Quality Assurance Project Plan

University of Rhode Island Watershed Watch Analytical Laboratory

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Prepared for
United States Environmental Protection Agency, Region 1
New England Laboratory
11 Technology Drive
North Chelmsford, Massachusetts 01863

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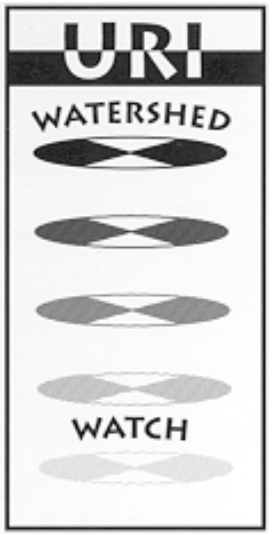
THE UNIVERSITY OF RHODE ISLAND
COLLEGE OF THE ENVIRONMENT AND LIFE SCIENCES

Quality Assurance Project Plan

University of Rhode Island
Watershed Watch
Analytical Laboratory



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2024

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NOTICE OF CHANGES
The following edits/changes have been incorporated to update the previous version (7) of this QAPP:

- Updated authorship, approval and distribution lists
- Updated senior staff and roles
- Added E. coli procedures/tables (SOP 028)
- Updated salinity procedures/tables (SOP 017b)
- Revised equation used for determining MDL
- Expanded data validation section
- Added Laboratory Data Management SOP (027)

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List of Abbreviations

Abbreviation	Definition
CA	Corrective Action
COC	Chain-of-Custody
%D	Percent Difference
DI	Deionized Water
DQIs	Data Quality Indicators
DO	Dissolved Oxygen
DQO	Data Quality Objectives
EPA-NE	Environmental Protection Agency – New England District (Region 1)
g	Gram
L	Liter
LCS	Laboratory Control Standard (standard analyzed as a sample)
MDL	Method Detection Limit
mL	Milli-liter
mg	Milli-gram
MSDS	Material Safety Data Sheet
MQ water	Ultra-pure water >18uohms
NA	Not Applicable
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
ppb	Part per billion (ug/L)
ppm	Part per million (mg/L)
R^2	Coefficient of Determination

List of Abbreviations (continued)

Abbreviation	Definition
%RPD	Replicate Percent Difference
RL	Reporting Limit (Quantitation Limit)
SOP	Standard Operating Procedure
SU	Standard Unit (pH units)
µg	Micro-gram
URIWW	University of Rhode Island Watershed Watch

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LIST OF FIGURES
(Tables listed in Table of Contents)

LIST OF APPENDICIES

1.0 PURPOSE AND DESCRIPTION

The University of Rhode Island Watershed Watch Program (URIWW) is a Cooperative Extension Water Quality Program in the Department of Natural Resources Science, College of the Environment and Life Sciences. The program is located in the Coastal Institute building on the URI Kingston campus. Begun in 1988, the URIWW program is a statewide volunteer monitoring program with over 300 volunteers. The program focuses on providing current information on the water quality of surface water resources throughout Rhode Island. It is a service provider to statewide and local decision-makers and is the sole source of long-term lake water quality data for Rhode Island. The URIWW laboratory provides analytical services to the Rhode Island Department of Environmental Management (RIDEM) and the Environmental Protection Agency, New England District (Region 1) (EPA-NE) as well as other URI researchers. It is a springboard for municipal board activities by volunteers, linked with all cooperative extension water quality activities. The program is intended to encourage communities and shoreline residents to understand the need to cooperatively manage and improve the water quality of all the water bodies within a watershed.

Information describing the URIWW program, program factsheets, water quality data as well as monitoring protocols are maintained at the following web-site: https://web.uri.edu/watershedwatch/. Water quality data are available in CSV format suitable for downloading and use by water resource professionals. Data are also provided in a variety of formats designed to be more accessible to a lay audience, including an interactive data dashboards, tables and charts by site or parameter, and watershed maps. Basic information describing URIWW is also available in Appendix C.

The purpose of this Quality Assurance Project Plan (QAPP) is to provide guidance on the analytical procedures and quality assurance/quality control (QA/QC) tasks performed by the URIWW. The URIWW Laboratory provides analysis of samples for the following contaminants of concern: fecal coliform, enterococci, E. coli, salinity, alkalinity, pH, chlorophyll-a, chloride, ammonia, orthophosphate, nitrate + nitrite, total phosphorus and total nitrogen. Assays are completed on ambient waters (rivers, lakes and streams) and marine waters (ocean, estuaries, brackish).

This QAPP does not describe field collection nor analysis procedures; that information is provided in other documents. A cross-reference between the information required by EPA-NE is provided in the table below. Note that information found in narrative format instead of in an EPA-NE table is listed as “in narrative”.

Required Information Checklist

EPA-NE Work-sheet number	Worksheet Title	Location In URIWW Laboratory QAPP
1	Title and approval	In narrative
2	Table of contents & document format	In narrative
3	Distribution list	In narrative
4	Project personnel sign-off sheet	All relevant personnel are included on the approval page
5a	Organizational chart	Figure 1
5b	Communication pathway	Section 1.2 in narrative
6	Personnel responsibilities and qualification	Section 1.2 and 1.2.1 in narrative
7	Special personnel training requirements	Section 1.2.2 in narrative
8a	Project scoping meeting attendance sheet, agenda	NA
8b	Problem definition/site history & background	Section 1.0 in narrative
9a	Project description	Section 1.0 in narrative
9b	Contaminants of concern	Section 2.6.1
9c	Field & QC sample summary	NA
10*	Project schedule timeline	Section 1.3 in narrative
11a	Project quality objectives/decision statements	Section 2.0 in narrative
11b	Measurement performance criteria table	Section 2.6.2
12a	Sampling design & rationale	NA
12b	Sampling locations, methods, SOP requirements table	NA

EPA-NE Work-sheet number	Worksheet Title	Location In URIWW Laboratory QAPP
13	Project sampling SOP table	Appendix A
14	Field equipment calibration	NA
15	Field equipment maintenance	NA
16	Sampling handling, tracking, custody	Section 3.0 in narrative and Section 3.2
17	Field method /SOP	NA
18	Field calibration	NA
19	Field maintenance	NA
20	Fixed lab. analytical , SOP reference table	Section 2.6.3
21	Lab instrument maintenance & calibration table	Section 2.6.4
22a	Field sampling QC	NA
22b	Field sampling QC continued	NA
23a	Field analytical QC	NA
23b	More field QC	NA
24a	Lab analytical QC	Section 2.6.5
24b	More lab analytical QC	No multiple analytes
25	Non-direct measurement criteria	NA
26	Project documentation and records	Section 4.0 in narrative
27a	Assessment and response	NA
27b	Project assessment	NA
27c	Project assessment plan	NA
28	QA management reports	Section 4.0 in narrative
29a	Data evaluation process	NA

EPA-NE Work-sheet number	Worksheet Title	Location In URIWW Laboratory QAPP
29b	Data validation summary	Section 5.0 in narrative
29c	Data validation modifications	NA
30	Data usability assessment	NA

Notes:
NA – Not applicable to this QAPP. This QAPP provides information regarding general laboratory protocols only. No project-specific information is contained in this general QAPP. No field sample collection or analysis information is provided in this QAPP and all data are generated in-house.

1.1 Quality Assurance Project Plan (QAPP) Objectives

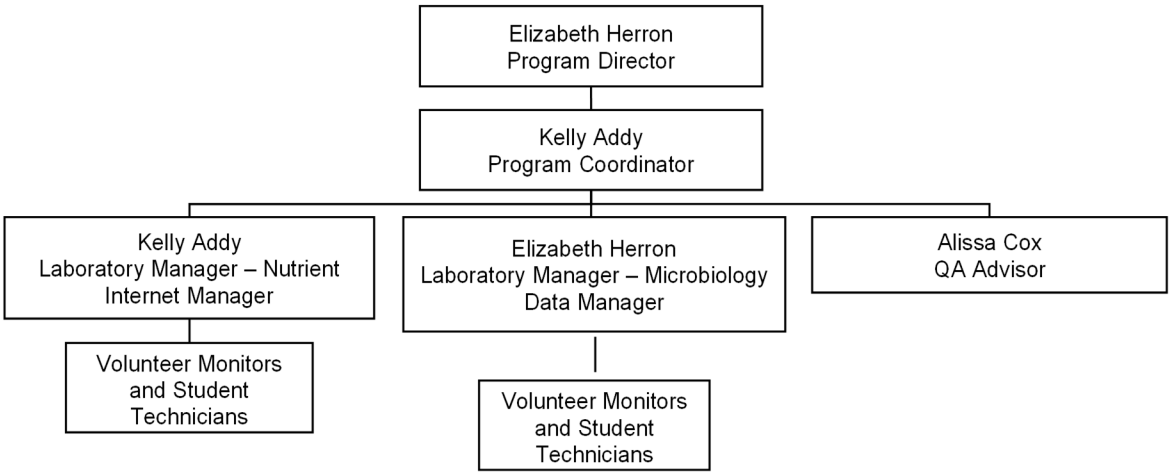
The objective of this QAPP is to present the organization, objectives and specific quality assurance/quality control (QA/QC) procedures associated with URIWW laboratory analysis protocols. Guidance on the analysis procedures for the following laboratory assays is provided in this document: fecal coliform, E. coli, enterococci, alkalinity, pH, salinity, chlorophyll-a, chloride, ammonia, orthophosphate, nitrate + nitrite nitrogen, total phosphorus and total nitrogen. Specific QA/QC criteria as well as documentation are outlined in individual Standard Operation Procedures (SOPs) located in Appendix A. This QAPP does not describe any field collection or analysis procedures; this information is provided in other documents.

1.2 Organization and Communication

Elizabeth Herron is the URIWW Program Director as well as the overall Analytical Laboratory manager, and Laboratory Manager for microbiological analysis (Figure 1). She is responsible for the analysis and QA/QC of microbiological assays. She is also responsible for overall operation of the laboratory, including QA/QC of all non-nutrient and chloride related assays, and data management for all laboratory analyses and field data. Kelly Addy is the Watershed Hydrology Laboratory Manager and URIWW Program Coordinator and Nutrient Analytical Laboratory manger. She is responsible for overall management of the nutrient analyses, including QA/QC of all nutrient and chloride assays. Dr. Alissa Cox will provide QA/QC guidance as the URIWW QA Advisor. Ms. Herron and Ms. Addy are both responsible for the supervision of student laboratory technicians.

All changes to the QAPP or specific SOPs will be completed only after review and acceptance by Ms. Herron or Ms. Addy.

Figure 1: University of Rhode Island Watershed Watch (URIWW) Laboratory Structure



1.2.1 Staff Responsibilities

The responsibilities of each staff position are described below.

1.2.1.1 Program Director URIWW Program and Laboratory Manager

Responsibilities and duties include:

- Daily operations and periodic review of URIWW program;
- Obtaining and managing grants and contracts;
- Updating of technical documentation when necessary including: establishment of acceptance criteria, monitoring corrective action, oversight of the QA/QC program and arranging for annual internal audits of operation;
- Being present on laboratory premises during most laboratory hours of operation to ensure adequate and appropriate supervision of laboratory activities;
- Ensuring accurate performance of all tests in the laboratory including submission of appropriate reports;
- Ensuring adequate supervision of laboratory staff and the hiring of adequately trained personnel;
- Adhering to written QA/QC procedures;
- Maintaining employee records;
- Maintaining compliance with relevant URI Health and Safety requirements.
- Coordination of volunteer monitors including equipment, supplies and sample delivery;
- In charge of data templates, data management, database implementation and data entry:

Qualifications:

- Masters degree in chemical, biological or environmental sciences;
- A minimum of four (4) years of analytical laboratory experience.
- Extensive experience working with volunteers on water quality projects.

1.2.1.2 Program Coordinator

Responsibilities and duties include:

- Updating technical documentation when necessary;
- Creating outreach tools and data reports;
- Assisting with obtaining and managing grants and contracts;
- Developing and maintaining program website;
- Ensuring adequate supervision of laboratory staff;
- Completing duties of the Program Director when they are absent from the laboratory;
- Assisting the program director with assigned tasks.

Qualifications:

- Masters degree in chemical, biological or environmental sciences;
- A minimum of two (2) years of analytical laboratory experience;
- Extensive experience working with volunteers on water quality projects.

1.2.1.3 Laboratory Manager - Nutrients

Responsibilities and duties include:

- Supervising and/or completing preparation and analysis of nutrients and chloride samples;
- Review of all nutrient data;
- Assuring that proper QA/QC procedures are followed as documented in laboratory QAPP;
- Maintaining proper instrument maintenance records;
- Documenting laboratory procedures;
- Ordering laboratory supplies;
- Maintaining compliance with URI Health and Safety requirements;
- Attending initial URI Health and Safety training: Environmental Awareness/Initial Laboratory Waste Management Training and the yearly refresher: Prudent Practices and Laboratory Waste Management.

Qualifications:

- Bachelors degree in chemical, biological or environmental sciences;
- Minimum of two (2) years of analytical laboratory experience.

1.2.1.4 Laboratory Manager – Microbiology

Responsibilities and duties include:

- Supervising and/or completing preparation and analysis of all microbiological samples;
- Supervising and/or completing preparation and analysis of all samples other than nutrient samples (including pH, alkalinity, chlorophyll, salinity, dissolved oxygen, and preparation of nutrient samples);
- Review of all program data;

- Training interns and student employees as well as documenting training activities;
- Assuring that proper QA/QC procedures are followed as documented in the laboratory QAPP;
- Maintaining proper instrument maintenance records;
- Documenting laboratory procedures;
- Ordering laboratory supplies;
- Maintaining compliance with URI Health and Safety requirements;
- Attending the initial URI Health and Safety training: Environmental Awareness/Initial Laboratory Waste Management Training and the yearly refresher: Prudent Practices and Laboratory Waste Management.

Qualifications:

- Bachelors degree in chemical, biological or environmental sciences;
- Minimum of two (2) years of analytical laboratory experience.

1.2.1.5 QA Advisor

Responsibilities and duties include:

- Providing technical assistance in determining appropriate QA/QC measures when requested by program director or coordinator.

Qualifications:

- Masters degree in chemical, biological or environmental sciences;
- Minimum of two (5) years of related experience;
- Extensive knowledge of QA/QC procedures.

1.2.1.6 Student Laboratory Technicians

Responsibilities and duties include:

- Labware cleaning and preparation for use;
- Organizing, set up and distribution of samples bottles;
- Logging in samples
- Cleaning, calibrating, break down and set up of monitoring supplies;
- Preparation and analysis of samples for pH, alkalinity, salinity and chlorophyll-a, and including occasional microbiological samples;
- Data entry and proof-reading data entries
- Properly following established QA/QC procedures;
- Following proper URI Health and Safety requirements;
- Maintaining compliance with URI Health and Safety requirements by attending initial student Health and Safety training.

Qualifications:

- High school diploma
- Either a bachelor’s degree in chemical, biological or environmental science or be currently working toward a bachelors in chemical, biological or environmental science.

1.2.2 Personnel Qualifications

A brief description of the experience of principal laboratory personnel is described here. Resumes of key personnel are in Appendix B.

Elizabeth Herron has more than 30 years of experience with the URIWW program, beginning by completing a QA assessment of the program to determine the representativeness of the data generated. She expanded the microbiology laboratory, updating it to current standards, enabling it to receive state-certification. She is the recipient of numerous grants and awards related to her work with URIWW. She is a former director of the North American Lake Management Society as well as a co-founding member of the Rhode Island Volunteer Monitoring Steering Committee. She has authored numerous articles and technical publications and has presented workshops, technical papers and webinars throughout the United States.

Kelly Addy is a watershed hydrologist who has over managed the Watershed Hydrology Laboratory (WHL) for over 20 years. She focuses on watershed sources and sinks of nitrogen, completing nutrient analyses for thousands of samples over the decades. She has authored many refereed articles and received numerous grants and awards for her work with the WHL, including the prestigious URI College of the Environment and Life Sciences Research Staff Research and Scholarship Excellence Award in 2019. Ms. Addy has assisted URIWW throughout her career and is well associated with its practices.

Dr. Alissa Cox is a Clinical Assistant Professor of Sustainable Ecological Design, and director of the New England Onsite Wastewater Training Program in the College of the Environment and Life Sciences at URI. She has more than a decade of experience in the field of water resources, particularly focused on the impact of on-site wastewater treatment systems to Rhode Island waters. She has published numerous refereed journal articles related to her wastewater work. In addition, she has an extensive background in science and math education, which is especially valuable for assessing training procedures. As head of the Laboratory of Soil Ecology and Microbiology, she is experienced and familiar with the procedures and instruments used by URIWW.

Linda Green has over 35 years of analytical laboratory related experience and was the director of URIWW for more than 30 years from its inception in 1988. She is the recipient of numerous awards and grants related to her work with the URIWW program and has authored numerous articles and technical publications. Ms. Green has hosted workshops on QA/QC in volunteer monitoring programs and for ten years was the sole volunteer monitoring representative on the National Water Quality Monitoring Council as well as a co-founding member of the Rhode Island Volunteer Monitoring Steering Committee. She continues to consult with URIWW ensuring that this vital and extensive institutional knowledge is not lost.

1.2.1 Training

Except for the mandatory URI safety training, laboratory personnel training is conducted by Elizabeth Herron. Laboratory training is provided on basic laboratory techniques as well as method-specific details. Training requirements for each assay are provided in analyte-specific SOPs, located in Appendix A. Detailed written procedures are posted in the vicinity of all procedure spaces to provide additional post-training support. All laboratory assays are conducted by laboratory personnel; no volunteer monitors conduct laboratory assays.

Figure 2 – Student Training Record

THE UNIVERSITY OF RHODE ISLAND

URI Watershed Watch Laboratory
Student Training Record

Student Name : _____

Method	Date of Training	Initials of Trainer	Initials of Student
Field			
Attended Watershed Watch Volunteer training			
General			
SOP 001 - URI General Laboratory Safety SOP 001a - University Safety & Waste Handling			
SOP 002 - Laboratory Water SOP 003 - General Labware Cleaning Procedure			
SOP 004 - General Autoclave Operation SOP 005 - Bottle Autoclaving Procedure SOP 006 - Waste Autoclaving Procedure			
SOP 019 - Analytical Balance Calibration			
SOP 025 - Lab Thermometer Calibration			
Chemistry and Particulates			
SOP 012 - Chlorophyll - a Analysis, Trilogy			
Sample preparation for SOP 016 - Total Phosphorus and Nitrogen Analysis			
SOP 017b - Salinity Analysis using Digital Refractometer			
SOP 021 - pH Procedures			
SOP 022 - Alkalinity Procedures			
SOP 023 - Filtering Water Samples			
Microbiology			
SOP 018 - Enterococci Analysis - Enterolert			
SOP 024 - Fecal coliform Analysis Coliert-18			
SOP 026 - HPC Quanti-tray Analysis			
SOP 028 - E. coli Analysis Coliert-18			

This form is intended to be used as a training record. This record will be maintained with student employment records by URI Watershed Watch for at least 5 years.

Training of laboratory personnel is recorded on the “Student Training Record” document, figure 2 above. Records of training are archived for at least 5 years.

1.3 Schedule/Timeline

This QAPP does not relate to a specific project, therefore no specific timeline or schedule is offered. Laboratory analyses are conducted as needed to provide information for partners, sponsors and various projects.

2.0 LABORATORY QUALITY OBJECTIVES AND MEASUREMENT PERFORMANCE CRITERIA

High quality data is the goal of all URIWW Laboratory analyses. Specific data quality objectives have been set on a method basis for method detection limits (MDL), precision, accuracy, comparability and completeness. Values specific to each of these objectives are located in analyte-specific SOPs located in Appendix A as well as below. Since this document is a general QAPP for laboratory assays only, there are no specific if/then statements linking laboratory criteria to project decisions.

2.1 Method Detection Limits (MDL) and Reporting Limit (RL)

The MDL is the analyte concentration where there is 99% confidence that the sample concentration is different than zero. Below the MDL it is uncertain if the concentration is not zero. The reporting limit (RL) is the value above which data have definable accuracy and precision. Each analyte of interest has a specific MDL and RL value. These values are located in the analyte-specific SOPs in Appendix A as well as worksheet 9b (see Section 2.6.1). Note that most MDL's and RL's are calculated annually, the most up-to-date values are available from the Laboratory Manager.

The analytical method MDL as reported in Section 2.6.1 for each assay is often different from the achievable laboratory MDL. Generally, the achievable laboratory MDL is higher than the analytical method MDL. This is often the case because the MDL listed for an analytical method is for the best-case scenario. In this scenario, there are no other contaminants present in a sample that could cause interferences during sample analysis, the method blank would be extremely low and all equipment would function without error. Unfortunately, this is generally not the case. At the very low contaminant levels that the laboratory is able to analyze samples to it is easy to introduce some contamination from water or reagents. Therefore, the URIWW laboratory elevates the method MDL to the RL to account for these concerns.

2.1.1 Method Detection Limit (MDL) calculation

The MDL is calculated for the following assays annually: chloride, ammonia, orthophosphate, nitrate+nitrite nitrogen, total nitrogen and total phosphorus. The MDL is calculated using the method found in 40 CFR part 136 Appendix B (Appendix B to Part 136 – Definition and Procedure for the Determination of the Method Detection Limit – Revision 1.11). Calculation of the MDL for the microbiology assays is dependent upon the amount of sample filtered or processed and is discussed in SOP 018 - Enterococci Using Enterolert IDEXX Method and SOP-024 – Fecal Coliform Analysis Using Colilert 18 (IDEXX method). The method detection limits for alkalinity, pH, chlorophyll-a and salinity are set by the method or the associated instrument and are not recalculated yearly.

The following provides a brief description of the method used to calculate MDL from 40 CFR part 136 Appendix B.

1. The MDL is estimated as the concentration 3 times the standard deviation of replicate measurements of a standard prepared in reagent water.

    a. The standard deviation is calculated as follows:

$$S^2 = \frac{1}{n-1}\left[\frac{\sum_{i=1}^{n} x_i^2 - \left(\sum_{i=1}^{n} X_i\right)^2}{n}\right]$$

$$S = \left(S^2\right)^{\frac{1}{2}}$$

Where:

S^2 = Variance
S = Standard deviation
N = Number of samples
X_i = Sample value i = 1 to n, are the analytical results in the final method reporting units obtained from the n sample aliquots and ∑ refers to the sum of the i = 1 to n

2. Prepare a standard in reagent water that is 1 to 5 times the concentration of the estimated MDL (which is 3 to 5 times the standard deviation as calculated above).

3. Analyze a minimum of 7 aliquots of this standard. If a blank measurement is required to determine the final sample concentration, analyze one blank per aliquot. Then use the average concentration of the blank in the final calculation to determine sample concentration.

4. Calculate the standard deviation of the final concentration of the seven aliquots from step 3.

5. Compute the MDL as follows:

    a. MDL = $t_{(n-1,1-\acute{\alpha} = 0.99)}$ x s

    Where: s = Standard deviation

    $t_{(n-1,1-\acute{\alpha} = 0.99)}$ = Students' t value appropriate for the 99% confidence level and a standard deviation estimate with n-1 degrees of freedom

Table 1 - Students' T Values At The 99% Confidence Level

Number of replicates	Degrees of freedom (n-1)	$t_{(n-1,.99)}$	Number of replicates	Degrees of freedom (n-1)	Number of replicates
7	6	3.143	10	9	2.821
8	7	2.998	11	10	2.764
9	8	2.896	16	15	2.602

6. If the calculated MDL is higher than expected, repeat the procedure with a standard of lower concentration.
7. The final MDL should be 1/3rd to 1/5th the calibrator used, or the lowest calibrator should be 3 to 5 times the estimated MDL.

2.2 Precision

Precision is an evaluation of the degree to which two or more measurements are in agreement as well as a measurement of random error. Precision will be assessed through the measurement of duplicate samples and subsequent calculation of the relative percent difference (%RPD) as described below.

$$\%RPD = \frac{|\text{Result of Replicate 1} - \text{Result of Replicate 2}|}{\text{Average of Result of Replicate 1 and Result of Replicate 2}} \times 100$$

Objectives for precision are located in the analyte specific SOPs (Appendix A) as well as worksheet 11b and 24a Section 2.6.2 and 2.6.5, respectively.

2.3 Accuracy

Accuracy is an evaluation of the degree to which a measured value and a known reference value or true value are in agreement. This is a measurement of systematic error and is often referred to as “bias”. Laboratory accuracy is determined by the analysis of reference material and comparison of the resulting value to that of the accepted value. The difference between the accepted and reference value is the percent difference (%D). The %D is calculated as follows:

$$\%D = \frac{|\text{Known Value of Reference Material} - \text{Calculated Value of Reference Material}|}{\text{Known Value of Reference Material}} \times 100$$

Objectives for accuracy are located in the analyte specific SOPs (Appendix A) as well as worksheet 11b and 24a (Section 2.6.2 and 2.6.5, respectively).

Accuracy is determined during both routine sample analysis procedures as well as by yearly participation in the EPA Water Pollution Proficiency Test Study for the following assays: alkalinity, ammonia, chloride, nitrate + nitrite-N, orthophosphate, total nitrogen, total phosphorus, and pH.

2.4 Comparability

All methods utilized by the URIWW Laboratory are based on methods found in *Standard Methods for the Examination of Water and Wastewater* published by the American Public Health Association, American Water Works Association and Water Environment Federation. Specific references for each method are found in the analyte specific SOPs (Appendix A).

2.5 Completeness

Completeness is a measure of the amount of valid data obtained from the laboratory methods compared to the amount that was expected to be obtained under normal conditions. Greater than 90% completeness of accepted field samples is expected. Completeness is calculated as follows:

$$\text{Completeness} = \frac{\text{Number of Valid Laboratory Measurements}}{\text{Number of Laboratory Measurements Planned}} \times 100$$

2.6 QA/QC Tables

Tables summarizing the QA/QC objectives for each analysis performed by the URIWW Laboratory are provided on the following pages. These tables specifically address the Data Quality Indicators (DQIs) or the procedures to be followed to provide assurance that an analytical procedure is returning valid results. Each DQI has a specific result that must be met before the data is considered acceptable. Information is also provided on the instruments utilized for each assay and the maintenance and calibration procedures that must be completed on each instrument. Analyte-specific tables provide information on the number of QA/QC samples to be prepared (blanks, replicates, etc.) and the expected result as well as the person(s) responsible for assessing any problems and determining the proper course of action, if necessary.

2.6.1 Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table) - Worksheet #9b

EPA-NE QAPP Worksheet #9b – EPA Rev. 10/99

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Reporting Units	Project Action Limit (Units) (wet or dry weight)	Project Quantitation Limit (Units) (wet or dry weight)	Analytical Method		Achievable Laboratory Limits	
					MDLs	Method RLs	MDLs[3]	RLs[3]
Fecal coliforms – SOP 024		number/100mL			<1[1]		<1[1]	
Enterococci – SOP 018		number/100mL			<1[1]		<1[1]	<1[1]
Heterotrophic Plate Count – SOP 020		number/100mL			<1[2]		<1[2]	<1[2]
Alkalinity – SOP 010		mg/L $CaCO_3$			Not Provided		0	0.1
pH – SOP 010		Standard Unit (SU)			1.0		1.00	1.0
Salinity – SOP 017b		ppt			Not Provided		1.0	1.0
Chlorophyll a – SOP 012		µg/L chlorophyll-a			0.1		0.1	0.2
Chloride – SOP 013	16887-00-6	mg/L Cl^-			0.2		0.13	1
Ammonia – SOP 014	7664-41-7	µg/L NH_3-N			5		3.0	20
Orthophosphate – SOP 015		µg/L PO_4-P			2		0.4	4
Nitrite + Nitrate – SOP 015		µg/L NO_3/NO_2-N			10		1.5	15

EPA-NE QAPP Worksheet #9b – EPA Rev. 10/99

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Reporting Units	Project Action Limit (Units) (wet or dry weight)	Project Quantitation Limit (Units) (wet or dry weight)	Analytical Method		Achievable Laboratory Limits	
					MDLs	Method RLs	MDLs[3]	RLs[3]
Total Phosphorus – SOP 016		µg/L P			2*		0.4	4
Total Nitrogen – SOP 016		µg/L N			10*		2	20

Notes:

*The MDLs for Total Phosphorus and Total Nitrogen were not provided by the method reference. Therefore, the method MDLs for orthophosphate and nitrate + nitrite were reported since the total phosphorus and nitrogen assays are based on the orthophosphate and nitrate + nitrite assays, respectively. After a sample is digested for total nitrogen and phosphorus the sample is analyzed as a nitrate + nitrite and orthophosphate sample (please refer to the analyte-specific SOP located in the URIWW Laboratory QAPP for more information).

[1]Taken from MPN Tables for 51 Well Quanti-Tray and Quanti-Tray/2000 - www.IDEXX.com accessed December, 2006

[2]Taken from HPC for Quanti-tray table https://www.idexx.com/en/water/water-products-services/hpc-quanti-tray/ accessed September 24, 2020

[3]Some MDLs and RLs are determined annually, for the most up-to-date values contact the Laboratory Manager

2.6.2 Measurement Performance Criteria Table – Worksheet 11b

Note: All QC Measurement Performance Criteria in this table are for assessment of analytical error only.

EPA-NE QAPP Worksheet #11b – EPA Rev. 10/99

Measurement Performance Criteria Table

Sampling Procedure	QC Sample and/or Activity Used to Assess Measurement Performance	Measurement Performance Criteria	Data Quality Indicators (DQIs)	Analytical Method/SOP
Fecal coliform, Enterococci	Method Blank	< 1 /100 mL	Bias	024/018
	Sample Replication	Not greater than 20%RPD	Precision	
	Inoculate a tray with a known positive sample (method for positive trays and QA check on new reagent batches)	Positive growth	Bias/false negatives	
	Check of UV sterilizer efficiency	Not less than 70% of initial efficiency	False positives	
	Sample bottle sterility checks	0 \number/mL	Bias/false positives	
	Check incubator temperature	41 °C Incubator 41 +/- 0.5 °C 35 °C Incubator 35 +/- 0.5 °C 44.5 °C Incubator 44.5 +/- 0.2 °C	Bias	
	EPA Water Pollution Proficiency Test Study (Analysis of Unknowns)	2 standard deviation	Accuracy/ Comparability	

EPA-NE QAPP Worksheet #11b – EPA Rev. 10/99

Measurement Performance Criteria Table

Sampling Procedure	QC Sample and/or Activity Used to Assess Measurement Performance	Measurement Performance Criteria	Data Quality Indicators (DQIs)	Analytical Method/SOP
Fecal coliform, Enterococci (continued)	EPA Water Pollution Proficiency Test Study (Analysis of Unknowns)	2 standard deviation	Accuracy/ Comparability	024/018
	IDEXX Mixing Bottle Sterility Check	0 number/mL	Bias/False positives	
Heterotrophic Plate Count (HPC)	Method Blank	< 1 colony/mL	Bias	020
	Check of UV sterilizer efficiency	Not less than 70% of initial efficiency	False positives	
	Sample bottle sterility checks	0 number/mL	Bias/false positives	
	Check incubator temperature	35 °C Incubator 35 +/- 0.5 °C	Bias	
Alkalinity and pH	EPA Water Pollution Proficiency Test Study (Analysis of Unknowns)	2 standard deviation	Accuracy/ Comparability	010
	Calibration	Electrode efficiency greater than 96%	Accuracy	
	Sample Replication	pH – difference not greater than +/- 0.5 S.U. Alkalinity – difference not greater than 25%D	Precision	

EPA-NE QAPP Worksheet #11b – EPA Rev. 10/99

Measurement Performance Criteria Table

Sampling Procedure	QC Sample and/or Activity Used to Assess Measurement Performance	Measurement Performance Criteria	Data Quality Indicators (DQIs)	Analytical Method/SOP
Alkalinity and pH (continued)	Standards as Samples (Calibration check)	Change in 7.0 standard not greater than +/- 0.2 SU	Accuracy/ Precision	010
Salinity	Sample Replication	Not greater than 2 ppt different	Precision	017b
	Sample Comparison	Not greater than 2 ppt different	Accuracy/ Comparability	
Chlorophyll-a	Method Blank	Not greater than 0.03 µg/L chlorophyll-a as read on the fluorometer	Bias	012
	Filter Blank	Not greater than 0.03 µg/L chlorophyll-a as read on the fluorometer	Bias	
	Initial Calibration Using Liquid Standards	N/A	Accuracy	
	LCS (Calibration check using Solid Standard)	Not greater than 15%D	Accuracy/ Precision	

EPA-NE QAPP Worksheet #11b – EPA Rev. 10/99

Measurement Performance Criteria Table

Sampling Procedure	QC Sample and/or Activity Used to Assess Measurement Performance	Measurement Performance Criteria	Data Quality Indicators (DQIs)	Analytical Method/SOP
Chloride	Method Blank	Not greater than 2 mg/L Cl^-	Bias	013
	Sample Replication	Not greater than 20%RPD (Replicate from same sample cup) Not greater than 20%RPD (Replicate from different sample cups)	Precision	
	Calibration	R^2 of calibration linear regression not less than 0.990	Accuracy	
	Matrix Spike	80 – 120 % recovery	Bias	
	EPA Water Pollution Proficiency Test Study (Analysis of Unknowns)	2 standard deviation	Accuracy/ Comparability	
	Laboratory Control Samples (Purchased External Standards)	Not greater than 20%D	Accuracy/ Comparability	
	Standards as Samples (Calibration check)	Not greater than 20%D	Accuracy	

EPA-NE QAPP Worksheet #11b – EPA Rev. 10/99

Measurement Performance Criteria Table

Sampling Procedure	QC Sample and/or Activity Used to Assess Measurement Performance	Measurement Performance Criteria	Data Quality Indicators (DQIs)	Analytical Method/SOP
Ammonia	Method Blank	Not greater than 30 µg/L NH_3-N	Bias	014
	Sample Replication	Not greater than 20%RPD (Replicate from different sample cups)	Precision	
	Calibration	R^2 of calibration linear regression not less than 0.990	Accuracy	
	Matrix Spike	80 – 120 % recovery	Bias	
	EPA Water Pollution Proficiency Test Study (Analysis of Unknowns)	2 standard deviation	Accuracy/ Comparability	
	Laboratory Control Samples (Purchased External Standards)	Not greater than 20%D	Accuracy/ Comparability	
	Standards as Samples (Calibration check)	Not greater than 20%D	Accuracy	

EPA-NE QAPP Worksheet #11b – EPA Rev. 10/99

Measurement Performance Criteria Table

Sampling Procedure	QC Sample and/or Activity Used to Assess Measurement Performance	Measurement Performance Criteria	Data Quality Indicators (DQIs)	Analytical Method/SOP
Orthophosphate & Nitrate + Nitrite	Method Blanks	Not greater than 4 µg/L PO_4-P and 20 µg/L NO_3/NO_2-N	Bias	015
	Sample Replication	Not greater than 20%RPD (Replicate from different sample cups)	Precision	
	Matrix Spike	80 – 120 % recovery	Bias	
	Calibration	R^2 of calibration linear regression not less than 0.990	Accuracy	
	EPA Water Pollution Proficiency Test Study (Analysis of Unknowns)	2 standard deviation	Accuracy/ Comparability	
	Laboratory Control Samples (Purchased External Standards)	Not greater than 20%D	Accuracy/ Comparability	
	Standards as Samples (Calibration check)	Not greater than 20%D	Accuracy	

EPA-NE QAPP Worksheet #11b – EPA Rev. 10/99

Measurement Performance Criteria Table

Sampling Procedure	QC Sample and/or Activity Used to Assess Measurement Performance	Measurement Performance Criteria	Data Quality Indicators (DQIs)	Analytical Method/SOP
Total Phosphorus and Nitrogen Analysis	Digestion (Method) Blank	Not greater than 4 µg P/L and 30 µg N/L	Bias	016
	Sample Replication	Not greater than 25%RPD (Replicate from different sample cups) Not greater than 25%RPD (Replicate digestions)	Precision	
	Calibration	R^2 of calibration linear regression not less than 0.990	Accuracy	
	Matrix Spike	80 – 120 % recovery	Bias	
	EPA Water Pollution Proficiency Test Study (Analysis of Unknowns)	2 standard deviation	Accuracy/ Comparability	
	Laboratory Control Samples (Purchased External Standards)	Not greater than 20%D	Accuracy/ Comparability	
	Standards as Samples (Calibration check)	Not greater than 20%D	Accuracy	
	Check Temperature of Water Bath	At least 100 °C (boiling) for 15 minutes	Bias	

2.6.3 Fixed Laboratory Analytical Method/SOP Reference Table – Worksheet 20

EPA-NE QAPP Worksheet #20 – EPA Rev. 10/99

Fixed Laboratory Analytical Method/SOP Reference Table

Reference Number (SOP Number)	Title, Revision Date and/or Number	Analytical Parameter	Instrument
024	Fecal coliform Analysis Using Colilert-18 IDEXX Method Rev. 2: 01/16	Fecal coliforms	Incubator – 44.5 °C ThermoScientific Heratherm incubator Autoclave UV Sterilization box
018	Enterococci Analysis Using Enterolert IDEXX Method, Rev. 3: 01/16	Enterococci	Incubator – 41 °C ThermoScientific Heratherm incubator UV Indicator lamp Autoclave UV Sterilization box
020	Heterotrophic Plate Count for Quanti-tray IDEXX Method, Rev. 3: 5/20	Heterotrophic plate count	Incubator – 35 °C Thermolyne Type 142300 incubator UV Indicator Lamp Autoclave UV Sterilization box
010	Alkalinity and pH Procedures, Rev. 4: 11/16	Alkalinity and pH	Hanna Instruments Model HI 902 automatic potentiometric titrator
017b	Salinity Analysis Using a Digital Refractometer, Rev. 1: 01/23	Salinity	Hanna Instruments HI96822 Seawater Refractometer

EPA-NE QAPP Worksheet #20 – EPA Rev. 10/99

Fixed Laboratory Analytical Method/SOP Reference Table

Reference Number (SOP Number)	Title, Revision Date and/or Number	Analytical Parameter	Instrument
012	Chlorophyll-a Analysis, Welschmeyer Method, Rev. 6: 04/18	Chlorophyll-a	Fluorometer – Turner Designs Trilogy®
013	Chloride Analysis, Rev. 5: 11/2016	Chloride (Cl^-)	Astoria®-Analyzer Model 303A Segmented Continuous Flow Autoanalyzer
014	Ammonia Analysis, Rev. 5: 11/2016	Ammonia (NH_3-N)	Astoria®-Analyzer Model 303A Segmented Continuous Flow Autoanalyzer
015	Orthophosphate and Nitrate + Nitrite Analysis, Rev. 5: 12/16	Orthophosphate (PO_4-P) and Nitrate + Nitrite (NO_3+NO_2-N)	Astoria®-Analyzer Model 303A Segmented Continuous Flow Autoanalyzer
016	Total Phosphorus and Nitrogen Analysis, Rev. 5: 12/16	Total phosphorus (P) and total nitrogen (N)	Astoria®-Analyzer Model 303A Segmented Continuous Flow Autoanalyzer Water baths (Labline and Precision Scientific 83)

Notes:
No SOP was modified for project work as this QAPP is for general laboratory procedures and not associated with a specific project.
All Fixed laboratory analytical methods are for definitive data
All fixed laboratory analytical methods are performed by URIWW laboratory
No analytical methods have Region 1 NESTS Method Codes.

2.6.4 Fixed Laboratory Instrument Maintenance and Calibration Table - Worksheet 21

EPA-NE QAPP Worksheet #21 – EPA Rev. 10/99
Fixed Laboratory Instrument Maintenance and Calibration Table

		Maintenance, Testing and Inspection Activities					
Activity	**Instrument**	**Activity**	**Frequency**	**Acceptance Criteria**	**Corrective Action (CA)**	**Person Responsible for CA**	**SOP Reference**
Heterotrophic plate count	Incubator – 35 °C Thermolyne 142300 incubator	Check temperature	Each time used	35 +/- 0.5 °C	Adjust temperature control	E. Herron	018, 020, 024
Fecal coliform, Heterotrophic plate count and Enterococci	UV sterilization box	Check UV sterilizer light efficiency using UV light meter	Quarterly	Not less than 70% of initial efficiency	Replace UV lamps	E. Herron	018, 020, 024
Fecal coliform, Heterotrophic plate count and Enterococci	Autoclave	Check temperature and pressure Use sterile indicator strips	Each time used	Must reach set temperature Must indicate “OK”	Contact professional to provide maintenance service	E. Herron	018, 020, 024
Fecal coliform, Heterotrophic plate count and Enterococci	Autoclave	Confirm sterilization using spore strips	Monthly	No growth	Contact professional to provide maintenance service	E. Herron	018, 020, 024

EPA-NE QAPP Worksheet #21 – EPA Rev. 10/99
Fixed Laboratory Instrument Maintenance and Calibration Table

		Maintenance, Testing and Inspection Activities					
Activity	**Instrument**	**Activity**	**Frequency**	**Acceptance Criteria**	**Corrective Action (CA)**	**Person Responsible for CA**	**SOP Reference**
Fecal coliforms,	Incubator – 44.5 °C ThermoScientific Heratherm incubator	Check temperature	Each time used	44.5 +/- 0.2 °C	Adjust temperature control	E. Herron	024
Enterococci	ThermoScientific Heratherm incubator	Check temperature	Each time used	41 °C +/- 0.5 °C	Adjust temperature control	E. Herron	018
Fecal coliform, Heterotrophic plate count and Enterococci	Flammables refrigerator	Check temperature	Daily when in use	4 °C +/- 2°C	Adjust temperature	E. Herron	018, 020, 024
Fecal coliform, Heterotrophic plate count and Enterococci	IDEXX Quanti-Tray Sealer Model 2x	Make sure sealer seals each tray	Each time used	Tray is sealed	Clean according to SOP and if still not working, send for repair	E. Herron	018, 024
Heterotrophic plate count and Enterococci	UV light box (for counting cells)	Check that bulbs function	Daily when in use	Light turns on	Replace bulbs	E. Herron	018, 020

EPA-NE QAPP Worksheet #21 – EPA Rev. 10/99
Fixed Laboratory Instrument Maintenance and Calibration Table

		Maintenance, Testing and Inspection Activities					
Activity	**Instrument**	**Activity**	**Frequency**	**Acceptance Criteria**	**Corrective Action (CA)**	**Person Responsible for CA**	**SOP Reference**
Alkalinity and pH	pH & alkalinity Meter – Hanna Instruments HI 902	Calibrate	Each time used	Electrode Efficiency >96%	Replace standards then if calibration still a problem replace the electrode filling solution, then replace electrode	URIWW Staff	010
	pH electrode – Hanna HI1053B	Refill electrode with saturated KCl solution, HI70300S	Check before each use	KCl solution is within ¼ inch of top of electrode and filling hole is open	Re-fill electrode as needed	URIWW Staff	010
Salinity	Hanna Instruments HI 96822 Seawater Refractometer	Check that prism is not damaged: compare with 0 and 20 ppt standards	Each time used	Prism is clean and not scratched or cracked	Send instrument to manufacturer for repair, calibrate & use another refractometer	E. Herron	017b
Chlorophyll-a	Fluorometer – Turner Designs Trilogy®	Calibrate	Calibrate yearly, Check calibration daily	Daily – Not greater than 15%D	Re-calibrate and then replace light source if calibration continues to drift	URIWW Staff E. Herron	012
	Flammables freezer	Check temperature	Daily when in use	-20 °C +/- 5°C	Adjust temperature	E. Herron	012, 018, 020, 024

EPA-NE QAPP Worksheet #21 – EPA Rev. 10/99
Fixed Laboratory Instrument Maintenance and Calibration Table

		Maintenance, Testing and Inspection Activities					
Activity	**Instrument**	**Activity**	**Frequency**	**Acceptance Criteria**	**Corrective Action (CA)**	**Person Responsible for CA**	**SOP Reference**
Chloride, Ammonia, Orthophosphate and Nitrate + Nitrite, Total Phosphorus and Total Nitrogen	Astoria®-Analyzer Model 303A Segmented Continuous Flow Autoanalyzer	Calibrate	Each time used	R^2 of calibration linear regression not less than 0.99	Re-calibrate	K. Addy	013, 014, 015, 016
		Check analytical tubing	Each time used	No cracks or clogs	Replace affected tubing	K. Addy	
		Check reagents flows	Each time used	No clogs in tubing causing pulsating flow	Replace affected tubing	K. Addy	
		Check light source voltage	Each time used	< 70V and greater than reference voltage	Replace light source	K. Addy	
		Check baseline	Each time used	Should be smooth	Replace tubing/trouble shoot instrument using instruction manual	K. Addy	
		Check inter sample bubble shape	Each time used	Bubble shape is uniform	Adjust tubing, flow or reagents	K. Addy	
		Check peak height and shape	Each time used	Check that peaks are not off scale	Dilute samples	K. Addy	

EPA-NE QAPP Worksheet #21 – EPA Rev. 10/99
Fixed Laboratory Instrument Maintenance and Calibration Table

		Maintenance, Testing and Inspection Activities					
Activity	**Instrument**	**Activity**	**Frequency**	**Acceptance Criteria**	**Corrective Action (CA)**	**Person Responsible for CA**	**SOP Reference**
Chloride, Ammonia, Orthophosphate and Nitrate + Nitrite, Total Phosphorus and Nitrogen	Indesit refrigerator (Rm 018)	Check temperature	Daily when in use	4 °C +/- 2°C	Adjust temperature	E. Herron	013, 014, 015, 016
	Small brown refrigerator (Rm 018)	Check temperature	Daily when in use	4 °C +/- 2°C	Adjust temperature	E. Herron	
Total Phosphorus and Total Nitrogen	Precision Scientific Company Water Bath	Check Temperature	Each time used	At least 100 °C (boiling) for 15 minutes	Adjust temperature	E. Herron	016
	Labline Water Bath	Check Temperature	Each time used	At least 100 °C (boiling) for 15 minutes	Adjust temperature	E. Herron	016

EPA-NE QAPP Worksheet #21 – EPA Rev. 10/99
Fixed Laboratory Instrument Maintenance and Calibration Table

		Maintenance, Testing and Inspection Activities					
Activity	**Instrument**	**Activity**	**Frequency**	**Acceptance Criteria**	**Corrective Action (CA)**	**Person Responsible for CA**	**SOP Reference**
All assays	Walk-in Refrigerator (Hartford Duracool)	Check temperature	Daily when in use	4 °C +/- 2°C	Report to Department Admin. Assist. To schedule repair	E. Herron	NA
	Aries Vaponics Water Filtration Units	Check resistively Check for leaking	Daily when in use	At least 17 Megaohms	Replace cartridges, contact American Aqua Systems for professional repair	E. Herron	002
	Laboratory Reagent Grade Water	Check concentration of lead, cadmium, chromium, copper, nickel and zinc	Annually	Metals individually at a level of less than 0.05 mg/L and the sum of all metals concentrations less than 0.1 mg/L	Replace water filtration cartridges or upgrade water treatment	E. Herron	002
	Laboratory Reagent Grade Water	Heterotrophic plate count	Monthly	Less than 500 CFU/mL	Replace water filtration cartridges or upgrade water treatment	E. Herron	020
	Frigidaire Refrigerator (Rm. 002)	Check temperature	Daily when in use	4 °C +/- 2°C	Adjust temperature	E. Herron	

EPA-NE QAPP Worksheet #21 – EPA Rev. 10/99
Fixed Laboratory Instrument Maintenance and Calibration Table

		Maintenance, Testing and Inspection Activities					
Activity	**Instrument**	**Activity**	**Frequency**	**Acceptance Criteria**	**Corrective Action (CA)**	**Person Responsible for CA**	**SOP Reference**
All assays (Continued)	Frigidaire Freezer (Rm 002)	Check temperature	Daily when in use	-20 °C +/- 5°C	Adjust temperature	E. Herron	
	Laboratory Thermometers	Check calibration of thermometer against NIST calibrated reference thermometer over the range the thermometer is generally utilized over or the temperature of interest.	Annually – glass thermometers and quarterly – all other thermometers	If checking calibration over a range, correction factors should be constant.	Any correction factors will be noted on the thermometer, if thermometer error in non-linear thermometer will be disposed of.	Laboratory staff	
	NIST calibrated reference thermometers	Re-calibration	Every 5 years	Determined by professional	Update correction factors or obtain new reference thermometer	E. Herron	
	Analytical Balance – Mettler Toledo AB 104	Check calibration	Each day used	Not greater than 10%D for 50 mg weight and 1% for 20 g weight	Contact professional to provide maintenance and calibration service	E. Herron	019
	Analytical Balance – Mettler Toledo AB 104	Check tare	Each Day used	+/-0.0001 g	Level, tare and check	E. Herron	019

EPA-NE QAPP Worksheet #21 – EPA Rev. 10/99
Fixed Laboratory Instrument Maintenance and Calibration Table

		Maintenance, Testing and Inspection Activities					
Activity	**Instrument**	**Activity**	**Frequency**	**Acceptance Criteria**	**Corrective Action (CA)**	**Person Responsible for CA**	**SOP Reference**
All assays (Continued)	Analytical Balance – Mettler Toledo AB 104	Re-calibration	Every 3-5 years	Determined by professional	Re-calibration of balance or service balance if necessary	E. Herron	019

Note: Maintenance and service record forms are in Appendix D.

Fixed Laboratory Analytical QC Sample Table –Worksheet #24 a

Fixed Laboratory Analytical QC Sample Table – EPA NE QAPP Worksheet #24 a – EPA Rev. 10/99

FECAL COLIFORMS

Medium/Matrix	Water	Analytical Method/ SOP Reference	SOP 024
Sampling SOP	NA	Laboratory Name	URIWW
Concentration Range (without dilution)	<1 to 2,419 CFU/100 mL using a Quanti-Tray/2000 <1 to 200 CFU/100 mL using a Quanti-Tray	No. of Sample Locations	NA

Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)
Method Blank	2/run or 2/100 samples, whichever is greater	Less than 1 cell/100 mL	Samples re-analyzed, data qualified as outside holding time	E. Herron	Bias
Sample Replication	25% of non-diluted samples	20%RPD	Data qualified	E. Herron	Precision
	Diluted samples replicated by comparing samples at different dilutions	20%RPD	Data qualified	E. Herron	Precision
Sample Bottle Sterility Check	1 per batch of bottles	Less than 1 cell/100 mL	Re-sterilize bottles	E. Herron	Bias/False positives
UV sterilizer light efficiency	Biennially	Less than 1 cell/100 mL	Replace UV lights	E. Herron	False Positives
Mixing bottle sterility check	1 per batch of bottles	Less than 1 cell/100 mL	Re-sterilize bottles	E. Herron	Bias/False positives
Positive Trays	2/run	Positive growth	Samples re-analyzed, data qualified as outside holding time	E. Herron	False Negatives/Bias
QA Checks of new reagent lots	1 set of QC per new lot	Positive growth for positive, no growth for negatives	Return reagent batch if reference lots exhibits correct growth but new lot does not. Re-run if reference doesn't exhibit growth	E. Herron	False negatives
EPA Water Pollution Proficiency Test Study – Analysis of unknown	yearly	2 standard deviation	Data reported to laboratory	NA	Accuracy/ Comparability

Note: No measurement performance criteria are provided in this table as this QAPP is for general laboratory procedures and not associated with a specific project.

Fixed Laboratory Analytical QC Sample Table – EPA NE QAPP Worksheet #24 a – EPA Rev. 10/99

ENTEROCOCCI

Medium/Matrix	Water	Analytical Method/ SOP Reference	SOP 018
Sampling SOP	NA	Laboratory Name	URIWW
Concentration Range (without dilution)	<1 to 2,419 CFU/100 mL using a Quanti-Tray/2000 <1 to 200 CFU/100 mL using a Quanti-Tray	No. of Sample Locations	NA

Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)
Method Blank	2/run	Less than 1 cell/100 mL	Samples re-analyzed, data qualified as outside holding time	E. Herron	Bias
Sample Replication	1 sample in 5 (20% of samples)	20%RPD	Data qualified	E. Herron	Precision
Sample Bottle Sterility Check	1 per batch of bottles	Less than 1 cell/100 mL	Re-sterilize bottles	E. Herron	Bias/False positives
UV sterilizer light efficiency	Biennially	Less than 1 cell/100 mL	Replace UV lights	E. Herron	False Positives
Positive Trays	1 per run	Positive growth	Samples re-analyzed, data qualified as outside holding time	E. Herron	False Negatives/Bias
Mixing bottle sterility check	1 per batch of bottles	Less than 1 cell/100 mL	Re-sterilize bottles	E. Herron	Bias/False positives
EPA Water Pollution Proficiency Test Study – Analysis of unknown	yearly	2 standard deviation	Data reported to laboratory	NA	Accuracy/ Comparability

Note:
No measurement performance criteria are provided in this table as this QAPP is for general laboratory procedures and not associated with a specific project.

Fixed Laboratory Analytical QC Sample Table – EPA NE QAPP Worksheet #24 a – EPA Rev. 10/99

Heterotrophic Plate Count

Medium/Matrix	Water	Analytical Method/ SOP Reference	SOP 026
Sampling SOP	NA	Laboratory Name	URIWW
Concentration Range (without dilution)	<1 to 200 colonies/ mL	No. of Sample Locations	NA

Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)
UV sterilizer light efficiency	Biennially	Less than 1 cell/100 mL	Replace UV lights	E. Herron	False Positives
Mixing bottle sterility check	1 per batch of bottles	Less than 1 cell/100 mL	Re-sterilize bottles	E. Herron	Bias/False positives

Note:
No measurement performance criteria are provided in this table as this QAPP is for general laboratory procedures and not associated with a specific project.

Fixed Laboratory Analytical QC Sample Table – EPA NE QAPP Worksheet #24 a – EPA Rev. 10/99

ALKALINITY AND pH

Medium/Matrix	Water		Analytical Method/ SOP Reference	SOP 010
Sampling SOP	NA		Laboratory Name	URIWW
Concentration Range (without dilution)	pH ambient & marine samples: 3 – 12 SU	Alkalinity Ambient water : <0.1 – 30 mg/L $CaCO_3$	No. of Sample Locations	NA

Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)
Calibrate pH meter	Each time used	Electrode Efficiency >96%	Replace standards, change electrode filling solution, replace the electrode	URIWW Staff	Accuracy
Standards as Samples (check of calibration using pH 7.0 standard)	At beginning and end of each run	Change in standard not greater than +/- 0.2 SU	Re-check calibrant (7.0 pH buffer), then recalibrate and re-analyze affected samples if necessary	URIWW Staff	Accuracy/Precision
Laboratory Control Standard (LCS) for Alkalinity	At beginning of each run	Mean of LCS is 85-115% of true value stock LCS	Make new diluted (20 ppm) LCS, purchase new LCS, re-analyze	URIWW Staff	Accuracy/Precision
Sample Replication	10%	pH – not greater than +/- 0.5 S.U., Alkalinity – not greater than 25%D	Re-analyze sample, then recalibrate instrument and re-analyze affected samples if necessary	URIWW Staff	Precision
EPA Water Pollution Proficiency Test Study – Analysis of unknown for pH and alkalinity	yearly	2 standard deviation	Data reported to laboratory	NA	Accuracy/Comparability

Note: No measurement performance criteria are provided in this table as this QAPP is for general laboratory procedures and not associated with a specific project.

Fixed Laboratory Analytical QC Sample Table – EPA NE QAPP Worksheet #24 a – EPA Rev. 10/99
SALINITY

Medium/Matrix	Water	Analytical Method/ SOP Reference	SOP 017b-Salinity Analysis Using a Digital Refractometer
Sampling SOP	NA	Laboratory Name	URIWW
Concentration Level (undiluted samples)	Marine samples: 0.4 - 40 ppt	No. of Sample Locations	NA

Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)
Sample Replication	100%	Not greater than 2 ppt different	Repeat refractometer measurement a third time. If still greater than 2 ppt different note deviation on project data sheet	URIWW Staff	Precision
Sample Comparison	50%	Not greater than 2 ppt different	Re-analyze sample by refractometer. If difference still greater than 2 ppt then recalibrate refractometer and measure DI and 20 ppt standards. If still greater than 2 ppt different it will be assumed the refractometer is in error and it will be replaced.	URIWW Staff	Accuracy/ Comparability

Note:
No measurement performance criteria are provided in this table as this QAPP is for general laboratory procedures and not associated with a specific project.

Fixed Laboratory Analytical QC Sample Table – EPA NE QAPP Worksheet #24 a – EPA Rev. 10/99
CHLOROPHYLL-a

Medium/Matrix	Water	Analytical Method/ SOP Reference	SOP 012
Sampling SOP	NA	Laboratory Name	URIWW
Concentration Level (undiluted samples)	Ambient and marine samples: <0.2 – 100 µg/L chlorophyll-a	No. of Sample Locations	NA

Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)
Calibrate fluorometer	Calibrate yearly with purchased liquid chl standards, also record solid standard readings	N/A	track solid standard LCS values to note drift; Purchase additional liquid standard to compare against	URIWW Staff/ E. Herron	Accuracy
LCS (Check standard using solid standard)	1/rack (38 samples)	Not greater than 15%D	Re-analyze on fluorometer, check value of primary standard, recalibrate if necessary, re-analyze associated samples	URIWW Staff	Accuracy
Method Blank	1/rack (38 samples)	Not greater than 0.03 µg/L chlorophyll-a as read on the fluorometer	Re-analyze on fluorometer, then qualify samples associated with blank if necessary	URIWW Staff	Bias
Filter Blank	1/rack (38 samples)	Not greater than 0.03 µg/L chlorophyll-a as read on the fluorometer	Re-analyze on fluorometer, then qualify samples associated with blank if necessary	URIWW Staff	Bias

Note:
No measurement performance criteria are provided in this table as this QAPP is for general laboratory procedures and not associated with a specific project.

Fixed Laboratory Analytical QC Sample Table – EPA NE QAPP Worksheet #24 a – EPA Rev. 10/99
CHLORIDE

Medium/Matrix	Water	Analytical Method/ SOP Reference	SOP 013
Sampling SOP	NA	Laboratory Name	URIWW
Concentration Range (without dilution)	Ambient samples: 5 – 50 mg/L Cl^-	No. of Sample Locations	NA

Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)
Calibrate	Each time used Analyze a set of calibrants at start and end of run	R^2 of calibration linear regression not less than 0.990	Re-calibrate/start a new analytical run	K. Addy	Accuracy
Method Blank	1 per15 sample cups	Not greater than 2 mg/L Cl^-	Re-analyze, then re-calibrate and re-analyze associated samples if necessary	K. Addy	Bias
Sample Replication	Samples aliquot from same cup – 100% Ambient samples poured into two separate cups – 10% of samples	Not greater than 20%RPD Not greater than 20%RPD	Re-analyze samples, if still greater than QC objective then note deviation on project data sheet	K. Addy	Precision
Matrix Spike	~1per 45 sample cups	80 – 120% recovery	Re-analyze, if still not acceptable but all other spikes and calibration checks are acceptable, flag data. If other spikes unacceptable spike another sample to determine if matrix is interfering, then consult laboratory manager.	K. Addy	Bias
LCS (Purchased External Standards)	1 or 2 per rack of 90 sample cups	Not greater than 20%D	Re-analyze standard, then recalibrate instrument and re-analyze associated samples if still greater than 20%D	K. Addy	Accuracy/ Comparability
Standards as Samples (Calibration Check)	1 per 15 sample cups	Not greater than 20%D	Re-analyze standard, then recalibrate instrument and re-analyze associated samples if still greater than 20%D	K. Addy	Accuracy
EPA Water Pollution Proficiency Test Study – Analysis of unknown	yearly	2 standard deviation	Data reported to laboratory	NA	Accuracy/ Comparability

Note: No measurement performance criteria are provided in this table as this QAPP is for general laboratory procedures and not associated with a specific project.

Fixed Laboratory Analytical QC Sample Table – EPA NE QAPP Worksheet #24 a – EPA Rev. 10/99
AMMONIA

Medium/Matrix	Water	Analytical Method/ SOP Reference	SOP 014
Sampling SOP	NA	Laboratory Name	URIWW
Concentration range (without dilution)	Ambient and marine samples: <40 – 500 µg/L NH_3-N	No. of Sample Locations	NA

Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)
Calibrate	Each time used. Analyze a set of calibrants at start and end of run	R^2 of calibration linear regression not less than 0.990	Re-calibrate/start a new analytical run	K. Addy	Accuracy
Method Blank	1/15 samples	Not greater than 30 µg/L NH_3-N	Re-analyze, then re-calibrate and re-analyze associated samples if necessary	K. Addy	Bias
Sample Replication	Ambient & marine samples poured into two separate cups – 1-2 per 15 sample cups	Not greater than 20%RPD	Re-analyze samples, if still greater than QC objective then note deviation on project data sheet	K. Addy	Precision
LCS (Purchased External Standards)	1 or 2 per rack of 90 sample cups	Not greater than 20%D	Re-analyze standard, if still outside QC objective recalibrate instrument and re-analyze associated samples	K. Addy	Accuracy/ Comparability
Standards as Samples (Calibration Check)	1/15 sample cups	Not greater than 20%D	Re-analyze standard, if still outside QC objective recalibrate instrument and re-analyze associated samples	K. Addy	Accuracy
Matrix Spike	1 per ~45 sample cups	80 – 120% recovery	Re-analyze, if still not acceptable but all other spikes and calibration checks are acceptable, flag data. If other spikes unacceptable spike another sample to determine if matrix is interfering, then consult laboratory manager.	K. Addy	Bias
EPA Water Pollution Proficiency Test Study – Analysis of unknown	Yearly	2 standard deviation	Data reported to laboratory	NA	Accuracy/ Comparability

Note: No measurement performance criteria are provided in this table as this QAPP is for general laboratory procedures and not associated with a specific project.

Fixed Laboratory Analytical QC Sample Table – EPA NE QAPP Worksheet #24 a – EPA Rev. 10/99

ORTHOPHOSPHATE AND NITRATE + NITRITE

Medium/Matrix	Water	Analytical Method/ SOP Reference	SOP 015
Sampling SOP	NA	Laboratory Name	URIWW
Concentration range (without dilution)	Nitrate/Nitrite: Ambient and marine samples: <15 – 1000 µg/L NO_3/NO_2-N Orthophosphate: Ambient and marine samples: <4– 100 µg/L PO_4-P	No. of Sample Locations	NA

Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)
Calibrate	Each time used, analyze a set of calibrants at beginning and end of run	R^2 of calibration linear regression not less than 0.990	Re-calibrate/start a new analytical run	K. Addy	Accuracy
Method Blank	1 per 15 sample cups	Not greater than 2 µg/L PO_4-P and 20 µg/L NO_3/NO_2-N	Re-analyze, then re-calibrate and re-analyze associated samples if necessary	K. Addy	Bias
Sample Replication	Ambient & marine samples poured into two separate cups 1 or 2 per 15 sample cups	Not greater than 20%RPD	Re-analyze samples, if still greater than QC objective then note deviation on project data sheet	K. Addy	Precision
LCS (Purchased External Standards)	1 or 2 per rack of 90 sample cups	Not greater than 20%D	Re-analyze standard, if still outside QC objective recalibrate instrument and re-analyze associated samples	K. Addy	Accuracy/ Comparability
Standards as Samples (Calibration Check)	1 per15 sample cups	Not greater than 20%D	Re-analyze standard, if still outside QC objective recalibrate instrument and re-analyze associated samples	K. Addy	Accuracy
Matrix Spike	1 per 45 sample cups	80 – 120% recovery	Re-analyze, if still not acceptable but all other spikes and calibration checks are acceptable, flag data. If other spikes unacceptable spike another sample to determine if matrix is interfering, then consult laboratory manager.	K. Addy	Bias
EPA Water Pollution Proficiency Test Study – Analysis of unknown	yearly	2 standard deviation	Data reported to laboratory	NA	Accuracy/ Comparability

Note: No measurement performance criteria are provided in this table as this QAPP is for general laboratory procedures and not associated with a specific project.

Fixed Laboratory Analytical QC Sample Table – EPA NE QAPP Worksheet #24 a – EPA Rev. 10/99
TOTAL PHOSPHORUS AND NITROGEN

Medium/Matrix	Water	Analytical Method/ SOP Reference	SOP 016
Sampling SOP	NA	Laboratory Name	URIWW
Concentration range (without dilution)	Total N Ambient and marine samples: <40 – 1000 µg/L N Total P Ambient and marine samples: <4 – 100 µg/L P	No. of Sample Locations	NA

Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)
Calibrate	Each time used; analyze a set of calibrants at the beginning and end of run	R^2 of calibration linear regression not less than 0.990	Re-calibrate/start a new analytical run	K. Addy	Accuracy
LCS (Purchased External Standards)	2-3 per rack of 90 sample cups	Not greater than 20%D	Re-analyze standard, then if still outside QC criteria recalibrate instrument and re-analyze associated samples	K. Addy	Accuracy/ Comparability
Standards as Samples (Calibration Check)	1 per 15 sample cups	Not greater than 20%D	Re-analyze standard, if still outside QC criteria recalibrate instrument and re-analyze associated samples	K. Addy	Accuracy
Matrix Spike	1 per ~30 sample cups	80 – 120% recovery	Re-analyze, if still not acceptable but all other spikes and calibration checks are acceptable, flag data. If other spikes unacceptable spike another sample to determine if matrix is interfering, then consult laboratory manager.	K. Addy	Bias
Method/Digestion Blank	~1 per 30 sample cups	Not greater than 5 µg/L P and 30 µg/L N	Note on project data sheet. If all digestion blanks are outside acceptable range, run is considered contaminated and data marked accordingly.	K. Addy	Bias
Sample Replication	~20% replicate digestions of marine and ambient samples	Not greater than 25%RPD	Re-analyze sample, if still outside QC criteria note deviation on project data sheet	K. Addy	Precision

Fixed Laboratory Analytical QC Sample Table – EPA NE QAPP Worksheet #24 a – EPA Rev. 10/99
TOTAL PHOSPHORUS AND NITROGEN

Medium/Matrix	Water	Analytical Method/ SOP Reference	SOP 016
Sampling SOP	NA	Laboratory Name	URIWW
Concentration range (without dilution)	Total N Ambient and marine samples: <40 – 1000 µg/L N Total P Ambient and marine samples: <4 – 100 µg/L P	No. of Sample Locations	NA

Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)
EPA Water Pollution Proficiency Test Study – Analysis of unknown	yearly	2 standard deviation	Data reported to laboratory	NA	Accuracy/ Comparability

Note: No measurement performance criteria are provided in this table as this QAPP is for general laboratory procedures and not associated with a specific project.

3.0 SAMPLE HANDLING, TRACKING AND CUSTODY REQUIREMENTS

Sample bottles are sent out prelabeled with each bottle identified by label color and / or bottle type. Labels include: Site name, sampling depth, date expected (exact sample date circled or written in), time sampled (line for writing in) and sample type (i.e. bacteria, unfiltered, filtered, etc.) to ensure that analyses are completed on appropriate types of sample. Bottles are brought to the laboratory in coolers with cold packs or ice. A chain-of-custody (COC) form or sample log sheet are completed for each set of samples by the person(s) responsible for collection and/or delivery of the samples to the laboratory. Sample log sheets are generally provided by the URIWW Laboratory. The COC form will include the following information:

1. Collection Period & type of sample (lake, river, salt ponds sites etc.)
2. Monitoring Location
3. Person(s) responsible for transporting samples
4. Date of sample collection, time of sample collection
5. Number and type of sample bottles
6. Temperature of bacteria sample upon receipt

A technician will be responsible for checking that the samples listed on the sample log sheet correspond correctly with the samples received. A copy of the sample log sheet will be maintained in the project file. The set of logs sheets for each sample collection period are scanned and pdfs kept in electronic files for that year. A portion of a sample log sheet is in Figure 3.

Figure 3. Portion of sample log sheet

2020 Lakes and Ponds Log Sheet: September Water Collection												
You should have all of the bottles/bags listed with your monitoring location.												
		Date	Time	Date	Time	Plastic	Brown	Plastic	Plastic	Chl-a	Trib	Temp C
Monitoring Location	Your name	Collected		Received		Unfiltered	Unfiltered	Filtered	Sterile	baggy	Bottles	at receipt
Annaquatucket Mill P						1	1	1	1			
Beach Pond						2	2	1	1			
Belleville P - Lower						1	1	1	1			
Carr Pond (WG)						2	2	1	1			
Flat River Reservoir						2	2	1	1			
Georgiaville Pond						2	2	1	1			
Long Pond (SK)						2	2	1	1			
Mashapaug Pond						2	2	1	1			
Mishnock Lake						2	2	1	1			
Pascoag Reservoir						2	2	1	1			
Pasquisett Pond						2	2	1	1			
Posnegansett Pond						2	2	1	1			
Posnegansett Pond						2	2	1	1			
Prince's Pond						2	2	1	1			
RWP #1 -Roosevelt Lake inflow						1	1	1	1			

3.1 Laboratory Sample Tracking

Once samples are accepted into the laboratory, internal laboratory tracking is accomplished by placing colored adhesive dots onto each sample bottle to designate the assays to be completed (Figure 4). After each process and/or analysis has been completed for a sample, the colored dot is removed. Unfiltered and filtered samples may be stored until after nutrient analyses are completed and reviewed.

Figure 4 – Internal Laboratory Tracking Scheme

General type of analysis	Type of bottle	Sample bottle label information	Colored label dot (Avery Cat. #)
Bacteria, shallow, unfiltered sample collected directly into sample bottle	HDPE autoclaved 250 ml	**White** colored label: Site name Date expected Time of collection __ **BACTERIA**	No dots STERILE label affixed across lid before use
Bacteria, shallow, unfiltered sample collected directly into sample bottle	HDPE autoclaved 250 ml	**Blue** colored label: Trib @ Site name Date expected Time of collection __ **BACTERIA**	No dots STERILE label affixed across lid before use
pH and Alkalinity, shallow, unfiltered water sample from lake sites	HDPE 500 ml	**Magenta** colored label Site name 1m (or mid-depth) Date expected Time of collection __ **pH and Alkalinity**	Half a yellow ¾" dot (UNV401141ND)
pH, shallow, unfiltered water sample from any sites	100 ml "specimen" cup	**Magenta** colored label Site name 1m (or mid-depth) Date expected Time of collection __ **pH - UNFILTERED**	Quarter of a yellow ¾" dot (UNV401141ND)
pH, deep (>1m), unfiltered water sample from any sites	100 ml "specimen" cup	**Green** colored label Site name 1m (or mid-depth) Date expected Time of collection __ **UNFILTERED**	Quarter of a yellow ¾" dot (UNV401141ND)
pH, shallow, unfiltered water sample from tributary stream or cove to lake sites	100 ml "specimen" cup	**Blue** colored label Trib @ Site name Date expected Time of collection __ **pH - UNFILTERED**	Quarter of a yellow ¾" dot (UNV401141ND)
Nutrients, shallow, unfiltered water sample from any sites for total phosphorus and total nitrogen	125 – 250 ml brown glass, acid washed	**Magenta** colored label Site name 1m (or mid-depth) Date expected Time of collection __ **UNFILTERED**	Neon green (AVE05052) If filtered water is needed, Light blue (AVE05050) with "F" written on it

(continued)
Figure 4 – Internal Laboratory Tracking Scheme (continued)

General type of analysis	Type of bottle	Sample bottle label information	Colored label dot (Avery Cat. #)
Nutrients, deep (>1m), unfiltered water sample from any sites for total phosphorus and total nitrogen	125 – 250 ml brown glass, acid washed	**Green** colored label Site name 1m (or mid-depth) Date expected Time of collection __ **UNFILTERED**	Neon green (AVE05052) and Light blue (AVE05050) with "F" written on it
Nutrients, shallow, unfiltered water sample from tributary stream or cove to lake sites total phosphorus and total nitrogen	125 – 250 ml brown glass, acid washed	**Blue** colored label Trib @ Site name Date expected Time of collection __ **UNFILTERED**	Neon green (AVE05052) and Light blue (AVE05050) with "F" written on it
Nutrients, filtered, water sample from any site and depth	125 ml HDPE, acid washed	**Yellow** colored label Site name 1m, mid-depth, or ___m DEEP Date expected Time of collection __ **FILTERED**	Neon orange (AVE05062) – nitrate+nitrite N; Light blue (AVE05050) – Dissolved P; White quartered (AVE05408) – ammonia; Neon red (AVE05051) - chloride

3.2 Acceptance of Expendable Laboratory supplies

All expendable laboratory supplies such as chemical reagents and sample bottles will be inspected upon arrival by either Elizabeth Herron or Kelly Addy. Packages containing damaged material or packages that were open upon arrival will not be accepted. Chemicals will be marked with the date of acceptance as well as the date they are opened.

3.3 Sample Handling System – Worksheet 16

EPA-NE QAPP Worksheet #16 – EPA Rev. 10/99 **Sample Handling System**
SAMPLE COLLECTION, PACKAGING AND SHIPMENT
Sample Collection: Various persons, staff or trained volunteers
Sample Packing: Person(s) responsible for sample collection, samples kept in a cooler with ice packs
Coordination of Delivery: Person(s) responsible for sample collection, delivered same day or next day with prior URIWW approval
Type of Shipment: Driven to URI Watershed Watch laboratory or to a designated collection point for transport to URI
SAMPLE RECEIPT AND ANALYSIS
Responsible Organization: University of Rhode Island Watershed Watch Laboratory (URIWW)
Sample Receipt: URIWW Staff
Sample Custody and Storage: URIWW Staff
Sample Preparation: URIWW Staff
Sample Determinative Analysis: URIWW Staff
SAMPLE ARCHIVAL
Field Sample Storage (No. of days from sample collection): Dependent upon analysis – Refer to analyte-specific SOPs (Appendix A)
Sample Extract/Digestate Storage: for TP & TN analysis <24 hours after digestion. Filtered samples frozen within hours, thawed within 16 hours of analysis. See also analyte-specific SOPs (Appendix A)
SAMPLE DISPOSAL
Responsible Organization and personnel: URIWW / URIWW Staff upon approval of E. Herron or K. Addy

4.0 PROJECT DOCUMENTATION AND RECORDS

All sample log sheets will be retained by the URI Watershed laboratory in laboratory file cabinets. Log sheets are also scanned and saved as pdfs in appropriate folders on URI servers. All hard copy sample data sheets and sample preparation worksheets are as discussed in each analyte-specific SOP under Section 7.0. Additional documentation will also be retained in project files as needed. For assays that produce electronic files, the electronic file will be stored on URI servers. Summary files will be produced and stored in both electronic and hard copy forms.

Project files are maintained in the main URIWW laboratory in the URI Coastal Institute by Elizabeth Herron and Kelly Addy. This location is locked when staff is not present. Electronic data are stored on shared drive on a University of Rhode Island server, with limited access. The server is backed up daily according to institution practices. All laboratory data (electronic and hard copy) are retained for at least 20 years.

Data will also been maintained online at the URI Watershed Watch website https://web.uri.edu/watershedwatch/data/ in a variety of format for the use by researchers and the public. A combined datafile (1988 – 2021 currently) is available as a csv file (see https://web.uri.edu/watershedwatch/data/historic-data/csv-data-files/). To facilitate downloading of specific year data, ArcGIS or R code tools will be used to create annual files from that combined file. Data will be presented using a variety of dashboard tools as well.

5.0 DATA VALIDATION

No general quality management reports are prepared. Laboratory data management follows SOP 027 (Appendix A) and is summarized here. During the analysis of samples, the technician completing sample analysis is responsible for recording any problems with meeting measurement performance criteria (Section 2.6.2) and/or instrument operational issues. Reruns of analyses that do not meet measurement criteria are completed when possible. If the rerun value meets criteria, that value is used. If rerun values are not possible, any failure of a sample to meet defined measurement performance criteria should be recorded and the data flagged for further review upon data entry and final data validation. Any analyses that do not meet standard operating procedures, for example being run after designated hold time, will be recorded and included in the comment field for the data entry.

Technicians may also proactively address possible analysis errors for some parameters. For example, chlorophyll analyses usually include four (4) filters for a particular sample date for a site. If the measured value for a one (1) of those filters is significantly different from the other three (3) filters, it may be rerun to confirm sample value. The rerun value is recorded in the comments section of the data sheet to allow for that information to be tagged with the value when the data is entered. Other parameters with replicate analyses (i.e. pH, alkalinity, nutrients) permit the opportunity for confirming sample values when the differences between replicate values are greater than anticipated. In addition, those parameters allow for reruns when the results are significantly different than usual for the site. For that reason, data summary sheets from the previous season are posted near the Hanna meter (pH and alkalinity) and the Astoria Pacific rapid flow analyzer to allow for comparison during sample runs. Annual summary sheets are also available in the microbiology lab to ensure that the appropriate sample volumes /

Quanti-trays are used to get results within the acceptable counting range, minimizing values having to be reported as greater than.

Data generated by each analysis is internally validated by either Ms. Herron or Ms. Addy. The data validation process occurs at each step from data production to posting. When the data are keyed into Microsoft Excel files missing results or values outside of the anticipated range are identified and reported to allow for reruns or to find missing samples if possible. After data has been entered into the appropriate file, URIWW staff completes an initial check to be sure all data was entered correctly (ie. as written on the work sheet). This proofing process ensures that the data entered into the Excel file are as written on the worksheet. Outliers and inconsistencies are flagged for further review with corrections or verification completed by Ms. Herron.

Nutrient analyses undergo an additional validation step. Values for total phosphorus (P) are compared to orthophosphate-P (dissolved phosphorus). If dissolved P is greater than total P samples are reanalyzed for both constituents. A similar check is done to compare total nitrogen with the sum of nitrate/nitrite and ammonia. If the sum of dissolved N constituents is greater than total nitrogen then samples are re-analyzed.

Data may be compared to value obtained for similar samples analyzed in the past. Data may be tagged with a comment or other qualifier or may be discarded. The decision to discard data will be made by either Ms. Herron or Ms. Addy. Notations or qualifiers will be added to any results that are discarded.