WELL IS FROM PLANE OF SECTION. WHERE NOT INDICATED, DISTANCE IS LESS THAN 2 m.
⊥	SCREENED INTERVAL
85-1-1 (6.5m)	MONITORING WELL WATER LEVEL WAS NOT USED IN THE BEDROCK GROUNDWATER FLOW ANALYSIS
⚡	OBSERVED FRACTURES ON DRILLED LOGS
―	GROUND SURFACE
- - - -	LOCATION OF BEDROCK DERIVED FROM 1954 GROUND CONTOUR OR BEDROCK INTERSECTIONS IN BOREHOLES
95-1-1 ⊕	ACTIVE GROUNDWATER WELL
☒	OVERBURDEN
▒	UNCONSOLIDATED SOIL AND FILL
▨	CLAY BERM
⊞	SHALLOW WEATHERED AND BLAST ALTERED BEDROCK
▤	DEEP BEDROCK
- - -▼- - -	INTERPRETED GROUNDWATER POTENTIOMETRIC SURFACE IN BEDROCK
- - - -	INFERRED GROUNDWATER POTENTIOMETRIC CONTOUR
< ―	INFERRED GROUNDWATER FLOW DIRECTION IN BEDROCK
112.50	GROUNDWATER ELEVATION (mASL) SEPTEMBER 2022
―	INFERRED HYDRAULIC CONNECTIONS
― - - ―	GROUNDWATER DIVIDE
▭	FAULT (MULLER, 1980)
?	INFERRED FAULT (AECOM, 2017)

Map Sources / Notes:
- Contours based on 24W542_2022 base.dwg, provided by the Capital Regional District, April 2023.
- Stratigraphy between boreholes is inferred and may vary from that shown

0 10 20 40 60 80 m
1 : 2000
Section Looking North

Reviewed by: KJ
Date Issued: August 2023
Prepared by: SP
Project Number: 60631284

Project: Hartland Landfill Monitoring
Location: Saanich, BC

Groundwater Flow in Cross Section B-B' (September 2022)

AECOM

Figure 4-3

File Location: C:\USERS\SUSAN.A.POWELL\DESKTOP\DESKTOP_WFH\60631284HARTLAND LANDFILL 2022-2023\900-CAD_GIS\910-CAD\20-SHEETS\C\434 - 2022-23 ANNUAL REPORT\FIG4.3-GW SECTION B-60631284-2022_.DWG Date Plotted: September 27, 2023 Saved By: susan.a.powell

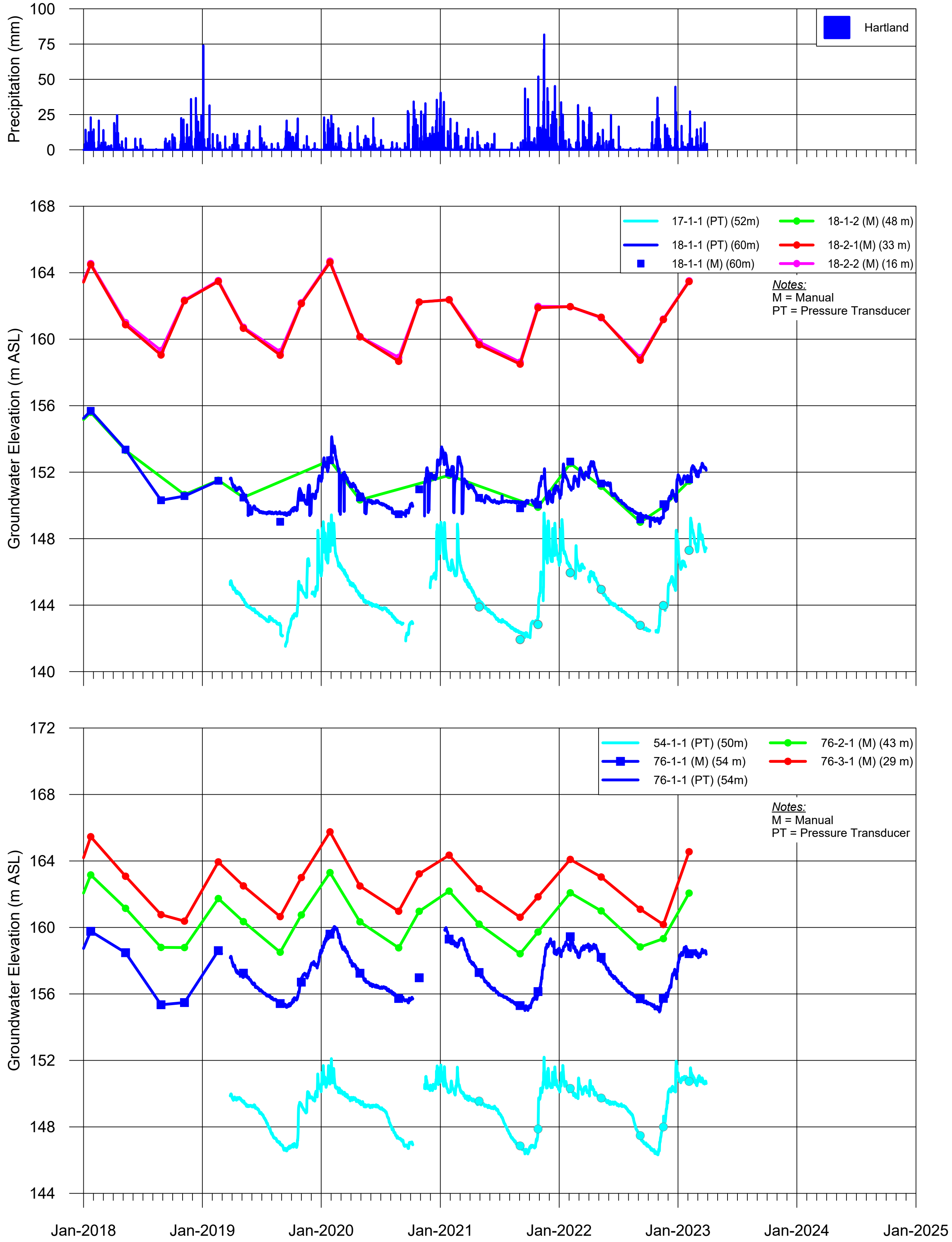


Figure 4-4. Groundwater Elevations East of Phase 1

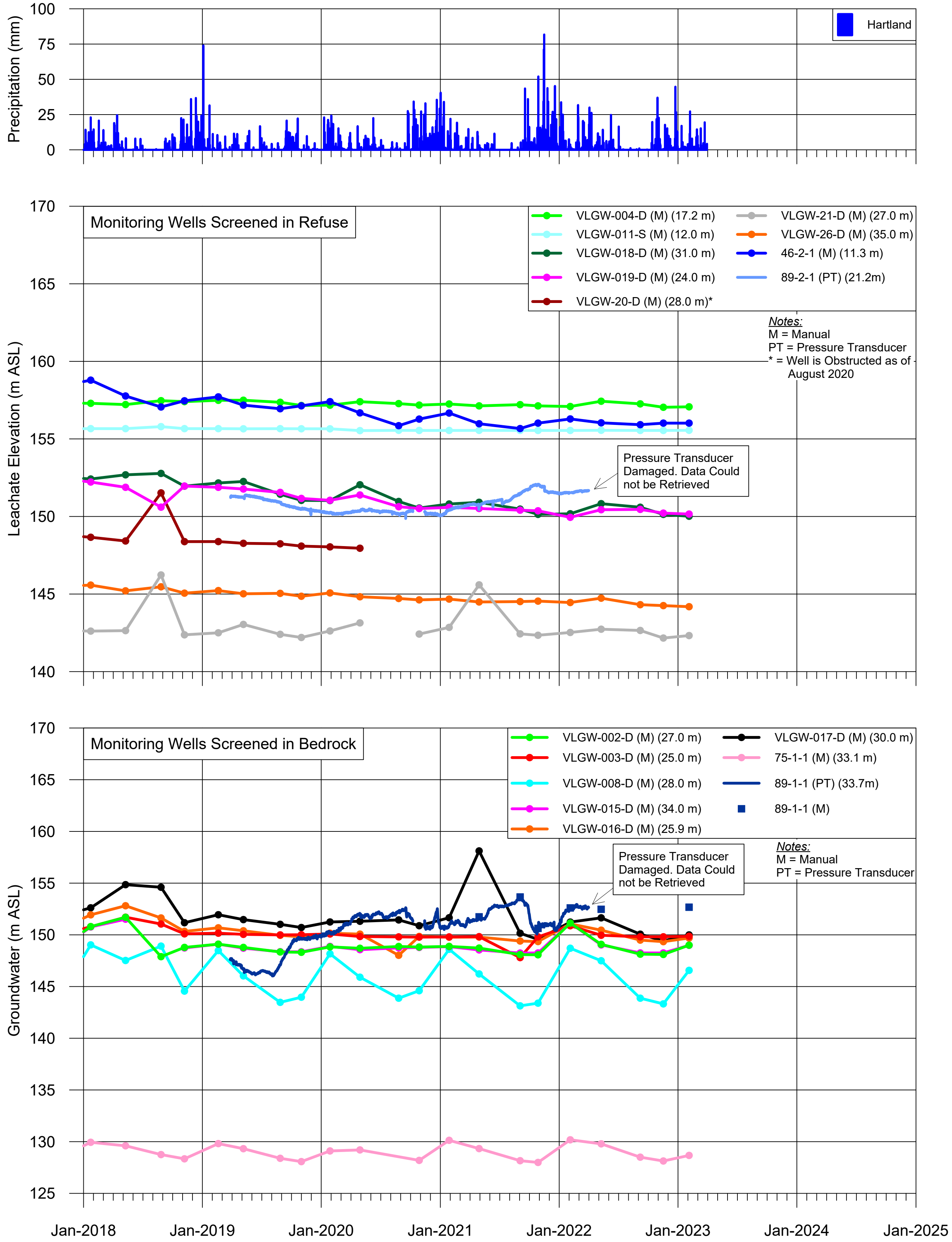
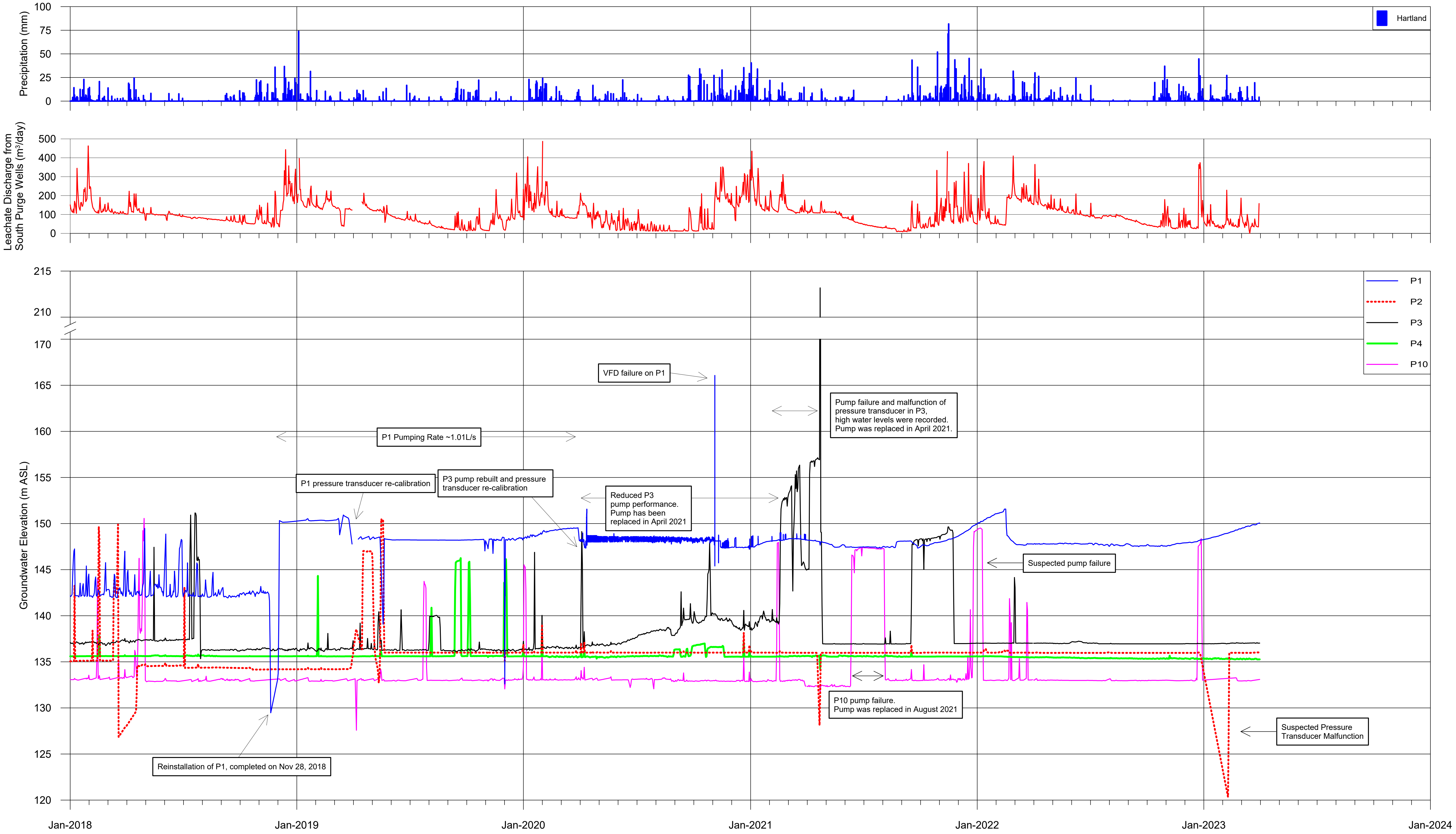


Figure 4-5. Leachate and Groundwater Elevations Within Phase 1

Figure 4-6. Groundwater Elevations Surrounding the North Purge Wells



VFD failure on P1

Pump failure and malfunction of pressure transducer in P3, high water levels were recorded. Pump was replaced in April 2021.

P1 Pumping Rate ~1.01L/s

P1 pressure transducer re-calibration

P3 pump rebuilt and pressure transducer re-calibration

Reduced P3 pump performance. Pump has been replaced in April 2021

Suspected pump failure

P10 pump failure. Pump was replaced in August 2021

Suspected Pressure Transducer Malfunction

Reinstallation of P1, completed on Nov 28, 2018

Figure 4-7. Groundwater Elevations in the South Purge Wells

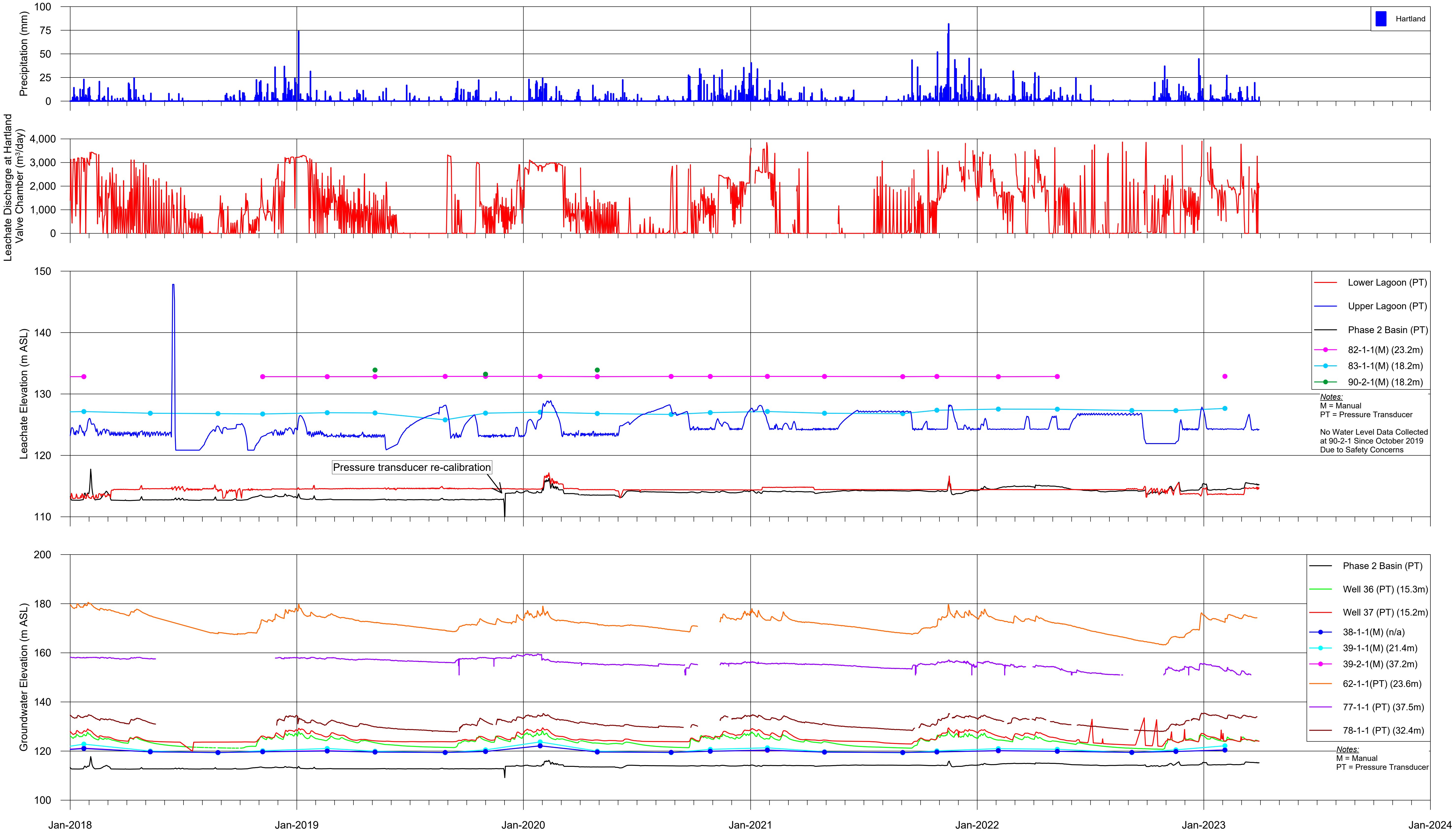
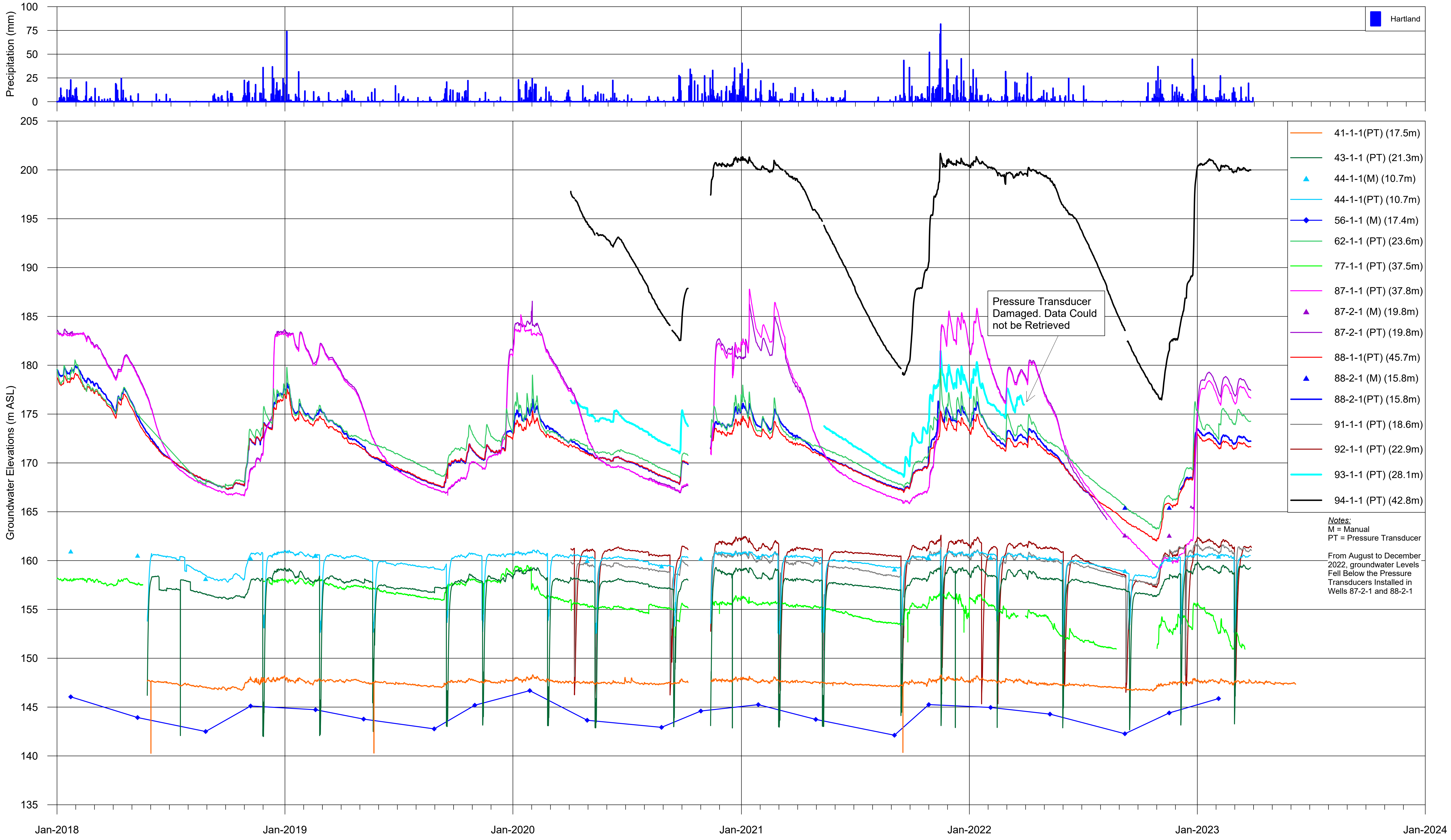


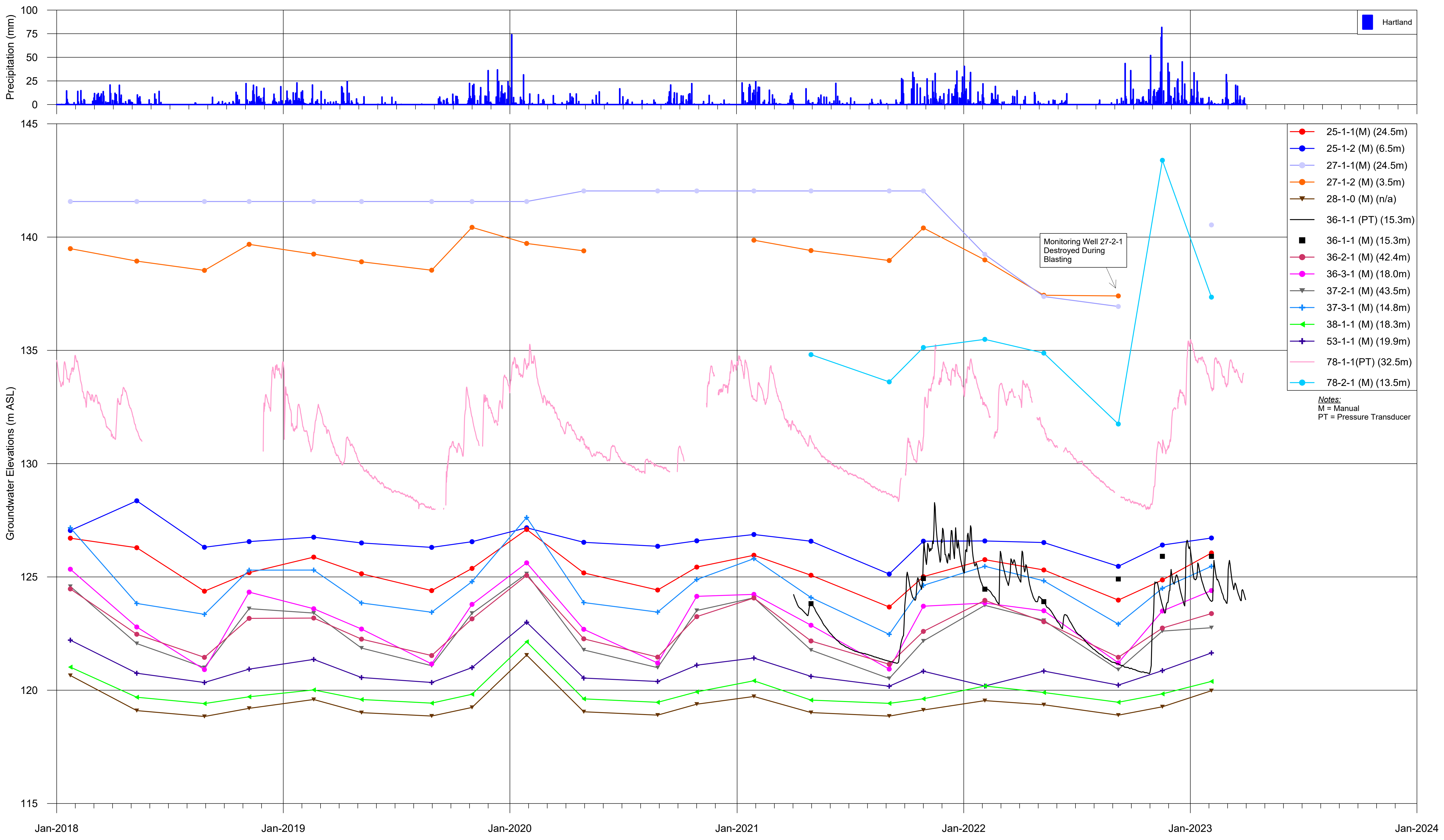
Figure 4-8. Water Elevations Within the Leachate Conveyance System and Surrounding the Phase 2 Basin



Notes:
M = Manual
PT = Pressure Transducer

From August to December 2022, groundwater Levels Fell Below the Pressure Transducers Installed in Wells 87-2-1 and 88-2-1

Figure 4-9. Groundwater Elevations in the North Ridge Area



Monitoring Well 27-2-1 Destroyed During Blasting

Notes:
M = Manual
PT = Pressure Transducer

Figure 4-10. Groundwater Elevations North of the Phase 2 Landfill

5. Groundwater Quality Monitoring Wells

5.1 Compliance Groundwater Monitoring Locations

A total of 36 compliance monitoring wells have been identified at 19 different locations at the Hartland Landfill. These stations are concentrated along the south, east and northern property boundaries and are located downgradient of areas that have the potential to be impacted by leachate or runoff from the site. The monitoring wells listed below are considered Boundary Compliance Wells.

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

North of the Hartland North Pad (5)

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

Compliance is assessed in Section 5.2. All data, including the applicable standards, are provided in Appendix B. Values that exceed CSR standards are noted with footnotes. Analytical results for groundwater samples collected from monitoring wells for the reporting period are presented in Appendix B.1. Table 5-1 presents a summary of the wells that exceeded CSR standards for one or more parameters in 2022/23. Most exceedances represent groundwater samples collected from leachate collection wells or near leachate collection infrastructure. Additionally, nitrate concentrations in several groundwater wells (e.g., GW-25-1-1, GW-16-1-1, and GW-104-1-1) located downgradient of aggregate stockpiles exceeded the CSR DW standard throughout the monitoring year.

A review of the sampling program was undertaken in early 2016, and recommendations for modifications to the number, location and sampling frequency of compliance monitoring locations were implemented beginning in the 2016/17 monitoring year. Groundwater quality data at compliance wells GW-04-2-1 and GW-72-2-1 has not been collected since 2016 due to the low recharge rate in the wells and these wells are no longer considered compliance locations. AECOM is in the process of reviewing and updating the sampling program to ensure it remains effective in monitoring the impacts from ongoing landfill operation, including activities such as aggregate production, stockpiling and other activities.

Based on the Stage 8 Amendments to the CSR, DW and AW standards for iron and manganese are no longer applied to municipal landfills.

Quarterly monitoring conducted by the CRD typically includes both compliance wells and other non-compliance locations that contribute to a fulsome understanding of landfill processes and the potential for environmental risks.

5.2 Assessment of Groundwater Quality Impacts

The primary causes for any groundwater quality degradation at the site include leachate, road salt and aggregate production, stockpiling or use for construction purposes. Professional judgement is used to differentiate between different contaminant sources (leachate, road salt and aggregates) and to assess the nature and degree of any impacts. The authors of this report are hydrogeologists and geochemists with considerable experience at other landfills in coastal regions of British Columbia. Groundwater quality may be judged to be impacted relative to background without exceeding regulatory criteria, and therefore compliant. If concentrations exceed CSR AW or DW standards for groundwater quality at the property boundary, standard protocols for notification of affected property owners should be followed.

Relative concentrations and patterns of conductivity, ammonia, chloride, sulphate, and nitrate are compared to background concentrations to differentiate between the site's typical contaminant sources as outlined below:

- Background conductivity is typically below 500 µS/cm but has been observed in some background wells at concentrations up to 1,000 µS/cm immediately after well installation or following prolonged dry periods. Background ammonia concentrations are typically below 0.1 mg/L, but occasionally reach 0.5 mg/L downgradient of wetland areas. Background chloride concentrations are typically below 20 mg/L. Background sulphate concentrations are typically below 50 mg/L but are regularly observed at concentrations up to 100 mg/L in wells screened within weathered bedrock and near geological alteration zones.
- Groundwater is considered to be impacted by leachate when conductivity concentrations are above 1,000 µS/cm, ammonia concentrations are above 1 mg/L, and chloride concentrations are above 20 mg/L. Peak concentrations in leachate impacted wells are typically observed during the dry summer and early fall months, when there is limited dilution by precipitation.
- Groundwater is considered impacted by aggregate (e.g., production, stockpiling or site construction works) when sulphate is present at concentrations above 75 mg/L and ammonia or nitrate are present at concentrations above background levels of 0.1 mg/L. Peak concentrations are typically observed during the first sampling event following the onset of wet weather in the fall months after recent blasting and aggregate stockpiling.
- Groundwater is considered impacted by road salt when both conductivity (>1,000 µS/cm) and chloride (>20 mg/L) are elevated above background levels, but ammonia and its degradation products (primarily nitrate) are not elevated. Chloride (Cl) to sodium (Na) molar ratios are also used to assess the source of potential chloride sources. Cl/Na molar ratios in road salt are generally one to one, assuming 100% compositional purity. In 2022/23, Cl/Na molar ratios in the north and south purge wells except for P9 ranged from 0.38 to 0.75, with a median ratio of 0.54. Road salt impacted sites must also be located downgradient (or downstream) of surfaces where road salt is known to be applied. Concentrations of conductivity and chloride typically exhibit peaks following cold weather periods when de-icing salt is often applied to roadways.

5.3 Electrical Conductivity

Figure 5-1 presents the electrical conductivity values in plan for samples collected at Hartland Landfill in September 2022. Figure 5-2 and Figure 5-3 present north-south and east-west cross-sections through the landfill and north of the landfill that show conductivity values in September 2022. Electrical conductivity is a good indicator of the presence of inorganic parameters and a good indicator of potential leachate contamination when elevated ammonia and chloride are also present. The highest conductivity values are typically observed during the dry season (i.e., August/ September), and were utilized to interpret the conductivity contours.

On Figure 5-1, the 1,000 µS/cm conductivity contour line is interpreted as indicating the presence of leachate in groundwater. Figure 5-1 shows that the 1,000 µS/cm contour closely resembles the outline of current refuse disposal and indicates that groundwater in these areas has been affected by leachate.

Like previous years, conductivity values in north and south purge wells were generally above 1,000 µS/cm in 2022/23, except for GW-81-1-0-P9. Conductivity values continuously fell below 1,000 µS/cm for well GW-81-1-0 (P9) through 2022/23. As shown on Figure 5-1, conductivity values in the north purge wells were highest in P8, which was close to 4,069 µS/cm in September 2022. In 2022/23, conductivity values in the south purge wells ranged from 990 to 2,600 µS/cm. Like previous years, the 1,000 µS/cm contour runs north of the north purge well system and Lower Leachate Lagoon, and extends south of P1, P2, P3, P4, and P10 of the south purge well system. Conductivity values at new purge wells P11 and P12 were relatively lower, ranged from 645 to 1,169 µS/cm. P12 was dry most of the time, and only one sample could be taken.

The 500 µS/cm conductivity contour is considered indicative of background groundwater quality. In September 2022, the 500 µS/cm conductivity contour along the northern boundary of the landfill expanded beneath the Upper Leachate Lagoon, as indicated by GW-38-1-1 and new wells GW-105-1-1 and GW-108-1-1, and slightly further north from the Lower Leachate Lagoon. Additionally, a 500 µS/cm contour was inferred around GW-31-1-1, and in 2022/23 extended to well GW-30-1-1. The elevated electrical conductivity values observed in this region could potentially be linked to impacts from the upgradient stockpiled aggregate located to the southeast of this area, in the Triangle Stockpile and Southeast Stockpile. Sulphate concentrations in well GW-31-1-1 and GW-31-1-2 ranged from 185 to 270 mg/L, which were well above the aggregate impact threshold of 75 mg/L. Chloride and ammonia concentrations remained low, that water quality is unlikely to be impacted by road salt or leachate.

Like previous years, the 500 µS/cm contour did not extend beyond location 25 at the north end of the landfill. Groundwater collected from location 36 showed that conductivity values during two of the four sampling events were above 1,000 µS/cm and remained slightly elevated in 2022/23. At Hartland North Pad, elevated conductivity was also observed at wells GW-43-1-1 (509 µS/cm) and GW-91-1-1 (510 µS/cm) Along the east boundary of the landfill, the 500 µS/cm contour did not extend beyond GW-18-1-1. At the west boundary, the location of the 500 µS/cm contour could not be determined due to the absence of monitoring wells on the steep slope. However, the presence of conductivity data for GW-27-1-1, coupled with eastward and upward groundwater flow in that area indicates the 500 µS/cm contour remains east of GW-27-1-1. South of the landfill, the 500 µS/cm contour did not extend to GW-07-1-1 but does encapsulate well GW-72-1-1.

Source control techniques should continue to be implemented throughout the landfill including minimizing the volume of aggregate stockpiles, application of covers and paving of traffic surfaces to maintain the quality of surface and groundwater in the future.

5.4 Overview of Groundwater Quality Exceedances

Groundwater quality data were compared to applicable BC CSR AW and DW standards, as shown in Appendix B-1. A summary of groundwater quality exceedances is presented in Table 5-1. In 2022/23, Boundary Compliance Wells and off-site monitoring wells met CSR AW and DW standards, except for one copper concentration exceedance (41.5 µg/L) observed at GW-21-1-1 during the May 2022 sampling event. However, the reported elevated copper concentration was derived from the mean of the parent and duplicate results (Table 3-1). While one result was below the detection limit of 0.25 µg/L, the other was significantly higher at 82.8 µg/L. This disagreement in measurements suggests the possibility of cross-contamination either during sampling or in post-sampling procedures. Therefore, it's likely that the recorded exceedance may not accurately represent true conditions.

Similar to previous years, most exceedances were present in groundwater wells in close proximity to leachate purge wells and known leachate sources. However, nitrate concentrations in several groundwater wells (e.g., GW-16-1-1, GW-25-1-1, GW-104-1-1, GW-105-1-1, GW-106-1-1, GW-107-1-1) located downgradient of aggregate stockpiles exceeded applicable CSR DW standards on one or more sampling event. In all wells except GW-106-1-1, ammonia concentrations remained below the detection limit. The nitrate exceedances are attributed to aggregate production and stockpiling at the landfill.

5.5 Monitoring Sites North of the Phase 1 Landfill

Figure 5-4 illustrates long-term groundwater quality trends north of the Phase 1 landfill.

5.5.1 Monitoring Site 58

Monitoring site 58 (not a Boundary Compliance Well) is located in the transition area between the Phase 1 and Phase 2 landfill 200 m from the property boundary. GW-58-1-0 is 19 m deep and screened in bedrock below refuse. Well GW-58-1-0 has exhibited elevated concentrations of leachate indicator parameters since 2001, shortly after landfilling upslope of the well began. Although solute concentrations have generally decreased since peak concentrations were observed from 2001 to 2004, concentrations of key leachate indicator parameters (e.g., conductivity, ammonia, chloride, and nitrate) remain highly elevated. Water quality is indicative of leachate-impacted groundwater flowing toward the Lower Leachate Lagoon and the north purge wells.

In 2022/23, four groundwater sampling events were conducted at location 58. Similar to previous years, all four samples from well GW-58-1-0 exhibited concentrations of ammonia and cobalt that exceeded CSR AW standards. Furthermore, concentrations of chloride, cobalt, nickel, strontium, and vanadium exceeded CSR DW standards during one or more sampling events. Sodium concentrations were above the CSR DW of 200 mg/L but well below the regional background concentration of 1,700 mg/L and therefore below CSR standards. In 2022/23, mean concentrations of ammonia and chloride were 105.8 mg/L and 988 mg/L, respectively, which are consistent with 2021/22 concentrations. Groundwater quality in GW-58-1-0 was generally stable with respect to all leachate indicator parameters other than conductivity. Since Q1 2020, sulphate concentrations have progressively increased from 60 mg/L to 120 mg/L and may reflect the influence of nearby aggregate storage and use to support landfill operations and closure.

Similar to previous years, dissolved cobalt concentrations ranged from 50.1 to 55.7 µg/L, exceeding both the CSR AW and regional background concentration of 14 µg/L. Continued water quality monitoring at this well over time is important as it provides an indication of the quality of leachate migrating to the Lower Leachate Lagoon and the north purge well system.

5.5.2 Monitoring Sites 52 (P7), 80 (P8) and 81 (P9)

Monitoring sites 52, 80 and 81 (not Boundary Compliance Wells) located in the centre of the leachate plume between the toe of the Phase 1 landfill and the lower leachate lagoon, approximately 100 m from the property boundary. Leachate flows along the bedrock/refuse interface underlying Phase 1 toward the lower leachate lagoon and the north purge wells (GW-52-4-0-P7, GW-80-1-0-P8 and GW-81-1-0-P9). Groundwater quality has been impacted heavily by leachate since monitoring began at these locations in the 1980's.

In 2022/23, groundwater samples were collected from well GW-52-1-1 (31 m deep) and leachate samples were collected from the north purge wells (GW-52-4-0-P7, GW-80-1-0-P8, and GW-81-1-0-P9). Prior to 2016/17, leachate samples had only been collected from the combined discharge at GW-52-4-0-P7 and GW-80-1-0-P8.

Concentrations of chloride in monitoring well GW-52-1-1 met the CSR DW standard of 250 mg/L during all sampling events in 2022/23. Ammonia concentrations were similar to previously reported values, exceeding the CSR AW standards on all sampling dates. Similarly, strontium concentrations exceeded the CSR DW standard on all sampling dates. In 2022/23, the mean annual conductivity in GW-52-1-1 was 1,785 µS/cm, which was about 7% lower than the mean value observed in 2021/22 (1,926 µS/cm). No statistically significant trend was observed in GW-52-1-1 over the past five years.

In 2022/23, conductivity values in GW-52-4-0-P7 and GW-81-1-0-P9 were consistent with those observed in 2021/22. However, in GW-80-1-0-P8, conductivity increased by approximately 15%. Unlike previous years, leachate in P8 was even more concentrated than P7, with conductivity ranging from 3,061 to 6,600 µS/cm. Leachate quality in P8 exhibited the most significant degradation, and ammonia, conductivity, and chloride concentrations were generally 10 to 20% higher than those measured in 2021/22, which may reflect reduced infiltration following closure of Phase 2 Cell 1, and prolonged dry weather.

Statistically significant increasing trends in conductivity, chloride and ammonia concentrations were observed in GW-80-1-0-P8, and a statistically significant increasing trend in conductivity was observed at GW-52-4-0-P7. Groundwater quality in GW-52-4-0-P7 exceeded CSR AW standards for ammonia on all sampling events and the CSR DW standard for chloride during three sampling events. Groundwater quality in GW-80-1-0-P8 exceeded the CSR AW standards for ammonia and chromium on all four sampling events. Moreover, arsenic, chloride, cobalt, and vanadium concentrations in GW-80-1-0-P8 exceeded the CSR DW standards on all sampling events. More frequent CSR exceedances and increased concentrations of leachate indicator parameters observed at GW-80-1-0-P8 indicate that leachate quality has continued to deteriorate throughout 2022/23. Leachate quality in GW-81-1-0-P9 has generally been stable over time, exhibiting statistically significant decreasing trends in nitrate and chloride concentrations. Although, in 2022/23, strontium concentrations observed at GW-81-1-0-P9 exceeded the CSR DW standard on one sampling event.

Overall, groundwater quality in and GW-80-1-0-P8 continued to degrade throughout 2022/23, while leachate indicator concentrations remained stable or decreased slightly in GW-52-4-0-P7 and GW-81-1-0-P9. Well GW-80-1-0-P8 exhibited the most substantive evidence of groundwater quality degradation, supported by an increased number of CSR exceedances and higher conductivity, chloride, and ammonia concentrations. Water quality at these wells should continue to be monitored to verify the effectiveness of the leachate collection system, assess temporal changes in leachate quality in response to seasonal changes in precipitation, and assess water quality impacts associated with aggregate production and stockpiling.

Table 5-1. Groundwater Quality Exceedances 2022-2023

Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	Alkalinity - Total - Ph 4.5	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chloride	Chromium	Cobalt	Copper	Hardness (As Caco3)	Iron	Lead	Lithium	Magnesium	Manganese	Molybdenum	Ammonia
BC CSR				AW Maximum (1)			90	50	10000	2 (9)		12000	0.5-4 (5)		1500	90 (7)	40	20-90 (5)			40-160 (5)				10000	1.31-18.4 (3)
				DW Maximum (2)		9500	6	10	1000	8		5000	5		250	6000	14 (9)	1500			10	33 (9)			250	
				Fraction	TOT	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	mg/L
				Method Detection Limit (MDL)	1	0.5	0.02	0.02	0.02	0.01	0.005	10	0.005	0.05	1	0.1	0.005	0.05	0.5	1	0.005	0.5	0.05	0.05	0.05	0.015
16-1-2	SS		2023-03-15	White, high turbidity	110.	17.8	0.027	0.121	27.4	< 0.01	< 0.005	14.	0.049 2	76.2	8.5	0.12	0.106	0.853	231.	9.9	0.037 9	< 0.5	9.94	5.54	0.206	< 0.015
16-2-1	SS		2023-03-16	clear and colourless	130.	52.6	0.067	0.179	14.9	< 0.01	< 0.005	17.	0.027 3	78.4	6.1	0.3	0.132	0.9	231.	110.	0.013 2	0.57	8.6	2.52	0.441	< 0.015
16-2-2	SS		2023-03-16	clear and colourless	120.	5.7	0.039	0.114	15.9	< 0.01	< 0.005	14.	0.035 6	79.8	7.2	0.16	0.074 1	1.65	241.	7.7	0.007 7	< 0.5	10.1	2.62	0.234	< 0.015
21-1-1	FR1	Y	2022-05-20		71.	< 2.5	< 0.1	1.22	1.93	< 0.05	< 0.025	3 860.	< 0.025	19.5	3.9	< 0.5	< 0.025	82.8 a	63.4	35.7	< 0.025	< 2.5	3.57	6.48	0.51	< 0.015
25-1-1	SS		2022-05-17	Clear and colourless	130.	2.05	0.151	0.121	6.05	< 0.01	< 0.005	228.	0.009 1	114.	5.	< 0.1	0.077 1	0.269	335.	2.4	0.005 5	< 0.5	11.9	36.5	0.533	< 0.015
52-1-1	SS		2022-05-18	Clear and slightly green	850.	3.	< 0.1	0.19	102.	< 0.05	< 0.025	2 870.	< 0.025	129.	190.	1.04	2.08	< 0.25	490.	562.	< 0.025	5.1	40.5	359.	0.38	24. a
52-1-1	SS		2022-09-20	Clear and colourless.	880.	3.9	0.044	0.257	118.	< 0.02	< 0.01	3 540.	< 0.01	141.	180.	1.12	2.33	0.14	535.	621.	< 0.01	5.5	44.6	397.	0.5	27. a
52-1-1	SS		2022-12-16	Clear and colourless	860.	5.	0.17	0.21	116.	< 0.05	< 0.025	3 340.	< 0.025	138.	180.	1.13	2.21	< 0.25	527.	535.	0.028	5.9	44.2	358.	0.35	25. a
52-1-1	SS		2023-03-02	Clear and colourless	860.	2.2	< 0.04	0.242	109.	< 0.02	< 0.01	3 130.	< 0.01	127.	170.	1.12	2.09	< 0.1	484.	566.	< 0.01	5.1	40.5	373.	0.42	23. a
58-1-0	SS		2022-05-17	Clear and moderately yellow	1 700.	9.3	0.402	1.32	33.4	< 0.02	< 0.01	4 160.	0.054	360.	890. b	9.59	52.3 a b	7.63	1 400.	876.	0.071	< 1.	121.	6 390.	6.87	99. a
58-1-0	FR1		2022-09-22	Clear, very orange	1 900.	15.6	0.4	1.21	32.4	< 0.05	< 0.025	3 070.	0.067	415.	990. b	9.89	55.7 a b	8.9	1 600.	858.	0.174	< 2.5	137.	6 470.	6.46	100. a
58-1-0	FR2		2022-09-22	Clear and colourless.	1 700.	11.6	0.4	1.19	32.8	< 0.05	< 0.025	3 230.	0.124	421.	1 000. b	9.81	55.5 a b	8.67	1 620.	884.	0.162	< 2.5	137.	6 500.	6.5	100. a
58-1-0	SS		2022-12-13	Clear, very yellow	2 000.	13.3	0.456	1.53	36.1	< 0.02	< 0.01	3 660.	0.066	418.	960. b	9.83	50.8 a b	7.74	1 590.	816.	0.082	< 1.	134.	6 350.	6.29	130. a
58-1-0	SS		2023-03-09	Very slight yellow, nil turbidity	1 900.	9.8	0.49	1.46	33.8	< 0.05	< 0.025	3 750.	0.087	358.	1 100. b	10.5	50.1 a b	7.12	1 380.	1 620.	0.268	< 2.5	119.	5 650.	6.27	100. a
95-1-1	SS		2022-09-15	Very turbid, very grey	220.	25 300. b	0.184	4.99	88.1	0.381	0.184	262.	0.315	98.4	6.6	76.7	42.9 a b	95.5 a	329.	56 300.	8.08	10.8	20.2	812.	5.63	0.21
104-1-1	SS		2022-11-29	Very turbid, very grey	68.	12.6	0.214	0.083	6.25	< 0.01	< 0.005	59.	0.009 3	90.7	3.1	0.15	0.067	1.03	266.	30.7	0.011 2	< 0.5	9.54	0.905	1.87	< 0.015
104-1-1	SS		2023-03-16	Slightly turbid, colourless	98.	8.81	0.198	0.094	8.	< 0.01	< 0.005	77.	0.013 6	130.	120.	0.15	0.089 9	1.15	388.	14.5	0.016 1	< 0.5	15.4	1.4	2.61	< 0.015
105-1-1	SS		2022-09-01	Slightly turbid, slightly grey	120.	12.2	0.13	0.184	33.2	< 0.01	< 0.005	98.	0.007 5	141.	4.3	< 0.1	0.109	0.314	427.	8.8	< 0.005	1.74	18.4	14.	3.73	0.073
105-1-1	SS		2022-11-29	Moderately turbid, slightly grey	110.	8.42	0.104	0.183	29.9	< 0.01	< 0.005	83.	0.006 2	109.	4.	< 0.1	0.047 1	0.306	321.	5.3	< 0.005	0.89	12.2	3.4	2.72	0.059
105-1-1	SS		2023-03-17	Low turbidity, brown in colour low intensi	100.	26.4	5.78	0.15	44.4	< 0.01	< 0.005	80.	0.006	198.	87.	< 0.1	0.121	0.217	594.	49.3	0.005 2	1.09	24.4	5.56	2.61	0.057
106-1-1	SS		2022-09-01	Moderately turbid, moderately grey	630.	291.	0.539	0.64	99.6	< 0.01	0.033 9	864.	0.136	151.	140.	3.25	8.01	19.7	507.	251.	0.133	3.54	31.3	242.	35.9	91. a
106-1-1	SS		2023-03-31	Extremely turbid, extremely grey	140.	1 640.	0.251	0.439	38.2	0.018	0.027 3	173.	0.015 3	149.	88.	4.02	2.99	7.5	476.	2 970.	0.277	0.57	25.1	424.	5.71	1.6
107-1-1	SS		2022-09-01	Very turbid, slightly grey	180.	40.1	0.317	0.23	68.9	< 0.01	< 0.005	189.	0.026 4	174.	32.	0.19	1.11	3.9	547.	74.3	0.036 3	3.21	27.1	398.	14.2	0.1
109-1-1	SS		2022-09-01	Very turbid, slightly grey	140.	11.1	0.815	18.9 b	10.1	< 0.01	< 0.005	237.	< 0.005	6.52	5.9	< 0.1	0.055 9	0.492	24.4	7.7	0.019 2	3.78	1.98	4.82	131.	0.41
109-1-1	SS		2022-11-30	Moderately turbid, moderately grey	170.	8.64	0.696	16.4 b	6.06	< 0.01	< 0.005	281.	< 0.005	7.12	3.5	< 0.1	0.036	0.161	28.5	12.5	0.041 1	5.09	2.61	3.83	160.	0.38
P1	SS		2022-05-26	Clear and colourless	600.	6.4	0.135	9.65	1 490. b	< 0.02	< 0.01	1 610.	< 0.01	81.6	110.	0.94	1.94	0.2	279.	20 700.	0.162	12.4	18.2	184.	14.3	42. a
P1	SS		2022-09-14		790.	5.1	< 0.1	7.07	1 930. b	< 0.05	< 0.025	2 650.	< 0.025	73.6	170.	1.12	3.61	< 0.25	281.	13 200.	0.034	20.2	23.5	65.1	16.3	70. a
P1	SS		2022-12-01	Clear and colourless	770.	4.2	0.82	7.38	1 590. b	< 0.05	< 0.025	2 830.	< 0.025	71.5	160.	1.35	3.71	0.71	267.	12 000.	0.575	18.3	21.5	102.	14.	72. a
P1	SS		2023-02-24	clear and colourless	460.	3.2	0.14	9.46	1 440. b	< 0.02	< 0.01	703.	< 0.01	91.1	39.	0.45	0.952	0.28	296.	23 400.	0.298	9.8	16.7	135.	4.38	23. a
P2	SS		2022-05-26	Clear and slightly yellow	870.	7.4	< 0.1	0.81	494.	< 0.05	< 0.025	3 120.	< 0.025	70.	190.	1.16	3.79	0.27	275.	598.	< 0.025	2.9	24.2	312.	14.1	72. a
P2	SS		2022-09-14		960.	7.3	< 0.1	0.86	467.	< 0.05	< 0.025	3 450.	< 0.025	82.8	210.	1.27	4.5	0.91	337.	1 470.	0.047	< 2.5	31.6	330.	14.8	82. a
P2	SS		2022-12-01	Slightly turbid, slightly yellow	980.	5.77	0.057	0.906	475.	< 0.01	< 0.005	3 040.	0.012 8	78.	200.	1.28	4.2	0.453	319.	765.	0.028 9	1.07	30.1	311.	15.5	90. a
P2	SS		2023-02-24	Very slight yellow, no turbidity	890.	4.1	0.048	0.787	480.	< 0.02	< 0.01	2 630.	< 0.01	62.1	120.	1.04	3.34	0.26	241.	516.	0.031	3.1	21.	264.	12.5	73. a
P3	SS		2022-05-26	Clear and slightly orange	1 000.	6.8	< 0.1	1.98	704.	< 0.05	< 0.025	3 680.	< 0.025	58.7	190.	1.42	4.6	0.32	253.	694.	< 0.025	4.8	25.8	282.	19.1	86. a
P3	SS		2022-09-14		990.	11.6	< 0.1	1.14	563.	< 0.05	< 0.025	3 540.	< 0.025	71.7	220.	0.97	4.3	0.5	305.	2 850.	< 0.025	< 2.5	30.5	392.	13.5	88. a
P3	SS		2022-12-01	Slightly turbid, slightly orange	960.	4.4	0.042	1.12	544.	< 0.01	< 0.005	3 220.	< 0.005	66.3	210.	0.97	3.77	0.311	287.	1 800.	0.01	1.15	29.5	379.	14.	91. a
P3	SS		2023-02-24	Clear and colourless	910.	4.	0.045	2.02	570.	< 0.02	< 0.01	3 230.	< 0.01	51.4	130.	0.98	3.26	0.28	219.	926.	0.028	3.8	22.	240.	14.3	81. a
P4	SS		2022-05-26	Clear and moderately orange	940.	3.8	< 0.04	1.55	160.	< 0.02	< 0.01	2 510.	< 0.01	82.8	200.	0.87	3.18	0.2	325.	3 100.	0.019	< 1.	28.6	696.	14.7	76. a
P4	SS		2022-09-14		890.	8.	< 0.1	1.87	171.	< 0.05	< 0.025	2 460.	< 0.025	80.6	180.	0.76	2.82	1.81	321.	7 380.	0.053	< 2.5	29.	654.	16.4	77. a
P4	SS		2022-12-01	Slightly turbid, slightly orange	880.	3.62	0.046	2.12	166.	< 0.01	< 0.005	2 470.	0.010 4	78.6	170.	0.92	2.77	0.173	315.	6 810.	0.065 1	< 0.5	28.7	652.	18.1	81. a
P4	SS		2023-02-24	Clear and colourless	920.	3.	< 0.04	1.25	138.	< 0.02	< 0.01	2 390.	< 0.01	78.2	170.	1.26	2.73	0.29	311.	1 290.	0.02	< 1.	28.	675.	14.2	78. a
52-4-0 (P7)	SS		2022-05-20	Clear and slightly yellow	1 200.	9.9	0.112	3.83	392.	< 0.02	< 0.01	2 610.	< 0.01	105.	230.	2.24	5.33	0.5	477.	15 000.	0.019	2.2	52.2	944.	0.65	120. a
52-4-0 (P7)	SS		2022-10-05		1 400.	8.3	0.1	6.92	398.	< 0.02	< 0.01	2 660.	< 0.01	125.	330. b	2.55	5.72	0.67	565.	15 000.	0.046	2.2	61.4	1 050.	0.9	140. a
52-4-0 (P7)	SS		2022-12-01	Moderately turbid, moderately brown	1 600.	17.9	0.194	7.37	414.	< 0.02	< 0.01	2 980.	< 0.01	114.	360. b	5.39	6.19	0.43	542.	18 200.	0.025	1.6	62.5	1 180.	0.97	170. a
52-4-0 (P7)	SS		2023-02-24	Clear and colourless	1 500.	11.5	0.127	5.17	449.	< 0.02	< 0.01	2 820.	< 0.01	127.	320. b	2.61	5.1	0.64	573.	19 900.	0.047	1.8	62.	1 200.	0.98	170. a
80-1-0 (P8)	SS		2022-05-20	Slightly silty and moderately brown	1 800.	85.1	2.15	13.8 b	126.	< 0.02	< 0.01	3 360.	0.019	111.	300. b	27.9	17.3 b	5.19	469.	14 900.	0.266	2.4	46.3	1 310.	1.25	450. a
80-1-0 (P8)	SS		2022-10-05		2 600.	192.	3.44	26.1 b	210.	< 0.05	< 0.025	4 060.	< 0.025	115.	510. b	55.1	21. b	4.57	487.	24 400.	0.398	< 2.5	48.2	1 610.	2.24	500. a
80-1-0 (P8)	SS		2022-12-01	Moderately turbid, very brown	1 600.	65.4	1.03	12.1 b	122.	0.012	< 0.005	2 850.	0.017 9	99.1	300. b	20.9	14.6 b	3.7	407.	10 300.	0.159	0.77	38.7	1 350.	2.16	270. a
80-1-0 (P8)	SS		2023-02-24	Clear and colourless	2 400.	226.	3.35	18.5 b	183.	0.041	< 0.01	5 470. b	0.041	128.	500. b	81.5	31.1 b	10.1	531.	13 400.	0.529	2.6	51.1	1 480.	1.7	530. a

Table 5-1. Groundwater Quality Exceedances 2022-2023

BC CSR				AW Maximum (1)			90	50	10000	2 (9)		12000	0.5-4 (5)		1500	90 (7)	40	20-90 (5)			40-160 (5)				10000	1.31-18.4 (3)
				DW Maximum (2)		9500	6	10	1000	8		5000	5		250	6000	14 (9)	1500			10	33 (9)			250	
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	Alkalinity - Total - Ph 4.5	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chloride	Chromium	Cobalt	Copper	Hardness (As Caco3)	Iron	Lead	Lithium	Magnesium	Manganese	Molybdenum	Ammonia
				Fraction	TOT	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	mg/L
				Method Detection Limit (MDL)	1	0.5	0.02	0.02	0.02	0.01	0.005	10	0.005	0.05	1	0.1	0.005	0.05	0.5	1	0.005	0.5	0.05	0.05	0.05	0.015
81-1-0 (P9)	SS		2022-10-05		230.	7.63	0.041	0.123	37.9	< 0.01	< 0.005	707.	< 0.005	79.7	92.	0.55	0.663	0.089	324.	79.1	0.011 3	0.61	30.4	144.	0.144	5.9
P10	SS		2022-05-26	Slightly silty and slightly orange	560.	2.36	0.036	0.855	747.	< 0.01	< 0.005	1 340.	0.018 3	99.3	100.	0.54	1.36	0.326	329.	504.	0.012	3.24	19.8	557.	4.68	33. a
P10	SS		2022-10-14		660.	22.2	< 0.1	0.94	921.	< 0.05	< 0.025	1 940.	< 0.025	91.8	140.	0.92	2.32	1.91	320.	609.	0.223	4.3	22.	501.	7.06	47. a
P10	SS		2022-12-01	Clear, slightly yellow	710.	6.4	0.051	0.979	921.	< 0.02	< 0.01	1 790.	< 0.01	93.1	140.	0.77	2.56	0.47	323.	568.	0.072	4.9	21.9	510.	6.75	54. a
P10	SS		2023-02-24	Very slight yellow, no turbidity	550.	4.15	0.034	1.12	726.	< 0.01	< 0.005	1 130.	< 0.005	85.8	54.	0.54	1.18	0.641	284.	498.	0.056 4	3.73	16.8	427.	3.74	33. a
P11	SS		2022-09-01	Moderately silty, very grey	110.	3.54	1.71	0.342	25.3	< 0.01	< 0.005	217.	0.013 5	131.	9.9	< 0.1	0.369	1.03	493.	5.1	0.074 2	0.72	40.3	82.8	4.43	0.34
P11	SS		2022-11-29	Clear and colourless	110.	10.6	0.186	0.087	16.5	< 0.01	< 0.005	187.	0.036 7	114.	5.	0.19	2.48	6.93	341.	21.7	0.062 5	< 0.5	13.7	189.	1.34	7.9
P11	SS		2023-03-08	Clear and colourless	88.	3.67	0.167	0.075	8.13	< 0.01	< 0.005	135.	0.032 1	155.	88.	< 0.1	0.864	2.87	473.	7.2	0.008 4	< 0.5	21.	60.2	1.32	1.4

Notes:

a	*Above CSR Schedule 3.2 AW Standard.*
b	*Above CSR Schedule 3.2 DW Standard.*
c	*Detection limits above applicable BC CSR standards.*
SS	*Single sample*
FRM	*Average of field replicates.*
(1)	*Aquatic Life (AW) Freshwater, Column 3.*
(2)	*Drinking Water (DW), Column 6.*
(3)	*Standard varies with pH. Every ammonia result was compared to a standard based on the associated pH result for that sample.*
(4)	*Standard varies with chloride. Every nitrite result was compared to a standard based on the associated chloride result for that sample.*
(5)	*Standard varies with hardness. Every result was compared to a standard that was based on the associated hardness result for that sample.*
(6)	*BC CSR Schedule 3.2 criterion for iron and manganese were not applied as directed by the Stage 8 CSR Amendments.*
(7)	*Standard is based on the trivalent (Cr(III)) species. The Cr(III) is the most common form of chromium.*
(8)	*Interim standard used for cobalt.*
(9)	*CSR Stage 13 amendments, protocol 9, background concentration is higher than the applicable CSR DW and/or most stringent CSR AW standard. A concentration above the CSR DW or most strigent CSR AW stanadard but below the regional background concentration (South Vancouver Island Region) is not considered contaminated and is not highlighted as a CSR DW or AW exceedance.*

Table 5-1. Groundwater Quality Exceedances 2022-2023

Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	Nitrite	Nitrate	Nitrite + Nitrate	Nickel	Phosphorus	Potassium	Selenium	Silicon	Silver	Sodium	Strontium	Sulphate	Sulfur	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	Zirconium	pH	Conductivity	Temperature
BC CSR				AW Maximum (1)	0.2-2 (4)	400	400	250-1500 (5)			20		0.5-15 (5)			128-429 (5)		3		1000	85		75-2400 (5)				
				DW Maximum (2)	1	10	10	80			10		20	1700 (9)	2500	500			2.5		20	20	3000				
				Fraction	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	TOT	TOT	TOT
				Unit	mg/L	mg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pH	µS/cm	°C
				Method Detection Limit (MDL)	0.005	0.02	0.02	0.02	2	0.05	0.04	50	0.005	0.05	0.05	1	3	0.002	0.2	0.5	0.002	0.2	0.1	0.1	0	0	0
16-1-2	SS		2023-03-15	White, high turbidity	< 0.005	17.9 b	17.9 b	0.382	3.2	0.241	0.219	6 540.	< 0.005	5.	261.	71.	22.7	0.004 1	< 0.2	< 0.5	0.124	0.5	3.9	< 0.1	6.85	376.	11.2
16-2-1	SS		2023-03-16	clear and colourless	0.021 2	14.5 b	14.5 b	0.561	5.7	0.351	0.176	6 790.	< 0.005	5.88	323.	55.	19.5	0.003 3	< 0.2	1.19	0.109	1.07	1.69	< 0.1	6.84	368.	10.7
16-2-2	SS		2023-03-16	clear and colourless	0.012 3	17.3 b	17.4 b	1.04	< 2.	0.3	0.19	6 770.	< 0.005	5.3	274.	63.	22.1	0.003 4	< 0.2	< 0.5	0.13	0.57	2.04	< 0.1	6.72	389.	11.
21-1-1	FR1	Y	2022-05-20		< 0.005	< 0.02	< 0.02	< 0.1	< 10.	< 0.25	< 0.2	19 500.	< 0.025	8.31	425.	12.	< 15.	< 0.01	< 1.	< 2.5	0.021	< 1.	19.8	< 0.5	8.32	127.	11.4
25-1-1	SS		2022-05-17	Clear and colourless	0.013	12.9 b	12.9 b	0.128	3.7	0.299	0.935	10 000.	< 0.005	4.51	358.	190.	53.4	< 0.002	< 0.2	< 0.5	0.248	0.44	0.39	< 0.1	7.45	505.	11.4
52-1-1	SS		2022-05-18	Clear and slightly green	< 0.005	< 0.02	< 0.02	12.1	49.	13.7	< 0.2	40 900.	< 0.025	229.	2 900. b	< 1.	< 15.	< 0.01	< 1.	< 2.5	< 0.01	< 1.	1.99	< 0.5	6.98	1 648.	13.8
52-1-1	SS		2022-09-20	Clear and colourless.	< 0.005	< 0.02	< 0.02	11.	30.3	14.9	0.127	38 700.	< 0.01	242.	3 490. b	< 1.	< 6.	< 0.004	< 0.4	< 1.	< 0.004	0.77	1.24	< 0.2	6.57	1 799.	15.3
52-1-1	SS		2022-12-16	Clear and colourless	< 0.005	< 0.02	< 0.02	12.7	37.	14.8	< 0.2	40 600.	< 0.025	242.	3 360. b	< 1.	< 15.	< 0.01	< 1.	< 2.5	< 0.01	< 1.	1.72	< 0.5	7.2	1 592.	12.4
52-1-1	SS		2023-03-02	Clear and colourless	< 0.005	< 0.02	< 0.02	10.6	25.5	13.7	0.114	37 400.	< 0.01	219.	3 310. b	< 1.	< 6.	< 0.004	< 0.4	< 1.	< 0.004	0.79	0.24	< 0.2	7.25	1 630.	13.
58-1-0	SS		2022-05-17	Clear and moderately yellow	0.072	< 0.2	< 0.2	84. b	66.4	56.5	0.372	19 100.	< 0.01	513.	4 290. b	110.	38.9	0.006 1	0.67	2.5	0.401	20.8 b	3.28	2.23	6.68	5 174.	20.
58-1-0	FR1		2022-09-22	Clear, very orange	0.179	0.457	0.636	86.7 b	92.	53.5	0.46	18 100.	< 0.025	522.	3 890. b	99.	28.	< 0.01	< 1.	< 2.5	0.388	20.9 b	5.23	2.28	6.64	5 699.	19.3
58-1-0	FR2		2022-09-22	Clear and colourless.	0.218	0.41	0.628	86.8 b	92.	54.2	0.44	18 300.	< 0.025	522.	3 900. b	100.	29.	< 0.01	< 1.	< 2.5	0.375	20.7 b	5.1	2.33	6.64	5 699.	19.3
58-1-0	SS		2022-12-13	Clear, very yellow	0.063 2	1.23	1.29	82.6 b	83.1	63.4	0.437	22 900.	< 0.01	564.	4 500. b	120.	31.7	< 0.004	0.74	3.5	0.385	30. b	4.57	2.93	6.8	5 164.	16.6
58-1-0	SS		2023-03-09	Very slight yellow, nil turbidity	< 0.05	5.81	5.81	82.4 b	86.	55.6	0.4	19 200.	< 0.025	511.	3 680. b	92.	30.	0.05	< 1.	4.9	0.415	28. b	5.2	2.58	6.87	5 841.	19.6
95-1-1	SS		2022-09-15	Very turbid, very grey	< 0.005	< 0.02	< 0.02	46.4	1 160.	1.05	0.437	32 100.	0.356	6.35	196.	36.	23.	0.124	0.57	453.	1.16	103. b	104.	1.4	7.12	395.	13.3
104-1-1	SS		2022-11-29	Very turbid, very grey	< 0.005	18.4 b	18.4 b	0.522	4.2	0.325	1.02	5 390.	< 0.005	4.47	217.	140.	44.9	0.002 4	< 0.2	< 0.5	0.204	0.84	1.04	< 0.1	7.52	437.	11.8
104-1-1	SS		2023-03-16	Slightly turbid, colourless	< 0.005	21.5 b	21.5 b	0.58	2.7	0.512	0.911	5 370.	< 0.005	36.6	345.	120.	43.5	0.008 6	< 0.2	0.61	0.597	0.84	1.38	< 0.1	7.61	713.	9.9
105-1-1	SS		2022-09-01	Slightly turbid, slightly grey	0.093 8	22.8 b	22.9 b	0.861	4.9	1.54	1.36	5 600.	< 0.005	5.44	254.	240.	77.	0.011 2	0.38	< 0.5	0.834	0.35	0.36	< 0.1	6.61	695.	13.5
105-1-1	SS		2022-11-29	Moderately turbid, slightly grey	0.023 2	11.2 b	11.2 b	0.366	6.5	1.34	1.26	5 880.	< 0.005	4.36	184.	180.	55.2	0.006 5	< 0.2	< 0.5	0.46	0.41	0.28	< 0.1	7.62	507.	11.8
105-1-1	SS		2023-03-17	Low turbidity, brown in colour low intensi	0.052 6	32. b	32.1 b	0.416	3.7	1.52	1.49	5 900.	< 0.005	8.56	367.	290.	92.7	0.008	< 0.2	< 0.5	0.602	0.44	1.16	< 0.1	7.63	930.	11.5
106-1-1	SS		2022-09-01	Moderately turbid, moderately grey	1.92 b	10.9 b	12.8 b	19.9	30.9	21.5	0.336	6 340.	< 0.005	74.8	609.	250.	74.2	0.021 5	0.93	2.12	1.53	1.22	5.91	0.44	7.43	2 162.	20.9
106-1-1	SS		2023-03-31	Extremely turbid, extremely grey	0.097	20.8 b	20.9 b	4.09	76.9	2.45	0.107	8 180.	0.006 1	66.	435.	260.	93.4	< 0.002	< 0.2	32.2	0.564	9.25	6.07	0.19	7.56	2 200.	14.1
107-1-1	SS		2022-09-01	Very turbid, slightly grey	0.288	23.9 b	24.2 b	3.61	7.9	1.21	0.225	5 860.	< 0.005	10.1	390.	270.	85.4	0.011 8	0.2	0.95	0.867	0.59	0.93	< 0.1	7.75	1 083.	21.
109-1-1	SS		2022-09-01	Very turbid, slightly grey	0.022 3	0.044	0.066	0.889	32.2	1.24	2.47	11 900.	< 0.005	85.9	83.2	76.	24.8	0.028 5	< 0.2	< 0.5	1.52	5.04	1.29	< 0.1	8.74	460.	21.9
109-1-1	SS		2022-11-30	Moderately turbid, moderately grey	0.024 3	0.029	0.053	0.439	35.3	1.11	1.06	13 300.	< 0.005	101.	109.	89.	27.6	0.003 9	< 0.2	< 0.5	2.36	1.52	0.31	< 0.1	7.98	387.	14.6
P1	SS		2022-05-26	Clear and colourless	< 0.005	< 0.02	< 0.02	7.33	86.9	37.6	0.08	19 800.	< 0.01	120.	957.	< 1.	< 6.	< 0.004	0.43	< 1.	0.024 1	0.64	7.22	< 0.2	7.09	1 261.	16.
P1	SS		2022-09-14		0.005	< 0.02	< 0.02	8.45	164.	58.5	< 0.2	21 100.	< 0.025	217.	1 080.	< 1.	< 15.	< 0.01	< 1.	< 2.5	< 0.01	< 1.	2.06	< 0.5	7.11	1 913.	18.3
P1	SS		2022-12-01	Clear and colourless	0.007 1	0.029	0.036	14.6	85.	53.2	< 0.2	20 000.	< 0.025	187.	1 000.	4.1	< 15.	< 0.01	< 1.	< 2.5	0.033	< 1.	50.9	< 0.5	7.1	1 730.	16.5
P1	SS		2023-02-24	clear and colourless	< 0.005	< 0.02	< 0.02	7.42	46.8	20.4	< 0.08	18 200.	< 0.01	44.	1 060.	1.2	< 6.	< 0.004	< 0.4	< 1.	0.029 9	< 0.4	30.8	< 0.2	7.07	888.	16.1
P2	SS		2022-05-26	Clear and slightly yellow	< 0.05	0.29	0.29	9.45	35.	65.2	< 0.2	11 800.	< 0.025	225.	922.	< 1.	< 15.	< 0.01	< 1.	< 2.5	0.018	2.2	1.88	< 0.5	7.22	1 924.	16.9
P2	SS		2022-09-14		0.015 9	0.069	0.085	9.88	53.	76.	< 0.2	13 000.	< 0.025	276.	1 210.	< 1.	< 15.	< 0.01	< 1.	< 2.5	0.017	2.4	5.88	< 0.5	7.35	2 157.	16.5
P2	SS		2022-12-01	Slightly turbid, slightly yellow	0.018 9	< 0.02	0.031	9.44	22.	72.6	0.155	12 100.	< 0.005	256.	1 170.	< 1.	< 3.	< 0.002	0.29	< 0.5	0.018 5	2.78	2.92	0.39	7.24	1 927.	12.8
P2	SS		2023-02-24	Very slight yellow, no turbidity	< 0.005	< 0.02	< 0.02	7.23	22.7	59.1	0.095	11 900.	< 0.01	199.	924.	< 1.	< 6.	< 0.004	< 0.4	< 1.	0.017 3	2.27	2.97	0.28	7.3	1 742.	15.5
P3	SS		2022-05-26	Clear and slightly orange	< 0.05	< 0.2	< 0.2	10.9	41.	79.7	< 0.2	14 700.	< 0.025	279.	937.	< 1.	< 15.	< 0.01	< 1.	< 2.5	0.013	2.9	2.25	< 0.5	7.22	2 197.	16.3
P3	SS		2022-09-14		0.14	0.034	0.174	9.41	44.	78.1	< 0.2	14 000.	< 0.025	286.	1 000.	< 1.	< 15.	< 0.01	< 1.	< 2.5	0.011	1.9	1.92	< 0.5	7.13	2 226.	16.
P3	SS		2022-12-01	Slightly turbid, slightly orange	0.036 9	< 0.02	0.05	7.95	16.7	75.6	0.16	13 200.	< 0.005	249.	1 010.	2.3	< 3.	< 0.002	< 0.2	< 0.5	0.010 3	2.24	0.9	0.2	7.16	1 625.	11.6
P3	SS		2023-02-24	Clear and colourless	0.019 6	0.025	0.045	7.16	26.3	69.9	0.106	15 200.	< 0.01	223.	889.	< 1.	< 6.	< 0.004	< 0.4	< 1.	0.010 2	2.64	2.87	0.21	7.36	1 678.	14.4
P4	SS		2022-05-26	Clear and moderately orange	0.935	0.95	1.89	7.73	24.7	64.5	0.153	14 100.	< 0.01	221.	926.	< 1.	< 6.	< 0.004	< 0.4	< 1.	0.012 4	2.02	1.17	< 0.2	7.05	2 004.	15.6
P4	SS		2022-09-14		0.014 3	0.033	0.047	8.1	43.	60.	< 0.2	14 300.	< 0.025	224.	847.	< 1.	< 15.	< 0.01	< 1.	< 2.5	< 0.01	1.9	6.98	< 0.5	7.09	2 011.	16.
P4	SS		2022-12-01	Slightly turbid, slightly orange	0.015 6	< 0.02	0.032	7.29	43.6	60.2	0.146	14 200.	< 0.005	216.	851.	< 1.	< 3.	< 0.002	0.22	0.85	0.010 6	2.6	1.63	0.21	7.04	1 770.	13.1
P4	SS		2023-02-24	Clear and colourless	0.005 7	0.095	0.101	7.18	25.1	63.	0.117	13 100.	< 0.01	213.	904.	< 1.	< 6.	< 0.004	< 0.4	< 1.	0.011 5	2.08	0.55	< 0.2	7.09	1 085.	13.4
52-4-0 (P7)	SS		2022-05-20	Clear and slightly yellow	< 0.005	< 0.02	< 0.02	13.1	302.	103.	0.127	18 500.	< 0.01	282.	1 070.	1.3	< 6.	< 0.004	0.58	1.9	0.022 8	2.4	6.32	0.54	6.7	2 959.	18.
52-4-0 (P7)	SS		2022-10-05		0.006 1	< 0.02	< 0.02	15.1	299.	109.	0.888	22 300.	< 0.01	326.	1 370.	59.	< 6.	< 0.004	0.54	1.7	0.021 7	2.66	16.1	0.67	6.9	3 482.	18.6
52-4-0 (P7)	SS		2022-12-01	Moderately turbid, moderately brown	< 0.005	< 0.02	< 0.02	17.2	550.	108.	0.155	20 800.	< 0.01	320.	1 340.	< 1.	< 6.	< 0.004	1.17	8.8	0.023 7	5.67	3.68	1.53	6.84	3 440.	15.2
52-4-0 (P7)	SS		2023-02-24	Clear and colourless	< 0.005	0.027	0.027	16.6	276.	115.	0.134	20 600.	< 0.01	341.	1 430.	< 1.	< 6.	< 0.004	29.5	2.6	0.026	3.2	19.2	0.75	7.01	3 063.	13.7
80-1-0 (P8)	SS		2022-05-20	Slightly silty and moderately brown	< 0.05	< 0.2	< 0.2	33.4	2 560.	118.	0.336	17 400.	< 0.01	340.	793.	18.	7.7	< 0.004	2.21	36.7	0.427	31.9 b	5.71	6.53	7.08	3 994.	15.3
80-1-0 (P8)	SS		2022-10-05		< 0.05	< 0.2	< 0.2	52.	5 230.	159.	0.84	19 600.	< 0.025	443.	977.	10.	< 15.	< 0.01	10.2	104.	0.312	70. b	9.05	15.8	7.29	4 069.	17.7
80-1-0 (P8)	SS		2022-12-01	Moderately turbid, very brown	< 0.05	< 0.2	< 0.2	31.9	864.	101.	0.442	16 300.	< 0.005	289.	871.	58.	15.4	0.002 6	2.27	31.5	0.531	44.7 b	9.15	9.46	7.3	3 061.	10.2
80-1-0 (P8)	SS		2023-02-24	Clear and colourless	< 0.05	< 0.2	< 0.2	69.9	2 500.	201.	0.668	25 600.	< 0.01	570.	1 250.	5.	18.6	< 0.004	11.9	107.	0.593	93.4 b	19.7	19.7	7.56	5 075.	11.8

Table 5-1. Groundwater Quality Exceedances 2022-2023

BC CSR				AW Maximum (1)	0.2-2 (4)	400	400	250-1500 (5)			20		0.5-15 (5)			128-429 (5)		3		1000	85		75-2400 (5)				
				DW Maximum (2)	1	10	10	80			10		20	1700 (9)	2500	500			2.5		20	20	3000				
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	Nitrite	Nitrate	Nitrite + Nitrate	Nickel	Phosphorus	Potassium	Selenium	Silicon	Silver	Sodium	Strontium	Sulphate	Sulfur	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	Zirconium	pH	Conductivity	Temperature
				Fraction	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	TOT	TOT	TOT
				Unit	mg/L	mg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pH	µS/cm	°C
				Method Detection Limit (MDL)	0.005	0.02	0.02	0.02	2	0.05	0.04	50	0.005	0.05	0.05	1	3	0.002	0.2	0.5	0.002	0.2	0.1	0.1	0	0	0
81-1-0 (P9)	SS		2022-10-05		< 0.005	< 0.02	< 0.02	6.26	228.	2.85	18.7 b	17 300.	< 0.005	36.	1 080.	75.	76.6	< 0.002	0.21	< 0.5	0.029 7	0.27	0.17	< 0.1	7.63	838.	17.7
P10	SS		2022-05-26	Slightly silty and slightly orange	0.028 3	0.208	0.237	4.03	6.6	29.9	0.076	14 700.	< 0.005	89.4	1 020.	< 1.	< 3.	< 0.002	0.47	< 0.5	0.012	0.74	2.01	0.1	7.05	1 110.	15.8
P10	SS		2022-10-14		0.008 9	0.38	0.389	6.52	52.	41.2	< 0.2	14 900.	< 0.025	150.	1 060.	< 1.	< 15.	< 0.01	< 1.	< 2.5	< 0.01	< 1.	4.76	< 0.5	7.4	1 459.	15.5
P10	SS		2022-12-01	Clear, slightly yellow	0.007	0.024	0.031	6.67	22.2	41.7	0.106	15 700.	< 0.01	156.	1 060.	< 1.	< 6.	0.004 9	< 0.4	< 1.	0.016 6	0.9	2.05	< 0.2	7.02	1 414.	13.
P10	SS		2023-02-24	Very slight yellow, no turbidity	< 0.005	< 0.02	< 0.02	3.38	9.7	27.9	0.064	14 700.	< 0.005	84.2	957.	< 1.	< 3.	< 0.002	< 0.2	< 0.5	0.010 7	0.77	1.11	< 0.1	7.9	986.	14.8
P11	SS		2022-09-01	Moderately silty, very grey	0.119	19.7 b	19.8 b	0.786	11.2	1.6	0.114	11 200.	< 0.005	17.2	1 160.	360.	117.	0.003 8	< 0.2	< 0.5	0.708	0.95	0.54	< 0.1	7.39	906.	16.9
P11	SS		2022-11-29	Clear and colourless	0.056 5	32.2 b	32.3 b	1.73	6.3	3.85	0.69	6 520.	< 0.005	13.8	339.	190.	58.4	0.007 2	< 0.2	< 0.5	0.292	0.72	4.38	< 0.1	6.87	645.	11.8
P11	SS		2023-03-08	Clear and colourless	0.056 3	30.3 b	30.4 b	0.927	6.	2.2	0.747	6 140.	< 0.005	14.9	380.	170.	61.2	0.009	< 0.2	< 0.5	0.473	0.68	3.85	< 0.1	7.06	716.	10.2

Notes:

a	*Above CSR Schedule 3.2 AW Standard.*
b	*Above CSR Schedule 3.2 DW Standard.*
c	*Detection limits above applicable BC CSR standards.*
SS	*Single sample*
FRM	*Average of field replicates.*
(1)	*Aquatic Life (AW) Freshwater, Column 3.*
(2)	*Drinking Water (DW), Column 6.*
(3)	*Standard varies with pH. Every ammonia result was compared to a standard based on t associated pH result for that sample.*
(4)	*Standard varies with chloride. Every nitrite result was compared to a standard based on associated chloride result for that sample.*
(5)	*Standard varies with hardness. Every result was compared to a standard that was based associated hardness result for that sample.*
(6)	*BC CSR Schedule 3.2 criterion for iron and manganese were not applied as directed by Stage 8 CSR Amendments.*
(7)	*Standard is based on the trivalent (Cr(III)) species. The Cr(III) is the most common form chromium.*
(8)	*Interim standard used for cobalt.*
(9)	*CSR Stage 13 amendments, protocol 9, background concentration is higher than the applicable CSR DW and/or most stringent CSR AW standard. A concentration above the CSR DW or most strigent CSR AW stanadard but below the regional background concentration (South Vancouver Island Region) is not considered contaminated and is not highlighted as a CSR DW or AW exceedance.*

File Location: C:\USERS\SUSAN.A.POWELL\DESKTOP_WFH\60631284\HARTLAND LANDFILL 2022-2023\900-CAD_GIS\910-CAD\20-SHEETS\C\434 - 2022-23 ANNUAL REPORT\FIG5.1_EC PLAN_60631284-2022.DWG

Date Plotted: September 27, 2023

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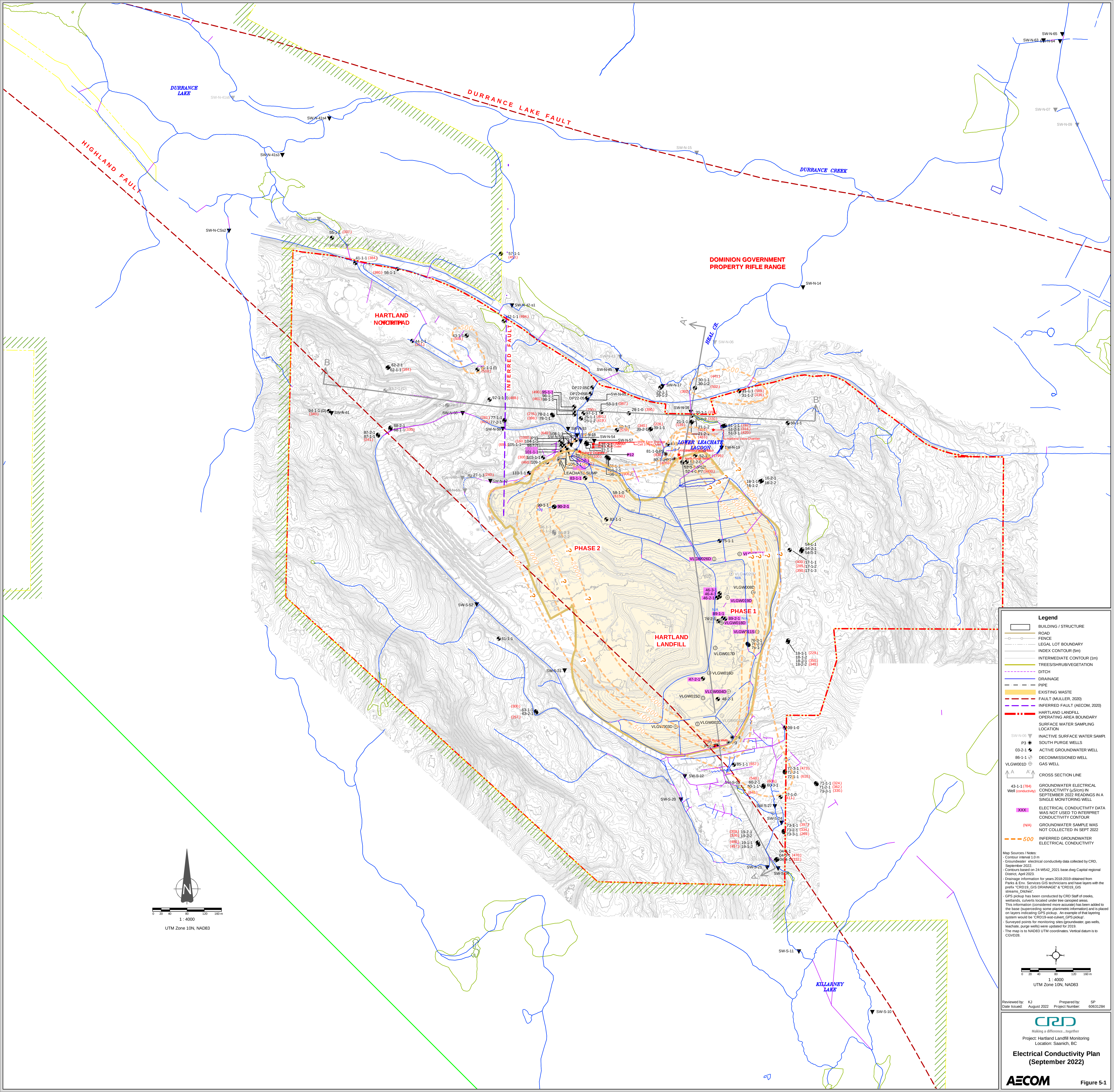


Legend

▭	BUILDING / STRUCTURE
—	ROAD
—□—□—	FENCE
—·—·—	LEGAL LOT BOUNDARY
—	INDEX CONTOUR (5m)
—	INTERMEDIATE CONTOUR (1m)
—	TREES/SHRUB/VEGETATION
- - - -	DITCH
—	DRAINAGE
—·—·—	PIPE
▬	EXISTING WASTE
— — —	FAULT (MULLER, 2020)
— — —	INFERRED FAULT (AECOM, 2020)
—▪▪—	HARTLAND LANDFILL OPERATING AREA BOUNDARY
	SURFACE WATER SAMPLING LOCATION
SW-N-06 ▼	INACTIVE SURFACE WATER SAMPL
P3 ◉	SOUTH PURGE WELLS
03-2-1 ●	ACTIVE GROUNDWATER WELL
86-1-1 ●	DECOMMISSIONED WELL
VLGW001D ⊕	GAS WELL
A A'	CROSS SECTION LINE
43-1-1 (784) Well (conductivity)	GROUNDWATER ELECTRICAL CONDUCTIVITY (µS/cm) IN SEPTEMBER 2022 READINGS IN A SINGLE MONITORING WELL
XXX	ELECTRICAL CONDUCTIVITY DATA WAS NOT USED TO INTERPRET CONDUCTIVITY CONTOUR
(N/A)	GROUNDWATER SAMPLE WAS NOT COLLECTED IN SEPT 2022
— — 500	INFERRED GROUNDWATER ELECTRICAL CONDUCTIVITY

Map Sources / Notes:
- Contour interval 1.0 m
- Groundwater electrical conductivity data collected by CRD, September 2022.
- Contours based on 24-W542_2021 base.dwg Capital regional District, April 2023.
- Drainage information for years 2018-2019 obtained from Parks & Env. Services GIS technicians and have layers with the prefix "CRD19_GIS DRAINAGE" & "CRD19_GIS streams_Ditches".
- GPS pickup has been conducted by CRD Staff of creeks, wetlands, culverts located under tree canopied areas. This information (considered more accurate) has been added to the base (superceding some planimetric information) and is placed on layers indicating GPS pickup. An example of that layering system would be 'CRD19-wat-culvert_GPS pickup'.
- Surveyed points for monitoring sites (groundwater, gas wells, leachate, purge wells) were updated for 2019.
- The map is to NAD83 UTM coordinates. Vertical datum is to CGVD28.

0 20 40 80 120 160 m
1 : 4000
UTM Zone 10N, NAD83

Reviewed by:	KJ	Prepared by:	SP
Date Issued:	August 2022	Project Number:	60631284

Making a difference...together

Project: Hartland Landfill Monitoring
Location: Saanich, BC

Electrical Conductivity Plan (September 2022)

Figure 5-1

Legend

85-1-1 (6.5m)	MONITORING WELL (NUMBER) INDICATES DISTANCE WELL IS FROM PLANE OF SECTION. WHERE NOT INDICATED, DISTANCE IS LESS THAN 2 m.
	SCREENED INTERVAL
	WATER BEARING FRACTURES
	GROUND SURFACE
	LOCATION OF BEDROCK DERIVED FROM 1954 GROUND CONTOUR OR BEDROCK INTERSECTIONS IN BOREHOLES
	REFUSE
	CLAY BERM
	UNCONSOLIDATED SOIL AND FILL
	INTERPRETED GROUNDWATER POTENTIOMETRIC SURFACE IN BEDROCK (SEPTEMBER 2022)
	INTERPRETED LEACHATE MOUND
	INFERRED VERTICAL LEACHATE FLOW
	FAULT (MULLER 1980)
	INFERRED ELECTRICAL CONDUCTIVITY CONTOUR (SEPTEMBER 2022).
834.0	ELECTRICAL CONDUCTIVITY SEPTEMBER 2022 (µ S/cm)
(N/A)	GROUNDWATER SAMPLE WAS NOT COLLECTED IN SEPTEMBER 2022
537.0	ELECTRICAL CONDUCTIVITY DATA WAS NOT USED TO INTERPRET CONDUCTIVITY CONTOUR

Map Sources / Notes:
- Contours based on 24W542_2022 base.dwg, provided by the Capital Regional District, April 2023.
- Stratigraphy between boreholes is inferred and may vary from that shown

0 10 20 40 60 80 m
1 : 2000
Section Looking West

Reviewed by: KJ
Date Issued: August 2023
Prepared by: SP
Project Number: 60631284

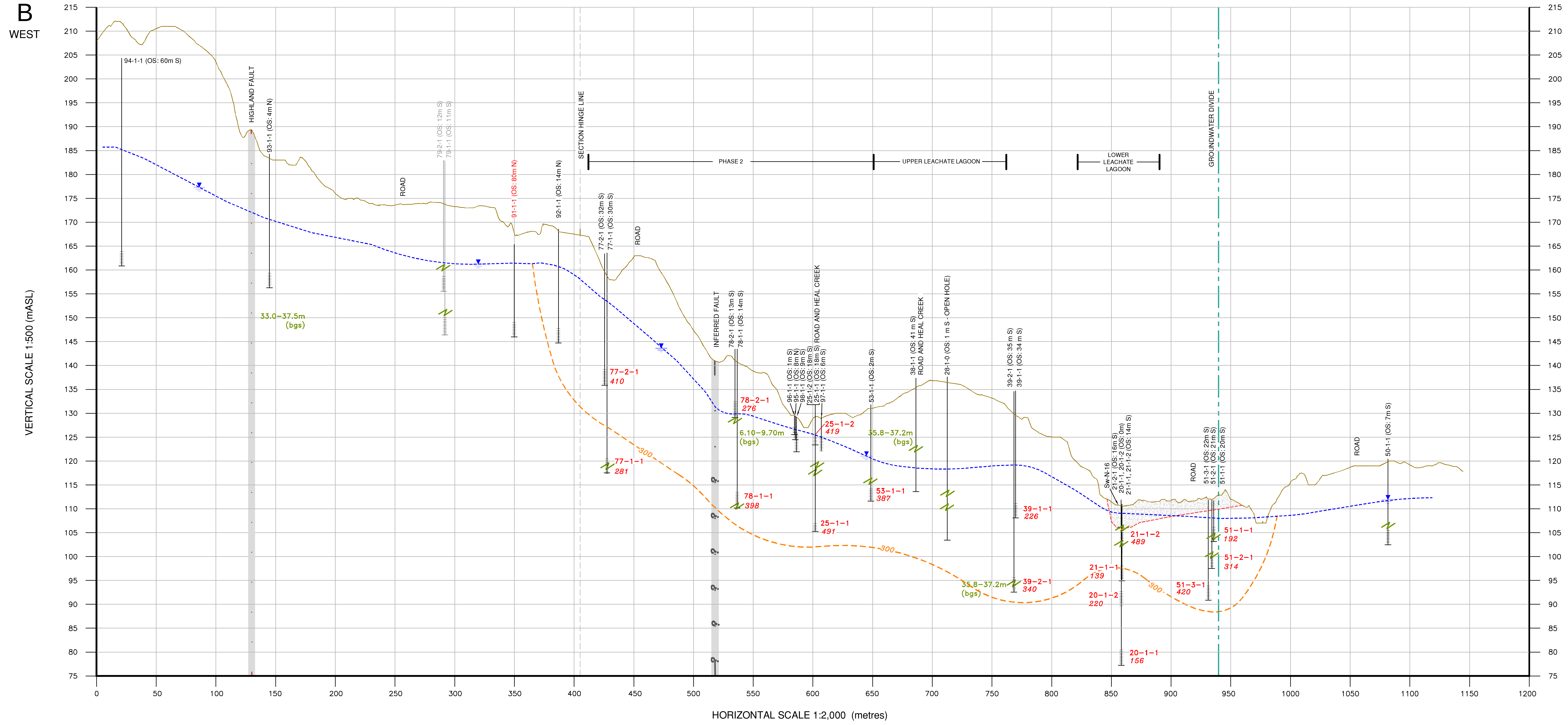
Project: Hartland Landfill Monitoring
Location: Saanich, BC

Electrical Conductivity in Cross Section A-A' (SEPTEMBER 2022)

AECOM

Figure 5-2

File Location: C:\USERS\SUSAN.A.POWELL\DESKTOP\DESKTOP_WFH\60631284HARTLAND LANDFILL 2022-2023\900-CAD_GIS\910-CAD\20-SHEETS\C\434 - 2022-23 ANNUAL REPORT\FIG5.2 & FIG5.3 - GW SECTIONS-A&B-60631284-2022.DWG Date Plotted: September 26, 2023 Saved By: susan.a.powell



Legend

85-1-1 (6.5m)	MONITORING WELL (NUMBER) INDICATES DISTANCE WELL IS FROM PLANE OF SECTION. WHERE NOT INDICATED, DISTANCE IS LESS THAN 2 m.
⊥	SCREENED INTERVAL
⚡	WATER BEARING FRACTURES
—	GROUND SURFACE
- - -	LOCATION OF BEDROCK DERIVED FROM 1954 GROUND CONTOUR OR BEDROCK INTERSECTIONS IN BOREHOLES
▨	UNCONSOLIDATED SOIL AND FILL
- -▼- -	INTERPRETED GROUNDWATER POTENTIOMETRIC SURFACE IN BEDROCK (SEPTEMBER 2022)
– – –	INFERRED ELECTRICAL CONDUCTIVITY CONTOUR (SEPTEMBER 2022).
834.0	ELECTRICAL CONDUCTIVITY SEPTEMBER 2022 (µ S/cm)
(N/A)	GROUNDWATER SAMPLE WAS NOT COLLECTED IN SEPTEMBER 2022
▨	FAULT (MULLER, 1980)
?	INFERRED FAULT (AECOM, 2017)

Map Sources / Notes:
- Contours based on 24W542_2022 base.dwg, provided by the Capital Regional District, April 2023.
- Stratigraphy between boreholes is inferred and may vary from that shown

0 10 20 40 60 80 m
1 : 2000
Section Looking North

Reviewed by: KJ
Date Issued: August 2023
Prepared by: SP
Project Number: 60631248

Project: Hartland Landfill Monitoring
Location: Saanich, BC

Electrical Conductivity in Cross Section B-B' (September 2022)

AECOM

Figure 5-3

File Location: C:\USERS\SUSAN.A.POWELL\DESKTOP\DESKTOP_WFH\60631284HARTLAND LANDFILL 2022-2023\900-CAD_GIS\910-CAD\20-SHEETS\C\434 - 2022-23 ANNUAL REPORT\FIG5.2 & FIG5.3 - GW SECTIONS-A&B-60631284-2022.DWG Date Plotted: September 26, 2023 Saved By: susan.a.powell

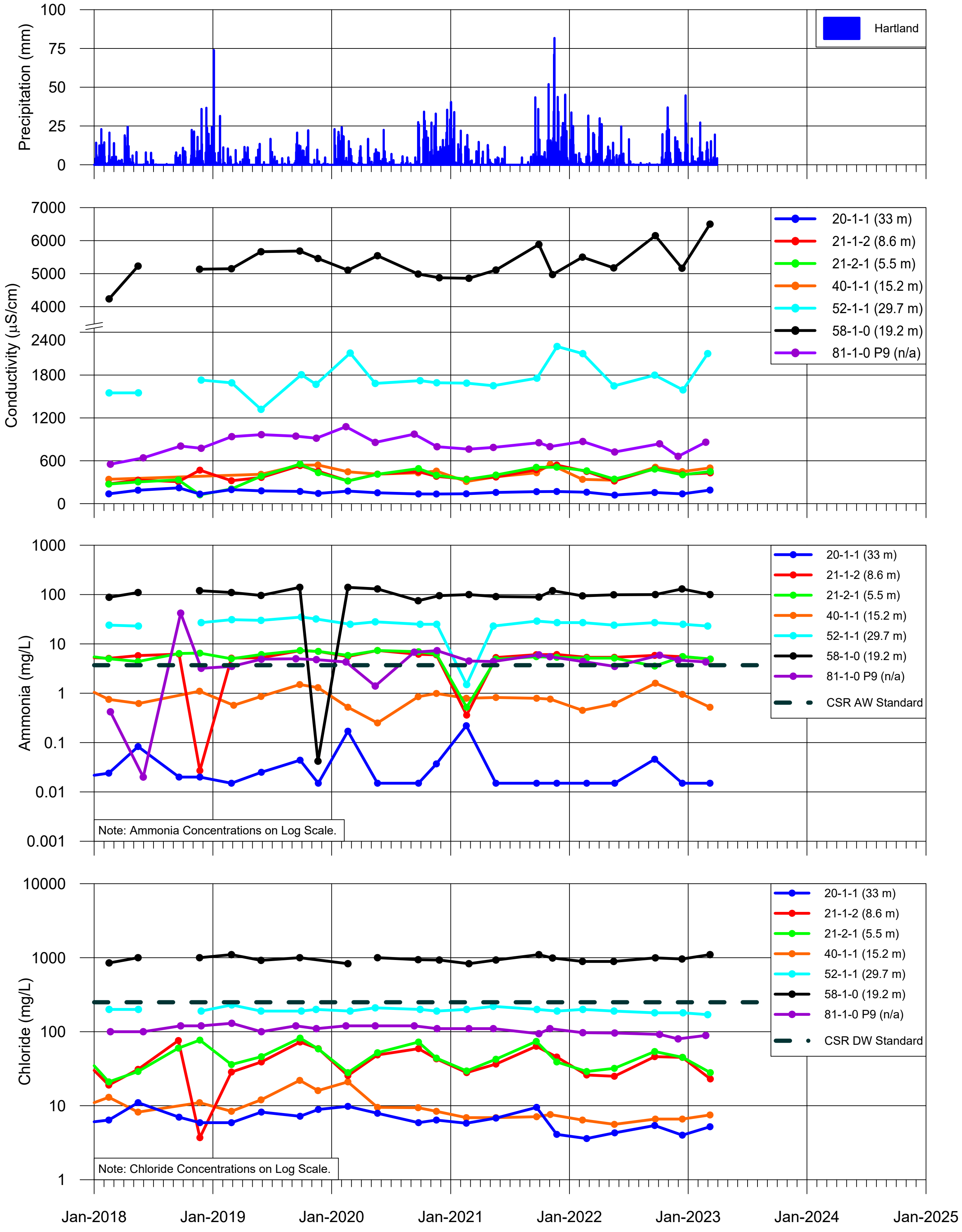


Figure 5-4. Groundwater Quality North of Phase 1

5.5.3 Monitoring Site 40

Monitoring well GW-40-1-1 is not a Boundary Compliance Well and was installed between the upper and lower leachate lagoons, approximately 70 m from the property boundary. Water quality impacts associated with leachate have been investigated at this location in the past and were subject of a previous report (AECOM 2009a). In 2022/23, all parameters met the CSR AW and DW standards on all sampling dates, and conductivity values remained below 510 µS/cm. Conductivity in GW-40-1-1 exhibited a pattern that was consistent with the north purge wells, with the most elevated conductivity observed in September 2022. Ammonia and nitrate concentrations were higher than those observed in 2021/22, while chloride concentrations were slightly lower.

Long-term concentrations of leachate indicator parameters (i.e., conductivity, ammonia, and chloride) suggest groundwater quality continued to improve at GW-40-1-1. The improvements in groundwater quality are likely due to reduced landfill leachate generation and ongoing lowering of the Phase 1 leachate mound following closure of Phase 2 Cell 1 in 2011. Further, the operation of GW-80-1-0-P8 and GW-81-1-0-P9 as purge wells since 2016 has also likely improved leachate collection in this area. This hypothesis is supported by the observation of more concentrated leachate collected by the North Purge wells in 2022/23. Statistical trend analysis revealed a decreasing trend in chloride concentrations over the past five years. However, sulphate concentrations were elevated slightly throughout 2022/23, ranging from 32 to 56 mg/L, and nitrate concentrations were elevated, ranging from 1.41 to 6.06 mg/L. Ammonia concentrations were elevated throughout the monitoring year, ranging from 0.52 to 1.60 mg/L. These water quality trends may reflect aggregate runoff impacts.

Water quality at GW-40-1-1 should continue to be closely monitored to verify the effectiveness of leachate collection north of the Phase 1 landfill and to identify any potential water quality impacts associated with aggregate stockpiling at Hartland. The ongoing purge well performance evaluation program should be expanded to include GW-81-1-0-P9, with the value of each well assessed based on the rate of contaminant mass removal.

5.5.4 Monitoring Sites 20 and 21

Monitoring locations 20 and 21 are considered Boundary Compliance Wells and are located directly north of the Phase 1 landfill and the lower leachate lagoon and between 5 and 15 m from the landfill property boundary. These monitors are in the most probable path for any potential subsurface leachate migration below the unlined lower lagoon. The concentrations of leachate indicator parameters at locations 20, 21, 40, 52, and 58 are plotted against time in Figure 5-4.

In 2022/23, groundwater quality at locations 20 and 21 met both CSR AW and DW standards, except for one copper concentration (41.5 µg/L) in GW-21-1-1 in May 2022, which exceeded the CSR AW standard. However, the recorded exceedance may not accurately represent in-situ water quality due to the high discrepancy between parent and duplicate samples. Copper concentrations observed in GW-21-1-1 throughout the rest of the monitoring year were low, ranging from 0.227 to 0.285 µg/L.

Groundwater quality in wells GW-21-1-2 and GW-21-2-1 have generally exhibited higher conductivity and ammonia/chloride concentrations because they were screened at shallower depths than adjacent wells. In 2022/23, conductivity concentrations in wells GW-21-1-2 and GW-21-2-1 ranged from 316 to 489 µS/cm, slightly lower than those observed in 2021/22. Chloride concentrations at location 21 have remained well-below the CSR DW standard (250 mg/L) since 1997 and below 60 mg/L in 2022/23. At location 20, conductivity values stayed below 220 µS/cm, and ammonia and chloride concentrations were consistent with background values. Sulphate and ammonia remained within their historical ranges in all four wells.

Over the past five years, groundwater quality data have exhibited statistically significant decreasing trends in ammonia in wells GW-21-2-1 and GW-20-1-2. Furthermore, chloride concentrations have exhibited a statistically significant decreasing trends in wells GW-20-1-2 and GW-20-1-1. These decreasing trends in leachate indicator parameters shows improved water quality at these locations. Overall, groundwater at monitoring stations 20 and 21 was not impacted by landfill leachate or aggregate stockpiling.

5.5.5 Monitoring Site 31

Monitoring wells at location 31 are considered Boundary Compliance Wells and they are located along the landfill north property line, south of Willis Point Road and 160 m northeast of the lower leachate lagoon. They are downgradient of the landfill and have the lowest groundwater elevations measured at the site.

In 2022/23, groundwater quality at location 31 met both CSR AW and DW standards. While the concentrations of conductivity, hardness, ammonia, sulphate, and nitrate were lower than their peak levels observed in Q3 and Q4 of 2021, which were associated with the wastewater residual spill event in October 2020, these parameters remained elevated compared to historical ranges. Conductivity and sulphate concentrations remain elevated, ranging from 436 to 589 µS/cm and 85.0 to 270 mg/L, respectively. Moreover, sulphate and conductivity in groundwater samples collected from GW-31-1-1 and GW-31-1-2 have exhibited statistically significant increasing trends for the past five years. In 2022/23, average nitrate concentrations increased by a factor of 4.0 in GW-31-1-2 (average of 1.36 mg/L) and by a factor of 1.5 in GW-31-1-1 (average of 0.65 mg/L). Groundwater quality at this location is impacted by aggregate stockpiling on the Northeast Ridge and should continue to be monitored closely.

5.5.6 Monitoring Sites 29 and 30

Monitoring locations 29 and 30 are located north of Willis Point Road and are Boundary Compliance Wells. Long-term conductivity, ammonia, and chloride concentrations trends observed at these locations are displayed in Figure 5-5. In 2022/23, all parameters met applicable CSR standards at sites 29 and 30.

At monitoring locations 29 and 30, elevated conductivity and chloride concentrations observed since 2007 likely reflect intermittent road salting on Willis Point Road. The District of Saanich has confirmed the use of de-icing salt (sodium chloride) on an as-needed basis on this road for several years and that no records of application dates are kept. As shown on Figure 5-5, conductivity and chloride concentrations measured in the shallow monitors at locations 29 and 30 have exhibited seasonal fluctuations for a very long time, with maximum concentrations typically occurring in winter and early spring months. In 2022/23, chloride concentrations at locations 29 and 30 remained below 100 mg/L, and ammonia concentrations remained very low (<0.02 mg/L). Low conductivity, chloride, and ammonia concentrations indicate that landfill leachate is not impacting groundwater quality north of Willis Point Road. The occasional elevated ammonia/nitrate concentration may reflect organic processes that occur in lowland environments during the winter season, which is supported by simultaneous observation of increased iron and manganese concentrations.

In 2022/23 nitrate concentrations observed at sites 29 and 30 continued to increase, with the average nitrate concentration observed at GW-29-1-1 increasing to 1.19 mg/L, and average nitrate concentrations observed at Site GW-30-1-2 increasing to 1.54 mg/L. Over the past five years, groundwater quality data collected from wells at locations 29 and 30 has exhibited statistically significant decreasing trends in chloride and nitrate concentrations in GW-30-1-1, however increasing trends in conductivity have been observed at GW-29-1-2 and GW-30-1-1. Additionally, increasing trends in sulphate concentrations have been observed at GW-29-1-1, GW-29-1-2, and GW-30-1-2. Sulphate concentrations at these stations were <51.5 mg/L, but the occasionally elevated nitrate concentrations are likely associated with surface water runoff from the Northwest and Northeast aggregate stockpiles.

5.5.7 Monitoring Sites 28 and 39

Groundwater monitoring wells 28 and 39 are located between the upper leachate lagoon and Willis Point Road and are considered Boundary Compliance Wells. In 2022/23, groundwater quality at sites 28 and 39 met CSR standards.

Similar to previous years, ammonia concentrations observed in well GW-28-1-0 were below the detection limit, and chloride concentrations were low, indicating groundwater quality was not impacted by landfill leachate. Sulphate concentrations were low, and over the past five years, groundwater quality in well GW-28-1-0 has exhibited statistically significant increasing trends in conductivity and nitrate concentrations. However, nitrate concentrations were less than 0.514 mg/L on all sampling dates.

At groundwater monitoring station 39, conductivity values were below 400 µS/cm, and nitrate concentrations decreased on most sampling dates. However, nitrate concentration was elevated at 7.49 mg/L in GW-39-1-1 and 1.94 mg/L in GW-39-2-1 in March 2023. Groundwater quality in both wells has exhibited statistically significant increasing trends in sulphate and nitrate concentrations, and a decreasing trend in ammonia concentration has been observed at GW-39-1-1. On all sampling dates, sulphate concentrations in both wells were below 25 mg/L. Overall, the slight increase in nitrate levels observed in groundwater at sites 28 and 39 may suggest minor impacts related to aggregate production, stockpiling and road construction activities along the northern property boundary. Groundwater quality at these locations should be monitored closely to evaluate aggregate runoff impacts.

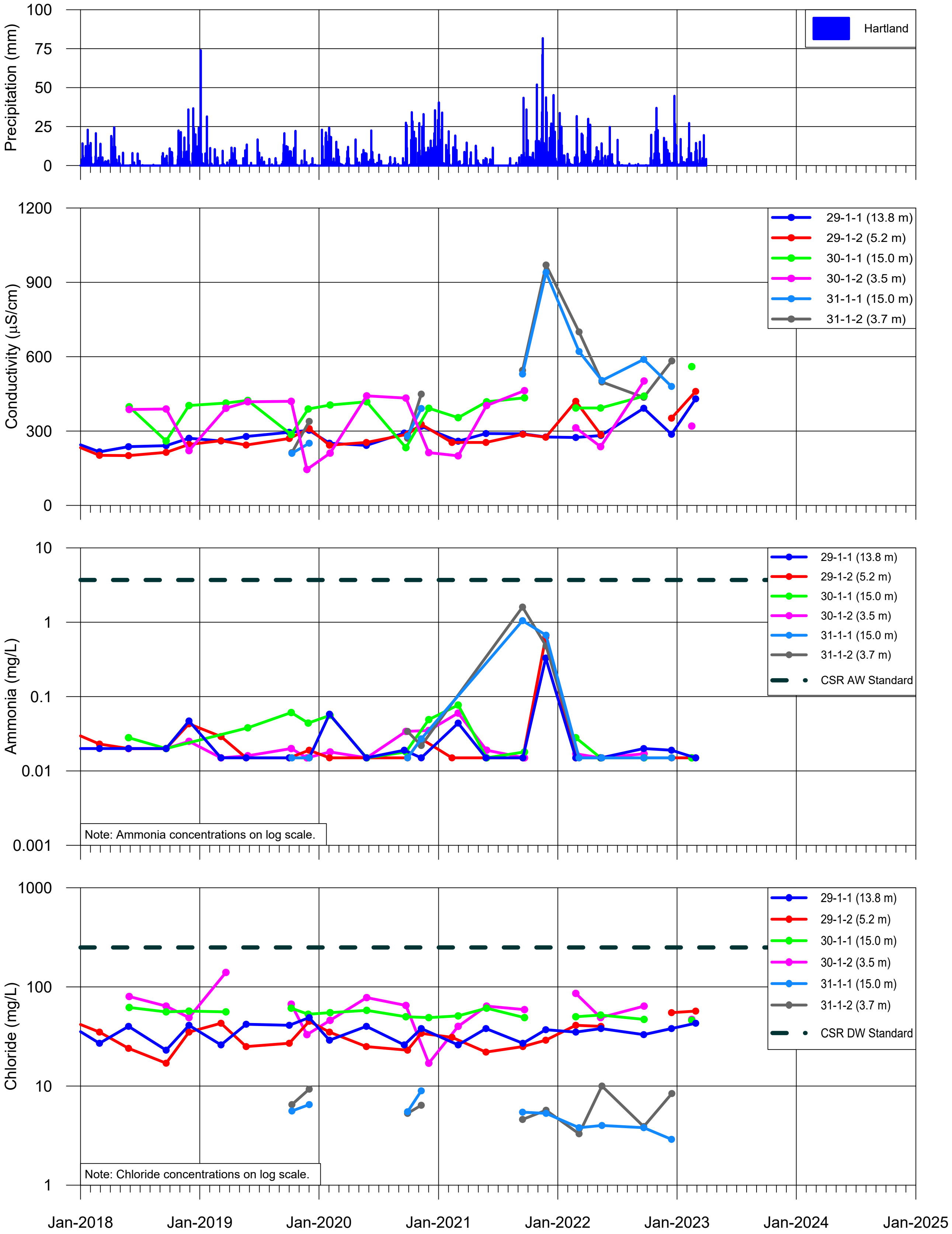


Figure 5-5. Groundwater Quality North of Willis Point Road

5.6 Monitors West and North of the Phase 2 Landfill

Background groundwater quality has been represented historically by monitoring location 63 (west of Phase 2) and five monitoring locations (77, 78, 79, 87, and 88) north of the Phase 2 landfill. Throughout the winter and spring of 2016/17, a portion of the slope between Phase 2 and the Hartland North Pad was cleared of vegetation to allow for construction of an aggregate storage area (The Northwest Stockpile). Since clearing, overburden soils have been stripped to expose the bedrock surface that consists of several closed depressions that may impact groundwater recharge. This work was conducted in the vicinity of monitoring locations 77, 78, 79, 87 and 88. Groundwater monitoring wells GW-79-1-1 and GW-79-2-1 were decommissioned in May 2018 to accommodate aggregate stockpiling. In 2019/20, excavation and blasting were conducted at the North Pad area and east of the Toutle Valley Road. Given the recent land clearing, excavation, and quarrying activities, water quality data from locations 77, 78, 87 and 88 was not considered representative of background groundwater quality since 2020, and groundwater at these wells should be closely monitored for landfill, aggregate stockpiling and construction related impacts.

Throughout July and September 2022, seven new monitoring wells (GW-104-1-1, GW-105-1-1, GW-106-1-1, GW-107-1-1, GW-108-1-1, GW-109-1-1, and GW-110-1-1) were installed North of Phase 2, near the Contractor's Shed, to characterize hydrogeological conditions near the Northwest Sedimentation Pond (NWSP) and monitor impacts associated with landfill operations and construction, aggregate production, and storage. The site investigation results are summarized in AECOM (2023). Quarterly groundwater sampling at these locations commenced in September 2022.

Overall, groundwater quality was monitored at two background locations (63 and 94), six locations (25, 27, 36, 37, 38 and 53) north of the Phase 2 landfill near the upper leachate lagoon, eight locations (41, 42, 43, 44, 55, 56, 57 and 62) near the Hartland North Pad, and ten locations (95, 96, 97, 98, 103, 104, 105, 106, 107, and 108) near the perimeter of the Phase 2 Basin, the NWSP, and Heal Creek.

5.6.1 Background Groundwater Quality

Monitoring well 63 is located at the western edge of the property, upgradient of the landfill, where groundwater quality is considered representative of background conditions. In 2022/23, groundwater quality at Site 63 was consistent with the previous monitoring year, and leachate/aggregate indicator parameters including conductivity, chloride, ammonia, nitrate, and sulphate concentrations were low and consistent with historical values. Groundwater quality at Site 63 shows no signs of landfill impacts.

In previous years, groundwater quality at monitoring station 94 was considered representative of background conditions. In 2022/23, groundwater quality at station 94 was characterized by low but variable conductivity (190 – 400 µS/cm), and low sulphate (<49 mg/L), chloride (<10 mg/L), and ammonia (<0.015 mg/L) concentrations. Statistically significant decreasing trends in chloride and sulphate have been observed in well GW-94-1-1 since it was installed in 2019. However, nitrate concentrations increased from the previous monitoring year. In 2021/22, nitrate concentrations were below detection on all sampling dates, and in 2022/23, nitrate exceeded the detection limit on three of four sampling dates, reaching a maximum concentration of 2.58 mg/L in March 2022, and an average of 0.68 mg/L throughout the monitoring year. Although sulphate concentrations were still below threshold of 75 mg/L in 2022/23, the elevated nitrate concentrations likely reflect aggregate stockpiling on the North Ridge, so groundwater quality at this site can no longer be considered representative of background conditions.

5.6.2 Wells North of the Phase 2 Landfill

In 2022, AECOM performed a water quality assessment to identify contaminant sources and pathways conveying dilute leachate from Phase 2 and nitrogen-rich runoff from the Northwest Aggregate Stockpile toward the NWSP and Heal Creek (AECOM 2023). A total of 17 wells were drilled around the northern perimeter of Phase 2, the NWSP, and Heal Creek to assess the groundwater quality on a local scale. These new wells were sampled quarterly, and the data has been integrated into 2022/23 annual monitoring report. Figures 5-6, 5-7, and 5-8 illustrate groundwater quality with selected landfill and leachate indicator parameters.

5.6.2.1 Monitoring Site 36

Monitoring location 36 is not a Boundary Compliance Well and is located 20 m northeast and downgradient of the Phase 2 basin. In 2022/23, well GW-36-3-1 was monitored and sampled on a quarterly basis. Well GW-36-2-1 has not been monitored since 2016/17 due to well construction related impacts. Well GW-36-3-1 is well-suited to assess whether leachate is migrating beneath the clay liner along the north side of Phase 2 because the elevation of the bottom of the well screen is 112 m asl, and the bottom of the Phase 2 basin is at 113 m asl. The bottom of the clay liner along the north side of the Phase 2 basin is at 114 m asl.

In 2022/23, groundwater quality in GW-36-3-1 was consistent with the previous monitoring year, exhibiting elevated conductivity (805 to 1,348 µS/cm), nitrate (0.055 to 0.583 mg/L) and sulphate (140 to 240 mg/L) concentrations. Conductivity slightly decreased following the installation of a leachate sump, and chloride concentrations remained stable and marginally below 20 mg/L. Ammonia concentrations were generally low, with one spike observed in May 2022. Over the past five years, statistically significant increasing trends in conductivity and chloride concentration have been observed, as well as a decreasing trend in nitrate concentrations. The elevated conductivity, sulphate, and nitrate concentrations likely reflect groundwater quality impacts associated with aggregate stockpiling on the North Ridge, and the low levels of leachate indicator parameters confirm that leachate has not migrated beneath the clay liner at the north edge of Phase 2.

Groundwater quality at this location should continue to be monitored closely to evaluate the severity and evolution of aggregate runoff impacts in this area of the landfill.

5.6.2.2 Monitoring Site 37

Groundwater monitoring station 37 is not a Boundary Compliance Well, and it is located 25 m north of the Phase 2 basin. In 2022/23, well GW-37-3-1 was routinely monitored, and well GW-37-1-1 has been excluded from the monitoring program due to the limited access. Sampling of GW-37-2-1 was discontinued in 2017 due to its low concentrations of leachate indicator parameters.

In 2022/23, conductivity and sulphate concentrations observed at GW-37-3-1 ranged from 590 to 838 µS/cm, and 110 to 240 mg/L, respectively, showing substantial increases from the previous monitoring year. The average conductivity observed at GW-37-3-1 increased by about 48% from the previous monitoring year, whereas sulphate concentrations increased by about 28%. Chloride concentrations remained low (i.e., <15 mg/L), but the average chloride concentration doubled from the previous monitoring year. Ammonia and nitrate concentrations increased slightly, peaking at levels of 0.51 mg/L and 0.689 mg/L, respectively. Due to the low chloride and ammonia concentrations, water quality degradation is interpreted to be the result of onsite aggregate stockpiling and not leachate.

Throughout the 2021/22 and 2022/23 monitoring periods, groundwater quality at monitoring station 37 degraded slightly, showing evidence of impacts associated with aggregate stockpiling. Groundwater quality at this location should be monitored closely to confirm the cause(s) of groundwater quality changes in this area. Consideration should be given to reinitiating sampling of GW-37-2-1.

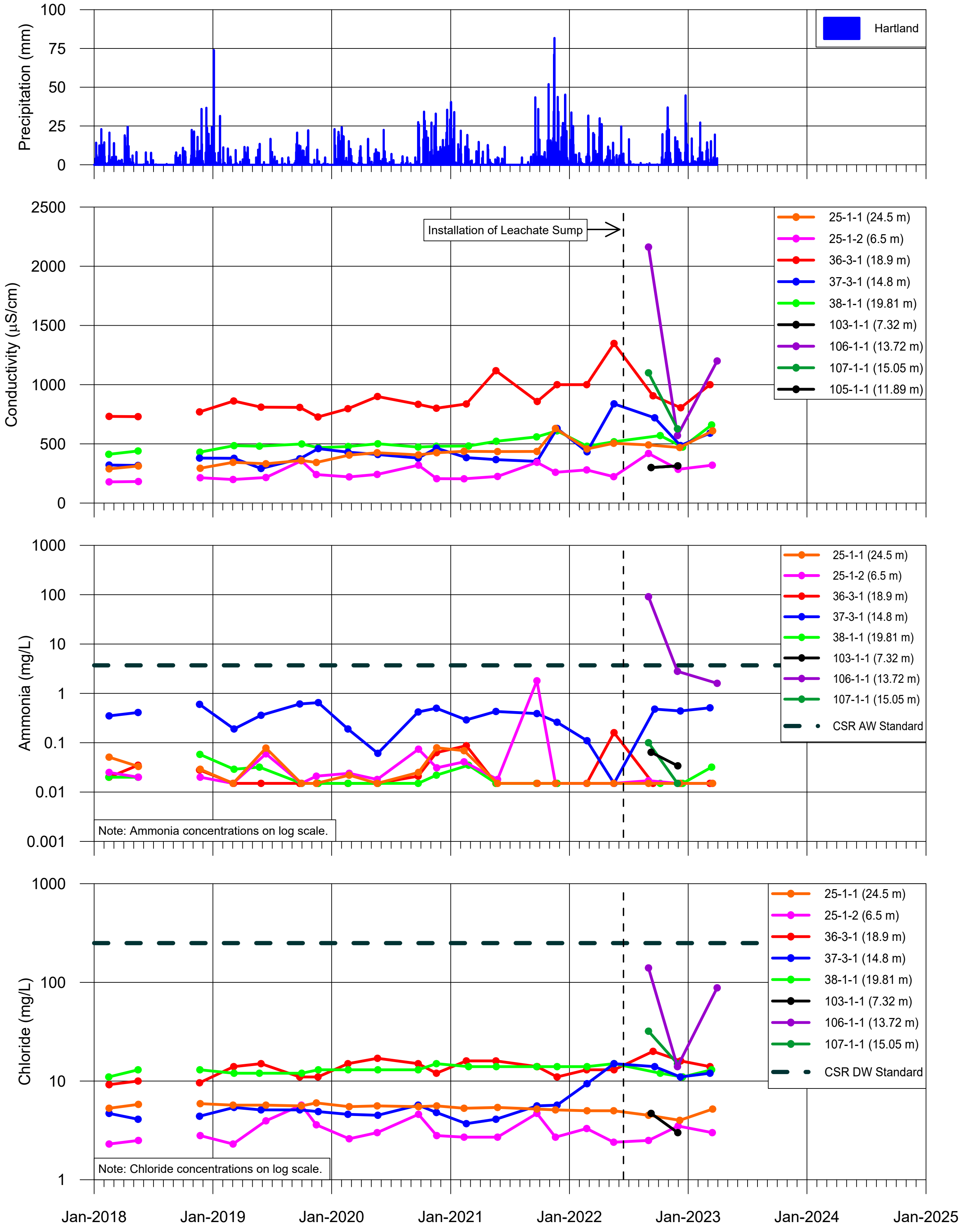


Figure 5-6. Groundwater Quality North of Phase 2 - Landfill Leachate Impacts

5.6.2.3 Monitoring Site 38

Groundwater monitoring station 38 is not a Boundary Compliance Well and is located roughly 80 m north of the Phase 2 basin immediately north of the upper leachate lagoon. Water quality at this location met CSR standards for all parameters in 2022/23, and conductivity continued to increase from previous monitoring years. Nitrate concentrations increased from an average of 0.28 mg/L in 2021/22 to 0.35 mg/L in 2022/23. Ammonia and chloride concentrations were low and within historical ranges. Sulphate concentrations were below 50 mg/L and slightly lower than the previous monitoring year. Over the past five years, no statistically significant trends in groundwater quality have been observed, indicating that the groundwater quality is stable.

5.6.2.4 Monitoring Sites 25 and 53

Wells GW-25-1-1, GW-25-1-2 (not Boundary Compliance Wells) and GW-53-1-1 (Boundary Compliance Well) are located on an east-west trending ridge 100 m north of the Phase 2 basin near the property boundary. These wells have exhibited good water quality in the past and remain unaffected by landfill leachate. However, evidence of aggregate runoff impacts were apparent in 2022/23, where water quality at all three wells met CSR AW and DW standards except for nitrate (12.9 mg/L) at GW-25-1-1 in May 2022.

In 2022/23, water quality in GW-25-1-1 and GW-25-1-2 degraded slightly, exhibiting higher average conductivity and nitrate concentrations than the previous monitoring year. Nitrate concentrations were highest in the deep well, GW-25-1-1, ranging from 3.54 to 12.9 mg/L. In GW-25-1-2, nitrate concentrations ranged from 0.212 to 0.655 mg/L. On all sampling dates, sulphate concentrations were moderate to elevated, ranging from 52 to 190 mg/L, and chloride and ammonia concentrations were low. Statistically significant decreasing trends in ammonia and chloride concentrations were observed in GW-25-1-1, along with increasing trends in sulphate and conductivity. In well GW-25-1-2, statistically significant increasing trends in sulphate and conductivity were observed.

Overall, groundwater quality at monitoring station 25 continued to show no evidence of landfill leachate contamination, but water quality impacts associated with aggregate stockpiling were prevalent, especially in well GW-25-1-1. This indicates that nitrogen-rich runoff from the Northwest Stockpile has infiltrated relatively deep bedrock around the NWSP. Groundwater quality at this location should continue to be monitored closely to monitor aggregate runoff impacts.

In 2022/23, water quality in GW-53-1-1 was relatively stable, exhibiting background conductivity values, and low chloride, ammonia, sulphate, and nitrate concentrations. Over the past five years, statistically significant increasing trends in conductivity and sulphate concentrations have been detected, and chloride concentrations have trended downward. Still, solute concentrations are low, providing no indication of groundwater quality impacts associated with aggregate stockpiling or landfill leachate.

5.6.2.5 Monitoring Site 27

Groundwater monitoring station 27 is located northwest of Phase 2 and adjacent to aggregate stockpiles, where shallow groundwater has been historically impacted by blasting residues. Similar to previous years, groundwater quality in well GW-27-1-1 met all applicable CSR standards. Well GW-27-1-2 was destroyed during construction in 2022 and could not be sampled.

In 2022/23, Groundwater quality at well GW-27-1-1 showed no evidence of impacts associated with landfill leachate or aggregate runoff; nitrate concentrations were below the detection limit, and ammonia, chloride, and sulphate concentrations were low. Conductivity values increased from the previous monitoring year, exhibiting an average of 221 µS/cm. In the past five years, statistically significant increasing trends in conductivity and sulphate concentrations have been observed, but all solute concentrations reflected background values.

Ultimately, hydraulic conditions and contaminant concentrations should be carefully monitored at this location because groundwater in this area reports to the surface water collection and conveyance system. Ongoing quarry development may impact well integrity and any wells in this area should be properly decommissioned in advance of construction. It is recommended that the CRD commence early planning for shallow groundwater, surface water, and leachate management in this area to maximize diversion of clean water out of the leachate collection system.

5.6.2.6 Monitoring Sites Along the Northern Edge of the Phase 2 Basin

Five monitoring wells (GW-103-1-1, GW-104-1-1, GW-105-1-1, GW-106-1-1, and GW-107-1-1/GW-107-2-1) were installed just outside the northwestern edge of the Phase 2 Basin and monitored in 2022/23. These wells were sampled quarterly, beginning in September 2022. The groundwater quality observed in these wells varies, with some wells (GW-105-1-1 and GW-106-1-1) showing distinct evidence of landfill leachate impacts, and other wells (GW-104-1-1, GW-105-1-1, and GW-107-1-1) exhibiting impacts related to aggregate stockpiling on the North Ridge. Well GW-103-1-1 was installed at the toe of the North Ridge, west of the Contractor Shed, and showed no evidence of groundwater quality impacts.

In 2022/23, monitoring well GW-104-1-1 showed evidence of groundwater quality impacts associated with aggregate stockpiling on the North Ridge and road-salt. Conductivity ranged from 160 to 1,000 µS/cm, and increased throughout the monitoring year. Chloride concentrations showed a similar trend, increasing from 4.4 mg/L in September to 120 mg/L in March. Elevated sodium (36.6 mg/L) and calcium (130 mg/L) concentrations were observed on the same sampling date, which may indicate that the groundwater was affected by road-salt. Ammonia concentrations were below the detection limits, so it is unlikely that the elevated chloride concentration was caused by landfill leachate. Nitrate concentrations increased throughout the monitoring year from 0.502 mg/L to 21.5 mg/L, exceeding the CSR DW standard on two of three sampling dates. Like conductivity, nitrate, and chloride concentrations, sulphate concentrations generally increased throughout the monitoring year, ranging from 16 to 140 mg/L. Overall, groundwater quality at monitoring station 104 showed evidence of aggregate runoff impacts, especially near the end of the wet season. Given the undetectable levels of ammonia concentrations, it is unlikely that the groundwater was affected by landfill leachate.

In 2022/23, monitoring well GW-105-1-1 showed similar trends as GW-104-1-1, with the highest conductivity (1,300 µS/cm), chloride (87 mg/L), sulphate (290 mg/L) and nitrate (32 mg/L) concentrations observed in March 2023. Zinc and strontium concentrations were also elevated during the March 2023 sampling event. All solute concentrations observed at GW-105-1-1 met CSR standards, except for nitrate on all sampling dates. Ammonia concentrations were slightly elevated, ranging from 0.05 to 0.073 mg/L. Given the low sodium levels, the source of the elevated chloride is unlikely to be road salt. The concurrent rise in conductivity, chloride, and metal levels, coupled with a mild increase in ammonia concentrations, could suggest the presence of dilute landfill leachate. However, the elevated nitrate and sulphate concentrations also suggest that effects of aggregate stockpiling on the North Ridge are more pronounced.

In September 2022, groundwater in well GW-106-1-1 exhibited exceptionally high conductivity (2,160 µS/cm), ammonia (91 mg/L), and chloride (140 mg/L) concentrations, characteristic of dilute landfill leachate. Ammonia concentrations exceeded CSR AW standards, and nitrite (1.92 mg/L) and nitrate (10.9 mg/L) concentrations exceeded CSR DW standards. Sulphate concentrations were relatively high throughout the monitoring year, ranging from 170 to 260 µS/cm, and groundwater quality was impacted by aggregate stockpiling on the North Ridge. The leachate impacts observed at monitoring station 106 reflect a leachate impact beyond the northern boundary of the Phase 2 Leachate Collection System, which impacted groundwater quality around the NWSP and downstream in Heel Creek in 2021/22 (AECOM 2023).

In early 2022, groundwater in well GW-107-1-1 exhibited elevated conductivity (627 to 1,100 µS/cm), nitrate (9.07 to 23.9 mg/L) and sulphate (190 to 270 mg/L) concentrations, with nitrate concentrations exceeding the CSR DW standard. Chloride concentrations were slightly elevated, ranging from 15 to 32 mg/L, and ammonia concentrations were generally near or at the detection limit. The elevated conductivity, sulphate, and nitrate concentrations in the absence of elevated chloride and ammonia concentrations signify groundwater quality impacts related to aggregate stockpiling on the North Ridge.

Overall, groundwater quality in this area is primarily impacted by runoff from aggregate stockpiling, with some wells (GW-106-1-1 and GW-105-1-1) showing evidence of dilute landfill leachate impacts. The influence of landfill leachate on groundwater is limited to an area less than 20 meters northwest of the Phase 2 Basin. However, the impact of aggregate runoff is more extensive, with most wells showing elevated nitrate and sulphate concentrations. Well GW-103-1-1 was installed at the toe of the North Ridge, west of the Contractor Shed, and showed no evidence of groundwater quality impacts. The use of magnesium lignosulfonate for road dust control has also resulted in increased sulphate concentration and conductivity at some locations.

5.6.2.7 Monitoring Sites near the Northwest Sedimentation Pond and Heal Creek

In 2022, during a Site Investigation, five monitoring wells (GW-95-1-1, GW-96-1-1, GW-97-1-1, GW-98-1-1, and GW-108-1-1) were installed around the NWSP and Heal Creek to assess the groundwater quality (AECOM 2023). These wells were sampled quarterly beginning in September 2022. Most of these wells have exhibited evidence of groundwater quality impacts associated with aggregate stockpiling.

Wells GW-95-1-1 and GW-96-1-1 were installed metres apart, along the north edge of Heel Creek, downstream of the NWSP. Groundwater quality in both wells was consistent with the CSR AW and DW guidelines, except for the groundwater sample collected from GW-95-1-1 in September 2022. On that sampling date, exceedances were observed in aluminum, chromium, cobalt, copper, and vanadium concentrations, and silicon and iron concentrations were exceptionally high. CRD staff noted that turbidity was very high during sampling, which likely explains the anomalous trace metal concentrations, as well as the elevated silicon and iron concentrations. At these wells, conductivity reflected background values, ranging from 392 to 490 µS/cm, and chloride and ammonia concentrations were low. In December 2022, nitrate concentrations were elevated in both wells, ranging from 2.65 to 8.68 mg/L, and sulphate concentrations were elevated, ranging from 100 to 120 mg/L. Overall, groundwater quality at monitoring stations 95 and 96 show no evidence of landfill leachate impacts, but elevated nitrate and sulphate concentrations suggest impacts by runoff emanating from the Northwest Stockpile.

Wells GW-97-1-1 and GW-98-1-1 were installed on either side of Heal Creek, between Heal Creek and the NWSP. Well GW-97-1-1 was installed south of Heel Creek, and well GW-98-1-1 was installed north of Heal Creek. Nitrate concentrations in groundwater collected from GW-98-1-1 exceeded the CSR DW in April 2022. At GW-97-1-1, groundwater quality met all CSR standards on all sampling dates. However, conductivity, nitrate and sulphate concentrations increased substantively in December 2022, when sulphate and nitrate concentrations reached 170 mg/L and 8.56 mg/L, respectively. Conductivity increased from 290 µS/cm in September to 472 µS/cm. Conversely, ammonia concentration was elevated in September 2022 (0.91 mg/L) but decreased in December (0.016 mg/L). At GW-98-1-1, conductivity, nitrate, ammonia, and sulphate concentrations were elevated in April and September 2022, but concentrations generally subsided after the installation of a leachate sump. Chloride concentrations were low in both wells (i.e., <5.0 mg/L), so there is no evidence of landfill leachate impacts in this area. However, groundwater in these two wells was impacted by aggregate runoff.

Well GW-108-1-1 was installed a few metres south of the NWSP and screened in relatively deep bedrock (14.48 m BGS; 116.2 m ASL). On all sampling dates, groundwater quality at GW-108-1-1 met all CSR standards, and conductivity was elevated, ranging from 519 to 640 µS/cm. Chloride, ammonia, and nitrate concentrations were low, and sulphate concentrations were elevated, ranging from 200 to 230 µS/cm. The elevated sulphate concentration may be due to aggregate stockpiling or natural sulphide minerals present in the bedrock, which has been observed in several monitoring wells around the landfill footprint in the past (AECOM 2023). Groundwater quality at Site 108 was good, with no evidence of impacts related to landfill leachate or aggregate runoff.

Overall, the aggregate stockpiles located in the Toutle Valley and atop the bedrock ridge north of the Phase 2 landfill are interpreted to be the primary source of nitrate and sulphate observed in groundwater wells. This is mainly evident in the shallow aquifer. However, the deeper groundwater in the bedrock aquifer, as seen in well GW-25-1-1, is also influenced by the aggregate stockpiles. This suggests that runoff from aggregate stockpiles has entered the bedrock before moving towards Heal Creek. However, there is no indication of landfill leachate impacts on groundwater in this area.

5.6.3 Wells near Hartland North Pad (Residual Treatment Facility)

The Hartland North Pad has had a variety of uses including yard waste composting (1994 – 2004), aggregate stockpiling (2006 to 2018), and currently, it accommodates the north trailer and new north scale residue.). The aggregate is only stored on the ridge south of the North Pad. Additionally, the area was a construction site for the RTF associated with CRD's McLoughlin Point Wastewater Treatment Plant project. The construction of the RTF buildings began in early 2019 and was completed in September 2020. The RTF is now operational and permitted under ENV Operational Certificate #109471.

Groundwater monitoring stations 41, 42, 55, 56 and 57 are considered Boundary Compliance Wells around the Hartland North Pad. Monitoring locations 43, 44 and 62 were installed adjacent to the Hartland North Pad and are not Boundary Compliance Wells. Monitoring locations 91, 92, 93 and 94 were established in November 2019 and located south of the RTF. 93-1-1 was destroyed in 2022 due to construction and no sample was collected in 2021/22.

In 2022/23, groundwater quality in all monitoring wells on the North Pad met all applicable CSR standards.

5.6.3.1 Monitoring Sites 44 and 62

Groundwater sampling at well GW-44-1-1 commenced in 2016/17 to track potential construction related impacts at the Hartland North Pad area. Well GW-44-1-1 is located southwest of monitoring location 43, and the groundwater quality is generally consistent with background conditions. In 2022/23, groundwater quality in GW-44-1-1 was consistent with background values, exhibiting moderate to low conductivity (<450 µS/cm), and low sulphate (<42 mg/L), chloride (<6.0 mg/L) and nitrate (<0.024 mg/L) concentrations. Ammonia concentrations were below detection. Over the past five years, a statistically significant increasing trend in nitrate concentrations has been observed. Overall, water quality at Site 44 is generally consistent with background conditions.

Monitoring location 62 is located southwest of monitoring location 44. Similar to previous years, groundwater quality at GW-62-1-1 (23.7 m BGS) and GW-62-2-1 (18.9 m BGS) reflected background conditions throughout 2022/23, except for slightly elevated nitrate concentrations in GW-62-1-1 that increased from 0.278 mg/L in September 2022 to 1.8 mg/L in December. Despite the elevated nitrate concentrations, sulphate concentrations were minimal. Over the past five years, a statistically significant increasing trend in nitrate concentrations and decreasing trends in chloride and conductivity have been observed at GW-62-1-1. In the shallow well, GW-62-2-1, nitrate concentrations reached a maximum of 0.473 mg/L, ammonia concentrations were below detection, sulphate concentrations were below 26 mg/L, and chloride concentrations were below

2.9 mg/L. Ultimately, groundwater quality at Site 62 shows no evidence of landfill leachate impacts, and the elevated nitrate concentrations in GW-62-1-1 likely do not reflect aggregate runoff because sulphate concentrations were low.

5.6.3.2 Monitoring Sites 41, 42, 43, 55, 56 and 57

Figure 5-8 displays leachate indicator parameters for monitoring locations 41, 42, 43, 55 and 56. In 2022/23, water quality at all of these locations was consistent with historical data. Conductivity in all wells increased during the wet season, reaching a max of 640 µS/cm at Site 43. Sulphate concentrations were relatively high at monitoring stations 42 and 43, ranging from 69 to 86 mg/L.

Over the past five years, statistically significant increasing trends in conductivity have been observed at groundwater monitoring stations 42, 43, 56 and 57. An increasing trend in sulphate concentration was observed at monitoring station 43, and an increasing trend in chloride concentration was detected at monitoring station 41. Decreasing trends in chloride concentrations were identified at monitoring stations 41 and 43.

Groundwater quality in this area of the landfill generally reflects background conditions, with slightly elevated sulphate concentration. Groundwater quality should continue to be monitored for any impacts associated with landfill operations, including quarrying, aggregate stockpiling, and construction.

5.6.3.3 Monitoring Sites 77, 78, 87 and 88

In 2022/23, concentrations of all parameters measured at monitoring stations 77, 78, 87 and 88 (not Boundary Compliance Wells) were below applicable CSR standards.

Groundwater quality at monitoring station 77 exhibited low leachate indicator parameters and nitrate concentrations. Groundwater quality at station 78 exhibited low leachate and aggregate runoff indicator parameters, but nitrate concentrations were elevated in the shallow well (GW-78-2-1), ranging from 1.66 to 2.35 mg/L. Sulphate concentrations observed in well GW-78-2-1 were low to moderate, ranging from 40 to 46 mg/L. Statistically significant decreasing trends in ammonia and chloride concentrations were observed over the past five years in well GW-78-2-1, and increasing trends in sulphate concentration have been identified in wells GW-77-2-1 and GW-78-1-1. The elevated nitrate and low to moderate sulphate concentrations observed at monitoring station 78 likely reflect aggregate runoff impacts, given the position of well downgradient of the Northwest Stockpile. Well GW-77-1-1 may have been screened at a depth that is above the flow path conveying aggregate runoff to monitoring station 78.

Groundwater monitoring stations 87 and 88 are located on either side of the Highland Fault, immediately south of the Northwest Stockpile. Groundwater collected from location 87 exhibited low to moderate nitrate concentrations, ranging from below the detection limit to 0.402 mg/L in well GW-87-2-1. Chloride concentrations were low (i.e., <5 mg/L), ammonia concentrations were below the detection limit, and sulphate concentrations were <25 mg/L. At location 88, nitrate concentrations were appreciably higher, ranging from 6.20 to 6.72 mg/L in well GW-88-1-1 and from 8.13 to 7.87 mg/L in well GW-88-2-1. Additionally, sulphate concentrations were elevated, ranging from 47 to 54 mg/L in well GW-88-1-1 and from 99 to 250 mg/L in well GW-88-2-1. Ammonia concentrations were below the detection limit, and chloride concentrations were below 3.6 mg/L. Over the past five years, a statistically significant increasing trend in sulphate concentration has been observed at well GW-87-1-1, and an increasing trend in conductivity and nitrate concentration has been observed at well GW-87-2-1. At location 88, increasing trends in conductivity, nitrate, and sulphate concentrations have been identified in GW-88-1-1, as well as decreasing trends in ammonia and chloride concentrations in GW-88-2-1. Groundwater quality in this area of the landfill shows no evidence of landfill leachate impacts. However, elevated nitrate and sulphate concentrations observed in the shallow well at location 88 clearly reflect aggregate impacts associated with runoff from the Northwest Stockpile.

5.6.3.4 Monitoring Sites 91 and 92, and 93

Figure 5-8 shows plots of leachate indicator parameters for monitoring locations 91, 92, and 93. Wells GW-91-1-1, GW-92-1-1, and GW-93-1-1 are located near the Hartland North Pad and are not Boundary Compliance Wells. Groundwater sampling at these locations commenced in March 2020. A groundwater sample was not collected from well GW-93-1-1 because it is no longer active.

In 2022/23, conductivity was generally higher at groundwater monitoring station 91 than previous years, increasing to maximum of 560 µS/cm in March 2023. Hardness (as $CaCO_3$) was relatively high, ranging from 247 to 302 mg/L. Chloride concentrations were below 5.2 mg/L, and ammonia concentrations were below the detection limit. Nitrate concentrations were low, reaching 0.078 mg/L in December 2022, and sulphate concentrations were moderate, ranging from 63 to 78 mg/L. Over the past five years, statistically significant increasing trends in conductivity and sulphate concentrations have been observed in well GW-91-1-1.

At groundwater monitoring station 92, conductivity was elevated and ranged from 406 to 580 µS/cm. Chloride and ammonia concentrations were low or below the detection limit. Nitrate concentrations were low, ranging from 0.067 mg/L in December 2022 to 0.204 mg/L in September 2022, and sulphate concentrations were elevated, ranging from 110 to 120 mg/L. Over the past five years, statistically significant increasing trends in conductivity and sulphate concentrations have been observed in well GW-92-1-1.

At groundwater monitoring stations 91 and 92, elevated conductivity and sulphate concentrations did not correlate with elevated nitrate concentrations, so it is unlikely that aggregate runoff impacted groundwater quality in this area of the landfill. Similarly, there are no signs of leachate impacts.

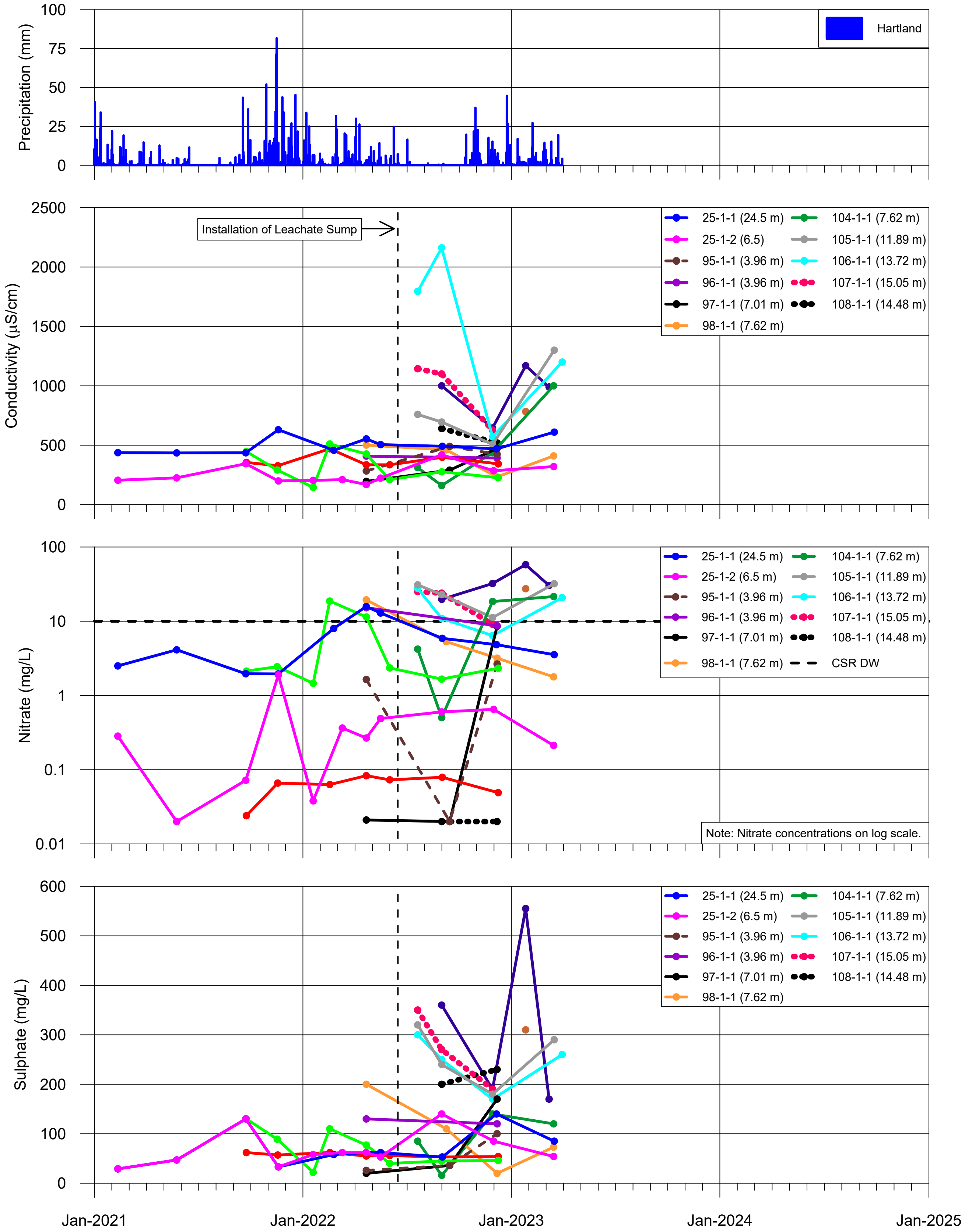


Figure 5-7. Groundwater Quality North of Phase 2 - Aggregate Impacts (2021 to Present)

5.7 Monitors South of the Phase 1 Landfill

Monitoring well locations 4, 7, 19, 60, 71, 72, 73 and 85 are all located south of the Phase 1 landfill. Only wells at locations 4, 71, 72 and 73 are considered Boundary Compliance Wells. Well GW-71-1-1 is located off site along Hartland Avenue. Wells at locations 4, 19, 60, 71, 72 and 73 are multi-level nested monitoring wells, and the well at location GW-7-1-1 is a 37 m deep, open borehole that was used until 1989 for domestic water supply at the landfill. Wells at locations 71, 72 and 73 were installed in 2003. Well GW-85-1-1 was installed in 2009 to replace well GW-3-2-1, which was decommissioned to permit construction of the bin facility.

Figure 5-9 shows plots of leachate indicator parameters in wells located south and downgradient of the landfill, and Figure 5-10 plots leachate indicator parameters for wells located southeast of the landfill. Like previous years, in 2022/23, all analytes in all groundwater sampled from wells south of the Phase 1 landfill met the applicable CSR standards.

Groundwater quality in these wells is sensitive to the performance of the south purge well system. When the purge well system is functioning properly, concentrations of leachate indicator parameters have been shown to decline, and seasonal fluctuations in concentrations of leachate indicator parameters are dampened. The reported concentrations indicate that the south purge well system successfully mitigated southward migration of leachate in 2022/23.

5.7.1 South Purge Wells (P1, P2, P3, P4 and P10)

Groundwater quality data collected from the south purge wells (P1, P2, P3 and P10) exhibited statistically significant increasing trends for multiple leachate indicator parameters over the past five years, indicating water quality degradation and therefore improved leachate capture. In 2022/23, the average conductivity of all groundwater samples collected from the south purge wells was 1,809 µS/cm, which was slightly higher than in the 1,784 µS/cm observed in 2021/22.

In 2022/23, ammonia concentrations in the south purge wells exceeded the CSR AW standard throughout the entire monitoring year. Ammonia concentrations ranged from 23 to 91 mg/L, and sulphate concentrations ranged from <1.0 to 4.1 mg/L. Chloride concentrations were relatively high, ranging from 39.0 to 220 mg/L.

5.7.2 Monitoring Site 85

In 2022/23, at groundwater monitoring station 85 (not a Boundary Compliance Well), chloride concentrations remained elevated, ranging from 130 to 160 mg/L. Conductivity increased throughout the monitoring year, reaching 770 µS/cm. Nitrate concentrations were generally consistent with historical ranges, fluctuating between approximately 1.21 and 2.69 mg/L. Sulphate concentrations were moderate and ranged from 34 to 47 mg/L. Ammonia concentrations were typically just above the detection limit. Given the low ammonia concentrations, groundwater at this location is unlikely to be impacted by leachate. The slightly increase in nitrate, sulphate and conductivity may be related to runoff from aggregate placed during nearby construction works. The Cl/Na molar ratio in 85-1-1 was greater than 1.5, indicating an additional source of chloride other than road salt and leachate. In 2022/23, the average Cl/Na molar ratios in south purge wells and Hartland Valve Chamber were calculated to be 0.67 and 0.52, respectively. Over the past five years, a statistically significant decreasing trend in ammonia concentration has been observed at this location, indicating the south purge wells have remained effective.

5.7.3 Monitoring Site 60

Three monitoring wells are present at location 60: GW-60-1-1 (23 m BGS), GW-60-2-1 (16 m BGS), and GW-60-3-1 (7 m BGS). These wells are not considered Boundary Compliance Wells. In 2022/23, solute concentrations met applicable CSR standards in all three wells, but elevated chloride concentrations were observed in each well, and elevated nitrate concentrations were observed in GW-60-3-1. Chloride concentrations ranged from 75 to 160 mg/L. Nitrate concentrations were below the detection limit in wells GW-60-1-1 and GW-60-2-1, but concentrations were higher near the surface, ranging from 1.85 to 2.6 mg/L in well GW-60-3-1. Conductivity values were elevated but slightly lower than in 2021/22, ranging from 465 to 850 µS/cm. Ammonia concentrations remained below the detection limit except for one sample collected from GW-60-3-1 (0.023 mg/L). Sulphate concentrations were low to moderate, and increased toward ground surface, with concentrations ranging from 38 to 40 mg/L in GW-60-1-1, 56 to 60 mg/L in GW-60-2-1, and 59 to 71 mg/L in GW-60-3-1.

Over the past five years, statistically significant increasing trends in chloride concentrations and conductivity have been detected in all three wells at monitoring station 60. Moreover, an increasing trend in sulphate concentrations has been observed in well GW-60-3-1. Decreasing trends in ammonia and sulphate concentrations were observed in GW-60-1-1, and a decreasing trend in nitrate concentrations was observed in well GW-60-2-1. The Cl/Na molar ratios observed in wells GW-60-1-1, GW-60-2-1, and GW-60-3-1 were well above 1 (i.e., >2.0), indicating an additional source of chloride other than road salt and leachate. The highest Cl/Na ratios (~5) were observed in well GW-60-2-1, where ammonia and nitrate concentrations were below detection. Overall, groundwater quality at monitoring station 60 degraded slightly in 2022/23, exhibiting relatively high conductivity and chloride concentrations, as well as elevated nitrate and sulphate concentrations near ground surface. Overall, landfill leachate likely did not impact groundwater at monitoring station 60 because ammonia concentrations were low, but the elevated conductivity, nitrate, and sulphate concentrations in GW-60-3-1 were consistent with aggregate runoff.

5.7.4 Monitoring Site 07

In 2022/23, two groundwater samples were collected from GW-07-1-0 (a Boundary Compliance Well). All solute concentrations were below applicable CSR standards. Sulphate and nitrate concentrations were low, and chloride concentration and conductivity were elevated. Chloride concentrations were 140 mg/L in May 2022 and 120 mg/L in October, whereas conductivity was 728 µS/cm in May and 411 µS/cm in October. The elevated conductivity readings occurred along with elevated nickel and cobalt concentrations, which ranged from 5.96 to 12.6 µg/L and 3.05 to 6.35 µg/L, respectively. Additionally, iron and manganese concentrations were elevated, ranging from 1.87 to 6.30 mg/L and 2.06 to 2.66 mg/L, respectively. Ammonia concentrations were relatively low, ranging from 0.016 to 0.056 mg/L.

Over the past five years, statistically significant increasing trends in chloride concentration and conductivity have been observed at this location, as well as a decreasing trend in nitrate concentration. High Cl/Na molar ratios (i.e., >4.4) indicate an additional source of chloride other than road salt. It is unlikely that landfill leachate impacted this area of the landfill because ammonia concentrations were low and nitrate concentrations were below detection limits. Similarly, sulphate concentrations were low, so it is not likely that aggregate stockpiling impacted groundwater at this location.

5.7.5 Monitoring Sites 71, 72, 73

Wells GW-71-1-1, GW-72-1-1, and GW-73-1-1 are located at or near the eastern landfill property boundary, south of Phase 1, and are considered Boundary Compliance Wells. Concentrations of leachate indicator parameters observed at monitoring stations 71, 72, and 73 are plotted in Figures 5-9 and 5-10.

In 2022/23, all solute concentrations observed at monitoring station 71 were below applicable CSR standards. Groundwater quality at this location was generally consistent with historical results, with conductivity values ranging from 216 to 340 µS/cm, and chloride concentrations below 10 mg/L. Ammonia concentrations were typically near or below the detection limit, except for in one sample collected from GW-71-1-1 in January 2023 (1.24 mg/L). Nitrate concentrations were below detection limits, except for well GW-71-3-1, where nitrate concentrations ranged from 0.82 to 1.34 mg/L. Sulphate concentrations were generally below 35 mg/L in all three wells. Over the past five years, a statistically significant increasing trend in conductivity has been observed in all three wells, and an increasing trend in nitrate concentrations is present for well GW-71-3-1. Overall, groundwater quality at this location showed no evidence of landfill leachate impacts, but shallow groundwater may be mildly impacted by dilute aggregate runoff.

In 2022/23, all solute concentrations observed at location 72 were below applicable CSR standards. The groundwater exhibited slightly elevated conductivity values, ranging from 426 to 610 µS/cm, and ammonia and nitrate concentrations were low. Chloride and sulphate concentrations were moderate, ranging from 39.0 to 74.0 mg/L and 44 to 68 mg/L, respectively. Over the past five years, a statistically significant increasing trend in conductivity has been observed in GW-72-1-1, and ammonia has shown a decreasing trend. Additionally, in well GW-72-3-1, conductivity and chloride concentrations have exhibited decreasing trends. Overall, groundwater quality at location 72 is good, with no evidence of landfill leachate or aggregate runoff impacts.

In 2022/23, all solute concentrations observed at location 73 were below applicable CSR standards. Conductivity was low to moderate, ranging from 269 to 525 µS/cm, and ammonia concentrations were generally at or below detection, except for in one groundwater sample collected from GW-73-3-1 in September 2022 (0.099 mg/L). Average nitrate concentrations were 0.083 mg/L in GW-73-1-1 and 0.708 mg/L in GW-73-3-1, with the highest concentrations nearest ground surface. In March 2023, a maximum nitrate concentration of 1.18 mg/L was observed at GW-73-3-1, but sulphate concentrations remained low (30 mg/L). Over the past five years, statistically significant increasing trends in conductivity and nitrate concentration have been observed in wells GW-73-1-1 and GW-73-2-1, and well GW-73-1-1 has exhibited an increasing trend in sulphate concentrations. Additionally, well GW-73-3-1 has exhibited and increasing trend in nitrate, and well GW-73-2-1 has exhibited a decreasing trend in ammonia. Groundwater quality at this location shows no evidence of landfill leachate impacts. Although nitrate concentrations were occasionally elevated, the low and stable sulphate concentrations indicate that groundwater quality was not impacted by aggregate runoff.

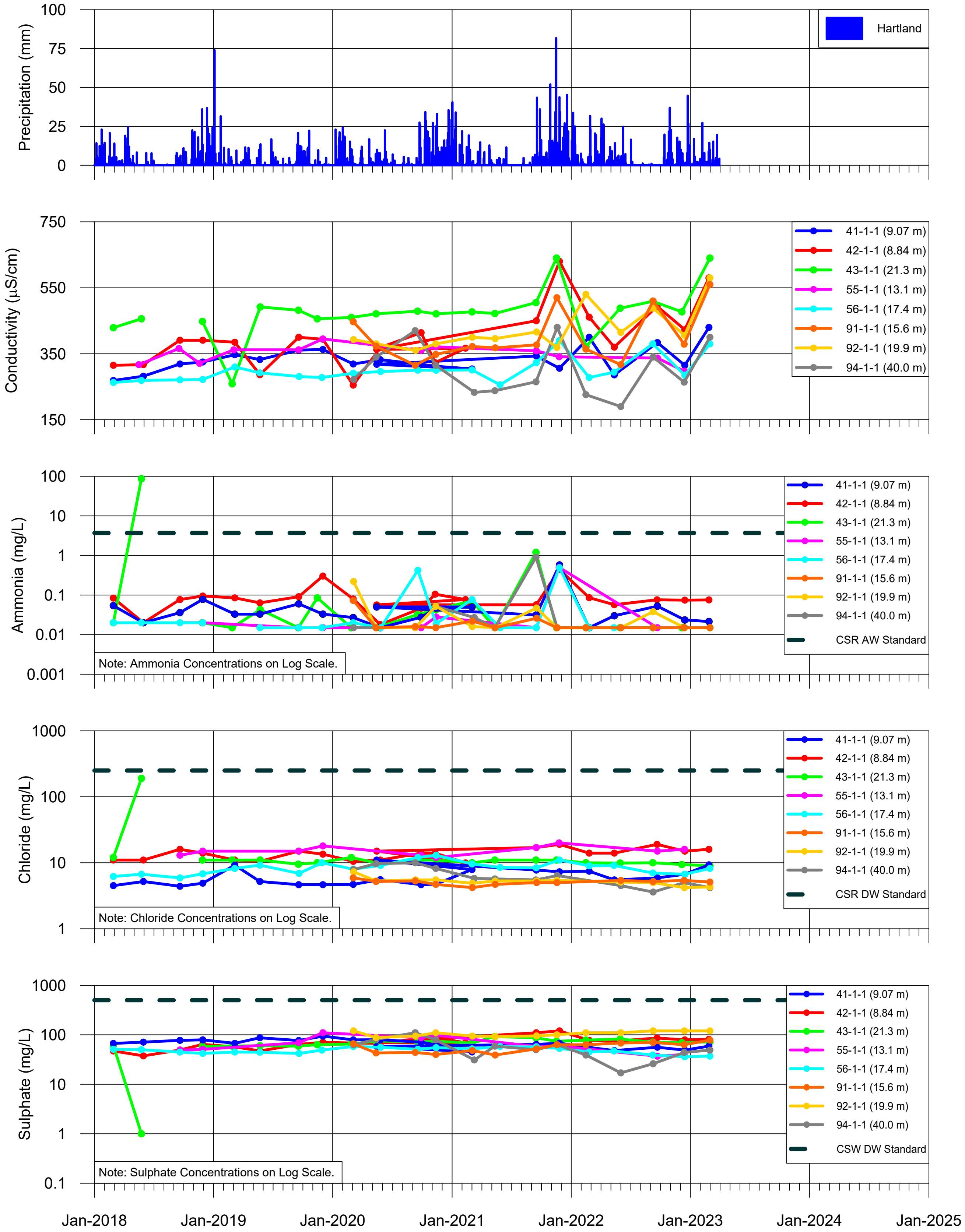


Figure 5-8. Groundwater Quality North of Hartland North Pad

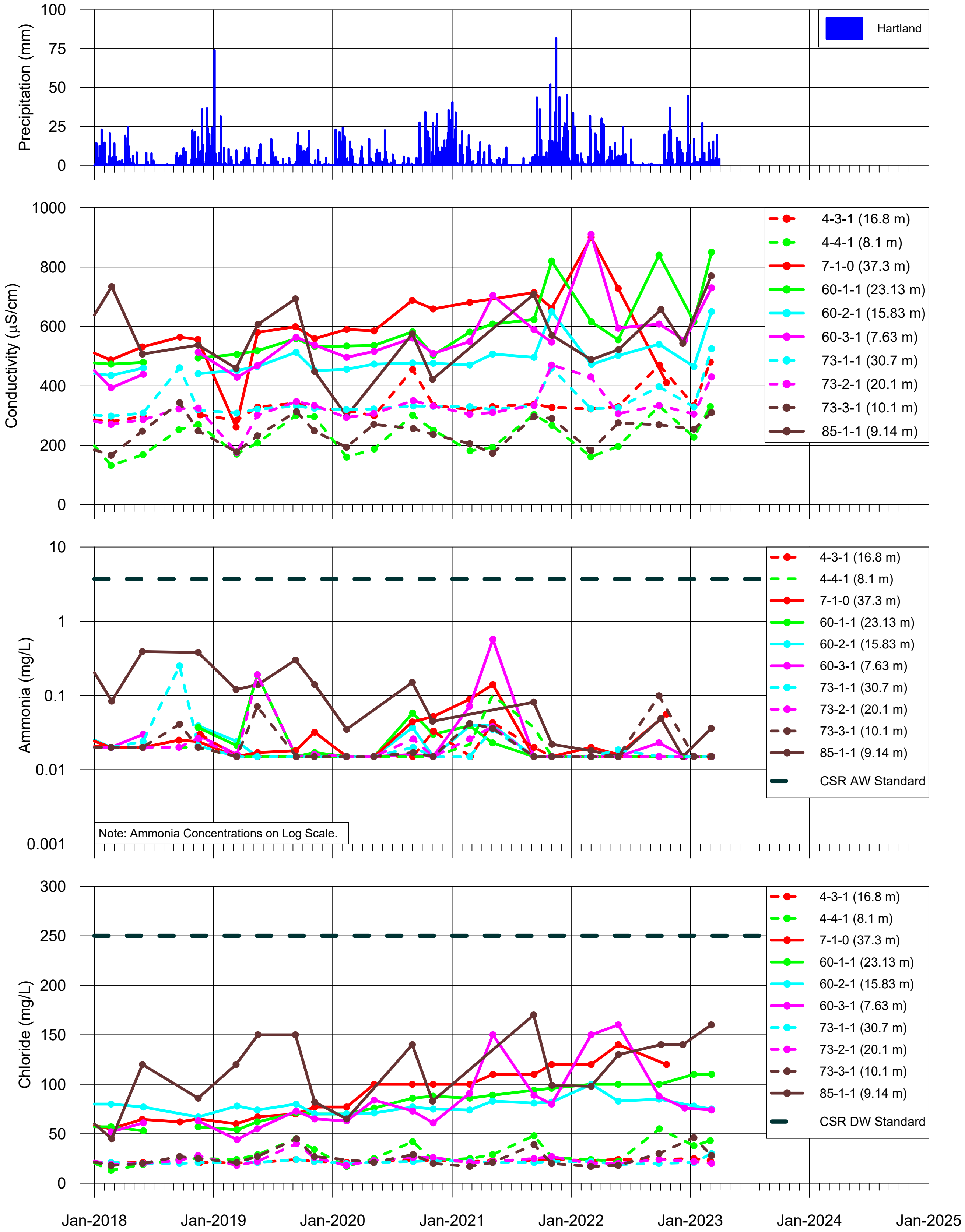


Figure 5-9. Groundwater Quality South of Landfill

5.7.6 Monitoring Site 04

Location 04 is the southernmost groundwater monitoring location at the landfill and is considered a Boundary Compliance Well. Groundwater sampling in the deepest monitoring well at Site 04 was discontinued in 2016 due to extremely slow recharge and resultant challenges in collecting representative samples.

In 2022/23, all concentrations observed in GW-04-3-1 and GW-04-4-1 met the applicable CSR standards. Groundwater quality in GW-04-4-1 continued to report slightly elevated concentrations of chloride in 2022/23, with a maximum concentration of 43 mg/L during March 2023 sampling event. Conductivity and ammonia concentrations in both wells were generally low and consistent with previous years, indicating water quality was not impacted by leachate.

Nitrate concentrations were elevated in the shallow well, with an average concentration of 1.13 mg/L, and a maximum of 1.84 mg/L. The maximum nitrate concentration observed in the deep well was 0.046 mg/L. Sulphate concentrations were slightly higher in the deep well, ranging from 38 to 39 mg/L as compared to 21 to 32 mg/L in the shallow well. Over the past five years, statistically significant increasing trends in conductivity, chloride, and sulphate concentration have been observed in GW-04-3-1, and nitrate concentrations have trended downward. An increasing trend in chloride concentrations was also detected in GW-04-4-1. Due to the low ammonia and conductivity concentrations, groundwater quality in at monitoring station 04 was not impacted by landfill leachate. The source of the chloride remains uncertain but is likely linked to the same cause of water quality impacts at stations 07, 85 and 60. Although nitrate concentrations were occasionally elevated, the low and stable sulphate concentrations indicate that groundwater quality was not impacted by aggregate runoff.

5.7.7 Monitoring Site 19

Four monitoring wells were installed at monitoring station19: GW-19-1-1 (38 m BGS), GW-19-1-2 (28 m BGS), GW-19-2-1 (17 m BGS), and GW-19-2-2 (9 m BGS). These wells are not considered Boundary Compliance Wells. In 2022/23, all samples collected at station 19 met applicable CSR AW and DW standards.

Unlike previous years, conductivity in one well (GW-19-1-1) surpassed 500 µS/cm, reaching a maximum conductivity of 740 µS/cm in March 2023. Ammonia and nitrate concentrations were generally close to detection limits, except for slightly elevated ammonia concentrations that ranged from 0.031 to 0.27 mg/L in wells GW-19-1-1 and GW-19-1-2. Chloride and sulphate concentrations were generally low to moderate, ranging from 15.0 to 33.0 mg/L and <1.0 to 49 mg/L, respectively. Over the past five years, statistically significant increasing trends in ammonia concentration and conductivity have been observed in GW-19-1-1, and a decreasing trend in ammonia concentrations has been observed in GW-19-1-2. Increasing trends in conductivity and chloride have been observed in well GW-19-2-1, and an increasing trend in chloride concentration has also been observed in GW-19-2-2. Similar to previous years, groundwater quality at monitoring station 19 was not impacted by leachate or aggregate placement.

5.8 Monitors East of the Phase 1 Landfill

Groundwater monitoring stations 16, 17, 18, 50, 54 and 76 are situated along the east boundary of the Phase 1 landfill, north of Hartland Avenue. Groundwater quality is no longer monitored stations 50, 54, and 76 due to continued demonstration of groundwater flow toward the landfill, and the presence of water quality reflective of background conditions.

5.8.1 Monitoring Sites 17 and 18

Figure 5-11 displays concentrations of leachate indicator parameters observed at groundwater monitoring stations 17 and 18. In 2022/23, solute concentrations in all wells at both sites met applicable CSR standards. At both sites, the groundwater exhibited relatively low conductivity (average of 380 mg/L), except for one sample collected from GW-18-1-1 in May 2022 (1,646 µS/cm). The anomalous conductivity value does not correspond to a noticeable increase in any major ion concentrations or alkalinity, so it was likely a transcription error. Throughout the monitoring year, ammonia and chloride concentrations were low, and nitrate concentrations were generally low to moderate, ranging from below detection to 1.23 mg/L, with an average of approximately 0.26 mg/L. Sulphate concentrations were low to moderate, ranging from 24 to 57 mg/L. Over the past five years, statistically significant increasing trends in conductivity, chloride, sulphate, and nitrate concentrations have been observed at GW-18-2-1, and an increasing trend in sulphate concentrations has been observed in GW-18-1-1 and GW-18-2-2. At monitoring station 17, decreasing trends in chloride concentration were observed in GW-17-1-1 and GW-17-1-2.

Groundwater quality at monitoring stations 17 and 18 did not show any evidence of landfill leachate impacts. Aggregate impacts were not observed at these locations, as nitrate and sulphate concentrations were relatively low and decreased slightly from the previous monitoring year.

5.8.2 Monitoring Site 16

Site 16 is located northeast of Phase 1 and is not considered a Boundary Compliance Station. In 2022/23, only two groundwater samples were collected at Site 16. All leachate indicator parameters were indicative of background conditions and met all applicable CSR standards. Average conductivity was relatively low at approximately 358 µS/cm. However, in March 2023, highly elevated nitrate and moderate sulphate concentrations were observed in all wells at monitoring station 16, when the average nitrate concentration was 14.5 mg/L. Sulphate concentrations showed similar increases over this period, reaching 71.0 mg/L in GW-16-1-2. Over the past five years, a statistically significant increasing trend in chloride concentrations has been observed in GW-16-1-2, GW-16-2-1, and GW-16-2-2. An increasing trend in conductivity has been observed at GW-16-2-2, as well as a decreasing trend in sulphate concentration at GW-16-2-1.

In 2022/23, groundwater quality at Site 16 showed no evidence of landfill leachate impacts because chloride and ammonia concentrations were low. However, during the March 2023 sampling event, groundwater quality at Site 16 appeared to be influenced by aggregate, as indicated by significantly elevated nitrate levels and moderate sulphate concentrations. Groundwater quality at this location should continue to be closely monitored to evaluate the severity and evolution of groundwater quality impacts linked to the Northeast Stockpile.

5.9 Summary

Groundwater quality results from 2022/23 indicate that leachate-impacted groundwater was contained within the landfill property boundary. At the north end of the landfill, leachate impacts extend just north of the unlined Lower Leachate Lagoon and through the middle of the lined Upper Leachate Lagoon but did not extend off-site. Similarly, south of the landfill, leachate-impacted groundwater did not extend off-site. Leachate-related exceedances were confined to the landfill footprint on the east side of Phase 1 and are inferred to extend to the west side of the Phase 2 landfill.

In 2022/23, multiple wells exhibited groundwater quality impacts related directly to aggregate production, use, and stockpiling at Hartland. Compared to the 2021/22, groundwater quality impacts associated with aggregate production and stockpiling have become more widespread. Nested wells impacted by aggregate stockpiling indicate that nitrate concentrations in shallower wells were more evidently elevated and more frequently exceeded the threshold of 0.1 mg/L, in comparison to sulphate levels.

Our review of the 2022/23 groundwater quality data revealed the following:

- Boundary Compliance Wells and off-site monitoring wells met CSR AW and DW standards, except for an anomalous copper exceedance at location 21 in May 2022. However, this recorded exceedance may not be an accurate representation of water quality as there was a high relative percent difference between parent and duplicate samples.
- CSR exceedances in groundwater were observed in on-site monitoring wells near the north and south purge wells and known leachate sources as follows:
  - Similar to previous years, water quality in well GW-58-1-0 (within the landfill waste footprint) exceeded CSR AW standards for ammonia and cobalt on all four sampling dates. Additionally, chloride, cobalt, nickel, strontium, and vanadium concentrations exceeded CSR DW on one or more sampling events. Sodium concentrations were above the CSR DW of 200 mg/L but well below the regional background concentration of 1,700 mg/L, indicating sodium concentrations were compliant with the CSR at this location.
  - Groundwater quality in well GW-52-1-1 (near the north purge wells) exceeded CSR AW standards for ammonia and CSR DW standards for strontium on all four sampling dates.
  - Groundwater quality in the north (GW-52-4-0-P7 and GW-80-1-0-P8) and south purge wells (P1, P2, P3, P4 and P10) exceeded CSR AW standards for ammonia on one or more sampling dates. Chloride, chromium, arsenic, barium, and nitrate concentrations occasionally exceeded CSR DW standards in some wells. Lithium and sodium concentrations in all wells were below regional background values, and therefore elevated concentrations were not considered CSR exceedances.
- Operation of the Phase 1 North Purge Well System continues to mitigate leachate impacts north of the landfill, as indicated by long-term stable or decreasing concentrations of leachate indicator parameters at stations 40, 20 and 21.

Groundwater quality in wells GW-20-1-1, GW-21-1-1, and GW-40-1-1 were generally stable in 2022/23, but nitrate concentrations at monitoring station 40 increased considerably from the previous monitoring year.

- Groundwater quality in some shallow wells located along the North Ridge (e.g., monitoring stations 77, 78, 87, 88), near the Northwest Stockpile exhibited elevated nitrate and sulphate concentrations. Groundwater quality was primarily impacted by aggregate stockpiling on the bedrock ridge north of the Phase 2 landfill.
- Along the northern edge of the Phase 2 basin, groundwater quality is primarily impacted by runoff from aggregate stockpiling, with some wells (GW-106-1-1 and GW-105-1-1) showing evidence of dilute landfill leachate impacts. The influence of landfill leachate on groundwater is limited to an area less than 20 meters northwest of the Phase 2 Basin and additional mitigation measures are being evaluated and implemented by CRD.
- Groundwater quality between the Lower Leachate Lagoon and Willis Point Road continued to show no indication of leachate impacts. However, the elevated conductivity, sulphate, and nitrate levels observed at Boundary Compliance Station 31 are likely associated with local aggregate use and stockpiling to the northeast of the landfill.
- Water quality along the southern boundary of the Phase 1 landfill showed no evidence of landfill leachate impacts. Since 2020, chloride concentrations have been occasionally elevated at some monitoring stations (e.g., stations 85 and 60) in the area, but the elevated chloride concentrations have not correlated with elevated ammonia concentrations. High Cl/Na molar ratios (>1) suggest there is additional source of chloride other than road salt, but the source of chloride is currently unknown. In addition, elevated nitrate concentrations were observed in some shallow wells, accompanied by moderate concentrations of sulphate. The elevated nitrate may be sourced from the Phase 1 Stockpile or dust originating from other stockpiles.
- Water quality along the east boundary of the Phase 1 landfill was similar to previous years and was not impacted by leachate. Ammonia concentrations at monitoring stations 16, 17 and 18 were below the detection limit on all sampling events, and groundwater quality at met all applicable CSR standards. However, groundwater quality at station 16 likely showed signs of aggregate impacts during the March 2023 sampling event.

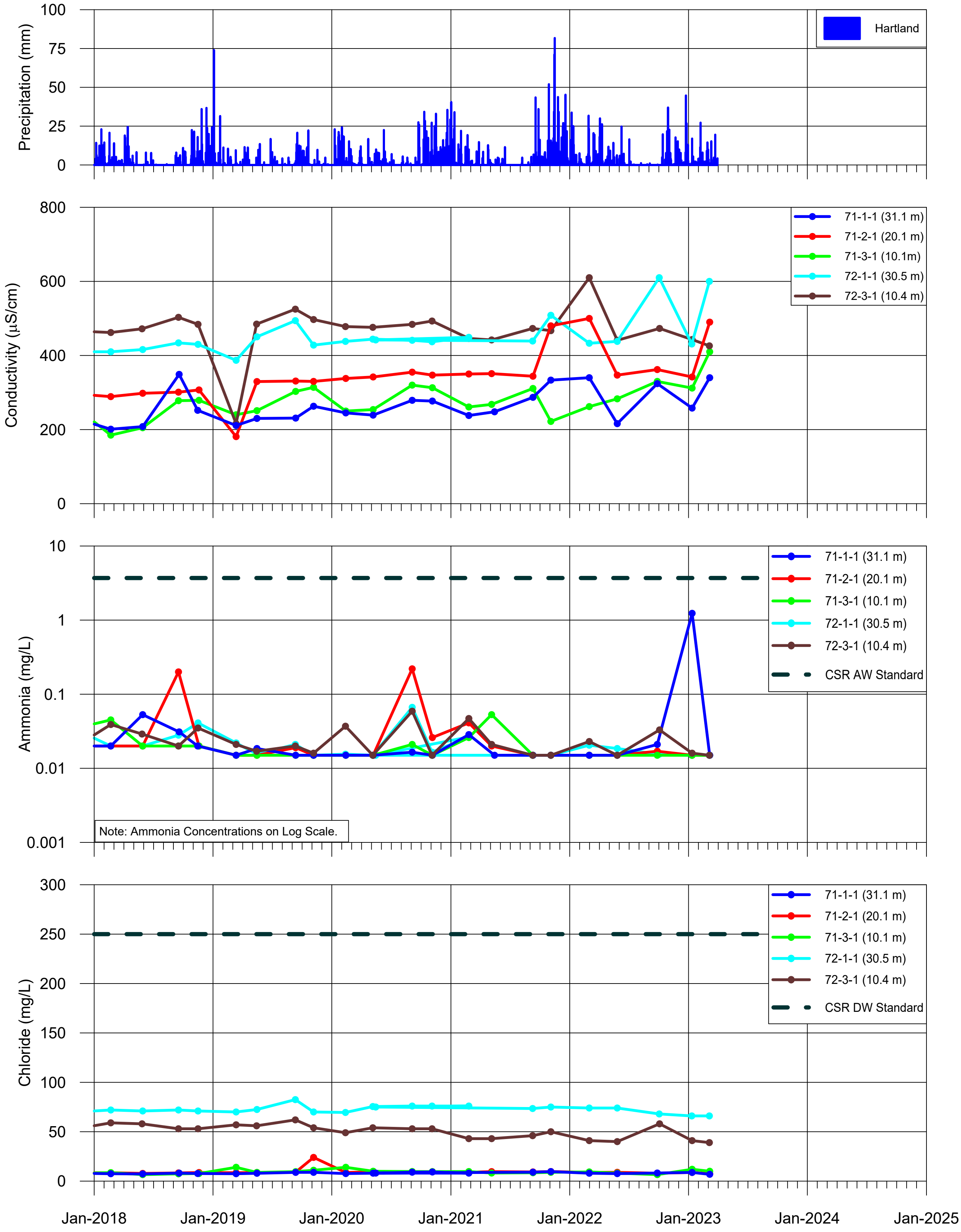


Figure 5-10. Groundwater Quality Southeast of Landfill

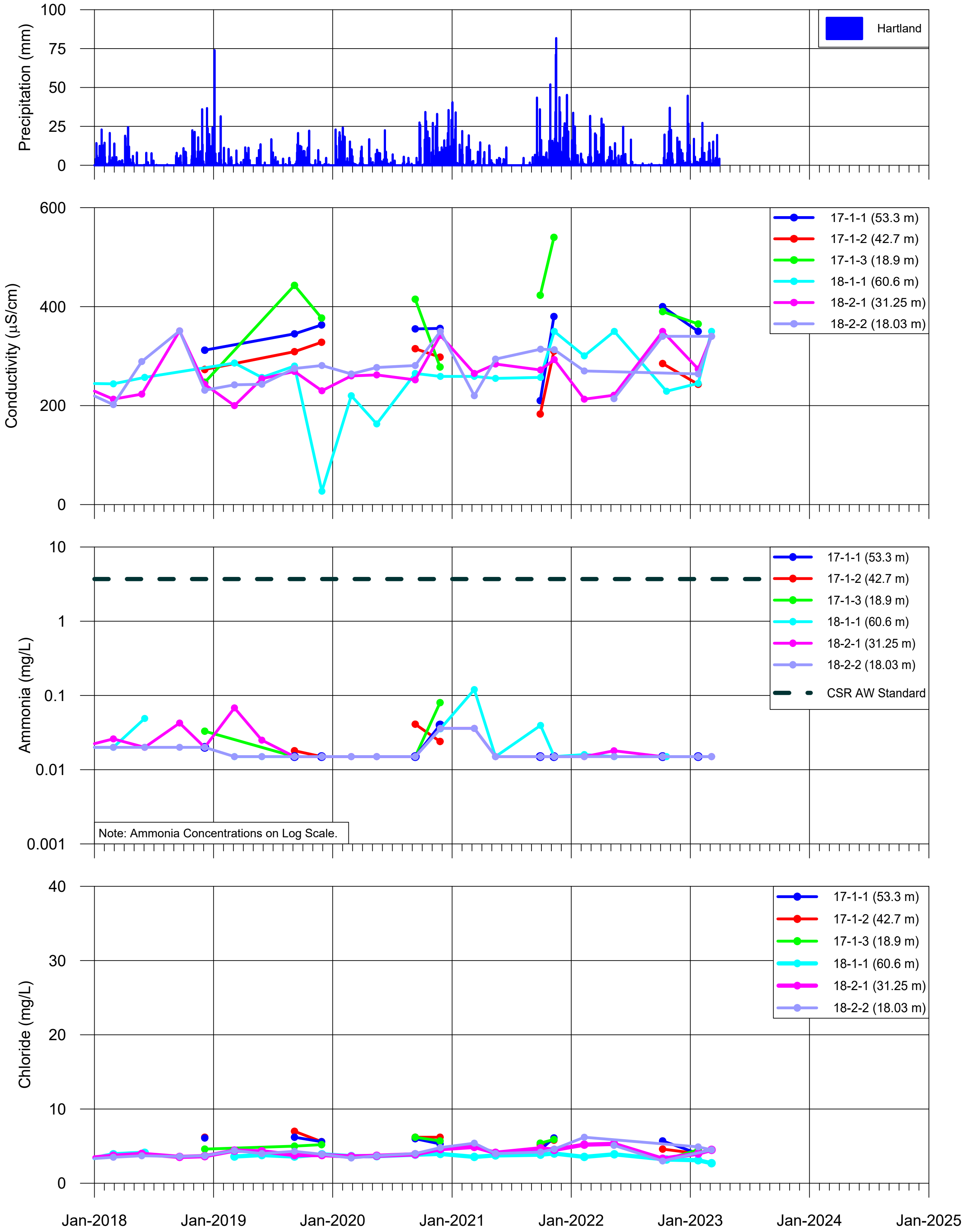


Figure 5-11. Groundwater Quality East of Landfill

6. Groundwater Quality in Domestic Wells

6.1 Monitoring Locations

This section of the report summarizes our interpretation of water quality data collected from domestic wells around Hartland Landfill in June 2023. Routine groundwater samples were collected June 2023, from sixteen (16) selected domestic wells located within a 2 km radius of the landfill.

Since the 1980s, the CRD has performed routine sampling and analysis of domestic wells near the landfill that are used as a primary source of drinking water. The number of wells included in the program have been reduced gradually as municipal water became available and residents chose to connect to the municipal supply system. Most of the domestic wells near Hartland Landfill are situated southeast of the landfill, as shown on Figure 6-1. The wells are primarily 0.15 m in diameter and penetrate between 30 m and 120 m of bedrock. Three of the wells are shallow dug wells completed in overburden. Well yields are generally low and substantial drawdown occurs during pumping, particularly during the dry summer months.

Routine groundwater samples collected in 2023 were analyzed for general water quality parameters and total metals. Tabulated results are presented in Appendix B.2. Results were compared to the *British Columbia Approved Source Drinking Water Quality Guidelines (SDWQGs)* where available and *Guidelines for Canadian Drinking Water Quality* (CDWQ). SDWQGs and CDWQ were updated in September 2020 and June 2019, respectively, with several parameters (e.g., sulphate, antimony, lead, cobalt, chromium, copper, manganese, nickel, etc.) added to the drinking water guidelines or updated.

6.2 Domestic Well Quality

Groundwater quality in the domestic wells was consistent with groundwater quality results reported since 2000. Although concentrations of some parameters have varied since the sampling program began, and pH in some of the wells was less than circumneutral, the groundwater is considered representative of natural conditions.

At all locations, the groundwater quality met applicable guidelines in all sampled wells, with some exceptions. Exceedances of the CDWQ guideline (aesthetic objectives) were noted at select locations as described below:

- Field pH values were below the CDWQ guideline of 7.0, at monitoring stations 3, 4, 7, 8, 9, 10, 12, 13, and 14.
- The manganese concentration observed in domestic wells 37 and 38 (stations 12 and 13, respectively) exceeded the total manganese SWWQG (0.02 mg/L). The SDWQG for total manganese in drinking water is an aesthetic objective to protect against staining and unpleasant taste but such concentrations are not considered toxic.

The five domestic wells located northwest of the landfill met CDWQ and SDWQG guidelines for leachate indicator parameters, indicating these wells were not impacted by leachate from Hartland Landfill.

In summary, domestic well water quality results are consistent with historical data and show no evidence of landfill-related impacts.

File Location: L:\LEGACY\CABNY1FP001\PROD\PROJECTS\60631284\900-CAD_GIS\910-CAD\20-SHEETS\C434 - 2022-23 ANNUAL REPORT\FIG6.1-DOMESTIC WELLS-60631284-2022.DWG
Date Plotted: August 15, 2023
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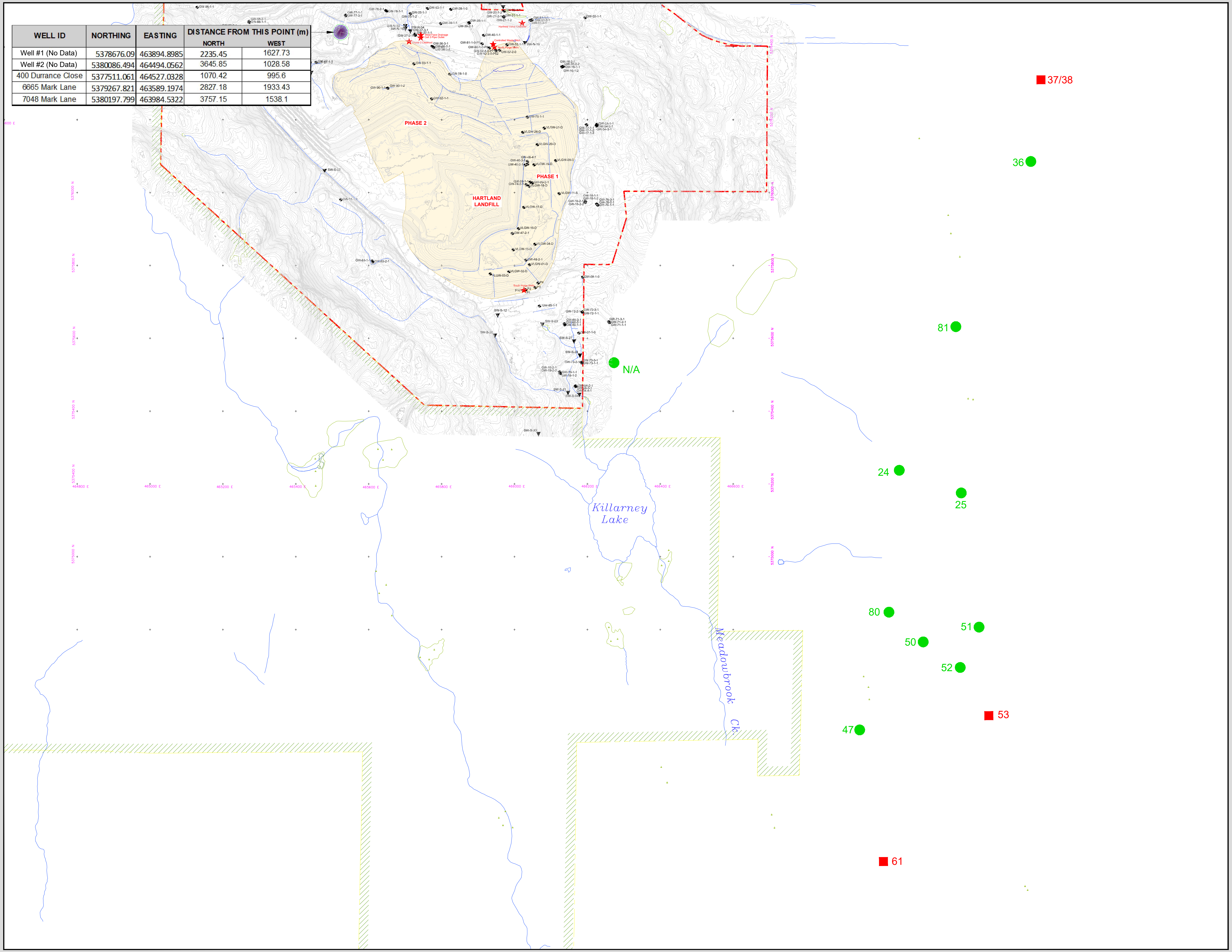
By: susan.a.powell



WELL ID	NORTHING	EASTING	DISTANCE FROM THIS POINT (m)	
			NORTH	WEST
Well #1 (No Data)	5378676.09	463894.8985	2235.45	1627.73
Well #2 (No Data)	5380086.494	464494.0562	3645.85	1028.58
400 Durrance Close	5377511.061	464527.0328	1070.42	995.6
6665 Mark Lane	5379267.821	463589.1974	2827.18	1933.43
7048 Mark Lane	5380197.799	463984.5322	3757.15	1538.1

Legend

☐	BUILDING / STRUCTURE
—	ROAD
—	FENCE
- · -	LEGAL LOT BOUNDARY
—	INDEX CONTOUR (5m)
—	INTERMEDIATE CONTOUR (1m)
—	TREES/SHRUB/VEGETATION
- - -	DITCH
—	DRAINAGE
- · -	PIPE
🟨	EXISTING WASTE
- - -	HARTLAND LANDFILL OPERATING AREA BOUNDARY
37 ●	DRILLED DOMESTIC WELL SAMPLED IN MAY-JUNE 2022
🟥 61	DUG DOMESTIC WELL SAMPLED IN MAY-JUNE 2022
● Well #1	NO DATA COLLECTED IN 2022

Map Sources / Notes:
- Contours based on 24-W542_2022_base.dwg, April 2022.
- Drainage information for years 2018-2019 obtained from Parks & Env. Services GIS technicians and have layers with the prefix "CRD19_GIS DRAINAGE" & "CRD19_GIS streams_Ditches".
- GPS pickup has been conducted by CRD Staff of creeks, wetlands, culverts located under tree canopied areas. This information (considered more accurate) has been added to the base (superceding some planimetric information) and is placed on layers indicating GPS pickup. An example of that layering system would be 'CRD19-wat-culvert_GPS pickup'.
- Surveyed points for monitoring sites (groundwater, gas wells, leachate, purge wells) were updated for 2019.
- The map is to NAD83 UTM coordinates. Vertical datum is to CGVD28.

N
W E
S

0 50 100 200 300 400 m
1 : 10,000
UTM Zone 10N, NAD83

Reviewed by: KJ
Date Issued: August 2023
Prepared by: SP
Project Number: 60631284

CRD
Making a difference...together

Project: Hartland Landfill Monitoring
Location: Saanich, BC

Domestic Well Locations

AECOM

Figure 6-1

7. Surface Water Quality near the Landfill

7.1 Compliance Monitoring Locations

Five surface water compliance monitoring stations (i.e., Boundary Compliance stations) surround Hartland Landfill. These stations are concentrated along the southern and northern property boundaries, downgradient of areas that could potentially be impacted by leachate or runoff from the landfill. The following Boundary Compliance stations are monitored to assess landfill compliance with the landfill operating permit:

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

In 2022/23, a total of 34 surface water stations were sampled, including nine newly established stations. Surface water quality analytical results are presented in Appendix B.3. Between December 2022 and February 2023, a total of nine (9) surface water stations (SW-N-57, SW-N-58, SW-N-59, SW-N-60, SW-N-61, SW-N-62, SW-N-63, SW-N-64, and SW-N-65) were established north of the landfill. These stations aim to monitor the effects on surface water quality due to various landfill activities, such as road construction, blasting, and aggregate stockpiling, and to assess their impact on the downstream environment.

7.1.1 Regulatory Comments

As discussed in Section 2.5.2, the results were compared to the BCWQG for the protection of freshwater aquatic wildlife (AW). Exceedances of BCWQGs are noted in Table 7-1. Some parameters have variable guidelines, as noted below:

- For ammonia, there is no single value for the protection of freshwater AW. The toxicity of ammonia is related to the temperature and pH of the water, and the BCWQG includes values for acute and chronic effects. The appropriateness of the chronic (allowable 30-day average) concentration for the assessment of ongoing operations is currently being evaluated. Using surface water quality data, CRD staff calculated the allowable LTC concentration of ammonia for the protection of freshwater AW and the short term acute (STA) based on the pH and temperature of each sample (as discussed in the footnotes of Table 7-1), with exceedances highlighted based on BCWQG-STAs.
- The BCWQG-STA for sulphate was calculated based on the hardness of each sample. A detailed description is presented in the footnotes of Appendix B.3.
- The BCWQG-STA and LTC values for total suspended solids (TSS) reference a “change from the background value” and the flow conditions (i.e., clear/turbid waters). Due to influences from aggregate stockpiling and ongoing construction, the water quality at stations Sw-N-CSs2 and Sw-N-14 cannot be considered representative of background conditions north of the landfill. Sw-S-52 is the only background station at the landfill and was used to assess TSS criteria. In 2022/23, background TSS values observed at Sw-S-52 were less than 1.0 mg/L.
- BCWQGs for cadmium, lead, nickel, manganese, sulphate, and silver are hardness dependent. Total metal concentrations were compared to guidelines based on the hardness of each sample.
- The dissolved copper BCWQG varies with hardness, pH, dissolved organic carbon (DOC) and temperature, and is calculated using the Biotic Ligand Model (BLM). The calculated BLM results were obtained from CRD. However, copper exceedances should be interpreted with caution due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives.
- The total aluminum table was updated in the approved BCWQG version dated August 2023. The total aluminum guideline is dependent on pH, hardness, and DOC and is calculated using the BC Water Quality Guideline calculator for Aluminum in Freshwater Ecosystems. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill.
- The total arsenic WQGs for freshwater and marine aquatic life were corrected in the approved BCWQG version from August 2023.

- The dissolved zinc table was updated in the approved BCWQG version from August 2023. The dissolved guideline is dependent on pH, hardness, and DOC. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill.

Table 7-1. Surface Water Quality Exceedances 2022-2023

B.C. Water Quality Guidelines				BC WQG MAXIMUM (1)(2)	---	---	---	---	600	110	---	---	1000	3.28 - 416.7 (5)	815 - 3394 (5)	46000	1.9 - 24.9 (3)	0.06 - 0.6 (4)
				BC WQG AVERAGE (1)	Variable (9)	5	1200	---	150	4	---	---	---	3.43 - 19.57 (5)	767 - 2585 (5)	7600	0.135 - 1.77 (3)	0.02 - 0.2 (4)
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	PARAMETER	Aluminum	Arsenic	Boron	Cadmium	Chloride	Cobalt	Copper	Hardness (As Caco3)	Iron	Lead	Manganese	Molybdenum	N - Nh3 (As N)	N - No2 (As N)
				STATE	TOT	TOT	TOT	TOT	DIS	TOT	TOT	TOT	TOT	TOT	TOT	TOT	TOT	DIS
				UNIT	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
				Method Detection Limit (MDL)	0.5	0.02	10	0.005	1	0.01	0.1	0.5	1	0.005	0.1	0.05	0.015	0.005
				Limit of Quantification (LOQ)	2.5	0.1	50	0.025	5	0.05	0.5	2.5	5	0.025	0.5	0.25	0.075	0.025
					30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
				COMMENTS	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
SW-N-05	FR1	Y	2022-05-04		45.1	0.198	233.	0.077 9	16.	0.784	12.8	423.	38.1	0.007 1	161.	2.95	6.5 b	0.389 b
SW-N-05	FR2	Y	2022-05-04		45.	0.182	235.	0.077	16.	0.794	12.7	425.	37.8	0.006 6	158.	2.95	6.5 b	0.39 b
SW-N-05	SS	Y	2022-11-07	Submitted to lab as 2022-0032160	118.	0.132	82.	0.021 4	4.8	0.708	3.47	372.	192.	0.026 2	12.8	0.717	2.9 b	0.156 b
SW-N-05	FR1	Y	2023-01-05	Clear, colourless.	104.	0.193	104.	0.039 4	8.7	0.165	5.28	618.	100.	0.017	5.26	2.82	< 0.015	< 0.005
SW-N-05	FR2	Y	2023-01-05	Clear, colourless.	105.	0.206	101.	0.081 7	8.7	0.168	5.35	623.	98.	0.027	5.09	2.82	< 0.015	< 0.005
SW-N-05	FR1	Y	2023-02-07	Moderate flow, clear & colourless.	217. b	0.204	90.	0.088 4	29.	0.277	6.75	271.	304.	0.037	7.61	2.84	< 0.015	< 0.005
SW-N-05	FR2	Y	2023-02-07	Moderate flow, clear & colourless.	221. b	0.221	94.	0.020 8	30.	0.298	7.26	302.	306.	0.038	8.88	3.05	< 0.015	< 0.005
SW-N-14	SS		2022-11-10	Submitted to lab as 2022-0032202	28.1	0.157	80.	0.005 6	11.	0.111	1.6	192.	52.4	0.036	5.57	0.429	< 0.015	< 0.005
SW-N-14	SS		2023-02-13	Moderate flow, clear & colourless.	63.5	0.107	75.	< 0.005	20.	0.113	1.38	173.	119.	0.045	7.97	0.639	< 0.015	< 0.005
SW-N-14	SS		2023-02-21	Moderate flow, clear and colourless.	23.1	0.15	68.	< 0.005	19.	0.076 1	1.04	183.	29.2	0.009 4	2.58	0.759	< 0.015	< 0.005
SW-N-14	SS		2023-03-20	Moderate flow, clear and colourless.	35.3	0.107	63.	0.005 5	29.	0.083	0.99	153.	67.7	0.025	4.75	0.415	< 0.015	< 0.005
SW-N-15	SS		2023-02-21	Moderate flow, clear and colourless.	6.33	0.105	29.	< 0.005	7.3	0.012 7	0.258	76.7	7.1	0.007 1	0.698	0.244	< 0.015	< 0.005
SW-N-15	SS		2023-03-20	High flow, clear and colourless.	6.2	0.069	24.	< 0.005	7.4	0.011	0.25	61.4	7.9	< 0.02	0.58	0.219	< 0.015	< 0.005
SW-N-16	FR1	Y	2022-11-09	Submitted to lab as 2022-0032198	47.	0.198	53.	0.028 3	6.1	0.244	5.94	180.	165.	0.071	33.2	0.891	0.049	0.018 2
SW-N-16	FR2	Y	2022-11-09	Submitted to lab as 2022-0032200	48.7	0.235	63.	0.030 5	6.5	0.278	6.91	212.	181.	0.077	39.9	1.09	0.048	0.017 5
SW-N-16	FR1	Y	2023-01-05	Clear, colourless.	34.8	0.194	50.	0.019 7	12.	0.207	6.47	181.	108.	0.014 5	39.	0.813	0.039	0.018 8
SW-N-16	FR2	Y	2023-01-05	Clear, colourless.	32.7	0.207	49.	0.016 1	11.	0.203	6.63	182.	111.	0.015 3	37.4	0.819	0.041	0.018 5
SW-N-16	FR1	Y	2023-02-07	Very high flow, moderately turbid, brown.	636. b	0.255	45.	0.222	16.	1.12	11.7	187.	1 250. a	0.095	56.5	0.862	< 0.075	0.021 7
SW-N-16	FR2	Y	2023-02-07	Very high flow, moderately turbid, brown.	606. b	0.213	40.	0.064 4	15.	1.05	10.1	164.	1 210. a	0.083	50.5	0.739	0.044	0.018 2
SW-N-17	SS		2022-11-10	Submitted to lab as 2022-0032204	9.37	0.107	145.	0.012 5	13.	0.268	0.944	295.	8.2	0.005 5	10.8	0.559	< 0.015	0.011 8
SW-N-17	SS		2023-02-13	Moderate flow, clear & colourless.	16.5	0.085	123.	0.007 3	27.	0.107	0.87	229.	21.8	< 0.02	2.38	3.34	< 0.015	< 0.005
SW-N-17	SS		2023-02-21	Moderate flow, clear and colourless.	8.42	0.127	122.	< 0.005	26.	0.086 4	0.701	231.	8.5	< 0.005	3.41	0.696	< 0.015	< 0.005
SW-N-17	SS		2023-03-20	Moderate flow, clear and colourless.	7.9	0.079	116.	0.006 1	39.	0.079	0.58	190.	12.5	< 0.02	2.62	0.492	< 0.015	< 0.005
SW-N-18	SS		2022-05-04		65.5	2.2	926.	0.056 5	84.	8.27 b	15.6	263.	1 110. a	0.36	650.	1.34	82. a b	0.121
SW-N-18	SS		2022-11-07	Submitted to lab as 2022-0032159	83.8	0.173	62.	0.008 6	3.6	1.14	1.56	408.	144.	0.028 6	50.7	2.98	11. a b	0.681 a b
SW-N-18	SS		2023-01-05	Clear, colourless.	254.	0.188	28.	0.007 9	5.6	0.581	1.75	190.	532.	0.197	22.6	1.66	1.9 b	0.306 a b
SW-N-18	FR1		2023-02-07	High flow, slightly turbid, slightly grey.	1 660. b	0.199	45.	0.012 8	6.5	2.77	4.17	325.	3 290. a	0.174	72.6	1.6	6.3 b	0.496 a b
SW-N-18	FR2		2023-02-07	High flow, slightly turbid, slightly grey.	1 540. b	0.211	46.	0.067	7.1	2.61	5.65	326.	3 080. a	0.216	71.6	1.65	6.3 b	0.492 a b
SW-N-19	SS		2022-05-04		20.4	0.256	59.	0.019 1	7.5	0.503	17.8	163.	49.4	0.018 2	22.6	1.05	< 0.015	0.007 6
SW-N-19	SS		2022-11-09	Submitted to lab as 2022-0032201	14.1	0.277	41.	0.013 4	5.3	0.422	8.65	238.	66.2	0.026	17.2	1.3	0.058	0.104 b
SW-N-19	SS		2023-01-05	Clear, colourless.	15.9	0.218	31.	0.014 4	9.7	0.198	11.4	201.	28.	0.007 5	5.23	0.898	0.02	0.046 3
SW-N-41S1	FR1	Y	2023-01-05	Clear, colourless.	85.1	0.264	19.	< 0.005	5.6	0.115	0.43	170.	200.	0.062	72.5	0.31	< 0.015	< 0.005
SW-N-41S1	FR2	Y	2023-01-05	Clear, colourless.	77.4	0.251	17.	< 0.005	5.7	0.103	0.4	160.	179.	0.059	66.	0.256	< 0.015	< 0.005
SW-N-41S1	FR1	Y	2023-02-06	Low flow, clear & colourless.	70.2	0.241	17.	< 0.005	5.4	0.129	0.35	169.	193.	0.059	92.6	0.292	< 0.015	< 0.005
SW-N-41S1	FR2	Y	2023-02-06	Low flow, clear & colourless.	69.9	0.157	19.	< 0.005	5.4	0.12	0.214	168.	189.	0.005 1	88.7	0.296	< 0.015	< 0.005
SW-N-42S1	FR1	Y	2022-05-04		42.2	0.087	48.	< 0.005	12.	0.103	0.52	168.	75.6	0.187	39.2	0.529	< 0.015	< 0.005
SW-N-42S1	FR2	Y	2022-05-04		46.	0.083	50.	0.007 2	12.	0.137	0.57	174.	116.	0.073	69.8	0.681	< 0.015	< 0.005
SW-N-42S1	FR1	Y	2022-11-09	Submitted to lab as 2022-0032194	455. b	0.364	60.	0.029 1	15.	0.842	2.	262.	799.	0.573	529.	0.755	0.042	< 0.005
SW-N-42S1	FR2	Y	2022-11-09	Submitted to lab as 2022-0032199	272.	0.254	60.	0.021 9	14.	0.501	1.43	250.	477.	0.32	287.	0.7	< 0.015	< 0.005
SW-N-42S1	FR1	Y	2023-01-05	Clear, colourless.	25.5	0.089	62.	0.005	27.	0.067	0.66	182.	39.8	0.038	15.7	0.479	< 0.015	< 0.005
SW-N-42S1	FR2	Y	2023-01-05	Clear, colourless.	43.7	0.092	64.	< 0.005	27.	0.089	0.77	184.	68.9	0.055	25.1	0.483	< 0.015	< 0.005
SW-N-45	SS		2022-11-10	Submitted to lab as 2022-0032205	9.82	0.101	213.	0.012 7	8.8	0.419	1.49	359.	6.4	0.005 4	7.8	0.916	< 0.015	0.020 3
SW-N-45	SS		2023-02-13	Moderate flow, clear & colourless.	15.9	0.081	158.	0.007 5	35.	0.113	2.24	243.	15.8	< 0.02	5.56	1.37	< 0.015	< 0.005
SW-N-45	SS		2023-02-21	Moderate flow, clear and colourless.	48.2	0.126	170.	0.011 6	31.	0.141	1.6	229.	44.5	0.017 9	12.3	1.07	< 0.015	< 0.005
SW-N-45	SS		2023-03-20	Low flow, clear and colourless	25.9	0.081	178.	0.008	54.	0.106	1.22	201.	22.8	< 0.02	5.32	0.866	< 0.015	< 0.005
SW-N-53	SS		2023-02-07	Low flow, very turbid, very brown.	140 000. b	4.49	< 100.	0.406	170. b	142. a b	341.	563.	235 000. a	14.4 a b	4 200. b	1.14	0.19	0.014 2
SW-N-54	SS		2022-05-04		20.4	0.342	59.	< 0.005	2.2	0.235	14.4	168.	88.1	0.009 6	39.6	0.504	0.016	< 0.005
SW-N-54	SS		2022-11-10	Submitted to lab as 2022-0032203	313.	0.709	42.	0.017 3	8.3	1.31	15.	283.	957.	0.111	370.	0.914	0.21	0.036 4
SW-N-54	SS		2023-01-05	Clear, colourless.	319. b	2.41	52.	0.065 4	17.	6.49 b	54.3	318.	1 340. a	0.202	3 620. b	1.49	1.2	0.147
SW-N-54	SS		2023-02-07	High flow. Moderately turbid,slightly grey.	3 360. b	1.08	53.	0.027 6	19.	4.37 b	19.8	259.	7 920. a	0.771	565.	0.812	0.94	0.026 5
SW-N-54	SS		2023-02-07	High flow. Moderately turbid,slightly grey.	3 360. b	1.08	53.	0.027 6	19.	4.37 b	19.8	259.	7 920. a	0.771	565.	0.812	0.94	0.026 5
SW-N-57	FR1		2023-02-07	Field characteristics not recorded.	1 370. b	0.214	39.	0.008 6	6.4	2.47	4.2	287.	2 650. a	0.157	62.4	1.69	6.5 b	0.49 a b
SW-N-57	FR2		2023-02-07	Field characteristics not recorded.	1 920. b	0.225	40.	0.01	7.1	3.02	4.79	287.	3 810. a	0.163	71.1	1.69	6.6 b	0.495 a b
SW-N-57	FRM		2023-02-07	Mean of duplicates	1 645. b	0.219 5	39.5	0.009 3	6.75	2.745	4.495	287.	3 230. a	0.16	66.75	1.69	6.55 b	0.492 5 a b
SW-N-62	SS		2023-02-07	Sampled flow before entering culvert. High flow, turbid, grey.	1 200. b	0.199	35.	0.007 4	6.5	2.15	3.23	273.	2 440. a	0.119	48.5	1.6	6. b	0.462 a b
SW-N-62	SS		2023-02-07	Sampled flow before entering culvert. High flow, turbid, grey.	1 200. b	0.199	35.	0.007 4	6.5	2.15	3.23	273.	2 440. a	0.119	48.5	1.6	6. b	0.462 a b
SW-N-63	SS		2023-02-13	NEW. Moderate flow, clear & colourless	91.5 b	0.163 ---	35. ---	< 0.005 --- ---	8.	0.14	1.51 --- ---	86.4 --- ---	252. ---	0.146	16.4	0.375	< 0.015	0.005 7
SW-N-63	SS		2023-02-21	Low flow, clear and colourless.	138. b	0.22 ---	35. ---	0.006 6 --- ---	9.	0.267	1.9 --- ---	95.2 --- ---	528. ---	0.245	33.2	0.358	0.018	< 0.005
SW-N-63	SS		2023-03-20	Moderate flow, clear and colourless.	72.4 b	0.159 ---	31. ---	< 0.005 --- ---	9.5	0.173	1.25 --- ---	81.3 --- ---	216. ---	0.112	27.5	0.307	0.019 --- ---	< 0.005
SW-N-64	SS		2023-02-13	NEW. Moderate flow, clear & colourless.	65.3 b b	0.314 ---	26. ---	0.005 5 --- ---	10.	0.124	1.5 --- ---	51.3 --- ---	279. ---	0.144	12.6	0.276	< 0.015	< 0.005
SW-N-64	SS		2023-03-20	Moderate flow, clear and very slightly yellow	55.1 b b	0.357 ---	24. ---	0.007 1 --- ---	14.	0.173	1.47 --- ---	52.8 --- ---	309. ---	0.122	24.8	0.297	0.021 --- ---	< 0.005
SW-N-65	SS		2023-02-13	NEW. Moderately high flow, clear & colourless.	107. b	0.256	28.	0.007 2	10.	0.182	1.6	63.3	315.	0.175	18.7	0.297	0.016	< 0.005
SW-N-65	SS		2023-03-20	Moderate flow, clear and very slightly yellow	63. b	0.302	28.	0.006 3	12.	0.175	1.76	67.3	283.	0.111	26.	0.317	0.022	< 0.005
SW-N-CS2	SS		2023-01-05	Clear, colourless.	6.58	0.046	< 10.	< 0.005	3.8	0.017 3	0.313	58.5	5.1	< 0.005	0.13	0.084	< 0.015	< 0.005
SW-N-CS2	SS		2023-02-06	Low flow, clear & colourless.	4.72	0.027	< 10.	< 0.005	3.6	0.016 1	0.179	85.9	12.1	< 0.005	0.227	0.124	< 0.015	< 0.005
SW-S-03	SS		2022-05-05		5 630. b	0.817	69.	0.141	18.	5.9 b	31.8	87.3	10 900. a	6.76 a b	271.	0.449	1.3	0.023 8
SW-S-03	SS		2022-11-08		344. b	0.312	44.	0.152	950. a b	0.56	7.33	175.	665.	0.531	32.1	0.3	0.045	< 0.005
SW-S-03	SS		2023-01-04	Clear, colourless.	38.7	0.203	66.	0.009 9	26.	0.502	5.8	108.	712.	0.035	200.	0.138	1.5	0.011 3
SW-S-03	SS		2023-02-06	High flow. Very turbid, very grey	5 060. b	0.657	55.	0.066 3	21.	6.54 b	18.4	104.	9 610. a	3.34 a	250.	0.332	1.3	0.023 4
SW-S-04	FR1	Y	2022-05-05		1 310. b	0.322	72.	0.038 5	18.	1.45	9.03	78.1	2 310. a	1.86	104.	0.28	< 0.015	0.008 6
SW-S-04	FR2	Y	2022-05-05		1 210. b	0.31	71.	0.051 1	18.	1.4	9.08	78.3	2 190. a	1.89	102.	0.257	< 0.015	0.009 1
SW-S-04	FR1	Y	04/01/2023	Clear, colourless.	25.5	0.099	56.	0.005 7	30.	0.062 3	1.68	92.4	35.5	0.022 5	1.76	0.127	0.021	0.007 8
SW-S-04	FRM	Y	2023-02-06	Mean of duplicates	71.3	0.112 ---	66.5 ---	0.012 25 --- ---	31.	0.131 5	1.99 --- ---	100.95 --- ---	102.8 ---	0.113 2	7.65	0.177	< 0.015	< 0.005
SW-S-12	SS		2022-05-05		1 960. b	0.417	115.	0.026 9	11.	2.45	15.2	109.	5 760. a	0.882	404.	0.27	4.2 b	0.014 3
SW-S-12	SS		2022-11-08		277. b	0.519	58.	0.044 4	33.	0.564	20.9	222.	544.	0.181	21.2	0.231	0.017	0.005
SW-S-12	SS		2023-01-04	Clear, slightly grey.	55.6	0.309	92.	0.017 4	20.	0.981	7.8	123.	1 700. a	0.049 4	414.	0.097	2.6 b	0.007 7
SW-S-12	SS		2023-02-06	High flow. Very turbid, very grey	4 390. b	0.545	97.	0.057 4	19.	6.72 b	21.	138.	9 410. a	2.65	463.	0.26	3.5 b	0.008 7
SW-S-20	SS		2023-01-04	Clear, colourless.	41.1	0.101	19.	< 0.005	5.6	0.125	1.14	47.3	112.	0.017 8	24.3	0.054	0.14	< 0.005
SW-S-21	SS		2023-01-04	Clear, colourless.	33.	0.091	17.	< 0.005	6.	0.031 9	1.	40.4	14.2	< 0.005	0.192	0.066	< 0.015	< 0.005
SW-S-24	SS		2023-01-04	Clear, colourless.	29.2 b	0.146	90.	0.007 3	41.	0.099 7	2.7	126.	85.7	0.046 7	5.43	0.136	0.13	0.018 3
SW-S-27	SS		2022-05-05		249.	0.23	93.	0.029 4	8.2	0.44	1.77	97.5	454.	0.76	91.6	0.177	0.02	< 0.005

Notes:

na	*Not applicable.*
Null	*No sample collected.*
a	*Above Maximum allowable concentration (MAC) British Columbia Water Quality Guideline.*
b	*Above 30-day average British Columbia Water Quality Guideline.*
(1)	*British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August 2023. British Columbia Ministry of Environment and a Compendium of Working Water Quality Guidelines for British Columbia, 1998 Edition, Updated in Feb 2021. British Columbia Ministry of Environment. The Guidelines cited specific to protection of freshwater aquatic life unless otherwise noted.*
(2)	*Maximum acceptable concentration unless otherwise noted.*
(3)	*The ammonia guideline is pH and temperature (15°C assumed) dependant. All ammonia results were compared to standards based on the associated pH and temperature results for that sample.*
(4)	*The nitrite guidelines are chloride dependant. All nitrite results were compared to standards based on the associated chloride result for that sample.*
(5)	*This value is hardness dependent. All metals results were compared to standards based on the associated hardness result for a particular sample.*
(6)	*This value is the short-term daily for streams with unknown fish distribution.*
(7)	*The TSS guidelines are "change from background" and flow condition dependent. The background TSS in the landfill are derived from background station Sw-S-52 .*
(8)	*Dissolved copper guideline varies with water hardness, temperature and DOC, and calcuated using BLM;*
(9)	*Total Aluminum guidance is pH, hardness, and DOC dependent and calculated based on BC Water Quality Guideline calculator for Aluminum in Freshwater Ecosystems.*
(10)	*Dissolved Zinc guidance is pH, hardness, and DOC dependent and calculated only where DOC was analyzed.*

Table 7-1. Surface Water Quality Exceedances 2022-2023

B.C. Water Quality Guidelines				BC WQG MAXIMUM (1)(2)	32.8	---	---	0.1 - 3 (5)	---	25	---	6.5 to 9.0	---	---	---	---	---
				BC WQG AVERAGE (1)	3	25-150 (5)	2	0.05 - 1.5 (5)	128 - 429 (5)	5	---	---	---	---	---	---	---
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	PARAMETER	N - No3 (As N)	Nickel	Selenium	Silver	Sulphate	TSS	Zinc	pH	Conductivity	Temperature	Aluminum	Arsenic	Boron
				STATE	DIS	TOT	TOT	TOT	DIS	TOT	TOT	TOT	TOT	TOT	DIS	DIS	DIS
				UNIT	mg/L	µg/L	µg/L	µg/L	mg/L	mg/L	µg/L	pH	µS/cm	°C	µg/L	µg/L	µg/L
				Method Detection Limit (MDL)	0.02	0.02	0.04	0.005	1	1	1	0.1	1	0.1	0.5	0.02	10
				Limit of Quantification (LOQ)	0.1	0.1	0.2	0.025	5	5	5	0.5	5	0.5	2.5	0.1	50
					30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
				COMMENTS	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
SW-N-05	FR1	Y	2022-05-04		32.5 b	5.18	0.593	< 0.005	240.	2.	6.93	.	.	.	29.	0.187	229.
SW-N-05	FR2	Y	2022-05-04		32.9 a b	5.05	0.589	0.005 6	260.	1.6	7.66	.	.	.	32.	0.2	233.
SW-N-05	SS	Y	2022-11-07	Submitted to lab as 2022-0032160	50.5 a b	1.56	2.12 b	< 0.005	180.	7.6 b	5.48	6.71	639.	10.5	3.59	0.134	76.
SW-N-05	FR1	Y	2023-01-05	Clear, colourless.	27.4 b	2.51	1.64	< 0.005	470. b	1.6	7.17	7.02	1 200.	8.6	58.7	0.196	103.
SW-N-05	FR2	Y	2023-01-05	Clear, colourless.	27.6 b	2.51	1.61	< 0.005	470. b	3.2	7.99	6.56	521.	8.6	54.7	0.186	102.
SW-N-05	FR1	Y	2023-02-07	Moderate flow, clear & colourless.	13.4 b	1.81	0.313	< 0.01	150.	4.8	3.7	6.57	460.	8.7	53.3	0.189	89.
SW-N-05	FR2	Y	2023-02-07	Moderate flow, clear & colourless.	13.8 b	1.98	0.339	< 0.01	150.	3.2	3.5	6.57	460.	8.7	56.	0.19	91.
SW-N-14	SS		2022-11-10	Submitted to lab as 2022-0032202	7.46 b	0.46	0.164	< 0.01	88.	6.4 b	2.1	7.72	440.	6.5	3.93	0.146	77.
SW-N-14	SS		2023-02-13	Moderate flow, clear & colourless.	6.6 b	1.27	0.12	< 0.01	73.	< 1.	1.9	6.75	271.	5.8	7.76	0.099	72.
SW-N-14	SS		2023-02-21	Moderate flow, clear and colourless.	6.02 b	1.76	0.078	< 0.005	70.	< 1.	1.08	7.68	26.	6.2	5.94	0.105	64.
SW-N-14	SS		2023-03-20	Moderate flow, clear and colourless.	5.35 b	0.41	0.068	< 0.01	63.	< 1.	1.3	7.23	227.2	6.8	5.33	0.09	68.
SW-N-15	SS		2023-02-21	Moderate flow, clear and colourless.	0.296	0.21	< 0.04	< 0.005	10.	< 1.	0.2	7.75	113.	5.6	1.49	0.074	35.
SW-N-15	SS		2023-03-20	High flow, clear and colourless.	0.166	0.21	< 0.04	< 0.01	9.4	< 1.	< 1.	6.65	115.7	5.9	1.61	0.08	30.
SW-N-16	FR1	Y	2022-11-09	Submitted to lab as 2022-0032198	6.73 b	1.16	0.144	< 0.01	110.	3.2	17.2	7.61	480.	5.8	12.5	0.218	60.
SW-N-16	FR2	Y	2022-11-09	Submitted to lab as 2022-0032200	6.87 b	1.36	0.163	< 0.01	110.	< 1.	19.6	6.8	293.	4.3	12.	0.222	59.
SW-N-16	FR1	Y	2023-01-05	Clear, colourless.	8.18 b	1.03	0.114	< 0.005	68.	< 1.	11.5	6.98	261.	6.2	13.6	0.196	49.
SW-N-16	FR2	Y	2023-01-05	Clear, colourless.	8.48 b	1.05	0.101	< 0.005	69.	< 1.	11.5	6.98	261.	6.2	15.1	0.196	49.
SW-N-16	FR1	Y	2023-02-07	Very high flow, moderately turbid, brown.	8.03 b	2.85	0.116	< 0.01	59.	15. b	25.1	6.72	290.	7.5	12.7	0.191	43.
SW-N-16	FR2	Y	2023-02-07	Very high flow, moderately turbid, brown.	8.53 b	2.47	0.109	< 0.01	60.	18. b	22.4	6.72	290.	7.5	14.2	0.191	43.
SW-N-17	SS		2022-11-10	Submitted to lab as 2022-0032204	32.7 b	0.623	0.886	< 0.005	130.	< 1.	5.13	6.83	690.	7.3	6.12	0.109	141.
SW-N-17	SS		2023-02-13	Moderate flow, clear & colourless.	9.94 b	12.3	0.149	< 0.01	100.	< 1.	1.3	7.34	346.	6.3	5.89	0.076	110.
SW-N-17	SS		2023-02-21	Moderate flow, clear and colourless.	8.81 b	1.06	0.131	< 0.005	95.	< 1.	1.12	7.44	331.	6.9	4.97	0.089	115.
SW-N-17	SS		2023-03-20	Moderate flow, clear and colourless.	6.9 b	0.33	0.105	< 0.01	86.	< 1.	1.	7.05	351.	7.1	4.22	0.085	126.
SW-N-18	SS		2022-05-04		2.02	19.	0.417	0.019	81.	3.2	128.	6.84	1 242.	10.9	18.	2.11	937.
SW-N-18	SS		2022-11-07	Submitted to lab as 2022-0032159	58.4 a b	2.77	3.04 b	< 0.005	180.	3.2	2.	8.05	675.	7.6	7.64	0.172	51.
SW-N-18	SS		2023-01-05	Clear, colourless.	12.3 b	1.39	0.661	< 0.005	81.	6.4 b	45.4	8.01	440.	6.7	11.6	0.16	27.
SW-N-18	FR1		2023-02-07	High flow, slightly turbid, slightly grey.	32.1 b	4.06	0.905	< 0.01	160.	250. a b	6.2	7.23	537.	8.5	68.8	0.165	43.
SW-N-18	FR2		2023-02-07	High flow, slightly turbid, slightly grey.	32.1 b	3.99	0.947	< 0.01	160.	240. a b	21.8	7.23	537.	8.5	16.6	0.159	43.
SW-N-19	SS		2022-05-04		3.05 b	2.94	0.143	0.007 2	40.	1.6	3.38	8.2	215.	11.	14.2	0.24	54.
SW-N-19	SS		2022-11-09	Submitted to lab as 2022-0032201	10.8 b	1.6	0.257	< 0.01	120.	< 1.	3.5	7.68	270.	5.2	7.78	0.268	39.
SW-N-19	SS		2023-01-05	Clear, colourless.	11.7 b	1.59	0.135	< 0.005	80.	< 1.	2.96	7.8	281.	6.6	14.9	0.219	31.
SW-N-41S1	FR1	Y	2023-01-05	Clear, colourless.	0.74	0.19	0.121	< 0.01	63.	8.4 b	1.2	7.67	360.	8.4	5.14	0.161	17.
SW-N-41S1	FR2	Y	2023-01-05	Clear, colourless.	0.732	0.15	0.109	< 0.01	61.	7.2 b	1.1	7.67	360.	8.4	5.44	0.166	17.
SW-N-41S1	FR1	Y	2023-02-06	Low flow, clear & colourless.	0.492	0.31	0.091	< 0.01	61.	10. b	1.4	7.95	258.	8.3	4.48	0.172	19.
SW-N-41S1	FR2	Y	2023-02-06	Low flow, clear & colourless.	0.485	0.36	0.077	< 0.01	62.	10. b	1.4	8.04	258.	8.3	4.15	0.252	17.
SW-N-42S1	FR1	Y	2022-05-04		0.024	0.16	0.051	< 0.01	66.	13. b	< 1.	7.91	.	.	6.99	0.072	43.
SW-N-42S1	FR2	Y	2022-05-04		0.023	0.24	0.06	< 0.01	69.	16. b	< 1.	7.89	.	.	5.75	0.063	45.
SW-N-42S1	FR1	Y	2022-11-09	Submitted to lab as 2022-0032194	0.036	0.74	0.123	< 0.01	120.	7.6 b	5.7	8.	305.	4.3	5.63	0.147	59.
SW-N-42S1	FR2	Y	2022-11-09	Submitted to lab as 2022-0032199	0.041	0.52	0.095	< 0.01	120.	6.8 b	4.1	7.07	305.	4.3	6.19	0.148	60.
SW-N-42S1	FR1	Y	2023-01-05	Clear, colourless.	0.399	0.16	0.06	< 0.01	81.	3.6	2.5	7.24	293.	7.2	4.87	0.088	60.
SW-N-42S1	FR2	Y	2023-01-05	Clear, colourless.	0.398	0.15	0.066	< 0.01	80.	3.2	1.1	7.05	450.	7.2	4.43	0.083	62.
SW-N-45	SS		2022-11-10	Submitted to lab as 2022-0032205	44.2 a b	0.751	1.16	< 0.005	160.	< 1.	1.89	6.87	313.	7.6	4.37	0.107	210.
SW-N-45	SS		2023-02-13	Moderate flow, clear & colourless.	9.38 b	2.12	0.309	< 0.01	120.	< 1.	1.3	7.03	3.84	7.3	5.41	0.086	145.
SW-N-45	SS		2023-02-21	Moderate flow, clear and colourless.	8.48 b	0.857	0.283	< 0.005	90.	< 1.	1.31	7.3	530.	7.3	6.45	0.094	167.
SW-N-45	SS		2023-03-20	Low flow, clear and colourless	7.91 b	0.52	0.217	< 0.01	70.	4.8	< 1.	6.66	372.5	7.8	4.6	0.085	176.
SW-N-53	SS		2023-02-07	Low flow, very turbid, very brown.	0.439	193. b	< 0.4	0.12	15.	2 200. a b	456.	8.27	492.	7.9	6 290.	0.815	19.
SW-N-54	SS		2022-05-04		0.69	1.33	0.208	< 0.005	36.	< 1.	0.85	7.63	305.	11.6	10.2	0.319	57.
SW-N-54	SS		2022-11-10	Submitted to lab as 2022-0032203	0.729	2.9	0.27	< 0.01	140.	6. b	3.3	7.82	570.	10.2	10.7	0.596	46.
SW-N-54	SS		2023-01-05	Clear, colourless.	1.6	10.2	0.424	0.02	68.	4.8	2.8	7.41	417.	8.7	26.4	2.1	77.
SW-N-54	SS		2023-02-07	High flow. Moderately turbid,slightly grey.	2.88	7.6	0.274	0.021	55.	67. a b	13.6	7.36	331.	7.6	31.1	0.607	49.
SW-N-54	SS		2023-02-07	High flow. Moderately turbid,slightly grey.	2.88	7.6	0.274	0.021	55.	67. a b	13.6	7.36	331.	7.6	31.1	0.607	49.
SW-N-57	FR1		2023-02-07	Field characteristics not recorded.	31.8 b	3.28	0.917	< 0.01	130.	48. a b	5.5	7.94	423.	8.3	18.1	0.158	36.
SW-N-57	FR2		2023-02-07	Field characteristics not recorded.	32.5 b	4.19	0.94	< 0.01	130.	45. a b	6.6	7.94	423.	8.3	18.2	0.177	40.
SW-N-57	FRM		2023-02-07	Mean of duplicates	32.15 b	3.735	0.928 5	< 0.01	130.	46.5 a b	6.05	7.94	423.	8.3	18.15	0.167 5	38.
SW-N-62	SS		2023-02-07	Sampled flow before entering culvert. High flow, turbid, grey.	29.8 b	3.01	0.873	< 0.01	120.	38. a b	4.2	7.9	480.	8.5	12.6	0.16	35.
SW-N-62	SS		2023-02-07	Sampled flow before entering culvert. High flow, turbid, grey.	29.8 b	3.01	0.873	< 0.01	120.	38. a b	4.2	7.9	480.	8.5	12.6	0.16	35.
SW-N-63	SS		2023-02-13	NEW. Moderate flow, clear & colourless	1.28	0.75	0.088 ---	< 0.01	20. ---	1.6	< 1.	7.56 ---	130. --- ---	5.8 --- ---	11.9	0.131 --- ---	33. --- ---
SW-N-63	SS		2023-02-21	Low flow, clear and colourless.	1.13	0.7	0.086 ---	< 0.01	18. ---	2.	1.3	7.57 ---	210. --- ---	6.2 --- ---	11.3	0.145 --- ---	31. --- ---
SW-N-63	SS		2023-03-20	Moderate flow, clear and colourless.	0.958	0.6	0.082 ---	< 0.01	16. ---	2.8	< 1.	6.33 a ---	137.6 --- ---	7. --- ---	14.5	0.137 --- ---	33. --- ---
SW-N-64	SS		2023-02-13	NEW. Moderate flow, clear & colourless.	0.294	0.74	0.045 ---	< 0.01	8.7 ---	< 1.	1.9	7.17 ---	91. --- ---	5. --- ---	20.1	0.287 --- ---	25. --- ---
SW-N-64	SS		2023-03-20	Moderate flow, clear and very slightly yellow	0.184	0.88	0.05 ---	< 0.01	9. ---	2.8	2.3	6.23 a ---	111.8 --- ---	8.1 --- ---	17.1	0.348 --- ---	25. --- ---
SW-N-65	SS		2023-02-13	NEW. Moderately high flow, clear & colourless.	0.582	0.74	0.064	< 0.01	12.	3.2	1.9	7.24	101.	5.1	18.8	0.241	27.
SW-N-65	SS		2023-03-20	Moderate flow, clear and very slightly yellow	0.497	0.75	0.067	< 0.01	12.	2.8	1.7	6.5	117.6	7.7	13.7	0.264	27.
SW-N-CS2	SS		2023-01-05	Clear, colourless.	0.862	0.035	0.065	< 0.005	6.1	9.2 b	0.37	7.33	130.	7.4	4.02	0.042	< 10.
SW-N-CS2	SS		2023-02-06	Low flow, clear & colourless.	3.24 b	0.218	0.073	< 0.005	9.9	< 1.	0.21	7.51	129.	7.8	1.96	0.024	10.
SW-S-03	SS		2022-05-05		1.19	9.54	0.1	0.04	20.	43. a b	76.9	7.11	154.	10.3	19.3	0.185	64.
SW-S-03	SS		2022-11-08		5.47 b	1.5	0.139	< 0.01	79.	130. a b	35.5	6.94	2 370.	9.7	17.6	0.272	53.
SW-S-03	SS		2023-01-04	Clear, colourless.	2.37	1.19	0.082	< 0.005	28.	< 1.	4.02	7.01	320.	9.9	16.9	0.193	67.
SW-S-03	SS		2023-02-06	High flow. Very turbid, very grey	1.85	9.21	0.097	0.021	18.	130. a b	64.	7.23	178.	8.7	16.4	0.204	54.
SW-S-04	FR1	Y	2022-05-05		1.02	2.36	0.055	0.014	16.	26. a b	22.	.	.	.	21.3	0.128	60.
SW-S-04	FR2	Y	2022-05-05		1.02	2.43	0.067	0.014	16.	20. b	25.	.	.	.	25.5	0.138	61.
SW-S-04	FR1	Y	04/01/2023	Clear, colourless.	1.43	0.297	0.05	< 0.005	27.	< 1.	3.76	6.83	174.	7.1	16.1	0.102	54.
SW-S-04	FRM	Y	2023-02-06	Mean of duplicates	1.925	0.59	0.055 5 ---	< 0.005	28. ---	< 1.7	2.945	7.37 ---	202. --- ---	7.5 --- ---	12.05	0.101 --- ---	65.5 --- ---
SW-S-12	SS		2022-05-05		1.45	4.51	0.106	0.012	23.	34. a b	15.9	6.95	234.	10.4	31.7	0.259	118.
SW-S-12	SS		2022-11-08		10.1 b	5.43	0.309	0.006 9	140.	6.8 b	5.88	7.24	427.	12.1	62.2	0.498	70.
SW-S-12	SS		2023-01-04	Clear, slightly grey.	2.87	1.95	0.08	< 0.005	31.	< 1.	4.67	6.69	350.	10.5	23.3	0.288	91.
SW-S-12	SS		2023-02-06	High flow. Very turbid, very grey	2.76	9.25	0.106	0.017	28.	140. a b	33.8	6.98	245.	9.4	21.5	0.256	89.
SW-S-20	SS		2023-01-04	Clear, colourless.	0.075	0.185	< 0.04	< 0.005	6.	4.4	6.97	7.32	71.	6.2	24.6	0.114	17.
SW-S-21	SS		2023-01-04	Clear, colourless.	0.22	0.154	< 0.04	< 0.005	6.	< 1.	8.13	7.64	100.	6.	29.6	0.094	16.
SW-S-24	SS		2023-01-04	Clear, colourless.	1.93	0.454	0.05	< 0.005	38.	< 1.	3.91	7.36	252.	7.8	9.33	0.15	90.
SW-S-27	SS		2022-05-05		0.021	0.74	0.057	< 0.01	23.	33. a b	5.7	7.59	167.	8.9	10.1	0.131	92.

Notes:

na	*Not applicable.*
Null	*No sample collected.*
a	*Above Maximum allowable concentration (MAC) British Columbia Water Quality Guideline.*
b	*Above 30-day average British Columbia Water Quality Guideline.*
(1)	*British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August 2023. British Columbia Ministry of Environment and a Compendium of Working Water Quality Guidelines for British Columbia, 1998 Edition, Updated in Feb 2021. British Columbia Ministry of Environment. The Guidelines cited specific to protection of freshwater aquatic life unless otherwise noted.*
(2)	*Maximum acceptable concentration unless otherwise noted.*
(3)	*The ammonia guideline is pH and temperature (15°C assumed) dependant. All ammonia results were compared to standards based on the associated pH and temperature results for that sample.*
(4)	*The nitrite guidelines are chloride dependant. All nitrite results were compared to standards based on the associated chloride result for that sample.*
(5)	*This value is hardness dependent. All metals results were compared to standards based on the associated hardness result for a particular sample.*
(6)	*This value is the short-term daily for streams with unknown fish distribution.*
(7)	*The TSS guidelines are "change from background" and flow condition dependent. The background TSS in the landfill are derived from background station Sw-S-52 .*
(8)	*Dissolved copper guideline varies with water hardness, temperature and DOC, and calcuated using BLM;*
(9)	*Total Aluminum guidance is pH, hardness, and DOC dependent and calculated based on BC Water Quality Guideline calculator for Aluminum in Freshwater Ecosystems.*
(10)	*Dissolved Zinc guidance is pH, hardness, and DOC dependent and calculated only where DOC was analyzed.*

Table 7-1. Surface Water Quality Exceedances 2022-2023

B.C. Water Quality Guidelines				BC WQG MAXIMUM (1)(2)	0.038-2.8 (5)	---	BC BLM software (8)	---	350	---	---	---	---	---	---	Variable (10)	---
				BC WQG AVERAGE (1)	0.018-0.645 (5)	---	BC BLM software (8)	---	---	---	---	---	---	---	---	Variable (10)	---
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	PARAMETER	Cadmium	Cobalt	Copper	Hardness (As Caco3)	Iron	Lead	Manganese	Molybdenum	Nickel	Selenium	Silver	Zinc	DOC
				STATE	DIS	DIS	DIS	TOT	DIS	TOT	DIS	DIS	DIS	DIS	DIS	DIS	Dissolved
				UNIT	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
				Method Detection Limit (MDL)	0.005	0.005	0.05	0.5	1	0.005	0.05	0.05	0.02	0.04	0.005	0.1	0.5
				Limit of Quantification (LOQ)	0.025	0.025	0.25	2.5	5	0.025	0.25	0.25	0.1	0.2	0.025	0.5	2.5
					30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
				COMMENTS	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
SW-N-05	FR1	Y	2022-05-04		0.078 2	0.768	12.2 b	434.	37.8	< 0.005	159.	2.96	5.26	0.567	< 0.005	6.68	1 400.
SW-N-05	FR2	Y	2022-05-04		0.084 2	0.774	12.5 b	423.	27.	0.008 6	159.	2.97	5.15	0.575	< 0.005	7.16	1 700.
SW-N-05	SS	Y	2022-11-07	Submitted to lab as 2022-0032160	0.021 4	0.589	2.96 b	383.	3.1	0.007 2	7.92	0.749	1.47	2.11	< 0.005	4.16	< 13.
SW-N-05	FR1	Y	2023-01-05	Clear, colourless.	0.032 3	0.132	4.81 b	617.	42.8	0.008 6	3.8	2.82	2.43	1.65	< 0.005	6.67	8.6
SW-N-05	FR2	Y	2023-01-05	Clear, colourless.	0.031 7	0.128	4.81 b	622.	33.	0.005 1	3.64	2.83	2.39	1.73	< 0.005	6.54	1 900.
SW-N-05	FR1	Y	2023-02-07	Moderate flow, clear & colourless.	0.041 4	0.134	5.87 b	280.	33.	0.007 1	2.76	2.82	1.56	0.324	< 0.005	2.77	300.
SW-N-05	FR2	Y	2023-02-07	Moderate flow, clear & colourless.	0.181	0.14	6.09 b	282.	31.8	0.009 6	2.95	2.94	1.65	0.306	< 0.005	3.49	94.
SW-N-14	SS		2022-11-10	Submitted to lab as 2022-0032202	< 0.005	0.093 9	1.36	181.	5.9	0.005 3	1.29	0.375	0.369	0.151	< 0.005	1.22	1 500.
SW-N-14	SS		2023-02-13	Moderate flow, clear & colourless.	< 0.005	0.104	1.34	176.	7.9	< 0.005	1.22	0.396	0.389	0.111	< 0.005	1.28	320.
SW-N-14	SS		2023-02-21	Moderate flow, clear and colourless.	< 0.005	0.066 6	0.965 b	174.	6.4	< 0.005	0.927	0.386	0.255	0.077	< 0.005	0.95	3.4
SW-N-14	SS		2023-03-20	Moderate flow, clear and colourless.	< 0.005	0.073 6	0.955 b	160.	4.5	< 0.005	0.266	0.366	0.231	0.064	< 0.005	0.9	3.2
SW-N-15	SS		2023-02-21	Moderate flow, clear and colourless.	< 0.005	0.011 1	0.625 b	78.2	< 1.	< 0.005	0.158	0.228	0.049	0.045	< 0.005	0.16	1.3
SW-N-15	SS		2023-03-20	High flow, clear and colourless.	< 0.005	0.010 8	0.293 b	72.4	1.4	< 0.005	0.101	0.244	0.072	< 0.04	< 0.005	0.28	1.3
SW-N-16	FR1	Y	2022-11-09	Submitted to lab as 2022-0032198	0.025 7	0.232	5.86	210.	40.1	0.010 8	36.8	1.02	1.28	0.152	< 0.005	16.7	1 600.
SW-N-16	FR2	Y	2022-11-09	Submitted to lab as 2022-0032200	0.024 5	0.223	5.95	210.	39.9	0.009 8	37.	1.03	1.23	0.168	< 0.005	16.8	990.
SW-N-16	FR1	Y	2023-01-05	Clear, colourless.	0.016 8	0.181	6.22 b	179.	48.5	0.007 3	36.5	0.828	1.01	0.109	< 0.005	10.9	7.
SW-N-16	FR2	Y	2023-01-05	Clear, colourless.	0.017	0.184	6.19 b	177.	50.2	0.007 5	36.6	0.809	0.993	0.1	< 0.005	11.	7.1
SW-N-16	FR1	Y	2023-02-07	Very high flow, moderately turbid, brown.	0.024 1	0.295	8.07 b	172.	54.6	0.006 5	38.2	0.721	1.43	0.115	< 0.005	16.4	220.
SW-N-16	FR2	Y	2023-02-07	Very high flow, moderately turbid, brown.	0.035 6	0.298	8.23 b	175.	59.9	0.006 2	38.2	0.776	1.42	0.113	< 0.005	16.2	710.
SW-N-17	SS		2022-11-10	Submitted to lab as 2022-0032204	0.013	0.277	0.958	288.	4.7	0.008 7	10.5	0.548	0.623	0.801	< 0.005	5.13	1 100.
SW-N-17	SS		2023-02-13	Moderate flow, clear & colourless.	< 0.005	0.093	0.821	219.	4.	< 0.005	1.67	0.508	0.242	0.151	< 0.005	0.91	3.3
SW-N-17	SS		2023-02-21	Moderate flow, clear and colourless.	< 0.005	0.085 5	0.757	219.	5.8	< 0.005	3.2	0.515	0.237	0.108	< 0.005	1.18	3.
SW-N-17	SS		2023-03-20	Moderate flow, clear and colourless.	< 0.005	0.090 5	0.998 b	197.	6.1	0.010 8	2.65	0.479	0.219	0.097	< 0.005	1.09	2.6
SW-N-18	SS		2022-05-04		0.030 8	8.25	11.5 b	255.	667. a	0.154	632.	1.31	18.6	0.372	0.006	116. a b	1 600.
SW-N-18	SS		2022-11-07	Submitted to lab as 2022-0032159	0.008 5	0.984	1.04	427.	4.2	0.009 7	50.3	3.	2.83	3.	< 0.005	1.02	990.
SW-N-18	SS		2023-01-05	Clear, colourless.	0.005 9	0.289	0.9 b	189.	19.3	0.009 9	15.	1.71	1.02	0.664	< 0.005	37.8 b	0.91
SW-N-18	FR1		2023-02-07	High flow, slightly turbid, slightly grey.	1.29 b	0.738	2.7	329.	171.	0.087 5	40.2	1.68	2.71	1.01	< 0.005	46.3 b	240.
SW-N-18	FR2		2023-02-07	High flow, slightly turbid, slightly grey.	0.010 4	0.634	1.12	328.	40.5	0.026 5	38.2	1.72	1.54	1.01	< 0.005	1.7	230.
SW-N-19	SS		2022-05-04		0.014 1	0.441	15.6 b	161.	25.4	0.006 2	18.	1.02	2.82	0.125	< 0.005	1.9	1 500.
SW-N-19	SS		2022-11-09	Submitted to lab as 2022-0032201	0.008 4	0.378	7.24	226.	50.6	0.009 1	16.2	1.2	1.5	0.228	< 0.005	2.19	650.
SW-N-19	SS		2023-01-05	Clear, colourless.	0.013 4	0.191	12. b	200.	21.8	0.009 8	4.92	1.15	1.63	0.137	< 0.005	3.4	8.2
SW-N-41S1	FR1	Y	2023-01-05	Clear, colourless.	< 0.005	0.046 3	0.263	167.	26.1	< 0.005	33.5	0.26	0.083	0.134	< 0.005	0.54	2.
SW-N-41S1	FR2	Y	2023-01-05	Clear, colourless.	< 0.005	0.046 5	0.257	165.	27.7	< 0.005	33.2	0.259	0.087	0.124	< 0.005	0.54	1.9
SW-N-41S1	FR1	Y	2023-02-06	Low flow, clear & colourless.	< 0.005	0.054 1	0.172	179.	27.	< 0.005	44.6	0.306	0.091	0.095	< 0.005	1.13	180.
SW-N-41S1	FR2	Y	2023-02-06	Low flow, clear & colourless.	< 0.005	0.055 3	0.62	181.	27.5	0.056	44.5	0.323	0.1	0.087	< 0.005	1.4	81.
SW-N-42S1	FR1	Y	2022-05-04		< 0.005	0.051 1	0.358	166.	16.4	< 0.005	19.3	0.508	0.108	0.044	< 0.005	0.4	1 900.
SW-N-42S1	FR2	Y	2022-05-04		< 0.005	0.054 4	0.373	167.	13.2	< 0.005	19.1	0.527	0.113	< 0.04	< 0.005	0.44	2 200.
SW-N-42S1	FR1	Y	2022-11-09	Submitted to lab as 2022-0032194	0.005 7	0.042 7	0.421	251.	9.4	0.011 5	7.08	0.628	0.159	0.079	< 0.005	1.34	310.
SW-N-42S1	FR2	Y	2022-11-09	Submitted to lab as 2022-0032199	< 0.005	0.044 5	0.448	250.	8.5	0.010 1	6.74	0.654	0.164	0.069	< 0.005	1.65	1 700.
SW-N-42S1	FR1	Y	2023-01-05	Clear, colourless.	< 0.005	0.047 7	0.508	188.	8.3	0.006 2	6.75	0.489	0.11	0.072	< 0.005	0.61	240.
SW-N-42S1	FR2	Y	2023-01-05	Clear, colourless.	< 0.005	0.048 1	0.509	187.	8.2	0.006 4	6.79	0.492	0.133	0.072	< 0.005	0.57	250.
SW-N-45	SS		2022-11-10	Submitted to lab as 2022-0032205	0.014 4	0.406	1.46	349.	2.5	0.012 2	6.86	0.885	0.702	1.15	< 0.005	1.82	1 700.
SW-N-45	SS		2023-02-13	Moderate flow, clear & colourless.	0.008 9	0.11	1.78 b	242.	3.4	< 0.005	5.11	0.979	0.479	0.316	< 0.005	0.89	4.2
SW-N-45	SS		2023-02-21	Moderate flow, clear and colourless.	0.006 9	0.108	1.44 b	230.	6.5	0.007 2	9.2	0.975	0.432	0.283	< 0.005	1.09	3.2
SW-N-45	SS		2023-03-20	Low flow, clear and colourless	0.007 4	0.1	1.16 b	205.	4.9	0.006 5	3.11	0.873	0.324	0.211	< 0.005	0.81	2.5
SW-N-53	SS		2023-02-07	Low flow, very turbid, very brown.	0.076 3	12.8	41.3 b	72.8	8 890. a	2.45	337.	1.42	9.12	0.119	0.015 7	41.6 b	340.
SW-N-54	SS		2022-05-04		< 0.005	0.213	13.4 b	169.	46.	< 0.005	38.6	0.445	1.31	0.186	< 0.005	0.83	1 500.
SW-N-54	SS		2022-11-10	Submitted to lab as 2022-0032203	0.014 1	1.03	7.53	277.	220.	0.016 5	361.	0.831	2.49	0.254	< 0.005	0.92	1 600.
SW-N-54	SS		2023-01-05	Clear, colourless.	0.054 5	5.77	20.1 b	290.	538. a	0.064 9	3 500.	1.45	9.07	0.372	0.007 7	6.45	61.
SW-N-54	SS		2023-02-07	High flow. Moderately turbid,slightly grey.	0.020 6	0.958	6.34	225.	501. a	0.029 5	477.	0.736	2.87	0.221	< 0.005	1.91	1 100.
SW-N-54	SS		2023-02-07	High flow. Moderately turbid,slightly grey.	0.020 6	0.958	6.34	225.	501. a	0.029 5	477.	0.736	2.87	0.221	< 0.005	1.91	1 100.
SW-N-57	FR1		2023-02-07	Field characteristics not recorded.	0.006	0.64	1.12	290.	17.2	0.005	29.4	1.74	1.23	1.03	< 0.005	1.28	280.
SW-N-57	FR2		2023-02-07	Field characteristics not recorded.	0.005 7	0.652	1.04	292.	16.2	0.006 1	30.4	1.79	1.31	1.04	< 0.005	1.1	330.
SW-N-57	FRM		2023-02-07	Mean of duplicates	0.005 85	0.646	1.08	291.	16.7	0.005 55	29.9	1.765	1.27	1.035	< 0.005	1.19	305.
SW-N-62	SS		2023-02-07	Sampled flow before entering culvert. High flow, turbid, grey.	0.005 4	0.599	0.932	280.	5.5	< 0.005	24.	1.69	1.16	1.07	< 0.005	0.54	69.
SW-N-62	SS		2023-02-07	Sampled flow before entering culvert. High flow, turbid, grey.	0.005 4	0.599	0.932	280.	5.5	< 0.005	24.	1.69	1.16	1.07	< 0.005	0.54	69.
SW-N-63	SS		2023-02-13	NEW. Moderate flow, clear & colourless	< 0.005	0.096 4 --- ---	1.02	87.2 --- ---	91.6 ---	0.027 5 --- ---	13.1 --- ---	0.298 --- ---	0.337 --- ---	0.07 --- ---	< 0.005 --- ---	0.43 --- ---	3.4 --- ---
SW-N-63	SS		2023-02-21	Low flow, clear and colourless.	< 0.005	0.118 --- ---	0.948	89.2 --- ---	93.2 ---	0.027 2 --- ---	18.5 --- ---	0.279 --- ---	0.37 --- ---	0.062 --- ---	< 0.005 --- ---	0.45 --- ---	3.2 --- ---
SW-N-63	SS		2023-03-20	Moderate flow, clear and colourless.	< 0.005	0.138 --- ---	0.857 b	83.7 --- ---	98.4 ---	0.029 6 --- ---	25.5 --- ---	0.274 --- ---	0.378 --- ---	0.071 --- ---	< 0.005 --- ---	0.73 --- ---	3. --- ---
SW-N-64	SS		2023-02-13	NEW. Moderate flow, clear & colourless.	< 0.005	0.11 --- ---	1.22 b	50.9 --- ---	168. ---	0.088 6 --- ---	11.1 --- ---	0.239 --- ---	0.568 --- ---	0.046 --- ---	< 0.005 --- ---	1.7 --- ---	6.2 --- ---
SW-N-64	SS		2023-03-20	Moderate flow, clear and very slightly yellow	< 0.005	0.154 --- ---	1.14 b	54.7 --- ---	200. ---	0.067 1 --- ---	24. --- ---	0.238 --- ---	0.623 --- ---	0.042 --- ---	< 0.005 --- ---	1.43 --- ---	6.7 --- ---
SW-N-65	SS		2023-02-13	NEW. Moderately high flow, clear & colourless.	< 0.005	0.102	1.16 b	62.7	143.	0.069	11.4	0.251	0.487	0.068	< 0.005	1.35	5.3
SW-N-65	SS		2023-03-20	Moderate flow, clear and very slightly yellow	< 0.005	0.154	0.989 b	65.5	167.	0.056 6	25.9	0.241	0.533	0.053	< 0.005	1.34	5.3
SW-N-CS2	SS		2023-01-05	Clear, colourless.	< 0.005	0.018	0.338	57.	1.9	< 0.005	0.084	0.091	0.031	0.062	< 0.005	0.19	1.8
SW-N-CS2	SS		2023-02-06	Low flow, clear & colourless.	< 0.005	0.013 6	0.16	85.4	< 1.	< 0.005	< 0.05	0.073	0.025	0.084	< 0.005	0.25	310.
SW-S-03	SS		2022-05-05		0.012 5	0.358	5.17 b	72.1	301.	0.031 5	124.	0.288	1.04	0.063	< 0.005	7.37	< 50.
SW-S-03	SS		2022-11-08		0.157	0.254	6.06 b	180.	46.9	0.064	23.6	0.36	1.19	0.178	< 0.01	32.	1 800.
SW-S-03	SS		2023-01-04	Clear, colourless.	0.009 8	0.478	5.07 b	110.	528. a	0.013 8	199.	0.144	1.2	0.071	< 0.005	3.34	4.9
SW-S-03	SS		2023-02-06	High flow. Very turbid, very grey	0.014 1	0.357	4.06	79.5	147.	0.025 8	123.	0.21	0.978	0.079	< 0.005	8.92	360.
SW-S-04	FR1	Y	2022-05-05		< 0.005	0.097 9	2.78	76.7	70.3	0.045 9	2.15	0.264	0.529	0.041	< 0.005	2.55	1 700.
SW-S-04	FR2	Y	2022-05-05		0.005 2	0.096 4	2.75	76.4	51.	0.050 7	2.17	0.272	0.473	0.044	< 0.005	2.48	1 900.
SW-S-04	FR1	Y	04/01/2023	Clear, colourless.	< 0.005	0.050 4	1.61 b	89.7	13.3	< 0.005	0.186	0.127	0.3	0.077	< 0.005	3.26	3.7
SW-S-04	FRM	Y	2023-02-06	Mean of duplicates	0.010 2	0.075 8 --- ---	1.715	102.5 --- ---	106.65 ---	0.009 8 --- ---	0.774 --- ---	0.300 5 --- ---	0.353 5 --- ---	0.053 5 --- ---	< 0.005 --- ---	1.79 --- ---	98.65 --- ---
SW-S-12	SS		2022-05-05		0.021 3	0.66	7.79 b	106.	1 920. a	0.033 3	356.	0.217	1.94	0.078	< 0.005	5.67	74.
SW-S-12	SS		2022-11-08		0.040 2	0.298	19.5 b	208.	95.8	0.035 2	15.2	0.294	4.86	0.274	< 0.005	4.05	1 300.
SW-S-12	SS		2023-01-04	Clear, slightly grey.	0.015 1	0.938	6.5 a b	122.	1 390. a	0.015 1	410.	0.087	1.88	0.101	< 0.005	3.97	5.9
SW-S-12	SS		2023-02-06	High flow. Very turbid, very grey	0.020 2	0.794	6.08 b	119.	1 030. a	0.021	367.	0.158	2.01	0.081	< 0.005	6.04	7.
SW-S-20	SS		2023-01-04	Clear, colourless.	< 0.005	0.111	1.04 b	46.7	68.1	0.011 3	23.8	0.058	0.165	0.069	< 0.005	6.61	4.2
SW-S-21	SS		2023-01-04	Clear, colourless.	< 0.005	0.032 6	0.989	40.	10.8	< 0.005	0.095	0.093	0.15	0.043	< 0.005	7.67 b	4.1
SW-S-24	SS		2023-01-04	Clear, colourless.	0.006	0.073 1	2.47 b	122.	18.6	0.007 7	1.54	0.166	0.443	0.092	< 0.005	3.1	3.8
SW-S-27	SS		2022-05-05		0.017	0.175	0.853	97.7	55.4	0.035 7	56.2	0.185	0.422	< 0.04	< 0.005	2.44	770.

Notes:

na	*Not applicable.*
Null	*No sample collected.*
a	*Above Maximum allowable concentration (MAC) British Columbia Water Quality Guideline.*
b	*Above 30-day average British Columbia Water Quality Guideline.*
(1)	*British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August 2023. British Columbia Ministry of Environment and a Compendium of Working Water Quality Guidelines for British Columbia, 1998 Edition, Updated in Feb 2021. British Columbia Ministry of Environment. The Guidelines cited specific to protection of freshwater aquatic life unless otherwise noted.*
(2)	*Maximum acceptable concentration unless otherwise noted.*
(3)	*The ammonia guideline is pH and temperature (15°C assumed) dependant. All ammonia results were compared to standards based on the associated pH and temperature results for that sample.*
(4)	*The nitrite guidelines are chloride dependant. All nitrite results were compared to standards based on the associated chloride result for that sample.*
(5)	*This value is hardness dependent. All metals results were compared to standards based on the associated hardness result for a particular sample.*
(6)	*This value is the short-term daily for streams with unknown fish distribution.*
(7)	*The TSS guidelines are "change from background" and flow condition dependent. The background TSS in the landfill are derived from background station Sw-S-52 .*
(8)	*Dissolved copper guideline varies with water hardness, temperature and DOC, and calcuated using BLM;*
(9)	*Total Aluminum guidance is pH, hardness, and DOC dependent and calculated based on BC Water Quality Guideline calculator for Aluminum in Freshwater Ecosystems.*
(10)	*Dissolved Zinc guidance is pH, hardness, and DOC dependent and calculated only where DOC was analyzed.*

7.3 Assessment of Surface Water Quality Impacts

The primary causes of any surface water quality degradation at the site include landfill leachate, road salt, and aggregate production, stockpiling, and use. Magnesium lignosulphonate has been used for dust suppression on gravel roads since 2014, so that may contribute some nitrate, nitrite, or ammonia to the surface water system. Background conductivity in surface water is typically below 200 µS/cm but has been observed at higher concentrations at some locations during periods of low flow, or after periods of prolonged dry weather. Background ammonia concentrations are typically below 0.01 mg/L, but occasionally exceed 0.1 mg/L downgradient of wetland areas. Background chloride concentrations are typically below 10 mg/L. Background sulphate concentrations are typically below 10 mg/L but often increase in the downstream direction as streams receive groundwater discharge.

Surface water is considered impacted by leachate when electrical conductivity surpasses 500 µS/cm, ammonia concentrations exceed 0.5 mg/L and chloride concentrations exceed 20 mg/L. Peak concentrations at surface water monitoring stations are typically observed during the dry summer and early fall months, when flows are low and there is limited dilution by precipitation.

Surface water is considered impacted by aggregate production, stockpiling or site construction works, when sulphate concentrations exceed 75 mg/L, and ammonia or nitrate (from blasting residuals) are present at concentrations above background levels (0.1 mg/L). Peak concentrations are typically observed during the first sampling event following the onset of wet weather in the fall months, and in areas of active quarry development, aggregate stockpiling or aggregate placement.

Surface water is considered impacted by road salt when electrical conductivity and chloride concentrations exceed background levels (300 µS/cm and 20 mg/L, respectively), and concentrations of ammonia and its degradation products (primarily nitrate) are below background levels (0.1 mg/L). Sites that are judged to be impacted by road salt must also be located downstream (or downgradient) of surfaces and roadways where road salt was applied. Electrical conductivity and chloride concentrations typically peak following cold weather periods when de-icing salt is applied to roadways.

Surface water quality in natural and anthropogenically modified systems can be highly variable due to temporal variations in flow and chemical inputs, and professional judgement is used to determine the nature and degree of any impacts due to leachate, road salt and aggregate stockpiles. The authors are hydrogeologists and geochemists with considerable experience evaluating leachate and water quality impacts at other landfills and industrial facilities in coastal regions of British Columbia. If any surface water concentrations exceed BCWQG for the protection of freshwater at the property boundary, standard CSR protocols for notification of affected property owners should be followed.

7.4 Data

Hartland landfill is located within the Tod Creek watershed on a drainage divide between the Heal Creek drainage basin to the north and the Killarney Creek basin to the south. Surface water from both the Heal Creek drainage basin and Killarney Creek basin flow into Tod Creek, ultimately discharging to Tod Inlet. Surface water sampling stations are shown on Figure 7-1. Surface water sampling stations have been established on the landfill property to monitor compliance at the property boundary and identify changes in surface water quality that could be related to landfill operations. Surface water quality monitoring stations located off-site are used to monitor surface water quality around the landfill.

Surface water quality data was collected at eight (8) locations south and west of the landfill, 21 locations north of the Phase 1 and Phase 2 landfill areas, and five (5) locations northwest of the landfill (Hartland North Pad). Surface water samples are collected four times per year from property Boundary Compliance and other key stations and twice per year from all other monitoring stations. Samples were not collected when watercourses were dry.

In December 2022, a total of five (6) surface water stations (SW-N-57, SW-N-58, SW-N-59, SW-N-60, SW-N-61 and SW-N-62) were established within the footprint of the Phase 2 landfill and quarry. The purpose of these stations is to monitor surface water quality impacts related to landfill activities, including road construction, blasting, and aggregate stockpiling. Many of these stations were either dry or only yielded a single set of data.

In February 2023, SW-N-63, SW-N-64, and SW-N-65 were established near the confluence of Durrance Creek and Heal Creek to assess and delineate any water quality impacts related to aggregate in the receiving environment.

Surface water sampling points utilized in the 2022/23 monitoring program are summarized below:

South and West of the Landfill

- Sw-S-03
- Sw-S-04 - compliance
- Sw-S-12
- Sw-S-20
- Sw-S-21
- Sw-S-24
- Sw-S-27
- Sw-S-52

North of the Hartland North Pad

- Sw-N-41s1 - compliance
- Sw-N-41s3
- Sw-N-41s4
- Sw-N-42s1 - compliance
- Sw-N-CS2

North of Phase 1 and Phase 2

- Sw-N-05 - compliance
- Sw-N-14
- Sw-N-15
- Sw-N-16 - compliance
- Sw-N-17
- Sw-N-18
- Sw-N-19
- Sw-N-45
- Sw-N-50
- Sw-N-51
- Sw-N-53
- Sw-N-54
- Sw-N-57
- Sw-N-58
- Sw-N-59

North of Phase 1 and Phase 2

- Sw-N-60
- Sw-N-61
- Sw-N-62
- Sw-N-63
- Sw-N-64
- Sw-N-65

7.5 Overview of Surface Water Exceedances

Surface water results were compared to the approved and working BCWQG AW criteria in Appendix B.3. A summary of surface water exceedances is presented in Table 7-1. In 2022/23, surface water quality data met the BCWQG-STA for all parameters except for TSS, total and dissolved iron, nitrite, and nitrate. Iron exceedances mostly reflect low flow and/or turbulent conditions, whereas nutrient exceedances are interpreted to reflect impacts due to runoff from the Northeast Stockpile and the Northwest Stockpile.

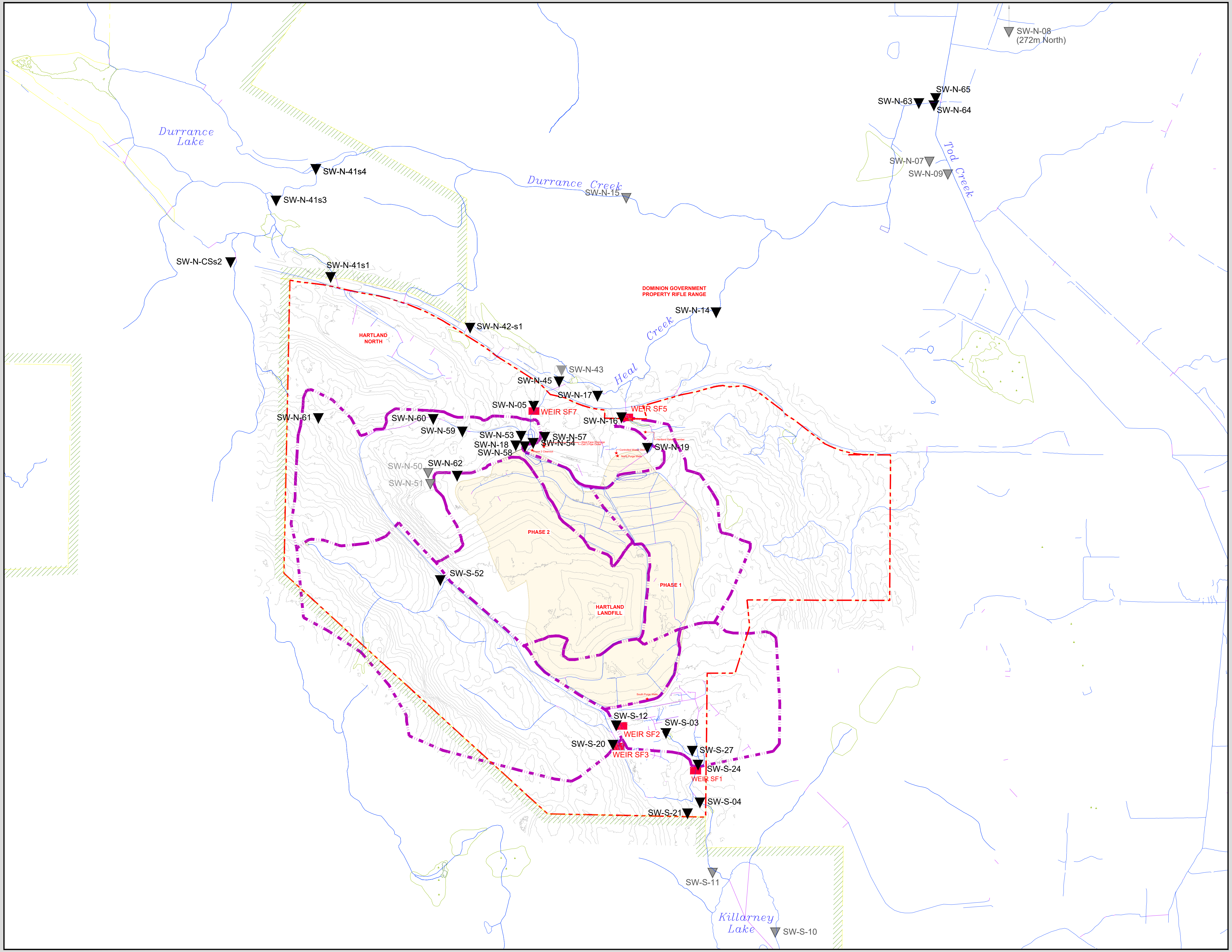
In 2022/23, surface water at the compliance location (SW-N-05) continued to show elevated and non-compliant nutrient concentrations at SW-N-05. On two out of the four sampling events, nitrate concentrations surpassed the BCWQG AW threshold of 32.8 mg/L, and reached a peak concentration of 50.5 mg/L. Runoff from the aggregate stockpiles situated in the Toutle Valley and on the bedrock ridge north of the Phase 2 landfill are believed to be the primary contributors of the nitrate and sulphate detected at SW-N-05 (AECOM 2023).

7.6 Surface Water Quality North of Phase 1

Clean runoff from the Phase 1 closure and the eastern perimeter of the landfill is directed to the NWSP and then into the wetland located north of the lower leachate lagoon. The wetland discharges northward to Heal Creek. Heal Creek also receives drainage from the area north of Phase 2 (High Level Road ditch), and from a small stream draining a small wetland below the east end of the Hartland North Pad. Aggregate and piping were added to select sections of the High Level Road ditch in June 2018 to protect the ditch from nearby construction and mitigate ponding, which may contribute to elevated concentrations of sulphate in surface drainage over time.

Heal Creek flows north-easterly from the NWSP at the north end of the Phase 2 Basin to the confluence with Durrance Creek, as shown in Figure 4-1. Durrance Creek discharges to Tod Creek, which in turn discharges to Tod Inlet, about 3 km north of the landfill. Heal Creek is a small creek with a watershed area of 128 ha. Heal Creek is mainly steep and rocky although the creek passes through a few small wetlands near the upper end. The creek dries up during the summer months except in the lower reaches where groundwater discharge maintains flow year-round.

Figures 7-2 and 7-3 present solute concentration and conductivity trends observed at surface water monitoring stations in the north area of the landfill and beyond the northern property boundary. In Figure 7-2, the distance of each station from the landfill boundary is shown in brackets in the legend. Sw-N-05 and Sw-N-16 are compliance monitoring stations. Elevated and non-compliant nitrate concentrations were observed at Sw-N-05. In addition, nitrate concentrations exceeded the BCWQG-LTC at Sw-N-05 and Sw-N-16 during all sampling events. Nitrite and ammonia concentrations exceeded BCWQG-LTC at Sw-N-05 on two out of four sampling dates. The water quality impacts observed at Sw-N-05 and Sw-N-16 are linked to runoff from the Northwest Stockpile. Similar water quality impacts were observed at Sw-N-17 and Sw-N-14. Like previous years, these sampling locations were dry periodically in 2022/23 due to arid summer conditions.



Legend

☐	BUILDING / STRUCTURE
—	ROAD
—	FENCE
— · —	LEGAL LOT BOUNDARY
—	INDEX CONTOUR (5m)
—	INTERMEDIATE CONTOUR (1m)
—	TREES/SHRUB/VEGETATION
- - -	DITCH
—	DRAINAGE
— · —	PIPE
▬	EXISTING WASTE
— · —	HARTLAND LANDFILL OPERATING AREA BOUNDARY
▼ SW-S-52	ACTIVE SURFACE WATER SAMPLING LOCATION
▼ SW-N-15	INACTIVE SURFACE WATER SAMPLING LOCATION
— · —	SURFACE WATER DIVIDE
🟥 WEIR SF1	WEIR LOCATION

Map Sources / Notes:
- Contour interval 1.0 m
- Contours based on 24-W542_2022_base.dwg, April 2022.
- Drainage information for years 2018-2019 obtained from Parks & Env. Services GIS technicians and have layers with the prefix "CRD19_GIS DRAINAGE" & "CRD19_GIS streams_Ditches".
- GPS pickup has been conducted by CRD Staff of creeks, wetlands, culverts located under tree canopied areas. This information (considered more accurate) has been added to the base (superceding some planimetric information) and is placed on layers indicating GPS pickup. An example of that layering system would be 'CRD19-wat-culvert_GPS pickup'.
- Surveyed points for monitoring sites (groundwater, gas wells, leachate, purge wells) were updated for 2019.
- The map is to NAD83 UTM coordinates. Vertical datum is to CGVD28.

N
W E
S

0 50 100 200 300 400 m

1 : 10,000

UTM Zone 10N, NAD83

Reviewed by: KJ
Date Issued: August 2023
Prepared by: SP
Project Number: 60631284

CRD
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Project: Hartland Landfill Monitoring
Location: Saanich, BC

Surface Water Bodies and Sampling Locations

AECOM

Figure 7-1

File Location: C:\USERS\SUSAN.A.POWELL\DESKTOP\DESKTOP_WFH\60631284\HARTLAND LANDFILL 2022-2023\900-CAD_GIS\910-CAD\20-SHEETS\C434 - 2022-23 ANNUAL REPORT\FIG7.1-SURFACE WATER & SAMPLE LOC-60631284-2022.DWG
Date Plotted: September 26, 2023 Saved By:susan.a.powell

7.6.1 Monitoring Site Sw-N-16

A small wetland is located just north of the lower leachate lagoon. In this wetland, surface water flows north and through a weir at Sw-N-16 (Boundary Compliance Station) before discharging into a culvert under Willis Point Road and then to Heal Creek. Sw-N-16 is located on the landfill property and is the compliance point used to monitor the quality of the surface water leaving the landfill through this route.

In 2022/23, all parameters met BCWQG-S guidelines at Sw-N-16 except for total iron concentration during one sampling event in February 2023. Similar to 2021/22, nitrate and sulphate concentrations were elevated, and nitrate concentrations exceeded the BCWQG-LTC on all sampling dates. Nitrate concentrations ranged from 6.80 to 8.28 mg/L from December 2022 through February 2023. Sulphate concentrations ranged from 36.0 to 110 mg/L. Ammonia and chloride concentrations were low, and conductivity was moderate, ranging from 237 to 386.5 µS/cm. Given the low ammonia and chloride concentrations, it is unlikely that surface water was impacted by leachate. However, the elevated nitrate and sulphate concentrations are characteristic of aggregate impacts, which may be related to nearby road building and hauling of aggregate to the Northeast Stockpile. Surface water quality at this location should continue to be monitored to assess the severity and evolution of these impacts.

The iron exceedance observed at Sw-N-16 was likely due to the disturbance of sediment during sampling, as indicated by the reported high TSS concentrations. Alternatively, elevated iron concentrations may be derived from the wetland located upgradient of Sw-N-16 or related to sediment accumulation at sampling locations. Dissolved copper concentrations were above the BCWQG-LTC guideline on two of four sampling events, corresponding with relatively lower pH (i.e., <7.0).

7.6.2 Monitoring Site Sw-N-05

Another route for surface water to leave the property to the north is through the main channel of Heal Creek, located just north of Phase 2 at Sw-N-05 (Boundary Compliance Station). During a hydrogeochemical site investigation in 2022, surface water quality was evaluated at location Sw-N-05, and AECOM determined that elevated metal and nutrient concentrations observed at Sw-N-05 were influenced by aggregate production/stockpiling and dilute leachate from the northwest corner of Phase 2. In 2022/23, surface water samples were collected on all four sampling dates at Sw-N-05.

Throughout the monitoring year, surface water quality at Sw-N-05 continued to degrade, with elevated conductivity, nutrient and sulphate concentrations. All parameters other than nitrate (50.5 mg/L) were compliant with the BCWQG-STA. Nitrate and dissolved copper concentrations exceeded the BCWQG-LTC on all sampling dates, ammonia and nitrite concentrations exceeded the BCWQG-LTC on two sampling dates (May and November 2022). TSS, selenium, and sulphate concentrations exceeded the BCWQG-LTC on one sampling date.

Nitrate concentrations were highly elevated, ranging from 13.6 mg/L to 50.5 mg/L, and were accompanied by sulphate concentrations ranging from 150 to 470 mg/L. Conductivity in the surface water was high, ranging from 460 to 860 µS/cm. Ammonia concentrations were elevated on the first two sampling dates, with an average of 4.7 mg/L. At the same time, nitrite concentrations were elevated, ranging from 0.16 to 0.39 mg/L. During the February 2023 sampling event, the surface water quality improved, but nitrate remained elevated, and chloride increased, reaching a maximum concentration of 29.5 mg/L. Over the past five years, statistically significant increasing trends in chloride, sulphate, and nitrate concentrations have been detected at Sw-N-05.

Similar to last year, surface water at Sw-N-05 displayed water quality impacts related directly to aggregate production and stockpiling north of the landfill. In general, solute concentrations tend to increase in the wet season, likely due to flushing of dust and ANFO residue from roads and the aggregate stockpiles. Surface water quality at this location should continue to be monitored closely to assess the severity and evolution of these impacts.

7.6.3 Monitoring Sites Sw-N-14

This sampling location is off site along Heal Creek north of Willis Point Road, within the Heals Rifle Range. Sw-N-14 is located on Heal Creek, upstream of the confluence with Durrance Creek. In 2022/23, surface water samples were collected at Sw-N-14 on four sampling dates.

Surface water quality at Site 14 met the BCWQG-STA, but nitrate exceeded the BCWQG-LTC on all four sampling dates. Additionally, dissolved copper and TSS exceeded the BCWQG-LTC during one sampling event. Nitrate concentrations ranged from 5.35 to 7.46 mg/L, decreasing throughout the monitoring year. Similarly, sulphate concentrations were elevated at the beginning of the monitoring year (88 mg/L), decreasing to 63 mg/L by the end of the monitoring year. These trends reflect impacts from aggregate production and stockpiling. Surface water quality at this location should continue to be closely monitored to assess the severity and evolution of these impacts.

7.6.4 Monitoring Site Sw-N-19

Sw-N-19 is located within the landfill property below the northeast freshwater retention pond, approximately 80 m east of the lower leachate lagoon. It is not a compliance monitoring station. It receives runoff primarily from the bedrock/refuse interface adjacent to Phase 1 and discharges to the wetland upstream of Sw-N-16. Surface water samples were collected from Sw-N-19 in May and November of 2022, and in May 2023.

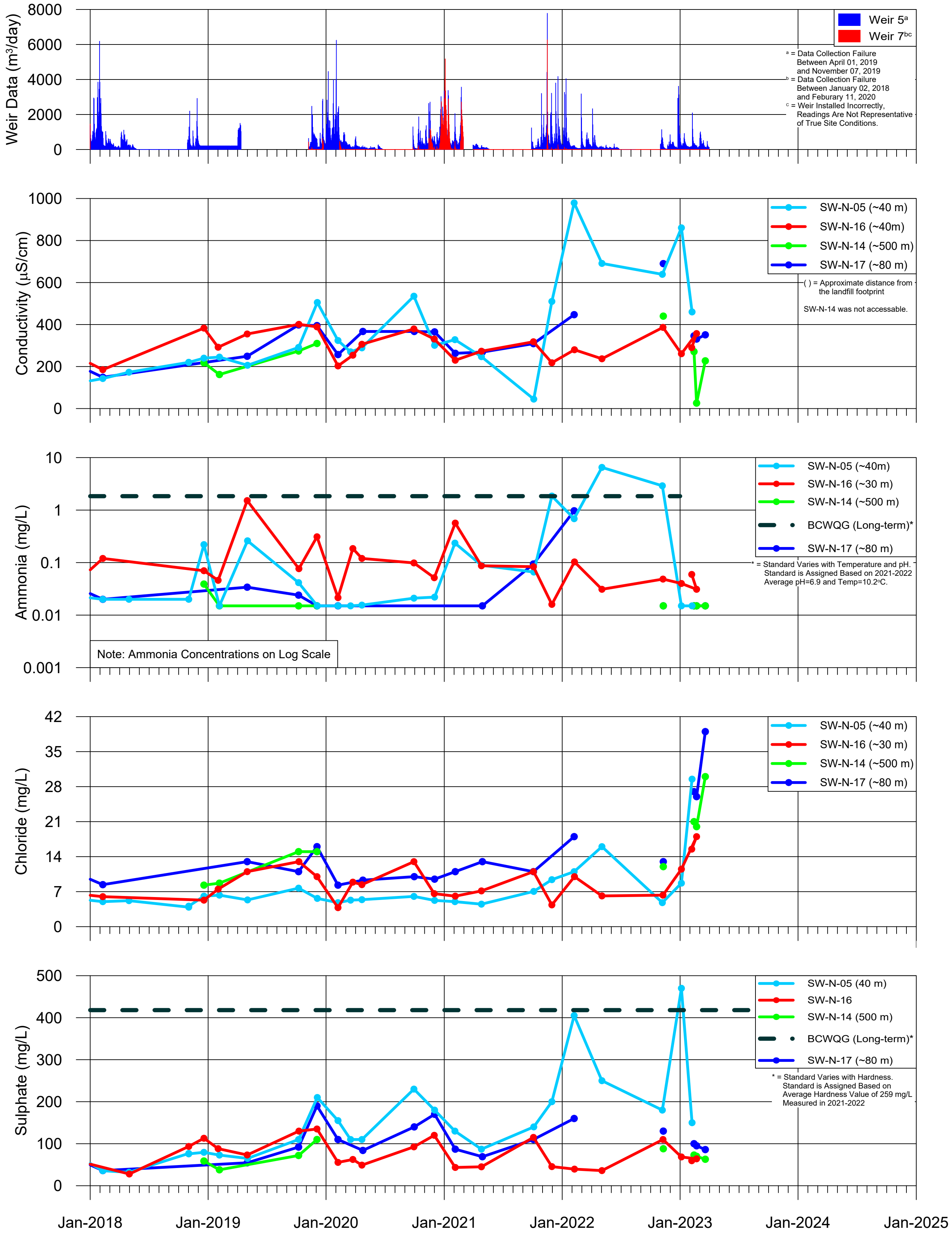
In 2022/23, all parameters were below BCWQG-STA guidelines on all sampling dates, but nitrite, nitrate and dissolved copper concentrations exceeded the BCWQG-LTC on at least one sampling date. Nitrate concentrations ranged from 3.05 to 11.7 mg/L, exceeding the BCWQG-LTC on all sampling dates. Copper concentrations ranged from 7.24 to 15.6 µg/L. Sulphate concentrations reflected historical values, ranging from 40 to 120 mg/L, and ammonia and chloride concentrations were low. Over the past five years, a statistically significant decreasing trend in conductivity has been observed at Sw-N-19. Ultimately, the elevated nitrate and sulphate concentrations suggest aggregate stockpiling at Hartland impacted surface water quality at this location.

7.6.5 Monitoring Sites Sw-N-45 and Sw-N-17

Sw-N-45 is located north of Phase 2, and outside the landfill property boundary on the north side of Willis Point Road. In 2022/23, water quality at Sw-N-45 met BCWQG-STA, except for nitrate (44.2 mg/L) in November 2022. Nitrate concentrations exceeded the BCWQG-LTC on all sampling dates, and dissolved copper concentration exceeded the BCWQG-LTC on three of four sampling dates. Copper concentrations only ranged from 1.16 to 1.78 µg/L. Sulphate concentrations were elevated and decreased throughout the monitoring year, ranging from 70 to 160 mg/L. Ammonia concentration was below the detection limit on all sampling dates. Chloride concentrations were generally low and increased to 54 mg/L in March 2023. Over the past five years, no statistical trends in solute concentrations have been identified at Sw-N-45.

Sw-N-17 is located north of Willis Point Road and is downstream of Sw-N-45 and Sw-N-05. Water quality at Sw-N-17 met BCWQG-STA guidelines on all sampling dates, but concentrations exceeded the BCWQG-LTC for nitrate on all sampling dates, and for dissolved copper in March 2023. Sulphate concentrations were elevated and decreased throughout the monitoring year, ranging from 86.0 to 130 mg/L. Chloride concentrations were also elevated slightly and decreased throughout the monitoring year from 13.0 to 39.0 mg/L. Ammonia concentrations were below the detection limit on all sampling dates. Conductivity was relatively high at the beginning of the monitoring year (690 µS/cm) and later decreased to values ranging from 331 to 351 µS/cm. Over the past five years, a statistically significant increasing trend in chloride concentrations has been observed at Sw-N-17, which may reflect road salting.

In 2022/23, surface water quality at monitoring locations 17 and 45 was impacted by aggregate production and stockpiling, as indicated by elevated conductivity, nitrate and sulphate concentrations. Surface water quality at these locations should continue to be monitored closely to assess the evolution of these water quality impacts downstream of the landfill.



ᵃ = Data Collection Failure Between April 01, 2019 and November 07, 2019
ᵇ = Data Collection Failure Between January 02, 2018 and Feburary 11, 2020
ᶜ = Weir Installed Incorrectly, Readings Are Not Representative of True Site Conditions.

( ) = Approximate distance from the landfill footprint

SW-N-14 was not accessable.

* = Standard Varies with Temperature and pH. Standard is Assigned Based on 2021-2022 Average pH=6.9 and Temp=10.2°C.

* = Standard Varies with Hardness. Standard is Assigned Based on Average Hardness Value of 259 mg/L Measured in 2021-2022

Figure 7-2. Surface Water Quality North of Phase 1

7.7 Surface Water Quality North of Phase 2

7.7.1 Surface Water Quality in the Hartland North Pad Area

The Hartland North Pad is located northwest of the landfill as shown on Figure 7-1. Recent geologic mapping of the ridge to the south of the North Pad (AECOM 2018) revealed an undulating bedrock surface with extensive deformation, fracturing, and mineralization. This area continued to undergo significant changes with the construction of the Residuals Treatment Facility (RTF). Development in the vicinity of the RTF began in 2017, and the construction was completed in late 2020. The treatment process at the RTF anaerobically digests residual solids from the McLoughlin Point Wastewater Treatment Plant into Class A biosolids.

The west side of the Hartland North Pad drains northward through an ephemeral channel that originates at the northwest corner of the Hartland North Pad. The water is carried through a culvert under Willis Point Road and into a drainage channel that eventually discharges into Durrance Lake approximately 450 m to the north. Flow through the channel only occurs during wet weather periods. During dry periods, several wetlands persist along the drainage course, but they are not connected by surface flows. In the downstream portions of the creek, flows increase due to groundwater discharge to the stream. Further downstream, a second creek of similar size joins the original creek. The “combined” creek has a well-defined channel in the area where it discharges to Durrance Lake.

7.7.1.1 Monitoring Sites Sw-N-41, Sw-N-42, and Sw-N-CSs2

Figure 7-5 presents conductivity, ammonia, chloride, and sulphate concentrations at sampling locations along the ephemeral channel at the northwest corner of the Hartland North Pad and the drainage channel discharging into Durrance Lake at stations Sw-N-41s1, Sw-N-41s3, Sw-N-41s4, Sw-N-42s1, and Sw-N-CSs2, which are located off-site. The sampling location Sw-N-CSs2 was dry in 2022/23, and surface water samples were not collected at that location.

At surface water station Sw-N-41s1, all parameters met the BCWQG-STA, but TSS exceeded the BCWQG-LTC on two sampling dates. Chloride and ammonia concentrations were low, and nitrate and sulphate concentrations were moderate, ranging from 0.17 to 0.736 mg/L and 48 to 68.5 mg/L, respectively. Conductivity was elevated, ranging from 229 to 360 mg/L. Over the past five years, statistically significant decreasing trends in ammonia, sulphate, and nitrate concentrations have been observed at this location. The slightly elevated sulphate, nitrate and conductivity exhibited continued minor impacts from aggregate stockpiling and placement on or near the Hartland North Pad.

At surface water station Sw-N-41s3, all parameters met applicable BCWQGs on all sampling dates. Conductivity was low and ranged from 122 to 320 mg/L. Chloride (<8.8 mg/L), ammonia (BDL), and sulphate (<25 mg/L) concentrations were low, and nitrate concentrations were low until February 2023, when they increased to 1.56 mg/L. On that sampling date, conductivity (147 µS/cm) and sulphate (17.0 mg/L) concentrations were low. The slightly elevated nitrate and sulphate concentrations may reflect dilute aggregate runoff.

At surface water station Sw-N-42s1, all parameters met applicable BCWQGs, except for TSS on the first two sampling dates. Conductivity was elevated, ranging from 276 to 371.5 µS/cm. Ammonia and chloride concentrations were low, and nitrate concentrations were moderate, reaching up to 0.39 mg/L in January 2023. Sulphate concentrations were elevated and ranged from 67.5 to 120 mg/L. Water quality at this location was impacted by aggregate stockpiling.

Sw-N-41s4 is located further downstream of Sw-N-41s3. In 2022/23, all parameters met applicable BCWQGs on all sampling dates. Conductivity was low, as well as sulphate, nitrate, ammonia, and chloride concentrations. No water quality impacts were observed at this location.

Overall, surface water quality at the Hartland North Pad and in the downstream receiving environment was generally consistent with historical results and exhibited continued minor impacts from aggregate stockpiling and placement. Further downstream of Sw-N-41s3, surface water is not impacted by aggregate stockpiling or any other landfill activities.

7.7.2 Surface Water Quality in the Phase 2 Area

7.7.2.1 Monitoring Sites Sw-N-51 and Sw-N-50

Stations Sw-N-50 and Sw-N-51 are located near the northern boundary of the newly constructed Phase 2 Cell 3 and near the northwest diversion ditch near the Toutle Valley rock quarry and aggregate processing area. They are not Boundary Compliance stations. In 2022/23, stations Sw-N-50 and Sw-N-51 were destroyed due the construction of Cells 4, 5 and 6 and could not be sampled.

7.7.2.2 Monitoring Sites Sw-N-54 and Sw-N-18

Sw-N-18 and Sw-N-54 (not Boundary Compliance stations) are located adjacent to the Upper Leachate Lagoon. Station Sw-N-18 is located near the headwaters of Heal Creek and monitors the combined discharge from the Sw-N-50 and Sw-N-51 catchment areas. Sw-N-54 monitors discharge from the northwest freshwater retention pond to Phase 2 Cell 1 and the NWSP.

Surface water at Sw-N-18 exhibited highly elevated conductivity, ammonia, nitrate, nitrite, aluminum, and metal concentrations. TSS, total and dissolved iron, ammonia, nitrite, and nitrate concentrations exceeded the BCWQG-STA, and TSS, dissolved copper, dissolved zinc, dissolved cadmium, total cobalt, and total aluminum concentrations exceeded the BCWQG-LTC. Conductivity values ranged from 440 to 1,240 µS/cm. Ammonia concentrations ranged from 6.3 to 82 mg/L, fluctuating throughout the monitoring year. Similarly, nitrate and nitrite concentrations fluctuated throughout the monitoring period, ranging from 2.02 to 58.4 mg/L and 0.306 to 0.681 mg/L, respectively. Chloride concentrations ranged from 3.6 to 84.0 mg/L, and sulphate concentrations ranged from 81.0 to 180 mg/L. Overall, surface water quality at location Sw-N-18 was impacted by dilute landfill leachate and aggregate runoff.

In November 2022, the plug and diversion measures at surface water station SW-N-18 were removed, directing the discharge to the Upper Leachate Lagoon, in response to water quality exceedances. Recognizing the need to handle potentially contaminated water more effectively, work is currently underway to install a diversion pipe at station SW-N-18. This new infrastructure aims to channel the contaminated water directly into the leachate system.

Similar to Sw-N-18, surface water at location Sw-N-54 exhibited elevated conductivity, ammonia, nitrate, iron, and cobalt concentrations. TSS, dissolved iron, and total iron and manganese concentrations exceeded the BCWQG-STA on at least one sampling date. Additionally, TSS, total aluminum, dissolved copper, and cobalt concentrations exceeded the BCWQG-LTC on at least one sampling date. Conductivity ranged from 331.0 to 570 mg/L, ammonia concentrations ranged from 0.016 to 1.2 mg/L, and nitrate concentrations ranged from 0.69 to 2.88 mg/L. Chloride concentrations ranged from 2.2 to 19.0 mg/L, and sulphate concentrations ranged from 36 to 140 mg/L. Overall, surface water continued to be impacted by aggregate stockpiling. Given the concurrent increase in ammonia, chloride and conductivity concentrations in January and February 2023, water quality is interpreted to have been impacted by dilute leachate over that period of time.

Due to the dilute leachate impacts and ongoing quarrying activities, CRD has implemented mitigation measures to manage water quality in the Toutle Valley and the NWSP. Temporary tarps were installed on a large portion of the Phase 2 landfill, and aggregate storage in the Toutle Valley was carefully managed. In 2021, aggregate was removed from Toutle Valley and placed in the cleared area south of the Hartland North Pad. A blasting program was initiated for Cell 4 preparation in October 2021. Given the sensitivity of surface water quality to blasting, quarrying and runoff from aggregate stockpiles at these locations, water quality at these locations should continue to be monitored closely. Careful surface water management planning is required for this area as the landfill develops to minimize impacts on groundwater and surface water that is not captured by the leachate collection system. Additional sediment control measures and efforts to reduce the quantity of blasting products may help reduce impairment to water quality as quarry development becomes increasingly close to the northern boundary of the landfill and these water quality monitoring stations.

7.7.2.3 Monitoring Site Sw-N-53

Sw-N-53 discharges into the NWSP and conveys surface water from a shotcrete-lined ditch south of the Hartland North Pad. Historically, few surface water samples have been collected from Sw-N-53 due to dry conditions. In 2022/23, only one sample was collected under very turbid conditions (February 2023). On that date, TSS, manganese, cobalt, total and dissolved iron, and zinc concentrations exceeded the BCWQG-STA, and TSS, dissolved copper, total zinc, chloride, aluminum and manganese concentrations exceeded the BCWQG-LTC. The chloride concentration was 170 mg/L, but ammonia was only 0.19 mg/L. Sulphate and nitrate concentrations were low.

At the time of sampling, turbidity had notably impacted the surface water quality at Sw-N-53, evident from the significantly elevated concentrations of iron and aluminum. While historically, water quality at Sw-N-53 was impacted by runoff from aggregate stockpiles, the one 2022/23 sample which was collected during the wet season, did not clearly indicate impacts by runoff from nearby aggregate stockpiles.

7.8 Surface Water Quality Further North of the Landfill

Surface water was collected at three locations (SW-N-63, SW-N-64, and SW-N-65) approximately 900 m northeast of Hartland, at confluence of Durrance Creek and Tod Creek. These stations are not Boundary Compliance stations. Water quality at these locations met all applicable BCWQG guidelines, except for low pH readings at Sw-N-63 and Sw-N-64, which were below the BCWQG-STA. Dissolved copper concentrations exceeded the BCWQG-LTC at all three locations on at least one sample date, likely due to lower pH and hardness values. Overall, surface water quality at these locations was good, with low sulphate, ammonia, and chloride concentrations, and near background conductivity (<210 µS/cm). At station Sw-N-63, nitrate and sulphate concentrations were slightly elevated, ranging from 0.958 to 1.28 mg/L, and 16 to 20 mg/L, respectively. Water quality at Sw-N-63 may be marginally affected by aggregate runoff or the application of fertilizers to neighboring agricultural areas. Monitoring at SW-N-63, SW-N-64, and SW-N-65 should continue to be monitored to assess the impact of aggregate runoff and to characterize the background signatures of nitrate/sulphate downstream of the landfill.

7.9 Surface Water Quality South of the Landfill

An ephemeral stream drains the area to the south of the landfill and flows southward towards Killarney Lake, which subsequently drains to Prospect Lake. Surface water flow south of the landfill occurs mainly during periods of wet weather, and groundwater seepage has been observed in the Killarney Creek channel during dry periods. Clean surface water runoff from the south slope of Phase 1 runs westward in a ditch to a culvert that discharges into a small wetland at Sw-S-03 and then into the ephemeral stream that flows south to Killarney Lake.

There are several surface water sampling stations located south of the landfill, listed from upstream to downstream, as follows:

- Sw-S-52 diversion ditch rerouted from north of the landfill, upstream of wheel wash facility.
- Sw-S-20 flow monitoring weir along diversion ditch at south end of Phase 1.
- Sw-S-12 flow monitoring weir upstream of the public weigh scale.
- Sw-S-03 culvert emerging from southeast corner of recycling area immediately upstream of a small natural wetland.
- Sw-S-27 Killarney Creek, north tributary.
- Sw-S-24 Killarney Creek, downstream of confluence of north and west tributaries.
- Sw-S-21 drainage ditch along road south of diversion ditch at south end of Phase 1.
- Sw-S-04 Killarney Creek, on property boundary, 270 m south of the landfill.

7.9.1 Upgradient Surface Water Quality

7.9.1.1 Monitoring Site Sw-S-52

Sw-S-52 is a background monitoring station. In 2022/23, surface water samples were collected at Sw-S-52 on all sampling dates. Concentrations of all parameters were below the BCWQG-STA. Like previous years, sulphate concentrations at Sw-S-52 were relatively stable and remained below 10 mg/L throughout the monitoring year. Nitrate concentrations were below 0.039 mg/L. No statistically significant trends have been observed at this sampling location over the past five years.

7.9.1.2 Monitoring Site Sw-S-20

Surface water samples were collected from Sw-S-20 on three sampling dates. Concentrations of all parameters were below the BCWQG-STA, and dissolved copper concentrations exceeded the BCWQG-LTC. Slightly elevated metal concentrations during the wet season may be partially due to elevated TSS. Ammonia concentrations were elevated (1.0 mg/L) in February 2023, but the chloride concentration (7.7 mg/L) was low. No statistically significant trends have been observed at this sampling location over the past five years.

7.9.2 Surface Water Quality Near and South of the Recycling Area

Figure 7-6 presents water quality data for surface water sampling stations located south of the landfill, including Sw-S-03, Sw-S-04, and Sw-S-12. The distance from each station to the landfill boundary is shown in brackets in the legend. CRD's recycling area went into operation in January 2001 and is located near Sw-S-12.

7.9.2.1 Monitoring Site Sw-S-12

In 2022/23, surface water samples were collected at station Sw-S-12 on all four sampling events. BCWQG-STA exceedances were reported for TSS (two sampling events), dissolved iron (three sampling events), and total iron (three sampling events). All three parameters exceeded BCWQG-STA on February 2023, which may reflect turbid flow conditions and high TSS. In November 2022, ammonia concentrations were relatively low at 0.017 mg/L. However, for all subsequent sampling dates, concentrations increased to more than 2.6 mg/L. In comparison, other parameters such as chloride, conductivity, nitrate, and sulphate exhibited a distinct pattern. Their highest concentrations were recorded in November 2022, which then decreased over the next two sampling events. The concurrent increase in conductivity, chloride, nitrate, and sulphate levels during the

November 2022 sampling suggests possible impacts from aggregate runoff or runoff from the paved areas around the bin facility. The elevated ammonia levels seen during the wet season could have resulted from denitrification, which may be due to decomposing organic matter. Chloride concentrations peaked at 33 mg/L in November 2022 but remained below 20 mg/L on other sampling dates. This occasional elevated chloride could be attributed to road salt application and unlikely to be influenced by leachate.

7.9.2.2 Monitoring Site Sw-S-03

Sw-S-03 is located on the landfill property in the main channel of Killarney Creek where the culvert discharges into a small wetland area. Sw-S-03 is not a compliance location. Historically, water quality at Sw-S-03 was affected by contaminated runoff from the south face of the landfill and the former truck wash area, until the truck wash facility was relocated in the fall of 1997. Due to the proximity to the public drop-off and storage area, water quality in Sw-S-03 may be affected by runoff from the bin facility, heavy traffic, and industrial activities.

In 2022/23, surface water quality at Sw-S-03 was poor. Surface water samples were collected on all four sampling events, and BCWQG-STA exceedances were reported for TSS (three sampling events), chloride (one sampling event), total iron (two sampling events), dissolved iron (one sampling event). Furthermore, exceedances of BCWQG-LTC criteria were reported for total aluminum (three sampling events), total cobalt (two sampling events), total lead (one sampling event), nitrate (one sampling event), and dissolved copper concentrations (three sampling events). Except for November 2022, ammonia concentrations were elevated, and ranged from 1.3 to 1.5 mg/L. In contrast, nitrate, conductivity, chloride, and sulphate peaked in November 2022 but reverted to historical values during subsequent sampling events. The notable conductivity spike to 2,370 µS/cm can be attributed to an exceptionally high chloride level of 950 mg/L. Leachate is not likely the source of the chloride and conductivity impacts, given the low ammonia reading of 0.045 mg/L in November and modest chloride concentrations (39 to 220 mg/L) in the south purge wells.

Overall, surface water quality at Sw-S-03 was temporarily impacted by road salting, aggregate runoff from the stockpiles on Phase 1 and/or from the paved area at the landfill entrance. Although surface water quality deteriorated in November 2022, it showed improvement during subsequent 2023 sampling events. Water quality should continue to be closely monitored for aggregate stockpiling and leachate impacts in the area downgradient of the bin facility and the south purge wells.

7.9.2.3 Monitoring Site Sw-S-04

Sw-S-04 is the southernmost Boundary Compliance Station at Hartland. In 2022/23, surface water quality at station Sw-S-04 met all BCWQG-STA criteria, except for one total iron concentration observed in May 2022. Furthermore, TSS, total aluminum, zinc, and dissolved copper concentrations exceeded the BCWQG-LTC on one sampling date. Nitrate concentrations were relatively high, ranging from 1.02 to 2.33 mg/L, and sulphate concentrations were moderate, ranging from 16 to 60 mg/L. Ammonia concentrations were generally at or below the detection limit, and conductivity was moderate to elevated, ranging from 157 to 253 µS/cm. Overall, the surface water quality at Sw-S-04 showed evidence of dilute aggregate runoff impacts, but low ammonia and chloride concentrations indicate that water quality was not impacted by leachate.

7.9.2.4 Monitoring Sites Sw-S-24 and Sw-S-27

Stations Sw-S-24 and Sw-S-27 (not Boundary Compliance stations) are located on the landfill property downgradient of the Phase 1 landfill, the landfill administration area, and mountain bike trails. In 2022/23, surface water samples were collected from Sw-S-27 on one date. The surface water quality met all BCWQG-STA criteria, except for TSS on one date, and all leachate and aggregate runoff indicator parameters were low. Surface water quality at Sw-S-24 met all BCWQG-STA criteria, except for TSS and total iron concentration in May 2022. Additionally, dissolved copper, and total aluminum, iron, and zinc concentrations exceeded the BCWQG-LTC during one sampling event. Nitrate concentrations were elevated throughout the monitoring period, ranging from 1.13 to 2.86 mg/L, and sulphate concentrations ranged from 15 to 72 mg/L. Similar to previous years, conductivity was elevated, with an average of 252 µS/cm. Overall, surface water quality at Sw-S-27 showed evidence of aggregate runoff impacts, as indicated by elevated conductivity, sulphate, and nitrate concentrations. Low chloride concentrations suggest water quality was not impacted by leachate.

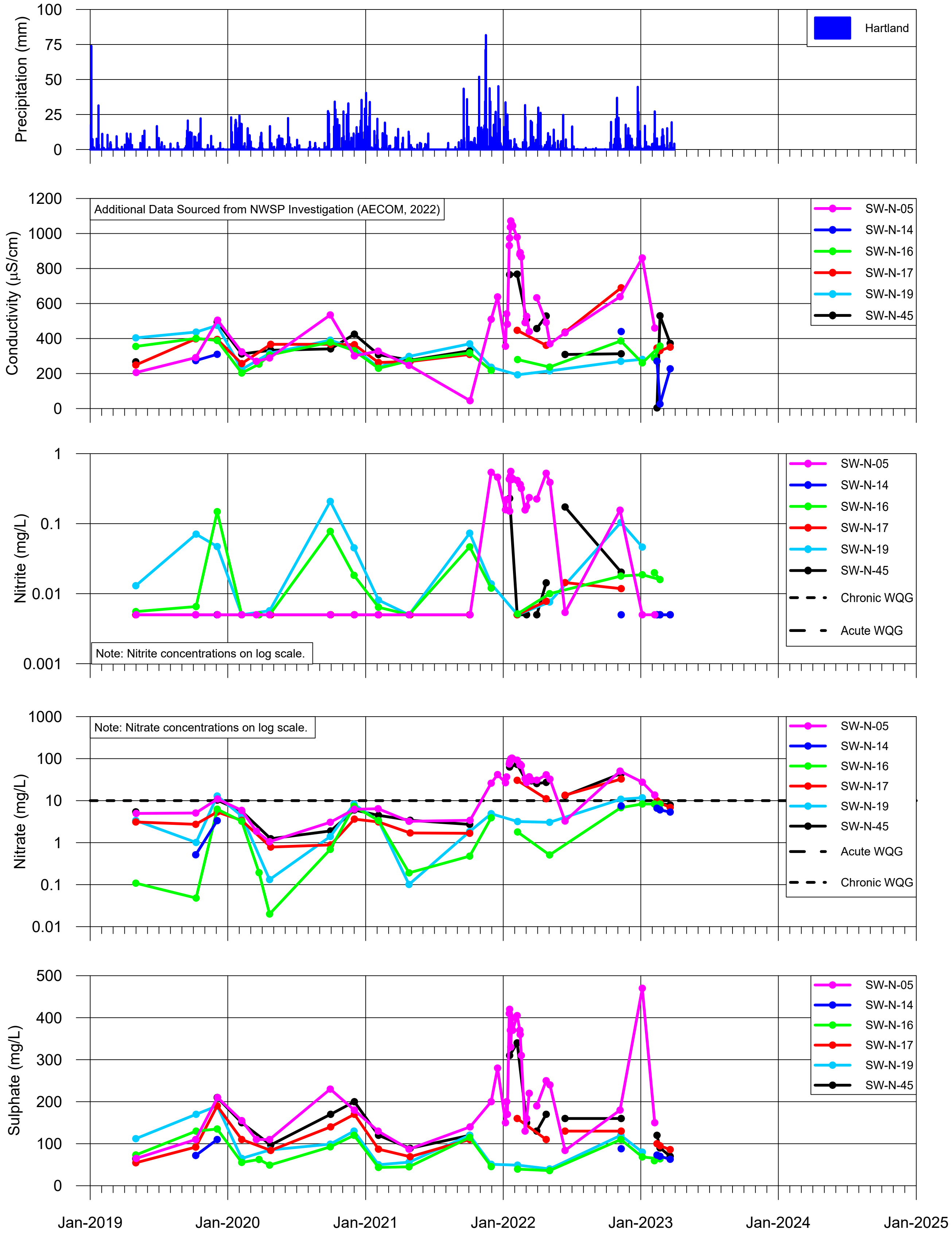


Figure 7-3. Surface Water Quality North of Phase 1 - Aggregate Impacts

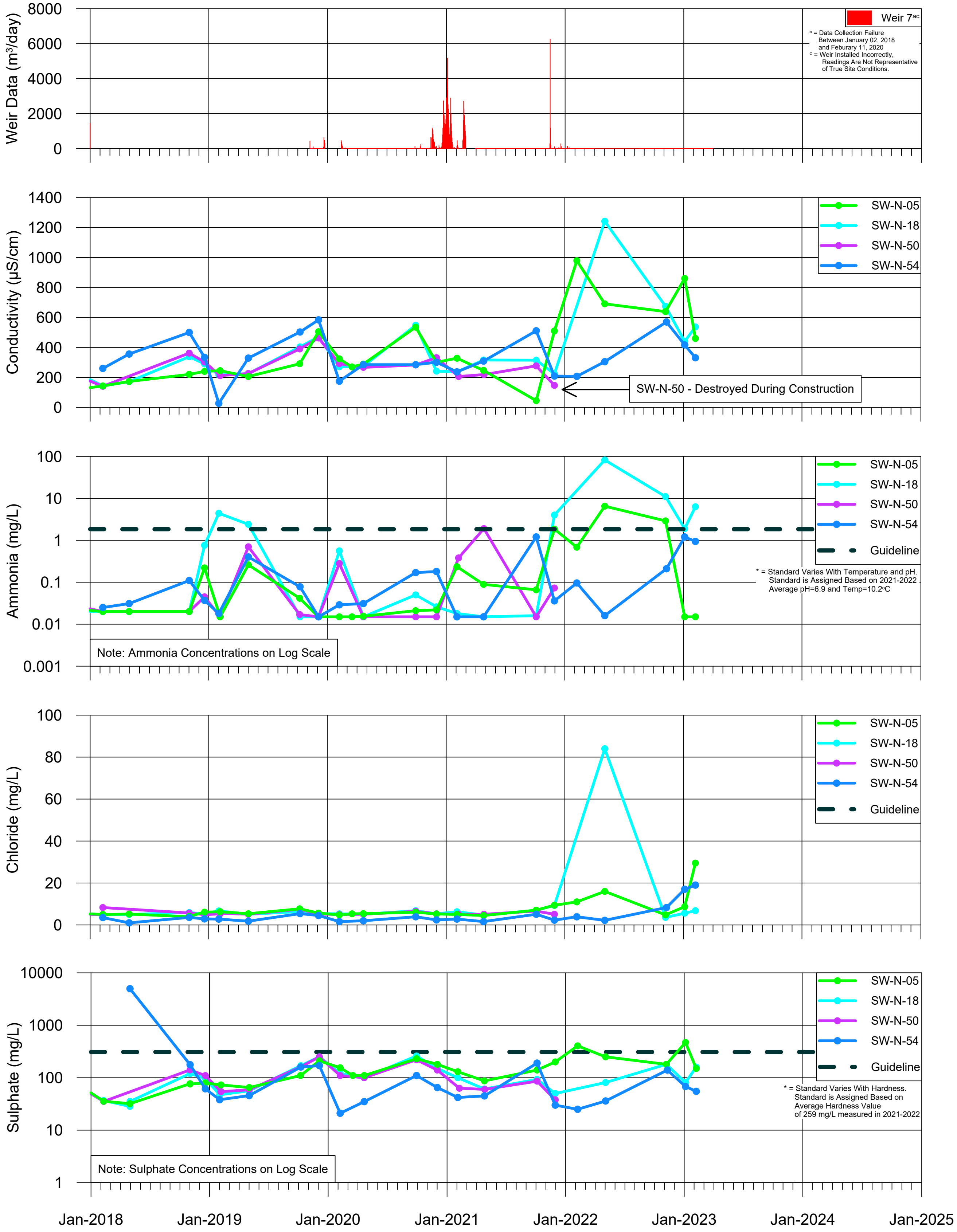


Figure 7-4. Surface Water Quality North of Phase 2

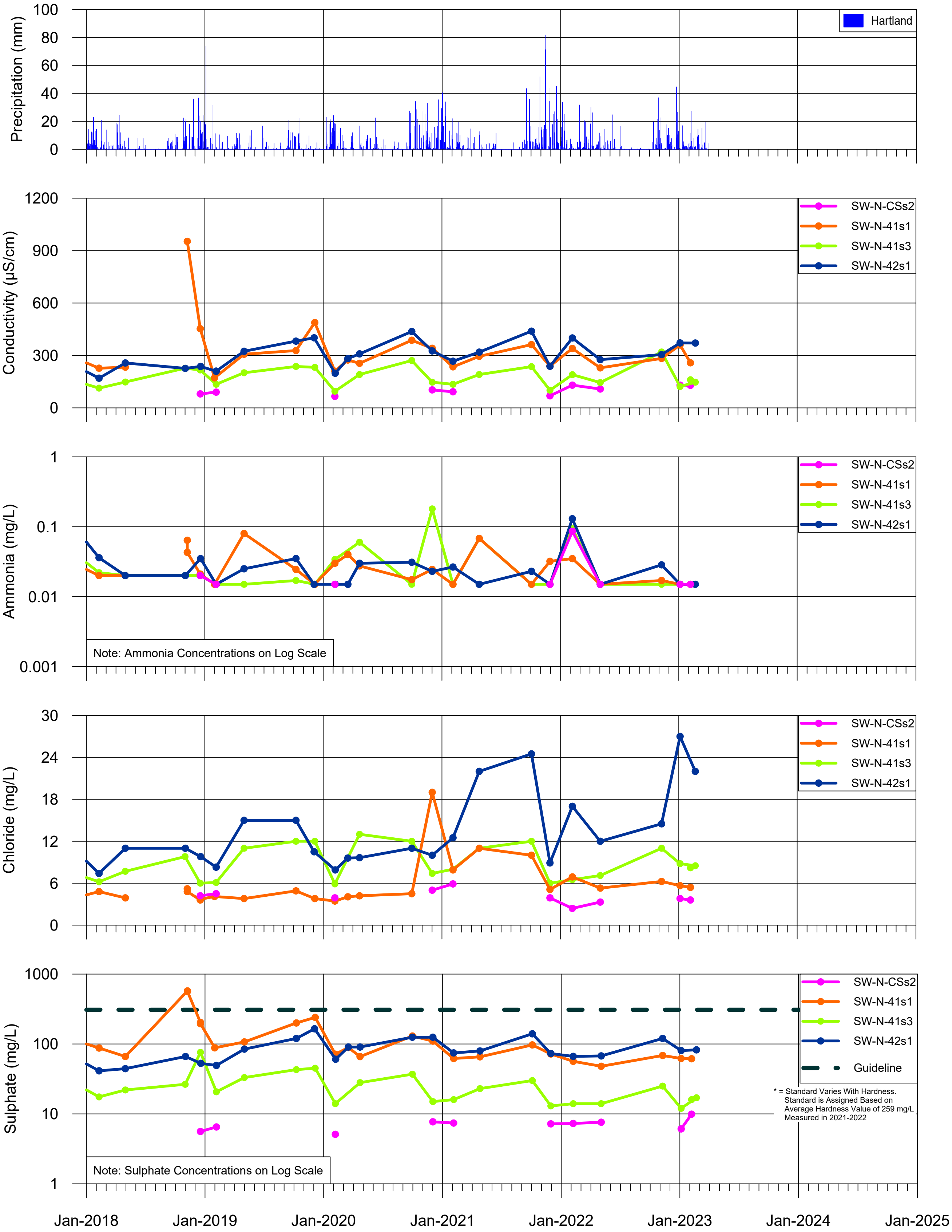


Figure 7-5. Surface Water Quality Downstream of the Hartland North Pad

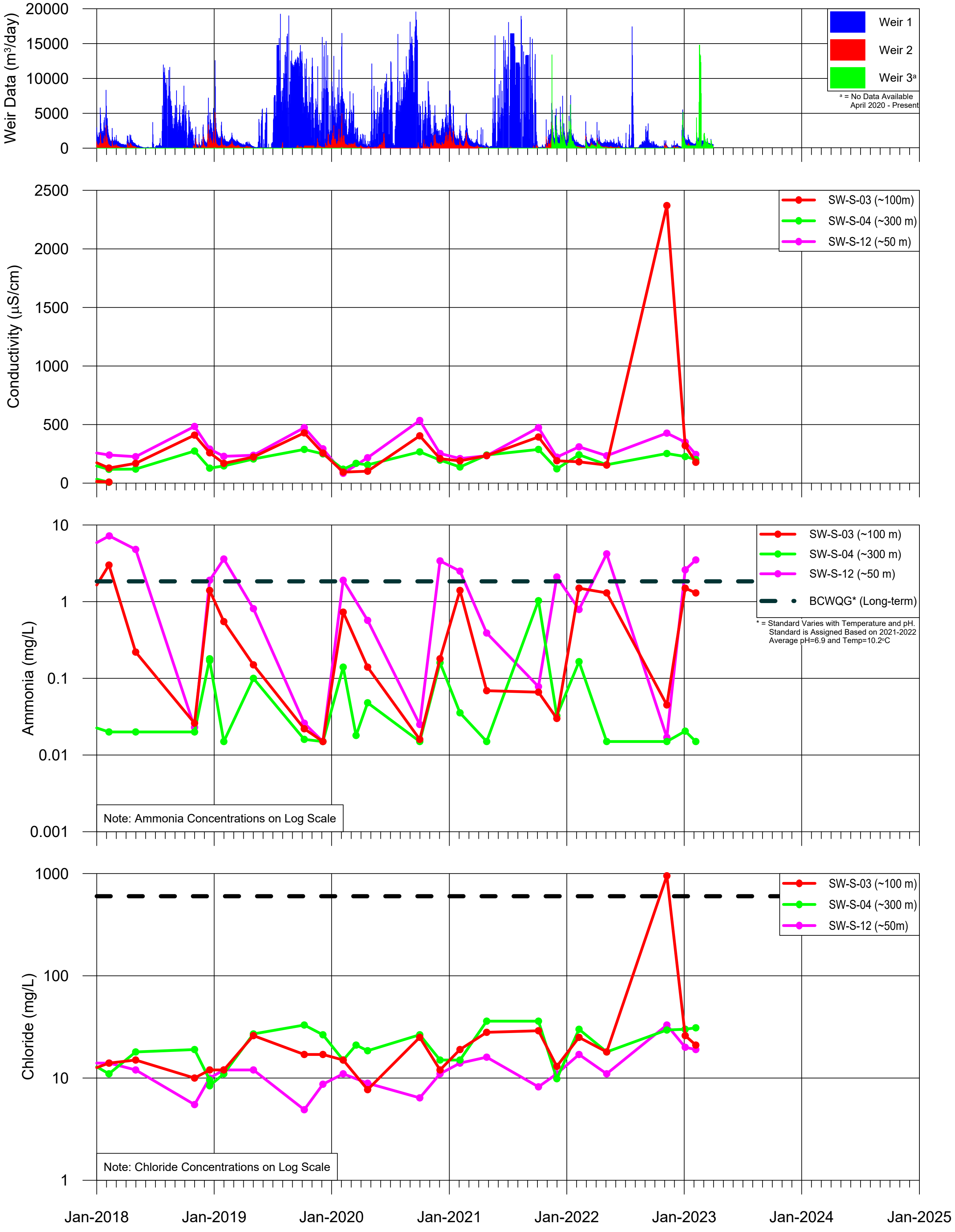


Figure 7-6. Surface Water Quality South of Landfill

7.10 Summary

The surface water quality observed at and around the landfill indicates that nearby surface water bodies, Tod Creek, Durrance Lake, Durrance Creek, and Killarney Lake were not impacted by landfill leachate in 2022/23. However, surface water quality monitoring stations at the landfill continued to show signs of water quality degradation, especially in the area northwest of Phase 2. Surface water quality in the Phase 2 area exhibited impacts related to runoff from the aggregate stockpiles located in the Phase 2 quarry, on the bedrock ridge north of the Phase 2 landfill, and other sources of ammonia during wet weather. Based on historic data and the 2022/23 surface water quality data, AECOM made the following interpretations:

- Surface water at Boundary Compliance location SW-N-05 continued to exhibit elevated nutrient concentrations in 2022/23, resulting in non-compliant water quality at this location. Nitrate concentrations at Sw-N-05 exceeded BCWQG-STA during the May 2022 and November 2022 sampling events. The elevated nitrate and sulphate concentrations suggest an impact on surface water from aggregate production and stockpiling. However, the absence of paired ammonia and chloride concentrations suggest water quality was not affected by leachate. The occasionally elevated ammonia concentrations may be associated with nitrate reduction via denitrification under reducing conditions.
- Surface water quality at Boundary Compliance station Sw-N-16 met BCWQG-STA, except for total iron during the February 2023 sampling event. The iron exceedance observed at Sw-N-16 was likely due to the disturbance of sediment during sampling, as indicated by the reported high TSS concentrations. Surface water quality at Sw-N-16 was not impacted by leachate, but continued to exhibit minor influence from nearby construction activities involving blasting, aggregate placement, aggregate hauling and excavation of organic soils. Similar aggregate impacts were observed at downstream at stations Sw-N-17 and Sw-N-45.
- Surface water at Sw-N-18 reflected dilute landfill leachate and may also have been impacted by aggregate runoff. In November 2022, the plug and diversion measures at surface water station SW-N-18 were removed, directing the discharge to the NWSP. Work is currently underway to install a diversion pipe at station SW-N-18 to direct the contaminated water directly into the leachate collection system.
- In the Hartland North Pad area, surface water quality at Boundary Compliance stations (Sw-N-41s1 and Sw-N-42s1) met BCWQG-STA in 2022/232, except for TSS. Leachate indicator parameters remained low in 2022/23, indicating surface water was not impacted by landfill leachate or construction activities. The slightly elevated sulphate, nitrate and conductivity exhibited continued minor impacts from aggregate stockpiling and placement.
- Historically, surface water stations Sw-N-14 and Sw-N-CS2 were used to monitor background conditions north of the landfill, but elevated conductivity, nitrate, and sulphate concentrations observed in 2022/23 indicate that surface water quality at these stations has been impacted by aggregate runoff. Sw-S-52 consistently showed no signs of impacts related to the landfill, confirming that the water quality remains representative of the background conditions south of the landfill.
- Surface water quality downgradient of the area north of the landfill (Sw-N-41s3) exhibited slightly elevated nitrate concentrations (1.28 to 1.57 mg/L) corresponding to low to moderate sulphate concentrations (17.0 to 20.0 mg/L). In the absence of elevated sulphate concentrations, it is difficult to interpret whether the elevated nitrate concentrations reflect a background process, agricultural impacts, or dilute aggregate runoff originating from Hartland landfill. Further downstream of Sw-N-41s3, water quality at Sw-N-41s4 was consistent with background conditions and showed no signs of aggregate or leachate impacts.
- Further downstream to the north of the landfill, at the confluence of Durrance Creek and Tod Creek (Sw-N-64 and Sw-N-65), surface water quality showed no impacts from landfill leachate or aggregate runoff. The slightly elevated nitrate (<1.5 mg/L) and sulphate (<20 mg/L) concentrations at Sw-N-63 may have originated from the on-site aggregate runoff or were associated with the application of fertilizers to the surrounding agricultural lands.
- Water quality at the Boundary Compliance location (Sw-S-04) met the BCWQG-STA values for all analytes in all samples collected during 2022/23, except for one total iron concentration observed in May 2022. Surface water quality along the south boundary was not impacted by leachate but exhibited impacts from dilute aggregate runoff.
- Water quality at station Sw-S-52 (not a Boundary Compliance location) is representative of background water quality. In 2021/22, concentrations of all parameters were below the BCWQG-STA. Concentrations of leachate indicator parameters were consistent with previously reported values.

- Surface water quality south of the recycling area (Sw-S-03, Sw-S-12) exhibited several BCWQG-STA exceedances, including TSS, dissolved and total iron, and chloride during one or more sampling date. Elevated ammonia, nitrate, conductivity and sulphate concentrations at these stations may be related to aggregate dust from the south face of Phase 1 and runoff from paved areas surrounding the bin facility, heavy traffic, and industrial activities.

8. Leachate

8.1 Compliance Monitoring Locations

Discharge from the leachate pipeline is subject to the CRD Regional Source Control Program (RSCP) Waste Discharge Authorization (Waste Discharge Authorization Number SC97.001). The compliance monitoring location for leachate at Hartland Landfill is the Hartland Valve Chamber (flow detection chamber) at the start of the leachate pipeline. Leachate compliance data is reported to the CRD RSCP on a quarterly basis.

8.2 Data

Our interpretation of the leachate chemistry data was based on samples collected at the following locations by CRD staff:

- Hartland Valve Chamber (leachate pipeline flow detection chamber and compliance point)
- Phase 1 North Purge Well System (combined discharge from 52-4-0-P7, 80-1-0-P8 and 81-1-0-P9)
- Phase 1 South Purge Well System (combined discharge from P1, P2, P3, P4 and P10)
- Controlled Waste Drainage
- West Face Drainage
- Cell 3 Pipe Outlet Drainage

These locations were sampled and analyzed for conventional parameters, organic compounds, and metals on a monthly basis in 2022/23. Additionally, Hartland Valve Chamber samples were analyzed quarterly for trace organic compounds including polycyclic aromatic hydrocarbons (PAHs), phthalate esters, ketones, aromatics, phenols, ethers, nitrosamines, alkanes, alkenes, and other select organic compounds.

In 2022/23, eight (8) leachate samples were collected at Cell 3 Pipe Outlet, and sixteen (16) leachate samples were collected from the Hartland Valve Chamber. Ten (10) leachate samples were collected from the Controlled Waste Drainage, and ten (10) leachate samples were collected from the South Purge Wells. Nine (9) leachate samples were collected from the West Face Drainage, where intermittent drainage patterns are attributed to precipitation, refuse settlement, and the increasing depth of waste cover over the toe drain. In 2022/23, no leachate samples were collected from the Phase 2 Cleanout because of ongoing site maintenance.

8.3 Leachate Generation and Discharge

Leachate collected from the Phase 1 and Phase 2 landfill is discharged to the lower leachate lagoon. During wet winter months, leachate is pumped into the lined upper leachate lagoon to minimize head build-up in the unlined lower lagoon. Leachate from the lagoons is discharged from the site through an 8.6 km long pipeline that discharges to the Saanich sanitary sewer and ultimately to the new McLoughlin Point Wastewater Treatment Plant. The CRL was activated on December 30, 2020, and the formal switch from the leachate pipeline to the CRL occurred in March 2021, with flow rates ranging between 60 and 80 L/s.

Total monthly leachate flows discharged to sewer are provided in Appendix D. Average monthly leachate flow in 2022/23 was 16.5 L/s and slightly lower than in 2021/22 (17.9 L/s). The highest monthly leachate flow was observed in January (90,297 m^3) in response to intense winter precipitation events. Changes in leachate discharge rates throughout the year may be related to the increased capacity of the Centrate Return Line (CRL) from the RTF, variability in precipitation, biofouling within the line, or operational improvements aimed at minimizing leachate generation.

8.4 Leachate Quality

Sampling and testing of leachate quality have been carried out since the early 1970s. Since 2000, leachate samples have been collected primarily from the Hartland Valve Chamber, which represents the point of discharge for compliance with the RSCP Waste Discharge Authorization.

The analytical results of the routine monthly leachate discharge samples are provided in Appendix B.4. Analysis of trace organics in the leachate discharge was conducted quarterly and is provided in Appendix B.5. The analytical results for samples collected from the leachate collection and conveyance network are presented in Appendices B.6., B.7., B.8., B.9., B.10, and B.11. Analysis of emerging contaminants at the Hartland Valve Chamber was momentarily paused while AECOM is reviewing data from 2018 to 2022. An updated list of emerging contaminants will be integrated into the 23/24 monitoring program. The results of a single sample taken in May 2022 for analysis of emerging contaminants is provided in Appendix B.12. In addition to the Sewer Use Bylaw Criteria, leachate quality results for trace organic compounds were screened against CSR standards for the protection of drinking water and aquatic life to support operational decisions regarding leachate containment and management.

8.4.1 Routine Monthly Leachate Analyses and Sewer Use Bylaw Comparison

The Hartland Valve Chamber is the compliance point for the Waste Discharge Authorization. In 2022/23, all leachate quality samples met RSCP Waste Discharge Authorization criteria, except for COD on multiple sampling dates. Since COD concentrations measured in 2022/23 are unreliable and were not representative of leachate quality, COD values are not discussed below.

Although the Waste Discharge Authorization criteria only apply to the combined discharge at the Hartland Valve Chamber, comparison of other leachate monitoring station results to these criteria allows for evaluation of individual leachate contributions to the combined leachate discharge. Concentrations above RSCP criteria at locations other than the Hartland Valve Chamber are not considered to be non-compliant, and the criteria are used for reference purposes only.

Figure 8-1 and Figure 8-2 present time series plots for selected parameters in leachate at the compliance point (Hartland Valve Chamber) and in Phases 1 and 2. Evaluation of this data allows for comparison of leachate from each landfill area. At all sampling locations, concentrations of inorganic parameters such as conductivity and chloride show a seasonal dilution effect whereby greater precipitation in the fall and winter months results in lower concentrations during the wet winter months. Higher concentrations occur during drier periods from May to October. Leachate discharge from the Phase 2 Basin is significantly more concentrated than leachate generated in Phase 1, which was closed in 1996. The mixing of leachate from Phases 1 and 2 in the Hartland Valve Chamber results in a leachate that exhibits chemistry which is intermediate between the two sources.

Similar to previous years, leachate concentrations at the Hartland Valve Chamber were well above background concentrations observed in surface water and groundwater, with conductivity concentrations ranging from 2,303 µS/cm to 5,846 µS/cm, ammonia concentrations ranging from 160 mg/L to 400 mg/L, and chloride concentrations ranging from 200 mg/L to 490 mg/L. Overall, annual average leachate concentrations in 2022/23 were slightly higher than in 2021/22.

Figure 8-2 shows BOD concentrations at the Hartland Valve Chamber. BOD concentrations at Hartland remain relatively low for a large landfill and were typically below 50 mg/L. Changes in BOD may be related to the elevated temperatures observed during summer months, or changes in leachate storage and management prior to sample collection.

Total sulphide, dissolved sulphide and PAH concentrations did not exceed the Waste Discharge Authorization criteria at Hartland Valve Chamber during any of the 2022/23 sampling events. Total and dissolved sulphide concentrations exceeded the Waste Discharge Authorization criteria in January 2019 but have since remained well below the standard of 1 mg/L. Infiltration through aggregate placed on the Phase 2 landfill during the winter months is known to be an important source of sulphate to the Phase 2 Cleanout. Sulphate can be reduced to sulphide by bacteria under reducing conditions in the absence of other reducing agents such as oxygen and nitrate.

Overall, leachate quality at the Hartland Valve Chamber was consistent with previous years, with concentrations of many parameters several orders of magnitude below Waste Discharge Authorization criteria. Over the past five years, a statistically significant decreasing trend in ammonia concentrations and an increasing trend in nitrate concentrations have been observed at the Hartland Valve Chamber. The elevated nitrate concentrations likely reflect aggregate runoff collected by the Leachate Collection System. Average nitrate concentrations decreased to 11.7 mg/L from 53.1 mg/L in 2022, and sulphate concentrations decreased to 95.3 mg/L from 129.0 mg/L in 2022.

8.4.1.1 Phase 2 Cleanout

In 2022/23, leachate samples were not collected from the Phase 2 cleanout due to ongoing site maintenance activities.

8.4.1.2 North Purge Wells

In 2022/23, leachate samples collected from the North Purge Wells (52-4-0-P7, 80-1-0-P8 and 81-1-0-P9) met all Waste Discharge Authorization criteria, except for COD on multiple sampling dates. Total sulphide concentrations in the Phase 1 leachate were low (<0.19 mg/L).

8.4.1.3 South Purge Wells

Leachate quality data from combined effluent samples collected from the South Purge Wells (P1, P2, P3, P4 and P10) is provided in Appendix B.9. Leachate sampling at the South Purge Wells began in November 2020 and is now part of the monthly leachate sampling program. During the 2022/23 monitoring year, leachate samples collected from the South Purge Wells met all Waste Discharge Authorization criteria. In 2022/23, total sulphide concentrations ranged from 0.0097 to 0.036 mg/L and was well below the Waste Discharge Authorization criteria. BOD ranged from 2.5 to 54 mg/L, with a median of 5.85 mg/L.

Leachate quality in the South Purge Wells is characterized by moderately elevated conductivity (1,059 to 1,944 µS/cm), ammonia (44 to 250 mg/L) and chloride concentrations (78 to 490 mg/L), and low concentrations of sulphate (<10 mg/L). In 2022/23, all metal concentrations in the South Purge Wells met Waste Discharge Authorization criteria.

8.4.1.4 Controlled Waste Drainage

Leachate collected by the Controlled Waste Drainage is not as concentrated as leachate collected from Phase 2 Cleanout and the West Face Drainage. In 2022/23, all leachate parameters and metal concentrations in the Controlled Waste Drainage leachate met Waste Discharge Authorization criteria.

8.4.1.5 West Face Drainage

In 2022/23, leachate discharged from the West Face Drainage throughout the year and was sampled monthly. Like previous years, the West Face Closure Toe Drain generally had the most concentrated leachate, with the highest BOD, ammonia, conductivity, and chloride concentrations.

In 2022/23, the average chloride, sulphate, nitrate, and BOD concentrations were generally lower than those measured in 2021/22, but the average conductivity and ammonia concentrations were slightly higher. Sulphide concentrations remained low and met Waste Discharge Authorization criteria on all sampling dates, and total phenols exceeded the Waste Discharge Authorization criteria on one sampling date (July 2022).

Leachate from the West Face Drainage is strongly reduced with abundant organic content. A weir and flow monitor have been installed at the West Face Drainage to evaluate seasonal trends in flows. Because leachate from the West Face Drainage is contributing a relatively small volume of leachate to the leachate collection system, it does not noticeably affect the quality of leachate at the Hartland Valve Chamber.

8.4.1.6 Cell 3 Pipe Outlet

Cell 3 includes new leachate containment and gravity flow conveyance infrastructure (i.e., the Toutle Drain), which discharges directly into the upper leachate lagoon. Starting in 2016, the Cell 3 Pipe Outlet began discharging leachate, and leachate from this location is considered representative of newly deposited refuse. In 2022/23, samples were collected on eight of 12 sampling dates. Sampling from this station is challenging due to the intermittent flows. In 2022/23, all parameters met Waste Discharge Authorization criteria.

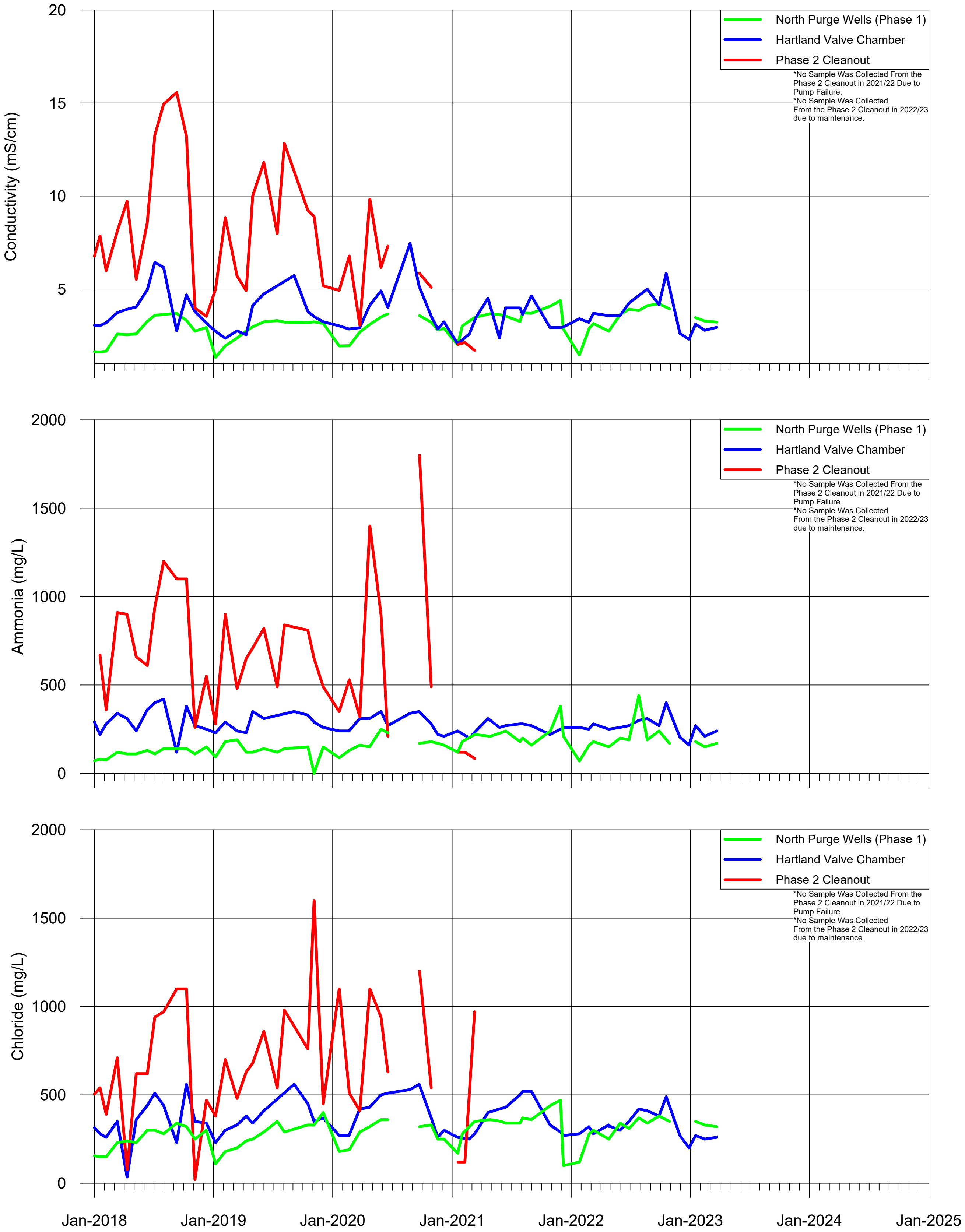


Figure 8-1. Hartland Valve Chamber Leachate Chemistry (Conductivity, Ammonia and Chloride)

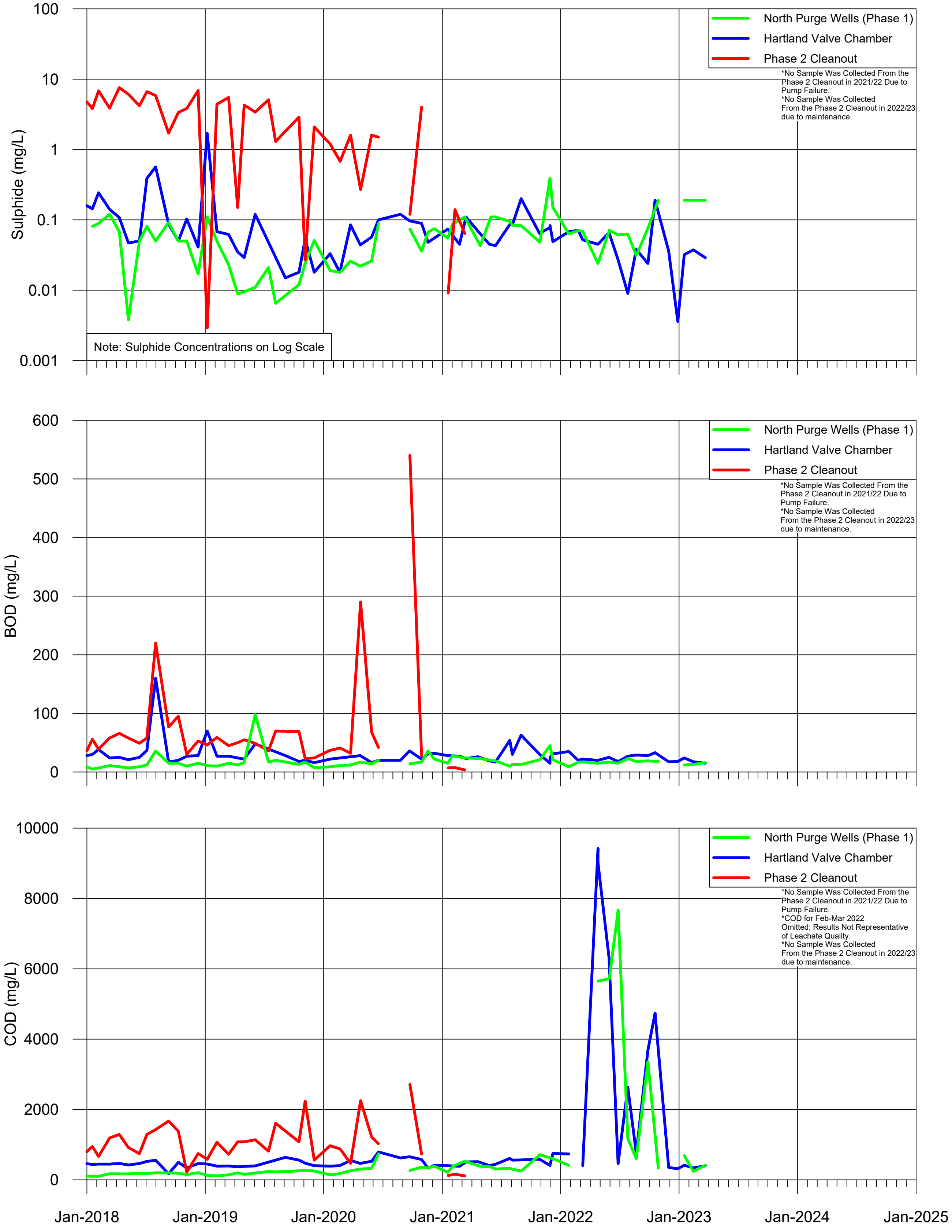


Figure 8-2. Hartland Valve Chamber Leachate Chemistry (Sulphide, BOD and COD)

8.4.2 Quarterly Trace Organic Analysis at Hartland Valve Chamber

Since 1998, trace volatile and semi-volatile organic analyses have been carried out quarterly on leachate samples collected from the Hartland Valve Chamber. Chlorinated phenol compound analytical results for combined leachate in 2022/23 are presented in Appendix B.5.

A total of four (4) volatile and semi-volatile organic compounds were reported at detectable concentrations across all sampling dates. The detected compounds were found at concentrations that are low compared to those commonly found in leachate at municipal solid waste landfills of similar size. None of the trace organics exceeded Waste Discharge Authorization criteria. Like previous years, concentrations of volatile organic compounds in Phase 2 leachate (i.e., the West Face Drainage and Phase 2 Cleanout) are exceedingly low and typically at concentrations on the order of 1% to 20% of Waste Discharge Authorization criteria. Regular sampling and analysis for VOC concentrations in leachate sources should continue, but it is not warranted in groundwater at compliance monitoring locations at this time.

In 2022/23, two phenolic compounds were above detection limits (2,4,6-trichlorophenol and 2,3,4,6-tetrachlorophenol). However, the phenol concentrations in leachate at Hartland are lower than or similar to those found at other large municipal solid waste landfills. Phenols are used in several manufacturing processes and occur naturally at low concentrations due to their presence in wood and other natural organic matter.

In 2022/23, all low-weight PAHs were detected in Hartland Landfill leachate. Total concentrations of low-weight PAHs ranged from 0.011 to 15 µg/L, which was consistent with historical concentrations. Acenaphthene exhibited a maximum concentration of 6.1 µg/L in October 2022, slightly above the maximum value (5.2 µg/L) observed in 2021/22. High-weight PAHs, including benzo(a)anthracene, fluoranthene, and pyrene continued to be detected with maximum concentrations of 0.12 µg/L, 1.1 µg/L, and 0.79 µg/L, respectively. Chrysene and benzo(a)pyrene have been marginally above detection limits since 2016. Overall, high-weight PAH concentrations were considerably lower than in 2021/22, ranging from 0.005 to 1.1 µg/L.

The CRD Environmental Protection Division conducted high-resolution analyses of leachate quality between 2004 and 2007. The high-resolution analytes included polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), nonylphenols, and chlorobenzenes. Data collected revealed that nonylphenols and PBDEs are not present at levels of environmental concern, even in full strength leachate (Golder 2008). The aquatic risks of PCBs observed in leachate samples were also found to be negligible. Additionally, concentrations of nonylphenols, PCBs, DDT and select PDBEs varied in comparison to CRD wastewater. At the time of the study, Hartland leachate contributed only 2% of the total wastewater discharge from the Macaulay Point outfall. The evaluation concluded that despite differences in the chemical profile of leachate and Macaulay Point wastewater, leachate had no observable impact on the chemical profile at Macaulay Point. Based on these findings, the high-resolution analyses were discontinued. Co-ordination between the CRD's Marine Monitoring and Environmental programs is on-going.

8.5 Summary

The leachate flow and quality data collected in 2022/23 indicates the following:

- The average daily leachate flow rate was 16.5 L/s, with a maximum monthly discharge of 90,297 m^3 in January 2023. The average flow was considerably higher than the long-term (1997 to 2022) average of approximately 12.2 L/s, which may be related to the expansion of the Phase 2, Cell 4/5/6 quarry.
- The exceedances of COD during multiple sampling events were determined to be due to compromised laboratory-supplied preservatives. Therefore, the analytical results are not considered representative of in-situ leachate.
- At the Hartland Valve Chamber, leachate quality was compliant with the Waste Discharge Authorization. Statistical trend analysis indicates that leachate quality has been relatively stable with minor improvements over the past five years.
- At the Hartland Valve Chamber, the highest concentrations of leachate parameters were observed in August and October 2022, when precipitation approached the annual minimum.
- Phase 1 leachate exhibited the lowest average values of BOD and highest sulphide concentrations compared to other leachate sampling locations.
- The West Face Closure Toe Drain exhibited the most concentrated leachate, with total phenols concentrations exceeding the Waste Discharge Authorization criteria on one sampling date.

9. Conclusions

Based on our review of historical data and interpretation of the groundwater, surface water, and leachate quality data collected between April 2022 and March 2023, the annual monitoring program allows for an effective assessment of landfill performance and compliance related to groundwater, surface water and leachate flow and quality. The following conclusions are drawn based on our interpretation of the 2022/23 data.

9.1 Leachate Flow

Based on review of historic data and leachate flow data collected in 2022/23, AECOM has drawn the following conclusions:

- Leachate elevation data collected in 2022/23 indicate that leachate mounding continued to persist in the Phase 1 landfill, as it has since it was closed in 1996. Leachate elevations in Phase 1 were generally stable and exhibited minor seasonal variations. The leachate mound in the upper portion of the refuse is interpreted as being ‘perched’ above the regional bedrock groundwater flow system, with relatively high water levels and strong downward hydraulic gradients.
- Like in 2021/22, leachate elevations in the Phase 2 Basin exceeded the elevation of the Lower Leachate Lagoon in November and remained above the elevation of the lagoon for the rest of the monitoring period. Historically, the leachate elevation in Phase 2 was approximately 1 to 2 m lower than the elevation of the Lower Leachate Lagoon. CRD confirmed that this trend was likely due to calibration/ instrument drift, and were not indicative of a change in operations. Nonetheless, the leachate elevation in Phase 2 was well-below the groundwater elevations observed at locations 36 and 37, indicating that the hydraulic trap was preserved throughout the monitoring year.
- Leachate discharge rates in 2022/23 were lower than those observed in 2021/22. The total volume of leachate discharged in 2022/23 was 520,740 m^3, approximately 7.5% lower than in 2021/22. The contrast in leachate discharge volumes likely reflects a lower volume of precipitation in 2022/23 compared to 2021/22. It is also possible the lower volume of leachate may be due to biofouling of the North Purge Wells and a resultant decrease in the volume of leachate extracted from these wells over the past year.
- In 2022/23. the highest leachate elevations (155 to 157 m asl) were typically observed in the east/southeast area of the Phase 1 (GW-46-2-1, VLGW-004D and VLGW-011S), an area with elevated topography and refuse heights. Leachate levels in deeper parts of the refuse respond to seasonal recharge events, indicating that the lower portions of the Phase 1 landfill are in hydraulic connection with the regional groundwater flow system in the bedrock.
- In 2022/23, a total of 30,580 m^3 of leachate was collected from the South Purge Wells, approximately 13.3% less than in the previous monitoring year. Leachate discharge volumes and consistent groundwater levels observed in the South Purge Wells suggest the South Purge Well system functioned effectively in 2022/23.
- In 2022/23, a total of 14,277 m^3 of leachate was collected from the North Purge Wells, approximately 21.3% less than in the previous monitoring year. Water levels in GW-40-1-1, GW-52-4-0-P7, GW-80-1-0-P8, and GW-81-1-0-P9 were generally consistent with historical ranges. Leachate discharge volumes and consistent groundwater levels observed in the North Purge Wells suggest the North Purge Well system functioned effectively in 2022/23, but there may be early signs of biofouling of the leachate collector wells. These wells have historically required rehabilitation every 5-10 years.

9.2 Groundwater Flow

In 2022/23, groundwater flow patterns observed at Hartland were consistent with historic interpretations, with some changes in the North Ridge area. Regional groundwater flows from Mount Work northeast to the north-south trending valley that underlies the northern portions of the Phase 1 and Phase 2 landfill footprint. Most of the northward groundwater flow in the bedrock below the landfill is captured by the Toutle Valley Underdrain, Phase 2 basin leachate collection system, springs discharging to the lower lagoon, and the north and south purge well systems. Groundwater monitors east of Phase 1 confirm flow from east to west toward the landfill, preventing off-site migration to the east.

Around the North Ridge and Hartland North Pad, located northwest of Phase 2, groundwater flows radially outward to the north, east and south from a topographic high situated north of Phase 2. Throughout 2022/23, continued blasting operations along the North Ridge resulted in reductions in both the topography and the groundwater potentiometric surface within the area contained by the Upper Level Road. Subsequently, this decline in groundwater surface led to diminished eastward hydraulic gradients. It is suspected that the quarry cut through the Highland Fault, potentially facilitating the drainage of eastward moving groundwater that was previously impeded by the fault. This is consistent with the groundwater seepage observed at the base of quarry and generally lower groundwater elevations in the North Ridge area. Although groundwater elevations in the North Ridge area continued to exhibit seasonal fluctuations, the intensity of the fluctuations was less pronounced.

9.3 Groundwater Quality

The groundwater quality results from 2022/23 indicate that leachate-impacted groundwater was contained within the landfill property. At the north end of the landfill, leachate-affected groundwater extended just north of the unlined Lower Leachate Lagoon and through the middle of the lined Upper Leachate Lagoon but did not extend off-site. Leachate was identified in well GW-106-1-1, but impacts were limited to an area less than 20 meters northwest of the Phase 2 Basin. South of the landfill, leachate-affected groundwater did not extend off-site. Leachate related exceedances were confined to the landfill footprint on the east side of Phase 1 and are inferred to extend to the western extent of the waste footprint within the Phase 2 landfill. These results indicate that the leachate collection system continued to function as intended, minimizing surface water and groundwater quality impacts.

In 2022/23, Boundary Compliance wells and off-site monitoring wells met CSR AW and DW standards, except for an anomalous copper concentration exceedance at GW-21-1-1 in May 2022. However, this recorded exceedance may not accurately represent true conditions as indicated by the high RPD discrepancy between parent and duplicate samples. Dissolved copper in the parent sample was non-detected but highly elevated in the duplicate sample. Similar to previous years, most exceedances were present in groundwater wells near leachate purge wells and known leachate sources. However, nitrate concentrations in several groundwater wells located downgradient of aggregate stockpiles exceeded applicable CSR DW standards on one or more sampling event.

In 2022/23, groundwater in many areas of the landfill exhibited elevated conductivity, nitrate, and sulphate concentrations, reflecting the impacts of aggregate production, transport, stockpiling and use for construction at Hartland. Elevated concentrations of aggregate runoff parameters were observed around the Northwest Stockpile, North of Phases 1 and 2, around the Northeast Stockpile, south of Phase 1, and throughout the surface water system. AECOM is currently updating the Groundwater, Surface Water and Leachate Monitoring Plan to capture the cumulative impact of various activities, including aggregate stockpiling, placement, leachate discharge and on-going construction.

North of the Landfill

- In 2022/23, annual average conductivity values in the North Purge Wells were generally higher than those in 2021/22, reflecting more concentrated leachate. Changes in leachate quality in the North Purge Wells may reflect more concentrated leachate due to lower precipitation in 2022/23 than 2021/22, or mixing of leachate from Phase 1 and the Lower Leachate Lagoon.
- Operation of the Phase 1 North Purge Well System continued to mitigate leachate impacts north of the landfill, as indicated by long-term stable or decreasing concentrations of leachate indicator parameters at locations 40, 20 and 21. However, nitrate concentrations at location 40 increased considerably from the previous monitoring year.
- 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. The increase in nitrate and sulphate concentrations in groundwater is interpreted to be due to runoff from aggregate stockpiles and roads constructed with aggregate.
- Along the northern edge of the Phase 2 Basin, groundwater quality is primarily impacted by runoff from aggregate stockpiles, with some wells (GW-106-1-1 and GW-105-1-1) showing evidence of dilute landfill leachate impacts. The influence of landfill leachate on groundwater is limited to an area less than 20 meters northwest of the Phase 2 Basin.
- Groundwater quality at Boundary Compliance Station 31 met all applicable CSR standards in 2022/23. However, highly elevated sulphate and nitrate concentrations observed at this location reflect aggregate runoff.

Hartland North Pad

- Groundwater quality at the Hartland North Pad was slightly deteriorated, with elevated conductivity, nitrate, and sulphate concentrations observed at some monitoring stations (e.g., GW-44-1-1, GW-62-1-1, GW-77-1-1, GW-78-1-1, GW-87-1-1, GW-88-1-1). The concurrent increase in conductivity, sulphate, and nitrate concentrations suggests widespread impacts of aggregate runoff on shallow groundwater quality.

- Groundwater quality in GW-91-1-1 and GW-92-1-1 was generally consistent with background conditions, except for elevated conductivity and sulphate concentrations. Nitrate concentrations remained low at both sites. The elevated sulphate may be associated with natural sulphide oxidation. Groundwater at location 94 was clearly impacted by aggregate runoff, indicating it cannot be considered a background station.

South of the Landfill

- Groundwater quality south of the landfill met all applicable CSR standards. Although ammonia concentrations in some wells south of the landfill were slightly elevated, they were within historical ranges and well below the applicable CSR standards.
- Groundwater quality at several locations (e.g., GW-85-1-1, GW-60-1-1, and GW-71-1-1) showed no evidence of landfill leachate impacts. However, elevated nitrate and moderate sulphate concentrations reflect impacts from aggregate stockpiling and use, which may be related to runoff from the paved area and wind-blown or transported aggregate dust. Since 2020, chloride concentrations have been occasionally elevated at some monitoring stations (e.g., s GW-85-1-1 and GW-60-1-1), but the elevated chloride concentrations have not correlated with elevated ammonia concentrations. High Cl/Na molar ratios (>1) suggest there is an additional source of chloride other than road salt, but the source of chloride is currently unknown.

East of the Landfill

- Water quality along the east boundary of the Phase 1 landfill was consistent with previous years, and concentrations of all parameters were below applicable CSR standards. However, elevated sulphate and nitrate concentrations were observed at Site 16, reflecting the influence of aggregate runoff from the Northeast Stockpile.

9.4 Domestic Well Water Quality

As part of the CRD's groundwater quality monitoring program, sixteen (16) domestic wells within a 2 km radius of the landfill were sampled in 2022/23. The groundwater quality data was consistent with historic results, meeting all applicable federal and provincial drinking water quality guidelines (CDWQ and SDWQG). This indicates that offsite domestic water wells continue to remain unimpacted by landfill leachate.

9.5 Surface Water Quality

Surface water quality data collected in 2022/23 confirmed that nearby surface water bodies, including Tod Creek, Durrance Lake and Durrance Creek and Killarney Lake continued to be unimpacted by landfill leachate. However, surface water quality monitoring stations at the landfill continued to show signs of water quality degradation, especially in the area northwest of Phase 2.

In 2021/22, dissolved copper concentrations exceeded BCWQG-STA values at 8 stations. In 2022/23, all copper concentrations met the BCWQG-STA, except for SW-S-12 in January 2023.

North of the Landfill and Downstream of the North Pad

- Surface water at Boundary Compliance location SW-N-05 continued to exhibit elevated nutrient concentrations in 2022/23, resulting in non-compliant conditions. Nitrate concentrations at Sw-N-05 exceeded BCWQG-STA during the May 2022 and November 2022 sampling events. The elevated nitrate and sulphate concentrations suggest an impact on surface water from quarrying, aggregate production, stockpiling and use. However, the absence of paired ammonia and chloride concentrations indicates the water was not impacted by leachate. The occasionally elevated ammonia concentrations may be associated with nitrate reduction via denitrification under reducing conditions.
- Surface water quality at Boundary Compliance station Sw-N-16 met BCWQG-STA, except for one total iron during February 2023 sampling event. The iron exceedance observed at Sw-N-16 was likely due to the disturbance of sediment during sampling, as indicated by the reported high TSS concentrations. Surface water quality at Sw-N-16 was not impacted by leachate, but continued to exhibit minor influence from nearby construction activities involving blasting, aggregate production, transport and placement, and excavation of organic soils. Similar aggregate impacts were observed downstream at stations Sw-N-17 and Sw-N-45.

- Surface water at Sw-N-18 reflected dilute landfill leachate impacts and may also have been impacted by aggregate runoff. In November 2022, the plug and diversion measures at surface water station SW-N-18 were removed, directing the discharge to the NWSP. Work is currently underway to install a diversion pipe at station SW-N-18 to direct the contaminated water into the leachate collection system.
- In the Hartland North Pad area, surface water quality at Boundary Compliance stations (Sw-N-41s1 and Sw-N-42s1) met BCWQG-STA in 2022/232, except for TSS. Leachate indicator parameters remained low in 2022/23, indicating surface water was not impacted by landfill leachate or construction activities. The slightly elevated sulphate, nitrate and conductivity concentrations indicate continued minor impacts from aggregate production, stockpiling and use.
- Historically, surface water stations Sw-N-14 and Sw-N-CS2 were used to monitor background conditions north of the landfill, but elevated conductivity, nitrate, and sulphate concentrations observed in 2022/23 indicate that surface water quality at these stations has been impacted by aggregate runoff and they are no longer suitable for use as background monitoring locations. Sw-S-52 consistently showed no signs of impacts related to the landfill, confirming that the water quality remains representative of the background conditions south of the landfill.
- Surface water quality downgradient of the North Pad (Sw-N-41s3) exhibited slightly elevated nitrate concentrations (1.28 to 1.57 mg/L) corresponding to low to moderate sulphate concentrations (17.0 to 20.0 mg/L). In the absence of elevated sulphate concentrations, it is difficult to interpret whether the elevated nitrate concentrations reflect a background process, or dilute runoff from aggregate stockpiles originating at Hartland landfill. Historically, nitrate concentrations have generally been below 0.2 mg/L, but they occasionally elevated to a peak level of 10 mg/L in 2007. Further downstream of Sw-N-41s3, water quality at Sw-N-41s4 was consistent with background conditions, and showed no signs of aggregate or leachate impacts.
- Further downstream to the north of the landfill, at the confluence of Durrance Creek and Tod Creek (Sw-N-64 and Sw-N-65), surface water quality showed no impacts from landfill leachate or aggregate runoff. The slightly elevated nitrate (<1.5 mg/L) and sulphate (<20 mg/L) concentrations at Sw-N-63 may have originated from the on-site aggregate runoff, or may be associated with the application of fertilizers to the surrounding agricultural lands.

South of the Landfill

- Water quality at the Boundary Compliance location (Sw-S-04) met the BCWQG-STA values for all analytes in all samples collected during 2022/23, except for one total iron concentration observed in May 2022. Surface water quality along the south boundary was not impacted by leachate but exhibited impacts from dilute aggregate runoff.
- Water quality at Sw-S-52 (not a compliance location) was representative of background water quality. In 2022/23, concentrations of all parameters were below the BCWQG-STA. Concentrations of leachate indicator parameters were consistent with previously reported values.
- Surface water quality south of the recycling area (Sw-S-03, Sw-S-12) exhibited several BCWQG-STA exceedances, including TSS, dissolved and total iron, and chloride during one or more sampling date. Elevated ammonia, nitrate, conductivity and sulphate concentrations at these stations may be related to aggregate dust from the south face of Phase 1 and runoff from paved areas surrounding the bin facility that experiences heavy traffic and several industrial activities.

9.6 Leachate Quality

In 2022/23, the leachate quality observed in the Hartland Valve Chamber followed the requirements of the Waste Discharge Authorization, except for COD exceedances on multiple sampling dates. Based on discussions with the analytical laboratory, CRD confirmed that the noted COD exceedances were due to the use of compromised/expired preservatives that were provided to CRD by the laboratory, and the exceedances do not likely reflect in-situ leachate quality. Overall, average annual leachate concentrations in 2022/23 were comparable with those measured in 2021/22.

9.7 Quality Assurance and Quality Control

Upon review of the quality assurance and quality control data collected in 2022/23, groundwater, surface water and leachate sampling and laboratory analysis have produced reliable results that are acceptable for the purposes of this monitoring report.

9.8 Compliance with Operating Certificate and Waste Discharge Authorization

Groundwater quality, surface water quality, and leachate quality data were used to assess compliance with the Amended Operational Certificate and Waste Discharge Authorization and are discussed individually below.

9.8.1 Groundwater

A total of 36 groundwater monitoring wells were identified as Boundary Compliance Monitoring Wells. Water quality data collected from these wells were compared to the CSR standards for the protection of freshwater aquatic life and drinking water to assess compliance with the landfill Operating Certificate and protect both current and future uses of the groundwater resource.

With respect to groundwater quality, Hartland Landfill remained in compliance with the Operational Certificate in 2022/23 except for one (1) copper exceedance at Boundary Compliance location 21. However, this recorded exceedance may not be representative of in-situ groundwater quality due to high RPD discrepancy. Dissolved copper was not detected in the parent sample but was highly elevated in the duplicate sample. Overall, the copper exceedance is unrelated to landfill activities, as indicated by low concentrations of parameters associated with aggregate runoff and leachate.

9.8.2 Surface Water

A total of five (5) surface water monitoring stations have been identified as Boundary Compliance stations surrounding Hartland Landfill. These stations are concentrated along the southern and northern property boundaries, downgradient of areas that have the potential to be impacted by leachate or landfill runoff. Water quality data collected from the Boundary Compliance stations were compared to the BCWQG-STA and BCWQG-LTC criteria to assess compliance with the Landfill Operational Certificate.

Some water quality impacts observed at the Boundary Compliance stations were caused by sources other than landfill leachate or aggregate runoff, including turbid samples collected under low-flow conditions and ongoing construction activities. In 2022/23, surface water quality was slightly deteriorated, exhibiting widespread impacts related to aggregate production and stockpiling. Throughout the monitoring year, highly elevated conductivity, sulphate, nitrate and/or ammonia concentrations consistent with aggregate runoff were observed at Boundary Compliance stations Sw-N-05, Sw-N-14, and Sw-N-16. Nitrate concentrations exceeded the BCWQG-STA at Sw-N-05 during the May and November 2022 sampling events. Additionally, moderately elevated conductivity, sulphate, and nitrate concentrations at Sw-N-41s1 and Sw-N-42s1 indicate minor impacts from aggregate production, stockpiling and use. Ultimately, in 2022/23, surface water quality at Sw-N-05 was not compliant with the Landfill Operational Certificate. Table 9-1 summarizes BCWQG-STA exceedances observed at Hartland in 2022/23.

Table 9-1. Surface Water Quality Compliance at Property Boundary Stations

Station	General Parameters	Nutrients	Metals	Comments
North of the Landfill				
Sw-N-05	None	Nitrate (2)	None	• Nitrate exceedances are associated with aggregate production and stockpiling at Hartland. The nitrate originates from leaching of blasting residue left on the aggregate after blasting.
Sw-N-16	None	None	Total Iron (1)	• Exceedances are anticipated to be related to turbid flow conditions following a prolonged dry period. Continued monitoring to assess these anomalous results.
SW-S-04	TSS (1)	None	Total Iron (1)	• Exceedances are anticipated to be related to turbid flow conditions following a prolonged dry period. Continued monitoring to assess these anomalous results.

9.8.3 Leachate

The Hartland Valve Chamber is the Compliance Monitoring Station for the Waste Discharge Authorization. During the monitoring period, leachate discharges at the Hartland Valve Chamber were in compliance with the Waste Discharge Authorization requirements due to the conclusion that noted COD exceedances were attributed to compromised/expired preservatives provided to CRD by the laboratory, and the exceedances do not likely reflect in-situ leachate quality.

10. Recommendations

Based on the findings of this report, our recommendations are summarized in Table 10-1:

Table 10-1. Summary of Recommendations

	Leachate Collection System	Status
1	Closely monitor water levels and leachate quality in the north purge wells to verify the effectiveness of the leachate collection system. Water levels in well 52-3-0, adjacent to 52-4-0-P7 have slowly increased since 2021/22 and may indicate diminished drawdown and leachate collection in this area. A step test should be conducted on each north purge well to measure the specific capacity which is an indicator of well performance. The measurements should be compared to historical assessments to determine the need for well rehabilitation. Options for maintaining lower leachate levels in P7 and P9 should be further investigated to continue improving groundwater quality west of the lower leachate lagoon.	New/Ongoing
2	Closely monitor water levels and leachate quality in the south purge wells to verify the effectiveness of the leachate collection system and identify opportunities for improvements. Several pump failures were reported for south purge wells P3 and P10. Increased water levels above operational targets were observed in P1, reaching a peak of 150.6m. Pumping elevations in the south purge wells (P2, P3, P4 and P10) should be maintained at elevations below 140 m asl. Pumping elevations in P1 should be maintained near the bottom of the screened interval around 146 m asl.	New/Ongoing
3	Periodically validate the pumping levels and the extent of the drawdown cones surrounding the north and south purge well systems (next assessment in 2024) to confirm the proper functioning of the purge wells. All procedures should follow the Standard Operating Procedure (SOP) – North Purge Well Drawdown Cone Verification (AECOM 2016), with interpretation of results by a qualified professional. Water levels in purge wells and pump maintenance should be conducted regularly to confirm the efficiency of the purge wells.	Ongoing
4	Conduct a detailed assessment of the effectiveness of the hydraulic trap and leachate collection systems including the north purge wells and south purge wells based on the design of the Phase 4/5/6 quarry and liner system. This is required to confirm the landfill will perform as intended as the landfill extends further north and west, and as additional lifts are constructed. Recent groundwater and surface water characterization between the Phase 2 Basin and the Northwest Sedimentation Pond suggests additional leachate containment or groundwater management measures need to be implemented to mitigate the potential for off-site leachate migration and non-compliant water quality at Sw-N-05.	Ongoing
	Runoff and Infiltration Associated with Aggregate Stockpiles	
5	Update the aggregate impact indicator parameters and thresholds based on recent geochemical testing results for aggregate samples and recommendations of the Aggregate Management Plan that is presently being developed.	New
6	Minimize the spatial extent and volume of aggregate stockpiles outside of the leachate collection system. Where this is not feasible, stockpiles should be covered with low permeability temporary tarps as soon as practical to minimize sulphate, ammonia, nitrate and TSS impacts on downgradient groundwater and surface water quality. Direct runoff from aggregate stockpiles away from natural water courses as it is known to exceed BCWQ guidelines for sulphate and some nitrogenous compounds. This approach proved to be effective for mitigation of historical aggregate impacts at the Hartland North Pad.	Ongoing
	Groundwater Monitoring Program	
7	Advance a network of boreholes into the bedrock slope west of the Phase 2 landfill to characterize the geology, hydrogeology and groundwater quality. This will also allow for establishment of a long-term groundwater monitoring network west and upslope of the Phase 2 landfill to support continued evaluations of hydraulic trap performance and monitor groundwater quality.	Ongoing
8	Groundwater monitoring wells in proximity to the Phase 2 Basin and Northwest Sedimentation Pond should be closely monitored to confirm the hydraulic trap leachate collection system is effectively containing leachate north of Phase 2. Continued quarrying may result in greater connection between the groundwater flow system on the west side of the Highland Fault and the Phase 2 hydraulic trap, resulting in lowering of the surrounding groundwater levels and increased leachate generation.	New/Ongoing
9	Decommission any monitoring wells that will be affected by quarrying, aggregate stockpiling, landfill development in advance of any damage to satisfy the requirements of the British Columbia Groundwater Protection Regulation. Based on near term construction activities, it is anticipated that monitoring wells 27-1-1, 78-1-1, and 78-2-1 will be inevitably impacted. Destroyed monitoring wells including 27-1-2and 93-1-1 should also be decommissioned.	New
10	Establish a new background groundwater monitoring well further upgradient of the Northwest Stockpile to replace 94-1-1. Water quality in well 94-1-1 is no longer considered representative of	New

Leachate Collection System		Status
	background groundwater quality. It is possible that this monitoring well could be coordinated with investigation of the bedrock hydrogeology west of the Phase 2 landfill.	
11	The existing Groundwater, Surface Water and Leachate Monitoring Plan should be updated to ensure that it remains effective in monitoring the impacts current and future of landfill operations, including aggregate production, stockpiling, transport and use. This work is currently underway.	Ongoing
12	Groundwater wells should be surveyed once every five years to verify well condition and ensure geodetic well elevations are accurate (i.e., next survey in 2025).	Ongoing
13	The elevation of the leachate mound in Phase 1 and 2 should be determined at least once every five years (i.e. next assessment in 2025).	Ongoing
14	Conduct a review of the landfill development plan and filling plan every two years to ensure the existing monitoring network and monitoring program remain sufficient and interpretation of the data benefits from a complete understanding of the landfill design and operations over the next five years. The next review should be conducted in 2024 following completion of the Phase 4/5/6 quarry and liner design.	Ongoing
15	As required by the Amended Operational Certificate, the results of the annual monitoring program should continue to be reviewed and interpreted by a Qualified Professional experienced in assessing the impacts of landfill leachate at large municipal landfills similar to Hartland.	Ongoing
Surface and Leachate Monitoring Program		
16	Add sodium to the surface water analytical packages. Analyzing sodium alongside chloride can help determine if elevated chloride concentrations originate from road salt application.	New
17	Establish a new background surface water station upgradient of the Phase 2 landfill to replace background water quality monitoring locations Sw-N-14 and Sw-N-C52 which are no longer representative of background conditions.	New
18	Surface water quality at locations Sw-N41s4, Sw-N-63, Sw-N-64 and Sw-N-65 should be sampled on quarterly basis to delineate the impact of aggregate runoff and assess its effect on the receiving environment.	New
19	Improve surface water flow monitoring upstream of Sw-N-05 in Heal Creek to ensure it provides an accurate measurement of surface water discharge from the landfill. Accurate flow measurements are important for evaluating environmental impacts and ensuring adequate collection and conveyance capacity.	New
20	Improve surface water management north of the Phase 2 landfill to minimize impacts of aggregate runoff on groundwater and surface water that is not captured by the leachate collection system. This may require lining of the NWSP and installation of an underdrain to allow for management of groundwater separately from surface water in the area. Additional sediment control measures and efforts to reduce the quantity of blasting residuals contained in aggregate stockpiles may help reduce impacts on water quality as quarry development becomes increasingly close to the northern property boundary and the water quality boundary compliance monitoring stations.	New
21	Characterize the chemistry of residual wastewater solids and stabilized biosolids (solids and leachate) to allow for future evaluation of any impacts to leachate chemistry. This information may be available from pilot studies or operational monitoring programs.	Ongoing
22	Determine the source of chloride, ammonia, dissolved copper and nitrate observed in surface water south of the Phase 1 landfill. Additional waste has been placed on the western and southern portions of Phase 2 over recent years and occasional leachate seeps and runoff from the truck wash facility have been noted in the past. Changes in activities at the south end of the landfill and management of impacted surface runoff may play a role. A multilevel monitoring well cluster should be established west of the bin facility and well 85-1-1 to resolve whether the source of impacts to surface water are due to runoff or discharge of leachate impacted groundwater.	New/Ongoing
23	Resume leachate sampling from the Phase 2 Cleanout as soon as the sampling pump is replaced. This information will be important for tracking changes in leachate chemistry as Phase 2 Cell 4/5/6 are developed.	Ongoing
24	In addition to the Sewer Use Criteria, leachate quality results for trace organic compounds should be compared to CSR standards for the protection of drinking water and aquatic life to allow for screening of data to identify parameters in leachate that exceed CSR standards and guide any refinements to the monitoring program in future years. Additionally, an updated list of emerging contaminants will be integrated into the monitoring program for the 2023/2024.	Ongoing
Construction Management		
25	Blasting and quarrying activities should continue be to be conducted under the direction of a qualified blasting professional to minimize the potential for blast-enhanced fracturing, with possible negative impacts on hydraulic properties. This has been demonstrated to have important implications on groundwater elevations west of the Highland Fault and the volume of seepage reporting to the Phase 2 Basin as the base of the quarry has been lowered In circumstances where blasting might induce substantial topographic alterations or changes to the elevation of the base of	New

Leachate Collection System		Status
	the Phase 2 quarry, consultation with a hydrogeologist is recommended to evaluate potential implications on the performance of the hydraulic trap and the leachate collection system.	
26	The placement of aggregate, road salt, dust suppressant and herbicides should be carefully considered and documented to help understand the causes of potential future concentrations of conductivity, ammonia, chloride, nitrate, sulphate and select metals at groundwater and surface water monitoring locations.	Ongoing
Quality Assurance and Quality Control		
27	Quality assurance for laboratory analyses should continue to be evaluated quarterly, and any discrepancies should be resolved with the laboratory and CRD sampling personnel within one month of receiving the laboratory results. The appropriate notation should be added to the data files to explain the reason for the low precision and the steps taken, if any, to improve the sampling or laboratory procedures.	Ongoing

11. Qualifications of the Authors

Matt Martinolich, M.Sc. is a Hydrogeologist / Geochemist with almost two years experience collecting, analyzing, and interpreting hydrogeochemical and hydrogeological data at AECOM in addition to a year of experience in exploration geology. He has been involved in several geological and geochemical investigations at Hartland landfill. Matt contributed to data analysis and authored several sections of this report.

Kun Jia, M.Sc., P.Geo. is a Hydrogeologist / Geochemist with over nine years of experience collecting, analyzing and interpreting hydrogeological and geochemistry data for waste management, mining and contaminated sites projects. Kun has contributed to and authored several monitoring reports at Hartland landfill since 2015. Kun was the primary author and reviewer of this report.

Ryan Mills, M.Sc., P.Geo. is a Senior Hydrogeologist with over 20 years of experience interpreting and analyzing hydrogeological and water chemistry data for waste management, water resources and mining related projects. Ryan has authored several groundwater monitoring reports and conducted numerous site investigations involving drilling and hydrogeologic testing at Hartland Landfill since 2004. He has also undertaken site investigations at numerous other municipal, industrial and small rural landfills throughout British Columbia. Ryan was the senior reviewer of this report.

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Appendix A

Monitoring Station and Groundwater Level Data

- A1. Monitoring Well Co-ordinates
- A2. Groundwater Monitoring Plan
- A3. Groundwater Elevations
- A4. Surface Water Station Details

A1. Monitoring Well Co-ordinates

Appendix A-1. Monitoring Well Co-ordinates 2022-2023

Station Name	Status	Location		Elevations					Depths				Survey Date	Monitor Class	Area of Landfill	Comments
		Northing (NAD 83)	Easting (NAD 83)	Ground Surface Elevation	Top of Casing Elevation	Top of Piezometer Elevation	Top of Screen Elevation	Bottom of Screen Elevation	Stickup	Borehole Depth Below Ground Surface	Depth to Top of Screen Below Ground Surface	Depth to Bottom of Screen Below Ground Surface		Shallow (S), Intermediate (I), Deep (D)		
		m	m	m ASL	m ASL	m ASL	m ASL	m ASL	m AGL	m BGS	m BGS	m BGS				
GW-04-3-1	Active	5375469.0	466167.8	127.11	128.20	128.09	114.26	111.21	1.05	15.90	12.85	15.90	2005 Mar	I	SP1	
GW-04-4-1	Active	5375466.8	466166.1	127.13	128.08	128.01	122.98	119.93	0.88	7.20	4.15	7.20	2005 Mar	S	SP1	
GW-07-1-0	Active	5375613.3	466177.0	140.60	142.69	142.29	N/A	N/A	1.69	No monitor	No monitor	No monitor	2005 Mar	D	SP1	
GW-09-1-0	Active	5375774.0	466187.0	148.96	150.14	150.14	N/A	N/A	1.18	No monitor	No monitor	No monitor	Historic	D	EP1	
GW-16-1-1	Active	5376345.6	466130.2	143.48	144.28	144.06	101.98	100.48	0.58	43.00	41.50	43.00	2005 Mar	D	EP1	
GW-16-1-2	Active	5376345.6	466130.1	143.48	144.28	144.00	110.98	109.48	0.52	34.00	32.50	34.00	2005 Mar	D	EP1	
GW-16-2-1	Active	5376347.1	466133.7	143.31	144.09	143.67	119.81	118.81	0.36	24.50	23.50	24.50	2005 Mar	I	EP1	
GW-16-2-2	Active	5376347.0	466133.7	143.31	144.09	143.72	129.81	126.81	0.41	16.50	13.50	16.50	2005 Mar	I	EP1	
GW-17-1-1	Active	5376186.4	466198.0	150.99	152.17	152.08	100.49	98.99	1.09	52.00	50.50	52.00	2005 Mar	D	EP1	
GW-17-1-2	Active	5376186.5	466198.0	150.99	152.17	152.11	110.99	109.49	1.12	41.50	40.00	41.50	2005 Mar	D	EP1	
GW-17-1-3	Active	5376186.5	466198.0	150.99	152.17	152.04	136.49	133.29	1.05	17.70	14.50	17.70	2005 Mar	I	EP1	
GW-18-1-1	Active	5375976.5	466194.8	168.81	169.48	168.82	110.64	109.14	0.19	59.67	58.17	59.67	2005 Mar	D	EP1	
GW-18-1-2	Active	5375976.5	466194.7	168.81	169.48	169.33	122.61	121.11	0.52	47.70	46.20	47.70	2005 Mar	D	EP1	
GW-18-2-1	Active	5375973.0	466193.8	168.92	169.68	169.16	138.42	136.92	0.24	32.00	30.50	32.00	2005 Mar	D	EP1	
GW-18-2-2	Active	5375973.0	466193.7	168.92	169.68	169.12	155.92	152.92	0.20	16.00	13.00	16.00	2005 Mar	I	EP1	
GW-19-1-1	Active	5375503.2	466125.3	132.89	133.86	133.85	96.89	95.39	0.96	37.50	36.00	37.50	2005 Mar	D	SP1	
GW-19-1-2	Active	5375503.2	466125.3	132.89	133.86	133.87	106.39	104.89	0.98	28.00	26.50	28.00	2005 Mar	I	SP1	
GW-19-2-1	Active	5375507.6	466124.1	132.60	133.37	133.26	117.10	115.60	0.66	17.00	15.50	17.00	2005 Mar	I	SP1	
GW-19-2-2	Active	5375507.6	466124.1	132.60	133.37	133.32	126.60	123.60	0.72	9.00	6.00	9.00	2005 Mar	S	SP1	
GW-20-1-1	Active	5376498.3	465971.1	110.46	111.32	111.17	80.46	77.46	1.20	33.00	30.00	33.00	2005 Mar	D	NP1	Deactivated in 2010.
GW-20-1-2	Active	5376498.4	465971.0	110.46	111.32	111.19	92.66	89.66	1.21	20.80	17.80	20.80	2005 Mar	I	NP1	
GW-21-1-1	Active	5376483.9	465970.8	110.92	111.79	111.69	98.02	94.92	1.25	16.00	12.90	16.00	2005 Mar	I	NP1	
GW-21-1-2	Active	5376483.9	465970.9	110.92	111.79	111.68	105.42	102.32	1.24	8.60	5.50	8.60	2005 Mar	S	NP1	
GW-21-2-1	Active	5376482.3	465970.0	111.10	111.87	111.80	No log	No log	0.70	NA	NA	NA	2005 Mar	S	NP1	
GW-25-1-1	Active	5376491.7	465713.9	129.91	130.89	130.77	106.91	105.41	0.86	24.50	23.00	24.50	2005 Mar	I	NP2	
GW-25-1-2	Active	5376491.7	465714.0	129.91	130.89	130.78	125.61	123.41	0.87	6.50	4.30	6.50	2005 Mar	S	NP2	
GW-27-1-1	Active	5376358.2	465455.8	141.09	141.91	141.57	118.09	116.59	0.48	24.50	23.00	24.50	2005 Mar	I	BKGND - WP2	
GW-28-1-0	Active	5376503.6	465825.1	136.25	137.07	136.52	N/A	N/A	0.27	NA	NA	NA	2005 Mar	D	NP1	
GW-29-1-1	Active	5376563.3	465898.2	113.39	114.41	114.38	100.28	98.87	0.99	14.52	13.11	14.52	2005 Mar	S	NP1	
GW-29-1-2	Active	5376563.3	465898.3	113.39	114.41	114.39	110.39	105.96	1.00	7.43	3.00	7.43	2005 Mar	S	NP1	
GW-30-1-1	Active	5376562.2	465978.4	109.84	110.89	110.79	95.51	94.10	0.95	15.74	14.33	15.74	2005 Mar	I	NP1	
GW-30-1-2	Active	5376562.3	465978.5	109.84	110.89	110.79	108.56	104.07	0.95	5.77	1.28	5.77	2005 Mar	S	NP1	
GW-31-1-1	Active	5376555.2	466080.9	105.28	106.34	106.26	90.92	89.50	0.98	15.78	14.36	15.78	2005 Mar	I	NP1	
GW-31-1-2	Active	5376555.2	466080.9	105.28	106.34	106.26	103.84	99.41	0.98	5.87	1.44	5.87	2005 Mar	S	NP1	

Notes:

Datum Description

m BGL	*metres below ground level*
m AGL	*metres above ground level*
m ASL	*metres above mean sea level*

Monitor Class

S	*Shallow well <15 m deep*
I	*Intermediate well between 15 and 30 m deep*
D	*Deep well >30 m deep*

Area of Landfill

SP1	*South of Phase 1 Landfill*
EP1	*East of Phase 1 Landfill*
NP1	*North of Phase 1 Landfill*
NP2	*North of Phase 2 Landfill*
BKGND - WP2	*Background Water Quality West of Phase 2*
HNP	*Hartland North Pad*
P1	*Phase 1*
P2	*Phase 2*

Appendix A-1. Monitoring Well Co-ordinates 2022-2023

Station Name	Status	Location		Elevations					Depths				Survey Date	Monitor Class	Area of Landfill	Comments
		Northing (NAD 83)	Easting (NAD 83)	Ground Surface Elevation	Top of Casing Elevation	Top of Piezometer Elevation	Top of Screen Elevation	Bottom of Screen Elevation	Stickup	Borehole Depth Below Ground Surface	Depth to Top of Screen Below Ground Surface	Depth to Bottom of Screen Below Ground Surface		Shallow (S), Intermediate (I), Deep (D)		
		m	m	m ASL	m ASL	m ASL	m ASL	m ASL	m AGL	m BGS	m BGS	m BGS				
GW-36-1-1	Active	5376398.9	465778.3	130.21	130.21	131.51	117.87	114.87	1.30	15.34	12.34	15.34	2005 Mar	I	NP2	
GW-36-2-1	Active	5376400.6	465776.5	130.00	131.11	131.07	90.68	87.63	1.07	42.37	39.32	42.37	2005 Mar	D	NP2	
GW-36-3-1	Active	5376401.7	465773.6	130.01	131.01	130.96	115.01	112.01	0.95	18.00	15.00	18.00	2005 Mar	I	NP2	
GW-37-1-1	Active	5376432.6	465725.6	129.59	130.12	129.98	117.35	114.35	0.39	15.24	12.24	15.24	2005 Mar	I	NP2	
GW-37-2-1	Active	5376432.5	465727.8	129.92	130.64	130.60	89.47	86.42	0.68	43.50	40.45	43.50	2005 Mar	D	NP2	
GW-37-3-1	Active	5376435.6	465726.8	129.95	130.75	130.63	119.72	115.15	0.68	14.80	10.23	14.80	2005 Mar	S	NP2	
GW-38-1-1	Active	5376464.6	465797.2	131.90	132.46	132.31	N/A	N/A	0.41	18.29	No monitor	18.29	2005 Mar	I	NP2	
GW-39-1-1	Active	5376467.2	465876.1	129.54	130.24	130.11	111.10	108.10	0.57	21.44	18.44	21.44	2005 Mar	I	NP2	
GW-39-2-1	Active	5376466.3	465874.7	129.75	130.72	130.58	95.56	92.56	0.83	37.19	34.19	37.19	2005 Mar	D	NP2	
GW-40-1-1	Active	5376432.1	465915.2	122.00	122.78	122.68	109.76	106.76	0.68	15.24	12.24	15.24	2005 Mar	I	NP1	
GW-41-1-1	Active	5376852.1	465190.4	149.48	150.30	150.16	143.41	140.41	0.68	9.07	6.07	9.07	2005 Mar	S	HNP	
GW-42-1-1	Active	5376717.6	465534.9	138.81	139.45	139.33	133.02	129.97	0.52	8.84	5.79	8.84	2005 Mar	S	HNP	
GW-43-1-1	Active	5376683.8	465448.7	162.60	163.05	163.10	144.31	141.26	0.50	21.34	18.29	21.34	2007 Apr	I	HNP	
GW-44-1-1	Active	5376671.5	465322.3	161.46	162.02	161.89	153.84	150.79	0.43	10.67	7.62	10.67	2005 Mar	S	HNP	
GW-46-2-1	Active	5376075.5	466029.9	169.97	171.25	171.70	161.69	158.69	1.73	11.28	8.28	11.28	2006 Apr	S	P1	
GW-46-3-1	Active	5376085.7	466035.7	169.83	172.46	172.38	137.83	134.78	2.55	35.05	32.00	35.05	2006 Apr	D	P1	Installed during 2005
GW-46-4-1	Active	5376078.5	466035.9	169.71	172.10	172.03	151.12	148.07	2.32	21.64	18.59	21.64	2006 Apr	I	P1	Installed during 2005
GW-47-2-1	Active	5375888.1	465996.7	171.84	174.46	174.40	154.78	151.73	2.55	20.11	17.06	20.11	2006 Apr	I	P1	Installed during 2005
GW-48-1-1	Active	5375840.5	466031.3	169.78	171.34	171.63	160.14	157.14	1.85	12.64	9.64	12.64	2006 Apr	S	P1	
GW-48-2-1	Active	537815.8	466031.6	168.87	171.28	171.22	149.97	146.92	2.35	21.95	18.90	21.95	2006 Apr	I	P1	Installed during 2005
GW-51-1-1	Active	5376475.1	466048.2	110.90	111.68	111.76	106.13	103.13	0.86	7.77	4.77	7.77	2005 Mar	S	NP1	
GW-51-2-1	Active	5376474.1	466045.6	110.90	111.83	111.89	100.49	97.49	0.99	13.41	10.41	13.41	2005 Mar	S	NP1	
GW-51-3-1	Active	5376473.3	466042.7	110.97	111.84	111.89	93.85	90.85	0.92	20.12	17.12	20.12	2005 Mar	I	NP1	
GW-52-1-1	Active	5376406.0	465979.1	119.91	120.94	120.90	93.19	90.19	0.99	29.72	26.72	29.72	Historic	I	NP1	
GW-52-2-0	Active	5376391.0	465959.0	119.99	120.65	120.65	N/A	N/A	0.66	NA	NA	NA	Historic	I	NP1	
GW-52-3-0	Active	5376389.9	465948.8	119.8	120.4	120.4	N/A	N/A	0.57	No monitor	No monitor	No monitor	Historic	I	NP1	
GW-52-4-0-P7	Active	5376388.0	465947.0	119.80	120.60	120.60	N/A	N/A	0.80	22.25	No monitor	No monitor	Historic	I	NP1	Purge well
GW-53-1-1	Active	5376506.2	465761.3	130.84	131.81	131.92	114.15	110.88	1.08	19.96	16.69	19.96	2005 Mar	I	NP2	
GW-54-1-1	Active	5376187.7	466226.9	154.63	155.58	155.65	107.91	104.91	1.02	49.72	46.72	49.72	2005 Mar	D	EP1	
GW-54-2-1	Active	5376185.6	466225.5	154.69	155.62	155.66	118.55	115.55	0.97	39.14	36.14	39.14	2005 Mar	D	EP1	
GW-54-3-1	Active	5376183.4	466224.7	154.66	155.50	155.53	138.05	135.05	0.87	19.61	16.61	19.61	2005 Mar	I	EP1	
GW-55-1-1	Active	5376910.6	465136.1	147.67	147.68	148.52	139.06	134.56	0.85	13.11	8.61	13.11	2005 Mar	S	HNP	
GW-56-1-1	Active	5376838.5	465287.8	148.67	149.69	149.61	139.92	131.29	0.94	17.38	8.75	17.38	2005 Mar	I	HNP	
GW-57-1-1	Active	5376873.9	465528.4	132.37	132.99	132.90	122.77	118.81	0.53	13.56	9.60	13.56	2005 Mar	S	HNP	
GW-58-1-0	Active	5376324.8	465822.9	137.17	138.30	138.23	N/A	N/A	1.06	19.20	No monitor	No monitor	2009 May	I	NP2	

Notes:

Datum Description

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m ASL	*metres above mean sea level*

Monitor Class

S	*Shallow well <15 m deep*
I	*Intermediate well between 15 and 30 m deep*
D	*Deep well >30 m deep*

Area of Landfill

SP1	*South of Phase 1 Landfill*
EP1	*East of Phase 1 Landfill*
NP1	*North of Phase 1 Landfill*
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		m	m	m ASL	m ASL	m ASL	m ASL	m ASL	m AGL	m BGS	m BGS	m BGS				
GW-60-1-1	Active	5375636.9	466137.2	141.63	142.40	142.32	122.23	119.23	0.69	22.40	19.40	22.40	2005 Mar	I	SP1	
GW-60-2-1	Active	5375638.4	466137.4	141.61	142.46	142.40	129.51	126.51	0.79	15.10	12.10	15.10	2005 Mar	I	SP1	
GW-60-3-1	Active	5375640.0	466137.5	141.74	142.60	142.49	137.84	134.84	0.75	6.90	3.90	6.90	2005 Mar	S	SP1	
GW-61-1-1	Active	5375980.6	465523.1	212.00	213.06	212.95	146.40	143.40	0.95	68.60	65.60	68.60	2005 Mar	D	BKGND - WP2	
GW-62-1-1	Active	5376609.3	465265.5	183.44	184.25	184.25	161.32	159.82	N/A	23.70	22.12	23.62	2008 May	I	HNP	Survey elevations suspect.
GW-62-2-1	Active	5376610.5	465267.3	183.06	183.96	183.96	168.70	165.70	N/A	18.90	14.36	17.36	2008 May	I	HNP	Survey elevations suspect.
GW-63-1-1	Active	5375812.3	465609.5	197.24	198.18	198.09	168.44	165.44	0.85	31.80	28.80	31.80	2005 Mar	I	BKGND - WP2	
GW-63-2-1	Active	5375809.7	465610.5	197.21	198.11	198.03	186.71	183.71	0.82	13.50	10.50	13.50	2005 Mar	S	BKGND - WP2	
GW-71-1-1	Active	5375643.3	466260.6	144.04	144.93	144.82	116.61	113.56	0.81	31.24	27.43	30.48	2005 Mar	D	SP1	
GW-71-2-1	Active	5375644.1	466259.9	144.04	144.92	144.81	127.04	123.98	0.80	20.10	17.00	20.06	2005 Mar	I	SP1	
GW-71-3-1	Active	5375645.3	466259.1	144.05	144.95	144.90	137.04	134.00	0.85	10.10	7.01	10.05	2005 Mar	S	SP1	
GW-72-1-1	Active	5375670.6	466186.6	143.29	144.13	144.03	115.86	112.81	0.79	30.48	27.43	30.48	2005 Mar	D	SP1	
GW-72-2-1	Active	5375671.7	466186.7	143.32	144.09	144.04	126.56	123.20	0.72	20.12	16.76	20.12	2005 Mar	I	SP1	
GW-72-3-1	Active	5375672.7	466186.8	143.38	144.17	144.12	136.06	133.02	0.74	10.36	7.32	10.36	2005 Mar	S	SP1	
GW-73-1-1	Active	5375532.1	466184.1	134.52	135.47	135.31	106.91	103.86	0.86	30.66	27.61	30.66	2005 Mar	D	SP1	
GW-73-2-1	Active	5375533.2	466184.1	134.50	135.40	135.36	117.40	114.38	0.86	20.12	17.10	20.12	2005 Mar	I	SP1	
GW-73-3-1	Active	5375534.3	466184.1	134.48	135.37	135.31	127.46	124.42	0.83	10.06	7.02	10.06	2005 Mar	S	SP1	
GW-75-1-1	Active	5376207.5	466035.3	154.82	155.62	155.97	127.72	121.72	1.15	33.10	27.10	33.10	2007 Apr	D	P1	
GW-76-1-1	Active	5375966.0	466228.4	171.08	171.79	171.69	123.23	117.13	0.61	61.90	47.85	53.95	2005 Mar	D	EP1	
GW-76-2-1	Active	5375967.5	466227.1	171.00	171.77	171.66	133.81	127.72	0.66	43.60	37.19	43.28	2005 Mar	D	EP1	
GW-76-3-1	Active	466226.0	5375968.8	171.0	171.8	171.7	145.1	142.0	0.72	29.00	25.91	28.96	2005 Mar	I	EP1	
GW-77-1-1	Active	5376487.8	465536.8	155.04	155.66	155.63	120.60	117.55	0.59	40.26	34.44	37.49	2006 Apr	D	NP2	Installed in 2006
GW-77-2-1	Active	5376485.8	465536.2	154.90	155.51	155.45	139.16	135.87	0.55	20.67	15.74	19.03	2006 Apr	I	NP2	Installed in 2006
GW-78-1-1	Active	5376498.8	465648.8	142.66	143.46	143.38	113.46	110.18	0.72	33.79	29.20	32.48	2006 Apr	D	NP2	Installed in 2006
GW-78-2-1	Active	5376500.3	465646.7	142.59	143.40	143.36	132.42	129.14	0.77	14.11	10.17	13.45	2006 Apr	S	NP2	Installed in 2006
GW-80-1-0-P8	Active	5376397.4	465931.0	119.61	120.29	N/A	N/A	N/A	N/A	20.42	No monitor	No monitor	2008 May	I	NP1	Purge well
GW-81-1-0-P9	Active	5376409.0	465910.8	122.17	122.85	N/A	N/A	N/A	N/A	26.82	No monitor	No monitor	2008 May	I	NP1	Installed in 2007
GW-82-1-1	Active	5376257.5	465772.7	154.67	155.89	155.86	135.17	131.50	1.18	23.77	19.50	23.17	2009 May	I	P2	Installed in 2007
GW-83-1-1	Active	5376353.3	465723.8	140.09	141.40	141.44	124.97	121.92	1.35	18.90	15.12	18.17	2009 May	I	P2	Installed in 2007
GW-85-1-1	Active	5375688.3	466068.7	149.09	150.09	150.07	142.99	139.95	0.98	9.14	6.1	9.14	2009 May	S	SP1	Installed in March 2009
GW-87-1-1	Active	5376451.7	465243.4	182.32	183.22	183.16	147.62	144.52	0.84	37.80	34.70	37.80	2015 Feb	D	NP2	Installed in 2014
GW-87-2-1	Active	5376453.8	465242.8	182.36	183.26	183.24	165.56	162.56	0.88	21.90	16.80	19.80	2015 Feb	I	NP2	Installed in 2014
GW-88-1-1	Active	5376467.2	465271.7	181.47	182.24	182.16	138.77	135.77	0.69	45.70	42.70	45.70	2015 Feb	D	NP2	Installed in 2014
GW-88-2-1	Active	5376470.1	465271.9	181.29	182.16	182.10	168.49	165.49	0.81	16.80	12.80	15.80	2015 Feb	I	NP2	Installed in 2014
GW-89-1-1	Active	5376028.4	466043.4	169.25	169.45	169.45	138.62	135.57	0.19	30.18	30.63	33.68	2018 Dec	D	P1	Installed in 208
GW-89-2-1	Active	5376026.8	466048.7	169.141	169.34	169.34	149.48	146.43	0.20	19.05	19.66	22.71	2018 Dec	I	P1	Installed in 2018
GW-90-1-1	Active	5376286.6	465651.3	151.876	152.69	152.69	118.34	115.30	0.81	38.40	33.54	36.58	2019 Oct	D	P2	leachate mound monitoring well
GW-90-2-1	Active	5376286.8	465652.3	152.00	152.75	152.75	136.84	133.79	0.75	14.94	15.16	18.21	2018 Dec	I	P2	leachate mound monitoring well
GW-91-1-1	Active	5376604.9	465473.7	164.61	165.33	165.33	149.01	145.97	0.72	18.64	15.60	18.64	2019 Nov	I	HNP	Installed in 2019
GW-92-1-1	Active	5376535.4	465501.9	167.68	168.57	168.57	147.76	144.72	0.88	22.96	19.92	22.96	2019 Nov	I	HNP	Installed in 2019
GW-94-1-1	Active	5376508.8	465129.5	203.65	204.32	204.32	163.87	160.83	0.67	42.82	39.78	42.82	2019 Dec	D	HNP	Installed in 2019
GW-95-1-1	Active	5376518.9	465698.3	128.44	129.36	129.36	126.00	124.48	0.92	4.84	2.44	3.96	2022 Apr	S	NP2	Installed in April 2022

Notes:

Datum Description

m BGL	*metres below ground level*
m AGL	*metres above ground level*
m ASL	*metres above mean sea level*
Monitor Class	
S	*Shallow well <15 m deep*
I	*Intermediate well between 15 and 30 m deep*
D	*Deep well >30 m deep*
Area of Landfill	
SP1	*South of Phase 1 Landfill*
EP1	*East of Phase 1 Landfill*
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NP2	*North of Phase 2 Landfill*
BKGND - WP2	*Background Water Quality West of Phase 2*
HNP	*Hartland North Pad*
P1	*Phase 1*
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Appendix A-1. Monitoring Well Co-ordinates 2022-2023

Station Name	Status	Location		Elevations					Depths				Survey Date	Monitor Class	Area of Landfill	Comments
		Northing (NAD 83)	Easting (NAD 83)	Ground Surface Elevation	Top of Casing Elevation	Top of Piezometer Elevation	Top of Screen Elevation	Bottom of Screen Elevation	Stickup	Borehole Depth Below Ground Surface	Depth to Top of Screen Below Ground Surface	Depth to Bottom of Screen Below Ground Surface		Shallow (S), Intermediate (I), Deep (D)		
		m	m	m ASL	m ASL	m ASL	m ASL	m ASL	m AGL	m BGS	m BGS	m BGS				
GW-96-1-1	Active	5376510.3	465695.6	129.49	130.45	130.45	127.05	125.53	0.95	4.43	2.44	3.96	2022 Apr	S	NP2	Installed in April 2022
GW-97-1-1	Active	5376503.5	465719.6	129.12	130.00	130.00	125.16	122.11	0.88	7.95	3.96	7.01	2022 Apr	S	NP2	Installed in April 2022
GW-98-1-1	Active	5376501	465698.7	130.41	131.30	131.30	125.84	122.79	0.90	8.54	4.57	7.62	2022 Apr	S	NP2	Installed in April 2022
GW-99-1-1	Active	5376427.6	465668.9	135.40	135.30	135.30	132.96	131.44	-0.10	3.88	2.44	3.96	2022 Apr	S	NP2	Installed in April 2022
GW-100-1-1	Active	5376419.7	465668.6	135.50	135.44	135.44	130.01	128.49	-0.06	7.02	5.49	7.01	2022 Apr	S	NP2	Installed in April 2022
GW-101-1-1	Active	5376414	465669.1	135.46	135.33	135.33	129.97	126.93	-0.12	8.51	5.49	8.53	2022 Apr	S	NP2	Installed in April 2022
GW-103-1-1	Active	5376400.9	465626.0	135.74	136.67	136.67	129.95	128.42	0.92	8.25	5.79	7.32	2022 Apr	S	NP2	Installed in April 2022
GW-104-1-1	Active	5376438.121	465666.3	135.52	135.46	135.46	129.36	127.84	-0.06	7.62	6.10	7.62	2022 Aug	S	NP2	Installed in August 2022
GW-105-1-1	Active	5376431.992	465673.0	135.51	135.42	135.42	126.58	123.53	-0.09	12.19	8.84	11.89	2022 Aug	I	NP2	Installed in August 2022
GW-106-1-1	Active	5376423.369	465679.7	135.43	135.34	135.34	123.15	121.62	-0.09	13.72	12.19	13.72	2022 Aug	I	NP2	Installed in August 2022
GW-107-1-1	Active	5376417.266	465684.4	135.54	135.40	135.40	121.88	120.35	-0.14	16.76	13.52	15.05	2022 Aug	D	NP2	Installed in August 2022
GW-107-1-2	Active	5376417.266	465684.4	135.54	135.43	135.43	129.33	128.27	-0.11	16.76	6.10	7.16	2022 Aug	S	NP2	Installed in August 2022
GW-108-1-1	Active	5376441.45	465701.6	129.80	130.69	130.69	119.26	116.21	0.89	15.24	11.43	14.48	2022 Aug	D	NP2	Installed in August 2022
GW-109-1-1	Active	5376390.117	465635.3	134.14	134.91	134.91	123.94	122.41	0.77	13.11	10.97	12.50	2022 Aug	S	NP2	Installed in August 2022
GW-110-1-1	Active	5376365.13	465593.6	137.61	138.32	138.32	134.21	132.68	0.71	5.94	4.11	5.64	2022 Aug	S	NP2	Installed in August 2022
VLGW-02-D	Active	5375782.7	465984.2	168.58	168.93	168.79	155.58	151.58	0.21	22.00	13.00	17.00	2008 May	I	P1	Landfill gas well
VLGW-03-D	Active	5375776.6	465933.6	170.04	170.30	170.30	156.29	153.29	0.26	17.00	13.75	16.75	2014 Feb	I	P1	Landfill gas well
VLGW-04-D	Active	5375858.1	466056.5	169.24	169.95	169.90	156.24	152.24	0.65	19.00	13.00	17.00	2008 May	I	P1	Landfill gas well
VLGW-08-D	Active	5376088.1	466113.6	164.42	165.28	165.14	147.41	137.38	0.72	28.04	17.01	27.04	2008 May	I	P1	Landfill gas well
VLGW-11-S	Active	5375996.8	466122.6	166.06	166.53	166.48	160.42	155.78	0.42	11.28	5.64	10.28	2008 May	I	P1	Landfill gas well
VLGW-15-D	Active	5375842.9	465997.0	170.61	171.13	171.07	156.41	148.21	0.46	23.31	14.2	22.4	2008 May	D	P1	Landfill gas well
VLGW-16-D	Active	5375901.0	466011.3	172.47	173.38	173.31	157.02	147.48	0.84	25.90	15.45	24.99	2008 May	I	P1	Landfill gas well
VLGW-17-D	Active	5375959.1	466025.5	171.40	171.81	171.77	157.20	144.28	0.37	28.04	14.2	27.12	2008 May	D	P1	Landfill gas well
VLGW-18-D	Active	5376017.5	466039.7	170.14	170.78	170.61	152.94	141.80	0.47	29.25	17.2	28.34	2008 May	D	P1	Landfill gas well
VLGW-19-D	Active	5376076.2	466054.1	168.80	169.53	169.21	151.60	141.37	0.42	28.34	17.2	27.43	2008 May	I	P1	Landfill gas well
VLGW-20-D	Active	5376131.2	466062.8	167.88	169.05	168.93	148.03	140.76	1.05	28.04	19.85	27.12	2008 May	I	P1	Landfill gas well
VLGW-21-D	Active	5376177.2	466082.0	164.81	165.40	165.30	147.89	140.43	0.49	25.93	16.92	24.38	2008 May	I	P1	Landfill gas well
VLGW-26-D	Active	5376165.6	466022.9	163.94	164.57	164.45	145.50	136.82	0.51	28.04	18.44	27.12	2008 May	D	P1	Landfill gas well
P1	Active	5375732.0	466026.0	157.60	158.17	158.17	151.50	145.41	0.57	12.50	6.10	12.19	2018 Dec	S	P1	Purge well, to replace the old well installed in 2005
P2	Active	5375733.3	466030.9	157.37	158.72	158.62	146.87	132.37	1.25	25.00	10.5	25	2005 Mar	I	P1	Purge well
P3	Active	5375739.0	466056.7	157.25	158.51	158.41	143.18	132.25	1.16	25.00	14.07	25	2005 Mar	I	P1	Purge well
P4	Active	5375751.7	466064.7	157.73	158.88	158.78	146.21	132.73	1.05	25.00	11.52	25	2005 Mar	I	P1	Purge well
P10	Active	5375731.5	466023.5	157.89	N/A	158.01	144.79	129.89	0.12	28.00	13.1	28	2010 October	I	P1	Purge well
P11	Active	5376434.0	465685.9	135.01	135.69	135.69	134.33	117.94	0.68	17.07	13.87	16.51	2022 Aug	D	NP2	Installed in August 2022
P12	Active	5376418.0	465702.6	135.22	135.86	135.86	134.58	116.47	0.64	18.75	13.56	14.78	2022 Aug	D	NP2	Installed in August 2022
VLGW-01-D	Inactive	5375802.0	466040.8	168.25	168.86	168.79	163.25	156.25	0.54	14.00	5.00	12.00	2008 May	I	P1	Landfill gas well
GW-01-1-1	Inactive	5375781.9	465852.0			168.56				55.54	42	44.5				
GW-01-1-2	Inactive	5375781.9	465852.0			168.53				40.10	24.4	24.8				
GW-01-1-3	Inactive	5375781.9	465852.0			168.53				29.53	13	14.75				
GW-01-2-1	Inactive	5375787.9	465859.0			168.25				20.50	4.7	5.1				
GW-01-3-1	Inactive	5375791.9	465851.0			167.81				21.02	5.11	5.91				
GW-02-1-1	Inactive	5375813.9	465996.0			166.90				48.58	33	33.5				
GW-02-1-2	Inactive	5375813.9	465996.0			166.90				39.29	23	24.6				
GW-02-1-3	Inactive	5375813.9	465996.0			166.90				28.79	12.2	13.8				
GW-02-2-1	Inactive	5375812.9	465990.0			167.14				22.53	6.25	7.5				
GW-03-1-1	Inactive	5375684.9	466042.0	147.41	148.21	148.05	122.91	122.21	0.64	26.03	24.5	25.2				

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I	*Intermediate well between 15 and 30 m deep*
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Area of Landfill	
SP1	*South of Phase 1 Landfill*
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NP2	*North of Phase 2 Landfill*
BKGND - WP2	*Background Water Quality West of Phase 2*
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Appendix A-1. Monitoring Well Co-ordinates 2022-2023

Station Name	Status	Location		Elevations					Depths				Survey Date	Monitor Class	Area of Landfill	Comments
		Northing (NAD 83)	Easting (NAD 83)	Ground Surface Elevation	Top of Casing Elevation	Top of Piezometer Elevation	Top of Screen Elevation	Bottom of Screen Elevation	Stickup	Borehole Depth Below Ground Surface	Depth to Top of Screen Below Ground Surface	Depth to Bottom of Screen Below Ground Surface		Shallow (S), Intermediate (I), Deep (D)		
		m	m	m ASL	m ASL	m ASL	m ASL	m ASL	m AGL	m BGS	m BGS	m BGS				
GW-03-1-2	Inactive	5375684.9	466042.0	147.41	148.21	148.05	134.11	133.61	0.64	16.33	13.3	13.8				
GW-03-1-3	Inactive	5375684.9	466042.0	147.41	148.21	148.05	143.41	141.61	0.64	7.03	4	5.8				
GW-03-2-1	Inactive	5375685.5	466037.7	149.20	150.01	149.28	145.15	142.10	0.08	7.10	4.05	7.1	2005 Mar	S	SP1	
GW-04-1-1	Inactive	5375464.0	466171.0	126.67	128.12	128.07	96.47	95.77	1.40	32.00	30.2	30.9				
GW-04-1-2	Inactive	5375464.0	466171.0	126.67	128.12	128.07	104.27	103.67	1.40	24.10	22.4	23				
GW-04-1-3	Inactive	5375464.0	466171.0	126.67	128.12	128.07	116.67	115.07	1.40	11.60	10	11.6				
GW-04-1-4	Inactive	5375464.0	466171.0	126.67	128.12	128.07	122.97	121.27	1.40	6.10	3.7	5.4				
GW-04-2-1	Inactive	5375468.5	466169.3	127.14	127.95	127.86	107.49	104.44	0.75	22.70	19.65	22.70	2005 Mar	I	SP1	Deactivated in 2016.
GW-05-1-1	Inactive	5376444.9	465813.9	126.29	127.49	127.49	112.59	110.59	1.20	16.90	13.7	15.7				
GW-05-1-2	Inactive	5376444.9	465813.9	126.29	127.49	127.49	118.69	116.69	1.20	10.80	7.6	9.6				
GW-05-1-3	Inactive	5376444.9	465813.9	126.29	127.49	127.49	122.89	121.89	1.20	5.60	3.4	4.4				
GW-05-2-1	Inactive	5376426.9	465774.9	126.00	126.80	126.80	125.20	124.20	0.80	2.60	0.8	1.8				
GW-06-1-1	Inactive	5376148.9	465661.9	127.70	128.41	128.40	107.00	104.90	0.70	23.50	20.7	22.8				
GW-06-1-2	Inactive	5376148.9	465661.9	127.70	128.41	128.40	115.20	113.20	0.70	15.20	12.5	14.5				
GW-06-1-3	Inactive	5376148.9	465661.9	127.70	128.41	128.40	120.80	118.80	0.70	9.60	6.9	8.9				
GW-06-2-1	Inactive	5376151.9	465669.9	127.46	127.76	127.76	125.86	124.86	0.30	2.90	1.6	2.6				
GW-08-1-1	Inactive	5375867.9	465738.0	159.26	160.28	160.26	145.86	143.76	1.00	16.50	13.4	15.5				
GW-08-1-2	Inactive	5375867.9	465738.0	159.26	160.28	160.26	152.11	150.11	1.00	10.15	7.15	9.15				
GW-08-1-3	Inactive	5375867.9	465738.0	159.26	160.28	160.26	156.76	155.76	1.00	4.50	2.5	3.5				
GW-10-1-1	Inactive	5376108.9	465701.9	135.11	135.41	135.41	133.61	132.61	0.30	2.80	1.5	2.5				
GW-11-1-1	Inactive	5376254.9	465770.9	134.13	135.13	135.13	131.23	130.23	1.00	4.90	2.9	3.9				
GW-12-1-0	Inactive	5375701.0	466189.0	143.02	143.82	143.82	N/A	N/A	0.80	3.40	No monitor	No monitor	Historic	S	SP1	Dug well, deactivated in 2010
GW-13-1-1	Inactive	5376166.9	466031.9	150.43	152.73	152.73	121.93	118.93	2.30	33.80	28.5	31.5				
GW-13-1-2	Inactive	5376166.9	466031.9	150.43	152.73	152.73	126.83	125.33	2.30	27.40	23.6	25.1				
GW-14-1-1	Inactive	5375968.9	465969.9	158.73	160.22	160.22	138.53	135.53	1.49	24.69	20.2	23.2				
GW-15-1-1	Inactive	5375754.9	466007.0	159.78	160.82	160.82	145.68	143.38	1.04	17.44	14.1	16.4				
GW-22-1-1	Inactive	5376290.1	465751.7	138.54	138.81	139.86	111.22	109.69	1.32	28.09	27.32	28.85				
GW-23-1-1	Inactive	5376260.7	465718.7	128.37	129.52	129.50	111.51	110.09	1.13	17.57	16.86	18.28				
GW-23-1-2	Inactive	5376260.7	465718.7	128.37	129.52	129.49	124.67	121.80	1.12	5.14	3.7	6.57				
GW-24-1-1	Inactive	5376421.9	465753.0	127.77	128.88	128.88	109.91	108.51	1.11	18.56	17.86	19.26				
GW-24-1-2	Inactive	5376421.9	465753.0	127.77	128.88	128.87	124.10	121.26	1.10	5.09	3.67	6.51				
GW-26-1-1	Inactive	5376319.8	465596.6	128.22	129.16	129.12	109.79	111.20	0.90	17.73	18.43	17.02				
GW-26-1-2	Inactive	5376319.8	465596.6	128.22	129.16	129.12	124.36	121.52	0.90	5.28	3.86	6.7				
GW-27-1-2	Inactive	5376358.2	465455.7	141.09	141.91	141.56	140.59	137.59	0.47	3.50	0.50	3.50	2005 Mar	S	BKGND - WP2	Destoryed in summer 2022
GW-32-1-1	Inactive	5376129.7	465569.9	165.41	166.44	166.34	123.85	122.44	0.93	42.27	41.56	42.97				
GW-32-1-2	Inactive	5376129.7	465569.9	165.41	166.44	166.37	157.93	152.04	0.96	10.43	7.48	13.37				
GW-33-1-1	Inactive	5376296.5	465627.4	124.55	123.43	124.54	111.11	109.69	-0.01	14.15	13.44	14.86				
GW-33-1-2	Inactive	5376296.5	465627.4	124.55	123.43		N/A	N/A	-124.55		no monitor	no monitor				
GW-34-1-1	Inactive	5376216.8	465668.4	119.47			104.64	101.64	-119.47		14.83	17.83				
GW-34-2-1	Inactive	5376214.9	465668.9	119.67			115.97	112.97	-119.67		3.7	6.7				
GW-35-1-1	Inactive	5376207.9	465677.3	120.19			108.29	105.29	-120.19		11.9	14.9				
GW-35-1-2	Inactive	5376207.0	465675.9	120.33			117.13	114.13	-120.33		3.2	6.2				

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		Northing (NAD 83)	Easting (NAD 83)	Ground Surface Elevation	Top of Casing Elevation	Top of Piezometer Elevation	Top of Screen Elevation	Bottom of Screen Elevation	Stickup	Borehole Depth Below Ground Surface	Depth to Top of Screen Below Ground Surface	Depth to Bottom of Screen Below Ground Surface		Shallow (S), Intermediate (I), Deep (D)		
		m	m	m ASL	m ASL	m ASL	m ASL	m ASL	m AGL	m BGS	m BGS	m BGS				
GW-45-1-1	Inactive	5376163.1	466106.3	162.37			143.71	140.71	-162.37		18.66	21.66				
GW-46-1-1	Inactive	5376078.3	466029.2	170.48	171.65	171.96	140.68	134.68	1.48		29.8	35.8				
GW-47-1-1	Inactive	5375918.3	465992.6	174.85	177.24	177.37	155.09	152.09	2.52	22.55	19.76	22.758	2008 May	I	P1	
GW-49-1-0	Inactive	5376759.5	465218.7	160.00	159.81	159.81	N/A	N/A	-0.19	62.20						
GW-50-1-1	Inactive	5376480.9	466193.4	119.37	120.41	120.43	105.47	102.47	1.06	16.90	13.9	16.9	2005 Mar	I	EP1	
GW-59-1-1	Inactive	5376254.5	465636.2	125.62	126.40	126.40	113.72	112.22	0.78	13.40	11.9	13.4				
GW-64-1-1	Inactive	5375855.0	465849.0	172.00		172.78	156.20	154.50	0.78	17.50	15.8	17.5				
GW-65-1-1	Inactive	5375831.0	465820.0	172.09		172.79	159.79	153.69	0.70	18.40	12.3	18.4				
GW-66-1-1	Inactive	5376088.0	465902.0	164.23		165.08	157.03	150.93	0.85	13.30	7.2	13.3				
GW-67-1-1	Inactive	5376256.2	465774.0	155.85	N/A	157.55	133.95	127.85	1.70	28.00	21.90	28.00	2005 Mar	I	P2	Destroyed. Replaced by GW-82-1-1
GW-67-2-1	Inactive	5376256.2	465774.0	155.85		157.55	133.95	127.85	1.70	28.00	21.9	28	2005 Mar	I	P2	
GW-68-1-1	Inactive	5376353.0	465718.0	141.56		142.74	130.36	124.26	1.18	17.30	11.2	17.3				
GW-68-2-1	Inactive	5376353.0	465718.0	141.56	N/A	142.29	123.76	120.76	0.73	20.80	17.80	20.80	Historic	I	P2	Destroyed. Replaced by GW-83-1-1
GW-69-1-1	Inactive	5376267.6	465665.8	140.64		142.50	127.64	121.54	1.86	19.10	13	19.1	2005 Mar	I	P2	
GW-69-2-1	Inactive	5376269.9	465667.0	140.67		142.11	121.67	115.67	1.44	25.20	19	25	2005 Mar	I	P2	
GW-70-1-1	Inactive	5376019.0	465891.0	167.00		167.59	149.50	143.40	0.59	23.60	17.5	23.6				
GW-74-1-1	Inactive	5376013.4	466018.4	170.94	171.56	171.60	138.04	132.04	0.66	38.90	32.90	38.90	2007 Apr	D	P1	
GW-74-2-1	Inactive	5 376 021.6	466 032.5	170.29	172.25	172.40	153.19	150.19	2.11	20.10	17.10	20.10	2006 Apr	I	P1	Installed during 2005
GW-79-1-1	Inactive	5376522.5	465404.3	182.87	183.63	183.59	147.82	144.77	0.72	39.62	35.05	38.10	2007 Apr	D	NP2	Installed during 2007, decommissioned in May 2018
GW-79-2-1	Inactive	5376521.9	465403.1	182.96	183.69	183.59	157.05	154.00	0.64	30.48	25.91	28.96	2007 Apr	I	NP2	Installed during 2007, decommissioned in May 2018
GW-84-1-1	Inactive	5376225.9	465646.9	158.20	158.86	158.79	120.63	117.58	0.59	27.74	37.565889	40.615889	2009 Feb	I	P2	Installed during 2007
GW-84-2-1	Inactive	5376224.8	465648.5	158.43	159.06	161.36	133.14	130.09	2.93	15.24	25.289839	28.339839	2009 Feb	S	P2	Installed during 2007
GW-86-1-1	Inactive	5376228.4	465651.4	160.55	N/A	N/A	N/A	N/A	N/A	42.98	N/A	N/A	2010 October	D	P2	SG piezo - 42.42 mBGS
GW-86-1-2	Inactive	5376228.4	465651.4	160.55	N/A	N/A	N/A	N/A	N/A	42.98	N/A	N/A	2010 October	I	P2	SG piezo - 20.85 mBGS
GW-86-2-1	Inactive	5376224.8	465651.8	160.55	N/A	N/A	N/A	N/A	N/A	30.78	N/A	N/A	2010 October	D	P2	SG piezo - 29.69 mBGS
GW-86-2-2	Inactive	5376224.8	465651.8	160.55	N/A	N/A	N/A	N/A	N/A	30.78	N/A	N/A	2010 October	I	P2	SG piezo - 8.67 mBGS
GW-93-1-1	Inactive	5376556.5	465260.0	183.42	184.24	184.24	159.34	156.29	0.83	28.04	24.08	27.13	2019 Nov	D	HNP	Installed in 2019
GW-102-1-1	Inactive	5376399.4	465663.5	134.46	135.01	135.01	129.89	128.36	0.56	6.65	5.47	6.10	2022 Apr	S	NP2	Installed in April 2022, decomissioned in Q3 2022
P5	Inactive	5375775.2	466079.9	158.35	159.46	159.36	144.43	133.35	1.01	25.00	13.92	25	2005 Mar	I	P1	Purge well
P6	Inactive	5375803.6	466098.0	159.88	161.65	161.55	147.74	134.88	1.67	25.00	12.14	25	2005 Mar	I	P1	Purge well

Notes:

Datum Description

m BGL	*metres below ground level*
m AGL	*metres above ground level*
m ASL	*metres above mean sea level*

Monitor Class

S	*Shallow well <15 m deep*
I	*Intermediate well between 15 and 30 m deep*
D	*Deep well >30 m deep*

Area of Landfill

SP1	*South of Phase 1 Landfill*
EP1	*East of Phase 1 Landfill*
NP1	*North of Phase 1 Landfill*
NP2	*North of Phase 2 Landfill*
BKGND - WP2	*Background Water Quality West of Phase 2*
HNP	*Hartland North Pad*
P1	*Phase 1*
P2	*Phase 2*

A2. Groundwater Monitoring Plan

Appendix A-2. Groundwater Monitoring Plan 2022-2023

Station Name	Status	Pipe Diameter (mm)	Monitored in 2022-2023				Development Method	Sampling Method	Comments
			Groundwater Quality Samples		Groudwater Level Measurements				
			Quarterly (4/yr)	Bi-annual (2/yr)	Manual measurement (4/yr)	Pressure transducer (continuous)			
GW-04-2-1	Active	50			Y		NA	NA	Dedicated submersible pump installed January 2012. Well recharges very slowly since 2014, so it is no longer sampled.
GW-04-3-1	Active	50	Y		Y		footvalve	footvalve	Submersile pump removed. Sampled using waterra from May 2019 onwards.
GW-04-4-1	Active	50	Y		Y		footvalve	footvalve	
GW-07-1-0	Active	220	Y		Y		well pump	well pump	Well pump replacement pending April 2023
GW-09-1-0	Active	150			Y		NA	NA	Sampling discontinued in 2010 due to outdated pump and redundancy. Water levels only.
GW-16-1-1	Active	50		Y	Y		footvalve	footvalve	
GW-16-1-2	Active	50		Y	Y		footvalve	footvalve	
GW-16-2-1	Active	50		Y	Y		footvalve	footvalve	
GW-16-2-2	Active	50		Y	Y		footvalve	footvalve	16-2-2 often dry; difficult to develop and sample. Sometimes use bailer.
GW-17-1-1	Active	50		Y	Y	Y	footvalve	footvalve	Pressure transducer installed in March 2019.
GW-17-1-2	Active	50		Y	Y		footvalve	footvalve	
GW-17-1-3	Active	50		Y	Y		footvalve	footvalve	
GW-18-1-1	Active	50	Y		Y	Y	sample pump	sample pump / footvalve	Dedicated submersible pump installed May 2009. Pump failed in September and November 2018. Waterra tubing from Feb/Mar 2019 onwards. Pressure transducer installed in March 2019.
GW-18-1-2	Active	50			Y		sample pump	sample pump	Pump damaged and stuck in well since 2004. Not sampled, only water levels.
GW-18-2-1	Active	50	Y		Y		footvalve	footvalve	
GW-18-2-2	Active	50	Y		Y		footvalve	footvalve	
GW-19-1-1	Active	50	Y		Y		footvalve	footvalve	19-1-1 sometimes flows artesian.
GW-19-1-2	Active	50	Y		Y		footvalve	footvalve	19-1-2 sometimes flows artesian.
GW-19-2-1	Active	50	Y		Y		footvalve	footvalve	19-2-1 sometimes flows artesian.
GW-19-2-2	Active	50	Y		Y		footvalve	footvalve	
GW-20-1-1	Active	50	Y		Y		sample pump	footvalve	Dedicated submersible pump installed January 2012. Pump ceased functioning in Nov 2019, was removed for repair and is currently sampled using waterra. Recharges in minutes
GW-20-1-2	Active	50	Y		Y		sample pump	sample pump	Dedicated submersible pump installed January 2012. Recharges completely in under 1 hour
GW-21-1-1	Active	50	Y		Y		sample pump	footvalve	Dedicated submersible pump installed January 2012. Pump replaced with waterra.
GW-21-1-2	Active	50	Y		Y		sample pump	sample pump	Dedicated submersible pump installed January 2012.
GW-21-2-1	Active	50	Y		Y		footvalve	footvalve	
GW-25-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-25-1-2	Active	50	Y		Y		footvalve	footvalve	
GW-27-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-27-1-2	Inactive	50					footvalve	footvalve	Destroyed in summer 2022. No longer exists.
GW-28-1-0	Active	150	Y		Y		sample pump	sample pump	Open borehole. Dedicated submersible pump installed January 2011.
GW-29-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-29-1-2	Active	50	Y		Y		footvalve	footvalve	
GW-30-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-30-1-2	Active	50	Y		Y		footvalve	footvalve	30-1-2 almost dry in summer, bailer used occasionally.
GW-31-1-1	Active	50		Y	Y		footvalve	footvalve	
GW-31-1-2	Active	50		Y	Y		footvalve	footvalve	
GW-36-1-1	Active	50				Y	NA	NA	Pressure transducer installed June 1997 records water levels continuously.
GW-36-2-1	Active	50			Y		footvalve	footvalve	
GW-36-3-1	Active	50	Y		Y		footvalve	footvalve	
GW-37-1-1	Active	50				Y	NA	NA	Pressure transducer installed June 1997 records water levels continuously.
GW-37-2-1	Active	50			Y		footvalve	footvalve	
GW-37-3-1	Active	50	Y		Y		footvalve	footvalve	
GW-38-1-1	Active	50	Y		Y		footvalve	footvalve	Recharges very slowly, 48 hours required after purging to sample.
GW-39-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-39-2-1	Active	50	Y		Y		sample pump	sample pump	Dedicated submersible pump installed January 2011.
GW-40-1-1	Active	50	Y		Y	Y	footvalve	footvalve	Pressure transducer installed in September 2008 records water levels continuously. Can be removed as required for sampling.
GW-41-1-1	Active	50	Y		Y	Y	footvalve	footvalve	Pressure transducer installed in May 2018.
GW-42-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-43-1-1	Active	50	Y		Y	Y	footvalve	footvalve	Pressure transducer installed in May 2018.
GW-44-1-1	Active	50	Y		Y	Y	footvalve	footvalve	Pressure transducer installed in May 2018.
GW-46-2-1	Active	50			Y		NA	NA	
GW-46-3-1	Active	50			Y		NA	NA	
GW-46-4-1	Active	50			Y		NA	NA	
GW-47-2-1	Active	50			Y		NA	NA	
GW-48-2-1	Active	50			Y		NA	NA	
GW-50-1-1	Active	50			Y		footvalve	NA	Deactivated in from sampling program September 2012 due to poor recharge. Now only monitored for water level.
GW-51-1-1	Active	50		Y	Y		footvalve	footvalve	
GW-51-2-1	Active	50		Y	Y		footvalve	footvalve	
GW-51-3-1	Active	50		Y	Y		footvalve	footvalve	

Notes:

Footvalves are 16 mm (5/8") unless otherwise noted.

NA - Not Available or Not Applicable.

Appendix A-2. Groundwater Monitoring Plan 2022-2023

Station Name	Status	Pipe Diameter (mm)	Monitored in 2022-2023				Development Method	Sampling Method	Comments
			Groundwater Quality Samples		Groudwater Level Measurements				
			Quarterly (4/yr)	Bi-annual (2/yr)	Manual measurement (4/yr)	Pressure transducer (continuous)			
GW-52-1-1	Active	50	Y		Y	Y	footvalve	footvalve	Pressure transducer installed in 2018
GW-52-2-0	Active	150			Y		NA	NA	
GW-52-3-0 (P52)	Active	150				Y	NA	NA	Pressure transducer records water levels continuously.
GW-52-4-0 (P7)	Active	250	Y			Y	NA	spigot	Pressure transducer installed. Purge well in conjunction with 80-1-0-P8. Pressure transducer records water levels continuously. Sampling spigot installed in 2016.
GW-53-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-54-1-1	Active	50			Y	Y	sample pump	sample pump	Dedicated submersible pump installed January 2012. Sampling discontinued in 2016. Water levels only. Pressure transducer installed in March 2019.
GW-54-2-1	Active	50			Y		footvalve	footvalve	Water levels only.
GW-54-3-1	Active	50			Y		footvalve	footvalve	Water levels only.
GW-55-1-1	Active	50		Y	Y		footvalve	footvalve	
GW-56-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-57-1-1	Active	50		Y	Y		footvalve	footvalve	
GW-58-1-0	Active	150	Y		Y		sample pump	sample pump	Dedicated submersible pump reinstalled after Phase 2 Cell one closure in October 2012. This well is an 8" diameter borehole.
GW-60-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-60-2-1	Active	50	Y		Y		footvalve	footvalve	
GW-60-3-1	Active	50	Y		Y		footvalve	footvalve	
GW-61-1-1	Active	150			Y		NA	NA	Borehole
GW-62-1-1	Active	50		Y	Y	Y	sample pump	sample pump	Portable pressure transducer installed January 2012 - records water levels every three hours. Dedicated submersible pump installed January 2012.
GW-62-2-1	Active	50		Y	Y		footvalve	footvalve	
GW-63-1-1	Active	50		Y	Y		sample pump	sample pump	Dedicated submersible pump installed January 2011.
GW-63-2-1	Active	50		Y	Y		footvalve	footvalve	
GW-71-1-1	Active	50	Y		Y		sample pump	sample pump	Dedicated submersible pump installed January 2012 has malfunctioned.
GW-71-2-1	Active	50	Y		Y		sample pump	footvalve	Dedicated submersible pump installed January 2012.
GW-71-3-1	Active	50	Y		Y		footvalve	footvalve	
GW-72-1-1	Active	50	Y		Y		sample pump	sample pump	Dedicated submersible pump installed January 2012.
GW-72-2-1	Active	50			Y		footvalve	footvalve	Well has been recharging very slowly since 2014, so it is no longer sampled. Water levels only.
GW-72-3-1	Active	50	Y		Y		footvalve	footvalve	
GW-73-1-1	Active	50	Y		Y		sample pump	sample pump	Dedicated submersible pump installed January 2012.
GW-73-2-1	Active	50	Y		Y		sample pump	sample pump	Dedicated submersible pump installed January 2012.
GW-73-3-1	Active	50	Y		Y		footvalve	footvalve	
GW-74-2-1	Active	50			Y		NA	NA	
GW-75-1-1	Active	50			Y		NA	NA	
GW-76-1-1	Active	50			Y	Y	sample pump	sample pump	Dedicated submersible pump installed January 2010. Sampling discontinued in 2016. Water levels only. Pressure transducer installed in March 2019.
GW-76-2-1	Active	50			Y		sample pump	sample pump	Sampling discontinued in 2016. Water levels only. Dedicated submersible pump installed January 2012.
GW-76-3-1	Active	50			Y		footvalve	footvalve	Sampling discontinued in 2016. Water levels only.
GW-77-1-1	Active	50		Y	Y	Y	footvalve	footvalve	Portable pressure transducer installed January 2012 - records water levels every three hours. Dedicated submersible pump installed. Pump failed in 2020, replaced by waterra tubing.
GW-77-2-1	Active	50		Y	Y		footvalve	footvalve	
GW-78-1-1	Active	50		Y	Y	Y	footvalve	footvalve	Portable pressure transducer installed January 2012 - records water levels every three hours.
GW-78-2-1	Active	50		Y	Y		footvalve	footvalve	
GW-80-1-0 (P8)	Active	NA	Y		Y	Y	sample pump	spigot	Pressure transducer installed. Purge well in conjunction with 52-4-0-P7. Pressure transducer records water levels continuously. Sampling spigot installed in 2016.
GW-81-1-0 (P9)	Active	NA	Y		Y	Y	NA	bailer	Borehole. Pressure transducer installed in 2018.
GW-82-1-1	Active	50			Y		NA	NA	
GW-83-1-1	Active	50			Y		NA	NA	
GW-85-1-1	Active	50	Y		Y		footvalve	footvalve	
GW-87-1-1	Active	50		Y	Y	Y	footvalve	sample pump	Well drilled in December 2014. Dedicated submersible pump (GeoTech) installed in February 2015. Pressure transducer installed March 2016.
GW-87-2-1	Active	50		Y	Y	Y	footvalve	waterra	Well drilled in December 2014. Pressure transducer installed in March 2016.
GW-88-1-1	Active	50		Y	Y	Y	footvalve	waterra	Well drilled in December 2014. Dedicated submersible pump (GeoTech) installed in February 2015 but replaced with waterra tubing after malfunctioning in 2016. Pressure transducer installed March 2016.
GW-88-2-1	Active	50		Y	Y	Y	footvalve	waterra	Well drilled in December 2014. Pressure transducer installed in March 2016.
GW-89-1-1	Active	50			Y	Y	NA	NA	Well drilled in Dec 2018. Pressure transducer installed in March 2019
GW-89-2-1	Active	50			Y	Y	NA	NA	Well drilled in Dec 2018. Pressure transducer installed in March 2019
GW-91-1-1	Active	50	Y		Y	Y	Waterra	Waterra	Well drilled in Dec 2019. Pressure transducer installed in March 2020
GW-92-1-1	Active	50	Y		Y	Y	Waterra	Waterra	Well drilled in Dec 2019. Pressure transducer installed in March 2020
GW-94-1-1	Active	50	Y		Y	Y	Waterra	Waterra	Well drilled in Dec 2019. Pressure transducer installed in March 2020
GW-95-1-1	Active	50		Y	Y		Waterra	Waterra	Well drilled April 14 2022
GW-96-1-1	Active	50		Y	Y		Waterra	Waterra	Well drilled April 14 2022
GW-97-1-1	Active	50		Y	Y		Waterra	Waterra	Well drilled April 14 2022
GW-98-1-1	Active	50	Y		Y		Waterra	Waterra	Well drilled April 18 2022
GW-99-1-1	Active	50		Y	Y		Waterra	Waterra	Well drilled April 18 2022. Dry at the time of drilling. Dry during the wet season in 2022
GW-100-1-1	Active	50	Y		Y		Waterra	Waterra	Well drilled April 18 2022. Dry at the time of drilling. Not enough volume to sample during the wet season in 2022
GW-101-1-1	Active	50		Y	Y		Waterra	Waterra	Well drilled April 18 2022. Dry during the wet season in 2022

Notes:

Footvalves are 16 mm (5/8") unless otherwise noted.

NA - Not Available or Not Applicable.

Appendix A-2. Groundwater Monitoring Plan 2022-2023

Station Name	Status	Pipe Diameter (mm)	Monitored in 2022-2023				Development Method	Sampling Method	Comments
			Groundwater Quality Samples		Groudwater Level Measurements				
			Quarterly (4/yr)	Bi-annual (2/yr)	Manual measurement (4/yr)	Pressure transducer (continuous)			
GW-103-1-1	Active	50		Y	Y		Waterra	Waterra	Well drilled April 18 2022
GW-104-1-1	Active	50	Y		Y		Waterra	Waterra	Well drilled July 11 2022
GW-105-1-1	Active	50	Y		Y		Waterra	Waterra	Well drilled July 11 2022
GW-106-1-1	Active	50	Y		Y		Waterra	Waterra	Well drilled July 12 2022
GW-107-1-1	Active	50		Y	Y		Waterra	Waterra	Well drilled July 11 2022
GW-108-1-1	Active	50		Y	Y		Waterra	Waterra	Well drilled August 2 2022
GW-109-1-1	Active	50			Y		Waterra	Waterra	Well drilled August 9 2022. Deep well.
GW-110-1-1	Active	50			Y		Waterra	Waterra	Well drilled August 5 2022. Deep well.
P11	Active	101.6	Y		Y		Waterra	Waterra	Well drilled August 3 2022. 4" diameter borehole. Submersible pump to be installed.
P12	Active	101.6	Y		Y		Waterra	Waterra	Well drilled August 5 2022. 4" diameter borehole
P1	Active	NA	Y			Y	NA	spigot	Pressure transducer installed. QED bladder pumps installed and pressure transducer records water levels continuously. Second bladder pump installed April 2013. Electric submersible pump installed 14-May-2015.
P10	Active	NA	Y			Y	NA	spigot	Pressure transducer installed. QED bladder pumps installed and pressure transducer records water levels continuously.
P2	Active	NA	Y			Y	NA	spigot	Pressure transducer installed. QED bladder pumps installed and pressure transducer records water levels continuously.
P3	Active	NA	Y			Y	NA	spigot	Pressure transducer installed. QED bladder pumps installed and pressure transducer records water levels continuously.
P4	Active	NA	Y			Y	NA	spigot	Pressure transducer installed. QED bladder pumps installed and pressure transducer records water levels continuously.
VLGW002D	Active	NA			Y		NA	NA	
VLGW003D	Active	NA			Y		NA	NA	
VLGW004D	Active	NA			Y		NA	NA	
VLGW008D	Active	NA			Y		NA	NA	
VLGW011S	Active	NA			Y		NA	NA	
VLGW015D	Active	NA			Y		NA	NA	
VLGW016D	Active	NA			Y		NA	NA	
VLGW017D	Active	NA			Y		NA	NA	
VLGW018D	Active	NA			Y		NA	NA	
VLGW019D	Active	NA			Y		NA	NA	
VLGW021D	Active	NA			Y		NA	NA	
VLGW026D	Active	NA			Y		NA	NA	
VLGW020D	Inactive	NA			Y		NA	NA	Became obstructed in 2021
GW-01-1-1	Inactive	20							Site destroyed.
GW-01-1-2	Inactive	20							
GW-01-1-3	Inactive	20							
GW-01-2-1	Inactive	20							
GW-01-3-1	Inactive	20							
GW-02-1-1	Inactive	20							Site destroyed
GW-02-1-2	Inactive	20							
GW-02-1-3	Inactive	20							
GW-02-2-1	Inactive	20							
GW-03-1-1	Inactive	20							Deactivated at end of 1998, replaced by well 60-1-1.
GW-03-1-2	Inactive	20							Deactivated at end of 1998, replaced by well 60-2-1.
GW-03-1-3	Inactive	20							Deactivated at end of 1998, replaced by well 60-3-1.
GW-03-2-1	Inactive	50							Destroyed and replaced with 85-1-1 in March 2009.
GW-04-1-1	Inactive	20							Deactivated at end of 1998, replaced by new 04-2-1.
GW-04-1-2	Inactive	20							Deactivated at end of 1998, replaced by well 04-3-1.
GW-04-1-3	Inactive	20							Deactivated at end of 1998, replaced by well 04-4-1.
GW-04-1-4	Inactive	40							Deactivated during 1998, failed to recharge after purging.
GW-04-2-1	Inactive	50			Y		sample pump	sample pump	Dedicated submersible pump installed January 2012. Sampling discontinued due to very slow recharge rate.
GW-05-1-1	Inactive	20							Site destroyed during construction of Phase 2 lagoon
GW-05-1-2	Inactive	20							
GW-05-1-3	Inactive	20							
GW-05-2-1	Inactive	20							
GW-06-1-1	Inactive	20							Site destroyed during dike contruction in interim filling area.
GW-06-1-2	Inactive	20							
GW-06-1-3	Inactive	20							
GW-06-2-1	Inactive	20							
GW-08-1-1	Inactive	20							Site destroyed
GW-08-1-2	Inactive	20							
GW-08-1-3	Inactive	20							
GW-10-1-1	Inactive	20							Site destroyed

Notes:

Footvalves are 16 mm (5/8") unless otherwise noted.

NA - Not Available or Not Applicable.

Appendix A-2. Groundwater Monitoring Plan 2022-2023

Station Name	Status	Pipe Diameter (mm)	Monitored in 2022-2023				Development Method	Sampling Method	Comments
			Groundwater Quality Samples		Groudwater Level Measurements				
			Quarterly (4/yr)	Bi-annual (2/yr)	Manual measurement (4/yr)	Pressure transducer (continuous)			
GW-11-1-1	Inactive	20							Site destroyed
GW-12-1-0	Inactive	220							Deactivated in 2010.
GW-13-1-1	Inactive	50							Site destroyed
GW-13-1-2	Inactive	50							
GW-14-1-1	Inactive	50							Site destroyed
GW-15-1-1	Inactive	50							Site destroyed
GW-22-1-1	Inactive	50							Destroyed during expansion of interim composting area.
GW-23-1-1	Inactive	50							Site destroyed in November 1994
GW-23-1-2	Inactive	50							
GW-24-1-1	Inactive	50							Site destroyed during construction of Phase 2 lagoon
GW-24-1-2	Inactive	50							
GW-26-1-1	Inactive	50							Site destroyed in August 1994
GW-26-1-2	Inactive	50							
GW-32-1-1	Inactive	50							Site destroyed in October 1997
GW-32-1-2	Inactive	50							Site destroyed in October 1997
GW-33-1-1	Inactive	50							Deactivated in August 1992.
GW-33-1-2	Inactive	50							
GW-34-1-1	Inactive	50							Site destroyed in August 1994
GW-34-2-1	Inactive	50							
GW-35-1-1	Inactive	50							Site destroyed in August 1994
GW-35-1-2	Inactive	50							
GW-45-1-1	Inactive	50							Site destroyed.
GW-46-1-1	Inactive	50							Deactivated in June 1999.
GW-47-1-1	Inactive	50							Deactivated in December 2012.
GW-48-1-1	Inactive	50					NA	NA	Obstructed. Unable to measure groundwater level.
GW-49-1-0	Inactive	50							Deactived in June 2005.
GW-59-1-1	Inactive	50							Destroyed Feb 2005 by Phase 2 construction.
GW-64-1-1	Inactive	50							Destroyed by interim fill area construction in 2003.
GW-65-1-1	Inactive	50							Destroyed by interim fill area construction in 2003.
GW-66-1-1	Inactive	50							Destroyed by interim fill area construction in 2003.
GW-67-1-1	Inactive	50							Destroyed. Replaced by GW-82-1-1
GW-67-2-1	Inactive	50							Destroyed. Replaced by GW-82-1-1
GW-68-1-1	Inactive	50							Destroyed. Replaced by GW-83-1-1
GW-68-2-1	Inactive	50							Destroyed. Replaced by GW-83-1-1
GW-69-1-1	Inactive	50							Destroyed July 2006 during construction on active face
GW-69-2-1	Inactive	50							Destroyed July 2006 during construction on active face
GW-70-1-1	Inactive	50							Destroyed by interim fill area construction in 2003.
GW-74-1-1	Inactive	50			Y		NA	NA	Decommissioned
GW-79-1-1	Inactive	50					sample pump	sample pump	Well decommissioned in May 2018 due to blasting in vicinity.
GW-79-2-1	Inactive	50					footvalve	footvalve	Well decommissioned in May 2018 due to blasting in vicinity.
GW-84-1-1	Inactive	50							Destroyed spring 2009. Recorded continuous water levels until April 2012. No longer functioning. Cannot be repaired because it's buried in garbage.
GW-84-2-1	Inactive	50							Destroyed spring 2009. Recorded continuous water levels until April 2012. No longer functioning. Cannot be repaired because it's buried in garbage.
GW-90-1-1	Inactive	50					NA	NA	Well drilled in Oct 2019. No water levels taken in well due to high landfill gas concentrations in area.
GW-90-2-1	Inactive	50					NA	NA	Well drilled in Dec 2018. No water levels taken in well since Oct 2019 due to high landfill gas concentrations in area.
GW-93-1-1	Inactive	50					Waterra	Waterra	Destroyed September 2022 due to aggregate stockpiling
T-86-1-1	Inactive	NA							
T-86-1-2	Inactive	NA			Y	Y	NA	NA	Pressure transducer installed October 2010. Well replaces GW-84-1-1 & GW-84-2-1. Pressure transducer records water levels continuously. No longer functioning.
T-86-2-1	Inactive	NA			Y	Y	NA	NA	Pressure transducer installed October 2010. Well replaces GW-84-1-1 & GW-84-2-1. Pressure transducer records water levels continuously. No longer functioning.
T-86-2-2	Inactive	NA			Y	Y	NA	NA	Pressure transducer installed October 2010. Well replaces GW-84-1-1 & GW-84-2-1. Pressure transducer records water levels continuously. No longer functioning.
VLGW001D	Inactive	NA					NA	NA	Well is obstructed. No water level measurements were taken in 2018-2019

Notes:

Footvalves are 16 mm (5/8") unless otherwise noted.

NA - Not Available or Not Applicable.

A3. Groundwater Elevations

Appendix A-3. Groundwater Elevations 2022-2023

Groundwater Level Elevations (mASL)				
Station	Q2	Q3	Q4	Q1
	May 9, 2022 to May 10, 2022	September 6, 2022 to September 7, 2022	November 14, 2022 to November 17, 2022	February 2, 2023 to February 4, 2023
04-2-1	127.01	125.49	125.99	127.28
04-3-1	124.38	123.07	124.54	124.62
04-4-1	125.29	123.93	124.97	125.58
07-1-0	141.64	141.18	141.48	141.64
09-1-0	146.40	144.20	---	146.87
16-1-1	129.99	123.93	129.25	130.95
16-1-2	131.19	123.95	129.30	131.05
16-2-1	131.59	126.10	130.55	132.15
16-2-2	131.59	126.01	130.46	132.01
17-1-1	144.95	142.79	143.98	147.30
17-1-2	144.94	142.80	143.97	147.29
17-1-3	145.33	143.57	144.21	147.54
18-1-1	151.32	149.16	150.08	151.57
18-1-2	151.15	148.99	149.92	151.46
18-2-1	161.32	158.74	161.18	163.47
18-2-2	161.29	158.89	161.21	163.51
19-1-1	133.54	133.27	133.44	133.54
19-1-2	133.66	132.35	133.41	133.66
19-2-1	133.19	132.02	133.19	133.19
19-2-2	132.68	129.94	132.61	132.52
20-1-1	109.85	109.02	109.93	110.13
20-1-2	109.61	108.88	109.63	109.77
21-1-1	110.28	109.54	109.85	110.52
21-1-2	109.88	109.06	110.33	110.04
21-2-1	109.88	109.07	109.83	110.05
25-1-1	125.31	123.98	124.87	126.06
25-1-2	126.52	125.47	126.41	126.72
27-1-1	137.38	136.94	Not accessible	140.54
27-1-2	137.43	137.40	Destroyed	Destroyed
28-1-0	119.36	118.90	119.27	119.98
29-1-1	112.12	111.19	112.06	112.36
29-1-2	112.22	111.29	112.17	112.40
30-1-1	106.06	104.81	105.79	109.39
30-1-2	107.11	105.86	106.89	109.21
31-1-1	104.66	103.61	104.42	102.22
31-1-2	104.44	103.66	102.41	103.40
36-1-1	123.91	124.91	125.91	125.91
36-2-1	123.02	121.45	122.74	123.38
36-3-1	123.51	121.21	123.50	124.40
37-1-1	125.24	126.24	127.24	127.24
37-2-1	123.08	120.91	122.61	122.76
37-3-1	124.83	122.92	124.50	125.47
38-1-1	119.90	119.47	119.84	120.39
39-1-1	120.72	119.39	120.50	122.15
39-2-1	119.90	119.46	119.82	120.51
40-1-1	117.30	118.30	119.30	119.30
41-1-1	147.37	147.00	147.28	147.55
42-1-1	137.69	137.08	137.60	134.82
43-1-1	158.22	157.05	158.11	158.77
44-1-1	160.21	158.94	160.10	160.43
46-2-1	156.04	155.92	156.02	156.02
46-3-1	151.82	151.92	150.50	152.30
46-4-1	149.27	149.36	149.36	149.41
47-2-1	152.16	151.98	151.93	151.93
48-2-1	149.63	148.51	148.20	149.27
50-1-1	117.44	113.45	114.89	118.04
51-1-1	109.96	108.79	110.04	110.17
51-2-1	110.17	108.85	110.23	110.41
51-3-1	110.26	108.87	110.27	110.51
52-1-1	117.74	117.23	117.30	117.49
52-2-0	118.11	117.75	118.09	118.13
52-3-0 (P52)	116.63	116.63	116.63	116.63
52-4-0 (P7)	112.94	112.94	112.94	112.94
53-1-1	120.85	120.23	120.87	121.65
54-1-1	149.74	147.48	148.00	150.74
54-2-1	149.32	147.10	147.60	150.29
54-3-1	149.37	147.50	147.91	150.41
55-1-1	142.68	140.66	141.06	143.34

Notes:

Bracketed data on bottom of well.

--- - *Not measured*

Appendix A-3 - Groundwater Elevations 2022-2023

Groundwater Level Elevations (mASL)

Station	Q2	Q3	Q4	Q1
	May 9, 2022 to May 10, 2022	September 6, 2022 to September 7, 2022	November 14, 2022 to November 17, 2022	February 2, 2023 to February 4, 2023
56-1-1	144.28	142.27	144.40	145.87
57-1-1	129.61	125.30	128.84	129.96
58-1-0	128.09	126.35	127.91	128.46
60-1-1	141.70	140.97	141.56	141.79
60-2-1	141.72	141.00	141.59	141.79
60-3-1	141.27	140.50	141.15	141.47
61-1-1	184.79	183.13	184.10	186.47
62-1-1	172.10	165.54	166.49	174.02
62-2-1	172.09	166.52	165.10	174.03
63-1-1	191.53	188.85	190.75	192.35
63-2-1	193.14	190.56	191.11	193.95
71-1-1	141.67	140.69	141.23	141.95
71-2-1	141.82	139.91	141.46	142.08
71-3-1	141.84	140.93	141.47	142.08
72-1-1	141.57	140.83	141.40	141.70
72-2-1	141.81	141.15	141.35	141.77
72-3-1	141.76	141.02	141.39	141.89
73-1-1	133.63	131.44	133.10	134.41
73-2-1	133.67	131.45	133.15	134.40
73-3-1	132.83	130.76	132.57	133.22
74-2-1	152.24	152.17	152.03	152.05
75-1-1	129.79	128.50	128.13	128.67
76-1-1	158.20	155.71	155.73	158.42
76-2-1	161.00	158.83	159.33	162.07
76-3-1	163.03	161.09	160.17	164.55
77-1-1	153.77	150.90	152.66	152.55
77-2-1	152.93	149.94	151.98	152.05
78-1-1	131.54	127.98	143.40	133.33
78-2-1	134.88	131.75	143.39	137.35
80-1-0 (P8)	113.01	114.01	115.01	115.01
81-1-0 (P9)	116.32	115.87	116.24	116.66
82-1-1	132.84	DRY	DRY	132.87
83-1-1	127.52	127.31	127.30	127.65
85-1-1	145.30	144.96	145.33	145.98
87-1-1	175.91	161.99	159.49	176.30
87-2-1	176.14	162.58	162.56	177.13
88-1-1	170.94	164.10	165.10	171.54
88-2-1	171.34	165.43	165.43	172.02
89-1-1	152.47	---	---	152.67
89-2-1	149.76	---	---	150.33
90-1-1	---	---	---	---
90-2-1	---	---	---	---
91-1-1	160.04	158.35	160.26	160.81
92-1-1	161.36	158.53	160.33	161.42
93-1-1	Obstructed	Destroyed	Destroyed	Destroyed
94-1-1	199.13	183.57	181.58	199.99
LG-02-D	149.08	148.13	148.10	149.00
LG-03-D	149.96	149.81	149.81	149.86
LG-04-D	157.43	157.26	157.04	157.07
LG-08-D	147.49	143.87	143.32	146.56
LG-11-S	155.56	155.55	155.55	155.56
LG-15-D	149.03	148.25	148.25	148.99
LG-16-D	150.45	149.49	149.34	149.69
LG-17-D	151.64	150.06	149.41	149.99
LG-18-D	150.83	150.60	150.14	150.02
LG-19-D	150.44	150.46	150.22	150.16
LG-21-D	142.73	142.65	142.16	142.32
LG-26-D	144.73	144.31	144.25	144.18
95-1-1	---	125.68	126.41	127.57
96-1-1	---	125.76	126.78	127.93
97-1-1	---	125.40	126.28	127.60
98-1-1	---	125.67	126.64	127.66
99-1-1	---	Dry	Dry	131.46
100-1-1	---	Dry	128.64	129.14
101-1-1	---	127.57	128.13	128.65
103-1-1	---	132.40	132.22	132.86
104-1-1	---	130.40	130.71	131.85
105-1-1	---	128.21	128.59	---
106-1-1	---	128.01	128.32	129.05
107-1-1	---	123.79	124.38	124.98
107-1-2	---	Dry	Dry	Dry
108-1-1	---	122.25	123.90	124.30
109-1-1	---	128.29	129.60	128.80
110-1-1	---	132.05	132.90	133.92
P-11	---	125.32	127.83	128.14
P-12	---	120.33	122.77	123.60

Notes:

Bracketed data on bottom of well.

--- - *Not measured*

A4. Surface Water Station Details

Appendix A-4. Surface Water Station Details 2022-2023

Station Name	Location		Status	Parameter List		Comments
	Northing	Easting		Routine		
	UTM (NAD83)	UTM (NAD83)		(4/yr)	(2/yr)	
Sw-N-05	5 376 534.511	465 729.384	Active	Y		Heal Creek - 40m from perimeter fence line
Sw-N-14	5 376 795.252	466 228.944	Active		Y	Heal Creek 2/3 of the way from the Northeast Diversion Ditch to Durrance Creek.
Sw-N-16	5 376 506.808	465 968.695	Active	Y		North Wetland at dischage of Weir SF5 into North Wetland Creek, just above confluence with Heal Creek.
Sw-N-17	5 376 566.303	465 903.628	Active	Y		Heal Creek below confluence with 42 Creek and above confluence with North Wetland Creek.
Sw-N-18	5 376 429.846	465 679.709	Active	Y		Manhole at discharge to Northwest Sedimentation Pond.
Sw-N-19	5 376 423.322	466 040.279	Active	Y		Northeast Diversion Ditch below Northeast Sedimentation Pond, just above discharge into North Wetland.
Sw-N-41s1	5 376 892.202	465 171.078	Active	Y		41 Creek at north side of Willis Point Road, near source.
Sw-N-41s3	5 377 102.438	465 021.226	Active	Y		41 Creek just above discharge to Durrance Lake.
Sw-N-42s1	5 376 753.436	465 553.804	Active	Y		42 Creek at discharge from 42 Wetland below southeast end of Yardwaste Pad. Across Willis Point Road from Well 42.
Sw-N-45	5 376 605.647	465 797.403	Active	Y		Heal Creek just above confluence with 42 Creek.
Sw-N-50	5 376 353.361	465 438.872	Active	Y		Toutle Valley break out.
Sw-N-51	5 376 323.976	465 444.733	Active	Y		NW diversion ditch just above confluence with Toutle Valley break out.
Sw-N-53	5 376 456.000	465 693.000	Active	Y		Drainage from High Level Road North Diversion Ditch to Northwest Sedimentation Pond.
Sw-N-54	5 376 438.000	465 713.000	Active	Y		Runoff from northeast face of Phase 2 and Phase 2 Cell 1 closure into Northwest Sedimentation Pond. Replaced Sw-N-47.
Sw-N-CSs2	5 376 933.072	464 896.583	Active		Y	Control station on south side of Willis Point Rd at ephemeral stream and culvert 300 m west of Yardwaste gate.
Sw-S-03	5 375 637.813	466 077.533	Active	Y		Kilarney Creek at culvert discharging from underneath Recycle Road.
Sw-S-04	5 375 447.329	466 171.246	Active	Y		Kilarney Creek below confluence with Southwest Diversion Ditch.
Sw-S-12	5 375 661.074	465 954.884	Active	Y		At the discharge of Weir SF2, upstream of Killarney Creek.
Sw-S-20	5 375 607.030	465 945.921	Active		Y	At the discharge of Weir SF3, in the Southwest Diversion Ditch where it converges with the South High Level Road.
Sw-S-21	5 375 419.559	466 150.441	Active	Y		Southwest Diversion Ditch just above confluence with Kilarney Creek.
Sw-S-24	5 375 553.049	466 179.487	Active	Y		Kilarney Creek just above confluence with Bike Trail Kiosk Creek and below confluence with Southeast Storm Drain.
Sw-S-27	5 375 591.468	466 163.597	Active	Y		Southeast Storm Drain just above confluence with Kilarney Creek.
Sw-S-52	5 376 059.905	465 472.066	Active		Y	Creek from Mt. Work before entering culvert draining to South Diversion Ditch.
Sw-N-57	5 376 439.917	465 744.608	Active	Y		Added December 5 2022. Green pipe outlet at West end of upper lagoon. Collects directed surface water runoff from Shane's pond and the Toutle Valley.
Sw-N-58	5 376 430.529	465 691.127	Active	Y		Added December 5 2022. Manhole near P11, collecting from black pipe in ditch along High Level Road and groundwater pumped out of P11.
Sw-N-59	5 376 468.163	465 532.662	Active	Y		Added December 5 2022. Manhole near GW 77, collecting surfacewater from the kitcen scraps pad (not yet bult as of May 25 2023).
Sw-N-60	5 376 504.232	465 439.352	Active	Y		Added December 5 2022. Manhole, smaller channel within the manhole collecting directed surfacewater runoff from Shane's pond.
Sw-N-61	5 376 504.346	465 135.424	Active	Y		Added December 5 2022. Manhole on the West side of the road collected surfacewater drainage from Shane's pond. On the East side of the road there is a pipe at the base of a block wall which feeds into this manhole. It is the beginning of the collection point which reports to SW-N-57.
Sw-N-62	5 376 346.869	465 503.734	Active	Y		Added December 5 2022. Culvert at the outlet of ditch in Toutle valley.
Sw-N-63	5 377 369.181	466 786.923	Active	Y		Added February 8 2023. Sampling point on Durrance creek after the confluence of Durrance Creek and Heal creek. Located adjacent to a culvert that runs under the road on private property.
Sw-N-64	5 377 367.064	466 825.288	Active	Y		Added February 8 2023. Sampling point on Todd Creek upstream of the Durrance Creek input.
Sw-N-65	5 377 383.733	466 830.580	Active	Y		Added February 8 2023. Sampling point on Todd Creek downstream of the Durrance Creek input.
Sw-N-15	5 377 109.531	465 982.354	Active	n/a		Durrance Creek well above confluence with Heal Creek.
Sw-N-41s4	5 377 189.115	465 130.141	Active	Y		Discharge from Durrance Lake.

Appendix B

Water Quality Data

- B1. Groundwater Quality
- B2. Domestic Well Quality
- B3. Surface Water Quality
- B4. Monthly Leachate Quality Data – Hartland Valve Chamber
- B5. Quarterly Leachate Quality – Trace Organics
- B6. Monthly Leachate Quality – Phase 2 Cleanout
- B7. Monthly Leachate Quality – North Purge Wells
- B8. Monthly Leachate Quality – Controlled Waste Drainage
- B9. Monthly Leachate Quality – South Purge Well
- B10. Monthly Leachate Quality – West Face Drainage
- B11. Monthly Leachate Quality - Cell 3 Pipe Outlet
- B12. Monthly Leachate Quality Emerging Contaminant

B1. Groundwater Quality

Appendix B-1. Groundwater Quality Data 2022-2023

BC CSR				a AW Maximum (1)							90	50	10000	2 (9)		12000	0.5-4 (5)		1500	90 (7)	40	20-90 (5)		40-160 (5)			
				b DW Maximum (2)						9500	6	10	1000	8		5000	5		250	6000	14 (9)	1500	(6)	10	33 (9)		(6)
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	PH (Field)	Specific Conductivity - 25°C (Field)	Temperature (Field)	Alkalinity	Hardness as CaCO3	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chloride	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese
				Fraction	TOT	TOT	TOT	TOT	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	pH	µS/cm	°C	mg/L	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/L	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l
				Method Detection Limit	0.1	1	0.1	1	0.5	0.5	0.02	0.02	0.02	0.01	0.005	10	0.005	0.05	1	0.1	0.005	0.05	1	0.005	0.5	0.05	0.05
04-3-1	SS	Y	5/25/2022	Clear and colourless	7.48	330	10.8	170	211	1.7	0.067	0.228	40.1	< 0.01	< 0.005	79.	0.029 8	70.2	24.	0.17	0.0505	0.338	2.4	0.039 1	0.72	8.75	0.269
04-3-1	SS	Y	9/28/2022	Clear and colourless.	6.8	470	10.2	160	205	2.75	0.071	0.242	39.8	< 0.01	< 0.005	76.	0.067 4	68.2	24.	0.11	0.033 1	0.401	1.9	0.039	0.6	8.5	0.106
04-3-1	SS	Y	1/12/2023	Clear and colourless	7.64	334	9.4	170	221	2.98	0.072	0.228	43.5	< 0.01	< 0.005	73.	0.021 9	73.	25.	< 0.1	0.033 8	0.485	3.4	0.043 4	0.7	9.46	0.296
04-3-1	SS	Y	3/3/2023	Clear and colourless	7.77	480	9.1	170	214	3.04	0.08	0.227	38.7	< 0.01	< 0.005	78.	0.087 4	71.5	23.	< 0.1	0.031	0.536	5.1	0.033 7	0.58	8.58	0.151
04-4-1	SS	Y	5/25/2022	Clear and colourless	6.95	196	9	66	84.4	8.33	0.052	0.069	7.73	< 0.01	< 0.005	61.	0.009 3	26.5	22.	0.1	0.069 4	1.71	2.3	< 0.005	< 0.5	4.42	2.02
04-4-1	SS	Y	9/28/2022	Clear and colourless.	6.6	332	10.9	98	157	7.73	0.043	0.083	14.1	< 0.01	< 0.005	74.	0.093 6	51.	55.	< 0.1	0.052 7	1.26	3.7	0.023 9	< 0.5	7.27	7.08
04-4-1	SS	Y	1/12/2023	Clear and colourless	6.71	227	8.7	59	105	8.77	0.06	0.088	9.45	< 0.01	< 0.005	62.	0.015 6	33.2	38.	< 0.1	0.064 2	1.87	4.1	0.067 6	< 0.5	5.41	3.01
04-4-1	SS	Y	3/3/2023	Clear and colourless	7.34	330	7.9	58	106	11.9	0.059	0.064	8.88	< 0.01	< 0.005	69.	0.078 8	33.7	43.	0.16	0.059 2	3.57	12.8	0.025 2	< 0.5	5.34	1.86
07-1-0	SS		5/25/2022	Clear and colourless	6.96	728	12.7	260	397	< 0.5	0.028	3.32	14.5	< 0.01	< 0.005	171.	0.011 6	136.	140.	< 0.1	3.05	0.752	1 870.	0.019 5	< 0.5	13.9	2 060.
07-1-0	SS		10/20/2022	Clear and colourless.	7.83	411	11.1	260	401	1.13	0.048	4.11	14.5	< 0.01	< 0.005	166.	0.019 2	138.	120.	< 0.1	6.35	3.39	6 300.	0.031	< 0.5	13.5	2 660.
07-1-0	NS		1/25/2023	Pump/cistern did not turn on, no sample.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
07-1-0	NS		3/3/2023	Pump/cistern did not turn on, no sample.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16-1-1	SS		5/13/2022	Clear and colourless	7.32	243	11	140	158	1.08	0.047	0.108	21.3	< 0.01	< 0.005	25.	0.007 9	52.4	3.3	< 0.1	0.010 3	0.37	23.2	< 0.005	< 0.5	6.62	0.141
16-1-1	NS		10/8/2022	Inaccessible	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16-1-1	NS		1/25/2023	No tubing to sample.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16-1-1	SS		3/16/2023	Clear and colourless	7.05	460	10.7	150	223	8.46	0.104	0.077	8.7	< 0.01	< 0.005	22.	0.022	72.9	5.1	< 0.1	0.091	0.791	13.2	0.010 1	< 0.5	9.95	3.15
16-1-2	SS		5/13/2022	Clear and colourless	6.91	177	10.9	110	113	62.7	0.041	0.132	17.1	0.019	< 0.005	17.	0.02	37.1	2.7	< 0.1	0.091 7	0.748	51.8	0.229	< 0.5	4.85	6.58
16-1-2	NS		10/8/2022	Inaccessible	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16-1-2	NS		1/25/2023	No tubing to sample.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16-1-2	SS		3/15/2023	White, high turbidity, moderate intensity	6.85	510	11.2	110	231	17.8	0.027	0.121	27.4	< 0.01	< 0.005	14.	0.049 2	76.2	8.5	0.12	0.106	0.853	9.9	0.037 9	< 0.5	9.94	5.54
16-2-1	SS		5/13/2022	Clear and colourless	7.1	229	11	150	160	4.52	0.066	0.214	9.28	< 0.01	< 0.005	21.	0.016 7	54.	3.8	< 0.1	0.027 2	0.468	9.4	0.008 9	0.64	5.98	0.218
16-2-1	NS		10/8/2022	Inaccessible	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16-2-1	NS		1/25/2023	No tubing to sample.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16-2-1	SS		3/16/2023	clear and colourless	6.84	500	10.7	130	231	52.6	0.067	0.179	14.9	< 0.01	< 0.005	17.	0.027 3	78.4	6.1	0.3	0.132	0.9	110.	0.013 2	0.57	8.6	2.52
16-2-2	SS		5/13/2022	Clear and colourless	6.99	214	11	110	125	2.25	0.039	0.112	9.4	< 0.01	< 0.005	14.	0.015 8	42.4	3.3	0.2	0.019 3	0.715	1.4	0.005 6	< 0.5	4.72	0.105
16-2-2	NS		10/8/2022	Inaccessible	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16-2-2	NS		1/25/2023	No tubing to sample.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16-2-2	SS		3/16/2023	Clear and colourless	6.72	530	11	120	241	5.7	0.039	0.114	15.9	< 0.01	< 0.005	14.	0.035 6	79.8	7.2	0.16	0.074 1	1.65	7.7	0.007 7	< 0.5	10.1	2.62
17-1-1	SS	Y	10/8/2022	Slightly turbid, colourless.	8.25	400	12	170	158	2.14	0.298	1.32	21.8	< 0.01	< 0.005	25.	0.013 6	47.5	5.7	< 0.1	0.008 6	1.05	2.4	0.009 5	2.78	9.62	1.48
17-1-1	SS	Y	1/25/2023	Clear and colourless	6.72	350	9.6	220	196	2.67	0.582	0.249	13.9	< 0.01	< 0.005	17.	0.018 2	61.6	4.	0.12	0.022 9	1.94	1.6	0.008 8	0.5	10.2	0.328
17-1-2	SS	Y	10/8/2022	Clear and colourless.	6.62	285	11.9	150	161	3.36	0.224	0.857	31.6	< 0.01	< 0.005	30.	0.012	49.8	4.6	< 0.1	0.016 8	1.55	15.7	0.018	2.36	8.83	2.6
17-1-2	SS	Y	1/25/2023	Very slightly turbid, very slightly yellow	6.76	243	9.9	150	174	2.07	0.2	0.279	27.6	< 0.01	< 0.005	16.	0.030 7	53.8	4.	0.26	0.026 9	2.13	15.7	0.006 9	0.61	9.57	0.393
17-1-3	SS	Y	10/8/2022	Clear and colourless.	7.01	390	11.7	240	271	2.18	0.027	0.242	14.2	< 0.01	< 0.005	20.	0.015 2	81.6	3.1	0.23	0.031	0.44	2.3	0.009 1	< 0.5	16.3	0.275
17-1-3	SS	Y	1/25/2023	Clear and colourless	7.37	365	9.4	240	287	9.16	0.033	0.224	20.5	< 0.01	< 0.005	15.	0.017 7	86.6	4.5	0.18	0.092	0.595	5.2	0.018 5	< 0.5	17.2	0.932
18-1-1	FRM	Y	5/13/2022	Mean of duplicates	7.43	1646	10.2	150	173	4.195	0.47	2.38	12.45	< 0.01	< 0.005	26.	0.014 35	57.15	3.85	< 0.1	0.375 5	0.141	14.25	0.010 9	0.905	7.32	78.65
18-1-1	SS	Y	10/20/2022	Clear and colourless.	8	229	12.6	150	165	3.08	0.318	2.66	12.5	< 0.01	< 0.005	28.	0.026 8	54.4	3.2	< 0.1	0.022 9	0.181	< 1.	0.007 4	1.85	7.03	4.92
18-1-1	FRM	Y	1/25/2023	Mean of duplicates	7.76	245	9.8	150	173.5	2.32	0.348	2.665	13.25	< 0.01	< 0.005	28.	0.071 7	57.75	3.05	< 0.1	0.285 5	0.156	2.4	0.011 35	1.605	7.175	72.9
18-1-1	FRM	Y	3/7/2023	Mean of duplicates	7.76	350	10	150	167	16.77	0.541	2.41	13.7	< 0.01	< 0.005	27.	0.014 35	54.95	2.7	0.25	0.205 5	0.15	46.05	0.009 4	0.95	7.255	60.95
18-2-1	SS	Y	5/12/2022	Clear and colourless	7.49	221	9.1	130	153	249.	0.052	0.101	6.83	0.084	0.012 8	< 10.	0.084 6	52.5	5.3	< 0.1	0.366	7.09	177.	1.2	< 0.5	5.29	15.6
18-2-1	SS	Y	10/8/2022	Clear and colourless.	7.04	350	11.9	140	175	1.54	0.026	0.054	2.41	< 0.01	< 0.005	12.	0.052 8	60.4	3.3	< 0.1	0.012 2	1.04	6.5	0.022 2	< 0.5	6.	1.47
18-2-1	SS	Y	1/25/2023	Clear and colourless	7.18	274	10.5	130	189	20.7	0.031	0.05	2.84	< 0.01	< 0.005	< 10.	0.074	64.7	4.	0.6	0.039 8	3.97	27.9	0.104	< 0.5	6.6	0.851
18-2-1	SS	Y	3/7/2023	Clear and colourless	7.36	340	10.4	130	158	11.9	0.029	0.058	2.39	< 0.01	< 0.005	< 10.	0.032 2	53.9	4.5	< 0.1	0.032 1	1.09	7.4	0.013 5	< 0.5	5.66	0.488
18-2-2	SS	Y	1/25/2023	Clear and colourless	6.97	264	10.5	110	155	1.47	0.022	0.048	5.98	< 0.01	< 0.005	< 10.	0.052 3	53.7	4.9	< 0.1	0.046 3	0.667	5.1	< 0.005	< 0.5	5.11	2.07
18-2-2	SS	Y	3/7/2023	Clear and colourless	7.13	340	10.5	130	147	4.18	0.031	0.077	6.44	< 0.01	< 0.005	< 10.	0.044 4	50.4	4.5	< 0.1	0.192	0.557	16.9	0.023 7	< 0.5	5.04	10.1
18-2-2	SS	Y	10/8/2022	Clear and colourless.	8.15	340	11.5	130	168	1.47	0.024	0.057	6.2	< 0.01	< 0.005	10.	0.034	58.5	3.	< 0.1	0.020 7	0.703	1.4	0.008 4	< 0.5	5.31	0.441
18-2-2	SS	Y	5/12/2022	Clear and colourless	7.28	214	10.2	130	155	9.24	0.025	0.055	4.57	< 0.01	< 0.005	< 10.	0.017 7	53.8	5.1	< 0.1	0.134	1.26	34.3	0.036 6	< 0.5	4.97	3.98
19-1-1	SS		5/25/2022	Clear and moderately orange	7.4	294	9.8	160	177	< 0.5	< 0.02	0.414	3.76	< 0.01	< 0.005	30.	< 0.005	57.5	11.	< 0.1	0.891	< 0.05	725.	< 0.005	0.59	8.04	1 800.
19-1-1	SS		9/28/2022	Slightly turbid, slightly yellow.	7.03	480	11.9	210	227	3.86	0.095	0.767	5.54	< 0.01	< 0.005	22.	0.073 3	74.5	17.	< 0.1	0.41	0.181	1 820.	0.010 6	0.57	9.91	2 560.
19-1-1	SS		1/25/2023	Very turbid, very orange/brown	7.11	532	9.7	330	389	2.43	0.157	3.28	8.19	< 0.01	< 0.005	22.	< 0.005	128.	32.	0.15	1.23	0.097	10 500.	0.014 1	< 0.5	16.6	4 880.
19-1-1	SS		3/3/2023	Clear and colourless	7.05	740	8.9	350	357	8.07	0.026	2.35	8.08	< 0.01	0.016 6	17.	0.012 3	118.	33.	0.16	0.158	0.241	15 100.	0.016 1	< 0.5	15.	4 700.
19-1-2	SS		5/25/2022	Clear and colourless	7.27	246	9.8	150	170	1.63	< 0.02	1.53	4.57	< 0.01	< 0.005	24.	< 0.005	55.	8.9	< 0.1	0.513	< 0.05	2 090.	< 0.005	< 0.5	7.84	1 030.
19-1-2	SS		9/28/2022	Clear and colourless.	6.01	357	12.3	190	206	13.8	0.02	1.12	4.24	< 0.01	< 0.005	16.	< 0.005	66.4	13.	< 0.1	0.096 1	0.119	3 820.	0.005	< 0.5	9.73	1 620.
19-1-2	SS		1/25/2023	Very slightly turbid with red/orange bits, water is colourless.	7.23	355	9.4	220	234	2.79	0.022	0.969	5.98	< 0.01	< 0.005	28.	< 0.005	76.3	18.	0.18	0.189	0.071	6 340.	0.007 6	< 0.5	10.5	1 710.
19-1-2	SS		3/3/2023	Clear and colourless	7.32	450	9	200	214	1.69	< 0.02	0.94	4.88	< 0.01	< 0.005	20.	< 0.005	69.8	14.	< 0.1	0.049 7	0.084	5 240.	< 0.005	< 0.5	9.67	1 470.
19-2-1	SS		5/25/2022	Clear and colourless	7.51	291	10.1	140	176	0.73	< 0.02	0.216	39.1	< 0.01	< 0.005	64.	< 0.005	53.3	15.	< 0.1	0.059 7	< 0.05	49.9	< 0.005	< 0.5	10.5	80.8
19-2-1	SS		9/27/2022	Clear and colourless.	7.28	309	11.2	140	188	2.21	< 0.02	0.248	40.6	< 0.01	< 0.005	68.	0.007 7	58.	15.	< 0.1	0.051 5	0.087	75.8	0.005 3	< 0.5	10.6	81.7
19-2-1	SS		1/25/2023	Clear and colourless	7.8	289	9.7	150	198	3.05	0.071	0.244	40.8	< 0.01	< 0.005	68.	0.005 3	60.5	15.	< 0.1	0.058 3	0.053	195.	0.011	< 0.5	11.4	89.6
19-2-1	SS		3/3/2023	Clear and colourless	7.75	400	9.3	150	198	2.5	0.023	0.291	40.8	< 0.01	< 0.005	68.	< 0.005	61.1	15.	< 0.1	0.108	0.14	95.2	0.005 5	< 0.5	11.	93.7
19-2-2	SS		5/25/2022	Slightly silty and slightly brown	7.53	249	9.7	110	150	1.15	< 0.02	0.033	11.5	< 0.01	< 0.005	60.	< 0.005	43.	15.	< 0.1	0.014 2	0.09	3.4	< 0.005	0.64	10.3	7.4
19-2-2	SS		9/27/2022	Slightly turbid, slightly yellow.	7.78	336	12.2	160	204	12.5	< 0.02	0.129	17.6	< 0.01	< 0.005	49.	0.047 3	62.1	20.	< 0.1	0.034 9	0.44	96.3	0.036 4	< 0.5	11.8	29.7
19-2-2	SS		1/25/2023	Moderatley turbid, moderately orange	7.58	149	9.8	110	160	6.3	0.022	0.104	15.6	< 0.01	< 0.005	58.	0.009 3	48.5	15.	< 0.1	0.007 8	0.148	15.	0.025 1	0.56	9.39	2.31
19-2-2	SS		3/6/2023	Clear and colourless	7.42	330	8.5	110	144	4.42	0.026	0.061	13.5	< 0.01	< 0.005	52.	0.367	41.9	16.	< 0.1	0.023 1	0.707	13.3	0.034 4	0.73	9.58	4.79
20-1-1	SS	Y	5/20/2022	Slightly silty and colourless	8.35	120	10.9	68	57.5	2.7	< 0.1	< 0.1	1.67	< 0.05	< 0.025	4 570.	< 0.025	18.6	4.3	< 0.5	< 0.025	< 0.25	< 5.	< 0.025	< 2.5	2.68	3.7
20-1-1	SS	Y	9/20/2022	Clear, colourless.	7.96	156	12.1	76	67.1	4.5	< 0.1	< 0.1	3.68	< 0.05	< 0.025	4 770.	< 0.025	21.5	5.4	< 0.5	< 0.025	< 0.25	< 5.	< 0.025	< 2.5	3.28	11.
20-1-1	SS	Y	12/14/2022	Clear and colourless	8.4	137	10.3	75	67.4	4.8	< 0.1	< 0.1	3.12	0.065	< 0.025	4 440.	0.047	21.8	4.	< 0.5	0.04	< 0.25	13.3	0.038	< 2.5	3.17	5.87
20-1-1	SS	Y	3/9/2023	Clear and colourless	8.4	190	10	73	66	3.2	< 0.1	< 0.1	3.45	< 0.05	< 0.025	4 270.	< 0.025	21.3	5.2	< 0.5	0.038	0.26	< 5.	< 0.025	< 2.5	3.11	10.4
20-1-2	SS	Y	5/20/2022	Clear and colourless	8.15	152	11.1	84	77.6	2.5	< 0.1	< 0.1	3.36	< 0.05	< 0.025	4 010.	< 0.025	24.2	7.5	< 0.5	0.028	< 0.25	7.4	< 0.025	< 2.5	4.17	16.4
20-1-2	SS	Y	9/20/2022	Clear, colourless.	7.08	220	13.1	85	86.2	3.9	< 0.1	< 0.1	4.88	< 0.05	< 0.025	3 270.	< 0.025	27.	8.	< 0.5	0.095	< 0.25	24.	< 0.025	< 2.5	4.56	18.6
20-1-2	SS	Y	12/13/2022	Clear and colourless	8.39	201	11	83	64.4	3.1	< 0.1	< 0.1	3.37	< 0.05	< 0.025	4 360.	< 0.025	20.7	5.3	< 0.5	0.026	< 0.25	15.3	< 0.025	< 2.5	3.1	10.6
20-1-2	SS	Y	3/9/2023	Clear and colourless	8.3	210	11.4	80	77.1	4.4	< 0.1	< 0.1	4.25	< 0.05	< 0.025	4 450.	0.052	24.	6.3	< 0.5	0.057	< 0.25	10.3	< 0.025	< 2.5	4.16	12.9
21-1-1	FRM	Y	5/20/2022	Mean of duplicates	8.32	127	11.4	70.5	64.2	< 2.5	< 0.1	1.215	1.745	< 0.05	< 0.025	3 945.	< 0.025	19.65	3.9	< 0.5	< 0.025	41.525 a	20.35	< 0.025	< 2.5	3.66	6.535
21-1-1	FRM	Y	9/21/2022	Mean of duplicates	7.595	139	12.8	68.5	67.55	6.43	< 0.02	3.715	2.615	< 0.01	< 0.005	3 840.	< 0.005	21.15	3.15	< 0.1	0.007 8	0.227	13.4	0.010 4	0.98	3.58	4.71
21-1-1	FRM	Y	12/15/2022	Mean of duplicates	8.51	131	10.2	71	67.1	7.9	0.070 5	1.595	3.085	0.106	0.028 5	4 305.	0.138 5	21.	2.85	0.375	0.149	0.285	21.3	0.136 5	1.85	3.56	8.425
21-1-1	FRM	Y	3/10/2023	Mean of duplicates	8.53	170	10.7	70	61.85	3.05	< 0.1	1.175	2.35	< 0.05	< 0.025	4 100.	< 0.025	19.15	3.6	< 0.5	< 0.025	0.275	6.9	0.060 5	< 2.5	3.39	9.4
21-1-2	FRM	Y	5/19/2022	Mean of duplicates	7.17	316	11.3	170	140	1.36	< 0.02	1.25	15.4	< 0.01	< 0.005	705.5	< 0.005	41.	25.	1.445	0.985	0.467 5	871.5	< 0.005	< 0.5	9.14	1 690.
21-1-2	FRM	Y	9/20/2022	Mean of duplicates	7.53	489	14.9	185	171.5	4.325	0.02	1.285	19.15	< 0.01	< 0.005	623.	0.007 7	51.55	46.	0.245	1.065	0.291	1 115.	0.005 9	< 0.5	10.35	2 035.
21-1-2	FRM	Y	12/14/2022	Mean of duplicates	6.9	410	10.9	190	181.5	23.56	0.030 5	1.385	19.8	< 0.01	< 0.005	866.	0.015 35	54.7	44.5	0.345	1.235	0.367	1 230.	0.016 8	< 0.5	11.	2 195.
21-1-2	FRM	Y	3/10/2023	Mean of duplicates	7.14	430	11.1	160	131	57.25	< 0.02	1.27	15.65	< 0.01	< 0.005	696.	0.008 7	39.2	23.	0.325	0.953 5	0.343 5	920.5	0.011 9	< 0.5	7.98	1 455.
21-2-1	FRM	Y	5/19/2022	Mean of duplicates	6.83	344	10.9	170	142	1.855	0.021 5	1.7	13.65	< 0.01	< 0.005	609.	0.007 1	41.55	31.5	0.13	1.06	0.36	1 005.	0.005 55	< 0.5	9.23	1 840.
21-2-1	FRM	Y	9/20/2022	Mean of duplicates	6.82	483	14.2	200	181.5	4.545	0.030 5	1.61	17.7	< 0.01	< 0.005	589.5	0.011 55	54.45	53.5	0.16	1.21	0.244 5	950.5	0.007 3	< 0.5	11.05	2 280.
21-2-1	FRM	Y	12/15/2022	Mean of duplicates	6.88	404	10.7	190	170	1.97	< 0.02	1.495	17.15	0.021 5	< 0.005	785.5	0.021 85	51.	45.	0.285	1.315	0.410 5	1 060.	0.024 1	< 0.5	10.25	2 240.
21-2-1	FRM	Y	3/10/2023	Mean of duplicates	7.04	450	10	160	127.5	24.335	< 0.02	1.745	12.9	< 0.01	< 0.005	582.	0.007 75	38.25	27.5	0.21	1.003	0.320 5	770.	0.012 35	< 0.5	7.855	1 600.

Appendix B-1. Groundwater Quality Data 2022-2023

BC CSR				a AW Maximum (1)							90	50	10000	2 (9)		12000	0.5-4 (5)		1500	90 (7)	40	20-90 (5)		40-160 (5)			
				b DW Maximum (2)						9500	6	10	1000	8		5000	5		250	6000	14 (9)	1500	(6)	10	33 (9)		(6)
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	PH (Field)	Specific Conductivity - 25°C (Field)	Temperature (Field)	Alkalinity	Hardness as CaCO3	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chloride	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese
				Fraction	TOT	TOT	TOT	TOT	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	pH	µS/cm	°C	mg/L	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/L	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l
				Method Detection Limit	0.1	1	0.1	1	0.5	0.5	0.02	0.02	0.02	0.01	0.005	10	0.005	0.05	1	0.1	0.005	0.05	1	0.005	0.5	0.05	0.05
25-1-1	SS		5/17/2022	Clear and colourless	7.45	505	11.4	130	335	2.05	0.151	0.121	6.05	< 0.01	< 0.005	228.	0.009 1	114.	5.	< 0.1	0.077 1	0.269	2.4	0.005 5	< 0.5	11.9	36.5
25-1-1	SS		9/1/2022	Clear, colourless	8.22	491	13.9	150	301	2.24	0.21	0.224	8.86	< 0.01	< 0.005	235.	0.008 8	104.	4.5	< 0.1	0.021 5	0.257	5.	< 0.005	0.63	10.3	7.71
25-1-1	SS		12/6/2022	Clear and colourless	7.32	469	10.2	140	325	3.24	0.15	0.128	6.83	< 0.01	< 0.005	252.	0.008 6	112.	4.	0.21	0.105	0.309	8.2	0.015 2	< 0.5	11.2	46.6
25-1-1	SS		3/17/2023	Clear and colourless	7.4	610	10.8	150	301	0.88	0.188	0.184	9.2	< 0.01	< 0.005	214.	0.014 6	103.	5.2	< 0.1	0.046 3	0.219	1.2	< 0.005	< 0.5	10.9	19.7
25-1-2	SS		5/17/2022	Clear and colourless	7.36	223	10.3	94	141	1.32	0.114	0.129	4.28	< 0.01	< 0.005	86.	< 0.005	50.4	2.4	< 0.1	0.121	0.457	113.	< 0.005	< 0.5	3.62	47.
25-1-2	SS		9/1/2022	Clear, colourless	8.15	419	14.5	110	242	11.7	0.193	0.15	6.61	< 0.01	< 0.005	112.	< 0.005	86.9	2.5	< 0.1	0.181	1.47	71.3	0.009 7	< 0.5	6.03	79.6
25-1-2	SS		12/1/2022	Clear and colourless	7.22	285	10.3	110	169	10.4	0.307	0.14	6.19	< 0.01	< 0.005	122.	0.005 7	60.7	3.5	< 0.1	0.091 4	0.536	14.5	0.010 5	< 0.5	4.2	41.2
25-1-2	SS		3/16/2023	clear and colourless	7.28	320	10.9	96	152	1.83	0.156	0.124	3.93	< 0.01	< 0.005	112.	< 0.005	54.4	3.	< 0.1	0.136	0.48	7.6	0.040 7	< 0.5	3.95	48.6
27-1-2	NS		12/14/2022	No sample, well destroyed	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
27-1-1	SS		9/9/2022	Slightly turbid, slightly grey	6.25	240	12.2	66	88.9	17.7	< 0.02	0.192	9.07	< 0.01	< 0.005	256.	< 0.005	25.	4.	< 0.1	0.036 2	0.16	73.8	0.021 7	0.53	6.45	35.7
27-1-1	SS		12/13/2022	Very silty, very grey	8.17	173	8.8	75	88.3	25.2	< 0.02	0.177	9.63	< 0.01	< 0.005	241.	< 0.005	24.5	3.8	< 0.1	0.027	0.252	42.8	0.034 5	0.6	6.56	29.3
27-1-1	SS		3/14/2023	Clear and colourless	8.4	250	8.9	71	85.8	81.2	< 0.04	0.204	8.96	< 0.02	< 0.01	236.	< 0.01	23.5	3.5	< 0.2	0.042	0.41	67.1	0.23	< 1.	6.61	29.5
27-1-2	NS		9/9/2022	DRY	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
27-1-2	NS		3/14/2023	Well destroyed, not sampled	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
29-1-2	SS	Y	5/13/2022	Clear and colourless	6.82	285	10.2	84	127	2.18	0.076	0.052	3.47	< 0.01	< 0.005	238.	0.007 1	42.4	40.	0.13	0.029 6	1.31	20.6	< 0.005	< 0.5	5.09	0.801
29-1-2	NS	Y	9/21/2022	Forgot?	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
29-1-2	SS	Y	12/15/2022	Clear and colourless	6.61	352	10	85	157	2.11	0.095	0.037	4.72	< 0.01	< 0.005	289.	0.011 3	52.5	55.	0.16	0.031 7	1.28	19.9	< 0.005	< 0.5	6.29	1.58
29-1-2	SS	Y	2/27/2023	Clear and colourless	6.99	460	9.8	84	139	1.73	0.097	0.05	3.92	< 0.01	< 0.005	270.	0.007 7	46.4	57.	0.17	0.025 6	1.11	124.	0.010 1	< 0.5	5.52	2.9
28-1-0	SS	Y	5/20/2022	Clear and colourless	7.26	279	11.7	160	172	0.63	0.024	0.095	1.48	< 0.01	< 0.005	1 140.	< 0.005	57.5	5.2	< 0.1	0.042 2	0.157	46.6	< 0.005	< 0.5	6.99	5.2
28-1-0	SS	Y	9/12/2022	Clear, colourless	6.55	390	14.4	150	191	0.94	0.044	0.117	1.11	< 0.01	< 0.005	809.	< 0.005	64.5	4.3	0.14	0.059 5	0.164	88.5	< 0.005	< 0.5	7.18	6.88
28-1-0	SS	Y	1/25/2023	Clear and colourless.	6.99	290	11.7	170	198	9.59	0.036	0.115	2.18	< 0.01	< 0.005	1 060.	0.010 5	66.5	5.2	0.16	0.039 4	0.232	29.8	0.012 5	< 0.5	7.69	4.98
28-1-0	SS	Y	3/14/2023	Clear and colourless	7.21	400	10.6	170	182	30.4	0.029	0.146	2.27	< 0.01	< 0.005	1 020.	0.009 4	61.1	5.2	0.31	0.084 4	0.291	78.3	0.006 7	< 0.5	7.23	5.33
29-1-1	SS	Y	5/13/2022	Clear and colourless	7.14	282	10.4	100	135	0.84	0.023	0.261	1.34	< 0.01	< 0.005	392.	0.017 6	45.3	38.	0.24	0.010 6	0.243	7.9	< 0.005	< 0.5	5.32	0.126
29-1-1	FRM	Y	9/21/2022	Mean of duplicates	6.985	392	12.7	105	137	4.435	0.02	0.335 5	2.275	< 0.01	< 0.005	310.	0.009 35	45.7	33.	0.155	0.039 95	0.174	73.25	0.007 75	< 0.5	5.5	10.15
29-1-1	SS	Y	12/15/2022	Clear and colourless	6.84	287	10	110	162	1.5	0.027	0.223	1.74	< 0.01	< 0.005	448.	0.009 9	54.3	38.	0.25	0.018 2	0.208	2.4	< 0.005	< 0.5	6.29	0.361
29-1-1	SS	Y	2/27/2023	Clear and colourless	6.98	430	9.9	100	155	< 0.5	< 0.02	0.232	1.73	< 0.01	< 0.005	406.	0.007 2	52.3	43.	0.27	0.011 8	0.227	2.5	< 0.005	< 0.5	5.9	0.068
30-1-1	SS	Y	5/12/2022	Clear and colourless	7.61	393	9.7	170	238	73.4	0.077	0.48	49.3	0.014	0.015	426.	0.037 2	81.5	52.	< 0.1	0.044 9	0.405	296.	0.642	2.01	8.33	6.4
30-1-1	SS	Y	9/22/2022	Clear and colourless.	7.55	441	12.7	170	220	2.05	0.047	0.418	45.8	< 0.01	< 0.005	348.	0.009 6	75.7	47.	< 0.1	0.084 7	0.148	7.4	0.010 4	1.43	7.44	19.7
30-1-1	NS	Y	12/15/2022	Heals Range - did not have access	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
30-1-1	SS	Y	2/15/2023	Clear and colourless	7.84	560	10.3	180	226	1.49	0.045	0.418	52.2	< 0.01	< 0.005	361.	0.014 6	77.8	46.	0.11	0.026 8	0.147	2.2	0.008 3	1.94	7.74	5.71
30-1-2	SS	Y	5/12/2022	Clear and colourless	6.9	237	9.4	53	66.5	8.18	0.025	0.137	6.84	< 0.01	< 0.005	42.	0.158	21.6	49.	< 0.1	0.039	0.751	6.4	0.008 1	< 0.5	3.05	0.444
30-1-2	SS	Y	9/22/2022	Clear and colourless.	8.22	502	13.7	160	216	1.93	0.059	0.3	9.48	< 0.01	< 0.005	285.	0.059 5	75.2	64.	< 0.1	0.052 7	0.571	10.7	< 0.005	< 0.5	6.9	1.38
30-1-2	NS	Y	12/15/2022	Heals Range - did not have access	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
30-1-2	SS	Y	2/15/2023	Clear and colourless	6.92	320	8.9	41	73.9	5.91	0.024	0.134	7.26	< 0.01	< 0.005	50.	0.125	24.2	47.	0.1	0.032 4	0.586	3.5	< 0.005	< 0.5	3.29	0.322
31-1-2	SS	Y	5/16/2022	Clear and colourless	6.78	498	10	110	342	2.62	0.04	0.083	3.51	< 0.01	< 0.005	46.	0.019 5	119.	10.	< 0.1	0.032 7	0.67	5.8	0.015 5	< 0.5	10.8	1.03
31-1-2	SS	Y	9/21/2022	Clear and colourless.	6.83	436	12.7	130	301	2.36	0.035	0.12	4.62	< 0.01	< 0.005	53.	0.021 6	105.	3.9	< 0.1	0.033 2	1.01	3.2	< 0.005	< 0.5	9.31	0.784
31-1-2	SS	Y	12/16/2022	Clear and colourless	7	583	10	120	405	2.12	0.04	0.133	6.23	< 0.01	< 0.005	44.	0.020 4	142.	8.4	< 0.1	0.038 8	1.09	2.3	0.006 5	< 0.5	12.5	0.125
31-1-1	FRM	Y	5/16/2022	Mean of duplicates	7.08	504	10.6	140	325	1.95	0.06	0.161 5	3.825	< 0.01	< 0.005	44.	0.034 75	114.5	3.95	< 0.1	0.187 5	0.67	3.4	< 0.005	< 0.5	9.22	41.15
31-1-1	FRM	Y	9/21/2022	Mean of duplicates	6.96	589	10.9	150	330.5	1.13	0.055 5	0.198	4.765	< 0.01	< 0.005	56.	0.031 35	117.5	3.8	< 0.1	0.183	1.008	23.6	< 0.005	< 0.5	8.86	38.9
31-1-1	FRM	Y	12/15/2022	Mean of duplicates	7.02	480	9.7	160	389	2.54	0.061	0.204 5	5.72	< 0.01	< 0.005	51.5	0.032 7	137.5	2.85	0.1	0.195	0.448	3.95	< 0.005	< 0.5	11.1	42.9
36-3-1	SS		5/18/2022	Clear and colourless	6.84	1348	11.1	150	269	1.71	0.062	0.161	15.9	< 0.01	< 0.005	280.	0.021	90.5	13.	0.13	1.46	0.431	118.	0.017 7	< 0.5	10.4	282.
36-3-1	SS		9/15/2022	Clear, colourless	7.99	906	14.7	290	580	2.88	0.071	0.267	36.1	< 0.01	< 0.005	85.	0.005 8	177.	20.	0.15	0.112	1.04	14.9	0.007 4	0.61	33.7	5.45
36-3-1	SS		12/9/2022	Clear and colourless	7	805	12	350	597	36.6	0.081	0.271	42.2	< 0.01	< 0.005	74.	0.010 5	183.	16.	0.16	0.159	1.14	69.3	0.011 1	< 0.5	33.8	3.38
36-3-1	SS		3/9/2023	Clear and colourless	7.27	1000	11.9	330	513	17.9	0.074	0.249	44.8	< 0.01	< 0.005	78.	0.022 2	152.	14.	0.15	0.142	1.11	29.	0.029 5	0.64	32.3	0.84
37-3-1	SS		5/18/2022	Clear and colourless	7.25	838	12.2	350	578	1.62	0.065	0.244	60.9	< 0.01	< 0.005	72.	0.005 5	171.	15.	< 0.1	0.106	1.18	1.7	< 0.005	0.74	36.5	0.589
37-3-1	SS		9/20/2022	Clear and colourless.	7.06	720	13.2	190	348	1.56	0.031	0.207	21.2	< 0.01	< 0.005	601.	0.025 1	118.	14.	0.11	1.45	0.223	627.	0.014 7	0.51	12.9	479.
37-3-1	FRM		12/8/2022	Mean of duplicates	6.92	486	10.2	180	391	8.265	0.037 5	0.242 5	22.25	< 0.01	< 0.005	316.	0.026 4	134.5	10.5	0.175	1.255	0.172	367.5	0.026 45	< 0.5	13.25	495.
37-3-1	SS		3/9/2023	Clear and colourless	7.16	590	10.1	170	274	2.65	0.021	0.374	17.9	< 0.01	< 0.005	245.	0.018 3	92.4	12.	< 0.1	0.737	0.105	725.	0.008 1	< 0.5	10.5	391.
38-1-1	SS		5/18/2022	Clear and colourless	7.37	518	12	300	320	2.51	0.243	0.366	7.56	< 0.01	< 0.005	207.	0.025 6	98.5	15.	0.1	0.081 8	0.944	1.4	< 0.005	0.65	18.	0.078
38-1-1	SS		10/7/2022	Clear and colourless.	6.78	570	12.8	240	330	5.83	0.231	0.503	9.55	< 0.01	< 0.005	198.	0.15	98.5	12.	< 0.1	0.039 1	1.07	6.7	0.038 9	0.84	20.3	0.296
38-1-1	SS		12/15/2022	Clear and colourless	7.37	473	12.1	290	329	2.56	0.188	0.443	8.06	< 0.01	< 0.005	204.	0.039 3	101.	11.	< 0.1	0.072 1	0.709	4.4	0.052 8	0.61	18.5	0.475
38-1-1	SS		3/14/2023	Clear and colourless	7.45	660	11	290	299	1.73	0.201	0.479	8.27	< 0.01	< 0.005	176.	0.026 4	90.8	13.	0.27	0.066 6	0.637	2.4	0.025 5	0.65	17.7	0.053
39-1-1	FRM	Y	5/17/2022	Mean of duplicates	8.21	195	11.4	99.5	116.5	2.64	0.117 5	0.336	6.155	< 0.01	< 0.005	17.	0.012 4	40.7	2.7	< 0.1	0.015	0.312	1.95	0.005 7	< 0.5	3.56	< 0.05
39-1-1	SS	Y	9/15/2022	Clear, colourless	7.8	226	13.9	100	117	5.82	0.112	0.254	6.69	< 0.01	< 0.005	20.	0.015 3	41.	1.8	< 0.1	0.021 1	0.418	15.8	0.010 4	< 0.5	3.45	0.295
39-1-1	SS	Y	12/7/2022	Clear and colourless	7.87	188	9.9	100	125	14.5	0.138	0.44	7.55	< 0.01	< 0.005	22.	0.027 7	44.	1.8	0.17	0.025 5	0.922	26.5	0.014 4	< 0.5	3.64	0.639
39-1-1	FRM	Y	3/9/2023	Mean of duplicates	7.95	320	10.7	98	141	2.54	0.691 5	0.308 5	7.645	< 0.01	< 0.005	17.5	0.025 1	49.35	4.35	0.115	0.034 35	0.208 5	3.8	0.006 05	< 0.5	4.345	0.169
39-2-1	SS	Y	12/7/2022	Clear and colourless	7.58	270	11.1	160	183	1.32	0.177	0.52	3.48	< 0.01	< 0.005	840.	< 0.005	63.6	3.9	0.21	0.009 6	0.208	2.1	< 0.005	< 0.5	5.84	1.75
39-2-1	SS	Y	3/9/2023	Clear and colourless	7.76	390	10.2	150	181	0.93	0.469	0.481	2.66	< 0.01	< 0.005	728.	< 0.005	62.1	9.1	< 0.1	0.031 5	0.268	< 1.	< 0.005	< 0.5	6.18	1.77
39-2-1	SS	Y	9/15/2022	Clear, colourless	7.45	340	12.1	150	158	1.37	0.17	0.502	3.16	< 0.01	< 0.005	957.	< 0.005	54.6	3.5	< 0.1	0.010 1	0.235	1.4	< 0.005	< 0.5	5.2	2.02
39-2-1	SS	Y	5/17/2022	Clear and colourless	7.62	262	11.7	150	175	1.64	0.206	0.451	1.62	< 0.01	< 0.005	783.	< 0.005	60.1	3.9	< 0.1	0.007 4	0.361	< 1.	< 0.005	< 0.5	5.96	0.911
40-1-1	SS		5/19/2022	Clear and colourless	7.23	328	13	170	172	2.45	0.178	0.063	4.22	< 0.01	< 0.005	115.	0.005 5	58.7	5.6	< 0.1	0.244	1.64	2.5	0.011 5	< 0.5	6.26	10.6
40-1-1	SS		9/22/2022	Clear and colourless.	6.51	510	14.3	210	233	4.91	0.157	0.1	5.76	< 0.01	< 0.005	149.	0.012 7	80.5	6.6	< 0.1	0.316	1.84	14.1	0.052 6	< 0.5	7.66	51.4
40-1-1	SS		12/14/2022	Clear and colourless	7.09	449	12.6	240	287	1.8	0.139	0.094	6.19	0.016	< 0.005	195.	0.024 3	99.7	6.6	0.15	0.404	1.49	6.2	0.017 8	< 0.5	9.22	141.
40-1-1	SS		3/9/2023	Clear and colourless	7.23	500	12.8	190	210	1.69	0.172	0.088	5.49	< 0.01	< 0.005	128.	0.011 5	72.4	7.5	0.14	0.272	1.53	3.3	0.011 9	< 0.5	7.18	29.6
41-1-1	FRM	Y	5/13/2022	Mean of duplicates	7.25	286	9.9	150	200	5.395	0.030 5	4.42	1.595	< 0.01	< 0.005	28.5	0.012 55	68.2	5.45	< 0.1	0.055 85	0.318	45.4	0.008 7	< 0.5	7.19	117.
41-1-1	FRM	Y	9/22/2022	Mean of duplicates	6.76	384	12.3	160	201.5	3.205	0.040 5	2.54	2.83	< 0.01	< 0.005	28.	0.078 5	68.9	5.9	< 0.1	0.111 5	0.309 5	9.1	< 0.005	< 0.5	7.095	329.
41-1-1	FRM	Y	12/15/2022	Mean of duplicates	7.36	315	10	160	216	1.255	0.034	4.17	2.77	0.022	< 0.005	53.5	0.017 2	73.95	6.65	0.11	0.117 5	0.221 5	11.95	0.008 3	< 0.5	7.56	476.5
41-1-1	FRM	Y	2/27/2023	Mean of duplicates	7.41	430	9	150	205	5.695	0.051	2.05	2.725	< 0.01	< 0.005	29.5	0.044 05	70.7	9.25	0.11	0.031 45	0.209 5	19.4	0.011 95	< 0.5	6.86	21.4
42-1-1	FRM	Y	5/13/2022	Mean of duplicates	7.01	370	9.2	190	259	5.46	< 0.02	0.162	13.85	0.010 5	< 0.005	76.5	< 0.005	94.4	13.5	0.165	0.050 25	0.053 5	662.5	< 0.005	< 0.5	5.675	158.5
42-1-1	SS	Y	9/21/2022	Clear and colourless.	7.65	494	12.5	210	304	77.1	< 0.02	0.206	16.6	0.01	< 0.005	100.	0.007 1	111.	19.	0.27	0.082 9	0.325	885.	0.022 7	< 0.5	6.5	172.
42-1-1	FRM	Y	12/15/2022	Mean of duplicates	7.04	423	9.4	220	296	24.875	< 0.02	0.163	15.95	0.022	< 0.005	113.5	0.005 9	108.5	15.	0.39	0.088 2	0.149	767.5	0.011 35	< 0.5	6.155	173.
42-1-1	FRM	Y	2/27/2023	Mean of duplicates	5.6	580	8.3	190	272.5	4.885	< 0.02	0.162 5	14.15	< 0.01	< 0.005	78.5	0.013 2	99.65	15.5	0.2	0.038 1	0.051	704.5	0.006 55	< 0.5	5.545	153.
43-1-1	SS		5/31/2022	Clear and colourless	7.87	488	11.5	240	330	7.31	0.269	0.228	7.75	< 0.01	< 0.005	665.	0.031 5	116.	9.9	< 0.1	0.087 3	2.96	2.4	0.028 9	0.83	9.85	3.48
43-1-1	SS		9/8/2022	Clear, colourless	8.06	509	13.2	220	326	4.19	0.439	0.206	10.2	< 0.01	< 0.005	647.	0.019 9	115.	10.	< 0.1	0.039 7	4.05	6.5	< 0.005	0.94	9.71	0.171
43-1-1	SS		12/6/2022	Clear and colourless	7.59	477	11.2	260	324	23.3	0.662	0.234	11.7	< 0.01	< 0.005	688.	0.041 7	114.	9.4	0.27	0.071 1	3.61	39.	0.045 8	0.82	9.45	3.28
43-1-1	SS		3/2/2023	Clear and colourless	7.65	640	8.8	250	335	21.1	0.351	0.258	10.1	< 0.01	< 0.005	656.	0.020 4	117.	9.	0.15	0.074 4	2.92	87.1	0.132	0.88	10.1	2.48
44-1-1	SS		5/31/2022	Clear and colourless	7.69	321	10.6	190	223	4.95	0.224	0.021	10.3	< 0.01	< 0.005	96.	0.013 7	80.7	6.	0.16	0.041 4	0.527	16.7	0.071 5	0.52	5.08	1.47
44-1-1	SS		9/15/2022	Clear, colourless	8.25	351	11.5	190	221	2.91	0.245	0.059	11.9	< 0.01	< 0.005	88.	0.013 8	80.1	5.8	< 0.1	0.025 7	0.433	16.7	0.082 6	0.68	5.19	1.56
44-1-1	SS		12/6/2022	Clear and colourless	7.51	328	10.6	200	224	1.43	0.217	0.067	11.8	< 0.01	< 0.005	94.	0.018 7	81.5	2.6	0.18	0.02	0.526	4.6	0.064 3	0.53	4.87	0.722
44-1-1	SS		3/2/2023	Clear and colourless	7.7	450	8.8	200	227	2.07	0.296	0.067	12.4	< 0.01	< 0.005	120.	0.015 1	82.4	5.5	< 0.1	0.045	0.391	6.5	0.053 7	0.63	5.18	5.7
51-1-1	SS		5/19/2022	Clear and colourless	7.02	176	10	73	96.2	2.26	0.035	0.427	3.9	< 0.01	< 0.005	46.	0.006	32.9	4.7	< 0.1	0.041 5	1.62	1.5	< 0.005	< 0.5	3.42	1.53
51-1-1	SS		9/9/2022	Clear, colourless	6.82	192	12.3	98	122	8.66	0.036	0.484	5.44	< 0.01	< 0.005	68.	0.009 5	42.6	4.1	< 0.1	0.042 3	1.72	27.	0.009 8	< 0.5	3.85	4.58
51-1-1	SS		12/13/2022	Clear and colourless	6.74	298	10.7	90	136	2.58	0.036	0.403	4.52	< 0.01	< 0.005	62.	0.008 2	47.2	5.1	< 0.1	0.029 8	1.32	2.6	0.005 1	< 0.5	4.44	3.35

Appendix B-1. Groundwater Quality Data 2022-2023

BC CSR				a AW Maximum (1)							90	50	10000	2 (9)		12000	0.5-4 (5)		1500	90 (7)	40	20-90 (5)		40-160 (5)			
				b DW Maximum (2)						9500	6	10	1000	8		5000	5		250	6000	14 (9)	1500	(6)	10	33 (9)		(6)
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	PH (Field)	Specific Conductivity - 25°C (Field)	Temperature (Field)	Alkalinity	Hardness as CaCO3	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chloride	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese
				Fraction	TOT	TOT	TOT	TOT	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	pH	µS/cm	°C	mg/L	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/L	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l
				Method Detection Limit	0.1	1	0.1	1	0.5	0.5	0.02	0.02	0.02	0.01	0.005	10	0.005	0.05	1	0.1	0.005	0.05	1	0.005	0.5	0.05	0.05
51-2-1	SS		5/19/2022	Clear and colourless	7.49	303	10.6	140	174	2.36	0.172	0.83	30.	< 0.01	< 0.005	170.	0.015 6	47.9	19.	< 0.1	0.077 1	0.436	1.7	0.011 2	1.11	13.1	12.
51-2-1	SS		9/9/2022	Clear, colourless	6.91	314	11.5	140	169	1.8	0.177	0.869	30.9	< 0.01	< 0.005	178.	0.011 8	49.5	20.	< 0.1	0.063 5	0.496	1.9	0.017 3	1.19	11.	9.86
51-2-1	SS		12/13/2022	Clear and colourless	7.89	268	9.7	140	185	28.2	0.234	0.946	31.	< 0.01	< 0.005	172.	0.017 1	53.	28.	0.1	0.115	0.619	45.3	0.039 8	1.12	12.7	15.7
51-3-1	SS		5/19/2022	Slightly silty and grey	7.74	265	10.5	120	168	3.41	0.136	0.441	19.7	< 0.01	< 0.005	225.	< 0.005	45.4	36.	< 0.1	0.034 8	0.632	1.9	0.040 3	1.12	13.2	0.258
51-3-1	SS		9/9/2022	Clear, colourless	6.99	420	11.6	110	139	20.8	0.109	0.661	34.	< 0.01	< 0.005	228.	< 0.005	40.7	52.	< 0.1	0.018 9	0.283	15.5	0.040 3	1.49	9.12	4.71
51-3-1	SS		12/13/2022	Clear and colourless	7.74	298	8.6	130	194	27.6	0.139	0.363	18.3	< 0.01	< 0.005	207.	0.006 3	54.9	35.	0.3	0.084 3	1.14	50.	0.07	1.	13.8	1.38
52-1-1	SS		5/18/2022	Clear and slightly green	6.98	1648	13.8	850	490	3.	< 0.1	0.19	102.	< 0.05	< 0.025	2 870.	< 0.025	129.	190.	1.04	2.08	< 0.25	562.	< 0.025	5.1	40.5	359.
52-1-1	SS		9/20/2022	Clear and colourless.	6.57	1799	15.3	880	535	3.9	0.044	0.257	118.	< 0.02	< 0.01	3 540.	< 0.01	141.	180.	1.12	2.33	0.14	621.	< 0.01	5.5	44.6	397.
52-1-1	SS		12/16/2022	Clear and colourless	7.2	1592	12.4	860	527	5.	0.17	0.21	116.	< 0.05	< 0.025	3 340.	< 0.025	138.	180.	1.13	2.21	< 0.25	535.	0.028	5.9	44.2	358.
52-1-1	SS		3/2/2023	Clear and colourless	7.25	2100	13	860	484	2.2	< 0.04	0.242	109.	< 0.02	< 0.01	3 130.	< 0.01	127.	170.	1.12	2.09	< 0.1	566.	< 0.01	5.1	40.5	373.
52-4-0 (P7)	SS		5/20/2022	Clear and slightly yellow	6.7	2959	18	1200	477	9.9	0.112	3.83	392.	< 0.02	< 0.01	2 610.	< 0.01	105.	230.	2.24	5.33	0.5	15 000.	0.019	2.2	52.2	944.
52-4-0 (P7)	SS		10/5/2022		7.39	3800	18.6	1400	565	8.3	0.1	6.92	398.	< 0.02	< 0.01	2 660.	< 0.01	125.	330. b	2.55	5.72	0.67	15 000.	0.046	2.2	61.4	1 050.
52-4-0 (P7)	SS		12/1/2022	Moderately turbid, moderately brown	6.84	3440	15.2	1600	542	17.9	0.194	7.37	414.	< 0.02	< 0.01	2 980.	< 0.01	114.	360. b	5.39	6.19	0.43	18 200.	0.025	1.6	62.5	1 180.
52-4-0 (P7)	SS		2/24/2023	Clear and colourless	7.01	3900	13.7	1500	573	11.5	0.127	5.17	449.	< 0.02	< 0.01	2 820.	< 0.01	127.	320. b	2.61	5.1	0.64	19 900.	0.047	1.8	62.	1 200.
53-1-1	SS	Y	5/20/2022	Clear and colourless	7.39	360	10.8	190	241	4.07	< 0.02	0.134	19.9	< 0.01	< 0.005	476.	0.011 4	83.8	7.	< 0.1	0.569	0.072	252.	< 0.005	< 0.5	7.65	204.
53-1-1	SS	Y	9/12/2022	Clear, colourless	8.02	387	11.5	200	247	0.86	< 0.02	0.126	18.	< 0.01	< 0.005	425.	0.013 3	87.5	6.4	< 0.1	0.495	< 0.05	313.	< 0.005	< 0.5	6.87	169.
53-1-1	SS	Y	1/26/2023	Clear and colourless	7.44	353	10	200	248	1.67	< 0.02	0.086	16.2	< 0.01	< 0.005	518.	0.009 2	87.4	6.4	< 0.1	0.25	0.138	381.	0.006 7	< 0.5	7.26	163.
53-1-1	SS	Y	3/9/2023	Clear and colourless	7.51	490	10.4	200	240	6.35	< 0.02	0.14	26.2	< 0.01	< 0.005	465.	0.012 9	83.4	6.6	< 0.1	0.465	0.074	316.	0.007 4	< 0.5	7.74	215.
55-1-1	SS	Y	9/22/2022	Clear and colourless.	8.26	337	11.3	160	184	0.75	0.11	0.161	4.72	< 0.01	< 0.005	22.	0.006 9	64.6	15.	< 0.1	0.02	0.266	3.	< 0.005	< 0.5	5.5	12.9
55-1-1	SS	Y	12/14/2022	Clear and colourless	7.24	297	8.6	170	204	4.48	0.105	0.147	5.17	< 0.01	< 0.005	43.	0.011 5	71.5	16.	0.15	0.030 8	0.271	10.9	0.008 4	< 0.5	6.27	6.28
56-1-1	SS	Y	5/12/2022	Clear and colourless	7.53	294	9.5	150	201	1.51	0.037	0.16	38.3	< 0.01	< 0.005	18.	0.011 9	70.5	9.1	< 0.1	0.006 7	0.148	5.1	< 0.005	< 0.5	6.05	0.265
56-1-1	SS	Y	9/8/2022	Clear and colourless.	8	380	11.4	150	176	3.29	0.029	0.142	18.3	< 0.01	< 0.005	27.	0.015 3	62.5	7.	< 0.1	0.006 8	0.08	6.	< 0.005	< 0.5	4.9	0.262
56-1-1	SS	Y	12/15/2022	Clear and colourless	7.74	285	9.4	150	201	5.97	0.065	0.159	43.3	< 0.01	< 0.005	70.	0.028 2	70.1	6.7	0.13	0.016 1	0.154	8.9	0.006 2	< 0.5	6.26	0.766
56-1-1	SS	Y	3/2/2023	Clear and colourless	7.26	380	9.2	150	190	11.7	0.04	0.152	21.9	< 0.01	< 0.005	30.	0.024 3	66.9	8.2	< 0.1	0.008 6	0.118	11.3	0.005 2	< 0.5	5.49	0.293
57-1-1	SS	Y	9/22/2022	Clear and colourless.	8.11	450	9.9	160	213	1.84	< 0.02	0.087	19.6	< 0.01	< 0.005	36.	0.021 2	76.9	13.	< 0.1	0.02	0.172	10.8	< 0.005	< 0.5	5.08	3.73
57-1-1	SS	Y	12/14/2022	Clear and colourless	7.56	347	8.8	170	237	5.24	0.055	0.039	11.2	0.015	< 0.005	83.	0.014 3	85.4	14.	< 0.1	0.065	0.221	18.4	0.013 3	< 0.5	5.68	12.2
58-1-0	SS		5/17/2022	Clear and moderately yellow	6.68	5174	20	1700	1400	9.3	0.402	1.32	33.4	< 0.02	< 0.01	4 160.	0.054	360.	890. b	9.59	52.3 a	7.63	876.	0.071	< 1.	121.	6 390.
58-1-0	FRM		9/22/2022	Mean of duplicates	6.985	6150	19.3	1800	1610	13.6	0.4	1.2	32.6	< 0.05	< 0.025	3 150.	0.095 5	418.	995. b	9.85	55.6 a	8.785	871.	0.168	< 2.5	137.	6 485.
58-1-0	SS		12/13/2022	Clear, very yellow	6.8	5164	16.6	2000	1590	13.3	0.456	1.53	36.1	< 0.02	< 0.01	3 660.	0.066	418.	960. b	9.83	50.8 a	7.74	816.	0.082	< 1.	134.	6 350.
58-1-0	SS		3/9/2023	Very slight yellow, no turbidity	6.87	6500	19.6	1900	1380	9.8	0.49	1.46	33.8	< 0.05	< 0.025	3 750.	0.087	358.	1 100. b	10.5	50.1 a	7.12	1 620.	0.268	< 2.5	119.	5 650.
60-1-1	SS		5/25/2022	Clear and colourless	7.4	555	10.9	250	364	< 0.5	< 0.02	0.282	21.2	< 0.01	< 0.005	190.	0.009 3	116.	100.	< 0.1	0.067 3	0.485	131.	< 0.005	0.61	18.1	93.2
60-1-1	SS		9/27/2022	Clear and colourless.	6.57	840	11.2	240	367	0.85	< 0.02	0.288	23.	< 0.01	< 0.005	190.	0.008 3	117.	100.	0.16	0.049 4	0.178	126.	0.006 7	< 0.5	18.3	96.5
60-1-1	SS		1/12/2023	Clear and colourless	7.31	616	10	250	410	1.37	< 0.02	0.245	22.6	< 0.01	< 0.005	197.	0.013 5	132.	110.	< 0.1	0.05	0.181	97.6	0.005 1	0.54	19.3	87.7
60-1-1	SS		3/7/2023	Clear and colourless	7.32	850	10.1	250	277	9.38	0.134	0.148	15.1	< 0.01	< 0.005	212.	0.085 5	94.3	110.	< 0.1	0.126	1.49	18.5	0.019 5	< 0.5	10.	36.
60-2-1	SS		5/25/2022	Clear and colourless	7.44	502	11	160	288	< 0.5	0.051	0.302	38.9	< 0.01	< 0.005	322.	0.014 4	90.1	83.	< 0.1	0.19	0.293	14.	< 0.005	0.75	15.3	72.7
60-2-1	SS		9/27/2022	Clear and colourless.	7.85	540	13	150	291	4.8	0.043	0.326	41.4	< 0.01	< 0.005	336.	0.019 7	92.5	85.	< 0.1	0.344	0.209	42.8	0.016 6	< 0.5	14.5	157.
60-2-1	SS		1/12/2023	Clear and colourless	7.53	465	10.3	150	304	5.87	0.05	0.319	39.3	< 0.01	< 0.005	328.	0.019 3	95.8	78.	< 0.1	0.155	0.287	21.3	0.010 2	0.68	15.6	51.5
60-2-1	SS		3/7/2023	Clear and colourless	7.57	650	10.1	150	273	3.43	0.048	0.311	38.6	< 0.01	< 0.005	302.	0.026 7	85.2	75.	< 0.1	0.194	0.32	20.2	0.010 6	0.66	14.7	67.1
60-3-1	SS		5/25/2022	Slightly silty and slightly brown	7.27	594	10.1	160	327	1.29	0.054	0.138	17.5	< 0.01	< 0.005	165.	0.119	110.	160.	< 0.1	0.158	1.29	< 1.	< 0.005	< 0.5	13.1	110.
60-3-1	SS		9/27/2022	Slightly turbid, slightly black.	6.41	608	12.4	190	281	1.94	0.058	0.173	15.4	< 0.01	< 0.005	301.	0.042 9	95.4	88.	< 0.1	0.106	1.23	4.6	0.005 7	< 0.5	10.3	23.4
60-3-1	SS		12/15/2022	Clear and colourless	7.2	554	10.3	210	319	0.88	0.048	0.152	15.4	< 0.01	< 0.005	301.	0.133	109.	76.	< 0.1	0.165	1.75	2.5	< 0.005	< 0.5	11.4	190.
60-3-1	SS		3/7/2023	Clear and colourless	7.26	730	9.8	170	398	3.63	0.021	0.29	24.1	< 0.01	< 0.005	195.	0.013 4	127.	74.	0.15	0.078 6	0.296	113.	0.010 9	0.58	19.6	101.
62-1-1	SS		5/30/2022	Clear and colourless	7.42	159	9.8	100	108	1.03	0.025	0.053	0.858	< 0.01	< 0.005	25.	< 0.005	37.8	2.1	0.14	0.018 3	0.109	< 1.	< 0.005	< 0.5	3.34	0.074
62-1-1	SS		9/20/2022	Clear, colourless	7.8	184	11.4	100	109	1.76	0.031	0.09	2.09	< 0.01	< 0.005	26.	< 0.005	38.2	1.9	0.18	0.022 1	0.16	8.8	< 0.005	< 0.5	3.37	0.411
62-1-1	SS		12/8/2022	Clear and colourless	6.98	179	9.3	110	124	2.62	0.059	0.09	1.74	< 0.01	< 0.005	27.	0.006 2	43.6	2.1	0.31	0.022 2	0.186	7.4	0.005 1	< 0.5	3.59	0.206
62-2-1	SS		5/30/2022	Slightly silty and slightly grey	7.12	179	9.8	96	105	2.26	0.035	0.045	2.78	< 0.01	< 0.005	175.	< 0.005	36.4	2.9	0.15	0.027 9	0.097	4.5	< 0.005	< 0.5	3.45	10.9
62-2-1	NS		9/20/2022	Insufficient volume for sampling.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
62-2-1	SS		12/8/2022	Clear and colourless	6.76	220	9.4	130	158	1.39	0.078	0.107	8.22	< 0.01	< 0.005	305.	0.014	55.4	2.5	0.2	0.048	0.112	2.1	0.014 4	0.52	4.78	18.3
63-1-1	SS		5/26/2022	Clear and colourless	7.72	233	10.1	160	159	1.01	< 0.02	0.055	11.5	< 0.01	< 0.005	11.	< 0.005	50.5	5.5	< 0.1	0.082 7	< 0.05	29.9	< 0.005	< 0.5	8.	42.1
63-1-1	SS		9/29/2022	Clear and colourless.	6.88	300	11.4	140	149	1.39	< 0.02	0.032	8.94	< 0.01	< 0.005	< 10.	< 0.005	47.7	4.8	< 0.1	0.056 9	0.06	22.4	< 0.005	< 0.5	7.33	31.3
63-1-1	SS		1/4/2023	Clear and colourless	7.75	219	10.2	160	153	1.63	< 0.02	0.049	8.07	< 0.01	< 0.005	11.	< 0.005	48.9	4.6	< 0.1	0.049 7	0.12	22.9	< 0.005	< 0.5	7.43	28.2
63-2-1	SS		5/26/2022	Clear and colourless	7.57	2	9.4	150	160	1.69	0.035	0.163	16.8	< 0.01	< 0.005	< 10.	0.011	55.5	4.7	< 0.1	0.012 7	0.252	< 1.	< 0.005	< 0.5	5.13	0.708
63-2-1	SS		9/29/2022	Clear and colourless.	7.18	257	12.7	150	158	2.09	0.022	0.139	16.6	< 0.01	< 0.005	< 10.	0.011 4	55.4	4.	< 0.1	0.007 4	0.328	4.8	0.005 8	< 0.5	4.9	1.07
63-2-1	SS		1/4/2023	Clear and colourless	7.69	242	9.4	150	171	2.16	0.021	0.147	16.7	< 0.01	< 0.005	< 10.	0.006	59.9	4.3	< 0.1	0.009 5	0.222	2.5	< 0.005	< 0.5	5.09	0.869
71-1-1	FRM	Y	5/27/2022	Mean of duplicates	7.73	216	10	140	149.5	1.5	0.046 5	0.424 5	6.66	< 0.01	< 0.005	515.5	0.063 8	49.15	7.6	< 0.1	0.076 9	0.201 5	15.8	0.005 65	< 0.5	6.52	92.45
71-1-1	FRM	Y	9/27/2022	Mean of duplicates	7.705	324	11.3	150	168	1.87	0.09	0.348	7.63	< 0.01	< 0.005	440.	0.006 5	55.	8.2	0.105	0.093 5	0.107 5	34.7	0.006 5	< 0.5	7.32	94.1
71-1-1	FRM	Y	1/12/2023	Mean of duplicates	7.66	258	10.1	155	174	3.01	0.105	0.419 5	8.475	< 0.01	< 0.005	478.	0.020 75	57.	8.8	0.13	0.127 5	0.052	38.65	0.005 4	< 0.5	7.755	147.
71-1-1	FRM	Y	3/7/2023	Mean of duplicates	7.73	340	8.9	140	149	10.535	0.085	0.41	7.9	< 0.01	< 0.005	481.	0.235 8	48.15	6.85	< 0.1	0.129	0.304 5	40.9	0.021 05	0.54	6.975	118.5
71-2-1	SS	Y	5/27/2022	Clear and colourless	7.45	347	10	220	235	1.68	0.025	0.312	15.1	< 0.01	< 0.005	302.	0.013 8	81.2	8.9	< 0.1	0.114	0.224	211.	0.040 3	< 0.5	7.91	80.3
71-2-1	SS	Y	9/27/2022	Clear and colourless.	6.68	362	11.3	210	231	2.29	< 0.02	0.2	14.5	< 0.01	< 0.005	279.	0.036 4	79.8	8.	< 0.1	0.119	0.271	233.	0.053	< 0.5	7.75	126.
71-2-1	SS	Y	1/12/2023	Clear and colourless	7.6	342	9.9	210	249	4.07	0.021	0.21	29.9	< 0.01	< 0.005	315.	0.115	85.9	8.8	< 0.1	0.144	0.412	20.3	0.061 6	< 0.5	8.48	87.3
71-2-1	SS	Y	3/7/2023	Clear and colourless	7.52	490	9.9	220	225	3.22	< 0.02	0.208	15.1	< 0.01	< 0.005	283.	0.009 5	76.8	7.5	0.1	0.127	0.17	134.	0.059 2	< 0.5	8.05	75.5
71-3-1	SS	Y	5/27/2022	Clear and colourless	6.84	283	9.8	150	176	1.71	< 0.02	0.052	5.95	< 0.01	< 0.005	251.	0.016 1	62.8	8.1	< 0.1	0.039	0.686	2.	< 0.005	< 0.5	4.62	0.211
71-3-1	SS	Y	9/27/2022	Slightly turbid, slightly yellow.	6.24	330	11.9	170	199	3.67	0.021	0.075	10.4	< 0.01	< 0.005	346.	0.031 3	71.1	6.6	< 0.1	0.039 1	0.8	8.7	0.008 7	< 0.5	5.15	0.319
71-3-1	SS	Y	1/12/2023	Clear and colourless	6.93	312	10.4	170	216	5.65	< 0.02	0.071	11.4	< 0.01	< 0.005	335.	0.08	77.	12.	< 0.1	0.048 4	0.81	11.8	0.009 6	< 0.5	5.76	0.249
71-3-1	SS	Y	3/7/2023	Clear and colourless	7	410	9.7	160	188	1.37	0.025	0.077	7.85	< 0.01	< 0.005	284.	0.016 4	66.2	10.	< 0.1	0.052 8	0.88	3.1	< 0.005	< 0.5	5.38	0.222
72-1-1	FRM	Y	5/27/2022	Mean of duplicates	7.75	438	10.5	160	268	2.35	< 0.04	0.136 5	12.	< 0.02	< 0.01	1 695.	< 0.01	85.8	74.	< 0.2	0.036	< 0.1	376.5	< 0.01	< 1.	13.1	117.
72-1-1	FRM	Y	10/3/2022	Mean of duplicates	8.17	610	11.2	150	262.5	1.33	< 0.02	0.136	12.8	< 0.01	< 0.005	1 565.	< 0.005	84.05	67.5	< 0.1	0.048 9	< 0.05	363.	< 0.005	< 0.5	12.8	114.
72-1-1	FRM	Y	1/11/2023	Mean of duplicates	7.64	431	10.5	150	260	2.03	< 0.03	0.090 5	12.95	< 0.015	< 0.007 5	1 525.	< 0.007 5	82.	65.5	0.16	0.079 4	< 0.075	351.	< 0.007 5	< 0.75	13.4	110.5
72-1-1	FRM	Y	3/6/2023	Mean of duplicates	7.81	600	10.3	150	263.5	3.625	< 0.03	0.142	12.9	< 0.015	< 0.007 5	1 645.	< 0.007 5	83.35	66.	0.16	0.062 8	0.088 5	370.5	0.008	0.78	13.55	112.5
72-3-1	SS	Y	5/27/2022	Clear and colourless	7.57	441	10.1	200	248	15.8	0.038	0.253	15.7	< 0.01	< 0.005	440.	0.013 9	87.4	40.	< 0.1	0.071 3	0.409	3.1	0.007 1	0.57	7.16	21.6
72-3-1	SS	Y	10/4/2022	Clear and colourless.	8.16	473	12.1	190	249	1.48	0.027	0.284	19.	< 0.01	< 0.005	487.	0.046 5	88.1	58.	< 0.1	0.081 2	0.355	4.6	< 0.005	< 0.5	6.98	39.
72-3-1	SS	Y	1/12/2023	Clear and colourless	7.43	443	10.8	200	262	8.02	0.034	0.264	18.8	< 0.01	< 0.005	511.	0.021 6	92.7	41.	< 0.1	0.080 2	0.358	9.	0.007 9	0.54	7.46	24.5
72-3-1	SS	Y	3/6/2023	Clear and colourless	7.55	426	10.4	190	227	4.26	0.029	0.375	15.1	< 0.01	< 0.005	450.	0.018 1	79.8	39.	0.11	0.128	0.328	21.7	0.011 9	0.54	6.76	78.1
73-1-1	FRM	Y	5/25/2022	Mean of duplicates	7.5	326	10.3	170	209.5	0.6	0.024 5	0.205	13.8	< 0.01	< 0.005	110.5	0.024 5	64.9	19.	0.105	0.363	0.405 5	1.25	0.014 1	< 0.5	11.55	112.
73-1-1	FRM	Y	9/27/2022	Mean of duplicates	7.445	397	10.6	160	211	2.47	0.043 5	0.230 5	15.4	< 0.01	< 0.005	120.5	0.278 7	65.65	20.	0.12	0.418 5	0.662	7.	0.024 5	< 0.5	11.4	88.4
73-1-1	FRM	Y	1/12/2023	Mean of duplicates	7.47	329	9.9	160	230	1.09	0.033 5	0.207 5	14.4	< 0.01	< 0.005	120.5	0.028 35	71.55	21.	0.11	0.354 5	0.449 5	5.25	0.013 8	< 0.5	12.4	71.3
73-1-1	FRM	Y	3/7/2023	Mean of duplicates	7.48	525	9.8	180	220	9.13	0.033	0.289	14.45	< 0.01	< 0.005	280.5	0.524 05	72.5	30.	0.105	0.196 5	0.473 5	19.35	0.019 65	0.52	9.43	82.8
73-2-1	SS	Y	5/25/2022	Clear and colourless	7.25	306	10.3	160	206	4.78	< 0.02	0.071	9.37	< 0.01	< 0.005	76.	0.020 5	64.5	20.	< 0.1	0.095 7	0.415	17.6	0.017 5	< 0.5	10.9	48.9
73-2-1	SS	Y	9/27/2022	Clear and colourless.	7.79	334	10.7	150	204	1.18	< 0.02	0.104	10.4	< 0.01	< 0.005	91.	0.059 8	64.3	24.	< 0.1	0.093 8	0.391	17.1	< 0.005	< 0.5	10.7	45.4
73-2-1	SS	Y	1/12/2023	Clear and colourless	7.15	305	10.3	160	207	1.38	< 0.02	0.082	10.	< 0.01	< 0.005	77.	0.011 9	65.2	22.	< 0.1	0.234	0.309	9.7	< 0.005	< 0.5	10.8	43.4
73-2-1	SS	Y	3/7/2023	Clear and colourless	7.2	430	10	160	204	1.67	< 0.02	0.1	9.79	< 0.01	< 0.005	74.	0.016 8	63.5	20.	< 0.1	0.104	0.278	10.4	< 0.005	< 0.5	11.1	47.6

Appendix B-1. Groundwater Quality Data 2022-2023

BC CSR				a AW Maximum (1)							90	50	10000	2 (9)		12000	0.5-4 (5)		1500	90 (7)	40	20-90 (5)		40-160 (5)			
				b DW Maximum (2)						9500	6	10	1000	8		5000	5		250	6000	14 (9)	1500	(6)	10	33 (9)		(6)
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	PH (Field)	Specific Conductivity - 25°C (Field)	Temperature (Field)	Alkalinity	Hardness as CaCO3	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chloride	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese
				Fraction	TOT	TOT	TOT	TOT	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	pH	µS/cm	°C	mg/L	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/L	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l
				Method Detection Limit	0.1	1	0.1	1	0.5	0.5	0.02	0.02	0.02	0.01	0.005	10	0.005	0.05	1	0.1	0.005	0.05	1	0.005	0.5	0.05	0.05
73-3-1	SS	Y	5/25/2022	Clear and colourless	7.33	275	10.3	78	91	25.	0.035	0.151	14.6	< 0.01	< 0.005	44.	0.026 1	28.3	18.	< 0.1	0.033	0.331	13.5	0.016 6	1.17	4.95	0.33
73-3-1	SS	Y	9/27/2022	Clear and colourless.	6.74	269	11.3	99	132	18.2	0.03	0.179	19.3	< 0.01	< 0.005	90.	0.158	41.7	30.	0.39	0.073 5	0.872	61.	0.018 7	0.73	6.83	0.743
73-3-1	FRM	Y	1/12/2023	Mean of duplicates	6.86	254	10.3	78.5	121	6.015	0.031 5	0.140 5	17.85	< 0.01	< 0.005	42.5	0.041 75	38.	45.5	< 0.1	0.024 5	0.291 5	4.15	0.007 55	1.06	6.345	0.220 5
73-3-1	SS	Y	3/7/2023	Clear and colourless	6.85	310	9.8	79	104	16.6	0.035	0.162	14.9	< 0.01	< 0.005	39.	0.046 2	32.8	28.	0.14	0.044 1	0.479	28.6	0.019 6	0.89	5.51	0.554
77-1-1	SS		6/2/2022	Clear and colourless	7.76	263	11.4	160	173	4.63	< 0.02	0.071	6.98	< 0.01	< 0.005	221.	< 0.005	52.9	5.9	< 0.1	0.066 6	< 0.05	148.	< 0.005	< 0.5	9.92	50.2
77-1-1	SS		9/15/2022	Clear, colourless	8.3	281	13.4	150	165	8.46	< 0.02	0.046	6.77	< 0.01	< 0.005	225.	< 0.005	50.7	5.4	< 0.1	0.056 7	< 0.05	56.	< 0.005	< 0.5	9.43	29.6
77-1-1	SS		12/7/2022	Clear and colourless	7.87	255	10.1	160	172	27.3	< 0.02	0.074	7.73	< 0.01	< 0.005	232.	0.018 6	53.7	5.1	0.1	0.077 7	0.132	90.9	0.022 7	< 0.5	9.3	26.8
77-2-1	SS		6/2/2022	Clear and colourless	7.71	287	11.6	160	195	2.28	0.043	0.722	18.6	< 0.01	< 0.005	184.	< 0.005	53.5	6.5	< 0.1	< 0.005	0.119	< 1.	< 0.005	0.68	14.9	0.921
77-2-1	SS		9/15/2022	Clear, colourless	7.33	410	11.9	160	193	2.7	0.028	0.784	17.7	< 0.01	< 0.005	205.	0.006	53.9	5.5	< 0.1	0.007 7	0.212	4.5	< 0.005	0.66	14.2	4.84
77-2-1	SS		12/7/2022	Clear and colourless	7.75	312	10.8	160	208	6.07	0.031	0.789	19.1	< 0.01	< 0.005	203.	0.008 5	58.4	5.4	< 0.1	0.015 9	0.146	13.7	< 0.005	0.58	15.2	9.14
78-1-1	SS		6/2/2022	Clear and colourless	7.55	335	11.6	180	220	3.47	1.12	0.484	24.8	< 0.01	< 0.005	315.	0.021 8	62.1	3.6	< 0.1	< 0.005	0.356	2.1	< 0.005	1.12	15.7	0.119
78-1-1	SS		9/2/2022	Clear and colourless.	7.01	398	14.4	200	229	12.8	0.868	0.535	29.5	< 0.01	< 0.005	348.	0.021 1	65.2	3.1	0.2	0.049 5	0.274	22.1	< 0.005	1.41	16.1	1.38
78-1-1	SS		12/9/2022	Clear and colourless	7.5	343	10.9	200	232	4.84	0.75	0.543	30.	< 0.01	< 0.005	326.	0.021 2	67.4	2.5	0.15	0.006 6	0.247	7.5	< 0.005	1.26	15.4	0.168
78-2-1	SS		6/2/2022	Clear and colourless	7.44	210	11.8	130	162	1.6	0.179	0.386	13.4	0.01	< 0.005	212.	0.188	52.7	2.3	0.13	0.055 4	0.307	2.6	< 0.005	0.98	7.44	1.69
78-2-1	SS		9/1/2022	Clear, colourless	6.91	276	13.8	150	204	3.32	0.145	0.358	14.6	< 0.01	< 0.005	310.	0.271	68.1	< 1.	0.1	0.061 5	0.194	6.2	< 0.005	0.83	8.21	0.69
78-2-1	SS		12/9/2022	Clear and colourless	6.9	226	10.9	100	158	18.8	0.116	0.255	11.2	< 0.01	< 0.005	176.	0.395	53.9	1.4	0.34	0.097 9	0.771	25.8	0.016	1.58	5.68	2.75
80-1-0 (P8)	SS		5/20/2022	Slightly silty and moderately brown	7.08	3994	15.3	1800	469	85.1	2.15	13.8 b	126.	< 0.02	< 0.01	3 360.	0.019	111.	300. b	27.9	17.3 b	5.19	14 900.	0.266	2.4	46.3	1 310.
80-1-0 (P8)	SS		10/5/2022		7.66	4069	17.7	2600	487	192.	3.44	26.1 b	210.	< 0.05	< 0.025	4 060.	< 0.025	115.	510. b	55.1	21. b	4.57	24 400.	0.398	< 2.5	48.2	1 610.
80-1-0 (P8)	SS		12/1/2022	Moderately turbid, very brown	7.3	3061	10.2	1600	407	65.4	1.03	12.1 b	122.	0.012	< 0.005	2 850.	0.017 9	99.1	300. b	20.9	14.6 b	3.7	10 300.	0.159	0.77	38.7	1 350.
80-1-0 (P8)	SS		2/24/2023	Clear and colourless	7.56	6600	11.8	2400	531	226.	3.35	18.5 b	183.	0.041	< 0.01	5 470. b	0.041	128.	500. b	81.5	31.1 b	10.1	13 400.	0.529	2.6	51.1	1 480.
81-1-0 (P9)	SS		5/20/2022	Clear and colourless	7.74	723	13.7	220	319	2.27	0.135	0.112	35.7	< 0.01	< 0.005	780.	< 0.005	74.	96.	0.42	0.859	0.935	8.9	0.039	0.74	32.5	131.
81-1-0 (P9)	SS		10/5/2022		7.95	838	17.7	230	324	7.63	0.041	0.123	37.9	< 0.01	< 0.005	707.	< 0.005	79.7	92.	0.55	0.663	0.089	79.1	0.011 3	0.61	30.4	144.
81-1-0 (P9)	SS		12/1/2022	Clear and colourless	7.76	662	14.7	190	305	16.	0.068	0.133	37.9	< 0.01	< 0.005	716.	< 0.005	74.4	80.	0.61	0.654	0.695	70.3	0.050 7	0.61	29.1	163.
81-1-0 (P9)	SS		2/24/2023	Clear and colourless	7.82	860	11.4	230	325	3.16	0.047	0.129	37.9	< 0.01	< 0.005	756.	< 0.005	78.8	89.	0.56	0.664	0.488	30.7	0.023 8	0.9	31.1	200.
85-1-1	SS		5/26/2022	Slightly silty and slightly brown	7.48	522	13.5	84	170	1.05	0.083	0.176	3.76	< 0.01	< 0.005	135.	0.012 7	50.8	130.	< 0.1	0.125	4.71	1.1	< 0.005	< 0.5	10.5	1.76
85-1-1	SS		10/3/2022	Clear and colourless.	6.8	657	16.1	89	192	3.36	0.057	0.192	5.32	< 0.01	< 0.005	157.	0.061 6	57.6	140.	< 0.1	0.155	5.07	19.	0.008 7	< 0.5	11.6	53.1
85-1-1	SS		12/9/2022	Clear and colourless	6.96	543	13.7	59	142	3.37	0.09	0.162	5.36	< 0.01	< 0.005	121.	0.011 7	42.7	140.	< 0.1	0.122	3.63	9.2	0.006 2	< 0.5	8.65	10.3
85-1-1	SS		3/6/2023	Clear and colourless	7.1	770	12.5	53	165	10.9	0.09	0.191	5.12	< 0.01	< 0.005	101.	0.015 4	50.1	160.	0.14	0.166	2.99	18.7	0.053 1	< 0.5	9.7	33.1
87-1-1	SS		6/2/2022	Clear and colourless	7.77	250	9.8	140	167	2.16	0.095	0.514	18.8	< 0.01	< 0.005	16.	0.008 2	52.4	5.	0.29	0.017 3	1.96	14.5	0.069 5	< 0.5	8.81	13.
87-1-1	SS		9/9/2022	Clear, colourless	7.23	241	14.1	150	155	2.25	0.066	0.44	24.5	< 0.01	< 0.005	18.	0.013 9	50.4	4.3	< 0.1	0.032 1	0.224	< 1.	< 0.005	< 0.5	7.12	32.2
87-1-1	SS		12/9/2022	Clear and colourless	7.57	237	8.8	150	170	5.57	0.044	0.542	14.2	< 0.01	< 0.005	17.	0.013 6	54.1	3.8	< 0.1	0.077 1	0.093	7.5	< 0.005	< 0.5	8.46	12.2
87-2-1	SS		6/1/2022	Clear and colourless	7.85	137	9.8	74	84.5	1.65	< 0.02	0.038	0.74	< 0.01	< 0.005	< 10.	< 0.005	27.5	4.	< 0.1	0.009 7	0.125	1.	< 0.005	< 0.5	3.86	0.08
87-2-1	NS		9/9/2022	No Sample. Well was dry.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
87-2-1	NS		12/9/2023	Not enough water to sample	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
87-2-1	NS		12/9/2023	Not enough water to sample	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
88-1-1	SS		6/1/2022	Clear and colourless	7.35	249	10.2	100	158	1.31	0.032	0.075	1.53	0.013	< 0.005	13.	< 0.005	53.4	3.6	< 0.1	0.057 9	0.537	1.1	< 0.005	< 0.5	6.03	0.096
88-1-1	SS		9/9/2022	Clear, colourless	8.04	330	13.4	120	180	1.62	0.038	0.114	3.33	< 0.01	< 0.005	13.	< 0.005	62.2	2.8	< 0.1	0.036 5	0.178	1.9	< 0.005	< 0.5	5.98	0.248
88-1-1	SS		12/8/2022	Clear and colourless	7.19	282	9	130	205	1.75	0.074	0.117	3.41	< 0.01	< 0.005	23.	0.005 9	70.3	2.8	0.12	0.033 6	0.187	1.7	< 0.005	< 0.5	7.09	0.489
88-2-1	SS		6/1/2022	Slightly silty and moderately brown	7.1	272	10.5	67	168	4.23	0.054	0.057	5.73	< 0.01	< 0.005	20.	< 0.005	57.5	3.1	< 0.1	0.054 9	0.33	5.1	< 0.005	< 0.5	6.03	19.8
88-2-1	NS		9/8/2022	No Sample. Well was dry.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
88-2-1	SS		12/9/2022	Moderately turbid, very brown	6.25	465	9.2	52	314	14.6	0.05	0.106	7.49	< 0.01	< 0.005	27.	< 0.005	108.	1.9	0.21	0.121	0.627	34.5	0.015 2	< 0.5	10.7	20.
91-1-1	SS		6/2/2022		7.51	317	11.3	210	262	3.04	0.199	0.397	43.8	< 0.01	< 0.005	69.	< 0.005	86.5	5.4	< 0.1	0.008 8	0.281	1.	< 0.005	2.8	11.1	2.39
91-1-1	SS		9/9/2022	Slightly turbid, slightly grey	7.26	510	18.6	210	247	2.39	0.212	0.41	46.2	< 0.01	< 0.005	82.	0.009	83.4	5.2	< 0.1	0.012 5	0.281	7.3	< 0.005	3.34	9.43	2.61
91-1-1	SS		12/13/2022	Very turbid, colourless	7.48	379	10.3	210	261	4.25	0.18	0.387	41.2	0.011	< 0.005	79.	0.011 7	87.1	5.4	0.14	0.019 4	0.251	30.2	0.013 9	2.34	10.6	3.23
91-1-1	SS		3/2/2023	Clear and colourless	7.83	560	9.5	210	302	1.81	0.189	0.381	47.2	< 0.01	< 0.005	79.	0.008 1	100.	5.1	< 0.1	0.010 6	0.207	2.	< 0.005	2.71	12.5	1.95
92-1-1	SS		6/2/2022		7.63	415	11.4	170	262	2.05	0.089	0.514	33.7	< 0.01	< 0.005	410.	0.005 5	82.3	5.1	< 0.1	0.014 8	0.199	1.1	< 0.005	2.33	13.6	9.61
92-1-1	SS		9/9/2022	Moderately turbid, slightly grey	8.13	488	14.7	170	246	3.94	0.107	0.521	37.7	< 0.01	< 0.005	428.	0.031 7	81.1	5.	< 0.1	0.017 1	0.751	10.8	0.007	3.16	10.6	14.2
92-1-1	SS		12/14/2022	Clear and colourless	7.77	406	9.1	180	286	4.31	0.166	0.507	35.6	< 0.01	< 0.005	425.	0.023 4	91.3	4.2	0.13	0.022	0.256	6.3	0.010 5	2.9	14.	11.2
92-1-1	SS		3/2/2023	Clear and colourless	7.87	580	9.4	180	270	27.5	0.126	0.478	36.7	< 0.01	< 0.005	437.	0.009 2	86.2	4.3	0.11	0.024 9	0.302	25.2	0.013 3	3.09	13.2	3.24
93-1-1	NS		9/15/2022	No Sample. Well is obstructed due to damage from stockpiling.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
93-1-1	NS		12/14/2022	Groundwater well destroyed/ obstructed	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
93-1-1	NS		3/16/2023	Well destroyed, not sampled	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
94-1-1	SS		6/2/2022		7.65	190	8.6	120	125	3.86	0.192	0.149	12.3	< 0.01	< 0.005	12.	< 0.005	42.5	4.5	< 0.1	0.021	0.268	4.5	< 0.005	< 0.5	4.62	1.95
94-1-1	SS		9/9/2022	Clear, colourless	8.16	340	10.2	150	144	3.85	0.152	0.234	28.4	< 0.01	< 0.005	26.	0.009 9	49.6	3.6	0.12	0.023 1	0.468	11.3	0.010 9	1.24	4.91	1.97
94-1-1	SS		12/13/2022	Moderately turbid, slightly grey	7.66	264	8.1	150	166	6.18	0.333	0.253	29.8	< 0.01	< 0.005	25.	0.016 5	55.6	5.	< 0.1	0.045 9	0.312	4.4	0.013 2	1.42	6.5	7.41
94-1-1	SS		3/2/2023	Clear and colourless	7.82	400	7.7	140	188	6.28	1.68	0.211	22.7	< 0.01	0.005 6	40.	0.011 3	62.2	4.2	< 0.1	0.044 7	0.208	10.1	0.005 1	0.74	8.01	2.22
95-1-1	SS		9/15/2022	Very turbid, very grey	8.17	490	13.3	220	329	25 300. b	0.184	4.99	88.1	0.381	0.184	262.	0.315	98.4	6.6	76.7	42.9 a	95.5 a	56 300.	8.08	10.8	20.2	812.
95-1-1	SS		12/7/2022	Very turbid, moderately grey	7.04	424	10.8	190	300	108.	0.204	0.69	21.7	< 0.01	< 0.005	207.	0.034 3	108.	5.3	0.35	0.524	0.803	210.	0.022 3	0.59	7.52	131.
96-1-1	NS		9/15/2022	No Sample. Well was dry.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
96-1-1	SS		12/7/2022	Moderately turbid, moderately grey	6.89	392	11.4	130	260	4.44	0.044	0.089	12.	< 0.01	< 0.005	119.	0.021 9	86.6	5.4	0.15	0.127	0.466	3.8	< 0.005	< 0.5	10.7	8.71
97-1-1	SS		9/15/2022	Clear and colourless.	7.85	290	13.9	150	154	12.6	0.305	0.428	39.9	< 0.01	< 0.005	82.	< 0.005	53.	2.3	< 0.1	0.079 4	0.449	18.7	< 0.005	3.25	5.33	29.3
97-1-1	SS		12/7/2022	Moderately turbid, moderately grey	7.1	472	11.5	140	308	3.1	0.155	0.135	16.4	< 0.01	< 0.005	132.	0.020 4	104.	5.	< 0.1	0.034 2	0.286	1.	< 0.005	< 0.5	11.6	3.51
98-1-1	SS		9/9/2022	Very turbid, very grey	7.29	461	14	160	279	64.1	0.158	0.155	20.8	< 0.01	< 0.005	149.	0.016 4	94.	3.3	0.4	0.076 1	0.451	127.	0.020 3	0.68	10.7	6.89
98-1-1	SS		12/7/2022	Moderately turbid, moderately grey	7.98	233	11	100	121	8.37	2.06	0.254	17.4	< 0.01	< 0.005	44.	0.006 1	44.6	3.	0.3	0.054 6	0.374	4.6	0.006 5	0.66	2.28	23.6
98-1-1	SS		3/16/2023	Moderate turbidity, colourless	7.28	410	10.9	120	184	4.35	0.192	0.102	10.6	< 0.01	< 0.005	103.	0.009 4	61.4	4.5	0.17	0.031 5	0.378	5.	< 0.005	< 0.5	7.49	4.92
99-1-1	NS		9/15/2022	No Sample	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
99-1-1	NS		11/30/2022	Dry (Not enough water volume to sample)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
99-1-1	NS		3/16/2023	No sample required this month	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
100-1-1	NS		9/15/2022	No Sample	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
100-1-1	NS		11/30/2022	Dry (Not enough water volume to sample)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
100-1-1	NS		3/16/2023	No sample required this month	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
101-1-1	NS		9/15/2022	No Sample	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
101-1-1	NS		11/30/2022	Dry (Not enough water volume to sample)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
101-1-1	NS		3/16/2023	No sample required this month	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
103-1-1	SS		9/9/2022	Very turbid, very grey	7.37	300	14.4	130	147	10.8	0.42	5.12	42.6	< 0.01	< 0.005	118.	< 0.005	43.4	4.7	< 0.1	0.276	0.059	17.8	0.013 2	2.2	9.32	81.1
103-1-1	SS		11/30/2022	Moderately turbid, moderately grey	8.24	314	12.4	150	181	8.64	0.27	5.82	45.2	< 0.01	< 0.005	104.	0.005 2	52.	3.	< 0.1	0.127	0.14	3.8	< 0.005	1.54	12.4	77.5
104-1-1	SS		9/1/2022	Slightly turbid, moderately grey	5.33	160	15.1	55	69.7	82.5	0.26	0.125	5.34	< 0.01	< 0.005	41.	< 0.005	23.4	4.4	0.73	0.206	1.59	165.	0.012 5	< 0.5	2.72	7.64
104-1-1	SS		11/29/2022	Very turbid, very grey	7.52	437	11.8	68	266	12.6	0.214	0.083	6.25	< 0.01	< 0.005	59.	0.009 3	90.7	3.1	0.15	0.067	1.03	30.7	0.011 2	< 0.5	9.54	0.905
104-1-1	SS		3/16/2023	Slightly turbid, colourless	7.61	1000	9.9	98	388	8.81	0.198	0.094	8.	< 0.01	< 0.005	77.	0.013 6	130.	120.	0.15	0.089 9	1.15	14.5	0.016 1	< 0.5	15.4	1.4
105-1-1	SS		9/1/2022	Slightly turbid, slightly grey	6.61	695	13.5	120	427	12.2	0.13	0.184	33.2	< 0.01	< 0.005	98.	0.007 5	141.	4.3	< 0.1	0.109	0.314	8.8	< 0.005	1.74	18.4	14.
105-1-1	SS		11/29/2022	Moderately turbid, slightly grey	7.62	507	11.8	110	321	8.42	0.104	0.183	29.9	< 0.01	< 0.005	83.	0.006 2	109.	4.	< 0.1	0.047 1	0.306	5.3	< 0.005	0.89	12.2	3.4
105-1-1	SS		3/17/2023	Low turbidity, brown in colour low intensity	7.63	1300	11.5	100	594	26.4	5.78	0.15	44.4	< 0.01	< 0.005	80.	0.006	198.	87.	< 0.1	0.121	0.217	49.3	0.005 2	1.09	24.4	5.56

BC CSR				a AW Maximum (1)							90	50	10000	2 (9)		12000	0.5-4 (5)		1500	90 (7)	40	20-90 (5)		40-160 (5)			
				b DW Maximum (2)						9500	6	10	1000	8		5000	5		250	6000	14 (9)	1500	(6)	10	33 (9)		(6)
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	PH (Field)	Specific Conductivity - 25°C (Field)	Temperature (Field)	Alkalinity	Hardness as CaCO3	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chloride	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese
				Fraction	TOT	TOT	TOT	TOT	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	pH	µS/cm	°C	mg/L	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/L	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l
				Method Detection Limit	0.1	1	0.1	1	0.5	0.5	0.02	0.02	0.02	0.01	0.005	10	0.005	0.05	1	0.1	0.005	0.05	1	0.005	0.5	0.05	0.05
106-1-1	SS		9/1/2022	Moderately turbid, moderately grey	7.43	2162	20.9	630	507	291.	0.539	0.64	99.6	< 0.01	0.033 9	864.	0.136	151.	140.	3.25	8.01	19.7	251.	0.133	3.54	31.3	242.
106-1-1	SS		11/29/2022	Very turbid, very grey	7.5	570	13.2	160	334	8.37	0.218	0.482	13.5	< 0.01	< 0.005	129.	0.005 3	105.	14.	0.18	1.43	2.54	101.	0.031 9	< 0.5	17.8	492.
106-1-1	SS		3/31/2023	Extremely turbid, grey extreme in colour	7.56	1200	14.1	140	476	1 640.	0.251	0.439	38.2	0.018	0.027 3	173.	0.015 3	149.	88.	4.02	2.99	7.5	2 970.	0.277	0.57	25.1	424.
107-1-1	SS		9/1/2022	Very turbid, slightly grey	7.75	1100	21	180	547	40.1	0.317	0.23	68.9	< 0.01	< 0.005	189.	0.026 4	174.	32.	0.19	1.11	3.9	74.3	0.036 3	3.21	27.1	398.
107-1-1	SS		11/29/2022	Very turbid, moderately grey	7.48	627	13.1	180	398	80.9	0.244	0.272	47.8	< 0.01	< 0.005	174.	0.031 5	129.	15.	< 0.1	0.672	4.05	48.2	0.095 2	1.59	18.6	174.
107-1-1	NS		3/17/2023	No sample required this month	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
108-1-1	SS		9/1/2022	Moderately turbid, very grey	8.21	640	13.3	120	288	5.22	0.237	0.81	71.6	< 0.01	< 0.005	137.	< 0.005	76.6	6.5	< 0.1	0.222	0.138	1.2	< 0.005	2.55	23.6	60.1
108-1-1	SS		12/7/2022	Slightly turbid, slightly grey	7.86	519	11	120	316	3.95	0.138	0.667	77.2	< 0.01	< 0.005	114.	0.007 3	81.4	9.7	< 0.1	0.39	0.132	2.4	0.005 8	2.39	27.4	99.
108-1-1	NS		3/17/2023	No sample required this month	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
109-1-1	SS		9/1/2022	Very turbid, slightly grey	8.74	460	21.9	140	24.4	11.1	0.815	18.9 b	10.1	< 0.01	< 0.005	237.	< 0.005	6.52	5.9	< 0.1	0.055 9	0.492	7.7	0.019 2	3.78	1.98	4.82
109-1-1	SS		11/30/2022	Moderately turbid, moderately grey	7.98	387	14.6	170	28.5	8.64	0.696	16.4 b	6.06	< 0.01	< 0.005	281.	< 0.005	7.12	3.5	< 0.1	0.036	0.161	12.5	0.041 1	5.09	2.61	3.83
109-1-1	NS		3/17/2023	No sample required this month	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
110-1-1	NS		9/15/2022	No Sample	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
110-1-1	NS		11/30/2022	No sample (Determined not to be representative)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
110-1-1	NS		3/17/2023	No sample required this month	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P1	SS		5/26/2022	Clear and colourless	7.09	1261	16	600	279	6.4	0.135	9.65	1 490. b	< 0.02	< 0.01	1 610.	< 0.01	81.6	110.	0.94	1.94	0.2	20 700.	0.162	12.4	18.2	184.
P1	SS		9/14/2022		7.11	1913	18.3	790	281	5.1	< 0.1	7.07	1 930. b	< 0.05	< 0.025	2 650.	< 0.025	73.6	170.	1.12	3.61	< 0.25	13 200.	0.034	20.2	23.5	65.1
P1	SS		12/1/2022	Clear and colourless	7.1	1730	16.5	770	267	4.2	0.82	7.38	1 590. b	< 0.05	< 0.025	2 830.	< 0.025	71.5	160.	1.35	3.71	0.71	12 000.	0.575	18.3	21.5	102.
P1	SS		2/24/2023	clear and colourless	7.07	990	16.1	460	296	3.2	0.14	9.46	1 440. b	< 0.02	< 0.01	703.	< 0.01	91.1	39.	0.45	0.952	0.28	23 400.	0.298	9.8	16.7	135.
P2	SS		5/26/2022	Clear and slightly yellow	7.22	1924	16.9	870	275	7.4	< 0.1	0.81	494.	< 0.05	< 0.025	3 120.	< 0.025	70.	190.	1.16	3.79	0.27	598.	< 0.025	2.9	24.2	312.
P2	SS		9/14/2022		7.35	2157	16.5	960	337	7.3	< 0.1	0.86	467.	< 0.05	< 0.025	3 450.	< 0.025	82.8	210.	1.27	4.5	0.91	1 470.	0.047	< 2.5	31.6	330.
P2	SS		12/1/2022	Slightly turbid, slightly yellow	7.24	1927	12.8	980	319	5.77	0.057	0.906	475.	< 0.01	< 0.005	3 040.	0.012 8	78.	200.	1.28	4.2	0.453	765.	0.028 9	1.07	30.1	311.
P2	SS		2/24/2023	Very slight yellow, no turbidity	7.3	2100	15.5	890	241	4.1	0.048	0.787	480.	< 0.02	< 0.01	2 630.	< 0.01	62.1	120.	1.04	3.34	0.26	516.	0.031	3.1	21.	264.
P3	SS		5/26/2022	Clear and slightly orange	7.22	2197	16.3	1000	253	6.8	< 0.1	1.98	704.	< 0.05	< 0.025	3 680.	< 0.025	58.7	190.	1.42	4.6	0.32	694.	< 0.025	4.8	25.8	282.
P3	SS		9/14/2022		7.13	2600	16	990	305	11.6	< 0.1	1.14	563.	< 0.05	< 0.025	3 540.	< 0.025	71.7	220.	0.97	4.3	0.5	2 850.	< 0.025	< 2.5	30.5	392.
P3	SS		12/1/2022	Slightly turbid, slightly orange	7.16	1625	11.6	960	287	4.4	0.042	1.12	544.	< 0.01	< 0.005	3 220.	< 0.005	66.3	210.	0.97	3.77	0.311	1 800.	0.01	1.15	29.5	379.
P3	SS		2/24/2023	Clear and colourless	7.36	2200	14.4	910	219	4.	0.045	2.02	570.	< 0.02	< 0.01	3 230.	< 0.01	51.4	130.	0.98	3.26	0.28	926.	0.028	3.8	22.	240.
P4	SS		5/26/2022	Clear and moderately orange	7.05	2004	15.6	940	325	3.8	< 0.04	1.55	160.	< 0.02	< 0.01	2 510.	< 0.01	82.8	200.	0.87	3.18	0.2	3 100.	0.019	< 1.	28.6	696.
P4	SS		9/14/2022		8.07	2300	16	890	321	8.	< 0.1	1.87	171.	< 0.05	< 0.025	2 460.	< 0.025	80.6	180.	0.76	2.82	1.81	7 380.	0.053	< 2.5	29.	654.
P4	SS		12/1/2022	Slightly turbid, slightly orange	7.04	1770	13.1	880	315	3.62	0.046	2.12	166.	< 0.01	< 0.005	2 470.	0.010 4	78.6	170.	0.92	2.77	0.173	6 810.	0.065 1	< 0.5	28.7	652.
P4	SS		2/24/2023	Clear and colourless	7.09	2300	13.4	920	311	3.	< 0.04	1.25	138.	< 0.02	< 0.01	2 390.	< 0.01	78.2	170.	1.26	2.73	0.29	1 290.	0.02	< 1.	28.	675.
P10	SS		5/26/2022	Slightly silty and slightly orange	7.05	1110	15.8	560	329	2.36	0.036	0.855	747.	< 0.01	< 0.005	1 340.	0.018 3	99.3	100.	0.54	1.36	0.326	504.	0.012	3.24	19.8	557.
P10	SS		9/14/2022	Clear and colourless.	8.15	1459	15.5	660	320	22.2	< 0.1	0.94	921.	< 0.05	< 0.025	1 940.	< 0.025	91.8	140.	0.92	2.32	1.91	609.	0.223	4.3	22.	501.
P10	SS		12/1/2022	Clear, slightly yellow	7.02	1414	13	710	323	6.4	0.051	0.979	921.	< 0.02	< 0.01	1 790.	< 0.01	93.1	140.	0.77	2.56	0.47	568.	0.072	4.9	21.9	510.
P10	SS		2/24/2023	Very slight yellow, no turbidity	7.9	1200	14.8	550	284	4.15	0.034	1.12	726.	< 0.01	< 0.005	1 130.	< 0.005	85.8	54.	0.54	1.18	0.641	498.	0.056 4	3.73	16.8	427.
P11	SS		9/1/2022	Moderately silty, very grey	7.39	1000	16.9	110	493	3.54	1.71	0.342	25.3	< 0.01	< 0.005	217.	0.013 5	131.	9.9	< 0.1	0.369	1.03	5.1	0.074 2	0.72	40.3	82.8
P11	SS		11/29/2022	Clear and colourless	6.87	645	11.8	110	341	10.6	0.186	0.087	16.5	< 0.01	< 0.005	187.	0.036 7	114.	5.	0.19	2.48	6.93	21.7	0.062 5	< 0.5	13.7	189.
P11	SS		1/26/2023	Mean of duplicates	6.94	1169	11.1	78	808	22.	0.16	0.068	20.35	< 0.02	< 0.01	123.5	0.069 5	266.	10.	0.21	1.265	3.37	40.	0.023	< 1.	34.9	109.5
P11	SS		3/8/2023	Clear and colourless	7.06	990	10.2	88	473	3.67	0.167	0.075	8.13	< 0.01	< 0.005	135.	0.032 1	155.	88.	< 0.1	0.864	2.87	7.2	0.008 4	< 0.5	21.	60.2
P12	NS		9/1/2022	No sample. Well was dry.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P12	NS		11/29/2022	Dry - Not enough water to sample	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P12	SS		1/26/2023	Clear and colourless	6.84	783	11.2	110	531	9.71	0.112	0.123	22.7	< 0.01	< 0.005	120.	0.024 3	177.	19.	0.2	0.527	6.76	314.	0.019 2	< 0.5	21.7	30.6
P12	SS		3/8/2023	Dry - Not enough water to sample	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Notes:

a	*Above CSR Schedule 3.2 AW Standard.*
b	*Above CSR Schedule 3.2 DW Standard.*
c	*Detection Limits above Applicable Standards.*
SS	*Single sample.*
FR1, FR2	*Field replicates.*
BC CSR	*CSR-Sch3.2: BC Contaminated Site Regulation - Schedule 3.2 - Generic Numerical Water Standards, be in effective on November 1, 2017.*
(1)	*Aquatic Life (AW) Freshwater, Column 3.*
(2)	*Drinking Water (DW), Column 6.*
(3)	*Standard varies with pH. Every ammonia result was compared to a standard based on the associated pH result for that sample.*
(4)	*Standard varies with chloride. Every nitrite result was compared to a standard based on the associated chloride result for that sample.*
(5)	*Standard varies with hardness. Every result was compared to a standard that was based on the associated hardness result for that sample.*
(6)	*BC CSR Schedule 3.2 criterion for iron and manganese were not applied as directed by the Stage 8 CSR Amendments.*
(7)	*Standard is based on the trivalent (Cr(III)) species.*
(8)	*Interim standard used.*
(9)	*CSR Stage 13 amendments, protocol 9, background concentration is higher than the applicable CSR DW and/or most stringent CSR a standard. A concentration above the CSR DW or most strigent CSR AW stanadard but below the regional background concentration (South Vancouver Island Region). Is not considered contaminated and is not highlighted as a CSR DW or AW exceedance*

Appendix B-1. Groundwater Quality Data 2022-2023

BC CSR				a AW Maximum (1)	10000	1.31-18.4 (3)	0.2-2 (4)	400	400	250-1500 (5)			20		0.5-15 (5)			128-429 (5)		3		1000	85		75-2400 (5)	
				b DW Maximum (2)	250		1	10	10	80			10		20	1700 (9)	2500	500			2.5		20	20	3000	
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	Molybdenum	Nitrogen - ammonia	Nitrogen - nitrite	Nitrogen - nitrate	Nitrogen - nitrate plus nitrite	Nickel	Phosphorus	Potassium	Selenium	Silicon	Silver	Sodium	Strontium	Sulphate	Sulphur	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	Zirconium
				Fraction	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	µg/l	mg/l	mg/l	mg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/L	µg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
				Method Detection Limit	0.05	0.015	0.005	0.02	0.02	0.02	2	0.05	0.04	50	0.005	0.05	0.05	1	3	0.002	0.2	0.5	0.002	0.2	0.1	0.1
04-3-1	SS	Y	5/25/2022	Clear and colourless	3.08	< 0.015	< 0.005	0.034	0.034	0.355	7.3	0.662	0.182	9 490.	< 0.005	13.	180.	38.	12.1	0.002 9	< 0.2	< 0.5	0.783	< 0.2	1.01	< 0.1
04-3-1	SS	Y	9/28/2022	Clear and colourless.	2.96	< 0.015	< 0.005	0.031	0.031	0.345	8.4	0.632	0.216	8 710.	< 0.005	11.5	181.	39.	12.1	0.002 3	< 0.2	< 0.5	0.65	< 0.2	0.94	< 0.1
04-3-1	SS	Y	1/12/2023	Clear and colourless	2.94	< 0.015	< 0.005	0.028	0.028	0.405	7.3	0.701	0.291	8 800.	< 0.005	12.3	182.	39.	11.9	< 0.002	< 0.2	< 0.5	0.66	< 0.2	0.73	< 0.1
04-3-1	SS	Y	3/3/2023	Clear and colourless	2.79	< 0.015	< 0.005	0.046	0.046	0.376	8.3	0.591	0.298	9 110.	< 0.005	12.8	191.	38.	12.	0.002 2	< 0.2	< 0.5	0.654	< 0.2	0.96	< 0.1
04-4-1	SS	Y	5/25/2022	Clear and colourless	0.2	< 0.015	< 0.005	0.582	0.582	0.283	2.6	1.22	0.043	5 860.	< 0.005	12.9	80.4	21.	5.8	< 0.002	< 0.2	< 0.5	0.011 9	0.45	0.31	< 0.1
04-4-1	SS	Y	9/28/2022	Clear and colourless.	0.21	< 0.015	< 0.005	0.256	0.256	0.431	3.5	1.64	0.042	6 050.	< 0.005	17.8	147.	28.	9.1	0.002 9	< 0.2	< 0.5	0.030 8	0.48	0.93	< 0.1
04-4-1	SS	Y	1/12/2023	Clear and colourless	0.152	< 0.015	< 0.005	1.83	1.83	0.342	3.	1.36	0.051	5 160.	< 0.005	19.2	91.1	32.	9.7	< 0.002	< 0.2	< 0.5	0.011	0.44	0.45	< 0.1
04-4-1	SS	Y	3/3/2023	Clear and colourless	0.132	< 0.015	< 0.005	1.84	1.84	0.996	2.9	1.35	0.102	5 370.	< 0.005	17.2	98.1	23.	7.7	< 0.002	< 0.2	< 0.5	0.006 9	0.37	6.62	< 0.1
07-1-0	SS		5/25/2022	Clear and colourless	0.259	0.016	< 0.005	< 0.02	< 0.02	5.96	< 2.	1.39	< 0.04	8 760.	< 0.005	27.7	293.	36.	12.2	< 0.002	< 0.2	< 0.5	0.279	< 0.2	51.9	< 0.1
07-1-0	SS		10/20/2022	Clear and colourless.	0.469	0.056	< 0.005	< 0.02	< 0.02	12.6	2.8	1.19	< 0.04	9 370.	< 0.005	26.7	309.	28.	10.4	0.002 6	< 0.2	< 0.5	0.281	< 0.2	44.8	< 0.1
07-1-0	NS		1/25/2023	Pump/cistern did not turn on, no sample.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
07-1-0	NS		3/3/2023	Pump/cistern did not turn on, no sample.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16-1-1	SS		5/13/2022	Clear and colourless	0.838	0.055	< 0.005	0.087	0.087	0.186	2.4	0.194	0.051	7 090.	< 0.005	4.49	180.	17.	5.6	0.002 4	< 0.2	< 0.5	0.281	0.56	0.95	< 0.1
16-1-1	NS		10/8/2022	Inaccessible	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16-1-1	NS		1/25/2023	No tubing to sample.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16-1-1	SS		3/16/2023	Clear and colourless	0.565	< 0.015	0.053 6	8.41	8.47	0.404	2.1	0.213	0.061	7 560.	< 0.005	4.44	237.	46.	15.2	0.002 1	0.41	< 0.5	0.158	0.66	1.18	< 0.1
16-1-2	SS		5/13/2022	Clear and colourless	0.467	< 0.015	< 0.005	0.532	0.532	0.253	3.9	0.186	0.065	6 010.	< 0.005	3.72	125.	12.	3.5	0.003 5	< 0.2	1.59	0.178	0.5	1.77	0.12
16-1-2	NS		10/8/2022	Inaccessible	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16-1-2	NS		1/25/2023	No tubing to sample.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16-1-2	SS		3/15/2023	White, high turbidity, moderate intensity	0.206	< 0.015	< 0.005	17.9 b	17.9 b	0.382	3.2	0.241	0.219	6 540.	< 0.005	5.	261.	71.	22.7	0.004 1	< 0.2	< 0.5	0.124	0.5	3.9	< 0.1
16-2-1	SS		5/13/2022	Clear and colourless	0.708	< 0.015	< 0.005	0.33	0.33	0.201	3.5	0.313	0.078	6 480.	< 0.005	4.8	228.	15.	4.7	< 0.002	< 0.2	< 0.5	0.156	1.01	0.45	< 0.1
16-2-1	NS		10/8/2022	Inaccessible	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16-2-1	NS		1/25/2023	No tubing to sample.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16-2-1	SS		3/16/2023	clear and colourless	0.441	< 0.015	0.021 2	14.5 b	14.5 b	0.561	5.7	0.351	0.176	6 790.	< 0.005	5.88	323.	55.	19.5	0.003 3	< 0.2	1.19	0.109	1.07	1.69	< 0.1
16-2-2	SS		5/13/2022	Clear and colourless	0.258	< 0.015	< 0.005	0.616	0.616	0.336	4.1	0.221	0.053	6 110.	< 0.005	3.66	145.	17.	5.5	0.002	< 0.2	0.76	0.067 1	0.65	1.24	< 0.1
16-2-2	NS		10/8/2022	Inaccessible	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16-2-2	NS		1/25/2023	No tubing to sample.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16-2-2	SS		3/16/2023	Clear and colourless	0.234	< 0.015	0.012 3	17.3 b	17.4 b	1.04	< 2.	0.3	0.19	6 770.	< 0.005	5.3	274.	63.	22.1	0.003 4	< 0.2	< 0.5	0.13	0.57	2.04	< 0.1
17-1-1	SS	Y	10/8/2022	Slightly turbid, colourless.	1.62	< 0.015	0.036 1	0.046	0.082	0.378	7.5	0.844	0.076	17 300.	< 0.005	22.5	457.	31.	10.7	0.003 6	< 0.2	< 0.5	0.928	2.66	1.09	< 0.1
17-1-1	SS	Y	1/25/2023	Clear and colourless	0.16	< 0.015	0.017 4	0.533	0.55	0.91	< 2.	0.44	0.102	9 130.	< 0.005	5.29	265.	34.	8.5	< 0.002	< 0.2	< 0.5	0.107	0.98	2.74	< 0.1
17-1-2	SS	Y	10/8/2022	Clear and colourless.	0.749	< 0.015	0.007 7	0.215	0.223	0.175	5.7	0.893	0.051	19 100.	< 0.005	13.7	474.	27.	9.3	0.005 1	< 0.2	< 0.5	0.571	2.13	1.27	< 0.1
17-1-2	SS	Y	1/25/2023	Very slightly turbid, very slightly yellow	0.23	< 0.015	0.075	1.23	1.31	0.284	< 2.	0.559	0.081	9 270.	< 0.005	5.33	374.	29.	7.7	0.003	< 0.2	< 0.5	0.119	1.22	2.66	< 0.1
17-1-3	SS	Y	10/8/2022	Clear and colourless.	0.32	< 0.015	0.014 2	0.03	0.045	0.926	3.4	0.298	0.046	9 310.	< 0.005	3.99	434.	29.	9.9	0.002 3	< 0.2	< 0.5	0.14	1.84	0.52	< 0.1
17-1-3	SS	Y	1/25/2023	Clear and colourless	0.195	< 0.015	0.021 4	0.361	0.383	3.39	< 2.	0.458	0.096	9 280.	< 0.005	4.33	509.	34.	9.3	< 0.002	< 0.2	< 0.5	0.132	2.58	0.81	< 0.1
18-1-1	FRM	Y	5/13/2022	Mean of duplicates	0.523	< 0.015	< 0.005	< 0.02	< 0.02	0.38	5.85	0.242	< 0.04	7 835.	< 0.005	4.81	90.4	26.5	7.9	< 0.002	< 0.2	< 0.5	0.141	0.62	0.75	< 0.1
18-1-1	SS	Y	10/20/2022	Clear and colourless.	0.727	< 0.015	< 0.005	< 0.02	< 0.02	0.592	7.1	0.321	< 0.04	9 430.	< 0.005	5.3	90.1	24.	9.2	0.002	< 0.2	< 0.5	0.141	0.5	0.99	< 0.1
18-1-1	FRM	Y	1/25/2023	Mean of duplicates	0.723	< 0.015	0.005 1	< 0.02	< 0.02	0.410 5	5.05	0.315	< 0.04	8 350.	< 0.005	5.7	90.45	25.	7.25	< 0.002	< 0.2	< 0.5	0.146	0.48	1.34	< 0.1
18-1-1	FRM	Y	3/7/2023	Mean of duplicates	0.59	< 0.015	< 0.005	< 0.02	< 0.02	0.332	7.75	0.249 5	< 0.04	8 220.	< 0.005	5.13	91.45	25.	6.65	0.002 3	< 0.2	0.685	0.154	0.435	0.88	< 0.1
18-2-1	SS	Y	5/12/2022	Clear and colourless	0.063	0.018	< 0.005	0.131	0.131	0.407	6.2	0.132	0.569	7 280.	< 0.005	3.12	56.1	24.	7.9	0.004 3	< 0.2	4.77	0.283	0.8	2.9	0.23
18-2-1	SS	Y	10/8/2022	Clear and colourless.	0.055	< 0.015	0.02	0.155	0.175	0.176	3.5	0.118	0.604	6 960.	< 0.005	3.38	62.5	30.	10.1	< 0.002	< 0.2	< 0.5	0.047 9	0.55	0.88	< 0.1
18-2-1	SS	Y	1/25/2023	Clear and colourless	< 0.05	< 0.015	0.007 1	0.4	0.407	0.178	2.2	0.107	0.805	6 770.	< 0.005	3.65	66.9	57.	16.5	< 0.002	< 0.2	< 0.5	0.037	0.65	3.16	< 0.1
18-2-1	SS	Y	3/7/2023	Clear and colourless	< 0.05	< 0.015	0.009	0.302	0.311	0.086	2.4	0.093	0.594	6 740.	< 0.005	3.26	61.1	37.	9.7	< 0.002	< 0.2	< 0.5	0.032 3	0.66	0.64	< 0.1
18-2-2	SS	Y	1/25/2023	Clear and colourless	< 0.05	< 0.015	< 0.005	0.411	0.411	0.11	< 2.	0.13	0.413	7 020.	< 0.005	3.48	56.8	37.	11.	< 0.002	< 0.2	< 0.5	0.026 4	0.51	0.64	< 0.1
18-2-2	SS	Y	3/7/2023	Clear and colourless	< 0.05	< 0.015	< 0.005	0.332	0.332	0.207	< 2.	0.142	0.378	6 670.	< 0.005	3.24	58.8	33.	9.1	0.002 7	< 0.2	< 0.5	0.044 4	0.53	0.87	< 0.1
18-2-2	SS	Y	10/8/2022	Clear and colourless.	< 0.05	< 0.015	0.005 8	0.265	0.271	0.162	2.6	0.154	0.805	6 840.	< 0.005	3.31	61.8	32.	10.7	0.002 7	< 0.2	< 0.5	0.052 8	0.58	0.86	< 0.1
18-2-2	SS	Y	5/12/2022	Clear and colourless	< 0.05	< 0.015	< 0.005	0.157	0.157	0.098	< 2.	0.126	0.509	7 330.	< 0.005	3.07	56.6	24.	7.9	0.002 2	< 0.2	< 0.5	0.028 1	0.61	0.39	< 0.1
19-1-1	SS		5/25/2022	Clear and moderately orange	0.691	0.047	< 0.005	< 0.02	< 0.02	0.43	2.3	0.201	< 0.04	11 700.	< 0.005	7.84	142.	34.	9.4	< 0.002	< 0.2	< 0.5	0.096 7	< 0.2	0.24	< 0.1
19-1-1	SS		9/28/2022	Slightly turbid, slightly yellow.	0.537	0.068	< 0.005	< 0.02	< 0.02	0.667	2.6	0.219	< 0.04	12 000.	< 0.005	8.78	186.	9.2	3.	< 0.002	< 0.2	< 0.5	0.109	< 0.2	0.86	< 0.1
19-1-1	SS		1/25/2023	Very turbid, very orange/brown	1.68	0.27	< 0.005	< 0.02	< 0.02	6.23	2.6	0.29	0.05	13 900.	< 0.005	8.8	307.	4.3	< 3.	< 0.002	0.23	< 0.5	0.029 1	0.75	2.95	< 0.1
19-1-1	SS		3/3/2023	Clear and colourless	0.4	0.077	< 0.005	< 0.02	< 0.02	0.45	8.3	0.253	0.252	13 900.	0.014 1	7.54	308.	< 1.	< 3.	< 0.002	< 0.2	< 0.5	0.009 8	1.6	1.07	< 0.1
19-1-2	SS		5/25/2022	Clear and colourless	0.331	0.031	< 0.005	< 0.02	< 0.02	0.302	3.4	0.154	< 0.04	10 700.	< 0.005	4.67	143.	30.	8.6	< 0.002	< 0.2	< 0.5	0.018 1	< 0.2	0.16	< 0.1
19-1-2	SS		9/28/2022	Clear and colourless.	0.189	0.044	< 0.005	< 0.02	< 0.02	0.219	3.3	0.153	0.066	10 600.	< 0.005	4.94	174.	10.	3.3	< 0.002	< 0.2	< 0.5	0.022 4	0.2	0.49	< 0.1
19-1-2	SS		1/25/2023	Very slightly turbid with red/orange bits, water is colourless.	0.302	0.032	0.014 9	< 0.02	< 0.02	0.139	4.6	0.143	< 0.04	10 900.	< 0.005	5.24	178.	13.	4.5	< 0.002	< 0.2	< 0.5	0.010 5	0.46	0.38	< 0.1
19-1-2	SS		3/3/2023	Clear and colourless	0.261	0.031	< 0.005	< 0.02	< 0.02	0.095	3.9	0.147	0.119	11 300.	0.005 9	4.81	191.	12.	4.3	< 0.002	< 0.2	< 0.5	0.012 2	0.43	0.16	< 0.1
19-2-1	SS		5/25/2022	Clear and colourless	0.597	< 0.015	< 0.005	< 0.02	< 0.02	0.16	2.3	0.148	< 0.04	11 800.	< 0.005	4.72	157.	49.	13.5	< 0.002	< 0.2	< 0.5	0.080 7	< 0.2	0.23	< 0.1
19-2-1	SS		9/27/2022	Clear and colourless.	0.602	0.039	< 0.005	< 0.02	< 0.02	0.163	2.8	0.139	< 0.04	12 600.	< 0.005	4.7	162.	43.	14.1	< 0.002	< 0.2	< 0.5	0.091 4	< 0.2	0.45	< 0.1
19-2-1	SS		1/25/2023	Clear and colourless	0.537	< 0.015	< 0.005	< 0.02	< 0.02	0.158	< 2.	0.141	< 0.04	12 900.	< 0.005	5.09	166.	36.	9.7	< 0.002	< 0.2	< 0.5	0.081 1	< 0.2	0.57	< 0.1
19-2-1	SS		3/3/2023	Clear and colourless	0.478	< 0.015	< 0.005	< 0.02	< 0.02	0.216	2.9	0.143	0.098	13 500.	< 0.005	4.92	176.	35.	11.7	< 0.002	< 0.2	< 0.5	0.076 1	< 0.2	0.26	< 0.1
19-2-2	SS		5/25/2022	Slightly silty and slightly brown	0.441	< 0.015	< 0.005	< 0.02	< 0.02	0.236	< 2.	0.248	< 0.04	5 690.	< 0.005	5.19	152.	43.	12.	< 0.002	< 0.2	< 0.5	0.062 9	< 0.2	0.24	< 0.1
19-2-2	SS		9/27/2022	Slightly turbid, slightly yellow.	0.728	< 0.015	< 0.005	< 0.02	< 0.02	0.367	5.2	0.223	< 0.04	10 000.	< 0.005	5.29	189.	34.	11.	< 0.002	< 0.2	< 0.5	0.169	< 0.2	1.2	< 0.1
19-2-2	SS		1/25/2023	Moderatley turbid, moderately orange	0.395	< 0.015	< 0.005	< 0.02	< 0.02	0.213	< 2.	0.21	< 0.04	8 330.	< 0.005	5.5	134.	33.	9.8	< 0.002	< 0.2	< 0.5	0.058	< 0.2	0.54	< 0.1
19-2-2	SS		3/6/2023	Clear and colourless	0.258	< 0.015	0.005 4	< 0.02	< 0.02	0.489	20.7	0.3	< 0.04	6 080.	< 0.005	5.4	142.	31.	9.1	< 0.002	< 0.2	< 0.5	0.089 3	< 0.2	4.76	< 0.1
20-1-1	SS	Y	5/20/2022	Slightly silty and colourless	0.53	< 0.015	< 0.005	< 0.02	< 0.02	0.29	10.	< 0.25	< 0.2	19 200.	< 0.025	8.69	335.	12.	< 15.	< 0.01	< 1.	< 2.5	< 0.01	< 1.	< 0.5	< 0.5
20-1-1	SS	Y	9/20/2022	Clear, colourless.	0.4	0.046	0.007 8	< 0.02	< 0.02	0.35	25.	0.27	< 0.2	18 800.	< 0.025	10.2	424.	13.	< 15.	< 0.01	< 1.	< 2.5	< 0.01	< 1.	0.75	< 0.5
20-1-1	SS	Y	12/14/2022	Clear and colourless	0.39	< 0.015	< 0.005	< 0.02	< 0.02	0.47	28.	< 0.25	< 0.2	20 500.	< 0.025	9.	405.	12.	< 15.	0.011	< 1.	< 2.5	0.045	< 1.	0.57	< 0.5
20-1-1	SS	Y	3/9/2023	Clear and colourless	0.41	< 0.015	0.018 5	< 0.02	0.021	0.34	32.	< 0.25	< 0.2	19 100.	< 0.025	9.5	400.	11.	< 15.	< 0.01	< 1.	< 2.5	0.024	< 1.	1.01	< 0.5
20-1-2	SS	Y	5/20/2022	Clear and colourless	0.47	0.065	< 0.005	< 0.02	< 0.02	0.1	11.	0.32	< 0.2	20 400.	< 0.025	11.2	452.	14.	< 15.	< 0.01	< 1.	< 2.5	< 0.01	< 1.	< 0.5	< 0.5
20-1-2	SS	Y	9/20/2022	Clear, colourless.	0.7	0.043	< 0.005	< 0.02	< 0.02	1.63	21.	0.32	0.66	19 100.	< 0.025	12.	523.	13.	< 15.	< 0.01	< 1.	< 2.5	0.017	< 1.	1.39	< 0.5
20-1-2	SS	Y	12/13/2022	Clear and colourless	0.33	< 0.015	< 0.005	< 0.02	< 0.02	0.17	20.	< 0.25	< 0.2	21 600.	< 0.025	9.53	376.	12.	< 15.	< 0.01	< 1.	< 2.5	0.012	< 1.	0.86	< 0.5
20-1-2	SS	Y	3/9/2023	Clear and colourless	0.43	0.027	< 0.005	< 0.02	< 0.02	0.25	30.	0.27	< 0.2	20 600.	< 0.025	10.1	459.	12.	< 15.	< 0.01	< 1.	< 2.5	< 0.01	< 1.	0.82	< 0.5
21-1-1	FRM	Y	5/20/2022	Mean of duplicates	0.485	< 0.015	< 0.005	< 0.02	< 0.02	< 0.1	10.	< 0.25	< 0.2	19 650.	< 0.025	8.52	420.5	12.	< 15.	< 0.01	< 1.	< 2.5	0.018	< 1.	10.15	< 0.5
21-1-1	FRM	Y	9/21/2022	Mean of duplicates	0.506 5	< 0.015	< 0.005	< 0.02	< 0.02	0.047 5	2.8	0.217	< 0.04	19 400.	< 0.005	8.92	455.5	11.	3.5	< 0.002	< 0.2	< 0.5	0.021 55	0.235	0.425	< 0.1
21-1-1	FRM	Y	12/15/2022	Mean of duplicates	0.525	< 0.015	< 0.005	0.020 5	0.020 5	0.273 5	31.6	0.24	< 0.14	20 600.	< 0.017 5	8.685	467.	11.	< 10.5	0.028 4	< 0.7	< 1.75	0.151 8	< 0.7	2.13	< 0.35
21-1-1	FRM	Y	3/10/2023	Mean of duplicates	0.435	< 0.015	< 0.005	0.022 5	0.022 5	< 0.1	28.	< 0.25	< 0.2	18 850.	< 0.025	8.245	416.5	10.	< 15.	< 0.01	< 1.	< 2.5	0.015 5	< 1.	0.94	< 0.5
21-1-2	FRM	Y	5/19/2022	Mean of duplicates	0.833 5	5.35	< 0.005	< 0.02	< 0.02	1.985	6.15	5.825	< 0.04	13 100.	< 0.005	25.	389.5	21.	6.2	0.003 35	< 0.2	< 0.5	0.057 2	0.325	0.22	< 0.1
21-1-2	FRM	Y	9/20/2022	Mean of duplicates	0.791	5.85	< 0.005	< 0.02	< 0.02	2.525	6.45	6.2	0.060 5	13 000.	< 0.005	25.35	487.5	16.5	5.35	0.002 5	< 0.2	< 0.5	0.072 55	0.245	0.82	< 0.1
21-1-2	FRM	Y	12/14/2022	Mean of duplicates	0.717 5	5.5	< 0.005	< 0.02	< 0.02	3.075	8.95	6.24	< 0.04	14 800.	< 0.005	26.65	550.5	17.	5.95	0.005 05	< 0.2	0.565	0.083 7	0.46	1.155	< 0.1
21-1-2	FRM	Y	3/10/2023	Mean of duplicates	0.8	4.9	< 0.005	< 0.02	< 0.02	1.49	8.15	5.175	< 0.04	12 400.	< 0.005	23.2	380.5	18.	5.2	0.028 2	< 0.2	1.555	0.049 4	0.59	0.65	< 0.1
21-2-1	FRM	Y	5/19/2022	Mean of duplicates	0.725 5	5.15	< 0.005	< 0.02	< 0.02	1.445	6.9	5.675	< 0.04	12 750.	< 0.005	24.65	380.5	24.	6.4	0.002 9	< 0.2	< 0.5	0.057 5	0.295	0.56	< 0.1
21-2-1	FRM	Y	9/20/2022	Mean of duplicates	0.592	3.55	< 0.005	0.022	0.022	2.21	5.65	6.27	0.048 5	12 850.	< 0.005	27.85	490.5	13.5	4.4	0.002 2	< 0.2	< 0.5	0.100 5	0.245	0.78	< 0.1
21-2-1	FRM	Y	12/15/2022	Mean of duplicates	0.716 5	5.55	0.005	< 0.02	< 0.02	2.26	7.4	6.36	0.052	13 850.	< 0.005	31.45	491.5	17.5	5.85	0.006 95	< 0.2	< 0.5	0.091 25	0.395	0.49	< 0.1
21-2-1	FRM	Y	3/10/2023	Mean of duplicates	0.734	4.95	< 0.005	< 0.02	< 0.02	1.395	5.85	5.06	< 0.04	12 250.	< 0.005	22.55	357.	19.	5.55	0.009 45	< 0.2	0.61	0.053 4	0.445	0.61	< 0.1

Appendix B-1. Groundwater Quality Data 2022-2023

BC CSR				a AW Maximum (1)	10000	1.31-18.4 (3)	0.2-2 (4)	400	400	250-1500 (5)			20		0.5-15 (5)			128-429 (5)		3		1000	85		75-2400 (5)	
				b DW Maximum (2)	250		1	10	10	80			10		20	1700 (9)	2500	500			2.5		20	20	3000	
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	Molybdenum	Nitrogen - ammonia	Nitrogen - nitrite	Nitrogen - nitrate	Nitrogen - nitrate plus nitrite	Nickel	Phosphorus	Potassium	Selenium	Silicon	Silver	Sodium	Strontium	Sulphate	Sulphur	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	Zirconium
				Fraction	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	µg/l	mg/l	mg/l	mg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/L	µg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
				Method Detection Limit	0.05	0.015	0.005	0.02	0.02	0.02	2	0.05	0.04	50	0.005	0.05	0.05	1	3	0.002	0.2	0.5	0.002	0.2	0.1	0.1
25-1-1	SS		5/17/2022	Clear and colourless	0.533	< 0.015	0.013	12.9 b	12.9 b	0.128	3.7	0.299	0.935	10 000.	< 0.005	4.51	358.	190.	53.4	< 0.002	< 0.2	< 0.5	0.248	0.44	0.39	< 0.1
25-1-1	SS		9/1/2022	Clear, colourless	0.745	< 0.015	0.006 5	5.88	5.88	0.133	5.4	0.368	0.604	8 810.	< 0.005	4.6	324.	130.	41.5	< 0.002	< 0.2	< 0.5	0.395	0.44	1.05	< 0.1
25-1-1	SS		12/6/2022	Clear and colourless	0.642	< 0.015	0.006	4.83	4.84	0.349	4.8	0.25	0.44	9 880.	< 0.005	4.17	352.	170.	56.6	< 0.002	< 0.2	< 0.5	0.28	0.43	0.8	< 0.1
25-1-1	SS		3/17/2023	Clear and colourless	0.7	< 0.015	0.006 6	3.54	3.54	0.142	3.	0.301	1.	9 420.	< 0.005	4.37	320.	140.	47.8	< 0.002	< 0.2	< 0.5	0.336	0.46	1.74	< 0.1
25-1-2	SS		5/17/2022	Clear and colourless	0.422	< 0.015	0.006 9	0.489	0.496	0.338	5.	0.185	0.186	8 130.	< 0.005	2.69	104.	53.	15.9	< 0.002	< 0.2	< 0.5	0.062 8	0.27	0.26	< 0.1
25-1-2	SS		9/1/2022	Clear, colourless	0.643	0.017	0.011	0.6	0.611	0.635	4.6	0.247	0.185	7 590.	< 0.005	3.89	184.	140.	43.8	< 0.002	< 0.2	< 0.5	0.121	0.27	0.75	< 0.1
25-1-2	SS		12/1/2022	Clear and colourless	0.962	< 0.015	0.006 4	0.649	0.655	1.23	4.6	0.245	0.229	7 890.	< 0.005	3.44	135.	85.	23.3	< 0.002	< 0.2	< 0.5	0.133	0.35	0.83	< 0.1
25-1-2	SS		3/16/2023	clear and colourless	0.939	< 0.015	< 0.005	0.212	0.212	0.505	< 2.	0.191	0.221	8 220.	< 0.005	3.12	114.	54.	18.8	< 0.002	< 0.2	< 0.5	0.082 7	0.29	0.42	< 0.1
27-1-2	NS		12/14/2022	No sample, well destroyed	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
27-1-1	SS		9/9/2022	Slightly turbid, slightly grey	0.362	0.024	0.02	< 0.02	0.033	0.262	4.8	0.168	< 0.04	14 200.	< 0.005	9.47	110.	47.	14.4	< 0.002	< 0.2	< 0.5	0.087 1	0.48	0.79	< 0.1
27-1-1	SS		12/13/2022	Very silty, very grey	0.368	0.042	0.014 6	< 0.02	< 0.02	0.15	7.7	0.215	< 0.04	19 600.	< 0.005	14.	115.	44.	14.3	< 0.002	< 0.2	< 0.5	0.122	0.57	0.94	< 0.1
27-1-1	SS		3/14/2023	Clear and colourless	0.41	< 0.015	0.014 7	< 0.02	< 0.02	0.234	28.	0.2	0.58	17 400.	< 0.01	12.3	106.	46.	14.	0.020 6	< 0.4	1.2	0.198	0.79	0.88	< 0.2
27-1-2	NS		9/9/2022	DRY	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
27-1-2	NS		3/14/2023	Well destroyed, not sampled	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
29-1-2	SS	Y	5/13/2022	Clear and colourless	0.368	< 0.015	< 0.005	2.58	2.58	0.498	2.9	0.357	0.163	5 870.	< 0.005	28.5	192.	40.	12.	0.002 5	< 0.2	< 0.5	0.038 9	< 0.2	0.26	< 0.1
29-1-2	NS	Y	9/21/2022	Forgot?	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
29-1-2	SS	Y	12/15/2022	Clear and colourless	0.321	< 0.015	< 0.005	2.25	2.25	0.474	3.	0.422	0.288	6 790.	< 0.005	31.	240.	58.	19.4	0.004 6	0.21	< 0.5	0.048 1	0.21	0.41	< 0.1
29-1-2	SS	Y	2/27/2023	Clear and colourless	0.359	< 0.015	< 0.005	0.903	0.903	0.458	3.5	0.371	0.225	6 490.	< 0.005	29.6	212.	47.	14.5	< 0.002	< 0.2	< 0.5	0.037 9	< 0.2	0.88	< 0.1
28-1-0	SS	Y	5/20/2022	Clear and colourless	1.	< 0.015	< 0.005	0.227	0.227	0.29	3.7	0.196	0.105	9 760.	< 0.005	3.69	309.	27.	7.5	< 0.002	< 0.2	< 0.5	0.189	0.75	0.13	< 0.1
28-1-0	SS	Y	9/12/2022	Clear, colourless	1.66	< 0.015	< 0.005	0.44	0.44	0.492	3.2	0.217	0.163	8 890.	< 0.005	3.77	324.	39.	12.5	< 0.002	< 0.2	< 0.5	0.242	0.87	0.19	< 0.1
28-1-0	SS	Y	1/25/2023	Clear and colourless.	1.1	< 0.015	< 0.005	0.514	0.514	0.344	< 2.	0.21	0.146	9 290.	< 0.005	3.93	341.	29.	8.3	< 0.002	< 0.2	< 0.5	0.23	0.85	0.95	< 0.1
28-1-0	SS	Y	3/14/2023	Clear and colourless	0.947	< 0.015	< 0.005	0.445	0.445	0.299	3.9	0.207	0.115	9 110.	0.006 5	3.69	334.	27.	7.5	0.002 5	< 0.2	1.04	0.226	1.11	0.49	< 0.1
29-1-1	SS	Y	5/13/2022	Clear and colourless	0.384	< 0.015	< 0.005	0.315	0.315	0.464	2.8	0.281	0.122	5 810.	< 0.005	20.9	205.	31.	9.2	< 0.002	< 0.2	< 0.5	0.069 4	0.5	0.26	< 0.1
29-1-1	FRM	Y	9/21/2022	Mean of duplicates	0.205	0.02	< 0.005	2.36	2.36	0.512	85.45	0.362	7.885	5 910.	< 0.005	23.2	188.5	51.5	24.	< 0.002	0.255	< 0.5	0.055 95	0.46	0.33	< 0.1
29-1-1	SS	Y	12/15/2022	Clear and colourless	0.343	0.019	< 0.005	1.36	1.36	0.577	6.	0.29	0.178	6 860.	< 0.005	22.1	249.	42.	14.7	< 0.002	< 0.2	< 0.5	0.089 4	0.45	0.36	< 0.1
29-1-1	SS	Y	2/27/2023	Clear and colourless	0.363	< 0.015	< 0.005	0.721	0.721	0.535	2.7	0.289	0.152	6 650.	< 0.005	21.6	238.	41.	12.5	< 0.002	< 0.2	< 0.5	0.074	0.41	0.19	< 0.1
30-1-1	SS	Y	5/12/2022	Clear and colourless	1.44	< 0.015	< 0.005	< 0.02	< 0.02	0.215	21.6	0.696	< 0.04	7 910.	< 0.005	20.5	529.	29.	9.4	0.003	< 0.2	3.89	0.403	0.39	1.79	0.13
30-1-1	SS	Y	9/22/2022	Clear and colourless.	1.26	< 0.015	0.037 1	< 0.02	0.046	0.307	8.1	0.637	< 0.04	7 660.	< 0.005	18.6	486.	28.	8.9	0.003 9	< 0.2	< 0.5	0.335	< 0.2	0.4	< 0.1
30-1-1	NS	Y	12/15/2022	Heals Range - did not have access	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
30-1-1	SS	Y	2/15/2023	Clear and colourless	1.12	< 0.015	0.009	< 0.02	0.023	0.215	9.3	0.583	< 0.04	8 080.	< 0.005	19.4	531.	30.	9.4	0.002 6	< 0.2	< 0.5	0.321	0.21	0.84	< 0.1
30-1-2	SS	Y	5/12/2022	Clear and colourless	0.33	< 0.015	< 0.005	1.56	1.56	0.808	7.2	1.62	0.054	4 670.	< 0.005	35.2	89.1	30.	9.	< 0.002	< 0.2	< 0.5	0.009 9	< 0.2	49.5	< 0.1
30-1-2	SS	Y	9/22/2022	Clear and colourless.	2.57	0.017	< 0.005	0.085	0.085	0.538	11.9	1.91	0.079	5 590.	< 0.005	29.6	322.	44.	13.6	< 0.002	< 0.2	< 0.5	0.315	< 0.2	7.83	< 0.1
30-1-2	NS	Y	12/15/2022	Heals Range - did not have access	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
30-1-2	SS	Y	2/15/2023	Clear and colourless	0.317	< 0.015	< 0.005	2.96	2.96	0.814	7.9	1.46	0.061	4 580.	< 0.005	28.9	89.2	27.	8.6	< 0.002	< 0.2	< 0.5	0.006 4	< 0.2	45.3	< 0.1
31-1-2	SS	Y	5/16/2022	Clear and colourless	0.503	< 0.015	< 0.005	0.382	0.382	0.118	2.9	0.677	0.057	5 450.	< 0.005	6.62	342.	190.	76.	0.002 6	< 0.2	< 0.5	0.459	0.46	1.6	< 0.1
31-1-2	SS	Y	9/21/2022	Clear and colourless.	0.471	< 0.015	< 0.005	0.502	0.502	0.189	< 2.	0.936	0.06	5 310.	< 0.005	6.48	286.	190.	61.2	0.002 1	< 0.2	< 0.5	0.378	0.39	1.63	< 0.1
31-1-2	SS	Y	12/16/2022	Clear and colourless	0.543	< 0.015	< 0.005	3.19	3.19	0.152	2.2	0.847	0.125	5 160.	< 0.005	6.73	384.	270.	89.6	< 0.002	< 0.2	< 0.5	0.558	0.47	1.7	< 0.1
31-1-1	FRM	Y	5/16/2022	Mean of duplicates	0.767 5	< 0.015	< 0.005	0.335	0.335	0.21	5.45	0.647	0.041 5	5 570.	< 0.005	6.63	362.5	185.	64.85	< 0.002	< 0.2	< 0.5	0.291 5	0.25	0.285	< 0.1
31-1-1	FRM	Y	9/21/2022	Mean of duplicates	0.975 5	< 0.015	< 0.005	0.234 5	0.234 5	0.233	4.05	0.672 5	< 0.04	5 275.	< 0.005	6.27	357.	195.	63.5	< 0.002	< 0.2	< 0.5	0.326	< 0.2	0.37	< 0.1
31-1-1	FRM	Y	12/15/2022	Mean of duplicates	0.855	< 0.015	< 0.005	1.395	1.395	0.336 5	4.5	0.678	0.116	6 190.	< 0.005	7.105	436.	210.	78.25	< 0.002	< 0.2	< 0.5	0.382 5	0.315	0.675	< 0.1
36-3-1	SS		5/18/2022	Clear and colourless	0.857	0.16	< 0.005	0.055	0.055	4.12	5.1	0.653	< 0.04	9 380.	< 0.005	6.52	197.	140.	43.2	0.009 4	< 0.2	< 0.5	0.56	0.27	0.67	< 0.1
36-3-1	SS		9/15/2022	Clear, colourless	0.236	< 0.015	< 0.005	0.583	0.583	0.276	7.9	0.764	0.103	9 360.	< 0.005	9.49	433.	230.	71.6	0.004 3	< 0.2	< 0.5	0.306	0.26	1.	< 0.1
36-3-1	SS		12/9/2022	Clear and colourless	0.283	< 0.015	0.036 9	0.511	0.548	0.357	9.3	0.754	0.119	13 500.	< 0.005	10.2	450.	240.	75.3	0.005 4	< 0.2	1.03	0.286	0.51	0.81	< 0.1
36-3-1	SS		3/9/2023	Clear and colourless	0.313	< 0.015	< 0.005	0.542	0.542	0.348	8.2	0.74	0.092	12 200.	< 0.005	10.7	415.	220.	68.	0.006 9	< 0.2	< 0.5	0.299	0.39	1.26	< 0.1
37-3-1	SS		5/18/2022	Clear and colourless	0.355	< 0.015	< 0.005	0.689	0.689	0.378	8.9	0.8	0.092	12 600.	< 0.005	9.65	487.	240.	81.4	0.005 7	< 0.2	< 0.5	0.324	< 0.2	0.42	< 0.1
37-3-1	SS		9/20/2022	Clear and colourless.	0.829	0.48	< 0.005	0.061	0.061	3.02	5.8	0.583	< 0.04	10 100.	< 0.005	7.4	266.	160.	55.	0.012 9	< 0.2	< 0.5	0.651	0.28	1.25	< 0.1
37-3-1	FRM		12/8/2022	Mean of duplicates	0.688 5	0.44	< 0.005	0.040 5	0.040 5	3.36	4.4	0.522 5	< 0.04	11 350.	< 0.005	6.91	293.	205.	63.35	0.013 15	< 0.2	< 0.5	0.517	0.325	0.995	< 0.1
37-3-1	SS		3/9/2023	Clear and colourless	0.454	0.51	< 0.005	< 0.02	< 0.02	1.48	4.4	0.448	< 0.04	10 500.	< 0.005	5.74	223.	110.	35.9	0.013 1	< 0.2	< 0.5	0.258	0.4	0.74	< 0.1
38-1-1	SS		5/18/2022	Clear and colourless	2.89	< 0.015	< 0.005	0.388	0.388	4.73	4.5	0.364	0.435	15 000.	< 0.005	12.6	554.	50.	13.8	< 0.002	< 0.2	< 0.5	0.566	1.91	1.17	< 0.1
38-1-1	SS		10/7/2022	Clear and colourless.	2.71	< 0.015	< 0.005	0.319	0.319	3.81	4.5	0.373	0.219	15 200.	< 0.005	11.4	594.	38.	13.5	0.002	< 0.2	< 0.5	0.603	2.12	2.47	< 0.1
38-1-1	SS		12/15/2022	Clear and colourless	1.97	< 0.015	< 0.005	0.213	0.213	3.73	5.5	0.312	0.187	15 700.	< 0.005	9.09	580.	38.	13.4	0.007 5	< 0.2	< 0.5	0.438	1.78	1.5	< 0.1
38-1-1	SS		3/14/2023	Clear and colourless	1.56	0.032	< 0.005	0.489	0.489	3.79	5.4	0.334	0.33	13 100.	0.005 3	8.62	519.	41.	11.3	< 0.002	< 0.2	0.79	0.449	1.89	1.63	< 0.1
39-1-1	FRM	Y	5/17/2022	Mean of duplicates	2.24	< 0.015	< 0.005	0.195 5	0.195 5	0.096	3.1	0.270 5	0.173 5	5 875.	< 0.005	4.235	244.	25.	8.35	< 0.002	< 0.2	< 0.5	0.137	1.895	0.57	< 0.1
39-1-1	SS	Y	9/15/2022	Clear, colourless	2.47	< 0.015	< 0.005	0.078	0.078	0.181	< 2.	0.285	0.187	4 680.	< 0.005	3.92	236.	24.	7.1	< 0.002	< 0.2	< 0.5	0.13	1.71	1.52	< 0.1
39-1-1	SS	Y	12/7/2022	Clear and colourless	2.43	< 0.015	0.022 6	0.666	0.689	0.364	3.3	0.304	0.123	5 990.	< 0.005	3.98	272.	26.	7.8	< 0.002	< 0.2	< 0.5	0.138	2.09	3.38	< 0.1
39-1-1	FRM	Y	3/9/2023	Mean of duplicates	2.25	< 0.015	0.037 65	7.485	7.525	0.172 5	2.6	0.285 5	0.199 5	5 125.	0.005 85	4.515	301.	24.	7.05	0.010 9	< 0.2	< 0.5	0.166	1.615	1.215	< 0.1
39-2-1	SS	Y	12/7/2022	Clear and colourless	1.16	< 0.015	< 0.005	0.094	0.094	0.112	3.	0.2	0.107	8 440.	< 0.005	3.55	327.	25.	7.4	< 0.002	< 0.2	< 0.5	0.167	1.2	0.26	< 0.1
39-2-1	SS	Y	3/9/2023	Clear and colourless	1.28	< 0.015	0.034 2	1.94	1.98	0.119	< 2.	0.194	0.606	7 470.	< 0.005	3.54	316.	23.	6.7	< 0.002	< 0.2	< 0.5	0.211	1.03	0.16	< 0.1
39-2-1	SS	Y	9/15/2022	Clear, colourless	1.38	1.3	< 0.005	0.097	0.097	0.087	< 2.	0.19	0.166	7 000.	< 0.005	3.25	264.	20.	5.9	< 0.002	< 0.2	< 0.5	0.135	1.17	0.19	< 0.1
39-2-1	SS	Y	5/17/2022	Clear and colourless	1.24	< 0.015	< 0.005	0.071	0.071	0.056	2.1	0.19	0.279	8 290.	< 0.005	3.39	303.	20.	6.	< 0.002	< 0.2	< 0.5	0.16	1.14	< 0.1	< 0.1
40-1-1	SS		5/19/2022	Clear and colourless	0.986	0.61	0.011 9	1.6	1.61	0.605	2.1	3.3	0.047	7 110.	< 0.005	9.35	296.	32.	9.	< 0.002	< 0.2	0.58	0.409	0.28	1.41	< 0.1
40-1-1	SS		9/22/2022	Clear and colourless.	1.09	1.6	< 0.005	1.41	1.41	0.812	43.6	3.7	0.053	7 150.	< 0.005	9.37	394.	45.	14.1	0.002	< 0.2	< 0.5	0.65	0.23	1.99	< 0.1
40-1-1	SS		12/14/2022	Clear and colourless	1.16	0.95	0.028 4	1.48	1.51	1.05	13.1	3.85	0.05	8 390.	< 0.005	10.3	507.	56.	19.1	0.006 6	< 0.2	< 0.5	0.8	0.35	2.29	< 0.1
40-1-1	SS		3/9/2023	Clear and colourless	0.9	0.52	0.047 5	6.06	6.11	0.666	2.8	3.38	< 0.04	6 970.	< 0.005	8.83	364.	33.	9.	0.005 1	< 0.2	< 0.5	0.5	0.35	6.24	< 0.1
41-1-1	FRM	Y	5/13/2022	Mean of duplicates	1.98	0.03	< 0.005	0.043	0.043	0.099	2.75	0.818 5	< 0.04	7 375.	< 0.005	4.77	206.	47.5	13.9	< 0.002	< 0.2	< 0.5	0.173	< 0.2	0.39	< 0.1
41-1-1	FRM	Y	9/22/2022	Mean of duplicates	2.	0.052 5	< 0.005	0.044 5	0.044 5	0.258	2.2	1.19	0.060 5	7 230.	< 0.005	4.995	191.	56.	17.75	< 0.002	< 0.2	< 0.5	0.261	< 0.2	0.41	< 0.1
41-1-1	FRM	Y	12/15/2022	Mean of duplicates	2.415	0.023 5	< 0.005	0.038 5	0.038 5	0.178 5	2.65	0.951	0.067	8 465.	< 0.005	5.13	221.5	49.	17.95	0.004 05	< 0.2	< 0.5	0.268	< 0.2	0.325	< 0.1
41-1-1	FRM	Y	2/27/2023	Mean of duplicates	1.295	0.021 5	0.005 95	0.363 5	0.369	0.109 5	2.65	0.86	0.062 5	8 160.	< 0.005	4.975	189.5	59.	16.5	< 0.002	< 0.2	< 0.5	0.181	< 0.2	0.49	< 0.1
42-1-1	FRM	Y	5/13/2022	Mean of duplicates	0.188	0.057	< 0.005	< 0.02	< 0.02	0.130 5	5.3	0.906	< 0.04	5 970.	< 0.005	9.055	366.	74.	21.9	< 0.002	< 0.2	< 0.5	0.045 9	0.77	0.225	< 0.1
42-1-1	SS	Y	9/21/2022	Clear and colourless.	0.339	0.076	< 0.005	< 0.02	< 0.02	0.204	21.2	1.16	0.296	6 910.	< 0.005	10.3	415.	86.	29.1	< 0.002	< 0.2	1.72	0.085 2	0.82	1.57	< 0.1
42-1-1	FRM	Y	12/15/2022	Mean of duplicates	0.256	0.074 5	< 0.005	< 0.02	< 0.02	0.143 5	9.15	0.897	< 0.04	7 775.	< 0.005	9.575	435.	78.5	29.05	< 0.002	< 0.2	0.785	0.068 3	1.105	0.38	< 0.1
42-1-1	FRM	Y	2/27/2023	Mean of duplicates	0.192	0.075 5	0.005 7	< 0.02	0.020 5	0.43	5.	0.817 5	< 0.04	7 055.	< 0.005	8.645	391.5	80.5	26.4	< 0.002	< 0.2	< 0.5	0.049 2	0.76	0.18	< 0.1
43-1-1	SS		5/31/2022	Clear and colourless	0.901	< 0.015	< 0.005	0.029	0.029	0.688	5.7	0.429	0.042	12 400.	< 0.005	9.67	465.	82.	24.9	0.002 1	< 0.2	< 0.5	0.165	1.01	1.69	< 0.1
43-1-1	SS		9/8/2022	Clear, colourless	0.82	< 0.015	< 0.005	0.077	0.077	0.674	3.6	0.481	0.076	9 810.	< 0.005	8.74	454.	71.	21.8	< 0.002	< 0.2	< 0.5	0.198	1.46	1.03	< 0.1
43-1-1	SS		12/6/2022	Clear and colourless	0.843	< 0.015	< 0.005	0.11	0.11	0.967	10.2	0.466	0.042	11 700.	< 0.005	8.88	468.	69.	24.	< 0.002	< 0.2	0.69	0.198	1.49	3.36	< 0.1
43-1-1	SS		3/2/2023	Clear and colourless	0.821	< 0.015	< 0.005	0.027	0.027	0.718	6.	0.492	0.123	11 900.	0.007 1	9.71	497.	72.	23.4	< 0.002	< 0.2	< 0.5	0.146	1.35	1.27	< 0.1
44-1-1	SS		5/31/2022	Clear and colourless	0.935	< 0.015	< 0.005	0.021	0.021	0.359	8.6	0.377	< 0.04	7 960.	< 0.005	5.84	200.	36.	10.5	< 0.002	< 0.2	< 0.5	0.158	0.32	1.43	< 0.1
44-1-1	SS		9/15/2022	Clear, colourless	1.02	< 0.015	< 0.005	0.022	0.022	0.373	7.5	0.403	0.044	6 840.	< 0.005	6.57	192.	42.	11.7	< 0.002	< 0.2	< 0.5	0.177	0.34	1.43	< 0.1
44-1-1	SS		12/6/2022	Clear and colourless	1.03	< 0.015	< 0.005	< 0.02	< 0.02	0.529	9.2	0.389	< 0.04	7 930.	< 0.005	6.27	205.	30.	11.	< 0.002	< 0.2	< 0.5	0.174	0.34	1.11	< 0.1
44-1-1	SS		3/2/2023	Clear and colourless	1.11	< 0.015	< 0.005	0.024	0.024	0.469	9.5	0.395	0.091	7 900.	0.005 7	6.66	209.	31.	11.1	< 0.002	< 0.2	< 0.5	0.167	0.35	1.15	< 0.1
51-1-1	SS		5/19/2022	Clear and colourless	0.095	< 0.015	< 0.005	0.851	0.851	0.305	4.6	0.308	< 0.04	5 120.	< 0.005	3.32	133.	29.	9.	0.002 8	< 0.2	< 0.5	0.016 3	0.23	0.6	< 0.1
51-1-1	SS		9/9/2022	Clear, colourless	0.184	< 0.015	< 0.005	0.221	0.221	0.409	5.	0.396	< 0.04	4 170.	< 0.005	3.5	174.	35.	11.1	0.002 7	< 0.2	< 0.5	0.030 4	0.3	0.72	< 0.1
51-1-1	SS		12/13/2022	Clear and colourless	0.159	< 0.015	< 0.005	2.74	2.74	0.311	2.4	0.3	0.053	6 080.	< 0.005	3.7	188.	40.	12.8	< 0.002	< 0.2	< 0.5	0.027 1	0.32	0.38	< 0.1

Appendix B-1. Groundwater Quality Data 2022-2023

BC CSR				a AW Maximum (1)	10000	1.31-18.4 (3)	0.2-2 (4)	400	400	250-1500 (5)			20		0.5-15 (5)			128-429 (5)		3		1000	85		75-2400 (5)	
				b DW Maximum (2)	250		1	10	10	80			10		20	1700 (9)	2500	500			2.5		20	20	3000	
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	Molybdenum	Nitrogen - ammonia	Nitrogen - nitrite	Nitrogen - nitrate	Nitrogen - nitrate plus nitrite	Nickel	Phosphorus	Potassium	Selenium	Silicon	Silver	Sodium	Strontium	Sulphate	Sulphur	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	Zirconium
				Fraction	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	µg/l	mg/l	mg/l	mg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/L	µg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
				Method Detection Limit	0.05	0.015	0.005	0.02	0.02	0.02	2	0.05	0.04	50	0.005	0.05	0.05	1	3	0.002	0.2	0.5	0.002	0.2	0.1	0.1
51-2-1	SS		5/19/2022	Clear and colourless	1.37	< 0.015	< 0.005	0.022	0.022	0.868	8.2	0.394	0.133	12 800.	< 0.005	10.6	565.	44.	12.7	0.006 3	< 0.2	< 0.5	0.412	0.51	1.07	< 0.1
51-2-1	SS		9/9/2022	Clear, colourless	1.36	< 0.015	< 0.005	< 0.02	< 0.02	0.737	9.	0.369	0.141	10 200.	< 0.005	9.72	590.	40.	12.4	0.005 8	< 0.2	< 0.5	0.466	0.47	0.67	< 0.1
51-2-1	SS		12/13/2022	Clear and colourless	1.3	< 0.015	< 0.005	< 0.02	< 0.02	1.36	9.8	0.379	0.138	14 500.	< 0.005	11.	637.	35.	12.8	0.004 6	< 0.2	1.41	0.407	0.67	1.29	< 0.1
51-3-1	SS		5/19/2022	Slightly silty and grey	0.745	< 0.015	0.007 6	0.123	0.131	0.658	4.5	0.319	0.049	14 900.	< 0.005	7.47	643.	19.	5.8	0.002 2	< 0.2	< 0.5	0.059 3	0.26	0.32	< 0.1
51-3-1	SS		9/9/2022	Clear, colourless	0.569	< 0.015	0.075 7	< 0.02	0.088	0.409	9.8	0.346	0.094	12 000.	< 0.005	6.26	556.	14.	4.3	0.002 1	< 0.2	< 0.5	0.084 4	0.32	0.42	< 0.1
51-3-1	SS		12/13/2022	Clear and colourless	0.481	< 0.015	0.032 4	1.38	1.41	0.817	9.3	0.287	< 0.04	15 500.	< 0.005	7.	777.	28.	8.5	< 0.002	< 0.2	< 0.5	0.057	0.34	0.71	< 0.1
52-1-1	SS		5/18/2022	Clear and slightly green	0.38	24. a	< 0.005	< 0.02	< 0.02	12.1	49.	13.7	< 0.2	40 900.	< 0.025	229.	2 900. b	< 1.	< 15.	< 0.01	< 1.	< 2.5	< 0.01	< 1.	1.99	< 0.5
52-1-1	SS		9/20/2022	Clear and colourless.	0.5	27. a	< 0.005	< 0.02	< 0.02	11.	30.3	14.9	0.127	38 700.	< 0.01	242.	3 490. b	< 1.	< 6.	< 0.004	< 0.4	< 1.	< 0.004	0.77	1.24	< 0.2
52-1-1	SS		12/16/2022	Clear and colourless	0.35	25. a	< 0.005	< 0.02	< 0.02	12.7	37.	14.8	< 0.2	40 600.	< 0.025	242.	3 360. b	< 1.	< 15.	< 0.01	< 1.	< 2.5	< 0.01	< 1.	1.72	< 0.5
52-1-1	SS		3/2/2023	Clear and colourless	0.42	23. a	< 0.005	< 0.02	< 0.02	10.6	25.5	13.7	0.114	37 400.	< 0.01	219.	3 310. b	< 1.	< 6.	< 0.004	< 0.4	< 1.	< 0.004	0.79	0.24	< 0.2
52-4-0 (P7)	SS		5/20/2022	Clear and slightly yellow	0.65	120. a	< 0.005	< 0.02	< 0.02	13.1	302.	103.	0.127	18 500.	< 0.01	282.	1 070.	1.3	< 6.	< 0.004	0.58	1.9	0.022 8	2.4	6.32	0.54
52-4-0 (P7)	SS		10/5/2022		0.9	140. a	0.006 1	< 0.02	< 0.02	15.1	299.	109.	0.888	22 300.	< 0.01	326.	1 370.	59.	< 6.	< 0.004	0.54	1.7	0.021 7	2.66	16.1	0.67
52-4-0 (P7)	SS		12/1/2022	Moderately turbid, moderately brown	0.97	170. a	< 0.005	< 0.02	< 0.02	17.2	550.	108.	0.155	20 800.	< 0.01	320.	1 340.	< 1.	< 6.	< 0.004	1.17	8.8	0.023 7	5.67	3.68	1.53
52-4-0 (P7)	SS		2/24/2023	Clear and colourless	0.98	170. a	< 0.005	0.027	0.027	16.6	276.	115.	0.134	20 600.	< 0.01	341.	1 430.	< 1.	< 6.	< 0.004	29.5	2.6	0.026	3.2	19.2	0.75
53-1-1	SS	Y	5/20/2022	Clear and colourless	0.546	0.017	< 0.005	< 0.02	< 0.02	0.629	4.3	0.348	< 0.04	11 000.	0.092	3.78	311.	56.	15.9	0.014 2	< 0.2	< 0.5	0.083 8	< 0.2	0.62	< 0.1
53-1-1	SS	Y	9/12/2022	Clear, colourless	0.571	< 0.015	< 0.005	< 0.02	< 0.02	0.528	2.7	0.254	< 0.04	10 600.	< 0.005	3.49	308.	53.	16.1	0.010 3	< 0.2	< 0.5	0.073 9	< 0.2	0.42	< 0.1
53-1-1	SS	Y	1/26/2023	Clear and colourless	0.584	< 0.015	< 0.005	< 0.02	< 0.02	0.354	3.1	0.232	< 0.04	12 200.	< 0.005	3.71	356.	50.	15.5	0.008 3	< 0.2	< 0.5	0.071 9	< 0.2	0.69	< 0.1
53-1-1	SS	Y	3/9/2023	Clear and colourless	0.548	< 0.015	< 0.005	< 0.02	< 0.02	0.551	3.4	0.272	< 0.04	11 500.	0.013 9	3.72	350.	48.	13.6	0.048 8	< 0.2	< 0.5	0.101	< 0.2	0.54	< 0.1
55-1-1	SS	Y	9/22/2022	Clear and colourless.	0.396	< 0.015	< 0.005	0.191	0.191	0.157	< 2.	1.37	0.196	5 440.	< 0.005	10.6	186.	37.	11.1	0.002 6	< 0.2	< 0.5	0.217	< 0.2	0.34	< 0.1
55-1-1	SS	Y	12/14/2022	Clear and colourless	0.421	< 0.015	< 0.005	0.357	0.357	0.229	4.1	1.42	0.25	6 160.	< 0.005	11.9	221.	40.	13.	0.003 6	< 0.2	< 0.5	0.254	0.33	0.49	< 0.1
56-1-1	SS	Y	5/12/2022	Clear and colourless	1.29	< 0.015	< 0.005	< 0.02	< 0.02	0.065	6.4	0.429	0.064	5 990.	< 0.005	4.07	274.	47.	15.2	0.003 4	< 0.2	< 0.5	0.111	< 0.2	0.22	< 0.1
56-1-1	SS	Y	9/8/2022	Clear and colourless.	1.09	< 0.015	< 0.005	< 0.02	< 0.02	0.073	4.5	0.275	< 0.04	6 030.	< 0.005	3.65	232.	39.	11.9	0.004 3	< 0.2	< 0.5	0.097 3	< 0.2	0.61	< 0.1
56-1-1	SS	Y	12/15/2022	Clear and colourless	1.01	< 0.015	< 0.005	< 0.02	< 0.02	0.184	7.5	0.486	0.101	6 620.	< 0.005	3.85	286.	36.	15.4	0.004 6	< 0.2	< 0.5	0.135	< 0.2	0.51	< 0.1
56-1-1	SS	Y	3/2/2023	Clear and colourless	1.05	< 0.015	< 0.005	< 0.02	< 0.02	0.075	5.1	0.32	0.108	6 640.	0.005 5	4.04	277.	37.	11.9	0.004 2	< 0.2	< 0.5	0.081 9	< 0.2	0.83	< 0.1
57-1-1	SS	Y	9/22/2022	Clear and colourless.	0.264	0.049	< 0.005	< 0.02	< 0.02	0.188	2.3	0.408	< 0.04	5 960.	< 0.005	8.08	196.	54.	16.3	0.004	< 0.2	< 0.5	0.030 6	< 0.2	0.66	< 0.1
57-1-1	SS	Y	12/14/2022	Clear and colourless	0.289	< 0.015	< 0.005	0.022	0.022	0.307	3.7	0.406	< 0.04	6 820.	< 0.005	8.89	245.	60.	21.1	0.005 3	< 0.2	< 0.5	0.034	< 0.2	0.58	< 0.1
58-1-0	SS		5/17/2022	Clear and moderately yellow	6.87	99. a	0.072	< 0.2	< 0.2	84. b	66.4	56.5	0.372	19 100.	< 0.01	513.	4 290. b	110.	38.9	0.006 1	0.67	2.5	0.401	20.8 b	3.28	2.23
58-1-0	FRM		9/22/2022	Mean of duplicates	6.48	100. a	0.198 5	0.433 5	0.632	86.75 b	92.	53.85	0.45	18 200.	< 0.025	522.	3 895. b	99.5	28.5	< 0.01	< 1.	< 2.5	0.381 5	20.8 b	5.165	2.305
58-1-0	SS		12/13/2022	Clear, very yellow	6.29	130. a	0.063 2	1.23	1.29	82.6 b	83.1	63.4	0.437	22 900.	< 0.01	564.	4 500. b	120.	31.7	< 0.004	0.74	3.5	0.385	30. b	4.57	2.93
58-1-0	SS		3/9/2023	Very slight yellow, no turbidity	6.27	100. a	< 0.05	5.81	5.81	82.4 b	86.	55.6	0.4	19 200.	< 0.025	511.	3 680. b	92.	30.	0.05	< 1.	4.9	0.415	28. b	5.2	2.58
60-1-1	SS		5/25/2022	Clear and colourless	0.367	< 0.015	< 0.005	< 0.02	< 0.02	0.494	4.5	0.314	< 0.04	13 000.	< 0.005	16.6	390.	39.	11.7	0.005 1	< 0.2	< 0.5	0.132	< 0.2	0.92	< 0.1
60-1-1	SS		9/27/2022	Clear and colourless.	0.337	< 0.015	< 0.005	< 0.02	< 0.02	0.548	3.2	0.295	< 0.04	12 500.	< 0.005	16.1	410.	40.	12.7	0.004 6	< 0.2	< 0.5	0.166	< 0.2	0.36	< 0.1
60-1-1	SS		1/12/2023	Clear and colourless	0.306	< 0.015	< 0.005	< 0.02	< 0.02	0.558	3.3	0.29	< 0.04	13 000.	< 0.005	17.6	425.	38.	11.5	0.003 8	< 0.2	< 0.5	0.134	< 0.2	0.48	< 0.1
60-1-1	SS		3/7/2023	Clear and colourless	0.382	< 0.015	< 0.005	< 0.02	< 0.02	0.781	4.	2.46	0.238	6 860.	< 0.005	27.9	237.	39.	21.	0.005 7	< 0.2	< 0.5	0.060 1	0.25	1.42	< 0.1
60-2-1	SS		5/25/2022	Clear and colourless	1.71	< 0.015	< 0.005	< 0.02	< 0.02	2.5	8.8	0.442	0.071	13 100.	< 0.005	11.1	265.	60.	18.3	0.010 6	< 0.2	< 0.5	0.217	< 0.2	0.51	< 0.1
60-2-1	SS		9/27/2022	Clear and colourless.	1.37	< 0.015	< 0.005	< 0.02	< 0.02	2.62	8.	0.398	0.056	12 100.	< 0.005	10.8	283.	58.	18.4	0.017 6	< 0.2	< 0.5	0.144	< 0.2	0.3	< 0.1
60-2-1	SS		1/12/2023	Clear and colourless	1.81	< 0.015	< 0.005	< 0.02	< 0.02	2.48	8.9	0.425	0.055	13 000.	< 0.005	11.3	276.	56.	17.	0.008 5	< 0.2	< 0.5	0.245	< 0.2	0.56	< 0.1
60-2-1	SS		3/7/2023	Clear and colourless	1.62	< 0.015	< 0.005	< 0.02	< 0.02	2.27	8.3	0.411	0.053	12 200.	< 0.005	11.1	270.	57.	16.6	0.007 6	< 0.2	< 0.5	0.227	< 0.2	0.69	< 0.1
60-3-1	SS		5/25/2022	Slightly silty and slightly brown	0.331	< 0.015	< 0.005	1.85	1.85	0.945	2.5	2.59	0.106	6 440.	< 0.005	45.7	295.	71.	19.4	< 0.002	< 0.2	< 0.5	0.047 1	< 0.2	0.56	< 0.1
60-3-1	SS		9/27/2022	Slightly turbid, slightly black.	0.392	0.023	< 0.005	2.45	2.45	0.621	3.2	2.61	0.098	7 040.	< 0.005	31.9	254.	59.	18.3	< 0.002	< 0.2	< 0.5	0.067 3	0.23	0.5	< 0.1
60-3-1	SS		12/15/2022	Clear and colourless	0.419	< 0.015	< 0.005	1.98	1.98	1.34	2.2	2.58	0.188	7 380.	< 0.005	30.5	258.	61.	18.4	< 0.002	< 0.2	< 0.5	0.076 8	0.22	0.63	< 0.1
60-3-1	SS		3/7/2023	Clear and colourless	0.356	< 0.015	< 0.005	2.6	2.6	0.728	3.8	0.297	< 0.04	13 400.	< 0.005	18.1	451.	70.	12.9	0.005 7	< 0.2	< 0.5	0.177	< 0.2	0.6	< 0.1
62-1-1	SS		5/30/2022	Clear and colourless	0.204	< 0.015	< 0.005	0.233	0.233	0.128	< 2.	0.134	0.041	6 620.	< 0.005	2.48	85.	12.	3.5	< 0.002	< 0.2	< 0.5	0.033 9	0.58	0.23	< 0.1
62-1-1	SS		9/20/2022	Clear, colourless	0.257	0.015	< 0.005	0.278	0.278	0.118	3.6	0.136	0.06	6 220.	< 0.005	2.56	89.3	12.	4.	< 0.002	< 0.2	< 0.5	0.038 5	0.52	0.46	< 0.1
62-1-1	SS		12/8/2022	Clear and colourless	0.289	< 0.015	< 0.005	1.8	1.8	0.346	< 2.	0.139	0.079	6 550.	< 0.005	2.56	91.	13.	3.8	< 0.002	< 0.2	< 0.5	0.047 3	0.58	0.6	< 0.1
62-2-1	SS		5/30/2022	Slightly silty and slightly grey	0.229	< 0.015	< 0.005	0.247	0.247	0.179	4.8	0.168	< 0.04	7 660.	< 0.005	2.68	78.2	11.	< 3.	0.002 4	< 0.2	< 0.5	0.067 4	0.53	0.55	< 0.1
62-2-1	NS		9/20/2022	Insufficient volume for sampling.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
62-2-1	SS		12/8/2022	Clear and colourless	0.273	< 0.015	0.011	0.473	0.484	0.252	3.2	0.249	0.258	8 110.	< 0.005	3.35	118.	26.	7.4	0.003 6	< 0.2	< 0.5	0.528	0.53	1.29	< 0.1
63-1-1	SS		5/26/2022	Clear and colourless	0.192	< 0.015	< 0.005	< 0.02	< 0.02	0.181	< 2.	< 0.05	< 0.04	9 500.	< 0.005	3.77	87.5	9.6	< 3.	0.004 9	< 0.2	< 0.5	0.015 6	< 0.2	0.15	< 0.1
63-1-1	SS		9/29/2022	Clear and colourless.	0.129	< 0.015	< 0.005	< 0.02	< 0.02	0.117	3.6	< 0.05	< 0.04	8 300.	< 0.005	3.45	86.9	8.1	< 3.	0.003 2	< 0.2	< 0.5	0.007 4	< 0.2	0.61	< 0.1
63-1-1	SS		1/4/2023	Clear and colourless	0.145	< 0.015	< 0.005	< 0.02	< 0.02	0.125	2.7	< 0.05	< 0.04	8 620.	< 0.005	3.49	81.7	8.3	< 3.	< 0.002	< 0.2	< 0.5	0.008 3	< 0.2	1.7	< 0.1
63-2-1	SS		5/26/2022	Clear and colourless	0.264	< 0.015	< 0.005	< 0.02	< 0.02	0.088	6.5	0.108	0.114	6 610.	< 0.005	3.18	58.7	12.	4.2	0.002 8	< 0.2	< 0.5	0.044 3	0.47	0.31	< 0.1
63-2-1	SS		9/29/2022	Clear and colourless.	0.301	0.06	< 0.005	< 0.02	< 0.02	0.066	6.9	0.091	0.047	6 180.	< 0.005	3.13	59.8	10.	3.3	0.002	< 0.2	< 0.5	0.031 2	0.45	0.61	< 0.1
63-2-1	SS		1/4/2023	Clear and colourless	0.321	< 0.015	< 0.005	< 0.02	< 0.02	0.063	6.3	0.08	0.075	6 560.	< 0.005	3.24	60.5	12.	3.6	< 0.002	< 0.2	< 0.5	0.027 2	0.6	0.42	< 0.1
71-1-1	FRM	Y	5/27/2022	Mean of duplicates	0.519	< 0.015	< 0.005	< 0.02	< 0.02	0.375 5	11.95	0.28	< 0.04	13 450.	< 0.005	8.375	129.	24.	7.15	0.008 45	< 0.2	< 0.5	0.285	0.325	0.91	< 0.1
71-1-1	FRM	Y	9/27/2022	Mean of duplicates	0.446 5	0.021	< 0.005	< 0.02	< 0.02	0.441	15.3	0.269	< 0.04	11 950.	< 0.005	7.285	152.	23.	6.6	0.006 75	< 0.2	< 0.5	0.288 5	0.345	0.415	< 0.1
71-1-1	FRM	Y	1/12/2023	Mean of duplicates	0.525	1.235	< 0.005	< 0.02	< 0.02	0.492 5	14.8	0.282	< 0.04	12 500.	< 0.005	8.195	143.	21.5	6.6	0.006 15	< 0.2	< 0.5	0.300 5	0.41	0.675	< 0.1
71-1-1	FRM	Y	3/7/2023	Mean of duplicates	0.493 5	< 0.015	< 0.005	< 0.02	< 0.02	0.595 5	15.65	0.288	< 0.04	11 950.	< 0.005	8.02	138.	22.5	6.5	0.005 95	< 0.2	< 0.5	0.276 5	0.435	2.39	< 0.1
71-2-1	SS	Y	5/27/2022	Clear and colourless	0.238	< 0.015	< 0.005	< 0.02	< 0.02	0.266	12.	0.314	< 0.04	10 000.	< 0.005	7.35	198.	34.	10.2	0.006 9	< 0.2	< 0.5	0.153	< 0.2	0.26	< 0.1
71-2-1	SS	Y	9/27/2022	Clear and colourless.	0.242	0.017	< 0.005	< 0.02	< 0.02	0.326	14.	0.282	< 0.04	9 510.	< 0.005	6.76	204.	29.	9.6	0.005 7	< 0.2	< 0.5	0.108	< 0.2	0.37	< 0.1
71-2-1	SS	Y	1/12/2023	Clear and colourless	0.215	< 0.015	< 0.005	< 0.02	< 0.02	0.45	19.	0.373	< 0.04	9 300.	< 0.005	7.52	203.	32.	9.6	0.013 2	< 0.2	< 0.5	0.125	0.23	0.71	< 0.1
71-2-1	SS	Y	3/7/2023	Clear and colourless	0.265	< 0.015	< 0.005	< 0.02	< 0.02	0.271	10.	0.282	< 0.04	8 770.	< 0.005	7.26	203.	32.	9.6	0.006 8	< 0.2	0.51	0.118	< 0.2	0.44	< 0.1
71-3-1	SS	Y	5/27/2022	Clear and colourless	0.131	< 0.015	< 0.005	0.822	0.822	0.245	3.7	0.215	0.108	8 830.	< 0.005	6.72	84.3	31.	10.3	0.004 2	< 0.2	< 0.5	0.14	0.47	0.24	< 0.1
71-3-1	SS	Y	9/27/2022	Slightly turbid, slightly yellow.	0.178	< 0.015	< 0.005	1.12	1.12	0.43	7.	0.267	0.11	7 950.	< 0.005	6.82	99.2	33.	10.5	0.004	< 0.2	< 0.5	0.231	0.43	0.53	< 0.1
71-3-1	SS	Y	1/12/2023	Clear and colourless	0.142	< 0.015	0.005 7	1.16	1.17	0.464	8.2	0.278	0.119	8 030.	< 0.005	7.59	91.5	33.	10.	0.003 4	< 0.2	< 0.5	0.23	0.51	0.51	< 0.1
71-3-1	SS	Y	3/7/2023	Clear and colourless	0.145	< 0.015	< 0.005	1.34	1.34	0.314	6.1	0.267	0.132	7 480.	< 0.005	7.58	98.9	33.	10.1	0.003 9	< 0.2	< 0.5	0.192	0.58	0.34	< 0.1
72-1-1	FRM	Y	5/27/2022	Mean of duplicates	0.635	0.018 5	< 0.005	< 0.02	< 0.02	1.795	12.5	0.225	< 0.08	21 200.	< 0.01	8.36	265.	49.	14.85	< 0.004	< 0.4	< 1.	0.018 2	< 0.4	< 0.2	< 0.2
72-1-1	FRM	Y	10/3/2022	Mean of duplicates	0.684	0.015 5	< 0.005	< 0.02	< 0.02	1.59	8.4	0.244 5	< 0.04	20 000.	< 0.005	8.28	281.5	45.	14.85	< 0.002	< 0.2	< 0.5	0.016 7	< 0.2	0.245	< 0.1
72-1-1	FRM	Y	1/11/2023	Mean of duplicates	0.670 5	< 0.015	< 0.005	< 0.02	< 0.02	1.685	17.75	0.240 5	0.297	20 250.	0.008 35	8.605	279.5	45.	14.05	< 0.003	< 0.3	< 0.75	0.019 3	< 0.3	0.24	< 0.15
72-1-1	FRM	Y	3/6/2023	Mean of duplicates	0.641	< 0.015	< 0.005	< 0.02	< 0.02	1.665	14.25	0.234 5	< 0.06	19 700.	< 0.007 5	8.415	280.	44.	13.45	< 0.003	< 0.3	< 0.75	0.017 85	< 0.3	0.265	< 0.15
72-3-1	SS	Y	5/27/2022	Clear and colourless	0.656	< 0.015	< 0.005	< 0.02	< 0.02	0.733	11.1	0.887	0.047	8 880.	< 0.005	27.6	170.	68.	19.8	0.007	< 0.2	< 0.5	0.225	< 0.2	0.31	< 0.1
72-3-1	SS	Y	10/4/2022	Clear and colourless.	0.66	0.033	< 0.005	< 0.02	< 0.02	0.81	13.2	0.914	0.05	8 650.	< 0.005	26.5	182.	58.	18.9	0.005 8	< 0.2	< 0.5	0.179	< 0.2	0.43	< 0.1
72-3-1	SS	Y	1/12/2023	Clear and colourless	0.707	0.016	0.002 5	< 0.02	< 0.02	0.919	13.8	0.974	0.049	8 840.	< 0.005	28.2	179.	59.	18.1	0.006 2	< 0.2	< 0.5	0.203	0.2	0.68	< 0.1
72-3-1	SS	Y	3/6/2023	Clear and colourless	0.594	< 0.015	< 0.005	< 0.02	< 0.02	0.594	10.1	0.868	0.047	8 210.	< 0.005	25.5	167.	57.	17.7	0.007 5	< 0.2	< 0.5	0.169	0.24	0.35	< 0.1
73-1-1	FRM	Y	5/25/2022	Mean of duplicates	0.943	0.018 5	< 0.005	0.130 5	0.130 5	0.894 5	12.65	0.457 5	< 0.04	10 100.	< 0.005	6.445	193.	42.5	12.65	0.005 65	< 0.2	< 0.5	0.247 5	0.635	0.575	< 0.1
73-1-1	FRM	Y	9/27/2022	Mean of duplicates	0.985 5	< 0.015	< 0.005	0.074 5	0.074 5	1.2	13.85	0.464 5	< 0.04	9 710.	< 0.005	6.415	199.5	46.	14.7	0.005 8	< 0.2	< 0.5	0.251	0.735	1.58	< 0.1
73-1-1	FRM	Y	1/12/2023	Mean of duplicates	0.929 5	< 0.015	< 0.005	0.068 5	0.068 5	1.04	13.1	0.46	< 0.04	10 045.	< 0.005	6.79	197.	43.	13.65	0.003 85	< 0.2	< 0.5	0.243 5	0.74	0.915	< 0.1
73-1-1	FRM	Y	3/7/2023	Mean of duplicates	0.807 5	< 0.015	0.006 6	0.062	0.066	0.743 5	11.85	0.666 5	0.043 5	8 930.	< 0.005	16.165	185.	51.	15.25	0.006	< 0.2	< 0.5	0.209	0.43	1.55	< 0.1
73-2-1	SS	Y	5/25/2022	Clear and colourless	1.03	< 0.015	< 0.005	0.259	0.259	0.343	7.4	0.376	< 0.04	9 670.	< 0.005	6.62	166.	32.	9.9	0.002 6	< 0.2	< 0.5	0.255	0.64	2.15	< 0.1
73-2-1	SS	Y	9/27/2022	Clear and colourless.	1.12	< 0.015	< 0.005	0.139	0.139	0.406	2.9	0.351	< 0.04	9 130.	< 0.005	6.66	170.	42.	13.7	< 0.002	< 0.2	< 0.5	0.25	0.62	0.4	< 0.1
73-2-1	SS	Y	1/12/2023	Clear and colourless	0.932	< 0.015	< 0.005	0.232	0.232	0.34	4.1	0.352	< 0.04	9 060.	< 0.005	7.06	162.	32.	9.8	< 0.002	< 0.2	< 0.5	0.218	0.6	0.34	< 0.1
73-2-1	SS	Y	3/7/2023	Clear and colourless	0.964	< 0.015	< 0.005	0.241	0.241	0.326	3.8	0.38	< 0.04	8 940.	< 0.005	6.96	172.	33.	10.1	0.003 3	< 0.2	< 0.5	0.25	0.7	0.19	< 0.1

Appendix B-1. Groundwater Quality Data 2022-2023

BC CSR				a AW Maximum (1)	10000	1.31-18.4 (3)	0.2-2 (4)	400	400	250-1500 (5)			20		0.5-15 (5)			128-429 (5)		3		1000	85		75-2400 (5)	
				b DW Maximum (2)	250		1	10	10	80			10		20	1700 (9)	2500	500			2.5		20	20	3000	
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	Molybdenum	Nitrogen - ammonia	Nitrogen - nitrite	Nitrogen - nitrate	Nitrogen - nitrate plus nitrite	Nickel	Phosphorus	Potassium	Selenium	Silicon	Silver	Sodium	Strontium	Sulphate	Sulphur	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	Zirconium
				Fraction	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	µg/l	mg/l	mg/l	mg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/L	µg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
				Method Detection Limit	0.05	0.015	0.005	0.02	0.02	0.02	2	0.05	0.04	50	0.005	0.05	0.05	1	3	0.002	0.2	0.5	0.002	0.2	0.1	0.1
73-3-1	SS	Y	5/25/2022	Clear and colourless	0.413	< 0.015	< 0.005	0.443	0.443	0.381	15.2	0.553	0.059	7 550.	< 0.005	15.1	69.4	28.	8.2	0.007 4	< 0.2	< 0.5	0.071 5	0.36	1.04	< 0.1
73-3-1	SS	Y	9/27/2022	Clear and colourless.	0.534	0.099	< 0.005	0.139	0.139	0.609	17.1	0.609	0.068	6 960.	< 0.005	14.4	105.	24.	7.8	0.008	< 0.2	< 0.5	0.094 3	0.51	1.42	< 0.1
73-3-1	FRM	Y	1/12/2023	Mean of duplicates	0.355 5	< 0.015	0.011 3	1.07	1.085	0.462 5	15.8	0.613	0.048	7 450.	< 0.005	18.85	85.7	27.5	7.75	0.006 6	< 0.2	< 0.5	0.038 15	0.365	1.55	< 0.1
73-3-1	SS	Y	3/7/2023	Clear and colourless	0.479	< 0.015	0.023 2	1.18	1.2	0.44	13.7	0.563	0.052	6 980.	< 0.005	16.	82.3	30.	7.3	0.005 8	< 0.2	< 0.5	0.083	0.48	1.4	< 0.1
77-1-1	SS		6/2/2022	Clear and colourless	0.368	< 0.015	< 0.005	< 0.02	< 0.02	0.099	6.1	0.254	< 0.04	11 400.	< 0.005	4.15	190.	20.	5.1	< 0.002	< 0.2	< 0.5	0.034 1	< 0.2	0.14	< 0.1
77-1-1	SS		9/15/2022	Clear, colourless	0.346	< 0.015	< 0.005	< 0.02	< 0.02	0.111	3.5	0.231	< 0.04	9 640.	< 0.005	4.12	181.	18.	5.6	< 0.002	< 0.2	< 0.5	0.020 5	0.21	0.32	< 0.1
77-1-1	SS		12/7/2022	Clear and colourless	0.36	< 0.015	0.006 6	< 0.02	< 0.02	0.226	5.4	0.233	< 0.04	11 600.	< 0.005	4.04	199.	20.	5.9	0.002 5	< 0.2	0.71	0.032 5	0.26	0.8	< 0.1
77-2-1	SS		6/2/2022	Clear and colourless	0.937	< 0.015	< 0.005	< 0.02	< 0.02	0.239	42.	0.456	0.157	14 400.	< 0.005	5.86	545.	38.	12.1	0.005 4	< 0.2	< 0.5	0.202	0.45	0.39	< 0.1
77-2-1	SS		9/15/2022	Clear, colourless	0.695	< 0.015	< 0.005	0.079	0.079	0.422	40.	0.408	0.089	13 200.	< 0.005	5.45	556.	46.	13.2	0.005 8	< 0.2	< 0.5	0.134	0.42	0.37	< 0.1
77-2-1	SS		12/7/2022	Clear and colourless	0.697	< 0.015	< 0.005	< 0.02	< 0.02	0.304	40.3	0.387	0.075	15 300.	< 0.005	5.7	618.	58.	16.7	0.007 2	< 0.2	< 0.5	0.148	0.45	0.6	< 0.1
78-1-1	SS		6/2/2022	Clear and colourless	1.77	< 0.015	< 0.005	0.073	0.073	0.51	40.6	0.517	0.183	15 800.	< 0.005	8.34	394.	56.	17.1	0.012 4	< 0.2	< 0.5	0.395	0.74	0.67	< 0.1
78-1-1	SS		9/2/2022	Clear and colourless.	1.93	< 0.015	< 0.005	0.079	0.079	0.488	48.1	0.655	0.344	15 000.	< 0.005	14.9	413.	53.	16.1	0.013 2	< 0.2	< 0.5	0.658	0.71	1.18	< 0.1
78-1-1	SS		12/9/2022	Clear and colourless	1.87	< 0.015	< 0.005	0.049	0.049	0.431	47.7	0.633	0.339	16 800.	< 0.005	13.4	424.	54.	16.8	0.012	< 0.2	< 0.5	0.647	0.71	0.78	< 0.1
78-2-1	SS		6/2/2022	Clear and colourless	2.52	< 0.015	0.006 5	2.35	2.36	2.88	30.7	0.409	0.682	12 100.	< 0.005	3.17	102.	40.	13.6	0.013 5	< 0.2	< 0.5	0.312	0.68	92.7	< 0.1
78-2-1	SS		9/1/2022	Clear, colourless	2.58	< 0.015	< 0.005	1.66	1.66	3.2	27.7	0.35	0.768	12 000.	< 0.005	3.05	115.	45.	11.9	0.010 1	< 0.2	< 0.5	0.506	0.68	150.	< 0.1
78-2-1	SS		12/9/2022	Clear and colourless	1.49	< 0.015	< 0.005	2.33	2.33	3.43	21.5	0.291	0.724	13 800.	< 0.005	3.16	83.2	46.	14.1	0.012	< 0.2	< 0.5	0.186	0.64	173.	< 0.1
80-1-0 (P8)	SS		5/20/2022	Slightly silty and moderately brown	1.25	450. a	< 0.05	< 0.2	< 0.2	33.4	2 560.	118.	0.336	17 400.	< 0.01	340.	793.	18.	7.7	< 0.004	2.21	36.7	0.427	31.9 b	5.71	6.53
80-1-0 (P8)	SS		10/5/2022		2.24	500. a	< 0.05	< 0.2	< 0.2	52.	5 230.	159.	0.84	19 600.	< 0.025	443.	977.	10.	< 15.	< 0.01	10.2	104.	0.312	70. b	9.05	15.8
80-1-0 (P8)	SS		12/1/2022	Moderately turbid, very brown	2.16	270. a	< 0.05	< 0.2	< 0.2	31.9	864.	101.	0.442	16 300.	< 0.005	289.	871.	58.	15.4	0.002 6	2.27	31.5	0.531	44.7 b	9.15	9.46
80-1-0 (P8)	SS		2/24/2023	Clear and colourless	1.7	530. a	< 0.05	< 0.2	< 0.2	69.9	2 500.	201.	0.668	25 600.	< 0.01	570.	1 250.	5.	18.6	< 0.004	11.9	107.	0.593	93.4 b	19.7	19.7
81-1-0 (P9)	SS		5/20/2022	Clear and colourless	0.446	3.5	0.005 2	0.289	0.295	6.67	49.6	2.57	< 0.04	16 600.	< 0.005	37.7	1 040.	85.	26.9	< 0.002	0.52	< 0.5	0.040 3	0.44	24.1	< 0.1
81-1-0 (P9)	SS		10/5/2022		0.144	5.9	< 0.005	< 0.02	< 0.02	6.26	228.	2.85	18.7 b	17 300.	< 0.005	36.	1 080.	75.	76.6	< 0.002	0.21	< 0.5	0.029 7	0.27	0.17	< 0.1
81-1-0 (P9)	SS		12/1/2022	Clear and colourless	0.105	4.7	0.052 8	0.084	0.137	6.01	279.	2.65	1.59	16 200.	< 0.005	34.3	1 030.	69.	63.5	< 0.002	0.23	< 0.5	0.025 3	0.35	1.5	< 0.1
81-1-0 (P9)	SS		2/24/2023	Clear and colourless	0.152	4.3	< 0.005	< 0.02	< 0.02	6.11	164.	2.66	< 0.04	17 300.	< 0.005	37.8	1 130.	66.	25.5	< 0.002	< 0.2	< 0.5	0.029 1	< 0.2	1.43	< 0.1
85-1-1	SS		5/26/2022	Slightly silty and slightly brown	0.524	< 0.015	< 0.005	2.56	2.56	0.613	6.6	6.29	0.12	6 450.	< 0.005	56.7	279.	47.	15.7	0.006 2	< 0.2	< 0.5	0.025 7	1.02	0.27	< 0.1
85-1-1	SS		10/3/2022	Clear and colourless.	0.94	0.049	< 0.005	1.21	1.21	1.25	7.7	6.45	0.108	5 780.	< 0.005	59.5	307.	41.	13.2	0.007 2	< 0.2	< 0.5	0.039 4	1.03	0.55	< 0.1
85-1-1	SS		12/9/2022	Clear and colourless	0.43	< 0.015	< 0.005	2.69	2.69	0.433	6.7	5.82	0.37	5 300.	< 0.005	64.8	218.	42.	12.	0.004 6	< 0.2	< 0.5	0.011 8	0.93	0.51	< 0.1
85-1-1	SS		3/6/2023	Clear and colourless	0.46	0.036	< 0.005	1.86	1.86	0.537	6.9	5.9	0.25	5 410.	< 0.005	63.8	255.	34.	9.7	0.004 3	< 0.2	0.59	0.024 5	0.89	0.51	< 0.1
87-1-1	SS		6/2/2022	Clear and colourless	0.709	< 0.015	< 0.005	< 0.02	< 0.02	0.329	22.	0.479	< 0.04	7 120.	< 0.005	4.71	156.	25.	8.5	0.012 9	< 0.2	< 0.5	0.334	< 0.2	1.32	< 0.1
87-1-1	SS		9/9/2022	Clear, colourless	0.801	< 0.015	< 0.005	< 0.02	< 0.02	0.56	26.3	0.754	0.053	4 960.	< 0.005	4.83	152.	25.	7.6	0.013 2	< 0.2	< 0.5	0.597	< 0.2	0.24	< 0.1
87-1-1	SS		12/9/2022	Clear and colourless	0.613	< 0.015	< 0.005	< 0.02	< 0.02	0.559	12.8	0.355	< 0.04	8 530.	< 0.005	4.74	154.	23.	6.6	0.007 3	< 0.2	< 0.5	0.168	0.21	0.54	< 0.1
87-2-1	SS		6/1/2022	Clear and colourless	0.064	< 0.015	< 0.005	0.402	0.402	0.032	2.6	0.125	0.054	6 400.	< 0.005	2.81	44.	15.	5.3	< 0.002	< 0.2	< 0.5	0.022 1	0.56	< 0.1	< 0.1
87-2-1	NS		9/9/2022	No Sample. Well was dry.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
87-2-1	NS		12/9/2023	Not enough water to sample	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
87-2-1	NS		12/9/2023	Not enough water to sample	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
88-1-1	SS		6/1/2022	Clear and colourless	0.175	< 0.015	< 0.005	6.55	6.55	0.186	< 2.	0.153	0.451	6 300.	< 0.005	3.27	99.3	47.	14.6	< 0.002	< 0.2	< 0.5	0.034 2	0.49	0.17	< 0.1
88-1-1	SS		9/9/2022	Clear, colourless	0.267	< 0.015	< 0.005	6.72	6.72	0.119	2.8	0.144	0.505	4 150.	< 0.005	3.04	117.	52.	15.6	< 0.002	< 0.2	< 0.5	0.070 8	0.55	0.48	< 0.1
88-1-1	SS		12/8/2022	Clear and colourless	0.296	< 0.015	< 0.005	6.2	6.2	0.204	3.	0.156	0.477	6 480.	< 0.005	3.48	127.	54.	16.1	< 0.002	< 0.2	< 0.5	0.071 4	0.6	0.8	< 0.1
88-2-1	SS		6/1/2022	Slightly silty and moderately brown	< 0.05	< 0.015	< 0.005	7.87	7.87	0.145	6.1	0.856	0.22	6 460.	< 0.005	6.23	147.	99.	26.9	0.002 2	< 0.2	< 0.5	0.105	< 0.2	0.2	< 0.1
88-2-1	NS		9/8/2022	No Sample. Well was dry.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
88-2-1	SS		12/9/2022	Moderately turbid, very brown	< 0.05	< 0.015	< 0.005	7.13	7.13	0.366	8.2	0.946	0.382	8 650.	< 0.005	6.99	253.	250.	77.4	< 0.002	< 0.2	< 0.5	0.021 7	0.22	0.54	< 0.1
91-1-1	SS		6/2/2022		1.06	< 0.015	< 0.005	0.031	0.031	0.428	16.4	1.57	0.156	8 250.	< 0.005	5.8	420.	68.	19.2	0.016 7	< 0.2	< 0.5	1.5	< 0.2	0.9	< 0.1
91-1-1	SS		9/9/2022	Slightly turbid, slightly grey	1.01	< 0.015	0.008 1	< 0.02	< 0.02	0.481	15.3	1.64	0.13	5 400.	< 0.005	5.72	432.	70.	22.5	0.013 8	< 0.2	< 0.5	1.65	< 0.2	0.52	< 0.1
91-1-1	SS		12/13/2022	Very turbid, colourless	0.927	< 0.015	< 0.005	0.078	0.078	0.413	15.8	1.39	0.105	8 930.	< 0.005	4.89	424.	63.	21.	0.012 3	< 0.2	< 0.5	1.15	< 0.2	1.3	< 0.1
91-1-1	SS		3/2/2023	Clear and colourless	1.02	< 0.015	0.013 4	0.024	0.037	0.372	16.3	1.68	0.163	8 780.	< 0.005	6.08	504.	78.	24.4	0.014 4	< 0.2	< 0.5	1.32	< 0.2	0.32	< 0.1
92-1-1	SS		6/2/2022		5.07	< 0.015	< 0.005	0.159	0.159	0.378	12.4	1.77	0.157	9 520.	< 0.005	9.13	269.	110.	34.2	0.022 7	< 0.2	< 0.5	1.14	< 0.2	0.95	< 0.1
92-1-1	SS		9/9/2022	Moderately turbid, slightly grey	4.42	0.038	< 0.005	0.204	0.204	0.579	12.2	1.92	0.202	6 380.	< 0.005	10.3	256.	120.	36.8	0.021 5	0.22	< 0.5	1.39	< 0.2	1.21	< 0.1
92-1-1	SS		12/14/2022	Clear and colourless	7.39	< 0.015	< 0.005	0.067	0.067	0.437	15.6	1.94	0.192	10 600.	< 0.005	11.4	306.	120.	41.6	0.023	< 0.2	< 0.5	1.65	0.2	0.66	< 0.1
92-1-1	SS		3/2/2023	Clear and colourless	5.4	< 0.015	< 0.005	0.08	0.08	0.465	12.6	2.08	0.279	9 380.	0.007 8	14.7	292.	120.	38.5	0.026 7	< 0.2	0.65	1.68	< 0.2	0.36	< 0.1
93-1-1	NS		9/15/2022	No Sample. Well is obstructed due to damage from stockpiling.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
93-1-1	NS		12/14/2022	Groundwater well destroyed/ obstructed	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
93-1-1	NS		3/16/2023	Well destroyed, not sampled	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
94-1-1	SS		6/2/2022		0.371	< 0.015	< 0.005	0.076	0.076	0.506	3.3	0.454	0.069	5 620.	< 0.005	3.74	78.5	17.	3.3	0.007 7	< 0.2	< 0.5	0.294	0.42	0.71	< 0.1
94-1-1	SS		9/9/2022	Clear, colourless	0.728	< 0.015	0.009	< 0.02	< 0.02	0.611	6.3	0.805	0.075	4 560.	< 0.005	10.3	120.	26.	8.7	0.011 1	< 0.2	< 0.5	1.17	0.36	1.53	< 0.1
94-1-1	SS		12/13/2022	Moderately turbid, slightly grey	0.655	< 0.015	0.009	0.053	0.062	0.756	6.1	0.897	0.058	7 080.	< 0.005	15.2	180.	44.	14.4	0.015 5	< 0.2	< 0.5	1.35	0.32	1.38	< 0.1
94-1-1	SS		3/2/2023	Clear and colourless	1.03	< 0.015	0.037	2.58	2.62	1.14	5.7	0.557	0.326	6 250.	0.009 4	7.44	142.	49.	15.7	0.009 4	< 0.2	< 0.5	0.55	0.37	0.63	< 0.1
95-1-1	SS		9/15/2022	Very turbid, very grey	5.63	0.21	< 0.005	< 0.02	< 0.02	46.4	1 160.	1.05	0.437	32 100.	0.356	6.35	196.	36.	23.	0.124	0.57	453.	1.16	103. b	104.	1.4
95-1-1	SS		12/7/2022	Very turbid, moderately grey	8.14	0.074	0.031 1	2.65	2.68	1.53	6.2	0.619	0.359	8 660.	< 0.005	12.3	219.	100.	31.4	0.006 4	< 0.2	3.54	0.806	0.77	0.86	< 0.1
96-1-1	NS		9/15/2022	No Sample. Well was dry.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
96-1-1	SS		12/7/2022	Moderately turbid, moderately grey	1.26	< 0.015	< 0.005	8.68	8.68	0.61	5.	0.386	0.736	8 770.	< 0.005	4.15	110.	120.	33.7	0.006	< 0.2	< 0.5	0.135	0.71	0.51	< 0.1
97-1-1	SS		9/15/2022	Clear and colourless.	4.36	0.91	< 0.005	< 0.02	< 0.02	0.769	9.6	1.53	0.246	5 560.	< 0.005	7.02	129.	36.	8.9	0.011 3	< 0.2	< 0.5	1.55	0.37	0.44	< 0.1
97-1-1	SS		12/7/2022	Moderately turbid, moderately grey	2.3	0.016	< 0.005	8.56	8.56	0.407	6.1	0.605	1.11	9 400.	< 0.005	4.65	148.	170.	47.1	0.010 5	< 0.2	< 0.5	0.239	0.62	0.49	< 0.1
98-1-1	SS		9/9/2022	Very turbid, very grey	1.74	0.035	< 0.005	5.31	5.31	0.745	6.9	0.704	0.758	7 340.	< 0.005	3.87	134.	110.	33.8	0.010 5	< 0.2	1.8	0.259	0.6	0.94	< 0.1
98-1-1	SS		12/7/2022	Moderately turbid, moderately grey	3.06	< 0.015	0.074 7	3.18	3.26	0.689	9.9	0.474	0.302	7 360.	< 0.005	4.15	76.2	20.	5.8	0.005 9	< 0.2	< 0.5	0.576	0.3	0.6	< 0.1
98-1-1	SS		3/16/2023	Moderate turbidity, colourless	1.32	< 0.015	< 0.005	1.78	1.78	0.366	2.9	0.315	0.768	8 340.	< 0.005	3.59	91.9	73.	22.2	0.006 5	< 0.2	< 0.5	0.19	0.72	0.51	< 0.1
99-1-1	NS		9/15/2022	No Sample	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
99-1-1	NS		11/30/2022	Dry (Not enough water volume to sample)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
99-1-1	NS		3/16/2023	No sample required this month	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
100-1-1	NS		9/15/2022	No Sample	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
100-1-1	NS		11/30/2022	Dry (Not enough water volume to sample)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
100-1-1	NS		3/16/2023	No sample required this month	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
101-1-1	NS		9/15/2022	No Sample	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
101-1-1	NS		11/30/2022	Dry (Not enough water volume to sample)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
101-1-1	NS		3/16/2023	No sample required this month	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
103-1-1	SS		9/9/2022	Very turbid, very grey	26.5	0.064	< 0.005	0.221	0.221	1.69	19.5	1.75	0.165	5 060.	< 0.005	9.27	322.	48.	14.1	< 0.002	< 0.2	< 0.5	1.08	0.84	0.39	< 0.1
103-1-1	SS		11/30/2022	Moderately turbid, moderately grey	20.9	0.034	< 0.005	< 0.02	< 0.02	1.23	13.1	1.58	0.196	7 230.	< 0.005	9.15	399.	56.	17.9	0.007 8	< 0.2	< 0.5	0.832	1.25	0.5	< 0.1
104-1-1	SS		9/1/2022	Slightly turbid, moderately grey	2.65	< 0.015	< 0.005	0.502	0.502	0.55	4.3	0.218	0.3	4 570.	< 0.005	2.94	48.5	16.	4.4	0.004	< 0.2	4.41	0.080 9	1.31	0.77	< 0.1
104-1-1	SS		11/29/2022	Very turbid, very grey	1.87	< 0.015	< 0.005	18.4 b	18.4 b	0.522	4.2	0.325	1.02	5 390.	< 0.005	4.47	217.	140.	44.9	0.002 4	< 0.2	< 0.5	0.204	0.84	1.04	< 0.1
104-1-1	SS		3/16/2023	Slightly turbid, colourless	2.61	< 0.015	< 0.005	21.5 b	21.5 b	0.58	2.7	0.512	0.911	5 370.	< 0.005	36.6	345.	120.	43.5	0.008 6	< 0.2	0.61	0.597	0.84	1.38	< 0.1
105-1-1	SS		9/1/2022	Slightly turbid, slightly grey	3.73	0.073	0.093 8	22.8 b	22.9 b	0.861	4.9	1.54	1.36	5 600.	< 0.005	5.44	254.	240.	77.	0.011 2	0.38	< 0.5	0.834	0.35	0.36	< 0.1
105-1-1	SS		11/29/2022	Moderately turbid, slightly grey	2.72	0.059	0.023 2	11.2 b	11.2 b	0.366	6.5	1.34	1.26	5 880.	< 0.005	4.36	184.	180.	55.2	0.006 5	< 0.2	< 0.5	0.46	0.41	0.28	< 0.1
105-1-1	SS		3/17/2023	Low turbidity, brown in colour low intensity	2.61	0.057	0.052 6	32. b	32.1 b	0.416	3.7	1.52	1.49	5 900.	< 0.005	8.56	367.	290.	92.7	0.008	< 0.2	< 0.5	0.602	0.44	1.16	< 0.1

Appendix B-1. Groundwater Quality Data 2022-2023

Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	Parameter	Molybdenum	Nitrogen - ammonia	Nitrogen - nitrite	Nitrogen - nitrate	Nitrogen - nitrate plus nitrite	Nickel	Phosphorus	Potassium	Selenium	Silicon
BC CSR				a AW Maximum (1)	10000	1.31-18.4 (3)	0.2-2 (4)	400	400	250-1500 (5)			20	
				b DW Maximum (2)	250		1	10	10	80			10	
				Fraction	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
				Unit	µg/l	mg/l	mg/l	mg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l
				Method Detection Limit	0.05	0.015	0.005	0.02	0.02	0.02	2	0.05	0.04	50
106-1-1	SS		9/1/2022	Moderately turbid, moderately grey	35.9	91. a	1.92 b	10.9 b	12.8 b	19.9	30.9	21.5	0.336	6 340.
106-1-1	SS		11/29/2022	Very turbid, very grey	12.7	2.8	0.163	6.41	6.57	2.32	37.9	2.15	0.198	5 390.
106-1-1	SS		3/31/2023	Extremely turbid, grey extreme in colour	5.71	1.6	0.097	20.8 b	20.9 b	4.09	76.9	2.45	0.107	8 180.
107-1-1	SS		9/1/2022	Very turbid, slightly grey	14.2	0.1	0.288	23.9 b	24.2 b	3.61	7.9	1.21	0.225	5 860.
107-1-1	SS		11/29/2022	Very turbid, moderately grey	19.8	< 0.015	0.12	9.07	9.19	2.15	103.	1.04	0.245	6 250.
107-1-1	NS		3/17/2023	No sample required this month	---	---	---	---	---	---	---	---	---	---
108-1-1	SS		9/1/2022	Moderately turbid, very grey	11.5	0.02	< 0.005	< 0.02	< 0.02	0.796	7.4	1.14	0.199	12 400.
108-1-1	SS		12/7/2022	Slightly turbid, slightly grey	14.1	0.025	0.009 8	< 0.02	< 0.02	1.35	12.5	1.14	0.102	12 800.
108-1-1	NS		3/17/2023	No sample required this month	---	---	---	---	---	---	---	---	---	---
109-1-1	SS		9/1/2022	Very turbid, slightly grey	131.	0.41	0.022 3	0.044	0.066	0.889	32.2	1.24	2.47	11 900.
109-1-1	SS		11/30/2022	Moderately turbid, moderately grey	160.	0.38	0.024 3	0.029	0.053	0.439	35.3	1.11	1.06	13 300.
109-1-1	NS		3/17/2023	No sample required this month	---	---	---	---	---	---	---	---	---	---
110-1-1	NS		9/15/2022	No Sample	---	---	---	---	---	---	---	---	---	---
110-1-1	NS		11/30/2022	No sample (Determined not to be representative)	---	---	---	---	---	---	---	---	---	---
110-1-1	NS		3/17/2023	No sample required this month	---	---	---	---	---	---	---	---	---	---
P1	SS		5/26/2022	Clear and colourless	14.3	42. a	< 0.005	< 0.02	< 0.02	7.33	86.9	37.6	0.08	19 800.
P1	SS		9/14/2022		16.3	70. a	0.005	< 0.02	< 0.02	8.45	164.	58.5	< 0.2	21 100.
P1	SS		12/1/2022	Clear and colourless	14.	72. a	0.007 1	0.029	0.036	14.6	85.	53.2	< 0.2	20 000.
P1	SS		2/24/2023	clear and colourless	4.38	23. a	< 0.005	< 0.02	< 0.02	7.42	46.8	20.4	< 0.08	18 200.
P2	SS		5/26/2022	Clear and slightly yellow	14.1	72. a	< 0.05	0.29	0.29	9.45	35.	65.2	< 0.2	11 800.
P2	SS		9/14/2022		14.8	82. a	0.015 9	0.069	0.085	9.88	53.	76.	< 0.2	13 000.
P2	SS		12/1/2022	Slightly turbid, slightly yellow	15.5	90. a	0.018 9	< 0.02	0.031	9.44	22.	72.6	0.155	12 100.
P2	SS		2/24/2023	Very slight yellow, no turbidity	12.5	73. a	< 0.005	< 0.02	< 0.02	7.23	22.7	59.1	0.095	11 900.
P3	SS		5/26/2022	Clear and slightly orange	19.1	86. a	< 0.05	< 0.2	< 0.2	10.9	41.	79.7	< 0.2	14 700.
P3	SS		9/14/2022		13.5	88. a	0.14	0.034	0.174	9.41	44.	78.1	< 0.2	14 000.
P3	SS		12/1/2022	Slightly turbid, slightly orange	14.	91. a	0.036 9	< 0.02	0.05	7.95	16.7	75.6	0.16	13 200.
P3	SS		2/24/2023	Clear and colourless	14.3	81. a	0.019 6	0.025	0.045	7.16	26.3	69.9	0.106	15 200.
P4	SS		5/26/2022	Clear and moderately orange	14.7	76. a	0.935	0.95	1.89	7.73	24.7	64.5	0.153	14 100.
P4	SS		9/14/2022		16.4	77. a	0.014 3	0.033	0.047	8.1	43.	60.	< 0.2	14 300.
P4	SS		12/1/2022	Slightly turbid, slightly orange	18.1	81. a	0.015 6	< 0.02	0.032	7.29	43.6	60.2	0.146	14 200.
P4	SS		2/24/2023	Clear and colourless	14.2	78. a	0.005 7	0.095	0.101	7.18	25.1	63.	0.117	13 100.
P10	SS		5/26/2022	Slightly silty and slightly orange	4.68	33. a	0.028 3	0.208	0.237	4.03	6.6	29.9	0.076	14 700.
P10	SS		9/14/2022	Clear and colourless.	7.06	47. a	0.008 9	0.38	0.389	6.52	52.	41.2	< 0.2	14 900.
P10	SS		12/1/2022	Clear, slightly yellow	6.75	54. a	0.007	0.024	0.031	6.67	22.2	41.7	0.106	15 700.
P10	SS		2/24/2023	Very slight yellow, no turbidity	3.74	33. a	< 0.005	< 0.02	< 0.02	3.38	9.7	27.9	0.064	14 700.
P11	SS		9/1/2022	Moderately silty, very grey	4.43	0.34	0.119	19.7 b	19.8 b	0.786	11.2	1.6	0.114	11 200.
P11	SS		11/29/2022	Clear and colourless	1.34	7.9	0.056 5	32.2 b	32.3 b	1.73	6.3	3.85	0.69	6 520.
P11	SS		1/26/2023	Mean of duplicates	1.16	2.4	0.099 3	57.8 b	57.9 b	1.425	15.85	2.445	2.345	5 975.
P11	SS		3/8/2023	Clear and colourless	1.32	1.4	0.056 3	30.3 b	30.4 b	0.927	6.	2.2	0.747	6 140.
P12	NS		9/1/2022	No sample. Well was dry.	---	---	---	---	---	---	---	---	---	---
P12	NS		11/29/2022	Dry - Not enough water to sample	---	---	---	---	---	---	---	---	---	---
P12	SS		1/26/2023	Clear and colourless	0.972	0.4	0.018 8	27.4 b	27.4 b	2.21	16.8	2.09	0.808	6 240.
P12	SS		3/8/2023	Dry - Not enough water to sample	---	---	---	---	---	---	---	---	---	---

Station	Sample Type	Date Sampled	Parameter	Silver	Sodium	Strontium	Sulphate	Sulphur	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	Zirconium
BC CSR			a AW Maximum (1)	0.5-15 (5)			128-429 (5)		3		1000	85		75-2400 (5)	
			b DW Maximum (2)	20	1700 (9)	2500	500			2.5		20	20	3000	
			Fraction	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS
			Unit	µg/l	mg/L	µg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
			Method Detection Limit	0.005	0.05	0.05	1	3	0.002	0.2	0.5	0.002	0.2	0.1	0.1
106-1-1	SS	9/1/2022	Moderately turbid, moderately grey	< 0.005	74.8	609.	250.	74.2	0.021 5	0.93	2.12	1.53	1.22	5.91	0.44
106-1-1	SS	11/29/2022	Very turbid, very grey	< 0.005	11.2	248.	170.	54.	< 0.002	< 0.2	< 0.5	0.424	0.72	0.64	< 0.1
106-1-1	SS	3/31/2023	Extremely turbid, grey extreme in colour	0.006 1	66.	435.	260.	93.4	< 0.002	< 0.2	32.2	0.564	9.25	6.07	0.19
107-1-1	SS	9/1/2022	Very turbid, slightly grey	< 0.005	10.1	390.	270.	85.4	0.011 8	0.2	0.95	0.867	0.59	0.93	< 0.1
107-1-1	SS	11/29/2022	Very turbid, moderately grey	< 0.005	6.07	285.	190.	58.8	0.007	< 0.2	0.65	0.58	0.82	4.88	< 0.1
107-1-1	NS	3/17/2023	No sample required this month	---	---	---	---	---	---	---	---	---	---	---	---
108-1-1	SS	9/1/2022	Moderately turbid, very grey	< 0.005	14.5	788.	200.	64.1	0.010 6	< 0.2	< 0.5	0.612	0.67	0.35	< 0.1
108-1-1	SS	12/7/2022	Slightly turbid, slightly grey	< 0.005	11.3	951.	230.	74.1	0.025 2	< 0.2	< 0.5	0.509	0.53	0.3	< 0.1
108-1-1	NS	3/17/2023	No sample required this month	---	---	---	---	---	---	---	---	---	---	---	---
109-1-1	SS	9/1/2022	Very turbid, slightly grey	< 0.005	85.9	83.2	76.	24.8	0.028 5	< 0.2	< 0.5	1.52	5.04	1.29	< 0.1
109-1-1	SS	11/30/2022	Moderately turbid, moderately grey	< 0.005	101.	109.	89.	27.6	0.003 9	< 0.2	< 0.5	2.36	1.52	0.31	< 0.1
109-1-1	NS	3/17/2023	No sample required this month	---	---	---	---	---	---	---	---	---	---	---	---
110-1-1	NS	9/15/2022	No Sample	---	---	---	---	---	---	---	---	---	---	---	---
110-1-1	NS	11/30/2022	No sample (Determined not to be representative)	---	---	---	---	---	---	---	---	---	---	---	---
110-1-1	NS	3/17/2023	No sample required this month	---	---	---	---	---	---	---	---	---	---	---	---
P1	SS	5/26/2022	Clear and colourless	< 0.01	120.	957.	< 1.	< 6.	< 0.004	0.43	< 1.	0.024 1	0.64	7.22	< 0.2
P1	SS	9/14/2022		< 0.025	217.	1 080.	< 1.	< 15.	< 0.01	< 1.	< 2.5	< 0.01	< 1.	2.06	< 0.5
P1	SS	12/1/2022	Clear and colourless	< 0.025	187.	1 000.	4.1	< 15.	< 0.01	< 1.	< 2.5	0.033	< 1.	50.9	< 0.5
P1	SS	2/24/2023	clear and colourless	< 0.01	44.	1 060.	1.2	< 6.	< 0.004	< 0.4	< 1.	0.029 9	< 0.4	30.8	< 0.2
P2	SS	5/26/2022	Clear and slightly yellow	< 0.025	225.	922.	< 1.	< 15.	< 0.01	< 1.	< 2.5	0.018	2.2	1.88	< 0.5
P2	SS	9/14/2022		< 0.025	276.	1 210.	< 1.	< 15.	< 0.01	< 1.	< 2.5	0.017	2.4	5.88	< 0.5
P2	SS	12/1/2022	Slightly turbid, slightly yellow	< 0.005	256.	1 170.	< 1.	< 3.	< 0.002	0.29	< 0.5	0.018 5	2.78	2.92	0.39
P2	SS	2/24/2023	Very slight yellow, no turbidity	< 0.01	199.	924.	< 1.	< 6.	< 0.004	< 0.4	< 1.	0.017 3	2.27	2.97	0.28
P3	SS	5/26/2022	Clear and slightly orange	< 0.025	279.	937.	< 1.	< 15.	< 0.01	< 1.	< 2.5	0.013	2.9	2.25	< 0.5
P3	SS	9/14/2022		< 0.025	286.	1 000.	< 1.	< 15.	< 0.01	< 1.	< 2.5	0.011	1.9	1.92	< 0.5
P3	SS	12/1/2022	Slightly turbid, slightly orange	< 0.005	249.	1 010.	2.3	< 3.	< 0.002	< 0.2	< 0.5	0.010 3	2.24	0.9	0.2
P3	SS	2/24/2023	Clear and colourless	< 0.01	223.	889.	< 1.	< 6.	< 0.004	< 0.4	< 1.	0.010 2	2.64	2.87	0.21
P4	SS	5/26/2022	Clear and moderately orange	< 0.01	221.	926.	< 1.	< 6.	< 0.004	< 0.4	< 1.	0.012 4	2.02	1.17	< 0.2
P4	SS	9/14/2022		< 0.025	224.	847.	< 1.	< 15.	< 0.01	< 1.	< 2.5	< 0.01	1.9	6.98	< 0.5
P4	SS	12/1/2022	Slightly turbid, slightly orange	< 0.005	216.	851.	< 1.	< 3.	< 0.002	0.22	0.85	0.010 6	2.6	1.63	0.21
P4	SS	2/24/2023	Clear and colourless	< 0.01	213.	904.	< 1.	< 6.	< 0.004	< 0.4	< 1.	0.011 5	2.08	0.55	< 0.2
P10	SS	5/26/2022	Slightly silty and slightly orange	< 0.005	89.4	1 020.	< 1.	< 3.	< 0.002	0.47	< 0.5	0.012	0.74	2.01	0.1
P10	SS	9/14/2022	Clear and colourless.	< 0.025	150.	1 060.	< 1.	< 15.	< 0.01	< 1.	< 2.5	< 0.01	< 1.	4.76	< 0.5
P10	SS	12/1/2022	Clear, slightly yellow	< 0.01	156.	1 060.	< 1.	< 6.	0.004 9	< 0.4	< 1.	0.016 6	0.9	2.05	< 0.2
P10	SS	2/24/2023	Very slight yellow, no turbidity	< 0.005	84.2	957.	< 1.	< 3.	< 0.002	< 0.2	< 0.5	0.010 7	0.77	1.11	< 0.1
P11	SS	9/1/2022	Moderately silty, very grey	< 0.005	17.2	1 160.	360.	117.	0.003 8	< 0.2	< 0.5	0.708	0.95	0.54	< 0.1
P11	SS	11/29/2022	Clear and colourless	< 0.005	13.8	339.	190.	58.4	0.007 2	< 0.2	< 0.5	0.292	0.72	4.38	< 0.1
P11	SS	1/26/2023	Mean of duplicates	< 0.01	10.75	647.5	555. b	174.5	0.01	< 0.4	< 1.	0.773	0.575	5.275	< 0.2
P11	SS	3/8/2023	Clear and colourless	< 0.005	14.9	380.	170.	61.2	0.009	< 0.2	< 0.5	0.473	0.68	3.85	< 0.1
P12	NS	9/1/2022	No sample. Well was dry.	---	---	---	---	---	---	---	---	---	---	---	---
P12	NS	11/29/2022	Dry - Not enough water to sample	---	---	---	---	---	---	---	---	---	---	---	---
P12	SS	1/26/2023	Clear and colourless	< 0.005	13.	459.	310.	96.4	0.013 3	< 0.2	< 0.5	0.144	0.93	1.45	< 0.1
P12	SS	3/8/2023	Dry - Not enough water to sample	---	---	---	---	---	---	---	---	---	---	---	---

Notes:

a	*Above CSR Schedule 3.2 AW Standard.*
b	*Above CSR Schedule 3.2 DW Standard.*
c	*Detection Limits above Applicable Standards.*
SS	*Single sample.*
FR1, FR2	*Field replicates.*
BC CSR	*CSR-Sch3.2: BC Contaminated Site Regulation - Schedule 3.2 - Generic Numerical Water Standards, be in effective on November 1, 2017.*
(1)	*Aquatic Life (AW) Freshwater, Column 3.*
(2)	*Drinking Water (DW), Column 6.*
(3)	*Standard varies with pH. Every ammonia result was compared to a standard based on the associated pH result for that sample.*
(4)	*Standard varies with chloride. Every nitrite result was compared to a standard based on the associated chloride result for that sample.*
(5)	*Standard varies with hardness. Every result was compared to a standard that was based on the associated hardness result for that sample.*
(6)	*BC CSR Schedule 3.2 criterion for iron and manganese were not applied as directed by the Stage 8 CSR Amendments.*
(7)	*Standard is based on the trivalent (Cr(III)) species.*
(8)	*Interim standard used.*
(9)	*CSR Stage 13 amendments, protocol 9, background concentration is higher than the applicable CSR DW and/or most stringent CSR a standard. A concentration above the CSR DW or most strigent CSR AW stanadard but below the regional background concentration (South Vancouver Island Region). Is not considered contaminated and is not highlighted as a CSR DW or AW exceedance*

B2. Domestic Well Quality

Parameters	Criteria		Well Number	Site # 1	Site #2	BFD of Site #2	Site #3	Site #11	Site #12	Site #13	Site #10
				Hartland Avenue	Kiowa Ave	Kiowa Ave	Spotts Close	Farmington Rd	Wallace Dr	Wallace Dr	Meadowbrook
	Canadian	British Columbia		99	24	24	25	36	37 (at house)	38 (at well head)	61
	DWQ Guidelines $^{(1)}$	SDWQ Guidelines $^{(2)}$	Sample Date	15-Jun-2022	14-Jun-2022	14-Jun-2022	14-Jun-2022	14-Jun-2022	14-Jun-2022	14-Jun-2022	15-Jun-2022
Metals											
Aluminum, total	0.1 ‡	9.5	mg/L	0.0134	< 0.0005	< 0.0005	0.00128	0.00118	0.00073	0.00075	0.0239
Antimony, total	0.006	0.006	mg/L	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	0.000085	0.000084	< 0.00002
Arsenic, total	0.010	0.010	mg/L	0.000039	0.000035	0.000021	0.000036	< 0.00002	0.00157	0.00162	0.000049
Barium, total	2	n/a	mg/L	0.00391	0.00138	0.00135	0.0024	0.000668	0.00914	0.0094	0.00156
Beryllium, total	n/a	n/a	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Bismuth, total	n/a	n/a	mg/L	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Boron, total	5	5	mg/L	< 0.01	0.164	0.16	0.138	0.719	0.28	0.28	< 0.01
Cadmium, total	0.007	0.005	mg/L	< 0.000005	0.0000277	0.0000272	0.0000065	< 0.000005	0.0000122	< 0.000005	0.0000081
Calcium, total	n/a	n/a	mg/L	---	---	---	---	---	---	---	---
Chromium, total	0.05	0.05	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.00028	< 0.0001	0.00031
Cobalt, total	n/a	0.001	mg/L	0.0000226	0.0000157	0.0000147	0.0000263	< 0.000005	0.0000367	0.000061	0.0000194
Copper, total	2 $^{(1)}$ and 1 †	2 $^{(2)}$ and 1 †	mg/L	0.00743	0.0116	0.0119	0.0563	0.000124	0.00731	0.00147	0.0524
Iron, total	0.3 †	0.3 †	mg/L	0.0299	< 0.001	< 0.001	0.0012	0.0104	0.0103	< 0.001	0.011
Lead, total	0.005	0.005	mg/L	0.000258	0.000113	0.000111	0.000994	0.0000179	0.000658	0.000417	0.00087
Lithium, total	n/a	n/a	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0011	0.00115	0.00111	< 0.0005
Magnesium, total	n/a	n/a	mg/L	1.07	4.64	4.51	5.68	2.75	9.3	9.44	5.23
Manganese, total	0.12$^{(1)}$ and 0.02 †	0.12$^{(2)}$ and 0.02 †	mg/L	0.00346	0.000174	0.000128	0.000376	0.000005	**0.0207**	**0.0637**	0.000275
Mercury, total	0.001	0.001	mg/L	< 0.0000019	< 0.0000019	< 0.0000019	< 0.0000019	< 0.000124	< 0.0000019	< 0.0000019	< 0.0000019
Molybdenum, total	n/a	0.088	mg/L	0.000061	0.000101	0.0001	0.000101	0.0104	0.00114	0.00113	0.000071
Nickel, total	n/a	0.08	mg/L	0.000249	0.000183	0.00015	0.000274	0.0000179	0.000458	0.000447	0.000195
Phosphorus, total	n/a	n/a	mg/L	0.0036	< 0.002	< 0.002	0.003	0.0011	0.0326	0.0323	0.0077
Potassium, total	n/a	n/a	mg/L	0.123	0.628	0.608	1.84	0.46	1.29	1.28	0.227
Selenium, total	0.05	0.01	mg/L	< 0.00004	< 0.00004	< 0.00004	< 0.00004	< 0.00004	0.00006	0.000049	0.00009
Silicon, total	n/a	n/a	mg/L	1.97	9.13	9.25	9.19	8.96	8.32	8.37	9.59
Silver, total	n/a	n/a	mg/L	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Sodium, total	200 †	n/a	mg/L	3.09	12.7	12.2	11.4	37.7	21.4	21.6	6.51
Strontium, total	7.0	7.0	mg/L	0.0134	0.0614	0.0606	0.0726	0.0234	0.157	0.16	0.0412
Sulphur, total	n/a	n/a	mg/L	< 3	3.5	3.1	6.2	4.9	9.9	9.6	< 3
Thallium, total	n/a	n/a	mg/L	< 0.000002	< 0.000002	< 0.000002	< 0.000002	< 0.000002	< 0.000002	< 0.000002	< 0.000002
Tin, total	n/a	n/a	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Titanium, total	n/a	n/a	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.00245
Uranium, total	0.02	0.02	mg/L	0.0000048	0.0000862	0.0000876	0.000175	< 0.000002	0.00034	0.000348	0.0000052
Vanadium, total	n/a	n/a	mg/L	< 0.0002	0.00058	0.00057	0.00086	< 0.0002	0.00046	0.00047	0.00066
Zinc, total	5 †	3$^{(2)}$ and 5 †	mg/L	0.00412	0.00878	0.00808	0.0344	0.00239	0.0058	0.00255	0.00608
Zirconium, total	n/a	n/a	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Conventionals											
Hardness (as CaCO3)	n/a	n/a	mg/L	16.1	176	173	158	35.5	144	145	68.3
Chloride, dissolved	250 †	250 †	mg/L	4.5	15	15	38	9.2	15	15	8.6
Total dissolved solids	500 †	n/a	mg/L	38	240	260	280	180	230	230	110
Specific Conductivity (Lab)	n/a	n/a	µS/cm	50	400	400	400	240	390	390	170
Conductivity (Field)	n/a	n/a	µS/cm	41	305	305	305	176	287	285	125
pH (lab)	7.0 to 10.5 †	n/a	pH	7.22	8.09	8.07	7.66	8.32	8.37	8.36	**6.84**
pH (field)	7.0 to 10.5 †	n/a	pH	7.54	7.04	7.04	**6.76**	8.78	7.73	7.7	**6.86**
Temperature (field)	15 †	15 †	°C	14.2	13.9	13.9	13.5	11.8	12.7	12.3	11.2
Ammonia	n/a	n/a	mg/L	---	---	---	---	---	---	---	---

Notes:

1) Health Canada (updated in September 2020 version). Guidelines for Canadian Drinking Water Quality—Summary Table.

(2) British Columbia Approved Source Drinking Water Quality Guideline (SDWQGs) (2020 edition).

‡ Limit for this parameter is an operational guideline (OG) only.

† Limit for this parameter is an aesthetic objective (AO), not a human health objective.

≠ Limit for this guideline is an iterim value.

BOLD *'Sample concentrations expressed in bold exceed AO drinking water quality guidelines.*

🟨 *'Sample concentrations highlighted in yellow exceed drinking water quality guidelines.*

n/a - no drinking water quality guideline is available for this parameter.

Appendix B-2. Domestic Well Quality - 2022 to 2023

Parameters	Criteria		Well Number	Site #9	Site #4	Site # 6	Site #7	Site #8	Site # 16	Site # 5	Site #14
				Wildview Cr	Lohr Rd	Lohr Rd	Lohr Road	Lohr Rd	Spotts Close	Lohr Rd	Hartland Ave
	Canadian	British Columbia		47	50	52	53	80	81	51	n/a
	DWQ Guidelines (1)	SDWQ Guidelines (2)	Sample Date	16-Jun-2022	15-Jun-2022	15-Jun-2022	15-Jun-2022	15-Jun-2022	14-Jun-2022	15-Jun-2022	15-Jun-2022
Metals											
Aluminum, total	0.1 ‡	9.5	mg/L	0.0479	0.0103	0.0062	0.00572	< 0.0005	0.00175	0.00057	0.00861
Antimony, total	0.006	0.006	mg/L	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Arsenic, total	0.010	0.010	mg/L	0.000056	0.000042	0.00005	< 0.00002	< 0.00002	< 0.00002	0.000053	< 0.00002
Barium, total	2	n/a	mg/L	0.0043	0.00776	0.00817	0.00257	0.0056	0.0022	0.0172	0.00214
Beryllium, total	n/a	n/a	mg/L	0.000023	< 0.00001	< 0.00001	< 0.00001	0.000011	< 0.00001	< 0.00001	0.000012
Bismuth, total	n/a	n/a	mg/L	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Boron, total	5	5	mg/L	< 0.01	0.076	0.071	0.011	< 0.01	0.93	0.044	0.012
Cadmium, total	0.007	0.005	mg/L	0.0000372	0.0000106	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	0.0000291
Calcium, total	n/a	n/a	mg/L	---	---	---	---	---	---	---	---
Chromium, total	0.05	0.05	mg/L	< 0.0001	0.00011	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Cobalt, total	n/a	0.001	mg/L	0.0000283	0.000057	0.0000241	0.0000084	0.0000055	< 0.000005	0.0000107	0.0000334
Copper, total	2 (1) and 1 †	2 (2) and 1 †	mg/L	0.195	0.0381	0.00515	0.00006	0.014	0.000102	0.00565	0.00644
Iron, total	0.3 †	0.3 †	mg/L	0.0292	0.142	0.002	0.0026	0.0152	0.0218	0.0013	0.119
Lead, total	0.005	0.005	mg/L	0.00171	0.0022	0.000488	< 0.000005	0.000366	0.000163	0.000288	0.000319
Lithium, total	n/a	n/a	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0012	< 0.0005	< 0.0005
Magnesium, total	n/a	n/a	mg/L	2.17	2.88	4.88	2.62	2.68	0.69	6.24	3.36
Manganese, total	0.12(1) and 0.02 †	0.12(2) and 0.02 †	mg/L	0.0162	0.000978	0.000167	0.000188	0.000509	0.000476	0.000194	0.00225
Mercury, total	0.001	0.001	mg/L	0.0000032	< 0.0000019	< 0.0000019	< 0.0000019	< 0.0000019	< 0.0000019	< 0.0000019	< 0.0000019
Molybdenum, total	n/a	0.088	mg/L	< 0.00005	0.000311	0.000462	0.000449	0.00038	0.00204	0.00102	0.000274
Nickel, total	n/a	0.08	mg/L	0.000146	0.000155	0.000183	0.000037	0.000099	0.000042	0.000591	0.000068
Phosphorus, total	n/a	n/a	mg/L	0.0086	0.004	0.0042	0.0069	0.0029	< 0.002	< 0.002	0.0035
Potassium, total	n/a	n/a	mg/L	0.372	0.338	0.542	0.262	0.411	0.212	0.388	0.307
Selenium, total	0.05	0.01	mg/L	0.000086	< 0.00004	0.000067	< 0.00004	0.000052	< 0.00004	0.000194	0.000092
Silicon, total	n/a	n/a	mg/L	6.9	6.31	7.64	7.77	8.04	11.2	7.73	6.91
Silver, total	n/a	n/a	mg/L	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Sodium, total	200 †	n/a	mg/L	7.77	7	5.8	4.48	10	42.7	6.24	15.4
Strontium, total	7.0	7.0	mg/L	0.0317	0.0436	0.0797	0.0379	0.0614	0.0488	0.137	0.0351
Sulphur, total	n/a	n/a	mg/L	< 3	< 3	3.1	< 3	< 3	5	3	8
Thallium, total	n/a	n/a	mg/L	< 0.000002	< 0.000002	< 0.000002	< 0.000002	< 0.000002	< 0.000002	< 0.000002	< 0.000002
Tin, total	n/a	n/a	mg/L	< 0.0002	0.00043	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Titanium, total	n/a	n/a	mg/L	0.00086	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Uranium, total	0.02	0.02	mg/L	0.0000663	0.0000191	0.000337	0.000113	0.000702	0.0000042	0.00061	0.0000152
Vanadium, total	n/a	n/a	mg/L	< 0.0002	0.00091	0.00058	0.00046	< 0.0002	< 0.0002	0.00053	0.00036
Zinc, total	5 †	3(2) and 5 †	mg/L	0.00761	0.0129	0.00275	0.00088	0.00742	0.00644	0.00289	0.0263
Zirconium, total	n/a	n/a	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Conventionals											
Hardness (as CaCO3)	n/a	n/a	mg/L	37.2	50.3	113	56.5	95.7	17.3	154	49.8
Chloride, dissolved	250 †	250 †	mg/L	8.7	11	10	5.3	7.9	15	14	17
Total dissolved solids	500 †	n/a	mg/L	100	92	160	88	130	140	190	120
Specific Conductivity (Lab)	n/a	n/a	µS/cm	120	140	260	140	240	230	330	190
Conductivity (Field)	n/a	n/a	µS/cm	84	106	193	138	171	165	236	139
pH (lab)	7.0 to 10.5 †	n/a	pH	**6.8**	**6.65**	7.17	7.03	7.25	8.48	7.54	**6.53**
pH (field)	7.0 to 10.5 †	n/a	pH	7.06	**6.69**	7.03	**6.72**	**6.82**	9.11	7.21	**6.73**
Temperature (field)	15 †	15 †	°C	10.6	10.5	12.1	10.1	11.4	10.7	10.7	10.7
Ammonia	n/a	n/a	mg/L	---	---	---	---	---	---	---	---

Notes:

1) Health Canada (updated in June 2019 version). Guidelines for Canadian Drinking Water Quality—Summary Table.

(2) British Columbia Approved Source Drinking Water Quality Guideline (SDWQGs) (2020 edition).

‡ *Limit for this parameter is an operational guideline (OG) only.*

† *Limit for this parameter is an aesthetic objective (AO), not a human health objective.*

* *Limit for this guideline is an iterim value.*

BOLD *'Sample concentrations expressed in bold exceed AO drinking water quality guidelines.*

🟨 *'Sample concentrations highlighted in yellow exceed drinking water quality guidelines.*

n/a - no drinking water quality guideline is available for this parameter.

Appendix B-2. Domestic Well Quality - 2022 to 2023

Parameters	Criteria		Well Number	Site #17	Site #21	Site #20	BFD of Site #20
				Durrance Close	Mark Lane	Mark Lane	Mark Lane
	Canadian	British Columbia		n/a	n/a	n/a	n/a
	DWQ Guidelines (1)	SDWQ Guidelines (2)	Sample Date	14-Jun-2022	16-Jun-2022	16-Jun-2022	16-Jun-2022
Metals							
Aluminum, total	0.1 ‡	9.5	mg/L	---	---	---	---
Antimony, total	0.006	0.006	mg/L	---	---	---	---
Arsenic, total	0.010	0.010	mg/L	---	---	---	---
Barium, total	2	n/a	mg/L	---	---	---	---
Beryllium, total	n/a	n/a	mg/L	---	---	---	---
Bismuth, total	n/a	n/a	mg/L	---	---	---	---
Boron, total	5	5	mg/L	---	---	---	---
Cadmium, total	0.007	0.005	mg/L	---	---	---	---
Calcium, total	n/a	n/a	mg/L	---	---	---	---
Chromium, total	0.05	0.05	mg/L	---	---	---	---
Cobalt, total	n/a	0.001	mg/L	---	---	---	---
Copper, total	2 (1) and 1 †	2 (2) and 1 †	mg/L	---	---	---	---
Iron, total	0.3 †	0.3 †	mg/L	---	---	---	---
Lead, total	0.005	0.005	mg/L	---	---	---	---
Lithium, total	n/a	n/a	mg/L	---	---	---	---
Magnesium, total	n/a	n/a	mg/L	---	---	---	---
Manganese, total	0.12(1) and 0.02 †	0.12(2) and 0.02 †	mg/L	---	---	---	---
Mercury, total	0.001	0.001	mg/L	---	---	---	---
Molybdenum, total	n/a	0.088	mg/L	---	---	---	---
Nickel, total	n/a	0.08	mg/L	---	---	---	---
Phosphorus, total	n/a	n/a	mg/L	---	---	---	---
Potassium, total	n/a	n/a	mg/L	---	---	---	---
Selenium, total	0.05	0.01	mg/L	---	---	---	---
Silicon, total	n/a	n/a	mg/L	---	---	---	---
Silver, total	n/a	n/a	mg/L	---	---	---	---
Sodium, total	200 †	n/a	mg/L	6.34	9.92	11.5	11.4
Strontium, total	7.0	7.0	mg/L	---	---	---	---
Sulphur, total	n/a	n/a	mg/L	---	---	---	---
Thallium, total	n/a	n/a	mg/L	---	---	---	---
Tin, total	n/a	n/a	mg/L	---	---	---	---
Titanium, total	n/a	n/a	mg/L	---	---	---	---
Uranium, total	0.02	0.02	mg/L	---	---	---	---
Vanadium, total	n/a	n/a	mg/L	---	---	---	---
Zinc, total	5 †	3(2) and 5 †	mg/L	---	---	---	---
Zirconium, total	n/a	n/a	mg/L	---	---	---	---
Conventionals							
Hardness (as CaCO3)	n/a	n/a	mg/L	---	---	---	---
Chloride, dissolved	250 †	250 †	mg/L	4.4	28	15	15
Total dissolved solids	500 †	n/a	mg/L	---	---	---	---
Specific Conductivity (Lab)	n/a	n/a	µS/cm	390	550	360	360
Conductivity (Field)	n/a	n/a	µS/cm	281	401	259	259
pH (lab)	7.0 to 10.5 †	n/a	pH	8.26	7.78	8.07	8.09
pH (field)	7.0 to 10.5 †	n/a	pH	7.08	7.2	7.79	7.79
Temperature (field)	15 †	15 †	°C	10.9	12.2	11.1	11.1
Ammonia	n/a	n/a	mg/L	< 0.015	< 0.015	< 0.015	< 0.015

Notes:

1) Health Canada (updated in June 2019 version). Guidelines for Canadian Drinking Water Quality—Summary Table.

(2) British Columbia Approved Source Drinking Water Quality Guideline (SDWQGs) (2020 edition).

[‡] *Limit for this parameter is an operational guideline (OG) only.*

[†] *Limit for this parameter is an aesthetic objective (AO), not a human health objective.*

[≠] *Limit for this guideline is an iterim value.*

BOLD	*'Sample concentrations expressed in bold exceed AO drinking water quality guidelines.*
🟨	*'Sample concentrations highlighted in yellow exceed drinking water quality guidelines.*

n/a - no drinking water quality guideline is available for this parameter.

B3. Surface Water Quality

Appendix B-3. Surface Water Quality - 2022-2023

B.C. Water Quality Guidelines				BC WQG-STA (1)	---	---	---	---	600	110	---	---	1000	3.28 - 416.7 (5)
				BC WQG-LTC (1)	Variable (9)	5	1200	---	150	4	---	---	---	3.43 - 19.57 (5)
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	PARAMETER	Aluminum	Arsenic	Boron	Cadmium	Chloride	Cobalt	Copper	Hardness (As Caco3)	Iron	Lead
				STATE	TOT	TOT	TOT	TOT	DIS	TOT	TOT	TOT	TOT	TOT
				UNIT	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L
				Method Detection Limit (MDL)	0.5	0.02	10	0.005	1	0.01	0.1	0.5	1	0.005
				Limit of Quantification (LOQ)	2.5	0.1	50	0.025	5	0.05	0.5	2.5	5	0.025
				COMMENTS	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
SW-N-05	FRM	Y	2022-05-04	Mean of duplicates	45.05	0.19	234.	0.077 45	16.	0.789	12.75	424.	37.95	0.006 85
SW-N-05	SS	Y	2022-11-07		118.	0.132	82.	0.021 4	4.8	0.708	3.47	372.	192.	0.026 2
SW-N-05	FRM	Y	2023-01-05	Mean of duplicates	104.5	0.199 5	102.5	0.060 55	8.7	0.166 5	5.315	620.5	99.	0.022
SW-N-05	FRM	Y	2023-02-07	Mean of duplicates	219. b	0.212 5	92.	0.054 6	29.5	0.287 5	7.005	286.5	305.	0.037 5
SW-N-14	NS		2022-05-03	No access to the Heals Range	---	---	---	---	---	---	---	---	---	---
SW-N-14	SS		2022-11-10		28.1	0.157	80.	0.005 6	11.	0.111	1.6	192.	52.4	0.036
SW-N-14	NS		2023-01-05	Heals Range, unable to access	---	---	---	---	---	---	---	---	---	---
SW-N-14	SS		2023-02-13	Moderate flow, clear & colourless.	63.5	0.107	75.	< 0.005	20.	0.113	1.38	173.	119.	0.045
SW-N-14	SS		2023-02-21	Moderate flow, clear and colourless.	23.1	0.15	68.	< 0.005	19.	0.076 1	1.04	183.	29.2	0.009 4
SW-N-14	SS		2023-03-20	Moderate flow, clear and colourless.	35.3	0.107	63.	0.005 5	29.	0.083	0.99	153.	67.7	0.025
SW-N-15	SS		2023-02-21	Moderate flow, clear and colourless.	6.33	0.105	29.	< 0.005	7.3	0.012 7	0.258	76.7	7.1	0.007 1
SW-N-15	SS		2023-03-20	High flow, clear and colourless.	6.2	0.069	24.	< 0.005	7.4	0.011	0.25	61.4	7.9	< 0.02
SW-N-16	FRM	Y	2022-05-04	Mean of duplicates	14.35	0.232 5	66.	0.009 45	6.15	0.357 5	7.485	146.5	366.5	0.010 25
SW-N-16	FRM	Y	2022-11-09	Mean of duplicates	47.85	0.216 5	58.	0.029 4	6.3	0.261	6.425	196.	173.	0.074
SW-N-16	FRM	Y	2023-01-05	Mean of duplicates	33.75	0.200 5	49.5	0.017 9	11.5	0.205	6.55	181.5	109.5	0.014 9
SW-N-16	FRM	Y	2023-02-21	Mean of duplicates	91.5	0.231 5	54.5	0.203 9	18.	0.279 5	6.485	201.	250.	0.016 85
SW-N-16	FRM	Y	2023-02-06	Mean of duplicates	621. b	0.234	42.5	0.143 2	15.5	1.085	10.9	175.5	1 230. a	0.089
SW-N-17	NS		2022-05-04	No access to the Heals Range	---	---	---	---	---	---	---	---	---	---
SW-N-17	SS		2022-11-10		9.37	0.107	145.	0.012 5	13.	0.268	0.944	295.	8.2	0.005 5
SW-N-17	NS		2023-01-05	No access to the Heals Range	---	---	---	---	---	---	---	---	---	---
SW-N-17	SS		2023-02-13	Moderate flow, clear & colourless.	16.5	0.085	123.	0.007 3	27.	0.107	0.87	229.	21.8	< 0.02
SW-N-17	SS		2023-02-21	Moderate flow, clear and colourless.	8.42	0.127	122.	< 0.005	26.	0.086 4	0.701	231.	8.5	< 0.005
SW-N-17	SS		2023-03-20	Moderate flow, clear and colourless.	7.9	0.079	116.	0.006 1	39.	0.079	0.58	190.	12.5	< 0.02
SW-N-18	SS		2022-05-04		65.5	2.2	926.	0.056 5	84.	8.27 b	15.6	263.	1 110. a	0.36
SW-N-18	SS		2022-11-07		83.8	0.173	62.	0.008 6	3.6	1.14	1.56	408.	144.	0.028 6
SW-N-18	SS		2023-01-05	Clear, colourless.	254.	0.188	28.	0.007 9	5.6	0.581	1.75	190.	532.	0.197
SW-N-18	FRM		2023-02-07	Mean of duplicates	1 600. b	0.205	45.5	0.039 9	6.8	2.69	4.91	325.5	3 185. a	0.195
SW-N-19	SS		2022-05-04		20.4	0.256	59.	0.019 1	7.5	0.503	17.8	163.	49.4	0.018 2
SW-N-19	SS		2022-11-09		14.1	0.277	41.	0.013 4	5.3	0.422	8.65	238.	66.2	0.026
SW-N-19	SS		2023-01-05	Clear, colourless.	15.9	0.218	31.	0.014 4	9.7	0.198	11.4	201.	28.	0.007 5
SW-N-41S	FRM	Y	2022-05-04	Mean of duplicates	59.95	0.269 5	23.	< 0.005	5.3	0.126	0.37	150.5	178.5	0.066 5
SW-N-41S	FRM	Y	2022-11-09	Mean of duplicates	30.5	0.302 5	19.	< 0.005	6.25	0.162	0.245	202.5	178.	0.027
SW-N-41S	FRM	Y	2023-01-05	Mean of duplicates	81.25	0.257 5	18.	< 0.005	5.65	0.109	0.415	165.	189.5	0.060 5
SW-N-41S	FRM	Y	2023-02-06	Mean of duplicates	70.05	0.199	18.	< 0.005	5.4	0.124 5	0.282	168.5	191.	0.032 05
SW-N-41S	SS		2022-05-04		11.2	0.095	27.	< 0.005	7.1	0.020 6	0.31	97.	15.8	0.011 1
SW-N-41S	SS		2022-11-09		9.1	0.16	42.	< 0.005	11.	0.015	0.22	120.	13.1	0.02
SW-N-41S	SS		2023-01-05	Clear, colourless.	14.7	0.079	20.	< 0.005	8.8	0.024 5	0.432	81.7	14.7	0.013
SW-N-41S	SS		2023-02-21	Moderate flow, clear and colourless.	71.	0.117	27.	0.006 5	8.5	0.057	0.74	101.	71.8	0.071
SW-N-41S	SS		2023-02-06	High flow, clear & colourless.	13.2	0.098	23.	< 0.005	8.2	0.019 3	0.317	102.	16.4	0.017 2
SW-N-41S	SS		2023-02-13	Moderate flow, clear & colourless.	13.7	0.1	34.	0.006 9	6.8	0.032	0.34	72.5	41.8	0.03
SW-N-41S	SS		2023-02-21	Moderate flow, clear and colourless.	18.9	0.146	39.	< 0.005	7.5	0.028 6	0.272	75.6	47.9	0.028
SW-N-42S	FRM	Y	2022-05-04	Mean of duplicates	44.1	0.085	49.	< 0.006 1	12.	0.12	0.545	171.	95.8	0.13
SW-N-42S	FRM	Y	2022-11-09	Mean of duplicates	363.5 b	0.309	60.	0.025 5	14.5	0.671 5	1.715	256.	638.	0.446 5
SW-N-42S	FRM	Y	2023-02-21	Mean of duplicates	85.75	0.097	59.5	0.007 45	22.	0.147 5	0.78	197.5	146.	0.143 5
SW-N-42S	FRM	Y	2023-01-05	Mean of duplicates	34.6	0.090 5	63.	< 0.005	27.	0.078	0.715	183.	54.35	0.046 5
SW-N-45	NS		2022-05-04	No access to the Heals Range	---	---	---	---	---	---	---	---	---	---
SW-N-45	SS		2022-11-10		9.82	0.101	213.	0.012 7	8.8	0.419	1.49	359.	6.4	0.005 4
SW-N-45	NS		2023-01-05	Heals Range, unable to access	---	---	---	---	---	---	---	---	---	---
SW-N-45	SS		2023-02-13	Moderate flow, clear & colourless.	15.9	0.081	158.	0.007 5	35.	0.113	2.24	243.	15.8	< 0.02
SW-N-45	SS		2023-02-21	Moderate flow, clear and colourless.	48.2	0.126	170.	0.011 6	31.	0.141	1.6	229.	44.5	0.017 9
SW-N-45	SS		2023-03-20	Low flow, clear and colourless	25.9	0.081	178.	0.008	54.	0.106	1.22	201.	22.8	< 0.02
SW-N-50	NS		2022-05-04	Destroyed - Cell 4, 5, 6 construction	---	---	---	---	---	---	---	---	---	---
SW-N-51	NS		2022-05-04	Destroyed - Cell 4, 5, 6 construction	---	---	---	---	---	---	---	---	---	---
SW-N-53	NS		2022-05-04	Dry	---	---	---	---	---	---	---	---	---	---
SW-N-53	NS		2022-11-09	Dry	---	---	---	---	---	---	---	---	---	---
SW-N-53	NS		2023-01-05	Dry (ditch along high level road)	---	---	---	---	---	---	---	---	---	---
SW-N-53	SS		2023-02-07	Low flow, very turbid, very brown.	######## b	4.49	< 100.	0.406	170. b	142 a b	341.	563.	######## a	14.4
SW-N-54	SS		2022-05-04		20.4	0.342	59.	< 0.005	2.2	0.235	14.4	168.	88.1	0.009 6
SW-N-54	SS		2022-11-10		313.	0.709	42.	0.017 3	8.3	1.31	15.	283.	957.	0.111
SW-N-54	SS		2023-01-05	Clear, colourless.	319. b	2.41	52.	0.065 4	17.	6.49 b	54.3	318.	1 340. a	0.202
SW-N-54	SS		2023-02-07	High flow. Moderately turbid,slightly grey.	3 360. b	1.08	53.	0.027 6	19.	4.37 b	19.8	259.	7 920. a	0.771
SW-N-57	FRM		2023-02-07	Mean of duplicates	1 645. b	0.219 5	39.5	0.009 3	6.75	2.745	4.495	287.	3 230. a	0.16
SW-N-58	NS		2023-02-07	MH by P11 - not flowing.	---	---	---	---	---	---	---	---	---	---
SW-N-58	NS		2023-02-07	MH by P11 - not flowing.	---	---	---	---	---	---	---	---	---	---
SW-N-59	NS		2023-02-07	Kitchen scraps channel - not yet set up.	---	---	---	---	---	---	---	---	---	---
SW-N-60	NS		2023-02-07	Dry	---	---	---	---	---	---	---	---	---	---
SW-N-61	NS		2023-02-07	Dry	---	---	---	---	---	---	---	---	---	---
SW-N-61	NS		2023-02-07	Dry	---	---	---	---	---	---	---	---	---	---
SW-N-62	SS		2023-02-07	Sampled flow before entering culvert. High flow, very turbid, g	1 200. b	0.199	35.	0.007 4	6.5	2.15	3.23	273.	2 440. a	0.119
SW-N-63	SS		2023-02-13	NEW. Moderate flow, clear & colourless	91.5	0.163	35.	< 0.005	8.	0.14	1.51	86.4	252.	0.146
SW-N-63	SS		2023-02-21	Low flow, clear and colourless.	138.	0.22	35.	0.006 6	9.	0.267	1.9	95.2	528.	0.245
SW-N-63	SS		2023-03-20	Moderate flow, clear and colourless.	72.4	0.159	31.	< 0.005	9.5	0.173	1.25	81.3	216.	0.112
SW-N-64	SS		2023-02-13	NEW. Moderate flow, clear & colourless.	65.3	0.314	26.	0.005 5	10.	0.124	1.5	51.3	279.	0.144
SW-N-64	SS		2023-02-21	Moderate flow, clear and colourless.	72.3	0.44	27.	0.005	13.	0.217	1.8	59.7	457.	0.147
SW-N-64	SS		2023-03-20	Moderate flow, clear and very slightly yellow	55.1	0.357	24.	0.007 1	14.	0.173	1.47	52.8	309.	0.122
SW-N-65	SS		2023-02-13	NEW. Moderately high flow, clear & colourless.	107.	0.256	28.	0.007 2	10.	0.182	1.6	63.3	315.	0.175
SW-N-65	SS		2023-02-21	Moderate flow, clear and colourless.	77.1	0.36	29.	< 0.005	12.	0.222	1.77	69.2	405.	0.145
SW-N-65	SS		2023-03-20	Moderate flow, clear and very slightly yellow	63.	0.302	28.	0.006 3	12.	0.175	1.76	67.3	283.	0.111
SW-N-CS2	SS		2022-05-04		4.5	0.024	14.	< 0.005	3.3	0.015 8	0.203	69.8	7.1	< 0.005
SW-N-CS2	NS		2022-11-09	Dry	---	---	---	---	---	---	---	---	---	---
SW-N-CS2	SS		2023-01-05	Clear, colourless.	6.58	0.046	< 10.	< 0.005	3.8	0.017 3	0.313	58.5	5.1	< 0.005
SW-N-CS2	SS		2023-02-06	Low flow, clear & colourless.	4.72	0.027	< 10.	< 0.005	3.6	0.016 1	0.179	85.9	12.1	< 0.005
SW-S-03	SS		2022-05-05		5 630. b	0.817	69.	0.141	18.	5.9 b	31.8	87.3	10 900. a	6.76 b
SW-S-03	SS		2022-11-08		344. b	0.312	44.	0.152	950. a b	0.56	7.33	175.	665.	0.531
SW-S-03	SS		2023-01-04	Clear, colourless.	38.7	0.203	66.	0.009 9	26.	0.502	5.8	108.	712.	0.035
SW-S-03	SS		2023-02-06	High flow. Very turbid, very grey	5 060. b	0.657	55.	0.066 3	21.	6.54 b	18.4	104.	9 610. a	3.34
SW-S-04	FRM	Y	2022-05-05	Mean of duplicates	1 260. b	0.316	71.5	0.044 8	18.	1.425	9.055	78.2	2 250. a	1.875
SW-S-04	FRM	Y	2022-11-08	Mean of duplicates	13.25	0.114	63.5	0.015 05	29.5	0.073 5	1.555	125.5	7.2	0.012 1
SW-S-04	FRM	Y	2023-01-04	Mean of duplicates	25.75	0.099 5	56.5	< 0.005 35	30.	0.063 2	1.675	92.5	30.85	0.026 3
SW-S-04	FRM	Y	2023-02-06	Mean of duplicates	71.3	0.112	66.5	0.012 25	31.	0.131 5	1.99	100.95	102.8	0.113 2
SW-S-12	SS		2022-05-05		1 960. b	0.417	115.	0.026 9	11.	2.45	15.2	109.	5 760. a	0.882
SW-S-12	SS		2022-11-08		277. b	0.519	58.	0.044 4	33.	0.564	20.9	222.	544.	0.181
SW-S-12	SS		2023-01-04	Clear, slightly grey.	55.6	0.309	92.	0.017 4	20.	0.981	7.8	123.	1 700. a	0.049 4
SW-S-12	SS		2023-02-06	High flow. Very turbid, very grey	4 390. b	0.545	97.	0.057 4	19.	6.72 b	21.	138.	9 410. a	2.65
SW-S-20	NS		2022-11-08	Dry	---	---	---	---	---	---	---	---	---	---
SW-S-20	SS		2023-01-04	Clear, colourless.	41.1	0.101	19.	< 0.005	5.6	0.125	1.14	47.3	112.	0.017 8
SW-S-20	SS		2023-02-06	Moderate flow. Slightly turbid, colorless.	77.3	0.112	38.	0.006 7	7.7	0.418	1.92	67.1	403.	0.065 1
SW-S-21	NS		2022-05-05	Dry	---	---	---	---	---	---	---	---	---	---
SW-S-21	NS		2022-11-08	Dry	---	---	---	---	---	---	---	---	---	---
SW-S-21	SS		2023-01-04	Clear, colourless.	33.	0.091	17.	< 0.005	6.	0.031 9	1.	40.4	14.2	< 0.005
SW-S-21	SS		2023-02-06	Clear, colourless.	21.	0.074	15.	< 0.005	6.	0.033 2	0.746	56.7	6.4	0.005 8
SW-S-24	SS		2022-05-05		1 660. b	0.366	78.	0.164	17	1.76	11.	83.2	2 940. a	2.04
SW-S-24	SS		2022-11-08		11.2	0.161	70.	0.011 8	27.	0.081	2.63	187.	15.	0.016 5
SW-S-24	SS		2023-01-04	Clear, colourless.	29.2	0.146	90.	0.007 3	41.	0.099 7	2.7	126.	85.7	0.046 7
SW-S-24	SS		2023-02-06	High flow. Clear, colourless.	143.	0.147	79.	0.013 3	30.	0.282	3.22	106.	303.	0.176
SW-S-27	SS		2022-05-05		249. b	0.23	93.	0.029 4	8.2	0.44	1.77	97.5	454.	0.76
SW-S-27	NS		2022-11-08	Dry	---	---	---	---	---	---	---	---	---	---
SW-S-27	NS		2023-01-05	Inaccessible	---	---	---	---	---	---	---	---	---	---
SW-S-27	NS		2023-02-06	Inaccessible	---	---	---	---	---	---	---	---	---	---
SW-S-52	NS		2022-11-08	Dry	---	---	---	---	---	---	---	---	---	---
SW-S-52	SS		2023-01-04	Clear, colourless.	9.06	0.051	21.	< 0.005	4.3	0.022 7	0.338	48.3	5.2	< 0.005
SW-S-52	SS		2023-02-06	High flow, clear & colourless.	6.66	0.044	14.	< 0.005	3.8	0.020 6	0.274	63.8	4.7	< 0.005

Notes:

na	Not applicable.
Null	No sample collected.
a	Above short-term acute (STA) British Columbia Water Quality Guideline.
b	Above long-term chronic (LTC) British Columbia Water Quality Guideline.
c	Detection Limits above Applicable Standards.
(1)	British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August 2023. British Columbia Ministry of Environment and a Compendium of Working Water Quality Guidelines for British Columbia, 1998 Edition, Updated in Feb 2021. British Columbia Ministry of Environment. The Guidelines cited specific to protection of freshwater aquatic life unless otherwise noted.
(2)	above STA unless otherwise noted.
(3)	The ammonia guideline is pH and temperature (15°C assumed) dependant. All ammonia results were compared to standards based on the associated pH and temperature results for that sample.
(4)	The nitrite guidelines are chloride dependant. All nitrite results were compared to standards based on the associated chloride result for that sample.
(5)	This value is hardness dependent. All metals results were compared to standards based on the associated hardness result for a particular sample.
(6)	This value is the short-term daily for streams with unknown fish distribution.
(7)	The TSS guidelines are "change from background" and flow condition dependent. The background TSS in the landfill are derived from stations Sw-S-52 .
(8)	*Dissolved copper guideline varies with water hardness, temperature and DOC, and calcuated using BLM;*
(9)	Total Aluminum guidance is pH, hardness, and DOC dependent and calculated based on BC Water Quality Guideline calculator for Aluminum in Freshwater. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill. Ecosystems.
(10)	Dissolved Zinc guidance is pH, hardness, and DOC dependent. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill.

Appendix B-3. Surface Water Quality - 2022-2023

B.C. Water Quality Guidelines				BC WQG-STA (1)	815 - 3394 (5)	46000	1.9 - 24.9 (3)	0.06 - 0.6 (4)	32.8	---	---	0.05 - 1.5 (5)	---	25
				BC WQG-LTC (1)	767 - 2585 (5)	7600	0.135 - 1.77 (3)	0.02 - 0.2 (4)	3	---	2	0.1 - 3 (5)	128 - 429 (5)	5
Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	PARAMETER	Manganese	Molybdenum	N - Nh3 (As N)	N - No2 (As N)	N - No3 (As N)	Nickel	Selenium	Silver	Sulphate	TSS
				STATE	TOT	TOT	TOT	DIS	DIS	TOT	TOT	TOT	DIS	TOT
				UNIT	µg/L	µg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	mg/L	mg/L
				Method Detection Limit (MDL)	0.1	0.05	0.015	0.005	0.02	0.02	0.04	0.005	1	1
				Limit of Quantification (LOQ)	0.5	0.25	0.075	0.025	0.1	0.1	0.2	0.025	5	5
				COMMENTS	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
SW-N-05	FRM	Y	2022-05-04	Mean of duplicates	159.5	2.95	6.5 b	0.389 5 b	32.7 b	5.115	0.591 ---	< 0.005 3	250. ---	1.8
SW-N-05	SS	Y	2022-11-07		12.8	0.717	2.9 b	0.156 b	50.5 a b	1.56	2.12 --- b	< 0.005	180. ---	7.6 b
SW-N-05	FRM	Y	2023-01-05	Mean of duplicates	5.175	2.82	< 0.015	< 0.005	27.5 b	2.51	1.625 ---	< 0.005	470. --- b	2.4
SW-N-05	FRM	Y	2023-02-07	Mean of duplicates	8.245	2.945	< 0.015	< 0.005	13.6 b	1.895	0.326 ---	< 0.01	150. ---	4.
SW-N-14	NS		2022-05-03	No access to the Heals Range	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-N-14	SS		2022-11-10		5.57	0.429	< 0.015	< 0.005	7.46 b	0.46	0.164 ---	< 0.01	88. ---	6.4 b
SW-N-14	NS		2023-01-05	Heals Range, unable to access	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-N-14	SS		2023-02-13	Moderate flow, clear & colourless.	7.97	0.639	< 0.015	< 0.005	6.6 b	1.27	0.12 ---	< 0.01	73. ---	< 1.
SW-N-14	SS		2023-02-21	Moderate flow, clear and colourless.	2.58	0.759	< 0.015	< 0.005	6.02 b	1.76	0.078 ---	< 0.005	70. ---	< 1.
SW-N-14	SS		2023-03-20	Moderate flow, clear and colourless.	4.75	0.415	< 0.015	< 0.005	5.35 b	0.41	0.068 ---	< 0.01	63. ---	< 1.
SW-N-15	SS		2023-02-21	Moderate flow, clear and colourless.	0.698	0.244	< 0.015	< 0.005	0.296	0.21	< 0.04 ---	< 0.005	10. ---	< 1.
SW-N-15	SS		2023-03-20	High flow, clear and colourless.	0.58	0.219	< 0.015	< 0.005	0.166	0.21	< 0.04 ---	< 0.01	9.4 ---	< 1.
SW-N-16	FRM	Y	2022-05-04	Mean of duplicates	127.5	0.814 5	0.031	0.01	0.509 5	1.425	0.102 5 ---	< 0.005	36. ---	< 2.65
SW-N-16	FRM	Y	2022-11-09	Mean of duplicates	36.55	0.990 5	0.048 5	0.017 85	6.8 b	1.26	0.153 5 ---	< 0.01	110. ---	< 2.1
SW-N-16	FRM	Y	2023-01-05	Mean of duplicates	38.2	0.816	0.04	0.018 65	8.33 b	1.04	0.107 5 ---	< 0.005	68.5 ---	< 1.
SW-N-16	FRM	Y	2023-02-21	Mean of duplicates	43.	0.787	0.031	0.015 9	8.3 b	1.52	0.094 ---	< 0.005	64. ---	1.8
SW-N-16	FRM	Y	2023-02-06	Mean of duplicates	53.5	0.800 5	< 0.059 5	0.019 95	8.28 b	2.66	0.112 5 ---	< 0.01	59.5 ---	16.5 b
SW-N-17	NS		2022-05-04	No access to the Heals Range	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-N-17	SS		2022-11-10		10.8	0.559	< 0.015	0.011 8	32.7 b	0.623	0.886 ---	< 0.005	130. ---	< 1.
SW-N-17	NS		2023-01-05	No access to the Heals Range	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-N-17	SS		2023-02-13	Moderate flow, clear & colourless.	2.38	3.34	< 0.015	< 0.005	9.94 b	12.3	0.149 ---	< 0.01	100. ---	< 1.
SW-N-17	SS		2023-02-21	Moderate flow, clear and colourless.	3.41	0.696	< 0.015	< 0.005	8.81 b	1.06	0.131 ---	< 0.005	95. ---	< 1.
SW-N-17	SS		2023-03-20	Moderate flow, clear and colourless.	2.62	0.492	< 0.015	< 0.005	6.9 b	0.33	0.105 ---	< 0.01	86. ---	< 1.
SW-N-18	SS		2022-05-04		650.	1.34	82. a b	0.121	2.02	19.	0.417 ---	0.019	81. ---	3.2
SW-N-18	SS		2022-11-07		50.7	2.98	11. a b	0.681 a b	58.4 a b	2.77	3.04 --- b	< 0.005	180. ---	3.2
SW-N-18	SS		2023-01-05	Clear, colourless.	22.6	1.66	1.9 b	0.306 a b	12.3 b	1.39	0.661 ---	< 0.005	81. ---	6.4 b
SW-N-18	FRM		2023-02-07	Mean of duplicates	72.1	1.625	6.3 b	0.494 a b	32.1 b	4.025	0.926 ---	< 0.01	160. ---	245. a b
SW-N-19	SS		2022-05-04		22.6	1.05	< 0.015	0.007 6	3.05 b	2.94	0.143 ---	0.007 2	40. ---	1.6
SW-N-19	SS		2022-11-09		17.2	1.3	0.058	0.104 b	10.8 b	1.6	0.257 ---	< 0.01	120. ---	< 1.
SW-N-19	SS		2023-01-05	Clear, colourless.	5.23	0.898	0.02	0.046 3	11.7 b	1.59	0.135 ---	< 0.005	80. ---	< 1.
SW-N-41S	FRM	Y	2022-05-04	Mean of duplicates	128.	0.312 5	< 0.015	< 0.005	0.17	0.17	0.147 5 ---	< 0.01	48. ---	2.
SW-N-41S	FRM	Y	2022-11-09	Mean of duplicates	155.	0.293	0.017	< 0.005	0.421 5	0.175	0.169 5 ---	< 0.01	68.5 ---	2.6
SW-N-41S	FRM	Y	2023-01-05	Mean of duplicates	69.25	0.283	< 0.015	< 0.005	0.736	0.17	0.115 ---	< 0.01	62. ---	7.8 b
SW-N-41S	FRM	Y	2023-02-06	Mean of duplicates	90.65	0.294	< 0.015	< 0.005	0.488 5	0.335	0.084 ---	< 0.01	61.5 ---	10. b
SW-N-41S	SS		2022-05-04		2.76	0.293	0.015	< 0.005	< 0.02	0.087	0.064 ---	< 0.005	14. ---	1.6
SW-N-41S	SS		2022-11-09		2.59	0.282	< 0.015	< 0.005	0.057	0.15	0.071 ---	< 0.01	25. ---	< 1.
SW-N-41S	SS		2023-01-05	Clear, colourless.	1.78	0.301	< 0.015	< 0.005	0.318	0.076	0.093 ---	< 0.005	12. ---	2.
SW-N-41S	SS		2023-02-21	Moderate flow, clear and colourless.	7.66	0.342	< 0.015	< 0.005	1.56	0.29	0.091 ---	< 0.01	17. ---	< 1.
SW-N-41S	SS		2023-02-06	High flow, clear & colourless.	2.58	0.394	< 0.015	< 0.005	1.27	0.296	0.095 ---	< 0.005	16. ---	1.6
SW-N-41S	SS		2023-02-13	Moderate flow, clear & colourless.	23.9	0.223	0.018	< 0.005	0.222	0.31	0.045 ---	< 0.01	6.7 ---	3.2
SW-N-41S	SS		2023-02-21	Moderate flow, clear and colourless.	25.4	0.23	0.017	< 0.005	0.139	0.272	< 0.04 ---	< 0.005	6.8 ---	1.6
SW-N-42S	FRM	Y	2022-05-04	Mean of duplicates	54.5	0.605	< 0.015	< 0.005	0.023 5	0.2	0.055 5 ---	< 0.01	67.5 ---	14.5 b
SW-N-42S	FRM	Y	2022-11-09	Mean of duplicates	408.	0.727 5	< 0.028 5	< 0.005	0.038 5	0.63	0.109 ---	< 0.01	120. ---	7.2 b
SW-N-42S	FRM	Y	2023-02-21	Mean of duplicates	46.15	0.571	< 0.015	< 0.005	0.239	0.3	0.063 5 ---	< 0.01	82.5 ---	< 3.5
SW-N-42S	FRM	Y	2023-01-05	Mean of duplicates	20.4	0.481	< 0.015	< 0.005	0.398 5	0.155	0.063 ---	< 0.01	80.5 ---	3.4
SW-N-45	NS		2022-05-04	No access to the Heals Range	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-N-45	SS		2022-11-10		7.8	0.916	< 0.015	0.020 3	44.2 a b	0.751	1.16 ---	< 0.005	160. ---	< 1.
SW-N-45	NS		2023-01-05	Heals Range, unable to access	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-N-45	SS		2023-02-13	Moderate flow, clear & colourless.	5.56	1.37	< 0.015	< 0.005	9.38 b	2.12	0.309 ---	< 0.01	120. ---	< 1.
SW-N-45	SS		2023-02-21	Moderate flow, clear and colourless.	12.3	1.07	< 0.015	< 0.005	8.48 b	0.857	0.283 ---	< 0.005	90. ---	< 1.
SW-N-45	SS		2023-03-20	Low flow, clear and colourless	5.32	0.866	< 0.015	< 0.005	7.91 b	0.52	0.217 ---	< 0.01	70. ---	4.8
SW-N-50	NS		2022-05-04	Destroyed - Cell 4, 5, 6 construction	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-N-51	NS		2022-05-04	Destroyed - Cell 4, 5, 6 construction	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-N-53	NS		2022-05-04	Dry	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-N-53	NS		2022-11-09	Dry	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-N-53	NS		2023-01-05	Dry (ditch along high level road)	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-N-53	SS		2023-02-07	Low flow, very turbid, very brown.	4 200. a b	1.14	0.19	0.014 2	0.439	193. b	< 0.4 ---	0.12	15. ---	2 200. a b
SW-N-54	SS		2022-05-04		39.6	0.504	0.016	< 0.005	0.69	1.33	0.208 ---	< 0.005	36. ---	< 1.
SW-N-54	SS		2022-11-10		370.	0.914	0.21	0.036 4	0.729	2.9	0.27 ---	< 0.01	140. ---	6. b
SW-N-54	SS		2023-01-05	Clear, colourless.	3 620. a b	1.49	1.2	0.147	1.6	10.2	0.424 ---	0.02	68. ---	4.8
SW-N-54	SS		2023-02-07	High flow. Moderately turbid,slightly grey.	565.	0.812	0.94	0.026 5	2.88	7.6	0.274 ---	0.021	55. ---	67. a b
SW-N-57	FRM		2023-02-07	Mean of duplicates	66.75	1.69	6.55 b	0.492 5 a b	32.15 b	3.735	0.928 5 ---	< 0.01	130. ---	46.5 a b
SW-N-58	NS		2023-02-07	MH by P11 - not flowing.	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-N-58	NS		2023-02-07	MH by P11 - not flowing.	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-N-59	NS		2023-02-07	Kitchen scraps channel - not yet set up.	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-N-60	NS		2023-02-07	Dry	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-N-61	NS		2023-02-07	Dry	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-N-61	NS		2023-02-07	Dry	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-N-62	SS		2023-02-07	Sampled flow before entering culvert. High flow, very turbid, g	48.5	1.6	6. b	0.462 a b	29.8 b	3.01	0.873 ---	< 0.01	120. ---	38. a b
SW-N-63	SS		2023-02-13	NEW. Moderate flow, clear & colourless	16.4	0.375	< 0.015	0.005 7	1.28	0.75	0.088 ---	< 0.01	20. ---	1.6
SW-N-63	SS		2023-02-21	Low flow, clear and colourless.	33.2	0.358	0.018	< 0.005	1.13	0.7	0.086 ---	< 0.01	18. ---	2.
SW-N-63	SS		2023-03-20	Moderate flow, clear and colourless.	27.5	0.307	0.019 --- ---	< 0.005	0.958	0.6	0.082 ---	< 0.01	16. ---	2.8
SW-N-64	SS		2023-02-13	NEW. Moderate flow, clear & colourless.	12.6	0.276	< 0.015	< 0.005	0.294	0.74	0.045 ---	< 0.01	8.7 ---	< 1.
SW-N-64	SS		2023-02-21	Moderate flow, clear and colourless.	28.9	1.32	< 0.015	< 0.005	0.161	5.42	0.056 ---	0.007 5	9.5 ---	< 1.
SW-N-64	SS		2023-03-20	Moderate flow, clear and very slightly yellow	24.8	0.297	0.021 --- ---	< 0.005	0.184	0.88	0.05 ---	< 0.01	9. ---	2.8
SW-N-65	SS		2023-02-13	NEW. Moderately high flow, clear & colourless.	18.7	0.297	0.016	< 0.005	0.582	0.74	0.064 ---	< 0.01	12. ---	3.2
SW-N-65	SS		2023-02-21	Moderate flow, clear and colourless.	27.5	1.83	< 0.015	< 0.005	0.512	7.49	0.066 ---	0.007 5	12. ---	2.8
SW-N-65	SS		2023-03-20	Moderate flow, clear and very slightly yellow	26.	0.317	0.022	< 0.005	0.497	0.75	0.067 ---	< 0.01	12. ---	2.8
SW-N-CS2	SS		2022-05-04		0.216	0.098	< 0.015	< 0.005	< 0.02	0.049	< 0.04 ---	< 0.005	7.6 ---	< 1.
SW-N-CS2	NS		2022-11-09	Dry	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-N-CS2	SS		2023-01-05	Clear, colourless.	0.13	0.084	< 0.015	< 0.005	0.862	0.035	0.065 ---	< 0.005	6.1 ---	9.2 b
SW-N-CS2	SS		2023-02-06	Low flow, clear & colourless.	0.227	0.124	< 0.015	< 0.005	3.24 b	0.218	0.073 ---	< 0.005	9.9 ---	< 1.
SW-S-03	SS		2022-05-05		271.	0.449	1.3	0.023 8	1.19	9.54	0.1 ---	0.04	20. ---	43. a b
SW-S-03	SS		2022-11-08		32.1	0.3	0.045	< 0.005	5.47 b	1.5	0.139 ---	< 0.01	79. ---	130. a b
SW-S-03	SS		2023-01-04	Clear, colourless.	200.	0.138	1.5	0.011 3	2.37	1.19	0.082 ---	< 0.005	28. ---	< 1.
SW-S-03	SS		2023-02-06	High flow. Very turbid, very grey	250.	0.332	1.3	0.023 4	1.85	9.21	0.097 ---	0.021	18. ---	130. a b
SW-S-04	FRM	Y	2022-05-05	Mean of duplicates	103.	0.268 5	< 0.015	0.008 85	1.02	2.395	0.061 ---	0.014	16. ---	23. b
SW-S-04	FRM	Y	2022-11-08	Mean of duplicates	0.718	0.116 5	< 0.015	< 0.005	2.33	#######	0.07 ---	< 0.005	60. ---	< 1.1
SW-S-04	FRM	Y	2023-01-04	Mean of duplicates	1.79	0.123	0.020 5	0.007 8	1.435	0.29	0.051 5 ---	< 0.005	27. ---	< 1.1
SW-S-04	FRM	Y	2023-02-06	Mean of duplicates	7.65	0.177	< 0.015	< 0.005	1.925	0.59	0.055 5 ---	< 0.005	28. ---	< 1.7
SW-S-12	SS		2022-05-05		404.	0.27	4.2 b	0.014 3	1.45	4.51	0.106 ---	0.012	23. ---	34. a b
SW-S-12	SS		2022-11-08		21.2	0.231	0.017	0.005	10.1 b	5.43	0.309 ---	0.006 9	140. ---	6.8 b
SW-S-12	SS		2023-01-04	Clear, slightly grey.	414.	0.097	2.6 b	0.007 7	2.87	1.95	0.08 ---	< 0.005	31. ---	< 1.
SW-S-12	SS		2023-02-06	High flow. Very turbid, very grey	463.	0.26	3.5 b	0.008 7	2.76	9.25	0.106 ---	0.017	28. ---	140. a b
SW-S-20	NS		2022-11-08	Dry	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-S-20	SS		2023-01-04	Clear, colourless.	24.3	0.054	0.14	< 0.005	0.075	0.185	< 0.04 ---	< 0.005	6. ---	4.4
SW-S-20	SS		2023-02-06	Moderate flow. Slightly turbid, colorless.	119.	0.111	1.	0.006 8	0.255	0.664	0.042 ---	< 0.005	7. ---	4.4
SW-S-21	NS		2022-05-05	Dry	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-S-21	NS		2022-11-08	Dry	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-S-21	SS		2023-01-04	Clear, colourless.	0.192	0.066	< 0.015	< 0.005	0.22	0.154	< 0.04 ---	< 0.005	6. ---	< 1.
SW-S-21	SS		2023-02-06	Clear, colourless.	0.199	< 0.05	< 0.015	< 0.005	0.361	0.114	< 0.04 ---	< 0.005	5.9 ---	< 1.
SW-S-24	SS		2022-05-05		116.	0.327	0.054	0.015 9	1.13	2.98	0.062 ---	0.012	15. ---	29. a b
SW-S-24	SS		2022-11-08		1.07	0.085	< 0.015	< 0.005	2.86	0.416	0.08 ---	< 0.005	72. ---	< 1.
SW-S-24	SS		2023-01-04	Clear, colourless.	5.43	0.136	0.13	0.018 3	1.93	0.454	0.05 ---	< 0.005	38. ---	< 1.
SW-S-24	SS		2023-02-06	High flow. Clear, colourless.	14.8	0.15	0.017	0.012 5	2.27	0.703	0.057 ---	< 0.005	28. ---	3.2
SW-S-27	SS		2022-05-05		91.6	0.177	0.02	< 0.005	0.021	0.74	0.057 ---	< 0.01	23. ---	33. a b
SW-S-27	NS		2022-11-08	Dry	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-S-27	NS		2023-01-05	Inaccessible	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-S-27	NS		2023-02-06	Inaccessible	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-S-52	NS		2022-11-08	Dry	---	---	---	---	---	---	--- ---	---	--- ---	---
SW-S-52	SS		2023-01-04	Clear, colourless.	0.147	< 0.05	< 0.015	< 0.005	0.032	0.038	0.047 ---	< 0.005	5.3 ---	< 1.
SW-S-52	SS		2023-02-06	High flow, clear & colourless.	0.271	0.087	< 0.015	< 0.005	0.039	0.217	< 0.04 ---	< 0.005	5.7 ---	< 1.

Notes:

na	Not applicable.
Null	No sample collected.
a	Above short-term acute (STA) British Columbia Water Quality Guideline.
b	Above long-term chronic (LTC) British Columbia Water Quality Guideline.
c	Detection Limits above Applicable Standards.
(1)	British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August 2023. British Columbia Ministry of Environment and a Compendium of Working Water Quality Guidelines for British Columbia, 1998 Edition, Updated in Feb 2021. British Columbia Ministry of Environment. The Guidelines cited specific to protection of freshwater aquatic life unless otherwise noted.
(2)	above STA unless otherwise noted.
(3)	The ammonia guideline is pH and temperature (15°C assumed) dependant. All ammonia results were compared to standards based on the associated pH and temperature results for that sample.
(4)	The nitrite guidelines are chloride dependant. All nitrite results were compared to standards based on the associated chloride result for that sample.
(5)	This value is hardness dependent. All metals results were compared to standards based on the associated hardness result for a particular sample.
(6)	This value is the short-term daily for streams with unknown fish distribution.
(7)	The TSS guidelines are "change from background" and flow condition dependent. The background TSS in the landfill are derived from stations Sw-S-52 .
(8)	*Dissolved copper guideline varies with water hardness, temperature and DOC, and calcuated using BLM;*
(9)	Total Aluminum guidance is pH, hardness, and DOC dependent and calculated based on BC Water Quality Guideline calculator for Aluminum in Freshwater. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill. Ecosystems.
(10)	Dissolved Zinc guidance is pH, hardness, and DOC dependent. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill.

Appendix B-3. Surface Water Quality - 2022-2023

Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	PARAMETER	Zinc	pH	Conductivity	Temperature	Aluminum	Arsenic	Boron	Cadmium	Cobalt	Copper
B.C. Water Quality Guidelines				BC WQG-STA (1)	---	6.5 to 9.0	---	---	---	---	---	0.038-2.8 (5)	---	BC BLM (8)
				BC WQG-LTC (1)	---	---	---	---	---	---	---	0.018-0.645 (5)	---	BC BLM (8)
				STATE	TOT	TOT	TOT	TOT	DIS	DIS	DIS	DIS	DIS	DIS
				UNIT	µg/L	pH	µS/cm	°C	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
				Method Detection Limit (MDL)	1	0.1	1	0.1	0.5	0.02	10	0.005	0.005	0.05
				Limit of Quantification (LOQ)	5	0.5	5	0.5	2.5	0.1	50	0.025	0.025	0.25
				COMMENTS	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
SW-N-05	FRM	Y	2022-05-04	Mean of duplicates	7.295	6.68	691.	9.2	30.5	0.193 5	231.	0.081 2	0.771	12.35 b
SW-N-05	SS	Y	2022-11-07		5.48	6.71	639.	10.5	3.59	0.134	76.	0.021 4	0.589	2.96 b
SW-N-05	FRM	Y	2023-01-05	Mean of duplicates	7.58	6.79	860.5	8.6	56.7	0.191	102.5	0.032	0.13	4.81 b
SW-N-05	FRM	Y	2023-02-07	Mean of duplicates	3.6	6.57	460.	8.7	54.65	0.189 5	90.	0.111 2	0.137	5.98 b
SW-N-14	NS		2022-05-03	No access to the Heals Range	---	---	---	---	---	---	---	---	---	---
SW-N-14	SS		2022-11-10		2.1	7.72	440.	6.5	3.93	0.146	77.	< 0.005	0.093 9	1.36
SW-N-14	NS		2023-01-05	Heals Range, unable to access	---	---	---	---	---	---	---	---	---	---
SW-N-14	SS		2023-02-13	Moderate flow, clear & colourless.	1.9	6.75	271.	5.8	7.76	0.099	72.	< 0.005	0.104	1.34
SW-N-14	SS		2023-02-21	Moderate flow, clear and colourless.	1.08	7.68	26.	6.2	5.94	0.105	64.	< 0.005	0.066 6	0.965
SW-N-14	SS		2023-03-20	Moderate flow, clear and colourless.	1.3	7.23	227.2	6.8	5.33	0.09	68.	< 0.005	0.073 6	0.955 b
SW-N-15	SS		2023-02-21	Moderate flow, clear and colourless.	0.2	7.75	113.	5.6	1.49	0.074	35.	< 0.005	0.011 1	0.625 b
SW-N-15	SS		2023-03-20	High flow, clear and colourless.	< 1.	6.65	115.7	5.9	1.61	0.08	30.	< 0.005	0.010 8	0.293 b
SW-N-16	FRM	Y	2022-05-04	Mean of duplicates	6.275	7.67	237.	10.	13.45	0.227 5	62.	0.009 4	0.367 5	6.7
SW-N-16	FRM	Y	2022-11-09	Mean of duplicates	18.4	7.205	386.5	5.05	12.25	0.22	59.5	0.025 1	0.227 5	5.905
SW-N-16	FRM	Y	2023-01-05	Mean of duplicates	11.5	6.98	261.	6.2	14.35	0.196	49.	0.016 9	0.182 5	6.205 b
SW-N-16	FRM	Y	2023-02-21	Mean of duplicates	9.18	7.02	357.	6.2	12.05	0.195	51.5	0.063 75	0.202 5	5.855 b
SW-N-16	FRM	Y	2023-02-06	Mean of duplicates	23.75	6.72	290.	7.5	13.45	0.191	43.	0.029 85	0.296 5	8.15 b
SW-N-17	NS		2022-05-04	No access to the Heals Range	---	---	---	---	---	---	---	---	---	---
SW-N-17	SS		2022-11-10		5.13	6.83	690.	7.3	6.12	0.109	141.	0.013	0.277	0.958
SW-N-17	NS		2023-01-05	No access to the Heals Range	---	---	---	---	---	---	---	---	---	---
SW-N-17	SS		2023-02-13	Moderate flow, clear & colourless.	1.3	7.34	346.	6.3	5.89	0.076	110.	< 0.005	0.093	0.821
SW-N-17	SS		2023-02-21	Moderate flow, clear and colourless.	1.12	7.44	331.	6.9	4.97	0.089	115.	< 0.005	0.085 5	0.757
SW-N-17	SS		2023-03-20	Moderate flow, clear and colourless.	1.	7.05	351.	7.1	4.22	0.085	126.	< 0.005	0.090 5	0.998 b
SW-N-18	SS		2022-05-04		128.	6.84	1 242.	10.9	18.	2.11	937.	0.030 8	8.25	11.5 b
SW-N-18	SS		2022-11-07		2.	8.05	675.	7.6	7.64	0.172	51.	0.008 5	0.984	1.04
SW-N-18	SS		2023-01-05	Clear, colourless.	45.4	8.01	440.	6.7	11.6	0.16	27.	0.005 9	0.289	0.9 b
SW-N-18	FRM		2023-02-07	Mean of duplicates	14.	7.23	537.	8.5	42.7	0.162	43.	0.650 2 b	0.686	1.91
SW-N-19	SS		2022-05-04		3.38	8.2	215.	11.	14.2	0.24	54.	0.014 1	0.441	15.6 b
SW-N-19	SS		2022-11-09		3.5	7.68	270.	5.2	7.78	0.268	39.	0.008 4	0.378	7.24
SW-N-19	SS		2023-01-05	Clear, colourless.	2.96	7.8	281.	6.6	14.9	0.219	31.	0.013 4	0.191	12. b
SW-N-41S	FRM	Y	2022-05-04	Mean of duplicates	< 1.15	8.14	229.	9.3	3.74	0.175	16.5	< 0.005	0.076 6	0.198
SW-N-41S	FRM	Y	2022-11-09	Mean of duplicates	1.45	8.195	283.	7.1	4.37	0.248	19.	< 0.005	0.136	0.188 5
SW-N-41S	FRM	Y	2023-01-05	Mean of duplicates	1.15	7.67	360.	8.4	5.29	0.163 5	17.	< 0.005	0.046 4	0.26
SW-N-41S	FRM	Y	2023-02-06	Mean of duplicates	1.4	7.995	258.	8.3	4.315	0.212	18.	< 0.005	0.054 7	0.396
SW-N-41S	SS		2022-05-04		0.32	7.93	145.	8.1	3.58	0.101	24.	< 0.005	0.015 7	0.293
SW-N-41S	SS		2022-11-09		< 1.	7.34	320.	5.1	5.14	0.197	49.	< 0.005	0.016 2	0.214
SW-N-41S	SS		2023-01-05	Clear, colourless.	0.62	7.46	122.	7.4	6.89	0.075	20.	< 0.005	0.020 4	0.385
SW-N-41S	SS		2023-02-21	Moderate flow, clear and colourless.	< 1.	7.2	147.	7.2	4.3	0.085	25.	< 0.005	0.016	0.268
SW-N-41S	SS		2023-02-06	High flow, clear & colourless.	0.41	7.6	161.	7.7	3.26	0.089	25.	< 0.005	0.013 2	0.244
SW-N-41S	SS		2023-02-13	Moderate flow, clear & colourless.	1.4	7.76	106.	4.7	2.44	0.089	33.	< 0.005	0.020 2	0.216
SW-N-41S	SS		2023-02-21	Moderate flow, clear and colourless.	0.97	7.77	104.	4.9	2.18	0.099	37.	< 0.005	0.019 9	0.199
SW-N-42S	FRM	Y	2022-05-04	Mean of duplicates	< 1.	7.9	276.	9.8	6.37	0.067 5	44.	< 0.005	0.052 75	0.365 5
SW-N-42S	FRM	Y	2022-11-09	Mean of duplicates	4.9	7.535	305.	4.3	5.91	0.147 5	59.5	< 0.005 35	0.043 6	0.434 5
SW-N-42S	FRM	Y	2023-02-21	Mean of duplicates	1.25	7.33	371.	6.3	4.09	0.084 5	58.5	< 0.005	0.042	0.378
SW-N-42S	FRM	Y	2023-01-05	Mean of duplicates	1.8	7.145	371.5	7.2	4.65	0.085 5	61.	< 0.005	0.047 9	0.508 5
SW-N-45	NS		2022-05-04	No access to the Heals Range	---	---	---	---	---	---	---	---	---	---
SW-N-45	SS		2022-11-10		1.89	6.87	313.	7.6	4.37	0.107	210.	0.014 4	0.406	1.46
SW-N-45	NS		2023-01-05	Heals Range, unable to access	---	---	---	---	---	---	---	---	---	---
SW-N-45	SS		2023-02-13	Moderate flow, clear & colourless.	1.3	7.03	3.84	7.3	5.41	0.086	145.	0.008 9	0.11	1.78 b
SW-N-45	SS		2023-02-21	Moderate flow, clear and colourless.	1.31	7.3	530.	7.3	6.45	0.094	167.	0.006 9	0.108	1.44 b
SW-N-45	SS		2023-03-20	Low flow, clear and colourless	< 1.	6.66	372.5	7.8	4.6	0.085	176.	0.007 4	0.1	1.16 b
SW-N-50	NS		2022-05-04	Destroyed - Cell 4, 5, 6 construction	---	---	---	---	---	---	---	---	---	---
SW-N-51	NS		2022-05-04	Destroyed - Cell 4, 5, 6 construction	---	---	---	---	---	---	---	---	---	---
SW-N-53	NS		2022-05-04	Dry	---	---	---	---	---	---	---	---	---	---
SW-N-53	NS		2022-11-09	Dry	---	---	---	---	---	---	---	---	---	---
SW-N-53	NS		2023-01-05	Dry (ditch along high level road)	---	---	---	---	---	---	---	---	---	---
SW-N-53	SS		2023-02-07	Low flow, very turbid, very brown.	456.	8.27	492.	7.9	6 290.	0.815	19.	0.076 3	12.8	41.3 b
SW-N-54	SS		2022-05-04		0.85	7.63	305.	11.6	10.2	0.319	57.	< 0.005	0.213	13.4 b
SW-N-54	SS		2022-11-10		3.3	7.82	570.	10.2	10.7	0.596	46.	0.014 1	1.03	7.53
SW-N-54	SS		2023-01-05	Clear, colourless.	2.8	7.41	417.	8.7	26.4	2.1	77.	0.054 5	5.77	20.1 b
SW-N-54	SS		2023-02-07	High flow. Moderately turbid,slightly grey.	13.6	7.36	331.	7.6	31.1	0.607	49.	0.020 6	0.958	6.34
SW-N-57	FRM		2023-02-07	Mean of duplicates	6.05	7.94	423.	8.3	18.15	0.167 5	38.	0.005 85	0.646	1.08
SW-N-58	NS		2023-02-07	MH by P11 - not flowing.	---	---	---	---	---	---	---	---	---	---
SW-N-58	NS		2023-02-07	MH by P11 - not flowing.	---	---	---	---	---	---	---	---	---	---
SW-N-59	NS		2023-02-07	Kitchen scraps channel - not yet set up.	---	---	---	---	---	---	---	---	---	---
SW-N-60	NS		2023-02-07	Dry	---	---	---	---	---	---	---	---	---	---
SW-N-61	NS		2023-02-07	Dry	---	---	---	---	---	---	---	---	---	---
SW-N-61	NS		2023-02-07	Dry	---	---	---	---	---	---	---	---	---	---
SW-N-62	SS		2023-02-07	Sampled flow before entering culvert. High flow, very turbid, g	4.2	7.9	480.	8.5	12.6	0.16	35.	0.005 4	0.599	0.932
SW-N-63	SS		2023-02-13	NEW. Moderate flow, clear & colourless	< 1.	7.56	130.	5.8	11.9	0.131	33.	< 0.005	0.096 4	1.02
SW-N-63	SS		2023-02-21	Low flow, clear and colourless.	1.3	7.57	210.	6.2	11.3	0.145	31.	< 0.005	0.118	0.948
SW-N-63	SS		2023-03-20	Moderate flow, clear and colourless.	< 1.	6.33 a	137.6	7.	14.5	0.137	33.	< 0.005	0.138	0.857 b
SW-N-64	SS		2023-02-13	NEW. Moderate flow, clear & colourless.	1.9	7.17	91.	5.	20.1	0.287	25.	< 0.005	0.11	1.22 b
SW-N-64	SS		2023-02-21	Moderate flow, clear and colourless.	2.12	7.27	160.	5.8	24.5	0.371	26.	0.005 7	0.191	1.38
SW-N-64	SS		2023-03-20	Moderate flow, clear and very slightly yellow	2.3	6.23 a	111.8	8.1	17.1	0.348	25.	< 0.005	0.154	1.14 b
SW-N-65	SS		2023-02-13	NEW. Moderately high flow, clear & colourless.	1.9	7.24	101.	5.1	18.8	0.241	27.	< 0.005	0.102	1.16
SW-N-65	SS		2023-02-21	Moderate flow, clear and colourless.	1.75	7.41	111.	5.9	20.2	0.297	29.	< 0.005	0.162	1.23
SW-N-65	SS		2023-03-20	Moderate flow, clear and very slightly yellow	1.7	6.5	117.6	7.7	13.7	0.264	27.	< 0.005	0.154	0.989 b
SW-N-CS2	SS		2022-05-04		0.5	7.87	108.	8.1	2.48	0.03	11.	< 0.005	0.013 7	0.26
SW-N-CS2	NS		2022-11-09	Dry	---	---	---	---	---	---	---	---	---	---
SW-N-CS2	SS		2023-01-05	Clear, colourless.	0.37	7.33	130.	7.4	4.02	0.042	< 10.	< 0.005	0.018	0.338
SW-N-CS2	SS		2023-02-06	Low flow, clear & colourless.	0.21	7.51	129.	7.8	1.96	0.024	10.	< 0.005	0.013 6	0.16
SW-S-03	SS		2022-05-05		76.9	7.11	154.	10.3	19.3	0.185	64.	0.012 5	0.358	5.17 b
SW-S-03	SS		2022-11-08		35.5	6.94	2 370.	9.7	17.6	0.272	53.	0.157	0.254	6.06 b
SW-S-03	SS		2023-01-04	Clear, colourless.	4.02	7.01	320.	9.9	16.9	0.193	67.	0.009 8	0.478	5.07 b
SW-S-03	SS		2023-02-06	High flow. Very turbid, very grey	64.	7.23	178.	8.7	16.4	0.204	54.	0.014 1	0.357	4.06
SW-S-04	FRM	Y	2022-05-05	Mean of duplicates	23.5	7.42	157.	9.5	23.4	0.133	60.5	< 0.005 1	0.097 15	2.765
SW-S-04	FRM	Y	2022-11-08	Mean of duplicates	1.935	7.035	253.	9.6	10.06	0.117 5	73.	0.012 25	0.066 8	1.58
SW-S-04	FRM	Y	2023-01-04	Mean of duplicates	3.75	6.84	227.	7.1	16.7	0.107 5	55.	< 0.005 45	0.050 55	1.61 b
SW-S-04	FRM	Y	2023-02-06	Mean of duplicates	2.945	7.37	202.	7.5	12.05	0.101	65.5	0.010 2	0.075 8	1.715
SW-S-12	SS		2022-05-05		15.9	6.95	234.	10.4	31.7	0.259	118.	0.021 3	0.66	7.79 b
SW-S-12	SS		2022-11-08		5.88	7.24	427.	12.1	62.2	0.498	70.	0.040 2	0.298	19.5 b
SW-S-12	SS		2023-01-04	Clear, slightly grey.	4.67	6.69	350.	10.5	23.3	0.288	91.	0.015 1	0.938	6.5 a b
SW-S-12	SS		2023-02-06	High flow. Very turbid, very grey	33.8	6.98	245.	9.4	21.5	0.256	89.	0.020 2	0.794	6.08 b
SW-S-20	NS		2022-11-08	Dry	---	---	---	---	---	---	---	---	---	---
SW-S-20	SS		2023-01-04	Clear, colourless.	6.97	7.32	71.	6.2	24.6	0.114	17.	< 0.005	0.111	1.04 b
SW-S-20	SS		2023-02-06	Moderate flow. Slightly turbid, colorless.	6.36	7.98	116.	7.3	20.2	0.107	38.	< 0.005	0.342	1.38
SW-S-21	NS		2022-05-05	Dry	---	---	---	---	---	---	---	---	---	---
SW-S-21	NS		2022-11-08	Dry	---	---	---	---	---	---	---	---	---	---
SW-S-21	SS		2023-01-04	Clear, colourless.	8.13	7.64	100.	6.	29.6	0.094	16.	< 0.005	0.032 6	0.989
SW-S-21	SS		2023-02-06	Clear, colourless.	8.22	7.52	88.	6.5	19.7	0.07	17.	< 0.005	0.029 4	0.775
SW-S-24	SS		2022-05-05		24.	7.49	160.	10.	14.9	0.15	67.	0.005 9	0.112	3.31
SW-S-24	SS		2022-11-08		3.93	7.13	382.	7.9	6.59	0.167	78.	0.009 8	0.082 5	2.58
SW-S-24	SS		2023-01-04	Clear, colourless.	3.91	7.36	252.	7.8	9.33	0.15	90.	0.006	0.073 1	2.47 b
SW-S-24	SS		2023-02-06	High flow. Clear, colourless.	4.57	7.5	214.	7.8	9.12	0.125	76.	0.008 5	0.085 4	2.5
SW-S-27	SS		2022-05-05		5.7	7.59	167.	8.9	10.1	0.131	92.	0.017	0.175	0.853
SW-S-27	NS		2022-11-08	Dry	---	---	---	---	---	---	---	---	---	---
SW-S-27	NS		2023-01-05	Inaccessible	---	---	---	---	---	---	---	---	---	---
SW-S-27	NS		2023-02-06	Inaccessible	---	---	---	---	---	---	---	---	---	---
SW-S-52	NS		2022-11-08	Dry	---	---	---	---	---	---	---	---	---	---
SW-S-52	SS		2023-01-04	Clear, colourless.	0.62	6.78	56.	7.2	7.49	0.059	19.	< 0.005	0.021 1	0.395
SW-S-52	SS		2023-02-06	High flow, clear & colourless.	2.32	7.82	86.	7.6	4.21	0.04	16.	< 0.005	0.013 9	0.335

Notes:

na	Not applicable.
Null	No sample collected.
a	Above short-term acute (STA) British Columbia Water Quality Guideline.
b	Above long-term chronic (LTC) British Columbia Water Quality Guideline.
c	Detection Limits above Applicable Standards.
(1)	British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August 2023. British Columbia Ministry of Environment and a Compendium of Working Water Quality Guidelines for British Columbia, 1998 Edition, Updated in Feb 2021. British Columbia Ministry of Environment. The Guidelines cited specific to protection of freshwater aquatic life unless otherwise noted.
(2)	above STA unless otherwise noted.
(3)	The ammonia guideline is pH and temperature (15°C assumed) dependant. All ammonia results were compared to standards based on the associated pH and temperature results for that sample.
(4)	The nitrite guidelines are chloride dependant. All nitrite results were compared to standards based on the associated chloride result for that sample.
(5)	This value is hardness dependent. All metals results were compared to standards based on the associated hardness result for a particular sample.
(6)	This value is the short-term daily for streams with unknown fish distribution.
(7)	The TSS guidelines are "change from background" and flow condition dependent. The background TSS in the landfill are derived from stations Sw-S-52 .
(8)	*Dissolved copper guideline varies with water hardness, temperature and DOC, and calcuated using BLM;*
(9)	Total Aluminum guidance is pH, hardness, and DOC dependent and calculated based on BC Water Quality Guideline calculator for Aluminum in Freshwater. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill. Ecosystems.
(10)	Dissolved Zinc guidance is pH, hardness, and DOC dependent. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill.

Appendix B-3. Surface Water Quality - 2022-2023

Station	Sample Type	Compliance Well (Y/N?)	Date Sampled	PARAMETER	Hardness (As Caco3)	Iron	Lead	Manganese	Molybdenum	Nickel	Selenium	Silver	Zinc	Dissolved Organic Carbon
B.C. Water Quality Guidelines				BC WQG-STA (1)	---	350	---	---	---	---	---	---	variable (10)	---
				BC WQG-LTC (1)	---	---	---	---	---	---	---	---	variable (10)	---
				STATE	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	Dissolved
				UNIT	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
				Method Detection Limit (MDL)	0.5	1	0.005	0.05	0.05	0.02	0.04	0.005	0.1	0.5
				Limit of Quantification (LOQ)	2.5	5	0.025	0.25	0.25	0.1	0.2	0.025	0.5	2.5
				COMMENTS	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
SW-N-05	FRM	Y	2022-05-04	Mean of duplicates	428.5	32.4	< 0.006 8	159.	2.965	5.205	0.571	< 0.005	6.92	1 550.
SW-N-05	SS	Y	2022-11-07		383.	3.1	0.007 2	7.92	0.749	1.47	2.11	< 0.005	4.16	< 13.
SW-N-05	FRM	Y	2023-01-05	Mean of duplicates	619.5	37.9	0.006 85	3.72	2.825	2.41	1.69	< 0.005	6.605	954.3
SW-N-05	FRM	Y	2023-02-07	Mean of duplicates	281.	32.4	0.008 35	2.855	2.88	1.605	0.315	< 0.005	3.13	197.
SW-N-14	NS		2022-05-03	No access to the Heals Range	---	---	---	---	---	---	---	---	---	---
SW-N-14	SS		2022-11-10		181.	5.9	0.005 3	1.29	0.375	0.369	0.151	< 0.005	1.22	1 500.
SW-N-14	NS		2023-01-05	Heals Range, unable to access	---	---	---	---	---	---	---	---	---	---
SW-N-14	SS		2023-02-13	Moderate flow, clear & colourless.	176.	7.9	< 0.005	1.22	0.396	0.389	0.111	< 0.005	1.28	320.
SW-N-14	SS		2023-02-21	Moderate flow, clear and colourless.	174.	6.4	< 0.005	0.927	0.386	0.255	0.077	< 0.005	0.95	3.4
SW-N-14	SS		2023-03-20	Moderate flow, clear and colourless.	160.	4.5	< 0.005	0.266	0.366	0.231	0.064	< 0.005	0.9	3.2
SW-N-15	SS		2023-02-21	Moderate flow, clear and colourless.	78.2	< 1.	< 0.005	0.158	0.228	0.049	0.045	< 0.005	0.16	1.3
SW-N-15	SS		2023-03-20	High flow, clear and colourless.	72.4	1.4	< 0.005	0.101	0.244	0.072	< 0.04	< 0.005	0.28	1.3
SW-N-16	FRM	Y	2022-05-04	Mean of duplicates	147.	250.5	0.006 05	153.5	0.799 5	1.5	0.098 5	< 0.005	5.935	1 550.
SW-N-16	FRM	Y	2022-11-09	Mean of duplicates	210.	40.	0.010 3	36.9	1.025	1.255	0.16	< 0.005	16.75	1 295.
SW-N-16	FRM	Y	2023-01-05	Mean of duplicates	178.	49.35	0.007 4	36.55	0.818 5	1.001 5	0.104 5	< 0.005	10.95	7.05
SW-N-16	FRM	Y	2023-02-21	Mean of duplicates	198.	58.95	0.006 95	43.35	0.715	1.08	0.086	< 0.005	8.995	7.65
SW-N-16	FRM	Y	2023-02-06	Mean of duplicates	173.5	57.25	0.006 35	38.2	0.748 5	1.425	0.114	< 0.005	16.3	465.
SW-N-17	NS		2022-05-04	No access to the Heals Range	---	---	---	---	---	---	---	---	---	---
SW-N-17	SS		2022-11-10		288.	4.7	0.008 7	10.5	0.548	0.623	0.801	< 0.005	5.13	1 100.
SW-N-17	NS		2023-01-05	No access to the Heals Range	---	---	---	---	---	---	---	---	---	---
SW-N-17	SS		2023-02-13	Moderate flow, clear & colourless.	219.	4.	< 0.005	1.67	0.508	0.242	0.151	< 0.005	0.91	3.3
SW-N-17	SS		2023-02-21	Moderate flow, clear and colourless.	219.	5.8	< 0.005	3.2	0.515	0.237	0.108	< 0.005	1.18	3.
SW-N-17	SS		2023-03-20	Moderate flow, clear and colourless.	197.	6.1	0.010 8	2.65	0.479	0.219	0.097	< 0.005	1.09	2.6
SW-N-18	SS		2022-05-04		255.	667. a	0.154	632.	1.31	18.6	0.372	0.006	116. b	1 600.
SW-N-18	SS		2022-11-07		427.	4.2	0.009 7	50.3	3.	2.83	3.	< 0.005	1.02	990.
SW-N-18	SS		2023-01-05	Clear, colourless.	189.	19.3	0.009 9	15.	1.71	1.02	0.664	< 0.005	37.8 b	0.91
SW-N-18	FRM		2023-02-07	Mean of duplicates	328.5	105.75	0.057	39.2	1.7	2.125	1.01	< 0.005	24.	235.
SW-N-19	SS		2022-05-04		161.	25.4	0.006 2	18.	1.02	2.82	0.125	< 0.005	1.9	1 500.
SW-N-19	SS		2022-11-09		226.	50.6	0.009 1	16.2	1.2	1.5	0.228	< 0.005	2.19	650.
SW-N-19	SS		2023-01-05	Clear, colourless.	200.	21.8	0.009 8	4.92	1.15	1.63	0.137	< 0.005	3.4	8.2
SW-N-41S	FRM	Y	2022-05-04	Mean of duplicates	157.	31.2	< 0.005	93.6	0.288	0.102	0.066 5	< 0.005	0.385	1 550.
SW-N-41S	FRM	Y	2022-11-09	Mean of duplicates	208.	77.75	< 0.008 45	144.5	0.300 5	0.12	0.163 5	< 0.005	1.28	1 750.
SW-N-41S	FRM	Y	2023-01-05	Mean of duplicates	166.	26.9	< 0.005	33.35	0.259 5	0.085	0.129	< 0.005	0.54	1.95
SW-N-41S	FRM	Y	2023-02-06	Mean of duplicates	180.	27.25	< 0.030 5	44.55	0.314 5	0.095 5	0.091	< 0.005	1.265	130.5
SW-N-41S	SS		2022-05-04		98.	7.6	< 0.005	1.18	0.332	0.07	0.059	< 0.005	0.43	1 700.
SW-N-41S	SS		2022-11-09		147.	10.4	0.010 7	6.99	0.376	0.091	0.074	< 0.005	1.67	86.
SW-N-41S	SS		2023-01-05	Clear, colourless.	80.	11.9	0.007 3	1.35	0.316	0.068	0.085	< 0.005	0.3	1 000.
SW-N-41S	SS		2023-02-21	Moderate flow, clear and colourless.	102.	4.7	0.010 7	1.24	0.311	0.077	0.088	< 0.005	0.4	1.4
SW-N-41S	SS		2023-02-06	High flow, clear & colourless.	107.	6.1	< 0.005	1.46	0.316	0.086	0.091	< 0.005	0.33	280.
SW-N-41S	SS		2023-02-13	Moderate flow, clear & colourless.	73.2	18.6	0.005 8	19.	0.195	0.073	0.048	< 0.005	0.38	2.8
SW-N-41S	SS		2023-02-21	Moderate flow, clear and colourless.	74.7	16.6	0.005 4	18.9	0.174	0.057	< 0.04	< 0.005	0.25	3.
SW-N-42S	FRM	Y	2022-05-04	Mean of duplicates	166.5	14.8	< 0.005	19.2	0.517 5	0.110 5	< 0.042	< 0.005	0.42	2 050.
SW-N-42S	FRM	Y	2022-11-09	Mean of duplicates	250.5	8.95	0.010 8	6.91	0.641	0.161 5	0.074	< 0.005	1.495	1 005.
SW-N-42S	FRM	Y	2023-02-21	Mean of duplicates	204.	9.2	0.005 75	7.455	0.541	0.118 5	0.055 5	< 0.005	0.56	2.75
SW-N-42S	FRM	Y	2023-01-05	Mean of duplicates	187.5	8.25	0.006 3	6.77	0.490 5	0.121 5	0.072	< 0.005	0.59	245.
SW-N-45	NS		2022-05-04	No access to the Heals Range	---	---	---	---	---	---	---	---	---	---
SW-N-45	SS		2022-11-10		349.	2.5	0.012 2	6.86	0.885	0.702	1.15	< 0.005	1.82	1 700.
SW-N-45	NS		2023-01-05	Heals Range, unable to access	---	---	---	---	---	---	---	---	---	---
SW-N-45	SS		2023-02-13	Moderate flow, clear & colourless.	242.	3.4	< 0.005	5.11	0.979	0.479	0.316	< 0.005	0.89	4.2
SW-N-45	SS		2023-02-21	Moderate flow, clear and colourless.	230.	6.5	0.007 2	9.2	0.975	0.432	0.283	< 0.005	1.09	3.2
SW-N-45	SS		2023-03-20	Low flow, clear and colourless	205.	4.9	0.006 5	3.11	0.873	0.324	0.211	< 0.005	0.81	2.5
SW-N-50	NS		2022-05-04	Destroyed - Cell 4, 5, 6 construction	---	---	---	---	---	---	---	---	---	---
SW-N-51	NS		2022-05-04	Destroyed - Cell 4, 5, 6 construction	---	---	---	---	---	---	---	---	---	---
SW-N-53	NS		2022-05-04	Dry	---	---	---	---	---	---	---	---	---	---
SW-N-53	NS		2022-11-09	Dry	---	---	---	---	---	---	---	---	---	---
SW-N-53	NS		2023-01-05	Dry (ditch along high level road)	---	---	---	---	---	---	---	---	---	---
SW-N-53	SS		2023-02-07	Low flow, very turbid, very brown.	72.8	8 890. a	2.45	337.	1.42	9.12	0.119	0.015 7	41.6 b	340.
SW-N-54	SS		2022-05-04		169.	46.	< 0.005	38.6	0.445	1.31	0.186	< 0.005	0.83	1 500.
SW-N-54	SS		2022-11-10		277.	220.	0.016 5	361.	0.831	2.49	0.254	< 0.005	0.92	1 600.
SW-N-54	SS		2023-01-05	Clear, colourless.	290.	538. a	0.064 9	3 500.	1.45	9.07	0.372	0.007 7	6.45	61.
SW-N-54	SS		2023-02-07	High flow. Moderately turbid,slightly grey.	225.	501. a	0.029 5	477.	0.736	2.87	0.221	< 0.005	1.91	1 100.
SW-N-57	FRM		2023-02-07	Mean of duplicates	291.	16.7	0.005 55	29.9	1.765	1.27	1.035	< 0.005	1.19	305.
SW-N-58	NS		2023-02-07	MH by P11 - not flowing.	---	---	---	---	---	---	---	---	---	---
SW-N-58	NS		2023-02-07	MH by P11 - not flowing.	---	---	---	---	---	---	---	---	---	---
SW-N-59	NS		2023-02-07	Kitchen scraps channel - not yet set up.	---	---	---	---	---	---	---	---	---	---
SW-N-60	NS		2023-02-07	Dry	---	---	---	---	---	---	---	---	---	---
SW-N-61	NS		2023-02-07	Dry	---	---	---	---	---	---	---	---	---	---
SW-N-61	NS		2023-02-07	Dry	---	---	---	---	---	---	---	---	---	---
SW-N-62	SS		2023-02-07	Sampled flow before entering culvert. High flow, very turbid, g	280.	5.5	< 0.005	24.	1.69	1.16	1.07	< 0.005	0.54	69.
SW-N-63	SS		2023-02-13	NEW. Moderate flow, clear & colourless	87.2	91.6	0.027 5	13.1	0.298	0.337	0.07	< 0.005	0.43	3.4
SW-N-63	SS		2023-02-21	Low flow, clear and colourless.	89.2	93.2	0.027 2	18.5	0.279	0.37	0.062	< 0.005	0.45	3.2
SW-N-63	SS		2023-03-20	Moderate flow, clear and colourless.	83.7	98.4	0.029 6	25.5	0.274	0.378	0.071	< 0.005	0.73	3.
SW-N-64	SS		2023-02-13	NEW. Moderate flow, clear & colourless.	50.9	168.	0.088 6	11.1	0.239	0.568	0.046	< 0.005	1.7	6.2
SW-N-64	SS		2023-02-21	Moderate flow, clear and colourless.	59.7	267.	0.087 9	26.8	0.253	0.72	0.046	0.006 1	1.93	7.2
SW-N-64	SS		2023-03-20	Moderate flow, clear and very slightly yellow	54.7	200.	0.067 1	24.	0.238	0.623	0.042	< 0.005	1.43	6.7
SW-N-65	SS		2023-02-13	NEW. Moderately high flow, clear & colourless.	62.7	143.	0.069	11.4	0.251	0.487	0.068	< 0.005	1.35	5.3
SW-N-65	SS		2023-02-21	Moderate flow, clear and colourless.	68.2	214.	0.069 4	24.1	0.262	0.576	0.051	< 0.005	1.4	5.9
SW-N-65	SS		2023-03-20	Moderate flow, clear and very slightly yellow	65.5	167.	0.056 6	25.9	0.241	0.533	0.053	< 0.005	1.34	5.3
SW-N-CS2	SS		2022-05-04		70.5	2.6	< 0.005	0.079	0.132	0.04	0.045	< 0.005	0.4	1 500.
SW-N-CS2	NS		2022-11-09	Dry	---	---	---	---	---	---	---	---	---	---
SW-N-CS2	SS		2023-01-05	Clear, colourless.	57.	1.9	< 0.005	0.084	0.091	0.031	0.062	< 0.005	0.19	1.8
SW-N-CS2	SS		2023-02-06	Low flow, clear & colourless.	85.4	< 1.	< 0.005	< 0.05	0.073	0.025	0.084	< 0.005	0.25	310.
SW-S-03	SS		2022-05-05		72.1	301.	0.031 5	124.	0.288	1.04	0.063	< 0.005	7.37	< 50.
SW-S-03	SS		2022-11-08		180.	46.9	0.064	23.6	0.36	1.19	0.178	< 0.01	32.	1 800.
SW-S-03	SS		2023-01-04	Clear, colourless.	110.	528. a	0.013 8	199.	0.144	1.2	0.071	< 0.005	3.34	4.9
SW-S-03	SS		2023-02-06	High flow. Very turbid, very grey	79.5	147.	0.025 8	123.	0.21	0.978	0.079	< 0.005	8.92	360.
SW-S-04	FRM	Y	2022-05-05	Mean of duplicates	76.55	60.65	0.048 3	2.16	0.268	0.501	0.042 5	< 0.005	2.515	1 800.
SW-S-04	FRM	Y	2022-11-08	Mean of duplicates	120.5	9.05	0.006 3	#######	0.734	0.349 5	0.080 5	< 0.005	1.775	995.
SW-S-04	FRM	Y	2023-01-04	Mean of duplicates	89.6	15.8	< 0.007 25	#######	0.129	0.306 5	0.076 5	< 0.005	3.215	3.75
SW-S-04	FRM	Y	2023-02-06	Mean of duplicates	102.5	106.65	0.009 8	0.774	0.300 5	0.353 5	0.053 5	< 0.005	1.79	98.65
SW-S-12	SS		2022-05-05		106.	1 920. a	0.033 3	356.	0.217	1.94	0.078	< 0.005	5.67	74.
SW-S-12	SS		2022-11-08		208.	95.8	0.035 2	15.2	0.294	4.86	0.274	< 0.005	4.05	1 300.
SW-S-12	SS		2023-01-04	Clear, slightly grey.	122.	1 390. a	0.015 1	410.	0.087	1.88	0.101	< 0.005	3.97	5.9
SW-S-12	SS		2023-02-06	High flow. Very turbid, very grey	119.	1 030. a	0.021	367.	0.158	2.01	0.081	< 0.005	6.04	7.
SW-S-20	NS		2022-11-08	Dry	---	---	---	---	---	---	---	---	---	---
SW-S-20	SS		2023-01-04	Clear, colourless.	46.7	68.1	0.011 3	23.8	0.058	0.165	0.069	< 0.005	6.61	4.2
SW-S-20	SS		2023-02-06	Moderate flow. Slightly turbid, colorless.	69.	226.	0.018 4	120.	0.064	0.325	0.044	< 0.005	5.42	250.
SW-S-21	NS		2022-05-05	Dry	---	---	---	---	---	---	---	---	---	---
SW-S-21	NS		2022-11-08	Dry	---	---	---	---	---	---	---	---	---	---
SW-S-21	SS		2023-01-04	Clear, colourless.	40.	10.8	< 0.005	0.095	0.093	0.15	0.043	< 0.005	7.67 b	4.1
SW-S-21	SS		2023-02-06	Clear, colourless.	57.6	5.2	0.008 2	0.148	< 0.05	0.111	0.042	< 0.005	8.25	3.
SW-S-24	SS		2022-05-05		75.9	50.9	0.036	7.14	0.276	0.568	0.044	< 0.005	2.54	56.
SW-S-24	SS		2022-11-08		173.	4.6	0.007 7	0.537	0.132	0.378	0.089	< 0.005	3.72	170.
SW-S-24	SS		2023-01-04	Clear, colourless.	122.	18.6	0.007 7	1.54	0.166	0.443	0.092	< 0.005	3.1	3.8
SW-S-24	SS		2023-02-06	High flow. Clear, colourless.	108.	16.	0.011 1	2.04	0.174	0.517	0.065	< 0.005	2.73	230.
SW-S-27	SS		2022-05-05		97.7	55.4	0.035 7	56.2	0.185	0.422	< 0.04	< 0.005	2.44	770.
SW-S-27	NS		2022-11-08	Dry	---	---	---	---	---	---	---	---	---	---
SW-S-27	NS		2023-01-05	Inaccessible	---	---	---	---	---	---	---	---	---	---
SW-S-27	NS		2023-02-06	Inaccessible	---	---	---	---	---	---	---	---	---	---
SW-S-52	NS		2022-11-08	Dry	---	---	---	---	---	---	---	---	---	---
SW-S-52	SS		2023-01-04	Clear, colourless.	47.7	4.6	0.007 5	0.118	0.051	0.041	0.071	< 0.005	1.45	2.3
SW-S-52	SS		2023-02-06	High flow, clear & colourless.	64.1	2.2	0.06	0.068	< 0.05	0.034	< 0.04	< 0.005	2.2	320.

Notes:

na	Not applicable.
Null	No sample collected.
a	Above short-term acute (STA) British Columbia Water Quality Guideline.
b	Above long-term chronic (LTC) British Columbia Water Quality Guideline.
c	Detection Limits above Applicable Standards.
(1)	British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, Updated in August 2023. British Columbia Ministry of Environment and a Compendium of Working Water Quality Guidelines for British Columbia, 1998 Edition, Updated in Feb 2021. British Columbia Ministry of Environment. The Guidelines cited specific to protection of freshwater aquatic life unless otherwise noted.
(2)	above STA unless otherwise noted.
(3)	The ammonia guideline is pH and temperature (15°C assumed) dependant. All ammonia results were compared to standards based on the associated pH and temperature results for that sample.
(4)	The nitrite guidelines are chloride dependant. All nitrite results were compared to standards based on the associated chloride result for that sample.
(5)	This value is hardness dependent. All metals results were compared to standards based on the associated hardness result for a particular sample.
(6)	This value is the short-term daily for streams with unknown fish distribution.
(7)	The TSS guidelines are "change from background" and flow condition dependent. The background TSS in the landfill are derived from stations Sw-S-52 .
(8)	*Dissolved copper guideline varies with water hardness, temperature and DOC, and calcuated using BLM;*
(9)	Total Aluminum guidance is pH, hardness, and DOC dependent and calculated based on BC Water Quality Guideline calculator for Aluminum in Freshwater. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill. Ecosystems.
(10)	Dissolved Zinc guidance is pH, hardness, and DOC dependent. Due to anomalously high DOC concentrations resulting from the use of compromised laboratory-supplied preservatives, the aluminum guideline is based on the 2021/22 average DOC concentration of 4.5 mg/L across the landfill.

B4. Monthly Leachate Quality Data – Hartland Valve Chamber

Appendix B-4. Monthly Leachate Quality Data - Hartland Valve Chamber 2022-2023

State	Parameter	Unit	Sewer Use Criteria			Hartland Valve Chamber FR1 26-Apr-2022			Hartland Valve Chamber FR2 26-Apr-2022			Hartland Valve Chamber FRM 26-Apr-2022			Hartland Valve Chamber SS 30-May-2022			Hartland Valve Chamber SS 27-Jun-2022			Hartland Valve Chamber SS 27-Jul-2022			Hartland Valve Chamber FR1 22-Aug-2022	
			min	max																					
CONVENTIONALS																									
Total	Alkalinity - Total - Ph 4.5	mg/L	---	---		---			---			---			---			---			---			---	
Total	BOD	mg/L	---	500	<	20		<	20		<	20			25.			18.			27.			27.	
Total	CBOD	mg/L	---	---		---			---			---			---			---			---			---	
Total	Chloride	mg/L	---	1500		330			320			325			300.			350.			420.			410.	
Total	COD	mg/L	---	1000		9420	a		8610	a		9015	a		6 320.	a		462.			2 630.	a		127.	
Total	Conductivity	µS/cm	---	---		3569			3569			3569			3 560.			4 249.			4 654.			4 994.	
Total	Cyanide SAD	mg/L	---	1		0.013			0.013			0.013			0.023 6			0.011			0.014		<	0.01	
Total	Cyanide WAD	mg/L	---	1		0.01			0.012			0.011			0.016 3			---		<	0.01		<	0.01	
Total	Dissolved Oxygen	mg/L	---	---		1.37			1.37			1.37			0.3			0.25			---			---	
Total	Fecal Coliforms	CFU/100 mL	---	---		---			---			---			---			---			---			---	
Total	N - Ammonia (As N)	mg/L	---	---		250			250			250			260.			270.			300.			310.	
Total	N - Nitrite (As N)	mg/L	---	---		1.17			1.21			1.190			0.615			0.028 6			0.367			0.115	
Total	N - Nitrate (As N)	mg/L	---	---		14			15			15			11.3			0.11			0.38			0.68	
Total	N - Nitrite+Nitrite (As N)	mg/L	---	---		---			---			---			---			---			---			---	
Total	N - TKN (As N)	mg/L	---	---		---			---			---			---			---			---			---	
Total	N - Total (As N)	mg/L	---	---		---			---			---			---			---			---			---	
Total	Oil & Grease, Mineral	mg/L	---	15	<	2		<	2		<	2.		<	2.		<	2.		<	2.		<	2.	
Total	Oil & grease, total	mg/L	---	100	<	1		<	1		<	1.		<	1.		<	1.		<	1.		<	1.	
Total	ORP	mV	---	---		113.0			113.0			113			146.			- 12.			64.			- 43.	
Total	pH	pH	5.5	11		7.82			7.81			7.82			7.25			7.75			8.03			8.43	
Dissolved	Sulphide	mg/L	---	1	<	0.045		<	0.045		<	0.0450			0.053			0.009			0.009 5			0.005 7	
Total	Sulphide	mg/L	---	1	<	0.045		<	0.045		<	0.0450			0.066			0.027		<	0.009			0.067	
Dissolved	Sulphate	mg/L	---	1500		130		<	100			115			44.			25.			19.		<	1.	
	Temperature	°C	---	---		16.4			16.4			16.4			17.7			21.4			24.5			22.5	
Total	TOC	mg/L	---	---		---			---			---			---			---			---			---	
Total	Total Phenols	mg/L	---	1	<	0.03		<	0.03		<	0.03			0.018			0.006 8			0.1		<	0.015	
Total	TSS	mg/L	---	350		19			19			19			31.			17.			23.			12.	

Appendix B-4. Monthly Leachate Quality Data - Hartland Valve Chamber 2022-2023

State	Parameter	Unit	Sewer Use Criteria			Hartland Valve Chamber FR1 26-Apr-2022		Hartland Valve Chamber FR2 26-Apr-2022		Hartland Valve Chamber FRM 26-Apr-2022		Hartland Valve Chamber SS 30-May-2022		Hartland Valve Chamber SS 27-Jun-2022		Hartland Valve Chamber SS 27-Jul-2022		Hartland Valve Chamber FR1 22-Aug-2022
			min	max														
METALS																		
Total	Aluminum	µg/L	---	---		---		---		---		---		---		---		---
Total	Antimony	µg/L	---	---		---		---		---		---		---		---		---
Total	Arsenic	µg/L	---	0.4		6.8		6.74		6.77		5.58		6.61		7.72		8.48
Total	Barium	µg/L	---	---		---		---		---		---		---		---		---
Total	Beryllium	µg/L	---	---		---		---		---		---		---		---		---
Total	Bismuth	µg/L	---	---		---		---		---		---		---		---		---
Total	Boron	µg/L	---	---		---		---		---		---		---		---		---
Total	Cadmium	µg/L	---	0.3		0.04		0.052		0.0460		0.038		0.032		0.057		0.034
Total	Calcium	µg/L	---	---		---		---		---		---		---		---		---
Total	Chromium	µg/L	---	4		44		49.8		46.90		41.6		50.8		59.5		63.7
Total	Chromium III	µg/L	---	---		---		---		---		---		---		---		---
Total	Chromium Vi	µg/L	---	---		---		---		---		---		---		---		---
Total	Cobalt	µg/L	---	5		13.3		13		13.15		11.2		14.2		15.7		17.6
Total	Copper	µg/L	---	1		10.2		10.5		10.35		8.34		11.6		9.92		9.08
Total	Hardness (As Caco3)	µg/L	---	---		---		---		---		---		---		---		---
Total	Iron	µg/L	---	50		2140		2120		2130		2240		2180		3120		3040
Total	Lead	µg/L	---	1		0.667		0.664		0.6655		0.575		0.459		0.66		0.65
Total	Lithium	µg/L	---	---		---		---		---		---		---		---		---
Total	Magnesium	µg/L	---	---		---		---		---		---		---		---		---
Total	Manganese	µg/L	---	5		674		656		665		657		699		741		839
Total	Mercury	µg/L	---	0.02	<	0.019	<	0.019	<	0.02	<	0.038	<	0.038	<	0.019	<	0.019
Total	Molybdenum	µg/L	---	5		1.98		2.35		2.165		2.39		3.01		3.5		3.36
Total	Nickel	µg/L	---	3		39.8		38.4		39.1		34.3		40.2		47.1		51.6
Total	Phosphorus	µg/L	---	---		---		---		---		---		---		---		---
Total	Potassium	µg/L	---	---		---		---		---		---		---		---		---
Total	Selenium	µg/L	---	0.3		0.42		0.46		0.44		0.356		0.48		0.59		0.49
Total	Silicon	µg/L	---	---		---		---		---		---		---		---		---
Total	Silver	µg/L	---	0.5	<	0.02	<	0.02	<	0.02	<	0.02	<	0.02	<	0.05	<	0.05
Total	Sodium	µg/L	---	---		---		---		---		---		---		---		---
Total	Strontium	µg/L	---	---		---		---		---		---		---		---		---
Total	Sulphur	µg/L	---	---		---		---		---		---		---		---		---
Total	Thallium	µg/L	---	---		---		---		---		---		---		---		---
Total	Tin	µg/L	---	---		---		---		---		---		---		---		---
Total	Titanium	µg/L	---	---		---		---		---		---		---		---		---
Total	Uranium	µg/L	---	---		---		---		---		---		---		---		---
Total	Vanadium	µg/L	---	---		---		---		---		---		---		---		---
Total	Zinc	µg/L	---	3		16.8		15.5		16.15		11.8		12.3		11.3		13.1
Total	Zirconium	µg/L	---	---		---		---		---		---		---		---		---

Appendix B-4. Monthly Leachate Quality Data - Hartland Valve Chamber 2022-2023

State	Parameter	Unit	Sewer Use Criteria		Hartland Valve Chamber FR1 26-Apr-2022	Hartland Valve Chamber FR2 26-Apr-2022	Hartland Valve Chamber FRM 26-Apr-2022	Hartland Valve Chamber SS 30-May-2022	Hartland Valve Chamber SS 27-Jun-2022	Hartland Valve Chamber SS 27-Jul-2022	Hartland Valve Chamber FR1 22-Aug-2022
			min	max							
POLYCYCLIC AROMATIC HYDROCARBONS											
Total	Total PAHs	µg/L		0.05	6.60	7.30	6.95	7.90	0.76	2.10	1.20
LOW WEIGHT											
Total	2-Chloronaphthalene	µg/L	---	---	---	---	---	---	---	---	---
Total	2-Methylnaphthalene	µg/L	---	---	---	---	---	---	---	---	---
Total	Acenaphthene	µg/L	---	---	2.9	3.1	3.000	2.5	0.071	0.44	0.3
Total	Acenaphthylene	µg/L	---	---	0.055	0.056	0.056	0.068	0.011	0.025	0.016
Total	Anthracene	µg/L	---	---	0.17	0.18	0.175	0.19	< 0.01	0.17	0.035
Total	Fluorene	µg/L	---	---	1.8	2.	1.900	1.8	0.15	0.54	0.32
Total	Naphthalene	µg/L	---	---	0.059	0.076	0.068	0.24	0.04	0.06	0.12
Total	Phenanthrene	µg/L	---	---	0.3	0.32	0.310	0.43	0.011	0.059	0.038
Total	Total Lmw-Pah'S	µg/L	---	---	---	---	---	---	---	---	---
HIGH WEIGHT											
Total	Benzo(A)Anthracene	µg/L	---	---	0.042	0.047	0.044 5	0.068	0.023	0.048	0.022
Total	Benzo(A)Pyrene	µg/L	---	---	0.007 8	0.008 1	0.007 95	0.019	< 0.005	0.014	0.006 6
Total	Benzo(B)Fluoranthene + Benzo(J)Fluoranthene	µg/L	---	---	0.011	0.012	0.011 5	0.024	< 0.01	0.02	< 0.01
Total	Benzo(G,H,I)Perylene	µg/L	---	---	< 0.02	< 0.02	< 0.02	0.26	< 0.02	< 0.02	< 0.02
Total	Benzo(K)Fluoranthene	µg/L	---	---	< 0.01	< 0.01	< 0.01	0.012	< 0.01	< 0.01	< 0.01
Total	Chrysene	µg/L	---	---	0.037	0.042	0.039 5	0.054	0.029	0.063	0.021
Total	Dibenzo(A,H)Anthracene	µg/L	---	---	< 0.02	< 0.02	< 0.02	0.16	< 0.02	< 0.02	< 0.02
Total	Fluoranthene	µg/L	---	---	0.56	0.62	0.59	0.7	0.2	0.34	0.17
Total	Indeno(1,2,3-C,D)Pyrene	µg/L	---	---	< 0.02	< 0.02	< 0.02	0.18	< 0.02	< 0.02	< 0.02
Total	Pyrene	µg/L	---	---	0.31	0.39	0.35	0.45	0.23	0.33	0.14
Total	Total Hmw-Pah'S	µg/L	---	---	---	---	---	---	---	---	---
VOLATILE ORGANICS											
Dissolved	Benzene	µg/L	---	100	0.6	0.51	0.56	0.63	< 0.4	< 0.4	< 0.4
Dissolved	Ethylbenzene	µg/L	---	200	< 0.4	< 0.4	< 0.40	0.55	< 0.4	< 0.4	< 0.4
Total	M & P Xylenes	µg/L	---	---	---	---	---	---	---	---	---
Total	Methyl Tertiary Butyl Ether	µg/L	---	---	---	---	---	---	---	---	---
Total	O-Xylene	µg/L	---	---	---	---	---	---	---	---	---
Total	Styrene	µg/L	---	---	---	---	---	---	---	---	---
Dissolved	Toluene	µg/L	---	200	1.5	1.1	1.30	1.2	< 0.4	< 0.4	< 0.4
Dissolved	Xylenes	µg/L	---	200	1.2	1	1.10	1.7	< 0.4	< 0.4	0.78

Notes:

a *- Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922.*

b *- Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.*

***** *- Exceedances are due to compromised/expired preservatives, and results are not representative*

--- = Not available.

FR1 - Field replicate 1.

FR2 - Field replicate 2.

FR3 - Field replicate 3.

FRM - Mean of field replicates.

SS - Single Sample

NS- Not sampled

Appendix B-4. Monthly Leachate Quality Data - Hartland Valve Chamber 2022-2023

State	Parameter	Unit	Sewer Use Criteria		Hartland Valve Chamber FR2 22-Aug-2022	Hartland Valve Chamber FRM 22-Aug-2022	Hartland Valve Chamber SS 27/Sep/2022	Hartland Valve Chamber SS 19/Oct/2022	Hartland Valve Chamber FR1 30/Nov/2022	Hartland Valve Chamber FR2 30/Nov/2022
			min	max						
CONVENTIONALS										
Total	Alkalinity - Total - Ph 4.5	mg/L	---	---	---	---	---	---	---	---
Total	BOD	mg/L	---	500	29.	28.	28	33.	16.	19.
Total	CBOD	mg/L	---	---	---	---	---	---	---	---
Total	Chloride	mg/L	---	1500	410.	410.	380	490.	270.	270.
Total	COD	mg/L	---	1000	759.	443.	3690 a	4 740. a	364.	339.
Total	Conductivity	µS/cm	---	---	4 994.	4 994.	4157	5 846.	2 614.	2 614.
Total	Cyanide SAD	mg/L	---	1	< 0.01	< 0.01	0.00845	0.014 3	0.014 4	0.015 4
Total	Cyanide WAD	mg/L	---	1	< 0.01	< 0.01	0.00535	0.006 88	0.005 2	0.005 4
Total	Dissolved Oxygen	mg/L	---	---	---	---	---	54.	1.09	1.09
Total	Fecal Coliforms	CFU/100 mL	---	---	---	---	---	---	---	---
Total	N - Ammonia (As N)	mg/L	---	---	310.	310.	270	400.	210.	200.
Total	N - Nitrite (As N)	mg/L	---	---	0.145	0.13	0.614	0.921	3.22	3.23
Total	N - Nitrate (As N)	mg/L	---	---	1.15	0.9	6.71	1.25	24.9	24.5
Total	N - Nitrite+Nitrite (As N)	mg/L	---	---	---	---	---	---	---	---
Total	N - TKN (As N)	mg/L	---	---	---	---	---	---	---	---
Total	N - Total (As N)	mg/L	---	---	---	---	---	---	---	---
Total	Oil & Grease, Mineral	mg/L	---	15	< 2.	< 2.	< 2	< 2.	< 2.	< 2.
Total	Oil & grease, total	mg/L	---	100	1.	1.	< 1	< 1.	1.2	< 1.
Total	ORP	mV	---	---	- 43.	- 43.	63.0	140.	- 14.	- 14.
Total	pH	pH	5.5	11	8.43	8.43	7.37	7.83	7.45	7.45
Dissolved	Sulphide	mg/L	---	1	0.01	0.007 85	< 0.009	0.069	0.014	0.024
Total	Sulphide	mg/L	---	1	0.038	0.052 5	0.024	0.19	< 0.036	< 0.036
Dissolved	Sulphate	mg/L	---	1500	< 1.	< 1.	25	55.	220.	220.
	Temperature	°C	---	---	22.5	22.5	17.9	20.3	9.1	9.1
Total	TOC	mg/L	---	---	---	---	---	---	---	---
Total	Total Phenols	mg/L	---	1	< 0.015	< 0.015	0.0083	0.013	< 0.007 5	< 0.007 5
Total	TSS	mg/L	---	350	22.	17.	37	21.	73.	36.

Appendix B-4. Monthly Leachate Quality Data - Hartland Valve Chamber 2022-2023

State	Parameter	Unit	Sewer Use Criteria		Hartland Valve Chamber FR2	Hartland Valve Chamber FRM	Hartland Valve Chamber SS	Hartland Valve Chamber SS	Hartland Valve Chamber FR1	Hartland Valve Chamber FR2
			min	max	22-Aug-2022	22-Aug-2022	27/Sep/2022	19/Oct/2022	30/Nov/2022	30/Nov/2022
METALS										
Total	Aluminum	µg/L	---	---	---	---	---	---	---	---
Total	Antimony	µg/L	---	---	---	---	---	---	---	---
Total	Arsenic	µg/L	---	0.4	8.18	8.33	6.38	8.16	5.51	5.48
Total	Barium	µg/L	---	---	---	---	---	---	---	---
Total	Beryllium	µg/L	---	---	---	---	---	---	---	---
Total	Bismuth	µg/L	---	---	---	---	---	---	---	---
Total	Boron	µg/L	---	---	---	---	---	---	---	---
Total	Cadmium	µg/L	---	0.3	0.048	0.041	0.15	0.089	0.0848	0.0761
Total	Calcium	µg/L	---	---	---	---	---	---	---	---
Total	Chromium	µg/L	---	4	61.6	62.65	36.80	72.5	35.4	33.8
Total	Chromium III	µg/L	---	---	---	---	---	---	---	---
Total	Chromium Vi	µg/L	---	---	---	---	---	---	---	---
Total	Cobalt	µg/L	---	5	16.8	17.2	15.00	24.1	13.4	13
Total	Copper	µg/L	---	1	9.18	9.13	15.10	13.8	23.6	22.3
Total	Hardness (As Caco3)	µg/L	---	---	---	---	---	---	---	---
Total	Iron	µg/L	---	50	3070	3055	4,600.00	3650	3670	3070
Total	Lead	µg/L	---	1	0.92	0.785	1.00	0.92	1.41	1.27
Total	Lithium	µg/L	---	---	---	---	---	---	---	---
Total	Magnesium	µg/L	---	---	---	---	---	---	---	---
Total	Manganese	µg/L	---	5	818	828.5	965.00	856	650	640
Total	Mercury	µg/L	---	0.02	< 0.019	< 0.019	< 0.04	< 0.019	< 0.019	< 0.019
Total	Molybdenum	µg/L	---	5	3.43	3.395	2.87	4.72	5.23	5.29
Total	Nickel	µg/L	---	3	50.2	50.9	37.40	76.3	38.1	36.8
Total	Phosphorus	µg/L	---	---	---	---	---	---	---	---
Total	Potassium	µg/L	---	---	---	---	---	---	---	---
Total	Selenium	µg/L	---	0.3	0.5	0.495	0	0.58	0.578	0.575
Total	Silicon	µg/L	---	---	---	---	---	---	---	---
Total	Silver	µg/L	---	0.5	< 0.05	< 0.05	< 0.02	< 0.05	0.018	0.018
Total	Sodium	µg/L	---	---	---	---	---	---	---	---
Total	Strontium	µg/L	---	---	---	---	---	---	---	---
Total	Sulphur	µg/L	---	---	---	---	---	---	---	---
Total	Thallium	µg/L	---	---	---	---	---	---	---	---
Total	Tin	µg/L	---	---	---	---	---	---	---	---
Total	Titanium	µg/L	---	---	---	---	---	---	---	---
Total	Uranium	µg/L	---	---	---	---	---	---	---	---
Total	Vanadium	µg/L	---	---	---	---	---	---	---	---
Total	Zinc	µg/L	---	3	17.2	15.15	78.60	20.7	32.9	26.4
Total	Zirconium	µg/L	---	---	---	---	---	---	---	---

Appendix B-4. Monthly Leachate Quality Data - Hartland Valve Chamber 2022-2023

State	Parameter	Unit	Sewer Use Criteria		Hartland Valve Chamber FR2	Hartland Valve Chamber FRM	Hartland Valve Chamber SS	Hartland Valve Chamber SS	Hartland Valve Chamber FR1	Hartland Valve Chamber FR2
			min	max	22-Aug-2022	22-Aug-2022	27/Sep/2022	19/Oct/2022	30/Nov/2022	30/Nov/2022
POLYCYCLIC AROMATIC HYDROCARBONS										
Total	Total PAHs	µg/L		0.05	1.20	1.20	3.50	34.00	2.80	2.30
LOW WEIGHT										
Total	2-Chloronaphthalene	µg/L	---	---	---	---	---	---	---	---
Total	2-Methylnaphthalene	µg/L	---	---	---	---	---	---	---	---
Total	Acenaphthene	µg/L	---	---	0.33	0.315	1.40	6.1	0.89	0.63
Total	Acenaphthylene	µg/L	---	---	0.015	0.0155	< 0.05	0.068	0.015	0.02
Total	Anthracene	µg/L	---	---	0.032	0.0335	0.09	0.55	0.072	0.075
Total	Fluorene	µg/L	---	---	0.32	0.32	1.10	3.9	0.61	0.48
Total	Naphthalene	µg/L	---	---	0.12	0.12	< 0.05	15	0.25	0.086
Total	Phenanthrene	µg/L	---	---	0.041	0.0395	0.21	1.7	0.12	0.072
Total	Total Lmw-Pah'S	µg/L	---	---	---	---	---	---	---	---
HIGH WEIGHT										
Total	Benzo(A)Anthracene	µg/L	---	---	0.026	0.024	< 0.05	0.084	0.022	0.043
Total	Benzo(A)Pyrene	µg/L	---	---	< 0.005	0.0058	< 0.03	0.019	< 0.005	0.0062
Total	Benzo(B)Fluoranthene + Benzo(J)Fluoranthene	µg/L	---	---	< 0.01	< 0.01	< 0.05	0.022	< 0.01	< 0.01
Total	Benzo(G,H,I)Perylene	µg/L	---	---	< 0.02	< 0.02	< 0.10	< 0.02	< 0.02	< 0.02
Total	Benzo(K)Fluoranthene	µg/L	---	---	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
Total	Chrysene	µg/L	---	---	< 0.01	0.0155	< 0.05	0.064	0.024	0.046
Total	Dibenzo(A,H)Anthracene	µg/L	---	---	< 0.02	< 0.02	< 0.10	< 0.02	< 0.02	< 0.02
Total	Fluoranthene	µg/L	---	---	0.13	0.15	0.29	0.8	0.36	0.45
Total	Indeno(1,2,3-C,D)Pyrene	µg/L	---	---	< 0.02	< 0.02	< 0.10	< 0.02	< 0.02	< 0.02
Total	Pyrene	µg/L	---	---	0.11	0.125	0.20	0.53	0.25	0.33
Total	Total Hmw-Pah'S	µg/L	---	---	---	---	---	---	---	---
VOLATILE ORGANICS										
Dissolved	Benzene	µg/L	---	100	< 0.4	< 0.4	< 0.40	0.64	< 0.4	< 0.4
Dissolved	Ethylbenzene	µg/L	---	200	< 0.4	< 0.4	< 0.40	0.88	< 0.4	< 0.4
Total	M & P Xylenes	µg/L	---	---	---	---	---	---	---	---
Total	Methyl Tertiary Butyl Ether	µg/L	---	---	---	---	---	---	---	---
Total	O-Xylene	µg/L	---	---	---	---	---	---	---	---
Total	Styrene	µg/L	---	---	---	---	---	---	---	---
Dissolved	Toluene	µg/L	---	200	< 0.4	< 0.4	0.53	0.58	0.61	0.52
Dissolved	Xylenes	µg/L	---	200	0.71	0.745	0.54	2.7	< 0.4	< 0.4

Notes:

a - Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922.

b - Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.

** - Exceedances are due to compromised/expired preservatives, and results are not representati*

--- = Not available.

FR1 - Field replicate 1.

FR2 - Field replicate 2.

FR3 - Field replicate 3.

FRM - Mean of field replicates.

SS - Single Sample

NS- Not sampled

Appendix B-4. Monthly Leachate Quality Data - Hartland Valve Chamber 2022-2023

State	Parameter	Unit	Sewer Use Criteria			Hartland Valve Chamber FRM 30/Nov/2022		Hartland Valve Chamber SS 28/Dec/2022		Hartland Valve Chamber SS 17/Jan/2023		Hartland Valve Chamber FR1 14/Feb/2023		Hartland Valve Chamber FR2 14/Feb/2023		Hartland Valve Chamber FRM 14/Feb/2023		Hartland Valve Chamber SS 23/Mar/2023
			min	max														
CONVENTIONALS																		
Total	Alkalinity - Total - Ph 4.5	mg/L	---	---		---		---		---		---		---		---		---
Total	BOD	mg/L	---	500		17.5		18.		24.		17.		18.		17.5		15.
Total	CBOD	mg/L	---	---		---		---		---		---		---		---		---
Total	Chloride	mg/L	---	1500		270.		200.		270.		250.		250.		250.		260.
Total	COD	mg/L	---	1000		351.5		315.		415.		331.		346.		338.5		398.
Total	Conductivity	µS/cm	---	---		2 614.		2 303.		3 113.		2 783.		2 783.		2 783.		2 942.
Total	Cyanide SAD	mg/L	---	1		0.014 9		0.014		0.022 2		0.013 3		0.008 4		0.010 85		0.011 2
Total	Cyanide WAD	mg/L	---	1		0.005 3	<	0.002 5		0.007 7		0.007 1	<	0.005		0.006 05		0.002 8
Total	Dissolved Oxygen	mg/L	---	---		1.09		0.16		2.7		0.81		0.81		0.81		1.02
Total	Fecal Coliforms	CFU/100 mL	---	---		---		---		---		---		---		---		---
Total	N - Ammonia (As N)	mg/L	---	---		205.		160.		270.		210.		210.		210.		240.
Total	N - Nitrite (As N)	mg/L	---	---		3.225		1.47		1.68		1.84		1.84		1.84		1.34
Total	N - Nitrate (As N)	mg/L	---	---		24.7		15.9		9.96		13.7		13.7		13.7		17.1
Total	N - Nitrite+Nitrite (As N)	mg/L	---	---		---		---		---		---		---		---		---
Total	N - TKN (As N)	mg/L	---	---		---		---		---		---		---		---		---
Total	N - Total (As N)	mg/L	---	---		---		---		---		---		---		---		---
Total	Oil & Grease, Mineral	mg/L	---	15	<	2.	<	2.	<	2.	<	2.	<	2.	<	2.	<	2.
Total	Oil & grease, total	mg/L	---	100		1.1	<	1.		1.3		3.8	<	1.		2.4		1.4
Total	ORP	mV	---	---		- 14.		- 298.		- 150.8		80.8		80.8		80.8		132.4
Total	pH	pH	5.5	11		7.45		7.36		8.1		7.82		7.82		7.82		8.
Dissolved	Sulphide	mg/L	---	1		0.019		---		0.023		0.042		0.034		0.038		0.031
Total	Sulphide	mg/L	---	1	<	0.036	<	0.003 6		0.032		0.045		0.03		0.037 5		0.029
Dissolved	Sulphate	mg/L	---	1500		220.		120.		110.		100.		110.		105.		100.
	Temperature	°C	---	---		9.1		12.6		14.3		13.4		13.4		13.4		13.3
Total	TOC	mg/L	---	---		---		---		---		---		---		---		---
Total	Total Phenols	mg/L	---	1	<	0.007 5	<	0.007 5		0.006 6	<	0.001 5	<	0.001 5		0.001 5	<	0.038
Total	TSS	mg/L	---	350		54.5		12.		15.		13.		10.		11.5		20.

Appendix B-4. Monthly Leachate Quality Data - Hartland Valve Chamber 2022-2023

State	Parameter	Unit	Sewer Use Criteria			Hartland Valve Chamber FRM 30/Nov/2022		Hartland Valve Chamber SS 28/Dec/2022		Hartland Valve Chamber SS 17/Jan/2023		Hartland Valve Chamber FR1 14/Feb/2023		Hartland Valve Chamber FR2 14/Feb/2023		Hartland Valve Chamber FRM 14/Feb/2023		Hartland Valve Chamber SS 23/Mar/2023
			min	max														
METALS																		
Total	Aluminum	µg/L	---	---		---		---		---		---		---		---		---
Total	Antimony	µg/L	---	---		---		---		---		---		---		---		---
Total	Arsenic	µg/L	---	0.4		5.495		5.65		7.04		7.6		4.99		6.295		5.37
Total	Barium	µg/L	---	---		---		---		---		---		---		---		---
Total	Beryllium	µg/L	---	---		---		---		---		---		---		---		---
Total	Bismuth	µg/L	---	---		---		---		---		---		---		---		---
Total	Boron	µg/L	---	---		---		---		---		---		---		---		---
Total	Cadmium	µg/L	---	0.3		0.08045		0.0781		0.0781		0.079		0.05		0.0645		0.073
Total	Calcium	µg/L	---	---		---		---		---		---		---		---		---
Total	Chromium	µg/L	---	4		34.6		32.2		43		55.3		37		46.15		51.9
Total	Chromium III	µg/L	---	---		---		---		---		---		---		---		---
Total	Chromium Vi	µg/L	---	---		---		---		---		---		---		---		---
Total	Cobalt	µg/L	---	5		13.2		10.6		12.9		15.5		10.5		13		12
Total	Copper	µg/L	---	1		22.95		29.4		19.3		21.4		14		17.7		24
Total	Hardness (As Caco3)	µg/L	---	---		---		---		---		---		---		---		---
Total	Iron	µg/L	---	50		3370		1580		2220		2610		1690		2150		1650
Total	Lead	µg/L	---	1		1.34		0.703		0.751		0.765		1.03		0.8975		0.529
Total	Lithium	µg/L	---	---		---		---		---		---		---		---		---
Total	Magnesium	µg/L	---	---		---		---		---		---		---		---		---
Total	Manganese	µg/L	---	5		645		480		640		855		569		712		591
Total	Mercury	µg/L	---	0.02	<	0.019		0.005	<	0.038	<	0.038	<	0.038	<	0.038	<	0.038
Total	Molybdenum	µg/L	---	5		5.26		4.54		2.95		3.86		2.52		3.19		16.1
Total	Nickel	µg/L	---	3		37.45		29.2		37.5		45.7		30.3		38		89.7
Total	Phosphorus	µg/L	---	---		---		---		---		---		---		---		---
Total	Potassium	µg/L	---	---		---		---		---		---		---		---		---
Total	Selenium	µg/L	---	0.3		0.5765		0.616		0.558		0.74		0.495		0.6175		0.569
Total	Silicon	µg/L	---	---		---		---		---		---		---		---		---
Total	Silver	µg/L	---	0.5		0.018		0.024		0.015	<	0.02	<	0.02	<	0.02	<	0.02
Total	Sodium	µg/L	---	---		---		---		---		---		---		---		---
Total	Strontium	µg/L	---	---		---		---		---		---		---		---		---
Total	Sulphur	µg/L	---	---		---		---		---		---		---		---		---
Total	Thallium	µg/L	---	---		---		---		---		---		---		---		---
Total	Tin	µg/L	---	---		---		---		---		---		---		---		---
Total	Titanium	µg/L	---	---		---		---		---		---		---		---		---
Total	Uranium	µg/L	---	---		---		---		---		---		---		---		---
Total	Vanadium	µg/L	---	---		---		---		---		---		---		---		---
Total	Zinc	µg/L	---	3		29.65		21.7		15.5		19.6		11.8		15.7		15.7
Total	Zirconium	µg/L	---	---		---		---		---		---		---		---		---

Appendix B-4. Monthly Leachate Quality Data - Hartland Valve Chamber 2022-2023

State	Parameter	Unit	Sewer Use Criteria		Hartland Valve Chamber FRM 30/Nov/2022	Hartland Valve Chamber SS 28/Dec/2022	Hartland Valve Chamber SS 17/Jan/2023	Hartland Valve Chamber FR1 14/Feb/2023	Hartland Valve Chamber FR2 14/Feb/2023	Hartland Valve Chamber FRM 14/Feb/2023	Hartland Valve Chamber SS 23/Mar/2023
			min	max							
POLYCYCLIC AROMATIC HYDROCARBONS											
Total	Total PAHs	μg/L		0.05	2.55	1.80	5.80	8.30	8.00	8.15	5.40
LOW WEIGHT											
Total	2-Chloronaphthalene	μg/L	---	---	---	---	---	---	---	---	---
Total	2-Methylnaphthalene	μg/L	---	---	---	---	---	---	---	---	---
Total	Acenaphthene	μg/L	---	---	0.76	0.27	1.9	3.3	3.2	3.25	2.3
Total	Acenaphthylene	μg/L	---	---	0.0175	0.04	0.062	0.086	0.08	0.083	< 0.01
Total	Anthracene	μg/L	---	---	0.0735	0.019	0.28	0.16	0.17	0.165	0.09
Total	Fluorene	μg/L	---	---	0.545	0.2	1.1	2	2	2	1
Total	Naphthalene	μg/L	---	---	0.168	0.13	0.033	0.46	0.32	0.39	0.1
Total	Phenanthrene	μg/L	---	---	0.096	0.023	0.083	0.35	0.38	0.365	0.23
Total	Total Lmw-Pah'S	μg/L	---	---	---	---	---	---	---	---	---
HIGH WEIGHT											
Total	Benzo(A)Anthracene	μg/L	---	---	0.0325	0.055	0.12	0.057	0.055	0.056	0.019
Total	Benzo(A)Pyrene	μg/L	---	---	0.0056	0.01	0.036	0.012	0.013	0.0125	< 0.005
Total	Benzo(B)Fluoranthene + Benzo(J)Fluoranthene	μg/L	---	---	< 0.01	0.013	0.052	0.013	0.012	0.0125	< 0.01
Total	Benzo(G,H,I)Perylene	μg/L	---	---	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Total	Benzo(K)Fluoranthene	μg/L	---	---	< 0.01	< 0.01	0.018	< 0.01	< 0.01	< 0.01	< 0.01
Total	Chrysene	μg/L	---	---	0.035	0.053	0.11	0.055	0.052	0.0535	0.019
Total	Dibenzo(A,H)Anthracene	μg/L	---	---	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Total	Fluoranthene	μg/L	---	---	0.405	0.52	1.1	0.66	0.62	0.64	0.19
Total	Indeno(1,2,3-C,D)Pyrene	μg/L	---	---	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Total	Pyrene	μg/L	---	---	0.29	0.39	0.79	0.45	0.42	0.435	0.11
Total	Total Hmw-Pah'S	μg/L	---	---	---	---	---	---	---	---	---
VOLATILE ORGANICS											
Dissolved	Benzene	μg/L	---	100	< 0.4	< 0.4	< 0.4	< 0.4	0.44	0.42	< 0.4
Dissolved	Ethylbenzene	μg/L	---	200	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total	M & P Xylenes	μg/L	---	---	---	---	---	---	---	---	---
Total	Methyl Tertiary Butyl Ether	μg/L	---	---	---	---	---	---	---	---	---
Total	O-Xylene	μg/L	---	---	---	---	---	---	---	---	---
Total	Styrene	μg/L	---	---	---	---	---	---	---	---	---
Dissolved	Toluene	μg/L	---	200	0.565	1.3	< 0.4	< 0.4	1	0.7	< 0.4
Dissolved	Xylenes	μg/L	---	200	< 0.4	0.47	< 0.4	0.41	0.55	0.48	< 0.4

Notes:

a - Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922.

b - Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.

** - Exceedances are due to compromised/expired preservatives, and results are not representati*

--- = Not available.

FR1 - Field replicate 1.

FR2 - Field replicate 2.

FR3 - Field replicate 3.

FRM - Mean of field replicates.

SS - Single Sample

NS- Not sampled

B5. Quarterly Leachate Quality – Trace Organics

Appendix B-5. Quarterly Leachate Quality - Trace Organics - 2022-2023

Sate	Parameters	Unit	Sewer Use Criteria			Hartland Valve Chamber FR1		Hartland Valve Chamber FR2		Hartland Valve Chamber FRM		Hartland Valve Chamber SS		Hartland Valve Chamber SS		Hartland Valve Chamber SS
			min	max		26-Apr-2022		26-Apr-2022		26-Apr-2022		27-Jul-2022		19-Oct-2022		17-Jan-2023
PHTHALATE ESTERS																
TOT	Bis(2-Ethylhexyl)Phthalate	µg/L	---	---		---		---		---		---		---		---
NA	N-Butylbenzyl Phthalate	µg/L	---	---		---		---		---		---		---		---
PHENOLS - HALOGENATED																
TOT	2,4 + 2,5 Dichlorophenol	µg/L	---	---	<	0.1	<	0.1	<	0.1	<	0.1	<	0.1	<	0.1
TOT	2,4,6-trichlorophenol	µg/L	---	---	<	0.1	<	0.1	<	0.1	<	0.1		0.2	<	0.1
TOT	2-Chlorophenol	µg/L	---	---		0.17		0.2		0.185	<	0.1	<	0.1	<	0.1
NA	Pentachlorophenol	µg/L	---	---	<	0.1	<	0.1	<	0.1	<	0.1	<	0.1	<	0.1
PHENOLS - NON-HALOGENATED																
TOT	2-Methyl-4,6-Dinitrophenol	µg/L	---	---		---		---		---		---		---		---
TOT	Phenol	µg/L	---	---		---		---		---		---		---		---
TOTAL CHLORINATED PHENOLIC COMPOUNDS																
TOT	Chlorinated phenols (total)	µg/L	---	---	<	0.41		0.41		0.41	<	0.41	<	0.41	<	0.1
TOT	Total Dichlorophenols	µg/L	---	---	<	0.22	<	0.22	<	0.22	<	0.22	<	0.22	<	0.1
TOT	Total Monochlorophenols	µg/L	---	---	<	0.09	<	0.09	<	0.09	<	0.09	<	0.09	<	0.08
TOT	Total Nonchlorinated phenols	µg/L	---	---		7.3		11		9.15	<	1.6		4.5	<	10
TOT	Total Tetrachlorophenols	µg/L	---	---	<	0.24	<	0.24	<	0.24	<	0.24	<	0.24	<	0.1
TOT	Total Trichlorophenols	µg/L	---	---	<	0.05	<	0.05	<	0.05	<	0.05	<	0.05	<	0.08
TOT	Total Phenolic Compounds	µg/L	---	---		0.21		0.21		0.21	<	0.17		0.18	<	0.1
ETHERS - HALOGENATED																
TOT	4-Bromophenyl Phenyl Ether	µg/L	---	---		---		---		---		---		---		---
TOT	Bis(2-Chloroethoxy)Methane	µg/L	---	---		---		---		---		---		---		---
TOT	Bis(2-Chloroethyl)Ether	µg/L	---	---		---		---		---		---		---		---
TOT	Bis(2-Chloroisopropyl)Ether	µg/L	---	---		---		---		---		---		---		---
TOT	N-Nitrosodimethylamine	µg/L	---	---		---		---		---		---		---		---
TOT	N-Nitrosodi-N-Propylamine	µg/L	---	---		---		---		---		---		---		---
TOT	N-Nitrosodiphenylamine	µg/L	---	---		---		---		---		---		---		---
TOT	1,2-diphenylhydrazine	µg/L	---	---		---		---		---		---		---		---
TOT	3,3-dichlorobenzidine	µg/L	---	---		---		---		---		---		---		---
TOT	Alpha-Terpineol	µg/L	---	---		---		---		---		---		---		---
TOT	Hexachlorobutadiene	µg/L	---	---		---		---		---		---		---		---
TOT	Hexachlorocyclopentadiene	µg/L	---	---		---		---		---		---		---		---
TOT	Isophorone	µg/L	---	---		---		---		---		---		---		---
ALKANES - HALOGENATED																
TOT	Hexachloroethane	µg/L	---	---		---		---		---		---		---		---
OTHER ORGANICS																
TOT	1,1,1,2-Tetrachloroethane	µg/L	---	---		---		---		---		---		---		---
TOT	1,1,1-trichloroethane	µg/L	---	---		---		---		---		---		---		---
TOT	1,1,2,2-tetrachloroethane	µg/L	---	---		---		---		---		---		---		---
TOT	1,1,2Trichloro-1,2,2Trifluoroethane	µg/L	---	---		---		---		---		---		---		---
TOT	1,1,2-trichloroethane	µg/L	---	---		---		---		---		---		---		---
TOT	1,1-dichloroethane	µg/L	---	---		---		---		---		---		---		---
TOT	1,1-dichloroethene	µg/L	---	---		---		---		---		---		---		---
TOT	1,2,3-Trichlorobenzene	µg/L	---	---		---		---		---		---		---		---
TOT	1,2,4-trichlorobenzene	µg/L	---	---		---		---		---		---		---		---
TOT	1,2-dichlorobenzene	µg/L	---	---		---		---		---		---		---		---
TOT	1,2-dichloroethane	µg/L	---	---		---		---		---		---		---		---
TOT	1,2-dichloropropane	µg/L	---	---		---		---		---		---		---		---
TOT	1,3,5-trimethylbenzene	µg/L	---	---		---		---		---		---		---		---
TOT	1,3-Butadiene	µg/L	---	---		---		---		---		---		---		---
TOT	1,3-dichlorobenzene	µg/L	---	---		---		---		---		---		---		---
TOT	1,3-dichloropropane	µg/L	---	---		---		---		---		---		---		---
TOT	1,4-dichlorobenzene	µg/L	---	---		---		---		---		---		---		---
TOT	1-Methylnaphthalene	µg/L	---	---		---		---		---		---		---		---
TOT	2,3,4,5-tetrachlorophenol	µg/L	---	---	<	0.1	<	0.1	<	0.1	<	0.1	<	0.1	<	0.1
TOT	2,3,4,6-tetrachlorophenol	µg/L	---	---		0.21		0.21		0.21		0.11		0.18	<	0.1
TOT	2,3,5,6-tetrachlorophenol	µg/L	---	---		---		---		---		---		---		---
TOT	2,4-dimethylphenol	µg/L	---	---		---		---		---		---		---		---
TOT	2,4-dinitrophenol	µg/L	---	---		---		---		---		---		---		---
TOT	2,4-dinitrotoluene	µg/L	---	---		---		---		---		---		---		---
TOT	2,6-dinitrotoluene	µg/L	---	---		---		---		---		---		---		---
TOT	2-Nitrophenol	µg/L	---	---		---		---		---		---		---		---
NA	4,6-dinitro-2-methylphenol	µg/L	---	---		---		---		---		---		---		---
TOT	4-Chloro-3-Methylphenol	µg/L	---	---		---		---		---		---		---		---
TOT	4-Chlorophenyl Phenyl Ether	µg/L	---	---		---		---		---		---		---		---
TOT	4-Methyl-2-Pentanone	µg/L	---	---		---		---		---		---		---		---
TOT	4-Nitrophenol	µg/L	---	---		---		---		---		---		---		---
TOT	Acridine	µg/L	---	---		---		---		---		---		---		---
TOT	Acrolein	µg/L	---	---		---		---		---		---		---		---
TOT	Acrylonitrile	µg/L	---	---		---		---		---		---		---		---
TOT	Benzidine	µg/L	---	---		---		---		---		---		---		---
TOT	Bromobenzene	µg/L	---	---		---		---		---		---		---		---
TOT	Bromodichloromethane	µg/L	---	---		---		---		---		---		---		---
TOT	Bromomethane	µg/L	---	---		---		---		---		---		---		---
TOT	Butylbenzyl Phthalate	µg/L	---	---		---		---		---		---		---		---
NA	Carbon Tetrachloride	µg/L	---	---		---		---		---		---		---		---
TOT	Chlorobenzene	µg/L	---	---		---		---		---		---		---		---
TOT	Chlorodibromomethane	µg/L	---	---		---		---		---		---		---		---
TOT	Chloroethane	µg/L	---	---		---		---		---		---		---		---
TOT	Chloroethene	µg/L	---	---		---		---		---		---		---		---
NA	Chloroform	µg/L	---	---		---		---		---		---		---		---
TOT	Chloromethane	µg/L	---	---		---		---		---		---		---		---
TOT	Cis-1,2-Dichloroethene	µg/L	---	---		---		---		---		---		---		---
TOT	cis-1,3-dichloropropene	µg/L	---	---		---		---		---		---		---		---
TOT	Csr Vph C6-C10 (Vh Minus Btex)	µg/L	---	---		---		---		---		---		---		---
TOT	Dibromoethane	µg/L	---	---		---		---		---		---		---		---
NA	Dibromomethane	µg/L	---	---		---		---		---		---		---		---
TOT	Dichlorodifluoromethane	µg/L	---	---		---		---		---		---		---		---
TOT	Dichloromethane	µg/L	---	---		---		---		---		---		---		---
TOT	Diethyl Phthalate	µg/L	---	---		---		---		---		---		---		---
TOT	Dimethyl Ketone	µg/L	---	---		---		---		---		---		---		---
TOT	Dimethyl Phthalate	µg/L	---	---		---		---		---		---		---		---
TOT	Di-N-Butyl Phthalate	µg/L	---	---		---		---		---		---		---		---
TOT	Di-N-Octyl Phthalate	µg/L	---	---		---		---		---		---		---		---
TOT	Isopropylbenzene	µg/L	---	---		---		---		---		---		---		---
TOT	Methyl Ethyl Ketone	µg/L	---	---		---		---		---		---		---		---
TOT	Nitrobenzene	µg/L	---	---		---		---		---		---		---		---
TOT	PCP	µg/L	---	---		---		---		---		---		---		---
TOT	Quinoline	µg/L	---	---		---		---		---		---		---		---
TOT	Sulfolane	µg/L	---	---		---		---		---		---		---		---
TOT	Tetrabromomethane	µg/L	---	---		---		---		---		---		---		---
TOT	Tetrachloroethene	µg/L	---	---		---		---		---		---		---		---
TOT	Tetrachloromethane	µg/L	---	---		---		---		---		---		---		---
TOT	Trans-1,2-Dichloroethene	µg/L	---	---		---		---		---		---		---		---
TOT	trans-1,3-dichloropropene	µg/L	---	---		---		---		---		---		---		---
TOT	Tribromomethane	µg/L	---	---		---		---		---		---		---		---
TOT	Trichloroethene	µg/L	---	---		---		---		---		---		---		---
TOT	Trichlorofluoromethane	µg/L	---	---		---		---		---		---		---		---
TOT	Trichloromethane	µg/L	---	---		---		---		---		---		---		---
TOT	VH C6-C10	µg/L	---	---		---		---		---		---		---		---
NA	Vinyl Chloride	µg/L	---	---		---		---		---		---		---		---

Notes:

a - Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922

b - Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.

FR1 - Field replicate 1.
FR2 - Field replicate 2.
FRM - Mean of field replicates.
NS- Not sampled
SS- Single sample

B6. Monthly Leachate Quality – Phase 2 Cleanout

Appendix B-6. Monthly Leachate Quality - Phase 2 Cleanout - 2022-2023

State	Parameter	Units	Sewer Use Criteria		Phase 2 Cleanout ---	Phase 2 Cleanout ---	Phase 2 Cleanout ---	Phase 2 Cleanout ---	Phase 2 Cleanout ---	Phase 2 Cleanout ---	Phase 2 Cleanout ---	Phase 2 Cleanout ---	Phase 2 Cleanout ---	Phase 2 Cleanout ---	Phase 2 Cleanout ---	Phase 2 Cleanout ---
			min	max	---	---	---	---	---	---	---	---	---	---	---	---
CONVENTIONALS																
Total	Alkalinity - Total - Ph 4.5	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	BOD	mg/L	---	500	---	---	---	---	---	---	---	---	---	---	---	---
Total	CBOD	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DIS	Chloride	mg/L	---	1500	---	---	---	---	---	---	---	---	---	---	---	---
Total	COD	mg/L	---	1000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Conductivity	µS/cm	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cyanide SAD	mg/L	---	1	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cyanide WAD	mg/L	---	1	---	---	---	---	---	---	---	---	---	---	---	---
Total	Dissolved Oxygen	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Fecal Coliforms	CFU/100 mL	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - NH3 (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - NO2 (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - NO3 (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - NO3 + NO2 (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Tkn (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Total (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Oil & Grease, Mineral	mg/L	---	15	---	---	---	---	---	---	---	---	---	---	---	---
Total	Oil & grease, total	mg/L	---	100	---	---	---	---	---	---	---	---	---	---	---	---
Total	ORP	mV	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	pH	pH	5.5	11	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Sulphide	mg/L	---	1	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphide	mg/L	---	1	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Sulphate	mg/L	---	1500	---	---	---	---	---	---	---	---	---	---	---	---
Total	Temperature	°C	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	TOC	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Total Phenols	mg/L	---	1	---	---	---	---	---	---	---	---	---	---	---	---
Total	TSS	mg/L	---	350	---	---	---	---	---	---	---	---	---	---	---	---
METALS																
Total	Aluminum	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Antimony	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Arsenic	µg/L	---	400	---	---	---	---	---	---	---	---	---	---	---	---
Total	Barium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Beryllium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Bismuth	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Boron	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cadmium	µg/L	---	300	---	---	---	---	---	---	---	---	---	---	---	---
Total	Calcium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium	µg/L	---	4000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium III	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium Vi	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cobalt	µg/L	---	5000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Copper	µg/L	---	1000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Hardness (As Caco3)	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Iron	µg/L	---	50000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Lead	µg/L	---	1000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Lithium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Magnesium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Manganese	µg/L	---	5000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Mercury	µg/L	---	20	---	---	---	---	---	---	---	---	---	---	---	---
Total	Molybdenum	µg/L	---	5000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Nickel	µg/L	---	3000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Phosphorus	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Potassium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Selenium	µg/L	---	300	---	---	---	---	---	---	---	---	---	---	---	---
Total	Silicon	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Silver	µg/L	---	500	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sodium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Strontium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphur	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Thallium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Tin	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Titanium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Uranium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Vanadium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Zinc	µg/L	---	3000	---	---	---	---	---	---	---	---	---	---	---	---
Total	Zirconium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VOLATILE ORGANICS																
Dissolved	Benzene	µg/L	---	100	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Ethylbenzene	µg/L	---	200	---	---	---	---	---	---	---	---	---	---	---	---
Total	M & P Xylenes	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Methyl Tertiary Butyl Ether	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	O-Xylene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Styrene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Toluene	µg/L	---	200	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Xylenes	µg/L	---	200	---	---	---	---	---	---	---	---	---	---	---	---

Notes:

a - Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922.

b - Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.

--- = Not available.

SS - Single Sample

NS - Not sampled

B7. Monthly Leachate Quality – North Purge Wells

Appendix B-7. Monthly Leachate Quality - North Purge Well 2022-2023

State	Parameters	Unit	Sewer Use Criteria		North Purge Well System	North Purge Well System	North Purge Well System	North Purge Well System	North Purge Well System	North Purge Well System	North Purge Well System	North Purge Well System	North Purge Well System	North Purge Well System	North Purge Well System	North Purge Well System
					SS	SS	SS	SS	SS	SS	SS	---	---	SS	SS	SS
			min	max	26-Apr-2022	31-May-2022	27-Jun-2022	27-Jul-2022	22-Aug-2022	27-Sep-2022	29-Oct-2022	30-Nov-2022	28-Dec-2022	17-Jan-2023	14-Feb-2023	23-Mar-2023
CONVENTIONALS																
Total	Alkalinity - Total - Ph 4.5	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	BOD	mg/L	---	500	15	17	15	23	18	19	18	---	---	12	13	16
Total	CBOD	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chloride	mg/L	---	1500	250	340	310	370	340	380	350	---	---	350	330	320
Total	COD	mg/L	---	1000	5650 a	5720 a	7670 a	1170 a	598	3360 a	331	---	---	686	242	419
Total	Conductivity	µS/cm	---	---	2739	3630	3915	3846	4108	4209	3936	---	---	3465	3283	3222
Total	Cyanide SAD	mg/L	---	1	0.00375	0.00731	0.00214	0.0069	< 0.005	0.00544	0.0042	---	---	0.00394	0.0057	0.00358
Total	Cyanide WAD	mg/L	---	1	0.00062	0.00281	---	0.0025	< 0.005	0.00447	0.00315	---	---	0.00088	< 0.0025	< 0.0005
Total	Dissolved Oxygen	mg/L	---	---	0.58	0.14	0.09	---	---	---	49	---	---	6.73	2.79	1.31
Total	Fecal Coliforms	CFU/100 mL	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Nh3 (As N)	mg/L	---	---	150	200	190	440	190	240	170	---	---	180	150	170
Total	N - No2 (As N)	mg/L	---	---	< 0.05	< 0.05	0.0217	< 0.05	< 0.005	0.0064	< 0.005	---	---	0.0063	0.0064	< 0.005
Total	N - No3 (As N)	mg/L	---	---	0.23	< 0.2	0.107	< 0.2	< 0.02	< 0.02	< 0.02	---	---	< 0.02	< 0.02	< 0.02
Total	N - No3 + No2 (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Tkn (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Total (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Oil & Grease, Mineral	mg/L	---	15	< 2	< 2	< 2	< 2	< 2	< 2	< 2	---	---	< 2	< 2	< 2
Total	Oil & grease, total	mg/L	---	100	< 1	< 1	< 1	< 1	1	1.7	1	---	---	1	< 1	< 1
Total	ORP	mV	---	---	-114	-92	-190	-202	-100	-16	95	---	---	-236.6	134.4	75.1
Total	pH	pH	5.5	11	6.82	6.85	6.85	6.99	7.35	6.91	6.8	---	---	6.79	7.22	7.83
Dissolved	Sulphide	mg/L	---	1	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphide	mg/L	---	1	0.024	0.071	0.061	0.063	0.031	0.076	0.19	---	---	0.19	0.19	0.19
Dissolved	Sulphate	mg/L	---	1500	18	17	12	7.5	< 1	< 5	< 1	---	---	25	2.3	< 1
Total	Temperature	°C	---	---	14.7	17.4	18.7	20.3	19.6	18.9	18.7	---	---	16.7	15.6	16.5
Total	TOC	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Total Phenols	mg/L	---	1	0	< 0.015	0.0098	0.087	0.01	0.0094	0.0074	---	---	0.0031	< 0.0075	< 0.0075
Total	TSS	mg/L	---	350	23	31	71	50	39	41	15	---	---	42	53	51
METALS																
Total	Aluminum	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Antimony	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Arsenic	µg/L	---	400	6.57	9.76	7.98	10.5	9.41	11.8	8.82	---	---	7.72	4.6	3.13
Total	Barium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Beryllium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Bismuth	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Boron	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cadmium	µg/L	---	300	0.025	0.225	0.015	0.027	0.012	0.016	< 0.01	---	---	< 0.005	< 0.01	< 0.01
Total	Calcium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium	µg/L	---	4 000.	15.1	19.4	17.4	23.4	18.2	21.9	13.2	---	---	6.54	4.07	6.35
Total	Chromium III	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium Vi	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cobalt	µg/L	---	5000	8.22	9.64	9.59	10.9	9.84	11.3	9.09	---	---	6.86	4.87	3.15
Total	Copper	µg/L	---	1000	4.35	4.3	5.53	5.5	3.07	3.36	1.98	---	---	1.04	0.51	0.43
Total	Hardness (As Caco3)	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Iron	µg/L	---	50 000.	10700	19500	18700	20300	19700	19100	18500	---	---	22100	16700	11500
Total	Lead	µg/L	---	1 000.	0.275	0.416	0.265	0.48	0.314	0.374	0.19	---	---	0.109	0.055	< 0.04
Total	Lithium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Magnesium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Manganese	µg/L	---	5000	949	1180	1190	1310	1250	1350	1380	---	---	1210	927	671
Total	Mercury	µg/L	---	20	< 0.019	< 0.038	< 0.038	< 0.019	< 0.019	< 0.038	< 0.019	---	---	< 0.038	< 0.038	< 0.038
Total	Molybdenum	µg/L	---	5000	1.32	1.37	1.25	1.66	1.59	1.52	1.2	---	---	1.07	0.64	4.8
Total	Nickel	µg/L	---	3000	18.1	22.3	22.2	26.3	23.9	26.5	21.5	---	---	18.3	13.3	26.2
Total	Phosphorus	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Potassium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Selenium	µg/L	---	300	0.211	0.238	0.262	0.28	0.266	0.318	0.235	---	---	0.172	0.148	0.101
Total	Silicon	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Silver	µg/L	---	500	< 0.02	0.024	< 0.02	< 0.05	< 0.02	< 0.02	< 0.02	---	---	< 0.01	< 0.02	< 0.02
Total	Sodium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Strontium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphur	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Thallium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Tin	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Titanium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Uranium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Vanadium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Zinc	µg/L	---	3000	4.6	9.1	5	12.7	6	5.8	2.9	---	---	1.9	< 2	< 2
Total	Zirconium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VOLATILE ORGANICS																
Dissolved	Benzene	µg/L	---	100	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	---	---	< 0.4	< 0.4	< 0.4
Dissolved	Ethylbenzene	µg/L	---	200	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	---	---	< 0.4	< 0.4	< 0.4
Total	M & P Xylenes	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Methyl Tertiary Butyl Ether	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	O-Xylene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Styrene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Toluene	µg/L	---	200	< 0.4	< 0.4	< 0.4	0.41	< 0.4	< 0.4	< 0.4	---	---	< 0.4	< 0.4	< 0.4
Dissolved	Xylenes	µg/L	---	200	< 0.4	< 0.4	< 0.4	< 0.4	0.52	< 0.4	< 0.4	---	---	< 0.4	< 0.4	< 0.4

Notes:

a - Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922.

b - Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.

** - Exceedances are due to compromised/expired preservatives, and results are not representative*

SS - Single Sample

NS - Not Sampled

B8. Monthly Leachate Quality – Controlled Waste Drainage

Appendix B-8. Monthly Leachate Quality - Controlled Waste Drainage 2022-2023

States	Parameter	Units	Sewer Use Criteria		Controlled Waste Ditch SS	Controlled Waste Ditch SS	Controlled Waste Ditch SS	Controlled Waste Ditch NS	Controlled Waste Ditch NS	Controlled Waste Ditch SS	Controlled Waste Ditch SS	Controlled Waste Ditch ---	Controlled Waste Ditch ---	Controlled Waste Ditch SS	Controlled Waste Ditch SS	Controlled Waste Ditch SS
			min	max	26-Apr-2022	31-May-2022	27-Jun-2022	27-Jul-2022	22-Aug-2022	27-Sep-2022	29-Oct-2021	30-Nov-2022	28-Dec-2022	17-Jan-2023	14-Feb-2023	23-Mar-2023
CONVENTIONALS																
Total	Alkalinity - Total - Ph 4.5	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	BOD	mg/L	---	500	60	83	72	37	170	39	19	---	---	34	22	65
Total	CBOD	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Chloride	mg/L	---	1500	390	480	500	600	620	670	690	---	---	280	260	450
Total	COD	mg/L	---	1000	396	496	583	1390 a	737	681	778	---	---	312	275	545
Total	Conductivity	µS/cm	---	---	3800	5158	6256	6610	7433	6543	6544	---	---	3230	2572	4773
Total	Cyanide SAD	mg/L	---	1	0.0086	0.0204	0.00396	0.021	0.011	0.00686	0.0102	---	---	0.0043	0.0096	0.0169
Total	Cyanide WAD	mg/L	---	1	< 0.0025	0.0132	---	< 0.01	< 0.01	< 0.0005	0.0064	---	---	0.0029	0.0042	< 0.0025
Total	Dissolved Oxygen	mg/L	---	---	5.23	4.26	6.1	---	---	---	52	---	---	7.77	7.14	4.4
Total	Fecal Coliforms	CFU/100 mL	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - NH3 (As N)	mg/L	---	---	260	380	450	480	510	610	580	---	---	230	190	410
Total	N - NO2 (As N)	mg/L	---	---	3.73	9.75	0.311	9.55	11.9	11	12.1	---	---	2.82	2.72	3.71
Total	N - NO3 (As N)	mg/L	---	---	13	3.22	0.212	1.9	1.19	< 0.25	6.04	---	---	14.5	20.4	4.33
Total	N - NO3 + NO2 (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Tkn (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Total (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Oil & Grease, Mineral	mg/L	---	15	< 2	< 2	< 2	< 2	< 2	< 2	0	---	---	< 2	< 2	< 2
Total	Oil & grease, total	mg/L	---	100	< 1	< 1	1	< 1	< 1	1	0	---	---	< 1	< 1	< 1
Total	ORP	mV	---	---	-1.0	-35.0	-23.0	-1.0	-21.0	109.0	132.0	---	---	-126.7	75.0	119.3
Total	pH	pH	5.5	11	8.23	8.26	8.26	8.17	8.59	8.55	8.15	---	---	8.22	8.4	8.69
Dissolved	Sulphide	mg/L	---	1	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphide	mg/L	---	1	0.032	0.019	< 0.009	< 0.009	0.075	< 0.009	< 0.036	---	---	< 0.036	< 0.036	< 0.036
Dissolved	Sulphate	mg/L	---	1500	< 10	< 10	< 10	< 10	< 1	< 25	< 1	---	---	29	24	< 1
Total	Temperature	°C	---	---	16.3	18.7	22.7	23.1	22	17.7	16.6	---	---	16	14.4	15.9
Total	TOC	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Total Phenols	mg/L	---	1	0	< 0.015	< 0.015	0.031	0.017	0.0083	< 0.0075	---	---	0.0057	< 0.015	< 0.015
Total	TSS	mg/L	---	350	5.3	8.8	24	11	280	15	6	---	---	2.4	6.8	31
METALS																
Total	Aluminum	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Antimony	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Arsenic	µg/L	---	400	4.11	4.99	5.95	5.81	8.71	6.93	6.23	---	---	3.68	3.12	5.89
Total	Barium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Beryllium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Bismuth	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Boron	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cadmium	µg/L	---	300	0.061	< 0.025	< 0.025	< 0.025	0.102	0.072	< 0.025	---	---	0.0524	0.061	0.035
Total	Calcium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium	µg/L	---	4000	32.9	34.8	39.8	41.7	66.7	46.9	46.3	---	---	21.6	20.9	36.2
Total	Chromium III	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium Vi	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cobalt	µg/L	---	5000	16.4	18.2	21.1	22.3	27.5	29.2	28.2	---	---	12.3	11	18.7
Total	Copper	µg/L	---	1000	10.6	2.19	1.42	1.53	16.6	1.91	0.92	---	---	12.3	13	5.4
Total	Hardness (As Caco3)	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Iron	µg/L	---	50000	1990	3100	3970	2680	22200	2710	2580	---	---	1440	1470	7020
Total	Lead	µg/L	---	1000	0.232	0.18	0.19	0.28	2	0.19	0.13	---	---	0.218	0.227	0.497
Total	Lithium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Magnesium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Manganese	µg/L	---	5000	1700	443	469	343	1150	130	113	---	---	1550	1320	1580
Total	Mercury	µg/L	---	20	< 0.019	< 0.038	< 0.038	< 0.019	< 0.019	< 0.019	< 0.038	---	---	< 0.038	< 0.038	< 0.038
Total	Molybdenum	µg/L	---	5000	1.24	1.39	1.69	1.8	2	1.87	1.57	---	---	1.31	1.05	3.36
Total	Nickel	µg/L	---	3000	36.7	37.7	42.9	46.9	55.7	57.4	55.1	---	---	32.4	28.2	46.8
Total	Phosphorus	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Potassium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Selenium	µg/L	---	300	0.43	0.53	0.59	0.56	0.76	0.75	0.62	---	---	0.378	0.336	0.57
Total	Silicon	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Silver	µg/L	---	500	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	---	---	0.012	< 0.02	< 0.02
Total	Sodium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Strontium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphur	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Thallium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Tin	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Titanium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Uranium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Vanadium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Zinc	µg/L	---	3000	49.9	56.6	51.4	52.7	395	39.5	39.7	---	---	22.2	29.7	80.3
Total	Zirconium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VOLATILE ORGANICS																
Dissolved	Benzene	µg/L	---	100	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	---	---	< 0.4	< 0.4	< 0.4
Dissolved	Ethylbenzene	µg/L	---	200	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	---	---	< 0.4	< 0.4	< 0.4
Total	M & P Xylenes	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Methyl Tertiary Butyl Ether	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	O-Xylene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Styrene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Toluene	µg/L	---	200	< 0.4	< 0.4	< 0.4	0.64	< 0.4	< 0.4	< 0.4	---	---	< 0.4	0.53	< 0.4
Dissolved	Xylenes	µg/L	---	200	< 0.4	< 0.4	< 0.4	0.94	< 0.4	< 0.4	< 0.4	---	---	< 0.4	1.7	< 0.4

Notes:

a - Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922.

b - Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.

** - Exceedances are due to compromised/expired preservatives, and results are not representative*

SS - Single Sample

NS - Not Sampled

B9. Monthly Leachate Quality – Markham Valve Chamber

Appendix B-9. Leachate Quality - South Purge Wells - 2022-2023

State	Parameter	Units	Sewer Use Criteria		South Purge Wells SS 26-Apr-2022	South Purge Wells SS 31-May-2022	South Purge Wells SS 27-Jun-2022	South Purge Wells SS 27-Jul-2022	South Purge Wells SS 22-Aug-2022	South Purge Wells SS 27-Sep-2022	South Purge Wells SS 28-Oct-2022	South Purge Wells --- 30-Nov-2022	South Purge Wells --- 28-Dec-2022	South Purge Wells SS 17-Jan-2023	South Purge Wells SS 14-Feb-2023	South Purge Wells SS 23-Mar-2033
			min	max												
CONVENTIONALS																
Total	Alkalinity - Total - Ph 4.5	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	BOD	mg/L	---	500	54	3.6	3	9.3	6.8	< 6	5.8	---	---	5.9	4.6	2.5
Total	CBOD	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chloride	mg/L	---	1500	490	110	120	150	150	160	160	---	---	110	88	78
Total	COD	mg/L	---	1000	9090 a	75	84	1010 a	5510 a	145	5710 a	---	---	68	62	59
Total	Conductivity	µS/cm	---	---	1258	1331	1059	1849	1944	1873	1910	---	---	1431	1127	1145
Total	Cyanide SAD	mg/L	---	1	0.047	0.00163	0.00189	0.00284	0.00181	0.00372	0.00155	---	---	0.00059	0.00108	0.00118
Total	Cyanide WAD	mg/L	---	1	0.016	0.00078	---	0.00087	< 0.0005	0.00163	0.00169	---	---	< 0.0005	< 0.0005	< 0.0005
Total	Dissolved Oxygen	mg/L	---	---	4.38	3.64	4.5	---	---	---	42	---	---	6.95	38.4	3.87
Total	Fecal Coliforms	CFU/100 mL	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - NH3 (As N)	mg/L	---	---	250	44	49	61	64	69	64	---	---	57	45	45
Total	N - NO2 (As N)	mg/L	---	---	42.7	< 0.005	< 0.005	0.0053	< 0.005	< 0.005	0.0075	---	---	0.0084	0.0058	< 0.005
Total	N - NO3 (As N)	mg/L	---	---	65	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	---	---	0.026	< 0.02	0.034
Total	N - NO3 + NO2 (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Tkn (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Total (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Oil & Grease, Mineral	mg/L	---	15	< 2	< 2	< 2	< 2	< 2	< 2	< 2	---	---	< 2	< 2	< 2
Total	Oil & grease, total	mg/L	---	100	< 1	< 1	< 1	< 1	< 1	< 1	< 1	---	---	1.4	< 1	< 1
Total	ORP	mV	---	---	-126	-107	-124	-105	19	106	91	---	---	-67.1	49.2	69.7
Total	pH	pH	5.5	11	7.28	7.15	7.16	7.43	7.96	7.4	7.28	---	---	7.3	7.89	8.71
Dissolved	Sulphide	mg/L	---	1	0	0	0	0	0	0	0.024	---	---	0	0	0
Total	Sulphide	mg/L	---	1	< 0.018	0.016	0.021	0.013	0.017	0.03	< 0.036	---	---	0.0097	0	0
Dissolved	Sulphate	mg/L	---	1500	< 100	< 10	< 1	< 1	< 1	< 1	< 1	---	---	3.2	1.4	< 1
Total	Temperature	°C	---	---	15.8	16.8	17.9	22.6	19.6	17.8	18.2	---	---	14.1	14	15
Total	TOC	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Total Phenols	mg/L	---	1	0	< 0.0015	0.0033	0.0083	0.0051	< 0.0015	0.0072	---	---	0.0027	0.002	< 0.0015
Total	TSS	mg/L	---	350	6	35	41	33	19	31	9.6	---	---	10	74	24
METALS																
Total	Aluminum	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Antimony	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Arsenic	µg/L	---	400	24.7	9.13	8.94	9.73	9.04	5.42	5.09	---	---	4.67	7.54	3.15
Total	Barium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Beryllium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Bismuth	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Boron	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cadmium	µg/L	---	300	0.212	< 0.01	< 0.005	0.019	< 0.01	< 0.01	0.15	---	---	0.0128	< 0.01	0.0394
Total	Calcium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium	µg/L	---	4000	125	1	0.92	1.22	1.17	0.9	1.57	---	---	0.97	0.9	0.7
Total	Chromium III	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium Vi	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cobalt	µg/L	---	5000	29.2	2.23	2.34	3.19	3.46	2.84	3.59	---	---	2.03	2.21	1.85
Total	Copper	µg/L	---	1000	73.6	0.24	0.19	0.47	< 0.2	< 0.2	0.63	---	---	0.58	0.4	0.57
Total	Hardness (As Caco3)	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Iron	µg/L	---	50000	1970	18200	16200	12200	10600	10200	10600	---	---	10700	32100	8600
Total	Lead	µg/L	---	1000	2.17	0.799	0.638	0.605	0.373	0.123	0.28	---	---	0.792	0.629	0.609
Total	Lithium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Magnesium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Manganese	µg/L	---	5000	263	188	149	129	120	88.5	145	---	---	260	256	259
Total	Mercury	µg/L	---	20	0.029	< 0.0019	< 0.038	< 0.0019	< 0.019	< 0.019	< 0.0019	---	---	< 0.0019	< 0.0019	< 0.0019
Total	Molybdenum	µg/L	---	5000	2.69	14.9	15.8	20.8	21.4	13.3	15.1	---	---	7.79	7.38	7.38
Total	Nickel	µg/L	---	3000	69.6	6.73	6.44	7.77	8.14	6.16	7.84	---	---	6.94	6.52	5.34
Total	Phosphorus	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Potassium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Selenium	µg/L	---	300	1.1	0.083	0.099	0.085	0.104	0.094	0.096	---	---	0.082	0.1	0.072
Total	Silicon	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Silver	µg/L	---	500	< 0.05	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	---	---	< 0.01	< 0.02	< 0.01
Total	Sodium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Strontium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphur	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Thallium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Tin	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Titanium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Uranium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Vanadium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Zinc	µg/L	---	3000	44.9	6.2	3.5	12.5	3.1	< 2	33.5	---	---	10.2	19.4	9.8
Total	Zirconium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VOLATILE ORGANICS																
Total	Benzene	µg/L	---	100	< 0.4	< 0.4	< 0.4	0.45	< 0.4	< 0.4	< 0.4	---	---	< 0.4	< 0.4	< 0.4
Total	Ethylbenzene	µg/L	---	200	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	---	---	< 0.4	< 0.4	< 0.4
Total	M & P Xylenes	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Methyl Tertiary Butyl Ether	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	O-Xylene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Styrene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Toluene	µg/L	---	200	0.41	< 0.4	< 0.4	0.61	< 0.4	< 0.4	< 0.4	---	---	< 0.4	< 0.4	< 0.4
Total	Xylenes	µg/L	---	200	< 0.4	< 0.4	< 0.4	0.48	0.45	< 0.4	< 0.4	---	---	< 0.4	< 0.4	< 0.4

Notes:

a - Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922.

b - Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.

** - Exceedances are due to compromised/expired preservatives, and results are not representativ*

--- = Not available.

B10. Monthly Leachate Quality – West Face Drainage

Appendix B-10. Monthly Leachate Quality - West Face Drainage 2022-2023

State	Parameter	Units	Sewer Use Criteria min	Sewer Use Criteria max	West Face Drainage SS 26-Apr-2022	West Face Drainage SS 31-May-2022	West Face Drainage SS 27-Jun-2022	West Face Drainage SS 27-Jul-2022	West Face Drainage SS 22-Aug-2022	West Face Drainage SS 27-Sep-2022	West Face Drainage --- 19-Oct-2022	West Face Drainage --- 30-Nov-2022	West Face Drainage --- 28-Dec-2022	West Face Drainage SS 17-Jan-2023	West Face Drainage SS 14-Feb-2023	West Face Drainage SS 23-Mar-2023
CONVENTIONALS																
Total	Alkalinity - Total - Ph 4.5	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	BOD	mg/L	---	500	50	59	110	170	170	150	---	---	---	67	71	82
Total	CBOD	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Chloride	mg/L	---	1500	490	700	890	1000	900	1000	---	---	---	760	790	920
Total	COD	mg/L	---	1000	7690 a	1060 a	5370 a	2820 a	9390 a	2590 a	---	---	---	1830 a	1550 a	1800 a
Total	Conductivity	µS/cm	---	---	6264	9401	13338	14066	14203	14953	---	---	---	11066	10663	12673
Total	Cyanide SAD	mg/L	---	1	< 0.013	0.0308	0.00401	0.041	< 0.05	0.0604	---	---	---	< 0.05	0.037	0.039
Total	Cyanide WAD	mg/L	---	1	< 0.013	0.0177	---	< 0.025	< 0.05	0.0416	---	---	---	< 0.05	< 0.025	< 0.025
Total	Dissolved Oxygen	mg/L	---	---	0.24	1.26	0.79	---	---	---	---	---	---	3.04	1.04	1.27
Total	Fecal Coliforms	CFU/100 mL	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Nh3 (As N)	mg/L	---	---	470	750	1300	1400	1300	1600	---	---	---	900	880	1100
Total	N - No2 (As N)	mg/L	---	---	< 0.5	< 0.5	0.0177	0.67	< 0.5	< 0.5	---	---	---	< 0.5	< 0.5	< 0.5
Total	N - No3 (As N)	mg/L	---	---	< 2	< 2	< 0.02	< 2	< 2	< 2	---	---	---	8.7	31.3	< 2
Total	N - No3 + No2 (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Tkn (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Total (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Oil & Grease, Mineral	mg/L	---	15	< 2	< 2	< 2	< 2	< 2	< 2	---	---	---	9.9	< 2	< 2
Total	Oil & grease, total	mg/L	---	100	< 1	< 1	< 1	< 1	2.4	1.3	---	---	---	19	< 1	3
Total	ORP	mV	---	---	-116	-14	-93	-130	-52	36	---	---	---	-158.5	151.0	141.0
Total	pH	pH	5.5	11	7.47	7.58	7.7	7.72	8.41	7.87	---	---	---	7.66	8.10	8.08
Dissolved	Sulphide	mg/L	---	1	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphide	mg/L	---	1	0.023	< 0.018	0.041	0.023	< 0.018	< 0.036	---	---	---	< 0.036	< 0.036	< 0.036
Dissolved	Sulphate	mg/L	---	1500	< 100	< 100	< 100	< 100	100	< 25	---	---	---	43	48	20
Total	Temperature	°C	---	---	23.4	25.5	26.6	24.1	25.4	22.4	---	---	---	27.7	27	25.5
Total	TOC	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Total Phenols	mg/L	---	1	0	0.065	0.099	1.3 a	0.08	0.0041	---	---	---	0.011	0.067	< 0.1
Total	TSS	mg/L	---	350	3.3	13	74	43	110	11	---	---	---	13	15	19
METALS																
Total	Aluminum	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Antimony	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Arsenic	µg/L	---	400	14	19.2	44.7	46.5	45.1	65.8	---	---	---	35	28.4	36.8
Total	Barium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Beryllium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Bismuth	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Boron	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cadmium	µg/L	---	300	0.081	0.13	0.284	0.262	0.268	0.329	---	---	---	0.204	0.182	0.256
Total	Calcium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium	µg/L	---	4000	72.2	97.5	209	273	242	317	---	---	---	153	89.2	194
Total	Chromium III	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium Vi	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cobalt	µg/L	---	5000	22.5	30.2	43.1	39	37.5	48.5	---	---	---	29	27.3	36.6
Total	Copper	µg/L	---	1000	19.1	17.9	51.3	7.2	18.6	8.75	---	---	---	33.8	35.2	43.4
Total	Hardness (As Caco3)	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Iron	µg/L	---	50000	2070	2740	4270	3670	4390	4430	---	---	---	2140	2000	2990
Total	Lead	µg/L	---	1000	1.64	2.01	4.88	4.29	4.24	4.85	---	---	---	2.96	1.85	3.56
Total	Lithium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Magnesium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Manganese	µg/L	---	5000	354	414	431	380	416	452	---	---	---	305	251	309
Total	Mercury	µg/L	---	20	< 0.019	< 0.038	< 0.038	< 0.019	< 0.019	< 0.038	---	---	---	< 0.038	< 0.038	< 0.038
Total	Molybdenum	µg/L	---	5000	1.32	1.02	2.85	1.51	1.84	1.49	---	---	---	2.65	1.27	5.7
Total	Nickel	µg/L	---	3000	66.9	91.2	126	115	106	134	---	---	---	87.1	83.3	117
Total	Phosphorus	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Potassium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Selenium	µg/L	---	300	0.64	0.71	1.16	0.98	1.14	1.29	---	---	---	0.879	0.76	1.09
Total	Silicon	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Silver	µg/L	---	500	< 0.05	< 0.05	< 0.05	< 0.1	< 0.05	< 0.05	---	---	---	0.019	< 0.05	< 0.05
Total	Sodium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Strontium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphur	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Thallium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Tin	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Titanium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Uranium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Vanadium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Zinc	µg/L	---	3000	25.2	35	89.3	103	99.7	120	---	---	---	49	41.7	70
Total	Zirconium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VOLATILE ORGANICS																
Total	Benzene	µg/L	---	100	1.3	1.6	1.7	1.1	< 0.4	< 0.4	---	---	---	2.2	1.3	2.1
Total	Ethylbenzene	µg/L	---	200	6	3.9	< 0.4	3.4	< 0.4	< 0.4	---	---	---	5.6	3.2	2.9
Total	M & P Xylenes	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Methyl Tertiary Butyl Ether	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	O-Xylene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Styrene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Toluene	µg/L	---	200	3.3	4.2	3.2	8.9	1.6	< 0.4	---	---	---	5	3.1	5.6
Total	Xylenes	µg/L	---	200	13	14	18	24	4.2	3.6	---	---	---	16	11	17

Notes:

a - Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922.

b - Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.

** - Exceedances may be due to compromised/expired preservatives, and results may not be representative*

SS - Single Sample

NS - Not Sampled

B11. Monthly Leachate Quality - Cell 3 Pipe Outlet

Appendix B-11. Monthly Leachate Quality - Cell 3 Pipe Outlet 2022-2023

State	Parameter	Units	Sewer Use Criteria		Cell 3 Pipe Outlet SS 26-Apr-2022	Cell 3 Pipe Outlet SS 31-May-2022	Cell 3 Pipe Outlet SS 27-Jun-2022	Cell 3 Pipe Outlet SS 27-Jul-2022	Cell 3 Pipe Outlet SS 22-Aug-2022	Cell 3 Pipe Outlet --- 27-Sep-2022	Cell 3 Pipe Outlet --- 19-Oct-2022	Cell 3 Pipe Outlet --- 30-Nov-2022	Cell 3 Pipe Outlet --- 28-Dec-2022	Cell 3 Pipe Outlet SS 17-Jan-2023	Cell 3 Pipe Outlet SS 25-Feb-2023	Cell 3 Pipe Outlet SS 23-Mar-2023
			min	max												
CONVENTIONALS																
Total	Alkalinity - Total - Ph 4.5	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	BOD	mg/L	---	500	< 30	59	47	80	61	---	---	---	---	36	25	50
Total	CBOD	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Chloride	mg/L	---	1500	1000	700	590	1000	1400	---	---	---	---	610	400	700
Total	COD	mg/L	---	1000	1430 a	1060 a	8250 a	2550 a	2720 a	---	---	---	---	1260 a	757	1380 a
Total	Conductivity	µS/cm	---	---	0	9401	5327	7848	11181	---	---	---	---	6187	3983	5845
Total	Cyanide SAD	mg/L	---	1	0.156	0.0308	0.0578	0.357	0.18	---	---	---	---	0.063	0.04	0.061
Total	Cyanide WAD	mg/L	---	1	0.016	0.0177	---	0.042	< 0.05	---	---	---	---	< 0.05	0.026	< 0.025
Total	Dissolved Oxygen	mg/L	---	---	0	1.26	2.72	---	---	---	---	---	---	3.13	2.03	0.69
Total	Fecal Coliforms	CFU/100 mL	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - NH3 (As N)	mg/L	---	---	650	750	290	540	610	---	---	---	---	590	330	490
Total	N - NO2 (As N)	mg/L	---	---	51.5	< 0.5	76.3	136	191	---	---	---	---	11.7	24.6	51.6
Total	N - NO3 (As N)	mg/L	---	---	79.4	< 2	113	165	235	---	---	---	---	20.6	41.8	77.3
Total	N - No3 + No2 (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Tkn (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	N - Total (As N)	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Oil & Grease, Mineral	mg/L	---	15	< 2	< 2	< 2	< 2	< 2	---	---	---	---	< 2	2	< 2
Total	Oil & grease, total	mg/L	---	100	< 1	< 1	< 1	< 1	< 1	---	---	---	---	2.5	1.3	1.5
Total	ORP	mV	---	---	0	-14	108	48	49	---	---	---	---	-132	79.9	127
Total	pH	pH	5.5	11	---	7.58	7.98	8.21	8.54	---	---	---	---	8.61	9.18	9
Dissolved	Sulphide	mg/L	---	1	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphide	mg/L	---	1	< 0.18	< 0.018	0.03	< 0.018	< 0.018	---	---	---	---	< 0.0036	0.0036	< 0.0036
Dissolved	Sulphate	mg/L	---	1500	< 100	< 100	110	< 100	200	---	---	---	---	26	110	99
Total	Temperature	°C	---	---	0	25.5	17.8	20.7	22	---	---	---	---	17.1	14.9	15.3
Total	TOC	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Total Phenols	mg/L	---	1	0.084	0.065	0.0096	0.045	< 0.03	---	---	---	---	0.075	0.03	< 0.038
Total	TSS	mg/L	---	350	18	13	17	62	21	---	---	---	---	13	4	15
METALS																
Total	Aluminum	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Antimony	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Arsenic	µg/L	---	400	48.9	19.2	33.9	47.6	64.5	---	---	---	---	29.2	22.8	36.9
Total	Barium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Beryllium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Bismuth	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Boron	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cadmium	µg/L	---	300	0.332	0.13	0.343	0.515	0.694	---	---	---	---	0.169	0.144	0.218
Total	Calcium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium	µg/L	---	4000	233	97.5	169	261	366	---	---	---	---	166	99	165
Total	Chromium III	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Chromium Vi	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Cobalt	µg/L	---	5000	47.6	30.2	43.4	63.8	91.5	---	---	---	---	30.1	22.7	37.3
Total	Copper	µg/L	---	1000	74.6	17.9	117	160	226	---	---	---	---	48.5	51.7	73.4
Total	Hardness (As Caco3)	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Iron	µg/L	---	50000	3590	2740	2960	4360	5960	---	---	---	---	2470	1670	2440
Total	Lead	µg/L	---	1000	4.99	2.01	3.04	4.19	5.75	---	---	---	---	2.19	1.35	2.27
Total	Lithium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Magnesium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Manganese	µg/L	---	5000	488	414	378	512	635	---	---	---	---	306	207	286
Total	Mercury	µg/L	---	20	< 0.038	< 0.038	< 0.038	< 0.19	< 1.9	---	---	---	---	< 0.038	0.038	< 0.038
Total	Molybdenum	µg/L	---	5000	5.72	1.02	4.02	6.1	8.82	---	---	---	---	3.06	2.02	3.51
Total	Nickel	µg/L	---	3000	133	91.2	101	153	210	---	---	---	---	76.6	56.6	93.7
Total	Phosphorus	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Potassium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Selenium	µg/L	---	300	1.99	0.71	1.58	2.13	2.54	---	---	---	---	1.09	1.06	1.44
Total	Silicon	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Silver	µg/L	---	500	0.076	< 0.05	0.046	< 0.1	< 0.1	---	---	---	---	0.069	0.05	< 0.05
Total	Sodium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Strontium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Sulphur	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Thallium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Tin	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Titanium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Uranium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Vanadium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Zinc	µg/L	---	3000	90.4	35	61.4	89	136	---	---	---	---	45.1	38.5	53.7
Total	Zirconium	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VOLATILE ORGANICS																
Dissolved	Benzene	µg/L	---	100	< 0.4	1.6	< 0.4	< 0.4	< 0.4	---	---	---	---	< 0.4	0.4	< 0.4
Dissolved	Ethylbenzene	µg/L	---	200	< 0.4	3.9	< 0.4	< 0.4	< 0.4	---	---	---	---	< 0.4	0.4	< 0.4
Total	M & P Xylenes	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Methyl Tertiary Butyl Ether	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	O-Xylene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total	Styrene	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved	Toluene	µg/L	---	200	< 0.4	4.2	0.5	0.62	0.56	---	---	---	---	< 0.4	0.44	< 0.4
Dissolved	Xylenes	µg/L	---	200	< 0.4	14	< 0.4	< 0.4	< 0.4	---	---	---	---	< 0.4	0.4	< 0.4

Notes:

a - Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922
b - Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922
** - Exceedances are due to compromised/expired preservatives, and results are not representative*
SS - Single sample
NS - Not sampled

B12. Monthly Leachate Quality Emerging Contaminant

Appendix B-12. Monthly Leachate Quality - Emerging Contaminant 2022-2023

State	Parameter	Units	Sewer Use Criteria		Hartland Valve Chamber	Hartland Valve Chamber	Hartland Valve Chamber	Hartland Valve Chamber	Hartland Valve Chamber	Hartland Valve Chamber	Hartland Valve Chamber	Hartland Valve Chamber	Hartland Valve Chamber	Hartland Valve Chamber	Hartland Valve Chamber
					---	SS	---	---	---	---	---	---	---	---	---
			min	max	26-Apr-2022	31-May-2022	27-Sep-2022	27-Sep-2022	27-Sep-2022	19-Oct-2022	30-Nov-2022	30-Nov-2022	30-Nov-2022	14-Feb-2023	14-Feb-2023
EMERGING CONTAMINANTS															
Total	Perfluorobutanesulfonic acid	µg/L	---	---	---	0.47	---	---	---	---	---	---	---	---	---
Total	Perfluorodecanesulfonic acid (PFDS)	µg/L	---	---	---	0.48	---	---	---	---	---	---	---	---	---
Total	Perfluoroheptanesulfonic acid	µg/L	---	---	---	< 0.02	---	---	---	---	---	---	---	---	---
Total	Perfluorohexanesulfonic acid	µg/L	---	---	---	0.047	---	---	---	---	---	---	---	---	---
Total	Perfluorononanesulfonic acid	µg/L	---	---	---	< 0.02	---	---	---	---	---	---	---	---	---
Total	Perfluorooctanesulfonic acid	µg/L	---	---	---	0.19	---	---	---	---	---	---	---	---	---
Total	Perfluorooctanoic acid (PFOA)	µg/L	---	---	---	1.	---	---	---	---	---	---	---	---	---
Total	Perfluoropentanesulfonic acid	µg/L	---	---	---	< 0.02	---	---	---	---	---	---	---	---	---
Total	PF3A	µg/L	---	---	---	0.037	---	---	---	---	---	---	---	---	---
Total	PF4A	µg/L	---	---	---	< 0.02	---	---	---	---	---	---	---	---	---
Total	PFBoA	µg/L	---	---	---	0.18	---	---	---	---	---	---	---	---	---
Total	PFDA	µg/L	---	---	---	0.6	---	---	---	---	---	---	---	---	---
Total	PFDoA	µg/L	---	---	---	0.026	---	---	---	---	---	---	---	---	---
Total	PFHpA	µg/L	---	---	---	0.43	---	---	---	---	---	---	---	---	---
Total	PFHxA	µg/L	---	---	---	< 0.02	---	---	---	---	---	---	---	---	---
Total	PFNA	µg/L	---	---	---	< 0.02	---	---	---	---	---	---	---	---	---
Total	PFOSA	µg/L	---	---	---	< 0.02	---	---	---	---	---	---	---	---	---
Total	PFPeA	µg/L	---	---	---	0.51	---	---	---	---	---	---	---	---	---
Total	PFUA	µg/L	---	---	---	< 0.02	---	---	---	---	---	---	---	---	---
Total	1,4-Dioxane	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---

Notes:

a - Exceeded maximum allowable value specified in CRD Sewer Use Bylaw 2922.

b - Exceeded minimum allowable value specified in CRD Sewer Use Bylaw 2922.

Appendix C

Climate Data

- C1. Daily Rainfall Data –
  Hartland Landfill Weather Station
- C2. Monthly Rainfall Data –
  Hartland Landfill Weather Station

C1. Daily Rainfall Data – Hartland Landfill Weather Station

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

Date		Daily Rainfall (mm)																										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
January	1	2.4	11.6	0	7.6	0	8	5.4	0	11	5	35	0	22.2	22	0	0	3	2	0	0	0	0	0	0	10.5	2.25	0
January	2	0	0	0	0	0	2.6	32.6	0	0	0.8	64.4	11.2	0	1.3	0.0	0.8	0.0	1.5	0.0	0.0	0.0	0.0	0	0	40.5	0	0
January	3	0	0.2	0	16.8	4.6	2.6	6.8	5.8	0	1.6	7.8	1.6	0.2	0.0	0.0	5.5	0.0	10.5	4.3	0.0	0.0	0.0	17.75	0	7.5	16	0.75
January	4	0	16.2	0	11.2	13	0.2	15	0	0	1.4	9.6	0.4	20.4	40.0	4.3	8.3	5.3	0.0	3.5	0.5	0.0	0.8	74	0	13.75	5.75	0
January	5	0	20.8	0	0	30.2	0	0	0	0	23.8	57.4	11	2.8	5.8	21.8	22.8	1.8	0.0	31.5	2.0	0.0	4.0	1.5	0	16.5	8.75	0.25
January	6	0	20.4	0.4	6.4	0	10.2	0	9.8	3	11.4	2.6	0	21	0.0	23.8	8.5	3.8	0.0	26.0	2.5	0.0	0.0	0.5	0	0.75	0	0.5
January	7	0	1	0	1.8	0	44.4	0	16.4	14.2	6	55.8	0	28.6	0	11	1	9	0	0	0	0	14	7.5	0	0.25	33.75	0
January	8	0	0	0	7.6	0.2	21.8	0	2.2	12.8	1.8	4.2	8.2	2.2	15.0	0.0	1.8	6.0	9.0	0.3	0.0	0.0	6.5	0	0	5	0.75	0
January	9	0	0	19.6	19.8	0	0	0	2	0	16.4	10.8	0.6	0.2	2.0	0.3	0.5	6.8	7.5	0.3	0.0	0.3	1.5	1.5	0	1.5	1.25	0
January	10	0	0	21	3	0	0.4	0	1.2	0	42.4	12	36.6	17.2	1.5	0.0	0.3	2.3	5.0	2.3	0.0	0.0	2.5	1.5	23	3.25	0	0
January	11	0	0	1	1.2	0	0.4	0	1.6	0.6	14.2	0.6	3.4	0.8	27.8	0.0	0.0	0.0	2.5	3.0	0.0	0.0	4.0	1.5	2	23.5	7	1.5
January	12	0	0	0.2	4.2	0	7.8	7	0	0	17	0	1.8	0	4	3	0	1	4	1	6	0	5	0	12.5	34	25	17
January	13	0	17.2	0	0.6	3.2	0	0.4	2.2	0	8.4	0	0	0	2.5	16.3	0.0	0.0	2.3	0.3	12.5	0.0	3.8	0	0	0.75	13.25	3.25
January	14	0	20.4	65.6	6	0	n/a	2.2	2.2	0	0	0	12	0	22	14	1	0	0	0	2	0	0	0	0	0	2.25	0
January	15	0	22.8	0.2	10.8	0	0	0	2	3.6	0	0	0	0	21	15	6	1	0	0	0	0	0	0	3.75	0	0.75	5.5
January	16	0	13.4	10.2	6.4	0	0.8	0	0	8.6	36	5.6	0	0	0	11	0	0	0	3	2	1	0	0	0	0.75	0.25	0
January	17	0	16.4	8.6	2.2	0.4	0.8	0	0	54.4	1.4	0	0	0	1.3	0.3	0.5	0.0	0.0	0.0	12.0	14.5	12.5	0	0	1.5	0	2.25
January	18	0	0.2	20.6	0	10.2	1.8	0	5.4	18.4	0	12.4	0.4	0	2	0	0	0	0	21	6	6	4	7.75	1.75	0.25	6.5	1.5
January	19	0	0.4	3.2	0	2.6	8.6	0	2.6	15.4	3.6	5.4	2.8	0	0.0	0.0	0.0	0.3	0.3	37.0	0.5	2.3	4.0	5.25	1.5	0	3.75	0
January	20	0	0	2.8	5.4	0.4	11.6	0.6	0	10	6	0	0	0	0	8	0	0	0	1	0	0	3	4.5	1.75	0	5	0
January	21	0	0.4	1	10	21.4	10.8	9.4	0	0.4	2.2	2	0	0	0.0	8.8	19.5	0.0	0.0	0.0	7.8	0.5	12.0	0.25	18	0.75	6.5	2.25
January	22	0	1	1.6	0	0	4	27.6	0	42.2	0	18.2	0	0	0	0	5	0	0	1	34	0	12	0	21.25	0	0	0.25
January	23	0	16	0.4	0.4	0	4.4	10	8.6	0.2	0.2	8.8	0	0	0.0	5.0	4.3	0.0	0.0	8.8	2.5	0.0	23.0	31.5	19.5	0.75	0	2
January	24	0	6.2	0	0	1.2	22.8	9.4	0.6	0	0	0	0	0	4	10	1	4	0	14	0	0	1	3.5	3.25	13.25	0.25	2
January	25	0	0.4	0.4	0.8	1	20.4	0.6	0	0	0	0.2	0	0	1	0	20	6	0	4	0	0	4	0.25	3.75	3.5	0	0.25
January	26	0	6.6	2	0	0	3	24.4	3.6	0	18.6	0	1	0	0.0	0.0	21.5	0.3	0.0	0.0	0.0	0.0	6.5	0	3	0.5	0	1.5
January	27	0	4	7.4	0	0	6.2	6.2	4.4	0	3	0	0.2	6	0	0	0	3	0	0	10	0	6	0	12	2	0	0.5
January	28	0	1.2	19.2	0	0	0	0	16.8	0.2	11.2	0	0.4	0	0.0	5.0	0.0	0.0	1.5	0.3	0.5	0.0	3.0	0	8.5	3.25	0.75	0
January	29	0	0	88.2	0	5.8	0	7.4	13.4	0	33.2	0	8.2	0	0.5	6.0	1.5	0.0	1.3	0.0	1.3	2.0	2.8	0	15.25	0	0	0
January	30	0	3.2	2.2	0	5.2	16	2.8	18.6	11.4	10.8	0	4.2	0	6.5	0.0	21.8	0.5	21.3	0.0	8.8	0.0	13.0	0	9.5	0	2.25	0
January	31	0	0	5	1	0	3.6	38	0.4	3.8	1	0	2.8	0	0	0	1	1	2	0	4	0	5	0	6.25	10.25	7.5	4
Total Monthly Rainfall		***2.4***	***200***	***280.8***	***123.2***	***99.4***	***213.2***	***205.8***	***119.8***	***210.2***	***277.4***	***312.8***	***106.8***	***121.6***	***180.5***	***161.75***	***150.75***	***53.75***	***70.25***	***160.75***	***114.5***	***26***	***153.5***	***158.75***	***166.5***	***194.5***	***149.5***	***45.25***
Maximum Daily Rainfall		***2.4***	***22.8***	***88.2***	***19.8***	***30.2***	***44.4***	***38***	***18.6***	***54.4***	***42.4***	***64.4***	***36.6***	***28.6***	***40***	***23.75***	***22.75***	***8.5***	***21.25***	***37***	***34***	***14.5***	***23***	***74***	***23***	***40.5***	***33.75***	***17***

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

Date		Daily Rainfall (mm)																										
		1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
February	1	0	0	28.8	26.4	0	0.8	0.2	6	0	10.2	0	0	1.4	3.0	0.0	4.8	0.5	0.0	1.0	7.5	0.0	14.50	1.0	24.25	22	0	1.5
February	2	0	0	45.4	0.4	9.4	0	0.2	8	0	11	0	0.2	4.6	2	0	5	0	0	3	1	0	5.50	11.3	0.25	7	0	0
February	3	0	0.4	3.2	0	3.2	0.4	0	1.2	1.6	5.6	1.6	0	0	1.0	2.0	0.0	0.0	0.0	3.5	0.3	0.0	1.50	0.0	0	0	2	4.25
February	4	0	0	6.2	0	9.2	0	0	2.2	10.6	32.6	6.6	0.2	0	0.5	9.8	0.0	1.8	0.0	1.0	1.8	14.0	1.3	0.3	13	0.75	3.75	2.5
February	5	0	0	0.6	0	4	2.6	0	0	0	0	0	12.8	0	1	0	0	0	0	4	0	3	0.0	0.0	18.5	0.25	2.25	2
February	6	0	0	17.6	0.4	0.4	11.8	0	6.4	25.4	0	0	14	4.4	0	9	0	10	0	28	0	0	0.8	1.3	17.75	0	0	11.5
February	7	0	0	5.4	0.4	0	8.2	0	0	0	0.2	4	13	0	2.8	0.3	0.0	6.8	0.0	17.3	0.0	0.3	0.3	0.3	18.25	0	0	27.25
February	8	0	1	11.4	5.4	13.4	0.2	0	0	0	0.4	1	1.8	0	0.5	0.0	0.0	0.0	0.0	10.8	0.0	0.0	0.3	0.0	0.25	0	0	0.5
February	9	0	1.6	1.6	1.8	0	0	0	0	0	0	1.4	3.4	0	0	0	6	0	0	5	0	15	0.0	0.0	0	0	1	5.75
February	10	0	0.8	2.2	0	0	0.6	0	0	0	0	0.4	5.8	12.2	0	0	15	0	0	11	0	4	0.0	0.0	0	0	0.5	1.25
February	11	0	0	0	0	0	4	0	0	0	0	1.2	3.4	1.4	3	1	2	0	17	2	4	1	0.0	0.0	0	0	0	0
February	12	0	13.8	0	0	0	0	0	0	0.6	0	0.8	0	0	4	23	1	0	7	0	15	0	0.0	0.0	0	0	0	2
February	13	0	11.8	2.4	0	0	0	0	0	0	5.8	1	0	0	2.0	1.8	4.0	1.0	5.8	5.8	10.5	0.0	1.3	0.0	2.5	0	0	8
February	14	0	0.2	0	0	0	0	0	1	0	0	14.6	0	0	4	12	1	0	2	4	12	5	1.0	0.0	0.25	1.5	0	0
February	15	0	0.6	0	0.6	0.6	0	1.2	3.8	0	0	10.8	3.4	0	1	0	0	9	10	0	8	5	1.0	0.0	4.5	11.75	0.5	0
February	16	0	0	4.8	0.2	10.8	7.8	2.4	2.8	0	0	0.8	0	0	5	7	0	1	18	0	74	0	6.0	10.5	0	11.25	0	2.25
February	17	0	0	12.8	0	0.4	0.6	5.4	3	0	0	2.8	0	0	0	0	7	0	3	0	0	0	20.8	0.5	0	0	0	1.75
February	18	0	0.6	10.6	0	3.4	0	1.6	8	0	0	1.6	0	0	0	0	9	0	13	0	15	0	0.5	0.0	0	5.25	0	0.5
February	19	0	3.2	9.6	0	0	4.8	2.4	0	0	0	22.2	0	0	0	0	28	6	18	0	6	0	0.0	0.0	0	3.25	0	0
February	20	0	0	0	0	0	0.4	10.2	0	0	0	16	2.2	0	0	0	0	0	11	2	1	0	0.0	0.8	0	4	0	1.25
February	21	0	3.2	3.8	1.4	0	65.8	2.4	0	0	0	1.2	0	0	0	1	3	1	3	0	3	0	0.0	0.3	0	19.25	0.5	2.25
February	22	0	3	24.4	1.4	4.4	38.2	0.8	0	0	0	0.6	0	2.4	0	0	2	1	0	0	1	0	2.8	0.0	2.5	1.25	5.25	0
February	23	0	2.6	10.6	4	0	14.4	0.2	0	0	1.2	0	0	1.6	2.3	0.0	0.0	21.3	4.0	0	11	0	3.3	4.5	15.25	5	0	0
February	24	0	0	54.2	0	0	0	0	0	0	0	5.4	0	1.8	10	0	1	0	0	0	0	0	3.5	5.3	0	0	0	0
February	25	0	1.8	1.6	0	0	0	0	4.2	0	0	0	0	13.4	1	0	28	2	4	0	0	0	5.0	3.5	0.25	10	1.25	0
February	26	0	0	0.2	5.8	0	0	0	3.8	0	12	0	0	0	5	0	6	6	16	1	0	0	0.0	0.0	0.25	1	0	9
February	27	0	1	21.6	16.8	0	0	0	1.8	0	0.2	0	1.2	0	3.0	2.5	0.0	1.3	0.0	15.0	0.3	0.0	0.8	0.0	0	0.75	7.25	1
February	28	0	13	7.4	1	0	0	2	0	1	0	0	0	0.6	0	4	2	0	0	20	1	4	0.3	0.0	10.25	0.5	31.75	14.5
February	29	n/a	n/a	n/a	13.6	n/a	n/a	n/a	0.8	n/a	n/a	n/a	1.6	n/a	n/a	n/a	0				3.25				1			
Total Monthly Rainfall		***0***	***58.6***	***286.4***	***79.6***	***59.2***	***160.6***	***29***	***53***	***39.2***	***79.2***	***94***	***63***	***43.8***	***50.25***	***72.5***	***122.5***	***67.3***	***130.0***	***133.0***	***172.8***	***50.0***	***70.0***	***39.3***	***129.0***	***104.8***	***56.0***	***99.0***
Maximum Daily Rainfall		***0***	***13.8***	***54.2***	***26.4***	***13.4***	***65.8***	***10.2***	***8***	***25.4***	***32.6***	***22.2***	***14***	***13.4***	***9.75***	***22.5***	***27.5***	***21.25***	***18.25***	***27.75***	***74***	***14.75***	***20.75***	***11.25***	***24.25***	***22***	***31.75***	***27.25***

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

Date		Daily Rainfall (mm)																										
		1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
March	1	0	11.8	9.8	0.4	6.6	0	0	0	6.6	0	0	2.8	0	0	4.25	5.00	18.00	0.00	0.00	3.00	1.75	0.25	0.00	0.75	0.25	23.25	0.25
March	2	0	1	3.6	2.6	11.2	0	1.2	0	0.2	0	5.4	1.6	0.2	2	6.5	0.0	3.3	0.0	4.0	22.5	7.0	14.0	0.0	5.75	0	5.75	10
March	3	0	2	32	6.2	2.2	0	1.4	2.2	0	0	2.4	4.6	0	0	1.75	5.75	6.25	13.00	0.25	5.50	11.75	0.75	0.00	0	0	5	3.5
March	4	2.2	0	9	5.8	0	0	0	0.2	0	0	0.2	0.2	0	0	7.25	0.00	0.00	4.00	0.00	7.50	0.00	0.00	0.00	0.75	2.5	0	3.5
March	5	0.8	0	0	0	0	0	0.4	11	0	0	1.2	0	0	0	5.5	4.8	0.0	14.0	0.0	0.0	4.0	0.0	0.0	1.25	0	0	0.25
March	6	0	0	0	0	0	0	0.4	0	0	2.2	0	0	0	0	0.25	12.25	3.75	2.5	0	0	1.75	0	0	0	0.75	0	0.25
March	7	0.2	0	0	0	0	0.2	4.8	43.8	0.6	0.4	2.8	2.2	0	1.5	0	0	6.5	14.75	0	7.75	10.25	0	0	0	2.75	0	0
March	8	0	2.6	0	0	5.2	2.8	0.8	0	1.6	15.8	8.8	0	1	0	0	0	1.5	0	0	11.75	7.75	5.25	0.25	0	0	0	0
March	9	8.8	8.2	0	1	2.8	1.2	20.4	0.2	3.4	5.4	1.6	4.4	0	0.25	7	0	0	2.5	0	1.75	11.75	0.25	0	0	0	1	0
March	10	0	5.8	0.6	0.2	0	3.4	3	0	0	0.8	12	0	0	2.25	15.75	15.5	0	0	0	6.25	0.25	0	0	0.75	0	0	1.25
March	11	0	0.4	0	4.6	0	44.8	13.6	0	0	3.8	65.8	0	0	11	2.75	5.5	0.25	2.75	0.25	38.5	7.5	0	0	0	0	1	0.75
March	12	0	1.2	2	0.6	0	18	17.4	0	0	0	3.4	0	0	13.25	1	0.75	6.25	0	3	1.5	2.25	0	9.5	0.5	0	1.75	15.25
March	13	0	2.8	3.6	1.8	3	16.6	17.6	0	0	0	1.2	0	0	1	1	7.25	2.5	0	0.75	0.25	9	2	1.25	0.25	0	0.25	3.25
March	14	0.6	0	7	14.4	0.2	0	6.8	0	0	0.4	3.2	10	0	5.75	2.75	0.75	13.25	3	1	8.5	11.25	0.25	0	0	0.25	0.25	0.5
March	15	0	0.6	0.4	0	4.6	1.6	0	0	0	0	6.4	24	0	2.5	19.25	3.5	9.5	6.25	16	2.5	1.75	0	1	0	0	20.5	0
March	16	0	0	8	3	0.6	15	0	0	4.6	1	6	15	0	1.5	8	19	2.5	22.25	36.25	0	2.5	0	0.25	0	0	4.5	0
March	17	0	0	0	5.8	0	0	1.2	0	1	0.8	9.8	3.8	2.2	0.25	4	1.75	0	0.75	0	0	13.75	2.75	0	0	0	0.5	0
March	18	1	0	0	4	5.4	8.6	0.8	6.6	0	0	0	2	0	0	0.25	1.25	0	0	0.75	0	9	0	0	0	0	19.5	0
March	19	0	0	0.6	5.2	7.2	2.2	3	15.8	11	0	6	4.6	0	0	1.25	0.25	8.5	0.75	0	0	0	0	0	0	1	0.75	0
March	20	0	0	0	1	0.8	13.4	0	0	4	0	1.4	2.2	0	0	0.5	0	3.25	1.25	17.25	0	0.25	0	0	0	0.5	0.75	4.75
March	21	0.2	2.2	4.6	0	0	1.6	8.6	0	0.4	0	0.4	0	0	0.75	0	15	5.75	0	7.25	2.25	2.75	0.5	0	0	8.75	4.75	0.25
March	22	0	7	0	7.6	0	0	27.4	0	0	1.4	4.4	0	0	0	4.75	0.25	0	0	13	1.25	0.75	2.5	0	0	0.75	9	0
March	23	0	8.8	1	0	0	0	6.2	0.2	0	0	9.6	0.8	0	0	0.25	0	0	1	0.5	0	1.5	0	0	0	0	5	0.5
March	24	0.8	3.4	0	0	0	0	1	7.8	0	2.6	8.4	0	0	0	0	0	0	0	1.5	4.5	2	0.25	0	1.25	8.25	0.25	19.5
March	25	0	1.4	0	0	8.4	0	0.4	2.4	0	0	0	0.2	0	5.25	0.5	0	0	0	0.5	1.5	1.25	0	0	0	0.75	0	1.5
March	26	1.6	0.4	15.2	0	5	2.2	6.4	1.6	34.8	1	0	0	0	0.5	1.5	0	0	8	6.75	0	2	3.25	2	0.75	0	0	0.5
March	27	7.6	0	0	0.2	5.6	0.6	3.6	0.2	4	0	0	0.6	0	0	0	1.75	0	2.75	0	3.25	1.75	0.25	0.5	5	0	4.5	0
March	28	0	4	0.4	0	7.6	3.6	0.4	0	4.4	0.6	0	4.6	0	2.75	0	0	0	0.5	1.25	7	20.75	0	0	9.25	14.75	0.75	0
March	29	0.2	0	5.4	0	1.8	0	0	0	3.8	0	0	0	0.2	40	0	2	0	7	0.25	0	11.75	0.75	0	1.25	0	7	0
March	30	0	3	6.8	0	0.8	0	0.6	2.2	0	0.4	0.4	0.6	0	1	2	16.5	0	5	11.75	0	0	0	0	12	0	0	0
March	31	0.6	6.2	0	0	2	0	2.2	2.8	5.6	0	1.4	15	0	0	10.25	10.75	0	0.5	0.25	0	0	0	0	0.25	0	0.5	4.25
Total Monthly Rainfall		***24.6***	***72.8***	***110***	***64.4***	***81***	***135.8***	***149.6***	***97***	***86***	***36.6***	***162.2***	***99.2***	***3.6***	***92***	***108***	***130***	***91***	***113***	***123***	***137***	***158***	***33***	***15***	***40***	***41***	***117***	***70***
Maximum Daily Rainfall		***8.8***	***11.8***	***32***	***14.4***	***11.2***	***44.8***	***27.4***	***43.8***	***34.8***	***15.8***	***65.8***	***24***	***2.2***	***40***	***19.25***	***19***	***18***	***22.25***	***36.25***	***38.5***	***20.75***	***14***	***9.5***	***12***	***14.75***	***23.25***	***19.5***

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

Date		Daily Rainfall (mm)																									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
April	1	9	0	0	0	1.2	0	0	0	7.6	13.4	0.4	0	18.6	0	4.25	2.25	0.00	0.00	0.25	0.00	4.50	0.0	0	4.75	0.00	0.25	
April	2	0	0	1.4	0	0	0	0	0	0.6	0	0	0	18.2	16	16	3	0	0	1	0	0	0.0	0.5	0	0	0	
April	3	0	0	1.2	0	0	0	0.4	0	2.2	5.6	0	0	0	3.5	16.5	0.0	0.0	0.0	1.0	4.8	0.0	0.0	3.5	0.8	0.0	18.3	
April	4	0	0	0	0	0	0	4.6	0	0	0	0	5	0	0	0.25	1.00	0.00	0.50	0.00	0.25	4.00	0.0	0	0.00	0.00	30.00	
April	5	0	0	0	0	3	0	0	0	9.2	0	0.2	0	0	0	15	0	11	0	0	1	12	18.8	1	0	0	3	
April	6	0	0	0	3.4	2.4	0	1.8	0	1.6	0	0	0.4	0	0.5	10.75	0.75	2.50	3.50	0.00	0.00	3.00	17.8	2	0.00	0.00	0.00	
April	7	0	0	2.2	0	6.4	2	3.8	0	4.6	0	4.6	4.6	0	8	2.75	6.75	3.75	0.00	0.00	0.00	10.50	1.3	0	0.00	0.00	0.00	
April	8	0	0.6	0.6	0	0	0	2.6	0	0	3.6	6	1.4	0	5.75	0	0	12	0	0	0	3	11.8	11.5	0	5	2	
April	9	0	0	0.2	0	0	2.4	1.8	0	0	5.6	2	0	n/a	0.5	0	0	0	12	0	0	0	3.0	3.5	0	0	2	
April	10	0	1.6	0	0	4	1	0	0	0.4	4.2	1.2	0	0	0	0	0	1	0	0	0	1	0.0	2	0	9	26	
April	11	0	1	0	0	0	0	0	0	1	0	0	0	0	0	4.5	0.0	14.8	0.0	4.5	0.0	0.0	0.5	8	0.0	0.5	0.5	
April	12	0	0.8	0.4	0	1.2	0.2	1	0	0.4	0.2	0	0	17.4	0	0.75	4.50	0.25	0.00	8.50	4.25	20.50	1.0	0.25	0.00	0.00	2.50	
April	13	0	0	0	1.6	0.6	11.2	13.6	0	0.6	4.8	1.4	0.2	3.6	0	1.75	2.25	5.50	0.00	0.25	0.00	6.25	0.5	6.75	0.00	0.00	0.50	
April	14	0	0	0	0.8	0	32	0.2	0	0	8.6	0.4	10.8	31.4	0	1.25	0.00	6.50	0.00	1.00	2.50	0.00	24.5	0	0.00	0.00	0.00	
April	15	0	0	0	0.4	0	9	0.8	2.2	8	0.4	0	0	n/a	0.5	7.5	0.0	0.8	0.0	1.5	0.0	10.0	3.5	0	0.0	0.0	0.0	
April	16	0.8	0	0	0	0	3.2	0.8	0	5	0	3.4	0	0	0	1.25	0.00	3.00	4.25	0.00	0.00	0.00	1.3	0	0.00	0.00	0.00	
April	17	1.2	0	0	0	12.2	0.6	0.6	0	0.2	2.4	0.8	0	4.4	3.25	0	9	1	7	0	0	1	12.3	0	0	0	0	
April	18	3.2	0.6	0	0	2.2	0	0.2	0	1.6	0.2	1	6.6	0	0	0	1	0	11	0	0	1	0.5	11.25	0	0	1	
April	19	2.8	0	4.4	0	0	0	2.8	0	0	0	0	22.6	0	3	0	1	1	0	0	0	0	0.0	0.75	0	0	1	
April	20	21.8	0	2.4	0	0	0	0	0	0	0.4	0	0	0	11.25	1.25	12.25	6.50	2.00	0.00	0.00	0.50	0.0	0	0.00	0.00	1.75	
April	21	0	1	0	0	0	0.2	1.4	0	0	1.2	0	8	0	0.5	1.5	0.3	0.8	1.0	0.0	0.0	0.0	3.8	0	0.0	0.0	1.3	
April	22	0	0	4.4	4.4	3	0	0	0	0	0	0.8	0	1	0	0	0	0	3	0	0	3	1.5	3.25	17	0	3	
April	23	4	0	0	1	3.6	0	1	0	0	0	0	1.4	0	7.25	0	0	0	2	0	1	1	0.0	0	0	0	0	
April	24	1.6	0.2	0	0	0	0	7.6	0	0.6	0	3.8	0	0	3.75	0	0	0	7	2	0	0	0.0	0	0	0	3	
April	25	0.8	0	0	0	0	0	0	0	0	0	0.8	0	0	0	2	5	0	11	12	0	0	0.0	0	3	13	4	
April	26	0.6	0	1.2	0	0	9.4	0	0	0	0	2.6	0	0	0	8.25	3.25	0.00	0.25	0.75	0.00	0.25	0.0	0	4.50	10.00	1.00	
April	27	1	0	0	0.4	0	0.6	1.2	2.2	0	0	11.4	3	0	1	0	0	0	1	0	0	5	0.0	0	1	1	6	
April	28	4.2	0	0	0	2	0	0	0.4	0	0	0	6.4	0	2.25	10.75	0.00	0.00	2.25	2.25	0.00	0.00	0.0	0	1.25	0.00	0.00	
April	29	1.8	0	0	0.2	1.4	0	0	0	0	5	0	0	0	0	3.5	0.0	0.8	0.0	0.5	0.0	4.8	6.0	0	0.8	0.0	0.8	
April	30	2	0	0	0.2	4.4	0	0	0	0	0	0	0	0	0.75	0	2	1	0	0	0	0	0.3	0	0	0	12	
Total Monthly Rainfall		***54.8***	***5.8***	***18.4***	***12.4***	***47.6***	***71.8***	***46.2***	***4.8***	***43.6***	***55.6***	***40.8***	***70.4***	***94.6***	***67.75***	***109.75***	***53.5***	***70.5***	***66***	***35***	***14***	***90.75***	***108***	***54.25***	***32.75***	***37.25***	***118***	
Maximum Daily Rainfall		***21.8***	***1.6***	***4.4***	***4.4***	***12.2***	***32***	***13.6***	***2.2***	***9.2***	***13.4***	***11.4***	***22.6***	***31.4***	***16***	***16.5***	***12.25***	***14.75***	***11.75***	***11.50***	***4.75***	***20.50***	***24.50***	***11.50***	***16.75***	***12.75***	***30***	

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

Date		Daily Rainfall (mm)																										
		1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
May	1	0.8	0	0.4	2.2	3.6	0	0	0	0	0	0	0	0	0.75	0	4.25	0	0	0	0	2.5	1.5	0	0	3.25	0	
May	2	0	0	5.2	0	0	0	0	0.2	2	0	2.8	0.4	4	15.75	0	0.75	0	0	0	0	2	0	0	1.75	0	1.5	
May	3	0	0	0.2	2	0	0	1.4	1	0	0	2.2	2.8	0	8.25	9.75	0	0	0	0	0.75	2	0	0	2	0	0.25	
May	4	0.6	0	2	3	2.2	0	11.4	0.6	0.4	0	0.2	0	3.2	6.75	0	10.75	0	1.75	0	0.25	0	0	0	0	1.5	1	
May	5	15.8	0	0	2	4	1	4.4	0.6	0	0	0.2	0	8.6	0	0	0	0	15	0	0	0	0	0	0	0	9.25	
May	6	3.6	0	0	1.6	1	0	0	0	0	0.8	1	0	11.8	2.75	2	0	0	5	3.5	0	0.25	0	0	0	0	0	
May	7	0	0	0.4	0	0	0	0	1	0	3.6	0	0	0	0	4.75	0	0	0	0	0	0	0	0	0	0	0	
May	8	0	0	3.4	1.6	0	0	0	0.2	0.8	0	0	0	0	0	1.5	0	0	0	0	0	0	0	0	0	0.25	1.25	
May	9	0	0	1.4	0	0	0	0	0	0.8	0	0	0	0	0	0	0	0	9.5	0	0	0	0	0	0	0	0.25	
May	10	0	0	0.4	11	0	0	0	1	0	0	0	0.2	3.6	2.25	0	0	0	0	0	0	0	0.75	0	0	0.5	0	
May	11	0	0.2	1.4	0.4	0	0	0	0.6	0	0	0	0.2	2.8	0	0.5	0	0	0	0	0	10.25	8.25	0	1.75	0	0	
May	12	0	0.8	0	0	0	0	0	0	0	0	0	0	0.4	0	5.75	0	2.5	0	0	0	1.25	0	0	7.25	0	3	
May	13	0	0	0.4	0	0	1	0	0	0.2	0	0	5.2	10.2	0	0	0	5.5	0	0	0	6.75	0	0	5.75	0	0	
May	14	0	3.6	0.2	0	6	0.2	1.4	0	0.2	0	0	0.2	9	0	0	0	3.25	0	0	0	0	0	4.75	0	0	2.5	
May	15	0	1	0	0	1	0	0.2	0	0.8	0	0	0	0	0	9.75	0	0	0	0.5	0	8.25	0	1.75	0	0	14.25	
May	16	0	0	0.2	0	5.2	0	0	0	0.2	0	0	0	0	0	20.75	0	1.75	0	0	0	2.75	0	0	10	0	1	
May	17	0	0	9.4	0	0	6.2	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.75	0	0	
May	18	0	0	1.8	0	0	0	0	0	0.4	0	0	0	7.8	4.5	0	0	3	0	0	0	0	0	0	0	3.5	5	
May	19	0	0	0	7.2	0	0	2.4	0	1.6	0	1.6	1.8	0	1.5	0	0	1	0	0	0	0	0	0	0	0	0	
May	20	0	0	0	0	0	1.8	0.6	0	0	0	10.4	0.2	0	7.25	0	0	0	0	0	0.75	0	0	9.75	0	0	0	
May	21	3	0.6	0	4.4	0	0.4	0.4	0	0.4	2.6	0	4.6	n/a	0	0	0.5	4.75	0	0	0	0	0	1.25	8	0	0	
May	22	1	0	0	0	0	0	2	9.4	0.4	17.4	0	0	0	1	1.5	5.75	6.75	0	0	0	0	0	0	0	0	0	
May	23	3.6	0	0	0	0	0	1	1.2	0.4	0	0	0	0	0	0.25	0	8	0	0	0.25	0	0	0	0	0	0	
May	24	0	0.4	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	1.25	3.25	0	0	0	0	0	0	0	0	
May	25	0	6.8	0	0	0	2.6	0	1.2	0	3	0	0	0	1.5	0	1.25	0	0	0	0	0	0	13.5	7.75	4.75	0.5	
May	26	0	1.8	0	9.6	0	2.4	0	0.6	0	6.2	0	0.2	1.2	7	2.25	0	0.25	2	0	0	0	0	0.25	0	4	6.25	
May	27	0.4	22.8	0	7.2	0	0	0.2	9	0	0.4	0	0	0	0	0	0	3.5	0.75	0	0	0	0	0	0	0	3.5	
May	28	4.8	2.4	0	0.8	3.2	2.4	0	3.2	0	0	0	0	n/a	6.25	2.5	0	5.25	3	0	9.75	0	0	0	0	4.25	0.5	
May	29	6	0	0	0	0	1.4	0	7.6	0	0	0	0	0	0.75	0.5	0.25	1.5	0	0	0	0	0	0	0	0	0	
May	30	5.2	0	0	6.2	1.2	0	0	1	0	0	0	0	0	3.75	0	0	4.25	0	0	0	5	0	0	2.5	0	0.25	
May	31	14	0	0	0.8	0	0	0	0	0.4	0	0	0	0	6.5	0	8.5	1	0	0	0	0.25	0	0	0	0	0	
Total Monthly Rainfall		***58.8***	***40.4***	***26.8***	***60***	***27.4***	***19.4***	***25.4***	***38.4***	***9.2***	***34.2***	***18.4***	***15.8***	***62.6***	***76.5***	***61.75***	***32***	***53.5***	***40.25***	***4***	***11.75***	***41.25***	***10.5***	***31.25***	***47.5***	***22***	***50.25***	
Maximum Daily Rainfall		***15.8***	***22.8***	***9.4***	***11***	***6***	***6.2***	***11.4***	***9.4***	***2***	***17.4***	***10.4***	***5.2***	***11.8***	***15.75***	***20.75***	***10.75***	***8***	***15***	***3.5***	***9.75***	***10.25***	***8.25***	***13.5***	***10***	***4.75***	***14.25***	

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

Date		Daily Rainfall (mm)																										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
June	1	0.2	0	0.6	0	8.4	0	0	0	0.4	5.4	0	0	0	0	0	1.75	0.5	0	0	7.5	0	0	0	0	0	0	
June	2	0.4	0	0	0	2.8	0	0	0	0	0.6	0	0.4	0	0	0	5.25	0.25	0	0.25	0.25	0.75	0.25	0	0.75	0	0	
June	3	8.2	0	0	0	0.8	0	0	0	0	0	1.4	4.4	0	0	1	0	0	0	0.25	0	0	0.25	0	0	0	4.5	
June	4	0.4	0	0	0	0	0	0	0	0	0	1.4	0.4	0	0	0	0	0	0	0	0	0	0	0	0.75	0	6	
June	5	0	0	4	1.6	0	2.4	0	4.8	0	0	0.8	2.8	0	0	0	0	0	0	0	0	0	0	0.25	0	1	0.25	
June	6	0	0	0.4	3.6	0.6	0	0	1	0	0	0.8	5.8	0	0	0	0	0	0	0	0	0	0	0.25	3.75	1	0	
June	7	0.6	0	1.6	0.4	0	0	0	0.2	0	6.2	0	0	0	0	0	0	0	0	0	0	0	0	1.75	0.25	0.5	0.25	
June	8	0	0	0.6	0	0	0	0	0	0.4	16.8	0	0	0	0	0	15	0.25	0	0	0	11.25	0	0	0	4	0	
June	9	0	0	0	0	10	0	0	5	0	0	9	10.2	0	0	0	0.25	0	0	0	0	0	8	0	22.5	0	24.75	
June	10	0	10.8	0	2.4	1.4	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	5.5	0.5	0	0.75	1	0.25	
June	11	3	0	0	2.6	1.4	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	
June	12	0.2	0	0	15.8	1.2	0	0	0.4	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	8.75	2.25	1	
June	13	0	0	0.2	0	0	0	0.6	8.4	0.2	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0.25	1.25	0.25	
June	14	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	1.5	1	0	3	0	2	0	0	3.75	0	
June	15	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	4.25	14	0	0	3.75	0	0.5	
June	16	1.2	3.6	2.4	0	0	0	0	0	0.2	0.8	0	0	0	0	1	0	0	0	0	11.75	0	0	0	0.25	11.5	7.25	
June	17	13.4	0	0	0	0.4	2.6	0	0	0	0.6	0	0	1.4	0.35	0	1	0	6.25	0	0	0.25	0	0	0	0	0.25	
June	18	0	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	0	1	0	0	0.25	2.25	0	0	0	0	1.25	
June	19	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	2.25	1.75	0.25	0	2.75	0	0	0	0	0.5	0	0	
June	20	0.4	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	3.25	0	0.25	0	0	0	0	1	0	0	
June	21	11.8	0	1.6	0	0	0	0	0	0.4	0	5.8	0	1.4	0.35	0	0	2.5	0	0	0	0	0	0	0	0	0	
June	22	0	0	0.2	0	0	0	0	0	0	0	1.4	0	0	0	0	0	0	0	0	8.5	0	0	0	0	0	0	
June	23	2.2	0	6.2	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	4.75	0	0	0	0	0	0	
June	24	0	7.8	7.6	0	0	0	0	0	0	0	3.2	0	2.8	0.7	0	4.25	1.25	0.75	0	1.25	0	0	0	0	0	0	
June	25	0.8	0	0.4	0	0	0	0	0.4	0	0	0	0	0.2	0.05	3	0	2	0	0	0	0	7.75	0	0	0	0	
June	26	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
June	27	0.6	0	0	0	0.8	1	0	0	0	0	0	0	1.4	0.35	0	0	1.5	0	0	0	0	0	16.75	1.75	0	0	
June	28	0	0	7.4	0	0.2	6.6	0	0	0	0	4	0	0	0	0.25	0	3	2	0	0	0	0	0	0.25	0	0	
June	29	27.4	0	0	0	0	5	0	0	0	0	4.4	0	0	0	0	2.5	0	1.75	0	0	0	0	0	0	0	0	
June	30	0	0	3.6	0.8	0	0	1.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	
Total Monthly Rainfall		***73.8***	***23.2***	***37***	***27.6***	***28***	***18***	***2***	***20.2***	***1.6***	***30.4***	***34.4***	***24.2***	***7.2***	***1.8***	***7.5***	***44.75***	***30.25***	***12***	***3.5***	***41.5***	***34***	***19.25***	***19***	***45.25***	***26.25***	***46.5***	
Maximum Daily Rainfall		***27.4***	***10.8***	***7.6***	***15.8***	***10***	***6.6***	***1.4***	***8.4***	***0.4***	***16.8***	***9***	***10.2***	***2.8***	***0.7***	***3***	***15***	***12***	***6.25***	***2.75***	***11.75***	***14***	***8***	***16.75***	***22.5***	***11.5***	***24.75***	

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

Date		Daily Rainfall (mm)																										
		1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
July	1	0	0	0	0	0	0	1.2	0	0	0	0	0	0	0	0	3	0	0	0	0.5	0	3	0	0	0	0	
July	2	0	0	3.2	0.2	0	0	0	3.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.25	0	0	0	
July	3	0	20.6	3.2	1.8	0	0	0	0	0	0	0	2.2	0	0	0.25	5.5	0	0	0	0	0	0	0	7	0	16.5	
July	4	0	1.8	0	0	0	0	0	0	0	0	0	0	0	0	0	4.25	0	0	0	0	0	0	0	0	0	1.75	
July	5	2.4	0	0	1	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0.25	0	0.25	0	0	0	0	0	0.25	
July	6	4.8	0	0	0	0	0	0	3.4	0.4	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
July	7	0	0	0	0	0	0	0	0	0	0	0	0	1.6	0.4	0	0	0	1	0	3.5	0	0	1.75	0	0	2.25	
July	8	23	0	0	0	0	7.4	0	0	0.6	0	0	0	6	1.5	0	0	0	0	0	0.75	0	0	0	0.25	0	0	
July	9	2.4	0	0	0	0	0	0	21	0	0	0	0	0	0	0	0	0	0	0	11.5	0	0	4	3	0	0	
July	10	0	0	0	0	0	0	0	0.8	0	1.8	0	0	0	0	0	0	0	0	0	0	0	0.25	5.25	0	0	0	
July	11	0	0	0	0	0	0	0	2.6	0.2	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0.5	0	0	0	
July	12	0	0.2	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	
July	13	0	0	0	0	n/a	0	3	0	0	0	0	0	0	0	2.25	0	0	0	0	0	0	0	0	0	0	0	
July	14	0	1.8	0.6	0	n/a	0	4.2	0	0	0	0	0	0	0	0.25	1.25	0	0	0	0	0	0	0	0	0	0	
July	15	0	9.2	0	0	n/a	0	0	0	0	0	0	0	0	0	9.75	0	0	0	0	0	0	0	0	0	0	0.25	
July	16	0	0	0.8	0	n/a	0	0	0	0	0	0	0	0	0	0.75	3	0	0	0	0	0	0	0	0	0	0	
July	17	0	0	0.6	0	n/a	0	0	0	0	0	5.6	0	0	0	12.75	0	0	0	0	0	0	0	2.5	0	0	0.25	
July	18	0	0	0	0	0	0	0	0	0	0	14.45	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0.25	
July	19	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
July	20	0	0	0	0	0	0	0.4	0	0	0	3.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
July	21	2.4	0	0	0	0	0	0	0	0	0	9.2	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	
July	22	0	0	0	0	0	0	0	0	0	0	7.8	0	0	0	0	0	0	0	0	1.5	0	0	0	0	0	0	
July	23	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
July	24	0	0	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.25	0	0	0	0	0	0	0	0	
July	25	0	0	0	0	0	0	0	0	0	0	0	0	3	0.75	0	0	0	3	7.75	0	0	0	0	0	0	0	
July	26	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
July	27	0	0	0	3.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9.5	0	0	0	0	0	0	0	
July	28	0	0	0	10.2	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	
July	29	0	0	0.4	0	0	0	0	0	0	0	0	3.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
July	30	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
July	31	0	0.8	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Monthly Rainfall		***35***	***34.4***	***9.6***	***16.6***	***10***	***7.4***	***11.8***	***31***	***1.2***	***2***	***41.65***	***7***	***10.6***	***2.65***	***26.25***	***21***	***0***	***6.5***	***17.5***	***18.5***	***0***	***3.25***	***22.25***	***10.25***	***0***	***21.5***	
Maximum Daily Rainfall		***23***	***20.6***	***3.2***	***10.2***	***10***	***7.4***	***4.2***	***21***	***0.6***	***1.8***	***14.45***	***3.8***	***6***	***1.5***	***12.75***	***5.5***	***0***	***3***	***9.5***	***11.5***	***0***	***3***	***8.25***	***7***	***0***	***16.5***	

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

Date		Daily Rainfall (mm)																									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
August	1	0	0	0	0	0	0	0	0	0	0	0	1.6	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	
August	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.25	0	0	0	
August	3	0	0	0.2	0	13.6	0	0	0.4	0	0	0	0	0	0	0	0	2.75	0	0	0	0	0	0	1.25	0	0	
August	4	0	0	0.2	0	5.4	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
August	5	0	0	7.8	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
August	6	5.4	0	0	0	2.4	0	0	25.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.5	0	0	
August	7	0	0	0	0	0	0	0	0.2	0	0	0	0	0	12.25	0	0	0	0	0	0	0	0	0	2.25	1.25	0.31	
August	8	0	0	0	0	0	0	0.6	0	0	0	0	0	0	0.25	0	2	0	0	0	0	0	0	0	0.25	4.75	1.19	
August	9	0	0	0	0	0	0	0	0	0	0	0	4.4	2	1.25	0	0.25	0	0	1	0	0	0	0	0	0	0	
August	10	0	0	0	0	0	0	0	0	0	0.8	0	0	12	0	0	0	0	0	0	0.5	0	0	0.75	0	0	0	
August	11	0	0	0	0	0	0	0	0	0	0.2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
August	12	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	1.75	0.5	0	0	0	0	
August	13	0	0	0.2	0	0	0	0	0	0	0	0	0	7.2	0	0	0	0	0	0	0	1.5	0	0	0	0	0	
August	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10.75	0	0	0	0	0	0	0	0	
August	15	0	0	8.2	0	0	0	0	0	0	0	1.4	0	0	0	0	0	0	1.75	0	0	0	0	0	0	0	0	
August	16	0	5.4	3.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	1	0	0	
August	17	0	0	0	0	0	0.8	0	0	2.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
August	18	0	0.2	0	3.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
August	19	0	0	0	0	0	0	0	0	0	0	12.2	5.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
August	20	0.2	0	0	0	0	0	0	0	0	0	0.8	4.8	0	0	0	0	0	0	0	0	0	0	0	4.75	0	0	
August	21	5.4	0	0	0	2.2	0	0	11.2	0	0	7.6	0.4	0	0	0	0	0	0	0	0	0	0	4.75	2.5	0	0	
August	22	0	0	0	0	11.2	0	0	3.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
August	23	0.2	0	0	0	6.4	0	0	0	0	0	0	0	0	0	16.5	0	0	0	0	0	0	0	2.25	0	0	0	
August	24	0.2	0	0	0	1.8	0	0	30	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0.25	0.25	0	0	
August	25	3.4	0	0	0	0	0	0	31.6	0	0	0	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
August	26	5	0	0	0	0	0	0	0.8	0	0	0	4.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
August	27	7.2	0	0	0	0	0	0	2.6	0	0	0	5.2	0	0.5	0	0	0	0	0	0	0	0	0	0	1.75	0.44	
August	28	0	0	0	0	0	0	0	0	0	2.4	0	1.2	0	0	0	0	0	0	0.25	0.5	0	0	0	0	0	0	
August	29	0	0	3.8	4.8	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	6.25	0	0	0	0	0	0	0	
August	30	0	0	0	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.75	0	0	0	0	1	0	0	
August	31	0	0	0	0	0	0	0	0	0	0	1.2	0	0	12	0	0	0	0	1.25	1.75	0	0	0	0	0	0	
Total Monthly Rainfall		***27***	***5.6***	***24.4***	***9.6***	***43.2***	***0.8***	***0.6***	***106.2***	***2.8***	***3.4***	***23.2***	***43.6***	***22.2***	***26.25***	***16.5***	***2.25***	***3***	***12.75***	***15.5***	***2.75***	***3.25***	***0.5***	***12.75***	***18.75***	***7.75***	***1.94***	
Maximum Daily Rainfall		***27***	***5.4***	***8.2***	***4.8***	***13.6***	***0.8***	***0.6***	***31.6***	***2.4***	***2.4***	***12.2***	***15***	***12***	***12.25***	***16.5***	***2***	***2.75***	***10.75***	***6.75***	***1.75***	***1.75***	***0.5***	***4.75***	***5.5***	***4.75***	***1.19***	

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

Date		Daily Rainfall (mm)																									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
September	1	0	0	0	0	5.2	0	0	2	0	0	0	0	0	0	0	0	0	0	8.5	3.5	0	0	0	0	0.25	0	
September	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	11.25	0	0	0	0	0	0	
September	3	0	0	0	0	1.6	0	0	0	0	0	5.6	0	1.6	0	0	0	0	19	12.25	0	0	0	0	0	0	0	
September	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.5	0	0	0	0	0	0	1	
September	5	0.4	0	2	0.2	0	0	0	0	0	0	0	0	1.4	0	0	0	0	0	0	2.5	0	0	0	0	5.25	0	
September	6	0	0	0.4	0	0	0	1.2	0	0	0	0	0	13.8	10.25	0	0	0	0	4.5	2	0	0	0	0	0.25	0	
September	7	0	0	0	0.4	0	0	7.6	0	0	0	0	0	5.4	7	0	0	0	0	15.25	2.5	0	0	0	0	0	0	
September	8	0	1.2	0	6	0	0	0	2.2	0	0	0	0	0	2.5	0	0	0	0	0	0	0.5	6	0	0	0	0	
September	9	0	0	0	0	0	0	0	0	0	11.6	0	0	12.2	0.25	0	0	0	0	0	0	7.75	1.5	1	0	0.75	0	
September	10	0	0	0	0	0	0	1.6	0	0	0	0	0	0	0.25	0	0.5	0	1	0	0	0	8	0	0	0	0	
September	11	0	0	0	0	0	0	0.8	21.4	0	0	0	0	0	1.25	0	0	0	0	0	0	0	0	0	0	0	0	
September	12	0.2	0	0	0	0	0	0	0.2	0	0	0	0	0	14.25	0	0	3.75	0	0	0	0	2.5	2.5	0	6.75	0	
September	13	0	0	0	0	0	0	0	11.4	0	0.6	0	0	0	8	0	0	0	0	0	0	0	0.5	0	0	0.5	0	
September	14	6.4	0	0	0	0	0	0.8	0.8	0	0.6	0	0	0	0.25	0	0	0	0	0	0	0	0	8.25	4.75	0	0	
September	15	3	0	0	0	0	0	0	17.2	0	0.2	0	0	0	1.25	0	0	0	0	3	0	0	0	13.5	2	3.5	0	
September	16	9.6	0	0	0	0	0	10	2.2	0	0	5.2	0	5.4	2.75	0	0	3	0	0	0	0	4.5	0.75	0.25	0	0	
September	17	9.6	0	0	0	0	0	0	6.8	0	3.2	0	0	0	13.25	0	0	0	0	1.25	13.25	1	4	20.75	0	0	0	
September	18	5.4	0.2	0	0	0	n/a	8	5.8	0	4.4	2.4	0	0	18	0.25	0	0	0.25	1.25	0	1.25	0	1.25	0	43.5	0	
September	19	0	0	0	0	0	n/a	4.6	7.6	0	1.2	0	0	6.2	10.75	2.25	0	0	0.75	0.25	5	2.75	0	0.5	0	8.5	0	
September	20	0	0	0	3.2	0	n/a	0	0	0	10	1	0.2	0	0.5	0	0	0	0	0.75	0	0.25	0	0	0	5.75	0	
September	21	0	0	0	0	5.8	n/a	0	0	0	0	0.6	0	0	0	0	0	8.75	0	4.5	0	0	5.25	0	2.25	0	0	
September	22	0	0	0	0	0	n/a	0	1.4	0	0	0.6	0	0	0	1.75	0	0.25	0	0	0	0	6.25	6.25	0	0	0	
September	23	0	0	0.4	0	0	n/a	0	4.2	0	0	0	0	0	10.5	11.5	0	12.5	0	0	2	0	2	12.5	27.5	0	0	
September	24	0	0	0	0	0	n/a	0	0	0	0	1	11.6	0	1.5	0	0	3.5	12.5	0	0.5	0	0	0.25	20	0	0	
September	25	0	2.2	6.2	0	0	n/a	0	0	0	0	0.4	8.4	0	7.75	0	0	9.25	3	4.5	0.25	3.25	0	0	26	0	0	
September	26	23	0	0.8	0	14.6	n/a	0	0	0	0	0	1.2	0	17.5	3	0	4.75	1.25	2.75	0	0	0	0.5	11.5	0	0	
September	27	12.4	0	0	0	0	n/a	0	0	0	0	0	0	0	6	24	0	0	12	0.25	0	0	0	12	0	36	0	
September	28	8.6	0	0	0	0.6	n/a	0	0	0	0	0.6	0	0.8	0	1	0	6.5	0	0	0	0	0	0.25	0	4.25	0.25	
September	29	0	0	0	15.6	0.8	n/a	0	0	0.4	0	1	0	8	0	0	0	4.75	0	0	0	1	0	0	0	3	0	
September	30	11	0	0	1.4	0	n/a	0	0	0	0	8.8	0	0	0	0	0	3.25	1.5	0	0	1.5	0	0	0	5.5	0	
Total Monthly Rainfall		***89.6***	***3.6***	***9.8***	***26.8***	***28.6***	***0***	***34.6***	***83.2***	***0.4***	***31.8***	***27.2***	***21.4***	***54.8***	***133.75***	***43.75***	***0.5***	***60.25***	***51.25***	***76.5***	***42.75***	***19.25***	***40.5***	***80.25***	***94.25***	***123.75***	***1.25***	
Maximum Daily Rainfall		***23***	***2.2***	***6.2***	***15.6***	***14.6***	***0***	***10***	***21.4***	***0.4***	***11.6***	***8.8***	***11.6***	***13.8***	***18***	***24***	***0.5***	***12.5***	***19***	***15.25***	***13.25***	***7.75***	***8***	***20.75***	***27.5***	***43.5***	***1***	

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

Date		Daily Rainfall (mm)																										
		1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
October	1	3	0	0	0	0	n/a	0	0	0	0	0	0	3.4	0	0	0	9.25	0	0	0.5	0	11	0	0	16.25	0	
October	2	0.4	9.6	0	0	0	n/a	0	0	0	0	10.2	2	0	0	0	0	7	0	0	0.5	0	3	0.75	0	0	0	
October	3	12	2.6	0	0	0	n/a	0	0	0	0	1	13.4	0	0	0.5	0	5.75	0	2.25	4.25	0	0.5	0.25	0.25	0	0	
October	4	15	0.4	0	0	0	n/a	0	0	0	0	1	6.4	0	0	0.25	0	0	0	0	1	0	0	9.25	0.25	0	0	
October	5	1	0	21	0	0	0	0	4.8	0.4	0	0	1.8	0	0	0	0	0	0	0	0.25	0	0	2.5	0.5	0	0	
October	6	0	0	0	0	0	0	4.6	5.2	0	1.6	9	1.8	0	0	2	0	0	0	0	8	2	8.75	0	0	1.25	0	
October	7	8	0	9.2	0	0	0	8.2	3.6	0.4	0	10.4	2.4	0	0	0	0	0	0	0	12.25	0	0	9	0.25	5.5	0	
October	8	13.6	3.4	23.6	1.4	2	0	7.4	19.2	0	5.2	0	0	0	2.75	0.5	0	1.75	0	11.75	5	0	8.5	0.75	0.25	0	0	
October	9	0.2	1.8	1	5.2	0	0	7.6	3.4	0	0	0.4	0.6	0	23	0.5	0	0	0	0	0.25	0	5.25	0	16.5	0	0	
October	10	12.2	0	0	3	16.2	0	2.8	0	0.4	0	0	0	0	3.5	0.5	0	0	0	0	0	0	0.25	0	6.5	5.25	0	
October	11	0.8	0	0	0	0	0	1.6	0	0	0	0	0	0	2.25	8	0.25	0.25	1.25	12.75	0	0.25	0	0	34.25	4.25	0	
October	12	2.2	13.2	3.2	0	7	0	24	0	0	0	0	0	0	0.5	15.75	0	0	4.25	0	4.5	3.25	0	5	2	0.25	5	
October	13	2.4	3	7.8	0	0	0	0	0	0	0	n/a	8.2	0.8	0	2.5	3.5	4	1	6.75	3.25	1.75	0	0	28.5	2	0	
October	14	6.6	14.2	0	0	7.4	0	0	0	0	5	0	0	3.2	0	0	17.75	0	7	0	2.5	0	0	0	0	0.75	19.75	
October	15	2	0	0	0	0	0	8	0	0	10	0	7.6	3.2	0	0	3	0	0	0.25	9.25	0	0	3.25	0	2.5	0	
October	16	0	0	0	8	0.4	0	100	0	0	1.6	0.2	7	14.2	0	0	14.25	0	3	0	2.75	0.5	0	10.5	0	7.25	0	
October	17	0.8	7.6	0	24.8	0	0	104.4	27.2	0	0	1.2	0	48.6	0	0	0	0	0.75	0	2.25	13	0	11.25	0.75	8.25	0	
October	18	0	0	0	5.8	1.2	0	0.6	5.2	0	11.8	22.6	0	0	0	0	0	0	4.5	0	3.75	5.75	0	11.5	21.75	4.5	0	
October	19	0	0	0	0.2	3.2	1.6	12.8	10.2	0	8.2	27.4	0	0	0	0	19.75	0.5	0.25	0	6.5	9.75	0	2.5	0	0.25	0	
October	20	0	0	0	19.2	0	1.2	85.4	3.2	0	0	9.8	1.8	0	0	0.25	1	0.5	6.25	0.25	23	2	0	4.5	0	0	0	
October	21	0	0	0	0	14.4	0	13.6	0	0	0	1.6	0	4.4	0	0	0.75	0	4.5	0.25	11.5	2.5	0	22.25	0	3	3.5	
October	22	0.2	0	0	0	10.4	0	1.6	1.6	0	0	5.6	0	1.4	0.25	5.25	0	0.25	2	0.25	0.25	5	0	0	0	3.25	0	
October	23	0	0	0	0	9.6	0	1.8	0	0	0	0	0	34.8	2.25	16.25	5.75	0.5	25.75	0.25	1.5	0	0	0	17.5	1.5	2.75	
October	24	0	0	3.2	0	0.4	0	0	0	0	3	0	0	0	17.75	0	3	0	8.75	0	0	0	0.25	0	0	0.25	7.75	
October	25	0	0	0.4	0	21.4	0	0	7.2	3	0.4	0	0	10	22.75	0	3.75	0	1.5	0.5	0.25	0	1	0.5	0	1.25	5.5	
October	26	6.8	0	0	0	9.2	0	0	0	0	0.2	0	0	7.6	3.25	0	0	0.25	22.75	14.5	14.25	0	4	0	0.75	15.75	0.75	
October	27	0	0	1.2	0	1.6	1.8	0	0	0	0	0	0	0	0	1.75	9.75	0	9.75	2.25	4.75	0	6.25	0	0	4.75	21.75	
October	28	4.2	0	20	4.6	0	0	0	1.6	11	0	0	0	8.4	2.75	4.25	21.25	0	5.25	0	0.25	0	22.5	0	0.75	3.5	4.25	
October	29	21	0	8	0	0	0	0	0.2	3.2	1	0	0	13.4	0.5	15	1.25	0	14.75	12.5	0.5	0	8.75	0	0	52	0.25	
October	30	47.2	0	44.4	0	6.4	0	0	12.6	12	0	0	0.6	14.4	0.5	0	22.5	0	2.75	0.75	6	0	3.5	0	8.25	0	37	
October	31	7.8	1.8	27.4	1.8	13.6	0	0	0	17.8	0	0	2.4	3	4.25	7	3.75	0.25	11.25	15.75	6	0	6	0	0	0	3.75	
Total Monthly Rainfall		***167.4***	***57.6***	***170.4***	***74***	***124.4***	***4.6***	***384.4***	***105.2***	***48.2***	***48***	***100.4***	***56***	***170.8***	***86.25***	***80.25***	***131.25***	***30.25***	***137.25***	***81***	***135***	***45.75***	***89.5***	***93.75***	***139***	***143.5***	***112***	
Maximum Daily Rainfall		***47.2***	***14.2***	***44.4***	***24.8***	***21.4***	***1.8***	***104.4***	***27.2***	***17.8***	***11.8***	***27.4***	***13.4***	***48.6***	***23***	***16.25***	***22.5***	***9.25***	***25.75***	***15.75***	***23***	***13***	***22.5***	***22.25***	***34.25***	***52***	***21.75***	

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

AECOM

Date		Daily Rainfall (mm)																										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
November	1	0.8	1	0	0	0.6	0	0	15.4	5.6	0	0	0	0	2.75	0	10	1.5	3	48.5	14.5	0	2.25	0	0	0	0.25	
November	2	0	19.4	0	0	0	0	0.6	36.4	12.6	16.6	0	1.4	0.8	0.25	0	1.25	4	0	16	14.5	22.25	20	0	0	8.5	13.5	
November	3	9.4	0	0.8	0	0	0	0	0	2.2	15.6	4	3.4	0	0	7.75	3	3	1.75	0	0.25	3.5	7	0	27.25	14	22.75	
November	4	0	7.4	1.2	9.8	5	0	0	n/a	10.2	21.4	0.2	6.4	0	0	1	5.75	0	21.25	0	2.25	4.75	21.5	0	9.75	15.75	8	
November	5	0.4	13	0	1.4	0.8	0	0	n/a	21.2	26.2	0	0	19.4	9	0	11	2.25	5	0.25	19	0.5	9.25	0	5	8.5	0	
November	6	3.2	0	14	7.8	0	4.2	0	n/a	2.2	88	2.6	66	17	2.75	0	0	5.75	8.25	0.5	0.5	0	0	0	0	1.5	7.75	
November	7	3.6	0	0	0	0	2.8	0	n/a	0	4.2	2	36.6	18.6	0.25	0	3.75	3.25	10.25	4.25	2.75	0	0	0	0	3.25	4.25	
November	8	0	0	2.8	11.8	0	4	0	n/a	2.4	17.6	7.4	2.2	0.8	0	0.75	0.25	11.75	0	15	1.75	3	0	0.75	0	12.75	3.25	
November	9	0	0	1.4	4	0	7	0	n/a	0.8	1	2	3	6.4	1	2.75	0	0	0	0.5	8.25	1.75	0	3.25	6	0.25	0	
November	10	0	0.2	6.2	0	0	4	0	n/a	3.4	18.2	4.2	2.2	8.2	0	0	0	0	3.25	2.5	0	0	4.25	0	0	14.5	0	
November	11	0	0	18.8	0	0	7.6	0	n/a	27.8	1.2	1.6	12	0.6	3.25	0	0	0	0	6.25	0	3.25	0.25	0	0	4	0.25	
November	12	0	22.2	14.6	0	4.8	11.6	0	n/a	0	42.2	22.6	22	0	0	9.5	24.5	0	0	0.5	0.75	2.5	0	0	25	17.25	0	
November	13	0	53.6	7.8	1.4	4.6	5.6	0	n/a	14	18	1.8	0	6.4	6.25	8.25	4	3.75	0	44.5	7	14.5	0	0	13	2.75	0	
November	14	0	22.2	4.4	0	25.8	4	0	n/a	0	0.6	2	0.8	0	2.25	0.25	3	0.5	0	23.25	0	20.5	9	0	2.5	34.5	0	
November	15	0	33.6	2.6	0	18.4	0	2.2	n/a	0	39.8	14.2	0.2	17	1.5	0	0.25	0	0	13	5.25	10.5	18	0	6.75	71.25	0.25	
November	16	0	27	10.6	0	6.4	11	22.6	n/a	0.6	0	4.6	0	58.4	0	0	0	3	0	3.75	6.5	2.5	0	0.75	33	81.75	0.5	
November	17	2.4	0	3.8	0	0	0	1.2	n/a	0	12.8	5.4	0	15	12.75	11.75	0.5	0	0	7	0	0.25	0.25	0.25	11.75	0	0	
November	18	0	0	0	0	0	15.2	68	14.4	0	6.8	1	0	16.4	2	6.5	4.5	5	0	49	0	0.25	0	9.75	5.5	0	0	
November	19	1.2	3.6	1	0	15.2	21.8	27.4	0	0	7.8	1.6	0	42.2	0.75	0	7	24	0	0	0	18.75	0	0.25	3.5	14.5	0	
November	20	8.4	35.2	9.4	0	6.8	1	0	0	0	14.4	0	3.4	7.2	0	0.25	3.75	0	0	0	1.25	7.75	0	0	1.25	0.75	0.75	
November	21	0.2	28.8	4	0	7.6	0	0	0	0	35.2	0	7.2	1	0	0	10.75	0	2.25	0	0	2.75	0	0	0.25	0	0	
November	22	1.4	19.6	3.4	0	7.2	0	0	1.2	0	1.8	0	0	17.6	0	5.75	14	0	17.75	0	16	7.75	9	0	2.5	0	17.75	
November	23	0.8	3.8	4.8	6.6	0.8	0	10.6	5.6	0	10.2	0	0	10.2	0	58	0.25	0	1.5	0	0.5	8.5	6.5	2.25	6	2	0	
November	24	3.2	28.2	18.4	0	0	0	5	13.4	0.8	1.4	0	0	2.6	0	15	10.25	0	18	8	11	2	8.75	0.5	8.5	2.25	0	
November	25	2.2	43.2	7.2	9	0.6	0	8	2.8	20.4	14.4	0	0	17.2	4.5	9.75	0.25	0	9.75	0.75	8.25	5.25	0	0	0.25	0	5.75	
November	26	0	10.8	0	25.6	2	0	0	1.6	0	32	10.6	0	9.4	14.25	0	0	0	27.75	0	6.5	6.5	3	0	1	43.75	10	
November	27	8	0.8	0.4	3.8	6.8	0	0.2	0.8	0	17.8	0	0	0	0.25	1.25	0	0	5.75	0	5.75	0.75	36	0	5	1.25	0	
November	28	16.8	0	0.4	0	33	0	66.8	0	5.2	0.8	10.4	2.2	8.2	0	24.25	0	0	7.25	0	0	2.25	13.5	0	0	34.25	0	
November	29	1.8	0.6	0	2	8.8	0	2.6	1.2	12	17.4	0.2	6	7	8	0	5.5	0	3.25	0	1.5	0.5	2	0	0	9.25	15.25	
November	30	9.4	1.2	2.8	4.4	2.4	0	0	5.6	0.2	2	0	0.6	1	17.75	7	0.5	7.75	0.25	0.25	0.25	7.5	0.25	0	11.5	1	6.5	
Total Monthly Rainfall		***73.2***	***375.4***	***140.8***	***87.6***	***157.6***	***99.8***	***215.2***	***98.4***	***141.6***	***485.4***	***98.4***	***175.6***	***308.6***	***89.5***	***169.75***	***124***	***75.5***	***146.25***	***243.75***	***134.25***	***160.25***	***170.75***	***17.75***	***185.25***	***399.5***	***116.75***	
Maximum Daily Rainfall		***16.8***	***53.6***	***18.8***	***25.6***	***33***	***21.8***	***68***	***36.4***	***27.8***	***88***	***22.6***	***66***	***58.4***	***17.75***	***58***	***24.5***	***24***	***27.75***	***49***	***19***	***22.25***	***36***	***9.75***	***33***	***81.75***	***22.75***	

Appendix C-1. Daily Rainfall Data: Hartland Landfill Weather Station

Date		Daily Rainfall (mm)																										
		1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
December	1	0	5.2	9.4	0	8.2	0	0	0	2.6	0	15.2	1.8	0	0.25	0.25	16	6.75	0.25	0.25	1	17.25	2.5	0	0	8.5	0	
December	2	0	19.4	16.4	12.4	12.8	0	1.4	0.2	0	0	46.4	0	0	0.25	0	23.25	5.75	0	9.5	0	2.5	1	0	0	0	3.5	
December	3	0	3.6	0	0	0	0	9	0.2	0	0	100.4	0	0	0.25	0	10.25	0	0.25	2.25	4.5	0	0	0	0	0	10	
December	4	0	0	0	0	6	3.2	0	16.6	0	3.6	18	0	0	0	0	13	0	0	7.75	0	0	0	0	0	0	0	
December	5	0	2.4	4.8	0	4.6	0	6.6	1.4	0	0.4	0.2	0	0	0	0	10.75	0	2	2.25	5	0	0	0	0.75	6.5	0.25	
December	6	0	0.4	16.2	0	5.2	0	9.8	12.4	0	0	0	4.2	0	0	0	8.5	0	1	17.5	0.25	0	0	0.25	0	0.25	5.25	
December	7	0.4	3	0	0	0	0	10.8	6	0	0.2	0	0.4	0	7	0	11	0	5.25	9.75	0	0	0	0.75	10.5	17.75	0.25	
December	8	1	2.8	1	0	12.4	0	0	16.2	0	0.2	0	0	0	4.25	1.75	7	0	0	5.75	0	0	0	0	16	2.75	7.75	
December	9	2.6	2.8	2.6	1.6	0	0	0	22	0	0.6	3.4	9.6	0	18.25	0	0	0	19.75	43	0	0.25	0	0	0	0.5	2	
December	10	1.8	8.4	3.2	0.8	5.4	4.4	9.2	38.4	0	1.4	0.2	3.8	0	0	0	9.25	0	13.75	15.25	8.25	0	8	0	0	0.5	3	
December	11	0	2.8	2.2	0	2.8	6.2	2	0	0	19.2	0.4	0	0	3.75	0	0.25	0	38.25	8	1.5	0	4.25	0	0.5	25	0	
December	12	0	11.4	28.8	0	8.4	20	4.4	0	0.2	17	0	22.2	0	5	0	6	0	6	0	0.25	0	36.75	4.75	0.25	27	0	
December	13	0	33.2	7.2	0	32.4	0.4	3.4	3	0	29.4	2.2	4.2	0	0.5	0	0	2	1.25	19	0	0	22.25	0.5	11.25	12	0	
December	14	1.6	0	22.6	1.2	15	21.4	18.6	14.4	0	31.8	9	1.6	10.4	3.25	0	7.75	2	0	10.25	0	0	24	0	2	4.25	0	
December	15	2.8	10	63	4.2	3.6	5	0	0.8	0	6.4	16.2	0	25.75	2	2.25	1.5	2.5	0	0	0	3	2.25	0	8.25	0.5	0	
December	16	47.6	7	0	49.2	61.8	5.8	8.4	0.6	0	0	0	0	14.25	0	1.25	0.75	4.5	0	0.25	0	4.5	0.75	0	8.5	0	0	
December	17	24.6	1	9.8	5.6	29.8	0.2	1.6	3.8	0	0	1.8	5.8	9.5	0	0.75	24.75	0	0.25	0	0	11	7	0.25	6.5	1	1.75	
December	18	2.2	0	3.8	0	1.6	0.2	0	1.8	0	1.8	6.2	3.4	4	0.75	0.75	10.75	0	2	25.75	1	6.5	13.5	0	16.5	9.25	0	
December	19	9.8	0	2.4	1.2	6	0.2	0	0	2	10	15.2	0	4.75	0.75	0.5	1.75	0	3.25	15.25	4	3	20	0	20.75	45.25	0	
December	20	7.8	0	1	3.8	0	0	0.6	0	15.2	6.2	0	0	11	1.5	0	22.75	0	3.75	0	1.25	0.75	5.5	0.5	0	0	0.25	
December	21	0.6	6.6	0	1.2	0	0	0.4	0	6.4	15.8	0	27.4	4.75	0	0	7.25	10.75	23.5	9	0	2.25	11.25	0.25	35.5	0	0	
December	22	0	0	0	4.8	0	0.4	0	0	10.6	1	19.4	13.2	0	0	0	0	2.5	3	9.25	0.25	0.75	0	0	12.5	5.25	0	
December	23	7	0.6	0	3.2	0	0	0	0	11.8	17.2	12.6	0.4	0	7	0.25	2.5	7.25	0	2.5	1.5	0	10.75	0	0.25	21.75	8.25	
December	24	0.2	18.2	0	4.6	0	1.2	4.8	0.8	15.4	23	0.2	21.8	0	5.25	1.25	4.25	6.75	11.75	8.25	0.25	0	12.25	0	0	1.25	44.75	
December	25	0	17.6	0	7.6	0	14.6	5.2	9.4	12.8	3.4	0	1.8	0	1	5.75	2	0	0.75	0	0	2.75	0	0	7	4.5	9.25	
December	26	7.4	21.8	0	2.4	0	12.2	0	4.4	0.4	4.8	0	7.8	0	8	3.5	22.25	0	0	0	0	0	0.5	0	4.75	3.25	26.75	
December	27	4.6	17	0	4.8	0	22.4	3.6	0	6.2	0	4.2	5	0	10.75	5.25	10	0	1.5	1	1	0.25	5.5	0	6.5	0	10.5	
December	28	10.6	15.4	0	0	2	1	1.8	0	13.8	0	7.6	0.6	0.25	0.5	30.75	0.75	2.5	6.25	12.25	0.25	19	1	0	0	0	0.75	
December	29	0.2	46.4	0.2	0	0	0	0	5.6	0.2	0.6	4.2	12.6	0	0	19.75	3	0	0.25	0	2.75	2.75	24.25	0	12.5	0	5	
December	30	0	0	0.2	3	0	4.2	0.2	0.6	5.6	0	1.8	1.6	3.5	0	5.25	3	0	0	0	0	4	19.5	0	29.25	0	13	
December	31	0	0.8	11.6	3.6	6.4	0	4.6	3.2	16.2	0	0	3	16.25	0	3.75	0	0.25	0	0	0.25	0	0	0	9.75	0	2.75	
Total Monthly Rainfall		***132.8***	***257.8***	***206.4***	***115.2***	***224.4***	***123***	***106.4***	***161.8***	***119.4***	***194***	***284.8***	***152.2***	***104.4***	***80.25***	***83***	***240.25***	***53.5***	***144***	***234***	***33.25***	***80.5***	***232.75***	***7.25***	***219.75***	***197***	***155***	
Maximum Daily Rainfall		***47.6***	***46.4***	***63***	***49.2***	***61.8***	***22.4***	***18.6***	***38.4***	***16.2***	***31.8***	***100.4***	***27.4***	***25.75***	***18.25***	***30.75***	***24.75***	***10.75***	***38.25***	***43***	***8.25***	***19***	***36.75***	***4.75***	***35.5***	***45.25***	***44.75***	

C2. Monthly Rainfall Data – Hartland Landfill Weather Station

Appendix C-2. Monthly Rainfall Data: Hartland Landfill Weather Station

Month	Monthly Rainfall (mm)																					
	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**Avg**
January	205.8	119.8	210.2	277.4	312.4	106.8	121.6	180.5	161.8	150.75	53.75	70.25	160.8	114.5	26	153.5	158.8	166.5	194.5	149.5	45.3	150.3
February	29	53	39.2	79.2	94	63	43.8	50.25	72.5	122.5	67.3	130	133	172.8	50	70	39.3	129.0	104.8	56.0	99.0	86.7
March	149.6	97	86	36.6	162.2	71.4	99.2	92	108	129.5	91	113	123	137	158	132	15.0	40.0	41.3	117.0	70.0	94.7
April	46.2	4.8	43.6	55.6	40.8	70.4	94.6	67.75	109.75	53.5	70.5	66	35	14	90.75	108	54.3	32.8	37.3	118.0		54.8
May	25.4	38.4	9.2	34.2	18.4	15.8	62.6	76.5	61.75	32	53.5	40.25	4	11.8	41.25	10.5	31.3	47.5	22.0	50.3		35.4
June	2	20.2	1.6	30.4	34.4	24.2	7.2	1.8	7.5	44.75	30.25	12	3.5	41.5	34	19.3	19.0	45.3	26.3	46.5		25.4
July	11.8	31	1.2	2	41.7	7	10.6	2.65	26.25	21	0	6.5	17.5	18.5	0	3.3	22.3	10.3	0.0	21.5		14.2
August	0.6	106.2	2.8	3.4	23.2	43.6	22.2	26.25	16.5	2.25	3	12.75	15.5	2.8	3.25	0.5	12.8	18.8	7.8	1.9		16.8
September	34.6	83.2	0.4	31.8	27.2	21.4	54.8	133.75	43.75	0.5	60.25	51.25	76.5	42.8	19.25	40.5	80.3	94.3	123.8	1.3		45.4
October	384.4	105.2	48.2	48	100.4	56	170.8	86.25	80.25	131.25	30.25	137.25	81	135	45.75	89.5	93.8	139.0	143.5	112.0		108.3
November	215.2	98.4	141.6	485	98.4	175.6	308.6	89.5	169.75	124	75.5	146.25	243.8	134.3	160.25	170.8	17.8	185.3	399.5	116.8		172.7
December	106.4	161.8	119.4	194	284.8	152.2	104.4	80.25	83	240.25	53.5	144	234	33.3	80.5	232.8	7.3	219.8	197.0	155.0		151.7
Total Yearly Rainfall	***1211***	***919***	***703***	***1278***	***1238***	***807***	***1100***	***887***	***941***	***1052***	***589***	***929***	***1127***	***858***	***709***	***1031***	***552***	***1128***	***1298***	***946***		***956***

Note:

No weather data was collected from Nov 4 - 17, 2004

Weather data collected in 2009 is unreliable due to equipment failure

Appendix D

Leachate Pipeline Flow Data

Appendix D. Leachate Pipeline Flow Data

Hartland Leachate System Monthly Flow Data

	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-1997	13	2148	0	2148	40816
Feb-1997	0	2700	732	2226	62334
Mar-1997	0	2759	2412	2696	83557
Apr-1997	0	2655	214	2545	78899
May-1997	4	2654	0	956	29561
Jun-1997	11	1563	0	546	17503
Jul-1997	17	2452	0	525	16090
Aug-1997	15	1608	0	386	11606
Sep-1997	21	2662	0	456	14159
Oct-1997	6	2782	0	1233	36996
Nov-1997	4	2533	0	1437	44565
Dec-1997	2	2408	0	1695	52547
TOTAL	93	2782	0	1404	488633

Hartland Leachate System Monthly Flow Data

	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-1998	0	2603	879	2187	65977
Feb-1998	3	2603	0	1624	43531
Mar-1998	3	2419	0	n/a	35275
Apr-1998	10	1542	0	542	16675
May-1998	13	1890	0	423	12574
Jun-1998	17	1241	0	239	7239
Jul-1998	21	1919	0	240	7645
Aug-1998	31	0	0	0	0
Sep-1998	27	1020	0	58	1821
Oct-1998	19	2379	0	511	14962
Nov-1998	7	2462	0	1538	45248
Dec-1998	0	2619	n/a	n/a	76518
TOTAL	151	2619	0	736	327465

Hartland Leachate System Monthly Flow Data

	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-1999	0	n/a	n/a	n/a	69000
Feb-1999	0	2970	1966	2681	74930
Mar-1999	0	2970	2539	2875	92028
Apr-1999	5	2894	0	1812	57986
May-1999	11	2889	0	660	20656
Jun-1999	18	1215	0	257	7480
Jul-1999	18	2772	0	365	11687
Aug-1999	30	n/a	n/a	n/a	1000
Sep-1999	4	1193	0	148	4597
Oct-1999	19	1473	0	163	4719
Nov-1999	4	2840	0	1497	43972
Dec-1999	4	3480		n/a	67907
TOTAL	113	3480	0	1162	455962

Appendix D. Leachate Pipeline Flow Data

Hartland Leachate System Monthly Flow Data

	Days Without Flow	Maximum Daily Flow in M^3	Minimum Daily Flow in M^3	Average Daily Flow in M^3	Monthly Total Flow in M^3
Jan-2000	3	2791	0	n/a	55088
Feb-2000	7	2235	0	n/a	29318
Mar-2000	7	2211	0	n/a	37258
Apr-2000	8	1737	0	n/a	21289
May-2000	19	2772	0	501	15547
Jun-2000	19	2685	0	396	11902
Jul-2000	22	1086	0	155	4831
Aug-2000	26	907	0	116	3619
Sep-2000	21	2640	0	354	10623
Oct-2000	n/a	n/a	n/a	n/a	8572
Nov-2000	n/a	n/a	n/a	n/a	11737
Dec-2000	12	2926	0	943	29235
TOTAL	144	2926	0	411	239019

Hartland Leachate System Monthly Flow Data

	Days Without Flow	Maximum Daily Flow in M^3	Minimum Daily Flow in M^3	Average Daily Flow in M^3	Monthly Total Flow in M^3
Jan-2001					38089
Feb-2001					30154
Mar-2001					24565
Apr-2001	15	2622	0	646	18746
May-2001	16	1647	0	400	12407
Jun-2001	22	2026	0	295	8862
Jul-2001	22	1521	0	244	7576
Aug-2001	24	2873	0	291	9047
Sep-2001	23	1633	0	157	4723
Oct-2001	15	2631	0	552	17112
Nov-2001	7	2899	0	993	29819
Dec-2001	0	3397	58	2241	69492
TOTAL	144	3397	0	647	270592

Hartland Leachate System Monthly Flow Data

	Days Without Flow	Maximum Daily Flow in M^3	Minimum Daily Flow in M^3	Average Daily Flow in M^3	Monthly Total Flow in M^3
Jan-2002	1	2892	0	1946	60342
Feb-2002	1	3395	0	1946	54497
Mar-2002	2	3412	0	2200	68224
Apr-2002	6	2444	0	1022	29651
May-2002	13	2118	0	578	17928
Jun-2002	16	1683	0	381	11435
Jul-2002	20	2330	0	330	10231
Aug-2002	23	1521	0	253	7848
Sep-2002	28	1154	0	72	2160
Oct-2002	26	1356	0	143	4450
Nov-2002	14	2477	0	618	18555
Dec-2002	9	2896	0	987	30615
TOTAL	159	3412	0	873	315936

Appendix D. Leachate Pipeline Flow Data

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2003	5	4880	0	1569	48664
Feb-2003	4	2819	0	1354	37921
Mar-2003	3	2849	0	1533	47546
Apr-2003	6	2185	0	846	24562
May-2003	18	1892	0	514	15962
Jun-2003	15	1397	0	340	10224
Jul-2003	20	1126	0	282	8768
Aug-2003	21	1140	0	214	6658
Sep-2003	23	1147	0	222	6671
Oct-2003	15	3869	0	1621	50260
Nov-2003	4	3681	0	2546	76397
Dec-2003	0	3587	96	2218	68773
TOTAL	134	4880	0	1105	402406

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2004	0	2859	99	1597	49509
Feb-2004	0	2833	2	1536	44551
Mar-2004	2	2792	0	1170	36288
Apr-2004	22	1675	0	319	9272
May-2004	31	0	0	0	0
Jun-2004	13	3565	0	1104	33135
Jul-2004	30	63	0	2	63
Aug-2004	23	3007	0	601	18636
Sep-2004	24	2998	0	454	13640
Oct-2004	14	3668	0	1138	35284
Nov-2004	2	2889	0	1631	48938
Dec-2004	4	3659	0	2191	67947
TOTAL	165	3668	0	979	357263

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2005	7	3671	0	2247	69680
Feb-2005	2	3662	0	2571	72002
Mar-2005	11	2484	0	824	25551
Apr-2005	4	2800	0	1041	30206
May-2005	18	2840	0	691	21437
Jun-2005	16	1800	0	431	12946
Jul-2005	18	1301	0	274	8512
Aug-2005	22	2771	0	417	12927
Sep-2005	19	1301	0	274	8512
Oct-2005	24	3025	0	432	13393
Nov-2005	5	2999	0	1347	40421
Dec-2005	5	2916	0	1180	36601
TOTAL	151	3671	0	977	352188

Appendix D. Leachate Pipeline Flow Data

Hartland Leachate System Monthly Flow Data

	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2006	0	3415	1123	3075	95329
Feb-2006	2	3435	0	2206	61795
Mar-2006	8	2926	0	846	26247
Apr-2006	14	2141	0	558	16762
May-2006	19	2058	0	464	14402
Jun-2006	21	2175	0	359	10795
Jul-2006	28	1996	0	105	3277
Aug-2006	23	1991	0	327	10148
Sep-2006	22	1770	0	255	7654
Oct-2006	23	2043	0	304	9427
Nov-2006	2	3677	0	2872	86167
Dec-2006	0	3563	3130	3425	106180
TOTAL	162	3677	0	1233	448183

Hartland Leachate System Monthly Flow Data

	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2007	0	3657	3272	3464	107411
Feb-2007	0	3619	815	2398	67168
Mar-2007	0	3442	38	2130	66034
Apr-2007	6	1929	0	872	26177
May-2007	14	2120	0	572	17740
Jun-2007	18	2127	0	477	14331
Jul-2007	22	2157	0	387	12019
Aug-2007	28	1730	0	92	2859
Sep-2007	29	76	0	2	76
Oct-2007	14	3288	0	945	29316
Nov-2007	11	2306	0	793	23813
Dec-2007	1	3715	0	2549	79041
TOTAL	143	3715	0	1223	445985

Hartland Leachate System Monthly Flow Data

	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2008	0	2949	260	1644	50970
Feb-2008	2	2927	0	1322	38343
Mar-2008	0	1874	0	901	27953
Apr-2008	7	1849	0	845	25364
May-2008	18	2946	0	537	16670
Jun-2008	25	2695	0	286	8594
Jul-2008					0
Aug-2008					0
Sep-2008					28892
Oct-2008					29892
Nov-2008					17433
Dec-2008					37620
TOTAL	52	2949	0	923	281731

Appendix D. Leachate Pipeline Flow Data

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2009	0	3522	799	2400.13	74404
Feb-2009	2	1551	0	866.54	24263
Mar-2009	0	2388	42	1040.23	32247
Apr-2009	5	2838	0	1056.40	31692
May-2009	11	2292	0	760.94	23589
Jun-2009	18	1839	0	426.58	13224
Jul-2009	9	2880	0	804.66	25749
Aug-2009	0	2871	402	942.19	29208
Sep-2009	18	2847	0	313.20	9396
Oct-2009	7	2838	0	814.52	25250
Nov-2009	0	3345	210	2426.10	72783
Dec-2009	0	3246	1125	2169.39	67251
TOTAL	70	3522	0	1168	429056

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2010	0	3438	1080	2460.58	76278
Feb-2010	0	1824	387	1013.46	28377
Mar-2010	10	1617	0	629.32	19509
Apr-2010	10	2853	0	1280.63	38419
May-2010	11	1989	0	704.32	21834
Jun-2010	16	1776	0	498.70	14961
Jul-2010	17	1815	0	399.87	12396
Aug-2010	18	2481	0	391.84	12147
Sep-2010	13	1752	0	647.50	19425
Oct-2010	7	1719	0	791.61	24540
Nov-2010	1	2034	0	1107.90	33237
Dec-2010	1	3462	0	2673.97	82893
TOTAL	104	3462	0	1050	384016

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2011	1	3324	0	2521.00	75630
Feb-2011	5	2823	0	1544.10	46323
Mar-2011	2	2832	0	1762.00	52860
Apr-2011	5	2715	0	1429.70	42891
May-2011	7	2847	0	894.68	27735
Jun-2011	13	1563	0	534.80	16044
Jul-2011	15	1428	0	441.19	13677
Aug-2011	13	1434	0	338.06	10818
Sep-2011	8	2604	0	454.94	14103
Oct-2011	20	1932	0	359.61	11148
Nov-2011	8	3288	0	1020.30	30609
Dec-2011	6	2589	0	1011.77	31365
TOTAL	103	3324	0	1026	373203

Appendix D. Leachate Pipeline Flow Data

Hartland Leachate System Monthly Flow Data

	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2012	0	2556	156	1693.94	52512
Feb-2012	1	2742	0	1634.28	47394
Mar-2012	1	2472	0	1518.68	47079
Apr-2012	3	2121	0	914.60	27438
May-2012	11	1671	0	563.16	17458
Jun-2012	16	1848	0	449.77	13493
Jul-2012	10	2979	0	606.97	18816
Aug-2012	20	1266	0	205.55	6372
Sep-2012	9	1410	0	460.90	13827
Oct-2012	15	2688	0	641.03	19872
Nov-2012	3	2847	0	1601.70	48051
Dec-2012	0	2610	779	2346.68	72747
TOTAL	89	2979	0	1053	385059

Hartland Leachate System Monthly Flow Data

	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2013	0	2526	43	1615.94	50094
Feb-2013	2	1986	0	1017.00	28476
Mar-2013	3	2694	0	1750.26	54258
Apr-2013	5	2136	0	997.30	29919
May-2013	10	1840	0	627.00	19437
Jun-2013	12	2515	0	594.30	17829
Jul-2013	14	1390	0	379.26	11757
Aug-2013	16	1590	0	355.55	11022
Sep-2013	9	2199	0	523.50	15705
Oct-2013	6	2448	0	772.81	23957
Nov-2013	6	2418	0	844.87	25346
Dec-2013	7	1848	0	708.74	21971
TOTAL	90	2694	0	849	309771

Hartland Leachate System Monthly Flow Data

	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2014	1	2316	0	1348.52	41804
Feb-2014	2	3366	0	1951.21	54634
Mar-2014	0	3387	150	2252.39	69824
Apr-2014	2	2535	0	1004.27	30128
May-2014	7	2562	0	796.90	24704
Jun-2014	5	1677	0	473.77	14213
Jul-2014	18	2517	0	485.68	15056
Aug-2014	14	911	0	302.55	9379
Sep-2014	16	959	0	305.43	9163
Oct-2014	16	2163	0	447.48	13872
Nov-2014	8	2808	0	1420.00	42601
Dec-2014	0	2589	600	1814.42	56247
TOTAL	89	3387	0	1050	381625

Appendix D. Leachate Pipeline Flow Data

Hartland Leachate System Monthly Flow Data

	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2015	0	2472	460	1976.13	61260
Feb-2015	0	2508	312	1750.36	49008
Mar-2015	0	2481	45	1493.71	46305
Apr-2015	1	2763	0	1118.30	33549
May-2015	15	2078	0	519.23	16096
Jun-2015	17	1744	0	449.57	13487
Jul-2015	23	1758	0	267.19	8283
Aug-2015	19	2595	0	376.71	11678
Sep-2015	15	1679	0	454.97	13649
Oct-2015	15	2251	0	460.35	14271
Nov-2015	3	3186	0	2154.30	64629
Dec-2015	0	3350	386	2693.29	83492
TOTAL	108	3350	0	1143	415707

Hartland Leachate System Monthly Flow Data

	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2016	1	3240	0	1836.23	56923
Feb-2016	1	3267	0	2639.38	76542
Mar-2016	1	3099	0	1818.87	56385
Apr-2016	8	3096	0	784.40	23532
May-2016	16	3098	0	540.00	16740
Jun-2016	10	1251	0	454.73	13642
Jul-2016	16	1222	0	340.00	10540
Aug-2016	16	1553	0	330.42	10243
Sep-2016	19	1707	0	324.00	9720
Oct-2016	7	2610	0	1328.81	41193
Nov-2016	0	3228	603	2038.40	61152
Dec-2016	0	3378	774	2344.35	72675
TOTAL	95	3378	0	1232	449287

Hartland Leachate System Monthly Flow Data

	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2017	1	2436	0	1390.29	43099
Feb-2017	2	3234	0	2049.18	57377
Mar-2017	0	3192	384	2050.16	63555
Apr-2017	0	2328	111	1547.40	46422
May-2017	11	3312	0	758.90	23526
Jun-2017	21	1410	0	291.60	8748
Jul-2017	7	882	0	356.03	11037
Aug-2017	15	2790	0	494.32	15324
Sep-2017	17	3375	0	494.00	14820
Oct-2017	23	2028	0	290.32	9000
Nov-2017	3	3324	0	1850.90	55527
Dec-2017	5	3276	0	1763.90	54681
TOTAL	105	3375	0	1111	403116

Appendix D. Leachate Pipeline Flow Data

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2018	2	3213	0	2401.16	74436
Feb-2018	1	3438	0	2097.71	58736
Mar-2018	9	27775	0	1048.97	32518
Apr-2018	11	3111	0	1023.00	30690
May-2018	17	2892	0	629.00	19497
Jun-2018	17	2184	0	482.00	14473
Jul-2018	11	1608	0	385.00	11942
Aug-2018	21	1593	0	158.00	4908
Sep-2018	18	1286	0	234.00	7026
Oct-2018	8	1692	0	520.00	16127
Nov-2018	1	2676	0	1157.00	35865
Dec-2018	1	3234	0	2428.00	75255
TOTAL	117	27775	0	1047	381473

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2019	2	3300	0	2607.00	80823
Feb-2019	3	2787	0	1302.00	36442
Mar-2019	5	2439	0	1013.00	31393
Apr-2019	8	2526	0	769.00	23078
May-2019	11	2172	0	595.00	18437
Jun-2019	21	802	0	152.00	4546
Jul-2019	29	14	0	1.00	19
Aug-2019	25	3320	0	158.00	4888
Sep-2019	12	3298	0	858.00	25725
Oct-2019	14	3010	0	897.00	27803
Nov-2019	7	2114	0	785.00	23560
Dec-2019	2	2196	0	1196.00	37091
TOTAL	139	3320	0	861	313805

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2020	0	3108	1092	2793.00	86573
Feb-2020	0	2990	2608	2910.00	84399
Mar-2020	3	2892	0	1117.00	34616
Apr-2020	6	2772	0	711.00	21319
May-2020	13	1342	0	483.00	14962
Jun-2020	26	1502	0	126.00	3791
Jul-2020	21	692	0	68.00	2107
Aug-2020	15	2840	0	356.00	11031
Sep-2020	17	4804	0	710.00	21298
Oct-2020	4	1956	0	976.00	30254
Nov-2020	4	2474	0	1749.00	52828
Dec-2020	0	3396	274	1767.00	54774
TOTAL	109	4804	0	1147	417952

Appendix D. Leachate Pipeline Flow Data

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2021	0	6558	2122	3284.00	101810
Feb-2021	15	18835	0	1722.00	48208
Mar-2021	20	12720	0	1444.00	44771
Apr-2021	29	3446	0	114.00	3446
May-2021	25	32661	0	1297.00	40133
Jun-2021	30	0	0	0.00	0
Jul-2021	21	17081	0	1158.00	37060
Aug-2021	25	2067	0	318.00	9846
Sep-2021	7	6273	0	954.00	28633
Oct-2021	9	3532	0	894.00	27700
Nov-2021	0	6133	1496	3850.00	115487
Dec-2021	0	5258	1377	3079.00	95452
TOTAL	181	32661	0	1510	552546

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2022	0	6256	1303	3202.00	99263
Feb-2022	2	4019	0	1443.00	40395
Mar-2022	3	6506	0	2118.00	65646
Apr-2022	4	3539	0	1880.00	56406
May-2022	10	6914	0	1538.00	47688
Jun-2022	20	5661	0	854.00	25631
Jul-2022	14	5058	0	1293.00	41368
Aug-2022	8	4974	0	716.00	22212
Sep-2022	0	6619	3	1266.00	38006
Oct-2022	1	2454	0	578.00	17933
Nov-2022	5	4306	0	1052.00	31578
Dec-2022	2	6489	0	1588.00	49249
TOTAL	69	6914	0	1461	535375

Hartland Leachate System Monthly Flow Data					
	Days Without Flow	*Maximum Daily Flow in M^3*	*Minimum Daily Flow in M^3*	*Average Daily Flow in M^3*	*Monthly Total Flow in M^3*
Jan-2023	0	7783	538	2912.00	90297
Feb-2023	0	4881	503	1762.00	49340
Mar-2023	5	5463	0	1701.00	51032
Apr-2023					
May-2023					
Jun-2023					
Jul-2023					
Aug-2023					
Sep-2023					
Oct-2023					
Nov-2023					
Dec-2023					
TOTAL	5	7783	0	2125	190669

Appendix E

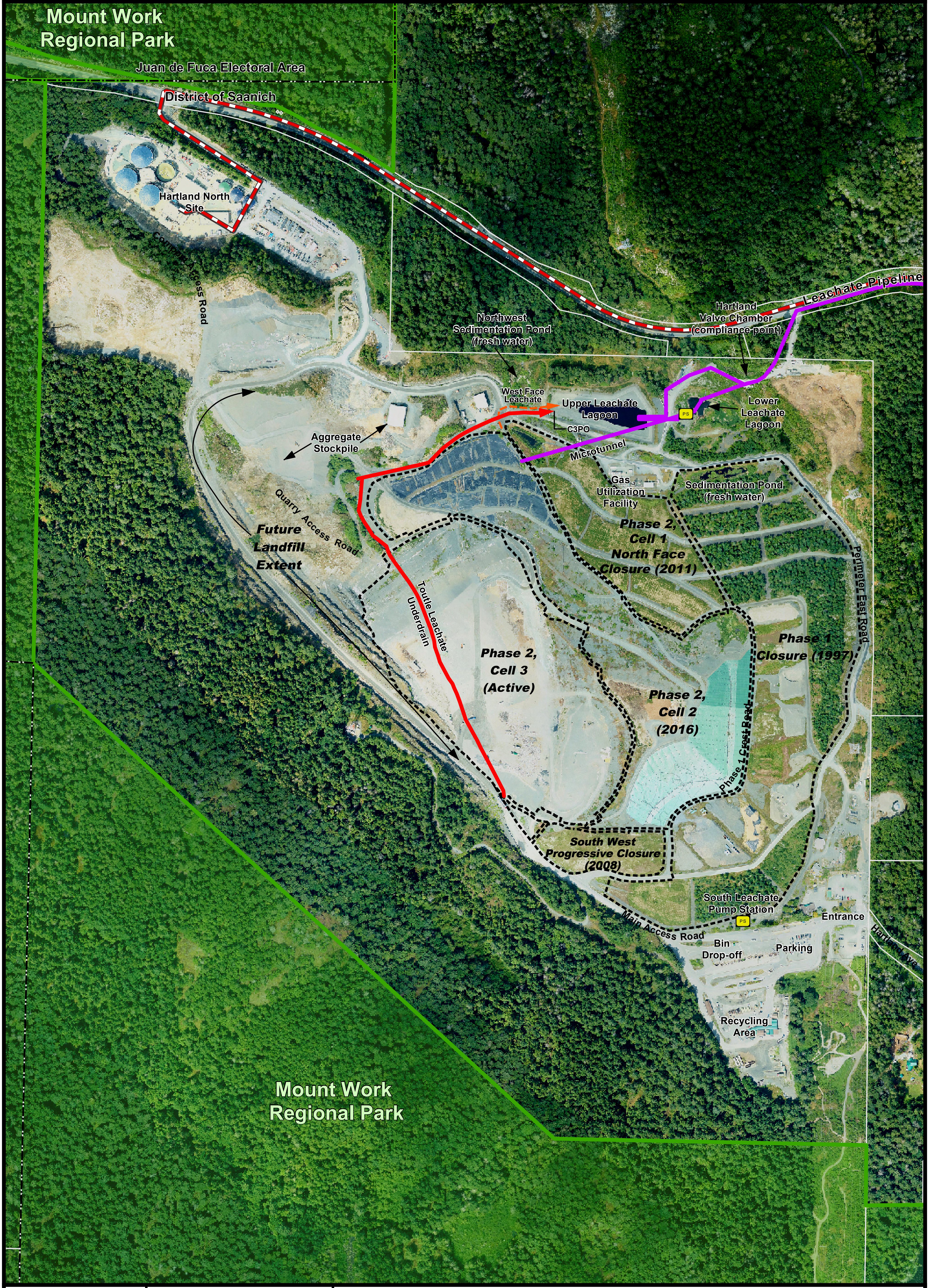
Hartland Landfill Site Plan and Sampling Locations

- E1. Hartland Landfill Site Plan
- E2. Groundwater Level Monitoring Locations
- E3. Groundwater Quality Monitoring Locations
- E4. Surface Water Quality Monitoring Locations
- E5. Leachate Quality Monitoring Locations

E1. Hartland Landfill Site Plan

CRD - Facilities Management & Engineering Services - Jun 07, 2021 - Technologist: jpbezeau - Map Document: HartlandSiteFacilitiesPhases2021.mxd

HARTLAND LANDFILL SITE PLAN



Making a difference...together

Metres

0 50 100 200

Projection: UTM ZONE 10N NAD 83

Observation Chamber

PS Pump Station

Residual Solids & Centrate Return Line

Hartland Leachate Line

Contours (5m interval)

Index

Index-Depression

Cell Phases

Lot Lines

Regional Park

E2. Groundwater Level Monitoring Locations

CRD - Parks & Environmental Services - Facilities Management & Engineering Services - Jun 05, 2023 - Technologist: jpbezeau - Map Document: HartlandGroundwaterLevel2023MonFreq.mxd

HARTLAND LANDFILL
GROUNDWATER LEVEL MONITORING LOCATIONS

Making a difference...together

Metres

0 25 50 100 150

Projection: UTM ZONE 10N NAD 83

Groundwater Level Monitoring Locations

Monitoring Frequency (# times per year)

- ◐ 4
- ◐ Continuous
- ◐ Variable - Focused Investigation

Roads

Contours (5m interval)

E3. Groundwater Quality Monitoring Locations

CRD - Parks & Environmental Services - Facilities Management & Engineering Services - Jun 05, 2023 - Technologist: jpbezeau - Map Document: HartlandGroundwaterQuality2023Seasonal.mxd

HARTLAND LANDFILL
GROUNDWATER QUALITY MONITORING LOCATIONS

Making a difference...together

Metres

0 25 50 100 150

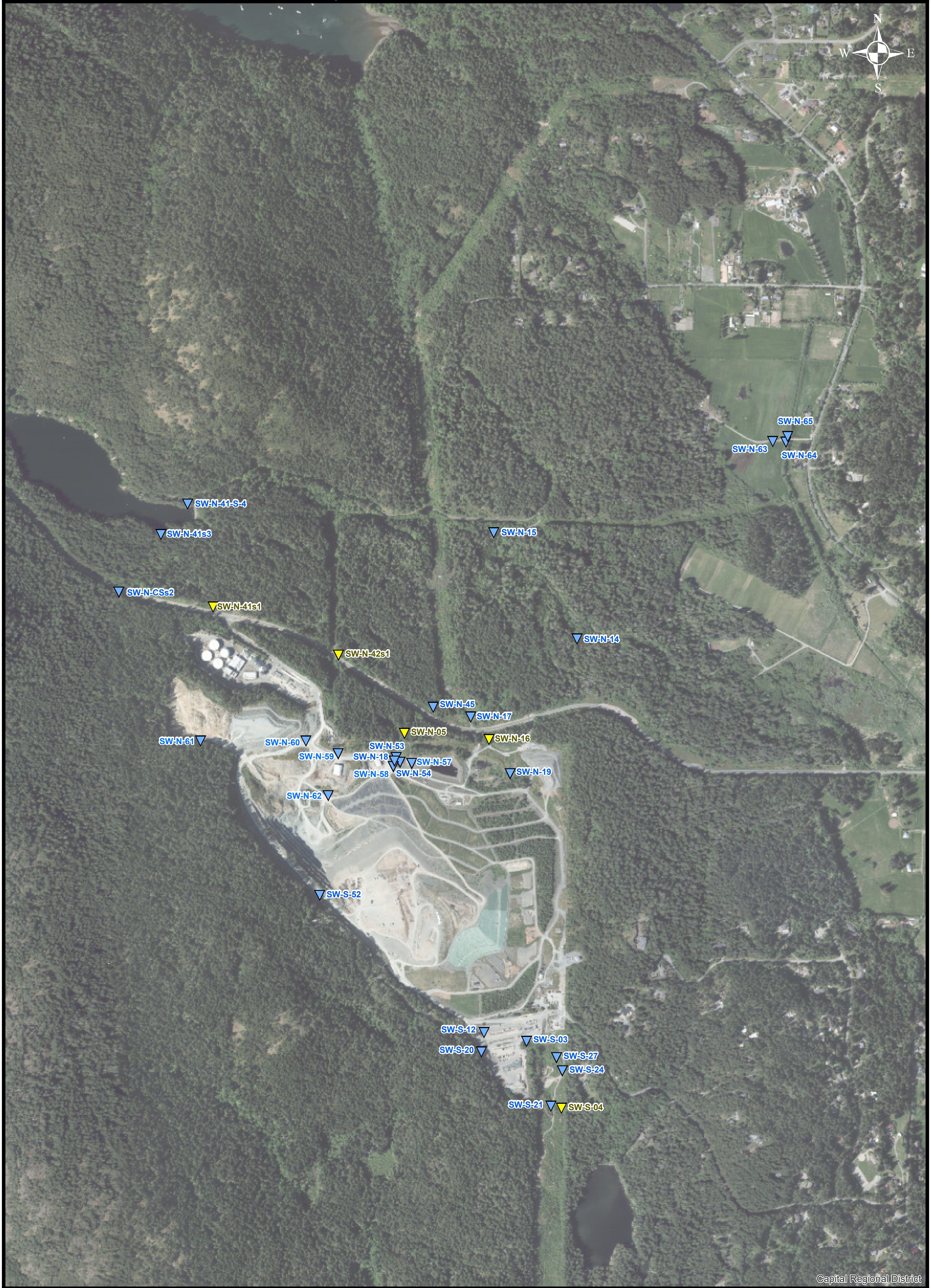
Projection: UTM ZONE 10N NAD 83

- ● Groundwater Monitoring Location – Non-Compliance Well
- ● Groundwater Monitoring Location – Compliance Well
- ▭ Roads
- ─ Contours (5m interval)

E4. Surface Water Quality Monitoring Locations

CRD - Parks & Environmental Services - Facilities Management & Engineering Services - May 30, 2023 - Technologist: jpbezeau - Map Document: HartlandSurfaceWaterQuality2023Seasonal.mxd

HARTLAND LANDFILL
SURFACE WATER QUALITY MONITORING LOCATIONS



CRD
Making a difference...together

Metres
0 50 100 200

Projection: UTM ZONE 10N NAD 83

- ▼ Surface Water Monitoring Location – Compliance Station
- ▽ Surface Water Monitoring Location – Non-compliance Station
- Road
- Contours (10m interval)

E5. Leachate Quality Monitoring Locations

HARTLAND LANDFILL
LEACHATE QUALITY MONITORING LOCATIONS

Making a difference...together

Metres
0 25 50 100 150

Projection: UTM ZONE 10N NAD 83

★ Leachate Quality Monitoring Locations

⟋ Roads

Appendix F

Hartland Landfill Leachate Pipeline Plan

CRD - Facilities Management & Engineering Services - Jun 08, 2021 - Technologist: jpbezeau - Map Document: Hartland_Leachate_Line.mxd

HARTLAND LANDFILL - LEACHATE PIPELINE PLAN

CRD
Making a difference...together

Metres
0 100 200 400 600

Projection: UTM ZONE 10N NAD 83

Leachate Pipeline Features
- Metering Chamber
- Observation Chamber
- PS Pump Station
- Residual Solids & Centrate Return Line
- Leachate Pipeline

Saanich Municipal Sewers
- 0 - 200 mm
- 201 - 599 mm
- 600 - 899 mm
- > 900 mm

- Municipal Boundaries
- Major Roads

Contours (10m Interval)
- Major Contour
- Major Contour - Depression

- 🟩 Municipal Park
- 🟩 Regional Park

Orthophoto flown in 2019

Appendix G

Results of Statistical Analysis

- G1. Groundwater
- G2. Surface Water
- G3. Leachate

G1. Groundwater

Appendix G-1. Results of Statistical Analysis - Groundwater

Station	Time Period	Parameter									
		Conductivity		Ammonia		Chloride		Sulphate		Nitrate	
		Increasing	Decreasing	Increasing	Decreasing	Increasing	Decreasing	Increasing	Decreasing	Increasing	Decreasing
		Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N
Boundary Compliance Monitoring Wells											
Gw-04-3-1	2018-2023	Y	N	N	N	Y	N	Y	N	N	Y
Gw-04-4-1	2018-2023	N	N	N	N	Y	N	N	N	N	N
Gw-17-1-1	2018-2023	N	N	N	N	N	Y	N	N	N	N
Gw-17-1-2	2018-2023	N	N	N	N	N	Y	N	N	N	N
Gw-17-1-3	2018-2023	N	N	N	N	N	N	N	N	N	N
Gw-18-1-1	2018-2023	N	N	N	N	N	N	Y	N	N	N
Gw-18-2-1	2018-2023	Y	N	N	N	Y	N	Y	N	Y	N
Gw-18-2-2	2018-2023	N	N	N	Y	N	N	Y	N	N	N
Gw-20-1-1	2018-2023	N	Y	N	N	N	Y	N	N	N	Y
Gw-20-1-2	2018-2023	N	N	N	Y	N	Y	N	N	N	N
Gw-21-1-1	2018-2023	N	N	N	N	N	N	N	N	N	N
Gw-21-1-2	2018-2023	N	N	N	N	N	N	Y	N	N	N
Gw-21-2-1	2018-2023	Y	N	N	Y	N	N	Y	N	N	N
Gw-28-1-0	2018-2023	Y	N	N	N	N	N	N	N	Y	N
Gw-29-1-1	2018-2023	N	N	N	N	N	N	Y	N	Y	N
Gw-29-1-2	2018-2023	Y	N	N	N	N	N	Y	N	Y	N
Gw-30-1-1	2018-2023	Y	N	N	N	N	Y	N	N	N	Y
Gw-30-1-2	2018-2023	N	N	N	N	N	N	Y	N	N	N
Gw-31-1-1	2018-2023	Y	N	N	N	N	Y	Y	N	N	N
Gw-31-1-2	2018-2023	Y	N	N	N	N	N	Y	N	N	N
Gw-39-1-1	2018-2023	N	N	N	Y	N	N	Y	N	Y	N
Gw-39-2-1	2018-2023	N	N	N	N	N	N	Y	N	Y	N
Gw-41-1-1	2018-2023	N	N	N	N	Y	N	N	Y	N	N
Gw-42-1-1	2018-2023	Y	N	N	N	Y	N	Y	N	N	N
Gw-53-1-1	2018-2023	Y	N	N	N	N	Y	Y	N	N	N
Gw-55-1-1	2018-2023	N	N	N	N	N	N	N	N	N	N
Gw-56-1-1	2018-2023	Y	N	N	N	N	N	N	N	N	N
Gw-57-1-1	2018-2023	Y	N	N	N	N	N	N	N	N	N
Gw-71-1-1	2018-2023	Y	N	N	N	N	N	Y	N	N	N
Gw-71-2-1	2018-2023	Y	N	N	N	N	N	Y	N	N	N
Gw-71-3-1	2018-2023	Y	N	N	N	N	N	Y	N	Y	N
Gw-72-1-1	2018-2023	Y	N	N	Y	N	N	N	N	N	N
Gw-72-3-1	2018-2023	N	Y	N	N	N	Y	N	N	N	N
Gw-73-1-1	2018-2023	Y	N	N	N	N	N	Y	N	Y	N
Gw-73-2-1	2018-2023	Y	N	N	Y	N	N	N	N	Y	N
Gw-73-3-1	2018-2023	N	N	N	N	N	N	N	N	Y	N

Notes:

NA indicates the analysis is unable to run due to insufficient dataset or over 80% of values were under detection limits

N - No Trend

Green highlights indicate decreasing trends

Red highlights indicate increasing trends

Appendix G-1. Results of Statistical Analysis - Groundwater

Additional Monitoring Wells											
Gw-07-1-0	2018-2023	Y	N	N	N	Y	N	N	N	N	Y
Gw-16-1-1	2018-2023	N	N	N	N	N	N	N	N	N	N
Gw-16-1-2	2018-2023	N	N	N	N	Y	N	N	N	N	N
Gw-16-2-1	2018-2023	N	N	N	N	Y	N	N	Y	N	N
Gw-16-2-2	2018-2023	Y	N	N	N	Y	N	N	N	N	N
Gw-19-1-1	2018-2023	Y	N	Y	N	N	N	N	N	N	N
Gw-19-1-2	2018-2023	N	N	N	Y	N	N	N	N	N	N
Gw-19-2-1	2018-2023	Y	N	N	N	Y	N	N	N	N	N
Gw-19-2-2	2018-2023	N	N	N	N	Y	N	N	Y	N	Y
Gw-25-1-1	2018-2023	Y	N	N	Y	N	Y	Y	N	Y	N
Gw-25-1-2	2018-2023	Y	N	N	N	N	N	Y	N	N	N
Gw-27-1-1	2018-2023	Y	N	N	N	N	N	Y	N	N	N
Gw-27-1-2	2018-2023	Y	N	N	N	N	N	Y	N	N	N
Gw-36-2-1	2018-2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gw-36-3-1	2018-2023	Y	N	N	N	Y	N	N	N	N	Y
Gw-37-2-1	2018-2023	N	N	N	N	N	N	N	N	N	N
Gw-37-3-1	2018-2023	Y	N	N	N	Y	N	N	N	N	N
Gw-38-1-1	2018-2023	N	N	N	N	N	N	N	N	N	N
Gw-40-1-1	2018-2023	N	N	N	N	N	Y	N	N	N	N
Gw-43-1-1	2018-2023	Y	N	N	N	N	Y	Y	N	N	N
Gw-44-1-1	2018-2023	N	N	N	N	N	N	N	N	Y	N
Gw-51-1-1	2018-2023	N	N	N	Y	N	Y	N	Y	N	N
Gw-51-2-1	2018-2023	N	N	N	Y	N	Y	Y	N	N	N
Gw-51-3-1	2018-2023	N	N	N	N	N	N	N	N	N	N
Gw-52-1-1	2018-2023	N	N	N	Y	N	N	N	N	N	N
Gw-52-4-0 (P7)	2018-2023	Y	N	N	N	N	N	N	N	N	N
Gw-58-1-0	2018-2023	N	N	N	N	N	N	Y	N	Y	N
Gw-60-1-1	2018-2023	Y	N	N	Y	Y	N	N	Y	N	N
Gw-60-2-1	2018-2023	Y	N	N	N	Y	N	N	N	N	Y
Gw-60-3-1	2018-2023	Y	N	N	N	Y	N	Y	N	N	N
Gw-62-1-1	2018-2023	N	Y	N	N	N	Y	N	N	Y	N
Gw-62-2-1	2018-2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gw-63-1-1	2018-2023	N	N	N	N	N	N	N	N	N	N
Gw-63-2-1	2018-2023	N	N	N	N	N	N	N	N	N	N
Gw-77-1-1	2018-2023	N	N	N	N	N	N	N	N	N	N
Gw-77-2-1	2018-2023	N	N	N	N	N	N	Y	N	N	N
Gw-78-1-1	2018-2023	N	N	N	N	N	N	Y	N	N	N
Gw-78-2-1	2018-2023	N	N	N	Y	N	Y	N	N	N	N
Gw-85-1-1	2018-2023	N	N	N	Y	N	N	N	N	N	N
Gw-87-1-1	2018-2023	N	N	N	N	N	N	Y	N	N	N
Gw-87-2-1	2018-2023	Y	N	N	N	N	N	N	N	Y	N
Gw-88-1-1	2018-2023	Y	N	N	N	N	Y	Y	N	Y	N
Gw-88-2-1	2018-2023	N	N	N	Y	N	Y	N	N	N	N
Gw-91-1-1	2018-2023	Y	N	N	N	N	N	Y	N	N	N
Gw-92-1-1	2018-2023	Y	N	N	N	N	Y	Y	N	Y	N
Gw-93-1-1	2018-2023	N	N	N	N	N	N	Y	N	N	N
Gw-94-1-1	2018-2023	N	N	N	N	N	Y	N	Y	N	N
Gw-95-1-1	2022	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gw-96-1-1	2022	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gw-97-1-1	2022	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gw-98-1-1	2022-2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gw-100-1-1	2022-2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gw-103-1-1	2022	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gw-104-1-1	2022-2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gw-105-1-1	2022-2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gw-106-1-1	2022-2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gw-107-1-1	2022	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gw-108-1-1	2022	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gw-109-1-1	2022	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gw-110-1-1	2022	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gw-P1	2018-2023	Y	N	N	N	Y	N	N	N	N	N
Gw-P2	2018-2023	Y	N	N	N	N	N	N	N	N	N
Gw-P3	2018-2023	N	N	N	Y	N	N	N	N	N	N
Gw-P4	2018-2023	Y	N	N	Y	N	Y	N	N	N	N
Gw-80-1-0 (P8)	2018-2023	Y	N	Y	N	Y	N	N	N	N	Y
Gw-81-1-0 (P9)	2018-2023	N	N	N	N	N	Y	N	N	N	Y
Gw-P10	2018-2023	Y	N	N	N	Y	N	N	N	N	N
Gw-P11	2022-2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gw-P12	2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

NA indicates the analysis is unable to run due to insufficient dataset or over 80% of values were under detection limits

N - No Trend

Green highlights indicate decreasing trends

Red highlights indicate increasing trends

G2. Surface Water

Appendix G-2. Results of Statistical Analysis - Surface Water

Station	Time Period	Parameter									
		Conductivity		Ammonia		Chloride		Sulphate		Nitrate	
		Increasing	Decreasing	Increasing	Decreasing	Increasing	Decreasing	Increasing	Decreasing	Increasing	Decreasing
		Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N
Boundary Surface Water Quality Location											
SW-S-04	2018-2023	N	N	N	N	Y	N	N	N	N	N
SW-N-05	2018-2023	Y	N	N	N	Y	N	Y	N	Y	N
SW-N-16	2018-2023	N	N	N	N	N	N	N	N	N	N
SW-N-41s1	2018-2023	N	N	N	Y	Y	N	N	Y	N	N
SW-N-42s1	2018-2023	Y	N	N	N	Y	N	N	N	N	N
Routine Surface Water Quality Location											
SW-S-03	2018-2023	N	N	N	N	Y	N	N	N	N	N
SW-N-CSs2	2018-2023	Y	N	N	N	N	Y	N	N	N	N
SW-S-12	2018-2023	N	N	N	N	Y	N	N	N	N	N
SW-N-14	2018-2023	N	N	N	N	Y	N	N	N	N	N
SW-N-15	2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SW-N-17	2018-2023	Y	N	N	N	Y	N	N	N	Y	N
SW-N-18	2018-2023	Y	N	Y	N	Y	N	N	N	Y	N
SW-N-19	2018-2023	N	N	N	N	N	N	N	N	N	N
SW-S-20	2018-2023	N	N	N	N	N	N	N	N	N	N
SW-S-21	2018-2023	Y	N	N	N	N	N	N	N	Y	N
SW-S-24	2018-2023	N	N	N	N	Y	N	N	N	N	N
SW-S-27	2018-2023	N	N	N	N	N	N	N	N	N	Y
SW-S-52	2018-2023	N	N	N	N	N	N	N	N	N	N
SW-N-41s3	2018-2023	N	N	N	N	N	N	N	Y	N	N
SW-N-41s4	2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SW-N-45	2017-2022	Y	N	N	N	Y	N	N	N	Y	N
SW-N-50	2018-2021	N	N	N	N	N	N	N	N	N	N
SW-N-51	2018, 2020	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SW-N-53	2018, 2021, 2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SW-N-54	2018-2023	N	N	N	N	N	N	N	N	N	N
SW-N-58	2023 (dry)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SW-N-59	2023 (dry)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SW-N-60	2023 (dry)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SW-N-61	2023 (dry)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SW-N-62	2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SW-N-63	2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SW-N-64	2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SW-N-65	2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

NA indicates the analysis is unable to run due to insufficient dataset or over 80% of values were under detection limits

Green highlights indicate decreasing trends

Red highlights indicate increasing trends

G3. Leachate

Appendix G-3. Results of Statistical Analysis - Leachate

Station	Time Period	Parameter									
		Conductivity		Ammonia		Chloride		Sulphate		Nitrate	
		Increasing Y/N	Decreasing Y/N	Increasing Y/N	Decreasing Y/N	Increasing Y/N	Decreasing Y/N	Increasing Y/N	Decreasing Y/N	Increasing Y/N	Decreasing Y/N
Hartland Valve Chamber	2018-2023	N	N	N	Y	N	N	N	N	Y	N

Notes:

Green highlights indicate decreasing trends

Red highlights indicate increasing trends

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