2013 ADDENDUM

to update the

Quality Assurance Project Plan for Rhode Island Ambient River Monitoring Program

State of Rhode Island and Providence Plantations

Rhode Island Department of Environmental Management (DEM)

Office of Water Resources

April 18, 2014

RIDEM Project QA Manager: Connie Carey

Signature/Date: Connie Carey 4/25/2014

2013 ARM QAPP ADDENDUM

This document and attachments serve as an update to amend the RI Ambient River Monitoring Program QAPP to reflect any changes to the document for the 2013 sampling season. Details of all laboratory analysis can be found in new attachments:

Table 14. ARM Stations 2013: Water Chemistry Suites analyzed by HEALTH
Table 15. 2013 Parameters analyzed by HEALTH
Table 16. 2013 Holding Times and Measurement Performance Criteria
Appendix G Addendum. HEALTH Analytical Measurement Performance Criteria.

The following bullets summarize all changes or updates:

- Total Aluminum was added in 2012 and was continued in 2013 as an additional parameter to be analyzed at select number of stations. Addition of this constituent did not change any field sampling procedures, as the container (with no preservative) used to collect water to test other metals holds enough sample volume to also test Total Aluminum. This parameter was added to Figure 2. Sample Submission Form/Chain of Custody

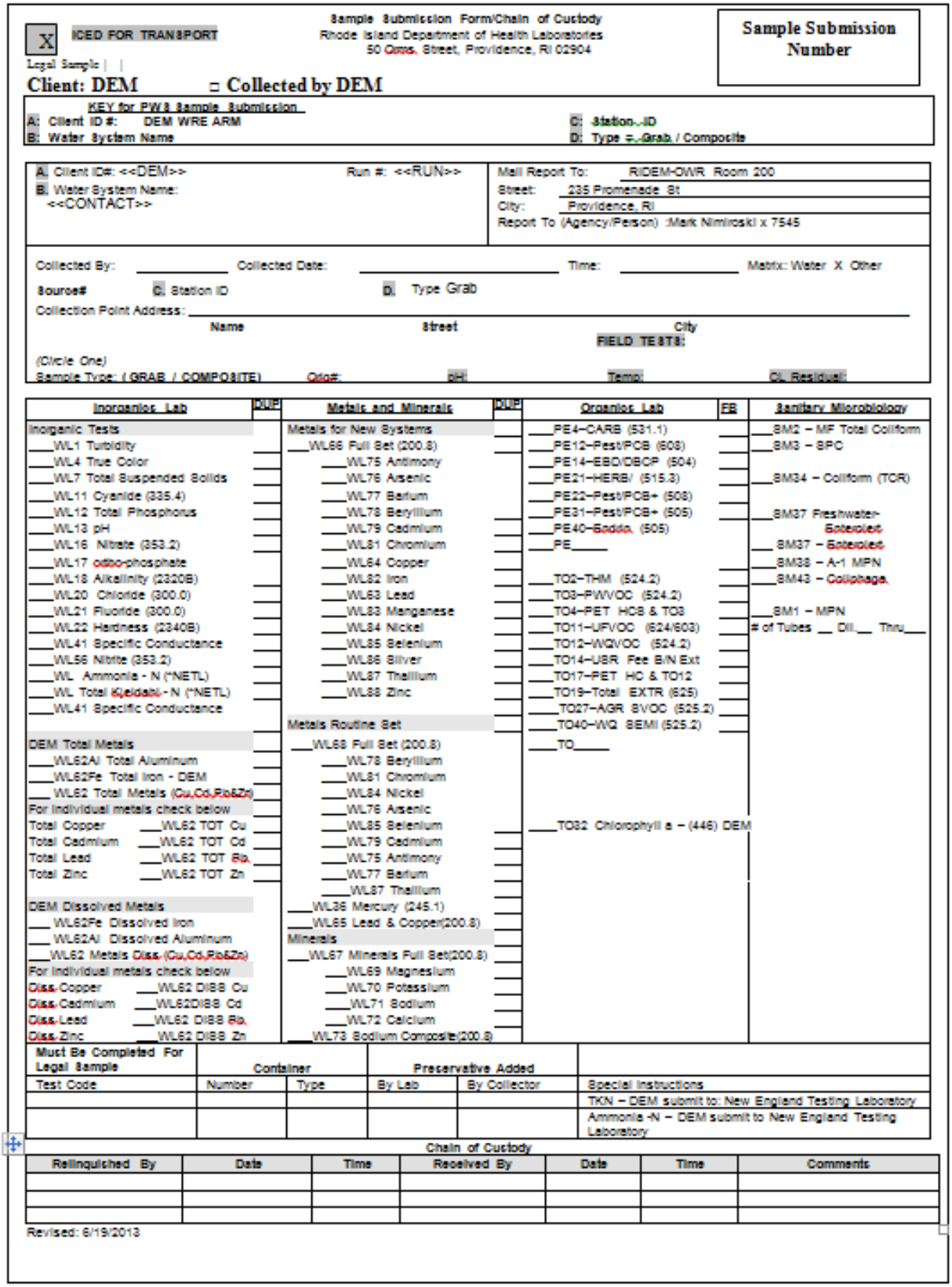
- Additionally, most metals analyzed in the past have been analyzed for as Dissolved Metals. For 2012, the option to analyze metals as Total Metals was added for stations located on waterbodies where State Water Quality Regulations specify Water Quality Criteria as Total Metals. For 2013, Total Metals was again an option at selected stations where applicable regulations specify Total Metals. This parameter was also added to Figure 2.

- A new map (Figure 9) and new list of 2013 sampling stations (Table 14) reflects the stations targeted for the 2013 basin rotation to the greater Blackstone River Watersheds.

- To aid in nutrient criteria development, additional fieldwork was performed and supplemental data was collected at some ARM sites in accordance with Appendix H. Table 14 lists the sites where this additional fieldwork was performed. This additional sampling included collecting periphyton by scraping substrates (both natural and artificial) in accordance with updated DEM SOP-WR-W-37 (http://www.dem.ri.gov/pubs/sops/wrw37.pdf). To help characterize the periphyton growth, an estimate of canopy cover was also measured using a densiometer in accordance with updated RIDEM SOP-WR-W-35 (http://www.dem.ri.gov/pubs/sops/wrw35.pdf), as well as an observed measurement of benthic algae cover using a viewing bucket and modified pebble count in accordance with updated RIDEM SOP-WR-36 (http://www.dem.ri.gov/pubs/sops/wrw36.pdf). The modified pebble count method also includes measurement of plant growth.

- In 2013, the supplemental NNC fieldwork also included collection of benthic chlorophyll *a* samples from natural substrates and a pebble count at selected sites by the contractor tasked to collect macroinvertebrate samples for the ARM program. This was undertaken as an effort to further evaluate quality assurance measures of the supplemental NNC fieldwork.
- Another change in the supplemental NNC fieldwork was the filtering of RIDEM/OWR-collected benthic chlorophyll *a* samples by the macroinvertebrate contractor. This practice was undertaken to reduce sample processing time at HEALTH.

Figure 2. Sample Submission Form/Chain of Custody



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Sample Submission Form/Chain of Custody
Rhode Island Department of Health Laboratories
50 Orms Street, Providence, RI 02904

Sample Submission Number

Legal Sample: | |

Client: DEM ☐ Collected by DEM

KEY for PWS Sample Submission
A: Client ID #: DEM WRE ARM
B: Water System Name
C: Station ID
D: Type = Grab / Composite

A. Client ID#: <<DEM>> Run #: <<RUN>>
B. Water System Name: <<CONTACT>>

Mail Report To: RIDEM-OWR Room 200
Street: 235 Promenade St
City: Providence, RI
Report To (Agency/Person) :Mark Nimiroski x 7545

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

Source# C. Station ID D. Type Grab

Collection Point Address: _____
Name Street City

FIELD TESTS:

(Circle One)
Sample Type: (GRAB / COMPOSITE) Odor: pH: Temp: Cl. Residual:

Inorganics Lab	DUP	Metals and Minerals	DUP	Organics Lab	FB	Sanitary Microbiology
Inorganic Tests		Metals for New Systems		___PE4-CARB (531.1)		___BM2 – MF Total Coliform
___WL1 Turbidity		___WL66 Full Set (200.8)		___PE12-Pest/PCB (608)		___BM3 – SPC
___WL4 True Color		___WL75 Antimony		___PE14-EBD/DBCP (504)		
___WL7 Total Suspended Solids		___WL76 Arsenic		___PE21-HERB/ (515.3)		___BM34 – Coliform (TCR)
___WL11 Cyanide (335.4)		___WL77 Barium		___PE22-Pest/PCB+ (508)		
___WL12 Total Phosphorus		___WL78 Beryllium		___PE31-Pest/PCB+ (505)		___BM37 Freshwater-Enterolert
___WL13 pH		___WL79 Cadmium		___PE40-Geddis (505)		___ BM37 – Enterolert
___WL16 Nitrate (353.2)		___WL81 Chromium		___PE_____		___BM38 – A-1 MPN
___WL17 ortho-phosphate		___WL84 Copper				___BM43 – Coliphage
___WL18 Alkalinity (2320B)		___WL82 Iron		___TO2-THM (524.2)		
___WL20 Chloride (300.0)		___WL83 Lead		___TO3-PWVOC (524.2)		___BM1 – MPN
___WL21 Fluoride (300.0)		___WL88 Manganese		___TO4-PET HCB & TO3		# of Tubes __ Dil.__ Thru___
___WL22 Hardness (2340B)		___WL84 Nickel		___TO11-UFVOC (624/603)		
___WL41 Specific Conductance		___WL85 Selenium		___TO12-WQVOC (524.2)		
___WL56 Nitrite (353.2)		___WL86 Silver		___TO14-USR Fee B/N Ext		
___WL Ammonia - N (*NETL)		___WL87 Thallium		___TO17-PET HC & TO12		
___WL Total Kjeldahl - N (*NETL)		___WL88 Zinc		___TO19-Total EXTR (625)		
___WL41 Specific Conductance				___TO27-AGR SVOC (525.2)		
		Metals Routine Set		___TO40-WQ SEMI (525.2)		
DEM Total Metals		___WL68 Full Set (200.8)		___TO_____		
___WL62Al Total Aluminum		___WL78 Beryllium				
___WL62Fe Total Iron - DEM		___WL81 Chromium				
___ WL62 Total Metals (Cu,Cd,Pb&Zn)		___WL84 Nickel				
For individual metals check below		___WL76 Arsenic				
Total Copper ___WL62 TOT Cu		___WL85 Selenium		___TO32 Chlorophyll a – (446) DEM		
Total Cadmium ___WL62 TOT Cd		___WL79 Cadmium				
Total Lead ___WL62 TOT Pb		___WL75 Antimony				
Total Zinc ___WL62 TOT Zn		___WL77 Barium				
		___WL87 Thallium				
DEM Dissolved Metals		___WL86 Mercury (245.1)				
___ WL62Fe Dissolved Iron		___WL85 Lead & Copper(200.8)				
___ WL62Al Dissolved Aluminum		Minerals				
___WL62 Metals Diss. (Cu,Cd,Pb&Zn)		___WL67 Minerals Full Set(200.8)				
For individual metals check below		___WL69 Magnesium				
Diss. Copper ___WL62 DISS Cu		___WL70 Potassium				
Diss. Cadmium ___WL62DISS Cd		___WL71 Sodium				
Diss. Lead ___WL62 DISS Pb		___WL72 Calcium				
Diss. Zinc ___WL62 DISS Zn		___WL73 Sodium Composite(200.8)				

Must Be Completed For Legal Sample	Container		Preservative Added		
Test Code	Number	Type	By Lab	By Collector	Special Instructions
					TKN – DEM submit to: New England Testing Laboratory
					Ammonia -N – DEM submit to New England Testing Laboratory

Chain of Custody

Relinquished By	Date	Time	Received By	Date	Time	Comments

Revised: 6/19/2013

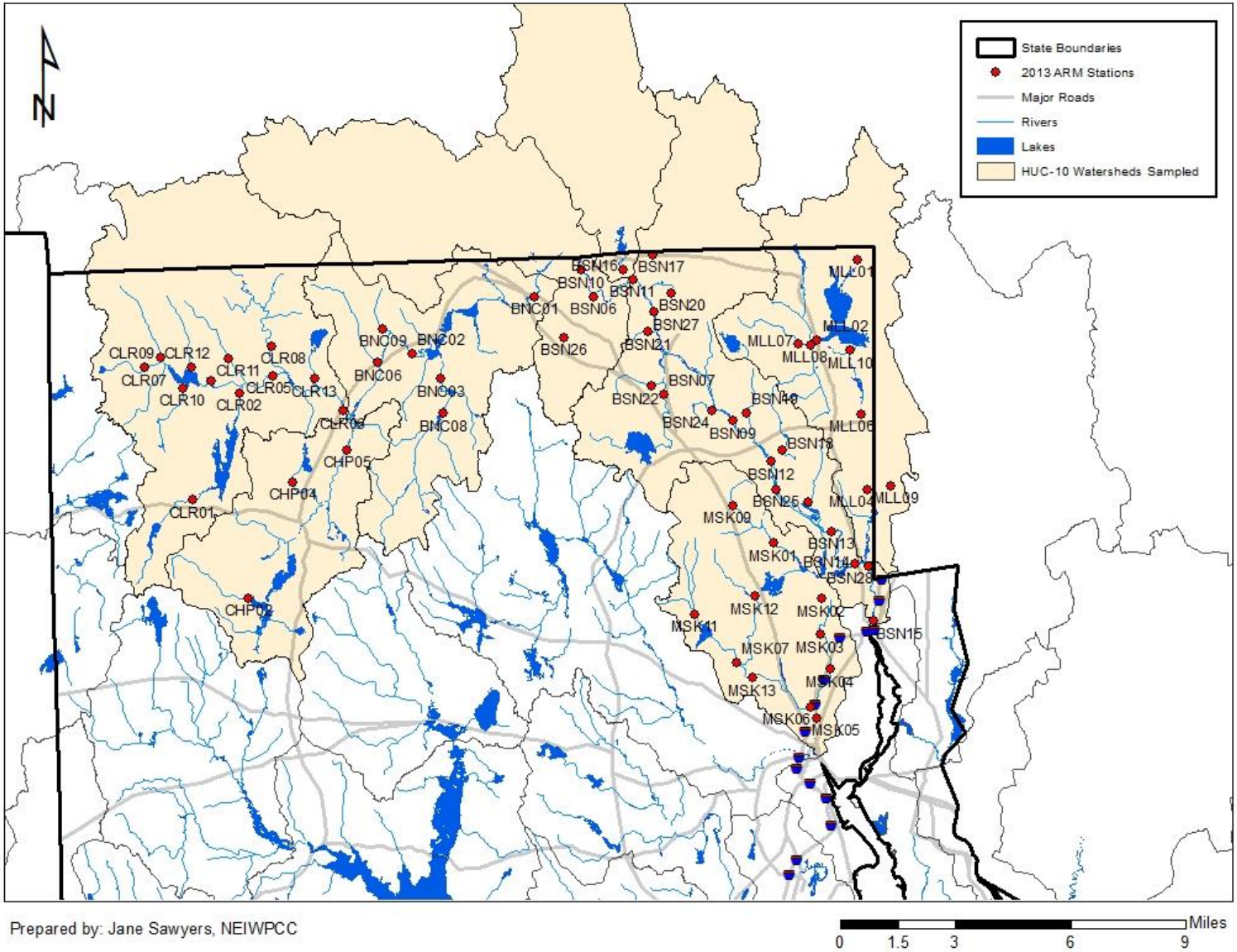

Figure 9. Map of 2013 Ambient River Monitoring Stations in the Clear, Branch, Blackstone, Chepachet, Mosshasuck, and Abbott Run/Millers Rivers Watersheds

Table 17. Ambient River Monitoring Stations 2013: Water Chemistry Suites[A] analyzed by HEALTH

See Table 18 for explanation of analytical methods for conventionals, nutrients, dissolved (*d*M) and total metals (*t*M), pathogens, and Chl *a*.

Station ID	River Name	Latitude	Longitude	"May" event May	"June" event June	"July" event July	"August" event August	"Sept." event September
BNC01	Branch River & Tribs	41.99981	-71.55276	P1	S1+ *d*M+ *d*Fe/Al	P1	S1+ *d*M+ *d*Fe/Al	S1+ *d*M+ *d*Fe/Al
BNC02	Branch River & Tribs	41.97818	-71.61491	P1	S1+ *d*M	P1	S1+ *d*M	S1+ *d*M
BNC03	Tarkiln Brook & Tribs	41.96879	-71.60035	P1	S1	P1	S1	S1
BNC06	Unnamed Trib to Confluence of the Branch	41.97482	-71.63235	P1	S1+ Chl *a*1	P1+ Chl *a*1	S1+ Chl *a*1	S1+ Chl *a* 2
BNC08	Tarkliln Brook	41.95587	-71.59937	P1	S1	P1	S1	S1
BNC09	Tucker Brook & Tribs	41.98771	-71.63008	P1	S1+ Chl *a*1	P1+ Chl *a*1	S1+ Chl *a*1	S1+ Chl *a* 2
BSN06	Cherry Brook & Tribs	41.99977	-71.52309	P1	S1+ *d*M	P1	S1+ *d*M	S1+ *d*M
BSN07	Crookfall Brook & Tribs	41.96300	-71.48760	P1	S1+ Chl *a*1	P1+ Chl *a*1	S1+ Chl *a*1	S1+ Chl *a* 2
BSN09	Blackstone River	41.95302	-71.45246	P1	S1+ *d*M+ *d*Fe/Al	P1	S1+ *d*M+ *d*Fe/Al	S1+ *d*M+ *d*Fe/Al
BSN10	Blackstone River	42.00993	-71.52935	P1	S1+ *dt*M +*dt*Fe/Al	P1	S1+ *dt*M +*dt*Fe/Al	S1+ *dt*M +*dt*Fe/Al
BSN11	Blackstone River	42.00649	-71.50316	P1	S1+ *d*M+ *d*Fe/Al	P1	S1+ *d*M+ *d*Fe/Al	S1+ *d*M+ *d*Fe/Al
BSN12	Blackstone River	41.93772	-71.43342	P1	S1+ *dt*M +*dt*Fe/Al	P1	S1+ *dt*M +*dt*Fe/Al	S1+ *dt*M +*dt*Fe/Al
BSN13	Blackstone River	41.91128	-71.40284	P1	S1+ *dt*M +*dt*Fe/Al	P1	S1+ *dt*M +*dt*Fe/Al	S1+ *dt*M +*dt*Fe/Al
BSN14	Blackstone River	41.89901	-71.39059	P1	S1+ *d*M+ *d*Fe/Al	P1	S1+ *d*M+ *d*Fe/Al	S1+ *d*M+ *d*Fe/Al

[A] S1 = Conventionals, nutrients, enterococci
P1 = enterococci
M (*dissolved, d OR total, t*)* = Cadmium, Copper, Lead and Zinc. Iron (Fe), and Aluminum (Al), only sampled where indicated
**dt*M indicates sampling for both dissolved and total metals
Chl *a*1= sampled from natural substrate
Chl *a*2= sampled from artificial and natural substrate
For complete list of parameters, see Table 18

Table 17 (cont.). Ambient River Monitoring Stations 2013: Water Chemistry Suites[A] analyzed by HEALTH

See Table 18 for explanation of analytical methods for conventionals, nutrients, dissolved (*d*M) and total metals (*t*M), pathogens, and Chl *a*.

Station ID	River Name	Latitude	Longitude	"May" event May	"June" event June	"July" event July	"August" event August	"Sept." event September
BSN15	Blackstone River	41.87755	-71.38175	P1	S1+ *d*M+ *d*Fe/Al	P1	S1+ *d*M+ *d*Fe/Al	S1+ *d*M+ *d*Fe/Al
BSN16	Mill River	42.00982	-71.50793	P1	S1	P1	S1	S1
BSN17	Peters River	42.01560	-71.49304	P1	S1+ *d*M	P1	S1+ *d*M	S1+ *d*M
BSN18	Scott Brook	41.94197	-71.42769	P1	S1	P1	S1	S1
BSN19	West Sneech Brook	41.95584	-71.44542	P1	S1	P1	S1	S1
BSN20	Unnamed Tribs to Blackstone	42.00131	-71.48386	P1	S1	P1	S1	S1
BSN21	Unnamed Tribs to Blackstone	41.98668	-71.49526	P1	S1+ *d*Zn	P1	S1+ *d*Zn	S1+ *d*Zn
BSN22	Spring Brook	41.96604	-71.49352	P1	S1	P1	S1	S1
BSN23	Monastery Brook	41.92241	-71.41443	P1	S1+ Chl *a*1	P1+ Chl *a*1	S1+ Chl *a*1	S1+ Chl *a* 2
BSN24	Mussey Brook	41.95704	-71.46307	P1	S1+ Chl *a*1	P1+ Chl *a*1	S1+ Chl *a*1	S1+ Chl *a* 2
BSN25	Blackstone River	41.92708	-71.43086	P1	S1+ *dt*M +*dt*Fe/Al	P1	S1+ *dt*M +*dt*Fe/Al	S1+ *dt*M +*dt*Fe/Al
BSN26	Cherry Brook & Tribs	41.98450	-71.53810	P1	S1	P1	S1	S1
BSN27	Blackstone River	41.99414	-71.49253	P1	S1+ *d*M+ *d*Fe/Al	P1	S1+ *d*M+ *d*Fe/Al	S1+ *d*M+ *d*Fe/Al
BSN28	Blackstone River	41.89821	-71.38425	P1	S1+ *d*M+ *d*Fe/Al	P1	S1+ *d*M+ *d*Fe/Al	S1+ *d*M+ *d*Fe/Al
CHP02	Saunders Brook	41.88608	-71.69734	P1	S1	P1	S1	S1
CHP04	Sucker Brook	41.92978	-71.67531	P1	S1+ Chl *a*1	P1+ Chl *a*1	S1+ Chl *a*1	S1+ Chl *a* 2
CHP05	Chepachet River & Tribs	41.94212	-71.64759	P1	S1	P1	S1	S1

[A] S1 = Conventionals, nutrients, enterococci
P1 = enterococci
M (*dissolved, d OR total, t*)* = Cadmium, Copper, Lead and Zinc. Iron (Fe), and Aluminum (Al), only sampled where indicated
**dt*M indicates sampling for both dissolved and total metals
Chl *a*1= sampled from natural substrate
Chl *a*2= sampled from artificial and natural substrate
For complete list of parameters, see Table 18

Table 17 (cont.). Ambient River Monitoring Stations 2013: Water Chemistry Suites[A] analyzed by HEALTH

See Table 18 for explanation of analytical methods for conventionals, nutrients, dissolved (*d*M) and total metals (*t*M), pathogens, and Chl *a*.

Station ID	River Name	Latitude	Longitude	"May" event May	"June" event June	"July" event July	"August" event August	"Sept." event September
CLR01	Brandy Brook & Tribs	41.92307	-71.72581	P1	S1+ Chl *a*1	P1+ Chl *a*1	S1+ Chl *a*1	S1+ Chl *a* 2
CLR02	Pascoag River	41.96333	-71.70221	P1	S1	P1	S1	S1
CLR03	Clear River & Tribs	41.96792	-71.71650	P1	S1+ *d*Pb	P1	S1+ *d*Pb	S1+ *d*Pb
CLR05	Clear River & Tribs	41.97005	-71.68506	P1	S1+ *d*M+ *d*Fe/Al+ Chl *a*1	P1+ Chl *a*1	S1+ *d*M+ *d*Fe/Al+ Chl *a*1	S1+ *d*M+ *d*Fe/Al+ Chl *a*1
CLR06	Clear River	41.95665	-71.64944	P1	S1+ *d*M+ *d*Fe/Al	P1	S1+ *d*M+ *d*Fe/Al	S1+ *d*M+ *d*Fe/Al
CLR07	Dry Arm Brook	41.97289	-71.75029	P1	S1	P1	S1	S1
CLR08	Nipmuc River	41.98109	-71.68621	P1	S1+ Chl *a*1	P1+ Chl *a*1	S1+ Chl *a*1	S1+ Chl *a* 2
CLR09	Clear River	41.97661	-71.74234	P1	S1+ *d*M+ *d*Fe/Al	P1	S1+ *d*M+ *d*Fe/Al	S1+ *d*M+ *d*Fe/Al
CLR10	Leland Brook	41.96526	-71.73059	P1	S1	P1	S1	S1
CLR11	Mowry Brook	41.97641	-71.70807	P1	S1	P1	S1	S1
CLR12	Unnamed Tributary to Wilson Reservoir	41.97288	-71.72674	P1	S1+ Chl *a*1	P1+ Chl *a*1	S1+ Chl *a*1	S1+ Chl *a* 2
CLR13	Herring Brook	41.96878	-71.66399	P1	S1	P1	S1	S1
MLL01	Burnt Swamp Brook & Tribs	42.01387	-71.38957	P1	S1+ *d*M+ *d*Fe+ Chl *a*1	P1+ Chl *a*1	S1+ *d*M+ *d*Fe+ Chl *a*1	S1+ *d*M+ *d*Fe+ Chl *a*1
MLL02	East Sneech Brook	41.98361	-71.40970	P1	S1	P1	S1	S1
MLL04	Millers River	41.92729	-71.38479	P1	S1+ Chl *a*1	P1+ Chl *a*1	S1+ Chl *a*1	S1+ Chl *a* 2

[A] S1 = Conventionals, nutrients, enterococci
P1 = enterococci
M (*dissolved, d OR total, t*)* = Cadmium, Copper, Lead and Zinc. Iron (Fe), and Aluminum (Al), only sampled where indicated
**d*M indicates sampling for both dissolved and total metals
Chl *a*1= sampled from natural substrate
Chl *a*2= sampled from artificial and natural substrate
For complete list of parameters, see Table 18

Table 17 (cont.). Ambient River Monitoring Stations 2013: Water Chemistry Suites[A] analyzed by HEALTH

See Table 18 for explanation of analytical methods for conventionals, nutrients, dissolved (*d*M) and total metals (*t*M), pathogens, and Chl *a*.

Station ID	River Name	Latitude	Longitude	"May" event May	"June" event June	"July" event July	"August" event August	"Sept." event September
MLL06	Abbott Run Brook North & Tribs	41.95545	-71.38748	P1	S1+ *d*Cd	P1	S1+ *d*Cd	S1+ *d*Cd
MLL07	East Sneech Brook	41.98217	-71.41965	P1	S1+ *d*M+ *d*Fe/Al+ Chl *a*1	P1+ Chl *a*1	S1+ *d*M+ *d*Fe/Al+ Chl *a*1	S1+ *d*M+ *d*Fe/Al+ Chl *a*1
MLL08	Long Brook & Tribs	41.98165	-71.41314	P1	S1+ Chl *a*1	P1+ Chl *a*1	S1+ Chl *a*1	S1+ Chl *a* 2
MLL09	Abbott Run Brook South & Tribs	41.92849	-71.37296	P1	S1+ *d*Cd+ Chl *a*1	P1+ Chl *a*1	S1+ *d*Cd+ Chl*a*1	S1+ *d*Cd+ Chl*a*1
MLL10	Abbott Run Brook North & Tribs	41.97956	-71.39329	P1	S1+ *d*Cd	P1	S1+ *d*Cd	S1+ *d*Cd
MSK01	Moshassuck River & Tribs	41.90702	-71.43216	P1	S1	P1	S1	S1
MSK02	Moshassuck River & Tribs	41.88593	-71.40762	P1	S1	P1	S1	S1
MSK03	Moshassuck River & Tribs	41.87250	-71.40834	P1	S1	P1	S1	S1
MSK04	Moshassuck River & Tribs	41.85949	-71.40358	P1	S1+ *d*M	P1	S1+ *d*M	S1+ *d*M
MSK05	Moshassuck River & Tribs	41.84097	-71.41031	P1	S1+ *d*M	P1	S1+ *d*M	S1+ *d*M
MSK06	West River & Tribs	41.84513	-71.41360	P1	S1+ *d*M	P1	S1+ *d*M	S1+ *d*M
MSK07	West River & Tribs	41.86214	-71.45048	P1	S1+ Chl *a*1	P1+ Chl *a*1	S1+ Chl *a*1	S1+ Chl *a* 2
MSK09	Moshassuck River & Tribs	41.92123	-71.45236	P1	S1+ Chl *a*1	P1+ Chl *a*1	S1+ Chl *a*1	S1+ Chl *a* 2
MSK11	West River & Tribs	41.88020	-71.47161	P1	S1+ Chl *a*1	P1+ Chl *a*1	S1+ Chl *a*1	S1+ Chl *a* 2
MSK12	West River & Tribs	41.88694	-71.44152	P1	S1+ Chl *a*1	P1+ Chl *a*1	S1+ Chl *a*1	S1+ Chl *a* 2
MSK13	West River & Tribs	41.85621	-71.44262	P1	S1	P1	S1	S1

[A] S1 = Conventionals, nutrients, enterococci
P1 = enterococci
M (*dissolved, d OR total, t*)* = Cadmium, Copper, Lead and Zinc. Iron (Fe), and Aluminum (Al), only sampled where indicated
**dM* indicates sampling for both dissolved and total metals
Chl *a*1= sampled from natural substrate
Chl *a*2= sampled from artificial and natural substrate
For complete list of parameters, see Table 18

Table 15. 2013 Parameters analyzed by HEALTH

Chemical parameters, analytical methods and Standard Operating Procedure Documents followed by RI State Health Laboratories to analyze water samples for the RIDEM Ambient River Monitoring Program.

Parameter	Abbreviation	Units	Method	Standard Operating Procedure Document
Conventionals				
Chloride	Cl	mg/L	EPA 300 Inorganic Anions by Ion Chromatography	RIDOH Doc ID# 1330
Hardness	--	mg/L	SM2340 Hardness by Titration and Calculation	RIDOH Doc ID# 1331
pH	pH	pH units	EPA 150.1 pH by Electrometric Method	RIDOH Doc ID# 1321
Sodium	Na	mg/L	EPA 200.8 Trace Elements by ICPMS	RIDOH Doc ID# 1327
Total Suspended Solids	TSS	mg/L	SM2540 Total Suspended and Settleable Solids	RIDOH Doc ID# 2450
True Color	--	CU	SM2120 Color by Visual Comparison	RIDOH Doc ID# 1317
Turbidity	--	NTU	EPA 180.1 Turbidity by Nephelometry	RIDOH Doc ID# 1316
Nutrients				
Total ammonia [A]	NH_3-N (total)	mg/L	EPA 350.1 Rev. 2.0 Semi-automated Colorimetry	ESS Laboratory SOP 40_0024L
Total Kjeldahl Nitrogen [A]	TKN	mg/L	EPA 351.2 Semi-automated Colorimetry	ESS Laboratory SOP 40_0019B Total Kjeldahl Nitrogen
Nitrate-Nitrite as Nitrogen, Dissolved	$NO_2 + NO_3$-N	mg/L	EPA 353.2 Nitrate and Nitrite as N by FIA	RIDOH Doc ID# 1322 (Nitrate), RIDOH Doc ID# 1326 (Nitrite)
Ortho-phosphate	PO4-P	mg/L	SM4500 Total Phosphorus by Persulfate Digestion and Spectrophotometry	RIDOH Doc ID# 1328
Total Phosphorus	TP	mg/L	SM4500 Total Phosphorus by Persulfate Digestion and Spectrophotometry	RIDOH Doc ID# 1328
Chlorophyll *a*	Chl *a*	mg/L	EPA 446 Chlorophylls by Visible Spectrophotometry	RIDOH Doc ID# 1079
Pathogens				
Enterococci	Entero	Entercocci/ 100mL	IDEXX Enterolert	RIDOH Doc ID# 1832
Metals				
Cadmium	Cd (dissolved)	µg/L	EPA 200.8 Trace Elements by ICPMS	RIDOH Doc ID# 1327
Copper	Cu (dissolved)	µg/L	EPA 200.8 Trace Elements by ICPMS	RIDOH Doc ID# 1327
Lead	Pb (dissolved)	µg/L	EPA 200.8 Trace Elements by ICPMS	RIDOH Doc ID# 1327
Zinc	Zn (dissolved)	µg/L	EPA 200.8 Trace Elements by ICPMS	RIDOH Doc ID# 1327
Total Aluminum	Al (total)	µg/L	EPA 200.8 Trace Elements by ICPMS	RIDOH Doc ID# 1327
Total Iron	Fe (total)	µg/L	EPA 200.8 Trace Elements by ICPMS	RIDOH Doc ID# 1327

[A] Samples are analyzed by a laboratory certified in RI to test these parameters in non-potable water.

Note: Dissolved Oxygen, water temperature, conductivity, specific conductance, and salinity are measured in the field using YSI instrumentation. Total Nitrogen is reported as the addition of the following fractions: (NO_3-N) + (TKN)

Table 16. 2013 Holding Times and Measurement Performance Criteria

Sample holding times, lab quantitation limits, and method detection limits of each parameter analyzed by RI State Health Laboratories for the RIDEM Ambient River Monitoring Program.

Parameter*	Abbreviation	Units	Max holding time	Quantitation Limit (QL)	Method Detection Limit (MDL)
Conventionals					
Chloride	Cl	mg/L	28 days	0.2	0.02
Hardness	--	mg/L	6 months	–	–
pH	pH	pH units	immediately	–	–
Sodium	Na	mg/L	6 months	1	0.05
Total Suspended Solids	TSS	mg/L	7 days	1.0	–
True Color	–	CU	48 hours	–	–
Turbidity	–	NTU	48 hours	0.2	–
Nutrients					
Total ammonia [A]	NH3-N (total)	mg/L	7 days	0.05	0.02
Total Kjehldahl Nitrogen [A]	TKN	mg/L	28 days	0.2	–
Nitrate-Nitrite as Nitrogen, Dissolved	NO3-N	mg/L	2 days	0.05	0.01
Ortho-phosphate	PO4-P	mg/L	48 hours	0.02	0.01
Total Phosphorus	TP	mg/L	28 days	0.02	0.01
Chlorophyll *a*	Chl *a*	mg/l	24 hours (unfiltered) 21 days (filtered)	0.1	0.046
Pathogens					
Enterococci	Entero	Entercocci per 100 mL	6 hours	< 1	–
Metals					
Cadmium	Cd	µg/L	6 months	1.0	0.07
Copper	Cu	µg/L	6 months	1.0	0.17
Lead	Pb	µg/L	6 months	1.0	0.03
Zinc	Zn	µg/L	6 months	20	0.95
Total Aluminum	Al (total)	µg/L	6 months	10	2.52
Total Iron	Fe (total)	µg/L	6 months	20	2.28

[A] Samples are analyzed by a laboratory certified in RI to test these parameters in non-potable water.

Note: Dissolved Oxygen, water temperature, conductivity, specific conductance, and salinity are measured in the field using YSI instrumentation. Total Nitrogen is reported as the addition of the following fractions: (NO_3-N) + (TKN)

Appendix G Addendum. HEALTH Analytical Measurement Performance Criteria.

Sampling SOP	EPA 446 Chlorophylls by Visible Spectrophotometry, Doc ID# 1079
Medium/Matrix	Surface Water
Analytical Parameter	Chlorophyll *a*
Concentration Level	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)
Method Blank/ Trip or Field Blank	Spectrophotometry / SOP Doc ID# 1079 / RIDOH	<0.10 mg/L (RL)	Accuracy/bias Contamination	S/A
Check Std (SSS) and Low Level Std (LLSS)	Spectrophotometry / SOP Doc ID# 1079 / RIDOH	70 – 130% recovery	Accuracy/bias Contamination	A
Data Review 100%	Spectrophotometry / SOP Doc ID# 1079 / RIDOH	Data collected are determined to be useable	Data - Completeness	A

Sampling SOP	EPA 200.8 Trace Elements by ICPMS, Doc ID# 1327
Medium/Matrix	Surface Water
Analytical Parameter	Al total
Concentration Level	µg/L (ppb)

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)
Laboratory Field/Trip Reagent blank	ICP/MS / SOP Doc ID# 1327 / RIDOH	<2.2 x MDL (~1.7ug/L)	Precision/contamination	S/A
QCS-Quality Control Sample	ICP/MS / SOP Doc ID# 1327 / RIDOH	Within Manufacturer's limit (<10%)	Accuracy/bias Contamination	A
Lab Duplicates	ICP/MS / SOP Doc ID# 1327 / RIDOH	<20 % RPD	Precision	A
Field Duplicates	ICP/MS / SOP Doc ID# 1327 / RIDOH	<20% RPD	Accuracy	S/A
Data Review	ICP/MS / SOP Doc ID# 1327 / RIDOH	Data collected to be deemed reportable	Data - Completeness	A

APPENDIX H

ADDENDUM FOR NUMERIC NUTRIENT CRITERIA DEVELOPMENT FIELDWORK TO BE CONDUCTED IN COORDINATION WITH THE AMBIENT RIVER MONITORING PROGRAM

Task Description

This addendum is intended to describe supplemental fieldwork conducted in conjunction with the current Ambient River Monitoring (ARM) program for the purpose of numeric nutrient criteria development. This fieldwork initiative will be incorporated into the ARM program for the current rotation cycle 2011-2014.

Project Organization

The fieldwork conducted for numeric nutrient criteria was undertaken by RIDEM/OWR permanent, contractual, and seasonal personnel. Jane Sawyers, Project Manager for numeric nutrient criteria development, served as the Supplemental Nutrient Fieldwork Team Leader and was in charge of organizing sample and field data collection for the supplemental fieldwork only.

Background

The U.S. Environmental Protection Agency (EPA) has directed all states and territories to strengthen narrative criteria for nutrients by development of specific numeric nutrient criteria. EPA guidance further recommends that acceptable levels of total phosphorus (TP), total nitrogen (TN), chlorophyll *a* (chl *a*), and turbidity in rivers and streams be established (USEPA 2000). The preferred approach is to develop criteria that reflect local conditions and protect specific uses of surface waters. A review of data available to support nutrient criteria development for Rhode Island rivers and streams revealed an information gap on the primary production response to nutrients, especially benthic algae and some of the important associated habitat parameters. Recognizing that numeric nutrient criteria development requires appropriate biological response and habitat data, RIDEM planned a data collection effort in coordination with the rotating basin schedule of the ARM program. The collection of benthic algae and associated habitat data will occur in a select number of the wadeable ARM sites each year of the entire rotation 2011-2014.

It has been the experience of some states that the relationship between elevated nutrient concentrations and biological response does not produce a threshold that allows for the identification of numeric nutrient criteria. Furthermore, several New England states have been challenged with how to appropriately address water bodies that exhibit elevated nutrient concentration without reaching nuisance or adverse levels of conventional biological response parameters (NEIWPCC 2011). Therefore, Rhode Island collected a number of benthic algal response variables and habitat measurements to address the potential biological and management issues in stream nutrient criteria development.

Based on observations of flow and benthic algae and non-vascular growth in 2011 Supplemental Nutrient Fieldwork, more extensive sampling is required to assess biological response to nutrients. At

some sites, plant growth appeared to be the dominant primary production. Therefore, assessment of plant growth was been added to the 2012 and 2013 Supplemental Nutrient Fieldwork in and update to SOP-WR-W-36.

Furthermore, due to forecasts and impacts of Hurricane Irene in 2011, artificial substrates were removed early, and natural substrate sampling did not occur until September. At some sites, biological growth appeared to be heaviest during the September sampling period in 2011, and flows were high enough for more appropriate placement of artificial substrates. Therefore, chlorophyll *a* sampling was conducted over several months from natural substrate to determine the maximum benthic primary growth time period and artificial substrate placement was moved to August. Natural substrate was sampled once per month June through September for chlorophyll *a*, and artificial deployment began in mid to late August with collection in mid-September. The sampling event in September included collection of diatom taxonomy samples as well.

For 2013, RIDEM/OWR measured taxonomic identification of diatoms, chlorophyll *a* abundance of benthic algae, coverage of benthic algae, coverage of plants, and percent coverage of floating aquatic macrophytes including duckweed (*Lemna minor*) and watermeal (*Wolffia sp.*), stream canopy, and low-gradient habitat in wadeable streams.

Methods

Site Selection

Sites for numeric nutrient criteria development were selected from the list annually generated by the ARM Project Team as described in Section II.1 of the ARM QAPP. From this list, only wadeable sites were reviewed for numeric nutrient criteria development fieldwork. Approximately 20 sites were selected per year, depending on funding and staff availability. Based on geographic analysis of the streams by RIDEM, an approximately equal division of high and low gradient sites were selected. Since the statistical analysis of the nutrient and response data necessitates a range of nutrient conditions, the historical data available from RIDEM's water quality database, WQUAL, was consulted for sites historically high and low in both TP and TN. From this information, sites encompassing the range of possible conditions were selected prior to the field season.

Sampling Methods

The procedures performed at the numeric nutrient criteria sites are documented in SOPs and the EPA Habitat Assessment Field Data Sheet-Low Gradient Streams, which are included in this addendum. The included SOPs are listed in the table below:

SOP #	Title
SOP-WR-W-35	Standard Operating Procedure for Stream Canopy Measurements by Densiometer
SOP-WR-W-36	Standard Operating Procedure for Measurement of Benthic Algae Cover by Viewing Bucket and Modified Pebble Count
SOP-WR-W-37	Standard Operating Procedure for Collection of Benthic Algae from Natural and Artificial Substrates

Four site visits to each of the selected nutrient criteria sites were required in late June through September. Unlike the water quality sampling described in the ARM QAPP, the supplementary sampling does not require dry weather prior to sampling. The Supplemental Nutrient Fieldwork Team Leader, Jane Sawyers, consulted with Field Data Collection Team Leader, Mark Nimiroski, and any field staff that recently visited the selected sites regarding conditions of the selected nutrient sites.

All sampling events employed section 5.2.8 of SOP-WR-W-37 for chlorophyll *a* only. The sampling event in July for the supplemental fieldwork included the procedures described in SOP-WR-W-35 and SOP-WR-W-36. Additionally, at low gradient sites only, the sampling event in September included completion of the EPA Habitat Assessment Field Data Sheet-Low Gradient Streams. The sampling event in August included the implementation of Sections 5.2.1 through 5.2.6 of SOP-WR-W-37, placement of the artificial substrates. The sampling event in September completed Sections 5.2.7 through 5.2.9 of SOP-WR-W-37, retrieval of the artificial substrates.

Data Quality Objectives and Measurement Performance Criteria

Data Quality Objectives

The supplemental fieldwork operated under the data quality objectives stated in the ARM QAPP. The relevant quality assurance procedures of the ARM QAPP were used to verify the use of proper, consistent field procedures, handling measures, laboratory analyses, and database management activities:

- Standard Operating Procedures (SOPs) were implemented during sampling and field data collection (see Addendum Appendices).
- EPA-approved, standardized methods were adhered to for all chemical analysis procedures;
- Qualified, trained scientists performed the sample collection and laboratory analyses;
- Chain of Custody forms were completed when handling samples and transferring custody from field crew to both the RIDOH Laboratories as well as the authorized state vendor for analytical laboratory services. (ARM Figure 2);
- One trip blank (sample bottles filled with DI water in the lab) for each day of sampling were transported by each field crew ensure there is no contamination of sampling containers in the field during transportation;

Data Quality Indicators

The same data quality indicators (DQI) as stated in the ARM QAPP were used for the chlorophyll *a* laboratory samples, except for Data Comparability and Precision of artificial substrate collection. The precision of the artificial substrate chlorophyll *a* took place at 10% duplicate sites. The samples sent to a contractor for diatom taxonomy used the same Data Representativeness and Sampling Completeness DQI as stated in the ARM QAPP. The Precision of the supplementary diatom taxonomy fieldwork were assessed by collection of 10% duplicate stations. A relative percent difference (RPD) on the percent or raw abundance data is not an appropriate measure of precision for duplicate taxonomy samples. The species abundance duplicate samples will be assessed by cluster confidence intervals. The duplicate samples must fall within the equivalent of a 95% confidence interval. The contracted laboratory are required to prepare as part of a final report the internal QAQC checks including a measure between analysts, which will indicate the major source of potential Bias. Because all of the supplementary fieldwork is data that has never been collected in Rhode Island, the Data Comparability will be assessed by reviewing relevant literature studies and relationships and communicating with other states about the results from similar studies.

Instrument/Equipment Testing, Inspection, Maintenance, and Calibration

The methods employed do not require calibration. The methods also do not require electronic instruments. All field equipment was inspected as required in the respective SOPs. At a minimum, equipment was inspected by the field analyst prior to a sampling event and annually by the Numeric Nutrient Criteria Development Project Manager, Jane Sawyers.

Inspection for Supplies and Consumables

The inspection of supplies occurred as stated in the ARM QAPP, except that Jane Sawyers performed the duties of the Project Manager and Supplemental Nutrient Fieldwork Team Leader for the supplemental fieldwork only. The samples sent to the contracted laboratory for diatom taxonomy required a preservative, and the artificial substrate cleaning process required acetone and bleach. The Numeric Nutrient Criteria Development Project Manager, Jane Sawyers, will ensured that the preservative and cleaning supplies were received by RIDEM were not damaged in shipment (i.e. no leaking contents; lid securely attached).

Non-direct Measurements

The supplemental fieldwork did not require dry conditions as described in the ARM QAPP. However, extreme high and low flows were a concern for the artificial substrate deployment. As described earlier, Jane Sawyers consulted with staff that had been to the sites recently regarding high flows. The USGS website for real-time stream data was also consulted: http://waterdata.usgs.gov/nwis/rt

Data Validation and Usability

As Project Manager of the numeric nutrient criteria project, Jane Sawyers completed all requirements stated in the ARM QAPP Sections III.1 through Sections III.3 for data generated from the supplementary fieldwork only.

Assessment and Oversight

As Project Manager of the numeric nutrient criteria project, Jane Sawyers completed all requirements stated in the ARM QAPP Sections IV.1 through Sections IV.2 for data generated from the supplementary fieldwork only.