2012 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

January 15, 2013

RIDEM Project Manager: Katie DeGoosh

Signature/Date: Katie DeGoosh 1-15-13

2012 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 2012 sampling season. The following bullets summarize all changes or updates:

- Total Aluminum has been added as an additional parameter to be analyzed where requested. 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; and details of all laboratory analysis can be found in new attachments:

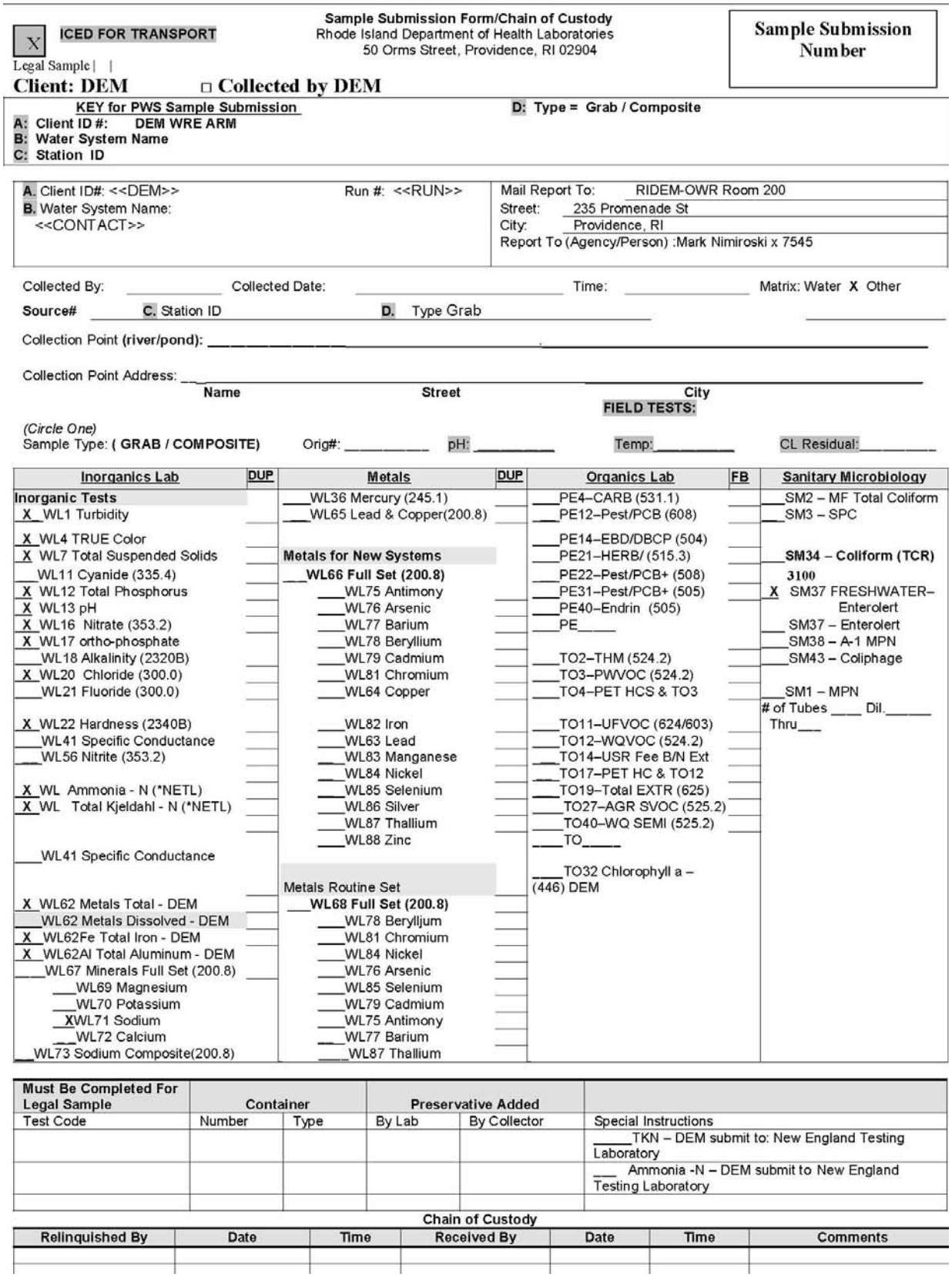
  Table 14. ARM Stations 2012: Water Chemistry Suites analyzed by HEALTH
  Table 15. 2012 Parameters analyzed by HEALTH
  Table 16. 2012 Holding Times and Measurement Performance Criteria
  Appendix G Addendum. HEALTH Analytical Measurement Performance Criteria.

- Additionally, most metals analyzed in the past have been analyzed for as Dissolved Metals. However, for 2012, the option to analyze metals as Total Metals has been added for stations located on waterbodies where State Water Quality Regulations specify Water Quality Criteria as Total Metals. This parameter was also added to Figure 2.

- A new map (Figure 9) and new list of 2012 sampling stations (Table 14) reflects the stations targeted for the 2012 basin rotation in the greater Pawtuxet River Watersheds (including the Scituate Reservoir Watersheds).

- To aid in nutrient criteria development, at some sites, additional fieldwork was performed and supplemental data was collected 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 non-vascular plant growth.

Figure 2. Sample Submission Form/Chain of Custody



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

X ICED FOR TRANSPORT
Legal Sample | |

Sample Submission Number

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 **(river/pond):** _____

Collection Point Address: _____
Name Street City

FIELD TESTS:

(Circle One)
Sample Type: **(GRAB / COMPOSITE)** Orig#: _____ pH: _____ Temp: _____ CL Residual: _____

Inorganics Lab	DUP	Metals	DUP	Organics Lab	FB	Sanitary Microbiology
Inorganic Tests		___WL36 Mercury (245.1)		___PE4–CARB (531.1)		___SM2 – MF Total Coliform
_X_WL1 Turbidity		___WL65 Lead & Copper(200.8)		___PE12–Pest/PCB (608)		___SM3 – SPC
_X_WL4 TRUE Color				___PE14–EBD/DBCP (504)		
_X_ WL7 Total Suspended Solids		**Metals for New Systems**		___PE21–HERB/ (515.3)		___**SM34 – Coliform (TCR)**
___WL11 Cyanide (335.4)		___**WL66 Full Set (200.8)**		___PE22–Pest/PCB+ (508)		**3100**
_X_ WL12 Total Phosphorus		___WL75 Antimony		___PE31–Pest/PCB+ (505)		_X_ SM37 FRESHWATER–Enterolert
_X_ WL13 pH		___WL76 Arsenic		___PE40–Endrin (505)		___ SM37 – Enterolert
_X_WL16 Nitrate (353.2)		___WL77 Barium		___PE_____		___SM38 – A-1 MPN
_X_WL17 ortho-phosphate		___WL78 Beryllium				___SM43 – Coliphage
___WL18 Alkalinity (2320B)		___WL79 Cadmium		___TO2–THM (524.2)		
_X_WL20 Chloride (300.0)		___WL81 Chromium		___TO3–PWVOC (524.2)		___SM1 – MPN
___WL21 Fluoride (300.0)		___WL64 Copper		___TO4–PET HCS & TO3		# of Tubes ____ Dil._____
						Thru___
_X_WL22 Hardness (2340B)		___WL82 Iron		___TO11–UFVOC (624/603)		
___WL41 Specific Conductance		___WL63 Lead		___TO12–WQVOC (524.2)		
___WL56 Nitrite (353.2)		___WL83 Manganese		___TO14–USR Fee B/N Ext		
		___WL84 Nickel		___TO17–PET HC & TO12		
_X_WL Ammonia - N (*NETL)		___WL85 Selenium		___TO19–Total EXTR (625)		
_X_WL Total Kjeldahl - N (*NETL)		___WL86 Silver		___TO27–AGR SVOC (525.2)		
		___WL87 Thallium		___TO40–WQ SEMI (525.2)		
		___WL88 Zinc		___TO_____		
___WL41 Specific Conductance						
		Metals Routine Set		___TO32 Chlorophyll a – (446) DEM		
_X_WL62 Metals Total - DEM		___**WL68 Full Set (200.8)**				
___WL62 Metals Dissolved - DEM		___WL78 Beryljum				
_X_WL62Fe Total Iron - DEM		___WL81 Chromium				
_X_WL62Al Total Aluminum - DEM		___WL84 Nickel				
___WL67 Minerals Full Set (200.8)		___WL76 Arsenic				
___WL69 Magnesium		___WL85 Selenium				
___WL70 Potassium		___WL79 Cadmium				
_XWL71 Sodium		___WL75 Antimony				
___WL72 Calcium		___WL77 Barium				
___WL73 Sodium Composite(200.8)		___WL87 Thallium				

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

Figure 9. Map of 2012 Ambient River Monitoring Stations in the Pawtuxet River, Upper Moosup River and Hunt River Watersheds

Table 14. Ambient River Monitoring Stations 2012: Water Chemistry Suites[A] analyzed by HEALTH

Station ID, river name, GPS location, dates and chemistry parameter suites collected at each station for 2012 RIDEM – ARM Program.
See Table 15 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 **Late May - 6/20/12**	"June" event **Late June - 8/14/12**	"July" event **Late Aug. - 9/13/12**	"August" event **Late Sept. - 10/22/12**	"Sept." event **Late Oct - December**
BGR01	Bear Brook & Tribs	41.66020	-71.62809	S1	P1	P1	S1	S1
BGR05	Congdon River & Tribs	41.61220	-71.62275	S1	P1+ Chl *a* 1	P1+ Chl *a* 1	S1 + Chl *a* 1	S1 + Chl *a* 2
BGR08	Carr River & Tribs	41.64333	-71.60792	S1 + *d* M + Fe	P1	P1	S1 + *d* M + Fe	S1 + *d* M + Fe
BGR09	Nooseneck River & Tribs	41.62662	-71.63248	S1	P1	P1	S1	S1
BGR10	Big River & Tribs	41.64473	-71.61281	S1	P1	P1	S1	S1
FL01	Boyd Brook	41.71496	-71.63008	S1	P1	P1	S1	S1
FL03	Flat River & Tribs	41.71453	-71.65203	S1	P1+ Chl *a* 1	P1+ Chl *a* 1	S1 + Chl *a* 1	S1 + Chl *a* 2
FL06	Negro Sawmill Brook	41.72062	-71.68380	S1	P1	P1	S1	S1
FL08	Quidneck Brook & Tribs	41.69136	-71.66939	S1	P1	P1	S1	S1
HNT02	Hunt River	41.62379	-71.48146	S1	P1	P1	S1	S1
HNT03	Frenchtown Brook & Tribs	41.62572	-71.48416	S1	P1+ Chl *a* 1	P1+ Chl *a* 1	S1 + Chl *a* 1	S1 + Chl *a* 2
HNT04	Hunt River	41.63601	-71.70348	S1 + Fecal	P2	P2	S1 + Fecal	S1 + Fecal
HNT05	Fry Brook & Tribs	41.63314	-71.48785	S1	P1+ Chl *a* 1	P1+ Chl *a* 1	S1 + Chl *a* 1	S1 + Chl *a* 2
HNT06a	Hunt River	41.63366	-71.47047	S1	P1	P1	S1	S1
HNT07	Scrabbletown Brook	41.59450	-71.49880	S1	P1	P1	S1	S1
HNT08	Mawney Brook	41.63183	-71.51403	S1	P1	P1	S1	S1
HNT09	Pierce Brook	41.64051	-71.46582	S1	P1	P1	S1	S1
HNT10	Hunt River	41.64119	-71.44512	S1 + Fecal	P2	P2	S1 + Fecal	S1 + Fecal
HNT11	Sandhill Brook	41.69250	-71.44686	S1 + Fecal	P2	P2	S1 + Fecal	S1 + Fecal

[A] S1 = Conventionals, nutrients, enterococci
S4 = Conventionals & nutrients
M (*dissolved or total*) = Cadmium, Copper, Lead and Zinc (Iron and Aluminum only sampled where indicated)
P1 = enterococci
P2 = enterococci and Fecal coliform.
Chl *a* 1= sampled from natural substrate
Chl *a* 2= sampled from artificial and natural substrate
For complete list of parameters, see Table 15

Table 14. (cont'd) Ambient River Monitoring Stations 2012: Water Chemistry Suites[A] analyzed by HEALTH

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NBP02	Pawtuxet River North Branch	41.73409	-71.55271	S1 + *d* M	P1	P1	S1 + *d* M	S1 + *d* M
NBP06	Pawtuxet River North Branch	41.71851	-71.51821	S1 + *d* M	P1	P1	S1 + *d* M	S1 + *d* M
NBP07	Pawtuxet River North Branch	41.74899	-71.51832	S4 + *d* M + Fe +Al	P1	P1	S4 + *d* M + Fe +Al	S4 + *d* M + Fe +Al
NBP08	Pawtuxet River North Branch	41.74489	-71.57711	+Al	P1	P1	S4 + *d* M + Fe +Al	S4 + *d* M + Fe +Al
PBR02	Hemlock Brook & Tribs	41.79068	-71.69849	S1	P1+ Chl *a* 1	P1+ Chl *a* 1	S1 + Chl *a* 1	S1 + Chl *a* 2
PBR03	Dolly Cole Brook & Tribs	41.82221	-71.70045	S1	P1+ Chl *a* 1	P1+ Chl *a* 1	S1 + Chl *a* 1	S1 + Chl *a* 2
PBR04	Windsor Brook & Tribs	41.83608	-71.72263	S1	P1	P1	S1	S1
PBR06	Shippee Brook	41.83092	-71.75057	S1	P1	P1	S1	S1
PBR07	Ponaganset River & Tribs	41.81899	-71.70498	S1	P1	P1	S1	S1
PCT01	Pocasset River & Tribs	41.81308	-71.49343	S1 + *d* M + Fe	P1	P1	S1 + *d* M + Fe	S1 + *d* M + Fe
PCT02	Pocasset River & Tribs	41.80278	-71.48606	S1 + *d* M + Fe	P1	P1	S1 + *d* M + Fe	S1 + *d* M + Fe
PCT03	Simmons Brook & Tribs	41.79625	-71.48360	S1 + *d* M + Fe	P1	P1	S1 + *d* M + Fe	S1 + *d* M + Fe
PCT04	Pocasset River & Tribs	41.79701	-71.47963	S1 + *d* M + Fe	P1	P1	S1 + *d* M + Fe	S1 + *d* M + Fe
PCT06	Pocasset River & Tribs	41.77082	-71.45394	P1	P1	P1	P1	P1
PCT07	Pocasset River & Tribs	41.75920	-71.44298	S1 + *d* M + Fe	P1+ Chl *a* 1	P1+ Chl *a* 1	S1 + *d* M + Fe + Chl *a* 1	S1 + *d* M + Fe + Chl *a* 2
PCT08	Dry Brook & Tribs	41.81186	-71.51014	S1	P1+ Chl *a* 1	P1+ Chl *a* 1	S1 + Chl *a* 1	S1 + Chl *a* 2
PCT09	Pocasset River & Tribs	41.83698	-71.52964	S1 + *d* M + Fe	P1	P1	S1 + *d* M + Fe	S1 + *d* M + Fe

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PXT01	Meshanticut Brook & Tribs	41.74865	-71.48487	S1	P1+ Chl *a* 1	P1+ Chl *a* 1	S1 + Chl *a* 1	S1 + Chl *a* 2
PXT02	Furnace Hill Brook & Tribs	41.75564	-71.48753	S1	P1+ Chl *a* 1	P1+ Chl *a* 1	S1 + Chl *a* 1	S1 + Chl *a* 2
PXT03	Pawtuxet River South Branch	41.68752	-71.52686	S1 + *t* M	P1	P1	S1 + *t* M	S1 + *t* M
PXT06	Pawtuxet River Main Stem	41.72258	-71.48935	Al	P1	P1	S1 + *t* M + Fe + Al	S1 + *t* M + Fe + Al
PXT07a	Pawtuxet River Main Stem	41.72610	-71.46872	Al	P1	P1	S1 + *t* M + Fe + Al	S1 + *t* M + Fe + Al
PXT08	Pawtuxet River Main Stem	41.73754	-71.45369	Al	P1	P1	S1 + *t* M + Fe + Al	S1 + *t* M + Fe + Al
PXT09	Pawtuxet River Main Stem	41.75003	-71.44648	Al	P1	P1	S1 + *t* M + Fe + Al	S1 + *t* M + Fe + Al
PXT10	Pawtuxet River Main Stem	41.75532	-71.43951	Al	P1	P1	S1 + *t* M + Fe + Al	S1 + *t* M + Fe + Al
PXT11	Pawtuxet River Main Stem	41.76158	-71.42516	Al	P1	P1	S1 + *t* M + Fe + Al	S1 + *t* M + Fe + Al
PXT14	Meshanticut Brook & Tribs	41.73633	-71.48790	S1	P1	P1	S1	S1
PXT15	Three Ponds Brook	41.73747	-71.44459	S1 + Cu & Pb	P1	P1	S1 + Cu & Pb	S1 + Cu & Pb
RMR02	Huntinghouse Brook	41.84666	-71.61173	S1	P1 + Chl *a* 1	P1 + Chl *a* 1	S1+ Chl *a* 1	S1+ Chl *a* 2
RMR03a	Rush Brook & Tribs	41.83785	-71.61189	S1			S1	S1
RMR04	Peeptoad Brook & Tribs	41.85238	-71.60628	S1	P1 + Chl *a* 1	P1+ Chl *a* 1	S1+ Chl *a* 1	S1+ Chl *a* 2
SBP02a	Mishnock River & Tribs	41.67983	-71.58012	S1	P1 + Chl *a* 1	P1 + Chl *a* 1	S1+ Chl *a* 1	S1+ Chl *a* 2
SBP03a	Tribs to Tiogue Lake	41.67607	-71.56237	S1	P1	P1	S1	S1
SBP04	Pawtuxet River South Branch	41.68994	-71.56583	S1 + *d* M	P1	P1	S1 + *d* M	S1 + *d* M
SBP05a	Hawkinson Brook & Tribs	41.68117	-71.52679	S1 + *d* M	P1	P1	S1 + *d* M	S1 + *d* M
SBP07a	Pawtuxet River South Branch	41.71502	-71.51213	S1 + *t* M	P1	P1	S1 + *t* M	S1 + *t* M

[A] S1 = Conventionals, nutrients, enterococci
S 4 = Conventionals & nutrients
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SBP08	Pawtuxet River South Branch	41.69635	-71.54493	S1 + *t* M + Fe + Al	P1	P1	S1 + *t* M + Fe + Al	S1 + *t* M + Fe + Al
SBPAA	Unnamed Trib #3 to South Branch Pawtuxet River	41.69603	-71.54788	S1 + *d* M	P1	P1	S1 + *d* M	S1 + *d* M
SCI01	Wilbur Hollow Brook & Tribs	41.76813	-71.63315	S1	P1 + Chl *a* 1	P1 + Chl *a* 1	S1+ Chl *a* 1	S1+ Chl *a* 2
SCI02a	Cork Brook	41.79351	-71.64576	S1	P1 + Chl *a* 1	P1 + Chl *a* 1	S1+ Chl *a* 1	S1+ Chl a2
SCI03	Westconnaug Brook	41.78548	-71.66714	S1	P1	P1	S1	S1
UMR01	Moosup River & Tribs	41.69085	-71.76326	S1	P1	P1	S1	S1
UMR03	Bucks Horn Brook & Tribs	41.69547	-71.75714	S1	P1	P1	S1	S1
UMR04	Moosup River & Tribs	41.70664	-71.76170	S1	P1	P1	S1	S1
UMR06	Moosup River & Tribs	41.75210	-71.75161	S1	P1 + Chl *a* 1	P1 + Chl *a* 1	S1+ Chl *a* 1	S1+ Chl *a* 2
UMR07	Roaring Brook	41.66999	-71.75295	S1	P1	P1	S1	S1
UMR08	Moosup River & Tribs	41.76021	-71.75483	YSI Pro Plus only	YSI Pro Plus	YSI Pro Plus	YSI Pro Plus only	YSI Pro Plus only

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Chl *a* 1= sampled from natural substrate
Chl *a* 2= sampled from artificial and natural substrate
For complete list of parameters, see Table 15

Table 15. 2012 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 300.0 Rev. 2.1 Ion Chromatography Lachet	RIDOH SOP WL20 rev. 3 Chloride
Hardness	--	mg/L	Standard Method 2340B Hardness by Calculation	RIDOH SOP WL22 rev. 4 Hardness
pH	pH	pH units	SM 4500-H+ B Electrode Orion Instrument model 720 A	RIDOH SOP WL13 rev. 6 PH
Sodium	Na	mg/L	EPA 200.8 ICP-MS	RIDOH SOP WL ICPMS rev. 1
Total Suspended Solids	TSS	mg/L	SM2540 D Gravimetric	RIDOH SOP WL 7 SOLIDS rev. 3 TSS
True Color	--	CU	Observation relative to standard	RIDOH SOP WL04 rev. 7
Turbidity	--	NTU	EPA 180.1 Nephelometric Turbidimeter	RIDOH SOP WL1 Turbidity
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 Rev. 2.0 Autoanalyzer – Lachet	RIDOH SOP WL16 rev. 4 nitrate & RIDOH SOP WL56 rev. 5 nitrite
Ortho-phosphate	PO4-P	mg/L	EPA 300.0 Rev. 2.1 Ion Chromatography	RIDOH SOP WL17 Ortho-phosphate
Total Phosphorus	TP	mg/L	SM 4500 P B.5 & E Persulfate Digestion and Ascorbic Acid Method	RIDOH SOP WL12 rev. 3 Total Phosphorus
Chlorophyll *a*	Chl *a*	mg/L	EPA 446.0 Rev. 1.2 Spectrophotometry	RIDOH SOP TO32
Pathogens				
Enterococci	Entero	Entercocci/ 100 mL	Enterolert	RIDOH SOP SM 37 Enterolert
Metals				
Cadmium	Cd (dissolved)	µg/L	EPA 200.8 ICP-MS	RIDOH SOP WL ICPMS rev. 1
Copper	Cu (dissolved)	µg/L	EPA 200.8 ICP-MS	RIDOH SOP WL ICPMS rev. 1
Lead	Pb (dissolved)	µg/L	EPA 200.8 ICP-MS	RIDOH SOP WL ICPMS rev. 1
Zinc	Zn (dissolved)	µg/L	EPA 200.8 ICP-MS	RIDOH SOP WL ICPMS rev. 1
Total Aluminum	Al (total)	µg/L	EPA 200.8 ICP-MS	RIDOH SOP WL ICPMS rev. 2
Total Iron	Fe (total)	µg/L	EPA 200.8 ICP-MS	RIDOH SOP WL ICPMS rev. 1

[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. 2012 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	28 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	0.05
Copper	Cu	µg/L	6 months	1.0	0.13
Lead	Pb	µg/L	6 months	1.0	0.08
Zinc	Zn	µg/L	6 months	20	1.13
Total Aluminum	Al (total)	µg/L	6 months	10	1.36
Total Iron	Fe (total)	µg/L	6 months	20	8.42

[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	RIDOH SOP TO32
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 TO32 / RIDOH	<0.10 mg/L (RL)	Accuracy/bias Contamination	A
Quality Control Sample - QCS	Spectrophotometry / SOP TO32 / RIDOH	70 – 130% recovery	Accuracy/bias Contamination	A
Field Duplicates	Spectrophotometry / SOP TO32 / RIDOH	<50% RPD	Accuracy	S/A
Data Review 100%	Spectrophotometry / SOP TO32 / RIDOH	Data collected are determined to be useable	Data - Completeness	A

Sampling SOP	RIDOH SOP ICP/MS rev 2
Medium/Matrix	Surface Water
Analytical Parameter	Al total
Concentration Level	ug/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	EPA 200.8/SOP ICP/MS RIDOH SOP ICP/MS rev 2	<1.36 ug/L (2.2XMDL).	Precision/contamination	S/A
QCS-Quality Control Sample	EPA 200.8/SOP ICP/MS RIDOH SOP ICP/MS rev 2	Within Manufacturer's limit (<10%)	Accuracy/bias Contamination	A
Lab Duplicates	EPA 200.8/SOP ICP/MS RIDOH SOP ICP/MS rev 2	<20 % RPD	Precision	A
Field Duplicates	EPA 200.8/SOP ICP/MS RIDOH SOP ICP/MS rev 2	<20% RPD	Accuracy	S/A
Data Review	EPA 200.8/SOP ICP/MS RIDOH SOP ICP/MS rev 2	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 has 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 plans to collect 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, non-vascular growth appeared to be the dominant primary production.

Therefore, assessment of non-vascular growth has been added to the 2012 Supplemental Nutrient Fieldwork in 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 will be conducted over several months from natural substrate to determine the maximum benthic primary growth time period and artificial substrate placement will be moved to August. Natural substrate was sampled once per month June through September for chlorophyll *a*, and artificial deployment will begin in mid to late August with collection in mid-September. The sampling event in September included collection of diatom taxonomy samples as well.

For 2012, RIDEM/OWR measured taxonomic identification of diatoms, chlorophyll *a* abundance of benthic algae, coverage of benthic algae, coverage of non-vascular plants, and percent coverage of 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 selected per year, depending on funding and staff availability. Based on geographic analysis of the streams by RIDEM, an 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, will be consulted for sites historically high and low in both TP and TN. From this information, sites encompassing the range of possible conditions will be selected prior to the field season.

Sampling Methods

The procedures to be 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 ARM Project Manager, Katie DeGoosh, and Field Data Collection Team Leader, Mark Nimiroski, and any field staff that had 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 included 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 will require a preservative, and the artificial substrate cleaning process requires acetone and bleach. The Numeric Nutrient Criteria Development Project Manager, Jane Sawyers, will ensure that the preservative and cleaning supplies 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 flows were a concern for the artificial substrate deployment. As described earlier, Jane Sawyers consulted with the ARM Project Manager, Katie DeGoosh, and other staff who have 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.