



**King County**

**Solid Waste Division**

Department of Natural Resources and Parks

King Street Center

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Seattle, WA 98104-3855

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[www.kingcounty.gov/solidwaste](http://www.kingcounty.gov/solidwaste)

April 1, 2021

TO: Darshan Dhillon, Health and Environmental Investigator III, Environmental Health Division, Public Health – Seattle and King County

VIA: Laura Belt, P.E., Interim FESS Manager

FM: Marisa Baptiste, Engineer III

RE: King County Vashon Island Closed Landfill 2020 Annual Groundwater Data Evaluation Report

The purpose of this letter is to transmit the *King County Vashon Island Closed Landfill 2020 Annual Groundwater Data Evaluation Report*. The potentiometric maps and groundwater velocity calculations that have been included in the report were prepared by a licensed hydrogeologist and have been previously submitted with quarterly reports. This report also includes an executive summary, site specific summary, exceedances table, trend test table, time-concentration plots of parameters of interest, and descriptive statistics summary table.

The 2020 Annual Report has been updated to include environmental data collected through December 2020.

If you have questions or need additional information, please contact me at 206-477-0458, or via email at [marisa.baptiste@kingcounty.gov](mailto:marisa.baptiste@kingcounty.gov).

Enclosures

cc: Tim O'Connor, Hydrogeologist III, Washington State Department of Ecology  
Alan Noell, PhD., P.E., Washington State Department of Ecology  
Yolanda Pon, Managing Supervisor, Public Health - Seattle & King County  
Glynda Steiner, P.E., CCM, Deputy Division Director, Solid Waste Division (SWD),  
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Laura Belt, P.E., Interim FESS Manager, SWD, DNRP  
Isabel McClure, Interim Engineer Supervisor, SWD, DNRP  
Jennifer Keune, Environmental Compliance Coordinator, SWD, DNRP



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April 1, 2021

Tim O'Connor, Hydrogeologist III  
Washington State Department of Ecology  
Northwest Regional Office  
3190 – 160<sup>th</sup> Avenue SE  
Bellevue, WA 98008-5452

RE: King County Vashon Island Closed Landfill 2020 Annual Groundwater Data Evaluation Report

Dear Mr. O'Connor:

The purpose of this letter is to transmit the *King County Vashon Island Closed Landfill 2020 Annual Groundwater Data Evaluation Report*. The potentiometric maps and groundwater velocity calculations that have been included in the report were prepared by a licensed hydrogeologist and have been previously submitted with quarterly reports. This report also includes an executive summary, site specific summary, exceedances table, trend test table, time-concentration plots of parameters of interest, and descriptive statistics summary table.

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Sincerely,

DocuSigned by:  
  
52CD32739BC9450...

Marisa Baptiste  
Engineer III

Enclosures

Tim O'Connor

April 1, 2021

Page 2

cc: Darshan Dhillon, Health and Environmental Investigator III, Environmental Health Division, Public Health – Seattle & King County  
Alan Noell, PhD., P.E., Solid Waste Program, Washington State Department of Ecology  
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Jennifer Keune, Environmental Compliance Coordinator, SWD, DNRP

# KING COUNTY VASHON ISLAND CLOSED LANDFILL

## 2020 ANNUAL GROUNDWATER DATA EVALUATION REPORT



**King County**

Department of  
Natural Resources and Parks  
**Solid Waste Division**

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**Community** ● *Protecting*  
**Environment** ● *Operating*  
**Excellence**

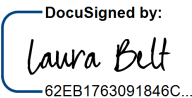
**April 2021**

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# CERTIFICATION

## KING COUNTY VASHON ISLAND CLOSED LANDFILL 2020 ANNUAL GROUNDWATER DATA EVALUATION REPORT CERTIFICATION

I certify in accordance with the requirements of WAC 173-351-400(c) (3), that the contents of this document were prepared under my direction or supervision under a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Where applicable, some specific and related hydrogeologic portions have been duly certified by the responsible groundwater scientist. Based on my inquiry of the person(s) directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete.

<b>Name:</b> Laura Belt, P.E.	<b>Title:</b> Supervising Engineer, Facility Engineering and Science Section	<b>Date:</b> April 1, 2021
<b>Mailing Address:</b> Solid Waste Division King County Department of Natural Resources & Parks 201 South Jackson Street, Suite 701 Seattle, WA 98104-3855		<b>Telephone Number:</b> 206-477-5215
<b>Signature:</b> <div style="text-align: center;">  <p>DocuSigned by:                      Laura Belt                      62EB1763091846C...</p> </div>		



EXPIRES 08-10-2021



**CHECKLIST FOR GROUNDWATER REPORTING**  
**Municipal Solid Waste Landfills**  
**WAC 173-351-415**

Include a signed, completed copy of this checklist with each quarterly and annual report.

Quarterly groundwater reports shall be submitted to the jurisdictional health department and Ecology within 60 days of receipt of analytical data. Annual groundwater reports shall be submitted to the jurisdictional health department and Ecology by April 1 of each year.

1 <sup>st</sup> _____ 2 <sup>nd</sup> _____ 3 <sup>rd</sup> _____ 4 <sup>th</sup> <input checked="" type="checkbox"/> _____ YEAR: 2020	Reference (section, subsection)	Included in this report	Location – section or appendix
<b><i>Quarterly Groundwater Reports: 173-351-415 (2) plus the referenced section</i></b>			
Statistical calculations and summaries			
Descriptive statistics	420, (1)	<input checked="" type="checkbox"/>	Table 3-1
Statistical tests	420, (2)	<input checked="" type="checkbox"/>	Tables 3-2 & 3-3; Appendix B
Notification of statistical increase (if applicable)	420, (4)	<input checked="" type="checkbox"/>	Sect 4.2.1, 4.2.2, 4.2.3, & 4.2.4
Notification of concentrations above Chapter 173-200 WAC criteria (if any)	430, (4)	<input checked="" type="checkbox"/>	Appendix B
Static water level readings	415, (2)	<input checked="" type="checkbox"/>	Appendix H
Potentiometric surface elevation maps depicting flow direction	415, (2)	<input checked="" type="checkbox"/>	Appendix G
Flow rate – calculated	415, (2)	<input checked="" type="checkbox"/>	Appendix G
Cation-anion balances	430, (5a)	<input checked="" type="checkbox"/>	Appendix I
Explanation of greater than 5% (or 10%) difference (if needed)	430, (5a)	<input checked="" type="checkbox"/>	Sect 4.2.1, 4.2.2, 4.2.3, & 4.2.4
Trilinear diagrams	430, (5b)	<input checked="" type="checkbox"/>	Appendix I
Leachate analyses (if sampled and tested)	415, (2)	<input checked="" type="checkbox"/>	Appendix K
Data entered into EIM database (date entered: 03/26/2021)	415, (3)	<input checked="" type="checkbox"/>	
Complete copy of the lab report with chain of custody record.		<input type="checkbox"/>	
<b><i>Annual Groundwater Reports: 173-351-415 (1) YEAR: 2020</i></b>			
Summary of statistical results and trends	415, (1)	<input checked="" type="checkbox"/>	Tables 3-1, 3-2, and 3-3
Summary of groundwater flow rate and direction for the year	415, (1)	<input checked="" type="checkbox"/>	Appendix G
Copy of all potentiometric maps for the year	415, (1)	<input checked="" type="checkbox"/>	Appendix G
Summary geochemical evaluation	415, (1)	<input checked="" type="checkbox"/>	Appendix I
<b><i>For Quarterly and Annual Reports</i></b>			
Stamped by a licensed professional	RCW 18.220	<input checked="" type="checkbox"/>	

DocuSigned by:

Signature of Report Author

April 1, 2021

Date

King County Vashon Island Closed Landfill

Landfill

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**KING COUNTY  
VASHON ISLAND CLOSED LANDFILL**

**2020 ANNUAL GROUNDWATER DATA  
EVALUATION REPORT**

**King County Department of Natural Resources & Parks  
Solid Waste Division, Facility Engineering & Science Section**

**April 2021**

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## EXECUTIVE SUMMARY

This report presents the results of statistical analyses on the groundwater monitoring data collected at the Vashon Island Closed Landfill (VLF) from January 1986 through December 2020 per WAC 173-351 and King County Solid Waste Code, Chapter 10.04. The fourth quarter 2020 data is presented in the following appendices: Appendix B Exceedance Reports, Appendix G Groundwater Velocity Calculations and Potentiometric Maps, Appendix H Groundwater Monitoring Data, Appendix I Ion Balance Summary & Trilinear Diagrams, Appendix J Surface Water Monitoring Data, Appendix K Leachate Monitoring Data, and Appendix L Landfill Gas Monitoring Data.

The Financial Assurance information in this document (included in Appendix N) presents the authorized 2021-2022 budget for the VLF. The financial information is presented in a format, which responds to the regulatory request for financial assurance and will be updated based on a remedial investigation and feasibility study ongoing for the landfill.

Landfilling was discontinued in August of 1999 with the final cover placement occurring in fall 2001. The landfill closure area is approximately 34 acres. The basic components of the cover system, from the top down, include vegetative layer, upper drainage layer, impervious layer consisting of high-density polyethylene (HDPE), and lower gravel drainage layer.

The groundwater monitoring wells on VLF penetrate two water-bearing zones, Unit C, including Channels Cc1, Cc2, and Cc3, and Unit D.

Channel Cc1 has two monitoring wells, MW-10 and MW-13, which are not considered to be impacted by landfilling activities. Monitoring wells, MW-3 and MW-4, have reduced water volumes and do not always yield enough water to be sampled.

In Channel Cc2, the recent data reflects the variability in water quality present in background monitoring well MW-20 that presently indicates low and stable concentrations. Monitoring wells in the groundwater perched in Channel Cc2 displaying impacts from landfill activities, include monitoring wells MW-2, MW-21, MW-33, and MW-35. Stronger reducing conditions are identified in monitoring wells MW-21, MW-33, and MW-35 than in monitoring well MW-2, consistent with historical conditions. Since the landfill was closed and capped, wells in the Channel Cc2 have shown an overall reduction in volatile organic compounds (VOCs). Patterns observed for VOCs in monitoring wells MW-2, MW-21, MW-33, and MW-35 indicate landfill gas as the most probable source of these groundwater impacts, which differs from other water quality parameters. In 2014, Channel Cc2 entered voluntary cleanup under the Washington State Model Toxics Control Act (MTCA).

There are two groundwater monitoring wells (MW-8 and MW-36) in Channel Cc3, both of which are considered to be of good quality with little evidence of landfilling impacts.

Conditions in Unit D Aquifer show as being stable and they do not indicate impacts attributable to landfill activities.

We have continued to monitor the effectiveness of the landfill gas control system. One new vertical landfill gas extraction well, GW-9, and four pairs of shallow/deep wells were installed in 2016 and 2017 to evaluate further for the presence of landfill gas on the South Slope area. In 2018, two more gas extraction wells, GW-10 and GW-11, and four additional temporary probes were installed and incorporated into the active landfill gas collection system. In February of 2020, the landfill gas blower went in to be repaired and it was determined based on the age of the blower, previous repairs, and the long-term needs for landfill gas collection at VLF to replace the blower. Two new direct drive blowers are scheduled to be installed during the second quarter of 2021 and active landfill gas collection will resume. There have been no methane detections at the compliance monitoring points since 2008.

Springs discharge on the hillslope to the west of Westside Highway SW. The water from these springs has been collected since 1991 at three weirs, SW-W1, SW-W2, and SW-W3. The only VOC detected with any frequency in the weirs is vinyl chloride. Vinyl chloride is occasionally detected in SW-W1 and infrequently in SW-W2 and routinely detected in SW-W3. A surface water sampling location, SW-E was added to the sampling network in November of 2012 and sample results show that water quality is similar to SW-W1 with no VOC detections.

King County Solid Waste Division (KCSWD) currently monitors quarterly for groundwater, surface water, and leachate at VLF, monthly for landfill gas, and semiannually for offsite wells. KCSWD is currently reviewing the need for improvements to the engineering control systems for the landfill.

## **1. PURPOSE**

The purpose of this report is to present the annual conditions at Vashon Island Closed Landfill (VLF) in compliance of the regulatory requirements of the Washington Administrative Code (WAC) 173-351, *Criteria for Municipal Solid Waste Landfills*.

## 2. INTRODUCTION

This is the 2020 Annual Groundwater Data Evaluation Report that presents the results of statistical analyses on the groundwater monitoring data collected at the VLF from January 1986 through December 2020. This annual report describes the hydrogeologic conditions at the landfill and presents the evaluations on the groundwater quality data collected from upgradient and downgradient monitoring wells and on the water quality from seeps on the hillside to the west of the landfill. The data in this report are presented in compliance with Washington State Department of Ecology (Ecology) *Criteria for Municipal Solid Waste Landfills* (WAC 173-351-415), and the King County Code, *King County Solid Waste Regulations* (Title 10, Rules and Regulations No. 8).

In accordance with the annual reporting requirement of WAC 173-351, this annual report includes a discussion of maintenance activities at the site in 2020 (Table 2-1), surface water data (Appendix J), landfill gas data (Appendix L), and leachate data (Appendix K).

This report also provides a brief description of the partial closure and site improvements that were completed in 1989, the site investigations conducted at the landfill in 1995 and 1999 and the final closure construction completed in 2001. Groundwater quality trends are discussed in context of these site improvements. This report also includes a summary of previous site investigations and ongoing efforts; a description of the location, topography, and regional geology and groundwater hydrology of the landfill; a history of the landfill; evaluation methods; data quality; site hydrogeology; and results and discussion of groundwater flow and chemistry at the landfill. Planned future activities at the site are presented in Section 6. This report has been updated to reflect the updated hydrogeological conceptual model (Aspect, 2020).

### 2.1. *SITE LOCATION and REGIONAL SETTING*

The VLF is located on a 54.3-acre King County owned parcel in the west central portion of Vashon Island (Figure 1). The landfill property is divided by Westside Highway SW. Most of the property exists in sparsely to unwooded, gently rolling terrain at elevations of 300 to 400 ft. The 39-acre area east of the highway is primarily unwooded open space and consists of 10.3 acres of municipal solid waste and 28.7 acres of landfill facilities. The 15.3-acre area west of the highway is steep, undeveloped, forested land sloping towards the Colvos Passage, commonly referred to as the West Hillslope. The VLF property is bounded by Westside Highway Southwest and rural residential land to the northwest, by Southwest 184th Street to the north, by forested land and rural residential land to the east, and by rural residential land to the south (Figure 1).

Vashon Island has a mild climate, tempered by the surrounding Puget Sound. Summers are cool and dry, while winters are moist and mild. Meteorological data collect from the West Judd Creek Rain Gage on Vashon Island by King County (precipitation collected from 2004 – present and air temperature collected from 2007 – 2014) shows that the average monthly precipitation ranges from 0.5 inches in July to 7.3 inches in November. Total annual precipitation ranges from a minimum of 30.9 inches in 2013 to a maximum of 56.5 inches in 2006. Average daily temperature ranges

from 48 °F to 54 °F. The annual maximum temperature ranges from 68 °F – 84 °F and the annual minimum temperature ranges from 19 °F – 32 °F.

## **2.2. SITE HISTORY**

Solid waste disposal began at the landfill property in the early 1900s. Operation of the landfill was assumed by the Solid Waste Division in the late 1950s, when daily cover, record keeping, and other updated solid waste management practices were initiated (R.W. Beck and Associates, 1983). The landfill was closed in two phases: a partial closure in 1988, in accordance with WAC 173-304, and a final closure in 2001, in accordance with WAC 173-351.

The 1988, Phase 1, closure occurred in the northwest portion of the landfill (approximately 2.3 acres). The closure included installation of a cover, a liner below the lateral expansion area, surface water management, leachate collection, and landfill gas collection systems. The selected design consisted of installing an impermeable composite liner (consisting of high density polyethylene (HDPE) geomembrane, low-permeability soil, geotextile, and foundation material/natural soil liner) over the existing refuse area; a passive gas collection system under this liner; a leachate collection and conveyance system; an aerated pretreatment lagoon; stormwater control facilities (ditches, culverts, and siltation and detention ponds); and a venting and treatment system of landfill gas. A liner for the future refuse area was installed. These improvements were completed in 1989.

Phase 2 closure began in August of 1999 with the discontinuation of material placement in the landfill and the installation of a temporary plastic cover over the refuse. Stormwater facility improvements were constructed during the summer and fall of 1999, including a detention pond in the southeast corner and an underground drain system around the perimeter of the landfill. The leachate collection and conveyance system were expanded before cap placement during the Phase 2 closure, and the leachate lagoon was constructed. Between 1996 and 2001, the landfill gas system had additional horizontal trench collectors between refuse lifts connected into the existing active collection system. The final cover placement occurred in the fall of 2001. The basic components of the cover system, from the top down, include a vegetative layer, upper drainage layer, impervious layer consisting of HDPE, and a lower gravel drainage layer (Berryman & Henigar et al, 1999). The combined Phase 1 and Phase 2 landfill closure area is approximately 10.3 acres.

## **2.3. PREVIOUS INVESTIGATIONS and SITE IMPROVEMENTS**

Hydrogeology, water quality, and environmental investigations have been conducted at the VLF since 1983, led by R.W. Beck and Associates and Sweet, Edwards and Associates (1984), Harper-Owes (1986), Harper-Owes, et al. (1988), CH2M Hill (1995, 1996), Berryman & Henigar (1999), Berryman & Henigar et al. (2000), Berryman & Henigar and Udaloy Environmental Services (UES) (2004, 2006a), King County (2011), and Aspect Consulting (Aspect) (2012, 2018). In 1983, the first four groundwater monitoring wells (MW-1, MW-2, MW-3, and MW-4; Figure 2) were installed at the landfill. Piezometers P-1/1A/1B and P-2/2A, previously located in the fill area on the east side, were abandoned in 1988 by overdrilling and then filling the borehole with bentonite in accordance with the requirements of WAC 173-160. Monitoring wells MW-5 and MW-6 were installed in



1986. These wells were installed as part of a site assessment completed to determine how to best bring the landfill into compliance with state and local solid waste disposal regulations. Two piezometers, P-3 and P-4, were installed in 1992, and then later renumbered as monitoring wells MW-13 and MW-24. Monitoring well MW-13 is now utilized as a compliance groundwater monitoring well. Monitoring well MW-24 is used to monitor static groundwater levels only.

The R. W. Beck (1984) and Harper-Owes (1986) reports indicated some evidence of leachate in the sand and gravel units beneath the till. Water quality conditions were reevaluated in 1988 just prior to construction of the landfill closure and upgraded disposal area (letter report by Harper-Owes to Kevin Kiernan, King County Solid Waste Division). Conclusions at that time were that the leachate was more dilute than is typical of municipal landfills in the Pacific Northwest, with no indication of elevated concentrations of organic compounds. Perimeter monitoring wells had some exceedances of primary and secondary drinking water criteria. The west hillside weeps had exceedances only of secondary drinking water criteria.

In the summer of 1995, the existing groundwater monitoring network was supplemented with the installation of eight groundwater monitoring wells (MW-7, MW-8, MW-9, MW-10, MW-11, MW-12, MW-14, and MW-19). In 1995 eight gas probes were installed around the perimeter of the refuse area to determine if gas migration was occurring at the landfill. Other improvements made to the gas collection system in 1996 included converting the system from passive to active and changing the treatment system from flares to activated carbon. A detailed discussion of the depths and locations of the monitoring wells and gas probes installed in 1995 is provided in the *Groundwater Monitoring Well Construction Work Plan* (CH2M Hill, 1995).

In the fall of 1998, monitoring wells MW-20 and MW-21 were installed to provide supplementary monitoring of an extensive sand bed in the lacustrine silt.

In order to address the requirements in WAC 173-351-490 the *Vashon Island Landfill Hydrogeologic Report* (Berryman & Henigar et. al., 2000) was produced, providing an evaluation of the site hydrogeology.

Monitoring well MW-11 was damaged in February 2001 during the Nisqually earthquake, after which samples ceased to be collected from that well. Monitoring well MW-11 was decommissioned and replaced with monitoring well MW-29 in the summer of 2003. Multi-completion monitoring well MW-6S/D was also damaged in the earthquake and was decommissioned in 2003.

Drilling operations in 2003 included installing three additional monitoring wells (MW-26, MW-27 and MW-28) and one piezometer (MW-25) to expand the monitoring network. Monitoring well MW-28 has been dry since completion. A revision to the 2000 hydrogeologic report was completed in December 2004 (Berryman & Henigar and UES, 2004) incorporating these new wells into the hydrogeologic interpretation of the site. Table 2-2 provides details on all the wells on the site.

Maintenance of the environmental control facilities is performed throughout the year. The Operations and Maintenance (O&M) Plan was produced at the end of 2005, which provided tables listing the specific O&M activities for each system. The new listings were incorporated into the

SWD Operations tracking database in 2006. A summary of the maintenance activities completed in 2020 is included as Table 2-1.

In March 2006, three documents covering the environmental evaluation of the landfill site were submitted to Ecology and Public Health-Seattle & King County (PH-SKC). (1) *Vashon Island Closed Landfill Environmental Evaluation* provided an evaluation of the landfill environmental control systems and their interaction with the hydrogeologic environment (Berryman & Henigar and UES, 2006a); (2) *Vashon Island Closed Landfill: Potential Effects of Landfill Gas and Leachate on Vashon Landfill Groundwater and Springs* provided a chemistry-based evaluation of the source of volatile organic compounds (VOCs) found in some of the wells present at the time (Berryman & Henigar and UES, 2006b); and (3) *VOC Sampling and Test Results* reported the findings of soil gas sampling performed at the site. Combined, these documents address the requirements of Compliance Task 4 in the *Vashon Closed Landfill Permit*.

These reports also provided recommendations for further actions, some of which were completed in 2006. One, the testing of the leachate lagoon liner, was completed in 2007. The results indicated that the liner did not have any leaks. In July 2015, the leachate lagoon was tested again for leaks by Beyond Leak Detection, a regulatory requirement, and a condition of the *Vashon Closed Landfill – Municipal Solid Waste Handling Permit* and found to have no leaks. Testing for leaks in the leachate lagoon is conducted every 5 years and was supposed occur again in 2020. KCSWD attempted the first test in August of 2020, but the test could not be completed, until repairs to liner in the anchor trench were made. KCSWD was scheduled to attempt the test again in December of 2020; however, due to travel restriction issued by the Washington State Governor, KCSWD requested to postpone leak testing until it was safe. PH-SKC approved this request and KCSWD will complete leak testing by June 30, 2021.

Other recommendations in the reports require the procurement of consultant services, including installing wells as needed to better define site geology and hydrogeology; evaluating and enhancing the landfill gas extraction system; and better defining the geological contacts and springs on the West Hillslope (Berryman & Henigar and UES, 2006). Some of these services were performed by King County Water and Land Resources Division (KCWLDRD). A consultant was hired to review all environmental investigations, monitoring, and remediation performed at the landfill and to identify data gaps and potential enhancements to the existing engineering control systems.

In December 2009, as part of an ongoing investigation on the West Hillslope, three shallow temporary monitoring wells (MW-30, MW-31, and MW-32) were installed by hand augur. These wells were sampled for one year and findings from this investigation are summarized in the *Vashon Closed Landfill Western Hillslope Investigation* (King County, 2011).

In March of 2015, in response to the recommendation to better define the hydrogeology model, monitoring wells MW-33, MW-34, MW-35, and MW-36 were installed. Monitoring well MW-33 was the only additional well location. Monitoring well MW-34 replaced monitoring well MW-27, which may have been completed in a way that allowed interconnection between Channel Cc3 and Unit D. Monitoring well MW-35 replaced monitoring well MW-5D, which was an old multi-completion well. Monitoring well MW-36 replaced monitoring well MW-14, which had a stuck

pump above the screen interval. Also, in 2015, monitoring well MW-1 was decommissioned due to not yielding enough water to sample.

In October of 2018, the *Agency Draft Vashon Island Closed Landfill Remedial Investigation Report (RI)* was distributed to Ecology and Public Health-Seattle & King County (Aspect, 2018). The RI began in 2014 and was conducted in accordance with the Washington State Model Toxics Control Act (MTCA; WAC 173-340). Data was gathered and analyzed to provide an understanding of the hydrogeologic site setting, nature and extent of contaminants, their fate and transport, and the receptors that may be impacted by the contaminants. The *Vashon Island Closed Landfill Remedial Investigation Report* (Aspect, 2020) was finalized in November 2020 after the addition of the 2018 and 2019 monitoring data, a beneficial use survey, and a terrestrial and ecological evaluation. The final RI will be used to prepare a Feasibility Study (FS) to determine the necessity for additional cleanup actions in compliance with MTCA regulations (WAC 173-340-350 through 173-340-390). Prior to the completion of the RI and FS, in 2016 and 2018, three gas extraction wells were installed (GW-9, GW-10, and GW-11) on southern slope of the landfill, in order to start to address the landfill gas infiltration into the groundwater in Channel Cc2.

## **2.4. GEOLOGY AND HYDROGEOLOGY**

### **2.4.1. Regional Geology**

Vashon Island is composed of glacially derived sediments from several glacial episodes. Surficial geology is primarily glacial till (or till-like units), (approximately 68 percent of the island), and glacial and alluvial outwash (the remaining 32 percent), (King County, 2005). A regional perspective is available in Figures 6 and 8, depicting a regional cross section in A-A'. Data suggest that tills representing at least three separate glacial advances occur on Vashon Island. The most recent of these was deposited during the Vashon Stage of the Fraser Glaciation, which reached its maximum southerly extent near Olympia about 17,000 years ago. The Vashon till (Qvt) mantles most of the island and is widespread throughout the Puget Lowlands. Surficial geologic materials in the VLF area consist of Quaternary (Vashon) till and advance outwash. The till is underlain by advance outwash (Qva) soils formed by water flowing in front of the approaching glacier; these outwash deposits were subsequently overridden and compacted by glacial ice and till. The advance outwash deposit tends to grade downward from gravelly sand to uniform fine to medium sand. Distribution of pre-Vashon and pre-Fraser deposits beneath the advance outwash is complex. The base of the advance outwash is defined by the uppermost appearance of interglacial silts or clay or oxidized non-glacial clasts. Exposures of the Quaternary pre-Fraser fine-grained facies (Qpff) unit are mapped on the steep bluff just west of the landfill. All VLF soils beneath the uppermost ("advance outwash") sands are presumed to be pre-Fraser in age and laterally continuous with those soils mapped west of the landfill. For the VLF, these soils include alluvial, fluvial, and lacustrine or glaciolacustrine sediments. (Aspect, 2020)

### **2.4.2. Site Geology**

The site stratigraphic model categorizes the subsurface into seven primary units, designated A through G, based on interpreted geologic origin (Table 2-3 and Figures 6-11). Unit A is comprised of surficial till (Vashon till) that mantles the site. Soils in this unit consist of gravelly, silty sand. This weathered till has a thickness of 15-50 ft. throughout most of the landfill site, although absent in the southern portion of the site. Groundwater has not been identified in Unit A and there are no monitoring wells for the Vashon Till (Figure 2).

Unit B is designated as an advance outwash sand underlying the till. This unit has been encountered in all borings that extend beyond Unit A and ranges in thickness from about 40 to 50 ft.

Unit C is made up of a lacustrine silt layer that is interpreted to be laterally continuous beneath the site and under the outwash. This lacustrine silt is incised by fluvial sands and gravels approximately 100 to 120 ft. thick. These sands and gravels are interpreted as channel deposits. Perched saturated zones identified beneath the VLF site occur in channel deposits (Cc1 & Cc2) within the uppermost lacustrine silt (Unit C). The fine-grained (Cf) portions of Unit C act as an aquitard and consist of interbedded sandy silts, silts, and clays. Incised within the fine-grained soil are coarser sand deposits (Cc). The Cf soils were deposited in a low-energy glaciomarine or glaciolacustrine setting and the Cc sediments are a higher energy glaciofluvial deposit. Glaciofluvial deposits are typically less laterally extensive than non-glaciofluvial deposits and appear to represent subglacial meltwater channel deposits and possibly eskers (sinuous ribbons of sand and gravel deposited in meltwater tunnels at the base of the ice). Three coarser units have been identified within Unit C, designated from shallowest to deepest Cc1, Cc2, and Cc3. As depicted in the cross section, the Cc units are continuous across the VLF property.

Unit D is comprised of fluvial deposits exhibiting a wide range in texture consistent with varying energy in a fluvial environment. Textures range from sandy gravel channel deposits to fine-grained overbank deposits, and the unit exhibits a corresponding range of hydraulic properties. Thickness of Unit D ranges from about 25 to 65 ft. and has been encountered in all deeper borings.

Unit E is a lacustrine unit approximately 40 ft. thick, underlies Unit D and is thought to be continuous beneath the site. This unit is mainly comprised of silt and acts as an aquitard between the water-bearing fluvial deposits in Unit D and Unit F.

Unit F consists of Pre-Vashon fluvial deposits of widely varying texture, similar to those of Unit D. The thickness of Unit F ranges from 30 to over 90 ft.

Unit G is the oldest and deepest unit encountered in soil borings at the VLF and is a dark gray, varved clay though to be regionally extensive and over 50 ft. thick.

### 2.4.3. Regional Hydrogeology

Groundwater flow on Vashon Island is largely radial and downward, flowing outward from the island's central uplands towards the surrounding Puget Sound (King County, 2005). Vashon Island hydrogeology has previously been characterized based on island well logs and two primary aquifers were identified as being used as Vashon Island's water supply source: the Principal

Aquifer generally located above sea level yielding moderate amounts of water to wells, and the Deep Aquifer at depths of about 100 to 300 ft. below sea level capable of yielding larger quantities of water (Carr, 1983). The 1998 groundwater management plan (GWAC, 1998) defined four hydrostratigraphic zones based on water level data and completion depths from 25 wells. Broadly speaking, Zones 1 and 2 are within the Principal Aquifer and Zones 3 and 4 are within the Deep Aquifer identified in the Carr Report. In both studies, groundwater flow in the shallower aquifers was to the east and west from a topographic high that extends in an approximate north-south axis along the island, with steeper gradients along the west side. Groundwater modeling completed as a component of the Water Resources Evaluation confirmed this aspect of groundwater flow on the island (King County, 2005). Research for the groundwater modeling found that groundwater use is fairly evenly divided among the shallow advance outwash, upper deep, and lower deep aquifers.

#### 2.4.4. Site Hydrogeology

Four principal water-bearing units were identified based on existing hydrogeologic data: Channel Cc2, Channel Cc3, Unit D, and Unit F (Figures 6-11). Channel Cc2 and Unit D are the only water bearing units with sufficient information to produce potentiometric maps. Direction of groundwater flow within Channel Cc2 was determined to be primarily westward in the updated hydrogeological conceptual model (Aspect, 2020) and subsequent quarterly potentiometric reports (Appendix G). The direction of groundwater flow within the Unit D Aquifer (previously defined as the regional aquifer) is indeterminate, with flow components potentially northward, westward, and southward. Units B and Cc1 are not considered principal water-bearing units. While occasional groundwater has been measured in wells completed in these units, the saturated zone is thin to dry with strong seasonal variability.

Monitoring well MW-24 is the only well screened in Unit B (Aspect, 2020).

Groundwater in Channel Cc1 is currently evaluated using monitoring wells MW-3, MW-4, MW-10, and MW-13 (Figures 6-11) and all monitoring wells measure water levels within the Cc1 deposits. Monitoring wells typically producing sufficient water include MW-10, MW-13, and periodically monitoring wells MW-3 and MW-4.

Groundwater in the principal water bearing units occur in sands and gravels within the lowermost Unit C channel deposits (Cc2 and Cc3) and within Units D and F.

Monitoring wells MW-2, MW-9, MW-20, MW-21, MW-33, and MW-35 are located within the middle channel deposits (Cc2) (Figures 6-11). Monitoring wells MW-33 and MW-35 were installed in March of 2015 for water quality monitoring and hydrostratigraphic data collection to be define Channel Cc2.

A steep slope west of the landfill cuts across a water-bearing silt/sand contact. As a result, some 400 to 500 ft. to the west of the landfill, groundwater emerges and enters an unnamed creek before entering Puget Sound at Colvos Passage approximately two-thirds of a mile to the west. A hydrogeologic investigation of the hillslope attempting to locate the outcroppings of the Unit C

channels and provide water quality monitoring locations for the channels was completed in 2011; the findings are presented in the *Vashon Landfill Western Hillslope Investigation Report*.

Monitoring wells MW-8 and MW-36 are installed in the lower channel deposits (Cc3) (Figures 6-11). Monitoring well MW-36 was installed in April of 2015.

Generally, water levels in the Channels Cc2 and Cc3 indicate unconfined groundwater conditions, with the exception of monitoring wells MW-20, MW-33, and MW-36. Groundwater in these three wells are above coarse-grained portions of the unit indicating confined conditions.

Monitoring wells MW-7, MW-12, MW-19, MW-25, MW-26, MW-29, and MW-34 are installed in Unit D (Figures 6-11). Monitoring well MW-34 was installed in March of 2015. Monitoring well MW-28 was installed to screen the contact between Unit D and Unit E and has been dry since installation and requires a two-foot rise in surrounding groundwater levels to reach screen bottom. The elevation of this contact exceeds the water table elevation in Unit D at this location.

Units D and F are generally separated by an aquitard (Unit E) although the aquitard has likely been removed by erosion beneath at least some portions of the property (specifically, at monitoring wells MW-25 and MW-26, Figure 8).

A deeper aquitard, Unit G, was encountered in only one boring for monitoring well MW-7 (Figures 7 and 10). Due to its limited distribution, the hydrogeologic effect of the Unit G aquitard beneath the landfill is limited.

### 3. EVALUATION METHODS

The landfill environmental evaluation was conducted in accordance with the *Environmental Monitoring Sampling and Analysis Plan and Quality Assurance Project Plan for Vashon Island Closed Landfill* (SAP). The evaluation tools include:

- Descriptive Statistics (Table 3-1 and 3-4)
- Mann Kendall Trend Test (Tables 3-2 and 3-3)
- Exceedance Tables (Appendix B)
- Interwell Prediction Limits (Appendix B)
- Intrawell Prediction Limits (Appendix B)
- Time Concentration Plots (Appendices C-F)
- Trilinear Plots (Appendix I)

The prediction limit exceedances, regulatory standard exceedances, ion balances and trilinear diagrams are prepared for each quarterly report and compiled in this report. Samples from all monitoring wells are compared to the *National Primary and Secondary Drinking Water Regulations* (40 CFR Parts 141 and 143) and *Water Quality Standards for Groundwaters of the State of Washington* (WAC 173-200) found in Appendix A. The data from monitoring wells screened within Unit D Aquifer are compared to the calculated intrawell prediction limits, and data from wells screened within Channel Cc2 are compared to interwell prediction limits calculated using data from upgradient monitoring well MW-20 (Appendix B). As described in the SAP, prediction limit calculations are dependent on the number of detections and the Shapiro-Wilk test for normality.

Beginning with the *Vashon Island Closed Landfill 2018 Annual Groundwater Data Evaluation* the Mann-Kendall trend test was performed using the R Project for Statistical Computing package ‘Kendall’. This tool produces more robust results compared with previously used technology. The trend test evaluates data for long-term trends, including historical data up to the last eight samples, and for short-term trends using the last eight samples. For wells with historical data beyond 50 samples, the most recent 50 samples are used in the long-term trend test. Monitoring wells that have not produced sufficient water for eight samples in the last two years are compiled for a long-term trend test only.

The descriptive statistics are calculated for long-term, including historical data up to the last eight samples, and for short-term using the last eight samples. Monitoring wells that have not produced sufficient water for eight samples in the last two years are compiled as a long-term trend only. These descriptive statistics are compared to historical values to identify any significant changes.

Groundwater levels in individual wells have been plotted as a function of time (Figures 12-16). Changes in water levels before and after the 1989 closure are noted. Groundwater flow directions were estimated based on water elevations in monitoring wells screened in similar water-bearing zones. Upgradient and downgradient wells are determined by flow direction.

### 3.1. DATA QUALITY

Five analytical labs have performed laboratory services for water samples collected at the Vashon Landfill including Laucks from 1986 to March 1990, AmTest from March 1990 to April 1992, and Analytical Resources (ARI) from April 1992 to May 1995, Laucks again from May 1995 to April 2008, Pace from April 2008 to March 2009, and the King County Environmental Laboratory from April 2009 to current. The State Manchester Laboratory accredited all five laboratories for the methods used at the time the samples were analyzed.

Contamination of blanks has important ramifications for data quality. However, some compounds have high blank contamination rates for compounds, such as methylene chloride. Although improvements have been made in reducing the rate of blank contamination in the lab, blank samples that have a longer residence time in the laboratory still show elevated rates. Since the common laboratory contaminants do not provide the only evidence of landfill impacts, other volatile organic compounds are used for this evaluation. Other compounds, such as, sulfate, zinc, and iron have also been detected in blanks. These detections will be noted for the individual samples in which they have occurred. Some data, particularly concerning solvents, must be qualified based on blank contamination events and measures of precision and accuracy. All sample results qualified with a “B” have blank contamination associated with the analysis. (See Appendix B)

There are instances where the limit of detection, because of technological limitations, is above the *National Primary and Secondary Drinking Water Regulations* and *Water Quality Standards for Groundwaters of the State of Washington* for groundwater or above the *Water Quality Standards for Surface Waters of the State of Washington* (WAC 173-201A) and *Water Quality Standards* (40 CFR Parts 131) for surface water. Because these concentrations are not quantifiable, they can be reported only qualitatively, as less than a reporting limit and are qualified accordingly. Another issue involving limits arises when the limits of detection or analytical sensitivity changes over time. Especially noticeable for parameters such as chloride, where more recent samples show more fluctuations or definition on the graphs due to more significant figures (greater sensitivity) being reported. Other factors that may contribute to these changes may be due to dilution, or due to technical or contractual specifications such as technical advancements in instrumentation in the contractual laboratory industry. These changes must be kept in mind while reviewing data evaluation and conclusions and laboratory qualifiers can be found in Appendix A.

A notable change in 2017 involves the methodology for the analytical testing covered by SW-846 (Test Methods for Evaluating Solid Waste). The previous Method Detection Limit (MDL) methodology has been updated in 2017 to use the Lower Limit of Quantitation (LLOQ).

The LLOQ is the lowest point on a calibration curve that can be used for quantification. It is a method that repeatedly tests and calibrates against known standards such as reagent water, method blanks, etc. Ultimately, the LLOQ's ability to detect an analyte at a specific concentration is dependent upon factors such as instrument sensitivity and can, at times, be greater than the baseline curve concentration.



During the second quarter of 2017, the transition to using the LLOQ methodology resulted in revised reporting limits for a number of analytes. Quantitation limits for all trace metals (i.e. non-major cationic species metals), and a subset of the VOCs analyzed for regularly are lower than past analyses, while some VOCs have higher or the same limits as before. As a result of these changes, previously unobserved trace metals and VOCs in a number of wells are now reportable at concentrations below previous methodologies could quantify.

## 4. RESULTS

### 4.1. GROUNDWATER ELEVATIONS AND FLOW DIRECTION

The updated hydrogeological conceptual model presents the latest interpretation of the hydrogeology and that interpretation has been used in the preparation of potentiometric surface maps and calculations of groundwater velocities (Aspect, 2020).

Monitoring well locations are shown on Figure 2. These monitoring wells penetrate four water-bearing zones (Channels Cc1, Cc2, and Cc3, and Unit D Aquifer). Cross-sections illustrating property stratigraphy are presented in Figures 6 through 11.

In order to utilize the most current information, an elevation datum transition from National Geodetic Vertical Datum of 1929 (NGVD29) to North American Vertical Datum of 1988 (NAVD88) was implemented. Water level elevations from 2016 to July 2019 were adjusted by approximately an increase in three feet from previous reports. In May of 2019, groundwater monitoring wells were resurveyed in the NAVD88 datum and starting in July of 2019 water level elevations were calculated from the updated reference elevations. Figures 12 through 16 highlight these modifications.

#### 4.1.1. Groundwater in Unit B

Previously, monitoring well MW-24 was considered to be screened in Channel Cc1, but information provided in the updated hydrogeological conceptual model placed this well in Unit B. Monitoring well MW-24 does not produce enough groundwater, in order to sample, so only water level measurements are taken (Figure 12).

#### 4.1.2. Groundwater in Channel Cc1

There are currently four monitoring wells screened in Channel Cc1 deposits: MW-3, MW-4, MW-10, and MW-13. Groundwater is encountered in this zone at elevations of 264 to 280 ft. (NAVD88) above mean sea level (MSL).

The saturated thickness of the Channel Cc1 is generally less than 11 ft. (Figure 13). The water levels in monitoring wells MW-3 and MW-4 have declined due to minimal recharge rates and seasonally there is an insufficient volume of water present to collect samples. Monitoring well MW-4 is screened across a silt contact and the well can act as a sump. The well is not sampled unless the water levels rise above the silt contact. Monitoring well MW-4 yielded sufficient groundwater for all quarterly samples in 2020. Monitoring well MW-3 yielded sufficient water for two samples in 2020. Monitoring wells MW-10 and MW-13 have yielded sufficient groundwater for continuing analysis since 1993.

Historically, groundwater levels in the monitoring wells in Channel Cc1 have shown a variation from less than one foot to almost five feet with no marked seasonality. Water levels for most of the

wells have fallen in elevation since 1991, at which time the practice began of periodically placing temporary HDPE cover over the completed refuse fill area. The final closure of the landfill in 2001 appears to have further reduced surface recharge to this sand zone.

Field permeability tests performed by Harper-Owes (1986) indicated that the average permeability of sand in Channel Cc1 was approximately 4.3 ft/day.

#### 4.1.3. Groundwater in Channel Cc2

Monitoring wells MW-9, MW-2, MW-20, MW-21, MW-30, MW-33, and MW-35 are completed in Channel Cc2 and groundwater is encountered at elevations between 229 and 250 ft. (NAVD88) MSL.

In 2020, water level fluctuations in monitoring wells MW-2, MW-9, MW-20, MW-21, MW-33, and MW-35 were less than one foot (Figure 14). This low or lack of response to the annual cycle of wet and dry seasons can be explained by the landfill not being located in an area where significant recharge to the aquifer occurs (Carr, 1983). Relatively low-permeability surficial deposits (till) and partial landfill closures in 1989 and 1999 contribute to the lack of significant recharge.

The general flow direction in the continuous thin sand, in which monitoring wells MW-2, MW-20, MW-21, MW-33 and MW-35 are located, is to the west. The potentiometric maps submitted quarterly and included in Appendix G generally agree with the flow directions reported by Carr (1983).

As part of the West Hillslope Investigation, monitoring wells MW-30, MW-31, and MW-32 were installed on the west hillslope, in order to better characterize the groundwater seeping out of the hillslope. Those wells were only sampled for the 2010 calendar year and water levels were collected quarterly through first quarter of 2016. Beginning in third quarter of 2019, monitoring well MW-30 began having quarterly water levels measured again, in order to better define the potentiometric map for Channel Cc2.

The south slope area perched zone monitored by monitoring wells MW-2, MW-20, MW-21, MW-33, and MW-35 has a hydraulic gradient of between 0.006 ft/ft and 0.021 ft/ft. Its hydraulic conductivity is estimated to be between 1.61 and 19.35 ft/day and the effective porosity is estimated to be 0.2. The estimated horizontal groundwater velocity for 2020 ranged from 0.05 to 2.03 ft/day. The calculated velocities are expected to be accurate only within one order of magnitude due to variability in permeability rates. Quarterly velocity calculations and potentiometric maps are attached in Appendix G.

#### 4.1.4. Groundwater in Channel Cc3

Monitoring wells MW-8 and MW-36 are screened within Channel Cc3. Groundwater is encountered at elevations of 206 to 228 ft. (NAVD88) MSL (Figure 15).

Monitoring wells MW-8 and MW-36 are screened within the coarser sand deposit of Channel Cc3. Monitoring well MW-8 was previously considered to not be hydraulically equivalent to groundwater in either Cc2 nor Cc3 and to be screened along a flow path from Cc2 to Cc3. The updated hydrogeological conceptual model (Aspect, 2020), shows that monitoring wells MW-8, MW-36, and decommissioned wells MW-14 and MW-27 are fully screened within Cc3 and that there is limited hydraulic interconnection between Channels Cc2 and Cc3.

Annual water-level fluctuations in the monitoring wells MW-8 and MW-36 are usually within an annual range of about one foot.

#### 4.1.5. Groundwater in the Unit D Aquifer

There are seven monitoring wells screened within the Unit D Aquifer (MW-7, MW-12, MW-19, MW-25, MW-26, MW-29, and MW-34). Groundwater is encountered at elevations of 154 to 198 ft. (NAVD88) MSL (Figure 16).

The general flow direction in the Unit D Aquifer is away from MW-7 southwest towards MW-12, northwest towards MW-19, and northeast towards MW-25 (Appendix G). The water fluctuations for the monitoring wells are less than two ft. in 2020, and without considerable seasonal trends (Figure 16). This lack of response to the annual cycle of wet and dry seasons can be explained by the landfill being located in an area where there is not significant recharge to the aquifer (Carr, 1983); which is in turn attributable to relatively low-permeability surficial deposits (till) and landfill closures. The potentiometric maps shown in Appendix G generally agree with the flow directions reported by Carr (1983).

In 2020, the groundwater velocity occurring in the Unit D Aquifer was between 0.32 and 7.95 ft/day, with a hydraulic gradient ranging from 0.015 to 0.035 ft/ft and a hydraulic conductivity estimated between 4.4 and 46.1 ft/day. The estimated velocities are expected to be accurate only within one order of magnitude due to variability in permeability rates (Appendix G).

## 4.2. GROUNDWATER QUALITY

Results for the groundwater quality beneath the VLF were derived from Channels Cc1, Cc2, Cc3, and the Unit D Aquifer. Statistical summaries present both short- and long-term data. Short-term results obtained from January 2019 to December 2020 (sampling period) are emphasized all statistics and trend information discussed here is for that period unless otherwise indicated. Tables 3-1, 3-2, and 3-3 provide statistics and trends for both this recent period and the previous samples, respectively. All screen intervals are in reference to NAVD88, unless otherwise indicated. During the recent sampling period, eight samples were taken from each well, with the exceptions of monitoring wells MW-3 and MW-4. Certain wells have limited data because they are seasonally dry, have low production, or are slow to recover and did not yield adequate data for comprehensive analyses. Only long-term trend tests are available for these wells. For monitoring wells MW-33, MW-34, MW-35, and MW-36, which were installed in 2015, this is the first year where there is sufficient data for both short- and long-term analyses. Apparent trends in individual wells, short- and long-

term, are discussed where applicable (Tables 3-2 and 3-3). Hydraulically upgradient wells are discussed first. Exceedances of water quality standards, prediction limit exceedances, time-concentration plots, potentiometric maps, groundwater velocities, and raw analytical data are provided in appendices.

Due to the presence of VOCs in the downgradient monitoring wells within Channel Cc2, MW-2, MW-21, and MW-5D were put into assessment monitoring. As the first step, the wells were tested with an expanded parameter list specified in WAC 173-351 Appendix III in 2011. Results indicated that the single Appendix III parameter detected in the downgradient wells was dichlorodifluoromethane. These results led to an agreement that wells in assessment monitoring on the property should continue to be tested for dichlorodifluoromethane in addition to the Appendix I and II lists. This requirement applied to monitoring wells MW-20, MW-2, MW-21, MW-5D, MW-4, MW-8, and MW-27, but for property-wide consistency, all wells on property are tested for both Appendix I and II parameters and dichlorodifluoromethane. At the request of Ecology, monitoring wells MW-2, MW-5D, MW-20, and MW-21 were sampled again for Appendix III analytes in 2012, but there were no detections of Appendix III analytes other than dichlorodifluoromethane. In 2014, Ecology was given a demonstration, and based on the findings, agreed that KCSWD would cease sampling for any Appendix III analytes other than dichlorodifluoromethane for five years starting from the last sampling event of 2013. In 2018, monitoring wells MW-2, MW-20, MW-21, MW-33, and MW-35 (replacement for decommissioned well MW-5D) were sampled for the Appendix III analyte list. Four analytes were detected between the five wells during this sampling, 2,4,5-TP Silvex, 2-methyl-1-propanol, bis(2-chloroethyl) ether, and bis(2-ethylhexyl) phthalate. In 2019, monitoring wells MW-2, MW-20, MW-21, MW-33, and MW-35 were sampled again for the Appendix III analyte list. There were two analytes (2,4,5-TP Silvex and bis(2-chloroethyl) ether) detected in monitoring wells MW-33 and MW-35 and one analyte (diethyl phthalate) detected in monitoring well MW-33. In 2020, KCSWD requested to stop appendix III sampling, expect for analytes that had been detected, 2,4,5-TP Silvex, 2-methyl-1-propanol, bis(2-chloroethyl) ether, and bis(2-ethylhexyl) phthalate, which would be sampled quarterly in monitoring wells MW-2, MW-20, MW-21, MW-33, and MW-35. Based on the detection of Appendix III analytes, Ecology denied the request to stop appendix III sampling, but agreed to the quarterly monitoring of detected Appendix III analytes and have Appendix III sampling only occur every five years.

It is also important to note that several compounds, in particular acetone, zinc, and methylene chloride, have been frequently detected in blanks and field samples at similar concentrations. The likely source of these compounds is laboratory contamination.

Iron, manganese, and arsenic occur naturally in groundwater of this region. The Washington State Department of Ecology conducted a background study on arsenic in groundwater and found for the Puget Sound basin the natural background is 0.008 mg/L (Ecology, 2016). Therefore, exceedances of the *Water Quality Standards for Groundwaters of the State of Washington* (SGWC) for these contaminants are believed to be representative of background groundwater quality unaffected by the Vashon Island Closed Landfill.

The pH field data for the period between late 1993 and early 1996 may not be reliable because of inconsistent field instrumentation.

#### 4.2.1. Groundwater in Channel Cc1

As described in Section 3.1.1, monitoring wells MW-3, MW-4, MW-10, and MW-13 are the only monitoring wells in the groundwater in Channel Cc1, previously described as monitoring groundwater perched above the lacustrine silt.

The Channel Cc1 trilinear diagrams (Appendix I) for 2020 shows the sample is within the same calcium-magnesium-bicarbonate hydrochemical facie. The cation/anion ratio for the monitoring wells MW-3, MW-4, MW-10, and MW-13 are within ten percent (Appendix I) for all sampling events, which is sufficient for characterization.

Raw analytical groundwater data and time-concentration plots for monitoring wells in Channel Cc1 can be found in Appendices J and C, respectively.

##### 4.2.1.1. MW-10

Monitoring well MW-10, located in the northwest corner of the property and northwest of the placement of the refuse, was installed with seven other additional groundwater monitoring wells during the summer of 1995. It is screened between 254.86 and 624.86 ft. MSL.

The pH (field) is neutral (median 7.17). Specific conductance (field) (median 147.1  $\mu\text{mhos/cm}$ ) and total dissolved solids (median 99.0 mg/L) are low and stable (Tables 3-1 and 3-2). Ammonia (only one detection in the past two years) and chloride (median 3.28 mg/L) are low and stable (Table 3-2 and Appendix C). There is a statistically significant short-term increasing trend for sulfate (median 8.885 mg/L) and a statistically significant long-term decreasing trend for sulfate. There is a statistically significant short-term decreasing trend for nitrate (median 0.6105 mg/L). During the recent period, no conventional parameters exceeded the water quality standards.

Dissolved iron was not detected in the last eight samples, but total iron was detected twice, however, iron is low and stable. Concentrations of common metals, calcium, and magnesium are low and stable. There are statistically significant short-term increasing trends for total (median 0.0016 mg/L) and dissolved arsenic (median 0.0016 mg/L). Total arsenic exceeded the primary SGWC in all eight samples.

M & P xylene was detected in the fourth quarter sampling results from monitoring well MW-10. The result was qualified as 'JT', meaning results are only reported as qualitative, i.e. 'present, but unquantified'.

In general, the water quality in this well is good with no indications of landfill impact.

#### 4.2.1.2. MW-13

Monitoring well MW-13 is screened above the lacustrine silt in sandy soils. It was installed in 1992 and placed on the quarterly monitoring schedule in June 1994. Monitoring well MW-13 is located in the southeast portion of the property and screened between 262.59 and 267.59 ft. MSL.

The pH (field) is neutral (median 7.055). Specific conductance (field) (median 163  $\mu\text{mhos/cm}$ ), alkalinity (median 61.9 mg/L), chloride (median 2.915 mg/L), and sulfate (median 11.45 mg/L) all have statistically significant short-term decreasing trends. There is a statistically significant long-term trend for nitrate (median 0.257 mg/L). (Table 3-1 and Appendix C)

Manganese is low and stable. There are statistically significant short-term decreasing trends for dissolved and total calcium, total magnesium, and total potassium. There are statistically significant short-term increasing trends in this well for dissolved arsenic and dissolved sodium (Tables 3-2 and 3-2). Vanadium is detected regularly at low levels. Mercury has been detected twice in the entire monitoring history.

Arsenic exceeds the primary SGWC of 0.05  $\mu\text{g/L}$  in all eight recent samples (Appendix B). No other samples exceeded Washington State or National water quality standards.

In general, water in this well is of good quality with no indications of potential landfill impact.

#### 4.2.1.3. MW-3 and MW-4

Monitoring wells MW-3 and MW-4 are shallow wells in Channel Cc1. Monitoring well MW-3 is screened between 275.74 and 280.74 ft. MSL. Monitoring well MW-4 is screened between 266.05 and 276.05 ft. MSL. Monitoring well MW-3 had sufficient water to provide two samples and monitoring well MW-4 had sufficient water to provide all four quarterly samples in 2020.

Monitoring well MW-3 shows similar or decreased values compared to previous years when sampled, except for nitrate, which has a long-term increasing trend in both monitoring wells (Tables 3-2 and 3-3). Since there were not eight samples take in the past two years for monitoring well MW-3 there are not short-term trends for this well. Monitoring well MW-4 had seven samples in the past two years, so short-term analyses were run with the 8 most recent samples from 2018 – 2020. Monitoring well MW-4 has a statistically significant short-term increasing trend for alkalinity (median mg/L).

Monitoring well MW-3 had one exceedance of the lower secondary SGWC and MCL for pH (field) and the two primary SGWC exceedances for total arsenic. Monitoring well samples from monitoring well MW-4 exceeded the primary SGWC for total arsenic four times and has a statistically significant short-term increasing trend for total and dissolved

arsenic. Monitoring well MW-4 also had two exceedances of the lower secondary SGWC and MCL for pH (field).

In 2020, there were two VOC detections for samples in monitoring well MW-3 tetrachloroethene (detection qualified 'JT') and trichlorofluoromethane. There were four VOCs detected for samples in monitoring well MW-4 in 2020, *cis*-1,2-dichloroethene (one detection qualified 'JT'), ethylbenzene, m & p xylene, and o-xylene (Appendix B). Sample results qualified 'JT' mean results are only reported as qualitative, i.e. 'present, but unquantified'.

#### 4.2.1.4. Groundwater in Channel Cc1 Summary

Water quality in monitoring well MW-10 is good and is not considered impacted by landfilling activities. The absence of dissolved manganese in this well is notable. The conditions in this well in combination with low iron suggest a predominantly oxidizing environment.

Monitoring well MW-13 water quality is good and is not considered impacted by landfilling activities as well.

Monitoring wells MW-3 does not have sufficient water for four samples a year and monitoring well MW-4 had sufficient water for four samples in 2020 for the first time since 2000. They have decreasing or stable long-term trends for all constituents with the exception of nitrate.

Reduced water volumes in the other shallow wells following installation of the landfill cover suggest the cover is adequately preventing recharge through the waste and is protecting the groundwater.

#### 4.2.2. **Groundwater in Channel Cc2**

Monitoring wells MW-2, MW-9, MW-20, MW-21, MW-33, and MW-35 monitor the groundwater perched within Channel Cc2. Monitoring wells MW-2, MW-20, MW-21, MW-33, and MW-35 are completed in continuous thin sand that correlates with the elevation and location of two of the seeps (seeps 2 and 3 or SW-S2 and SW-S3) on the west side of the landfill (King County, 2011).

The trilinear diagram shows all of the samples to be within the same calcium-magnesium-bicarbonate hydro-chemical facie, as they have been in past samples for these wells. Monitoring wells MW-2, MW-21, MW-33, and MW-35 continue to be characterized by more dominant bicarbonate-carbonate characteristics. The cation/anion ratio for the wells in this channel was within ten percent (Appendix I) for all 2020. The reported results are sufficient for characterization.

Interwell prediction limits for the fourth quarter of 2020 are tabulated in Appendix B. The prediction limits for monitoring wells in Channel Cc2 are compared to upgradient monitoring well MW-20.



Raw analytical groundwater data and time-concentration plots for monitoring wells in Channel Cc2 can be found in Appendices J and D, respectively.

#### 4.2.2.1. MW-20

Monitoring well MW-20 is located in the southeast portion of the property. It was installed in October 1998 and is screened between 236.41 and 241.41 ft. MSL in a continuous sand bed within the lacustrine silt.

The field pH results show a neutral pH (median 7.52). Measurements of chloride (median 3.17 mg/L), sulfate (median 16.0 mg/L,) and total dissolved solids (median 134 mg/L) are stable. There are statistically significant short-term decreasing trends for specific conductance (median 189.2  $\mu$ mhos/cm) and alkalinity (median 73.5 mg/L). (Tables 3-1, 3-2, and 3-3)

Many of the dissolved metals exhibit short-term stability; calcium (median 13.2 mg/L) and potassium (median 2.16 mg/L), and sodium (median 6.14 mg/L). Dissolved magnesium (median 12.0 mg/L), total (median 0.16 mg/L) and dissolved manganese (median 0.15 mg/L) have a statistically significant short-term decreasing trends. During 2020, total arsenic and dissolved manganese sample results exceeded the respective primary and secondary SGWC and MDLs in all four quarterly samples.

In 2020, dichlorodifluoromethane was detected in monitoring well MW-20 in all four quarters and has no short-term trend.

Groundwater quality conditions are low and stable in monitoring well MW-20 and because of that, it is used to calculate prediction limits and for upgradient comparison to monitoring wells MW-2, MW-9, MW 21, MW-33, and MW-35.

#### 4.2.2.2. MW-9

MW-9 is located in the northwest portion of the property. It was installed as part of the addition of eight groundwater monitoring wells during the summer of 1995. It is screened between 224.22 and 236.22 ft. MSL in sand and gravel.

The pH conditions in this well are neutral, with a median of 7.08. The specific conductance (median 175.3  $\mu$ mhos/cm), alkalinity (median 70.2 mg/L), chloride (median 4.39 mg/L), and nitrate (median 0.37 mg/L) are all stable. Ammonia has not been detected in the past two years. There are no statistically significant short-term trends for conventional parameters. (Tables 3-1, 3-2, and 3-3)

Dissolved iron and dissolved manganese levels are low and stable with no detections in the past eight samples. All metals show as being low and stable with no statistically significant

short-term trends. Total arsenic results exceeded the SGWC of 0.05 µg/L in the eight most recent samples.

In 2020, there were no volatile organic compounds detected in MW-9.

The general water characteristics in this well demonstrate good quality with no indications of landfill impact.

#### 4.2.2.3. MW-2 and MW-21

Monitoring wells MW-2 and MW-21 are located downgradient and in the southwest portion of the property. Monitoring well MW-2 has been monitored quarterly since September 1986. Monitoring well MW-21 was installed in fall 1998 and has been monitored continuously since then. The screen elevation for monitoring well MW-2 is 232.06 ft. to 237.06 ft. MSL and for monitoring well MW-21 237.05 ft. to 246.45 ft. MSL.

The pH measurements from these wells show conditions close to neutrality. The pH median values for monitoring wells MW-2 and MW-21 are 6.95 and 6.9, respectively, and are stable. In recent sampling in both wells, several indicator parameters and metals were elevated, compared to the upgradient monitoring well MW-20. Monitoring well MW-2 has the higher concentrations compared with monitoring well MW-20 for specific conductance (median 308 µmhos/cm), alkalinity (median 144.5 mg/L), total dissolved solids (median 184 mg/L), dissolved calcium (median 21.4 mg/L), dissolved magnesium (median 23.2 mg/L), and dissolved sodium (median 9.26 mg/L). Monitoring well MW-21 has higher concentrations compared to monitoring well MW-20 for specific conductance (median 284 µmhos/cm), alkalinity (median 133 mg/L), total dissolved solids (median 180.5 mg/L), dissolved calcium (median 20.3 mg/L), dissolved magnesium (median 20.1 mg/L), and dissolved sodium (median 10.8 mg/L). (Tables 3-1, 3-2, and 3-3)

For three of the samples taken in 2020 from monitoring well MW-2 and all four of the samples taken from monitoring well MW-21 exceeded the secondary SGWC and MDL for dissolved manganese. All four samples taken from both monitoring well MW-2 and MW-21 exceeded the SGWC for the total arsenic. Monitoring well MW-21 exceeded the SGWC and MDL for dissolved iron in two samples. (Appendix B).

Both monitoring wells MW-2 and MW-21 showed statistically significant short-term trends for the past eight samples. Monitoring well MW-2 had short-term increasing trends for nitrate, total dissolved solids, total magnesium, and trichlorofluoromethane. Monitoring well MW-2 had short-term decreasing trends for chloride, total manganese, and *cis*-1,2-dichloroethene. For the monitoring period of 2019 through 2020, monitoring well MW-21 has showed statistically significant increasing short-term trends for indicator analytes including alkalinity, total dissolved solids, and total magnesium. Monitoring well MW-21 had short-term decreasing trends for dissolved arsenic and *cis*-1,2-dichloroethene.

Groundwater sampling results from monitoring wells MW-2 and MW-21 continue to show VOCs. The past eight samples for monitoring well MW-2 indicate overall stable levels for VOCs with minimal short-term trends as shown above. All of these compounds are present in landfill gas as well as leachate and their distribution between phases (partitioning) is regulated by physical properties (Henry's constant, solubility, vapor pressure) where these phases are in contact.

Most of these compounds are likely components of the waste stream; however, others are almost certainly degradation products of tetrachloroethene and/or trichloroethene by the process of reductive dechlorination. The detected VOCs, median values, or recent detection frequency for the last eight samples are as follows (Table 3-1):

- *cis*-1,2-Dichloroethene in MW-2 (four out of eight samples, median 0.078 µg/L), and MW-21 (eight out of eight samples, median 0.62 µg/L).
- Dichlorodifluoromethane in MW-2 (eight out of eight samples, median 3.57 µg/L), and MW-21 (eight out of eight samples, median 1.92 µg/L).
- *trans*-1,2-dichloroethene in MW-21 (one out of eight samples, result value 0.109 ug/L qualified 'JT').
- Trichlorofluoromethane in MW-2 (eight out of eight samples, median 0.835 µg/L), and MW-21 (eight out of eight samples, median 0.773 µg/L).
- Vinyl chloride in MW-2 (eight out of eight samples, median 0.066 µg/L), and MW-21 (eight out of eight samples, median 0.070 µg/L).

In 2020, monitoring wells MW-2 and MW-21 exceeded the SGWQ for vinyl chloride for all four samples taken (Appendix B).

#### 4.2.2.4. MW-5D, MW-33, and MW-35

Monitoring well MW-5D was monitored quarterly beginning in 1986 and decommissioned in April 2015. Historically, monitoring well MW-5D has displayed elevated concentrations of some indicator constituents, along with some exceedances. However, evaluation of recent data indicates in most cases short-term stability at considerably lower concentrations than historical data in this well. In 1992-1995, total dissolved solids, chloride, manganese, calcium, and magnesium levels went up while iron levels went down. In early 2002, manganese, total dissolved solids, and chloride levels were slightly higher than previous quarters while iron levels were unusually low. Levels for total dissolved solids, chloride, manganese, calcium, and magnesium returned to previous levels and iron came back up. During 2001 and 2002 an event similar to the one observed between 1992 and 1995, might have occurred but to a much lesser extent. In 2015, monitoring well MW-5D was decommissioned, due to silting.

Monitoring well MW-35 was installed in March of 2015, to replace monitoring well MW-5D and monitoring well MW-33 was installed in March of 2015, in order to better define groundwater quality in Channel Cc2. The screen elevation for monitoring well MW-33 is 219.63 ft. to 229.63ft. MSL and for monitoring well MW-35, 234.20 ft. to 244.2 ft. MSL

The pH measurements for monitoring wells MW-33 and MW-35 are close to neutral with median values of 6.705 and 6.65, respectively. In 2020, sample results from monitoring well MW-35 twice exceeded the lower secondary SGWC and MCL for pH (field). Sample results from monitoring well MW-33 twice exceeded the secondary SGWC for specific conductance (field). In recent sampling in both wells, several indicator parameters and metals were elevated, compared to the upgradient monitoring well MW-20. Monitoring well MW-33 has higher concentrations compared with monitoring well MW-20 for the following indicator parameters: specific conductance (median 730.5  $\mu\text{mhos/cm}$ ), alkalinity (median 386.5 mg/L), ammonia (median 0.032 mg/L), chloride (median 3.84 mg/L), and total dissolved solids (median 428.5 mg/L), and for the following dissolved metals: arsenic (median 0.0393 mg/L), calcium (median 64.15 mg/L), iron (median 6.65 mg/L), magnesium (median 51.5 mg/L), manganese (median 0.95 mg/L), potassium (median 3.45 mg/L), and sodium (median 18.75 mg/L). Monitoring well MW-35 has higher concentrations compared with monitoring well MW-20 for the following indicator parameters: specific conductance (median 684.5  $\mu\text{mhos/cm}$ ), alkalinity (median 337 mg/L), ammonia (median 0.066 mg/L), chloride (median 4.18 mg/L), sulfate (median 22.3 mg/L), and total dissolved solids (median 425 mg/L) and for the following dissolved metals: arsenic (median 0.029 mg/L), calcium (median 63.2 mg/L), iron (median 14.1 mg/L), magnesium (median 42.7 mg/L), manganese (median 2.37 mg/L), potassium (median 3.19 mg/L), and sodium (median 16.8 mg/L). (Appendix B; Tables 3-1, 3-2, and 3-3)

For all four samples taken in 2020 from both monitoring wells MW-33 and MW-35 the primary SGWC and MDL were exceeded for total arsenic and the secondary SGWC and MDL was exceeded for dissolved iron and dissolved manganese. (Appendix B)

Both monitoring wells MW-33 and MW-35 showed statistically significant short-term trends for the past eight samples. Monitoring well MW-33 had statistically significant short-term decreasing trends for specific conductance, alkalinity, chloride, total dissolved solids, total and dissolved calcium, total iron, total and dissolved magnesium, total potassium, and chloroethane; and statistically significant short-term increasing trends for *cis*-1,2-dichloroethene and *trans*-1,2-dichloroethene. Monitoring well MW-35 had statistically significant short-term decreasing trends for 1,2-dichloropropane, benzene, *cis*-1,2-dichloroethene, and *trans*-1,2-dichloroethene; and had statistically significant short-term increasing trends for sulfate and total sodium.

Groundwater sampling results from monitoring wells MW-33 and MW-35 show elevated concentrations of VOCs. The past eight samples indicate overall stable levels for VOCs with minimal short-term trends as shown above. The detected VOCs, median values, or recent detection frequency for the last eight samples are as follows (Table 3-1):

- 1,1-Dichloroethane in MW-33 (eight out of eight samples, median 1.61  $\mu\text{g/L}$ ), and MW-35 (eight out of eight samples, median 0.26  $\mu\text{g/L}$ ).
- 1,2-Dichloropropane in MW-33 (eight out of eight samples, median 7.43  $\mu\text{g/L}$ ), and MW-35 (eight out of eight samples, median 0.70  $\mu\text{g/L}$ ).

- Benzene in MW-33 (eight out of eight samples, median 1.01 µg/L), and MW-35 (eight out of eight samples, median 0.67 µg/L).
- Chloroethane in MW-33 (six out of eight samples, median 0.38 µg/L)
- *cis*-1,2-Dichloroethene in MW-33 (eight out of eight samples, median 31.65 µg/L), and MW-35 (eight out of eight samples, median 7.00 µg/L).
- Dichlorodifluoromethane in MW-33 (eight out of eight samples, median 5.12 µg/L), and MW-35 (eight out of eight samples, median 0.69 µg/L).
- *trans*-1,2-Dichloroethene in MW-33 (eight out of eight samples, median 0.74 µg/L), and MW-35 (eight out of eight samples, median 0.27 µg/L).
- Trichloroethene in MW-33 (six out of eight samples, median 0.15 µg/L), and MW-35 (eight out of eight samples, median 0.99 µg/L).
- Vinyl chloride in MW-33 (eight out of eight samples, median 30.8 µg/L), and MW-35 (eight out of eight samples, median 4.49 µg/L).

In 2018, monitoring wells MW-33 and MW-35 exceeded the primary SGWC and MDL for vinyl chloride for all four samples taken. Monitoring well MW-33 exceeded primary SGWC for 1,1-dichloroethane during all four sampling events and benzene during two sampling events and exceeded the primary SGWC and MDL for 1,2-dichloropropane during all four sampling events. (Appendix B).

#### 4.2.2.5. Groundwater in Channel Cc2 Summary

The recent data reflects low and stable condition in water quality present in monitoring well MW-20. Chemical data from monitoring well MW-20 represents natural aquifer conditions in the vicinity of the landfill.

Impact from landfill activities is evident in monitoring wells MW-2, MW-21, MW-33, and MW-35. Closure activities have contributed to improvement of the water in monitoring well MW-2. Improvement in water quality is characterized by decreases in specific conductance, ammonia, and chloride and a reduction in the frequency and level of several VOCs.

In general, conditions in monitoring well MW-2 appear to be more oxidizing than other wells in Channel Cc2. This environment is characterized by lower levels of iron and ammonia, absence of manganese, and higher levels of nitrate.

The redox conditions in monitoring wells MW-21, MW-33, and MW-35 are more reducing, determined by lower levels of nitrate, and higher levels of iron, manganese, and ammonia.

The declines in concentration of general water quality indicators (specific conductance, dissolved solids, chlorides, metals, etc.) suggest that leachate impacts have been controlled with closure. A different response for several VOCs demonstrates that the source of these compounds has not been completely addressed by leachate control and most likely results from a landfill gas transport mechanism (although several show decreasing levels). The VOCs detected in groundwater are all present in significant amounts in landfill gas.

Characterization of leachate and low chloride concentrations in Channel Cc2 groundwater wells indicate that the observed groundwater quality in impacted wells could not be achieved by leachate.

In 2014, Channel Cc2 was entered into voluntary cleanup under MTCA. These evaluations will contribute to determining if any additional improvements are needed.

#### 4.2.3. Groundwater in Channel Cc3

Monitoring wells MW-8 and MW-36 monitor the groundwater in Channel Cc3. Monitoring well MW-14 was decommissioned in April of 2015 and monitoring well MW-27, which was previously thought to be screened in both Channel Cc3 and Unit D Aquifer, was decommissioned in July of 2016. The updated hydrogeological model shows monitoring well MW-27 had been fully screened in Unit C (Figure 9). Monitoring well MW-36, which replaced monitoring well MW-14, was commissioned in April of 2015.

The trilinear diagram shows all of the samples to be within the same calcium-magnesium-bicarbonate hydro-chemical facie, as they have been in past samples for these wells. The cation/anion ratio for the wells in this channel was within ten percent (Appendix I) for all of 2020. The reported results are sufficient for characterization.

Raw analytical groundwater data and time-concentration plots for monitoring wells in Channel Cc3 can be found in Appendices J and E, respectively.

##### 4.2.3.1. MW-8

Monitoring well MW-8 is located in the west portion of the property. It was installed as part of the addition of eight groundwater monitoring wells during the summer of 1995. Monitoring well MW-8 is screened between 205.81 and 215.81 ft. MSL and is beneath the lacustrine silt.

Monitoring well MW-8 has a slightly acidic pH values (median 6.58) with little variability and no apparent trends. Monitoring well MW-8 exceed the lower secondary SGWC and MCL for pH (field) twice during 2020. Specific conductance (median 167.2  $\mu$ mhos/cm), alkalinity (median 55.5 mg/L), chloride (median 4.42 mg/L), nitrate (median 2.80 mg/L), sulfate (median 7.9 mg/L), and total dissolved solids (median 125 mg/L), levels exhibit minor variability. (Tables 3-1, 3-2, and 3-3)

Dissolved iron levels are low and stable with only no detections in the past eight samples. Other metals detected are barium, manganese, vanadium, and zinc, all near or at the laboratory minimum detectable level. Dissolved magnesium (median 9.59 mg/L), dissolved potassium (median 1.17 mg/L), and dissolved sodium (median 6.43 mg/L) are all low and stable with no statistically significant trends.

Monitoring well MW-8 exceeded the SGWC for total arsenic in all four sampling events of 2020 (Appendix B).

General characteristics show this well to be of good quality except for nitrate at a low level of impact, which in the short-term is decreasing. The source of the nitrate is uncertain due to the lack of any other impact indicators.

#### 4.2.3.2. MW-36

Monitoring well MW-36 is located in the west portion of the property. It was installed as part of the addition of four groundwater monitoring wells during the spring of 2015. Monitoring well MW-36 is screened between 211.36 and 221.36 ft. MSL.

Monitoring well MW-36 has a pH value (median 7.65) with little variability and no apparent trends. Specific conductance (median 175.0  $\mu$ mhos/cm), chloride (median 3.05 mg/L), nitrate (median 0.02 mg/L), sulfate (median 13.2 mg/L), and total dissolved solids (median 130.5 mg/L), levels exhibit minor variability and with no statistically significant trends. (Tables 3-1, 3-2, and 3-3)

Dissolved iron levels are low and stable with only no detections in the past eight samples. Other dissolved metals detected are barium, chromium, copper, manganese, and vanadium, all near or at the laboratory minimum detectable level. Dissolved magnesium (median 9.71 mg/L), dissolved potassium (median 2.76 mg/L), and dissolved sodium (median 6.6 mg/L) are all low and stable with no statistically significant trends. Monitoring well MW-36 had a statistically significant short-term increasing trend for total sodium and a statistically significant short-term decreasing trend for dissolved manganese.

Monitoring well MW-36 exceeded the SGWC for total arsenic in all four sampling events of 2020 (Appendix B).

General characteristics show this well to be of good quality.

#### 4.2.3.3. Groundwater in Channel Cc3 Summary

Monitoring wells MW-8 and MW-36 both appear to be well of good quality with little evidence of landfilling impacts. Monitoring well MW-36 had only one increasing trend short-term trend for total sodium; however, the overall water quality indicates that Channel Cc3 is not impacted from landfilling activities.

### 4.2.4. **Groundwater in the Unit D Aquifer**

Monitoring wells MW-7, MW-12, MW-19, MW-26, MW-29, and MW-34 monitor the groundwater in the Unit D Aquifer.

Construction differences make the determination of groundwater gradients and flow direction difficult in the area monitored by these wells. Average screened depth below the water table in the wells ranges from near zero in monitoring wells MW-26 and MW-29 to more than 30 ft. in monitoring wells MW-7, MW-12, and MW-34.

The trilinear diagram shows all samples are within the same calcium-magnesium-bicarbonate hydrochemical facie. During 2020, the cation/anion for the wells in this zone are within ten percent (Appendix I), which is sufficient for characterization.

Raw analytical groundwater data and time-concentration plots for monitoring wells in Unit D Aquifer can be found in Appendices J and F, respectively.

#### 4.2.4.1. MW-7

Monitoring well MW-7 is located in the southeast portion of the property. Historically, monitoring well MW-7 has been interpreted to represent upgradient conditions. However, the interpretation provided in the 2004 Hydrogeologic Update redefined monitoring well MW-7 as downgradient. In the latest update of the hydrogeological model monitoring well MW-7 was redefined again as being upgradient (Aspect, 2020). This well was installed as part of the addition of eight groundwater monitoring wells during the summer of 1995. The screened elevations for this well are between 144.40 and 154.4. ft. MSL.

The pH conditions in monitoring well MW-7 are slightly alkaline (median 7.57). Specific conductance (median 187.7  $\mu$ mhos/cm), alkalinity (median 77.3 mg/L), chloride (median 3.37 mg/L), nitrate (median 0.02 mg/L), sulfate (median 11.1 mg/L), and total dissolved solids (median 132 mg/L) are stable. (Tables 3-1, 3-2, and 3-3)

Monitoring well MW-7 has statistically significant short-term increasing trends of dissolved (median 0.013 mg/L) and total iron (median 0.10 mg/L). In 2020, total arsenic sample results exceeded the primary SGWC and dissolved manganese sample results exceeded the secondary MCL and SGWC, in all four quarters. Other metals detected occasionally in this period included cobalt, copper, vanadium, and zinc.

Monitoring well MW-7 exceeded the intrawell prediction limit for total solids in one sample, in 2020 (Appendix B).

In 2020, 2-butanone was detected in one sample from monitoring well MW-7. This sample result was qualified as 'JT', meaning results are only reported as qualitative, i.e. 'present but unquantified' and 2-butanone is a known laboratory contaminant.

The results from monitoring well MW-7 are considered to represent natural conditions and not related to landfilling activities.



#### 4.2.4.2. MW-11, MW-25, and MW-29

Monitoring well MW-11 was installed as one of eight groundwater monitoring wells installed during the summer of 1995. The screened elevations for these wells are between 152.28 and 162.28 ft. MSL (NAVD 29). Monitoring well MW-11 was damaged during the Nisqually earthquake and decommissioned in 2003. The 2001 report provided the last assessment on well monitoring well MW-11 and indicated no impacts in this well from the landfill.

Monitoring well MW-25 was installed in 2003 to replace monitoring well MW-11. However, the screen failed during installation and the well cannot be developed. The well has been left in place for use for water level measurements only. Monitoring well MW-29 was subsequently installed in 2003 as the new replacement well for monitoring well MW-11. The screened elevations for monitoring well MW-29 are between 158.63 and 173.03 ft. MSL.

The water pH for monitoring well MW-29 is slightly alkaline (median 7.40). Specific conductance (median 242.4  $\mu$ mhos/cm), chloride (median 3.61 mg/L), sulfate (median 15.7 mg/L), and total dissolved solids (median 152.5 mg/L) are stable (Tables 3-1, 3-2, and 3-3). Monitoring well MW-29 has a statistically significant short-term decreasing trend for alkalinity (median 100.2 mg/L).

Dissolved iron (median 0.845 mg/L) and dissolved manganese (median 0.10 mg/L) are both stable. Sample results for monitoring well MW-29 exceeded primary SGWC for total arsenic in all four quarters for 2020 and exceeded the primary MCL for two quarters. Sample results for monitoring well MW-29 exceeded in the secondary SGWC and MCL for dissolved iron and dissolved manganese in all 2020 samples results (Appendix B). Other metals occasionally detected in this period include chromium, nickel, and zinc.

The redox conditions in the north portion of the property (including monitoring well MW-29) are more reducing, determined by lower levels of nitrate, and higher levels of iron, manganese, and ammonia (Table 3-1).

The results from monitoring well MW-29 resemble the historic monitoring MW-11 data and are considered to represent natural conditions and not related to landfilling activities.

#### 4.2.4.3. MW-12, MW-19, MW-26, MW-28, and MW-34

Monitoring wells MW-12 and MW-19 were both installed in the summer of 1995. Monitoring well MW-12 is located to the south of the property. Monitoring well MW-19 is located to the northwest of the property. The screened elevations for monitoring well MW-12 are between 139.72 and 142.72 ft. MSL. The screened elevations for monitoring well MW-19 are between 131.64 and 143.14 ft. MSL.

Monitoring wells MW-26 and MW-28 were both installed in 2003. Monitoring well MW-26 is located in the northwest corner of the property and the screened elevations are between 144.15 and 158.25 ft. MSL. Monitoring well MW-28 has been dry since installation; its screened elevations are between 162.65 and 177.15 ft. MSL.

Monitoring well MW-34 was installed in March of 2015 to replace monitoring well MW-27 and was drilled to be fully screened in Unit D Aquifer. Monitoring well MW-34 is located on the western side of the property, east of Westside Hwy. The screened elevations for monitoring well MW-34 are between 137.94 ft. and 147.94 ft. MSL.

The pH for the Unit D Aquifer in monitoring wells MW-19 and MW-26 are slightly alkaline (medians 7.54 and 7.9, respectively) and monitoring wells MW-12 and MW-34 are neutral (medians 7.27 and 6.89, respectively). Monitoring well MW-19 has a statistically significant decreasing short-term trend for pH (field).

Monitoring wells MW-12, MW-19, MW-26, and MW-34 are all stable in the short-term alkalinity (medians 64.6, 84.5, 75.4, and 68.5 mg/L, respectively), chloride (median 3.2, 4.6, 3.8, and 5.0 mg/L, respectively), and sulfate (medians 10.6, 17.0, 13.5, and 13.4 mg/L, respectively). Monitoring wells MW-12 and MW-26 both have statistically significant short-term decreasing trends for specific conductance (field). Monitoring well MW-34 has a statistically significant short-term decreasing trend for nitrate (median 1.96 mg/L).

In 2020, all sample results from monitoring wells MW-12, MW-19, MW-26, and MW-34 exceeded the primary SGWC for total arsenic. Monitoring wells MW-7, MW-19, and MW-26 also exceeded the secondary MCL and SGWC for dissolved manganese for all sample results in 2020. (Appendix B)

Monitoring well MW-12 has statistically significant short-term decreasing trend for total calcium (median 11.8 mg/L) and total potassium (median 1.9 mg/L). Monitoring well MW-26 has a statistically significant short-term decreasing trend for total calcium (median 17.6 mg/L). Monitoring well MW-34 has statistically significant short-term decreasing trends for total manganese (median 0.0002 mg/L). (Tables 3-1, 3-2 and 3-3)

Monitoring wells MW-26 and MW-34 exceeded the intrawell prediction limit for pH (field) for one quarter each in 2020. Monitoring well MW-34 exceeded the intrawell prediction limit for total dissolved solids in one quarter in 2020.

In general, conditions in monitoring wells MW-12 and MW-34 appear to be more oxidizing than other wells in Unit D Aquifer. This environment is characterized by lower levels of iron and ammonia, absence of manganese, and higher levels of nitrate (Table 3-1).

The redox conditions in the north portion of the property (including monitoring wells MW-19 and MW-26) are more reducing, determined by lower levels of nitrate, and higher levels of iron, manganese, and ammonia (Table 3-1).

Table 4-1 presents a water quality comparison of background conditions and Unit D Aquifer characterized beneath the Vashon Landfill. VOCs are not summarized due to the absence of detections in these wells.

#### 4.2.4.4. *Groundwater in Unit D Aquifer Summary*

Trend analyses for most monitoring wells in this unit show stable concentrations for many of the constituents in the short-term. Conditions present in wells in the Unit D Aquifer do not indicate impacts attributable to landfill activities. The water quality in this unit is good and is believed to represent natural conditions.

### 4.3. ***WEIR and SURFACE WATER QUALITY***

The seeps and weirs are located on the western ravine adjacent to the landfill (Figure 3). The elevations for the seeps are 245 ft. for Seep 1; 227 ft. for Seep 2; and 218.74 ft. for Seep 3. The weir sampling locations SW-W1, SW-W2 and SW-W3 are located downstream of each weir. The elevations for the sampling locations are 230.59 ft. for SW-W1; 193.57 ft. for SW-W2; and 192.53 ft. for SW-W3 (Figure 3). The sampling stations consist of a v-notch weir.

Historically, the naming for these locations has on occasion been inadvertently switched. After a thorough review of the data, corrections have been made and the probable results from switching location names have been associated with the correct location name. However, single unusual results may be the result of the naming issues rather than true fluctuations in the data. As a result of this data issue, results reported previously may differ from the current conditions.

The *Vashon Closed Landfill Western Hillslope Investigation* (King County, 2011) identified the groundwater sources for each of the weirs as follows; weir SW-W1 contains groundwater seeping from Unit A, Unit B, Channel Cc1, and possibly Channel Cc2, weir SW-W2 contains groundwater seeping from Channel Cc2 and possibly Channel Cc3, and weir SW-W3 contains groundwater seeping from Channel Cc2 and possibly Channel Cc3. The sampling location of weir SW-W1 is closer to the groundwater seep SW-S1, than weirs SW-W2 and SW-W3 are to their associated seeps. The updated hydrogeological conceptual model further clarified the groundwater sources following out of the seeps and into the weirs with all three weirs being primarily sourced from Channel Cc2 seeps (Aspect, 2020).

The weirs have been monitored since March 1991. Results for water from the weirs are presented in two periods similar to groundwater. Emphasis is on results obtained from the last eight samples, predominantly between 2019 and 2020. Four samples were collected from each of the three weirs in 2020.

The specific conductance ranges between 183.3 and 228.6  $\mu\text{mhos/cm}$  for weir SW-W1; 449.8 to 623.0  $\mu\text{mhos/cm}$  for weir SW-W2; and 94.6 to 307.2  $\mu\text{mhos/cm}$  for SW-W3. Chloride levels range from 5.69 to 7.66 mg/L for SW-W1; 13.6 to 18.8 mg/L for SW-W2; and 6.88 to 9.72 mg/L for SW-W3. In general, for specific conductance and chloride, SW-W1 has the lowest levels while

SW-W2 displays the highest levels, and SW-W3 is midrange but tends closer to SW-W1. The maximum levels for both constituents have decreased compared to historical values for all three locations and in general the variability has decreased, as shown by decreases in standard deviation for short- and long-term periods at SW-W2 and SW-W3 (Table 3-4).

The medians for total calcium concentrations are 16.5 mg/L for SW-W1, 52.45 mg/L for SW-W2, and 24.05 mg/L for SW-W3. The medians for total magnesium concentrations are 12.20 mg/L for SW-W1, 42.75 mg/L for SW-W2, and 19.65 for SW-W3. The medians for total potassium concentrations are 1.28 mg/L for SW-W1, 3.11 mg/L for SW-W2, and 2.40 mg/L for SW-W3. The medians for total sodium concentrations are 7.37 mg/L for SW-W1, 15.90 mg/L for SW-W2, and 9.31 mg/L for SW-W3. As with specific conductance and chloride, SW-W1 and SW-W3 have lower levels for calcium, magnesium, potassium, and sodium, while SW-W2 has the higher levels. The levels of these metals are stable relative to long-term values at all three locations. All medians above are approximately equal to or lower than last year's values (Table 3-4).

The only volatile organic compound detected with any frequency in the weirs is vinyl chloride. Vinyl chloride was detected in SW-W1 four times in 2019 and four times in 2020. Vinyl chloride is occasionally detected in SW-W2, but is routinely detected in SW-W3 (eight of eight samples between 2019 and 2020). SW-W2 had no vinyl chloride detections in the recent eight samples (Table 3-4).

Most of the exceedances of the Water Quality Standards for Surface Waters of the State of Washington (WAC 173-201A) and Water Quality Standards (40 CFR Parts 131) are for metals. Historically the value of these exceedances in evaluating water impacts associated with municipal solid waste landfills is limited since the standards are based on dissolved metals and the weir results are based on total metals. In 2007, field procedures changed allowing samples collected to be field filtered and metals to be analyzed for both total and dissolved constituents. Dissolved metals were then compared to groundwater criteria and total metals were compared to surface water criteria. Because water collected at the weirs is truly surface water, having been exposed to atmospheric conditions, it will no longer be compared to groundwater standards starting in 2011. Dissolved oxygen, total iron, total lead, and turbidity exceeded the surface water quality standards in 2020 (Appendix B).

In November of 2011, a new surface water sampling location was established. Station SW-E is located approximately 1200 ft. southwest of the weir locations on the east side of a culvert on Robinwood Road SW, approximately 200 ft. south of the Robinwood Road SW-Sunset Road SW intersection (Figure 1). The first sample was analyzed for the same analytes as for the weirs, but this analyte set was be paired down to a few analytes starting in the first quarter of 2015. As of 2015, station SW-E has only be sampled for pH (field), specific conductance (field and laboratory), dissolved oxygen (field), oxidation-reduction potential (field), turbidity (field and laboratory), total arsenic, total calcium, total iron, total magnesium, total manganese, total potassium, total sodium, and vinyl chloride.

Station SW-E had a slightly alkaline pH with a median of 7.585 and a specific conductance median of 209.8  $\mu$ mhos/cm. The median values for total metals are arsenic 0.0023 mg/L, calcium 15.9 mg/L, iron is 0.44 mg/L, magnesium is 13.9 mg/L, potassium is 2.00 mg/L, and sodium is 7.02

mg/L. Station SW-E has lower metal values in all metals compared to SW-W1, with the exception of potassium which is less than 1 mg/L higher (Table 3-4).

Station SW-E exceeded the surface quality standards for turbidity, total iron, and total iron after a long period of heavy rain in 2020. Station SW-E exceeded the surface quality standard for turbidity on one other event.

SW-E had no vinyl chloride detections.

#### *4.3.1.1. Weir and Surface Water Summary*

Conditions in SW-W1 represent the lowest levels of impact while SW-W2 displays somewhat higher low levels. SW-W3 exhibits a midrange impact based on conventional parameters and metals and showing detections of vinyl chloride. The increased detection frequency of vinyl chloride in sample results from weir SW-W1 maybe be the result of the change in the laboratory detection limit to the LLOQ, which occurred in second quarter of 2017 coinciding with the increased detection frequency. Many of the vinyl chloride results since second quarter of 2017 have been qualified 'JT', meaning results are only reported as qualitative, i.e. 'present, but unquantified', including three of the four detections in 2019. Water quality monitoring will continue at the weirs to provide water quality data for surface water flow leaving the property. The water quality is compared to surface water standards. The new down-stream surface water station has water quality values similar or better than SW-W1.

#### **4.4. OFFSITE DOMESTIC WELL MONITORING**

In 2002, Department of Natural Resources and Parks (DNRP) conducted sampling on Vashon-Maury Island in eleven domestic wells located around the landfill. No evidence of contamination originating from the landfill was found. The data was presented in the *2002 Vashon Island Closed Landfill Annual Report*. Data are included with the onsite well data in the pdf files.

In 2005, King County Solid Waste Division agreed to monitor three of these eleven wells. The first round of these samples was collected in October 2005. One of the three wells is no longer sampled as access is no longer available. Starting in 2010, samples have been collected from both of the off-property wells bi-annually. Samples from the 85 Acres well (DW-85) are collected from the well head and the Paquette well (DW-PA) sample is taken from one of the properties connected to that well. Four samples were collected in 2020 from the two off property wells (DW-85 and DW-PA) (Figure 4). No evidence of contamination originating from the landfill was found. The results from the domestic wells are included in Appendix H.

## **5. LEACHATE**

Second quarter of 2020 leachate results are compiled in Appendix K and include sample results for station LS-LVT (required monitoring under Wastewater Discharge Authorization No. 4366-01). As explained in a May 21, 2020 email from Joan Kenton and approved by Washington State Department of Ecology, quarterly leachate characterization samples from stations LS-B and LS-PS1 (see Figure 8) were not taken during second quarter of 2020 because of reduced capacity at the King County Environmental Laboratory due to Covid-19.

## 6. LANDFILL GAS

Landfill gas is monitored by a network of compliance probes installed around the perimeter of the landfill and ambient air stations around the property boundary (Figure 5). The monitoring network comprises of nine ambient air stations, two groundwater monitoring wells, and twenty-six gas probes. Probes are monitored monthly. The results can be found in Appendix L. There were no detections in 2020 and there have been no methane detections at the compliance monitoring points since 2008. The effects of landfill gas on current groundwater conditions are being reviewed to determine whether data gaps exist in the current analysis. In 2017, two sets (shallow and deep) temporary gas probes were installed to continue the determination of landfill gas on the south hillslope. In 2016 and 2018, three gas extraction wells (GW-9, GW-10, and GW-11) were installed on the south slope hillslope of the landfill, in order to increase the radius of influence of the landfill extraction system. The *Landfill Gas System Evaluation Summary Report* determined that the radius of influence for extracting methane was 190 ft., 135 ft., and 50 ft. for gas wells GW-9, GW-10, and GW-11, respectively (Aspect, 2019). In February of 2020, the landfill gas blower went in to be repaired and it was determined based on the age of the blower, previous repairs, and the long-term needs for landfill gas collection at VLF to replace the blower. Two new direct drive blowers are scheduled to be installed during second quarter of 2021 and active landfill gas collection will resume.

## **7. CONCLUSIONS AND RECOMMENDATIONS**

### ***7.1. CONCLUSIONS***

Conditions at the Vashon Island Closed Landfill have continued the historic trend, with some VOCs showing decreasing trends. Therefore, most of the conclusions drawn from the previous Annual Reports hold true for this report. The following conclusions reiterate some conclusions from previous Annual Reports:

1. The groundwater generally moves westward in the middle channel of the lacustrine silt, Channel Cc2, within Unit C.
2. The flow direction within the Unit D Aquifer is better defined and potentiometric maps show less radial flow after monitoring well MW-27 was decommissioned. The updated hydrogeological conceptual model provided a further definition in the potentiometric maps (Appendix G).
3. The monitoring wells in the Unit D Aquifer showed low sensitivity to hydrologic activity, based on the observation of very small seasonal water level fluctuations, indicating limited groundwater recharge in the area of the landfill.
4. Landfilling impacts have been recognized in Channel Cc2 at monitoring wells MW-2, MW-21, MW-33, and MW-35, including for VOCs. Detections for many VOCs have declined significantly or are stable in the short-term. Leachate is believed to have contributed to past impacts. Recent data, specifically levels of VOCs in monitoring wells MW-2, MW-21, MW-33, and MW-35, suggest possible transport of historic contaminants from landfill gas.
5. The landfill closure has been effective in improving the water quality condition of impacted wells, based on reductions in specific conductance, total dissolved solids, chloride, and several VOCs.
6. Results obtained from wells in Unit D Aquifer do not show impacts attributable to landfill activities, but instead reflect the natural variations in water quality that exist around the landfill.

### ***7.2. RECOMMENDATIONS/PROPOSED ACTIONS***

1. The existing monitoring network shall continue to be monitored as described in the 2004 Vashon Island Landfill Hydrogeologic Report Update and following protocols from the Environmental Monitoring Sampling and Analysis Plan and Quality Assurance Project Plan for Vashon Island Closed Landfill.
2. Evaluation of the operating efficiency of the landfill gas collection system and probe network will continue into 2020 to determine if more improvements to the collection and treatment system are needed. Furthermore, we will continue to assess the effect of landfill gas wells GW-9, GW-10, and GW-11 have on groundwater conditions.
3. Monitoring of the groundwater wells will continue for Appendix I and II parameters, with the addition of dichlorodifluoromethane. In 2020, KCSWD requested to stop appendix III sampling, except for detected Appendix III constituents (2,4,5-TP Silvex, 2-methyl-1-



propanol, bis(2-chloroethyl) ether, and bis(2-ethylhexyl) phthalate), which KCSWD proposed to sample quarterly. Ecology denied the request to stop Appendix III sampling but approved quarterly sampling of detected Appendix III analytes quarterly and stated that Appendix III sampling could take place every five years. In 2021, KCSWD will begin sampling the detected Appendix III analytes quarter in monitoring well MW-2, MW-20, MW-21, MW-33, and MW-35 and the next Appendix III sampling will occur in 2024.

4. The water-bearing zone in Channel Cc2 shall continue in assessment monitoring in accordance with WAC 173-351-430. The RI was completed in 2020. KCSWD is working to start on the Feasibility Study in 2021.
5. In 2021, KCSWD will be evaluating removing monitoring well MW-28 from the monitoring network, since the screen for MW-28 was installed at the contact between Unit D and unit below (Unit E) and requires a two foot rise in surrounding groundwater levels to reach the screen bottom.
6. In 2021, KCSWD will add two offsite domestic water sources (one well and one spring) to the offsite monitoring program.
7. Surface water sampling site SW-E will be sampled quarterly for pH (field), specific conductance (field and laboratory), turbidity (field and laboratory), hardness, total metals, and vinyl chloride.
8. In accordance with WAC 173-350-340, the leachate lagoon at VLF was to be tested in 2020 for leaks. KCSWD attempted the first test in August of 2020, but the test could not be completed. KCSWD was scheduled to attempt the test again in December of 2020; however, due travel restrictions issued by the Washington State Governor, KCSWD requested to postpone leak testing until it was safe. PH-SKC approved this request and KCSWD will complete leak testing by June 30, 2021.
9. KCSWD is developing a schedule and budget for testing leachate conveyance pipes at VLF, in order to be in compliance with the newly updated WAC 173-350-340.
10. Two new direct drive blowers will be installed during second quarter of 2020 to replace the previous belt drive blower and active landfill gas collection will resume.

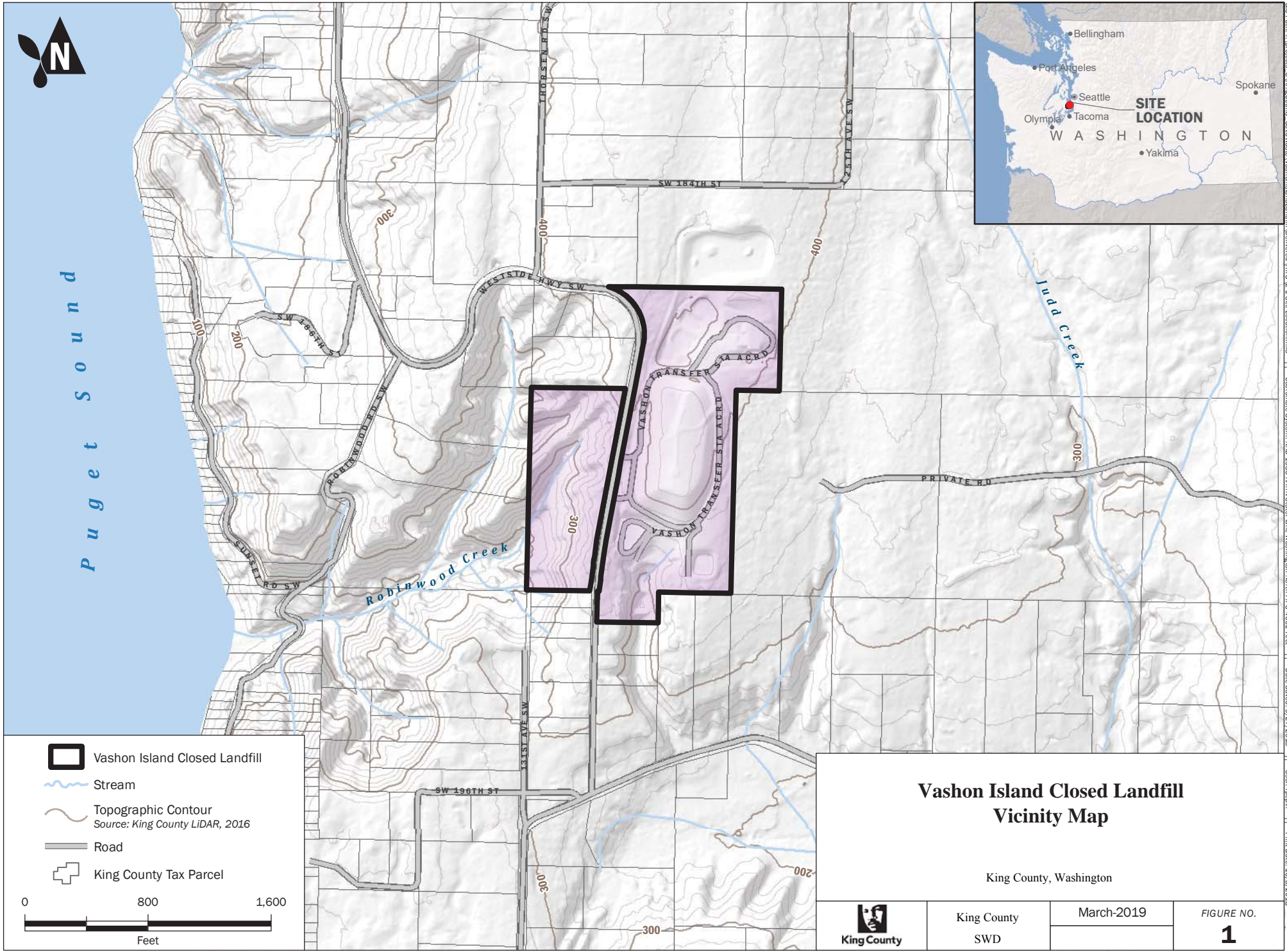
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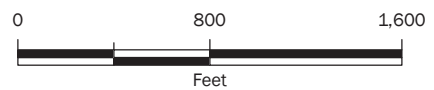
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## FIGURES and TABLES



P u g e t S o u n d

-  Vashon Island Closed Landfill
-  Stream
-  Topographic Contour  
Source: King County LiDAR, 2016
-  Road
-  King County Tax Parcel



## Vashon Island Closed Landfill Vicinity Map

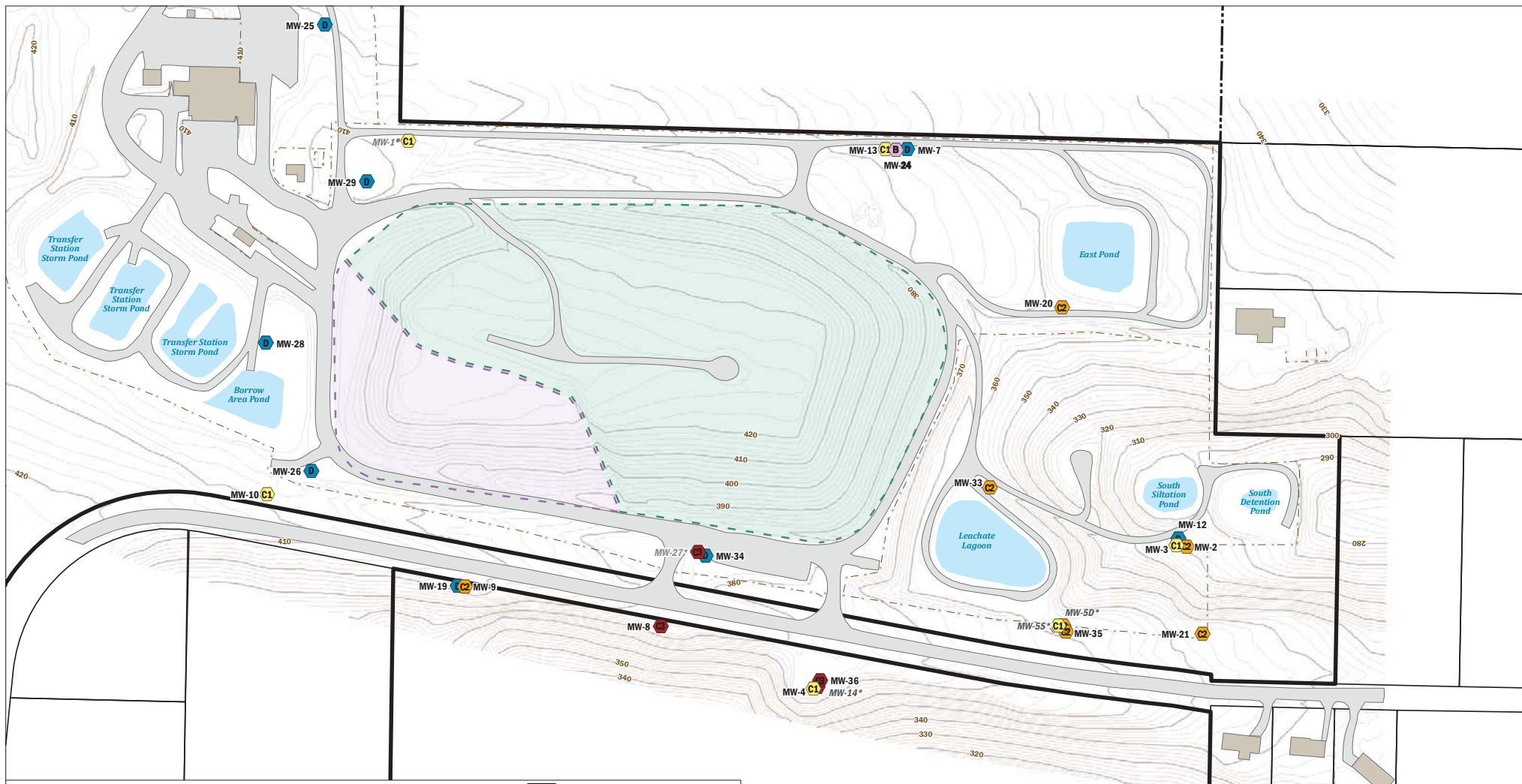
King County, Washington



King County  
SWD

March-2019

FIGURE NO.  
**1**



### Groundwater Monitoring Locations

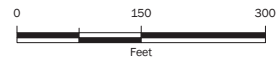
#### Completion Aquifer


- Unit B
- Unit Cc1
- Unit Cc2
- Unit Cc3
- Unit D

- Phase 1 - 1988 Final Cover
- Phase 2 - 2001 Final Cover
- Pond
- Building
- Road
- Fence

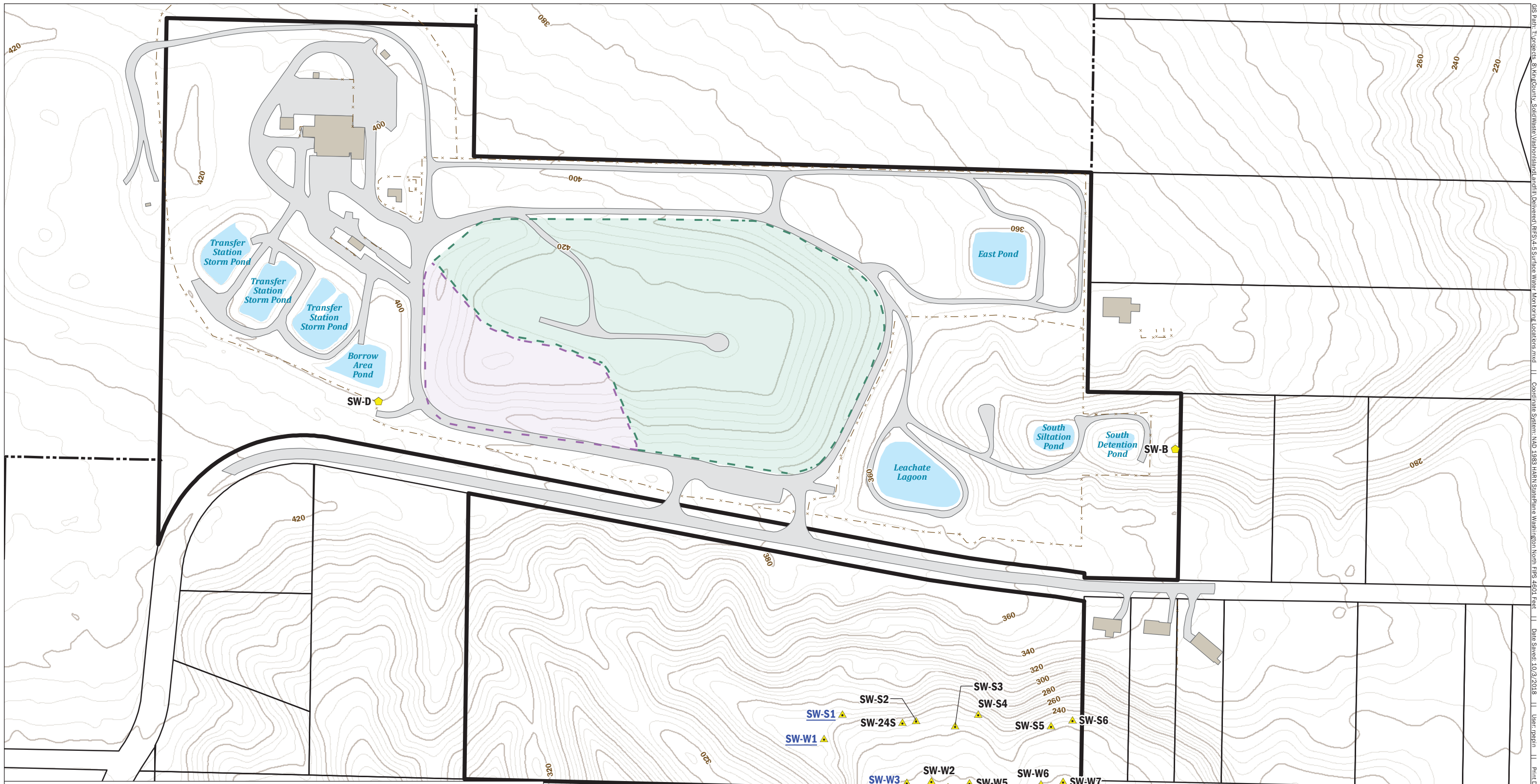
- Vashon Island Closed Landfill
- Other King County-Owned Property
- King County Tax Parcel

Topographic contours from King County Survey, Spring 2017.  
\*Indicates decommissioned monitoring well.



<h2>Groundwater Monitoring Well Locations</h2> <p>Vashon Island Closed Landfill King County, Washington</p>		
	King County Solid Waste Division	FIGURE NO. <b>2</b>
Nov-2018		

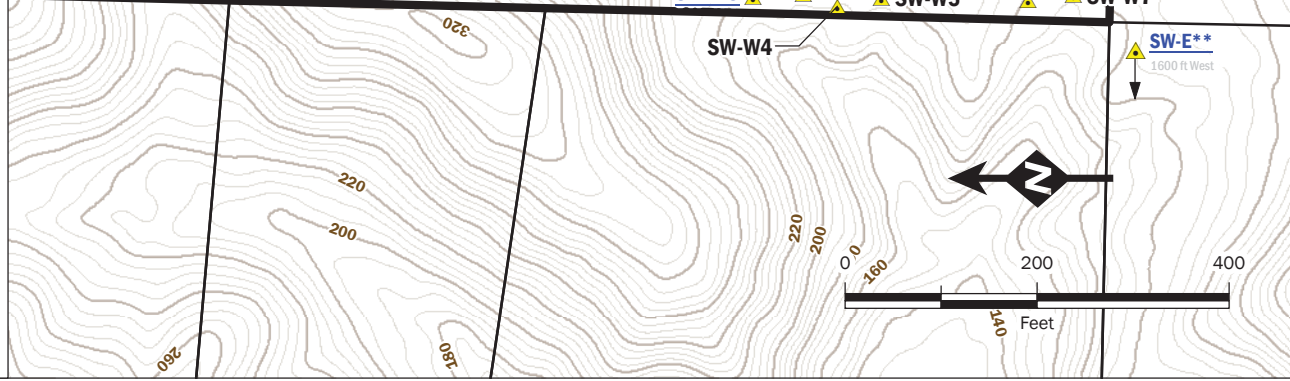
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**Surface Water Monitoring Locations**

- Seep/Weir Sampling Location
- Former Surface Water Monitoring Station
- Phase 1 - 1988 Final Cover
- Phase 2 - 2001 Final Cover
- Pond
- Building
- Road
- Fence
- Vashon Island Closed Landfill
- Other King County-Owned Property
- King County Tax Parcel

*Topographic contours from King County LiDAR, 2016.*



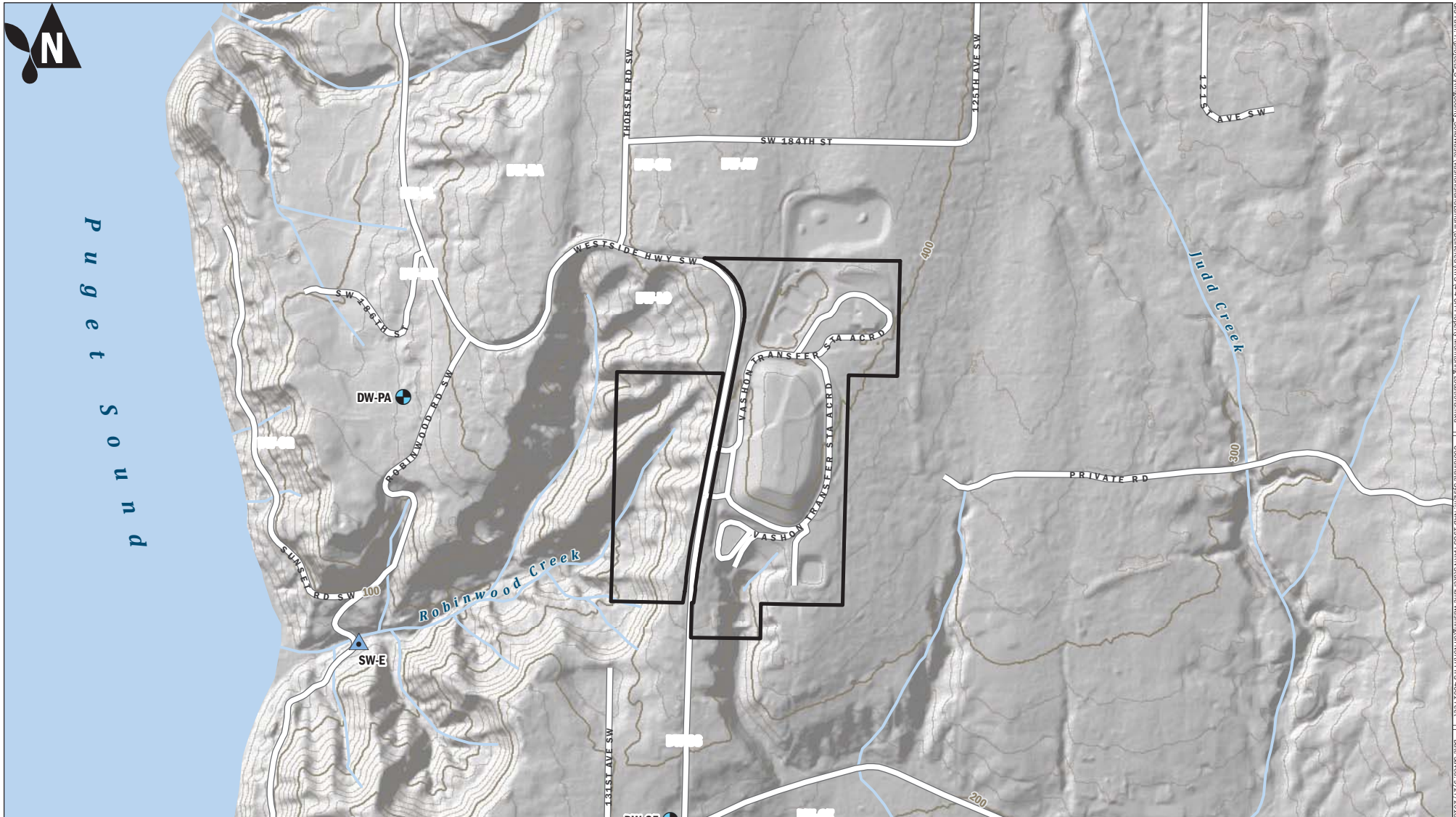
**Surface Water Monitoring Well Locations**

Vashon Island Closed Landfill  
King County, Washington

	2018	FIGURE NO.
		<b>3</b>

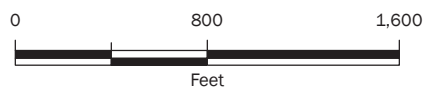
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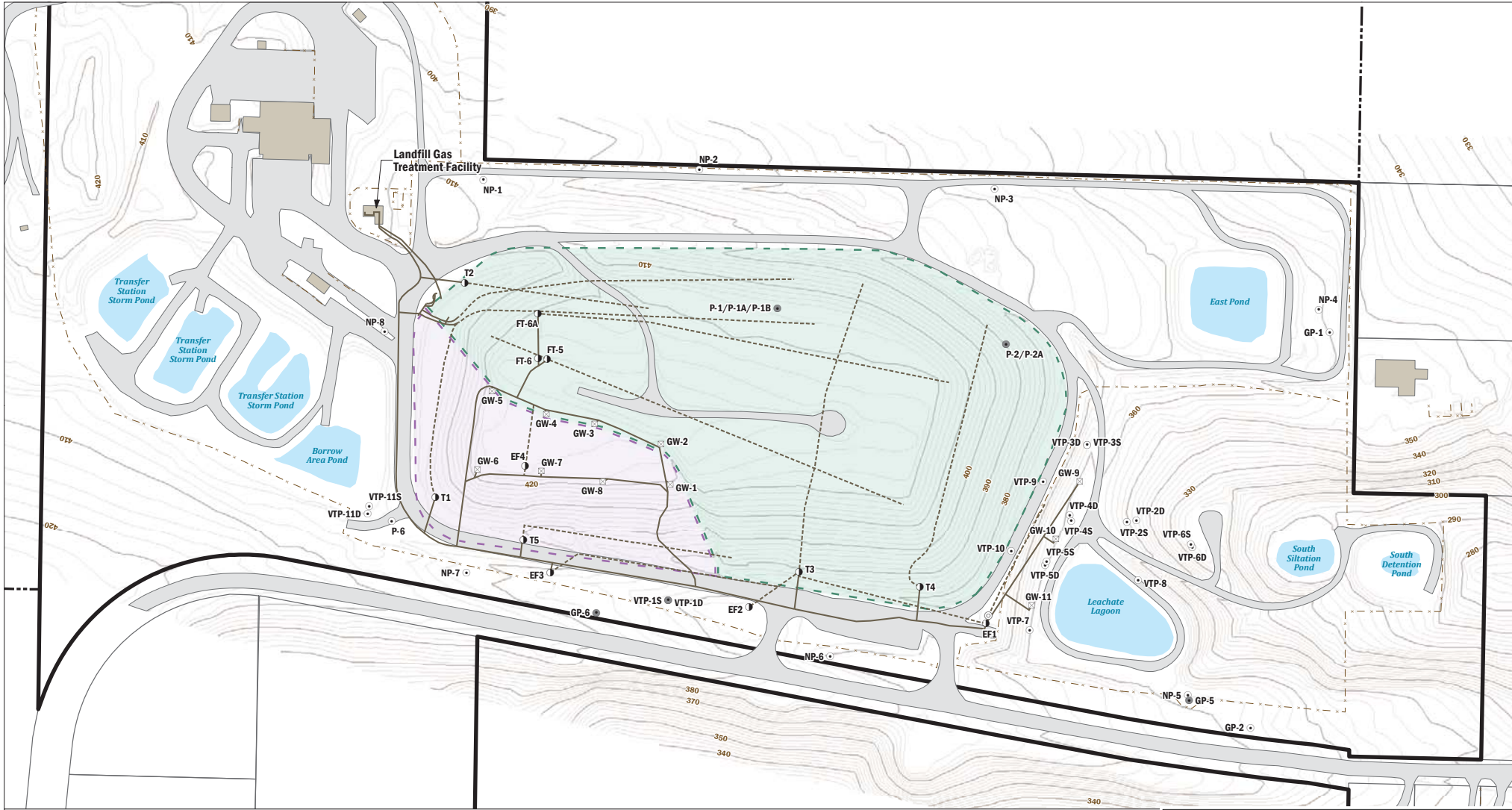
- Regional Well Sampling Location
- Surface Water Sampling Location
- Vashon Island Closed Landfill

Topographic contours derived from King County LIDAR, 2016.



<b>Private Monitoring Well Locations</b>			
Vashon Island Closed Landfill King County, Washington			
 <b>King County</b>	King County Solid Waste Division	Nov-2018	FIGURE NO. <b>4</b>

GIS Data: Topographic & King County Solid Waste Landfill, Vashon Island, Vashon, King County, Washington; Monitoring Locations; Coordinate System: NAD 1983 HARN StatePlane Washington North FIPS 4001 Feet; Date Saved: 9/27/2018; Layer: Terrain; Print Date: 10/9/2018




○ Gas Probe/Piezometer	Phase 1 - 1988 Final Cover	- - - Fence
● Decommissioned Gas Probe	Phase 2 - 2001 Final Cover	▭ Vashon Island Closed Landfill
⊠ LFG Extraction Well	▭ Pond	⊠ Other King County-Owned Property
○ LFG Trench Riser	▭ Building	⊠ King County Tax Parcel
— LFG Pipe	▭ Road	
- - - LFG Pipe (Perforated)		

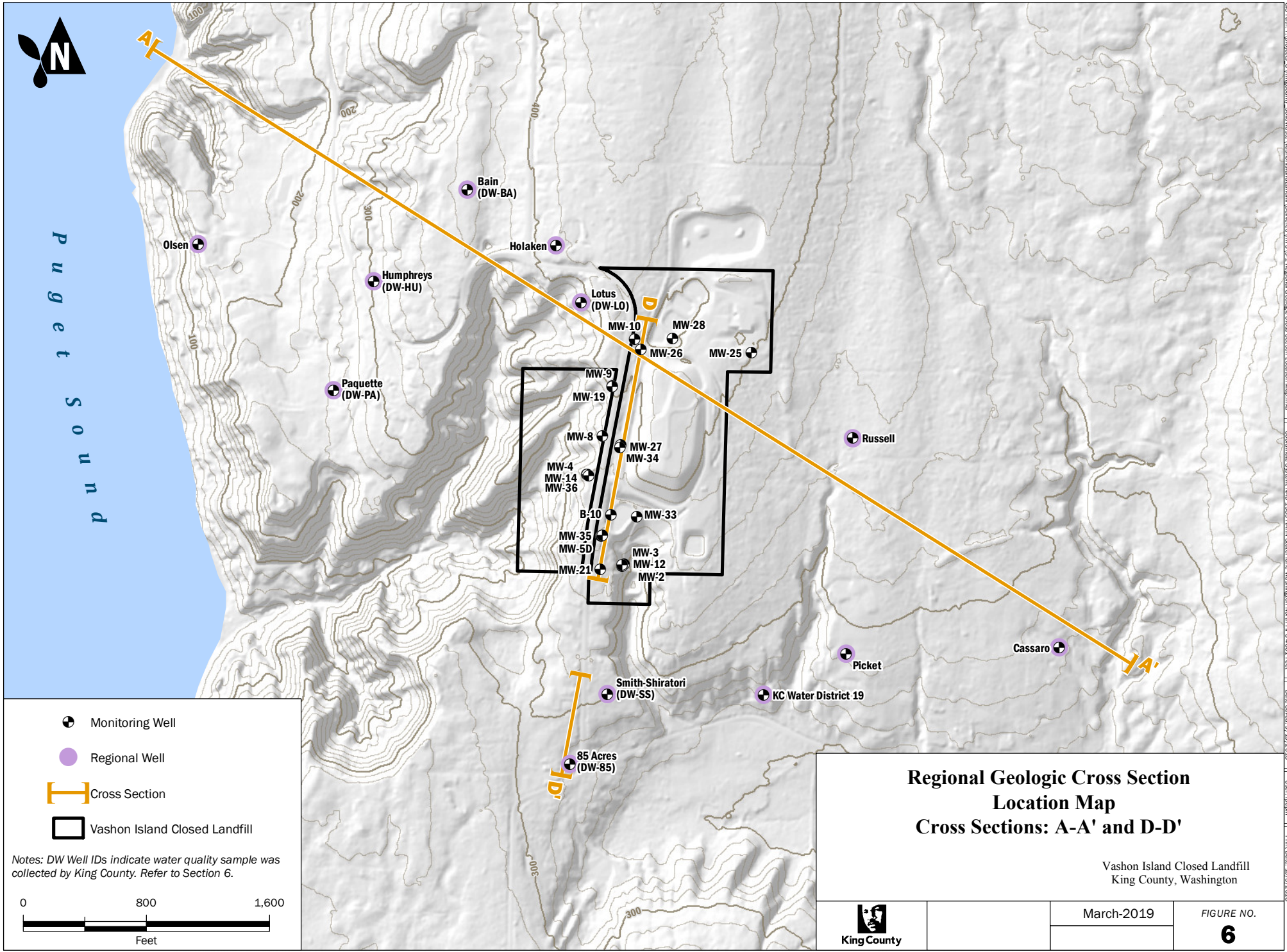
*Topographic contours from King County Survey, Spring 2017. Landfill gas system features are approximated from as-built locations, and revised to match survey data where available.*





## Landfill Gas Collection and Monitoring Systems

Vashon Island Closed Landfill  
King County, Washington

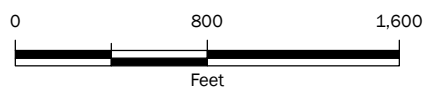
 King County Solid Waste Division	Nov-2018	FIGURE NO. <b>5</b>
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GIS Data: 3/20/2018; 3/21/2018; 3/22/2018; 3/23/2018; 3/24/2018; 3/25/2018; 3/26/2018; 3/27/2018; 3/28/2018; 3/29/2018; 3/30/2018; 3/31/2018; 4/1/2018; 4/2/2018; 4/3/2018; 4/4/2018; 4/5/2018; 4/6/2018; 4/7/2018; 4/8/2018; 4/9/2018; 4/10/2018; 4/11/2018; 4/12/2018; 4/13/2018; 4/14/2018; 4/15/2018; 4/16/2018; 4/17/2018; 4/18/2018; 4/19/2018; 4/20/2018; 4/21/2018; 4/22/2018; 4/23/2018; 4/24/2018; 4/25/2018; 4/26/2018; 4/27/2018; 4/28/2018; 4/29/2018; 4/30/2018; 5/1/2018; 5/2/2018; 5/3/2018; 5/4/2018; 5/5/2018; 5/6/2018; 5/7/2018; 5/8/2018; 5/9/2018; 5/10/2018; 5/11/2018; 5/12/2018; 5/13/2018; 5/14/2018; 5/15/2018; 5/16/2018; 5/17/2018; 5/18/2018; 5/19/2018; 5/20/2018; 5/21/2018; 5/22/2018; 5/23/2018; 5/24/2018; 5/25/2018; 5/26/2018; 5/27/2018; 5/28/2018; 5/29/2018; 5/30/2018; 5/31/2018; 6/1/2018; 6/2/2018; 6/3/2018; 6/4/2018; 6/5/2018; 6/6/2018; 6/7/2018; 6/8/2018; 6/9/2018; 6/10/2018; 6/11/2018; 6/12/2018; 6/13/2018; 6/14/2018; 6/15/2018; 6/16/2018; 6/17/2018; 6/18/2018; 6/19/2018; 6/20/2018; 6/21/2018; 6/22/2018; 6/23/2018; 6/24/2018; 6/25/2018; 6/26/2018; 6/27/2018; 6/28/2018; 6/29/2018; 6/30/2018; 7/1/2018; 7/2/2018; 7/3/2018; 7/4/2018; 7/5/2018; 7/6/2018; 7/7/2018; 7/8/2018; 7/9/2018; 7/10/2018; 7/11/2018; 7/12/2018; 7/13/2018; 7/14/2018; 7/15/2018; 7/16/2018; 7/17/2018; 7/18/2018; 7/19/2018; 7/20/2018; 7/21/2018; 7/22/2018; 7/23/2018; 7/24/2018; 7/25/2018; 7/26/2018; 7/27/2018; 7/28/2018; 7/29/2018; 7/30/2018; 7/31/2018; 8/1/2018; 8/2/2018; 8/3/2018; 8/4/2018; 8/5/2018; 8/6/2018; 8/7/2018; 8/8/2018; 8/9/2018; 8/10/2018; 8/11/2018; 8/12/2018; 8/13/2018; 8/14/2018; 8/15/2018; 8/16/2018; 8/17/2018; 8/18/2018; 8/19/2018; 8/20/2018; 8/21/2018; 8/22/2018; 8/23/2018; 8/24/2018; 8/25/2018; 8/26/2018; 8/27/2018; 8/28/2018; 8/29/2018; 8/30/2018; 8/31/2018; 9/1/2018; 9/2/2018; 9/3/2018; 9/4/2018; 9/5/2018; 9/6/2018; 9/7/2018; 9/8/2018; 9/9/2018; 9/10/2018; 9/11/2018; 9/12/2018; 9/13/2018; 9/14/2018; 9/15/2018; 9/16/2018; 9/17/2018; 9/18/2018; 9/19/2018; 9/20/2018; 9/21/2018; 9/22/2018; 9/23/2018; 9/24/2018; 9/25/2018; 9/26/2018; 9/27/2018; 9/28/2018; 9/29/2018; 9/30/2018; 10/1/2018; 10/2/2018; 10/3/2018; 10/4/2018; 10/5/2018; 10/6/2018; 10/7/2018; 10/8/2018; 10/9/2018; 10/10/2018; 10/11/2018; 10/12/2018; 10/13/2018; 10/14/2018; 10/15/2018; 10/16/2018; 10/17/2018; 10/18/2018; 10/19/2018; 10/20/2018; 10/21/2018; 10/22/2018; 10/23/2018; 10/24/2018; 10/25/2018; 10/26/2018; 10/27/2018; 10/28/2018; 10/29/2018; 10/30/2018; 10/31/2018; 11/1/2018; 11/2/2018; 11/3/2018; 11/4/2018; 11/5/2018; 11/6/2018; 11/7/2018; 11/8/2018; 11/9/2018; 11/10/2018; 11/11/2018; 11/12/2018; 11/13/2018; 11/14/2018; 11/15/2018; 11/16/2018; 11/17/2018; 11/18/2018; 11/19/2018; 11/20/2018; 11/21/2018; 11/22/2018; 11/23/2018; 11/24/2018; 11/25/2018; 11/26/2018; 11/27/2018; 11/28/2018; 11/29/2018; 11/30/2018; 12/1/2018; 12/2/2018; 12/3/2018; 12/4/2018; 12/5/2018; 12/6/2018; 12/7/2018; 12/8/2018; 12/9/2018; 12/10/2018; 12/11/2018; 12/12/2018; 12/13/2018; 12/14/2018; 12/15/2018; 12/16/2018; 12/17/2018; 12/18/2018; 12/19/2018; 12/20/2018; 12/21/2018; 12/22/2018; 12/23/2018; 12/24/2018; 12/25/2018; 12/26/2018; 12/27/2018; 12/28/2018; 12/29/2018; 12/30/2018; 12/31/2018



-  Monitoring Well
-  Regional Well
-  Cross Section
-  Vashon Island Closed Landfill

Notes: DW Well IDs indicate water quality sample was collected by King County. Refer to Section 6.



### Regional Geologic Cross Section Location Map Cross Sections: A-A' and D-D'

Vashon Island Closed Landfill  
King County, Washington

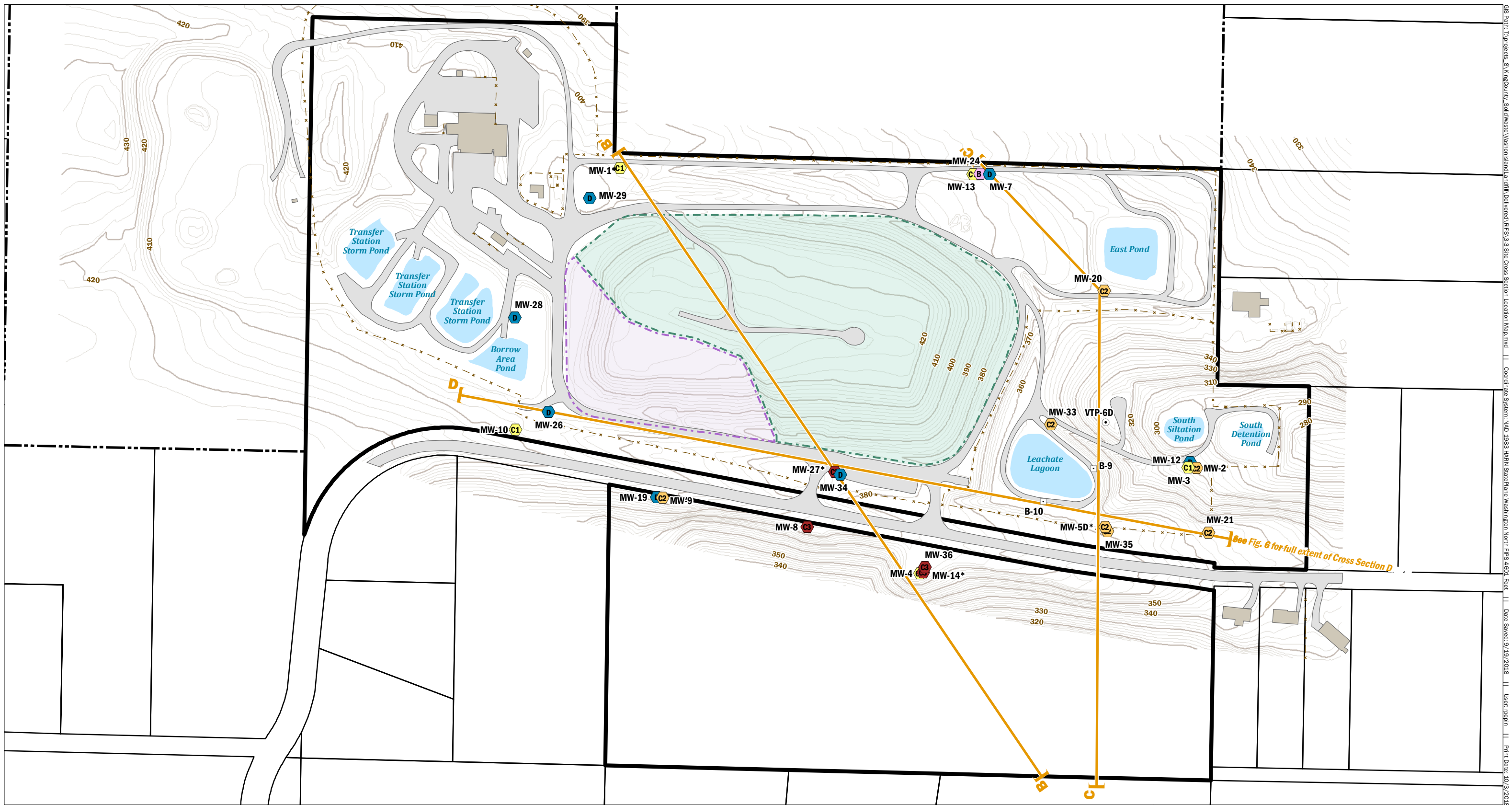


March-2019

FIGURE NO.

**6**

GIS Data: T. Proctor & King County; Software: AutoCAD; Data: King County; Date: 9/19/2018; User: gregm; File: DW-85-2018.dwg



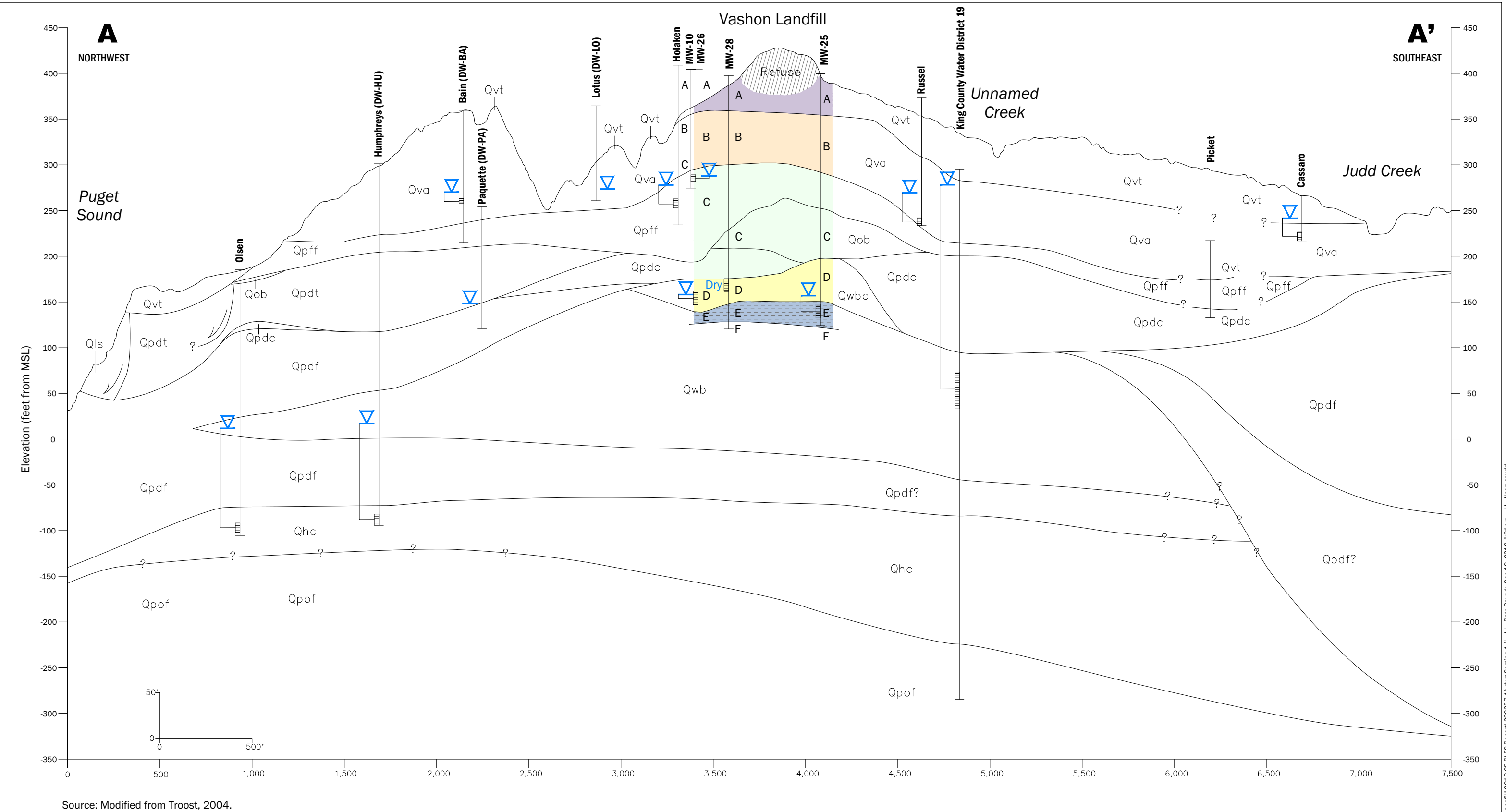
GIS Path: \\projdata\8\KingCounty\_SolidWaste\VashonIsland\landfill\Delivered\_RFS\3.3 Site Cross Section Location Map.mxd | Coordinate System: NAD 1983 HARN StatePlane Washington North FIPS 5601 Feet | Date Saved: 9/19/2018 | User: jmapin | Print Date: 10/2/2018

<b>Monitoring Well Completion Aquifer</b> Unit B Unit Cc1 Unit Cc2 Unit Cc3 Unit D	Boring Gas Probe Cross Section Phase 1 - 1988 Final Cover Phase 2 - 2001 Final Cover	Pond Building Road Fence	Vashon Island Closed Landfill Other King County-Owned Property King County Tax Parcel <p><i>Topographic contours from King County Survey, Spring 2017. *indicates decommissioned monitoring well.</i></p>	 
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**Site Cross Section Location Map**  
**Cross Sections: B-B', C-C', and D-D'**

Vashon Island Closed Landfill  
 King County, Washington

	March-2019	FIGURE NO.
		<b>7</b>



Source: Modified from Troost, 2004.

- Geologic Units**
- Qls Landslide Deposits (Holocene)
  - Qvt Vashon Till
  - Qva Advance Outwash
  - Qob Olympia Beds
  - Qpdt Possession Drift Till
  - Qpdc Possession Drift, Coarse-Grained Facies
  - Qpdf Possession Drift, Fine-Grained Facies
  - Qwb Whidbey Beds, Undifferentiated
  - Qhc Hamm Creek Formation
  - Qpof Pre-Olympia Deposits, Fine-Grained Facies
  - Qpff Pre-Fraser Glaciation Deposits, Fine-Grained Facies
  - Qwbc Whidbey Beds, Coarse-Grained Facies

- Refuse/Fill
- Unit A
- Unit B
- Unit C
- Unit D
- Unit E
- Coarse
- Fine
- Static Water Level
- Screen Interval

**Note:** DW well ID's indicate water quality sample was collected by county. Refer to Section 6 for data.

Horizontal Scale: 1" = 500'  
 Vertical Scale: 1" = 100'  
 Vertical Exaggeration 5x

### Regional Geologic Cross Section A-A'

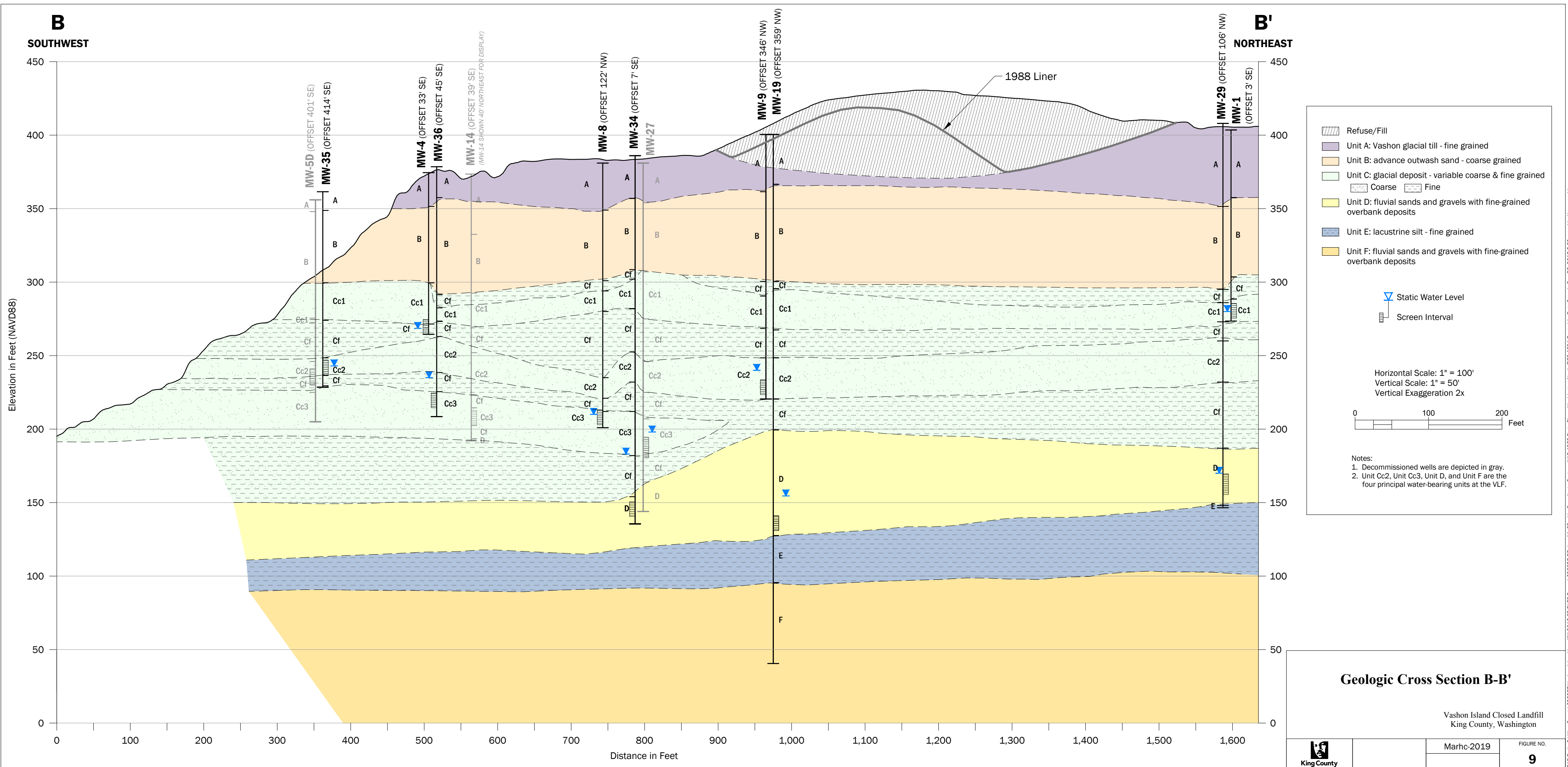
Vashon Island Closed Landfill  
 King County, Washington



March-2019

FIGURE NO.  
**8**

CAD Path: Q:\King County\090057 Vashon Island Landfill\2018-05 RIFS Report\090057-AA.dwg Section A-A' | Date Saved: Sep 19, 2018 4:31pm | User: srudd



**Legend**

- Refuse/Fill
- Unit A: Vashon glacial till - fine grained
- Unit B: advance outwash sand - coarse grained
- Unit C: glacial deposit - variable coarse & fine grained
  - Coarse
  - Fine
- Unit D: fluvial sands and gravels with fine-grained overbank deposits
- Unit E: lacustrine silt - fine grained
- Unit F: fluvial sands and gravels with fine-grained overbank deposits

Static Water Level

Screen Interval

Horizontal Scale: 1" = 100'  
 Vertical Scale: 1" = 50'  
 Vertical Exaggeration 2x

0 100 200 Feet

**Notes:**

1. Decommissioned wells are depicted in gray.
2. Unit Cc2, Unit Cc3, Unit D, and Unit F are the four principal water-bearing units at the VLF.

**Geologic Cross Section B-B'**

Vashon Island Closed Landfill  
 King County, Washington



Marhc-2019

FIGURE NO.

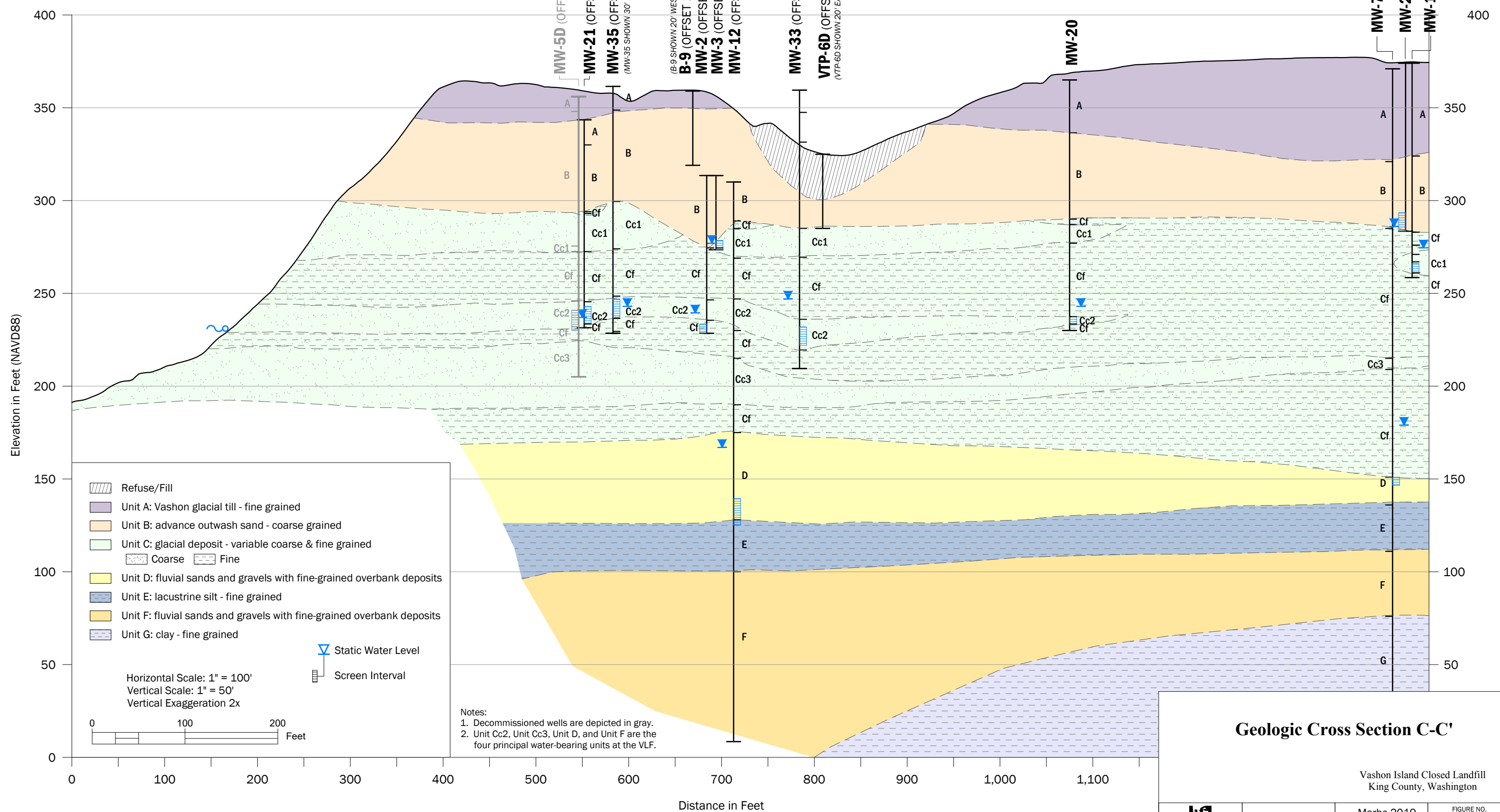
**9**

CAD Path: C:\King County\090057 Vashon Island Landfill\2018-05 RIFS Report\090057-BB.dwg 11x22 | Coordinate System: NAD 1983 State Plane Washington North FIPS 4601 Feet | Date Saved: Sep 28, 2018 2:20pm | User: scudd

**C**  
WEST

**BEND IN SECTION**  
EAST

**C'**  
NORTHEAST

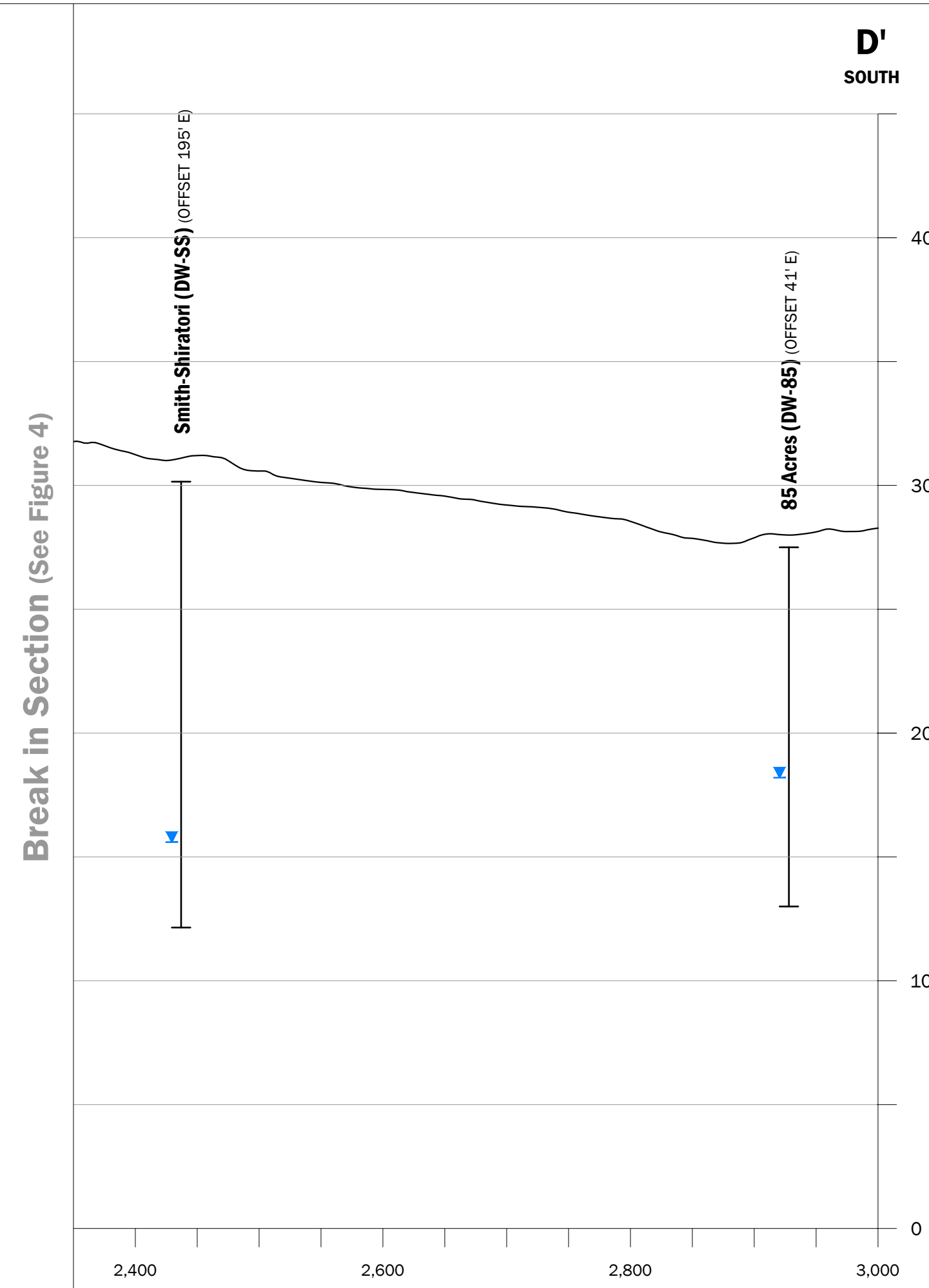
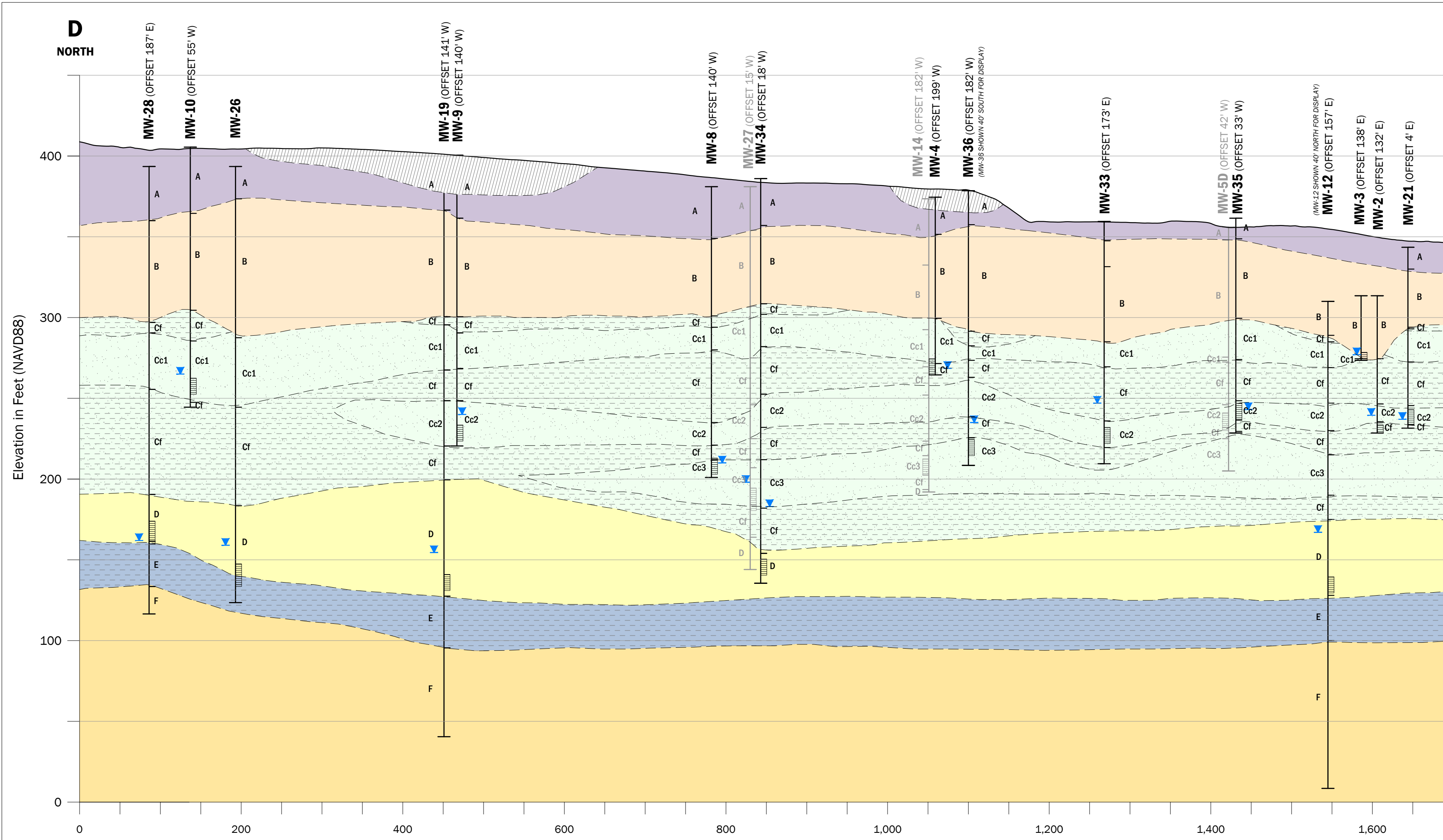


**Geologic Cross Section C-C'**

Vashon Island Closed Landfill  
King County, Washington

	Marhc-2019	FIGURE NO. <b>10</b>
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CAD Path: Q:\King County\090057 Vashon Island Landfill\2018-05 RI-FS Report\090057-CC.dwg 11x17 Landscape | Coordinate System: NAD 1983 State Plane Washington North FIPS 4601 Feet | Date Saved: Sep 28, 2018 2:22pm | User: scudd



Break in Section (See Figure 4)

**Geologic Cross Section D-D'**

Vashon Island Closed Landfill  
King County, Washington

March-2019

FIGURE NO. **11**



Figure 12 - Water Level Elevations in Unit B Aquifer

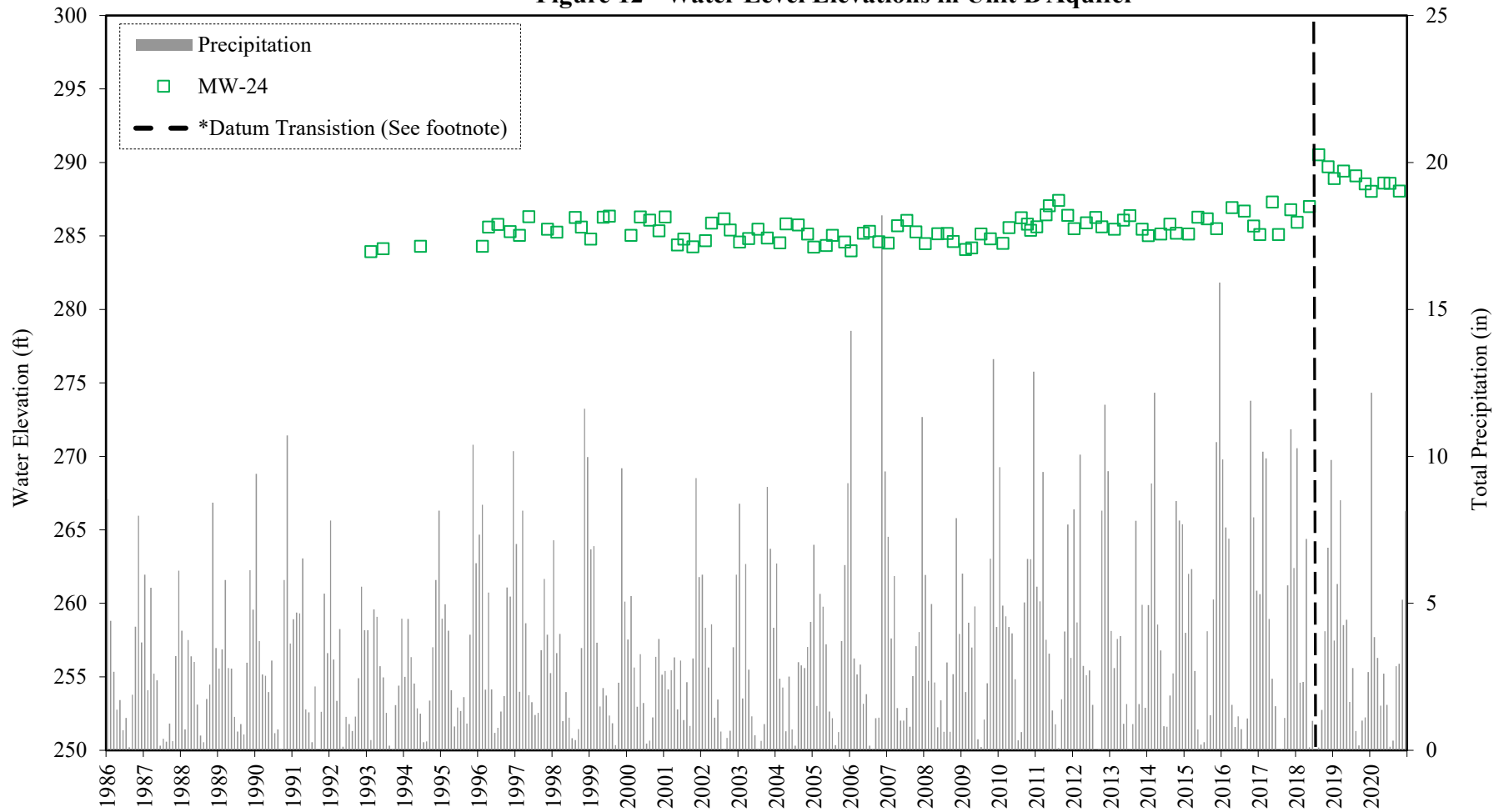


Figure 13 - Water Level Elevations in Channel Cc1

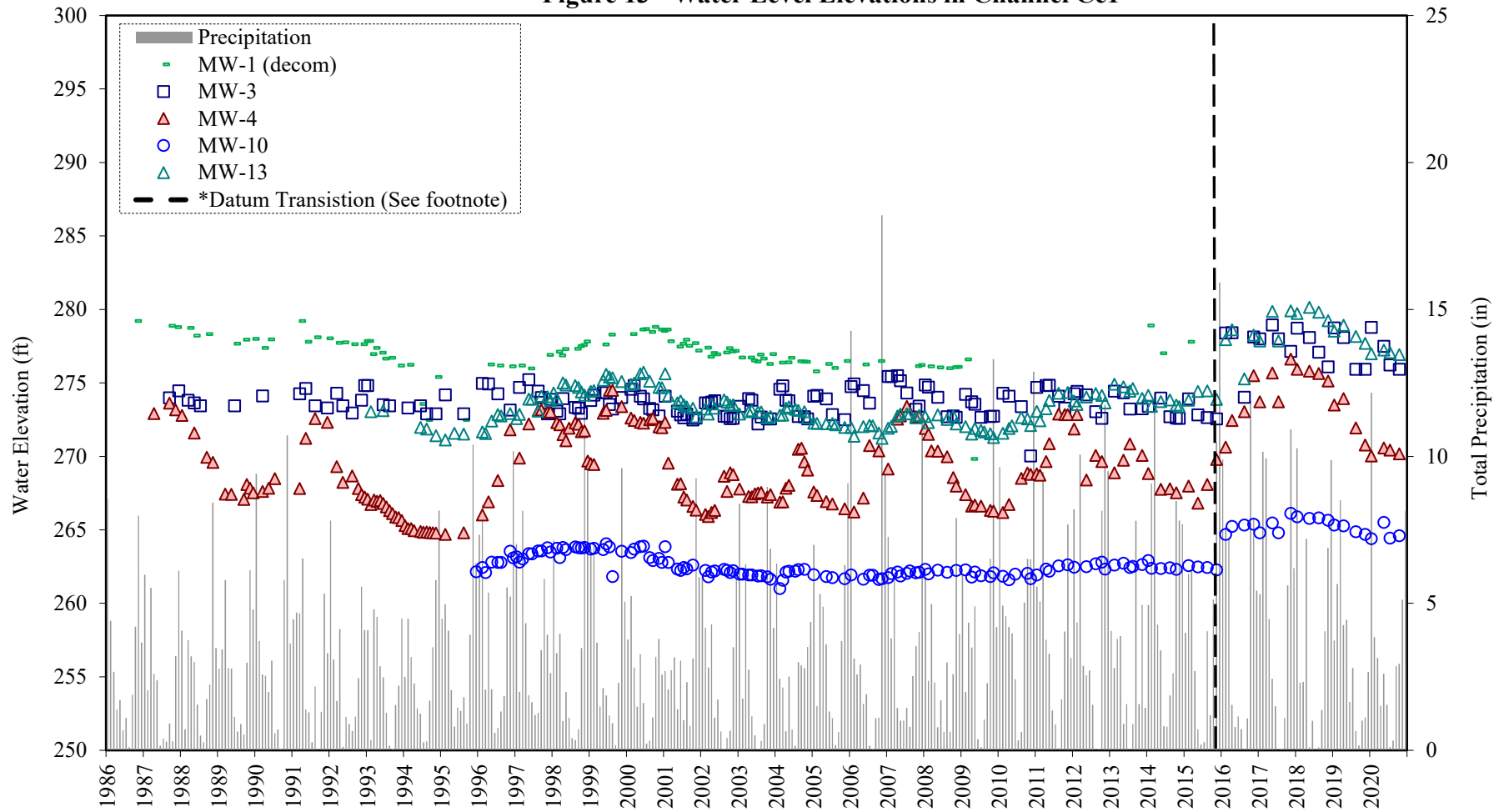


Figure 14 - Water Level Elevations in Channel Cc2

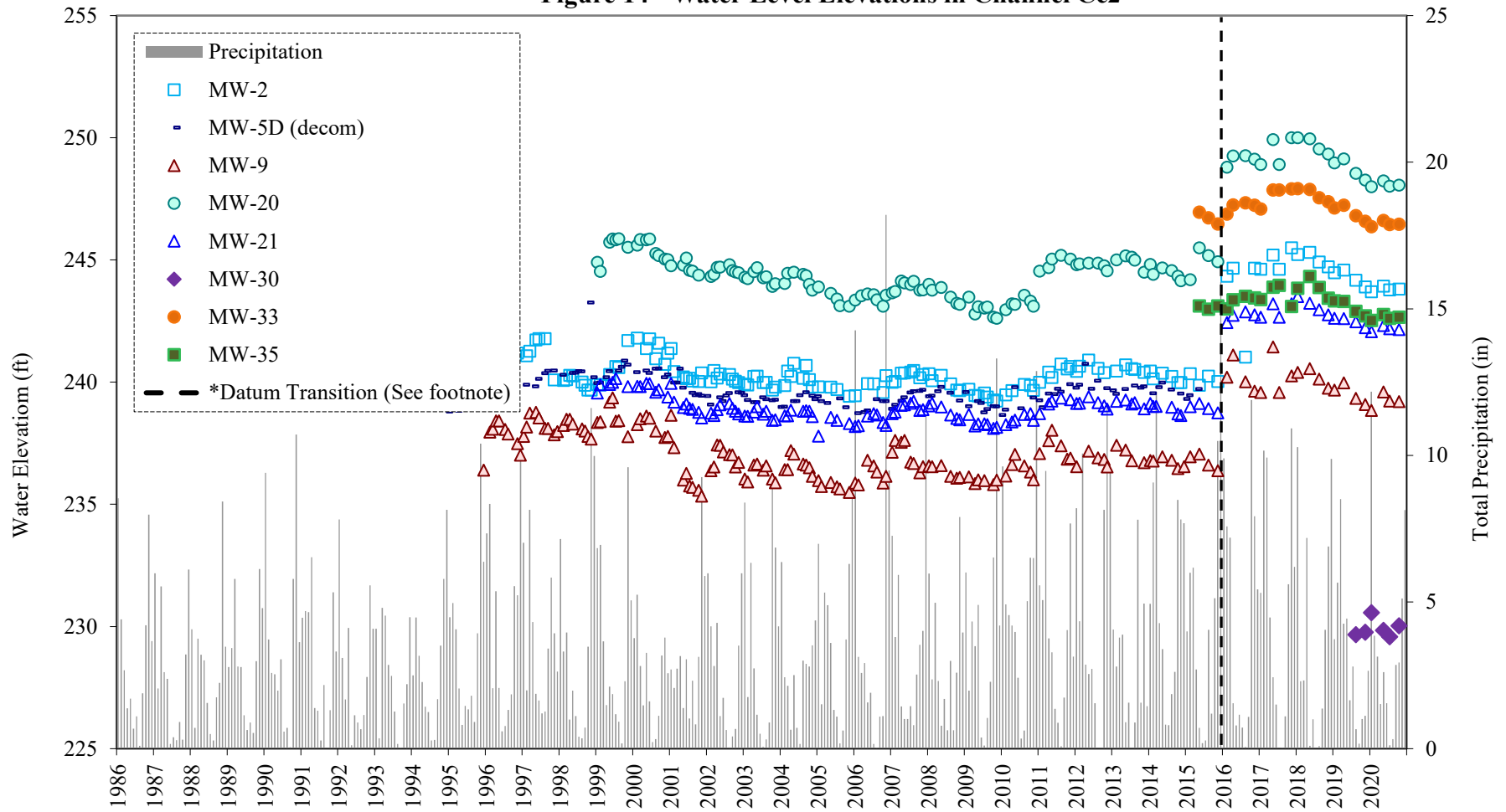


Figure 15 - Water Level Elevations in Channel Cc3

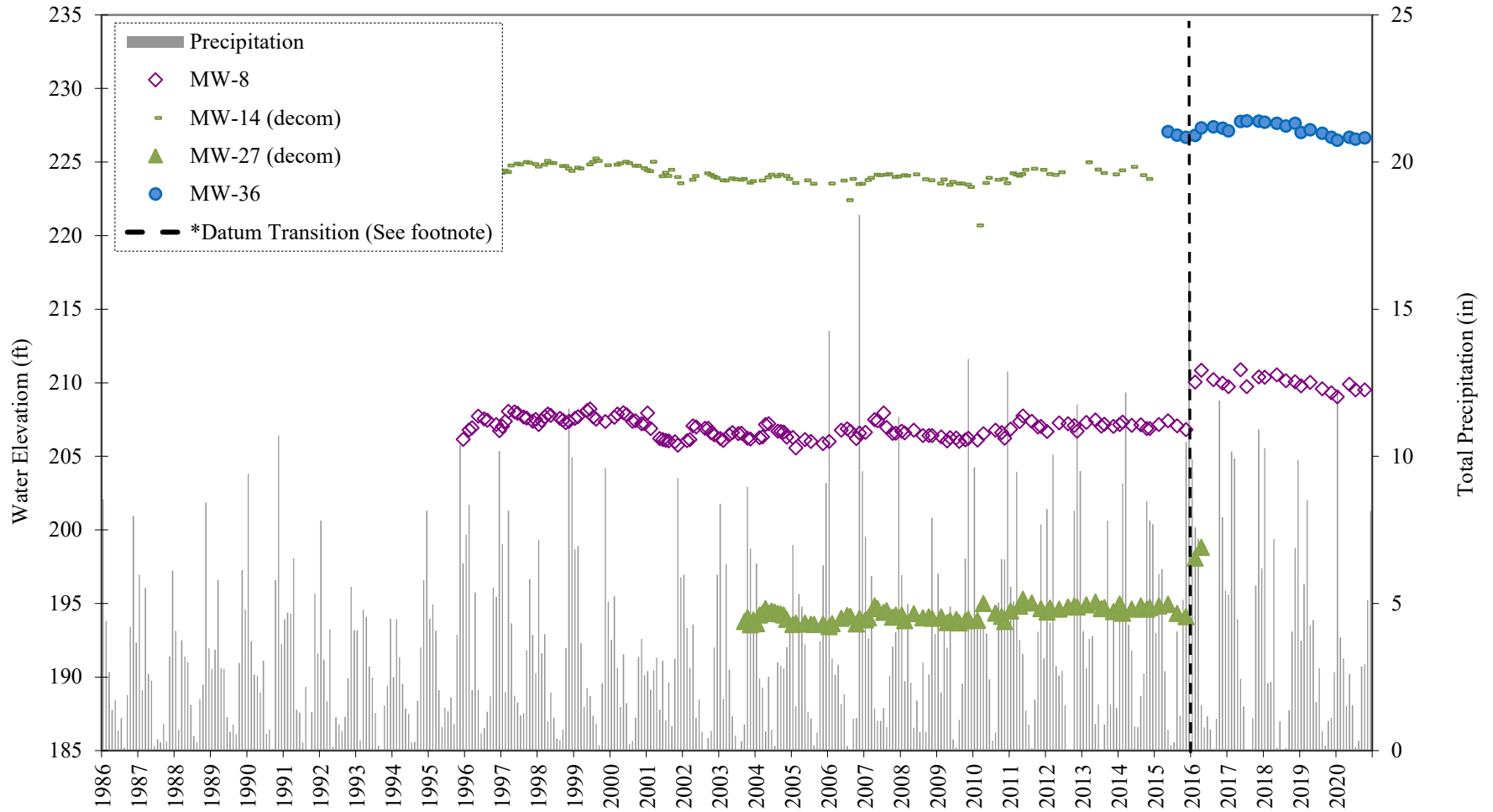
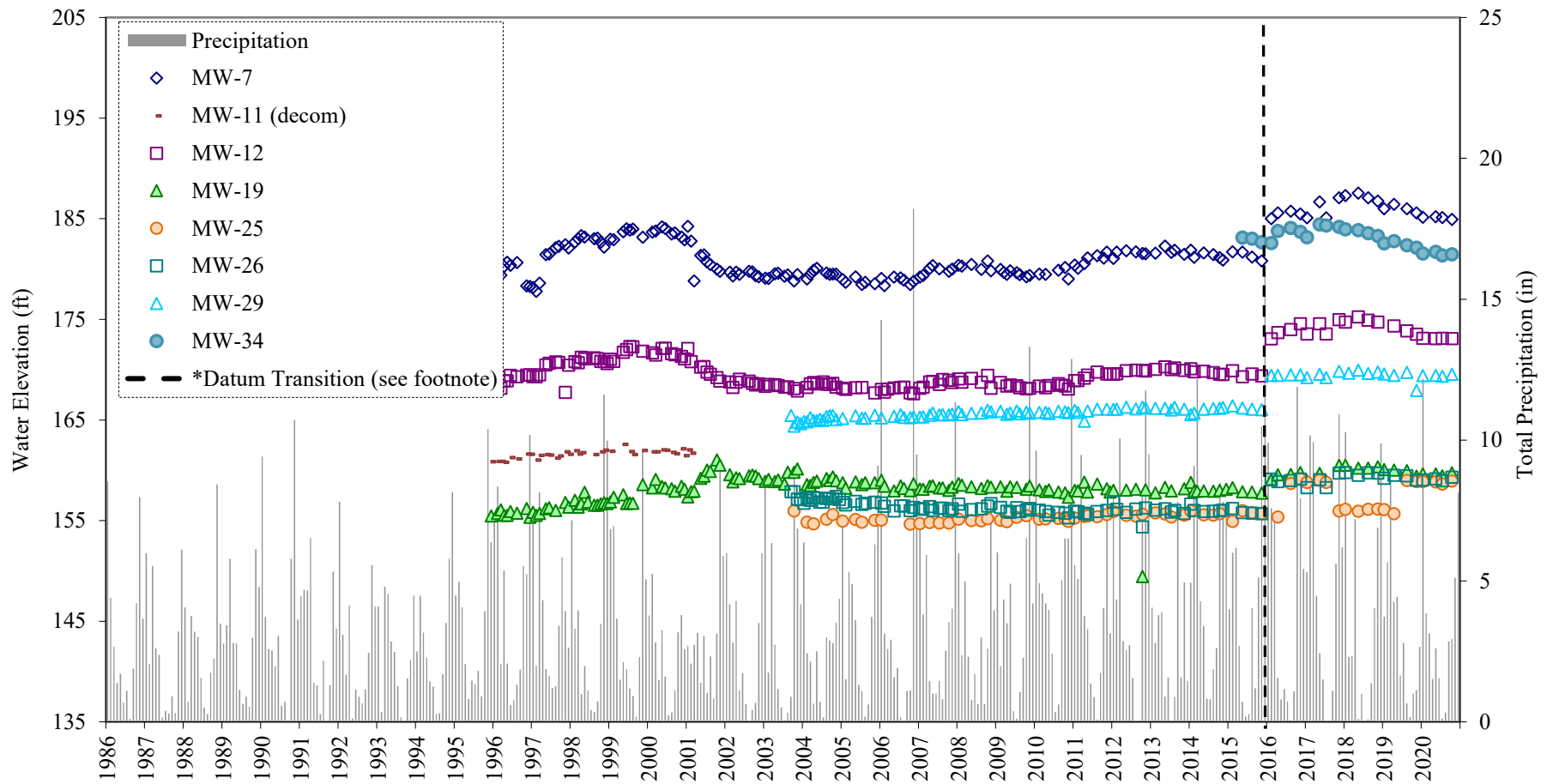


Figure 16 - Water Level Elevations in Unit D Aquifer



**Table 2-1  
Significant Maintenance Activities Summary 2020**

<b>Maintenance Activity</b>	<b>Resolution</b>
Landfill Gas Blower Maintenance	The landfill gas blower was sent in for repairs, due to the fan moving out of position, causing a lot of noise. It was determine due to the repair needs and the age of the blower to replace the blower with two direct drive blowers running in parallel. The installation of these blowers will be completed in second quarter of 2021.
Leachate Box Lid	Sampling location LS-LVT is accessed through a hinged vault lid. The hinged on the vault had been broken and was repaired during 2020.
Groundwater Monitoring Well Lids	Well lids were replaced for MW-3, MW-4, MW-8, and MW-10. The steel casing was extended for MW-3 and MW-4. The lid was modified for MW-20 to prevent bees from entering.
Leachate Lagoon Liner Testing/Liner Flap Installation	The leachate lagoon liner was tested in 2020, in accordance with the requirement to test surface impoundment every five years in WAC 173-350-340. The test was unsuccessful due to damage to the liner beneath the perimeter road. The damaged liner was repaired and a flap was installed for accessibility during future tests. The liner will be retested and results will be submitted to Public Health - Seattle/King County and Washington State Department of Ecology by June 30, 2021.

**Table 2-2  
Vashon Island Closed Landfill Groundwater Monitoring Well Completion Details**

Well Number	Date Completed	Installed By	Top of PVC Casing Elevation (feet) <sup>a</sup>	Well Casing and Screen	Well Dia. (inches)	Screen slot (inches)	Top of Screen Elevation <sup>b</sup>	Bottom of Screen Elevation <sup>b</sup>	Top of Seal Elevation <sup>b</sup>	Bottom of Seal Elevation <sup>b</sup>	Seal Type	Top of Sand Pack (feet elev.) <sup>b</sup>	Bottom of Sand Pack (feet elev.) <sup>b</sup>	Sand Type	Reference <sup>c</sup>
MW-1 <sup>d</sup>	8/9/1983	Sweet- Edwards	407.06	Sch 80 PVC	3	0.010	287.94	277.94	405.94	292.94	Bentonite	292.94	275.94	3/8 minus pea gravel	A
MW-2	9/9/1983	Sweet- Edwards	318.09	Sch 80 PVC	3	0.010	237.39	232.39	316.39	250.39	Bentonite	248.39	231.39	3/8 minus pea gravel	A
MW-3	12/9/1983	Sweet- Edwards	318.12	Sch 80 PVC	3	0.010	281.15	276.15	316.15	284.15	Bentonite	284.15	276.15	3/8 minus pea gravel	A
MW-4	9/14/1983	Sweet- Edwards	377.30	Sch 80 PVC	3	0.010	276.17	266.17	376.17	281.17	Bentonite	281.17	266.17	3/8 minus pea gravel	A
MW-5S <sup>d</sup>	6/3/1986	Golder	360.09	Sch 40 PVCb	2	0.020	285.32	275.32	359.32	356.32	Bentonite	356.32	274.82	#8 Monterey & Gravel	B
MW-5D <sup>d</sup>	6/3/1986	Golder	360.66	Sch 40 PVCb	2	0.020	244.32	233.32	258.82	253.32	Bentonite	257.32	233.32	#8 Monterey & Gravel	B
MW-6S <sup>d</sup>	3/19/1986	Golder	397.7	Sch 40 PVCb	2	0.020	290.88	280.88	395.88	392.88	Bentonite	392.88	279.88	#8 Aqua and Gravel	B
MW-6D <sup>d</sup>	3/19/1986	Golder	397.6	Sch 40 PVCb	2	0.020	245.38	235.38	259.88	253.88	Bentonite	247.88	234.88	#8 Aqua	B
MW-7	4/28/1995	CH2M HILL	376.56	Sch 40 PVC	2	0.010	154.40	144.40	374.40	157.40	Bentonite	157.40	142.40	#20 x 40	C
MW-8	6/30/1995	CH2M HILL	386.13	Sch 40 PVC	2	0.010	215.95	205.95	383.95	216.95	Bentonite	216.95	203.95	#20 x 40	C
MW-9	12/6/1995	CH2M HILL	405.32	Sch 40 PVC	2	0.010	236.39	226.39	403.39	239.39	Bentonite	239.39	223.39	#20 x 40	C
MW-10	1/7/1995	CH2M HILL	410.21	Sch 40 PVC	2	0.010	265.04	255.04	408.04	268.04	Bentonite	268.04	253.04	#20 x 40	C
MW-11 <sup>d</sup>	5/15/1995	CH2M HILL	409.85	Sch 40 PVC	2	0.010	165.74	155.74	407.74	167.74	Bentonite	167.74	147.74	#20 x 40	C
MW-12	5/26/1995	CH2M HILL	315.67	Sch 40 PVC	2	0.010	142.90	132.90	313.40	146.40	Bentonite	146.40	127.40	#20 x 40	C
MW-13	4/22/1992	Terra	377.37	Sch 40 PVC	2	0.020	267.30	262.30	375.30	269.30	Bentonite	269.30	259.80	#8	D
MW-14 <sup>d</sup>	6/21/1995	CH2M HILL	379.14	Sch 40 PVC	2	0.020	216.08	206.08	377.08	223.08	Bentonite	223.08	205.08	#20 x 40	C
MW-19	12/6/1995	CH2M HILL	405.58	Sch 40 PVC	2	0.020	142.85	132.85	402.35	142.35	Bentonite	142.35	126.35	#20 x 40	C
MW-20	10/21/1998	UES	370.43	Sch 40 PVC	2	0.020	240.79	236.49	368.49	244.09	Bentonite	244.09	234.49	#20 x 40	E
MW-21	10/21/1998	UES	348.95	Sch 40 PVC	2	0.020	246.46	237.06	347.06	252.06	Bentonite	252.06	236.06	#20 x 40	E
MW-24	4/27/1992	Terra	377.53	Sch 40 PVC	2	0.020	294.96	284.96	375.46	298.46	Bentonite	298.46	285.46	#8	D
MW-25	11/8/2003	UES	402.48	Sch 80 PVC	4	0.020	152.04	137.94	400.54	155.54	Bentonite	155.54	133.54	#16 x 30	F
MW-26	6/8/2003	UES	406.58	Sch 80 PVC	4	0.020	158.30	144.20	404.40	162.10	Bentonite	162.10	140.70	#16 x 30	F
MW-27 <sup>d</sup>	8/15/2003	UES	386.34	Sch 80 PVC	4	0.020	197.55	183.35	384.05	200.55	Bentonite	200.55	180.55	#16 x 30	F
MW-28	8/29/2003	UES	398.72	Sch 80 PVC	4	0.020	177.04	162.64	396.64	180.14	Bentonite	180.14	160.84	#16 x 30	F
MW-29	8/29/2003	UES	413.79	Sch 80 PVC	4	0.020	173.02	158.22	411.22	175.22	Bentonite	175.22	150.22	#16 x 30	G
MW-33	3/13/2015	Aspect Consulting	359.77	Sch 40 PVC	4	0.020	229.78	219.78	357.07	232.90	Bentonite	232.90	217.82	10 x 20 Colorado Silica	I
MW-34	3/26/2015	Aspect Consulting	385.88	Sch 40 PVC	4	0.020	147.96	137.96	383.26	151.26	Bentonite	151.26	135.76	10 x 20 Colorado Silica	I
MW-35	3/18/2015	Aspect Consulting	361.47	Sch 40 PVC	4	0.020	244.25	233.35	358.75	247.25	Bentonite	247.25	233.55	10 x 20 Colorado Silica	I
MW-36	4/2/2015	Aspect Consulting	378.24	Sch 40 PVC	4	0.020	221.25	211.25	375.25	223.25	Bentonite	223.25	210.25	10 x 20 Colorado Silica	I
P-1S <sup>d</sup>	12/3/1986	Golder	No data	Sch 40 PVC	2	0.020	307.46	297.46	396.46	393.46	Bentonite	393.46	291.46	#8 Aqua and Gravel	B
P-1D <sup>d</sup>	12/3/1986	Golder	No data	Sch 40 PVC	2	0.020	281.96	271.96	291.46	286.46	Bentonite	286.46	271.46	#8 Aqua	B
P-1A <sup>d</sup>	3/25/1986	Golder	No data	Sch 40 PVC	2	0.020	283.48	273.48	357.48	289.48	Bentonite	289.48	272.48	#8 Monterey	B
P-1B <sup>d</sup>	3/29/1986	Golder	No data	Sch 40 PVC	2	0.020	302.54	292.54	383.54	307.54	Bentonite	307.54	292.54	10 x 20 silica	B
P-2 <sup>d</sup>	3/19/1986	Golder	No data	Sch 40 PVC	2	0.020	277.19	262.19	287.19	282.19	Bentonite	282.19	260.19	#8 Aqua	B
P-2A <sup>d</sup>	3/24/1986	Golder	No data	Sch 40 PVC	2	0.020	297.06	285.06	352.06	310.06	Bentonite	310.06	283.56	#8 Aqua	B
P-4	2/29/1988	Golder	No data	Sch 80 PVC	1	0.020	378.36	376.36	410.86	380.36	Bentonite	380.36	375.36	#16 Monterey	H

<sup>a</sup>All survey data in feet are relative to site NAVD88 datum.

<sup>b</sup>Well installed as a dual-completion.

<sup>c</sup>A = R.W. Beck, 1984; B = Golder Associates, 1986; C = CH2M HILL, 1996; D = Terra Associates., 1992; E = B&H and UES, 1999b; F = B&H and UES, 2003b; G = B&H and UES, 2003a; H = Golder Associates, 1986; I = Aspect Consulting, 2015.

<sup>d</sup>Well has been decommissioned.

<b>Formation <sup>b</sup></b>	<b>Depositional Facies</b>	<b>Sediment Type</b>	<b>Approximate Elevations at Vashon Island Closed Landfill Site</b>
Unit A: Vashon glacial till - fine grained (Qvt)	Vashon glacial till	The till ranges in thickness from 15 to 50 feet, except where it has been eroded or removed by landfill-related activities. The unit mainly consists gravelly, silty sand soils.	Occurs as surficial deposit in all portions of the site except where absent by erosion. The base of the till varies from elevations of about 405 feet in the northeast to about 350 feet in the south. In general, till is absent below about 330 feet.
Unit B: Advance outwash sand - coarse grained (Qva)	Advance outwash	Approximately 40 to 50 foot-thick deposit of an advance outwash sand.	Occurs beneath entire site directly beneath till or as surficial unit in areas where till is absent by erosion. Basal contact elevation ranges from 370 to 280 feet.
Unit C: Glacial deposit - variable coarse & fine grained (Qob, Qpdc, and Qpff)	Pre-Fraser Glaciation Deposits, Fine-Grained Facies, Olympia Beds, and Possession Drift, Coarse-Grained Facies	Approximately 100 to 120 foot-thick sequence. Fine-grained portions of Unit C consist of interbedded sandy silts, silts, and clays. Incised within the fine-grained soil are coarser sand deposits. Three significant extensive channel deposits have been identified within this unit (i.e. Cc1, Cc2, and Cc3) with limited hydraulic interconnection between them.	Occurs beneath entire site at elevations of about 304 to about 150 feet. Where fully penetrated, the basal contact elevation ranges from 181 to 191 feet.
Unit D: Fluvial sands and gravels with fine-grained overbank deposits (Qwbc)	Whidbey Beds, Coarse-Grained Facies	Fluvial deposits exhibiting a wide range in texture consistent with varying energy in a fluvial environment. Textures range from sandy gravel channel deposits to fine-grained overbank deposits, and the unit exhibits a corresponding range of hydraulic properties. Thickness of Unit D ranges from about 25 to 65 feet.	Occurs beneath the entire site at elevations of about 115 to 200 feet. Where fully penetrated, the basal contact elevation ranges from 125 to 134 feet.
Unit E: Lacustrine silt - fine grained (Qwb and/ or Qwbc)	Whidbey Beds, Undifferentiated or Coarse-Grained Facies	Mainly comprised of silt and acts as an aquitard between the water-bearing fluvial deposits in Unit D and Unit F. A lacustrine unit with its thickness of approximately 40 feet, Unit D and is thought to be continuous beneath the site.	Occurs at elevations of 90 to 160 feet, apparently beneath most of the site.
Unit F: Fluvial sands and gravels with fine-grained overbank deposits (Qwb)	Whidbey Beds, Undifferentiated	The thickness of Unit F varies from 30 to over 90 feet. The unit consists of Pre-Vashon fluvial deposits of widely varying texture, similar to those of Unit D	Occurs at elevations below about 90 to 130 feet beneath all portions of the site.
Unit G: Clay - fine grained (Qwb)	Whidbey Beds, Undifferentiated	More than 50-foot-thick deposit of dark gray, varved clay	Occurs at elevations below about 0 to 75 feet.

<sup>a</sup> – Remedial Investigation Report (2018);

<sup>b</sup> - Assignments to classifications derived from Booth (1991) are queried where tentative.



**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
 Vashon Island Closed Landfill  
 1986 through 2020

Well Location Time Interval	Channel Cc1						
	MW-3 Long	MW-4		MW-10		MW-13	
	Long	Long	Short	Long	Short	Long	Short
<b>pH, Field [standard units]</b>							
No. of Analyses	32	43	8	93	8	98	8
No. of Detections	32	43	8	93	8	98	8
Minimum	5.44	5.94	6.32	6.75	6.84	6.70	6.70
Maximum	6.82	7.97	6.90	8.42	7.39	7.96	7.99
Mean	6.09	6.52	6.60	7.37	7.16	7.21	7.13
Standard Deviation	0.34	0.34	0.24	0.29	0.19	0.23	0.39
Median	6.11	6.44	6.565	7.37	7.17	7.21	7.055
<b>Specific Conductance, Field [umhos/cm]</b>							
No. of Analyses	32	43	8	93	8	97	8
No. of Detections	32	43	8	93	8	97	8
Minimum	60.5	160.2	149.5	100.0	133.7	130.0	133.7
Maximum	200.0	860.0	221.1	158.8	148.2	195.0	166.4
Mean	108.4	509.7	176.4	131.2	145.5	160.8	152.6
Standard Deviation	29.1	197.6	28.1	11.9	4.8	14.7	11.8
Median	100	496	166.95	130	147.1	160.1	158.1
<b>Alkalinity [mg/L]</b>							
No. of Analyses	25	22	8	93	8	95	8
No. of Detections	25	22	8	93	8	95	8
Minimum	18.9	40.3	37.8	52	55.1	30	58.1
Maximum	41	320	66.5	70	57.7	80	64.2
Mean	27.63	168.90	51.51	56.71	56.45	63.86	61.46
Standard Deviation	5.68	108.47	10.86	2.81	0.82	7.53	2.45
Median	27.7	190	50.95	56	56.55	64	61.9
<b>Ammonia-N [mg/L]</b>							
No. of Analyses	31	55	8	93	8	100	8
No. of Detections	11	23	1	14	1	11	1
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	0.65	0.332	0.0028	0.06	0.0028	0.07	0.0022
Mean	0.102	0.051	ID	0.010	ID	0.009	ID
Standard Deviation	0.196	0.073	ID	0.011	ID	0.011	ID
Median	0.005	0.025	ID	0.005	ID	0.005	ID
<b>Chloride [mg/L]</b>							
No. of Analyses	32	55	8	93	8	100	8
No. of Detections	32	53	8	92	8	100	8
Minimum	0.941	ND	7.01	ND	3.14	2.5	2.62
Maximum	11	19	10.9	30.9	3.43	10.6	3.02
Mean	2.60	8.94	8.69	3.39	3.27	3.51	2.86
Standard Deviation	2.21	4.23	1.41	2.91	0.09	1.03	0.15
Median	2	7.84	8.385	3	3.28	3.09	2.915
<b>Nitrate-N [mg/L]</b>							
No. of Analyses	32	55	8	93	8	100	8
No. of Detections	32	30	8	93	8	99	8
Minimum	0.2	ND	1.54	0.21	0.457	ND	0.185
Maximum	5.53	6.3	2.45	0.84	0.702	0.28	0.407
Mean	1.825	1.284	1.941	0.410	0.589	0.105	0.284
Standard Deviation	1.362	1.832	0.301	0.120	0.098	0.053	0.076
Median	1.3	0.1	1.945	0.388	0.6105	0.08635	0.257
<b>Sulfate [mg/L]</b>							
No. of Analyses	32	55	8	93	8	99	8
No. of Detections	32	55	8	93	8	99	8
Minimum	4.7	3.7	10.8	2.6	8.5	12.2	8.39
Maximum	19	46	19	11	9.37	26.81	13.7
Mean	9.8	17.3	14.5	9.5	8.9	18.5	11.3
Standard Deviation	4.0	9.2	2.6	0.9	0.3	2.6	1.8
Median	9.13	15	14.25	9.66	8.885	19	11.45
<b>Total Dissolved Solids [mg/L]</b>							
No. of Analyses	27	40	8	92	8	99	8
No. of Detections	27	40	8	92	8	99	8
Minimum	8	29	127	46	94.7	68	101
Maximum	90	500	185	130	115	150	119
Mean	66	322	146	97	106	116	113
Standard Deviation	16	124	20	13	6	14	6
Median	68	340	138.5	99	105.5	119	115.5

**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location Time Interval	Channel Cc1						
	MW-3	MW-4		MW-10		MW-13	
	Long	Long	Short	Long	Short	Long	Short
<b>Arsenic, Dissolved [mg/L]</b>							
No. of Analyses	32	55	8	93	8	100	8
No. of Detections	3	12	8	92	8	99	8
Minimum	ND	ND	0.000313	ND	0.0015	ND	0.00177
Maximum	0.007	0.006	0.000403	0.002	0.00165	0.003	0.00222
Mean	0.00085	0.00122	0.00035	0.00161	0.00159	0.00180	0.00202
Standard Deviation	0.00134	0.00114	0.00003	0.00034	0.00006	0.00030	0.00015
Median	0.0005	0.0005	0.000365	0.00165	0.00159	0.001865	0.00203
<b>Arsenic, Total [mg/L]</b>							
No. of Analyses	10	7	8	21	8	24	8
No. of Detections	7	6	8	21	8	24	8
Minimum	ND	ND	0.00033	0.00147	0.00153	0.00155	0.00187
Maximum	0.0005	0.000623	0.000406	0.00175	0.00171	0.00219	0.00222
Mean	0.00022	0.00042	0.00036	0.00158	0.00160	0.00183	0.00204
Standard Deviation	0.00020	0.00010	0.00003	0.00008	0.00006	0.00019	0.00013
Median	0.00012	0.000366	0.000365	0.00156	0.001595	0.00184	0.002045
<b>Calcium, Dissolved [mg/L]</b>							
No. of Analyses	26	32	8	93	8	100	8
No. of Detections	26	32	8	93	8	100	8
Minimum	6.02	11.1	11.8	4.3	9.37	6.5	8.47
Maximum	11	73.6	17.8	13	10.1	11.5	10.4
Mean	8.8	44.5	13.8	9.0	9.8	9.4	9.4
Standard Deviation	1.2	22.7	2.4	1.0	0.2	0.9	0.6
Median	9.05	46	12.8	9	9.86	9.53	9.295
<b>Calcium, Total [mg/L]</b>							
No. of Analyses	10	7	8	21	8	24	8
No. of Detections	10	7	8	21	8	24	8
Minimum	5.91	11.2	11.7	8.23	9.47	8.41	8.21
Maximum	9.67	17.2	17.7	11.2	10.1	11.5	10.4
Mean	8.08	12.51	13.95	9.49	9.82	9.79	9.32
Standard Deviation	1.18	2.11	2.22	0.79	0.19	0.82	0.70
Median	8.4	11.7	13.1	9.33	9.87	9.76	9.265
<b>Iron, Dissolved [mg/L]</b>							
No. of Analyses	32	55	8	93	8	100	8
No. of Detections	21	40	0	55	0	63	2
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	8.6	0.5	ND	0.3	ND	0.49	0.0124
Mean	0.89	0.08	ID	0.03	ID	0.03	ID
Standard Deviation	2.24	0.11	ID	0.05	ID	0.06	ID
Median	0.0325	0.04	ID	0.012	ID	0.018	ID
<b>Iron, Total [mg/L]</b>							
No. of Analyses	10	7	8	21	8	24	8
No. of Detections	10	7	6	16	2	24	5
Minimum	0.0236	0.016	ND	ND	ND	0.011	ND
Maximum	0.353	0.335	0.035	0.041	0.025	2.18	0.0348
Mean	0.148	0.087	0.017	0.014	ID	0.173	0.016
Standard Deviation	0.105	0.113	0.012	0.008	ID	0.438	0.012
Median	0.143	0.0554	0.0135	0.012	ID	0.05085	0.01065
<b>Magnesium, Dissolved [mg/L]</b>							
No. of Analyses	26	32	8	93	8	100	8
No. of Detections	26	32	8	93	8	100	8
Minimum	1.8	8.08	8.03	4.2	9.15	7.7	10.2
Maximum	3.1	56.8	12.2	12	9.73	14	12.1
Mean	2.41	33.85	9.30	8.33	9.43	10.68	11.06
Standard Deviation	0.29	17.31	1.67	0.97	0.20	1.22	0.75
Median	2.4	36.5	8.43	8.2	9.42	10.5	11
<b>Magnesium, Total [mg/L]</b>							
No. of Analyses	10	7	8	21	8	24	8
No. of Detections	10	7	8	21	8	24	8
Minimum	2.2	8.86	7.75	8.04	9.24	9.63	9.99
Maximum	2.94	11.9	12.3	10.9	9.95	13.6	12.2
Mean	2.54	9.59	9.50	9.30	9.48	11.57	11.04
Standard Deviation	0.22	1.06	1.70	0.82	0.23	1.20	0.73
Median	2.515	9.14	8.96	9.05	9.435	11.35	11.15

**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location Time Interval	Channel Cc1						
	MW-3 Long	MW-4 Long Short		MW-10 Long Short		MW-13 Long Short	
<b>Manganese, Dissolved [mg/L]</b>							
No. of Analyses	32	55	8	93	8	100	8
No. of Detections	25	48	8	9	2	61	6
Minimum	ND	ND	0.000188	ND	ND	ND	ND
Maximum	2.7	0.97	0.0047	0.0032	0.000284	0.027	0.00307
Mean	0.3048	0.1606	0.0014	0.0006	ID	0.0027	0.0009
Standard Deviation	0.8056	0.2162	0.0017	0.0004	ID	0.0042	0.0012
Median	0.0018	0.0700	0.0009	0.0005	ID	0.0010	0.0004
<b>Manganese, Total [mg/L]</b>							
No. of Analyses	10	7	8	21	8	24	8
No. of Detections	10	7	8	12	8	21	8
Minimum	0.0015	0.0014	0.0039	ND	0.0001	ND	0.0002
Maximum	0.0357	0.1690	0.0228	0.0019	0.0009	0.0650	0.0024
Mean	0.0099	0.0410	0.0135	0.0007	0.0003	0.0084	0.0010
Standard Deviation	0.0109	0.0635	0.0081	0.0005	0.0003	0.0131	0.0009
Median	0.0046	0.0070	0.0137	0.0005	0.0002	0.0050	0.0006
<b>Potassium, Dissolved [mg/L]</b>							
No. of Analyses	26	32	8	93	8	100	8
No. of Detections	26	32	8	93	8	100	8
Minimum	1.39	0.88	0.913	0.65	1.39	1.1	1.63
Maximum	4.1	2.7	1.14	2	1.51	2.24	1.87
Mean	2.89	1.73	0.99	1.36	1.47	1.70	1.76
Standard Deviation	0.77	0.52	0.08	0.15	0.04	0.17	0.08
Median	2.85	1.75	0.9465	1.36	1.485	1.7	1.75
<b>Potassium, Total [mg/L]</b>							
No. of Analyses	10	7	8	21	8	24	8
No. of Detections	10	7	8	21	8	24	8
Minimum	1.39	0.975	0.901	1.28	1.41	1.48	1.55
Maximum	2.8	1.17	1.13	1.65	1.53	2.5	1.86
Mean	2.19	1.08	1.01	1.49	1.48	1.85	1.72
Standard Deviation	0.53	0.07	0.08	0.09	0.04	0.18	0.10
Median	2.26	1.09	1.01	1.49	1.49	1.84	1.74
<b>Sodium, Dissolved [mg/L]</b>							
No. of Analyses	26	32	8	93	8	100	8
No. of Detections	26	32	8	93	8	100	8
Minimum	2.4	5.4	5.74	2.3	4.9	4.9	5.78
Maximum	7.1	24.8	7.56	6.4	5.34	14.4	6.42
Mean	4.6	13.6	6.5	4.6	5.1	6.0	6.1
Standard Deviation	1.2	6.1	0.8	0.5	0.2	1.0	0.2
Median	4.57	13	6.045	4.57	5.14	5.885	6.145
<b>Sodium, Total [mg/L]</b>							
No. of Analyses	10	7	8	21	8	24	8
No. of Detections	10	7	8	21	8	24	8
Minimum	2.34	6.21	5.84	4.41	4.92	5.4	5.87
Maximum	7.73	7.45	7.71	5.72	5.3	15.8	6.56
Mean	4.44	6.91	6.62	5.01	5.14	6.55	6.19
Standard Deviation	1.78	0.38	0.73	0.36	0.14	2.02	0.24
Median	4.11	6.99	6.495	4.93	5.17	6.21	6.175

**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location Time Interval	Channel Cc1						
	MW-3 Long	MW-4 Long Short		MW-10 Long Short		MW-13 Long Short	
<b>1,1-Dichloroethane [ug/L]</b>							
No. of Analyses	32	55	8	93	8	100	8
No. of Detections	0	17	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	5	ND	ND	ND	ND	ND
Mean	ID	0.48	ID	ID	ID	ID	ID
Standard Deviation	ID	0.67	ID	ID	ID	ID	ID
Median	ID	0.5	ID	ID	ID	ID	ID
<b>1,2-Dichloropropane [ug/L]</b>							
No. of Analyses	32	55	8	93	8	100	8
No. of Detections	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID
<b>Benzene [ug/L]</b>							
No. of Analyses	32	55	8	93	8	100	8
No. of Detections	0	0	0	1	0	1	0
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	0.28	ND	0.22	ND
Mean	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID
<b>Chloroethane [ug/L]</b>							
No. of Analyses	32	55	8	93	8	100	8
No. of Detections	0	6	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	5	ND	ND	ND	ND	ND
Mean	ID	0.983	ID	ID	ID	ID	ID
Standard Deviation	ID	1.065	ID	ID	ID	ID	ID
Median	ID	0.82	ID	ID	ID	ID	ID
<b>cis - 1,2-Dichloroethene [ug/L]</b>							
No. of Analyses	29	42	8	93	8	100	8
No. of Detections	0	16	7	0	0	1	0
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	16	1.28	ND	ND	0.79	ND
Mean	ID	1.134	0.342	ID	ID	ID	ID
Standard Deviation	ID	2.561	0.417	ID	ID	ID	ID
Median	ID	0.5	0.1285	ID	ID	ID	ID
<b>Dichlorodifluoromethane [ug/L]</b>							
No. of Analyses	25	23	8	93	8	95	8
No. of Detections	0	12	0	0	0	1	0
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	5	ND	ND	ND	1.5	ND
Mean	ID	1.263	ID	ID	ID	ID	ID
Standard Deviation	ID	1.440	ID	ID	ID	ID	ID
Median	ID	0.87	ID	ID	ID	ID	ID

**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location Time Interval	Channel Cc1						
	MW-3 Long	MW-4 Long Short		MW-10 Long Short		MW-13 Long Short	
<b>Toluene [ug/L]</b>							
No. of Analyses	32	55	8	93	8	100	8
No. of Detections	0	0	0	1	0	1	0
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	0.35	ND	0.78	ND
Mean	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID
<b>trans -1,2-Dichloroethene [ug/L]</b>							
No. of Analyses	31	47	8	93	8	100	8
No. of Detections	0	1	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	5	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID
<b>Trichloroethene [ug/L]</b>							
No. of Analyses	32	55	8	93	8	100	8
No. of Detections	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID
<b>Trichlorofluoromethane [ug/L]</b>							
No. of Analyses	26	33	8	93	8	100	8
No. of Detections	14	26	0	1	0	1	0
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	0.67	5	ND	0.2	ND	1	ND
Mean	0.219	0.996	ID	ID	ID	ID	ID
Standard Deviation	0.164	0.963	ID	ID	ID	ID	ID
Median	0.219	0.9	ID	ID	ID	ID	ID
<b>Vinyl Chloride [ug/L]</b>							
No. of Analyses	32	55	8	93	8	100	8
No. of Detections	0	23	0	1	0	1	0
Minimum	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	19	ND	0.02	ND	0.1	ND
Mean	ID	3.268	ID	ID	ID	ID	ID
Standard Deviation	ID	5.029	ID	ID	ID	ID	ID
Median	ID	0.5	ID	ID	ID	ID	ID

**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location Time Interval	Channel Cc2											
	MW-2		MW-9		MW-20		MW-21		MW-33		MW-35	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
<b>pH, Field [standard units]</b>												
No. of Analyses	148	8	96	8	81	8	82	8	15	8	15	8
No. of Detections	148	8	96	8	81	8	82	8	15	8	15	8
Minimum	6.06	6.50	6.55	6.72	6.57	6.87	6.41	6.59	6.32	6.63	6.37	6.39
Maximum	7.75	7.22	7.98	7.31	8.56	7.58	8.24	7.02	6.87	6.89	6.91	6.78
Mean	6.86	6.94	7.33	7.06	7.80	7.40	6.88	6.83	6.69	6.73	6.69	6.62
Standard Deviation	0.24	0.24	0.25	0.21	0.44	0.24	0.25	0.17	0.15	0.10	0.16	0.13
Median	6.9	6.95	7.35	7.08	7.88	7.515	6.87	6.9	6.75	6.705	6.71	6.65
<b>Specific Conductance, Field [umhos/cm]</b>												
No. of Analyses	148	8	96	8	82	8	82	8	15	8	15	8
No. of Detections	148	8	96	8	82	8	82	8	15	8	15	8
Minimum	230.0	292.7	110.0	165.9	140.0	172.4	200.0	266.9	748.0	608.4	587.6	569.0
Maximum	1024.0	332.3	209.9	195.7	242.1	205.2	480.0	332.3	921.6	770.3	884.9	749.0
Mean	439.6	308.8	157.2	178.2	177.5	186.7	337.4	289.6	835.6	715.6	753.9	675.9
Standard Deviation	121.9	13.0	20.7	9.6	23.8	11.2	70.0	21.3	46.1	57.9	86.9	52.9
Median	417.5	308	150	175.25	170	189.15	322.85	284	835	730.5	748.5	684.5
<b>Alkalinity [mg/L]</b>												
No. of Analyses	96	8	95	8	81	8	81	8	15	8	15	8
No. of Detections	96	8	95	8	81	8	81	8	15	8	15	8
Minimum	110	136	56	67.5	58.5	70.9	116	122	393	342	331	309
Maximum	500	149	100	73.8	94.9	79.3	290	139	496	398	460	359
Mean	214.05	142.75	67.19	70.35	73.98	73.73	190.43	132.13	439.13	377.25	386.00	336.50
Standard Deviation	56.34	5.01	6.39	2.33	6.47	2.66	48.90	5.87	30.25	20.92	38.74	15.00
Median	212.5	144.5	67	70.15	72	73.45	185	133	435	386.5	385	337
<b>Ammonia-N [mg/L]</b>												
No. of Analyses	153	8	95	8	81	8	80	8	15	8	15	8
No. of Detections	21	5	12	0	49	8	43	8	15	8	15	8
Minimum	ND	ND	ND	ND	ND	0.0137	ND	0.0056	0.0291	0.0152	0.0319	0.0577
Maximum	0.04	0.0088	0.06	ND	0.1	0.0204	0.13	0.0145	0.0651	0.0341	0.0954	0.0707
Mean	0.012	0.003	0.010	ID	0.018	0.016	0.018	0.011	0.036	0.029	0.069	0.066
Standard Deviation	0.009	0.003	0.011	ID	0.013	0.003	0.019	0.003	0.009	0.006	0.013	0.004
Median	0.005	0.00235	0.005	ID	0.015	0.01585	0.015	0.01195	0.0338	0.03155	0.0688	0.06605
<b>Chloride [mg/L]</b>												
No. of Analyses	154	8	95	8	81	8	81	8	15	8	15	8
No. of Detections	151	8	95	8	81	8	81	8	15	8	15	8
Minimum	ND	2.4	3	4.26	3	2.99	2.13	2.01	4.2	3.46	3.83	3.9
Maximum	10.6	2.92	23	4.68	4.3	3.25	15.2	2.44	5.78	3.95	5.97	4.39
Mean	4.31	2.64	4.45	4.43	3.60	3.15	3.95	2.26	4.97	3.74	4.76	4.16
Standard Deviation	1.55	0.19	2.01	0.15	0.36	0.08	1.89	0.17	0.52	0.20	0.77	0.16
Median	4	2.675	4.05	4.385	3.6	3.165	3.8	2.32	4.97	3.84	4.8	4.175
<b>Nitrate-N [mg/L]</b>												
No. of Analyses	154	8	96	8	81	8	81	8	15	8	15	8
No. of Detections	72	6	95	8	14	1	48	8	1	1	1	0
Minimum	ND	ND	ND	0.323	ND	ND	ND	0.176	ND	ND	ND	ND
Maximum	1.25	0.498	1.6	0.512	0.11	0.011	0.555	0.45	0.0426	0.015	0.025	ND
Mean	0.125	0.202	0.259	0.387	0.015	ID	0.084	0.274	ID	ID	ID	ID
Standard Deviation	0.235	0.184	0.254	0.064	0.015	ID	0.091	0.093	ID	ID	ID	ID
Median	0.05	0.191	0.1855	0.369	0.005	ID	0.064	0.254	ID	ID	ID	ID
<b>Sulfate [mg/L]</b>												
No. of Analyses	154	8	95	8	81	8	81	8	15	8	15	8
No. of Detections	154	8	95	8	81	8	81	8	15	8	15	8
Minimum	1.54	12.6	9	10.7	14	15	10	12.5	13.9	15.9	13.8	21.1
Maximum	18.8	15.9	18	12.2	18	16.5	19	15.2	17.4	17.9	22.3	26.4
Mean	12.6	14.3	12.9	11.3	16.1	15.9	14.0	13.7	15.3	17.1	19.2	23.2
Standard Deviation	2.8	1.0	1.3	0.6	1.1	0.6	2.7	0.8	1.0	0.6	2.5	1.9
Median	12	14.25	13	11.2	16	16	13.9	13.55	15.3	17.1	19.7	22.3
<b>Total Dissolved Solids [mg/L]</b>												
No. of Analyses	143	8	95	8	80	8	81	8	15	8	15	8
No. of Detections	143	8	95	8	80	8	81	8	15	8	15	8
Minimum	34	170	58	113	50	127	157	173	445	402	409	404
Maximum	480	201	160	140	160	146	307	192	519	453	539	460
Mean	269	186	113	126	124	135	226	182	491	429	465	426
Standard Deviation	65	10	18	8	18	6	36	7	21	18	32	19
Median	260	184	113	124.5	124	134	230	180.5	495	428.5	467	425

**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location Time Interval	Channel Cc2											
	MW-2		MW-9		MW-20		MW-21		MW-33		MW-35	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
<b>Arsenic, Dissolved [mg/L]</b>												
No. of Analyses	154	8	95	8	81	8	81	8	15	8	15	8
No. of Detections	93	8	94	8	80	8	74	8	15	8	15	8
Minimum	ND	0.00074	ND	0.00224	ND	0.00184	ND	0.000695	0.0327	0.0354	0.0229	0.0279
Maximum	0.004	0.000947	0.003	0.00251	0.005	0.0021	0.023	0.00155	0.0572	0.0421	0.0384	0.0324
Mean	0.00105	0.00082	0.00239	0.00236	0.00175	0.00196	0.00486	0.00121	0.04281	0.03903	0.03103	0.02929
Standard Deviation	0.00062	0.00007	0.00041	0.00008	0.00050	0.00010	0.00585	0.00029	0.00670	0.00236	0.00500	0.00140
Median	0.001	0.0008085	0.00234	0.002345	0.00165	0.001965	0.0019	0.001255	0.0436	0.0393	0.0311	0.02885
<b>Arsenic, Total [mg/L]</b>												
No. of Analyses	24	8	23	8	23	8	23	8	15	8	15	8
No. of Detections	8	8	23	8	23	8	20	8	15	8	15	8
Minimum	ND	0.000701	0.00217	0.00225	0.0013	0.00212	ND	0.00179	0.0323	0.0372	0.0204	0.0289
Maximum	0.0025	0.000926	0.0025	0.00244	0.0044	0.00377	0.00873	0.00413	0.0471	0.0428	0.0404	0.0553
Mean	0.00073	0.00082	0.00230	0.00235	0.00200	0.00278	0.00326	0.00285	0.03986	0.04025	0.02958	0.03359
Standard Deviation	0.00043	0.00007	0.00009	0.00006	0.00072	0.00057	0.00226	0.00080	0.00412	0.00221	0.00610	0.00888
Median	0.0005	0.000815	0.00227	0.002345	0.00167	0.00275	0.00308	0.002555	0.0392	0.0408	0.0282	0.0301
<b>Calcium, Dissolved [mg/L]</b>												
No. of Analyses	129	8	95	8	81	8	81	8	15	8	15	8
No. of Detections	129	8	95	8	81	8	81	8	15	8	15	8
Minimum	4.3	19.5	7.8	12.6	9.1	12.8	16.3	19.3	59.8	57.8	52.1	61.6
Maximum	47.9	22.3	15.8	14.6	18	14.1	40	21.8	77.1	69.1	77.4	72.8
Mean	31.5	21.2	11.9	13.5	12.3	13.3	25.5	20.3	69.6	64.5	62.7	64.6
Standard Deviation	9.6	1.0	1.5	0.8	1.6	0.5	6.1	0.9	4.5	4.2	6.6	3.6
Median	31	21.35	12	13.4	12.4	13.2	25	20.25	70.4	64.15	62.7	63.2
<b>Calcium, Total [mg/L]</b>												
No. of Analyses	23	8	23	8	23	8	23	8	15	8	15	8
No. of Detections	23	8	23	8	23	8	23	8	15	8	15	8
Minimum	18.4	20.4	8.51	12.7	11.5	12.5	16.1	19.4	64.7	60.2	52.8	62
Maximum	27.1	23	16.7	14.3	14.6	13.6	24.9	21	78.7	70	73.2	71.5
Mean	22.46	21.61	13.21	13.50	13.36	13.23	20.37	20.28	72.12	65.38	65.63	65.31
Standard Deviation	2.61	0.96	1.88	0.65	0.92	0.37	2.32	0.62	3.60	3.71	5.16	3.33
Median	23.5	21.75	13.1	13.55	13.7	13.35	20	20.35	72.5	65.45	65	64
<b>Iron, Dissolved [mg/L]</b>												
No. of Analyses	154	8	95	8	81	8	81	8	15	8	15	8
No. of Detections	104	0	50	0	60	8	81	8	15	8	15	8
Minimum	ND	ND	ND	ND	ND	0.183	0.146	0.196	6.51	5.77	10.8	13.3
Maximum	0.89	ND	0.29	ND	0.51	0.332	5.2	0.508	8.19	7.28	16.4	15.9
Mean	0.07	ID	0.03	ID	0.08	0.23	1.46	0.33	7.51	6.66	13.54	14.51
Standard Deviation	0.11	ID	0.05	ID	0.10	0.05	1.27	0.12	0.42	0.46	2.08	1.09
Median	0.0295	ID	0.013	ID	0.0506	0.222	1.03	0.2755	7.53	6.645	13	14.1
<b>Iron, Total [mg/L]</b>												
No. of Analyses	24	8	23	8	23	8	23	8	15	8	15	8
No. of Detections	18	0	18	4	22	8	23	8	15	8	15	8
Minimum	ND	ND	ND	ND	ND	0.361	0.231	0.573	6.44	5.87	11	14.3
Maximum	0.15	ND	0.346	0.0936	5.12	1.38	3.28	1.86	9.1	6.97	18	23.8
Mean	0.023	ID	0.053	0.023	0.649	0.770	1.261	1.124	7.727	6.656	14.107	17.200
Standard Deviation	0.030	ID	0.076	0.030	1.093	0.391	0.830	0.442	0.562	0.345	2.127	3.201
Median	0.0161	ID	0.021	0.01135	0.369	0.7055	1.08	1.13	7.74	6.76	13.9	16.2
<b>Magnesium, Dissolved [mg/L]</b>												
No. of Analyses	129	8	95	8	81	8	81	8	15	8	15	8
No. of Detections	129	8	95	8	81	8	81	8	15	8	15	8
Minimum	3.9	20.9	6.6	10.1	7.7	11.5	15.2	17.7	51.9	45.1	37.8	39.9
Maximum	53.9	23.8	13	12.3	15.1	13.7	43.2	22	65.1	57.4	51.4	46.6
Mean	35.36	22.75	9.44	11.03	10.49	12.38	25.55	20.15	57.67	51.93	44.37	42.91
Standard Deviation	10.76	1.13	1.30	0.78	1.83	0.88	7.83	1.36	3.23	4.20	4.09	1.91
Median	34.7	23.2	9.29	11.15	9.99	12	24	20.05	57.3	51.5	43.4	42.7
<b>Magnesium, Total [mg/L]</b>												
No. of Analyses	23	8	23	8	23	8	23	8	15	8	15	8
No. of Detections	23	8	23	8	23	8	23	8	15	8	15	8
Minimum	19.4	20.6	8.54	10.1	8.69	11.7	14.3	17.4	49.8	46.2	36.5	38.7
Maximum	31.8	23.5	14	11.8	15.7	13.9	25.7	21.8	61.1	55.6	59.6	46.1
Mean	25.53	22.55	11.11	10.98	12.65	12.50	19.62	20.10	56.45	52.01	45.07	43.24
Standard Deviation	3.88	0.93	1.27	0.65	2.06	0.68	3.49	1.43	2.96	3.47	5.33	2.64
Median	26.1	22.9	10.9	11.2	13.2	12.3	19	20.3	56.6	52.15	43.9	43.95

**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location Time Interval	Channel Cc2											
	MW-2		MW-9		MW-20		MW-21		MW-33		MW-35	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
<b>Manganese, Dissolved [mg/L]</b>												
No. of Analyses	154	8	95	8	81	8	80	8	15	8	15	8
No. of Detections	153	8	10	0	81	8	80	8	15	8	15	8
Minimum	ND	0.0181	ND	ND	0.0531	0.136	0.169	0.165	0.877	0.887	1.63	2.25
Maximum	0.59	0.248	0.54	ND	0.548	0.225	1.6	0.52	1.13	1.04	2.56	2.5
Mean	0.1263	0.1341	0.0067	ID	0.2144	0.1591	0.5690	0.3654	1.0412	0.9624	2.2607	2.3663
Standard Deviation	0.0761	0.0818	0.0555	ID	0.0920	0.0289	0.3160	0.1285	0.0766	0.0505	0.2818	0.0873
Median	0.1100	0.1264	0.0005	ID	0.2200	0.1485	0.4950	0.3865	1.0800	0.9520	2.3700	2.3650
<b>Manganese, Total [mg/L]</b>												
No. of Analyses	24	8	23	8	23	8	23	8	15	8	15	8
No. of Detections	24	8	16	8	23	8	23	8	15	8	15	8
Minimum	0.0695	0.0183	ND	0.0002	0.1460	0.1400	0.1680	0.2100	0.8970	0.9010	1.9400	2.2100
Maximum	0.3060	0.2990	0.0146	0.0037	2.9200	0.2410	1.0500	0.5550	1.2900	1.0700	2.7900	2.6100
Mean	0.1294	0.1513	0.0022	0.0010	0.4493	0.1656	0.5520	0.4434	1.0791	0.9766	2.4413	2.4338
Standard Deviation	0.0515	0.0972	0.0033	0.0012	0.5481	0.0324	0.2698	0.1156	0.1130	0.0561	0.2541	0.1245
Median	0.1165	0.1340	0.0005	0.0006	0.3050	0.1575	0.4970	0.4780	1.0600	0.9745	2.4300	2.4550
<b>Potassium, Dissolved [mg/L]</b>												
No. of Analyses	129	8	95	8	81	8	81	8	15	8	15	8
No. of Detections	129	8	95	8	81	8	81	8	15	8	15	8
Minimum	0.59	2.05	1.2	2	1.5	1.99	1.8	2.12	3.03	3.04	3.07	3.03
Maximum	3.7	2.32	2.41	2.29	2.9	2.27	3.3	2.48	3.7	3.79	3.72	3.6
Mean	2.51	2.19	1.94	2.16	2.07	2.14	2.37	2.28	3.45	3.45	3.35	3.24
Standard Deviation	0.40	0.11	0.20	0.11	0.21	0.10	0.35	0.11	0.17	0.22	0.17	0.18
Median	2.49	2.205	1.9	2.16	2.08	2.155	2.29	2.265	3.49	3.445	3.3	3.19
<b>Potassium, Total [mg/L]</b>												
No. of Analyses	23	8	23	8	23	8	23	8	15	8	15	8
No. of Detections	23	8	23	8	23	8	23	8	15	8	15	8
Minimum	2.08	2.07	1.92	2.02	1.98	1.91	2.02	2.11	3.32	3.27	3.31	3.07
Maximum	2.58	2.36	2.67	2.26	2.48	2.24	2.74	2.45	3.89	3.68	3.88	3.65
Mean	2.34	2.23	2.20	2.13	2.23	2.12	2.26	2.28	3.60	3.49	3.55	3.39
Standard Deviation	0.14	0.09	0.18	0.10	0.13	0.10	0.20	0.13	0.15	0.14	0.18	0.17
Median	2.37	2.225	2.17	2.1	2.21	2.125	2.18	2.305	3.62	3.49	3.54	3.385
<b>Sodium, Dissolved [mg/L]</b>												
No. of Analyses	129	8	95	8	81	8	81	8	15	8	15	8
No. of Detections	129	8	95	8	81	8	81	8	15	8	15	8
Minimum	2.2	8.85	4.5	5.59	4.2	5.86	8.35	9.88	16.9	17.8	13.8	15.2
Maximum	14	9.67	6.59	6.49	8	6.67	13	11.4	21.4	19.7	17.7	17.6
Mean	10.4	9.3	5.3	6.0	6.2	6.2	10.4	10.7	19.0	18.7	15.9	16.6
Standard Deviation	1.7	0.3	0.5	0.3	0.8	0.3	1.0	0.5	1.2	0.7	1.3	0.9
Median	10	9.275	5.22	6.095	6.16	6.14	10	10.8	19.1	18.75	16	16.8
<b>Sodium, Total [mg/L]</b>												
No. of Analyses	23	8	23	8	23	8	23	8	15	8	15	8
No. of Detections	23	8	23	8	23	8	23	8	15	8	15	8
Minimum	8.15	8.88	5.19	5.62	4.85	5.95	9.16	9.81	16.5	18	13.2	14.8
Maximum	11.4	9.62	6.84	6.45	7.27	6.57	12.2	11.1	20.8	19.4	17.5	17.8
Mean	9.32	9.19	5.93	6.00	6.21	6.29	10.76	10.66	18.93	18.74	16.03	16.55
Standard Deviation	0.71	0.24	0.47	0.27	0.60	0.19	0.83	0.42	1.09	0.47	1.27	1.01
Median	9.21	9.235	5.87	6.04	6.15	6.27	10.9	10.75	18.9	18.85	16.1	16.65



**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location Time Interval	Channel Cc2											
	MW-2		MW-9		MW-20		MW-21		MW-33		MW-35	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
<b>1,1-Dichloroethane [ug/L]</b>												
No. of Analyses	164	8	96	8	82	8	82	8	15	8	15	8
No. of Detections	8	0	0	0	0	0	0	0	15	8	15	8
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	1.29	1.4	0.12	0.144
Maximum	0.5	ND	ND	ND	ND	ND	ND	ND	2.32	1.9	0.483	0.333
Mean	0.19	ID	ID	ID	ID	ID	ID	ID	1.66	1.62	0.28	0.25
Standard Deviation	0.16	ID	ID	ID	ID	ID	ID	ID	0.33	0.14	0.12	0.07
Median	0.1	ID	ID	ID	ID	ID	ID	ID	1.53	1.605	0.27	0.26
<b>1,2-Dichloropropane [ug/L]</b>												
No. of Analyses	164	8	96	8	82	8	82	8	15	8	15	8
No. of Detections	0	0	0	0	0	0	0	0	15	8	15	8
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	6.26	6.58	0.581	0.321
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	12.5	8.53	1.28	1.33
Mean	ID	ID	ID	ID	ID	ID	ID	ID	8.20	7.56	0.94	0.78
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	1.93	0.57	0.25	0.38
Median	ID	ID	ID	ID	ID	ID	ID	ID	8.08	7.425	0.895	0.7015
<b>Benzene [ug/L]</b>												
No. of Analyses	164	8	96	8	82	8	82	8	15	8	15	8
No. of Detections	0	0	0	0	0	0	3	0	15	8	15	8
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	0.934	0.939	0.784	0.518
Maximum	ND	ND	ND	ND	ND	ND	0.25	ND	1.76	1.08	1.14	1.17
Mean	ID	ID	ID	ID	ID	ID	0.100	ID	1.199	1.004	0.951	0.749
Standard Deviation	ID	ID	ID	ID	ID	ID	0.028	ID	0.256	0.052	0.100	0.252
Median	ID	ID	ID	ID	ID	ID	0.1	ID	1.14	1.005	0.959	0.673
<b>Chloroethane [ug/L]</b>												
No. of Analyses	164	8	96	8	82	8	82	8	15	8	15	8
No. of Detections	26	0	0	0	0	0	0	0	14	6	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	2.5	ND	ND	ND	ND	ND	ND	ND	0.947	0.533	ND	ND
Mean	0.620	ID	ID	ID	ID	ID	ID	ID	0.461	0.319	ID	ID
Standard Deviation	0.851	ID	ID	ID	ID	ID	ID	ID	0.193	0.178	ID	ID
Median	0.1	ID	ID	ID	ID	ID	ID	ID	0.455	0.3765	ID	ID
<b>cis-1,2-Dichloroethene [ug/L]</b>												
No. of Analyses	139	8	96	8	82	8	82	8	15	8	15	8
No. of Detections	40	4	0	0	1	0	80	8	15	8	15	8
Minimum	ND	ND	ND	ND	ND	ND	ND	0.445	24.1	27.1	4.92	2.7
Maximum	0.6	0.294	ND	ND	0.977	ND	8.7	0.823	52.7	37.8	11.2	10.7
Mean	0.177	0.140	ID	ID	ID	ID	2.104	0.617	34.380	31.813	7.624	6.866
Standard Deviation	0.129	0.111	ID	ID	ID	ID	2.130	0.125	9.489	3.251	2.100	3.437
Median	0.1	0.0775	ID	ID	ID	ID	1.12	0.62	33	31.65	8.42	6.995
<b>Dichlorodifluoromethane [ug/L]</b>												
No. of Analyses	96	8	96	8	82	8	82	8	15	8	15	8
No. of Detections	94	8	0	0	17	8	80	8	15	8	15	8
Minimum	ND	2.45	ND	ND	ND	0.286	ND	1.01	3.21	4.07	0.225	0.434
Maximum	ND	4.34	ND	ND	1.86	0.359	ND	2.69	8.82	6.32	1.13	1.07
Mean	ID	3.551	ID	ID	0.226	0.323	ID	1.868	5.153	5.226	0.546	0.679
Standard Deviation	ID	0.757	ID	ID	0.321	0.025	ID	0.577	1.600	0.826	0.306	0.224
Median	ID	3.57	ID	ID	0.1	0.3245	ID	1.915	5.27	5.12	0.43	0.693

**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
Vashon Island Closed Landfill  
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Well Location Time Interval	Channel Cc2											
	MW-2		MW-9		MW-20		MW-21		MW-33		MW-35	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
<b>Toluene [ug/L]</b>												
No. of Analyses	164	8	96	8	82	8	82	8	15	8	15	8
No. of Detections	2	0	0	0	1	0	0	0	6	0	7	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	2.5	ND	ND	ND	0.22	ND	ND	ND	2.25	ND	0.21	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	0.28	ID	0.11	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	0.56	ID	0.03	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	0.1	ID	0.1	ID
<b>trans -1,2-Dichloroethene [ug/L]</b>												
No. of Analyses	142	8	96	8	82	8	82	8	15	8	15	8
No. of Detections	0	0	0	0	0	0	16	1	15	8	15	8
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	0.632	0.636	0.27	0.222
Maximum	ND	ND	ND	ND	ND	ND	0.41	0.109	1.15	0.923	0.401	0.38
Mean	ID	ID	ID	ID	ID	ID	0.128	ID	0.866	0.760	0.330	0.279
Standard Deviation	ID	ID	ID	ID	ID	ID	0.076	ID	0.195	0.095	0.043	0.057
Median	ID	ID	ID	ID	ID	ID	0.1	ID	0.82	0.738	0.33	0.2655
<b>Trichloroethene [ug/L]</b>												
No. of Analyses	164	8	96	8	82	8	82	8	15	8	15	8
No. of Detections	0	0	0	0	0	0	0	0	7	6	15	8
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.856	0.866
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	0.17	0.18	1.16	1.45
Mean	ID	ID	ID	ID	ID	ID	ID	ID	0.123	0.130	1.021	1.054
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	0.027	0.051	0.098	0.190
Median	ID	ID	ID	ID	ID	ID	ID	ID	0.1	0.147	1.04	0.9905
<b>Trichlorofluoromethane [ug/L]</b>												
No. of Analyses	129	8	96	8	82	8	82	8	15	8	15	8
No. of Detections	125	8	0	0	1	0	78	8	0	0	0	0
Minimum	ND	0.469	ND	ND	ND	ND	ND	0.456	ND	ND	ND	ND
Maximum	23	1.42	ND	ND	0.606	ND	9	0.945	ND	ND	ND	ND
Mean	6.485	0.850	ID	ID	ID	ID	2.176	0.724	ID	ID	ID	ID
Standard Deviation	5.507	0.350	ID	ID	ID	ID	2.292	0.194	ID	ID	ID	ID
Median	4.3	0.835	ID	ID	ID	ID	1.03	0.7725	ID	ID	ID	ID
<b>Vinyl Chloride [ug/L]</b>												
No. of Analyses	164	8	96	8	82	8	82	8	15	8	15	8
No. of Detections	152	8	0	0	1	0	81	8	15	8	15	8
Minimum	ND	0.0235	ND	ND	ND	ND	ND	0.0557	24.3	22.6	1.78	2.83
Maximum	40	0.132	ND	ND	0.0867	ND	1	0.084	53.1	34.1	9.19	6.06
Mean	6.226	0.073	ID	ID	ID	ID	0.334	0.071	33.407	29.638	4.251	4.616
Standard Deviation	8.368	0.036	ID	ID	ID	ID	0.224	0.010	7.381	3.627	2.483	1.050
Median	0.745	0.0656	ID	ID	ID	ID	0.332	0.07035	32.6	30.8	3.54	4.49

**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
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Well Location Time Interval	Channel Cc3			
	MW-8		MW-36	
	Long	Short	Long	Short
<b>pH, Field [standard units]</b>				
No. of Analyses	95	8	15	8
No. of Detections	95	8	15	8
Minimum	5.97	6.22	6.51	7.12
Maximum	7.95	6.93	8.95	7.78
Mean	6.84	6.56	7.68	7.59
Standard Deviation	0.32	0.24	0.49	0.23
Median	6.81	6.58	7.75	7.65
<b>Specific Conductance, Field [umhos/cm]</b>				
No. of Analyses	95	8	15	8
No. of Detections	95	8	15	8
Minimum	130.0	154.0	133.2	161.0
Maximum	650.0	169.8	183.4	190.4
Mean	169.1	165.7	174.2	173.2
Standard Deviation	51.8	4.9	11.7	9.3
Median	165	167.25	176.9	174.95
<b>Alkalinity [mg/L]</b>				
No. of Analyses	94	8	15	8
No. of Detections	94	8	15	8
Minimum	46.5	54.6	67.5	67.7
Maximum	78	59.2	70.9	69.5
Mean	59.22	56.18	69.68	68.36
Standard Deviation	5.98	1.75	0.99	0.73
Median	60	55.45	69.8	68.1
<b>Ammonia-N [mg/L]</b>				
No. of Analyses	94	8	15	8
No. of Detections	9	1	1	3
Minimum	ND	ND	ND	ND
Maximum	0.43	0.002	0.005	0.0034
Mean	0.015	ID	ID	0.002
Standard Deviation	0.046	ID	ID	0.001
Median	0.005	ID	ID	0.001
<b>Chloride [mg/L]</b>				
No. of Analyses	94	8	15	8
No. of Detections	94	8	15	8
Minimum	3	4.19	2.89	2.89
Maximum	6.23	4.77	3.28	3.14
Mean	4.38	4.40	3.12	3.03
Standard Deviation	0.47	0.21	0.10	0.08
Median	4.29	4.36	3.13	3.05
<b>Nitrate-N [mg/L]</b>				
No. of Analyses	94	8	15	8
No. of Detections	93	8	15	8
Minimum	ND	2.66	0.014	0.019
Maximum	8.1	3.11	0.027	0.022
Mean	3.892	2.848	0.020	0.020
Standard Deviation	0.907	0.141	0.003	0.001
Median	3.8	2.795	0.02	0.02
<b>Sulfate [mg/L]</b>				
No. of Analyses	94	8	15	8
No. of Detections	94	8	15	8
Minimum	6.71	7.46	12.3	12.7
Maximum	11	9.01	13.5	13.8
Mean	8.5	8.0	13.0	13.2
Standard Deviation	0.9	0.5	0.4	0.3
Median	8.39	7.91	12.9	13.2
<b>Total Dissolved Solids [mg/L]</b>				
No. of Analyses	94	8	15	8
No. of Detections	94	8	15	8
Minimum	54	118	111	121
Maximum	150	131	137	141
Mean	117	125	128	130
Standard Deviation	16	4	6	7
Median	120	125	130	130.5

**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
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Well Location Time Interval	Channel Cc3			
	MW-8		MW-36	
	Long	Short	Long	Short
<b>Arsenic, Dissolved [mg/L]</b>				
No. of Analyses	94	8	15	8
No. of Detections	8	8	15	8
Minimum	ND	0.000481	0.0016	0.0017
Maximum	0.0021	0.000522	0.002	0.00189
Mean	0.00051	0.00050	0.00173	0.00179
Standard Deviation	0.00017	0.00001	0.00011	0.00008
Median	0.0005	0.000494	0.00172	0.00178
<b>Arsenic, Total [mg/L]</b>				
No. of Analyses	22	8	15	8
No. of Detections	7	8	15	8
Minimum	ND	0.000472	0.00157	0.0017
Maximum	0.000502	0.000523	0.00192	0.00188
Mean	0.00049	0.00050	0.00170	0.00178
Standard Deviation	0.00001	0.00002	0.00009	0.00006
Median	0.0005	0.0004935	0.0017	0.001765
<b>Calcium, Dissolved [mg/L]</b>				
No. of Analyses	94	8	15	8
No. of Detections	94	8	15	8
Minimum	9.67	11.3	10.4	13.3
Maximum	15.9	12.2	14.5	14.6
Mean	11.9	11.9	12.9	14.0
Standard Deviation	1.2	0.3	1.1	0.4
Median	11.85	11.9	12.7	13.9
<b>Calcium, Total [mg/L]</b>				
No. of Analyses	22	8	15	8
No. of Detections	22	8	15	8
Minimum	9.51	11.3	11.5	13.4
Maximum	12.5	12.4	14.9	14.6
Mean	11.32	11.78	13.25	13.96
Standard Deviation	0.71	0.32	1.03	0.43
Median	11.5	11.75	13.5	13.85
<b>Iron, Dissolved [mg/L]</b>				
No. of Analyses	94	8	15	8
No. of Detections	52	0	1	0
Minimum	ND	ND	ND	ND
Maximum	0.17	ND	0.036	ND
Mean	0.03	ID	ID	ID
Standard Deviation	0.03	ID	ID	ID
Median	0.0125	ID	ID	ID
<b>Iron, Total [mg/L]</b>				
No. of Analyses	22	8	15	8
No. of Detections	8	1	6	1
Minimum	ND	ND	ND	ND
Maximum	0.0687	0.024	0.334	0.113
Mean	0.013	ID	0.035	ID
Standard Deviation	0.018	ID	0.085	ID
Median	0.005	ID	0.005	ID
<b>Magnesium, Dissolved [mg/L]</b>				
No. of Analyses	94	8	15	8
No. of Detections	94	8	15	8
Minimum	7.1	8.93	7.95	9.13
Maximum	11.9	10.2	10	9.97
Mean	9.26	9.56	9.07	9.60
Standard Deviation	0.77	0.37	0.60	0.33
Median	9.265	9.59	9.06	9.705
<b>Magnesium, Total [mg/L]</b>				
No. of Analyses	22	8	15	8
No. of Detections	22	8	15	8
Minimum	8.27	9.19	7.8	9.38
Maximum	10	9.68	10.3	9.83
Mean	9.13	9.53	9.18	9.69
Standard Deviation	0.46	0.16	0.71	0.15
Median	9.24	9.55	9.23	9.73

**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
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Well Location Time Interval	Channel Cc3			
	MW-8		MW-36	
	Long	Short	Long	Short
<b>Manganese, Dissolved [mg/L]</b>				
No. of Analyses	94	8	15	8
No. of Detections	4	0	15	8
Minimum	ND	ND	0.00117	0.000639
Maximum	0.0029	ND	0.0356	0.00158
Mean	0.0005	ID	0.0048	0.0010
Standard Deviation	0.0004	ID	0.0087	0.0003
Median	0.0005	ID	0.0018	0.0009
<b>Manganese, Total [mg/L]</b>				
No. of Analyses	22	8	15	8
No. of Detections	3	4	15	8
Minimum	ND	ND	0.0025	0.0013
Maximum	0.0022	0.0004	0.2430	0.1190
Mean	0.0005	0.0001	0.0268	0.0183
Standard Deviation	0.0005	0.0001	0.0611	0.0407
Median	0.0005	0.0001	0.0059	0.0035
<b>Potassium, Dissolved [mg/L]</b>				
No. of Analyses	94	8	15	8
No. of Detections	94	8	15	8
Minimum	0.9	1.09	2.3	2.56
Maximum	1.5	1.2	2.82	2.9
Mean	1.09	1.16	2.61	2.74
Standard Deviation	0.11	0.03	0.16	0.12
Median	1.1	1.165	2.66	2.76
<b>Potassium, Total [mg/L]</b>				
No. of Analyses	22	8	15	8
No. of Detections	22	8	15	8
Minimum	1.02	1.09	2.49	2.52
Maximum	1.29	1.19	2.97	2.82
Mean	1.14	1.15	2.70	2.73
Standard Deviation	0.07	0.03	0.12	0.11
Median	1.12	1.145	2.68	2.76
<b>Sodium, Dissolved [mg/L]</b>				
No. of Analyses	94	8	15	8
No. of Detections	94	8	15	8
Minimum	4.5	6.09	5.47	6.13
Maximum	7.31	7.05	6.91	6.99
Mean	6.1	6.5	6.1	6.6
Standard Deviation	0.5	0.3	0.4	0.3
Median	6.155	6.43	6.09	6.6
<b>Sodium, Total [mg/L]</b>				
No. of Analyses	22	8	15	8
No. of Detections	22	8	15	8
Minimum	5.64	6.27	5.22	6.28
Maximum	6.61	6.78	6.88	6.79
Mean	6.20	6.47	6.22	6.50
Standard Deviation	0.28	0.19	0.44	0.16
Median	6.26	6.425	6.21	6.47

**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
Vashon Island Closed Landfill  
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Well Location Time Interval	Channel Cc3			
	MW-8		MW-36	
	Long	Short	Long	Short
<b>1,1-Dichloroethane [ug/L]</b>				
No. of Analyses	93	8	15	8
No. of Detections	0	0	0	0
Minimum	ND	ND	ND	ND
Maximum	ND	ND	ND	ND
Mean	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID
Median	ID	ID	ID	ID
<b>1,2-Dichloropropane [ug/L]</b>				
No. of Analyses	93	8	15	8
No. of Detections	0	0	0	0
Minimum	ND	ND	ND	ND
Maximum	ND	ND	ND	ND
Mean	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID
Median	ID	ID	ID	ID
<b>Benzene [ug/L]</b>				
No. of Analyses	93	8	15	8
No. of Detections	0	0	0	0
Minimum	ND	ND	ND	ND
Maximum	ND	ND	ND	ND
Mean	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID
Median	ID	ID	ID	ID
<b>Chloroethane [ug/L]</b>				
No. of Analyses	93	8	15	8
No. of Detections	0	0	0	0
Minimum	ND	ND	ND	ND
Maximum	ND	ND	ND	ND
Mean	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID
Median	ID	ID	ID	ID
<b>cis-1,2-Dichloroethene [ug/L]</b>				
No. of Analyses	93	8	15	8
No. of Detections	0	0	0	0
Minimum	ND	ND	ND	ND
Maximum	ND	ND	ND	ND
Mean	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID
Median	ID	ID	ID	ID
<b>Dichlorodifluoromethane [ug/L]</b>				
No. of Analyses	93	8	15	8
No. of Detections	11	0	0	0
Minimum	ND	ND	ND	ND
Maximum	0.64	ND	ND	ND
Mean	0.132	ID	ID	ID
Standard Deviation	0.105	ID	ID	ID
Median	0.1	ID	ID	ID

**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
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Well Location Time Interval	Channel Cc3			
	MW-8		MW-36	
	Long	Short	Long	Short
<b>Toluene [ug/L]</b>				
No. of Analyses	93	8	15	8
No. of Detections	1	0	0	0
Minimum	ND	ND	ND	ND
Maximum	0.33	ND	ND	ND
Mean	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID
Median	ID	ID	ID	ID
<b>trans -1,2-Dichloroethene [ug/L]</b>				
No. of Analyses	93	8	15	8
No. of Detections	0	0	0	0
Minimum	ND	ND	ND	ND
Maximum	ND	ND	ND	ND
Mean	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID
Median	ID	ID	ID	ID
<b>Trichloroethene [ug/L]</b>				
No. of Analyses	93	8	15	8
No. of Detections	0	0	0	0
Minimum	ND	ND	ND	ND
Maximum	ND	ND	ND	ND
Mean	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID
Median	ID	ID	ID	ID
<b>Trichlorofluoromethane [ug/L]</b>				
No. of Analyses	93	8	15	8
No. of Detections	20	0	0	0
Minimum	ND	ND	ND	ND
Maximum	0.56	ND	ND	ND
Mean	0.151	ID	ID	ID
Standard Deviation	0.114	ID	ID	ID
Median	0.1	ID	ID	ID
<b>Vinyl Chloride [ug/L]</b>				
No. of Analyses	93	8	15	8
No. of Detections	0	0	0	0
Minimum	ND	ND	ND	ND
Maximum	ND	ND	ND	ND
Mean	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID
Median	ID	ID	ID	ID

**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
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Well Location Time Interval	Unit D Aquifer											
	MW-7		MW-12		MW-19		MW-26		MW-29		MW-34	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
<b>pH, Field [standard units]</b>												
No. of Analyses	94	8	94	8	95	8	66	8	66	8	15	8
No. of Detections	94	8	94	8	95	8	66	8	66	8	15	8
Minimum	6.76	7.13	6.59	6.85	6.84	7.21	7.34	7.07	6.65	7.25	6.64	6.71
Maximum	8.38	8.06	8.37	7.38	8.54	7.70	9.20	8.29	7.80	7.62	7.32	7.55
Mean	7.69	7.58	7.46	7.18	7.63	7.49	8.11	7.84	7.51	7.43	6.98	6.97
Standard Deviation	0.30	0.26	0.28	0.21	0.26	0.15	0.27	0.39	0.19	0.14	0.14	0.27
Median	7.775	7.57	7.48	7.265	7.65	7.535	8.135	7.9	7.54	7.395	6.95	6.89
<b>Specific Conductance, Field [umhos/cm]</b>												
No. of Analyses	94	8	94	8	95	8	66	8	66	8	15	8
No. of Detections	94	8	94	8	95	8	66	8	66	8	15	8
Minimum	100.0	174.2	115.0	151.7	100.0	198.6	136.1	177.5	165.0	221.9	150.0	179.7
Maximum	194.2	189.6	185.0	170.5	230.0	219.5	200.0	192.8	265.0	243.2	210.0	197.9
Mean	160.8	185.5	141.4	163.9	195.6	213.9	171.1	188.4	216.9	237.8	198.0	192.3
Standard Deviation	16.2	5.8	13.4	7.5	23.9	8.7	13.8	5.9	21.9	8.4	13.6	7.5
Median	160	187.65	140	167.15	200	218.55	170	191.3	215	242.35	201	195.95
<b>Alkalinity [mg/L]</b>												
No. of Analyses	94	8	94	8	95	8	66	8	66	8	15	8
No. of Detections	94	8	94	8	95	8	66	8	66	8	15	8
Minimum	58	76.5	30	62.3	64	82.4	67.2	74	88	99	67.4	67.4
Maximum	100	79.1	66	66.3	110	86.2	86	75.8	140	102	80.2	69.8
Mean	73.80	77.54	57.83	64.30	84.12	84.63	74.53	75.14	99.19	100.33	70.68	68.58
Standard Deviation	5.00	0.83	4.45	1.22	12.15	1.21	3.43	0.60	7.26	1.32	2.89	0.85
Median	73.3	77.3	58.25	64.55	84.8	84.5	74.75	75.35	100	100.2	70.1	68.45
<b>Ammonia-N [mg/L]</b>												
No. of Analyses	94	8	93	8	95	8	66	8	66	8	15	8
No. of Detections	94	8	7	1	80	8	66	8	9	8	3	1
Minimum	0.073	0.213	ND	ND	ND	0.0263	0.03	0.24	ND	0.0023	ND	ND
Maximum	0.32	0.261	0.06	0.0028	0.2	0.0325	0.3	0.298	0.03	0.0038	0.0587	0.0029
Mean	0.207	0.235	0.008	ID	0.046	0.029	0.222	0.255	0.009	0.003	0.009	ID
Standard Deviation	0.051	0.015	0.008	ID	0.034	0.002	0.045	0.019	0.007	0.001	0.015	ID
Median	0.206	0.2305	0.005	ID	0.036	0.02955	0.2265	0.25	0.005	0.00275	0.005	ID
<b>Chloride [mg/L]</b>												
No. of Analyses	94	8	94	8	95	8	66	8	66	8	15	8
No. of Detections	94	8	94	8	95	8	66	8	66	8	15	8
Minimum	2.7	3.17	2.6	2.95	3.7	4.32	3	3.48	3.39	3.38	4.58	4.6
Maximum	5	3.46	5	3.3	37.6	4.79	9.11	3.85	5.6	3.71	5.2	5.24
Mean	3.20	3.34	3.08	3.15	5.48	4.61	3.94	3.72	3.88	3.57	5.01	4.97
Standard Deviation	0.33	0.09	0.36	0.11	3.39	0.14	0.81	0.12	0.32	0.11	0.17	0.19
Median	3.1	3.37	3	3.175	5	4.6	3.845	3.76	3.9	3.605	5.04	5.015
<b>Nitrate-N [mg/L]</b>												
No. of Analyses	94	8	94	8	95	8	66	8	66	8	15	8
No. of Detections	38	8	94	8	34	1	28	8	1	0	15	8
Minimum	ND	0.011	0.55	0.692	ND	ND	ND	0.01	ND	ND	1.78	1.59
Maximum	0.34	0.021	1.9	0.787	0.81	0.012	0.232	0.016	0.082	ND	2.57	2.23
Mean	0.022	0.017	0.738	0.724	0.024	ID	0.027	0.013	ID	ID	2.220	1.919
Standard Deviation	0.038	0.004	0.144	0.032	0.083	ID	0.031	0.002	ID	ID	0.273	0.238
Median	0.0155	0.0165	0.74	0.723	0.01	ID	0.025	0.0125	ID	ID	2.25	1.96
<b>Sulfate [mg/L]</b>												
No. of Analyses	94	8	94	8	95	8	66	8	66	8	15	8
No. of Detections	94	8	94	8	95	8	66	8	66	8	15	8
Minimum	8.7	10.5	9	9.76	12	16.1	11	12.7	14.9	15	12	12.5
Maximum	14	11.4	12	11.1	24	17.9	14.2	13.9	18	16.8	13.9	14
Mean	10.5	11.0	10.2	10.5	18.8	17.0	13.1	13.4	16.4	15.8	13.0	13.3
Standard Deviation	0.6	0.3	0.5	0.5	2.1	0.5	0.7	0.4	0.9	0.6	0.6	0.5
Median	10.4	11.05	10	10.55	18.1	17	13	13.45	16.45	15.7	12.9	13.35
<b>Total Dissolved Solids [mg/L]</b>												
No. of Analyses	94	8	94	8	95	8	66	8	66	8	15	8
No. of Detections	94	8	94	8	95	8	66	8	66	8	15	8
Minimum	63	127	53	105	80	137	90	128	90	147	131	129
Maximum	160	137	150	124	170	147	450	143	170	163	147	149
Mean	116	132	102	117	133	142	135	138	145	154	137	138
Standard Deviation	16	3	15	6	20	3	43	5	15	5	5	6
Median	120	132	101.5	118.5	130	142.5	131	139	149	152.5	135	137



**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
 Vashon Island Closed Landfill  
 1986 through 2020

Well Location Time Interval	Unit D Aquifer											
	MW-7		MW-12		MW-19		MW-26		MW-29		MW-34	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
<b>Arsenic, Dissolved [mg/L]</b>												
No. of Analyses	94	8	94	8	95	8	66	8	66	8	15	8
No. of Detections	94	8	94	8	95	8	66	8	66	8	15	8
Minimum	0.0021	0.00473	0.0017	0.00198	0.00105	0.000979	0.002	0.00285	0.00384	0.00391	0.00111	0.00128
Maximum	0.022	0.00512	0.0056	0.00207	0.027	0.00107	0.00341	0.00301	0.008	0.00422	0.00138	0.00133
Mean	0.00698	0.00487	0.00212	0.00202	0.00365	0.00104	0.00289	0.00293	0.00462	0.00404	0.00132	0.00131
Standard Deviation	0.00308	0.00015	0.00040	0.00003	0.00377	0.00003	0.00041	0.00006	0.00068	0.00010	0.00007	0.00002
Median	0.006165	0.004805	0.002005	0.00202	0.0022	0.00105	0.003005	0.00292	0.004505	0.004025	0.00134	0.001305
<b>Arsenic, Total [mg/L]</b>												
No. of Analyses	23	8	22	8	23	8	23	8	23	8	15	8
No. of Detections	23	8	22	8	23	8	23	8	23	8	15	8
Minimum	0.00455	0.00499	0.00185	0.00201	0.00108	0.00115	0.00294	0.00333	0.00354	0.00685	0.00116	0.00127
Maximum	0.00592	0.00541	0.00228	0.00209	0.00211	0.00168	0.0108	0.00617	0.0131	0.0155	0.00178	0.00145
Mean	0.00514	0.00516	0.00204	0.00205	0.00142	0.00142	0.00436	0.00425	0.00621	0.01101	0.00134	0.00132
Standard Deviation	0.00026	0.00014	0.00011	0.00003	0.00026	0.00017	0.00181	0.00102	0.00257	0.00352	0.00014	0.00005
Median	0.00511	0.005145	0.00202	0.00205	0.00133	0.00142	0.00379	0.00388	0.00534	0.0115	0.00132	0.00131
<b>Calcium, Dissolved [mg/L]</b>												
No. of Analyses	94	8	94	8	95	8	66	8	66	8	15	8
No. of Detections	94	8	94	8	95	8	66	8	66	8	15	8
Minimum	9.2	15.1	7.7	11.4	9.2	14.6	11.2	16.6	13.6	18.9	10.8	13
Maximum	18	16.8	13	12.3	19.6	15.5	18.3	18.7	23	21.1	14.4	14.6
Mean	13.2	15.9	9.9	11.9	14.2	15.1	15.8	17.5	18.6	20.2	13.3	13.7
Standard Deviation	1.6	0.6	1.1	0.3	1.9	0.4	1.3	0.7	1.5	0.9	1.0	0.6
Median	13	15.9	9.855	11.75	14.1	15.1	15.8	17.3	18.45	20.5	13.6	13.55
<b>Calcium, Total [mg/L]</b>												
No. of Analyses	23	8	22	8	23	8	23	8	23	8	15	8
No. of Detections	23	8	22	8	23	8	23	8	23	8	15	8
Minimum	12.2	15.5	7.97	11.3	13.5	14.7	14.9	17.2	17.6	19.5	11.9	13.3
Maximum	16.8	16.8	12.8	12.5	16.8	16	19.1	18.6	22.2	21.3	14.9	14.6
Mean	14.61	16.00	10.65	11.91	15.02	15.30	17.03	17.74	19.73	20.36	13.55	13.80
Standard Deviation	1.16	0.41	1.08	0.46	0.88	0.47	1.30	0.54	1.26	0.65	0.82	0.46
Median	14.4	15.9	10.35	11.8	15.2	15.15	17.6	17.6	19.9	20.3	13.8	13.7
<b>Iron, Dissolved [mg/L]</b>												
No. of Analyses	94	8	94	8	95	8	66	8	66	8	15	8
No. of Detections	67	6	51	0	93	8	66	8	66	8	0	0
Minimum	ND	ND	ND	ND	ND	0.0412	0.033	0.0739	0.29	0.796	ND	ND
Maximum	0.22	0.0427	0.42	ND	0.191	0.0592	0.23	0.168	0.975	0.932	ND	ND
Mean	0.04	0.02	0.03	ID	0.06	0.05	0.10	0.10	0.68	0.85	ID	ID
Standard Deviation	0.04	0.01	0.06	ID	0.04	0.01	0.04	0.03	0.12	0.04	ID	ID
Median	0.0365	0.01255	0.011	ID	0.045	0.04735	0.099	0.0939	0.7125	0.845	ID	ID
<b>Iron, Total [mg/L]</b>												
No. of Analyses	23	8	22	8	23	8	23	8	23	8	15	8
No. of Detections	22	8	14	5	23	8	23	8	23	8	12	2
Minimum	ND	0.0546	ND	ND	0.0607	0.218	0.14	0.737	0.729	2.12	ND	ND
Maximum	0.0593	0.193	0.937	0.0536	1.09	0.893	10.5	5.24	4.24	5.85	1.38	0.469
Mean	0.027	0.116	0.081	0.017	0.270	0.475	2.439	2.125	1.695	3.894	0.117	ID
Standard Deviation	0.014	0.055	0.204	0.016	0.249	0.216	3.092	1.641	1.024	1.539	0.351	ID
Median	0.0226	0.09505	0.01445	0.0134	0.18	0.4465	1.64	1.395	1.28	3.965	0.0163	ID
<b>Magnesium, Dissolved [mg/L]</b>												
No. of Analyses	94	8	94	8	95	8	66	8	66	8	15	8
No. of Detections	94	8	94	8	95	8	66	8	66	8	15	8
Minimum	6.3	9.75	6.2	9.45	8.4	13.5	5.4	7.27	10	13.9	10.8	11.6
Maximum	11	10.6	10	10.1	17.1	14.4	7.94	8.06	16.2	15.6	13.7	12.8
Mean	8.22	10.06	7.85	9.76	12.77	14.06	6.70	7.58	13.05	14.56	12.01	12.24
Standard Deviation	0.84	0.33	0.91	0.27	1.91	0.32	0.61	0.32	1.34	0.64	0.86	0.42
Median	8.2	9.91	7.8	9.67	13	14.1	6.68	7.5	13.1	14.35	11.9	12.3
<b>Magnesium, Total [mg/L]</b>												
No. of Analyses	23	8	22	8	23	8	23	8	23	8	15	8
No. of Detections	23	8	22	8	23	8	23	8	23	8	15	8
Minimum	7.81	9.78	7.86	9.63	12.2	13.8	6.13	7.28	11.9	14.4	11	11.9
Maximum	11.1	10.7	10.7	10.6	16	14.7	9.59	8.18	15.9	15.2	13.4	12.7
Mean	9.11	10.18	8.97	9.99	14.26	14.36	7.44	7.65	14.13	14.70	12.07	12.39
Standard Deviation	0.92	0.34	0.79	0.36	1.03	0.34	0.82	0.26	0.99	0.29	0.66	0.25
Median	8.96	10.1	8.895	9.91	14.5	14.45	7.4	7.64	14.1	14.65	12.1	12.4

**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location Time Interval	Unit D Aquifer											
	MW-7		MW-12		MW-19		MW-26		MW-29		MW-34	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
<b>Manganese, Dissolved [mg/L]</b>												
No. of Analyses	94	8	94	8	94	8	66	8	66	8	15	8
No. of Detections	92	8	4	1	93	8	66	8	66	8	8	8
Minimum	ND	0.126	ND	ND	ND	0.438	0.042	0.0582	0.0678	0.0874	ND	0.000101
Maximum	0.255	0.175	0.1400	0.0001	1.3500	0.5100	0.0846	0.0686	0.1230	0.1160	0.0158	0.0003
Mean	0.1404	0.1481	0.0020	ID	0.4359	0.4773	0.0634	0.0645	0.0922	0.0957	0.0014	0.0002
Standard Deviation	0.0339	0.0173	0.0144	ID	0.1925	0.0224	0.0079	0.0038	0.0077	0.0094	0.0040	0.0001
Median	0.1405	0.1480	0.0005	ID	0.4720	0.4800	0.0640	0.0653	0.0920	0.0942	0.0005	0.0002
<b>Manganese, Total [mg/L]</b>												
No. of Analyses	23	8	22	8	23	8	23	8	23	8	15	8
No. of Detections	23	8	11	7	23	8	23	8	23	8	14	8
Minimum	0.1470	0.1880	ND	ND	0.4410	0.4980	0.0527	0.0736	0.0849	0.0948	ND	0.0001
Maximum	0.2890	0.5570	0.0151	0.0014	0.7200	0.8630	0.2030	0.1120	0.2110	0.1720	0.0502	0.0156
Mean	0.1874	0.3130	0.0015	0.0004	0.5335	0.5971	0.0872	0.0863	0.1065	0.1234	0.0057	0.0022
Standard Deviation	0.0339	0.1189	0.0032	0.0004	0.0672	0.1228	0.0379	0.0148	0.0294	0.0269	0.0133	0.0054
Median	0.1810	0.2660	0.0005	0.0002	0.5190	0.5500	0.0776	0.0782	0.0972	0.1145	0.0007	0.0002
<b>Potassium, Dissolved [mg/L]</b>												
No. of Analyses	94	8	94	8	95	8	66	8	66	8	15	8
No. of Detections	94	8	94	8	95	8	66	8	66	8	15	8
Minimum	1.6	2.65	1.40	1.83	1.70	2.38	2.10	2.91	1.55	2.01	1.35	1.44
Maximum	3.6	2.95	2.30	1.94	3.30	2.62	3.30	3.29	2.50	2.37	1.67	1.68
Mean	2.55	2.81	1.73	1.90	2.41	2.50	2.85	3.07	2.06	2.23	1.53	1.57
Standard Deviation	0.28	0.11	0.17	0.04	0.24	0.08	0.22	0.12	0.18	0.12	0.09	0.08
Median	2.52	2.835	1.75	1.91	2.43	2.52	2.90	3.06	2.09	2.26	1.54	1.58
<b>Potassium, Total [mg/L]</b>												
No. of Analyses	23	8	22	8	23	8	23	8	23	8	15	8
No. of Detections	23	8	22	8	23	8	23	8	23	8	15	8
Minimum	2.12	2.66	1.67	1.83	2.29	2.37	2.76	2.84	2.02	2.05	1.47	1.46
Maximum	2.95	2.91	2.08	1.95	2.86	2.64	3.37	3.20	2.36	2.34	1.80	1.61
Mean	2.67	2.80	1.82	1.89	2.50	2.50	3.07	3.07	2.19	2.21	1.61	1.56
Standard Deviation	0.16	0.08	0.11	0.05	0.12	0.10	0.17	0.11	0.11	0.09	0.09	0.05
Median	2.69	2.78	1.81	1.90	2.47	2.49	3.06	3.09	2.18	2.22	1.60	1.57
<b>Sodium, Dissolved [mg/L]</b>												
No. of Analyses	94	8	94	8	94	8	66	8	66	8	15	8
No. of Detections	94	8	94	8	94	8	66	8	66	8	15	8
Minimum	4.77	6.11	4.3	5.73	4.8	6.57	6.5	8.6	5.08	6.46	5.9	6.52
Maximum	7.5	6.76	10	6.31	7.54	7.32	9.54	9.73	7.56	7.09	7.46	7.37
Mean	5.9	6.4	5.5	6.0	6.3	6.9	8.1	9.1	6.1	6.8	6.6	6.9
Standard Deviation	0.5	0.2	0.9	0.2	0.6	0.2	0.8	0.4	0.5	0.2	0.5	0.3
Median	5.885	6.385	5.305	6.035	6.3	6.9	8.085	9.12	6.14	6.715	6.55	6.81
<b>Sodium, Total [mg/L]</b>												
No. of Analyses	23	8	22	8	23	8	23	8	23	8	15	8
No. of Detections	23	8	22	8	23	8	23	8	23	8	15	8
Minimum	5.36	6.11	5.02	5.88	6.09	6.77	7.06	8.75	5.33	6.44	5.92	6.73
Maximum	6.83	6.96	6.74	6.34	8.01	7.33	10.1	9.66	7.1	6.97	7.25	7.18
Mean	5.98	6.41	5.84	6.14	6.88	7.10	8.57	9.08	6.47	6.78	6.60	6.86
Standard Deviation	0.46	0.29	0.48	0.17	0.48	0.19	0.82	0.35	0.44	0.18	0.42	0.16
Median	5.98	6.305	5.81	6.14	6.92	7.115	8.61	8.895	6.49	6.84	6.65	6.775

**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location Time Interval	Unit D Aquifer											
	MW-7		MW-12		MW-19		MW-26		MW-29		MW-34	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
<b>1,1-Dichloroethane [ug/L]</b>												
No. of Analyses	94	8	95	8	95	8	66	8	66	8	15	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
<b>1,2-Dichloropropane [ug/L]</b>												
No. of Analyses	94	8	95	8	95	8	66	8	66	8	15	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
<b>Benzene [ug/L]</b>												
No. of Analyses	94	8	95	8	95	8	66	8	66	8	15	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
<b>Chloroethane [ug/L]</b>												
No. of Analyses	94	8	95	8	95	8	66	8	66	8	15	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
<b>cis-1,2-Dichloroethene [ug/L]</b>												
No. of Analyses	94	8	95	8	95	8	66	8	66	8	15	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
<b>Dichlorodifluoromethane [ug/L]</b>												
No. of Analyses	94	8	95	8	95	8	66	8	66	8	15	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID

**Table 3-1**  
**Summary of Statistical Analyses for Groundwater Well Samples**  
 Vashon Island Closed Landfill  
 1986 through 2020

Well Location Time Interval	Unit D Aquifer											
	MW-7		MW-12		MW-19		MW-26		MW-29		MW-34	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
<b>Toluene [ug/L]</b>												
No. of Analyses	94	8	95	8	95	8	66	8	66	8	15	8
No. of Detections	0	0	0	0	1	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	0.946	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
<b>trans -1,2-Dichloroethene [ug/L]</b>												
No. of Analyses	94	8	95	8	95	8	66	8	66	8	15	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
<b>Trichloroethene [ug/L]</b>												
No. of Analyses	94	8	95	8	95	8	66	8	66	8	15	8
No. of Detections	0	0	1	0	1	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	0.35	ND	0.28	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
<b>Trichlorofluoromethane [ug/L]</b>												
No. of Analyses	94	8	95	8	95	8	66	8	66	8	15	8
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
<b>Vinyl Chloride [ug/L]</b>												
No. of Analyses	94	8	95	8	95	8	66	8	66	8	15	8
No. of Detections	0	0	0	0	0	1	0	0	0	0	0	0
Minimum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	ND	ND	ND	ND	ND	0.0101	ND	ND	ND	ND	ND	ND
Mean	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Standard Deviation	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Median	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID

**NOTES:**

- Short - eight most recent analyses in the last two years.
- Long - historical data up to the last eight samples, but no greater than 50 samples.
- umhos/cm - microSiemens per centimeter
- mg/L - milligram per liter
- ug/L - microgram per liter
- ID - insufficient Data (i.e. the number of detections is less than 3)
- ND - Not Detected (i.e. at laboratory MDL - Method Detection Limit)

Table 3-2  
**Summary of Trend Results for Groundwater Well Samples**  
**Summary of Trend Analysis**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location Time Interval	Channel Cc1						
	MW-3	MW-4		MW-10		MW-13	
	Long	Long	Short	Long	Short	Long	Short
pH, Field [standard units]	D	--	--	D	--	--	--
Specific Conductance, Field [umhos/cm]	D	D	--	I	--	--	D
Alkalinity [mg/L]	D	D	I	--	--	D	D
Ammonia-N [mg/L]	D	D	--	D	--	--	--
Chloride [mg/L]	D	--	--	I	--	--	D
Nitrate-N [mg/L]	I	I	--	I	D	I	--
Sulfate [mg/L]	D	--	--	D	I	D	D
Total Dissolved Solids [mg/L]	D	D	--	I	--	D	--
Arsenic, Dissolved [mg/L]	D	D	I	--	I	I	--
Arsenic, Total [mg/L]	D	--	I	--	I	--	--
Calcium, Dissolved [mg/L]	D	D	--	I	--	--	D
Calcium, Total [mg/L]	--	--	--	I	--	--	D
Iron, Dissolved [mg/L]	D	--	--	D	--	--	--
Iron, Total [mg/L]	--	--	--	--	--	D	--
Magnesium, Dissolved [mg/L]	--	D	--	I	--	I	--
Magnesium, Total [mg/L]	--	--	--	I	--	--	D
Manganese, Dissolved [mg/L]	D	--	--	D	--	I	--
Manganese, Total [mg/L]	--	--	--	D	--	--	--
Potassium, Dissolved [mg/L]	D	D	--	I	--	I	--
Potassium, Total [mg/L]	D	--	--	--	--	--	D
Sodium, Dissolved [mg/L]	--	D	--	I	--	I	--
Sodium, Total [mg/L]	D	--	--	I	--	--	--
1,1-Dichloroethane [ug/L]	--	D	--	--	--	--	--
1,2-Dichloropropane [ug/L]	--	--	--	--	--	--	--
Benzene [ug/L]	--	--	--	--	--	--	--
Chloroethane [ug/L]	--	-- <sup>a</sup>	--	--	--	--	--
cis -1,2-Dichloroethene [ug/L]	--	--	I	--	--	--	--
Dichlorodifluoromethane [ug/L]	--	D	--	--	--	--	--
Toluene [ug/L]	--	--	--	--	--	--	--
trans -1,2-Dichloroethene [ug/L]	--	-- <sup>a</sup>	--	--	--	--	--
Trichloroethene [ug/L]	--	--	--	--	--	--	--
Trichlorofluoromethane [ug/L]	--	D	--	--	--	--	--
Vinyl Chloride [ug/L]	--	D	--	--	--	-- <sup>a</sup>	--

Table 3-2  
 Summary of Trend Results for Groundwater Well Samples  
 Summary of Trend Analysis  
 Vashon Island Closed Landfill  
 1986 through 2020

Well Location Time Interval	Channel Ce2												
	MW-2		MW-9		MW-20		MW-21		MW-33		MW-35		
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	
pH, Field [standard units]	--	--	D	--	D	--	--	--	--	--	--	D	--
Specific Conductance, Field [umhos/cm]	D	--	I	--	I	D	D	--	D	D	D	D	--
Alkalinity [mg/L]	D	--	I	--	I	D	D	I	D	D	D	D	--
Ammonia-N [mg/L]	D	--	D	--	--	--	--	--	--	--	--	--	--
Chloride [mg/L]	--	D	I	--	D	--	D	--	D	D	D	D	--
Nitrate-N [mg/L]	--	I	I	--	D	--	I	--	--	--	--	--	--
Sulfate [mg/L]	I	--	D	--	--	--	I	--	--	--	--	I	I
Total Dissolved Solids [mg/L]	D	I	I	--	I	--	D	I	D	D	D	D	--
Arsenic, Dissolved [mg/L]	--	--	--	--	--	--	--	D	D	--	--	I	--
Arsenic, Total [mg/L]	I	--	--	--	I	--	I	--	D	--	--	I	--
Calcium, Dissolved [mg/L]	D	--	I	--	I	--	D	--	--	D	--	--	--
Calcium, Total [mg/L]	D	--	I	--	I	--	D	--	--	D	--	--	--
Iron, Dissolved [mg/L]	D	--	D	--	--	--	D	--	D	--	--	I	--
Iron, Total [mg/L]	--	--	--	--	I	--	I	--	D	D	I	I	--
Magnesium, Dissolved [mg/L]	D	--	I	--	I	D	D	--	--	D	--	--	--
Magnesium, Total [mg/L]	D	I	I	--	I	--	D	I	--	D	--	--	--
Manganese, Dissolved [mg/L]	--	--	D	--	I	D	--	--	--	--	--	I	--
Manganese, Total [mg/L]	--	D	D	--	--	D	I	--	D	--	--	--	--
Potassium, Dissolved [mg/L]	D	--	I	--	I	--	D	--	--	--	--	--	--
Potassium, Total [mg/L]	D	--	--	--	--	--	D	--	--	D	--	--	--
Sodium, Dissolved [mg/L]	D	--	I	--	--	--	--	--	--	--	--	--	--
Sodium, Total [mg/L]	--	--	I	--	I	--	I	--	--	--	--	--	I
1,1-Dichloroethane [ug/L]	--	--	--	--	--	--	--	--	D	--	--	D	--
1,2-Dichloropropane [ug/L]	--	--	--	--	--	--	--	--	D	--	--	D	D
Benzene [ug/L]	--	--	--	--	--	--	--	--	D	--	--	--	D
Chloroethane [ug/L]	--	--	--	--	--	--	--	--	D	D	--	--	--
cis-1,2-Dichloroethene [ug/L]	I	D	--	--	-- <sup>a</sup>	--	D	D	D	I	D	D	D
Dichlorodifluoromethane [ug/L]	D	--	--	--	I	--	D	--	D	--	--	D	--
Toluene [ug/L]	--	--	--	--	-- <sup>a</sup>	--	--	--	D	--	--	--	--
trans-1,2-Dichloroethene [ug/L]	--	--	--	--	--	--	-- <sup>b</sup>	--	D	I	I	I	D
Trichloroethene [ug/L]	--	--	--	--	--	--	--	--	I	--	--	I	--
Trichlorofluoromethane [ug/L]	D	I	--	--	-- <sup>a</sup>	--	D	--	--	--	--	--	--
Vinyl Chloride [ug/L]	D	--	--	--	-- <sup>a</sup>	--	D	--	D	--	--	D	--

Table 3-2  
 Summary of Trend Results for Groundwater Well Samples  
 Summary of Trend Analysis  
 Vashon Island Closed Landfill  
 1986 through 2020

Well Location Time Interval	Channel Cc3			
	MW-8		MW-36	
	Long	Short	Long	Short
pH, Field [standard units]	--	--	D	--
Specific Conductance, Field [umhos/cm]	--	--	--	--
Alkalinity [mg/L]	D	--	--	--
Ammonia-N [mg/L]	D	--	D	--
Chloride [mg/L]	--	--	D	--
Nitrate-N [mg/L]	D	--	--	--
Sulfate [mg/L]	D	--	--	--
Total Dissolved Solids [mg/L]	--	--	--	--
Arsenic, Dissolved [mg/L]	D	--	I	--
Arsenic, Total [mg/L]	D	--	--	--
Calcium, Dissolved [mg/L]	--	--	I	--
Calcium, Total [mg/L]	I	--	I	--
Iron, Dissolved [mg/L]	D	--	--	--
Iron, Total [mg/L]	--	--	--	--
Magnesium, Dissolved [mg/L]	--	--	I	--
Magnesium, Total [mg/L]	--	--	I	--
Manganese, Dissolved [mg/L]	D	--	D	D
Manganese, Total [mg/L]	D	--	--	--
Potassium, Dissolved [mg/L]	I	--	--	--
Potassium, Total [mg/L]	--	--	--	--
Sodium, Dissolved [mg/L]	I	--	--	--
Sodium, Total [mg/L]	--	--	I	I
1,1-Dichloroethane [ug/L]	--	--	--	--
1,2-Dichloropropane [ug/L]	--	--	--	--
Benzene [ug/L]	--	--	--	--
Chloroethane [ug/L]	--	--	--	--
cis-1,2-Dichloroethene [ug/L]	--	--	--	--
Dichlorodifluoromethane [ug/L]	--	--	--	--
Toluene [ug/L]	-- <sup>a</sup>	--	--	--
trans-1,2-Dichloroethene [ug/L]	--	--	--	--
Trichloroethene [ug/L]	--	--	--	--
Trichlorofluoromethane [ug/L]	--	--	--	--
Vinyl Chloride [ug/L]	--	--	--	--

**Table 3-2**  
**Summary of Trend Results for Groundwater Well Samples**  
**Summary of Trend Analysis**  
 Vashon Island Closed Landfill  
 1986 through 2020

Well Location Time Interval	Unit D Aquifer											
	MW-7		MW-12		MW-19		MW-26		MW-29		MW-34	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
pH, Field [standard units]	D	--	D	--	D	D	D	--	D	--	--	--
Specific Conductance, Field [umhos/cm]	I	--	I	D	--	--	I	D	I	--	--	--
Alkalinity [mg/L]	I	--	I	--	D	--	--	--	I	D	D	--
Ammonia-N [mg/L]	I	--	D	--	--	--	I	--	D	--	D	--
Chloride [mg/L]	I	--	I	--	D	--	--	--	D	--	--	--
Nitrate-N [mg/L]	D	--	--	--	D	--	D	--	D	--	I	D
Sulfate [mg/L]	I	--	I	--	D	--	--	--	D	--	D	--
Total Dissolved Solids [mg/L]	I	--	I	--	--	--	I	--	I	--	--	--
Arsenic, Dissolved [mg/L]	D	--	--	--	D	--	--	--	D	--	--	--
Arsenic, Total [mg/L]	D	--	--	--	--	--	I	--	--	--	--	--
Calcium, Dissolved [mg/L]	I	--	I	--	--	--	I	--	I	--	I	--
Calcium, Total [mg/L]	I	--	I	D	--	--	--	D	I	--	--	--
Iron, Dissolved [mg/L]	--	I	D	--	D	--	--	--	--	--	--	--
Iron, Total [mg/L]	I	I	--	--	--	--	I	--	--	--	--	--
Magnesium, Dissolved [mg/L]	I	--	I	--	--	--	I	--	I	--	--	--
Magnesium, Total [mg/L]	I	--	I	--	--	--	I	--	I	--	I	--
Manganese, Dissolved [mg/L]	I	--	D	--	--	--	--	--	--	--	D	--
Manganese, Total [mg/L]	--	--	D	--	--	--	I	--	--	--	D	D
Potassium, Dissolved [mg/L]	I	--	I	--	--	--	I	--	I	--	--	--
Potassium, Total [mg/L]	I	--	I	D	--	--	--	--	--	--	--	--
Sodium, Dissolved [mg/L]	I	--	I	--	I	--	I	--	I	--	--	--
Sodium, Total [mg/L]	--	--	I	--	--	--	--	--	I	--	I	--
1,1-Dichloroethane [ug/L]	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane [ug/L]	--	--	--	--	--	--	--	--	--	--	--	--
Benzene [ug/L]	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane [ug/L]	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene [ug/L]	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane [ug/L]	--	--	--	--	--	--	--	--	--	--	--	--
Toluene [ug/L]	--	--	--	--	-- <sup>a</sup>	--	--	--	--	--	--	--
trans-1,2-Dichloroethene [ug/L]	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene [ug/L]	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane [ug/L]	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride [ug/L]	--	--	--	--	--	--	--	--	--	--	--	--

**NOTES:**

- Short - eight most recent analyses in the last two years.
- Long - historical data up to the last eight samples, but no greater than 50 samples.
- D - decreasing trend
- I - increasing trend
- - no detectable trend or too few data point to determine significance
- NaN - too few data points to calculate probability
- Probability - probability null hypothesis (i.e. 'No Trend') is true (aka p-value)
- Significance - trend is significant at 0.05
- umhos/cm - microSiemens per centimeter
- mg/L - milligram per liter
- ug/L - microgram per liter
- <sup>a</sup> Trend analysis resulted in artificial decreasing trend caused by changes in MDL.
- <sup>b</sup> Trend analysis resulted in artificial increasing trend caused by changes in MDL.



**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location	Channel Cc1						
	MW-3	MW-4		MW-10		MW-13	
	Long	Long	Short	Long	Short	Long	Short
<b>pH, Field [standard units]</b>							
No. of Analyses	32	43	8	50	8	50	8
No. of Detections	32	43	8	50	8	50	8
Trend	D	--	--	D	--	--	--
S-value	-148	72	-2	-336	-14	76	-16
Probability	0.017105	0.457216	0.901539	0.005041	0.107762	0.530089	0.063487
Significant	YES	NO	NO	YES	NO	NO	NO
<b>Specific Conductance, Field [umhos/cm]</b>							
No. of Analyses	32	43	8	50	8	50	8
No. of Detections	32	43	8	50	8	50	8
Trend	D	D	--	I	--	--	D
S-value	-259	-513	4	399	-4	-228	-20
Probability	2.65E-05	8.37E-08	0.710523	0.000747	0.710523	0.05634	0.018741
Significant	YES	YES	NO	YES	NO	NO	YES
<b>Alkalinity [mg/L]</b>							
No. of Analyses	25	22	8	50	8	50	8
No. of Detections	25	22	8	50	8	50	8
Trend	D	D	I	--	--	D	D
S-value	-157	-183	20	134	2	-278	-20
Probability	0.000261	2.8E-07	0.018741	0.265304	0.901539	0.020416	0.018741
Significant	YES	YES	YES	NO	NO	YES	YES
<b>Ammonia-N [mg/L]</b>							
No. of Analyses	31	50	8	50	8	50	8
No. of Detections	11	23	1	9	1	0	1
Trend	D	D	--	D	--	--	--
S-value	-292	-411	5	-657	5	0	-3
Probability	4.26E-07	0.000486	0.382733	2.32E-09	0.382733	NaN	0.662521
Significant	YES	YES	--	YES	--	--	--
<b>Chloride [mg/L]</b>							
No. of Analyses	32	50	8	50	8	50	8
No. of Detections	32	48	8	49	8	50	8
Trend	D	--	--	I	--	--	D
S-value	-308	81	-8	383	11	130	-22
Probability	5.59E-07	0.501735	0.386476	0.001381	0.202866	0.279946	0.008321
Significant	YES	NO	NO	YES	NO	NO	YES
<b>Nitrate-N [mg/L]</b>							
No. of Analyses	32	50	8	50	8	50	8
No. of Detections	32	29	8	50	8	49	8
Trend	I	I	--	I	D	I	--
S-value	131	550	0	872	-24	239	16
Probability	0.034676	3.64E-06	1	3.04E-13	0.004434	0.046499	0.063487
Significant	YES	YES	NO	YES	YES	YES	NO
<b>Sulfate [mg/L]</b>							
No. of Analyses	32	50	8	50	8	50	8
No. of Detections	32	50	8	50	8	50	8
Trend	D	--	--	D	I	D	D
S-value	-348	147	6	-509	18	-810	-20
Probability	1.71E-08	0.221725	0.536187	2.11E-05	0.035448	1.21E-11	0.018741
Significant	YES	NO	NO	YES	YES	YES	YES
<b>Total Dissolved Solids [mg/L]</b>							
No. of Analyses	27	40	8	50	8	50	8
No. of Detections	27	40	8	50	8	50	8
Trend	D	D	--	I	--	D	--
S-value	-104	-483	8	355	9	-241	-11
Probability	0.031664	1.9E-08	0.386476	0.003024	0.318567	0.044262	0.212486
Significant	YES	YES	NO	YES	NO	YES	NO

**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location	Channel Cc1						
	MW-3	MW-4		MW-10		MW-13	
	Long	Long	Short	Long	Short	Long	Short
<b>Arsenic, Dissolved [mg/L]</b>							
No. of Analyses	32	50	8	50	8	50	8
No. of Detections	3	12	8	50	8	50	8
Trend	D	D	I	--	I	I	--
S-value	-268	-553	17	-107	22	297	14
Probability	5.13E-07	2.98E-07	0.046063	0.374305	0.008321	0.013179	0.107762
Significant	YES	YES	YES	NO	YES	YES	NO
<b>Arsenic, Total [mg/L]</b>							
No. of Analyses	10	7	8	21	8	24	8
No. of Detections	7	6	8	21	8	24	8
Trend	D	--	I	--	I	--	--
S-value	-26	-5	23	-33	20	68	14
Probability	0.023232	0.548006	0.006091	0.332789	0.016965	0.095577	0.107762
Significant	YES	NO	YES	NO	YES	NO	NO
<b>Calcium, Dissolved [mg/L]</b>							
No. of Analyses	26	32	8	50	8	50	8
No. of Detections	26	32	8	50	8	50	8
Trend	D	D	--	I	--	--	D
S-value	-137	-369	13	416	0	222	-22
Probability	0.002678	2.37E-09	0.134625	0.000516	1	0.06419	0.009375
Significant	YES	YES	NO	YES	NO	NO	YES
<b>Calcium, Total [mg/L]</b>							
No. of Analyses	10	7	8	21	8	24	8
No. of Detections	10	7	8	21	8	24	8
Trend	--	--	--	I	--	--	D
S-value	-21	-2	16	103	-16	31	-20
Probability	0.073638	0.879257	0.063487	0.00206	0.063487	0.456381	0.018741
Significant	NO	NO	NO	YES	NO	NO	YES
<b>Iron, Dissolved [mg/L]</b>							
No. of Analyses	32	50	8	50	8	50	8
No. of Detections	21	36	0	14	0	24	2
Trend	D	--	--	D	--	--	--
S-value	-279	-156	0	-491	0	-157	-7
Probability	5.42E-06	0.193695	NaN	2.06E-07	NaN	0.158395	0.32394
Significant	YES	NO	--	YES	--	NO	--
<b>Iron, Total [mg/L]</b>							
No. of Analyses	10	7	8	21	8	24	8
No. of Detections	10	7	6	16	2	24	5
Trend	--	--	--	--	--	D	--
S-value	-3	3	-15	-44	-5	-128	-1
Probability	0.858028	0.763891	0.080905	0.188524	0.510798	0.001632	1
Significant	NO	NO	NO	NO	--	YES	NO
<b>Magnesium, Dissolved [mg/L]</b>							
No. of Analyses	26	32	8	50	8	50	8
No. of Detections	26	32	8	50	8	50	8
Trend	--	D	--	I	--	I	--
S-value	49	-349	14	574	-10	275	-15
Probability	0.288962	1.65E-08	0.107762	1.64E-06	0.26551	0.021376	0.080905
Significant	NO	YES	NO	YES	NO	YES	NO
<b>Magnesium, Total [mg/L]</b>							
No. of Analyses	10	7	8	21	8	24	8
No. of Detections	10	7	8	21	8	24	8
Trend	--	--	--	I	--	--	D
S-value	2	-2	14	98	-10	-2	-21
Probability	0.928444	0.879257	0.107762	0.003332	0.26551	0.980187	0.012649
Significant	NO	NO	NO	YES	NO	NO	YES

**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location	Channel Cc1						
	MW-3	MW-4		MW-10		MW-13	
	Long	Long	Short	Long	Short	Long	Short
<b>Manganese, Dissolved [mg/L]</b>							
No. of Analyses	32	50	8	50	8	50	8
No. of Detections	25	43	8	7	2	22	6
Trend	D	--	--	D	--	I	--
S-value	-283	-98	14	-390	-1	326	-9
Probability	4.2E-06	0.41682	0.107762	2.24E-05	1	0.002998	0.318567
Significant	YES	NO	NO	YES	--	YES	NO
<b>Manganese, Total [mg/L]</b>							
No. of Analyses	10	7	8	21	8	24	8
No. of Detections	10	7	8	12	8	21	8
Trend	--	--	--	D	--	--	--
S-value	5	-3	-8	-114	-16	-75	-8
Probability	0.720515	0.763891	0.386476	0.000364	0.063487	0.066121	0.386476
Significant	NO	NO	NO	YES	NO	NO	NO
<b>Potassium, Dissolved [mg/L]</b>							
No. of Analyses	26	32	8	50	8	50	8
No. of Detections	26	32	8	50	8	50	8
Trend	D	D	--	I	--	I	--
S-value	-247	-368	2	539	-4	372	-15
Probability	5.71E-08	2.13E-09	0.901539	6.5E-06	0.706197	0.00181	0.080905
Significant	YES	YES	NO	YES	NO	YES	NO
<b>Potassium, Total [mg/L]</b>							
No. of Analyses	10	7	8	21	8	24	8
No. of Detections	10	7	8	21	8	24	8
Trend	D	--	--	--	--	--	D
S-value	-30	-3	8	46	-13	-75	-17
Probability	0.009207	0.763891	0.386476	0.173798	0.134625	0.06601	0.046063
Significant	YES	NO	NO	NO	NO	NO	YES
<b>Sodium, Dissolved [mg/L]</b>							
No. of Analyses	26	32	8	50	8	50	8
No. of Detections	26	32	8	50	8	50	8
Trend	--	D	--	I	--	I	--
S-value	-66	-347	14	548	8	315	0
Probability	0.151844	1.86E-08	0.107762	4.69E-06	0.386476	0.008599	1
Significant	NO	YES	NO	YES	NO	YES	NO
<b>Sodium, Total [mg/L]</b>							
No. of Analyses	10	7	8	21	8	24	8
No. of Detections	10	7	8	21	8	24	8
Trend	D	--	--	I	--	--	--
S-value	-31	2	16	82	-5	-31	-10
Probability	0.00729	0.879257	0.063487	0.014358	0.617989	0.456381	0.26551
Significant	YES	NO	NO	YES	NO	NO	NO

**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location	Channel Cc1						
	MW-3	MW-4		MW-10		MW-13	
	Long	Long	Short	Long	Short	Long	Short
<b>1,1-Dichloroethane [ug/L]</b>							
No. of Analyses	32	50	8	50	8	50	8
No. of Detections	0	17	0	0	0	0	0
Trend	--	D	--	--	--	--	--
S-value	0	-529	0	0	0	0	0
Probability	NaN	5.88E-06	NaN	NaN	NaN	NaN	NaN
Significant	--	YES	--	--	--	--	--
<b>1,2-Dichloropropane [ug/L]</b>							
No. of Analyses	32	50	8	50	8	50	8
No. of Detections	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--
S-value	0	0	0	0	0	0	0
Probability	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Significant	--	--	--	--	--	--	--
<b>Benzene [ug/L]</b>							
No. of Analyses	32	50	8	50	8	50	8
No. of Detections	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--
S-value	0	0	0	0	0	0	0
Probability	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Significant	--	--	--	--	--	--	--
<b>Chloroethane [ug/L]</b>							
No. of Analyses	32	50	8	50	8	50	8
No. of Detections	0	6	0	0	0	0	0
Trend	--	-- <sup>a</sup>	--	--	--	--	--
S-value	0	-672	0	0	0	0	0
Probability	NaN	4.91E-09	NaN	NaN	NaN	NaN	NaN
Significant	--	--	--	--	--	--	--
<b>cis -1,2-Dichloroethene [ug/L]</b>							
No. of Analyses	29	42	8	50	8	50	8
No. of Detections	0	16	7	0	0	0	0
Trend	--	--	I	--	--	--	--
S-value	0	-1	18	0	0	0	0
Probability	NaN	1	0.035448	NaN	NaN	NaN	NaN
Significant	--	NO	YES	--	--	--	--
<b>Dichlorodifluoromethane [ug/L]</b>							
No. of Analyses	25	23	8	50	8	50	8
No. of Detections	0	12	0	0	0	0	0
Trend	--	D	--	--	--	--	--
S-value	0	-174	0	0	0	0	0
Probability	NaN	3.67E-06	NaN	NaN	NaN	NaN	NaN
Significant	--	YES	--	--	--	--	--

**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location	Channel Cc1						
	MW-3	MW-4		MW-10		MW-13	
	Long	Long	Short	Long	Short	Long	Short
<b>Toluene [ug/L]</b>							
No. of Analyses	32	50	8	50	8	50	8
No. of Detections	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--
S-value	0	0	0	0	0	0	0
Probability	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Significant	--	--	--	--	--	--	--
<b><i>trans</i>-1,2-Dichloroethene [ug/L]</b>							
No. of Analyses	31	47	8	50	8	50	8
No. of Detections	0	1	0	0	0	0	0
Trend	--	-- <sup>a</sup>	--	--	--	--	--
S-value	0	-581	0	0	0	0	0
Probability	NaN	3.85E-09	NaN	NaN	NaN	NaN	NaN
Significant	--	--	--	--	--	--	--
<b>Trichloroethene [ug/L]</b>							
No. of Analyses	32	50	8	50	8	50	8
No. of Detections	0	0	0	0	0	0	0
Trend	--	--	--	--	--	--	--
S-value	0	0	0	0	0	0	0
Probability	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Significant	--	--	--	--	--	--	--
<b>Trichlorofluoromethane [ug/L]</b>							
No. of Analyses	26	33	8	50	8	50	8
No. of Detections	14	26	0	0	0	0	0
Trend	--	D	--	--	--	--	--
S-value	-36	-208	0	0	0	0	0
Probability	0.42896	0.001309	NaN	NaN	NaN	NaN	NaN
Significant	NO	YES	--	--	--	--	--
<b>Vinyl Chloride [ug/L]</b>							
No. of Analyses	32	50	8	50	8	50	8
No. of Detections	0	20	0	0	0	1	0
Trend	--	D	--	--	--	-- <sup>a</sup>	--
S-value	0	-594	0	0	0	-331	0
Probability	NaN	5.51E-07	NaN	NaN	NaN	1.31E-05	NaN
Significant	--	YES	--	--	--	--	--

**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location	Channel Cc2											
	MW-2		MW-9		MW-20		MW-21		MW-33		MW-35	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
<b>pH, Field [standard units]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	15	8	15	8
Trend	--	--	D	--	D	--	--	--	--	--	D	--
S-value	217	-14	-512	-16	-681	-2	98	-5	-31	-1	-44	-4
Probability	0.070549	0.107762	1.88E-05	0.063487	1.27E-08	0.901539	0.416603	0.617989	0.135715	1	0.033126	0.710523
Significant	NO	NO	YES	NO	YES	NO	NO	NO	NO	NO	YES	NO
<b>Specific Conductance, Field [umhos/cm]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	15	8	15	8
Trend	D	--	I	--	I	D	D	--	D	D	D	--
S-value	-717	0	349	-10	447	-22	-578	6	-79	-26	-69	-8
Probability	2.05E-09	1	0.003452	0.26551	0.000174	0.009375	1.36E-06	0.536187	0.000113	0.001982	0.000765	0.386476
Significant	YES	NO	YES	NO	YES	YES	YES	NO	YES	YES	YES	NO
<b>Alkalinity [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	15	8	15	8
Trend	D	--	I	--	I	D	D	I	D	D	D	--
S-value	-993	8	270	3	392	-18	-825	18	-86	-24	-84	-10
Probability	1.00E-16	0.386476	0.024361	0.803089	0.00107	0.035448	5.38E-12	0.032667	2.54E-05	0.004434	3.91E-05	0.26551
Significant	YES	NO	YES	NO	YES	YES	YES	YES	YES	YES	YES	NO
<b>Ammonia-N [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	6	5	2	0	38	8	27	8	15	8	15	8
Trend	D	--	D	--	--	--	--	--	--	--	--	--
S-value	-549	4	-646	0	222	11	134	-1	-27	-12	-27	-1
Probability	1.78E-07	0.700116	4E-10	NaN	0.06248	0.212486	0.259087	1	0.198211	0.173546	0.19711	1
Significant	YES	NO	YES	--	NO	NO	NO	NO	NO	NO	NO	NO
<b>Chloride [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	15	8	15	8
Trend	--	D	I	--	D	--	D	--	D	D	D	--
S-value	-206	-18	299	6	-606	-3	-662	-8	-81	-23	-79	-4
Probability	0.08621	0.035448	0.012637	0.536187	4.09E-07	0.803089	3.16E-08	0.37908	7.53E-05	0.006091	0.000113	0.710523
Significant	NO	YES	YES	NO	YES	NO	YES	NO	YES	YES	YES	NO
<b>Nitrate-N [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	39	6	49	8	10	1	44	8	1	1	1	0
Trend	--	I	I	--	D	--	I	--	--	--	--	--
S-value	-159	27	432	10	-383	1	324	8	19	-3	17	0
Probability	0.184804	0.001189	0.000312	0.26551	0.000303	1	0.006832	0.386476	0.127736	0.662521	0.175781	NaN
Significant	NO	YES	YES	NO	YES	--	YES	NO	NO	--	NO	--
<b>Sulfate [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	15	8	15	8
Trend	I	--	D	--	--	--	I	--	--	--	I	I
S-value	470	10	-271	5	148	-8	276	9	12	-5	48	24
Probability	8.52E-05	0.26551	0.023495	0.617989	0.217159	0.386476	0.021258	0.318567	0.584812	0.617989	0.019872	0.004434
Significant	YES	NO	YES	NO	NO	NO	YES	NO	NO	NO	YES	YES
<b>Total Dissolved Solids [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	15	8	15	8
Trend	D	I	I	--	I	--	D	I	D	D	D	--
S-value	-764	17	507	-4	628	-3	-766	19	-54	-24	-64	10
Probability	1.7E-10	0.046063	2.25E-05	0.710523	1.51E-07	0.803089	1.54E-10	0.024822	0.008639	0.004434	0.001799	0.26551
Significant	YES	YES	YES	NO	YES	NO	YES	YES	YES	YES	YES	NO

**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location Time Interval	Channel Cc2											
	MW-2		MW-9		MW-20		MW-21		MW-33		MW-35	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
<b>Arsenic, Dissolved [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	28	8	50	8	50	8	43	8	15	8	15	8
Trend	--	--	--	--	--	--	--	D	D	--	I	--
S-value	-21	2	-25	13	28	1	-196	-18	-59	16	63	-16
Probability	0.861713	0.901539	0.840665	0.134625	0.821069	1	0.102277	0.035448	0.004011	0.063487	0.002153	0.063487
Significant	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	YES	NO
<b>Arsenic, Total [mg/L]</b>												
No. of Analyses	24	8	23	8	23	8	23	8	15	8	15	8
No. of Detections	8	8	23	8	23	8	20	8	15	8	15	8
Trend	I	--	--	--	I	--	I	--	D	--	I	--
S-value	73	2	67	9	164	-12	124	2	-59	12	70	3
Probability	0.039028	0.901539	0.079902	0.318567	1.66E-05	0.173546	0.001143	0.901539	0.004101	0.173546	0.000629	0.798966
Significant	YES	NO	NO	NO	YES	NO	YES	NO	YES	NO	YES	NO
<b>Calcium, Dissolved [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	15	8	15	8
Trend	D	--	I	--	I	--	D	--	--	D	--	--
S-value	-781	12	394	-2	548	-8	-702	8	7	-24	17	-14
Probability	6.59E-11	0.166905	0.000969	0.901539	4.29E-06	0.37908	4.43E-09	0.386476	0.765968	0.004434	0.42848	0.107762
Significant	YES	NO	YES	NO	YES	NO	YES	NO	NO	YES	NO	NO
<b>Calcium, Total [mg/L]</b>												
No. of Analyses	23	8	23	8	23	8	23	8	15	8	15	8
No. of Detections	23	8	23	8	23	8	23	8	15	8	15	8
Trend	D	--	I	--	I	--	D	--	--	D	--	--
S-value	-167	9	124	1	77	-3	-109	10	-37	-28	-27	-10
Probability	1.13E-05	0.318567	0.001146	1	0.044084	0.800021	0.004313	0.26551	0.074825	0.000837	0.198211	0.26551
Significant	YES	NO	YES	NO	YES	NO	YES	NO	NO	YES	NO	NO
<b>Iron, Dissolved [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	11	0	12	0	30	8	50	8	15	8	15	8
Trend	D	--	D	--	--	--	D	--	D	--	I	--
S-value	-414	0	-404	0	226	-14	-552	8	-50	-16	76	-9
Probability	1.73E-06	NaN	6.31E-06	NaN	0.051412	0.107762	4.03E-06	0.386476	0.015189	0.063487	0.000186	0.318567
Significant	YES	--	YES	--	NO	NO	YES	NO	YES	NO	YES	NO
<b>Iron, Total [mg/L]</b>												
No. of Analyses	24	8	23	8	23	8	23	8	15	8	15	8
No. of Detections	18	0	18	4	22	8	23	8	15	8	15	8
Trend	--	--	--	--	I	--	I	--	D	D	I	--
S-value	-15	0	-61	12	159	-10	152	10	-53	-20	70	14
Probability	0.725927	NaN	0.110954	0.143943	2.97E-05	0.26551	6.62E-05	0.26551	0.00989	0.018741	0.00061	0.107762
Significant	NO	--	NO	NO	YES	NO	YES	NO	YES	YES	YES	NO
<b>Magnesium, Dissolved [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	15	8	15	8
Trend	D	--	I	--	I	D	D	--	--	D	--	--
S-value	-763	16	581	7	728	-20	-679	14	-11	-18	-30	4
Probability	1.8E-10	0.063487	1.21E-06	0.454427	1.17E-09	0.016965	1.4E-08	0.107762	0.619832	0.035448	0.15075	0.710523
Significant	YES	NO	YES	NO	YES	YES	YES	NO	NO	YES	NO	NO
<b>Magnesium, Total [mg/L]</b>												
No. of Analyses	23	8	23	8	23	8	23	8	15	8	15	8
No. of Detections	23	8	23	8	23	8	23	8	15	8	15	8
Trend	D	I	I	--	I	--	D	I	--	D	--	--
S-value	-179	19	96	5	163	-14	-106	18	13	-27	-17	7
Probability	2.55E-06	0.024822	0.011879	0.617989	1.86E-05	0.102358	0.005536	0.035448	0.552615	0.001189	0.42848	0.454427
Significant	YES	YES	YES	NO	YES	NO	YES	YES	NO	YES	NO	NO

**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location	Channel Cc2											
	MW-2		MW-9		MW-20		MW-21		MW-33		MW-35	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
<b>Manganese, Dissolved [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	49	8	7	0	50	8	50	8	15	8	15	8
Trend	--	--	D	--	I	D	--	--	--	--	I	--
S-value	94	-16	-407	0	574	-26	-62	2	-22	-14	59	-8
Probability	0.436186	0.063487	2.55E-06	NaN	1.64E-06	0.001982	0.609834	0.901539	0.296519	0.107762	0.004011	0.386476
Significant	NO	NO	YES	--	YES	YES	NO	NO	NO	NO	YES	NO
<b>Manganese, Total [mg/L]</b>												
No. of Analyses	24	8	23	8	23	8	23	8	15	8	15	8
No. of Detections	24	8	16	8	23	8	23	8	15	8	15	8
Trend	--	D	D	--	--	D	I	--	D	--	--	--
S-value	25	-18	-80	10	-71	-23	123	0	-67	-16	22	0
Probability	0.551517	0.035448	0.034052	0.26551	0.064497	0.006091	0.001273	1	0.00106	0.063487	0.298105	1
Significant	NO	YES	YES	NO	NO	YES	YES	NO	YES	NO	NO	NO
<b>Potassium, Dissolved [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	15	8	15	8
Trend	D	--	I	--	I	--	D	--	--	--	--	--
S-value	-465	2	547	-4	369	-11	-553	10	14	-16	13	-7
Probability	0.000102	0.901539	4.82E-06	0.710523	0.002044	0.212486	3.82E-06	0.26551	0.519496	0.063487	0.551639	0.454427
Significant	YES	NO	YES	NO	YES	NO	YES	NO	NO	NO	NO	NO
<b>Potassium, Total [mg/L]</b>												
No. of Analyses	23	8	23	8	23	8	23	8	15	8	15	8
No. of Detections	23	8	23	8	23	8	23	8	15	8	15	8
Trend	D	--	--	--	--	--	D	--	--	D	--	--
S-value	-99	-1	71	-4	47	-12	-121	16	3	-18	-25	10
Probability	0.009546	1	0.06431	0.710523	0.223764	0.173546	0.001517	0.063487	0.920965	0.035448	0.233806	0.26551
Significant	YES	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO	NO
<b>Sodium, Dissolved [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	15	8	15	8
Trend	D	--	I	--	--	--	--	--	--	--	--	--
S-value	-334	2	530	7	-20	-7	172	-12	-5	-10	11	15
Probability	0.005337	0.901539	9.57E-06	0.454427	0.873689	0.454427	0.15097	0.173546	0.842705	0.26551	0.620691	0.080905
Significant	YES	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Sodium, Total [mg/L]</b>												
No. of Analyses	23	8	23	8	23	8	23	8	15	8	15	8
No. of Detections	23	8	23	8	23	8	23	8	15	8	15	8
Trend	--	--	I	--	I	--	I	--	--	--	--	I
S-value	-62	-5	102	10	114	-5	79	-13	18	-14	17	20
Probability	0.107049	0.617989	0.007622	0.26551	0.002832	0.617989	0.038484	0.134625	0.398452	0.107762	0.427346	0.018741
Significant	NO	NO	YES	NO	YES	NO	YES	NO	NO	NO	NO	YES



**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location	Channel Cc2											
	MW-2		MW-9		MW-20		MW-21		MW-33		MW-35	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
<b>1,1-Dichloroethane [ug/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	0	0	0	0	0	0	0	0	15	8	15	8
Trend	--	--	--	--	--	--	--	--	D	--	D	--
S-value	0	0	0	0	0	0	0	0	-78	10	-72	-16
Probability	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	0.000136	0.26551	0.000435	0.063487
Significant	--	--	--	--	--	--	--	--	YES	NO	YES	NO
<b>1,2-Dichloropropane [ug/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	0	0	0	0	0	0	0	0	15	8	15	8
Trend	--	--	--	--	--	--	--	--	D	--	D	D
S-value	0	0	0	0	0	0	0	0	-85	10	-54	-26
Probability	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	3.23E-05	0.26551	0.008639	0.001982
Significant	--	--	--	--	--	--	--	--	YES	NO	YES	YES
<b>Benzene [ug/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	0	0	0	0	0	0	0	0	15	8	15	8
Trend	--	--	--	--	--	--	--	--	D	--	--	D
S-value	0	0	0	0	0	0	0	0	-83	-4	-17	-22
Probability	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	4.95E-05	0.710523	0.42848	0.009375
Significant	--	--	--	--	--	--	--	--	YES	NO	NO	YES
<b>Chloroethane [ug/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	0	0	0	0	0	0	0	0	14	6	0	0
Trend	--	--	--	--	--	--	--	--	D	D	--	--
S-value	0	0	0	0	0	0	0	0	-45	-17	0	0
Probability	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	0.029448	0.046063	NaN	NaN
Significant	--	--	--	--	--	--	--	--	YES	YES	--	--
<b>cis -1,2-Dichloroethene [ug/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	9	4	0	0	1	0	49	8	15	8	15	8
Trend	I	D	--	--	-- <sup>a</sup>	--	D	D	D	I	D	D
S-value	307	-20	0	0	-267	0	-244	-24	-81	22	-53	-22
Probability	0.000236	0.011603	NaN	NaN	0.000443	NaN	0.042027	0.004434	7.53E-05	0.009375	0.010072	0.009375
Significant	YES	YES	--	--	--	--	YES	YES	YES	YES	YES	YES
<b>Dichlorodifluoromethane [ug/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8
No. of Detections	49	8	0	0	16	8	49	8	15	8	15	8
Trend	D	--	--	--	I	--	D	--	D	--	D	--
S-value	-533	10	0	0	484	-10	-733	14	-43	8	-64	10
Probability	8.57E-06	0.26551	NaN	NaN	9.9E-07	0.26551	9.18E-10	0.107762	0.037667	0.386476	0.001799	0.26551
Significant	YES	NO	--	--	YES	NO	YES	NO	YES	NO	YES	NO

**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location	Channel Cc2												
	MW-2		MW-9		MW-20		MW-21		MW-33		MW-35		
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	
<b>Toluene [ug/L]</b>													
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8	
No. of Detections	0	0	0	0	1	0	0	0	6	0	7	0	
Trend	--	--	--	--	-- <sup>a</sup>	--	--	--	D	--	--	--	
S-value	0	0	0	0	-321	0	0	0	-68	0	28	0	
Probability	NaN	NaN	NaN	NaN	2.38E-05	NaN	NaN	NaN	0.000544	NaN	0.144292	NaN	
Significant	--	--	--	--	--	--	--	--	YES	--	NO	--	
<b>trans -1,2-Dichloroethene [ug/L]</b>													
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8	
No. of Detections	0	0	0	0	0	0	7	1	15	8	15	8	
Trend	--	--	--	--	--	--	-- <sup>b</sup>	--	D	I	I	D	
S-value	0	0	0	0	0	0	286	-7	-87	24	49	-20	
Probability	NaN	NaN	NaN	NaN	NaN	NaN	7.22E-05	0.19043	2.08E-05	0.004434	0.017255	0.018741	
Significant	--	--	--	--	--	--	--	--	YES	YES	YES	YES	
<b>Trichloroethene [ug/L]</b>													
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8	
No. of Detections	0	0	0	0	0	0	0	0	7	6	15	8	
Trend	--	--	--	--	--	--	--	--	I	--	I	--	
S-value	0	0	0	0	0	0	0	0	44	13	48	2	
Probability	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	0.020063	0.134625	0.01957	0.901539	
Significant	--	--	--	--	--	--	--	--	YES	NO	YES	NO	
<b>Trichlorofluoromethane [ug/L]</b>													
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8	
No. of Detections	50	8	0	0	1	0	48	8	0	0	0	0	
Trend	D	I	--	--	-- <sup>a</sup>	--	D	--	--	--	--	--	
S-value	-669	20	0	0	-267	0	-696	16	0	0	0	0	
Probability	2.3E-08	0.018741	NaN	NaN	0.000443	NaN	6.09E-09	0.063487	NaN	NaN	NaN	NaN	
Significant	YES	YES	--	--	--	--	YES	NO	--	--	--	--	
<b>Vinyl Chloride [ug/L]</b>													
No. of Analyses	50	8	50	8	50	8	50	8	15	8	15	8	
No. of Detections	49	8	0	0	1	0	49	8	15	8	15	8	
Trend	D	--	--	--	-- <sup>a</sup>	--	D	--	D	--	D	--	
S-value	-849	-14	0	0	-267	0	-925	8	-47	-14	-73	6	
Probability	1.28E-12	0.107762	NaN	NaN	0.000443	NaN	1E-14	0.386476	0.022822	0.107762	0.000367	0.536187	
Significant	YES	NO	--	--	--	--	YES	NO	YES	NO	YES	NO	

**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location	Channel Cc3			
	MW-8		MW-36	
	Long	Short	Long	Short
<b>Time Interval</b>				
<b>pH, Field [standard units]</b>				
No. of Analyses	50	8	15	8
No. of Detections	50	8	15	8
Trend	--	--	D	--
S-value	22	-8	-50	-3
Probability	0.860477	0.386476	0.014611	0.803089
Significant	NO	NO	YES	NO
<b>Specific Conductance, Field [umhos/cm]</b>				
No. of Analyses	50	8	15	8
No. of Detections	50	8	15	8
Trend	--	--	--	--
S-value	-53	-2	-21	0
Probability	0.66195	0.901539	0.321112	1
Significant	NO	NO	NO	NO
<b>Alkalinity [mg/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	50	8	15	8
Trend	D	--	--	--
S-value	-480	6	-22	-3
Probability	6.09E-05	0.536187	0.296916	0.800021
Significant	YES	NO	NO	NO
<b>Ammonia-N [mg/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	2	1	1	3
Trend	D	--	D	--
S-value	-639	7	-54	0
Probability	1.01E-09	0.19043	0.00281	1
Significant	YES	--	YES	NO
<b>Chloride [mg/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	50	8	15	8
Trend	--	--	D	--
S-value	46	-6	-46	5
Probability	0.706439	0.536187	0.02577	0.617989
Significant	NO	NO	YES	NO
<b>Nitrate-N [mg/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	50	8	15	8
Trend	D	--	--	--
S-value	-397	-7	38	-5
Probability	0.000922	0.454427	0.065203	0.604571
Significant	YES	NO	NO	NO
<b>Sulfate [mg/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	50	8	15	8
Trend	D	--	--	--
S-value	-540	-8	-33	11
Probability	6.47E-06	0.386476	0.110338	0.212486
Significant	YES	NO	NO	NO
<b>Total Dissolved Solids [mg/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	50	8	15	8
Trend	--	--	--	--
S-value	96	11	7	-1
Probability	0.425854	0.212486	0.765407	1
Significant	NO	NO	NO	NO

**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location Time Interval	Channel Cc3			
	MW-8		MW-36	
	Long	Short	Long	Short
<b>Arsenic, Dissolved [mg/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	8	8	15	8
Trend	D	--	I	--
S-value	-275	5	43	1
Probability	0.000594	0.617989	0.036578	1
Significant	YES	NO	YES	NO
<b>Arsenic, Total [mg/L]</b>				
No. of Analyses	22	8	15	8
No. of Detections	7	8	15	8
Trend	D	--	--	--
S-value	-60	6	29	8
Probability	0.042921	0.536187	0.162386	0.386476
Significant	YES	NO	NO	NO
<b>Calcium, Dissolved [mg/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	50	8	15	8
Trend	--	--	I	--
S-value	-193	-6	58	-5
Probability	0.106268	0.520912	0.004638	0.617989
Significant	NO	NO	YES	NO
<b>Calcium, Total [mg/L]</b>				
No. of Analyses	22	8	15	8
No. of Detections	22	8	15	8
Trend	I	--	I	--
S-value	90	-10	54	-16
Probability	0.011736	0.258095	0.008639	0.063487
Significant	YES	NO	YES	NO
<b>Iron, Dissolved [mg/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	12	0	1	0
Trend	D	--	--	--
S-value	-367	0	-14	0
Probability	6.82E-05	NaN	0.132464	NaN
Significant	YES	--	NO	--
<b>Iron, Total [mg/L]</b>				
No. of Analyses	22	8	15	8
No. of Detections	8	1	6	1
Trend	--	--	--	--
S-value	-42	1	-23	7
Probability	0.176932	1	0.216108	0.19043
Significant	NO	--	NO	--
<b>Magnesium, Dissolved [mg/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	50	8	15	8
Trend	--	--	I	--
S-value	62	14	52	2
Probability	0.609743	0.107762	0.011506	0.901539
Significant	NO	NO	YES	NO
<b>Magnesium, Total [mg/L]</b>				
No. of Analyses	22	8	15	8
No. of Detections	22	8	15	8
Trend	--	--	I	--
S-value	49	10	49	-10
Probability	0.175552	0.26551	0.017531	0.258095
Significant	NO	NO	YES	NO

**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location	Channel Cc3			
	MW-8		MW-36	
	Long	Short	Long	Short
<b>Manganese, Dissolved [mg/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	2	0	15	8
Trend	D	--	D	D
S-value	-356	0	-74	-22
Probability	1.87E-05	NaN	0.000298	0.009375
Significant	YES	--	YES	YES
<b>Manganese, Total [mg/L]</b>				
No. of Analyses	22	8	15	8
No. of Detections	3	4	15	8
Trend	D	--	--	--
S-value	-82	4	-29	-6
Probability	0.010449	0.690242	0.165857	0.536187
Significant	YES	NO	NO	NO
<b>Potassium, Dissolved [mg/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	50	8	15	8
Trend	I	--	--	--
S-value	312	6	27	-10
Probability	0.008971	0.520912	0.19711	0.26551
Significant	YES	NO	NO	NO
<b>Potassium, Total [mg/L]</b>				
No. of Analyses	22	8	15	8
No. of Detections	22	8	15	8
Trend	--	--	--	--
S-value	-2	0	36	-7
Probability	0.976841	1	0.082132	0.447278
Significant	NO	NO	NO	NO
<b>Sodium, Dissolved [mg/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	50	8	15	8
Trend	I	--	--	--
S-value	298	16	31	10
Probability	0.012916	0.063487	0.137646	0.26551
Significant	YES	NO	NO	NO
<b>Sodium, Total [mg/L]</b>				
No. of Analyses	22	8	15	8
No. of Detections	22	8	15	8
Trend	--	--	I	I
S-value	53	14	47	17
Probability	0.142569	0.107762	0.022049	0.046063
Significant	NO	NO	YES	YES

**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location	Channel Cc3			
	MW-8		MW-36	
	Long	Short	Long	Short
<b>Time Interval</b>				
<b>1,1-Dichloroethane [ug/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	0	0	0	0
Trend	--	--	--	--
S-value	0	0	0	0
Probability	NaN	NaN	NaN	NaN
Significant	--	--	--	--
<b>1,2-Dichloropropane [ug/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	0	0	0	0
Trend	--	--	--	--
S-value	0	0	0	0
Probability	NaN	NaN	NaN	NaN
Significant	--	--	--	--
<b>Benzene [ug/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	0	0	0	0
Trend	--	--	--	--
S-value	0	0	0	0
Probability	NaN	NaN	NaN	NaN
Significant	--	--	--	--
<b>Chloroethane [ug/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	0	0	0	0
Trend	--	--	--	--
S-value	0	0	0	0
Probability	NaN	NaN	NaN	NaN
Significant	--	--	--	--
<b>cis -1,2-Dichloroethene [ug/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	0	0	0	0
Trend	--	--	--	--
S-value	0	0	0	0
Probability	NaN	NaN	NaN	NaN
Significant	--	--	--	--
<b>Dichlorodifluoromethane [ug/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	0	0	0	0
Trend	--	--	--	--
S-value	0	0	0	0
Probability	NaN	NaN	NaN	NaN
Significant	--	--	--	--

**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location	Channel Cc3			
	MW-8		MW-36	
	Long	Short	Long	Short
<b>Toluene [ug/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	1	0	0	0
Trend	-- <sup>a</sup>	--	--	--
S-value	-315	0	0	0
Probability	3.37E-05	NaN	NaN	NaN
Significant	--	--	--	--
<b><i>trans</i>-1,2-Dichloroethene [ug/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	0	0	0	0
Trend	--	--	--	--
S-value	0	0	0	0
Probability	NaN	NaN	NaN	NaN
Significant	--	--	--	--
<b>Trichloroethene [ug/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	0	0	0	0
Trend	--	--	--	--
S-value	0	0	0	0
Probability	NaN	NaN	NaN	NaN
Significant	--	--	--	--
<b>Trichlorofluoromethane [ug/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	0	0	0	0
Trend	--	--	--	--
S-value	0	0	0	0
Probability	NaN	NaN	NaN	NaN
Significant	--	--	--	--
<b>Vinyl Chloride [ug/L]</b>				
No. of Analyses	50	8	15	8
No. of Detections	0	0	0	0
Trend	--	--	--	--
S-value	0	0	0	0
Probability	NaN	NaN	NaN	NaN
Significant	--	--	--	--

**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location	Unit D Aquifer											
	MW-7		MW-12		MW-19		MW-26		MW-29		MW-34	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
<b>pH, Field [standard units]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	50	8	15	8
Trend	D	--	D	--	D	D	D	--	D	--	--	--
S-value	-430	-4	-264	1	-506	-19	-353	-10	-403	-6	-22	-4
Probability	0.00033	0.710523	0.02767	1	2.35E-05	0.024822	0.003219	0.26551	0.000763	0.536187	0.298105	0.710523
Significant	YES	NO	YES	NO	YES	YES	YES	NO	YES	NO	NO	NO
<b>Specific Conductance, Field [umhos/cm]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	50	8	15	8
Trend	I	--	I	D	--	--	I	D	I	--	--	--
S-value	328	0	545	-20	191	-12	307	-19	341	-14	-13	-12
Probability	0.005702	1	4.08E-06	0.018741	0.110438	0.173546	0.009983	0.024822	0.004305	0.107762	0.552615	0.166905
Significant	YES	NO	YES	YES	NO	NO	YES	YES	YES	NO	NO	NO
<b>Alkalinity [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	50	8	15	8
Trend	I	--	I	--	D	--	--	--	I	D	D	--
S-value	473	1	636	-16	-381	-5	100	1	325	-17	-41	5
Probability	7.82E-05	1	1.07E-07	0.063487	0.001473	0.617989	0.407235	1	0.005999	0.042707	0.047217	0.617989
Significant	YES	NO	YES	NO	YES	NO	NO	NO	YES	YES	YES	NO
<b>Ammonia-N [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8
No. of Detections	50	8	2	1	43	8	50	8	6	8	3	1
Trend	I	--	D	--	--	--	I	--	D	--	D	--
S-value	504	-12	-634	5	-101	-2	352	-6	-653	15	-50	1
Probability	2.56E-05	0.173546	2.19E-09	0.382733	0.402068	0.901539	0.003286	0.520912	1.39E-10	0.080905	0.008559	1
Significant	YES	NO	YES	--	NO	NO	YES	NO	YES	NO	YES	--
<b>Chloride [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	50	8	15	8
Trend	I	--	I	--	D	--	--	--	D	--	--	--
S-value	338	2	389	-7	-566	-7	-18	2	-461	-8	-7	-2
Probability	0.004764	0.901539	0.001151	0.454427	2.28E-06	0.444833	0.88684	0.901539	0.000118	0.386476	0.766525	0.901539
Significant	YES	NO	YES	NO	YES	NO	NO	NO	YES	NO	NO	NO
<b>Nitrate-N [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8
No. of Detections	17	8	50	8	17	1	28	8	1	0	15	8
Trend	D	--	--	--	D	--	D	--	D	--	I	D
S-value	-398	-1	-141	-9	-578	-5	-443	-2	-419	0	55	-26
Probability	0.000424	1	0.241347	0.318567	3.14E-07	0.382733	0.000174	0.895533	1.05E-06	NaN	0.007533	0.001982
Significant	YES	NO	NO	NO	YES	--	YES	NO	YES	--	YES	YES
<b>Sulfate [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	50	8	15	8
Trend	I	--	I	--	D	--	--	--	D	--	D	--
S-value	412	-3	475	-15	-557	-13	127	0	-479	5	-46	2
Probability	0.000561	0.803089	6.94E-05	0.080905	3.04E-06	0.134625	0.289146	1	6.17E-05	0.617989	0.025408	0.901539
Significant	YES	NO	YES	NO	YES	NO	NO	NO	YES	NO	YES	NO
<b>Total Dissolved Solids [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	50	8	15	8
Trend	I	--	I	--	--	--	I	--	I	--	--	--
S-value	599	-5	626	-16	-82	-10	434	-3	451	8	23	5
Probability	5.39E-07	0.610492	1.64E-07	0.059451	0.497276	0.258095	0.000286	0.803089	0.000161	0.386476	0.273916	0.617989
Significant	YES	NO	YES	NO	NO	NO	YES	NO	YES	NO	NO	NO



**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location	Unit D Aquifer											
	MW-7		MW-12		MW-19		MW-26		MW-29		MW-34	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
<b>Arsenic, Dissolved [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	50	8	15	8
Trend	D	--	--	--	D	--	--	--	D	--	--	--
S-value	-594	0	-113	8	-978	-8	-163	-3	-589	1	2	-10
Probability	6.99E-07	1	0.348085	0.37908	2.95E-16	0.37908	0.175061	0.803089	8.62E-07	1	0.960287	0.258095
Significant	YES	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO
<b>Arsenic, Total [mg/L]</b>												
No. of Analyses	23	8	22	8	23	8	23	8	23	8	15	8
No. of Detections	23	8	22	8	23	8	23	8	23	8	15	8
Trend	D	--	--	--	--	--	I	--	--	--	--	--
S-value	-85	16	67	-5	-59	0	116	-9	-37	-10	20	-6
Probability	0.026277	0.063487	0.062039	0.612407	0.125306	1	0.002357	0.318567	0.341718	0.26551	0.343716	0.473542
Significant	YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO
<b>Calcium, Dissolved [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	50	8	15	8
Trend	I	--	I	--	--	--	I	--	I	--	I	--
S-value	576	-13	653	-14	101	-9	401	-10	511	-9	41	-8
Probability	1.4E-06	0.134625	4.86E-08	0.102358	0.40231	0.308325	0.000796	0.26551	1.87E-05	0.318567	0.046492	0.386476
Significant	YES	NO	YES	NO	NO	NO	YES	NO	YES	NO	YES	NO
<b>Calcium, Total [mg/L]</b>												
No. of Analyses	23	8	22	8	23	8	23	8	23	8	15	8
No. of Detections	23	8	22	8	23	8	23	8	23	8	15	8
Trend	I	--	I	D	--	--	--	D	I	--	--	--
S-value	124	-7	120	-22	2	-8	74	-19	79	-14	30	-15
Probability	0.001134	0.454427	0.000781	0.008321	0.978893	0.386476	0.053219	0.024822	0.038484	0.107762	0.148404	0.074619
Significant	YES	NO	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
<b>Iron, Dissolved [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8
No. of Detections	23	6	11	0	49	8	50	8	50	8	0	0
Trend	--	I	D	--	D	--	--	--	--	--	--	--
S-value	-167	19	-372	0	-433	10	-14	-12	206	-6	0	0
Probability	0.129483	0.024822	3.22E-05	NaN	0.0003	0.26551	0.913383	0.173546	0.086276	0.536187	NaN	NaN
Significant	NO	YES	YES	--	YES	NO	NO	NO	NO	NO	--	--
<b>Iron, Total [mg/L]</b>												
No. of Analyses	23	8	22	8	23	8	23	8	23	8	15	8
No. of Detections	22	8	14	5	23	8	23	8	23	8	12	2
Trend	I	I	--	--	--	--	I	--	--	--	--	--
S-value	115	20	23	13	44	0	119	-10	-17	-10	-24	-9
Probability	0.002588	0.018741	0.524044	0.126484	0.255937	1	0.001831	0.26551	0.672611	0.26551	0.252893	0.188445
Significant	YES	YES	NO	NO	NO	NO	YES	NO	NO	NO	NO	--
<b>Magnesium, Dissolved [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	50	8	15	8
Trend	I	--	I	--	--	--	I	--	I	--	--	--
S-value	619	-6	756	-5	193	1	647	0	531	-10	34	-5
Probability	2.31E-07	0.536187	2.62E-10	0.617989	0.107768	1	6.46E-08	1	8.92E-06	0.258095	0.101191	0.617989
Significant	YES	NO	YES	NO	NO	NO	YES	NO	YES	NO	NO	NO
<b>Magnesium, Total [mg/L]</b>												
No. of Analyses	23	8	22	8	23	8	23	8	23	8	15	8
No. of Detections	23	8	22	8	23	8	23	8	23	8	15	8
Trend	I	--	I	--	--	--	I	--	I	--	I	--
S-value	121	3	78	-11	-13	-2	91	-8	76	-9	45	-2
Probability	0.001528	0.803089	0.029848	0.212486	0.750739	0.900004	0.017457	0.386476	0.047074	0.318567	0.028657	0.897842
Significant	YES	NO	YES	NO	NO	NO	YES	NO	YES	NO	YES	NO

**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location Time Interval	Unit D Aquifer											
	MW-7		MW-12		MW-19		MW-26		MW-29		MW-34	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
<b>Manganese, Dissolved [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8
No. of Detections	49	8	3	1	49	8	50	8	50	8	8	8
Trend	I	--	D	--	--	--	--	--	--	--	D	--
S-value	396	-4	-280	7	-161	-4	192	-16	-93	-14	-78	-10
Probability	0.000946	0.710523	0.000781	0.19043	0.180539	0.710523	0.109984	0.063487	0.441408	0.107762	5.44E-05	0.26551
Significant	YES	NO	YES	--	NO	NO	NO	NO	NO	NO	YES	NO
<b>Manganese, Total [mg/L]</b>												
No. of Analyses	23	8	22	8	23	8	23	8	23	8	15	8
No. of Detections	23	8	11	7	23	8	23	8	23	8	14	8
Trend	--	--	D	--	--	--	I	--	--	--	D	D
S-value	9	2	-80	16	16	-16	115	-14	0	-8	-51	-18
Probability	0.832435	0.901539	0.016852	0.063487	0.691887	0.063487	0.002606	0.107762	1	0.386476	0.013348	0.035448
Significant	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO	YES	YES
<b>Potassium, Dissolved [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	50	8	15	8
Trend	I	--	I	--	--	--	I	--	I	--	--	--
S-value	612	-8	664	-2	163	-10	475	-11	563	-10	-3	-8
Probability	3.08E-07	0.386476	2.67E-08	0.900004	0.174839	0.26551	7.11E-05	0.212486	2.51E-06	0.26551	0.920706	0.386476
Significant	YES	NO	YES	NO	NO	NO	YES	NO	YES	NO	NO	NO
<b>Potassium, Total [mg/L]</b>												
No. of Analyses	23	8	22	8	23	8	23	8	23	8	15	8
No. of Detections	23	8	22	8	23	8	23	8	23	8	15	8
Trend	I	--	I	D	--	--	--	--	--	--	--	--
S-value	128	0	83	-17	-49	-8	-3	-10	53	-13	-15	-9
Probability	0.000771	1	0.020429	0.042707	0.204272	0.386476	0.957845	0.258095	0.168353	0.134625	0.487354	0.318567
Significant	YES	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO
<b>Sodium, Dissolved [mg/L]</b>												
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8
No. of Detections	50	8	50	8	50	8	50	8	50	8	15	8
Trend	I	--	I	--	I	--	I	--	I	--	--	--
S-value	368	2	751	12	335	8	253	7	420	-2	35	6
Probability	0.00213	0.901539	3.47E-10	0.173546	0.005198	0.386476	0.034981	0.454427	0.000455	0.901539	0.09246	0.536187
Significant	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	NO	NO
<b>Sodium, Total [mg/L]</b>												
No. of Analyses	23	8	22	8	23	8	23	8	23	8	15	8
No. of Detections	23	8	22	8	23	8	23	8	23	8	15	8
Trend	--	--	I	--	--	--	--	--	I	--	I	--
S-value	61	14	113	-12	39	8	-45	8	91	-2	47	9
Probability	0.113051	0.107762	0.001588	0.173546	0.315235	0.386476	0.245211	0.386476	0.0173	0.900004	0.022822	0.318567
Significant	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	YES	NO

**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location	Unit D Aquifer												
	MW-7		MW-12		MW-19		MW-26		MW-29		MW-34		
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	
<b>1,1-Dichloroethane [ug/L]</b>													
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8	
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	
Trend	--	--	--	--	--	--	--	--	--	--	--	--	
S-value	0	0	0	0	0	0	0	0	0	0	0	0	
Probability	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
Significant	--	--	--	--	--	--	--	--	--	--	--	--	
<b>1,2-Dichloropropane [ug/L]</b>													
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8	
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	
Trend	--	--	--	--	--	--	--	--	--	--	--	--	
S-value	0	0	0	0	0	0	0	0	0	0	0	0	
Probability	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
Significant	--	--	--	--	--	--	--	--	--	--	--	--	
<b>Benzene [ug/L]</b>													
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8	
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	
Trend	--	--	--	--	--	--	--	--	--	--	--	--	
S-value	0	0	0	0	0	0	0	0	0	0	0	0	
Probability	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
Significant	--	--	--	--	--	--	--	--	--	--	--	--	
<b>Chloroethane [ug/L]</b>													
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8	
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	
Trend	--	--	--	--	--	--	--	--	--	--	--	--	
S-value	0	0	0	0	0	0	0	0	0	0	0	0	
Probability	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
Significant	--	--	--	--	--	--	--	--	--	--	--	--	
<b>cis -1,2-Dichloroethene [ug/L]</b>													
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8	
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	
Trend	--	--	--	--	--	--	--	--	--	--	--	--	
S-value	0	0	0	0	0	0	0	0	0	0	0	0	
Probability	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
Significant	--	--	--	--	--	--	--	--	--	--	--	--	
<b>Dichlorodifluoromethane [ug/L]</b>													
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8	
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	
Trend	--	--	--	--	--	--	--	--	--	--	--	--	
S-value	0	0	0	0	0	0	0	0	0	0	0	0	
Probability	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
Significant	--	--	--	--	--	--	--	--	--	--	--	--	

**Table 3-3**  
**Summary of Trend Analyses for Groundwater Well Samples Groundwater**  
**Trends in Individual Wells**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location	Unit D Aquifer												
	MW-7		MW-12		MW-19		MW-26		MW-29		MW-34		
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	
<b>Toluene [ug/L]</b>													
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8	
No. of Detections	0	0	0	0	1	0	0	0	0	0	0	0	
Trend	--	--	--	--	-- <sup>a</sup>	--	--	--	--	--	--	--	
S-value	0	0	0	0	-309	0	0	0	0	0	0	0	
Probability	NaN	NaN	NaN	NaN	4.75E-05	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
Significant	--	--	--	--	--	--	--	--	--	--	--	--	
<b>trans -1,2-Dichloroethene [ug/L]</b>													
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8	
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	
Trend	--	--	--	--	--	--	--	--	--	--	--	--	
S-value	0	0	0	0	0	0	0	0	0	0	0	0	
Probability	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
Significant	--	--	--	--	--	--	--	--	--	--	--	--	
<b>Trichloroethene [ug/L]</b>													
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8	
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	
Trend	--	--	--	--	--	--	--	--	--	--	--	--	
S-value	0	0	0	0	0	0	0	0	0	0	0	0	
Probability	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
Significant	--	--	--	--	--	--	--	--	--	--	--	--	
<b>Trichlorofluoromethane [ug/L]</b>													
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8	
No. of Detections	0	0	0	0	0	0	0	0	0	0	0	0	
Trend	--	--	--	--	--	--	--	--	--	--	--	--	
S-value	0	0	0	0	0	0	0	0	0	0	0	0	
Probability	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
Significant	--	--	--	--	--	--	--	--	--	--	--	--	
<b>Vinyl Chloride [ug/L]</b>													
No. of Analyses	50	8	50	8	50	8	50	8	50	8	15	8	
No. of Detections	0	0	0	0	0	1	0	0	0	0	0	0	
Trend	--	--	--	--	--	--	--	--	--	--	--	--	
S-value	0	0	0	0	0	-5	0	0	0	0	0	0	
Probability	NaN	NaN	NaN	NaN	NaN	0.382733	NaN	NaN	NaN	NaN	NaN	NaN	
Significant	--	--	--	--	--	--	--	--	--	--	--	--	

**NOTES:**

- Short - eight most recent analyses in the last two years.
- Long - historical data up to the last eight samples, but no greater than 50 samples.
- D - decreasing trend
- I - increasing trend
- - no detectable trend or too few data point to determine significance
- NaN - too few data points to calculate probability
- Probability - probability null hypothesis (i.e. 'No Trend') is true (aka p-value)
- Significance - trend is significant at 0.05
- umhos/cm - microSiemens per centimeter
- mg/L - milligram per liter
- ug/L - microgram per liter
- <sup>a</sup> Trend analysis resulted in artificial decreasing trend caused by changes in MDL.
- <sup>b</sup> Trend analysis resulted in artificial increasing trend caused by changes in MDL.

**Table 3-4**  
**Summary of Statistical Analyses for West Hillslope Seep/Weir Surface Water Samples**  
 Vashon Island Closed Landfill  
 1986 through 2020

Well Location Time Interval	West Hillslope Seep/Weir							
	SW-W1		SW-W2		SW-W3		SW-E	
	Long	Short	Long	Short	Long	Short	Long	Short
<b>pH, Field [standard units]</b>								
No. of Analyses	77	8	108	8	108	8	25	8
No. of Detections	77	8	108	8	108	8	25	8
Minimum	6.54	7.21	6.88	7.44	ND	7.05	6.42	6.53
Maximum	8.76	7.86	8.89	8.34	ND	7.94	10.18	8.1
Mean	7.55	7.47	7.95	7.86	ID	7.58	7.64	7.51
Standard Deviation	0.44	0.23	0.38	0.29	ID	0.29	0.71	0.54
Median	7.61	7.4	8.05	7.855	ID	7.65	7.6	7.585
<b>Specific Conductance, Field [umhos/cm]</b>								
No. of Analyses	78	8	109	8	109	8	24	8
No. of Detections	78	8	109	8	109	8	24	8
Minimum	70	183.3	325	449.8	190	94.6	110	119.9
Maximum	860	228.6	1200	623	1034	307.2	370	223.8
Mean	313.41	208.91	741.43	548.03	441.81	253.13	188.14	198.86
Standard Deviation	163.91	16.56	182.48	72.13	161.78	69.17	49.05	34.20
Median	238	215.2	715	569.95	415	266.95	180	209.75
<b>Alkalinity [mg/L]</b>								
No. of Analyses	49	8	68	8	67	8		
No. of Detections	49	8	68	8	67	8		
Minimum	66.2	64.2	222	226	86.6	97.4		
Maximum	150	91.1	530	311	290	136		
Mean	89.60	80.34	387.63	283.13	171.28	124.43		
Standard Deviation	18.14	9.17	72.31	27.99	52.51	12.69		
Median	85.5	80.9	391	293	159	129.5		
<b>Ammonia-N [mg/L]</b>								
No. of Analyses	77	8	110	8	109	8		
No. of Detections	48	8	46	8	34	8		
Minimum	ND	0.0169	ND	0.0032	ND	0.0052		
Maximum	0.14	0.0415	45	0.0091	0.2	0.0445		
Mean	0.024	0.026	0.424	0.006	0.016	0.012		
Standard Deviation	0.027	0.009	4.289	0.002	0.024	0.013		
Median	0.015	0.02225	0.01	0.00575	0.0062	0.00845		
<b>Chemical Oxygen Demand [mg/L]</b>								
No. of Analyses	77	8	109	8	108	8		
No. of Detections	70	8	107	8	94	8		
Minimum	ND	7.3	ND	12	ND	8.1		
Maximum	100	71.5	130	37	160	43.9		
Mean	19.67	20.60	21.02	19.26	17.52	20.43		
Standard Deviation	16.48	20.77	17.90	9.41	19.98	14.05		
Median	15	13.5	16	15.5	14	15		
<b>Chloride [mg/L]</b>								
No. of Analyses	77	8	108	8	108	8		
No. of Detections	77	8	106	8	106	8		
Minimum	3	5.69	ND	13.6	ND	6.88		
Maximum	15	7.66	79	18.8	48	9.72		
Mean	5.99	6.77	30.81	17.61	11.89	8.67		
Standard Deviation	1.83	0.61	11.46	1.72	5.99	0.86		
Median	5.55	6.84	31	18.25	10	8.605		
<b>Nitrate-N [mg/L]</b>								
No. of Analyses	77	8	110	8	109	8		
No. of Detections	69	8	81	8	101	8		
Minimum	ND	0.286	ND	0.0518	ND	0.175		
Maximum	4.26	1.44	9	0.326	1.4	0.587		
Mean	1.54	0.75	0.23	0.13	0.36	0.29		
Standard Deviation	1.08	0.44	0.85	0.09	0.28	0.14		
Median	1.64	0.584	0.12	0.1105	0.303	0.241		

**Table 3-4**  
**Summary of Statistical Analyses for West Hillslope Seep/Weir Surface Water Samples**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location Time Interval	West Hillslope Seep/Weir							
	SW-W1		SW-W2		SW-W3		SW-E	
	Long	Short	Long	Short	Long	Short	Long	Short
<b>Sulfate [mg/L]</b>								
No. of Analyses	77	8	110	8	109	8		
No. of Detections	76	8	110	8	109	8		
Minimum	ND	8.11	4.6	12	6	9.26		
Maximum	35.9	10.6	29.9	16.2	109	13		
Mean	11.31	9.16	8.95	13.89	12.11	11.96		
Standard Deviation	4.93	0.99	3.46	1.40	9.56	1.15		
Median	10.2	9.035	8	13.7	11.4	12.3		
<b>Arsenic, Dissolved [mg/L]</b>								
No. of Analyses	45	8	47	8	47	8	24	8
No. of Detections	42	8	45	8	47	8	24	8
Minimum	ND	0.00208	ND	0.00112	0.0017	0.00299	0.00112	0.00142
Maximum	0.0086	0.0052	0.0160	0.0016	0.0039	0.0039	0.0023	0.0022
Mean	0.0026	0.0038	0.0018	0.0013	0.0028	0.0034	0.0018	0.0019
Standard Deviation	0.0018	0.0012	0.0022	0.0002	0.0005	0.0003	0.0003	0.0003
Median	0.0021	0.0040	0.0015	0.0013	0.0027	0.0034	0.0018	0.0019
<b>Arsenic, Total [mg/L]</b>								
No. of Analyses	78	8	109	8	108	8	24	8
No. of Detections	78	8	109	8	107	8	24	8
Minimum	0.00197	0.00348	0.00151	0.00155	ND	0.00419	0.00149	0.00191
Maximum	0.0830	0.0153	0.0170	0.0086	0.0520	0.0089	0.0106	0.0027
Mean	0.0110	0.0077	0.0046	0.0039	0.0059	0.0060	0.0025	0.0022
Standard Deviation	0.0117	0.0035	0.0028	0.0025	0.0061	0.0020	0.0018	0.0003
Median	0.0066	0.0074	0.0038	0.0031	0.0046	0.0048	0.0022	0.0023
<b>Calcium, Dissolved [mg/L]</b>								
No. of Analyses	45	8	47	8	47	8	24	8
No. of Detections	45	8	47	8	47	8	24	8
Minimum	12.2	13.3	35	39.1	17.2	18.5	7.78	8.97
Maximum	18.3	18.5	74.3	57.1	33	26.5	16.7	17
Mean	15.42	16.24	56.79	50.25	23.76	22.96	13.58	14.77
Standard Deviation	1.58	1.68	8.00	5.86	3.55	2.39	2.66	2.54
Median	15.3	15.95	56.5	50.65	23	22.9	14.35	15.3
<b>Calcium, Total [mg/L]</b>								
No. of Analyses	73	8	103	8	102	8	24	8
No. of Detections	73	8	103	8	102	8	24	8
Minimum	12.4	15.4	27	40.2	17.3	19	8.51	9.74
Maximum	84.8	19	127	55.4	93	26.7	18.9	16.7
Mean	28.97	16.88	73.86	51.24	40.94	23.64	14.38	15.12
Standard Deviation	19.98	1.19	20.73	4.96	19.19	2.33	2.78	2.29
Median	18.2	16.5	70	52.45	34.25	24.05	15	15.9
<b>Iron, Dissolved [mg/L]</b>								
No. of Analyses	45	8	47	8	47	8	24	8
No. of Detections	44	8	47	8	47	8	24	8
Minimum	ND	0.127	0.012	0.0115	0.018	0.0181	0.033	0.0378
Maximum	1.43	0.534	8.97	0.0512	0.215	0.136	0.221	0.171
Mean	0.2709	0.2404	0.2668	0.0269	0.0755	0.0452	0.0760	0.0670
Standard Deviation	0.2978	0.1289	1.3015	0.0158	0.0513	0.0388	0.0474	0.0464
Median	0.1790	0.2115	0.0292	0.0227	0.0505	0.0326	0.0581	0.0481
<b>Iron, Total [mg/L]</b>								
No. of Analyses	78	8	109	8	108	8	24	8
No. of Detections	78	8	109	8	108	8	24	8
Minimum	0.682	1.39	0.364	0.492	0.49	0.51	0.226	0.29
Maximum	76	11	27.9	9.07	37.5	5.43	14.9	2.46
Mean	7.79	3.01	4.29	3.08	3.41	2.14	1.51	0.68
Standard Deviation	10.62	3.24	4.81	3.01	5.34	1.98	3.07	0.73
Median	4.15	1.98	2.80	2.10	1.86	1.00	0.61	0.44

**Table 3-4**  
**Summary of Statistical Analyses for West Hillslope Seep/Weir Surface Water Samples**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location Time Interval	West Hillslope Seep/Weir							
	SW-W1		SW-W2		SW-W3		SW-E	
	Long	Short	Long	Short	Long	Short	Long	Short
<b>Magnesium, Dissolved [mg/L]</b>								
No. of Analyses	45	8	47	8	47	8	24	8
No. of Detections	45	8	47	8	47	8	24	8
Minimum	10.1	10.1	28.9	31.9	11.7	14.6	6.36	7.52
Maximum	16	13.6	63.6	46.6	25.8	22.3	15.8	15
Mean	12.66	12.18	48.42	41.55	19.47	19.08	12.14	13.12
Standard Deviation	1.26	1.13	7.40	4.77	2.97	2.29	2.63	2.44
Median	12.70	12.00	48.20	41.40	19.30	19.50	12.40	13.60
<b>Magnesium, Total [mg/L]</b>								
No. of Analyses	73	8	103	8	103	8	24	8
No. of Detections	73	8	103	8	103	8	24	8
Minimum	10.1	11	20	32.7	14.5	14.9	6.98	8.04
Maximum	55.3	13.6	104	47.6	89	22.4	15.7	15
Mean	19.02	12.34	62.63	42.43	32.16	19.55	12.67	13.29
Standard Deviation	10.07	0.87	18.65	4.84	14.61	2.37	2.36	2.27
Median	14.30	12.20	59.00	42.75	29.00	19.65	13.45	13.85
<b>Manganese, Dissolved [mg/L]</b>								
No. of Analyses	45	8	47	8	47	8	24	8
No. of Detections	45	8	47	8	47	8	24	8
Minimum	0.0113	0.165	0.016	0.0155	0.112	0.224	0.00725	0.00616
Maximum	3.18	0.904	2.4	0.0657	0.514	0.581	0.0188	0.0115
Mean	0.388	0.505	0.122	0.036	0.302	0.369	0.011	0.009
Standard Deviation	0.514	0.256	0.345	0.018	0.096	0.118	0.002	0.002
Median	0.268	0.448	0.056	0.031	0.301	0.364	0.011	0.009
<b>Manganese, Total [mg/L]</b>								
No. of Analyses	78	8	108	8	107	8	24	8
No. of Detections	78	8	108	8	107	8	24	8
Minimum	0.325	0.476	0.126	0.143	0.254	0.475	0.0243	0.0303
Maximum	18	3.52	17.9	1.9	8.56	2.14	1.14	0.171
Mean	2.383	1.208	1.974	0.645	1.177	1.028	0.113	0.073
Standard Deviation	2.817	0.959	2.519	0.598	1.462	0.665	0.222	0.046
Median	1.400	0.911	0.977	0.443	0.763	0.713	0.061	0.064
<b>Potassium, Dissolved [mg/L]</b>								
No. of Analyses	45	8	47	8	47	8	24	8
No. of Detections	44	8	47	8	46	8	24	8
Minimum	ND	0.945	1.2	2.82	ND	1.93	1.68	1.79
Maximum	1.53	1.45	4.05	3.45	2.8	2.56	2.78	2.14
Mean	1.08	1.26	3.17	3.11	2.10	2.32	1.99	1.97
Standard Deviation	0.22	0.15	0.42	0.25	0.38	0.19	0.22	0.13
Median	1.09	1.29	3.17	3.09	2.11	2.35	1.97	2.02
<b>Potassium, Total [mg/L]</b>								
No. of Analyses	73	8	104	8	103	8	24	8
No. of Detections	73	8	104	8	103	8	24	8
Minimum	0.82	0.944	1.8	2.88	1.7	1.92	1.65	1.76
Maximum	2.8	1.73	5.6	3.59	17	2.77	3.38	2.34
Mean	1.35	1.30	3.45	3.15	2.64	2.40	2.00	2.00
Standard Deviation	0.41	0.22	0.53	0.23	1.51	0.24	0.32	0.16
Median	1.20	1.28	3.40	3.11	2.40	2.40	1.97	2.00

**Table 3-4**  
**Summary of Statistical Analyses for West Hillslope Seep/Weir Surface Water Samples**  
Vashon Island Closed Landfill  
1986 through 2020

Well Location Time Interval	West Hillslope Seep/Weir							
	SW-W1		SW-W2		SW-W3		SW-E	
	Long	Short	Long	Short	Long	Short	Long	Short
<b>Sodium, Dissolved [mg/L]</b>								
No. of Analyses	45	8	47	8	47	8	24	8
No. of Detections	45	8	47	8	47	8	24	8
Minimum	5.44	6.26	9.55	12.4	6.21	7.24	4.47	4.71
Maximum	8.04	7.87	19.3	17.5	11.1	9.99	7.54	7.8
Mean	6.84	7.27	15.21	15.75	8.68	8.96	6.39	6.85
Standard Deviation	0.59	0.54	1.74	1.65	0.87	0.86	0.83	0.96
Median	6.80	7.37	15.10	15.70	8.66	9.15	6.58	7.00
<b>Sodium, Total [mg/L]</b>								
No. of Analyses	73	8	104	8	102	8	24	8
No. of Detections	73	8	104	8	102	8	24	8
Minimum	5.33	6.35	7.8	12.5	6.52	7.25	4.73	4.74
Maximum	17.2	8.01	25	17.7	18.2	10.4	7.42	7.57
Mean	8.69	7.30	16.02	15.90	11.04	9.10	6.51	6.80
Standard Deviation	2.98	0.56	2.40	1.61	2.89	0.91	0.76	0.89
Median	7.26	7.37	16.00	15.90	10.00	9.31	6.69	7.02
<b>Vinyl Chloride [ug/L]</b>								
No. of Analyses	75	8	107	8	106	8	24	8
No. of Detections	15	8	1	0	79	8	0	0
Minimum	ND	0.0103	ND	ND	ND	0.0294	ND	ND
Maximum	1	0.0244	ND	ND	1	0.0578	ND	ND
Mean	0.060	0.018	ID	ID	0.076	0.049	ID	ID
Standard Deviation	0.195	0.006	ID	ID	0.161	0.012	ID	ID
Median	0.010	0.019	ID	ID	0.044	0.057	ID	ID

**NOTES:**

- Short - eight most recent analyses in the last two years.
- Long - historical data up to the last eight samples, but no greater than 50 samples.
- umhos/cm - microSiemens per centimeter
- mg/L - milligram per liter
- ug/L - microgram per liter
- ID - insufficient Data (i.e. the number of detections is less than 3)
- ND - Not Detected (i.e. at laboratory MDL - Method Detection Limit)



**Table 4-1**  
**Comparison of Background Conditions and Unit D Aquifer**  
Vashon Island Closed Landfill

Constituent	Area Background Range*	Unit D Aquifer Jan. 2019 - Dec. 2020
<b><u>General Indicators</u></b>		
pH (Field)	6.5 to 8.3	6.71 to 8.29
Specific Conductance (Field)	80 to 545	151.7 to 243.2
Chloride	1.6 to 14	2.95 to 5.24
Nitrate	<0.2 to 5.8	<0.01 to 2.23
Sulfate	<0.50 to 41	9.76 to 17.9
<b><u>Metals</u></b>		
Arsenic, Total	<0.001 to 0.017	0.0012 to 0.0155
Iron, Total	0.04 to 10	<0.01 to 5.85
Manganese, Total	0.005 to 0.960	<0.0001 to 0.86
Sodium, Total	5.0 to 62	5.88 to 9.66
<b><u>Notes:</u></b> All values except pH (standard units) and specific conductivity (umhos/cm) are reported in milligrams per liter (mg/L). *Background values are based on Carr (1983) and Vashon-Maury Island Groundwater Management Plan (1998)		

# **Appendix A**

## **Groundwater Quality Standards**

## Water Quality Standards

Analyte	CAS No.	National Drinking Water Regulation			Washington State Groundwater Quality Criteria		
		MCL	Eff. Date	Ref.	Criterion*	Eff. Date	Ref.
Primary Standards							
A. Inorganics							
Antimony	7440-36-0	0.006 mg/L	17-Jan-94	FR v. 57 No.138	0.006 mg/L	17-Jan-94	WAC 173-200
Arsenic c	7440-38-2	0.01 mg/L	23-Jan-06	66 FR 28342	0.00005 mg/L	01-Dec-90	WAC 173-200
Asbestos	132207-33-1	7 mf/L	30-Jul-92	FR v. 56 No. 20	7 mf/L	30-Jul-92	WAC 173-200
Barium	7440-39-3	2.0 mg/L	1-Jan-93	FR v. 56 No. 126	1.0 mg/L	01-Dec-90	WAC 173-200
Beryllium	7440-41-7	0.004 mg/L	17-Jan-94	FR v. 57 No.138	0.004 mg/L	17-Jan-94	WAC 173-200
Cadmium	7440-43-9	0.005 mg/L	30-Jul-92	FR v. 56 No. 20	0.005 mg/L	01-Dec-90	WAC 173-200
Chromium	7440-47-3	0.1 mg/L	30-Jul-92	FR v. 56 No. 20	0.05 mg/L	01-Dec-90	WAC 173-200
Copper	7440-50-8	1.3** mg/L	7-Dec-92	FR v. 57 No. 125	1.0 mg/L	01-Dec-90	WAC 173-200
Cyanide	57-12-5	0.2 mg/L	17-Jan-94	FR v. 57 No.138	0.2 mg/L	17-Jan-94	WAC 173-200
Fluoride	16984-48-8	4.0 mg/L	2-Oct-87	40 CFR 141	4.0 mg/L	01-Dec-90	WAC 173-200
Lead	7439-92-1	0.015** mg/L	7-Dec-92	FR v. 57 No. 125	0.015 mg/L	01-Dec-90	WAC 173-200
Mercury	7439-97-6	0.002 mg/L	2-Apr-86	40 CFR 141	0.002 mg/L	01-Dec-90	WAC 173-200
Nickel	7440-02-0	0.1 mg/L	17-Jan-94	FR v. 57 No.138	0.1 mg/L	17-Jan-94	WAC 173-200
Nitrate	14797-55-8	10.0 mg/L	2-Apr-86	FR v. 56 No. 20	10.0 mg/L	01-Dec-90	WAC 173-200
Nitrate and Nitrite	14797-55-8+14797-65-0	10.0 mg/L	30-Jul-92	FR v. 56 No. 20	10.0 mg/L	30-Jul-92	WAC 173-200
Nitrite	14797-65-0	1 mg/L	30-Jul-92	FR v. 56 No. 20	1.0 mg/L	30-Jul-92	WAC 173-200
Selenium	7782-49-2	0.05 mg/L	30-Jul-92	FR v. 56 No. 20	0.01 mg/L	01-Dec-90	WAC 173-200
Silver	7440-22-4	--			0.05 mg/L	01-Dec-90	WAC 173-200
Sodium	7440-23-5	20*** mg/L	20-Sep-04		20*** mg/L	03-Jul-04	WAC 246-290
Thallium	7440-28-0	0.002 mg/L	17-Jan-94	FR v. 57 No.138	0.002 mg/L	17-Jan-94	WAC 173-200
Total Coliforms		1/100 mL	24-Dec-75	40 CFR 141	1/100 mL	01-Dec-90	WAC 173-200
Turbidity		1 NTU	24-Dec-75	40 CFR 141	--	--	--
B. Organic Chemicals							
Alachlor	15972-60-8	2 µg/L	30-Jul-92	FR v. 56 No. 20	2 µg/L	30-Jul-92	WAC 173-200
Atrazine	1912-24-9	3 µg/L	30-Jul-92	FR v. 56 No. 20	3 µg/L	30-Jul-92	WAC 173-200
Benzene c	71-43-2	5 µg/L	9-Jan-89	40 CFR 141	1 µg/L	01-Dec-90	WAC 173-200
Bis(2-ethylhexyl)phthalate	117-81-7	6 µg/L	17-Jan-94	FR v. 57 No.138	6 µg/L	01-Dec-90	WAC 173-200
Bromodichloromethane c	75-27-4	--			0.3 µg/L	01-Dec-90	WAC 173-200
Bromoform c	75-25-2	--			5 µg/L	01-Dec-90	WAC 173-200
Carbofuran	1563-66-2	40 µg/L	30-Jul-92	FR v. 56 No. 20	40 µg/L	30-Jul-92	WAC 173-200
Carbon Tetrachloride c	56-23-5	5 µg/L	9-Jan-89	40 CFR 141	0.3 µg/L	01-Dec-90	WAC 173-200
Chlordane c	5103-71-9	2 µg/L	30-Jul-92	FR v. 56 No. 20	0.06 µg/L	01-Dec-90	WAC 173-200
Chlorobenzene	108-90-7	100 µg/L	30-Jul-92	FR v. 56 No. 20	100 µg/L	30-Jul-92	WAC 173-200
Chlorodibromomethane c	124-48-1	--			0.5 µg/L	01-Dec-90	WAC 173-200
Chloroform c	67-66-3	--			7 µg/L	01-Dec-90	WAC 173-200
2,4-D	94-75-7	70 µg/L	30-Jul-92	FR v. 56 No. 20	70 µg/L	01-Dec-90	WAC 173-200
Dalapon	75-99-0	200 µg/L	17-Jan-94	FR v. 57 No.138	200 µg/L	17-Jan-94	WAC 173-200
1,2-Dibromo-3-chloropropane	96-12-8	0.2 µg/L	30-Jul-92	FR v. 56 No. 20	0.2 µg/L	30-Jul-92	WAC 173-200
1,2-Dichlorobenzene	95-50-1	600 µg/L	30-Jul-92	FR v. 56 No. 20	600 µg/L	30-Jul-92	WAC 173-200
1,4-Dichlorobenzene c	106-46-7	75 µg/L	9-Jan-89	40 CFR 141	4 µg/L	01-Dec-90	WAC 173-200
1,1-Dichloroethane c	75-34-3	--			1 µg/L	01-Dec-90	WAC 173-200
1,2-Dichloroethane c	107-06-2	5 µg/L	9-Jan-89	40 CFR 141	0.5 µg/L	01-Dec-90	WAC 173-200
1,1-Dichloroethene	75-35-4	7 µg/L	9-Jan-89	40 CFR 141	7 µg/L	01-Dec-90	WAC 173-200
c-1,2-Dichloroethene	156-59-2	70 µg/L	30-Jul-92	FR v. 56 No. 20	70 µg/L	30-Jul-92	WAC 173-200
t-1,2-Dichloroethene	156-60-5	100 µg/L	30-Jul-92	FR v. 56 No. 20	100 µg/L	30-Jul-92	WAC 173-200
1,2-Dichloropropane c	78-87-5	5 µg/L	30-Jul-92	FR v. 56 No. 20	0.6 µg/L	01-Dec-90	WAC 173-200
1,3-Dichloropropene tot. c	542-75-6	--			0.2 µg/L	01-Dec-90	WAC 173-200
Di(ethylhexyl)adipate	103-23-1	400 µg/L	17-Jan-94	FR v. 57 No.138	400 µg/L	17-Jan-94	WAC 173-200
Dinoseb	88-85-7	7 µg/L	17-Jan-94	FR v. 57 No.138	7 µg/L	17-Jan-94	WAC 173-200
Diquat	231-36-7	20 µg/L	17-Jan-94	FR v. 57 No.138	20 µg/L	17-Jan-94	WAC 173-200
Endothall	145-73-3	100 µg/L	17-Jan-94	FR v. 57 No.138	100 µg/L	17-Jan-94	WAC 173-200
Endrin	72-20-8	2 µg/L	17-Jan-94	40 CFR 141	0.2 µg/L	01-Dec-90	WAC 173-200
Ethylbenzene	100-41-4	700 µg/L	30-Jul-92	FR v. 56 No. 20	700 µg/L	30-Jul-92	WAC 173-200
Ethylene dibromide c	106-93-4	0.05 µg/L	30-Jul-92	FR v. 56 No. 20	0.001 µg/L	01-Dec-90	WAC 173-200
Glyphosate	1071-83-6	70 µg/L	17-Jan-94	FR v. 57 No.138	70 µg/L	17-Jan-94	WAC 173-200
Heptachlor c	76-44-8	0.4 µg/L	30-Jul-92	FR v. 56 No. 20	0.02 µg/L	01-Dec-90	WAC 173-200
Heptachlor epoxide c	1024-57-3	0.2 µg/L	30-Jul-92	FR v. 56 No. 20	0.009 µg/L	01-Dec-90	WAC 173-200
Hexachlorobenzene	118-74-1	1 µg/L	17-Jan-94	FR v. 57 No.138	0.05 µg/L	01-Dec-90	WAC 173-200
Hexachlorocyclopentadiene (HEX)	77-47-4	50 µg/L	17-Jan-94	FR v. 57 No.138	50 µg/L	17-Jan-94	WAC 173-200
Lindane c	58-89-9	0.2 µg/L	30-Jul-92	FR v. 56 No. 20	0.06 µg/L	01-Dec-90	WAC 173-200

## Water Quality Standards

Analyte	CAS No.	National Drinking Water Regulation			Washington State Groundwater Quality Criteria				
		MCL	Eff. Date	Ref.	Criterion*	Eff. Date	Ref.		
Methoxychlor	72-43-5	40	µg/L	30-Jul-92	FR v. 56 No. 20	40	µg/L	30-Jul-92	WAC 173-200
Methylene Chloride c	75-09-2	5	µg/L	17-Jan-94	FR v. 57 No.138	5	µg/L	17-Jan-94	WAC 173-200
Oxamyl (vydate)	23135-22-0	200	µg/L	17-Jan-94	FR v. 57 No.138	200	µg/L	17-Jan-94	WAC 173-200
PAHs [Benzo(a)pyrene]		0.2	µg/L	17-Jan-94	FR v. 57 No.138	0.01	µg/L	17-Jan-94	WAC 173-200
PCBs c	27323-18-8	0.5	µg/L	30-Jul-92	FR v. 56 No. 20	0.01	µg/L	01-Dec-90	WAC 173-200
Pentachlorophenol	87-86-5	1	µg/L	1-Jan-93	FR v. 56 No. 126	1	µg/L	01-Jan-93	WAC 173-200
Picloram	1918-02-1	500	µg/L	17-Jan-94	FR v. 57 No.138	500	µg/L	17-Jan-94	WAC 173-200
Simazine	122-34-9	4	µg/L	17-Jan-94	FR v. 57 No.138	4	µg/L	17-Jan-94	WAC 173-200
Styrene	100-42-5	100	µg/L	30-Jul-92	FR v. 56 No. 20	100	µg/L	30-Jul-92	WAC 173-200
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	3E-05	µg/L	17-Jan-94	FR v. 57 No.138	0.0000006	µg/L	01-Dec-90	WAC 173-200
Tetrachloroethylene c	127-18-4	5	µg/L	30-Jul-92	FR v. 56 No. 20	0.8	µg/L	30-Jul-92	WAC 173-200
Toluene	108-88-3	1000	µg/L	30-Jul-92	FR v. 56 No. 20	1000	µg/L	30-Jul-92	WAC 173-200
Total Trihalomethanes c	75-27-4, 75-25-2, 124-48-1, 67-66-3	100	µg/L	29-Nov-79	40 CFR 141	--	--	--	--
Toxaphene c	8001-35-2	3	µg/L	30-Jul-92	FR v. 56 No. 20	0.08	µg/L	01-Dec-90	WAC 173-200
2,4,5-TP	93-72-1	50	µg/L	30-Jul-92	FR v. 56 No. 20	100	µg/L	01-Dec-90	WAC 173-200
1,2,4-Trichlorobenzene	120-82-1	70	µg/L	17-Jan-94	FR v. 57 No.138	70	µg/L	17-Jan-94	WAC 173-200
1,1,1-Trichloroethane	71-55-6	200	µg/L	9-Jan-89	40 CFR 141	200	µg/L	01-Dec-90	WAC 173-200
1,1,2-Trichloroethane	79-00-5	5	µg/L	17-Jan-94	FR v. 57 No.138	5	µg/L	17-Jan-94	WAC 173-200
Trichloroethylene (TCE) c	79-01-6	5	µg/L	9-Jan-89	40 CFR 141	3	µg/L	01-Dec-90	WAC 173-200
Vinyl chloride c	75-01-4	2	µg/L	9-Jan-89	40 CFR 141	0.02	µg/L	01-Dec-90	WAC 173-200
Xylenes (total)	1330-20-7	10000	µg/L	30-Jul-92	FR v. 56 No. 20	10000	µg/L	30-Jul-92	WAC 173-200
<b>C. Radionuclides and Radioactivity</b>									
Radium 226 & Radium 228		5	pCi/L	9-Jul-76	FR v. 41 No. 133	5	pCi/L	01-Dec-90	WAC 173-200
Radium 226	13982-63-3	--				3	pCi/L	01-Dec-90	WAC 173-200
Radium 228	15262-20-1	--				5	pCi/L	01-Dec-90	WAC 173-200
Gross Alpha particle activity		15	pCi/L	9-Jul-76	FR v. 41 No. 133	15	pCi/L	01-Dec-90	WAC 173-200
Tritium	10028-17-8	20,000	pCi/L	9-Jul-76	FR v. 41 No. 133	20,000	pCi/L	01-Dec-90	WAC 173-200
Strontium	7440-24-6	8	pCi/L	9-Jul-76	FR v. 41 No. 133	8	pCi/L	01-Dec-90	WAC 173-200
Gross Beta particle activity		50	pCi/L	9-Jul-76	FR v. 41 No. 133	50	pCi/L	01-Dec-90	WAC 173-200
<b>D. Additional Carcinogens Listed in Groundwater Criteria</b>									
Acrylamide	79-06-1	--				0.02	µg/L	01-Dec-90	WAC 173-200
Acrylonitrile	107-13-1	--				0.07	µg/L	01-Dec-90	WAC 173-200
Aldrin	309-00-2	--				0.005	µg/L	01-Dec-90	WAC 173-200
Aniline	62-53-3	--				14	µg/L	01-Dec-90	WAC 173-200
Aramite	140-57-8	--				3	µg/L	01-Dec-90	WAC 173-200
Azobenzene	103-33-3	--				0.7	µg/L	01-Dec-90	WAC 173-200
Benidine	92-87-5	--				0.0004	µg/L	01-Dec-90	WAC 173-200
Benzo(a)pyrene	50-32-8	--				0.008	µg/L	01-Dec-90	WAC 173-200
Benzotrithloride	98-07-7	--				0.007	µg/L	01-Dec-90	WAC 173-200
Benzyl chloride	100-44-7	--				0.5	µg/L	01-Dec-90	WAC 173-200
Bis(chloroethyl)ether	111-44-4	--				0.07	µg/L	01-Dec-90	WAC 173-200
Bis(chloromethyl)ether	542-88-1	--				0.0004	µg/L	01-Dec-90	WAC 173-200
Carbazole	86-74-8	--				5	µg/L	01-Dec-90	WAC 173-200
4-Chloro-2-methyl aniline	95-69-2	--				0.1	µg/L	01-Dec-90	WAC 173-200
4-Chloro-2-methyl aniline hydrochloride	3165-93-3	--				0.2	µg/L	01-Dec-90	WAC 173-200
o-Chloronitrobenzene	88-73-3	--				3	µg/L	01-Dec-90	WAC 173-200
p-Chloronitrobenzene	100-00-5	--				5	µg/L	01-Dec-90	WAC 173-200
Chlorthalonil	1897-45-6	--				30	µg/L	01-Dec-90	WAC 173-200
Diallate	2303-16-4	--				1	µg/L	01-Dec-90	WAC 173-200
DDT (includes DDE and DDD)	50-29-3, 72-55-9, 72-54-8	--				0.3	µg/L	01-Dec-90	WAC 173-200
1,2-Dibromomethane	106-93-4	--				0.001	µg/L	01-Dec-90	WAC 173-200
3,3'-Dichlorobenzidine	91-94-1	--				0.2	µg/L	01-Dec-90	WAC 173-200
Dichlorovos	62-73-7	--				0.3	µg/L	01-Dec-90	WAC 173-200
Dieldrin	60-57-1	--				0.005	µg/L	01-Dec-90	WAC 173-200
3,3'-Dimethoxybenzidine	119-90-4	--				6.0	µg/L	01-Dec-90	WAC 173-200
3,3-Dimethylbenzidine	119-93-7	--				0.007	µg/L	01-Dec-90	WAC 173-200
1,2-Dimethylhydrazine	540-73-8	--				60	µg/L	01-Dec-90	WAC 173-200
2,4-Dinitrotoluene	121-14-2	--				0.1	µg/L	01-Dec-90	WAC 173-200
2,6-Dinitrotoluene	606-20-2	--				0.1	µg/L	01-Dec-90	WAC 173-200
1,4-Dioxane	123-91-1	--				7	µg/L	01-Dec-90	WAC 173-200
1,2-Diphenylhydrazine	122-66-7	--				0.09	µg/L	01-Dec-90	WAC 173-200

## Water Quality Standards

Analyte	CAS No.	National Drinking Water Regulation			Washington State Groundwater Quality Criteria				
		MCL	Eff. Date	Ref.	Criterion*	Eff. Date	Ref.		
Direct Black 38	1937-37-7	--			0.009	µg/L	01-Dec-90	WAC 173-200	
Direct Blue 6	2602-46-2	--			0.009	µg/L	01-Dec-90	WAC 173-200	
Direct Brown 95	16071-86-6	--			0.009	µg/L	01-Dec-90	WAC 173-200	
Epichlorohydrin	106-89-8	--			8	µg/L	01-Dec-90	WAC 173-200	
Ethyl acrylate	140-88-5	--			2	µg/L	01-Dec-90	WAC 173-200	
Ethylene thiourea	96-45-7	--			2	µg/L	01-Dec-90	WAC 173-200	
Folpet	133-07-3	--			20	µg/L	01-Dec-90	WAC 173-200	
Furazolidone	67-45-8	--			0.02	µg/L	01-Dec-90	WAC 173-200	
Furium	531-82-8	--			0.002	µg/L	01-Dec-90	WAC 173-200	
Furmecyclox	60568-05-0	--			3	µg/L	01-Dec-90	WAC 173-200	
Hexachlorocyclohexane (alpha)	319-84-6	--			0.001	µg/L	01-Dec-90	WAC 173-200	
Hexachlorocyclohexane (technical)	608-73-1	--			0.05	µg/L	01-Dec-90	WAC 173-200	
Hexachlorodibenzo-p-dioxin, mix	34465-46-8	--			0.00001	µg/L	01-Dec-90	WAC 173-200	
Hydrazine/hydrazine sulfate	302-01-2/10034-93-2	--			0.03	µg/L	01-Dec-90	WAC 173-200	
2-Methoxy-5-nitroaniline	99-59-2	--			2.0	µg/L	01-Dec-90	WAC 173-200	
2-Methylaniline	95-53-4	--			0.2	µg/L	01-Dec-90	WAC 173-200	
2-Methylaniline hydrochloride	636-21-5	--			0.5	µg/L	01-Dec-90	WAC 173-200	
4,4'-Methylene bis(N,N'-dimethyl) aniline	101-61-1	--			2.0	µg/L	01-Dec-90	WAC 173-200	
Mirex	2385-85-5	--			0.05	µg/L	01-Dec-90	WAC 173-200	
Nitrofurazone	59-87-0	--			0.06	µg/L	01-Dec-90	WAC 173-200	
N-Nitrosodiethanolamine	1116-54-7	--			0.03	µg/L	01-Dec-90	WAC 173-200	
N-Nitrosodiethylamine	55-18-5	--			0.0005	µg/L	01-Dec-90	WAC 173-200	
N-Nitrosodimethylamine	62-75-9	--			0.002	µg/L	01-Dec-90	WAC 173-200	
N-Nitrosodiphenylamine	86-30-6	--			17.0	µg/L	01-Dec-90	WAC 173-200	
N-Nitroso-di-n-propylamine	621-64-7	--			0.01	µg/L	01-Dec-90	WAC 173-200	
N-Nitrosopyrrolidine	930-55-2	--			0.04	µg/L	01-Dec-90	WAC 173-200	
N-Nitroso-di-n-butylamine	924-16-3	--			0.02	µg/L	01-Dec-90	WAC 173-200	
N-Nitroso-N-methylethylamine	10595-95-6	--			0.004	µg/L	01-Dec-90	WAC 173-200	
PBBs	59536-65-1	--			0.01	µg/L	01-Dec-90	WAC 173-200	
o-Phenylenediamine	95-54-5	--			0.005	µg/L	01-Dec-90	WAC 173-200	
Propylene oxide	75-56-9	--			0.01	µg/L	01-Dec-90	WAC 173-200	
p,a,a,a-Tetrachlorotoluene	5216-25-1	--			0.004	µg/L	01-Dec-90	WAC 173-200	
2,4-Toluediamine	95-80-7	--			0.002	µg/L	01-Dec-90	WAC 173-200	
o-Toluidine	95-53-4	--			0.2	µg/L	01-Dec-90	WAC 173-200	
2,4,6-Trichlorophenol	88-06-2	--			4.0	µg/L	01-Dec-90	WAC 173-200	
Trimethyl phosphate	512-56-1	--			2.0	µg/L	01-Dec-90	WAC 173-200	
<b>Secondary Standards</b>									
Aluminum	7429-90-5	0.05-0.2	mg/L	30-Jul-92	FR v. 56 No. 20	0.05-0.2	mg/L	30-Jul-92	WAC 173-200
Copper	7440-50-8	1.0	mg/L	7-Dec-92	FR v. 57 No. 125	1.0	mg/L	01-Dec-90	WAC 173-200
Iron	7439-89-6	0.3	mg/L	2-Apr-86	40 CFR 143	0.3	mg/L	01-Dec-90	WAC 173-200
Manganese	7439-96-5	0.05	mg/L	2-Apr-86	40 CFR 143	0.05	mg/L	01-Dec-90	WAC 173-200
Color		15	units	2-Apr-86	40 CFR 143	15	units	01-Dec-90	WAC 173-200
pH	12408-02-5	6.5-8.5	units	2-Apr-86	40 CFR 143	6.5-8.5	units	01-Dec-90	WAC 173-200
Specific Conductivity		--				700	µS/cm		WAC 246-290
Total Dissolved Solids		500	mg/L	2-Apr-86	40 CFR 143	500	mg/L	01-Dec-90	WAC 173-200
Chloride	16887-00-6	250	mg/L	2-Apr-86	40 CFR 143	250	mg/L	01-Dec-90	WAC 173-200
Fluoride	16984-48-8	2.0	mg/L	2-Apr-86	40 CFR 143	p			
Silver	7440-22-4	0.1	mg/L	30-Jul-92	FR v. 56 No. 20	p			
Sulfate	14808-79-8	250	mg/L	2-Apr-86	40 CFR 143	250	mg/L	01-Dec-90	WAC 173-200
Surfactants		0.5	mg/L	2-Apr-86	40 CFR 143	0.5	mg/L	01-Dec-90	WAC 173-200
Corrosivity		non-corrosive		2-Apr-86	40 CFR 143	non-corrosive		01-Dec-90	WAC 173-200
Odor-Threshold		3	units	2-Apr-86	40 CFR 143	3	units	01-Dec-90	WAC 173-200
Zinc	7440-66-6	5.0	mg/L	2-Apr-86	40 CFR 143	5.0	mg/L	01-Dec-90	WAC 173-200
<b>NOTES:</b>									mg/L = milligrams per liter
p = Listed as a primary standard									mf/L = million fibers per liter
c = Listed as a carcinogen in the Washington State Groundwater Quality Criteria									mL = milliliter
-- = no standard established									NTU = Nephelometric Turbidity Unit
* = Criteria shall be the most stringent concentration of the Federal MCLG, MCL, or State MCL									µg/L = micrograms per liter
** = treatment technique in lieu of an MCL									pCi/L = per liter
*** = A Drinking Water Advisory, not an enforceable standard.									µS/cm = microSiemen per centimeter
National Primary and Secondary Drinking Water Regulations (40 CFR Parts 141 and 143)									units = standard unit for either color, pH, or odor
Washington State Groundwater Quality Criteria = Water Quality Standards for Groundwaters of the State of Washington (WAC 173-200)									MCL = Maximum Contaminant Level
									MCLG = Maximum Contaminant Level Goal

Compiled by KCSWD 1/12/94. Revised 12/13/19

**KING COUNTY SOLID WASTE DIVISION  
QUALIFIER INFORMATION**  
(Effective 8/27/2015)

QUAL	QUALIFIER DESCRIPTION
U	Undetected; Analyte Concentration Less than Method Detection Limit (< MDL)
T	Estimated; Less than Reporting Detection Limit (<RDL) but Greater than Method Detection Limit (> MDL)
J	Reported Value is an Estimate
B	Matrix Target Analyte Present in Blank, AND, Sample Result Less than or Equal to 10x Blank Detection
C	Confluent Growth
E	Estimated; Outside Expected Accuracy
H	Exceeds Holding Time
R	Data Rejected
S	Sample Handling Errors
X	Too Numerous to Count
D	Re-analysis Due to Dilution
P	PASS – Qualitative Result Acceptable
F	FAIL – Qualitative Result is not Acceptable
G	Estimated with Low Bias (Coliform; BOD; All Other Chemistry Parameters)
L	Estimated with High Bias (BOD; All Other Chemistry Parameters)

# **Appendix B**

## **Exceedance Reports**

Summary of Groundwater Quality Criteria Exceedances

Summary of Groundwater Prediction Limit Exceedances

Summary of Groundwater Volatile Organic Compound  
Detections Exceedances

Summary of Surface Water Monitoring Location Exceedances  
vs. Surface Water Quality Standards

**Table B-1**  
**Channel Cc1: Summary of groundwater quality criteria exceedances**  
**January 1, 2020 - December 31, 2020**

Parameter	Units	Site ID	Sample Date	Sample Value	Standard(s) Exceeded	Standard(s) Exceeded Numerical Limit
pH (Field)	std. pH Units	MW-3	5/19/2020	5.94	MCL2; SGWC2	< 6.5
		MW-4	8/3/2020	6.33		
		MW-4	11/18/2020	6.42		
Arsenic, Total <sup>1</sup>	mg/L	MW-3	1/27/2020	0.000209	SGWC1	0.00005
		MW-3	5/19/2020	0.0000562		
		MW-4	1/29/2020	0.000367		
		MW-4	5/19/2020	0.00039		
		MW-4	8/3/2020	0.000406		
		MW-4	11/18/2020	0.000375		
		MW-10	1/27/2020	0.00161		
		MW-10	5/19/2020	0.00161		
		MW-10	8/3/2020	0.00171		
		MW-10	11/16/2020	0.00163		
		MW-13	1/27/2020	0.00218		
		MW-13	5/27/2020	0.00211		
		MW-13	8/5/2020	0.00199		
MW-13	11/16/2020	0.00222				

<sup>1</sup> Natural Background for arsenic in the Puget Sound Basin is 0.008 mg/L (Ecology, 2016)  
MCL2 = National Secondary Drinking Water Regulation Maximum Contaminant Level  
SGWC1 = Washington State Primary Groundwater Quality Criterion  
SGWC2 = Washington State Secondary Groundwater Quality Criterion  
See Analytical Data Qualifier Page for Data Qualifier Information (Page B-1, Appendix B)



**Table B-2**  
**Channel Cc2: Summary of groundwater quality criteria exceedances**  
**January 1, 2020 - December 31, 2020**

Parameter	Units	Site ID	Sample Date	Sample Value	Standard(s) Exceeded	Standard(s) Exceeded Numerical Limit
pH (Field)	std. pH Units	MW-35	8/6/2020	6.48	MCL2; SGWC2	< 6.5
		MW-35	12/21/2020	6.39		
Specific Conductance (Field)	µmhos/cm	MW-33	1/30/2020	713	SGWC2	700
		MW-33	8/6/2020	705		
Arsenic, Total <sup>1</sup>	mg/L	MW-2	1/30/2020	0.000853	SGWC1	0.00005
		MW-2	5/27/2020	0.00079		
		MW-2	8/6/2020	0.000858		
		MW-2	11/18/2020	0.000778		
		MW-9	1/30/2020	0.00244		
		MW-9	5/28/2020	0.00234		
		MW-9	8/5/2020	0.00234		
		MW-9	11/16/2020	0.00235		
		MW-20	1/30/2020	0.00377		
		MW-20	5/28/2020	0.00298		
		MW-20	8/6/2020	0.00221		
		MW-20	11/18/2020	0.00212		
		MW-21	1/30/2020	0.00413		
		MW-21	5/28/2020	0.00242		
		MW-21	8/6/2020	0.00247		
		MW-21	12/21/2020	0.00314		
				MW-33		
MW-33	5/27/2020			0.0428		
MW-33	8/6/2020			0.042		
MW-33	11/18/2020			0.0419		
MW-35	1/30/2020			0.0312		
MW-35	5/28/2020			0.0304		
MW-35	8/6/2020			0.0298		
MW-35	12/21/2020			0.0553		
Iron, Dissolved	mg/L	MW-21	5/28/2020	0.47	MCL2; SGWC2	0.3; 0.3
		MW-21	8/6/2020	0.508		
		MW-33	1/30/2020	6.67		
		MW-33	5/27/2020	6.62		
		MW-33	8/6/2020	6.43		
		MW-33	11/18/2020	5.77		
		MW-35	1/30/2020	13.6		
		MW-35	5/28/2020	13.3		
Manganese, Dissolved	mg/L	MW-2	1/30/2020	0.077	MCL2; SGWC2	0.05; 0.05
		MW-2	5/27/2020	0.0662		
		MW-2	8/6/2020	0.0987		
		MW-20	1/30/2020	0.145		
		MW-20	5/28/2020	0.143		
		MW-20	8/6/2020	0.144		
		MW-20	11/18/2020	0.136		
		MW-21	1/30/2020	0.337		
		MW-21	5/28/2020	0.464		
		MW-21	8/6/2020	0.436		
		MW-21	12/21/2020	0.239		
		MW-33	1/30/2020	1.04		
		MW-33	5/27/2020	0.959		
		MW-33	8/6/2020	0.917		
		MW-33	11/18/2020	0.887		
		MW-35	1/30/2020	2.47		
		MW-35	5/28/2020	2.25		
MW-35	8/6/2020	2.3				
MW-35	12/21/2020	2.35				

**Table B-2 (continued)**

**Channel Cc2: Summary of groundwater quality criteria exceedances**

**January 1, 2020 - December 31, 2020**

Parameter	Units	Site ID	Sample Date	Sample Value	Standard(s) Exceeded	Standard(s) Exceeded Numerical Limit
1,1-Dichloroethane	µg/L	MW-33	1/30/2020	1.6	SGWC1	1
		MW-33	5/27/2020	1.54		
		MW-33	8/6/2020	1.63		
		MW-33	11/18/2020	1.9		
1,2-Dichloropropane	µg/L	MW-33	1/30/2020	7.43	MCL1; SGWC1	5; 0.6
		MW-33	5/27/2020	7.65		
		MW-33	8/6/2020	7.4		
		MW-33	11/18/2020	8.53		
Benzene	ug/L	MW-33	5/27/2020	1.01	SGWC1	1
		MW-33	11/18/2020	1.03		
Vinyl Chloride	µg/L	MW-2	1/30/2020	0.0445	SGWC1	0.02
		MW-2	5/27/2020	0.0555		
		MW-2	8/6/2020	0.0757 D		
		MW-2	11/18/2020	0.0235		
		MW-21	1/30/2020	0.0699		
		MW-21	5/28/2020	0.0759		
		MW-21	8/6/2020	0.0815 D		
		MW-21	12/21/2020	0.0606		
		MW-33	8/30/2019	25.9	MCL1; SGWC1	2; 0.02
		MW-33	5/27/2020	31.2		
		MW-33	8/6/2020	31.1 D		
		MW-33	11/18/2020	22.6		
		MW-35	8/30/2019	4.09		
MW-35	5/28/2020	6.06				
MW-35	8/6/2020	5.56 D				
MW-35	12/21/2020	2.83				

<sup>1</sup> Natural Background for arsenic in the Puget Sound Basin is 0.008 mg/L (Ecology, 2016)

MCL1 = National Primary Drinking Water Regulation Maximum Contaminant Level

MCL2 = National Secondary Drinking Water Regulation Maximum Contaminant Level

SGWC1 = Washington State Primary Groundwater Quality Criterion

SGWC2 = Washington State Secondary Groundwater Quality Criterion

See Analytical Data Qualifier Page for Data Qualifier Information (Page B-1, Appendix B)

**Table B-3**  
**Channel Cc3: Summary of groundwater quality criteria exceedances**  
**January 1, 2020 - December 31, 2020**

Parameter	Units	Site ID	Sample Date	Sample Value	Standard(s) Exceeded	Standard(s) Exceeded Numerical Limit
pH (Field)	std. pH Units	MW-8	8/3/2020	6.32	MCL2; SGWC2	< 6.5
		MW-8	11/16/2020	6.41		
Arsenic, Total <sup>1</sup>	mg/L	MW-8	1/27/2020	0.000512	SGWC1	0.00005
		MW-8	5/19/2020	0.000482		
		MW-8	8/3/2020	0.000523		
		MW-8	11/16/2020	0.000494		
		MW-36	1/28/2020	0.00184		
		MW-36	5/28/2020	0.00181		
		MW-36	8/3/2020	0.00188		
		MW-36	11/16/2020	0.00171		

<sup>1</sup> Natural Background for arsenic in the Puget Sound Basin is 0.008 mg/L (Ecology, 2016)  
MCL2 = National Secondary Drinking Water Regulation Maximum Contaminant Level  
SGWC1 = Washington State Primary Groundwater Quality Criterion  
SGWC2 = Washington State Secondary Groundwater Quality Criterion  
See Analytical Data Qualifier Page for Data Qualifier Information (Page B-1, Appendix B)

**Table B-4**

**Unit D Aquifer: Summary of groundwater quality criteria exceedances**

**January 1, 2020 - December 31, 2020**

Parameter	Units	Site ID	Sample Date	Sample Value	Standard(s) Exceeded	Standard(s) Exceeded Numerical Limit
Arsenic, Total <sup>1</sup>	mg/L	MW-7	1/28/2020	0.00507	SGWC1	0.00005
		MW-7	5/27/2020	0.00517		
		MW-7	8/5/2020	0.00541		
		MW-7	11/16/2020	0.00524		
		MW-12	1/27/2020	0.00201		
		MW-12	5/27/2020	0.00201		
		MW-12	8/3/2020	0.00206		
		MW-12	11/16/2020	0.00203		
		MW-19	1/28/2020	0.00127		
		MW-19	5/28/2020	0.00151		
		MW-19	8/5/2020	0.00168		
		MW-19	11/16/2020	0.00115		
		MW-26	1/28/2020	0.00333		
		MW-26	5/27/2020	0.00378		
		MW-26	8/5/2020	0.00398		
		MW-26	11/18/2020	0.00345		
				MW-29		
		MW-29	5/28/2020	0.00698	SGWC1	0.00005
		MW-29	8/5/2020	0.0125	MCL1; SGWC1	0.01; 0.00005
		MW-29	11/18/2020	0.00778	SGWC1	0.00005
		MW-34	1/28/2020	0.00131		
		MW-34	5/28/2020	0.00131		
		MW-34	8/5/2020	0.00131		
		MW-34	11/18/2020	0.00131		
Iron, Dissolved	mg/L	MW-29	1/28/2020	0.806	MCL2; SGWC2	0.3; 0.3
		MW-29	5/28/2020	0.796		
		MW-29	8/5/2020	0.826		
		MW-29	11/18/2020	0.88		
Manganese, Dissolved	mg/L	MW-7	1/28/2020	0.145	MCL2; SGWC2	0.05; 0.05
		MW-7	5/27/2020	0.175		
		MW-7	8/5/2020	0.151		
		MW-7	11/16/2020	0.132		
		MW-19	1/28/2020	0.478		
		MW-19	5/28/2020	0.454		
		MW-19	8/5/2020	0.484		
		MW-19	11/16/2020	0.479		
		MW-26	1/28/2020	0.0655		
		MW-26	5/27/2020	0.0651		
		MW-26	8/5/2020	0.0611		
		MW-26	11/18/2020	0.0582		
		MW-29	1/28/2020	0.0884		
		MW-29	5/28/2020	0.0914		
		MW-29	8/5/2020	0.097		
MW-29	11/18/2020	0.0874				

<sup>1</sup> Natural Background for arsenic in the Puget Sound Basin is 0.008 mg/L (Ecology, 2016)

MCL1 = National Primary Drinking Water Regulation Maximum Contaminant Level

MCL2 = National Secondary Drinking Water Regulation Maximum Contaminant Level

SGWC1 = Washington State Primary Groundwater Quality Criterion

SGWC2 = Washington State Secondary Groundwater Quality Criterion

See Analytical Data Qualifier Page for Data Qualifier Information (Page B-1, Appendix B)

**Table B-5**

**Channel Cc2: Summary of groundwater prediction limit exceedances**

**Interwell**

**January 1, 2020 - December 31, 2020**

Parameter	Units	Well ID	Sample Date	Sample Value	Prediction Limit (PL) Value
Specific Conductance (Field)	umhos/cm	MW-2	1/30/2020	332.3	242.1
		MW-2	5/27/2020	292.7	
		MW-2	8/6/2020	316.3	
		MW-2	11/18/2020	293.1	
		MW-21	1/30/2020	332.3	
		MW-21	5/28/2020	272.9	
		MW-21	8/6/2020	300.1	
		MW-21	12/21/2020	275.4	
		MW-33	1/30/2020	713	
		MW-33	5/27/2020	656	
		MW-33	8/6/2020	705	
		MW-33	11/18/2020	608.4	
		MW-35	1/30/2020	683.00	
		MW-35	5/28/2020	646.00	
		MW-35	8/6/2020	686.00	
		MW-35	12/21/2020	569.00	
Alkalinity	mg/L	MW-2	1/30/2020	149	94.9
		MW-2	5/27/2020	147	
		MW-2	8/6/2020	144	
		MW-2	11/18/2020	145	
		MW-21	1/30/2020	137	
		MW-21	5/28/2020	131	
		MW-21	8/6/2020	135	
		MW-21	12/21/2020	139	
		MW-33	1/30/2020	383.0	
		MW-33	5/27/2020	365.0	
		MW-33	8/6/2020	354.0	
		MW-33	11/18/2020	342.0	
		MW-35	1/30/2020	345	
		MW-35	5/28/2020	332	
		MW-35	8/6/2020	329	
		MW-35	12/21/2020	309	
Ammonia	mg/L	MW-35	1/30/2020	0.0676	0.0322
		MW-35	5/28/2020	0.0657	
		MW-35	8/6/2020	0.0684	
		MW-35	12/21/2020	0.0647	
Chloride	mg/L	MW-9	1/30/2020	4.34	4.09
		MW-9	5/28/2020	4.37	
		MW-9	8/5/2020	4.68	
		MW-9	11/16/2020	4.53	
		MW-35	1/30/2020	4.39	
		MW-35	8/6/2020	4.34	
Nitrate	mg/L	MW-2	1/30/2020	0.21	0.05
		MW-2	5/27/2020	0.24	
		MW-2	8/6/2020	0.43	
		MW-2	11/18/2020	0.50	
		MW-9	1/30/2020	0.33	
		MW-9	5/28/2020	0.44	
		MW-9	8/5/2020	0.51	
		MW-9	11/16/2020	0.40	
		MW-21	1/30/2020	0.18	
		MW-21	5/28/2020	0.23	
		MW-21	8/6/2020	0.27	
		MW-21	12/21/2020	0.30	

**Table B-5 (continued)**

**Channel Cc2: Summary of groundwater prediction limit exceedances**

**Interwell**

**January 1, 2020 - December 31, 2020**

Parameter	Units	Well ID	Sample Date	Sample Value	Prediction Limit (PL) Value
Sulfate	mg/L	MW-35	1/30/2020	24.5	18.51
		MW-35	5/28/2020	22.4	
		MW-35	8/6/2020	25.3	
		MW-35	12/21/2020	26.4	
Total Dissolved Solids	mg/L	MW-2	1/30/2020	183.00	159.02
		MW-2	5/27/2020	193.00	
		MW-2	8/6/2020	191.00	
		MW-2	11/18/2020	201.00	
		MW-21	1/30/2020	179.00	
		MW-21	5/28/2020	182.00	
		MW-21	8/6/2020	183.00	
		MW-21	12/21/2020	191.00	
		MW-33	1/30/2020	419.00	
		MW-33	5/27/2020	423.00	
		MW-33	8/6/2020	413.00	
		MW-33	11/18/2020	402.00	
		MW-35	1/30/2020	404.00	
		MW-35	5/28/2020	436.00	
MW-35	8/6/2020	412.00			
MW-35	12/21/2020	460.00			
Total Organic Carbon	mg/L	MW-35	1/30/2020	3.72	2.33
		MW-35	5/28/2020	2.9	
		MW-35	8/6/2020	2.77	
		MW-35	12/21/2020	3.51	
Total Solids	mg/L	MW-33	1/30/2020	452	286.00
		MW-33	5/27/2020	438	
		MW-33	8/6/2020	459	
		MW-33	11/18/2020	436	
		MW-35	1/30/2020	660	
		MW-35	5/28/2020	690	
		MW-35	8/6/2020	506	
MW-35	12/21/2020	579			
Total Suspended Solids	mg/L	MW-35	1/30/2020	453	95.00
		MW-35	5/28/2020	317	
		MW-35	12/21/2020	374	
Arsenic, Total	mg/L	MW-33	1/30/2020	0.0421	0.0044
		MW-33	5/27/2020	0.0428	
		MW-33	8/6/2020	0.0420	
		MW-33	11/18/2020	0.0419	
		MW-35	1/30/2020	0.0312	
		MW-35	5/28/2020	0.0304	
		MW-35	8/6/2020	0.0298	
MW-35	12/21/2020	0.0553			
Barium, Total	mg/L	MW-35	1/30/2020	0.0504	0.0384
		MW-35	5/28/2020	0.0566	
		MW-35	12/21/2020	0.0790	

Table B-5 (continued)

Channel Cc2: Summary of groundwater prediction limit exceedances

Interwell

January 1, 2020 - December 31, 2020

Parameter	Units	Well ID	Sample Date	Sample Value	Prediction Limit (PL) Value
Calcium, Total	mg/L	MW-2	1/30/2020	22.1	15.4
		MW-2	5/27/2020	22.5	
		MW-2	8/6/2020	21.4	
		MW-2	11/18/2020	22.1	
		MW-21	1/30/2020	20.8	
		MW-21	5/28/2020	19.4	
		MW-21	8/6/2020	20.4	
		MW-21	12/21/2020	20.9	
		MW-33	1/30/2020	64.8	
		MW-33	5/27/2020	62.8	
		MW-33	8/6/2020	61.4	
		MW-33	11/18/2020	60.2	
		MW-35	1/30/2020	66.9	
		MW-35	5/28/2020	63.6	
		MW-35	8/6/2020	63.3	
MW-35	12/21/2020	62.0			
Chromium, Total	mg/L	MW-35	5/28/2020	0.0112	0.0111
		MW-35	12/21/2020	0.0120	
Cobalt, Total	mg/L	MW-35	1/30/2020	0.0035	0.0030
		MW-35	5/28/2020	0.0049	
		MW-35	12/21/2020	0.0054	
Iron, Dissolved	mg/L	MW-21	5/28/2020	0.47	0.39
		MW-21	8/6/2020	0.51	
		MW-33	1/30/2020	6.67	
		MW-33	5/27/2020	6.62	
		MW-33	8/6/2020	6.43	
		MW-33	11/18/2020	5.77	
		MW-35	1/30/2020	13.60	
		MW-35	5/28/2020	13.30	
		MW-35	8/6/2020	13.70	
		MW-35	12/21/2020	15.60	
Lead, Total	mg/L	MW-35	1/30/2020	0.0022	0.0019
		MW-35	12/21/2020	0.0020	
Magnesium, Total	mg/L	MW-2	1/30/2020	22.90	17.33
		MW-2	5/27/2020	23.10	
		MW-2	8/6/2020	22.90	
		MW-2	11/18/2020	23.50	
		MW-21	1/30/2020	20.50	
		MW-21	5/28/2020	20.00	
		MW-21	8/6/2020	20.70	
		MW-21	12/21/2020	21.80	
		MW-33	1/30/2020	50.70	
		MW-33	5/27/2020	49.80	
		MW-33	8/6/2020	49.50	
		MW-33	11/18/2020	46.20	
		MW-35	1/30/2020	43.60	
		MW-35	5/28/2020	46.10	
		MW-35	8/6/2020	44.30	
MW-35	12/21/2020	43.60			
Manganese, Dissolved	mg/L	MW-33	1/30/2020	1.04	0.548
		MW-33	5/27/2020	0.96	
		MW-33	8/6/2020	0.92	
		MW-33	11/18/2020	0.89	
		MW-35	1/30/2020	2.47	
		MW-35	5/28/2020	2.25	
		MW-35	8/6/2020	2.30	
MW-35	12/21/2020	2.35			
Nickel, Total	mg/L	MW-35	5/28/2020	0.0212	0.0119
		MW-35	12/21/2020	0.0190	

Table B-5 (continued)

Channel Cc2: Summary of groundwater prediction limit exceedances

Interwell

January 1, 2020 - December 31, 2020

Parameter	Units	Well ID	Sample Date	Sample Value	Prediction Limit (PL) Value
Potassium, Total	mg/L	MW-33	1/30/2020	3.42	2.52
		MW-33	5/27/2020	3.50	
		MW-33	8/6/2020	3.37	
		MW-33	11/18/2020	3.27	
		MW-35	1/30/2020	3.53	
		MW-35	5/28/2020	3.37	
		MW-35	8/6/2020	3.36	
		MW-35	12/21/2020	3.65	
Sodium, Total	mg/L	MW-2	1/30/2020	8.88	7.57
		MW-2	5/27/2020	8.99	
		MW-2	8/6/2020	9.29	
		MW-2	11/18/2020	9.23	
		MW-21	1/30/2020	10.30	
		MW-21	5/28/2020	10.70	
		MW-21	8/6/2020	10.80	
		MW-21	12/21/2020	9.81	
		MW-33	1/30/2020	18.20	
		MW-33	5/27/2020	18.50	
		MW-33	8/6/2020	18.90	
		MW-33	11/18/2020	18.00	
		MW-35	1/30/2020	16.70	
		MW-35	5/28/2020	17.50	
		MW-35	8/6/2020	17.80	
		MW-35	12/21/2020	17.10	
Vanadium, Total	mg/L	MW-35	5/28/2020	0.01010	0.00767
		MW-35	12/21/2020	0.00985	
Vinyl Chloride	ug/L	MW-33	1/30/2020	25.90	0.0867
		MW-33	5/27/2020	31.20	
		MW-33	8/6/2020	31.10	
		MW-33	11/18/2020	22.60	
		MW-35	1/30/2020	4.09	
		MW-35	5/28/2020	6.06	
		MW-35	8/6/2020	5.56	
		MW-35	12/21/2020	2.83	



**Table B-6**  
**Unit D Aquifer: Summary of groundwater prediction limit exceedances**  
**Intrawell**  
**January 1, 2020 - December 31, 2020**

Parameter	Units	Well ID	Sample Date	Sample Value	Prediction Limit (PL) Value
pH (Field)	std. pH Units	MW-34	1/28/2020	7.55	7.34 (lower)
		MW-26	8/5/2020	7.07	7.34 (lower)
Total Dissolved Solids	mg/L	MW-34	8/5/2020	149	148.3486
Total Solids	mg/L	MW-7	8/5/2020	142	141.0000

**Table B-7**

**Channel Cc1: Summary of groundwater volatile organic compound detections**

January 1, 2020 - December 31, 2020

Compound	Units	Site ID	Date	Sample Value
<i>cis</i> -1,2-Dichloroethene	ug/L	MW-4	1/29/2020	0.113 JT
		MW-4	5/19/2020	0.576
		MW-4	8/3/2020	0.357
		MW-4	11/18/2020	1.28
Ethylbenzene	ug/L	MW-4	11/18/2020	0.441
M & P Xylene	ug/L	MW-4	11/18/2020	2.03
		MW-10	11/16/2020	0.188 JT
O-Xylene	ug/L	MW-4	11/18/2020	1.12
Tetrachloroethene	ug/L	MW-3	1/27/2020	0.103 JT
Trichlorofluoromethane	ug/L	MW-3	1/27/2020	0.218

Table B-8

Channel Cc2: Summary of groundwater volatile organic compound detections

January 1, 2020 - December 31, 2020

Compound	Units	Site ID	Date	Sample Value
1,1-Dichloroethane	ug/L	MW-33	1/30/2020	1.6
		MW-33	5/27/2020	1.54
		MW-33	8/6/2020	1.63
		MW-33	11/18/2020	1.9
		MW-35	1/30/2020	0.199 JT
		MW-35	5/28/2020	0.23
		MW-35	8/6/2020	0.207
1,1-Dichloroethane	ug/L	MW-33	1/30/2020	0.16 JT
		MW-33	5/27/2020	0.159JT
		MW-33	8/6/2020	0.17 JT
		MW-33	11/18/2020	0.189 JT
1,2-Dichloropropane		MW-33	1/30/2020	7.43
		MW-33	5/27/2020	7.65
		MW-33	8/6/2020	7.4
		MW-33	11/18/2020	8.53
		MW-35	1/30/2020	0.469
		MW-35	5/28/2020	0.515
		MW-35	8/6/2020	0.465
Acetone	ug/L	MW-2	8/6/2020	2.99
Benzene	ug/L	MW-33	1/30/2020	0.974
		MW-33	5/27/2020	1.01
		MW-33	8/6/2020	0.939
		MW-33	11/18/2020	1.03
		MW-35	1/30/2020	0.518
		MW-35	5/28/2020	0.577
		MW-35	8/6/2020	0.53
Chloroethane	ug/L	MW-33	8/6/2020	0.395
		MW-33	11/18/2020	0.313
<i>cis</i> -1,2-Dichloroethene	ug/L	MW-21	1/30/2020	0.503
		MW-21	5/28/2020	0.611
		MW-21	8/6/2020	0.528
		MW-21	12/21/2020	0.445
		MW-33	1/30/2020	31.5
		MW-33	5/27/2020	31.8
		MW-33	8/6/2020	33.6
		MW-33	11/18/2020	37.8
		MW-35	1/30/2020	4.68
		MW-35	5/28/2020	3.85
		MW-35	8/6/2020	3.61
		MW-35	12/21/2020	2.7

Table B-8 (continued)

Channel Cc2: Summary of groundwater volatile organic compound detections

January 1, 2020 - December 31, 2020

Compound	Units	Site ID	Date	Sample Value		
Dichlorodifluoromethane	ug/L	MW-2	1/30/2020	4.23		
		MW-2	5/27/2020	4.34		
		MW-2	8/6/2020	3.99		
		MW-2	11/18/2020	3.13		
		MW-20	1/30/2020	0.311		
		MW-20	5/28/2020	0.326		
		MW-20	8/6/2020	0.323		
		MW-20	11/18/2020	0.294		
		MW-21	1/30/2020	2.01		
		MW-21	5/28/2020	2.69		
		MW-21	8/6/2020	2.41		
		MW-21	12/21/2020	1.59		
		MW-33	1/30/2020	4.95		
		MW-33	5/27/2020	6.24		
		MW-33	8/6/2020	6.32		
trans-1,2-Dichloroethene	ug/L	MW-33	1/30/2020	0.743		
		MW-33	5/27/2020	0.831		
		MW-33	8/6/2020	0.832		
		MW-33	11/18/2020	0.923		
		MW-35	1/30/2020	0.226		
		MW-35	5/28/2020	0.235		
		MW-35	8/6/2020	0.222		
		MW-35	12/21/2020	0.249		
		Trichloroethene	ug/L	MW-33	5/27/2020	0.166JT
				MW-33	8/6/2020	0.153 JT
				MW-33	11/18/2020	0.18 JT
				MW-35	1/30/2020	0.866
				MW-35	5/28/2020	1.02
				MW-35	8/6/2020	0.971
				MW-35	12/21/2020	1.45
Trichlorofluoromethane	ug/L	MW-2	1/30/2020	1.2		
		MW-2	5/27/2020	0.702		
		MW-2	8/6/2020	0.984		
		MW-2	11/18/2020	1.42		
		MW-21	1/30/2020	0.852		
		MW-21	5/28/2020	0.811		
		MW-21	8/6/2020	0.734		
		MW-21	12/21/2020	0.945		
		Vinyl Chloride	ug/L	MW-2	1/30/2020	0.0445
MW-2	5/27/2020			0.0555		
MW-2	8/6/2020			0.0757 D		
MW-2	11/18/2020			0.0235		
MW-21	1/30/2020			0.0699		
MW-21	5/28/2020			0.0759		
MW-21	8/6/2020			0.0815 D		
MW-21	12/21/2020			0.0606		
MW-33	1/30/2020			25.9		
MW-33	5/27/2020			31.2		
MW-33	8/6/2020			31.1 D		
MW-33	11/18/2020			22.6		
MW-35	1/30/2020			4.09		
MW-35	5/28/2020			6.06		
MW-35	8/6/2020			5.56 D		
MW-35	12/21/2020	2.83				

**Table B-9**

**Channel Cc3: Summary of groundwater volatile organic compound detections**

January 1, 2020 - December 31, 2020

Compound	Units	Site ID	Date	Sample Value
<b>There were no volatile organic compounds detected this year in Channel Cc3 samples.</b>				

**Table B-10**

**Unit D Aquifer: Summary of groundwater volatile organic compound detections**

January 1, 2020 - December 31, 2020

Compound	Units	Site ID	Date	Sample Value
2-Butanone	ug/L	MW-7	8/5/2020	1.09 JT

**Table B-11**

**Summary of Trip, Field, and Method Blanks Volatile Organic Compound Detections**

January 1, 2020 - December 31, 2020

**Summary of trip blank volatile organic compound detections**

Compound	Units	Sample ID	Date	Sample Value
There were no volatile organic compounds detected in trip blanks this year.				

**Summary of field blank volatile organic compound detections**

Compound	Units	Sample ID	Date	Sample Value
Chloroform	ug/L	WV8-200127F	1/29/2020	0.851
		WV33200527F	5/27/2020	2.66
		WV4-200803F	8/3/2020	0.166 JT

**Summary of method blank volatile organic compound detections**

Compound	Units	Workgroup ID	Date	Sample Value
There were no volatile organic compounds detected in method blanks this year.				

**Table B-12**  
**Summary of surface water monitoring location exceedances vs. SW quality standard**  
 West Hillslope Seeps & Site Surface Water Discharge

Vashon Island Closed Landfill  
 January 1, 2020 - December 31, 2020

Compound	Units	Site ID	Sample Date	Sample Value	Reg. Limit	Standard(s) Exceeded
Dissolved Oxygen (Field)	mg/L	SW-W1	1/29/2020	3.09	< 8; 4; 6.5	SSWC; FA; FC
		SW-W1	8/4/2020	7.07	< 8	SSWC
		SW-W1	11/17/2020	0.45	< 8; 4; 6.5	SSWC; FA; FC
Turbidity (Field)	NTU	SW-E	1/29/2020	42.9	25	SSWC; FA; FC
		SW-E	5/19/2020	28.9		
		SW-W1	1/29/2020	91		
		SW-W1	8/4/2020	1.55		
		SW-W2	1/29/2020	40.5		
		SW-W2	8/4/2020	1.9		
		SW-W3	1/29/2020	27.7		
Iron, Total	mg/L	SW-E	1/29/2020	2.46	1	FC
		SW-W1	1/29/2020	11		
		SW-W1	5/19/2020	1.77		
		SW-W1	8/4/2020	2		
		SW-W2	1/29/2020	6.26		
		SW-W2	5/19/2020	2.3		
		SW-W3	1/29/2020	3.29		
		SW-W3	5/19/2020	1.1		
Lead, Total	mg/L	SW-E	1/29/2020	0.00209	0.00124; 0.00157	SSWC; FC
		SW-W1	1/29/2020	0.00429		

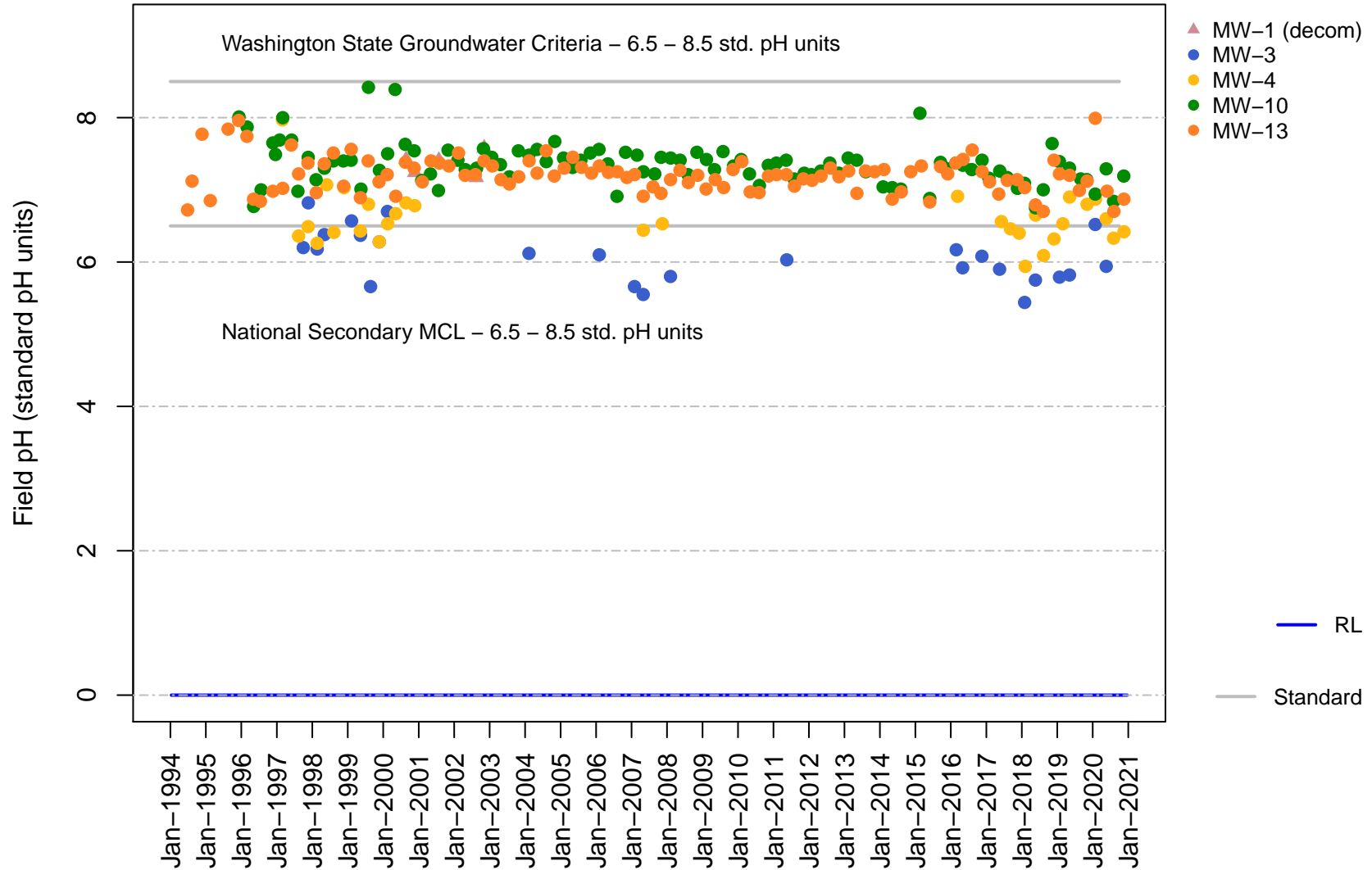
FC = Federal chronic surface water quality criteria  
 FA = Federal Acute Surface Water Criteria  
 SSWC = Washington State chronic surface water quality criteria  
 See Data Qualifiers Section in Appendix B for Qualifier Information.



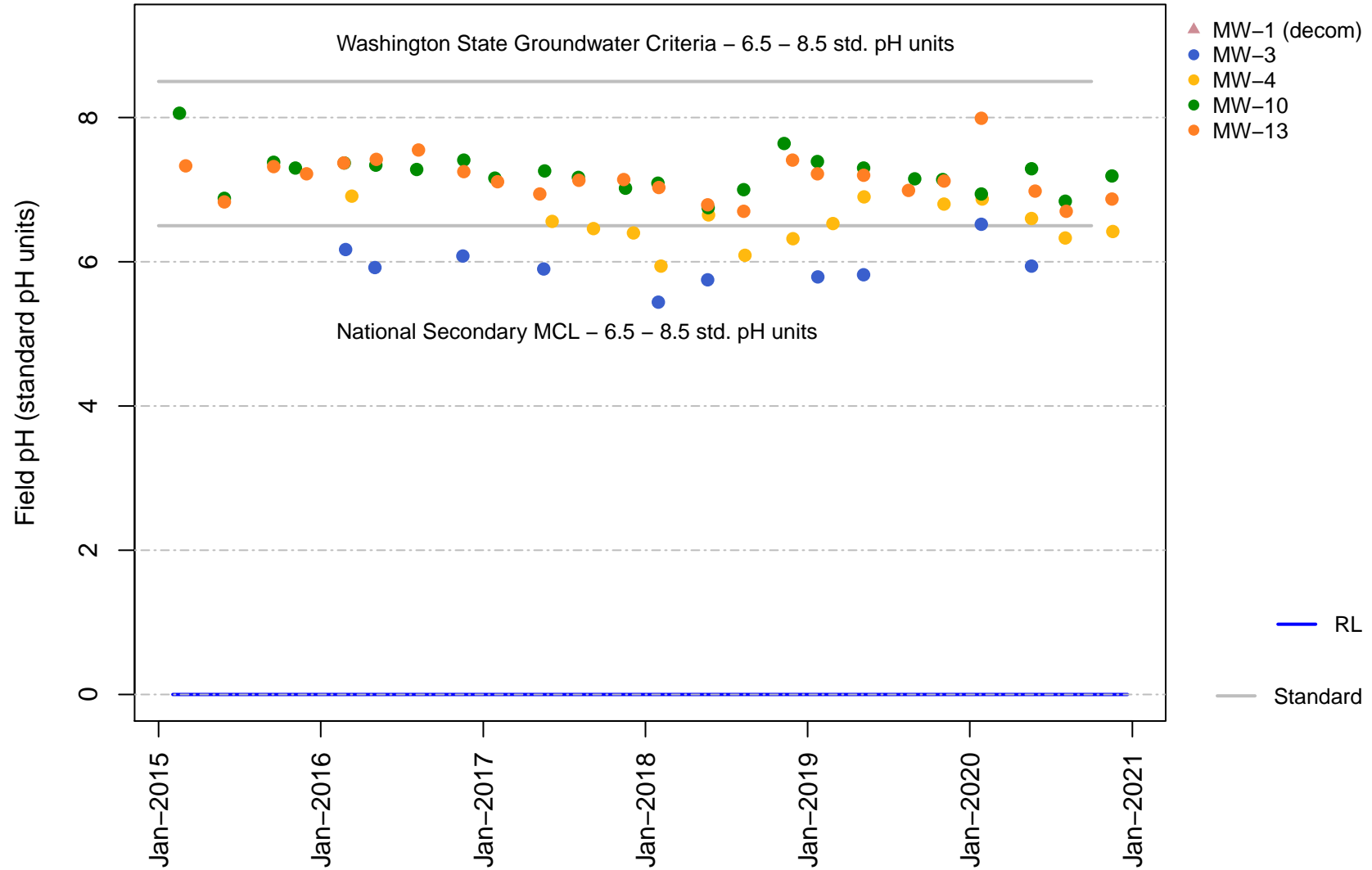
## **Appendix C**

Time Concentration Plots for  
Groundwater in Channel Cc1

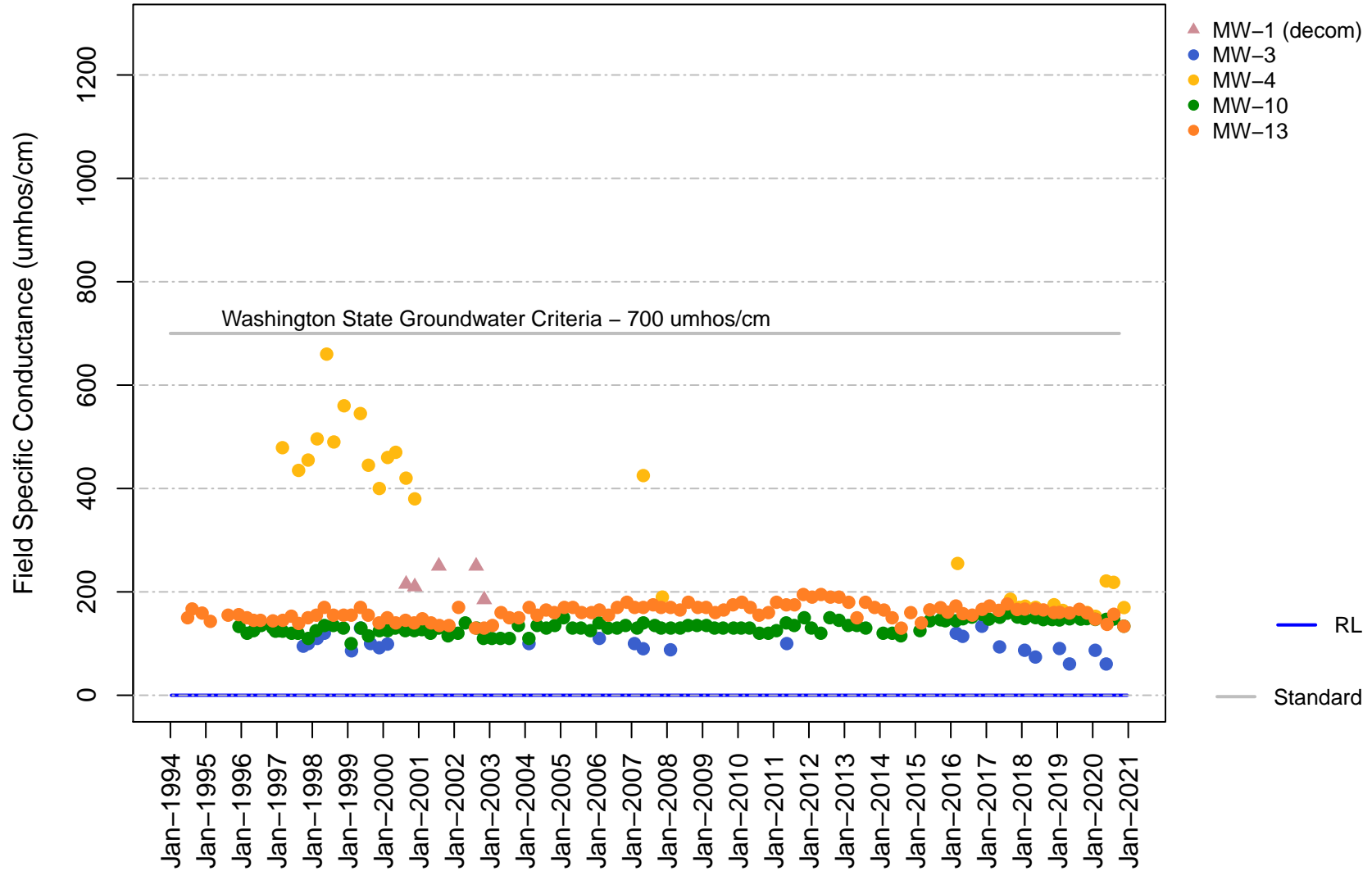
# Vashon Island Closed Landfill Channel Cc1 Field pH



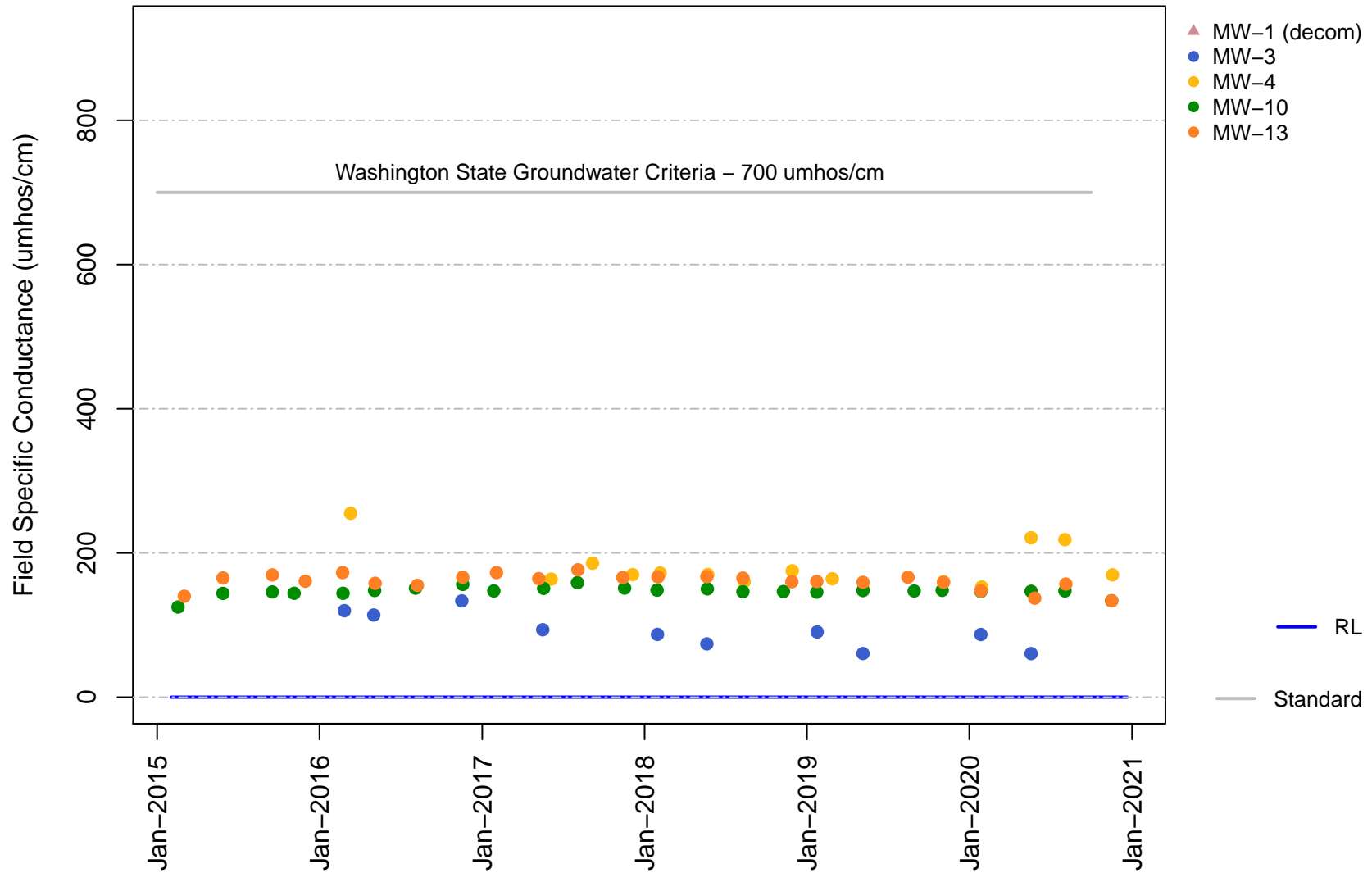
# Vashon Island Closed Landfill Channel Cc1 Field pH



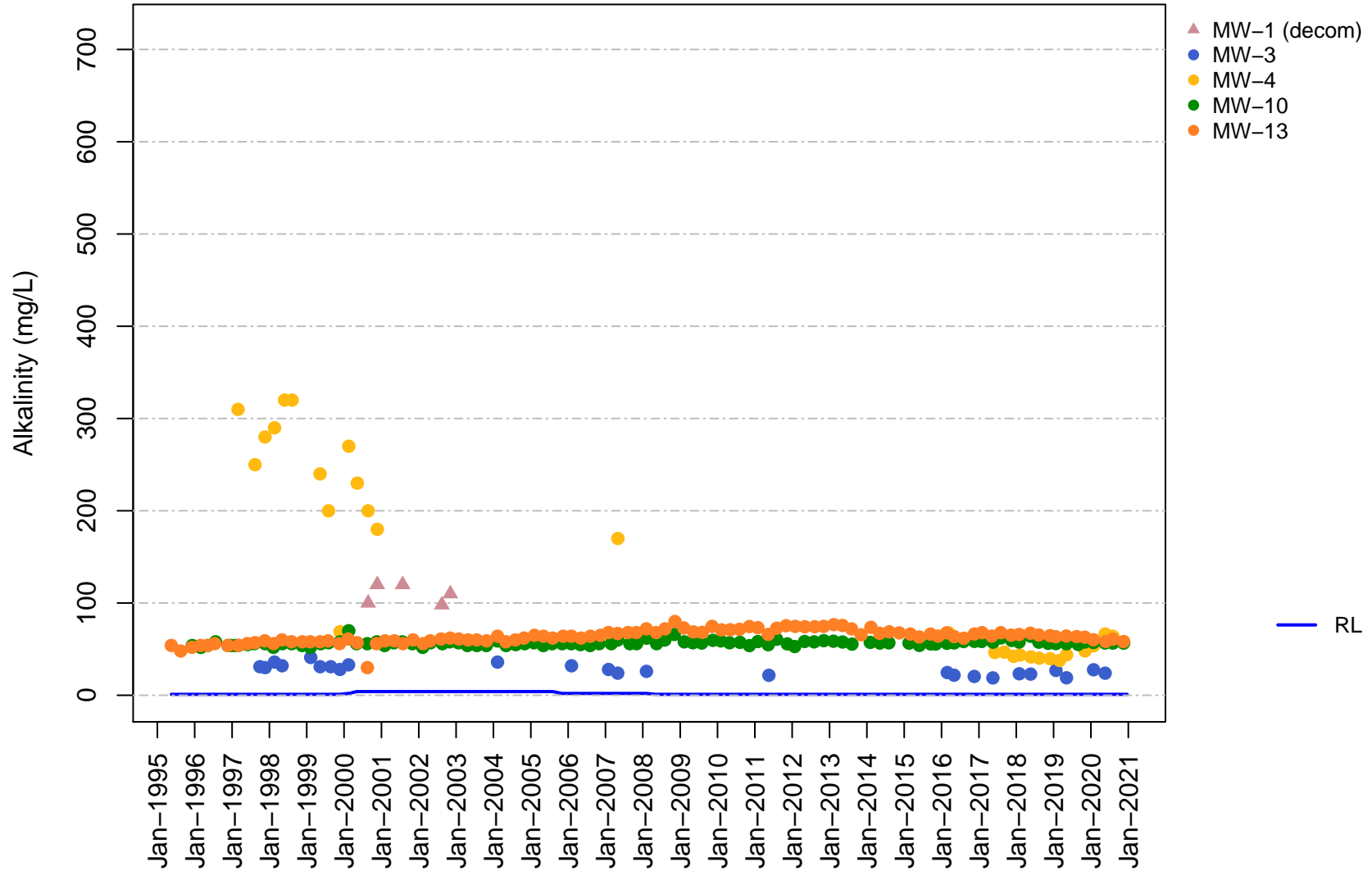
# Vashon Island Closed Landfill Channel Cc1 Field Specific Conductance



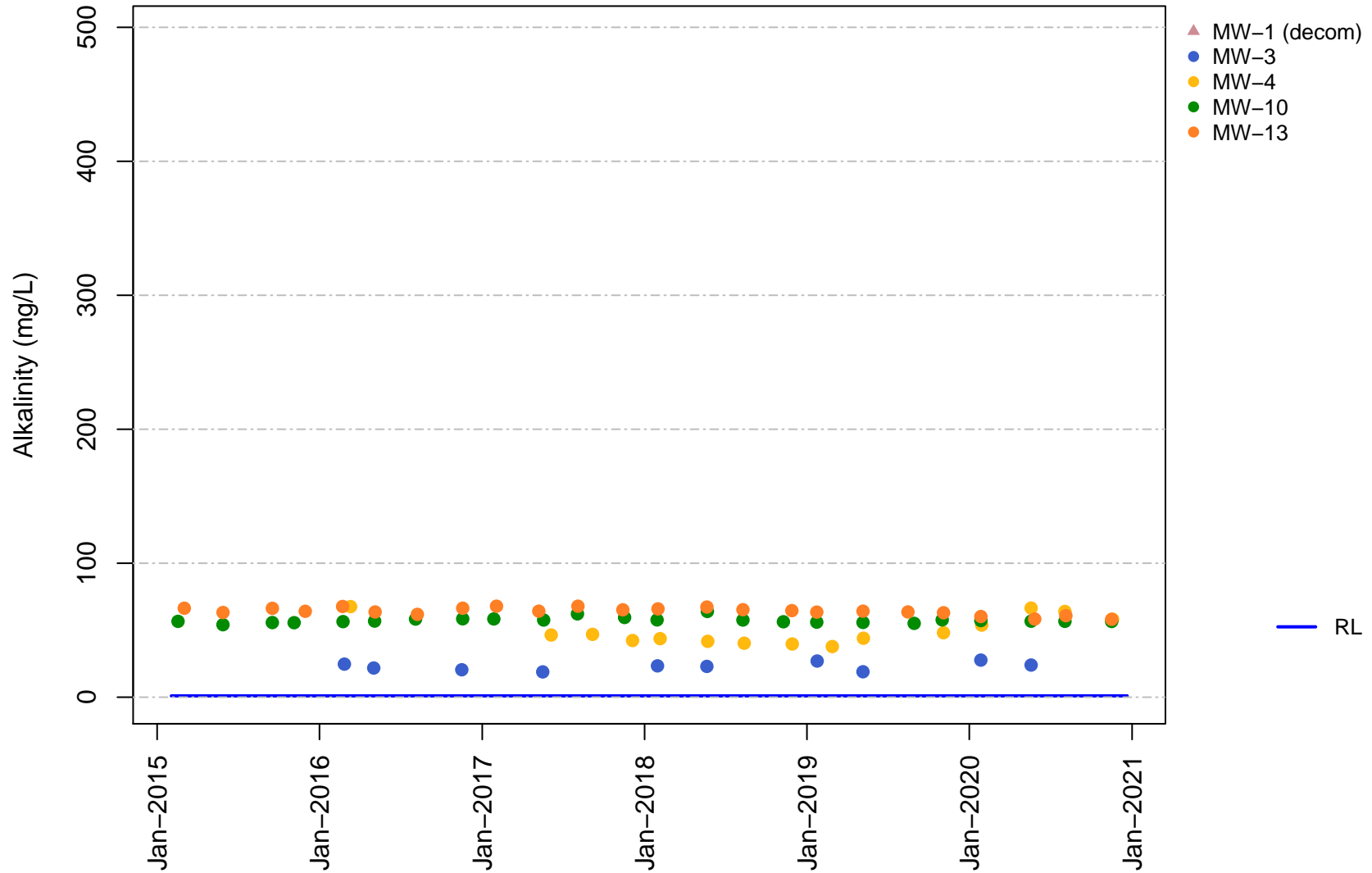
# Vashon Island Closed Landfill Channel Cc1 Field Specific Conductance



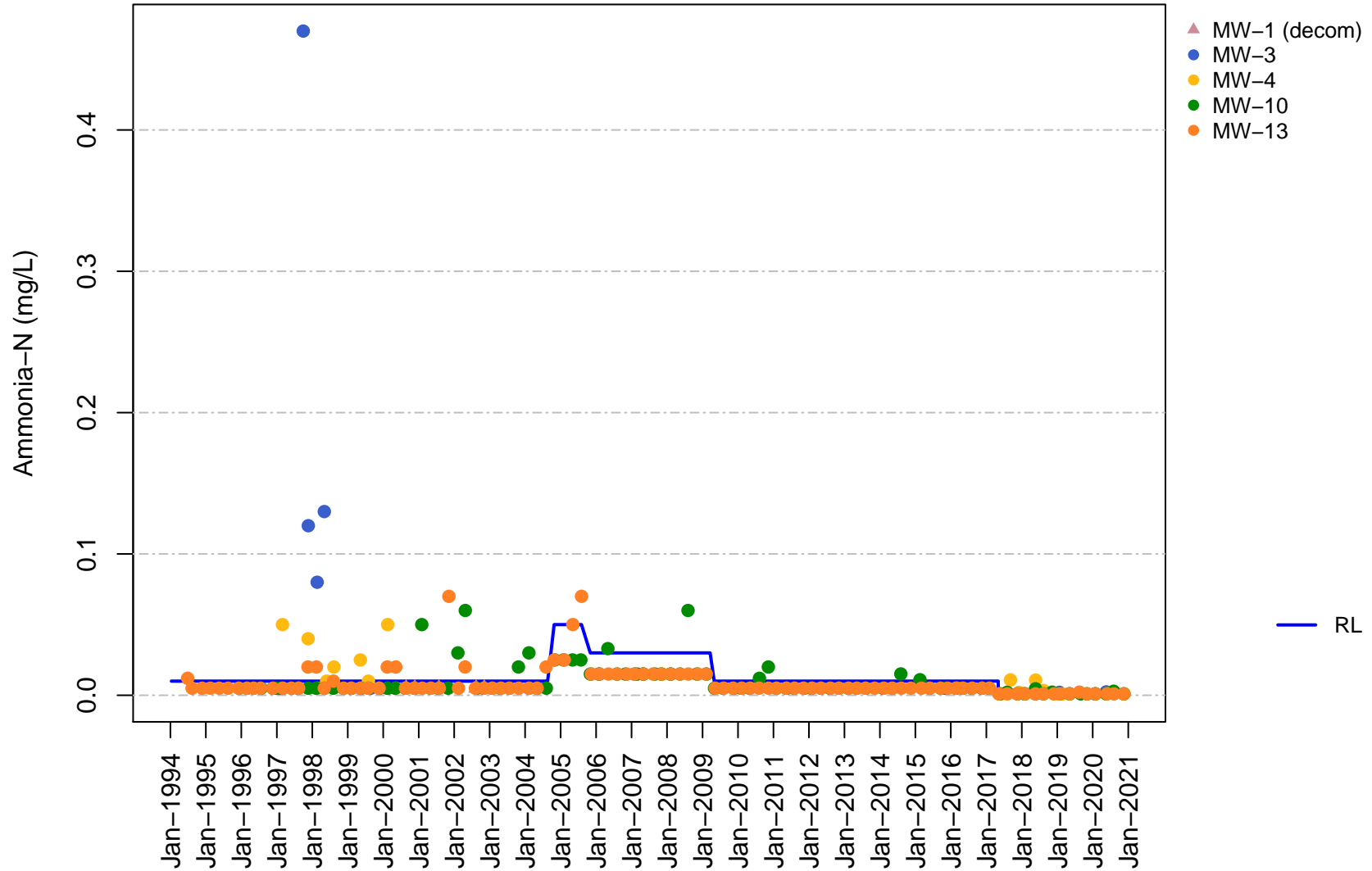
# Vashon Island Closed Landfill Channel Cc1 Alkalinity



# Vashon Island Closed Landfill Channel Cc1 Alkalinity

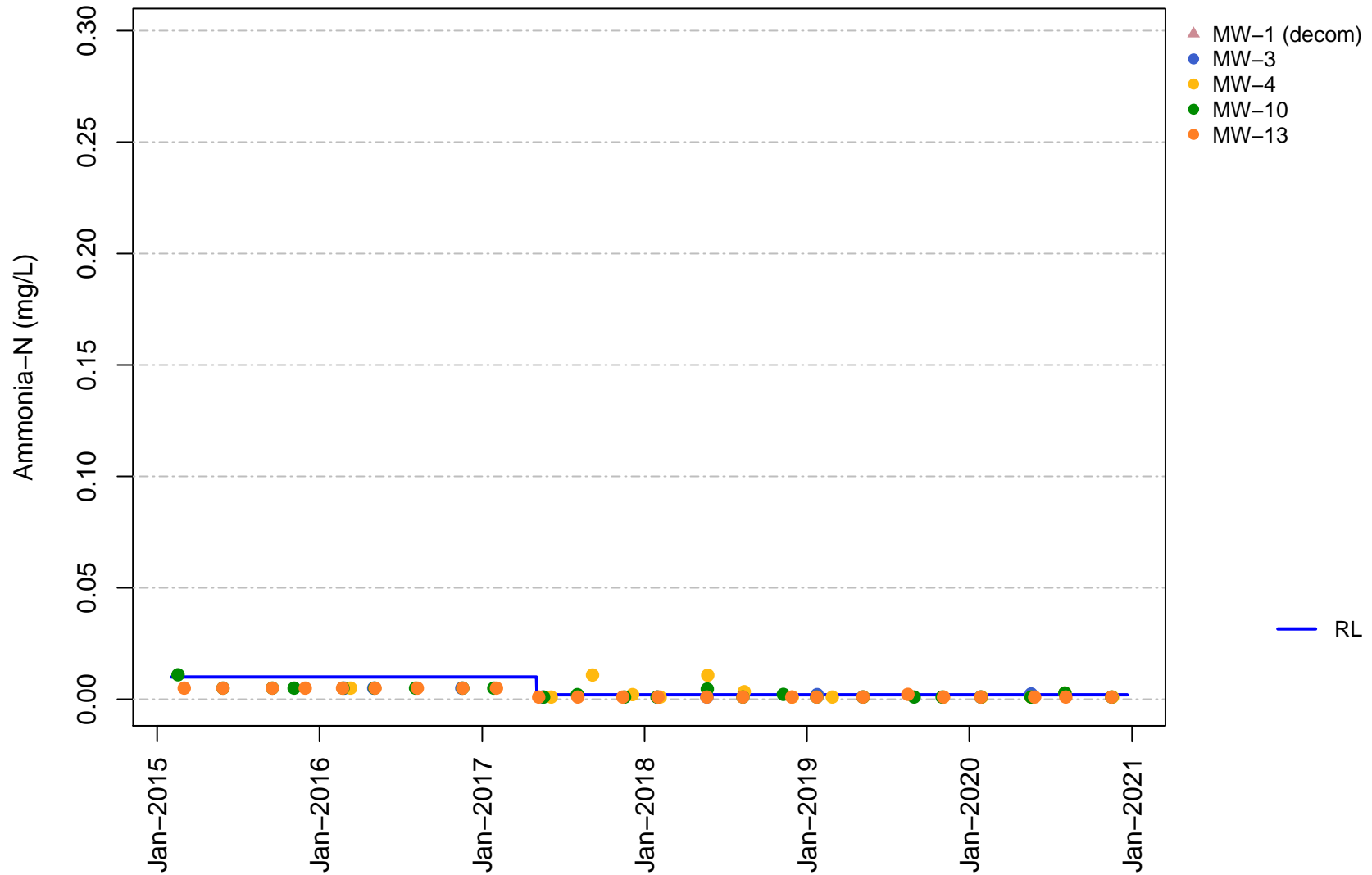


# Vashon Island Closed Landfill Channel Cc1 Ammonia

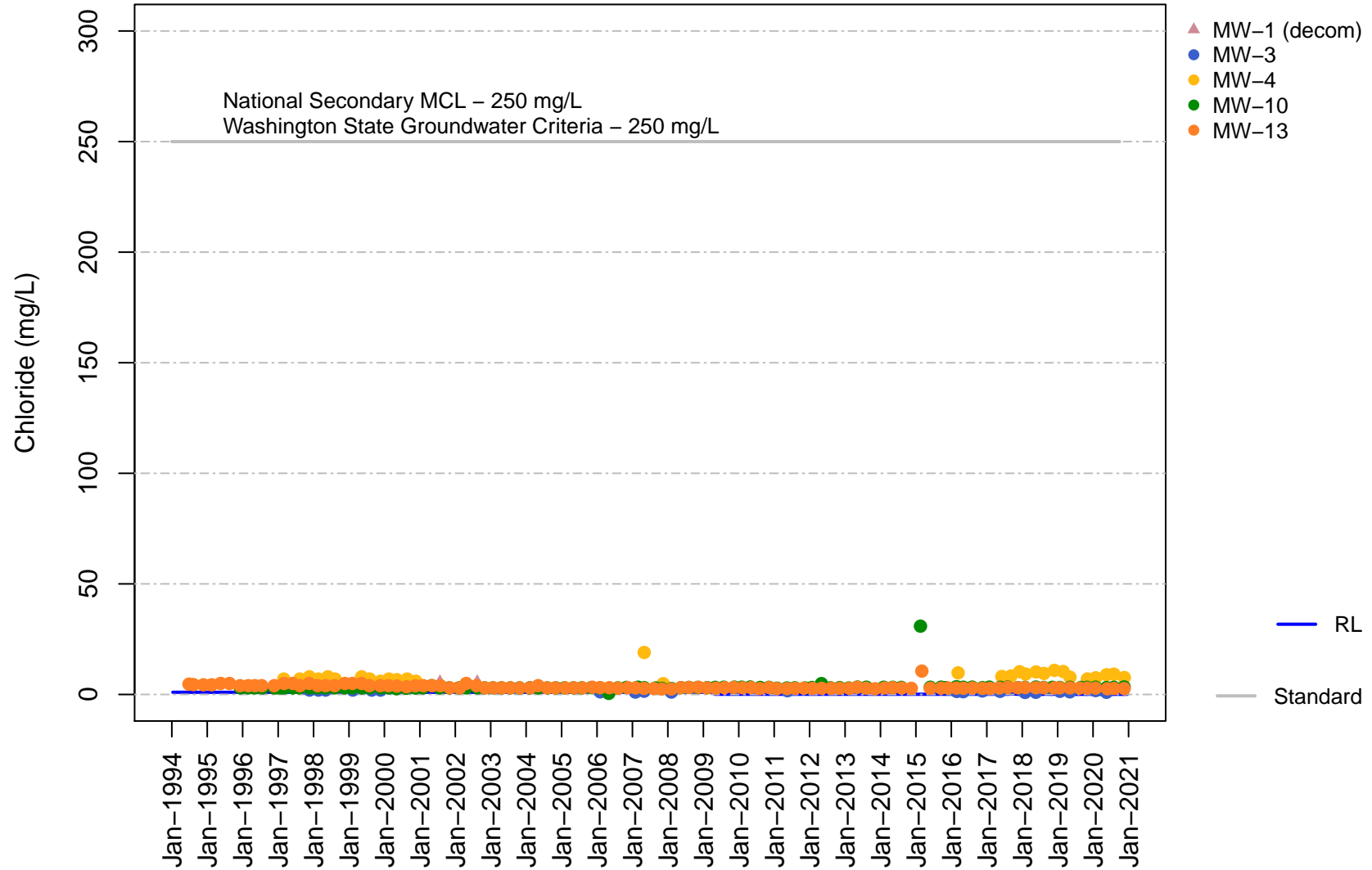




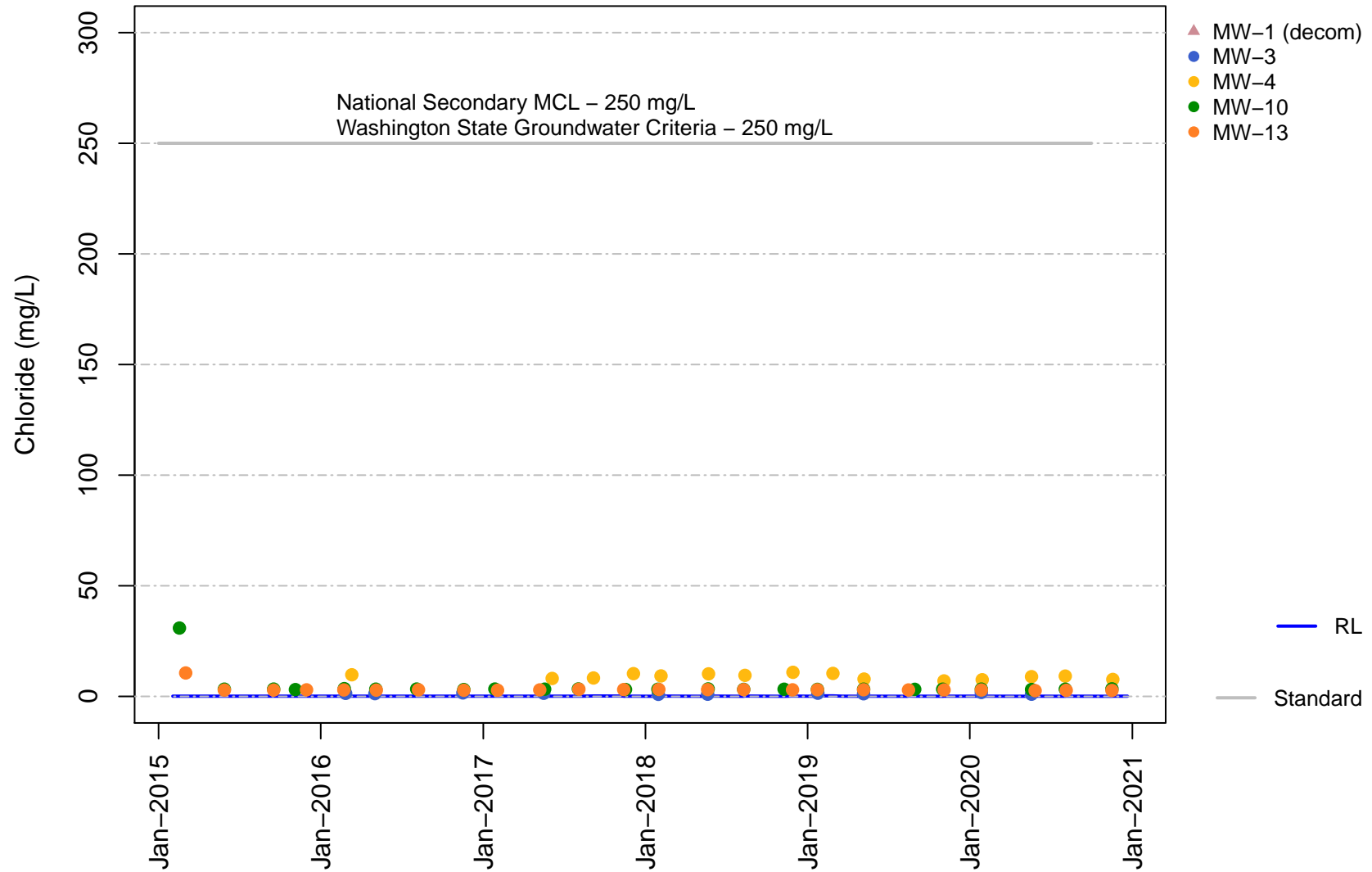
# Vashon Island Closed Landfill Channel Cc1 Ammonia



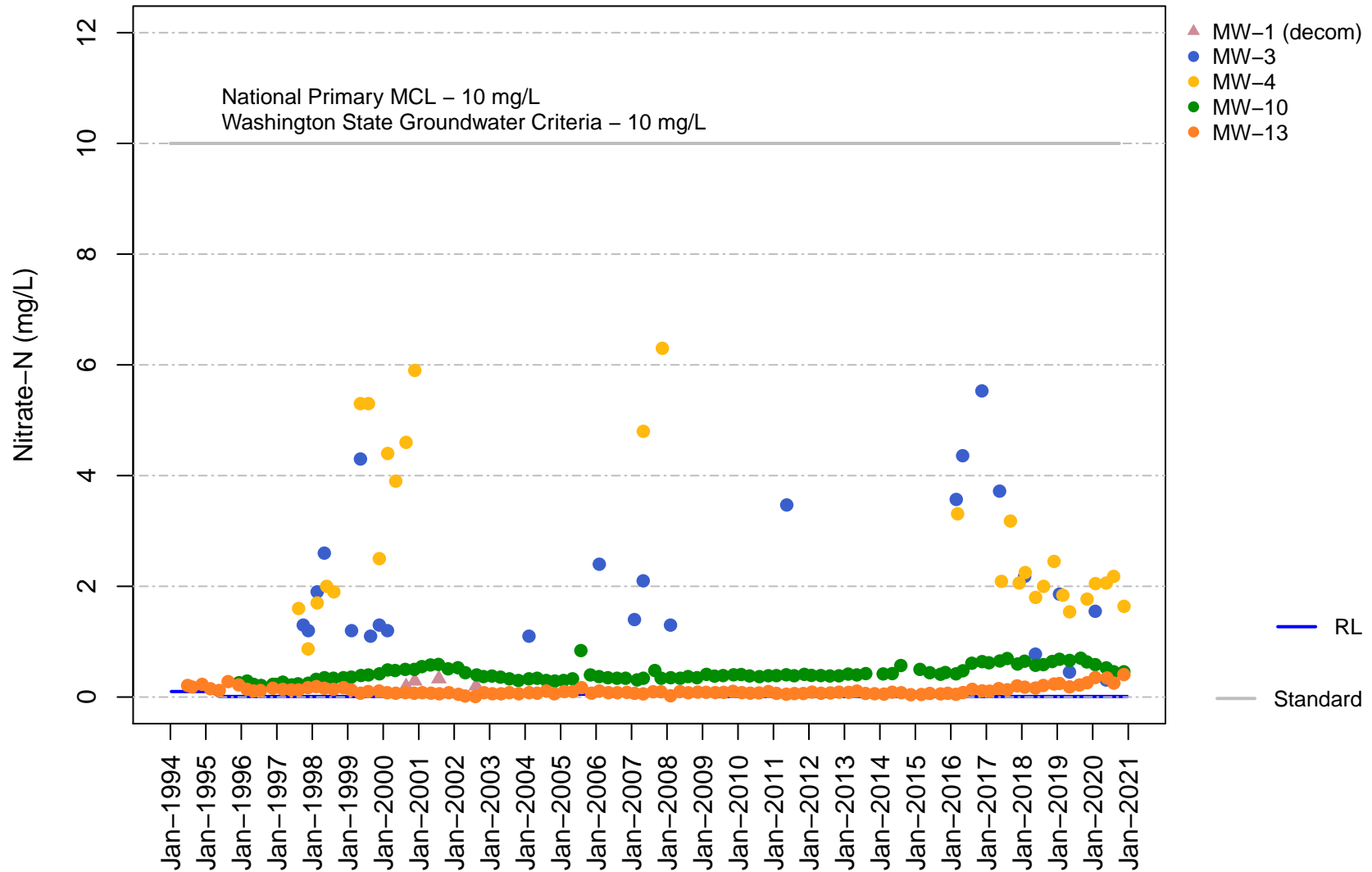
# Vashon Island Closed Landfill Channel Cc1 Chloride



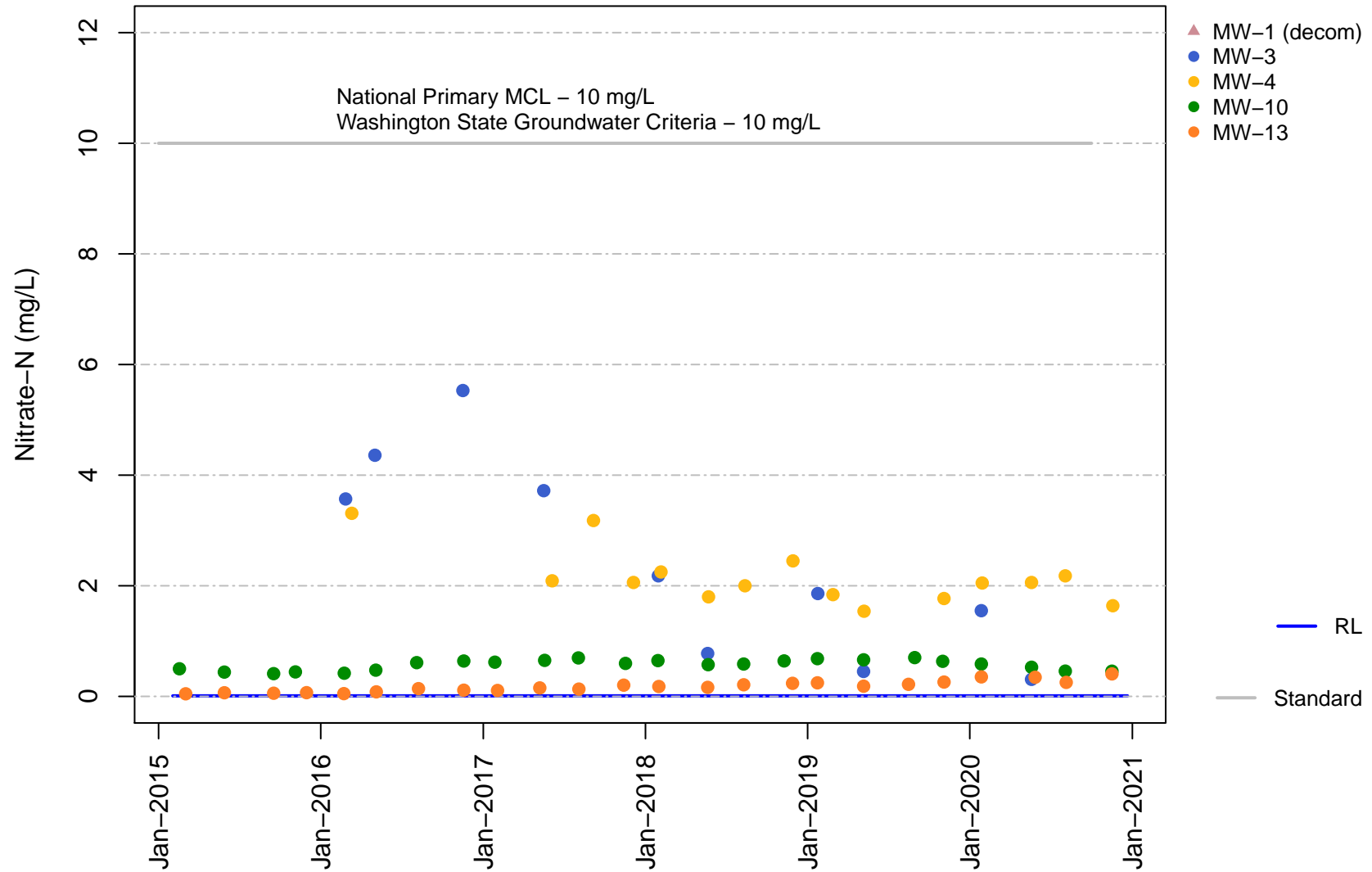
# Vashon Island Closed Landfill Channel Cc1 Chloride



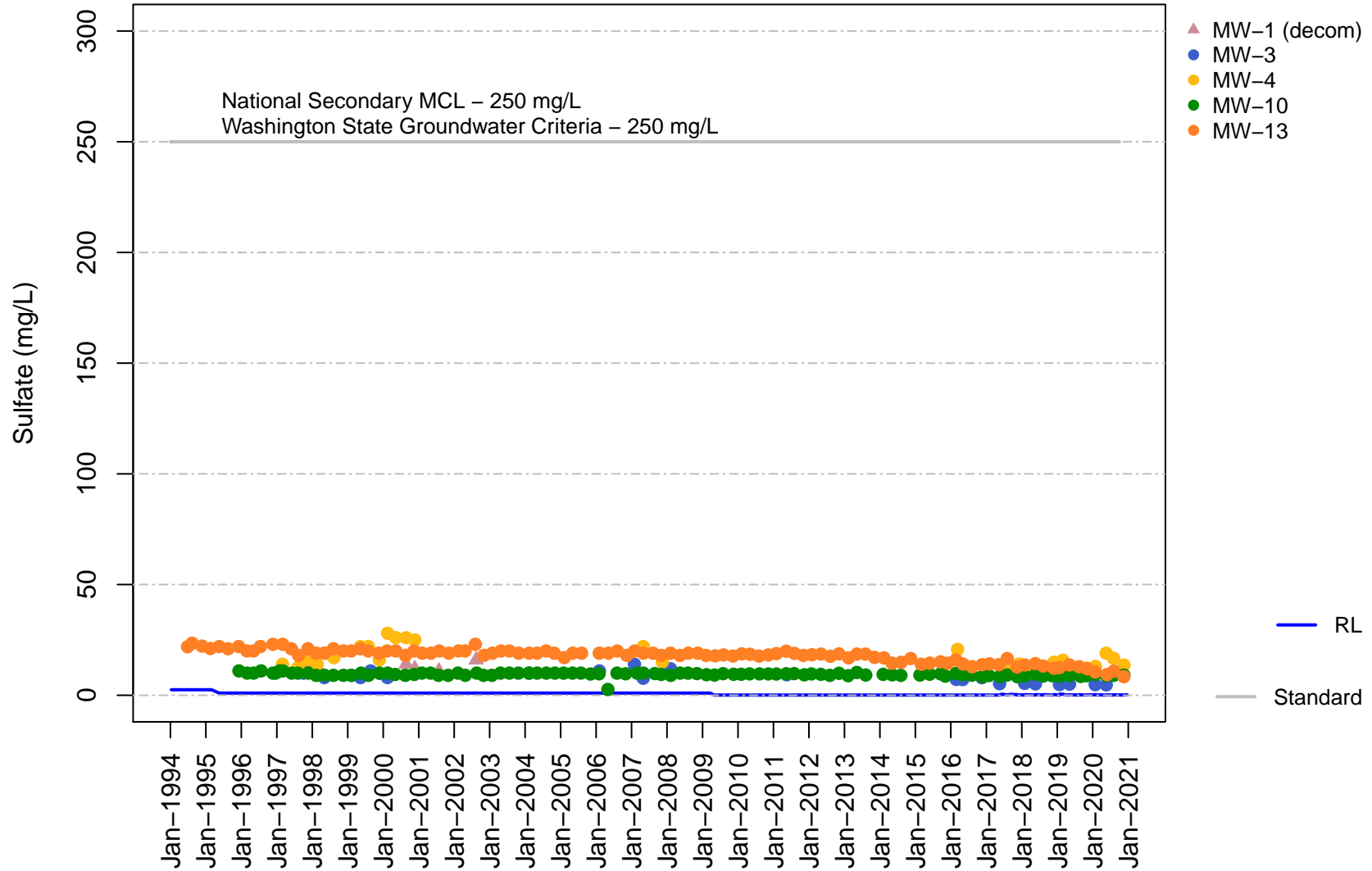
**Vashon Island Closed Landfill  
Channel Cc1  
Nitrate**



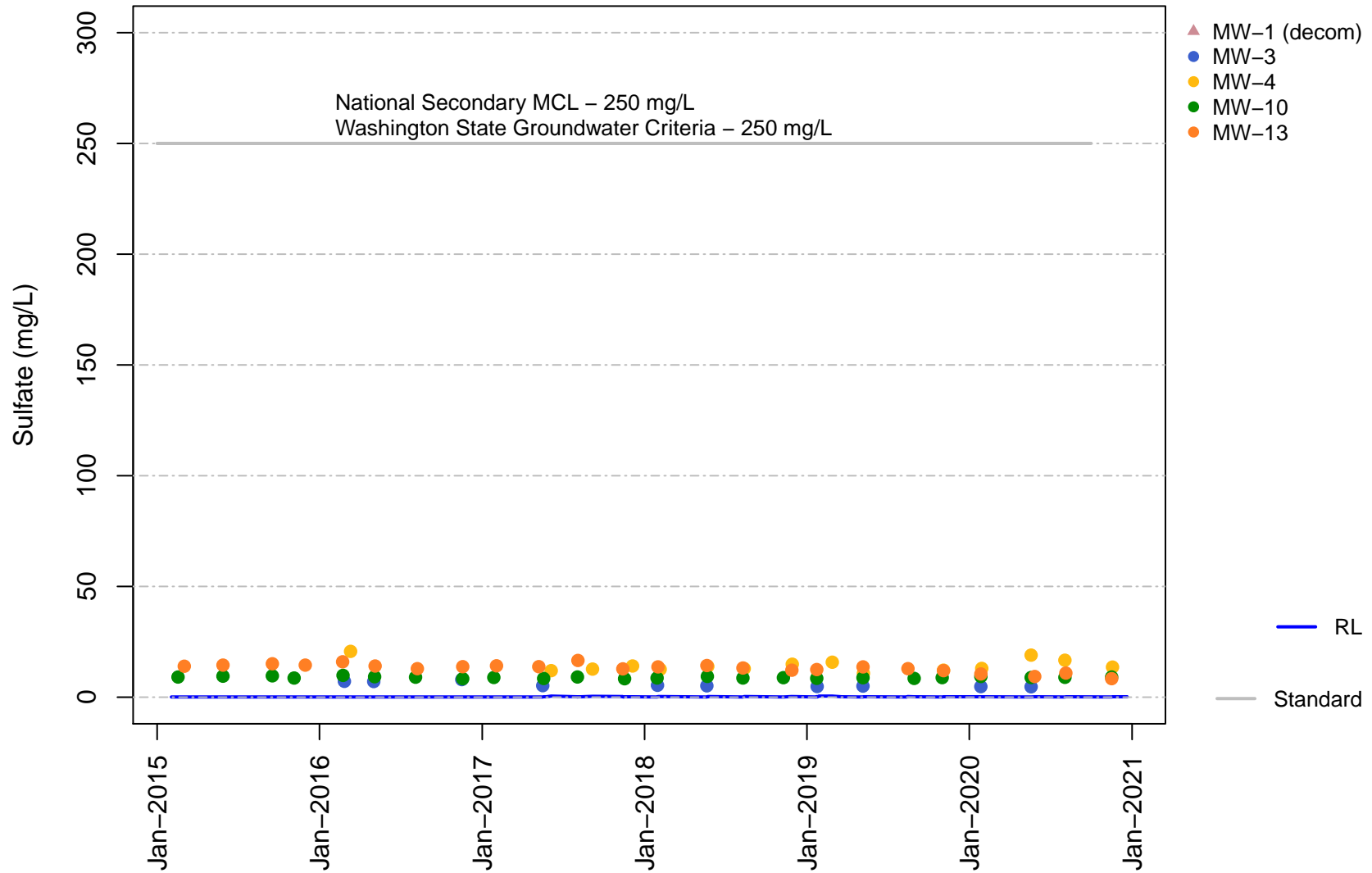
**Vashon Island Closed Landfill  
Channel Cc1  
Nitrate**



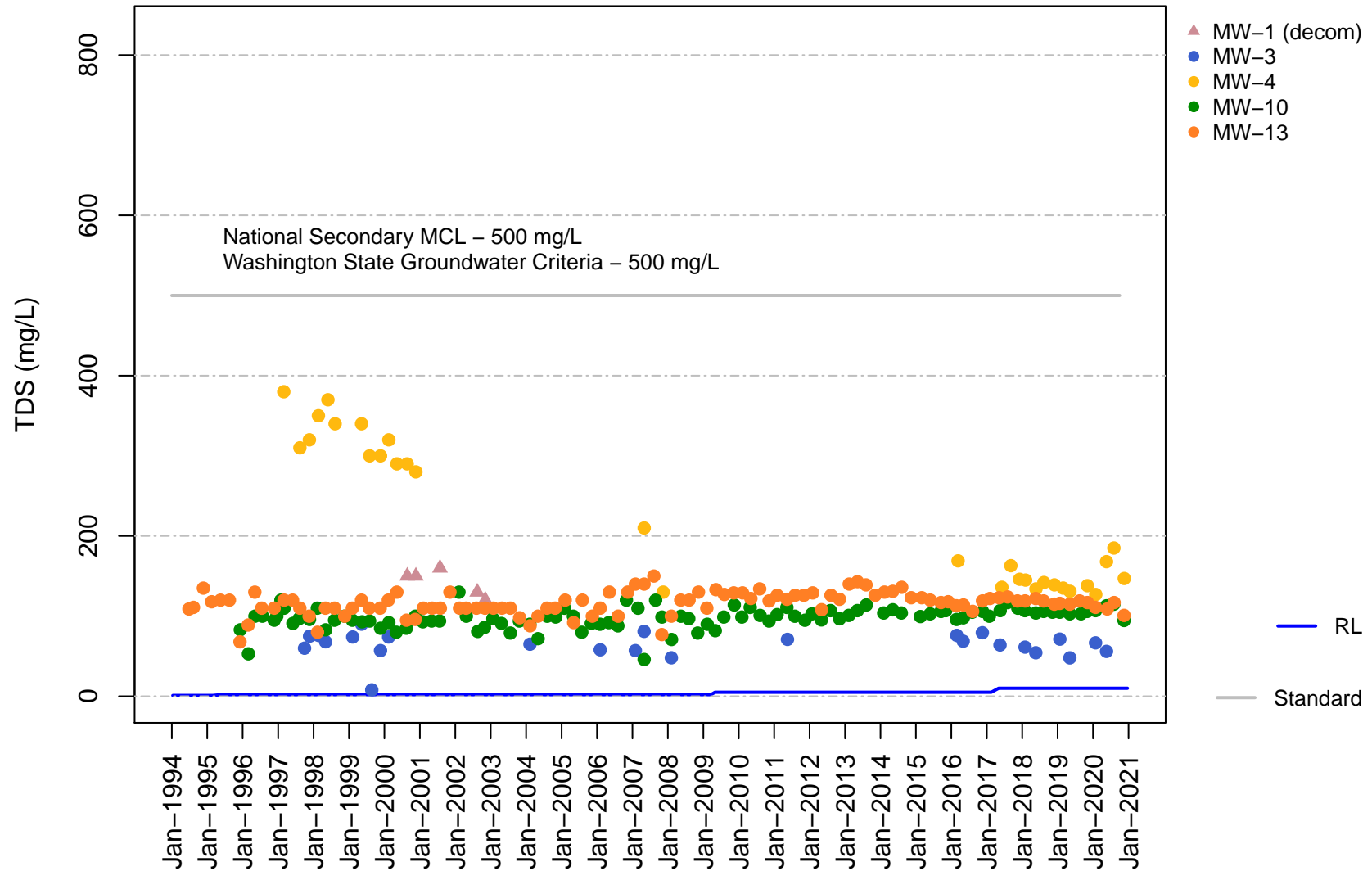
# Vashon Island Closed Landfill Channel Cc1 Sulfate



# Vashon Island Closed Landfill Channel Cc1 Sulfate

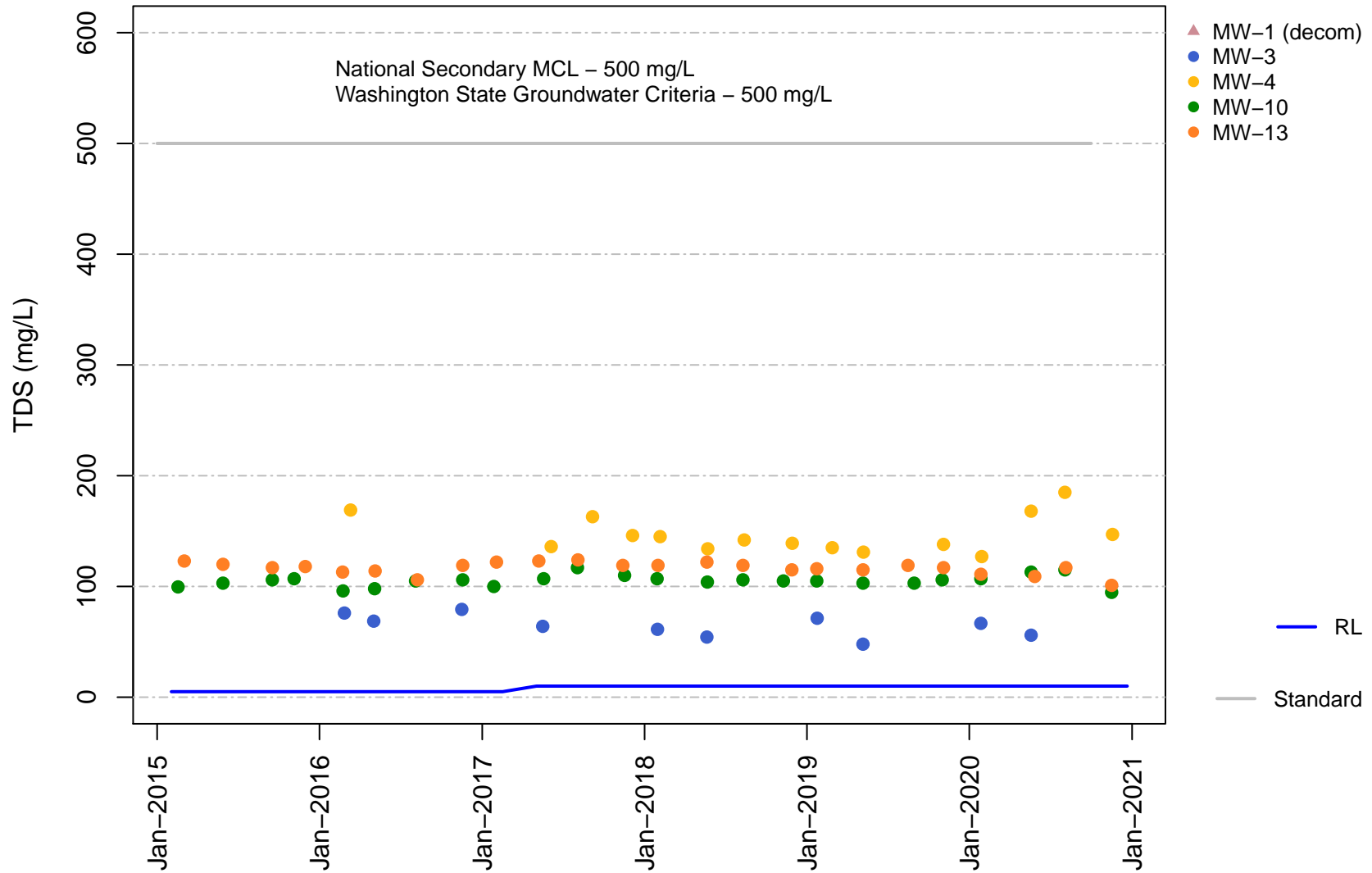


# Vashon Island Closed Landfill Channel Cc1 Total Dissolved Solids

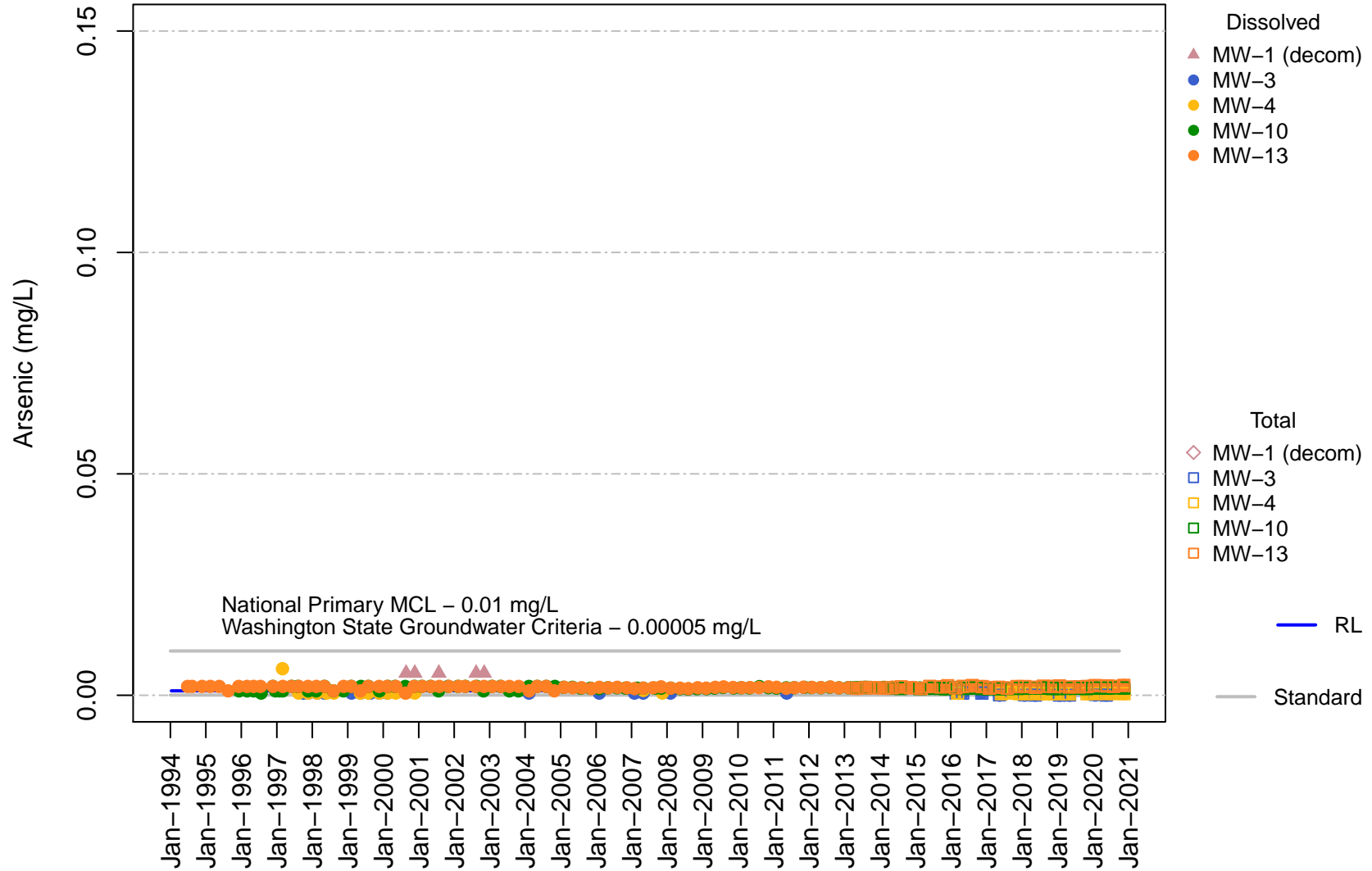




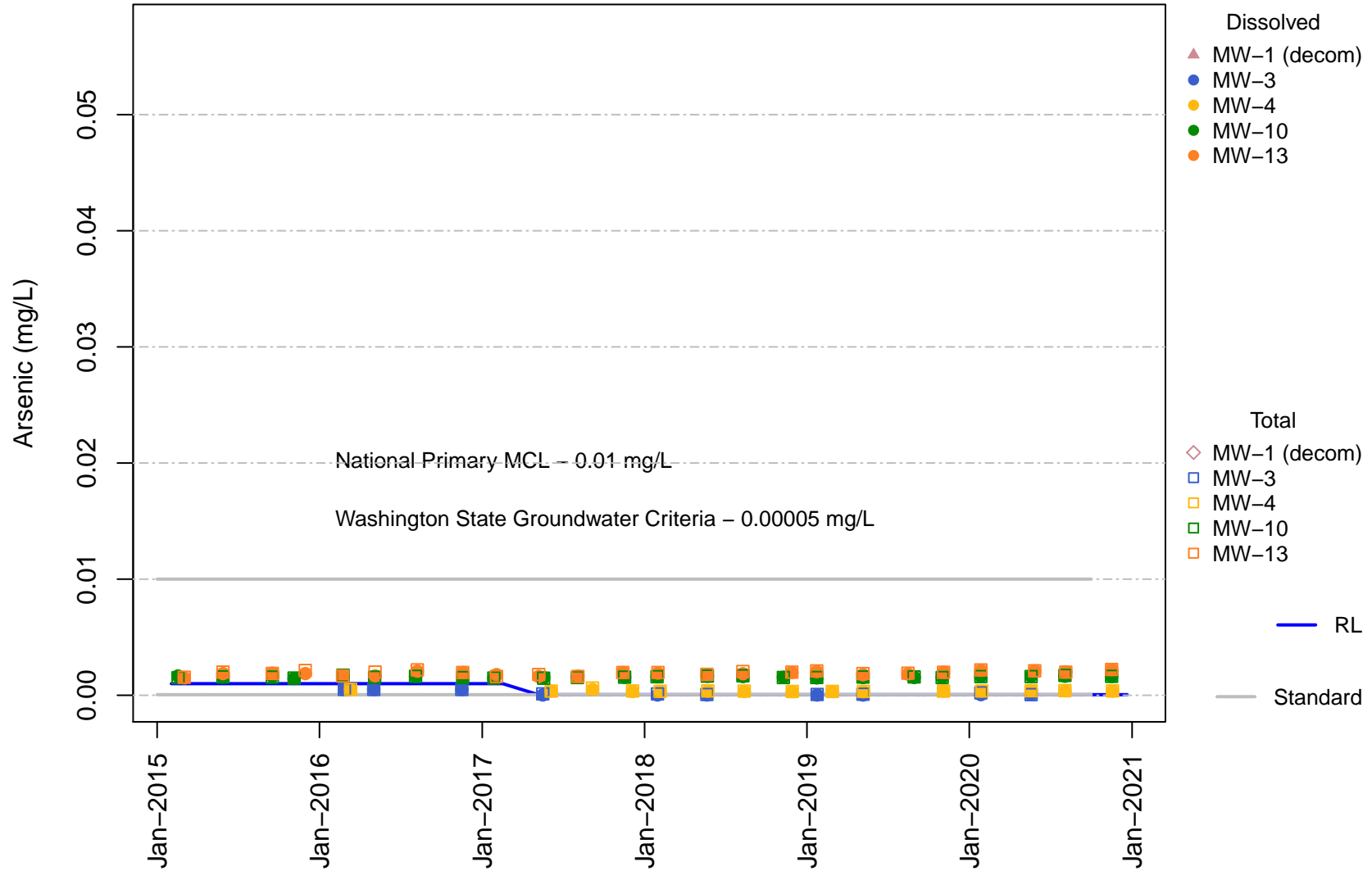
**Vashon Island Closed Landfill  
Channel Cc1  
Total Dissolved Solids**



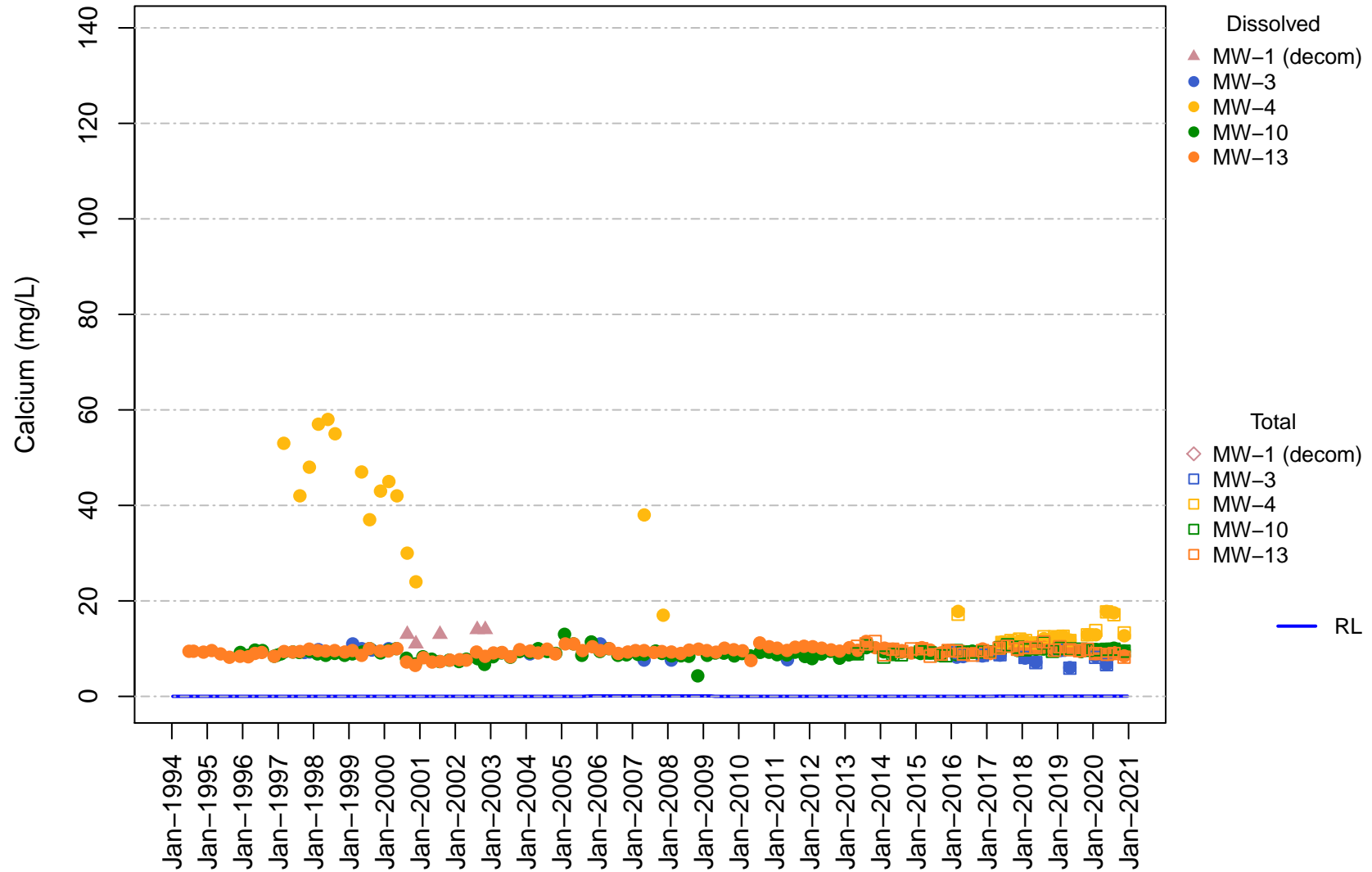
# Vashon Island Closed Landfill Channel Cc1 Arsenic



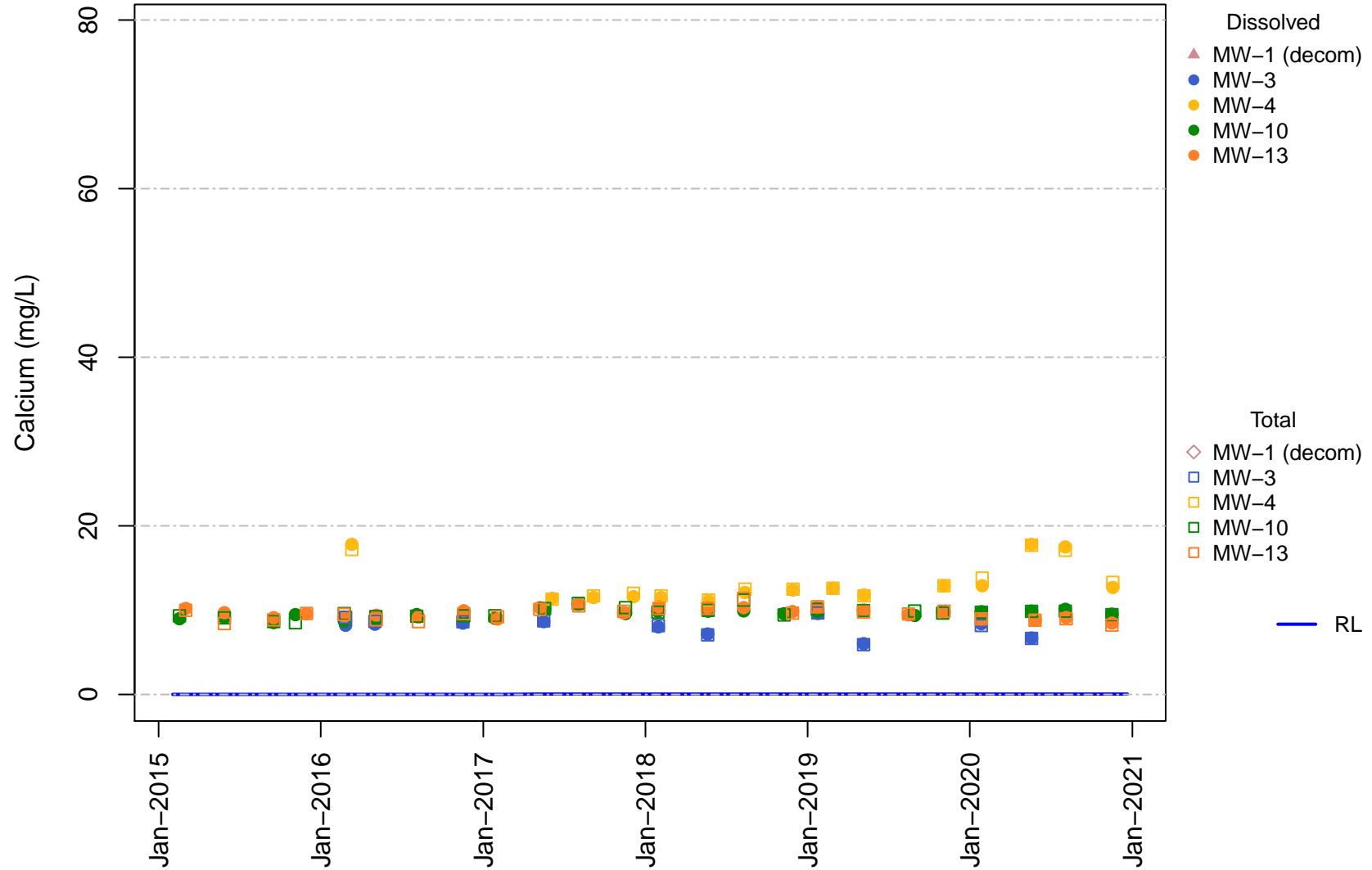
**Vashon Island Closed Landfill  
Channel Cc1  
Arsenic**



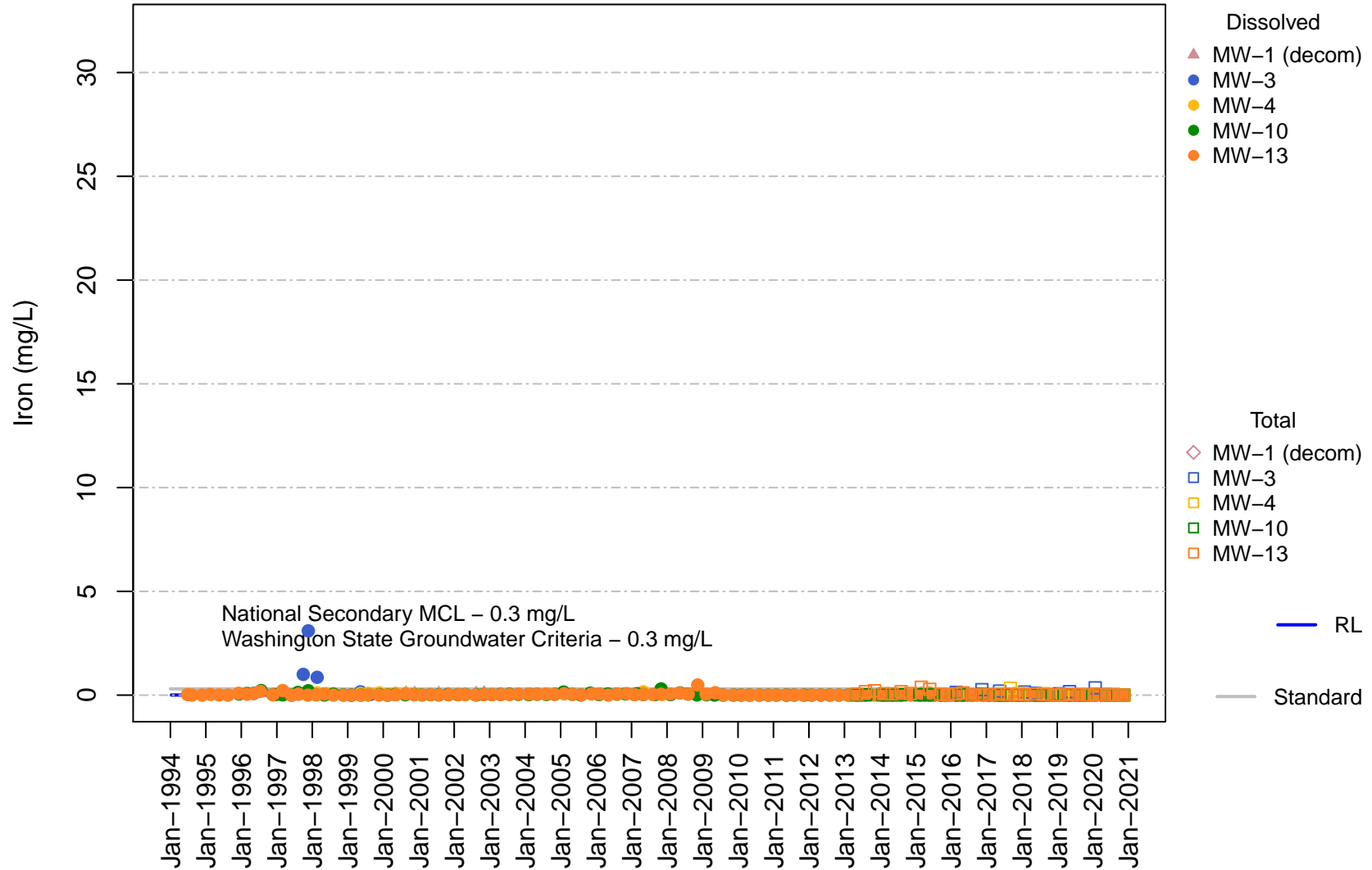
# Vashon Island Closed Landfill Channel Cc1 Calcium



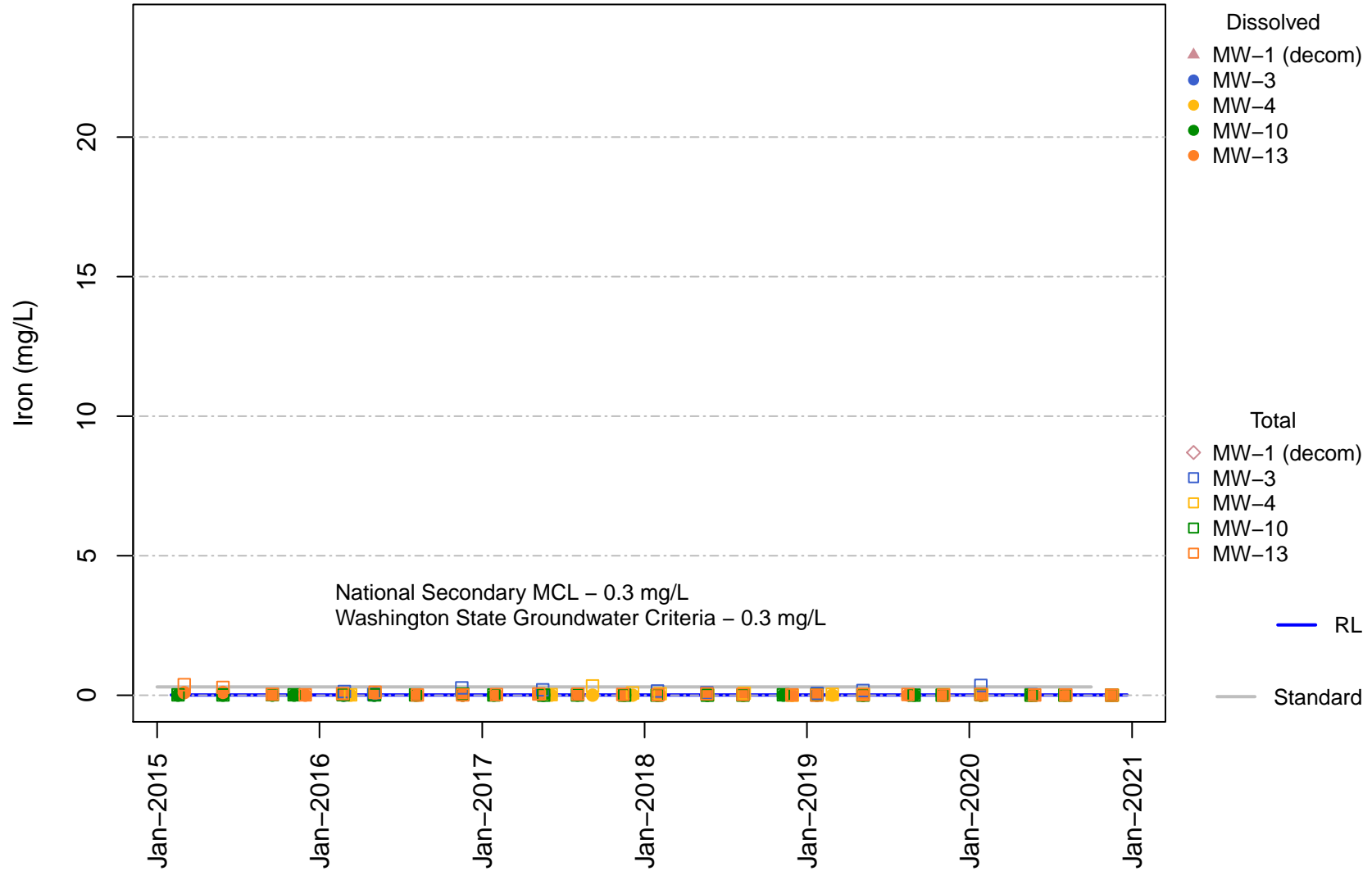
**Vashon Island Closed Landfill  
Channel Cc1  
Calcium**



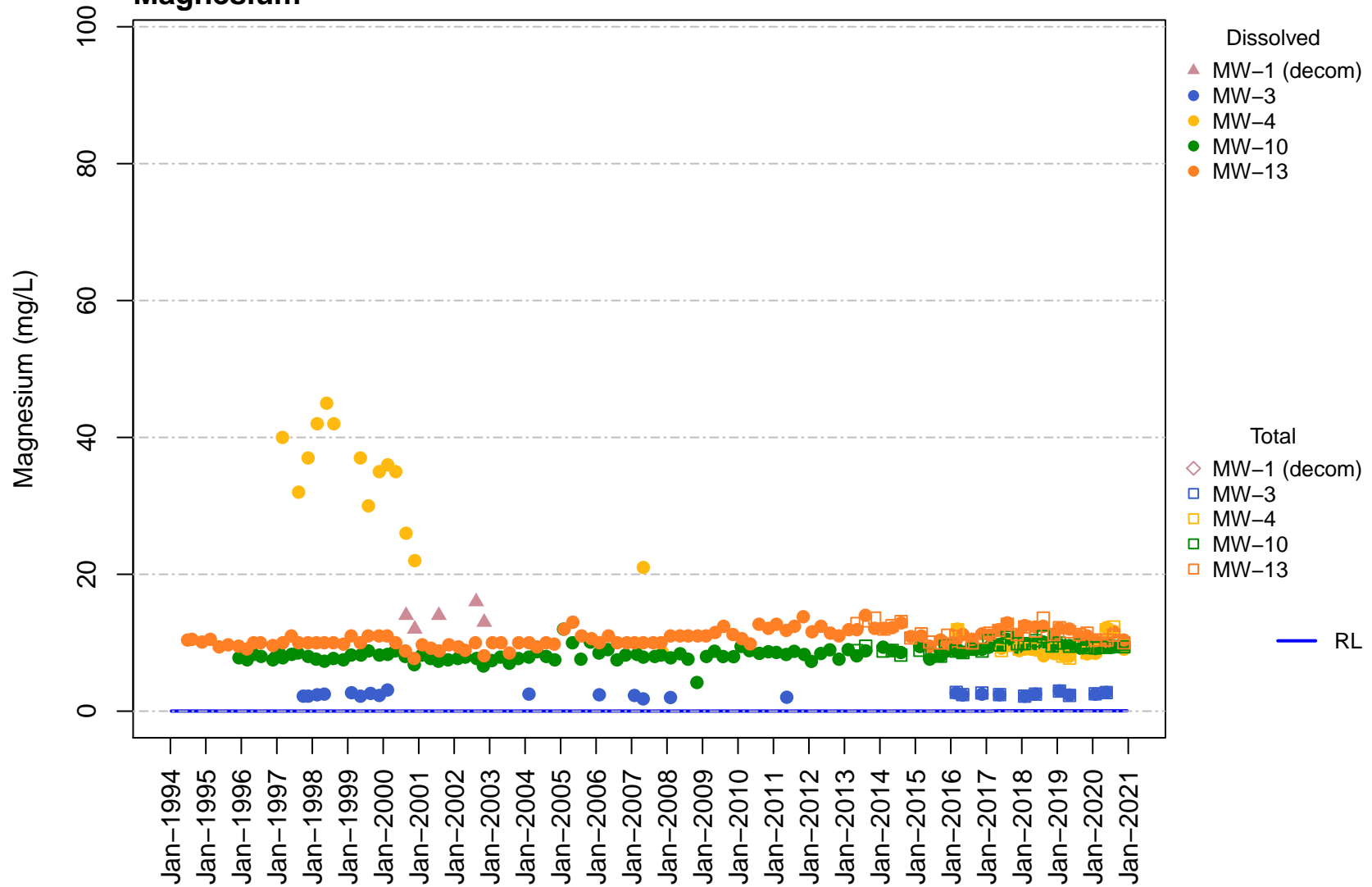
# Vashon Island Closed Landfill Channel Cc1 Iron



**Vashon Island Closed Landfill  
Channel Cc1  
Iron**

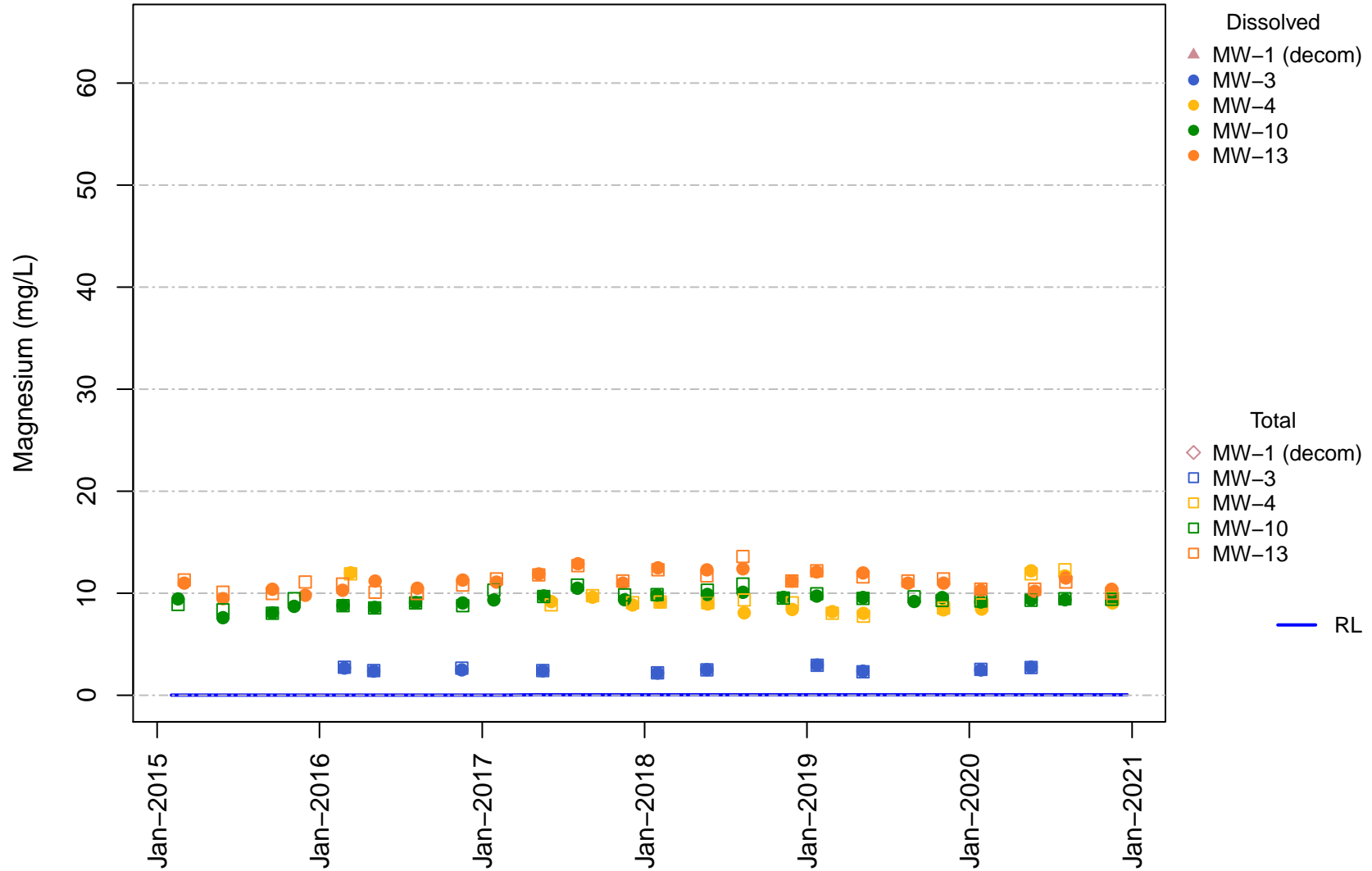


# Vashon Island Closed Landfill Channel Cc1 Magnesium

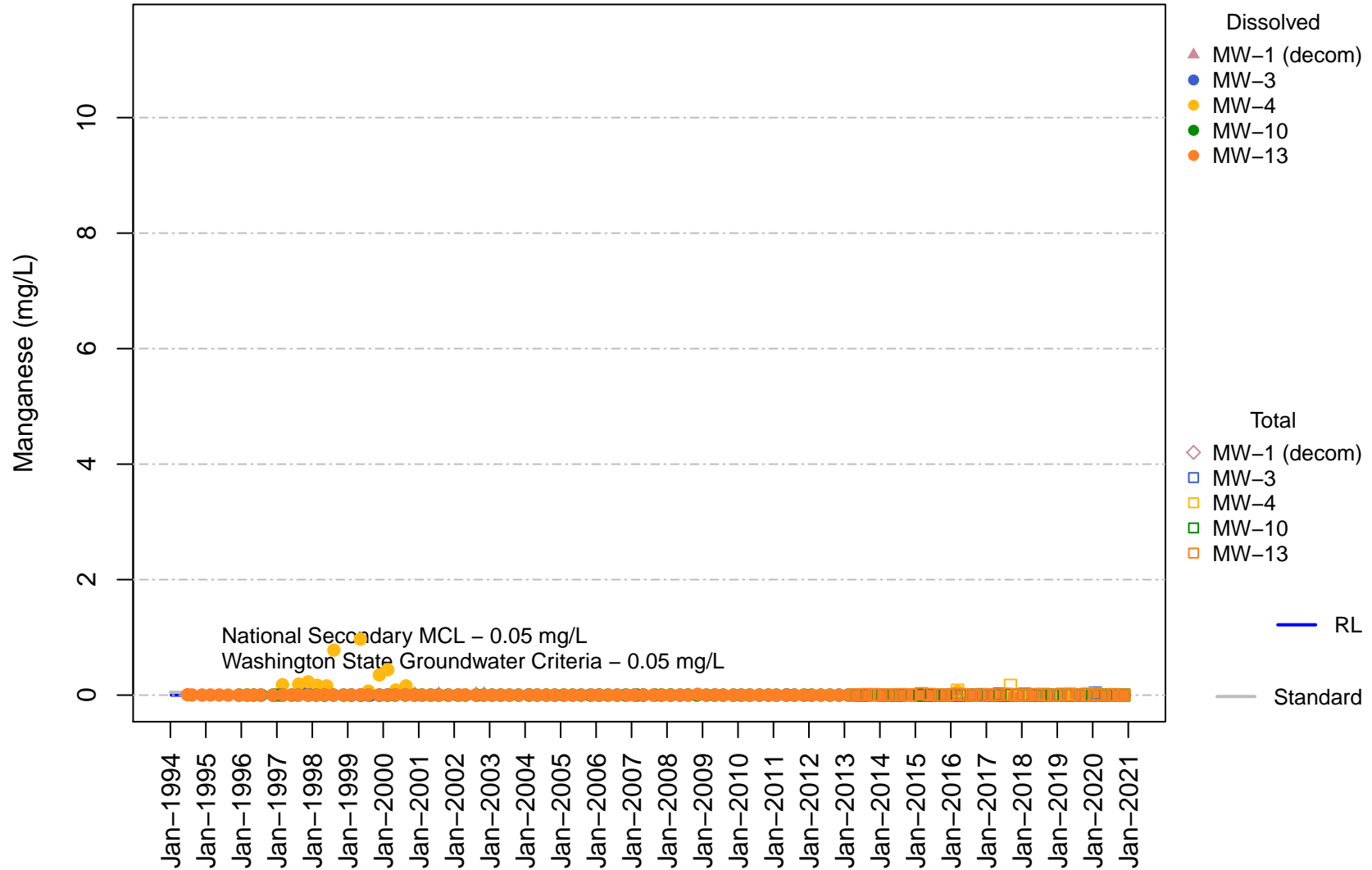




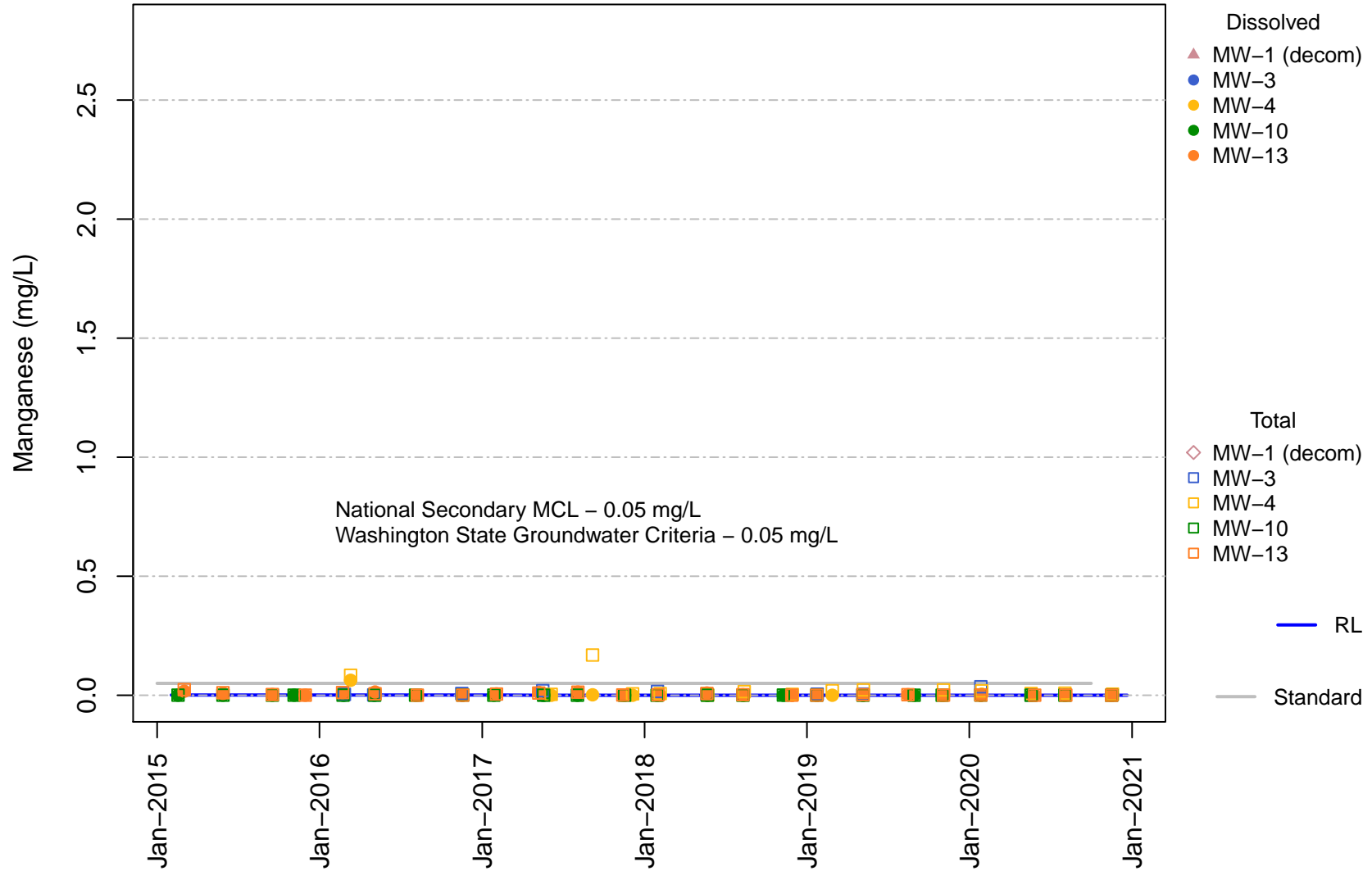
# Vashon Island Closed Landfill Channel Cc1 Magnesium



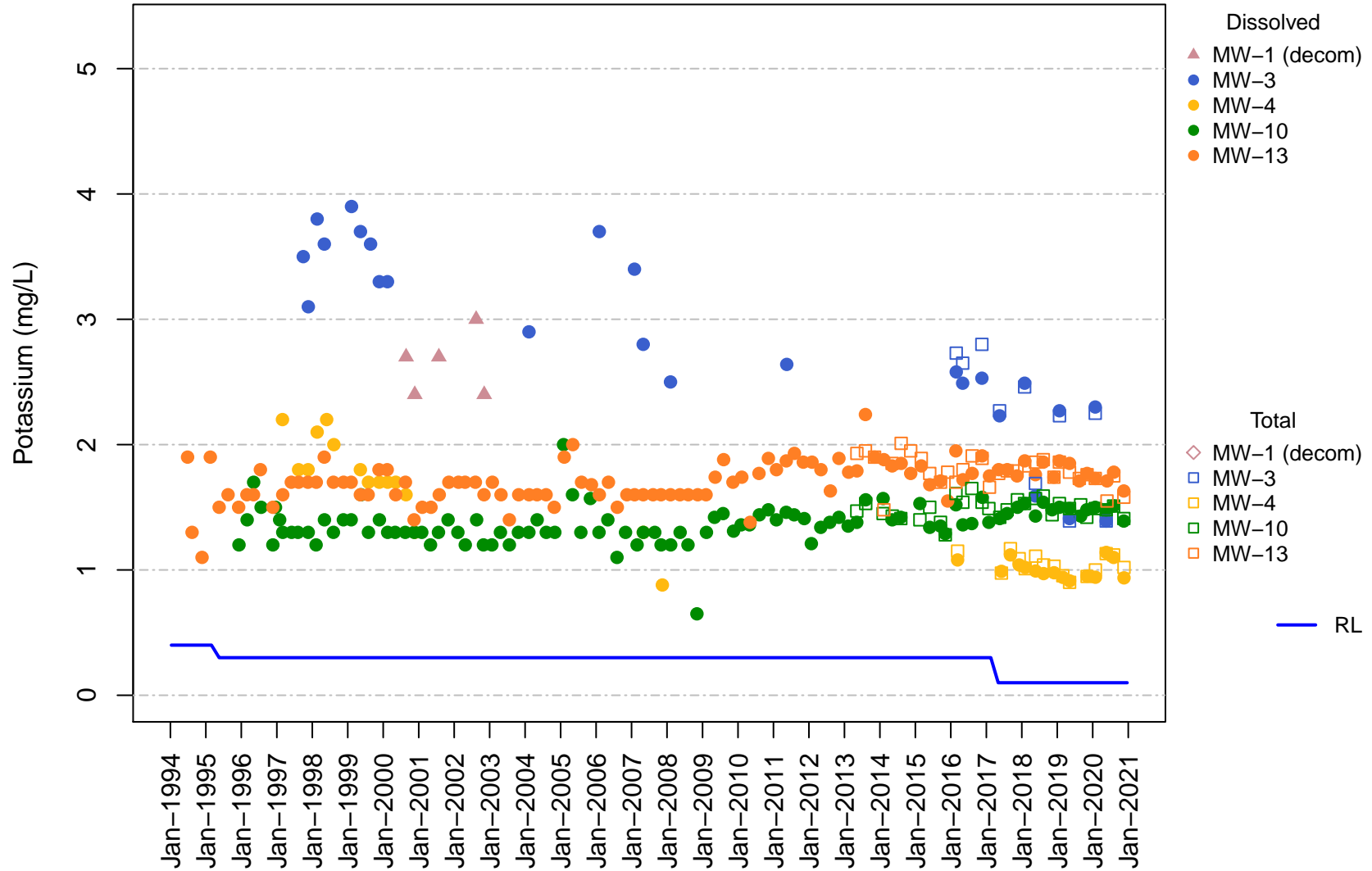
# Vashon Island Closed Landfill Channel Cc1 Manganese



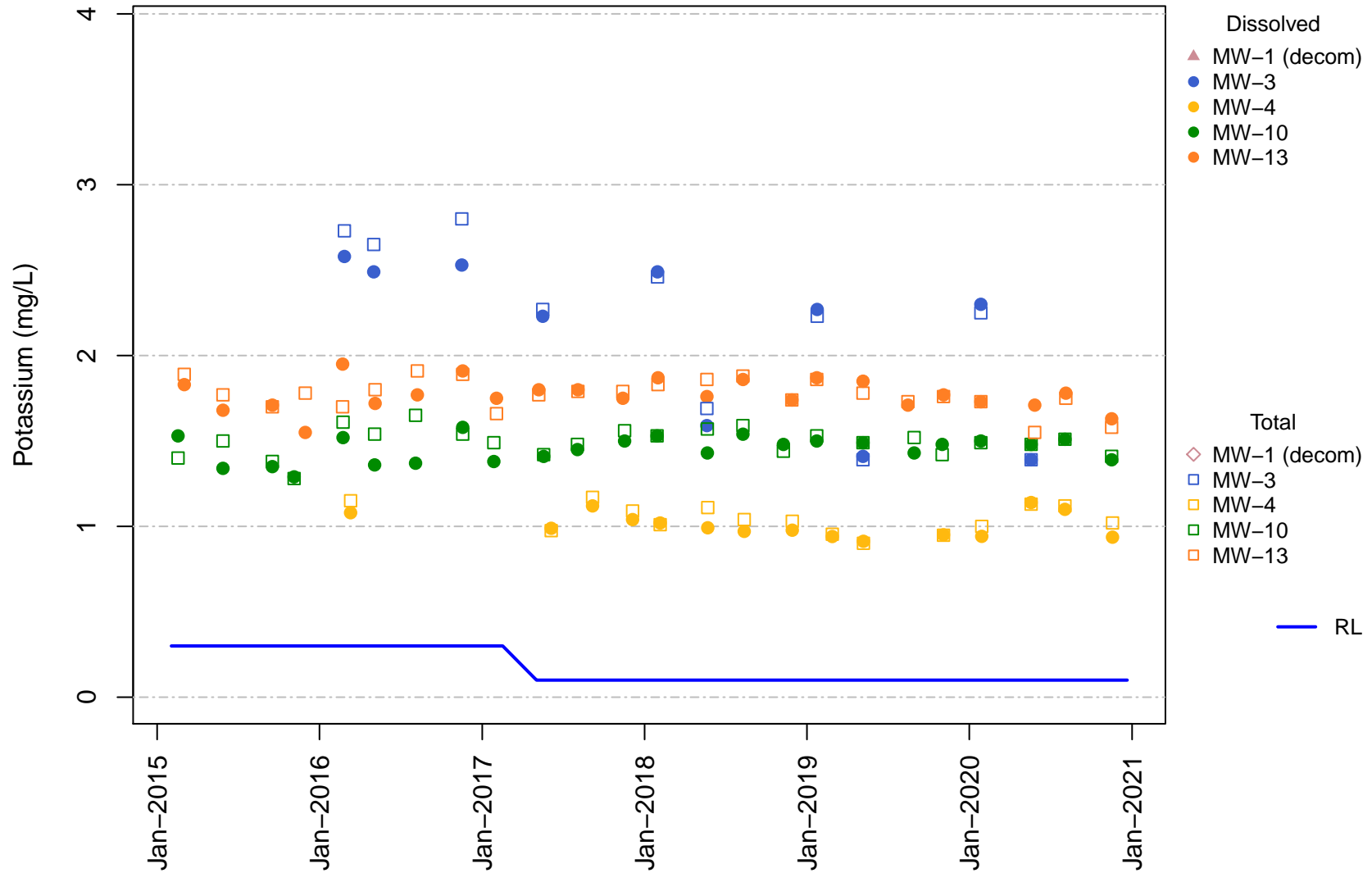
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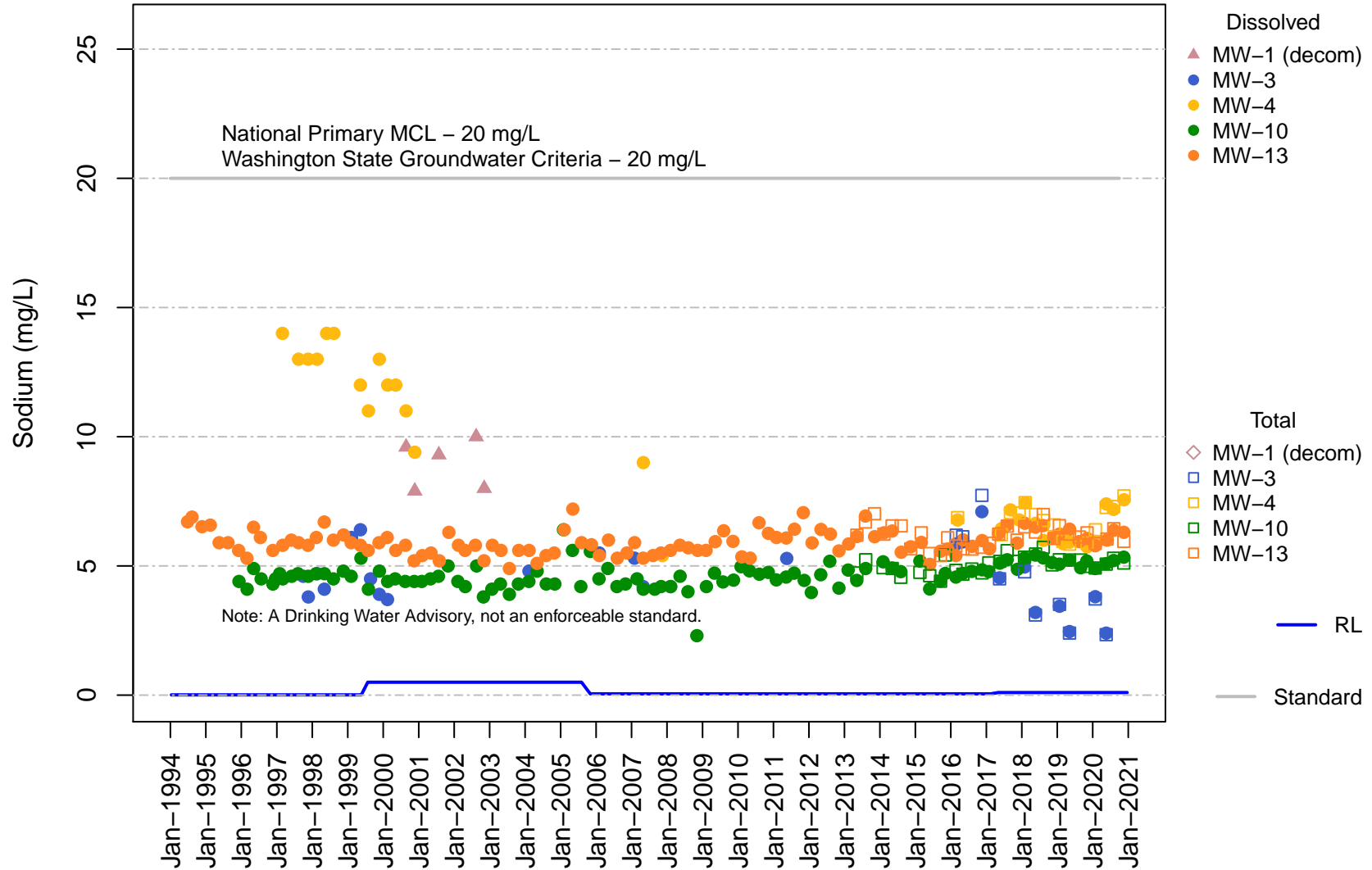
# Vashon Island Closed Landfill Channel Cc1 Potassium



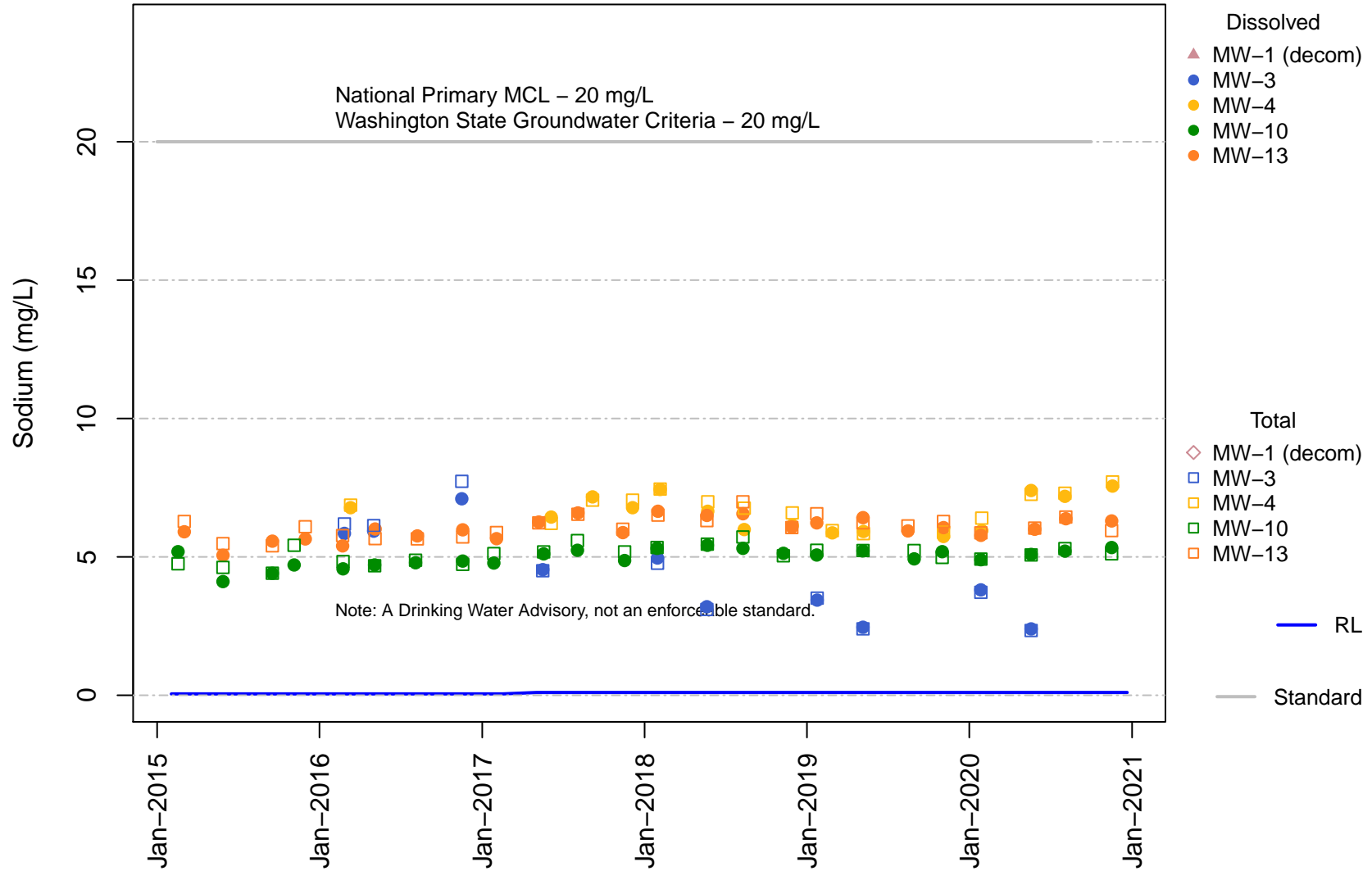
# Vashon Island Closed Landfill Channel Cc1 Potassium



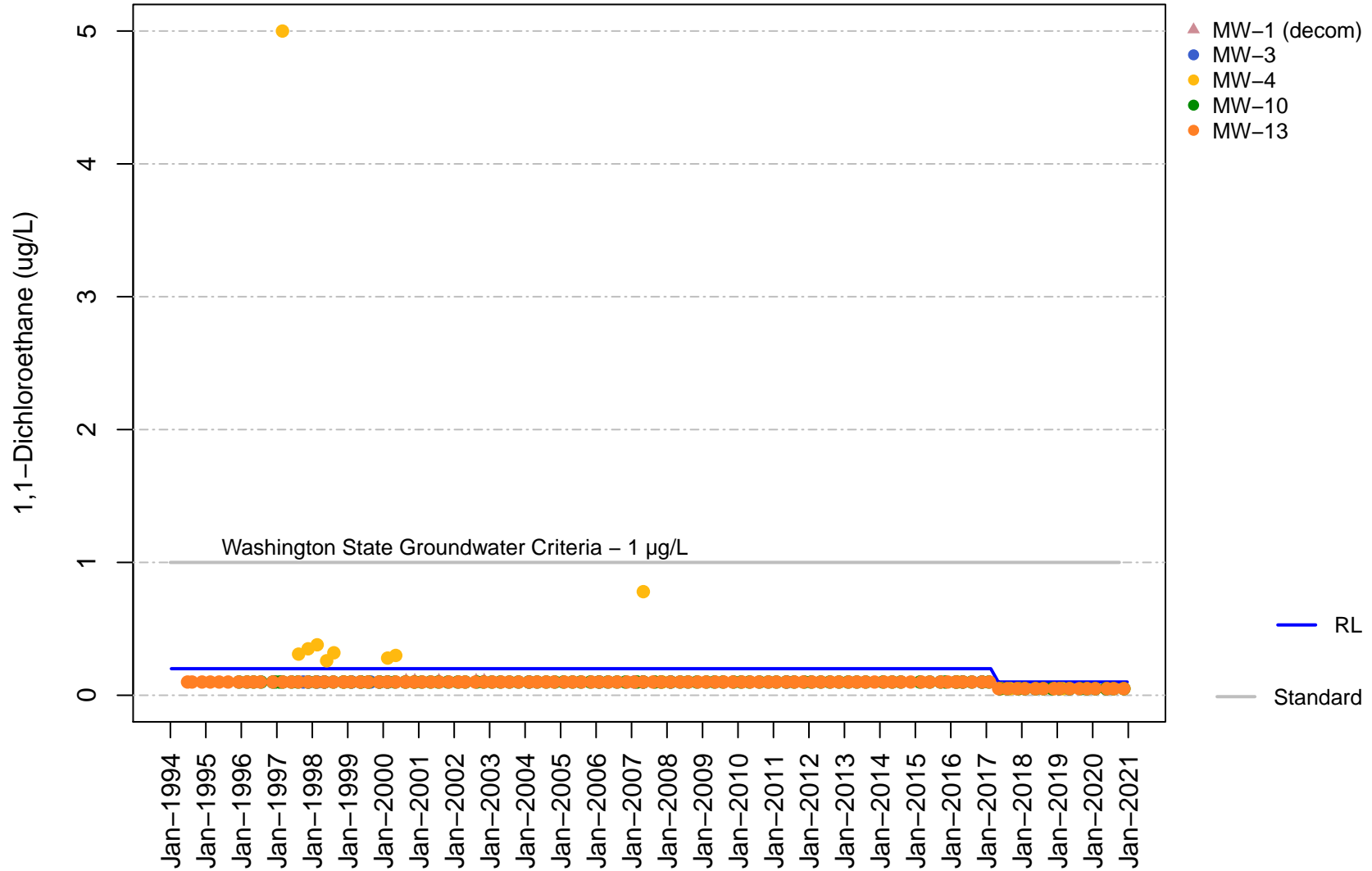
# Vashon Island Closed Landfill Channel Cc1 Sodium



# Vashon Island Closed Landfill Channel Cc1 Sodium

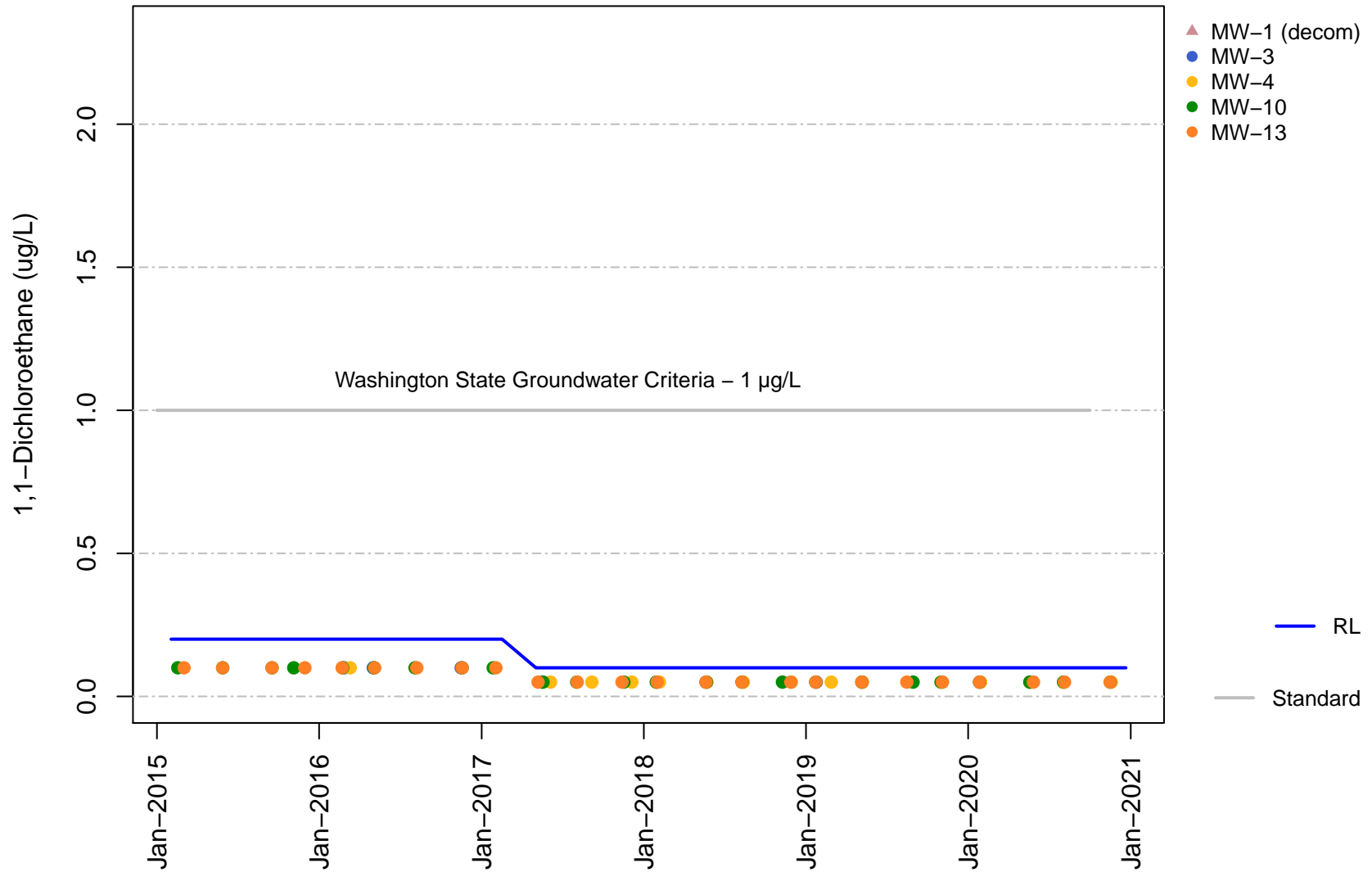


**Vashon Island Closed Landfill  
Channel Cc1  
1,1-Dichloroethane**

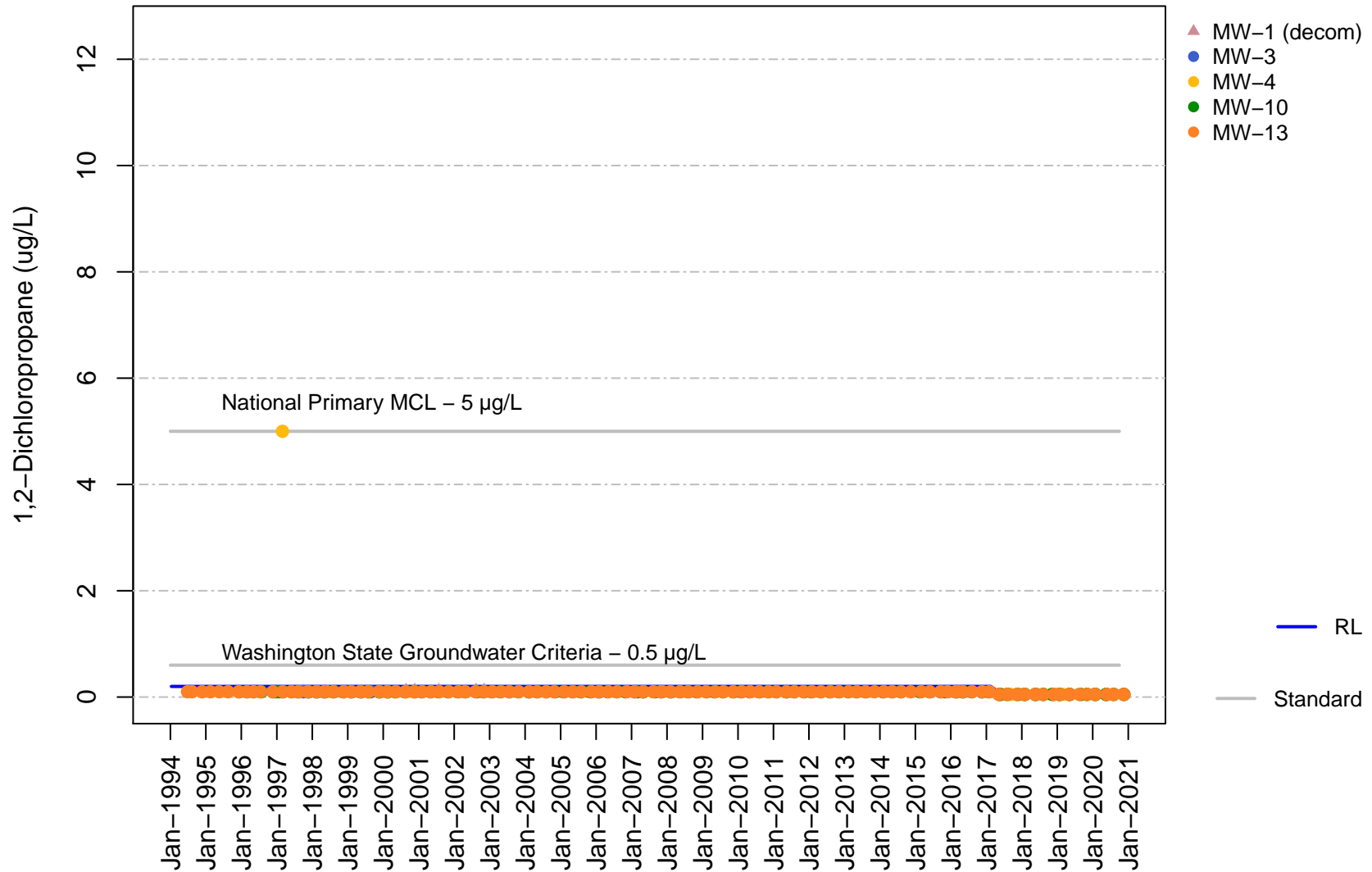




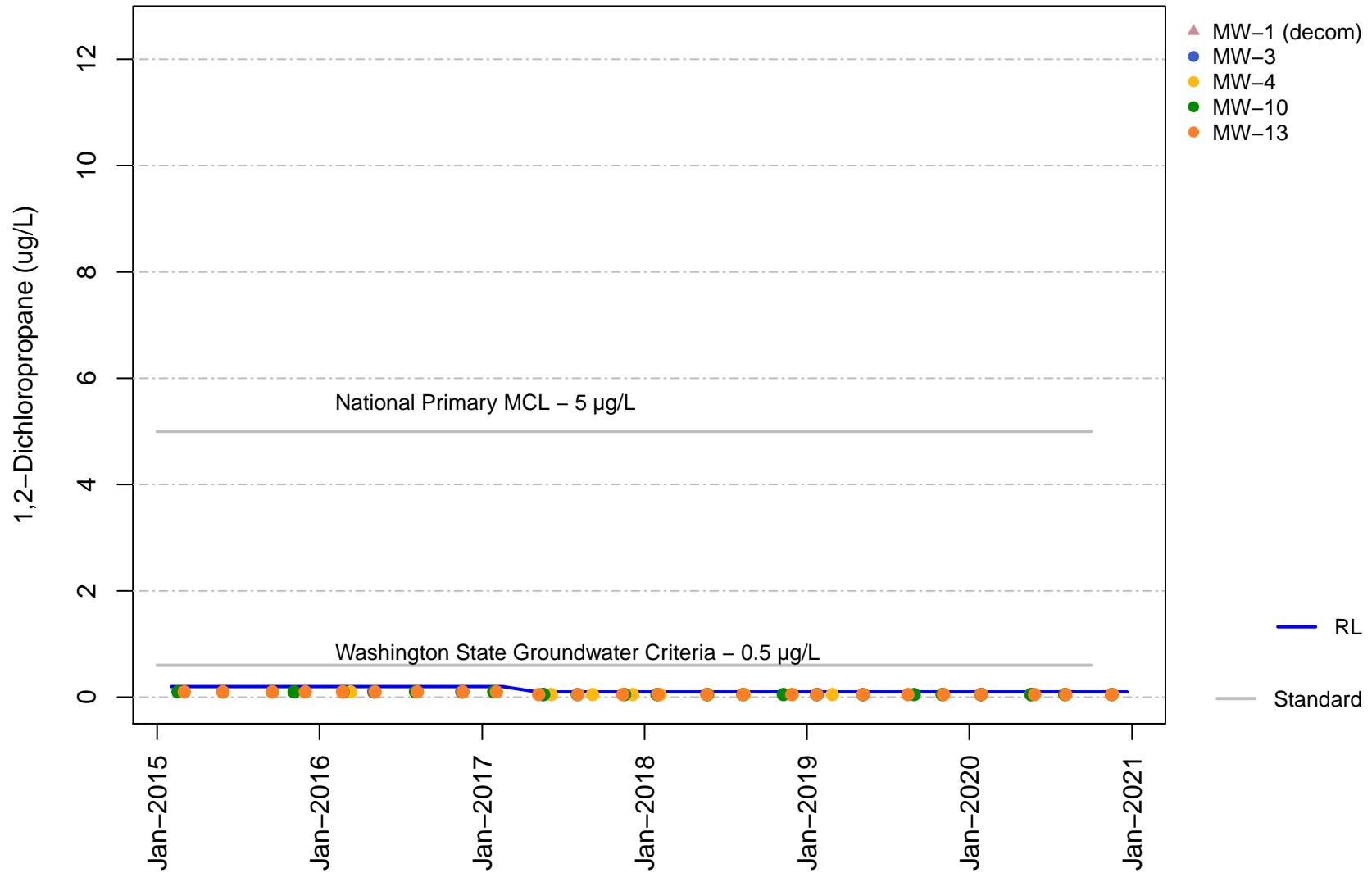
Vashon Island Closed Landfill  
 Channel Cc1  
 1,1-Dichloroethane



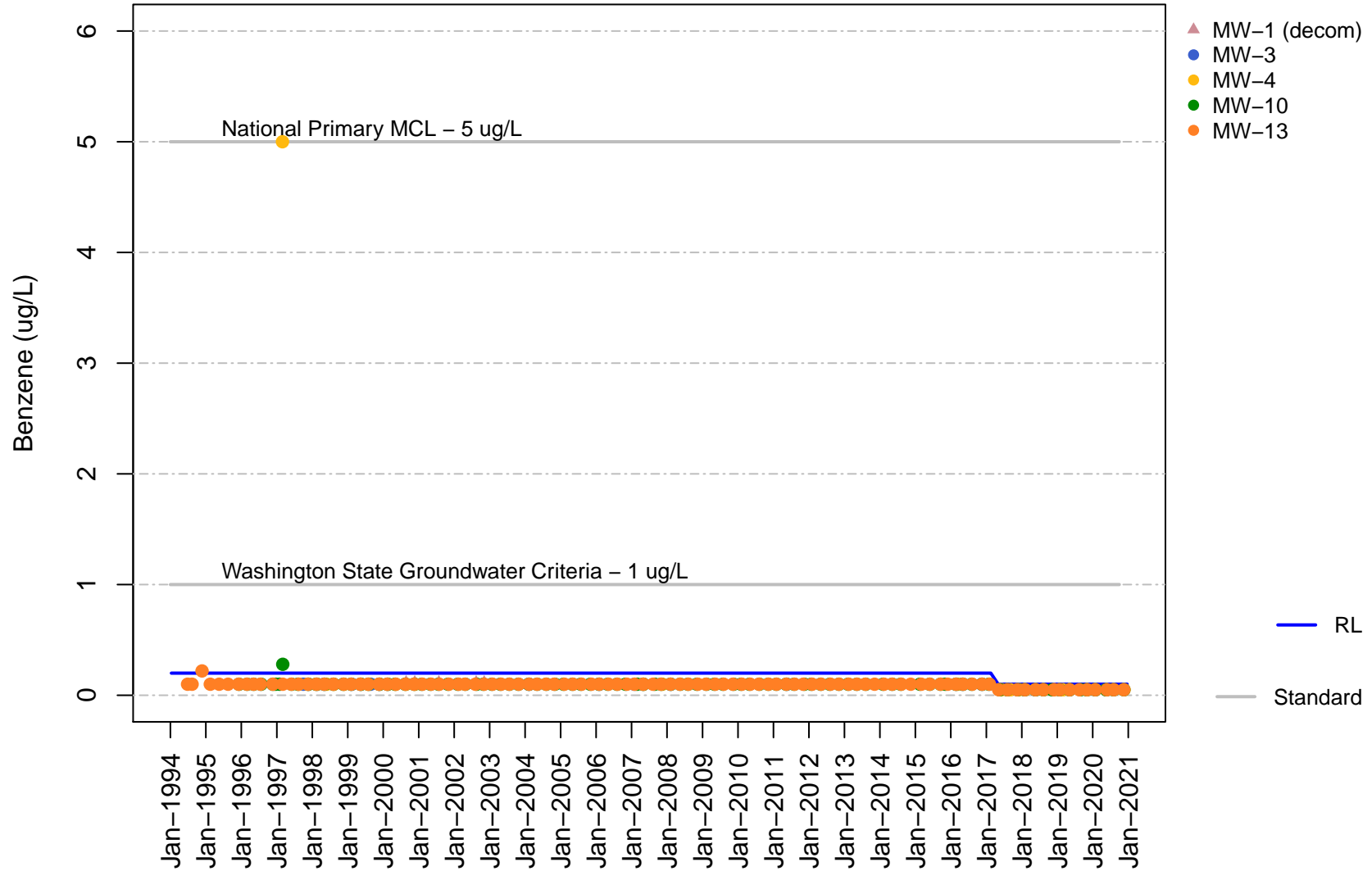
**Vashon Island Closed Landfill  
Channel Cc1  
1,2-Dichloropropane**



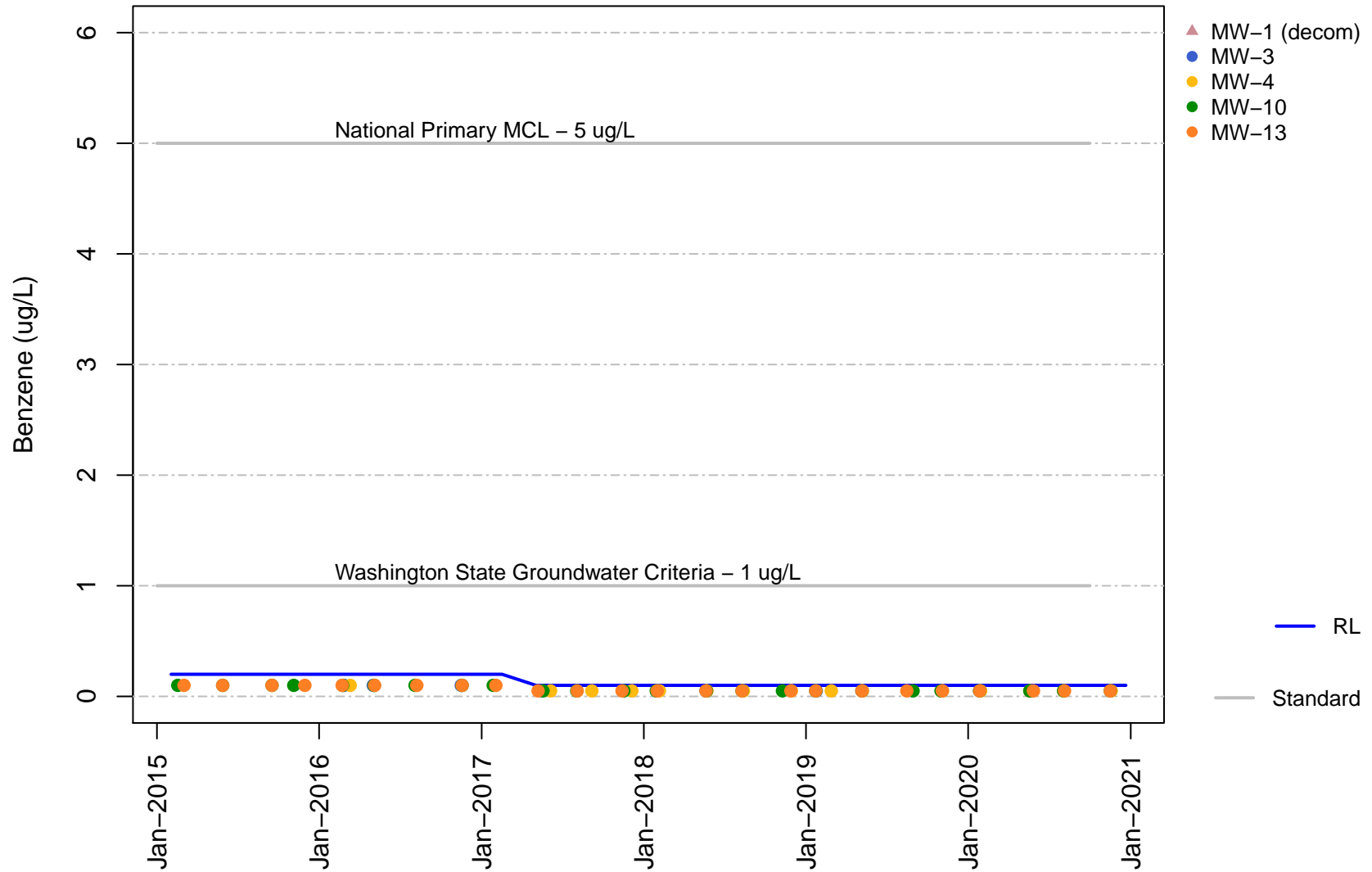
**Vashon Island Closed Landfill  
Channel Cc1  
1,2-Dichloropropane**



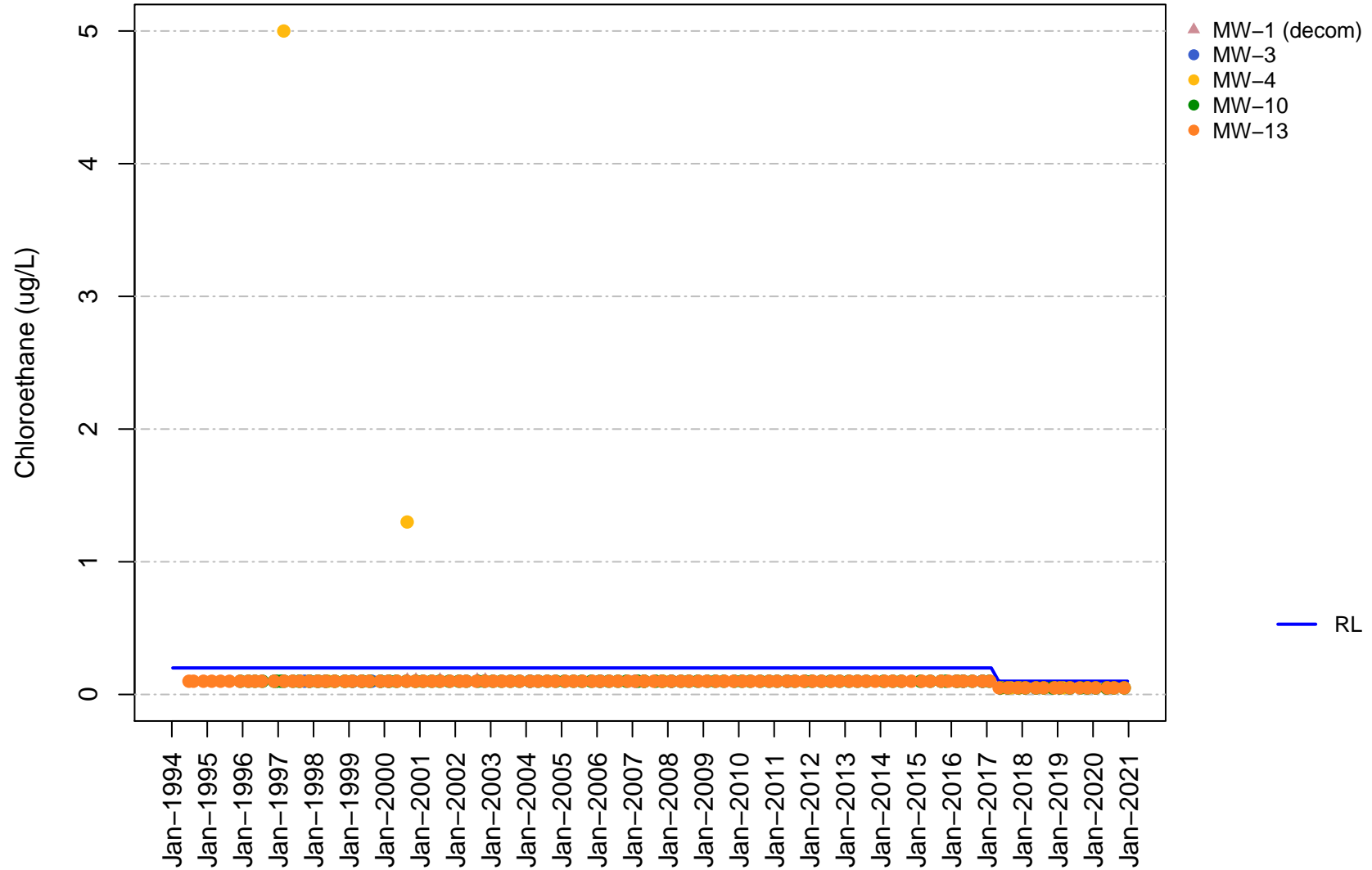
**Vashon Island Closed Landfill  
Channel Cc1  
Benzene**



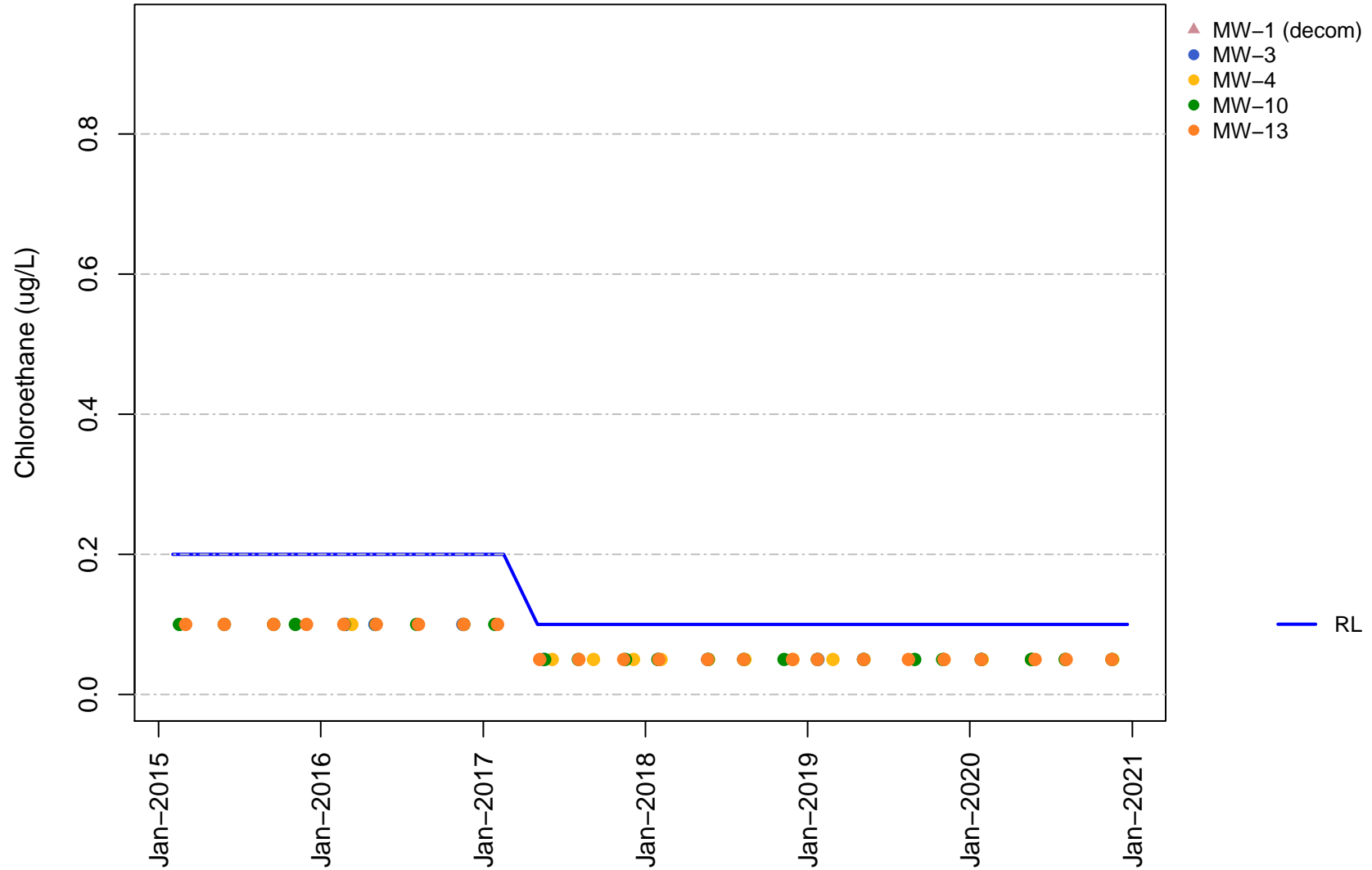
# Vashon Island Closed Landfill Channel Cc1 Benzene



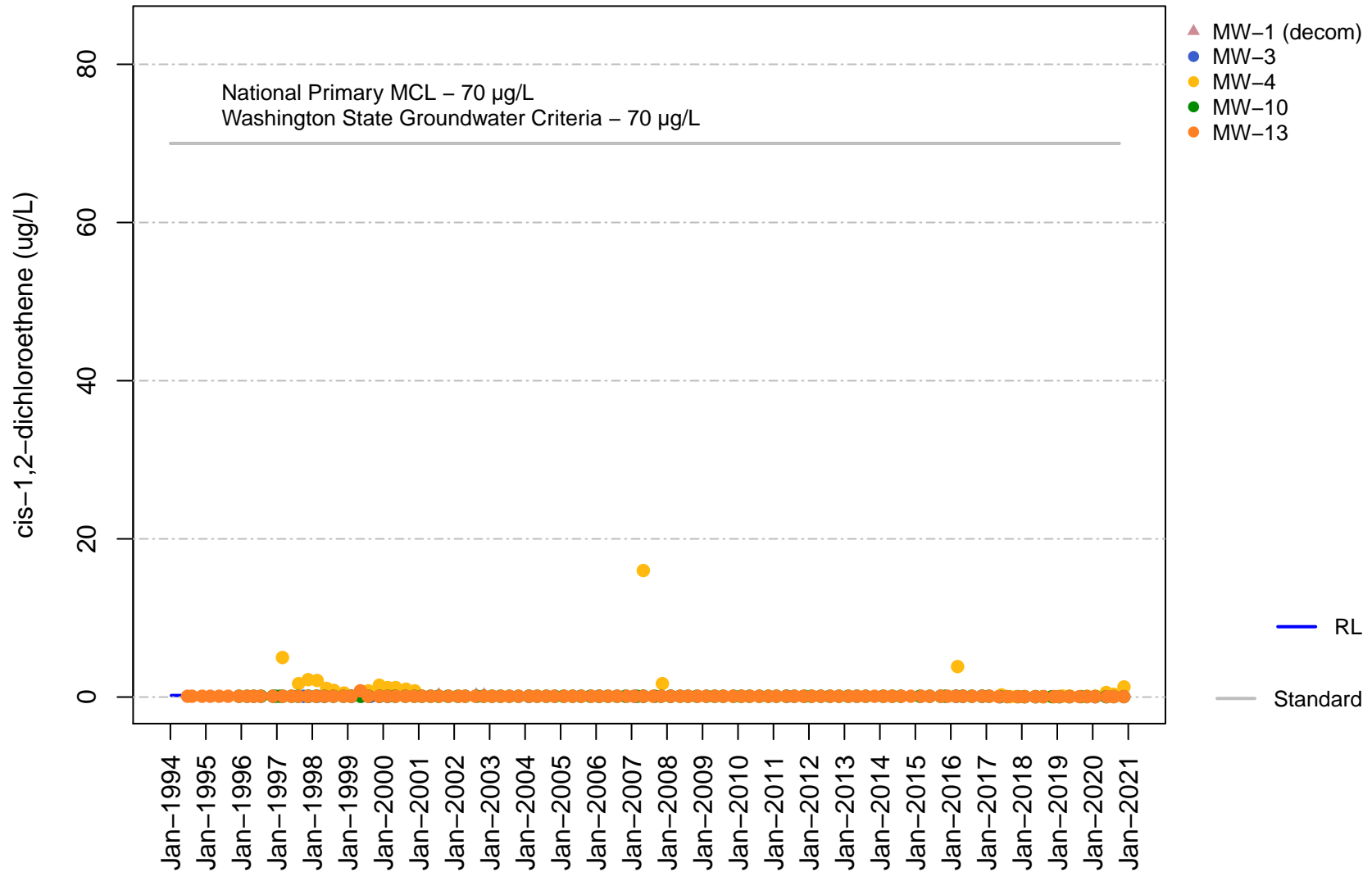
# Vashon Island Closed Landfill Channel Cc1 Chloroethane



# Vashon Island Closed Landfill Channel Cc1 Chloroethane

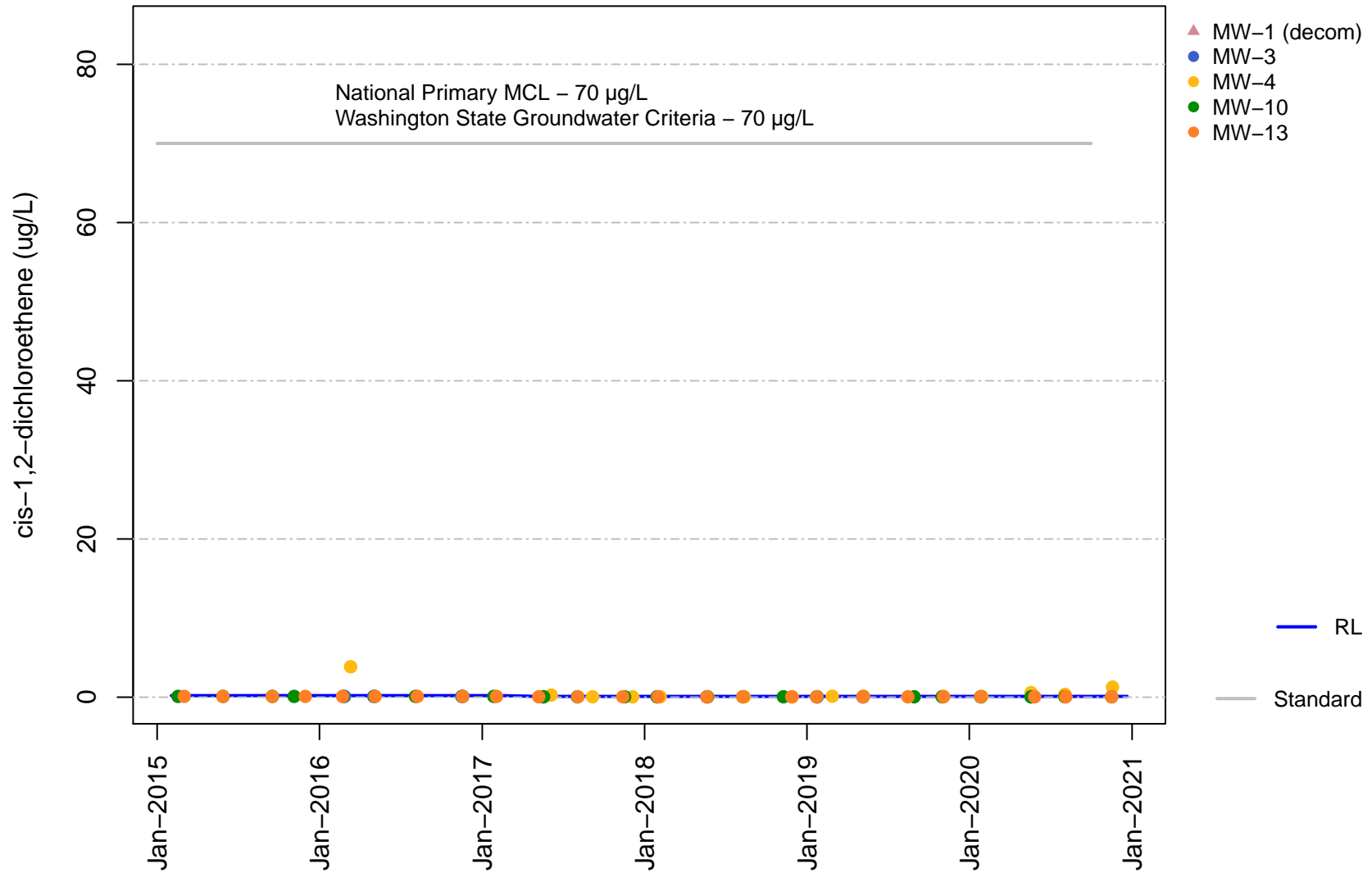


**Vashon Island Closed Landfill  
Channel Cc1  
cis-1,2-Dichloroethene**

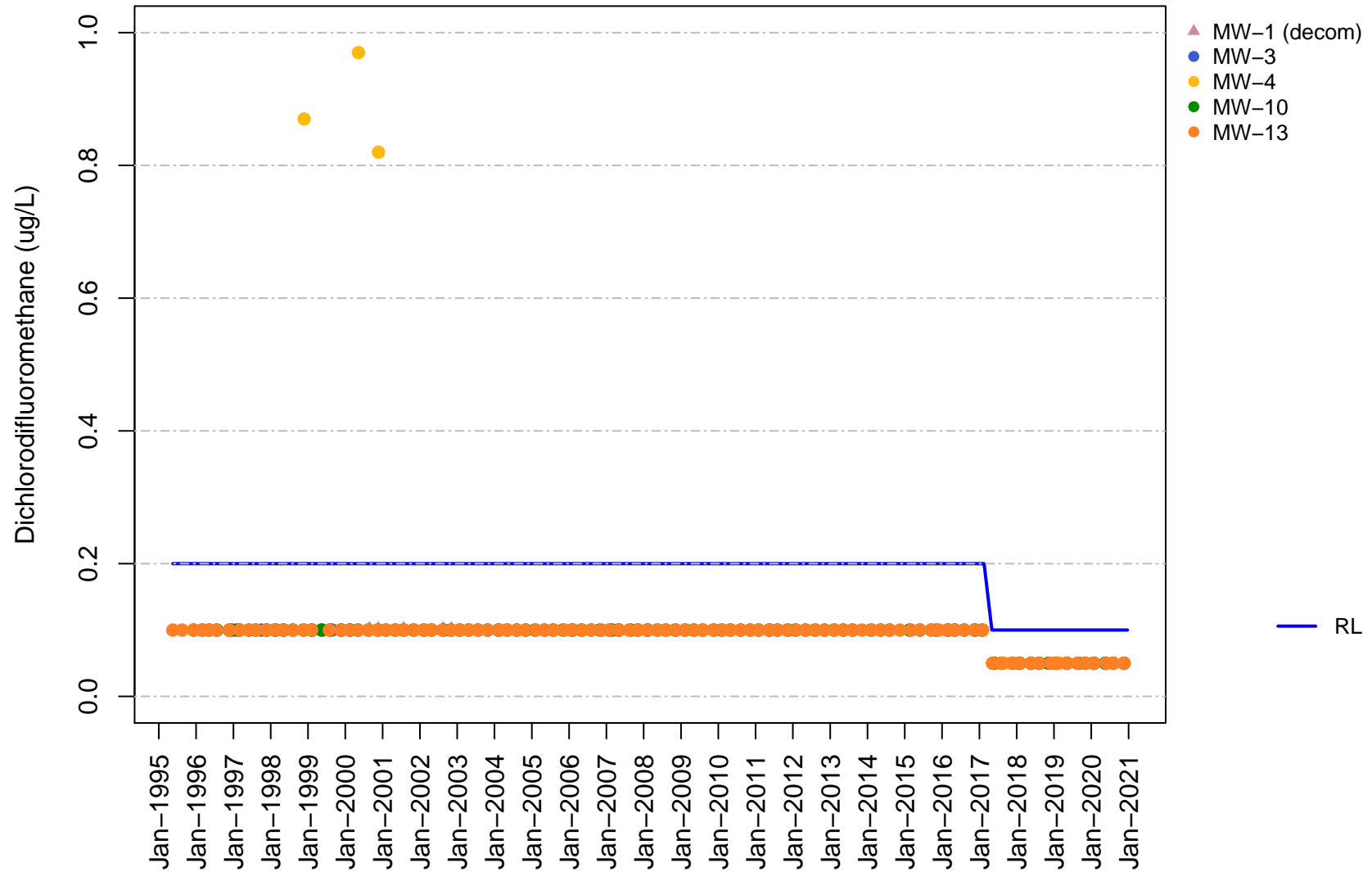




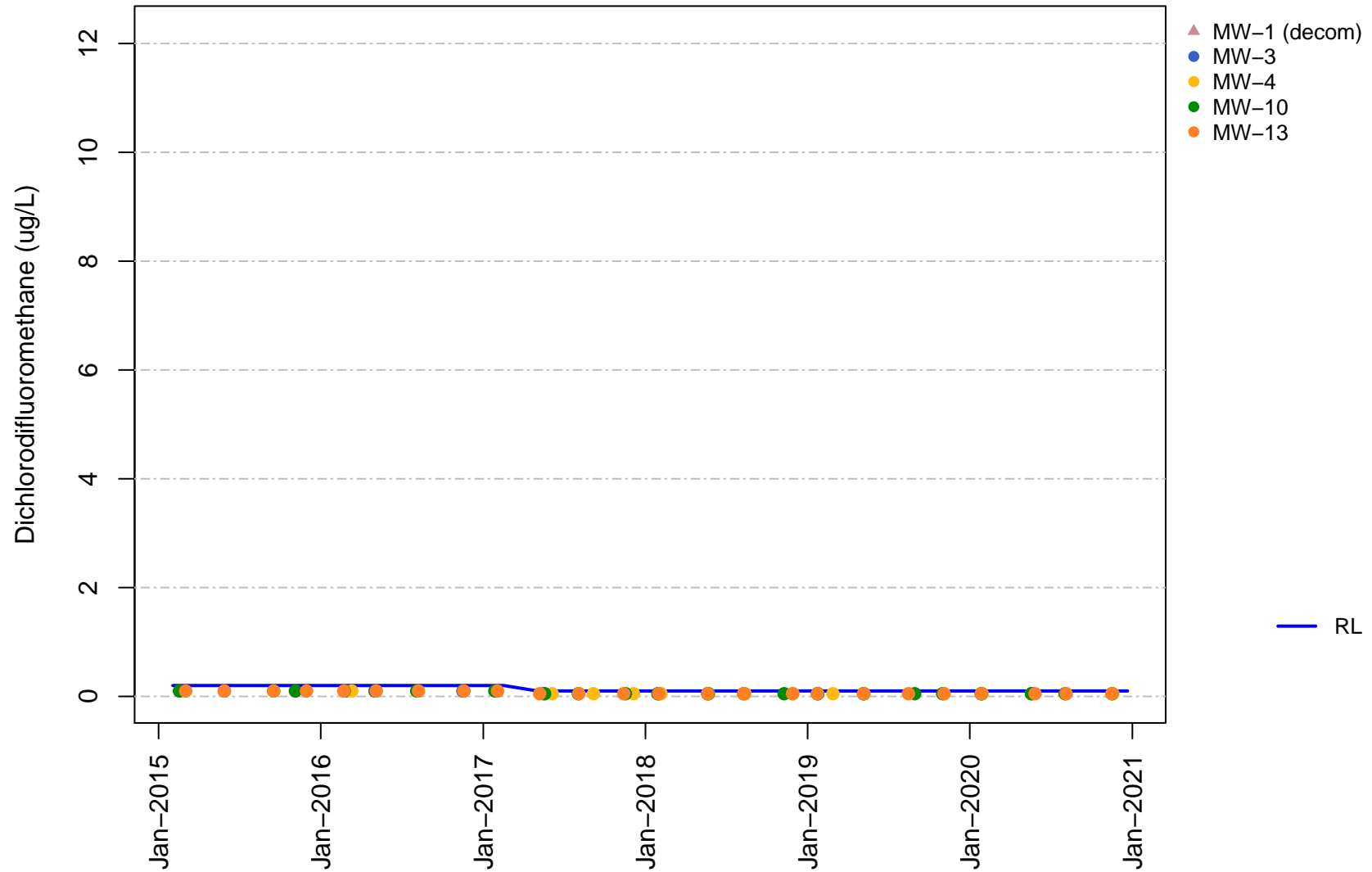
# Vashon Island Closed Landfill Channel Cc1 cis-1,2-Dichloroethene



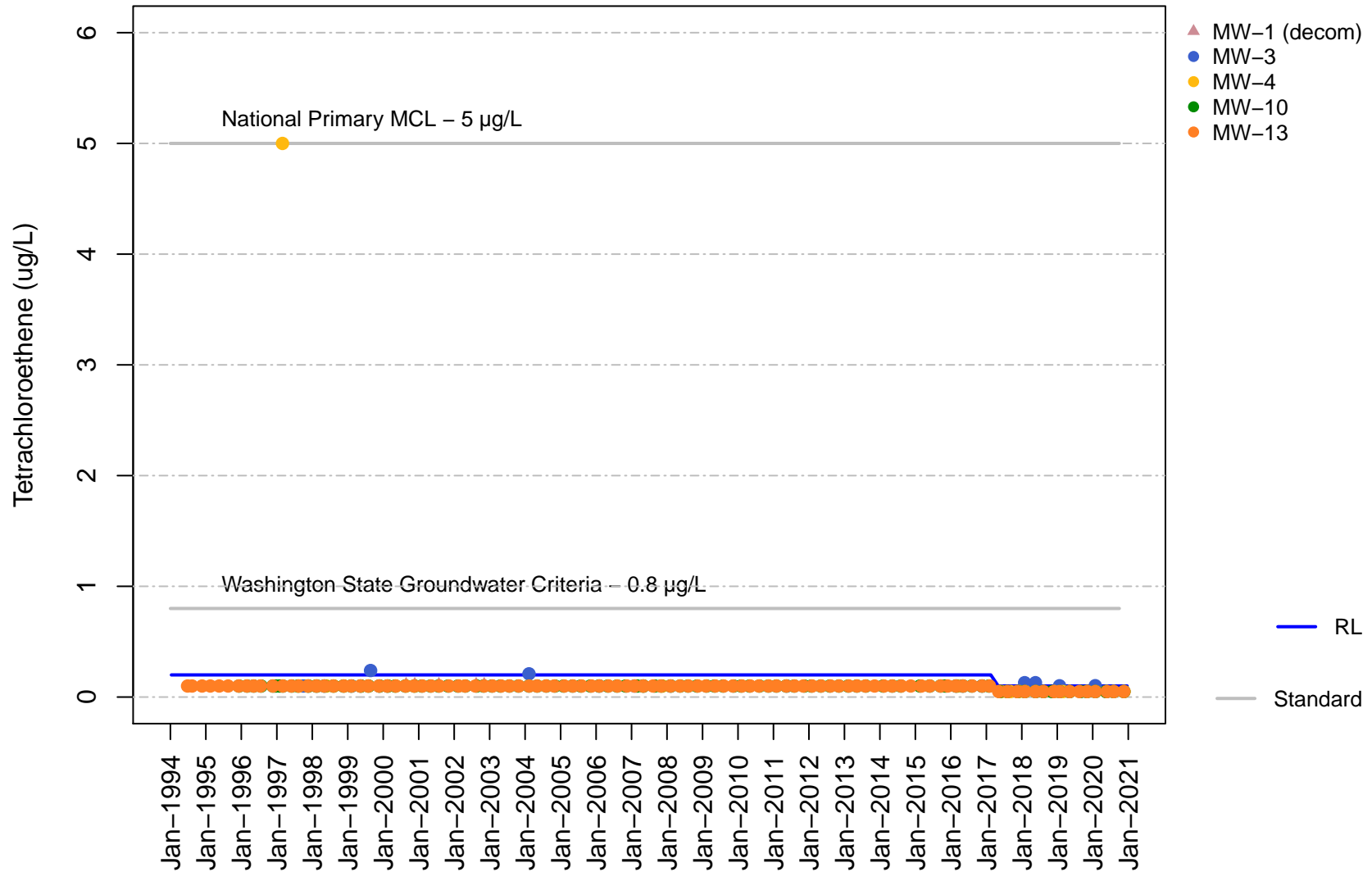
Vashon Island Closed Landfill  
 Channel Cc1  
 Dichlorodifluoromethane



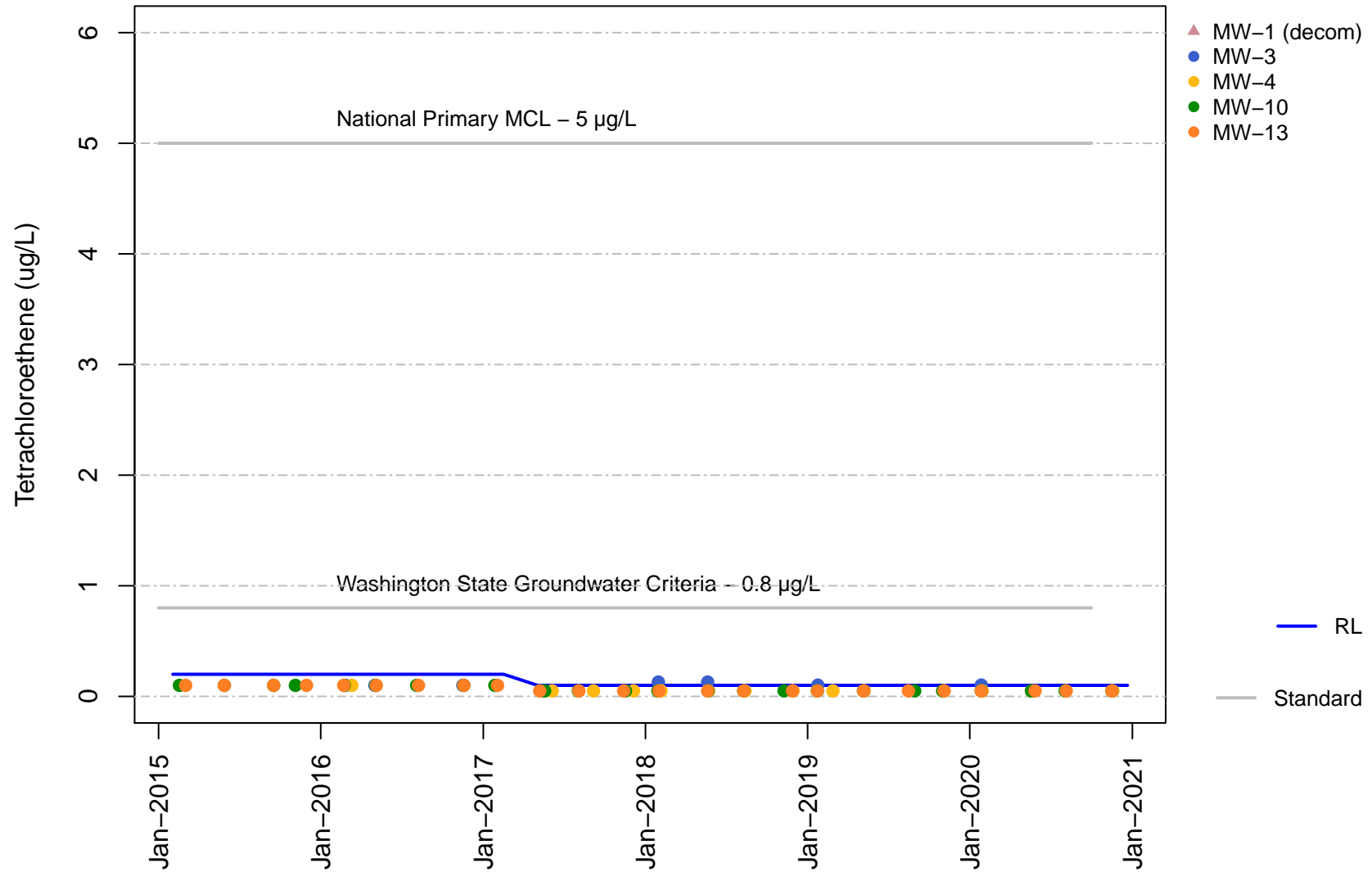
Vashon Island Closed Landfill  
Channel Cc1  
Dichlorodifluoromethane



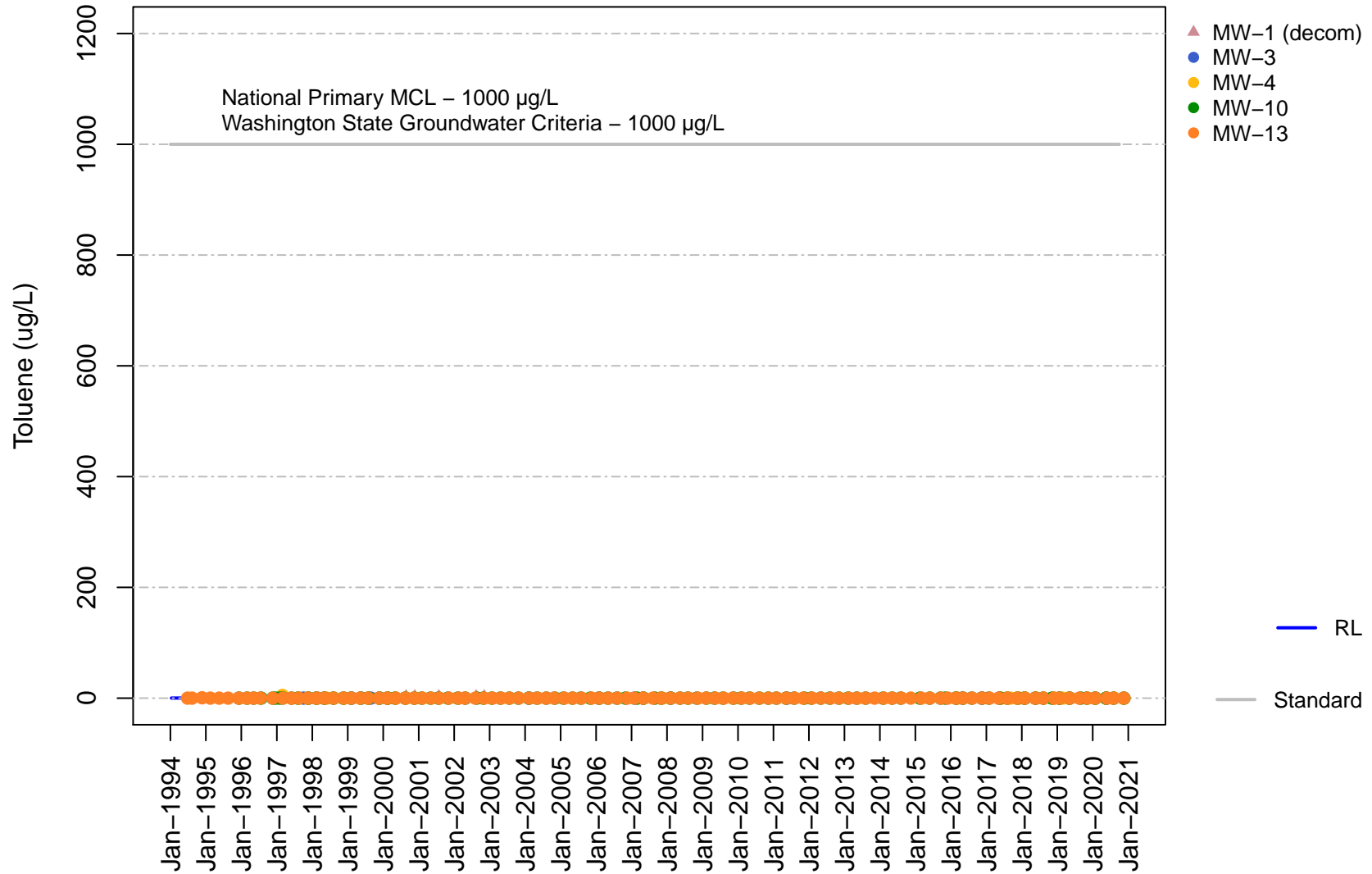
**Vashon Island Closed Landfill  
Channel Cc1  
Tetrachloroethene**



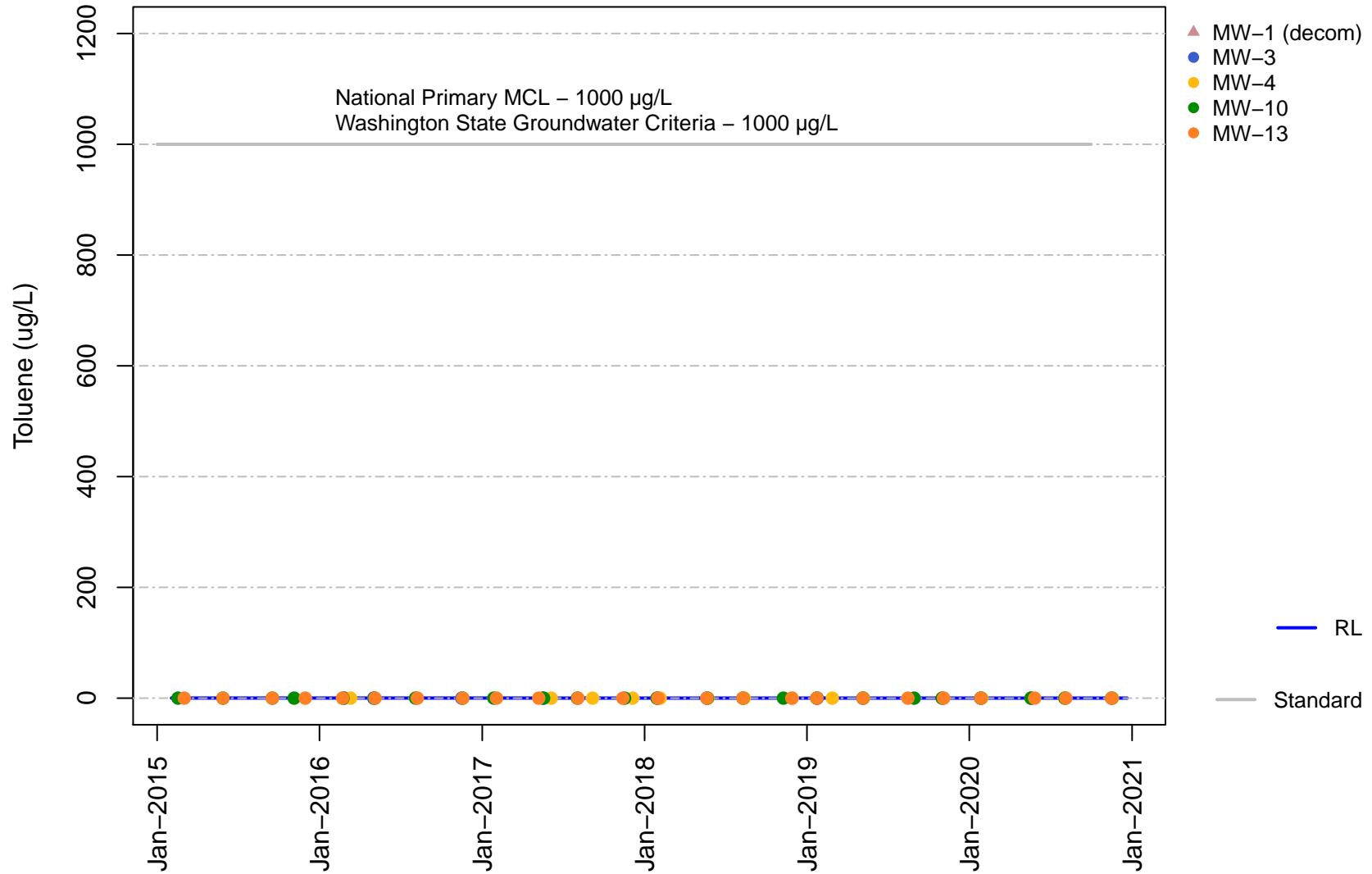
**Vashon Island Closed Landfill  
Channel Cc1  
Tetrachloroethene**



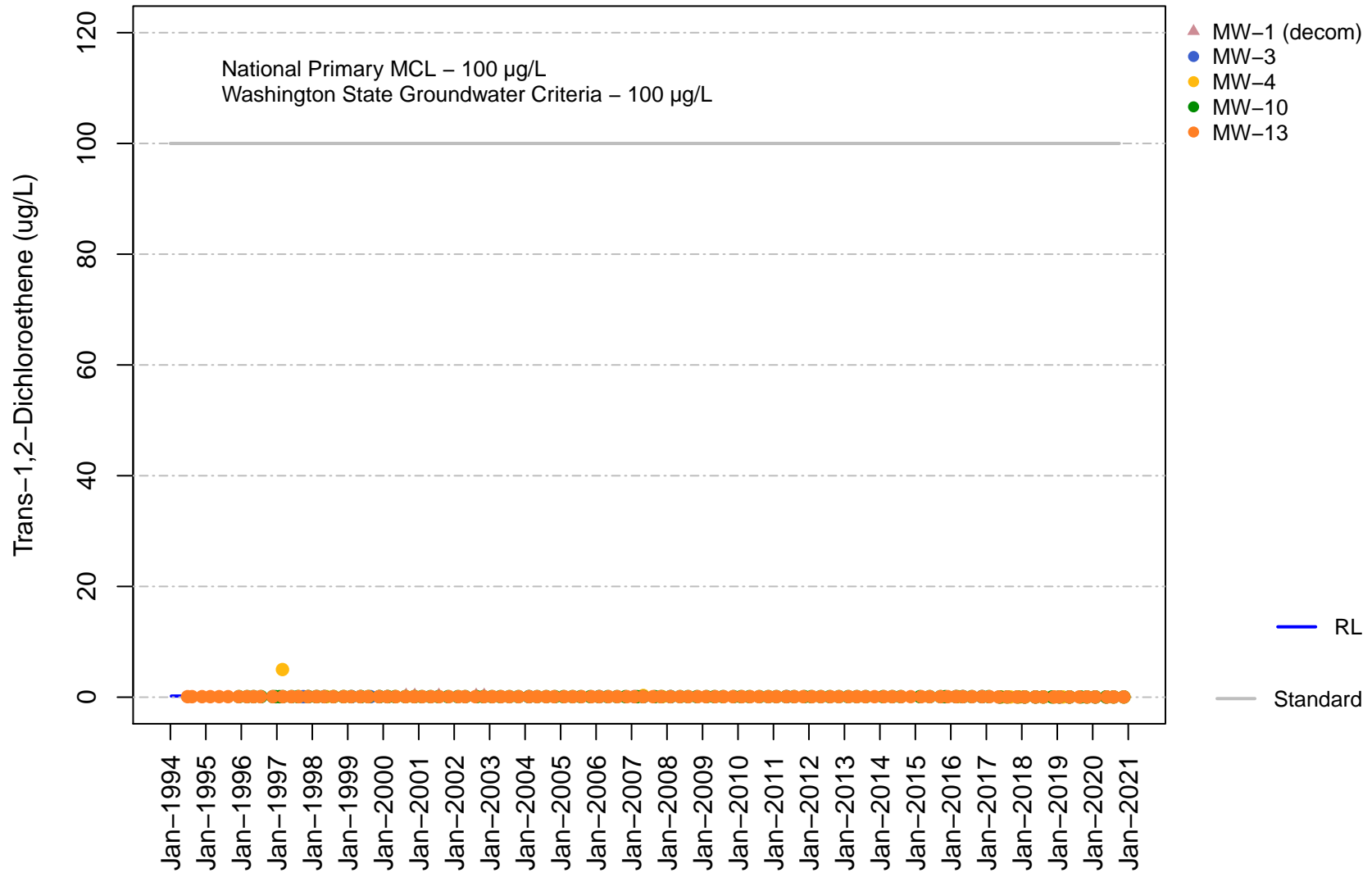
# Vashon Island Closed Landfill Channel Cc1 Toluene



# Vashon Island Closed Landfill Channel Cc1 Toluene

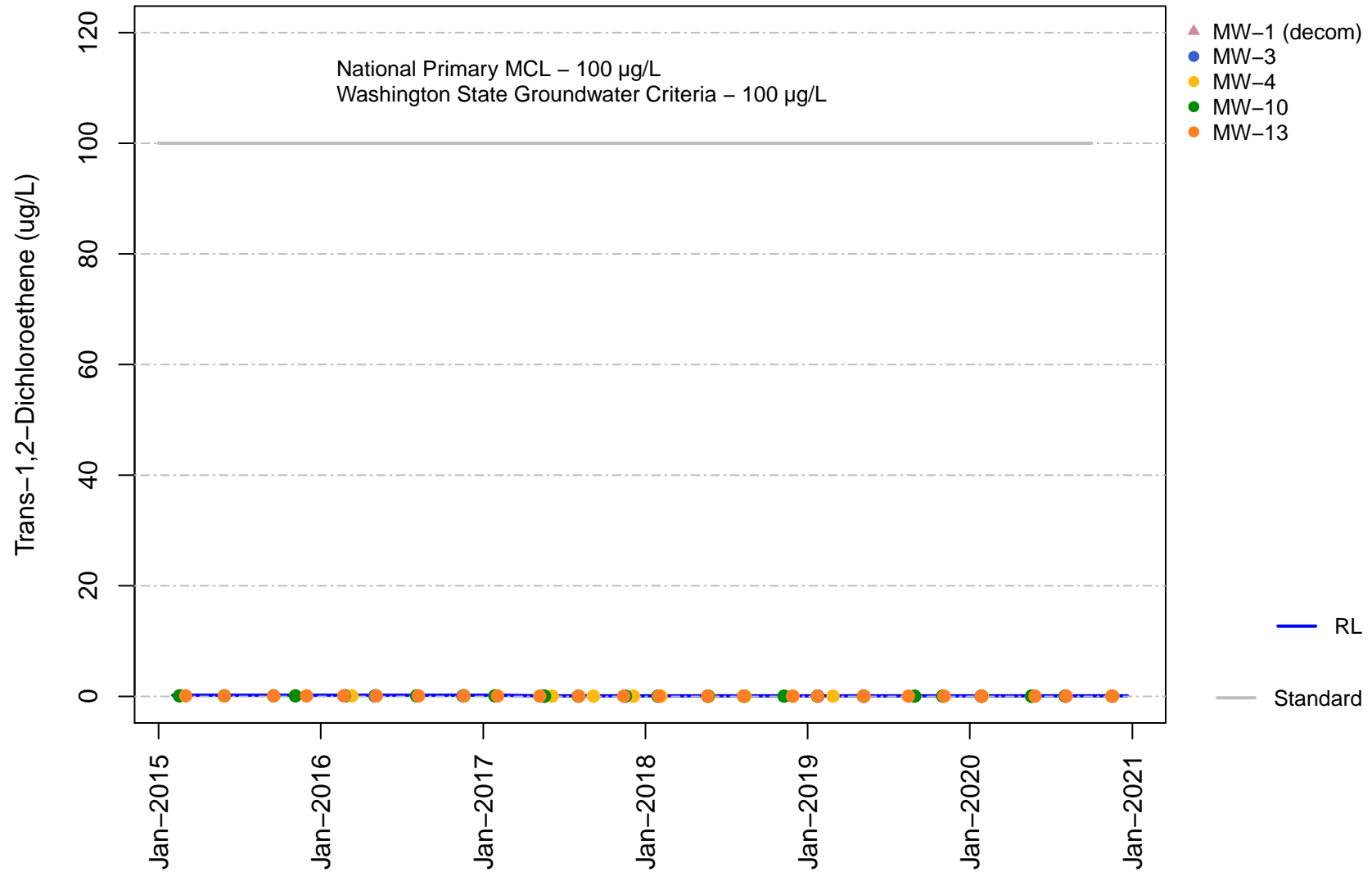


# Vashon Island Closed Landfill Channel Cc1 Trans-1,2-Dichloroethene

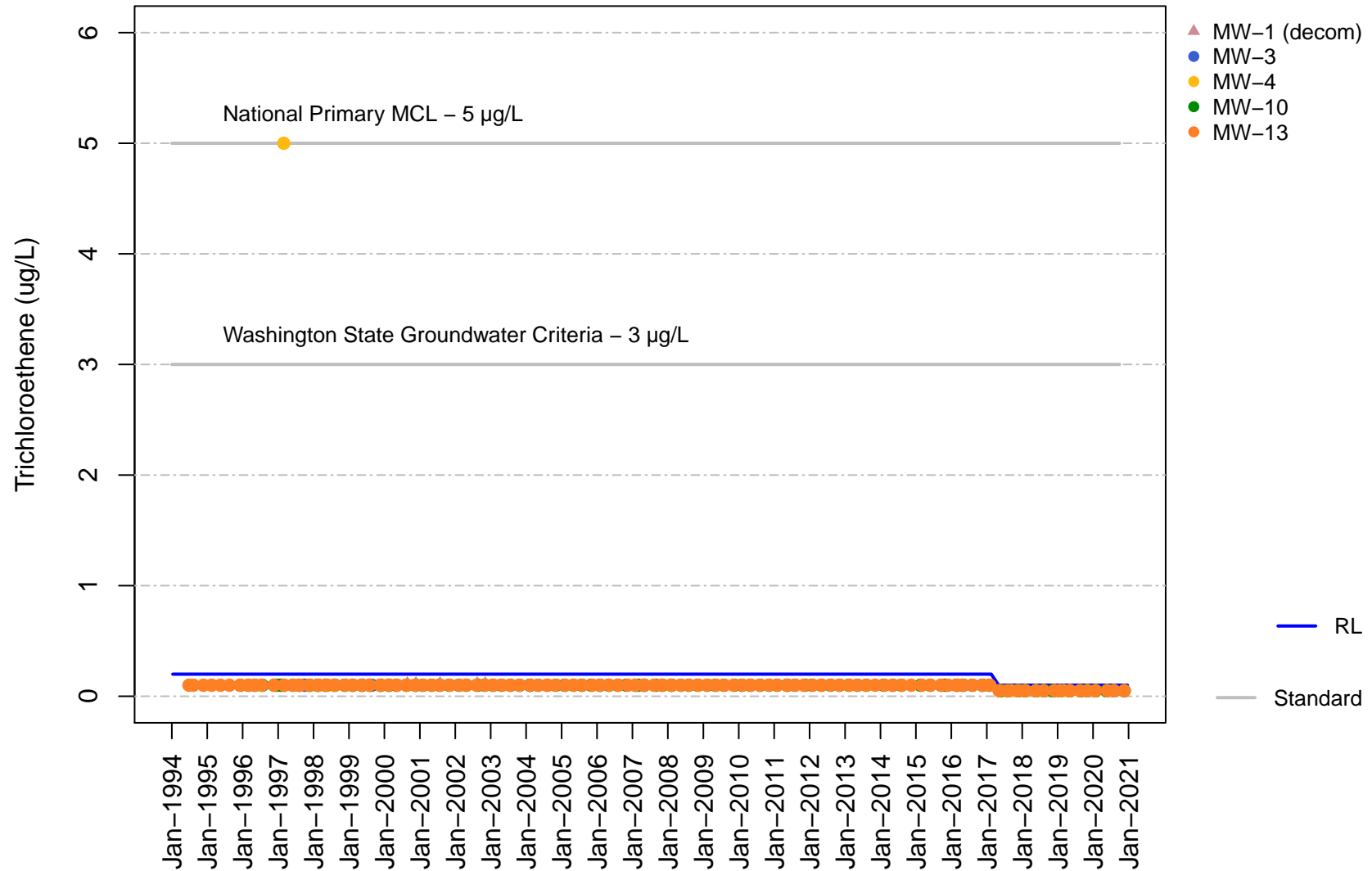




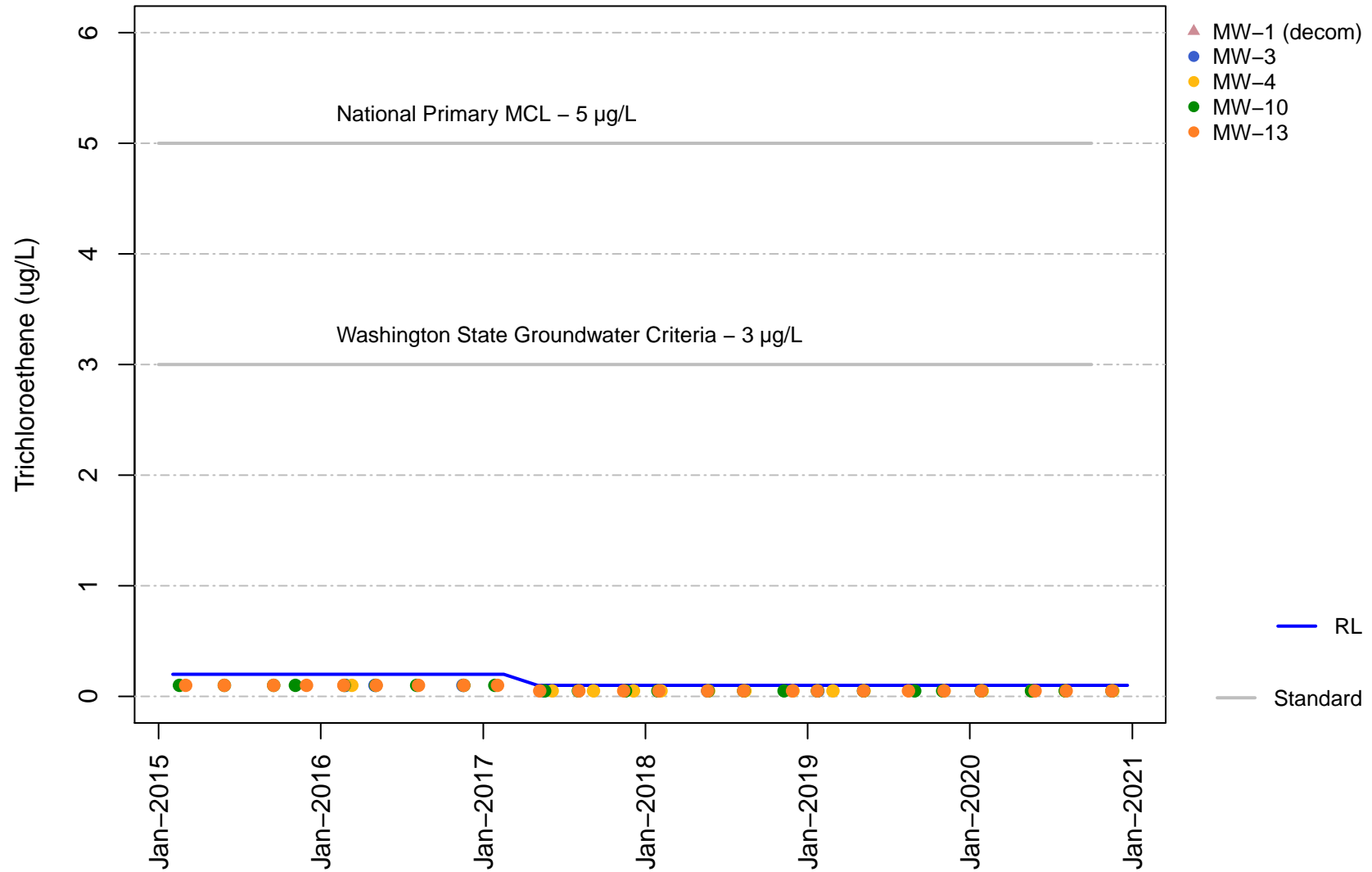
# Vashon Island Closed Landfill Channel Cc1 Trans-1,2-Dichloroethene



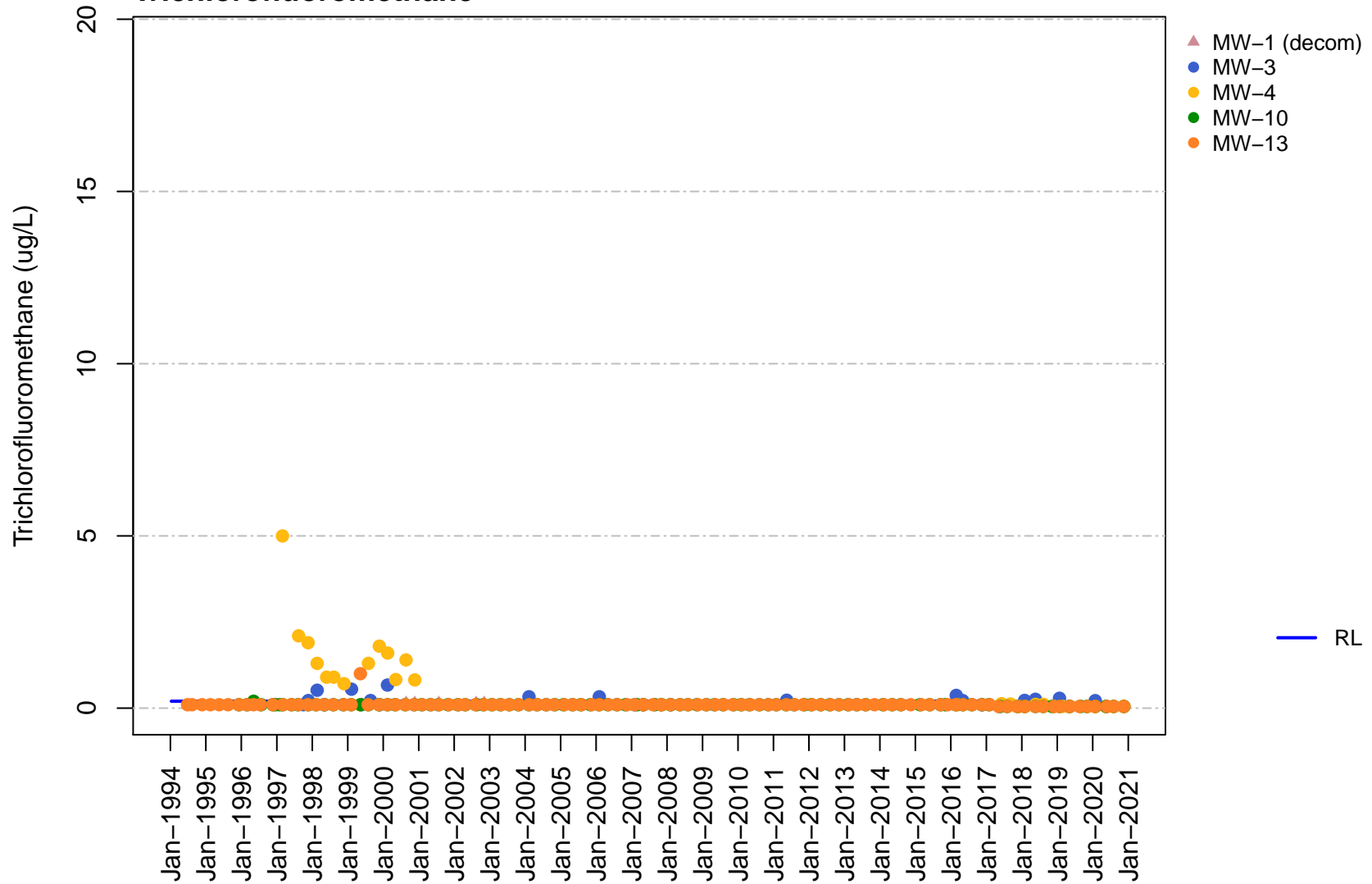
**Vashon Island Closed Landfill  
Channel Cc1  
Trichloroethene**



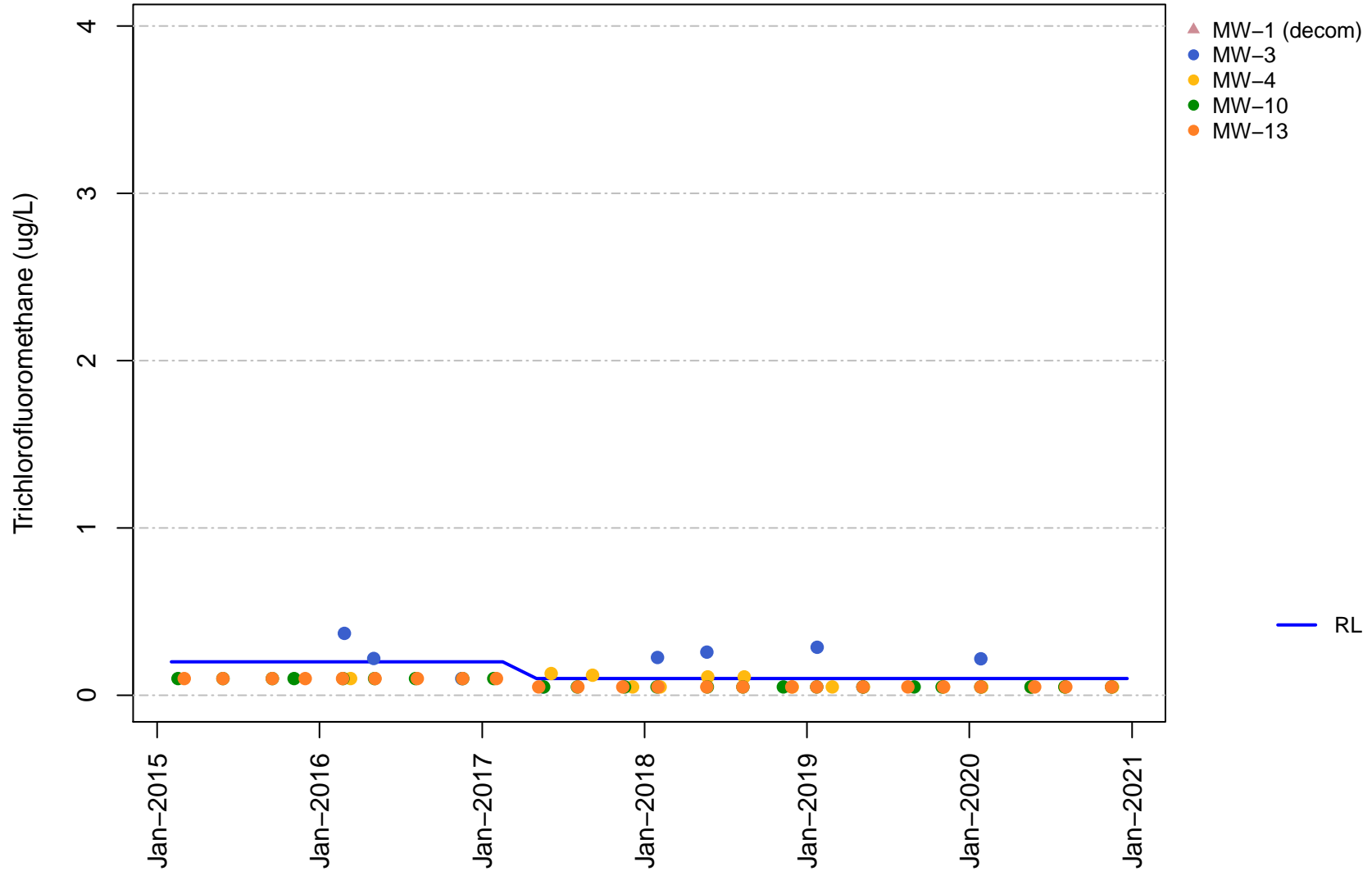
# Vashon Island Closed Landfill Channel Cc1 Trichloroethene



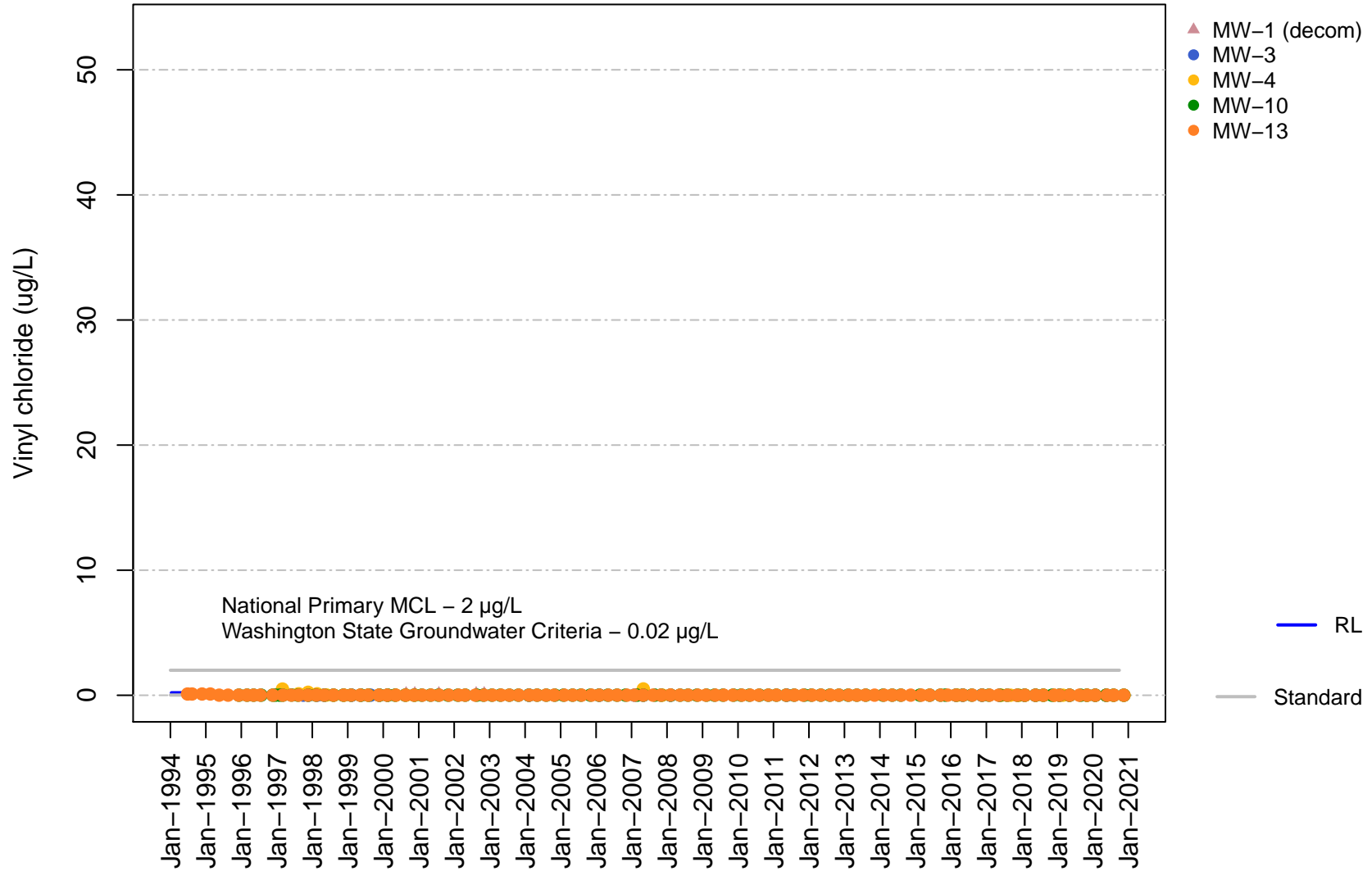
# Vashon Island Closed Landfill Channel Cc1 Trichlorofluoromethane



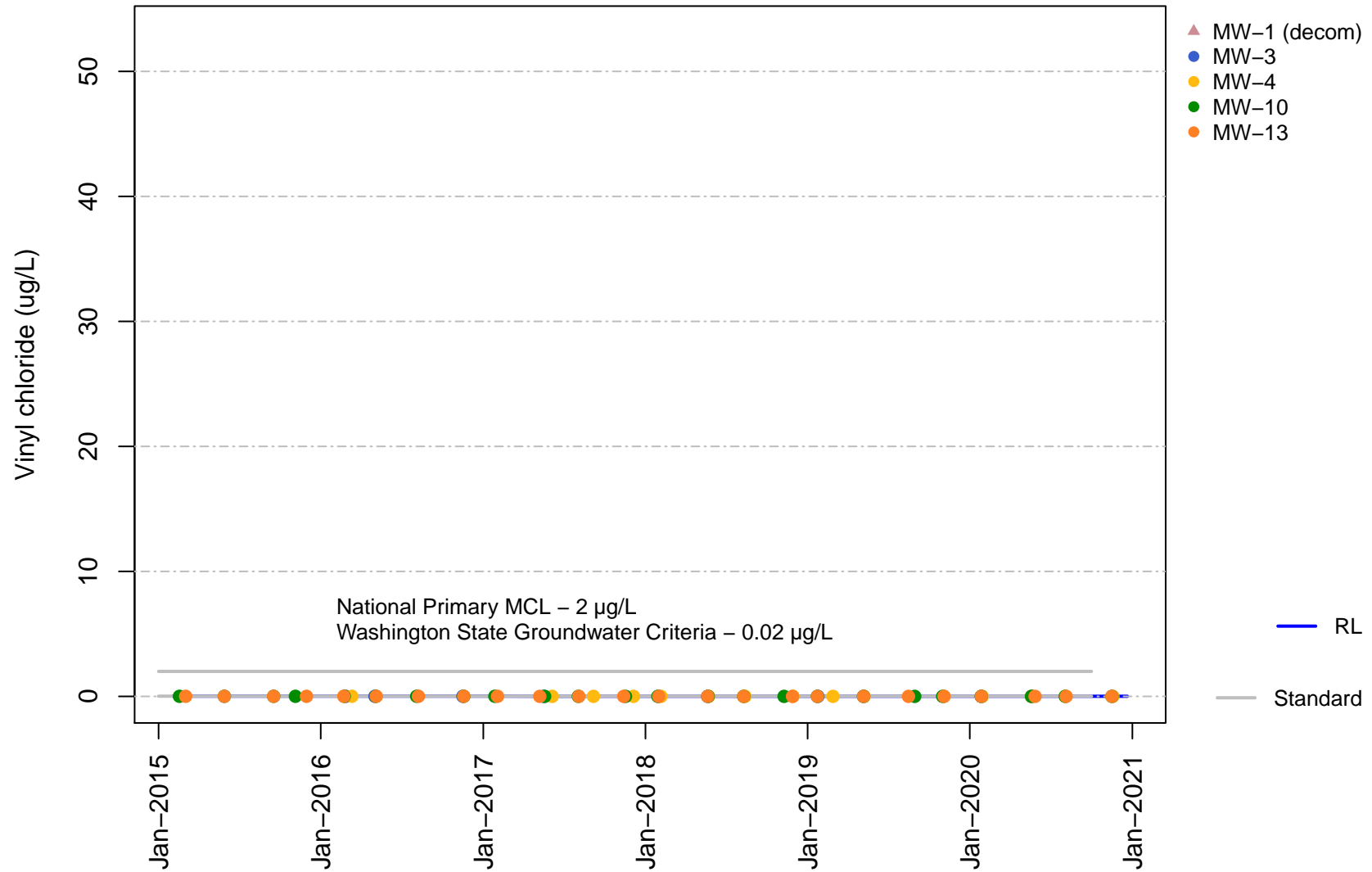
Vashon Island Closed Landfill  
 Channel Cc1  
 Trichlorofluoromethane



**Vashon Island Closed Landfill  
Channel Cc1  
Vinyl chloride**



**Vashon Island Closed Landfill  
Channel Cc1  
Vinyl chloride**

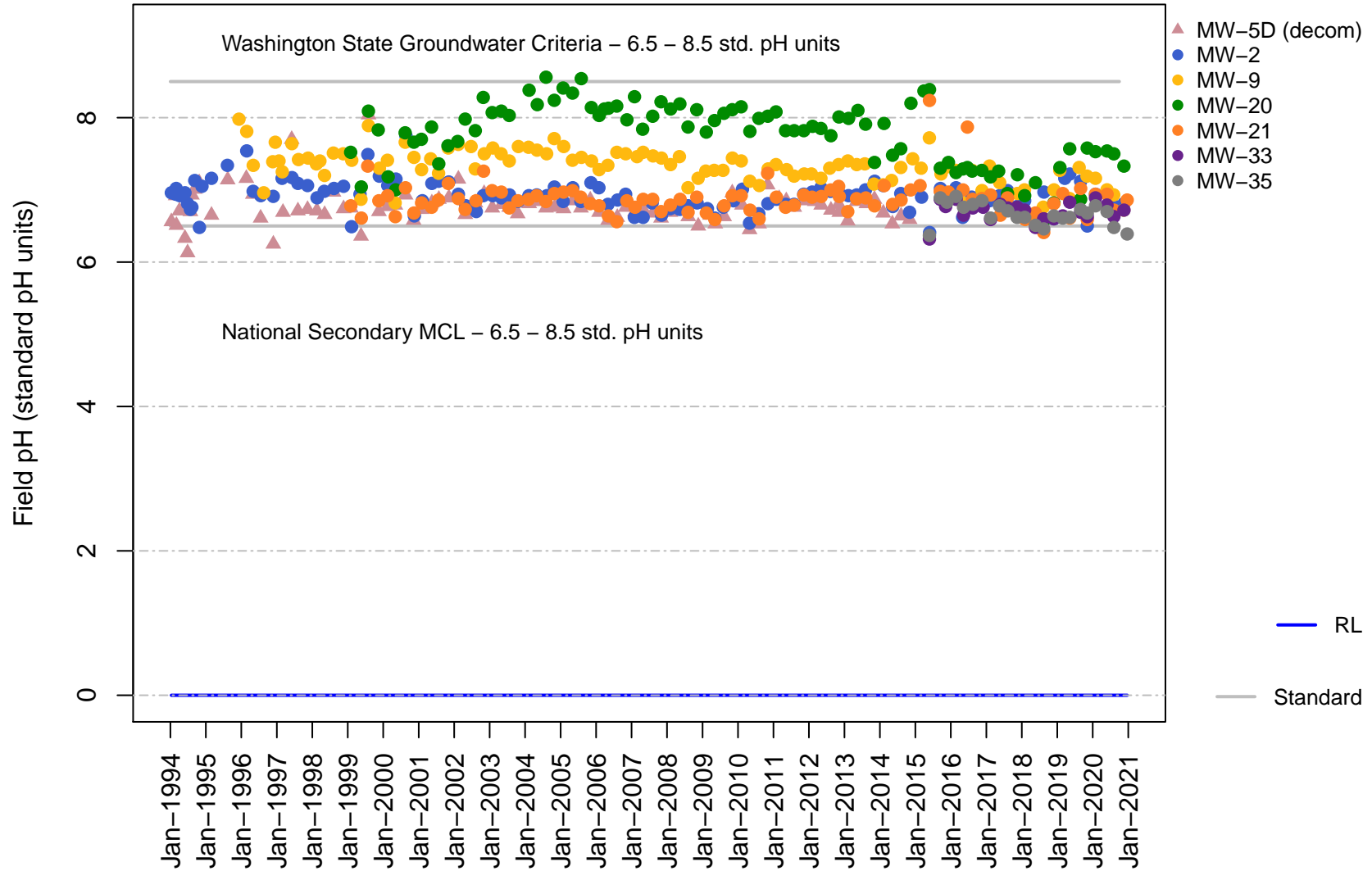


## **Appendix D**

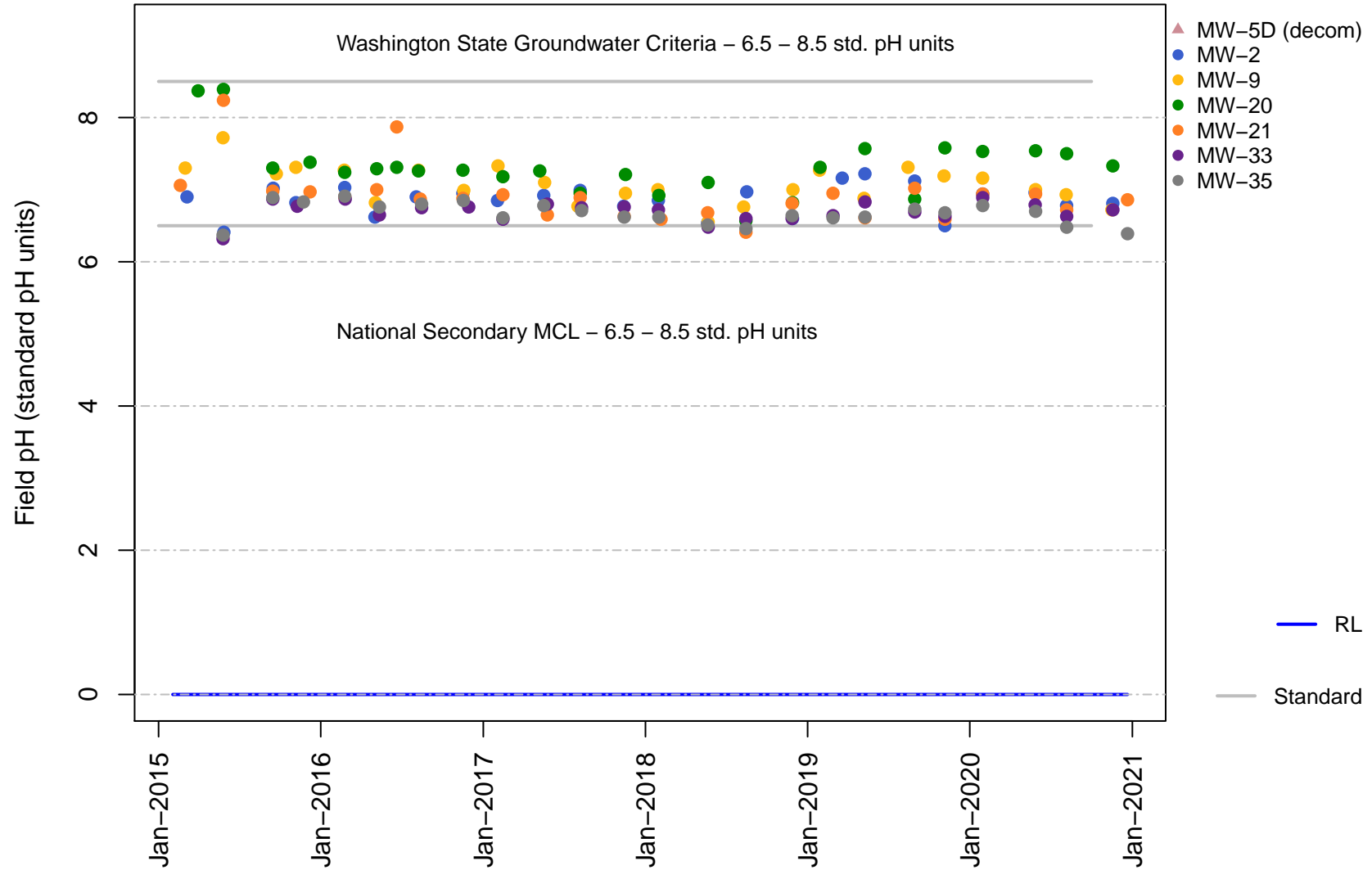
Time Concentration Plots for  
Groundwater in Channel Cc2



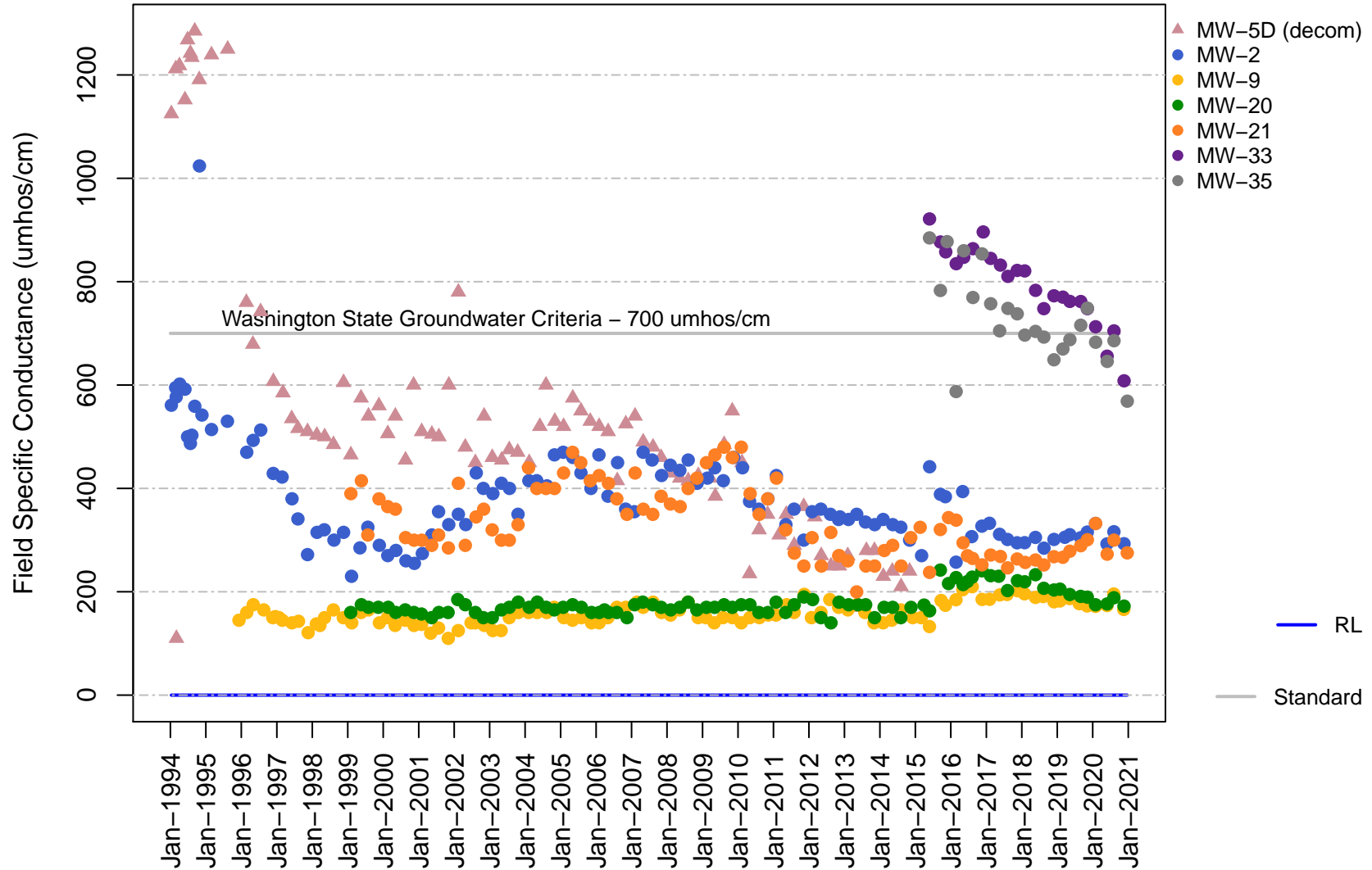
# Vashon Island Closed Landfill Channel Cc2 Field pH



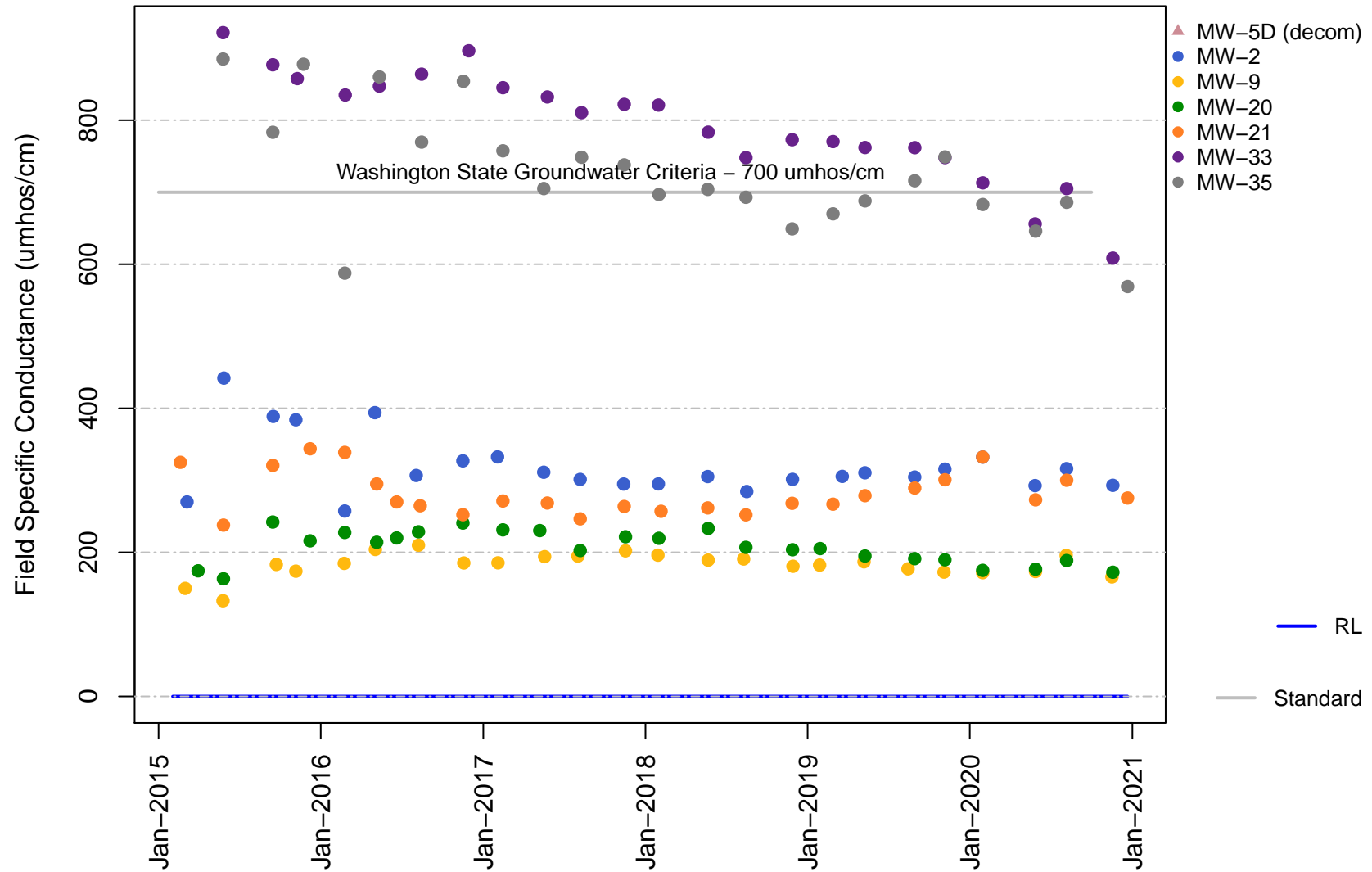
# Vashon Island Closed Landfill Channel Cc2 Field pH



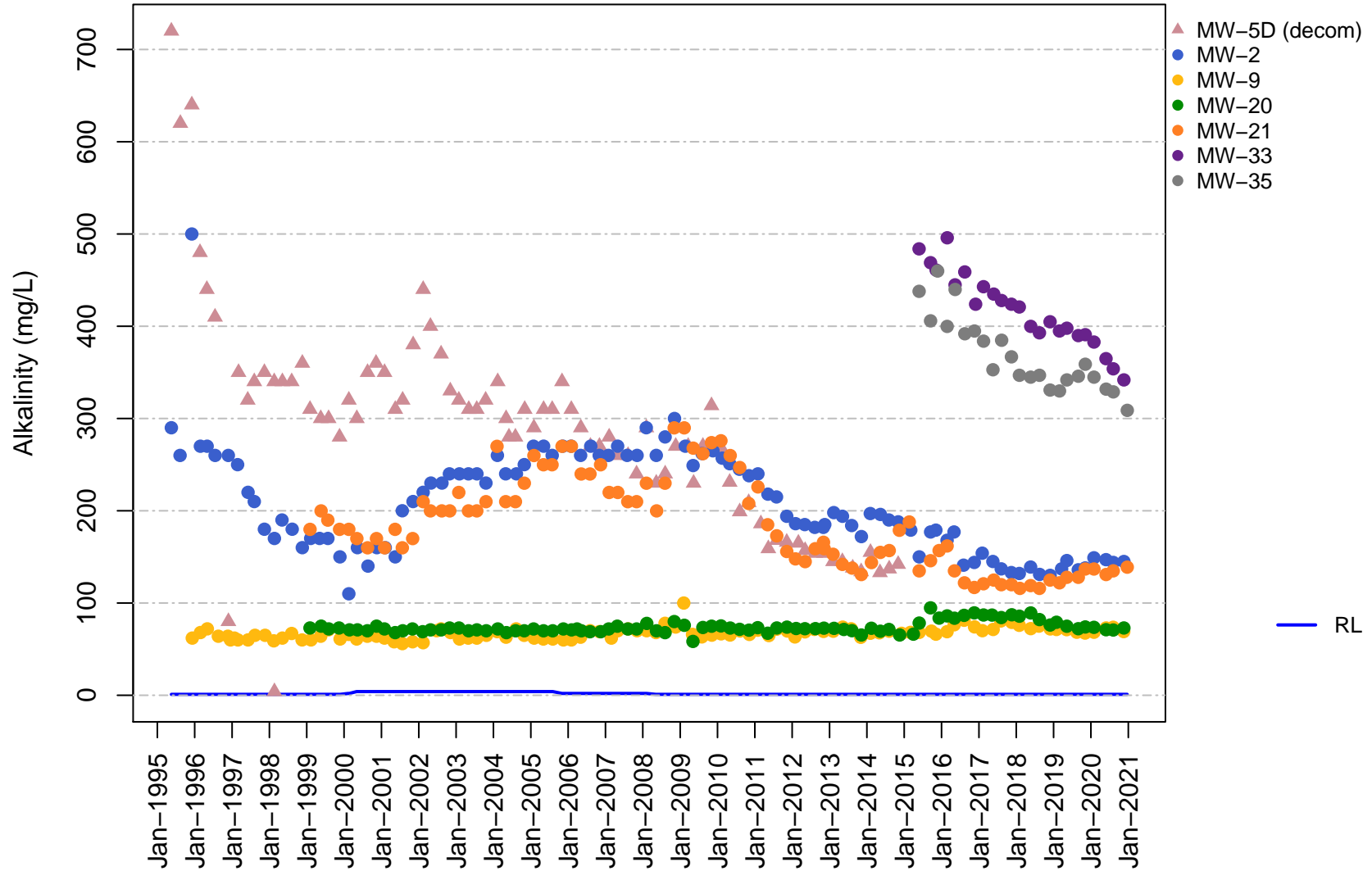
# Vashon Island Closed Landfill Channel Cc2 Field Specific Conductance



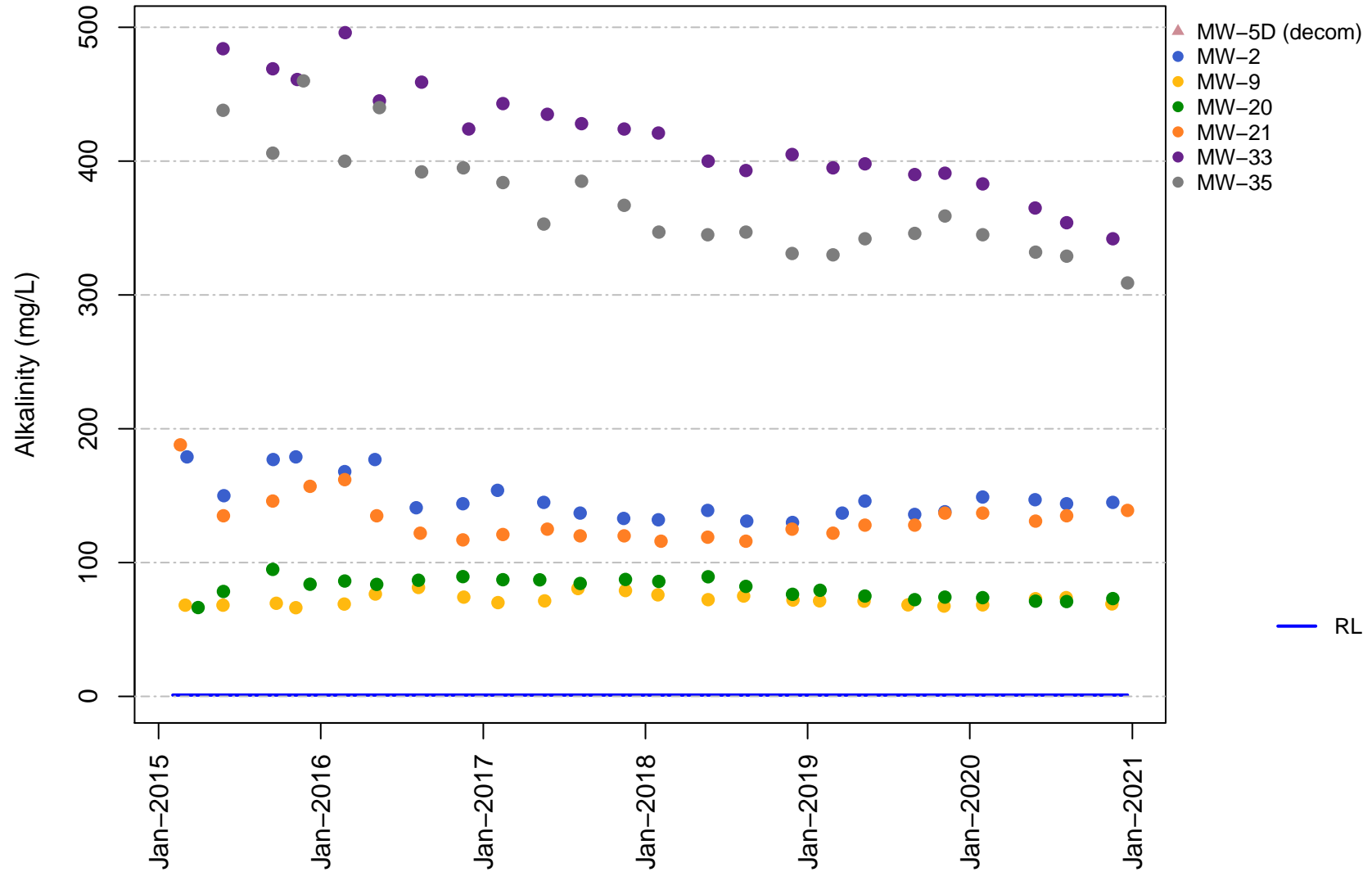
# Vashon Island Closed Landfill Channel Cc2 Field Specific Conductance



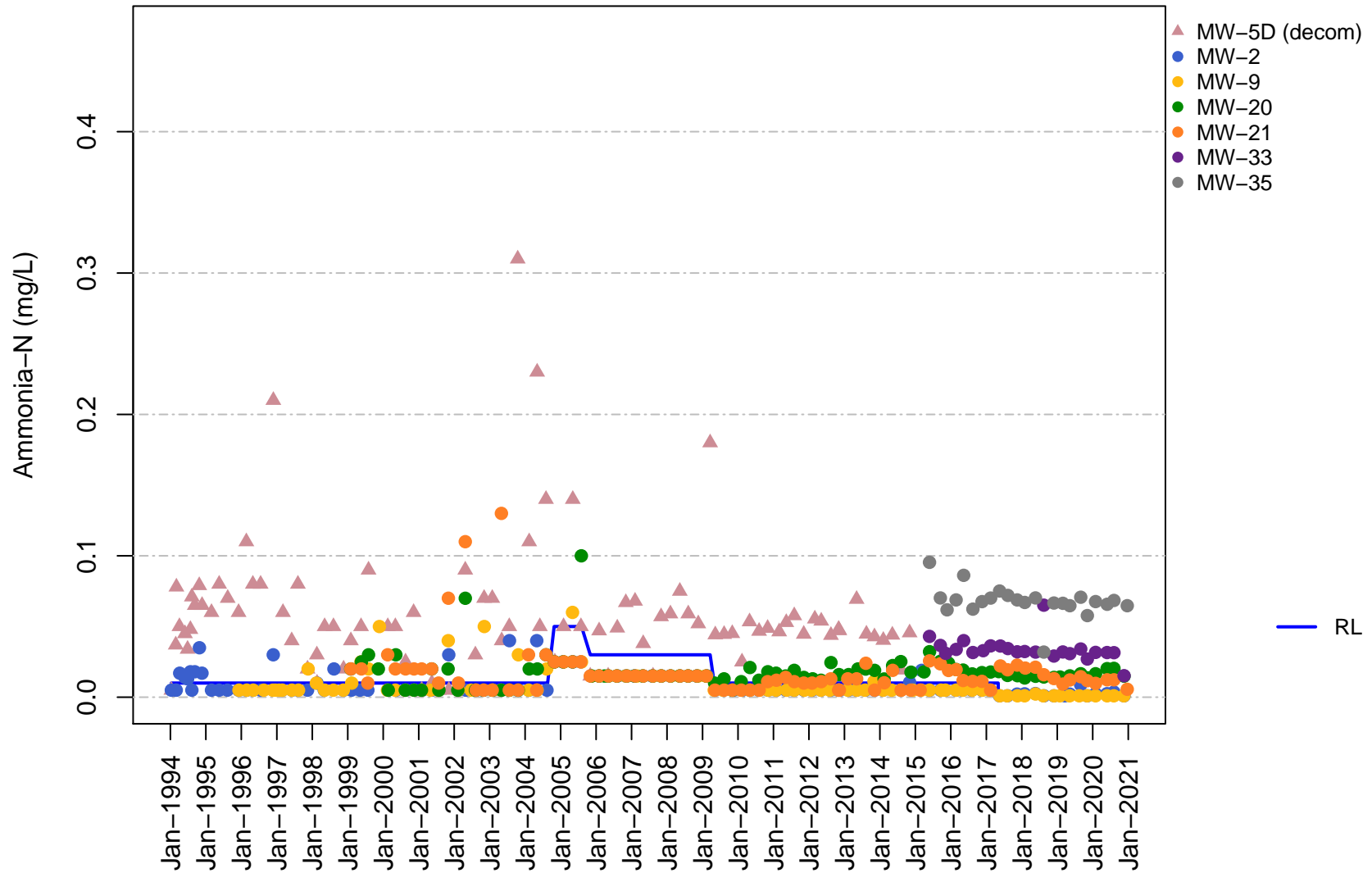
# Vashon Island Closed Landfill Channel Cc2 Alkalinity



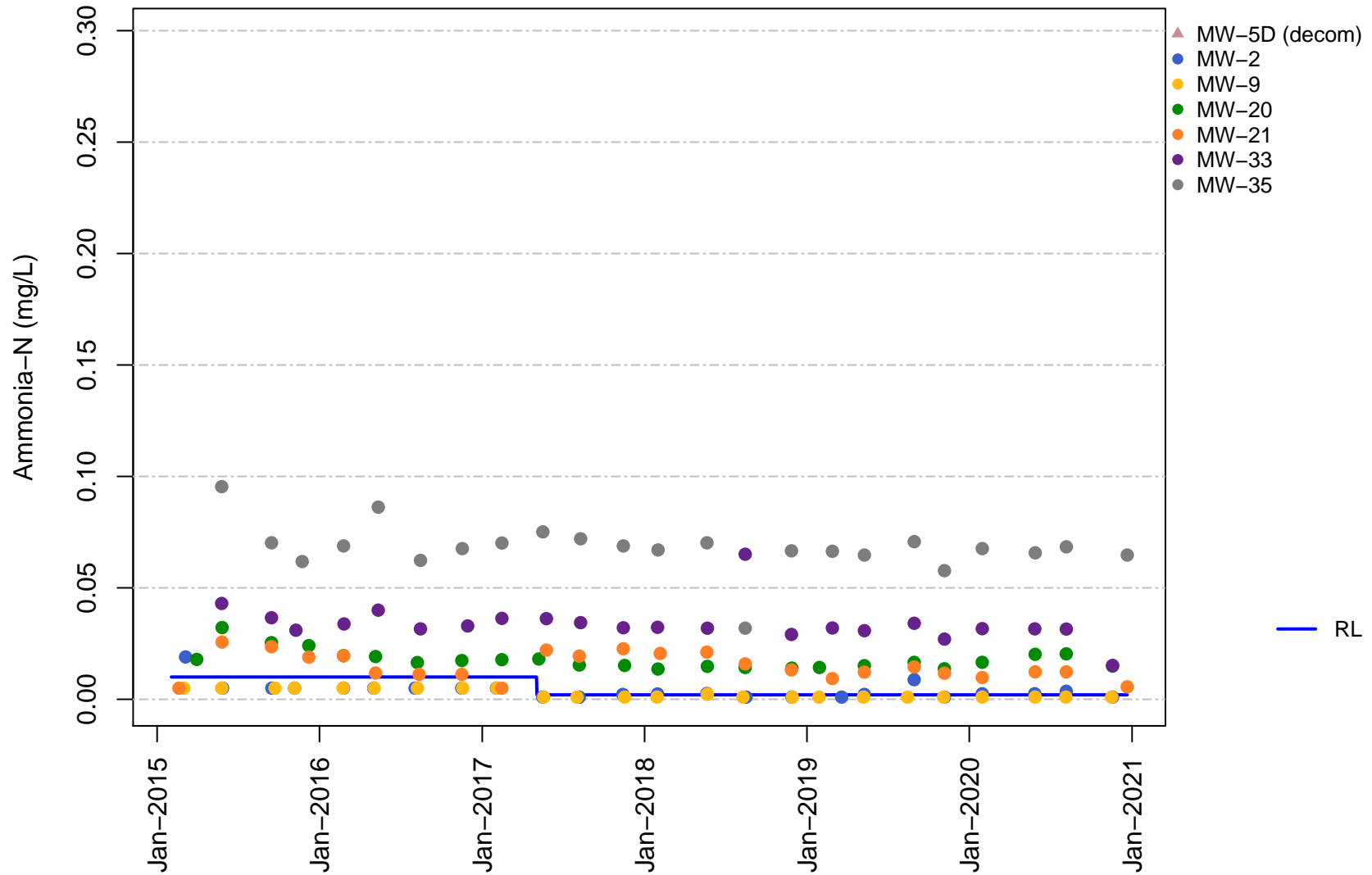
# Vashon Island Closed Landfill Channel Cc2 Alkalinity



# Vashon Island Closed Landfill Channel Cc2 Ammonia

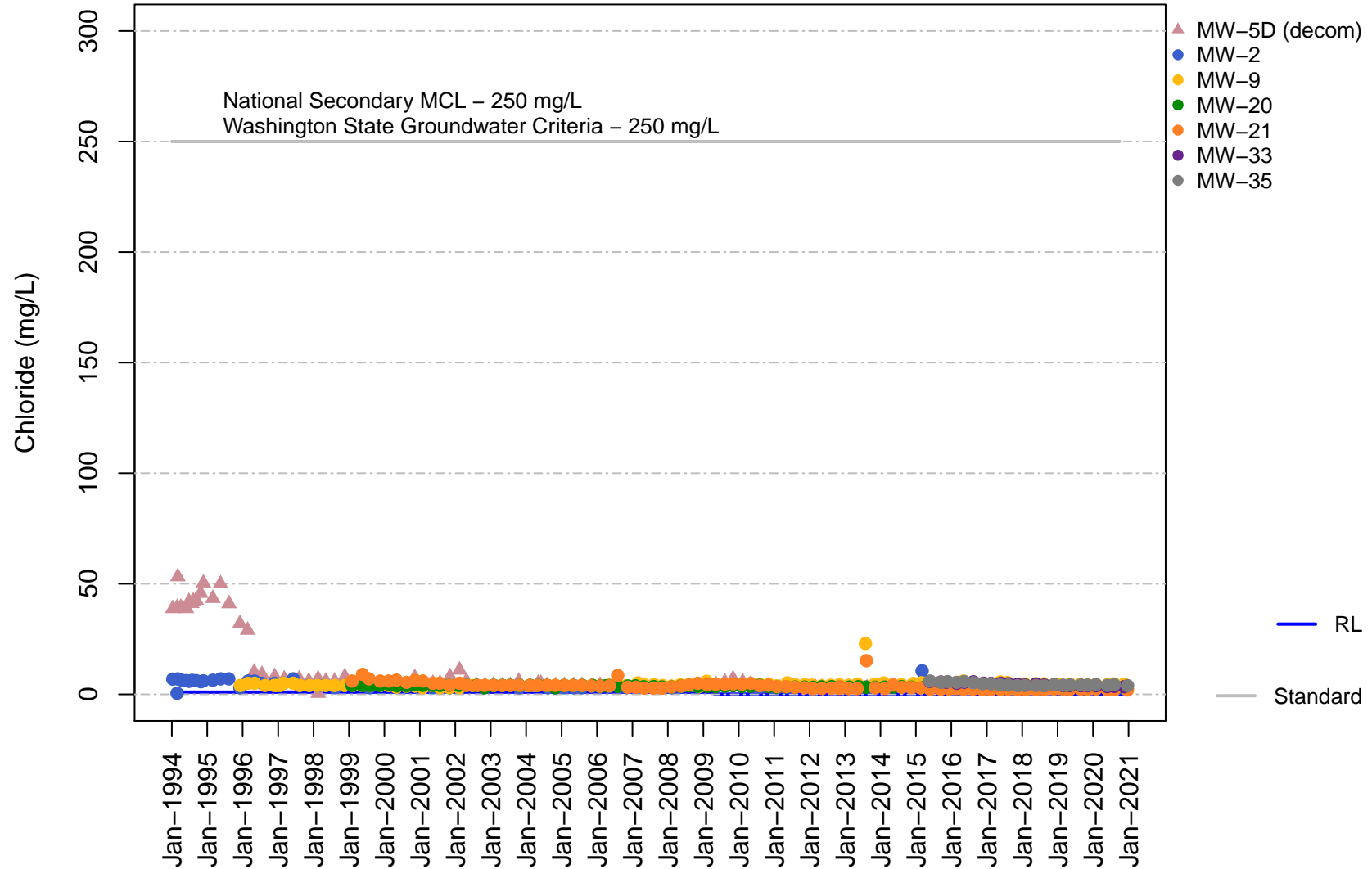


**Vashon Island Closed Landfill  
Channel Cc2  
Ammonia**

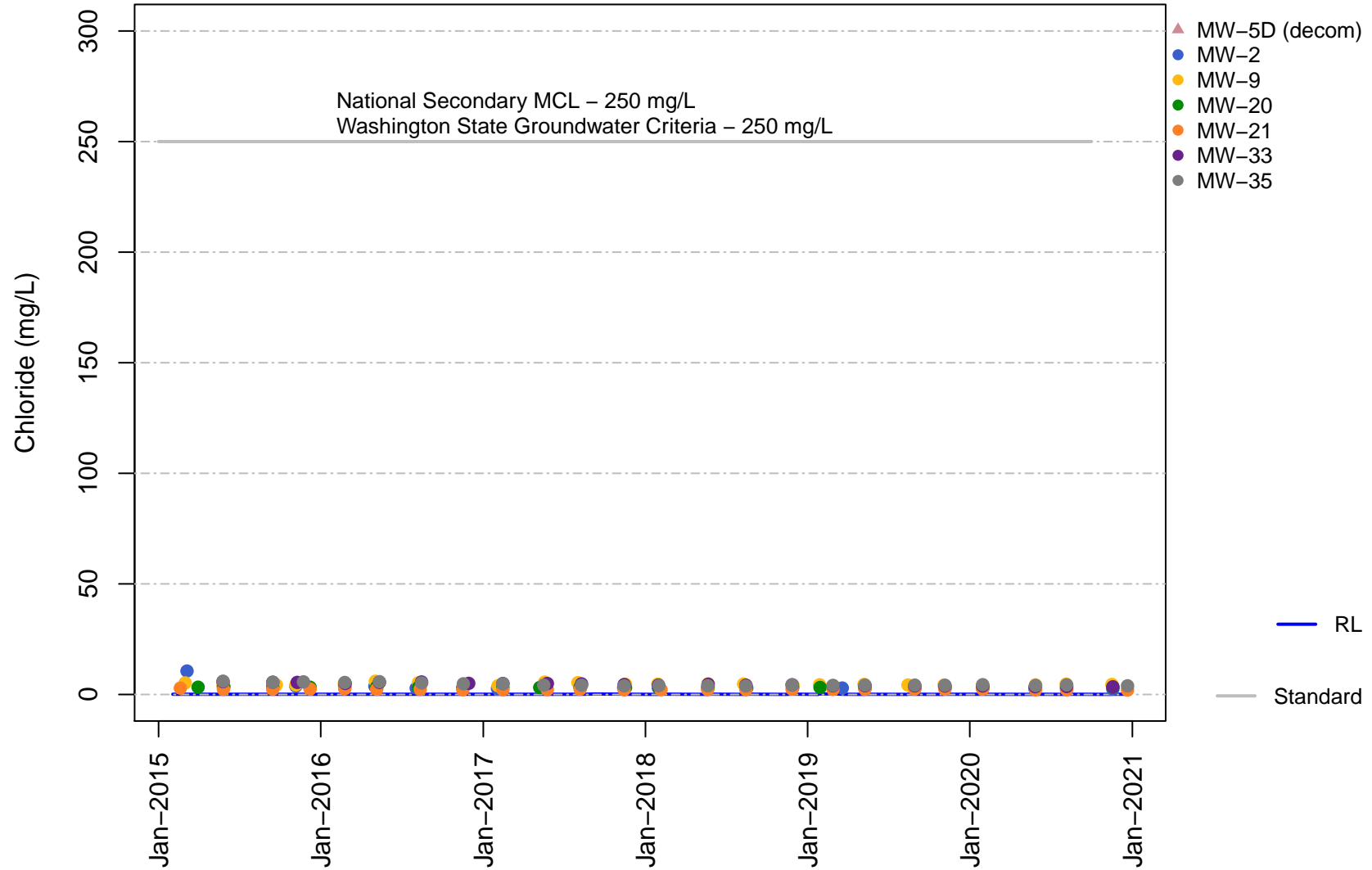




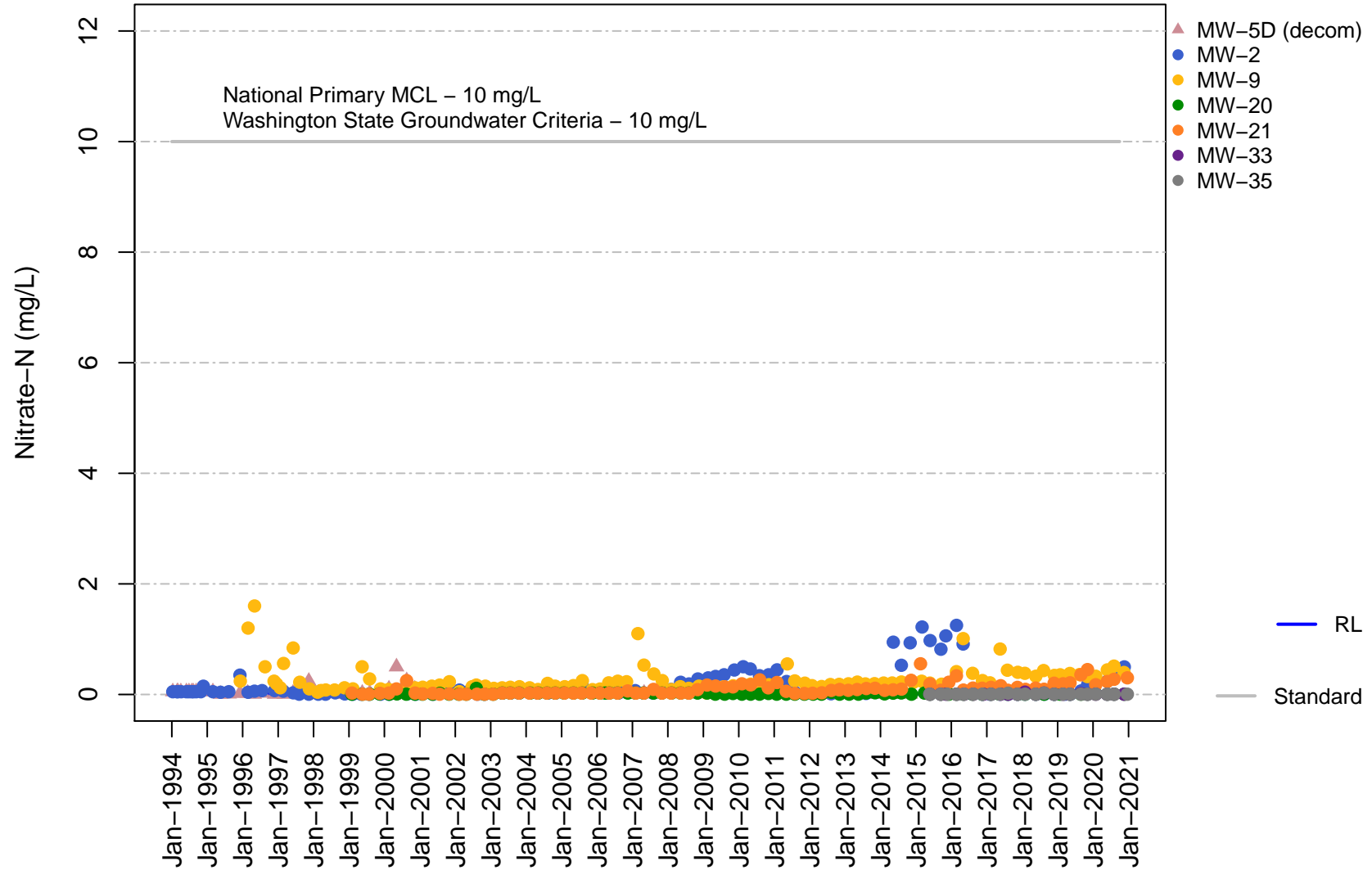
# Vashon Island Closed Landfill Channel Cc2 Chloride



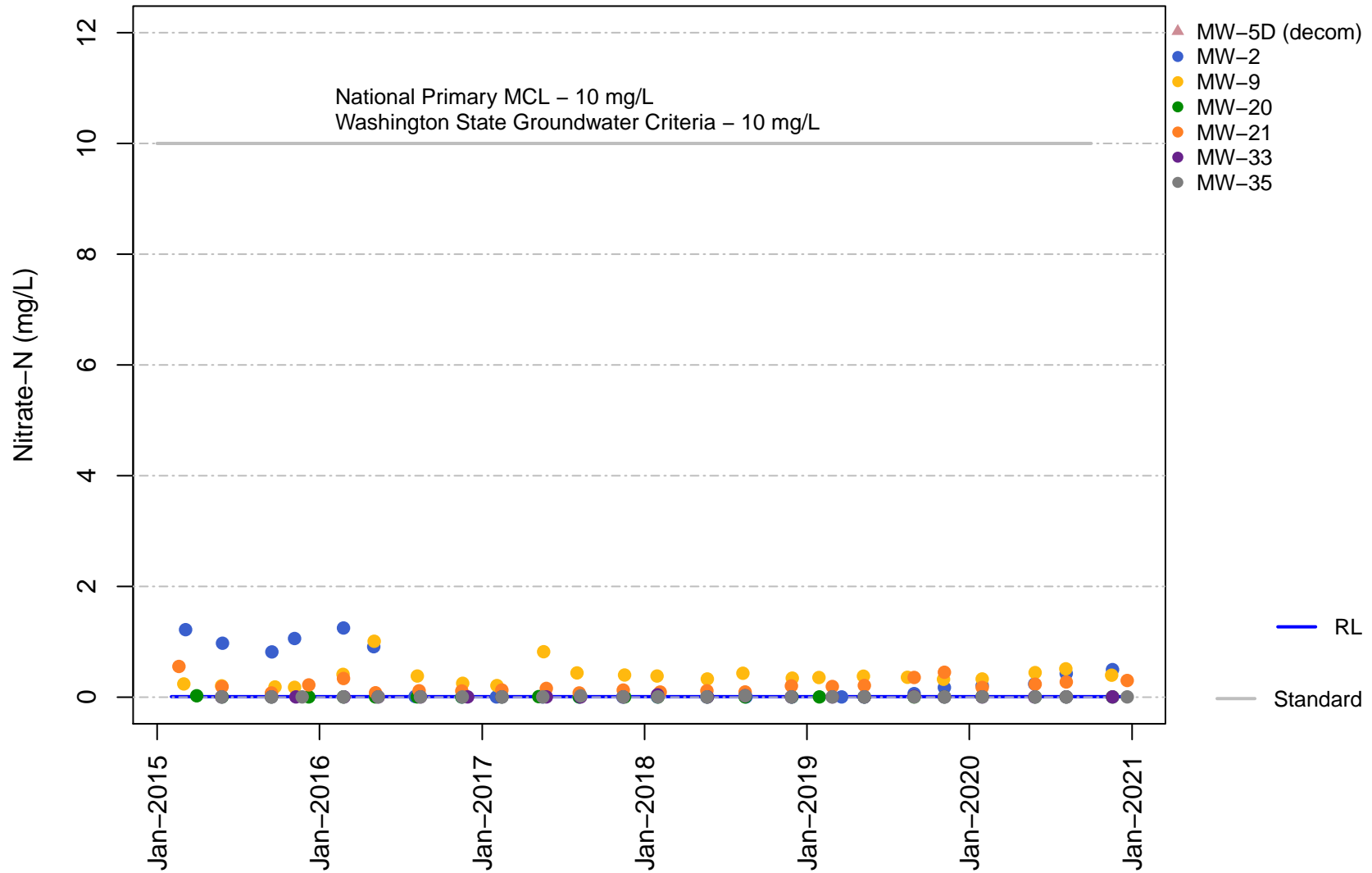
**Vashon Island Closed Landfill  
Channel Cc2  
Chloride**



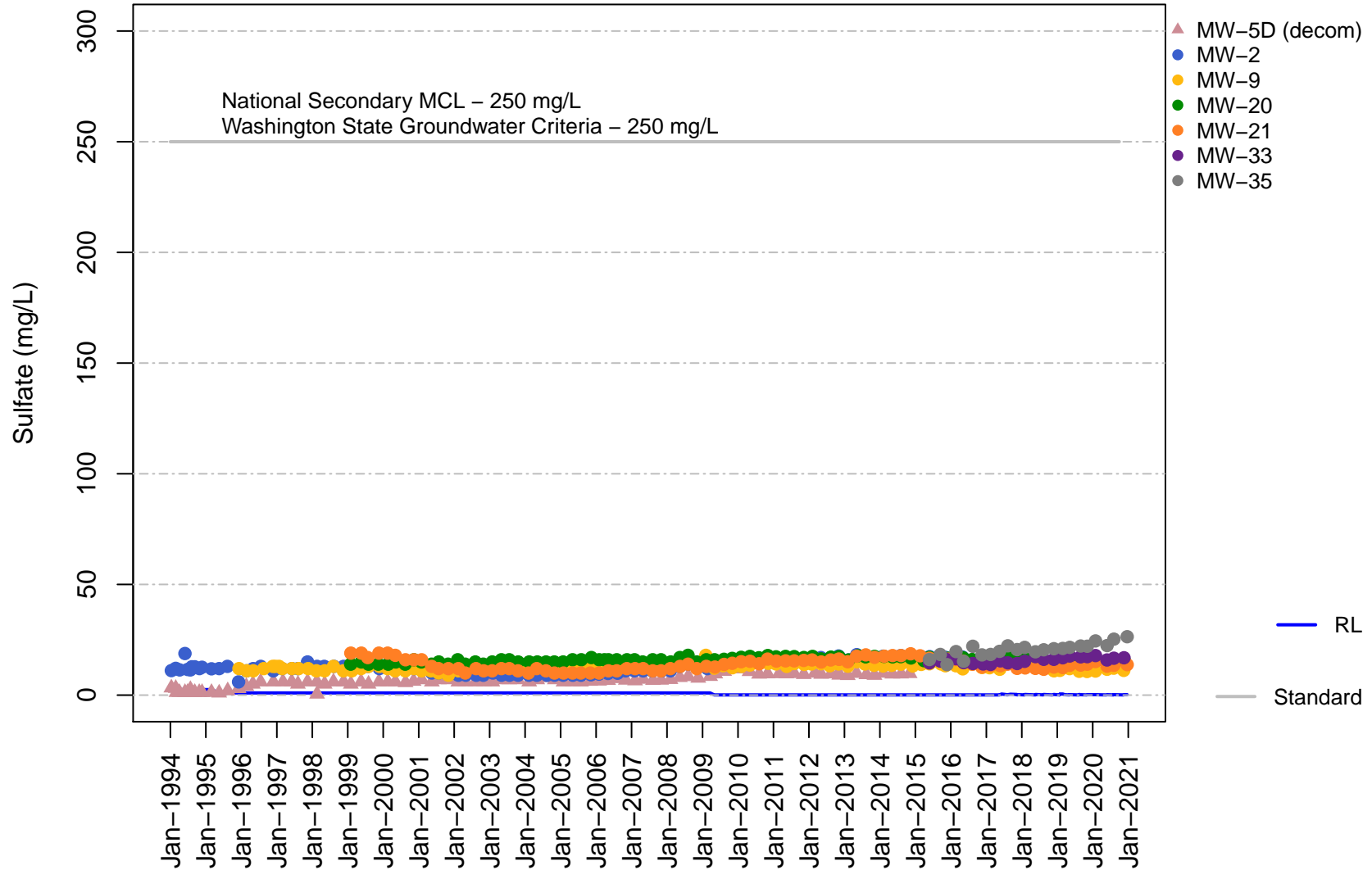
# Vashon Island Closed Landfill Channel Cc2 Nitrate



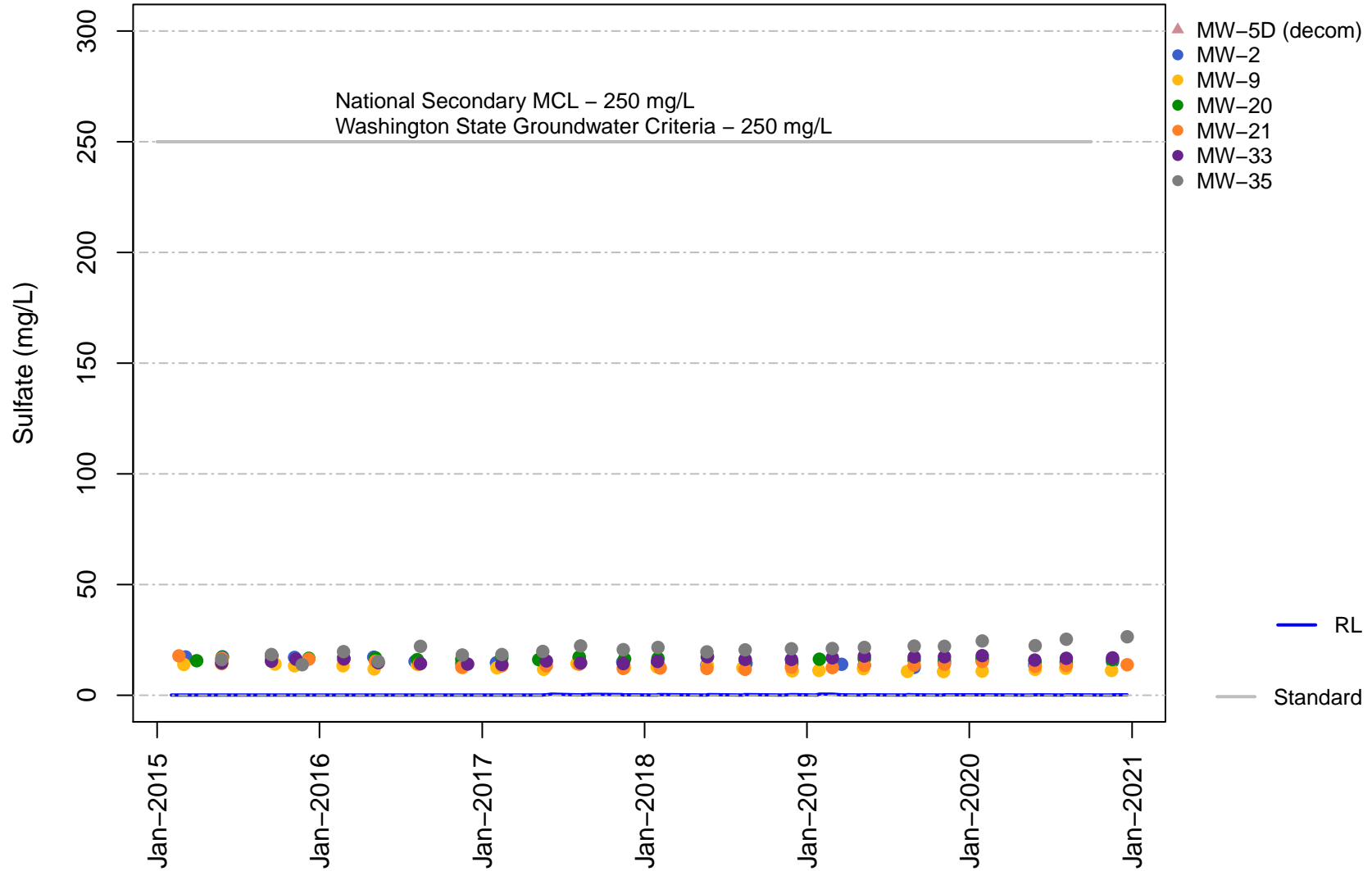
# Vashon Island Closed Landfill Channel Cc2 Nitrate



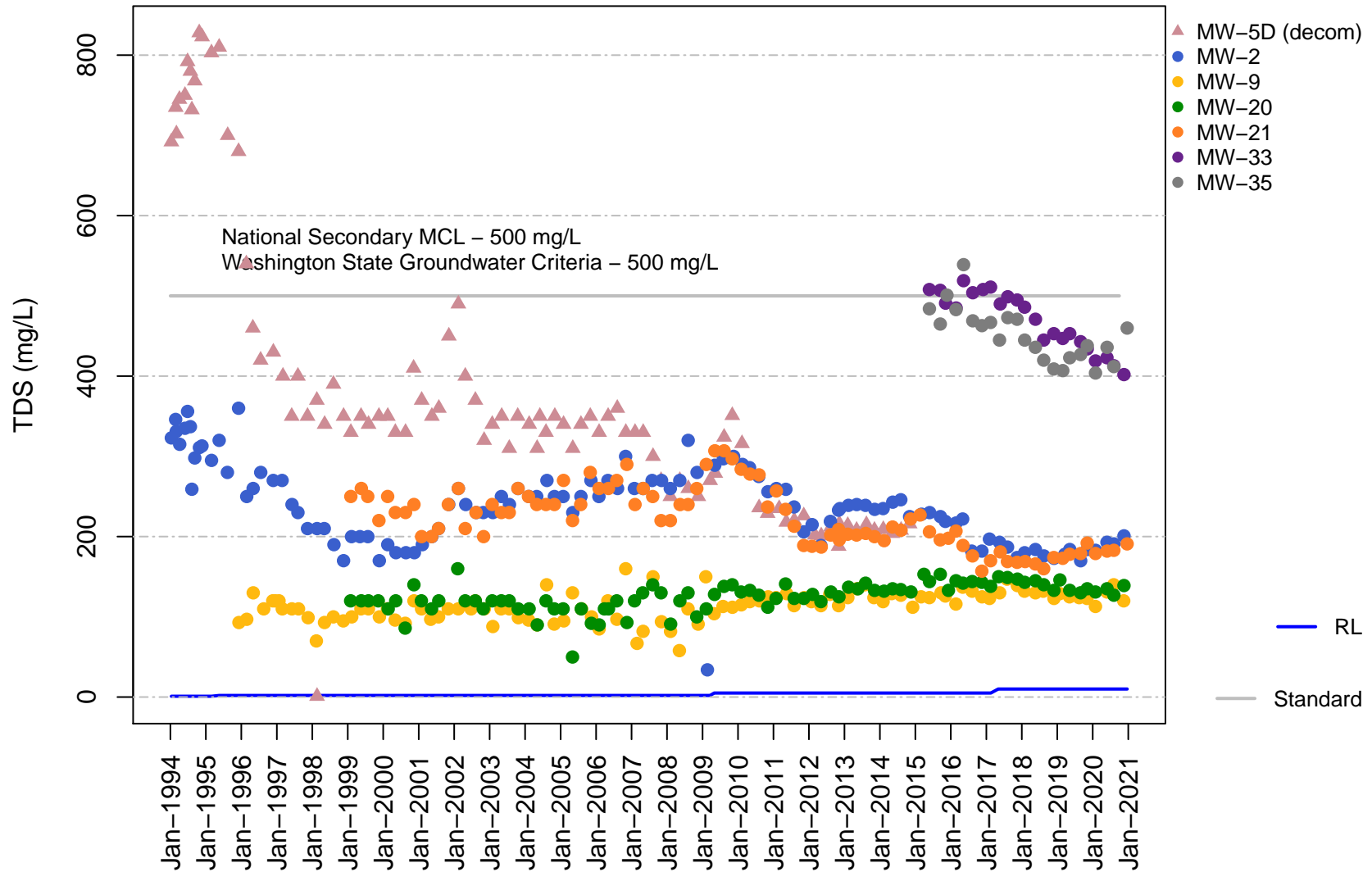
# Vashon Island Closed Landfill Channel Cc2 Sulfate



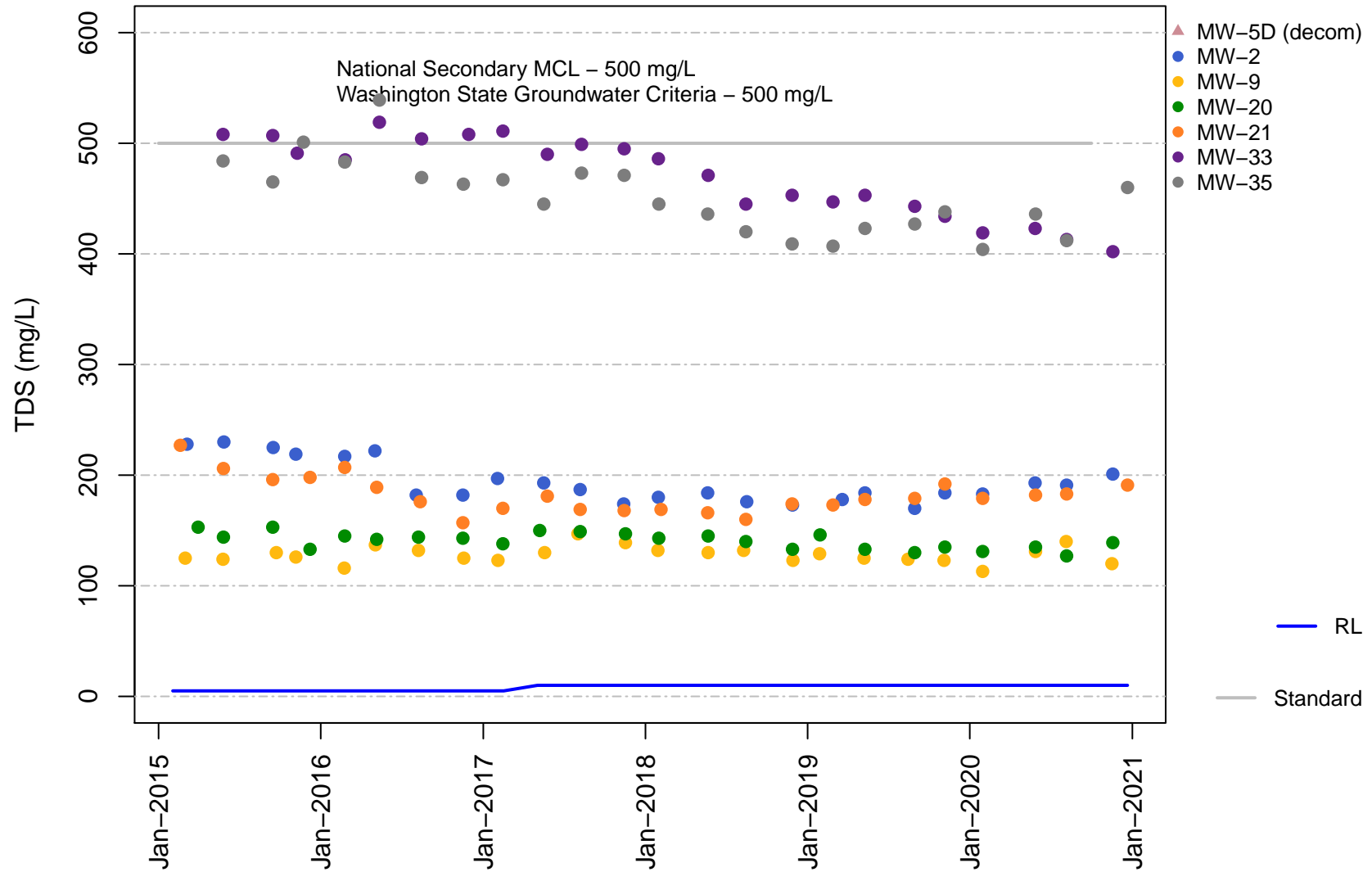
# Vashon Island Closed Landfill Channel Cc2 Sulfate



# Vashon Island Closed Landfill Channel Cc2 Total Dissolved Solids

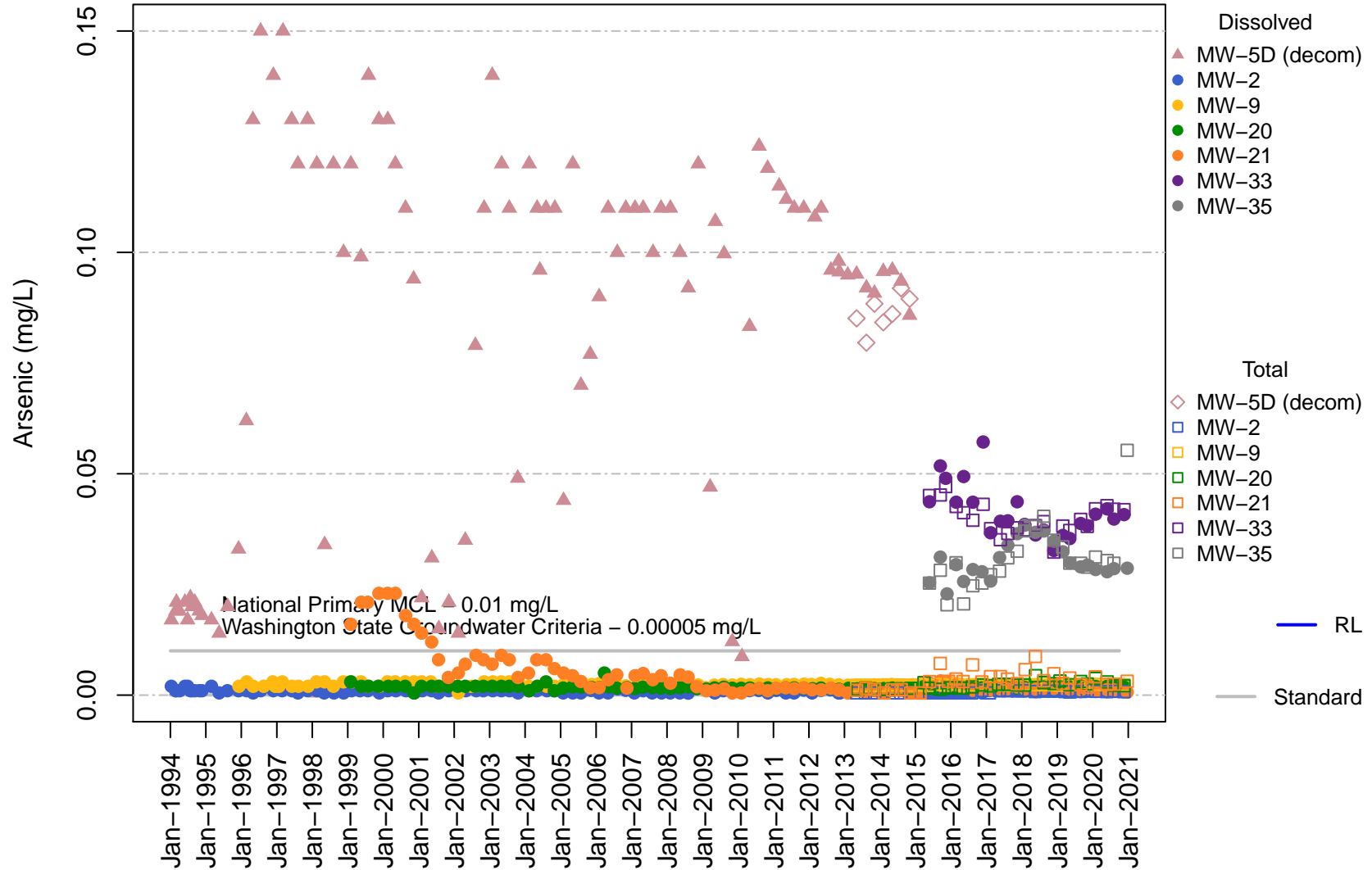


# Vashon Island Closed Landfill Channel Cc2 Total Dissolved Solids

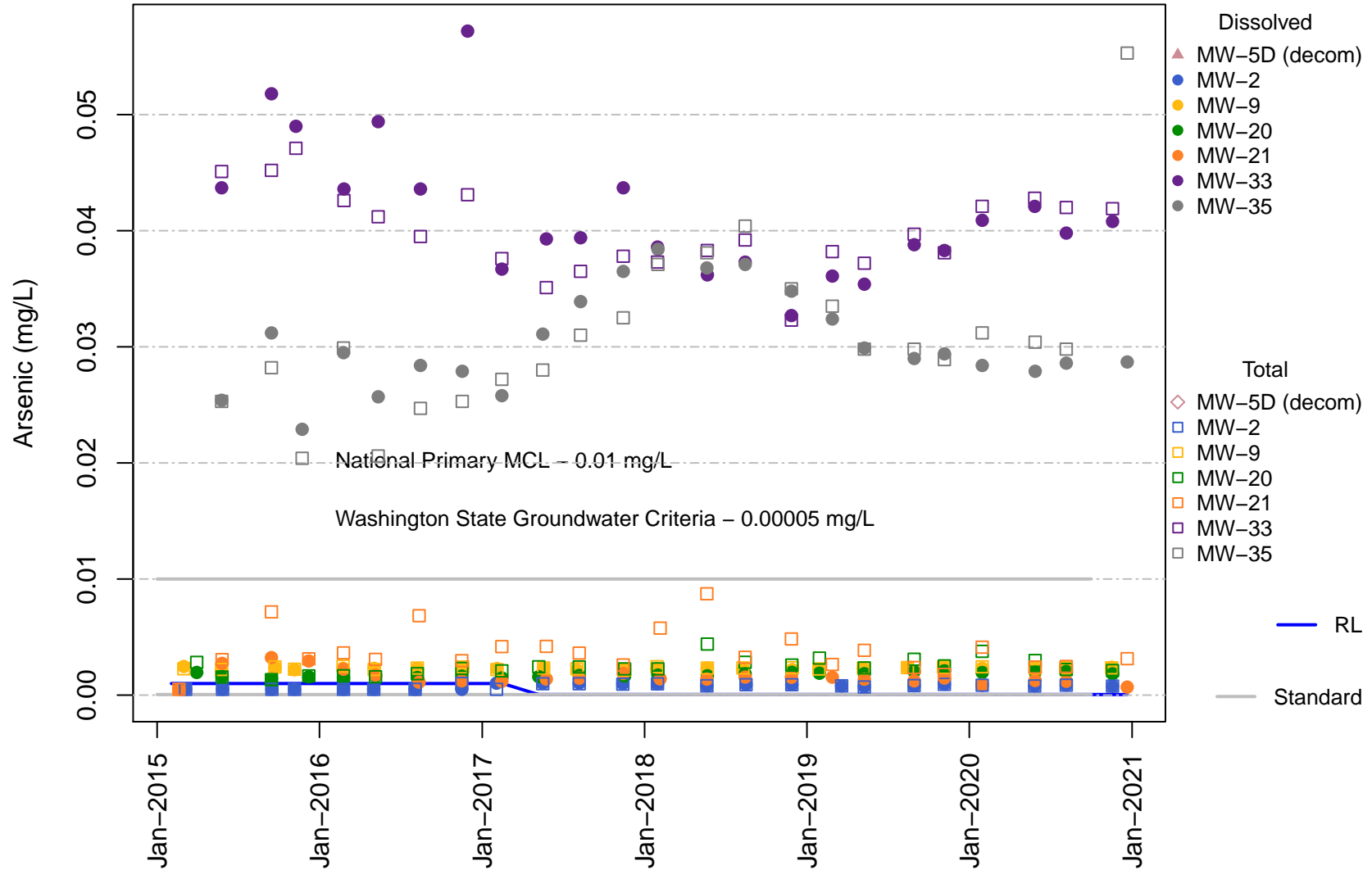




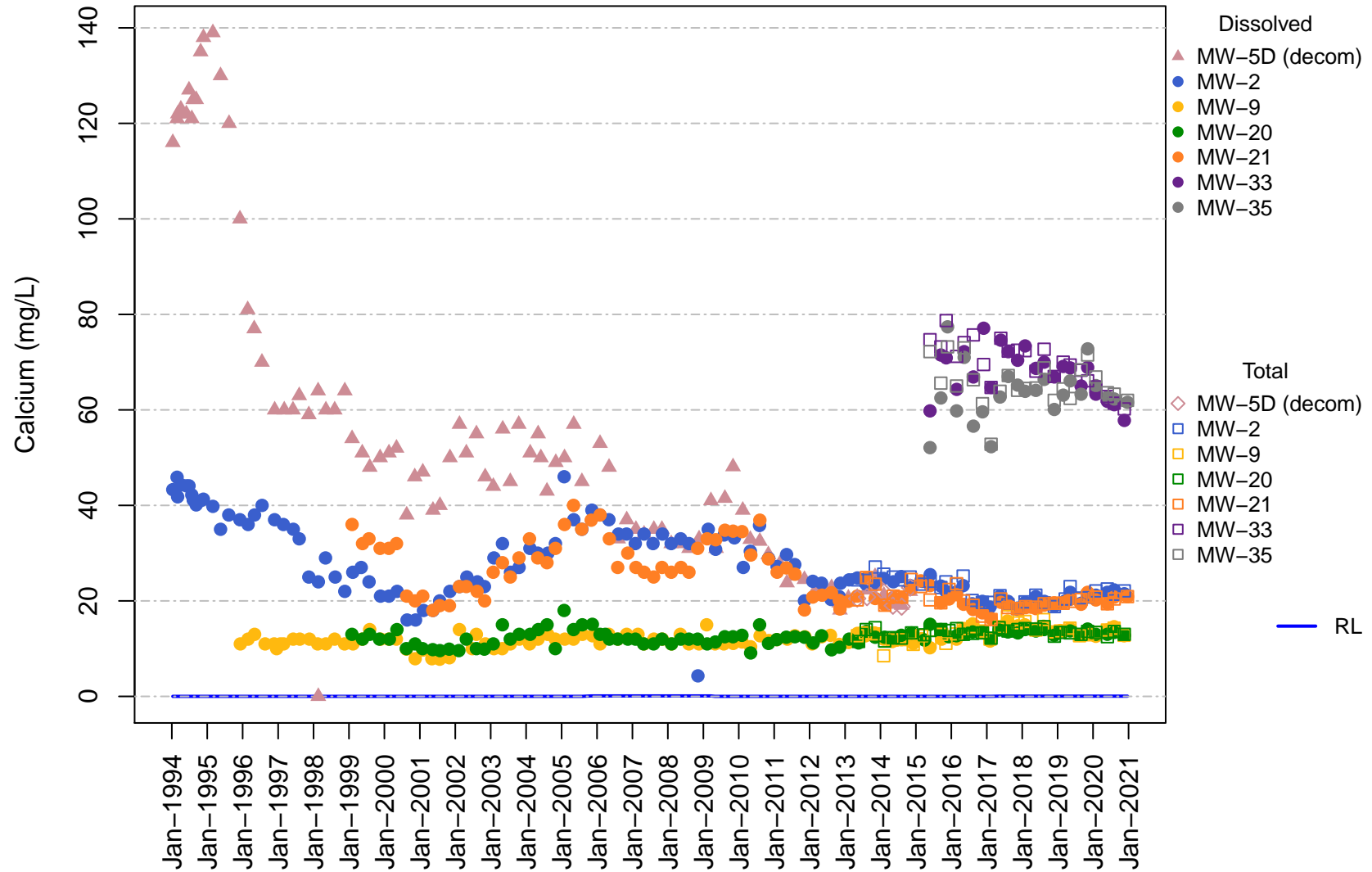
# Vashon Island Closed Landfill Channel Cc2 Arsenic



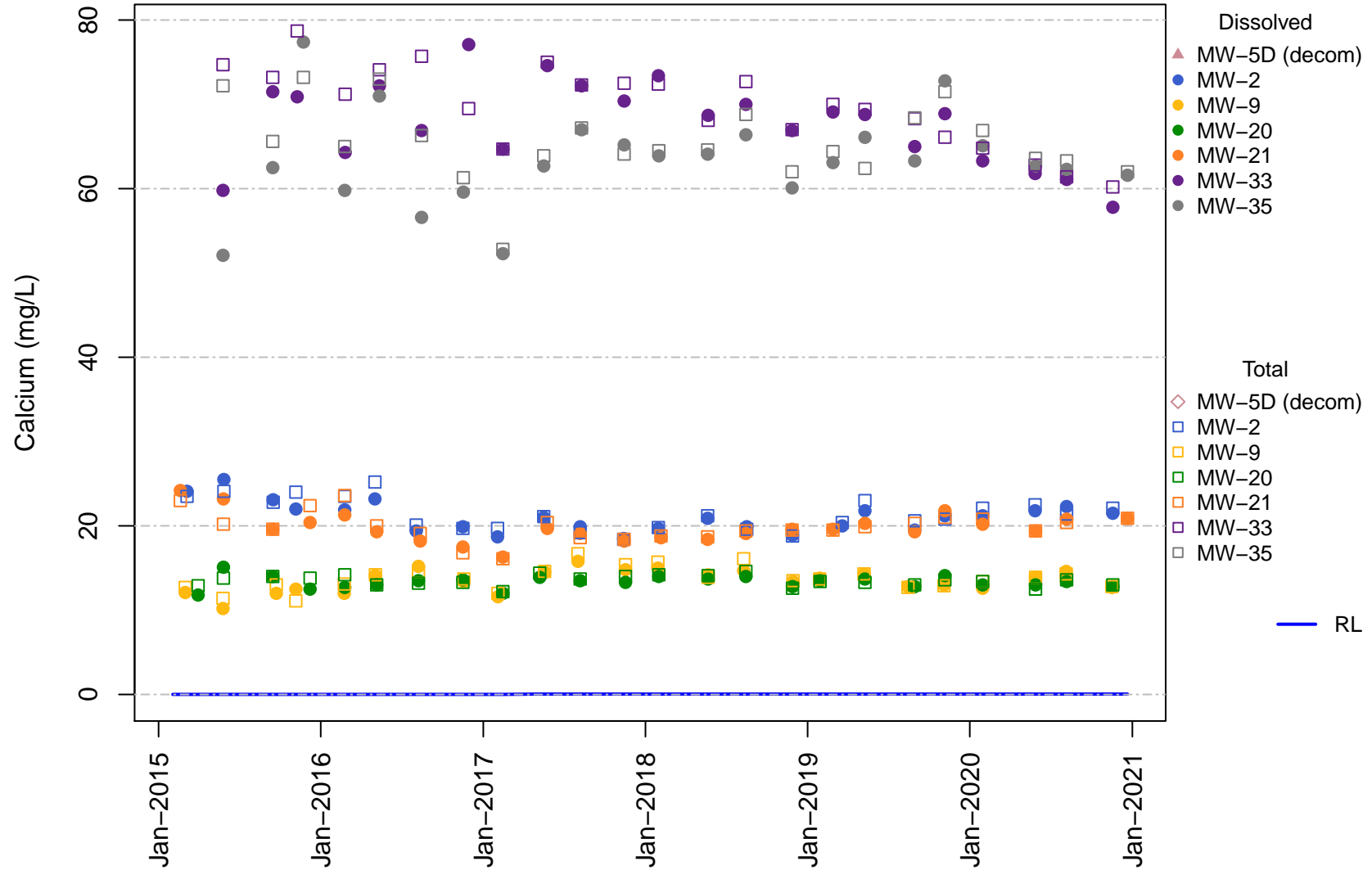
# Vashon Island Closed Landfill Channel Cc2 Arsenic



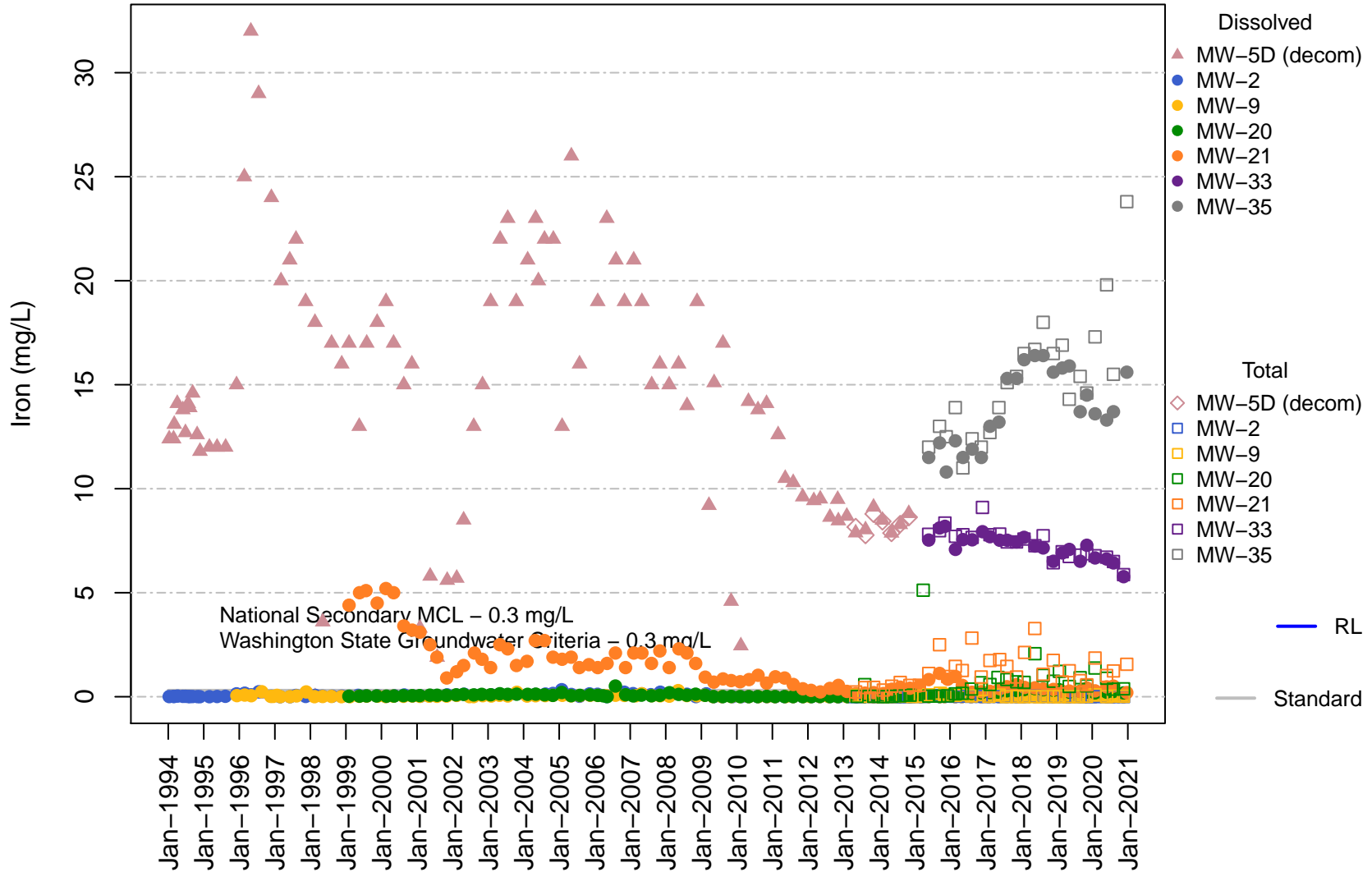
# Vashon Island Closed Landfill Channel Cc2 Calcium



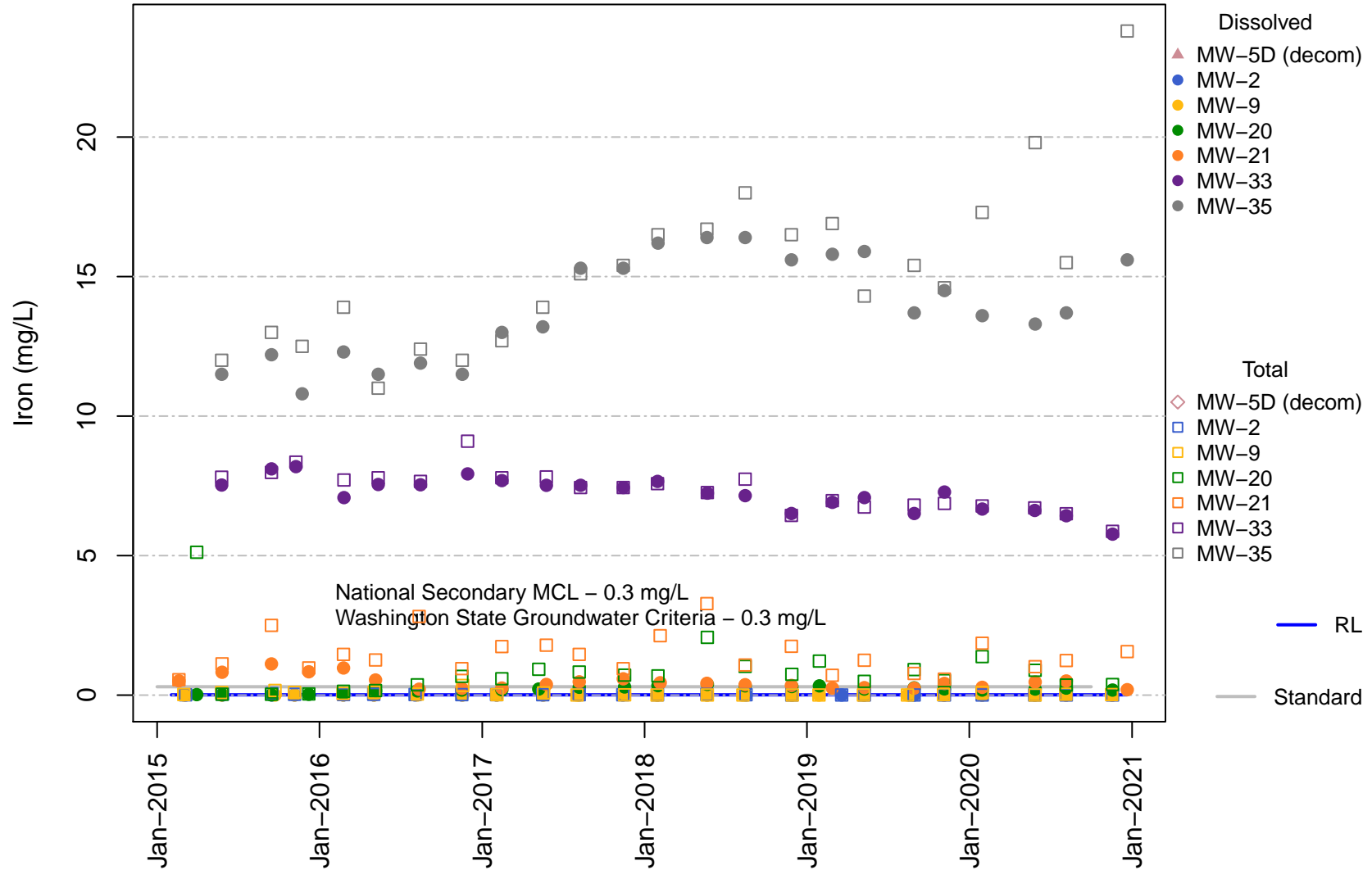
# Vashon Island Closed Landfill Channel Cc2 Calcium



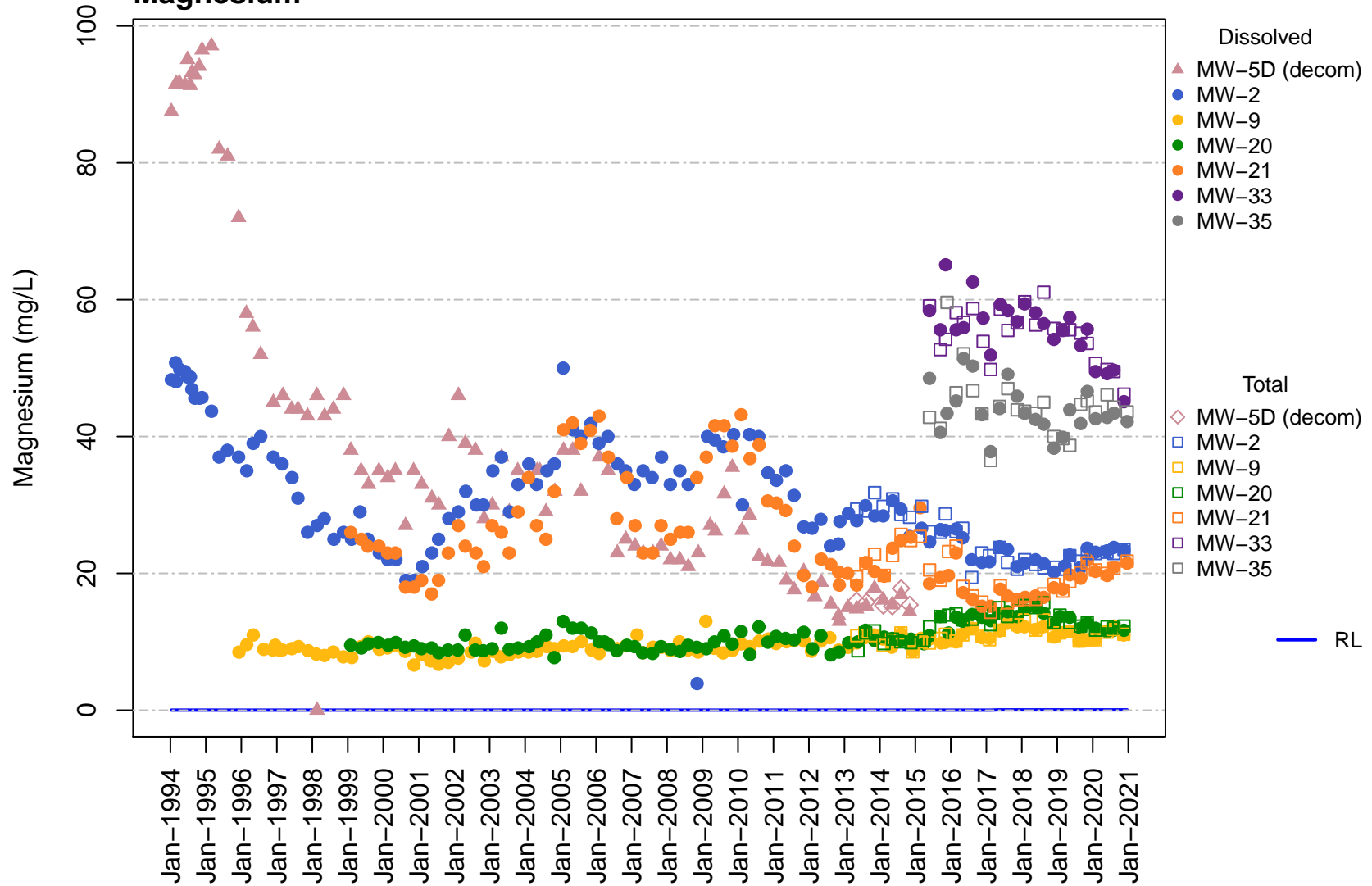
# Vashon Island Closed Landfill Channel Cc2 Iron



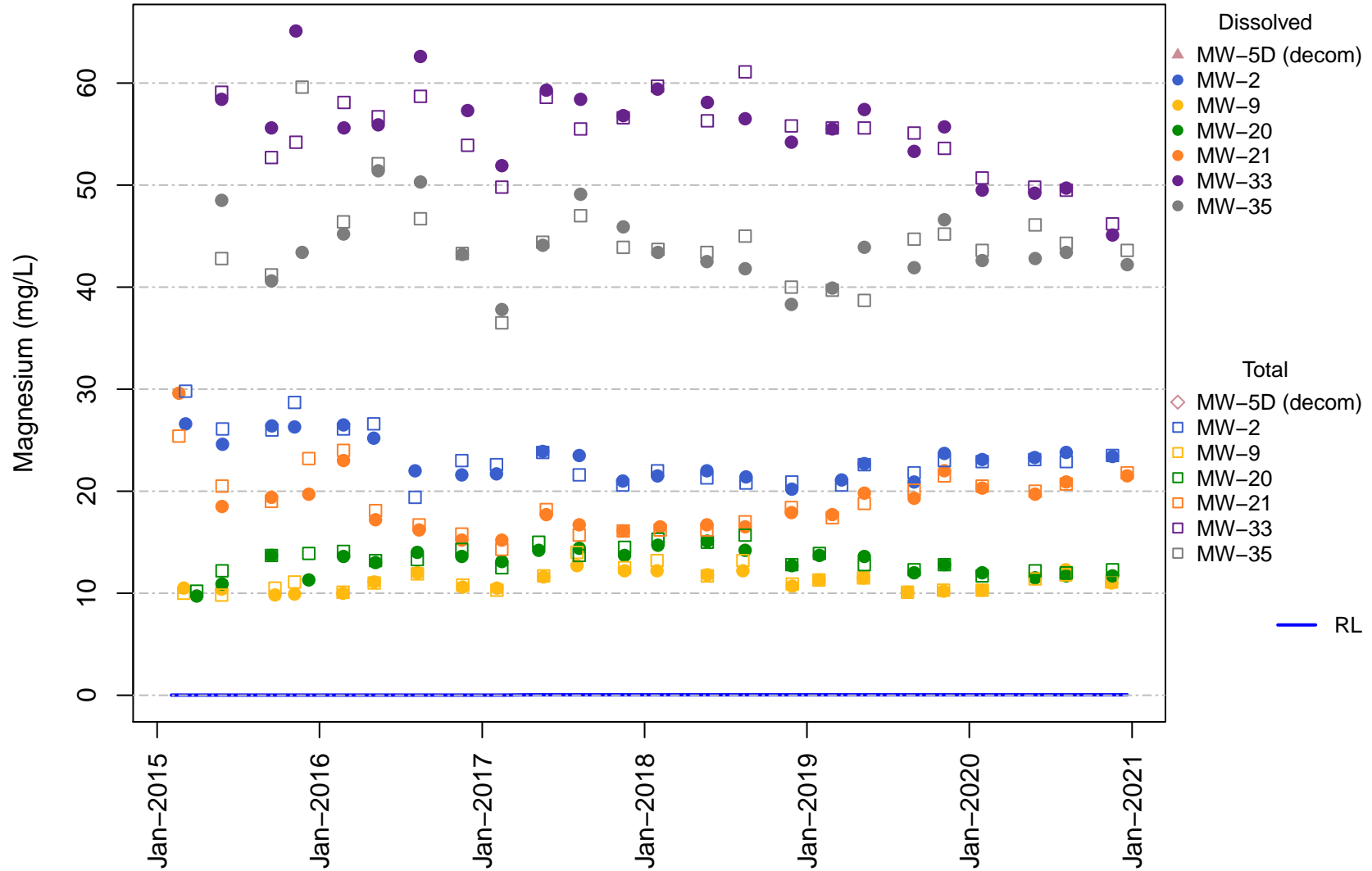
# Vashon Island Closed Landfill Channel Cc2 Iron



# Vashon Island Closed Landfill Channel Cc2 Magnesium

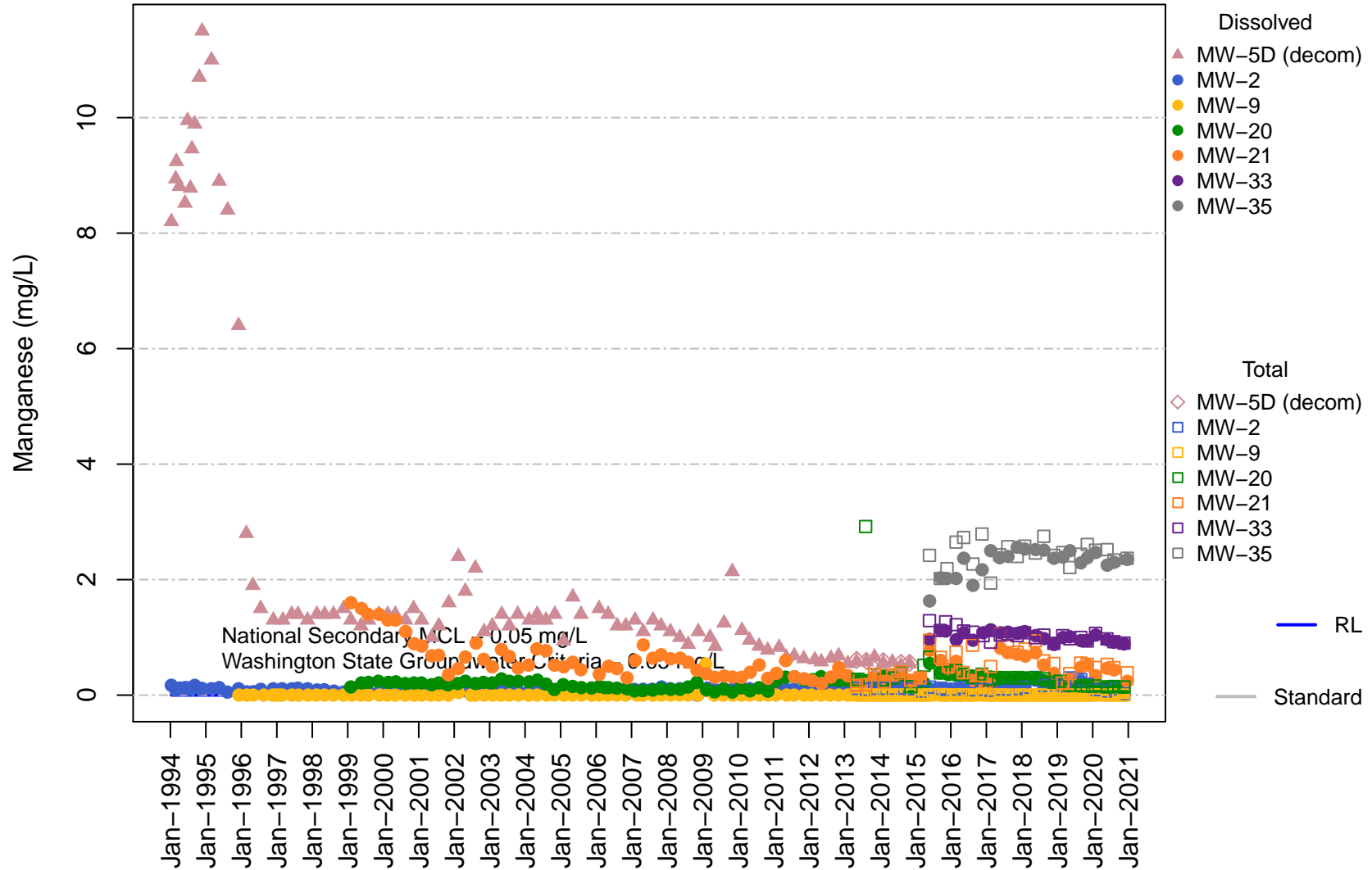


# Vashon Island Closed Landfill Channel Cc2 Magnesium

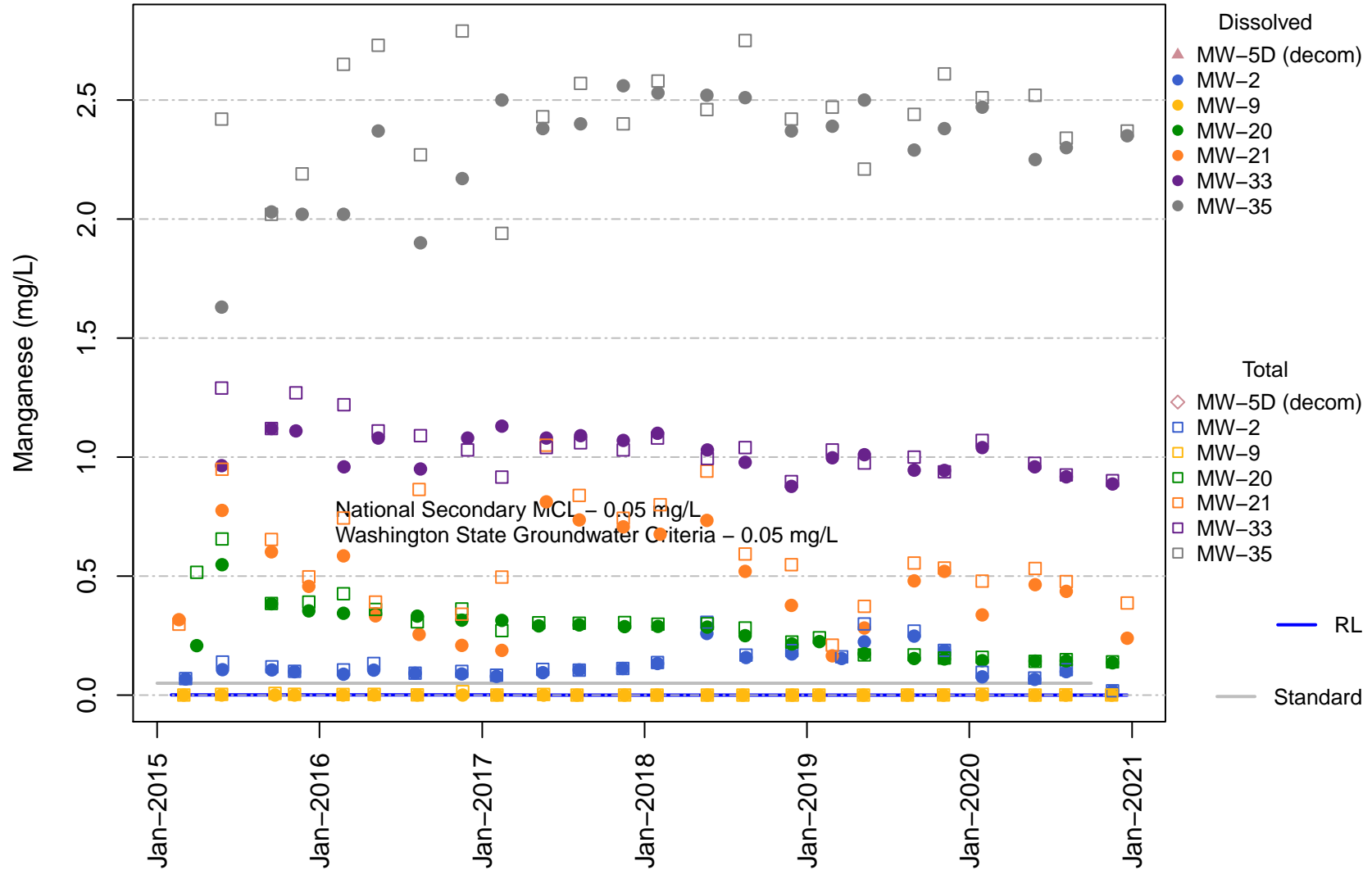




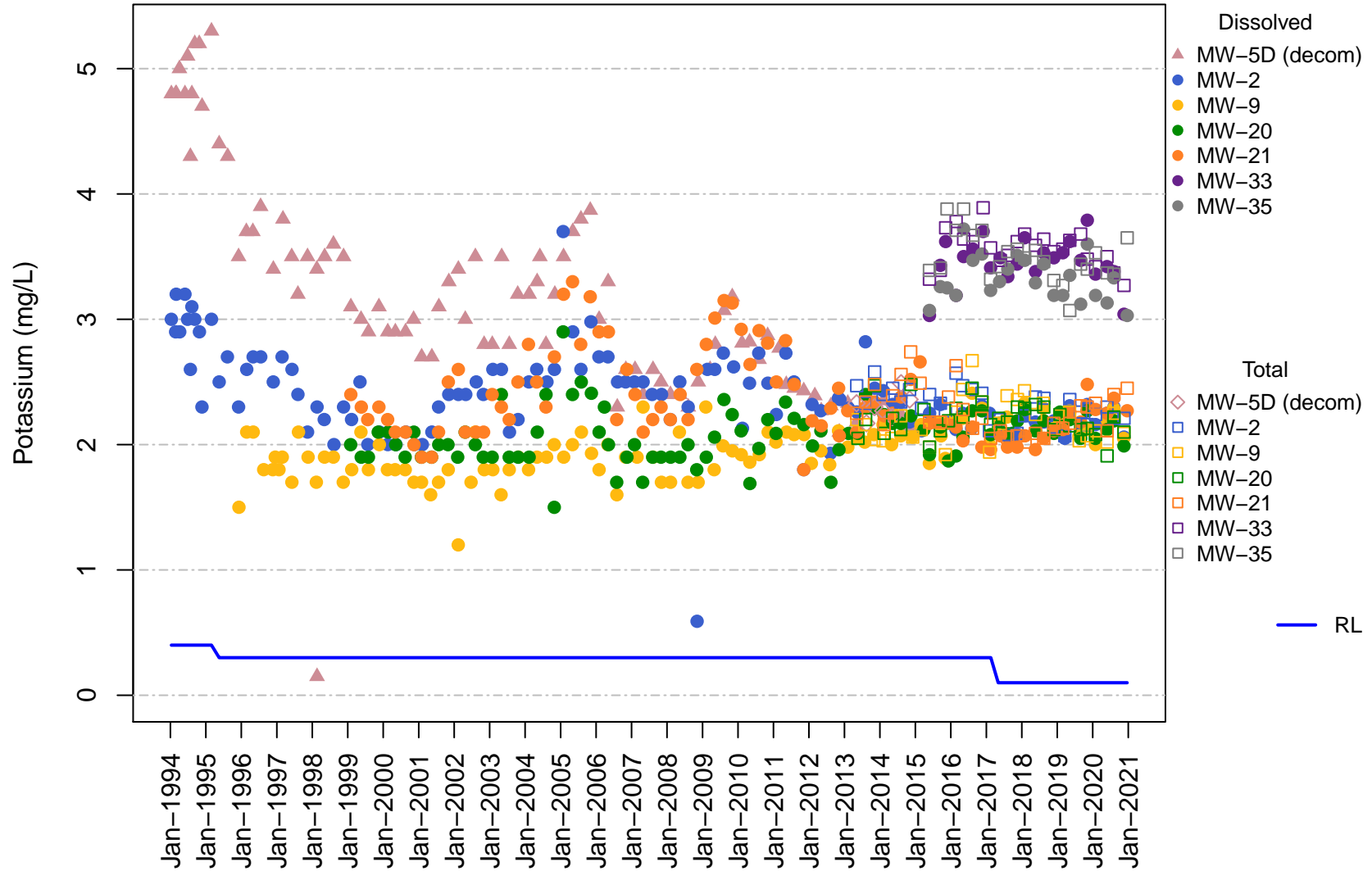
# Vashon Island Closed Landfill Channel Cc2 Manganese



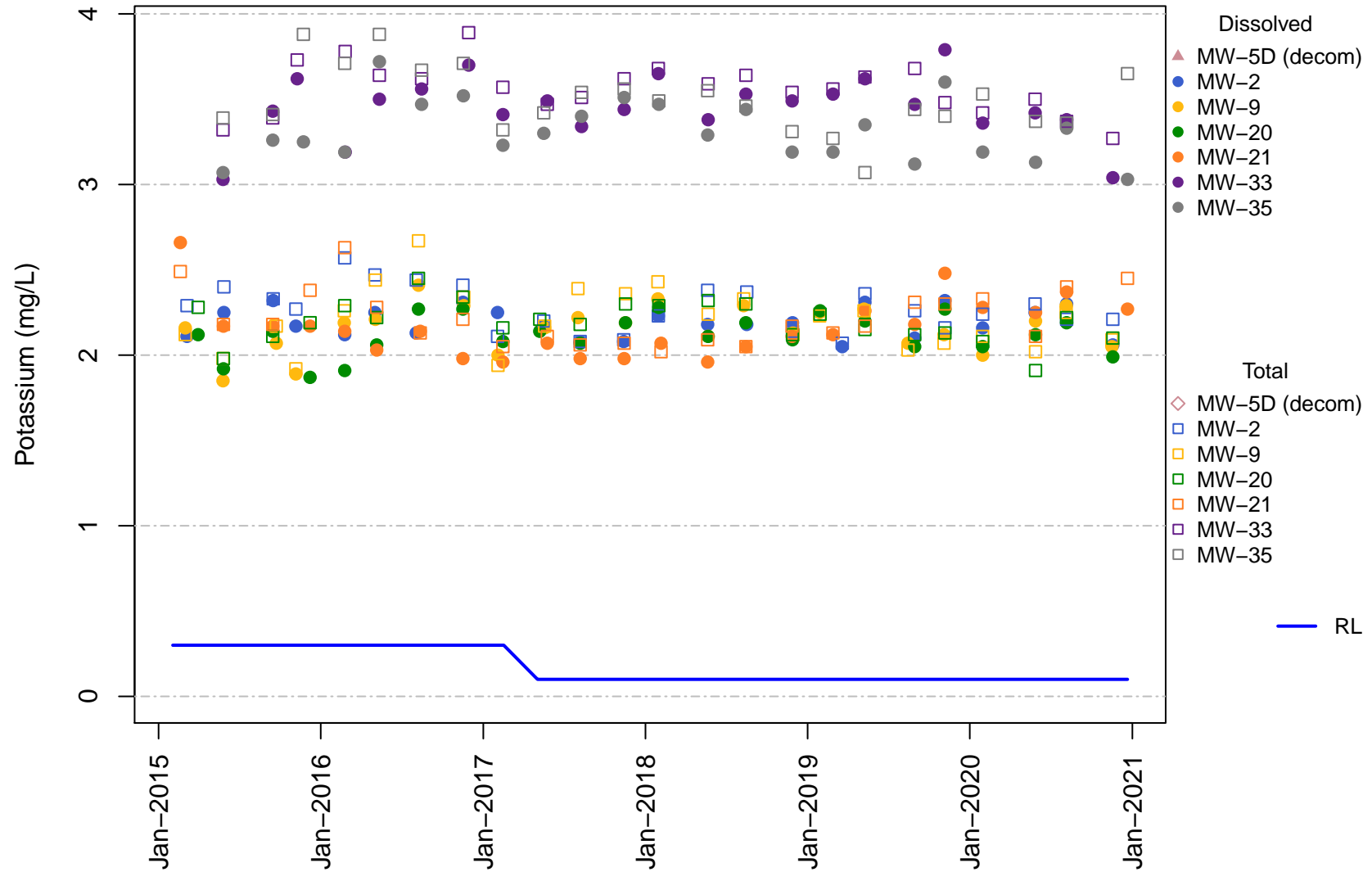
# Vashon Island Closed Landfill Channel Cc2 Manganese



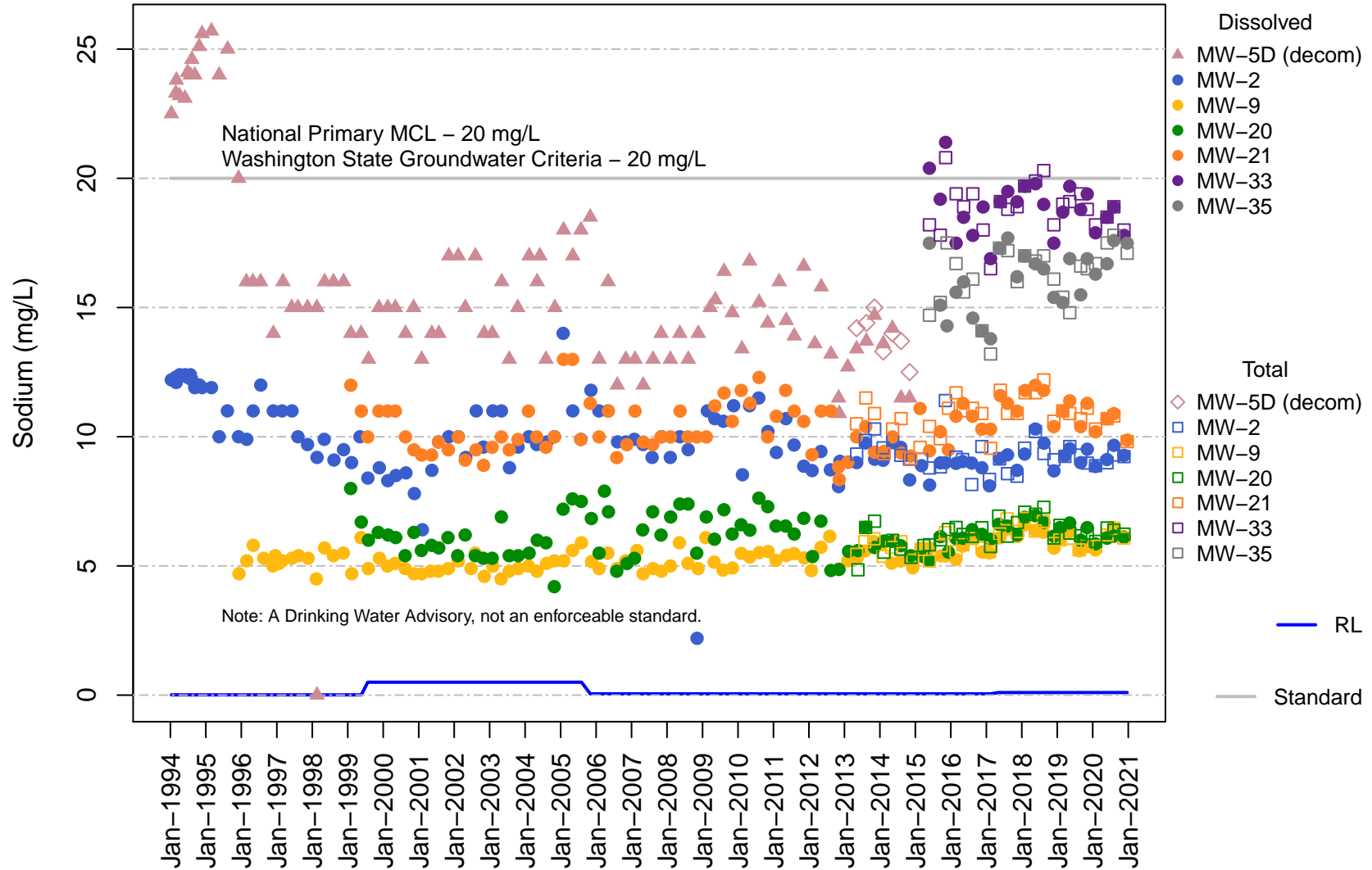
# Vashon Island Closed Landfill Channel Cc2 Potassium



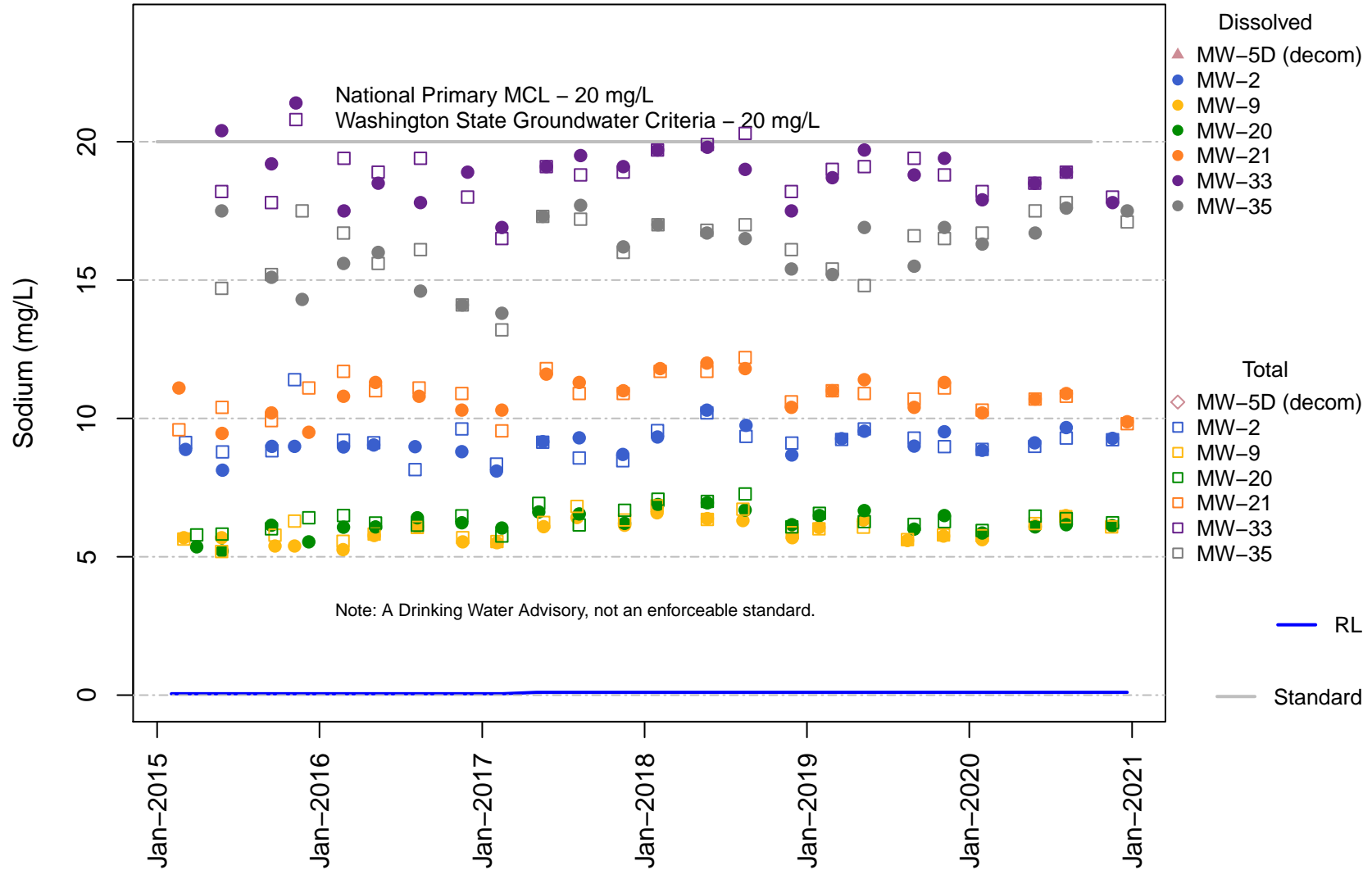
# Vashon Island Closed Landfill Channel Cc2 Potassium



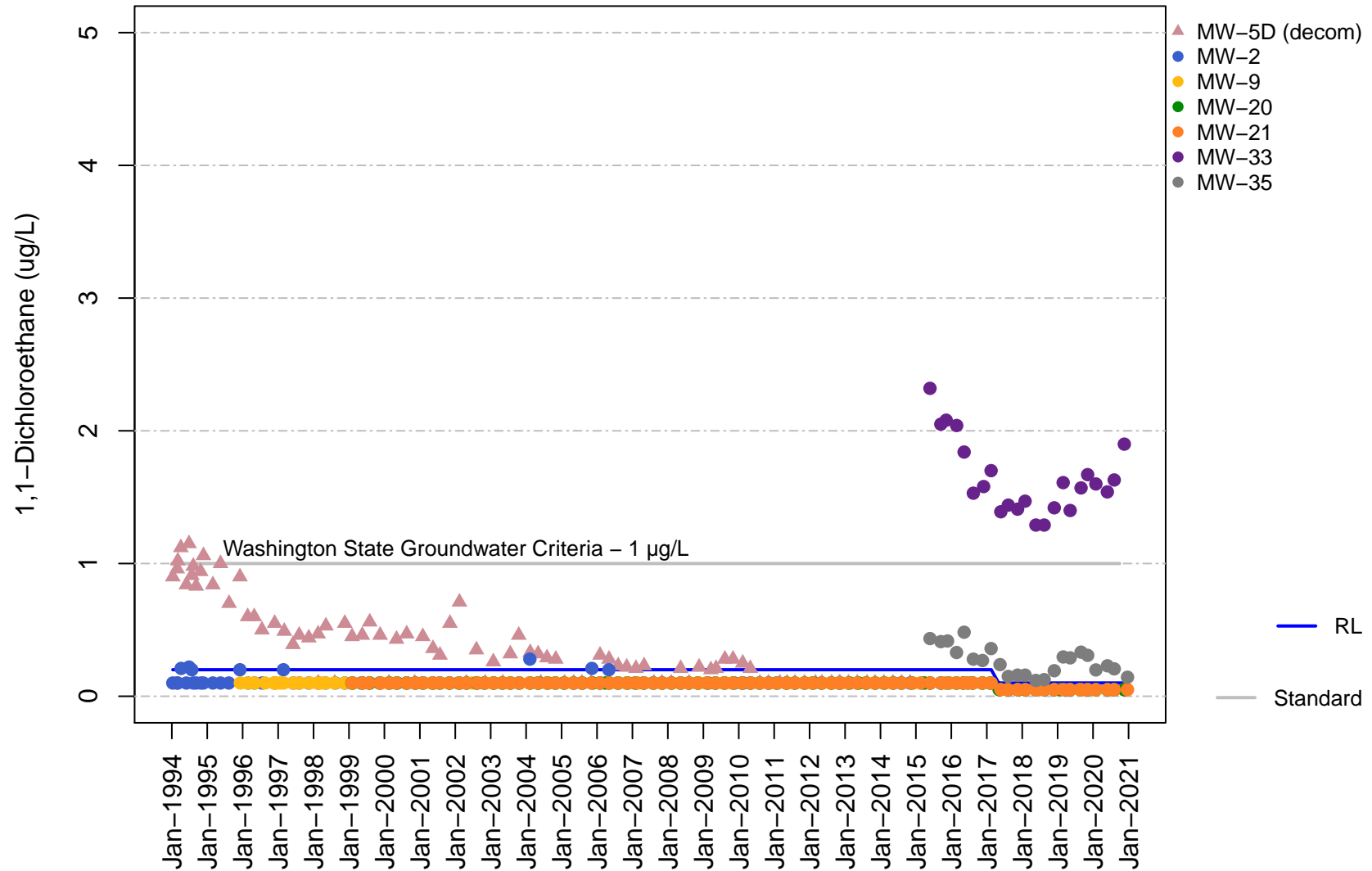
# Vashon Island Closed Landfill Channel Cc2 Sodium



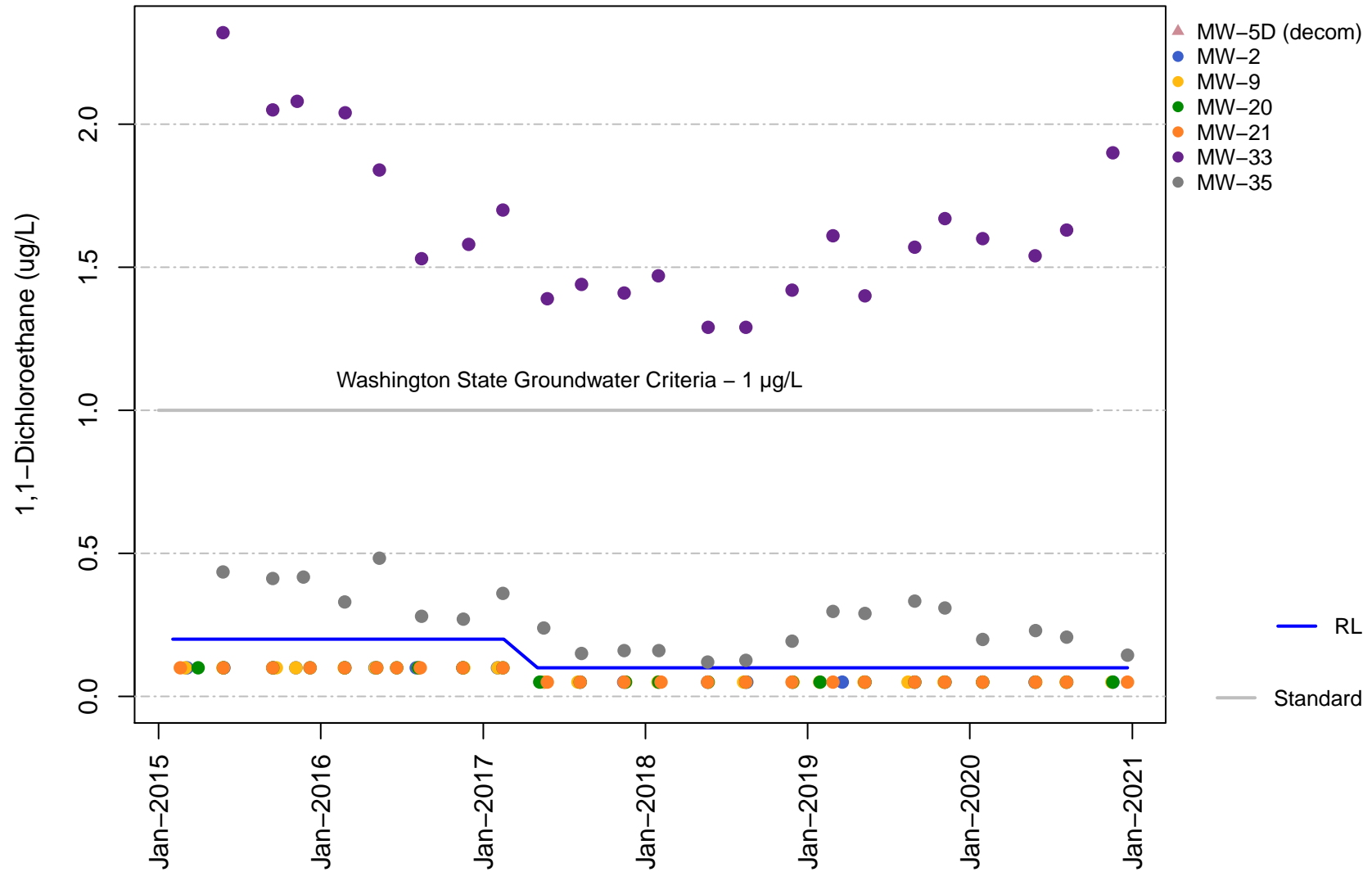
# Vashon Island Closed Landfill Channel Cc2 Sodium



**Vashon Island Closed Landfill  
Channel Cc2  
1,1-Dichloroethane**

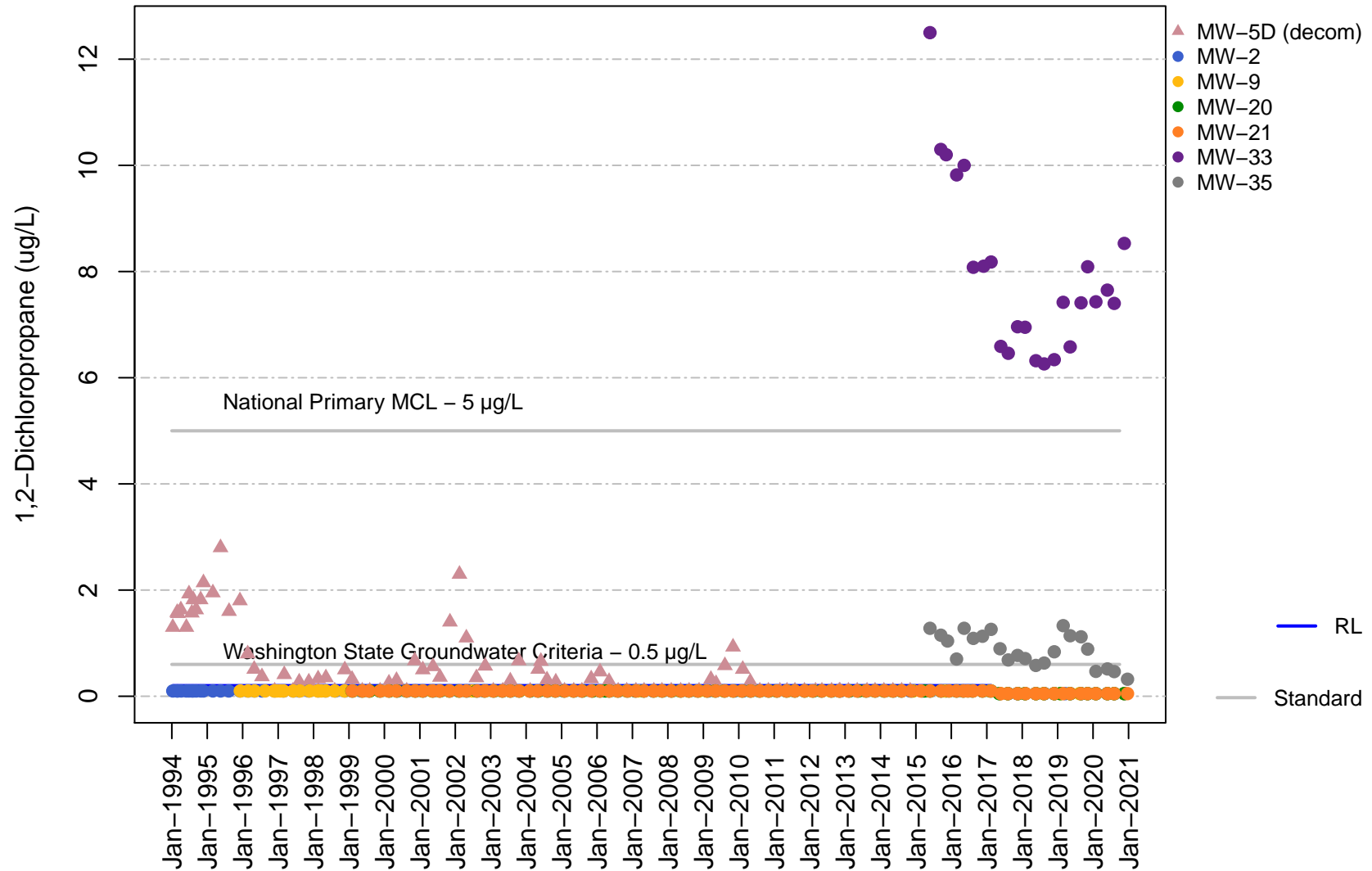


Vashon Island Closed Landfill  
 Channel Cc2  
 1,1-Dichloroethane

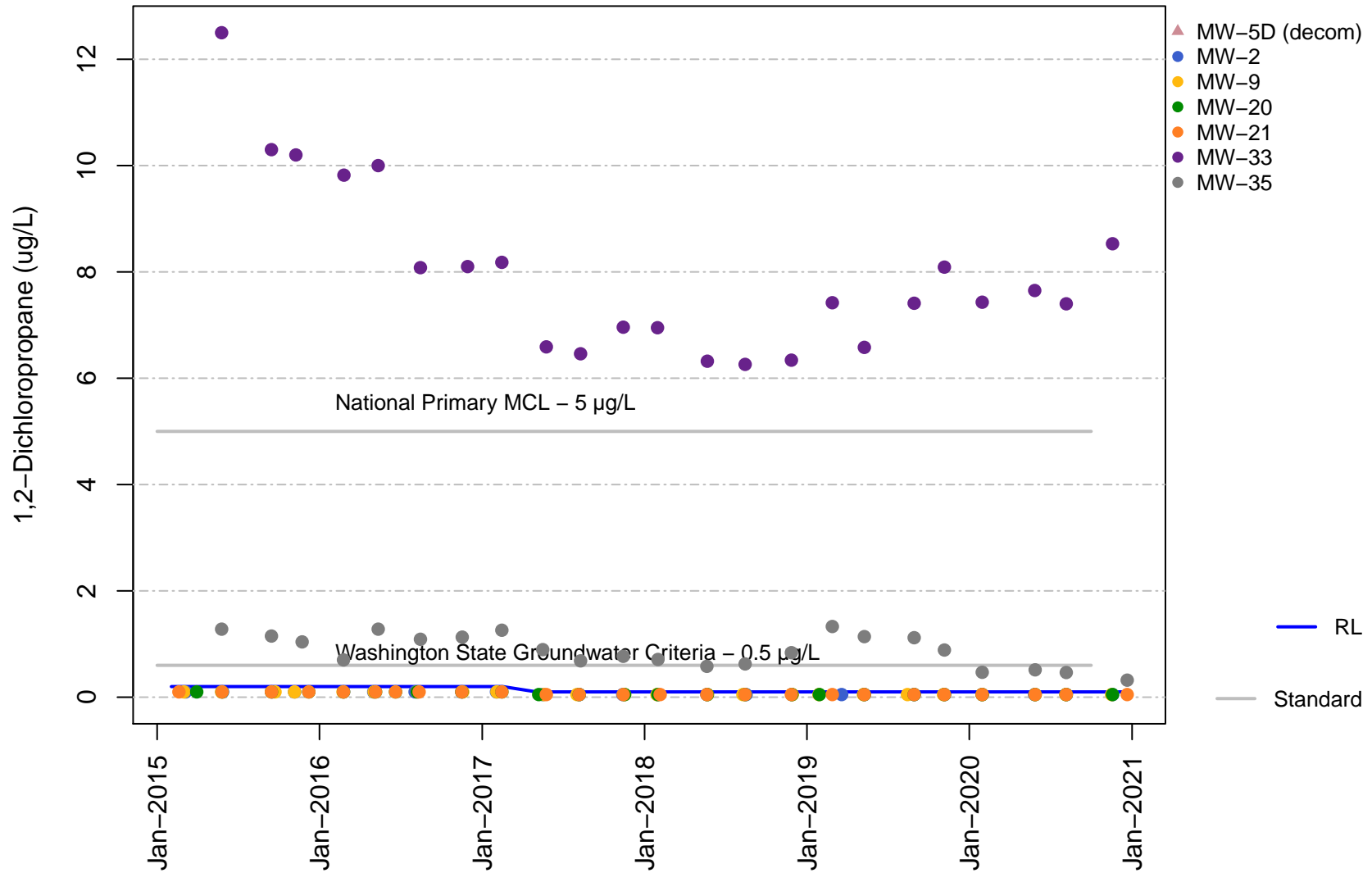




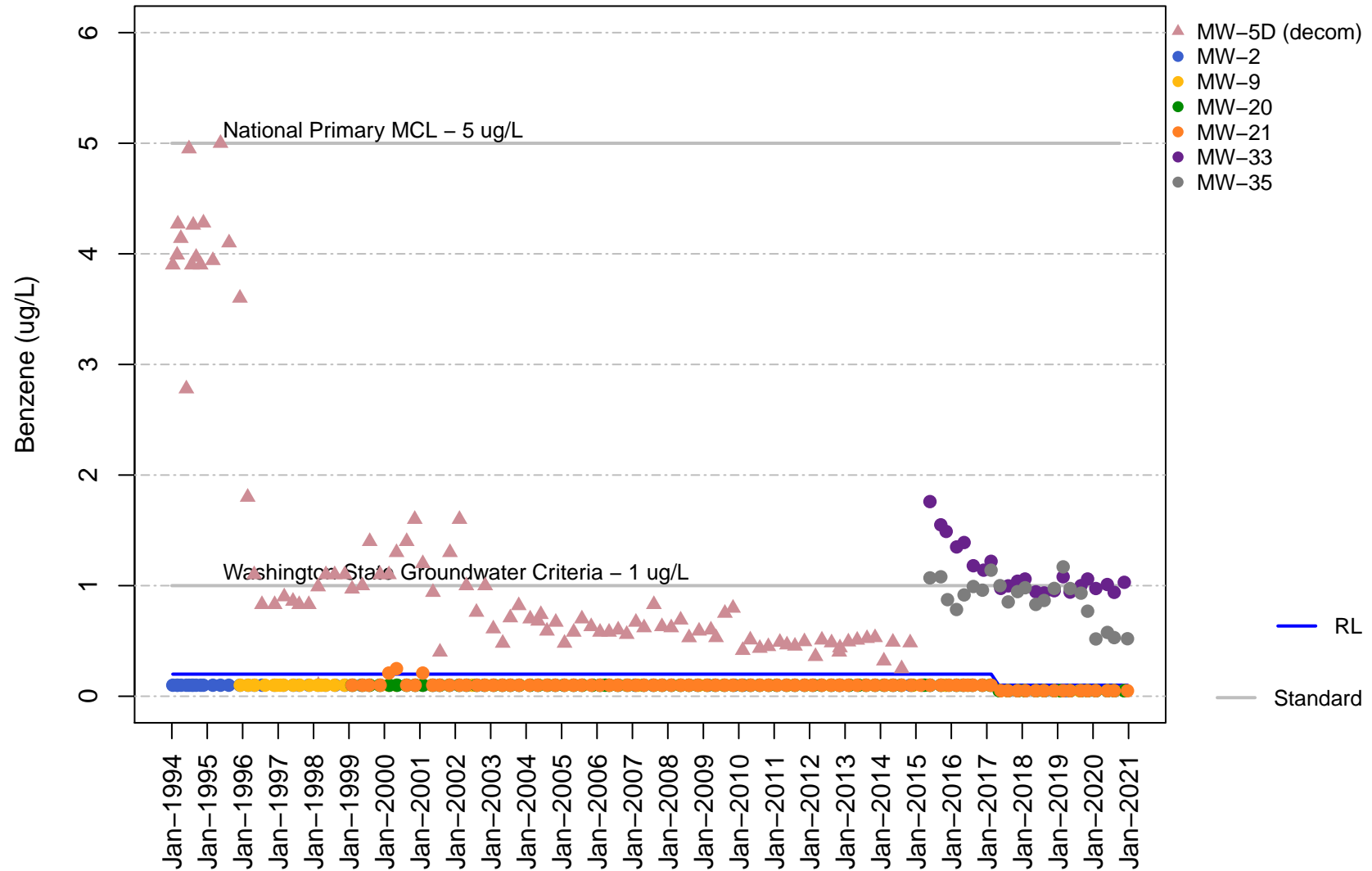
**Vashon Island Closed Landfill  
Channel Cc2  
1,2-Dichloropropane**



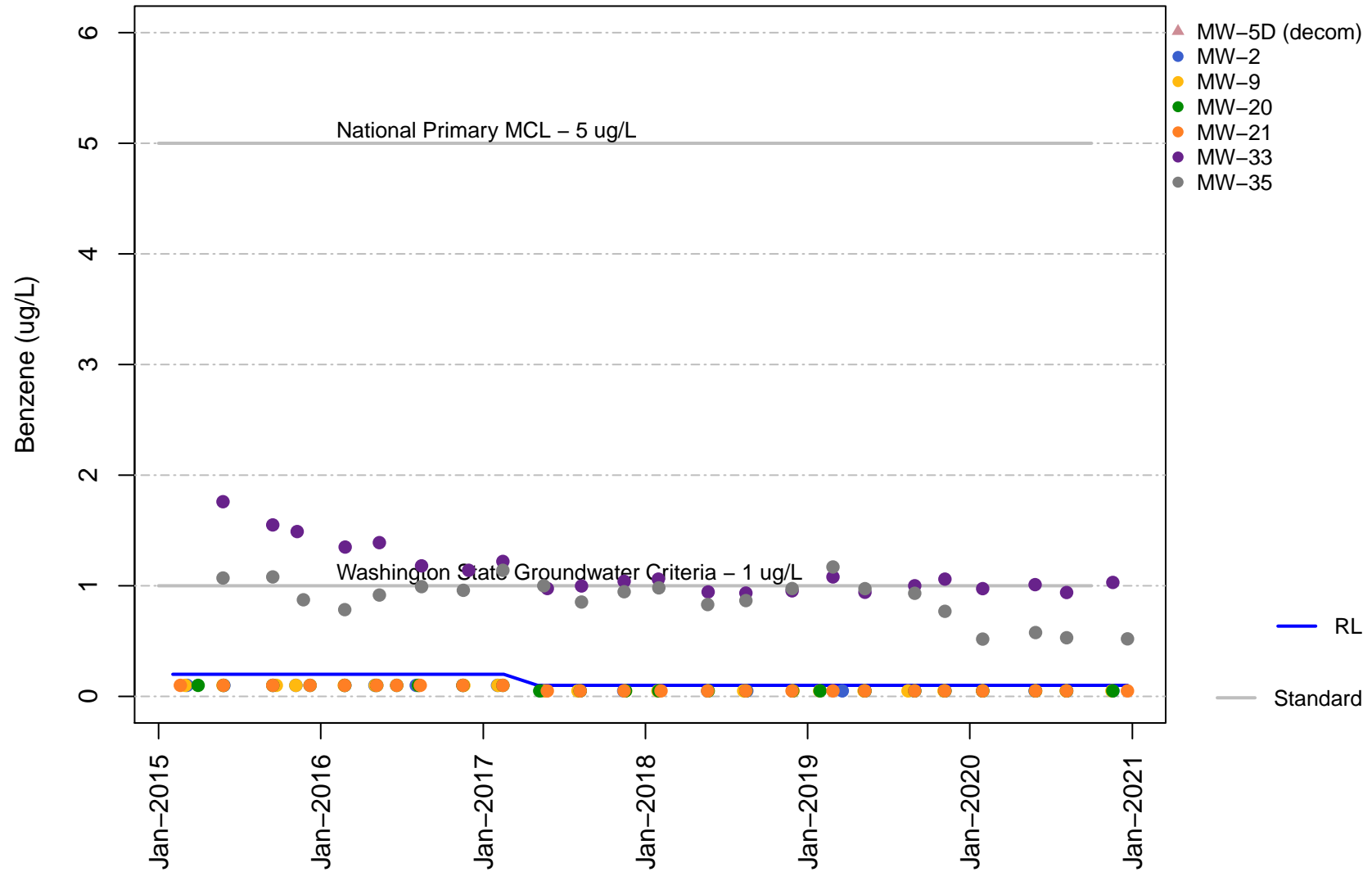
**Vashon Island Closed Landfill  
Channel Cc2  
1,2-Dichloropropane**



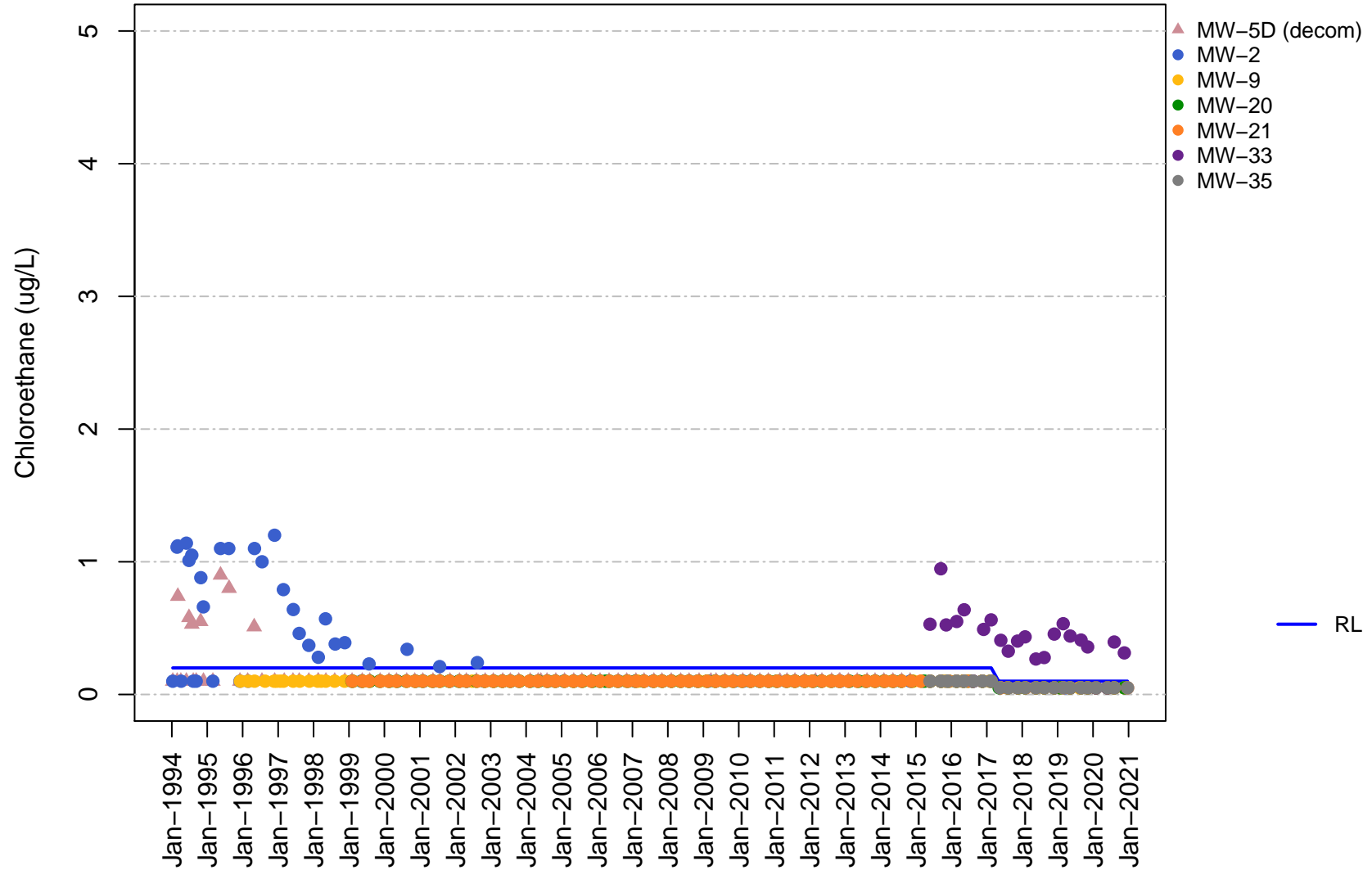
# Vashon Island Closed Landfill Channel Cc2 Benzene



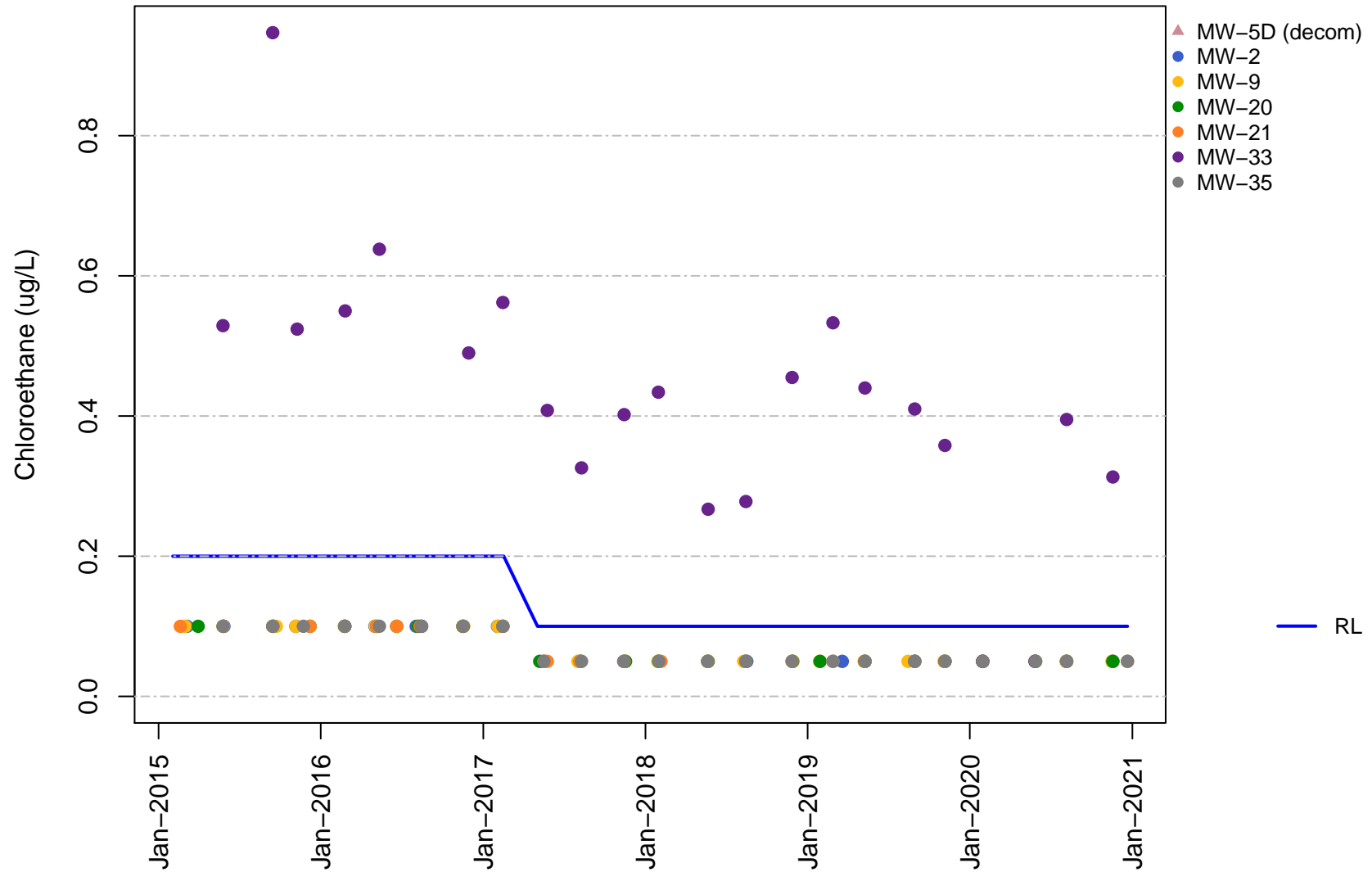
# Vashon Island Closed Landfill Channel Cc2 Benzene



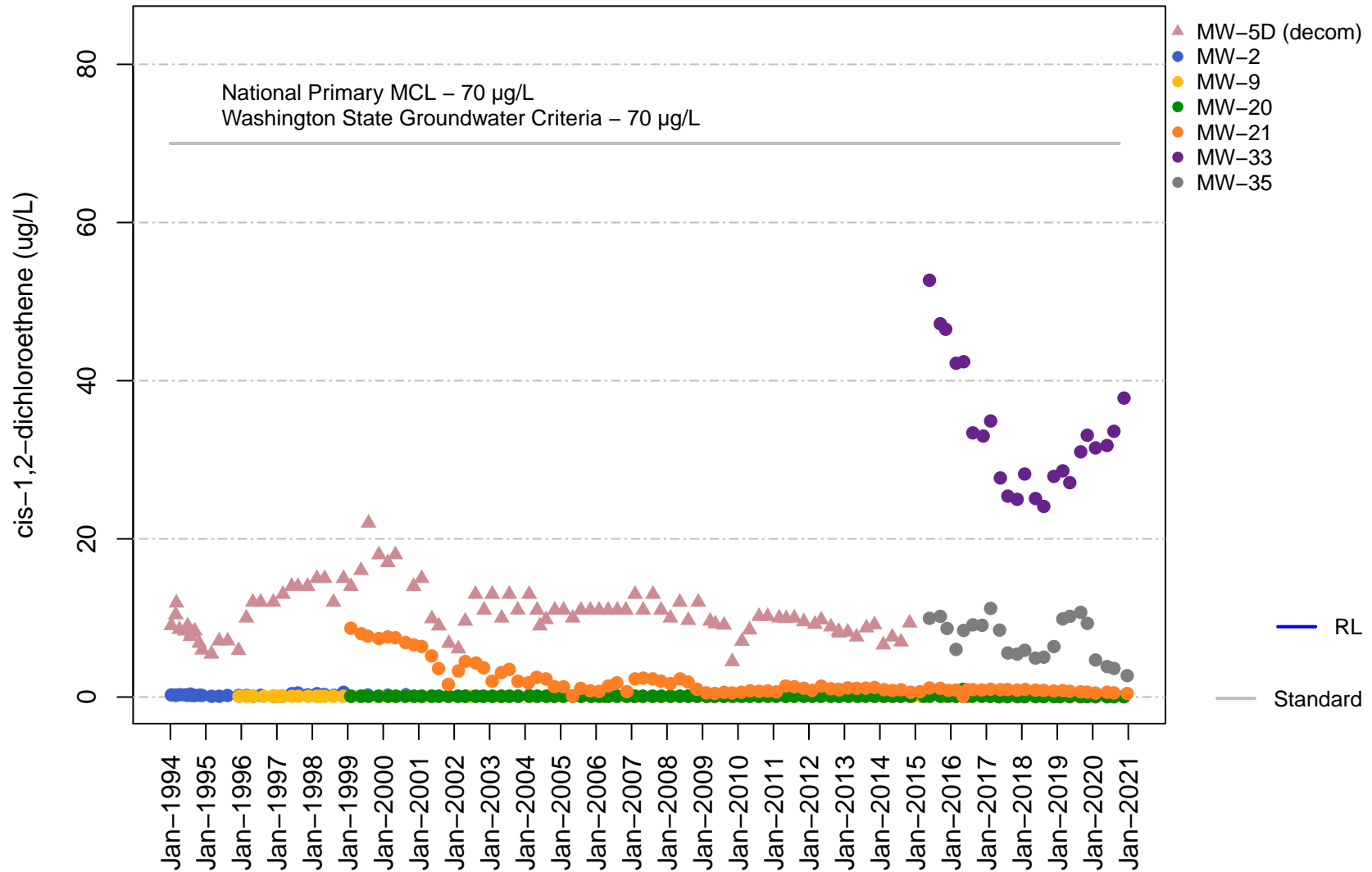
Vashon Island Closed Landfill  
 Channel Cc2  
 Chloroethane



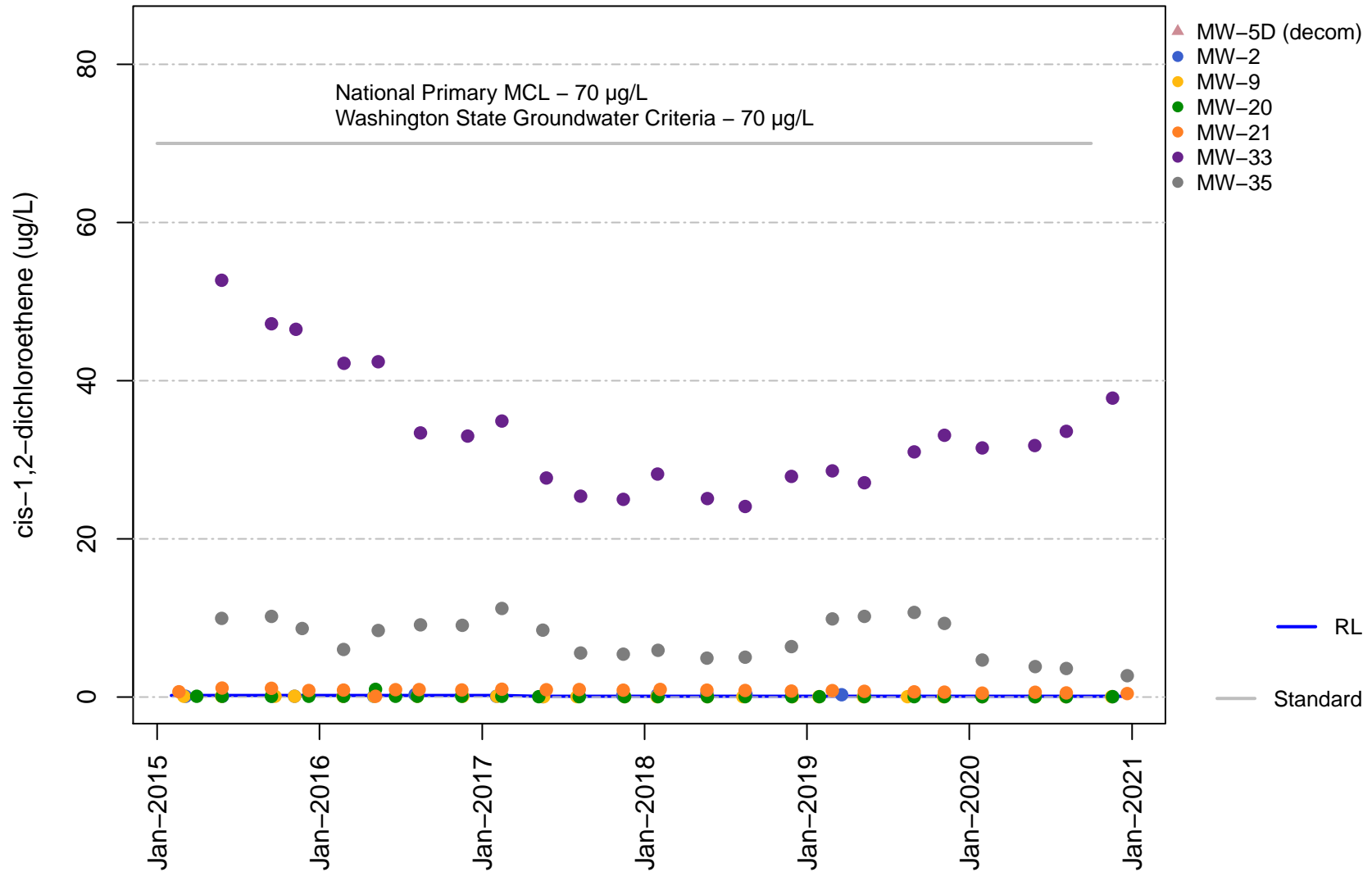
Vashon Island Closed Landfill  
 Channel Cc2  
 Chloroethane



**Vashon Island Closed Landfill  
Channel Cc2  
cis-1,2-Dichloroethene**

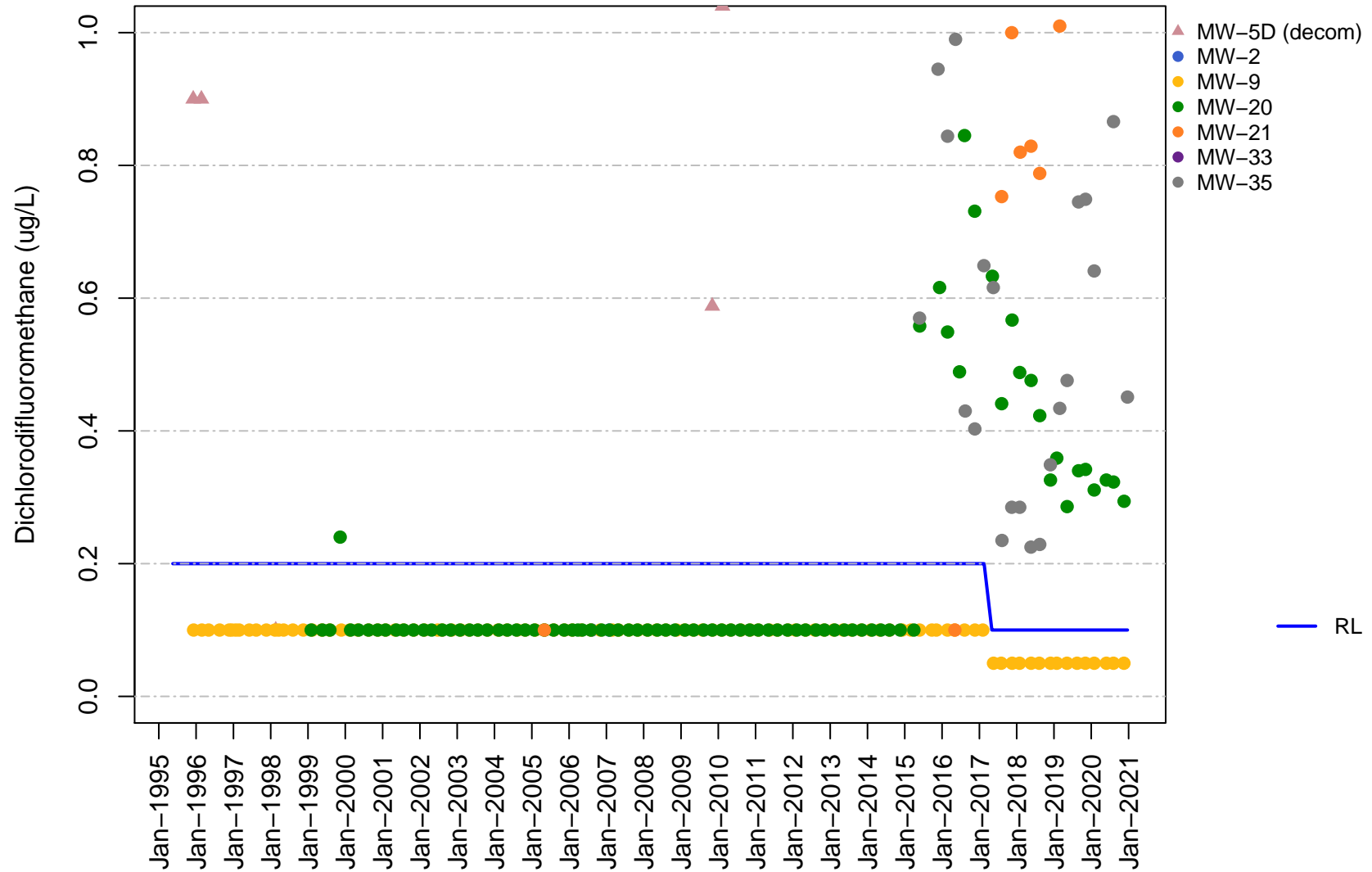


**Vashon Island Closed Landfill  
Channel Cc2  
cis-1,2-Dichloroethene**

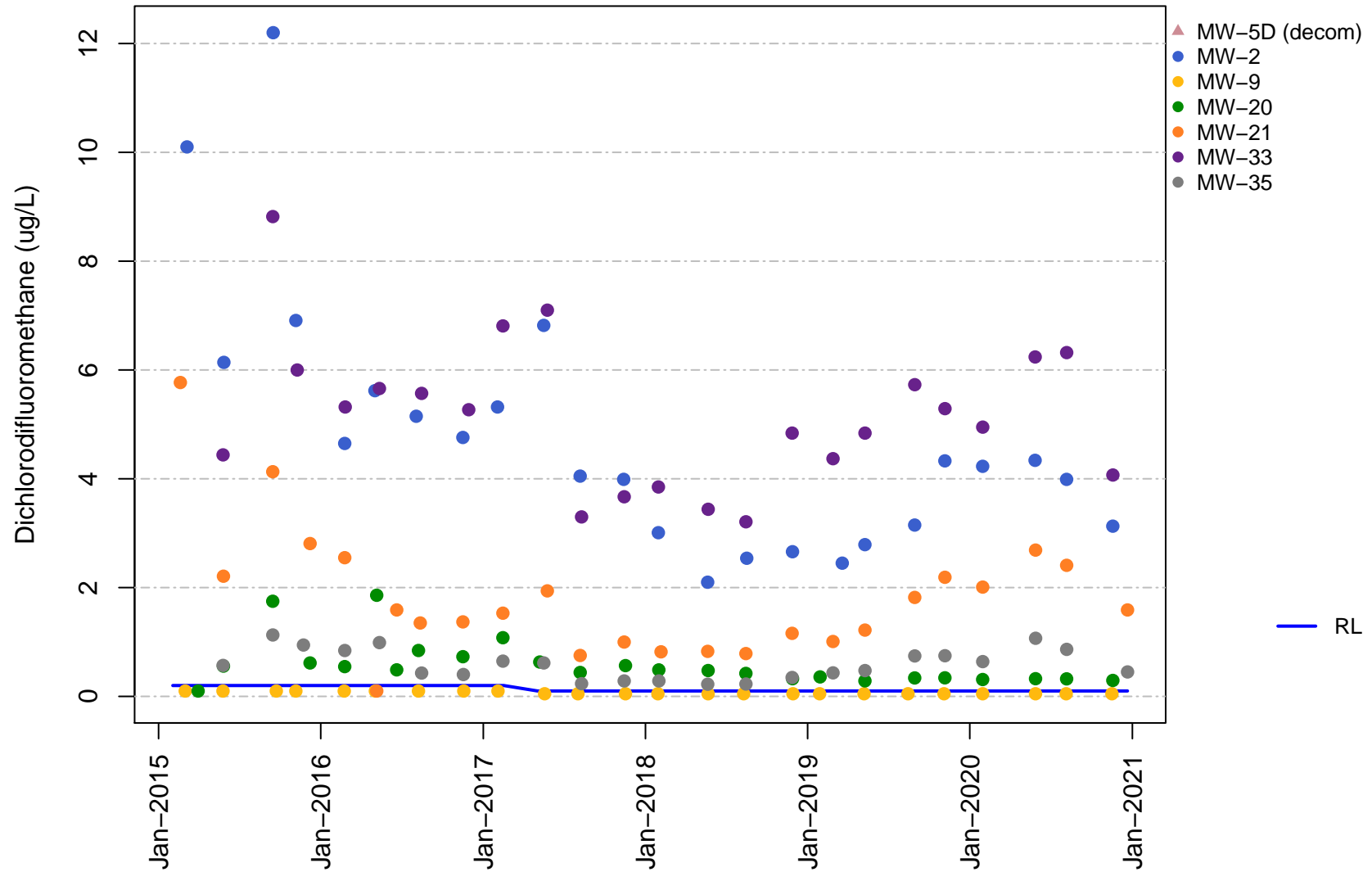




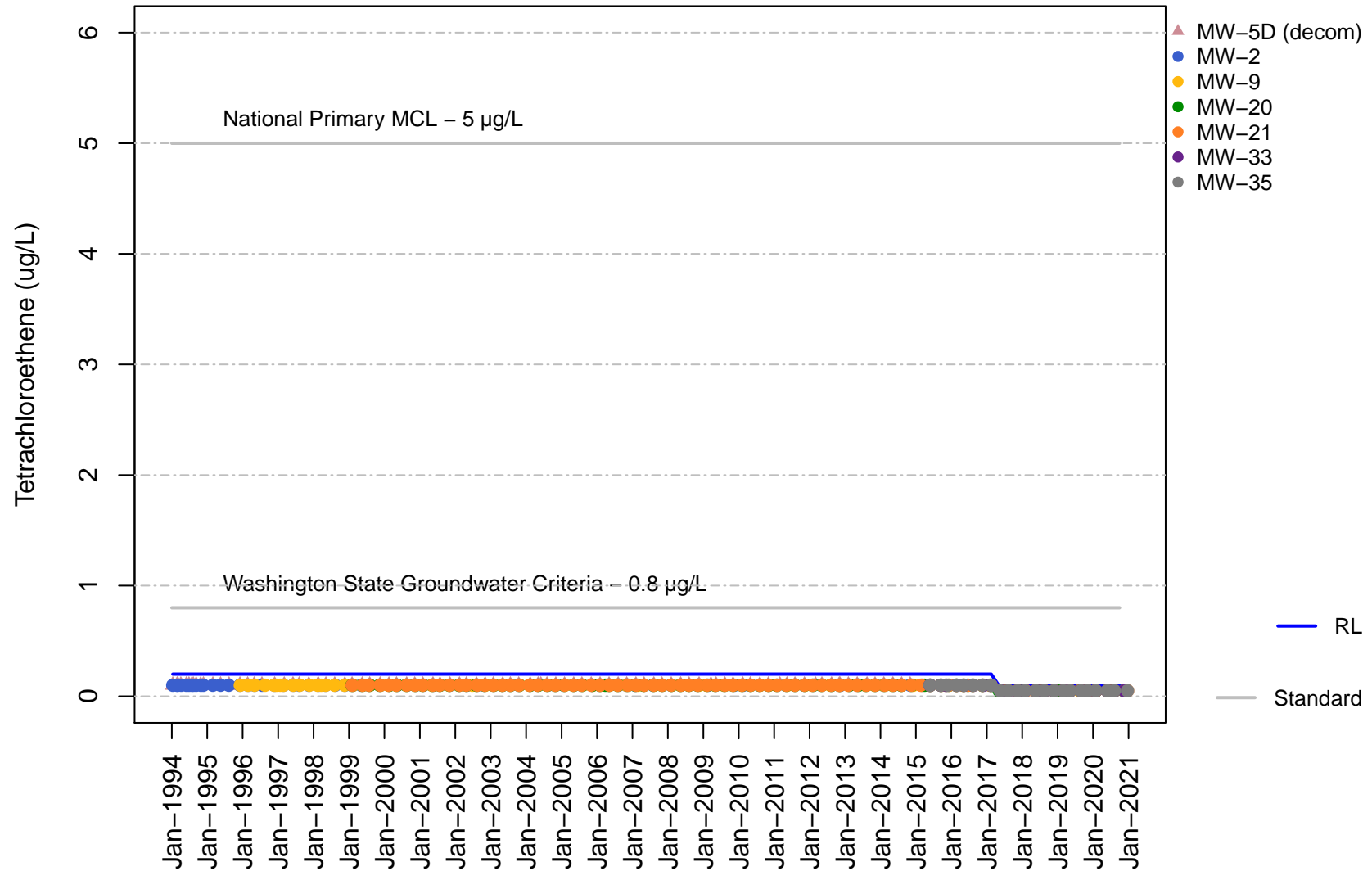
Vashon Island Closed Landfill  
 Channel Cc2  
 Dichlorodifluoromethane



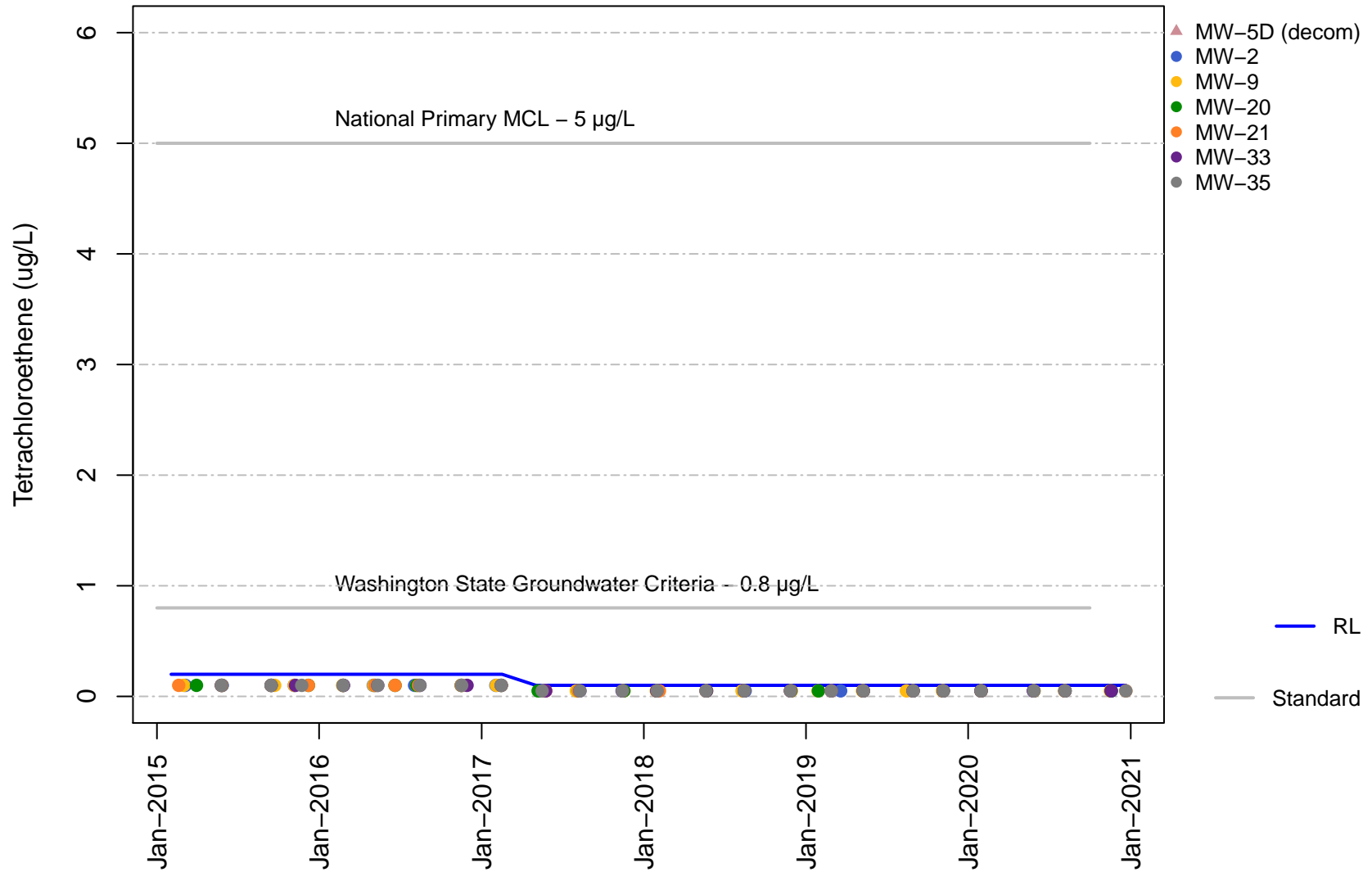
**Vashon Island Closed Landfill  
Channel Cc2  
Dichlorodifluoromethane**



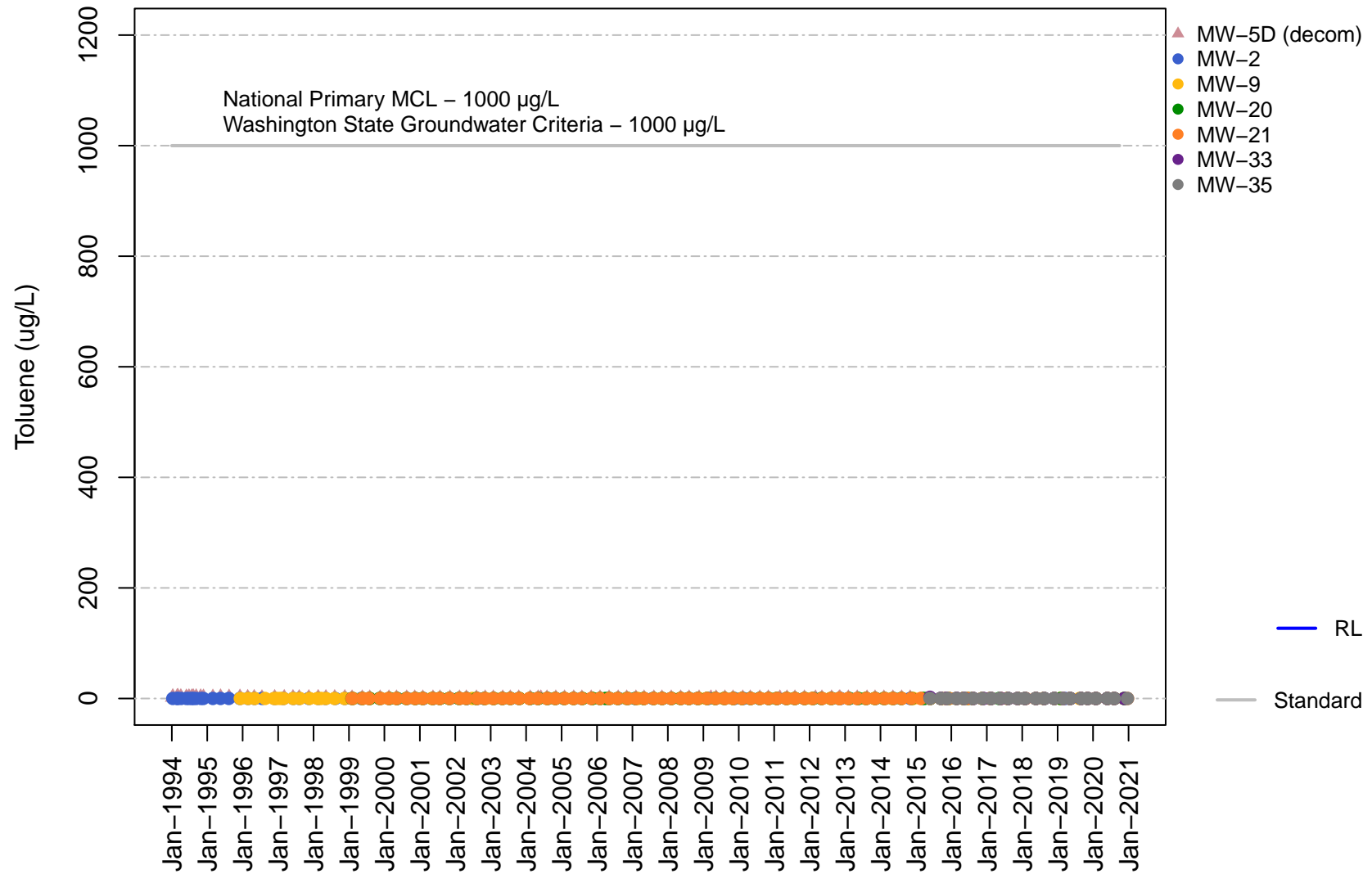
**Vashon Island Closed Landfill  
Channel Cc2  
Tetrachloroethene**



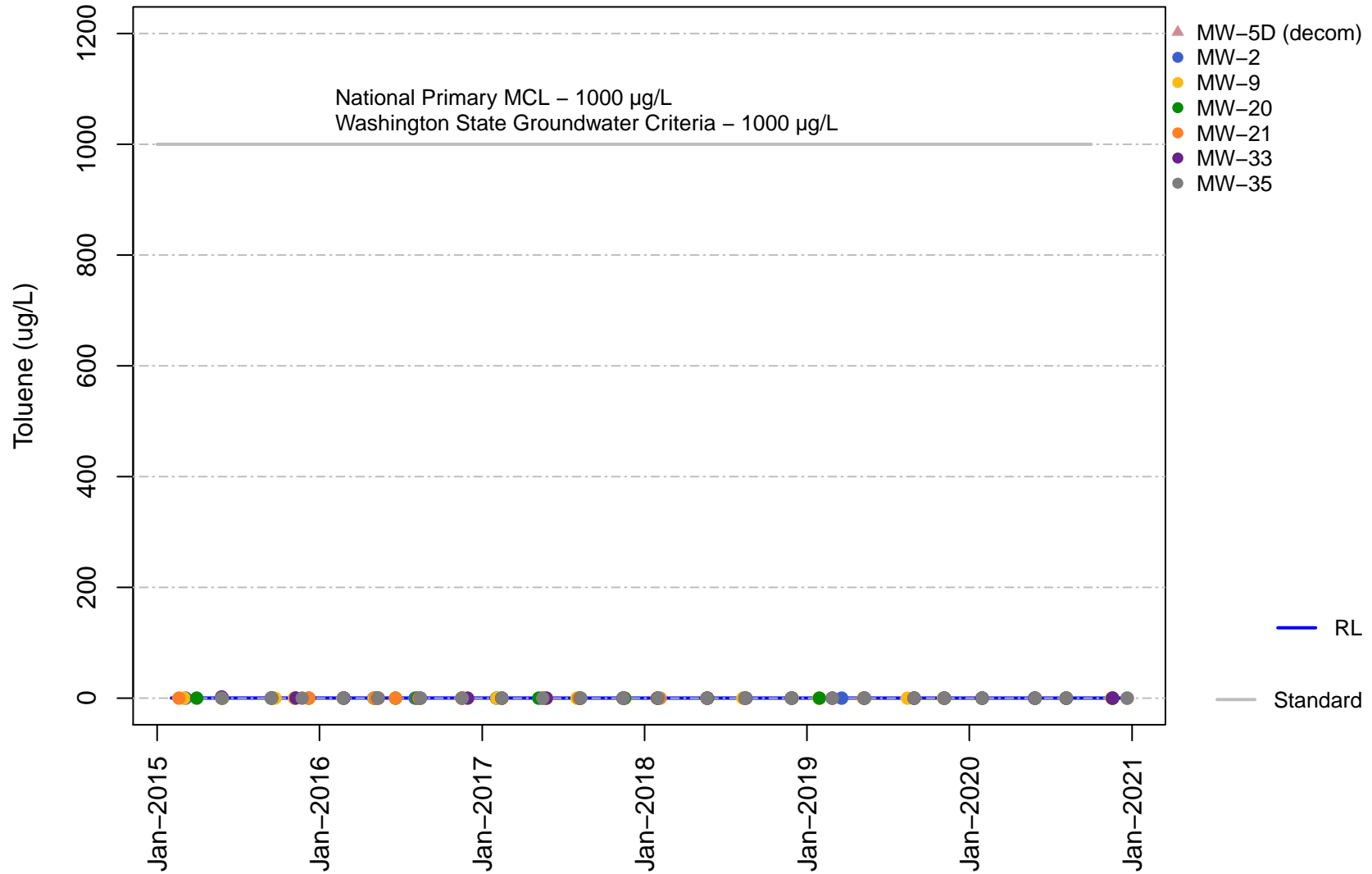
**Vashon Island Closed Landfill  
Channel Cc2  
Tetrachloroethene**



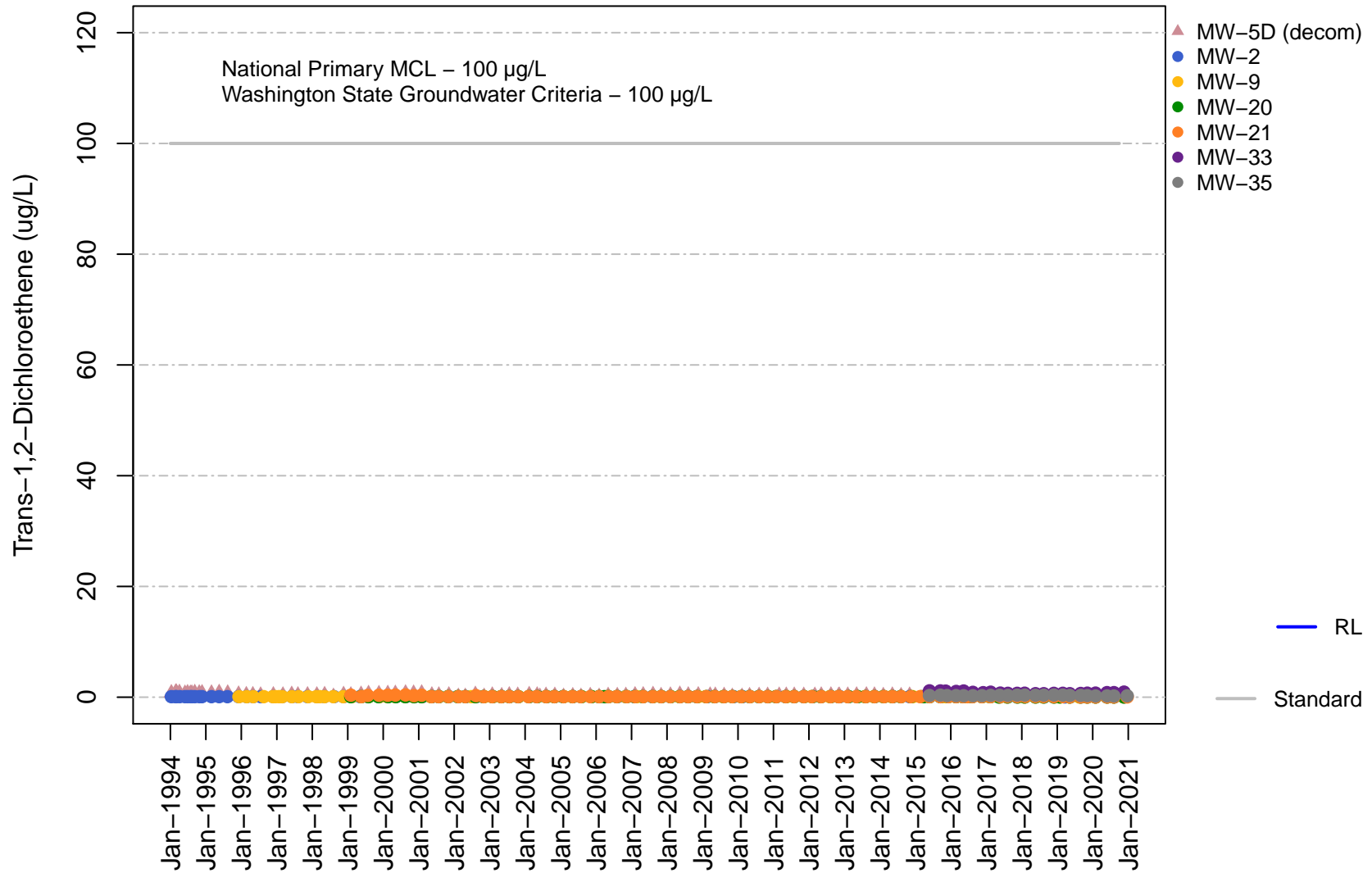
# Vashon Island Closed Landfill Channel Cc2 Toluene



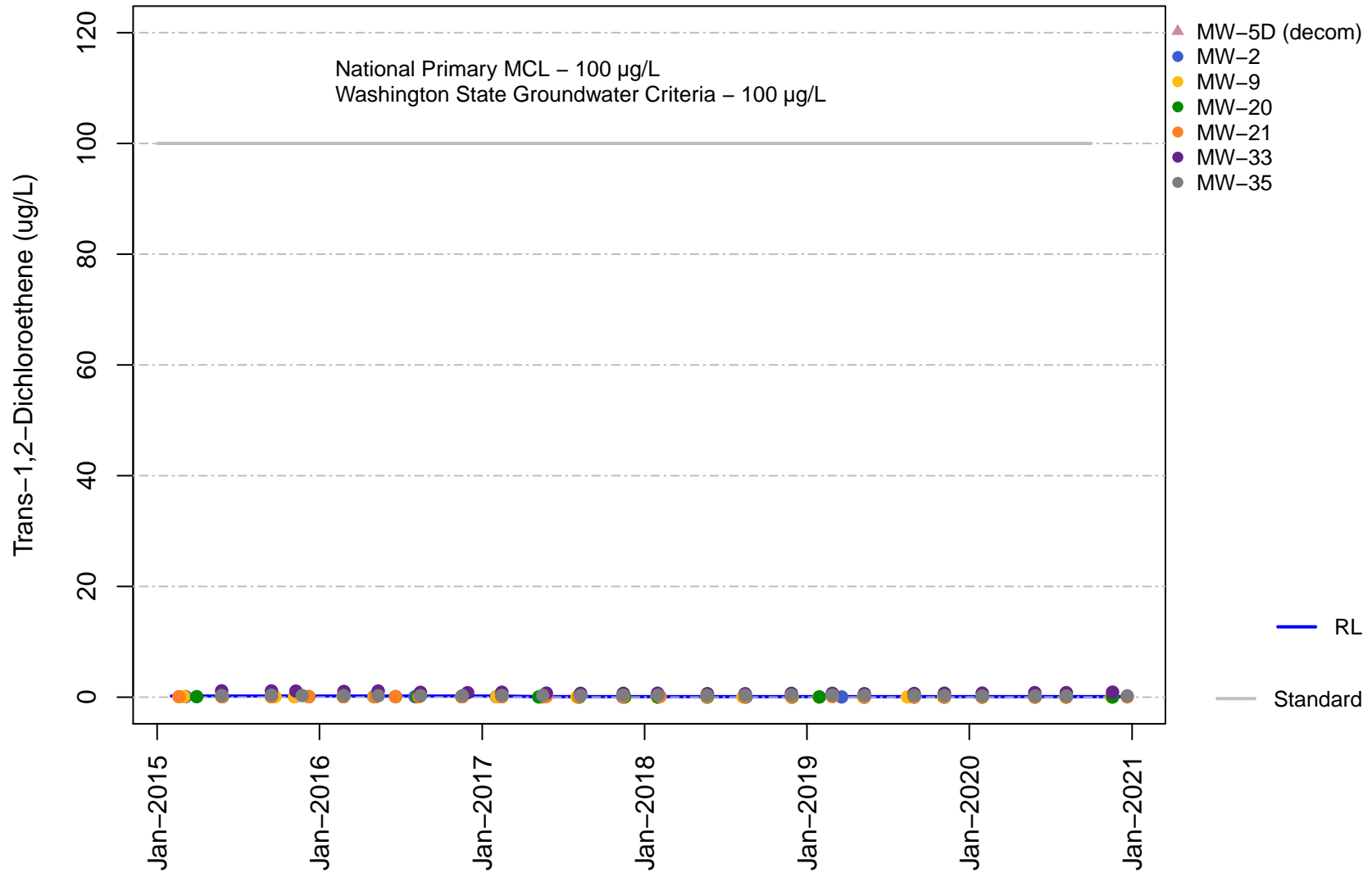
# Vashon Island Closed Landfill Channel Cc2 Toluene



**Vashon Island Closed Landfill  
Channel Cc2  
Trans-1,2-Dichloroethene**

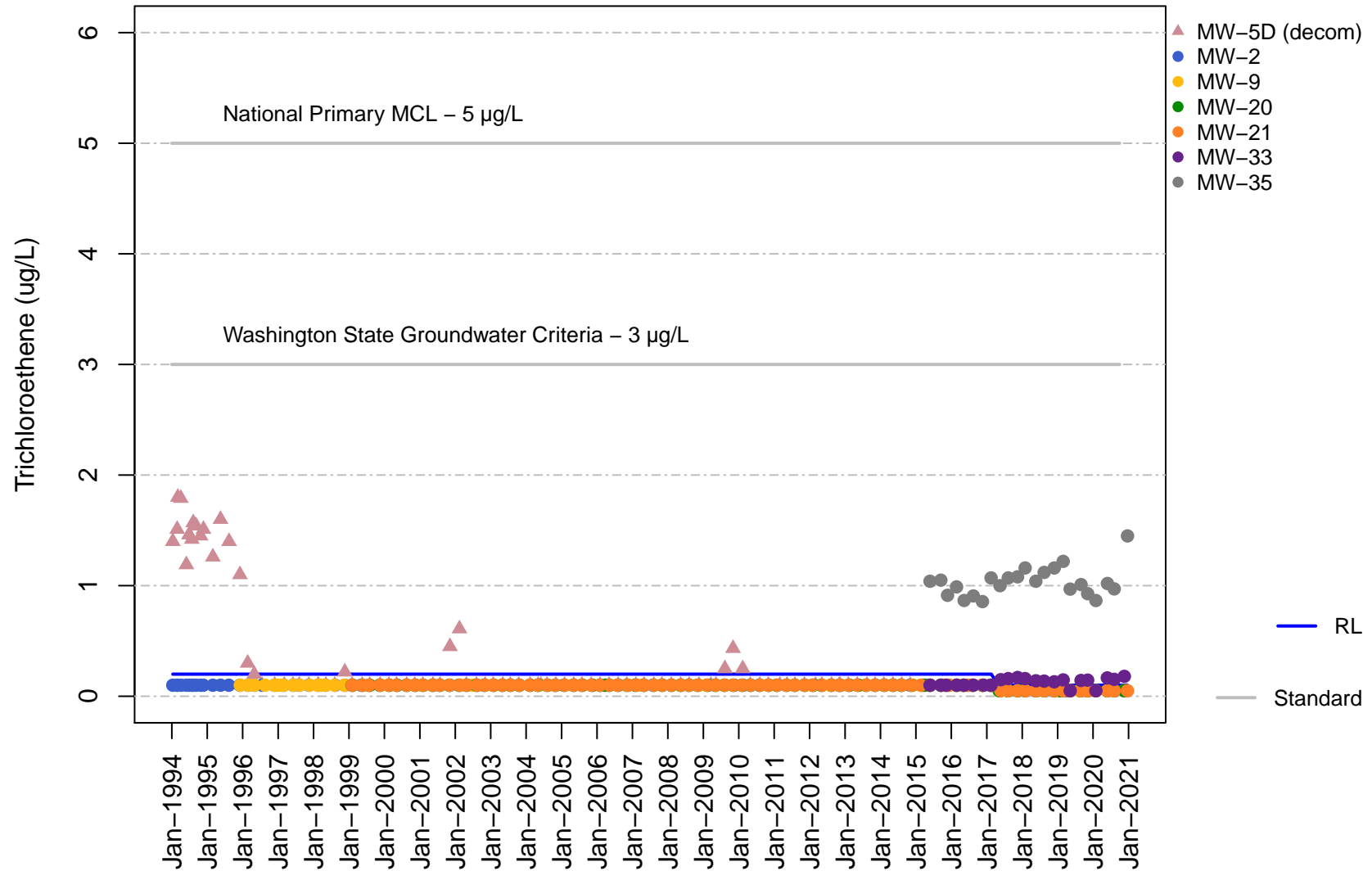


**Vashon Island Closed Landfill  
Channel Cc2  
Trans-1,2-Dichloroethene**

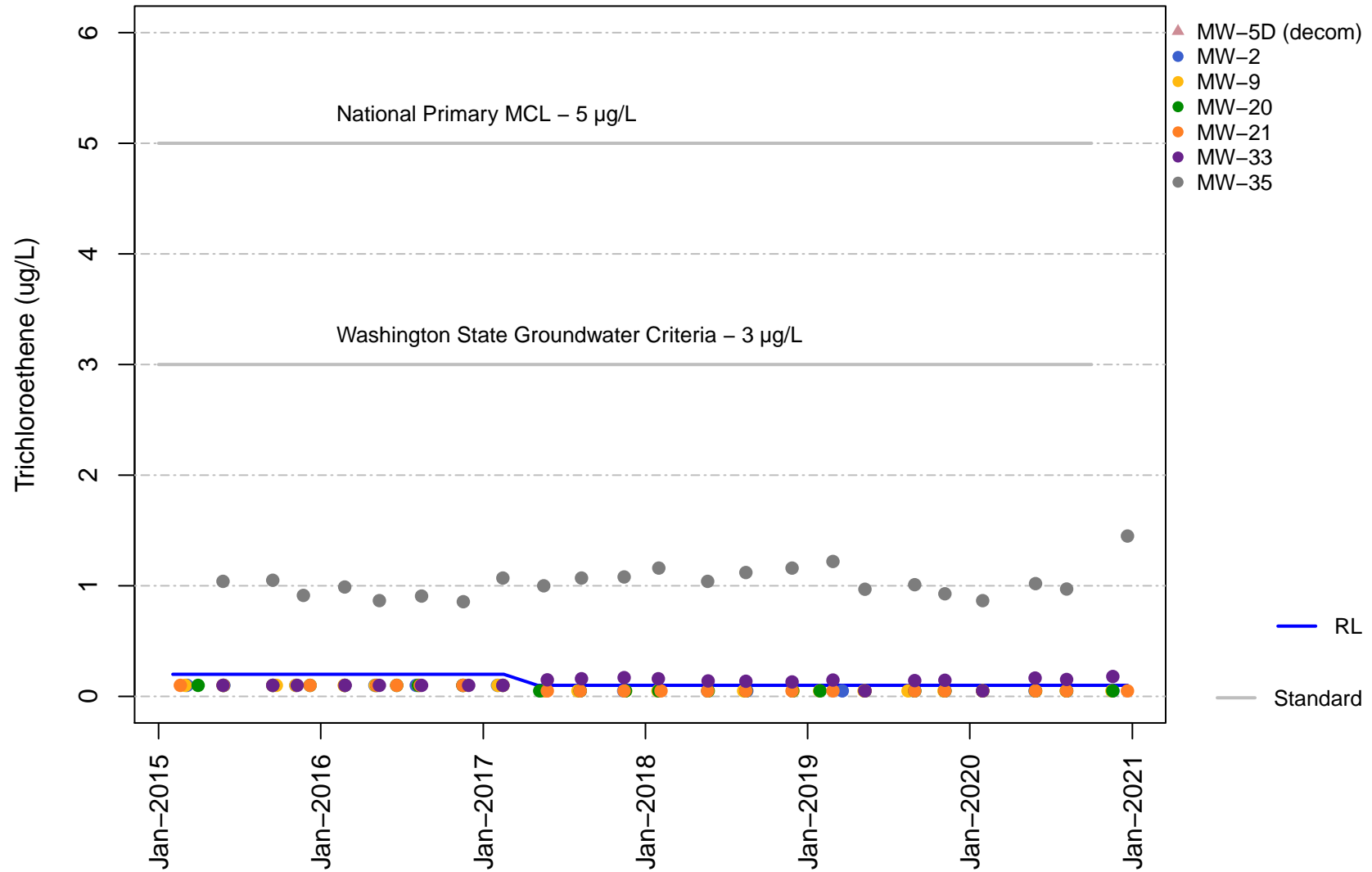




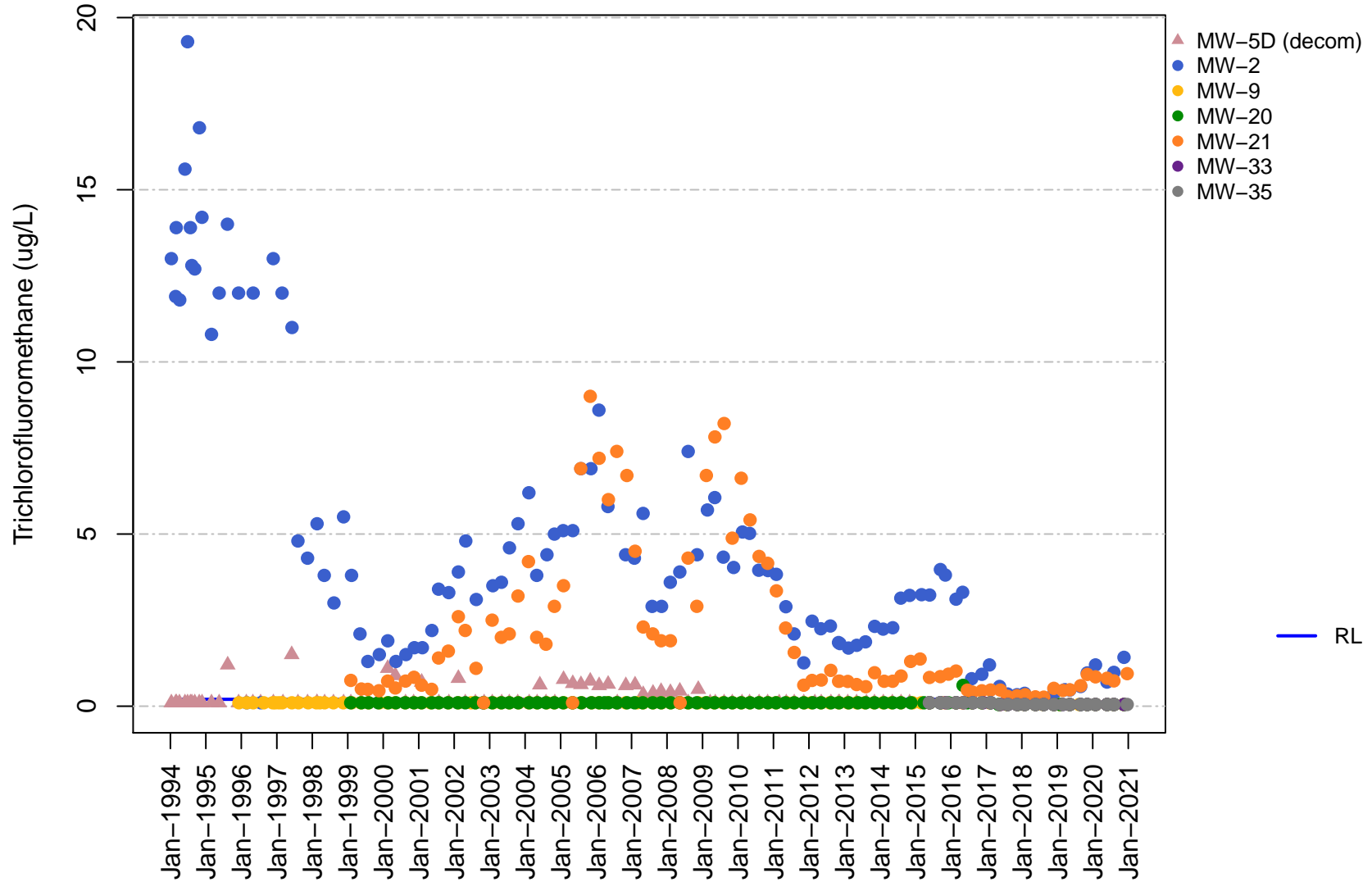
**Vashon Island Closed Landfill  
Channel Cc2  
Trichloroethene**



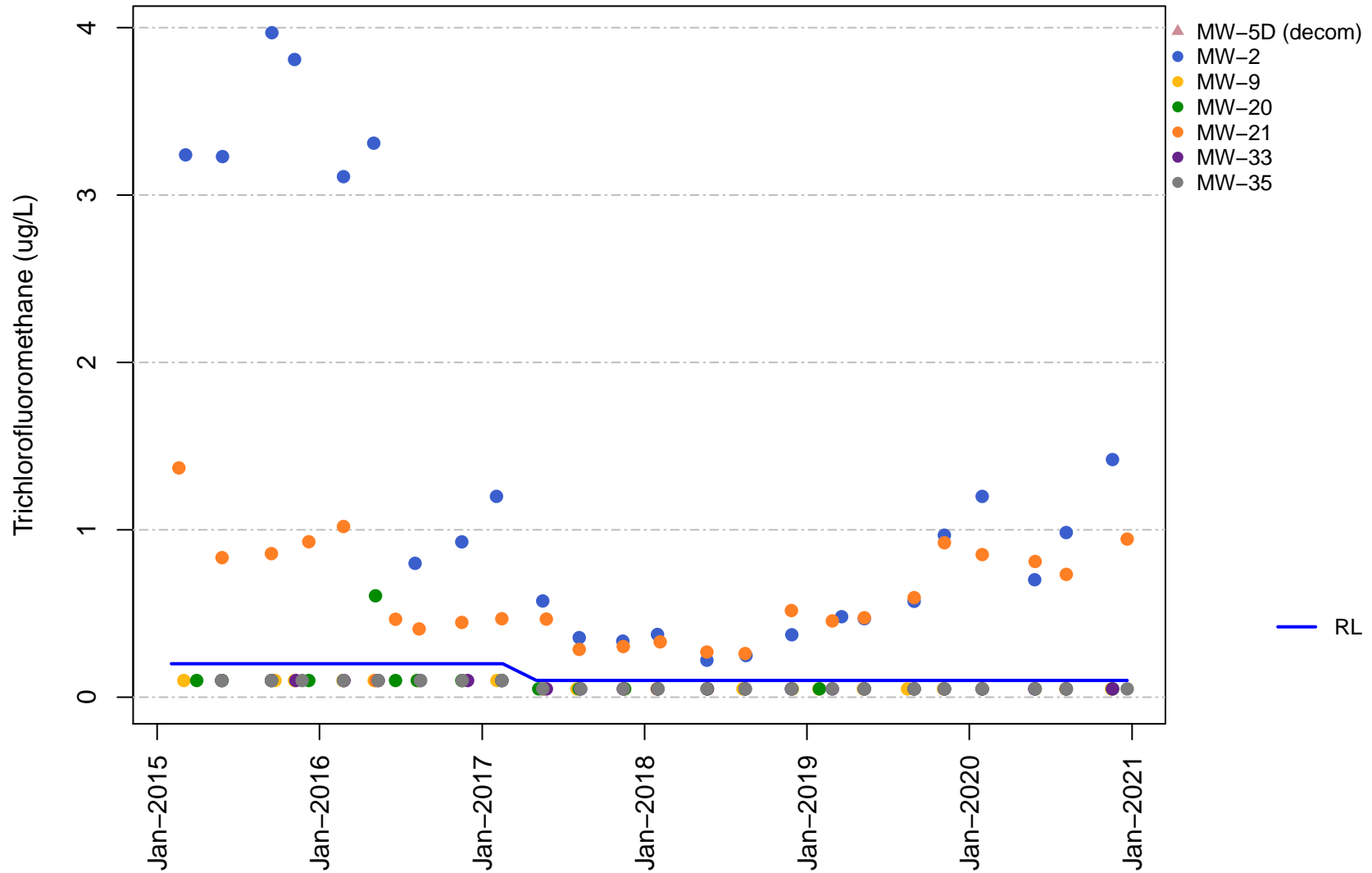
**Vashon Island Closed Landfill  
Channel Cc2  
Trichloroethene**



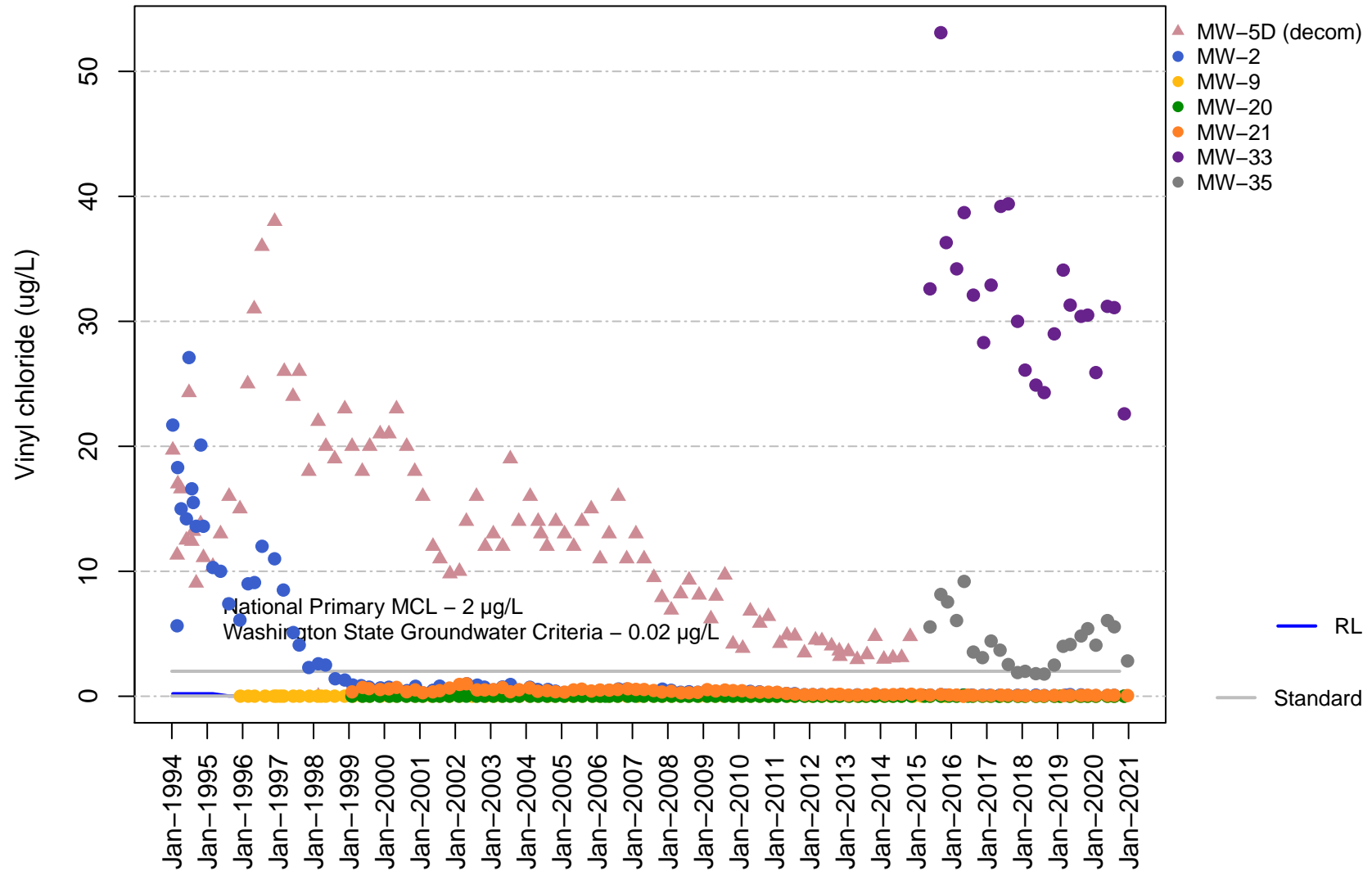
Vashon Island Closed Landfill  
 Channel Cc2  
 Trichlorofluoromethane



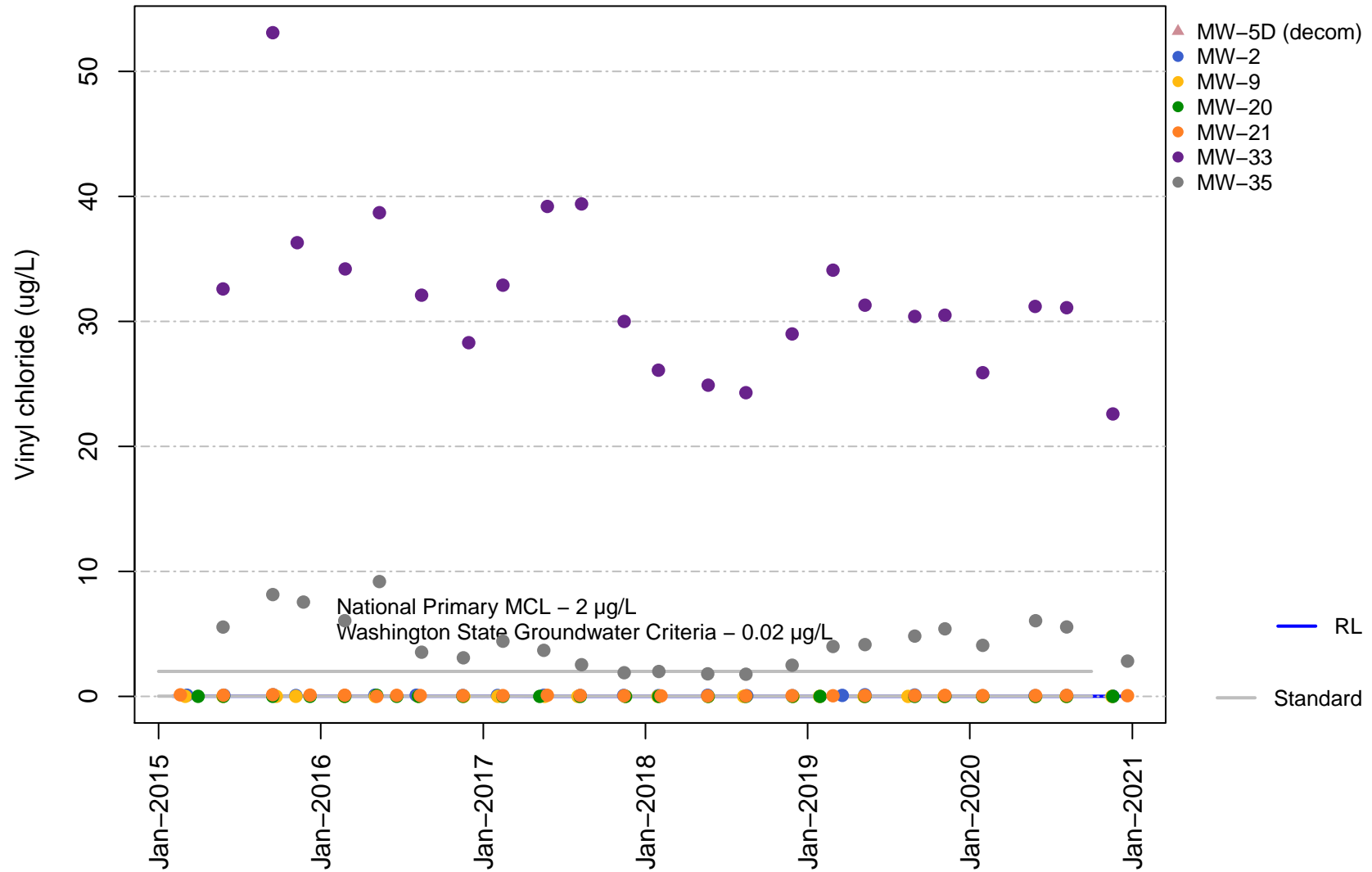
Vashon Island Closed Landfill  
 Channel Cc2  
 Trichlorofluoromethane



**Vashon Island Closed Landfill  
Channel Cc2  
Vinyl chloride**



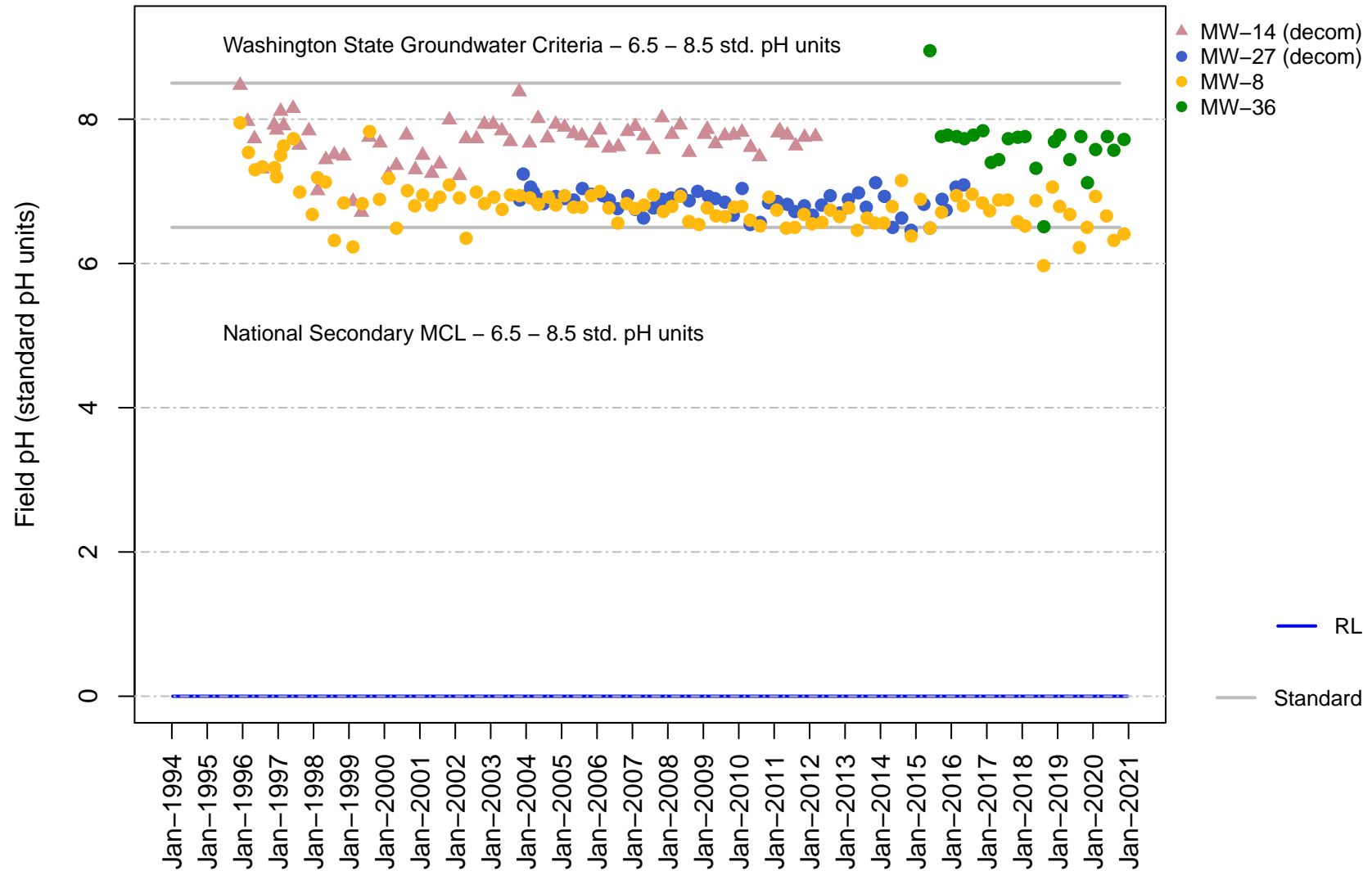
**Vashon Island Closed Landfill  
Channel Cc2  
Vinyl chloride**



## **Appendix E**

Time Concentration Plots for  
Groundwater in Channel Cc3

# Vashon Island Closed Landfill Channel Cc3 Field pH

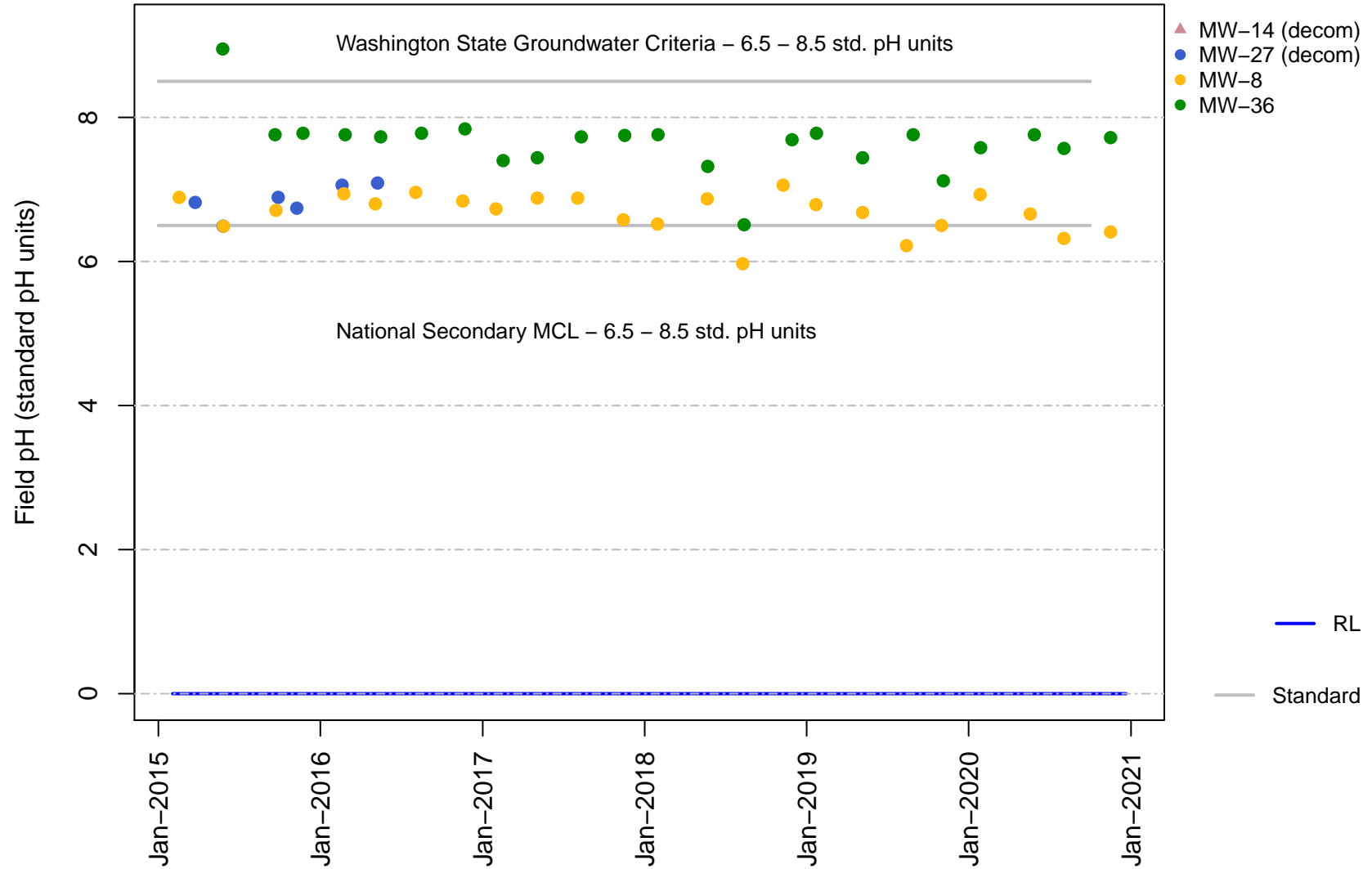




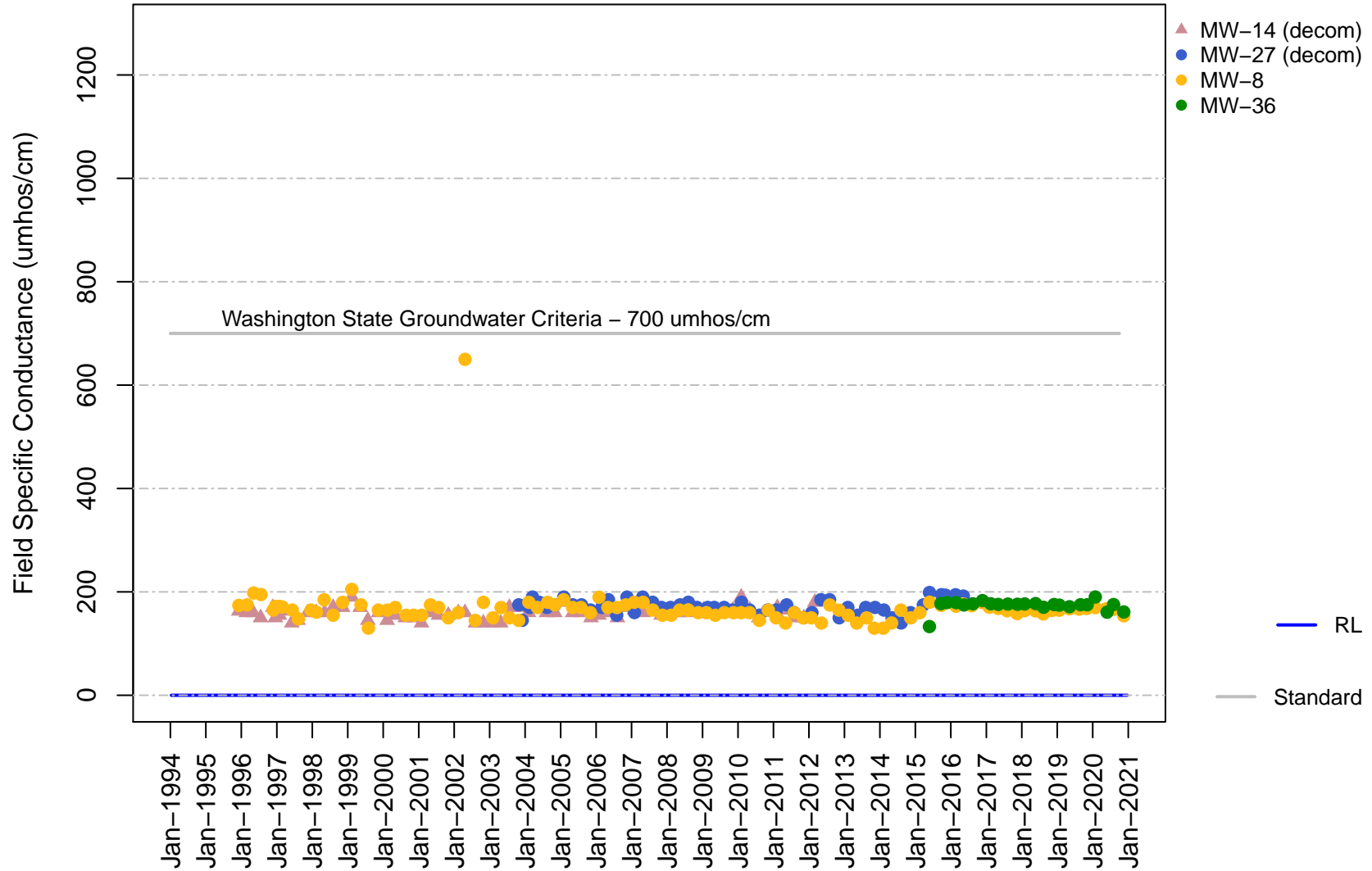
# Vashon Island Closed Landfill

## Channel Cc3

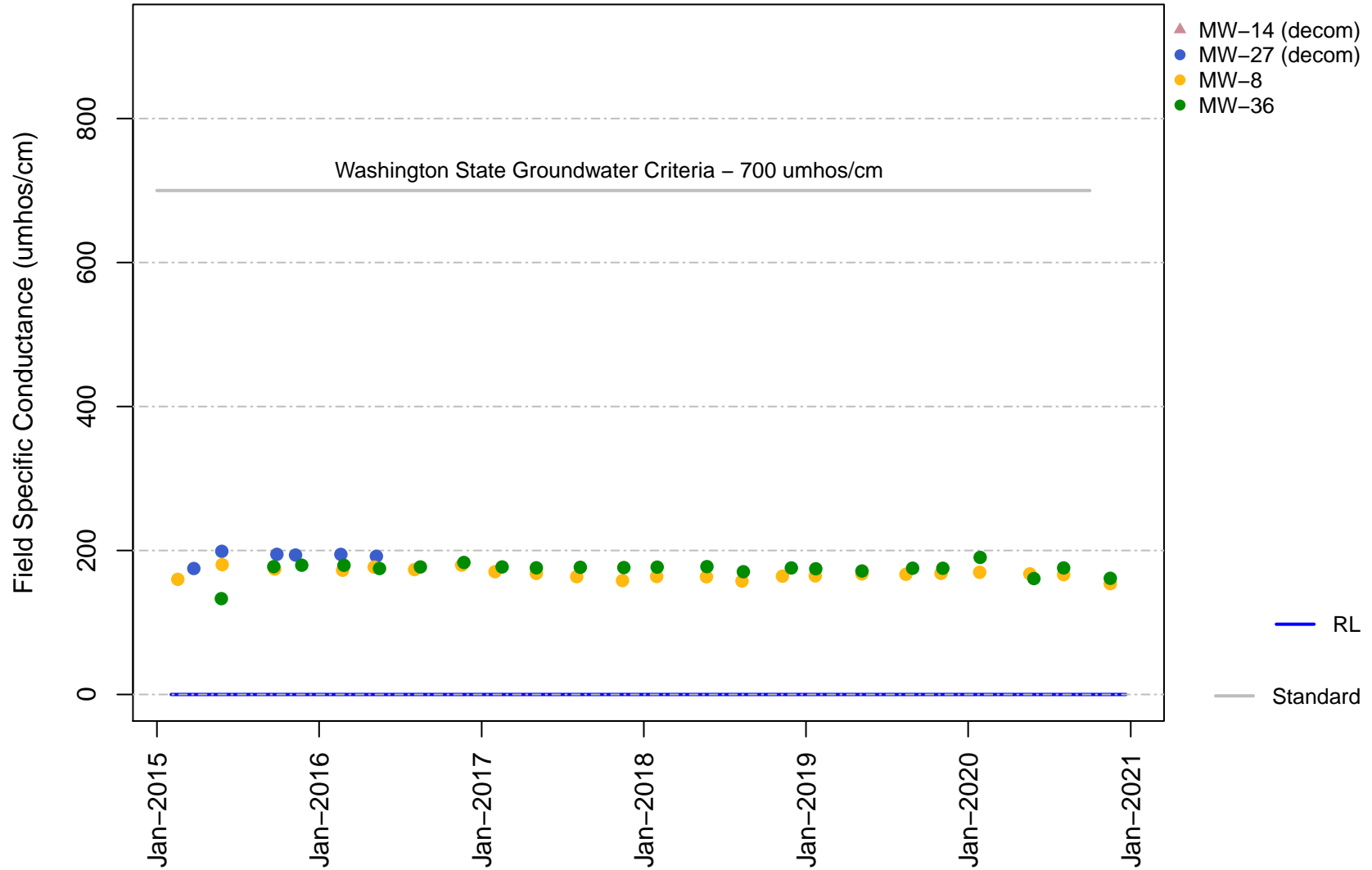
### Field pH



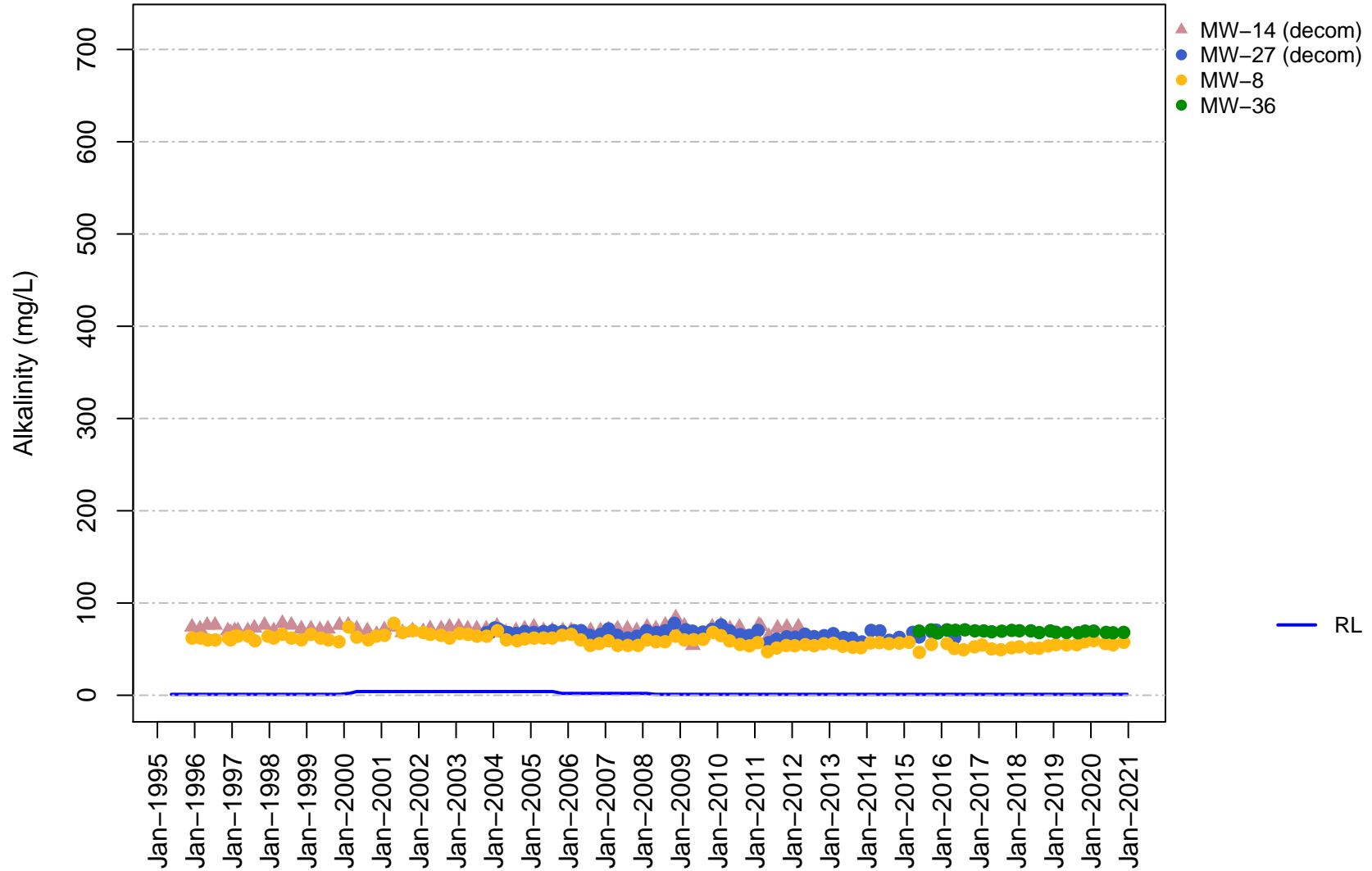
# Vashon Island Closed Landfill Channel Cc3 Field Specific Conductance



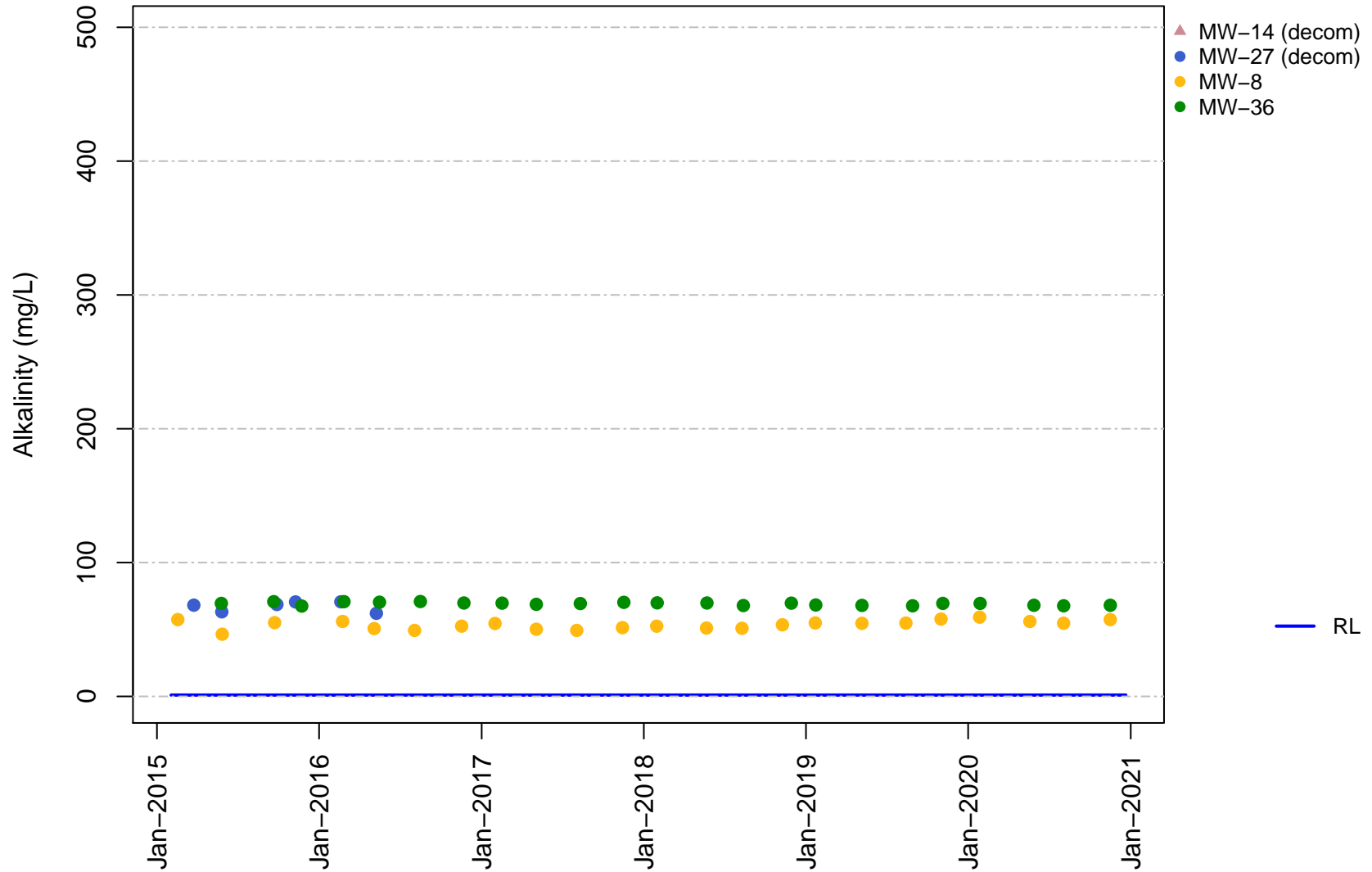
# Vashon Island Closed Landfill Channel Cc3 Field Specific Conductance



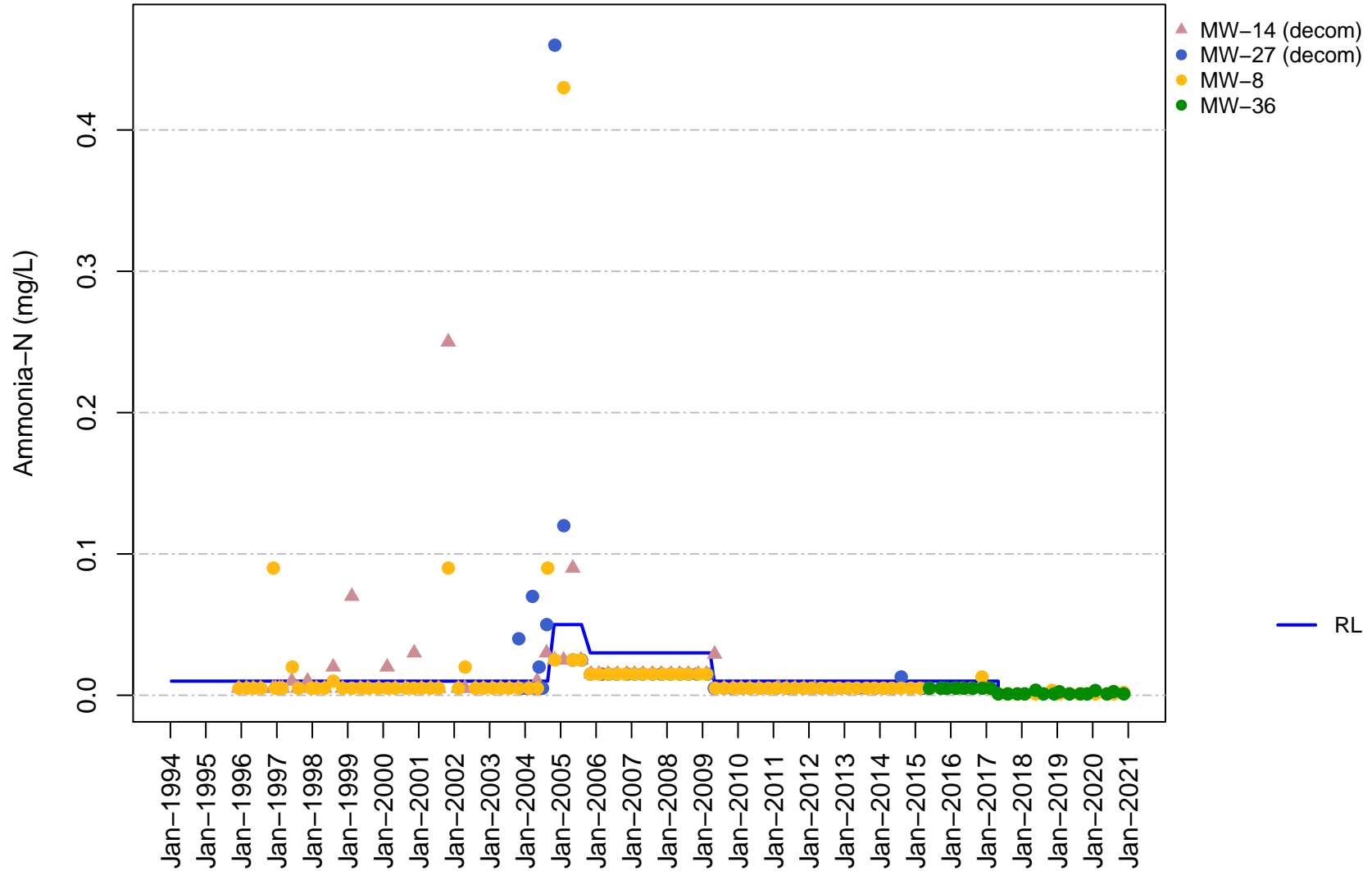
# Vashon Island Closed Landfill Channel Cc3 Alkalinity



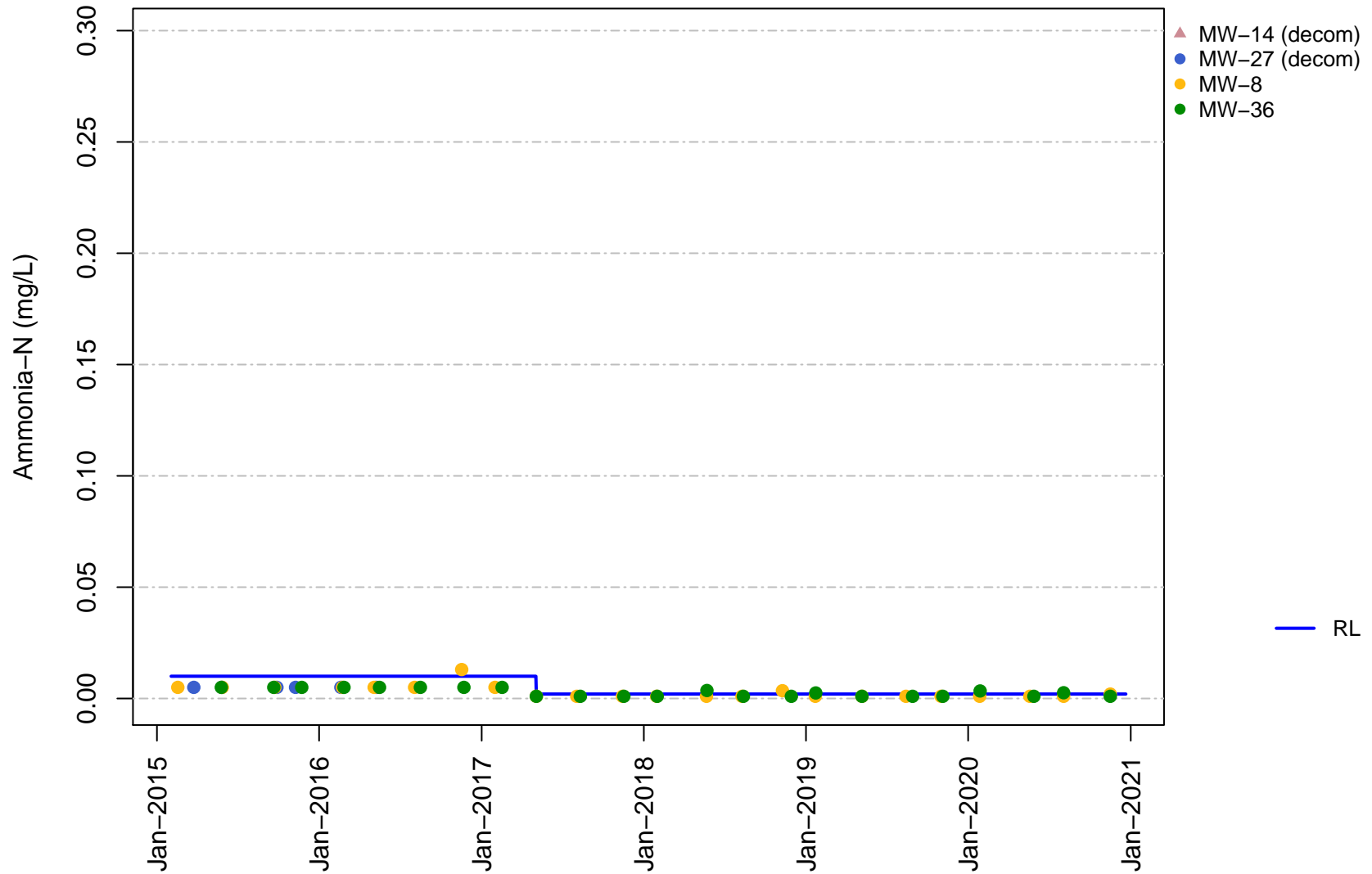
# Vashon Island Closed Landfill Channel Cc3 Alkalinity



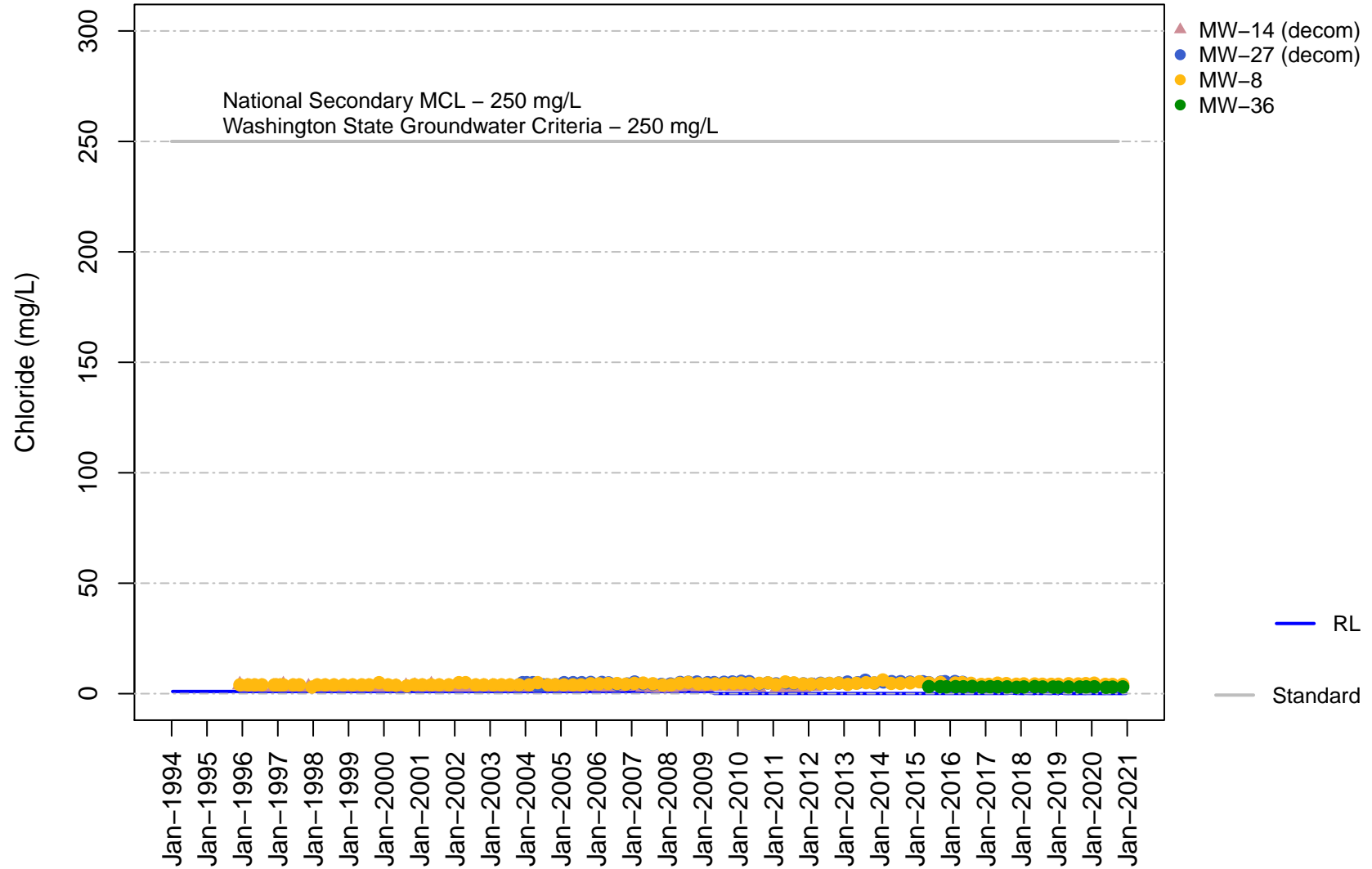
**Vashon Island Closed Landfill  
Channel Cc3  
Ammonia**



# Vashon Island Closed Landfill Channel Cc3 Ammonia

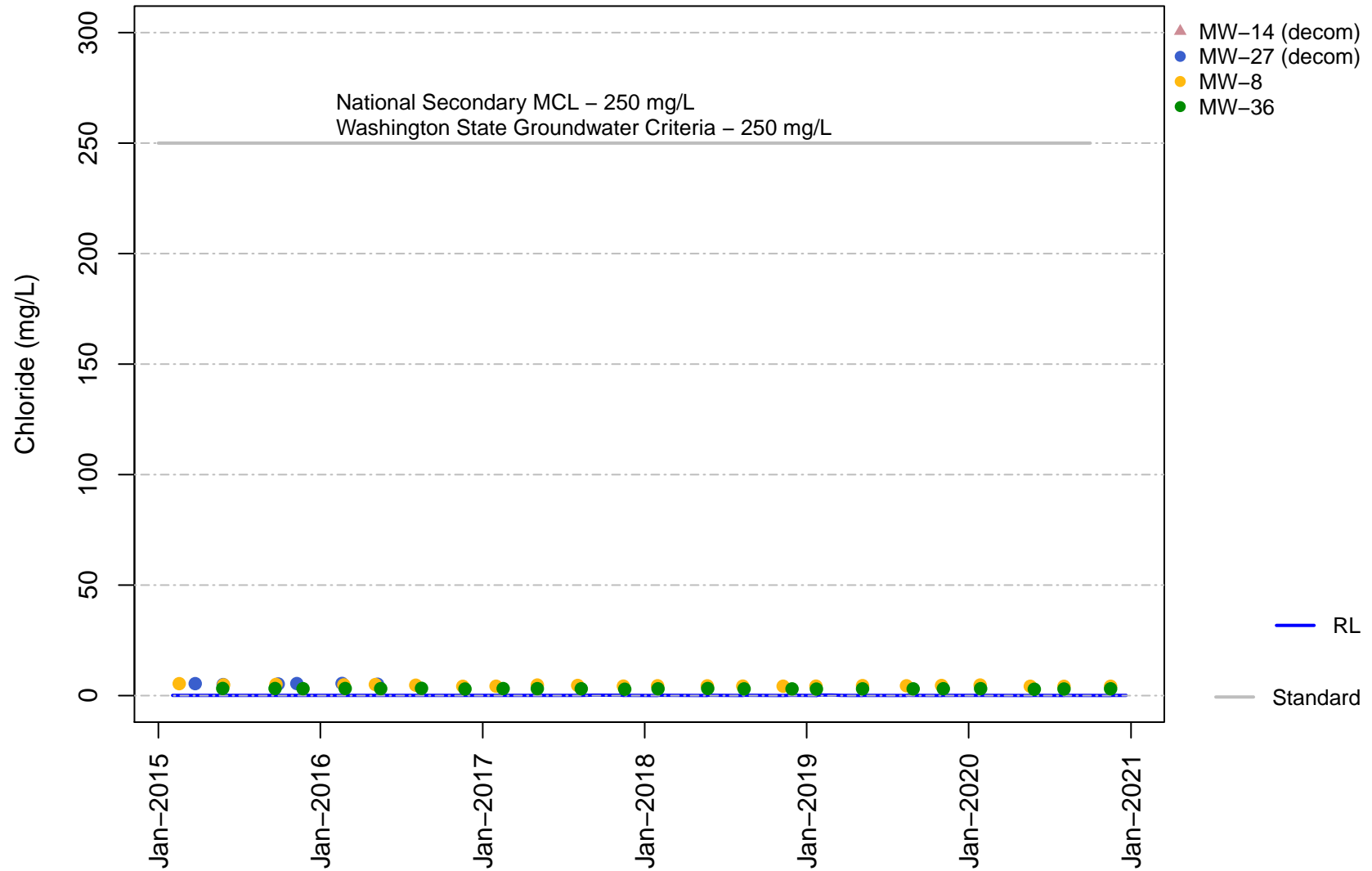


# Vashon Island Closed Landfill Channel Cc3 Chloride

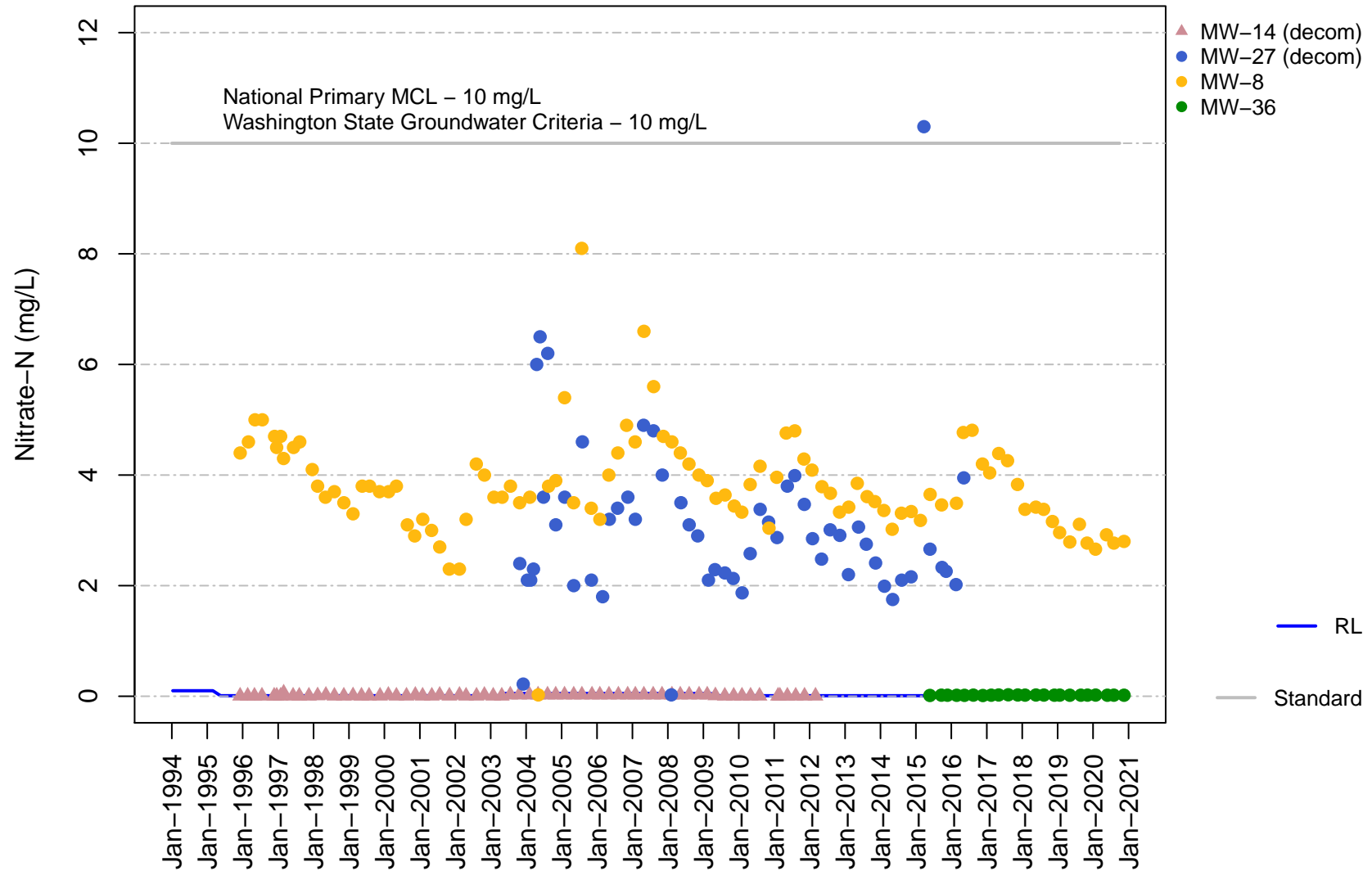




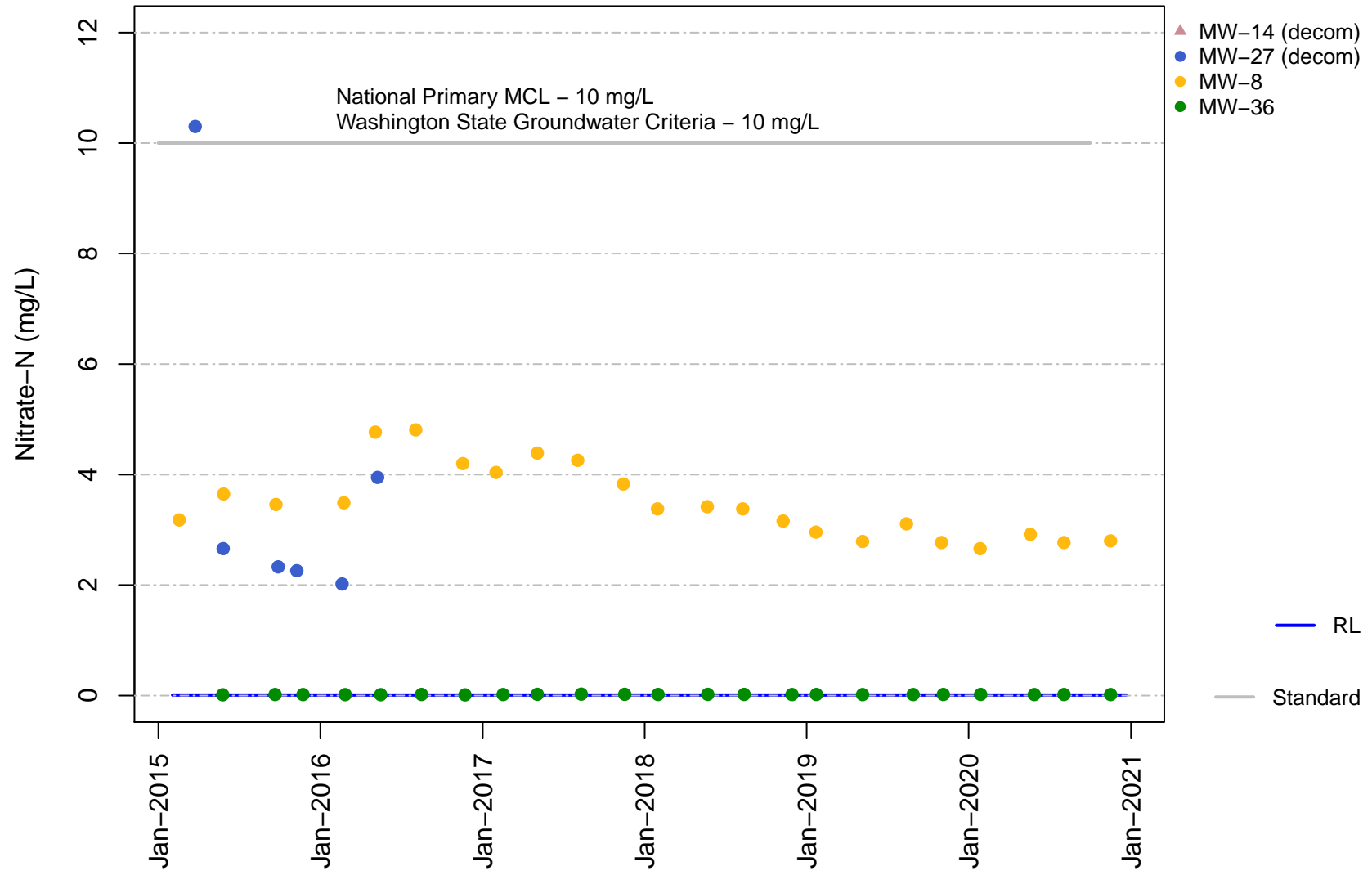
# Vashon Island Closed Landfill Channel Cc3 Chloride



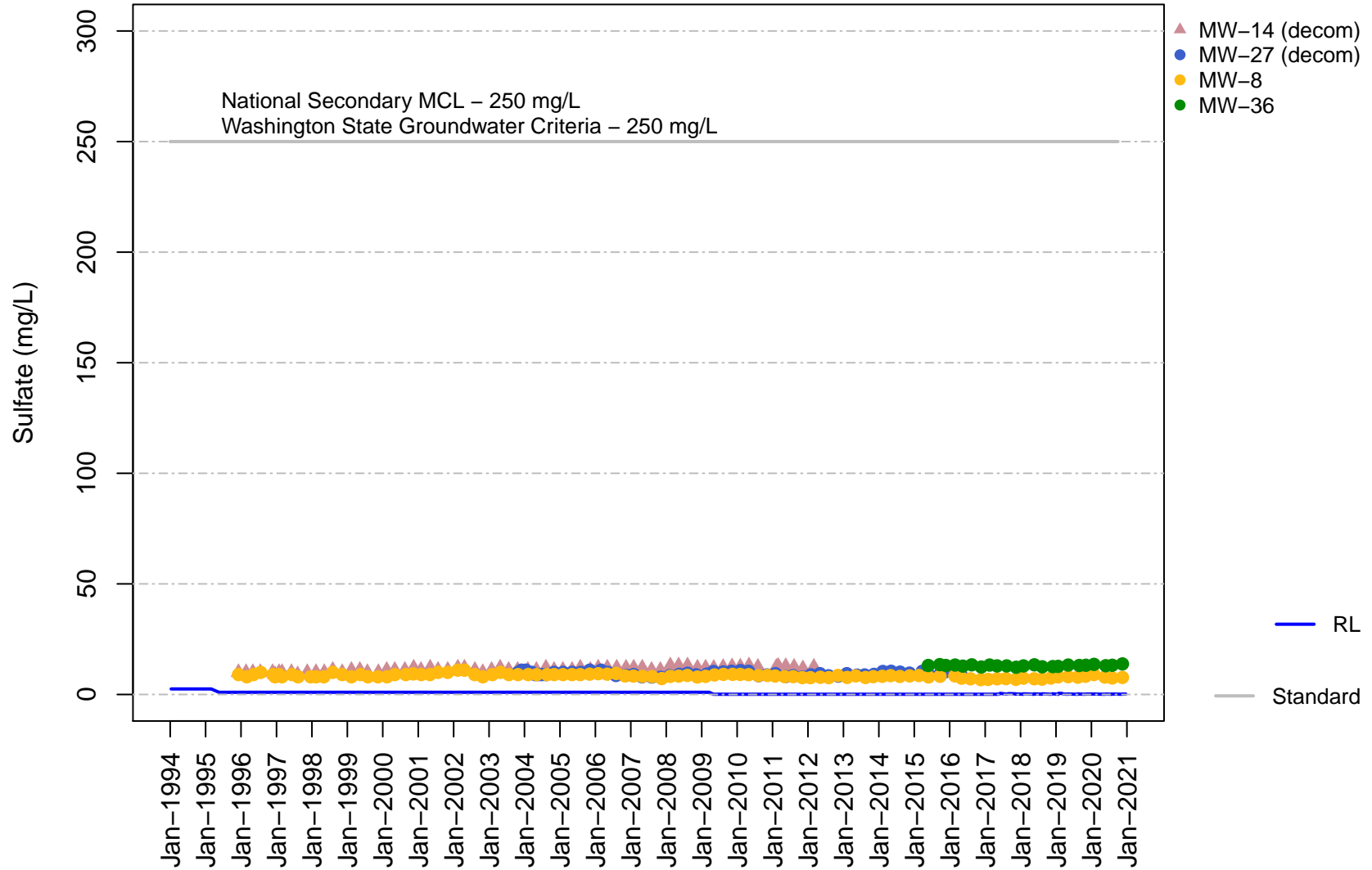
# Vashon Island Closed Landfill Channel Cc3 Nitrate



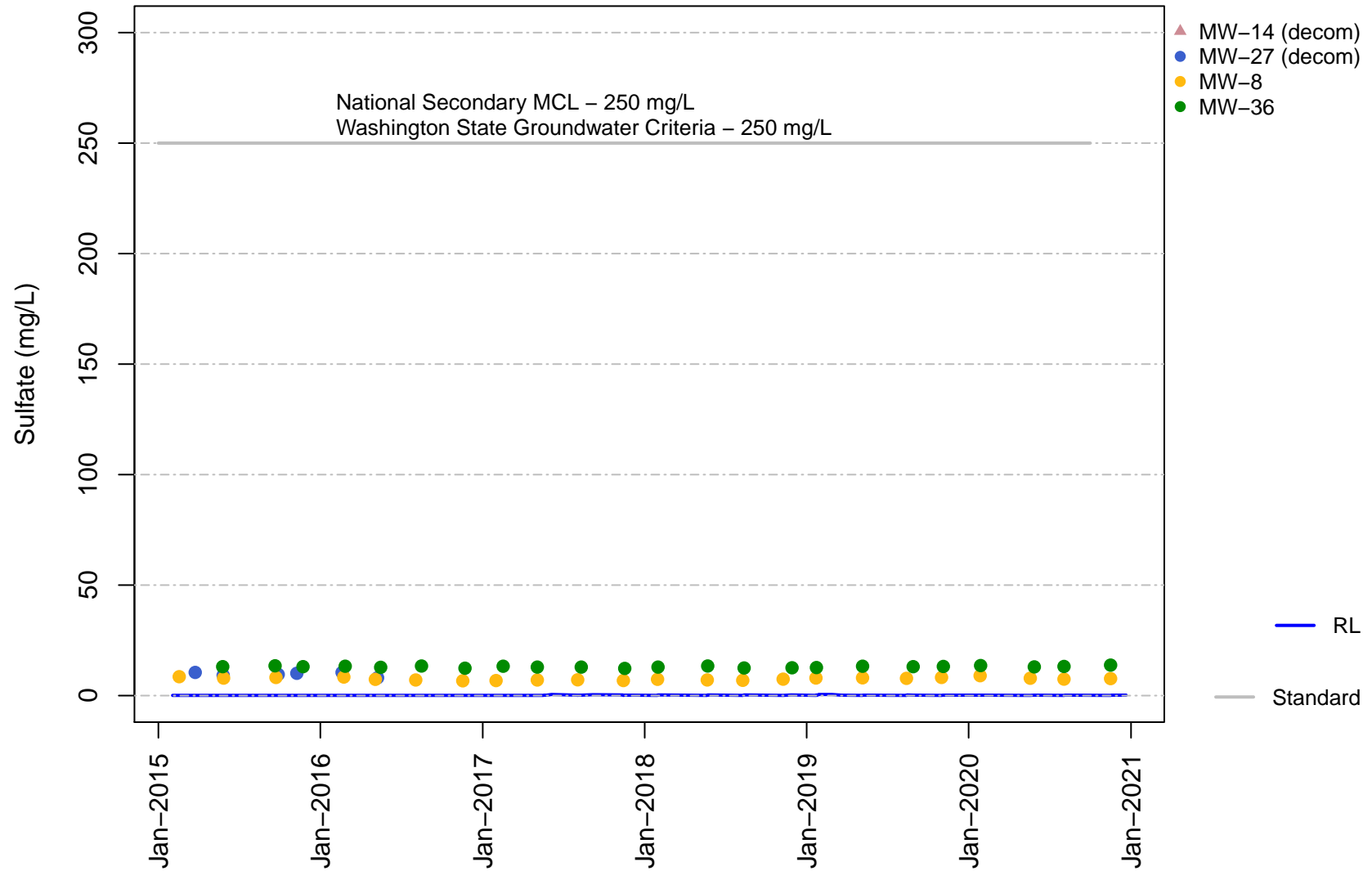
**Vashon Island Closed Landfill  
Channel Cc3  
Nitrate**



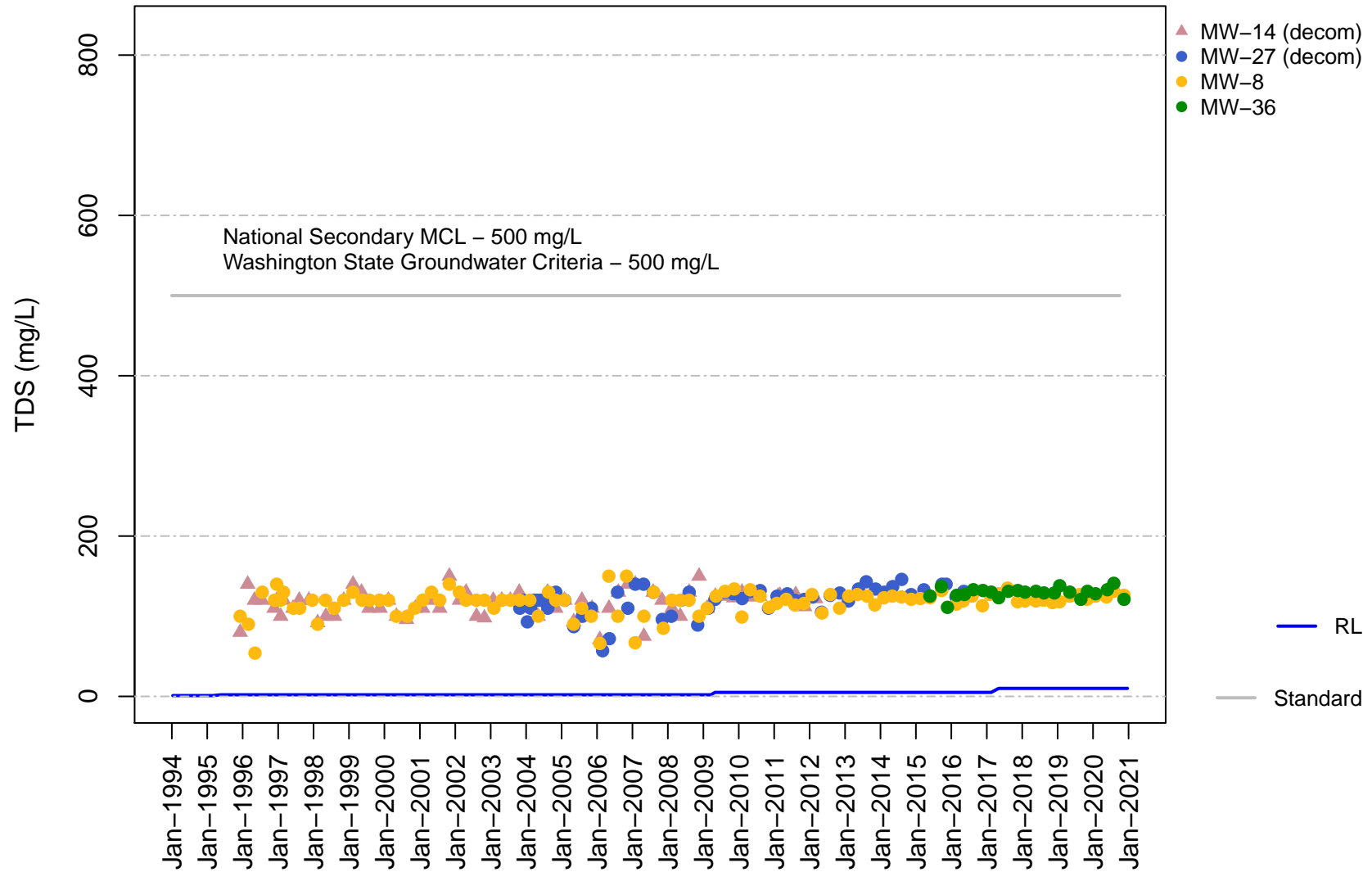
# Vashon Island Closed Landfill Channel Cc3 Sulfate



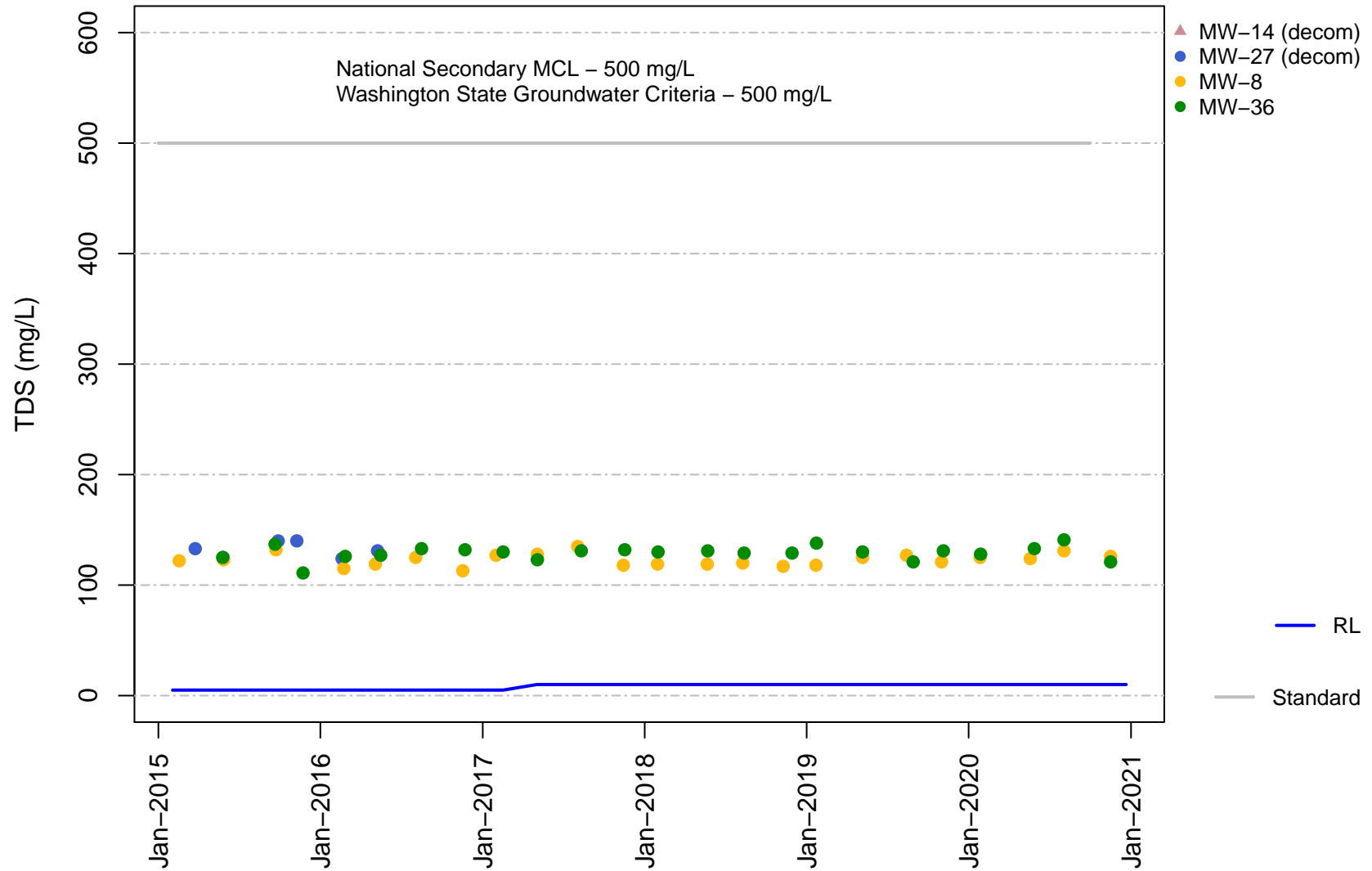
# Vashon Island Closed Landfill Channel Cc3 Sulfate



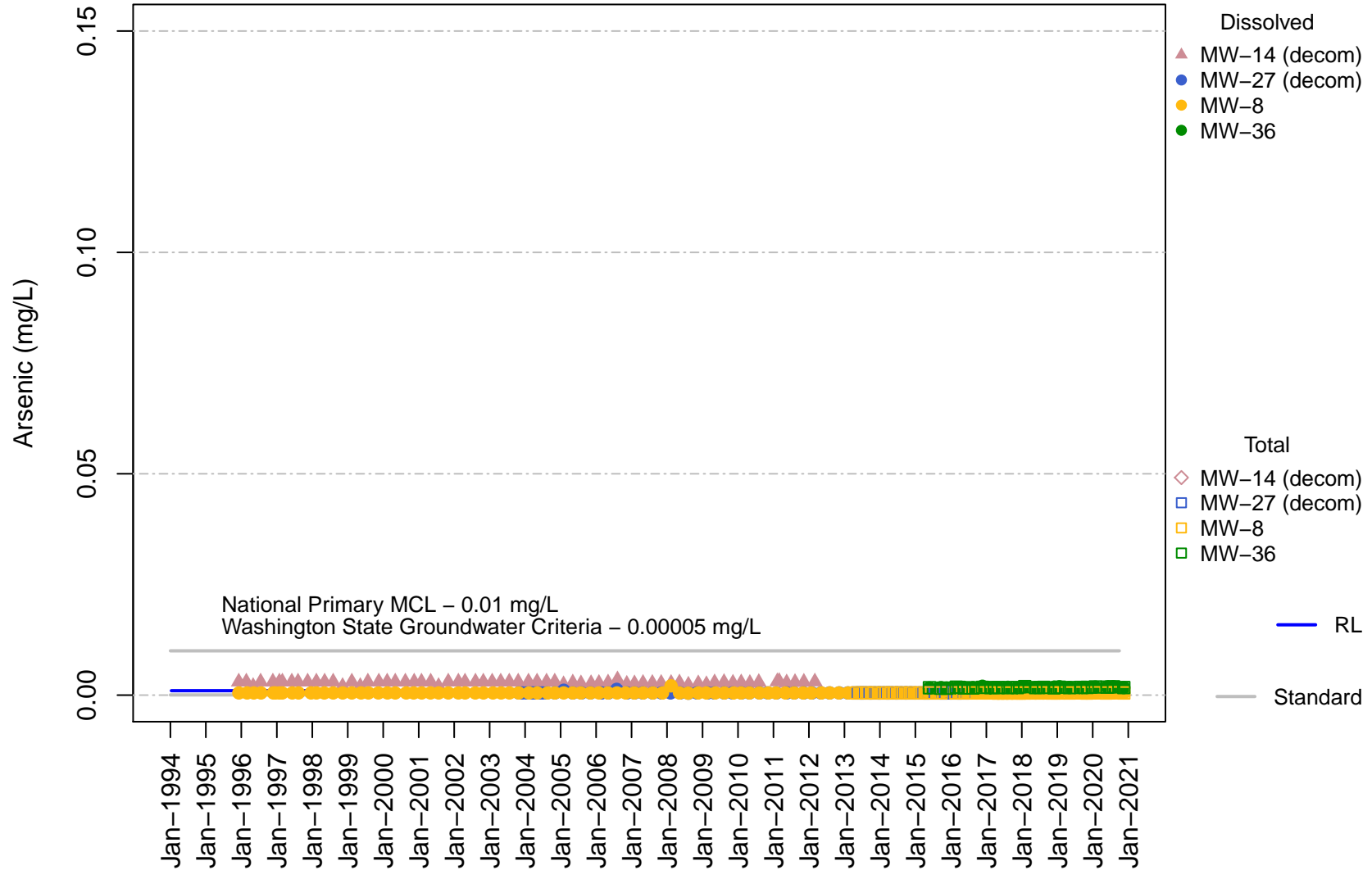
**Vashon Island Closed Landfill  
Channel Cc3  
Total Dissolved Solids**



**Vashon Island Closed Landfill  
Channel Cc3  
Total Dissolved Solids**

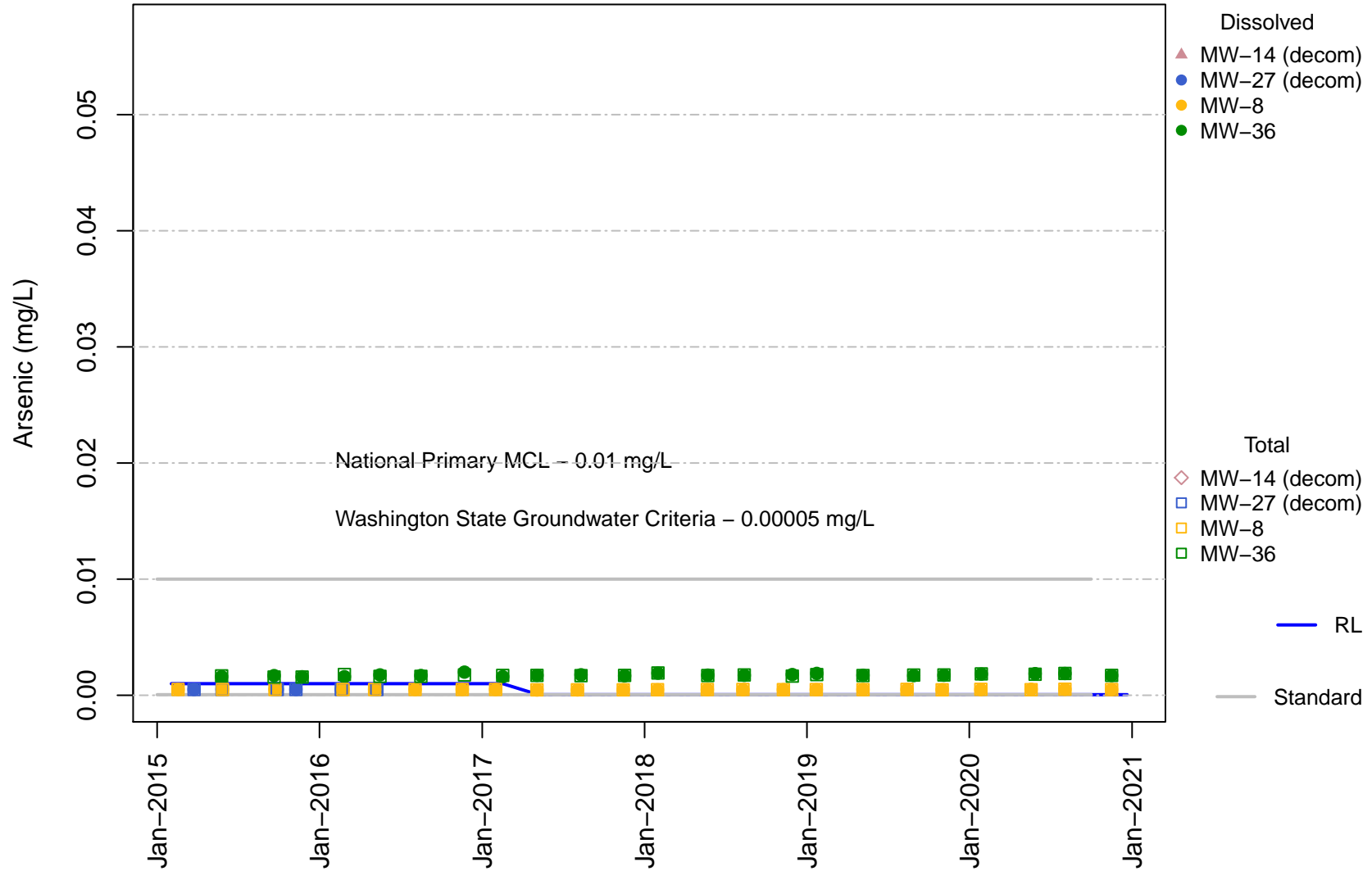


# Vashon Island Closed Landfill Channel Cc3 Arsenic

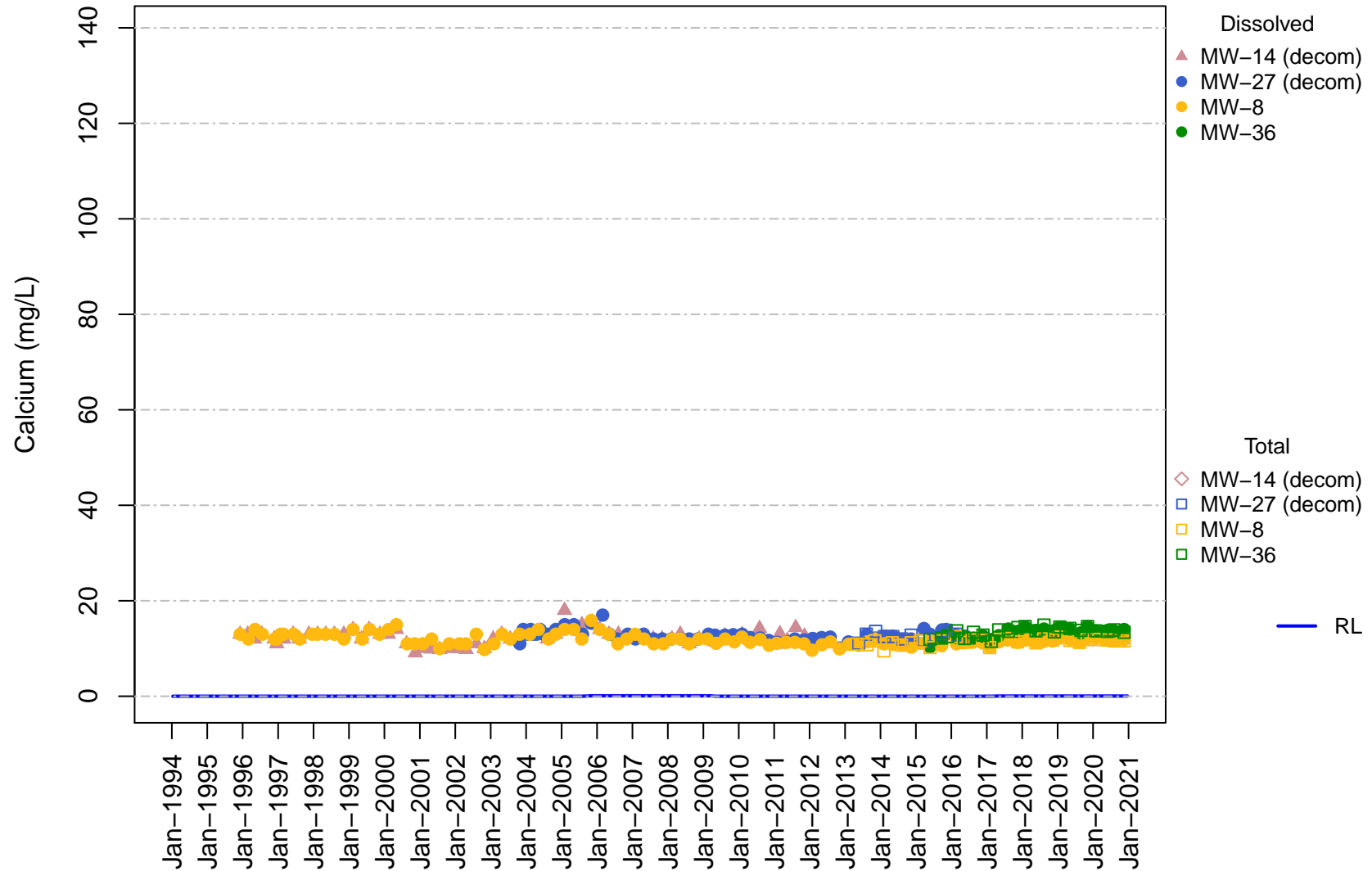




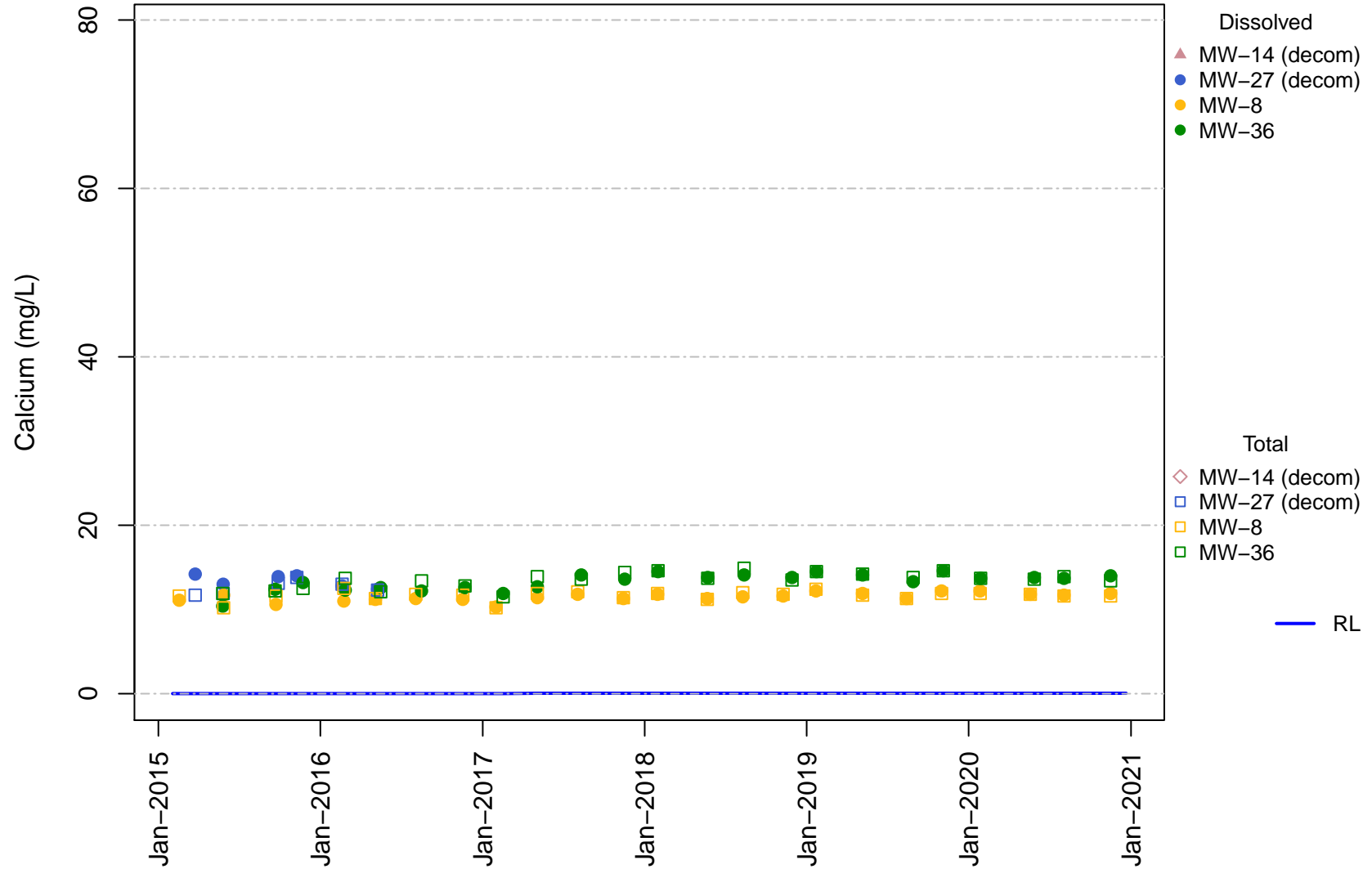
**Vashon Island Closed Landfill  
Channel Cc3  
Arsenic**



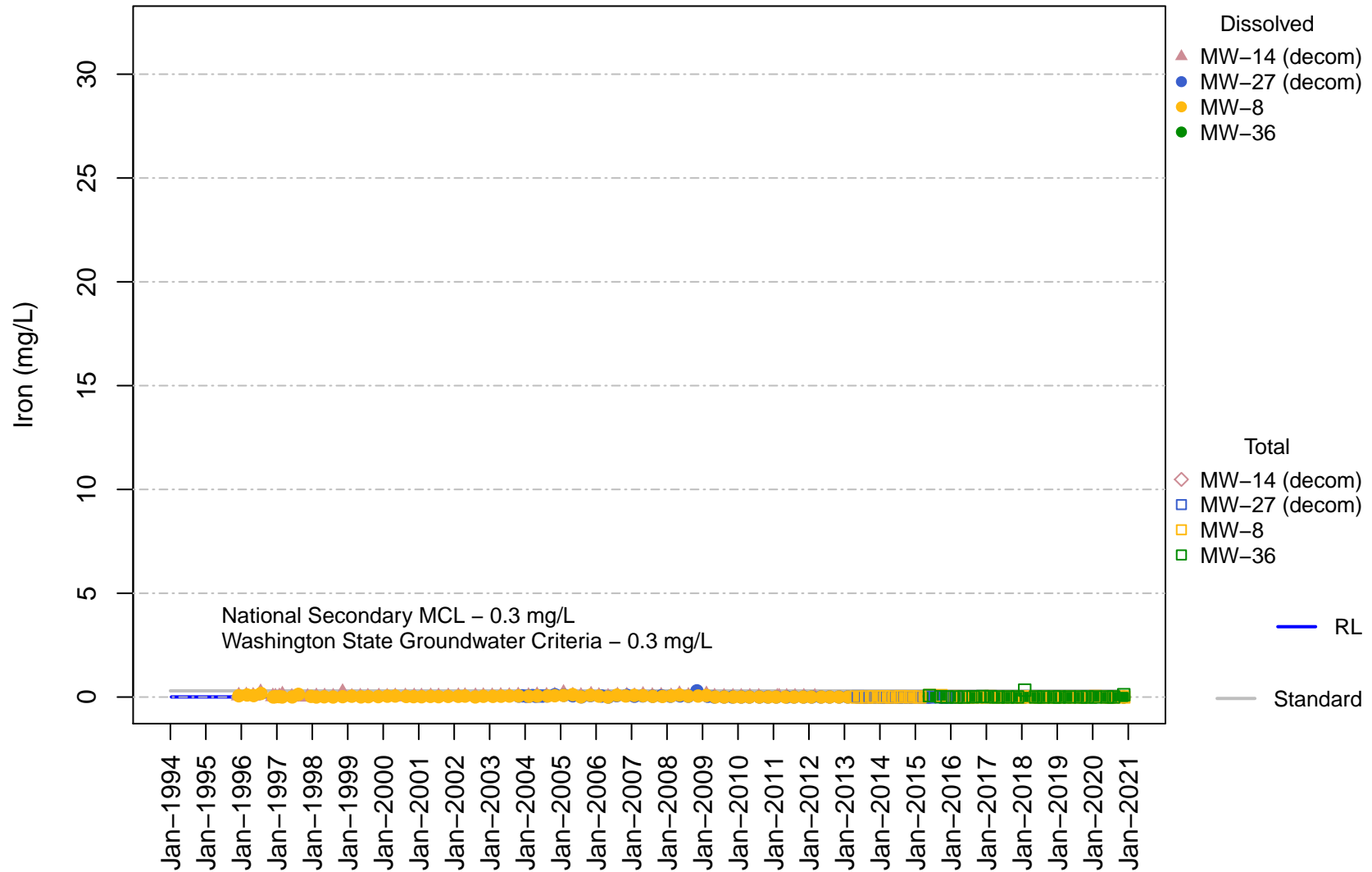
# Vashon Island Closed Landfill Channel Cc3 Calcium



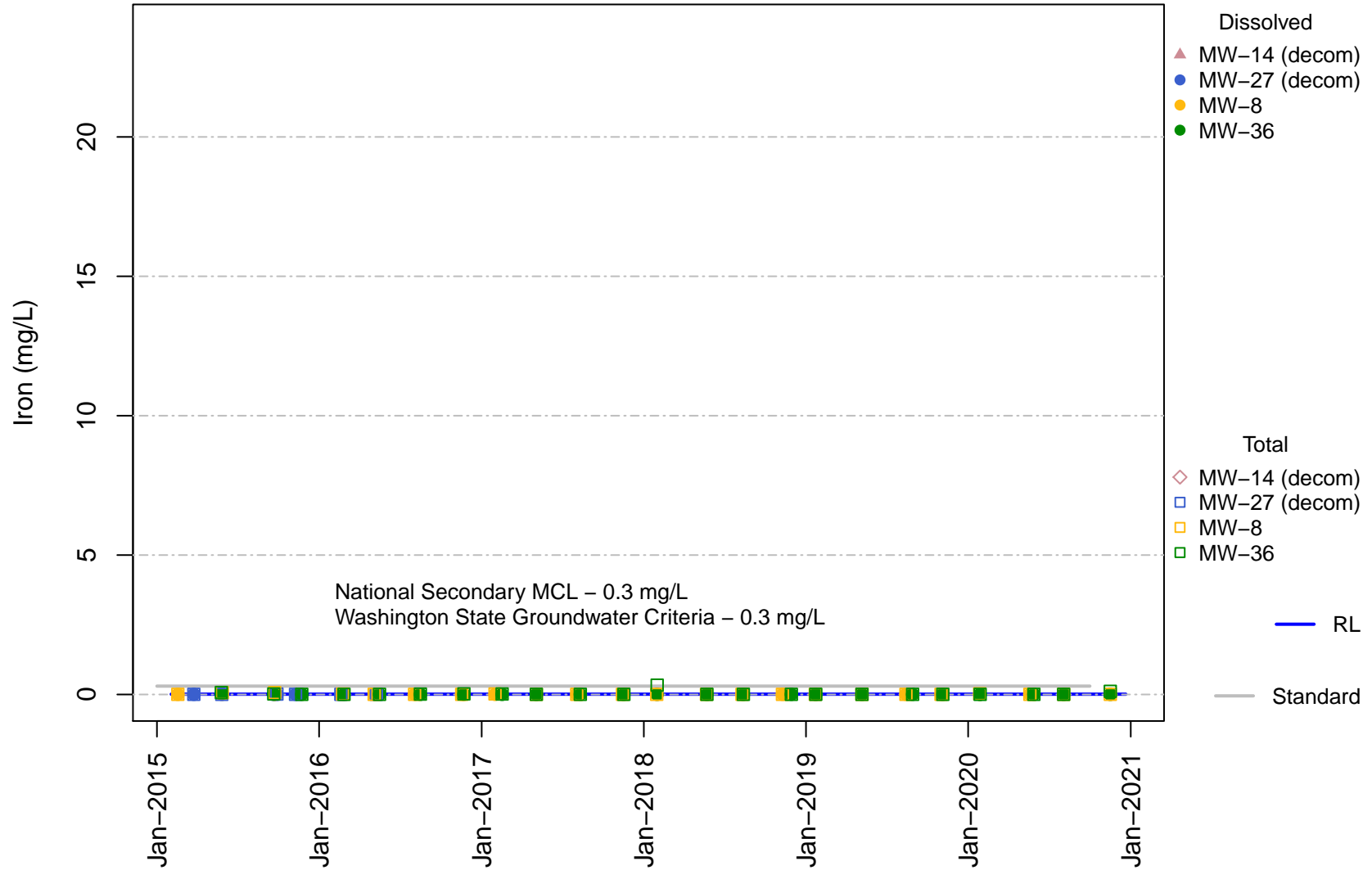
**Vashon Island Closed Landfill  
Channel Cc3  
Calcium**



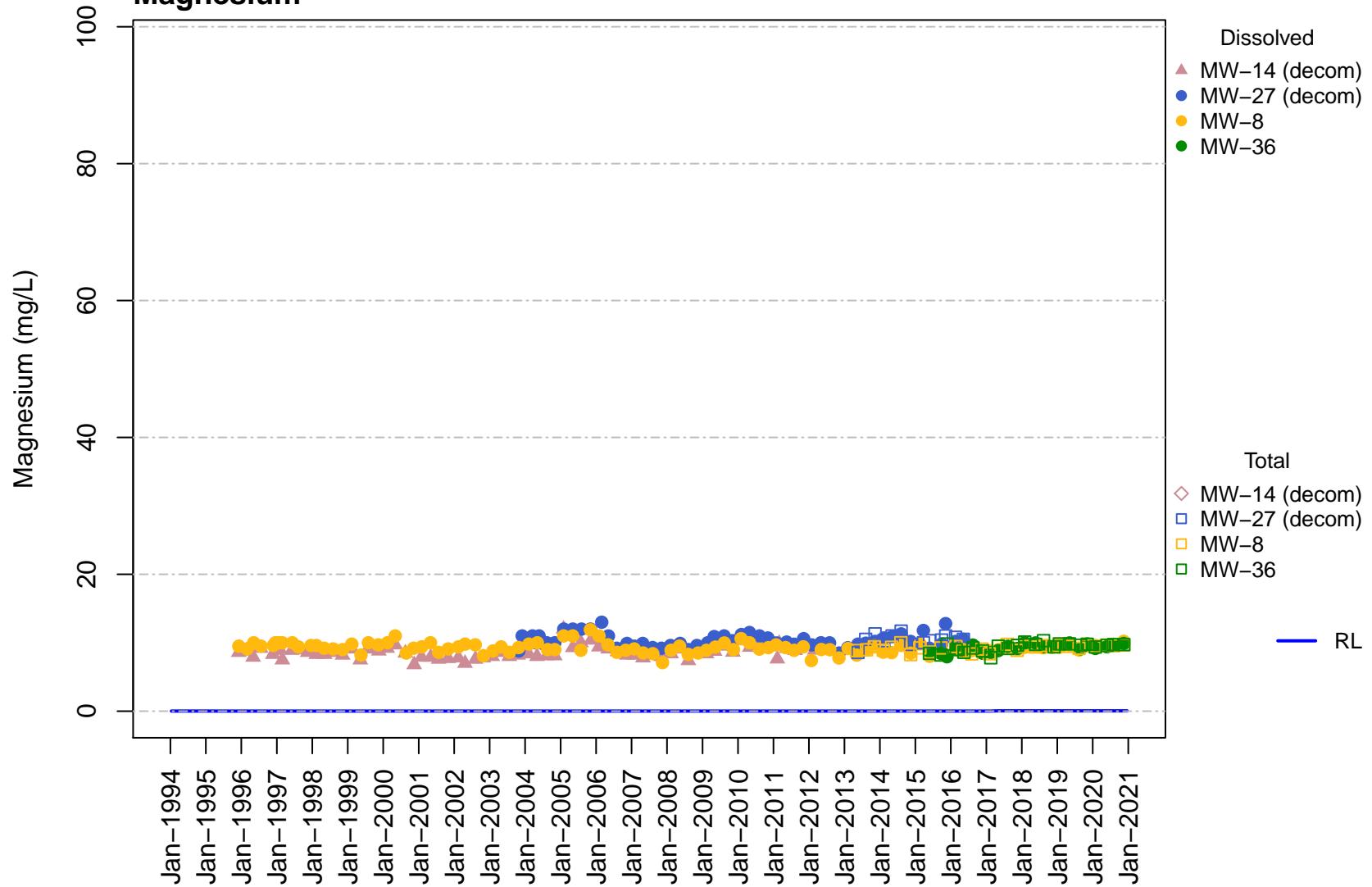
# Vashon Island Closed Landfill Channel Cc3 Iron



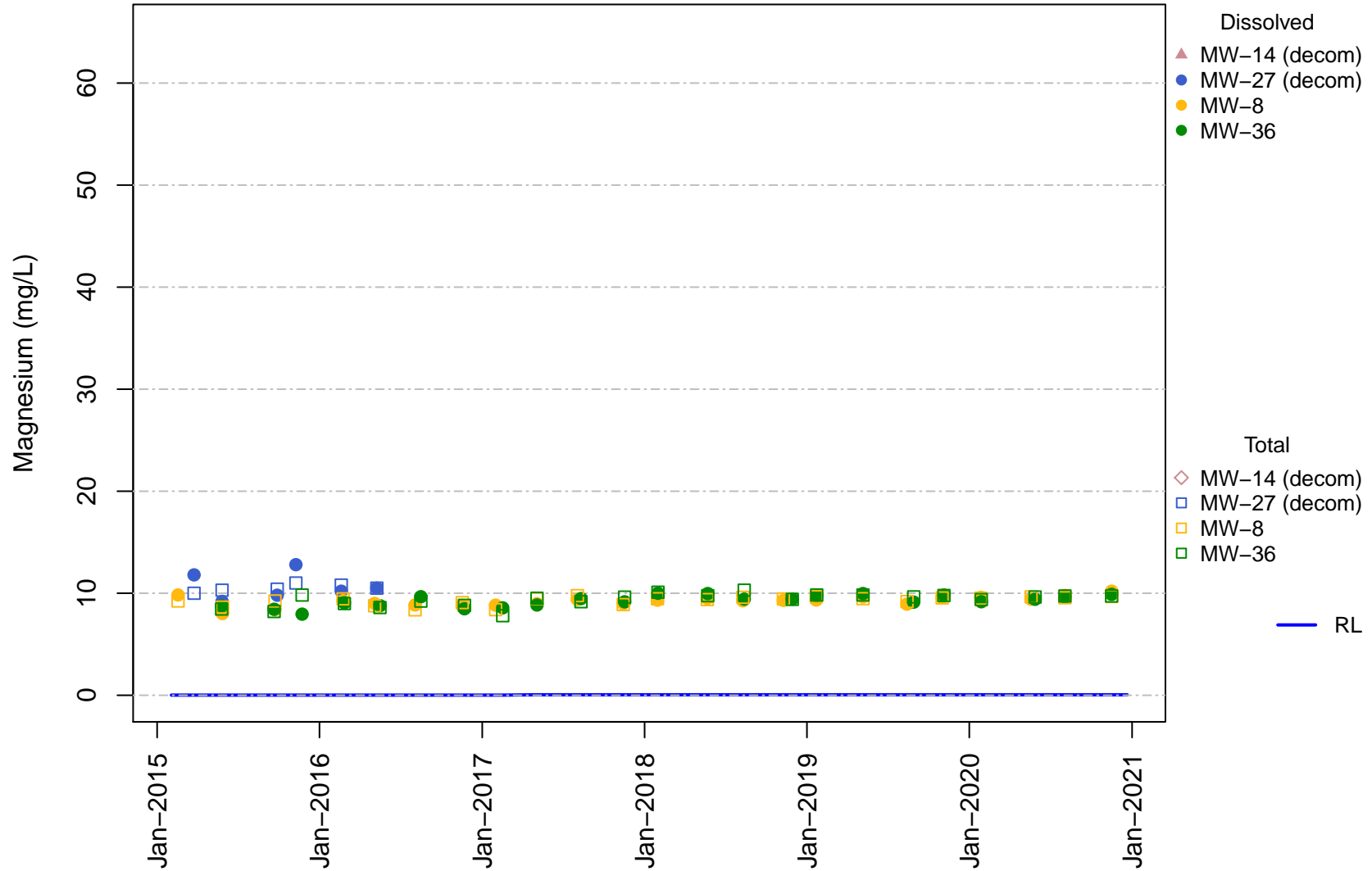
**Vashon Island Closed Landfill  
Channel Cc3  
Iron**



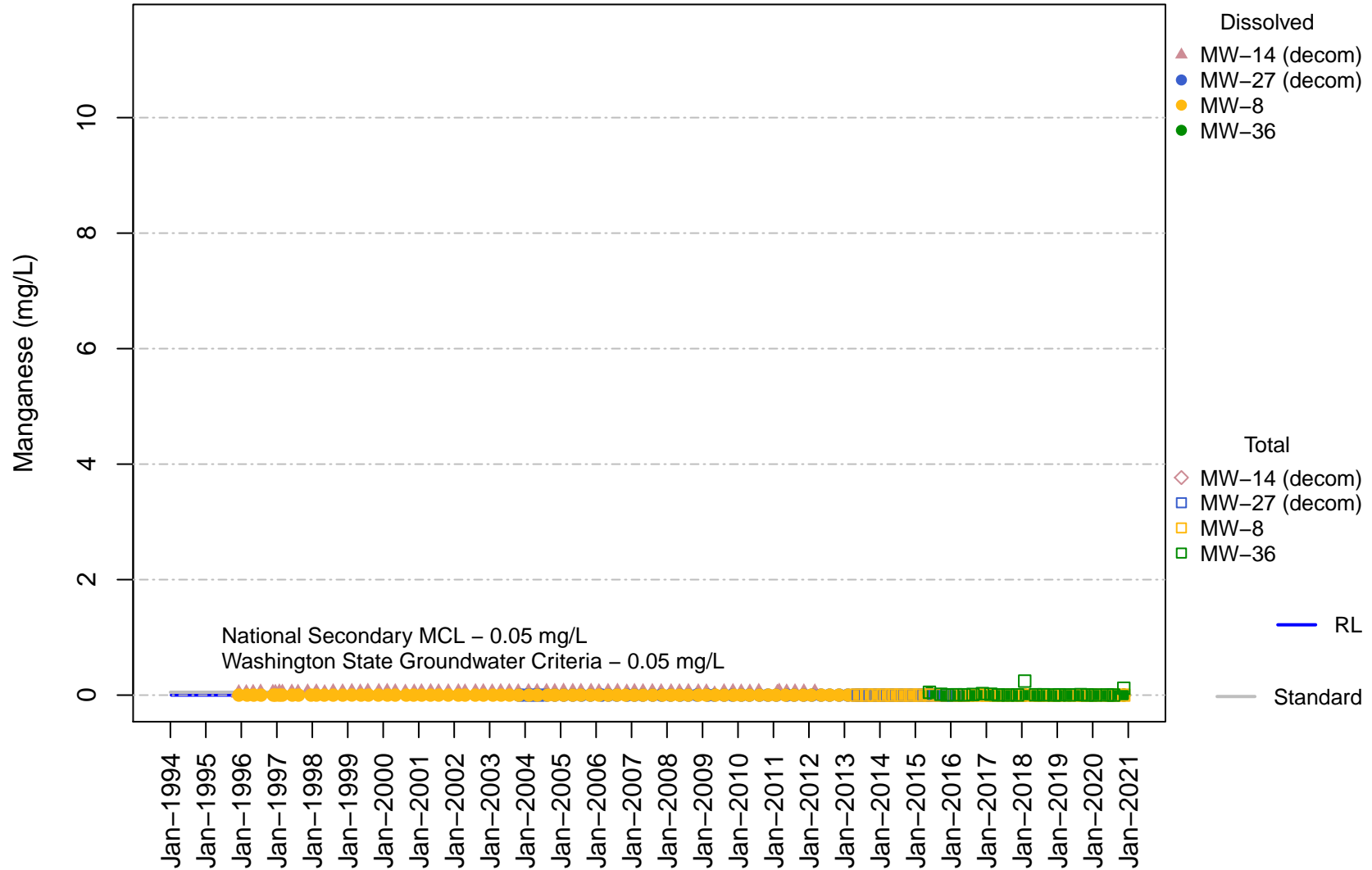
**Vashon Island Closed Landfill  
Channel Cc3  
Magnesium**



# Vashon Island Closed Landfill Channel Cc3 Magnesium

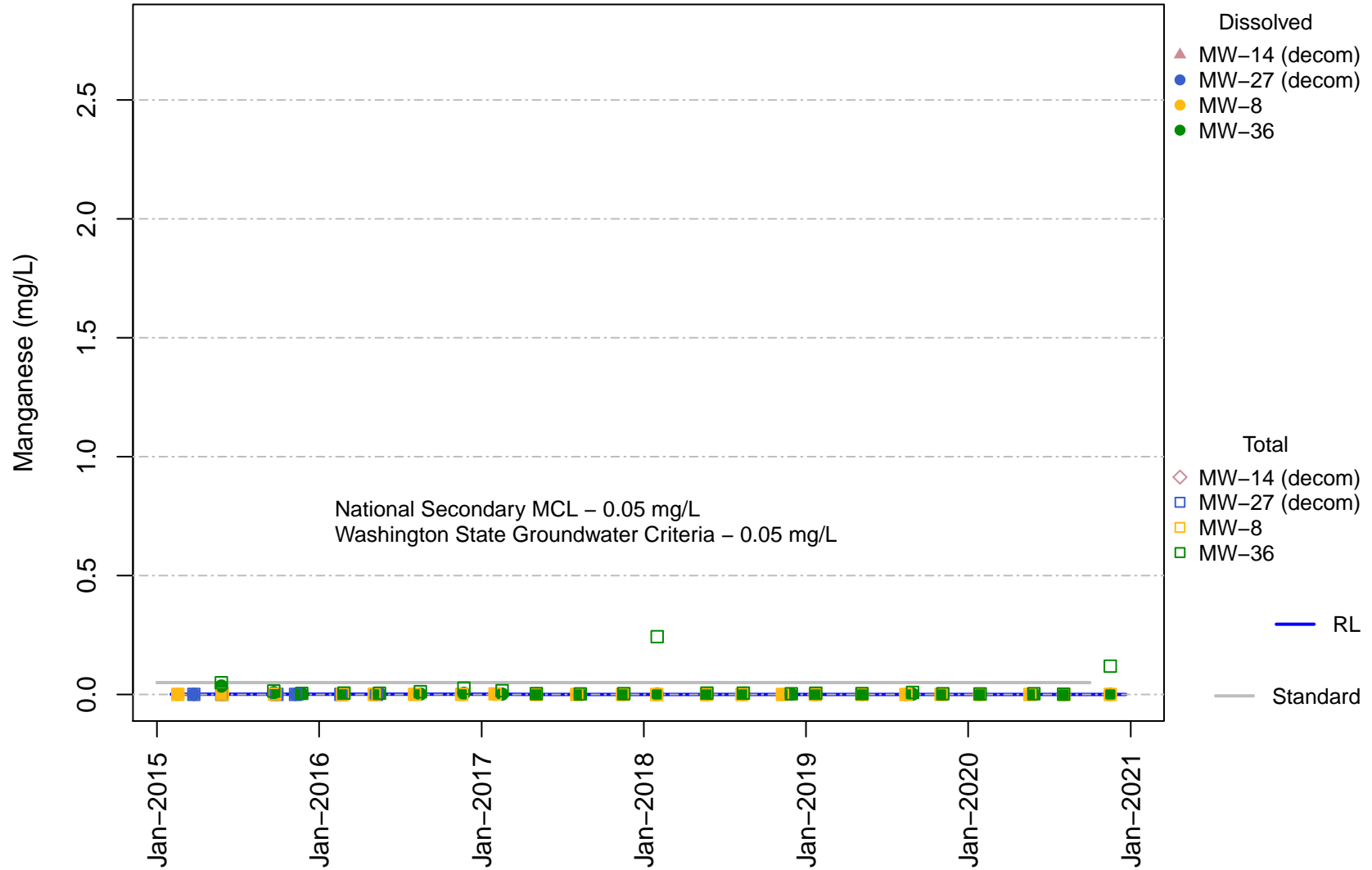


# Vashon Island Closed Landfill Channel Cc3 Manganese

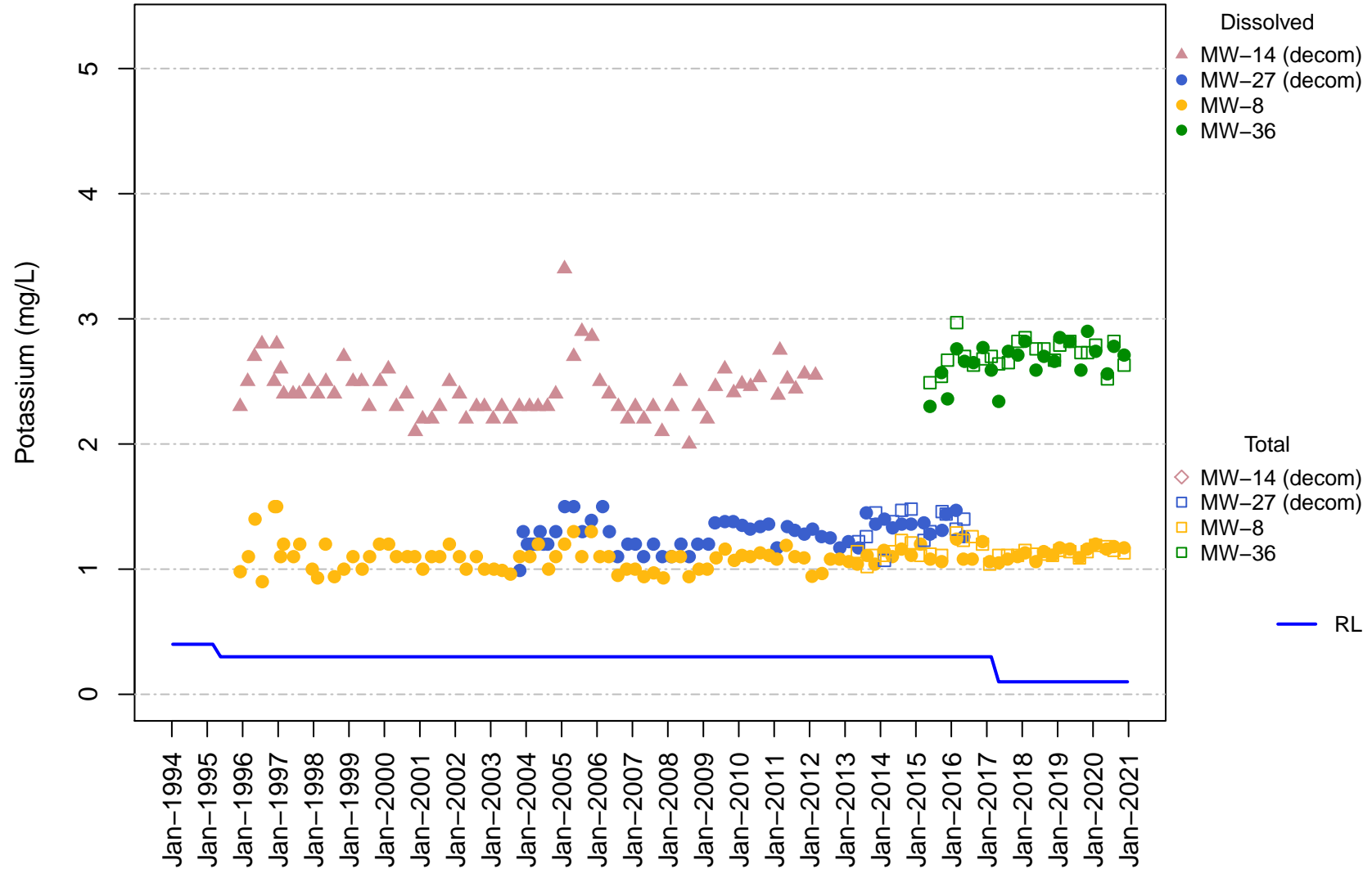




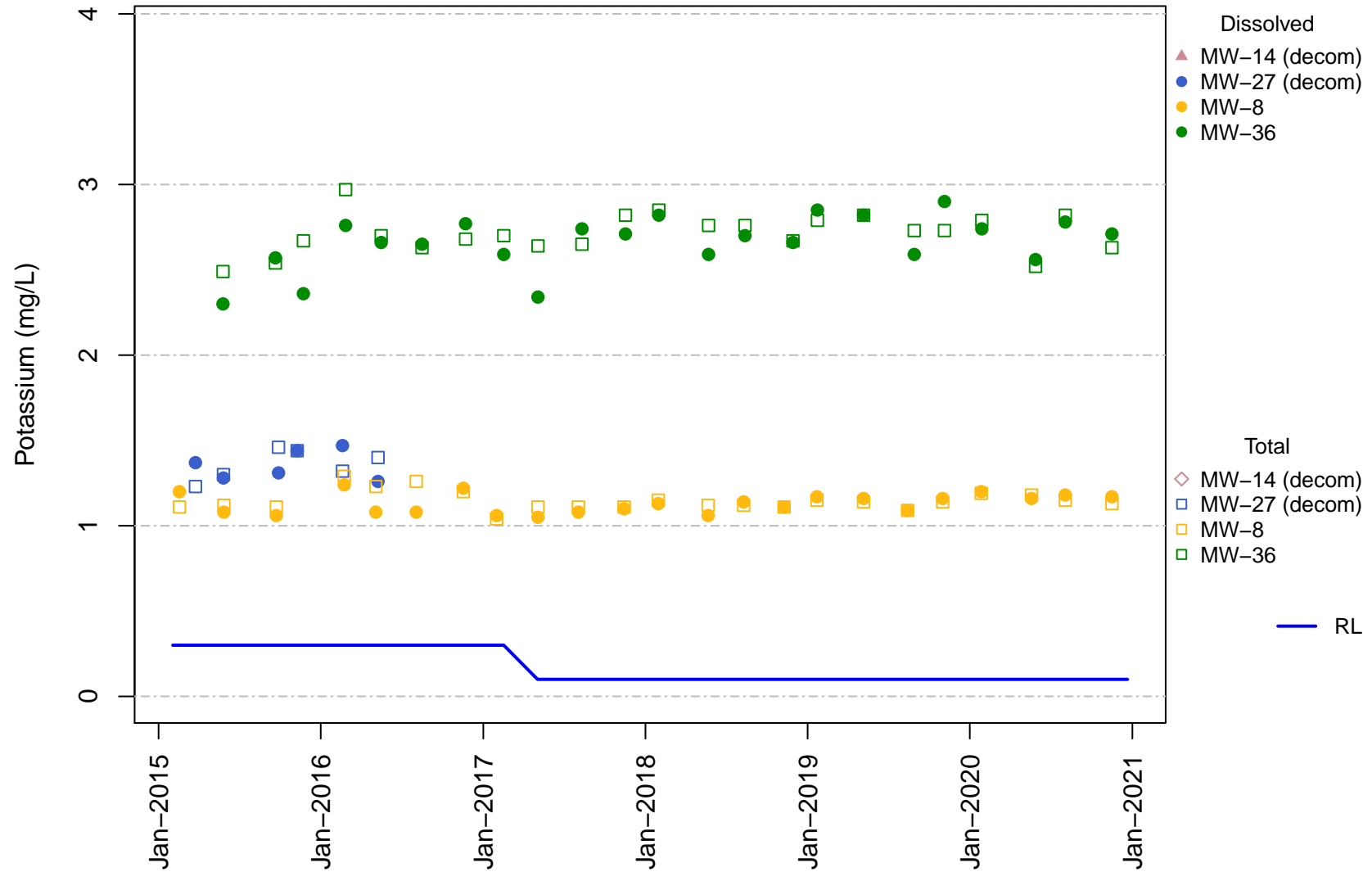
# Vashon Island Closed Landfill Channel Cc3 Manganese



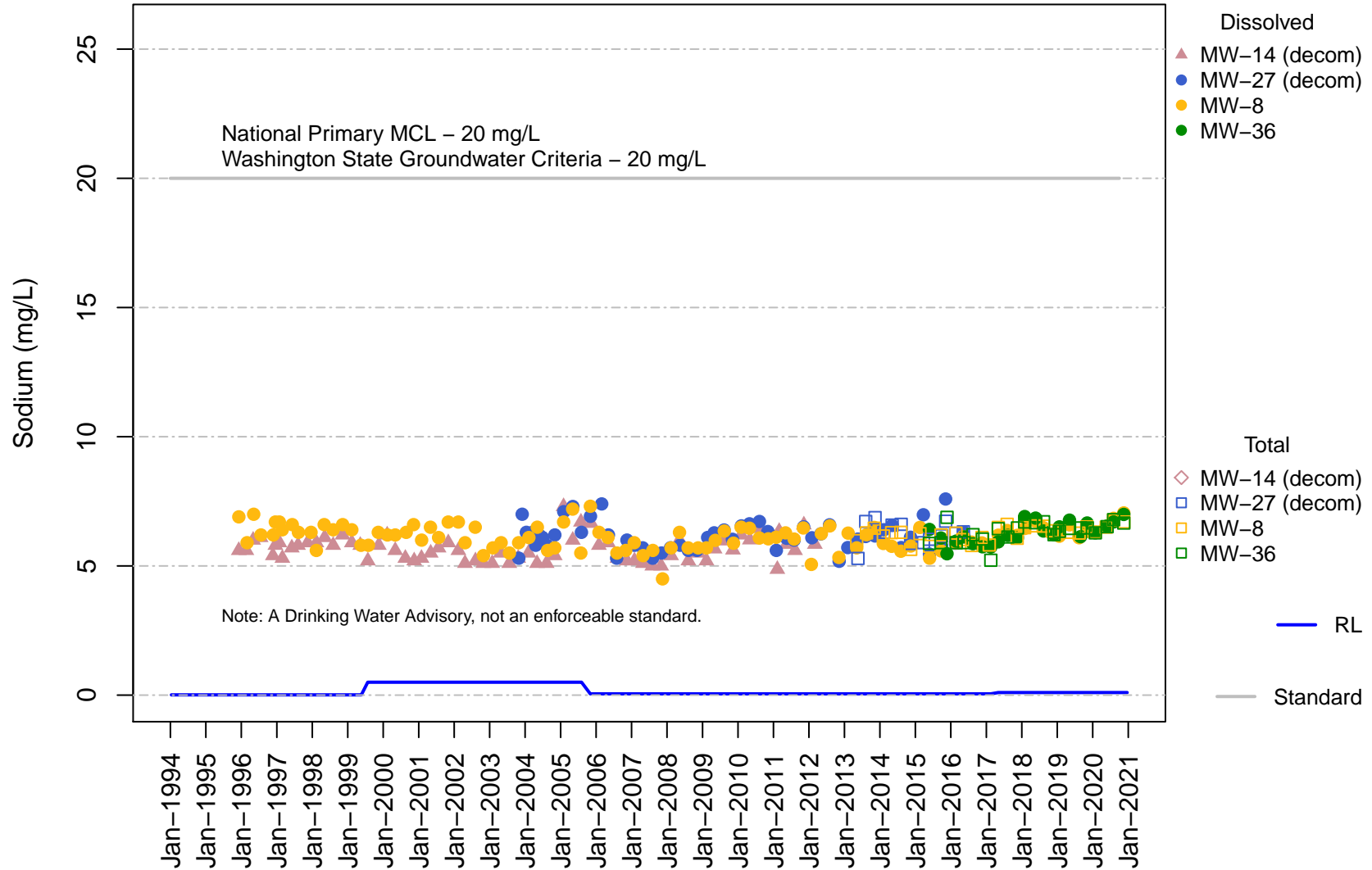
# Vashon Island Closed Landfill Channel Cc3 Potassium



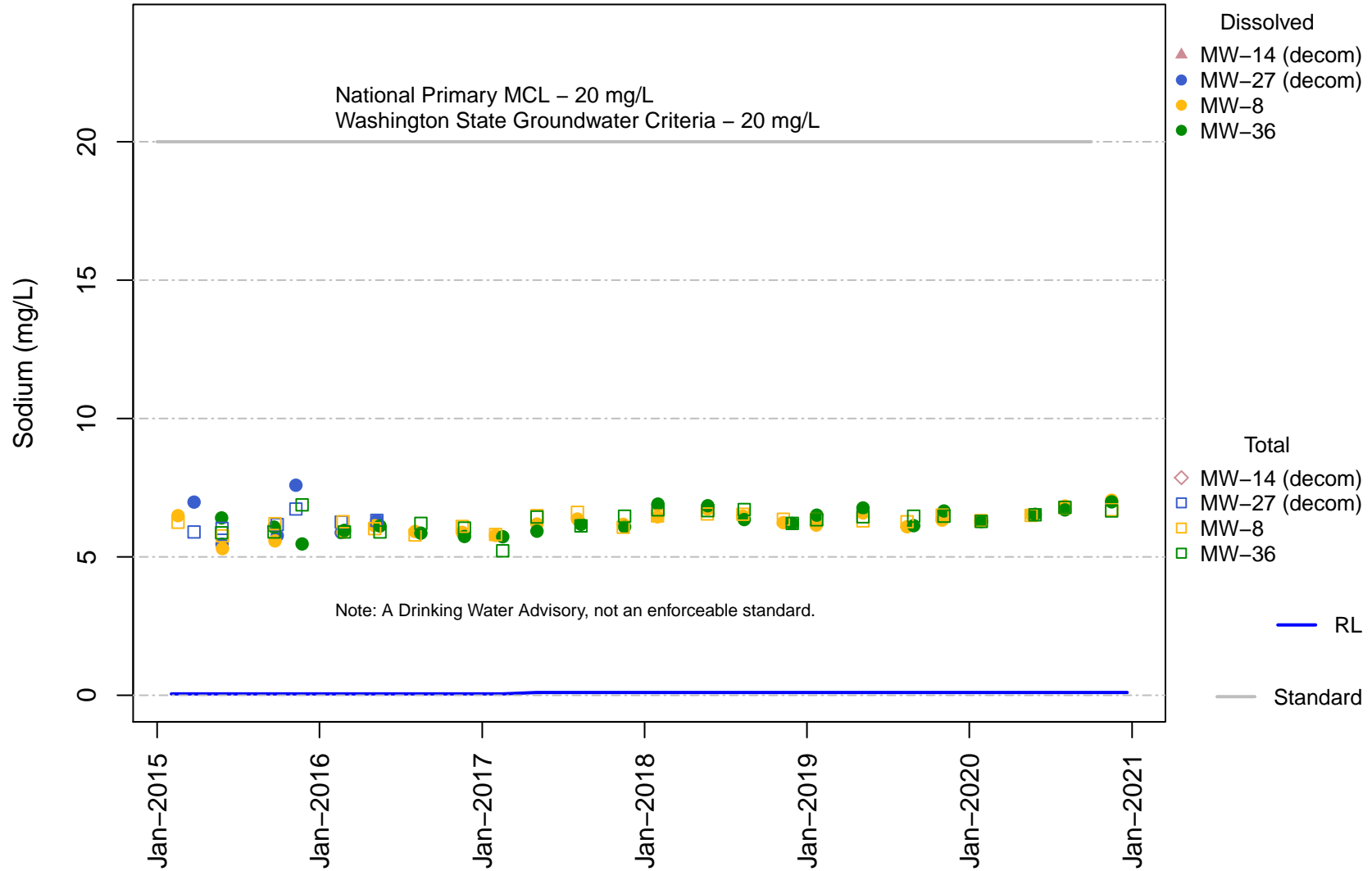
# Vashon Island Closed Landfill Channel Cc3 Potassium



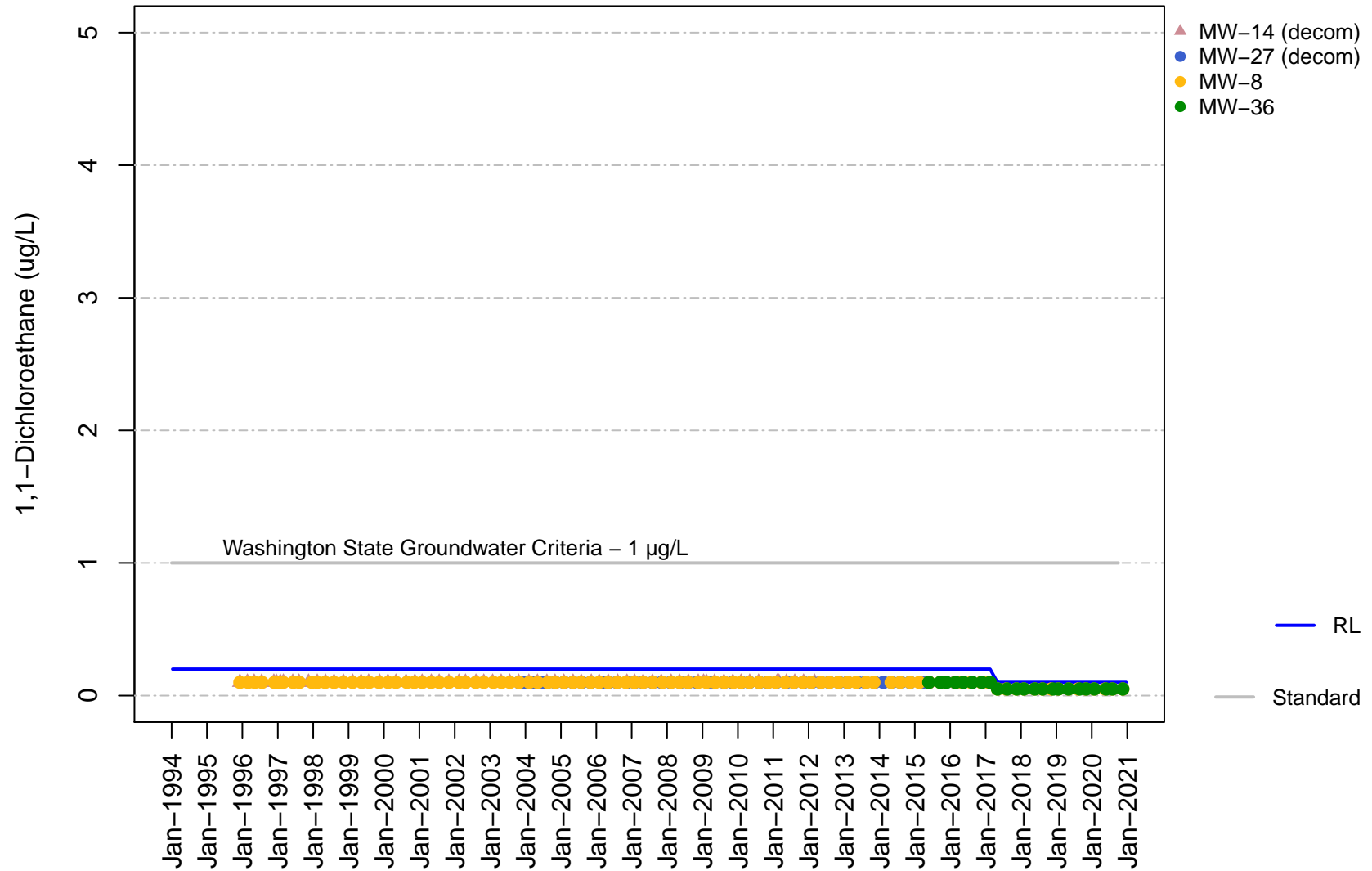
# Vashon Island Closed Landfill Channel Cc3 Sodium



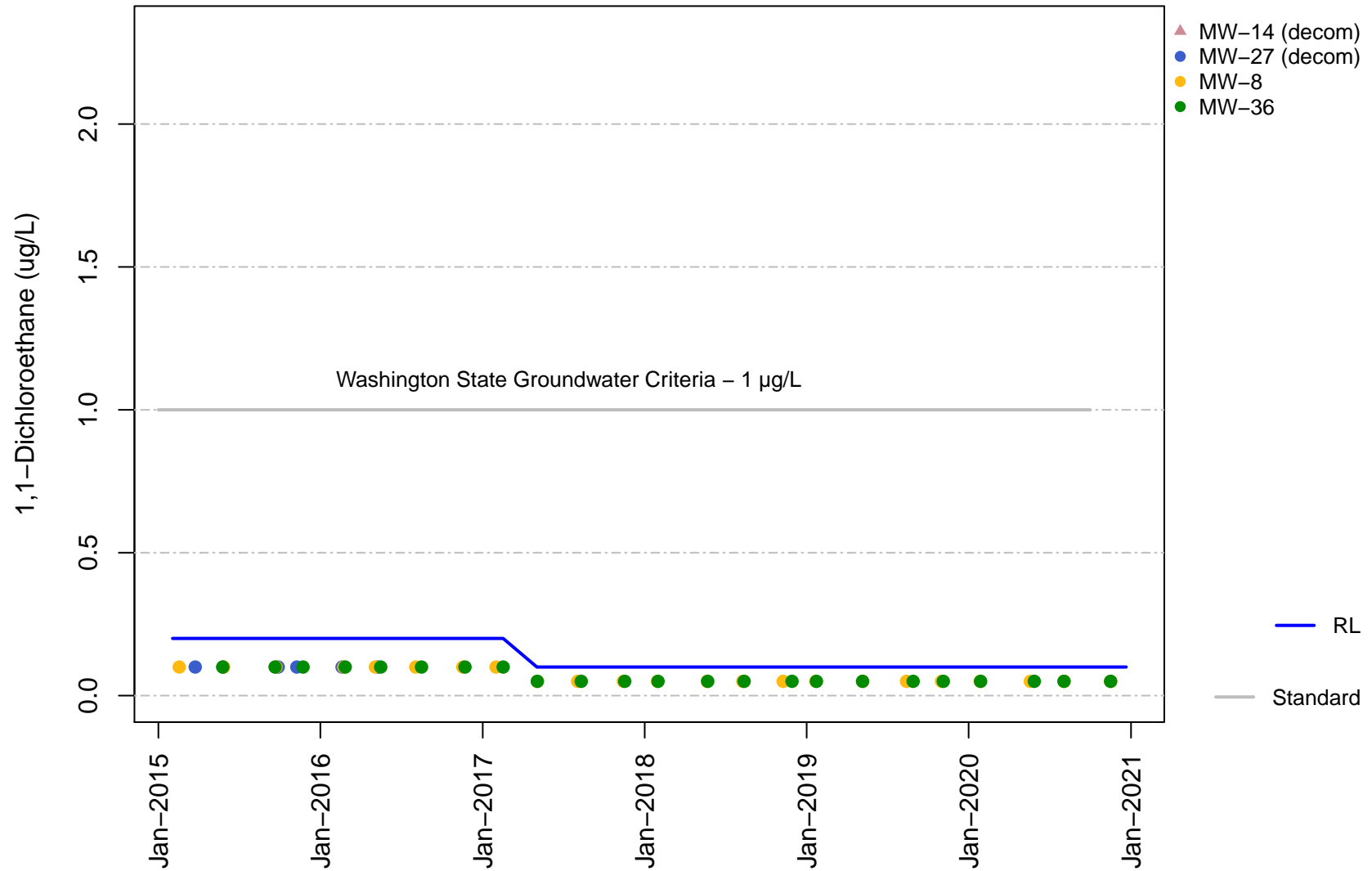
# Vashon Island Closed Landfill Channel Cc3 Sodium



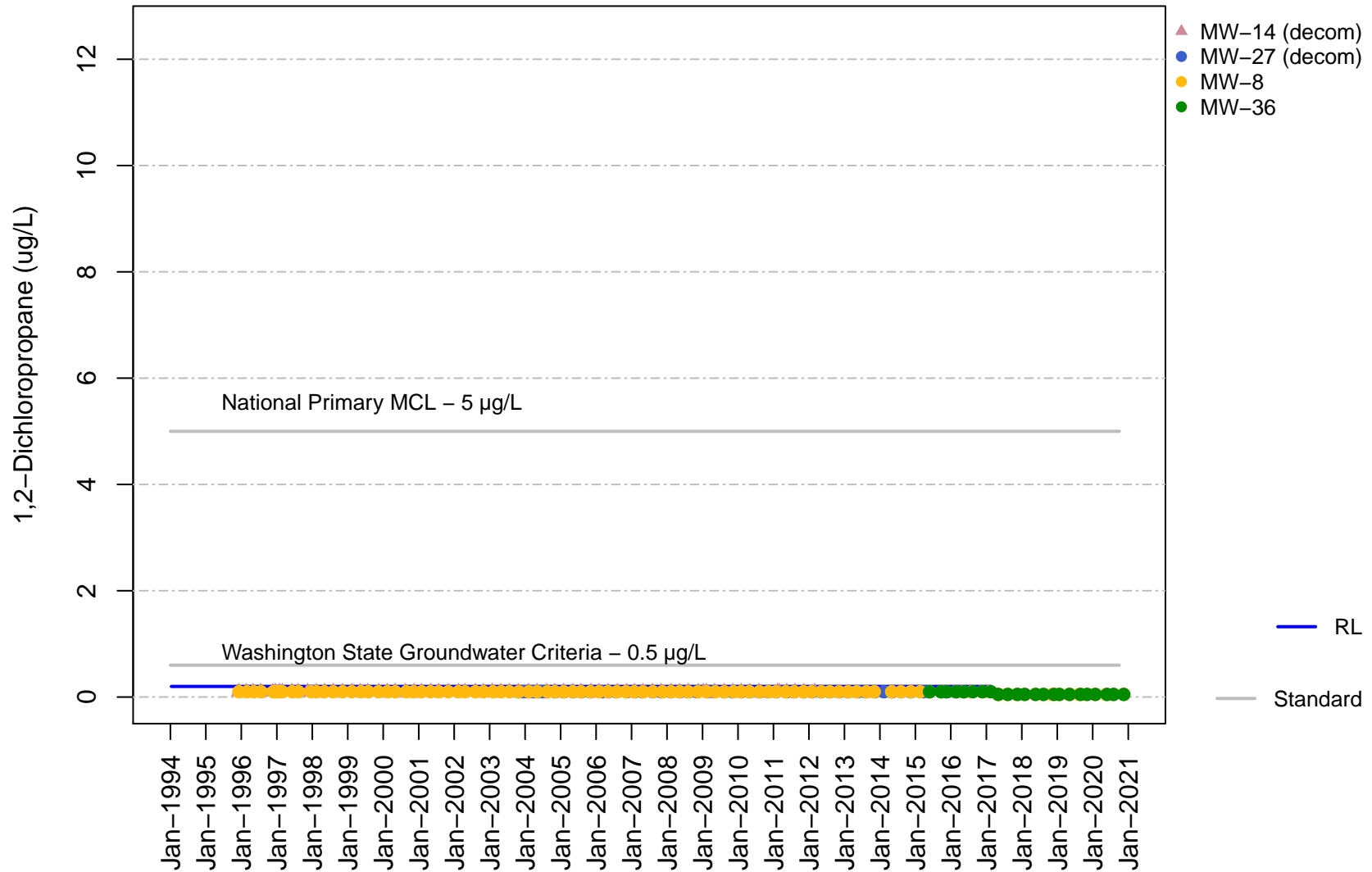
**Vashon Island Closed Landfill  
Channel Cc3  
1,1-Dichloroethane**



Vashon Island Closed Landfill  
 Channel Cc3  
 1,1-Dichloroethane

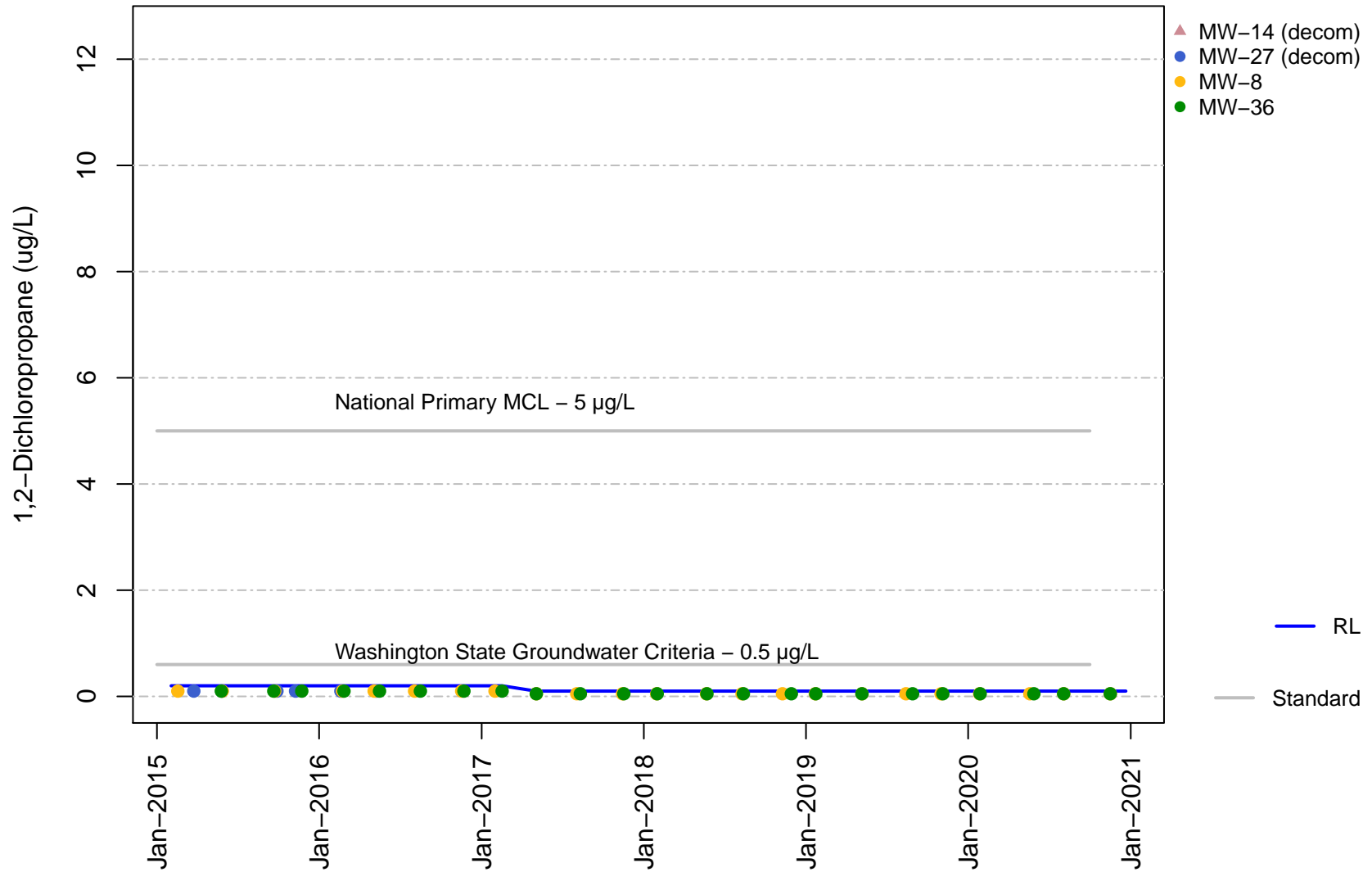


**Vashon Island Closed Landfill  
Channel Cc3  
1,2-Dichloropropane**

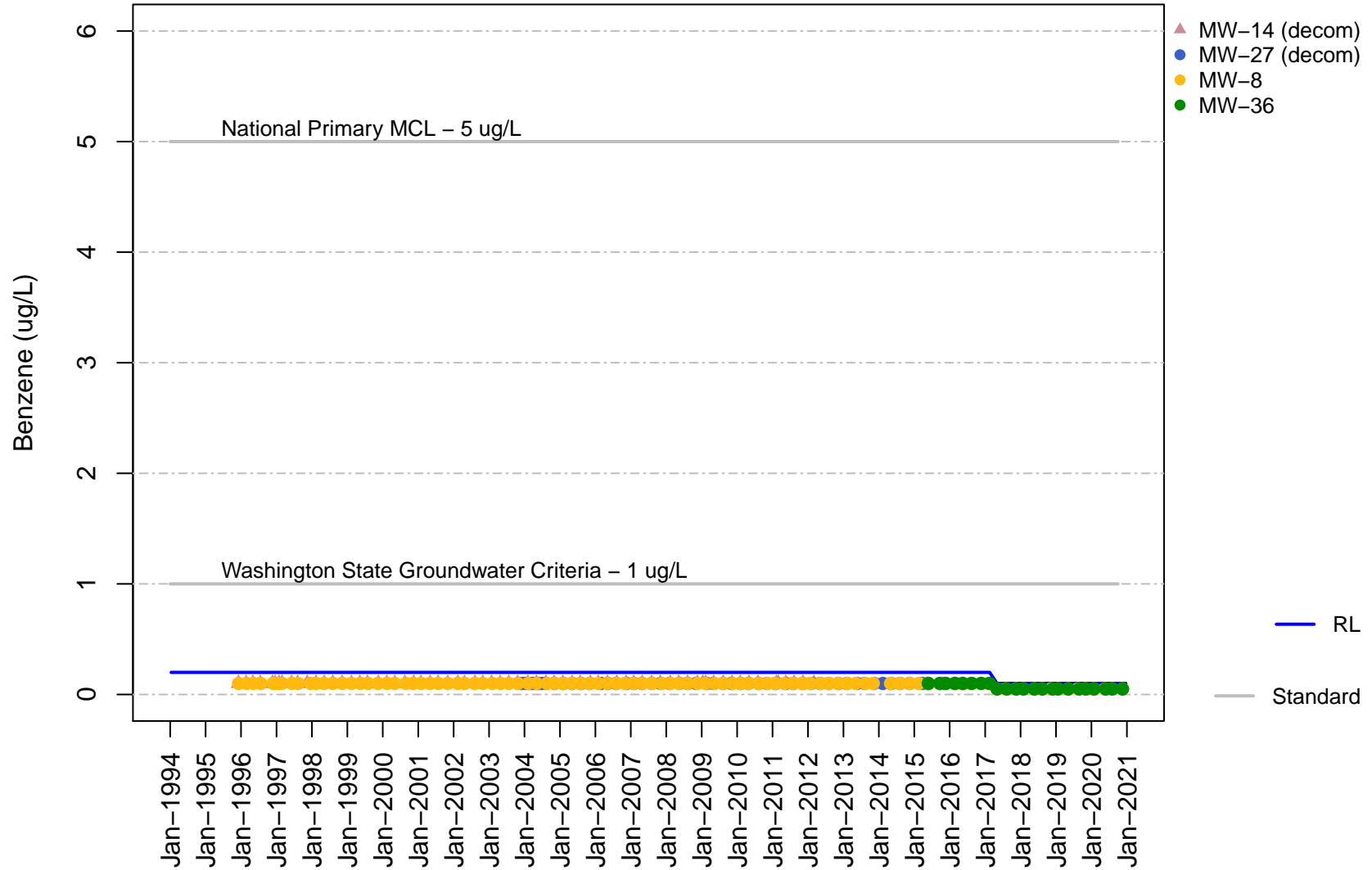




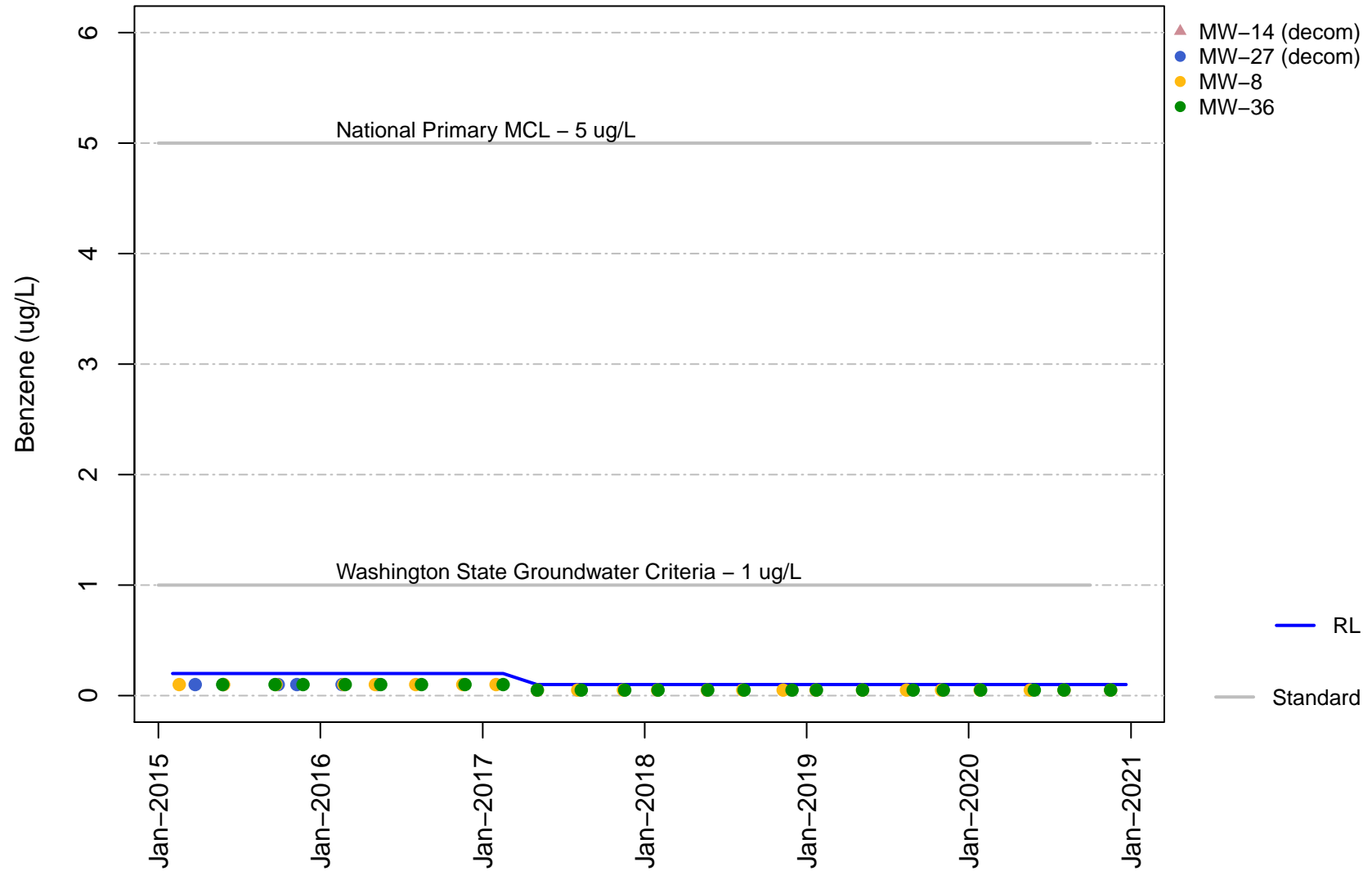
# Vashon Island Closed Landfill Channel Cc3 1,2-Dichloropropane



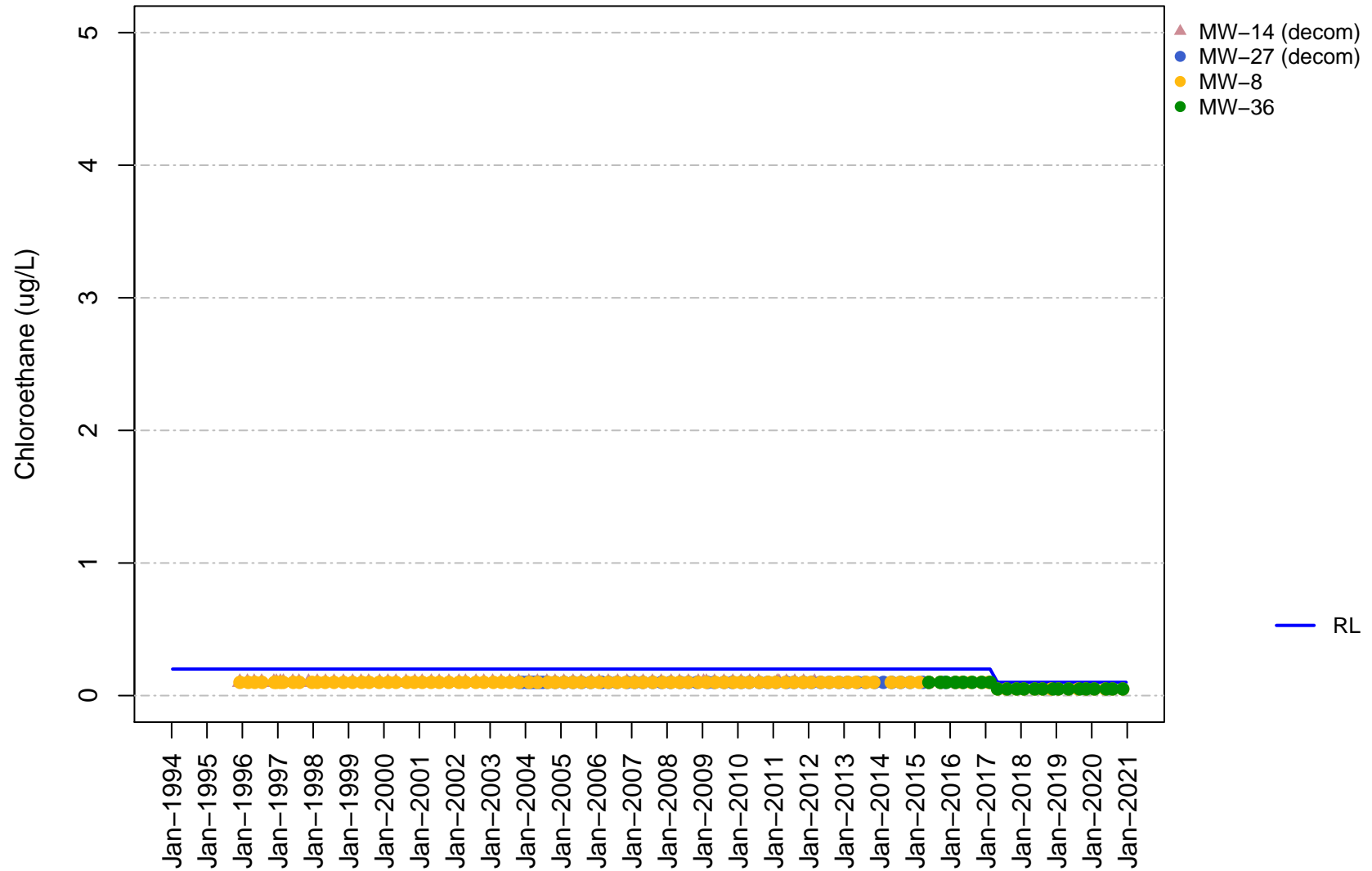
# Vashon Island Closed Landfill Channel Cc3 Benzene



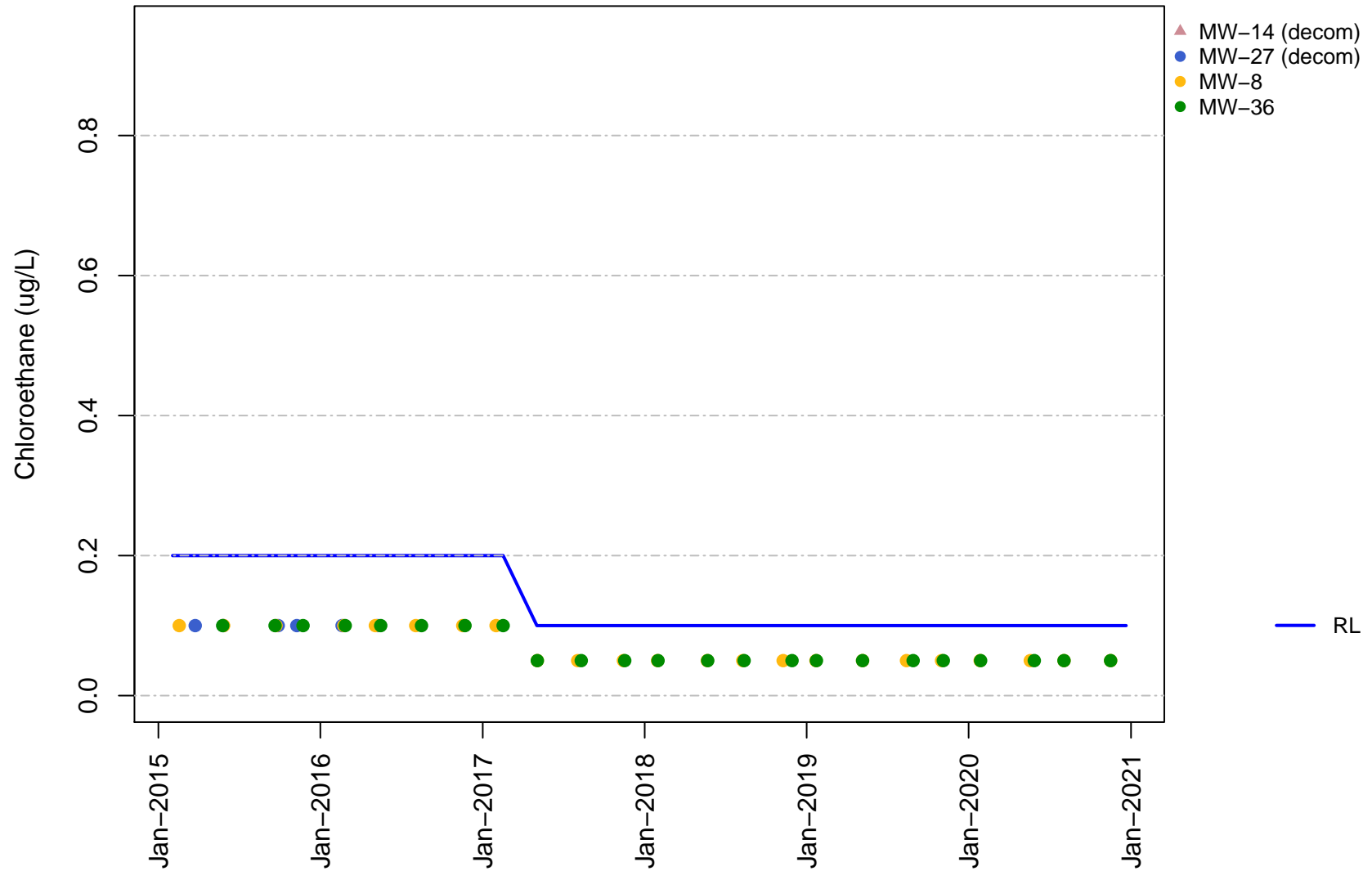
**Vashon Island Closed Landfill  
Channel Cc3  
Benzene**



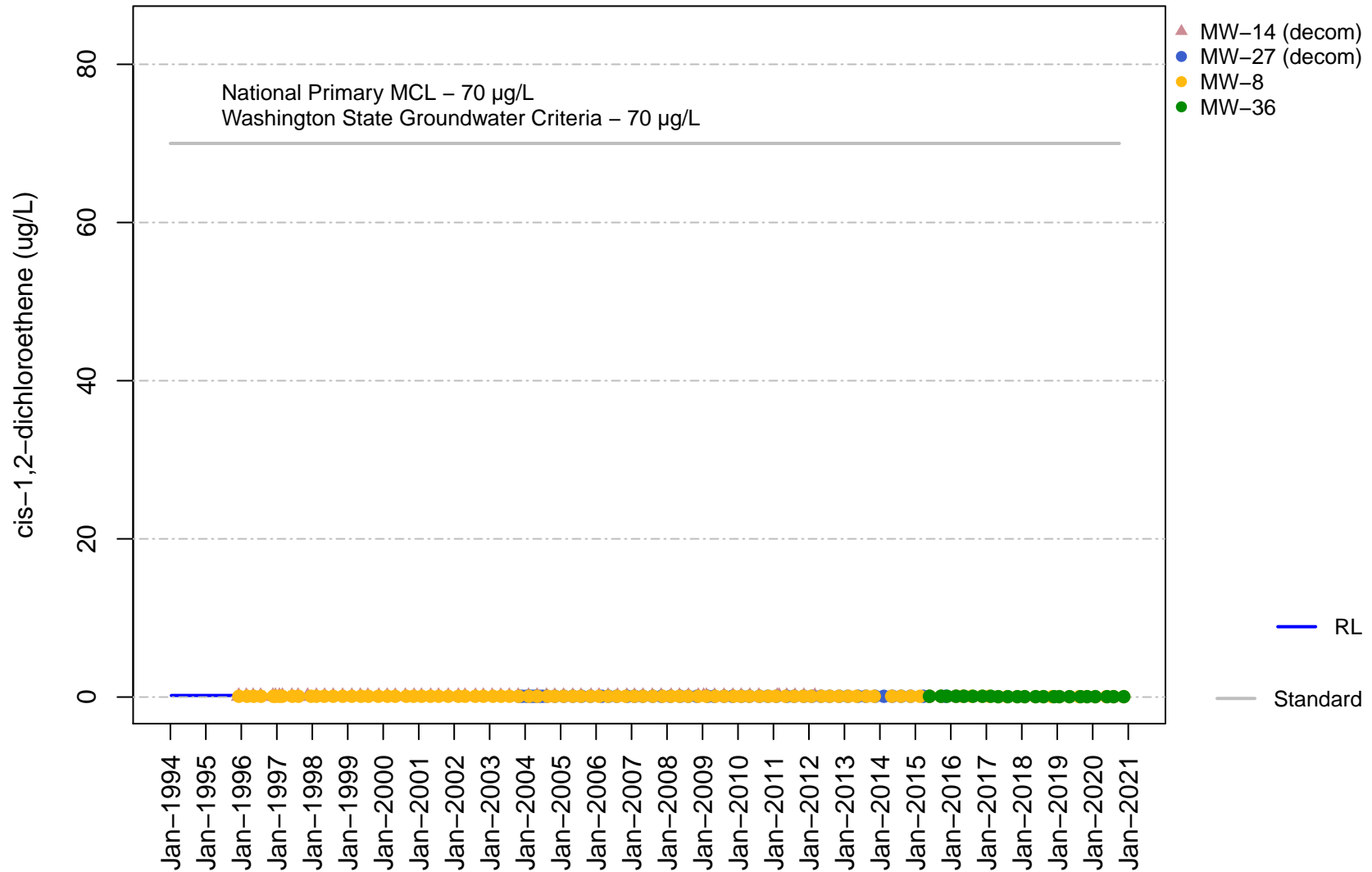
# Vashon Island Closed Landfill Channel Cc3 Chloroethane



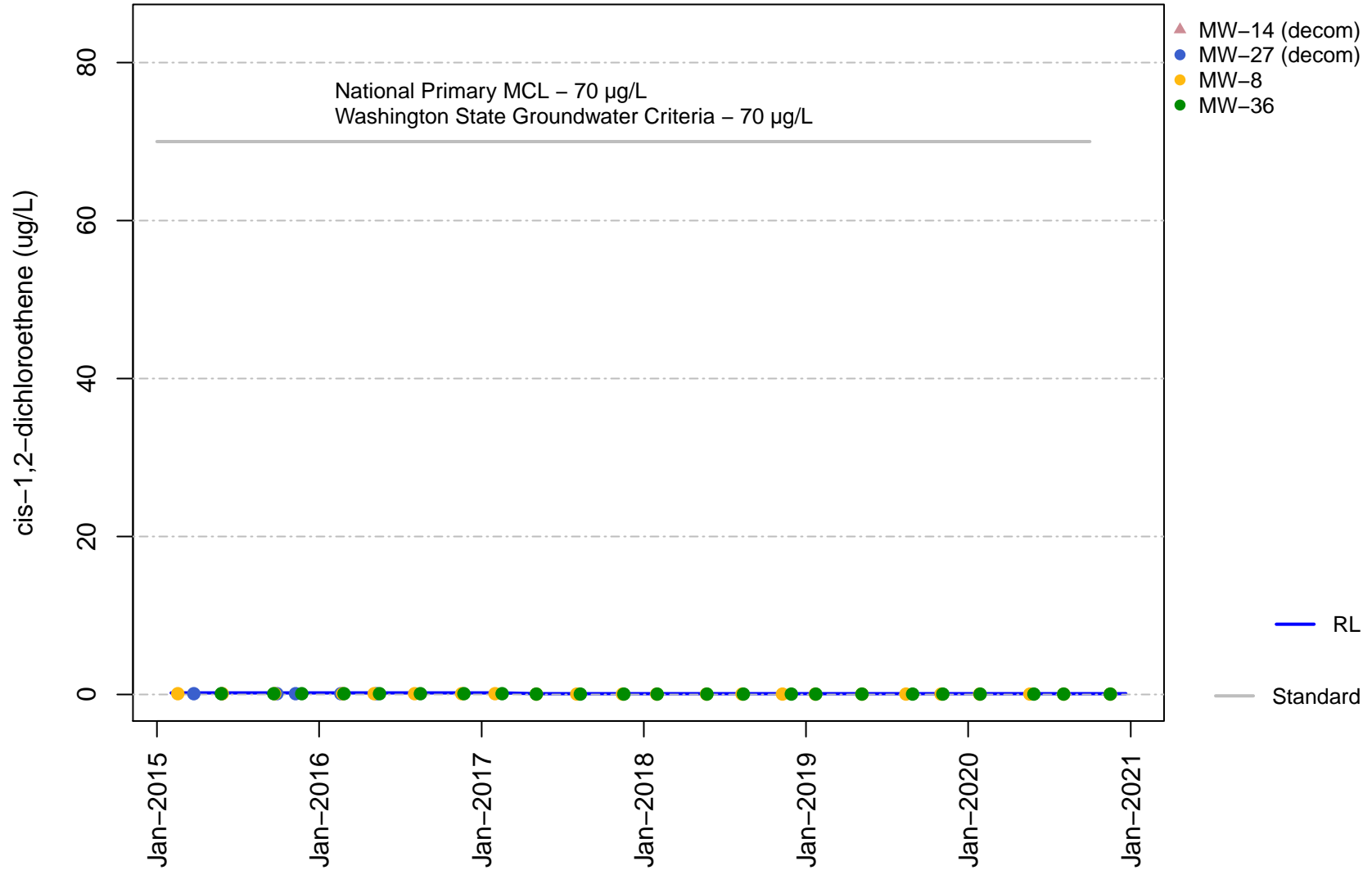
# Vashon Island Closed Landfill Channel Cc3 Chloroethane



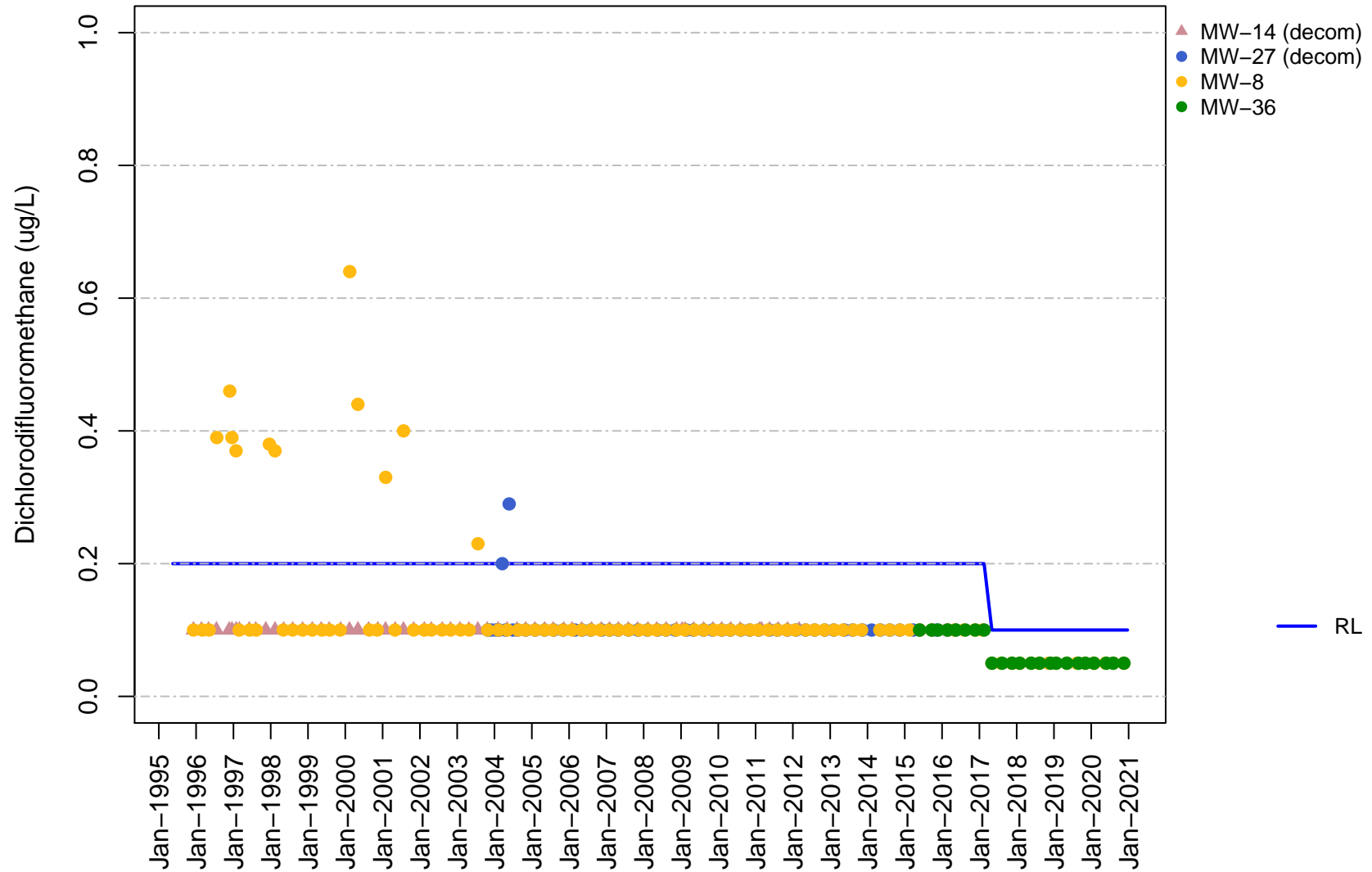
**Vashon Island Closed Landfill  
Channel Cc3  
cis-1,2-Dichloroethene**



# Vashon Island Closed Landfill Channel Cc3 cis-1,2-Dichloroethene

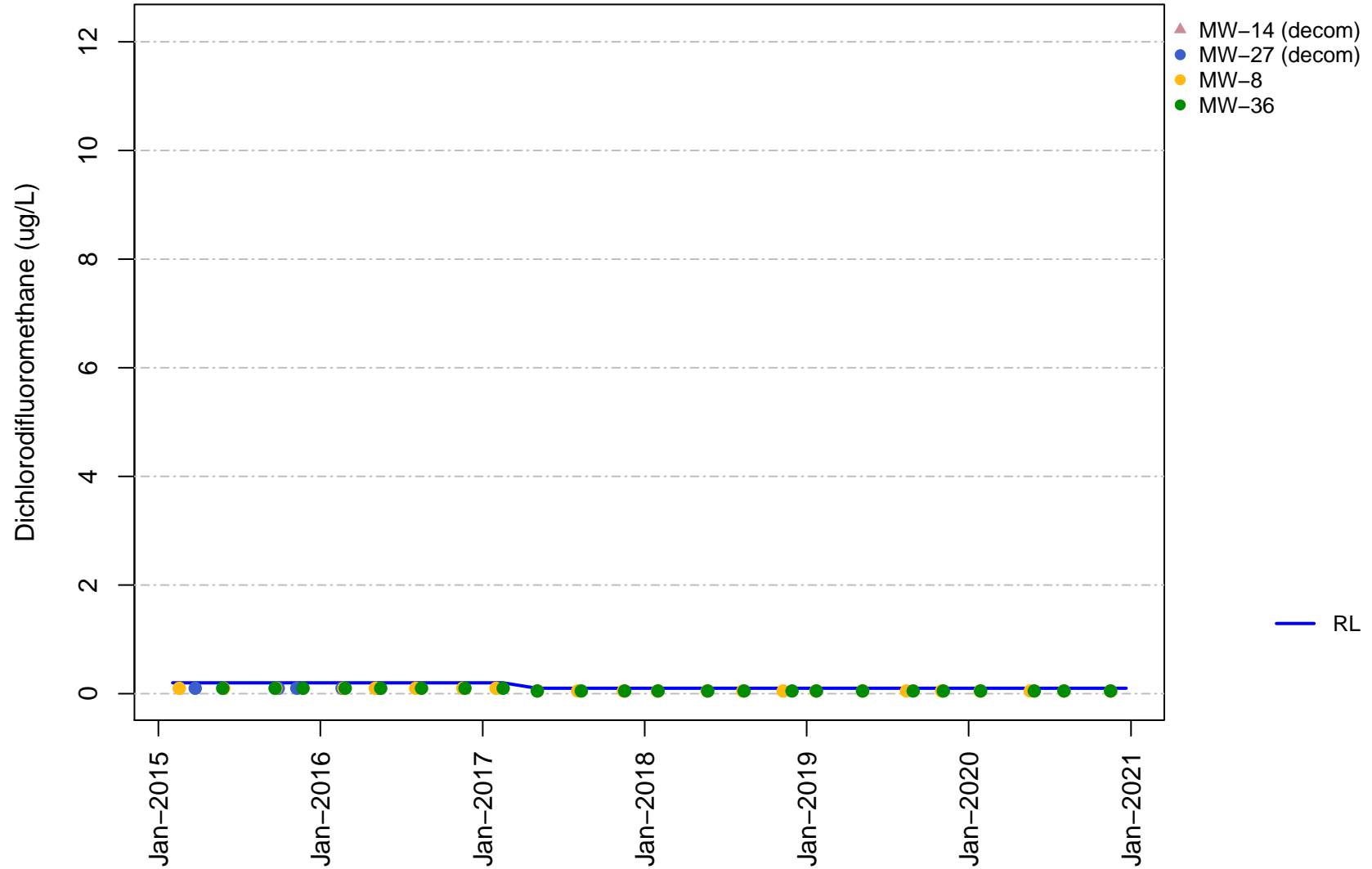


**Vashon Island Closed Landfill  
Channel Cc3  
Dichlorodifluoromethane**

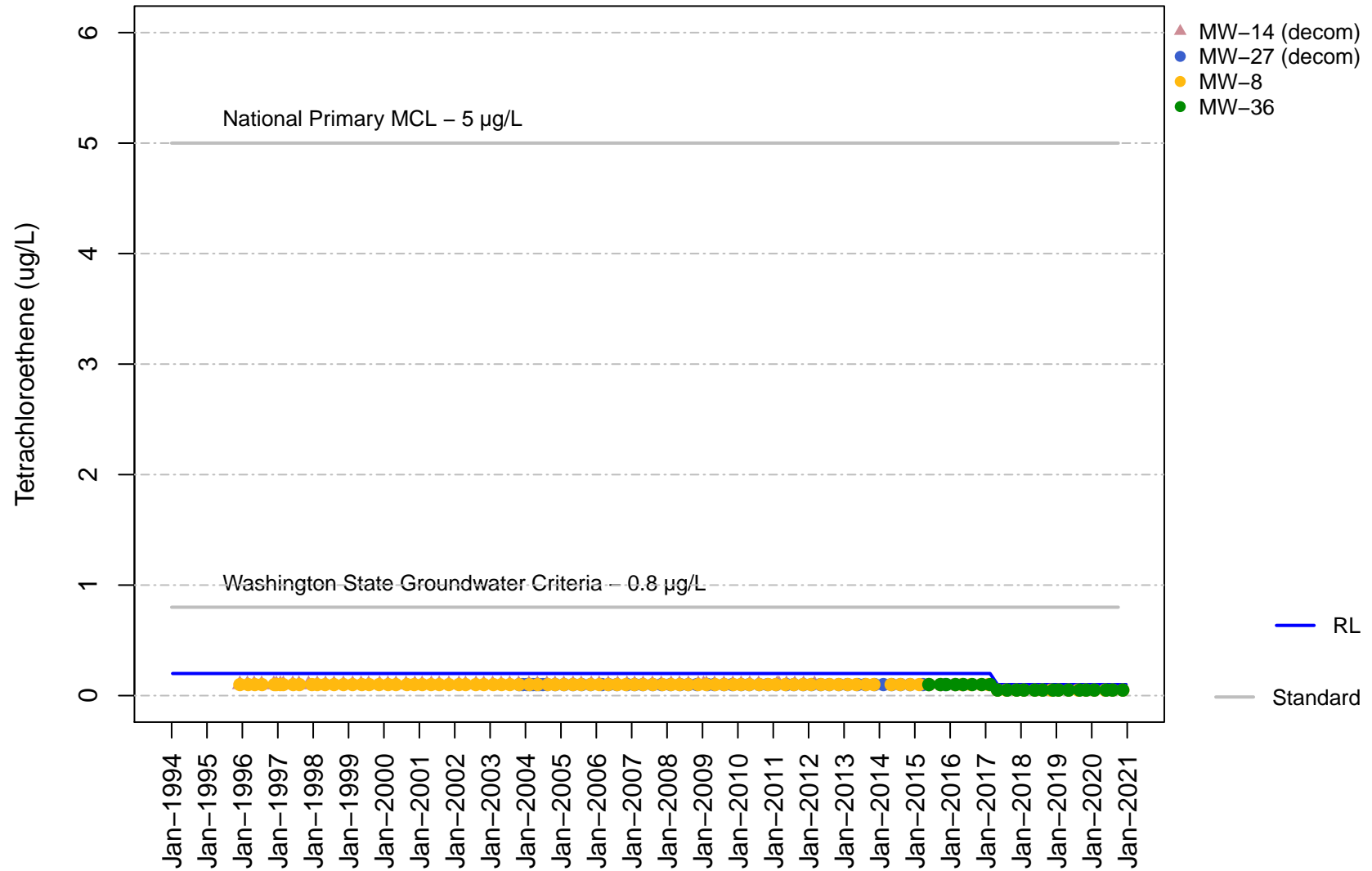




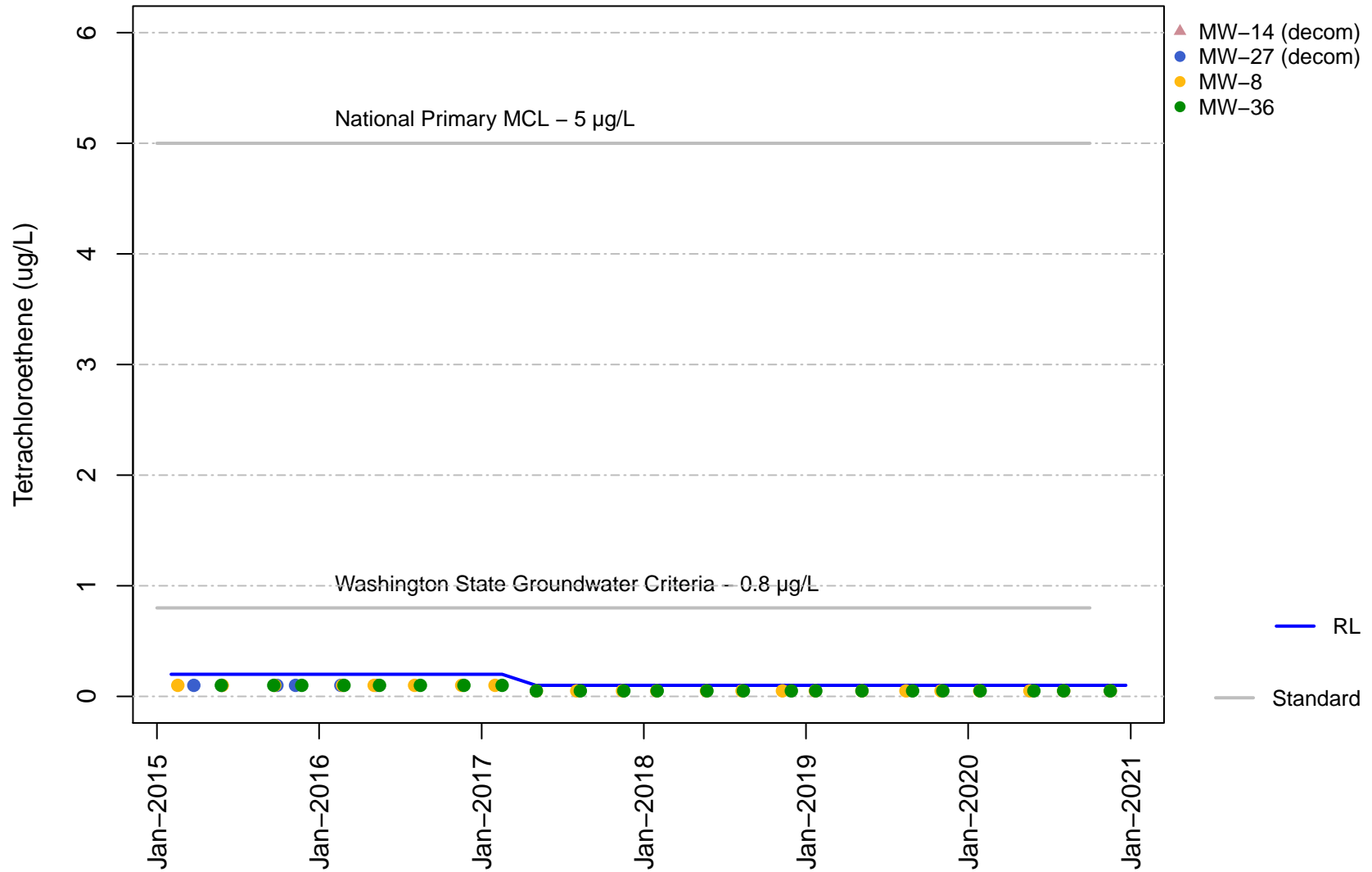
Vashon Island Closed Landfill  
Channel Cc3  
Dichlorodifluoromethane



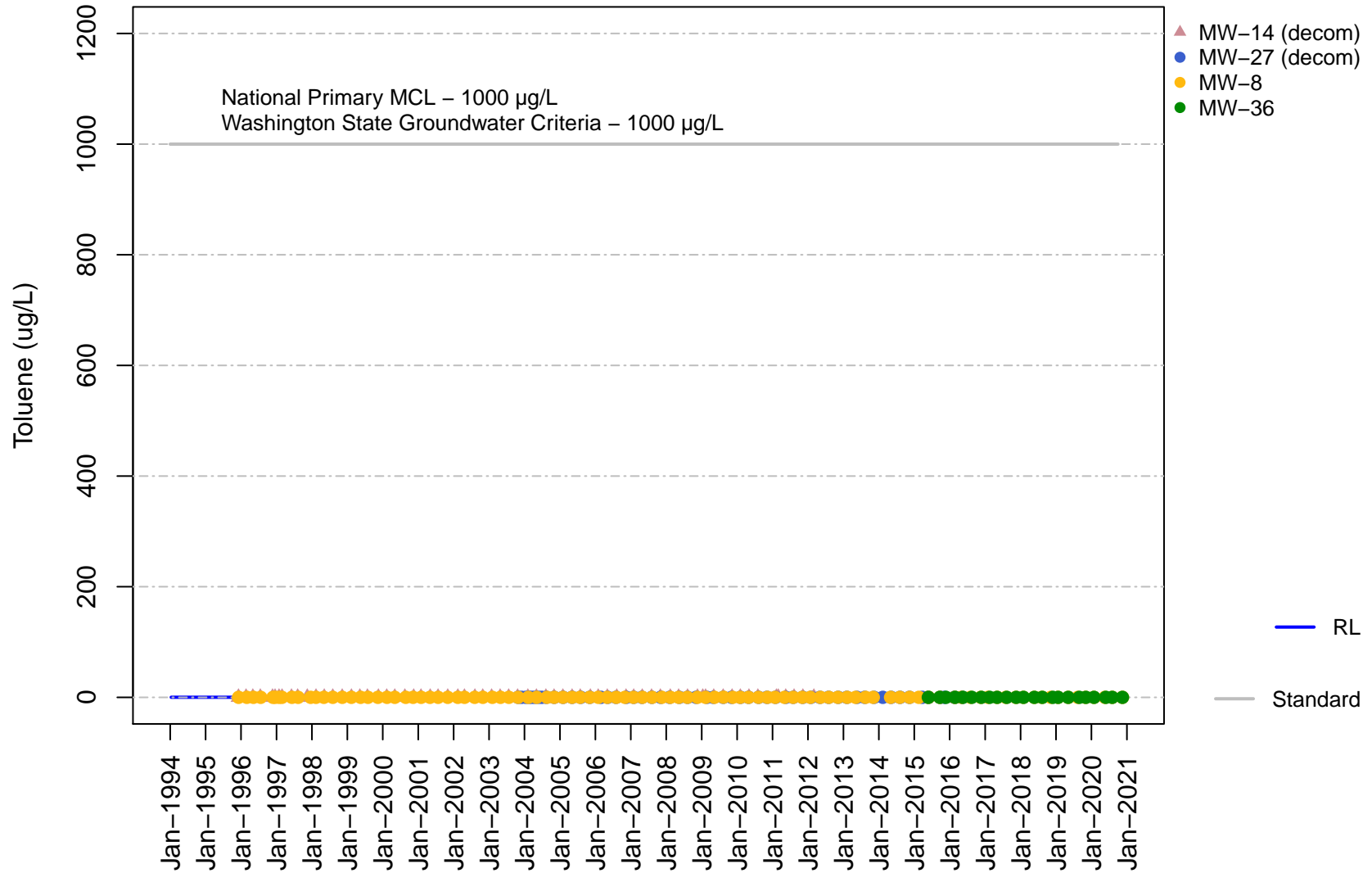
**Vashon Island Closed Landfill  
Channel Cc3  
Tetrachloroethene**



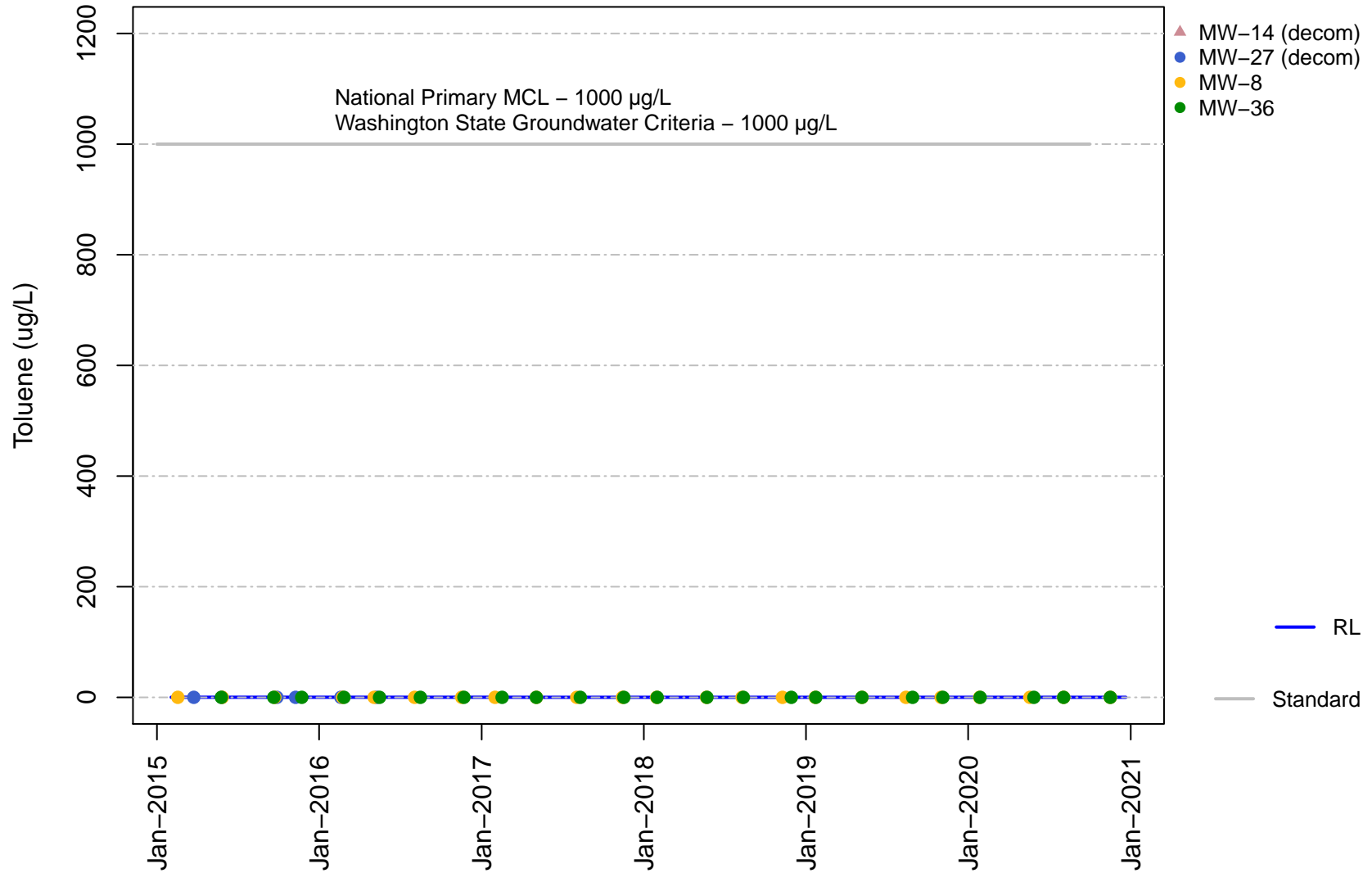
# Vashon Island Closed Landfill Channel Cc3 Tetrachloroethene



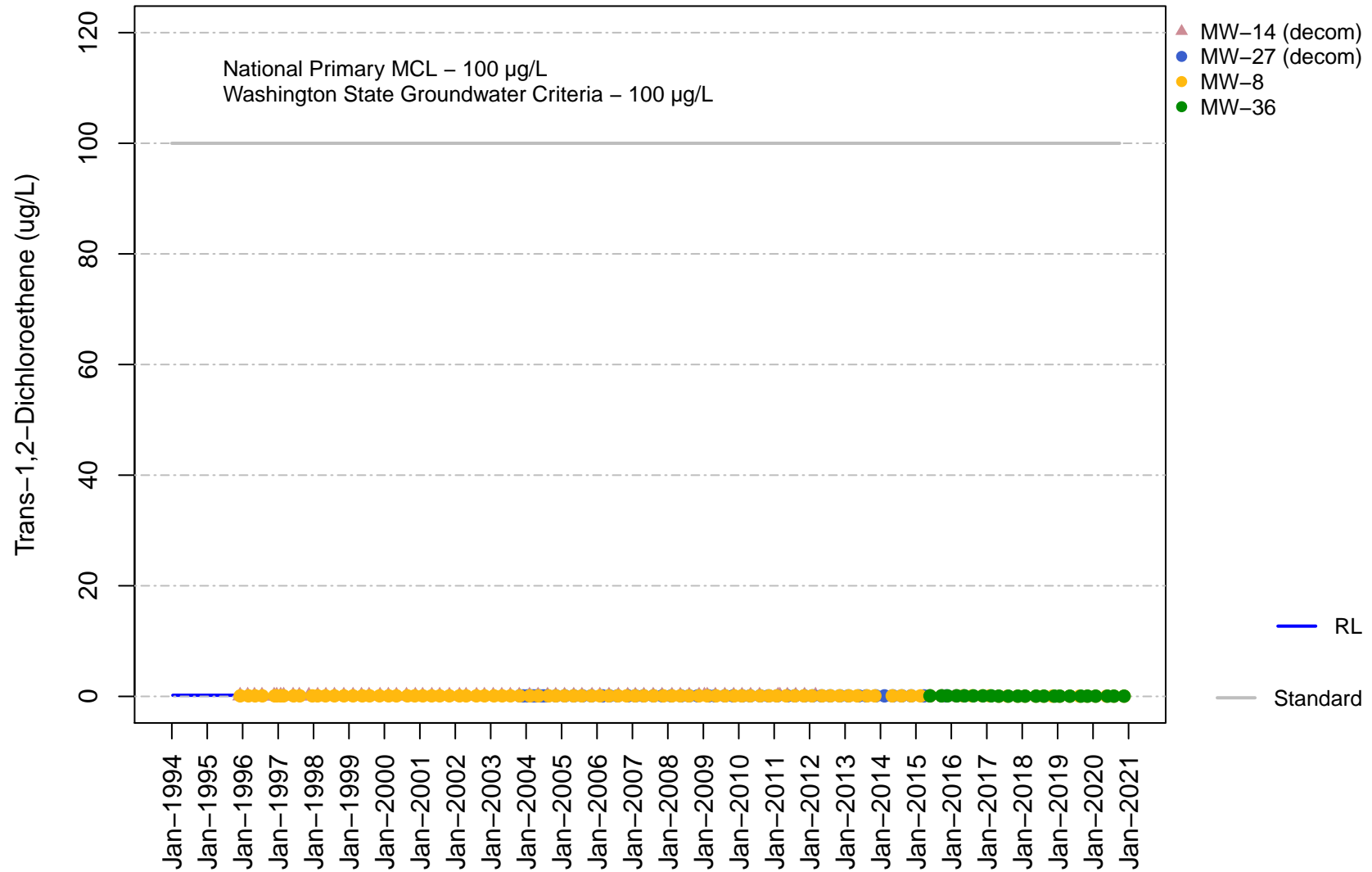
# Vashon Island Closed Landfill Channel Cc3 Toluene



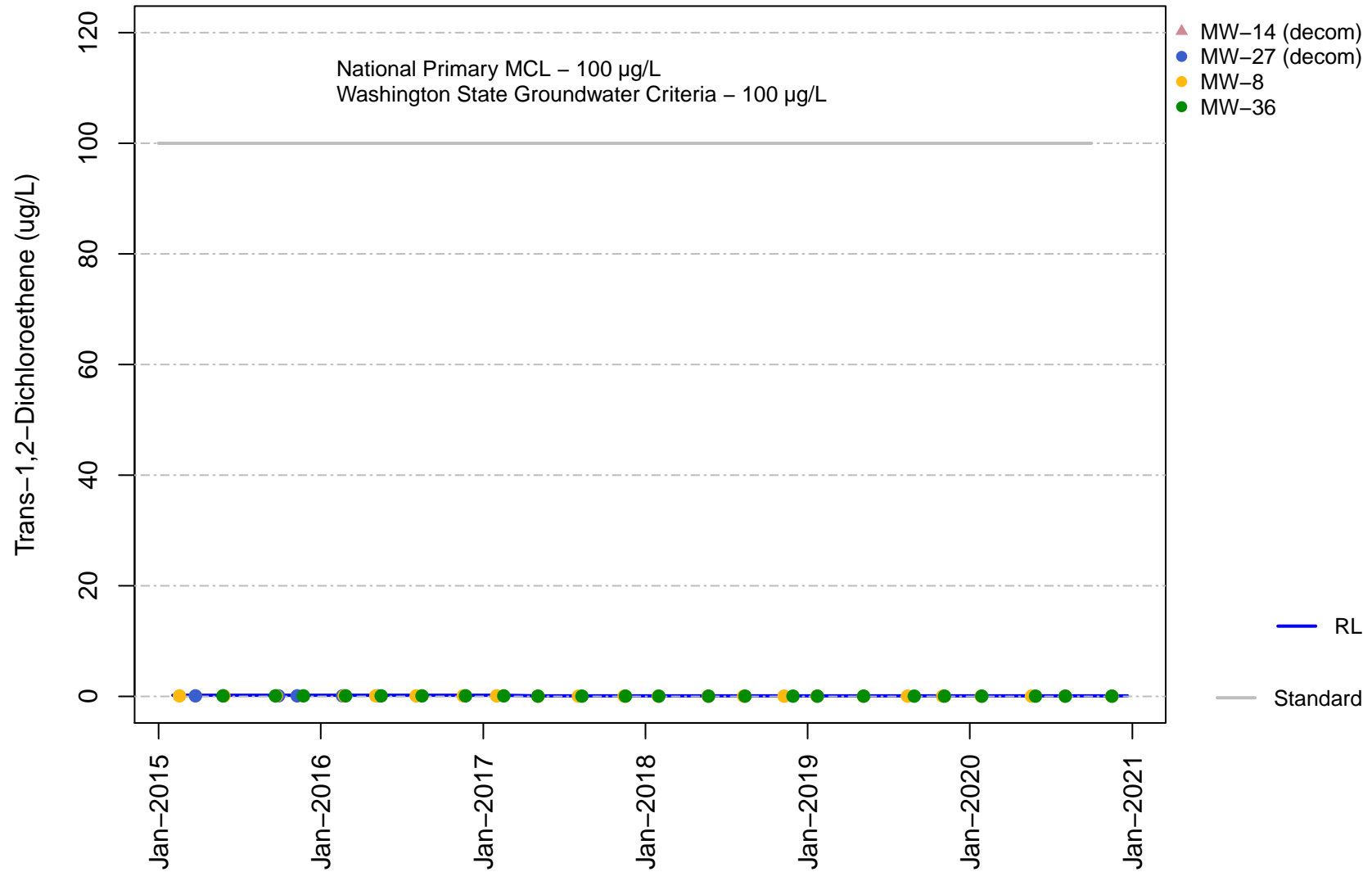
# Vashon Island Closed Landfill Channel Cc3 Toluene



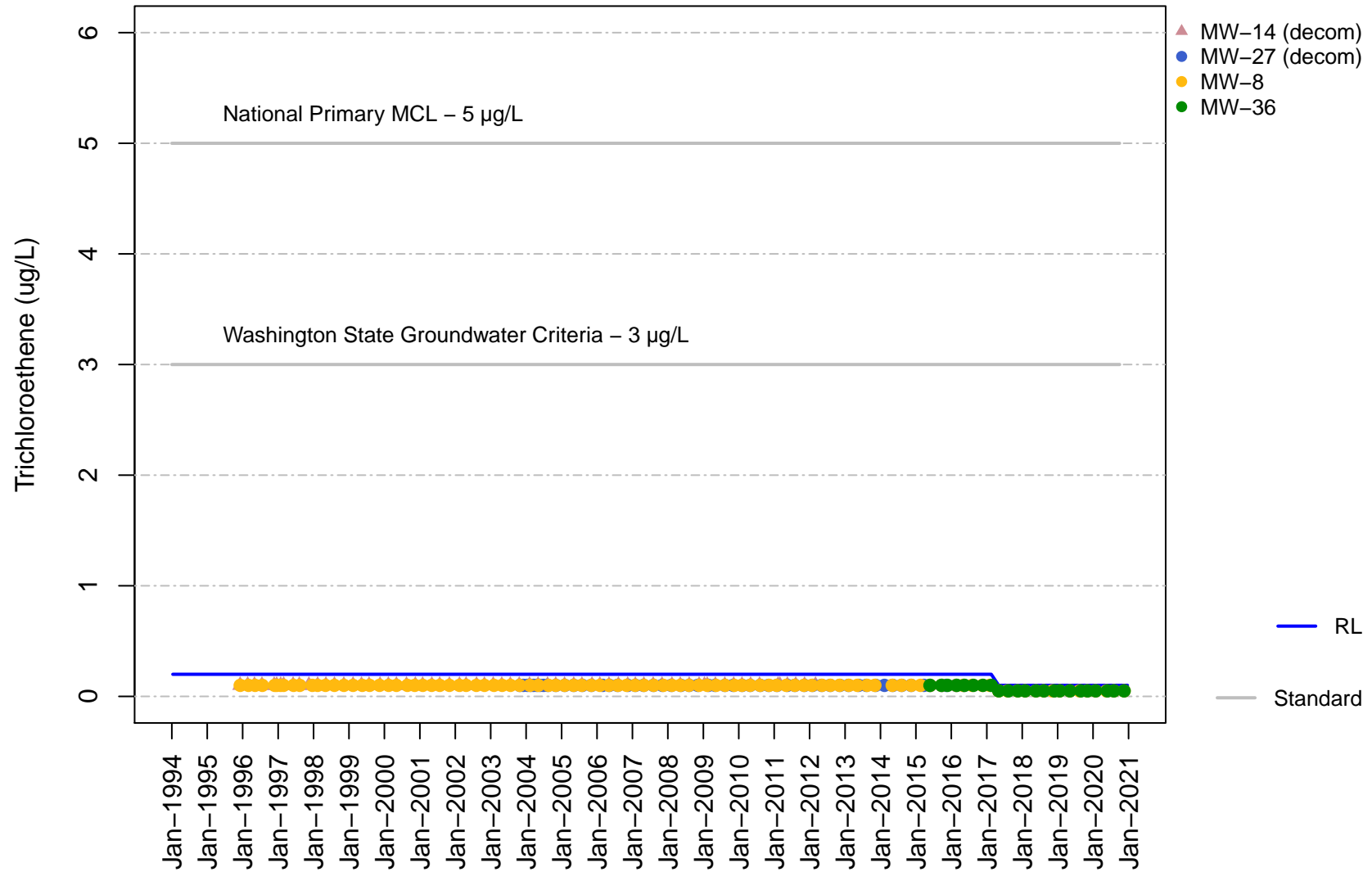
# Vashon Island Closed Landfill Channel Cc3 Trans-1,2-Dichloroethene



# Vashon Island Closed Landfill Channel Cc3 Trans-1,2-Dichloroethene

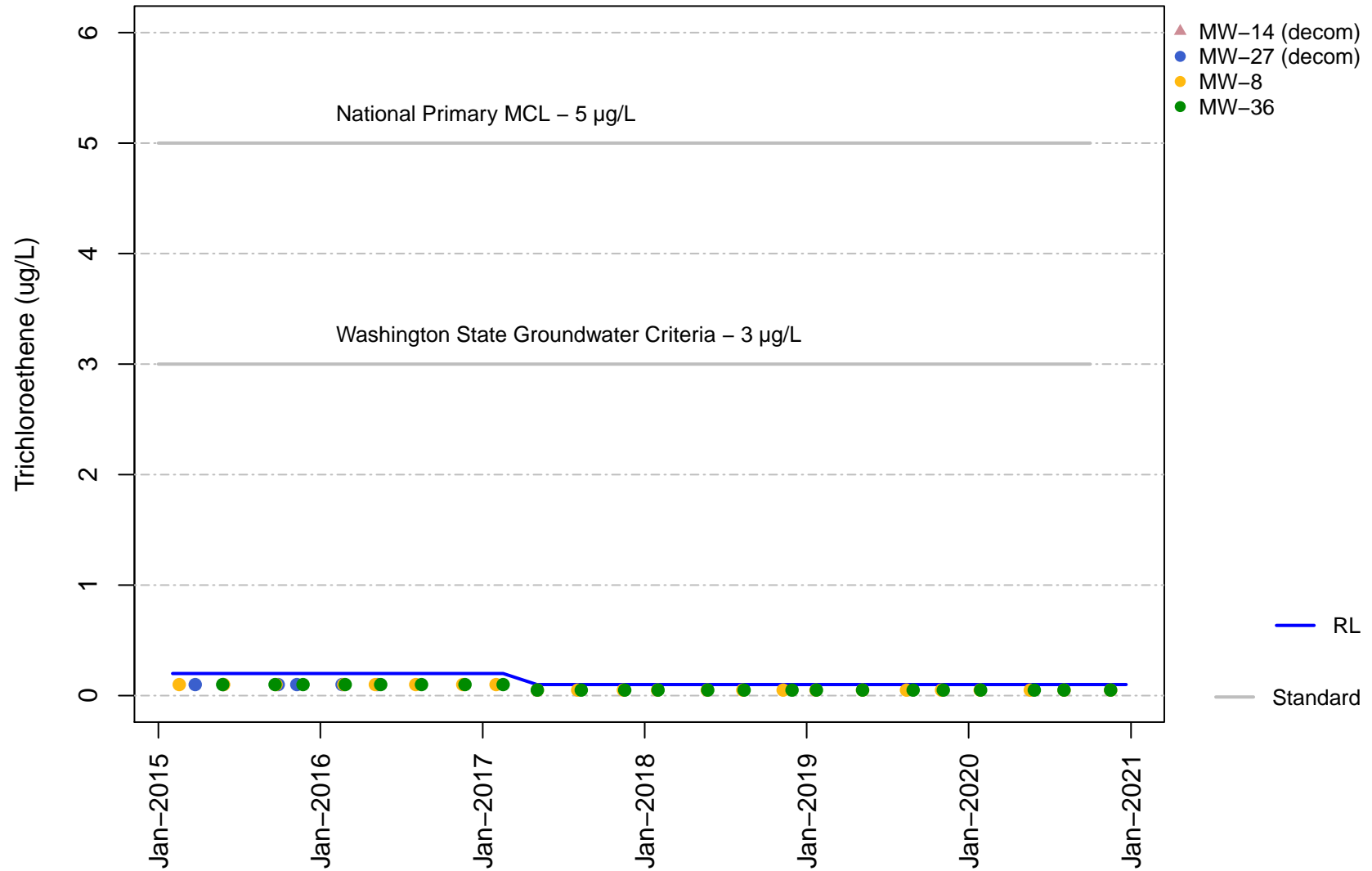


# Vashon Island Closed Landfill Channel Cc3 Trichloroethene

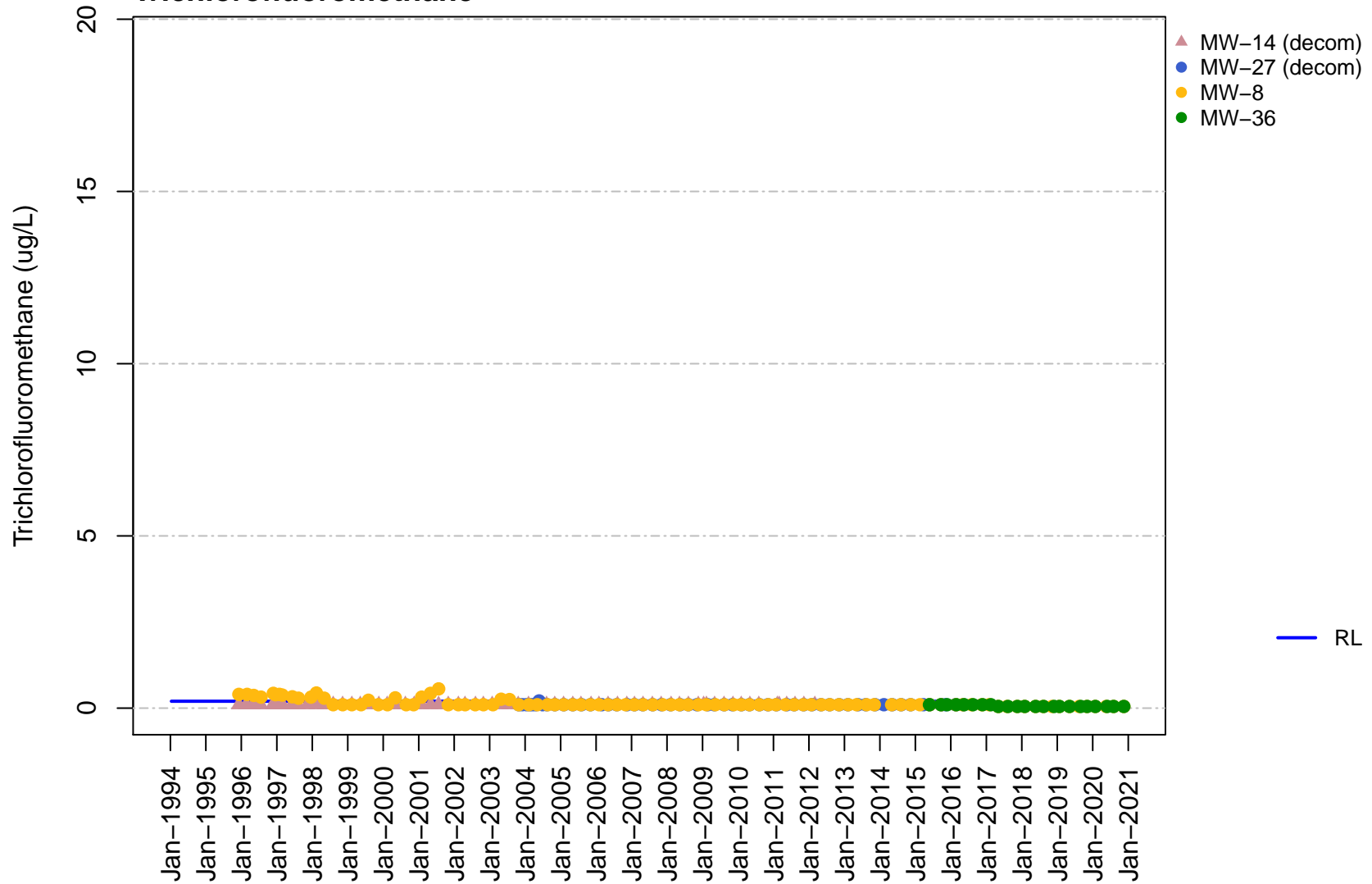




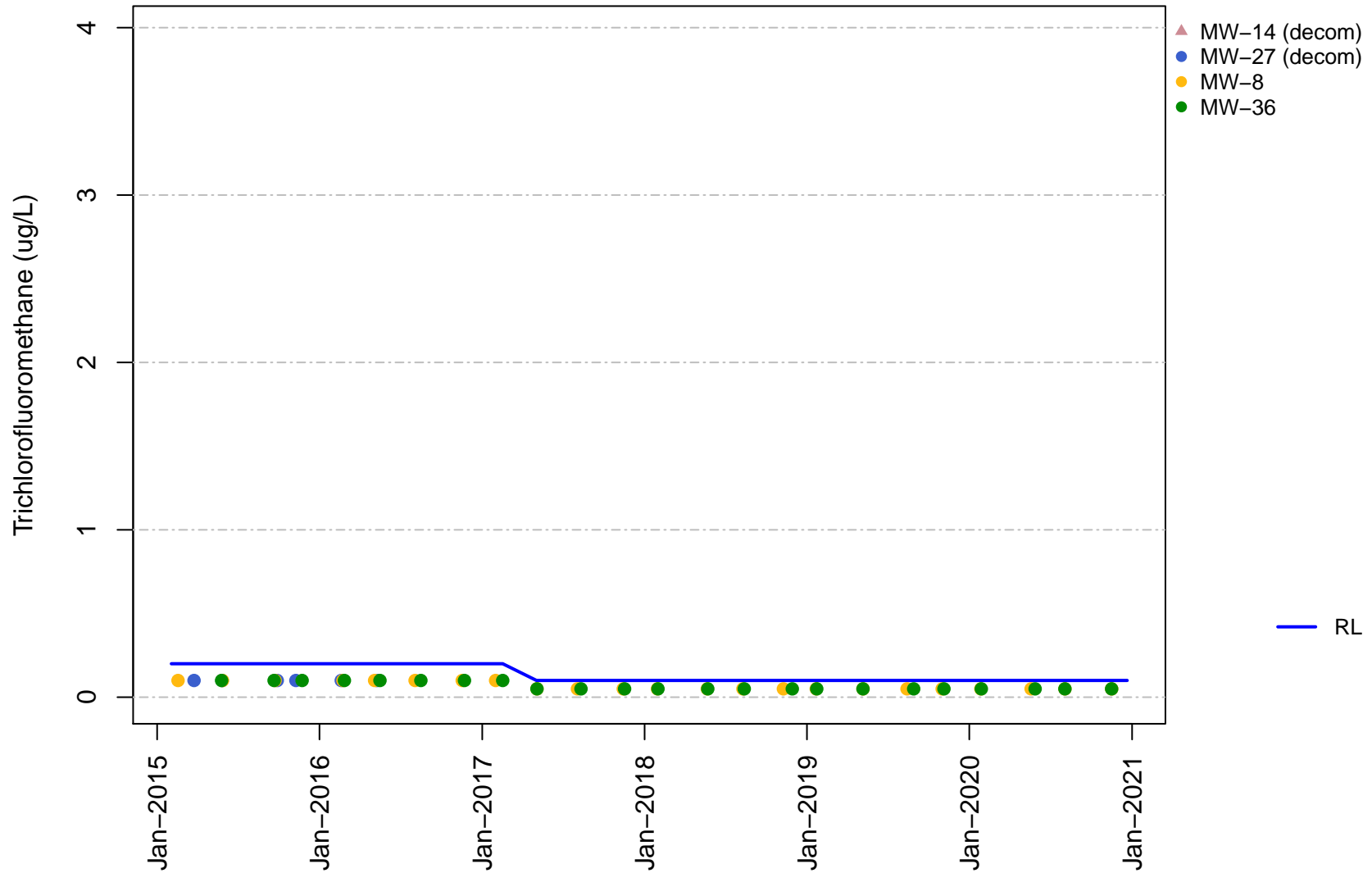
**Vashon Island Closed Landfill  
Channel Cc3  
Trichloroethene**



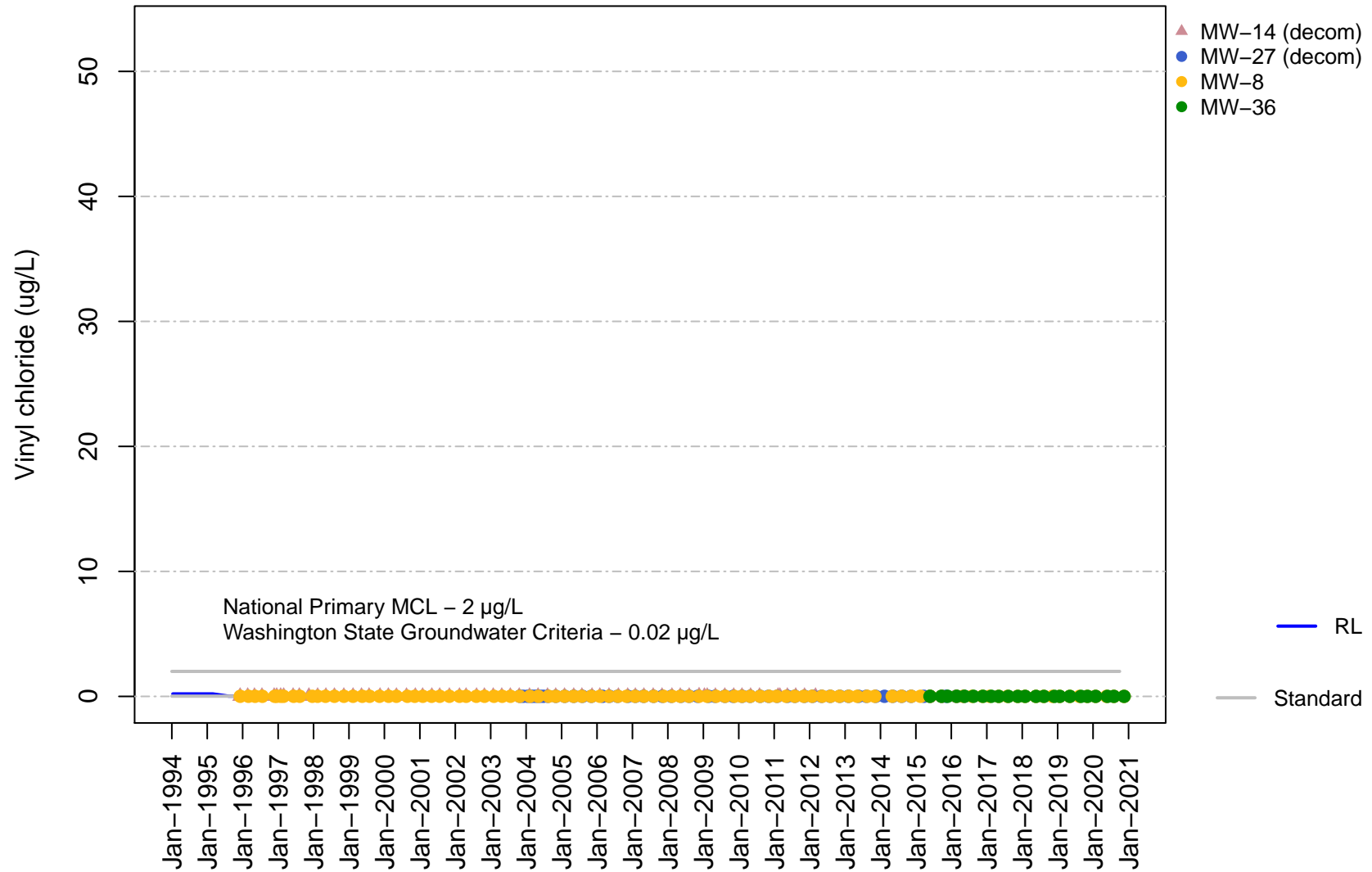
# Vashon Island Closed Landfill Channel Cc3 Trichlorofluoromethane



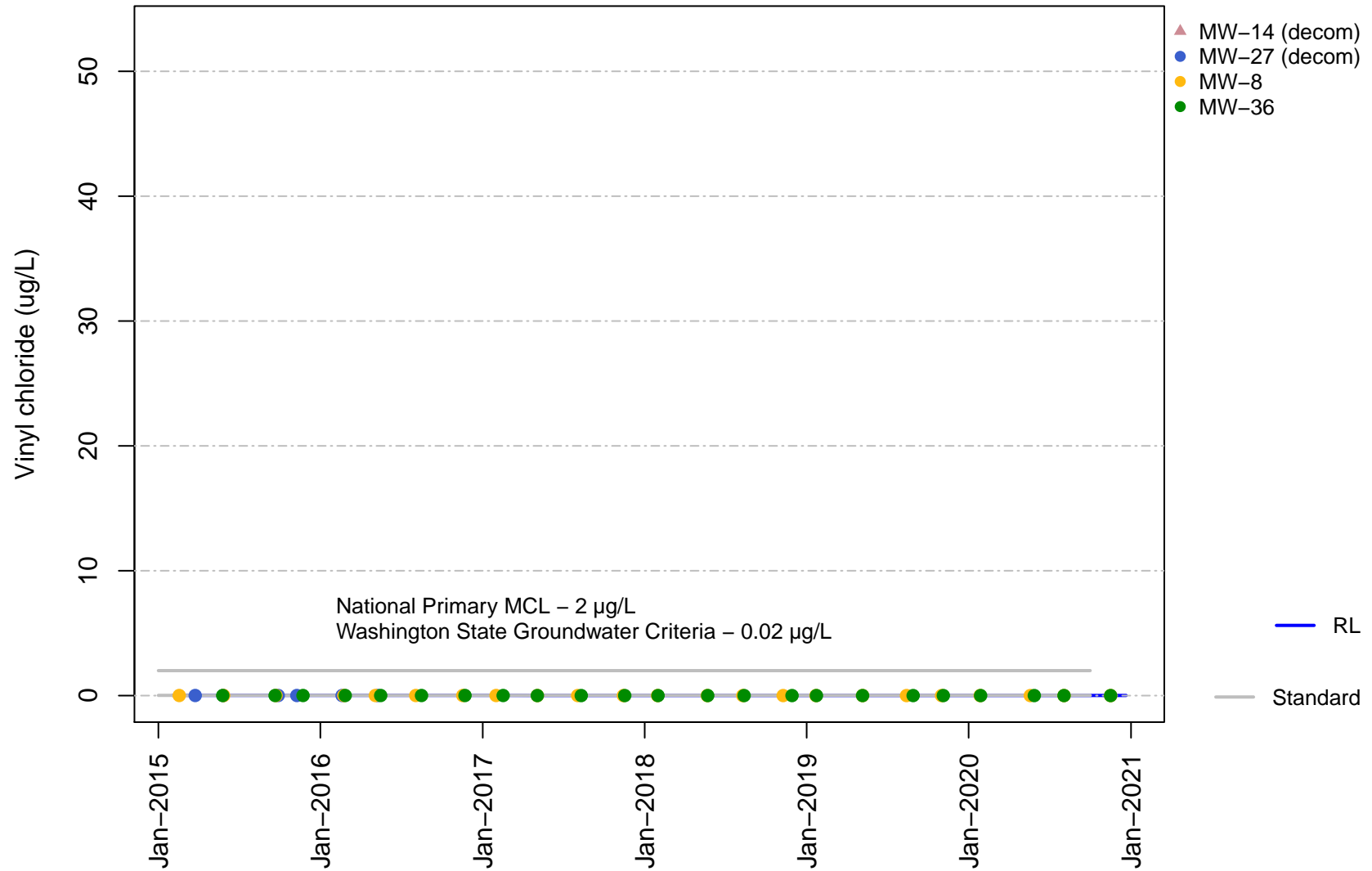
# Vashon Island Closed Landfill Channel Cc3 Trichlorofluoromethane



# Vashon Island Closed Landfill Channel Cc3 Vinyl chloride



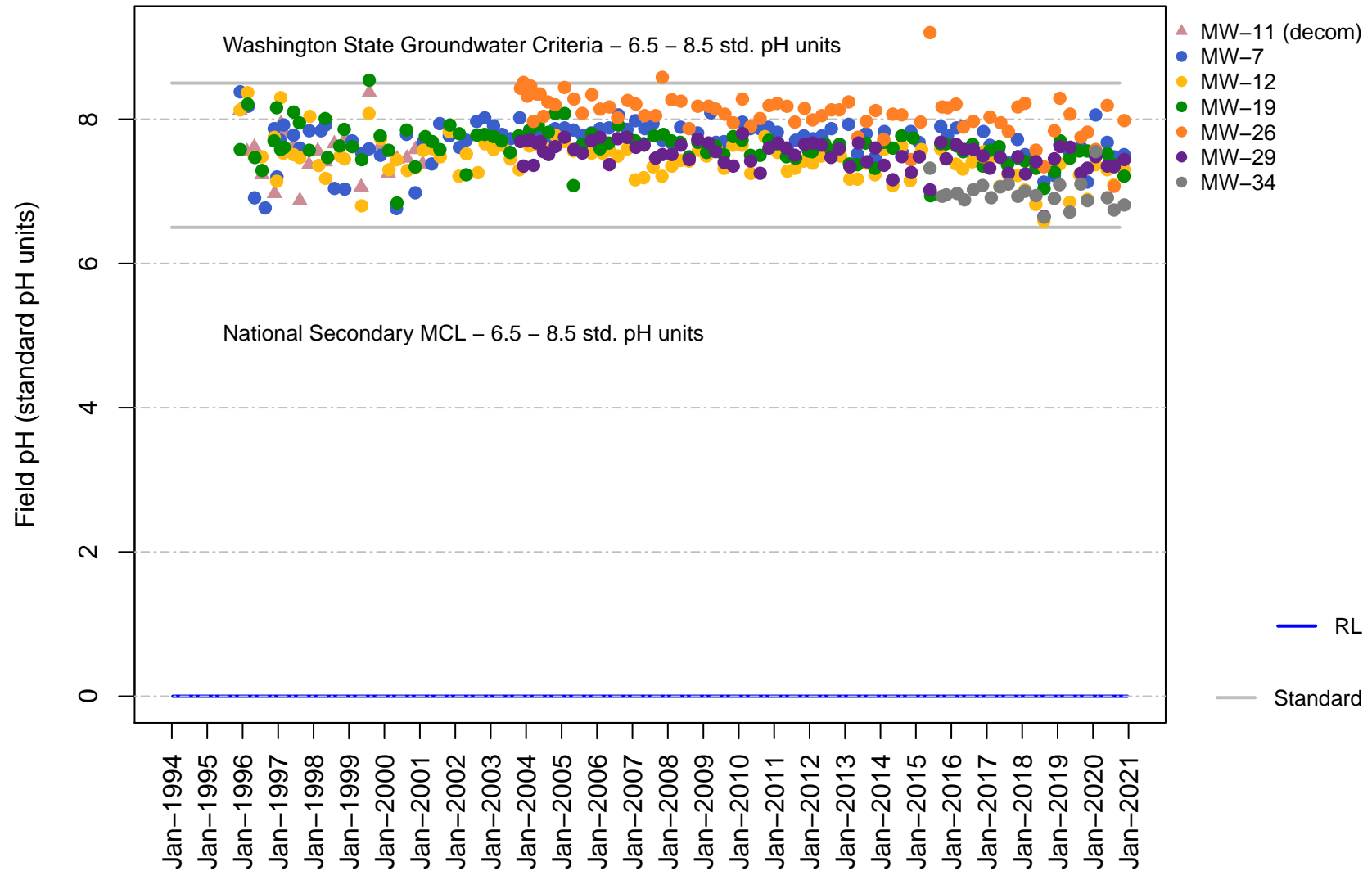
# Vashon Island Closed Landfill Channel Cc3 Vinyl chloride



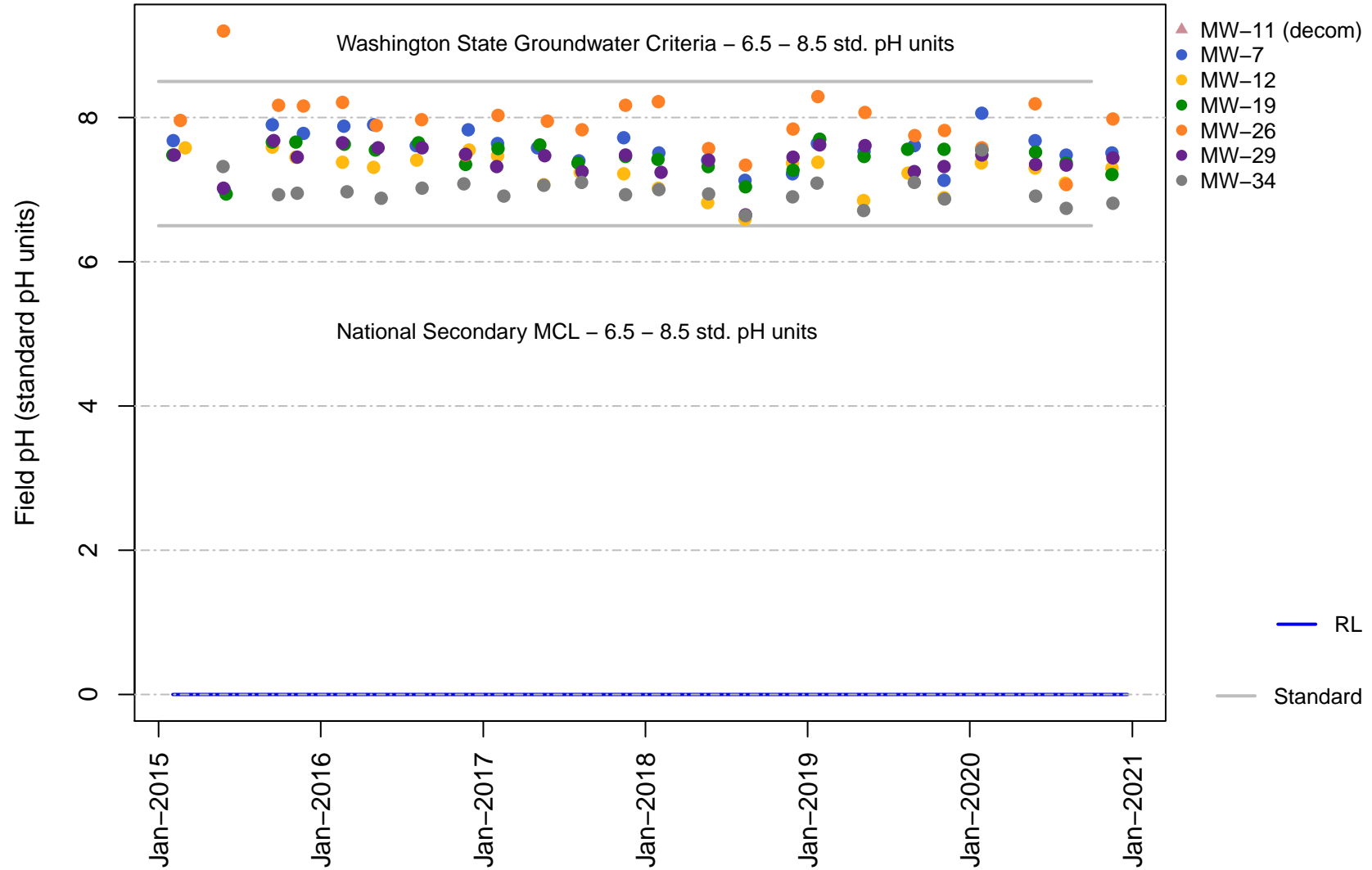
## **Appendix F**

Time Concentration Plots for  
Groundwater in Unit D Aquifer

# Vashon Island Closed Landfill Unit D Field pH

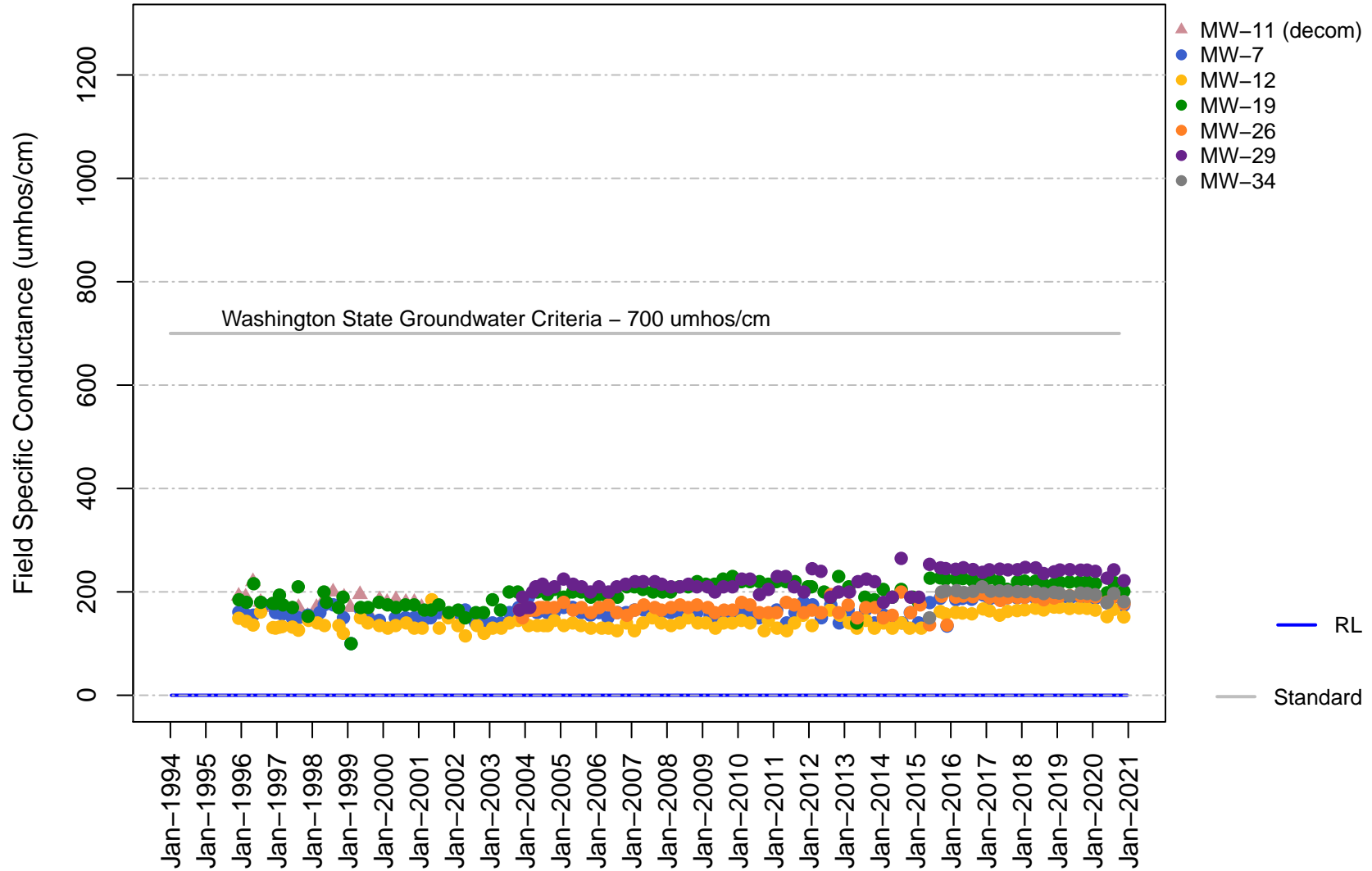


# Vashon Island Closed Landfill Unit D Field pH

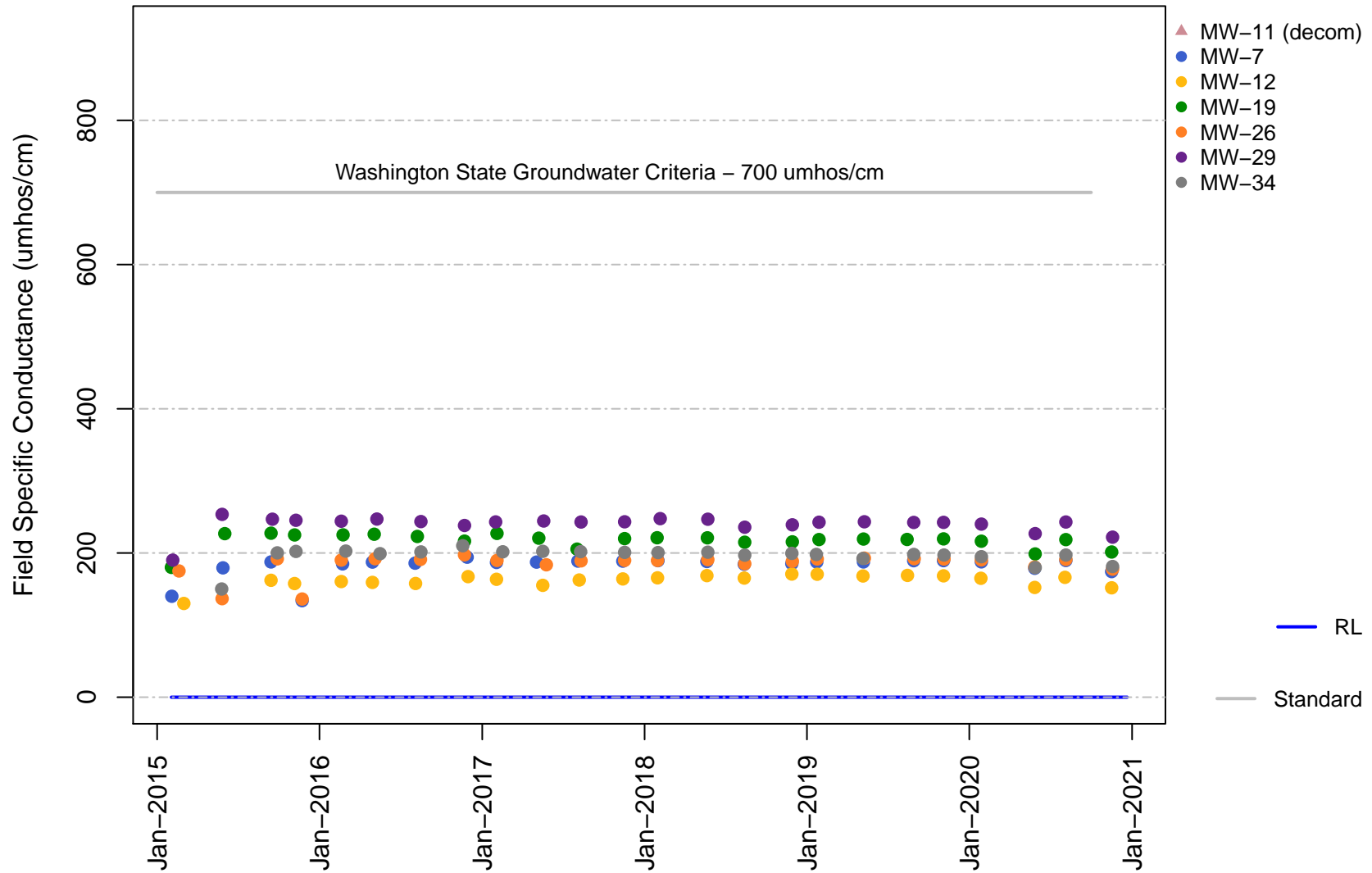




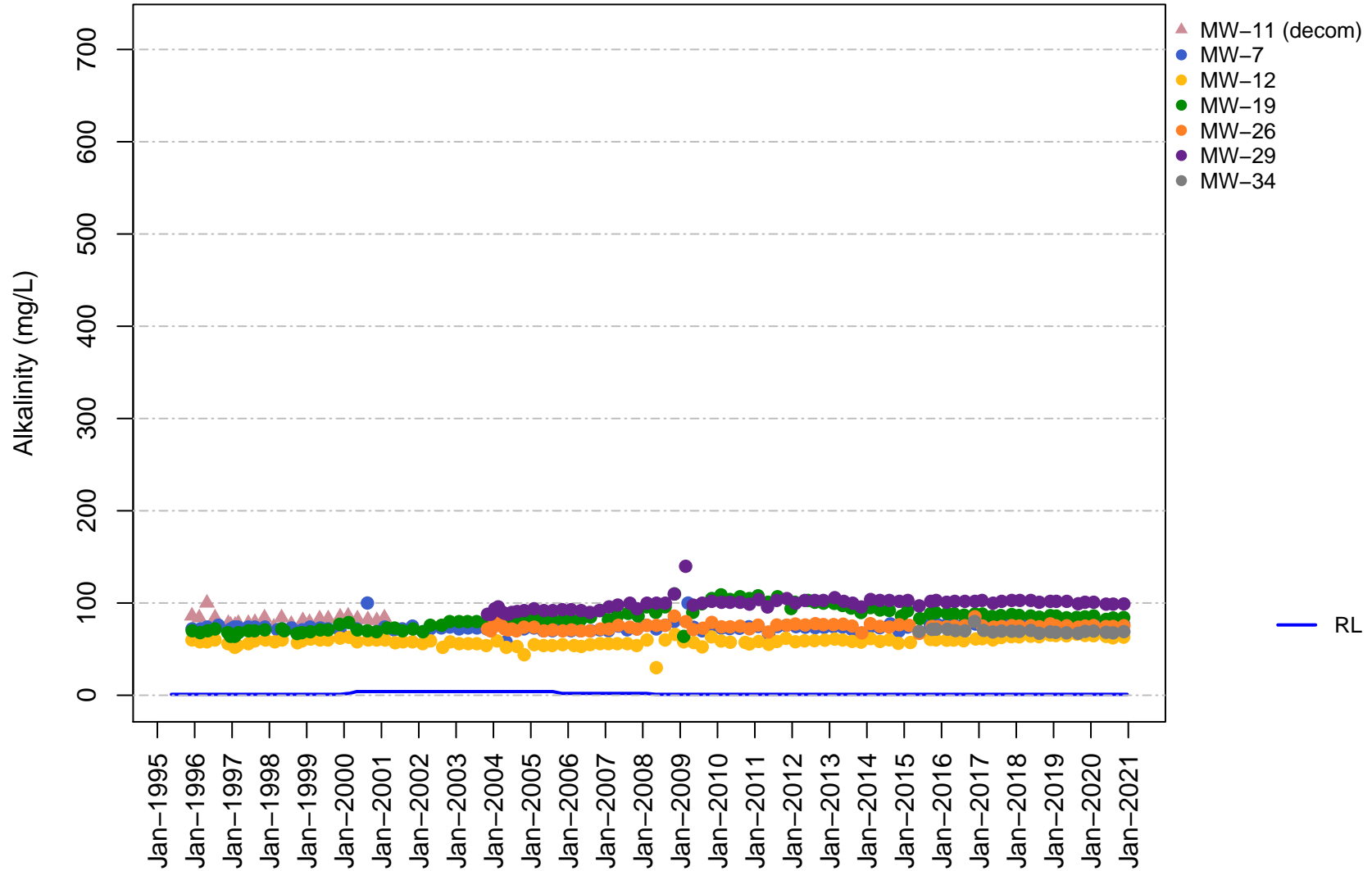
# Vashon Island Closed Landfill Unit D Field Specific Conductance



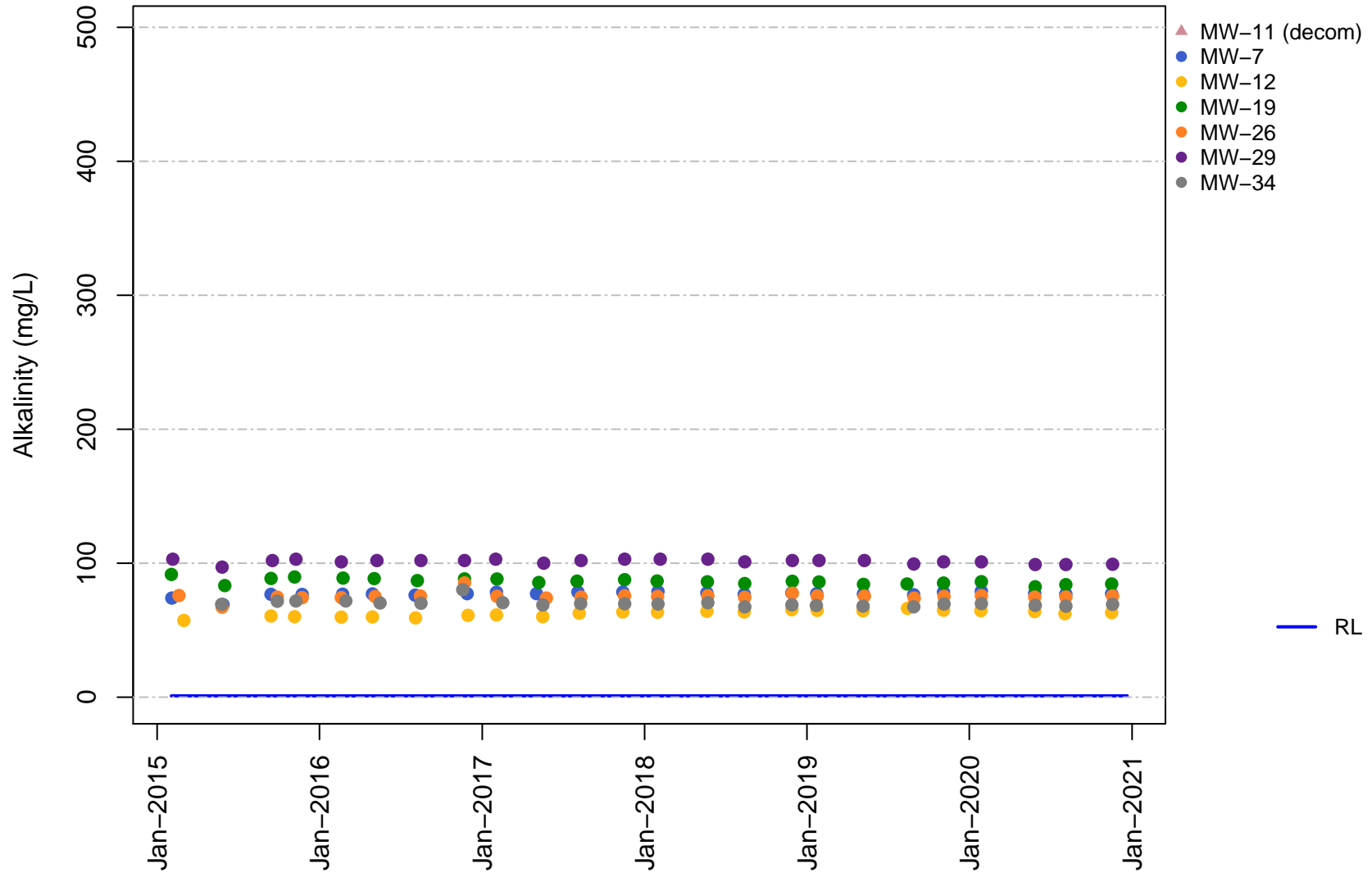
# Vashon Island Closed Landfill Unit D Field Specific Conductance



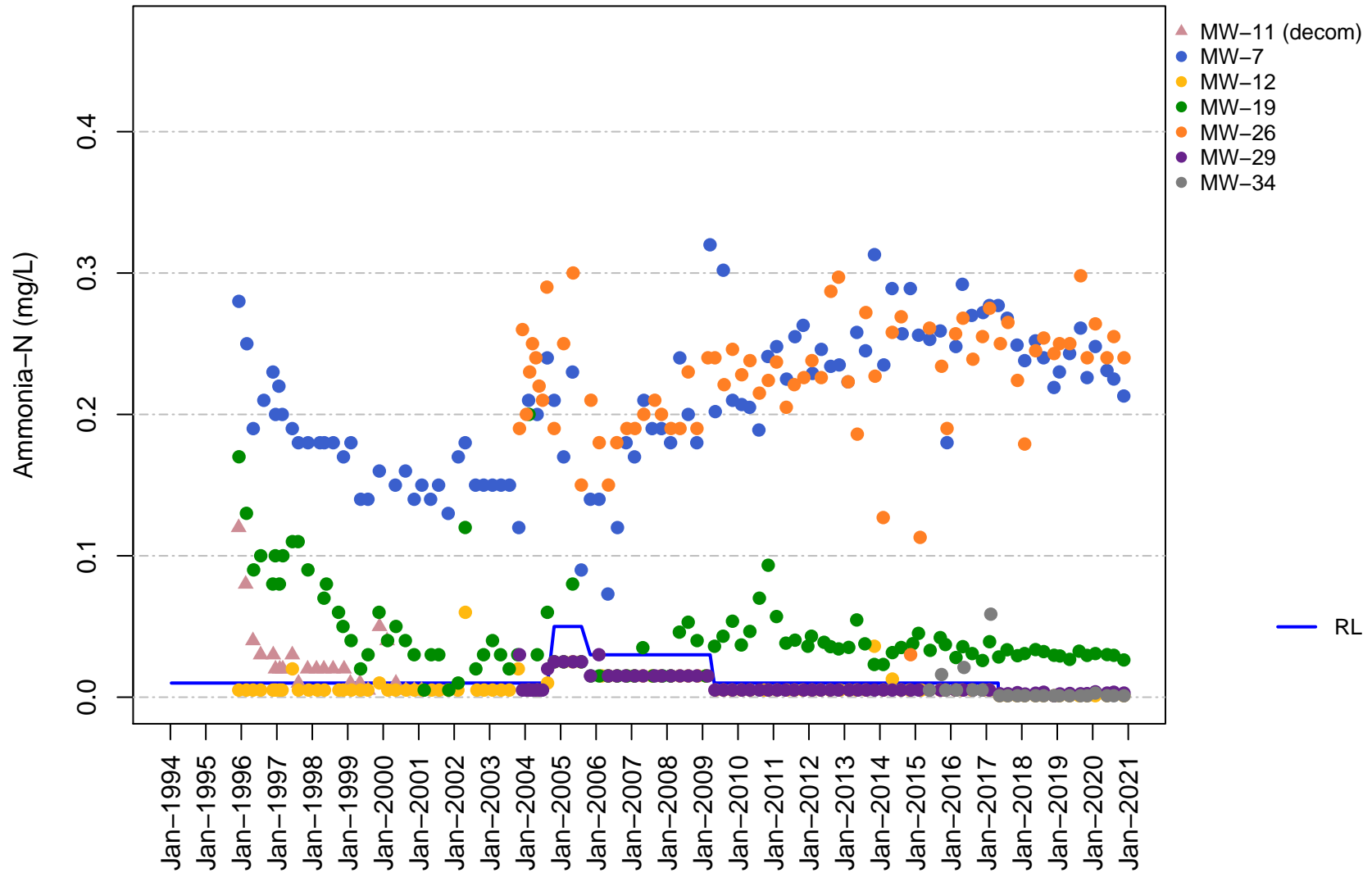
# Vashon Island Closed Landfill Unit D Alkalinity



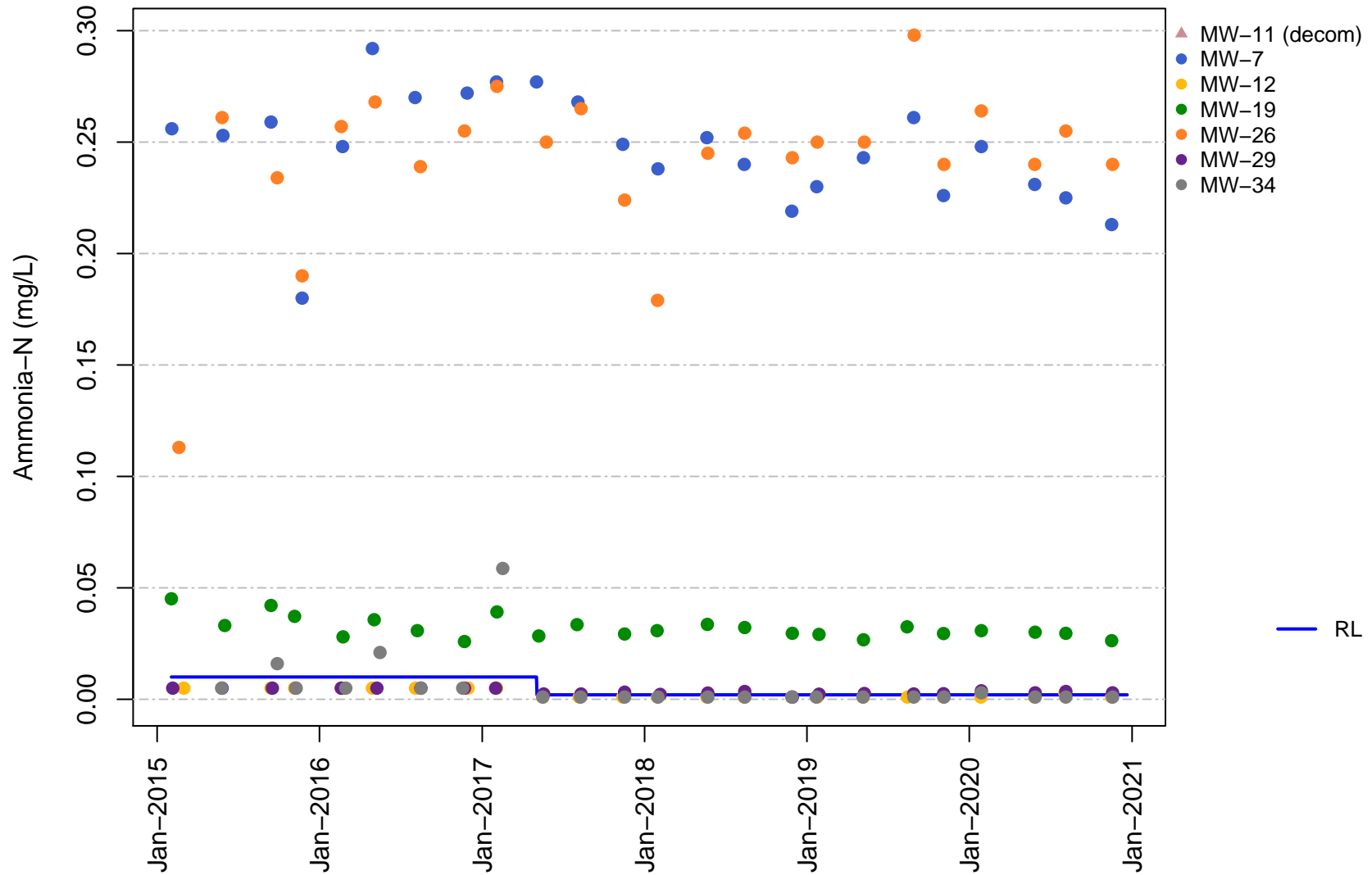
# Vashon Island Closed Landfill Unit D Alkalinity



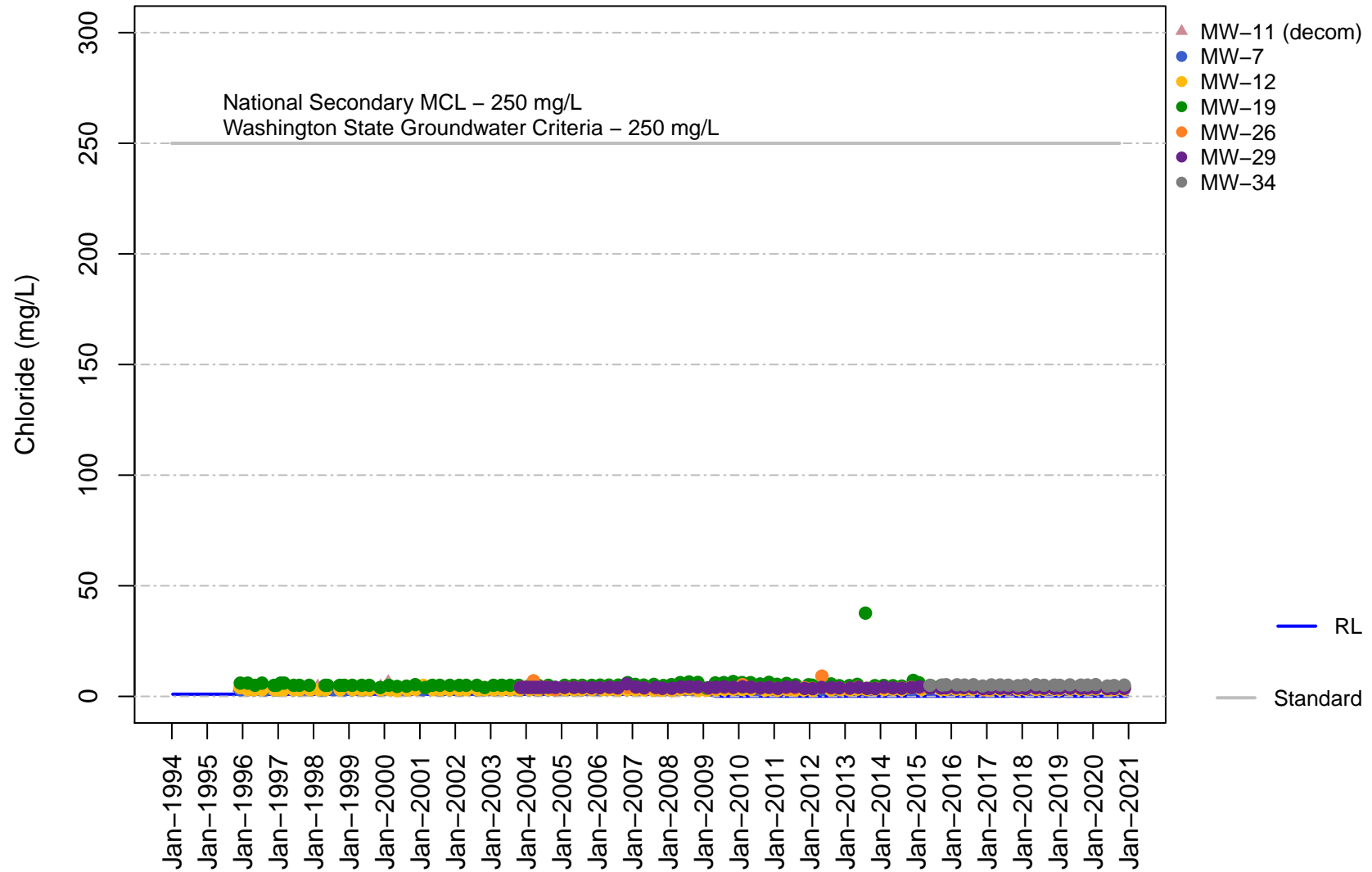
# Vashon Island Closed Landfill Unit D Ammonia



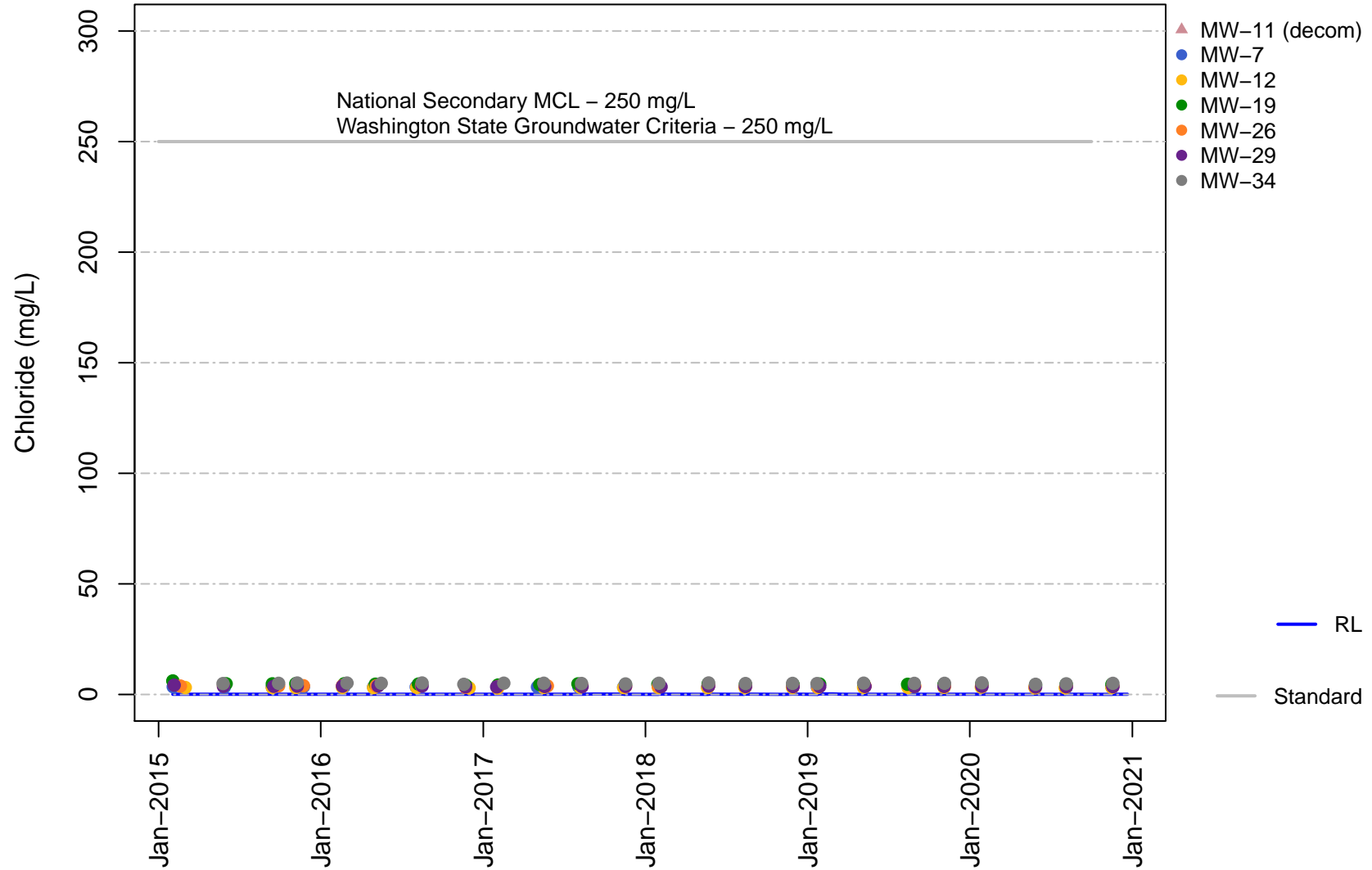
# Vashon Island Closed Landfill Unit D Ammonia



# Vashon Island Closed Landfill Unit D Chloride

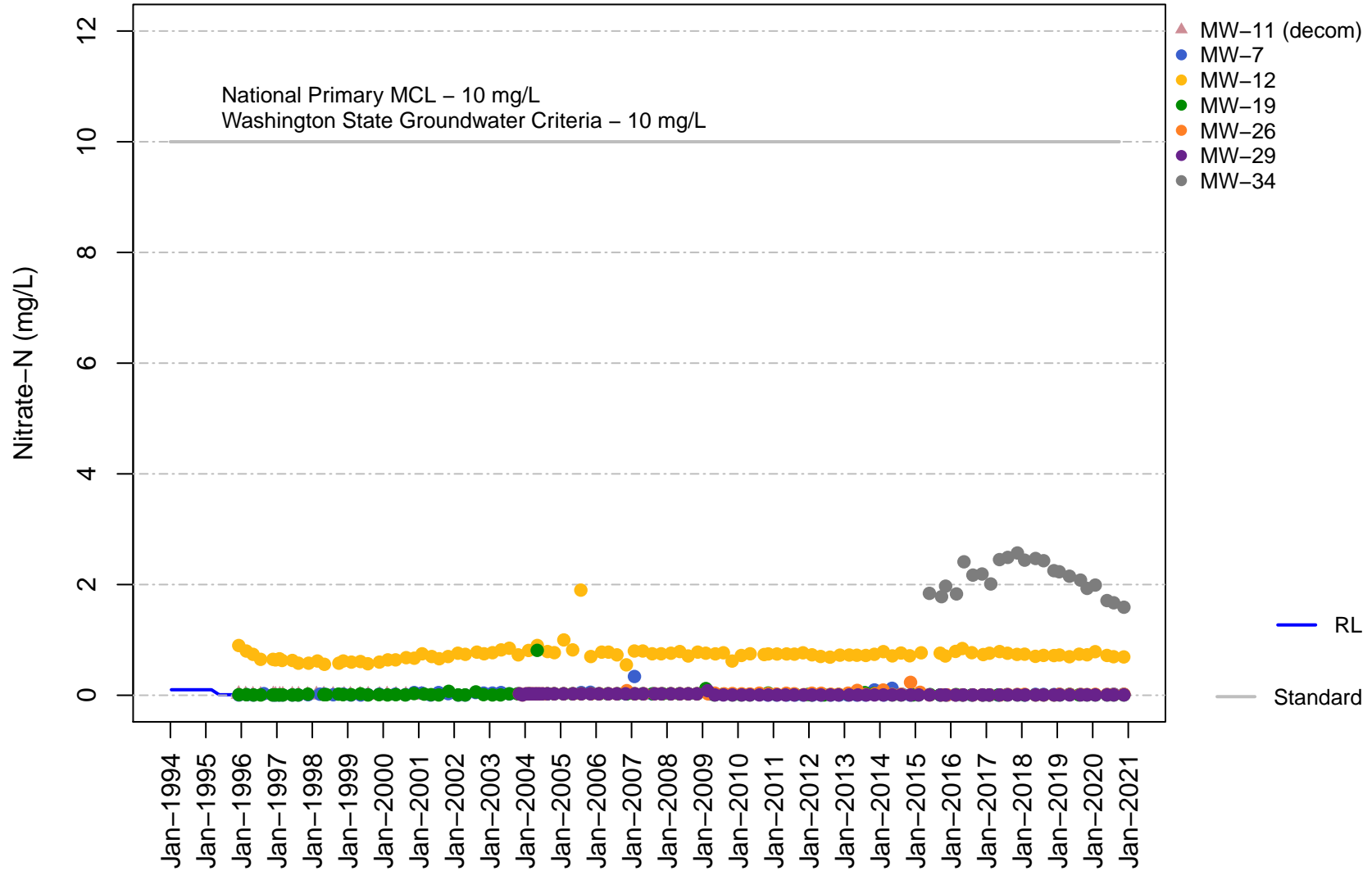


# Vashon Island Closed Landfill Unit D Chloride

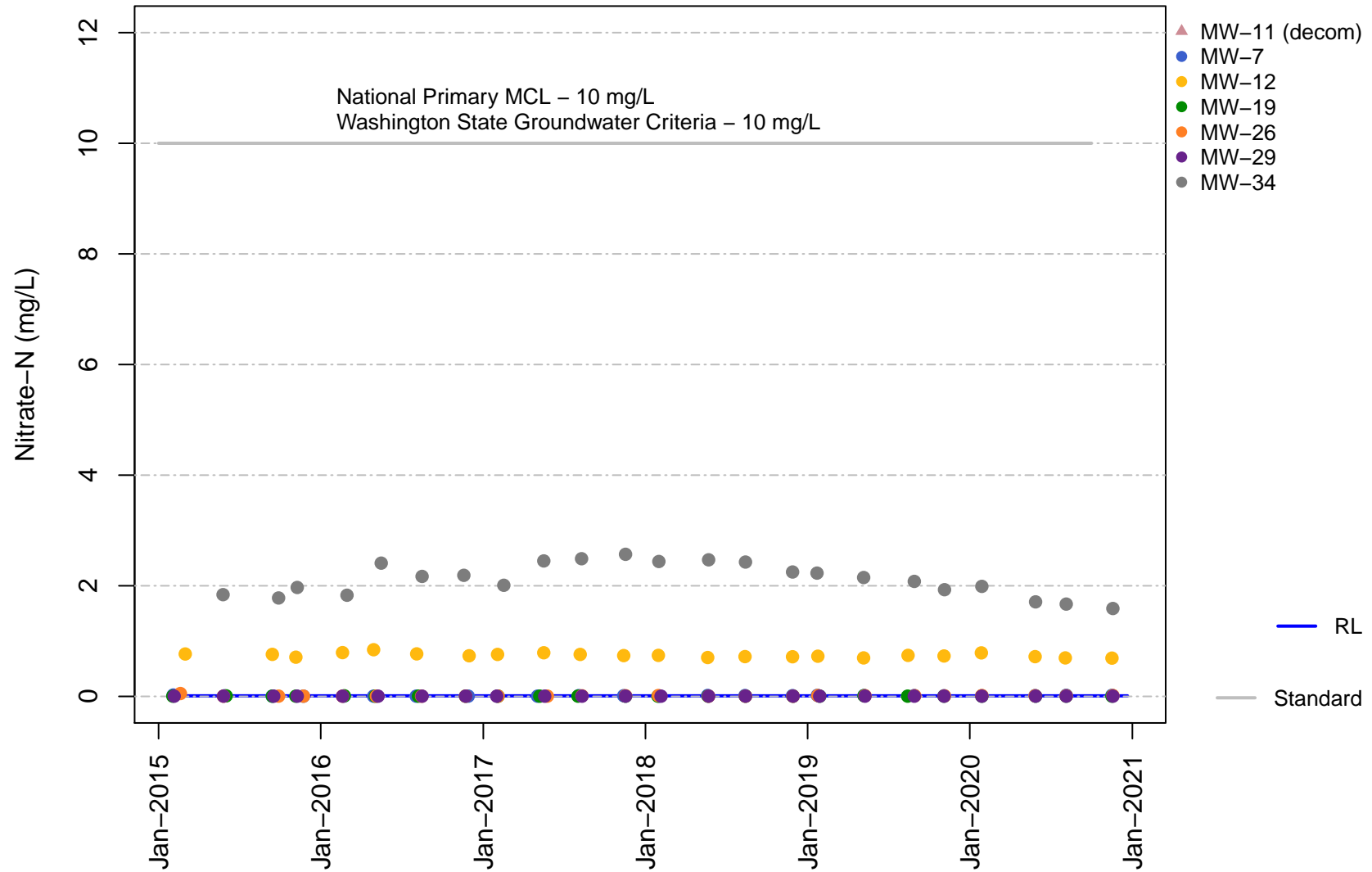




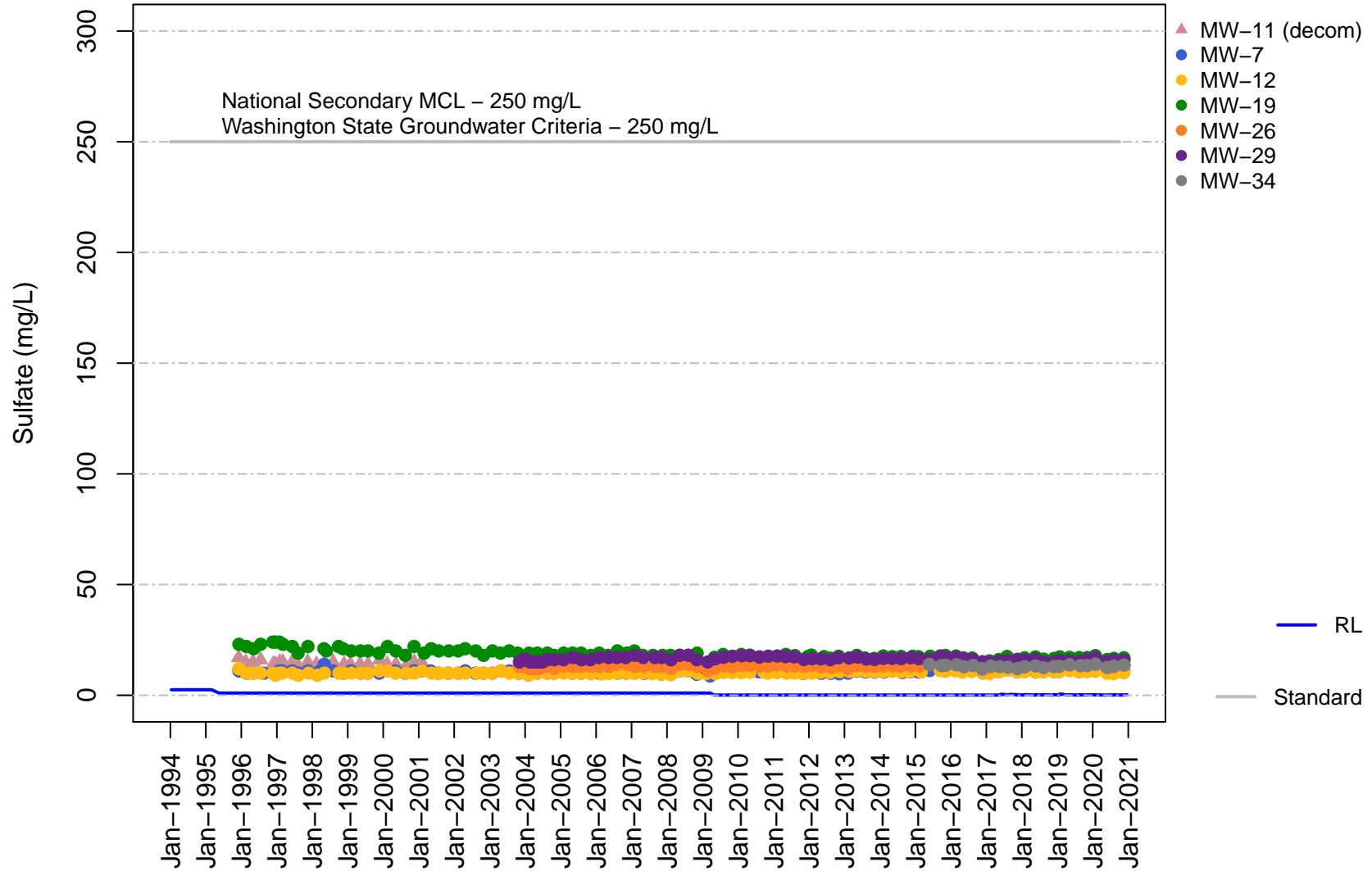
**Vashon Island Closed Landfill  
Unit D  
Nitrate**



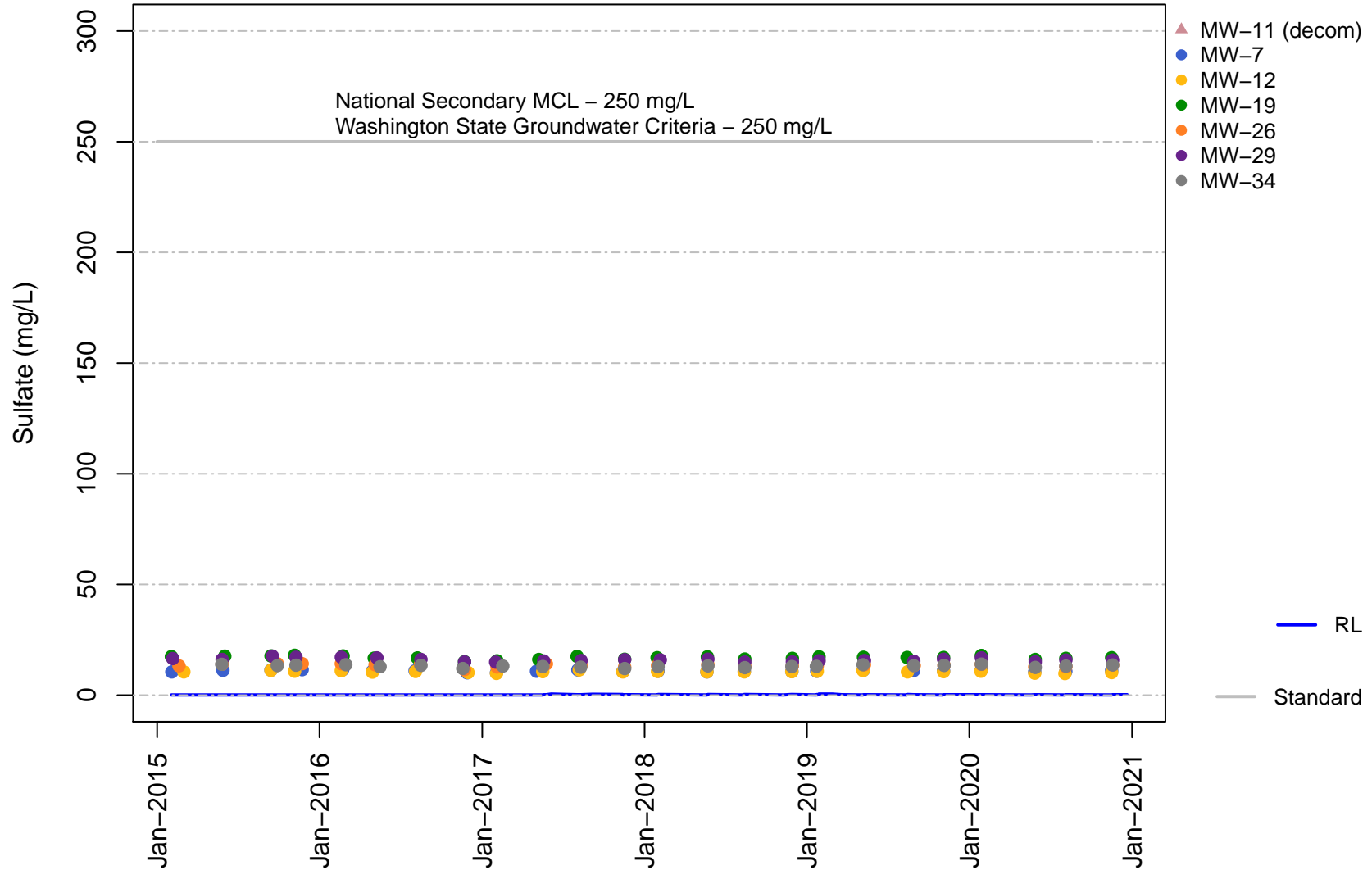
**Vashon Island Closed Landfill  
Unit D  
Nitrate**



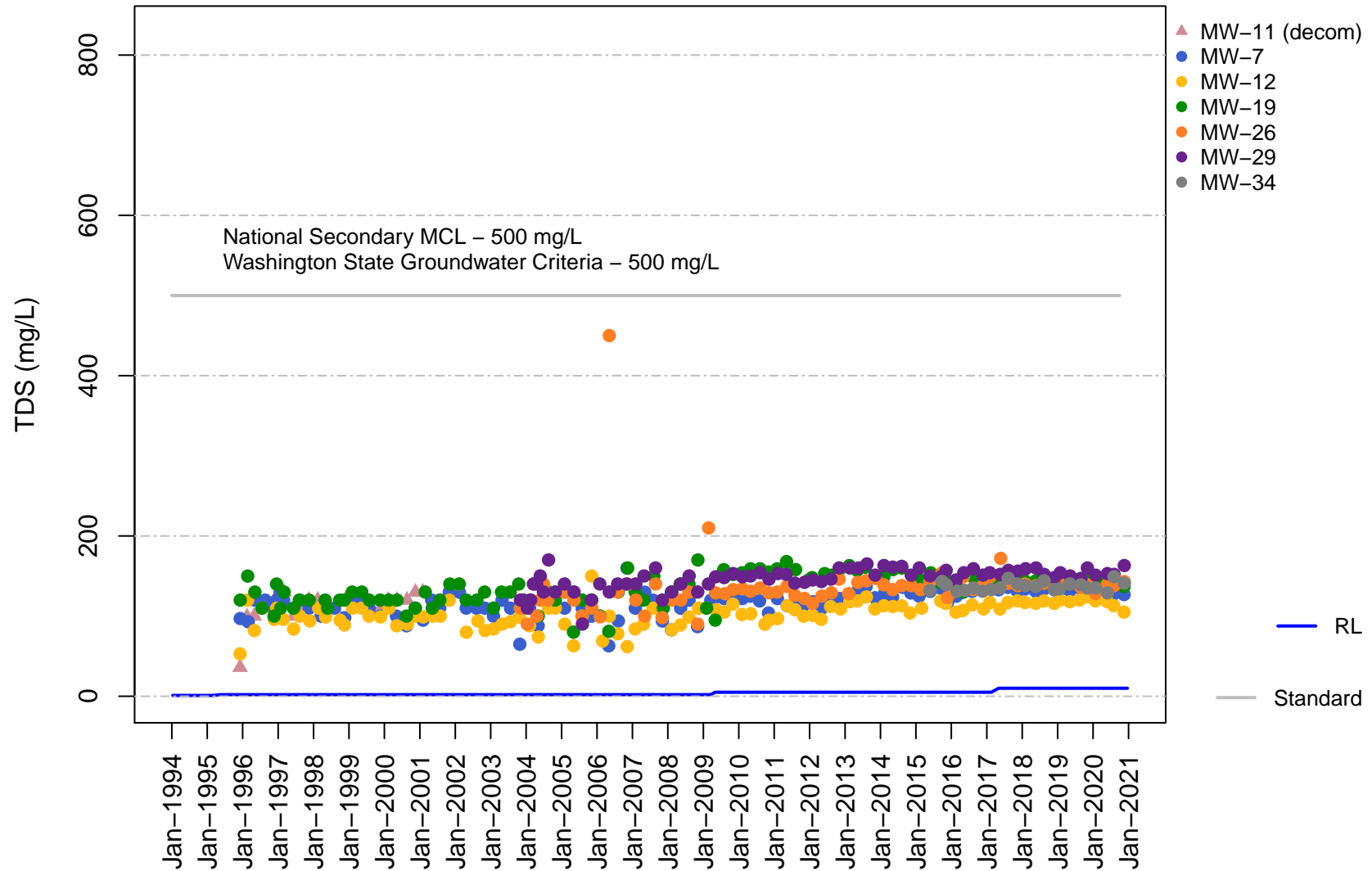
# Vashon Island Closed Landfill Unit D Sulfate



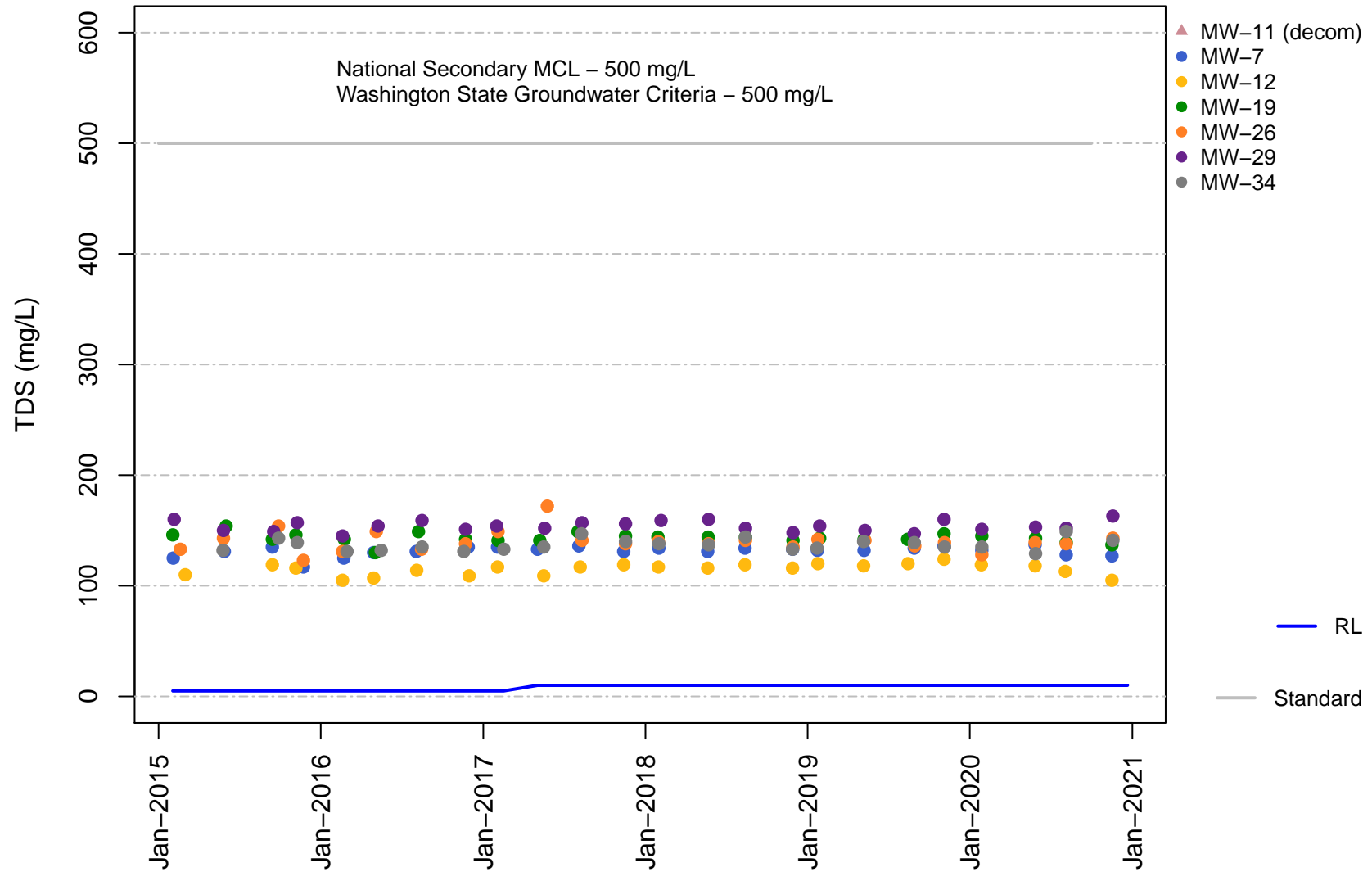
# Vashon Island Closed Landfill Unit D Sulfate



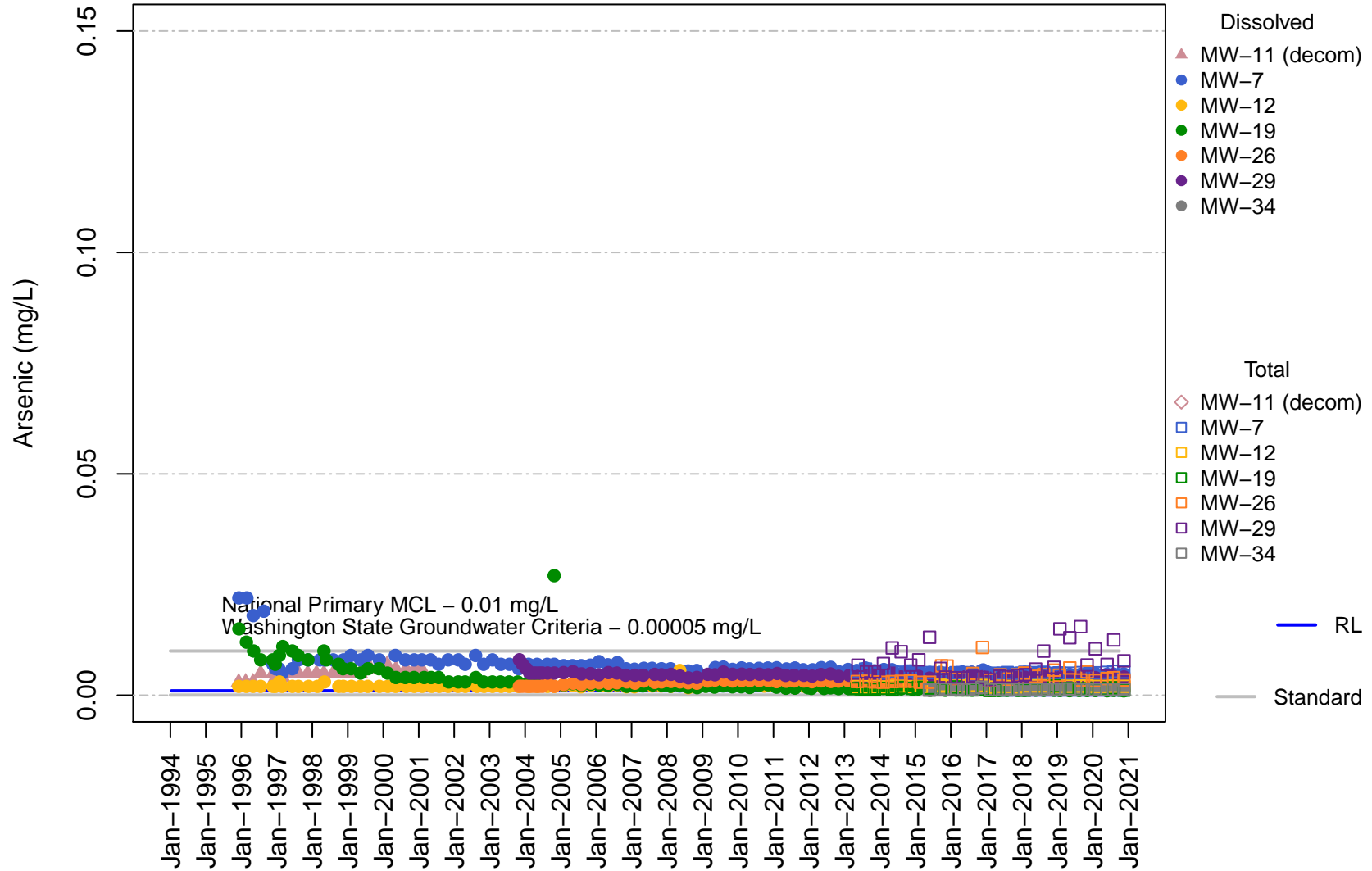
# Vashon Island Closed Landfill Unit D Total Dissolved Solids



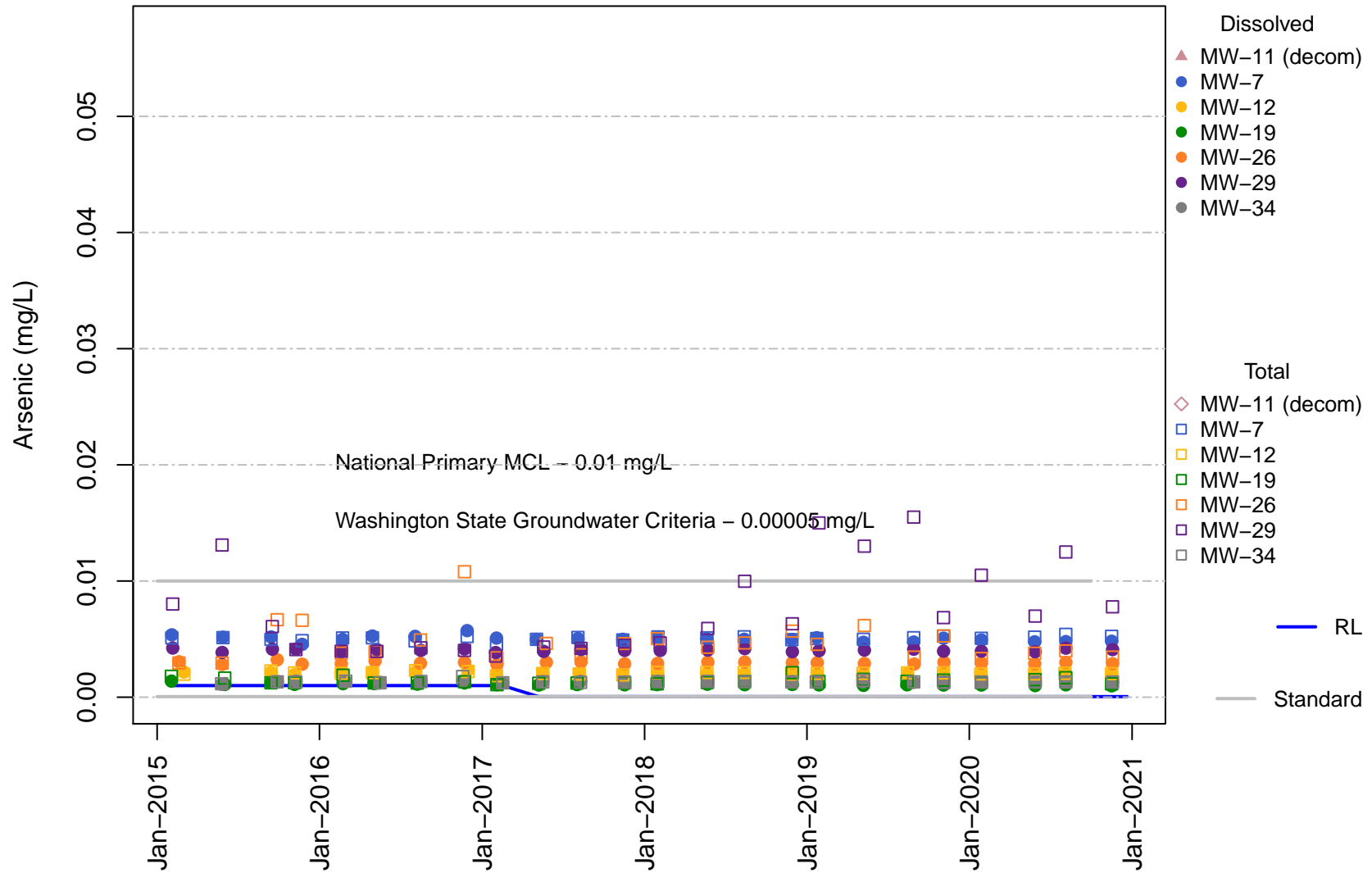
# Vashon Island Closed Landfill Unit D Total Dissolved Solids



# Vashon Island Closed Landfill Unit D Arsenic

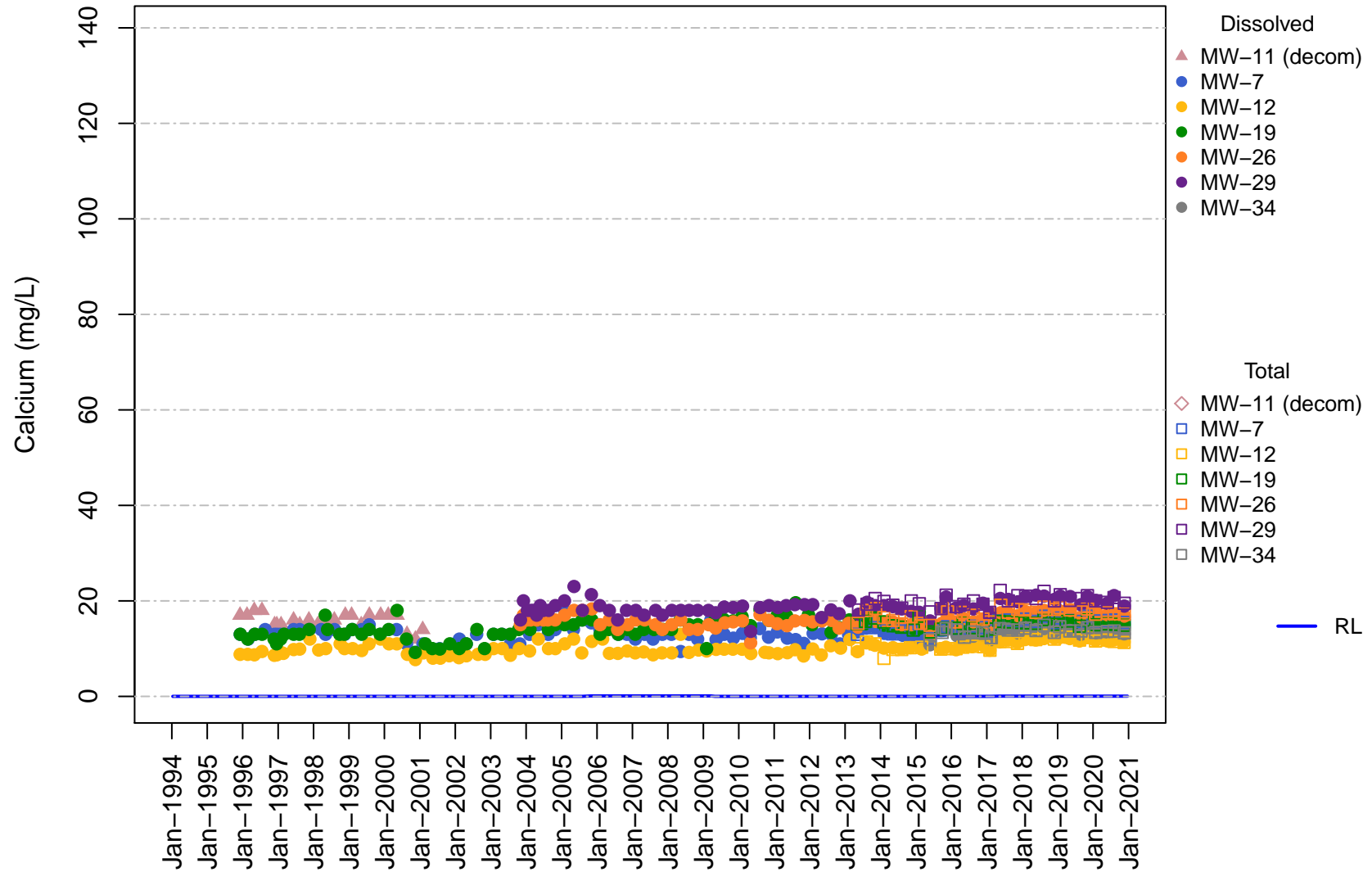


# Vashon Island Closed Landfill Unit D Arsenic

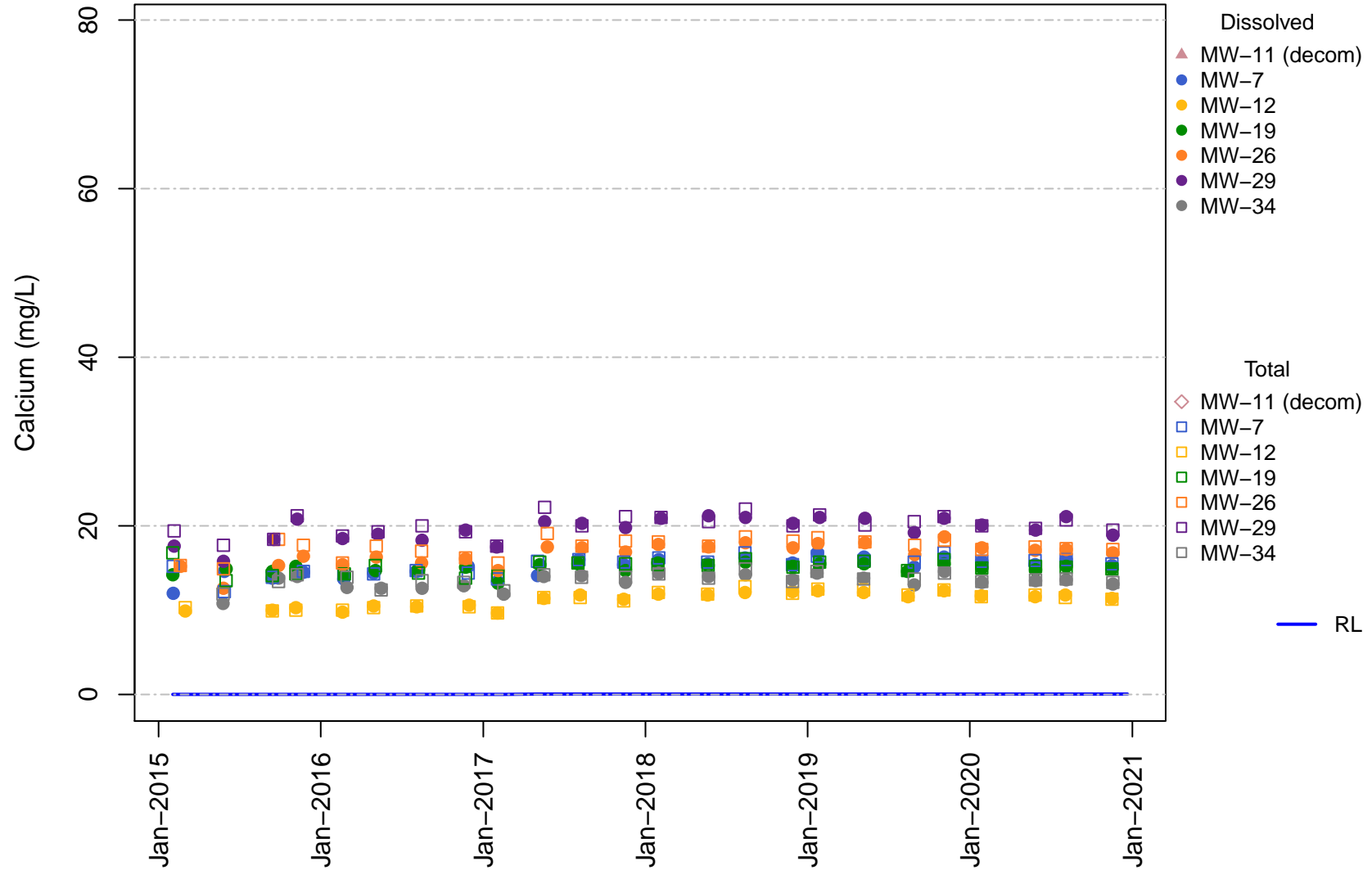




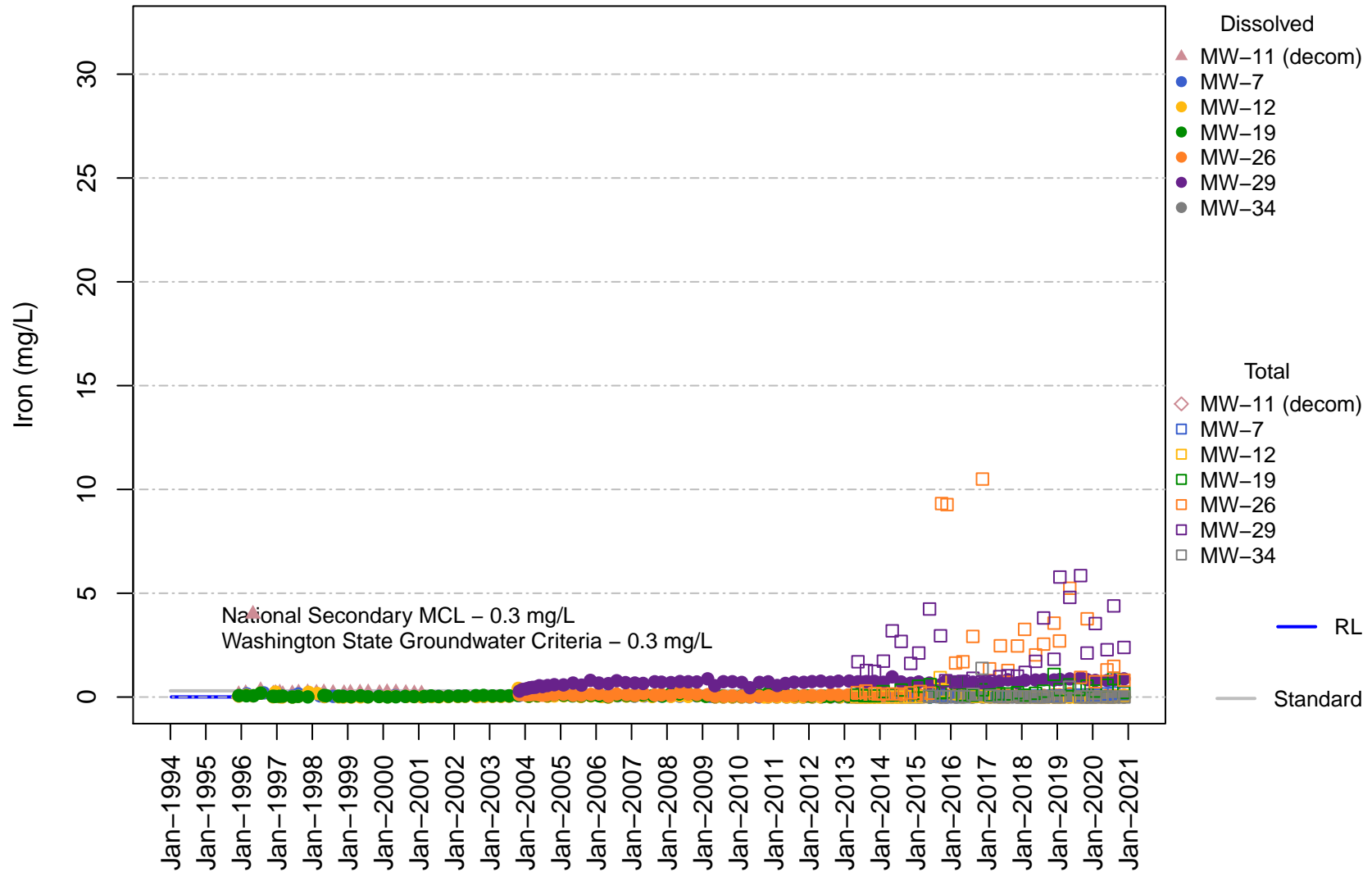
# Vashon Island Closed Landfill Unit D Calcium



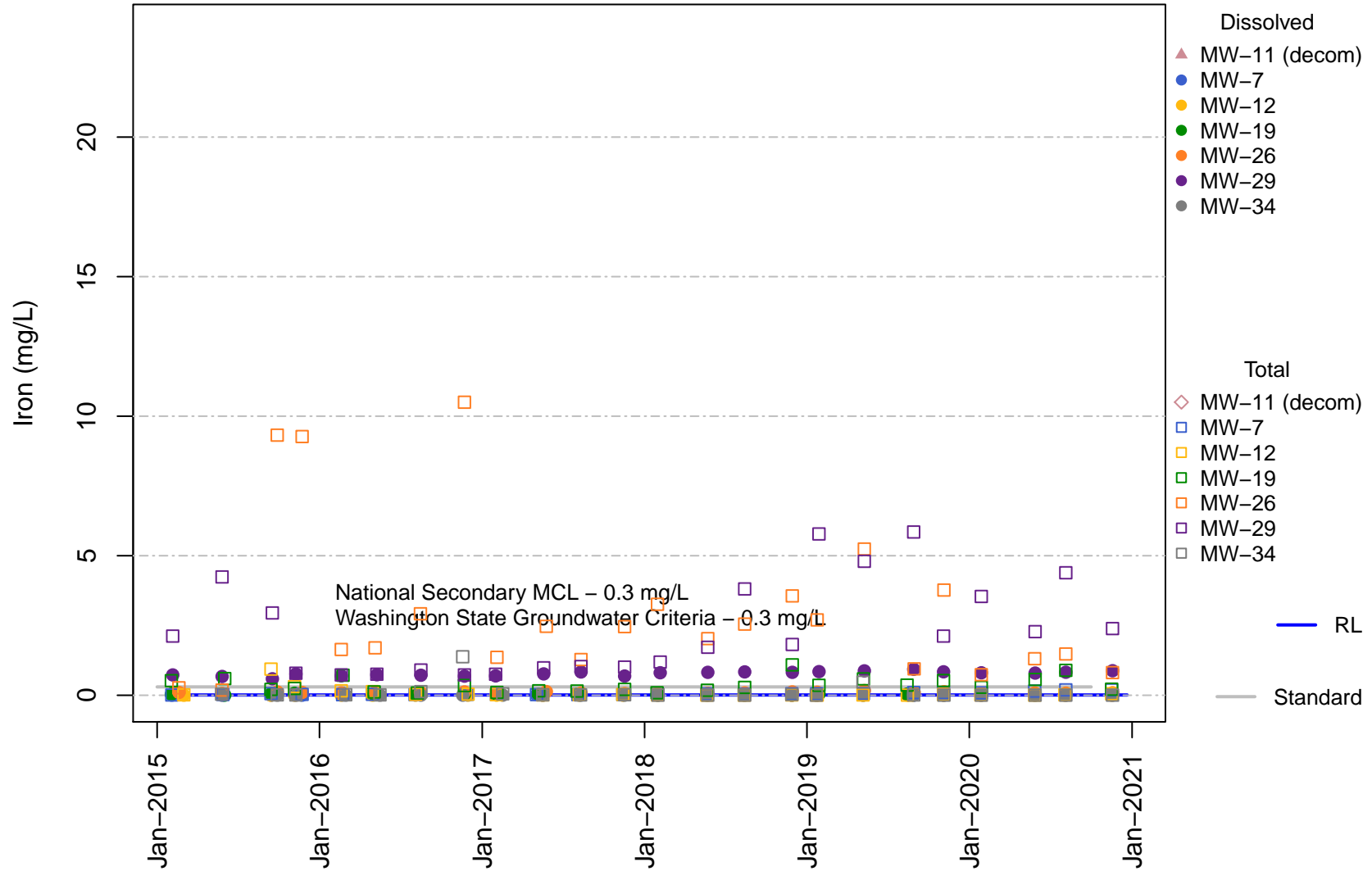
# Vashon Island Closed Landfill Unit D Calcium



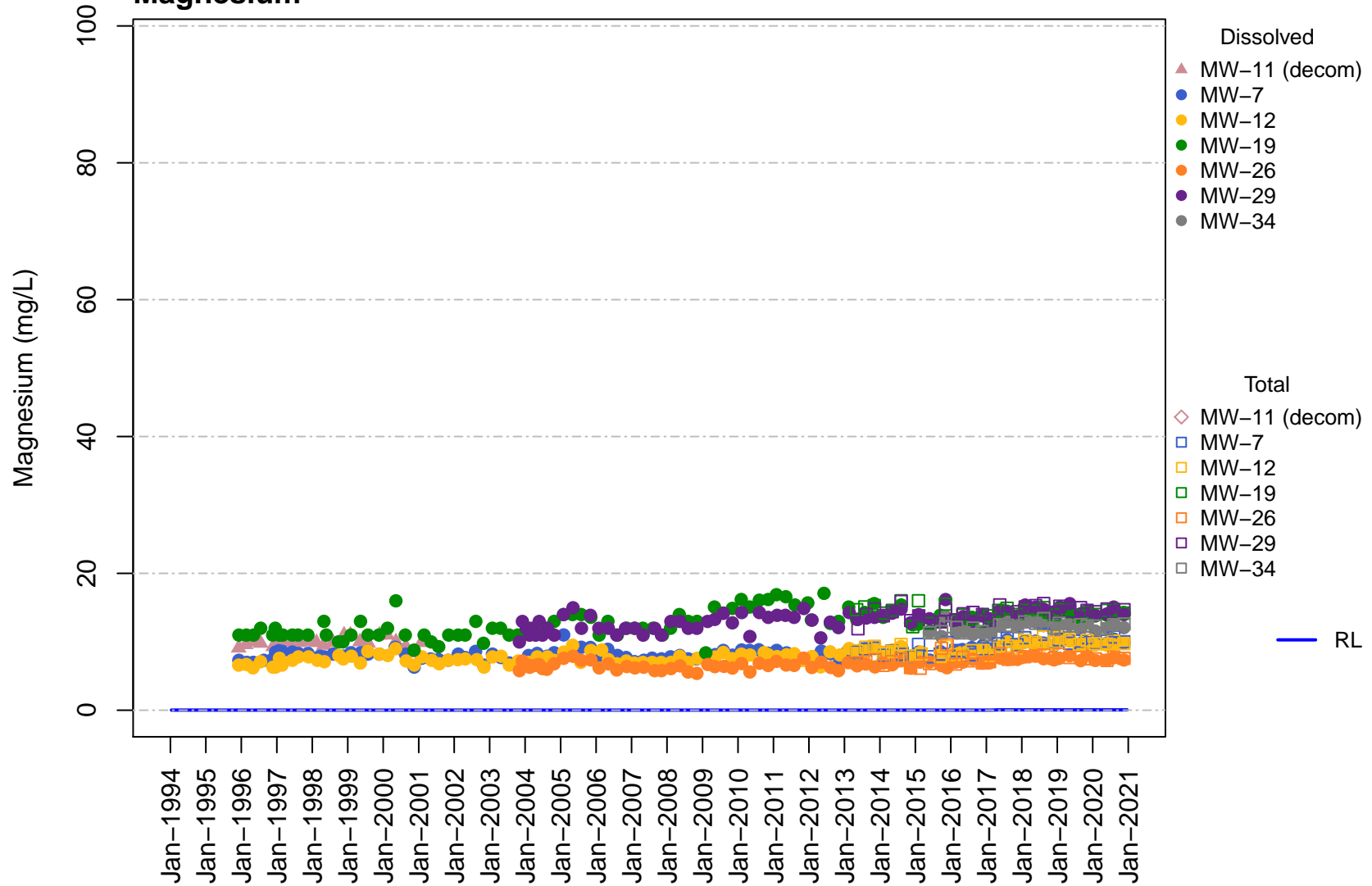
# Vashon Island Closed Landfill Unit D Iron



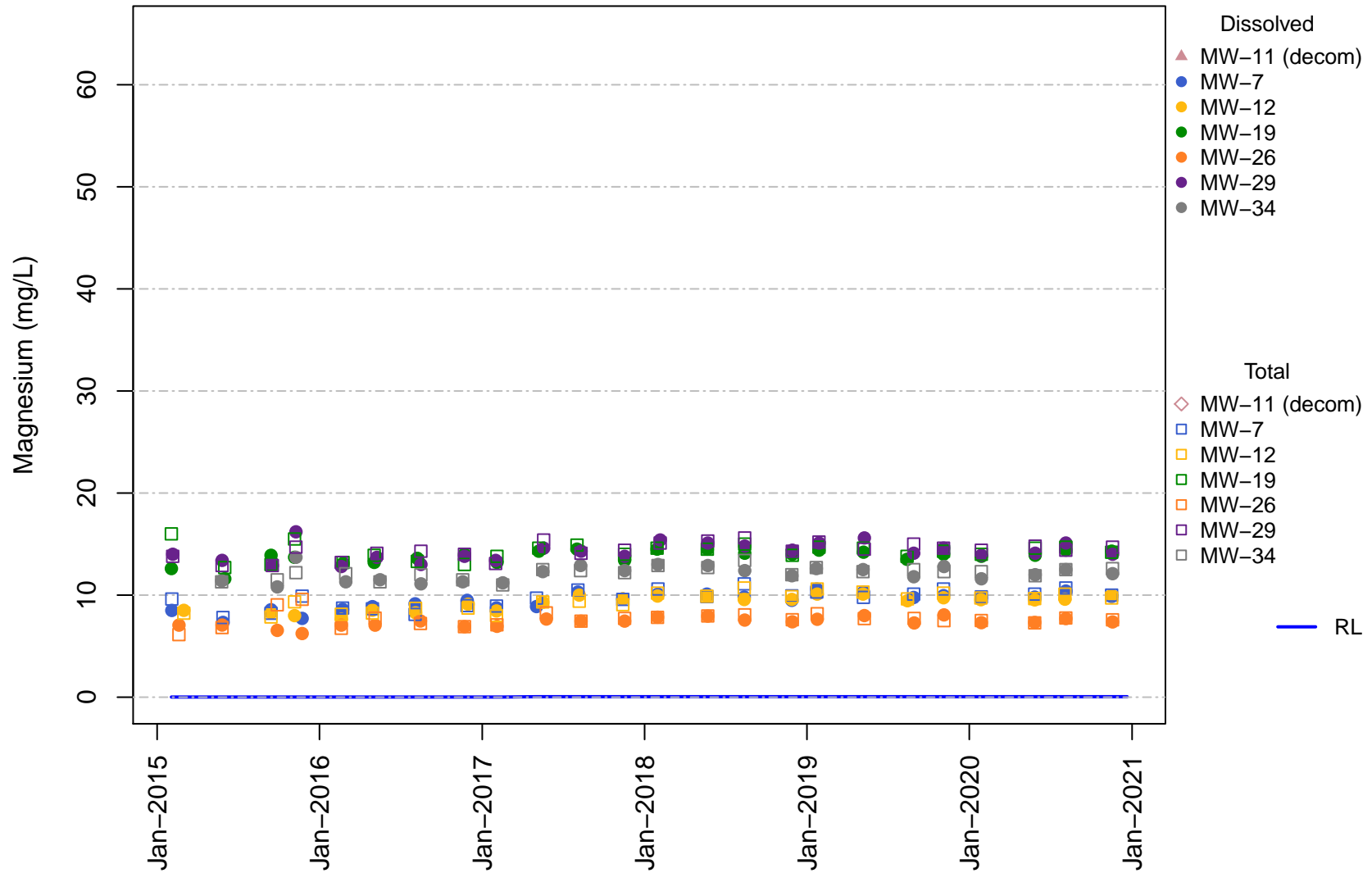
# Vashon Island Closed Landfill Unit D Iron



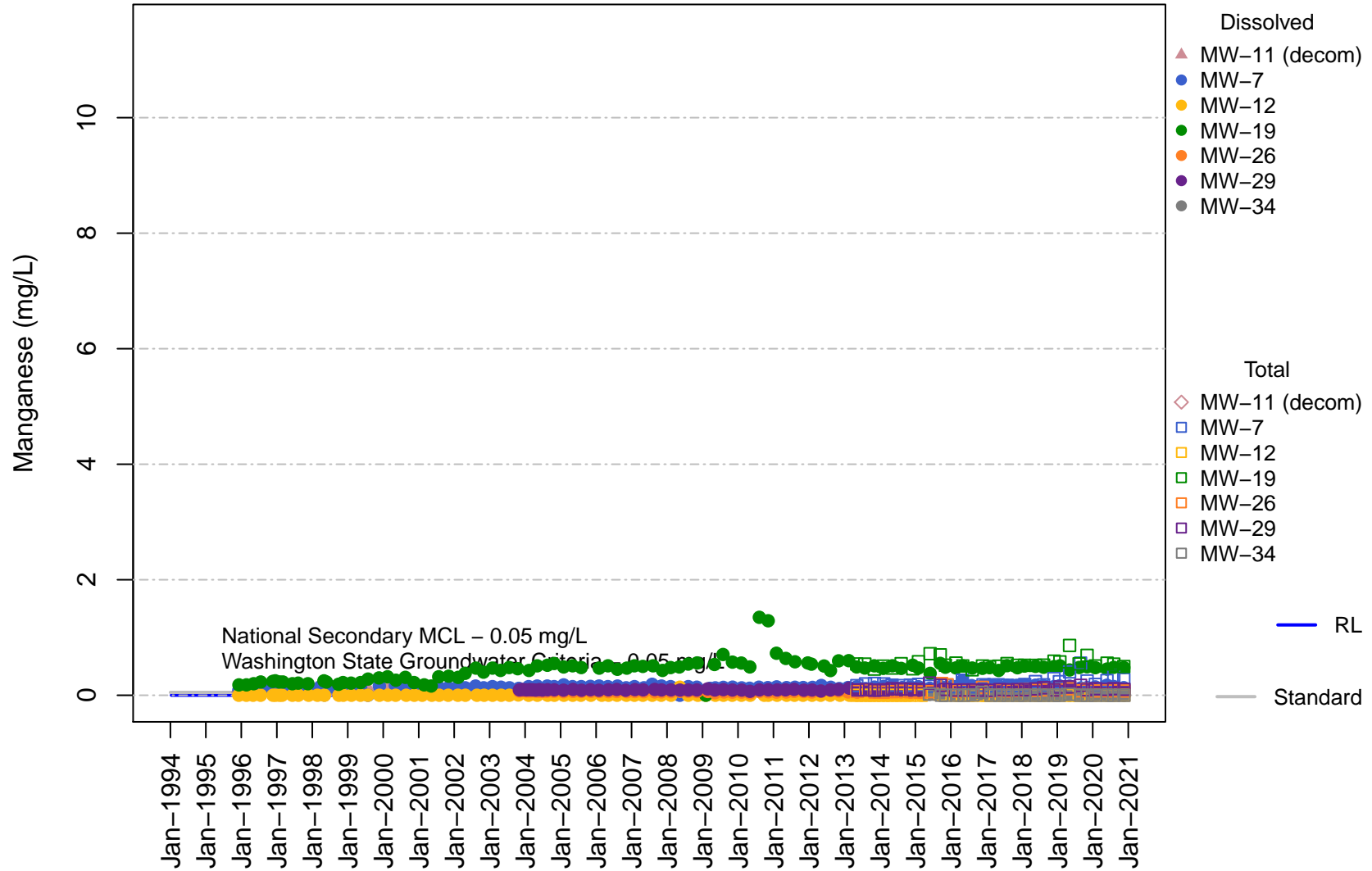
# Vashon Island Closed Landfill Unit D Magnesium



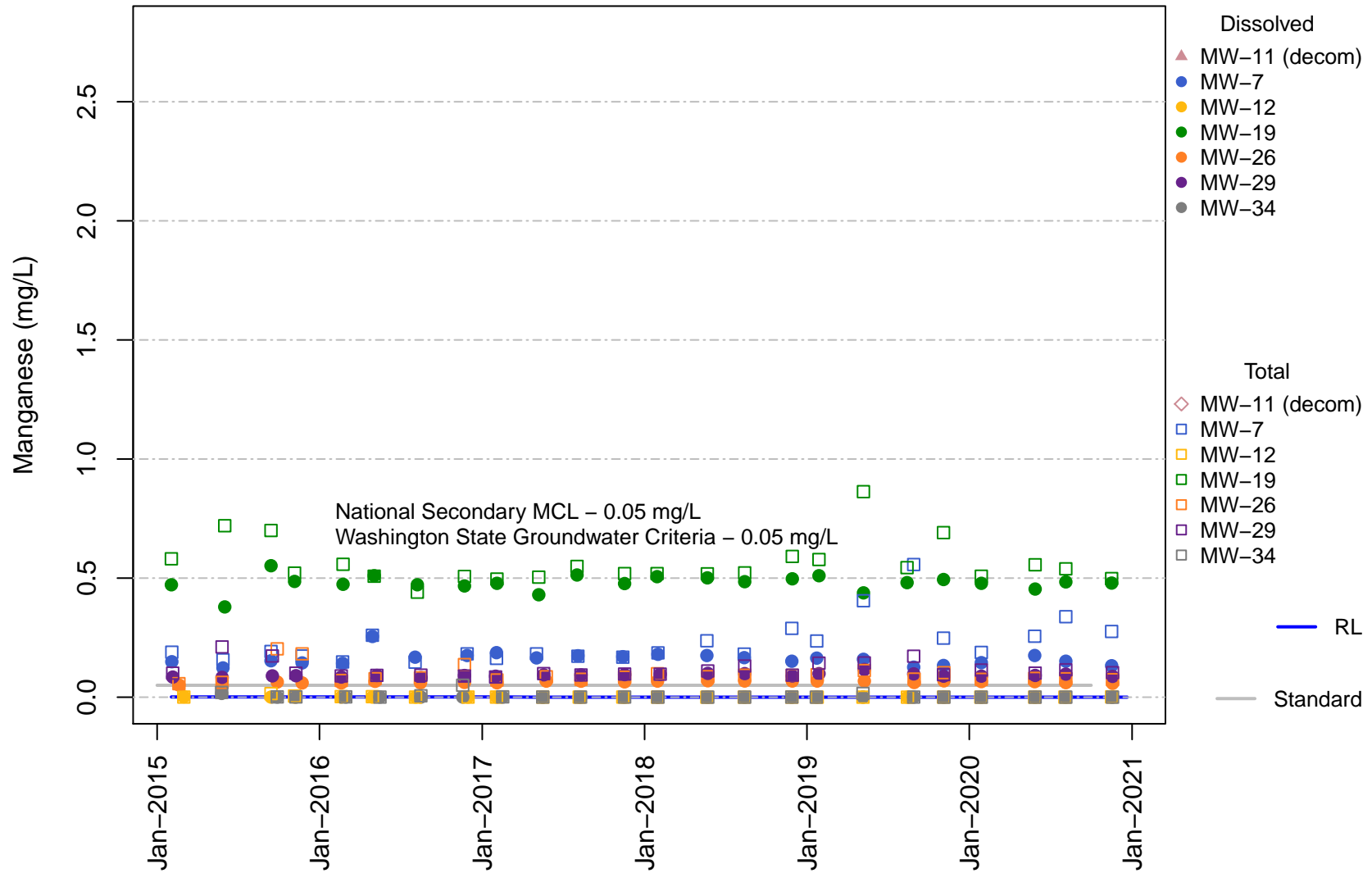
# Vashon Island Closed Landfill Unit D Magnesium



# Vashon Island Closed Landfill Unit D Manganese

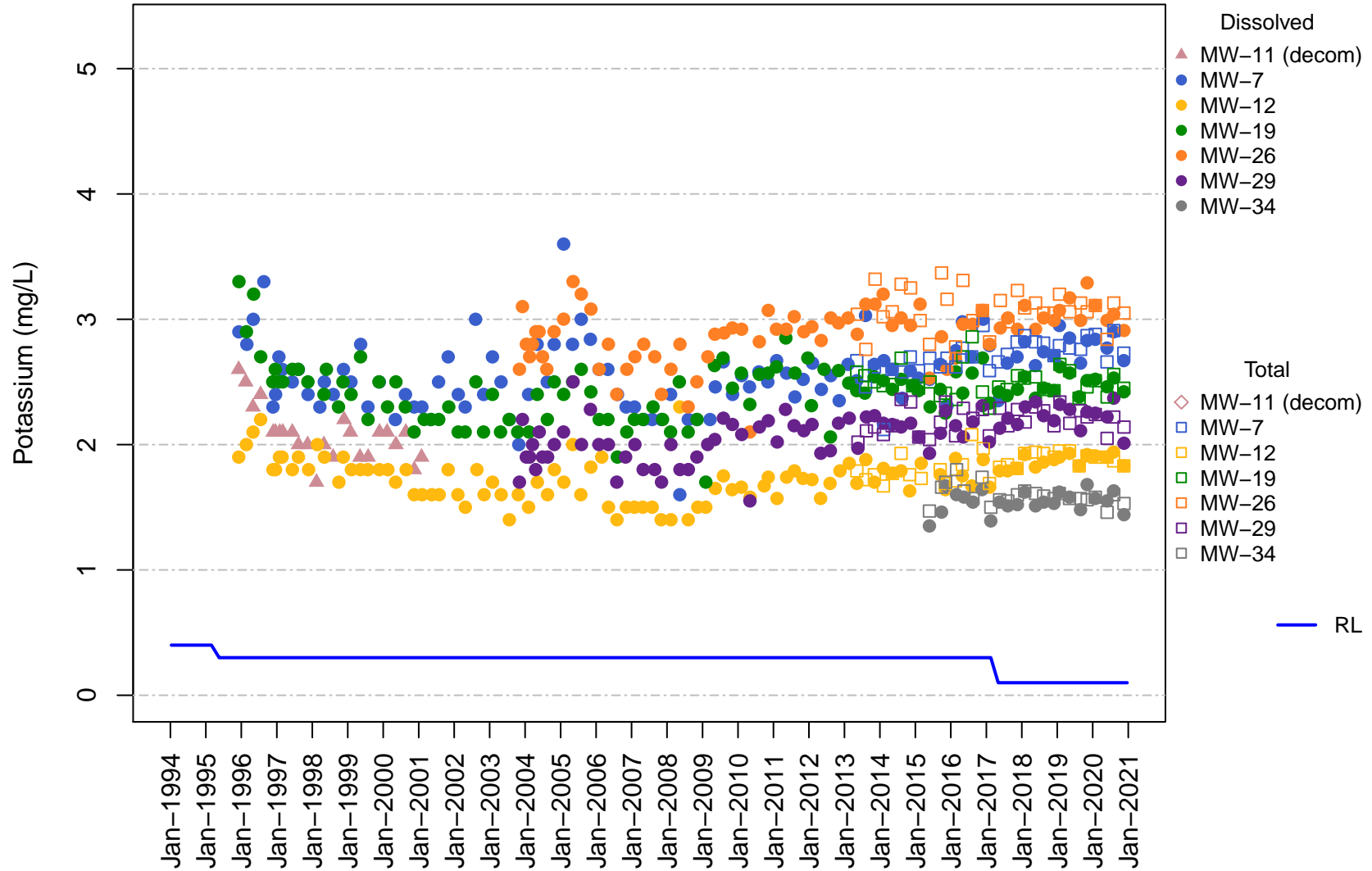


# Vashon Island Closed Landfill Unit D Manganese

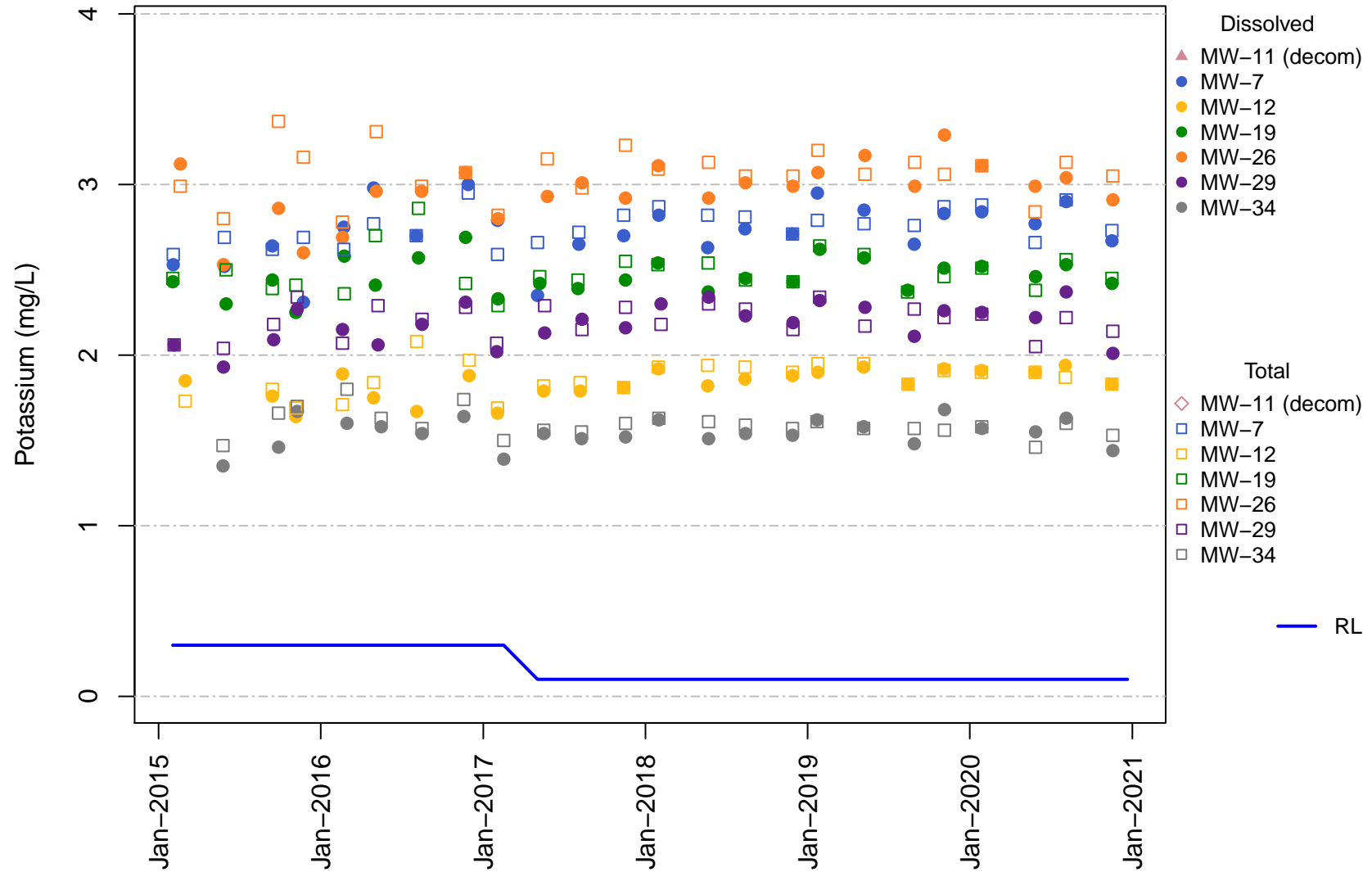




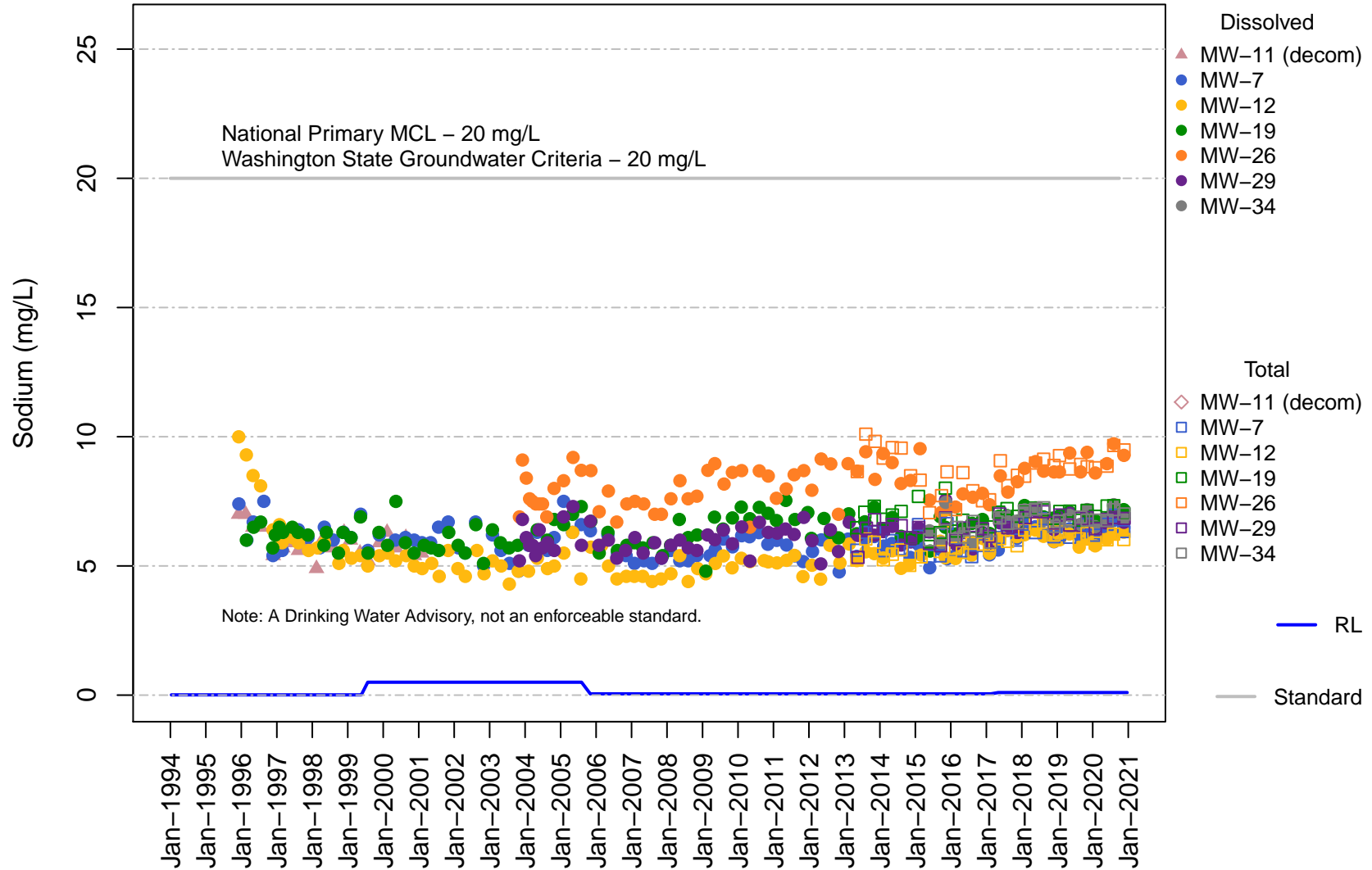
# Vashon Island Closed Landfill Unit D Potassium



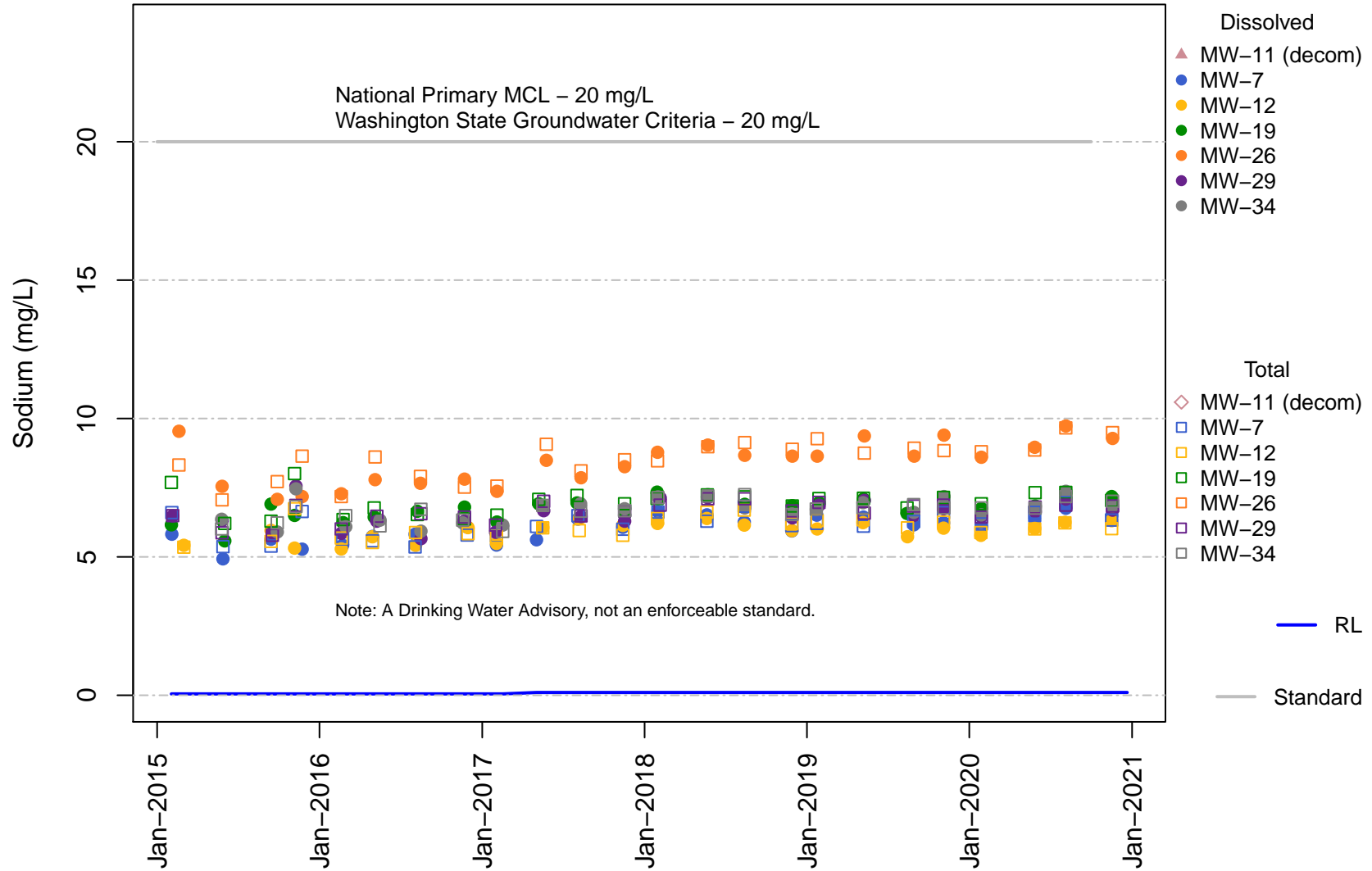
# Vashon Island Closed Landfill Unit D Potassium



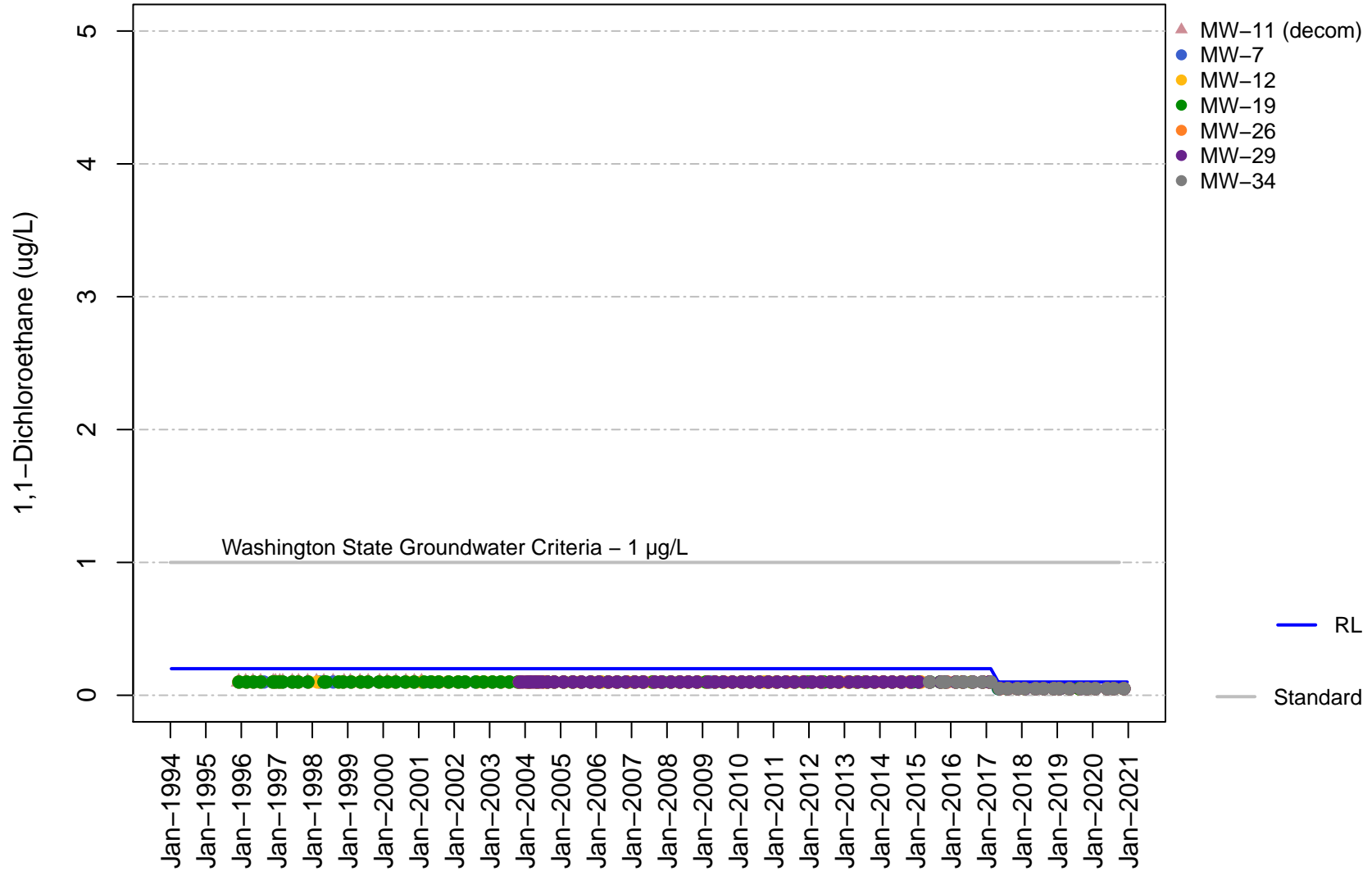
# Vashon Island Closed Landfill Unit D Sodium



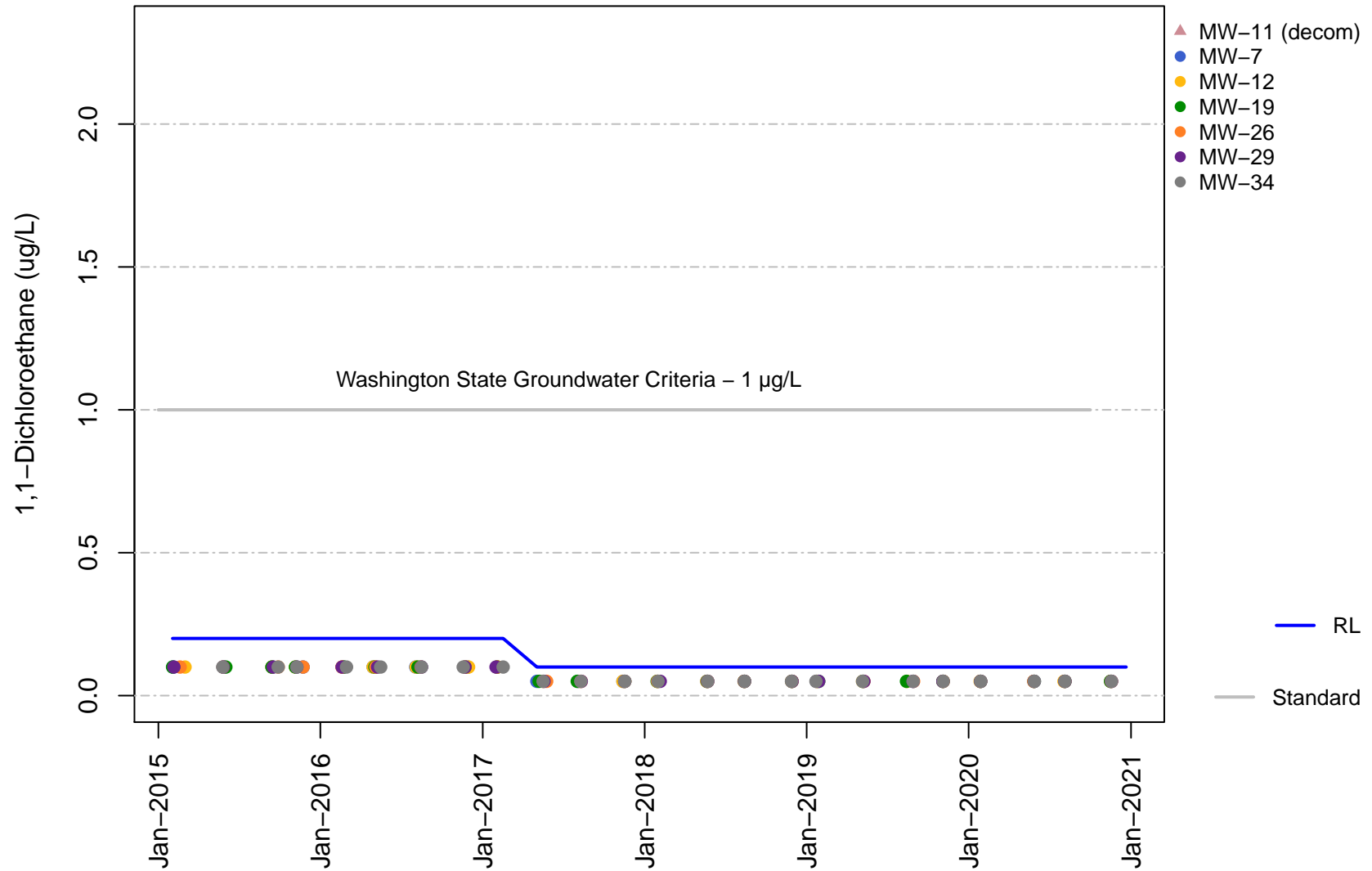
# Vashon Island Closed Landfill Unit D Sodium



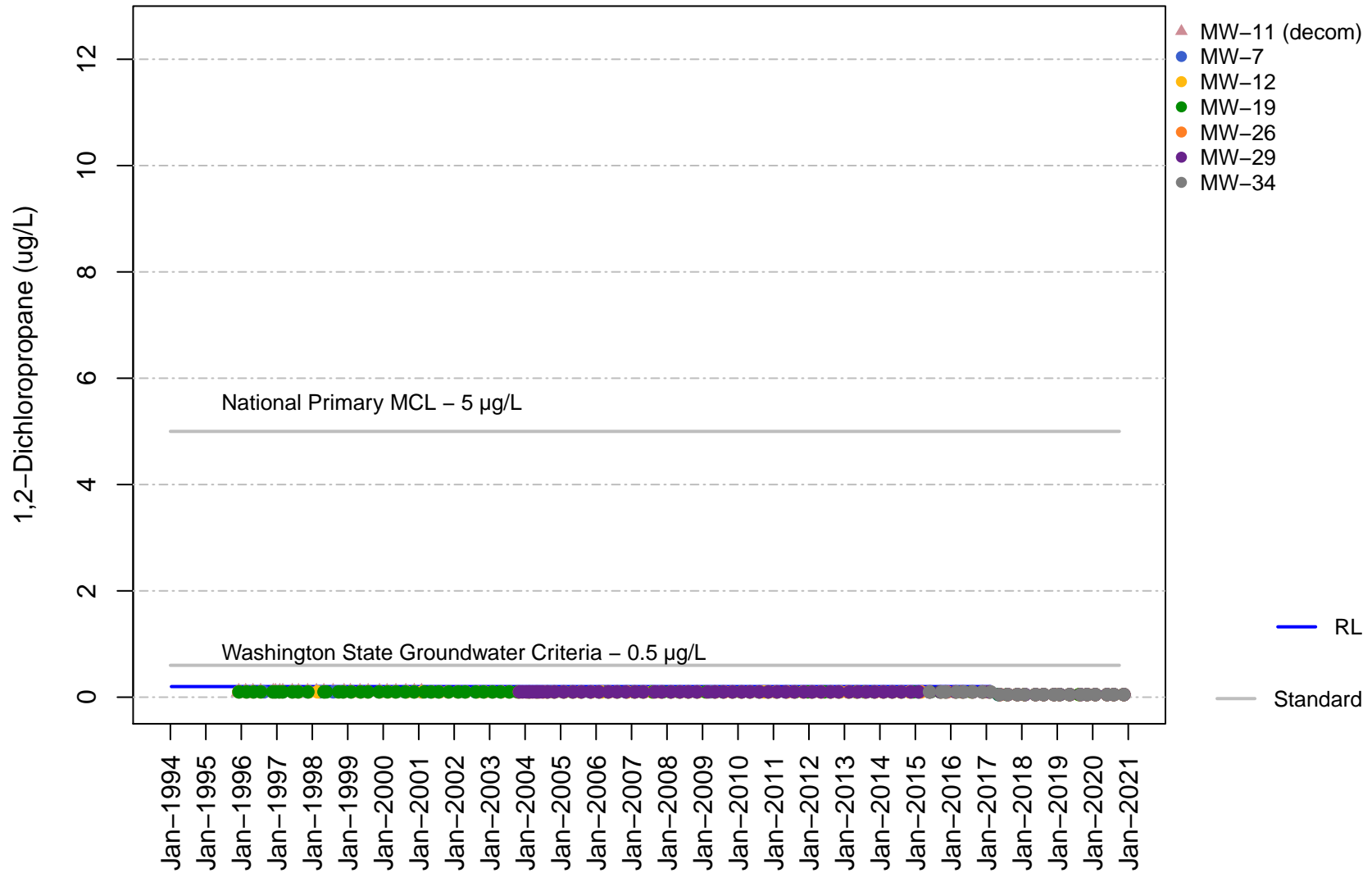
**Vashon Island Closed Landfill  
Unit D  
1,1-Dichloroethane**



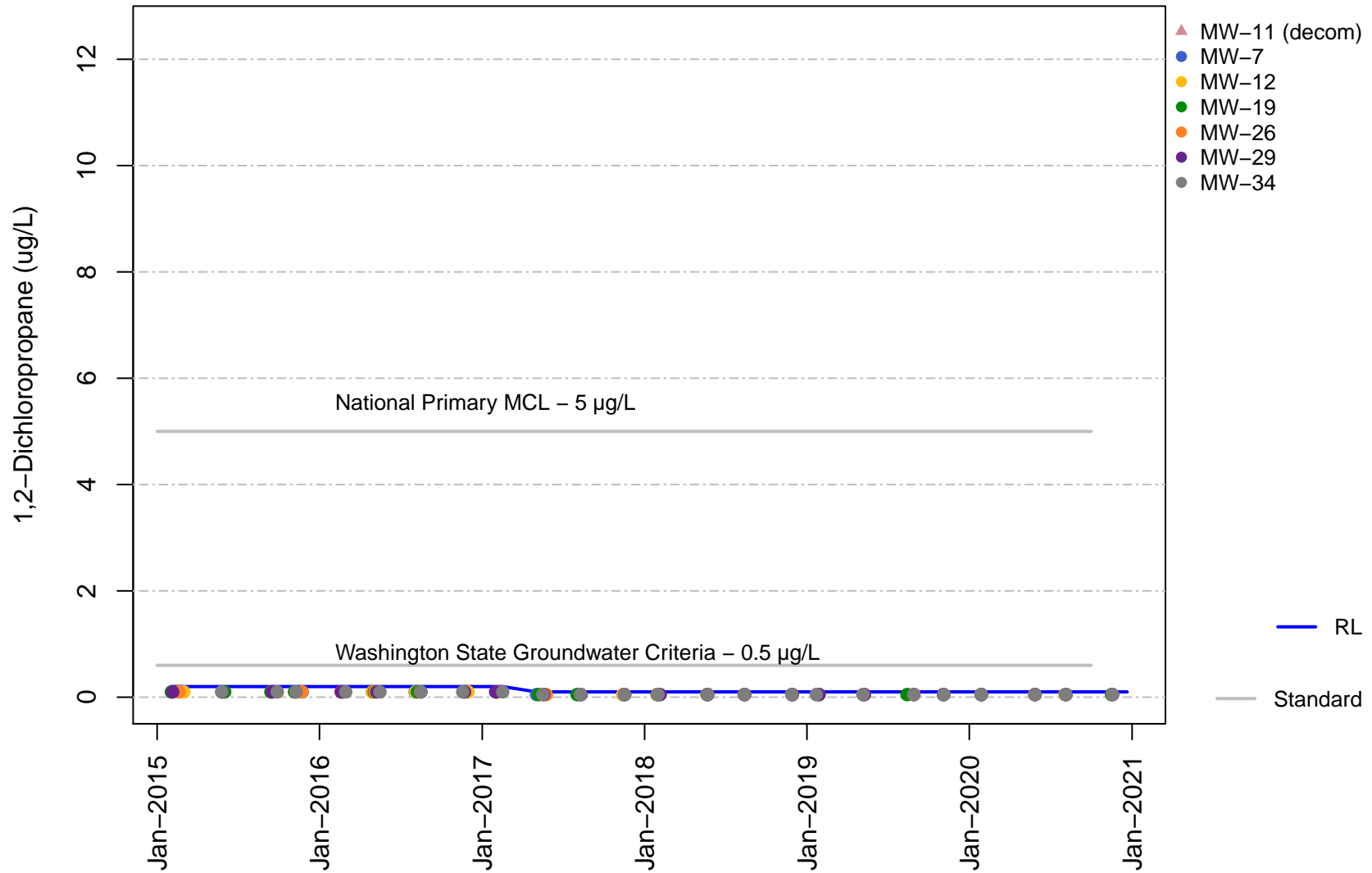
**Vashon Island Closed Landfill  
Unit D  
1,1-Dichloroethane**



**Vashon Island Closed Landfill  
Unit D  
1,2-Dichloropropane**

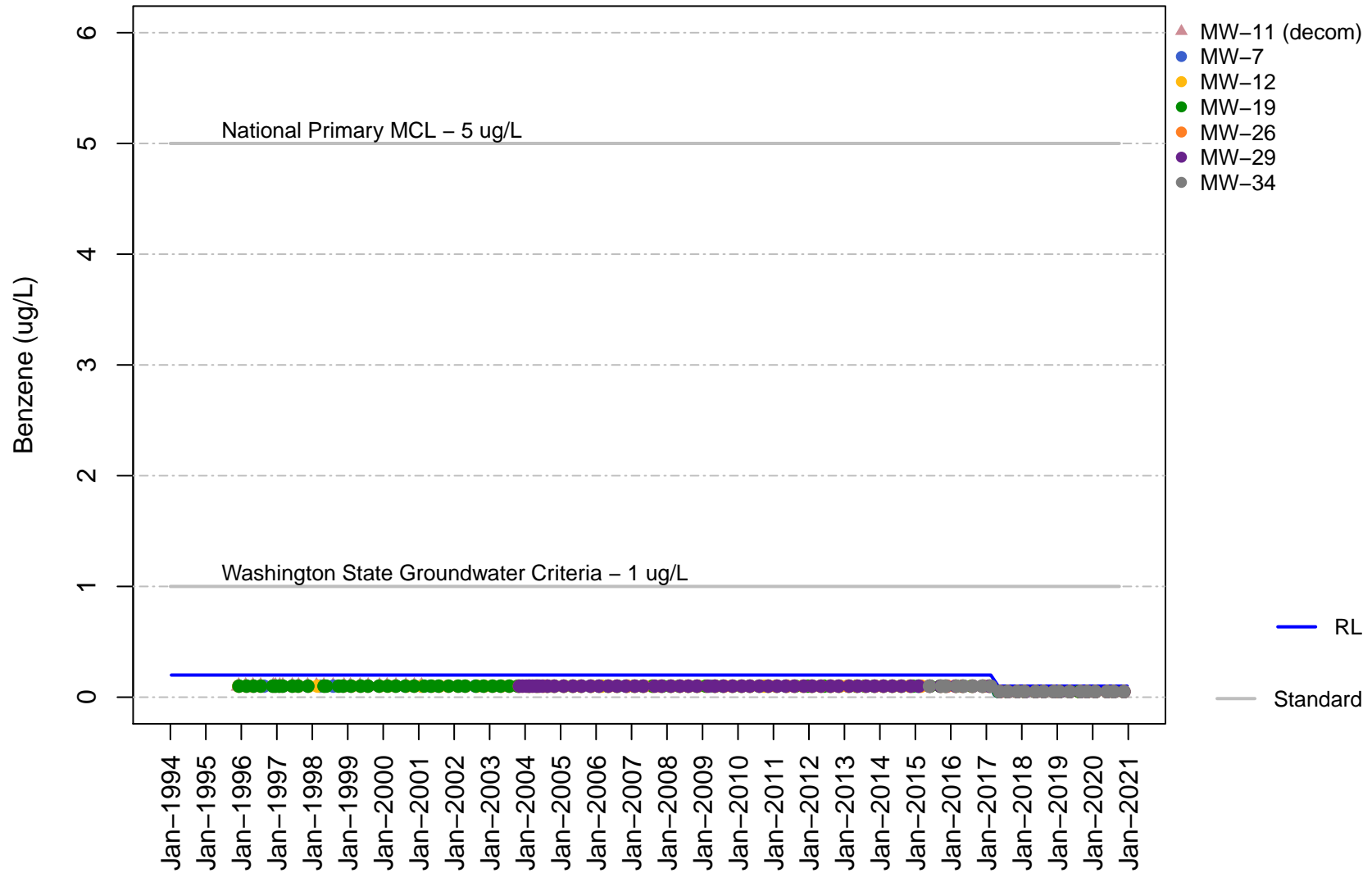


# Vashon Island Closed Landfill Unit D 1,2-Dichloropropane

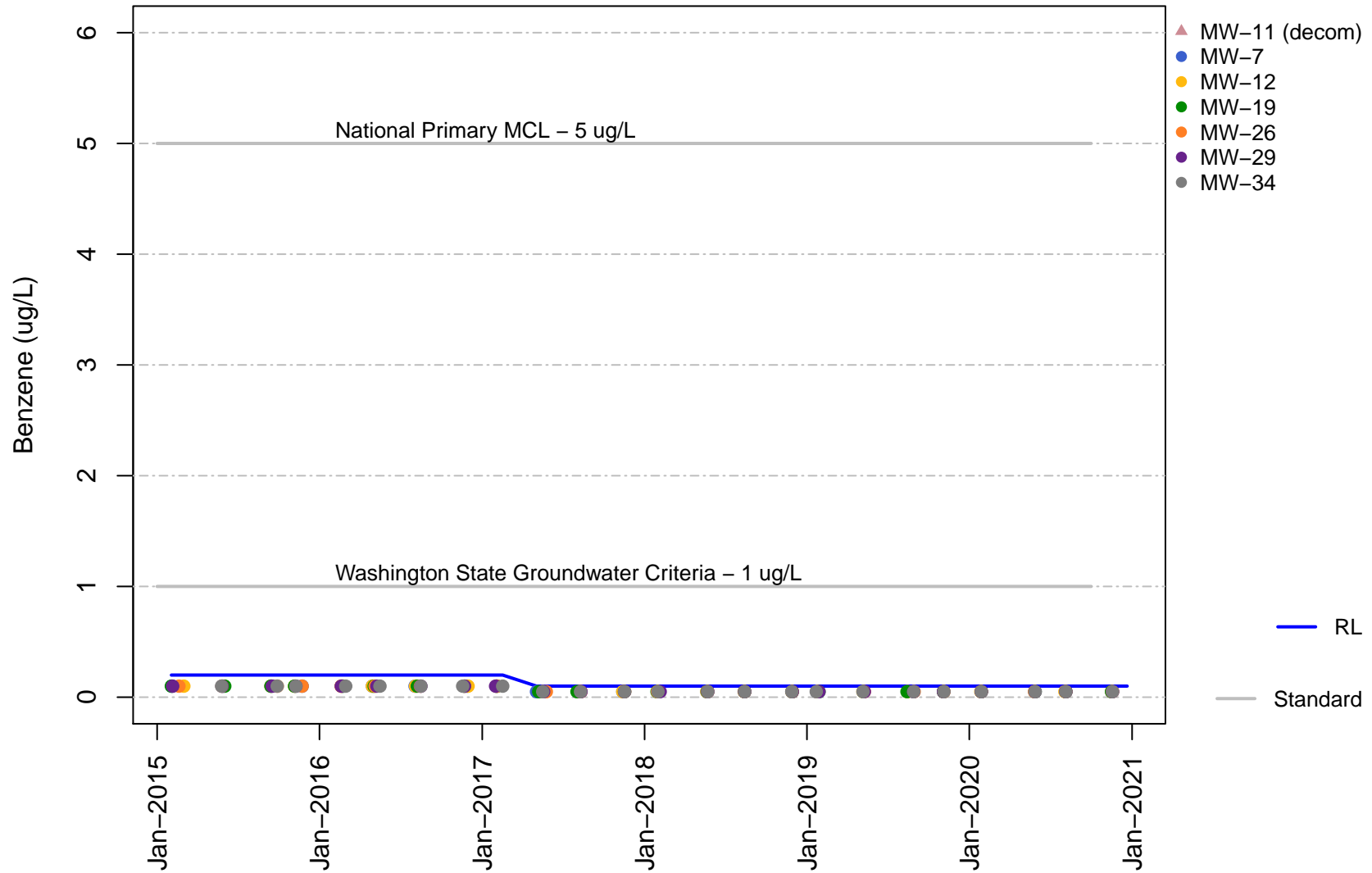




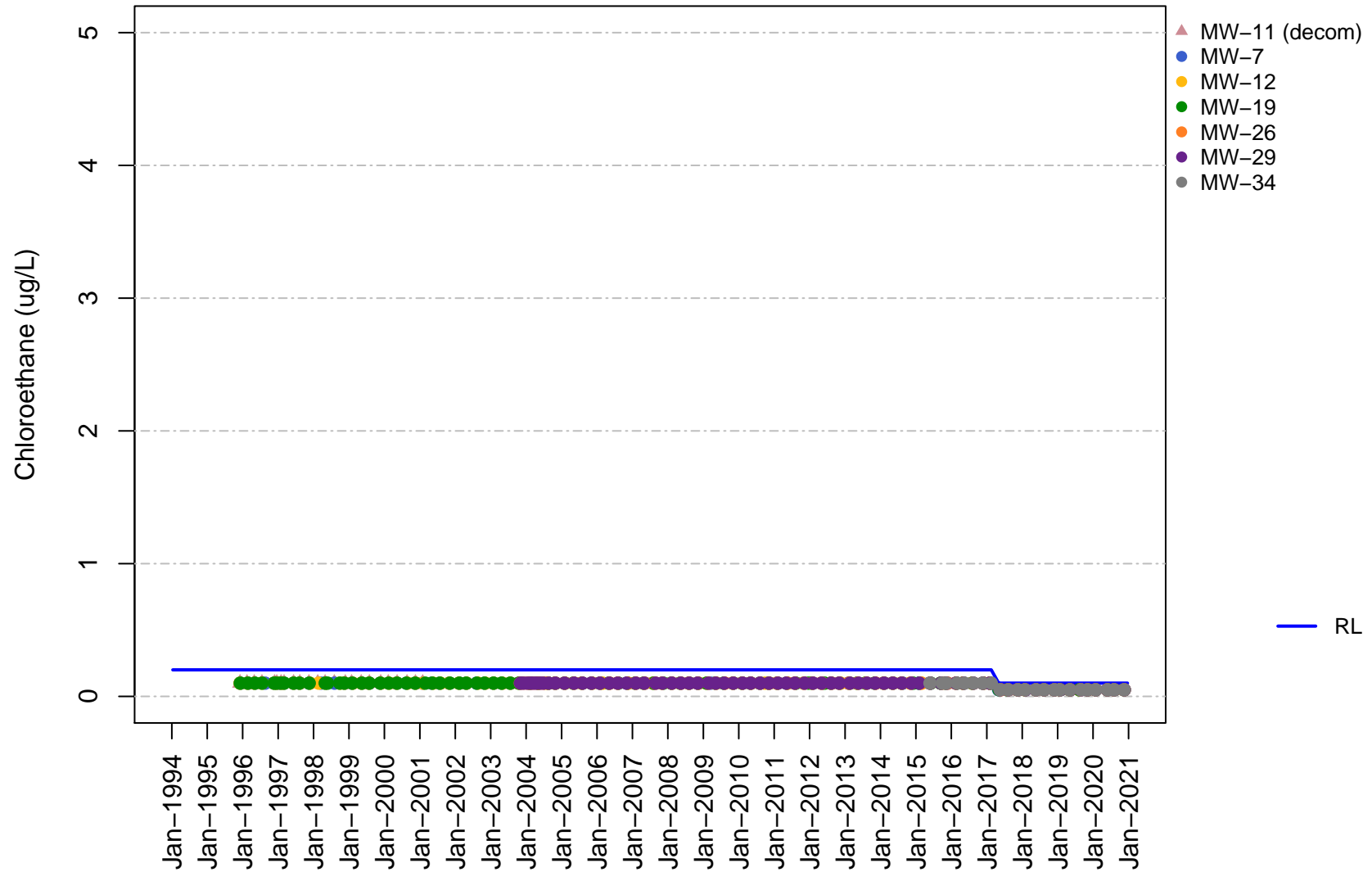
# Vashon Island Closed Landfill Unit D Benzene



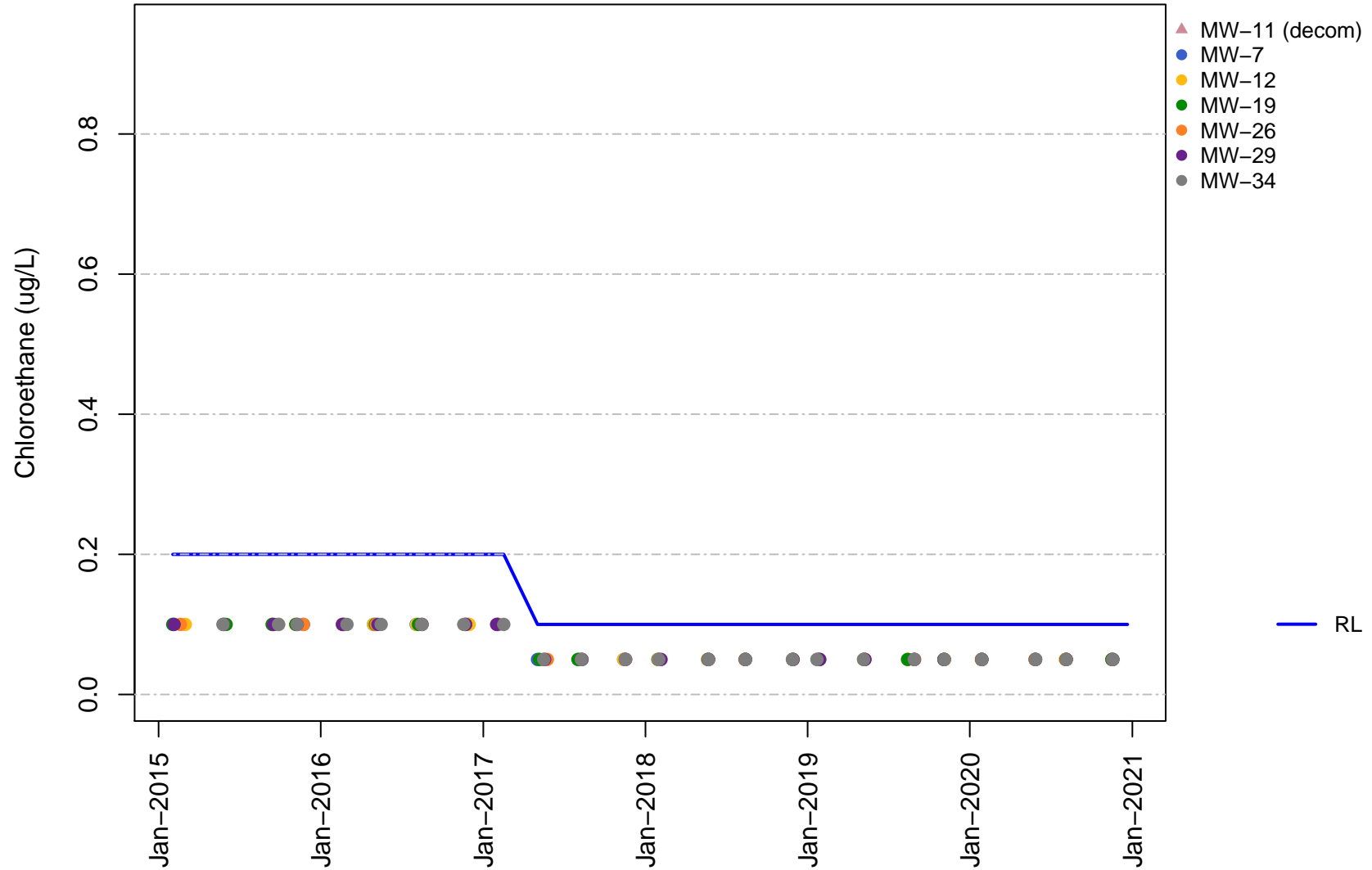
**Vashon Island Closed Landfill  
Unit D  
Benzene**



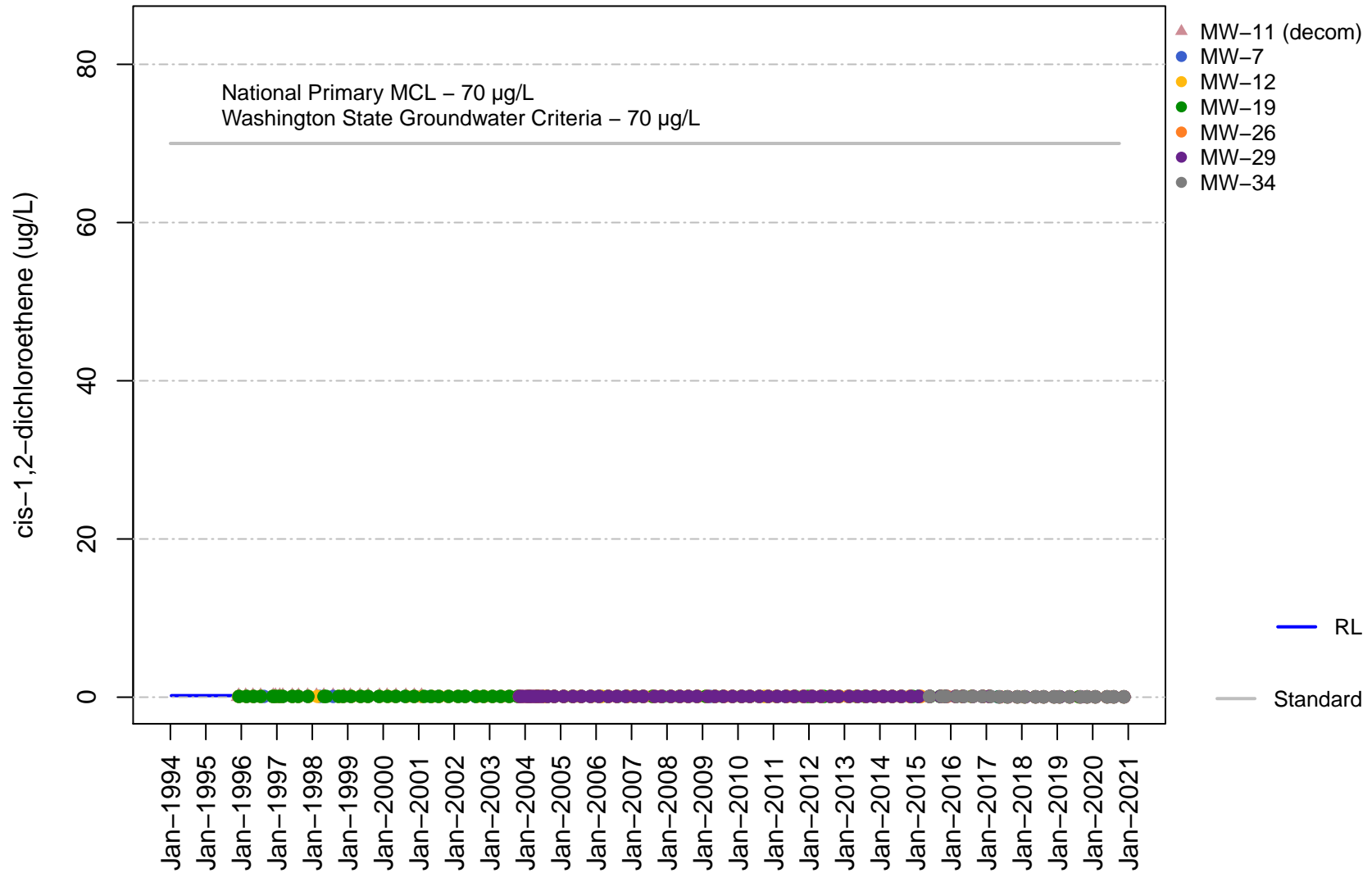
# Vashon Island Closed Landfill Unit D Chloroethane



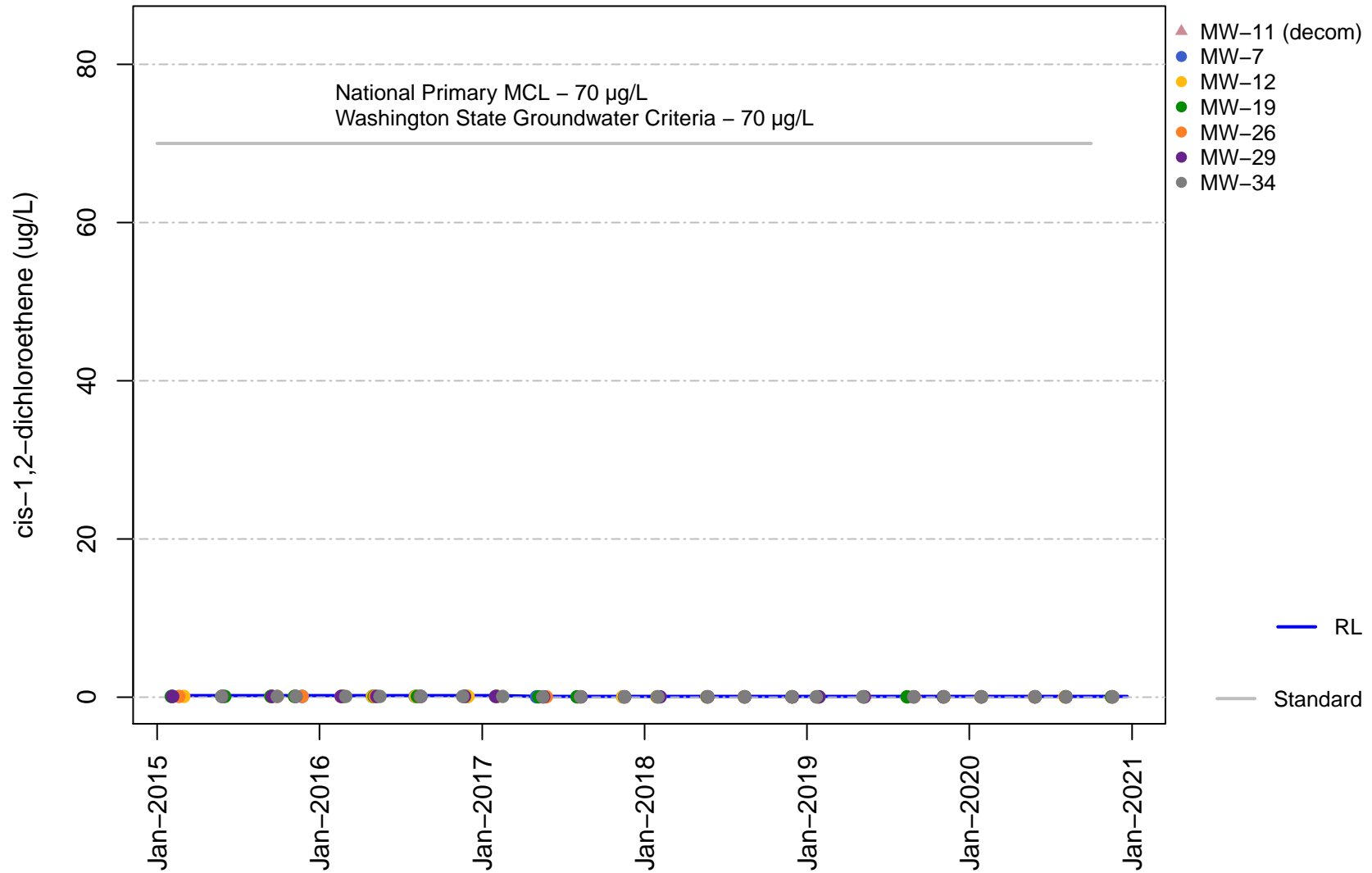
# Vashon Island Closed Landfill Unit D Chloroethane



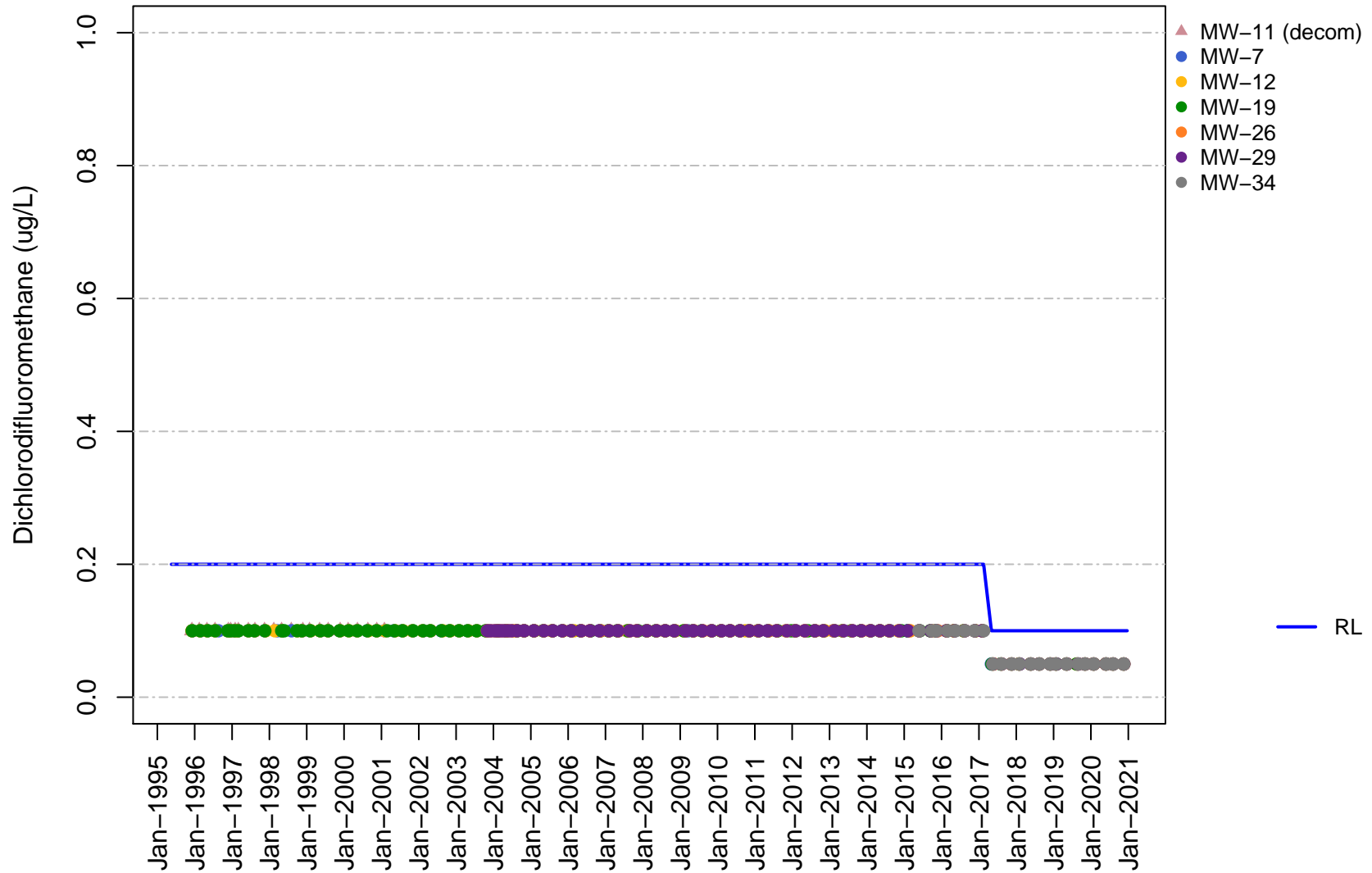
**Vashon Island Closed Landfill  
Unit D  
cis-1,2-Dichloroethene**



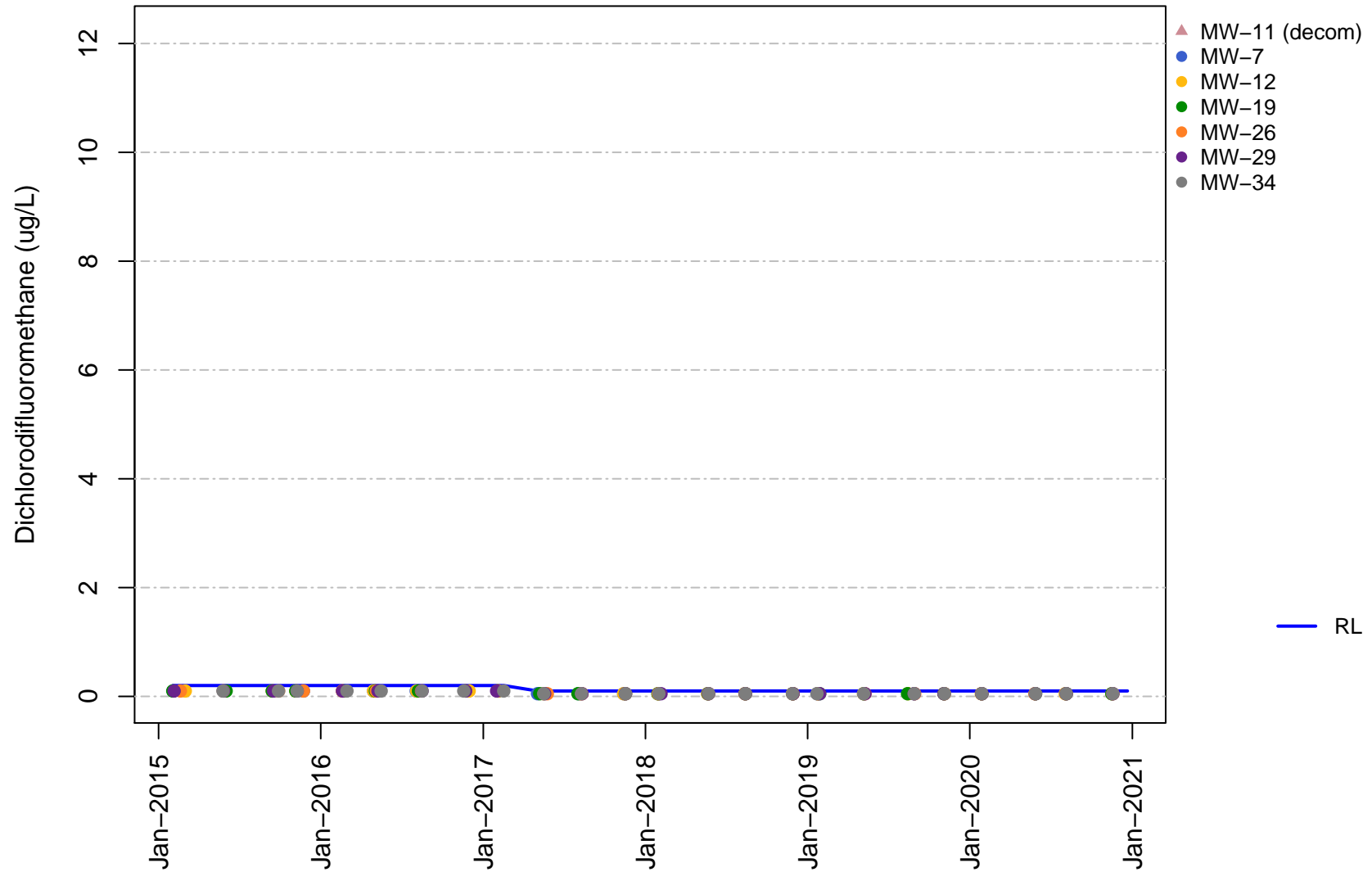
# Vashon Island Closed Landfill Unit D cis-1,2-Dichloroethene



# Vashon Island Closed Landfill Unit D Dichlorodifluoromethane

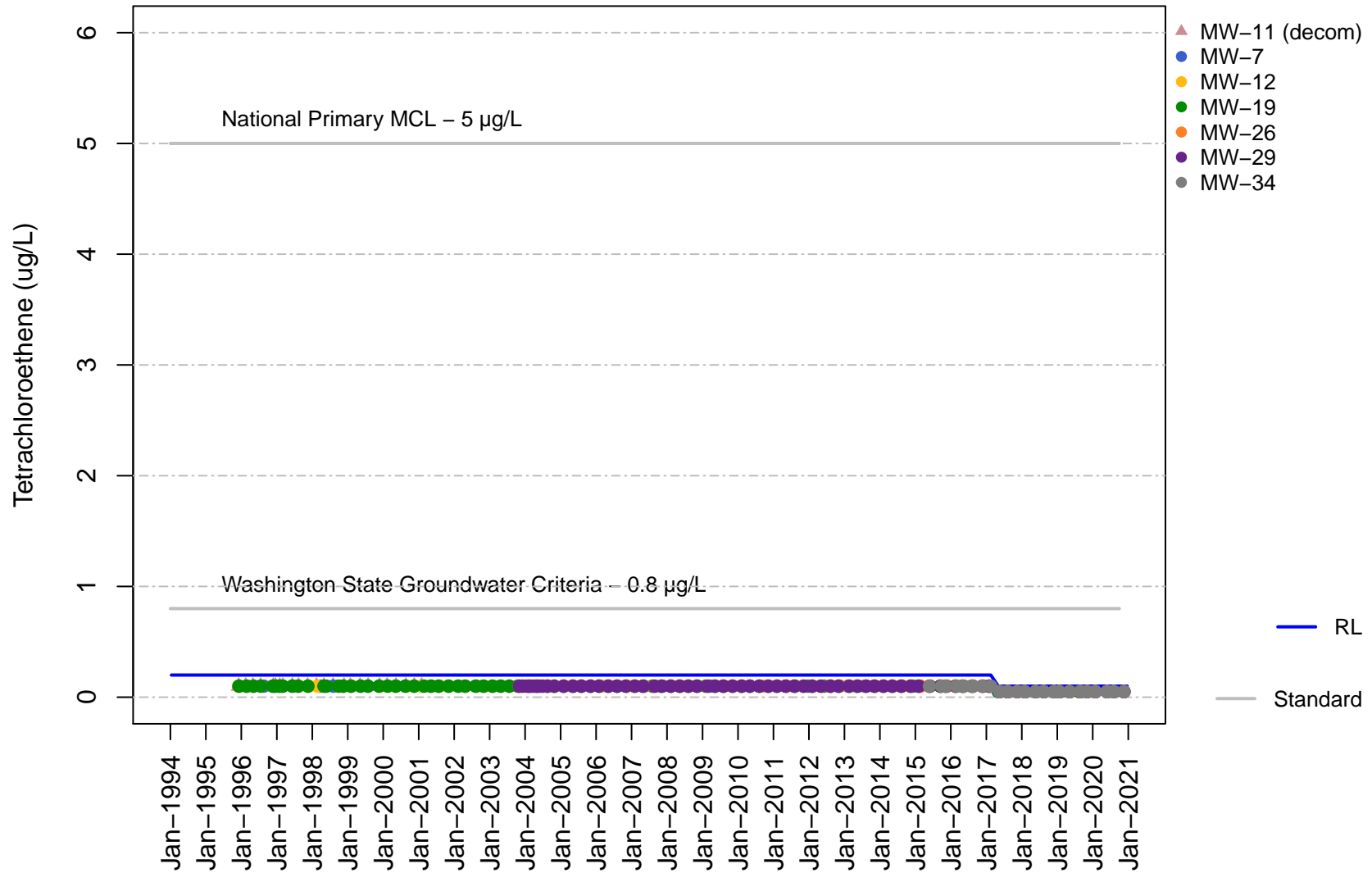


Vashon Island Closed Landfill  
Unit D  
Dichlorodifluoromethane

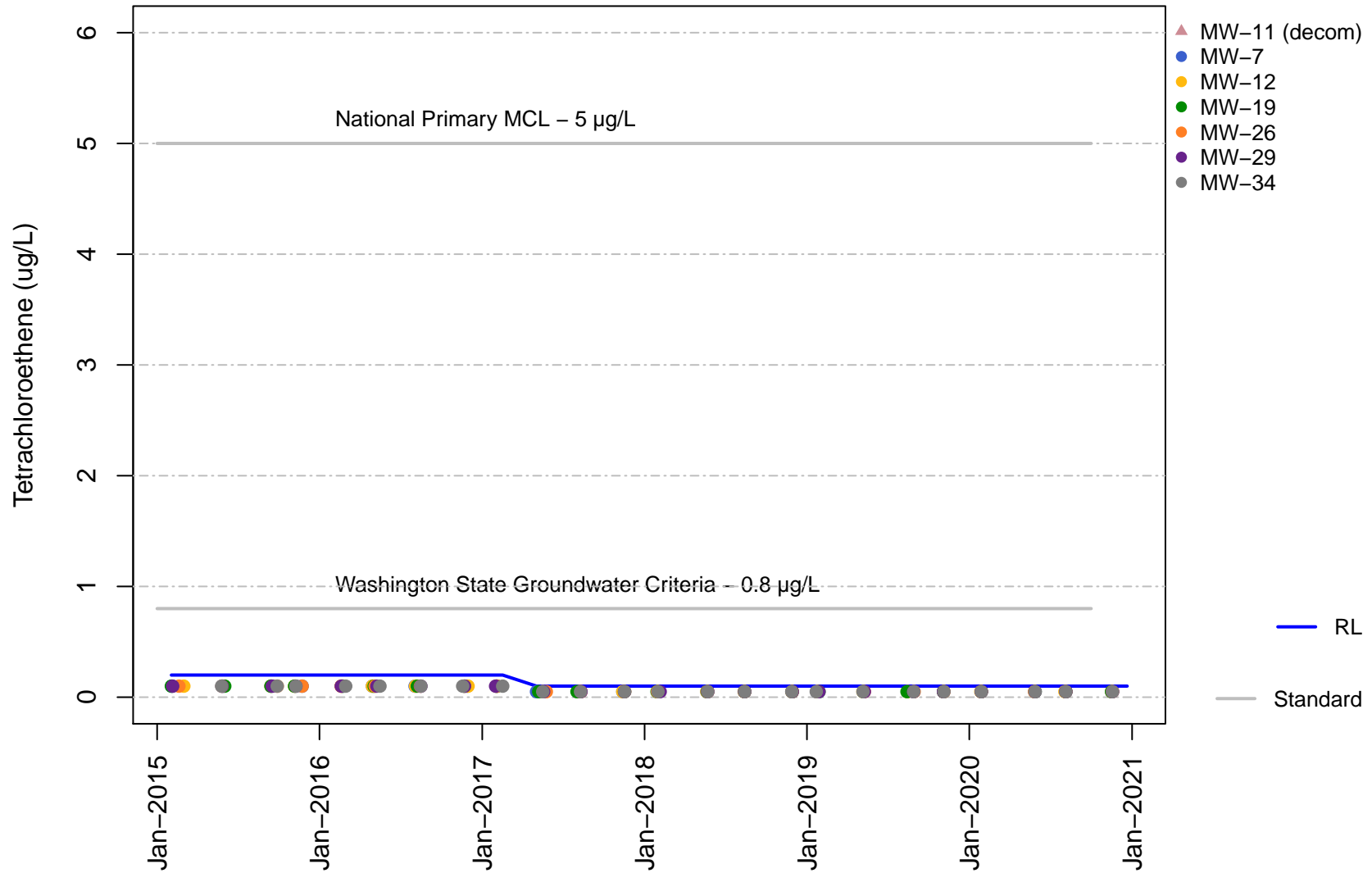




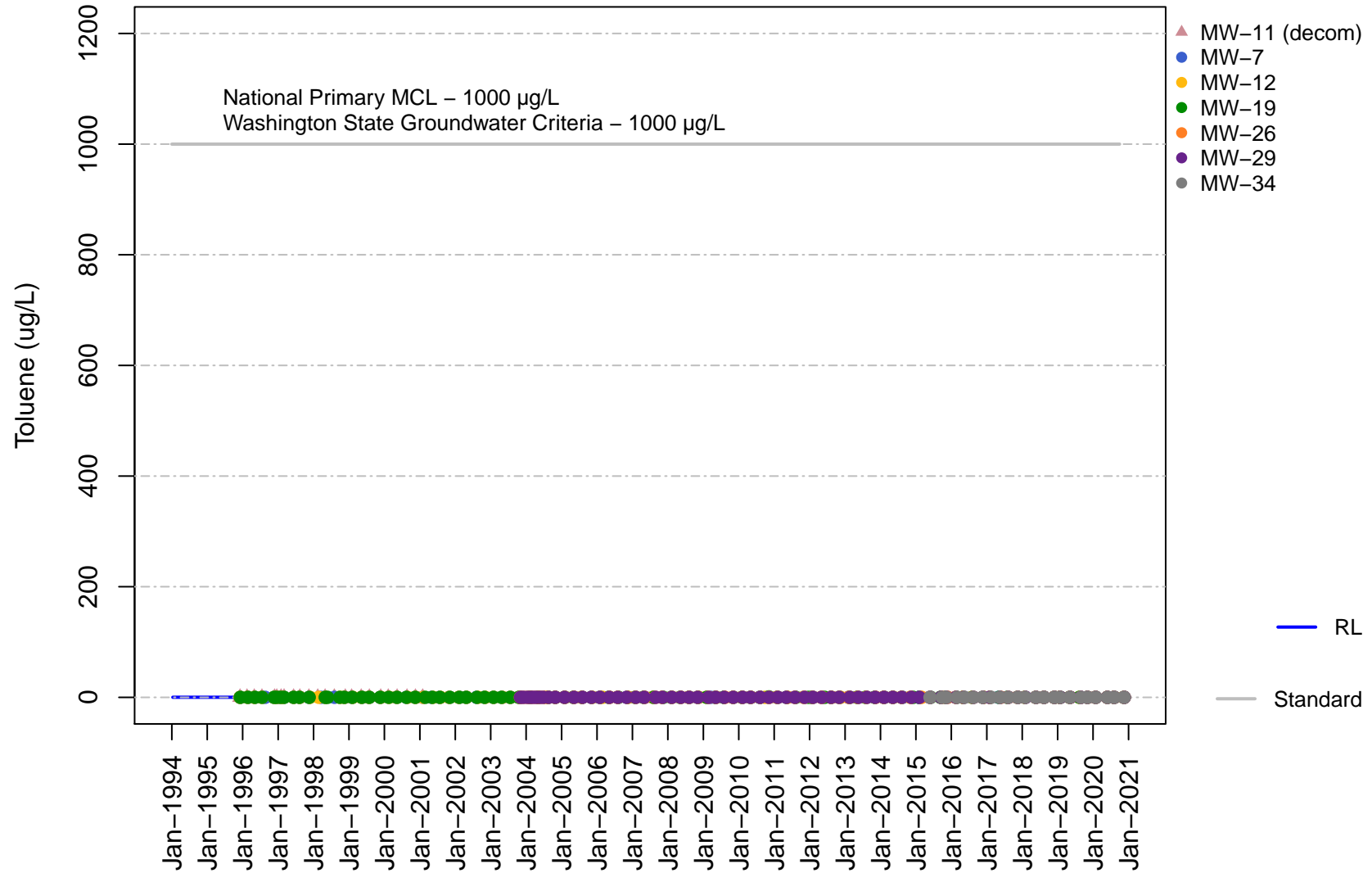
**Vashon Island Closed Landfill  
Unit D  
Tetrachloroethene**



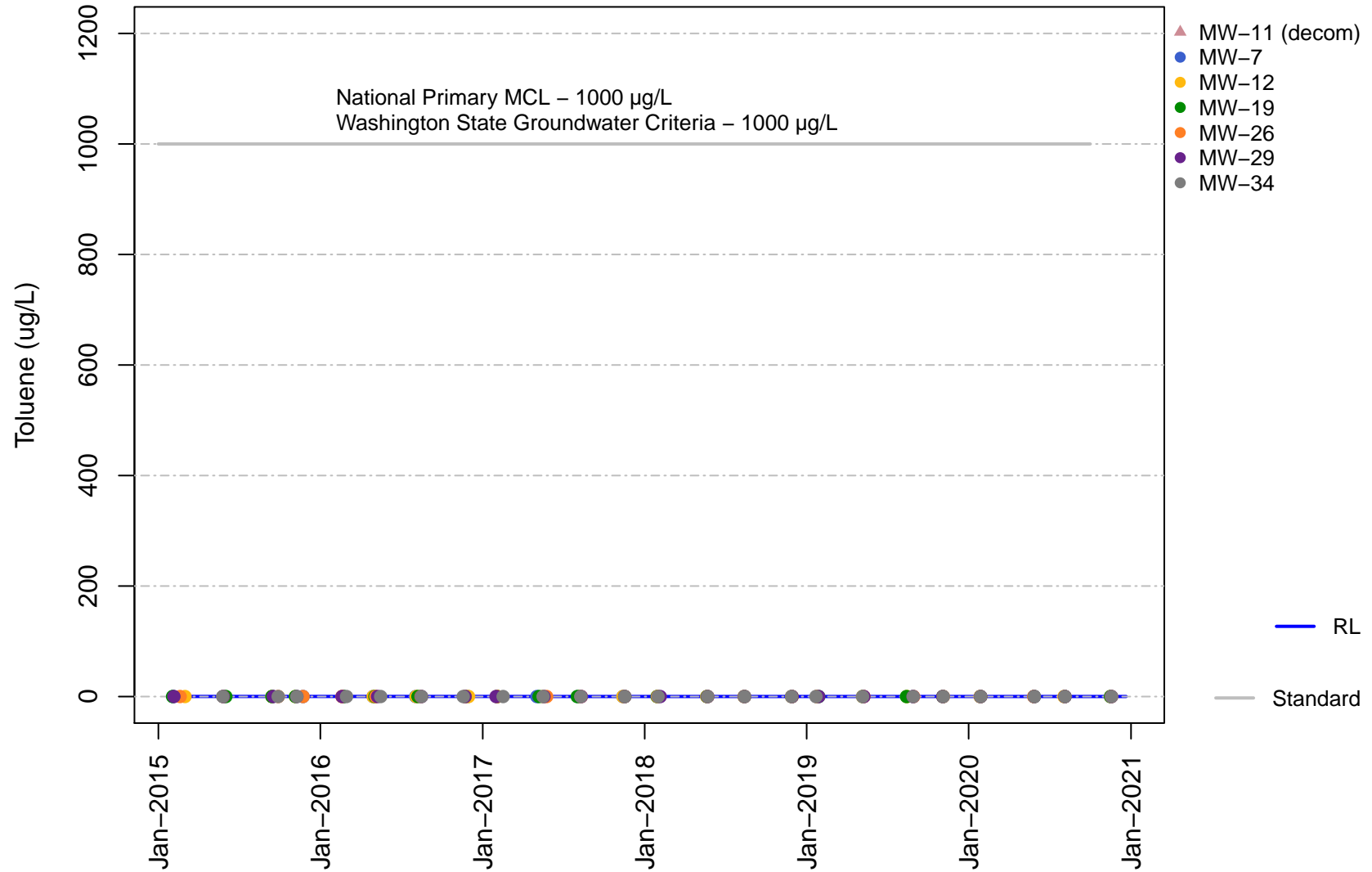
**Vashon Island Closed Landfill  
Unit D  
Tetrachloroethene**



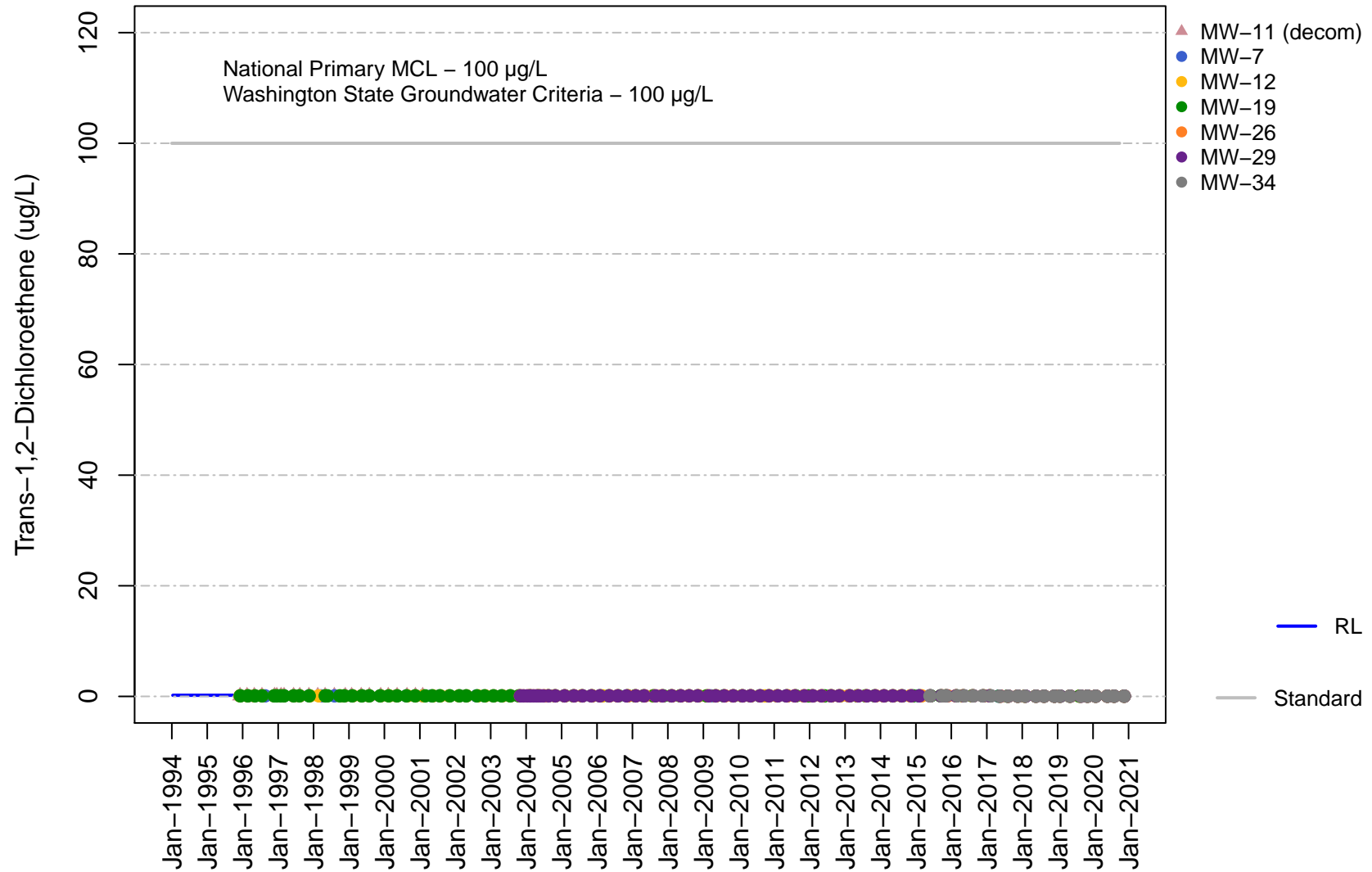
# Vashon Island Closed Landfill Unit D Toluene



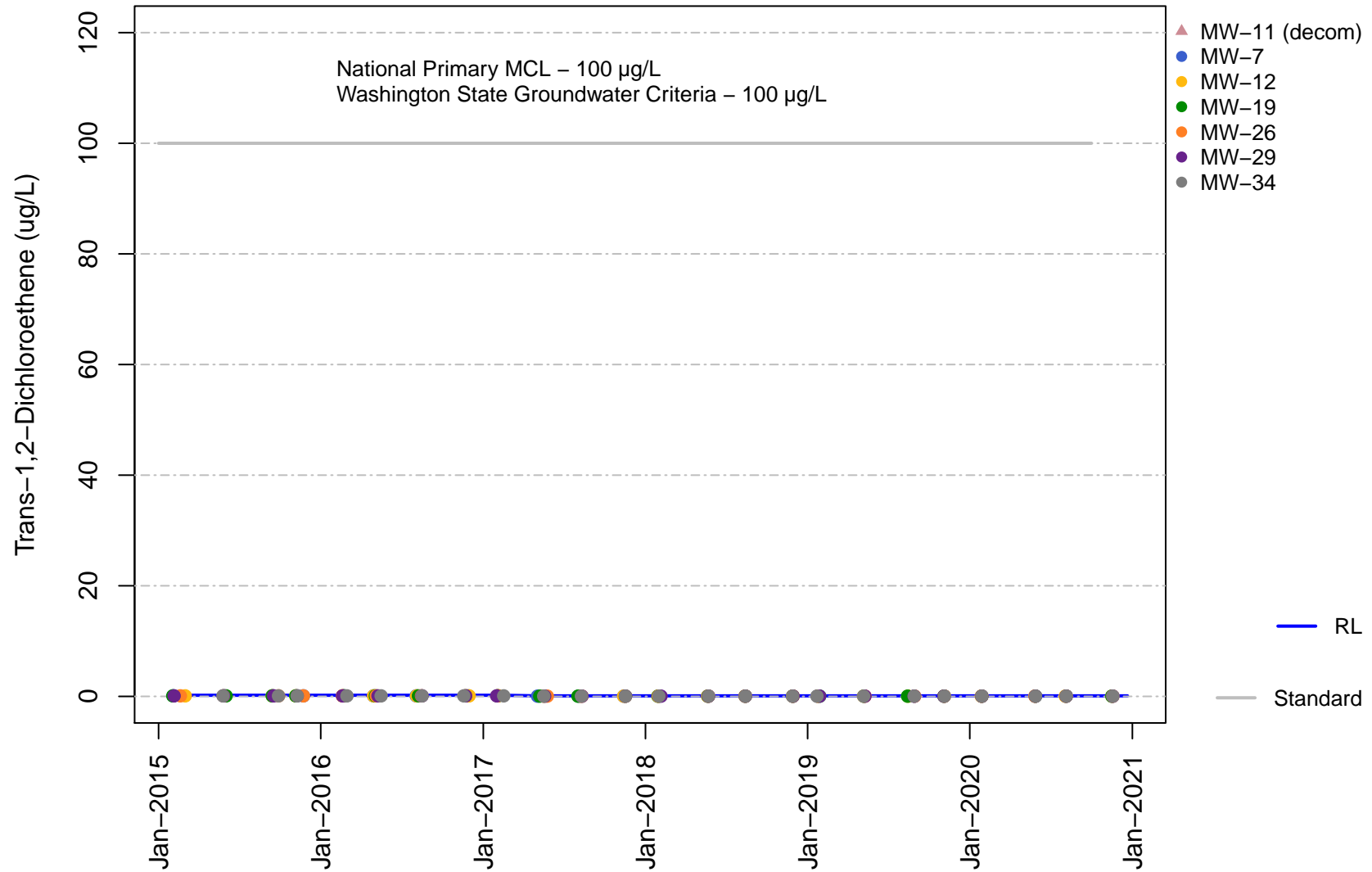
# Vashon Island Closed Landfill Unit D Toluene



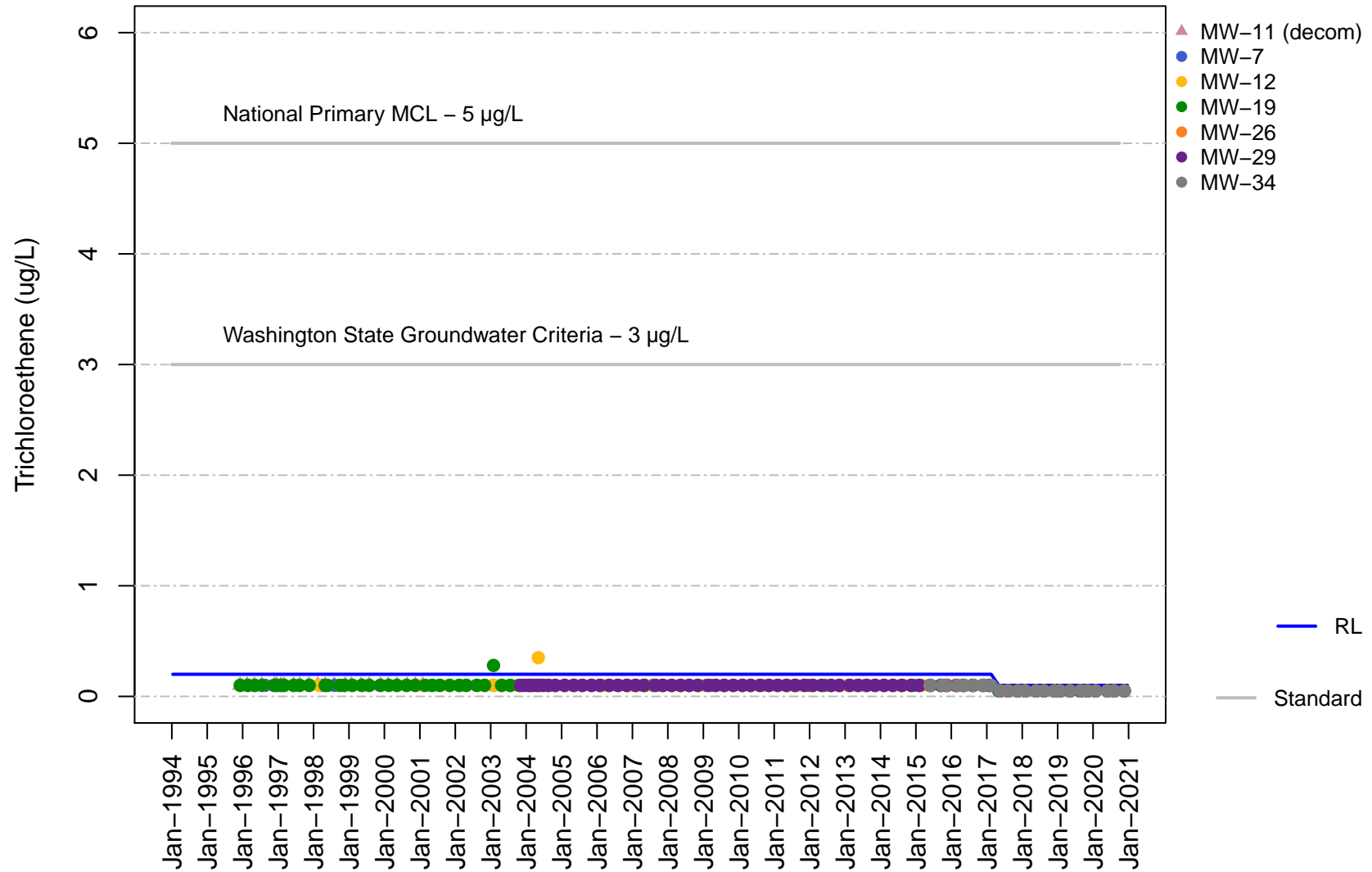
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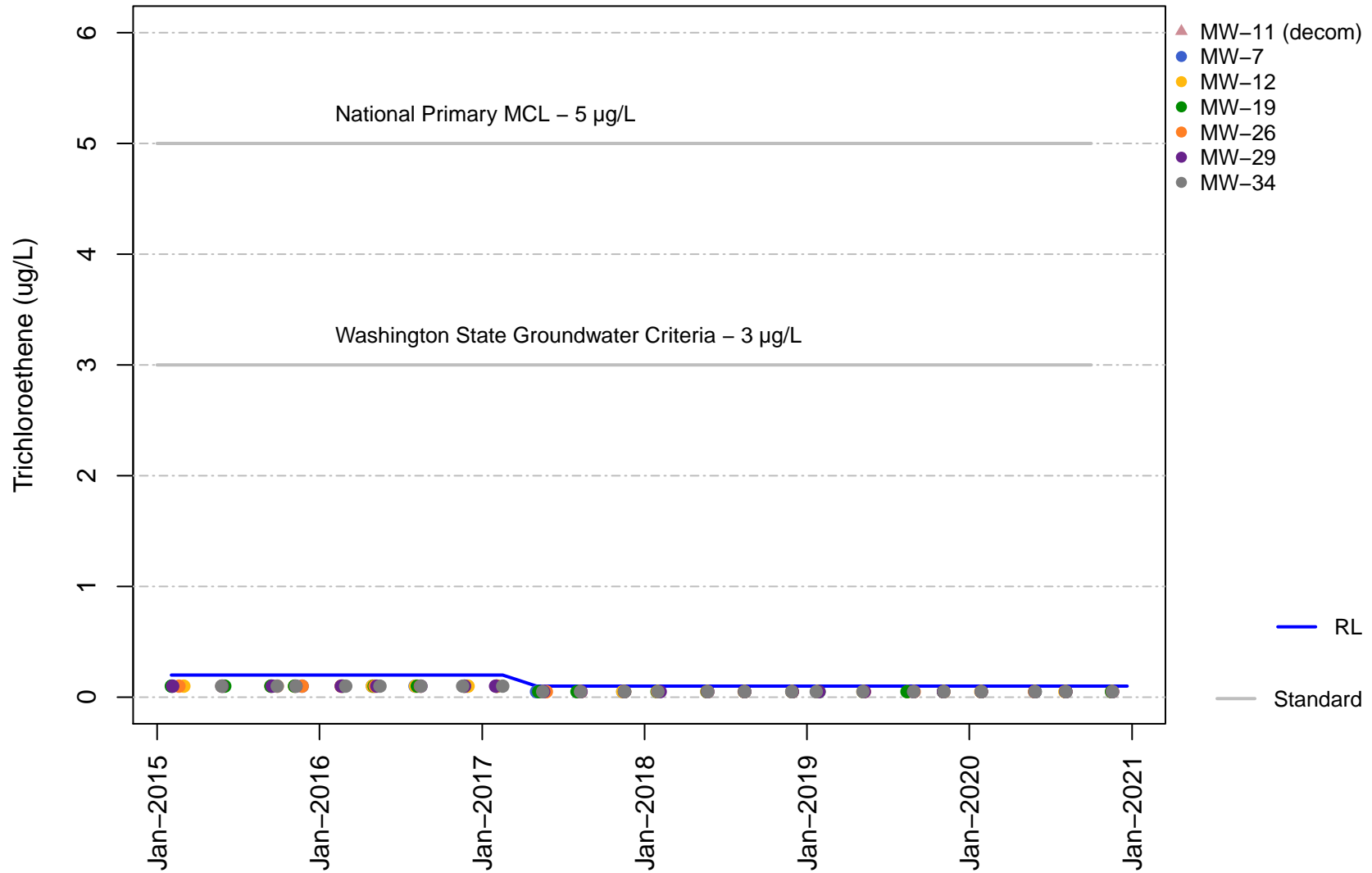
# Vashon Island Closed Landfill Unit D Trans-1,2-Dichloroethene



**Vashon Island Closed Landfill  
Unit D  
Trichloroethene**

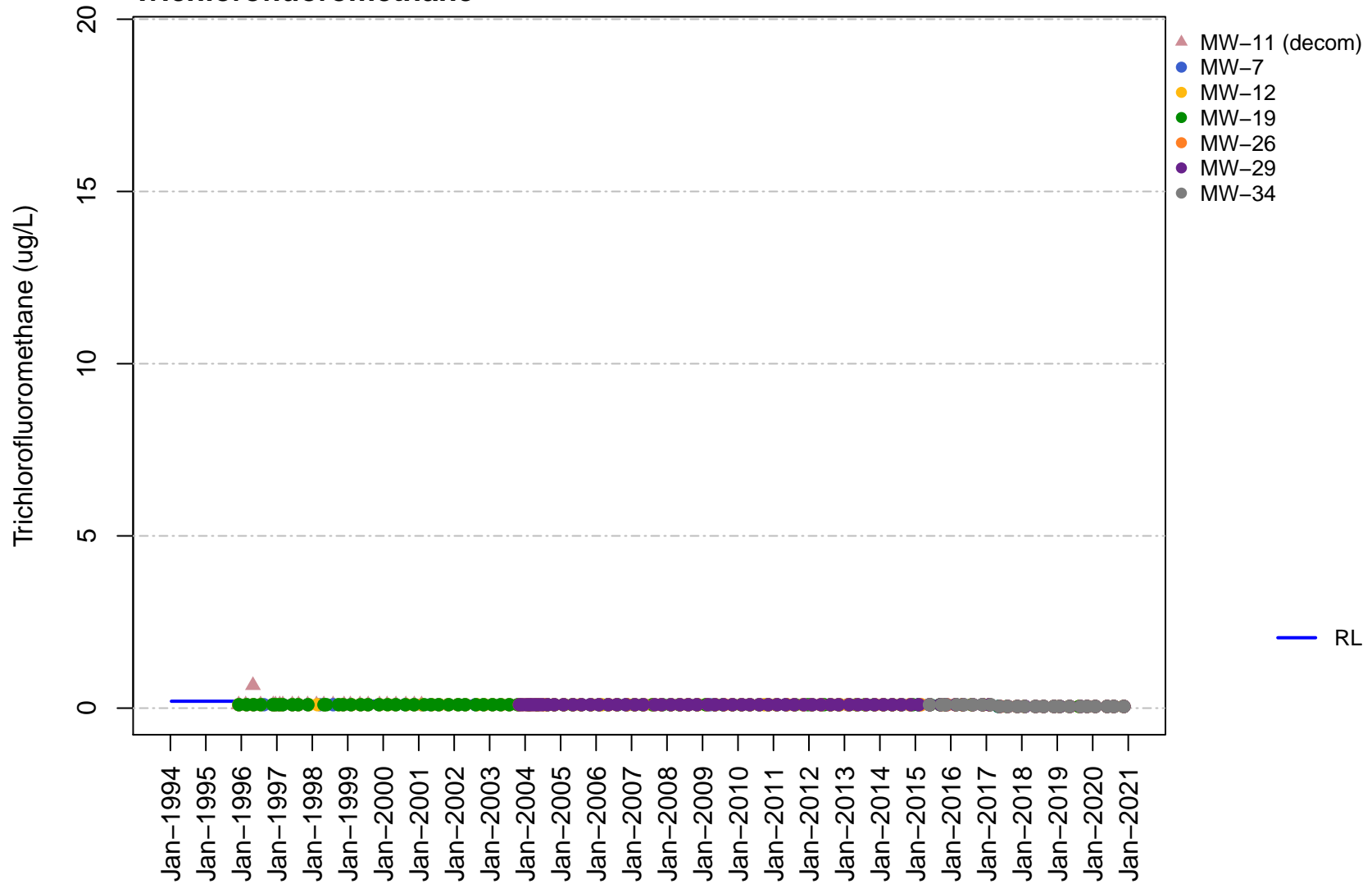


# Vashon Island Closed Landfill Unit D Trichloroethene

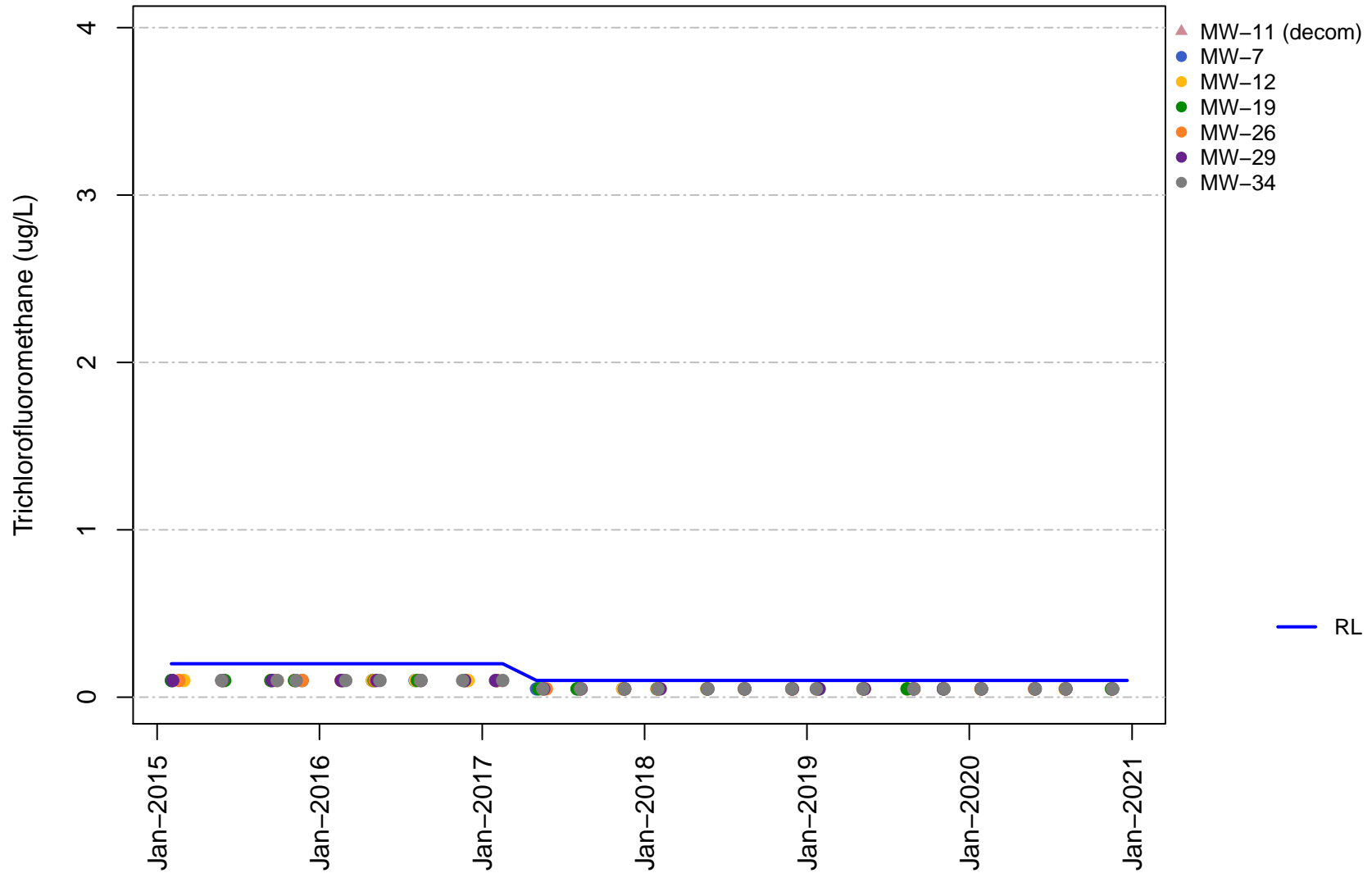




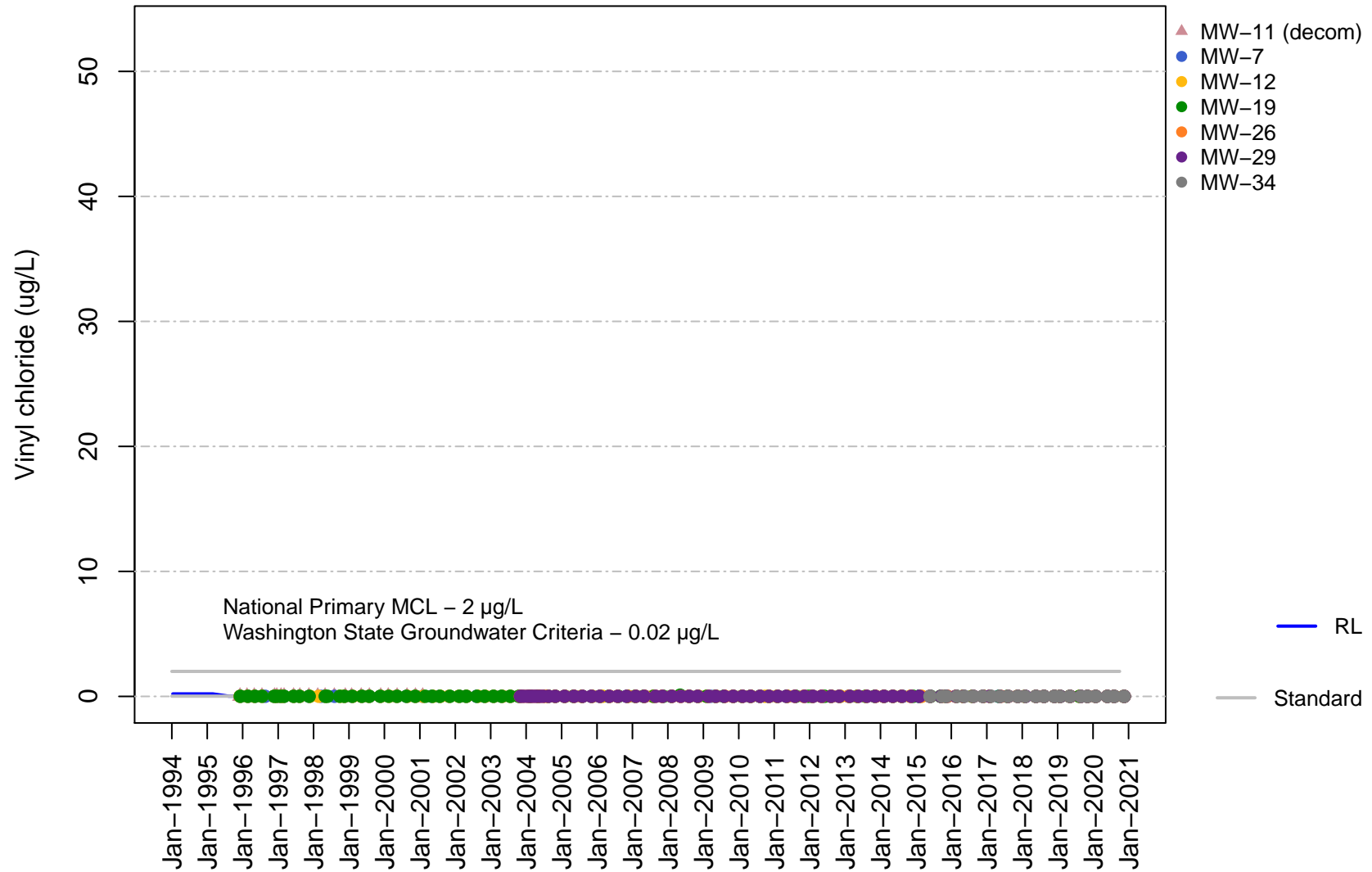
# Vashon Island Closed Landfill Unit D Trichlorofluoromethane



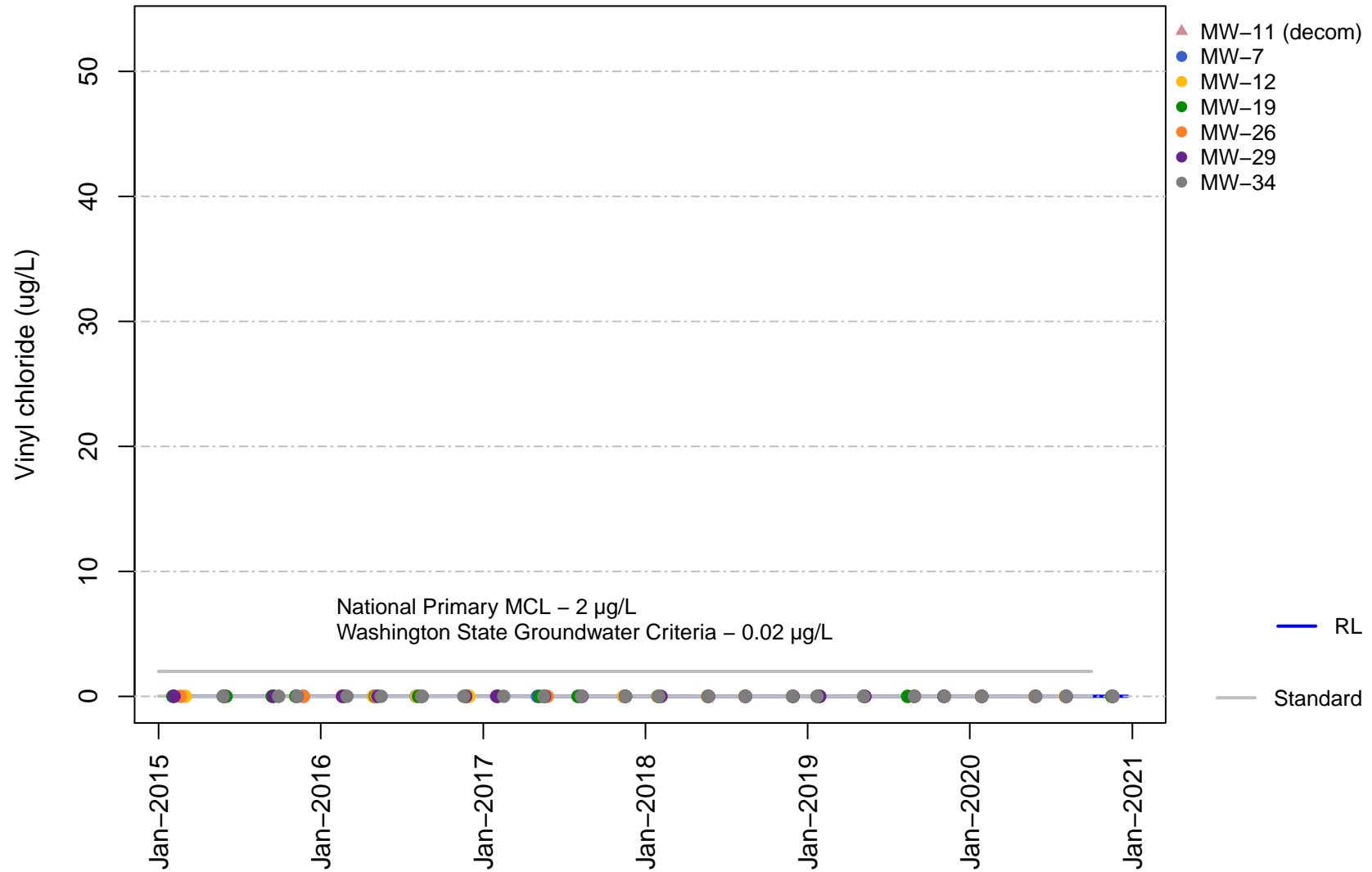
# Vashon Island Closed Landfill Unit D Trichlorofluoromethane



# Vashon Island Closed Landfill Unit D Vinyl chloride



# Vashon Island Closed Landfill Unit D Vinyl chloride



## **Appendix G**

### Groundwater Velocity Calculations and Potentiometric Maps



## King County

### Water and Land Resources Division

Department of Natural Resources and Parks  
King Street Center  
201 South Jackson Street, Suite 704  
Seattle, WA 98104-3855

**206-477-4800** Fax 206-296-0192  
TTY Relay: 711

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## TECHNICAL MEMORANDUM

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April 27, 2020

TO: Marisa Baptiste, Engineer III, Facility Engineering and Science Section, Solid Waste Division, Department of Natural Resources and Parks (DNRP)

FM: Sevin Bilir, Environmental Scientist IV, Science and Technical Support Section, Water and Land Resources Division, DNRP

RE: Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations First Quarter 2020 Results  
Vashon Island Closed Landfill, King County, Washington  
Project No. 1033601 – Task 29.14.137.45

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The King County Water and Land Resources Division (WLRD) submits this memorandum report on groundwater conditions during the first quarter of 2020 for the middle channel deposit in the Cc2 perched zone and the Unit D aquifer beneath the Vashon Island Closed Landfill (Landfill), in accordance with the *Proposal for Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations* (WLRD, 2020). King County Solid Waste Division (SWD) personnel measured groundwater levels at the Landfill on January 27, 2020. These measurements were received by WLRD on April 1, 2020 and were used to:

1. Evaluate the potentiometric groundwater surface elevation for the Cc2 perched zone and the Unit D aquifer;
2. Determine the groundwater flow direction and horizontal gradient for the Cc2 perched zone and the Unit D aquifer; and
3. Calculate the groundwater velocity of the Cc2 perched zone and the Unit D aquifer.

There have been no significant changes in the interpreted groundwater conditions for the Cc2 perched zone and the Unit D aquifer since the report submitted for the fourth quarter of 2019.

## **Groundwater Elevation Data**

The SWD attempted groundwater level measurements at 14 monitoring wells during the first quarter of 2020. These wells are completed in the Cc2 perched zone and the Unit D aquifer, as referred to in *Remedial Investigation Report, Phase 1 – Vashon Island Closed Landfill, Volume 1* (Aspect 2018).

Table A-1 lists the groundwater monitoring well identifications, locations, construction details, measured depth to groundwater levels and calculated groundwater elevations for monitoring wells screened in the Cc2 perched zone and Unit D aquifer.

### **Cc2 Perched Zone**

Three separate coarse-grained perched zones are identified within variable fine-grained sediment in the Cc2 perched zone (Aspect 2018). The Cc2 channel deposit perched zone is not laterally extensive across the Landfill as was not identified in borings southeast and northwest of the landfill closure area (Aspect 2018). Groundwater in this perched zone is monitored by wells MW-2, MW-9, MW-20, MW-21, MW-30, MW-33, and MW-35 (Aspect 2018).

According to Aspect (2018), water levels in the Unit Cc2 perched zone generally indicate unconfined groundwater conditions, with the exception of monitoring wells MW-20 and MW-33. Groundwater elevations in these two wells are above coarse-grained layers indicating confined conditions (Aspect 2018). During this quarter, the water level in monitoring well MW-33 was measured at almost 17 feet above the top of the screen and may be influenced by confining conditions.

Figure A-1 shows calculated groundwater elevations at monitoring well locations and interpreted groundwater potentiometric surface contours for the Cc2 perched zone based on measurements taken on January 27, 2020.

### **Unit D Aquifer**

Groundwater in the Unit D aquifer is monitored by wells MW-7, MW-12, MW-19, MW 25, MW-26, MW-28, MW-29, and MW-34 (Aspect 2018). Measured water levels in monitoring wells MW-7, MW-12, MW-19, MW-25, and MW-34 were at least 16.5 feet above the top of the screen and may be influenced by vertical gradients, permeability differences (Aspect 2018), or confining conditions in the Unit D aquifer.

Monitoring well MW-28 was again reported as dry as the water level was noted below the screen bottom elevation. This well has historically been reported as “dry” for this reason. The screen for MW-28 was installed at the contact between Unit D and unit below (Unit E) and requires a two foot rise in surrounding groundwater levels to reach the screen bottom.

Figure A-2 shows calculated groundwater elevations at monitoring well locations and interpreted groundwater potentiometric surface contours for the Unit D aquifer based on measurements taken on January 27, 2020.

## **Direction of Groundwater Flow**

Interpreted groundwater flow directions in the Cc2 perched zone and Unit D aquifer, based on measurements taken on January 27, 2020, are shown in Figures A-1 and A-2. Table A-2 lists the flow direction for the Cc2 perched zone and Unit D aquifer beneath the Landfill based on measurements and mapping of groundwater elevation contours taken during the first quarter of 2020.

### **Cc2 Perched Zone**

Calculated groundwater elevations and interpreted groundwater potentiometric surface contours indicate that groundwater in the Cc2 perched zone generally flows towards the west-northwest property-wide with a west to west-southwest component in the south slope area (Figure A-1).

### **Unit D Aquifer**

As per Aspect (2018), groundwater flow direction in Unit D is strongly influenced by the typically higher water levels in MW-7 and MW-34 and this is seen in quarterly mapping of the potentiometric surface forming a groundwater divide running generally west-east beneath the southern area of the landfill footprint. Calculated groundwater elevations and interpreted groundwater potentiometric surface contours during the first quarter of 2020 indicate that groundwater in the Unit D aquifer flows generally southwesterly in the area south of the divide and northerly in the area north of the divide with components of flow to the northeast and northwest (Figure A-2). The groundwater gradient south of the divide is less steep than that north of the divide.

## **Groundwater Parameters**

Table A-2 presents a summary of the groundwater parameters. Hydraulic conductivity and effective porosity values are based on the ranges referred to in *Remedial Investigation Report, Phase 1 – Vashon Island Closed Landfill, Volume 1* (Aspect 2018). However, average horizontal hydraulic conductivity values for Unit Cc2 are assumed incorrectly listed in that document but assumed correctly commented on later in the notes of that document. Table A-2 reflects this correction (also noted in the accompanying notes) and presents a summary of the groundwater parameters used to calculate groundwater velocities from the first quarter 2020 data.

The average horizontal hydraulic conductivity for the Cc2 perched zone beneath the Landfill is reported to be 8.2 feet per day (ft/d) property wide and 5.8 ft/d in the south slope area (Aspect 2018). The average horizontal hydraulic conductivity in the Unit D aquifer beneath the landfill is reported to be 10.2 ft/d (Aspect 2018). The effective



porosity is reported as 20 percent for both the Cc2 perched zone and the Unit D aquifer (Aspect 2018).

Average hydraulic gradients are approximately 0.019 ft/ft property wide and 0.012 ft/d for the south slope area based on measurements made during the first quarter of 2020. The average hydraulic gradients for the Unit D aquifer, based on measurements made during the first quarter of 2020, are approximately 0.030 and 0.016 ft/ft in the northerly and southerly flow directions, respectively.

Average horizontal groundwater velocities calculated for the Cc2 perched zone and Unit D aquifer beneath the Landfill, are based on spatial differences in aquifer parameters, hydraulic gradients, and calculations using the following formula:

$$\text{where: } v = \frac{I}{n_{eff}} K \frac{\Delta H}{\Delta L}$$

$v$  = Groundwater velocity [L/t]  
 $n_{eff}$  = Effective porosity [dimensionless]  
 $K$  = Hydraulic conductivity [L/t]  
 $\frac{\Delta H}{\Delta L}$  = Hydraulic gradient [L/L]

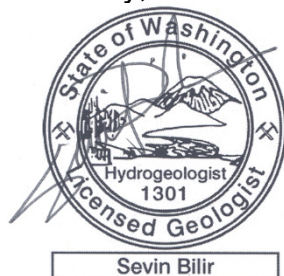
The average horizontal groundwater velocities in the Cc2 perched zone are approximately 0.76 ft/d property wide and 0.35 ft/d in the south slope area. The average horizontal groundwater velocities in the Unit D aquifer are approximately 1.50 and 0.82 ft/d in the northerly and southerly direction, respectively.

## References

- Aspect Consulting, LLC. (Aspect). 2018. Remedial Investigation Report, Phase 1 – Vashon Island Closed Landfill, Volume 1 (Contract Number E00102E08; Task No. 310.3 – D310.3.2). AGENCY DRAFT. October 9.
- King County Water and Land Resources Division (WLRD). 2020. Proposal for 2020 Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations; King County Closed Landfills (Cedar Falls, Enumclaw, Hobart and Vashon Island) and Cedar Hills Regional Landfill. February.

Thank you for the opportunity to provide hydrogeologic services to SWD. If you have any questions, please feel free to contact me at 206-477-4646 or [sevin.bilir@kingcounty.gov](mailto:sevin.bilir@kingcounty.gov).

Sincerely,



Sevin Bilir, WA LHG  
Environmental Scientist IV  
King County Water and Land Resources Division

Enclosures:

- Table A-1: Well Details and Groundwater Elevations – First Quarter 2020
- Table A-2: Groundwater Parameters – First Quarter 2020
- Figure A-1: Groundwater Potentiometric Surface Map – First Quarter 2020 – Cc2 Perched Zone
- Figure A-2: Groundwater Potentiometric Surface Map – First Quarter 2020 – Unit D Aquifer

**Table A-1: Well Details and Groundwater Elevations – First Quarter 2020**  
Vashon Island Closed Landfill  
King County, Washington

	Well Identification	Easting <sup>2</sup> (ft)	Northing <sup>2</sup> (ft)	Top of Casing Elevation (ft MSL)	Top of Screen Elevation (ft MSL)	Bottom of Screen Elevation (ft MSL)	January 27, 2020	
							Measured Depth to Water <sup>1</sup> (ft)	Groundwater Elevations (ft MSL)
Cc2 Perched Zone	MW-2	1227788.53	162365.91	317.97	237.06	232.06	74.27	243.70
	MW-9	1227723.68	163527.21	405.17	236.22	224.22	166.33	238.84
	MW-20	1228173.43	162566.52	370.32	241.41	236.41	122.32	248.00
	MW-21	1227647.90	162340.10	349.05	246.45	237.05	106.99	242.06
	MW-30	1227273.26	162671.10	235.67	230.40	225.40	5.11	230.56
	MW-33	1227883.53	162682.24	359.17	229.63	219.63	112.81	246.36
	MW-35	1227651.53	162559.82	361.34	244.20	234.20	118.81	242.53
Unit D Aquifer	MW-7	1228427.68	162811.30	376.75	154.40	144.40	191.61	185.14
	MW-12	1227800.99	162375.28	315.53	142.72	132.72	142.42	173.11
	MW-19	1227725.02	163535.12	405.43	143.14	131.64	245.80	159.63
	MW-25	1228628.13	163749.00	402.33	141.76	137.76	243.45	158.88
	MW-26	1227910.18	163770.66	406.54	153.55	144.15	247.50	159.04
	MW-28 <sup>3</sup>	1228116.11	163843.88	398.73	172.15	162.65	Dry	NA
	MW-29	1228375.59	163681.26	413.85	168.03	158.63	244.44	169.41
	MW-34	1227774.04	163135.04	385.96	147.94	137.94	204.41	181.55

**Notes:**

1. Water level measurements made by SWD personnel.
2. Reference datum for eastings and northings is the North American Datum of 1983 (NAD83/11).
3. MW-28 requires 2 foot rise in groundwater levels. MW-28 screen installed at contact between Unit D and unit below (Unit E). Historically reported as a dry well (Aspect 2018).

Elevations are reported in feet (ft) above mean sea level (MSL) based on the North American Vertical Datum of 1988 (NAVD88).

DRY Well indicated as dry, water detected below screen interval.

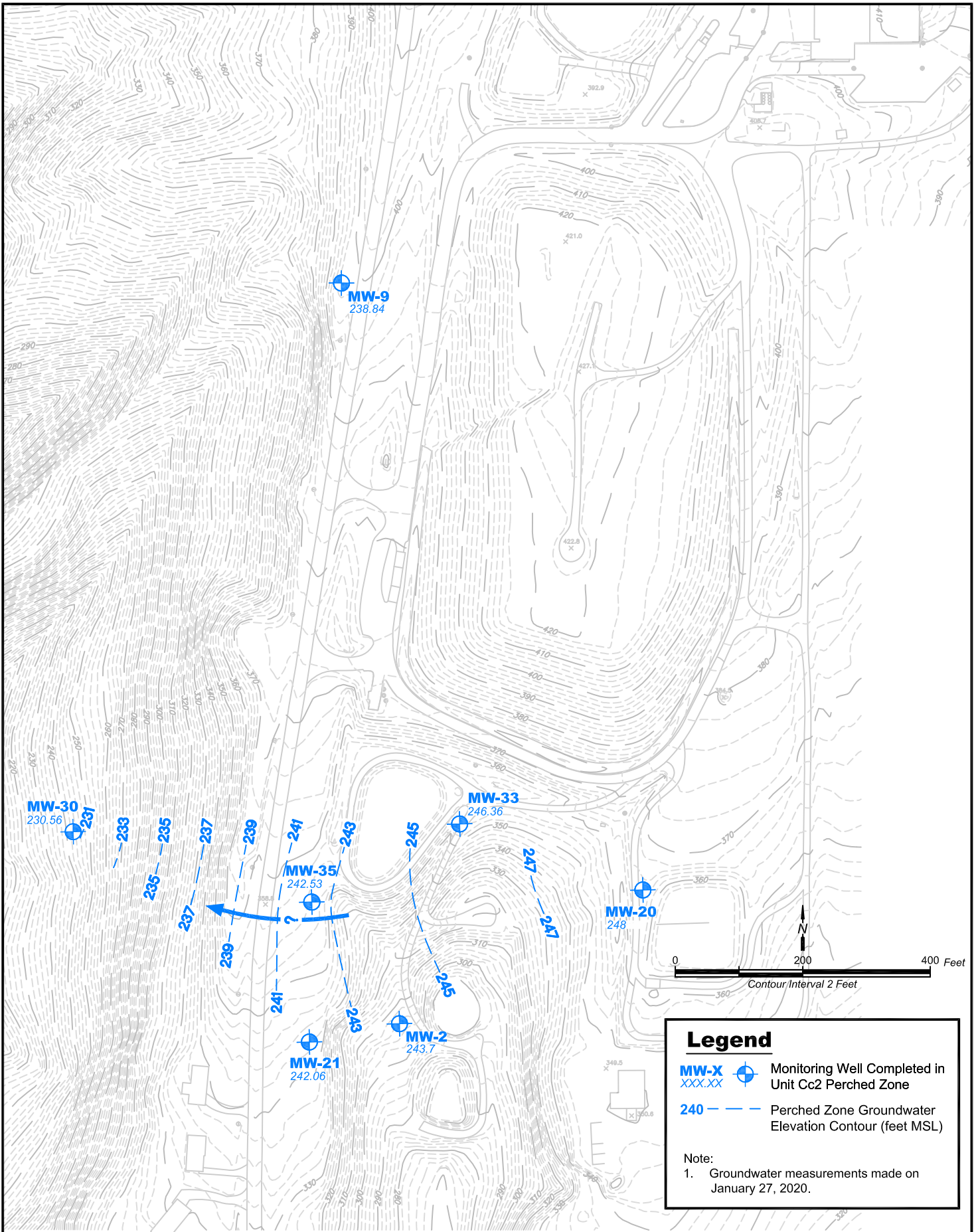
NA Not applicable

**Table A-2: Groundwater Parameters – First Quarter 2020**  
Vashon Island Closed Landfill  
King County, Washington

Water Bearing Zone	Horizontal Hydraulic Conductivity ( $K$ ) <sup>1,2</sup>			Horizontal Hydraulic Gradient (DH/DL) <sup>3</sup>	Effective Porosity ( $n_{eff}$ ) <sup>1</sup>	Horizontal Groundwater Velocity ( $v$ )	General Groundwater Flow Direction
	Range	(cm/s)	(ft/d)	(ft/ft)		(ft/d)	
Unit Cc2 - Property Wide <sup>4,6</sup>	Low	5.7E-04	1.61	0.006	20%	0.05	West-northwest
	High	1.6E-02	46.08	0.031		7.14	
	Average <sup>6</sup>	2.9E-03	8.21	0.019		0.76	
Unit Cc2 - South Slope Area <sup>5,6</sup>	Low	5.7E-04	1.61	0.006		0.05	West to West-southwest
	High	6.8E-03	19.35	0.018		1.74	
	Average <sup>6</sup>	2.1E-03	5.81	0.012		0.35	
Unit D - Northerly flow direction	Low	1.5E-03	4.4	0.030		0.64	North - with flow to the northeast and northwest
	High	1.6E-02	46.1			6.80	
	Average	3.6E-03	10.2			1.50	
Unit D - Southerly flow direction	Low	1.5E-03	4.4	0.016	0.35	Southwest - away from divide	
	High	1.6E-02	46.1		3.69		
	Average	3.6E-03	10.2		0.82		

**Notes:**

1. Horizontal hydraulic conductivity values and effective porosity values (Aspect 2018). However, average horizontal hydraulic conductivity values for Unit Cc2 are assumed incorrectly listed in the Aspect (2018) document table and assumed correctly commented on in the document table notes. The table above reflects the assumed correct values. See notes 4 and 6 below.
2. Average horizontal hydraulic conductivity values are the geometric mean of values reported per well and unit (Aspect 2018).
3. Horizontal hydraulic gradients based on average of gradients measured at several points from the maps shown on Figures A-1 and A-2.
4. Calculations for property wide Unit Cc2 horizontal hydraulic conductivities include data from wells MW-2, MW-9, MW-20, MW-21, MW-33, and MW-35. (Aspect 2018).
5. Calculations for South Slope Area Unit Cc2 horizontal hydraulic conductivities include data from wells MW-2, MW-20, MW-21, MW-33, and MW-35. (Aspect 2018).
6. Calculations of average hydraulic conductivities for Unit Cc2 did not include data obtained in 1986 from MW-2 as the value was significantly lower than a remeasurement completed in 2015 (Aspect 2018).



**Legend**

**MW-X** Monitoring Well Completed in Unit Cc2 Perched Zone

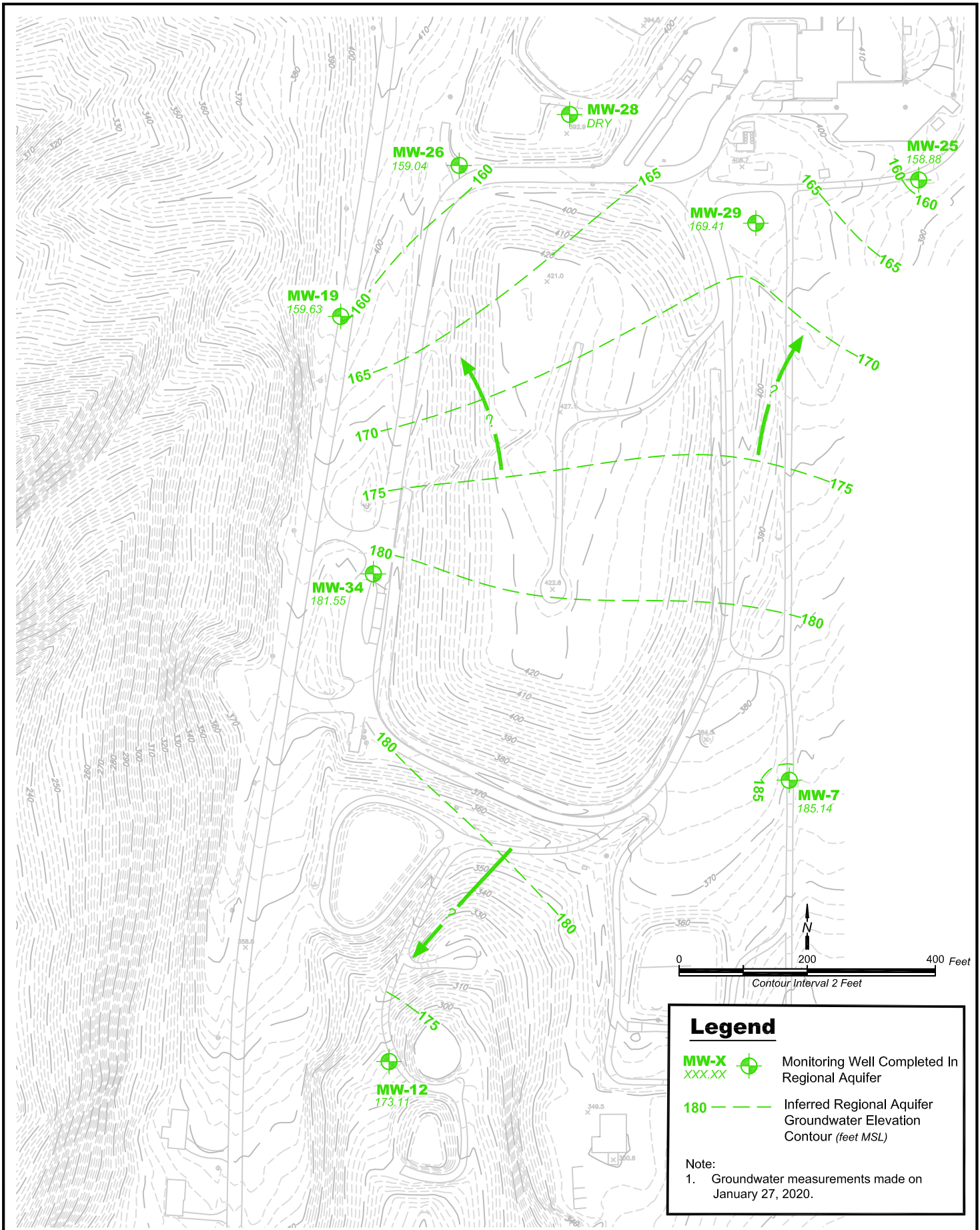
**240** - - - Perched Zone Groundwater Elevation Contour (feet MSL)

Note:  
1. Groundwater measurements made on January 27, 2020.





**Groundwater Potentiometric Surface Map**  
**First Quarter 2020 - Cc2 Perched Zone**  
 Vashon Island Closed Landfill  
 King County, Washington

DATE: April 2020	PROJECT NO. 1033601
DESIGNED BY: SB	FIGURE NO. <b>A-1</b>
DRAWN BY: KK	
REVISED BY: SB	



**Legend**

**MW-X**  Monitoring Well Completed In Regional Aquifer  
**XXX.XX**

**180**  Inferred Regional Aquifer Groundwater Elevation Contour (feet MSL)

Note:  
 1. Groundwater measurements made on January 27, 2020.



**Groundwater Potentiometric Surface Map**  
**First Quarter 2020 - Unit D Aquifer**  
 Vashon Island Closed Landfill  
 King County, Washington

DATE: April 2020	PROJECT NO. 1033601
DESIGNED BY: SB	FIGURE NO. <b>A-2</b>
DRAWN BY: KK	
REVISED BY: SB	



## King County

### Water and Land Resources Division

Department of Natural Resources and Parks  
King Street Center  
201 South Jackson Street, Suite 704  
Seattle, WA 98104-3855

**206-477-4800** Fax 206-296-0192  
TTY Relay: 711

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## TECHNICAL MEMORANDUM

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August 27, 2020

TO: Marisa Baptiste, Engineer III, Facility Engineering and Science Section, Solid Waste Division, Department of Natural Resources and Parks (DNRP)

FM: Sevin Bilir, Environmental Scientist IV, Science and Technical Support Section, Water and Land Resources Division, DNRP

RE: Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations  
Second Quarter 2020 Results  
Vashon Island Closed Landfill, King County, Washington  
Project No. 1033601 – Task 29.14.137.45

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The King County Water and Land Resources Division (WLRD) submits this memorandum report on groundwater conditions during the second quarter of 2020 for the middle channel deposit in the Cc2 perched zone and the Unit D aquifer beneath the Vashon Island Closed Landfill (Landfill), in accordance with the *Proposal for Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations* (WLRD, 2020). King County Solid Waste Division (SWD) personnel measured groundwater levels at the Landfill on May 15, 2020. These measurements were received by WLRD on July 1, 2020 and were used to:

1. Evaluate the potentiometric groundwater surface elevation for the Cc2 perched zone and the Unit D aquifer;
2. Determine the groundwater flow direction and horizontal gradient for the Cc2 perched zone and the Unit D aquifer; and
3. Calculate the groundwater velocity of the Cc2 perched zone and the Unit D aquifer.

There have been no significant changes in the interpreted groundwater conditions for the Cc2 perched zone and the Unit D aquifer since the report submitted for the first quarter of 2020.

## **Groundwater Elevation Data**

The SWD attempted groundwater level measurements at 14 monitoring wells during the second quarter of 2020. These wells are completed in the Cc2 perched zone and the Unit D aquifer, as referred to in *Remedial Investigation Report, Phase 1 – Vashon Island Closed Landfill, Volume 1* (Aspect 2018).

Table A-1 lists the groundwater monitoring well identifications, locations, construction details, measured depth to groundwater levels and calculated groundwater elevations for monitoring wells screened in the Cc2 perched zone and Unit D aquifer.

### **Cc2 Perched Zone**

Three separate coarse-grained perched zones are identified within variable fine-grained sediment in the Cc2 perched zone (Aspect 2018). The Cc2 channel deposit perched zone is not laterally extensive across the Landfill as was not identified in borings southeast and northwest of the landfill closure area (Aspect 2018). Groundwater in this perched zone is monitored by wells MW-2, MW-9, MW-20, MW-21, MW-30, MW-33, and MW-35 (Aspect 2018).

According to Aspect (2018), water levels in the Unit Cc2 perched zone generally indicate unconfined groundwater conditions, with the exception of monitoring wells MW-20 and MW-33. Groundwater elevations in these two wells are above coarse-grained layers indicating confined conditions (Aspect 2018). During this quarter, the water level in monitoring well MW-33 was measured at almost 17 feet above the top of the screen and may be influenced by confining conditions.

Figure A-1 shows calculated groundwater elevations at monitoring well locations and interpreted groundwater potentiometric surface contours for the Cc2 perched zone based on measurements taken on May 15, 2020.

### **Unit D Aquifer**

Groundwater in the Unit D aquifer is monitored by wells MW-7, MW-12, MW-19, MW 25, MW-26, MW-28, MW-29, and MW-34 (Aspect 2018). Measured water levels in monitoring wells MW-7, MW-12, MW-19, MW-25, and MW-34 were at least 16.5 feet above the top of the screen and may be influenced by vertical gradients, permeability differences (Aspect 2018), or confining conditions in the Unit D aquifer.

Monitoring well MW-28 was again reported as dry as the water level was noted below the screen bottom elevation. This well has historically been reported as “dry” for this reason. The screen for MW-28 was installed at the contact between Unit D and unit below (Unit E) and requires a two foot rise in surrounding groundwater levels to reach the screen bottom.



Figure A-2 shows calculated groundwater elevations at monitoring well locations and interpreted groundwater potentiometric surface contours for the Unit D aquifer based on measurements taken on May 15, 2020.

## **Direction of Groundwater Flow**

Interpreted groundwater flow directions in the Cc2 perched zone and Unit D aquifer, based on measurements taken on May 15, 2020, are shown in Figures A-1 and A-2. Table A-2 lists the flow direction for the Cc2 perched zone and Unit D aquifer beneath the Landfill based on measurements and mapping of groundwater elevation contours taken during the second quarter of 2020.

### **Cc2 Perched Zone**

Calculated groundwater elevations and interpreted groundwater potentiometric surface contours indicate that groundwater in the Cc2 perched zone generally flows towards the west-northwest property-wide with a west to west-southwest component in the south slope area (Figure A-1).

### **Unit D Aquifer**

As per Aspect (2018), groundwater flow direction in Unit D is strongly influenced by the typically higher water levels in MW-7 and MW-34 and this is seen in quarterly mapping of the potentiometric surface forming a groundwater divide running generally west-east beneath the southern area of the landfill footprint. Calculated groundwater elevations and interpreted groundwater potentiometric surface contours during the second quarter of 2020 indicate that groundwater in the Unit D aquifer flows generally southwesterly in the area south of the divide and northerly in the area north of the divide with components of flow to the northeast and northwest (Figure A-2). The groundwater gradient south of the divide is less steep than that north of the divide.

## **Groundwater Parameters**

Table A-2 presents a summary of the groundwater parameters. Hydraulic conductivity and effective porosity values are based on the ranges referred to in *Remedial Investigation Report, Phase 1 – Vashon Island Closed Landfill, Volume 1* (Aspect 2018). However, average horizontal hydraulic conductivity values for Unit Cc2 are assumed incorrectly listed in that document but assumed correctly commented on later in the notes of that document. Table A-2 reflects this correction (also noted in the accompanying notes) and presents a summary of the groundwater parameters used to calculate groundwater velocities from the second quarter 2020 data.

The average horizontal hydraulic conductivity for the Cc2 perched zone beneath the Landfill is reported to be 8.2 feet per day (ft/d) property wide and 5.8 ft/d in the south slope area (Aspect 2018). The average horizontal hydraulic conductivity in the Unit D aquifer beneath the landfill is reported to be 10.2 ft/d (Aspect 2018). The effective

porosity is reported as 20 percent for both the Cc2 perched zone and the Unit D aquifer (Aspect 2018).

Average hydraulic gradients for the Cc2 perched zone are approximately 0.020 ft/ft property wide and 0.012 ft/ft for the south slope area based on measurements made during the second quarter of 2020. The average hydraulic gradients for the Unit D aquifer, based on measurements made during the second quarter of 2020, are approximately 0.034 and 0.016 ft/ft in the northerly and southerly flow directions, respectively.

Average horizontal groundwater velocities calculated for the Cc2 perched zone and Unit D aquifer beneath the Landfill, are based on spatial differences in aquifer parameters, hydraulic gradients, and calculations using the following formula:

$$\text{where: } v = \frac{l}{n_{eff}} K \frac{\Delta H}{\Delta L}$$

$v$  = Groundwater velocity [L/t]

$n_{eff}$  = Effective porosity [dimensionless]

$K$  = Hydraulic conductivity [L/t]

$\frac{\Delta H}{\Delta L}$  = Hydraulic gradient [L/L]

The average horizontal groundwater velocities in the Cc2 perched zone are approximately 0.80 ft/d property wide and 0.35 ft/d in the south slope area. The average horizontal groundwater velocities in the Unit D aquifer are approximately 1.73 and 0.82 ft/d in the northerly and southerly direction, respectively.

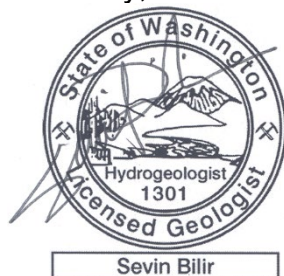
## References

Aspect Consulting, LLC. (Aspect). 2018. Remedial Investigation Report, Phase 1 – Vashon Island Closed Landfill, Volume 1 (Contract Number E00102E08; Task No. 310.3 – D310.3.2). AGENCY DRAFT. October 9.

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Environmental Scientist IV  
King County Water and Land Resources Division

Enclosures:

- Table A-1: Well Details and Groundwater Elevations – Second Quarter 2020
- Table A-2: Groundwater Parameters – Second Quarter 2020
- Figure A-1: Groundwater Potentiometric Surface Map – Second Quarter 2020 – Cc2 Perched Zone
- Figure A-2: Groundwater Potentiometric Surface Map – Second Quarter 2020 – Unit D Aquifer

**Table A-1: Well Details and Groundwater Elevations – Second Quarter 2020**  
Vashon Island Closed Landfill  
King County, Washington

	Well Identification	Easting <sup>2</sup> (ft)	Northing <sup>2</sup> (ft)	Top of Casing Elevation (ft MSL)	Top of Screen Elevation (ft MSL)	Bottom of Screen Elevation (ft MSL)	May 15, 2020	
							Measured Depth to Water <sup>1</sup> (ft)	Groundwater Elevations (ft MSL)
Cc2 Perched Zone	MW-2	1227788.53	162365.91	317.97	237.06	232.06	74.04	243.93
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	MW-29	1228375.59	163681.26	413.85	168.03	158.63	244.42	169.43
	MW-34	1227774.04	163135.04	385.96	147.94	137.94	204.24	181.72

**Notes:**

1. Water level measurements made by SWD personnel.
2. Reference datum for eastings and northings is the North American Datum of 1983 (NAD83/11).
3. MW-28 requires 2 foot rise in groundwater levels. MW-28 screen installed at contact between Unit D and unit below (Unit E). Historically reported as a dry well (Aspect 2018).

Elevations are reported in feet (ft) above mean sea level (MSL) based on the North American Vertical Datum of 1988 (NAVD88).

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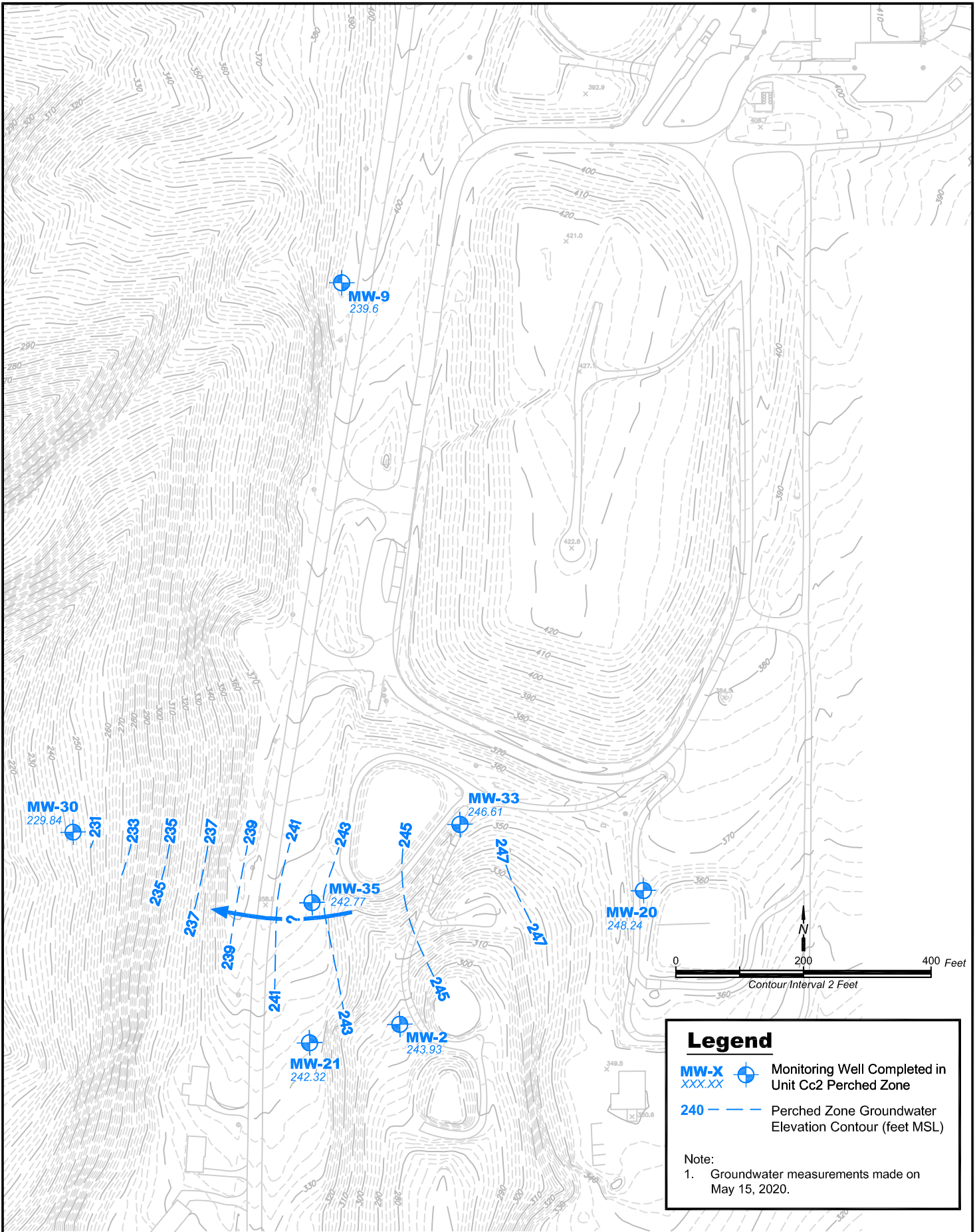
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**Table A-2: Groundwater Parameters – Second Quarter 2020**  
 Vashon Island Closed Landfill  
 King County, Washington

Water Bearing Zone	Horizontal Hydraulic Conductivity ( $K$ ) <sup>1,2</sup>			Horizontal Hydraulic Gradient (DH/DL) <sup>3</sup>	Effective Porosity ( $n_{eff}$ ) <sup>1</sup>	Horizontal Groundwater Velocity ( $v$ )	General Groundwater Flow Direction
	Range	(cm/s)	(ft/d)	(ft/ft)		(ft/d)	
Unit Cc2 - Property Wide <sup>4,6</sup>	Low	5.7E-04	1.61	0.006	20%	0.05	West-northwest
	High	1.6E-02	46.08	0.033		7.60	
	Average <sup>6</sup>	2.9E-03	8.21	0.020		0.80	
Unit Cc2 - South Slope Area <sup>5,6</sup>	Low	5.7E-04	1.61	0.006		0.05	West to West-southwest
	High	6.8E-03	19.35	0.018		1.74	
	Average <sup>6</sup>	2.1E-03	5.81	0.012		0.35	
Unit D - Northerly flow direction	Low	1.5E-03	4.4	0.034		0.74	North - with flow to the northeast and northwest
	High	1.6E-02	46.1			7.84	
	Average	3.6E-03	10.2			1.73	
Unit D - Southerly flow direction	Low	1.5E-03	4.4	0.016	0.35	Southwest - away from divide	
	High	1.6E-02	46.1		3.69		
	Average	3.6E-03	10.2		0.82		

**Notes:**

1. Horizontal hydraulic conductivity values and effective porosity values (Aspect 2018). However, average horizontal hydraulic conductivity values for Unit Cc2 are assumed incorrectly listed in the Aspect (2018) document table and assumed correctly commented on in the document table notes. The table above reflects the assumed correct values. See notes 4 and 6 below.
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5. Calculations for South Slope Area Unit Cc2 horizontal hydraulic conductivities include data from wells MW-2, MW-20, MW-21, MW-33, and MW-35. (Aspect 2018).
6. Calculations of average hydraulic conductivities for Unit Cc2 did not include data obtained in 1986 from MW-2 as the value was significantly lower than a remeasurement completed in 2015 (Aspect 2018).



**Legend**

**MW-X  
XXX.XX** Monitoring Well Completed in Unit Cc2 Perched Zone

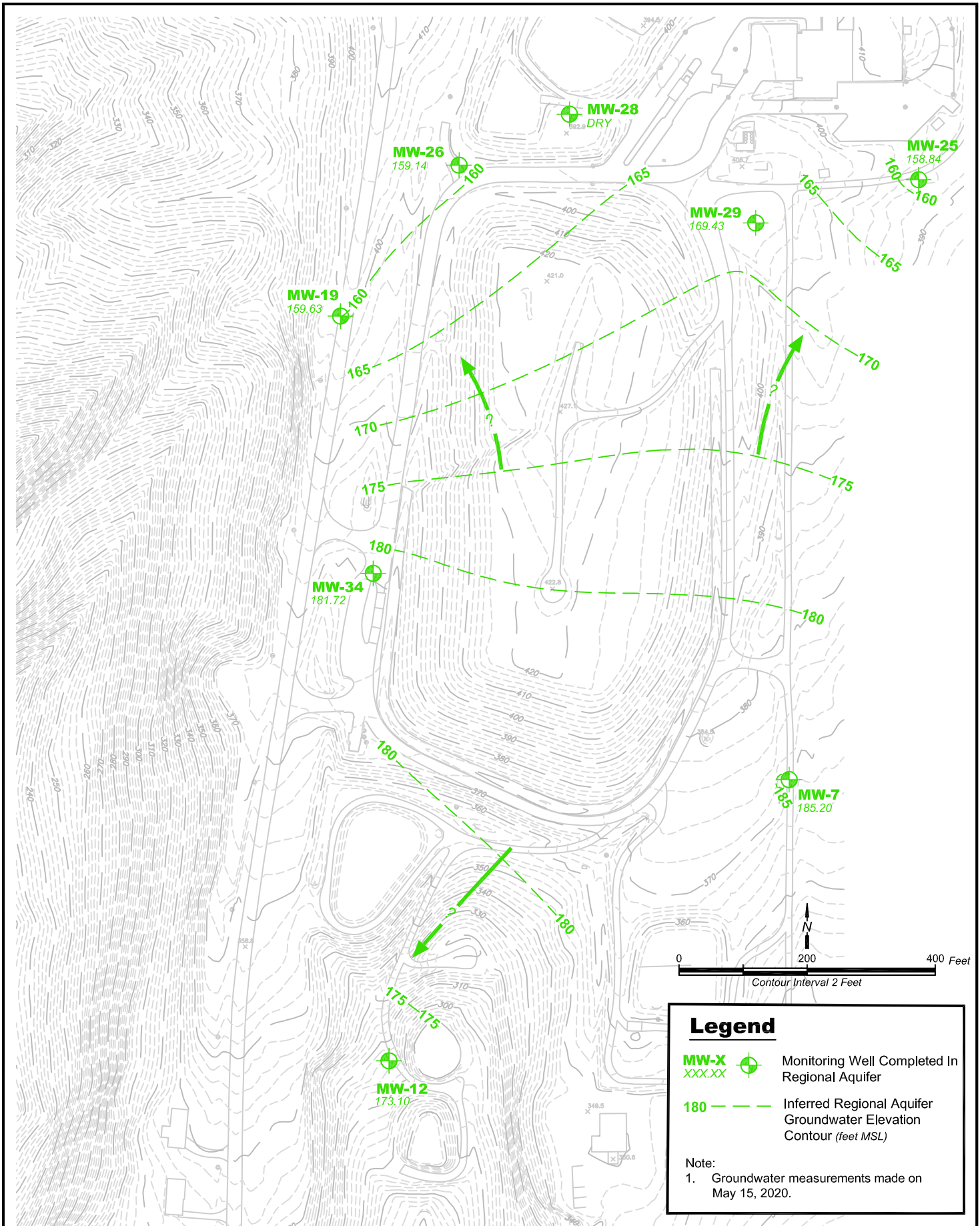
**240** Perched Zone Groundwater Elevation Contour (feet MSL)

Note:  
1. Groundwater measurements made on May 15, 2020.





**Groundwater Potentiometric Surface Map**  
**Second Quarter 2020 - Cc2 Perched Zone**  
 Vashon Island Closed Landfill  
 King County, Washington

DATE: August 2020	PROJECT NO. <b>1033601</b>
DESIGNED BY: SB	FIGURE NO. <b>A-1</b>
DRAWN BY: KK	
REVISED BY: SB	



**Legend**

**MW-X  
XXX.XX**  Monitoring Well Completed In Regional Aquifer

**180**  Inferred Regional Aquifer Groundwater Elevation Contour (feet MSL)

Note:  
1. Groundwater measurements made on May 15, 2020.



**Groundwater Potentiometric Surface Map**  
**Second Quarter 2020 - Unit D Aquifer**  
 Vashon Island Closed Landfill  
 King County, Washington

DATE: August 2020	PROJECT NO. <b>1033601</b>
DESIGNED BY: SB	FIGURE NO. <b>A-2</b>
DRAWN BY: KK	
REVISED BY: SB	



## King County

### Water and Land Resources Division

Department of Natural Resources and Parks  
King Street Center  
201 South Jackson Street, Suite 704  
Seattle, WA 98104-3855

**206-477-4800** Fax 206-296-0192  
TTY Relay: 711

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## TECHNICAL MEMORANDUM

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October 30, 2020

TO: Marisa Baptiste, Engineer III, Facility Engineering and Science Section, Solid Waste Division, Department of Natural Resources and Parks (DNRP)

FM: Sevin Bilir, Environmental Scientist IV, Science and Technical Support Section, Water and Land Resources Division, DNRP

RE: Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations Third Quarter 2020 Results  
Vashon Island Closed Landfill, King County, Washington  
Project No. 1033601 – Task 29.14.137.45

---

The King County Water and Land Resources Division (WLRD) submits this memorandum report on groundwater conditions during the third quarter of 2020 for the middle channel deposit in the Cc2 perched zone and the Unit D aquifer beneath the Vashon Island Closed Landfill (Landfill), in accordance with the *Proposal for Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations* (WLRD, 2020). King County Solid Waste Division (SWD) personnel measured groundwater levels at the Landfill on July 30, 2020. These measurements were received by WLRD on October 1, 2020 and were used to:

1. Evaluate the potentiometric groundwater surface elevation for the Cc2 perched zone and the Unit D aquifer;
2. Determine the groundwater flow direction and horizontal gradient for the Cc2 perched zone and the Unit D aquifer; and
3. Calculate the groundwater velocity of the Cc2 perched zone and the Unit D aquifer.

There have been no significant changes in the interpreted groundwater conditions for the Cc2 perched zone and the Unit D aquifer since the report submitted for the second quarter of 2020.



## **Groundwater Elevation Data**

The SWD attempted groundwater level measurements at 15 monitoring wells during the third quarter of 2020. These wells are completed in the Cc2 perched zone and the Unit D aquifer, as referred to in *Remedial Investigation Report, Phase 1 – Vashon Island Closed Landfill, Volume 1* (Aspect 2018).

Table A-1 lists the groundwater monitoring well identifications, locations, construction details, measured depth to groundwater levels and calculated groundwater elevations for monitoring wells screened in the Cc2 perched zone and Unit D aquifer.

### **Cc2 Perched Zone**

Three separate coarse-grained perched zones are identified within variable fine-grained sediment in the Cc2 perched zone (Aspect 2018). The Cc2 channel deposit perched zone is not laterally extensive across the Landfill as was not identified in borings southeast and northwest of the landfill closure area (Aspect 2018). Groundwater in this perched zone is monitored by wells MW-2, MW-9, MW-20, MW-21, MW-30, MW-33, and MW-35 (Aspect 2018).

According to Aspect (2018), water levels in the Unit Cc2 perched zone generally indicate unconfined groundwater conditions, with the exception of monitoring wells MW-20 and MW-33. Groundwater elevations in these two wells are above coarse-grained layers indicating confined conditions (Aspect 2018). During this quarter, the water level in monitoring well MW-33 was measured at almost 17 feet above the top of the screen and may be influenced by confining conditions.

Figure A-1 shows calculated groundwater elevations at monitoring well locations and interpreted groundwater potentiometric surface contours for the Cc2 perched zone based on measurements taken on July 30, 2020.

### **Unit D Aquifer**

Groundwater in the Unit D aquifer is monitored by wells MW-7, MW-12, MW-19, MW 25, MW-26, MW-28, MW-29, and MW-34 (Aspect 2018). Measured water levels in monitoring wells MW-7, MW-12, MW-19, MW-25, and MW-34 were at least 16.3 feet above the top of the screen and may be influenced by vertical gradients, permeability differences (Aspect 2018), or confining conditions in the Unit D aquifer.

Monitoring well MW-28 was again reported as dry as the water level was noted below the screen bottom elevation. This well has historically been reported as “dry” for this reason. The screen for MW-28 was installed at the contact between Unit D and unit below (Unit E) and requires a two foot rise in surrounding groundwater levels to reach the screen bottom.

Figure A-2 shows calculated groundwater elevations at monitoring well locations and interpreted groundwater potentiometric surface contours for the Unit D aquifer based on measurements taken on July 30, 2020.

## **Direction of Groundwater Flow**

Interpreted groundwater flow directions in the Cc2 perched zone and Unit D aquifer, based on measurements taken on July 30, 2020, are shown in Figures A-1 and A-2. Table A-2 lists the flow direction for the Cc2 perched zone and Unit D aquifer beneath the Landfill based on measurements and mapping of groundwater elevation contours taken during the third quarter of 2020.

### **Cc2 Perched Zone**

Calculated groundwater elevations and interpreted groundwater potentiometric surface contours indicate that groundwater in the Cc2 perched zone generally flows towards the west-northwest property-wide with a west to west-southwest component in the south slope area (Figure A-1).

### **Unit D Aquifer**

As per Aspect (2018), groundwater flow direction in Unit D is strongly influenced by the typically higher water levels in MW-7 and MW-34 and this is seen in quarterly mapping of the potentiometric surface forming a groundwater divide running generally west-east beneath the southern area of the landfill footprint. Calculated groundwater elevations and interpreted groundwater potentiometric surface contours during the third quarter of 2020 indicate that groundwater in the Unit D aquifer flows generally southwesterly in the area south of the divide and northerly in the area north of the divide with components of flow to the northeast and northwest (Figure A-2). The groundwater gradient south of the divide is less steep than that north of the divide.

## **Groundwater Parameters**

Table A-2 presents a summary of the groundwater parameters. Hydraulic conductivity and effective porosity values are based on the ranges referred to in *Remedial Investigation Report, Phase 1 – Vashon Island Closed Landfill, Volume 1* (Aspect 2018). However, average horizontal hydraulic conductivity values for Unit Cc2 are assumed incorrectly listed in that document but assumed correctly commented on later in the notes of that document. Table A-2 reflects this correction (also noted in the accompanying notes) and presents a summary of the groundwater parameters used to calculate groundwater velocities from the third quarter 2020 data.

The average horizontal hydraulic conductivity for the Cc2 perched zone beneath the Landfill is reported to be 8.2 feet per day (ft/d) property wide and 5.8 ft/d in the south slope area (Aspect 2018). The average horizontal hydraulic conductivity in the Unit D aquifer beneath the landfill is reported to be 10.2 ft/d (Aspect 2018). The effective

porosity is reported as 20 percent for both the Cc2 perched zone and the Unit D aquifer (Aspect 2018).

Average hydraulic gradients for the Cc2 perched zone are approximately 0.020 ft/ft property wide and 0.014 ft/ft for the south slope area based on measurements made during the third quarter of 2020. The average hydraulic gradients for the Unit D aquifer, based on measurements made during the third quarter of 2020, are approximately 0.033 and 0.015 ft/ft in the northerly and southerly flow directions, respectively.

Average horizontal groundwater velocities calculated for the Cc2 perched zone and Unit D aquifer beneath the Landfill, are based on spatial differences in aquifer parameters, hydraulic gradients, and calculations using the following formula:

$$\text{where: } v = \frac{I}{n_{eff}} K \frac{\Delta H}{\Delta L}$$

$v$  = Groundwater velocity [L/t]  
 $n_{eff}$  = Effective porosity [dimensionless]  
 $K$  = Hydraulic conductivity [L/t]  
 $\frac{\Delta H}{\Delta L}$  = Hydraulic gradient [L/L]

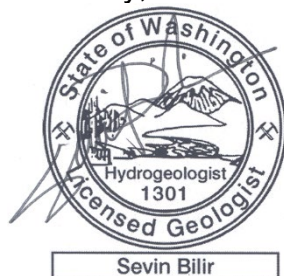
The average horizontal groundwater velocities in the Cc2 perched zone are approximately 0.82 ft/d property wide and 0.39 ft/d in the south slope area. The average horizontal groundwater velocities in the Unit D aquifer are approximately 1.68 and 0.76 ft/d in the northerly and southerly direction, respectively.

## References

- Aspect Consulting, LLC. (Aspect). 2018. Remedial Investigation Report, Phase 1 – Vashon Island Closed Landfill, Volume 1 (Contract Number E00102E08; Task No. 310.3 – D310.3.2). AGENCY DRAFT. October 9.
- King County Water and Land Resources Division (WLRD). 2020. Proposal for 2020 Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations; King County Closed Landfills (Cedar Falls, Enumclaw, Hobart and Vashon Island) and Cedar Hills Regional Landfill. February.

Thank you for the opportunity to provide hydrogeologic services to SWD. If you have any questions, please feel free to contact me at 206-477-4646 or [sevin.bilir@kingcounty.gov](mailto:sevin.bilir@kingcounty.gov).

Sincerely,



Sevin Bilir, WA LHG  
Environmental Scientist IV  
King County Water and Land Resources Division

Enclosures:

- Table A-1: Well Details and Groundwater Elevations – Third Quarter 2020
- Table A-2: Groundwater Parameters – Third Quarter 2020
- Figure A-1: Groundwater Potentiometric Surface Map – Third Quarter 2020 – Cc2 Perched Zone
- Figure A-2: Groundwater Potentiometric Surface Map – Third Quarter 2020 – Unit D Aquifer

**Table A-1: Well Details and Groundwater Elevations – Third Quarter 2020**  
Vashon Island Closed Landfill  
King County, Washington

	Well Identification	Easting <sup>2</sup> (ft)	Northing <sup>2</sup> (ft)	Top of Casing Elevation (ft MSL)	Top of Screen Elevation (ft MSL)	Bottom of Screen Elevation (ft MSL)	July 30, 2020	
							Measured Depth to Water <sup>1</sup> (ft)	Groundwater Elevations (ft MSL)
Cc2 Perched Zone	MW-2	1227788.53	162365.91	317.97	237.06	232.06	74.20	243.77
	MW-9	1227723.68	163527.21	405.17	236.22	224.22	165.94	239.23
	MW-20	1228173.43	162566.52	370.32	241.41	236.41	122.30	248.02
	MW-21	1227647.90	162340.10	349.05	246.45	237.05	106.87	242.18
	MW-30	1227273.26	162671.10	235.67	230.40	225.40	6.09	229.58
	MW-33	1227883.53	162682.24	359.17	229.63	219.63	112.72	246.45
	MW-35	1227651.53	162559.82	361.34	244.20	234.20	118.73	242.61
Unit D Aquifer	MW-7	1228427.68	162811.30	376.75	154.40	144.40	191.62	185.13
	MW-12	1227800.99	162375.28	315.53	142.72	132.72	142.41	173.12
	MW-19	1227725.02	163535.12	405.43	143.14	131.64	245.98	159.45
	MW-25	1228628.13	163749.00	402.33	141.76	137.76	243.69	158.64
	MW-26	1227910.18	163770.66	406.54	153.55	144.15	247.59	158.95
	MW-28 <sup>3</sup>	1228116.11	163843.88	398.73	172.15	162.65	DRY	NA
	MW-29 <sup>4</sup>	1228375.59	163681.26	413.85	172.83 <sup>4</sup>	158.63 <sup>4</sup>	244.51	169.34
	MW-34	1227774.04	163135.04	385.96	147.94	137.94	204.60	181.36

**Notes:**

1. Water level measurements made by SWD personnel.
2. Reference datum for eastings and northings is the North American Datum of 1983 (NAD83/11).
3. MW-28 requires 2 foot rise in groundwater levels. MW-28 screen installed at contact between Unit D and unit below (Unit E). Historically reported as a dry well (Aspect 2018).
4. MW-29 top and bottom of screen elevations were reported differently in Table A-1 of previous reports. This did not impact outcomes for generated groundwater maps and data reported in Table A-2 of related reports.

Elevations are reported in feet (ft) above mean sea level (MSL) based on the North American Vertical Datum of 1988 (NAVD88).

DRY Well indicated as dry, water detected below screen interval.

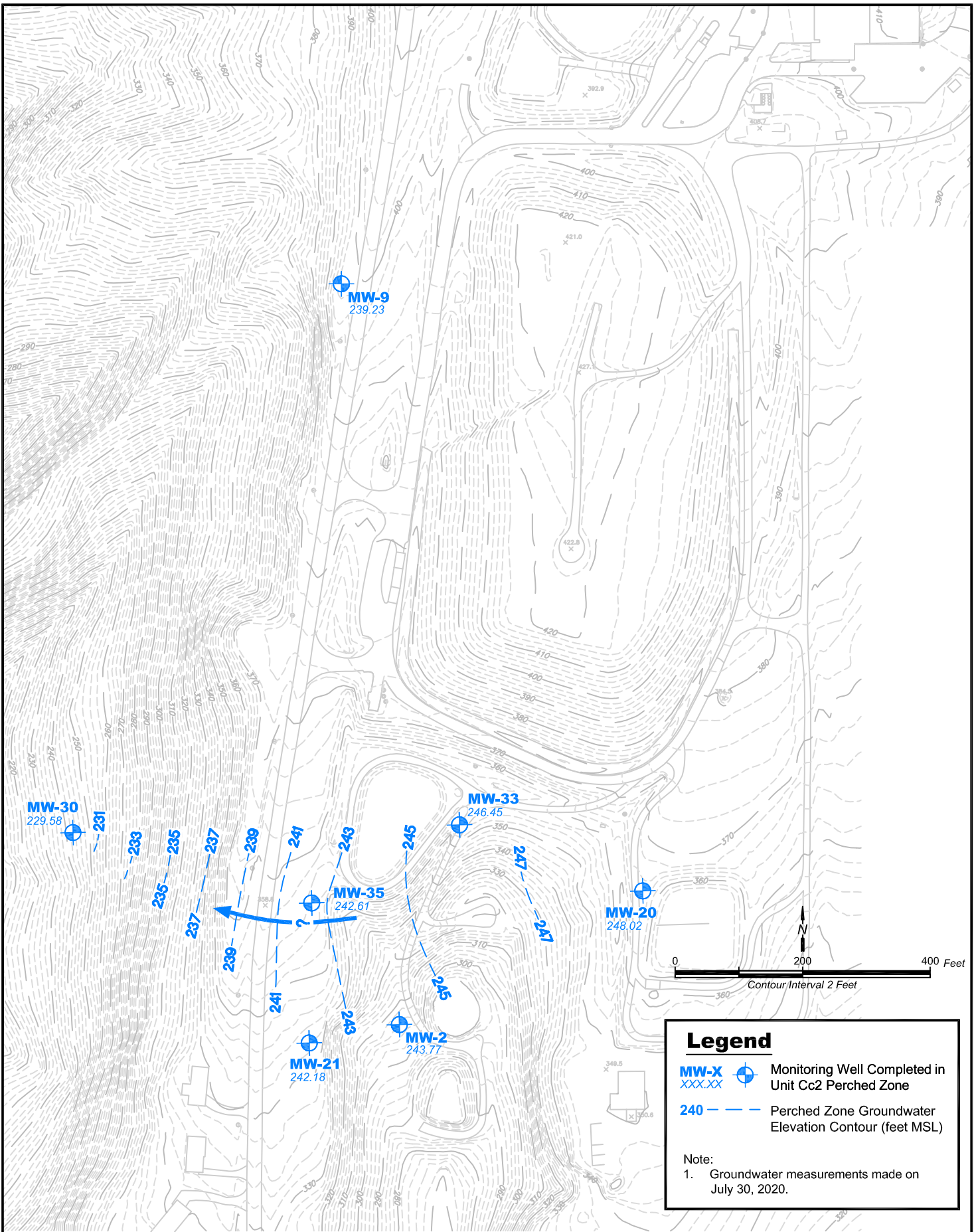
NA Not applicable

**Table A-2: Groundwater Parameters – Third Quarter 2020**  
Vashon Island Closed Landfill  
King County, Washington

Water Bearing Zone	Horizontal Hydraulic Conductivity ( $K$ ) <sup>1,2</sup>			Horizontal Hydraulic Gradient (DH/DL) <sup>3</sup>	Effective Porosity ( $n_{eff}$ ) <sup>1</sup>	Horizontal Groundwater Velocity ( $v$ )	General Groundwater Flow Direction
	Range	(cm/s)	(ft/d)	(ft/ft)		(ft/d)	
Unit Cc2 - Property Wide <sup>4,6</sup>	Low	5.7E-04	1.61	0.007	20%	0.06	West-northwest
	High	1.6E-02	46.08	0.033		7.60	
	Average <sup>6</sup>	2.9E-03	8.21	0.020		0.82	
Unit Cc2 - South Slope Area <sup>5,6</sup>	Low	5.7E-04	1.61	0.006		0.05	West to West-southwest
	High	6.8E-03	19.35	0.021		2.03	
	Average <sup>6</sup>	2.1E-03	5.81	0.014		0.39	
Unit D - Northerly flow direction	Low	1.5E-03	4.4	0.033		0.72	North - with flow to the northeast and northwest
	High	1.6E-02	46.1			7.60	
	Average	3.6E-03	10.2			1.68	
Unit D - Southerly flow direction	Low	1.5E-03	4.4	0.015	0.33	Southwest - away from divide	
	High	1.6E-02	46.1		3.46		
	Average	3.6E-03	10.2		0.76		

**Notes:**

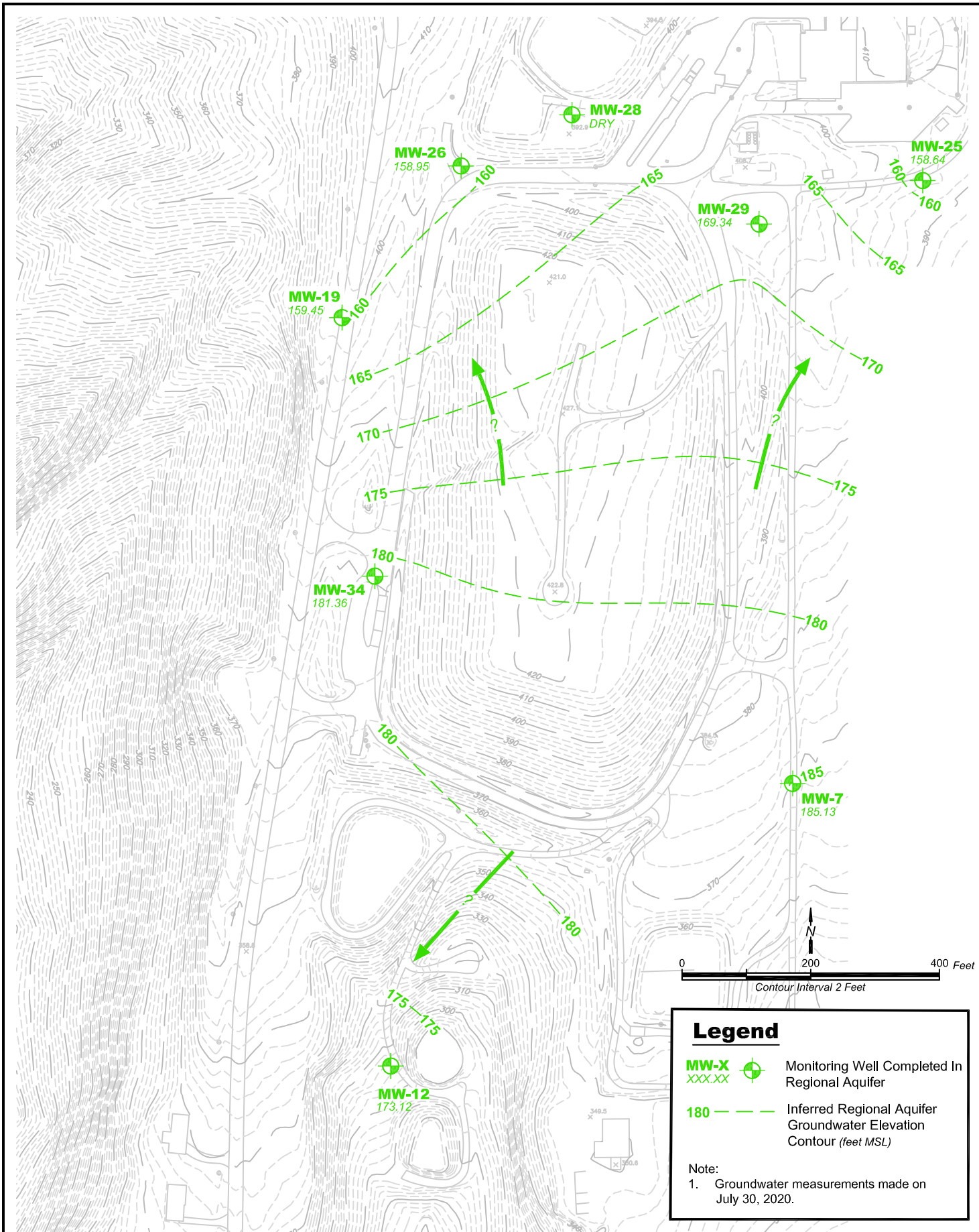
1. Horizontal hydraulic conductivity values and effective porosity values (Aspect 2018). However, average horizontal hydraulic conductivity values for Unit Cc2 are assumed incorrectly listed in the Aspect (2018) document table and assumed correctly commented on in the document table notes. The table above reflects the assumed correct values. See notes 4 and 6 below.
2. Average horizontal hydraulic conductivity values are the geometric mean of values reported per well and unit (Aspect 2018).
3. Horizontal hydraulic gradients based on average of gradients measured at several points from the maps shown on Figures A-1 and A-2.
4. Calculations for property wide Unit Cc2 horizontal hydraulic conductivities include data from wells MW-2, MW-9, MW-20, MW-21, MW-33, and MW-35. (Aspect 2018).
5. Calculations for South Slope Area Unit Cc2 horizontal hydraulic conductivities include data from wells MW-2, MW-20, MW-21, MW-33, and MW-35. (Aspect 2018).
6. Calculations of average hydraulic conductivities for Unit Cc2 did not include data obtained in 1986 from MW-2 as the value was significantly lower than a remeasurement completed in 2015 (Aspect 2018).



**Groundwater Potentiometric Surface Map**  
**Third Quarter 2020 - Cc2 Perched Zone**  
 Vashon Island Closed Landfill  
 King County, Washington

DATE:	October 2020
DESIGNED BY:	SB
DRAWN BY:	KK
REVISED BY:	SB

PROJECT NO.	1033601
FIGURE NO.	<b>A-1</b>



King County

## Groundwater Potentiometric Surface Map Third Quarter 2020 - Unit D Aquifer

Vashon Island Closed Landfill  
King County, Washington

DATE:	October 2020
DESIGNED BY:	SB
DRAWN BY:	KK
REVISED BY:	SB

PROJECT NO.

1033601

FIGURE NO.

**A-2**





## King County

### Water and Land Resources Division

Department of Natural Resources and Parks  
King Street Center  
201 South Jackson Street, Suite 5600  
Seattle, WA 98104-3855

**206-477-4800** Fax 206-296-0192  
TTY Relay: 711

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## TECHNICAL MEMORANDUM

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March 3, 2021

TO: Marisa Baptiste, Engineer III, Facility Engineering and Science Section, Solid Waste Division, Department of Natural Resources and Parks (DNRP)

FM: Sevin Bilir, Environmental Scientist IV, Science and Technical Support Section, Water and Land Resources Division, DNRP

RE: Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations Fourth Quarter 2020 Results  
Vashon Island Closed Landfill, King County, Washington  
Project No. 1033601 – Task 29.14.137.45

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The King County Water and Land Resources Division (WLRD) submits this memorandum report on groundwater conditions during the fourth quarter of 2020 for the middle channel deposit in the Cc2 perched zone and the Unit D aquifer beneath the Vashon Island Closed Landfill (Landfill), in accordance with the *Proposal for Potentiometric Groundwater Surface Maps & Groundwater Velocity Calculations* (WLRD, 2020). King County Solid Waste Division (SWD) personnel measured groundwater levels at the Landfill on October 13, 2020. These measurements were received by WLRD on December 30, 2020 and were used to:

1. Evaluate the potentiometric groundwater surface elevation for the Cc2 perched zone and the Unit D aquifer;
2. Determine the groundwater flow direction and horizontal gradient for the Cc2 perched zone and the Unit D aquifer; and
3. Calculate the groundwater velocity of the Cc2 perched zone and the Unit D aquifer.

There have been no significant changes in the interpreted groundwater conditions for the Cc2 perched zone and the Unit D aquifer since the report submitted for the third quarter of 2020.

## **Groundwater Elevation Data**

The SWD attempted groundwater level measurements at 15 monitoring wells during the fourth quarter of 2020. These wells are completed in the Cc2 perched zone and the Unit D aquifer, as referred to in *Remedial Investigation Report, Phase 1 – Vashon Island Closed Landfill, Volume 1* (Aspect 2018).

Table A-1 lists the groundwater monitoring well identifications, locations, construction details, measured depth to groundwater levels and calculated groundwater elevations for monitoring wells screened in the Cc2 perched zone and Unit D aquifer.

### **Cc2 Perched Zone**

Three separate coarse-grained perched zones are identified within variable fine-grained sediment in the Cc2 perched zone (Aspect 2018). The Cc2 channel deposit perched zone is not laterally extensive across the Landfill as was not identified in borings southeast and northwest of the landfill closure area (Aspect 2018). Groundwater in this perched zone is monitored by wells MW-2, MW-9, MW-20, MW-21, MW-30, MW-33, and MW-35 (Aspect 2018).

According to Aspect (2018), water levels in the Unit Cc2 perched zone generally indicate unconfined groundwater conditions, with the exception of monitoring wells MW-20 and MW-33. Groundwater elevations in these two wells are above coarse-grained layers indicating confined conditions (Aspect 2018). During this quarter, the water level in monitoring well MW-33 was measured at almost 17 feet above the top of the screen and may be influenced by confining conditions.

Figure A-1 shows calculated groundwater elevations at monitoring well locations and interpreted groundwater potentiometric surface contours for the Cc2 perched zone based on measurements taken on October 13, 2020.

### **Unit D Aquifer**

Groundwater in the Unit D aquifer is monitored by wells MW-7, MW-12, MW-19, MW-25, MW-26, MW-28, MW-29, and MW-34 (Aspect 2018). Measured water levels in monitoring wells MW-7, MW-12, MW-19, MW-25, and MW-34 were at least 16.6 feet above the top of the screen and may be influenced by vertical gradients, permeability differences (Aspect 2018), or confining conditions in the Unit D aquifer.

Monitoring well MW-28 was again reported as dry as the water level was noted below the screen bottom elevation. This well has historically been reported as “dry” for this reason. The screen for MW-28 was installed at the contact between Unit D and unit below (Unit E) and requires a two foot rise in surrounding groundwater levels to reach the screen bottom.

Figure A-2 shows calculated groundwater elevations at monitoring well locations and interpreted groundwater potentiometric surface contours for the Unit D aquifer based on measurements taken on October 13, 2020.

## **Direction of Groundwater Flow**

Interpreted groundwater flow directions in the Cc2 perched zone and Unit D aquifer, based on measurements taken on October 13, 2020, are shown in Figures A-1 and A-2. Table A-2 lists the flow direction for the Cc2 perched zone and Unit D aquifer beneath the Landfill based on measurements and mapping of groundwater elevation contours taken during the fourth quarter of 2020.

### **Cc2 Perched Zone**

Calculated groundwater elevations and interpreted groundwater potentiometric surface contours indicate that groundwater in the Cc2 perched zone generally flows towards the west-northwest property-wide with a west to west-southwest component in the south slope area (Figure A-1).

### **Unit D Aquifer**

As per Aspect (2018), groundwater flow direction in Unit D is strongly influenced by the typically higher water levels in MW-7 and MW-34 and this is seen in quarterly mapping of the potentiometric surface forming a groundwater divide running generally west-east beneath the southern area of the landfill footprint. Calculated groundwater elevations and interpreted groundwater potentiometric surface contours during the fourth quarter of 2020 indicate that groundwater in the Unit D aquifer flows generally southwesterly in the area south of the divide and northerly in the area north of the divide with components of flow to the northeast and northwest (Figure A-2). The groundwater gradient south of the divide is less steep than that north of the divide.

## **Groundwater Parameters**

Table A-2 presents a summary of the groundwater parameters. Hydraulic conductivity and effective porosity values are based on the ranges referred to in *Remedial Investigation Report, Phase 1 – Vashon Island Closed Landfill, Volume 1* (Aspect 2018). However, average horizontal hydraulic conductivity values for Unit Cc2 are assumed incorrectly listed in that document but assumed correctly commented on later in the notes of that document. Table A-2 reflects this correction (also noted in the accompanying notes) and presents a summary of the groundwater parameters used to calculate groundwater velocities from the fourth quarter 2020 data.

The average horizontal hydraulic conductivity for the Cc2 perched zone beneath the Landfill is reported to be 8.2 feet per day (ft/d) property wide and 5.8 ft/d in the south slope area (Aspect 2018). The average horizontal hydraulic conductivity in the Unit D aquifer beneath the landfill is reported to be 10.2 ft/d (Aspect 2018). The effective

porosity is reported as 20 percent for both the Cc2 perched zone and the Unit D aquifer (Aspect 2018).

Average hydraulic gradients for the Cc2 perched zone are approximately 0.020 ft/ft property wide and 0.013 ft/ft for the south slope area based on measurements made during the fourth quarter of 2020. The average hydraulic gradients for the Unit D aquifer, based on measurements made during the fourth quarter of 2020, are approximately 0.035 and 0.015 ft/ft in the northerly and southerly flow directions, respectively.

Average horizontal groundwater velocities calculated for the Cc2 perched zone and Unit D aquifer beneath the Landfill, are based on spatial differences in aquifer parameters, hydraulic gradients, and calculations using the following formula:

$$\text{where: } v = \frac{I}{n_{eff}} K \frac{\Delta H}{\Delta L}$$

$v$  = Groundwater velocity [L/t]  
 $n_{eff}$  = Effective porosity [dimensionless]  
 $K$  = Hydraulic conductivity [L/t]  
 $\frac{\Delta H}{\Delta L}$  = Hydraulic gradient [L/L]

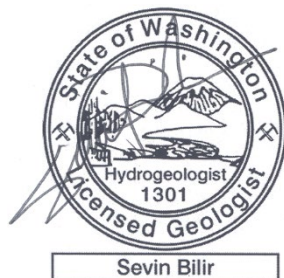
The average horizontal groundwater velocities in the Cc2 perched zone are approximately 0.82 ft/d property wide and 0.36 ft/d in the south slope area. The average horizontal groundwater velocities in the Unit D aquifer are approximately 1.76 and 0.75 ft/d in the northerly and southerly direction, respectively.

## References

- Aspect Consulting, LLC. (Aspect). 2018. Remedial Investigation Report, Phase 1 – Vashon Island Closed Landfill, Volume 1 (Contract Number E00102E08; Task No. 310.3 – D310.3.2). AGENCY DRAFT. October 9.
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Thank you for the opportunity to provide hydrogeologic services to SWD. If you have any questions, please feel free to contact me at 206-477-4646 or [sevin.bilir@kingcounty.gov](mailto:sevin.bilir@kingcounty.gov).

Sincerely,



Sevin Bilir, WA LHG  
Environmental Scientist IV  
King County Water and Land Resources Division

Enclosures:

- Table A-1: Well Details and Groundwater Elevations – Fourth Quarter 2020
- Table A-2: Groundwater Parameters – Fourth Quarter 2020
- Figure A-1: Groundwater Potentiometric Surface Map – Fourth Quarter 2020 – Cc2 Perched Zone
- Figure A-2: Groundwater Potentiometric Surface Map – Fourth Quarter 2020 – Unit D Aquifer

**Table A-1: Well Details and Groundwater Elevations – Fourth Quarter 2020**  
Vashon Island Closed Landfill  
King County, Washington

							October 13, 2020	
	Well Identification	Easting <sup>2</sup> (ft)	Northing <sup>2</sup> (ft)	Top of Casing Elevation (ft MSL)	Top of Screen Elevation (ft MSL)	Bottom of Screen Elevation (ft MSL)	Measured Depth to Water <sup>1</sup> (ft)	Groundwater Elevations (ft MSL)
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	MW-21	1227647.90	162340.10	349.05	246.45	237.05	106.90	242.15
	MW-30	1227273.26	162671.10	235.67	230.40	225.40	5.64	230.03
	MW-33	1227883.53	162682.24	359.17	229.63	219.63	112.71	246.46
	MW-35	1227651.53	162559.82	361.34	244.20	234.20	118.68	242.66
Unit D Aquifer	MW-7	1228427.68	162811.30	376.75	154.40	144.40	191.81	184.94
	MW-12	1227800.99	162375.28	315.53	142.72	132.72	142.43	173.10
	MW-19	1227725.02	163535.12	405.43	143.14	131.64	245.67	159.76
	MW-25	1228628.13	163749.00	402.33	141.76	137.76	243.40	158.93
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	MW-28 <sup>3</sup>	1228116.11	163843.88	398.73	172.15	162.65	DRY	NA
	MW-29 <sup>4</sup>	1228375.59	163681.26	413.85	172.83	158.63	244.30	169.55
	MW-34	1227774.04	163135.04	385.96	147.94	137.94	204.50	181.46

**Notes:**

1. Water level measurements made by SWD personnel.
2. Reference datum for eastings and northings is the North American Datum of 1983 (NAD83/11).
3. MW-28 requires 2 foot rise in groundwater levels. MW-28 screen installed at contact between Unit D and unit below (Unit E). Historically reported as a dry well (Aspect 2018).
4. MW-29 top and bottom of screen elevations were reported differently in Table A-1 of previous reports. This did not impact outcomes for generated groundwater maps and data reported in Table A-2 of related reports.

Elevations are reported in feet (ft) above mean sea level (MSL) based on the North American Vertical Datum of 1988 (NAVD88).

DRY Well indicated as dry, water detected below screen interval.

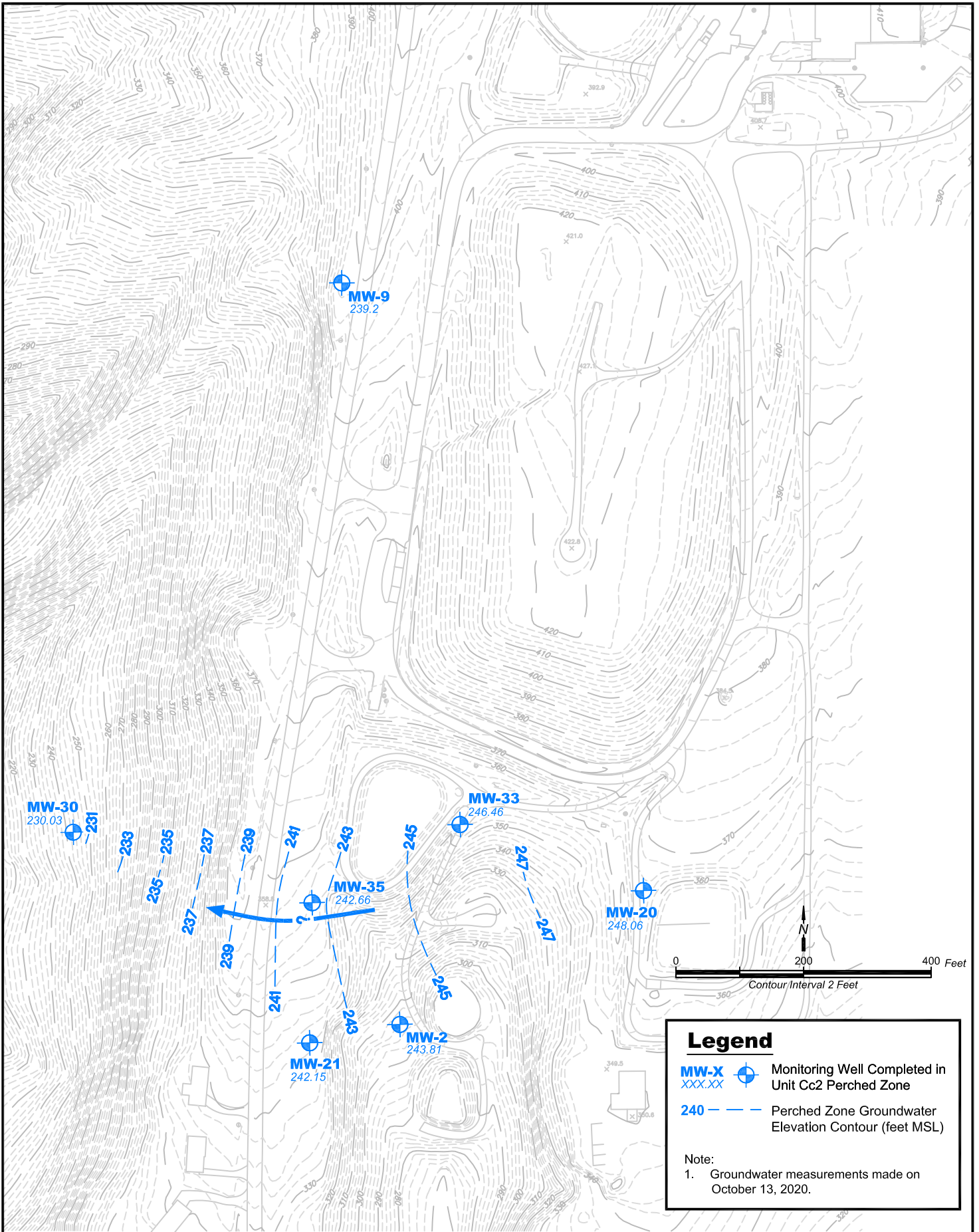
NA Not applicable

**Table A-2: Groundwater Parameters – Fourth Quarter 2020**  
Vashon Island Closed Landfill  
King County, Washington


Water Bearing Zone	Horizontal Hydraulic Conductivity ( $K$ ) <sup>1,2</sup>			Effective Porosity ( $n_{eff}$ ) <sup>1</sup>	October 13, 2020		General Groundwater Flow Direction	
	Range	(cm/s)	(ft/d)		Horizontal Hydraulic Gradient (DH/DL) <sup>3</sup> (ft/ft)	Horizontal Groundwater Velocity ( $v$ ) (ft/d)		
Unit Cc2 - Property Wide <sup>4,6</sup>	Low	5.7E-04	1.61	20%	0.007	0.06	West-northwest	
	High	1.6E-02	46.08		0.033	7.60		
	Average <sup>6</sup>	2.9E-03	8.21		0.020	0.82		
Unit Cc2 - South Slope Area <sup>5,6</sup>	Low	5.7E-04	1.61		0.007	0.06	West to West-southwest	
	High	6.8E-03	19.35		0.018	1.74		
	Average <sup>6</sup>	2.1E-03	5.81		0.013	0.36		
Unit D - Northerly flow direction	Low	1.5E-03	4.4		20%	0.035	0.75	North - with flow to the northeast and northwest
	High	1.6E-02	46.1				7.95	
	Average	3.6E-03	10.2				1.76	
Unit D - Southerly flow direction	Low	1.5E-03	4.4	20%		0.015	0.32	Southwest - away from divide
	High	1.6E-02	46.1				3.40	
	Average	3.6E-03	10.2				0.75	


**Notes:**

1. Horizontal hydraulic conductivity values and effective porosity values (Aspect 2018). However, average horizontal hydraulic conductivity values for Unit Cc2 are assumed incorrectly listed in the Aspect (2018) document table and assumed correctly commented on in the document table notes. The table above reflects the assumed correct values. See notes 4 and 6 below.
2. Average horizontal hydraulic conductivity values are the geometric mean of values reported per well and unit (Aspect 2018).
3. Horizontal hydraulic gradients based on average of gradients measured at several points from the maps shown on Figures A-1 and A-2.
4. Calculations for property wide Unit Cc2 horizontal hydraulic conductivities include data from wells MW-2, MW-9, MW-20, MW-21, MW-33, and MW-35. (Aspect 2018).
5. Calculations for South Slope Area Unit Cc2 horizontal hydraulic conductivities include data from wells MW-2, MW-20, MW-21, MW-33, and MW-35. (Aspect 2018).
6. Calculations of average hydraulic conductivities for Unit Cc2 did not include data obtained in 1986 from MW-2 as the value was significantly lower than a remeasurement completed in 2015 (Aspect 2018).



**Legend**

**MW-X  
XXX.XX**  Monitoring Well Completed in Unit Cc2 Perched Zone

**240**  Perched Zone Groundwater Elevation Contour (feet MSL)

Note:  
1. Groundwater measurements made on October 13, 2020.

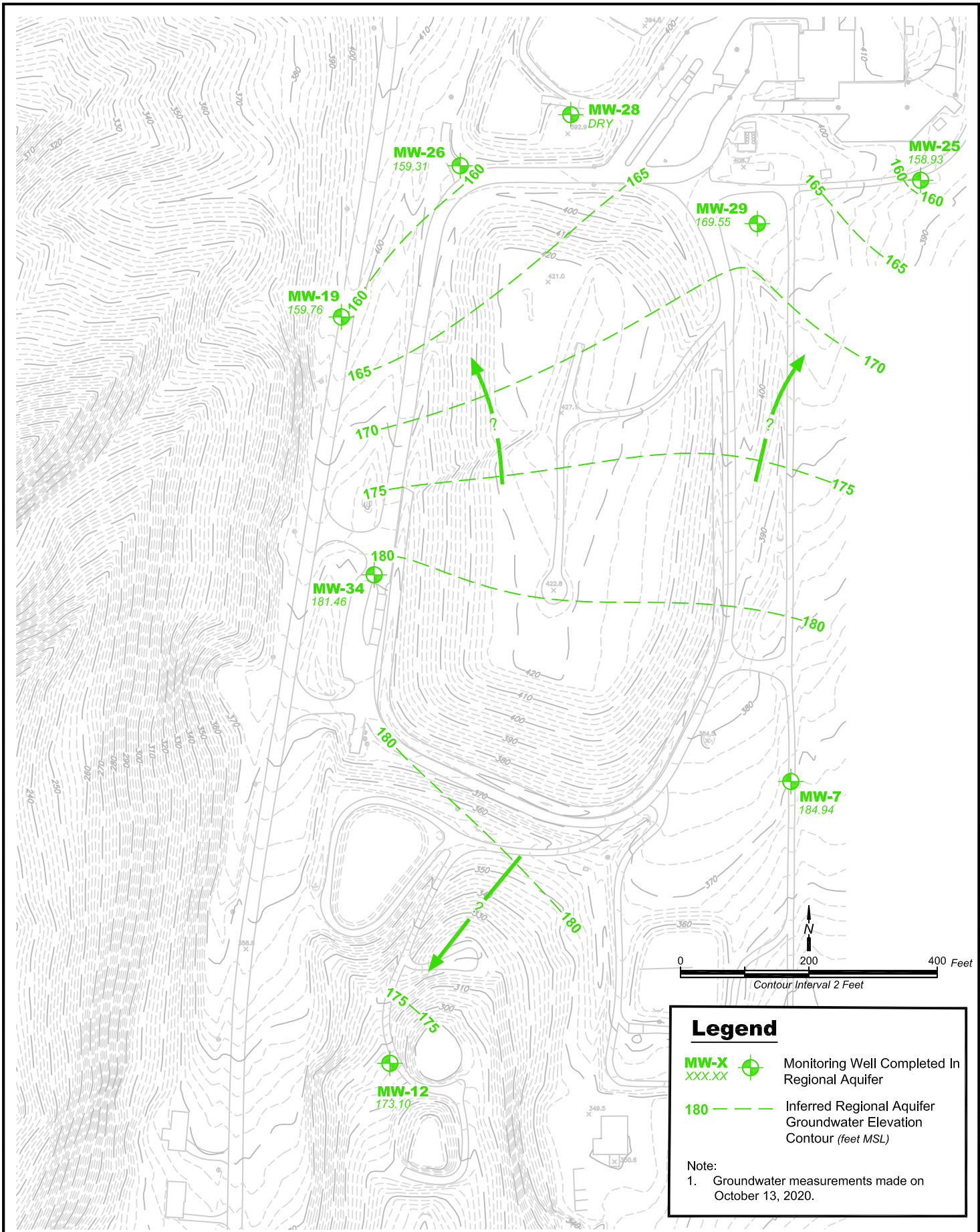


**Groundwater Potentiometric Surface Map**  
**Fourth Quarter 2020 - Cc2 Perched Zone**  
 Vashon Island Closed Landfill  
 King County, Washington

DATE:	February 2021
DESIGNED BY:	SB
DRAWN BY:	KK
REVISED BY:	SB

PROJECT NO.	1033601
FIGURE NO.	<b>A-1</b>





**Legend**

**MW-X** Monitoring Well Completed In Regional Aquifer  
 XXX.XX

**180** Inferred Regional Aquifer Groundwater Elevation Contour (feet MSL)

Note:  
 1. Groundwater measurements made on October 13, 2020.



**Groundwater Potentiometric Surface Map**  
**Fourth Quarter 2020 - Unit D Aquifer**  
 Vashon Island Closed Landfill  
 King County, Washington

DATE:	February 2021
DESIGNED BY:	SB
DRAWN BY:	KK
REVISED BY:	SB

PROJECT NO.	1033601
FIGURE NO.	<b>A-2</b>

# **Appendix H**

## Groundwater Monitoring Data

**Table H-1**  
**Groundwater - Static Water Levels**

Groundwater - Static Water Levels		Top of PVC Casing Elevation	Depth to Groundwater	Groundwater Elevation
Well #	Measurement Date	(feet)	(feet)	(feet above MSL)
<b>Unit B</b>				
MW-24	1/27/2020	377.48	288.03	89.45
MW-24	5/15/2020	377.48	288.59	88.89
MW-24	7/30/2020	377.48	288.58	88.90
MW-24	10/13/2020	377.48	288.05	89.43
<b>Channel Cc1</b>				
MW-3	1/27/2020	318.02	278.77	39.25
MW-3	5/15/2020	318.02	277.49	40.53
MW-3	7/30/2020	318.02	276.22	41.80
MW-3	10/13/2020	318.02	275.92	42.10
MW-4	1/27/2020	377.18	270.02	107.16
MW-4	5/15/2020	377.18	270.58	106.60
MW-4	7/30/2020	377.18	270.43	106.75
MW-4	10/13/2020	377.18	270.17	107.01
MW-10	1/27/2020	409.94	264.41	145.53
MW-10	5/15/2020	409.94	265.51	144.43
MW-10	7/30/2020	409.94	264.43	145.51
MW-10	10/13/2020	409.94	264.61	145.33
MW-13	1/27/2020	377.28	276.98	100.30
MW-13	5/15/2020	377.28	277.23	100.05
MW-13	7/30/2020	377.28	277.07	100.21
MW-13	10/13/2020	377.28	276.93	100.35
<b>Channel Cc2</b>				
MW-2	1/27/2020	317.97	243.70	74.27
MW-2	5/15/2020	317.97	243.93	74.04
MW-2	7/30/2020	317.97	243.77	74.20
MW-2	10/13/2020	317.97	243.81	74.16
MW-9	1/27/2020	405.17	238.84	166.33
MW-9	5/15/2020	405.17	239.60	165.57
MW-9	7/30/2020	405.17	239.23	165.94
MW-9	10/13/2020	405.17	239.20	165.97
MW-20	1/27/2020	370.32	248.00	122.32
MW-20	5/15/2020	370.32	248.24	122.08
MW-20	7/30/2020	370.32	248.02	122.30
MW-20	10/13/2020	370.32	248.06	122.26
MW-21	1/27/2020	349.05	242.06	106.99
MW-21	5/15/2020	349.05	242.32	106.73
MW-21	7/30/2020	349.05	242.18	106.87
MW-21	10/13/2020	349.05	242.15	106.90
MW-30	1/27/2020	235.67	230.56	5.11
MW-30	5/15/2020	235.67	229.84	5.83
MW-30	7/30/2020	235.67	229.58	6.09
MW-30	10/13/2020	235.67	230.03	5.64
MW-33	1/27/2020	359.17	246.36	112.81
MW-33	5/15/2020	359.17	246.61	112.56
MW-33	7/30/2020	359.17	246.45	112.72
MW-33	10/13/2020	359.17	246.46	112.71
MW-35	1/27/2020	361.34	242.53	118.81
MW-35	5/15/2020	361.34	242.77	118.57
MW-35	7/30/2020	361.34	242.61	118.73
MW-35	10/13/2020	361.34	242.66	118.68

**Table H-1 (continued)**  
**Groundwater - Static Water Levels**

Groundwater - Static Water Levels		Top of PVC Casing Elevation	Depth to Groundwater	Groundwater Elevation
Well #	Measurement Date	(feet)	(feet)	(feet above MSL)
<b>Channel Cc3</b>				
MW-8	1/27/2020	386.00	209.05	176.95
MW-8	5/15/2020	386.00	209.90	176.10
MW-8	7/30/2020	386.00	209.51	176.49
MW-8	10/13/2020	386.00	209.52	176.48
MW-36	1/27/2020	378.19	226.48	151.71
MW-36	5/15/2020	378.19	226.68	151.51
MW-36	7/30/2020	378.19	226.56	151.63
MW-36	10/13/2020	378.19	226.65	151.54
<b>Unit D Aquifer</b>				
MW-7	1/27/2020	376.75	185.14	191.61
MW-7	5/15/2020	376.75	185.20	191.55
MW-7	7/30/2020	376.75	185.13	191.62
MW-7	10/13/2020	376.75	184.94	191.81
MW-12	1/27/2020	315.53	173.11	142.42
MW-12	5/15/2020	315.53	173.10	142.43
MW-12	7/30/2020	315.53	173.12	142.41
MW-12	10/13/2020	315.53	173.10	142.43
MW-19	1/27/2020	405.43	159.63	245.80
MW-19	5/15/2020	405.43	159.63	245.80
MW-19	7/30/2020	405.43	159.45	245.98
MW-19	10/13/2020	405.43	159.76	245.67
MW-25	1/27/2020	402.33	158.88	243.45
MW-25	5/15/2020	402.33	158.84	243.49
MW-25	7/30/2020	402.33	158.64	243.69
MW-25	10/13/2020	402.33	158.93	243.40
MW-26	1/27/2020	406.54	159.04	247.50
MW-26	5/15/2020	406.54	159.14	247.40
MW-26	7/30/2020	406.54	158.95	247.59
MW-26	10/13/2020	406.54	159.31	247.23
MW-28	1/27/2020	398.73	DRY	DRY
MW-28	5/15/2020	398.73	DRY	DRY
MW-28	7/30/2020	398.73	DRY	DRY
MW-28	10/13/2020	398.73	DRY	DRY
MW-29	1/27/2020	413.85	169.41	244.44
MW-29	5/15/2020	413.85	169.43	244.42
MW-29	7/30/2020	413.85	169.34	244.51
MW-29	10/13/2020	413.85	169.55	244.30
MW-34	1/27/2020	385.96	181.55	204.41
MW-34	5/15/2020	385.96	181.72	204.24
MW-34	7/30/2020	385.96	181.36	204.60
MW-34	10/13/2020	385.96	181.46	204.50

**Table H-2**  
**Groundwater - Sampling Water Levels**

Groundwater - Sampling Water Levels		Top of PVC Casing Elevation	Depth to Groundwater	Groundwater Elevation
Well #	Measurement Date	(feet)	(feet)	(feet above MSL)
<b>Channel Cc1</b>				
MW-3	1/27/2020	318.02	278.77	39.25
MW-3	5/19/2020	318.02	277.52	40.50
MW-3	8/3/2020	318.02	275.97	42.05
MW-3	11/16/2020	318.02	276.62	41.40
MW-4	1/29/2020	377.18	270.12	107.06
MW-4	5/19/2020	377.18	270.44	106.74
MW-4	8/3/2020	377.18	270.44	106.74
MW-4	11/18/2020	377.18	269.91	107.27
MW-10	1/27/2020	409.94	264.41	145.53
MW-10	5/19/2020	409.94	264.45	145.49
MW-10	8/3/2020	409.94	264.43	145.51
MW-10	11/16/2020	409.94	264.34	145.60
MW-13	1/27/2020	377.28	276.98	100.30
MW-13	5/27/2020	377.28	277.29	99.99
MW-13	8/5/2020	377.28	277.16	100.12
MW-13	11/16/2020	377.28	276.40	100.88
<b>Channel Cc2</b>				
MW-2	1/30/2020	317.97	243.69	74.28
MW-2	5/27/2020	317.97	243.96	74.01
MW-2	8/6/2020	317.97	243.75	74.22
MW-2	11/18/2020	317.97	243.51	74.46
MW-9	1/30/2020	405.17	238.94	166.23
MW-9	5/28/2020	405.17	239.62	165.55
MW-9	8/5/2020	405.17	239.26	165.91
MW-9	11/16/2020	405.17	238.92	166.25
MW-20	1/30/2020	370.32	247.98	122.34
MW-20	5/28/2020	370.32	248.28	122.04
MW-20	8/6/2020	370.32	248.12	122.20
MW-20	11/18/2020	370.32	247.80	122.52
MW-21	1/30/2020	349.05	242.13	106.92
MW-21	5/28/2020	349.05	242.29	106.76
MW-21	8/6/2020	349.05	242.09	106.96
MW-21	12/21/2020	349.05	242.16	106.89
MW-33	1/30/2020	359.17	246.31	112.86
MW-33	5/27/2020	359.17	246.67	112.50
MW-33	8/6/2020	359.17	246.38	112.79
MW-33	11/18/2020	359.17	246.14	113.03
MW-35	1/30/2020	361.34	242.49	4/27/00
MW-35	5/28/2020	361.34	242.73	118.61
MW-35	8/6/2020	361.34	242.54	118.80
MW-35	12/21/2020	361.34	242.81	118.53
<b>Channel Cc3</b>				
MW-8	1/27/2020	386.00	209.05	176.95
MW-8	5/19/2020	386.00	209.84	176.16
MW-8	8/3/2020	386.00	209.53	176.47
MW-8	11/16/2020	386.00	209.14	176.86
MW-36	1/28/2020	378.19	226.63	151.56
MW-36	5/28/2020	378.19	226.84	151.35
MW-36	8/3/2020	378.19	226.54	151.65
MW-36	11/16/2020	378.19	226.48	151.71

**Table H-2 (continued)**  
**Groundwater - Sampling Water Levels**

Groundwater - Sampling Water Levels		Top of PVC Casing Elevation	Depth to Groundwater	Groundwater Elevation
Well #	Measurement Date	(feet)	(feet)	(feet above MSL)
<b>Unit D Aquifer</b>				
MW-7	1/28/2020	376.75	185.33	191.42
MW-7	5/27/2020	376.75	185.14	191.61
MW-7	8/5/2020	376.75	185.13	191.62
MW-7	11/16/2020	376.75	184.37	192.38
MW-12	1/27/2020	315.53	173.11	142.42
MW-12	5/27/2020	315.53	173.18	142.35
MW-12	8/3/2020	315.53	172.85	142.68
MW-12	11/16/2020	315.53	172.71	142.82
MW-19	1/28/2020	405.43	159.82	245.61
MW-19	5/28/2020	405.43	159.68	245.75
MW-19	8/5/2020	405.43	159.39	246.04
MW-19	11/16/2020	405.43	159.30	246.13
MW-26	1/28/2020	406.54	159.14	247.40
MW-26	5/27/2020	406.54	158.90	247.64
MW-26	8/5/2020	406.54	159.14	247.40
MW-26	11/18/2020	406.54	159.29	247.25
MW-29	1/28/2020	413.85	169.38	244.47
MW-29	5/28/2020	413.85	169.53	244.32
MW-29	8/5/2020	413.85	169.55	244.30
MW-29	11/18/2020	413.85	169.30	244.55
MW-34	1/28/2020	385.96	181.76	204.20
MW-34	5/28/2020	385.96	181.74	204.22
MW-34	8/5/2020	385.96	181.38	204.58
MW-34	11/18/2020	385.96	181.20	204.76

**Table H-3**  
**Groundwater - Field Parameters**

Groundwater - Field Parameters			Dissolved Oxygen (DO) (Field) (mg/L)	Oxidation- Reduction Potential (mV)	pH (Field)  (std. units)	Specific Conductance (Field)  (umhos/cm)	Temperature (Field)  (°C)	Turbidity (Field)  (NTU)	Volume Purged  (gal)
Well #	Sample Date	Sample ID							
<b>Channel Cc1</b>									
MW-3	1/27/2020	WV3-200127-	10.55	228.7	6.52	87	9.43	3.6	1.5
MW-3	5/19/2020	WV3-200519-	9.76	237	5.94	60.5	10.13	2.83	0.75
MW-3*	8/3/2020	WV3-200803-	--	--	--	--	--	--	--
MW-3*	11/16/2020	WV3/201116-	--	--	--	--	--	--	--
MW-4	1/29/2020	WV4-200129-	--	--	6.87	152.80	8.75	2.64	1.25
MW-4	5/19/2020	WV4-200519-	--	--	6.60	221.10	12.90	0.74	1.75
MW-4	8/3/2020	WV4-200803-	10.1	298.7	6.33	218.50	14.06	0.51	1.75
MW-4	11/18/2020	WV4-201118-	--	--	6.42	169.70	10.50	1.18	2.80
MW-10	1/27/2020	WV10200127-	4.96	192.9	6.94	146.70	9.88	0.75	3.00
MW-10	5/19/2020	WV10200519-	5.05	315.8	7.29	146.90	10.61	0.46	2.80
MW-10	8/3/2020	WV10200803-	4.7	300.0	6.84	147.40	10.68	0.31	3.25
MW-10	11/16/2020	WV10201116-	4.77	356.3	7.19	133.70	10.39	0.28	2.50
MW-13	1/27/2020	WV13200127-	7.72	170.3	7.99	147.3	10.5	1.57	1.5
MW-13	5/27/2020	WV13200527-	8.43	206	6.98	137.3	11.1	0.79	1.3
MW-13	8/5/2020	WV13200805-	5.73	279.8	6.7	156.9	10.59	0.32	4.25
MW-13	11/16/2020	WV13201116-	8.19	248.4	6.87	133.7	10.32	0.53	1.5
<b>Channel Cc2</b>									
MW-2	1/30/2020	WV2-200130-	1.13	218.8	6.94	332.30	9.57	0.83	3.00
MW-2	5/27/2020	WV2-200527-	0.92	196.2	6.96	292.70	9.59	0.41	2.50
MW-2	8/6/2020	WV2-200806-	0.84	96.9	6.78	316.30	9.64	0.65	3.00
MW-2	11/18/2020	WV2-201118-	1.73	329.4	6.81	293.10	9.74	0.35	1.50
MW-9	1/30/2020	WV9-200130-	7.48	284.4	7.16	171.80	9.70	0.84	3.00
MW-9	5/28/2020	WV9-200528-	8.54	212.9	7.00	173.40	10.28	1.02	2.50
MW-9	8/5/2020	WV9-200805-	8.84	287.8	6.93	195.70	10.32	0.62	2.90
MW-9	11/16/2020	WV9-201116-	7.68	240.5	6.72	165.90	10.02	0.42	2.50
MW-20	1/30/2020	WV20200130-	1.03	-60.0	7.53	175.00	10.53	9.24	3.50
MW-20	5/28/2020	WV20200528-	1.18	-83.2	7.54	176.60	12.55	4.74	3.00
MW-20	8/6/2020	WV20200806-	0.9	-94.5	7.50	188.60	11.11	0.74	3.50
MW-20	11/18/2020	WV20201118-	2.13	116.4	7.33	172.40	11.33	1.19	1.50
MW-21	1/30/2020	WV21200130-	1.13	218.8	6.94	332.30	9.57	0.83	3.00
MW-21	5/28/2020	WV21200528-	0.71	2.2	6.94	272.90	10.18	3.28	4.00
MW-21	8/6/2020	WV21200806-	6.82	5.5	6.72	300.10	10.22	1.80	4.00
MW-21	12/21/2020	WV21201221-	1.35	96.7	6.86	275.40	9.63	7.88	2.50
MW-33	1/30/2020	WV33200130-	0.41	-63.7	6.89	713.00	12.47	0.58	3.00
MW-33	5/27/2020	WV33200527-	0.7	-52.7	6.79	656.00	13.37	0.49	2.50
MW-33	8/6/2020	WV33200806-	0.34	-63.5	6.63	705.00	13.23	0.49	3.75
MW-33	11/18/2020	WV33201118-	0.88	-12.0	6.72	608.40	13.47	1.36	1.75
MW-35	1/30/2020	WV35200130-	0.34	-57.1	6.78	683.00	10.33	47.50	3.25
MW-35	5/28/2020	WV35200528-	0.28	-66.6	6.70	646.00	11.25	9.95	3.90
MW-35	8/6/2020	WV35200806-	0.4	-60.9	6.48	686.00	11.02	6.01	3.50
MW-35	12/21/2020	WV35201221-	0.67	-25.1	6.39	569.00	10.00	51.60	2.00

**Table H-3 (continued)**  
**Groundwater - Field Parameters**

Groundwater - Field Parameters			Dissolved Oxygen (DO) (Field) (mg/L)	Oxidation- Reduction Potential (mV)	pH (Field)  (std. units)	Specific Conductance (Field)  (umhos/cm)	Temperature (Field)  (°C)	Turbidity (Field)  (NTU)	Volume Purged  (gal)
Well #	Sample Date	Sample ID							
<b>Channel Cc3</b>									
MW-8	1/27/2020	WV8-200127-	10.14	186.6	6.93	169.8	10.12	0.33	2
MW-8	5/19/2020	WV8-200519-	10.38	307.1	6.66	167.6	10.6	0.53	2.5
MW-8	8/3/2020	WV8-200803-	10.47	349.5	6.32	166.50	12.29	0.32	1.50
MW-8	11/16/2020	WV8-201116-	10.25	373.9	6.41	154.00	10.82	0.31	1.50
MW-36	1/28/2020	WV36200128-	0.54	-59.0	7.58	190.40	10.08	4.87	7.75
MW-36	5/28/2020	WV36200528-	3.5	175.9	7.76	161.00	11.72	1.97	2.75
MW-36	8/3/2020	WV36200803-	3.62	363.4	7.57	175.80	12.24	0.41	3.50
MW-36	11/16/2020	WV36201116-	3.83	349.3	7.72	161.40	11.44	3.31	2.50
<b>Unit D Aquifer</b>									
MW-7	1/28/2020	WV7-200128-	1	32.0	8.06	187.70	10.33	1.00	3.90
MW-7	5/27/2020	WV7-200527-	1.27	3.2	7.68	178.80	11.60	1.50	3.60
MW-7	5/27/2020	WV7-200527D	1.27	3.2	7.68	178.80	11.60	1.50	3.60
MW-7	8/5/2020	WV7-200805-	1.61	192.2	7.48	189.60	10.96	2.11	3.50
MW-7	11/16/2020	WV7-201116-	1.74	103.3	7.51	174.20	10.60	1.16	2.60
MW-7	11/16/2020	WV7-201116D	1.74	103.3	7.51	174.20	10.60	1.16	2.60
MW-12	1/27/2020	WV12200127-	5.06	189.7	7.37	164.90	9.45	0.95	3.00
MW-12	5/27/2020	WV12200527-	5.4	199.8	7.30	152.20	9.58	0.37	2.50
MW-12	8/3/2020	WV12200803-	5.11	298.3	7.09	166.20	9.94	0.51	2.50
MW-12	11/16/2020	WV12201116-	5.28	246.1	7.30	151.70	9.18	1.51	1.75
MW-19	1/28/2020	WV19200128-	0.94	13.1	7.55	216.30	9.65	2.17	5.00
MW-19	1/28/2020	WV19200128D	0.94	13.1	7.55	216.30	9.65	2.17	5.00
MW-19	5/28/2020	WV19200528-	1.05	40.5	7.52	198.60	10.10	4.38	5.00
MW-19	8/5/2020	WV19200805-	0.75	4.5	7.37	218.50	10.14	16.50	6.50
MW-19	11/16/2020	WV19201116-	0.64	-2.5	7.21	201.30	9.94	1.60	5.50
MW-26	1/28/2020	WV26200128-	0.54	-59.0	7.58	190.40	10.08	4.87	7.75
MW-26	5/27/2020	WV26200527-	0.76	-106.2	8.19	180.50	10.92	5.21	5.50
MW-26	8/5/2020	WV26200805-	1.16	108.1	7.07	191.00	11.12	13.40	4.25
MW-26	8/5/2020	WV26200805D	1.16	108.1	7.07	191.00	11.12	13.40	4.25
MW-26	11/18/2020	WV26201118-	0.85	-1.8	7.98	177.50	10.03	11.60	6.00
MW-29	1/28/2020	WV29200128-	0.65	-86.1	7.48	240.00	10.38	7.91	5.50
MW-29	5/28/2020	WV29200528-	0.79	-85.4	7.35	226.80	10.68	7.87	5.20
MW-29	8/5/2020	WV29200805-	1.07	-74.9	7.34	242.90	11.50	21.10	5.50
MW-29	11/18/2020	WV29201118-	0.91	-81.2	7.44	221.90	10.31	17.60	4.50
MW-34	1/28/2020	WV34200128-	6.22	202.2	7.55	194.80	11.90	0.27	2.10
MW-34	5/28/2020	WV34200528-	6.08	194.2	6.91	179.70	12.49	0.31	3.25
MW-34	8/5/2020	WV34200805-	6.12	177.5	6.74	197.10	13.78	0.50	2.50
MW-34	11/18/2020	WV34201118-	5.87	168.0	6.81	181.20	11.69	0.62	3.50
<b>Field Blanks</b>									
FIELD BLANK	1/27/2020	WV8-200127F	--	--	7.37	0.64	10.10	--	--
FIELD BLANK	5/27/2020	WV33200527F	--	--	8.19	180.50	10.92	--	--
FIELD BLANK	8/3/2020	WV4-200803F	--	--	5.55	1.10	18.86	--	--
<b>Offsite Domestic Wells</b>									
DW-85	1/29/2020	WV85200129-	0.48	-262.6	6.26	150.4	9.45	1.49	90
DW-85	8/5/2020	WV85200805-	0.42	-110.6	7.9	150.4	10.065	0.33	82.5
DW-PA	1/29/2020	WVPA200129-	8.33	-22.3	6.86	183.4	9.34	2.63	60
DW-PA	8/5/2020	WVPA200805-	12.56	368.2	6.97	184.9	11.958	0.81	45

Notes:

\* Water level was below pump - no sample collected.



**Table H-4  
 Groundwater - Conventionals**

Groundwater - Conventionals			Alkalinity, Total (as CaCO <sub>3</sub> )	Ammonia as N	Chloride	Nitrate	Specific Conductance (Lab)	Sulfate	Total Dissolved Solids	Total Organic Carbon	Total Solids	Total Suspended Solids
Well #	Sample Date	Sample ID	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(µmhos/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
<b>Channel Cc1</b>												
MW-3	1/27/2020	WV3-200127-	27.70	0.002 U	1.79	1.55	90.80	4.79	66.70	0.88 T	74.70	2.90
MW-3	5/19/2020	WV3-200519-	24.00	0.0024 T	1.00	0.31	71.80	4.70	56.00	0.97 T	60.70	0.5 GU
MW-3*	8/3/2020	WV3-200803-	--	--	--	--	--	--	--	--	--	--
MW-3*	11/16/2020	WV3/201116-	--	--	--	--	--	--	--	--	--	--
MW-4	1/29/2020	WV4-200129-	53.80	0.002 U	7.54	2.05	181.00	13.00	127.00	0.52 T	137.00	0.5 T
MW-4	5/19/2020	WV4-200519-	66.50	0.002 U	8.93	2.06	229.00	19.00	168.00	0.54 T	185.00	0.77 GU
MW-4	8/3/2020	WV4-200803-	64.00	0.0028 T	9.19	2.18	222.00	16.70	185.00	0.57 T	186.00	0.5 U
MW-4	11/18/2020	WV4-201118-	58.20	0.002 U	7.68	1.64	180.00	13.60	147.00	0.8 T	155.00	0.5 U
MW-10	1/27/2020	WV10200127-	57.20	0.002 U	3.32	0.59	152.00	9.37	107.00	0.5 U	131.00	1.20
MW-10	5/19/2020	WV10200519-	56.70	0.002 U	3.14	0.53	150.00	8.91	113.00	0.5 U	113.00	1 GU
MW-10	8/3/2020	WV10200803-	56.60	0.0028 T	3.28	0.46	153.00	8.99	115.00	0.5 U	117.00	1 U
MW-10	11/16/2020	WV10201116-	56.50	0.002 U	3.43	0.46	147.00	9.11	94.70	0.52 T	96.70	0.51 U
MW-13	1/27/2020	WV13200127-	60.20	0.002 U	2.90	0.35	156.00	10.50	111.00	0.5 U	115.00	1.60
MW-13	5/27/2020	WV13200527-	58.30	0.002 U	2.62	0.35	153.00	9.35	109.00	0.7 T	111.00	0.5 U
MW-13	8/5/2020	WV13200805-	60.80	0.002 U	2.75	0.25	163.00	10.90	117.00	0.5 U	115.00	0.5 U
MW-13	11/16/2020	WV13201116-	58.10	0.002 U	2.70	0.41	145.00	8.39	101.00	0.72 T	101.00	0.5 U
<b>Channel Cc2</b>												
MW-2	1/30/2020	WV2-200130-	149.00	0.0025 T	2.71	0.21	329.00	15.90	183.00	0.71 T	190 H	1 U
MW-2	5/27/2020	WV2-200527-	147.00	0.0025 T	2.40	0.24	330.00	13.70	193.00	0.95 T	197.00	0.5 U
MW-2	8/6/2020	WV2-200806-	144.00	0.0036 T	2.44	0.43	325.00	14.50	191.00	0.5 U	205.00	0.5 U
MW-2	11/18/2020	WV2-201118-	145.00	0.002 U	2.47	0.50	322.00	15.20	201.00	0.79 T	213.00	0.5 U
MW-9	1/30/2020	WV9-200130-	68.40	0.002 U	4.34	0.33	178.00	10.90	113.00	0.5 U	123.00	4.50
MW-9	5/28/2020	WV9-200528-	73.00	0.002 U	4.37	0.44	196.00	11.70	131.00	0.5 U	135.00	0.5 U
MW-9	8/5/2020	WV9-200805-	73.80	0.002 U	4.68	0.51	200.00	12.20	140.00	0.5 U	145.00	1.20
MW-9	11/16/2020	WV9-201116-	69.10	0.002 U	4.53	0.40	179.00	11.20	120.00	0.5 U	121.00	0.5 T
MW-20	1/30/2020	WV20200130-	73.80	0.02	3.25	0.011 T	193.00	16.50	131.00	0.5 U	148.00	3.80
MW-20	5/28/2020	WV20200528-	71.20	0.02	2.99	0.01 U	191.00	15.00	135.00	0.5 U	139.00	2.83
MW-20	8/6/2020	WV20200806-	70.90	0.02	3.10	0.01 U	198.00	15.20	127.00	0.5 U	147.00	0.5 U
MW-20	11/18/2020	WV20201118-	73.10	0.01	3.20	0.01 U	190.00	16.10	139.00	0.64 T	146.00	0.7 T
MW-21	1/30/2020	WV21200130-	137.00	0.0098 T	2.44	0.18	306.00	15.20	179.00	0.62 T	190.00	2.00
MW-21	5/28/2020	WV21200528-	131.00	0.01	2.10	0.23	296.00	13.10	182.00	0.92 T	191.00	2.23
MW-21	8/6/2020	WV21200806-	135.00	0.01	2.10	0.27	307.00	13.50	183.00	0.57 T	205.00	1.20
MW-21	12/21/2020	WV21201221-	139.00	0.0056 T	2.01	0.30	314.00	13.80	191.00	0.72 T	197.00	3.60
MW-33	1/30/2020	WV33200130-	383.00	0.03	3.84	0.01 U	731.00	17.90	419.00	1.58	452.00	9.50
MW-33	5/27/2020	WV33200527-	365.00	0.03	3.48	0.01 U	715.00	15.90	423.00	1.69	438.00	8.20
MW-33	8/6/2020	WV33200806-	354.00	0.03	3.60	0.01 U	707.00	16.70	413.00	1.37	459.00	8.20
MW-33	11/18/2020	WV33201118-	342.00	0.02	3.46	0.01 U	657.00	16.90	402.00	1.92	436.00	11.70
MW-35	1/30/2020	WV35200130-	345.00	0.07	4.39	0.01 U	680.00	24.50	404 J	3.72	660 J	453 J
MW-35	5/28/2020	WV35200528-	332.00	0.07	4.03	0.01 U	673.00	22.40	436.00	2.90	690.00	317.00
MW-35	8/6/2020	WV35200806-	329.00	0.07	4.34	0.01 U	674.00	25.30	412.00	2.77	506.00	79.40
MW-35	12/21/2020	WV35201221-	309.00	0.06	3.90	0.01 U	630.00	26.40	460 J	3.51	579 J	374 J

**Table H-4 (continued)**  
**Groundwater - Conventionals**

Groundwater - Conventionals			Alkalinity, Total (as CaCO <sub>3</sub> )	Ammonia as N	Chloride	Nitrate	Specific Conductance (Lab)	Sulfate	Total Dissolved Solids	Total Organic Carbon	Total Solids	Total Suspended Solids
Well #	Sample Date	Sample ID	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(µmhos/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
<b>Channel Cc3</b>												
MW-8	1/27/2020	WV8-200127-	59.20	0.002 U	4.77	2.66	176.00	9.01	125.00	0.5 U	129.00	1.10
MW-8	5/19/2020	WV8-200519-	56.00	0.002 U	4.22	2.92	174.00	7.86	124.00	0.5 U	128.00	0.5 GT
MW-8	8/3/2020	WV8-200803-	54.70	0.002 U	4.19	2.77	171.00	7.46	131.00	0.5 U	135.00	0.5 U
MW-8	11/16/2020	WV8-201116-	57.40	0.002 T	4.23	2.80	168.00	7.70	126.00	0.5 U	114.00	0.5 U
MW-36	1/28/2020	WV36200128-	69.50	0.0034 T	3.14	0.022 T	180.00	13.60	128.00	0.5 U	134.00	0.5 U
MW-36	5/28/2020	WV36200528-	68.10	0.002 U	2.89	0.019 T	181.00	13.00	133.00	0.5 U	134.00	0.5 U
MW-36	8/3/2020	WV36200803-	67.70	0.0026 T	3.00	0.02 T	181.00	13.20	141.00	0.5 U	144.00	0.53 U
MW-36	11/16/2020	WV36201116-	68.10	0.002 U	3.08	0.019 T	177.00	13.80	121.00	0.5 U	131.00	4.18
<b>Unit D Aquifer</b>												
MW-7	1/28/2020	WV7-200128-	79.10	0.25	3.46	0.011 T	194.00	11.40	132 H	0.5 U	134 H	1.10
MW-7	5/27/2020	WV7-200527-	77.60	0.23	3.17	0.015 T	195.00	10.50	137.00	0.5 U	141.00	0.5 U
MW-7	5/27/2020	WV7-200527D	77.50	0.24	3.17	0.015 T	195.00	10.40	136.00	0.5 U	141.00	0.51 T
MW-7	8/5/2020	WV7-200805-	77.00	0.23	3.27	0.021 T	195.00	10.70	128.00	0.5 U	142.00	1.00
MW-7	11/16/2020	WV7-201116-	77.30	0.21	3.40	0.02 T	188.00	11.10	127.00	0.5 U	133.00	0.5 U
MW-7	11/16/2020	WV7-201116D	77.60	0.22	3.39	0.02 T	188.00	11.00	128.00	0.5 U	132.00	0.5 T
MW-12	1/27/2020	WV12200127-	64.60	0.002 U	3.30	0.79	170.00	10.80	119.00	0.5 U	123.00	0.5 T
MW-12	5/27/2020	WV12200527-	63.90	0.002 U	2.95	0.72	172.00	9.90	118.00	0.5 U	121.00	1 U
MW-12	8/3/2020	WV12200803-	62.30	0.0028 T	3.03	0.70	170.00	9.76	113.00	0.5 U	133.00	0.5 T
MW-12	11/16/2020	WV12201116-	63.10	0.002 U	3.14	0.69	163.00	10.20	105.00	0.5 U	110.00	2.40
MW-19	1/28/2020	WV19200128-	86.20	0.03	4.79	0.01 U	224.00	17.90	145.00	0.5 U	151.00	0.76 T
MW-19	1/28/2020	WV19200128D	86.10	0.04	4.77	0.01 U	224.00	17.90	141.00	0.5 U	155.00	0.7 T
MW-19	5/28/2020	WV19200528-	82.40	0.03	4.32	0.01 U	219.00	16.10	143.00	0.55 T	148.00	1.76
MW-19	8/5/2020	WV19200805-	84.00	0.03	4.59	0.01 U	224.00	16.60	139.00	0.5 U	171.00	8.00
MW-19	11/16/2020	WV19201116-	84.50	0.03	4.61	0.01 U	218.00	16.90	137.00	0.5 U	131.00	0.8 T
MW-26	1/28/2020	WV26200128-	75.80	0.26	3.85	0.016 T	195.00	13.90	128.00	0.5 U	153.00	10.70
MW-26	5/27/2020	WV26200527-	74.70	0.24	3.48	0.012 T	196.00	12.70	139.00	0.55 T	157.00	18.80
MW-26	8/5/2020	WV26200805-	74.80	0.26	3.61	0.012 T	197.00	12.80	138.00	0.5 U	159.00	25.00
MW-26	8/5/2020	WV26200805D	74.40	0.33	3.64	0.012 T	197.00	13.10	150.00	0.5 U	162.00	22.40
MW-26	11/18/2020	WV26201118-	75.60	0.24	3.78	0.016 T	192.00	13.60	143.00	0.59 T	169.00	11.20
MW-29	1/28/2020	WV29200128-	101.00	0.0038 T	3.71	0.01 U	246.00	16.80	151.00	0.5 U	162.00	4.50
MW-29	5/28/2020	WV29200528-	99.00	0.0029 T	3.38	0.01 U	245.00	15.00	153.00	0.5 U	159.00	7.20
MW-29	8/5/2020	WV29200805-	99.00	0.0035 T	3.48	0.01 U	248.00	15.80	152.00	0.5 U	168.00	8.40
MW-29	11/18/2020	WV29201118-	99.20	0.0029 T	3.51	0.01 U	242.00	15.80	163.00	0.5 U	188.00	6.80
MW-34	1/28/2020	WV34200128-	69.80	0.0029 T	5.24	1.99	202.00	14.00	135.00	0.5 U	143.00	0.5 U
MW-34	5/28/2020	WV34200528-	68.50	0.002 U	4.60	1.71	202.00	12.50	129.00	0.5 U	137.00	0.5 U
MW-34	8/5/2020	WV34200805-	67.90	0.002 U	4.81	1.67	201.00	13.10	149.00	0.5 U	133.00	0.5 U
MW-34	11/18/2020	WV34201118-	69.20	0.002 U	5.02	1.59	196.00	13.60	141.00	0.5 U	148.00	0.5 U
<b>Field Blanks</b>												
FIELD BLANK	1/27/2020	WV8-200127F	1 U	0.002 U	0.05 U	0.01 U	1.4 T	0.1 U	10 U	0.5 U	10 U	0.5 U
FIELD BLANK	5/27/2020	WV32200527F	1 U	0.002 U	0.068 T	0.01 U	1.9 T	0.1 U	10 U	0.5 U	10 U	0.5 U
FIELD BLANK	8/3/2020	WV4-200803F	1 U	0.002 U	0.05 U	0.01 U	2.3 T	0.1 U	10 U	0.5 U	11 T	0.51 U
<b>Offsite Domestic Wells</b>												
DW-85	1/29/2020	WV85200129-	70.80	0.27	2.70	0.01 U	157.00	2.18	101.00	0.5 U	110.00	0.5 U
DW-85	8/5/2020	WV85200805-	68.50	0.27	2.51	0.01 U	157.00	2.02	113.00	0.5 U	106.00	0.53 U
DW-PA	1/29/2020	WVPA200129-	68.40	0.002 U	5.70	0.91	190.00	12.40	119.00	0.5 U	129.00	0.5 U
DW-PA	8/5/2020	WVPA200805-	67.40	0.0023 T	5.43	0.99	191.00	11.00	125.00	0.5 U	127.00	0.5 U

Notes:

\* Water level was below pump - no sample collected.

-- = parameter is not sampled for

**Table H-5  
 Groundwater - Metals (Dissolved & Total)**

Groundwater - Metals (Dissolved & Total)			Antimony, Dissolved (mg/L)	Antimony, Total (mg/L)	Arsenic, Dissolved (mg/L)	Arsenic, Total (mg/L)	Barium, Dissolved (mg/L)	Barium, Total (mg/L)	Beryllium, Dissolved (mg/L)	Beryllium, Total (mg/L)	Cadmium, Dissolved (mg/L)	Cadmium, Total (mg/L)	Calcium, Dissolved (mg/L)	Calcium, Total (mg/L)	Chromium, Dissolved (mg/L)	Chromium, Total (mg/L)	Cobalt, Dissolved (mg/L)	Cobalt, Total (mg/L)	Copper, Dissolved (mg/L)	Copper, Total (mg/L)	Iron, Dissolved (mg/L)	Iron, Total (mg/L)	Lead, Dissolved (mg/L)	Lead, Total (mg/L)
			<b>Channel Cc1</b>																					
MW-3	1/27/2020	WV3-200127-	0.0003 U	0.0003 U	0.0000553	0.000209	0.0254	0.0312	0.0001 U	0.0001 U	5E-05 U	5E-05 U	8.39	8.18	0.0002 U	0.000556	5E-05 U	0.00022	0.0002 U	0.000751	0.01 U	0.353	0.0001 U	0.000622
MW-3	5/19/2020	WV3-200519-	0.0003 U	0.0003 U	0.0000572	0.0000562	0.0154	0.0152	0.0001 U	0.0001 U	5E-05 U	5E-05 U	6.69	6.65	0.0002 U	0.000206	5E-05 U	5E-05 U	0.00023	0.000272	0.01 U	0.0236	0.0001 U	0.0001 U
MW-3*	8/3/2020	WV3-200803-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-3*	11/16/2020	WV3-201116-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-4	1/29/2020	WV4-200129-	0.0003 U	0.0003 U	0.000366	0.000367	0.00419	0.00471	0.0001 U	0.0001 U	0.00011	5E-05 U	12.9	13.8	0.00557	0.00674	5E-05 U	5E-05 U	0.0038	0.000321	0.01 U	0.0147	0.0001 U	0.0001 U
MW-4	5/19/2020	WV4-200519-	0.0003 U	0.0003 U	0.000403	0.00039	0.00537	0.00532	0.0001 U	0.0001 U	5E-05 U	5E-05 U	17.8	17.7	0.00736	0.00665	5E-05 U	5E-05 U	0.0002 U	0.000329	0.01 U	0.0123	0.0001 U	0.0001 U
MW-4	8/3/2020	WV4-200803-	0.0003 U	0.0003 U	0.000387	0.000406	0.00524	0.00534	0.0001 U	0.0001 U	5E-05 U	5E-05 U	17.5	17.1	0.00567	0.00556	5E-05 U	5E-05 U	0.0002 U	0.000925	0.01 U	0.0103	0.0001 U	0.0001 U
MW-4	11/18/2020	WV4-201118-	0.0003 U	0.0003 U	0.000365	0.000375	0.00423	0.00507	0.0001 U	0.0001 U	5E-05 U	5E-05 U	12.7	13.3	0.00905	0.00984	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-10	1/27/2020	WV10200127-	0.0003 U	0.0003 U	0.00163	0.00161	0.00335	0.00327	0.0001 U	0.0001 U	0.0000968	0.0000861	9.81	9.76	0.00284	0.00284	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.025	0.0001 U	0.0001 U
MW-10	5/19/2020	WV10200519-	0.0003 U	0.0003 U	0.00165	0.00161	0.00339	0.00333	0.0001 U	0.0001 U	5E-05 U	5E-05 U	9.88	9.86	0.00285	0.00284	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-10	8/3/2020	WV10200803-	0.0003 U	0.0003 U	0.00165	0.00171	0.0033	0.00329	0.0001 U	0.0001 U	5E-05 U	5E-05 U	10.1	9.88	0.00267	0.0027	5E-05 U	5E-05 U	0.000212	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-10	11/16/2020	WV10201116-	0.0003 U	0.0003 U	0.00163	0.00163	0.00309	0.00345	0.0001 U	0.0001 U	5E-05 U	5E-05 U	9.52	9.47	0.00267	0.00269	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-13	1/27/2020	WV13200127-	0.0003 U	0.0003 U	0.00216	0.00218	0.00388	0.00416	0.0001 U	0.0001 U	5E-05 U	5E-05 U	8.97	8.97	0.00241	0.00253	5E-05 U	5E-05 U	0.000288	0.00028	0.01 U	0.0348	0.0001 U	0.0001 U
MW-13	5/27/2020	WV13200527-	0.0003 U	0.0003 U	0.0021	0.00211	0.00384	0.00359	0.0001 U	0.0001 U	5E-05 U	5E-05 U	8.8	8.81	0.00245	0.00238	5E-05 U	5E-05 U	0.000292	0.000237	0.01 U	0.0102	0.0001 U	0.0001 U
MW-13	8/5/2020	WV13200805-	0.0003 U	0.0003 U	0.00202	0.00199	0.00394	0.00405	0.0001 U	0.0001 U	5E-05 U	0.0000885	9.13	8.98	0.00185	0.00185	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.0111	0.0001 U	0.0001 U
MW-13	11/16/2020	WV13201116-	0.0003 U	0.0003 U	0.00222	0.00222	0.00404	0.00436	0.0001 U	0.0001 U	5E-05 U	5E-05 U	8.47	8.21	0.0027	0.0027	5E-05 U	5E-05 U	0.000229	0.000276	0.01 U	0.01 U	0.0001 U	0.0001 U
			<b>Channel Cc2</b>																					
MW-2	1/30/2020	WV2-200130-	0.0003 U	0.0003 U	0.000845	0.000853	0.00697	0.00764	0.0001 U	0.0001 U	5E-05 U	5E-05 U	21.2	22.1	0.0002 U	0.00022	5E-05 U	0.0000587	0.0002 U	0.000214	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-2	5/27/2020	WV2-200527-	0.0003 U	0.0003 U	0.0008	0.00079	0.00669	0.00656	0.0001 U	0.0001 U	5E-05 U	5E-05 U	21.8	22.5	0.000282	0.000516	5E-05 U	5E-05 U	0.000277	0.000255	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-2	8/6/2020	WV2-200806-	0.0003 U	0.0003 U	0.000871	0.000858	0.00683	0.00697	0.0001 U	0.0001 U	5E-05 U	5E-05 U	22.3	21.4	0.0002 U	0.000237	0.0000533	0.0000615	0.0002 U	0.000221	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-2	11/18/2020	WV2-201118-	0.0003 U	0.0003 U	0.000764	0.000778	0.00567	0.0068	0.0001 U	0.0001 U	5E-05 U	5E-05 U	21.5	22.1	0.00034	0.000441	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-9	1/30/2020	WV9-200130-	0.0003 U	0.0003 U	0.00233	0.00244	0.00342	0.00389	0.0001 U	0.0001 U	5E-05 U	5E-05 U	12.6	13.4	0.00375	0.00408	5E-05 U	5E-05 U	0.0002 U	0.000228	0.01 U	0.0936	0.0001 U	0.0001 U
MW-9	5/28/2020	WV9-200528-	0.0003 U	0.0003 U	0.00233	0.00234	0.00379	0.00363	0.0001 U	0.0001 U	5E-05 U	5E-05 U	13.9	13.9	0.00378	0.00362	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-9	8/5/2020	WV9-200805-	0.0003 U	0.0003 U	0.00236	0.00234	0.00392	0.00395	0.0001 U	0.0001 U	5E-05 U	5E-05 U	14.6	14.3	0.00395	0.00408	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.0319	0.0001 U	0.0001 U
MW-9	11/16/2020	WV9-201116-	0.0003 U	0.0003 U	0.0024	0.00235	0.00367	0.00397	0.0001 U	0.0001 U	5E-05 U	5E-05 U	12.7	12.8	0.00389	0.00394	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.0201	0.0001 U	0.0001 U
MW-20	1/30/2020	WV20200130-	0.0003 U	0.0003 U	0.00195	0.00197	0.00501	0.00674	0.0001 U	0.0001 U	5E-05 U	5E-05 U	13	13.4	0.0002 U	0.0002 U	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.184	1.38	0.0001 U	0.0001 U
MW-20	5/28/2020	WV20200528-	0.0003 U	0.0003 U	0.00198	0.00198	0.00523	0.00533	0.0001 U	0.0001 U	5E-05 U	5E-05 U	13	12.5	0.0002 U	0.0002 U	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.219	0.89	0.0001 U	0.0001 U
MW-20	8/6/2020	WV20200806-	0.0003 U	0.0003 U	0.00204	0.00221	0.00555	0.00555	0.0001 U	0.0001 U	5E-05 U	5E-05 U	13.4	13.6	0.0002 U	0.0002 U	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.253	0.361	0.0001 U	0.0001 U
MW-20	11/18/2020	WV20201118-	0.0003 U	0.0003 U	0.00184	0.00212	0.00492	0.00549	0.0001 U	0.0001 U	5E-05 U	5E-05 U	12.8	13	0.0002 U	0.0002 U	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.183	0.38	0.0001 U	0.0001 U
MW-21	1/30/2020	WV21200130-	0.0003 U	0.0003 U	0.000901	0.000913	0.0075	0.00989	0.0001 U	0.0001 U	5E-05 U	5E-05 U	20.2	20.8	0.0002 U	0.0002 U	0.000161	0.000263	0.0002 U	0.0002 U	0.281	1.86	0.0001 U	0.0001 U
MW-21	5/28/2020	WV21200528-	0.0003 U	0.0003 U	0.00127	0.00127	0.00817	0.00803	0.0001 U	0.0001 U	5E-05 U	5E-05 U	19.4	19.4	0.0002 U	0.000207	0.000266	0.0002 U	0.0002 U	0.0002 U	0.47	1.02	0.0001 U	0.0001 U
MW-21	8/6/2020	WV21200806-	0.0003 U	0.0003 U	0.0012	0.00127	0.00899	0.00941	0.0001 U	0.0001 U	5E-05 U	5E-05 U	20.8	20.4	0.0002 U	0.0002 U	0.00023	0.000287	0.0002 U	0.0002 U	0.508	1.24	0.0001 U	0.0001 U
MW-21	12/21/2020	WV21201221-	0.0003 U	0.0003 U	0.000695	0.000314	0.00793	0.0101	0.0001 U	0.0001 U	5E-05 U	5E-05 U	20.9	20.9	0.0002 U	0.0002 U	0.000158	0.000278	0.0002 U	0.0002 U	0.196	1.56	0.0001 U	0.0001 U
MW-33	1/30/2020	WV33200130-	0.0003 U	0.0003 U	0.0409	0.0421	0.0251	0.0264	0.0001 U	0.0001 U	5E-05 U	5E-05 U	63.3	64.8	0.0002 U	0.0002 U	0.00123	0.00126	0.0002 U	0.0002 U	6.67	6.78	0.0001 U	0.0001 U
MW-33	5/27/2020	WV33200527-	0.0003 U	0.0003 U	0.0421	0.0428	0.0249	0.0248	0.0001 U	0.0001 U	5E-05 U	5E-05 U	61.8	62.8	0.0002 U	0.0002 U	0.0012	0.00122	0.0002 U	0.0002 U	6.62	6.71	0.0001 U	0.0001 U
MW-33	8/6/2020	WV33200806-	0.0003 U	0.0003 U	0.0398	0.042	0.0252	0.025	0.0001 U	0.0001 U	5E-05 U	5E-05 U	61.1	61.4	0.0002 U	0.0002 U	0.00122	0.00123	0.0002 U	0.0002 U	6.43	6.5	0.0001 U	0.0001 U
MW-33	11/18/2020	WV33201118-	0.0003 U	0.0003 U	0.0408	0.0419	0.0202	0.0229	0.0001 U	0.0001 U	5E-05 U	5E-05 U	57.8	60.2	0.0002 U	0.0002 U	0.00108	0.00113	0.0002 U	0.0002 U	5.77	5.87	0.0001 U	0.0001 U
MW-35	1/30/2020	WV35200130-	0.0003 U	0.0003 U	0.0284	0.0312	0.0232	0.0504	0.0001 U	0.0001 U	5E-05 U	0.0000695	65.1	66.9	0.0002 U	0.000638	0.00184	0.00352	0.0002 U	0.004	13.6	17.3	0.0001 U	0.00218
MW-35	5/28/2020	WV35200528-	0.0003 U	0.0003 U	0.0279	0.0304	0.0225	0.0566	0.0001 U	0.0001 U	5E-05 U	5E-05 U	62.7</											

Table H-5 (continued)  
 Groundwater - Metals (Dissolved & Total)

Groundwater - Metals (Dissolved & Total)			Magnesium, Dissolved (mg/L)	Magnesium, Total (mg/L)	Manganese, Dissolved (mg/L)	Manganese, Total (mg/L)	Mercury, Dissolved (mg/L)	Mercury, Total (mg/L)	Nickel, Dissolved (mg/L)	Nickel, Total (mg/L)	Potassium, Dissolved (mg/L)	Potassium, Total (mg/L)	Selenium, Dissolved (mg/L)	Selenium, Total (mg/L)	Silver, Dissolved (mg/L)	Silver, Total (mg/L)	Sodium, Dissolved (mg/L)	Sodium, Total (mg/L)	Thallium, Dissolved (mg/L)	Thallium, Total (mg/L)	Vanadium, Dissolved (mg/L)	Vanadium, Total (mg/L)	Zinc, Dissolved (mg/L)	Zinc, Total (mg/L)
<b>Channel Cc1</b>																								
MW-3	1/27/2020	WV3-200127-	2.48	2.54	0.000708	0.0357	5E-05 U	5E-05 U	0.000234	0.000752	2.3	2.25	0.0005 U	0.0005 U	4E-05 U	4E-05 U	3.81	3.72	0.0001 U	0.0001 U	0.000365	0.000812 D	0.000779	0.00146
MW-3	5/19/2020	WV3-200519-	2.75	2.72	0.000519	0.00148	5E-05 DU	5E-05 U	0.000376	0.000387	1.39	1.39	0.0005 U	0.0005 U	4E-05 U	4E-05 U	2.4	2.34	0.0001 U	0.0001 U	0.000233	0.000165	0.000546	0.000726
MW-3*	8/3/2020	WV3-200803-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-3*	11/16/2020	WV3/201116-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-4	1/29/2020	WV4-200129-	8.45	8.86	0.0047	0.0185	5E-05 U	5E-05 U	0.00105	0.00139	0.942	1	0.0005 U	0.000502	4E-05 U	4E-05 U	5.95	6.4	0.0001 U	0.0001 U	0.00238	0.00243	0.0102	0.000677
MW-4	5/19/2020	WV4-200519-	12.2	11.9	0.00188	0.00735	5E-05 DU	5E-05 U	0.000721	0.000979	1.14	1.13	0.0005 U	0.000505	4E-05 U	4E-05 U	7.4	7.26	0.0001 U	0.0001 U	0.00294	0.00274	0.0005 U	0.0005 U
MW-4	8/3/2020	WV4-200803-	11.7	12.3	0.00105	0.00881	5E-05 U	5E-05 U	0.000717	0.00108	1.1	1.12	0.0005 U	0.0005 U	4E-05 U	4E-05 U	7.19	7.3	0.0001 U	0.0001 U	0.00247	0.00259 D	0.0005 U	0.000891
MW-4	11/18/2020	WV4-201118-	9.05	9.51	0.00325	0.00476	5E-05 U	5E-05 U	0.000709	0.000866	0.937	1.02	0.000579	0.000611	4E-05 U	4E-05 U	7.56	7.71	0.0001 U	0.0001 U	0.00247	0.00258	0.0005 U	0.0005 U
MW-10	1/27/2020	WV10200127-	9.15	9.24	0.000284	0.000875	5E-05 U	5E-05 U	0.00031	0.000339	1.5	1.49	0.0005 U	0.0005 U	4E-05 U	0.000041	4.9	4.92	0.0001 U	0.0001 U	0.00428	0.00414 D	0.00075	0.000676
MW-10	5/19/2020	WV10200519-	9.4	9.31	0.0001 U	0.000166	5E-05 DU	5E-05 U	0.000277	0.000285	1.48	1.48	0.0005 U	0.0005 U	4E-05 U	4E-05 U	5.09	5.07	0.0001 U	0.0001 U	0.00428	0.00414	0.0005 U	0.0005 U
MW-10	8/3/2020	WV10200803-	9.37	9.46	0.0001 U	0.000109	5E-05 U	5E-05 U	0.000306	0.000318	1.51	1.51	0.0005 U	0.0005 U	4E-05 U	4E-05 U	5.21	5.3	0.0001 U	0.0001 U	0.00381	0.00413 D	0.0005 U	0.0005 U
MW-10	11/16/2020	WV10201116-	9.44	9.41	0.0001 U	0.000116	5E-05 U	5E-05 U	0.000334	0.00049	1.39	1.41	0.0005 U	0.0005 U	4E-05 U	4E-05 U	5.34	5.11	0.0001 U	0.0001 U	0.00398	0.00405	0.0005 U	0.0014
MW-13	1/27/2020	WV13200127-	10.3	10.4	0.0001 U	0.000983	5E-05 U	5E-05 U	0.000927	0.00102	1.73	1.73	0.0005 U	0.0005 U	4E-05 U	4E-05 U	5.78	5.87	0.0001 U	0.0001 U	0.00678	0.00653 D	0.000546	0.00099
MW-13	5/27/2020	WV13200527-	10.2	10.4	0.000293	0.000389	5E-05 U	5E-05 U	0.00095	0.000974	1.71	1.55	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6	6.04	0.0001 U	0.0001 U	0.0065	0.00658	0.00108	0.0005 U
MW-13	8/5/2020	WV13200805-	11.5	11.1	0.000522	0.000679	5E-05 U	5E-05 U	0.00103	0.00105	1.78	1.75	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.38	6.44	0.0001 U	0.0001 U	0.00602 D	0.00613 D	0.0005 U	0.0005 U
MW-13	11/16/2020	WV13201116-	10.4	9.99	0.0001 U	0.000174	5E-05 U	5E-05 U	0.000934	0.000912	1.63	1.58	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.3	5.95	0.0001 U	0.0001 U	0.00685	0.00682	0.0005 U	0.0005 U
<b>Channel Cc2</b>																								
MW-2	1/30/2020	WV2-200130-	23.1	22.9	0.077	0.0958	5E-05 U	5E-05 U	0.00304	0.00294	2.16	2.24	0.0005 U	0.0005 U	4E-05 U	4E-05 U	8.85	8.88	0.0001 U	0.0001 U	0.00336	0.00331	0.000596	0.000834
MW-2	5/27/2020	WV2-200527-	23.3	23.1	0.0662	0.0719	5E-05 U	5E-05 U	0.00241	0.00225	2.25	2.3	0.0005 U	0.0005 U	4E-05 U	4E-05 U	9.12	8.99	0.0001 U	0.0001 U	0.00291	0.00285	0.00124	0.000833
MW-2	8/6/2020	WV2-200806-	23.8	22.9	0.0987	0.107	5E-05 U	5E-05 U	0.00338	0.0035	2.3	2.21	0.0005 U	0.0005 U	4E-05 U	4E-05 U	9.67	9.29	0.0001 U	0.0001 U	0.0034	0.00324	0.0005 U	0.00295
MW-2	11/18/2020	WV2-201118-	23.4	23.5	0.0181	0.0183	5E-05 U	5E-05 U	0.00103	0.001	2.06	2.21	0.0005 U	0.0005 U	4E-05 U	4E-05 U	9.28	9.23	0.0001 U	0.0001 U	0.0027	0.00269	0.00114	0.0005 U
MW-9	1/30/2020	WV9-200130-	10.3	10.3	0.0001 U	0.00037	5E-05 U	5E-05 U	0.000136	0.000387	2	2.11	0.0005 U	0.0005 U	4E-05 U	4E-05 U	5.62	5.76	0.0001 U	0.0001 U	0.00486	0.00514	0.000746	0.00201
MW-9	5/28/2020	WV9-200528-	11.5	11.4	0.0001 U	0.000176	5E-05 DU	5E-05 U	0.000137	0.000151	2.2	2.02	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.13	6.2	0.0001 U	0.0001 U	0.00488	0.0048	0.000938	0.000636
MW-9	8/5/2020	WV9-200805-	12.3	11.8	0.0001 U	0.00129	5E-05 U	5E-05 U	0.000212	0.000332	2.29	2.25	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.49	6.45	0.0001 U	0.0001 U	0.00484 D	0.00486 D	0.0005 U	0.000577
MW-9	11/16/2020	WV9-201116-	11	11.1	0.0001 U	0.000772	5E-05 U	5E-05 U	0.000133	0.000179	2.05	2.09	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.13	6.08	0.0001 U	0.0001 U	0.00485	0.00493	0.0005 U	0.0005 U
MW-20	1/30/2020	WV20200130-	12	11.7	0.145	0.159	5E-05 U	5E-05 U	0.000167	0.000239	2.05	2.08	0.0005 U	0.0005 U	4E-05 U	4E-05 U	5.86	5.95	0.0001 U	0.0001 U	0.00126	0.00144	0.0005 U	0.00144
MW-20	5/28/2020	WV20200528-	11.5	12.2	0.143	0.142	5E-05 DU	5E-05 U	0.000144	0.000302	2.12	1.91	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.08	6.47	0.0001 U	0.0001 U	0.00188	0.00138	0.000885	0.000522
MW-20	8/6/2020	WV20200806-	11.7	12	0.144	0.149	5E-05 U	5E-05 U	0.000142	0.000161	2.19	2.22	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.16	6.38	0.0001 U	0.0001 U	0.00203	0.00217	0.0005 U	0.0005 U
MW-20	11/18/2020	WV20201118-	11.7	12.3	0.136	0.14	5E-05 U	5E-05 U	0.000177	0.000209	1.99	2.1	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.12	6.23	0.0001 U	0.0001 U	0.00143	0.00168	0.0005 U	0.0005 U
MW-21	1/30/2020	WV21200130-	20.3	20.5	0.337	0.479	5E-05 U	5E-05 U	0.00179	0.00206	2.28	2.33	0.0005 U	0.0005 U	4E-05 U	4E-05 U	10.2	10.3	0.0001 U	0.0001 U	0.000551	0.00104	0.0011	0.00102
MW-21	5/28/2020	WV21200528-	19.7	20	0.464	0.532	5E-05 DU	5E-05 U	0.00183	0.00193	2.25	2.11	0.0005 U	0.0005 U	4E-05 U	4E-05 U	10.7	10.7	0.0001 U	0.0001 U	0.000617	0.000764	0.000798	0.000598
MW-21	8/6/2020	WV21200806-	20.9	20.7	0.436	0.477	5E-05 U	5E-05 U	0.00207	0.00219	2.37	2.4	0.0005 U	0.0005 U	4E-05 U	4E-05 U	10.9	10.8	0.0001 U	0.0001 U	0.000685	0.000879	0.0005 U	0.000564
MW-21	12/21/2020	WV21201221-	21.5	21.8	0.239	0.387	5E-05 U	5E-05 U	0.0017	0.00199	2.27	2.45	0.0005 U	0.0005 U	4E-05 U	4E-05 U	9.88	9.81	0.0001 U	0.0001 U	0.000611	0.00113	0.0005 U	0.000926
MW-33	1/30/2020	WV33200130-	49.5	50.7	1.04	1.07	5E-05 U	5E-05 U	0.00528	0.00544	3.36	3.42	0.0005 U	0.0005 U	4E-05 U	4E-05 U	17.9	18.2	0.0001 U	0.0001 U	0.00065	0.000674	0.000633	0.0005 U
MW-33	5/27/2020	WV33200527-	49.2	49.8	0.959	0.974	5E-05 U	5E-05 U	0.00552	0.00544	3.42	3.5	0.0005 U	0.0005 U	4E-05 U	4E-05 U	18.5	18.5	0.0001 U	0.0001 U	0.000658	0.000667	0.000846	0.0005 U
MW-33	8/6/2020	WV33200806-	49.7	49.5	0.917	0.925	5E-05 U	5E-05 U	0.00552	0.00558	3.38	3.37	0.0005 U	0.0005 U	4E-05 U	4E-05 U	18.9	18.9	0.0001 U	0.0001 U	0.000668	0.000713	0.0005 U	0.0005 U
MW-33	11/18/2020	WV33201118-	45.1	46.2	0.887	0.901	5E-05 U	5E-05 U	0.00507	0.0053	3.04	3.27	0.0005 U	0.0005 U	4E-05 U	4E-05 U	17.8	18	0.0001 U	0.0001 U	0.000674	0.000702	0.0005 U	0.000592
MW-35	1/30/2020	WV35200130-	42.6	43.6	2.47	2.51	5E-05 U	5E-05 U	0.00319	0.0116	3.19	3.53	0.0005 U	0.0005 U	4E-05 U	4E-05 U	16.3	16.7	0.0001 U	0.0001 U	0.000255	0.00544	0.00207	0.0493
MW-35	5/28/2020	WV35200528-	42.8	46.1	2.25	2.52	5E-05 U	5E-05 U	0.00325	0.0212	3.13	3.37	0.0005 U	0.000639	4E-05 U	4E-05 U	16.7	17.5	0.0001 U	0.0001 U	0.00024	0.0101	0.00176	0.0362
MW-35	8/6/2020	WV35200806-	43.4	44.3	2.3	2.34	5E-05 U	5E-05 U	0.00342	0.00624	3.33	3.36	0.0005 U	0.0005 U	4E-05 U	4E-05 U	17.6	17.8	0.0001 U	0.0				

Table H-5 (continued)  
 Groundwater - Metals (Dissolved & Total)

Groundwater - Metals (Dissolved & Total)			Antimony, Dissolved (mg/L)	Antimony, Total (mg/L)	Arsenic, Dissolved (mg/L)	Arsenic, Total (mg/L)	Barium, Dissolved (mg/L)	Barium, Total (mg/L)	Beryllium, Dissolved (mg/L)	Beryllium, Total (mg/L)	Cadmium, Dissolved (mg/L)	Cadmium, Total (mg/L)	Calcium, Dissolved (mg/L)	Calcium, Total (mg/L)	Chromium, Dissolved (mg/L)	Chromium, Total (mg/L)	Cobalt, Dissolved (mg/L)	Cobalt, Total (mg/L)	Copper, Dissolved (mg/L)	Copper, Total (mg/L)	Iron, Dissolved (mg/L)	Iron, Total (mg/L)	Lead, Dissolved (mg/L)	Lead, Total (mg/L)
<b>Channel Cc3</b>			<b>Channel Cc3</b>																					
MW-8	1/27/2020	WV8-200127-	0.0003 U	0.0003 U	0.000492	0.000512	0.00363	0.0037	0.0001 U	0.0001 U	5E-05 U	5E-05 U	12.2	11.9	0.00227	0.00228	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.024	0.0001 U	0.0001 U
MW-8	5/19/2020	WV8-200519-	0.0003 U	0.0003 U	0.000522	0.000482	0.0039	0.00376	0.0001 U	0.0001 U	5E-05 U	5E-05 U	11.8	11.8	0.00226	0.00222	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-8	8/3/2020	WV8-200803-	0.0003 U	0.0003 U	0.000517	0.000523	0.00365	0.00356	0.0001 U	0.0001 U	5E-05 U	5E-05 U	11.7	11.6	0.0019	0.00186	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-8	11/16/2020	WV8-201116-	0.0003 U	0.0003 U	0.000491	0.000494	0.00391	0.00383	0.0001 U	0.0001 U	5E-05 U	5E-05 U	11.9	11.6	0.002	0.00198	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-36	1/28/2020	WV36200128-	0.0003 U	0.0003 U	0.00183	0.00184	0.00759	0.00761	0.0001 U	0.0001 U	5E-05 U	5E-05 U	13.7	13.7	0.000558	0.000575	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-36	5/28/2020	WV36200528-	0.0003 U	0.0003 U	0.00187	0.00181	0.00697	0.00684	0.0001 U	0.0001 U	5E-05 U	5E-05 U	13.8	13.6	0.000577	0.000566	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-36	8/3/2020	WV36200803-	0.0003 U	0.0003 U	0.00188	0.00188	0.00768	0.00747	0.0001 U	0.0001 U	5E-05 U	5E-05 U	13.7	13.9	0.000524	0.000541	5E-05 U	5E-05 U	0.00034	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-36	11/16/2020	WV36201116-	0.0003 U	0.0003 U	0.00171	0.00171	0.0076	0.0098	0.0001 U	0.0001 U	5E-05 U	5E-05 U	14	13.4	0.000549	0.000695	5E-05 U	0.000729	0.0002 U	0.000377	0.01 U	0.113	0.0001 U	0.0001 U
<b>Unit D Aquifer</b>			<b>Unit D Aquifer</b>																					
MW-7	1/28/2020	WV7-200128-	0.0003 U	0.0003 U	0.00493	0.00507	0.0118	0.0144	0.0001 U	0.0001 U	5E-05 U	5E-05 U	15.8	15.8	0.0002 U	0.0002 U	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.015	0.0852	0.0001 U	0.0001 U
MW-7	5/27/2020	WV7-200527-	0.0003 U	0.0003 U	0.00477	0.00517	0.0133	0.0136	0.0001 U	0.0001 U	5E-05 U	5E-05 U	15.4	15.9	0.0002 U	0.000204	5E-05 U	5E-05 U	0.0002 U	0.000363	0.018	0.151	0.0001 U	0.0001 U
MW-7	5/27/2020	WV7-200527D	0.0003 U	0.0003 U	0.00476	0.00524	0.0133	0.0136	0.0001 U	0.0001 U	5E-05 U	5E-05 U	15.4	15.7	0.0002 U	0.0002 U	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.0181	0.152	0.0001 U	0.0001 U
MW-7	8/5/2020	WV7-200805-	0.0003 U	0.0003 U	0.00479	0.00541	0.0127	0.0155	0.0001 U	0.0001 U	5E-05 U	5E-05 U	16	16	0.0002 U	0.0002 U	5E-05 U	0.0000695	0.0002 U	0.0002 U	0.0121	0.193	0.0001 U	0.0001 U
MW-7	11/16/2020	WV7-201116-	0.0003 U	0.0003 U	0.00482	0.00524	0.0128	0.016	0.0001 U	0.0001 U	5E-05 U	5E-05 U	15.3	15.5	0.0002 U	0.0002 U	5E-05 U	0.0000659	0.0002 U	0.0002 U	0.0427	0.191	0.0001 U	0.0001 U
MW-7	11/16/2020	WV7-201116D	0.0003 U	0.0003 U	0.00493	0.00529	0.0123	0.0162	0.0001 U	0.0001 U	5E-05 U	5E-05 U	15.7	15.3	0.0002 U	0.0002 U	5E-05 U	0.0000604	0.0002 U	0.0002 U	0.048	0.19	0.0001 U	0.0001 U
MW-12	1/27/2020	WV12200127-	0.0003 U	0.0003 U	0.00201	0.00201	0.00464	0.0039	0.0001 U	0.0001 U	5E-05 U	5E-05 U	11.7	11.6	0.00381	0.00382	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.015	0.0001 U	0.0001 U
MW-12	5/27/2020	WV12200527-	0.0003 U	0.0003 U	0.00202	0.00201	0.00479	0.00458	0.0001 U	0.0001 U	5E-05 U	5E-05 U	11.6	11.8	0.00383	0.00392	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-12	8/3/2020	WV12200803-	0.0003 U	0.0003 U	0.00205	0.00206	0.00465	0.00471	0.0001 U	0.0001 U	5E-05 U	5E-05 U	11.8	11.5	0.00389	0.00393	5E-05 U	5E-05 U	0.000355	0.0002 U	0.01 U	0.0158	0.0001 U	0.0001 U
MW-12	11/16/2020	WV12201116-	0.0003 U	0.0003 U	0.00202	0.00203	0.00454	0.00493	0.0001 U	0.0001 U	5E-05 U	5E-05 U	11.4	11.3	0.00389	0.00391	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.0536	0.0001 U	0.0001 U
MW-19	1/28/2020	WV19200128-	0.0003 U	0.0003 U	0.00105	0.00127	0.0156	0.0168	0.0001 U	0.0001 U	5E-05 U	5E-05 U	15	15	0.0002 U	0.0002 U	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.0426	0.287	0.0001 U	0.0001 U
MW-19	1/28/2020	WV19200128D	0.0003 U	0.0003 U	0.00104	0.00129	0.0151	0.0173	0.0001 U	0.0001 U	5E-05 U	5E-05 U	15	15	0.0002 U	0.0002 U	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.0424	0.304	0.0001 U	0.0001 U
MW-19	5/28/2020	WV19200528-	0.0003 U	0.0003 U	0.001	0.00151	0.0154	0.0172	0.0001 U	0.0001 U	5E-05 U	5E-05 U	14.8	15.2	0.0002 U	0.0002 U	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.0474	0.568	0.0001 U	0.0001 U
MW-19	8/5/2020	WV19200805-	0.0003 U	0.0003 U	0.00107	0.00168	0.0157	0.0183	0.0001 U	0.0001 U	5E-05 U	5E-05 U	15.2	15.1	0.0002 U	0.0002 U	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.0592	0.893	0.0001 U	0.0001 U
MW-19	11/16/2020	WV19201116-	0.0003 U	0.0003 U	0.000979	0.00115	0.0161	0.0188	0.0001 U	0.0001 U	5E-05 U	5E-05 U	14.9	14.9	0.0002 U	0.0002 U	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.0546	0.218	0.0001 U	0.0001 U
MW-26	1/28/2020	WV26200128-	0.0003 U	0.0003 U	0.00294	0.00353	0.00908	0.0113	0.0001 U	0.0001 U	5E-05 U	5E-05 U	17.4	17.2	0.0002 U	0.000543	5E-05 U	0.000139	0.0002 U	0.000483	0.0739	0.737	0.0001 U	0.000117
MW-26	5/27/2020	WV26200527-	0.0003 U	0.0003 U	0.00288	0.00378	0.00893	0.0113	0.0001 U	0.0001 U	5E-05 U	5E-05 U	17.1	17.5	0.0002 U	0.000919	5E-05 U	0.000162	0.0002 U	0.000722	0.0862	1.31	0.0001 U	0.000135
MW-26	8/5/2020	WV26200805-	0.0003 U	0.0003 U	0.00299	0.00398	0.00903	0.0129	0.0001 U	0.0001 U	5E-05 U	0.000052	17.2	17.3	0.0002 U	0.00042	5E-05 U	0.000173	0.0002 U	0.000283	0.0777	1.48	0.0001 U	0.000204
MW-26	8/5/2020	WV26200805D	0.0003 U	0.0003 U	0.00294	0.00387	0.00895	0.0131	0.0001 U	0.0001 U	5E-05 U	5E-05 U	17.2	17.4	0.0002 U	0.000518	5E-05 U	0.000167	0.0002 U	0.000291	0.0743	1.36	0.0001 U	0.00016
MW-26	11/18/2020	WV26201118-	0.0003 U	0.0003 U	0.00288	0.00345	0.00858	0.0124	0.0001 U	0.0001 U	5E-05 U	5E-05 U	16.8	17.2	0.0002 U	0.000302	5E-05 U	0.0000875	0.0002 U	0.000201	0.091	0.813	0.0001 U	0.0001 U
MW-29	1/28/2020	WV29200128-	0.0003 U	0.0003 U	0.00396	0.0105	0.01	0.0138	0.0001 U	0.0001 U	5E-05 U	5E-05 U	20.1	20	0.0002 U	0.000226	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.806	3.54	0.0001 U	0.0001 U
MW-29	5/28/2020	WV29200528-	0.0003 U	0.0003 U	0.00391	0.00698	0.0101	0.0107	0.0001 U	0.0001 U	5E-05 U	5E-05 U	19.5	19.7	0.0002 U	0.0002 U	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.796	2.28	0.0001 U	0.0001 U
MW-29	8/5/2020	WV29200805-	0.0003 U	0.0003 U	0.00422	0.0125	0.0108	0.0147	0.0001 U	0.0001 U	5E-05 U	5E-05 U	21.1	20.7	0.0002 U	0.0002 U	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.826	4.39	0.0001 U	0.0001 U
MW-29	11/18/2020	WV29201118-	0.0003 U	0.0003 U	0.0041	0.00778	0.00867	0.0132	0.0001 U	0.0001 U	5E-05 U	5E-05 U	18.9	19.5	0.0002 U	0.0002 U	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.88	2.39	0.0001 U	0.0001 U
MW-34	1/28/2020	WV34200128-	0.0003 U	0.0003 U	0.0013	0.00131	0.00427	0.00461	0.0001 U	0.0001 U	5E-05 U	5E-05 U	13.3	13.4	0.00104	0.00116	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-34	5/28/2020	WV34200528-	0.0003 U	0.0003 U	0.00129	0.00131	0.00426	0.004	0.0001 U	0.0001 U	5E-05 U	5E-05 U	13.5	13.6	0.00104	0.00104	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-34	8/5/2020	WV34200805-	0.0003 U	0.0003 U	0.00132	0.00131	0.00446	0.00446	0.0001 U	0.0001 U	5E-05 U	5E-05 U	13.6	13.7	0.000999	0.00104	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
MW-34	11/18/2020	WV34201118-	0.0003 U	0.0003 U	0.00128	0.00131	0.00399	0.00462	0.0001 U	0.0001 U	5E-05 U	5E-05 U	13.1	13.3	0.00094	0.00103	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U
<b>Field Blanks</b>			<b>Field Blanks</b>																					
FIELD BLANK	1/27/2020	WV8-200127F	0.0003 U	0.0003 U	5E-05 U	5E-05 U	0.0005 U	0.0005 U	0.0001 U	0.0001 U	5E-05 U	5E-05 U	0.05 U	0.05 U	0.0002 U	0.0002 U	5							

Table H-5 (continued)  
Groundwater - Metals (Dissolved & Total)

Groundwater - Metals (Dissolved & Total)			Magnesium, Dissolved (mg/L)	Magnesium, Total (mg/L)	Manganese, Dissolved (mg/L)	Manganese, Total (mg/L)	Mercury, Dissolved (mg/L)	Mercury, Total (mg/L)	Nickel, Dissolved (mg/L)	Nickel, Total (mg/L)	Potassium, Dissolved (mg/L)	Potassium, Total (mg/L)	Selenium, Dissolved (mg/L)	Selenium, Total (mg/L)	Silver, Dissolved (mg/L)	Silver, Total (mg/L)	Sodium, Dissolved (mg/L)	Sodium, Total (mg/L)	Thallium, Dissolved (mg/L)	Thallium, Total (mg/L)	Vanadium, Dissolved (mg/L)	Vanadium, Total (mg/L)	Zinc, Dissolved (mg/L)	Zinc, Total (mg/L)
<b>Channel Cc3</b>																								
MW-8	1/27/2020	WV8-200127-	9.6	9.51	0.0001 U	0.00035	5E-05 U	5E-05 U	0.000633	0.000656	1.2	1.19	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.3	6.31	0.0001 U	0.0001 U	0.0026	0.00247 D	0.000586	0.0005 U
MW-8	5/19/2020	WV8-200519-	9.41	9.65	0.0001 U	0.000159	5E-05 DU	5E-05 U	0.000586	0.000611	1.16	1.18	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.53	6.5	0.0001 U	0.0001 U	0.00263	0.00245	0.000581	0.000633
MW-8	8/3/2020	WV8-200803-	9.78	9.56	0.0001 U	0.0001 U	5E-05 U	5E-05 U	0.000584	0.000586	1.18	1.15	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.84	6.78	0.0001 U	0.0001 U	0.00232	0.00242 D	0.0005 U	0.0005 U
MW-8	11/16/2020	WV8-201116-	10.2	9.68	0.0001 U	0.000163	5E-05 U	5E-05 U	0.000571	0.000601	1.17	1.13	0.0005 U	0.0005 U	4E-05 U	4E-05 U	7.05	6.7	0.0001 U	0.0001 U	0.00248	0.00246	0.0005 U	0.0005 U
MW-36	1/28/2020	WV36200128-	9.17	9.38	0.000948	0.00244	5E-05 U	5E-05 U	0.0001 U	0.000107	2.74	2.79	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.28	6.28	0.0001 U	0.0001 U	0.00206	0.0018 D	0.0005 U	0.000568
MW-36	5/28/2020	WV36200528-	9.41	9.63	0.000846	0.00323	5E-05 U	5E-05 U	0.0001 U	0.000111	2.56	2.52	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.54	6.52	0.0001 U	0.0001 U	0.0017	0.00173	0.000728	0.000942
MW-36	8/3/2020	WV36200803-	9.65	9.73	0.000639	0.00128	5E-05 U	5E-05 U	0.0001 U	0.0001 U	2.78	2.82	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.7	6.79	0.0001 U	0.0001 U	0.00172	0.00176 D	0.0005 U	0.0005 U
MW-36	11/16/2020	WV36201116-	9.89	9.73	0.000749	0.119	5E-05 U	5E-05 U	0.0001 U	0.00071	2.71	2.63	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.99	6.66	0.0001 U	0.0001 U	0.00185	0.00202	0.0005 U	0.00226
<b>Unit D Aquifer</b>																								
MW-7	1/28/2020	WV7-200128-	9.75	9.83	0.145	0.188	5E-05 U	5E-05 U	0.0001 U	0.000142	2.84	2.88	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.11	6.19	0.0001 U	0.0001 U	0.000373	0.000131 D	0.000717	0.00136
MW-7	5/27/2020	WV7-200527-	9.81	10.1	0.175	0.256	5E-05 U	5E-05 U	0.00014	0.00021	2.77	2.66	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.33	6.61	0.0001 U	0.0001 U	0.000205	0.000145	0.000715	0.0011
MW-7	5/27/2020	WV7-200527D	9.86	10.2	0.175	0.256	5E-05 U	5E-05 U	0.000242	0.000164	2.73	2.57	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.32	6.65	0.0001 U	0.0001 U	0.000208	0.000146	0.000554	0.00119
MW-7	8/5/2020	WV7-200805-	10.4	10.7	0.151	0.338	5E-05 U	5E-05 U	0.0001 U	0.000185	2.9	2.91	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.76	6.96	0.0001 U	0.0001 U	0.00019 D	0.000143 D	0.0005 U	0.00119
MW-7	11/16/2020	WV7-201116-	9.87	10	0.132	0.276	5E-05 U	5E-05 U	0.000147	0.000292	2.67	2.73	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.49	6.33	0.0001 U	0.0001 U	0.000146	0.000194	0.000663	0.00232
MW-7	11/16/2020	WV7-201116D	10.2	9.95	0.14	0.263	5E-05 U	5E-05 U	0.000168	0.000273	2.75	2.73	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.75	6.3	0.0001 U	0.0001 U	0.00016	0.000195	0.000708	0.00228
MW-12	1/27/2020	WV12200127-	9.55	9.72	0.0001 U	0.000276	5E-05 U	5E-05 U	0.00019	0.000233	1.91	1.9	0.0005 U	0.0005 U	4E-05 U	4E-05 U	5.78	5.88	0.0001 U	0.0001 U	0.00518	0.00505 D	0.0005 U	0.0005 U
MW-12	5/27/2020	WV12200527-	9.53	9.66	0.0001 U	0.000211	5E-05 U	5E-05 U	0.000177	0.000222	1.9	1.9	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.03	6.01	0.0001 U	0.0001 U	0.00504	0.00511	0.000501	0.0005 U
MW-12	8/3/2020	WV12200803-	9.6	10.1	0.0001 U	0.000267	5E-05 U	5E-05 U	0.000222	0.000275	1.94	1.87	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.25	6.23	0.0001 U	0.0001 U	0.00473	0.0051 D	0.0005 U	0.0005 U
MW-12	11/16/2020	WV12201116-	9.98	9.72	0.000105	0.00139	5E-05 U	5E-05 U	0.000184	0.000295	1.83	1.83	0.0005 U	0.0005 U	4E-05 U	0.0000484	6.31	6.02	0.0001 U	0.0001 U	0.00496	0.00512	0.0005 U	0.000521
MW-19	1/28/2020	WV19200128-	13.8	14	0.478	0.508	5E-05 U	5E-05 U	0.0001 U	0.0001 U	2.52	2.51	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.75	6.92	0.0001 U	0.0001 U	0.000331	7.5E-05 DU	0.000681	0.00057
MW-19	1/28/2020	WV19200128D	13.7	14.1	0.478	0.519	5E-05 U	5E-05 U	0.0001 U	0.0001 U	2.5	2.51	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.83	6.9	0.0001 U	0.0001 U	0.000342	7.5E-05 DU	0.000566	0.000522
MW-19	5/28/2020	WV19200528-	13.9	14.6	0.454	0.556	5E-05 U	5E-05 U	0.0001 U	0.0001 U	2.46	2.38	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.84	7.32	0.0001 U	0.0001 U	0.0000867	7.5E-05 U	0.000571	0.000535
MW-19	8/5/2020	WV19200805-	14.4	14.7	0.484	0.539	5E-05 U	5E-05 U	0.0001 U	0.000109	2.53	2.56	0.0005 U	0.0005 U	4E-05 U	4E-05 U	7.32	7.33	0.0001 U	0.0001 U	7.5E-05 DU	8.16E-05 D	0.000547	0.0005 U
MW-19	11/16/2020	WV19201116-	14.3	14.2	0.479	0.498	5E-05 U	5E-05 U	0.0001 U	0.000157	2.42	2.45	0.0005 U	0.0005 U	4E-05 U	4E-05 U	7.18	7.04	0.0001 U	0.0001 U	7.5E-05 U	0.0000993	0.0005 U	0.0005 U
MW-26	1/28/2020	WV26200128-	7.3	7.51	0.0655	0.075	5E-05 U	5E-05 U	0.000207	0.000659	3.11	3.11	0.0005 U	0.0005 U	4E-05 U	4E-05 U	8.6	8.8	0.0001 U	0.0001 U	0.000294	0.000477 D	0.00284	0.0198
MW-26	5/27/2020	WV26200527-	7.32	7.28	0.0651	0.079	5E-05 U	5E-05 U	0.00039	0.0011	2.99	2.84	0.0005 U	0.0005 U	4E-05 U	4E-05 U	8.96	8.86	0.0001 U	0.0001 U	0.000149	0.000434	0.000725	0.0198
MW-26	8/5/2020	WV26200805-	7.7	7.76	0.0611	0.0773	5E-05 U	5E-05 U	0.000162	0.000741	3.04	3.13	0.0005 U	0.0005 U	4E-05 U	4E-05 U	9.73	9.66	0.0001 U	0.0001 U	0.000193	0.000462 D	0.000545	0.0208
MW-26	8/5/2020	WV26200805D	7.67	7.47	0.0612	0.0756	5E-05 U	5E-05 U	0.000152	0.000795	3.04	3.16	0.0005 U	0.0005 U	4E-05 U	4E-05 U	9.47	9.55	0.0001 U	0.0001 U	0.000198	0.000507 D	0.000521	0.019
MW-26	11/18/2020	WV26201118-	7.37	7.58	0.0582	0.0736	5E-05 U	5E-05 U	0.000134	0.000396	2.91	3.05	0.0005 U	0.0005 U	4E-05 U	4E-05 U	9.28	9.49	0.0001 U	0.0001 U	0.000123	0.000291	0.000734	0.00892
MW-29	1/28/2020	WV29200128-	13.9	14.4	0.0884	0.114	5E-05 U	5E-05 U	0.000116	0.000247	2.25	2.24	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.46	6.44	0.0001 U	0.0001 U	0.000247	0.000173 D	0.000784	0.00111
MW-29	5/28/2020	WV29200528-	14.1	14.8	0.0914	0.101	5E-05 DU	5E-05 U	0.000113	0.00012	2.22	2.05	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.64	6.8	0.0001 U	0.0001 U	0.0000914	0.00008	0.0005 U	0.000905
MW-29	8/5/2020	WV29200805-	15.1	14.4	0.097	0.115	5E-05 U	5E-05 U	0.0001 U	0.000134	2.37	2.22	0.0005 U	0.0005 U	4E-05 U	4E-05 U	7.09	6.87	0.0001 U	0.0001 U	7.5E-05 U	0.000138	0.0005 U	0.000849
MW-29	11/18/2020	WV29201118-	14	14.7	0.0874	0.103	5E-05 U	5E-05 U	0.0001 U	0.00012	2.01	2.14	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.69	6.84	0.0001 U	0.0001 U	0.000088	0.000163	0.0005 U	0.0005 U
MW-34	1/28/2020	WV34200128-	11.6	12.3	0.000127	0.000213	5E-05 U	5E-05 U	0.00122	0.00123	1.57	1.58	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.52	6.77	0.0001 U	0.0001 U	0.00292	0.00268 D	0.000879	0.00141
MW-34	5/28/2020	WV34200528-	12	11.9	0.000245	0.000364	5E-05 U	5E-05 U	0.00118	0.00117	1.55	1.46	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.79	6.76	0.0001 U	0.0001 U	0.00267	0.0027	0.00086	0.00116
MW-34	8/5/2020	WV34200805-	12.5	12.5	0.000101	0.00017	5E-05 U	5E-05 U	0.00118	0.0012	1.63	1.6	0.0005 U	0.0005 U	4E-05 U	4E-05 U	7.37	7.18	0.0001 U	0.0001 U	0.00249	0.00273 D	0.000605	0.000589
MW-34	11/18/2020	WV34201118-	12.1	12.6	0.000105	0.000146	5E-05 U	5E-05 U	0.00117	0.00124	1.44	1.53	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.83	7.01	0.0001 U	0.0001 U	0.00271	0.0027	0.000642	0.0005 U
<b>Field Blanks</b>																								
FIELD BLANK	1/27/2020	WV8-200127F	0.05 U	0.05 U	0.0001 U	0.0001 U	5E-05 U	5E-05 U	0.0001 U	0.0001 U	0.1 U	0.1 U	0.0005 U	0.0005 U	4E-05 U	4E-05 U	0.1 U	0.1 U	0.0001 U	0.0001 U	0.000229	7.5E-05 DU	0.0005 U	0.000618
FIELD BLANK	5/27/2020	WV33200527F	0.05 U	0.05 U	0.000259	0.000135	5E-05 U	5E-05 U	0.000112	0.0001 U	0.1 U	0.1 U	0.0005 U	0.0005 U	4									

**Table H-6  
 Groundwater - Volatile Organic Compounds**

Groundwater - Volatile Organic Compounds			1,1,1,2-Tetrachloroethane	1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethane	1,2,3-Trichloropropane	1,2-Dibromo-3-Chloropropane	1,2-Dibromoethane	1,2-Dichlorobenzene	1,2-Dichloroethane	1,2-Dichloropropane	1,4-Dichlorobenzene	2-Butanone	2-Hexanone	4-Methyl-2-Pentanone	Acetone	Acrylonitrile	Benzene	Bromochloromethane	Bromodichloromethane	Bromoform	Bromomethane	Carbon Disulfide	Carbon Tetrachloride		
Well #	CAS #	Sample ID	630-20-6	71-55-6	79-34-5	79-00-5	75-34-3	75-35-4	96-18-4	96-12-8	106-93-4	95-50-1	107-06-2	78-87-5	106-46-7	78-93-3	591-78-6	108-10-1	67-64-1	107-13-1	71-43-2	74-97-5	75-27-4	75-25-2	74-83-9	75-15-0	56-23-5		
			(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	
<b>Channel Cc1</b>																													
MW-3	1/27/2020	WV3-200127-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-3	5/19/2020	WV3-200519-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-3*	8/3/2020	WV3-200803-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
MW-3*	11/16/2020	WV3201116-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
MW-4	1/29/2020	WV4-200129-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-4	5/19/2020	WV4-200519-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-4	8/3/2020	WV4-200803-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-4	11/18/2020	WV4-201118-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-10	1/27/2020	WV10200127-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-10	5/19/2020	WV10200519-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-10	8/3/2020	WV10200803-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-10	11/16/2020	WV10201116-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-13	1/27/2020	WV13200127-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-13	5/27/2020	WV13200527-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-13	8/5/2020	WV13200805-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-13	11/16/2020	WV13201116-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
<b>Channel Cc2</b>																													
MW-2	1/30/2020	WV2-200130-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-2	5/27/2020	WV2-200527-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-2	8/6/2020	WV2-200806-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-2	11/18/2020	WV2-201118-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-9	1/30/2020	WV9-200130-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-9	5/28/2020	WV9-200528-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-9	8/5/2020	WV9-200805-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-9	11/16/2020	WV9-201116-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-20	1/30/2020	WV20200130-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-20	5/28/2020	WV20200528-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-20	8/6/2020	WV20200806-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-20	11/18/2020	WV20201118-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-21	1/30/2020	WV21200130-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-21	5/28/2020	WV21200528-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-21	8/6/2020	WV21200806-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-21	12/21/2020	WV21201221-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-33	1/30/2020	WV33200130-	0.25 U	0.1 U	0.1 U	0.1 U	1.6	0.16 JT	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	7.43	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.974	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-33	5/27/2020	WV33200527-	0.25 U	0.1 U	0.1 U	0.1 U	1.54	0.159 JT	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	7.65	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	1.01	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-33	8/6/2020	WV33200806-	0.25 U	0.1 U	0.1 U	0.1 U	1.63	0.17 JT	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	7.4	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.939	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-33	11/18/2020	WV33201118-	0.25 U	0.1 U	0.1 U	0.1 U	1.9	0.189 JT	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	8.53	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	1.03	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-35	1/30/2020	WV35200130-	0.25 U	0.1 U	0.1 U	0.1 U	0.199 JT	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.469	0.1 U	1 U													

Table H-6 (continued)  
 Groundwater - Volatile Organic Compounds

Groundwater - Volatile Organic Compounds			Chloro- benzene	Chloro- dibromo- methane	Chloro- ethane	Chloroform	Chloro- methane	Cis-1,2- Dichloro- ethene	Cis-1,3- Dichloro- propene	Dibromo- methane	Dichloro- difluoro- methane	Ethyl- benzene	M & P Xylene	Methyl Iodide	Methylene Chloride	O-Xylene	Styrene	Tetra- chloroethene	Toluene	Trans-1,2- Dichloro-ethene	Trans-1,3- Dichloro- propene	Trans-1,4- Dichloro-2- Butene	Trichloro- ethene	Trichloro- fluoro-methane	Vinyl Acetate	Vinyl Chloride
CAS #	Sample Date	Sample ID	108-90-7 (µg/L)	124-48-1 (µg/L)	75-00-3 (µg/L)	67-66-3 (µg/L)	74-87-3 (µg/L)	156-59-2 (µg/L)	10061-01-5 (µg/L)	74-95-3 (µg/L)	75-71-8 (µg/L)	100-41-4 (µg/L)	MPX (µg/L)	74-88-4 (µg/L)	75-09-2 (µg/L)	95-47-6 (µg/L)	100-42-5 (µg/L)	127-18-4 (µg/L)	108-88-3 (µg/L)	156-60-5 (µg/L)	10061-02-6 (µg/L)	110-57-6 (µg/L)	79-01-6 (µg/L)	75-69-4 (µg/L)	108-05-4 (µg/L)	75-01-4 (µg/L)
			Channel Cc1																							
MW-3	1/27/2020	VV3-200127-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.103 JT	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.218	0.1 U	0.01 DU
MW-3	5/19/2020	VV3-200519-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-3*	8/3/2020	VV3-200803-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-3*	11/16/2020	VV3/201116-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-4	1/29/2020	VV4-200129-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.113 JT	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-4	5/19/2020	VV4-200519-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.576	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-4	8/3/2020	VV4-200803-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.357	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-4	11/18/2020	VV4-201118-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	1.28	0.25 U	0.1 U	0.1 U	0.441	2.03	0.1 U	2.5 U	1.12	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-10	1/27/2020	VV10200127-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 DU
MW-10	5/19/2020	VV10200519-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-10	8/3/2020	VV10200803-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-10	11/16/2020	VV10201116-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.188 JT	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-13	1/27/2020	VV13200127-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 DU
MW-13	5/27/2020	VV13200527-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-13	8/5/2020	VV13200805-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 DU
MW-13	11/16/2020	VV13201116-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
			Channel Cc2																							
MW-2	1/30/2020	VV2-200130-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	4.23	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	1.2	0.1 U	0.0445
MW-2	5/27/2020	VV2-200527-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	4.34	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.702	0.1 U	0.0555
MW-2	8/6/2020	VV2-200806-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	3.99	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.984	0.1 U	0.0757 D
MW-2	11/18/2020	VV2-201118-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	3.13	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	1.42	0.1 U	0.0235
MW-9	1/30/2020	VV9-200130-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-9	5/28/2020	VV9-200528-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-9	8/5/2020	VV9-200805-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 DU
MW-9	11/16/2020	VV9-201116-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-20	1/30/2020	VV20200130-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.311	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-20	5/28/2020	VV20200528-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.326	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-20	8/6/2020	VV20200806-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.323	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 DU
MW-20	11/18/2020	VV20201118-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.294	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U
MW-21	1/30/2020	VV21200130-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.503	0.25 U	0.1 U	2.01	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.852	0.1 U	0.0699
MW-21	5/28/2020	VV21200528-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.611	0.25 U	0.1 U	2.69	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.811	0.1 U	0.0759
MW-21	8/6/2020	VV21200806-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.528	0.25 U	0.1 U	2.41	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.734	0.1 U	0.0815 D
MW-21	12/21/2020	VV21201221-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.445	0.25 U	0.1 U	1.59	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.945	0.1 U	0.0606
MW-33	1/30/2020	VV33200130-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	31.5	0.25 U	0.1 U	4.95	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.743	0.5 U	5 U	0.1 U	0.1 U	0.1 U	25.9
MW-33	5/27/2020	VV33200527-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	31.8	0.25 U	0.1 U	6.24	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.831	0.5 U	5 U	0.166 JT	0.1 U	0.1 U	31.2
MW-33	8/6/2020	VV33200806-	0.1 U	0.5 U	0.395	0.1 U	0.25 U	33.6	0.25 U	0.1 U	6.32	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.832	0.5 U	5 U	0.153 JT	0.1 U	0.1 U	31.1 D
MW-33	11/18/2020	VV33201118-	0.1 U	0.5 U	0.313	0.1 U	0.25 U	37.8	0.25 U	0.1 U	4.07	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.923	0.5 U	5 U	0.18 JT	0.1 U	0.1 U	22.6
MW-35	1/30/2020	VV35200130-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	4.68	0.25 U	0.1 U	0.641	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.226	0.5 U	5 U	0.866	0.1 U	0.1 U	4.09
MW-35	5/28/2020	VV35200528-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	3.85	0.25 U	0.1 U	1.07	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.235	0.5 U	5 U	1.02	0.1 U	0.1 U	6.06
MW-35	8/6/2020	VV35200806-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	3.61	0.25 U	0.1 U	0.866	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.222	0.5 U	5 U	0.971	0.1 U	0.1 U	5.56 D
MW-35	12/21/2020	VV35201221-	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	2.7	0.25 U	0.1 U	0.45															



**Table H-6 (continued)**  
**Groundwater - Volatile Organic Compounds**

Groundwater - Volatile Organic Compounds			1,1,2-Tetrachloro-ethane	1,1,1-Trichloro-ethane	1,1,2,2-Tetrachloro-ethane	1,1,2-Trichloro-ethane	1,1-Dichloro-ethane	1,1-Dichloro-ethene	1,2,3-Trichloro-propane	1,2-Dibromo-3-Chloropropane	1,2-Dibromo-ethane	1,2-Dichloro-benzene	1,2-Dichloro-ethane	1,2-Dichloro-propane	1,4-Dichloro-benzene	2-Butanone	2-Hexanone	4-Methyl-2-Pentanone	Acetone	Acrylonitrile	Benzene	Bromochloro-methane	Bromo-dichloro-methane	Bromoform	Bromo-methane	Carbon Disulfide	Carbon Tetrachloride		
CAS #			630-20-6	71-55-6	79-34-5	79-00-5	75-34-3	75-35-4	96-18-4	96-12-8	106-93-4	95-50-1	107-06-2	78-87-5	106-46-7	78-93-3	591-78-6	108-10-1	67-64-1	107-13-1	71-43-2	74-97-5	75-27-4	75-25-2	74-83-9	75-15-0	56-23-5		
Well #	Sample Date	Sample ID	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	
<b>Channel C3</b>																													
MW-8	1/27/2020	WV8-200127-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-8	5/19/2020	WV8-200519-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-8	8/3/2020	WV8-200803-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-8	11/16/2020	WV8-201116-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-36	1/28/2020	WV36200128-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-36	5/28/2020	WV36200528-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-36	8/3/2020	WV36200803-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-36	11/16/2020	WV36201116-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
<b>Unit D Aquifer</b>																													
MW-7	1/28/2020	WV7-200128-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-7	5/27/2020	WV7-200527-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-7	5/27/2020	WV7-200527D	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-7	8/5/2020	WV7-200805-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1.09 JT	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-7	11/16/2020	WV7-201116-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-7	11/16/2020	WV7-201116D	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-12	1/27/2020	WV12200127-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-12	5/27/2020	WV12200527-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-12	8/3/2020	WV12200803-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-12	11/16/2020	WV12201116-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-19	1/28/2020	WV19200128-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-19	1/28/2020	WV19200128D	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-19	5/28/2020	WV19200528-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-19	8/5/2020	WV19200805-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-19	11/16/2020	WV19201116-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-26	1/28/2020	WV26200128-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-26	5/27/2020	WV26200527-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-26	8/5/2020	WV26200805-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-26	8/5/2020	WV26200805D	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-26	11/18/2020	WV26201118-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-29	1/28/2020	WV29200128-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-29	5/28/2020	WV29200528-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-29	8/5/2020	WV29200805-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-29	11/18/2020	WV29201118-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-34	1/28/2020	WV34200128-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-34	5/28/2020	WV34200528-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-34	8/5/2020	WV34200805-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.1 U	0.25 U	
MW-34	11/18/2020	WV34201118-	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U						



Table H-7  
 Groundwater - Volatile Organic Compounds Trip Blanks

Groundwater - Volatile Organic Compounds Trip Blanks			1,1,1,2-Tetrachloro-ethane 630-20-6	1,1,1-Trichloro-ethane 71-55-6	1,1,2,2-Tetrachloro-ethane 79-34-5	1,1,2-Trichloro-ethane 79-00-5	1,1-Dichloro-ethane 75-34-3	1,1-Dichloro-ethene 75-35-4	1,2,3-Trichloro-propane 96-18-4	1,2-Dibromo-3-Chloro-propane 96-12-8	1,2-Dibromo-ethane 106-93-4	1,2-Dichloro-benzene 95-50-1	1,2-Dichloro-ethane 107-06-2	1,2-Dichloro-propane 78-87-5	1,4-Dichloro-benzene 106-46-7	2-Butanone 78-93-3	2-Hexanone 591-78-6	4-Methyl-2-Pentanone 108-10-1	Acetone 67-64-1	Acrylonitrile 107-13-1	Benzene 71-43-2	Bromochloro-methane 74-97-5	Bromodichloro-methane 75-27-4	Bromofor-m 75-25-2	Bromo-methane 74-83-9	Carbon Disulfide 75-15-0	Carbon Tetrachloride 56-23-5	
Site ID	Sample Date	Sample ID	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
VOA TRIP BLANK	1/24/2020	VTRP200127X	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	1/24/2020	VTRP200127Y	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	1/24/2020	VTRP200130Y	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	1/27/2020	VTRP200128X	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	1/27/2020	VTRP200128Y	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	1/27/2020	VTRP200128Z	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	1/28/2020	VTRP200129X	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	1/28/2020	VTRP200129Y	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	1/29/2020	VTRP200130X	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	1/29/2020	VTRP200130Z	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	5/18/2020	VTRP200519X2	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	5/18/2020	VTRP200519Y	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	5/18/2020	VTRP200519Z	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	5/26/2020	VTRP200527Y	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	5/26/2020	VTRP200527Z	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	5/27/2020	VTRP200528Y	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	5/27/2020	VTRP200528Z	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	7/30/2020	VTRP200803X	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	7/30/2020	VTRP200803Y	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	7/30/2020	VTRP200803Z	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	8/4/2020	VTRP200805X	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	8/4/2020	VTRP200805Y	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	8/4/2020	VTRP200805Z	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	8/5/2020	VTRP200806Y	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	8/5/2020	VTRP200806Z	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	11/12/2020	VTRP201116X	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	11/12/2020	VTRP201116Y	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	11/12/2020	VTRP201116Z	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	11/17/2020	VTRP201118X	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	11/17/2020	VTRP201118Y	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	11/18/2020	VTRP201118Z	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	
VOA TRIP BLANK	12/21/2020	VTRP201221Y	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	

Table H-7 (continued)  
 Groundwater - Volatile Organic Compounds Trip Blanks

Groundwater - Volatile Organic Compounds Trip Blanks			Chloro- benzene 108-90- 7	Chloro- dibromo- methane 124-48-1	Chloro- ethane 75-00-3	Chloro- form 67-66-3	Chloro- methane 74-87-3	Cis-1,2- Dichloro- ethene 156-59-2	Cis-1,3- Dichloro- propane 10061-01- 5	Dibromo- methane 74-95-3	Dichloro- difluoro- methane 75-71-8	Ethylbenzene 100-41-4	M & P Xylene MPX	Methyl Iodide 74-88-4	Methylene Chloride 75-09-2	O- Xylene 95-47- 6	Styrene 100-42- 5	Tetrachloro- ethene 127-18-4	Toluene 108-88- 2	Trans-1,2- Dichloro- ethene 156-60-5	Trans-1,3- Dichloro- propane 10061-02- 6	Trans-1,4- Dichloro- butene 110-57-6	Trichloro- ethene 79-01-6	Trichloro- fluoro- methane 75-69-4	Vinyl Acetate 108-05- 4	Vinyl Chloride 75-01-4	
Site ID	Sample Date	CAS # Sample ID	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
VOA TRIP BLANK	1/24/2020	VTRP200127X	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.1 U	
VOA TRIP BLANK	1/24/2020	VTRP200127Y	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 DU	
VOA TRIP BLANK	1/24/2020	VTRP200130Y	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	1/27/2020	VTRP200128X	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 DU	
VOA TRIP BLANK	1/27/2020	VTRP200128Y	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 DU	
VOA TRIP BLANK	1/27/2020	VTRP200128Z	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 DU	
VOA TRIP BLANK	1/28/2020	VTRP200129X	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 DU	
VOA TRIP BLANK	1/28/2020	VTRP200129Y	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	1/29/2020	VTRP200130X	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	1/29/2020	VTRP200130Z	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	5/18/2020	VTRP200519X2	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	5/18/2020	VTRP200519Y	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	5/18/2020	VTRP200519Z	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	5/26/2020	VTRP200527Y	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	5/26/2020	VTRP200527Z	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	5/27/2020	VTRP200528Y	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	5/27/2020	VTRP200528Z	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	7/30/2020	VTRP200803X	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	7/30/2020	VTRP200803Y	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	7/30/2020	VTRP200803Z	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	8/4/2020	VTRP200805X	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 DU	
VOA TRIP BLANK	8/4/2020	VTRP200805Y	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 DU	
VOA TRIP BLANK	8/4/2020	VTRP200805Z	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 DU	
VOA TRIP BLANK	8/5/2020	VTRP200806Y	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 DU	
VOA TRIP BLANK	8/5/2020	VTRP200806Z	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 DU	
VOA TRIP BLANK	11/12/2020	VTRP201116X	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	11/12/2020	VTRP201116Y	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	11/12/2020	VTRP201116Z	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	11/17/2020	VTRP201118X	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	11/17/2020	VTRP201118Y	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	11/18/2020	VTRP201118Y	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
VOA TRIP BLANK	12/21/2020	VTRP201221Y	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	

## **Appendix I**

### Ion Balance Summary and Trilinear Diagrams

**Table I-1**  
**Channel Cc1: Ion Balance Summary for Groundwater**  
**January 1, 2020 - March 31, 2020**

Well #			MW-3			MW-4			MW-10			MW-13		
Sample Date			1/27/2020			1/29/2020			1/27/2020			1/27/2020		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		6.52			6.87			6.94			7.99		
Conductance	--		87			152.8			146.7			147.3		
TDS	--		66.7			127			107			111		
Calcium	40.1	2	8.39	0.4187	49.4	12.9	0.6437	39.7	9.81	0.4895	32.8	8.97	0.4476	28.1
Magnesium	24.3	2	2.48	0.2041	24.1	8.45	0.6953	42.9	9.15	0.7529	50.4	10.3	0.8476	53.3
Potassium	39.1	1	2.3	0.0588	6.9	0.942	0.0241	1.5	1.5	0.0384	2.6	1.73	0.0442	2.8
Sodium	23.0	1	3.81	0.1657	19.6	5.95	0.2588	16.0	4.9	0.2131	14.3	5.78	0.2514	15.8
Iron	55.8	2	0.005	0.0002	0.02	0.005	0.0002	0.01	0.005	0.0002	0.01	0.005	0.0002	0.01
Manganese	54.9	2	0.000708	0.0000	0.00	0.0047	0.0002	0.01	0.000284	0.0000	0.00	0.000005	0.0000	0.00
Ammonia-N	14.0	1	0.001	0.0001	0.01	0.001	0.0001	0.00	0.001	0.0001	0.00	0.001	0.0001	0.00
<b>Total Cations (meq/L)</b>			<b>0.8</b>			<b>1.6</b>			<b>1.5</b>			<b>1.6</b>		
<b>Anion Parameters</b>	<b>Molecular Weight (g/mol)</b>	<b>n</b>												
Alkalinity, Total	--		27.7			53.8			57.2			60.2		
Carbonate	60.0	2	0.006	0.0002	0.0226	0.024	0.0008	0.0468	0.030	0.0010	0.0677	0.350	0.0117	0.7637
Bicarbonate	61.0	1	33.8	0.5537	68.0	65.6	1.0750	63.0	69.7	1.1428	77.5	72.7	1.1921	77.9
Chloride	35.5	1	1.79	0.0505	6.2	7.54	0.2127	12.5	3.32	0.0936	6.4	2.9	0.0818	5.3
Nitrate-N	14.0	1	1.55	0.1107	13.581	2.05	0.1464	8.581	0.586	0.0418	2.838	0.353	0.0252	1.648
Sulfate	96.1	2	4.79	0.0997	12.2	13	0.2707	15.9	9.37	0.1951	13.2	10.5	0.2186	14.3
<b>Total Anions (meq/L)</b>			<b>0.8</b>			<b>1.7</b>			<b>1.5</b>			<b>1.5</b>		
<b>Total Ions (meq/L)</b>			<b>1.7</b>			<b>3.3</b>			<b>3.0</b>			<b>3.1</b>		
<b>Cation/Anion Ratio</b>			<b>1.04</b>			<b>0.95</b>			<b>1.01</b>			<b>1.04</b>		
<b>Percent Difference</b>			<b>1.97</b>			<b>-2.50</b>			<b>0.67</b>			<b>1.98</b>		

**Table I-1 (continued)**  
**Channel Cc1: Ion Balance Summary for Groundwater**  
**April 1, 2020 - June 30, 2020**

Well #		MW-3			MW-4			MW-10			MW-13			
Sample Date		5/19/2020			5/19/2020			5/19/2020			5/27/2020			
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		5.94			6.6			7.29			6.98		
Conductance	--		60.5			221.1			146.9			137.3		
TDS	--		56			168			113			109		
Calcium	40.1	2	6.69	0.3338	47.7	17.8	0.8882	39.6	9.88	0.4930	32.3	8.8	0.4391	27.7
Magnesium	24.3	2	2.75	0.2263	32.3	12.2	1.0039	44.7	9.4	0.7735	50.7	10.2	0.8393	53.0
Potassium	39.1	1	1.39	0.0356	5.1	1.14	0.0292	1.3	1.48	0.0379	2.5	1.71	0.0437	2.8
Sodium	23.0	1	2.4	0.1044	14.9	7.4	0.3219	14.3	5.09	0.2214	14.5	6	0.2610	16.5
Iron	55.8	2	0.005	0.0002	0.03	0.005	0.0002	0.01	0.005	0.0002	0.01	0.005	0.0002	0.01
Manganese	54.9	2	0.000519	0.00002	0.003	0.000188	0.00001	0.0003	0.00005	0.000002	0.0001	0.000293	0.0000	0.00
Ammonia-N	14.0	1	0.0024	0.0002	0.02	0.001	0.00007	0.0032	0.001	0.0001	0.0047	0.001	0.0001	0.005
<b>Total Cations (meq/L)</b>			<b>0.7</b>			<b>2.2</b>			<b>1.5</b>			<b>1.6</b>		
<b>Anion Parameters</b>		<b>Molecular Weight (g/mol)</b>												
Alkalinity, Total	--		24.0			66.5			56.7			58.3		
Carbonate	59.9992	2	0.0013	0.00004	0.0067	0.0159	0.0005	0.0250	0.066	0.002	0.153	0.033	0.001	0.076
Bicarbonate	61.0092	1	29.277	0.480	76.417	81.098	1.329	62.573	69.039	1.132	78.280	71.058	1.165	79.824
Chloride	35.5	1	1.000	0.028	4.492	8.930	0.252	11.857	3.140	0.089	6.127	2.620	0.074	5.065
Nitrate-N	14.0	1	0.308	0.022	3.502	2.06	0.147	6.923	0.528	0.038	2.608	0.346	0.025	1.693
Sulfate	96.1	2	4.7	0.098	15.6	19	0.396	18.6	8.91	0.186	12.8	9.35	0.195	13.3
<b>Total Anions (meq/L)</b>			<b>0.6</b>			<b>2.1</b>			<b>1.4</b>			<b>1.5</b>		
<b>Total Ions (meq/L)</b>			<b>1.3</b>			<b>4.4</b>			<b>3.0</b>			<b>3.0</b>		
<b>Cation/Anion Ratio</b>			<b>1.12</b>			<b>1.06</b>			<b>1.06</b>			<b>1.09</b>		
<b>Percent Difference</b>			<b>5.45</b>			<b>2.73</b>			<b>2.71</b>			<b>4.09</b>		

**Table I-1 (continued)**  
**Channel Cc1: Ion Balance Summary for Groundwater**  
**July 1, 2020 - September 30, 2020**

Well # Sample Date	MW-4 8/3/2020			MW-10 8/3/2020			MW-13 8/5/2020					
	Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--			6.33			6.84			6.7		
Conductance	--			218.5			147.4			156.9		
TDS	--			185			115			117		
Calcium	40.1	2		17.5	0.8733	40.1	10.1	0.5040	32.7	9.13	0.4556	26.4
Magnesium	24.3	2		11.7	0.9628	44.2	9.37	0.7710	50.0	11.5	0.9463	54.9
Potassium	39.1	1		1.1	0.0281	1.3	1.51	0.0386	2.5	1.78	0.0455	2.6
Sodium	23.0	1		7.19	0.3127	14.4	5.21	0.2266	14.7	6.38	0.2775	16.1
Iron	55.8	2		0.005	0.0002	0.01	0.005	0.0002	0.01	0.005	0.0002	0.01
Manganese	54.9	2		0.00105	0.0000	0.00	0.00005	0.0000	0.00	0.000522	0.0000	0.00
Ammonia-N	14.0	1		0.0028	0.0002	0.01	0.0028	0.0002	0.01	0.001	0.0001	0.00
<b>Total Cations (meq/L)</b>				<b>2.2</b>			<b>1.5</b>			<b>1.7</b>		
<b>Anion Parameters</b>												
Alkalinity, Total	--			64			56.6			60.8		
Carbonate	60.0	2		0.008	0.0003	0.0134	0.024	0.0008	0.0543	0.018	0.0006	0.0397
Bicarbonate	61.0	1		78.1	1.2795	62.6	69.0	1.1310	78.3	74.1	1.2152	79.0
Chloride	35.5	1		9.19	0.2592	12.7	3.28	0.0925	6.4	2.75	0.0776	5.0
Nitrate-N	14.0	1		2.18	0.1556	7.620	0.458	0.0327	2.264	0.254	0.0181	1.179
Sulfate	96.1	2		16.7	0.3477	17.0	8.99	0.1872	13.0	10.9	0.2269	14.8
<b>Total Anions (meq/L)</b>				<b>2.0</b>			<b>1.4</b>			<b>1.5</b>		
<b>Total Ions (meq/L)</b>				<b>4.2</b>			<b>3.0</b>			<b>3.3</b>		
<b>Cation/Anion Ratio</b>				<b>1.07</b>			<b>1.07</b>			<b>1.12</b>		
<b>Percent Difference</b>				<b>3.20</b>			<b>3.23</b>			<b>5.72</b>		

NOTE: The water level at MW-3 was below the bottom of the pump – no samples were collected.

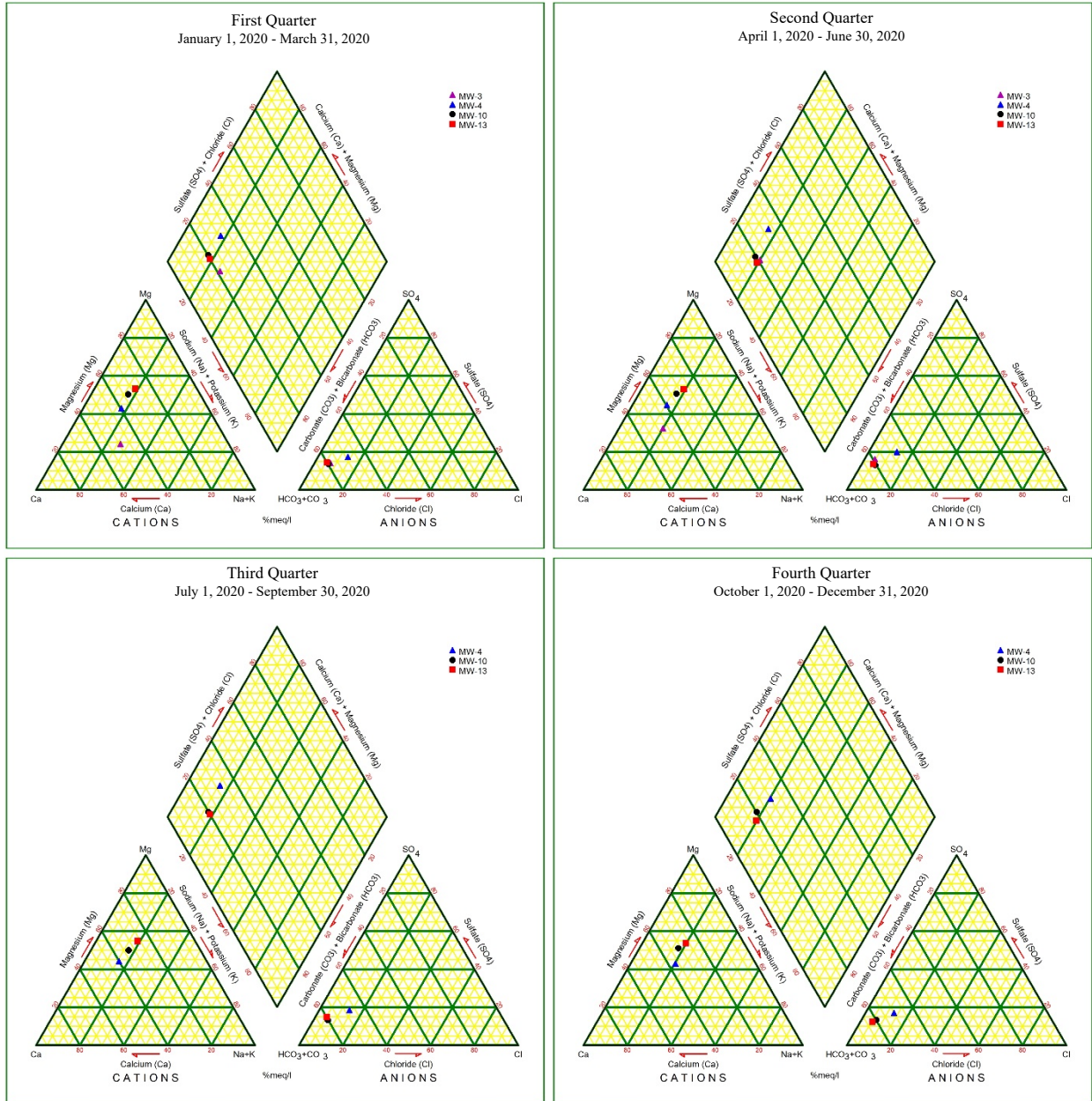


**Table I-1 (continued)**  
**Channel Cc1: Ion Balance Summary for Groundwater**  
**October 1, 2020 - December 31, 2020**

Well #			MW-4			MW-10			MW-13		
Sample Date			11/18/2020			11/16/2020			11/16/2020		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		6.42			7.19			6.87		
Conductance	--		169.7			133.7			133.7		
TDS	--		147			94.7			101		
Calcium	40.1	2	12.7	0.6337	36.6	9.52	0.4750	31.3	8.47	0.4227	26.5
Magnesium	24.3	2	9.05	0.7447	43.0	9.44	0.7768	51.1	10.4	0.8558	53.7
Potassium	39.1	1	0.937	0.0240	1.4	1.39	0.0356	2.3	1.63	0.0417	2.6
Sodium	23.0	1	7.56	0.3288	19.0	5.34	0.2323	15.3	6.3	0.2740	17.2
Iron	55.8	2	0.005	0.0002	0.01	0.005	0.0002	0.01	0.005	0.0002	0.01
Manganese	54.9	2	0.00325	0.0001	0.01	0.00005	0.0000	0.00	0.00005	0.0000	0.00
Ammonia-N	14.0	1	0.001	0.0001	0.00	0.001	0.0001	0.00	0.001	0.0001	0.00
<b>Total Cations (meq/L)</b>				<b>1.7</b>			<b>1.5</b>			<b>1.6</b>	
<b>Anion Parameters</b>	<b>Molecular Weight (g/mol)</b>	<b>n</b>									
Alkalinity, Total	--		58.2			56.5			58.1		
Carbonate	59.9992	2	0.00920428	0.00030681	0.01722996	0.05254797	0.00175162	0.12089476	0.0258842	0.00086282	0.05984621
Bicarbonate	61.0092	1	70.9852846	1.16351771	65.3405742	68.8231525	1.12807826	77.8585274	70.8293688	1.1609621	80.5258578
Chloride	35.5	1	7.68	0.2166	12.2	3.43	0.0967	6.7	2.7	0.0762	5.3
Nitrate-N	14.0	1	1.64	0.1171	6.575	0.457	0.0326	2.252	0.407	0.0291	2.015
Sulfate	96.1	2	13.6	0.2832	15.9	9.11	0.1897	13.1	8.39	0.1747	12.1
<b>Total Anions (meq/L)</b>				<b>1.8</b>			<b>1.4</b>			<b>1.4</b>	
<b>Total Ions (meq/L)</b>				<b>3.5</b>			<b>3.0</b>			<b>3.0</b>	
<b>Cation/Anion Ratio</b>				<b>0.97</b>			<b>1.05</b>			<b>1.11</b>	
<b>Percent Difference</b>				<b>-1.40</b>			<b>2.39</b>			<b>5.03</b>	

NOTE: The water level at MW-3 was below the bottom of the pump -- no samples were collected.

Figure I-1. Channel Cc1 Trilinear Diagrams  
January 1, 2020 - December 31, 2020



NOTE: Third Quarter: The water level at MW-3 was below the bottom of the pump – no samples were collected.  
Fourth Quarter: The water level at MW-3 was below the bottom of the pump – no samples were collected.

**Table I-2**  
**Channel Cc2: Ion Balance Summary for Groundwater**  
**January 1, 2020 - March 31, 2020**

Well #			MW-2			MW-9			MW-20			MW-21			MW-33			MW-35		
Sample Date			1/30/2020			1/30/2020			1/30/2020			1/30/2020			1/30/2020			1/30/2020		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		6.94			7.16			7.53			6.94			6.89			6.78		
Conductance	--		332.3			171.8			175			332.3			713			683		
TDS	--		183			113			131			179			419			404		
Calcium	40.1	2	21.2	1.0579	31.1	12.6	0.6287	35.5	13	0.6487	33.2	20.2	1.0080	31.5	63.3	3.1587	37.7	65.1	3.2485	40.0
Magnesium	24.3	2	23.1	1.9008	55.9	10.3	0.8476	47.8	12	0.9875	50.5	20.3	1.6704	52.1	49.5	4.0732	48.6	42.6	3.5055	43.1
Potassium	39.1	1	2.16	0.0552	1.6	2	0.0512	2.9	2.05	0.0524	2.7	2.28	0.0583	1.8	3.4	0.0859	1.0	3.2	0.0816	1.0
Sodium	23.0	1	8.85	0.3850	11.3	5.62	0.2445	13.8	5.86	0.2549	13.0	10.2	0.4437	13.8	17.9	0.7786	9.3	16.3	0.7090	8.7
Iron	55.8	2	0.005	0.0002	0.01	0.005	0.0002	0.01	0.184	0.0066	0.34	0.281	0.0101	0.31	6.67	0.2389	2.85	13.60	0.4870	5.99
Manganese	54.9	2	0.077	0.0028	0.08	0.00005	0.0000	0.00	0.145	0.0053	0.27	0.337	0.0123	0.38	1.04	0.0379	0.45	2.47	0.0899	1.11
Ammonia-N	14.0	1	0.0025	0.0002	0.01	0.001	0.0001	0.00	0.0166	0.0012	0.06	0.0098	0.0007	0.02	0.03	0.0023	0.03	0.07	0.0048	0.06
<b>Total Cations (meq/L)</b>			<b>3.4</b>			<b>1.8</b>			<b>2.0</b>			<b>3.2</b>			<b>8.4</b>			<b>8.1</b>		
Anion Parameters	Molecular Weight (g/mol)	n																		
Alkalinity, Total	--		149			68.4			73.8			137			383			345		
Carbonate	60.0	2	0.078	0.0026	0.0764	0.059	0.0020	0.1137	0.150	0.0050	0.2613	0.072	0.0024	0.0762	0.179	0.0060	0.0732	0.125	0.0042	0.0553
Bicarbonate	61.0	1	181.6	2.9770	87.5	83.3	1.3658	78.5	89.7	1.4708	76.9	167.0	2.7372	87.2	466.9	7.6529	94.0	420.6	6.8948	91.5
Chloride	35.5	1	2.71	0.0764	2.2	4.34	0.1224	7.0	3.25	0.0917	4.8	2.44	0.0688	2.2	3.8	0.1083	1.3	4.4	0.1238	1.6
Nitrate-N	14.0	1	0.208	0.0148	0.437	0.329	0.0235	1.349	0.011	0.0008	0.041	0.176	0.0126	0.400	0.005	0.0004	0.004	0.005	0.0004	0.005
Sulfate	96.1	2	15.9	0.3311	9.7	10.9	0.2269	13.0	16.5	0.3435	18.0	15.2	0.3165	10.1	17.9	0.3727	4.6	24.5	0.5101	6.8
<b>Total Anions (meq/L)</b>			<b>3.4</b>			<b>1.7</b>			<b>1.9</b>			<b>3.1</b>			<b>8.1</b>			<b>7.5</b>		
<b>Total Ions (meq/L)</b>			<b>6.8</b>			<b>3.5</b>			<b>3.9</b>			<b>6.3</b>			<b>16.5</b>			<b>15.7</b>		
<b>Cation/Anion Ratio</b>			<b>1.00</b>			<b>1.02</b>			<b>1.02</b>			<b>1.02</b>			<b>1.03</b>			<b>1.08</b>		
<b>Percent Difference</b>			<b>0.00</b>			<b>0.90</b>			<b>1.16</b>			<b>1.04</b>			<b>1.42</b>			<b>3.79</b>		

**Table I-2 (continued)**  
**Channel Cc2: Ion Balance Summary for Groundwater**  
**April 1, 2020 - June 30, 2020**

Well #			MW-2			MW-9			MW-20			MW-21			MW-33			MW-35		
Sample Date			5/27/2020			5/28/2020			5/28/2020			5/28/2020			5/27/2020			5/28/2020		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		6.96			7			7.54			6.94			6.79			6.7		
Conductance	--		292.7			173.4			176.6			272.9			656			646		
TDS	--		193			131			135			182			423			436		
Calcium	40.1	2	21.8	1.0878	31.4	13.9	0.6936	35.3	13	0.6487	33.6	19.4	0.9681	30.8	61.8	3.0838	37.2	62.7	3.1287	39.0
Magnesium	24.3	2	23.3	1.9173	55.4	11.5	0.9463	48.2	11.5	0.9463	49.1	19.7	1.6211	51.5	49.2	4.0485	48.8	42.8	3.5219	43.9
Potassium	39.1	1	2.25	0.0575	1.7	2.2	0.0563	2.9	2.12	0.0542	2.8	2.25	0.0575	1.8	3.4	0.0875	1.1	3.1	0.0801	1.0
Sodium	23.0	1	9.12	0.3967	11.5	6.13	0.2666	13.6	6.08	0.2645	13.7	10.7	0.4654	14.8	18.5	0.8047	9.7	16.7	0.7264	9.1
Iron	55.8	2	0.005	0.0002	0.01	0.005	0.0002	0.01	0.219	0.0078	0.41	0.47	0.0168	0.53	6.62	0.2371	2.86	13.30	0.4763	5.94
Manganese	54.9	2	0.0662	0.0024	0.07	0.00005	0.000002	0.0001	0.143	0.0052	0.27	0.464	0.0169	0.54	0.96	0.0349	0.42	2.25	0.0819	1.02
Ammonia-N	14.0	1	0.0025	0.0002	0.005	0.001	0.0001	0.0036	0.0202	0.0014	0.07	0.0123	0.0009	0.03	0.03	0.0023	0.03	0.07	0.0047	0.06
<b>Total Cations (meq/L)</b>				<b>3.5</b>			<b>2.0</b>			<b>1.9</b>			<b>3.1</b>			<b>8.3</b>			<b>8.0</b>	
<b>Anion Parameters</b>	<b>Molecular Weight (g/mol)</b>	<b>n</b>																		
Alkalinity, Total	--		147.0			73			71.2			131.0			365.0			332.0		
Carbonate	59.9992	2	0.081	0.003	0.081	0.044	0.001	0.079	0.148	0.005	0.271	0.069	0.002	0.077	0.135	0.005	0.058	0.100	0.003	0.046
Bicarbonate	61.0092	1	179.176	2.937	88.741	88.971	1.458	78.474	86.563	1.419	77.925	159.681	2.617	88.176	445.025	7.294	94.383	404.837	6.636	91.914
Chloride	35.5	1	2.400	0.068	2.045	4.370	0.123	6.633	2.990	0.084	4.632	2.100	0.059	1.996	3.480	0.098	1.270	4.030	0.114	1.575
Nitrate-N	14.0	1	0.238	0.0170	0.513	0.444	0.0317	1.706	0.005	0.0004	0.020	0.234	0.0167	0.563	0.005	0.0004	0.005	0.005	0.0004	0.005
Sulfate	96.1	2	13.7	0.2852	8.6	11.7	0.2436	13.1	15	0.3123	17.2	13.1	0.2728	9.2	15.9	0.3311	4.3	22.4	0.4664	6.5
<b>Total Anions (meq/L)</b>				<b>3.3</b>			<b>1.9</b>			<b>1.8</b>			<b>3.0</b>			<b>7.7</b>			<b>7.2</b>	
<b>Total Ions (meq/L)</b>				<b>6.8</b>			<b>3.8</b>			<b>3.7</b>			<b>6.1</b>			<b>16.0</b>			<b>15.2</b>	
<b>Cation/Anion Ratio</b>				<b>1.05</b>			<b>1.06</b>			<b>1.06</b>			<b>1.06</b>			<b>1.07</b>			<b>1.11</b>	
<b>Percent Difference</b>				<b>2.25</b>			<b>2.74</b>			<b>2.86</b>			<b>2.92</b>			<b>3.56</b>			<b>5.25</b>	

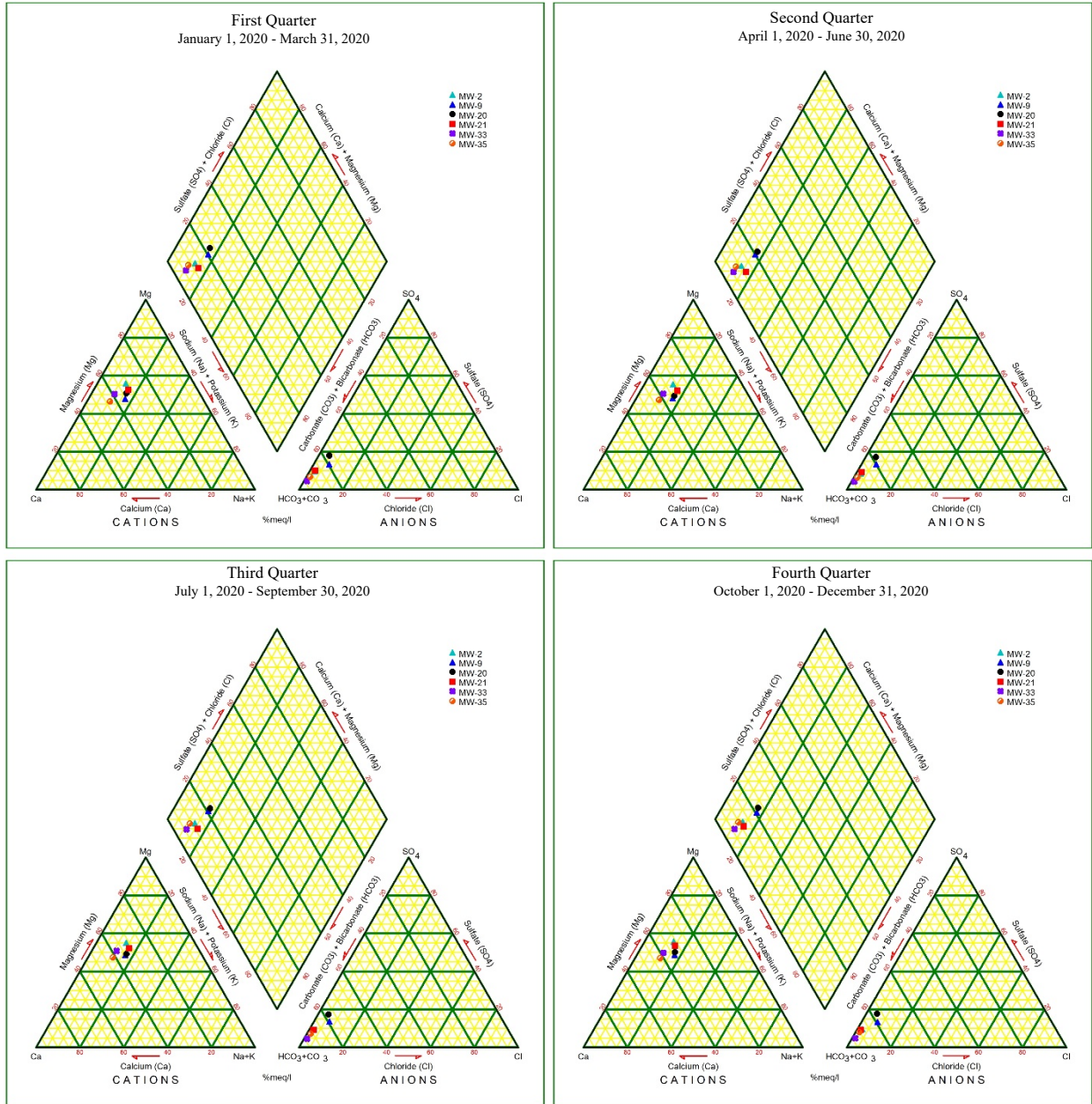
**Table I-2 (continued)**  
**Channel Cc2: Ion Balance Summary for Groundwater**  
**July 1, 2020 - September 30, 2020**

Well #			MW-2			MW-9			MW-20			MW-21			MW-33			MW-35		
Sample Date			8/6/2020			8/5/2020			8/6/2020			8/6/2020			8/6/2020			8/6/2020		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		6.78			6.93			7.5			6.72			6.63			6.48		
Conductance	--		316.3			195.7			188.6			300.1			705			686		
TDS	--		191			140			127			183			413			412		
Calcium	40.1	2	22.3	1.1128	31.3	14.6	0.7285	35.0	13.4	0.6687	33.9	20.8	1.0379	31.2	61.1	3.0489	36.7	62.3	3.1088	38.3
Magnesium	24.3	2	23.8	1.9584	55.1	12.3	1.0121	48.6	11.7	0.9628	48.8	20.9	1.7198	51.7	49.7	4.0897	49.2	43.4	3.5713	44.0
Potassium	39.1	1	2.3	0.0588	1.7	2.29	0.0586	2.8	2.19	0.0560	2.8	2.37	0.0606	1.8	3.4	0.0864	1.0	3.3	0.0852	1.1
Sodium	23.0	1	9.67	0.4206	11.8	6.49	0.2823	13.6	6.16	0.2679	13.6	10.9	0.4741	14.2	18.9	0.8221	9.9	17.6	0.7656	9.4
Iron	55.8	2	0.005	0.0002	0.01	0.005	0.0002	0.01	0.253	0.0091	0.46	0.508	0.0182	0.55	6.43	0.2303	2.77	13.70	0.4906	6.05
Manganese	54.9	2	0.0987	0.0036	0.10	0.00005	0.0000	0.00	0.144	0.0052	0.27	0.436	0.0159	0.48	0.92	0.0334	0.40	2.30	0.0837	1.03
Ammonia-N	14.0	1	0.0036	0.0003	0.01	0.001	0.0001	0.00	0.0204	0.0015	0.07	0.0123	0.0009	0.03	0.03	0.0022	0.03	0.07	0.0049	0.06
<b>Total Cations (meq/L)</b>			<b>3.6</b>			<b>2.1</b>			<b>2.0</b>			<b>3.3</b>			<b>8.3</b>			<b>8.1</b>		
<b>Anion Parameters</b>	<b>Molecular Weight (g/mol)</b>	<b>n</b>																		
Alkalinity, Total	--		144			73.8			70.9			135			354			329		
Carbonate	60.0	2	0.052	0.0017	0.0530	0.038	0.0013	0.0663	0.134	0.0045	0.2459	0.043	0.0014	0.0464	0.091	0.0030	0.0402	0.060	0.0020	0.0275
Bicarbonate	61.0	1	175.6	2.8778	87.7	90.0	1.4745	77.7	86.2	1.4133	77.6	164.6	2.6982	88.2	431.7	7.0759	94.0	401.3	6.5770	91.0
Chloride	35.5	1	2.44	0.0688	2.1	4.68	0.1320	7.0	3.1	0.0874	4.8	2.1	0.0592	1.9	3.6	0.1015	1.3	4.3	0.1224	1.7
Nitrate-N	14.0	1	0.427	0.0305	0.929	0.512	0.0366	1.926	0.005	0.0004	0.020	0.274	0.0196	0.639	0.005	0.0004	0.005	0.005	0.0004	0.005
Sulfate	96.1	2	14.5	0.3019	9.2	12.2	0.2540	13.4	15.2	0.3165	17.4	13.5	0.2811	9.2	16.7	0.3477	4.6	25.3	0.5268	7.3
<b>Total Anions (meq/L)</b>			<b>3.3</b>			<b>1.9</b>			<b>1.8</b>			<b>3.1</b>			<b>7.5</b>			<b>7.2</b>		
<b>Total Ions (meq/L)</b>			<b>6.8</b>			<b>4.0</b>			<b>3.8</b>			<b>6.4</b>			<b>15.8</b>			<b>15.3</b>		
<b>Cation/Anion Ratio</b>			<b>1.08</b>			<b>1.10</b>			<b>1.08</b>			<b>1.09</b>			<b>1.10</b>			<b>1.12</b>		
<b>Percent Difference</b>			<b>4.01</b>			<b>4.61</b>			<b>3.93</b>			<b>4.20</b>			<b>4.95</b>			<b>5.75</b>		

**Table I-2 (continued)**  
**Channel Cc2: Ion Balance Summary for Groundwater**  
**October 1, 2020 - December 31, 2020**

Well #		MW-2			MW-9			MW-20			MW-21			MW-33			MW-35			
Sample Date		11/18/2020			11/16/2020			11/18/2020			12/21/2020			11/18/2020			12/21/2020			
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		6.81			6.72			7.33			6.86			6.72			6.39		
Conductance	--		293.1			165.9			172.4			275.4			608.4			569		
TDS	--		201			120			139			191			402			460		
Calcium	40.1	2	21.5	1.0729	31.0	12.7	0.6337	34.1	12.8	0.6387	33.1	20.9	1.0429	31.5	57.8	2.8842	37.5	61.6	3.0739	38.3
Magnesium	24.3	2	23.4	1.9255	55.7	11	0.9052	48.7	11.7	0.9628	49.9	21.5	1.7692	53.4	45.1	3.7112	48.3	42.2	3.4725	43.2
Potassium	39.1	1	2.06	0.0527	1.5	2.05	0.0524	2.8	1.99	0.0509	2.6	2.27	0.0581	1.8	3.0	0.0778	1.0	3.0	0.0775	1.0
Sodium	23.0	1	9.28	0.4037	11.7	6.13	0.2666	14.3	6.12	0.2662	13.8	9.88	0.4298	13.0	17.8	0.7743	10.1	17.5	0.7612	9.5
Iron	55.8	2	0.005	0.0002	0.01	0.005	0.0002	0.01	0.183	0.0066	0.34	0.196	0.0070	0.21	5.77	0.2066	2.69	15.60	0.5587	6.95
Manganese	54.9	2	0.0181	0.0007	0.02	0.00005	0.0000	0.00	0.136	0.0050	0.26	0.239	0.0087	0.26	0.89	0.0323	0.42	2.35	0.0856	1.06
Ammonia-N	14.0	1	0.001	0.0001	0.00	0.001	0.0001	0.00	0.0149	0.0011	0.06	0.0056	0.0004	0.01	0.02	0.0011	0.01	0.06	0.0046	0.06
<b>Total Cations (meq/L)</b>				<b>3.5</b>			<b>1.9</b>			<b>1.9</b>			<b>3.3</b>			<b>7.7</b>			<b>8.0</b>	
<b>Anion Parameters</b>	<b>Molecular Weight (g/mol)</b>	<b>n</b>																		
Alkalinity, Total	--		145			69.1			73.1			139			342			309		
Carbonate	59.9992	2	0.05626888	0.00187565	0.05647413	0.02179871	0.00072663	0.04102718	0.09379267	0.00312646	0.16563057	0.06051747	0.00201728	0.06414043	0.10788944	0.00359636	0.049341	0.04560714	0.00152026	0.02222892
Bicarbonate	61.0092	1	176.785587	2.89768734	87.2465453	84.2576759	1.38106508	77.9776872	88.9912882	1.45865358	77.2750381	169.456948	2.77756384	88.3142107	417.020625	6.83537278	93.7792227	376.887265	6.17754807	90.3269116
Chloride	35.5	1	2.47	0.0697	2.1	4.53	0.1278	7.2	3.2	0.0903	4.8	2.01	0.0567	1.8	3.5	0.0976	1.3	3.9	0.1100	1.6
Nitrate-N	14.0	1	0.498	0.0356	1.070	0.397	0.0283	1.600	0.005	0.0004	0.019	0.301	0.0215	0.683	0.005	0.0004	0.005	0.005	0.0004	0.005
Sulfate	96.1	2	15.2	0.3165	9.5	11.2	0.2332	13.2	16.1	0.3352	17.8	13.8	0.2873	9.1	16.9	0.3519	4.8	26.4	0.5497	8.0
<b>Total Anions (meq/L)</b>				<b>3.3</b>			<b>1.8</b>			<b>1.9</b>			<b>3.1</b>			<b>7.3</b>			<b>6.8</b>	
<b>Total Ions (meq/L)</b>				<b>6.8</b>			<b>3.6</b>			<b>3.8</b>			<b>6.5</b>			<b>15.0</b>			<b>14.9</b>	
<b>Cation/Anion Ratio</b>				<b>1.04</b>			<b>1.05</b>			<b>1.02</b>			<b>1.05</b>			<b>1.05</b>			<b>1.17</b>	
<b>Percent Difference</b>				<b>1.98</b>			<b>2.40</b>			<b>1.14</b>			<b>2.65</b>			<b>2.66</b>			<b>8.03</b>	

Figure I-2. Channel Cc2 Trilinear Diagrams  
 January 1, 2020 - December 31, 2020



**Table I-3**  
**Channel Cc3: Ion Balance Summary for Groundwater**  
**January 1, 2020 - March 31, 2020**

Well #			MW-8			MW-36		
Sample Date			1/27/2020			1/28/2020		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		6.93			7.58		
Conductance	--		169.8			190.4		
TDS	--		125			128		
Calcium	40.1	2	12.2	0.6088	35.7	13.7	0.6836	38.4
Magnesium	24.3	2	9.6	0.7900	46.4	9.17	0.7546	42.3
Potassium	39.1	1	1.2	0.0307	1.8	2.74	0.0701	3.9
Sodium	23.0	1	6.3	0.2740	16.1	6.28	0.2732	15.3
Iron	55.8	2	0.005	0.0002	0.01	0.005	0.0002	0.01
Manganese	54.9	2	0.00005	0.000002	0.0001	0.000948	0.00003	0.002
Ammonia-N	14.0	1	0.001	0.0001	0.004	0.0034	0.0002	0.014
<b>Total Cations (meq/L)</b>			<b>1.7</b>			<b>1.8</b>		
Anion Parameters	Molecular Weight (g/mol)	n						
Alkalinity, Total	--		59.2			69.5		
Carbonate	60.0	2	0.030	0.0010	0.0595	0.158	0.0053	0.2993
Bicarbonate	61.0	1	72.2	1.1828	69.7	84.5	1.3845	78.5
Chloride	35.5	1	4.77	0.1345	7.9	3.14	0.0886	5.0
Nitrate-N	14.0	1	2.66	0.1899	11.198	0.022	0.0016	0.089
Sulfate	96.1	2	9.01	0.1876	11.1	13.6	0.2832	16.1
<b>Total Anions (meq/L)</b>			<b>1.7</b>			<b>1.8</b>		
<b>Total Ions (meq/L)</b>			<b>3.4</b>			<b>3.5</b>		
<b>Cation/Anion Ratio</b>			<b>1.00</b>			<b>1.01</b>		
<b>Percent Difference</b>			<b>0.23</b>			<b>0.53</b>		



**Table I-3 (continued)**  
**Channel Cc3: Ion Balance Summary for Groundwater**  
**April 1, 2020 - June 30, 2020**

Well #			MW-8			MW-36		
Sample Date			5/19/2020			5/28/2020		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		6.66			7.76		
Conductance	--		167.6			161		
TDS	--		124			133		
Calcium	40.1	2	11.8	0.5888	35.1	13.8	0.6886	38.0
Magnesium	24.3	2	9.41	0.7743	46.2	9.41	0.7743	42.7
Potassium	39.1	1	1.16	0.0297	1.8	2.56	0.0655	3.6
Sodium	23.0	1	6.53	0.2840	16.9	6.54	0.2845	15.7
Iron	55.8	2	0.005	0.0002	0.01	0.005	0.0002	0.01
Manganese	54.9	2	0.00005	0.000002	0.0001	0.000846	0.00003	0.002
Ammonia-N	14.0	1	0.001	0.0001	0.004	0.001	0.0001	0.004
<b>Total Cations (meq/L)</b>			<b>1.7</b>			<b>1.8</b>		
Anion Parameters	Molecular Weight (g/mol)	n						
Alkalinity, Total	--		56			68.1		
Carbonate	59.9992	2	0.015	0.001	0.032	0.234	0.008	0.455
Bicarbonate	61.0092	1	68.289	1.119	69.481	82.606	1.354	78.934
Chloride	35.5	1	4.220	0.119	7.389	2.890	0.082	4.752
Nitrate-N	14.0	1	2.92	0.2085	12.940	0.019	0.0014	0.079
Sulfate	96.1	2	7.86	0.1637	10.2	13	0.2707	15.8
<b>Total Anions (meq/L)</b>			<b>1.6</b>			<b>1.7</b>		
<b>Total Ions (meq/L)</b>			<b>3.3</b>			<b>3.5</b>		
<b>Cation/Anion Ratio</b>			<b>1.04</b>			<b>1.06</b>		
<b>Percent Difference</b>			<b>2.01</b>			<b>2.77</b>		

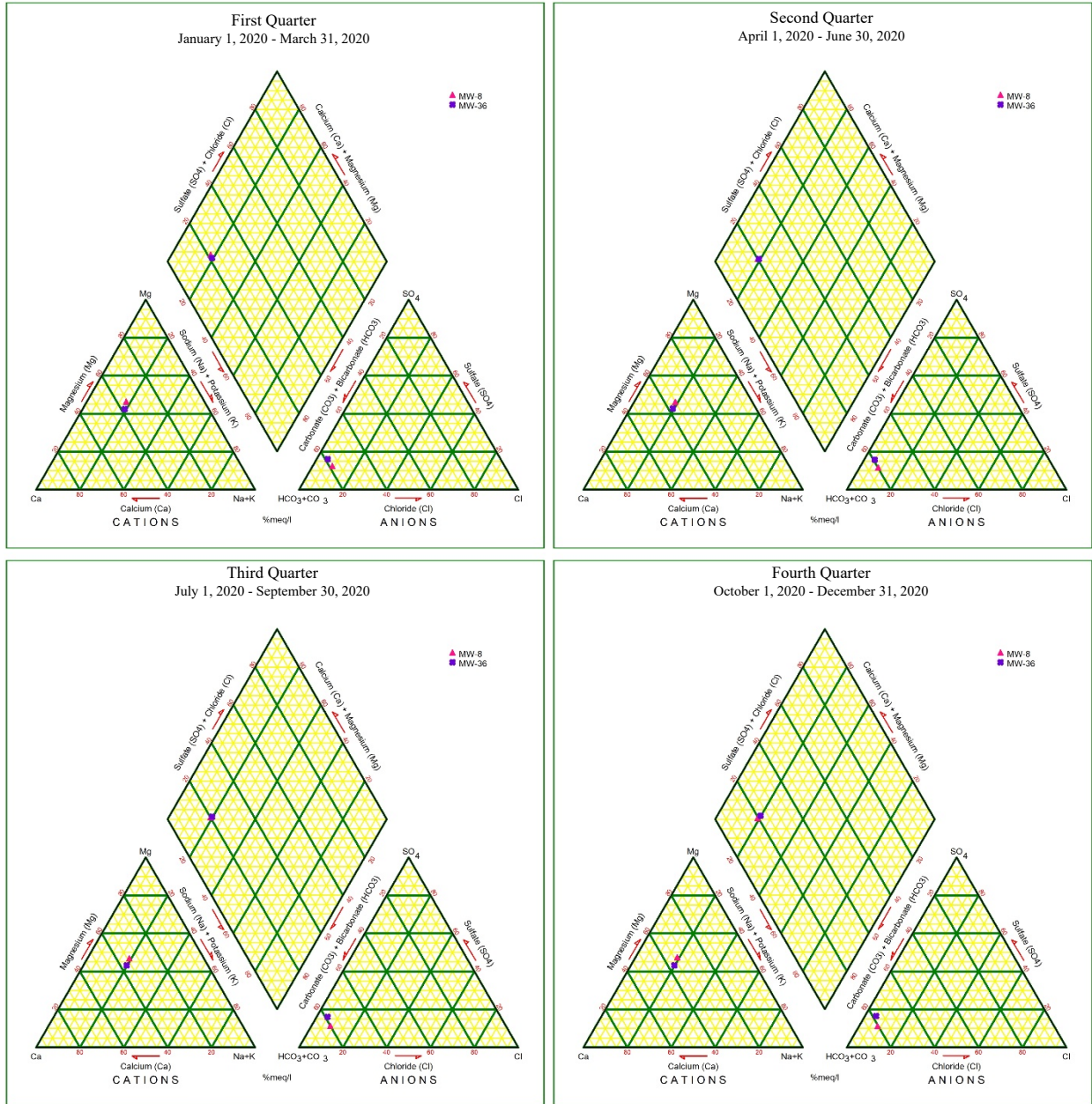
**Table I-3 (continued)**  
**Channel Cc3: Ion Balance Summary for Groundwater**  
**July 1, 2020 - September 30, 2020**

Well #			MW-8			MW-36		
Sample Date			8/3/2020			8/3/2020		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		6.32			7.57		
Conductance	--		166.5			175.8		
TDS	--		131			141		
Calcium	40.1	2	11.7	0.5838	34.0	13.7	0.6836	37.1
Magnesium	24.3	2	9.78	0.8048	46.9	9.65	0.7941	43.1
Potassium	39.1	1	1.18	0.0302	1.8	2.78	0.0711	3.9
Sodium	23.0	1	6.84	0.2975	17.3	6.7	0.2914	15.8
Iron	55.8	2	0.005	0.0002	0.01	0.005	0.0002	0.01
Manganese	54.9	2	0.00005	0.000002	0.0001	0.000639	0.00002	0.001
Ammonia-N	14.0	1	0.001	0.0001	0.004	0.0026	0.0002	0.010
<b>Total Cations (meq/L)</b>			<b>1.7</b>			<b>1.8</b>		
Anion Parameters	Molecular Weight (g/mol)	n						
Alkalinity, Total	--		54.7			67.7		
Carbonate	60.0	2	0.007	0.0002	0.0146	0.151	0.0050	0.2930
Bicarbonate	61.0	1	66.7	1.0936	69.9	82.3	1.3488	78.7
Chloride	35.5	1	4.19	0.1182	7.6	3	0.0846	4.9
Nitrate-N	14.0	1	2.77	0.1978	12.635	0.02	0.0014	0.083
Sulfate	96.1	2	7.46	0.1553	9.9	13.2	0.2748	16.0
<b>Total Anions (meq/L)</b>			<b>1.6</b>			<b>1.7</b>		
<b>Total Ions (meq/L)</b>			<b>3.3</b>			<b>3.6</b>		
<b>Cation/Anion Ratio</b>			<b>1.10</b>			<b>1.07</b>		
<b>Percent Difference</b>			<b>4.62</b>			<b>3.54</b>		

**Table I-3 (continued)**  
**Channel Cc3: Ion Balance Summary for Groundwater**  
**October 1, 2020 - December 31, 2020**

Well #			MW-8			MW-36		
Sample Date			11/16/2020			11/16/2020		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		6.41			7.72		
Conductance	--		154			161.4		
TDS	--		126			121		
Calcium	40.1	2	11.9	0.5938	33.5	14	0.6986	37.0
Magnesium	24.3	2	10.2	0.8393	47.4	9.89	0.8138	43.1
Potassium	39.1	1	1.17	0.0299	1.7	2.71	0.0693	3.7
Sodium	23.0	1	7.05	0.3067	17.3	6.99	0.3040	16.1
Iron	55.8	2	0.005	0.0002	0.01	0.005	0.0002	0.01
Manganese	54.9	2	0.00005	0.000002	0.0001	0.000749	0.00003	0.001
Ammonia-N	14.0	1	0.002	0.0001	0.008	0.001	0.0001	0.004
<b>Total Cations (meq/L)</b>			<b>1.8</b>			<b>1.9</b>		
Anion Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
Alkalinity, Total	--		57.4			68.1		
Carbonate	59.9992	2	0.00887118	0.00029571	0.018171135	0.213820689	0.007127451	0.41024716
Bicarbonate	61.0092	1	70.0099619	1.14753122	70.51488154	82.64723127	1.354668333	77.97301038
Chloride	35.5	1	4.23	0.1193	7.3	3.08	0.0869	5.0
Nitrate-N	14.0	1	2.8	0.1999	12.284	0.019	0.0014	0.078
Sulfate	96.1	2	7.7	0.1603	9.9	13.8	0.2873	16.5
<b>Total Anions (meq/L)</b>			<b>1.6</b>			<b>1.7</b>		
<b>Total Ions (meq/L)</b>			<b>3.4</b>			<b>3.6</b>		
<b>Cation/Anion Ratio</b>			<b>1.09</b>			<b>1.09</b>		
<b>Percent Difference</b>			<b>4.20</b>			<b>4.10</b>		

Figure I-3. Channel Cc3 Trilinear Diagrams  
January 1, 2020 - December 31, 2020



**Table I-4**  
**Unit D Aquifer: Ion Balance Summary for Groundwater**  
**January 1, 2020 - March 31, 2020**

Well #			MW-7			MW-12			MW-19			MW-26			MW-29			MW-34		
Sample Date			1/28/2020			1/27/2020			1/28/2020			1/28/2020			1/28/2020			1/28/2020		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		8.06			7.37			7.55			7.58			7.48			7.55		
Conductance	--		187.7			164.9			216.3			190.4			240			194.8		
TDS	--		132			119			145			128			151			135		
Calcium	40.1	2	15.8	0.7884	40.4	11.7	0.5838	35.0	15	0.7485	33.1	17.4	0.8683	44.6	20.1	1.0030	39.8	13.3	0.6637	34.2
Magnesium	24.3	2	9.75	0.8023	41.1	9.55	0.7858	47.1	13.8	1.1356	50.2	7.3	0.6007	30.9	13.9	1.1438	45.4	11.6	0.9545	49.1
Potassium	39.1	1	2.84	0.0726	3.7	1.91	0.0489	2.9	2.52	0.0645	2.8	3.11	0.0795	4.1	2.25	0.0575	2.3	1.57	0.0402	2.1
Sodium	23.0	1	6.11	0.2658	13.6	5.78	0.2514	15.1	6.75	0.2936	13.0	8.6	0.3741	19.2	6.46	0.2810	11.2	6.52	0.2836	14.6
Iron	55.8	2	0.015	0.0005	0.03	0.005	0.0002	0.01	0.0426	0.0015	0.07	0.0739	0.0026	0.14	0.806	0.0289	1.15	0.005	0.0002	0.01
Manganese	54.9	2	0.145	0.0053	0.27	0.00005	0.0000	0.00	0.478	0.0174	0.77	0.0655	0.0024	0.12	0.0884	0.0032	0.13	0.000127	0.0000	0.00
Ammonia-N	14.0	1	0.248	0.0177	0.91	0.001	0.0001	0.00	0.0308	0.0022	0.10	0.264	0.0188	0.97	0.0038	0.0003	0.01	0.0029	0.0002	0.01
<b>Total Cations (meq/L)</b>			<b>2.0</b>			<b>1.7</b>			<b>2.3</b>			<b>1.9</b>			<b>2.5</b>			<b>1.9</b>		
<b>Anion Parameters</b>	<b>Molecular Weight (g/mol)</b>	<b>n</b>																		
Alkalinity, Total	--		79.1			64.6			86.2			75.8			101			69.8		
Carbonate	60.0	2	0.540	0.0180	0.9387	0.091	0.0030	0.1818	0.183	0.0061	0.2738	0.173	0.0058	0.3006	0.183	0.0061	0.2464	0.14842082	0.0049	0.2502
Bicarbonate	61.0	1	95.4	1.5638	81.6	78.6	1.2888	77.4	104.8	1.7176	77.0	92.1	1.5100	78.9	122.8	2.0136	81.4	84.9	1.3908	70.3
Chloride	35.5	1	3.46	0.0976	5.1	3.3	0.0931	5.6	4.79	0.1351	6.1	3.85	0.1086	5.7	3.71	0.1046	4.2	5.24	0.1478	7.5
Nitrate-N	14.0	1	0.011	0.0008	0.041	0.787	0.0562	3.373	0.005	0.0004	0.016	0.016	0.0011	0.060	0.005	0.0004	0.014	1.99	0.1421	7.186
Sulfate	96.1	2	11.4	0.2374	12.4	10.8	0.2249	13.5	17.9	0.3727	16.7	13.9	0.2894	15.1	16.8	0.3498	14.1	14	0.2915	14.7
<b>Total Anions (meq/L)</b>			<b>1.9</b>			<b>1.7</b>			<b>2.2</b>			<b>1.9</b>			<b>2.5</b>			<b>2.0</b>		
<b>Total Ions (meq/L)</b>			<b>3.9</b>			<b>3.3</b>			<b>4.5</b>			<b>3.9</b>			<b>5.0</b>			<b>3.9</b>		
<b>Cation/Anion Ratio</b>			<b>1.02</b>			<b>1.00</b>			<b>1.01</b>			<b>1.02</b>			<b>1.02</b>			<b>0.98</b>		
<b>Percent Difference</b>			<b>0.91</b>			<b>0.13</b>			<b>0.70</b>			<b>0.82</b>			<b>0.87</b>			<b>-0.89</b>		

**Table I-4 (continued)**  
**Unit D Aquifer: Ion Balance Summary for Groundwater**  
**April 1, 2020 - June 30, 2020**

Well #			MW-7			MW-12			MW-19			MW-26			MW-29			MW-34		
Sample Date			5/27/2020			5/27/2020			5/28/2020			5/27/2020			5/28/2020			5/28/2020		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		7.68			7.3			7.52			8.19			7.35			6.91		
Conductance	--		178.8			152.2			198.6			180.5			226.8			179.7		
TDS	--		137			118			143			139			153			129		
Calcium	40.1	2	15.4	0.7685	39.5	11.6	0.5788	34.6	14.8	0.7385	32.6	17.1	0.8533	43.9	19.5	0.9731	38.8	13.5	0.6737	33.7
Magnesium	24.3	2	9.81	0.8072	41.5	9.53	0.7842	46.8	13.9	1.1438	50.5	7.32	0.6023	31.0	14.1	1.1603	46.2	12	0.9875	49.5
Potassium	39.1	1	2.77	0.0708	3.6	1.9	0.0486	2.9	2.46	0.0629	2.8	2.99	0.0765	3.9	2.22	0.0568	2.3	1.55	0.0396	2.0
Sodium	23.0	1	6.33	0.2753	14.2	6.03	0.2623	15.7	6.84	0.2975	13.1	8.96	0.3897	20.0	6.64	0.2888	11.5	6.79	0.2953	14.8
Iron	55.8	2	0.018	0.0006	0.03	0.005	0.0002	0.01	0.0474	0.0017	0.08	0.0862	0.0031	0.16	0.796	0.0285	1.14	0.005	0.0002	0.01
Manganese	54.9	2	0.175	0.0064	0.33	0.00005	0.000002	0.0001	0.454	0.0165	0.73	0.0651	0.0024	0.12	0.0914	0.0033	0.13	0.000245	0.00001	0.0004
Ammonia-N	14.0	1	0.231	0.0165	0.85	0.001	0.0001	0.0043	0.0301	0.0021	0.09	0.24	0.0171	0.88	0.0029	0.0002	0.01	0.001	0.0001	0.0036
<b>Total Cations (meq/L)</b>			<b>1.9</b>			<b>1.7</b>			<b>2.3</b>			<b>1.9</b>			<b>2.5</b>			<b>2.0</b>		
<b>Anion Parameters</b>	<b>Molecular Weight (g/mol)</b>	<b>n</b>																		
Alkalinity, Total	--		77.6			63.9			82.4			74.7			99.0			68.5		
Carbonate	59.9992	2	0.222	0.007	0.398	0.077	0.003	0.158	0.164	0.005	0.259	0.685	0.023	1.230	0.133	0.004	0.186	0.033	0.001	0.059
Bicarbonate	61.0092	1	94.220	1.544	82.991	77.802	1.275	78.794	100.195	1.642	78.012	89.741	1.471	79.201	120.510	1.975	82.727	83.502	1.369	72.729
Chloride	35.5	1	3.170	0.089	4.805	2.950	0.083	5.141	4.320	0.122	5.788	3.480	0.098	5.285	3.380	0.095	3.993	4.600	0.130	6.895
Nitrate-N	14.0	1	0.015	0.0011	0.058	0.719	0.0513	3.172	0.005	0.0004	0.017	0.012	0.0009	0.046	0.005	0.0004	0.015	1.71	0.1221	6.487
Sulfate	96.1	2	10.5	0.2186	11.7	9.9	0.2061	12.7	16.1	0.3352	15.9	12.7	0.2644	14.2	15	0.3123	13.1	12.5	0.2603	13.8
<b>Total Anions (meq/L)</b>			<b>1.9</b>			<b>1.6</b>			<b>2.1</b>			<b>1.9</b>			<b>2.4</b>			<b>1.9</b>		
<b>Total Ions (meq/L)</b>			<b>3.8</b>			<b>3.3</b>			<b>4.4</b>			<b>3.8</b>			<b>4.9</b>			<b>3.9</b>		
<b>Cation/Anion Ratio</b>			<b>1.05</b>			<b>1.03</b>			<b>1.08</b>			<b>1.05</b>			<b>1.05</b>			<b>1.06</b>		
<b>Percent Difference</b>			<b>2.22</b>			<b>1.69</b>			<b>3.62</b>			<b>2.29</b>			<b>2.52</b>			<b>2.95</b>		

**Table I-4 (continued)**  
**Unit D Aquifer: Ion Balance Summary for Groundwater**  
**July 1, 2020 - September 30, 2020**

Well # Sample Date	MW-7 8/5/2020			MW-12 8/3/2020			MW-19 8/5/2020			MW-26 8/5/2020			MW-29 8/5/2020			MW-34 8/5/2020					
	Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)			
pH	--			7.48			7.09			7.37			7.07			7.34			6.74		
Conductance	--			189.6			166.2			218.5			191			242.9			197.1		
TDS	--			128			113			139			138			152			149		
Calcium	40.1	2		16	0.7984	39.1	11.8	0.5888	34.6	15.2	0.7585	32.3	17.2	0.8583	42.6	21.1	1.0529	39.0	13.6	0.6786	32.8
Magnesium	24.3	2		10.4	0.8558	41.9	9.6	0.7900	46.5	14.4	1.1849	50.5	7.7	0.6336	31.4	15.1	1.2425	46.1	12.5	1.0286	49.7
Potassium	39.1	1		2.9	0.0742	3.6	1.94	0.0496	2.9	2.53	0.0647	2.8	3.04	0.0778	3.9	2.37	0.0606	2.2	1.63	0.0417	2.0
Sodium	23.0	1		6.76	0.2940	14.4	6.25	0.2719	16.0	7.32	0.3184	13.6	9.73	0.4232	21.0	7.09	0.3084	11.4	7.37	0.3206	15.5
Iron	55.8	2		0.0121	0.0004	0.02	0.005	0.0002	0.01	0.0592	0.0021	0.09	0.0777	0.0028	0.14	0.826	0.0296	1.10	0.005	0.0002	0.01
Manganese	54.9	2		0.151	0.0055	0.27	0.00005	0.0000	0.00	0.484	0.0176	0.75	0.0611	0.0022	0.11	0.097	0.0035	0.13	0.000101	0.0000	0.00
Ammonia-N	14.0	1		0.225	0.0161	0.79	0.0028	0.0002	0.01	0.0296	0.0021	0.09	0.255	0.0182	0.90	0.0035	0.0002	0.01	0.001	0.0001	0.00
<b>Total Cations (meq/L)</b>				<b>2.0</b>			<b>1.7</b>			<b>2.3</b>			<b>2.0</b>			<b>2.7</b>			<b>2.1</b>		
<b>Anion Parameters</b>																					
Alkalinity, Total	--			77			62.3			84			74.8			99			67.9		
Carbonate	60.0	2		0.139	0.0046	0.2504	0.046	0.0015	0.0969	0.118	0.0039	0.1827	0.053	0.0018	0.0944	0.130	0.0043	0.1800	0.0224291	0.0007	0.0397
Bicarbonate	61.0	1		93.7	1.5351	82.7	75.9	1.2443	78.5	102.2	1.6758	77.8	91.1	1.4940	80.1	120.5	1.9754	82.1	82.8	1.3570	72.0
Chloride	35.5	1		3.27	0.0922	5.0	3.03	0.0855	5.4	4.59	0.1295	6.0	3.61	0.1018	5.5	3.48	0.0982	4.1	4.81	0.1357	7.2
Nitrate-N	14.0	1		0.021	0.0015	0.081	0.696	0.0497	3.137	0.005	0.0004	0.017	0.012	0.0009	0.046	0.005	0.0004	0.015	1.67	0.1192	6.323
Sulfate	96.1	2		10.7	0.2228	12.0	9.76	0.2032	12.8	16.6	0.3456	16.0	12.8	0.2665	14.3	15.8	0.3290	13.7	13.1	0.2728	14.5
<b>Total Anions (meq/L)</b>				<b>1.9</b>			<b>1.6</b>			<b>2.2</b>			<b>1.9</b>			<b>2.4</b>			<b>1.9</b>		
<b>Total Ions (meq/L)</b>				<b>3.9</b>			<b>3.3</b>			<b>4.5</b>			<b>3.9</b>			<b>5.1</b>			<b>4.0</b>		
<b>Cation/Anion Ratio</b>				<b>1.10</b>			<b>1.07</b>			<b>1.09</b>			<b>1.08</b>			<b>1.12</b>			<b>1.10</b>		
<b>Percent Difference</b>				<b>4.82</b>			<b>3.55</b>			<b>4.29</b>			<b>3.89</b>			<b>5.69</b>			<b>4.66</b>		

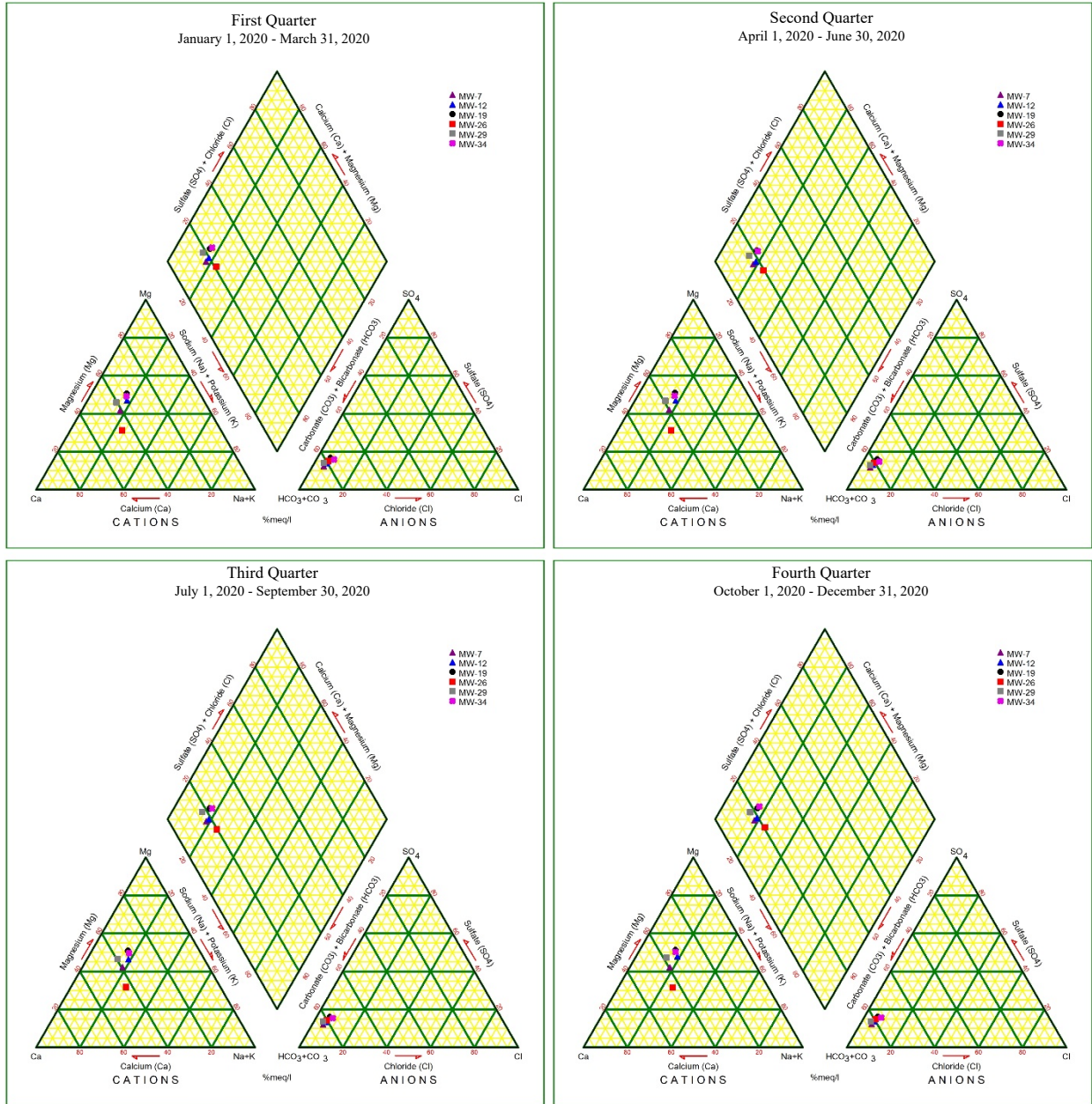
**Table I-4 (continued)**  
**Unit D Aquifer: Ion Balance Summary for Groundwater**  
**October 1, 2020 - December 31, 2020**

Well #		MW-7			MW-12			MW-19			MW-26			MW-29			MW-34			
Sample Date		11/16/2020			11/16/2020			11/16/2020			11/18/2020			11/18/2020			11/18/2020			
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		7.51			7.3			7.21			7.98			7.44			6.81		
Conductance	--		174.2			151.7			201.3			177.5			221.9			181.2		
TDS	--		127			105			137			143			163			141		
Calcium	40.1	2	15.3	0.7635	39.2	11.4	0.5689	33.2	14.9	0.7435	32.1	16.8	0.8383	43.1	18.9	0.9431	38.1	13.1	0.6537	33.0
Magnesium	24.3	2	9.87	0.8122	41.7	9.98	0.8212	48.0	14.3	1.1767	50.8	7.37	0.6065	31.2	14	1.1520	46.6	12.1	0.9957	50.2
Potassium	39.1	1	2.67	0.0683	3.5	1.83	0.0468	2.7	2.42	0.0619	2.7	2.91	0.0744	3.8	2.01	0.0514	2.1	1.44	0.0368	1.9
Sodium	23.0	1	6.49	0.2823	14.5	6.31	0.2745	16.0	7.18	0.3123	13.5	9.28	0.4037	20.7	6.69	0.2910	11.8	6.83	0.2971	15.0
Iron	55.8	2	0.0427	0.0015	0.08	0.005	0.0002	0.01	0.0546	0.0020	0.08	0.091	0.0033	0.17	0.88	0.0315	1.27	0.005	0.0002	0.01
Manganese	54.9	2	0.132	0.0048	0.25	0.000105	0.0000	0.00	0.479	0.0174	0.75	0.0582	0.0021	0.11	0.0874	0.0032	0.13	0.000105	0.0000	0.00
Ammonia-N	14.0	1	0.213	0.0152	0.78	0.001	0.0001	0.00	0.0263	0.0019	0.08	0.24	0.0171	0.88	0.0029	0.0002	0.01	0.001	0.0001	0.00
<b>Total Cations (meq/L)</b>				<b>1.9</b>			<b>1.7</b>			<b>2.3</b>			<b>1.9</b>			<b>2.5</b>			<b>2.0</b>	
<b>Anion Parameters</b>	<b>Molecular Weight (g/mol)</b>	<b>n</b>																		
Alkalinity, Total	--		77.3			63.1			84.5			75.6			99.2			69.2		
Carbonate	59.9992	2	0.14995271	0.00499849	0.26669874	0.07556886	0.002519	0.15625026	0.08228724	0.00274294	0.12628623	0.43009608	0.01433673	0.75349379	0.16386854	0.00546236	0.22646287	0.02685384	0.00089514	0.04657177
Bicarbonate	61.0092	1	94.0010961	1.5407692	82.2090606	76.8283433	1.25929111	78.1123086	102.922683	1.68700266	77.6702547	91.3574713	1.49743762	78.7006644	120.690801	1.97823936	82.0154595	84.3693972	1.3828963	71.9484496
Chloride	35.5	1	3.4	0.0959	5.1	3.14	0.0886	5.5	4.61	0.1300	6.0	3.78	0.1066	5.6	3.51	0.0990	4.1	5.02	0.1416	7.4
Nitrate-N	14.0	1	0.02	0.0014	0.076	0.692	0.0494	3.064	0.005	0.0004	0.016	0.016	0.0011	0.060	0.005	0.0004	0.015	1.59	0.1135	5.906
Sulfate	96.1	2	11.1	0.2311	12.3	10.2	0.2124	13.2	16.9	0.3519	16.2	13.6	0.2832	14.9	15.8	0.3290	13.6	13.6	0.2832	14.7
<b>Total Anions (meq/L)</b>				<b>1.9</b>			<b>1.6</b>			<b>2.2</b>			<b>1.9</b>			<b>2.4</b>			<b>1.9</b>	
<b>Total Ions (meq/L)</b>				<b>3.8</b>			<b>3.3</b>			<b>4.5</b>			<b>3.8</b>			<b>4.9</b>			<b>3.9</b>	
<b>Cation/Anion Ratio</b>				<b>1.04</b>			<b>1.06</b>			<b>1.07</b>			<b>1.02</b>			<b>1.03</b>			<b>1.03</b>	
<b>Percent Difference</b>				<b>1.92</b>			<b>2.99</b>			<b>3.20</b>			<b>1.11</b>			<b>1.24</b>			<b>1.57</b>	



# Figure I-4. Unit D Aquifer Trilinear Diagrams

January 1, 2020 - December 31, 2020



**Table I-5**  
**Private Wells: Ion Balance Summary for Groundwater**  
**January 1, 2020 - March 31, 2020**

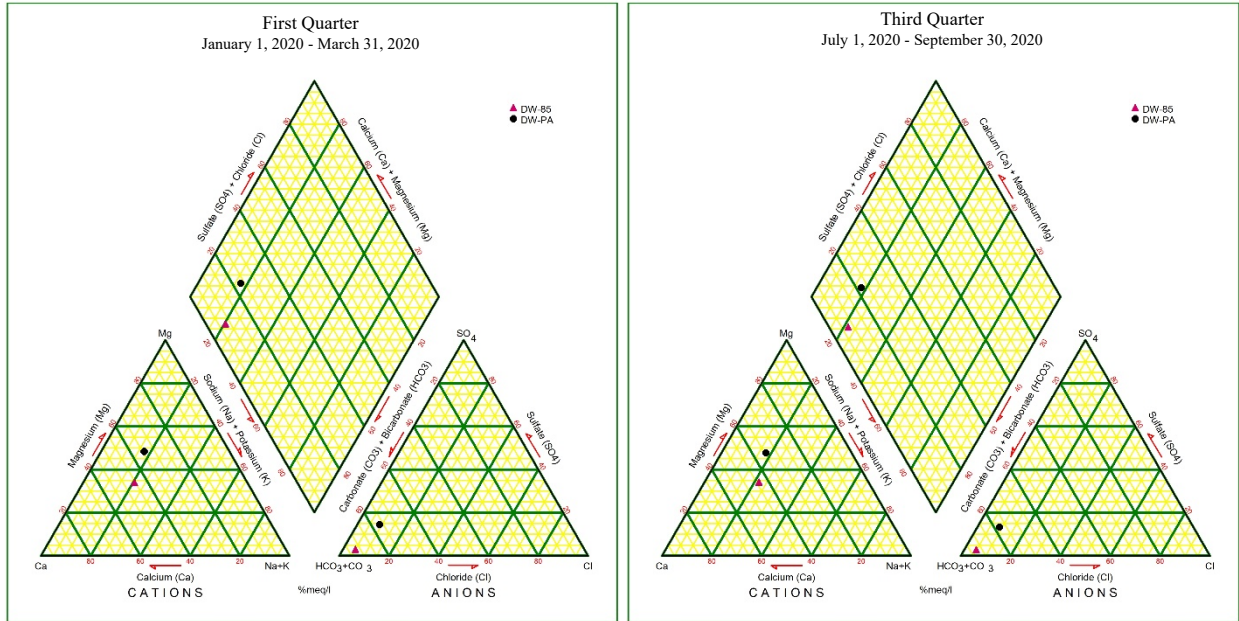
			DW-85			DW-PA		
Well #			1/29/2020			1/29/2020		
Sample Date								
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		6.26			6.86		
Conductance	--		150.4			183.4		
TDS	--		101			119		
Calcium	40.1	2	14.1	0.7036	44.8	13	0.6487	34.3
Magnesium	24.3	2	6.39	0.5258	33.5	11.1	0.9134	48.3
Potassium	39.1	1	2.51	0.0642	4.1	1.61	0.0412	2.2
Sodium	23.0	1	5.85	0.2545	16.2	6.57	0.2858	15.1
Iron	55.8	2	0.0687	0.0025	0.16	0.0191	0.0007	0.04
Manganese	54.9	2	0.0542	0.0020	0.13	0.00322	0.0001	0.01
Ammonia-N	14.0	1	0.272	0.0194	1.24	0.001	0.0001	0.00
<b>Total Cations (meq/L)</b>			<b>1.6</b>			<b>1.9</b>		
Anion Parameters	Molecular Weight (g/mol)	n						
Alkalinity, Total	--		70.8			68.4		
Carbonate	60.0	2	0.008	0.0003	0.0168	0.030	0.0010	0.054
Bicarbonate	61.0	1	86.4	1.4155	92.1	83.4	1.3668	73.8
Chloride	35.5	1	2.7	0.0762	5.0	5.7	0.1608	8.7
Nitrate-N	14.0	1	0.005	0.0004	0.023	0.905	0.0646	3.490
Sulfate	96.1	2	2.18	0.0454	3.0	12.4	0.2582	13.9
<b>Total Anions (meq/L)</b>			<b>1.5</b>			<b>1.9</b>		
<b>Total Ions (meq/L)</b>			<b>3.1</b>			<b>3.7</b>		
<b>Cation/Anion Ratio</b>			<b>1.02</b>			<b>1.02</b>		
<b>Percent Difference</b>			<b>1.10</b>			<b>1.03</b>		

**Table I-5 (continued)**  
**Private Wells: Ion Balance Summary for Groundwater**  
**July 1, 2020 - September 30, 2020**

			Well #					
			Sample Date					
			DW-85			DW-PA		
			8/5/2020			8/5/2020		
Cation Parameters	Molecular Weight (g/mol)	n	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)
pH	--		7.9			6.97		
Conductance	--		150.4			184.9		
TDS	--		113			125		
Calcium	40.1	2	13.9	0.6936	43.4	13.2	0.6587	34.4
Magnesium	24.3	2	6.54	0.5382	33.7	11.1	0.9134	47.7
Potassium	39.1	1	2.61	0.0668	4.2	1.63	0.0417	2.2
Sodium	23.0	1	6.35	0.2762	17.3	6.87	0.2988	15.6
Iron	55.8	2	0.0612	0.0022	0.14	0.005	0.0002	0.01
Manganese	54.9	2	0.0521	0.0019	0.12	0.00005	0.0000	0.00
Ammonia-N	14.0	1	0.271	0.0193	1.21	0.0023	0.0002	0.01
<b>Total Cations (meq/L)</b>			<b>1.6</b>			<b>1.9</b>		
Anion Parameters	Molecular Weight (g/mol)	n						
Alkalinity, Total	--		68.5			67.4		
Carbonate	60.0	2	0.325	0.0108	0.7297	0.038	0.0013	0.070
Bicarbonate	61.0	1	82.9	1.3590	91.6	82.2	1.3465	74.8
Chloride	35.5	1	2.51	0.0708	4.8	5.43	0.1532	8.5
Nitrate-N	14.0	1	0.005	0.0004	0.024	0.992	0.0708	3.933
Sulfate	96.1	2	2.02	0.0421	2.8	11	0.2290	12.7
<b>Total Anions (meq/L)</b>			<b>1.5</b>			<b>1.8</b>		
<b>Total Ions (meq/L)</b>			<b>3.1</b>			<b>3.7</b>		
<b>Cation/Anion Ratio</b>			<b>1.08</b>			<b>1.06</b>		
<b>Percent Difference</b>			<b>3.74</b>			<b>3.02</b>		

# Figure I-5. Private Wells Trilinear Diagrams

January 1, 2020 - December 31, 2020



## **Appendix J**

### Surface Water Monitoring Data

**Table J-1**  
**Surface Water - Field Parameters**

Surface Water - Field Parameters			Dissolved Oxygen (DO) (Field)	Oxidation- Reduction Potential (ORP) (Field)	pH (Field)	Specific Conductance (Field)	Temperature (Field)	Turbidity (Field)
Site ID	Sample Date	Sample ID	(mg/L)	(mV)	(µmhos/cm)	(std. Units)	(°C)	(NTU)
SW-W1	01/29/20	SVW1200129Q	3.09	-64.2	7.38	183.3	8.12	91
SW-W1	5/19/2020	WVW1200519Q	9.29	-30.2	7.25	191.9	11.21	12.6
SW-W1	8/4/2020	SVW1200804Q	7.07	13.9	7.21	220.5	15.086	8.61
SW-W1	11/17/2020	SVW1201117Q	0.45	-105.3	7.37	221.9	9.09	8.91
SW-W2	1/29/2020	SVW2200129Q	11.3	204.9	7.44	449.8	8.18	40.5
SW-W2	5/19/2020	WVW2200519Q	10.81	174.5	8.06	542	11.18	20.4
SW-W2	8/4/2020	SVW2200804Q	10.2	297.5	7.99	613.2	13.85	14.4
SW-W2	11/17/2020	SVW2201117Q	10.69	202	8.04	484	8.81	2.87
SW-W3	1/29/2020	SVW3200129Q	11.01	219.8	7.6	229.1	8.81	27.7
SW-W3	5/19/2020	WVW3200519Q	10.8	57.3	7.67	260.3	10.85	11.9
SW-W3	8/4/2020	SVW3200804Q	10.3	204.2	7.25	266.6	12.589	4.77
SW-W3	11/17/2020	SVW3201117Q	10.21	194.4	7.75	94.6	9.74	4.27
SW-E	1/29/2020	SVE-200129Q	11.76	-12.6	6.53	119.9	8.37	42.9
SW-E	5/19/2020	SVE-200519Q	11.19	194.4	8.02	211.3	11.07	28.9
SW-E	8/4/2020	SVE-200804Q	10.72	347	7.9	208.2	13.056	6.59
SW-E	11/17/2020	SVE-201117Q	10.98	236.2	7.49	183.8	9.493	4.02
FIELD BLANK	1/29/2020	SVW3200129F	10.14	150.6	8.07	1.8	9.64	0.52
FIELD BLANK	8/4/2020	SVW1200804F	--	--	6.77	1.2	--	0.33

Note:

-- = parameter is not sampled for

**Table J-2**  
**Surface Water - Conventionals**

Surface Water - Conventionals			Alkalinity, Total (as CaCO <sub>3</sub> )	Ammonia as N	Biological Oxygen Demand - 5 Dav	Chemical Oxygen Demand	Chloride	Coliforms, Fecal	Coliforms, Total	Cyanide	Fluoride	Hardness	Nitrate	Nitrite as N	Phosphorous, Soluble Reactive	Phosphorous, Total as P	Specific Conductance	Sulfate	Total Dissolved Solids	Total Kjeldahl Nitrogen	Total Organic Carbon	Total Solids	Total Suspended Solids	Turbidity
Site ID	Sample Date	Sample ID	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(CFU/100 mL)	(CFU/100 mL)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	µmhos/cm	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(NTU)
SW-W1	01/29/20	SVW1200129Q	64.2	0.0243	2 U	71.5	5.69	78	900	0.002 U	0.02 U	83.8	1.44	1.44	0.0346	0.366	176	8.26	132	1.39	14.8	252	111	58.6
SW-W1	5/19/2020	WVW1200519Q	76.4	0.0198	2 U	14 T	6.25	19 C	14 C	0.002 SU	0.02 U	90.7	1.06	1.06	0.0493	0.146	209	8.21	155	0.339	4.08	185	20.2	10.9
SW-W1	8/4/2020	SVW1200804Q	88	0.0415	2 U	7.3 T	6.59	20	4100	0.002 U	0.02 U	98.3	0.524	0.524	0.0451	0.2	226	8.11	173	0.16 T	2.97	190	10.8	9.04
SW-W1	11/17/2020	SVW1201117Q	77.2	0.0342	2 U	17 T	7.21	5	100	0.002 U	0.02 U	91.8	0.486	0.486	0.0645	0.188	204	10.6	161	0.365	5.66	177	7.6	8.23
SW-W2	1/29/2020	SVW2200129Q	226	0.0076 T	2 U	37	13.6	71	800	0.002 U	0.02 U	235	0.326	0.326	0.0143	0.183	478	12	272	0.779	13.1	372	53.5	47.7
SW-W2	5/19/2020	WVW2200519Q	291	0.0091 T	2 U	15 T	17.4	6	100	0.002 U	0.02 U	305	0.125	0.125	0.0171	0.0893	604	13.6	373	0.339	4.29	405	22.4	17.5
SW-W2	8/4/2020	SVW2200804Q	298	0.006 T	2 U	13 T	18.1	5	140	0.002 U	0.02 U	327	0.096	0.0965	0.0107	0.0939	635	13.7	396	0.332	5.27	436	40.2	17.1
SW-W2	11/17/2020	SVW2201117Q	262	0.004 T	2 U	17 T	18.4	2	190	0.002 U	0.02 U	286	0.0518	0.0518	0.0131	0.0429	562	16.2	356	0.22	6.14	377	3.8	3.64
SW-W3	1/29/2020	SVW3200129Q	97.4	0.0095 T	2 U	41.4	6.88	57	80 C	0.002 U	0.02 U	109	0.587	0.587	0.0707	0.297	238	9.26	152 H	0.739	12.3	252	66	28.3
SW-W3	5/19/2020	WVW3200519Q	129	0.0087 T	2 U	13 T	8.56	1 U	7	0.002 U	0.04 U	141	0.268	0.268	0.0699	0.153	309	12.3	206	0.215	3.57	235	25	10.6
SW-W3	8/4/2020	SVW3200804Q	134	0.0445	2 U	8.1 T	9.27	6	250	0.002 U	0.02 U	154	0.175	0.175	0.0698	0.172	326	12.3	219	0.1 U	3.61	251	55	7.03
SW-W3	11/17/2020	SVW3201117Q	124	0.0084 T	2 U	17 T	9.34	5	50	0.002 U	0.02 U	140	0.178	0.178	0.0562	0.157	298	12.5	212	0.32	5.74	224	8.6	4.64
SW-E	1/29/2020	SVE-200129Q	--	--	--	--	--	--	--	--	--	57.4	--	--	--	--	128	--	--	--	--	--	--	37.6
SW-E	5/19/2020	SVE-200519Q	--	--	--	--	--	--	--	--	--	96.3	--	--	--	--	217	--	--	--	--	--	--	9.03
SW-E	8/4/2020	SVE-200804Q	--	--	--	--	--	--	--	--	--	101	--	--	--	--	227	--	--	--	--	--	--	7.6
SW-E	11/17/2020	SVE-201117Q	--	--	--	--	--	--	--	--	--	88.4	--	--	--	--	199	--	--	--	--	--	--	4.98
FIELD BLANK	1/29/2020	SVW3200129F	1 U	0.002 U	2 U	5 U	0.05 U	1 U	1 U	0.002 U	0.02 U	0.331 U	0.01 U	0.01 U	0.0005 U	0.0063 T	1.6 T	0.1 U	10 U	0.1 U	0.5 U	10 U	0.5 U	0.2 U
FIELD BLANK	8/4/2020	SVW1200804F	1 U	0.002 U	2 U	5 U	0.097 T	1 U	1 U	0.002 U	0.02 U	0.331 U	0.01 U	0.01 U	0.00059 T	0.006 T	3.8 T	0.1 U	10 U	0.1 U	0.5 U	10 U	0.5 U	0.2 U

Note:  
 -- = parameter is not sampled for

Table J-3  
 Surface Water - Metals (Dissolved & Total)

Surface Water - Metals (Dissolved & Total)				Aluminum, 7429-90-5	Aluminum, 7429-90-5	Antimony, 7440-36-0	Antimony, 7440-36-0	Arsenic, 7440-38-2	Arsenic, 7440-38-2	Barium, 7440-39-3	Barium, 7440-39-3	Beryllium, 7440-41-7	Beryllium, 7440-41-7	Cadmium, 7440-43-9	Cadmium, 7440-43-9	Calcium, 7440-70-2	Calcium, 7440-70-2	Chromium, 7440-47-3	Chromium, 7440-47-3	Cobalt, 7440-48-4	Cobalt, 7440-48-4	Copper, 7440-50-8	Copper, 7440-50-8	Iron, 7439-89-6	Iron, 7439-89-6	Lead, 7439-92-1	Lead, 7439-92-1	Magnesium, 7439-95-4	Magnesium, 7439-95-4	Manganese, 7439-96-5	Manganese, 7439-96-5
Site ID	Sample Date	Sample ID	CAS #	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)
SW-W1	1/29/2020	SVW1200129Q	7429-90-5	0.00893 D	1.23	0.0003 U	0.0003 U	0.00232	0.0153	0.00087	0.0262	0.0001 U	0.0001 U	5E-05 U	0.000091	13.3	15.4	0.000456	0.00634	0.000118	0.00379	0.000948	0.00523	0.192	11	0.0001 U	0.00429	10.1	11	0.399	3.52
SW-W1	5/19/2020	WVW1200519Q	7429-90-5	0.005 U	0.14	0.0003 U	0.0003 U	0.00322	0.00532	0.00071	0.00382	0.0001 U	0.0001 U	5E-05 U	5E-05 U	15.6	16.2	0.000303	0.00101	0.0000613	0.000522	0.000273	0.000863	0.17	1.77	0.0001 U	0.000534	12.1	12.2	0.308	0.734
SW-W1	8/4/2020	SVW1200804Q	7429-90-5	0.005 U	0.079	0.0003 U	0.0003 U	0.00516	0.00779	0.00133	0.00299	0.0001 U	0.0001 U	5E-05 U	5E-05 U	17.3	17.7	0.0002 U	0.000583	0.000157	0.000382	0.000271	0.000272	0.231	1.55	0.0001 U	0.00029	12.9	13.1	0.904	1.13
SW-W1	11/17/2020	SVW1201117Q	7429-90-5	0.005 DU	0.0622	0.0003 U	0.0003 U	0.0049	0.00781	0.00116	0.00284	0.0001 U	0.0001 U	5E-05 U	5E-05 U	15.3	16.6	0.000232	0.000596	1.02E-04	0.000325	0.00029	0.000524	0.534	2	0.0001 U	0.000233	11.9	12.2	0.845	1.16
SW-W2	1/29/2020	SVW2200129Q	7429-90-5	0.005 DU	0.345	0.0003 U	0.0003 U	0.00119	0.00677	0.00246	0.0191	0.0001 U	0.0001 U	5E-05 U	5E-05 U	39.1	40.2	0.000383	0.00161	5E-05 U	5.71E-04	0.000623	0.0019	0.0483	6.26	0.0001 U	0.00134	31.9	32.7	0.0155	1.19
SW-W2	5/19/2020	WVW2200519Q	7429-90-5	0.005 U	0.104	0.0003 U	0.0003 U	0.00138	0.00324	0.00322	0.00896	0.0001 U	0.0001 U	5E-05 U	5E-05 U	50.2	52	0.000213	0.000601	5E-05 U	1.85E-04	0.0002 U	0.000501	0.0151	2.3	0.0001 U	0.000262	41.2	42.6	0.0223	0.466
SW-W2	8/4/2020	SVW2200804Q	7429-90-5	0.005 U	0.123	0.0003 U	0.0003 U	0.00157	0.00324	0.00361	0.00884	0.0001 U	0.0001 U	5E-05 U	5E-05 U	53.6	52.9	0.0002 U	0.000537	5E-05 U	2.16E-04	0.0002 U	0.000237	0.017	1.9	0.0001 U	0.000236	45.1	47.2	0.0333	0.425
SW-W2	11/17/2020	SVW2201117Q	7429-90-5	0.005 DU	0.0315	0.0003 U	0.0003 U	0.00112	0.00155	0.0032	0.00479	0.0001 U	0.0001 U	5E-05 U	5E-05 U	45.6	49.4	0.0002 U	0.000302	5E-05 U	8.11E-05	0.000246	0.000381	0.0512	0.492	0.0001 U	0.0001 U	38.9	39.5	0.0437	0.143
SW-W3	1/29/2020	SVW3200129Q	7429-90-5	0.0236 D	0.642	0.0003 U	0.0003 U	0.00299	0.0076	0.00332	0.0146	0.0001 U	0.0001 U	5E-05 U	5E-05 U	18.5	19	0.000508	0.00268	0.0000891	8.07E-04	0.000947	0.00286	0.136	3.29	0.0001 U	0.0021	14.6	14.9	0.302	0.963
SW-W3	5/19/2020	WVW3200519Q	7429-90-5	0.005 U	0.206	0.0003 U	0.0003 U	0.00342	0.00485	0.00448	0.00923	0.0001 U	0.0001 U	5E-05 U	5E-05 U	23.2	23.7	0.000339	0.000979	0.0000912	3.47E-04	0.000228	0.000806	0.0376	1.1	0.0001 U	0.000548	19.4	19.9	0.406	0.733
SW-W3	8/4/2020	SVW3200804Q	7429-90-5	0.005 U	0.168	0.0003 U	0.0003 U	0.00389	0.00479	0.00508	0.00852	0.0001 U	0.0001 U	5E-05 U	5E-05 U	25	25.1	0.0002 U	0.000701	0.000102	2.97E-04	0.0002 U	0.000359	0.0308	0.74	0.0001 U	0.000327	20.6	22.1	0.444	0.692
SW-W3	11/17/2020	SVW3201117Q	7429-90-5	0.00637 D	0.104	0.0003 U	0.0003 U	0.00323	0.00433	0.0047	0.00735	0.0001 U	0.0001 U	5E-05 U	5E-05 U	22.6	24.2	0.000244	0.000634	0.0000954	2.21E-04	0.000359	0.000635	0.0587	0.637	0.0001 U	0.000296	19.6	19.4	0.42	0.604
SW-E	1/29/2020	SVE-200129Q	7439-97-6	0.078 D	1.73	0.0003 U	0.0003 U	0.00142	0.00269	0.00579	0.0194	0.0001 U	0.0001 U	5E-05 U	5E-05 U	8.97	9.74	0.00109	0.00616	0.0000736	1.15E-03	0.00153	0.0043	0.171	2.46	0.000191	0.00209	7.52	8.04	0.00764	0.171
SW-E	5/19/2020	SVE-200519Q	7439-97-6	0.0102	0.26	0.0003 U	0.0003 U	0.00194	0.00226	0.00507	0.00778	0.0001 U	0.0001 U	5E-05 U	5E-05 U	15.2	15.7	0.0012	0.00222	5E-05 U	2.14E-04	0.000316	0.000874	0.0401	0.516	0.0001 U	0.000412	13.6	13.9	0.00906	0.0746
SW-E	8/4/2020	SVE-200804Q	7439-97-6	0.0104	0.269	0.0003 U	0.0003 U	0.00215	0.00252	0.00494	0.00797	0.0001 U	0.0001 U	5E-05 U	5E-05 U	16.1	16.1	0.00121	0.00217	5E-05 U	2.39E-04	0.0002 U	0.000556	0.05	0.587	0.0001 U	0.000424	14.9	14.8	0.0115	0.0932
SW-E	11/17/2020	SVE-201117Q	7439-97-6	0.0248 D	0.182	0.0003 U	0.0003 U	0.00172	0.00194	0.00538	0.00703	0.0001 U	0.0001 U	5E-05 U	5E-05 U	13.8	14.6	0.00113	0.00177	5E-05 U	1.47E-04	0.000704	0.00107	0.0979	0.348	0.0001 U	0.000218	12.3	12.6	0.00946	0.0303
FIELD BLANK	1/29/2020	SVW3200129F	7429-90-5	0.005 DU	0.005 U	0.0003 U	0.0003 U	5E-05 U	5E-05 U	0.0005 U	0.0005 U	0.0001 U	0.0001 U	5E-05 U	5E-05 U	0.05 U	0.05 U	0.0002 U	0.0002 U	5E-05 U	5E-05 U	0.0002 U	0.000262	0.01 U	0.01 U	0.0001 U	0.0001 U	0.05 U	0.05 U	0.0001 U	0.0001 U
FIELD BLANK	8/4/2020	SVW1200804F	7429-90-5	0.005 U	0.005 U	0.0003 U	0.0003 U	5E-05 U	5E-05 U	0.0005 U	0.0005 U	0.0001 U	0.0001 U	5E-05 U	5E-05 U	0.05 U	0.05 U	0.0002 U	0.0002 U	5E-05 U	5E-05 U	0.0002 U	0.0002 U	0.01 U	0.01 U	0.0001 U	0.0001 U	0.05 U	0.05 U	0.0001 U	0.0001 U

Surface Water - Metals (Dissolved & Total)				Mercury, 7439-97-6	Nickel, 7440-02-0	Nickel, 7440-02-0	Potassium, 7440-09-7	Potassium, 7440-09-7	Selenium, 7782-49-2	Selenium, 7782-49-2	Silver, 7440-22-4	Silver, 7440-22-4	Sodium, 7440-23-5	Sodium, 7440-23-5	Thallium, 7440-28-0	Thallium, 7440-28-0	Tin, 7440-31-5	Tin, 7440-31-5	Vanadium, 7440-62-2	Vanadium, 7440-62-2	Zinc, 7440-66-6	Zinc, 7440-66-6
Site ID	Sample Date	Sample ID	CAS #	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)
SW-W1	1/29/2020	SVW1200129Q	7439-97-6	5E-05 U	0.000977	0.0154	1.18	1.27	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.26	6.35	0.0001 U	0.0001 U	0.0005 U	0.0005 U	0.000738	0.0078 D	0.00202	0.0133
SW-W1	5/19/2020	WVW1200519Q	7439-97-6	5E-05 U	0.000625	0.00239	1.25	1.29	0.0005 U	0.0005 U	4E-05 U	4E-05 U	7.53	7.51	0.0001 U	0.0001 U	0.0005 U	0.0005 U	0.000406	0.0013	0.0015	0.00251
SW-W1	8/4/2020	SVW1200804Q	7439-97-6	5E-05 U	0.000892	0.00167	1.35	1.42	0.0005 U	0.0005 U	4E-05 U	4E-05 U	7.87	8.01	0.0001 U	0.0001 U	0.0005 U	0.0005 U	0.000461	0.000945 D	0.00094	0.0103
SW-W1	11/17/2020	SVW1201117Q	7439-97-6	5E-05 U	0.000745	0.00157	1.45	1.73	0.0005 U	0.0005 U	4E-05 U	4E-05 U	6.95	7.05	0.0001 U	0.0001 U	0.0005 U	0.0005 U	0.000325	0.00106	0.000918	0.000969
SW-W2	1/29/2020	SVW2200129Q	7439-97-6	5E-05 U	0.00165	0.00388	2.87	2.9	0.0005 U	0.0005 U	4E-05 U	4E-05 U	12.4	12.5	0.0001 U	0.0001 U	0.0005 U	0.0005 U	0.000627	0.0022 D	0.000842	0.00299
SW-W2	5/19/2020	WVW2200519Q	7439-97-6	5E-05 U	0.00184	0.00253	2.99	3.1	0.0005 U	0.0005 U	4E-05 U	4E-05 U	15.8	16.1	0.0001 U	0.0001 U	0.0005 U	0.0005 U	0.000315	0.000758	0.000516	0.00108
SW-W2	8/4/2020	SVW2200804Q	7439-97-6	5E-05 U	0.00208	0.0027	3.18	3.11	0.0005 U	0.0005 U	4E-05 U	4E-05 U	17.4	17.7	0.0001 U	0.0001 U	0.0005 U	0.0005 U	0.000385	0.000816 D	0.0005 U	0.000823
SW-W2	11/17/2020	SVW2201117Q	7439-97-6	5E-05 U	0.00178	0.00206	3.28	3.59	0.0005 U	0.0005 U	4E-05 U	4E-05 U	15.6	15.6	0.0001 U	0.0001 U	0.0005 U	0.0005 U	0.000288	0.000519	0.0005 U	0.0005 U
SW-W3	1/29/2020	SVW3200129Q	7439-97-6	5E-05 U	0.00132	0.00477	2.32	2.32	0.0005 U	0.0005 U	4E-05 U	4E-05 U	7.24	7.25	0.0001 U	0.0001 U	0.0005 U	0.0005 U	0.00123	0.00389 D	0.00094	0.0048
SW-W3	5/19/2020	WVW3200519Q	7439-97-6	5E-05 U	0.00101	0.0021	2.28	2.36	0.0005 U	0.0005 U	4E-05 U	4E-05 U	9.16	9.27	0.0001 U	0.0001 U	0.0005 U	0.0005 U	0.000648	0.00162	0.00115	0.00145
SW-W3	8/4/2020	SVW3200804Q	7439-97-6	5E-05 U	0.00118	0.00183	2.46	2.49	0.0005 U	0.0005 U	4E-05 U	4E-05 U	9.62	10.4	0.0001 U	0.0001 U	0.0005 U	0.0005 U	0.000643	0.00127 D	0.00118	0.00126
SW-W3	11/17/2020	SVW3201117Q	7439-97-6	5E-05 U	0.00106	0.00167	2.38	2.77														



Table J-4  
Surface Water - Volatile Organic Compounds

Surface Water - Volatile Organic Compounds			1,1,1,2-Tetrachloroethane 630-20-6	1,1,1-Trichloroethane 71-55-6	1,1,2,2-Tetrachloroethane 79-34-5	1,1,2-Trichloroethane 79-00-5	1,1-Dichloroethane 75-34-3	1,1-Dichloroethene 75-35-4	1,2,3-Trichloropropane 96-18-4	1,2-Dibromo-3-Chloropropane 96-12-8	1,2-Dibromoethane 106-93-4	1,2-Dichlorobenzene 95-50-1	1,2-Dichloroethane 107-06-2	1,2-Dichloropropane 78-87-5	1,4-Dichlorobenzene 106-46-7	2-Butanone 78-93-3	2-Hexanone 591-78-6	4-Methyl-2-Pentanone 108-10-1	Acetone 67-64-1	Acrylonitrile 107-13-1	Benzene 71-43-2	Bromo-chloromethane 74-97-5	Bromo-dichloromethane 75-27-4	Bromofor m 75-25-2	Bromo-methane 74-83-9	Carbon Disulfide 75-15-0	Carbon Tetra-chloride 56-23-5
Site ID	Sample Date	CAS # Sample ID	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
SW-W1	1/29/2020	SVW1200129Q	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U
SW-W1	5/19/2020	WVW1200519Q	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U
SW-W1	8/4/2020	SVW1200804Q	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U
SW-W1	11/17/2020	SVW1201117Q	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U
SW-W2	1/29/2020	SVW2200129Q	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U
SW-W2	5/19/2020	WVW2200519Q	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U
SW-W2	8/4/2020	SVW2200804Q	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U
SW-W2	11/17/2020	SVW2201117Q	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U
SW-W3	1/29/2020	SVW3200129Q	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U
SW-W3	5/19/2020	WVW3200519Q	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U
SW-W3	8/4/2020	SVW3200804Q	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U
SW-W3	11/17/2020	SVW3201117Q	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U
SW-E	1/29/2020	SVE-200129Q	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SW-E	5/19/2020	SVE-200519Q	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SW-E	8/4/2020	SVE-200804Q	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SW-E	11/17/2020	SVE-201117Q	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FIELD BLANK	1/29/2020	SVW3200129F	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	9.29	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.305	0.25 U
FIELD BLANK	8/4/2020	SVW1200804F	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U
VOA TRIP BLANK	1/28/2020	VTRP200129X2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VOA TRIP BLANK	1/28/2020	VTRP200129Y	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U
VOA TRIP BLANK	5/18/2020	VTRP200519X	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U
VOA TRIP BLANK	8/3/2020	VTRP200804X	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U
VOA TRIP BLANK	8/3/2020	VTRP200804X2	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U
VOA TRIP BLANK	11/16/2020	VTRP201117Z	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U
VOA TRIP BLANK	11/16/2020	VTRP201117Z2	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.5 U	2.5 U	2.5 U	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U

Surface Water - Volatile Organic Compounds			Chloro-benzene 108-90-7	Chloro-dibromo-methane 124-48-1	Chloro-ethane 75-00-3	Chloroform 67-66-3	Chloro-methane 74-87-3	Cis-1,2-Dichloro-ethene 156-59-2	Cis-1,3-Dichloro-propene 10061-01-5	Dibromo-methane 74-95-3	Dichloro-difluoro-methane 75-71-8	Ethyl-benzene 100-41-4	M & P Xylene MPX	Methyl Iodide 74-88-4	Methylene Chloride 75-09-2	O-Xylene 95-47-6	Styrene 100-42-5	Tetrachloro-ethene 127-18-4	Toluene 108-88-3	Trans-1,2-Dichloro-ethene 156-60-5	Trans-1,3-Dichloro-propene 10061-02-6	Trans-1,4-Dichloro-2-Butene 110-57-6	Trichloro-ethene 79-01-6	Trichloro-fluoro-methane 75-69-4	Vinyl Acetate 108-05-4	Vinyl Chloride 75-01-4	
Site ID	Sample Date	CAS # Sample ID	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
SW-W1	1/29/2020	SVW1200129Q	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.0122 DJT	
SW-W1	5/19/2020	WVW1200519Q	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.0244	
SW-W1	8/4/2020	SVW1200804Q	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.0213 D	
SW-W1	11/17/2020	SVW1201117Q	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.0238	
SW-W2	1/29/2020	SVW2200129Q	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 DU	
SW-W2	5/19/2020	WVW2200519Q	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
SW-W2	8/4/2020	SVW2200804Q	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 DU	
SW-W2	11/17/2020	SVW2201117Q	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
SW-W3	1/29/2020	SVW3200129Q	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.0566 D	
SW-W3	5/19/2020	WVW3200519Q	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.0578	
SW-W3	8/4/2020	SVW3200804Q	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.057 D	
SW-W3	11/17/2020	SVW3201117Q	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.0571	
SW-E	1/29/2020	SVE-200129Q	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.01 DU	
SW-E	5/19/2020	SVE-200519Q	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.01 U	
SW-E	8/4/2020	SVE-200804Q	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.01 DU	
SW-E	11/17/2020	SVE-201117Q	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.01 U	
FIELD BLANK	1/29/2020	SVW3200129F	0.1 U	0.5 U	0.1 U	0.781	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	5 U	0.1 U	0.1 U	0.1 U	0.01 U	
FIELD BLANK	8/4/2020	SVW1200804F	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	2.5 U	0.1											

**Table J-5**  
**Surface Water - Pesticides & Herbicides**

Surface Water - Pesticides & Herbicides			2,4,5-T	2,4,5-TP Silvex	2,4-D	Dinoseb	Endrin	Lindane (Gamma)	Methoxychlor	Toxaphene
		CAS #	93-76-5	93-72-1	94-75-7	88-85-7	72-20-8	58-89-9	72-43-5	8001-35-2
Site ID	Sample	Sample ID	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
SW-W1	01/29/20	SVW1200129Q	0.0263 U	0.0263 U	0.0526 U	0.0263 U	0.0129 U	0.0129 U	0.0644 U	1.29 U
SW-W1	05/19/20	WVW1200519Q	0.025 U	0.025 U	0.05 U	0.025 U	0.0125 U	0.0125 U	0.0625 U	1.25 U
SW-W1	08/04/20	SVW1200804Q	0.025 U	0.025 U	0.05 U	0.025 U	0.0125 U	0.0125 U	0.0625 U	1.25 U
SW-W1	11/17/20	SVW1201117Q	0.025 U	0.025 U	0.05 U	0.025 U	0.0125 U	0.0125 U	0.0625 U	1.25 U
SW-W2	01/29/20	SVW2200129Q	0.0263 U	0.0263 U	0.0526 U	0.0771	0.0126 U	0.0126 U	0.0631 U	1.26 U
SW-W2	05/19/20	WVW2200519Q	0.0253 U	0.0253 U	0.0505 U	0.0253 U	0.0125 U	0.0125 U	0.0625 U	1.25 U
SW-W2	08/04/20	SVW2200804Q	0.0255 U	0.0255 U	0.051 U	0.0255 U	0.0125 U	0.0125 U	0.0625 U	1.25 U
SW-W2	11/17/20	SVW2201117Q	0.025 U	0.025 U	0.05 U	0.05 U	0.0125 U	0.0125 U	0.0625 U	1.25 U
SW-W3	01/29/20	SVW3200129Q	0.0263 U	0.0263 U	0.0526 U	0.0263 U	0.0129 U	0.0129 U	0.0644 U	1.29 U
SW-W3	05/19/20	WVW3200519Q	0.0253 U	0.0253 U	0.0505 U	0.0253 U	0.0125 U	0.0125 U	0.0625 U	1.25 U
SW-W3	8/4/2020	SVW3200804Q	0.0253 U	0.0253 U	0.0505 U	0.0253 U	0.0125 U	0.0125 U	0.0625 U	1.25 U
SW-W3	11/17/2020	SVW3201117Q	0.025 U	0.025 U	0.05 U	0.025 U	0.0125 U	0.0125 U	0.0625 U	1.25 U
FIELD BLANK	1/29/2020	SVW3200129F	0.0263 U	0.0263 U	0.0526 U	0.0263 U	0.0132 U	0.0132 U	0.0658 U	1.32 U
FIELD BLANK	8/4/2020	SVW1200804F	0.0258 U	0.0258 U	0.0515 U	0.0258 U	0.0125 U	0.0125 U	0.0625 U	1.25 U

## **Appendix K**

### Leachate Monitoring Data

**Table K-1  
 Leachate - Field Parameters**

Leachate - Field Parameters			Dissolved Sulfide	pH (Field)	Specific Conductance (Field)	Temperature (Field)
Site ID	Sample Date	Sample ID	ppm	(Std. pH Units)	(µmhos/cm)	(°C)
LS-LVT	3/13/2020	LVT-200313P	0.1 U	7.5	392.5	8.34
LS-LVT	6/18/2020	LVT-200618P	0.1 U	7.13	355.4	18.3
LS-LVT	9/15/2020	LVT-200915P	0.1 U	7.75	409.6	18.7
LS-LVT	12/8/2020	LVT-201208D	0.1	7.99	401.1	9
LS-LVT	12/8/2020	LVT-201208P	0.1	7.99	401.1	9
LS-PS1	1/29/2020	LVP-200129Q	--	8.54	227.1	7.7
LS-PS1	8/4/2020	LVP-200804Q	--	7.43	354.9	20.2
LS-PS1	11/17/2020	LVP-201117Q	--	7.15	278.4	10.07
LS-B	1/29/2020	LVB-200129Q	--	6.28	1331	10.6
LS-B	8/4/2020	LVB-200804Q	--	6.39	4390	19.6
LS-B	11/17/2020	LVB-201117D	--	6.59	1659	16.9
LS-B	11/17/2020	LVB-201117Q	--	6.59	1659	16.9

Note:

Stations LS-PS1 and LS-B were not sampled this quarter because of reduced laboratory capacity due to Covid-19.

-- = parameter is not sampled for

**Table K-3**  
**Leachate - Metals (Total)**

Leachate - Metals			Aluminum, Total 7429-90-5 (mg/L)	Antimony, Total 7440-36-0 (mg/L)	Arsenic, Total 7440-38-2 (mg/L)	Barium, Total 7440-39-3 (mg/L)	Beryllium, Total 7440-41-7 (mg/L)	Cadmium, Total 7440-43-9 (mg/L)	Calcium, Total 7440-70-2 (mg/L)	Chromium, Total 7440-47-3 (mg/L)	Cobalt, Total 7440-48-4 (mg/L)	Copper, Total 7440-50-8 (mg/L)	Iron, Total 7439-89-6 (mg/L)	Lead, Total 7439-92-1 (mg/L)
Site ID	Sample Date	Sample ID												
LS-LVT	3/13/2020	LVT-200313P	--	--	0.00133	--	--	0.000494 U	--	0.0021	--	0.00423	--	0.000988 U
LS-LVT	6/18/2020	LVT-200618P	--	--	0.00262	--	--	0.000492 U	--	0.00337	--	0.00992	--	0.00297
LS-LVT	9/15/2020	LVT-200915P	--	--	0.00286	--	--	0.0005 U	--	0.002 U	--	0.002 U	--	0.001 DU
LS-LVT	12/8/2020	LVT-201208D	--	--	0.00246	--	--	0.000482 U	--	0.00193 U	--	0.00479	--	0.00128
LS-LVT	12/8/2020	LVT-201208P	--	--	0.00246	--	--	0.000491 U	--	0.00196 U	--	0.00437	--	0.00124
LS-PS1	1/29/2020	LVP-200129Q	0.316	0.00295 U	0.000694	0.0188	0.000983 U	0.000492 U	23.2	0.00197 U	0.000492 U	0.00279	0.302	0.000983 U
LS-PS1	8/4/2020	LVP-200804Q	0.0499 U	0.00299 U	0.00184	0.0435	0.000997 U	0.000499 U	29.3	0.00199 U	0.000499 U	0.00199 U	0.0997 U	0.000997 U
LS-PS1	11/17/2020	LVP-201117Q	0.294	0.0003 U	0.00135	0.0326	0.0001 U	0.0000686	26.4	0.0006	0.000295	0.0046	0.335	0.000212
LS-B	1/29/2020	LVB-200129Q	0.0498 U	0.00299 U	0.00159	0.0155	0.000996 U	0.000498 U	76.5	0.00199 U	0.00131	0.00296	0.0996 U	0.000996 U
LS-B	8/4/2020	LVB-200804Q	0.0496 U	0.00297 U	0.00218	0.101	0.000991 U	0.0012	343	0.00198 U	0.00542	0.00939	0.0991 U	0.000991 U
LS-B	11/17/2020	LVB-201117D	0.00714	0.00039	0.0015	0.0437	0.0001 U	0.000701	145	0.000259	0.00449	0.00794	0.0285	0.0001 U
LS-B	11/17/2020	LVB-201117Q	0.00664	0.000384	0.00149	0.0443	0.0001 U	0.000679	142	0.000279	0.00442	0.00783	0.0282	0.0001 U

Leachate - Metals			Magnesium, Total 7439-95-4 (mg/L)	Manganese, Total 7439-96-5 (mg/L)	Mercury, Total 7439-97-6 (mg/L)	Nickel, Total 7440-02-0 (mg/L)	Potassium, Total 7440-09-7 (mg/L)	Selenium, Total 7782-49-2 (mg/L)	Silver, Total 7440-22-4 (mg/L)	Sodium, Total 7440-23-5 (mg/L)	Thallium, Total 7440-28-0 (mg/L)	Tin, Total 7440-31-5 (mg/L)	Vanadium, Total 7440-62-2 (mg/L)	Zinc, Total 7440-66-6 (mg/L)
Site ID	Sample Date	Sample ID												
LS-LVT	3/13/2020	LVT-200313P	--	--	--	0.00514	--	--	0.000395 U	--	--	--	--	0.0188
LS-LVT	6/18/2020	LVT-200618P	--	--	--	0.00617	--	--	0.000394 U	--	--	--	--	0.0379
LS-LVT	9/15/2020	LVT-200915P	--	--	--	0.00574	--	--	0.0004 U	--	--	--	--	0.0122
LS-LVT	12/8/2020	LVT-201208D	--	--	--	0.00873	--	--	0.000386 U	--	--	--	--	0.032
LS-LVT	12/8/2020	LVT-201208P	--	--	--	0.00856	--	--	0.000393 U	--	--	--	--	0.03
LS-PS1	1/29/2020	LVP-200129Q	6.9	0.0733	5E-05 U	0.00367	2.57	0.00492 U	0.000393 U	12.9	0.000983 U	0.00492 U	0.000737 U	0.0369
LS-PS1	8/4/2020	LVP-200804Q	11.8	0.111	0.0001 U	0.00443	4.47	0.00499 U	0.000399 U	21.6	0.000997 U	0.00499 U	0.000895	0.00499 U
LS-PS1	11/17/2020	LVP-201117Q	11.2	0.128	0.0001 U	0.00572	4.19	0.0005 U	4E-05 U	19.1	0.0001 U	0.0005 U	0.00114	0.0125
LS-B	1/29/2020	LVB-200129Q	49.8	0.00384	5E-05 U	0.021	14.4	0.00498 U	0.000398 U	103	0.000996 U	0.00498 U	0.000747 U	0.0498
LS-B	8/4/2020	LVB-200804Q	213	0.817	0.0001 U	0.198	47.6	0.00496 U	0.000396 U	395	0.000991 U	0.00496 U	0.00119	0.252
LS-B	11/17/2020	LVB-201117D	79.9	2.73	0.0001 U	0.121	20.7	0.0005 U	4E-05 U	147	0.0001 U	0.0005 U	0.000593	0.184
LS-B	11/17/2020	LVB-201117Q	79.1	2.69	0.0001 U	0.117	20.5	0.0005 U	4E-05 U	144	0.0001 U	0.0005 U	0.000562	0.181

Note:

Stations LS-PS1 and LS-B were not sampled this quarter because of reduced laboratory capacity due to Covid-19.

-- = parameter is not sampled for

**Table K-2**  
**Leachate - Conventionals**

Leachate - Conventionals			Alkalinity, Total (as CaCO <sub>3</sub> )	Ammonia as N	Biological Oxygen Demand - 5 Day	Chemical Oxygen Demand	Chloride	Coliforms, Fecal	Coliforms, Total	Cyanide	Fluoride	Nitrate + Nitrite as N	Phosphorous, Soluble Reactive
Site ID	Sample Date	Sample ID	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(CFU/100 mL)	(CFU/100 mL)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
LS-LVT	03/13/20	LVT-200313P	--	--	--	--	--	--	--	--	--	--	--
LS-LVT	06/18/20	LVT-200618P	--	--	--	--	--	--	--	--	--	--	--
LS-LVT	09/15/20	LVT-200915P	--	--	--	--	--	--	--	--	--	--	--
LS-LVT	12/08/20	LVT-201208D	--	--	--	--	--	--	--	--	--	--	--
LS-LVT	12/08/20	LVT-201208P	--	--	--	--	--	--	--	--	--	--	--
LS-PS1	01/29/20	LVP-200129Q	60	0.0215	3.66	19 T	17	32	1300	0.002 U	0.036 T	0.171	0.0017 T
LS-PS1	08/04/20	LVP-200804Q	93.1	0.285	2 U	18 T	26.7	3	1800	0.002 U	0.0435	0.764	0.108
LS-PS1	11/17/20	LVP-201117Q	85	0.0619	2 U	53.1	25.7	86	1000	0.002 U	0.031 T	0.269	0.021
LS-B	01/29/20	LVB-200129Q	57.2	0.002 T	2 U	21.7	156	20	90	0.002 U	0.02 U	24.1	0.0217
LS-B	08/04/20	LVB-200804Q	630	0.0124	2 U	73.2	552	1 U	2	0.002 U	0.1 U	38.6	0.0018 T
LS-B	11/17/20	LVB-201117D	326	0.0454	2.93	47.6	216	1	300	0.002 U	0.4 U	8.55	0.002 T
LS-B	11/17/2020	LVB-201117Q	327	0.0454	3.61	44.9	205	1 U	200	0.002 U	0.4 U	8.34	0.00209

Leachate - Conventionals			Phosphorus, Total as P	Specific Conductanc e	Sulfate	Sulfide, Total	Total Fats, Oil, & Grease	Total Nitrogen	Total Carbon	Total Suspende d Solids	Total Volatile Solids	Volatile Suspended Solids
Site ID	Sample Date	Sample ID	(mg/l)	(µohms/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
LS-LVT	03/13/20	LVT-200313P	--	--	--	--	1.9 U	--	--	--	--	--
LS-LVT	6/18/2020	LVT-200618P	--	--	--	--	1.9 T	--	--	--	--	--
LS-LVT	9/15/2020	LVT-200915P	--	--	--	--	1.8 U	--	--	--	--	--
LS-LVT	12/8/2020	LVT-201208D	--	--	--	--	3.5 T	--	--	--	--	--
LS-LVT	12/8/2020	LVT-201208P	--	--	--	--	12.1	--	--	--	--	--
LS-PS1	1/29/2020	LVP-200129Q	0.983 U	247	25.4	0.01 U	1.5 U	0.787	3.5 T	7	46	5.4
LS-PS1	8/4/2020	LVP-200804Q	0.997 U	354	22.5	0.01 U	1.5 U	0.666	7.07	1 U	60.7 B	1 U
LS-PS1	11/17/2020	LVP-201117Q	0.1 U	312	24.3	0.01 U	1.7 U	0.806	6.8	2	47.3	0.9 T
LS-B	1/29/2020	LVB-200129Q	0.996 U	1310	271	0.01 U	1.5 U	0.605	6.7	0.52 U	222 H	0.52 U
LS-B	8/4/2020	LVB-200804Q	0.991 U	4490	895	0.03 U	1.5 U	2.08	30	1.1	896 H	1.1
LS-B	11/17/2020	LVB-201117D	0.1 U	1830	346	0.01 U	1.5 U	1.44	15.2	1.2	323	1
LS-B	11/17/2020	LVB-201117Q	0.1 U	1830	329	0.01 U	1.5 U	1.43	15	1.4 T	399	1.2 T

Note:  
 Stations LS-PS1 and LS-B were not sampled this quarter because of reduced laboratory capacity due to Covid-19.  
 -- = parameter is not sampled for

**Table K-4**  
**Leachate - Volatile Organic Compounds**

Leachate - Volatile Organic Compounds			1,1,1,2-Tetrachloroethane 630-20-6	1,1,1-Trichloroethane 71-55-6	1,1,2,2-Tetrachloroethane 79-34-5	1,1,2-Trichloroethane 79-00-5	1,1-Dichloroethane 75-34-3	1,1-Dichloroethene 75-35-4	1,1-Dichloropropene 563-58-6	1,2,3-Trichloropropane 96-18-4	1,2-Dibromo-3-Chloropropane 96-12-8	1,2-Dibromoethane 106-93-4	1,2-Dichlorobenzene 95-50-1	1,2-Dichloroethane 107-06-2	1,2-Dichloropropane 78-87-5	1,3-Dichlorobenzene 541-73-1	1,3-Dichloropropane 142-28-9	1,4-Dichlorobenzene 106-46-7	2,2-Dichloropropane 594-20-7	2-Butanone 78-93-3	2-Hexanone 591-78-6	2-Methyl-1-Propanol 78-83-1	3-Chloropropene 107-05-1	4-Methyl-2-Pentanone 108-10-1	Acetone 67-64-1	Acetonitrile 75-05-8	Acrolein 107-02-8
Site ID	Sample Date	Sample ID	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
LS-PS1	1/29/2020	LVP-200129Q	2.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2.5 U	5 U	50 U	1 U	25 U	25 U	50 U	25 U
LS-PS1	8/4/2020	LVP-200804Q	2.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2.5 U	5 U	50 U	1 U	25 U	25 U	50 U	25 U
LS-PS1	11/17/2020	LVP-201117Q	2.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2.5 U	5 U	50 U	1 U	25 U	25 U	50 U	25 U
LS-B	1/29/2020	LVB-200129Q	2.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2.5 U	5 U	50 U	1 U	25 U	25 U	50 U	25 U
LS-B	8/4/2020	LVB-200804Q	2.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2.5 U	5 U	50 U	1 U	25 U	25 U	50 U	25 U
LS-B	11/17/2020	LVB-201117D	2.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2.5 U	5 U	50 U	1 U	25 U	25 U	50 U	25 U
LS-B	11/17/2020	LVB-201117Q	2.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2.5 U	5 U	50 U	1 U	25 U	25 U	50 U	25 U
VOA TRIP BLANK	1/28/2020	VTRP200129Z	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.25 U	0.5 U	5 U	0.1 U	2.5 U	2.5 U	5 U	2.5 U
VOA TRIP BLANK	8/3/2020	VTRP200804Y	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.25 U	0.5 U	5 U	0.1 U	2.5 U	2.5 U	5 U	2.5 U
VOA TRIP BLANK	11/16/2020	VTRP201117Y	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.25 U	0.5 U	5 U	0.1 U	2.5 U	2.5 U	5 U	2.5 U

Leachate - Volatile Organic Compounds			Acrylonitrile 107-13-1	Benzene 71-43-2	Bromo-chloromethane 74-97-5	Bromo-dichloromethane 75-27-4	Bromoform 75-25-2	Bromo-methane 74-83-9	Carbon Disulfide 75-15-0	Carbon Tetrachloride 56-23-5	Chlorobenzene 108-90-7	Chloro-dibromomethane 124-48-1	Chloro-ethane 75-00-3	Chloroform 67-66-3	Chloro-methane 74-87-3	Chloroprene 126-99-8	Cis-1,2-Dichloroethane 156-59-2	Cis-1,3-Dichloropropene 10061-01-5	Dibromo-methane 74-95-3	Dichloro-difluoro-methane 75-71-8	Ethyl-benzene 100-41-4	M & P Xylene MPX	Methyl Iodide 74-88-4	Methyl Methacrylate 80-62-6	Methyl-acrylonitrile 126-98-7	Methylene Chloride 75-09-2	O-Xylene 95-47-6
Site ID	Sample Date	Sample ID	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
LS-PS1	1/29/2020	LVP-200129Q	0.35 U	1 U	1 U	2.5 U	5 U	1 U	1 U	2.5 U	1 U	5 U	1 U	1 U	2.5 U	1 U	1 U	2.5 U	1 U	1 U	1 U	1 U	1 U	2.5 U	1 U	25 U	1 U
LS-PS1	8/4/2020	LVP-200804Q	0.35 U	1 U	1 U	2.5 U	5 U	1 U	1 U	2.5 U	1 U	5 U	1 U	1 U	2.5 U	1 U	1 U	2.5 U	1 U	1 U	1 U	2 U	2.5 U	1 U	25 U	1 U	
LS-PS1	11/17/2020	LVP-201117Q	0.35 U	1 U	1 U	2.5 U	5 U	1 U	1 U	2.5 U	1 U	5 U	1 U	1 U	2.5 U	1 U	1 U	2.5 U	1 U	1 U	1 U	2 U	2.5 U	1 U	25 U	1 U	
LS-B	1/29/2020	LVB-200129Q	0.35 U	1 U	1 U	2.5 U	5 U	1 U	1 U	2.5 U	1 U	5 U	1 U	1 U	2.5 U	1 U	1 U	2.5 U	1 U	1 U	1 U	1 U	2 U	2.5 U	1 U	25 U	1 U
LS-B	8/4/2020	LVB-200804Q	0.35 U	1 U	1 U	2.5 U	5 U	1 U	1 U	2.5 U	1 U	5 U	1 U	1 U	2.5 U	1 U	1 U	2.5 U	1 U	1 U	1 U	2 U	2.5 U	1 U	25 U	1 U	
LS-B	11/17/2020	LVB-201117D	0.35 U	1 U	1 U	2.5 U	5 U	1 U	1 U	2.5 U	1 U	5 U	1 U	1 U	2.5 U	1 U	1 U	2.5 U	1 U	1 U	1 U	2 U	2.5 U	1 U	25 U	1 U	
LS-B	11/17/2020	LVB-201117Q	0.35 U	1 U	1 U	2.5 U	5 U	1 U	1 U	2.5 U	1 U	5 U	1 U	1 U	2.5 U	1 U	1 U	2.5 U	1 U	1 U	1 U	2 U	2.5 U	1 U	25 U	1 U	
VOA TRIP BLANK	1/28/2020	VTRP200129Z	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.25 U	0.1 U	2.5 U	0.1 U
VOA TRIP BLANK	8/3/2020	VTRP200804Y	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.2 U	0.25 U	0.1 U	2.5 U	0.1 U	
VOA TRIP BLANK	11/16/2020	VTRP201117Y	0.035 U	0.1 U	0.1 U	0.25 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.5 U	0.1 U	0.1 U	0.25 U	0.1 U	0.1 U	0.25 U	0.1 U	0.1 U	0.1 U	0.2 U	0.25 U	0.1 U	2.5 U	0.1 U	

Leachate - Volatile Organic Compounds			Propionitrile 107-12-0	Styrene 100-42-5	Tetrachloroethene 127-18-4	Toluene 108-88-3	Trans-1,2-Dichloroethene 156-60-5	Trans-1,3-Dichloropropene 10061-02-6	Trans-1,4-Dichloro-2-Butene 110-57-6	Trichloroethene 79-01-6	Trichloro-fluoro-methane 75-69-4	Vinyl Acetate 108-05-4	Vinyl Chloride 75-01-4
Site ID	Sample Date	Sample ID	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
LS-PS1	1/29/2020	LVP-200129Q	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U	1 U	0.1 U
LS-PS1	8/4/2020	LVP-200804Q	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U	1 U	0.1 DU
LS-PS1	11/17/2020	LVP-201117Q	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U	1 U	0.1 U
LS-B	1/29/2020	LVB-200129Q	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U	1 U	0.1 U
LS-B	8/4/2020	LVB-200804Q	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U	1 U	0.1 DU
LS-B	11/17/2020	LVB-201117D	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U	1 U	0.1 U
LS-B	11/17/2020	LVB-201117Q	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U	1 U	0.1 U
VOA TRIP BLANK	1/28/2020	VTRP200129Z	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	0.5 U	0.1 U	0.1 U	0.1 U	0.01 U
VOA TRIP BLANK	8/3/2020	VTRP200804Y	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	0.5 U	0.1 U	0.1 U	0.1 U	0.01 DU
VOA TRIP BLANK	11/16/2020	VTRP201117Y	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	0.5 U	0.1 U	0.1 U	0.1 U	0.01 U

Note:  
 Stations LS-PS1 and LS-B were not sampled this quarter because of reduced laboratory capacity due to Covid-19.  
 -- = parameter is not sampled for

**Table K-5**  
**Leachate - Pesticides, Herbicides, & Polychlorinated Biphenyls (PCBs)**

Leachate - Pesticides, Herbicides, & Polychlorinated Biphenyls (PCBs)			2,4,5-T	2,4,5-TP Silvex	2,4-D	4,4'DDD	4,4'DDE	4,4'DDT	Aldrin	Alpha BHC	Alpha Chlordane	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Beta BHC	
CAS #			93-76-5	93-72-1	94-75-7	72-54-8	72-55-9	50-29-3	309-00-2	319-84-6	5103-71-9	12674-11-2	11104-28-2	11141-16-5	53469-21-9	12672-29-6	11097-69-1	11096-82-5	319-85-7	
Site ID	Sample Date	Sample ID	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
LS-PS1	01/29/20	LVP-200129Q	0.25 U	0.25 U	0.5 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.01 U
LS-PS1	08/04/20	LVP-200804Q	0.25 U	0.25 U	0.5 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.01 U
LS-PS1	11/17/20	LVP-201117Q	0.25 U	0.25 U	0.5 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.01 U
LS-B	01/29/20	LVB-200129Q	0.25 U	0.25 U	0.5 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.01 U
LS-B	08/04/20	LVB-200804Q	0.25 U	0.25 U	0.5 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.01 U
LS-B	11/17/20	LVB-201117D	0.25 U	0.25 U	0.5 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.01 U
LS-B	11/17/20	LVB-201117Q	0.25 U	0.25 U	0.5 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.01 U

Leachate - Pesticides, Herbicides, & Polychlorinated Biphenyls (PCBs)			Delta BHC	Dieldrin	Dinoseb	Endosulfan I	Endosulfan II	Endosulfan Sulfate	Endrin	Endrin Aldehyde	Heptachlor	Heptachlor Epoxide	Isodrin	Lindane (Gamma BHC)	Methoxychlor	Total Aroclors	Toxaphene	trans- Chlordane
CAS #			319-86-8	60-57-1	88-85-7	959-98-8	33213-65-9	1031-07-8	72-20-8	7421-93-4	76-44-8	1024-57-3	465-73-6	58-89-9	72-43-5	T_AROC LOR	8001-35-2	5103-74-2
Site ID	Sample Date	Sample ID	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
LS-PS1	01/29/20	LVP-200129Q	0.01 U	0.01 U	0.25 U	0.4 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	0.025 U	1 U	0.01 U
LS-PS1	8/4/2020	LVP-200804Q	0.01 U	0.01 U	0.25 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	0.025 U	1 U	0.01 U
LS-PS1	11/17/2020	LVP-201117Q	0.01 U	0.01 U	0.25 U	0.02 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	0.025 U	1 U	0.01 U
LS-B	1/29/2020	LVB-200129Q	0.01 U	0.01 U	0.25 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	0.025 U	1 U	0.01 U
LS-B	8/4/2020	LVB-200804Q	0.01 U	0.01 U	4.11	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0356 J	0.01 U	0.05 U	0.025 U	1 U	0.01 U
LS-B	11/17/2020	LVB-201117D	0.01 U	0.01 U	0.5 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	0.025 U	1 U	0.01 U
LS-B	11/17/2020	LVB-201117Q	0.01 U	0.01 U	0.75 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	0.025 U	1 U	0.01 U

Note:  
 Stations LS-PS1 and LS-B were not sampled this quarter because of reduced laboratory capacity due to Covid-19.  
 -- = parameter is not sampled for



## **Appendix L**

### Landfill Gas Monitoring Data

**Table L-1**  
**Landfill Gas Monitoring Data**  
January 1, 2020 - March 31, 2020

Sample ID	Date/Time	CH4		CO2	O2	Static Pressure	Map Location (see Fig. 7)	
		(% Vol)	(% LEL)	(% Vol)	(% Vol)	(in H2O)		
GP-001	1/9/2020	0	0.2	20.3	0	-1.68	GP-1	
GP-001	2/5/2020	0	2.9	17.2	0	0.9		
GP-001	3/13/2020	0	3.5	19	0	2.52		
GP-002	1/9/2020	0	2.1	17.9	0	0.01	GP-2	
GP-002	2/5/2020	0	2.1	17.4	0	0.11		
GP-002	3/13/2020	0	2.8	18.9	0	0.52		
GP-01D	1/9/2020	0	0.2	20.7	0	-3.83	NP-1	
GP-01D	2/5/2020	0	0.1	19.7	0	1.64		
GP-01D	3/13/2020	0	0.2	21	0	5.07		
GP-01I	1/9/2020	0	0.2	20.7	0	-3.21		
GP-01I	2/5/2020	0	0.3	19.1	0	1.58		
GP-01I	3/13/2020	0	0.5	18.4	0	3.6		
GP-01S	1/9/2020	0	2.2	18	0	2.64		
GP-01S	2/5/2020	0	1.2	18.2	0	0.05		
GP-01S	3/13/2020	0	0.5	20.8	0	0.02		
GP-02D	1/9/2020	0	0.3	20.5	0	-3.78		NP-2
GP-02D	2/5/2020	0	0.4	18.6	0	1.32		
GP-02D	3/13/2020	0	0.8	19.4	0	4.91		
GP-02I	1/9/2020	0	1.4	18.6	0	-3.83		
GP-02I	2/5/2020	0	0.4	17.6	0	1.33		
GP-02I	3/13/2020	0	0.6	18.9	0	4.64		
GP-02S	1/9/2020	0	1.6	18.6	0	2.88		
GP-02S	2/5/2020	0	1	18.8	0	0.26		
GP-02S	3/13/2020	0	0.3	21	0	0.01		
GP-03D	1/9/2020	0	1.6	18.5	0	-3.63	NP-3	
GP-03D	2/5/2020	0	1.6	17.7	0	1.34		
GP-03D	3/13/2020	0	1.8	19	0	4.43		
GP-03I	1/9/2020	0	1.4	19.1	0	-3.59		
GP-03I	2/5/2020	0	1.1	18.7	0	1.37		
GP-03I	3/13/2020	0	1.6	19.8	0	4.38		
GP-03S	1/9/2020	0	0.1	20.6	0	-3.37		
GP-03S	2/5/2020	0	0.5	19.6	0	0.04		
GP-03S	3/13/2020	0	1.3	19.9	0	0.9		
GP-04D	1/9/2020	0	1.1	18.8	0	-3.08	NP-4	
GP-04D	2/5/2020	0	1	18.5	0	1.74		
GP-04D	3/13/2020	0	0.9	21	0	4.51		
GP-04I	1/9/2020	0	0.3	20.2	0	-2		
GP-04I	2/5/2020	0	0.2	19.9	0	0.95		
GP-04I	3/13/2020	0	1.3	21	0	2.81		
GP-04S	1/9/2020	0	1.8	18.8	0	-1.64		
GP-04S	2/5/2020	0	2.9	17.7	0	2.57		
GP-04S	3/13/2020	0	2.5	20.1	0	2.77		

**Table L-1 (continued)**  
**Landfill Gas Monitoring Data**  
 January 1, 2020 - March 31, 2020

Sample ID	Date/Time	CH4		CO2	O2	Static Pressure	Map Location (see Fig. 7)
		(% Vol)	(% LEL)	(% Vol)	(% Vol)	(in H2O)	
GP-05D	1/9/2020	0	0.2	20	0	-0.68	NP-5
GP-05D	2/5/2020	0	1.2	18.8	0	0.12	
GP-05D	3/13/2020	0	2.1	20.3	0	1.41	
GP-05I	1/9/2020	0	1.1	19	0	-0.34	
GP-05I	2/5/2020	0	1.1	19	0	0.09	
GP-05I	3/13/2020	0	1.7	20.9	0	0.72	
GP-05S	1/9/2020	0	0.3	19.9	0	-0.02	
GP-05S	2/5/2020	0	4	17.1	0	0.07	
GP-05S	3/13/2020	0	4.2	18.3	0	0.02	
GP-06D	1/9/2020	0	0.3	20.3	0	-1.82	NP-6
GP-06D	2/5/2020	0	0.3	19.9	0	0.5	
GP-06D	3/13/2020	0	0.5	21	0	2.59	
GP-06I	1/9/2020	0	0.2	20.3	0	-0.98	
GP-06I	2/5/2020	0	0.3	19.6	0	-0.02	
GP-06I	3/13/2020	0	2	20.9	0	0.9	
GP-06S	1/9/2020	0	3	17.9	0	0.04	
GP-06S	2/5/2020	0	1.8	18.5	0	0.09	
GP-06S	3/13/2020	0	3.6	18.1	0	-0.03	
GP-07D	1/9/2020	0	1.5	18.7	0	-0.07	NP-7
GP-07D	2/5/2020	0	2.5	16.8	0	6.45	
GP-07D	3/13/2020	0	1.6	19.7	0	0.19	
GP-07I	1/9/2020	0	0.1	20.3	0	-2.83	
GP-07I	2/5/2020	0	0.2	19.9	0	0.32	
GP-07I	3/13/2020	0	0.5	21	0	3.01	
GP-07S	1/9/2020	0	0.2	20.2	0	-2.64	
GP-07S	2/5/2020	0	0.2	19.7	0	0.89	
GP-07S	3/13/2020	0	1.4	20.2	0	3.43	
GP-08D	1/9/2020	0	0.8	15.4	0	-3.89	NP-8
GP-08D	2/5/2020	0	0.8	13.3	0	1.59	
GP-08D	3/13/2020	0	1.1	14.1	0	4.88	
GP-08I	1/9/2020	0	3	16	0	-3.94	
GP-08I	2/5/2020	0	3.1	13.4	0	1.31	
GP-08I	3/13/2020	0	5.2	6.3	0	0.69	
GP-08S	1/9/2020	0	3.8	15.1	0	-6.6	
GP-08S	2/5/2020	0	3.3	5.1	0	0.45	
GP-08S	3/13/2020	0	4	15.2	0	4.67	

**Table L-2**  
**Landfill Gas Monitoring Data**  
 April 1, 2020 - June 30, 2020

Sample ID	Date/Time	CH4		CO2	O2	Static Pressure	Map Location (see Fig. 7)	
		(% Vol)	(% LEL)	(% Vol)	(% Vol)	(in H2O)		
GP-001	4/7/2020	0	0.2	21	0	-1.46	GP-1	
GP-001	5/8/2020	0	1.3	19.8	0	0.52		
GP-001	6/22/2020	0	0.1	20.5	0	-0.39		
GP-002	4/7/2020	0	2.3	18.8	0	-0.01	GP-2	
GP-002	5/8/2020	0	2.3	17.8	0	-0.02		
GP-002	6/22/2020	0	1.9	18.6	0	0.03		
GP-01D	4/7/2020	0	0.2	21	0	-4.14	NP-1	
GP-01D	5/8/2020	0	0.2	20.6	0	1.09		
GP-01D	6/22/2020	0	0.1	20.4	0	-1.47		
GP-01I	4/7/2020	0	0.2	21	0	-2.77		
GP-01I	5/8/2020	0	0.3	20.3	0	1.11		
GP-01I	6/22/2020	0	0.1	20.3	0	-1.03		
GP-01S	4/7/2020	0	0.5	20.7	0	0		
GP-01S	5/8/2020	0	0.7	19.9	0	0.09		
GP-01S	6/22/2020	0	0.6	19.2	0	0.02		
GP-02D	4/7/2020	0	0.2	20.9	0	-3.81		NP-2
GP-02D	5/8/2020	0	0.2	20.9	0	1.12		
GP-02D	6/22/2020	0	0.1	20.5	0	-1.26		
GP-02I	4/7/2020	0	0.2	20.9	0	-3.63		
GP-02I	5/8/2020	0	0.6	18	0	1.06		
GP-02I	6/22/2020	0	0.1	20.5	0	-1.16		
GP-02S	4/7/2020	0	0.3	20.9	0	0.01		
GP-02S	5/8/2020	0	0.3	20.8	0	0.08		
GP-02S	6/22/2020	0	0.5	19.8	0	0.01		
GP-03D	4/7/2020	0	1.6	18.1	0	-3.18	NP-3	
GP-03D	5/8/2020	0	1.6	18.7	0	1.06		
GP-03D	6/22/2020	0	1.5	17.9	0	-0.96		
GP-03I	4/7/2020	0	1.7	18.8	0	-3.21		
GP-03I	5/8/2020	0	1.7	19	0	0.86		
GP-03I	6/22/2020	0	1.7	18.3	0	-0.99		
GP-03S	4/7/2020	0	1.3	18.6	0	-0.17		
GP-03S	5/8/2020	0	1.1	19.5	0	0		
GP-03S	6/22/2020	0	1	18.7	0	-0.06		
GP-04D	4/7/2020	0	1.1	19.7	0	-3.13	NP-4	
GP-04D	5/8/2020	0	1.1	19.7	0	1.11		
GP-04D	6/22/2020	0	1.2	18.6	0	-0.97		
GP-04I	4/7/2020	0	0.9	20.3	0	-1.75		
GP-04I	5/8/2020	0	0.7	20.5	0	0.92		
GP-04I	6/22/2020	0	0.6	19.8	0	-0.51		
GP-04S	4/7/2020	0	2.5	18.5	0	-1.52		
GP-04S	5/8/2020	0	2.5	18	0	0.17		
GP-04S	6/22/2020	0	2.4	17.8	0	-0.11		

**Table L-2 (continued)**  
**Landfill Gas Monitoring Data**  
 April 1, 2020 - June 30, 2020

Sample ID	Date/Time	CH4		CO2	O2	Static Pressure	Map Location (see Fig. 7)
		(% Vol)	(% LEL)	(% Vol)	(% Vol)	(in H2O)	
GP-05D	4/7/2020	0	1.9	19.1	0	-0.42	NP-5
GP-05D	5/8/2020	0	2	19.1	0	0.18	
GP-05D	6/22/2020	0	1.9	18.2	0	-0.1	
GP-05I	4/7/2020	0	1.6	19.6	0	-0.19	
GP-05I	5/8/2020	0	1.6	19.7	0	-0.01	
GP-05I	6/22/2020	0	1.5	18.9	0	-0.08	
GP-05S	4/7/2020	0	0.2	21	0	0.02	
GP-05S	5/8/2020	0	4	16.9	0	0.26	
GP-05S	6/22/2020	0	0.2	20.1	0	-0.03	
GP-06D	4/7/2020	0	0.5	21	0	-0.94	NP-6
GP-06D	5/8/2020	0	0.4	20.2	0	0.57	
GP-06D	6/22/2020	0	0.3	21	0	-0.12	
GP-06I	4/7/2020	0	0.3	21	0	-0.38	
GP-06I	5/8/2020	0	0.3	20.3	0	0.02	
GP-06I	6/22/2020	0	0.2	21	0	0	
GP-06S	4/7/2020	0	3.6	16.7	0	0.02	
GP-06S	5/8/2020	0	3.3	16.1	0	0.01	
GP-06S	6/22/2020	0	3.1	17.1	0	0.08	
GP-07D	4/7/2020	0	1.7	18.6	0	0.01	NP-7
GP-07D	5/8/2020	0	1.7	16.8	0	0.03	
GP-07D	6/22/2020	0	1.5	16	0	0.09	
GP-07I	4/7/2020	0	0.2	21	0	-1.79	
GP-07I	5/8/2020	0	0.2	20.6	0	0.63	
GP-07I	6/22/2020	0	0.1	20.8	0	-0.43	
GP-07S	4/7/2020	0	0.2	21	0	-2.24	
GP-07S	5/8/2020	0	0.2	20.7	0	0.89	
GP-07S	6/22/2020	0	0.1	20.7	0	-0.63	
GP-08D	4/7/2020	0	0.3	20.9	0	-3.97	NP-8
GP-08D	5/8/2020	0	0.2	20.6	0	0.01	
GP-08D	6/22/2020	0	0.1	19.3	0	-1.27	
GP-08I	4/7/2020	0	0.3	20.7	0	-3.72	
GP-08I	5/8/2020	0	3.2	15.8	0	1.08	
GP-08I	6/22/2020	0	0	20.1	0	-1.15	
GP-08S	4/7/2020	0	6.3	2.8	0	-1.01	
GP-08S	5/8/2020	0	5	5.8	0	0.01	
GP-08S	6/22/2020	0	0.1	20.1	0	-0.12	

**Table L-3**  
**Landfill Gas Monitoring Data**  
July 1, 2020 - September 30, 2020

Sample ID	Date/Time	CH4		CO2	O2	Static Pressure	Map Location (see Fig. 7)
		(% Vol)	(% LEL)	(% Vol)	(% Vol)	(in H2O)	
GP-001	7/8/2020	0	0.1	20.8	0.0	-0.02	GP-1
GP-001	8/7/2020	0	0.2	21.0	0.0	-0.68	
GP-001	9/11/2020	0	0.2	20.8	0.0	-0.09	
GP-002	7/8/2020	0	1.8	18.0	0.0	0.04	GP-2
GP-002	9/11/2020	0	1.5	18.5	0.0	0.19	
GP-002	7/8/2020	0	0.1	20.7	0.0	-0.50	
GP-01D	8/7/2020	0	0.2	21.0	0.0	-2.26	NP-1
GP-01D	9/11/2020	0	0.1	20.4	0.0	-0.68	
GP-01D	7/8/2020	0	0.1	20.7	0.0	-0.16	
GP-01I	8/7/2020	0	0.2	21.0	0.0	-1.70	
GP-01I	9/11/2020	0	0.1	20.8	0.0	-0.48	
GP-01I	7/8/2020	0	0.9	18.9	0.0	-0.05	
GP-01S	8/7/2020	0	1.4	19.0	0.0	-0.04	
GP-01S	9/11/2020	0	0.8	19.1	0.0	0.05	
GP-01S	7/8/2020	0	0.1	20.8	0.0	-0.44	
GP-02D	8/7/2020	0	0.2	21.0	0.0	-2.08	NP-2
GP-02D	9/11/2020	0	0.1	20.9	0.0	-0.70	
GP-02D	7/8/2020	0	0.1	20.7	0.0	-0.42	
GP-02I	8/7/2020	0	0.2	21.0	0.0	-1.96	
GP-02I	9/11/2020	0	0.1	20.8	0.0	-0.69	
GP-02I	7/8/2020	0	0.2	20.6	0.0	-0.16	
GP-02S	8/7/2020	0	1.2	19.8	0.0	0.04	
GP-02S	9/11/2020	0	0.2	20.7	0.0	0.03	
GP-02S	7/8/2020	0	1.5	18.0	0.0	-0.37	
GP-03D	8/7/2020	0	1.9	18.2	0.0	-1.69	NP-3
GP-03D	9/11/2020	0	1.2	18.5	0.0	-0.74	
GP-03D	7/8/2020	0	1.6	18.3	0.0	-0.07	
GP-03I	8/7/2020	0	1.9	18.5	0.0	-1.65	
GP-03I	9/11/2020	0	1.4	18.5	0.0	-0.61	
GP-03I	7/8/2020	0	1.1	18.7	0.0	0.02	
GP-03S	8/7/2020	0	1.3	19.3	0.0	-0.05	
GP-03S	9/11/2020	0	0.8	19.5	0.0	0.02	
GP-03S	7/8/2020	0	1	18.9	0.0	-0.39	
GP-04D	8/7/2020	0	1.5	19.0	0.0	-0.98	NP-4
GP-04D	9/11/2020	0	1	19.1	0.0	-0.82	
GP-04D	7/8/2020	0	1	19.6	0.0	-0.19	
GP-04I	8/7/2020	0	1	20.2	0.0	-0.89	
GP-04I	9/11/2020	0	0.7	20.1	0.0	-0.39	
GP-04I	7/8/2020	0	1.5	18.9	0.0	0.01	
GP-04S	8/7/2020	0	2.6	18.6	0.0	-0.29	
GP-04S	9/11/2020	0	2	19.0	0.0	-0.02	
GP-04S	7/8/2020	0	1.6	19.0	0.0	-0.02	

**Table L-3 (continued)**  
**Landfill Gas Monitoring Data**  
 July 1, 2020 - September 30, 2020

Sample ID	Date/Time	CH4		CO2	O2	Static Pressure	Map Location (see Fig. 7)
		(% Vol)	(% LEL)	(% Vol)	(% Vol)	(in H2O)	
GP-05D	8/7/2020	0	2.1	19.1	0.0	-0.25	NP-5
GP-05D	9/11/2020	0	1.6	19.0	0.0	-0.02	
GP-05D	7/8/2020	0	1.4	19.5	0.0	-0.01	
GP-05I	8/7/2020	0	1.7	19.8	0.0	-0.02	
GP-05I	9/11/2020	0	1.2	19.6	0.0	0.13	
GP-05I	7/8/2020	0	0.6	20.3	0.0	0.02	
GP-05S	8/7/2020	0	0.3	21.0	0.0	0.02	
GP-05S	9/11/2020	0	0.2	20.7	0.0	0.09	
GP-05S	7/8/2020	0	0.4	20.5	0.0	-0.01	
GP-06D	8/7/2020	0	0.3	20.6	0.0	-0.50	NP-6
GP-06D	8/7/2020	0	2	18.6	0.0	0.06	
GP-06D	9/11/2020	0	0.4	20.3	0.0	-0.01	
GP-06I	7/8/2020	0	0.2	20.7	0.0	0.03	
GP-06I	8/7/2020	0	0.2	20.8	0.0	-0.04	
GP-06I	9/11/2020	0	0.2	20.4	0.0	0.15	
GP-06S	7/8/2020	0	2.9	16.9	0.0	0.06	
GP-06S	8/7/2020	0	3.6	17.3	0.0	0.06	
GP-06S	9/11/2020	0	3.2	17.6	0.0	0.16	
GP-07D	7/8/2020	0	1.4	16.2	0.0	0.04	NP-7
GP-07D	8/7/2020	0	1.8	15.8	0.0	0.05	
GP-07D	9/11/2020	0	1.5	15.7	0.0	0.14	
GP-07I	7/8/2020	0	0.1	21.0	0.0	-0.02	
GP-07I	8/7/2020	0	0.2	21.0	0.0	-0.67	
GP-07I	9/11/2020	0	0.1	20.6	0.0	-0.04	
GP-07S	7/8/2020	0	0.1	21.0	0.0	-0.23	
GP-07S	8/7/2020	0	0.2	20.9	0.0	-0.95	
GP-07S	9/11/2020	0	0.1	20.7	0.0	-0.09	
GP-08D	7/8/2020	0	0.1	21.0	0.0	-0.42	NP-8
GP-08D	8/7/2020	0	0.2	20.8	0.0	-1.89	
GP-08D	9/11/2020	0	0.1	20.9	0.0	-0.70	
GP-08I	7/8/2020	0	0.1	21.0	0.0	-0.26	
GP-08I	8/7/2020	0	0.2	20.9	0.0	-0.01	
GP-08I	9/11/2020	0	0.1	20.9	0.0	-0.61	
GP-08S	7/8/2020	0	0.2	21.0	0.0	0.04	
GP-08S	8/7/2020	0	0.3	20.8	0.0	-1.68	
GP-08S	9/11/2020	0	0.2	20.7	0.0	0.00	

**Table L-4**  
**Landfill Gas Monitoring Data**  
October 1, 2020 - December 31, 2020

Sample ID	Date/Time	CH4		CO2	O2	Static Pressure	Map Location (see Fig. 7)
		(% Vol)	(% LEL)	(% Vol)	(% Vol)	(in H2O)	
GP-001	10/6/2020	0	0.2	21.0	0.0	0.43	GP-1
GP-001	11/2/2020	0	0.9	20.2	0.0	0.69	
GP-001	12/4/2020	0	0.2	20.9	0.0	-0.16	
GP-002	10/6/2020	0	1.8	17.5	0.0	0.25	GP-2
GP-002	11/2/2020	0	2	19.1	0.0	0.07	
GP-002	12/4/2020	0	2.1	18.3	0.0	0.07	
GP-01D	10/6/2020	0	0.1	21.0	0.0	0.58	NP-1
GP-01D	11/2/2020	0	0.2	20.6	0.0	1.28	
GP-01D	12/4/2020	0	0.2	20.8	0.0	-2.02	
GP-01I	10/6/2020	0	0.1	20.9	0.0	0.38	
GP-01I	11/2/2020	0	0.4	19.0	0.0	1.25	
GP-01I	12/4/2020	0	0.2	20.8	0.0	-1.89	
GP-01S	10/6/2020	0	1.3	18.6	0.0	0.03	
GP-01S	11/2/2020	0	1.4	18.1	0.0	0.19	
GP-01S	12/4/2020	0	0.2	20.8	0.0	-1.01	
GP-02D	10/6/2020	0	0.1	21.0	0.0	0.60	NP-2
GP-02D	11/2/2020	0	0.2	20.2	0.0	1.41	
GP-02D	12/4/2020	0	0.2	20.8	0.0	-1.67	
GP-02I	10/6/2020	0	0.1	21.0	0.0	0.55	
GP-02I	11/2/2020	0	0.5	17.6	0.0	1.17	
GP-02I	12/4/2020	0	0.2	20.7	0.0	-1.54	
GP-02S	10/6/2020	0	0.7	20.2	0.0	0.02	
GP-02S	11/2/2020	0	0.9	19.7	0.0	0.03	
GP-02S	12/4/2020	0	1.4	19.3	0.0	0.03	
GP-03D	10/6/2020	0	1.5	18.7	0.0	0.58	NP-3
GP-03D	11/2/2020	0	1.4	18.2	0.0	1.07	
GP-03D	12/4/2020	0	1.4	18.7	0.0	-1.21	
GP-03I	10/6/2020	0	1.7	18.6	0.0	0.57	
GP-03I	11/2/2020	0	1.6	18.4	0.0	1.20	
GP-03I	12/4/2020	0	1.5	19.0	0.0	-1.25	
GP-03S	10/6/2020	0	1.3	19.6	0.0	0.07	
GP-03S	11/2/2020	0	1.1	19.1	0.0	0.09	
GP-03S	12/4/2020	0	1.1	19.5	0.0	0.08	
GP-04D	10/6/2020	0	0.7	20.3	0.0	0.64	NP-4
GP-04D	11/2/2020	0	0.6	20.3	0.0	1.15	
GP-04D	12/4/2020	0	1.1	19.5	0.0	-1.21	
GP-04I	10/6/2020	0	0.8	20.5	0.0	0.39	
GP-04I	11/2/2020	0	0.8	20.2	0.0	0.84	
GP-04I	12/4/2020	0	0.6	20.6	0.0	-0.51	
GP-04S	10/6/2020	0	1.9	19.7	0.0	0.21	
GP-04S	11/2/2020	0	2	19.2	0.0	0.35	
GP-04S	12/4/2020	0	0.5	20.7	0.0	-0.07	



**Table L-4 (continued)**  
**Landfill Gas Monitoring Data**  
October 1, 2020 - December 31, 2020

Sample ID	Date/Time	CH4		CO2	O2	Static Pressure	Map Location (see Fig. 7)
		(% Vol)	(% LEL)	(% Vol)	(% Vol)	(in H2O)	
GP-05D	10/6/2020	0	1.9	18.6	0.0	0.38	NP-5
GP-05D	11/2/2020	0	2.1	18.9	0.0	0.66	
GP-05D	12/4/2020	0	2.3	18.3	0.0	0.00	
GP-05I	10/6/2020	0	1.6	19.2	0.0	0.17	
GP-05I	11/2/2020	0	1.7	19.6	0.0	0.12	
GP-05I	12/4/2020	0	1.6	19.3	0.0	-0.04	
GP-05S	10/6/2020	0	2.3	18.8	0.0	0.05	
GP-05S	11/2/2020	0	3.7	17.7	0.0	0.13	
GP-05S	12/4/2020	0	0.4	20.2	0.0	-0.03	
GP-06D	10/6/2020	0	0.4	20.0	0.0	0.70	NP-6
GP-06D	11/2/2020	0	0.4	21.3	0.0	1.23	
GP-06D	12/4/2020	0	0.4	20.4	0.0	0.04	
GP-06I	10/6/2020	0	0.6	19.7	0.0	0.28	
GP-06I	11/2/2020	0	1	20.6	0.0	0.40	
GP-06I	12/4/2020	0	0.4	20.4	0.0	0.12	
GP-06S	10/6/2020	0	3.6	17.3	0.0	0.09	
GP-06S	11/2/2020	0	3.8	18.1	0.0	0.09	
GP-06S	12/4/2020	0	3.6	17.4	0.0	0.03	
GP-07D	10/6/2020	0	2.2	14.9	0.0	0.13	NP-7
GP-07D	11/2/2020	0	2.3	15.9	0.0	0.19	
GP-07D	12/4/2020	0	0.3	20.6	0.0	-1.48	
GP-07I	10/6/2020	0	0.2	20.6	0.0	0.70	
GP-07I	11/2/2020	0	0.3	20.9	0.0	0.98	
GP-07I	12/4/2020	0	0.2	20.7	0.0	-1.40	
GP-07S	10/6/2020	0	0.1	20.7	0.0	0.91	
GP-07S	11/2/2020	0	0.2	21.6	0.0	1.39	
GP-07S	12/4/2020	0	0.2	20.6	0.0	0.04	
GP-08D	10/6/2020	0	0.4	18.6	0.0	0.51	NP-8
GP-08D	11/2/2020	0	0.3	20.1	0.0	1.09	
GP-08D	12/4/2020	0	1.7	16.7	0.0	0.06	
GP-08I	10/6/2020	0	3.5	15.5	0.0	0.47	
GP-08I	11/2/2020	0	8.7	4.4	0.0	0.06	
GP-08I	12/4/2020	0	0.2	20.7	0.0	-0.44	
GP-08S	10/6/2020	0	8.7	4.9	0.0	0.08	
GP-08S	11/2/2020	0	3.4	15.9	0.0	1.15	
GP-08S	12/4/2020	0	0.2	20.5	0.0	-0.58	

## **Appendix M**

### Inspection Survey Reports

# SOLID WASTE INSPECTION REPORT

<b>PUBLIC HEALTH - SEATTLE &amp; KING COUNTY</b> Downtown Office 401 - 5th Ave., Ste 1100 Seattle, WA 98104 206-263-9566	<b>PURPOSE OF VISIT:</b> Routine Inspection/Field Review of a Closed Landfill - Permitted establishment (PE=1002)
<b>ESTABLISHMENT INFORMATION:</b>  <b>VASHON LANDFILL</b> VASHON LANDFILL 18900 SW WESTSIDE HWY SW VASHON ISLAND, WA 98070 206-296-4385  <b>Program Record:</b> PR0015723	<b>INSPECTION INFORMATION:</b>  <b>Date of Inspection:</b> Wednesday, June 10, 2020 <b>Time In:</b> 1:15 pm <b>Time Out:</b> 1:55 pm  <b>Inspector:</b> Darshan Dhillon <b>Result:</b> COMPLETE

**VIOLATIONS OBSERVED (if any)**

**OVERALL INSPECTION COMMENTS:**

Weather: Cloudy and overcast

**1. ACTIONS AND RECOMMENDATIONS:**

1.1 Landfill cover needs to be landscaped. Tall grasses are growing on the entire landfill cover.

**2.0 OBSERVATIONS:**

2.1 Storm water ponds were half full with storm water.

2.2 Leachate pond aerators were operating.

2.3 Landfill gas extraction system is operating and Landfill gas (LFG) being passed through the activated carbon filters.

2.4 Landfill gas is monitored on a monthly basis and no exceedances were noticed.

2.5 Access to the facility has been controlled by a locking gate.

2.6 Groundwater monitoring wells and gas probes are secured by pad locks.

2.7 Groundwater is being monitored on a quarterly basis.

2.8 Weekly inspections carried out by the landfill staff and records are maintained.



Darshan Dhillon  
HEI III

**PIC Phone #:** 206-477-0458

**Email:** Marisa.Baptiste@kingcounty.gov

The following items are evaluated during inspections.  
Violations cited as out of compliance during this inspection are highlighted below.

Out=out of compliance

### OUT

#### Abandoned Landfill Sites BOH 10.09.040

- 0888-Abandoned landfills maintained so as to not create a risk to the public health.

#### Closer Landfill Leachate Management for surface

##### impoundment WAC-173-350-330

- 0754-Records kept of weekly inspections and liner inspections at least every 5 years
- 0763-Liners, embankments, tank piping and secondary containment maintained and logs kept
- 0766-Surface impoundments not equipped with a leak detection layer must meet WAC 173-350-500
- 0767-Surface impoundments w/a leak detection layer are subject to WAC 173-350-040 (5),173-350-330(b)

#### Closure Performance Standard WAC-173-304-407 (3)

- 0870-Closure must be performed in a manner to minimize maintenance
- 0871-Closure must be performed to control and prevent threats to human health and the environment
- 0872-Facility must be prepared for post-closure period

#### Closure Plan and Amendments WAC-173-304-407 (4)

- 0873-Facility must provide a closure plan amendments as directed by JHD
- 0874-Facility must be closed in accordance with the approved closure plan amendments

#### Closure Procedure WAC 173-304-407 (4)

- 0875-Closure plan sheets signed by WS PE showing as-built changes in final constn per closure plan

#### Closure Requirements WAC-173-351-500

- 0856-Final cover installed to minimize, infiltration and erosion per design
- 0857-Closure plan followed for areas of the MSWLF unit within 30 days of final receipt of wa-stes
- 0858-For closed areas, closure activities must be completed within 180 days

#### Financial Assurance Criteria WAC-173-351-600

- 0864-Financial assurance for post closure care per WAC 173-351-600 (3)

#### Landfill requirements for landfill closed under WAC

##### 173-304-460

- 0882-Must prevent groundwater contamination per WAC 173-304-100
- 0883-Operation shall not result in explosive gas generation in facility structures
- 0884-Operation shall not result in explosive gas generated by the landfill at property boundary
- 0885-Landfill shall not cause violation of ambient air quality standard at property boundary
- 0886-Landfill shall not cause water quality violations

#### Methane Monitoring BOH 10.09.050

- 0889-Methane monitoring must be conducted per BOH 10.09.050
- 0890-Structures within 1,000 ft of landfill must be protected from potential methane migration

#### Performance Standards

- 0290-Must not pose a threat to human health or environment
- 0291-Protects from ground water contamination
- 0292-The facility must conform to the approved local comprehensive solid waste management plan
- 0293-Complies with RCW 70.94 Emission or ambient air quality standards
- 0294-Complies with all other local/state/federal laws and regulations

#### Permit Requirements

- 0891-Permit Required for Landfills operating under WAC 173-351

#### Post Closure care WAC-173-351-500

### OUT

- 0859-For closed areas post closure care must be conducted per post-closure plan and WAC

- 0860-Final cover for closed areas must be maintained (vegetation, settlement, erosion,# run on/off)

- 0861-Leachate collection systems maintained and operated per post-closure plan and WAC 173-351-300

- 0862-Gas monitoring systems maintained and operated per post-closure plan and WAC 173-351-200

#### Post Closure Performance Standards WAC 173-304-407 (6)

- 0876-Post-closure activities must provide maintenance & monitoring of air/land/ water for stability

#### Post Closure Plan WAC 173-304-407 (7)

- 0877-Facility must keep and abide by approved plan of post closure
- 0878-Facility must provide an approved financial assurance instrument for all post closure costs
- 0879-Post-closure activities must be completed per the closure plan and schedule
- 0880-Owner/operator must implement post closure activities w/ a valid post closure plan and any requ

#### Post Closure Procedure WAC 173-304-407 (8)

- 0881-WA PE certification must be to the JHD of why post-closure activities are no longer necessary

#### Requirements sf Landfills BOH 10.09: for landfills closed under WAC 173-351/304&pre WAC173-.04

- 0887-Necessary maintenance, site inspections, and reporting provided for closed landfills

## **Appendix N**

### Financial Summary

# **King County Solid Waste Division**

## **Vashon Island Closed Landfill**

### **2020 Financial Summary**

#### **King County Vashon Closed Landfill – Closed 2001 WAC 173-351**

The minimum 30-year post closure required funding period is currently planned through 2031. Financial Assurance is derived from three sources: the established post-closure fund [WAC 173-351-600 (5) (a) (i), the recurring two-year operational and capital improvement program funds WAC 173-351-600 (5) (a) (ii) and the high security bonding options [WAC 173-351-600 (5) (a) (iii)] described in the April 18, 2014 letter from V. Okereke KCSWD to B. Lasby SKCDPH.

Landfill Systems being maintained during post-closure:

- Geomembrane cover
- Landfill gas collection with carbon treatment
- Leachate/Wastewater control and management
- Groundwater, surface water, leachate, and landfill gas monitoring

Completion of the following projects will provide necessary information to reevaluate the current post-closure assumptions and financial assurance plans:

- Enhancements to landfill gas control and treatment
- Modifications to leachate and wastewater management
- Groundwater monitoring of natural attenuation and landfill gas control improvements
- Determination of remaining post-closure period

# King County Solid Waste Division

## Vashon Island Closed Landfill

### 2020-2021 Financial Summary

Account Description	2021 Budget	2022 Budget
<b>PCM Budget: Routine Maintenance, Operations, Compliance Reporting, Public Response (Excludes Capitol Improvement Project)</b>		
LABOR	\$ 146,760.00	\$ 151,089.00
MISC OPERATING SUPPLIES	\$ 177.00	\$ 177.00
SMALL TOOLS NON CAP NON CONTROL	\$ 11,675.00	\$ 11,675.00
OTHER CONTRACTUAL PROF SVCS	\$ 73,232.83	\$ 73,232.83
UTILITIES SURFACE WATER UTILITY	\$ 12.00	\$ 12.00
DISPOSAL	\$ 16,524.00	\$ 16,524.00
LABORATORY ANALYSIS	\$ 87,224.00	\$ 87,224.00
<b>PCM BUDGET SUBTOTAL</b>	<b>\$ 335,604.83</b>	<b>\$ 339,933.83</b>

**Capitol Improvement Program Budget: Environmental Investigation, Engineering Control Systems Modifications, Groundwater Monitoring Network Evaluation and Modifications**

<b>CIP BUDGET SUBTOTAL</b>	<b>\$2,656,780</b>
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