White Salmon River Watershed Bacteria Monitoring Study (2022 – 2024)

Data Summary Report

By Devon Julian and Rylynn Carney

For the
Environmental Assessment Program
Washington State Department of Ecology
Olympia, Washington

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Water Resource Inventory Area (WRIA) and 8-digit Hydrologic Unit Code (HUC) numbers for the study area:

- WRIA: 29 — Wind/White Salmon
- HUC Numbers: 17070105 — Middle Columbia-Hood

Cover Photo: White Salmon River near B Z Corner, WA. Photo by Devon Julian.

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[1] https://www.ecology.wa.gov/Research-Data/Data-resources/Environmental-Information-Management-database

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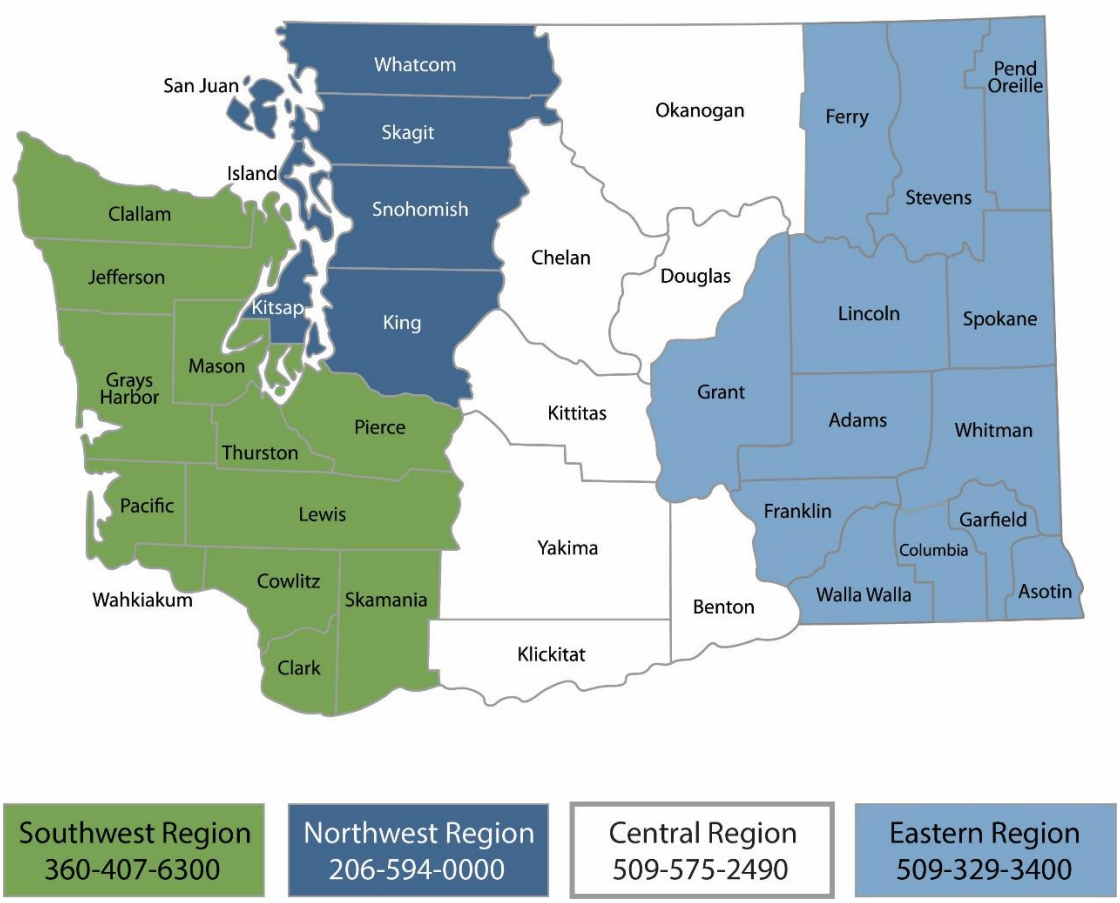
Map of Counties Served



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Acknowledgments

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Abstract

In 2019, Washington State adopted *Escherichia coli (E. coli)* as the new water quality standard for bacteria, replacing fecal coliform in accordance with U.S. Environmental Protection Agency guidelines (WAC 173-201A). This change required WA State Department of Ecology to resurvey the White Salmon River Watershed, a system with known stream segments that have historically exceeded bacteria standards. To establish a new bacteria baseline, water samples were collected every two weeks at ten primary sites from 2022 to 2024, and at eight additional source tracking sites in 2024. Streamflow was also measured biweekly at seven primary locations from 2023 to 2024. This monitoring study successfully achieved its objectives by collecting high-quality bacteria (92% completeness) and streamflow (75% completeness) data and by conducting source tracking efforts.

Introduction

This data quality summary report establishes an *Escherichia coli (E. coli)* bacteria baseline for the White Salmon River Watershed. Data from this study has been uploaded to EIM, Ecology's Environmental Information Management, database. Washington State Department of Ecology (Ecology) collected water samples to provide the information required to determine if the White Salmon River and its main tributaries meet the new Water Quality Standard, *E. coli* (WAC 173-201A). Ecology also performed streamflow measurements for future studies to calculate bacteria loading.

Background

To date there have been long term issues with Fecal Coliform in the White Salmon Watershed. From 1992 – 2015 Washington Department of Ecology and Underwood Conservation District has been gathering fecal coliform (FC) bacteria data. Results of these studies have revealed several segments of the White Salmon River and multiple tributaries are out of compliance with the federal Clean Water Act, earning them a place on the 303(d) list of impaired waterbodies (Collyard and Von Prause 2009; Collyard 2011; Underwood Conservation District 2016; Hanson et al. 2023).

In 2019, Washington State changed the water quality standard for surface water bacteria from FC to *E. coli.* This updated testing method is more precise than FC and has been implemented by the Environmental Protection Agency (EPA) to improve public and environmental health. Limited *E. coli* data existed in the White Salmon River Watershed. Full project background, including previous studies and existing data, can be found in the Quality Assurance Project Plan (QAPP): White Salmon River Watershed Bacteria Assessment (Hanson et al. 2023).

Study Area

The study area is displayed in Figure 1. The White Salmon River runs through Skamania, Yakima and Klickitat counties and is part of the Water Resource Inventory Area (WRIA) 29. Please see Quality Assurance Project Plan (QAPP): White Salmon River Watershed Bacteria Assessment (Hanson et al. 2023), for full description and history of the study area.

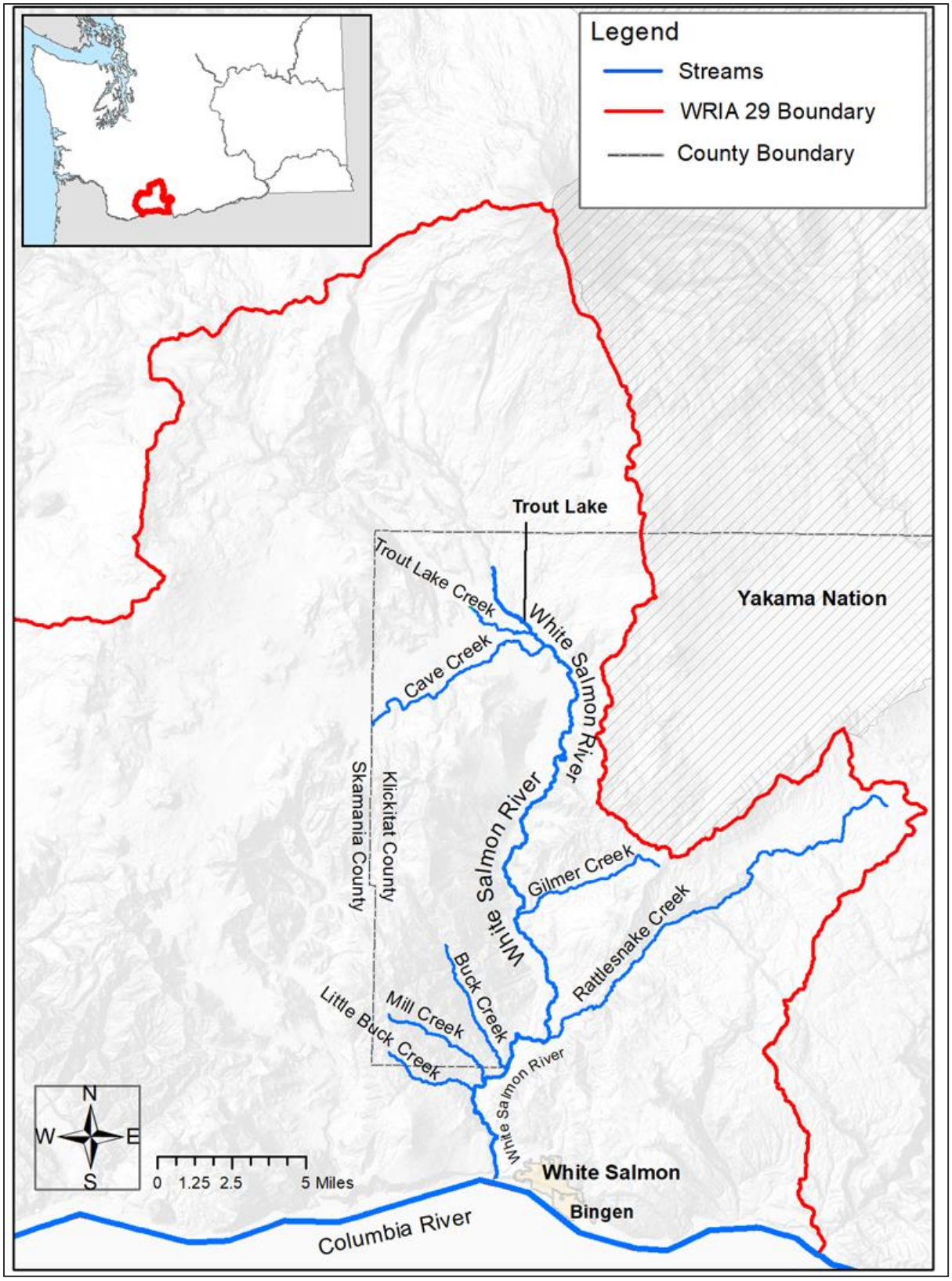

Figure 1. Map of Study area for the Bacteria Monitoring Study of the White Salmon River Watershed (2022 – 2024)

Parameter of Interest

This monitoring study focused on the collection of *E. coli* bacteria surface water samples and streamflow discharge measurements. This bacteria parameter is crucial in determining if the White Salmon River Watershed is complying with the new water quality standard. Table 1 shows the primary contact for recreation bacteria criteria in freshwater. These criteria are based on *E. coli* and fecal coliform organism levels and expressed as colony forming units (CFU) or most probable number (MPN). The use of fecal coliform organism levels as a bacterial indicator, to determine compliance in freshwater, expired on December 31, 2020. Please see Quality Assurance Project Plan (QAPP): White Salmon River Watershed Bacteria Assessment (Hanson et al. 2023), for full description of parameter, potential sources and regulatory criteria.

Project Goals

This project was designed to accomplish two key goals: first, to determine if stream reaches in the watershed meet the new *E. coli* standard (WAC 173-201A). The second goal was to identify potential sources of *E. coli*. This data summary report provides the data that could be used for future analysis.

Project Objectives

Field data collection took place from December 2022 to August 2024. Specific objectives of this study set out by the Quality Assurance Project Plan (QAPP): White Salmon River Watershed Bacteria Assessment (Hanson et al. 2023) were as follows:

- Collect and analyze bi-weekly E. coli samples at primary locations.
- When streamflow conditions permit, take streamflow measurements at each location.
- Conduct source identification monitoring for bacteria exceedances when indicated by results from primary locations.

Table 1. Primary Contact Recreation Bacteria Criteria in Freshwater

Bacterial Indicator	Criteria
E. coli	E. coli organism levels within an averaging period must not exceed a geometric mean value of 100 CFU or MPN per 100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained within the averaging period exceeding 320 CFU or MPN per 100 mL.
Fecal coliform (expired 12/31/2020)	Fecal coliform organism levels within an averaging period must not exceed a geometric mean value of 100 CFU or MPN per 100 mL, with no more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained within an averaging period exceeding 200 CFU or MPN per 100 mL.

(A) Effluent bacteria samples: When averaging effluent bacteria sample values for comparison to the geometric mean criteria, or for determining permit compliance, the averaging period shall be thirty days or less.

(B) Ambient water quality samples: When averaging bacteria sample values for comparison to the geometric mean criteria, it is preferable to average by season. The averaging period of bacteria sample data shall be ninety days or less.

(i) A minimum of three samples is required to calculate a geometric mean for comparison to the geometric mean criteria. Sample collection dates shall be well distributed throughout the averaging period so as not to mask noncompliance periods.

(ii) When determining compliance with the bacteria criteria in or around small sensitive areas, such as swimming beaches, it is recommended that multiple samples are taken throughout the area during each visit. Such multiple samples should be arithmetically averaged together (to reduce concerns with low bias when the data later used in calculating a geometric mean) to reduce sample variability and to create a single representative data point.

(iii) As determined necessary by the department, more stringent bacteria criteria may be established for rivers and streams that cause, or significantly contribute to, the decertification or conditional certification of commercial or recreational shellfish harvest areas, even when the preassigned bacteria criteria for the river or stream are being met.

(iv) Where information suggests that sample results are due primarily to sources other than warm-blooded animals (e.g., wood waste), alternative indicator criteria may be established on a site-specific basis as described in WAC 173-201A-430.

Methods

Ecology collected water samples and performed streamflow measurements in the White Salmon Watershed from December 2022 to August 2024. This data collection effort followed the study design in the Quality Assurance Project Plan (QAPP): White Salmon River Watershed Bacteria Assessment (Hanson et al. 2023).

Study Design

Ecology conducted synoptic sampling every two weeks at ten primary locations from 2022 – 2024, with the addition of eight source tracking sites in 2024. Of the ten primary sample sites, streamflow measurements were taken at seven sites when weather and streamflow conditions permitted. Stream access was limited by the White Salmon River's steep, entrenched channels, which restricted sampling design. Preliminary *E. coli* data from the primary sites were used to identify source tracking locations by using geometric mean calculation (Table 1). Instead of source identification, this study utilized source tracking to expand the monitoring area and locate stream reaches that may be exceeding the *E. coli* bacteria Water Quality Standard (WAC 173-201A).

Table 2 lists all sampling locations, detailing location identification (ID), site type (primary or source tracking), site description, streamflow designation, and coordinates for each site. Figure 2 displays the location of each sampling location in the White Salmon River Watershed.

For more information regarding source tracking efforts and geometric mean calculations, please see Quality Assurance Project Plan (QAPP): White Salmon River Watershed Bacteria Assessment (Hanson et al. 2023) and WAC 173-201A.

Table 2. List of Primary and Source Tracking Sample Locations

Location ID	Type	Location Description	Streamflow Site	Latitude	Longitude
29-TLC-2.23	ST	Trout Lake Creek at Guler Road	No	46.0024220	-121.5385700
29-WS-29.38	ST	White Salmon River, bridge on Mt. Adams Recreation Highway	No	46.0155300	-121.5280520
29-TLC-0.03	P	Trout Lake Creek Station @ river mile 0.30 off Old Creamery Bridge	Yes	45.9951251	-121.5080788
29-WS-25.18	P	White Salmon River @ River Road Bridge	Yes	45.9886351	-121.4920687
29-RRD-1	ST	White Salmon River irrigation ditch 1 at River Road	No	45.9856941	-121.4834187
29-RRD-2	ST	White Salmon River irrigation ditch 2 at River Road	No	45.9857131	-121.4830287
29-WS-22.55	P	White Salmon River @ river mile 22.5 bridge of Sunnyside Road	No	45.9641550	-121.4693787
29-WS-20.9	ST	White Salmon River @ river Mile 20.9 bridge of Strong Road	No	45.9455950	-121.4791589
29-TLD-2.6	P	Trout Lake Ditch @ Sunnyside Road culvert	Yes	45.9422145	-121.4834681
29-GC-5.6	ST	Gilmer Creek @ river mile 5.6 off BZ Highway	No	45.8845847	-121.4200989
29-GC-3.25	ST	Gilmer Creek @ river mile 3.25 off Oak Ridge Road culvert	No	45.8716846	-121.4649493
29-GC-0.20	P	Gilmer Creek @ river mile 0.2 near mouth	Yes	45.8577846	-121.5043998
29-GC-1.0	P*	Gilmer Creek @ river mile 1.0 off BZ Highway	Yes	45.8644746	-121.4940896
29-WS-12	P	White Salmon River @ river mile 12 near boat launch	No	45.8506045	-121.5079998
29-RSC-0.1	P	Rattlesnake Creek @ river mile 0.1 near mouth	Yes	45.7971743	-121.4850500
29-IC-0.1	ST	Indian Creek at mouth	No	45.7994070	-121.4766170
29F060	P	Buck Creek at Big Buck Creek Road	Yes	45.7820490	-121.5168010
29-WS-1.43	P	White Salmon River @ river mile 1.43 below dam	No	45.7488441	-121.5222007
29-MC-0.1	P	Mill Creek at Lakeview Road	Yes	45.7789800	-121.5320600

*Temporary site that was sampled for three months until access was granted for primary site, 29-GC-0.2

P = Primary Site

ST =Source Tracking Site

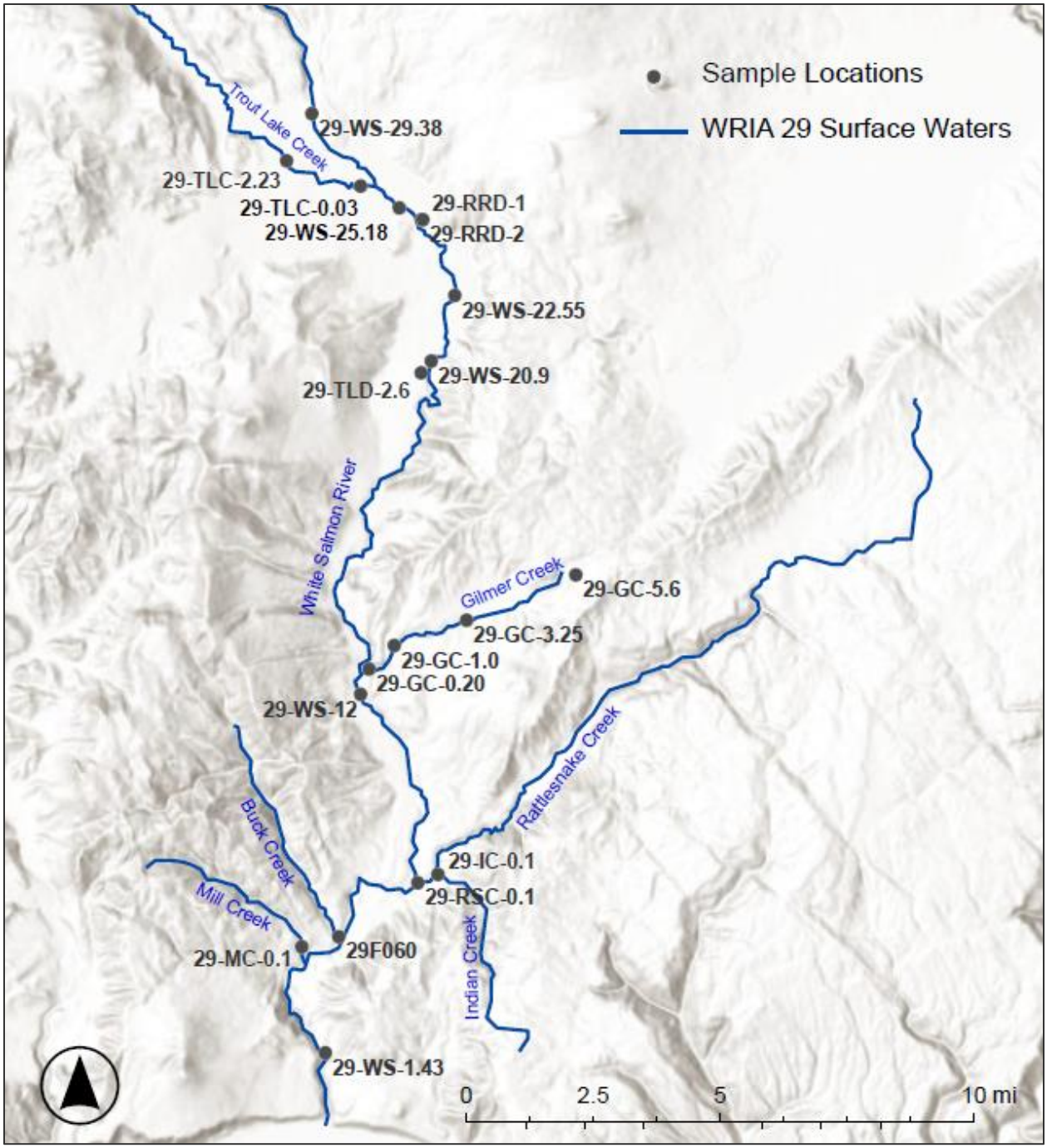

Figure 2. Map of Sampling Locations in the White Salmon River Watershed.

Water Sampling

Field staff collected water samples biweekly at every primary sampling location from 2022 – 2024. Source tracking sites were added to the sampling effort in 2024. Water samples were collected in compliance with Standard Operating Procedure EAP030 (Ecology 2018). All samples were collected from the thalweg or well mixed areas of the stream. Ecology did not collect samples when channels were dry or frozen over, nor were samples collected from stagnant pools. All samples were analyzed at Manchester Environmental Laboratory (MEL).

For more information regarding sampling technique and frequency please see Quality Assurance Project Plan (QAPP): White Salmon River Watershed Bacteria Assessment (Hanson et al. 2023), Standard Operating Procedure EAP030 (Ecology 2018), and Programmatic Quality Assurance Project Plan (McCarthy and Mathieu 2017).

Streamflow Measurement

Streamflow measurements were taken at seven primary sites. Due to the large variation of stream conditions that make up the White Salmon River Watershed, three different flowmeters were used for the course of this project, Teledyne StreamPro Acoustic Doppler Current Profiler (ADCP), OTT MF Pro and SonTek FlowTracker 2. Each flowmeter is designed to operate in different stream conditions and compensate for specific site characteristics.

The StreamPro ADCP was used at sites with high volume of flow such as flood events or when sites were only accessible from bridges. SonTek FlowTracker 2 was best used in situations of low flow and shallow water. The OTT MF Pro was preferred for measuring at sites characterized by low flow, abundant stream vegetation, and rocky bottoms.

Flowmeters were operated in the field according to Standard Operating Procedure EAP058 (Ecology 2021b) and Standard Operating Procedure EAP024 (Ecology 2026). StreamPro ADCP was ran according to Standard Operating Procedure EAP055 (Ecology 2024).

Quality Assurance/Quality Control

Quality Assurance and Quality Control (QA/QC) procedures provide the information needed to assess the quality of the data that is collected. These procedures also help identify problems or issues associated with data collection and analysis, while the project is underway. Furthermore, these standards are set to ensure the data collected is accurate, reliable, and reproducible.

Comparability, Completeness and Representativeness

- Comparability: Results from this study cannot be compared to previous studies due to the lack of *E. coli* data in this watershed. This study addressed the data deficiency and created a new bacteria baseline against which future studies can be compared.
- Completeness: Objectives of this study were to collect and analyze 95% of water samples and perform 70% streamflow measurements. Due to weather, wildfire activity and staffing restrictions, water sample and analysis efforts resulted in 92% completeness. Ecology successfully obtained 75% data completeness for streamflow measurements by collecting data during periods that avoided limitations from staff shortages, weather, high/low flows, and wildfire restrictions.
- Representativeness: Ecology collected samples every other week for 21 months throughout the dry and wet seasons at locations that are considered representative of the stream reaches and major tributaries. Streamflow measurements were conducted every two weeks at primary locations when conditions and safety permitted.

Please see sections 6.2.2.1, 6.2.2.2 and 6.2.2.3 in the Programmatic Quality Assurance Project Plan (McCarthy and Mathieu 2017) for more information.

Water Quality

Ecology addressed sampling variability and precision by routinely collecting field replicates. One replicate water sample was taken for every five samples on every sampling effort. Field replicates are collected by taking an additional sample at a randomly chosen site at the same time as the original sample.

Field replicates evaluate sample precision, a measure of the variability in the results due to random error. Random error is imparted by the variation in concentrations of samples from the environment and other introduced sources of variation (e.g., field and laboratory analytical procedures). The White Salmon River Watershed Bacteria Assessment QAPP (Hanson et al. 2023) and Programmatic Quality Assurance Project Plan (McCarthy and Mathieu 2017) established the measurement quality objectives (MQOs) for microbiology lab and field precision, Table 3.

Table 3. Bacteria MQOs for Laboratory and Field Procedures

Analysis	Method	Method Lower Reporting Limit[a]	Lab Blank Limit	Precision Lab Duplicates (RPD)	Precision — Field Duplicates (median)[b]
E. coli — MF	SM9222G 1	1.0 CFU/100 mL, filtered	<RL	40%	50% of replicate pairs < 20% RSD, 90% of replicate pairs <50% RSD[b]

MF = Membrane filtration
MQO= Measurement Quality Objectives
RL = Reporting limit
CFU = colony forming units
RPD = Relative percent difference
RSD = Relative standard difference
[a] reporting limit may vary depending on dilutions; detection limit in parentheses, no parentheses indicates MDL = lowest possible RL.
[b] %RSD for field duplicate results with a mean of less than or equal to 5x the RL will be evaluated separately from field duplicate results with a mean greater than 5x the RL. The precision MQO is the median of those %RSD results with an objective of <50%.

In addition to field replicates to ensure precision in the field, MEL analyzed lab duplicates to evaluate analytical precision (MEL 2016). Precision lab duplicates consisted of two subsamples taken from the same sample container but analyzed separately. At least 10% of the submitted field samples were selected to evaluate analytical precision. The calculated paired duplicate samples' relative percent difference (RPD) was 28%, well below the MQO target of a pooled mean of less than 40% (Table 3).

Sample bias was addressed by MEL running random lab method blanks throughout the duration of the project. Method blanks are used to check for contamination, instrument calibration, and detection of all forms of the parameter. All blank results showed no contamination above the method reporting limit. In accordance with Ecology's Water Quality Program Policy 1-11 (Chapter 1 and 2, Ecology 2020 and 2021a), reporting limits are substituted for nondetects.

Throughout the course of the study a total of 507 samples were collected, 86 of those samples being field replicates. Of the field replicate samples, 14 samples had no detectable levels of bacteria present. Therefore, 72 were used to analyze the Relative Standard Difference (RSD) to determine if the data met the MQO targets for precision (Table 3). Table 4 presents the results for field and lab precision. All MQOs were met, with 61% of replicate pairs being less than 20% RSD and 95% having RSD less than 50%.

Table 4. Field Precision results for Bacteria Data from 2022 and 2024 sample events

Parameter	Number of samples	Number of replicates used in evaluation[a]	RL (mg/L)	% of replicate pairs < 20% RSD	% of replicate pairs <50% RSD	% RSD[b]≤5X RL Median	% RSD>5X RL Median
E. coli	507	72	1.0	61.02	94.92	35.36	12.48

RSD = Relative Standard Deviation

RL = Reporting Limit

[a]Results reported at or below the reporting limit were excluded from evaluation.

[b]%RSD for field duplicate results with a mean of less than or equal to 5x the RL will be evaluated separately from field duplicate results with a mean greater than 5x the RL. The precision MQO is the median of those %RSD results with an objective of <50%.

Results summaries, also known as laboratory case narratives, were provided by MEL for every batch of samples analyzed. These case narratives provided information regarding sample condition upon arrival at the laboratory, e.g., samples arriving at correct temperature (0°C – 10°C) and within holding time (≤24hrs). Each sample arrived at MEL within the proper temperature range. All samples, except for 27 samples, were received within the established holding time. Results of these 27 samples that were analyzed by the lab out of hold time were qualified as estimates.

Streamflow

The QA/QC process was unique for each streamflow meter. Prior to each measurement, flow meters underwent specific manufacturer quality assurance checks and followed Ecology's Standard Operating Procedures (SOPs).

Quality control process for Teledyne StreamPro ADCP data was done by uploading each streamflow measurement into QRev, a United States Geological Survey (USGS) discharge software application (Ecology, 2024). QRev uses Coefficient of Variance percent (COV%) to determine uncertainty in discharge calculations. The rating range for COV% is a value of less than 3%, the measurement is considered excellent, between 3% and 5% is good, 5% to 8% is fair and a measurement greater than 8% is considered poor and is qualified an estimate.

Data collected from the SonTek FlowTracker2 and OTT MF Pro flowmeters were imported into Ecology's worksheets that used USGS mid-section discharge calculations (Ecology 2026). FlowTracker 2 also provides an uncertainty value percent called the Interpolated Variance Estimator (IVE%) (Ecology 2018). IVE% has the same rating range as the COV%. OTT MF Pro does not calculate uncertainty values.

The watershed's complex topography, characterized by deep, narrow canyons, significantly restricted site accessibility. Consequently, streamflow measurements were limited to accessible

reaches, resulting in non-ideal streamflow measurement locations. These physical constraints introduced additional complexity to the hydrologic data and measurement accuracy.

Please see Quality Assurance Project Plan (QAPP): White Salmon River Watershed Bacteria Assessment (Hanson et al. 2023), Standard Operating Procedure EAP058 (Ecology, 2021b), Standard Operating Procedure EAP055 (Ecology 2024), Standard Operating Procedure EAP024 (Ecology 2026) and Programmatic Quality Assurance Project Plan (McCarthy and Mathieu 2017) for information regarding streamflow, streamflow MQOs and pre/post processing methodology.

Results

This data summary report provides the verified raw data and observations collected during the monitoring study, without offering further interpretation or analysis beyond the steps taken for data quality control (QC) and identification of stream reaches for source tracking. To maintain these established objectives, Ecology limited analysis efforts to QC and preliminary geometric mean calculations. Based on these initial findings, Ecology selected six source tracking sites (29-WS-29.38, 29-TLC-2.23, 29-WS-20.9, 29-GC-5.6, 29-GC-3.25, and 19-IC-0.1) within specific assessment units to further investigate contamination sources.

This study collected sufficient high-quality data to meet project goals and objectives. Ecology achieved 75% completeness for streamflow measurements and 92% completeness for bacteria sampling. *E. coli* bacteria MQOs were met with 61% of sample replicate pairs having an RSD <20% and 95% having an RSD <50%. Stream reaches were adequately sampled, in both quantity and quality, to determine if they meet the new bacteria Water Quality Standard (WAC 173-201A). Furthermore, source tracking efforts characterized the extent of bacterial contamination within the White Salmon River watershed, establishing a reliable baseline for future study comparisons.

Data collected during this study are presented in the following appendices:

- Appendix A: Bacteria Data Results
    - Table A-1. *E. coli* Bacteria Data Results
    - Figure A-1. *E. coli* Bacteria Concentration at 29-TLC-0.3
    - Figure A-2. *E. coli* Bacteria Concentration at 29-WS-22.55
    - Figure A-3. *E. coli* Bacteria Concentration at 29-WS-25.18
    - Figure A-4. *E. coli* Bacteria Concentration at 29-TLD-2.6
    - Figure A-5. *E. coli* Bacteria Concentration at 29-GC-0.20 and 29-GC-1.0
    - Figure A-6. *E. coli* Bacteria Concentration at 29-RSC-0.1
    - Figure A-7. *E. coli* Bacteria Concentration at 29-WS-12
    - Figure A-8. *E. coli* Bacteria Concentration at 29F060
    - Figure A-9. *E. coli* Bacteria Concentration at 29-MC-0.1
    - Figure A-10. *E. coli* Bacteria Concentration at 29-WS-1.43
    - Figure A-11. *E. coli* Bacteria Concentration at 29-RRD-1
    - Figure A-12. *E. coli* Bacteria Concentration at 29-RRD-2
    - Figure A-13. *E. coli* Bacteria Concentration Across Source Tracking Sites
- Appendix B: Streamflow Measurement Data
    - Table B-1. Instantaneous Streamflow Measurements 2023 – 2024.
- Appendix C: Summary of Laboratory Case Narratives
    - Table C-1. Summary of Laboratory Case Narratives

All data in Appendices are available from Ecology's EIM online database.[2]

Results may be accessed by searching the EIM database using the User Study ID (ERHA0001), the Study Name (White Salmon River Watershed Bacteria Assessment), or the EIM location ID of any of the locations listed in Table 2.

[2] https://apps.ecology.wa.gov/eim/search/default.aspx.

Discussion

This study meets the data quality objectives described in the White Salmon Bacteria Assessment QAPP (Hanson et al. 2023). Sampling took place every two weeks during the dry and wet season and streamflow measurements took place when safety and streamflow conditions allowed. Ecology collected data that was of sufficient quality and quantity to assess *E. coli* levels in the White Salmon River Watershed. All deviations from the study design are documented below.

Study Duration

This study began in December 2022 and was scheduled to last two years. However, due to laboratory capacity and staff shortages, the study was cut short and ended 3 months early in August 2024. Although this study did not last for the full proposed duration, Ecology collected an ample amount of data to establish an *E. coli* bacteria baseline and meet the project representativeness goal.

Primary Site Selection

During the scoping process, Ecology identified site 29-WS-25.18 as a suitable location for streamflow measurement. Ecology decided to convert this site to a primary sampling location at the start of the sampling effort to include water quality collection. This redesignation provided a cost-effective way to enhance the overall dataset.

Identify Sources

One study goal in the White Salmon Bacteria Assessment QAPP (Hanson et al. 2023), was to identify sources of *E. coli*. To align with the purpose and findings of this data summary report, this should be clarified as source tracking. Unlike source identification, these source tracking efforts were conducted to expand the study area and identify new reaches that could be out of compliance.

Source Tracking

Source tracking sites were not added into the study throughout the project term. This deviation from the QAPP was due to the preliminary data not showing exceedances until late fall of 2023. Instead, source tracking sites were added after a complete year of sampling was conducted. The first sites were added in January 2024, with additional source tracking sites being added in June 2024.

The first two sites added to the study were, 29-RRD-1 and 29-RRD-2. Ecology's Water Quality Program team requested these sites be added to the study in attempts to gather more information regarding their status on the Federal Clean Water Act Section 303(d) list.

In June, six source tracking sites were added to the project. These sites were selected based on preliminary geometric mean calculations of downstream primary sampling locations. The intention of this study, as described in the White Salmon Bacteria Assessment QAPP (Hanson et al. 2023), was to sample each source tracking site up to 4-5 times. Due to the study being cut short and the Williams Mine fire restricting access, only two sites were sampled 5 times, 29-GC-3.25 and 29-IC-0.1. The Williams Mine Wildfire restricted access to 29-TLC-2.23, 29-WS-29.38, and 29-WS-20.9. One sample was collected from 29-GC-5.6; this resulted from the stream drying up during the source tracking sampling efforts.

Streamflow Completeness

Staffing restrictions affected the streamflow measurements, which coincided with the alteration to the study duration. As a result, streamflow measurements took place over 17 consecutive months (from January 2023 to April 2024), instead of the planned 24 months. While the original plan was significantly altered, Ecology successfully collected sufficient streamflow measurements for any subsequent bacteria loading calculations. Additionally, Ecology achieved 75% completeness, exceeding the 70% completeness goal defined in the White Salmon Bacteria Assessment QAPP (Hanson et al. 2023).

The original project objective was to measure streamflow at seven sites. While the total number of sites remained the same, Ecology adjusted the specific locations. Ecology did not conduct streamflow measurements at site 29-WS-1.43 due to dangerous flow conditions and access. Instead, Ecology added site 29-MC-0.1, a change from the original White Salmon Bacteria Assessment QAPP (Hanson et al. 2023). Although initial land access issues designated it only as a water collection site, Ecology successfully resolved these restrictions and consistently took measurements there throughout the project duration. Ecology did not measure streamflow at source tracking sites.

The White Salmon River channel is made up of deep, narrow canyons with complex river bottoms which prevent streamflow measurements at certain locations. For example, site 29-TLC-0.03, had significant high flows throughout most of the study which prevented streamflow measurements from being taken. However, during a period of low flow, two instantaneous streamflow measurements were successfully collected.

In addition, no streamflow measurements were taken at extreme high flows due to safety concerns and quality of measurement (high uncertainty rating). Furthermore, no streamflow measurements were taken during extreme low flows (flowmeters do not work in depths less than 0.2 ft) or when the channel was dry.

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Glossary, Acronyms, and Abbreviations

Glossary

Clean Water Act: A federal act passed in 1972 that contains provisions to restore and maintain the quality of the nation's waters. Section 303(d) of the Clean Water Act establishes the Total Maximum Daily Load (TMDL) program.

Designated uses: Those uses specified in Chapter 173-201A WAC (Water Quality Standards for Surface Waters of the State of Washington) for each water body or segment, regardless of whether or not the uses are currently attained.

Fecal coliform (FC): That portion of the coliform group of bacteria which is present in intestinal tracts and feces of warm-blooded animals as detected by the product of acid or gas from lactose in a suitable culture medium within 24 hours at 44.5 plus or minus 0.2 degrees Celsius. Fecal coliform bacteria are "indicator" organisms that suggest the possible presence of disease-causing organisms.

Geometric mean: A mathematical expression of the central tendency (an average) of multiple sample values. A geometric mean, unlike an arithmetic mean, tends to dampen the effect of very high or low values, which might bias the mean if a straight average (arithmetic mean) were calculated. This is helpful when analyzing bacteria concentrations, because levels may vary anywhere from 10- to 10,000-fold over a given period. The calculation is performed by either: (1) taking the n^{th} root of a product of n factors, or (2) taking the antilogarithm of the arithmetic mean of the logarithms of the individual values.

J: The analyte was positively identified. The associated numerical result is an estimate.

Measurement Quality Objectives (MQOs): Performance or acceptance criteria for individual data quality indicators, usually precision, bias, sensitivity, completeness, comparability and representativeness.

Nondetect (U): sample contained no detectable level of analyte at or above the reported result.

Parameter: Water quality constituent being measured (analyte). A physical, chemical, or biological property whose values determine environmental characteristics or behavior.

Precision: measure of variability in the results of replicate measurements due to random error.

Primary contact recreation: Activities where a person would have direct contact with water to the point of complete submergence including, but not limited to, skin diving, swimming, and water skiing.

Quality Assurance Project Plan (QAPP): A document that describes the objectives of the project, and the processes and activities necessary to develop data that will support those objectives.

Reach: A specific portion or segment of a stream.

Sample: A portion of a population (environment entity) that is measured and assumed to represent the entire population.

Streamflow: Discharge of water in a surface stream (river or creek).

Streamflow Loading Capacity: The maximum amount of pollutant load a stream can handle before negatively impacting water quality or aquatic life.

Surface waters of the state: Lakes, rivers, ponds, streams, inland waters, salt waters, wetlands and all other surface waters and water courses within the jurisdiction of Washington State.

Standard Operating Procedures (SOP): A document which describes in detail a reproducible and repeatable organized activity.

Thalweg: the line connecting the lowest points along a riverbed or valley. It traces the path of maximum depth and greatest water velocity.

Water Sample: representative portion of water collected from a source (e.g., river) for testing to assess its physical, chemical, and biological quality, ensuring safety for drinking, environmental health, or industrial use.

Watershed: A drainage area or basin in which all land and water areas drain or flow toward a central collector, such as a stream, river, or lake at a lower elevation.

303(d) list: Section 303(d) of the federal Clean Water Act requires Washington State to periodically prepare a list of all surface waters in the state for which beneficial uses of the water — such as for drinking, recreation, aquatic habitat, and industrial use — are impaired by pollutants. These are water quality limited estuaries, lakes, and streams that fall short of state surface water quality standards and are not expected to improve within the next two years.

Acronyms and Abbreviations

ADCP	Acoustic Doppler Current Profiler
COV	Coefficient of Variance
E. coli	*Escherichia coli* bacteria
e.g.	For example
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management database
EPA	U.S. Environmental Protection Agency
et al.	and others
FC	Fecal coliform bacteria
GIS	Geographic Information System software
IVE	Interpolated Variance Estimator
J	estimate
MEL	Manchester Environmental Laboratory
MF	Membrane filtration
MQO	Measurement quality objective
P	Primary site
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RL	reporting limit
RM	river mile
RPD	relative percent difference
RSD	relative standard deviation
SOP	standard operating procedures
ST	Source Tracking site
TMDL	Total Maximum Daily Load
U	nondetect
USGS	U.S. Geological Survey
WAC	Washington Administrative Code
WRIA	Water Resource Inventory Area

Units of Measurement

°C	degrees centigrade
cfs	cubic feet per second
CFU	colony forming units
EST	estimate
ft	feet
hrs	hours
mL	milliliters
MPN	most probable number

Appendices

Appendix A. Bacteria Data Results

Table A-1. *E. coli* Bacteria Data Results

Site ID	Date and Time	Results (#/100mL)
29F060	12/6/2022 11:51	6
29F060	1/3/2023 12:34	3
29F060	1/17/2023 12:00	2
29F060	1/30/2023 12:15	3
29F060	2/14/2023 11:53	1 U
29F060	2/28/2023 10:53	9
29F060	3/7/2023 10:50	4
29F060	3/28/2023 12:48	4
29F060	4/11/2023 9:53	6
29F060	4/25/2023 11:16	1 U
29F060	5/10/2023 10:38	1 U
29F060	5/23/2023 12:35	10
29F060	6/6/2023 11:27	23
29F060	6/27/2023 10:00	84
29F060	7/11/2023 11:43	37
29F060	7/18/2023 10:24	92
29F060	8/1/2023 11:44	61
29F060	8/15/2023 10:00	40
29F060	8/29/2023 11:42	76
29F060	9/12/2023 10:14	28
29F060	9/26/2023 10:38	51
29F060	10/10/2023 10:26	48
29F060	10/24/2023 9:58	15 J
29F060	11/7/2023 11:25	230
29F060	11/28/2023 10:25	8
29F060	12/5/2023 11:07	210
29F060	12/18/2023 14:20	12
29F060	1/3/2024 10:48	23
29F060	1/24/2024 13:06	220
29F060	1/29/2024 13:15	20
29F060	2/13/2024 11:02	3
29F060	2/21/2024 9:40	96
29F060	3/12/2024 10:35	68
29F060	3/26/2024 10:30	1 U
29F060	4/9/2024 10:05	1 U
29F060	4/23/2024 10:19	4

Site ID	Date and Time	Results (#/100mL)
29F060	5/6/2024 12:48	7
29F060	5/20/2024 11:53	1 U
29F060	6/24/2024 13:38	44
29F060	7/29/2024 14:45	280 J
29-GC-0.20	4/10/2023 13:56	24
29-GC-0.20	4/24/2023 14:28	4
29-GC-0.20	5/9/2023 15:47	27
29-GC-0.20	5/22/2023 14:49	25
29-GC-0.20	6/5/2023 15:27	28
29-GC-0.20	6/26/2023 13:25	13
29-GC-0.20	7/10/2023 14:47	19
29-GC-0.20	7/17/2023 12:01	17
29-GC-0.20	7/31/2023 15:41	12
29-GC-0.20	8/14/2023 12:01	11
29-GC-0.20	8/28/2023 15:52	41
29-GC-0.20	9/11/2023 13:30	11
29-GC-0.20	9/25/2023 13:39	250
29-GC-0.20	10/9/2023 14:50	47
29-GC-0.20	10/23/2023 13:48	110
29-GC-0.20	11/6/2023 13:06	310
29-GC-0.20	11/27/2023 13:57	6
29-GC-0.20	12/4/2023 13:55	800 J
29-GC-0.20	12/18/2023 13:00	18
29-GC-0.20	1/2/2024 13:54	28
29-GC-0.20	1/24/2024 12:20	350
29-GC-0.20	1/29/2024 12:32	190
29-GC-0.20	2/12/2024 14:02	28 J
29-GC-0.20	2/20/2024 13:23	150
29-GC-0.20	3/11/2024 12:30	11 J
29-GC-0.20	3/25/2024 13:17	88
29-GC-0.20	4/8/2024 12:43	13
29-GC-0.20	4/22/2024 14:28	5
29-GC-0.20	5/6/2024 11:32	36
29-GC-0.20	5/20/2024 11:15	20
29-GC-0.20	6/24/2024 12:43	1 U
29-GC-0.20	7/29/2024 13:50	100
29-GC-0.20	8/12/2024 10:55	16
29-GC-0.20	8/26/2024 10:50	14
29-GC-1.0	12/5/2022 14:40	8 J
29-GC-1.0	1/3/2023 11:57	33
29-GC-1.0	1/17/2023 11:20	31
29-GC-1.0	1/30/2023 11:35	8

Site ID	Date and Time	Results (#/100mL)
29-GC-1.0	2/13/2023 15:08	8
29-GC-1.0	2/27/2023 14:26	10
29-GC-1.0	3/6/2023 14:06	17
29-GC-1.0	3/27/2023 15:40	6
29-GC-3.25	6/24/2024 12:28	1000 J
29-GC-3.25	7/29/2024 13:30	200
29-GC-3.25	8/12/2024 10:37	220
29-GC-3.25	8/26/2024 10:28	53 J
29-GC-5.6	6/24/2024 12:17	470 J
29-IC-0.1	6/24/2024 13:26	66
29-IC-0.1	7/29/2024 14:30	260
29-IC-0.1	8/12/2024 11:26	49
29-IC-0.1	8/26/2024 11:24	72
29-MC-0.1	1/17/2023 12:15	3
29-MC-0.1	1/30/2023 12:32	1 U
29-MC-0.1	2/14/2023 13:02	1 U
29-MC-0.1	2/28/2023 12:05	1 U
29-MC-0.1	3/7/2023 12:00	1 U
29-MC-0.1	5/23/2023 14:33	6
29-MC-0.1	6/6/2023 13:04	6
29-MC-0.1	6/27/2023 11:21	7
29-MC-0.1	7/11/2023 12:40	44 J
29-MC-0.1	7/18/2023 11:35	47
29-MC-0.1	8/1/2023 13:22	36
29-MC-0.1	8/15/2023 11:02	8
29-MC-0.1	8/29/2023 12:38	16
29-MC-0.1	9/12/2023 11:31	56
29-MC-0.1	9/26/2023 11:38	20
29-MC-0.1	10/10/2023 11:21	27
29-MC-0.1	10/24/2023 10:58	19
29-MC-0.1	11/7/2023 12:35	41
29-MC-0.1	11/28/2023 11:54	2
29-MC-0.1	12/5/2023 10:43	120
29-MC-0.1	12/19/2023 10:40	14
29-MC-0.1	1/3/2024 12:06	32
29-MC-0.1	2/13/2024 10:37	10
29-MC-0.1	2/21/2024 11:07	99
29-MC-0.1	3/12/2024 10:17	17
29-MC-0.1	3/26/2024 10:15	1 U
29-MC-0.1	4/9/2024 9:50	2 J
29-MC-0.1	4/23/2024 10:06	1 U
29-MC-0.1	5/6/2024 13:04	4

Site ID	Date and Time	Results (#/100mL)
29-MC-0.1	5/20/2024 12:05	1 U
29-MC-0.1	6/24/2024 13:50	4 J
29-MC-0.1	7/29/2024 15:05	27
29-RRD-1	2/12/2024 11:57	220
29-RRD-1	2/20/2024 11:40	260
29-RRD-1	3/11/2024 10:52	28
29-RRD-1	3/25/2024 11:15	36
29-RRD-1	4/8/2024 11:15	49
29-RRD-1	4/22/2024 12:30	5
29-RRD-1	5/6/2024 10:41	410 J
29-RRD-1	5/20/2024 10:32	28 J
29-RRD-1	6/24/2024 11:14	130 J
29-RRD-1	7/29/2024 12:00	140 J
29-RRD-2	1/2/2024 11:48	5
29-RRD-2	1/29/2024 11:45	6
29-RRD-2	2/12/2024 12:00	2
29-RRD-2	2/20/2024 11:45	1 U
29-RRD-2	3/11/2024 10:34	13 J
29-RRD-2	3/25/2024 11:17	2
29-RRD-2	4/8/2024 11:20	1 U
29-RRD-2	4/22/2024 12:31	1 U
29-RRD-2	5/6/2024 10:44	3 J
29-RRD-2	5/20/2024 10:35	5 J
29-RRD-2	6/24/2024 11:15	130 J
29-RRD-2	7/29/2024 12:10	110
29-RSC-0.1	12/6/2022 11:24	2
29-RSC-0.1	1/3/2023 12:22	9
29-RSC-0.1	1/17/2023 11:51	11
29-RSC-0.1	1/30/2023 12:05	1 U
29-RSC-0.1	2/14/2023 10:22	2
29-RSC-0.1	2/27/2023 15:01	3
29-RSC-0.1	3/7/2023 9:30	3
29-RSC-0.1	3/28/2023 11:07	5
29-RSC-0.1	4/11/2023 9:35	4
29-RSC-0.1	4/25/2023 9:46	3
29-RSC-0.1	5/10/2023 10:23	7
29-RSC-0.1	5/23/2023 11:09	64
29-RSC-0.1	6/6/2023 9:52	47
29-RSC-0.1	6/26/2023 14:44	16
29-RSC-0.1	7/11/2023 10:07	63 J
29-RSC-0.1	7/17/2023 13:25	44
29-RSC-0.1	8/1/2023 10:15	81

Site ID	Date and Time	Results (#/100mL)
29-RSC-0.1	8/14/2023 13:18	47
29-RSC-0.1	8/29/2023 10:16	13
29-RSC-0.1	9/11/2023 14:00	40
29-RSC-0.1	9/25/2023 15:06	180
29-RSC-0.1	10/10/2023 10:08	240
29-RSC-0.1	10/23/2023 15:11	52
29-RSC-0.1	11/7/2023 10:05	51
29-RSC-0.1	11/27/2023 15:24	4
29-RSC-0.1	12/4/2023 15:31	100
29-RSC-0.1	12/18/2023 13:55	3
29-RSC-0.1	1/2/2024 14:55	8
29-RSC-0.1	1/24/2024 12:51	45
29-RSC-0.1	1/29/2024 13:00	19
29-RSC-0.1	2/12/2024 15:26	4 J
29-RSC-0.1	2/20/2024 14:48	3
29-RSC-0.1	3/11/2024 13:30	5
29-RSC-0.1	3/25/2024 14:35	4
29-RSC-0.1	4/8/2024 14:09	4
29-RSC-0.1	4/22/2024 15:38	11
29-RSC-0.1	5/6/2024 12:35	10
29-RSC-0.1	5/20/2024 11:43	11
29-RSC-0.1	6/24/2024 13:11	14
29-RSC-0.1	7/29/2024 14:20	110
29-TLC-0.03	12/5/2022 11:45	3
29-TLC-0.03	1/3/2023 10:30	8
29-TLC-0.03	1/17/2023 10:20	17
29-TLC-0.03	1/30/2023 10:28	3
29-TLC-0.03	2/13/2023 10:51	4
29-TLC-0.03	2/27/2023 10:20	2
29-TLC-0.03	3/6/2023 10:44	2 J
29-TLC-0.03	3/27/2023 10:30	3
29-TLC-0.03	4/10/2023 10:23	89
29-TLC-0.03	4/24/2023 10:28	12
29-TLC-0.03	5/9/2023 10:58	7
29-TLC-0.03	5/22/2023 11:07	18
29-TLC-0.03	6/5/2023 10:53	12
29-TLC-0.03	6/26/2023 10:15	22
29-TLC-0.03	7/10/2023 11:15	15 J
29-TLC-0.03	7/17/2023 10:07	43
29-TLC-0.03	7/31/2023 12:43	15
29-TLC-0.03	8/14/2023 10:05	33 J
29-TLC-0.03	8/28/2023 13:55	52

Site ID	Date and Time	Results (#/100mL)
29-TLC-0.03	9/11/2023 10:05	37
29-TLC-0.03	9/25/2023 10:37	320
29-TLC-0.03	10/9/2023 11:56	87
29-TLC-0.03	10/23/2023 10:34	31
29-TLC-0.03	11/6/2023 10:14	130
29-TLC-0.03	11/27/2023 10:40	9
29-TLC-0.03	12/4/2023 10:29	120
29-TLC-0.03	12/18/2023 10:26	11
29-TLC-0.03	1/2/2024 10:43	13
29-TLC-0.03	1/24/2024 10:59	1 U
29-TLC-0.03	1/29/2024 10:30	6
29-TLC-0.03	2/12/2024 10:28	12
29-TLC-0.03	2/20/2024 10:16	9
29-TLC-0.03	3/11/2024 10:12	24
29-TLC-0.03	3/25/2024 10:20	16
29-TLC-0.03	4/8/2024 10:05	19
29-TLC-0.03	4/22/2024 11:38	7
29-TLC-0.03	5/6/2024 10:22	35 J
29-TLC-0.03	5/20/2024 10:15	17 J
29-TLC-0.03	6/24/2024 10:49	14 J
29-TLC-0.03	7/29/2024 11:40	18
29-TLC-2.23	6/24/2024 10:20	23 J
29-TLC-2.23	7/29/2024 11:00	37
29-TLD-2.6	12/5/2022 13:58	1 U
29-TLD-2.6	1/3/2023 11:16	53
29-TLD-2.6	1/17/2023 10:52	64
29-TLD-2.6	2/13/2023 13:20	1 U
29-TLD-2.6	2/27/2023 12:40	10
29-TLD-2.6	3/6/2023 12:35	14
29-TLD-2.6	3/27/2023 13:08	1 U
29-TLD-2.6	4/10/2023 12:46	24
29-TLD-2.6	4/24/2023 12:36	3
29-TLD-2.6	5/9/2023 14:26	2
29-TLD-2.6	5/22/2023 14:15	16
29-TLD-2.6	6/5/2023 14:06	16
29-TLD-2.6	6/26/2023 12:05	56
29-TLD-2.6	7/10/2023 13:25	29 J
29-TLD-2.6	7/17/2023 11:40	29 J
29-TLD-2.6	7/31/2023 15:12	36
29-TLD-2.6	8/14/2023 11:43	53
29-TLD-2.6	8/28/2023 15:35	100
29-TLD-2.6	9/11/2023 12:10	72

Site ID	Date and Time	Results (#/100mL)
29-TLD-2.6	9/25/2023 13:16	290
29-TLD-2.6	10/9/2023 13:34	57
29-TLD-2.6	10/23/2023 12:21	260
29-TLD-2.6	11/6/2023 12:07	81
29-TLD-2.6	11/27/2023 12:44	3
29-TLD-2.6	12/4/2023 12:43	63
29-TLD-2.6	2/12/2024 12:51	4
29-TLD-2.6	2/20/2024 12:15	1 U
29-TLD-2.6	3/11/2024 11:39	6
29-TLD-2.6	3/25/2024 12:00	5
29-TLD-2.6	4/22/2024 13:29	4
29-TLD-2.6	5/6/2024 11:05	21
29-TLD-2.6	5/20/2024 10:54	18
29-TLD-2.6	6/24/2024 11:47	7 J
29-TLD-2.6	7/29/2024 12:45	20
29-WS-1.43	12/6/2022 12:40	1 U
29-WS-1.43	1/3/2023 13:16	40
29-WS-1.43	1/17/2023 12:35	75
29-WS-1.43	1/30/2023 12:58	1 U
29-WS-1.43	2/14/2023 13:42	17
29-WS-1.43	2/28/2023 12:55	8
29-WS-1.43	3/7/2023 12:35	14
29-WS-1.43	3/28/2023 13:16	3
29-WS-1.43	4/11/2023 10:52	6 J
29-WS-1.43	4/25/2023 11:49	2
29-WS-1.43	5/10/2023 11:05	21
29-WS-1.43	5/23/2023 15:04	5
29-WS-1.43	6/6/2023 13:35	1 U
29-WS-1.43	6/27/2023 11:52	3
29-WS-1.43	7/11/2023 13:08	9 J
29-WS-1.43	7/18/2023 12:02	2 J
29-WS-1.43	8/1/2023 13:50	1 U
29-WS-1.43	8/15/2023 11:25	9
29-WS-1.43	8/29/2023 13:14	12
29-WS-1.43	9/12/2023 11:59	12
29-WS-1.43	9/26/2023 12:02	40
29-WS-1.43	10/10/2023 11:45	33
29-WS-1.43	10/24/2023 11:28	39
29-WS-1.43	11/7/2023 12:57	110
29-WS-1.43	11/28/2023 12:27	5
29-WS-1.43	12/5/2023 11:27	420
29-WS-1.43	12/19/2023 11:04	31

Site ID	Date and Time	Results (#/100mL)
29-WS-1.43	1/3/2024 12:41	6
29-WS-1.43	2/13/2024 11:39	6
29-WS-1.43	2/21/2024 10:42	25
29-WS-1.43	3/12/2024 11:16	19
29-WS-1.43	3/26/2024 10:51	5
29-WS-1.43	4/9/2024 10:23	4
29-WS-1.43	4/23/2024 10:34	2
29-WS-1.43	5/6/2024 13:26	11
29-WS-1.43	5/20/2024 12:24	5
29-WS-1.43	6/24/2024 14:13	1 U
29-WS-1.43	7/29/2024 15:30	7
29-WS-12	12/5/2022 15:02	2
29-WS-12	1/3/2023 12:02	63
29-WS-12	1/17/2023 11:33	100
29-WS-12	1/30/2023 11:50	2
29-WS-12	2/13/2023 15:30	19
29-WS-12	2/27/2023 14:41	8
29-WS-12	3/6/2023 14:26	27
29-WS-12	3/27/2023 15:58	1 U
29-WS-12	4/10/2023 14:15	16 J
29-WS-12	4/24/2023 14:30	4
29-WS-12	5/9/2023 15:59	5
29-WS-12	5/22/2023 16:04	7
29-WS-12	6/5/2023 15:46	6
29-WS-12	6/26/2023 13:37	13
29-WS-12	7/10/2023 15:08	14
29-WS-12	7/17/2023 12:09	17
29-WS-12	7/31/2023 15:58	8
29-WS-12	8/14/2023 12:09	33
29-WS-12	8/28/2023 16:00	20
29-WS-12	9/11/2023 13:39	13
29-WS-12	9/25/2023 13:48	220
29-WS-12	10/9/2023 15:00	20
29-WS-12	10/23/2023 14:00	45
29-WS-12	11/6/2023 13:15	51
29-WS-12	11/27/2023 14:08	1 U
29-WS-12	12/4/2023 14:03	280
29-WS-12	12/18/2023 13:11	5
29-WS-12	1/2/2024 14:10	8
29-WS-12	1/24/2024 12:38	41
29-WS-12	1/29/2024 12:43	18
29-WS-12	2/12/2024 14:13	6

Site ID	Date and Time	Results (#/100mL)
29-WS-12	2/20/2024 13:30	15
29-WS-12	3/11/2024 12:40	4
29-WS-12	3/25/2024 13:30	3
29-WS-12	4/8/2024 12:37	9
29-WS-12	4/22/2024 14:38	1 U
29-WS-12	5/6/2024 11:45	8
29-WS-12	5/20/2024 11:26	10
29-WS-12	6/24/2024 12:55	7 J
29-WS-12	7/29/2024 14:00	7
29-WS-12	8/12/2024 11:07	13
29-WS-12	8/26/2024 11:03	5
29-WS-20.9	6/24/2024 11:39	21 J
29-WS-20.9	7/29/2024 12:40	28
29-WS-22.55	12/5/2022 12:42	1 U
29-WS-22.55	1/3/2023 10:55	110
29-WS-22.55	1/17/2023 10:43	210
29-WS-22.55	1/30/2023 11:01	1 U
29-WS-22.55	2/13/2023 12:19	35
29-WS-22.55	2/27/2023 12:28	24
29-WS-22.55	3/6/2023 12:25	39
29-WS-22.55	3/27/2023 12:22	2
29-WS-22.55	4/10/2023 11:48	32
29-WS-22.55	4/24/2023 11:33	6 J
29-WS-22.55	5/9/2023 12:57	2
29-WS-22.55	5/22/2023 12:46	5
29-WS-22.55	6/5/2023 12:56	9
29-WS-22.55	6/26/2023 11:20	77
29-WS-22.55	7/10/2023 12:21	22 J
29-WS-22.55	7/17/2023 10:56	22 J
29-WS-22.55	7/31/2023 14:09	57
29-WS-22.55	8/14/2023 11:02	45
29-WS-22.55	8/28/2023 15:26	52
29-WS-22.55	9/11/2023 11:20	83
29-WS-22.55	9/25/2023 12:16	300
29-WS-22.55	10/9/2023 12:54	260
29-WS-22.55	10/23/2023 11:32	220
29-WS-22.55	11/6/2023 11:31	100
29-WS-22.55	11/27/2023 11:48	2
29-WS-22.55	12/4/2023 12:00	75
29-WS-22.55	12/18/2023 11:43	6
29-WS-22.55	1/2/2024 12:23	4
29-WS-22.55	1/24/2024 11:38	14

Site ID	Date and Time	Results (#/100mL)
29-WS-22.55	1/29/2024 11:59	10 J
29-WS-22.55	2/12/2024 12:15	2
29-WS-22.55	2/20/2024 11:58	1 U
29-WS-22.55	3/11/2024 11:02	8
29-WS-22.55	3/25/2024 11:26	5
29-WS-22.55	4/8/2024 11:34	6
29-WS-22.55	4/22/2024 12:40	3
29-WS-22.55	5/6/2024 10:54	15
29-WS-22.55	5/20/2024 10:45	13
29-WS-22.55	6/24/2024 11:26	12 J
29-WS-22.55	7/29/2024 12:25	22
29-WS-25.18	2/13/2023 11:55	5
29-WS-25.18	2/27/2023 11:59	1 U
29-WS-25.18	3/6/2023 11:47	3
29-WS-25.18	3/27/2023 10:49	7
29-WS-25.18	4/10/2023 11:26	32 J
29-WS-25.18	4/24/2023 11:18	6
29-WS-25.18	5/9/2023 12:42	4
29-WS-25.18	5/22/2023 12:30	5
29-WS-25.18	6/5/2023 12:32	17
29-WS-25.18	6/26/2023 11:07	51
29-WS-25.18	7/10/2023 12:05	13 J
29-WS-25.18	7/17/2023 10:42	16
29-WS-25.18	7/31/2023 13:51	13
29-WS-25.18	8/14/2023 10:47	55
29-WS-25.18	8/28/2023 15:12	11
29-WS-25.18	9/11/2023 11:07	19
29-WS-25.18	9/25/2023 11:56	220
29-WS-25.18	10/9/2023 12:40	43
29-WS-25.18	10/23/2023 11:16	6
29-WS-25.18	11/6/2023 11:18	71
29-WS-25.18	11/27/2023 11:33	3
29-WS-25.18	12/4/2023 11:43	73
29-WS-25.18	12/18/2023 11:26	6
29-WS-25.18	1/2/2024 11:26	7 J
29-WS-25.18	1/24/2024 11:12	2
29-WS-25.18	1/29/2024 11:28	3
29-WS-25.18	2/12/2024 11:45	4
29-WS-25.18	2/20/2024 11:26	2
29-WS-25.18	3/11/2024 10:43	8
29-WS-25.18	3/25/2024 11:06	9
29-WS-25.18	4/8/2024 11:03	11

Site ID	Date and Time	Results (#/100mL)
29-WS-25.18	4/22/2024 12:23	4
29-WS-25.18	5/6/2024 10:33	22 J
29-WS-25.18	5/20/2024 10:22	9 J
29-WS-25.18	6/24/2024 11:06	9 J
29-WS-25.18	7/29/2024 11:50	11
29-WS-29.38	6/24/2024 10:38	5 J
29-WS-29.38	7/29/2024 11:25	7

U = Nondetect

J = Estimate

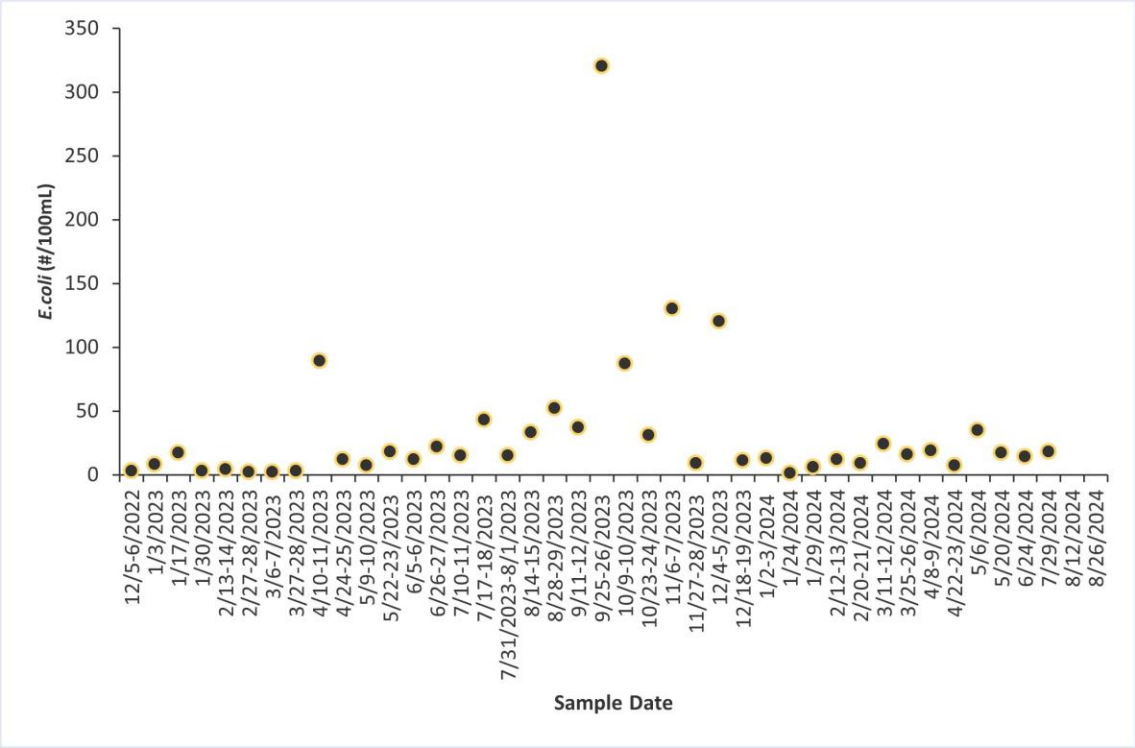

Figure A-1. *E. coli* Bacteria Concentration at 29-TLC-0.3

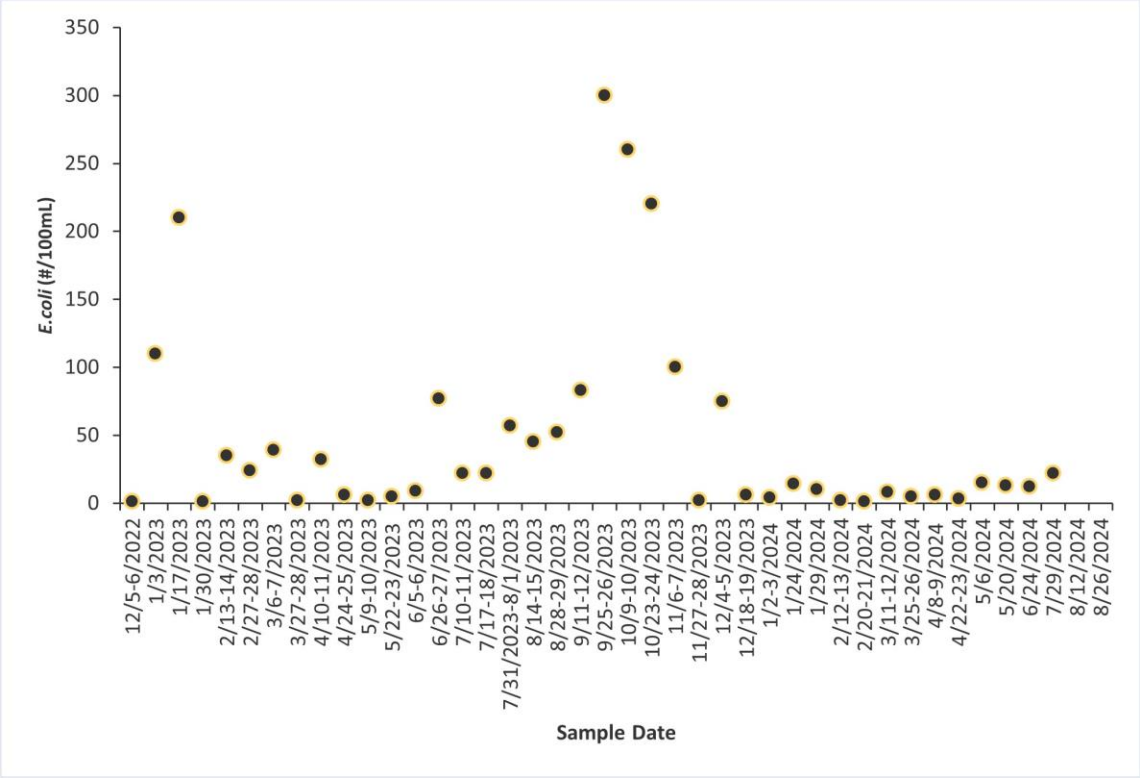

Figure A-2. *E. coli* Bacteria Concentration at 29-WS-22.55

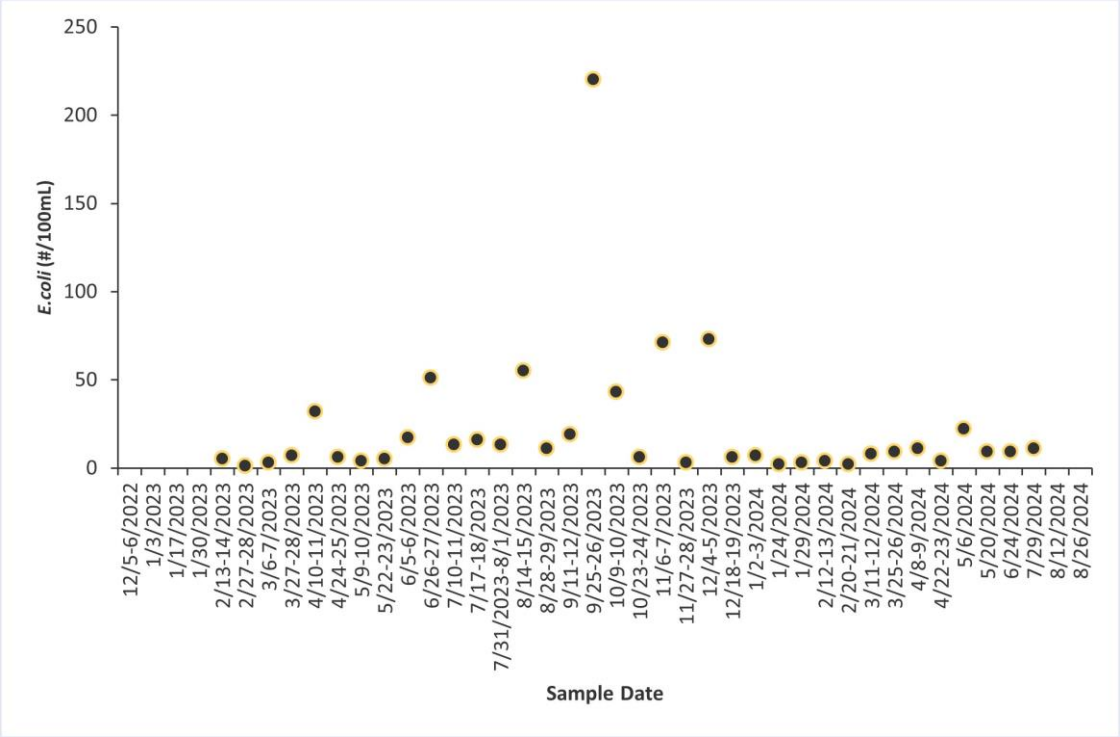

Figure A-3. *E. coli* Bacteria Concentration at 29-WS-25.18

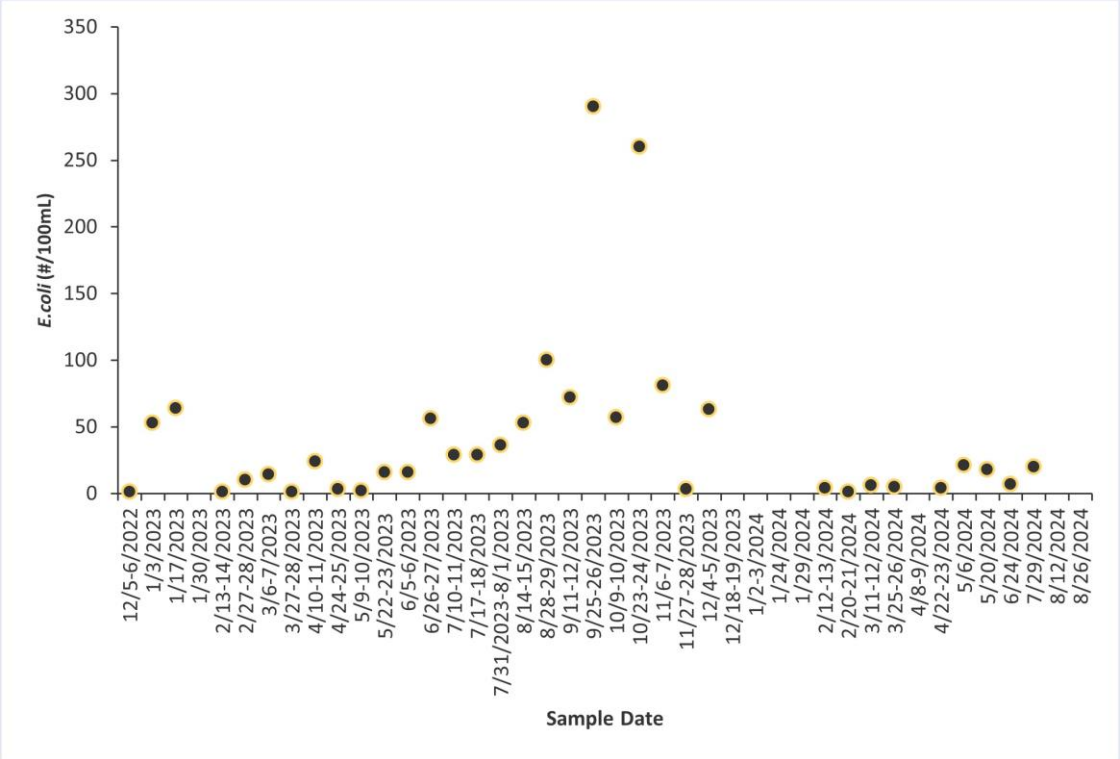

Figure A-4. *E. coli* Bacteria Concentration at 29-TLD-2.6

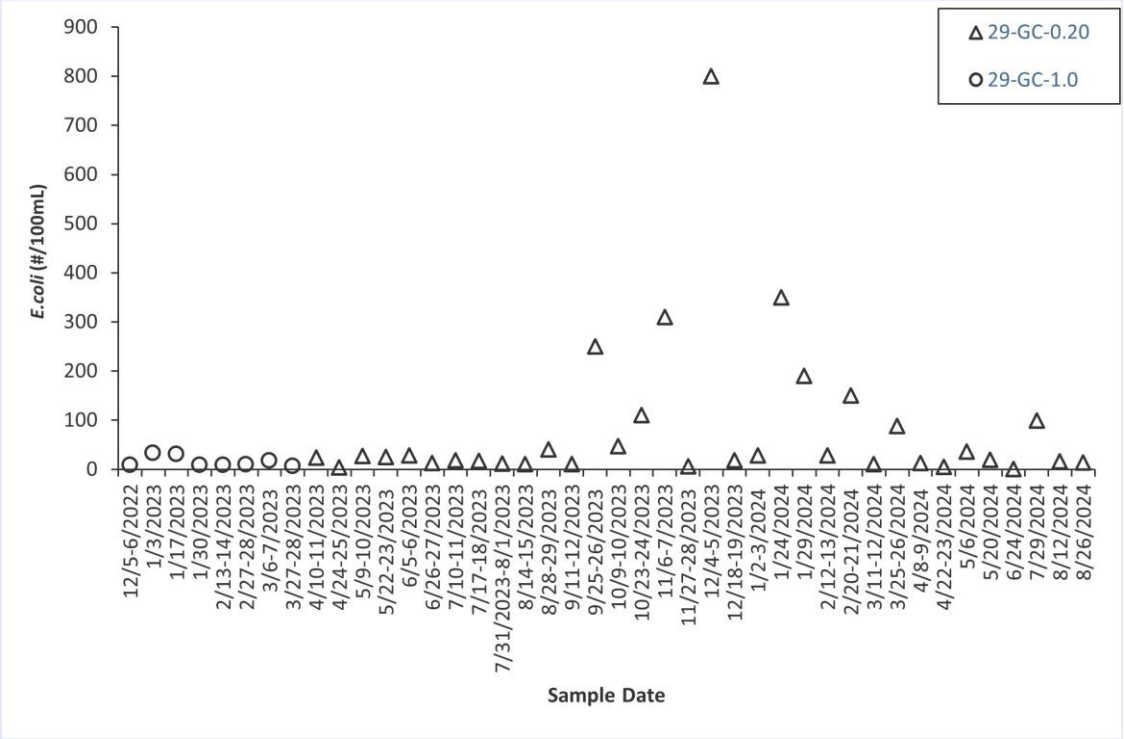

Figure A-5. *E. coli* Bacteria Concentration at 29-GC-0.20 and 29-GC-1.0

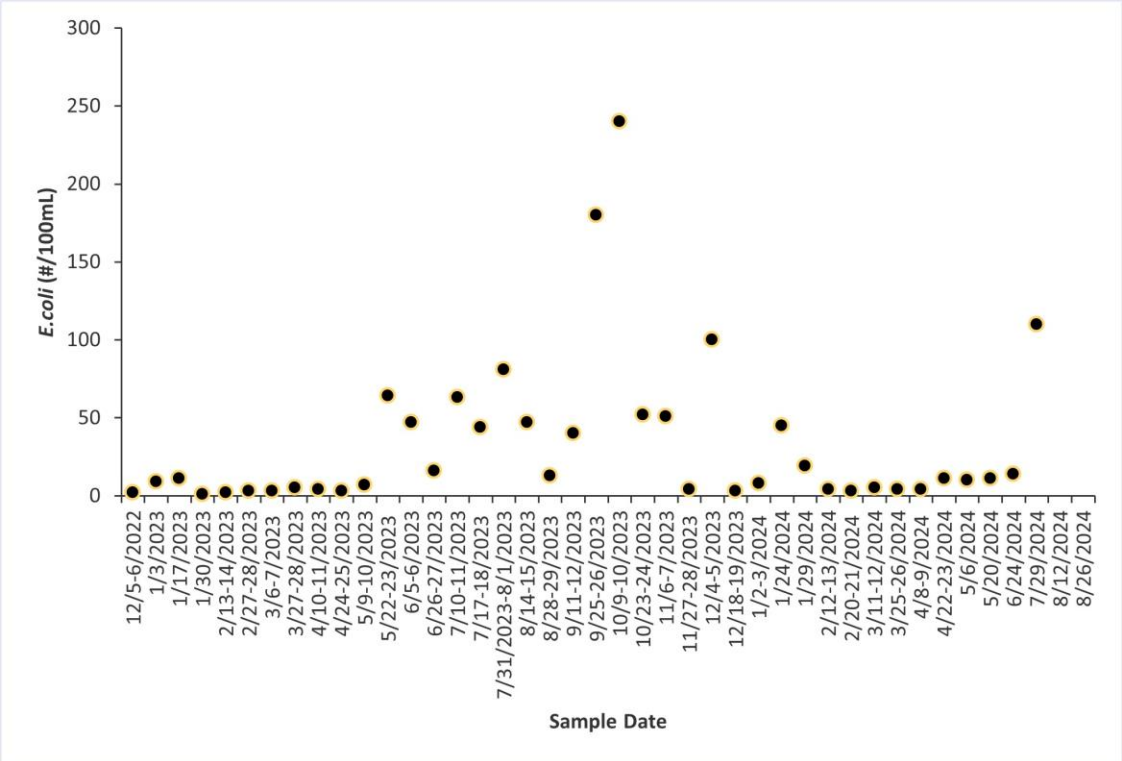

Figure A-6. *E. coli* Bacteria Concentration at 29-RSC-0.1

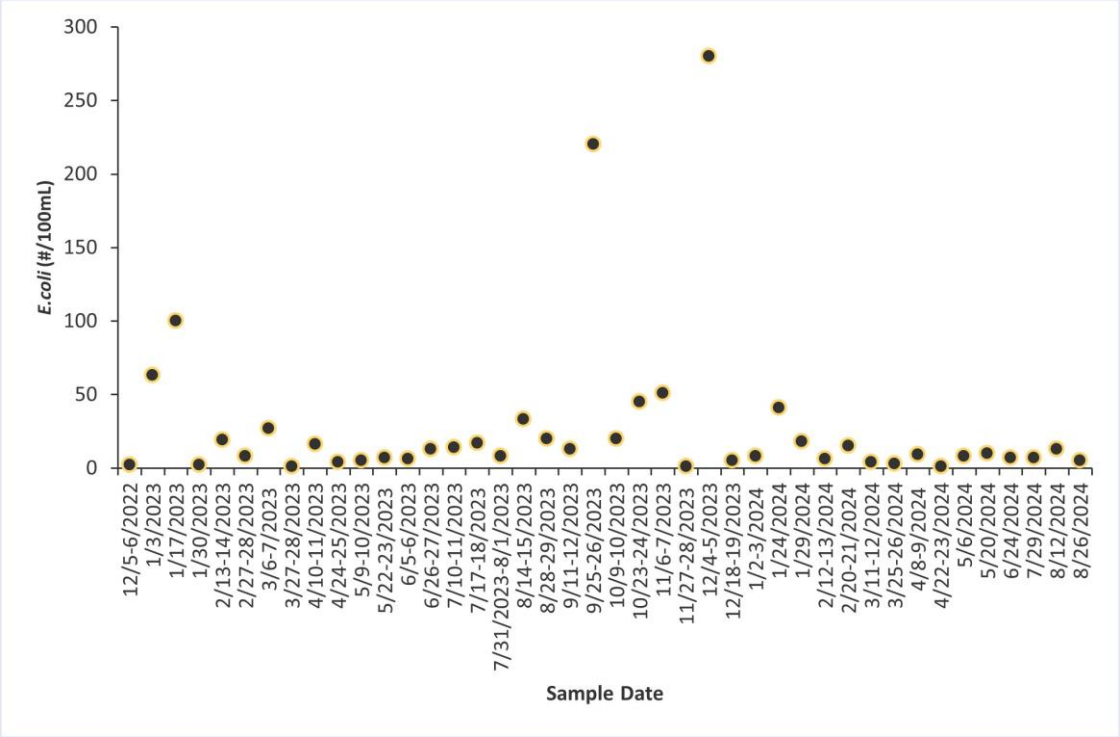

Figure A-7. *E. coli* Bacteria Concentration at 29-WS-12

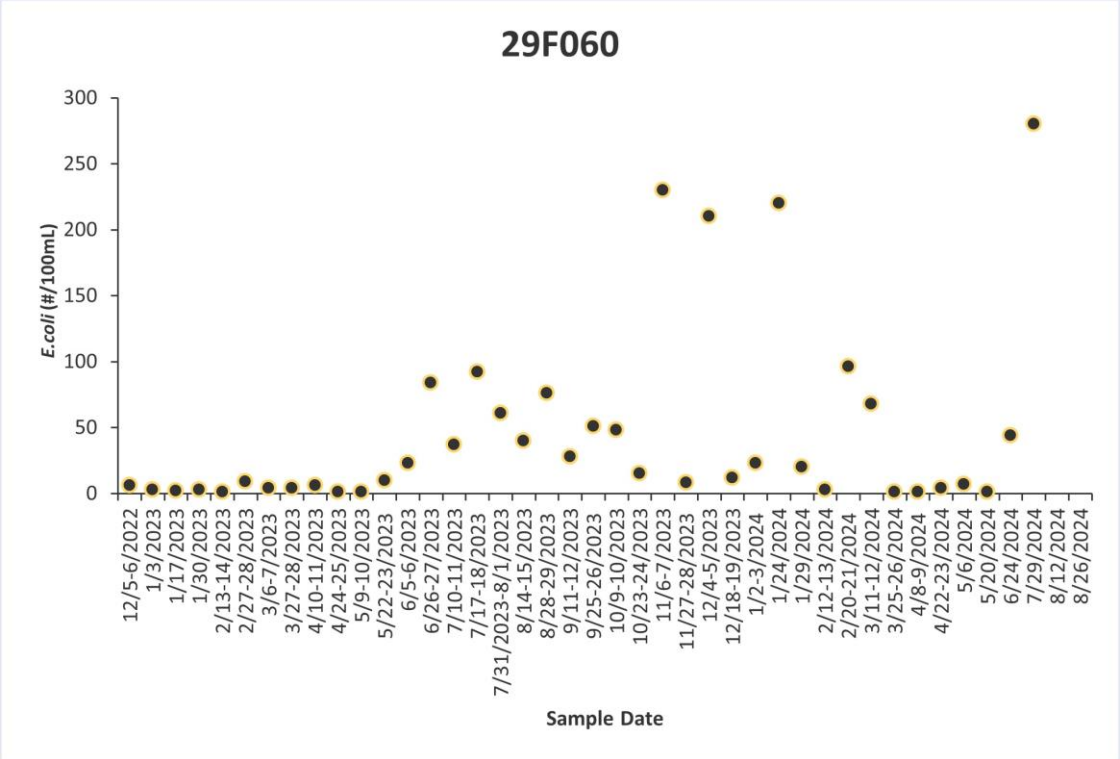

Figure A-8. *E. coli* Bacteria Concentration at 29F060

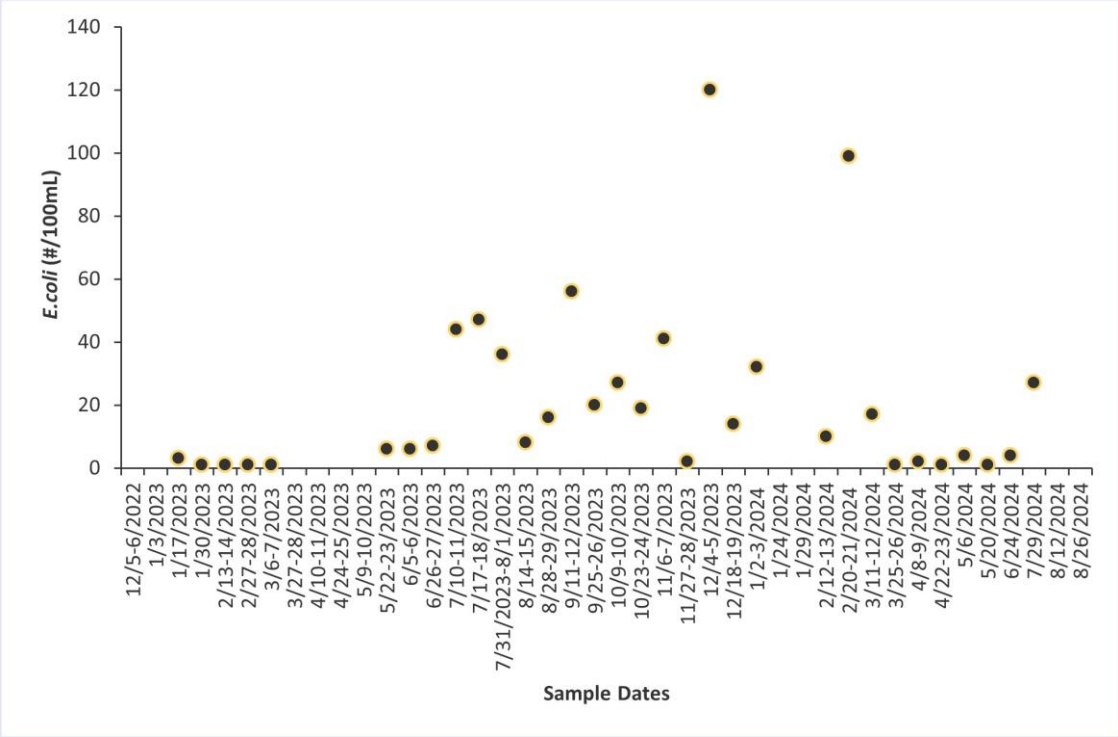

Figure A-9. *E. coli* Bacteria Concentration at 29-MC-0.1

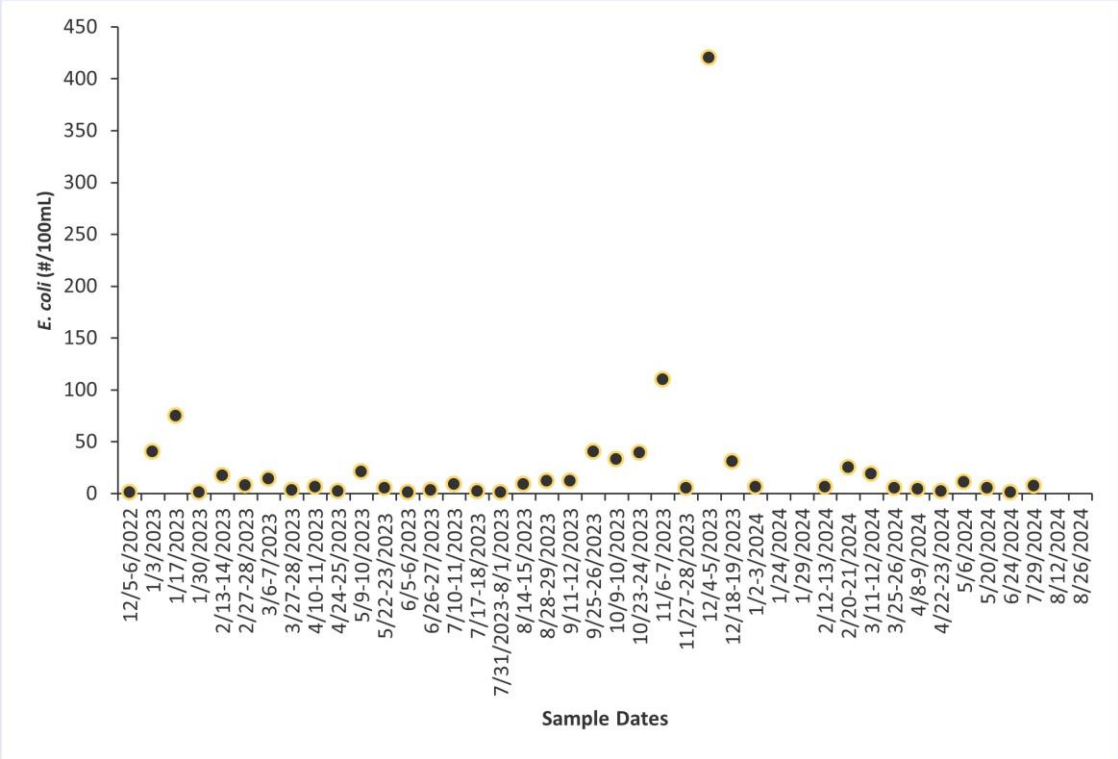

Figure A-10. *E. coli* Bacteria Concentration at 29-WS-1.43

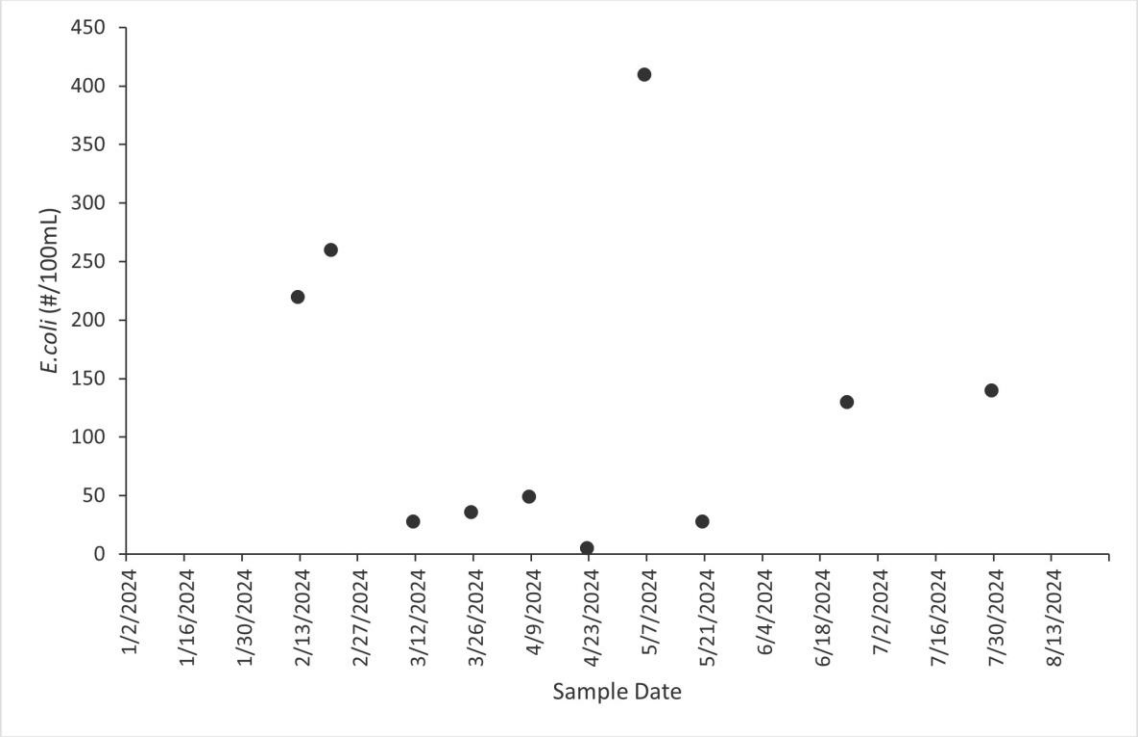

Figure A-11. *E. coli* Bacteria Concentration at 29-RRD-1

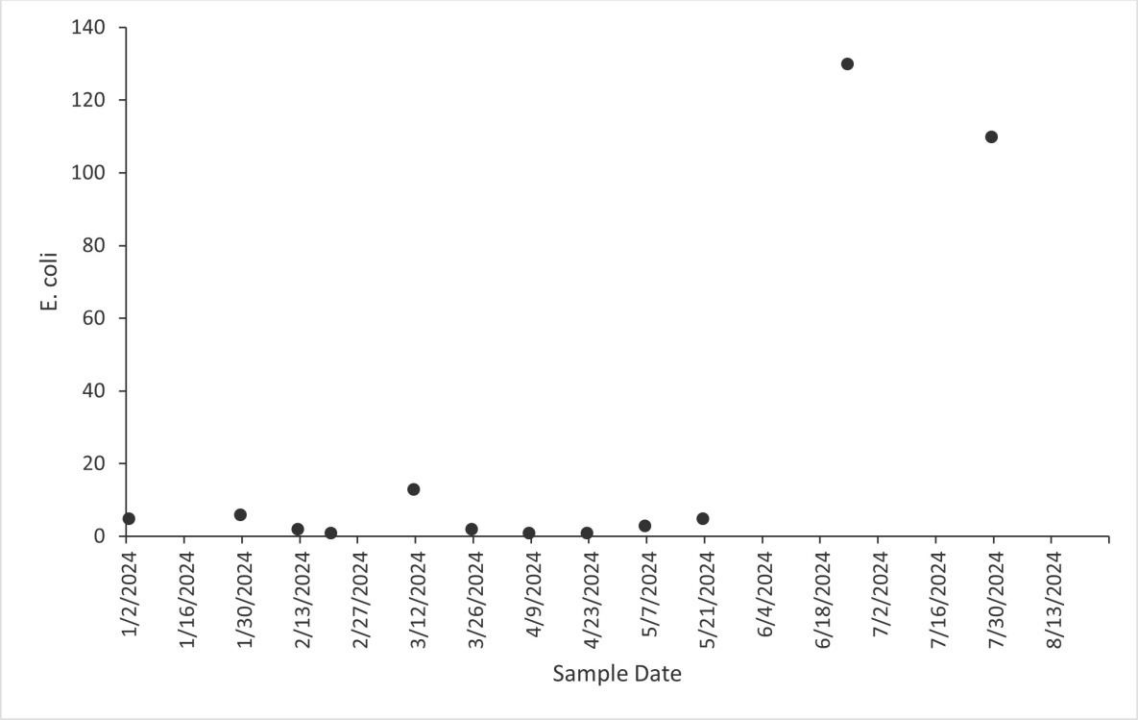

Figure A-12. *E. coli* Bacteria Concentration at 29-RRD-2

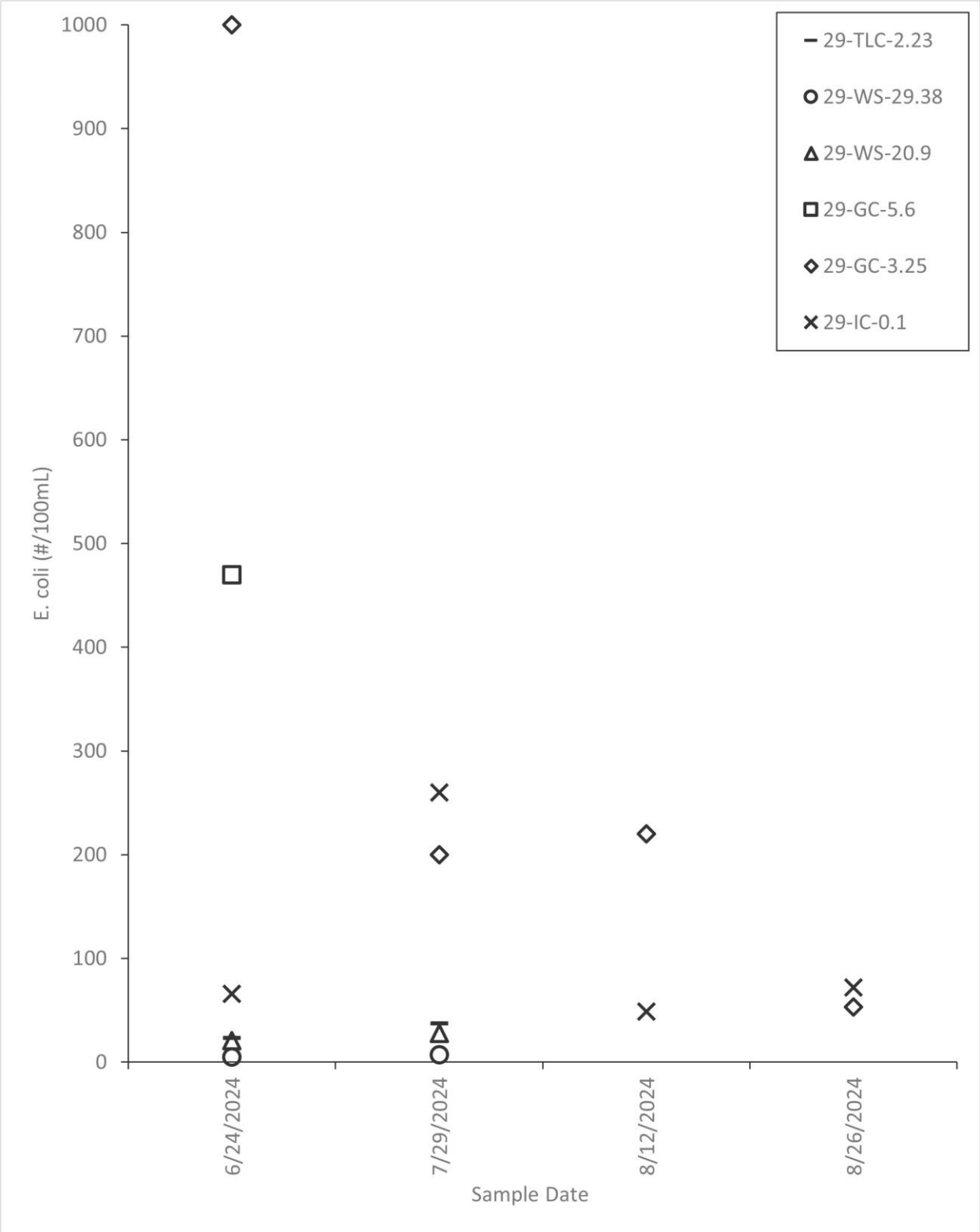

Figure A-13. *E. coli* Bacteria Concentration Across Source Tracking Sites

Appendix B. Streamflow Measurement Data

Table B-1. Instantaneous Streamflow measurements 2023 – 2024

Location ID	Date/Time	Flow (cfs)	Meter Type	Uncertainty (COV% or IVE%)
29F060	1/30/2023 11:19	32.47	FT2	EST
29F060	2/14/2023 10:50	35.08	FT2	EST
29F060	2/28/2023 9:30	33.84	FT2	6.4
29F060	3/7/2023 9:52	25.2	FT2	7.0
29F060	3/28/2023 11:36	37.21	FT2	8.0
29F060	4/25/2023 10:16	56.0	FT2	5.4
29F060	5/23/2023 11:43	29.08	FT2	6.8
29F060	6/6/2023 9:29	18.46	FT2	EST
29F060	6/27/2023 8:09	9.62	FT2	EST
29F060	7/11/2023 9:49	6.93	FT2	EST
29F060	7/18/2023 8:38	7.59	FT2	EST
29F060	8/1/2023 9:50	5.74	FT2	EST
29F060	8/15/2023 8:19	4.57	FT2	EST
29F060	8/29/2023 9:46	6.36	FT2	EST
29F060	9/12/2023 8:34	6.21	FT2	EST
29F060	9/26/2023 8:56	8.33	FT2	EST
29F060	10/24/2023 8:16	7.75	FT2	7.4
29F060	11/7/2023 10:37	28.0	FT2	6.6
29F060	11/28/2023 9:39	7.21	FT2	EST
29F060	1/3/2024 9:47	24.25	FT2	EST
29-GC-0.20	4/10/2023 13:42	18.92	ADCP	EST
29-GC-0.20	4/24/2023 12:54	11.05	ADCP	EST
29-GC-0.20	5/9/2023 14:05	5.58	FT2	4.6
29-GC-0.20	5/22/2023 14:48	1.73	FT2	EST
29-GC-0.20	6/5/2023 13:52	0.49	MF Pro	*NA
29-GC-0.20	6/26/2023 11:45	1.13	FT2	1.1
29-GC-0.20	7/10/2023 13:26	0.84	MF Pro	*NA
29-GC-0.20	7/31/23 15:41	<1.00	*Observed	EST
29-GC-0.20	9/11/2023 8:34	1.14	FT2	EST
29-GC-0.20	9/25/2023 13:39	<1.00	*Observed	EST
29-GC-0.20	10/9/2023 13:10	1.17	FT2	5.8
29-GC-0.20	10/23/2023 12:02	1.52	FT2	6.2
29-GC-0.20	11/6/2023 12:29	4.37	FT2	7.4
29-GC-0.20	11/27/2023 13:31	1.4	MF Pro	*NA
29-GC-0.20	12/4/2023 13:55	22.4	ADCP	EST
29-GC-0.20	12/18/2023 12:17	8.81	FT2	3.6
29-GC-0.20	1/2/2024 13:13	5.89	FT2	3.5
29-GC-0.20	2/12/2024 13:43	31.1	ADCP	EST
29-GC-0.20	2/20/2024 13:00	21.07	ADCP	6.9
29-GC-0.20	3/11/2024 12:13	19.3	ADCP	6.5

Location ID	Date/Time	Flow (cfs)	Meter Type	Uncertainty (COV% or IVE%)
29-GC-0.20	3/25/2024 11:50	12.26	MF Pro	*NA
29-GC-0.20	4/8/2024 11:21	6.09	MF Pro	*NA
29-GC-0.20	4/22/2024 13:05	3.72	MF Pro	*NA
29-GC-1.0	1/30/2023 9:41	9.35	FT2	2.7
29-GC-1.0	2/13/2023 14:14	10.54	FT2	3.0
29-GC-1.0	2/27/2023 13:20	6.81	FT2	2.9
29-GC-1.0	3/6/2023 13:10	5.66	FT2	3.7
29-GC-1.0	3/27/2023 15:40	9.63	FT2	3.1
29-MC-0.1	2/14/2023 12:12	9.93	FT2	4.1
29-MC-0.1	2/28/2023 11:23	9.05	FT2	5.1
29-MC-0.1	3/7/2023 11:20	8.47	FT2	4.0
29-MC-0.1	5/23/2023 13:18	5.27	FT2	EST
29-MC-0.1	6/6/2023 11:12	5.3	FT2	EST
29-MC-0.1	6/27/2023 9:38	4.46	FT2	EST
29-MC-0.1	7/11/2023 11:21	2.41	MF Pro	*NA
29-MC-0.1	7/18/2023 9:52	3.27	MF Pro	*NA
29-MC-0.1	8/1/2023 11:27	2.93	FT2	EST
29-MC-0.1	8/15/2023 9:30	2.69	FT2	EST
29-MC-0.1	8/29/2023 11:18	2.3	MF Pro	*NA
29-MC-0.1	9/12/2023 9:49	3.19	FT2	EST
29-MC-0.1	9/26/2023 10:13	2.43	MF Pro	*NA
29-MC-0.1	10/10/2023 9:49	2.71	FT2	EST
29-MC-0.1	10/24/2023 9:35	2.34	MF Pro	*NA
29-MC-0.1	11/7/2023 11:59	7.22	FT2	6.0
29-MC-0.1	11/28/2023 11:28	2.26	MF Pro	*NA
29-MC-0.1	12/5/2023 9:52	32.5	FT2	5.5
29-MC-0.1	12/18/2023 9:57	7.57	FT2	5.3
29-MC-0.1	1/2/2024 11:28	5.96	FT2	5.4
29-MC-0.1	2/13/2024 10:03	16.84	MF Pro	*NA
29-MC-0.1	2/21/2024 10:20	18.04	MF Pro	*NA
29-MC-0.1	3/12/2024 8:53	20.84	MF Pro	*NA
29-MC-0.1	3/25/2024 8:56	13.09	MF Pro	*NA
29-MC-0.1	4/9/2024 8:19	9.33	MF Pro	*NA
29-MC-0.1	4/23/2024 8:42	7.76	MF Pro	*NA
29-RSC-0.1	3/7/2023 9:30	41.27	ADCP	7.7
29-RSC-0.1	3/28/2023 11:07	78.8	ADCP	6.1
29-RSC-0.1	4/11/2023 9:35	146.88	ADCP	5.8
29-RSC-0.1	4/25/2023 9:46	53.16	ADCP	5.9
29-RSC-0.1	5/10/2023 10:23	25.7	ADCP	EST
29-RSC-0.1	5/23/2023 8:56	11.8	FT2	4.2
29-RSC-0.1	6/6/2023 8:04	6.3	FT2	7.3
29-RSC-0.1	6/26/2023 13:04	2.88	FT2	6.5
29-RSC-0.1	7/11/2023 8:20	1.26	FT2	8.0

Location ID	Date/Time	Flow (cfs)	Meter Type	Uncertainty (COV% or IVE%)
29-RSC-0.1	7/17/2023 11:44	1.14	FT2	6.0
29-RSC-0.1	8/1/2023 8:33	0.66	FT2	EST
29-RSC-0.1	8/14/2023 11:38	0.57	FT2	8.0
29-RSC-0.1	8/29/2023 8:32	0.64	FT2	8.0
29-RSC-0.1	9/25/2023 13:22	2.46	FT2	8.0
29-RSC-0.1	10/10/2023 8:30	1.79	FT2	EST
29-RSC-0.1	10/23/2023 13:25	2.16	FT2	EST
29-RSC-0.1	11/7/2023 9:05	13.2	ADCP	EST
29-RSC-0.1	11/27/2023 9:39	3.8	FT2	5.5
29-RSC-0.1	12/18/2023 13:55	37.9	ADCP	EST
29-RSC-0.1	2/12/2024 15:02	175.0	ADCP	5.6
29-RSC-0.1	2/20/2024 14:31	117.0	ADCP	8.0
29-RSC-0.1	3/11/2024 13:15	120.33	ADCP	7.1
29-RSC-0.1	3/25/2024 14:35	84.65	ADCP	4.8
29-RSC-0.1	4/8/2024 13:53	43.5	ADCP	5.5
29-RSC-0.1	4/22/2024 14:15	20.47	MF Pro	*NA
29-TLC-0.03	7/31/2023 10:30	12.44	FT2	EST
29-TLC-0.03	8/28/2023 11:02	9.84	FT2	EST
29-TLD-2.6	2/13/2023 12:40	1.12	FT2	EST
29-TLD-2.6	3/27/2023 13:18	0.65	FT2	EST
29-TLD-2.6	4/10/2023 12:08	8.64	MF Pro	*NA
29-TLD-2.6	4/24/2023 11:50	18.8	MF Pro	*NA
29-TLD-2.6	5/9/2023 13:03	23.49	MF Pro	*NA
29-TLD-2.6	5/22/2023 13:18	21.6	MF Pro	*NA
29-TLD-2.6	6/5/2023 12:36	18.56	MF Pro	*NA
29-TLD-2.6	6/26/2023 10:45	28.46	MF Pro	*NA
29-TLD-2.6	7/10/2023 11:54	13.79	MF Pro	*NA
29-TLD-2.6	7/17/2023 10:21	21.3	MF Pro	*NA
29-TLD-2.6	7/31/2023 13:37	26.66	FT2	5.2
29-TLD-2.6	8/14/2023 10:25	25.8	MF Pro	*NA
29-TLD-2.6	9/11/2023 10:49	22.03	MF Pro	*NA
29-TLD-2.6	9/25/2023 11:52	16.81	MF Pro	*NA
29-TLD-2.6	10/9/2023 12:16	20.82	MF Pro	*NA
29-TLD-2.6	10/23/2023 11:03	25.52	MF Pro	*NA
29-TLD-2.6	11/6/2023 11:52	24.8	MF Pro	*NA
29-TLD-2.6	11/27/2023 12:23	20.2	MF Pro	*NA
29-TLD-2.6	12/4/2023 12:28	1.02	MF Pro	*NA
29-TLD-2.6	2/12/2024 12:41	1.92	MF Pro	*NA
29-TLD-2.6	3/11/2024 10:28	1.2	MF Pro	*NA
29-TLD-2.6	3/25/2024 10:51	1.81	MF Pro	*NA
29-TLD-2.6	4/22/2024 12:14	20.11	MF Pro	*NA
29-WS-25.18	2/13/2023 11:55	297.24	ADCP	6.9
29-WS-25.18	2/27/2023 11:39	284.0	ADCP	6.8

Location ID	Date/Time	Flow (cfs)	Meter Type	Uncertainty (COV% or IVE%)
29-WS-25.18	3/6/2023 11:53	250.34	ADCP	7.7
29-WS-25.18	3/27/2023 10:49	253.91	ADCP	5.6
29-WS-25.18	4/10/2023 11:26	585.55	ADCP	EST
29-WS-25.18	4/24/2023 11:18	561.31	ADCP	EST
29-WS-25.18	5/9/2023 12:42	1075.58	ADCP	EST
29-WS-25.18	6/5/2023 12:32	604.0	ADCP	6.1
29-WS-25.18	6/26/2023 11:07	292.62	ADCP	6.4
29-WS-25.18	7/10/2023 12:05	206.45	ADCP	5.9
29-WS-25.18	7/17/2023 10:42	173.98	ADCP	5.8
29-WS-25.18	7/31/2023 13:51	133.0	ADCP	4.9
29-WS-25.18	8/14/2023 10:47	133.0	ADCP	6.9
29-WS-25.18	8/28/2023 15:12	133.0	ADCP	EST
29-WS-25.18	9/11/2023 11:07	114.6	ADCP	6.1
29-WS-25.18	10/9/2023 12:40	111.0	ADCP	6.1
29-WS-25.18	10/23/2023 11:16	129.0	ADCP	4.4
29-WS-25.18	11/6/2023 10:56	561.0	ADCP	EST
29-WS-25.18	11/27/2023 11:33	219.0	ADCP	5.0
29-WS-25.18	12/4/2023 11:43	490.56	ADCP	EST
29-WS-25.18	12/18/2023 11:26	500.14	ADCP	6.8
29-WS-25.18	1/2/2024 11:26	354.0	ADCP	5.2
29-WS-25.18	2/12/2024 11:13	583.62	ADCP	7.9
29-WS-25.18	2/20/2024 11:06	445.0	ADCP	6.9
29-WS-25.18	3/11/2024 10:33	505.46	ADCP	4.5
29-WS-25.18	3/25/2024 11:06	777.9	ADCP	EST
29-WS-25.18	4/8/2024 10:32	540.0	ADCP	EST
29-WS-25.18	4/22/2024 12:00	523.62	ADCP	EST

cfs = cubic feet per second

FT2 = SonTek FlowTracker 2

MF Pro = OTT MF Pro Flowmeter

ADCP = Teledyne StreamPro Acoustic Doppler Current Profiler

*Observed =Visual estimate of discharge

*NA = Percent Uncertainty Not Available

EST = Estimate

COV% (Coefficient of Variance) and IVE% (Interpolated Variance Estimator) rating range: ≤3% Excellent, 3-5% Good, 5-8% Fair, >8% Poor and qualified as EST.

Appendix C. Summary of Laboratory Case Narratives

Table C-1. Summary of Laboratory Case Narratives

Laboratory Work Order	Analyses Date	Narratives
2212034	12/6/2022 – 12/7/2022	Samples 29-GC-1.0 and the field duplicate 29-TLC-0.03 sample were qualified as estimates. Samples 29-WS-22.55, 29-TLD-2.6 and 29-WS-1.43 were qualified as nondetects.
2301032	1/4/2023	No Issues.
2301033	1/18/2023	No Issues.
2301034	1/31/2023	Samples 29-WS-22.55, 29-RSC-0.1, 29-MC-0.1, 29-WS-1.43 and the field duplicate 29F060 sample, were qualified as nondetects.
2302030	2/14/2023 – 12/15/2023	Samples 29-TLD-2.6, 29F060 and 29-MC-0.1 were qualified as nondetects.
2302031	2/28/2023 – 3/1/2023	Samples 29-MC-0.1, 29-WS-25.18 and the field duplicate 29-MC-0.1 sample were qualified as nondetects.
2303023	3/7/2023 – 3/8/2023	Sample 29-TLC-0.03 and its field duplicate sample were received at the lab and analyzed out of holding time. Results for this site were qualified as estimates. Sample 29-MC-0.1 was qualified as nondetects.
2303024	3/28/2023 – 3/29/2023	Samples 29-TLD-2.6 and 29-WS-12 were qualified as nondetects.
2304029	4/11/2023 – 4/12/2023	Sample 29-RSC-0.1 was received at the lab and analyzed out of holding time. These results were qualified as estimates. Samples 29-WS-12, 29-WS-1.43, 29-WS-25.18, and field duplicates at 29-GC-0.2 and 29F060 were qualified as estimates.
2304030	4/25/2023 – 4/26/2023	Sample 29-WS-22.55 was qualified as an estimate. Sample 29F060 and field duplicate 29-TLD-2.6 were qualified as nondetects.
2305026	5/10/2023 – 5/11/2023	Sample 29F060, and field duplicate samples at 29-TLD-2.6 and 29F060 were qualified as nondetects.
2305027	5/23/2023 – 5/24/2023	No Issues.
2306019	6/6/2023 – 6/7/2023	Field duplicate sample at 29-WS-22.55 was qualified as an estimate. Sample 29-WS-1.43 was qualified as nondetect.
2306020	6/27/2023 – 6/28/2023	No Issues.
2307015	7/11/2023 – 7/12/2023	Samples 29-TLC-0.03, 29-WS-22.55, 29-TLC-2.6, 29-RSC-0.1, 29-MC-0.1, 29-WS-1.43 and 29-WS-25.18 were all qualified as estimates.
2307016	7/18/2023 – 7/19/2023	Samples 29-WS-22.55, 29-TLC-2.6 and 29-WS-1.43 were qualified as estimates.
2308017	8/1/2023 – 8/2/2023	Sample 29-WS-1.43 was qualified as nondetect.

Laboratory Work Order	Analyses Date	Narratives
2308015	8/15/2023 – 8/16/2023	Sample 29-TLC-0.03 arrived at the lab and was analyzed out of holding time. The result was qualified as an estimate.
2308016	8/29/23 – 8/30/2023	No Issues.
2309015	9/12/2023 – 9/13/2023	No Issues.
2309016	9/26/2023 – 9/27/2023	No Issues.
2310006	10/10/2023 – 10/11/2023	No Issues.
2310007	10/24/2023 – 10/25/2023	Sample 29F060 arrived at the lab and was analyzed out of holding time. The result was qualified as an estimate.
2311006	11/7/2023 – 11/8/2023	No Issues.
2311007	11/28/2023 – 11/29/2023	Sample 29-WS-12 and field duplicate at 29-WS-12 were qualified as nondetects.
2312006	12/5/2023 – 12/6/2023	Sample 29-GC-0.2 and field duplicate at 29-WS-22.55 were qualified as estimates.
2312007	12/19/2023 – 12/20/2023	No Issues.
2401023	1/3/2023 – 1/4/2023	Sample 29-WS-25.18 was qualified as an estimate.
2401024	1/25/2024	Sample 29-TLC-0.03 was qualified as nondetect.
2401025	1/30/2024	Sample 29-WS-22.55 was qualified as an estimate.
2402016	2/13/2024 – 2/14/2024	Samples 29-GC-0.2 and 29-RSC-0.1 were qualified as estimates.
2402017	2/21/2024 – 2/22/2024	Samples 29-WS-22.55, 29-TLD-2.6, 29-RRD-2 and a field duplicate at 29-WS-25.18 were qualified as nondetects.
2403014	3/12/2024 – 3/13/2024	Samples 29-GC-0.20, 29-RRD-2, and a field duplicate at 29-TLC-0.03 were qualified as estimates.
2403015	3/26/2024 – 3/27/2024	Samples 290F060, 29-MC-0.1 and a field duplicate at 29F060 were qualified as nondetects.
2404015	4/9/2024 – 4/10/2024	Sample 29-MC-0.1 arrived at the lab and was analyzed out of holding time. Result was qualified as an estimate. Samples 29F060 and 29-RRD-2 were qualified as nondetects.
2404016	4/23/2024 – 4/24/2024	Samples 29-WS-12, 29-MC-0.1, 29-RRD-2 and a field duplicate at 29-RRD-2 were all qualified as nondetects.
2405009	5/7/2024	Samples 29-TLC-0.03, 29-RRD-2, 29-WS-25.18 and 29-RRD-1 arrived at the lab and were analyzed out of holding time. The results were all qualified as estimates.
2405010	5/21/2024	Samples 29-TLC-0.03, 29-RRD-2, 29-WS-25.18, 29-RRD-1 and field duplicate at 29-WS-25.18 arrived at the lab and were analyzed out of holding time. The results were qualified as estimates. Samples 29F060 and 29-MC-0.1 were qualified as nondetects.

Laboratory Work Order	Analyses Date	Narratives
2406010	6/25/2024	Samples 29-TLC-0.03, 29-WS-22.55, 29-RRD-2, 29-WS-25.18, 29-RRD-1, 29-TLC-2.23, 29-WS-29.38, 29-WS-20.9 and field duplicates at 29-WS-29.38 and 29-TLC-0.03 arrived at the lab and were analyzed out of holding time. The results were all qualified as estimates. Samples 29-TLC-2.6, 29-WS-12, 29-MC-0.1, 29-GC-5.6, 29-GC-3.25, and field duplicates at 29-GC-0.2 and 29-MC-0.1 were all qualified as estimates. Samples 29-GC-0.2 and 29-WS-1.43 were qualified as nondetects.
2407009	7/30/2024	Samples 29F060, 29-RRD-1 and a field duplicate at 29-RRD-1 were qualified as estimates.
2408003	8/13/2024	Field duplicate sample at 29-WS-12 was qualified as an estimate.
2408004	8/27/2024	Sample 29-GC-3.25 and its field duplicate sample arrived at the lab and were analyzed out of holding time. Results were qualified as estimates.