2023 ANNUAL REPORT FOR THE VANCOUVER LANDFILL

Prepared for:

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

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EXECUTIVE SUMMARY

The purpose of this report is to fulfill the annual reporting requirements defined in the Landfill's Operational Certificate (OC) MR-01611 (BC Ministry of Environment and Climate Change Strategy, formerly known as BC Ministry of Environment Lands and Parks, hereafter ENV, 2001) and the BC *Landfill Criteria for Municipal Solid Waste, Second Edition* (ENV, 2016). The report covers the period of January 1 to December 31, 2023. The ENV Annual Compliance Status Form is also included.

Background

The Vancouver Landfill opened in 1966 and is owned and operated by the City of Vancouver. It is located at 5400 72nd Street in Delta, in the southwest corner of Burns Bog, and is only accessible via Highway 99 Southbound. Further details on the site background and regulatory structure are included in the report.

The Landfill plays an integral role in the management of municipal solid waste (MSW) from commercial and residential sources within Metro Vancouver as part of Metro Vancouver's *Integrated Solid Waste and Resource Management Plan* (Metro Vancouver, 2010). Most of the waste received at the Landfill is first delivered to either the Vancouver South Transfer Station (VSTS) also owned and operated by the City of Vancouver, or one of Metro Vancouver's Recycling and Waste Centres.

Authorized waste discharge

The Landfill is authorized to accept up to 750,000 tonnes of MSW for disposal each year. Materials used beneficially, such as for cover, road building and closure, are not counted towards this annual discharge limit. In 2023, 743,809 tonnes of waste were disposed at the Vancouver Landfill.

Leachate and stormwater management

In 2023, approximately 1.5 million cubic metres (cu. m) of leachate and surface runoff were delivered to Annacis Island Wastewater Treatment Plant for treatment at a cost of approximately $2.8 million.

A total of 51 leachate, surface water and groundwater monitoring stations are sampled quarterly as part of the Landfill's Water Quality Monitoring Program. In 2023, an additional 12 monitoring stations were sampled during the winter (January to March) and fall (October to December) to assess stormwater quality in closed areas and potential receiving water bodies. As an ongoing operational practice, clean stormwater is periodically released from storage ponds to the Dredge Pond, diverting flow from the leachate collection and containment system and subsequently reducing leachate treatment and conveyance costs. Through surface evaporation from the storage ponds and controlled release to the Dredge Pond, approximately 274,000 cu. m of clean stormwater were diverted in 2023, saving approximately $465,000.

Landfill gas control

In 2023, new horizontal gas collectors were installed on three different lifts. One leachate collector sample port and one leachate collector were also installed. By the end of 2023, there were a total of 265 vertical gas wells, 130 horizontal gas collectors, 13 DRAINTUBE (DT)

gas collectors, 15 side slope gas collectors, and one pressure relief gas collector for a total of 424 gas collection points.

Construction of two renewable natural gas (RNG) facilities progressed through 2023 with commissioning planned in 2024. As a result, landfill gas (LFG) was flared for the year. Approximately 75 million cu. m of LFG (normalized to 50 percent methane) were collected and destroyed in 2023.

Closure capacity

To date, a total of 126.8 ha have been closed, representing 56 percent of the 225 ha Landfill footprint.

Recycling

Through the Zero Waste Centre, 1,542 tonnes of materials were recycled in 2023. A breakdown of the types and quantities of recycled materials is included in this report. New material streams for recycling were piloted in 2023, including furniture and durable plastics.

Compost

The City operates a composting facility to process yard trimmings dropped off at the VSTS and Landfill into finished compost for sale and donation. In 2023, approximately 21,000 tonnes of yard trimmings were composted and approximately 7,428 cu. m of finished compost were distributed.

CITY OF VANCOUVER

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1. Introduction

This report covers the period from January 1 to December 31, 2023. It has been prepared to fulfill the requirements of the Landfill's Operational Certificate MR-01611. This report is available online at vancouver.ca/landfill-annual-report, along with reports from previous years.

This report addresses the reporting requirements described in Section 3.5.2 of the OC with Table 1 summarizing where the required information is located in this report.

Table 1: Operational Certificate Reporting Requirements

Reporting Requirement	2023 Annual Report Section(s)
Updates to the design and operating plan	2. Design and operating plans
Revised closure/post closure costs	3. Closure and post closure costs
Planned improvements	4. Planned improvements
Records for waste, recyclable material and compost quantities	Table 5: Inbound Material Quantities for 2022 & 2023 Table 7: 2022 & 2023 Recycling Quantities 7.4 Yard trimmings collection & composting Appendix 2: Annual waste quantities
An evaluation of recycling and composting programs, including waste diversion projections	7. Waste reduction & recycling initiatives
A review of receiving environmental monitoring data with interpretation, including leachate flow data and leachate/drainage ditch levels suitably tabulated	8.3 Water quality monitoring program & annual review Appendix 6: 2023 Water quality monitoring program review executive summary Appendix 7: 2023 Weekly leachate and drainage ditch water elevations
An evaluation of leachate generation control measures	8.1 Leachate, surface runoff and stormwater management system 8.2 Leachate generation control measures
An evaluation of the efficiency of the landfill gas management systems, including an estimation of the landfill gas generation rate, percent recovery and the actual rates/volumes of gas collected, utilized and flared	8.5 Landfill gas collection efficiency
A list of operating problems and corrective actions taken	9.3 Operating problems & corrective actions
A summary of the public complaint and resolution log	9.5 Public complaint & resolution log

This report also meets the reporting requirements as per Section 10.6 of the BC *Landfill Criteria for Municipal Solid Waste, Second Edition* (ENV, 2016) with Table 2 summarizing where the required information is located in this report.

Table 2: Additional Reporting Requirements as per the Landfill Criteria

Reporting Requirement	2023 Annual Report Section(s)
Total volume of waste discharged into the landfill for the year	Table 5: Inbound Material Quantities for 2022 & 2023 Appendix 2: Annual waste quantities
Operational plan for the next 12 months	2. Design & operating plans
Remaining site life and capacity	2.3 Remaining capacity
Closure works completed	2.1 Site plan & progressive closure status Appendix 1: Progressive closure status
Results of regular inspection for cover integrity, health of vegetation, undesirable plant species, burrowing animals, erosion, settlement, etc.	9.2 Site inspections
Any changes from approved reports, plans and specifications	2. Design & operating plans
Compaction, waste to cover ratio, waste to road ratio and airspace utilization factor	2.2 Operational efficiency
Operational and maintenance expenditures	9.4 Operational and maintenance expenditures

As of January 1, 2016, annual reports for high priority authorizations must include the ENV Annual Compliance Status Form. The form for the Vancouver Landfill lists all OC conditions, all of which were met in 2023, and is included at the back of this document in Appendix 9.

2. Design and operating plans

Golder Associates Ltd. (Golder) completed the *Design Plan, Vancouver Landfill, Delta, BC* (Golder, 2019a) and *Operating Plan, Vancouver Landfill, Delta, BC* (Golder, 2019b) in early 2019. The Design Plan is a reference for landfill design and progressive closure, while the Operating Plan is a guide for day-to-day operation of the Landfill.

Figures in the Operating Plan that referenced the final contours and filling sequence of Phases 4 and 5 were updated in April 2020 and August 2021, respectively. The ENV was notified of the updates in a letter issued in October 2021, and details were provided in the 2021 *Annual Report for the Vancouver Landfill* (City of Vancouver, 2022). No changes were made to the Design or Operating Plans in 2023.

In August 2022, the City retained Sperling Hansen Associates Inc. (SHA) to complete an updated Design, Operations and Progressive Closure Plan (DOCP) for the Landfill. SHA submitted the draft DOCP to the City in December 2023, which is scheduled to be finalized in the first half of 2024.

2.1. Site plan & progressive closure status

The Landfill property is 320 ha in size, which contains the operational area (within the perimeter ditches) at 225 ha, a 16.7 ha pond historically used for dredging cover material and perimeter buffer zones. Approximately 320 ha of undeveloped land that were part of the original Landfill property were transferred back to the City of Delta as shown in Figure 1. The site plan for the Landfill property is shown in Figure 2.

Progressive closure phases and a profile view of the engineered fill plan are shown in Figure 3.

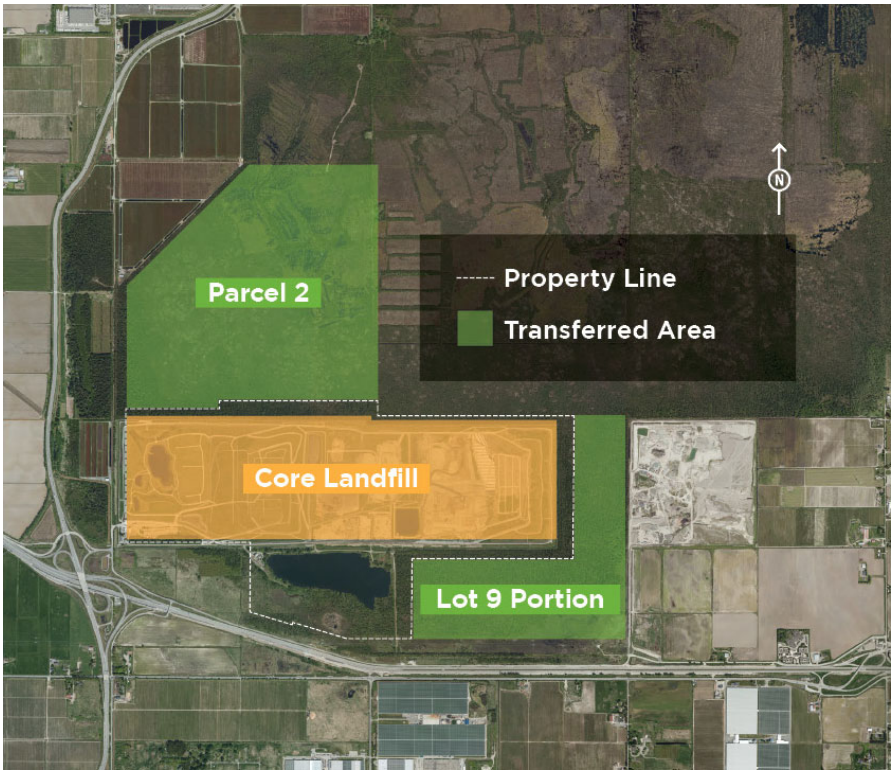

Figure 1: Vancouver Landfill Property and Footprint

Figure 2: 2023 Vancouver Landfill Site Plan

Figure 3: 2023 Landfill Fill and Progressive Closure Plan

In 2023, MSW filling and asbestos disposal mainly occurred in Phase 5 South. During periods of landfill gas infrastructure construction, some filling occurred in Phase 5 North to ensure safety of customers, staff and contractors.

The operational plan over the next 12 months includes completion of filling in Phase 5 South in preparation for closure in 2025, moving the filling operation into Phase 5 North, adding litter fencing on every lift and expanding gas collection infrastructure in Phase 5.

As of the end of 2023, several phases have been closed with engineered cover systems, including the Western 40 Hectares, Phases 1, 2, 3 and 4. No closure work occurred in 2023, as planned. A breakdown of the progressive closure status, up to and including 2023, is available in Appendix 1.

2.2. Operational efficiency

Aerial mapping and analysis has been completed at the Landfill annually since 2000. The flight to generate contour data occurs around the beginning of April when weather permits, and the data are typically available within three months. SHA is under contract to the City to complete the annual data analysis from 2022 to 2024.

The purpose of this project is to utilize the contour data from the previous and current years coupled with the tonnages of materials disposed and beneficially used to assess the following parameters:

- Landfill settlement
- Compaction density
- Air space consumption
- Waste to cover ratio and waste to road[1] materials ratio
- Remaining capacity
- Lifespan analysis

As per SHA's *Vancouver Landfill 2022 to 2023 Aerial Mapping Report* (SHA, 2024), the following operational efficiencies were achieved from May 22, 2022 to March 29, 2023, for the Phase 5 active area:

- Compaction density of 0.77 tonnes per cu. m for waste in Phase 5. This value is back-calculated using assumed densities from various geotechnical sources and survey volumes after accounting for settlement.
- Airspace utilization factor of 1.38 cu. m per tonne in Phase 5.
- Waste to cover ratio by volume of 2.25:1 was achieved in Phase 5. This is dependent on multiple factors, including estimated settlement and the large amount of cover materials coming to the site.

[1]Road materials include beneficial use materials such as clean wood waste, demo hog and crushed concrete/rubble.

- Waste to road materials ratio by volume of 5.75:1 was achieved in Phase 5. Waste to road materials ratio represents the volume of waste divided by the volume of all materials used for construction of roads, including recycled crushed rock, wood waste and demo hog.

2.3. Remaining capacity

Per the 1999 agreement between the City of Vancouver and City of Delta (City of Vancouver and the Corporation of Delta, 1999), the current waste capacity of the Landfill is defined as 20 million tonnes of MSW as of October 1, 1997. The remaining capacity as of December 31, 2023 is 4,913,453 tonnes. Based on the current airspace utilization factor, an estimated volume of 6.98 million cu. m is required. The volume is derived from taking the difference between the latest aerial contours (March 2023 in this case) and the final design contours in the 2021 update to the Design Plan (SHA, 2021).

3. Closure and post closure costs

The OC requires the City to maintain a dedicated reserve fund sufficient to finance closure, post-closure and environmental contingencies related to the Landfill. The Solid Waste Capital Reserve (SWCR) was established to address these costs. In 2001, Council set the minimum balance of the SWCR at $30 million and directed that the requirements for the SWCR be reviewed every five years. At the end of 2023, the closing balance of the SWCR was approximately $80 million. This reflects a net increase of $9.1 million from 2022, which is due to the transfer of surplus tipping fees exceeding operating and pay-as-you-go capital costs in 2023.

Every year, closure and post-closure costs are reviewed and updated with current available information. For the 2023 Landfill liability calculation, the updated 2019 Design Plan was used as the primary resource. The net present value for closure and post-closure costs is $141 million, up from $128 million from 2022 as a result of higher forecast closure unit costs and an increase in inflation for 2024-2027 to reflect current economic conditions.

According to the 1989 Tripartite Agreement (Greater Vancouver Sewerage and Drainage District, City of Vancouver and City of Delta (formerly Corporation), 1989), Metro Vancouver is responsible for closure and post-closure costs based on the proportion of regional waste in place at the Landfill. The City of Vancouver is responsible to pay for closure and post-closure costs for Vancouver and Delta waste. These percentages are reviewed and adjusted annually. At the end of 2023, 37.8 percent of the total waste in place at the Landfill was regional waste, with the remaining 62.2 percent originating from Vancouver and Delta. This represents an increase of 1.2% in proportion of regional waste since 2022, and corresponds to a current liability for the City of Vancouver of $74.3 million.

4. Planned improvements

4.1. Leachate, surface water runoff and stormwater management

In October 2022, the City awarded the 2022-2027 Water Quality Consulting and Stormwater Management Planning Project to AECOM Canada Ltd. (AECOM). Key tasks that were completed under this contract in 2023 include:

- Annual Water Quality Monitoring Review
- 2023 Hydrogeology Review (five-year update)
- 2023 Geotechnical Settlement Analysis
- 2023 Groundwater Model Update

In 2024, the City will focus on the Perimeter Stormwater Management Strategy and Conceptual Design to address challenges resulting from ongoing settlement of the berm between the twin perimeter ditch system (see Table 13). In addition, certain aspects of the *City of Vancouver Landfill Stormwater Management Plan* (AECOM, 2020) will be advanced, namely assessing the feasibility of increasing Dredge Pond storage and developing conceptual designs for engineered discharge and conveyance structures.

In 2023, routine stormwater monitoring was continued per the recommendations of the *Stormwater Management Plan* and will extend into the spring of 2024. In addition, the City will expand upon Phase 1 of the *Landfill Leachate Pump Station Assessment* (AECOM, 2022) by completing Phase 2 of the study in 2024.

4.2. Landfill gas collection

Modifications and system upgrades undertaken in 2023 are summarized in Table 3. Planned modifications and upgrades to the LFG collection system scheduled for 2024 are summarized in Table 4.

Table 3: Implemented Modifications and System Upgrades in 2023

Landfill Sub Area	Activity	Description
Phase 4 North	Install and Commission	Leachate collector sample port
Phase 5 South	Install and Commission	Lift 4 horizontal gas collectors
	Install and Commission	Lift 5 leachate collectors
	Install and Commission	Lift 6 horizontal gas collectors
Phase 5 North	Install and Commission	Lift 2 horizontal gas collectors

Table 4: Planned Modifications and Upgrades in 2024

Landfill Sub Area	Activity	Description
Phase 1,3, 4	Installation	19 vertical gas extraction wells (re-drills)
Phase 5 South	Installation	Lift 6 horizontal gas collectors
	Installation	17 pre-closure vertical gas extraction wells
	Installation	12 vertical gas extraction wells
Phase 5 North	Installation	Lift 2 horizontal gas collectors
	Installation	Lift 3 leachate collector
	Installation	Lift 4 horizontal gas collectors
	Installation	9 vertical gas extraction wells (finished banks)
	Installation	4 vertical gas extraction wells
Phase 6	Installation	Lift 0 leachate collector

The construction of two Renewable Natural Gas (RNG) facilities are currently underway. The progress of each project is detailed below.

The City and Village Farms Clean Energy (VFCE) have an agreement to upgrade existing equipment previously used by VFCE to turn LFG into heat and energy for nearby greenhouses to now produce RNG. This project is referred to as Delta RNG. Construction for necessary upgrades to this facility began in 2023 with full start-up of commercial operations planned for 2024.

The City and FortisBC have an agreement for FortisBC to develop an upgrading plant at the Landfill to convert LFG to RNG for the FortisBC pipeline. System design and construction of this facility took place between 2021 and 2023. Start-up of commercial operations is planned for 2024.

4.3. Progressive landfill closure

The contract for design and construction supervision of Phase 5 Closure was awarded to SHA in March 2023. The construction contract is expected to be awarded in late 2024 with construction planned in 2025 once filling is complete.

During the initial design of Phase 5 closure, SHA proposed a change to the Landfill filling plan to recover airspace on the south and west banks of Phase 5 South resulting from settlement. This change deferred closure of Phase 5S to 2025, and the City plans to install the vertical gas extraction wells ahead of closure to maximize gas recovery.

4.4. Landfill facilities

The following works at were completed in 2023:

- Paving 290 m of the main Landfill road toward the active face.
- Assessment of the 25kV overhead power line to enable future electrical upgrades, including the connection of the Fortis RNG facility.

The following works at Landfill facilities are planned for 2024:

- Landfill Civil Works Project
- Sign Fabrication and Installation Project
- Landfill Electrical Upgrades
- Diesel Pump Replacement and Pond Water Supply
- Prefab Storage and Workshop Units

Details on these planned works are found below.

4.4.1 Landfill Civil Works Project

RAM Engineering Ltd. was retained in 2021 to provide project management and engineering design to undertake site improvements in the Zero Waste Centre (ZWC) as part of the Landfill Civil Works Project. The following were completed in 2023:

- Detailed design of a new household hazardous waste area cover, two bin canopies for the drop-off bays to support new diversion opportunities and additional covered storage with construction planned for summer 2024 (budget permitting)
- A detailed feasibility report examining wheelwash options and associated costs

4.4.2 Sign Fabrication and Installation Project

EDG Experience Design Group Inc. (EDG) was first retained in 2017 to provide wayfinding and sign design services for the Vancouver ZWC to improve traffic flow, increase customer satisfaction, reduce safety-related incidents and reduce emissions from idling cars. EDG has subsequently produced wayfinding and site signage specifications, strategies and designs for both sites.

In 2023, Pacific Sign Group Inc. DBA Knight Signs (Knight Signs) was retained to fabricate and install the new signs as well as decommission and recycle/dispose of existing site signs. Fabrication and installation is planned for 2024.

4.4.3 Landfill Electrical Upgrades

Stantec Engineering Ltd. (Stantec) was retained in 2022 to provide an assessment of the state of Landfill electrical infrastructure and determine what (if any) upgrades are required to accommodate the increased load brought on by the new FortisBC RNG facility and future infrastructure. A report was received in 2023 containing Stantec's recommendations for electrical upgrades (Stantec, 2023).

In 2023, Binnie was retained to provide project management services for the electrical upgrades project, with Stantec providing technical design for enhancements identified in the assessment and coordinating with BC Hydro on the required upgrades to their line. The construction contract is expected to be awarded in mid 2024 with work planned to begin in late 2024.

4.4.4 Diesel Pump Replacement and Pond Water Supply

A contractor-owned and operated diesel pump is typically used to supply collected rainwater in the Phase 3 stormwater pond for on-site dust control throughout the dry summer months. In addition, the Composting Facility (adjacent to Phase 3 Pond) has historically used municipal water for operational requirements. In this project, the City identified the opportunity to purchase an electric pump to reduce rental costs as well as the potential to use stormwater instead of municipal water at the Composting Facility.

Water Street Engineering Ltd. was retained in 2023 to provide professional services, including detailed design and construction supervision for an electric pump and associated connections. Detailed design and construction are planned for 2024 provided the business case is sound.

4.4.5 Prefab Storage and Workshop Units

Pre-design work to address the need for updated and expanded office, storage and indoor workshop areas at the Landfill restarted in 2023 after being paused during the COVID-19 pandemic. In early 2024, McGinn Engineering & Preservation Ltd. was retained to support this work. Construction of these improvements is expected to take place between May and December 2024.

4.5. Material diversion

Since 2022, City staff have looked at new opportunities for aggregate recovery and reuse from excavated soils sourced from City sewers, streets, and water operations. In 2023, staff began exploring options to divert this excavated soil altogether from the Landfill. This work includes engaging with internal and external stakeholders to characterize the quality and quantity of materials, research policy opportunities, explore process changes, and identify markets for excavated soil with a goal to reduce excess soil being delivered to the Landfill, reduce GHGs and costs attributed to transportation and handling, and ensure the highest and best use of this material.

5. Waste disposal and beneficial use materials

The Landfill is authorized to accept up to 750,000 tonnes of waste each year. The annual totals for 2022 and 2023 for municipal solid waste, demolition waste, soil, road construction and capital & closure materials are provided in Table 5. Historical quantities are shown in Figure A1.

Table 5: Inbound Material Quantities for 2022 & 2023

Material	2023 Quantity (tonnes)	2022 Quantity (tonnes)
Waste Discharge		
Municipal Solid Waste	684,499	643,190
Bottom Ash	38,177	37,281
Demolition Material	20,932	52,969
Out-of-Region Flood Relief*	0	1,045
Soil including Cover	455,900	437,493
Road Construction & Other Beneficial Use Materials		
Demo hog	90,791	91,295
Wood waste	3,432	3,515
Crushed concrete	67,787	38,767
Purchased concrete & rock	32,073	52,997
Sand	775	399
Capital & Closure Materials		
Aggregate	21,567	44,662
Sand & Soil	11,827	147,676
Total**	1,427,760	1,551,289

Note:
* Authorized by ENV in 2021 due to flooding event in Fraser Valley.
** Totals may vary due to rounding errors.

5.1. Municipal solid waste disposal

Waste disposed of at the Landfill is either direct-hauled, or transferred through the VSTS or one of Metro Vancouver's Recycling and Waste Centres.

In 2023, a total of 743,809 tonnes of waste (MSW, bottom ash, and demolition material) were disposed of at the Landfill, reflecting an increase of approximately 1.3% from 2022 mainly attributed to an increase in Metro Vancouver transfer waste. Of this, 134,455 tonnes were transferred through the VSTS, and 411,890 tonnes were transferred from regional facilities.

Table A1 in Appendix 2 provides a breakdown of material type, origin and disposal location for 2023. Table A2 provides the 2022 breakdown for comparison. Table A3 shows the breakdown by month of material types for 2023. Details on some of these materials are included in the following sections.

5.1.1 Asbestos waste

The Landfill receives asbestos waste from commercial and residential sources. The definition of asbestos waste used in the Landfill's Asbestos Policy (City of Vancouver, 2019) follows the *Occupational Health & Safety Regulation* (BC Ministry of Labour, 1998).

Commercial asbestos waste is received for direct burial, while residential asbestos waste is received in a dedicated bin at the Zero Waste Centre. Commercial loads of asbestos waste must meet the *Transportation of Dangerous Goods Regulation* (Transport Canada, 1985).

Burials occur a minimum of 20 metres away from all active areas and include the placement of a minimum of 0.5 m of material on the waste. An exposure control plan is in place that includes periodic exposure monitoring to confirm the risk of asbestos exposure to Staff is low.

A total of 9,447 tonnes of asbestos waste was disposed of in 2023 from commercial and residential customers, down from 14,018 tonnes in 2022.

A total of 536 tonnes of used residential drywall (suspect asbestos containing material) was received at the Landfill in 2023, down from 668 tonnes in 2022. Used drywall from commercial customers is not accepted due to the availability of alternative disposal options within the commercial sector.

In December 2022, the City submitted an application for an ENV authorization amendment to increase the Landfill's authorized capacity for asbestos to correct an administrative error in the previous authorization. The application has been received by ENV and is currently in the pre-application phase to be reviewed by an ENV regional case manager.

5.1.2 Demolition material

Demolition material is mainly wood waste with small amounts of soft construction material, which has to meet the minimum criteria for wood content of 80 percent. In 2023, a total of 20,932 tonnes of demolition material was received at the Landfill. This represents a significant decrease from the 52,969 tonnes received in 2022, likely due to a Landfill rate increase in January 2023 and suggesting a slow-down in demolition activities in the region. Most demolition material was used for preparation of roads, drainage and gas collection layers in Phase 5 and the remaining material was landfilled.

5.1.3 Construction and demolition processing residual waste

The Landfill receives construction and demolition processing residual waste from around the region. This waste stream is composed of the materials that remain after construction and demolition waste has been processed to remove recyclable materials. In 2023, a total of 64,524 tonnes of this material was received from licensed transfer stations and material recovery facilities in the region, down from 96,173 tonnes in 2022, likely attributed to a Landfill rate increase in January 2023.

5.1.4 Bottom ash

The Landfill receives bottom ash from the regional Waste-To-Energy Facility. Bottom ash undergoes testing to confirm that it does not meet hazardous waste criteria (ENV, 1988) before it is landfilled, according to Metro Vancouver's Bottom Ash Management Plan

(Metro Vancouver, 2020a). A total of 38,177 tonnes of bottom ash was disposed of in 2023, slightly more than 37,281 tonnes in 2022.

5.3 Soil including Cover

Soil received at the Landfill operations is typically excavation material generated by sewer, water and street construction activities in the Metro Vancouver region.

In 2023, the Landfill received a total of 455,900 tonnes of soil. The majority of soil received was sent directly to Phase 5 for cover where needed or disposed. The remaining soil is directed to the soil stockpile area (see Figure 2).

The soil stockpile area is managed by the on-site contractor, Poschner Construction 88 Ltd. (Poschner), who must maintain a minimum of 30,000 cu. m of soil in the area at all times. Articulated ('Yuke') dump trucks are used to deliver soil to the active face on an as needed basis. Soil usage data by location is considered for Annual Aerial Mapping.

5.4 Road construction & other beneficial use materials

Road construction materials for temporary access roads on the active areas at the Landfill include purchased and recycled concrete, demolition (demo) hog and wood waste.

The City regularly retains a contractor for processing clean concrete and asphalt received at the Landfill. Crushed material is used in closure works and for Landfill operations. In 2023, there were two crushing events. Approximately 56,600 tonnes of recycled crushed concrete and asphalt and 33,680 tonnes of purchased aggregate were received for road construction in 2023.

Demo hog is ground construction wood waste received at a reduced fee from local wood waste processors for use as top dressing on tipping pads. Demo hog is classified as a beneficial use material and not counted towards the annual authorized discharge as approved by the ENV in February 2008 (ENV, 2008). Approximately 73,350 tonnes of demo hog were received in 2023.

Since January 1, 2011, residential quantities of wood waste have been accepted at the Landfill at a reduced fee to encourage diversion. Wood waste is ground onsite and then used as road base. At the Landfill, 3,074 tonnes of wood waste were received and reused in 2023.

5.5 Capital & closure materials

Materials used for the construction of engineered cover systems, roads and other improvements in completed areas of the Landfill are periodically sourced and brought to the Landfill. In 2023, contractors sourced approximately 21,570 tonnes of aggregate and 11,827 tonnes of sand and soil for capital works such as emergency berm repairs (see Section 8.3) and improvements to the landfill gas and stormwater collection systems.

5.6 Other authorized waste

Other ongoing waste disposal authorized by ENV are for Non-Recyclable Wastewater Treatment Plant (WWTP) Residuals and Non-Recyclable Drinking Water Treatment Plant (WTP) Residuals, both generated by regional facilities.

5.6.1 Non-Recyclable Wastewater Treatment Plant Residuals

The Landfill has a consolidated authorization from ENV to dispose of non-recyclable WWTP residuals from any of the five regional WWTPs (ENV, 2012). The following residuals were received in 2023:

- Grit from Annacis Island, Lion's Gate, Lulu Island and Iona WWTPs. Grit is primarily composed of materials that are denser than water and may include sand, pebbles, cinders, coffee grounds, seeds, cigarette filters and organic matter.
- Sludge and scum screenings from Annacis Island WWTP. Sludge screenings are solids composed of hair, plastic debris, paper fibers and other finer materials. Scum screenings are floating materials such as toilet paper, waste paper products, plastics and other buoyant materials, which are generally combined with fat and grease.

As part of ENV's authorization to accept WWTP residuals, the City and Metro Vancouver were required to develop a sampling and reporting program. Metro Vancouver completes a Landfill Waste Assessment Form annually to confirm that WWTP residuals are not Hazardous Waste. Further, Metro Vancouver completes characterization sampling and reporting on a biennial basis.

The most recent *Grit and Screenings Characterization Study Sub-Report* was completed for Metro Vancouver in November 2022. (WSP, 2022). This report summarizes the 2022 sampling program results of the non-recyclable WWTP residuals disposed of at the Landfill. In 2022, all samples from all WWTPs met the applicable guidelines. The next report is expected in 2024.

In 2023, 2,418 tonnes of grit were buried as nuisance waste in Phase 5. Additionally, 6.6 tonnes of sludge and scum screenings were received (most are directed to Lafarge Canada Inc). The tonnage of WWTP residuals received is reported as a separate line item (Sewage Treatment Plant Residuals) in Table A1 in Appendix 2.

5.6.2 Non-Recyclable Drinking Water Treatment Plant Residuals

The Landfill receives WTP residuals from the Seymour Capilano Filtration Plant under authorization by ENV for disposal as MSW (ENV, 2011). The residuals consist of silt and sediment from the raw water reservoir and the coagulants added to bind the sediment together. In 2023, 2,594 tonnes of WTP residuals were accepted at the Landfill.

5.7 Nuisance Waste

Nuisance waste is defined as material that requires special consideration, documentation, handling or disposal (such as direct burial). These materials typically originate from small businesses or light industry and are not classified as Hazardous Waste. The waste generator completes a Landfill Waste Assessment Form and submits it for review and approval by City staff.

Nuisance waste also includes materials ordered for destruction or burial by the Canadian Food Inspection Agency (CFIA). Deep burial is required to meet CFIA requirements and is often witnessed by a CFIA Officer. The Canadian Border Services Agency also periodically orders destruction of specific materials entering Canada.

Table 6 lists the types of nuisance wastes and quantities received at the Landfill in 2023. The tonnage of CFIA burials in 2023 was 3,126 tonnes more than in 2022, mainly attributed to Japanese beetle soil (and its expanded regulated area). Overall 2023 nuisance waste quantities decreased by 894 tonnes when compared to 2022 quantities, which represents a 7% decrease.

Table 6: 2023 Nuisance Waste Quantities

Material	2023 Quantity (tonnes)
CFIA Burials	10,086
Plastic-Contaminated Green Waste	274.4
Soil mixed with Wood Waste	257.2
Artificial Turf and Track Waste	168.0
Marine Nets and Ropes	157.1
Fish and Shellfish Waste	112.8
Other*	92.9
Non-Compostable Food	54.3
Street Sweepings	46.5
Non-Recyclable Cardboard & Styrofoam	38.0
Invasive and Toxic Species	14.0
Total	11,301

Note:
* Other includes waste perlite, ice paint, nylon web slings, cargo straps, non-recyclable plastic waste, rubber and odourous waste.

6. Waste composition

Metro Vancouver publishes waste composition study reports for the region, and the City of Vancouver contributes as a partner by coordinating waste audits at the VSTS. The data is combined with data gathered at other regional facilities.

Metro Vancouver published four waste composition studies in 2023, focusing on different sectors within the region's solid waste system. All four studies were prepared by Dillon Consulting Limited:

1. The 2022 Multi-Family Waste Composition Study (Dillon, 2023a) examines garbage, recycling and organics from multi-family residences throughout the region.
2. The 2022 Commercial & Institutional Waste Composition Study (Dillion, 2023b) examines garbage, recycling and organics from the following sectors:
    - Retail and Wholesale Trade
    - Food and Accommodation
    - Manufacturing
    - Business and Commercial Services (Offices)
    - Education
    - Health and Welfare
3. The 2022 Construction & Demolition Waste Composition Study (Dillon, 2023c) examines the non-recyclable waste generated by construction & demolition activities in the region.
4. The 2022 Full-Scale Waste Composition Study (Dillon, 2023d), provides composition breakdowns from the following sources:
    - Single-family Residential
    - Multi-family Residential
    - Commercial/Institutional
    - Small Loads

These studies, as well as those completed in previous years, are available on Metro Vancouver's website: https://metrovancouver.org/services/solid-waste/reports-resources

7. Waste reduction & recycling initiatives

7.1 Zero Waste Centre

The ZWC offers a recycling area for large items not typically included in curbside collection programs (e.g. mattresses, scrap metal, white goods) and a number of Product Stewardship Program materials (i.e. paper and packaging, household batteries, lead acid batteries, smoke alarms, tires, thermostats, used oil, used oil filters).

In 2023, a pilot project was launched to trial the collection of upholstered furniture and bulky, durable plastics for recycling. The purpose of the pilot project is to assess the operational and financial feasibility of collecting and preparing to haul these difficult to recycle items and is ongoing in 2024.

Recycled quantities received are provided in Table 7. The total amount of materials recycled in 2023, including the tonnes associated with materials measured in litres and units, was 1,542 tonnes. This is a 17% increase from 1,322 tonnes in 2022.

Note that the total recycling tonnages for 2022 reported in the *2022 Annual Report for the Vancouver Landfill* (City of Vancouver, 2023a) was 1,500 tonnes, but has been corrected in this report to exclude the tonnages for refrigerators, freezers & air Conditioners in the scrap metal category.

Table 7: Recycling Quantities for 2022 & 2023

Item	2023	2022	Units
Books	8.1	7.1	tonnes
Clothing	7.0	12.8	tonnes
Containers (Plastic, Metal, Paper)[1]	2.4	6.4	tonnes
Cooking Oil	1.2	0.8	tonnes
Drywall, new scraps only	76	90	tonnes
Durable Plastics	7.3	-	tonnes
Electronics & Small Appliances[1]	128	121	tonnes
Fire Extinguishers	1.5	0.7	tonnes
	676	322	units
Furniture (Upholstered)	62	-	tonnes
	1,128	-	units
Glass Bottles & Jars[1]	5.1	8.3	tonnes
Household Batteries & Cell Phones[1,2]	1.1	0.5	tonnes
Lead Acid Batteries[1]	20	13	tonnes
Light Bulbs[1,3]	1.3	1.2	tonnes
Mattresses	266	239	tonnes
	10,655	9,581	units
Mixed Paper & Cardboard, Residential[1]	197	33	tonnes
Flexible Plastics[1]	6.4	6.2	tonnes
Plastic Foam Packaging[1]	7.8	7.2	tonnes
Product Care Items (Paint, Aerosol, Pesticide, Solvent)[1,3]	50	51	tonnes
Propane Tanks	4,534	4,435	units
	6.2	5.3	tonnes
Refrigerators, Freezers & Air Conditioners[1]	156	178	tonnes
	2,418	3,155	units
Scrap Metal (excluding Refrigerators, Freezers & Air Conditioners)	468	508	tonnes
Smoke Alarms[1]	0	1	boxes
Thermostats	73	0	units
Tires[1]	29	21	tonnes
	2,746	2,070	units
Waste Antifreeze[1]	2.9	0.7	tonnes
	2,931	701	litres
Waste Oil[1]	31	10	tonnes
	34,492	11,441	litres
Waste Oil Filters[1]	1.0	0.3	tonnes
Total[3]	**1,542**	**1,322**	**tonnes**

Note:

[1] Product Stewardship Program material

[2] Cell phone weights not tracked by vendor. Included in battery totals.

[3] Includes tonnes calculated for items measured in units, pieces, and litres. Conversion factors are provided by Metro Vancouver and Product Stewards.

7.2 Household Hazardous Waste

Household hazardous wastes (HHW), such as paints, used oil, flammable liquids and pesticides, are banned from disposal at the Landfill. The City partners with the Product Care Association of Canada to accept a variety of HHW products regulated under the Product Stewardship Program at the Landfill ZWC. However, residents periodically abandon or discard non-program HHW in loads of refuse. HHW materials are stored in a secure area until they are picked-up and disposed of appropriately by a third party.

In 2023, 1.23 tonnes of non-program hazardous wastes were collected at the HHW facility. The cost of contracted services for the removal and disposal of HHW not covered by stewardship programs was approximately $11,353, compared to $17,800 in 2022. Costs incurred in 2023 were approximately 36 percent lower than 2022 due to increased public participation in the Product Care collection program. Note that City staff time to segregate and pack the materials is not included in the costs above.

7.3 Disposal bans

Since 2008, the City has implemented disposal bans in alignment with Metro Vancouver to reduce the amount of material being landfilled that could instead be recycled and follow BC's *Recycling Regulation* (ENV, 2004) (defines materials to be managed under provincial Extended Producer Responsibility Programs).

Materials banned from disposal as garbage at the Landfill are defined in the appendices of the City's *Solid Waste By-law No. 8417* (City of Vancouver, 2023b) and, as much as practical, mirror those which are banned in Metro Vancouver's *Tipping Fee Bylaw* (GVS&DD, 2023).

Disposal bans are enforced by Metro Vancouver's inspection officers that routinely visit the City's disposal facilities. Disposal ban violation notices and surcharges are issued to those customers that dispose of banned materials in excess of the defined thresholds. Appendix 3 contains a complete list of materials that are accepted for recycling at the Landfill and those that are banned from disposal as garbage.

7.4 Yard trimmings collection and composting

In 2023, approximately 21,000 tonnes of yard trimmings were received, up from approximately 16,900 tonnes in 2022.

The Composting Facility includes a 4.2 ha paved surface. Equipment includes a dual-shaft shredder, excavator, two front-end loaders, a star screener and windrow turner.

The static windrow composting method is used to process yard trimmings into finished compost. The feedstock is ground up and placed in windrows (piles) using front end loaders, then turned regularly to maintain optimal oxygen and temperature levels. After a minimum of six months in windrows, the material is screened and stockpiled for curing and subsequent sale or donation.

Approximately 7,428 cu. m of finished compost were distributed in 2023, significantly less than 14,160 cu. m in 2022. The decrease in total compost produced in 2023 can be attributed to the timing of the windrow composting process. Fewer yard trimmings received in the end of 2022 resulted in less finished compost available for purchase by mid 2023.

Compost sales totaled 6,240 cu. m in 2023 and the remaining 1,188 cu. m were donated to City of Delta and City of Vancouver residents during free compost campaigns.

Compost quality is compared to standards set out in ENV's *Organic Matter Recycling Regulation* (ENV, 2002) based on the feedstock and composting method used. In 2022 and 2023, the compost met the standards for unrestricted distribution for all parameters listed in the Regulation. A summary of the annual mean compost quality in 2022 and 2023, and the standards for unrestricted use are provided in Table 8.

Table 8: Compost Quality for 2022 & 2023

Parameter	BC Standard mg/kg unless stated	2023 Mean Value mg/kg unless stated	2022 Mean Value mg/kg unless stated
Arsenic	13	4.00	1.08
Cadmium	3	0.41	0.25
Chromium	100	18.2	8.3
Cobalt	34	4.03	2.83
Copper	400	40.3	33.3
Lead	150	19.7	12.5
Mercury	2	0.09	0.17
Molybdenum	5	1.45	0.42
Nickel	62	13.1	5.2
Selenium	2	<0.50	<0.50
Zinc	500	140	42
Foreign Matter (%)	1	<0.1	<0.1

7.5 Diversion projections

The *Integrated Solid Waste and Resource Management Plan* (ISWRMP) (Metro Vancouver, 2010) established future diversion targets. The ISWRMP outlines initiatives for achieving these rates which include diverting demolition, landfill clearing and construction waste for recycling as well as food waste to composting and energy recovery.

As per the *2021 ISWRMP Biennial Report* (Metro Vancouver, 2022) produced by Metro Vancouver, 65 percent of the waste generated in the region in 2020 were recycled or diverted from disposal. This diversion rate is slightly higher than the rate determined in the previous period (2018) as reported in the *2019 ISWRMP Biennial Report* (Metro Vancouver, 2020b). The next ISWRMP report is anticipated to be published in 2024.

8. Environmental protection programs

8.1 Leachate, surface runoff and stormwater management system

Water management at the Landfill is described using the following terminology:

- **Leachate** - produced by rainwater percolating through waste.
- **Surface runoff** - rainwater that flows along the surface of areas of the Landfill (subject to the placement of daily or intermediate cover), and may be impacted by leachate.
- **Stormwater** - rainwater that is collected above the engineered cover system installed in closed areas of the Landfill. Stormwater is not impacted by leachate.

The Landfill site is underlain by compressed peat and a continuous layer of relatively impermeable clayey-silt, which is referred to as the natural soil barrier layer. Prior to the placement of waste in each landfill cell, a layer of demolition material was placed on top of the peat to provide a conduit for lateral leachate flow to the perimeter ditch system. The layer of demolition material, natural soil barrier layer and perimeter ditch system are collectively referred to as the leachate collection system, as shown in Figure 4. The inner ditch collects leachate, while the outer ditch, more commonly known as the drainage ditch, collects clean water that runs off adjacent land. The drainage ditch is maintained at a higher level than the inner ditch to contain leachate in the inner ditch as shown in Figure 5. Leachate is conveyed from the pump station located in the southwest corner of the Landfill through force mains to the Annacis Island WWTP under *Waste Discharge Permit SC-100168-FSA* (GVS&DD, 2011), referred to as WDP.

In addition to leachate, surface runoff is routed to the inner ditch. An internal storage pond (linear pond 4) is used to reduce peak discharge to the sewer system and located north of the Phase 4 stormwater retention pond. The Phase 2, Phase 3 and Phase 4 closure areas each have a dedicated pond for stormwater retention, while Phase 1 utilizes a toe ditch. There are six retention ponds for clean stormwater in the Western 40 Hectares, as shown in Figure 4**.**

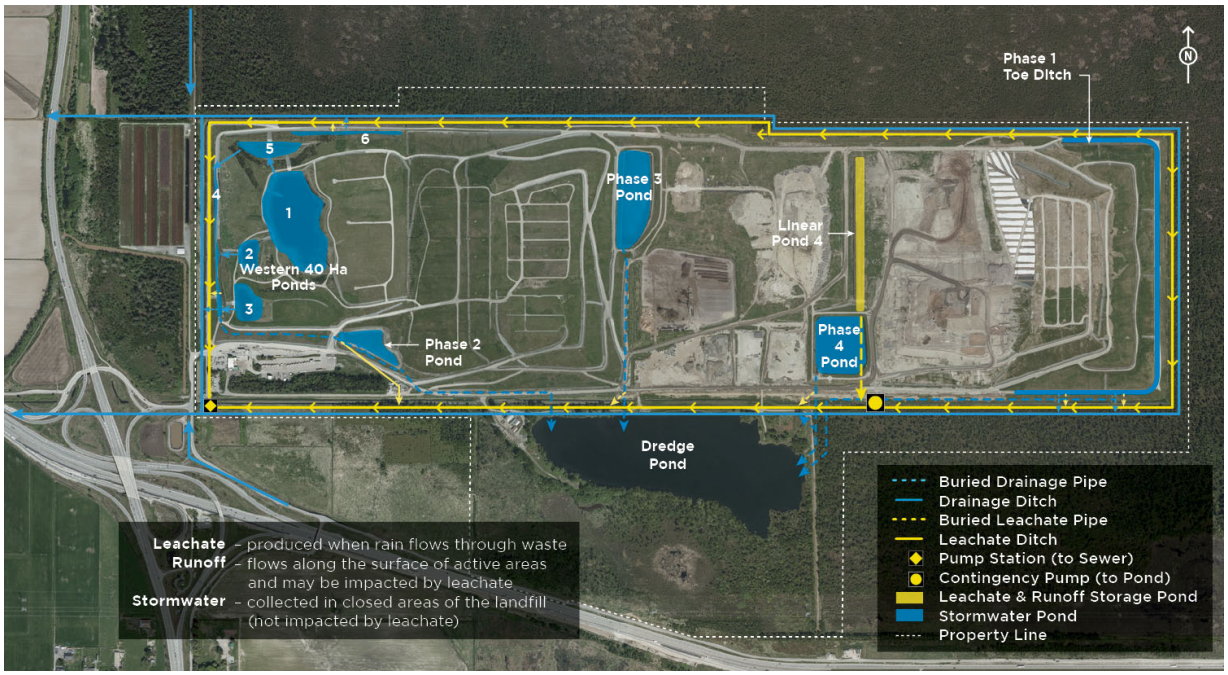

Figure 4: Leachate, Surface Runoff and Stormwater Management

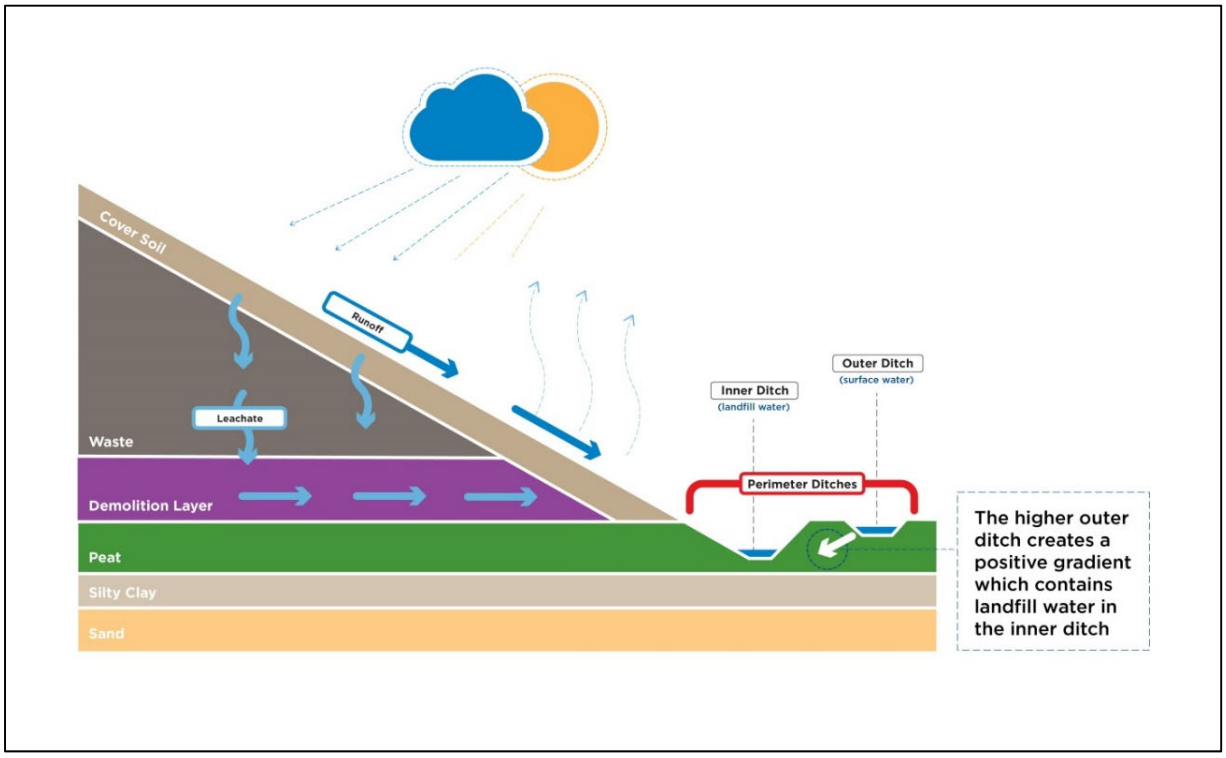

Figure 5: Leachate Collection System Cross-Section

Table 9 shows the cumulative pond storage capacity for stormwater or leachate.

Table 9: Pond Storage Capacity

Landfill Area	Storage Type	Current Capacity (m^3)
W40 Ponds 1-6	Stormwater	87,000
Phase 1 Toe Ditch	Stormwater	7,000
Phase 2 Pond	Stormwater	10,500
Phase 3 Pond	Stormwater	54,900
Phase 4 Pond	Stormwater	100,000
Linear Pond 4	Leachate	47,500

Through controlled release to the Dredge Pond and surface evaporation from the storage ponds, approximately 274,000 cu. m of clean stormwater were diverted from the pump station in 2023, saving approximately $465,000 in costs associated with leachate management.

8.2. Leachate generation

Leachate generation at the Landfill is controlled through a number of mechanisms, which include the following:

- Progressive closure of completed phases, with an impermeable geomembrane cover system installed to minimize infiltration and leachate generation.
- A dedicated linear pond for leachate and surface runoff to control flows to the leachate pump station as well as stormwater retention ponds to reduce flows from closed areas to the Dredge Pond during significant precipitation events.
- Use of daily and intermediate cover at the active face and keeping the active face as small as possible to minimize infiltration from precipitation.
- Erosion control measures on side slopes, such as swales and downchutes, to convey water to internal ditches.

The annual fees associated with leachate, surface runoff and stormwater management include a conveyance fee paid to Delta for the use of the sewer system, and an industrial discharge fee made up of capacity and usage components for the treatment of the leachate at the WWTP. The capacity and usage charges account for biological oxygen demand, total suspended solids and flow. In 2023, the cost associated with leachate conveyance and treatment totaled $2.79 million. Approximately 70 percent of this cost was associated with conveyance, which is slightly lower than 2022 due to less precipitation in 2023.

Monthly leachate flow and precipitation data for 2023 are provided in Table 10.

Table 10: 2023 Leachate Flow Volumes and Precipitation

Month	Leachate Flow (m^3)	Precipitation[2] (mm)	Precipitation Volume (m^3)	Ratio of Leachate Flow to Precipitation Volume
January[1]	331,062	98	220,500	150%
February	162,116	73	164,250	99%
March[1]	128,246	40	90,000	142%
April	125,972	84	189,000	67%
May[1]	67,438	14	31,500	214%
June[1]	37,435	16	36,000	104%
July	27,942	19	42,750	65%
August	25,640	25	56,250	46%
September	23,572	43	96,750	24%
October	66,597	133	299,250	22%
November	143,792	160	360,000	40%
December	360,547	185	416,250	87%
Total	1,500,359	890	2,002,500	75%

Notes:

[1] The high ratio of leachate flow to precipitation volume reported in select months can be due to the release of stored water that occurs when the Landfill becomes saturated, groundwater flow into the leachate ditch, and the controlled release of stormwater from storage ponds.

[2] Recorded at Landfill Weather Station.

A total of 1,500,359 cu. m of leachate, surface runoff and stormwater were pumped to Annacis Island WWTP in 2023. Leachate from the Vancouver Landfill is considered dilute compared to other MSW landfills because of the high volume of surface runoff and stormwater from the closed areas that have historically been treated as leachate. As closure activities progress, the volume of leachate generated is expected to decrease.

8.3 *Water quality monitoring program & annual review*

The OC requires regular sampling and analysis of leachate, and surface and ground waters in the vicinity of the Landfill, for specific stations and parameters. Leachate flow measurement and leachate/drainage ditch water level measurements are also required. The Landfill's WDP also requires regular sampling and analysis of leachate, in addition to leachate flow measurement. The Landfill Water Quality Monitoring Program (WQM Program) is in place to meet the above requirements and includes stormwater sampling as well. Sampling and data collection is completed by Staff, according to the *Leachate, Groundwater, Surface Water and Stormwater Monitoring and Sampling Manual* (AECOM, 2021).

In 2023, one leachate station, 13 surface water locations, 18 shallow groundwater wells and 20 deep groundwater wells were sampled quarterly by Staff. Shallow groundwater wells are screened in the peat aquifer and range in depth between 2.5 – 4 m, while deep groundwater wells are screened in the sand aquifer and range in depth between 6 – 9 m. Well and sampling locations are shown in Appendix 4. Additionally, a 24-hour composite sample representing the leachate pumped to Annacis Island WWTP was taken monthly. Samples were analyzed for the parameters listed in Appendix 5.

Consultants hired by the City have completed annual reviews of the WQM Program each year since 1999. The *City of Vancouver Landfill - 2023 Annual Water Quality Monitoring Report* (AECOM, 2024) confirms that the 2023 Landfill WQM Program meets or exceeds the requirements set out in the OC and WDP with respect to the number, type and locations of stations monitored, sampling frequency, water quality parameters, and detection limits with the exception of five surface water stations (Stations 43, 44, 45, 91 and 96) which were not sampled during dry ditch conditions in the third quarter. This is consistent with past years.

The December 2019 *City of Vancouver – 2018/19 Stormwater and Surface Water Monitoring Report* (AECOM, 2019) recommended that a regular monitoring program for stormwater be implemented, and include monthly sample collection from October to March each year. Sampling began in December 2019 and continued into 2023 at 12 stations. Results from the sampling events are included in the 2023 WQM Report.

The executive summary from the 2023 WQM Report, including recommendations, is included in Appendix 6. A tabulation of the leachate/drainage ditch levels is included in Appendix 7.

8.4 *Landfill gas management system*

Due to the ongoing construction of the Delta RNG and FortisBC facilities, all LFG collected in 2023 was flared on site. Figure 6 provides on overview of the Landfill's current LFG collection & beneficial use system. The distribution of LFG infrastructure across the Landfill footprint is shown in Figure 7.

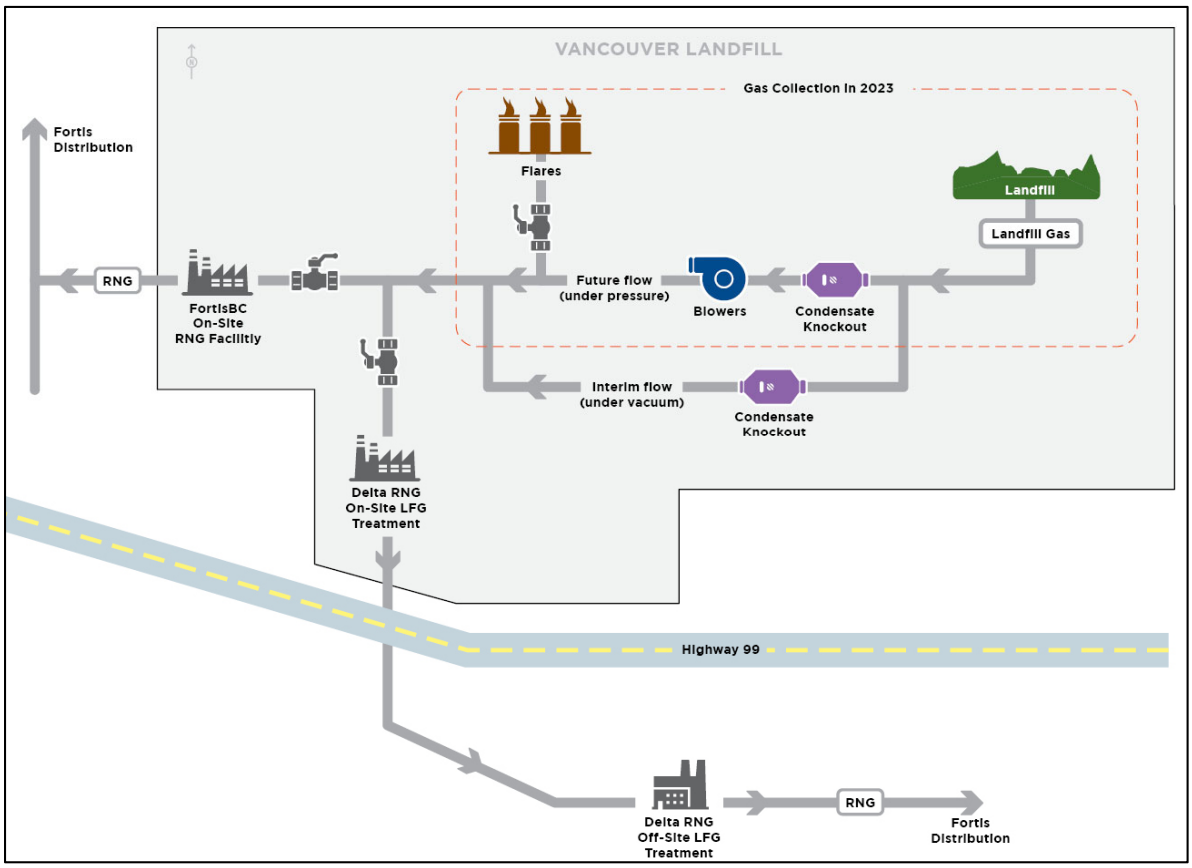

Figure 6: Landfill Gas Collection & Beneficial Use System

Figure 7: 2023 Landfill Gas Collection System

8.5 *Landfill gas collection efficiency*

The total volume of LFG collected in 2023 is reported in two ways in Table 11:

1. As measured by individual meters; and,
2. On a normalized basis (to 50 percent methane by volume) as per the methodology used by the ENV in Section 3.2 of the 2010 *Landfill Gas Management Facilities Design Guidelines* (Conestoga-Rovers & Associates, 2010).

Table 11: 2023 Landfill Gas Collection and Beneficial Use

2023	Weighted Average Methane Content (% by vol.)	LFG to Utilization Facility (cu. m)	LFG to Flare (cu. m)	LFG Captured for Period (cu .m)
Total (metered)	50.4	-	74,712,534	74,712,534
Total (normalized to 50 percent methane)	50.0	-	75,327,782	75,327,782
Daily Average	50.4	-	204,692	204,692
Daily Average (normalized to 50 percent methane)*	**50.0**	**-**	**206,377**	**206,377**

Note:

*All LFG collected in 2023 was flared.

LFG Collection Efficiency (CE) is defined as the normalized average collected flow rate of LFG in the given calendar year divided by the estimated generated LFG flow rate in the given calendar year multiplied by 100 percent. LFG generation is calculated using the following methods:

- A site-specific calibrated model developed by SCS Engineers for the Landfill; and
- ENV LFG Generation Estimate Tool for Annual Reporting.

The 2023 Landfill CE was 86.3 percent, which is a 16.4 percent increase from 2022. The Landfill's CE exceeds ENV's target of 75 percent. The increase in CE is attributed to the annual installation of new LFG capital works as well as the absence of large well field shutdowns typically resulting from progressive closure work.

As shown in Table 4, the City will continue to implement LFG system modifications and upgrades in order to maximize CE. Further details on LFG collection activities in 2023 can be found in the *2023 Annual Landfill Gas Report for the Vancouver Landfill* (City of Vancouver, 2024).

9. Operational information

9.1. Bird control

Birds, particularly gulls, are a nuisance at landfill sites. In large numbers, they create a negative image of landfills and scatter litter onto surrounding areas. Birds are also a potential aviation hazard. A formal program using birds of prey started at the Landfill in July 2001. The program includes the use of trained raptors (hawks) near the active face as a primary control method. Trained raptors discourage gulls and other birds from approaching the waste. Secondary control methods are used when trained raptors are not an option, such as when traffic is heavy or during very windy or rainy conditions. These methods include noise deterrents (stock or bull whips, pyrotechnics, whistles), visual deterrents (aerial projectiles, laser pointers, kites), and positioning the bird control vehicle close to the active face.

Pacific Northwest Raptors has been providing bird control services since January 2016.

In early 2018, the City began working the Hancock Wildlife Foundation (HWF) in collaboration with Simon Fraser University for the Bald Eagle Tracking Alliance Project. This project aims to better understand the movements of bald eagles using tracking devices. In July 2023, the City sent a letter to HWF (City of Vancouver, 2023c) extending the agreement until July 31, 2024 to allow periodic visits to the Landfill for the purpose of plotting, baiting and catching bald eagles for banding and GPS tracking.

9.2. Site inspections

Formal site inspection activities beyond those conducted as part of environmental monitoring programs, are summarized in Table 12.

Table 12: 2023 Site Inspection Activities

Type of Inspection	Description	Findings & Action Taken (if applicable)
Site Tour	Conducted weekly by the Landfill Engineer, GPS Technician and Superintendent to assess progress of filling, cover integrity, erosion and settlement in active areas.	Any signs of leachate breakouts or erosion on side slopes are addressed promptly by Operations Staff at the direction of the Superintendent.
Workplace Inspections	Conducted monthly by representatives from the Joint Operation Health & Safety (OH&S) Committee and exempt Staff to verify compliance with the Landfill's Safety Management Program and *OH&S Regulation*.	Any deficiencies identified are logged and addressed as soon as practical with discussion following in the monthly OH&S Committee Meetings.

Type of Inspection	Description	Findings & Action Taken (if applicable)
Construction Site Safety Observations	Conducted regularly during construction projects by contracted safety consultants to ensure safety standards are being met and identify potential hazards or safety concerns arising from construction activities.	Construction contractor to complete recommended action items on observation report as soon as possible. Observation reports typically reviewed during construction coordination meetings.
Leachate Collection and Stormwater Systems Inspection	Conducted in advance of and during significant precipitation events by the Environmental Technician and/or Operations Staff to ensure ditches and culverts are not obstructed by debris, leachate and stormwater flows are unobstructed, and freeboard exists in the leachate and drainage ditches.	Any accumulation of debris is managed promptly by Operations Staff.
Vegetation Inspection	Regular monthly inspections for invasive plants completed by the landscaping services contractor in established naturescaping areas.	Several different invasive plants are present in large numbers throughout the landfill closed areas. In the naturescaping areas, multiple invasive plants were removed by hand as part of regular monthly maintenance tasks, including: Himalayan Blackberries, Creeping Buttercup, Teasel, Common Mullein, Reed Canary Grass and Common Butterfly Bush.

9.3. *Operating problems and corrective actions*

The operating problems and corrective actions taken in 2023 are detailed in Table 13.

Table 13: 2023 Operating Problems and Corrective Actions

Problem	**Collection Disruption - Electronics, Small Appliances & Power Tools**
Description	On August 18, 2023, the City learned that a labour dispute between a collection partner and their distribution centre and truck driving staff was set to result in a strike that would negatively impact collection of electronics and small appliances from the City's Zero Waste Centres (Delta and Vancouver).
Corrective Action	After learning about the strike, the City decided to make use of storage space at the Landfill and continue to accept electronics, small appliances and power tools without receiving pick-ups from the collection partner. After one week of service disruption, collection from the public for these materials was paused at the Landfill due to volumes, and staff began investigating alternative methods for collection. In collaboration with Encorp Pacific (Return-It), the City was able to organize alternative collection on an interim basis. Collection of these items resumed at the Landfill ZWC on September 22, 2023.
Problem	**Landfill Entrance Gate Damage**
Description	After upgrading the Landfill entrance gate with an additional automatic opener, new rollers and a new motor in 2022, the gate was damaged in 2023 by a vehicle. The damage affected operation of the automatic opener and functionality of the gate.
Corrective Action	Repairs began in 2023 to replace damaged components and return the gate system to its proper alignment and are expected to be fully completed in 2024.
Problem	**Perimeter Ditch Berm Repairs**
Description	It was discovered during an inspection of the leachate collection system (December 11, 2023) that a 25 metre section (approximate) of the intermediate berm north of the W40 ha closure had cracked and shifted towards the inner ditch, partially restricting leachate flow. The resulting crack was allowing water from the outer ditch to flow into and mix with leachate in the inner ditch, thereby increasing the amount of leachate that required disposal.
Corrective Action	The City restricted access to the area and notified ENV and other stakeholders of the compromised berm. SHA was retained to assess the situation and proposed mitigation measures in consultation with a contractor who was working elsewhere on site. The berm was stabilized by placing geotextile fabric and gravel within the inner ditch to prevent further movement. The gravel was shaped to allow leachate to continue to flow along the channel. Cracks in the berm were filled with peat to reduce flow from the outer ditch. Prior to the work, water quality samples were collected upstream and downstream of the compromised berm. AECOM was retained to analyze the result to determine if there were any water quality impacts to the outer ditch and results are pending. The repairs will be monitored in 2024 to determine if further work is necessary.

Problem	**Water Line Leaks**
Description	In 2023, Staff began to notice the invoiced values from the City of Delta for water use at the Landfill were significantly higher than previous years. After extensive investigation, two water distribution system leaks were found, one at the Composting Facility and another at a hydrant by the flare station.
Corrective Action	Investigations to identify the source of the water leak involved closing valves in different areas and monitoring the water meter to see if any change in flow occurred. Once identified, both leaks were repaired in 2023.

9.4. Operational and maintenance expenditures

As detailed in Table 13, the total spent on operations and maintenance at the Landfill in 2023 was $26.8 million, 4.6 percent lower than in 2022.

Table 14: Operational and Maintenance Expenditures for 2022 & 2023

Item[1]	2023	2022
Salaries, Administration, Wages & Fringe Benefits	$6,784,585	$6,133,694
Vehicle & Equipment Rental	$5,290,727	$5,856,743
Insurance, Taxes, Loan Payments, Utilities, Building Maintenance, Permits & Landscaping	$6,741,540	$7,400,197
Recycling	$392,266	$380,814
Roads and Cover	$1,906,205	$1,765,750
Water Quality, Gas Management, Ditch Maintenance, Bird Control, Household Hazardous Waste Disposal, etc.	$1,519,587	$1,817,091
Consulting Projects (Leachate Upgrades, Gas, etc.)	$269,140	$116,025
Sewer and Soil Deposit Fees	$3,009,469	$3,856,844
Weighscales	$914,909	$788,042
Total	$26,828,428	$28,115,199

Note:
[1] Items do not include capital loan repayments and other cost allocations.

9.5. *Public complaint and resolution log*

In 2023, there were 19 complaints logged related to the Landfill, up from 12 received in 2023. The Public Complaint and Resolution Log for 2023 is available in Appendix 8.

More than one complaint was received related to each of the following categories:

- Compost Sales
    - Customers raised concerns about the price and availability of compost for purchase, as well as the restriction on the amount of compost each customer is permitted to purchase per day. Compost sales and restrictions are based on availability, which varies depending on the amount of yard trimmings received.
- Customer Experience
    - Customers raised concerns regarding communications by Staff, such that messaging could have been communicated in a friendlier and more understanding manner. When a customer experience complaint is received, a Superintendent contacts the customer to gather information and works with the Staff member to resolve the issue for the future.
- Disposal Pricing
    - Customers raised concerns about the price of disposal for various materials including mattresses and food scraps. Feedback is noted for future reviews of disposal pricing. Tipping fees are updated annually and are aligned with Metro Vancouver's Recycling and Waste Centres.
- Website Clarity
    - Customers raised concerns about inconsistency between information presented on City of Vancouver website and what they are told on arrival at the Landfill. Specifically, customers reported confusion regarding the residential volume restrictions on recycling at the ZWC. When this type of complaint is received, Staff review related information and make necessary changes to the website or clarify information with the customer.

9.6. *Landfill tours*

Landfill Staff typically provide tours of the Landfill for a variety of visitors, including school groups (grade 5 to university levels), special interest groups, industry associations and professionals, delegates from other countries and members of the public. Tours provide the opportunity to showcase how waste is responsibly managed to minimize environmental impacts, and how much work we still have to do as a society to reduce the amount of waste sent for disposal.

Landfill tours resumed in 2023 for smaller groups after a suspension from 2020 to 2022 due to COVID-19. Formal tours for school classes in grades 5 to 12 are resuming in 2024 as well as the Landfill Open House. Teachers interested in signing up their classes for this tour can visit the Metro Vancouver website: https://metrovancouver.org/school-programs/vancouver-landfill

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Appendix 1: Progressive closure status

Area	Construction Timeframe	As of Dec 31, 2023			Completed by
		Area Closed	Additional Infrastructure Installed	Spend in year incurred	
Phase 1	2009-2010	14 ha	22 vertical gas wells and 1 horizontal gas collector; 9 stormwater discharge bridges	$ 12M	CH2M Hill, SHA, Tyam Construction
	2012-2013	3.5 ha	Toe closure and ditch to divert stormwater to 2 southern discharge bridges only	Included with Phase 2 below	RF Binnie Civil Engineering Consultants (Binnie), SHA, SCS Engineers (SCS), King Hoe Excavating (King Hoe)
Phase 2	2012-2013	19 ha	89 vertical gas wells and 12 horizontal gas collectors; 1 stormwater retention pond with 11,500 m^3 design capacity	$ 17.4M	Binnie, SHA, SCS, King Hoe
Phase 3W	2013	9.5 ha	13 vertical gas wells; 1 stormwater retention pond with 88,500 m^3 design capacity (to serve all of Phase 3)	$ 15.3M	Binnie, SHA, SCS, BD Hall Constructors (Hall)
Phase 3SE	2017-2018	9.7 ha	11 vertical gas wells	$ 10M	Binnie, Golder, Hall
Phase 3NE	2018-2019	15.2 ha	33 vertical gas wells and 7 horizontal gas collectors	$ 19.9M	Binnie, SHA, SCS, M2K
W40 ha	2017-2020	36.4 ha	27 vertical gas wells, 32 DRAINTUBE gas collectors; 6 stormwater retention ponds with 87,700 m^3 design capacity	$ 23.5M	Binnie, SHA, SCS, King Hoe
Phase 4S	2020	10.8 ha	19 vertical gas wells, 28 horizontal gas collectors; 1 stormwater retention pond with 100,000 m^3 design capacity	$ 11.5M	SHA, SCS, King Hoe
Phase 4N	2021-2022	8.7 ha	27 vertical gas wells; 6 horizontal gas collectors; 7 temporary vertical gas wells	$10.2M	SHA, SCS, King Hoe
Total (ha)		**126.8**			

ha = hectare (equal to 10,000 m^2 or 2.47 acres)

Appendix 2: Annual waste quantities

Table A1: 2023 Material Summary by Source

	Waste Discharge				Cover	Road Construction & Other Beneficial Use					Capital & Closure		VLF Composting	
Source	VSTS MSW tonnes	VLF MSW tonnes	Total MSW tonnes	Demo tonnes	Cover Soil tonnes	Sand tonnes	Demo hog tonnes	Wood Waste tonnes	Crushed Concrete & Asphalt Grindings tonnes	Purchased Aggregate tonnes	Aggregate tonnes	Sand & Soil tonnes	VSTS Yard Trimmings tonnes	VLF Yard Trimmings tonnes
By Municipality	**134,455**	**133,136**	**267,590**										**11,888**	**9,134**
Vancouver Residential Collection	33,832	26	33,858											
Vancouver Public Works	6,429	9,154	15,583		304,207			21	10,080	20,656	197		1,319	6,778
Vancouver Commercial & Residential Drop-Off	52,509	28,913	81,422	5,254	2,278	775	17,866	628	28,710				10,155	436
Delta Residential Contractor		14,708	14,708											
Delta Public Works		3,338	3,338		71,647			7	8,629					324
Delta Commercial	474	14,039	14,513	1,425	25,176			161	1,166		6,554	150	10	100
Delta Residential Drop-Off	59	4,181	4,240					1,585					7	1,071
Richmond	36,729	30,581	67,310	1,369			55,482	441	5,631	11,417	1,779	2,681	234	114
UEL	2,672	39	2,711					0.1	42				4	0
Surrey	113	24,021	24,133	5,817	31,996		17,443	412	12,022		1	8,995	30	244
White Rock	8	361	369	156				63	142				1	34
Other Municipalities*	1,630	3,775	5,405	6,911	20,595			115	1,366				129	32
Out of Region											13,035			
Regional Waste Transfer		**411,890**	**411,890**											
Coquitlam Recycling and Waste Centre		131,154	131,154											
North Shore Recycling and Waste Centre		110,967	110,967											
Surrey Recycling and Waste Centres		154,900	154,900											
Maple Ridge Recycling and Waste Centre		8,298	8,298											
Langley Recycling and Waste Centre		6,571	6,571											
Other Authorized Waste		**43,196**	**43,196**											
Bottom Ash		38,177	38,177											
Water Treatment Plant Residuals		2,594	2,594											
Sewage Treatment Plant Residuals		2,425	2,425											
Digester Solids		-	-											
Non-Recyclable Marine Debris		-	-											
Totals	**134,455**	**588,222**	**722,676**	**20,932**	**455,900**	**775**	**90,791**	**3,432**	**67,787**	**32,073**	**21,567**	**11,827**	**11,888**	**9,134**
Total Materials to Vancouver Landfill												**1,427,760**		**21,022**

* Burnaby, City of Langley, City of North Vancouver, Coquitlam, District of North Vancouver, District of West Vancouver, Langley Township, Maple Ridge, New Westminster, Pitt Meadows, Port Coquitlam, Port Moody.

Note: Totals may vary due to rounding errors.

Table A2: 2022 Material Summary by Source

	Waste Discharge				Cover	Road Construction & Other Beneficial Use					Closure		VLF Composting	
Source	VSTS MSW tonnes	VLF MSW tonnes	Total MSW tonnes	Demo tonnes	Cover Soil tonnes	Sand tonnes	Demo hog tonnes	Wood Waste tonnes	Crushed Concrete & Asphalt Grindings tonnes	Purchased Aggregate tonnes	Aggregate tonnes	Sand & Soil tonnes	VSTS Yard Trimmings tonnes	VLF Yard Trimmings tonnes
By Municipality	**136,151**	**175,934**	**312,085**										**11,231**	**5,666**
Vancouver Residential Collection	34,945		34,945											
Vancouver Public Works	5,960	4,942	10,902		232,965			9	3,649	17,329	3,501		640	3,276
Vancouver Commercial & Residential Drop-Off	54,749	47,282	102,031	9,966	28,487		18,397	823	14,277	74		28,920	10,051	505
Delta Residential Contractor		15,135	15,135											
Delta Public Works		3,813	3,813		78,323			12	15,615					133
Delta Commercial	1,213	15,157	16,370	2,822	15,864	399		99	609	1,607	120	6	7	96
Delta Residential Drop-Off	22	4,607	4,629					1,582					5	1,159
Richmond	35,378	36,795	72,173	16,675			59,712	419	345	28,637	14,359	137	328	156
UEL	2,686	0	2,686										12	0
Surrey	48	38,443	38,491	10,168	27,849		13,186	379	3,276			33,172	27	242
White Rock	6	449	455	575				86	140				2	62
Other Municipalities*	1,144	8,265	9,409	12,763	54,004			105	855		225	85,441	160	36
Out of Region		1,045	1,045							5,350	26,457			
Regional Waste Transfer		**326,019**	**326,019**											**0**
Coquitlam Resource Recovery Transfer		105,549	105,549											
North Shore Transfer Station Transfer		99,121	99,121											
Surrey Transfer Station Transfer		106,266	106,266											
Maple Ridge Transfer Station		8,788	8,788											
Langley Transfer Station		6,295	6,295											
Other Authorized Waste		**43,413**	**43,413**											
Bottom Ash		37,281	37,281											
Water Treatment Plant Residuals		3,258	3,258											
Sewage Treatment Plant Residuals		2,811	2,811											
Digester Solids		48	48											
Non-Recyclable Marine Debris		15	15											
Totals	**136,151**	**545,366**	**681,516**	**52,969**	**437,493**	**399**	**91,295**	**3,515**	**38,767**	**52,997**	**44,662**	**147,676**	**11,231**	**5,666**
Total Materials to Vancouver Landfill												**1,551,288**		**16,896**

* Burnaby, City of Langley, City of North Vancouver, Coquitlam, District of North Vancouver, District of West Vancouver, Langley Township, Maple Ridge, New Westminster, Pitt Meadows, Port Coquitlam, Port Moody.

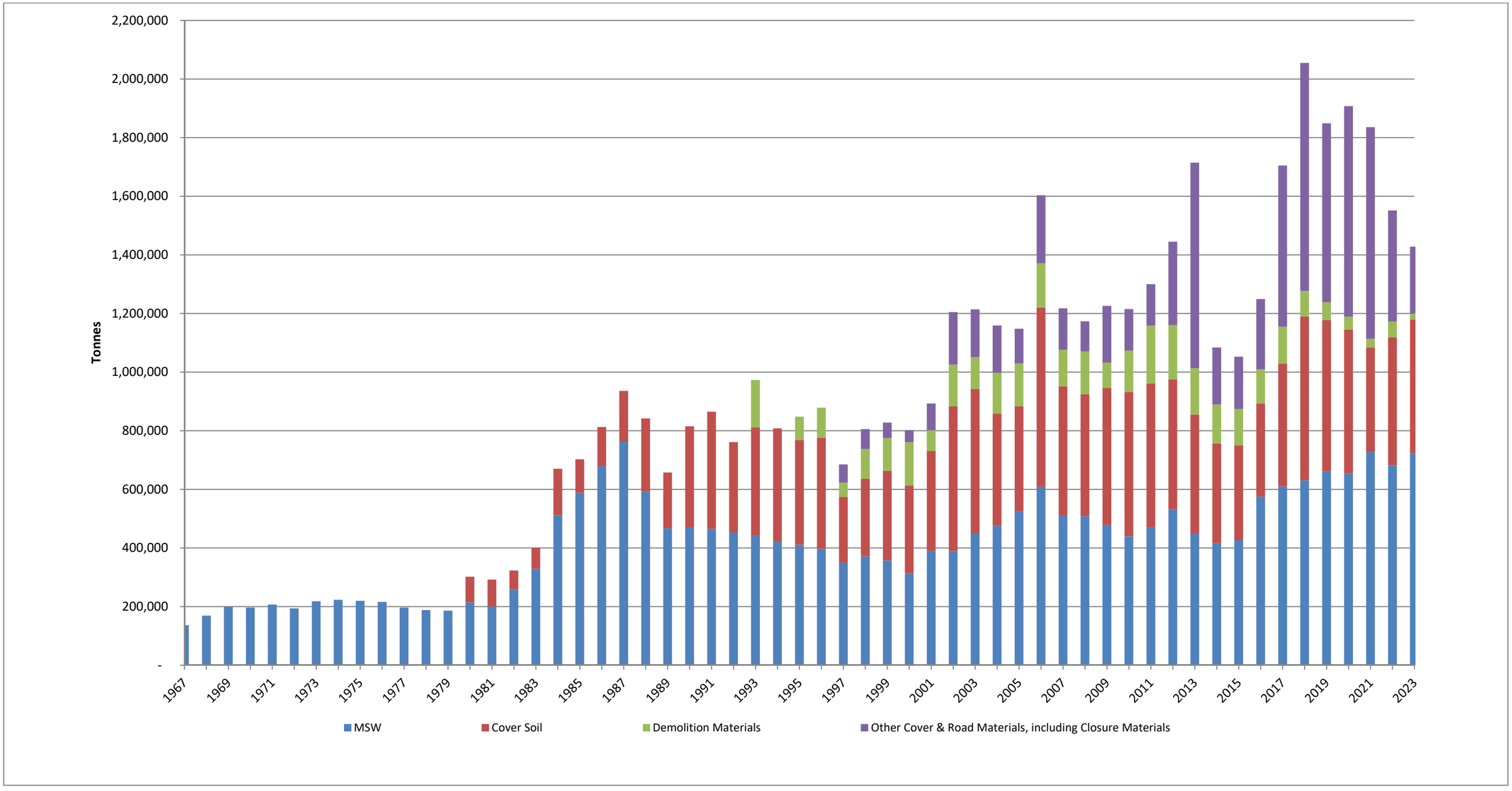
Note: Totals may vary due to rounding errors.

Table A3: 2023 Material Summary by Month

2023	Waste Discharge					Cover, Road, Capital & Closure Materials			VLF Composting		
Month	VSTS tonnes	VLF tonnes	Total tonnes	Bottom Ash tonnes	Demolition Material tonnes	Cover Material tonnes	Road & Other Beneficial Use Materials tonnes	Capital & Closure Materials tonnes	VSTS Yard Trimmings tonnes	VLF Yard Trimmings tonnes	Yard Trimmings Total tonnes
January	11,292	47,672	58,965	3,220	2,928	28,860	19,676	2,640	1,238	455	1,693
February	9,599	33,687	43,287	2,966	1,457	30,022	10,608	5,576	600	333	933
March	12,444	40,971	53,416	3,489	3,074	59,761	16,108	3,382	1,136	479	1,615
April	10,514	42,040	52,553	2,939	2,058	39,471	14,968	5,543	836	331	1,166
May	11,720	51,796	63,516	3,534	1,430	31,962	19,109	0	802	442	1,244
June	10,939	49,248	60,187	3,946	1,752	33,752	17,361	715	777	513	1,289
July	11,182	50,245	61,427	2,119	2,373	48,046	16,287	1,292	629	379	1,009
August	11,652	46,927	58,579	3,695	2,031	45,173	15,534	2,851	601	360	961
September	11,030	46,995	58,025	2,805	1,274	33,839	20,005	1,899	630	347	977
October	11,598	46,604	58,202	2,804	705	31,259	14,286	4,004	1,292	441	1,733
November	11,469	47,343	58,813	3,394	1,100	45,926	16,109	2,463	2,384	2,386	4,770
December	11,015	46,515	57,530	3,267	751	27,827	14,806	3,027	962	2,669	3,632
Totals	134,455	550,045	684,499	38,177	20,932	455,900	194,858	33,394	11,888	9,134	21,022
Total Materials to Vancouver Landfill								1,427,760			

Note: Totals may vary due to rounding errors.

Figure A1: Historical Regional Waste Quantities



Appendix 3: 2023 Recyclable and banned materials

Recyclable Materials – Accepted for FREE (Residential Only)

- ✓ Aerosol paint and empty containers
- ✓ Antifreeze and empty antifreeze containers
- ✓ Books
- ✓ Cardboard (flatten)
- ✓ Cell phones
- ✓ Clothing
- ✓ Cooking oil and grease (maximum 10 L per day)
- ✓ Electronics, small appliances and power tools (max 5 large items)
- ✓ Flammable liquids
- ✓ Flexible Plastics
- ✓ Fluorescent light bulbs and tubes
- ✓ Foam packaging (no foam peanuts)
- ✓ Glass bottles and jars
- ✓ Household batteries
- ✓ Large appliances (including refrigerators, freezers, air conditioners)
- ✓ Lawnmowers – electric, battery, or gas-powered (drain gasoline and oil)
- ✓ Lead acid car and truck batteries
- ✓ Metal containers (cans, tins, foil, empty aerosol cans excluding spray paint cans)
- ✓ Paint and empty paint cans
- ✓ Paper containers (tetra-packs, coffee cups)
- ✓ Pesticides
- ✓ Plastic containers (jars, jugs, bottles)
- ✓ Printed paper and paper packaging (newspaper, magazines, catalogues, writing paper, paper bags)
- ✓ Propane tanks (maximum 4 disposable and 2 refillable)
- ✓ Scrap metal
- ✓ Smoke and carbon monoxide alarms
- ✓ Thermostats
- ✓ Tires (passenger or light truck with or without rims; maximum of 10)
- ✓ Used oil (maximum 15 litres), oil filters (maximum 3) and empty oil containers

Recyclable Materials – Accepted for a FEE

- ✓ Gypsum drywall, new scraps only (maximum level pick-up truckload)
- ✓ Food scraps (maximum 130 kg)
- ✓ Mattresses and box springs (maximum 8 pieces)
- ✓ Wood waste (includes painted, stained and treated wood, residential quantities)
- ✓ Yard & garden trimmings

Banned Materials

The lists of Banned Materials that follow are taken from City of Vancouver *Solid Waste By-Law No. 8417,* in effect as of January 1, 2023.

Banned Hazardous and Operational Impact Materials (Schedule E)

The following wastes are prohibited from disposal at the Vancouver Landfill and Vancouver South Transfer Station:

1. Automobile bodies.
2. Refuse that is on fire, smoldering, flammable or explosive.
3. Hazardous Waste as defined in the *Hazardous Waste Regulation* (B.C. Reg. 63/88), with the exception of asbestos waste delivered to the Vancouver Landfill in accordance with the Asbestos Policy.
4. Propane tanks, with the exception of Propane Tanks delivered as recyclable materials;

5. Liquids or sludge.
6. Coated or uncoated wire and cable that exceeds either 1% of the total weight of the load or 1% of the total volume of the load.
7. Dead animals from personal or business activities.
8. Inert fill material including soil, sod, gravel, concrete and asphalt exceeding 0.5 cubic metres per load, with the exception of those materials meeting the City Engineer's specifications for landfill cover, road building, and closure.
9. Excrement, other than amounts of pet excrement that are double bagged and discarded with Municipal Solid Waste and that do not exceed either 5% of the total weight of the load or 5% of the total volume of the load.
10. Barrels, drums, pails or other large (205 litre or greater) liquid containers.
11. New or used gypsum (drywall), with the exception of residential used gypsum (drywall) delivered to the Vancouver Landfill in accordance with the Drywall Policy.
12. Mattresses, with the exception of Mattresses that are delivered in dedicated loads to the Vancouver Landfill for management as special handle waste requiring burial
13. Railroad ties or creosote treated wood.
14. Toxic Plants, with the exception of Toxic Plants that are double bagged and delivered in dedicated loads to the Vancouver Landfill for management as special handle waste requiring burial.
15. Personal hygiene products where the personal hygiene products make up more than 10% of the total weight of the load unless the personal hygiene products are double bagged in sealed plastic bags that are sufficiently durable to resist leaking or breaking during collection and disposal.
16. Any material that would cause undue risk of injury or occupational disease to any person at the Vancouver Landfill and Transfer Station or that would otherwise contravene the *Occupational Health and Safety Regulation* (B.C. Reg. 296/97) enacted pursuant to the *Workers Compensation Act*, as amended or replaced from time to time.
17. Any other material deemed by the City Engineer as unacceptable for disposal at the Vancouver Landfill or Vancouver South Transfer Station.

Banned Recyclable Materials (Schedule F)

1. Beverage containers identified in "Schedule 1 — Beverage Container Product Category" to the *Recycling Regulation* (B.C. Reg. 449/2004) of the *Environmental Management Act*.
2. Containers other than beverage containers made of:
    i. Metal,
    ii. Glass,
    iii. Plastic identified by the SPI Code #1 (Polyethylene Terephthalate or PET) or SPI Code #2 (High Density Polyethylene or HDPE) or SPI Code #4 (Low Density Polyethylene or LDPE) or SPI Code #5 (Polypropylene or PP), or
    iv. Composite materials to create rigid packaging consisting of paper and polyethylene (gable top cartons, frozen food boxes, ice cream cartons, and microwaveable dinner cartons) or paper, polyethylene and aluminum (aseptic cartons).
3. Recyclable Paper.
4. Corrugated Cardboard.
5. Yard Waste.
6. Food Waste.
7. Clean Wood Waste.
8. Expanded Polystyrene Packaging.

Banned Product Stewardship Materials (Schedule G)

The following materials included in the effective Product Stewardship Program product categories of the *Recycling Regulation* of the *Environmental Management Act,* are banned from garbage containers, and from disposal as garbage at the Vancouver South Transfer Station, and Vancouver Landfill:

1. The following materials pursuant to Schedule 2 – Residual Product Category to the *Recycling Regulation*:
    - Solvents and flammable liquids;
    - Pesticides;
    - Gasoline;
    - Pharmaceutical products and medications;
    - Oil, oil filters and oil containers;
    - Paint and paint containers;
    - Lead-acid batteries; and
    - Antifreeze and antifreeze containers;
2. Electronics and electrical products, including metal household and commercial appliance, as identified in Schedule 3 – Electronics and Electrical Products Category to the *Recycling Regulation*;
3. Tires pursuant to Schedule 4 – Tire Product Category to the *Recycling Regulation*.

Appendix 4: 2023 Water quality monitoring location plan

Appendix 5: 2023 Water quality monitoring program parameters

Surface Water

alkalinity as $CaCO_3$	dissolved organic carbon	sodium, total & dissolved
aluminium, total	hardness as $CaCO_3$	specific conductivity
ammonia	iron, total & dissolved	sulphate
arsenic, total	lead, total	zinc, total
cadmium, total	magnesium, total & dissolved	temperature*
calcium, total & dissolved	manganese, total & dissolved	turbidity
chloride	nickel, total	TSS
chromium, total	pH*	TOC
cobalt, total	true colour	VOCs
copper, total	phenols	
dissolved oxygen*	potassium, total & dissolved	

Groundwater

alkalinity as CaCO3	cobalt, dissolved	pH*
aluminium, dissolved	copper, dissolved	phenols
ammonia	hardness as $CaCO_3$	potassium, dissolved
arsenic, dissolved	iron, dissolved	sodium, dissolved
cadmium, dissolved	lead, dissolved	specific conductivity
calcium, dissolved	magnesium, dissolved	sulphate
chloride	manganese, dissolved	temperature*
chromium, dissolved	nickel, dissolved	zinc, dissolved
		VOCs

Leachate Grab Samples

alkalinity as $CaCO_3$	cyanide	potassium, total & dissolved
aluminium, total	dissolved oxygen*	sodium, total & dissolved
ammonia	hardness as $CaCO_3$	specific conductivity
cadmium, total	iron, total & dissolved	sulphate
calcium, total & dissolved	lead, total	sulphide, total & dissolved
chloride	magnesium, total & dissolved	temperature*
chromium, total	manganese, total & dissolved	toxicity
cobalt, total	pH*	volatile organic compounds
copper, total	phenols, total**	zinc, total

Leachate Composite Samples

aluminium, total	copper, total	nickel, total
cadmium, total	iron, total	pH
chemical oxygen demand	lead, total	total suspended solids
chromium, total	manganese, total	zinc, total
cobalt, total	molybdenum, total	

Note:

* Field Data

** Total of 2,3,4,5 and 2,3,4,6 tetrachlorophenols and pentachlorophenols

Appendix 6: 2023 Annual water quality monitoring report executive summary

The City of Vancouver (CoV) has owned and operated the Vancouver Landfill (landfill) since 1966. AECOM Canada Ltd. (AECOM) reviewed historical data and interpreted leachate, groundwater, surface water and stormwater quality data collected at the landfill by CoV and AECOM staff between January 1, 2023 and December 31, 2023. This annual monitoring report presents the findings of the monitoring program review in accordance with the landfill Operational Certificate MR-01611 (OC). The requirements of the monitoring program and subsequent interpretation and reporting are specified within the OC and Waste Discharge Permit SC-100168-FSA (WDP). Section 3.5.2 of the OC requires that the annual report include a review and interpretation of the analytical data from receiving environment monitoring for the preceding year, and leachate flow data and leachate/drainage ditch levels. The WDP governs the discharge of leachate from the landfill. Leachate discharged from the landfill is conveyed through City of Delta and Metro Vancouver forcemains to the Annacis Island Wastewater Treatment Plant.

Monitoring data included measurements of leachate flows and leachate quality at the leachate pump station near the southwest corner of the landfill. Groundwater elevations and groundwater quality were measured in the shallow and deep aquifers with monitoring stations that surround the footprint of the landfill and are located immediately outside the perimeter ditch leachate collection system (perimeter ditch system). Surface water elevations and surface water quality were measured in the outer surface water drainage ditch (Drainage Ditch) surrounding the landfill footprint, in downstream municipal ditches, and in Crescent Slough and the Delta Irrigation Enhancement Project Irrigation Canal (DIEP Canal), which are connected to the Fraser River. A Remote Water Level Monitoring System was commissioned in 2021 and became operational in May 2022. The new system continuously monitors water levels at 13 stations at the landfill, including the Dredge Pond, stormwater ponds, and the inner leachate collection ditch (Leachate Ditch) and Drainage Ditch in support of stormwater management at the landfill.

A routine stormwater monitoring program commenced in December 2019. Stormwater monitoring is not a requirement of the OC or the WDP. The purpose of the program is to monitor the quality of stormwater from closed phases/lined ponds at the landfill to support discharge of stormwater outside the leachate collection system. Three pilot stormwater discharge tests were carried out in 2019/2020 to assess the potential impacts of discharging clean stormwater to the Dredge Pond. Following favorable results, discharge of clean stormwater to the Dredge Pond became standard operating practice in 2021.

The 2023 monitoring program met or exceeded the requirements of the OC and WDP with respect to the number of stations, media being monitored, and parameters being analyzed, with the exception of a few surface water monitoring stations when ditches were dry and prohibited monitoring in late summer, similar to previous years.

The 2023 monitoring program included a quality assurance and quality control component that confirmed groundwater, surface water, leachate and stormwater quality data were acceptably precise and reliable. It also included a field sampling audit that confirmed the absence of issues that would materially affect the quality of data collected.

Flow Control System - Perimeter Ditch System

The perimeter ditch system consists of the Leachate Ditch and the Drainage Ditch, which are separated by an intermediate soil berm. The Drainage Ditch diverts natural surface runoff and shallow groundwater flow from Burns Bog around the landfill footprint. The Leachate Ditch collects the following waters, which are collectively referred to as ‘leachate’ once they reach the Leachate Ditch:

- Leachate – Rainwater that is contaminated after the water percolates through waste.
- Surface Runoff – Rainwater that flows along other surfaces at the landfill such as intermediate cover areas (temporarily closed) and operational areas (i.e. entrance area buildings and scales) that may be impacted by leachate.
- Stormwater – Rainwater that is collected above the impermeable geomembrane in closed areas of the landfill, that is not able to be redirected outside of the leachate collection system. It is not impacted by leachate.

- Impacted Stormwater – Rainwater that is collected above the impermeable geomembrane in closed areas of the landfill that is not yet suitable for discharge to the environment. Impacts are temporary and associated with recently closed phases of the landfill. It is not impacted by leachate.

Water collected in the Leachate Ditch flows to the landfill's leachate pump station before being discharged off-site through the municipal sanitary sewer system. Water in the sanitary line is conveyed to the Annacis Island Wastewater Treatment Plant.

The purpose of the perimeter ditch system is to maintain an inward hydraulic gradient around the landfill footprint to ensure leachate is collected and conveyed to the leachate pump station. To achieve this, water levels in the Leachate Ditch are actively maintained at a lower elevation than the Drainage Ditch through pump station control. Water levels in the Drainage Ditch are reflective of natural inputs from the surrounding lands; however, a system of weirs is in place to increase retention of natural runoff and maintain higher water elevations adjacent to Burns Bog.

Prior to 2022, leachate collection system containment efficiency was assessed using daily/weekly manual measurements from five (5) staff gauge locations, and the average containment efficiency between 1995 to 2021 was 93%. Based on continuous water level measurements from eight (8) Remote Water Level Monitoring System stations, the overall efficiency of the system in 2023 was estimated to be 76%, which was similar to the overall containment efficiency in 2022 (78%). The apparent sudden reduction in containment efficiency after 2021 is an artifact of the change in monitoring method, not a result of landfill operational changes, and doesn't signify a sudden decrease in containment efficiency. Furthermore, a comparison of manual water level measurements and Remote Water Level Monitoring System outputs was conducted in January 2024 to evaluate the accuracy of the system. Results indicated significant discrepancies (up to 0.1 m) that resulted in Remote Water Level Monitoring System outputs biased toward outward gradients (i.e. lower containment efficiency). The CoV is working on identifying the issue so the system can be recalibrated. The minor reduction in containment efficient between 2022 (78%) and 2023 (76%) is likely attributed to less precipitation in 2023. Although temporary outward gradients were observed at nearly all monitoring stations, calculated groundwater flow velocities across the berm (from Leachate Ditch to the Drainage Ditch) indicate that it is highly unlikely that leachate migrated to the Drainage Ditch in 2023.

Leachate Flow

The CoV maintained suitable flow measuring devices for the purpose of recording the volume of leachate discharged to the sanitary sewer each month as required under Section 3.2.2 of the OC. The total leachate discharge volume was approximately 30% lower than in 2022, while total precipitation in 2023 was about 25% lower than in 2022. The leachate and precipitation ratio in 2023 was 75%, which is noticeably lower than the results recorded between 2010 and 2022. The reduced leachate to precipitation ratio indicates that on-going stormwater management works continue to be effective at decreasing the volume of leachate-impacted waters generated at the landfill.

The highest daily leachate flow rate (33,247 m^3/day) occurred on December 5, 2023. This is below the WDP maximum (under review) daily limit of 45,000 m^3/day. Leachate discharge volumes remained in compliance with OC and WDP requirements during 2023.

Groundwater Flow

Two groundwater flow systems are present beneath the landfill. The shallow aquifer consists primarily of organic peat that extends from ground surface to approximately six (6) metres depth and is underlain by a thick permeable deep sand aquifer (known as the deep aquifer). The shallow and deep aquifers are separated by a low permeability silt/clay aquitard that varies in thickness from 1 to 5 metres. Water levels are monitored in both aquifers on a quarterly basis using a series of monitoring wells located around the perimeter of the landfill. The perimeter ditch system and Dredge Pond are important hydrologic features that influence groundwater levels and flow directions in both aquifers. Groundwater elevations fluctuated on the order of one metre seasonally. Groundwater levels were lower than the historical range in both the shallow and deep aquifers, likely because of reduced precipitation and recharge in 2023. However, seasonal patterns and flow gradient directions were generally similar to previous years. Groundwater flow directions were predominantly from northeast to southwest, which is consistent with previous years. Because topography is relatively flat, horizontal groundwater gradients and flow velocities in both the shallow and deep aquifers are relatively low.

Surface Water Flow
Regional surface water flows southwest from Burns Bog toward the perimeter ditch system. Surface water and shallow groundwater that enter the perimeter ditch system is diverted around the landfill footprint and discharged into Crescent Slough, the DIEP Canal, or the municipal ditch network from connection points at the northwestern and southwestern corners of the landfill. The City of Delta intermittently opens a floodgate to allow river water to flow into the DIEP Canal for irrigation purposes on nearby agricultural lands. As a result, periodic surface water flow reversals have been observed under certain tidal, river discharge and operational scenarios. In late summer, portions of the perimeter ditch system on the north, east and southeast sides of the landfill cease to flow or become dry following prolonged periods of dry weather. Surface water in the Drainage Ditch near the leachate pump station receives water inputs from the municipal ditch network west of the landfill. Surface water in this area is primarily discharged to the DIEP Canal and the municipal ditch network south of the landfill.

Leachate Quality Summary
Monthly leachate quality samples were collected from the approved sampling point at the leachate pump station in accordance with OC and WDP requirements. All samples were analyzed for the parameters stipulated in the OC and WDP. All leachate quality samples met applicable discharge criteria in 2023 except toxicity, which exceeded HWR criteria in four leachate grab samples (similar to previous years).

Groundwater Quality
As per the OC, quarterly monitoring must be conducted on five (5) shallow monitoring wells and seven (7) deep monitoring wells. In 2023, the monitoring program included 18 shallow monitoring wells and 20 deep monitoring wells. Quarterly groundwater quality samples were collected from the monitoring stations required by the OC. The remaining monitoring wells were also sampled on a quarterly basis, except for three wells that were only monitored for water levels and field parameters. All samples were analyzed for the parameters stipulated in the OC.

Groundwater quality in the shallow aquifer is strongly influenced by bog water chemistry. Upgradient groundwater flowing from Burns Bog toward the landfill is naturally acidic and contains elevated concentrations of several constituents that are readily mobilized under acidic conditions. Deep groundwater chemistry appears to have minimal influence from Burns Bog and represents a compilation of upgradient sources. Water chemistry in both shallow and deep aquifers naturally evolves along the flow path, particularly in the shallow aquifer, as groundwater travels away from the bog hydrologic system. Professional judgement was used to assess the nature and degree of any water quality impacts that may have occurred due to leachate, road salt, runoff from neighbouring lands, and brackish waters from tidal fluctuations and municipal floodgate operations.

Groundwater quality results were tabulated and compared against applicable *Contaminated Sites Regulation* (CSR) standards. The shallow aquifer is not considered to be a drinking water aquifer due to the presence of organic soils. Primary leachate indicator parameters are considered to be ammonia, conductivity, and chloride. Secondary leachate indicator parameters include alkalinity and hardness. All of these parameters were used to assess any leachate impacts in consideration of background concentrations of leachate indicator parameters and the results of statistical trend analysis.

Similar to previous years, leachate-impacted groundwater was contained within the landfill property.

Shallow Groundwater Quality
Background water quality in the shallow aquifer was similar to previous years and reflected natural water chemistry in Burns Bog. Shallow groundwater quality at all monitoring stations does not appear to be impacted by leachate, with one exception (54-2013).

Shallow groundwater quality at monitoring station 54-2013 (south of the landfill and northeast of the Dredge Pond) continued to exhibit dilute leachate impacts. Based on the results of the *2023 Hydrogeology Review*, groundwater quality at this location, and up to 25 metres beyond the perimeter ditch system, is impacted by dilute leachate. The impacts are relatively minor and are contained within the landfill property boundary due to net-inward hydraulic gradients from the bog towards the perimeter ditch system. Water quality at 54-2013 met all applicable CSR standards.

The consistently elevated ammonia and conductivity in shallow groundwater wells along the southwestern corner of the property (wells 25-2019, 26-2013 and 50) are attributed to the upwelling and mixing of deep groundwater and not associated with leachate impacts due to low chloride concentrations.

Shallow groundwater quality data met all applicable CSR Freshwater Aquatic Life (AW) and Irrigation Water Use (IW) standards in 2023 except for arsenic in the well adjacent to the Cranberry Research Facility (39-2013), which exceeded the AW standard in Q1 and Q2. Impacts at this location have not been observed historically. The exceedances appear to be temporary, are likely attributed to off-site activities in the vicinity of the well.

Deep Groundwater Quality

In 2023, deep groundwater quality at all monitoring stations does not appear to be impacted by leachate. Background water quality in the deep aquifer was similar to previous years and reflected natural water chemistry. Concentrations of leachate indicator parameters and other dissolved minerals are higher than those observed in the overlying shallow aquifer. Concentrations of select leachate indicator parameters at downgradient monitoring wells are slightly higher than upgradient of the landfill, which may be the result of off-site sources (i.e. upwelling saline waters, municipal irrigation system, road salt impacts, tidal influences, etc.).

Deep groundwater quality data met the applicable CSR Irrigation Water Use (IW) standards, with the exception of chloride at well 124 (located at the southwest corner of the landfill), aluminum at well 36-2013 and chromium at wells 36-2013 and 57. Chloride concentrations at well 124 are inferred to be the result of DIEP Canal construction in 2013 and potentially impacts associated with land clearing works south of the landfill. Elevated aluminum concentrations at well 36-2013 were localized and temporary and are attributed to off-site activities in the vicinity of the well. Chromium is not considered an accurate indicator of landfill leachate impacts at the landfill due to the low concentrations of chromium in leachate.

Deep groundwater quality data met CSR AW standards, except for chromium at wells 36-2013 and 57. As mentioned above, localized chromium impacts are not associated with leachate.

Deep groundwater quality data met applicable CSR Drinking Water Use (DW) standards, with the exception of dissolved vanadium at background well 121 and downgradient wells 36-2013 and 57. Vanadium impacts are not considered an indicator of landfill leachate due to relatively low concentrations of vanadium in leachate and high natural background concentrations.

Surface Water Quality

As per the OC, quarterly monitoring and sampling must be conducted at eight (8) surface water monitoring stations. In 2023, 13 surface water monitoring stations were monitored and sampled to confirm compliance with the OC.

In 2023, the surface water monitoring program exceeded the requirements stipulated in the OC based on the number of stations and parameters monitored. The only exceptions were associated with locations that could not be sampled in the summer when ditches were dry.

Surface water quality at monitoring stations located north, northwest, northeast, and south of the landfill does not appear to be impacted by leachate. Water chemistry at these locations is strongly influenced by naturally acidic surface water runoff and groundwater seepage from Burns Bog. Similar to previous years, pH, turbidity, total suspended solids and select metals concentrations exceeded BCWQG AW and IW criteria. Exceedances at these stations are consistent with background water quality and are attributed to the naturally acidic water quality due to water inputs from Burns Bog.

Surface water quality at monitoring stations located west and southwest of the landfill do not appear to be impacted by leachate in 2023. Similar to previous years, pH, turbidity, total suspended solids and select metals concentrations exceeded BCWQG AW and IW criteria. Water quality impacts at these locations are attributed to poor water quality in the municipal irrigation network caused by seasonal runoff from nearby agricultural fields, roadways, upwelling of deep saline waters, and influences from the Fraser River.

Stormwater Quality

The purpose of the stormwater monitoring program is to characterize the quality of stormwater discharging from closed landfill phases and lined stormwater detention ponds to confirm if the water is suitable for discharge outside the leachate collection system.

Based on 2023 results, stormwater quality from the closed Phases 1, 2, 3, Western 40 Pond 6, and Phase 4 Pond was similar to or better than water quality in nearby on-site and off-site receiving environments (e.g. Dredge Pond, Crescent Slough, and Centre Ditch). As such, stormwater from these locations were considered acceptable for discharge outside the leachate collection system. Stormwater from Phases 1, 2, 3 and Phase 4 Pond was discharged to the Dredge Pond in 2023, and water quality in the Dredge Pond was not affected. Stormwater from Western 40 Pond 6 is discharged into the Leachate Ditch because conveyance infrastructure capable of discharging stormwater beyond the Leachate Ditch was not yet available.

Stormwater quality from station 107 (Western 40 Pond 4) has improved since previous years, with no exceedances of applicable regulatory criteria in 2023. Favourable 2023 results indicate that water may be suitable for discharge outside of the leachate collection system in 2024.

Based on the findings of the 2023 Water Quality Monitoring Program Review, the following recommendations were made, and are presented with ongoing recommendations from previous years.

2023 - Monitoring Network		**Status**
2023-1	Leachate, groundwater, surface water and stormwater monitoring (i.e. water level monitoring and sampling) should be conducted as per the recommended 2024 Water Monitoring Program as outlined in **Appendix G** of this report. This includes resuming collection of monitoring field parameters at wells 112 (shallow), 113 (deep), and 35 (deep) to assist with groundwater quality contouring.	New
2023-2	Identify the cause of Drainage Ditch and Leachate Ditch water elevation discrepancies between manual and automated readings from Remote Water Level Monitoring System. Recalibrate the system, if required, and establish a weekly monitoring routine to collect manual water level measurements from all stilling wells that can be used to verify the accuracy of Remote Water Level Monitoring System outputs.	New
2023-3	Consult with survey professionals to determine the feasibility of increasing the accuracy of elevation measurements for stilling wells at stations L1/D1 to L8/D8. Continue to resurvey stilling wells on an annual basis to account for settlement impacts and recalibrate the Remote Water Level Monitoring System, as required.	New
2023-4	Complete the routine maintenance plan for the Remote Water Level Monitoring System stations to support collection of reliable and consistent data. At minimum, the maintenance program should include: annual cleaning of the stilling wells to remove sediments, quarterly cleaning of solar panels, and quarterly battery checks/ replacements, as required.	New
2023 – Stormwater Management		
2023-5	Stormwater quality data from 2023 supports stormwater discharge from W40-P4 (which receives stormwater inputs from all W40 ponds except W40-P6) outside of the leachate collection system starting in 2024. Stormwater discharge quality should continue to be monitored for verification purposes.	New
2023-6	The annual stormwater monitoring plan should be modified to reduce the number of samples that are collected and submitted for herbicide and pesticide parameters on an annual basis. Receiving environments (i.e. Dredge Pond and the municipal irrigation network) and on-site stormwater discharge points that do not have the appropriate infrastructure to convey stormwater beyond the Leachate Ditch (i.e. W40 P6 [108]) should be removed from the plan. Monitoring of on-site stormwater discharge points with the ability to discharge beyond the Leachate Ditch should continue, this includes Phase 1 (101), Phase 2 (103), Phase 3 (105), Phase 4 Pond (144), and W40 P4 (107). These changes have been incorporated into the recommended 2024 stormwater monitoring plan (**Appendix G4**).	New
2019 - Monitoring Network		
2019-2	Inactive monitoring Wells 19 and 20 should be decommissioned once access to the property south of the landfill is granted. The landowner has not responded to requests from the City.	On-going

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Appendix 7: 2023 Weekly leachate and drainage ditch water elevations

Date	L1/D1		Flow Direction	L2/D2		Flow Direction	L3/D3		Flow Direction	L4/D4		Flow Direction	L5/D5		Flow Direction	L6/D6		Flow Direction	L7/D7		Flow Direction	L8/D8		Flow Direction
	L1 m	D1 m		L2 m	D2 m		L3 m	D3 m		L4 m	D4 m		L5 m	D5 m		L6 m	D6 m		L7 m	D7 m		L8 m	D8 m	
Daily Data - Remote Water Level Monitoring System (Jan 01, 2023 - Dec 31, 2023)																								
1/1/2023	-0.12	-0.01	inward	-0.01	0.42	inward	0.27	1.10	inward	0.38	0.93	inward	0.13	0.72	inward	1.59	1.78	inward	1.50	1.70	inward	0.94	1.26	inward
1/2/2023	-0.14	-0.18	outward	-0.03	0.38	inward	0.26	1.09	inward	0.36	0.89	inward	0.04	0.70	inward	1.58	1.76	inward	1.49	1.67	inward	0.93	1.23	inward
1/3/2023	-0.15	-0.19	outward	-0.02	0.34	inward	0.27	1.06	inward	0.34	0.85	inward	-0.01	0.71	inward	1.60	1.76	inward	1.51	1.67	inward	0.92	1.21	inward
1/4/2023	-0.17	-0.20	outward	-0.03	0.33	inward	0.22	1.04	inward	0.32	0.83	inward	-0.06	0.65	inward	1.57	1.75	inward	1.50	1.65	inward	0.91	1.18	inward
1/5/2023	0.12	-0.21	outward	0.24	0.32	inward	0.51	1.04	inward	0.33	0.82	inward	0.05	0.68	inward	1.56	1.74	inward	1.49	1.62	inward	0.92	1.17	inward
1/6/2023	0.07	-0.22	outward	0.20	0.29	inward	0.45	1.00	inward	0.33	0.79	inward	0.00	0.62	inward	1.56	1.73	inward	1.48	1.60	inward	0.90	1.16	inward
1/7/2023	-0.01	-0.22	outward	0.10	0.29	inward	0.41	1.00	inward	0.31	0.77	inward	-0.08	0.61	inward	1.55	1.74	inward	1.46	1.60	inward	0.88	1.15	inward
1/8/2023	-0.06	-0.21	outward	0.04	0.31	inward	0.28	1.04	inward	0.35	0.81	inward	-0.06	0.68	inward	1.58	1.74	inward	1.49	1.64	inward	0.93	1.17	inward
1/9/2023	-0.13	-0.21	outward	0.04	0.31	inward	0.28	1.06	inward	0.34	0.86	inward	-0.10	0.72	inward	1.56	1.75	inward	1.48	1.66	inward	0.92	1.19	inward
1/10/2023	-0.16	-0.21	outward	0.01	0.32	inward	0.25	1.04	inward	0.33	0.81	inward	-0.14	0.71	inward	1.55	1.75	inward	1.48	1.65	inward	0.91	1.18	inward
1/11/2023	-0.17	-0.22	outward	-0.05	0.29	inward	0.25	1.02	inward	0.31	0.78	inward	-0.17	0.67	inward	1.55	1.73	inward	1.47	1.63	inward	0.89	1.16	inward
1/12/2023	-0.17	-0.23	outward	-0.05	0.33	inward	0.22	1.00	inward	0.30	0.75	inward	-0.17	0.64	inward	1.54	1.71	inward	1.48	1.59	inward	0.88	1.14	inward
1/13/2023	-0.18	-0.20	outward	-0.01	0.34	inward	0.27	1.04	inward	0.35	0.82	inward	-0.07	0.68	inward	1.56	1.74	inward	1.51	1.66	inward	0.92	1.18	inward
1/14/2023	-0.16	-0.21	outward	0.00	0.33	inward	0.30	1.06	inward	0.36	0.83	inward	-0.06	0.72	inward	1.59	1.75	inward	1.50	1.65	inward	0.93	1.20	inward
1/15/2023	-0.19	-0.21	outward	-0.05	0.31	inward	0.29	1.04	inward	0.33	0.82	inward	-0.06	0.71	inward	1.59	1.76	inward	1.50	1.64	inward	0.94	1.19	inward
1/16/2023	-0.22	-0.22	outward	-0.08	0.31	inward	0.26	1.03	inward	0.33	0.79	inward	-0.12	0.70	inward	1.61	1.74	inward	1.52	1.64	inward	0.91	1.17	inward
1/17/2023	-0.17	-0.19	outward	-0.04	0.32	inward	0.27	1.07	inward	0.33	0.89	inward	-0.04	0.73	inward	1.59	1.77	inward	1.49	1.71	inward	0.92	1.21	inward
1/18/2023	-0.10	-0.20	outward	0.06	0.33	inward	0.31	1.07	inward	0.34	0.85	inward	-0.05	0.71	inward	1.61	1.74	inward	1.53	1.67	inward	0.93	1.21	inward
1/19/2023	-0.14	-0.22	outward	-0.03	0.32	inward	0.29	1.05	inward	0.31	0.83	inward	-0.06	0.71	inward	1.57	1.76	inward	1.48	1.68	inward	0.89	1.20	inward
1/20/2023	-0.20	-0.23	outward	-0.09	0.28	inward	0.22	1.02	inward	0.29	0.80	inward	-0.16	0.64	inward	1.56	1.72	inward	1.49	1.66	inward	0.87	1.17	inward
1/21/2023	-0.20	-0.23	outward	-0.11	0.28	inward	0.22	1.00	inward	0.30	0.76	inward	-0.14	0.60	inward	1.56	1.72	inward	1.49	1.63	inward	0.87	1.15	inward
1/22/2023	-0.20	-0.22	outward	-0.06	0.28	inward	0.26	1.02	inward	0.35	0.81	inward	-0.11	0.67	inward	1.57	1.75	inward	1.48	1.68	inward	0.90	1.17	inward
1/23/2023	-0.25	-0.22	inward	-0.11	0.28	inward	0.24	1.03	inward	0.30	0.80	inward	-0.16	0.69	inward	1.57	1.75	inward	1.47	1.65	inward	0.87	1.17	inward
1/24/2023	-0.25	-0.23	inward	-0.12	0.26	inward	0.22	1.01	inward	0.29	0.77	inward	-0.20	0.61	inward	1.55	1.74	inward	1.49	1.65	inward	0.86	1.15	inward
1/25/2023	-0.24	-0.23	inward	-0.10	0.26	inward	0.22	1.00	inward	0.31	0.77	inward	-0.21	0.59	inward	1.55	1.75	inward	1.47	1.65	inward	0.87	1.15	inward
1/26/2023	-0.24	-0.24	inward	-0.10	0.25	inward	0.22	1.00	inward	0.31	0.78	inward	-0.21	0.60	inward	1.56	1.74	inward	1.49	1.64	inward	0.86	1.15	inward
1/27/2023	-0.19	-0.23	outward	-0.07	0.25	inward	0.26	1.00	inward	0.33	0.76	inward	-0.20	0.60	inward	1.60	1.76	inward	1.53	1.64	inward	0.88	1.15	inward
1/28/2023	-0.22	-0.23	outward	-0.08	0.25	inward	0.24	1.00	inward	0.32	0.76	inward	-0.19	0.63	inward	1.56	1.76	inward	1.47	1.65	inward	0.88	1.16	inward
1/29/2023	-0.25	-0.25	outward	-0.10	0.27	inward	0.22	0.98	inward	0.30	0.74	inward	-0.19	0.65	inward	1.56	1.73	inward	1.46	1.65	inward	0.86	1.14	inward
1/30/2023	-0.25	-0.25	outward	-0.09	0.23	inward	0.21	0.98	inward	0.29	0.72	inward	-0.17	0.64	inward	1.52	1.71	inward	1.48	1.64	inward	0.84	1.12	inward
1/31/2023	-0.23	-0.25	outward	-0.13	0.23	inward	0.21	0.97	inward	0.29	0.73	inward	-0.21	0.61	inward	1.53	1.73	inward	1.46	1.62	inward	0.84	1.11	inward
2/1/2023	-0.22	-0.25	outward	-0.10	0.22	inward	0.21	0.96	inward	0.30	0.71	inward	-0.20	0.58	inward	1.52	1.73	inward	1.47	1.62	inward	0.84	1.10	inward
2/2/2023	-0.22	-0.25	outward	-0.09	0.20	inward	0.21	0.95	inward	0.31	0.71	inward	-0.18	0.56	inward	1.53	1.72	inward	1.44	1.59	inward	0.85	1.10	inward
2/3/2023	-0.21	-0.25	outward	-0.12	0.18	inward	0.22	0.93	inward	0.31	0.71	inward	-0.18	0.55	inward	1.51	1.71	inward	1.45	1.62	inward	0.84	1.09	inward
2/4/2023	-0.23	-0.25	outward	-0.10	0.15	inward	0.20	0.93	inward	0.30	0.70	inward	-0.17	0.55	inward	1.52	1.72	inward	1.46	1.61	inward	0.84	1.09	inward
2/5/2023	-0.20	-0.25	outward	-0.10	0.15	inward	0.22	0.92	inward	0.32	0.70	inward	-0.15	0.56	inward	1.52	1.75	inward	1.44	1.61	inward	0.87	1.09	inward
2/6/2023	-0.24	-0.26	outward	-0.15	0.16	inward	0.20	0.92	inward	0.30	0.71	inward	-0.26	0.56	inward	1.48	1.73	inward	1.44	1.64	inward	0.81	1.10	inward
2/7/2023	-0.21	-0.25	outward	-0.15	0.20	inward	0.19	0.93	inward	0.29	0.70	inward	-0.26	0.55	inward	1.50	1.74	inward	1.42	1.61	inward	0.82	1.09	inward
2/8/2023	-0.15	-0.23	outward	-0.03	0.27	inward	0.23	0.99	inward	0.32	0.81	inward	-0.21	0.63	inward	1.54	1.78	inward	1.48	1.73	inward	0.86	1.16	inward
2/9/2023	-0.18	-0.24	outward	-0.10	0.28	inward	0.21	1.02	inward	0.29	0.77	inward	-0.21	0.61	inward	1.51	1.76	inward	1.44	1.70	inward	0.83	1.16	inward
2/10/2023	-0.17	-0.24	outward	-0.09	0.29	inward	0.22	0.99	inward	0.32	0.75	inward	-0.21	0.60	inward	1.52	1.76	inward	1.44	1.66	inward	0.84	1.14	inward
2/11/2023	-0.19	-0.24	outward	-0.11	0.31	inward	0.23	0.99	inward	0.29	0.72	inward	-0.26	0.56	inward	1.50	1.75	inward	1.43	1.67	inward	0.83	1.13	inward
2/12/2023	-0.19	-0.25	outward	-0.11	0.29	inward	0.20	0.98	inward	0.28	0.73	inward	-0.26	0.56	inward	1.50	1.71	inward	1.45	1.65	inward	0.83	1.12	inward
2/13/2023	-0.15	-0.25	outward	-0.04	0.32	inward	0.22	0.95	inward	0.32	0.71	inward	-0.23	0.59	inward	1.52	1.73	inward	1.45	1.66	inward	0.88	1.11	inward
2/14/2023	-0.16	-0.25	outward	-0.06	0.26	inward	0.23	0.95	inward	0.30	0.71	inward	-0.24	0.57	inward	1.52	1.73	inward	1.46	1.64	inward	0.87	1.12	inward
2/15/2023	-0.27	-0.26	inward	-0.15	0.26	inward	0.20	0.94	inward	0.28	0.70	inward	-0.26	0.56	inward	1.49	1.74	inward	1.44	1.65	inward	0.81	1.11	inward
2/16/2023	-0.26	-0.25	inward	-0.16	0.23	inward	0.21	0.93	inward	0.28	0.69	inward	-0.27	0.54	inward	1.49	1.73	inward	1.43	1.63	inward	0.82	1.10	inward
2/17/2023	-0.23	-0.25	outward	-0.12	0.25	inward	0.22	0.93	inward	0.30	0.69	inward	-0.22	0.57	inward	1.52	1.73	inward	1.46	1.62	inward	0.83	1.11	inward
2/18/2023	-0.24	-0.25	outward	-0.11	0.29	inward	0.23	0.94	inward	0.31	0.74	inward	-0.24	0.57	inward	1.52	1.75	inward	1.44	1.66	inward	0.83	1.12	inward
2/19/2023	-0.24	-0.25	outward	-0.11	0.25	inward	0.21	0.94	inward	0.30	0.74	inward	-0.26	0.60	inward	1.51	1.76	inward	1.44	1.68	inward	0.83	1.13	inward
2/20/2023	-0.28	-0.25	inward	-0.17	0.25	inward	0.23	0.94	inward	0.30	0.71	inward	-0.27	0.59	inward	1.52	1.73	inward	1.46	1.67	inward	0.84	1.13	inward
2/21/2023	-0.23	-0.24	outward	-0.12	0.26	inward	0.22	0.93	inward	0.31	0.71	inward	-0.22	0.60	inward	1.52	1.77	inward	1.46	1.65	inward	0.91	1.13	inward
2/22/2023	-0.25	-0.24	inward	-0.13	0.24	inward	0.22	0.95	inward	0.31	0.70	inward	-0.26	0.54	inward	1.49	1.74	inward	1.44	1.64	inward	0.83	1.13	inward
2/23/2023	-0.25	-0.25	outward	-0.12	0.24	inward	0.23	0.93	inward	0.30	0.69	inward	-0.28	0.52	inward	1.49	1.74	inward	1.45	1.63	inward	0.82	1.12	inward
2/24/2023	-0.27	-0.26	inward	-0.16	0.26	inward	0.18	0.93	inward	0.28	0.68	inward	-0.30	0.51	inward	1.49	1.72	inward	1.42	1.63	inward	0.79	1.11	inward
2/25/2023	-0.26	-0.26	inward	-0.17	0.26	inward	0.18	0.90	inward	0.29	0.69	inward	-0.31	0.50	inward	1.46	1.71	inward	1.44	1.59	inward	0.79	1.10	inward
2/26/2023	-0.21	-0.24	outward	-0.13	0.26	inward	0.20	0.89	inward	0.30	0.68	inward	-0.28	0.50	inward	1.49	1.74	inward	1.44	1.58	inward	0.79	1.11	inward
2/27/2023	-0.19	-0.24	outward	-0.12	0.29	inward	0.20	0.94	inward	0.30	0.69	inward	-0.27	0.51	inward	1.49	1.72	inward	1.43	1.64	inward	0.81	1.12	inward
2/28/2023	-0.15	-0.23	outward	-0.07	0.29	inward	0.21	0.95	inward	0.31	0.70	inward	-0.26	0.52	inward	1.51	1.75	inward	1.45	1.66	inward	0.81	1.12	inward
3/1/2023	-0.17	-0.24	outward	-0.10	0.28	inward	0.20	0.95	inward	0.30	0.73	inward	-0.26	0.55	inward	1.48	1.75	inward	1.44	1.65	inward	0.81	1.15	inward
3/2/2023	-0.17	-0.23	outward	-0.10	0.27	inward	0.21	0.96	inward	0.33	0.73	inward	-0.25	0.55	inward	1.50	1.77	inward	1.44	1.70	inward	0.82	1.16	inward
3/3/2023	-0.18	-0.23	outward	-0.09	0.30	inward	0.21	1.00	inward	0.30	0.78	inward	-0.23	0.59	inward	1.52	1.80	inward	1.46	1.74	inward	0.81	1.18	inward
3/4/2023	-0.16	-0.23	outward	-0.09	0.30	inward	0.23	1.00	inward	0.30	0.77	inward	-0.24	0.58	inward	1.52	1.78	inward	1.46	1.73	inward	0.82	1.19	inward
3/5/2023	-0.17	-0.24	outward	-0.07	0.30	inward	0.23	0.99	inward	0.30	0.78	inward	-0.27	0.59	inward	1.51	1.77	inward	1.45	1.70	inward	0.82	1.19	inward
3/6/2023	-0.29	-0.24	inward	-0.16	0.30	inward	0.19	0.99	inward	0.30	0.75	inward	-0.28	0.55	inward	1.52	1.77	inward	1.45	1.67	inward	0.80	1.17	inward
3/7/2023	-0.31	-0.25	inward	-0.16	0.26	inward	0.19	1.00	inward	0.29	0.73	inward	-0.28	0.53	inward	1.49	1.75	inward	1.45	1.67	inward	0.79	1.16	inward

Date	L1/D1		Flow Direction	L2/D2		Flow Direction	L3/D3		Flow Direction	L4/D4		Flow Direction	L5/D5		Flow Direction	L6/D6		Flow Direction	L7/D7		Flow Direction	L8/D8		Flow Direction
	L1	D1		L2	D2		L3	D3		L4	D4		L5	D5		L6	D6		L7	D7		L8	D8	
	m	m		m	m		m	m		m	m		m	m		m	m		m	m		m	m	
3/8/2023	-0.29	-0.25	inward	-0.15	0.27	inward	0.22	0.96	inward	0.29	0.70	inward	-0.29	0.54	inward	1.51	1.75	inward	1.45	1.65	inward	0.79	1.15	inward
3/9/2023	-0.29	-0.24	inward	-0.14	0.26	inward	0.19	0.95	inward	0.29	0.71	inward	-0.31	0.54	inward	1.51	1.72	inward	1.43	1.62	inward	0.79	1.15	inward
3/10/2023	-0.29	-0.24	inward	-0.13	0.30	inward	0.21	0.93	inward	0.30	0.68	inward	-0.30	0.52	inward	1.48	1.73	inward	1.44	1.58	inward	0.82	1.15	inward
3/11/2023	-0.28	-0.25	inward	-0.17	0.27	inward	0.19	0.91	inward	0.28	0.68	inward	-0.29	0.52	inward	1.48	1.73	inward	1.45	1.56	inward	0.79	1.14	inward
3/12/2023	-0.28	-0.25	inward	-0.19	0.24	inward	0.19	0.91	inward	0.30	0.69	inward	-0.30	0.50	inward	1.45	1.71	inward	1.43	1.56	inward	0.78	1.13	inward
3/13/2023	-0.20	-0.23	outward	-0.09	0.30	inward	0.24	0.91	inward	0.31	0.69	inward	-0.27	0.53	inward	1.52	1.74	inward	1.45	1.57	inward	0.82	1.16	inward
3/14/2023	-0.19	-0.23	outward	-0.07	0.28	inward	0.27	0.93	inward	0.33	0.71	inward	-0.24	0.54	inward	1.55	1.75	inward	1.46	1.60	inward	0.82	1.17	inward
3/15/2023	-0.23	-0.24	outward	-0.12	0.28	inward	0.20	0.94	inward	0.30	0.74	inward	-0.30	0.55	inward	1.49	1.77	inward	1.44	1.68	inward	0.81	1.19	inward
3/16/2023	-0.27	-0.25	inward	-0.19	0.27	inward	0.18	0.93	inward	0.30	0.74	inward	-0.31	0.54	inward	1.48	1.74	inward	1.43	1.64	inward	0.77	1.17	inward
3/17/2023	-0.25	-0.25	inward	-0.16	0.28	inward	0.18	0.93	inward	0.29	0.70	inward	-0.31	0.52	inward	1.48	1.74	inward	1.45	1.62	inward	0.78	1.15	inward
3/18/2023	-0.24	-0.25	outward	-0.16	0.28	inward	0.18	0.94	inward	0.28	0.69	inward	-0.31	0.51	inward	1.47	1.73	inward	1.44	1.60	inward	0.78	1.15	inward
3/19/2023	-0.22	-0.25	outward	-0.14	0.26	inward	0.19	0.92	inward	0.29	0.69	inward	-0.29	0.53	inward	1.48	1.72	inward	1.42	1.55	inward	0.79	1.14	inward
3/20/2023	-0.20	-0.25	outward	-0.17	0.27	inward	0.22	0.91	inward	0.31	0.69	inward	-0.31	0.55	inward	1.45	1.72	inward	1.43	1.56	inward	0.79	1.14	inward
3/21/2023	-0.22	-0.25	outward	-0.10	0.25	inward	0.19	0.90	inward	0.28	0.67	inward	-0.32	0.54	inward	1.44	1.70	inward	1.41	1.55	inward	0.78	1.13	inward
3/22/2023	-0.20	-0.25	outward	-0.11	0.32	inward	0.18	0.91	inward	0.31	0.67	inward	-0.33	0.49	inward	1.43	1.69	inward	1.41	1.55	inward	0.78	1.13	inward
3/23/2023	-0.20	-0.25	outward	-0.12	0.25	inward	0.19	0.88	inward	0.28	0.70	inward	-0.31	0.48	inward	1.42	1.69	inward	1.41	1.54	inward	0.78	1.12	inward
3/24/2023	-0.21	-0.26	outward	-0.13	0.24	inward	0.16	0.88	inward	0.29	0.68	inward	-0.34	0.52	inward	1.43	1.71	inward	1.39	1.51	inward	0.77	1.12	inward
3/25/2023	-0.21	-0.26	outward	-0.12	0.20	inward	0.16	0.89	inward	0.28	0.66	inward	-0.35	0.48	inward	1.42	1.69	inward	1.40	1.53	inward	0.76	1.11	inward
3/26/2023	-0.31	-0.26	inward	-0.20	0.21	inward	0.16	0.88	inward	0.27	0.65	inward	-0.33	0.52	inward	1.41	1.69	inward	1.40	1.52	inward	0.75	1.11	inward
3/27/2023	-0.31	-0.27	inward	-0.18	0.22	inward	0.15	0.87	inward	0.26	0.66	inward	-0.34	0.51	inward	1.40	1.68	inward	1.39	1.50	inward	0.75	1.11	inward
3/28/2023	-0.26	-0.25	inward	-0.16	0.21	inward	0.19	0.88	inward	0.28	0.67	inward	-0.33	0.47	inward	1.41	1.68	inward	1.42	1.49	inward	0.77	1.10	inward
3/29/2023	-0.25	-0.26	outward	-0.16	0.24	inward	0.17	0.88	inward	0.29	0.66	inward	-0.35	0.46	inward	1.38	1.68	inward	1.43	1.50	inward	0.77	1.10	inward
3/30/2023	-0.23	-0.26	outward	-0.15	0.22	inward	0.19	0.87	inward	0.29	0.66	inward	-0.34	0.43	inward	1.38	1.65	inward	1.42	1.50	inward	0.77	1.10	inward
3/31/2023	-0.24	-0.26	outward	-0.15	0.21	inward	0.17	0.86	inward	0.28	0.65	inward	-0.35	0.42	inward	1.40	1.67	inward	1.40	1.50	inward	0.77	1.09	inward
4/1/2023	-0.22	-0.26	outward	-0.14	0.24	inward	0.20	0.89	inward	0.27	0.65	inward	-0.31	0.43	inward	1.41	1.67	inward	1.41	1.48	inward	0.78	1.10	inward
4/2/2023	-0.23	-0.25	outward	-0.17	0.24	inward	0.18	0.88	inward	0.27	0.64	inward	-0.32	0.41	inward	1.37	1.66	inward	1.39	1.48	inward	0.77	1.10	inward
4/3/2023	-0.24	-0.25	outward	-0.16	0.25	inward	0.18	0.87	inward	0.26	0.64	inward	-0.34	0.44	inward	1.39	1.66	inward	1.41	1.50	inward	0.77	1.11	inward
4/4/2023	-0.24	-0.26	outward	-0.16	0.26	inward	0.17	0.87	inward	0.27	0.65	inward	-0.34	0.43	inward	1.38	1.66	inward	1.41	1.51	inward	0.76	1.10	inward
4/5/2023	-0.25	-0.26	outward	-0.16	0.23	inward	0.16	0.87	inward	0.26	0.64	inward	-0.33	0.42	inward	1.38	1.64	inward	1.39	1.50	inward	0.75	1.09	inward
4/6/2023	-0.23	-0.26	outward	-0.14	0.26	inward	0.18	0.86	inward	0.27	0.62	inward	-0.34	0.42	inward	1.38	1.64	inward	1.40	1.51	inward	0.77	1.10	inward
4/7/2023	-0.18	-0.24	outward	-0.12	0.27	inward	0.19	0.90	inward	0.29	0.64	inward	-0.29	0.41	inward	1.41	1.66	inward	1.44	1.51	inward	0.79	1.12	inward
4/8/2023	-0.19	-0.25	outward	-0.12	0.25	inward	0.20	0.90	inward	0.27	0.65	inward	-0.26	0.44	inward	1.40	1.67	inward	1.41	1.51	inward	0.78	1.13	inward
4/9/2023	-0.20	-0.25	outward	-0.13	0.25	inward	0.17	0.88	inward	0.27	0.66	inward	-0.30	0.44	inward	1.40	1.68	inward	1.42	1.54	inward	0.77	1.14	inward
4/10/2023	-0.31	-0.24	inward	-0.18	0.25	inward	0.17	0.91	inward	0.28	0.69	inward	-0.31	0.47	inward	1.41	1.72	inward	1.42	1.57	inward	0.77	1.15	inward
4/11/2023	-0.26	-0.23	inward	-0.13	0.12	inward	0.18	0.91	inward	0.28	0.70	inward	-0.29	0.49	inward	1.43	1.71	inward	1.44	1.56	inward	0.78	1.16	inward
4/12/2023	-0.26	-0.25	inward	-0.14	0.11	inward	0.19	0.91	inward	0.27	0.72	inward	-0.31	0.51	inward	1.44	1.73	inward	1.42	1.61	inward	0.78	1.17	inward
4/13/2023	-0.26	-0.25	inward	-0.16	0.09	inward	0.17	0.91	inward	0.29	0.71	inward	-0.29	0.51	inward	1.43	1.71	inward	1.42	1.59	inward	0.78	1.18	inward
4/14/2023	-0.26	-0.25	inward	-0.16	0.11	inward	0.18	0.90	inward	0.29	0.69	inward	-0.32	0.50	inward	1.40	1.71	inward	1.44	1.58	inward	0.79	1.17	inward
4/15/2023	-0.25	-0.25	outward	-0.15	0.08	inward	0.17	0.90	inward	0.26	0.69	inward	-0.33	0.50	inward	1.37	1.71	inward	1.45	1.58	inward	0.77	1.16	inward
4/16/2023	-0.30	-0.25	inward	-0.16	0.10	inward	0.20	0.90	inward	0.26	0.69	inward	-0.34	0.50	inward	1.39	1.70	inward	1.47	1.58	inward	0.80	1.17	inward
4/17/2023	-0.24	-0.23	inward	-0.10	0.13	inward	0.25	0.95	inward	0.30	0.77	inward	-0.24	0.54	inward	1.42	1.74	inward	1.50	1.65	inward	0.82	1.21	inward
4/18/2023	-0.23	-0.24	outward	-0.10	0.21	inward	0.23	0.94	inward	0.29	0.76	inward	-0.31	0.59	inward	1.43	1.74	inward	1.50	1.67	inward	0.83	1.21	inward
4/19/2023	-0.28	-0.24	inward	-0.17	0.20	inward	0.19	0.94	inward	0.27	0.74	inward	-0.32	0.57	inward	1.42	1.72	inward	1.50	1.65	inward	0.81	1.21	inward
4/20/2023	-0.31	-0.26	inward	-0.20	0.17	inward	0.20	0.93	inward	0.26	0.74	inward	-0.35	0.54	inward	1.38	1.71	inward	1.48	1.64	inward	0.79	1.20	inward
4/21/2023	-0.29	-0.26	inward	-0.15	0.19	inward	0.19	0.92	inward	0.26	0.74	inward	-0.35	0.51	inward	1.42	1.72	inward	1.49	1.62	inward	0.80	1.20	inward
4/22/2023	-0.29	-0.25	inward	-0.16	0.18	inward	0.20	0.93	inward	0.28	0.70	inward	-0.35	0.52	inward	1.38	1.72	inward	1.46	1.60	inward	0.79	1.20	inward
4/23/2023	-0.25	-0.25	inward	-0.11	0.18	inward	0.22	0.94	inward	0.28	0.70	inward	-0.34	0.51	inward	1.43	1.73	inward	1.52	1.61	inward	0.82	1.21	inward
4/24/2023	-0.22	-0.20	inward	-0.09	0.21	inward	0.24	0.93	inward	0.31	0.74	inward	-0.27	0.55	inward	1.45	1.75	inward	1.53	1.66	inward	0.83	1.23	inward
4/25/2023	-0.27	-0.24	inward	-0.13	0.22	inward	0.20	0.94	inward	0.28	0.77	inward	-0.32	0.57	inward	1.40	1.73	inward	1.50	1.67	inward	0.80	1.24	inward
4/26/2023	-0.27	-0.24	inward	-0.13	0.22	inward	0.20	0.99	inward	0.27	0.74	inward	-0.33	0.54	inward	1.40	1.73	inward	1.51	1.66	inward	0.79	1.22	inward
4/27/2023	-0.28	-0.25	inward	-0.15	0.25	inward	0.19	0.92	inward	0.27	0.72	inward	-0.34	0.51	inward	1.40	1.71	inward	1.50	1.64	inward	0.80	1.22	inward
4/28/2023	-0.28	-0.25	inward	-0.12	0.25	inward	0.21	0.92	inward	0.26	0.71	inward	-0.34	0.52	inward	1.40	1.73	inward	1.51	1.61	inward	0.79	1.21	inward
4/29/2023	-0.26	-0.25	inward	-0.19	0.26	inward	0.21	0.90	inward	0.26	0.70	inward	-0.35	0.50	inward	1.41	1.71	inward	1.53	1.59	inward	0.80	1.20	inward
4/30/2023	-0.26	-0.24	inward	-0.19	0.27	inward	0.22	0.90	inward	0.26	0.69	inward	-0.35	0.49	inward	1.40	1.71	inward	1.50	1.58	inward	0.79	1.19	inward
5/1/2023	-0.27	-0.24	inward	-0.17	0.31	inward	0.19	0.90	inward	0.26	0.68	inward	-0.36	0.47	inward	1.39	1.71	inward	1.52	1.55	inward	0.79	1.18	inward
5/2/2023	-0.28	-0.25	inward	-0.17	0.28	inward	0.19	0.90	inward	0.28	0.68	inward	-0.35	0.48	inward	1.39	1.71	inward	1.50	1.55	inward	0.79	1.17	inward
5/3/2023	-0.30	-0.25	inward	-0.20	0.23	inward	0.19	0.89	inward	0.26	0.68	inward	-0.37	0.52	inward	1.38	1.68	inward	1.51	1.53	inward	0.77	1.17	inward
5/4/2023	-0.30	-0.25	inward	-0.16	0.24	inward	0.16	0.90	inward	0.25	0.67	inward	-0.35	0.52	inward	1.38	1.68	inward	1.49	1.54	inward	0.77	1.16	inward
5/5/2023	-0.30	-0.24	inward	-0.18	0.22	inward	0.18	0.86	inward	0.25	0.68	inward	-0.37	0.53	inward	1.38	1.69	inward	1.49	1.53	inward	0.78	1.15	inward
5/6/2023	-0.28	-0.25	inward	-0.19	0.21	inward	0.17	0.87	inward	0.26	0.67	inward	-0.36	0.53	inward	1.37	1.68	inward	1.48	1.56	inward	0.78	1.16	inward
5/7/2023	-0.30	-0.25	inward	-0.19	0.24	inward	0.16	0.89	inward	0.25	0.66	inward	-0.38	0.55	inward	1.35	1.68	inward	1.50	1.55	inward	0.76	1.15	inward
5/8/2023	-0.33	-0.25	inward	-0.19	0.24	inward	0.16	0.87	inward	0.27	0.66	inward	-0.38	0.52	inward	1.35	1.68	inward	1.49	1.51	inward	0.76	1.14	inward
5/9/2023	-0.34	-0.24	inward	-0.20	0.30	inward	0.16	0.86	inward	0.24	0.67	inward	-0.38	0.54	inward	1.35	1.68	inward	1.50	1.51	inward	0.77	1.13	inward
5/10/2023	-0.34	-0.25	inward	-0.20	0.27	inward	0.16	0.86	inward	0.24	0.66	inward	-0.39	0.54	inward	1.35	1.66	inward	1.47	1.50	inward	0.76	1.12	inward
5/11/2023	-0.35	-0.25	inward	-0.22	0.23	inward	0.18	0.85	inward	0.24	0.66	inward	-0.37	0.56	inward	1.34	1.66	inward	1.48	1.51	inward	0.76	1.12	inward
5/12/2023	-0.35	-0.25	inward	-0.21	0.25	inward	0.16	0.86	inward	0.24	0.63	inward	-0.39	0.54	inward	1.32	1.65	inward	1.46	1.50	inward	0.76	1.11	inward
5/13/2023	-0.35	-0.25	inward	-0.20	0.22	inward	0.17	0.85	inward	0.24	0.62	inward	-0.37	0.54	inward	1.34	1.65	inward	1.47	1.46	outward	0.75	1.09	inward
5/14/2023	-0.34	-0.25	inward	-0.20	0.25	inward	0.16	0.81	inward	0.25	0.60	inward	-0.39	0.56	inward	1.32	1.64	inward	1.45	1.46	inward	0.76	1.08	inward

Date	L1/D1		Flow Direction	L2/D2		Flow Direction	L3/D3		Flow Direction	L4/D4		Flow Direction	L5/D5		Flow Direction	L6/D6		Flow Direction	L7/D7		Flow Direction	L8/D8		Flow Direction
	L1 m	D1 m		L2 m	D2 m		L3 m	D3 m		L4 m	D4 m		L5 m	D5 m		L6 m	D6 m		L7 m	D7 m		L8 m	D8 m	
5/15/2023	-0.31	-0.25	inward	-0.17	0.25	inward	0.17	0.82	inward	0.25	0.59	inward	-0.36	0.55	inward	1.35	1.64	inward	1.48	1.47	outward	0.78	1.07	inward
5/16/2023	-0.33	-0.25	inward	-0.19	0.23	inward	0.17	0.77	inward	0.25	0.57	inward	-0.37	0.53	inward	1.34	1.62	inward	1.45	1.48	inward	0.78	1.06	inward
5/17/2023	-0.32	-0.25	inward	-0.20	0.25	inward	0.17	0.77	inward	0.24	0.56	inward	-0.37	0.52	inward	1.34	1.61	inward	1.45	1.45	outward	0.77	1.05	inward
5/18/2023	-0.32	-0.17	inward	-0.18	0.23	inward	0.16	0.77	inward	0.24	0.56	inward	-0.39	0.54	inward	1.34	1.62	inward	1.47	1.46	outward	0.79	1.04	inward
5/19/2023	-0.33	-0.17	inward	-0.22	0.21	inward	0.15	0.76	inward	0.24	0.56	inward	-0.39	0.52	inward	1.32	1.59	inward	1.43	1.44	inward	0.77	1.04	inward
5/20/2023	-0.32	-0.18	inward	-0.18	0.25	inward	0.15	0.76	inward	0.23	0.55	inward	-0.39	0.53	inward	1.32	1.60	inward	1.43	1.45	inward	0.77	1.03	inward
5/21/2023	-0.32	-0.15	inward	-0.18	0.23	inward	0.17	0.75	inward	0.23	0.54	inward	-0.39	0.51	inward	1.33	1.59	inward	1.44	1.43	outward	0.77	1.01	inward
5/22/2023	-0.32	-0.19	inward	-0.18	0.21	inward	0.16	0.74	inward	0.23	0.54	inward	-0.39	0.49	inward	1.30	1.58	inward	1.46	1.44	outward	0.76	1.01	inward
5/23/2023	-0.31	-0.17	inward	-0.18	0.22	inward	0.16	0.74	inward	0.24	0.54	inward	-0.41	0.48	inward	1.30	1.60	inward	1.43	1.42	outward	0.76	1.00	inward
5/24/2023	-0.30	-0.17	inward	-0.22	0.24	inward	0.16	0.73	inward	0.24	0.53	inward	-0.37	0.50	inward	1.30	1.58	inward	1.48	1.45	outward	0.76	1.00	inward
5/25/2023	-0.30	-0.20	inward	-0.24	0.21	inward	0.17	0.72	inward	0.23	0.53	inward	-0.38	0.47	inward	1.33	1.61	inward	1.48	1.41	outward	0.76	0.99	inward
5/26/2023	-0.29	-0.24	inward	-0.21	0.20	inward	0.16	0.73	inward	0.24	0.52	inward	-0.37	0.49	inward	1.30	1.58	inward	1.46	1.43	outward	0.76	0.98	inward
5/27/2023	-0.28	-0.25	inward	-0.22	0.23	inward	0.14	0.70	inward	0.24	0.51	inward	-0.39	0.46	inward	1.30	1.60	inward	1.46	1.42	outward	0.76	0.98	inward
5/28/2023	-0.31	-0.24	inward	-0.23	0.21	inward	0.15	0.68	inward	0.23	0.51	inward	-0.37	0.45	inward	1.29	1.57	inward	1.45	1.42	outward	0.73	0.96	inward
5/29/2023	-0.29	-0.24	inward	-0.19	0.26	inward	0.16	0.69	inward	0.23	0.50	inward	-0.39	0.46	inward	1.29	1.59	inward	1.44	1.41	outward	0.74	0.95	inward
5/30/2023	-0.28	-0.25	inward	-0.20	0.25	inward	0.15	0.67	inward	0.23	0.50	inward	-0.39	0.45	inward	1.32	1.57	inward	1.43	1.41	outward	0.74	0.95	inward
5/31/2023	-0.29	-0.26	inward	-0.22	0.26	inward	0.14	0.67	inward	0.23	0.50	inward	-0.39	0.45	inward	1.31	1.58	inward	1.44	1.40	outward	0.73	0.95	inward
6/1/2023	-0.29	-0.27	inward	-0.23	0.23	inward	0.14	0.66	inward	0.23	0.49	inward	-0.37	0.42	inward	1.29	1.55	inward	1.44	1.37	outward	0.71	0.92	inward
6/2/2023	-0.29	-0.26	inward	-0.21	0.23	inward	0.15	0.65	inward	0.23	0.48	inward	-0.37	0.42	inward	1.30	1.55	inward	1.45	1.36	outward	0.72	0.92	inward
6/3/2023	-0.30	-0.26	inward	-0.23	0.22	inward	0.15	0.64	inward	0.23	0.48	inward	-0.36	0.41	inward	1.30	1.57	inward	1.44	1.35	outward	0.73	0.91	inward
6/4/2023	-0.30	-0.26	inward	-0.21	0.21	inward	0.13	0.63	inward	0.23	0.49	inward	-0.39	0.40	inward	1.30	1.55	inward	1.43	1.35	outward	0.73	0.90	inward
6/5/2023	-0.30	-0.27	inward	-0.23	0.23	inward	0.15	0.62	inward	0.23	0.48	inward	-0.38	0.39	inward	1.30	1.56	inward	1.44	1.36	outward	0.73	0.89	inward
6/6/2023	-0.27	-0.27	inward	-0.24	0.22	inward	0.15	0.61	inward	0.23	0.47	inward	-0.35	0.39	inward	1.30	1.54	inward	1.43	1.32	outward	0.72	0.87	inward
6/7/2023	-0.28	-0.27	inward	-0.23	0.22	inward	0.16	0.59	inward	0.23	0.46	inward	-0.37	0.39	inward	1.32	1.55	inward	1.42	1.31	outward	0.73	0.85	inward
6/8/2023	-0.31	-0.27	inward	-0.23	0.22	inward	0.16	0.59	inward	0.23	0.45	inward	-0.36	0.38	inward	1.30	1.52	inward	1.40	1.31	outward	0.74	0.84	inward
6/9/2023	-0.32	-0.28	inward	-0.21	0.19	inward	0.15	0.57	inward	0.23	0.45	inward	-0.37	0.36	inward	1.30	1.54	inward	1.39	1.29	outward	0.72	0.84	inward
6/10/2023	-0.32	-0.27	inward	-0.18	0.19	inward	0.16	0.60	inward	0.23	0.47	inward	-0.36	0.37	inward	1.30	1.56	inward	1.46	1.33	outward	0.74	0.91	inward
6/11/2023	-0.32	-0.25	inward	-0.16	0.28	inward	0.15	0.60	inward	0.23	0.47	inward	-0.37	0.39	inward	1.31	1.54	inward	1.48	1.34	outward	0.77	0.91	inward
6/12/2023	-0.30	-0.26	inward	-0.16	0.21	inward	0.15	0.59	inward	0.23	0.47	inward	-0.36	0.36	inward	1.28	1.54	inward	1.44	1.34	outward	0.76	0.89	inward
6/13/2023	-0.28	-0.27	inward	-0.24	0.23	inward	0.16	0.58	inward	0.24	0.46	inward	-0.39	0.35	inward	1.28	1.56	inward	1.44	1.33	outward	0.76	0.87	inward
6/14/2023	-0.30	-0.27	inward	-0.21	0.23	inward	0.16	0.57	inward	0.23	0.46	inward	-0.40	0.35	inward	1.27	1.53	inward	1.46	1.32	outward	0.72	0.84	inward
6/15/2023	-0.33	-0.28	inward	-0.25	0.17	inward	0.15	0.56	inward	0.23	0.44	inward	-0.41	0.36	inward	1.26	1.55	inward	1.42	1.33	outward	0.72	0.83	inward
6/16/2023	-0.33	-0.28	inward	-0.22	0.18	inward	0.14	0.54	inward	0.23	0.45	inward	-0.42	0.34	inward	1.28	1.53	inward	1.43	1.29	outward	0.69	0.84	inward
6/17/2023	-0.29	-0.27	inward	-0.23	0.16	inward	0.16	0.55	inward	0.24	0.44	inward	-0.41	0.35	inward	1.27	1.52	inward	1.45	1.29	outward	0.74	0.84	inward
6/18/2023	-0.26	-0.27	outward	-0.17	0.16	inward	0.16	0.54	inward	0.24	0.44	inward	-0.39	0.32	inward	1.29	1.54	inward	1.43	1.31	outward	0.71	0.84	inward
6/19/2023	-0.26	-0.27	outward	-0.24	0.20	inward	0.15	0.53	inward	0.23	0.43	inward	-0.39	0.32	inward	1.28	1.54	inward	1.44	1.28	outward	0.70	0.81	inward
6/20/2023	-0.31	-0.27	inward	-0.22	0.28	inward	0.15	0.54	inward	0.23	0.43	inward	-0.38	0.34	inward	1.27	1.54	inward	1.45	1.31	outward	0.71	0.82	inward
6/21/2023	-0.33	-0.26	inward	-0.27	0.21	inward	0.14	0.53	inward	0.21	0.43	inward	-0.41	0.31	inward	1.28	1.53	inward	1.42	1.30	outward	0.68	0.82	inward
6/22/2023	-0.30	-0.25	inward	-0.19	0.32	inward	0.16	0.54	inward	0.23	0.42	inward	-0.41	0.33	inward	1.26	1.51	inward	1.42	1.31	outward	0.68	0.82	inward
6/23/2023	-0.26	-0.24	inward	-0.16	0.26	inward	0.17	0.53	inward	0.24	0.42	inward	-0.39	0.31	inward	1.28	1.51	inward	1.46	1.27	outward	0.73	0.80	inward
6/24/2023	-0.28	-0.25	inward	-0.21	0.21	inward	0.15	0.52	inward	0.22	0.40	inward	-0.41	0.30	inward	1.28	1.52	inward	1.45	1.27	outward	0.70	0.77	inward
6/25/2023	-0.30	-0.26	inward	-0.24	0.20	inward	0.16	0.52	inward	0.22	0.40	inward	-0.42	0.29	inward	1.26	1.52	inward	1.44	1.28	outward	0.69	0.79	inward
6/26/2023	-0.28	-0.26	inward	-0.18	0.21	inward	0.16	0.51	inward	0.23	0.40	inward	-0.42	0.28	inward	1.27	1.52	inward	1.44	1.25	outward	0.70	0.78	inward
6/27/2023	-0.26	-0.25	inward	-0.18	0.21	inward	0.16	0.50	inward	0.22	0.38	inward	-0.41	0.28	inward	1.27	1.49	inward	1.44	1.24	outward	0.73	0.75	inward
6/28/2023	-0.26	-0.26	inward	-0.17	0.19	inward	0.16	0.50	inward	0.22	0.37	inward	-0.38	0.29	inward	1.29	1.51	inward	1.41	1.23	outward	0.71	0.74	inward
6/29/2023	-0.28	-0.26	inward	-0.21	0.19	inward	0.14	0.49	inward	0.21	0.37	inward	-0.41	0.26	inward	1.29	1.48	inward	1.40	1.23	outward	0.72	0.75	inward
6/30/2023	-0.28	-0.27	inward	-0.20	0.15	inward	0.16	0.49	inward	0.22	0.36	inward	-0.41	0.26	inward	1.26	1.49	inward	1.43	1.24	outward	0.70	0.74	inward
7/1/2023	-0.28	-0.27	inward	-0.20	0.14	inward	0.17	0.48	inward	0.21	0.34	inward	-0.41	0.25	inward	1.27	1.48	inward	1.41	1.22	outward	0.72	0.75	inward
7/2/2023	-0.29	-0.27	inward	-0.20	0.15	inward	0.18	0.47	inward	0.21	0.34	inward	-0.40	0.26	inward	1.28	1.48	inward	1.45	1.20	outward	0.71	0.74	inward
7/3/2023	-0.27	-0.27	inward	-0.19	0.13	inward	0.19	0.46	inward	0.22	0.33	inward	-0.41	0.24	inward	1.28	1.48	inward	1.45	1.19	outward	0.71	0.71	inward
7/4/2023	-0.27	-0.27	outward	-0.18	0.10	inward	0.19	0.44	inward	0.22	0.32	inward	-0.38	0.22	inward	1.28	1.46	inward	1.46	1.20	outward	0.70	0.70	outward
7/5/2023	-0.25	-0.27	outward	-0.19	0.11	inward	0.19	0.41	inward	0.21	0.31	inward	-0.40	0.23	inward	1.28	1.45	inward	1.45	1.20	outward	0.73	0.69	outward
7/6/2023	-0.23	-0.27	outward	-0.21	0.10	inward	0.20	0.40	inward	0.22	0.30	inward	-0.38	0.23	inward	1.28	1.43	inward	1.46	1.17	outward	0.75	0.69	outward
7/7/2023	-0.22	-0.26	outward	-0.19	0.09	inward	0.20	0.40	inward	0.22	0.29	inward	-0.37	0.19	inward	1.26	1.44	inward	1.48	1.17	outward	0.74	0.65	outward
7/8/2023	-0.23	-0.27	outward	-0.20	0.09	inward	0.20	0.38	inward	0.22	0.29	inward	-0.40	0.19	inward	1.28	1.42	inward	1.47	1.17	outward	0.73	0.67	outward
7/9/2023	-0.22	-0.27	outward	-0.19	0.10	inward	0.19	0.37	inward	0.22	0.29	inward	-0.40	0.18	inward	1.28	1.44	inward	1.47	1.18	outward	0.74	0.66	outward
7/10/2023	-0.22	-0.27	outward	-0.18	0.10	inward	0.18	0.35	inward	0.22	0.27	inward	-0.41	0.18	inward	1.29	1.44	inward	1.43	1.16	outward	0.73	0.64	outward
7/11/2023	-0.25	-0.28	outward	-0.18	0.07	inward	0.18	0.35	inward	0.21	0.26	inward	-0.41	0.17	inward	1.25	1.44	inward	1.45	1.14	outward	0.71	0.62	outward
7/12/2023	-0.22	-0.28	outward	-0.17	0.07	inward	0.19	0.33	inward	0.22	0.25	inward	-0.40	0.17	inward	1.27	1.41	inward	1.44	1.12	outward	0.73	0.62	outward
7/13/2023	-0.23	-0.28	outward	-0.20	0.10	inward	0.19	0.33	inward	0.22	0.25	inward	-0.42	0.16	inward	1.27	1.42	inward	1.48	1.13	outward	0.74	0.61	outward
7/14/2023	-0.24	-0.27	outward	-0.19	0.09	inward	0.18	0.31	inward	0.22	0.24	inward	-0.40	0.16	inward	1.25	1.40	inward	1.45	1.13	outward	0.73	0.60	outward
7/15/2023	-0.23	-0.28	outward	-0.18	0.06	inward	0.19	0.30	inward	0.22	0.24	inward	-0.41	0.15	inward	1.25	1.39	inward	1.46	1.11	outward	0.73	0.59	outward
7/16/2023	-0.20	-0.28	outward	-0.19	0.06	inward	0.19	0.30	inward	0.23	0.24	inward	-0.42	0.14	inward	1.25	1.41	inward	1.49	1.10	outward	0.75	0.60	outward
7/17/2023	-0.19	-0.28	outward	-0.17	0.04	inward	0.19	0.29	inward	0.23	0.23	outward	-0.41	0.14	inward	1.26	1.41	inward	1.48	1.11	outward	0.73	0.59	outward
7/18/2023	-0.24	-0.29	outward	-0.18	0.04	inward	0.19	0.27	inward	0.22	0.22	outward	-0.41	0.13	inward	1.27	1.38	inward	1.44	1.10	outward	0.74	0.59	outward
7/19/2023	-0.22	-0.28	outward	-0.20	0.03	inward	0.19	0.26	inward	0.22	0.22	outward	-0.42	0.15	inward	1.25	1.37	inward	1.45	1.10	outward	0.73	0.58	outward
7/20/2023	-0.19	-0.28	outward	-0.20	0.04	inward	0.19	0.25	inward	0.23	0.22	outward	-0.41	0.14	inward	1.25	1.38	inward	1.46	1.08	outward	0.73	0.55	outward
7/21/2023	-0.20	-0.26	outward	-0.20	0.02	inward	0.19	0.25	inward	0.23	0.21	outward	-0.39	0.13	inward	1.27	1.36	inward	1.47	1.08	outward	0.75	0.54	outward

Date	L1/D1		Flow Direction	L2/D2		Flow Direction	L3/D3		Flow Direction	L4/D4		Flow Direction	L5/D5		Flow Direction	L6/D6		Flow Direction	L7/D7		Flow Direction	L8/D8		Flow Direction
	L1 m	D1 m		L2 m	D2 m		L3 m	D3 m		L4 m	D4 m		L5 m	D5 m		L6 m	D6 m		L7 m	D7 m		L8 m	D8 m	
7/22/2023	-0.19	-0.27	outward	-0.19	0.05	inward	0.21	0.24	inward	0.24	0.20	outward	-0.37	0.12	inward	1.26	1.35	inward	1.48	1.05	outward	0.74	0.54	outward
7/23/2023	-0.17	-0.26	outward	-0.18	0.02	inward	0.20	0.24	inward	0.24	0.19	outward	-0.40	0.11	inward	1.25	1.37	inward	1.47	1.04	outward	0.73	0.53	outward
7/24/2023	-0.16	-0.27	outward	-0.19	0.05	inward	0.21	0.22	inward	0.23	0.20	outward	-0.39	0.10	inward	1.28	1.36	inward	1.46	1.04	outward	0.74	0.54	outward
7/25/2023	-0.20	-0.27	outward	-0.19	0.05	inward	0.22	0.36	inward	0.29	0.30	inward	-0.38	0.12	inward	1.30	1.43	inward	1.47	1.12	outward	0.75	0.62	outward
7/26/2023	-0.22	-0.16	inward	-0.19	0.06	inward	0.22	0.36	inward	0.24	0.28	inward	-0.41	0.14	inward	1.28	1.41	inward	1.46	1.10	outward	0.77	0.59	outward
7/27/2023	-0.17	-0.18	outward	-0.17	0.08	inward	0.22	0.33	inward	0.23	0.26	inward	-0.43	0.13	inward	1.27	1.40	inward	1.48	1.11	outward	0.77	0.59	outward
7/28/2023	-0.17	-0.20	outward	-0.19	0.09	inward	0.20	0.30	inward	0.25	0.24	outward	-0.42	0.12	inward	1.29	1.39	inward	1.46	1.07	outward	0.76	0.56	outward
7/29/2023	-0.16	-0.25	outward	-0.19	0.06	inward	0.19	0.30	inward	0.25	0.24	outward	-0.39	0.11	inward	1.28	1.35	inward	1.48	1.08	outward	0.78	0.53	outward
7/30/2023	-0.18	-0.26	outward	-0.18	0.06	inward	0.19	0.27	inward	0.25	0.22	outward	-0.41	0.12	inward	1.28	1.37	inward	1.48	1.06	outward	0.74	0.54	outward
7/31/2023	-0.18	-0.26	outward	-0.18	0.05	inward	0.20	0.26	inward	0.23	0.20	outward	-0.42	0.10	inward	1.26	1.35	inward	1.48	1.07	outward	0.75	0.51	outward
8/1/2023	-0.17	-0.26	outward	-0.19	0.05	inward	0.19	0.24	inward	0.25	0.20	outward	-0.42	0.11	inward	1.25	1.34	inward	1.46	1.03	outward	0.76	0.51	outward
8/2/2023	-0.15	-0.26	outward	-0.19	0.05	inward	0.20	0.22	inward	0.25	0.20	outward	-0.41	0.10	inward	1.28	1.34	inward	1.45	1.02	outward	0.73	0.50	outward
8/3/2023	-0.15	-0.27	outward	-0.16	0.04	inward	0.20	0.22	inward	0.25	0.19	outward	-0.39	0.09	inward	1.26	1.31	inward	1.48	1.01	outward	0.73	0.49	outward
8/4/2023	-0.16	-0.27	outward	-0.20	0.02	inward	0.18	0.20	inward	0.25	0.19	outward	-0.41	0.08	inward	1.28	1.31	inward	1.47	1.02	outward	0.72	0.49	outward
8/5/2023	-0.16	-0.28	outward	-0.17	0.02	inward	0.19	0.20	inward	0.25	0.17	outward	-0.41	0.09	inward	1.28	1.31	inward	1.47	1.01	outward	0.75	0.48	outward
8/6/2023	-0.16	-0.28	outward	-0.18	0.00	inward	0.20	0.19	outward	0.25	0.19	outward	-0.39	0.08	inward	1.28	1.32	inward	1.45	1.02	outward	0.73	0.49	outward
8/7/2023	-0.16	-0.27	outward	-0.20	-0.01	inward	0.20	0.18	outward	0.25	0.19	outward	-0.39	0.10	inward	1.25	1.31	inward	1.44	1.02	outward	0.74	0.50	outward
8/8/2023	-0.14	-0.27	outward	-0.19	0.01	inward	0.19	0.23	inward	0.25	0.19	outward	-0.40	0.07	inward	1.27	1.34	inward	1.44	1.00	outward	0.73	0.51	outward
8/9/2023	-0.10	-0.26	outward	-0.19	0.00	inward	0.19	0.20	inward	0.26	0.19	outward	-0.39	0.09	inward	1.28	1.31	inward	1.45	0.99	outward	0.75	0.47	outward
8/10/2023	-0.11	-0.26	outward	-0.17	-0.01	inward	0.20	0.23	inward	0.27	0.21	outward	-0.37	0.10	inward	1.29	1.33	inward	1.44	1.01	outward	0.74	0.47	outward
8/11/2023	-0.13	-0.27	outward	-0.20	0.00	inward	0.20	0.26	inward	0.26	0.22	outward	-0.39	0.08	inward	1.27	1.33	inward	1.44	1.00	outward	0.73	0.49	outward
8/12/2023	-0.17	-0.28	outward	-0.18	-0.02	inward	0.19	0.23	inward	0.25	0.20	outward	-0.41	0.07	inward	1.25	1.30	inward	1.45	0.98	outward	0.71	0.47	outward
8/13/2023	-0.18	-0.28	outward	-0.22	-0.03	inward	0.19	0.20	inward	0.25	0.18	outward	-0.42	0.07	inward	1.25	1.29	inward	1.43	0.97	outward	0.71	0.48	outward
8/14/2023	-0.13	-0.27	outward	-0.19	-0.02	inward	0.20	0.17	outward	0.25	0.17	outward	-0.37	0.07	inward	1.26	1.30	inward	1.45	0.97	outward	0.74	0.45	outward
8/15/2023	-0.12	-0.28	outward	-0.19	-0.03	inward	0.19	0.16	outward	0.27	0.16	outward	-0.40	0.07	inward	1.27	1.29	inward	1.46	0.95	outward	0.75	0.47	outward
8/16/2023	-0.12	-0.28	outward	-0.21	-0.02	inward	0.19	0.15	outward	0.26	0.16	outward	-0.40	0.05	inward	1.27	1.29	inward	1.45	0.94	outward	0.75	0.43	outward
8/17/2023	-0.09	-0.28	outward	-0.20	-0.01	inward	0.18	0.14	outward	0.26	0.15	outward	-0.38	0.06	inward	1.29	1.27	outward	1.45	0.95	outward	0.75	0.44	outward
8/18/2023	-0.06	-0.28	outward	-0.18	-0.04	inward	0.19	0.12	outward	0.26	0.15	outward	-0.24	0.03	inward	1.26	1.29	inward	1.43	0.94	outward	0.73	0.42	outward
8/19/2023	-0.15	-0.31	outward	-0.22	-0.05	inward	0.19	0.11	outward	0.25	0.14	outward	-0.27	0.03	inward	1.27	1.25	outward	1.44	0.93	outward	0.69	0.44	outward
8/20/2023	-0.12	-0.30	outward	-0.22	-0.05	inward	0.19	0.09	outward	0.25	0.14	outward	-0.30	0.02	inward	1.25	1.25	outward	1.46	0.94	outward	0.71	0.40	outward
8/21/2023	-0.08	-0.28	outward	-0.22	-0.05	inward	0.19	0.08	outward	0.25	0.15	outward	-0.30	0.03	inward	1.25	1.27	inward	1.43	0.95	outward	0.74	0.40	outward
8/22/2023	-0.12	-0.30	outward	-0.19	-0.06	inward	0.19	0.06	outward	0.26	0.14	outward	-0.29	0.03	inward	1.25	1.25	outward	1.44	0.92	outward	0.73	0.41	outward
8/23/2023	-0.15	-0.31	outward	-0.22	-0.08	inward	0.19	0.05	outward	0.25	0.13	outward	-0.30	0.03	inward	1.27	1.25	outward	1.42	0.93	outward	0.70	0.38	outward
8/24/2023	-0.18	-0.31	outward	-0.20	-0.05	inward	0.19	0.04	outward	0.24	0.13	outward	-0.35	0.01	inward	1.27	1.26	outward	1.42	0.90	outward	0.71	0.37	outward
8/25/2023	-0.13	-0.30	outward	-0.19	-0.06	inward	0.19	0.03	outward	0.24	0.13	outward	-0.33	0.02	inward	1.26	1.24	outward	1.44	0.90	outward	0.73	0.40	outward
8/26/2023	-0.15	-0.31	outward	-0.20	-0.07	inward	0.21	0.04	outward	0.26	0.14	outward	-0.33	0.02	inward	1.28	1.26	outward	1.43	0.89	outward	0.72	0.40	outward
8/27/2023	-0.14	-0.30	outward	-0.21	-0.07	inward	0.20	0.02	outward	0.26	0.13	outward	-0.33	-0.01	inward	1.26	1.24	outward	1.43	0.90	outward	0.72	0.39	outward
8/28/2023	-0.15	-0.31	outward	-0.19	-0.07	inward	0.19	0.01	outward	0.26	0.12	outward	-0.34	-0.01	inward	1.28	1.26	outward	1.45	0.89	outward	0.72	0.35	outward
8/29/2023	-0.17	-0.31	outward	-0.19	-0.05	inward	0.19	0.00	outward	0.25	0.11	outward	-0.32	-0.02	inward	1.28	1.26	outward	1.43	0.89	outward	0.70	0.35	outward
8/30/2023	-0.17	-0.29	outward	-0.16	-0.03	inward	0.21	0.16	outward	0.26	0.25	outward	-0.29	0.03	inward	1.27	1.31	inward	1.46	0.98	outward	0.70	0.39	outward
8/31/2023	-0.14	-0.29	outward	-0.17	-0.05	inward	0.22	0.19	outward	0.26	0.20	outward	-0.31	0.02	inward	1.28	1.30	inward	1.43	0.94	outward	0.71	0.43	outward
9/1/2023	-0.12	-0.29	outward	-0.19	-0.05	inward	0.22	0.21	outward	0.26	0.20	outward	-0.31	0.02	inward	1.28	1.29	inward	1.44	0.93	outward	0.69	0.42	outward
9/2/2023	-0.13	-0.30	outward	-0.20	-0.06	inward	0.20	0.18	outward	0.26	0.18	outward	-0.32	0.01	inward	1.27	1.29	inward	1.44	0.94	outward	0.70	0.43	outward
9/3/2023	-0.12	-0.29	outward	-0.18	-0.05	inward	0.21	0.15	outward	0.25	0.16	outward	-0.32	0.03	inward	1.29	1.26	outward	1.46	0.91	outward	0.69	0.42	outward
9/4/2023	-0.15	-0.30	outward	-0.20	-0.03	inward	0.21	0.14	outward	0.25	0.18	outward	-0.34	0.02	inward	1.29	1.26	outward	1.42	0.91	outward	0.72	0.39	outward
9/5/2023	-0.17	-0.30	outward	-0.19	-0.04	inward	0.21	0.13	outward	0.25	0.16	outward	-0.33	0.00	inward	1.26	1.27	inward	1.44	0.90	outward	0.70	0.39	outward
9/6/2023	-0.15	-0.29	outward	-0.20	-0.05	inward	0.20	0.12	outward	0.25	0.14	outward	-0.34	0.01	inward	1.29	1.25	outward	1.44	0.89	outward	0.71	0.39	outward
9/7/2023	-0.16	-0.30	outward	-0.16	-0.06	inward	0.20	0.10	outward	0.25	0.14	outward	-0.34	0.00	inward	1.27	1.25	outward	1.42	0.89	outward	0.69	0.38	outward
9/8/2023	-0.19	-0.31	outward	-0.18	-0.07	inward	0.20	0.08	outward	0.25	0.14	outward	-0.35	-0.01	inward	1.28	1.26	outward	1.41	0.89	outward	0.71	0.38	outward
9/9/2023	-0.20	-0.31	outward	-0.18	-0.06	inward	0.20	0.07	outward	0.25	0.14	outward	-0.36	-0.02	inward	1.28	1.26	outward	1.41	0.89	outward	0.68	0.34	outward
9/10/2023	-0.18	-0.30	outward	-0.19	-0.06	inward	0.20	0.05	outward	0.25	0.14	outward	-0.35	-0.02	inward	1.28	1.26	outward	1.41	0.89	outward	0.69	0.36	outward
9/11/2023	-0.18	-0.33	outward	-0.18	-0.07	inward	0.22	0.04	outward	0.25	0.14	outward	-0.34	-0.01	inward	1.28	1.26	outward	1.41	0.89	outward	0.72	0.33	outward
9/12/2023	-0.18	-0.33	outward	-0.19	-0.05	inward	0.21	0.02	outward	0.25	0.14	outward	-0.33	-0.02	inward	1.28	1.26	outward	1.41	0.89	outward	0.70	0.35	outward
9/13/2023	-0.21	-0.33	outward	-0.17	-0.06	inward	0.21	0.01	outward	0.25	0.11	outward	-0.34	-0.03	inward	1.28	1.22	outward	1.43	0.85	outward	0.69	0.32	outward
9/14/2023	-0.22	-0.33	outward	-0.20	-0.08	inward	0.20	0.00	outward	0.25	0.11	outward	-0.35	-0.02	inward	1.26	1.21	outward	1.44	0.84	outward	0.70	0.32	outward
9/15/2023	-0.17	-0.33	outward	-0.19	-0.04	inward	0.21	-0.01	outward	0.24	0.11	outward	-0.32	-0.03	inward	1.29	1.22	outward	1.44	0.86	outward	0.70	0.34	outward
9/16/2023	-0.16	-0.32	outward	-0.17	-0.06	inward	0.21	-0.01	outward	0.25	0.10	outward	-0.31	-0.04	inward	1.27	1.23	outward	1.45	0.85	outward	0.73	0.30	outward
9/17/2023	-0.17	-0.32	outward	-0.18	-0.05	inward	0.21	-0.03	outward	0.25	0.10	outward	-0.31	-0.04	inward	1.28	1.21	outward	1.41	0.85	outward	0.74	0.32	outward
9/18/2023	-0.16	-0.32	outward	-0.19	-0.05	inward	0.22	-0.03	outward	0.26	0.09	outward	-0.29	-0.05	inward	1.28	1.21	outward	1.44	0.85	outward	0.73	0.29	outward
9/19/2023	-0.21	-0.33	outward	-0.17	-0.09	inward	0.22	-0.03	outward	0.25	0.10	outward	-0.32	-0.05	inward	1.28	1.20	outward	1.43	0.85	outward	0.72	0.28	outward
9/20/2023	-0.18	-0.31	outward	-0.18	-0.07	inward	0.23	0.00	outward	0.26	0.19	outward	-0.31	-0.04	inward	1.29	1.29	outward	1.44	0.89	outward	0.75	0.33	outward
9/21/2023	-0.23	-0.34	outward	-0.19	-0.07	inward	0.22	0.07	outward	0.24	0.16	outward	-0.32	-0.04	inward	1.29	1.23	outward	1.45	0.87	outward	0.73	0.31	outward
9/22/2023	-0.20	-0.32	outward	-0.19	-0.08	inward	0.22	0.07	outward	0.25	0.14	outward	-0.32	-0.04	inward	1.29	1.25	outward	1.45	0.87	outward	0.74	0.32	outward
9/23/2023	-0.15	-0.33	outward	-0.16	-0.06	inward	0.22	0.06	outward	0.26	0.13	outward	-0.29	-0.02	inward	1.30	1.23	outward	1.43	0.85	outward	0.73	0.34	outward
9/24/2023	-0.20	-0.33	outward	-0.19	-0.09	inward	0.22	0.05	outward	0.25	0.14	outward	-0.32	-0.05	inward	1.30	1.22	outward	1.42	0.85	outward	0.74	0.33	outward
9/25/2023	-0.13	-0.31	outward	-0.16	-0.06	inward	0.24	0.05	outward	0.26	0.16	outward	-0.31	-0.04	inward	1.28	1.27	outward	1.44	0.89	outward	0.73	0.34	outward
9/26/2023	-0.16	-0.30	outward	-0.17	-0.07	inward	0.25	0.25	inward	0.26	0.25	outward	-0.27	-0.02	inward	1.30	1.29	outward	1.46	0.95	outward	0.75	0.39	outward
9/27/2023	-0.19	-0.30	outward	-0.14	-0.06	inward	0.24	0.24	inward	0.26	0.21	outward	-0.28	-0.02	inward	1.28	1.29	inward	1.46	0.93	outward	0.75	0.39	outward

CITY OF VANCOUVER

Date	L1/D1		Flow	L2/D2		Flow	L3/D3		Flow	L4/D4		Flow	L5/D5		Flow	L6/D6		Flow	L7/D7		Flow	L8/D8		Flow
	L1	D1	Direction	L2	D2	Direction	L3	D3	Direction	L4	D4	Direction	L5	D5	Direction	L6	D6	Direction	L7	D7	Direction	L8	D8	Direction
	m	m		m	m		m	m		m	m		m	m		m	m		m	m		m	m	
9/28/2023	-0.23	-0.30	outward	-0.16	-0.05	inward	0.24	0.27	inward	0.26	0.26	outward	-0.31	0.01	inward	1.28	1.30	inward	1.45	0.94	outward	0.73	0.42	outward
9/29/2023	-0.22	-0.30	outward	-0.16	-0.07	inward	0.24	0.27	inward	0.25	0.24	outward	-0.28	0.00	inward	1.28	1.29	inward	1.44	0.96	outward	0.75	0.43	outward
9/30/2023	-0.22	-0.29	outward	-0.16	-0.06	inward	0.24	0.25	inward	0.25	0.22	outward	-0.32	-0.01	inward	1.31	1.27	outward	1.47	0.92	outward	0.77	0.41	outward
10/1/2023	-0.26	-0.31	outward	-0.16	-0.07	inward	0.22	0.23	inward	0.23	0.20	outward	-0.34	-0.01	inward	1.30	1.26	outward	1.44	0.92	outward	0.75	0.42	outward
10/2/2023	-0.23	-0.29	outward	-0.17	-0.05	inward	0.22	0.22	outward	0.25	0.19	outward	-0.33	-0.01	inward	1.30	1.26	outward	1.44	0.90	outward	0.76	0.40	outward
10/3/2023	-0.22	-0.29	outward	-0.15	-0.03	inward	0.25	0.32	inward	0.26	0.28	inward	-0.31	0.03	inward	1.29	1.35	inward	1.45	0.98	outward	0.77	0.46	outward
10/4/2023	-0.28	-0.30	outward	-0.18	-0.06	inward	0.24	0.29	inward	0.25	0.25	inward	-0.33	0.03	inward	1.28	1.31	inward	1.44	0.94	outward	0.73	0.45	outward
10/5/2023	-0.28	-0.30	outward	-0.18	-0.07	inward	0.24	0.27	inward	0.23	0.23	inward	-0.34	0.02	inward	1.30	1.29	outward	1.43	0.93	outward	0.73	0.45	outward
10/6/2023	-0.27	-0.29	outward	-0.17	-0.04	inward	0.24	0.26	inward	0.24	0.22	outward	-0.34	0.00	inward	1.28	1.30	inward	1.43	0.93	outward	0.77	0.44	outward
10/7/2023	-0.23	-0.29	outward	-0.14	-0.06	inward	0.26	0.25	outward	0.25	0.20	outward	-0.34	0.00	inward	1.28	1.27	outward	1.43	0.92	outward	0.78	0.45	outward
10/8/2023	-0.20	-0.28	outward	-0.17	-0.06	inward	0.26	0.24	outward	0.26	0.19	outward	-0.31	0.00	inward	1.29	1.27	outward	1.45	0.92	outward	0.77	0.44	outward
10/9/2023	-0.14	-0.27	outward	-0.16	-0.05	inward	0.26	0.24	outward	0.26	0.19	outward	-0.32	0.00	inward	1.28	1.29	inward	1.46	0.92	outward	0.82	0.42	outward
10/10/2023	-0.14	-0.26	outward	-0.17	-0.06	inward	0.28	0.29	inward	0.27	0.26	outward	-0.30	0.00	inward	1.29	1.33	inward	1.47	0.94	outward	0.82	0.41	outward
10/11/2023	-0.09	-0.24	outward	-0.10	-0.05	inward	0.31	0.37	inward	0.29	0.30	inward	-0.26	0.04	inward	1.33	1.38	inward	1.46	0.99	outward	0.84	0.47	outward
10/12/2023	-0.24	-0.28	outward	-0.16	-0.08	inward	0.28	0.33	inward	0.26	0.28	inward	-0.30	0.04	inward	1.30	1.34	inward	1.46	0.96	outward	0.77	0.47	outward
10/13/2023	-0.22	-0.28	outward	-0.14	-0.05	inward	0.28	0.31	inward	0.25	0.27	inward	-0.33	0.03	inward	1.28	1.33	inward	1.45	0.95	outward	0.77	0.45	outward
10/14/2023	-0.21	-0.28	outward	-0.14	-0.04	inward	0.29	0.35	inward	0.27	0.31	inward	-0.31	0.03	inward	1.28	1.35	inward	1.46	0.97	outward	0.81	0.47	outward
10/15/2023	-0.26	-0.29	outward	-0.16	-0.05	inward	0.26	0.34	inward	0.26	0.28	inward	-0.32	0.03	inward	1.29	1.32	inward	1.46	0.96	outward	0.79	0.48	outward
10/16/2023	-0.22	-0.27	outward	-0.13	-0.04	inward	0.29	0.37	inward	0.26	0.30	inward	-0.32	0.06	inward	1.29	1.36	inward	1.48	1.00	outward	0.81	0.50	outward
10/17/2023	-0.22	-0.27	outward	-0.06	-0.07	outward	0.32	0.42	inward	0.32	0.34	inward	-0.24	0.08	inward	1.29	1.39	inward	1.45	1.06	outward	0.81	0.51	outward
10/18/2023	-0.15	-0.23	outward	0.13	-0.03	outward	0.44	0.49	inward	0.47	0.38	outward	-0.22	0.10	inward	1.36	1.46	inward	1.50	1.13	outward	0.84	0.62	outward
10/19/2023	0.02	-0.22	outward	0.14	0.07	outward	0.43	0.53	inward	0.43	0.40	outward	-0.06	0.16	inward	1.38	1.50	inward	1.48	1.24	outward	0.96	0.61	outward
10/20/2023	-0.09	-0.23	outward	0.03	0.09	inward	0.43	0.49	inward	0.35	0.38	inward	-0.21	0.16	inward	1.34	1.48	inward	1.50	1.25	outward	0.88	0.61	outward
10/21/2023	-0.21	-0.25	outward	-0.03	0.09	inward	0.41	0.48	inward	0.33	0.37	inward	-0.25	0.18	inward	1.36	1.48	inward	1.48	1.25	outward	0.85	0.60	outward
10/22/2023	-0.23	-0.24	outward	-0.08	0.09	inward	0.39	0.47	inward	0.32	0.36	inward	-0.26	0.18	inward	1.36	1.48	inward	1.47	1.22	outward	0.79	0.56	outward
10/23/2023	-0.25	-0.26	outward	-0.10	0.09	inward	0.35	0.45	inward	0.32	0.36	inward	-0.28	0.18	inward	1.32	1.47	inward	1.48	1.24	outward	0.77	0.54	outward
10/24/2023	-0.28	-0.26	inward	-0.12	0.05	inward	0.34	0.44	inward	0.31	0.34	inward	-0.26	0.18	inward	1.34	1.44	inward	1.46	1.21	outward	0.78	0.54	outward
10/25/2023	-0.16	-0.23	outward	-0.02	0.09	inward	0.46	0.52	inward	0.45	0.38	outward	-0.21	0.19	inward	1.42	1.47	inward	1.51	1.27	outward	0.82	0.63	outward
10/26/2023	-0.25	-0.25	inward	-0.11	0.12	inward	0.41	0.50	inward	0.35	0.38	inward	-0.18	0.21	inward	1.36	1.51	inward	1.48	1.28	outward	0.77	0.62	outward
10/27/2023	-0.26	-0.26	inward	-0.09	0.14	inward	0.41	0.49	inward	0.32	0.37	inward	-0.26	0.20	inward	1.31	1.51	inward	1.47	1.28	outward	0.76	0.61	outward
10/28/2023	-0.35	-0.26	inward	-0.16	0.14	inward	0.38	0.49	inward	0.30	0.36	inward	-0.28	0.20	inward	1.34	1.49	inward	1.48	1.27	outward	0.75	0.59	outward
10/29/2023	-0.36	-0.27	inward	-0.17	0.15	inward	0.38	0.47	inward	0.30	0.36	inward	-0.29	0.19	inward	1.31	1.47	inward	1.48	1.24	outward	0.72	0.56	outward
10/30/2023	-0.36	-0.27	inward	-0.19	0.14	inward	0.40	0.46	inward	0.31	0.36	inward	-0.30	0.18	inward	1.32	1.48	inward	1.48	1.24	outward	0.75	0.59	outward
10/31/2023	-0.34	-0.23	inward	-0.16	0.14	inward	0.39	0.46	inward	0.32	0.35	inward	-0.29	0.19	inward	1.34	1.47	inward	1.47	1.23	outward	0.73	0.56	outward
11/1/2023	-0.33	-0.24	inward	-0.17	0.17	inward	0.40	0.45	inward	0.33	0.34	inward	-0.26	0.18	inward	1.31	1.48	inward	1.47	1.25	outward	0.75	0.57	outward
11/2/2023	-0.27	-0.19	inward	-0.12	0.19	inward	0.39	0.52	inward	0.34	0.38	inward	-0.26	0.22	inward	1.34	1.50	inward	1.47	1.26	outward	0.78	0.63	outward
11/3/2023	-0.20	-0.23	outward	-0.02	0.23	inward	0.44	0.54	inward	0.43	0.39	outward	-0.12	0.26	inward	1.37	1.57	inward	1.47	1.31	outward	0.81	0.71	outward
11/4/2023	-0.20	-0.23	outward	-0.02	0.23	inward	0.46	0.53	inward	0.36	0.41	inward	-0.21	0.26	inward	1.38	1.56	inward	1.48	1.32	outward	0.80	0.71	outward
11/5/2023	-0.09	-0.21	outward	0.12	0.27	inward	0.50	0.56	inward	0.46	0.47	inward	-0.07	0.35	inward	1.41	1.61	inward	1.48	1.40	outward	0.85	0.75	outward
11/6/2023	-0.10	-0.21	outward	0.11	0.25	inward	0.50	0.60	inward	0.41	0.50	inward	-0.16	0.38	inward	1.41	1.61	inward	1.50	1.41	outward	0.83	0.78	outward
11/7/2023	-0.06	-0.21	outward	0.18	0.27	inward	0.51	0.62	inward	0.48	0.53	inward	-0.13	0.41	inward	1.48	1.63	inward	1.52	1.45	outward	0.86	0.88	inward
11/8/2023	-0.05	-0.24	outward	0.18	0.22	inward	0.39	0.67	inward	0.45	0.67	inward	-0.12	0.46	inward	1.41	1.69	inward	1.47	1.43	outward	0.83	0.95	inward
11/9/2023	-0.06	-0.24	outward	0.15	0.24	inward	0.33	0.69	inward	0.41	0.67	inward	-0.15	0.48	inward	1.40	1.70	inward	1.49	1.43	outward	0.81	0.95	inward
11/10/2023	-0.08	-0.23	outward	0.16	0.25	inward	0.33	0.69	inward	0.42	0.70	inward	-0.15	0.51	inward	1.46	1.70	inward	1.48	1.44	outward	0.83	0.95	inward
11/11/2023	-0.04	-0.21	outward	0.19	0.25	inward	0.31	0.71	inward	0.47	0.69	inward	-0.11	0.56	inward	1.47	1.72	inward	1.48	1.44	outward	0.87	0.96	inward
11/12/2023	0.08	-0.22	outward	0.22	0.32	inward	0.36	0.77	inward	0.52	0.82	inward	-0.03	0.61	inward	1.47	1.76	inward	1.50	1.48	outward	0.90	1.01	inward
11/13/2023	-0.07	-0.21	outward	0.25	0.28	inward	0.35	0.82	inward	0.54	0.82	inward	-0.10	0.61	inward	1.51	1.75	inward	1.51	1.51	outward	0.92	1.04	inward
11/14/2023	-0.14	-0.22	outward	0.20	0.25	inward	0.31	0.83	inward	0.49	0.77	inward	-0.10	0.61	inward	1.47	1.73	inward	1.48	1.49	inward	0.88	1.04	inward
11/15/2023	-0.14	-0.30	outward	-0.21	0.22	inward	0.28	0.87	inward	0.46	0.73	inward	-0.13	0.62	inward	1.43	1.71	inward	1.44	1.47	inward	0.86	1.04	inward
11/16/2023	-0.14	-0.30	outward	-0.22	0.23	inward	0.28	0.85	inward	0.46	0.72	inward	-0.16	0.57	inward	1.44	1.71	inward	1.43	1.48	inward	0.85	1.03	inward
11/17/2023	-0.14	-0.31	outward	-0.26	0.22	inward	0.27	0.86	inward	0.46	0.68	inward	-0.18	0.54	inward	1.42	1.71	inward	1.46	1.46	outward	0.85	1.03	inward
11/18/2023	-0.26	-0.31	outward	-0.31	0.21	inward	0.27	0.87	inward	0.45	0.67	inward	-0.19	0.56	inward	1.41	1.72	inward	1.44	1.48	inward	0.85	1.03	inward
11/19/2023	-0.26	-0.31	outward	-0.28	0.22	inward	0.28	0.86	inward	0.47	0.67	inward	-0.16	0.58	inward	1.43	1.71	inward	1.45	1.49	inward	0.87	1.03	inward
11/20/2023	-0.31	-0.31	inward	-0.30	0.23	inward	0.24	0.87	inward	0.48	0.69	inward	-0.16	0.59	inward	1.41	1.73	inward	1.46	1.48	inward	0.85	1.05	inward
11/21/2023	-0.32	-0.30	inward	-0.33	0.23	inward	0.24	0.86	inward	0.44	0.68	inward	-0.19	0.49	inward	1.39	1.73	inward	1.46	1.49	inward	0.86	1.04	inward
11/22/2023	-0.33	-0.29	inward	-0.33	0.28	inward	0.42	0.89	inward	0.50	0.68	inward	-0.19	0.44	inward	1.43	1.73	inward	1.45	1.50	inward	0.87	1.05	inward
11/23/2023	-0.35	-0.29	inward	-0.38	0.27	inward	0.75	0.91	inward	0.47	0.70	inward	-0.17	0.50	inward	1.43	1.72	inward	1.44	1.48	inward	0.88	1.06	inward
11/24/2023	-0.35	-0.31	inward	-0.37	0.30	inward	0.81	0.90	inward	0.46	0.69	inward	-0.17	0.46	inward	1.41	1.73	inward	1.45	1.47	inward	0.93	1.06	inward
11/25/2023	-0.44	-0.31	inward	-0.36	0.29	inward	0.86	0.92	inward	0.46	0.68	inward	-0.20	0.45	inward	1.39	1.69	inward	1.46	1.48	inward	0.96	1.05	inward
11/26/2023	-0.44	-0.31	inward	-0.37	0.29	inward	0.90	0.92	inward	0.46	0.68	inward	-0.19	0.50	inward	1.39	1.72	inward	1.47	1.46	outward	1.00	1.04	inward
11/27/2023	-0.48	-0.32	inward	-0.36	0.29	inward	0.95	0.91	outward	0.45	0.67	inward	-0.20	0.50	inward	1.39	1.69	inward	1.46	1.47	inward	1.04	1.03	outward
11/28/2023	-0.48	-0.31	inward	-0.33	0.28	inward	0.93	0.90	outward	0.44	0.68	inward	-0.21	0.44	inward	1.38	1.69	inward	1.46	1.47	inward	1.03	1.03	inward
11/29/2023	-0.22	-0.31	outward	-0.17	0.28	inward	0.29	0.91	inward	0.43	0.68	inward	-0.21	0.45	inward	1.39	1.70	inward	1.47	1.46	outward	0.91	1.02	inward
11/30/2023	-0.46	-0.31	inward	-0.19	0.28	inward	0.25	0.89	inward	0.43	0.65	inward	-0.21	0.42	inward	1.37	1.70	inward	1.44	1.48	inward	0.86	1.03	inward
12/1/2023	-0.40	-0.31	inward	-0.42	0.31	inward	0.25	0.92	inward	0.48	0.66	inward	-0.19	0.40	inward	1.41	1.70	inward	1.46	1.48	inward	0.86	1.03	inward
12/2/2023	-0.36	-0.29	inward	-0.31	0.29	inward	0.25	0.93	inward	0.59	0.74	inward	-0.10	0.45	inward	1.46	1.73	inward	1.49	1.51	inward	0.91	1.07	inward
12/3/2023	-0.31	-0.28	inward	-0.36	0.33	inward	0.27	0.99	inward	0.55	0.83	inward	-0.08	0.59	inward	1.43	1.75	inward	1.48	1.56	inward	0.93	1.13	inward
12/4/2023	-0.38	-0.28	inward	-0.39	0.34	inward	0.28	1.05	inward	0.56	0.83	inward	-0.07	0.58	inward	1.46	1.74	inward	1.49	1.56	inward	0.92	1.15	inward

Date	L1/D1		Flow Direction	L2/D2		Flow Direction	L3/D3		Flow Direction	L4/D4		Flow Direction	L5/D5		Flow Direction	L6/D6		Flow Direction	L7/D7		Flow Direction	L8/D8		Flow Direction
	L1 m	D1 m		L2 m	D2 m		L3 m	D3 m		L4 m	D4 m		L5 m	D5 m		L6 m	D6 m		L7 m	D7 m		L8 m	D8 m	
12/5/2023	0.44	0.33	outward	0.32	0.45	inward	0.83	1.14	inward	1.10	1.07	outward	0.74	0.77	inward	1.74	1.88	inward	1.71	1.75	inward	1.19	1.30	inward
12/6/2023	0.13	0.25	inward	0.00	0.54	inward	0.39	1.18	inward	0.82	0.98	inward	0.42	0.71	inward	1.55	1.81	inward	1.50	1.71	inward	1.00	1.32	inward
12/7/2023	-0.01	-0.03	outward	-0.07	0.45	inward	0.31	1.14	inward	0.66	0.93	inward	0.07	0.67	inward	1.50	1.77	inward	1.49	1.68	inward	0.94	1.25	inward
12/8/2023	-0.08	-0.16	outward	-0.16	0.40	inward	0.29	1.12	inward	0.67	0.92	inward	0.04	0.67	inward	1.49	1.76	inward	1.47	1.66	inward	0.94	1.25	inward
12/9/2023	-0.30	-0.22	inward	-0.34	0.37	inward	0.27	1.10	inward	0.59	0.89	inward	-0.01	0.64	inward	1.47	1.75	inward	1.46	1.63	inward	0.91	1.22	inward
12/10/2023	-0.16	-0.08	inward	-0.13	0.42	inward	0.34	1.12	inward	0.75	0.95	inward	0.09	0.68	inward	1.54	1.79	inward	1.50	1.69	inward	0.98	1.25	inward
12/11/2023	-0.17	0.02	inward	-0.18	0.45	inward	0.35	1.14	inward	0.74	0.95	inward	0.12	0.69	inward	1.54	1.78	inward	1.49	1.71	inward	0.98	1.29	inward
12/12/2023	-0.01	-0.22	outward	0.03	0.39	inward	0.66	1.13	inward	0.62	0.91	inward	0.13	0.49	inward	1.51	1.77	inward	1.49	1.65	inward	0.94	1.25	inward
12/13/2023	0.03	-0.23	outward	0.01	0.41	inward	0.62	1.09	inward	0.59	0.84	inward	0.09	0.46	inward	1.49	1.75	inward	1.48	1.62	inward	0.92	1.21	inward
12/14/2023	-0.11	-0.25	outward	-0.06	0.38	inward	0.50	1.06	inward	0.60	0.84	inward	0.05	0.48	inward	1.46	1.72	inward	1.48	1.61	inward	0.90	1.19	inward
12/15/2023	-0.29	-0.25	inward	-0.32	0.35	inward	0.30	1.06	inward	0.63	0.81	inward	0.00	0.51	inward	1.48	1.75	inward	1.48	1.60	inward	0.89	1.17	inward
12/16/2023	-0.29	-0.25	inward	-0.36	0.38	inward	0.30	1.04	inward	0.63	0.81	inward	0.00	0.53	inward	1.48	1.73	inward	1.48	1.61	inward	0.89	1.18	inward
12/17/2023	-0.31	-0.27	inward	-0.40	0.37	inward	0.28	1.05	inward	0.61	0.80	inward	-0.03	0.51	inward	1.45	1.74	inward	1.48	1.60	inward	0.89	1.16	inward
12/18/2023	-0.35	-0.26	inward	-0.46	0.38	inward	0.27	1.02	inward	0.59	0.78	inward	-0.04	0.46	inward	1.44	1.71	inward	1.48	1.55	inward	0.88	1.15	inward
12/19/2023	-0.38	-0.27	inward	-0.46	0.38	inward	0.31	1.03	inward	0.61	0.75	inward	-0.07	0.48	inward	1.47	1.73	inward	1.46	1.54	inward	0.88	1.14	inward
12/20/2023	-0.38	-0.28	inward	-0.44	0.36	inward	0.28	0.99	inward	0.63	0.76	inward	-0.06	0.49	inward	1.46	1.73	inward	1.46	1.55	inward	0.88	1.14	inward
12/21/2023	-0.39	-0.28	inward	-0.48	0.36	inward	0.25	1.00	inward	0.59	0.75	inward	-0.05	0.49	inward	1.44	1.73	inward	1.46	1.55	inward	0.87	1.13	inward
12/22/2023	-0.37	-0.28	inward	-0.49	0.35	inward	0.25	1.01	inward	0.59	0.75	inward	-0.07	0.49	inward	1.42	1.73	inward	1.48	1.56	inward	0.86	1.14	inward
12/23/2023	-0.38	-0.27	inward	-0.51	0.36	inward	0.28	1.00	inward	0.59	0.79	inward	-0.03	0.49	inward	1.43	1.72	inward	1.48	1.59	inward	0.86	1.15	inward
12/24/2023	-0.39	-0.28	inward	-0.52	0.37	inward	0.26	1.00	inward	0.56	0.75	inward	-0.03	0.44	inward	1.41	1.73	inward	1.47	1.56	inward	0.85	1.13	inward
12/25/2023	-0.41	-0.29	inward	-0.51	0.34	inward	0.25	0.99	inward	0.54	0.73	inward	-0.04	0.41	inward	1.42	1.71	inward	1.45	1.54	inward	0.84	1.13	inward
12/26/2023	-0.38	-0.29	inward	-0.46	0.36	inward	0.26	1.00	inward	0.58	0.75	inward	-0.04	0.41	inward	1.43	1.73	inward	1.45	1.56	inward	0.86	1.12	inward
12/27/2023	-0.37	-0.28	inward	-0.50	0.36	inward	0.28	0.99	inward	0.56	0.73	inward	-0.03	0.43	inward	1.42	1.73	inward	1.45	1.56	inward	0.84	1.12	inward
12/28/2023	-0.40	-0.29	inward	-0.53	0.33	inward	0.25	0.99	inward	0.55	0.73	inward	-0.04	0.44	inward	1.42	1.73	inward	1.48	1.53	inward	0.84	1.12	inward
12/29/2023	-0.38	-0.29	inward	-0.53	0.33	inward	0.24	0.98	inward	0.52	0.72	inward	-0.02	0.42	inward	1.41	1.71	inward	1.47	1.55	inward	0.83	1.11	inward
12/30/2023	-0.42	-0.29	inward	-0.52	0.33	inward	0.23	0.97	inward	0.53	0.71	inward	-0.05	0.40	inward	1.38	1.72	inward	1.45	1.52	inward	0.83	1.11	inward
12/31/2023	-0.41	-0.29	inward	-0.54	0.33	inward	0.25	0.99	inward	0.55	0.73	inward	-0.07	0.41	inward	1.39	1.70	inward	1.45	1.55	inward	0.83	1.10	inward
Summary Statistics - Remote Water Level Monitoring System																								
Mean	-0.226	-0.254		-0.162	0.174		0.242	0.659		0.314	0.522		-0.269	0.363		1.381	1.569		1.457	1.359		0.795	0.877	
Standard Deviation	0.097	0.058		0.121	0.140		0.117	0.340		0.116	0.244		0.139	0.230		0.103	0.184		0.031	0.275		0.074	0.309	
Number of Remote Measurements			365			365			365			365			365			365			365			365
Number of Days with Outward or No Flow			216			3			51			85			0			40			184			127
Outward Flow Percentage			59.2%			0.8%			14.0%			23.3%			0.0%			11.0%			50.4%			34.8%
2023 Average Outward Flow	**24.18%**																							

Notes:

1) All measured data are converted to geodetic elevations.

3) Data Source: Remote Water Level Monitoring System

Outward Flow Percentages are averaged to get the overall Average Outward Flow. The system efficiency is 100% - Average Outward Flow. This information is used in Table 6-4.

Indicates outward gradient flow direction

Appendix 8: 2023 Public complaint and resolution log

No.	Issue	Resolution
1	Customer wrote to suggest that disposal prices should decrease with the increased cost of living.	No response was requested. Disposal fees are reviewed annually.
2	A citizen wrote to inform that the actual cost of asbestos testing was significantly higher than indicated on the City's website.	No response was requested. The City website was updated to remove mention of specific testing costs. This service is performed by private companies and the price is not under the City's control.
3	A customer called to report multiple negative experiences at the Landfill Zero Waste Centre. The customer explained that there was confusion regarding whether his materials constituted a commercial load and that he was told he could not recycle his materials at the Zero Waste Centre. The customer felt they were not treated respectfully. The customer spoke to a supervisor to clear up confusion.	Customer call returned. Customer was informed of impacts of commercial loads at City's residential Zero Waste Centres and that staff are not permitted to accept commercial loads for recycling.
4	A customer called to inform that they visited the Landfill to purchase compost, but at the compost facility there was no City staff with a loader to assist with loading compost. The customer expressed concerns over using shovels to load compost without City staff supervision.	No response was requested. Compost loading for trailer and trucks is available after 3 pm. When purchasing compost, the weighmaster will ask the customer if a loader is needed. If so, operations staff are called to meet the customer with the loader to assist with loading the compost.
5	Caller phoned 3-1-1 about disposing of flammable liquids. The Landfill website shows flammable liquids under "Materials accepted for free recycling", however, it directs to Product Care. Waste Wizard also directs to Product Care. The customer stated that they contacted Productcare, who told them they needed to bring their flammable liquids to the Landfill. The customer requested that the City website be updated to reflect that the material is collected at the Landfill.	No response was requested. The City partners with Product Care to collect flammable liquids in addition to other materials in the program. Customers may bring these materials to the Landfill, to be eventually removed and processed by Product Care. The website accurately reflects what materials are accepted for disposal and provides links to Product Care for more detailed information about materials accepted within the program.

No.	Issue	Resolution
6	A citizen called to state that other cities allow for free disposal of mattresses and that Vancouver should also follow similar practice. Caller stated that Vancouver is a very expensive place to live and that there should be some sort of accommodation.	No response was requested. The fee associated with disposal of mattresses is used to cover the cost of transport and recycling. The City's disposal fees align with the regional Transfer Station minimum charges.
7	A customer raised concerns about information on the City website regarding disposal of large volumes of concrete and/or asphalt at the Landfill. The customer suggested putting a direct contact to the Landfill so citizens are not required to call 3-1-1 for inquiries about this.	Customer was phoned back and provided with the necessary forms for concrete and asphalt disposal.
8	Customer called to report displeasure with their experience at the Landfill. The customer stated that they arrived in a dump truck requesting 6 yards of compost and was told they don't have enough to supply a dump truck. They then requested 4 yards and was still told they don't have enough. The customer also stated that there is no information on the website that indicates a dump truck cannot be supplied with compost.	No response was requested. The City website was updated to reflect current limits. Limits on compost for purchase are subjected to change based on availability.
9	Citizen expressed concerned about no compost being available at Landfill and thinks that there is a private company or person who bought all compost and selling it at higher price. Customer stated they feel that this is not right and very suspicious and requested to speak to a representative from the Landfill.	The customer was phoned back to explain that availability of compost varies throughout the year and purchase limits are imposed on all customers to allow fair distribution between residents. Finished compost is also periodically used on site for operations, which may affect availability.

No.	Issue	Resolution
10	A customer called to explain that they brought both new and used drywall to the Landfill for disposal. At the scales, the customer was asked if the material was personal or from a business and the customer explained that it was personal. The customer was then told that they could only dispose of new drywall and needed to bring used drywall to another facility. The customer explained that they had disposed of used drywall at the Landfill before, and checked the website to confirm this. They ultimately had to visit three different disposal facilities.	The customer was phoned back and was sent an email. Weighmasters were subsequently spoken to about the incident. Used drywall is accepted for disposal at the Landfill, but is limited to 50 bags or 5 trips per customer per year. The customer may have exceeded the limit and was asked to provide their license plate number for verification.
11	Citizen stated that they are unhappy with the fact that Burnaby takes extra food scraps for free while Vancouver charges for disposal fees. Citizen says that they are trying to do the right thing when it comes to composting, and that the City is going about promoting Vancouver's "green" agenda the wrong way by charging for disposal.	No response was requested. The City does not currently offer free food scraps disposal. A future review will include the disposal pricing for food scraps.
12	A Customer expressed that they are displeased with the fact that the Landfill is no longer accepting Transfer and Landfill credit account applications. He says he has multiple vehicles and staff and the credit account would be helpful.	The customer was phoned back and notified that while we are not accepting credit applications from the public, credit cards and company cheques are acceptable.
13	A citizen called to suggest that free compost should be offered year round.	No response was requested. While compost sales help cover facility operating costs, residents of Vancouver and Delta are offered free compost during specific periods each year.
14	A customer provided feedback from their visit to the Landfill Zero Waste Centre. The customer stated that the website was misleading and one page indicated that televisions aren't accepted. However, at the bottom of the same page, televisions are listed under “What’s Accepted”. The customer was turned away when trying to dispose of a television.	No response was requested. This complaint took place during a pause of collection of electronics and appliances due to a labour disruption with the City’s collection contractor. The special notice at the top of the page contained accurate information about the disruption and directed customers to nearby facilities for disposal.

No.	Issue	Resolution
15	A customer raised concerns that non-packaging hard plastics (storage bins, plant pots, etc.) were not accepted for recycling and was frustrated that they needed to take the materials to the Landfill in Delta, coming from Vancouver, to recycling these materials with no information about this on the website. The customer disposed of the materials for a fee at the Transfer Station.	The customer was phoned back and informed of the durable plastics recycling pilot at the Landfill. Collection of additional plastics at the Vancouver Zero Waste Centre is being explored.
16	A citizen called to ask what it means to bring “residential” cardboard only for recycling. The citizen reported past negative interactions with staff at the Landfill regarding difficulty managing the guidelines for residential vs commercial quantities for recycling. The citizen recommended clearer policies for customers who may be bringing residential materials from multiple homes or large volumes saved up over time.	The citizen was called back and explained that they service several private residences and come to the Zero Waste Centre to recycle cardboard. The residential policy was explained to the citizen and it was communicated that spreading out visits to bring lower volumes would reduce friction with staff looking for commercial loads, which are not permitted.
17	A citizen called to report that the new lighting installed at the Landfill was dangerous.	The citizen was contacted. The discolored lighting was due to a manufacturer issue and have since been repaired.
18	A customer called expressing concern that their company vehicle was banned from the site. They were told they were speeding through the complex.	Returned customer call. There seemed to have been confusion and this customer is not considered banned and had no previous offence on the plate.
19	A customer expressed concern about their experience disposing of drywall at the Landfill. The customer explained that they were turned away with 7 bags of drywall because of the commercial vehicle they were in, but told the weighmaster it was currently for personal use and the drywall came from a relative’s residence. The customer expressed that they should be allowed to dispose of this material as it is residential, and requests if the owner of the residence can provide an approval letter as proof of residential origin.	The customer was phoned back. The Landfill’s asbestos policy regarding commercial vehicles was explained. It was concluded that a step was missed at the scales and a Superintendent should have been called to assess whether the load could be disposed of. The customer was given the opportunity to return with the material with proof approval from the owner of the residence the drywall came from.

Appendix 9: 2023 Annual Compliance Status Form

Annual Compliance Status Form

AUTHORIZATION NUMBER: 1611
AUTHORIZATION TYPE: Operational Certificate
LEGAL AUTHORIZATION HOLDER NAME: City of Vancouver
PERIOD OF COMPLIANCE STATUS ASSESSMENT: 2023-01-01 to 2023-12-31

AUTHORIZED PERSON NAME: Mike Budzik, P.Eng.
AUTHORIZED PERSON SIGNATURE:
SIGNATURE DATE: March 22, 2024

I understand that it is an offense to mislead a government official, and I declare that all of the information presented is accurate and true.
I have been given the authority by the authorization holder to sign this form.

AUTHORIZATION CLAUSE NUMBER	AUTHORIZATION CLAUSE DESCRIPTION	COMPLIANT? (Yes/No/ND)	RATIONALE FOR YOUR COMPLIANCE DETERMINATION	LOCATION OF SUPPORTING INFORMATION IN ANNUAL REPORT
1.1.1	The discharge of refuse [to a sanitary landfill from sources within the Greater Vancouver Regional District and other sources as specifically authorized by the Regional Waste Manager] is authorized for the full term of the Greater Vancouver Regional District Solid Waste Management Plan, dated July 1995. The solid waste management plan must be amended to authorize the discharge beyond this term.	Yes	Discharging waste under authorizations.	Annual Report for the Vancouver Landfill (Sections referenced herein), Executive Summary. Greater Regional District Solid Waste Management Plan (Metro Vancouver, 2010)
1.1.2	The maximum authorized rate of discharge is 750,000 tonnes per year	Yes	Discharged less than 750 000 tonnes in 2022.	Annual Report Sections 5. Waste disposal, Appendix 2 Table A1
1.1.3	The characteristics of the discharge shall be typical municipal solid waste and other materials as specifically authorized by the Regional Waste Manager. Asbestos waste may be discharged in accordance with the The characteristics of the discharge shall be typical municipal solid waste and other materials as specifically authorized by the Regional Waste Manager. Asbestos waste may be discharged in accordance with the *Special Waste Regulation*.	Yes	MSW and other specifically authorized waste only accepted for discharge. All other authorized wastes are listed as separate line items in annual report. Special Waste (other than asbestos) is not accepted for disposal in the landfill.	Annual Report Sections 5. Waste disposal, Appendix 2 Table A1
1.1.4	Waste shall not be discharged within a buffer zone as identified in Section 2.9. Putrescible and household waste shall not be discharged into water. The burning of waste is prohibited.	Yes	Minimum 50 metres wide buffer is present along all boundaries except where 30 metres maximum is allowed on northern boundary.	**2019 Operating Plan report** (Golder 2021b), Site Layout Plan (first drawing after references)
1.1.5	The authorized works common to this Section and Sections 1.2, 1.3 and 1.4 are a locking gate to control access by the public, a weigh scale and fire protection equipment, approximately located as shown on attached Site Plan A.	Yes	Locking gate and weigh scales operating near landfill entrance. Works laid out in accordance with Site Plan A from OC.	Annual Report Section 2. Design and operating plans, Figure 2
1.1.6	The authorized works specific to this Section are those associated with a landfill operation and include berms, covering material, surface water diversionary works, environmental monitoring systems, leachate collection/pumping works and a landfill gas management system consisting of existing and future collection works, a blower/flare station and gas utilization works, approximately located as shown on attached Site Plan B.	Yes	Environmental controls in operation include perimeter ditch system for leachate (inner) and surface water (outer) collection, stormwater ponds, suitable daily and final cover, gas collection system including blower and flare station.	Annual Report Sections 8. Environmental protection programs, 9. Operational information
1.1.7	The location of the point of discharge is Lot 9, Section 5 and 6, New Westminster District, Plan 38013. Discharge within the area identified as the "100 Acre Reserve", approximately as shown on Site Plan B, is restricted to construction and demolition waste in accordance with the approved closure plan required in Section 2.8.	Yes	Currently discharging within areas shown in Site Plan B. "100 Acre Reserve" is closed.	Annual Report Section 2. Design and operating Plans, Figure 3
1.2.1	The characteristics of the waste [at the landfill transfer station facility] are the same as set out in Section 1.1.3.	Yes	Waste accepted for discharge is typical MSW and other authorized wastes, all other materials accepted at this facility are for off-site recycling (Recycling depot and household hazardous waste storage facility, compost facility) or beneficial use.	Annual Report Section 5. Waste disposal, Appendix 2 Table A1, Section 7. Waste reduction and recycling initiatives
1.2.2	The authorized works are those associated with a transfer station and include a paved access area and roll off bins, approximately located as shown on attached Site Plan C.	Yes	The facility has paved access and roll off bins, operating as shown in Site Plan C of OC.	Annual Report Sections 7. Waste reduction and recycling initiatives, 2. Design and operating plans, Figure 2
1.2.3	The location of the facilities is Lot 9, Section 5 and 6, New Westminster District, Plan 38013.	Yes	Location is as described.	Annual Report Section 2. Design and operating plans, Figure 2

Authorized Person Initial: MB

Date: March 22, 2024

AUTHORIZATION CLAUSE NUMBER	AUTHORIZATION CLAUSE DESCRIPTION	COMPLIANT? (Yes/No/ND)	RATIONALE FOR YOUR COMPLIANCE DETERMINATION	LOCATION OF SUPPORTING INFORMATION IN ANNUAL REPORT
1.3.1	The type of materials which may be managed at this facility [recycling depot and household hazardous waste storage facility] are typical recyclable materials and household hazardous waste.	Yes	Accepting recyclables and household hazardous waste at this facility. See complete list of accepted items.	Annual Report Section 7. Waste reduction and recycling initiatives, Table 7 and Appenidx 3
1.3.2	The authorized works are those associated with a recycling depot and household hazardous waste storage facility and include roll off bins, recycling containers, a secure (fenced) storage area and storage shed for household hazardous waste, approximately located as shown on attached Site Plan C.	Yes	Listed works are present at the facility, as shown on Site Plan C.	Annual Report Section 7. Waste reduction and recycling initiatives (7.1 and 7.2) and Figure 2
1.3.3	The location of the facilities is the same location as set out in Section 1.2.3.	Yes	Same location as as set out in Section 1.2.3.	Annual Report Section 2. Design and operating plans, Figure 2
1.4.1	The type of waste that may be composted is restricted to fruit and vegetable waste, typical yardwaste and christmas trees.	Yes	Yard trimmings/green waste only accepted for compost, no food scraps are composted on site.	Annual Report Section 7. Waste reduction and recycling initiatives (7.4)
1.4.2	The authorized works are those associated with a composting facility and include an impermeable pad, a stationary grinding plant, and windrow turning equipment, approximately located as shown on attached Site Plan A.	Yes	Facility is on paved pad, equipment include grinder, windrow turner and screener. Located in area shown in Site Plan A.	Annual Report Section 7. Waste reduction and recycling initiatives (7.4) and Figure 2
1.4.3	The location of the facilities [compost] is the same location as set out in Section 1.2.3.	Yes	Located as described.	Annual Report Figure 2
2.1	In the event of an emergency which prevents compliance with a requirement of this operational certificate, that requirement will be suspended for such time as the emergency continues or until otherwise directed by the Regional Waste Manager.	Yes	No emergencies in 2023 causing prevention of compliance.	N/A
2.2	The operational certificate holder shall inspect the authorized works regularly and maintain them in good working order. Notify the Regional Waste Manager of any malfunction of these works.	Yes	Landfill staff/contractors perform various regular inspection on works.	Annual Report Section 9. Operational information (9.2)
2.3	The operational certificate holder shall inspect the property boundaries regularly and notify the Regional Waste Manager of any visual evidence of environmental impacts on adjacent properties.	Yes	Monitoring effects on surrounding area (Burns Bog) through regular inspection of perimeter ditch system. Issues noticed in inspection are brought to attention of staff and environmental concerns are reported to ENV.	Annual Report Section 9. Operational information (9.2 and 9.3)
2.4	Provision of fencing, site access, vehicle safety barriers, surface water diversionary works, firebreaks and site restoration as required, shall be carried out to the satisfaction of the Regional Waste Manager.	Yes	Site access limited to entrance. Vehicle safety barriers present on main roads. Surface water diversionary works include perimeter ditch system and ponds. Firebreaks used in filling of active areas as per Design Plan.	Surface water diversionary works found in Annual report Section 8. Environmental protection programs (8.1). Other information not required in annual report by OC, available in Design and Operating Plans .
2.5	In preparation for the placement of putrescible waste, the operational certificate, holder shall construct a base cell consisting of an approximate 3 metre lift of demolition and construction waste covered with a minimum 0.15 metre layer of suitable cover material. Firebreaks shall be incorporated into each cell in such quantity and manner as to prevent fires from becoming an environmental or safety hazard. Putrescible and household waste shall not be discharged in the base cell. suitable cover consists of soil, utilized in accordance with Section 2.7 or other material as deemed acceptable by the Regional Waste Manager.	Yes	Base cell layer contains only construction and demolition waste. Firebreaks present throughout according to Landfill design, soil cover used on each lift.	Annual Report Section 8.0 Environmental protection programs. Detailed information available in 2019 Design Plan report (Golder, 2019a) Section 6.0 Regulatory Design and Closure Requirements
2.6	All waste shall be placed in cells of a size acceptable to the Regional Waste Manager. The working face shall be confined to the smallest practical area. Waste shall be discharged in layers of 0.6 metres or less and compacted to the smallest practical volume. Intermediate cover, consisting of a minimum 0.30 metre of suitable cover material shall he applied as the filling proceeds. Side slopes shall be a maximum of l :3 (vertical:horizontal). During non-discharge hours, the working face shall be covered with a tarp or other measures to the satisfaction of the manager to provide vector and litter control. The working face shall be covered with a minimum of 0.15 metres of suitable cover material once a week. The manager may vary the frequency of covering when freezing conditions adversely affect normal operation	Yes	Active face kept as small as possible per operating procedure. Daily soil cover - minimum 0.15 m used. Intermediate soil cover - typical 0.6 m used. Litter fencing installed around active area. Side sloped maximum 1:3.	2019 Operating Plan Report (Golder, 2019b), Section 7.2 Operating Parameters (7.2.3 Active Face)
2.7	Urban park quality soil may be utilized for berm construction, intermediate and final cover, top dressing and landscaping. Soil with any substance with a concentration exceeding the lowest applicable numerical soil standard for urban park land may only be used for internal berms or intermediate cover. The utilization or discharge of special waste soil is prohibited.	Yes	Urban Park quality soil is sourced and used for landscaping, berms, intermediate and final cover. Other soils exceeding PL soil quality are used for daily and intermediate cover or are stockpiled. PL soil stockpiled separately when needed.	2019 Operating Plan report, Sections 3.0 Regulatory Operating Requirements and 6.2.4 Temporary Soil Stockpile Area

Authorized Person Initial: 

Date: March 22, 2024

AUTHORIZATION CLAUSE NUMBER	AUTHORIZATION CLAUSE DESCRIPTION	COMPLIANT? (Yes/No/ND)	RATIONALE FOR YOUR COMPLIANCE DETERMINATION	LOCATION OF SUPPORTING INFORMATION IN ANNUAL REPORT
2.8	The operational certificate holder shall submit a closure plan for the area identified as the "100 acre reserve"... the Regional Waste Manager by December 31, 2001 for approval. For the remainder of the landfill, the operational certificate holder shall apply final cover to any area of the landfill, which will not receive any further waste. Final cover shall be applied within one (l) year of completing the subject area. Final cover shall consist of a minimum of 1.0 metre of low permeability (<l x 10-5 emfs) compacted soil (or equivalent) cap plus a minimum of 0.15 metre of topsoil and suitable vegetative cover. Soil shall be utilized in accordance with Section 2.7. Final cover shall be sloped to promote surface water runoff. Surface water runoff shall be directed outside of the leachate collection system.	Yes	Final closure of "100 Acre reserve" referred to as Western 40 Hectares was completed in 2019.	2019 Operating Plan report, Section 5.4 Filling Progression 2018 to 2024. Closure design available in the report.
2.9	The operational certificate holder shall maintain a buffer zone along the north, east and south perimeters of the site, approximately as shown on Site Plan B and as follows: a minimum of 50 metres wide along the west half of the northern boundary and 30 metres wide along the balance of the northern boundary; and a minimum of 50 meters wide along all remaining boundaries . The buffer zone along the southern boundary of the site shall include a minimum fifteen (15) metre wide natural or landscaped screen.	Yes	Minimum buffer zones maintained.	**2019 Operating Plan report**, Site Layout Plan (first drawing after references)
2.10	The operational certificate holder shall post a sign, to the satisfaction of the Regional Waste Manager, at the entrance of the landfill site with the following current information: site name, owner and operator, contact telephone number and address for owner or operator, telephone number in case of emergency, hours of operation, materials and wastes accepted for recycling and landfilling, prohibited materials and wastes, and tipping fees.	Yes	Sign posted behind gates at landfill entrance with required information.	Google Maps Street View. 5400 72nd St. Delta, BC.
2.11	The operational certificate holder shall take all reasonable measures necessary to prevent fires from occurring at the site. Provide and maintain fire fighting equipment and materials to the satisfaction of the Regional Waste Manager. The operational certificate holder is responsible for complying with all municipal fire safety requirements. In the event of a landfill fire, immediately notify the local fire department, the Provincial Emergency Program and the manager.	Yes	Fire prevention and control plans in place. Safe Operating Guidelines in place for staff use with respect to fire monitoring, prevention and response.	2019 Operating Plan report Section 12.0 Fire Safety Plan
2.12	This operational certificate does not authorize the discharge of leachate to the environment. The operational certificate holder shall, to the satisfaction of the Regional Waste Manager, take measures to minimize leachate generation, including but not limited to, providing effective covering and surface water runoff. Measures taken, their effectiveness and any proposed measures shall be detailed in the annual report required in Section 3.5.2. The leachate collection works shall be maintained in accordance with sound engineering principles as supported by qualified personnel.	Yes	Leachate contained through perimeter ditch system and discharged to Annacis Island Waste Water Treatment Plant via sewers. Storm water runoff from closed areas of the landfill is collected in storage ponds. This water is discharged to the environment when proven to meet water quality criteria - otherwise it managed as leachate.	Annual Report Section 8.0 Environmental protection programs. (8.1 and 8.2)
2.13	Submit a report to the Regional Waste Manager by April 30, 2001 detailing measures taken to minimize odours and greenhouse gas emissions and their effectiveness. The report shall also include a description of any planned measures, including energy recovery, and an implementation schedule. The annual report required by Section 3.5.2. shall include a description of measures taken and the beneficial results accomplished by those measures, any revisions to the implementation schedule and any new measures planned for the coming year.	Yes	Report submitted in 1999. LFG collection system reduces odours and greenhouse gas emissions by collecting LFG and conveying to flare plant. Gas conditioning plants to convert LFG to RNG currently in construction.	Final Report Vancouver Landfill Gas Management System Project I (Conestoga-Rovers & Associates, 1999) Annual Report Section 8.4 Landfill gas management system
2.14	The amount of compostable materials and finished compost accumulated at the facility authorized in Section 1.4 shall be limited to the maximum which can be properly managed at the site.	Yes	Compostable materials receieved and compost produced reported in annual report. Amounts produced are manageable at the site.	Annual Report Section 7.4 Yard trimmings collection and composting
2.15	The amount of recyclable materials and household hazardous waste accumulated at the facility authorized in Section 1.3 shall be limited to the maximum which can be properly managed at the site.	Yes	Residential volumes only accepted for HHW and recyclable materials. Quantities and manageable and reported annually.	Annual Report Sections 7. Waste reduction and recycling initiatives (7.1 and 7.2)
2.16	Conduct a hydrogeological assessment to determine the following: the hydrogeological impact of continuing extraction of sand and water from the dredge pond and it's effect on leachate management; the natural attenuation properties of the peat and silt layers in the long term; the effect of additional height of waste on the horizontal hydraulic conductivity of the demolition layer (base cell); and the hydrogeological impact of current operating practices. The hydrogeological assessment shall be reviewed and updated every five (5) years. The first review shall occur prior to December 31. 2005.	Yes	Current hydrogeological review was completed in 2023. The next review will be submitted by end of 2028.	2023 Hydrogeology Review - Submitted to ENV Dec 22 2023
2.17	Register a covenant or other legal notification acceptable to the Regional Waste Manager, not later than 6 months following the subdivision of the property described in Section 1.1.7, that the property was used for the purpose of waste disposal as a charge against the title to the property. Notify the manager of the registration of the covenant or legal notification.	ND	N/A in 2023	N/A

Authorized Person Initial: MB

Date: March 22, 2024

AUTHORIZATION CLAUSE NUMBER	AUTHORIZATION CLAUSE DESCRIPTION	COMPLIANT? (Yes/No/ND)	RATIONALE FOR YOUR COMPLIANCE DETERMINATION	LOCATION OF SUPPORTING INFORMATION IN ANNUAL REPORT
2.18	Operate the facilities authorized in Sections 1.1, 1.2, 1.3 and 1.4 in accordance with a design and operating plan certified by a qualified professional licensed to practice in the Province of British Columbia. The operational certificate holder shall review the plan on an annual basis. Any revisions to the plan shall be submitted to the Regional Waste Manager as part of the annual report.	Yes	Updates to Operating Plan available in annual report.	Annual Report Section 2. Design and operating plan. Full reports are 2019 Design Plan report and 2019 Operating plan report.
2.19	Accrue, during the life of the landfill, a dedicated reserve fund in a form acceptable to the Regional Waste Manager, sufficient to finance closure, post-closure and environmental contingencies related to the landfill. The estimated cost of carrying out closure and post-closure activities for a minimum post-closure period of twenty five (25) years and how the fund will be accrued shall be included in the design and operating plan. The estimated costs of closure and post-closure activities shall be updated annually and reported to the manager as part of the annual report. Should the estimated costs of closure and post-closure increase then the operational certificate holder shall increase the rate of accrual accordingly.	Yes	NPV for closure + post closure costs = $141 million ($128.1M end 2022) Capital reserve balance = $80 million	Annual Report Section 3. Closure and post closure costs
2.20	The operational certificate holder shall submit a closure plan for the facilities at least six (6) months prior to the closure of the landfill to the Regional Waste Manager for approval. The plan shall incorporate details of the closure plan and include the required information.	ND	N/A in 2023	N/A
2.21	In accordance with the Waste Management Act and its regulations, the operational certificate holder shall submit a site profile to the Regional Waste Manager not less than IO days prior to decommissioning the facilities authorized in Section 1.	ND	Not yet decommissioned.	N/A
3.1	Record the quantity, in tonnes, of waste received at the landfill, recycling and composting facilities. Also, the quantity and destination of recyclable materials and mature compost removed from these facilities shall be recorded.	Yes	Records kept for all materials received at landfill and for outbound recycled materials. Summaries available in annual report.	For waste: Annual Report Appendix 2 Table A1 For recycling and compost: Annual Report Section 7. Waste reduction and recycling initiatives, Table 7. (7.1 and 7.3)
3.2.1	Maintain leachate, surface water and groundwater monitoring stations, approximately located as shown on the attached Site Plan D, and as outlined in Table I. Obtain grab samples at each station and analyze for each parameter at a frequency as indicated in Table 2. Proper care should be taken in sampling, storing and transporting the samples to adequately control temperature and avoid contamination, breakage. etc.	Yes	Currently exceeding the number of required monitoring stations. Samples taken at required frequency at all stations and best practices are used for sampling, storing and transporting including QA/QC .	Annual Report Section 8. Environmental protection programs, Appendix 4
3.2.2	Provide and maintain a suitable flow measuring device and record the volume of leachate discharged to sanitary sewer each month.	Yes	Monthly flows recorded and tabulated in annual report.	Annual Report Section 8. Environmental protection programs, Table 10
3.2.3	Establish and maintain a minimum of four (4) ditch water level monitoring stations and record once per month the water level elevation in the leachate and drainage ditches at each station.	Yes	Exceeding required monitoring in both number of stations and frequency of recordings. Using remote water level monitoring system at 8 stations in both ditches to record water level every 5 minutes.	Annual Report Section 8. Environmental protection programs, Appendix 7
3.3.1	Sampling and flow measurement shall be carried out in accordance with the procedures described in "British Columbia Field Sampling Manual for Continuous Monitoring plus the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment and Biological Samples", 1996 Edition (Permittee), 312 pp., or by suitable alternative procedures as authorized by the Regional Waste Manager.	Yes	Sampling is periodically supervised by contracted qualified professionals to verify that best practices are used during sampling.	Annual Report Section 8. Environmental protection programs, Appendix 6
3.3.2	Analyses are to be carried out in accordance with procedures described in the latest version of "British Columbia Environmental Laboratory Manual for the Analysis of Water, Wastewater, Sediment and Biological Materials, (March 1994 Permittee Edition)", or by suitable alternative procedures as authorized by the Regional Waste Manager.	Yes	Samples are only sent to laboratories certified to perform the analyses.	Annual Report Section 8. Environmental protection programs, Appendix 6
3.3.3	All data analyses required to be submitted by the permit shall be conducted by a laboratory acceptable to the Regional Waste Manager. At the request of the manager, the operational certificate holder shall provide the laboratory quality assurance data, associated field blanks, and duplicate analysis results along with the submission of data required.	Yes	Same as 3.3.2.	Same as 3.3.2.
3.4	The operational certificate holder shall maintain the following information and records, current and suitably tabulated, at the landfill office for inspection: a copy of Operational Certificate MR-01611; training procedures and personnel training records; contingency plans and notification procedures; the current design and operating plan; inspection records from staff and regulatory agencies; hydrogeological, geotechnical and landfill gas assessments; incoming waste, and soil records; records of recyclable materials shipped off site; environmental monitoring results and interpretations; and annual operating and monitoring reports for the previous year.	Yes	All required records are stored at the Landfill Technical Trailer and electronically.	N/A. Documents available upon request.
3.5.1	Maintain data of analyses and records of waste and recyclable material quantities for inspection. Submit the data of analyses suitably tabulated, to the Regional Waste Manager for the previous three months. The reporting period ends March 31, June 30, September 30 and December 31. All reports shall be received by the manager within 31 days of the end of the reporting period.	Yes	Data maintained and reported in accordance with described schedule.	N/A. Reports submitted before each deadline.

Authorized Person Initial: MB

Date: March 22, 2024

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3.5.2	Prepare an annual report which shall include a compendium of data submitted under Section 3.5.1. In addition, the annual report shall include the following: a review and interpretation of the analytical data from receiving environment monitoring for the preceding year; waste, recyclable material and compost records; leachate flow data and leachate/drainage ditch levels suitably tabulated; an evaluation of leachate generation control measures; an evaluation of the efficiency of the landfill gas management system, including an estimation of the landfill gas generation rate, percent recovery and the actual rates/volumes of gas collected, utilized and flared; revised closure/post closure costs and amount of funds currently available; revised design and operating plan and planned improvements; identification of operating problems and corrective actions taken; an evaluation of the recycling and composting programs including waste diversion projections; and public complaint/resolution log for the landfill. The annual report shall be submitted to the Regional Waste Manager on or before March 31 of the following year.	Yes	2023 annual report submitted meeting operational certificate requirements.	**2023 Annual Report for the Vancouver Landfill**

Authorized Person Initial: 

Date: March 22, 2024