QUALITY ASSURANCE PROJECT PLAN

Sampling Plan to Characterize Buckeye Brook Biodiversity Impairment and Potential Causes and/or Pollution Sources Contributing to the Impairment

Rhode Island Department of Environmental Management

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PROJECT MANAGER

O.J. (Skip) Viator
RIDEM, Office of Water Resources
235 Promenade Street Providence, RI 02908
Tel: 401.222.4700 ext. 7608 skip.viator@dem.ri.gov

Date

QUALITY ASSURANCE OFFICER

Elizabeth Scott
RIDEM, Office of Water Resources
235 Promenade Street Providence, RI 02908
Tel: 401.222.4700 ext. 7300 elizabeth.scott@dem.ri.gov

Date

EPA PROJECT OFFICER

Steve Winnett
EPA New England Region 1, Office of Ecosystem Protection
1 Congress Street Boston, MA 02114
Tel: 617.918.1599 winnett. steve@epa.gov

Date

EPA QA MANAGER

Steve DiMattei, Quality Assurance Chemist
USEPA
11 Technology Drive North Chelmsford, MA 01863
Tel: 617.918.8369 dimattei.steve@epa.gov

Date

2.0 Table of Contents

List of Tables

List of Figures

3.0 Distribution List

Table 3.1 Distribution List.

QAPP Recipient	Organization	Telephone Number	Address
Elizabeth Scott	RIDEM	401.222.4700 ext. 7300	235 Promenade Street Providence, RI 02908 elizabeth.scott@dem.ri.gov
O.J. (Skip) Viator	RIDEM	401.222.4700 ext. 7608	235 Promenade Street Providence, RI 02908 skip.viator@dem.ri.gov
Steve DiMattei	Lexington Laboratory New England EPA	781.860.4369	60 Westview Street Lexington, MA 02421 dimattei.steve@epa.gov
Dave McDonald	New England Regional Laboratory - EPA	617.918.8609	11 Technology Drive N. Chelmsford, MA 01863 mcdonald.dave@epa.gov
Carl Nielsen	ESS Group, Inc	401.330.1224	401 Wampanoag Trail, #400 E. Providence, RI 02915 cnielsen@essgroup.com
Henry Leibovitz	RI State Health Laboratories	401.222.5578	50 Orms Street Providence, RI 02904 Henry.leibovitzhealth.ri.gov

4.0 Project Organization

4.1 Project Organizational Chart

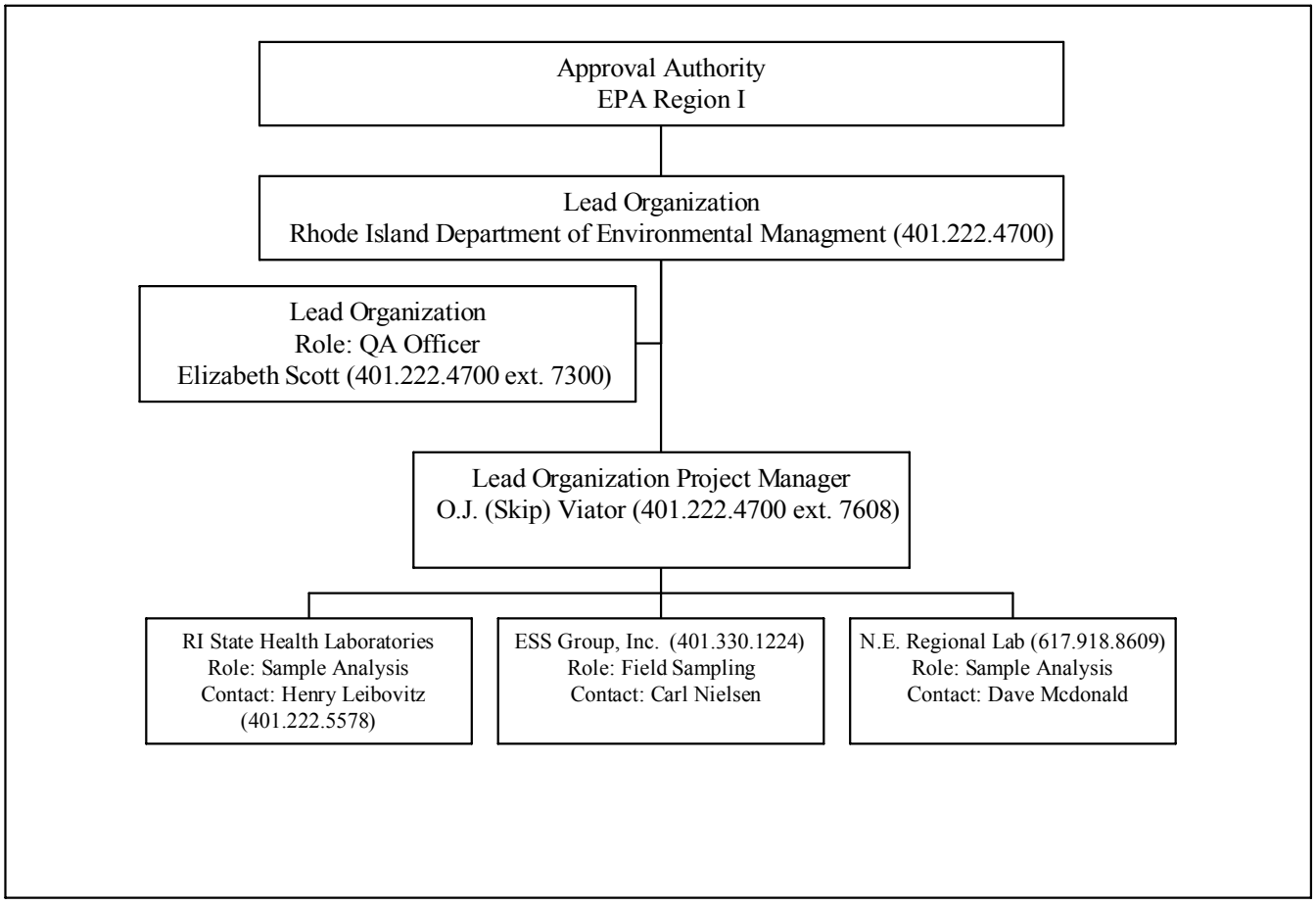


Figure 4.1 Project Organizational Chart

4.2 Communication Pathways

In all, two dry weather surveys and two wet weather surveys will be conducted to collect information to further characterize Buckeye Brook's biodiversity impairment, and to document water quality conditions related to possible stressors contributing to the biodiversity impairment, and to identify potential pollution sources contributing to the impairment. ESS Group will conduct the habitat assessment, and biological macroinvertebrate sampling and analyses, and periphyton. RIDEM staff will collect water quality and toxicity samples and take in-situ measurements. New England Regional Laboratory-EPA will analyze for toxicity, and the Rhode Island State Health Laboratories will conduct the water chemistry analyses.

The projected time period for the dry weather surveys are July and August 2008. The wet weather surveys will be conducted during a storm event in the September - November 2008 timeframe when the flows in the brook are high, and during the December 2008 – February 2009 winter season. Due to the limited nature of the surveys, it is anticipated that a minimum of personnel will be required to conduct the water quality sampling and in-situ measurements. The Project Manager will contact the personnel directly associated with this survey if any changes to the survey dates occur. Prior to the survey, the

Project Manager will contact the EPA laboratory and the RI State Health Laboratory to arrange for sample bottles. These bottles will be kept at RIDEM and will be used for all sampling activities with the exception of the biological sampling.

4.3 Training

All personnel associated with this survey will be given a Monitoring Plan that outlines the station locations and sampling protocol before sampling begins. If necessary, the field personnel will also be given a tour of the sampling locations prior to the commencement of the survey. The Project Manager will detail the protocol for each station during the sampling station tour.

In addition, for those unfamiliar with the equipment being used, training will include an introduction to all possible sampling equipment.

The Project Manager will keep a list of all individuals trained. This list will include the names of the individuals trained, who trained them, and the date.

5.0 Problem Definition/Background

Buckeye Brook is on the State of Rhode Island's 2008 303(d) list as being impaired for Biodiversity (Benthic-Macroinvertebrate Bioassessments), Enterococcus, and Fecal Coliform. TMDLs are required under Section 303(d) of the Clean Water Act and USEPA's Water Quality Planning and Management Regulations (40 CFR Part 130). RIDEM has completed water quality investigations for the pathogen impairments within the watershed and is completing preparation of the pathogen TMDL document. The goal of this sampling program is to further characterize the biological impairment of Buckeye Brook (through macroinvertebrate and periphyton sampling), to document water quality conditions related to possible stressors contributing to the biodiversity impairment, and to identify potential pollution sources contributing to the impairment. These data will be used to develop a TMDL addressing Buckeye Brook's biodiversity impairments.

Buckeye Brook was first listed as having a biodiversity impairment in 1998. Macroinvertebrate sampling conducted by RIDEM's contractor, ESS, Inc., as part of the Rhode Island Wadeable Streams, Biomonitoring and Habitat Assessment project, confirmed the Buckeye Brook biodiversity impairment based upon samples collected at a station located upstream of Warwick Avenue in Warwick, Rhode Island. Possible stressors contributing to the observed impairments at this location include runoff from nearby roads in this highly urbanized watershed, runoff from T.F. Green Airport (including use of glycol as a de-icing agent during the winter months), and runoff and/or groundwater leachate from an uncapped landfill (Truk-Away Landfill) located in the easternmost section of the airport property – along the western bank of Buckeye Brook.

5.1 Buckeye Brook Watershed

Buckeye Brook originates at the outlet of Warwick Pond in Warwick, Rhode Island. The brook runs in a southeast direction and empties into Old Mill Cove, which is south of Conimicut Point. Buckeye Brook is a second order stream with two main tributaries, Lockwood Brook and Warner Brook, both which join with Buckeye Brook below Route 117, and just prior to Old Mill Creek estuary. A smaller stream system north of the airport includes Spring Green Pond and a small stream that drains an agricultural area located on the northern side of Airport Road.

The highly urbanized watershed is 6.53 mi^2 and is the site of Rhode Island's primary airport, T.F. Green. The current land use in the watershed (RIGIS, s44llu95) is 44% residential, 19.7% forest and wetland, 16.1% airport, 11.4% commercial-industrial, 5.2 open, 3.3 agricultural, and 2.2% institutional. Figure 5.1 shows the watershed for Buckeye Brook.

5.2 Truk-Away Landfill

Truk-Away landfill is located on Industrial Drive in Warwick adjacent the approach end of runway 34. The landfill comprises approximately 36 acres of a 52-acre parcel and is zoned light industrial. Figure 5.2 shows the approximate boundary of the landfill. There are no buildings on the property and varying depths of fill are evidenced by rises and slopes and exposed trash and debris throughout the property.

During its operation, the landfill accepted municipal and industrial wastes from 1970 until its closure in 1977. The earliest known use of the property was a sand and gravel operation. In 1970, the site was operated by the Sanitas Disposal Company, and began accepting municipal and industrial wastes under the name of the Warwick Sanitary Landfill. By 1976, the company changed its name to Truk-Away of Rhode Island, Inc and the landfill became known as the Truk-Away Landfill.

During a state inspection in 1982, a landfill employee told the Rhode Island Department of Health (RIDOH) that he was responsible for overseeing the disposal of drummed chemical wastes. According to the employee, the types of wastes disposed at the landfill during its operations in the 1970s included: sulfur monochloride, benzyl chloride, xylol, toluene, pyridine, spent solvents, nitrobenzene, chlorobenzene, trichloroethylene, dyes, pigments, intermediate compounds made from benzene reactions, phenols, hydrogen peroxide, and benzene sulfonyl. During its operation, the landfill was the subject of several complaints, including roach and odor problems.

In 1977, the landfill was sold to the Rhode Island Department of Transportation (RIDOT), Division of Airports and ceased operations due to the hazards posed to T.F. Green State Airport by sea gulls attracted to the landfill. The landfill has never been clean closed, and various types of wastes are exposed throughout the landfill including medical waste, electrical waste, paint cans, mercury film packs, and fly ash.

There are no public or known private drinking wells within a 4-mile radius of the landfill. RIDEM classifies the groundwater beneath the landfill as GB: groundwater sources which may not be suitable for public or private drinking water without treatment due to known or presumed degradation. Surface water from the landfill drains to Buckeye Brook. Drainage from the northwest section of the landfill flows overland north, to a ponded section that traverses the northern border of the property. Groundwater appears to seep into this unnamed pond near the overland flow probable point of entry to the brook. Wetlands surround the landfill to the north, east, and south and appear to drain toward Buckeye Brook. Several areas of the landfill itself are ponded and support wetland type plants such as cattails and phragmites. Dark red and orange-stained soils, evidence of several leachate outbreaks, lead from the landfill's edges into the surrounding wetlands.

The nearest residence is located approximately 500 feet south of the landfill. There are no people living on or within 200 feet of an area of observed contamination. An estimated 700-800 people live within 1 mile of the landfill. Analytical results from surficial soil samples collected by Camp Dresser & McKee

(CDM, 1993) showed chromium, lead, mercury, polychlorinated biphenyls (PCBs), toluene, and several semi-volatile organic compounds to be present in the landfill. Several of the samples were taken adjacent to the unnamed stream that flows along the northern end of the landfill into the wetlands and eventually Buckeye Brook. No samples were taken in Buckeye Brook downstream of the confluence with the flow from the landfill.

5.3 Water Quality History

Buckeye Brook is a small watershed that is located in a heavily urbanized area. A comprehensive water quality study by RIDEM has never been conducted within the watershed, however, some volunteer monitoring has been performed on the brook and its tributaries in 2003 to 2005, as well as some winter surveys conducted on behalf of the Rhode Island Airport Corporation (RIAC). Additionally, the Truk-Away Landfill, located to the west of Buckeye Brook, had a site inspection performed in 1993 by CDM Federal Programs Corporation (CDM, 1993), and several monitoring wells on the landfill property were sampled by Lincoln Environmental for RIDEM in 2005.

Comprising 16% of the watershed's land area, T. F. Green Airport is a significant land use activity. During the winter months, aircraft de-icing and anti-icing operations are conducted, with the excess glycol runoff flowing into Buckeye Brook at two primary locations. One site is prior to the brook entering Warwick Pond, and the other site, which is the largest contributor, is just downstream of the exit for Warwick Pond. During and after these events, the presence of runoff from anti-icing and de-icing operations was detected in the brook downstream of Warwick Pond.

The Rhode Island Wadeable Streams, Biomonitoring and Habitat Assessment project has a station on the main stem of Buckeye Brook at the Old Warwick Road crossing. The ESS Group has been conducting an annual biological survey at this site since 2003 (ESS, 2004, ESS, 2005). Because the monitoring at this local is strictly biological, only field water quality measurements are collected. This location has been rated as moderately impaired for biodiversity in 2003 and 2004, which is the reason it was placed on the states 303 (d) list.

Table 5.1 lists the work that was done in the Buckeye Brook watershed over the past fifteen years. Data from these studies is available in the preliminary data report that is a part of the TMDL developmental process.

Table 5.1 Water Quality Studies Completed in Buckeye Brook Watershed.

Primary Organization	Sample Location	Period	Analyte
Rhode Island Department of Environmental Management (RIDEM)	Buckeye Brook, Lockwood Brook, and Warner Brook	2006	Field Measurements, FC, Enterococci
Rhode Island Department of Environmental Management (RIDEM)	Buckeye Brook, Lockwood Brook, and Warner Brook	2006	Field measurements
Watershed Watch University of Rhode Island	Buckeye Brook, Lockwood Brook, and Warner Brook	2003-2005	FC, Nutrients,
Rhode Island Department of Environmental Management (RIDEM)	Buckeye Brook at Old Warwick Avenue Bridge crossing	2003-present	Biological Assessment
Rhode Island Department of Environmental Management (RIDEM)	Truk-Away Landfill groundwater from monitoring wells	2005	VOCs
U.S. Environmental Protection Agency (USEPA)	Main area of Truk-Away Landfill	1993	Soil and Leachates

FC = Fecal Coliform, VOC = Volatile Organic Carbon

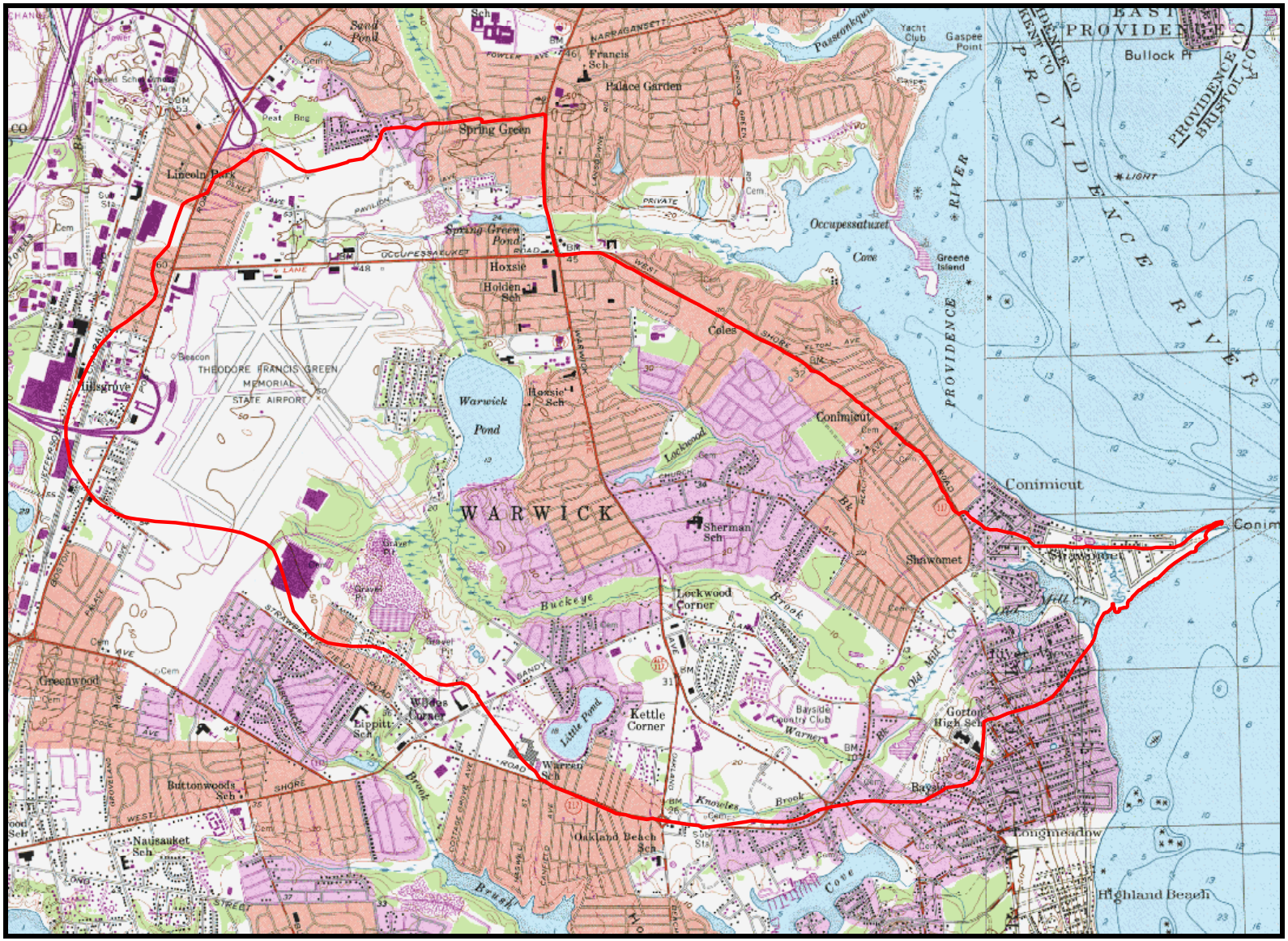


Figure 5.1 Buckeye Brook Watershed

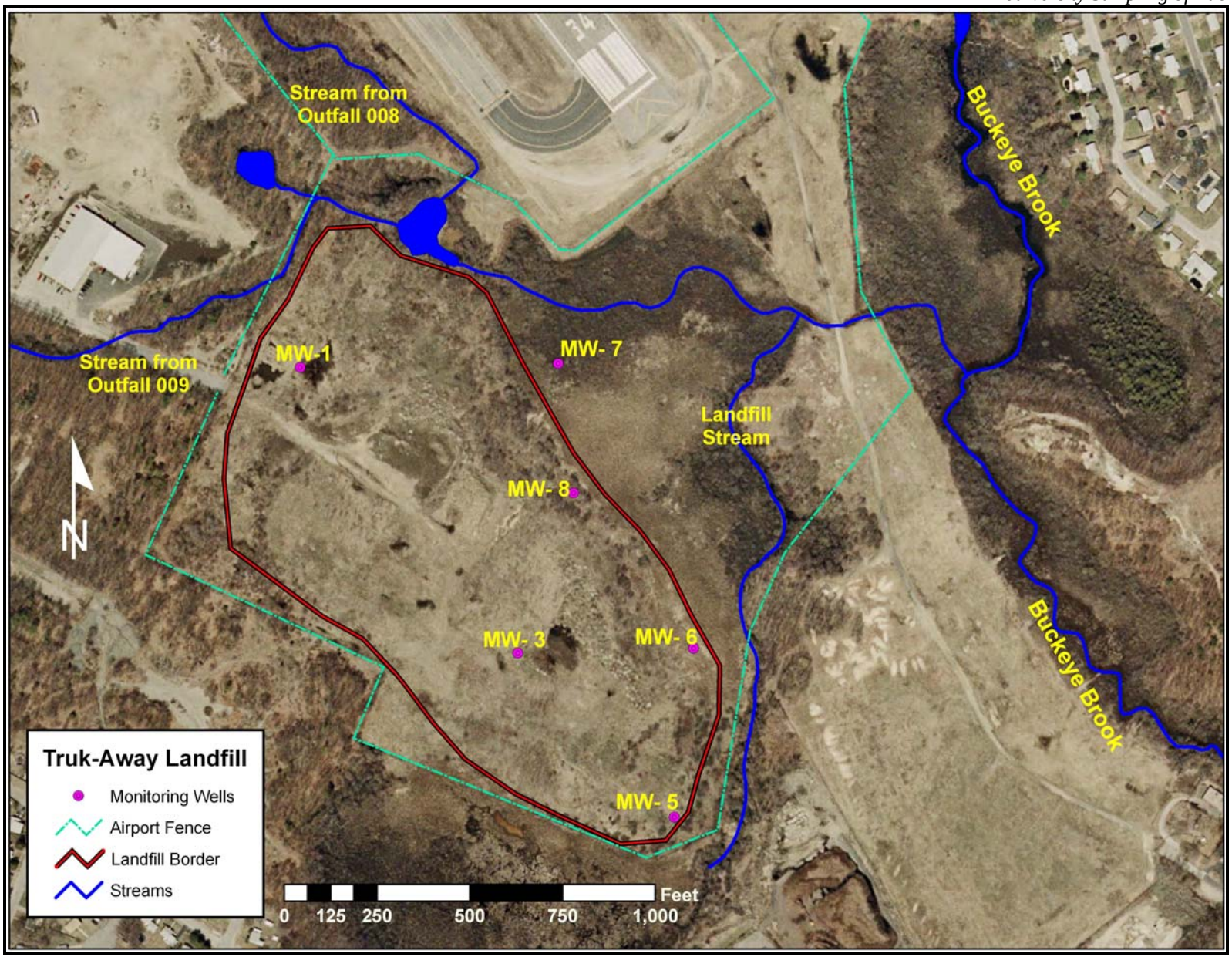


Figure 5.2 Truk-Away Landfill with Monitoring Well (MW) Locations

6.0 Project Description and Schedule

Starting in the summer of 2008, RIDEM will conduct four surveys to further characterize the biological impairment of Buckeye Brook (through water quality, macroinvertebrate, and periphyton sampling), to document conditions related to possible stressors contributing to the biodiversity impairment, and to identify potential pollution sources contributing to the impairment. The surveys will include biological, water quality, and toxicity testing for selected locations in Buckeye Brook, as well as the tributary streams receiving surface and/or groundwater discharge from the Truk-Away Landfill and T.F. Green Airport.

6.1 Project Objective

The objectives of this project as stated above are to provide additional monitoring data to characterize the extent of biological impairment, to document water quality conditions in Buckeye Brook related to possible stressors contributing to the biodiversity impairment, and to identify potential pollution sources contributing to the impairment by sampling discrete sources (streams receiving surface and/or groundwater discharge from T.F. Green airport and the Truk-Away Landfill) and by collecting samples along Buckeye Brook to bracket other possible sources/stressors. The data collected will be used in the development of a Biodiversity TMDL for Buckeye Brook.

Table 6.1 Proposed Project Schedule.

Task	Deliverable	2008										2009						
		M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J
Review Existing Data	Monitoring Plan																	
QAPP Preparation	QAPP Document																	
Site Preparation	NA																	
Sample Collection	NA																	
Laboratory Analysis	Laboratory Report																	
Final Data Report	Final Data Report																	

7.0 Project Quality Objectives and Measurement Performance Criteria

Collecting high quality data is one of the most important goals of this project. Specific data quality objectives include method detection limits, precision, accuracy, representativeness, comparability, and completeness. All the data quality objectives will be met if the data collected are useful in further characterizing the benthic community, possible stressors, and/or pollutant sources contributing to the brook's degraded condition.

7.1 Measurement Performance Criteria

Collecting high quality data is one of the most important goals of this project. Specific data quality objectives include precision, accuracy, representativeness, comparability, and completeness. Measurement performance criteria are briefly presented below. The complete listing of performance criteria can be found in Appendix A.

Precision
Precision is the degree of agreement among repeated measurements of the same characteristic under the same or similar conditions. The QC sample used to measure overall precision will consist of field duplicates. Duplicate precision is evaluated by calculating the Relative Percent Difference (RPD) and will considered precise if the RPD is less than 20 percent. The QC sample used to measure laboratory precision will consist of a matrix spike (MS) and a matrix spiked duplicate (MSD). Laboratory analysis will be considered precise if the RPD is less than 20 percent.

Accuracy/Bias
Accuracy is the extent of agreement between an observed value (sample result) and the true value of the parameter being measured. Bias describes the systematic or persistent error associated with a measurement process. These terms are used interchangeably in this document.

Representiveness
The selected stations and sampling frequency were chosen for their representativeness of conditions in the Buckeye Brook subwatershed. The extent to which the measurements represent actual environmental conditions will be somewhat restricted by the time of year the samples are collected and the overall weather conditions of that year (i.e. dry versus wet year).

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.

Completeness
If the data collected is sufficient to complete the TMDL report, then the data is considered to be complete. Measurement performance criteria help determine the completeness of a data set.

8.0 Sampling Process Design

This section describes the sampling system in terms of what media/matrices will be sampled, where the samples will be taken, the number of samples to be taken and the sampling frequency

8.1 Sampling Design Rationale

The media to be sampled will consist of surface water from Buckeye Brook, from the two outfall streams from the airport, and from the small stream that flows from the landfill and joins the discharge coming from airport Outfall 008. Figure 8.1 shows the sampling locations for the study and Table 8.1 describes the sample station locations, purpose/justification of locations, and parameters being sampled.

Two dry weather and two wet weather surveys will be conducted in 2008 and 2009. The first dry survey will be in July 2008 and will include water quality and toxicity testing. The second dry survey, scheduled for August 2008, will be for biological and water quality monitoring. The third survey will be under wet weather conditions during the September to November 2008 timeframe when flows in the brook are expected to be significantly higher than the flows during the dry surveys, and will include water quality testing only. The fourth survey will be conducted immediately after a winter de-icing event during the 2008-2009 winter season, again to determine the wet weather impact, but under winter

conditions when de-icing operations have been activated, and will include toxicity and water quality testing.

RIDEM staff will conduct two dry weather surveys to collect a single grab sample from each site in the Buckeye Brook watershed. Along with the samples from each site, one blank and one duplicate will be collected per survey for a total of ten samples per dry weather survey. These samples will be analyzed for dissolved trace metals (Mn, Fe, Cd, Cu, Zn, and Pb), hardness, five-day Biological Oxygen Demand (BOD_5), chlorides, ammonia nitrogen (NH_3-N), nitrate-nitrite nitrogen (NO_2+NO_3-N), Total Kjeldahl Nitrogen (TKN), Total Phosphorus (TP), Total Suspended Solids (TSS), Total Organic Carbon (TOC), and pH. These analyses, with the exception of TOC, will be conducted at the RI State Health Laboratories in Providence, RI. ESS Laboratories in Cranston, RI will conduct the TOC analysis. Dissolved oxygen, temperature, and specific conductance will be measured in RIDEM staff the field using a YSI 85 meter. All constituents listed will be analyzed for in all surveys with the exception of TOC, which will only be analyzed for the second dry weather survey when biological sampling will be done.

Two of the surveys will be under wet weather conditions. During the first wet survey, which is anticipated to occur in the September to November 2008 time frame, RIDEM staff will collect grab samples from all Buckeye Brook water quality monitoring stations. In addition to a prestorm sample, runoff samples will be collected at 2 to 3 hour intervals until the end of the storm. Not all samples will be analyzed, but those collected at key points on the storm hydrograph will be selected for analysis. These include the rising and falling limbs as well as the peak of the storm hydrograph. A trip blank and one duplicate will also be collected during the storm. It is estimated that a total of eighteen samples will be analyzed. The same suite of water chemistry constituents analyzed for the dry weather surveys will be analyzed for this survey.

The second wet weather survey will be under winter, de-icing conditions, and will include all Buckeye Brook stations. The same constituents listed above will be analyzed for during this survey. Toxicity sampling will be included in this survey and will follow the sampling protocol described in the paragraph below. This survey is expected to take place during the Winter 2008-9 time frame.

For two of the surveys (July 2008 and Winter 2008-9), RIDEM staff will collect surface water from six sites and delivered to the EPA Region 1 Laboratory at Chelmsford, MA where the toxicity testing will be conducted (Two Species – 7 Day Chronic Toxicity Test). The test is a renewable test, meaning that every two days, fresh surface water will be delivered to the lab. Over the seven days of testing, 2.5 gallons of sample water will be delivered to the lab three times. Toxicity testing will be conducted for each site, once per survey for a total of 12 toxicity tests. The summer toxicity testing is scheduled to be started on July 16, 2008, with additional samples collected and delivered to the Chelmsford lab on July 18th, and 21st, 2008. As stated previously, the winter testing will be conducted in the December 2008 to February 2009 timeframe with samples collected immediately following a winter storm that requires the activation of de-icing operations at the airport.

In August 2008, ESS Group will conduct biological field sampling at six selected stations that will consist of a combination of any or all of the following: Macroinvertebrate sampling, Periphyton sampling, and Stream Habitat Assessments. Only Stream Habitat Assessments will be done for stations OF01 and TA01, and no biological testing will be conducted at station BB03.

Table 8.1 Biodiversity Sampling Station Locations and Description

Station ID	Location	Description	Type	Purpose
BB00	Unidentified brook above Airport Road	In-stream: Upstream of Airport Road culvert	Water Quality, Biological, CPOM, FPOM, TOC, Flow	Background sample of stream away from airport and landfill influence
BB02	Buckeye Brook @ Lakeshore Drive	In-Stream, Downstream of culverts under Lakeshore Dr.	Water Quality, Biological, Toxicity, CPOM, FPOM, TOC, Flow	Brackets airport Outfalls 002 and 003 with background site BB00
BB03	Buckeye Brook @ Lakeshore Drive	In-stream, Exit of Warwick Pond	Water Quality, Toxicity, Flow	Separates Warwick Pond from confluence of airport Outfalls 008 and 009 with Buckeye Bk
BB04	Buckeye Brook @ Rufus Road	In-stream: Downstream of confluence of Buckeye Brook and airport outfall flows	Water Quality, Biological, Toxicity, CPOM, FPOM, TOC, Flow, YSI Continuous Measurements	Samples the brook after the confluence of all airport outfalls and the landfill
BB05A	Buckeye Brook downstream of Old Warwick Avenue	In-stream and approximately 1000 ft downstream of the ESS Biological Monitoring Site	Water Quality, Biological, Toxicity, CPOM, FPOM, TOC, Flow	To compare the 2008-09 monitoring results to the ESS biomonitoring at BB05 located at Old Warwick Avenue
WR01A	Warner Brook @ West Shore Drive	In-stream and downstream of WR01 site for Buckeye Brook pathogen surveys	Water Quality, Biological, CPOM, FPOM, TOC, Flow	Urban evaluation site away from airport and landfill influence
OF08	Stream from the airport Outfall 008	In-stream, prior to confluence with landfill stream	Water Quality, Habitat Assessment, Toxicity, Flow	Isolates Outfall 008 flows from landfill influence
TA01	Stream from Truk-Away Landfill	In-stream, prior to confluence with stream from Outfall 008	Water Quality, Habitat Assessment, Toxicity, Flow	Isolates landfill stream from outfall stream coming from airport
AP01	Stream downstream of confluence from stations OF08 and TA01	In-stream, prior to discharge into Buckeye Brook upstream of airport service road.	Biological, CPOM, FPOM, TOC, Flow	Evaluates biological community in stream downstream of landfill and airport
Adamsville Brook	@ USGS Gage off of Route 81, Little Compton, RI	In-stream sampling	Macroinvertebrate	Biological Reference Site

Note: Water Quality includes dissolved trace metals (Mn, Fe, Cd, Cu, Zn, and Pb), hardness, five-day Biological Oxygen Demand (BOD_5), chlorides, ammonia nitrogen (NH_3-N), nitrite-nitrate nitrogen (NO_2+NO_3-N), Total Kjeldahl Nitrogen (TKN), Total Phosphorus (TP), Total Suspended Solids (TSS), Total Organic Carbon (TOC), and pH. Field measurements will be collected for temperature, dissolved oxygen and specific conductance.
CPOM (coarse particulate organic matter) > 1mm; FPOM (fine particulate organic matter) is less than 1mm and more than .05 micrometers

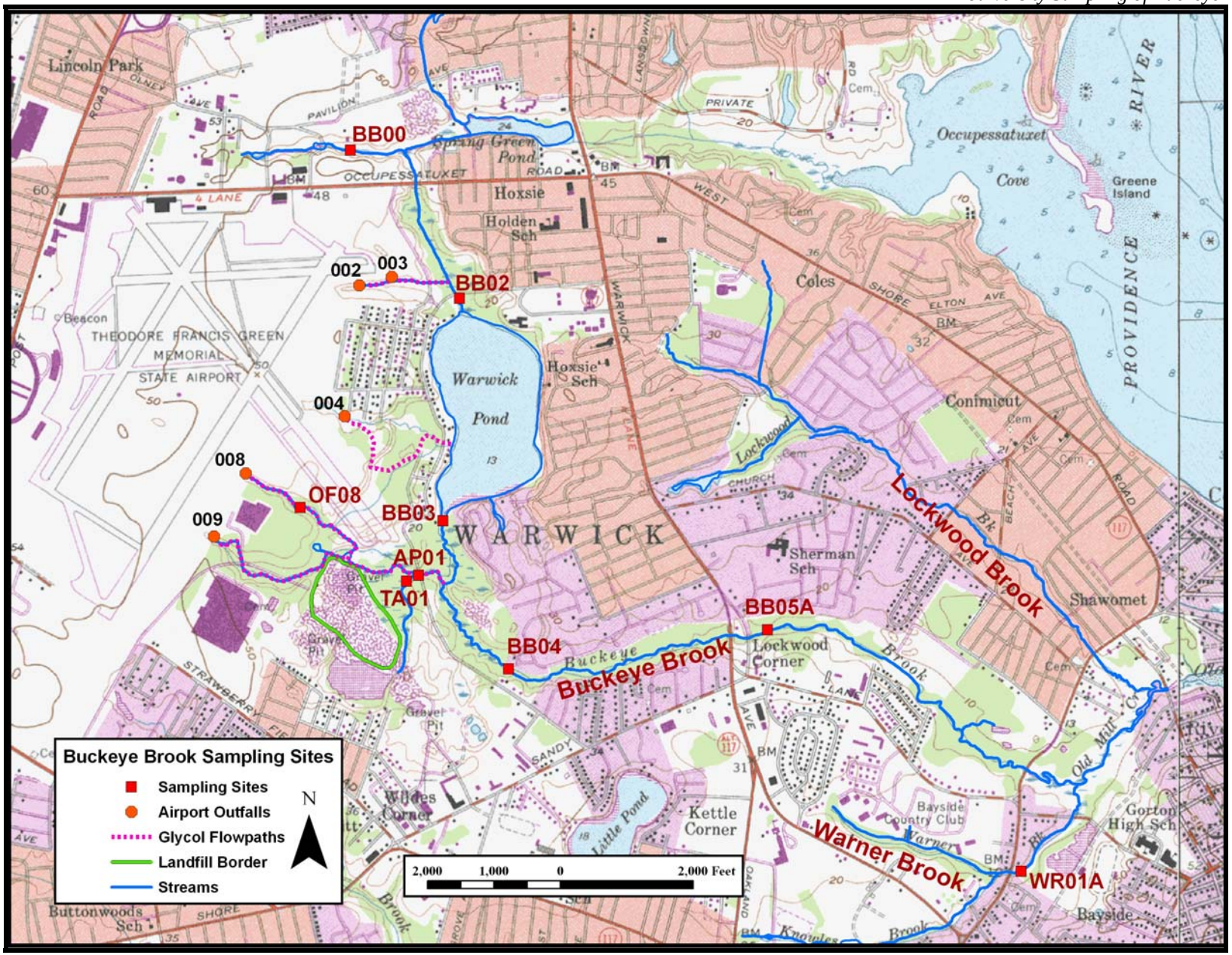


Figure 8.1 Sampling Locations for Water Quality, Toxicity and/or Benthic Macro-invertebrates

Macroinvertebrate samples will be collected from three locations at seven sites during the August survey. Macroinvertebrate populations will be collected using a Surber sampler, which consists of a 1'x 1' square that rests on the substrate, with an attached cylindrical net that is funneled into a small specimen jar. All rocks within the 1'x1' square are picked up and rubbed clean of any organisms. All organisms rubbed from the rocks will be swept into the specimen jar. These organisms are then taken back to the lab for sorting and identification. Taxonomic identification will be done to the lowest practical taxonomic level (subfamily for aquatic worms and genus/species level for aquatic insects, crustaceans and mollusks). During the macroinvertebrate sampling, ESS will collect particulate organic matter samples from each location that will be analyzed for Coarse Particulate Organic Matter (CPOM) and Fine Particulate Organic Matter (FPOM).

Three artificial substrate samplers will be deployed at each site to collect Periphyton samples for identification of algal taxa to the genus/species level, with biovolume analysis for each taxonomic group. This sampling will require two trips by ESS staff, one to deploy the samplers and one to collect the samplers.

As part of the biological monitoring, ESS Group field staff will also conduct Stream Habitat Assessments at each of the sampled sites following procedures outlined in EPA's Rapid Bio-assessment Protocol. Upstream and downstream conditions at each site will be photo documented during the survey.

During the August 2008 sampling survey, RIDEM staff will accompany ESS staff and will be collecting water quality and sediment TOC samples at each location that ESS collects the full biological suite of samples.

The last site shown in Table 8.1 is Adamsville Brook. This is one of two biomonitoring reference sites used by RIDEM for the Statewide Wadeable Stream Biomonitoring Program. Buckeye Brook is in the Narragansett Bristol Lowland region, and Adamsville Brook is the closest reference site to Buckeye Brook in the region. The results of the biological monitoring from Buckeye Brook will be compared to those from Adamsville Brook to determine the extent of the biological impairment in Buckeye Brook.

9.0 Sampling Procedures and Requirements

9.1 Sampling Procedures

Standard operating procedures for field sampling are located in Appendix A of this report, and Table 9.1 shows a summary of the project's SOPs and associated constituents.

9.2 Equipment Cleaning

All laboratories conducting analyses for this project will provide appropriate sterile bottles for the constituent that is collected.

Table 9.1 Project Sampling SOP Reference Table.

Reference Number /Title	Originating Organization	Equipment Identification	Modified for Work Project
Field Sampling SOP - FSOP-5 **Dissolved Oxygen, Temp, Specific Conductance**	RIDEM	YSI-85	No
Field-Sampling SOP FSOP-6 **Stream Discharge Measurement**	RIDEM	Marsh-McBirney, Inc.: Models 201D and 2000 Portable Flow Meters	No
Field Sampling SOP FSOP-BB1 **NH_3-N**	RIDEM	Not Applicable	No
Field Sampling SOP FSOP-BB1 **NO_2+NO_3-N**	RIDEM	Not Applicable	No
Field Sampling SOP FSOP-BB1 **Total Kjeldahl Nitrogen**	RIDEM	Not Applicable	No
Field Sampling SOP FSOP-BB1 **Total Phosphorous**	RIDEM	Not Applicable	No
Field Sampling SOP FSOP-BB2 **BOD_5**	RIDEM	Not Applicable	No
Field Sampling SOP FSOP-BB2 **Chloride**	RIDEM	Not Applicable	No
Field Sampling SOP FSOP-BB2 **pH**	RIDEM	Not Applicable	No
Field Sampling SOP FSOP-BB2 **Total and Dissolved Metals**	RIDEM	Not Applicable	No
Field Sampling SOP FSOP-BB2 **Total Suspended Solids**	RIDEM	Not Applicable	No
Field Sampling SOP FSOP-BB2 **Toxicity**	RIDEM	Not Applicable	No
Field Sampling SOP FSOP-BB3 **Sediment Total Organic Carbon** (TOC)	RIDEM	Not Applicable	No

9.3 Field Equipment Calibration and Maintenance

The Project Manager will ensure that all field equipment is operating properly. Table 9.2 shows the field sampling equipment calibration requirements for the project.

Table 9.2 Field Sampling Equipment Calibration Table.

Equipment	Inspection Frequency	Type of Inspection	Post Check Criteria	Acceptance Criteria/Post Check Criteria	Corrective Action
Marsh-McBirney, Inc. Model 201D Portable Water Flow Meter	Before Use in field	Zero Check, Zero Adjust		±0.05 ft/sec	Send to Factory
Dissolved Oxygen Meter, YSI 85	Each monitoring event	Battery Life, electrical connections, membrane condition	Saturated air and zero-DO (<0.5mg/l) checks at beginning of day, reconfirm after every 25 samples and at end	Recalibrate	Recalibrate
Specific Conductance Meter, YSI 85	Each monitoring event	At beginning of each sampling day, reconfirm after every 25 samples and at end	Standard 1000 uS/cm solution reads 1000+/-1%	Standard 1000 uS/cm solution reads 1000+/-1%	Recalibrate
Marsh-McBirney, Inc. Model 2000 Portable Flow Meter	Once before Sampling or as Needed	Low Battery Flag is displayed		Low Battery Flag is not displayed	Change Batteries

Table 9.3 Field Equipment Maintenance, Testing, and Inspection Table.

Survey	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Reference
Marsh-McBirney, Inc. Model 201D Portable Water Flow Meter	Clean Sensor	Once before Sampling Season or as Needed	Visibly free of non-conductive grease or oils	Clean Sensor	E-1
Marsh-McBirney, Inc. Model 201D Portable Water Flow Meter	Batteries	Before Sampling or as Needed	Display 9.8 and 10.2 within 10 seconds	Change Batteries	S-3
Marsh-McBirney, Inc. Model 2000 Portable Flow Meter	Clean Sensor	Once before Sampling Season or as Needed	Visibly free of non-conductive grease or oils	Clean Sensor	E-1
Marsh-McBirney, Inc. Model 2000 Portable Flow Meter	Batteries	Low Battery Flag is displayed	Low Battery Flag is not displayed	Change Batteries	NA

10.0 Sample Handling, Tracking, and Custody Requirements

10.1 Field Notes

Sample teams will utilize either field notebooks or field log sheets to record relevant information prior to and during sampling events to include the following minimum information: Time of arrival at site, related site sketches, and general observations/comments. A copy of a blank field sheet is presented in Attachment E. Field notebooks will contain the same information as the field sheets.

10.2 Sample Handling and Tracking System

Immediately prior to collecting each sample, the sample label will be filled out completely using a permanent marker. All samples will be placed in a cooler with ice immediately after the sample is collected. Sample identification will be written on the sample bottle using a permanent marker.

Samples will be delivered to the laboratory the same day they are collected. All samples will be transported to the laboratory under proper chain-of-custody protocol. A copy of a blank chain-of-custody is presented in Figure 10.1.

At the completion of sampling, all log sheets and notebooks will be turned over to the Project Manager.

11.0 Field Analytical Method Requirements

Field analysis will be conducted for the following constituents: Dissolved Oxygen, Temperature, and Specific Conductivity. These measurements will be taken using a YSI- 85 Handheld Dissolved Oxygen, Conductivity, Salinity, and Temperature System

12.0 Fixed Laboratory Analytical

All samples will be taken to RI State Health Laboratories in Providence, RI. Table 12.1 summarizes the laboratory SOPs presented in Attachment C.

Figure 10.1 RI Department of Health Chain of Custody Form

☐ **ICED FOR TRANSPORT**

SAMPLE SUBMISSION FORM/CHAIN OF CUSTODY
Rhode Island Department of Health Laboratories
50 Orms Street, Providence, RI 02904

Sample Submission Number

Legal Sample | |
Client: DEM - WRE Ambient River Monitoring

A. Client ID#: Run #:	Mail Report To:
B. Client Name:	Street:
	City:
	Report To (Agency/Person) :

Collected By: _____ Collected Date: _____ Time: _____ Matrix: Water **X** Other

Source# _____ **C.** Facility ID#: _____ **D.** _____ **E.** Sample Point ID#: _____

Collection Point **(tap/well):** _____

Collection Point Address: _____
Name **Street** **City**

Class:_____ Origin#: _____ pH: _____ (adj.pH): _____ CL Residual: _____

Inorganics Lab	*DUP*	*Metals*	*DUP*	**Organics Lab**	*FB*	**Sanitary Microbiology**
Non-metals Tests		___WL36 Mercury (245.1)		___PE4–CARB (531.1)		___SM2 – MF Total Coliform
___WL1 Turbidity		___WL65 Lead & Copper(200.8)		___PE12–Pest/PCB (608)		___SM3 – SPC
___WL7 Total Suspended Solids				___PE14–EBD/DBCP (504)		___SM34 – Colilert
___WL10 BOD		***Metals for New Systems***		___PE18–Pest/PCB (508)		___SM36 – Pres./Abs.
___WL12 Total Phosphorous		**___WL66 Full Set (200.8)**		___PE21–HERB/ (515.3)		___SM1 – MPN
___WL13 pH		___WL75 Antimony		___PE22–Pest/PCB+ (508)		# of Tubes ____ Dil._____
___WL17 ortho-phosphate		___WL76 Arsenic		___PE_____		Thru___ Fecal Coliform____
___WL ammonia - N		___WL77 Barium				___SM37 Enterolert
____WL Total Kjeldahl - N		___WL78 Berylllium		___TO2–THM (524.2)		___SM38 A1 Fecal Coliform
____WL Total Nitrogen		___WL79 Cadmium		___TO3–PWVOC (524.2)		
___WL11 Cyanide (335.4)		___WL81 Chromium		___TO4–PET HCS & TO3		
___WL16 Nitrate (353.2)		___WL64 Copper		___TO11–UFVOC (624/603)		
___WL18 Alkalinity (2320B)		___WL82 Iron		___TO12–WQVOC (524.2)		
___WL20 Chloride (300.0)		___WL63 Lead		___TO14–USR Fee B/N Ext		
___WL21 Fluoride (300.0)		___WL83 Manganese		___TO17–PET HC & TO12		
___WL22 Hardness (2340B)		___WL84 Nickel		___TO19–Total EXTR (625)		
___WL56 Nitrite (353.2)		___WL85 Selenium		___TO25–WQ SEMI (525.2)		
___WL_____		___WL86 Silver		___TO27–AGR SVOC (525/2)		
___WL_____		___WL87 Thallium		___TO_____		
		___WL88 Zinc				
Metals DEM Ambient River Monitor		***Metals Routine Set***				
__WL62 (200.8) Diss. Cd, Cu, Pb		**___WL68 Full Set (200.8)**				
		___WL78 Berylljum				
__WL62Fe (200.8) Total Fe		___WL81 Chromium				
		___WL84 Nickel				
__WL67 Full Set (200.8)		___WL76 Arsenic				
___WL69 Magnesium		___WL85 Selenium				
___WL70 Potassium		___WL79 Cadmium				
___WL71 Sodium		___WL75 Antimony				
___WL72 Calcium		___WL77 Barium				
		____WL87 Thallium				
___WL73 Sodium Composite(200.8)						

Must Be Completed For Legal Sample	**Container**		**Preservative Added**		
Test Code	Number	Type	By Lab	By Collector	Special Instructions

Chain of Custody

Relinquished By	**Date**	**Time**	**Received By**	**Date**	**Time**	**Comments**

Table 12.1 Fixed Laboratory Analytical Method – SOP Reference Table

Fixed Laboratory Performing Analysis	Title, Revision Date and/or Number	Definitive or Screening	Analytical Parameter	Instrument	Modified for Work Project Y or N
RI State Health Laboratories	RIDOH SOP WL 10 rev. 4 BOD_5	Definitive	5 Day Biological Oxygen Demand		N
RI State Health Laboratories	RIDOH SOP WL12 rev. 3 Chloride	Definitive	Chloride	Ion Chromatograph	N
RI State Health Laboratories	RIDOH SOP WL 22 rev. 4 Hardness	Definitive	Hardness as $CaCO_3$	ICP-Mass Spectrometer	N
RI State Health Laboratories	RIDOH SOP WL ICPMS rev. 1 Dissolved Metals	Definitive	Trace Metals	ICP-Mass Spectrometer	N
RI State Health Laboratories	RIDOH SOP WL ICPMS rev. 1 Total Metals	Definitive	Trace Metals	ICP-Mass Spectrometer	N
ESS Laboratories	ESS Laboratory SOP 40_0024L NH_3-N	Definitive	NH_3-N		N
RI State Health Laboratories	RIDOH SOP WL16 nitrate rev. 4 and RIDOH SOP WL56 rev 5 nitrite NO_2+NO_3-N	Definitive	NO_2+NO_3-N	Auto analyzer	N
RI State Health Laboratories	RIDOH SOP WL 13 rev. 6 pH	Definitive	pH	microprocessor	N
ESS Laboratories	ESS Laboratory SOP 40_0019B Total Kjeldahl Nitrogen	Definitive	TKN		N
RI State Health Laboratories	RIDOH SOP WL12 rev. 3 Total Phosphorus	Definitive	Total Phosphorus	spectrophotometer	N
RI State Health Laboratories	RIDOH SOP WL SOLIDS rev. 3 TSS	Definitive	Total Suspended Solids		N
ESS	SOP-X TOC	Definitive	Total Organic Carbon		N
EPA Laboratory	Chronic Toxicity Test Method for Ceriodaphnia Dubai Rev 4. 2/19/08	Definitive	Toxicity		N
EPA Laboratory	Chronic Toxicity Test Method for Pimephales Promelas Rev 6. 1/31/08	Definitive	Toxicity		N

*Lotus Notes- SOP Database

13.0 Quality Control Requirements

Quality control (QC) is the system of technical activities that measures the performance of a process. Field sampling and laboratory QC protocols are presented in this section.

13.1 Field Quality Control Samples

The types and quantities of field QC samples are summarized in Appendix C.

13.2 Fixed Laboratory Analytical Quality Control Samples

The types and quantities of fixed laboratory QC samples are summarized in Appendix A.

14.0 Data Acquisition Requirements

There are no data acquisition requirements

15.0 Documentation, Records, and Data Management

All samplers will be given either a field notebook or log sheets. The monitoring plan given out when the each sampler collects his/her equipment includes specific information on what needs to be recorded on these sheets. All log sheets will be given to field leader at the conclusion of sampling. Initials on these sheets identify the sampler. The Project Manager will review the sheets within three days to identify any possible errors or omissions. The Project Manager will contact any sampler whose sheet shows any discrepancies. In addition, the Project Manager will try to contact all samplers to identify any problems or additional feedback that would make future sampling easier.

Each sampler will be responsible for filling out the chain of custody sheets (Figure 10.1) and for delivering the samples to the respective laboratory unless the Project Manager or designee collects the samples from the samplers for transportation to the lab. When the samples are picked up from the samplers, the Project Manager or designee will check the chain of custody sheets. The samples and chain of custody sheets are also checked at the laboratory. A copy of the chain of custody form will be given to RIDEM when the samples are dropped off at the laboratory. After analysis is complete, sample results from the laboratory will be mailed to RIDEM.

After each sampling report, a brief Status Report will be written to document any changes to the Monitoring Plan. All information collected throughout the project will be summarized in the Final Data Report. Information included in the Final Data Report is described in Section 17.0. Table 15.1 lists records that will be generated throughout this project.

After each sampling event, and upon the completion of all analysis by the participating laboratories, all data will be sent to the Project Manager (Skip Viator 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 15.1 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			

16.0 Assessments and Response Actions

The Project Manager or designee will be responsible for each of the project tasks and their associated quality assurance and quality control procedures. The Project Manger will provide consistency between sampling events and sampling teams. Continual reports to the QA Officer about the status of sampling, quality assurance, and quality control will highlight any problems that are encountered during sampling. If needed, the QA Officer and Project Manager will halt sampling until problems are remedied.

Table 16.1 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 Systems Audit	Start of Sampling	I	Skip Viator RIDEM	Elizabeth Scott RIDEM
ESS	Start of Sampling	E	Carl Nielsen ESS	Elizabeth Scott RIDEM
EPA Lab	Start of Sampling	E	Dave McDonald EPA Lab	Elizabeth Scott RIDEM
RI State Health Laboratories	Prior to Sample Receipt	E	Henry Leibovitz, RI State Health Laboratories	Skip Viator RIDEM

17.0 QA Management Reports

Table 17.1 lists the QA Management Reports that will be generated throughout this study.

As needed during this project, the Project Manager and the QA Officer will meet 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.

At the completion of all sampling events, the Project Manager will write a final report summarizing the results of the completed sampling program. Information in this final report will include the following information:

- Brief description of each sampling event
- Data tables of all data collected during the sampling event
- Attachments
  - Status Reports

- Sampling Logs
- Chain of Custody forms
- Laboratory data sheets provided by the labs

Table 17.1 QA Management Reports.

Type of Report	Frequency	Person(s) Responsible for Report Preparation	Report Recipient
Verbal Status Report	As needed	Skip Viator RIDEM	Elizabeth Scott RIDEM
Written Status Report	After each wet weather survey	Skip Viator RIDEM	Elizabeth Scott RIDEM
Final Report	Completion of sampling	Skip Viator RIDEM	Elizabeth Scott RIDEM

18.0 Verification and Validation Requirements

Both the Project Manager and the QA Officer will review all data collected during this study to determine if the data meets QAPP Objectives. Decisions to qualify or reject data will be made by the Project Manager and QA Officer. 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 an Appendix to the report and discussed in the general text of the report. Problems will also be documented in each survey's written Status Report. 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.

19.0 Verification and Validation Procedures

All data collected during the wet weather studies will be included in the appendix of the report. Once the data has been collected, it will be entered into Microsoft Excel files. The Project manager will proofread the data entry for errors. Errors will be corrected. Outliers and inconsistencies will be flagged for further review with the QA Officer. The decision to discard data will be made by the Project manager and QA Officer. Problems will be discussed in the Final Report. Table 19.1 discusses the data verification process.

Table 19.1 Data Verification Process.

Verification Task	Description	I/E	Responsible for Verification
Field Notes	Field notes will be collected at the end of each day and reviewed. Any required corrective actions will be addressed with the field samplers prior to further sampling. After the field notes will be entered into Excel, the data will be proofread for any data entry errors. Copies of the field notes will be maintained in the project file.	I	Skip Viator/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	Skip Viator/RIDEM Dave McDonald/EPA Henry Leibovitz/ RI State Health Lab
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 be also reviewed by the sampling organization.	I/E	Skip Viator/RIDEM Dave McDonald/EPA Henry Leibovitz/ RI State Health Lab

Data validation will utilize the measurement performance criteria documented in Appendix A of this report.

20.0 Data Usability/Reconciliation with Project Quality Objectives

As soon as possible after each sampling event, calculations and determinations 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 QA 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 equipment failure, calibration/maintenance techniques will be reassessed and improved. If the problem is sampling team error, retraining will occur. Any limitations with the data will be documented in the Status Reports and the Final Report.

References

Marsh-McBirney, Inc. *Instruction Manual Model 201/201D Portable Water Flow Meter.*

Marsh-McBirney, Inc. (1990). *Model 2000 Installation and Operations Manual.*

YSI, Inc. (1998). *YSI Model 85 Handheld Oxygen, Conductivity, Salinity, and Temperature System Operations Manual*

Appendix A: Laboratory Performance Criteria

Sampling SOP	RIDOH SOP WL ICPMS rev. 1			
Medium/Matrix	Surface Water			
Analytical Parameter	**Metals - Mn Cd, Cu, Pb, Fe, Zn,**			
Concentration Level	Mn, Cd, Cu, Pb, 1 ug/L, Fe 10 ug/L, Zn 20 ug/L,			
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 200.8	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	EPA 200.8	1.0 ug/L	Method Blank	A
Accuracy/bias Contamination	EPA 200.8	Quantitation within limits	Quality Control Sample - QCS	A
Data - Completeness	EPA 200.8	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	EPA 200.8	<20%RPD	Field Duplicates	S/A

Sampling SOP	RIDOH SOP WL16 nitrate rev. 4 and RIDOH SOP WL56 rev 5 nitrite			
Medium/Matrix	Surface Water			
Analytical Parameter	**Nitrate -Nitrite -N**			
Concentration Level	<0.05 mg/L			
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 353.2	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	EPA 353.2	<0.05 mg/L	Method Blank	A
Accuracy/bias Contamination	EPA 353.2	90 -110% R	Laboratory Fortified Blank Sample -LFB	A
Data - Completeness	EPA 353.2	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	EPA 353.2	<20%RPD	Field Duplicates	S/A

Sampling SOP	ESS Laboratory SOP 40_0024L			
Medium/Matrix	Surface Water			
Analytical Parameter	**Ammonia Nitrogen**			
Concentration Level	0.10 mg/L			
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 350.2 /SM 4500 –NH3 B G	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	EPA 350.2 /SM 4500 –NH3 B G	0.1 mg/L	Method Blank	A
Accuracy/bias Contamination	EPA 350.2 /SM 4500 –NH3 B G	80 -120% R	Laboratory Control Sample -LCS	A
Data - Completeness	EPA 350.2 /SM 4500 –NH3 B G	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	EPA 350.2 /SM 4500 –NH3 B G	<20%RPD	Field Duplicates	S/A

Sampling SOP	ESS Laboratory SOP 40_0019B			
Medium/Matrix	Surface Water			
Analytical Parameter	**Total Kjeldahl Nitrogen**			
Concentration Level	0.20 mg/L			
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	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	EPA 351.2	0.2 mg/L	Method Blank	A
Accuracy/bias Contamination	EPA 351.2	80 -120% R	Laboratory Control Sample -LCS	A
Data - Completeness	EPA 351.2	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	EPA 351.2	<20%RPD	Field Duplicates	S/A

Sampling SOP	RIDOH SOP WL12 rev. 3			
Medium/Matrix	Surface Water			
Analytical Parameter	**Total Phosphorous**			
Concentration Level	<0.02 mg/L			
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	SM 4500 P E	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	SM 4500 P E	<0.02 mg/L	Method Blank	A
Accuracy/bias Contamination	SM 4500 P E	90 -110% R	Laboratory Fortified Blank Sample -LFB	A
Data - Completeness	SM 4500 P E	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	SM 4500 P E	<20%RPD	Field Duplicates	S/A

Sampling SOP	RIDOH SOP WL12 rev. 3			
Medium/Matrix	Surface Water			
Analytical Parameter	**Chloride**			
Concentration Level	<0.2 mg/L			
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 300	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	EPA 300	<0.2 mg/L	Method Blank	A
Accuracy/bias Contamination	EPA 300	90 -110% R	Laboratory Fortified Blank Sample -LFB	A
Data - Completeness	EPA 300	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	EPA 300	<20%RPD	Field Duplicates	S/A

Sampling SOP	RIDOH SOP WL SOLIDS rev. 3			
Medium/Matrix	Surface Water			
Analytical Parameter	**Total Suspended Solids - TSS**			
Concentration Level	< 0.1 mg/L			
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	SM2540 D	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	SM2540 D	<0.1 mg/L	Method Blank	A
Accuracy/bias Contamination	SM2540 D	Quantitation within limits	Quality Control Sample - QCS	A
Data - Completeness	SM2540 D	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	SM2540 D	<20%RPD	Field Duplicates	S/A

Sampling SOP	RIDOH SOP WL 13 rev. 6			
Medium/Matrix	Surface Water			
Analytical Parameter	**pH**			
Concentration Level	pH 1-14 in 0.1 units			
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	SM4500 H^+ B	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	SM4500 H^+ B	0.1 pH units	Method Blank	A
Accuracy/bias Contamination	SM4500 H^+ B	Quantitation within limits	Quality Control Sample - QCS	A
Data - Completeness	SM4500 H^+ B	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	SM4500 H^+ B	<20%RPD	Field Duplicates	S/A

Sampling SOP	RIDOH SOP WL 22 rev. 4			
Medium/Matrix	Surface Water			
Analytical Parameter	**Hardness**			
Concentration Level	< 1.0 mg/L			
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	SM2340 B	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	SM2340 B	< 1.0 mg/L	Method Blank	A
Accuracy/bias Contamination	SM2340 B	Quantitation within limits	Quality Control Sample - QCS	A
Data - Completeness	SM2340 B	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	SM2340 B	<20%RPD	Field Duplicates	S/A

Sampling SOP	RIDOH SOP WL 10 rev. 4			
Medium/Matrix	Surface Water			
Analytical Parameter	**5-Day BOD**			
Concentration Level	1.0 mg/L			
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	SM 5210 B	<20%RPD	Lab Duplicates	A
Accuracy/bias Contamination	SM 5210 B	1.0 mg/L	Method Blank	A
Accuracy/bias Contamination	SM 5210 B	Quantitation within limits	Quality Control Sample - QCS	A
Data - Completeness	SM 5210 B	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	SM 5210 B	<20%RPD	Field Duplicates	S/A

Appendix B: Field Sampling SOPs –RIDEM

FSOP-BB1

Total Phosphorus (TP)
Total Kjeldahl Nitrogen (TKN)
Ammonia Nitrogen (NH_3-N)
Nitrite-Nitrate Nitrogen (NO_2 + NO_3–N)

1. The following field procedures shall be followed for those sample containers with Sulfuric Acid (H_2SO_4) preservative.

2. The laboratory shall provide clean sample bottles of the appropriate size and type.

3. Ensure all bottles are labeled properly prior to sampling. Bottles for sampling in Buckeye Brook are preserved with H_2SO_4 and therefore the sample bottle cannot be used as a collection device.

4. Where there is flow or current, always approach the sampling location slowly from the downstream. Once you have reached the sampling location allow the water to return to a pre-disturbed condition.

5. Surface sampling with the water collection container (Maximum depth of 1 to1 ½ ft)
    - Remove cap from the collection container, taking care not to touch inside of the collection container mouth or cap.

    - Rinse the collection container with water by holding it by the bottom and plunging it mouth-first into the medium to about elbow depth. Your hand should always move in a forward motion to avoid water from sliding over your arm and into the container.

    - To fill the sample collection container, turn the mouth upward, bring it above the surface and empty the container. Rinse the collection container three times at each sampling location prior to transferring the collected sampled into the sample bottle containing the preservative.

    - Remove the cap from the sample container, taking care not to touch the inside of the container or cap. Be especially careful not to spill any of the preservative.

    - Carefully transfer the water from the collection container into the sample container. Repeat as required until the sample container is filled within one-half inch of the top, taking care NOT to overflow the container. Replace the cap on the sample container ensuring it is on tight to avoid any leakage of the sample. Replace the cap on the collection container.

    - Store the sample container in cooler. Add ice or freezer packs to cooler to maintain proper temperature (4 °C or less). Transport all samples to the appropriate laboratory as soon as possible or within 6 hours.

FSOP-BB2

BOD_5
Chloride
pH
Trace Metals
TSS
Toxicity

1. The following field procedures shall be followed for those sample containers that DO NOT have Sulfuric Acid (H_2SO_4) preservative.

2. The laboratory shall provide clean sample bottles of the appropriate size and type.

3. Ensure all bottles are labeled properly prior to sampling.

4. Where there is flow or current, always approach the sampling location slowly from the downstream. Once you have reached the sampling location allow the water to return to a pre-disturbed condition.

5. Surface sampling with the sample container (Maximum depth of 1 to1 ½ ft)
    - Remove cap from appropriate sample container, taking care not to touch the inside of the container mouth or cap.

    - Rinse the container with water from the sampling location by holding it by the bottom and plunging it mouth-first into the water to about elbow depth. Your hand should always move in a forward motion to avoid water from sliding over your arm and into the container.

    - After rinsing, fill the container by holding it by the bottom and plunging it mouth-first into the water to about elbow depth. Your hand should always move in a forward motion to avoid water from sliding over your arm and into the container. Turn the mouth of the container upwards and bring it above the surface of the water.

    - For the **BOD_5** sample container, tip out some of the water to leave an air space and cap the container being careful not to touch the inside of the cap.

    - For the **pH**, **Chloride**, and **TSS** sample container, ensure the container is completely filled and that all air is expelled from the container. Replace the cap on the container being careful not to touch the inside of the cap.

    - Store container in cooler. Add ice or freezer packs to cooler to maintain proper temperature. Transport all samples to the appropriate laboratory as soon as possible or within 6 hours.

FSOP-BB3

Sediment TOC

1. The laboratory shall provide clean sample bottles of the appropriate size and type.

2. Ensure all bottles are labeled properly prior to sampling.

3. Samples should be stored in glass jars with tight fitting Teflon lined lids at 4EC.

4. Where there is flow or current, always approach the sampling location slowly from the downstream. Once you have reached the sampling location allow the water to return to a pre-disturbed condition.

5. Amount of a sample collected should be sufficient to ensure a representative sample and allow for replicate analysis.

6. Use a stainless steel or Teflon scoop to collect sediments in the same area as for the biological samples. Carefully scoop a sufficient quantity of sediments into the sample container and securely the cap.

7. Store container in cooler. Add ice or freezer packs to cooler to maintain proper temperature. Transport all samples to the appropriate laboratory as soon as possible.

FSOP-5

Temperature, Specific Conductance, Dissolved Oxygen, Salinity Field Sampling SOP
Equipment- YSI Model 85

Field Operation

1. Turn the meter on- the instrument will activate all segments of the display for a few seconds, which will be followed by a self-test procedure that will last for several more seconds. During this power on self-test sequence, the instrument's microprocessor is verifying that the instrument is working properly.

2. Select a measurement mode (dissolved oxygen %, dissolved oxygen mg/L, conductivity, specific conductance, or salinity). Temperature is always displayed. Selecting a measurement mode is accomplished by simply pressing and releasing the mode button. If the instrument is reading specific conductance (temperature compensated), the large numbers on the display will be followed by μS or mS. Additionally, the small portion of the display will show the °C flashing on and off. If the instrument is reading conductivity (NOT temperature compensated), the large numbers on the display will be followed by either a μS or an mS; however, the small portion of the display will show the °C NOT flashing.

3. Lower electrode to the desired depth (surface, middle, or bottom of the water column). When recording the bottom measurement, be sure to keep the electrode at least 0.5 ft above the bottom. Be sure not to disturb bottom substrates prior to or during measurement.

4. Record measurement

5. Cycle to the next measurement mode and record the next parameter. This step should be continued until measurements for all parameters are recorded.

6. Place electrode into storage chamber. To avoid having to recalibrate, do not turn off instrument. Keep extra batteries.

Note: If sampling sites are relatively close together, it is acceptable to leave the meter on until all measurements are recorded. See attached SOP provided by EPA for calibration procedures.

FSOP-6
Measuring Stream Discharge - Field Sampling

Stream discharge will be measured with the aid of a Marsh McBirney flow meter (Model 2000 or Model 201D), following protocol established by the United States Geological Survey (Rantz et al. 1982).

Stream discharge will be measured utilizing the velocity-area method. This method requires the physical measurement of the cross-sectional area and the velocity of the flowing water. Discharge is determined as the product of the area times the velocity. Velocity will be measured using a March-McBirney, Flow Mate 2000 or Model 201D, flow meter. Information about using the Flow Meters is available in Field Sampling SOP 3.

Measuring the average velocity of an entire cross section is impractical, so the method uses an incremental method. The width of the stream is divided into a number of increments; the size and number of the increments depends on the depth and velocity of the stream. The purpose is to divide the stream section into increments with approximately equal discharges. For each incremental width, the stream depth and average velocity of flow are measured. For each incremental width, the meter is placed at a depth where average velocity is expected to occur. That depth has been determined to be about 0.6 of the distance from the water surface to the streambed when depths are shallow. When a depth greater than three feet, the average velocity is best represented by averaging velocity readings at 0.2 and 0.8 of the distance from the water surface to the streambed. The product of the width, depth, and velocity of the section is the discharge through that increment of the cross section. The total of the incremental section discharges equals the discharge of the river.

Field Calibration is as follows:

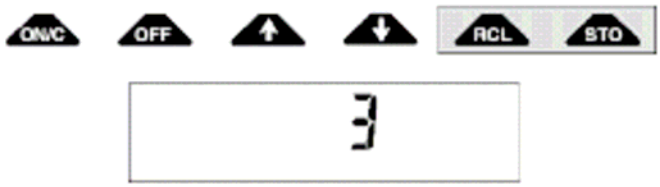
Zero Check

First clean the sensor (Page 12) because a thin film of oil on the electrodes can cause noisy readings. Then place the sensor in a five gallon plastic bucket of water. Keep it at least three inches away from the sides and bottom of the bucket. To make sure the water is not moving, wait 10 or 15 minutes after you have positioned the sensor before taking any zero readings. Use a filter value of 5 seconds. Zero stability is ± 0.05 ft/sec.

Zero Adjust

continued on next page

- Position the sensor as described in the zero check procedure.
- To initiate the zero start sequence, press the STO and RCL keys at the same time. You will see the number 3 on the display.
- Decrement to zero with the ↓ key.



- The number 32 will be displayed.
- The unit will decrement itself to zero and turn off. The unit is now zeroed.

Comment:

Each key in the zero adjust sequence must be pressed within 5 seconds of the previous key. If the time between key entries is longer than 5 seconds or if a wrong key is pressed, the unit will display an ERR 3. Turn the unit OFF then back ON and try again.

9

Appendix C: Projected Water Quality Sample Requirements for Buckeye Brook

Table C.1 Projected Water Quality Sample Requirements for Buckeye Brook Biodiversity Monitoring Project

Station ID	Location	Description	Type	Dry Wx Jul 2008	Dry Wx Aug 2008	Wet Wx Sep-Nov 2008	Wet Wx Winter 2008-09	
BB00	Unidentified brook above Airport Road	In-stream: Upstream of Airport Road culvert	Water Quality, Biological, CPOM, FPOM, TOC, Flow	1	1	4	4	
BB02	Buckeye Brook @ Lakeshore Drive	In-Stream, Downstream of culverts under Lakeshore Dr.	Water Quality, Biological, Toxicity, CPOM, FPOM, TOC, Flow	1	1	4	4	
BB03	Buckeye Brook @ Lakeshore Drive	In-stream, Exit of Warwick Pond	Water Quality, Toxicity, Flow	1		4	4	
BB04	Buckeye Brook @ Rufus Road	In-stream: Downstream of confluence of Buckeye Brook and airport outfall flows	Water Quality, Biological, Toxicity, CPOM, FPOM, TOC, Flow, YSI Continuous Measurements	1	1	4	4	
BB05A	Buckeye Brook downstream of Old Warwick Avenue	In-stream and approximately 1000 ft downstream of the ESS Biological Monitoring Site	Water Quality, Biological, Toxicity, CPOM, FPOM, TOC, Flow	1	1	4	4	
WR01A	Warner Brook @ West Shore Drive	In-stream and downstream of WR01 site for Buckeye Brook pathogen surveys	Water Quality, Biological, CPOM, FPOM, TOC, Flow	1	1	4	4	
OF08	Stream from the airport Outfall 008	In-stream, prior to confluence with landfill stream	Water Quality, Habitat Assessment, Toxicity, Flow	1		4	4	
TA01	Stream from Truk-Away Landfill	In-stream, prior to confluence with stream from Outfall 008	Water Quality, Habitat Assessment, Toxicity, Flow	1		4	4	
AP01	Stream downstream of confluence from stations OF08 and TA01	In-stream, prior to discharge into Buckeye Brook upstream of airport service road.	Biological, CPOM, FPOM, TOC, Flow		1			
Adamsville Brook	@ USGS Gage off of Route 81, Little Compton, RI	In-stream sampling	Macroinvertebrate					
			Trip Blank[1]	1	1	1	1	Project
			Duplicate[2]	1	1	2	2	Total
			Total per Survey	10	8	35	35	88

Notes: 1. Trip Blanks are used as a Field Quality Control Check. Analyte-free water is used to fill sample containers that are transported to the field. The blanks are not opened and are treated in the same manner as are the collected samples. Trip Blanks are analyzed along with the collected samples by the receiving laboratory.

2. At a minimum, one field WQ duplicate will be taken per dry weather event and two field WQ duplicates will be taken per wet weather event.