4 May 2015

SURFACE WATER MONITORING IN THE CITY OF NEWPORT'S NINE WATER SUPPLY RESERVOIRS

SAMPLING PLAN 2015

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
SURFACE WATER PROTECTION SECTION
235 PROMENADE STREET
PROVIDENCE, RHODE ISLAND 02908

SAMPLING PLAN
YEAR 2015
Newport Water Supply Reservoir Sampling

Project Approvals

Brian Zalewsky, Project Manager
RIDEM, Office of Water Resources — 7 MAY 2015 Date

Elizabeth Scott, Quality Assurance Officer
RIDEM, Office of Water Resources — 5/7/15 Date

Joseph LiVolsi
EPA Atlantic Ecology Division — 5/7/15 Date

Henry Leibovitz, Chief Environmental Laboratory
RI State Health Laboratories — 5/7/2015 Date

Steve DiMattei, Quality Assurance Chemist
USEPA — 05/07/15 Date

Steve Winnett, Project Officer
EPA Region 1 — 5/7/15 Date

Table of Contents

List of Tables

1.0 Introduction

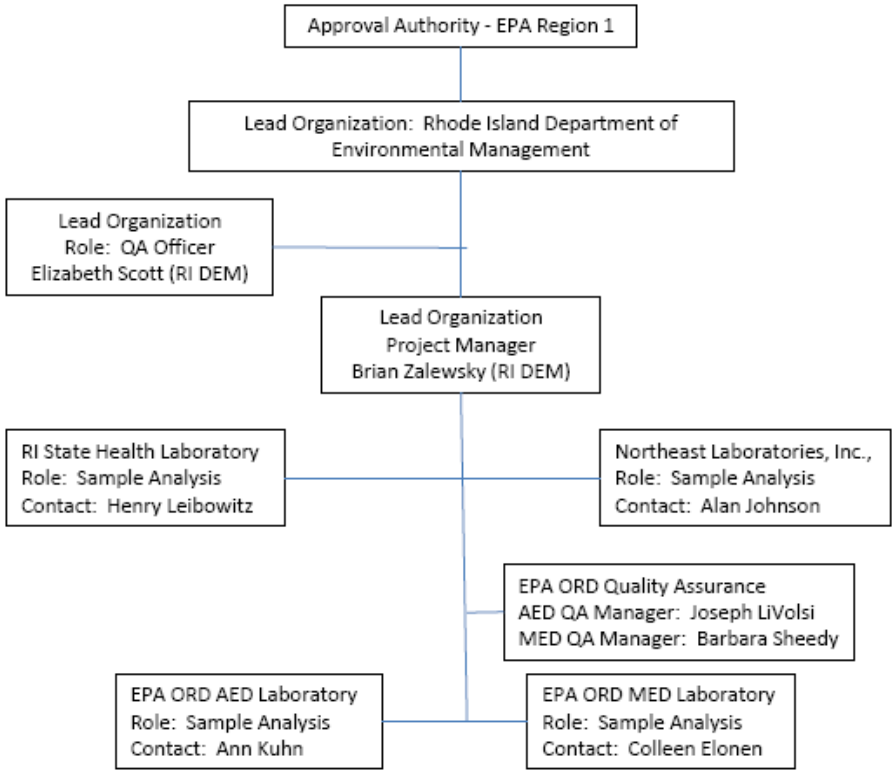
This document serves as a *Quality Assurance Project Plan (QAPP)* developed by RIDEM for surface water sampling in the City of Newport's nine drinking water reservoirs. The purpose of the QAPP is to detail the field and analytical scope and quality control procedures to be implemented during the sampling. The QAPP is designed to detail procedures for planning, implementing, and evaluating field sampling, water sample collection and analytical techniques for analysis as well as to define the structure for data quality such that the data collected will support the specific objectives defined in this QAPP.

This QAPP describes a surface water quality sampling program to be carried out by RIDEM staff in the nine (9) reservoirs which comprise the City of Newport's water supply system. Seven (7) reservoirs are located on Aquidneck Island and remaining two (2) reservoirs are located on the mainland portion of eastern Rhode Island in the Towns of Tiverton and Little Compton. Sampling in the Newport Reservoirs is scheduled to commence in early May and continue thru mid-October 2015.

2.0 Project Organization/Management

A project organizational chart is shown below.

Project Organizational Chart



The individuals listed in Table 1 will receive a copy of this sampling plan. RIDEM staff participating in sampling will also receive a copy as needed.

Table 1. Sampling Plan Distribution List.

Sampling Plan Recipients	Organization/Location
Elizabeth Scott	RIDEM, Office of Water Resources, Providence, RI
Brian Zalewsky	RIDEM, Office of Water Resources, Providence, RI
Anne Kuhn	EPA Atlantic Ecology Division (AED), Narragansett, RI
Colleen Elonen	EPA Mid-Continent Ecology Division (MED), Duluth, MN
Henry Leibovitz	RI State Health Laboratories, Providence, RI
Steve DiMattei	USEPA Region 1 Laboratory, Chelmsford, MA

Table 2 lists the analytical laboratories that will be conducting analysis of surface water samples collected by RIDEM staff. The appropriate staff and contact information are also provided.

Table 2. Laboratory Contact Information.

Analytical Lab	Analytical Staff	Contact Information
EPA MED Laboratory	Colleen Elonen	218-529-5195
EPA AED Laboratory	Anne Kuhn	401.782.3199
RI State Health Laboratories	Henry Leibovitz	401.222.5578
Northeast Laboratories Inc.	Alan Johnson	1.800.654.1230

2.1 Modifications to Approved QAPP

It may be necessary to make changes to the sampling plan due to the results of the water quality surveys. The Project Manager shall record all modifications to the sampling plan and the decision to add, drop or relocate stations will be made jointly by the QA Officer and the Project Manager. All changes to the QA Plan will be reported in the sampling Status Report and the Final Report.

2.2 Personnel Responsibilities and Qualifications

Each sampling event will be carried out by two teams consisting of two RIDEM, Office of Water Resource (OWR) staff. All staff will have been trained in all applicable sampling protocol and are otherwise qualified to conduct the routine sampling. A copy of the sampling plan will be provided to each staff person for review, prior to conducting sampling. The Project Manager shall record on the field sheet the name and title of the additional staff members who take part in sampling.

2.3 Problem Definition

RIDEM has begun work to develop TMDLs to address nutrient related water quality impairments in the nine water supply reservoirs operated by the City of Newport. Elevated levels of phosphorus and nitrogen contribute to excessive algal growth and cyanobacteria blooms in all nine reservoirs. Data available from instantaneous measurements taken by Fuss & O'Neill, though not quality assured, also suggest dissolved oxygen is depressed in Watson, Sisson and Nelson-Paradise Ponds. Further, the Newport Water System has a history of violations of trihalomethane (THM) MCLs and taste and order complaints, which has necessitated upgrades to their treatment facilities to incorporate advanced treatment. Based upon data collected in 2011 and 2012, all nine reservoirs will be listed as impaired for aquatic life use (for total phosphorus) and drinking water use (based on need for advanced treatment and historic taste & odor complaints and THM MCL violations) on the 2014 303d list expected to be completed in 2015.

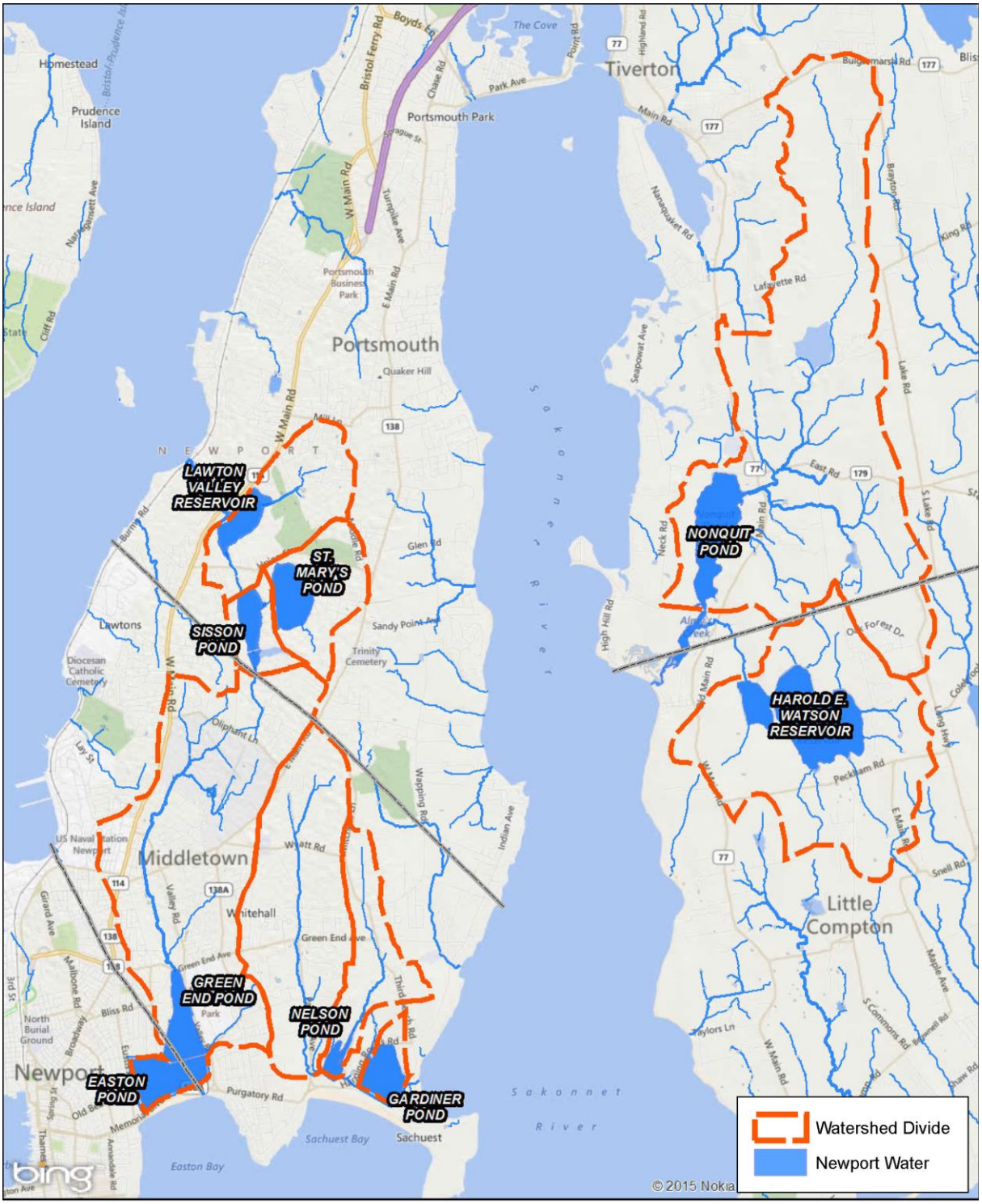
2.4 Newport Water Supply Reservoirs-Background

The Newport Water Division (NWD) provides the sole source of public water to residents of Aquidneck Island – serving retail customers in Newport and Middletown and wholesale customers, Portsmouth Water and Fire District and Naval Station Newport. The NWD operates and maintains two water treatment facilities with a combined capacity of 16 MGD, 170 miles of water main and approximately 14,700 service connections. Newport Water draws its raw water supply from a system of nine surface reservoirs which includes North and South Easton Ponds, Gardiner Pond, Paradise Pond, St Mary's Pond, Sisson Pond, Lawton Valley Reservoir, Nonquit Pond and Watson Reservoir (Schematic 1).

The reservoirs and their associated watersheds are located in Newport, Middletown, Portsmouth, Tiverton (Nonquit Pond), and Little Compton (Watson Reservoir). The reservoirs and ponds are interconnected through a complex network of piping and pump stations. The water supplies for the Newport Water System are located in developed watersheds and susceptible to contamination. The relatively poor quality of the raw water creates challenges for the treatment plants to provide drinking water that meets drinking water standards on a reliable basis. After various studies the recommendation for NWD was to replace one treatment plant and provide significant improvements to the treatment processes at the other plant, and to include Advanced Water Treatment Processes at both plants due to the raw water quality at certain times of the year. Upgrades to the Station 1 Treatment Plant went online at the end of July 2014 and the new Lawton Valley Treatment Plan came online September 17, 2014. The Newport Water System is the first water treatment system in New England to incorporate Advanced Treatment Processes. NWD recognizes an improvement in the overall quality of the source water is a priority in order to lessen the dependency on the use of the Advanced Treatment Processes.

Based upon data collected in 2011 and 2012, all nine reservoirs exhibit elevated phosphorus concentrations in excess of established aquatic life based TP criteria, elevated nitrogen levels, excessive algal growth and frequent cyanobacteria blooms. The ponds' enriched condition has led to a long history of the City of Newport applying copper sulfate to the ponds in attempts to control the blooms. In addition to the aquatic life use impairments evident on the nine reservoirs, the RI Department of Health Division of Drinking Water Quality has determined that all nine reservoirs be listed as impaired for drinking water use based upon the fact that the excessive algal growth has led to elevated levels of Total Organic Carbon (TOC) at the intake to both water treatment plants which in turn has contributed to violations of Trihalomethane (THM) MCLs, and necessitated the need for the City of Newport's construction of Advanced Water Treatment facilities.

RIDEM completed a phosphorus TMDL to address aquatic life use concerns for North Easton's Pond as part of the Eutrophic Ponds TMDL which was completed in 2007. RIDEM will revisit the North Easton's Pond TMDL as part of the current TMDL efforts. Nutrient related concerns on Aquidneck Island are not restricted to the public water supply reservoirs, as evidence by the discovery in 2014 by the RI Dept. of Health of private wells in an area of Middletown not currently served by public water having elevated levels of nitrates. HEALTH Division of Drinking Water Quality, RIDEM/OWR and DEM Division of Agriculture have been coordinating efforts to collect additional well samples and to better characterize the extent of the problem. Complementary to the TMDL development efforts, RIDEM will also be undertaking the development of a watershed plan for Aquidneck Island over the next 2 years. The watershed plan will serve as a mechanism to integrate the full range of actions recommended for protecting and restoring water quality and aquatic habitat on Aquidneck Island. The watershed plan provides an opportunity to identify partners and to collaborate across all levels of the public and private sectors to determine and implement actions that are supported by sound science. This approach provides a process for government and other stakeholders to prioritize NPS pollution and other water quality problems and work collaboratively on a watershed basis to optimize results in terms of environmental outcomes and the other societal benefits associated with improved water quality and habitat.



Schematic 1. City of Newport drinking water supply reservoirs.

2.5 Project Planning

In late 2014, RIDEM convened three meetings of a 'Technical Advisory Group' consisting of individuals from and/or representing RIDEM, University of Rhode Island, the Environmental Protection Agency (EPA) Atlantic Ecology Division, City of Newport, and the MA Department of Environmental Protection (MADEP) to provide advice and feedback to RIDEM on technical issues associated with development of the Newport Water Supply Reservoirs TMDL. The advisory group discussed various the technical aspects of developing the TMDL such as 1) identification of water quality targets (total phosphorus, total nitrogen, chlorophyll-a, total organic carbon, etc) that would be protective of the reservoirs' use as drinking water supplies, 2) evaluation of the linkages between nutrient-related enrichment and potential human health-related impacts to potable water supplies, 3) development of approaches to calculating existing and allowable phosphorus loads to each reservoir, and 4) identification of approaches to estimate internal phosphorus loading from reservoirs sediments. One of the issues raised by the group was the need for additional water quality data in the reservoirs to further evaluate the trophic status as well as to explore linkages between nutrient enrichment and potential human-health related impacts. It was agreed that if resources could be secured, additional monitoring should be undertaken.

At RIDEM's request, the Environmental Protection Agency (EPA) Atlantic Ecology Division (AED) and Mid Continent Ecology Division (MED) are providing analytical assistance to RIDEM. This assistance consists of both laboratory analytical analysis and sample preparation (including appropriate filtering) and shipment of samples. The AED Laboratory in Narragansett, Rhode Island will be analyzing samples for chlorophyll-a and ultraviolet absorbance and will also prepare and ship samples to EPA's MED Laboratory in Duluth, Minnesota. EPA MED will analyze samples for the following parameters: nitrate-nitrite nitrogen, ammonia nitrogen, total nitrogen, dissolved and total organic carbon, total phosphorus, and orthophosphate. The Rhode Island Department of Health (HEALTH) Laboratories, located in Providence, Rhode Island will be analyzing samples for total trihalomethane yield (using uniform formation conditions) and Northeast Laboratories in Berlin, Connecticut will be analyzing samples for algal-cyanobacteria enumeration and identification and the algal toxin microcystin-LR.

2.6 Goals/Objectives of Monitoring and Intended Use of the Newport Reservoir Data

At present, the data available for TMDL development consists of 2 years (2011-2012) worth of water chemistry and physical data from the nine reservoirs and two major tributaries. The proposed sampling is meant to fill significant data gaps and provide critical information needed for TMDL development. The specific objectives of this monitoring are as follows:

1. Obtain an additional year of water chemistry and field data that will be used to evaluate the trophic status of the reservoirs and add to the existing dataset used to develop the TMDL. Data collection will coincide with 1) ongoing reservoir tributary monitoring by URI researchers in coordination with colleagues from Salve Regina University working under a NSF Grant, 2) City of Newport water quality/sediment sampling in Watson Reservoir and St Mary's Pond, and 3) RIDEM monitoring of Maidford River and Paradise Brook as part of the National Water Quality Initiative.

2. Investigate the relationship(s) between nutrient related indices and selected human health related indices to better understand the relationships between phosphorus (and nitrogen), chlorophyll *a*, and Total Organic Carbon (TOC) and/or Dissolved Organic Carbon (DOC)), and disinfection byproduct formation potential in the drinking water reservoirs. The findings from this investigation may be used in the development of chlorophyll and phosphorus targets for the Newport Reservoirs. In conjunction with DOC measurements, ultraviolet absorbance (UV) measurements from the reservoirs will be used to calculate specific UV absorbance (SUVA). SUVA is calculated as the ratio of UV absorbance to DOC concentration SUVA is useful for

generalizing about sources and properties of DOC because internal and external derived DOC are end members of the SUVA spectrum.

3. Obtain an additional year of cyanobacteria cell abundance and microcystin concentrations to evaluate cyanobacteria bloom frequency and severity, and toxin formation. These data will be used to assess public health risks and better understand the reservoirs' ecological condition.

4. Obtain sufficient water column data to estimate internal cycling of phosphorus from reservoir sediments. It is believed that internal cycling of phosphorus constitutes a significant load to the reservoirs and evaluation of this is critical to understanding nutrient dynamics and in setting allowable load allocations. With additional data, various methodologies developed by Nurnberg (citation(s)) may be applied to estimate internal loading of phosphorus from the reservoirs.

DEM also proposes to deploy continuous monitoring equipment (YSI probes) at the sampling locations in Lawton Valley Reservoir and North Easton's Pond to measure chlorophyll a, pH, conductivity, and DO. Details of the deployment will be provided in a separate QAPP.

2.7 Project Design

Tentative sampling dates (week of) are shown in Table 3 but dates may change based on weather/safety related and/or staffing issues. It is anticipated that sampling the nine reservoirs will be accomplished within 2 consecutive days. This will also include transportation of samples to appropriate laboratories. If this is not possible, either extra staff or time will be allocated to complete the sampling.

Table 3. Newport Reservoir Sampling Schedule (week of)

May 4	June 1	June 29	July 27	Aug 24	Sept 21
May 18	June 15	July 13	Aug 10	Sept 7	Oct 5

2.8 Data Quality Objectives and Measurement Performance Criteria

Data Quality Objectives (DQOs) are qualitative and quantitative statements that clarify the intended use of the data, define which purposes the data may be used for, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions. DQOs delineate the type of data needed to support decisions, identify the conditions under which the data should be collected, and state what requirements must be met in order to use the data for its intended purpose. If applicable, the DQOs should specify the tolerable limits of the probability of making a decision error because of uncertainty in the data.

For the Newport Reservoir sampling project, the intended purpose of the data collection and analysis is described above in Section 2.6. This QAPP deals specifically with the data quality objectives during data collection and outlines the proper collection methods, procedures, and measurements to be utilized to reduce sources, magnitude, and frequency of errors during data generation. By outlining and following these steps, uncertainties in the data will be reduced and data quality will be assured for proper use and interpretation of the data. To meet the data quality objectives, the following quality assurance measures will be employed to verify the use of proper, consistent field procedures, handling measures, and laboratory analyses.

- Standard Operating Procedures (SOPs) will be implemented during sampling and field data collection.

- EPA-approved, standardized methods will be adhered to for all chemical analysis procedures (UFC TTHM following Summers et al. (1996) using Standard Method 4500 C1-I (chlorine residual) and EPA Method 524.2 (TTHM)).
- Qualified, trained scientists will perform the sample collection and laboratory analyses.
- Chain of Custody forms will be completed when handling samples and transferring custody from field crew to all analytical laboratories.
- One trip blank (bottles filled with de-ionized water) per round of sampling will be transported by each field crew to ensure there is not contamination of sampling containers in the field during transport.
- Field duplicate samples are collected to ensure the reproducibility of results. If two samples are taken of the same water, under the same conditions, the data generated from those two samples should theoretically be the same. Duplicates allow the analyst to quantify the error involved in sampling (the difference between the value obtained and "reality"). Duplicates will be collected at the frequency specified in the project plan. When a sample is taken and another is taken right after, the sample is referred to as a sequential duplicate. These samples do not gather data under the exact same conditions; therefore, there may be a difference in the values. Analysis of sequential samples allows the analyst to quantify the error involved in filling bottles sequentially. For this project, 10% of the total number of samples will consist of a sequential duplicate.

Data Quality Indicators

Data quality indicators (DQI) are the quantitative statistics and qualitative descriptors used to evaluate data quality and interpret the degree of acceptability of data to the user. The principal data quality indicators are: precision, accuracy, sensitivity, bias, representativeness, completeness, and comparability. To determine that the data meet the project's quality objectives, the data quality indicators are compared against predetermined standards deemed *measurement performance criteria* as discussed below for each DQI.

All samples collected and/or submitted to an analytical laboratory will be subject to that laboratory's data quality objectives and criteria. The Project Manager will communicate to all analytical laboratories the acceptable measurement performance criteria required for the data to meet project-specific data quality objectives. Contractual laboratory QAPPs or SOPs are referenced in this QAPP. All laboratory procedures for water sample analysis will follow the guidelines for data quality objectives and criteria outlined in each laboratory's QAPP/SOP. Any changes to this should be discussed with the Project Manager.

Precision

Precision is a measure of agreement among repeated measurements of the same property under identical or substantially similar conditions, expressed generally in terms of the standard deviation (USEPA 2002). At 10% of monitoring locations, a set of duplicate water samples will be collected. For field measurements, at least 10% of monitoring locations will include the repeated measurement of each parameter by the same analyst using the same equipment and technique. For field measurements, refer to the respective SOP for procedure of repeated measurements and acceptable limits. Precision of duplicate sample analyses run in a contracted laboratory will be assessed with a relative percent difference (RPD), and an RPD greater than 20% will require the water sample to be reanalyzed. If the data from the duplicate samples are not within the acceptable RPD range, the data will not be used from these samples.

Accuracy

Accuracy is the overall agreement of a measurement to a known value and includes error from both bias (systematic error) and precision (random error) (USEPA 2002). The accuracy of electronic field equipment will be checked according to manufacturer's specification to known values or standards.

The accuracy of all other field equipment will be assured by comparison with known standards in the field (i.e. Secchi depth determined by a tape measure instead of markings on the rope). For water collections, one (1) trip blank (sample bottles filled with DI water in the lab) for each bi-weekly sampling event will be transported by the field crew for laboratory analyses to ensure there is no contamination of sampling containers during transport.

The accuracy of each laboratory method is established by the laboratory calibration and use of its pre-determined method detection limit (MDL) and quantitation level (QL). The QL is the minimum concentration of a substance that can be reliably identified, measured, and reported with confidence it is accurate. The MDL is the lowest concentration of a substance that can reliably be measured and reported with some degree of confidence that the substance is present in the sample.

Bias

Bias is the persistent influence of a measurement process that causes error in one direction (USEPA 2002). All field analysts will be trained to use the field equipment with the same SOPs to reduce operator bias. The use of trip blanks and duplicate samples will be used to assess sampling, transportation, and laboratory bias due to contamination. The acceptability of all constituent concentrations will be evaluated using reagent and procedural blanks. The results of the trip and procedural blanks will be reported with the data results.

Sensitivity

The method and instrument detection limit is addressed by the range of measurements capable by the equipment used. Information regarding this is presented in the field SOP for the YSI ProPlus and Depthmate Depth sounder.

Completeness

Completeness is the measure of valid data obtained from sampling. At a minimum, the project should require that 90% of the data received to be collected, analyzed, and judged valid for completeness to be achieved. If the project team or requirements of the project determine that a percentage greater than 90% should be achieved for completeness, this will be indicated in the project-specific addendum. If completeness is not met, statistical procedures, including power analysis, and best professional judgment will be used to determine whether use of the remaining data will produce correct data interpretations and conclusions.

Data Comparability

To maximize the quality of the data collected, and to collect data that is comparable with other studies, accepted sampling procedures will be used during this study. All samples collected will be sent to laboratories that use standard methods.

Representativeness

The representativeness of sample collection is, in part, determined from information gleaned from the vertical profiling. In general, because the reservoirs are shallow, relatively small in size, and for the most part uniformly mixed, a single surface grab sample will be sufficient to characterize the waterbody as a whole. For lakes, a single sampling station (usually located at the deepest point of the lake) is generally considered representative for the entire lake. Sample locations were chosen to match those locations sampled by the City of Newport in 2011 and 2012. A minimum of 90% of samples should meet the specific conditions required for the project to be considered representative of the water quality conditions the project is designed to examine.

Measurement performance criteria for all parameters are described below in Tables 4-15.

Table 4. Measurement Performance Criteria: Chlorophyll-a

Sampling SOP	FSOP4
Medium/Matrix	Surface Water
Analytical Parameter	Chlorophyll-a
Concentration Level	Low to high

Data Quality Indicator	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Precision	EPA 445.0/446.0	≤ 20% RPD (field) ≤ 10% RPD (lab)	≤ 20% RPD (field) ≤ 10% RPD (lab)	S/A
Accuracy/bias Contamination	EPA 445.0/446.0	75-125%	Matrix Spike	A
Accuracy/bias Contamination	EPA 445.0/446.0	NA		
Data - Completeness	EPA 445.0/446.0	Data collected are determined to be usable	≥ 90-95%	A
Accuracy	EPA 445.0/446.0	<20%RPD	Field Duplicates	S/A

Table 5. Measurement Performance Criteria: Nitrate-Nitrite Nitrogen

Sampling SOP	FSOP4
Medium/Matrix	Surface Water
Analytical Parameter	Nitrate –Nitrite Nitrogen
Concentration Level	Low to high

Data Quality Indicator	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Precision	EPA 353.3 SOP attached separate/EPA Lab	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	EPA 353.3 SOP attached separate/EPA Lab	<0.02 mg/l	Method Blank	A
Accuracy/bias Contamination	EPA 353.3 SOP attached separate/EPA Lab	Quantitation within limits	Performance Evaluation Standards - PES	A
Data - Completeness	EPA 353.3 SOP attached separate/EPA Lab	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	EPA 353.3 SOP attached separate/EPA Lab	<20%RPD	Field Duplicates	S/A

Table 6. Measurement Performance Criteria: Ammonia-Nitrogen

Sampling SOP	FSOP4
Medium/Matrix	Surface Water
Analytical Parameter	Ammonia Nitrogen
Concentration Level	low

Data Quality Indicator	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Precision	EPA 350.1 SOP attached separate/ EPA Lab	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	EPA 350.1 SOP attached separate/ EPA Lab	< 0.10 mg/l	Method Blank	A
Accuracy/bias Contamination	EPA 350.1 SOP attached separate/ EPA Lab	Quantitation within limits	Performance Evaluation Standards - PES	A
Data - Completeness	EPA 350.1 SOP attached separate/ EPA Lab	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	EPA 350.1 SOP attached separate/ EPA Lab	<20%RPD	Field Duplicates	S/A

Table 7. Measurement Performance Criteria: Total Nitrogen

Sampling SOP	FSOP4
Medium/Matrix	Surface Water
Analytical Parameter	Total Nitrogen
Concentration Level	Low to high

Data Quality Indicator	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Precision	EPA 351.2 SOP attached separate/EPA Lab	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	EPA 351.2 SOP attached separate/EPA Lab	<0.20 mg/l	Method Blank	A
Accuracy/bias Contamination	EPA 351.2 SOP attached separate/EPA Lab	Quantitation within limits	Performance Evaluation Standards - PES	A
Data - Completeness	EPA 351.2 SOP attached separate/EPA Lab	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	EPA 351.2 SOP attached separate/EPA Lab	<20%RPD	Field Duplicates	S/A

Table 8. Measurement Performance Criteria: Dissolved Organic Carbon

Sampling SOP	FSOP4
Medium/Matrix	Surface Water
Analytical Parameter	DOC
Concentration Level	Low to high

Data Quality Indicator	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Precision	EPA Method 415.1, APHA Method 5310B/EPA MED	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	EPA Method 415.1, APHA Method 5310B/EPA MED	<0.20 mg/l	Method Blank	A
Accuracy/bias Contamination	EPA Method 415.1, APHA Method 5310B/EPA MED	Quantitation within limits	Performance Evaluation Standards - PES	A
Data - Completeness	EPA Method 415.1, APHA Method 5310B/EPA MED	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	EPA Method 415.1, APHA Method 5310B/EPA MED	<20%RPD	Field Duplicates	S/A

Table 9. Measurement Performance Criteria: Total Organic Carbon

Sampling SOP	FSOP4
Medium/Matrix	Surface Water
Analytical Parameter	TOC
Concentration Level	Low to high

Data Quality Indicator	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Precision	EPA Method 415.1, APHA Method 5310B/EPA MED	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	EPA Method 415.1, APHA Method 5310B/EPA MED	<0.20 mg/l	Method Blank	A
Accuracy/bias Contamination	EPA Method 415.1, APHA Method 5310B/EPA MED	Quantitation within limits	Performance Evaluation Standards - PES	A
Data - Completeness	EPA Method 415.1, APHA Method 5310B/EPA MED	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	EPA Method 415.1, APHA Method 5310B/EPA MED	<20%RPD	Field Duplicates	S/A

Table 10. Measurement Performance Criteria: Uniform Formation Condition (TTHM)

Sampling SOP	FSOP4
Medium/Matrix	Surface Water
Analytical Parameter	TTHM (UFC)
Concentration Level	Low to high

Data Quality Indicator	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Precision	SOP attached separate/HEALTH Lab	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	SOP attached separate/HEALTH Lab	<0.20 mg/l	Method Blank	A
Accuracy/bias Contamination	SOP attached separate/HEALTH Lab	Quantitation within limits	Performance Evaluation Standards - PES	A
Data - Completeness	SOP attached separate/HEALTH Lab	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	SOP attached separate/HEALTH Lab	<20%RPD	Field Duplicates	S/A

Table 11. Measurement Performance Criteria: Ultraviolet Absorbance (254nm)

Sampling SOP	FSOP4
Medium/Matrix	Surface Water
Analytical Parameter	UV 254
Concentration Level	Low to high

Data Quality Indicator	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Precision	EPA 415.3 SOP attached separate/EPA AED Lab	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	EPA 415.3 SOP attached separate/EPA AED Lab	<0.20 mg/l	Method Blank	A
Accuracy/bias Contamination	EPA 415.3 SOP attached separate/EPA AED Lab	Quantitation within limits	Performance Evaluation Standards - PES	A
Data - Completeness	EPA 415.3 SOP attached separate/EPA AED Lab	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	EPA 415.3 SOP attached separate/EPA AED Lab	<20%RPD	Field Duplicates	S/A

Table 12. Measurement Performance Criteria: Total Phosphorus

Sampling SOP	FSOP4, FSOP5
Medium/Matrix	Surface Water
Analytical Parameter	Total Phosphorus
Concentration Level	low to high

Data Quality Indicator	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Precision	EPA 365.1 SOP attached separate/EPA MED	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	EPA 365.1 SOP attached separate/EPA MED	<0.01 mg/l	Method Blank	A
Accuracy/bias Contamination	EPA 365.1 SOP attached separate/EPA MED	Quantitation within limits	Performance Evaluation Standards - PES	A
Data - Completeness	EPA 365.1 SOP attached separate/EPA MED	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	EPA 365.1 SOP attached separate/EPA MED	<20%RPD	Field Duplicates	S/A

Table 13. Measurement Performance Criteria: Ortho Phosphate

Sampling SOP	FSOP4, FSOP5
Medium/Matrix	Surface Water
Analytical Parameter	Ortho Phosphate
Concentration Level	low to high

Data Quality Indicator	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Precision	EPA 365.1 SOP attached separate/EPA MED	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	EPA 365.1 SOP attached separate/EPA MED	<0.01 mg/l	Method Blank	A
Accuracy/bias Contamination	EPA 365.1 SOP attached separate/EPA MED	Quantitation within limits	Performance Evaluation Standards - PES	A
Data - Completeness	EPA 365.1 SOP attached separate/EPA MED	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	EPA 365.1 SOP attached separate/EPA MED	<20%RPD	Field Duplicates	S/A

Table 14. Measurement Performance Criteria: Microcystin-LR

Sampling SOP	FSOP4
Medium/Matrix	Surface Water
Analytical Parameter	Microcystin-LR
Concentration Level	Varied
Laboratory	EPA Laboratory

Data Quality Indicator	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Precision	Abraxis 522015 ELISA EIASOP-INGICPMS4	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	Abraxis 522015 ELISA EIASOP-INGICPMS4	< ½ RL	Method Blank	A
Accuracy/bias Contamination	Abraxis 522015 ELISA EIASOP-INGICPMS4	Quantitation within limits	Performance Evaluation Standards - PES	A
Data - Completeness	Abraxis 522015 ELISA EIASOP-INGICPMS4	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	Abraxis 522015 ELISA EIASOP-INGICPMS4	<20%RPD	Field Duplicates	S/A

2.9 Documentation and Records

The retention of all field collection records will follow the policy of the State of Rhode Island General Records Retention Schedule GRS5. The Project Manager will be responsible for determining the extent and scope of data records required for each project and ensuring that field staff are provided with the most recent version of this QAPP, SOP(s) used, and other documents necessary for field collection efforts. At a minimum, the Project Manager will retain any original field notes, instrument data sheets, copies of chains of custody, and laboratory results for samples submitted to an external contractor. The explicit location and organization of these hardcopy files will be identified in the project-specific addendum. All electronic data will be permanently retained and backed up in a separate storage device (i.e. CD/DVD, flash drive). Electronic data may also be stored in OWR's water quality database, SWIMS. Digital photograph records will follow the storage requirements and organization of RIDEM/OWR SOP-WR-W-26 Digital Photograph Collection and Storage SOP available for viewing at: http://www.dem.ri.gov/pubs/data.htm.

3.0 Field Measurements and Water Sample Collection

The Newport Reservoir sampling sites, parameters and sampling frequency are described in Appendix A. Sampling locations are shown in Figures 2-10 in Appendix B. These figures were generated by Fuss and O' Neill for the City of Newport as part of the 2011 and 2012 source water monitoring. The locations of sampling stations for this project were chosen based on locations from the 2011 and 2012 sampling. Water quality surveys on the Newport reservoirs will be conducted bi-weekly from early May through October in 2015 at a total of nine (9) locations. Each reservoir will be sampled at a single location above its deepest point, which is based on existing bathymetry data. Sampling efforts will include various *in situ* measurements as well as water column sampling. Instantaneous in situ field measurements include

Secchi disc depth and use of YSI ProPlus to measure temperature, dissolved oxygen (mg/L and percent saturation), specific conductance, and pH at half meter intervals for reservoirs less than 5m maximum depth and at 1m intervals in reservoirs greater than 5m maximum depth. Water column sampling will be conducted at depths described below.

Water samples collected during the study will be analyzed for conventional parameters (e.g. trophic state variables, etc.) and associated human health parameters. Nutrient-related parameters proposed in this study include total phosphorus, ortho-phosphorus, dissolved and total organic carbon, nitrogen fractions, chlorophyll *a*, total algal cell enumeration, total cyanobacteria cell enumeration, ultraviolet absorbance (UV254), and water clarity, as measured by Secchi disk. The human health indices of focus in this study include trihalomethane formation potential (UFC test) and the algal toxin microcystin-LR.

The total number of water samples collected in each reservoir will be dependent upon: 1) reservoir conditions at the time of sampling (i.e. stratified or un-stratified). Under stratified conditions: 1) samples to be analyzed for total and ortho-phosphorus will be collected from three depths at the sample station- one from the epilimnion (upper waters), one from the thermocline surface, and one from the hypolimnion (lower waters). For un-stratified conditions- samples to be analyzed for total and ortho-phosphorus will be collected from approximately one meter below the surface and approximately one meter above the bottom. The phosphorus samples collected from various depths will support estimation of internal phosphorus loading. Table 15 summarizes the sampling protocol as based on vertical profiling data.

Table 15. Newport Reservoir sampling protocol.

Sampling Parameter	Sampling Specifics				
	Clear Stratification			Weak/marginal or non-stratified	
	~ 1m below surface[1]	Within the thermocline[2]	~1 m off bottom[2]	~1m. below surface[1]	~1 m off bottom[2]
Chlorophyll-a	X	none		X	none
Nitrate-Nitrogen (NO3)	X			X	
Ammonia Nitrogen (NH3-N)	X			X	
Nitrate-Nitrogen (NO2)	X			X	
Total Nitrogen	X			X	
Dissolved Organic Carbon	X			X	
Total Organic Carbon	X			X	
Trihalomethane (UFC test)	X			X	
Ultraviolet Absorbance (254 nm)	X			X	
Microcystin-LR	X			X	
Total algal/cyanobacteria ID and enumeration	X			X	
Total Phosphorus	X	X	X	X	X
Orthophosphate	X	X	X	X	X

1 Collected by direct inversion of bottle
2 Collected at specific depth by Van Dorn sampler

3.1 Field Sampling Standard Operating Procedures

Field sampling standard operating procedures (SOP) used for this study are referenced below in Table 16. All field sampling SOP's are detailed in Appendix C.

Table 16. Project Sampling SOP Reference Table

Reference Number/Title	Originating Organization	Equipment ID	Modified for Work Project
Field Sampling SOP FSOP-1 **Sounding Depth**	RIDEM	Depthmate Model SM-5	No
Field Sampling SOP FSOP-2 **Secchi Disc Depth**	RIDEM	NA	No
Field Sampling SOP FSOP-3 **YSI ProPlus**	RIDEM	YSI ProPlus Multi-Parameter Meter	No
Field Sampling SOP FSOP-4 **Surface Water Sample Collection**	RIDEM	NA	No
Field Sampling SOP FSOP-5 **Van Dorn Sample Collection**	RIDEM	NA	No

Upon arrival at the desired sampling location in each reservoir, RIDEM staff will perform field activities in the following order:

- Take soundings with the digital depth finder to confirm deepest spot sample location.
- Set anchor and secure field equipment. The anchor will be lowered slowly to avoid disturbing the bottom.
    - If the bottom is disturbed, the field team should record this in the field notebook and relocate a reasonable distance before continuing sampling.
- Record field observations, including weather information, and take pictures if necessary.
- Perform Secchi depth readings.

- Conduct vertical profiling (temperature, specific conductance, dissolved oxygen, pH) and evaluate data.
    - Determine sampling protocol (Table 15).
- Commence collection of water samples per Table 15 and the SOP's in Appendix C and D.
    - Samples for water quality analysis should be collected from a location in the boat as far as reasonable from where the anchor is set.
- Information on water transfers between reservoirs on the day of sampling will be obtained from Newport Water during the course of the season's fieldwork.

3.2 Equipment Calibration, Cleaning, and Maintenance

The project manager and appropriate project staff shall ensure that all field equipment is calibrated and maintained properly. The project manager will ensure that all field sampling equipment are maintained according to the manufacturer's instructions. Table 17 provides an overview of sampling equipment calibration and maintenance.

Table 17. Sampling Equipment and Field Analytical Calibration/Maintenance Table.

EQUIPMENT	**Activity**	**Frequency**	**Acceptance Criteria**	**Corrective Action**	**SOP Reference**
Depthmate Model SM-5	Clean Transducer Surface	Once before Sampling or as needed	Visibly free of non-conductive grease or oils	Clean Transducer Surface	FSOP1and Manual
Depthmate Model SM-5	Check Batteries	Once before sampling or as needed	Display is visible when switch is held down	Replace Batteries	FSOP1 and Manual
Secchi Disc	Ensure Disc is appropriately connected to rope	Proir to sampling	Appropriate connection	Appropriate action	FSOP2
YSI Pro-Plus	Check Batteries	Prior to sampling	See FSOP3	See FSOP3	FSOP3 and manual
YSI Pro-Plus	Calibration-barometric pressure, specific conductance, pH, temperature	Once per week	See FSOP3	See FSOP3	FSOP3 and manual
YSI Pro-Plus	Calibration-dissolved oxygen	Once per day	See FSOP3	See FSOP3	FSOP3 and manual
Van Dorn Sampler	Check integrity of sampler (hoses, clamps, ropes, rubber/silicone parts, wires, stoppers are functioning properly)	Prior to sampling	Sampler works appropriately and inspection reveals no problems	Repair as needed	FSOP5

3.3 Inspection and Acceptance Requirements for Sample Containers/Bottles

The Project Manager shall ensure that all sample bottles/containers are acceptable for use. EPA AED and MED, RI Department of Health, and Northeast Laboratory will provide appropriate sampling bottles as required for each sampling run. The Project Manager shall appropriately maintain this bottle supply. A log shall be kept in the project notebook documenting receipt and labeling of each sample bottle. Reference is also made to the appropriate SOP attached to this document for each constituent and respective laboratory.

The Project Manager shall maintain a field notebook for all field notes. The Project Manager shall also record any changes to the sampling locations or number of stations and the reason thereof. The Project Manager will transfer any applicable data from the field notebook to either excel spreadsheets or word documents as required.

3.4 Sample Identification

All sample bottles will be appropriately labeled in the field by RIDEM staff. The reservoir name, sample type, depth (denoted s-surface, t-thermocline, d-depth), date, time and initials shall be filled in prior to sampling using a permanent marker. To an extent, sample identification will be determined by each analytical laboratory's chain of custody format.

3.5 Sample Handling, Storage, Preservation, Holding Time, and Tracking

All samples will be capped tightly stored in coolers on ice. To limit mishandling, separate coolers will be used to store/transport samples from individual reservoirs. Sampling containers, sample preservation and sample holding time requirements are detailed in Table 18. Sample tracking is accomplished via Chain of Custody forms. Copies of these forms are provided in Appendix E. The Project Manager or a designee shall deliver the samples to the appropriate laboratory for analysis. Samples for algal identification will be preserved in the field with Lugols solution, and samples for microcystin analysis will be iced. Samples requiring algal identification and enumeration and toxin analysis will be kept on ice and delivered to Northeast Laboratories in Berlin, CT after completion of each sampling event (i.e. after sampling all nine waterbodies).

Procedures are in place to ensure that all samples with short holding times (chlorophyll and UFC test) are preserved on ice until delivery.

Table 18. Water Sampling Requirements

Parameter	Lab	Container Type[1]/ Preparation	Typical Sample Volume	Sample Preservation	Holding Time
Chlorophyll-a	EPA AED	Amber glass	1 Liter	On ice, stored < 6°until analysis	48 hours
Nitrate-Nitrogen (NO3)	EPA MED	Polyethylene bottle, 10% HCL wash	125 ml	Filter (0.45µm), store frozen, 0°C	6 months
Ammonia Nitrogen (NH3-N)	EPA MED	Polyethylene bottle, 10% HCL wash	125 ml	Filter (0.45µm), store frozen, 0°C	6 months
Nitrite-Nitrogen (NO2)	EPA MED	Polyethylene bottle, 10% HCL wash	125 ml	Filter (0.45µm), store frozen, 0°C	6 months
Total Nitrogen	EPA MED	Polyethylene bottle, 10% HCL wash	125 ml	Unfiltered, Storage at 0°C	6 months
Dissolved Organic Carbon	EPA MED	Glass amber bottles w/Teflon lined cap, 10% HCL wash	60 ml	Acidify with H_3PO_4, store at 4C	28 days
Total Organic Carbon	EPA MED	Glass amber bottles w/Teflon lined cap, 10% HCL wash	60 ml	Acidify with H_3PO_4, store at 4C	28 days
Uniform Formation Conditions (TTHM)	HEALTH	Amber glass	1 Liter	On ice, stored < 4°C until analysis	24 hours chlorine demand; 14 days TTHM
Ultraviolet Absorbance (254 nm)	EPA AED	Amber glass	1 Liter	On ice until analysis	48 hours
Microcystin-LR	Northeast Laboratories Inc.	Amber Plastic	1 oz	Cool and dark (refrigeration)	1-28 days
Total algal/cyanobacteria ID and enumeration	Northeast Laboratories Inc.	Amber Plastic	1 liter	Lugol's Iodine (3ml/liter) and frozen	1-28 days
Total Phosphorus	EPA MED	Polyethylene bottle, 10% HCL wash	125 ml	Store frozen (-20C)	28 days
Orthophosphate	EPA MED	Polyethylene bottle, 10% HCL wash	125 ml	Filter (0.45), store frozen (-20C)	28 days

[2]The laboratory that completes the sample analysis will provide appropriate bottles.

4.0 Laboratory Analytical Services

Analytical services will be provided by 1) US EPA Mid-Continent Ecology Laboratory Division in Duluth, MN, 2) US EPA Atlantic Ecology Division in Narragansett, RI, 3) The Rhode Island Department of Health (HEALTH) Laboratory in Providence, RI, and 4) Northeast Laboratories Inc. in Berlin, CT. An analytical services summary is provided below in Table 19.

Table 19. Analytical Services Table.

Analytical Parameter	Lab	Analytical Method/Other Method	Number of Sampling Locations	Number of Sampling Events	Number of Samples	# of Field Duplicates (10% of total)	Total # of Samples
Chlorophyll-a	EPA-AED	EPA 445.0/446.0	9	12	108	10	118
Nitrate-Nitrogen (NO3)	EPA-MED	EPA 353.3/353.2	9	12	108	10	118
Ammonia Nitrogen (NH3-N)	EPA-MED	EPA 350.1	9	12	108	10	118
Nitrate-Nitrogen (NO2)	EPA-MED	EPA 353.3/353.2	9	12	108	10	118
Total Nitrogen	EPA-MED	EPA 351.3/351.1	9	12	108	10	118
Dissolved Organic Carbon	EPA-MED	EPA 415.3 (AED)	9	12	132	13	145
Total Organic Carbon	EPA-MED	EPA 415.3 (AED)	9	12	132	13	145
Uniform Formation Conditions (TTHM)	RI State Health Laboratories	SM4500 C1-I EPA 524.2	9	12	132	13	145
Ultraviolet Absorbance (254 nm)	EPA-AED	EPA 415.3 (AED)	9	12	132	13	145
Microcystin-LR	Northeast Laboratories Inc.	Abraxis 522015 ELISA	9	6 (1/month)	54	5	59
Total algal ID and enumeration	Northeast Laboratories Inc.	SM10200	9	6 (1/month)	54	5	59
Total Phosphorus	EPA-MED	EPA 365.1	9	12	216/324	22/32	238/356
Orthophosphate	EPA-MED	EPA 365.1	9	12	216/324	22/32	238/356

4.1 Analytical Methods

All applicable laboratory analytical methods and achievable laboratory limits are summarized below in Table 20 and the full laboratory SOP's (LSOP) are provided in Appendix D.

Table 20. Newport Reservoir Analytical Parameters.

Parameter	Analytical Method/	Detection Limit, accuracy, precision	Instrument	Analytical Laboratory	Laboratory SOP (LSOP) Reference
Chlorophyll-a	EPA 445.0/446.0	RPO >90%	Turner Designs TD-700 digital Fluorometer	EPA AED Laboratory Narragansett, RI	LSOP1
Nitrate and Nitrite-Nitrogen (NO3)	EPA 353.3/353.2	MDL 1.0 ugl ±10%	Lachat 8000 Quik Chem System	EPA MED Laboratory Duluth, MN	LSOP2
Ammonia Nitrogen (NH3-N)	EPA 350.1	MDL 2.0 ug/l ±10%	Lachat 8000 Quik Chem System	EPA MED Laboratory Duluth, MN	LSOP3
Total Nitrogen	EPA 351.3/351.1	MDL 5.0 ug/l ±10%	Autoclave; Latchet Automated Ion Analyzer (FIA)	EPA MED Laboratory Duluth, MN	LSOP4
Dissolved Organic Carbon	EPA 415.3 (AED)	Precision 5-10% for total DL = 0.53 mg/L	Takmar-Dohrmann Phoenix 8000 TOC Analyzer	EPA MED Laboratory Duluth, MN	LSOP5
Total Organic Carbon	EPA 415.3 (AED)	Precision 5-10% for total DL = 0.53 mg/L	Takmar-Dohrmann Phoenix 8000 TOC Analyzer	EPA MED Laboratory Duluth, MN	LSOP5
Uniform Formation Conditions (TTHM)	SM4500 Cl-I EPA 524.2	± 30% Accuracy ± 30% Precision DL=1.0 ug/L	Tekmar Stratum Purge and Trap, Agilent GC/MSD 6890N/5973N	RI State Health Laboratories	LSOP6 ID 1083 Revision 4
Ultraviolet Absorbance (254 nm)	EPA 415.3 (AED)	Daily check ±10% Precision <10% RPD	Perkin-Elmer Lambda 35 UV Spectrophotometer	EPA AED Narragansett, RI	LSOP7
Microcystin-LR	Abraxis 522015 ELISA			Northeast Laboratories Inc. Berlin, CT	LSOP8
Total algal ID and enumeration	Standard Method SM 10200	NA	NA	Northeast Laboratories Inc. Berlin, CT	LSOP9
Total Phosphorus	EPA 365.1	MDL = 4.0 ug/l ±10%	Lachat 8000 Quik Chem System	EPA MED Laboratory Duluth, MN	LSOP10
Orthophosphate	EPA 365.1	MDL = 2.5 ug/l ±10%	Lachat 8000 Quik Chem System	EPA MED Laboratory Duluth, MN	LSOP10

Fixed laboratory analytical quality control requirements for all analytical parameters are given Tables 21-30.

Table 21. Fixed Laboratory Analytical QC – Chlorophyll-a

LAB SOP	LSOP1					
MEDIUM / MATRIX	Surface Water					
Analytical Parameter	Chlorophyll a					
Concentration Level	Low to high					
Analytical SOP						
Laboratory	EPA AED Laboratory					
Laboratory QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person (s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	NA					
Reagent Blank	5%	≤ 10X lowest sample concentration	Re-Run	Laboratory Manager	Accuracy/ Contamination	
Storage Blank	NA					
Instrument Blank	NA					
Laboratory Duplicate	5%	10% RPD	Re-Run	Laboratory Manager	Precision	
Laboratory Matrix Spike	NA					
Matrix Duplicate Spikes	NA					
LCS	NA					
LFB	NA					
Surrogates	NA					
Internal Standards (ISs)						

Table 22. Fixed Laboratory Analytical QC – Nitrate-Nitrite Nitrogen

LAB SOP	LSOP2					
MEDIUM / MATRIX	Surface Water					
Analytical Parameter	Nitrate-Nitrite Nitrogen					
Concentration Level	Low to high					
Analytical SOP						
Laboratory	EPA MED Laboratory					
Laboratory QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person (s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	NA					
Reagent Blank	2 per sample set	≤ 10X lowest sample concentration	Re-Run	Laboratory Manager	Accuracy/ Contamination	
Storage Blank	NA					
Instrument Blank	NA					
Laboratory Duplicate	1 per 5 samples	10% RPD	Re-Run	Laboratory Manager	Precision	
Laboratory Matrix Spike	1 per 9 samples	80% - 120% Recovery	Re-Run	Laboratory Manager	Accuracy/ Contamination	
Matrix Duplicate Spikes	3/sample set	80% - 120% Recovery	Re-Run	Laboratory Manager	Accuracy/ Contamination	
LCS	NA					
LFB	NA					
Surrogates	NA					
Internal Standards (ISs)	1 per 6 samples	90% - 110% of expected value	Re-Run	Laboratory Manager	Accuracy/ Contamination	

Table 23. Fixed Laboratory Analytical QC – Ammonia Nitrogen

LAB SOP	LSOP3					
MEDIUM / MATRIX	Surface Water					
Analytical Parameter	Ammonia Nitrogen					
Concentration Level	Low to high					
Analytical SOP						
Laboratory	EPA MED Laboratory					
Laboratory QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person (s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per batch	TA ≤ QL	Reanalyze batch	Laboratory Manager	Accuracy/Bias-Contamination	TA ≤ QL
Reagent Blank	NA	NA	NA	NA	NA	NA
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	NA	NA	NA	NA	NA	NA
Laboratory Duplicate	1 per batch	RPD < 20%	Qualify Data	Laboratory Manager	Precision	RPD < 20%
Laboratory Matrix Spike	1 per batch	75-125%	Qualify Data	Laboratory Manager	Accuracy	75-125%
Matrix Duplicate Spikes	NA	NA	NA	NA	NA	NA
LCS	1 per batch	80-120%	Reprep/Reanalyze	Laboratory Manager	Accuracy	80-120%
LFB	NA	NA		NA	NA	NA
Surrogates	NA	NA		NA	NA	NA
Internal Standards (ISs)	NA	NA		NA	NA	NA

Table 24. Fixed Laboratory Analytical QC – Total Nitrogen

LAB SOP	LSOP4					
MEDIUM / MATRIX	Surface Water					
Analytical Parameter	Total Nitrogen					
Concentration Level	Low to high					
Analytical SOP						
Laboratory	EPA AED Laboratory					
Laboratory QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person (s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per batch	TA ≤ QL	Reanalyze batch	Laboratory Manager	Accuracy/Bias-Contamination	TA ≤ QL
Reagent Blank	NA	NA	NA	NA	NA	NA
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	NA	NA	NA	NA	NA	NA
Laboratory Duplicate	1 per batch	RPD < 20%	Qualify Data	Laboratory Manager	Precision	RPD < 20%
Laboratory Matrix Spike	1 per batch	75-125%	Qualify Data	Laboratory Manager	Accuracy	75-125%
Matrix Duplicate Spikes	NA	NA	NA	NA	NA	NA
LCS	1 per batch	80-120%	Reprep/Reanalyze	Laboratory Manager	Accuracy	80-120%
LFB	NA	NA		NA	NA	NA
Surrogates	NA	NA		NA	NA	NA
Internal Standards (ISs)	NA	NA		NA	NA	NA

Table 25. Fixed Laboratory Analytical QC – Total and Dissolved Organic Carbon

LAB SOP	LSOP5					
MEDIUM / MATRIX	Surface Water					
Analytical Parameter	Total and Dissolved Organic Carbon					
Concentration Level	Low to high					
Analytical SOP						
Laboratory	EPA MED Laboratory					
Laboratory QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person (s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per batch	TA ≤ QL	Reanalyze batch	Laboratory Manager	Accuracy/ Bias-Contamination	TA ≤ QL
Reagent Blank	NA	NA	NA	NA	NA	NA
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	NA	NA	NA	NA	NA	NA
Laboratory Duplicate	1 per batch	RPD < 20%	Qualify Data	Laboratory Manager	Precision	RPD < 20%
Laboratory Matrix Spike	1 per batch	75-125%	Qualify Data	Laboratory Manager	Accuracy	75-125%
Matrix Duplicate Spikes	NA	NA	NA	NA	NA	NA
LCS	1 per batch	80-120%	Reprep/Reanalyze	Laboratory Manager	Accuracy	80-120%
LFB	NA	NA		NA	NA	NA
Surrogates	NA	NA		NA	NA	NA
Internal Standards (ISs)	NA	NA		NA	NA	NA

Table 26. Fixed Laboratory Analytical QC – Uniform Formation Condition (TTHM)

LAB SOP	LSOP6 ID 1083 Revision 4					
MEDIUM / MATRIX	Surface Water					
Analytical Parameter	Uniform Trihalomethane Formation Condition (TTHM)					
Concentration Level	Low to high					
Analytical SOP						
Laboratory	RI State Health Laboratories					
Laboratory QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person (s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per batch	TA ≤ QL	Reanalyze batch	Laboratory Manager	Accuracy/ Bias-Contamination	TA ≤ QL
Reagent Blank	NA	NA	NA	NA	NA	NA
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	NA	NA	NA	NA	NA	NA
Field Duplicate	1 per batch	RPD < 30%	Qualify Data	Laboratory Manager	Precision	RPD < 30%
Laboratory Matrix Spike	NA	NA	NA	NA	NA	NA
Matrix Duplicate Spikes	NA	NA	NA	NA	NA	NA
LCS	NA	NA	NA	NA	NA	NA
LFB	1 per batch	±30% Accuracy	Reprep/ Reanalyze	Laboratory Manager	Accuracy	±30% RPD
Surrogates	4-Bromofluorobenze and 1,2-	70-130% R	Qualify Data	Laboratory Manager	Accuracy	±30% RPD
Internal Standards (ISs)		70-130% R	Qualify Data	Laboratory Manager	Accuracy	±30% RPD

Table 27. Fixed Laboratory Analytical QC – Total Phosphorus

LAB SOP	LSOP10					
MEDIUM / MATRIX	Surface Water					
Analytical Parameter	Total Phosphorus					
Concentration Level	Low to high					
Analytical SOP						
Laboratory	EPA MED Laboratory					
Laboratory QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person (s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	NA					
Reagent Blank	5%	≤ 10X lowest sample concentration	Re-Run	Laboratory Manager	Accuracy/ contamination	≤ 10X lowest sample concentration
Storage Blank	NA					
Instrument Blank	NA					
Laboratory Duplicate	5%	10% RPD	Re-Run	Laboratory Manager	Precision	10% RPD
Laboratory Matrix Spike	5/sample set	80-120% Recovery	Re-Run	Laboratory Manager	Accuracy/ contamination	80-120% Recovery
Matrix Duplicate Spikes	3/sample set	80-120% Recovery	Re-Run	Laboratory Manager	Accuracy/ contamination	80-120% Recovery
LCS	NA					
LFB	NA					
Surrogates	NA					
Internal Standards (ISs)	NA					

Table 28. Fixed Laboratory Analytical QC – Orthophosphate

LAB SOP	LSOP10					
MEDIUM / MATRIX	Surface Water					
Analytical Parameter	Orthophosphate					
Concentration Level	Low to high					
Analytical SOP						
Laboratory	EPA MED Laboratory					
Laboratory QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person (s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	NA					
Reagent Blank	5%	≤ 10X lowest sample concentration	Re-Run	Laboratory Manager	Accuracy/ contamination	≤ 10X lowest sample concentration
Storage Blank	NA					
Instrument Blank	NA					
Laboratory Duplicate	5%	10% RPD	Re-Run	Laboratory Manager	Precision	10% RPD
Laboratory Matrix Spike	5/sample set	80-120% Recovery	Re-Run	Laboratory Manager	Accuracy/ contamination	80-120% Recovery
Matrix Duplicate Spikes	3/sample set	80-120% Recovery	Re-Run	Laboratory Manager	Accuracy/ contamination	80-120% Recovery
LCS	NA					
LFB	NA					
Surrogates	NA					
Internal Standards (ISs)	NA					

Table 29. Fixed Laboratory Analytical QC – Ultraviolet Absorbance (254 nm)

LAB SOP	LSOP4					
MEDIUM / MATRIX	Surface Water					
Analytical Parameter	UV 254					
Concentration Level	Low to high					
Analytical SOP	LSOP7					
Laboratory	EPA AED Laboratory					
Laboratory QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person (s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Filter Blank	1 per batch	TA ≤ 0.01 cm-1UVA	Reanalyze batch	Laboratory Manager	Accuracy/Bias-Contamination	TA ≤ QL
Reagent Blank	NA	NA	NA	NA	NA	NA
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	NA	NA	NA	NA	NA	NA
Laboratory Duplicate	1 per batch	RPD < 20%	Qualify Data	Laboratory Manager	Precision	RPD < 20%
Laboratory Matrix Spike	NA	NA	NA	NA	NA	NA
Matrix Duplicate Spikes	NA	NA	NA	NA	NA	NA
LCS	1 per batch	80-120%	Reprep/Reanalyze	Laboratory Manager	Accuracy	Daily check standard, 1 per batch, ±10% expected value
LFB	NA	NA		NA	NA	NA
Surrogates	NA	NA		NA	NA	NA
Internal Standards (ISs)	NA	NA		NA	NA	NA

Table 30. Fixed Laboratory Analytical QC – Microcystins

LAB SOP	LSOP4					
MEDIUM / MATRIX	Surface Water					
Analytical Parameter	Microcystins					
Concentration Level	Low to high					
Analytical SOP						
Laboratory	Northeast Laboratories Inc.					
Laboratory QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person (s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per batch	TA ≤ QL	Reanalyze batch	Laboratory Manager	Accuracy/Bias - Contamination	TA ≤ QL
Reagent Blank	NA	NA	NA	NA	NA	NA
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	NA	NA	NA	NA	NA	NA
Laboratory Duplicate	1 per batch	RPD < 20%	Qualify Data	Laboratory Manager	Precision	RPD < 20%
Laboratory Matrix Spike	1 per batch	75-125%	Qualify Data	Laboratory Manager	Accuracy	75-125%
Matrix Duplicate Spikes	NA	NA	NA	NA	NA	NA
LCS	1 per batch	80-120%	Reprep/Reanalyze	Laboratory Manager	Accuracy	80-120%
LFB	NA	NA		NA	NA	NA
Surrogates	NA	NA		NA	NA	NA
Internal Standards (ISs)	NA	NA		NA	NA	NA

4.3 Documentation, Records, and Data Management

The Project Manager shall maintain a field notebook, including field log sheets. The monitoring plan as detailed within this report shall be adhered to while sampling. The Project Manager shall review and consult with other Project staff following each sampling event in order to identify any possible errors or omissions.

The Project Manager and appropriate staff shall collect all samples and complete the chain of custody forms for each sampling event. The samples and chain of custody forms shall also be rechecked upon delivery of the samples to the laboratory. A copy of the chain of custody form will be given to the Project Manager when the samples are dropped off at the laboratory. This copy will be retained in the project file. After analysis is complete, sample results from the laboratory will be mailed to Brian Zalewsky at RIDEM.

After each sampling report, a brief Status Report will be written to document any changes to the final Monitoring Plan. All information collected throughout the project will be summarized in the Final Data Report. Table 31 Lists records that will be generated throughout this project.

After each sampling event, and upon completion of all analysis by the participating laboratories, all data will be sent to the Project Manager (Brian Zalewsky at RIDEM) in both electronic and paper format. The Project Manager is responsible for the storage of all project files. RIDEM has a central filing system at its Providence Office where all original documents will be kept.

Table 31. Project Documentation and Records

Sample Collection Records	Field Analysis Records	Fixed Laboratory Records	Data Assessment Records
FIELD NOTES / LOG SHEETS	Field Notes / Log Sheets	Chain of Custody Records	Status Reports
Chain of Custody Records		Tabulated Data Summary Forms: Draft and Final	Final Data Report
Monitoring Plan			

4.4 Assessments and Response Actions

The Project Manager shall be responsible for each of the project tasks and their associated quality assurance and quality control procedures. The Project Manager will ensure consistency between sampling events and will evaluate the status of the project, sampling, quality assurance and quality control and will highlight any problems that are encountered during sampling. Project assessment is described further in Table 32.

Table 32. Project Assessment Table

Assessment Type	Frequency	Internal or External	Person Responsible for Performing Assessment and Implementing Corrective Actions	Person Responsible for Monitoring the Effectiveness of the Corrective Action
Field Sampling Technical System Audit	Start of Sampling	I	Brian Zalewsky RIDEM	Brian Zalewsky RIDEM
EPA AED Laboratory	Prior to Sample Receipt	E	Anne Kuhn EPA AED Laboratory	Brian Zalewsky RIDEM
EPA MED Laboratory	Prior to Sample Receipt	E	Colleen Elonen EPA MED Laboratory	Brian Zalewsky RIDEM
Northeast Laboratories Inc.	Prior to Sample Receipt	E	Alan Johnson Northeast Laboratories Inc.	Brian Zalewsky RIDEM

4.5 Quality Control Requirements

Quality control requirements for analytical parameters are specified in Tables 33-44.

Table 33. Field Sampling QC: Chlorophyll-a.

SAMPLING SOP	FSOP4			
MEDIUM / MATRIX	Surface Water			
Analytical Parameter	Chlorophyll-a			
Concentration Level	ug/l			
Analytical Method/ SOP Reference	LSOP1			
QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action
Field Duplicates	Minimum 1 per 10 samples	FSOP4	Discuss any problems with Project Quality Control Officer	Project Manager
Cooler Temperature Blank	1 Per Cooler	4^0 C or less	Add Ice / Re- sample	Project Manager

Table 34. Field Sampling QC: Nitrate-Nitrite Nitrogen.

SAMPLING SOP	FSOP4			
MEDIUM / MATRIX	Surface Water			
Analytical Parameter	Nitrate-Nitrite			
Concentration Level	mg/l			
Analytical Method/ SOP Reference	LSOP2			
QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action
Field Duplicates	Minimum 1 per 10 samples	FSOP4	Discuss any problems with Project Quality Control Officer	Project Manager
Cooler Temperature Blank	1 Per Cooler	4^0 C or less	Add Ice / Re- sample	Project Manager

Table 35. Field Sampling QC: Ammonia Nitrogen.

SAMPLING SOP	FSOP4
MEDIUM / MATRIX	Surface Water
Analytical Parameter	Ammonia Nitrogen
Concentration Level	mg/l
Analytical Method/ SOP Reference	LSOP3

QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action
Field Duplicates	Minimum 1 per 10 samples	FSOP4	Discuss any problems with Project Quality Control Officer	Project Manager
Cooler Temperature Blank	1 Per Cooler	4^0 C or less	Add Ice / Re- sample	Project Manager

Table 36. Field Sampling QC: Total Nitrogen.

SAMPLING SOP	FSOP4
MEDIUM / MATRIX	Surface Water
Analytical Parameter	Total Nitrogen
Concentration Level	mg/l
Analytical Method/ SOP Reference	LSOP4

QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action
Field Duplicates	Minimum 1 per 10 samples	FSOP4	Discuss any problems with Project Quality Control Officer	Project Manager
Cooler Temperature Blank	1 Per Cooler	4^0 C or less	Add Ice / Re- sample	Project Manager

Table 37. Field Sampling QC: Dissolved Organic Carbon.

SAMPLING SOP	FSOP4			
MEDIUM / MATRIX	Surface Water			
Analytical Parameter	Dissolved Organic Carbon			
Concentration Level	mg/l			
Analytical Method/ SOP Reference	LSOP5			
QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action
Field Duplicates	Minimum 1 per 10 samples	FSOP4	Discuss any problems with Project Quality Control Officer	Project Manager
Cooler Temperature Blank	1 Per Cooler	4^0 C or less	Add Ice / Re- sample	Project Manager

Table 38. Field Sampling QC: Total Organic Carbon.

SAMPLING SOP	FSOP4			
MEDIUM / MATRIX	Surface Water			
Analytical Parameter	Total Organic Carbon			
Concentration Level	mg/l			
Analytical Method/ SOP Reference	LSOP5			
QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action
Field Duplicates	Minimum 1 per 10 samples	FSOP4	Discuss any problems with Project Quality Control Officer	Project Manager
Cooler Temperature Blank	1 Per Cooler	4^0 C or less	Add Ice / Re- sample	Project Manager

Table 39. Field Sampling QC: Uniform Formation Conditions (TTHM).

SAMPLING SOP	FSOP4
MEDIUM / MATRIX	Surface Water
Analytical Parameter	Uniform Formation Conditions
Concentration Level	ug/l
Analytical Method/ SOP Reference	LSOP6

QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action
Field Duplicates	Minimum 1 per 10 samples	FSOP4	Discuss any problems with Project Quality Control Officer	Project Manager
Cooler Temperature Blank	1 Per Cooler	4^0 C or less	Add Ice / Re- sample	Project Manager

Table 40. Field Sampling QC: Ultraviolet Absorbance (UV 254 nm).

SAMPLING SOP	FSOP4
MEDIUM / MATRIX	Surface Water
Analytical Parameter	UV 254
Concentration Level	L/mg-m
Analytical Method/ SOP Reference	LSOP7

QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action
Field Duplicates	Minimum 1 per 10 samples	FSOP4	Discuss any problems with Project Quality Control Officer	Project Manager
Cooler Temperature Blank	1 Per Cooler	4^0 C or less	Add Ice / Re- sample	Project Manager

Table 41. Field Sampling QC: Total Phosphorus.

SAMPLING SOP	FSOP4 FSOP5			
MEDIUM / MATRIX	Surface Water			
Analytical Parameter	Total Phosphorus			
Concentration Level	mg/l			
Analytical Method/ SOP Reference	LSOP10			
QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action
Field Duplicates	Minimum 1 per 10 samples	FSOP4/FSOP5	Discuss any problems with Project Quality Control Officer	Project Manager
Cooler Temperature Blank	1 Per Cooler	4^0 C or less	Add Ice / Re- sample	Project Manager

Table 42. Field Sampling QC: Ortho-Phosphorus.

SAMPLING SOP	FSOP4 FSOP5			
MEDIUM / MATRIX	Surface Water			
Analytical Parameter	Ortho-Phosphorus			
Concentration Level	mg/l			
Analytical Method/ SOP Reference	LSOP10			
QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action
Field Duplicates	Minimum 1 per 10 samples	FSOP4/FSOP5	Discuss any problems with Project Quality Control Officer	Project Manager
Cooler Temperature Blank	1 Per Cooler	4^0 C or less	Add Ice / Re- sample	Project Manager

Table 43. Field Sampling QC: Algal Enumeration/ID.

SAMPLING SOP	FSOP4
MEDIUM / MATRIX	Surface Water
Analytical Parameter	Algal Enumeration/ID
Concentration Level	cells/ml
Analytical Method/ SOP Reference	LSOP9

QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action
Field Duplicates	Minimum 1 per 10 samples	FSOP4	Discuss any problems with Project Quality Control Officer	Project Manager
Cooler Temperature Blank	1 Per Cooler	4^0 C or less	Add Ice / Re- sample	Project Manager

Table 44. Field Sampling QC: Microcystin-LR.

SAMPLING SOP	FSOP4
MEDIUM / MATRIX	Surface Water
Analytical Parameter	Microcystin-LR
Concentration Level	ug/l
Analytical Method/ SOP Reference	LSOP8

QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action
Field Duplicates	Minimum 1 per 10 samples	FSOP4	Discuss any problems with Project Quality Control Officer	Project Manager
Cooler Temperature Blank	1 Per Cooler	4^0 C or less	Add Ice / Re- sample	Project Manager

4.6 QA Management Reports

Table 45 lists the QA Management Reports that will be generated throughout this study. Upon completion of each survey, a brief status report via memorandum will be written in order to document any issues related to sampling and if needed, any changes made to the monitoring plan. As needed during the project, the Project Manager will meet with other staff to discuss any issues related to sampling. These meetings will be verbal status reports. Problems encountered in the field will be discussed and any appropriate actions determined and implemented. Any changes and/or problems will be included in the final report.

After all monitoring is complete the Project Manager will generate a Status Report. This Status Report will be the written record of any changes to the sampling plan. Issues discussed during the Verbal Status Report can also be included. Upon completion of the sampling the Project Manager will write a final report summarizing the sampling events. Information in this final report will include the following information:

- Brief description of each sampling event;
- Data tables of all data collected during each sampling event; and
- Attachments
  - Status Reports
  - Sampling Logs
  - Chain of Custody Forms
  - Laboratory data sheets provided by the labs

Table 45. QA Management Reports

Type of Report	Frequency	Person(s) Responsible for Report Preparation	Report Recipient
Verbal Status Report	As needed	Brian Zalewsky RIDEM	Elizabeth Scott RIDEM
Written Status Report (memorandum)	As needed	Brian Zalewsky RIDEM	Elizabeth Scott RIDEM
Final Report	Completion of Sampling	Brian Zalewsky RIDEM	Elizabeth Scott RIDEM

4.7 Verification and Validation Requirements

The Project Manager will review data collected during this study to determine if the data meets the sampling plans objectives. Decisions to qualify or reject data will be made by the Project Manager. All data collected will be included in the Final Report. To ensure correct interpretation of the data, all problems encountered in the field will be included in the Appendix of the report and discussed in the general text of the report. Problems will also be documented in each survey's written Status Report or included in the Field Notebook. To assist in data interpretation, statistical information on sampling events, including sampling size, sample mean, and sample variance, will be reported, where applicable. A discussion on duplicate precision and accuracy criteria and results will also be discussed in the Final Report.

4.8 Verification and Validation Procedures

All data collected during sampling events will be included in the appendix of the Final Data Report. Once the data has been collected, it will be entered into Microsoft Excel or similar spreadsheet reporting software. The Project Manager will proofread the data entry for errors, and will correct any discrepancies. Outliers and inconsistencies will be flagged for further review with other project staff.

All data will be reviewed against the criteria included in Tables 22-44. The decision to discard data will be made by the Project Manager and other project staff. Problems will be discussed in the Final Report. Table 46 discusses the data verification process.

Table 46. Data Verification Process

Verification Task	Description	Internal / External	Responsible for Verification
Field Notes	Field notes will be collected at the end of each sampling event. Any required corrective actions will be addressed and implemented prior to the next sampling session. Field notes will be transcribed into the final project report and copies will be maintained with the project file.	I	Brian Zalewsky RIDEM
Chain of Custody Forms	Chain of Custody forms will be reviewed when samples are collected for delivery to the laboratory in the field and at the laboratory. The forms will be maintained in the project file.	I/E	Brian Zalewsky RIDEM EPA AED/MED, HEALTH, and Northeast Laboratories, Inc.
Laboratory Data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness prior to submittal. The data packages will also be reviewed by the Project Manager.	I/E	Brian Zalewsky RIDEM EPA AED/MED, HEALTH, and Northeast Laboratories, Inc.

4.9 Data Usability / Reconciliation with Project Quality Objectives

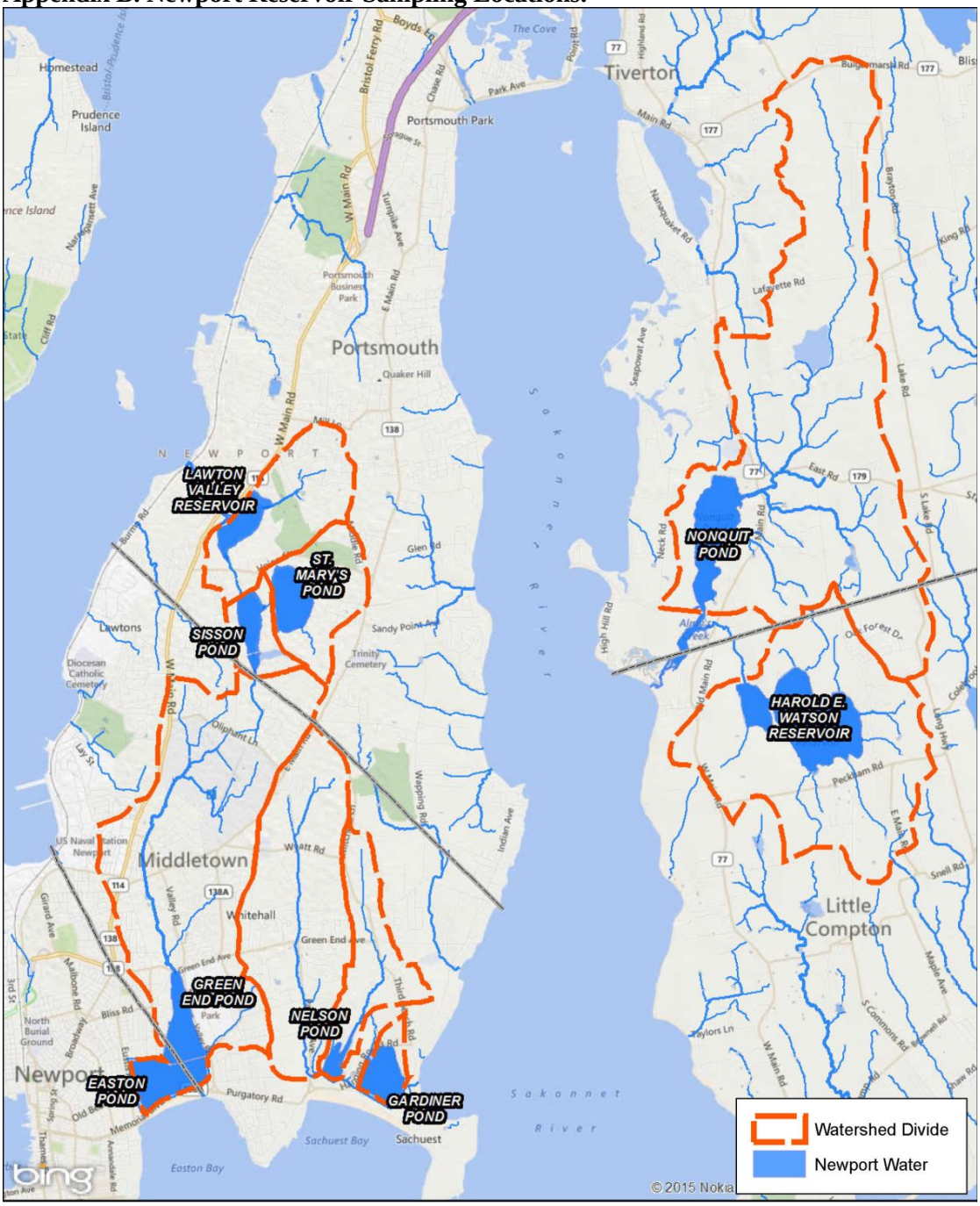
As soon as possible after each sampling event, calculations and determination for precision, completeness, and accuracy will be made and corrective action implemented if needed. If data quality indicators meet those measurement performance criteria documented throughout this sampling plan, the project will be considered a success. If there are data that do not meet the measurement performance criteria established in this QA Plan, the data may be discarded and sampled again or the data may be used with stipulations written about its accuracy in the Final Report. The cause of the error will be evaluated. If the cause is sampling error, additional training will be provided. Any limitations with the data will be documented in the Status Reports and the Final Report. All water quality data will be entered into Rhode Island DEM's State Water Information Management System (SWIMS) database. In addition, all data will be entered and saved onto the Project Managers computer for appropriate storage.

Appendix A. Sampling Site information

Table A1. Sampling Sites, Descriptions, Parameters and Frequency for the Newport Reservoir monitoring.

Reservoir	Station ID#	Site Description	Analytical/Field Data Collection Parameters	Frequency
Watson Reservoir	WR	Watson Reservoir Little Compton, RI Deepest spot (see Figure 10 Appendix B)	(Analytical-TP, OP, NH_3-N, TN, NO3, NO2, TOC, DOC, TTHM-UFC, Chl-a, algal ID/enumeration, microcystin-LR, UV absorbance) **Multiprobe** (DO; Temperature; Specific Conductance, pH) **Secchi Depth**	Bi-weekly from May to October (12 surveys total)
Nonquit Pond	NP	Nonquit Pond Tiverton, RI (see Figure 6 Appendix B)		Bi-weekly from May to October (12 surveys total)
Lawton Valley Reservoir	LVR	Lawton Valley Reservoir Portsmouth, RI (see Figure 9 Appendix B)		Bi-weekly from May to October (12 surveys total)
St. Mary's Pond	SMP	St. Mary's Pond Portsmouth, RI (see Figure 8 Appendix B)		Bi-weekly from May to October (12 surveys total)
Sisson Pond	SP	Sisson Pond Portsmouth, RI(see Figure 7 Appendix B)		Bi-weekly from May to October (12 surveys total)
North Easton Pond	NEP	North Easton Pond Middletown, RI (see Figure 2 Appendix B)		Bi-weekly from May to October (12 surveys total)
South Easton Pond	SEP	South Easton Pond Middletown-Newport, RI (see Figure 3 Appendix B)		Bi-weekly from May to October (12 surveys total)
Gardiner Pond	GP	Gardiner Pond Middletown, RI (see Figure 4 Appendix B)		Bi-weekly from May to October (12 surveys total)
Paradise Pond	PP	Paradise Pond Middletown, RI (see Figure 5 Appendix B)		Bi-weekly from May to October (12 surveys total)

Appendix B. Newport Reservoir Sampling Locations.



Title:	
Scale:	
Date:	3/4/2015
Drawn by:	paj

0 1 Mile

This map was created for informational, planning and guidance use only. It is a general reference, not a legally authoritative source for the location of natural or manmade features. Proper interpretation of this map may requre the assistance of appropriate professional services. The cartographic representations depicted have not been verified by a RI Registered Professional Land Surveyor and are not intended to be used in place of a survey.

File: F:\Work\TMDL grp\NewportWaterSupply\8x11_watersheds.mxd

RIGIS

Appendix B Table 1. Project sample site information.

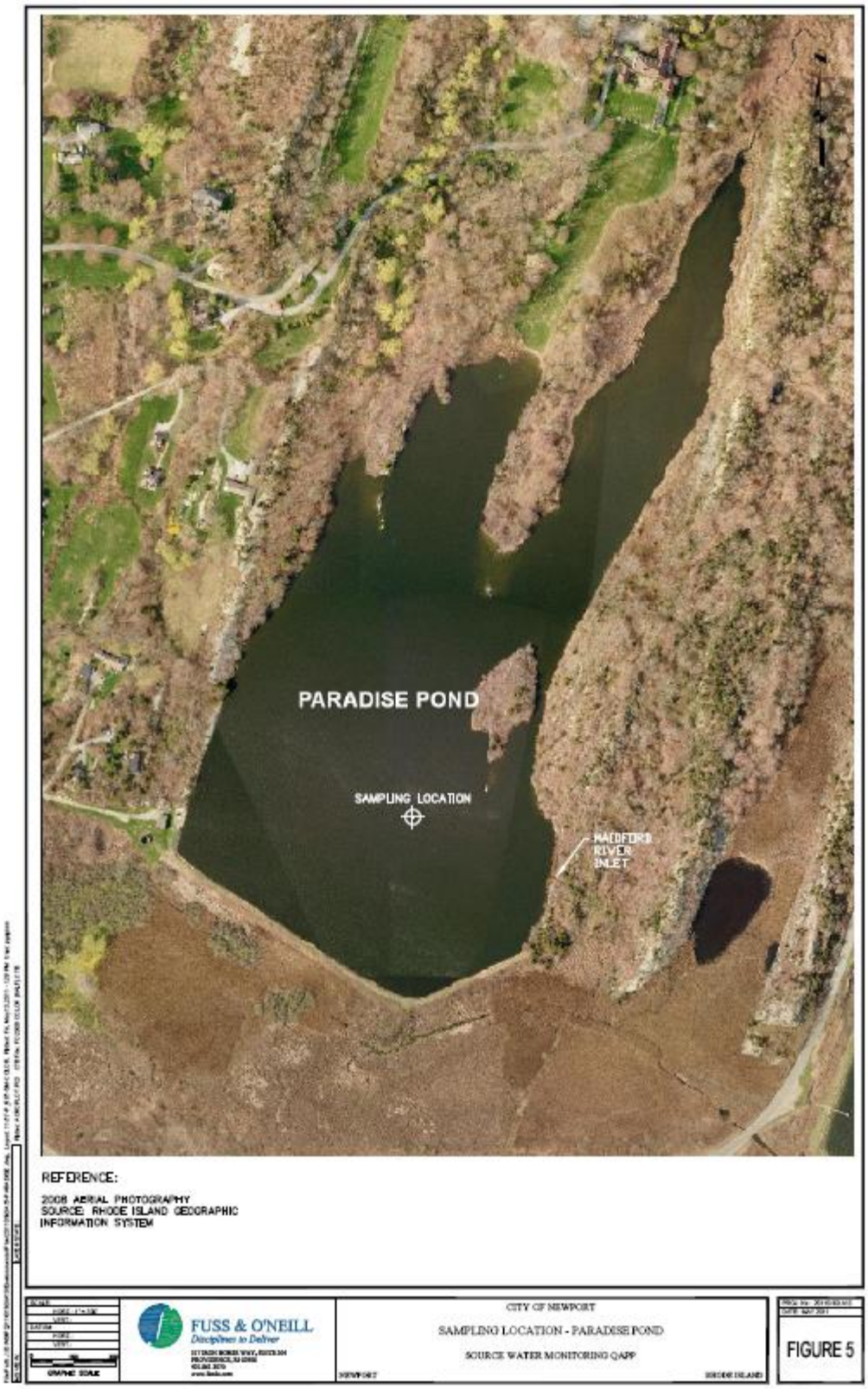
Reservoir	Location	Latitude (N)	Longitude (W)	Maximum Depth (ft)*
South Easton Pond	Newport	41.489321	-71.295056	14
North Easton Pond	Middletown	41.499749	-71.289699	14
Gardiner Pond	Middletown	41.492982	-71.255024	17
Paradise Pond	Middletown	41.492681	-71.262246	20
Sisson Pond	Portsmouth	41.553498	-71.277524	13
St. Mary's Pond	Portsmouth	41.554528	-71.273085	14
Lawton Valley Reservoir	Portsmouth	41.565248	-71.280271	30
Watson Reservoir	Little Compton	41.541103	-71.186162	25
Nonquit Pond	Tiverton	41.567661	-71.194591	14

* Deepest site discerned from bathymetry data.


BAILEY BROOK
INLET
SAMPLING LOCATION
EASTON POND NORTH
REFERENCE:
2008 AERIAL PHOTOGRAPHY
SOURCE: RHODE ISLAND GEOGRAPHIC
INFORMATION SYSTEM
FUSS & O'NEILL
Disciplines to Deliver
CITY OF NEWPORT
SAMPLING LOCATION - EASTON POND NORTH
SOURCE WATER MONITORING QAPP
NEWPORT
RHODE ISLAND
FIGURE 2


REFERENCE:
2008 AERIAL PHOTOGRAPHY
SOURCE: RHODE ISLAND GEOGRAPHIC INFORMATION SYSTEM
EASTON POND SOUTH
SAMPLING LOCATION
N
FUSS & O'NEILL
Disciplines to Deliver
CITY OF NEWPORT
SAMPLING LOCATION - EASTON POND SOUTH
SOURCE WATER MONITORING QAPP
NEWPORT
RHODE ISLAND
FIGURE 3


SAMPLING LOCATION
GARDINER POND
N
REFERENCE:
2008 AERIAL PHOTOGRAPHY
SOURCE: RHODE ISLAND GEOGRAPHIC INFORMATION SYSTEM
FUSS & O'NEILL
Disciplines to Deliver
CITY OF NEWPORT
SAMPLING LOCATION-GARDINER POND
SOURCE WATER MONITORING QAPP
NEWPORT
RHODE ISLAND
FIGURE 4


PARADISE POND
SAMPLING LOCATION
MACOFORD RIVER INLET
REFERENCE:
2008 AERIAL PHOTOGRAPHY
SOURCE: RHODE ISLAND GEOGRAPHIC INFORMATION SYSTEM
FUSS & O'NEILL
Disciplines to Deliver
CITY OF NEWPORT
SAMPLING LOCATION - PARADISE POND
SOURCE WATER MONITORING QAPP
FIGURE 5


SAMPLING LOCATION
NONQUIT POND
REFERENCE:
2008 AERIAL PHOTOGRAPHY
SOURCE: RHODE ISLAND GEOGRAPHIC
INFORMATION SYSTEM
FUSS & O'NEILL
Disciplines to Deliver
CITY OF NEWPORT
SAMPLING LOCATION - NONQUIT POND
SOURCE WATER MONITORING QAPP
NEWPORT
RHODE ISLAND
FIGURE 6


SAMPLING LOCATION
SISSON POND
N
REFERENCE:
2008 AERIAL PHOTOGRAPHY
SOURCE: RHODE ISLAND GEOGRAPHIC
INFORMATION SYSTEM
FUSS & O'NEILL
Disciplines to Deliver
CITY OF NEWPORT
SAMPLING LOCATION - SISSON POND
SOURCE WATER MONITORING QAPP
NEWPORT
RHODE ISLAND
FIGURE 7

REFERENCE:

2008 AERIAL PHOTOGRAPHY
SOURCE: RHODE ISLAND GEOGRAPHIC INFORMATION SYSTEM

FUSS & O'NEILL
Disciplines to Deliver

CITY OF NEWPORT

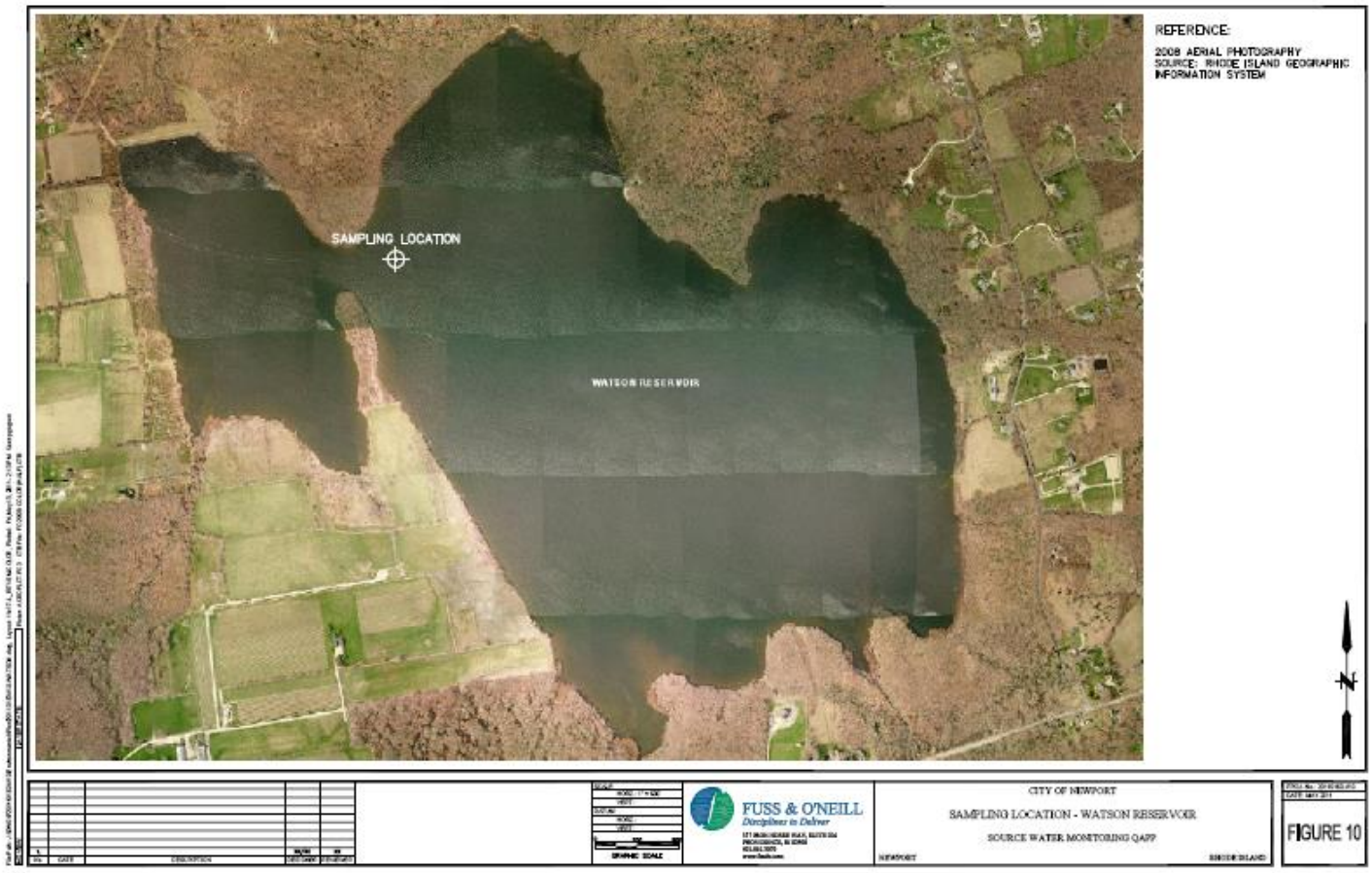
SAMPLING LOCATION - ST. MARY'S POND

SOURCE WATER MONITORING QAPP

NEWPORT RHODE ISLAND

FIGURE 8


SAMPLING LOCATION
Lawton Valley Reservoir
N
REFERENCE:
2008 AERIAL PHOTOGRAPHY
SOURCE: RHODE ISLAND GEOGRAPHIC INFORMATION SYSTEM
FUSS & O'NEILL
Disciplines to Deliver
CITY OF NEWPORT
SAMPLING LOCATION - LAWTON VALLEY RESERVOIR
SOURCE WATER MONITORING QAPP
NEWPORT
RHODE ISLAND
FIGURE 9


SAMPLING LOCATION
WATSON RESERVOIR
REFERENCE:
2008 AERIAL PHOTOGRAPHY
SOURCE: RHODE ISLAND GEOGRAPHIC INFORMATION SYSTEM
N
FUSS & O'NEILL
Disciplines to Deliver
CITY OF NEWPORT
SAMPLING LOCATION - WATSON RESERVOIR
SOURCE WATER MONITORING QAPP
NEWPORT
RHODE ISLAND
FIGURE 10

Appendix C. Field Sampling Standard Operating Procedures (FSOP)

FSOP1 Sounding Depth- Depthmate Model SM-5
FSOP2 Secchi Disc Depth
FSOP3 YSI ProPlus
FSOP4 RIDEM Surface Water Sample Collection
FSOP5 RIDEM Van Dorn Sample Collection

Appendix D. Laboratory Standard Operating Procedures (LSOP).

LSOP1: Chlrophyll-a
LSOP2: Nitrite-Nitrate Nitrogen
LSOP3: Ammonia Nitrogen
LSOP4: Total Nitrogen
LSOP5: Dissolved Organic Carbon/Total Organic Carbon
LSOP6: Uniform Formation Conditions (TTHM)
LSOP7: Ultraviolet Absorbance (254 nm)
LSOP8: Microcystin-LR
LSOP9: Total algal/cyanobacteria enumeration and ID
LSOP10: Total and Ortho-Phosphorus
LSOP11: EPA AED Laboratory Operating Procedures
LSOP12: EPA MED Water Quality Sample Processing SOP
LSOP13: EPA MED Bottle Washing for Field Samples SOP

Appendix E. Chain of Custody Forms
US EPA MED COC
US EPA AED COC
RI Dept. of HEALTH COC
Northeast Laboratories Inc. COC