6 June, 2007

SAMPLING PLAN
YEAR 2007
SURFACE WATER MONITORING IN THE
TEN MILE RIVER WATERSHED

Project Approvals

Brian Zalewsky, Project Manager
RIDEM, Office of Water Resources — Date: 7 Jun 07

Elizabeth Scott, Quality Assurance Officer
RIDEM, Office of Water Resources — Date: 6/7/07

Dan Boudreau, EPA Chemistry Team Lead
EPA New England Region 1, Office of Environmental Measurement and Evaluation — Date: 6/7/07

Tom Faber, Water Quality Engineer
EPA New England Region 1, Office of Environmental Measurement and Evaluation — Date: 6/7/07

Charles Porfret, Water Quality Chemist
EPA New England Region 1, Office of Environmental Measurement and Evaluation — Date: 6/7/07

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SAMPLING PLAN
SURFACE WATER MONITORING IN THE TEN MILE RIVER WATERSHED
YEAR 2007

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

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Charles Porfret, Water Quality Chemist EPA New England Region 1, Office of Environmental Measurement and Evaluation	Date

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A0 Sampling Plan Distribution List/Laboratory Information

The following individuals will receive either a paper or electronic copy of this sampling plan. RIDEM staff who will participate in sampling will also receive a copy as needed.

Table A0. 1 Sampling Plan Distribution List

Sampling Plan Recipients	Organization	Telephone Number
Elizabeth Scott	RIDEM	401.222.4700 xt. 7145
Tom Faber	EPA	617-918-8672
Charles Porfert	EPA	617.918.8313
Dan Boudreau	EPA	617.918.8340
Steve Winnett	EPA	617.918.1687
Mike Hill	EPA	617.918.1398
Brian Friedmann	MADEP	508.767.2867
Richard Chase	MADEP	508.767.2859

The following analytical laboratories will conduct analysis of surface water samples collected by RIDEM staff from the Ten Mile River and impoundments.

Table A0. 2 Laboratory Information

Analysis	Analytical Lab	Contact
Nutrients, Bacteria	ESS Laboratory 185 Frances Avenue Cranston, RI 02910	John Gaspari 401.461.7181
Dissolved/Total Metals Hardness	US EPA New England Regional Laboratory Office of Environmental Measurement & Evaluation 11 Technology Drive Chelmsford, MA 01863-2431	Tom Faber 617.918.8672 Dan Boudreau 617.918.8340

A1 Project/Task Organization

This sampling plan describes surface water quality monitoring efforts by RIDEM staff in the Ten Mile River watershed, located in both Massachusetts and Rhode Island. Staff from the Massachusetts Department of Environmental Protection (MADEP) will be sampling in the MA-portion of the watershed while concurrent sampling in the Rhode Island portion of the watershed will be conducted by staff from the Rhode Island Department of Environmental Management (RIDEM). The Project Manager, Brian Zalewsky, of RIDEM has developed this Sampling Plan for the Ten Mile River watershed scheduled to take place from May through October 2007

A2 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.

A3 Personnel Responsibilities and Qualifications

Each sampling event will be carried out by the Project Manager and two to three additional RIDEM, Office of Water Resource (OWR) staff. All staff will have been trained in Clean Metals 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.

A4 Project Planning / Problem Definition

The Ten Mile River, Slater Park Pond, Turner Reservoir, and Omega Pond are all identified on the State of Rhode Island's 2006 303(d) list as being impaired for numerous parameters (Table A4.1). The goal of this sampling program is to document water quality conditions specific to these parameters of concern under varying hydrologic conditions. During this sampling program, RIDEM will collect and organize all existing information and obtain additional information as required to develop a TMDL for the various waterbodies within the Ten Mile River basin.

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). The goal of this TMDL study is to quantify the existing water quality conditions in the Ten Mile River, Slater Park Pond, Turner Reservoir, and Omega Pond under a range of hydrologic and atmospheric conditions (dry versus wet weather). This data will be used to develop TMDLs for specific waterbody segments within the Ten Mile River watershed.

Table A4. 1 303(d) Listings in the Ten Mile River watershed.

Waterbody	Waterbody ID	2006 303(d) Listings
Ten Mile River	RI0004009-10A	Pb, Cu, Cd
Slater Park Pond	RI0004009L-02	Excess algal growth, chl-a, TP, pathogens
Turner Reservoir	RI0004009L-01A	Low DO, TP, Pb, Cu, pathogens
Turner Reservoir	RI0004009L-01B	Low DO, TP, Pb, Cu, pathogens
Ten Mile River	RI0004009-01B	Cu, Pb, biodiversity
Omega Pond	RI0004009L-03	TP, Pb, Cu

A5 Project Planning Meetings

Staff from RIDEM, MADEP, and EPA have had several informal meetings to formulate and define the purpose and expected results of this bi-state sampling effort. In addition, two site visits were completed by DEM staff on March 27 and April 20, 2007 to allow staff to become familiar with the watershed and to assess proposed monitoring locations, determine access to these locations, and estimate travel times likely during the course of normal sampling.

A6 Ten Mile River Watershed

The Ten Mile River Watershed is located in southeastern Massachusetts and a small portion of northeastern Rhode Island. It is the smallest of the 27 major watersheds in Massachusetts with a total drainage area of approximately 54 square miles. The watershed encompasses all or part of seven municipalities. The Ten Mile River originates from its headwaters in the Town of Plainville, meanders south along the Massachusetts and Rhode Island border before ultimately emptying into the Seekonk and Providence Rivers of Narragansett Bay. The Ten Mile River picks up flow from two major tributaries, the Seven Mile River and the Bungay River, located in Attleboro.

Attleboro and North Attleboro comprise the urban core of the watershed that, at the turn of the century, supported a diversified mix of industries led by jewelry plating and textiles. As a result of increasing levels of industrial use and residential development, the Ten Mile River was grossly polluted by the mid 1900s. The Ten Mile is much cleaner today thanks in part to the construction of two wastewater treatment plants and the introduction of pre-treatment of wastes by industries along the river. However, high concentrations of metals in the water column and sediments and nutrient enrichment (such as phosphorus and nitrogen) continue to impact the basin's biological communities and diminish its full recreational potential. Excessive nutrients can result in accelerated growth of aquatic weeds and algae and low dissolved oxygen levels, which can impair recreational uses such as swimming and boating.

The construction of dams on the river over the last 200 years has prevented fish passage to upstream spawning habitats. The Ten Mile River would support the largest herring and shad fishery in the Rhode Island portion of Narragansett Bay if fish passage at three dams, opening the 33 acre Omega Pond, 297 acre Turner Reservoir, and approximately 7.5 river miles. Some river herring return each year to the mouth of the river and are carried over the first dam into Omega Pond by local fisherman. The proposed restoration is the first phase of a three-phase plan to restore anadromous fish to the Ten Mile River, restoring significant habitat by providing fish passage at the first dam at Omega Pond. Fish passage will be create by the construction of a Denil fishway 60 feet long with a single turning pool. A level notch in the dam will facilitate downstream migration of juveniles. Restoring fish passage to the Ten Mile River would provide significant benefits to the freshwater and estuarine ecosystems and to the surrounding communities.

A7 Goals & Objectives and Intended Use of the Ten Mile River Watershed Data

Over the past month, RIDEM has met with MADEP to discuss a joint water quality monitoring plan for the Ten Mile River Watershed – to both update baseline data (much of which in the RI portion of the river was collected more than 10 years ago) and to support future TMDL development. The MA/RI border runs along the eastern shore of the Ten Mile River and Turner Reservoir. The river is a tributary of Narragansett Bay, discharging into the Seekonk River in East Providence, Rhode Island – though the majority of the watershed lies in Massachusetts. Plans are underway to construct fish passageways to restore anadromous fisheries on the river. RIDEM wishes to conduct water quality monitoring of the Rhode Island portion of the river in 2007 to coincide with the planned monitoring of the Massachusetts portion of the river by MADEP as part of their rotating basin monitoring schedule.

The states' 303(d) lists identify a host of water quality problems on the Ten Mile, Turner Reservoir, and its various tributaries in Massachusetts including bacteria, metals, nutrients, excess algal growth, dissolved oxygen, and biodiversity impairments. The focus of the bi-state monitoring effort is on metals and nutrients with the addition of bacteria sampling in the RI reaches of the river. For the 2007 monitoring effort, DEM has selected eight locations (primarily road crossings) at which historic WQ data are available. DEM plans to monitor monthly from May through September – to coincide with MADEP's planned sampling schedule. Additionally, RIDEM proposes to conduct up to 3-4 additional surveys over the course of this time period to target critical conditions, e.g. low flow, high flow and/or wet weather conditions.

The goal of the Ten Mile River Watershed survey is to obtain information at a total of 8 water quality-sampling stations that meets the following RIDEM programmatic objectives and watershed-specific sub-objectives.

- Evaluate specific water bodies for support of designated uses, determine if State surface water quality standards are being met and evaluate the level of waterbody impairment.

- Provide quality-assured data for the purposes of developing TMDLs for dissolved metals, nutrients, and pathogen impairments in selected waterbody segments within the watershed.

Six river segments are currently on Rhode Island's 2006 303(d) List of water quality impaired waters. These waters will require development of a TMDL. Monitoring of these segments during this sampling period can provide data in the development of TMDLs. Table A4.1 lists waterbody quality impaired segments in the Ten Mile River watershed.

A8 Project Description

A TMDL report is required for all waterbodies that do not meet their designated uses. The mainstem of the Ten Mile River is impaired by lead, cadmium, copper, and biodiversity impacts. Turner Reservoir is impaired by low dissolved oxygen, phosphorus, lead, copper, and pathogens. Slater Park Pond is impaired by excess algal growth/chl-A, phosphorus, and pathogens. Omega Pond is impaired by phosphorus, lead, and copper. The scope of this monitoring plan has been defined by the need to address the TMDL parameters as well as to provide a more recent and robust dataset for which to assess surface waters within the watershed.

Table A8. 1 Contaminants of Concern

Contaminant	Analytical Method/	Achievable Laboratory Limits	Project Limits	Laboratory
Fecal Coliform	SM 9222-D	<1 CFU/mL	20 MPN	ESS Laboratory
Ammonia Nitrogen	EPA 350.1	0.10 mg/l	NA	ESS Laboratory
Total Kkjeldahl Nitrogen	EPA 351.3/351.1	0.20 mg/l	NA	ESS Laboratory
Nitrate-Nitrite Nitrogen	EPA 353.3/353.2	0.02 mg/l	NA	ESS Laboratory
Total Phosphorus	EPA 365.3/365.1	0.02 mg/l	.025 mg/l	ESS Laboratory
Dissolved Oxygen	YSI-MODEL 85	<0.5 mg/l	5.0 mg/l	YSI MODEL 85
Total Metals[1]	EPA 200.7/200.8/6010B	[2]	NA	EPA Laboratory
Dissolved Metals[1]	EPA 200.7/200.8/6010B	[2]	Criteria depends on associated hardness	EPA Laboratory
Hardness	SM 2340B	na	NA	EPA Laboratory

[1]Suite of metals includes Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, V, and Zn.
[2]Reporting Limits (ug/l) are: Ag (0.20), Al (5.0), As (0.50), Ba (0.20), Be (0.20), Ca (100), Cd (0.20), Co (0.20), Cr (0.50), Cu (0.20), Fe (50) Mg (50), Mn (0.20), Mo (0.50), Ni (0.20), Pb (0.20), Sb (0.50), Se (1.0), Tl (0.50), V (0.20), Zn (5.0)

Quality assured data collected during the monitoring period will be used to establish the existing water quality in the Ten Mile River, Slater Park Pond, Turner Reservoir, and Omega Pond. Sampling results for total phosphorus (TP), dissolved oxygen, fecal coliform bacteria, and a suite of dissolved metals will all be used to assess water quality within the waterbodies listed in Table A4.1. Information gathered during this monitoring program will be used to establish reductions in concentrations of contaminants in order to achieve compliance with the state's water quality standards.

Table A8. 2 Analytical Services Table.

Medium /Matrix	Analytical Parameter	Analytical Method	Number of Sampling Locations	Number of Field Duplicates	Number of Field Blanks	Total No. Samples to Lab	Data Package Turnaround	Lab
Surface Water	Fecal Coliform	SM 9222-D	8	1	0	9	10 Days	ESS Lab
Surface Water	Ammonia Nitrogen	EPA 350.1	8	1	0	9	10 Days	ESS Lab
Surface Water	Total Kjeldahl Nitrogen	EPA 351.3/351.1	8	1	0	9	10 Days	ESS Lab
Surface Water	Nitrate-Nitrite Nitrogen	EPA 353.3/353.2	8	1	0	9	10 Days	ESS Lab
Surface Water	Total Phosphorus	EPA 365.3/365.1	8	1	0	9	10 Days	ESS Lab
Surface Water	Total Metals	EPA 200.7/200.8/6 010B	8	1	1	10	N/A	EPA Lab
Surface Water	Dissolved Metals	EPA 200.7/200.8/6 010B	8	1	1	10	N/A	EPA Lab
Surface Water	Hardness	SM 2340B	8	1	1	10	N/A	EPA Lab

A9 Project Schedule

The eight (8) sampling runs planned in the Ten Mile are shown in Table A9.1. Dates in bold are those where RIDEM and MADEP staff will be sampling concurrently. Sampling will be conducted either Tuesdays or Wednesdays of a given sampling week.

Table A9. 1 Ten Mile River Sampling Schedule

May 21st		June 18th		**July 2nd**		**July 30th**
Aug 20th		**Sept 3rd**		Sept 24th		Oct 15th

A10 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 is of sufficient quality to complete scientifically defendable TMDLs for specific parameters listed in Table A4. In addition, it is important that field and lab SOPs used by both MADEP and RIDEM are consistent such that the data can be reliably compared and evaluated throughout the entire watershed.

A11 Measurement Performance Criteria

Representativeness

The selected stations and sampling frequency were chosen for their representativeness of conditions in the mainstem and three impoundments. This systematic random sampling targets conditions of varying hydrologic and atmospheric conditions, which minimizes bias and variability. Systematic random sampling involves the collection of water samples from established sites. A random sampling schedule is used to ensure that samples are collected with equal chance of varying hydrologic and atmospheric conditions. In order for random sampling to be a valid and reliable means of monitoring water quality, the sampling must be scheduled regardless of environmental condition. Thus, sample collection is scheduled sufficiently far in advance to support random collection with respect to environmental conditions.

Comparability

To maximize the quality of the data collected, and to collect data that is comparable with data collected in the Massachusetts portion of the river by MADEP staff, accepted field sampling procedures will be used during this study. In addition, all samples collected will by RIDEM staff will be sent to laboratories that use accepted EPA or Standard Methods for analysis. One station, located at Central Avenue in Pawtucket, RI will be sampled jointly by MADEP and RIDEM staff for quality assurance comparability.

Sensitivity

Analytical methods were selected such that quantitation limits will not limit the usefulness of the data set.

Completeness

If the data collected is sufficient to complete the TMDL report, than the data is considered to be complete. Measurement performance criteria help determine the completeness of a data set. Tables, A11.1 through A11.8 document the measurement performance criteria for this project. These criteria have been supplied by the appropriate analytical laboratory.

Table A11. 1 Fecal Coliform Measurement Performance Criteria

Sampling SOP	FSOP-1
Medium/Matrix	Surface Water
Analytical Parameter	Fecal Coliform Bacteria
Concentration Level	<1 CFU/100ml

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-9222-D SOP attached separate/ ESS Lab	<20%RPD	Field Duplicates/Split	S/A
Accuracy/bias Contamination	SM-9222-D SOP attached separate/ ESS Lab	Positive Growth (>2)	Method Blank	A
Accuracy/bias Contamination	SM-9222-D SOP attached separate/ ESS Lab	No Growth	Reagent Blank	A
Data - Completeness	SM-9222-D SOP attached separate/ ESS Lab	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	SM-9222-D SOP attached separate/ ESS Lab	<20% RPD	Field Duplicates/Split	S/A

Table A11. 2 NH3-Nitrogen Measurement Performance Criteria

Sampling SOP	FSOP-2
Medium/Matrix	Surface Water
Analytical Parameter	Ammonia
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 350.1 SOP attached separate/ ESS Lab	<30%RPD (<35% with MADEP station)	Lab Duplicates	A
Accuracy/bias Contamination	EPA 350.1 SOP attached separate/ ESS Lab	< 0.10 mg/l	Method Blank	A
Accuracy/bias Contamination	EPA 350.1 SOP attached separate/ ESS Lab	Quantitation within limits	Performance Evaluation Standards - PES	A
Data - Completeness	EPA 350.1 SOP attached separate/ ESS Lab	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	EPA 350.1 SOP attached separate/ ESS Lab	<30%RPD (<35% with MADEP station)	Field Duplicates	S/A

Table A11. 3 Total Kjeldahl Nitrogen Measurement Performance Criteria

Sampling SOP	FSOP-2
Medium/Matrix	Surface Water
Analytical Parameter	TKN
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 SOP attached separate/ESS Lab	<30%RPD	Lab Duplicates	A
Accuracy/bias Contamination	EPA 351.2 SOP attached separate/ESS Lab	<0.20 mg/l	Method Blank	A
Accuracy/bias Contamination	EPA 351.2 SOP attached separate/ESS Lab	Quantitation within limits	Performance Evaluation Standards - PES	A
Data - Completeness	EPA 351.2 SOP attached separate/ESS Lab	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	EPA 351.2 SOP attached separate/ESS Lab	<30%RPD	Field Duplicates	S/A

Table A11. 4 Total Phosphorus Measurement Performance Criteria

Sampling SOP	FSOP-2
Medium/Matrix	Surface Water
Analytical Parameter	Total Phosphorus
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	EPA 365.1 SOP attached separate/ESS Lab	<30%RPD (<35% with MADEP station)	Lab Duplicates	A
Accuracy/bias Contamination	EPA 365.1 SOP attached separate/ESS Lab	<0.02 mg/l	Method Blank	A
Accuracy/bias Contamination	EPA 365.1 SOP attached separate/ESS Lab	Quantitation within limits	Performance Evaluation Standards - PES	A
Data - Completeness	EPA 365.1 SOP attached separate/ESS Lab	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	EPA 365.1 SOP attached separate/ESS Lab	<30%RPD (<35% with MADEP station)	Field Duplicates	S/A

Table A11. 5 Nitrate-Nitrite Nitrogen Measurement Performance Criteria.

Sampling SOP	FSOP-3
Medium/Matrix	Surface Water
Analytical Parameter	NO3-NO2 Nitrogen
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	EPA 353.3 SOP attached separate/ESS Lab	<30%RPD (<35% with MADEP station)	Lab Duplicates	A
Accuracy/bias Contamination	EPA 353.3 SOP attached separate/ESS Lab	<0.02 mg/l	Method Blank	A
Accuracy/bias Contamination	EPA 353.3 SOP attached separate/ESS Lab	Quantitation within limits	Performance Evaluation Standards - PES	A
Data - Completeness	EPA 353.3 SOP attached separate/ESS Lab	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	EPA 353.3 SOP attached separate/ESS Lab	<30%RPD (<35% with MADEP station)	Field Duplicates	S/A

Table A11. 6 Total Metals Measurement Performance Criteria.

Sampling SOP	FSOP-4
Medium/Matrix	Surface Water
Analytical Parameter	Total Recoverable Metals in Water
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	EPA 200.8 EIASOP-INGICPMS4	<30%RPD (<30% with MADEP station)	Lab Duplicates	A
Accuracy/bias Contamination	EPA 200.8 EIASOP-INGICPMS4	< ½ RL	Method Blank	A
Accuracy/bias Contamination	EPA 200.8 EIASOP-INGICPMS4	Quantitation within limits	Performance Evaluation Standards - PES	A
Data - Completeness	EPA 200.8 EIASOP-INGICPMS4	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	EPA 200.8 EIASOP-INGICPMS4	<30%RPD (<30% with MADEP station)	Field Duplicates	S/A

Table A11. 7 Dissolved Metals Measurement Performance Criteria

Sampling SOP	FSOP-4
Medium/Matrix	Surface Water
Analytical Parameter	Dissolved Metals in Water
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	EPA 200.8 EIASOP-INGICPMS4	<30%RPD (<30% with MADEP station)	Lab Duplicates	A
Accuracy/bias Contamination	EPA 200.8 EIASOP-INGICPMS4	< ½ RL	Method Blank	A
Accuracy/bias Contamination	EPA 200.8 EIASOP-INGICPMS4	Quantitation within limits	Performance Evaluation Standards - PES	A
Data - Completeness	EPA 200.8 EIASOP-INGICPMS4	Data collected are determined to be useable	Anticipate 100%	A
Accuracy	EPA 200.8 EIASOP-INGICPMS4	<30%RPD (<30% with MADEP station)	Field Duplicates	S/A

B1 Sampling Design for 2007 Ten Mile River Watershed Monitoring

Consistent with RIDEMs approach to surface water quality monitoring in the Ten Mile River to meet defined programmatic objectives, water quality surveys on streams/rivers in the watershed will be conducted approximately once every three weeks from May through October in 2007 at a total of 8 locations. Field measurements for dissolved oxygen (DO), temperature, and conductivity will be performed, grab samples for analytical parameters (via wade-in or bridge drop) will be taken, and stream flow measurements or staff gage readings may be made at selected stations. Staff from MADEP will be sampling stations in the MA portion of the Ten Mile River concurrently on the dates shown in bold in Table A9.1.

Sampling of the Ten Mile River will be coordinated with staff from MADEP such that samples are collected in both MA and RI on the same day. One station, TM1 (located at Central Avenue in Pawtucket) will be sampled by both MADEP and RIDEM for data comparison purposes.

See Appendix A, Table A1 for river/stream sample station IDs, descriptions, parameters and frequencies, and Appendix A. Figure A1-A3 maps for sample site locations. All samples requiring total and dissolved metals analysis will either be shipped to EPA Laboratory-New England Regional Laboratory 11 Technology Drive, North Chelmsford, MA 01863-2431 or transported by RIDEM staff the next day. Samples requiring analysis for nutrients and bacteria will be taken to ESS Laboratory, located at 185 Frances Avenue, Cranston, RI 02910.

Table B1.1 contains information about sampling and analysis methods.

Table B1. 1 Sampling and Analysis Method/SOP requirements

Lab	Medium/	Depth	Analytic	SOP		Container[2]			Container[2]		*Holding*
	Matrix		Parameter	Sampling	*Analytical*	No.	Size	Type	Req.	Preservative	Time
ESS	Water	2-12 inches	Fecal Coliform	Appendix B FSOP-1	Appendix D	1	Sterile Cup	Plastic	Ice	Non-Chemical, Ice only	6 Hours
ESS	Water	2-12 inches	Total Phosphorus	Appendix B FSOP-2	" "	1	1 L	Plastic	Ice	Ice and H_2SO_4 (pH<2)	28 days
ESS	Water	2-12 inches	Ammonia Nitrogen	Appendix B FSOP-2	" "	1	1 L	Plastic	Ice	Ice and H_2SO_4 (pH<2)	28 days
ESS	Water	2-12 inches	Total Kjeldahl Nitrogen	Appendix B FSOP-2	" "	1	1 L	Plastic	Ice	Ice and H_2SO_4 (pH<2)	28 days
ESS	Water	2-12 inches	Nitrate-Nitrite Nitrogen	Appendix B FSOP-3	" "	1	1 L	Plastic	Ice	Non-Chemical, Ice only	48 hrs
EPA	Water	2-12 inches	Total Metals	Appendix B Attached	" "	1	250 mL	Polyethylene	None	Preserved at Lab	5 Days to Lab
EPA	Water	2-12 inches	Dissolved Metals	Appendix B Attached	" "	1	250 mL	Polyethylene	None	Preserved at Lab	5 Days to Lab

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

General information and sampling rationales for specific waterbody segments proposed for 2007 monitoring are as follows:

B1.1 Ten Mile River (Waterbody ID Number RI0004009R-01A)
Location: Ten Mile River from the MA-RI border to the inlet to Turner Reservoir North, excluding Slater Park Pond. Pawtucket
Segment Length: 2.21 miles.
Classification: Class B1, Waters in this segment are designated for fish and wildlife habitat and primary and secondary contact recreational activities. These waters shall have good aesthetic value. Primary contact recreational activities may be impacted due to pathogens from approved wastewater discharges however all Class B criteria must be met.

This segment is a Group 2 water (TMDL Planned) on the State's 2006 303(d) List of Impaired Waters. These waters are not meeting Rhode Island Water Quality Standards and TMDL development is planned for the future. The 2006 listing results from 2000/2001 Narragansett Bay Commission data and data collected in 1997 by the Massachusetts Department of Environmental Protection's Ten Mile River Study were used to assess this portion of the Ten Mile River for swimming and aquatic life use. NBC data showed levels of dissolved cadmium, copper and lead were violating criteria, which caused the river to be assessed as not supporting aquatic life use. Pathogen data was meeting swimming criteria, and the river is assessed as fully supporting swimming use.

Station TM1 – Ten Mile River at Central Avenue Bridge
Parameters – metals, hardness, nutrients, fecal coliform bacteria, multiprobe (dissolved oxygen, temperature, conductivity)

B1.2 Slater Park Pond (Waterbody ID Number RI0004009L-02)
Location: Slater Park Pond. Pawtucket
Waterbody Size: 21.36 acres.
Classification: Class B1, Waters in this segment are designated for fish and wildlife habitat and primary and secondary contact recreational activities. These waters shall have good aesthetic value. Primary contact recreational activities may be impacted due to pathogens from approved wastewater discharges however all Class B criteria must be met.

Slater Park Pond is located in the Ten Mile watershed in the city of Pawtucket. Sampling of Slater Park Pond by URI Watershed Watch (URIWW) began in 1993. 1999 and 2000 URIWW data was used to assess Slater Park Pond for swimming and aquatic life use. Violations of total phosphorus and fecal coliform caused Slater Park Pond to be assessed as not supporting both swimming and aquatic life use.

Station TM2 – Slater Park Pond outlet at Armstice Boulevard Bridge
Parameters – metals, hardness, nutrients, fecal coliform bacteria, multiprobe (dissolved oxygen, temperature, conductivity)

B1.3 Ten Mile River (Waterbody ID Number RI0004009R-01A)
Location: Ten Mile River from the MA-RI border to the inlet to Turner Reservoir North, excluding Slater Park Pond. Pawtucket
Segment Length: 2.21 miles.
Classification: Class B1, Waters in this segment are designated for fish and wildlife habitat and primary and secondary contact recreational activities. These waters shall have good aesthetic value.

This segment is a Group 2 water (TMDL Planned) on the State's 2006 303(d) List of Impaired Waters. These waters are not meeting Rhode Island Water Quality Standards and TMDL development is planned for the future. The 2006 listing results from 2000/2001 Narragansett Bay Commission data and data collected in 1997 by the Massachusetts Department of Environmental Protection Ten Mile River Study were used to assess this portion of the Ten Mile River for swimming and aquatic life use. NBC data showed levels of dissolved cadmium, copper and lead were violating criteria, which caused

the river to be assessed as not supporting aquatic life use. Pathogen data was meeting swimming criteria, and the river is assessed as fully supporting swimming use.

Station TM3 – Ten Mile River at Slater Park, Pawtucket, RI.
Parameters – metals, hardness, nutrients, fecal coliform bacteria, multiprobe (dissolved oxygen, temperature, conductivity)

B1.4 Turner Reservoir (Waterbody ID Number RI0004009L-01A)
Location: Turner Reservoir North of Newman Avenue Dam. East Providence
Waterbody Size: 129.7 acres.
Classification: Class B1, Waters in this segment are designated for fish and wildlife habitat and primary and secondary contact recreational activities. These waters shall have good aesthetic value. Primary contact recreational activities may be impacted due to pathogens from approved wastewater discharges however all Class B criteria must be met.

This portion of Turner Reservoir was originally listed as impaired for DO, total phosphorus, copper, lead and pathogens from the 1988 USGS sampling project. Metals sampling conducted as part of RIDEM's TMDL work in 1998 indicated that copper and lead were still violating criteria. Limited data collected in 2000 by URI Watershed Watch, indicate elevated nutrients and occasional fecal coliform criteria violations. A January 2001 Army Corps of Engineers (ACOE) Report on Turner Reservoir indicated violations of dissolved oxygen, nutrients, fecal coliform and metals. Turner Reservoir is assessed as not supporting for both swimming and aquatic life uses.

Station TM4 – Turner Reservoir at Route 152, East Providence, RI.
Parameters – metals, hardness, nutrients, fecal coliform bacteria, multiprobe (dissolved oxygen, temperature, conductivity)

B1.5 Turner Reservoir (Waterbody ID Number RI---4009L-01B)
Location: Turner Reservoir South of Newman Avenue Dam. East Providence
Waterbody Size: 85.1 acres.
Classification: Class B, Waters in this segment are designated for fish and wildlife habitat and primary and secondary contact recreational activities. These waters shall have good aesthetic value.

This portion of Turner Reservoir was originally listed as impaired for DO, total phosphorus, copper, lead and pathogens from the 1988 USGS sampling project. Metals sampling conducted as part of RIDEM's TMDL work in 1998 indicated that copper and lead were still violating criteria. Limited data collected in 2000 by URI Watershed Watch, indicate elevated nutrients and occasional fecal coliform criteria violations. A January 2001 Army Corps of Engineers (ACOE) Report on Turner Reservoir indicated violations of dissolved oxygen, nutrients, fecal coliform and metals. Turner Reservoir is assessed as not supporting for both swimming and aquatic life uses.

Station TM5 – Turner Reservoir at outflow at Route 114A, East Providence, RI.
Parameters – metals, hardness, nutrients, fecal coliform bacteria, multiprobe (dissolved oxygen, temperature, conductivity)

B1.6 Ten Mile River (Waterbody ID Number RI0004009R-01B)
Location: Ten Mile River downstream of Turner Reservoir South to the Omega Pond inlet. East Providence
Segment Length: 1.99 miles.
Classification: Class B, Waters in this segment are designated for fish and wildlife habitat and primary and secondary contact recreational activities. These waters shall have good aesthetic value.

2000 Rapid Bioassessment Protocol (RBP) data, Summer 2000 Random Sampling Design data, and metals data collected by the Narragansett Bay Commission were utilized to assess this portion of the Ten Mile River for swimming and aquatic life use. RBP data indicates that the biological community is not supporting an aquatic life use. NBC data showed violations of dissolved lead and copper criteria. Both of these factors caused Ten Mile River to be assessed as not

supporting aquatic life use. Pathogen data met swimming criteria, and the river is assessed as fully supporting swimming use.

Station TM6 – Ten Mile River at Route 1A, East Providence, RI.
Parameters – metals, hardness, nutrients, fecal coliform bacteria, multiprobe (dissolved oxygen, temperature, conductivity)

B1.7 Ten Mile River (Waterbody ID Number RI0004009R-01B)
Location: Ten Mile River downstream of Turner Reservoir South to the Omega Pond inlet. East Providence
Segment Length: 1.99 miles.
Classification: Class B, Waters in this segment are designated for fish and wildlife habitat and primary and secondary contact recreational activities. These waters shall have good aesthetic value.

2000 Rapid Bioassessment Protocol (RBP) data, Summer 2000 Random Sampling Design data, and metals data collected by the Narragansett Bay Commission were utilized to assess this portion of the Ten Mile River for swimming and aquatic life use. RBP data indicates that the biological community is not supporting an aquatic life use. NBC data showed violations of dissolved lead and copper criteria. Both of these factors caused Ten Mile River to be assessed as not supporting aquatic life use. Pathogen data met swimming criteria, and the river is assessed as fully supporting swimming use.

Station TM7 – Ten Mile River at Roger Williams Way, East Providence, RI.
Parameters – metals, hardness, nutrients, fecal coliform bacteria, multiprobe (dissolved oxygen, temperature, conductivity)

B1.8 Omega Pond (Waterbody ID Number RI0004009L-03)
Location: Omega Pond. East Providence
Waterbody Size: 33.2 acres.
Classification: Class B, Waters in this segment are designated for fish and wildlife habitat and primary and secondary contact recreational activities. These waters shall have good aesthetic value.

2000/2001 Narragansett Bay Commission data, and 2001 Pond View Recycling data were used to assess Omega Pond. Pathogen data collected met swimming criteria, and Omega Pond is assessed as fully supporting the swimming use. Dissolved lead and copper, and total phosphorus were violating criteria, which caused Omega Pond to be assessed as not supporting aquatic life use.

Station TM8 – Omega Pond outlet to Seekonk River off Roger Williams Way at Railroad Bridge, East Providence, RI.
Parameters – metals, hardness, nutrients, fecal coliform bacteria, multiprobe (dissolved oxygen, temperature, conductivity)

B2 Sampling Procedures and Requirements

B2.1 Sampling Procedures

To ensure consistency in regards to field sampling, RIDEM will adopt Standard Operating Procedures (SOPs) for field sampling as described in the State of Massachusetts Final Quality Assurance Project Plan for 2005-2009 Surface Water Monitoring & Assessment. (MADEP 2005). Field sampling for the collection of surface water for dissolved and total metals analysis will be conducted according to EPA's low-level metals sampling SOP. This SOP is attached as a separate document to this sampling plan.

Table B2. 1 Project Sampling SOP Reference Table

Reference Number/Title	Originating Organization	Equipment ID	Modified for Work Project
Field Sampling SOP FSOP-1 **Fecal Coliform Bacteria**	RIDEM	Not applicable	No
Field Sampling SOP FSOP-2 **Ammonia-N**	RIDEM	Not applicable	No
Field Sampling SOP FSOP-2 **TKN**	RIDEM	Not applicable	No
Field Sampling SOP FSOP-2 **Total Phosphorous**	RIDEM	Not applicable	No
Field Sampling SOP FSOP-3 **NO3-NO2**	RIDEM	Not applicable	No
Field Sampling SOP FSOP-4 **Total Recoverable Metals**	EPA	Not applicable	No
Field Sampling SOP FSOP-4 **Dissolved Metals**	EPA	Not applicable	No
Field Sampling SOP FSOP-5 **Dissolved Oxygen, Temp, Specific Conductance**	RIDEM	YSI Model 85	No
Field-Sampling SOP FSOP-6 **Flow**	RIDEM	Marsh McBirney Model 2000	No

B3 Equipment Cleaning

The laboratory that completes the sample analysis will provide the appropriately sterilized and preserved bottles for sample collection.

B4 Field Equipment Calibration and Maintenance

The project manager and appropriate project staff shall ensure that all field equipment is calibrated and maintained properly.

Table B4. 1 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	Once Before Sampling or as Needed	Visibly free of non-conductive grease or oils		Visibly free of non-conductive grease or oils	Clean Sensor
Marsh-McBirney, Inc. Model 201D Portable Water Flow Meter	Once Before Sampling or as Needed	Display 9.8 and 10.2 within 10 seconds		Display 9.8 and 10.2 within 10 seconds	Change Batteries
Marsh-McBirney, Inc. Model 2000 Portable Flow Meter	Once Before Sampling or as Needed	Visibly free of non-conductive grease or oils		Visibly free of non-conductive grease or oils	Clean Sensor
Marsh-McBirney, Inc. Model 2000 Portable Flow Meter	Low Battery Flag is displayed			Low Battery Flag is not displayed	Change Batteries
Specific Conductance Meter, YSI 85	At beginning of each sampling day, reconfirm after every 25 samples and at end	Battery Life	Standard 1000 uS/cm solution reads 1000+/-1%	Standard 1000 uS/cm solution reads 1000+/-1%	Check Batteries, electrical connections
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	Saturated air and zero-DO (<0.5mg/l) checks at beginning of day, reconfirm after every 25 samples and at end	

B5 Inspection and Acceptance Requirements for Sample Containers

The Project Manager shall ensure that all sample containers are acceptable for use. ESS and EPA Laboratories 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. All certificates of cleanliness shall be retained in the project file. Reference is also made to the appropriate SOP' attached to this document for each constituent and respective laboratory.

B6 Sample Handling, Tracking and Custody Requirements

B6.1 Field Notes

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 shall transfer all applicable data from the field notebook to either excel spreadsheets or word documents as required.

B6.2 Sample Tracking

All sample bottles will be appropriately labeled in the field by appropriate staff. The station number, including sample type, date, time and initials shall be filled in prior to sampling using a permanent marker. A single one-liter plastic bottle is used to collect surface water samples for Total Phosphorus, Ammonia Nitrogen, and Total Kjeldahl Nitrogen analysis. A single one-liter bottle is used to collect surface water samples for Nitrate-Nitrite analysis. A single bottle (cup) is used to collect surface water samples for fecal coliform analysis. The Sample ID contains the Station Number followed by a letter noting the contaminant to analyze. For example, the Station TM1 sample for total phosphorous, TKN, and Ammonia nitrogen would be labeled TM1-TP/TKN/NH3. Duplicates are given a "99" designation. For example, a field duplicate for fecal coliform at station TM2 would be labeled "TM299-FC" The following is a list of the contaminants and their nomenclature:

Total Phosphorous	"TP"
Total Kjeldahl Nitrogen	"TKN"
Ammonia Nitrogen	"NH3'
Nitrate-Nitrite	"NO3-NO2"
Fecal Coliform Bacteria	"FC"
Total Metals	"TM"
Dissolved Metals	"DM"

B6.3 Sample Handling, Tracking , and Custody

All samples will be collected according to the requirements outlined RIDEM's field sampling SOP's for nutrients and bacteria and according to the EPA SOP for low level metals ambient water samples. The Project Manager or a designee shall deliver the samples to the appropriate laboratory for analysis. Samples requiring metals analysis at the EPA Laboratory may be mailed from the DEM Offices in Providence. Copies of the chain of custody forms for each laboratory are included in Appendix C.

Table B6. 1 Sample Handling System

	Responsible Party	Samples
Sample Collection	RIDEM	Surface Water
Sample Delivery	RIDEM	Surface Water
Sample Analysis	ESS Laboratory/EPA Laboratory	Surface Water
Sample Archival	None	N/A
Sample Disposal	ESS Laboratory/EPA Laboratory	Surface Water

B7 Field Analytical Method Requirements

During sampling the dissolved oxygen, temperature, and conductivity will be analyzed in the field using the YSI 85 Multiproble. The Project Manager shall record in the field notebook the sample location and all results of field measurements. Any applicable field observations pertinent to the sampling will be recorded in the field notebooks. Field Sampling SOPs are provided in Appendix B.

B8 Field Analytical Methods and Standard Operating Procedures

Table B8. 1 Field Analytical Method/SOP Reference Table

Reference Number	Title, Revision Date and/or Number	Definitive or Screening Data	Originating Organization	Analytical Parameter	Instrument	Organization Performing Field Analysis	Modified for Project Work Plan Y or N
FSOP – 5	RIDEM – Procedure for field sampling Dissolved Oxygen, Temperature, and conductivity	Definitive	RIDEM	Dissolved Oxygen, Temperature, Conductivity	YSI Model 85	RIDEM	N
FSOP - 6	RIDEM-Procedure for discharge measurement	Definitive	RIDEM	Flow	Marsh McBirney Model 2000	RIDEM	N

B9 Fixed Laboratory Analytical Method Requirements

All samples shall be taken to the appropriate laboratory for analysis. Total and dissolved metals, as well as hardness analysis will be analyzed at the EPA Laboratory located in Chelmsford, MA. Bacteria and nutrient samples will be analyzed at ESS Laboratory in Cranston, RI. Analytical methodologies for bacteria and nutrient analysis differ slightly between MADEPs WES Lab and ESS Lab. These differences are shown below in Table B9.1. As long as quantitation limits are acceptable and provide adequate resolution and comparability, differences in analytical analysis (methodology) will be acceptable. All applicable ESS and EPA Laboratory Analytical SOPs are attached to this document separately as pdf files.

Table B9. 1 MADEP and RIDEM Analytical methods comparison

MA (WES) Lab		RI (ESS) Lab		Comparability
Parameter	**Lab Method**	**Parameter**	**Lab Method**	
NH3-N	EPA 350.1	**NH3-N**	EPA 350.1	**YES**
NO3-N & NO2-N	353.1	**NO3-N-NO2-N**	353.3	**YES**
TN	EPA 351.2 (TKN) USGS I-4650-03 (TN)	**TN**	SM 4500NB	**No**
TP	SM 4500-P-E USGS I-4650-03	**TP**	EPA 365.3	**YES**
Fecal Coliform	SM 9222-D	**Fecal Coliform**	SM 9222-D	**YES**

B9.1 Fixed Laboratory Analytical Methods and Standard Operating Procedures

Table B9. 2 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
ESS Laboratory	SOP-1 Total Phosphorous	Definitive	Total Phosphorus		N
ESS Laboratory	SOP – 2 Total Kjeldahl Nitrogen	Definitive	Total Kjeldahl Nitrogen		N
ESS Laboratory	SOP – 3 Ammonia Nitrogen	Definitive	Ammonia Nitrogen		N
ESS Laboratory	SOP –4 NO3-NO2 Nitrogen	Definitive	NO3-NO2 Nitrogen		N
EPA Laboratory	SOP – 5 Dissolved Metals	Definitive	Dissolved Metals		N
EPA Laboratory	SOP –6 NO3-Total Metals	Definitive	Total Metals		N
ESS Laboratory	SOP – 7 Fecal Coliform Bacteria	Definitive	Fecal Coliform Bacteria		N

B10 Quality Control Requirements

Field Sampling QC methods are presented in Appendix B and titled "Sample Collection Techniques for DWM Surface Water Quality Monitoring."

Table B10. 1 Fixed Laboratory Analytical QC: Fecal Coliform Bacteria.

SAMPLING SOP	FSOP-1
MEDIUM / MATRIX	Surface Water
Analytical Parameter	Fecal coliform
Concentration Level	CFU/100 mL
Laboratory	BAL Laboratory (ESS)

QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action	Measurement Performance Criteria
Method Blank	2 per series run (one before run and one after to check for contamination in Rinse water)	<1 CFU/mL	Recheck rinse water for contamination. Check for cross contamination from samples.	BAL Laboratory Director	<1 CFU/mL
Constant	A positive and a negative control sample is run with each series run	+/- 10% strain concentration.	Recheck controls for evidence of cross contamination or deterioration.	BAL Laboratory Director	Presence / Absence and within 10% of strain concentration
Laboratory Sample Replicate	1 every 10 samples	+/- 20% agreement between replicates	Re-run samples	BAL Laboratory Director	+/- 20%

Table B10. 2 Fixed Laboratory Analytical QC: Ammonia Nitrogen.

SAMPLING SOP	FSOP-2
MEDIUM / MATRIX	Surface Water
Analytical Parameter	Ammonia Nitrogen
Concentration Level	mg/l
Laboratory	ESS 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 Sample Batch	<QL	Re-run	Laurel Stoddard	Accuracy/contamination	<QL
Reagent Blank	N/A					
Storage Blank	N/A					
Instrument Blank	N/A					
Laboratory Duplicate	1 per 10 Samples or per Anal. Batch	<20%RPD	Re-run	Laurel Stoddard	Precision	<20%RPD
Laboratory Matrix Spike	1 per 10 Samples or per Anal. Batch	± 10%	Re-run	Laurel Stoddard	Accuracy/precision Matrix Bias	± 10%
Matrix Duplicate Spikes	N/A					
LCS	1 per 10 Samples or per Anal. Batch	± 10%	Re-run	Laurel Stoddard	Accuracy/precision	± 10%
LFB	N/A					
Surrogates	N/A					
Internal Standards (ISs)	N/A					

Table B10. 3 Fixed Laboratory Analytical QC: Total Kjeldahl Nitrogen.

SAMPLING SOP	FSOP-2					
MEDIUM / MATRIX	Surface Water					
Analytical Parameter	Total Kjeldahl Nitrogen					
Concentration Level	mg/l					
Laboratory	ESS 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 Sample Batch	<QL	Re-run	Laurel Stoddard	Accuracy/contamination	<QL
Reagent Blank	N/A					
Storage Blank	N/A					
Instrument Blank	N/A					
Laboratory Duplicate	1 per 10 Samples or per Anal. Batch	<20%RPD	Re-run	Laurel Stoddard	Precision	<20%RPD
Laboratory Matrix Spike	1 per 10 Samples or per Anal. Batch	± 25%	Re-run	Laurel Stoddard	Accuracy/precision Matrix Bias	± 25%
Matrix Duplicate Spikes	N/A					
LCS	1 per 10 Samples or per Anal. Batch	± 20%	Re-run	Laurel Stoddard	Accuracy/precision	± 20%
LFB	N/A					
Surrogates	N/A					
Internal Standards (ISs)	N/A					

Table B10. 4 Fixed Laboratory Analytical QC: Total Phosphorus.

SAMPLING SOP	FSOP-2					
MEDIUM / MATRIX	Surface Water					
Analytical Parameter	Total Phosphorus					
Concentration Level	mg/l					
Laboratory	ESS 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 Sample Batch	<½QL	Re-run	Laurel Stoddard	Accuracy/contamination	<½QL
Reagent Blank	N/A					
Storage Blank	N/A					
Instrument Blank	N/A					
Laboratory Duplicate	1 per 10 Samples or per Anal. Batch	<20%RPD	Re-run	Laurel Stoddard	Precision	<20%RPD
Laboratory Matrix Spike	1 per 10 Samples or per Anal. Batch	± 10%	Re-run	Laurel Stoddard	Accuracy/precision Matrix Bias	± 10%
Matrix Duplicate Spikes	N/A					
LCS	1 per 10 Samples or per Anal. Batch	± 10%	Re-run	Laurel Stoddard	Accuracy/precision	± 10%
LFB	N/A					
Surrogates	N/A					
Internal Standards (Ss)	N/A					

Table B10. 5 Fixed Laboratory Analytical QC: Nitrate-Nitrite Nitrogen.

SAMPLING SOP	**FSSOP-3**
MEDIUM / MATRIX	Surface Water
Analytical Parameter	Nitrate-Nitrite Nitrogen
Concentration Level	mg/l
Laboratory	ESS 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 Sample Batch	<½QL	Re-run	Laurel Stoddard	Accuracy/ contamination	<½QL
Reagent Blank	N/A					
Storage Blank	N/A					
Instrument Blank	N/A					
Laboratory Duplicate	1 per 10 Samples or per Anal. Batch	<20%RPD	Re-run	Laurel Stoddard	Precision	<20%RPD
Laboratory Matrix Spike	1 per 10 Samples or per Anal. Batch	± 10%	Re-run	Laurel Stoddard	Accuracy/precision Matrix Bias	± 10%
Matrix Duplicate Spikes	N/A					
LCS	1 per 10 Samples or per Anal. Batch	± 10%	Re-run	Laurel Stoddard	Accuracy/precision	± 10%
LFB	N/A					
Surrogates	N/A					
Internal Standards (ISs)	N/A					

Table B10. 6 Fixed Laboratory Analytical QC: Dissolved Metals.

SAMPLING SOP	FSOP-4
MEDIUM / MATRIX	Surface Water
Analytical Parameter	Dissolved Metals
Concentration Level	Ug/l
Laboratory	EPA Region 1

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
Prep Blank (LRB)	1 per analytical batch or 1 per 20 samples, whichever is more frequent	<1/2 RL	Qualify data with a J that are <10x values in LRB	Mike Dowling	Accuracy; contamination	<1/2 RL
Reagent Blank	See prep blank	See prep blank	See prep blank	See prep blank	See prep blank	See prep blank
Storage Blank	NA	NA	NA	NA	NA	NA
Initial Calibration Blank (ICB)	After calibration	<1/2 RL	Re-calibrate, prep new ICB	Mike Dowling	Bias/accuracy	< ½ RL
Continuing Calibration Blank (CCB)	Every 10 samples	< ½ RL	Same as ICB	Mike Dowling	Bias/accuracy	< ½ RL
Laboratory Duplicate	1 per analytical batch or 1 per 20 samples, whichever is more frequent	< 20% RPD	Re-analyze, qualify data	Mike Dowling	Precision	< 20% RPD
Laboratory Matrix Spike	1 per analytical batch or 1 per 20 samples, whichever is more frequent	+/- 30% of true value	Qualify data for sample if LFB is OK, if LFB not OK, qualify all sample results.	Mike Dowling	Accuracy/precision	+/- 30% of true value
Matrix Duplicate Spikes	NA	NA	NA	NA	NA	NA
QCS	After calibration	+/- 10 % of true value	Re-calibrate, prepare new QCS and/or ICS	Mike Dowling	Accuracy	+/- 10 % of true value
LFB	1 per analytical batch or 1 per 20 samples, whichever is more frequent	+/- 15% of true value	Qualify data, re-digest	Mike Dowling	Accuracy	+/- 15% of true value
Surrogates	NA	NA	NA	NA	NA	NA

Internal Standards (ISs)	Every sample	60 – 125%	Stop analysis flush system with calibration blank. Re-run sample. Dilute sample	Mike Dowling	Accuracy/precision	60 - 125%
Reporting Limit Standard (RLS)	Beginning of run	+/- 20% of true value	Prepare new standard, run higher value RLS	Mike Dowling	Accuracy/precision	+/- 20 %
Instrument Performance Check Standard (IPC)	After every 10 samples	+/- 10% of true value	Recalibrate	Mike Dowling	Accuracy	+/- 10%
Interference Check Standard A (IFCS A)	Beginning of run	+/- 20% of true value of interferents	Prepare new standard, check correction equations.	Mike Dowling	Bias	+/- 20 %
Interference Check Standard AB (IFCS AB)	Beginning of run	+/- 20% of true value of interferents	Prepare new standard, check correction equations.	Mike Dowling	Bias	+/- 20 %

Table B10. 7 Fixed Laboratory Analytical QC: Total Recoverable Metals.

SAMPLING SOP	FSOP-4
MEDIUM / MATRIX	Surface Water
Analytical Parameter	Total Recoverable Metals
Concentration Level	Ug/l
Laboratory	EPA Region 1

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
Prep Blank (LRB)	1 per analytical batch or 1 per 20 samples, whichever is more frequent	<1/2 RL	Qualify data with a J that are <10x values in LRB	Mike Dowling	Accuracy; contamination	<1/2 RL
Reagent Blank	See prep blank	See prep blank	See prep blank	See prep blank	See prep blank	See prep blank
Storage Blank	NA	NA	NA	NA	NA	NA
Initial Calibration Blank (ICB)	After calibration	<1/2 RL	Re-calibrate, prep new ICB	Mike Dowling	Bias/accuracy	< ½ RL
Continuing Calibration Blank (CCB)	Every 10 samples	< ½ RL	Same as ICB	Mike Dowling	Bias/accuracy	< ½ RL

Laboratory Duplicate	1 per analytical batch or 1 per 20 samples, whichever is more frequent	< 20% RPD	Re-analyze, qualify data	Mike Dowling	Precision	< 20% RPD
Laboratory Matrix Spike	1 per analytical batch or 1 per 20 samples, whichever is more frequent	+/- 30% of true value	Qualify data for sample if LFB is OK, if LFB not OK, qualify all sample results.	Mike Dowling	Accuracy/precision	+/- 30% of true value
Matrix Duplicate Spikes	NA	NA	NA	NA	NA	NA
QCS	After calibration	+/- 10 % of true value	Re-calibrate, prepare new QCS and/or ICS	Mike Dowling	Accuracy	+/- 10 % of true value
LFB	1 per analytical batch or 1 per 20 samples, whichever is more frequent	+/- 15% of true value	Qualify data, re-digest	Mike Dowling	Accuracy	+/- 15% of true value
Surrogates	NA	NA	NA	NA	NA	NA
Internal Standards (ISs)	Every sample	60 – 125%	Stop analysis flush system with calibration blank. Re-run sample. Dilute sample	Mike Dowling	Accuracy/precision	60 - 125%
Reporting Limit Standard (RLS)	Beginning of run	+/- 20% of true value	Prepare new standard, run higher value RLS	Mike Dowling	Accuracy/precision	+/- 20 %
Instrument Performance Check Standard (IPC)	After every 10 samples	+/- 10% of true value	Recalibrate	Mike Dowling	Accuracy	+/- 10%
Interference Check Standard A (IFCS A)	Beginning of run	+/- 20% of true value of interferents	Prepare new standard, check correction equations.	Mike Dowling	Bias	+/- 20 %
Interference Check Standard AB (IFCS AB)	Beginning of run	+/- 20% of true value of interferents	Prepare new standard, check correction equations.	Mike Dowling	Bias	+/- 20 %

B11 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.

Table B11. 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			

B12 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.

Table B12. 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 System Audit	Start of Sampling	I	Brian Zalewsky RIDEM	Elizabeth Scott RIDEM
ESS Laboratory Technical System Audit	Prior to Sample Receipt	E	Elizabeth Ouk ESS Laboratory	Brian Zalewsky RIDEM

B13.0 Quality Control Requirements

Table B13. 1 Field Sampling QC: Fecal Coliform Bacteria

SAMPLING SOP	FSOP-1			
MEDIUM / MATRIX	Surface Water			
Analytical Parameter	Fecal Coliform Bacteria			
Concentration Level	<2 cfu/ml			
Analytical Method/ SOP Reference	SOP-1			
QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action
Field Duplicates	Minimum 1 per 8 samples	FSOP-1	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 B13. 2 Field Sampling QC: Total Phosphorus

SAMPLING SOP	FSOP-2			
MEDIUM / MATRIX	Surface Water			
Analytical Parameter	Total Phosphorous			
Concentration Level	0.02 mg/l			
Analytical Method/ SOP Reference	SOP-2			
QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action
Field Duplicates	Minimum 1 per 8 samples	FSOP-2	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 B13. 3 Field Sampling QC: Total Kjeldahl Nitrogen

SAMPLING SOP	FSOP-2			
MEDIUM / MATRIX	Surface Water			
Analytical Parameter	Total Kjeldahl Nitrogen (TKN)			
Concentration Level	0.20 mg/l			
Analytical Method/ SOP Reference	SOP-2			
QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action
Field Duplicates	Minimum 1 per 8 samples	FSOP-2	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 B13. 4 Field Sampling QC: Ammonia Nitrogen

SAMPLING SOP	FSOP-2			
MEDIUM / MATRIX	Surface Water			
Analytical Parameter	Ammonia Nitrogen			
Concentration Level	0.10 mg/l			
Analytical Method/ SOP Reference	SOP-3			
QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action
Field Duplicates	Minimum 1 per 8 samples	FSOP-3	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 B13. 5 Field Sampling QC: Nitrate-Nitrite Nitrogen

SAMPLING SOP	FSOP-3
MEDIUM / MATRIX	Surface Water
Analytical Parameter	NO3-NO2 Nitrogen
Concentration Level	0.02 mg/l
Analytical Method/ SOP Reference	SOP-4

QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action
Field Duplicates	Minimum 1 per 8 samples	FSOP-4	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 B13. 6 Field Sampling QC: Total Recoverable Metals

SAMPLING SOP	FSOP-4
MEDIUM / MATRIX	Surface Water
Analytical Parameter	
Concentration Level	
Analytical Method/ SOP Reference	SOP-4

QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action
Field Duplicates	Minimum 1 per 8 samples	FSOP-4	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 B13. 7 Field Sampling QC: Dissolved Metals

SAMPLING SOP	FSOP-4
MEDIUM / MATRIX	Surface Water
Analytical Parameter	
Concentration Level	
Analytical Method/ SOP Reference	SOP-4

QC	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person Responsible for Corrective Action
Field Duplicates	Minimum 1 per 8 samples	FSOP-4	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

Upon completion of the eight (8) planned surveys, a brief status report will be written in order to document any changes made to the monitoring plan. All information collected throughout the project will be summarized in a Final Data Report. Information included in the Final Data Report is summarized in section B17.0. Table B11.1 summarizes the records that will be generated throughout this project.

The Project Manager is responsible for maintaining a project file, and storage of all sampling data. A central file is located in the Providence Office of RIDEM. All original documents, including the field notebook shall be maintained in this central file.

B14 QA Management Reports

Table B13.1 lists the QA Management Reports that will be generated throughout this study. 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. If stations are changed it will be documented here. 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 B14. 1 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	After completion of sampling	Brian Zalewsky RIDEM	Elizabeth Scott RIDEM
Final Report	Completion of Sampling	Brian Zalewsky RIDEM	Elizabeth Scott RIDEM

B15 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 to 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.

B16 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. 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 B16.1 discusses the data verification process.

Table B16. 1 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 and the dry and wet weather shore- line surveys. 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 Elizabeth Ouk ESS Laboratory
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 Elizabeth Ouk ESS Laboratory

Data validation will utilize the measurement performance criteria documented in Tables A11.1 through A11.8 of this report.

B17 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. In addition, all water quality data will be uploaded into EPA's Water Quality exchange database. 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 AP. 1 Sampling Sites, Descriptions, Parameters and Sampling Frequency for the Ten Mile River.

Sampling Site Name(Segment)	Station ID#	Site Description	Parameters	Frequency
River/Impoundment Water Quality Surveys				
Ten Mile River (Segment RI0004009R-01A)	TM1	Ten Mile River at Central Avenue Bridge, Pawtucket, RI.	(Analytical-TP, NH_3-N, TKN, NO3, NO2, Total and dissolved metals, hardness, Fecal Coliform) **Multiprobe** (DO; Temperature; Specific Conductivity) **Flow Measurement- Read Staff Gauge**	Single grab samples and Multiprobe for a total of 8 surveys.
Slater Park Pond (RI0004009L-02)	TM2	Slater Park Pond outlet at Armstice Boulevard Bridge, Pawtucket, RI.	(Analytical-TP, NH_3-N, TKN, NO3, NO2, Total and dissolved metals, hardness, Fecal Coliform) **Multiprobe** (DO; Temperature; Specific Conductivity) **Flow Measurement**	Single grab samples and Multiprobe for a total of 8 surveys.
Ten Mile River (Segment RI0004009R-01A)	TM3	Ten Mile River at Slater Park, Pawtucket, RI.	(Analytical-TP, NH_3-N, TKN, NO3, NO2, Total and dissolved metals, hardness, Fecal Coliform) **Multiprobe** (DO; Temperature; Specific Conductivity) **Flow Measurement**)	Single grab samples and Multiprobe for a total of 8 surveys.
Turner Reservoir (RI0004009L-01A)	TM4	Turner Reservoir at Route 152, East Providence, RI.	(Analytical-TP, NH_3-N, TKN, NO3, NO2, Total and dissolved metals, hardness, Fecal Coliform) **Multiprobe** (DO; Temperature; Specific Conductivity) **Flow Measurement**	Single grab samples and Multiprobe for a total of 8 surveys.
Turner Reservoir (RI0004009L-01B)	TM5	Tuner Reservoir outflow at Route 114A, East Providence, RI.	(Analytical-TP, NH_3-N, TKN, NO3, NO2, Total and dissolved metals, hardness, Fecal Coliform) **Multiprobe** (DO; Temperature; Specific Conductivity) **Flow Measurement ; Read USGS Staff Gauge**	Single grab samples and Multiprobe for a total of 8 surveys.
Ten Mile River (RI0004009R-01B)	TM6	Ten Mile River at Route 1A, East Providence, RI.	(Analytical-TP, NH_3-N, TKN, NO3, NO2, Total and dissolved metals, hardness, Fecal Coliform) **Multiprobe** (DO; Temperature; Specific Conductivity) **Flow Measurement**	Single grab samples and Multiprobe for a total of 8 surveys.
Ten Mile River (RI0004009R-01B)	TM7	Ten Mile River at Roger Williams Way, East Providence, RI.	(Analytical-TP, NH_3-N, TKN, NO3, NO2, Total and dissolved metals, hardness, Fecal Coliform) **Multiprobe** (DO; Temperature; Specific Conductivity) **Flow Measurement**	Single grab samples and Multiprobe for a total of 8 surveys.
Omega Pond (RI0004009L-03	TM8	Omega Pond outlet to Seekonk River off Roger Williams Way at RR bridge, East Providence, RI.	(Analytical-TP, NH_3-N, TKN, NO3, NO2, Total and dissolved metals, hardness, Fecal Coliform) **Multiprobe** (DO; Temperature; Specific Conductivity) **Flow Measurement Read Staff Gauge**	Single grab samples and Multiprobe for a total of 8 surveys.

APPENDIX A continued.

Field Sampling Station Locations, TM1-TM8

Figure A 1 Sampling Stations TM1 and TM2.

Figure A 2 Sampling Station TM3.

Figure A 3 Sampling Stations TM4-TM8.

Appendix B. Field Sampling SOPs- RIDEM

FSOP-1
Fecal Coliform Bacteria Collection, Field Sampling SOP

1. The laboratories will provide autoclaved sample bottles.

2. Sample bottles will be labeled prior to sampling. Wet labels are difficult to write on. Use permanent marker or waterproof pen for labeling.

Example Sample Bottle Label (may be modified for specific project, minimum require)
Station:
Depth:
Date:
Time:
Initials:
Sample Type:
Remarks:

1. Surface grab samples will be collected at each sampling station using the sample bottles provided by the laboratories. In cases where laboratory sample bottles are too large to be fully submersed in the stream, a smaller pre-clean-sterile bottle will be used to transfer the sample into the larger container. All sampling containers and sampling equipment that the sample comes into contact must be sterile.

2. 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.

3. Place sealed sample bottle in sampling stick. When you are ready to take the sample, take the cap off the sample bottle. Hold the cap in your other hand. Do not touch the inside of the bottle or cap. Do not put the cap on the ground.

4. Avoid contaminating the samples by not allowing the sample water to come in contact with anything before it is placed in the bottle. If standing in stream, stand downstream of sampling location. Be careful not to bring the rim or cap of the sample bottle into contact with anything. Samples should be taken with a sample stick to avoid causing upstream disturbance prior to and during sampling.

5. Holding the bottle upside down, push the bottle through the water to mid-depth or as far as you can reach. Turn the bottle forward and scoop it forward and up and out of the water. Do this in one sweeping motion. Make sure you sample forward and away from you so that there is no chance that you will contaminate the sample with bacteria from your arm.

6. Sample bottles will be filled with sample until the sample reaches between an inch to an inch and a half of the top of the sample bottle.

7. Once sample is taken, sample bottles will be capped and placed in a cooler with ice to maintain a temperature of 4°C.

8. Fecal coliform samples will be delivered to the appropriate laboratory within 6 hours of collection.

9. For QA/QC purposes, duplicate fecal coliform samples will be randomly collected at 10% of the sampling stations. All bacteria samples (including field duplicate samples) shall be taken using the above field procedures.

10. A record of the sample locations and sample date and time shall be recorded in a field notebook and made part of the permanent project record. In addition a description of the current weather (i.e. cloud cover, temperature, wind speed, weather conditions) should also be noted. The full name of the samplers should also be recorded in the field notebook.

FSOP-2

TOTAL PHOSPHOROUS (TP)
Total Kjeldahl Nitrogen (TKN)
Ammonia Nitrogen (NH3-N)

1. The following field procedures shall be followed.

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 the Ten Mile River 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 (Maximum depth of 1 to1 ½ ft)
    - Remove cap from appropriate 1-liter sampling device, taking care not to touch the container mouth.
    - Rinse the 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.
    - Fill the container, turn the mouth upwards, bring it above the surface, empty the container.
    - Rinse the cap at the same depth, holding the outside of the cap when plunging.
    - Using the same motion, collect the sample of water in the sampling device. Remove the cap from the sampling bottle and carefully transfer the water from the sampling device to the sampling bottle. Fill the sample bottle to within a half-inch of the top, taking care not to overflow.
    - Store container in cooler. Add ice or freezer packs to cooler to maintain proper temperature (4 deg C or less). Transport all samples to the appropriate laboratory as soon as possible or within 6 hours.

FSOP-3

Nitrate-Nitrite Nitrogen

1. The following field procedures shall be followed.

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 (Maximum depth of 1 to1 ½ ft)
    - Remove cap from appropriate sample container, taking care not to touch the container mouth.
    - Rinse the container with pond water by holding it by the bottom and plunging it mouth-first into the pond 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.
    - Fill the container, turn the mouth upwards, bring it above the surface, empty the container.
    - Rinse the cap at the same depth, holding the outside of the cap when plunging.
    - Using the same motion, collect the sample of water in the container. Tip out some of the water to leave an air space and cap the container.
    - 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-4
Low Level Metals Sampling
STANDARD OPERATING PROCEDURE
FOR THE COLLECTION OF LOW LEVEL METALS AMBIENT WATER SAMPLES

Attached as separate SOP

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 oC 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 oC 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 as well as oxygen solubility tables.

DISSOLVED OXYGEN

Dissolved oxygen (DO) content in water is measured using a membrane electrode. The DO probe's membrane and electrolyte solution should be replaced prior to the sampling period. Failure to perform this step may lead to erratic measurements.

Calibration Procedure

1. Gently dry the temperature sensor according to manufacturer's instructions.

2. Place a wet sponge or a wet paper towel on the bottom of the DO calibration container.

3. Place the DO probe into the container without the probe coming in contact with the wet sponge or paper towel. The probe must fit tightly into the container to prevent the escape of moisture evaporating from the sponge or towel.

4. Allow the confined air to become saturated with water vapor (saturation occurs in approximately 10 to 15 minutes). During this time, turn-on the instrument to allow the DO probe to warm-up. Select monitoring/run mode. Check temperature readings. Readings must stabilize before continuing to the next step.

5. Select calibration mode; then select "DO %".

6. Enter the local barometric pressure (usually in mm of mercury) for the sampling location into the instrument. This measurement must be determined from an on-site barometer. Do not use barometric pressure obtained from the local weather services unless the pressure is corrected for the elevation of the sampling location. [Note: inches of mercury times 25.4 mm/inch equals mm of mercury or consult Oxygen Solubility at Indicated Pressure chart attached to the SOP for conversion at selected pressures].

7. The instrument should indicate that the calibration is in progress. The instrument will take approximately one minute to calibrate. After calibration, the instrument should display percent saturated DO.

8. Select monitoring/run mode. Compare the DO mg/l reading to the Oxygen Solubility at Indicated Pressure chart attached to the SOP. The numbers should agree. If they do not agree to the accuracy of the instrument (usually ± 0.2 mg/L), repeat calibration. If this does not work, change the membrane and electrolyte solution.

9. Remove the probe from the container and place it into a 0.0 mg/L DO standard (see note). The standard must be filled to the top of its container and the DO probe must fit tightly into the standard's container (no head space). Check temperature readings. They must stabilize before continuing.

10. Wait until the "mg/l DO" readings have stabilized. The instrument should read 0.0 mg/L or to the accuracy of the instrument (usually ± 0.2 mg/L). If the instrument cannot reach these values, it will be necessary to clean the probe, and change the membrane and electrolyte solution. If this does not work, prepare a new 0.0 mg/L DO standard. If these measures do not work, contact manufacturer.

Note: To prepare a zero mg/L DO standard follow the procedure stated in Standard Methods (Method 4500-O G). The method basically states to add excess sodium sulfite (until no more dissolves) and a trace amount of cobalt chloride to water. The standard container must be completely filled (no head space). This solution is prepared prior to the sampling event. If some of the solution is lost during instrument calibration, add more water to the container so that the standard is stored with no head space.

Oxygen Solubility Tables are below.

100% Dissolved Oxygen Solubility **Chlorinity: 0** **Salinity: 0**

Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)
0.0	**14.62**	**5.0**	**12.77**	**10.0**	**11.29**	**15.0**	**10.08**	**20.0**	**9.09**	**25.0**	**8.26**	**30.0**	**7.56**	**35.0**	**6.95**
0.1	14.58	5.1	12.74	10.1	11.26	15.1	10.06	20.1	9.07	25.1	8.24	30.1	7.55	35.1	6.94
0.2	14.54	5.2	12.71	10.2	11.24	15.2	10.04	20.2	9.06	25.2	8.23	30.2	7.53	35.2	6.93
0.3	14.50	5.3	12.67	10.3	11.21	15.3	10.02	20.3	9.04	25.3	8.21	30.3	7.52	35.3	6.92
0.4	14.46	5.4	12.64	10.4	11.19	15.4	10.00	20.4	9.02	25.4	8.20	30.4	7.51	35.4	6.91
0.5	14.42	5.5	12.61	10.5	11.16	15.5	9.97	20.5	9.00	25.5	8.18	30.5	7.49	35.5	6.89
0.6	14.38	5.6	12.58	10.6	11.13	15.6	9.95	20.6	8.99	25.6	8.17	30.6	7.48	35.6	6.88
0.7	14.34	5.7	12.55	10.7	11.11	15.7	9.93	20.7	8.97	25.7	8.15	30.7	7.47	35.7	6.87
0.8	14.30	5.8	12.51	10.8	11.08	15.8	9.91	20.8	8.95	25.8	8.14	30.8	7.46	35.8	6.86
0.9	14.26	5.9	12.48	10.9	11.06	15.9	9.89	20.9	8.94	25.9	8.12	30.9	7.44	35.9	6.85
1.0	**14.22**	**6.0**	**12.45**	**11.0**	**11.03**	**16.0**	**9.87**	**21.0**	**8.92**	**26.0**	**8.11**	**31.0**	**7.43**	**36.0**	**6.84**
1.1	14.18	6.1	12.42	11.1	11.01	16.1	9.85	21.1	8.90	26.1	8.10	31.1	7.42	36.1	6.83
1.2	14.14	6.2	12.39	11.2	10.98	16.2	9.83	21.2	8.88	26.2	8.08	31.2	7.41	36.2	6.82
1.3	14.10	6.3	12.36	11.3	10.96	16.3	9.81	21.3	8.87	26.3	8.07	31.3	7.39	36.3	6.81
1.4	14.06	6.4	12.33	11.4	10.93	16.4	9.79	21.4	8.85	26.4	8.05	31.4	7.38	36.4	6.80
1.5	14.03	6.5	12.30	11.5	10.91	16.5	9.77	21.5	8.83	26.5	8.04	31.5	7.37	36.5	6.78
1.6	13.99	6.6	12.26	11.6	10.88	16.6	9.75	21.6	8.81	26.6	8.03	31.6	7.36	36.6	6.77
1.7	13.95	6.7	12.23	11.7	10.86	16.7	9.73	21.7	8.79	26.7	8.01	31.7	7.35	36.7	6.76
1.8	13.91	6.8	12.20	11.8	10.83	16.8	9.71	21.8	8.78	26.8	8.00	31.8	7.33	36.8	6.75
1.9	13.87	6.9	12.17	11.9	10.81	16.9	9.69	21.9	8.76	26.9	7.98	31.9	7.32	36.9	6.74
2.0	**13.83**	**7.0**	**12.14**	**12.0**	**10.78**	**17.0**	**9.67**	**22.0**	**8.74**	**27.0**	**7.97**	**32.0**	**7.31**	**37.0**	**6.73**
2.1	13.79	7.1	12.11	12.1	10.76	17.1	9.65	22.1	8.72	27.1	7.96	32.1	7.30	37.1	6.72
2.2	13.76	7.2	12.08	12.2	10.73	17.2	9.63	22.2	8.71	27.2	7.94	32.2	7.28	37.2	6.71
2.3	13.72	7.3	12.05	12.3	10.71	17.3	9.61	22.3	8.69	27.3	7.93	32.3	7.27	37.3	6.70
2.4	13.68	7.4	12.02	12.4	10.68	17.4	9.59	22.4	8.68	27.4	7.91	32.4	7.26	37.4	6.69
2.5	13.65	7.5	11.99	12.5	10.66	17.5	9.57	22.5	8.66	27.5	7.90	32.5	7.24	37.5	6.67
2.6	13.61	7.6	11.96	12.6	10.64	17.6	9.55	22.6	8.64	27.6	7.89	32.6	7.23	37.6	6.66
2.7	13.57	7.7	11.93	12.7	10.61	17.7	9.53	22.7	8.63	27.7	7.87	32.7	7.22	37.7	6.65
2.8	13.53	7.8	11.90	12.8	10.59	17.8	9.51	22.8	8.61	27.8	7.86	32.8	7.21	37.8	6.64
2.9	13.50	7.9	11.87	12.9	10.56	17.9	9.49	22.9	8.60	27.9	7.84	32.9	7.19	37.9	6.63
3.0	**13.46**	**8.0**	**11.84**	**13.0**	**10.54**	**18.0**	**9.47**	**23.0**	**8.58**	**28.0**	**7.83**	**33.0**	**7.18**	**38.0**	**6.62**
3.1	13.43	8.1	11.81	13.1	10.52	18.1	9.45	23.1	8.56	28.1	7.82	33.1	7.17	38.1	6.61
3.2	13.39	8.2	11.78	13.2	10.49	18.2	9.43	23.2	8.55	28.2	7.80	33.2	7.16	38.2	6.60
3.3	13.36	8.3	11.76	13.3	10.47	18.3	9.41	23.3	8.53	28.3	7.79	33.3	7.15	38.3	6.59
3.4	13.32	8.4	11.73	13.4	10.45	18.4	9.39	23.4	8.52	28.4	7.77	33.4	7.14	38.4	6.58
3.5	13.29	8.5	11.70	13.5	10.43	18.5	9.37	23.5	8.50	28.5	7.76	33.5	7.12	38.5	6.57
3.6	13.25	8.6	11.67	13.6	10.40	18.6	9.36	23.6	8.48	28.6	7.75	33.6	7.11	38.6	6.56
3.7	13.22	8.7	11.64	13.7	10.38	18.7	9.34	23.7	8.47	28.7	7.73	33.7	7.10	38.7	6.55
3.8	13.18	8.8	11.62	13.8	10.36	18.8	9.32	23.8	8.45	28.8	7.72	33.8	7.09	38.8	6.54
3.9	13.15	8.9	11.59	13.9	10.33	18.9	9.30	23.9	8.44	28.9	7.70	33.9	7.08	38.9	6.53
4.0	**13.11**	**9.0**	**11.56**	**14.0**	**10.31**	**19.0**	**9.28**	**24.0**	**8.42**	**29.0**	**7.69**	**34.0**	**7.07**	**39.0**	**6.52**
4.1	13.08	9.1	11.53	14.1	10.29	19.1	9.26	24.1	8.40	29.1	7.68	34.1	7.06	39.1	6.51
4.2	13.04	9.2	11.51	14.2	10.26	19.2	9.24	24.2	8.39	29.2	7.66	34.2	7.05	39.2	6.50
4.3	13.01	9.3	11.48	14.3	10.24	19.3	9.22	24.3	8.37	29.3	7.65	34.3	7.03	39.3	6.49
4.4	12.97	9.4	11.45	14.4	10.22	19.4	9.20	24.4	8.36	29.4	7.64	34.4	7.02	39.4	6.48
4.5	12.94	9.5	11.43	14.5	10.20	19.5	9.18	24.5	8.34	29.5	7.62	34.5	7.01	39.5	6.46
4.6	12.91	9.6	11.40	14.6	10.17	19.6	9.17	24.6	8.32	29.6	7.61	34.6	7.00	39.6	6.45
4.7	12.87	9.7	11.37	14.7	10.15	19.7	9.15	24.7	8.31	29.7	7.60	34.7	6.99	39.7	6.44
4.8	12.84	9.8	11.34	14.8	10.13	19.8	9.13	24.8	8.29	29.8	7.59	34.8	6.97	39.8	6.43
4.9	12.80	9.9	11.32	14.9	10.10	19.9	9.11	24.9	8.28	29.9	7.57	34.9	6.96	39.9	6.42
5.0	**12.77**	**10.0**	**11.29**	**15.0**	**10.08**	**20.0**	**9.09**	**25.0**	**8.26**	**30.0**	**7.56**	**35.0**	**6.95**	**40.0**	**6.41**

5.2 CALIBRATION OF CONDUCTIVITY

IMPORTANT: System calibration is rarely required because of the factory calibration of the YSI Model 85. However, from time to time it is wise to check the system calibration and make adjustments when necessary.

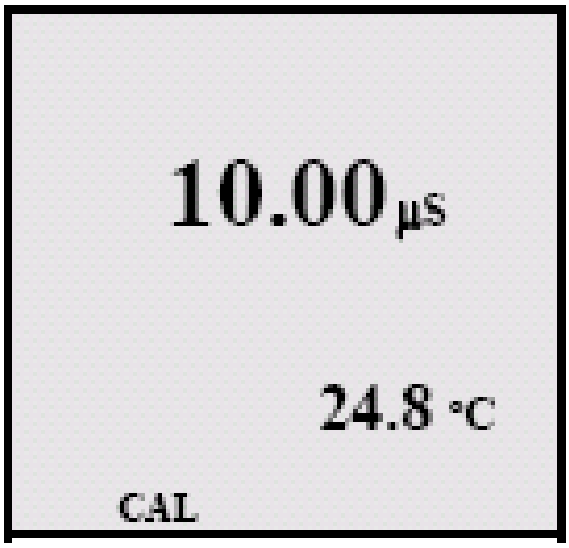
Prior to calibration of the YSI Model 85, it is important to remember the following:

1. Always use clean, properly stored, NIST traceable calibration solutions (see Accessories and Replacement Parts). When filling a calibration container prior to performing the calibration procedures, make certain that the level of calibrant buffers is high enough in the container to cover the entire probe. Gently agitate the probe to remove any bubbles in the conductivity cell.
2. Rinse the probe with distilled water (and wipe dry) between changes of calibration solutions.
3. During calibration, allow the probe time to stabilize with regard to temperature (approximately 60 seconds) before proceeding with the calibration process. The readings after calibration are only as good as the calibration itself.
4. Perform sensor calibration at a temperature as close to 25°C as possible. This will minimize any temperature compensation error.

Follow these steps to perform an accurate calibration of the YSI Model 85:

1. Turn the instrument on and allow it to complete its self-test procedure.
2. Select a calibration solution that is most similar to the sample you will be measuring.
    - For sea water choose a 50 mS/cm conductivity standard (YSI Catalog# 3169)
    - For fresh water choose a 1 mS/cm conductivity standard (YSI Catalog# 3167)
    - For brackish water choose a 10 mS/cm conductivity standard (YSI Catalog # 3168)
3. Place at least 3 inches of solution in a clean glass beaker.
4. Use the MODE button to advance the instrument to display conductivity.
5. Insert the probe into the beaker deep enough so that the oval-shaped hole on the side of the probe is completely covered. Do not rest the probe on the bottom of the container -- suspend it above the bottom at least 1/4 inch.
6. Allow at least 60 seconds for the temperature reading to become stable.
7. Move the probe vigorously from side to side to dislodge any air bubbles from the electrodes.
8. Press and release the UP ARROW and DOWN ARROW buttons at the same time.

The CAL symbol will appear at the bottom left of the display to indicate that the instrument is now in Calibration mode.



9. Use the **UP ARROW** or **DOWN ARROW** button to adjust the reading on the display until it matches the value of the calibration solution you are using.
10. Once the display reads the exact value of the calibration solution being used (the instrument will make the appropriate compensation for temperature variation from 25°C), press the **ENTER** button once. The word "SAVE" will flash across the display for a second indicating that the calibration has been accepted.

The YSI Model 85 is designed to retain its last conductivity calibration permanently. Therefore, there is no need to calibrate the instrument after battery changes or power down.

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:

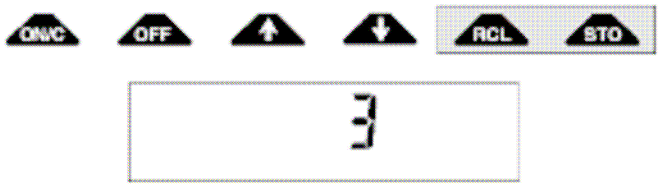
Zero Check

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.



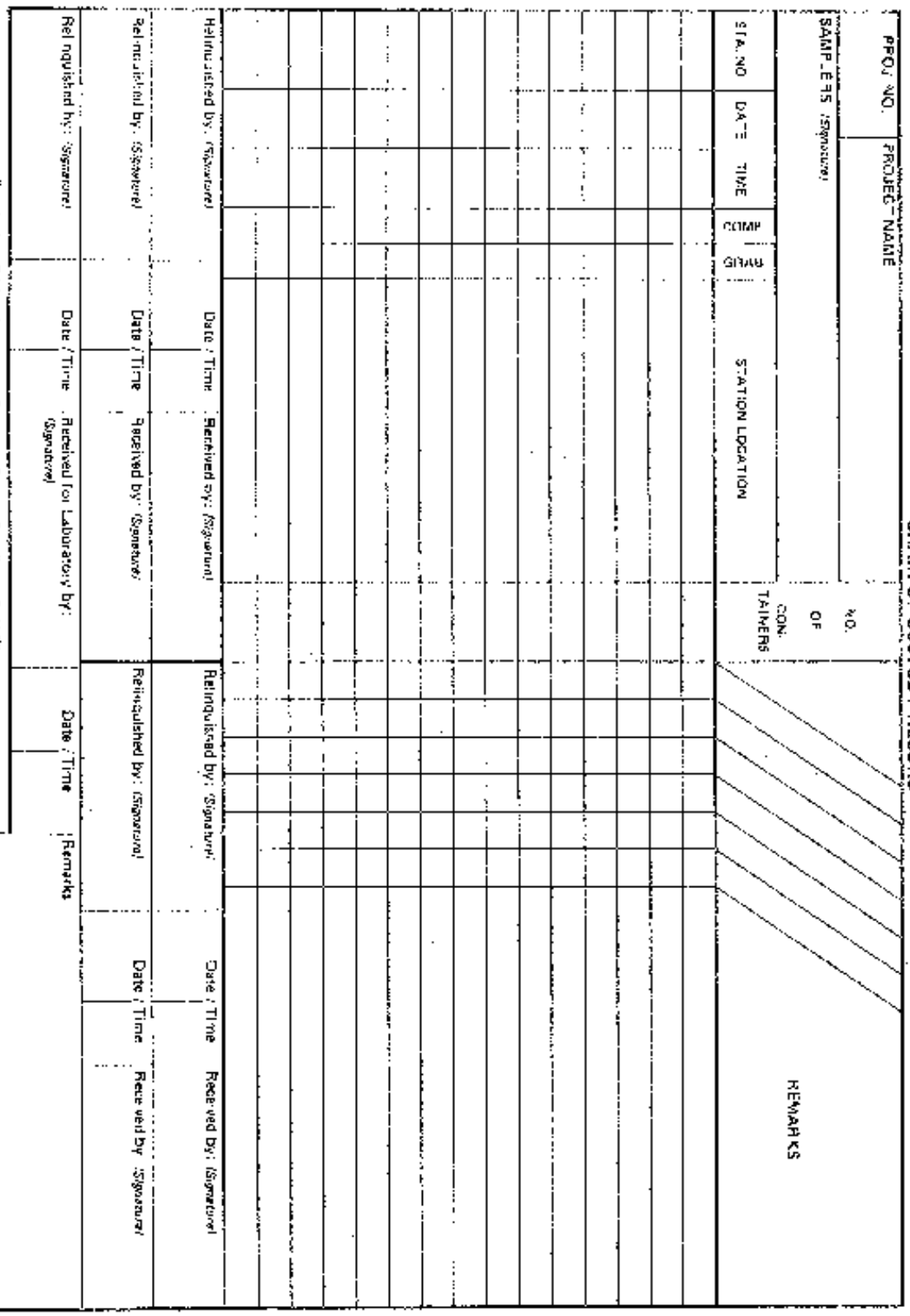
- The number 32 will be displayed.
- The unit will decrement itself to zero and turn off. The unit is now zeroed.

Comment:

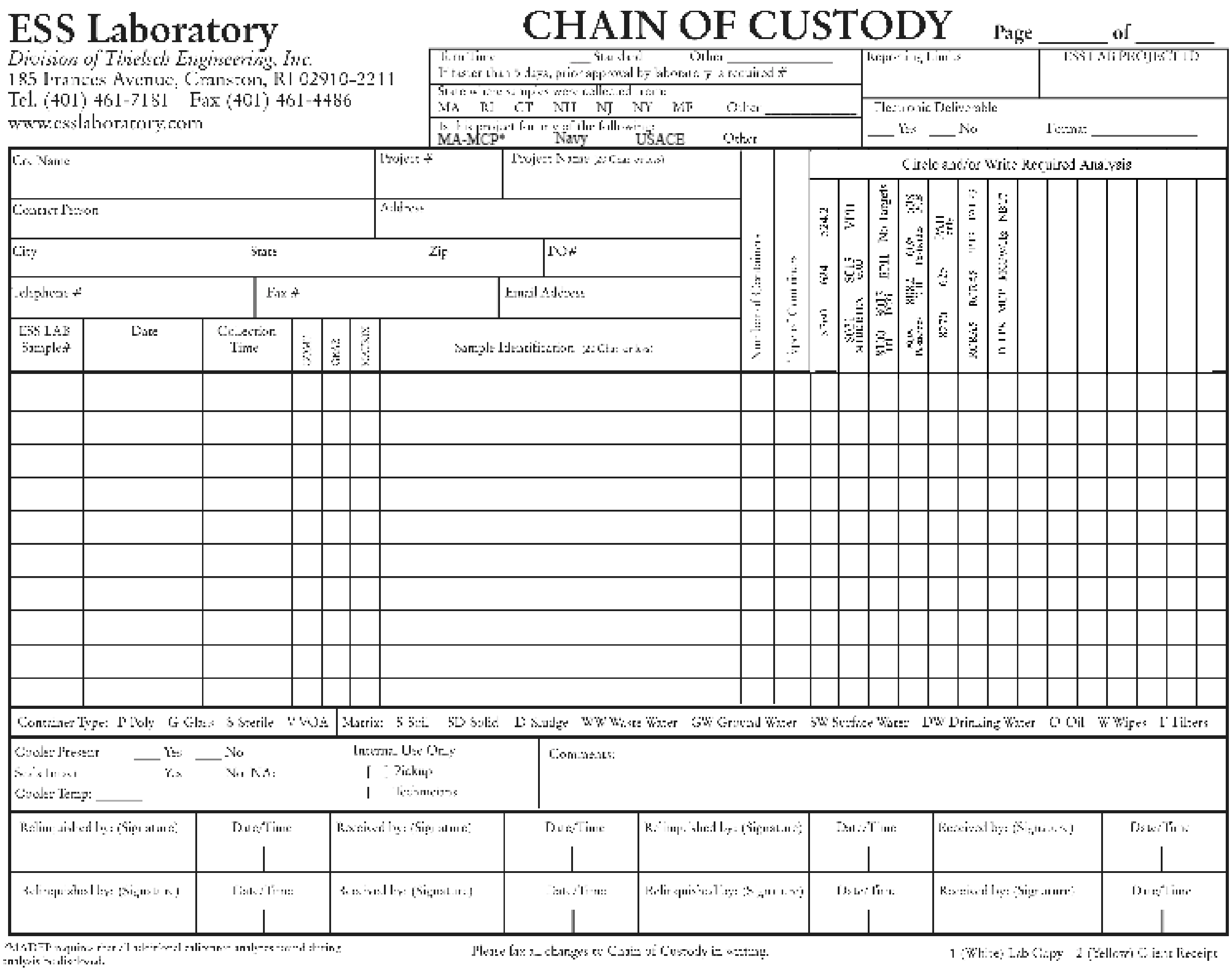
Each key in the zero adjust sequence must be pressed within 5 seconds of the previous key. If the time between key entries is longer than 5 seconds or if a wrong key is pressed, the unit will display an ERR 3. Turn the unit OFF then back ON and try again.

9

Appendix C. Chain of Custody Forms


ENVIRONMENTAL PROTECTION AGENCY
REGION 1
CHAIN OF CUSTODY RECORD
PROJ. NO.
PROJECT NAME
NO. OF CONTAINERS
SAMPLERS (Signature)
STA. NO.
DATE
TIME
COMP
GRAB
STATION LOCATION
REMARKS
Relinquished by: (Signature)
Date / Time
Received by: (Signature)
Relinquished by: (Signature)
Date / Time
Received for Laboratory by: (Signature)
Date / Time
Remarks
Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

EPA Laboratory Chain of Custody Form.



ESS Laboratory

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www.esslaboratory.com

CHAIN OF CUSTODY Page ______ of ______

Turn Time ___ Standard Other ______

If faster than 5 days, prior approval by laboratory is required #

State where samples were collected from: MA RI CT NH NJ NY ME Other ______

Is this project for any of the following: MA-MCP* Navy USACE Other

Reporting Limits

ESS LAB PROJECT ID

Electronic Deliverable ___ Yes ___ No Format: ______

Co. Name	Project #	Project Name
Contact Person	Address	
City	State	Zip
PO#		
Telephone #	Fax #	Email Address

Circle and/or Write Required Analysis

ESS LAB Sample#	Date	Collection Time	[illegible]	[illegible]	MATRIX	Sample Identification	Number of Containers	Type of Containers	524.2 / 624 / 8260	VPH / 8015 / 8021	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]							

Container Type: P-Poly G-Glass S-Sterile V-VOA | Matrix: S-Soil SD-Solid D-Sludge WW-Waste Water GW-Ground Water SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filters

Cooler Present ___ Yes ___ No

Seals Intact Yes No NA:

Cooler Temp: ______

Internal Use Only

[ ] Pickup

[ ] Technicians

Comments:

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time

*MADEP requires that all identified substance analyses must be disclosed during analysis and disclosed.

Please fax all changes to Chain of Custody in writing.

1 (White) Lab Copy 2 (Yellow) Client Receipt

ESS Laboratory Chain of Custody Form.

Appendix D. Laboratory SOPs

BAL Laboratory **BAL-ALP-SOP05** **SOP: ALP-05**
Revised: 05/12/06

mTEC Method for Detection of Fecal Coliforms and *E. coli*

References:

Method 9213D, Standard Methods for the Examination of Water and Wastewater, APHA, 20th ed. 1998.

Sample Collection:

Representative samples from recreational waters are collected using aseptic technique with sterile glass or plastic containers. Suggested sample volumes are between 250 and 500mL. Samples are kept on ice (4°C) and brought to the laboratory for analysis preferably within six (6) hours of collection; however, samples may be analyzed up to 24 hours from time of collection.

Media Preparation:

mTEC agar, mTEC, (DIFCO #233410), is prepared according to manufacturer's instructions. After sterilization by autoclaving at 121°C for 15 minutes and allowing the media to temper to 50°C, the agar is dispensed into sterile 50x9mm Petri plates (Fisher Scientific). The plates are tightly sealed and stored under refrigerated conditions for up to one month.

Procedure:

1. Membrane filter holders are sterilized using ultraviolet (UV) light for 3 minutes prior to each use.

2. The membrane filter holder base is place on the vacuum assembly and a membrane filter (Millipore 0.7um pore, 47mm) is placed on the unit. The top half of the holder unit is placed on the base securing the membrane filter between the assembly pieces.

3. Appropriate sample volumes, usually between 10 and 100mL, are dispensed into the assembly with the vacuum pressure off. The vacuum pressure is turned on and the sample is filtered through the membrane filters. Once the sample has been completely filtered the membrane and assembly unit is rinsed several times with sterile phosphate buffer.

4. Using aseptic techniques the membrane is removed from the filter assembly base and carefully placed on the surface o the mTEC agar.

5. The plates are incubated at 35 $\pm$ 0.5°C for two (2) hours to rejuvenate injured or stressed bacteria. After two hours the plates are moved into an incubator set at 44 $\pm$ 0.2°C for an additional 22 hours. Total time for incubation of samples will be 24 hours.

Interpreting Results:

After 24 hours the plates are removed from the incubator and assessed for growth of fecal coliforms and *E. coli* if requested. Count all colonies present as fecal coliforms. Report results for fecal coliforms as colony forming units per 100 mL (CFU/100 mL). Apply a multiplier if volumes other than 100 mL were analyzed.

To determine *E. coli* counts, the membranes are transferred to a filter pad saturated with urea substrate. After 15 minutes, the colonies that remain yellow or yellow-brown, viewed using a fluorescent lamp and a magnifying lens are considered to be *E. coli*, any blue colonies are usually *Klebsiella* sp. or other fecal coliform bacteria.

Urea Substrate: To 100mL of reagent-grade water add 2.0 grams of Urea and 10 mg of Phenol Red. Stir until combined. Adjust the pH to between 3 and 4. The solution may be stored up to one week between 2 and 8°C.

Quality Control

Prior to use, each batch of mTEC agar must undergo a QC check in which 5 plates of the new batch are compared to 5 plates of the previous batch by inoculation with a stock culture of *E. coli.*

Prior to use, each batch of membrane filters must undergo a QC check in which 5 membranes of the new lot are compared with 5 membranes of the previous lot by inoculation with a stock culture of E. coli which is plated on mTEC or mENDO-Les agar. The test plates are incubated according to Standard Methods. A membrane filter of each batch is also checked for sterility by placing it into Trypticase Soy Broth (TSB) and incubated for 24 hours at 35.5^{o}C.

Ten percent of all samples received are analyzed in duplicate. All other samples are analyzed one time only.

Ten percent of all positive mTEC plates are confirmed by transferring 10 well-isolated colonies to EC media (EC) and incubated at 44.5^{o}C for 24 hours. Tubes producing gas are considered positive for fecal coliform. If confirmation of *E. coli* is required, colonies are transferred to EC-MUG media and incubated at 44.5^{o}C for 24 hours. Tubes producing fluorescence under ultraviolet light are considered positive for *E. coli.*

Positive Control: Combine 0.5ml of *E. coli* river isolate, with 50-100mL of sterile buffer water or sterile phosphate buffer water and analyze as you would any of the samples in the batch.

Suspend a small amount of *Klebsiella pneumonia* from the stock control plate in approximately 50-100mL of sterile buffer water or sterile phosphate buffer water and analyze as you would any of the samples in the batch.

Negative Control: Use 100mL of sterile buffer water or sterile phosphate buffer water and analyze as you would any of the samples in the batch.

Storage Conditions:

Store prepared media at refrigerated for no longer than expressed in BAL Quality Control/Quality Assurance Manual.

Revised by: _____
Darlene Capuano
Laboratory Director

By signing your name below, you indicate that you have read and understand the Standard Operating Procedure ALP-05 and that you will follow the Standard Operating Procedures when utilizing this method.

_____
Darlene Capuano

_____
Janet Ventura

_____
James Grogan

SOP for TKN, TP, NO3, NO2, NH3, and Dissolved and Total Metals are attached separately