Quality Assurance Program Plan

for the

RI Wadeable Stream Biomonitoring & Habitat Assessment Program

State of Rhode Island and Providence Plantations

Department of Environmental Management

Office of Water Resources

235 Promenade Street – Room 200

Providence, Rhode Island 02908

August 2024

Acknowledgements

This Quality Assurance Project Plan (QAPP) was developed according to the guidance and requirements set forth in *EPA Guidance for QAPPs -- EPA QA/G-5* (EPA/240/R-02/009, 2002) and *EPA Requirements for QAPPs – EPA QA/R-5* (EPA/240/B-01/003, 2006). Technical components of this document were compiled from previous versions of the QAPPs for this program, which were prepared under contractual agreements with ESS Group, Inc. To keep all procedures consistent under this multi-year, long term monitoring program, the technical methods will not be modified and therefore much of this QAPP remains the same as previous versions in order to collect reliable, comparable data. With gratitude, we acknowledge the contributions of ESS Group, Inc. as previous authors of the QAPPs for this program, originally developed in 2002, and their subsequent revisions in 2007 as well as in 2014:

ESS, 2002. Quality Assurance Project Plan for Taxonomic Identification of Benthic Macroinvertebrates, Rhode Island. Project No R298-001. Wellesley, MA.

ESS, 2007. Quality Assurance Project Plan for Taxonomic Identification of Benthic Macroinvertebrates, Rhode Island. Project No R298-005 http://www.dem.ri.gov/pubs/qapp/taxbenth.pdf.

ESS, 2014. Quality Assurance Project Plan Rhode Island Wadeable Stream Biomonitoring and Habitat Assessment. Project No R298-011, http://www.dem.ri.gov/pubs/qapp/wadestea.pdf.

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Cover Photos:
Top Left: Roaring Brook, Exeter (Station WRB40)
Top Right: Latham Brook, Smithfield (Station WON11)
Bottom Left: Wilbur Hollow Brook, Scituate (Station SCI01)
Bottom Right: Bucks Horn Brook, Coventry (Station UMR03)

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I. PROJECT DESCRIPTION

1.1 QAPP Distribution List and Management Approval Page

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1.2 Table of Contents

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APPENDIX A

1.3 Quality Assurance Project Plan Objectives

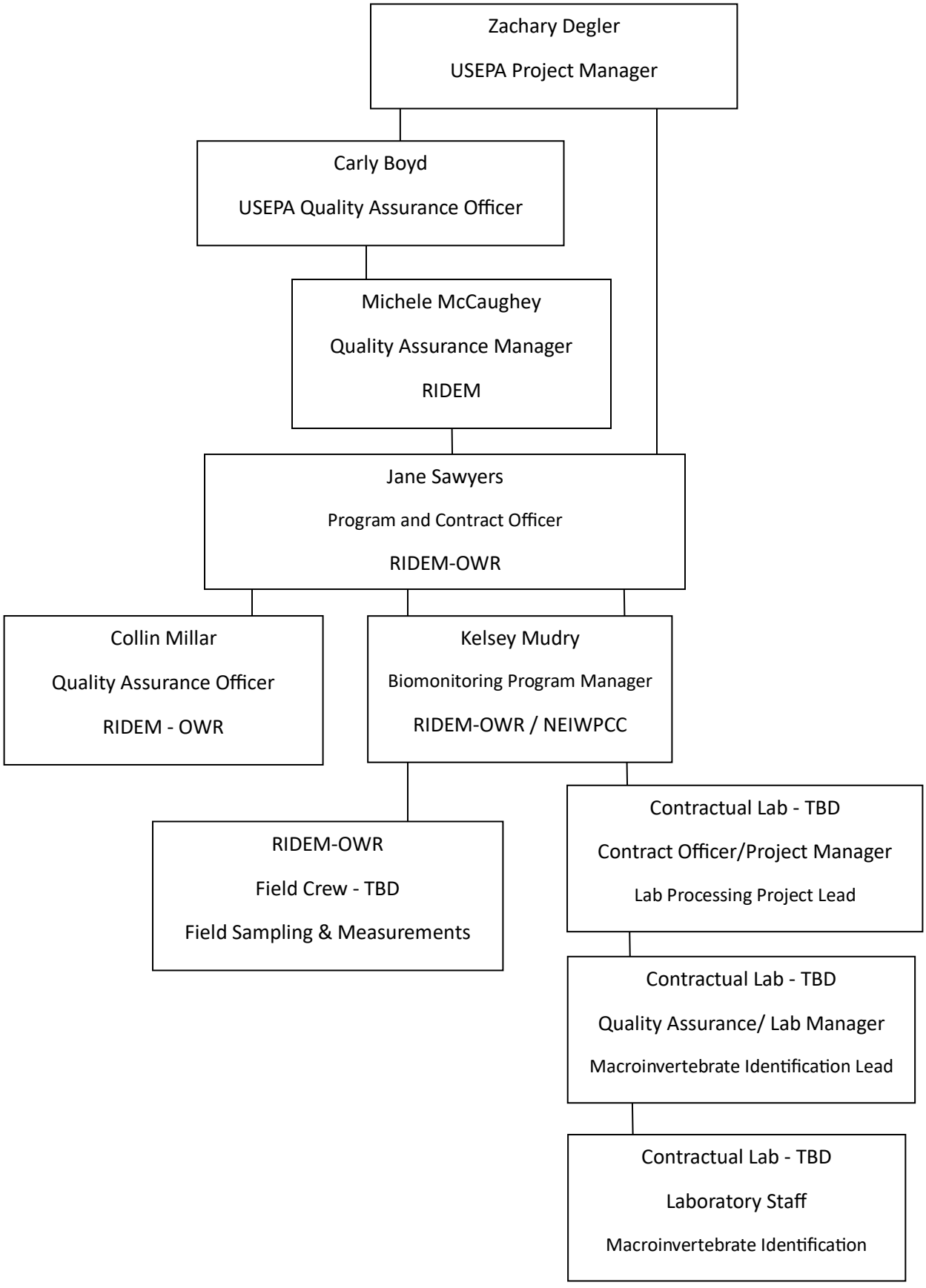
This Quality Assurance Project Plan (QAPP) for the RI Wadeable Stream Biomonitoring and Habitat Assessment Program outlines its personnel management organization, program objectives, data quality requirements, experimental design and sampling methodology. This QAPP provides instruction for field activities, laboratory activities, and data review actions in order to facilitate consistent data collection, and to ensure data quality and program objectives are met. Quality assurance and quality control (QA/QC) criteria, sampling and analysis procedures, and method documentation for laboratory and field analyses are detailed herein. This QAPP shall serve as the reference and guiding document for all organizations, agencies and personnel (contracted or otherwise) involved in all aspects of this project.

1.4 Project Organization

The Rhode Island Department of Environmental Management (RIDEM), Office of Water Resources (RIDEM/OWR) will conduct macroinvertebrate stream biomonitoring and habitat assessment as part of the on-going RIDEM/OWR Wadeable Stream Monitoring in Rhode Island, as resources allow. In this long-term program, RIDEM/OWR may execute fieldwork using permanent, contractual, and/or seasonal personnel to collect field samples, and may also contract out for the execution of the laboratory analysis portion of the program as required. Major personnel associated with the project are noted in the organizational chart which illustrates their role in the chain of command and pathway of communication (Figure 1).

Kelsey Mudry will act as the project manager responsible for coordinating all tasks. These duties include training all field personnel in the procedures specified herein, ensuring that field equipment is properly calibrated, data are recorded in a consistent manner, sampling methodology is being conducted in accordance with standardized procedures, samples are being properly delivered to laboratories, and quality assurance activities are correctly performed. The Project Manager will also coordinate electronic or verbal communications to document project milestones and will keep the Contract and QA Officer up to date regarding project progress. **Jane Sawyers** will serve as contract officer to ensure that contract agreements are finalized, and all deliverables are completed in a manner consistent with contract expectations. Communication between project staff is also anticipated in order to coordinate day-to-day sampling activities, arrange sample transfers, provide or review project deliverables, or initiate discussion on proposed project changes. Such communication interactions should follow a chain of command as outlined in the project organizational chart (Figure 1). Future contractual agreements filed after the date of the QAPP resulting in additional contractual staff new to the chain of command will be reflected in written Addendums to this QAPP to show annotated pathways of communication and detail their responsibilities.

Figure 1. Project Organizational Chart



1.5 Project Timetable

Consistent with the RIDEM Quality Management Plan, the program activities are centered around the classic quality management system of plan, do, check, act. Planning for activities will begin at the start of a calendar year. The program activities begin with preparatory planning, which includes selecting stations, purchasing supplies, and filing a Scientific Collector's Permit Application (Appendix A) with the RIDEM Division of Fish and Wildlife (fee is waived). Then field sampling and laboratory activities are executed, including data management, and conclude with program assessment and response actions. Stream habitat assessment and macroinvertebrate sampling will be targeted to occur during the summer low-flow period (August 1 through the end of September). This period is expected to be the one of greatest environmental stress on stream organisms due to typical hydrologic and weather conditions. In October, the success of field operations will be evaluated, including checking of all field forms and labels, and any response actions needed will be completed, before samples are sent to the laboratory with completed chain of custody forms. Macroinvertebrate laboratory work, data entry with QAQC, and reporting will be completed between November of the sampling calendar year and May of the following calendar year.

RIDEM Quality Management and Continuous Improvement Stage	Program Timeline for Any Given Calendar Year	RIDEM and Field Crews	Laboratory Services
Plan	January-April	• Issue RFP and complete contracts with outside staff/labs. • Finalize station list • Buy supplies • File collectors permit • Develop or update forms, QAPP, or complete QAPP Addendum (if needed)	• (Plan) Contractors provide SOPs, or personnel changes, to RIDEM to include in QAPP Addenda • (Do) Contractors complete laboratory subsampling, picking, identification, and enumeration of macroinvertebrate samples • (Do) Enter data into Excel template • (Check) Review invert identifications and review data entry • (Act) Complete corrective actions as needed
	May	• Submit QAPP or QAPP Addendum to EPA • Import last year's finalized macroinvertebrate data into Bioqual • Use Bioqual to create data spreadsheets for upload to WQX • Upload data to WQX	(Act) Submit final lab reports/documents and data spreadsheets to RIDEM
	June-July	Train Field Crews in Procedures and Safety	
Do	August 1-Sept 30	Complete field sampling	
Check	October	Review field forms and labels, enter and review habitat data entry	
Act	Nov-Dec	• Complete any QAQC corrective actions on forms, or in data entry • Transfer samples to lab for processing with COC • Note any needed changes to field forms, or procedures • Import habitat data into database	

1.6 Training

1.6.1 Field Training

Although some field staff may have previous experience collecting macroinvertebrates through university coursework, research assistantships, or prior employment, all members of the RIDEM field crew will receive, at a minimum, training by the program manager on proper sample collection technique, use of field instrumentation, sample labeling and preservation. Training consists of hands-on field training with sampling equipment and review of this QAPP. This training will enable staff to be familiar with the methods, and requirements necessary to complete field sheets and meet project needs. Completing in house training with the field crew leader or program manager will minimize bias among staff completing habitat assessments and ensure sampling procedures and effort are consistent among individual staff. To document field training, receipt, and review of this QAPP, all field staff will complete and sign the Field Training Documentation Form (Appendix A) to document and keep consistent records of training. The program manager will keep and file the signed copies of the Field Training Documentation Form. Field staff will also receive RIDEM's Quality System Awareness Training, Field Safety Training, and complete EPA's Online Water Quality Standards Academy prior to commencing field activities.

1.6.2 Laboratory Training

Contractual staff selected to complete macroinvertebrate sorting, enumeration and identification should receive appropriate training and oversight from their in-house supervisors, quality assurance officers, and/or laboratory managers who have experience and training in macroinvertebrate taxonomy. At minimum, senior staff working on the project (QA Officer, Project lead and/or Laboratory Managers), will maintain taxonomic certification, which they will provide documented proof of upon selection, through the Society for Freshwater Science for the identification of freshwater macroinvertebrates. The laboratory staff and QA Officer must be familiar with the methods, forms and quality control activities detailed in laboratory-specific sections of this QAPP, appropriately use aquatic macroinvertebrate taxonomic keys, and be familiar with the organisms found in Rhode Island streams. These taxonomic skills will provide the level of training necessary to identify organisms to the targeted taxonomic level (lowest practical: all taxa will be identified to, at least, genus and when possible, to species; Chironomids and oligochaetes can be identified to sub-family or tribe). Staff responsible for slide mounting Chironomidae and Oligochaeta should also be familiar with the protocols outlined by Epler (2001) or provide a similar cited protocol to be documented in any future QAPP addendums.

II. DATA GENERATION AND AQUISITION

2.1 Purpose and Objectives

The objective of the RI Wadeable Streams Biomonitoring and Habitat Assessment Program is to evaluate conditions in wadeable streams throughout Rhode Island via a characterization of benthic macroinvertebrate communities and overall habitat. These biomonitoring methods are based on US EPA's Rapid Bioasssessment Protocols (RBP; Barbour et al. 1999) to measure local habitat features (e.g., physical structure, flow regime), water quality parameters and collect macroinvertebrates to infer aquatic ecosystem quality from a relatively "rapid" assessment of the prevailing biologic conditions. Biological monitoring can provide information about past and/or episodic pollution and readily gives an accurate representation of relative health of aquatic ecosystems.

The data collected using the methods described herein are used to characterize and assess the health of wadeable streams to determine if the stream adequately supports fish and wildlife habitat (its Aquatic Life Use). These assessments generated from this data are published in the Integrated Water Quality Monitoring and Assessment Report () that is issued by RIDEM to USEPA as required under Sections 305(b) and 303(d) of the Clean Water Act (CWA). The RIDEM Wadeable Stream Biomonitoring and Habitat Assessment Program provides a vital source of water quality data and is an integral part of RI's Water Quality Monitoring Strategy (RIDEM/OWR, 2005a).

2.2 Problem Definition: Background and Sampling Design Rationale

Benthic macroinvertebrates are relatively sedentary within a stream and spend much of their life cycle in the water, so the health of the macroinvertebrate community reflects local ambient environmental conditions. The macroinvertebrates sampled are good indicators of stream water quality and can be used to evaluate the biological integrity of a stream--its ability to support and maintain healthy aquatic communities. These biological communities assimilate the effects of different pollution sources over time providing an aggregate measure of stressors. Therefore, sampling the resident populations provides a stable representation of the overall river condition under fluctuating environmental variables. Lack of invertebrates that are sensitive to pollution or invertebrate communities dominated by pollution tolerant organisms may indicate "impaired" waters that do not support healthy aquatic communities ("aquatic life use"). Because invertebrate communities reflect water quality over time and are relatively easy to collect and identify, biomonitoring is often regarded as a more cost-effective ambient monitoring technique to identify problems than intensive water sampling for multiple toxic pollutants that are highly variable over time.

In line with RI Water Quality Monitoring Strategy, RIDEM's macroinvertebrate biomonitoring program has refined its current sampling approach as an adaptive response to changing data and assessment needs. Extensive background information is provided in previous revisions of this QAPP (ESS, 2014) to document how and why the sampling approach was modified over several years from 1991 to 2014. As the biomonitoring program has evolved over the years, as resources allow, the sampling design has changed from a fixed station network (Figure 2) to a rotating basin approach. The rotating basin approach may also be supplemented with additional sampling stations to fill newly identified data gaps for water quality assessment purposes or refinements to the biotic index and assessment methodology (as done in 2009 and 2010). The rotating basin approach was used in 2004-2008 (Figure 3) and 2011-2014 (Figure 4) to systematically and intensively sample several stations in specific watershed basins. In 2015, to begin another statewide rotation, RIDEM conducted sampling and collected 37 samples mostly in the Wood and Pawcatuck River Basins including the Queen and Lower Pawcatuck River basins (Table 1). Two stations (LPK03 and QN10a) were visited with the intent to sample, but they were both dry at the time field crews arrived and were not sampled. In 2016, RIDEM conducted field sampling and collected 37 samples in the Scituate Reservoir and Pawtuxet River watersheds (Table 2). Two additional stations visited had no riffle habitat to sample, so no samples or data were collected (HNT06 and HNT11) and two other rivers were dry at the time of sampling, and no samples or data were collected (PCT08 and PXT20). Due to funding constraints no data was collected in 2017 or 2018. RIDEM finished the state-wide rotation in 2019 (Table 3, Figure 5). Sampling was suspended in 2020 due to COVID restrictions. In 2021, RIDEM conducted field sampling with the

Low Gradient method as the first pilot year. In total only 3 sites of the proposed 17 met low gradient criteria and were sampled in the coastal streams (Table 4, Figure 6). In 2022, RIDEM conducted sampling and collected at 20 sites in the Pawcatuck, Saugatuck, Queen, and Wood River basins (Table 5, Figure 6). Sampling was suspended in 2023 due to staff changes and is to resume in 2024 (Figure 6).

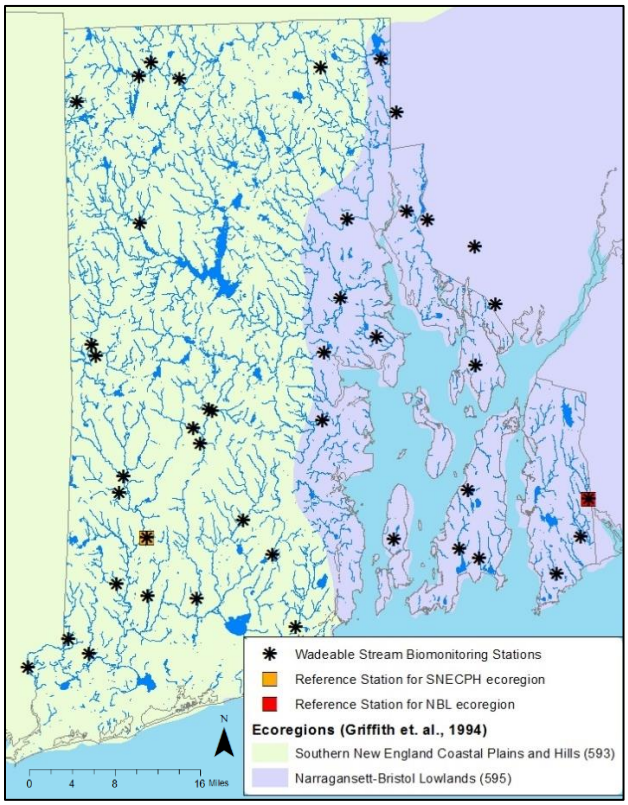


Figure 2. The original sampling design for the Biomonitoring and Habitat Assessment Program included a set of 45 fixed stations intermittently sampled throughout RI between 1991-2003.

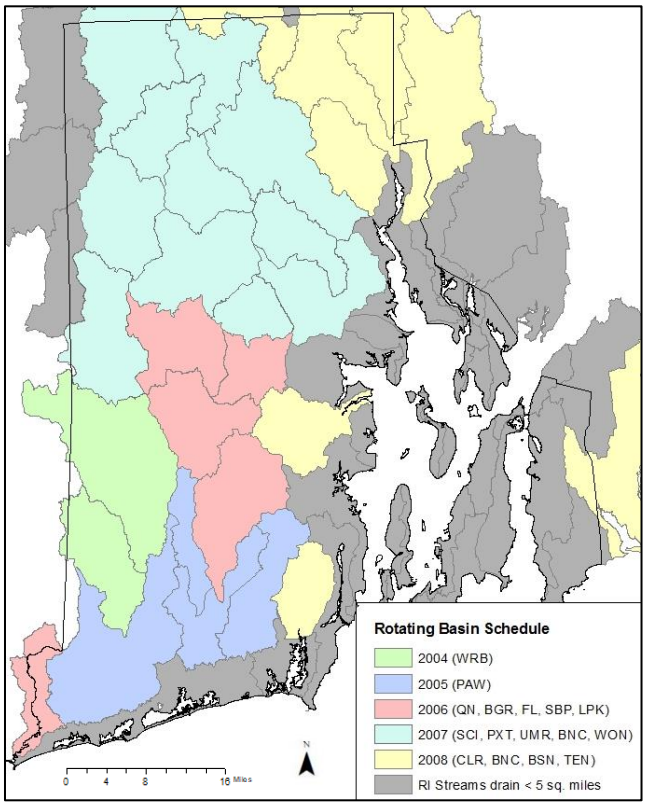


Figure 3. The pilot rotating basin schedule for the Biomonitoring and Habitat Assessment started in 2004 with intensive sampling the Wood River Basin and took 5 years to complete the rest of the watersheds in RI (draining ≥ 5 square mi in RI).

Figure 4. Station siting was revised for the second state-wide rotation schedule for 2011-2014 and the program became more efficient, taking only 4 years to complete the statewide sampling of watersheds in RI (draining ≥ 5 square mi in RI).

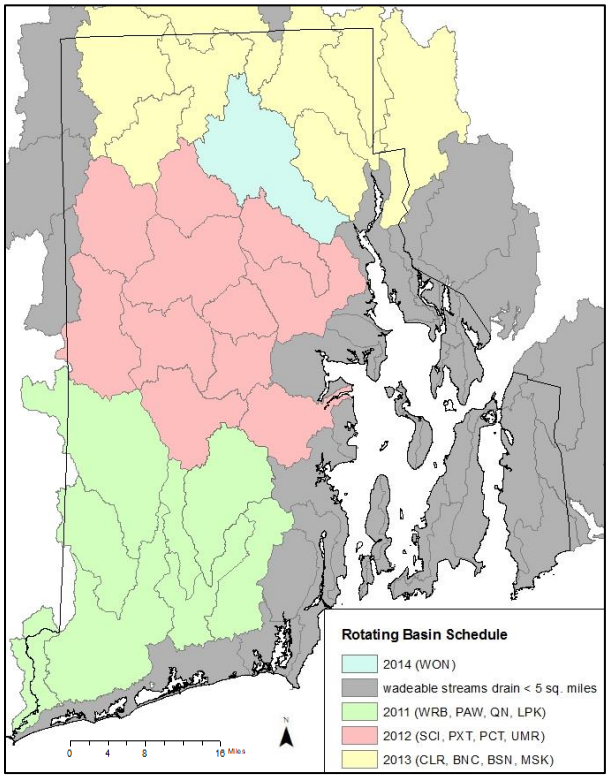
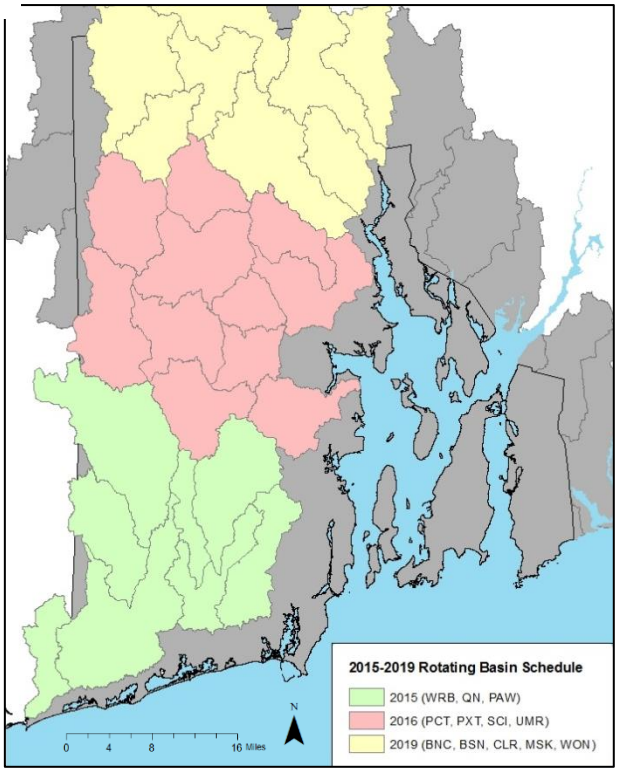


Figure 5. The third statewide-rotation schedule began in 2015, continued in 2016, but was suspended in 2017 and 2018 due to staff turn-over and resource constraints. This statewide rotation was completed in 2019.



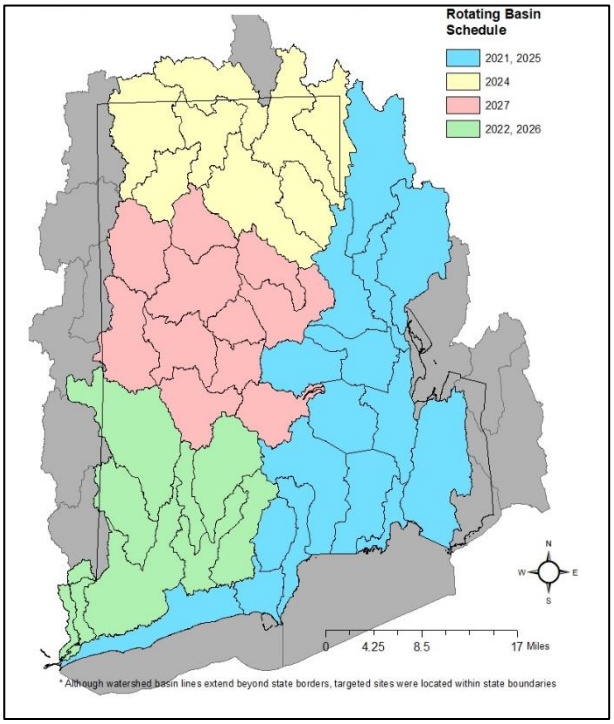


Figure 6. The most recent rotation schedule began in 2021, after the program was suspended in 2020 due to COVID. The rotation began again in 2021 and continued in 2022. Sampling was suspended in 2023 due to staffing overturn. Sampling will begin again in 2024 with projected basins scheduled out to 2027.

2.3 Project Sampling Task Descriptions & Sampling Methods

2.3.1 Field Sampling

Prior to departing from the RIDEM OWR Sampling Center, field crews should consult the NOAA National Weather Service and Weather.com online to determine safe weather conditions are expected in the field, and rain is not expected (to dramatically increase stream flows). This information should be noted on the RIDEM Macroinvertebrate Biomonitoring Program Sampling Event Documentation form (Appendix A). Field crews should also complete this form while packing to ensure that all field gear is included when packing the car and note on the inventory any disposable supplies are getting low so that the Project Manager can re-order as necessary.

RIDEM field crews will follow field methods for benthic macroinvertebrate as given in the "single habitat approach: 1-meter kick net" as recommended by the U.S. EPA Rapid Bioassessment Protocol using a standard D dip net with 500 micron mesh (RBP; Barbour et al., 1999:). Full descriptions of sampling procedures are provided below (and/or have an associated method citation and/or Standard Operating Procedure document URL address linked herein) with data forms available in Appendix A: Field Forms. Wadeable stream field sampling anticipated under this QAPP includes each of the following elements, and should be done in the following order in the field:

1) Physical site characterization
2) Measurement of in-stream water quality parameters
3) Measurement of stream flow velocity/discharge
4) Macroinvertebrate sample collection
5) Stream habitat assessment

2.3.1.1 Physical Site Characterization

As specified within the U.S. EPA methodology, the habitat assessment includes physical characterization of the station and in-field measurement of water quality parameters. This information is not incorporated into habitat assessment scores but serves as further insight into the ability of the stream to support a healthy aquatic community and provides background documentation of stream conditions and morphology. RIDEM will take pictures with the issued monitoring IPad, which will be fully charged in the office the night prior, at the location (Figure 7), and those pictures will be stored electronically in the appropriate watershed and station folder on the common drive (J:\COMMON\ARM\Pictures). Photos will be renamed upon downloading at the office to include the site name and date in the filename (year, month, day).

Physical characterization includes documenting surrounding land use; and subsystem classification; presence or absence of dams; local water erosion & potential non-point source (NPS) pollution; stream width, depth and flow; inorganic and organic substrate types; and presence of odors, oils and deposits (see "Physical Characterization/Water Quality Field Data Sheet" in Appendix A: Field Forms). On this form, RIDEM staff will sketch a map in the field depicting the entire sampling reach and in-stream physical features such as riffles, falls, coarse woody habitat, pools, bends, undercut banks, areas of erosion, vegetation types, bridges, culverts, road crossings and other important structures sketched for each stream segment. An arrow will indicate the direction of stream flow. Field staff should fill out the form to the most complete extent possible upon arrival at the station, however, if there are elements of that form (see "watershed or instream features" sections) that are better evaluated after kick-sampling and exploring the 100 m reach, completion of these elements of the form may be saved until the end

of the site visit. If any information required on the form is not available, it should be noted as such.

Figure 7. Photographic logs of a station help provide background information about the physical site conditions at the time of sampling. For example, this is the same station under different flow scenarios (the top picture was taken in July 2010, whereas the bottom picture was taken in September 2015.

2.3.1.2 In-stream water quality

As specified within the U.S. EPA methodology, RIDEM field crews will measure in-stream water quality parameters *before* any macroinvertebrates are collected to avoid disturbing the substrate and re-suspending any sediment in the water column prior to documenting water quality. Water quality parameters will be measured once in the field at each site and include: dissolved oxygen (mg/L and % Saturation); pH (SU – when available); specific conductance (µS/cm); and temperature (°C). These measurements will be taken in accordance with a YSI Pro Plus (when available) or YSI-85 meter using the guidelines set forth for calibration and use in the RIDEM Standard Operating Procedures: YSI ProPlus or YSI Model 85 (http://www.dem.ri.gov/pubs/sops/wrw34.pdf or http://www.dem.ri.gov/pubs/sops/wrw14.pdf, respectively).

The water quality data collected will be documented on the back of the Physical Characterization/Water Quality Field Data Sheet under the "Water Quality" section of the field form (Appendix A: Field Forms). In the field, crews will be sure to allow ample time for the probe to acclimate to temperatures in the water before recording data. Duplicate readings will be taken at one station per day (at least 10% of all stations) for quality assurance purposes to ensure reliable, reproducible, precise measurements and avoid sampling error. These measurements will be recorded under the water quality section (first column on the bottom of the form) under to the original data and will be marked as QC. In the field, these QC measurements should be reviewed to ensure they are within ± 5% of the original data. If QC data are outside ± 5% range, corrective action should be taken to re-test a third time. If this 3rd QC measurement is outside the ± 5% range, the instrument should be recalibrated, and this will all be noted on the data sheet.

To address sources of analytical error and ensure accurate and precise measurements, water quality meters will be calibrated (for dissolved oxygen) in the Sampling Center, the morning before each field day as well as at the end of the day, with documentation as required by their respective SOP. Documentation records of each calibration will be retained in the Calibration and Maintenance Logs located in the RIDEM OWR Sampling Center. Morning DO calibration should meet parameter-specific measurement performance criteria ranges as specified in the aforementioned SOPs, or the instrument will be recalibrated until such criteria are met. Should the DO calibration at the end of the day not meet parameter-specific measurement performance criterion, it should be noted in the Maintenance and Logbook, as well as on each Field Data Sheet

where the YSI data was recorded during the day since the last calibration. Data will be flagged as suspect and if errors persist, instrument should be sent for repair.

2.3.1.3 Flow measurements

Stream flow will be measured, where available, by reading the gage height on nearby USGS gages according to RIDEM Field Sampling SOP 2 (S-2): Reading the Staff Gauge (http://www.dem.ri.gov/pubs/sops/wrw10.pdf). Upon returning to the office, the flow rating curve for that station will be looked up to determine discharge, and the date this data was looked up will be included on the Physical Characterization form.

Should a station be at the location of a USGS gage house (pictured on the left) where flow information is collected and available online, the date and time of the visit will be recorded in order to recall the information at the time of sampling from the online USGS NWIS Surface Water Data System and that data should be recorded on the field data sheet (along with the date that it was looked up online).

However, where flow information is not available online from a USGS gaging station, or readable from a USGS staff gage, flow will be measured manually using a Marsh-McBirney Flowmate 2000 current meter and data documented on the USGS Discharge Measurement and Gage Inspection Notes Form 9-275F (Appendix A) following RIDEM Equipment Maintenance/Calibration SOP 1 (E-1): Current Meters http://www.dem.ri.gov/pubs/sops/wrw2.pdf). Flow data collected will be taken back to the office to calculate discharge, and that calculated data will be added to the back of the field data sheet (Physical Characterization/Water Quality Field Data Sheet) with the date it was calculated.

This method may also be used to verify USGS measurements taken from staff gages or online.

2.3.1.4 Macroinvertebrate sampling

RIDEM field crews will use a single habitat assessment approach to sampling as detailed by the U.S. EPA (Barbour et al., 1999) using a standard D-frame kick net. This approach entails sampling benthic macroinvertebrates from riffle/run communities at each selected 100-m wadeable stream segment. Sampling will be conducted in accordance with the cited methods in the following manner:

- Select a representative 100-meter section of stream at each stream segment (whenever possible, the area should be at least 100 meters away from any road or bridge crossing to minimize its effect on stream velocity, depth, habitat quality with no major tributaries discharging into the stream within the section).
- Kick sample within a series of riffles (working upstream) for a total cumulative duration of 3-minutes using a 500um D-frame kick/dip net: Position the net on the stream bottom so water flows into the net; Using the toe or heel of the boot, disturb the upper layer of cobble or gravel 0.5 m upstream of the net to dislodge organisms from the substrate so they travel in the water current and flow into the net (this is NOT designed to capture copious amounts of gravel in the net); if larger substrate (cobbles/sticks) are present, they may be picked up/rubbed by hand in the net to dislodge and catch organisms. At the end of three minutes, if water depths allow, you may dip the bottom net into the stream (careful not to let any water into the rim of the net) to dislodge (with water) any sample stuck to the top of the net, and better concentrate the sample to the bottom of the net.
- With a gloved hand, lightly grab the bottom of the net where the majority of the sample is concentrated and, holding the rim over a standard #35 sieve (to catch any escapees), push your hand through the D-ring rim to invert the net and transfer the contents of the net into the sieve. Make sure to thoroughly clean the net (this may require use of small forceps or a squirt bottle of water (tap or DI) – limit rinsing net to two squirt bottles of water). Large debris can be rinsed with the squirt bottle, inspected for organisms to be placed in the sample jar, and then discard the cleaned, large debris.
- Any small vertebrates (small fish, salamanders) or crawfish caught in the net, or the sieve can be removed from the sample and placed back in the stream. Be sure to note on the field forms these were caught and returned to the stream.

RIDEM Macroinvertebrate Sample
STATION
DATE
STREAM
COLLECTOR
JAR # _____ of _____

- Transfer the contents of the sieve into to the sample collection jar (a funnel may be used to transfer small materials). Thoroughly clean the sieve – limit to one squirt bottle of water to rinse sample to bottom of sieve; be careful not to get rinse water in the sample container). Do one final rinse of the sieve and funnel into the sample bottle using a squirt bottle of ethanol to make sure the preservative is not diluted. During the transfer, place a clean, white dissecting tray underneath the sample collection jar. During sample transfer, if any of the sample misses the mouth of the jar or funnel, it will fall onto the white surface and be easily recovered. If more than one container is needed for a large volume of sample, use multiple jars (rule of thumb: do not fill jar more that 2/3 full with sample as adequate preservative is needed to retain sample quality).

- Preserve sample in 95% ethanol solution (add enough ethanol to cover sample); be sure container is labeled with appropriate MSDS Chemical Safety HMIS label (Hazardous Material Information System).

  - Fill out labels for both the inside of the jar (on rite in the rain paper with pencil) as well as the outside of the jar (sticker label with sharpie), with the station name, stream name, town, date collected, and initials of person who collected it. Include “Jar # of #”, to indicate if there is more than one jar (see Appendix A for labels). Cap jar and cover seal with black electrical tape to avoid evaporation of ethanol. Apply label to outside of jar and cover the outside label with clear packing tape to use as a barrier in the event ethanol is spilled on the container (ethanol can make sharpie/permanent marker run and render a label unreadable). HDPE (plastic) jars are recommended for field work to avoid glass jars breaking in the field or during transport.

- Complete the relevant section of the U.S. EPA “Benthic Macroinvertebrate Log-In Sheet” (Barbour et al., 1999; Appendix A), which details the date the sample was collected, who it was collected by the number of containers filled by the sample, the preservative used, the identification code for the stream segment and the name and location of the stream.

2.3.1.5 Stream habitat assessment

RIDEM will evaluate habit quality within each selected stream segment by completing a Habitat Assessment Field Data Sheet for High Gradient Streams (Appendix A: Field Forms). The habitat assessment process involves rating ten habitat parameters as optimal, sub-optimal, marginal, or poor based on the U.S. EPA-developed rubric. Ten parameters will be evaluated for each stream segment studied and rated on a numerical scale of 0 to 20 (highest) for each stream segment using the rubric on the form. Scores increase as habitat quality increases. The individual parameter scores are added together to calculate the overall Habitat Score. A brief summary of the parameters evaluated and the criteria upon which the assessment is based, is provided in the table below.

Score Range	Habitat Parameter Name	Description of Habitat Parameter Assessed
0 - 20	Epifaunal Substrate / Available Cover	Quantity/ variety of natural structures in-stream which serve as shelter, nursery or feeding areas to aquatic organisms (cobbles/boulders, logs/snags and undercut banks).
0 - 20	Embeddedness	Degree to which gravel/cobble/boulders/snags are covered or sunken into the fine sediments on the bottom, impacting surface area available to macroinvertebrates.
0 - 20	Velocity/Depth Regime	Evaluates availability of 4 hydromorphologic patterns to demonstrate a variety of stable habitats for different taxa: slow-deep, slow-shallow, fast-deep, fast-shallow.
0 - 20	Sediment Deposition	Describes volume of sediment that has accumulated in pools and other changes to the stream bottom as a result of stream erosion and sediment deposition.
0 - 20	Channel Flow Status	Degree to which the channel is filled with water, indicating volume of habitat available to aquatic organisms.
0 - 20	Channel Alteration	Evaluates stream channel modifications which affect the quantity and quality of natural habitat for organisms (e.g. channelization, dredging and artificial embankments).
0 - 20	Frequency of Riffles (Or bends)	Describes stream morphology and variety of riffle and run habitat available for a diverse of aquatic community
Left & Right bank 0-10	Bank Stability	Separately evaluate each bank for the extent of (and/or potential for) bank erosion (the bank scores are added).
Left & Right bank 0-10	Vegetative Protection	Separately evaluate the vegetative buffer on each bank (to protect stream banks, to help resist erosion and in-stream scouring and to providing shade); add bank scores.
Left & Right bank 0-10	Riparian Vegetative Zone Width	Separately evaluate the width of natural vegetation from each stream bank out through the riparian zone. A vegetated riparian zone buffer is more optimal than buffers with roads, parking lots, lawns and buildings. Each bank is evaluated separately, and scores are added together.

2.3.2 Laboratory Analysis: Macroinvertebrate Identification and Enumeration

All macroinvertebrate samples will be immediately preserved in the field in using 95% ethanol (with water in sample, estimated dilution of solution in sample bottle will be approximately 70% ethanol). Preserved samples will be safely stored and retained until they can be sent to a qualified contract laboratory (TBD) for subsampling, sorting, taxonomic identification and enumeration. Once a laboratory contractor is retained, the contract laboratory organizational information, personnel contact information and roles as well as methods for enumeration and identification, if different from below, will be detailed in subsequent Addendums to this QAPP. Contractors should strive to keep laboratory activities consistent with the methods described below, but the Addendum may include contractor-specific Standard Operating Procedures/Standard Operating Guidelines, quality assurance activities, or Measurement Performance Criteria.

Upon receipt of samples, prior to processing, the Sample Log-in Sheet will be reviewed to verify all samples, and associated sample bottles, are accounted for and in proper condition for processing. First samples will be rinsed to remove preservatives and fine sediments. All material from all bottles of one sample will be rinsed in a 500 micron mesh (standard #35) sieve lightly and carefully with tap water as not to damage macroinvertebrates in the sample. Any large materials (rocks, twigs, leaves) not removed in the field may be carefully rinsed, visually inspected and discarded once organisms have been removed and placed in the sieve. Because the samples have been preserved in ethanol, it may be helpful to soak the sampled in water for about 15 minutes to rehydrate the macroinvertebrates to prevent them from floating on the water surface during sorting. While the sample soaks, large, unique and/or obviously rare species may be removed and sorted into separate vials as “supplemental taxa” to be identified later.

After rinsing the sample in the sieve and soaking, the sample should be spread out in a large, gridded sorting tray or pan in order to sub-sample the material. The contract lab will use a random number generator (or table) to select a grid cell from the tray to be sub-sampled. All material within the grid square should be removed and transferred to a small container (such as a petri dish) for temporary holding and soring. The remainder of the sorting tray should be covered to prevent desiccation of the remainder of the sample.

The sub-sampled material should be sorted under a dissecting microscope sufficient to pick out organisms as small as 500 microns. Sample debris (substrate or flora) should be retained in the petri dish while all organisms should be picked from the sub-sample, counted, and placed into a glass vial with 70% ethanol. The sub-sample should be sorted until 100 organisms are removed. If the sub-sample does not have 100 organisms, then another random number should be used to select a grid from the sorting pan, and that sub-sample should be sorted until 100 organisms total have been picked from the sample. The number of grids picked should be noted on the back of the Benthic Macroinvertebrate Laboratory Bench Sheet (Appendix A) along with the name of the sorter, and date and time it was sorted.

The sorted residue (part of the sub-sample that has been picked) should be bagged in a small whirl pack bag with 70% ethanol and labeled with the sample information and “sorted residue”. Of the total number of samples, the contract lab is processing, 5% of the samples should have the sorted residue checked for quality assurance. The Laboratory/QA Manager, or qualified designee, should re-sort the residue to determine if any macroinvertebrates were left behind and not picked for enumeration. The number of macroinvertebrates recovered by the checker (if any) should be entered into the QC formula on the back of the Benthic Macroinvertebrate Laboratory

Bench Sheet to determine the sorting efficiency. If the sorting efficiency is less than 90% than all samples sorted by the individual will be reprocessed.

The sorted residue bag, as well as the remaining unsorted sample left in the sorting tray should be placed back into the original labeled sample bottle and preserved with 70% ethanol. Sample identification information should be filled out on the front side of the Benthic Macroinvertebrate Laboratory Bench Sheet.

The glass vial(s) with 100 picked organisms preserved in 70% ethanol should be labeled inside and out with the sample station number, date, stream name and city, and if more than one vial is needed, each vial should be numbered 1 of n. The organisms may be further sorted into taxonomic groups, and if so, the labels should note which taxa group (Ephemeroptera, diptera, midges, crustacea, others, etc).

2.3.3 Sample Handling and Custody

At the end of the sampling day, all equipment (waders, net, buckets, coolers etc.) will be rinsed and left to dry in the RIDEM OWR Sampling Center. Other materials will be put away, paperwork will be filed, and digital photographs will be downloaded, renamed and organized into file folders (at the end of the sampling day, or soon thereafter).

RIDEM will immediately preserve all macroinvertebrate samples collected in the field and transport them to the RIDEM OWR Sampling Center under the supervision of the Project Manager or qualified designee. Because samples may get very warm sitting in a hot car during transit in summer, sample bottles will be kept in a cooler with an ice pack to help keep transport temperatures below 23 degrees C.. All samples (labeled in accordance with section 2.3.1.4 above) will be delivered to the RIDEM OWR Sampling Center in Providence by the end of the working day, accompanied by a completed Benthic Macroinvertebrate Sample Log-in Sheet (Appendix A). Samples will be retained and stored in a flammables cabinet for safety until delivery can be scheduled to the contract laboratory for enumeration and identification (name will be provided in subsequent QAPP addendum). Once samples are slated for transport to the laboratory, the Project Manager of qualified designee will use the Benthic Macroinvertebrate Sample Log-in Sheet to prepare a Chain of Custody Form with space for the Project Manager to sign off/date when shipping (or delivering) samples, and a space for the Laboratory/QA or Contract Officer to sign off/date that samples have been received. RIDEM will pack samples and coordinate shipment to the contract laboratory. Copies of the Macroinvertebrate Sample Log-in Sheet will also be transferred so that the laboratory may complete the remaining section to date when the sample is received, sorted, mounted (if necessary) and identified. The appropriate representative from RIDEM OWR and the Contract Laboratory will sign the Chain of Custody form to verify the bottle exchange, and the Contract Laboratory with retain the custody forms to keep with the samples but should scan in a copy to email to RIDEM for their records.

Upon completion of the project, after laboratory picking, sorting, identifying, enumeration, and data transferal, the macroinvertebrate samples should be returned to RIDEM for long-term archival storage, up to five years from the date of sample collection (upon return, they should be accompanied by another chain of custody form to be signed by both parties). RIDEM will be responsible for disposing of the sample after five years from the date of sample collection, and upon disposal, date and responsible staff initials will be added to the last chain of custody form to record that the sample was disposed of.

III. PROJECT DOCUMENTATTION AND DATA MANAGEMENT

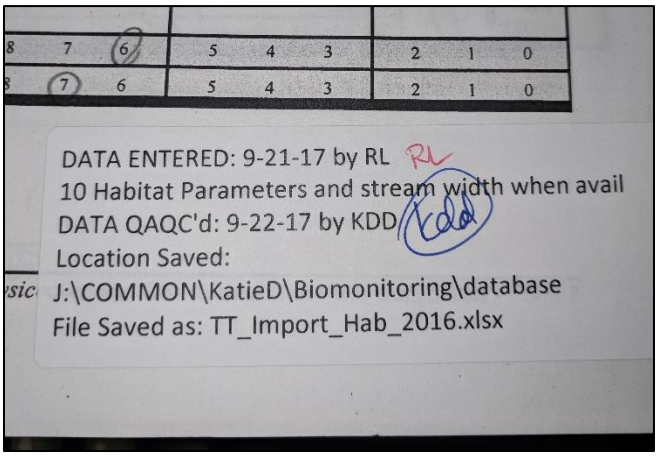
3.1 Project Records

3.1.1 Management of Paper Field Forms

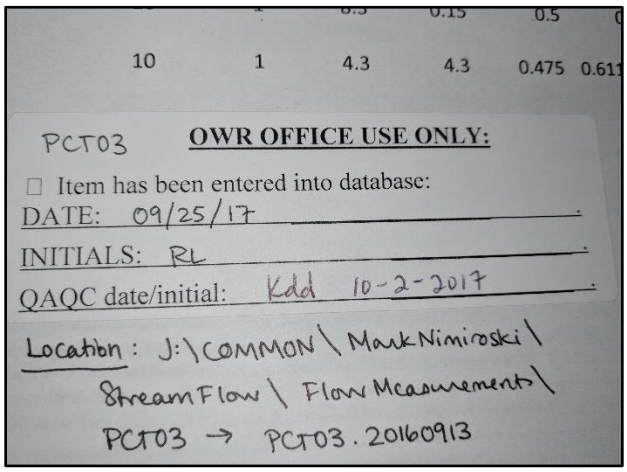
RIDEM field personnel will record field data (from Appendix A) on weatherproof field sheets (Rite in the Rain paper) that will be stored in accordance with the RIDEM Record Retention Schedule (i.e.: indefinitely; should an OWR-specific record retention schedule become available, the document link will be provided in a future annual Quality Assurance Project Plan Addendum.

3.1.2 Electronic Field Data Management

Upon returning from the field, RIDEM staff will transcribe numerical data from the Habitat Assessment Field Data Sheet into an Excel file Template (Appendix A) for upload into the BioQual Access Database. RIDEM staff entering data will visually double check numbers as they are typed into the form. To ensure accurate data transcription, upon completion of data entry, the excel spreadsheet will be printed. The staff member will then check each line of data in the spreadsheet against the original data to insure conformity. Should there be any mistakes, the staff member should circle the number, and correct the number in the electronic spreadsheet and print it again with the correction. This corrected print out will be given to the project manager, or qualified designee to review each line of data for consistency with the original Habitat Assessment Field Data Sheet. Should there be any mistakes, the program manager should circle the number, and correct the number in the electronic spreadsheet and print it again to confirm the correction. A sticker should then be posted on the bottom of the original data sheet (with care not to obscure any original data) to confirm the data has been entered. It should contain information about the date when the data was transcribed, with staff initials, the date the data was reviewed for quality assurance and the initials of the project manager, the electronic Excel filename it is saved under and path to the location where the electronic copy of the Excel File template is saved on the RIDEM network.



Similarly, upon returning from the field, RIDEM staff will transcribe numerical data from the Discharge Measurement Form 9-275f (Appendix A) into an excel file template (see Excel file in folder on the network J:\COMMON\Mark Nimiroski\Streamflow\Flow Measurement) to calculate discharge from the flow data collected. RIDEM staff entering data will visually double check numbers as they are typed into the form. To ensure accurate data transcription, upon completion of data entry, the excel spreadsheet will be printed. The staff member will then check each line of



data in the spreadsheet against the original data to insure conformity. Should there be any mistakes, the staff member should circle the number, and correct the number in the electronic spreadsheet and print it again with the correction. This corrected print out will be given to the project manager, or a qualified designee, to review each line of data for consistency with the original Habitat Assessment Field Data Sheet. Should there be any mistakes, the program manager should circle the number, and correct the number in the electronic spreadsheet and print it again to confirm the correction. This print out will be stapled to the original data form and affixed with a sticker (as above) to confirm the data has been entered. It should contain information about the date the data was transcribed, with staff initials, the date the data was reviewed for quality assurance and the initials of the project manager, the electronic Excel filename it is saved under and path to the location where the electronic copy of the Excel File template is saved on the RIDEM network. The total calculated discharge value should be transcribed from this Excel file onto the Physical Characterization/Water Quality Field Data sheet with the date it was calculated (under “instream Features: Surface Velocity – and note it should be provided in cfs (cubic feet per second) not m/sec). This data should then also be transcribed as a parameter with the habitat data on the Excel Template (“TT_Import_Hab_YEAR.xls”) for upload to the BioQual Access Database.

3.1.3 Management of Laboratory Forms

The contract laboratory will retain any associated laboratory forms (Appendix A) consistent with their Standard Operating Procedures or Guidelines (SOP or SOG), but will provide scanned electronic copies to RIDEM for project record documentation and storage.

3.1.4 Electronic Laboratory Data Management

Taxonomic macroinvertebrate data will be provided electronically as Excel files to RIDEM by contactors (TBD and listed in addendum) and stored in the format required by RIDEM for uploading into the state’s BioQual Access database. Contractors must provide data using the RIDEM Excel template provided to them to ensure taxonomic names (in drop-down list) are consistent with previous identifications (Appendix A).

3.2 Quality Control Requirements, Quality Assessment and Response Actions

Field data collection efforts, field notes, and data forms generated as part of this project will be periodically assessed by the Program Manager to ensure that data collected is usable for the purposes of the study. The Program Manager will provide oversight for each field data collection effort to ensure that protocols described in the QAPP are being followed. Should assessment of these oversight actions (within the index period) indicate protocols were not followed correctly, samples may be taken again (on a separate day, or different stream reach) to ensure proper collection procedures are followed. Data collection efforts may also be assessed

after laboratory analyses are complete to measure precision of duplicate/replicate field collections as detailed below (section 3.4.1) More detailed quality control requirements for in-stream water quality measurements with a YSI instrument are detailed in the above section 2.3.1.2 explaining the frequency of duplicate measurements (10%), and acceptable range (5% of original value) to assess if the measurement is precise, and any appropriate response actions (recalibration) needed should the duplicate fail to meet the range of acceptable values.

3.3 Quality Management Reporting

To inform RIDEM on the status of the laboratory portion of the project and confirm that the expected quality and type of data will meet project goals, the contract laboratory should communicate with RIDEM when laboratory results are internally reviewed and amended (if necessary) and drafts may be sent to RIDEM for review if requested. Any problems detected in the data, or non-conformance of laboratory procedures or data will be verbally discussed with RIDEM to determine the best course of quality control actions to be pursued in accordance with the contract laboratories internal Standard Operating Procedures or Guidelines. Copies of electronic communications will be retained indefinitely to maintain records and document the quality management decisions.

3.4 Quality Assurance and Quality Control

The quality of an environmental monitoring program can be evaluated in three steps: (1) Establishing scientific assessment quality objectives; (2) Evaluating program design for whether the objectives can be met; and (3) Establishing assessment and measurement quality objectives that can be used to evaluate the appropriateness of the methods being used in the program. The process of establishing DQOs involves identifying the allowable uncertainty of a data set that may lead to two types of error: *false positives* (Type I error: a problem is found to exist when in fact it does not) and *false negatives* (Type II error: a problem is not found when in fact it does exist). The acceptance probabilities of those errors as established by the data users are the DQOs. The DQO process entails establishing action-triggering values and selecting rates of false positives and false negatives that are acceptable to the data user (decision maker). The quality of a particular data set is some measure of the types and amount of error associated with the data.

Sources of error or uncertainty associated with variables and indicators include the following:

1. Sampling error: The difference between actual representative values and sampling values that are related to error in sampling design. Sampling error consists of station specific natural variability due to unknown stream characteristics (may produce adequate living conditions in an isolated area) and anthropogenic variability associated with the impact of unknown recent disturbance events (may result in temporary loss of adequate living conditions).

2. Analytical error (e.g., identification error): The difference between sample values and *in situ* “true” values associated with the sorting and identification process. Identification error includes bias and imprecision associated with sample labeling, handling, storage, sorting and taxonomic classification.

The data requirements for this project encompass aspects of field sampling, laboratory analysis, and database management to reduce sources of errors and uncertainty in the use of the data. Methods and procedures described in this document are intended to reduce the magnitude of measurement error sources and frequency of occurrence. Project quality objectives include the following:

- Use of standardized, repeatable sample collection procedures
- Use of trained scientists to perform the sample collection and analyses
- Calibration of measurement equipment
- Analysis of duplicate samples
- Use of Chains-of-Custody when transferring samples or sample material between ESS, any outside QA/QC laboratories or experts, and RIDEM or RIDOH
- A QA/QC check on a percentage of samples analyzed during sorting and identification.
- Maintenance of a taxonomic reference collection

Data generated under this QAPP may be used to inform the state's assessments of wadeable streams or develop specific criteria or policies. Therefore, it is of utmost importance that the data are of sufficient quality to permit these actions.

If data are not accepted during review, they will not be used in the project. Therefore, no specific project action limits or if/then statements are required.

DQOs are qualitative and quantitative statements that clarify the intended use of the data, define the type of data needed to support the decision, identify the conditions under which the data should be collected, and specify tolerable limits on the probability of making a decision error because of uncertainty in the data. To ensure the collection of high-quality data, specific DQOs have been set for laboratory and field analytical procedures on a method basis for precision, accuracy, comparability and completeness.

3.4.1 Precision

Precision is a measure of the degree to which two or more measurements of the same sample are in agreement as well as a measurement of random error. Precision will be assessed through the measurement of duplicate samples (one sample split into two replicates) and subsequent calculation of the relative percent difference (RPD) as follows:

$$RPD = \frac{\left| \text{Result of Replicate 1} - \text{Result of Replicate 2} \right|}{\text{Average of Result of Replicate 1 and Result of Replicate 2}} \times 100$$

Objectives for precision are located in the SOGs/SOPs (Appendix A) as well as worksheet 11b (Section 3.5.3).

3.4.2 Accuracy

Accuracy is an evaluation of the degree to which a measured value and a known reference value or true value are in agreement. This is a measurement of systematic error and is often

referred to as “bias”. Accuracy is determined by the analysis of reference material and comparison of the resulting value to that of the accepted value. The difference between the accepted and reference value is the percent difference. The percent difference is calculated as follows:

$$\% \text{ Difference} = \frac{\left| \text{Known Value of Reference Material} - \text{Calculated Value of Reference Material} \right|}{\text{Known Value of Reference Material}} \times 100$$

Objectives for accuracy are located in the SOGs/SOPs (Appendix A) as well as worksheet 11b (Section 3.5.3).

3.4.3 Comparability

Comparability is a measure of how comparable proposed methods are to accepted methods. ESS field and laboratory SOGs are based on US EPA methods and protocols, where available. ESS will implement methods based on approved RIDEM SOPs for densiometer, pebble count, and benthic algae sampling, which are based on US EPA method and protocols, or as otherwise noted in their respective SOP/SOG.

Laboratory filtration procedures for chlorophyll *a* are based upon known and accepted methods. For this project, filtration will meet the requirements specified by RIDOH SOP TO32 and be consistent with US EPA Method 446.0 (1997).

3.4.4 Completeness

Completeness is a measure of the amount of valid data obtained compared to the amount that was expected to be obtained under normal conditions. Greater than 90% completeness of samples accepted into the laboratory is expected. Greater than 90% completeness of field analytical procedures and collection of valid samples is expected. Completeness is calculated as follows:

$$\text{Completeness} = \frac{\text{Number of Valid Measurements}}{\text{Number of Measurements Planned}} \times 100$$

3.4.5 Quality Assurance/Quality Control Tables

Summaries of the QA/QC objectives for the analysis and collection of samples for this project are provided in the tables on subsequent pages. These tables specifically address the DQIs or the procedures to be followed to provide assurance that an analytical procedure is returning valid results. Each DQI has a specific result that must be met before the data are considered acceptable. Maintenance and calibration procedures for equipment and instrumentation are also provided along with sample collection methods. Analyte-specific tables provide information on the number of QA/QC samples to be prepared (replicates, etc.) and the expected result as well as the person(s) responsible for assessing any problems and determining the proper course of action, if necessary.

Worksheet 9b: Contaminants of Concern and Other Target Analytes Table – Worksheet #9b

USEPA-NE QAPP Worksheet #9b - Rev. 10/99 Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)				
Analyte	**CAS Number**	**Reporting Units**	**Project Action Limit (Units)**	**Project Quantitation Limit (Units)**
Specific Conductance	NA	µS/cm	NA	0.1
Dissolved Oxygen	NA	mg/L O_2	NA	0.1
Temperature	NA	°C	NA	0.1
pH	NA	SU	NA	0.1

Worksheet 9c Field and Quality Control Sample Summary Table – Worksheet #9c

USEPA-NE QAPP Worksheet #9c - Rev. 10/99 Field and Quality Control Sample Summary Table													
Medium/ Matrix	Analytical Parameter	Conc. Level	No. of Sampling Location	No. of Field Duplicate Pairs	Organic		Inorganic		No. of Trip Blanks	No. of Bottle Blanks	No. of Equip. Blanks	No. of PE Samples	Total No. of Samples to Lab
					No. of MS	No. of MSD	No. of Duplicates	No. of MS					
Bethos	Sampling			N/A									
Surface Water	Dissolved Oxygen			N/A									
Surface Water	Temperature			N/A									
Surface Water	Conductivity			N/A									
Surface Water	pH			N/A									
Surface Water	Turbidity			10% of all samples									
Surface Water	Flow			N/A									

Worksheet 11b Measurement Performance Criteria Table – Worksheet #11b

USEPA-NE QAPP Worksheet #11b - Rev. 10/99 Measurement Performance Criteria Table
Data Quality Indicators (DQIs)
Precision
Accuracy
Representativeness
Completeness
Comparability

Worksheet 12b Sampling Locations, Sampling and Analysis Method/SOP Requirements Table – Worksheet #12b

USEPA-NE QAPP Worksheet #12b - Rev. 10/99 Sampling Locations, Sampling and Analysis Method/SOP Requirements Table								
Sampling Location	**Medium/Matrix**	**Depth (Units)**	**No. of Samples (Identify field duplicates and replicas)**	**Sampling SOP**	**Analytical Method/SOP**	**Sampling Volume**	**Containers (Number, size and type)**	**Preservation Requirements (chemical, temperature, light protected)**
Riffle/Run	Benthic Macroinvertebrates	Benthic Substrate	N/A	ESS Sampling SOG	ESS Macroinvertebrate SOG	1 L	1L jar	95% Ethanaol

Worksheet 15 Field Equipment Maintenance, Testing and Inspection Table – Worksheet #15

USEPA-NE QAPP Worksheet #15 - Rev. 10/99 Field Equipment Maintenance, Testing and Inspection Table								
Sampling Equipment/ Instrument	**Maintenance Activity**	**Testing Activity**	**Inspection Activity**	**Responsible Person**	**Frequency**	**Acceptance Criteria**	**Corrective Action**	**SOP Reference**
YSI 85 Multi-parameter meter	Rinse with clean water after use. Keep DO membrane moist during storage.	Calibration	Look for wear in cables and check to be sure probes are not damaged	Person(s) collecting sample	Before each use	Instrument is not damaged and calibration acceptable	If calibration will not hold throughout sampling day as evidenced by problems with post-calibrations, then send to licensed maintenance company.	ESS Dissolved Oxygen, Conductivity and Temperature SOGs
pH Meter	Rinse with tap water after use. Keep pH electrode bulb moist during storage.	Calibration	Look for damage to instrument	Person(s) collecting sample	Before each use	Instrument is not damaged and calibration acceptable	If acceptable calibration cannot be achieved, send instrument to manufacturer or licensed dealer for repair.	ESS pH SOG

Worksheet 16 Sample Handling System – Worksheet #16

USEPA-NE QAPP Worksheet #16 - Rev. 10/99 Sample Handling System
Sample Collection, Packaging and System
Sample Collection: DEM data collection field team
Sample Packaging: DEM data collection field team
Coordination of Shipping: DEM data collection field team
Type of Shipment (Courier): TBD
Sample Receipt and Analysis
Responsible Organization: TBD
Sample Receipt: Laboratory sample custodian
Sample Custody and Storage: Laboratory sample custodian
Sample Preparation: Laboratory personnel
Sample Determinative Analysis: Laboratory personnel
Sample Archival
Field Sample Storage (No. of days from sample collection): 2 months, Samples preserved in 95% ethanol solution
Sample Disposal
Responsible Organization: DEM
Responsible Personnel: Kelsey Mudry

Worksheet 23a Field Analytical QC Table – Worksheet #23a

USEPA-NE QAPP Worksheet #23a - Rev. 10/99 **Field Analytical QC Table – pH**					
Sampling SOP	ESS pH SOG		Analytical Method/SOP Reference	NA – Field Measurement	
Medium/Matrix	Surface Water		Sampler's Name	Various	
Analytical Parameter	pH		Field Sampling Organization	RIDEM (or designee) or ESS	
Concentration Level	0 to 14 SU		No. of Sample Locations	35	
Field QC:	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**DQI**
Calibrate	At the beginning and end of each field day	pH post-calibration values ±0.2 SU from calibration value	Flag data, try and recalibrate instrument, send instrument out for repair if continues to be in error	Field staff	Accuracy
Field duplicate pair	10%	±0.2 SU	Flag data, try and recalibrate instrument, send instrument out for repair if continues to be in error	Field staff	Precision

Worksheet 23a Field Analytical QC Table – Worksheet #23a

USEPA-NE QAPP Worksheet #23a - Rev. 10/99 **Field Analytical QC Table – Turbidity**					
Sampling SOP	ESS Turbidity SOG		Analytical Method/SOP Reference	NA – Field Measurement	
Medium/Matrix	Surface Water		Sampler's Name	Various	
Analytical Parameter	Turbidity		Field Sampling Organization	RIDEM (or designee) or ESS	
Concentration Level	0 to 1000 NTU		No. of Sample Locations	35	
Field QC:	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**DQI**
Calibrate	At the beginning and end of each field day	Turbidity post-calibration values ±2% from calibration value	Flag data, try and recalibrate instrument, send instrument out for repair if continues to be in error	Field staff	Accuracy
Field duplicate pair	10%	±2% below 100 NTU ±3% at or above 100 NTU	Flag data, try and recalibrate instrument, send instrument out for repair if continues to be in error	Field staff	Precision

Worksheet 23 a cont. Field Analytical QC Table – Worksheet #23a (Continued)

USEPA-NE QAPP Worksheet #23a - Rev. 10/99 **Field Analytical QC Table – Temperature, Dissolved Oxygen and Specific Conductance**					
Sampling SOP	ESS Dissolved Oxygen, Conductivity and Temperature SOGs		Analytical Method/SOP Reference	NA – Field Measurement	
Medium/Matrix	Surface Water		Sampler's Name	Various	
Analytical Parameter	Temperature, dissolved oxygen and specific conductance		Field Sampling Organization	ESS	
Concentration Level	Temp: 1-30 °C Dissolved oxygen 0-20 mg/L Specific conductance 0-2,000 µS/cm		No. of Sample Locations	35	
Field QC:	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**DQI**
Field duplicate pair	10%	Specific conductance and dissolved oxygen: ±2%	Flag data, try and recalibrate instrument, send instrument out for repair if continues to be in error	Field staff	Precision
Calibrate	At the beginning and end of each field day	Specific conductance and dissolved oxygen: Post-calibration values <10 RPD from calibration value	Flag data, try and recalibrate instrument, send instrument out for repair if continues to be in error	Field staff	Accuracy

Worksheet 24a Fixed Laboratory Analytical QC Sample Table – Worksheet #24a

USEPA-NE QAPP Worksheet #24a - Rev. 10/99 **Fixed Laboratory Analytical QC Sample Table – Macroinvertebrates**					
Medium/Matrix	Natural Substrate Biological Sample		Analytical Method/ SOP Reference	NA	
Sampling SOP	ESS Macroinvertebrate SOG		Laboratory Name	ESS Group, Inc.	
Concentration Level	NA		No. of Sample Locations	35	
Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**DQI**
Duplicate Pair	10%	<20 RPD	NA	NA	Precision
Sorting Efficiency Check	10%	Efficiency ≥90%	Provide guidance to sorter, re-sort additional sample(s), re-sort all samples completed by the sorter if sorting efficiency check is outside limits on four samples.	ESS Taxonomists	Accuracy
Identification and Enumeration Check	10%	≥90% correctly identified Enumeration within ±10%	Provide guidance to taxonomist, re-identify/ enumerate additional sample(s), re-identify/enumerate all samples completed by the taxonomist if outside limits on four samples.*	ESS Taxonomists	Accuracy

*For these acceptance limits, taxonomists work in teams to ensure checks in house with a QC by a second taxonomist as per their contract states.

4.4 Verification and Validation Requirements

Data review, validation, and verification provide methods for determining the usability and limitations of data, as well as a standardized data quality assessment. ESS will be responsible for reviewing field data, laboratory data, data entries, and transmittals for completeness, correctness, and adherence to QC requirements.

4.5 Verification and Validation Procedures

All field entries, chain-of-custody forms, laboratory notebooks or sheets, and other records will be reviewed by the ESS Project Manager for completeness and correctness. Data will be reviewed and validated internally to provide information on whether they are acceptable or should be flagged or rejected.

Data packages will include, to the extent possible, sample receipt and tracking information, chain-of-custody forms, tabulated data summary forms, and raw analytical data for all field samples, standards, QC checks, and other project-specific documents. Data quality will be assessed by comparing entered data to original data or by comparing results with the measurement performance criteria summarized in Section 3.5.3 (Worksheet #11b) to determine whether to accept, reject, or qualify the data.

Results of the verification and validation processes will be reported to RIDEM, who will make the final determination to reject and remove any unusable data. If less than 90% of the data are judged valid (completeness requirement), best professional judgment will be applied to verify whether the remaining data will make it possible to draw the correct conclusions. Limitations in the data set will be communicated to RIDEM through quality management reports and, as necessary, in the draft and final project reports. All final project reports will be made available to the USEPA PO upon completion.

4.6 Data Usability/Reconciliation with Project Quality Objectives

Following completion of each year's effort, the precision, accuracy, and completeness measures will be assessed and compared with the criteria discussed in Section 3.5.3 (Worksheet #11b). If data collected meet the DQOs for the study, then the data are considered to meet the objectives of the study. Uncertainties and limitations in the use of these data and interpretation of results will be provided to RIDEM and will be reconciled, as possible.

5.0 REFERENCES

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Tables

Table 1: Biomonitoring stations sampled by RIDEM in 2015

	Station Name	Alternative Station Names	Official State River Name	Rhode Island Waterbody ID Number	Town	Latitude	Longitude
1	**AI01**	AI01 ESS20near	Lawton Brook	RI0007035R-04	Portsmouth	41.56664	-71.28171
2	**ESS41**	ESS41	Chipuxet River & Tribs	RI0008039R-06A	Exeter	41.52113	-71.52365
3	**ESS45**	ESS45	Adamsville Brook & Tribs	RI0009041R-01	Tiverton	41.56216	-71.13383
4	**LPK03**	LPK03 ESS35	Mastuxet Brook & Tribs	RI0008039R-11	Westerly	41.34676	-71.81543
5	**PAW09**	PAW09	Chickasheen Brook & Tribs	RI0008039R-05B	South Kingstown	41.34676	-71.81543
6	**PAW11**	PAW11	Mile Brook	RI0008039R-14	Hopkinton	41.41645	-71.79055
7	**PAW12A**	PAW12 ESS22 BL03 RWU04	Ashaway River & Tribs	RI0008039R-02A	Hopkinton	41.42414	-71.79018
8	**PAW17**	PAW17	Perry Healy Brook & Tribs	RI0008039R-19	Charlestown	41.37473	-71.71612
9	**PAW25**	PAW25	Taney Brook	RI0008039R-23	Richmond	41.46058	-71.64782
10	**PAW29**	PAW29	Beaver River & Tribs	RI0008039R-03	Richmond	41.49253	-71.62800
11	**PAW35**	PAW35 ESS40	Chipuxet River	RI0008039R-06C	South Kingstown	41.48253	-71.55113
12	**PAW45**	ESS37	White Brook	RI0008039R-26	Richmond	41.46275	-71.66950
13	**QN03**	QN03	Glen Rock Brook & Tribs	RI0008039R-09	South Kingstown	41.52221	-71.61242
14	**QN04**	QN04	Sherman Brook	RI0008039R-34	South Kingstown	41.51821	-71.60405
15	**QN06**	QN06	Locke Brook & Tribs	RI0008039R-10	Exeter	41.53762	-71.58581
16	**QN08**	QN08	Sodom Brook	RI0008039R-22	Exeter	41.56499	-71.56408
17	**QN09**	QN09	Queens River & Tribs	RI0008039R-21A	Exeter	41.56256	-71.54817
18	**QN13**	QN13	Dutemple Brook	RI0008039R-30	Exeter	41.57235	-71.57206
19	**QNAB**	QNAB ESS29 BL21	Queens River & Tribs	RI0008039R-21C	Exeter	41.53899	-71.56862

20	**WRB05**	WRB05	Canonchet Brook & Tribs	RI0008040R-04B	Hopkinton	41.47799	-71.73450
21	**WRB08**	WRB08	Wood River & Tribs	RI0008040R-16C	Hopkinton	41.49841	-71.71628
22	**WRB15**	WRB15 ESS31 PAW47 WD-REF	Wood River	RI0008040R-16B	Hopkinton	41.54041	-71.69612
23	**WRB17**	WRB17 ESS26	Wood River & Tribs	RI0008040R-16A	Exeter	41.57410	-71.72054
24	**WRB18**	WRB18 ESS28 BL19	Parris Brook & Tribs	RI0008040R-13	Exeter	41.56487	-71.72587
25	**WRB22**	WRB22 BL12	Falls River & Tribs	RI0008040R-07	Exeter	41.58018	-71.72120
26	**WRB23**	WRB23	Breakheart Brook & Tribs	RI0008040R-02	Exeter	41.58789	-71.70923
27	**WRB27**	WRB27	Phillips Brook & Tribs	RI0008040R-14	West Greenwich	41.62132	-71.73102
28	**WRB28**	WRB28	Acid Factory Brook & Tribs	RI0008040R-01	West Greenwich	41.63401	-71.72187
29	**WRB31L**	WRB31	Kelly Brook	RI0008040R-10	West Greenwich	41.62812	-71.75969
30	**WRB40**	WRB40	Roaring Brook	RI0008040R-15	West Greenwich	41.5933900	-71.6674297
31	**WRB41**	WRB41	Baker Brook	RI0008040R-18	Richmond	41.5422500	-71.6932167

Table 2: Biomonitoring stations sampled by RIDEM in 2016.

	Station Name	**Alternative Station Names**	**Official State River Name**	**Rhode Island Waterbody ID Number**	**Town**	**Latitude**	**Longitude**
1	BGR01	BGR01	Bear Brook & Tribs	RI0006012R-01	Coventry	41.66022	-71.62814
2	BGR05	BGR05	Congdon River & Tribs	RI0006012R-04	West Greenwich	41.61220	-71.62275
3	BGR08	BGR08	Carr River & Tribs	RI0006012R-03	West Greenwich	41.64333	-71.60792
4	BGR09	BGR09	Nooseneck River & Tribs	RI0006012R-05	West Greenwich	41.62662	-71.63248
5*	FL01	FL01	Boyd Brook	RI0006013R-01	Coventry	41.71496	-71.63008
6	FL03	FL03	Flat River & Tribs	RI0006013R-02	Coventry	41.71453	-71.65203

7	FL06	FL06	Negro Sawmill Brook	RI0006013R-04	Coventry	41.72062	-71.68380
8	FL08	FL08	Quidneck Brook & Tribs	RI0006013R-08B	Coventry	41.69136	-71.66939
9	HNT02	HNT02	Hunt River	RI0007028R-03A	East Greenwich, North Kingstown	41.62379	-71.48146
10	HNT03	HNT03	Frenchtown Brook & Tribs	RI0007028R-01	East Greenwich	41.62572	-71.48416
11*	HNT05	HNT05	Fry Brook & Tribs	RI0007028R-02	East Greenwich	41.63314	-71.48785
12*	HNT06	HNT06	Hunt River	RI0007028R-03C	East Greenwich, North Kingstown	41.63366	-71.47047
13*	HNT07	HNT07	Scrabbletown Brook	RI0007028R-06	North Kingstown	41.59450	-71.49880
14	HNT08	HNT08	Mawney Brook	RI0007028R-04	East Greenwich	41.63183	-71.51403
15*	HNT11	HNT11	Sandhill Brook	RI0007028R-05	North Kingstown	41.62950	-71.44686
16	NBP02	NBP02	Pawtuxet River North Branch	RI0006016R-06C	Scituate	41.73409	-71.55271
17	NBP06	NBP06	Pawtuxet River North Branch	RI0006016R-06C	West Warwick	41.71851	-71.51821
18	PBR02	PBR02	Hemlock Brook & Tribs	RI0006015R-10	Foster	41.79068	-71.69849
19	PBR04	PBR04	Windsor Brook & Tribs	RI0006015R-30	Foster	41.83608	-71.72263
20	PBR06	PBR06	Shippee Brook	RI0006015R-23	Foster	41.83092	-71.75057
21	PBR07	PBR07	Ponaganset River & Tribs	RI0006015R-20B	Foster	41.81899	-71.70498
22	PCT02	PCT02	Pocasset River & Tribs	RI0006018R-03A	Johnston	41.80278	-71.48606
23	PCT03	PCT03	Simmons Brook & Tribs	RI0006018R-04	Johnston	41.79625	-71.48360
24	PCT07	PCT07	Pocasset River & Tribs	RI0006018R-03B	Cranston	41.75920	-71.44298
25*	PCT08	PCT08	Dry Brook & Tribs	RI0006018R-02A	Johnston	41.81186	-71.51014
26	PCT12	PCT12	Pocasset River & Tribs	RI0006018R-02B	Cranston	41.80810	-71.49390
27	PXT01	PXT01	Meshanticut Brook & Tribs	RI0006017R-02	Cranston	41.74865	-71.48487
28	PXT02	PXT02	Furnace Hill Brook & Tribs	RI0006017R-01	Cranston	41.75564	-71.48753
29*	PXT20	PXT20	Meshanticut Brook and tributaries	RI0006017R-02	West Warwick	41.73121	-71.49481

30	RMR02	RMR02	Huntinghouse Brook	RI0006015R-11	Scituate	41.84666	-71.61173
31	RMR03a	RMR03a	Rush Brook & Tribs	RI0006015R-22	Scituate	41.83785	-71.61189
32	RMR04	RMR04	Peeptoad Brook & Tribs	RI0006015R-19B	Scituate	41.85238	-71.60628
33	SBP02	SBP02	Mishnock River & Tribs	RI0006014R-02	Coventry	41.68043	-71.57836
34	SBP03b	SBP03b	Tribs to Tiogue Lake	RI0006014R-05	Coventry	41.67241	-71.56443
35	SBP04	SBP04	Pawtuxet River South Branch	RI0006014R-04A	Coventry	41.68991	-71.56583
36	SCI01	SCI01	Wilbur Hollow Brook & Tribs	RI0006015R-29	Scituate	41.76813	-71.63315
37	SCI02a	SCI02a	Cork Brook	RI0006015R-06	Scituate	41.79351	-71.64576
38	SCI03	SCI03	Westconnaug Brook	RI0006015R-27	Scituate	41.78548	-71.66714
39	UMR03	ESS43 UMR03 BL22	Bucks Horn Brook & Tribs	RI0005011R-01	Coventry	41.69547	-71.75714
40	UMR04	UMR04	Moosup River & Tribs	RI0005011R-03	Coventry	41.70664	-71.76170
41	UMR07	UMR07	Roaring Brook	RI0005011R-04	Coventry	41.66999	-71.75295

* not sampled (due to lack of riffle at FL01, HNT06, HNT07, HNT11; construction at HNT05; no flow at PCT08 & PXT20)

Table 3: Biomonitoring stations to be sampled by RIDEM in 2019

	Station Name	AlternativeStation Names	Official State River Name	Rhode Island Waterbody ID Number	Town	Latitude	Longitude
	BNC01		Branch River & Tribs	RI0001002R-01B	North Smithfield	41.99981	-71.55276
1	BNC03	BNC03 ESS10	Tarkiln Brook & Tribs	RI0001002R-13B	Burrillville	41.96879	-71.60035
	BNC06		Unnammed Trib	RI0001002R-38	Burrillville	41.97482	-71.63235
2	BNC08	BNC08	Tarkiln Brook & Tribs	RI0001002R-13C	Burrillville	41.95587	-71.59937
3	BNC09	BNC09 ESS09	Tucker Brook & Tribs	RI0001002R-21	Burrillville	41.98771	-71.63008
4	BSN06	BSN06 ESS11	Cherry Brook & Tribs	RI0001003R-02	Woonsocket	41.99977	-71.52309
5	BSN16	BSN16	Mill River	RI0001003R-03	Woonsocket	42.00982	-71.50793
	BSN17		Peters River	RI10001003R-04	Woonsocket	42.0156	-71.49304

6	BSN18	BSN18	Scott Brook & Tribs	RI0001003R-05	Cumberland	41.94197	-71.42769
7	BSN19	BSN19	West Sneech Brook & Tribs	RI0001003R-06	Cumberland	41.95584	-71.44542
8	CHP02	CHP02	Saunders Brook & Tribs	RI0001002R-12	Glocester	41.88608	-71.69734
9	CLR01	CLR01 ESS06	Brandy Brook & Tribs	RI0001002R-02	Glocester	41.92307	-71.72581
10	CLR02	CLR02 ESS03 BL20	Pascoag River	RI0001002R-09	Burrillville	41.96333	-71.70221
	CLR07		Dry Arm Brook	RI10001002R-06	Burrillville	41.97289	-71.75029
11	CLR08	CLR08	Nipmuc River & Tribs	RI0001002R-08	Burrillville	41.98109	-71.68621
12	CLR09	CLR09	Clear River & Tribs	RI0001002R-05B	Burrillville	41.97661	-71.74234
13	CLR10	CLR10	Leland Brook & Tribs	RI0001002R-17	Burrillville	41.96526	-71.73059
	CLR11		Mowry Brook	RI10001002R-18	Burrillville	41.97641	-71.70807
14	MLL04	MLL04	Moshassuck River & Tribs	RI0001006R-08	Cumberland	41.92729	-71.38479
15	MLL09	MLL09 BSN01 BL02	Abbott Run Brook South & Tribs	RI0001006R-01B	North Attleboro, MA	41.92849	-71.37296
16	MLL10	MLL10 BSN02 near ESS01 near BL01	Abbott Run Brook North & Tribs	RI0001006R-01A	Cumberland	41.97956	-71.39329
17	MSK01	MSK01	Moshassuck River & Tribs	RI0003008R-01A	Lincoln	41.90702	-71.43216
18	MSK02	MSK02	Moshassuck River & Tribs	RI0003008R-01B	Lincoln	41.88593	-71.40762
19	MSK04	MSK04	Moshassuck River & Tribs	RI0003008R-01C	Pawtucket	41.85949	-71.40358
	MSK05		Moshassuck River & Tribs	RI0003008R-03C	Providence	41.84097	-71.41031
20	MSK06	MSK06	West River & Tribs	RI0003008R-03C	Providence	41.84513	-71.41360
21	MSK07	MSK07	West River & Tribs	RI0003008R-03B	North Providence	41.86214	-71.45048
22	SAU03	SAU03	Fresh Meadow Brook	RI0010045R-01	South Kingstown	41.47908	-71.48243
23	SAU04	SAU04 ESS55	Indian Run Brook & Tribs	RI0010045R-02	South Kingstown	41.44983	-71.49554
24	SAU05	SAU05	Rocky Brook & Tribs	RI0010045R-04	South Kingstown	41.45158	-71.50143

25	TLC08	TLC08	Tribs East of Cold Brook	RI0010048R03	Little Compton	41.51664	-71.12908
26	TLC09	TLC09	Dundery Brook	RI0010048R-02C	Little Compton	41.48835	-71.17143
27	WON01	WON01	Woonasquatucket River & Tribs	RI0002007R-10A	Smithfield	41.92085	-71.55265
	WON03		Woonasquatucket River & Tribs	RI0002007R-10C	Johnston	41.85920	-71.48740
28	WON04	WON04	Woonasquatucket River & Tribs	RI0002007R-10C	Johnston	41.83286	-71.47033
29	WON06	WON06	Stillwater River & Tribs	RI0002007R-09	Smithfield	41.87452	-71.55488
30	WON11	WON11	Latham Brook & Tribs	RI0002007R-05	Smithfield	41.91943	-71.56013
31	WON12	WON12	Woonasquatucket River & Tribs	RI0002007R-10D	Providence	41.8214	-71.4547
32	WON13	WON13	Unnamed Tribs to Stillwater Pond	RI0002007R-12	Smithfield	41.91089	-71.52803
33	WON15	WON15	Harris Brook & Tribs	RI0002007R-03	Smithfield	41.90139	-71.50945
34	WON16	WON16	Unnamed Tribs to Georgiaville Pond	RI0002007R-16	Smithfield	41.89473	-71.50713
35	WON19	WON19	Hawkins Brook & Tribs	RI0002007R-04	Smithfield	41.87344	-71.50132
36	WON02	WON02	Woonasquatucket River & Tribs	RI0002007R-10B	Smithfield	41.878723	-71.501721
	WONWR3A	WONWR3A	Woonasquatucket River & Tribs	RI0002007R-10B	Smithfield	41.87368	-71.49713
	WR1		Woonasquatucket River & Tribs	RI0002007R-10A	Smithfield	41.90866	-71.50713
37	ESS45	ESS45	Adamsville Brook & Tribs	RI0009041R-01	Tiverton	41.56216	-71.13383
	LFR01	LFR01	Cady Brook	RI0005047R-08	Glocester	41.89706	-71.79649

Table 4: Biomonitoring stations sampled by RIDEM in 2021.

	Station Name	Alternative Station Names	Official State River Name	Rhode Island Waterbody ID Number	Town	Latitude	Longitude
1*	AI01	nearESS20	Lawton Brook	RI0007035R-04	Portsmouth	41.56664	-71.28171
2 *	AQI02		Bailey's Brook & Tribs	RI007035R-01	Middletown	41.510810	-71.293260
3 *	AQI03		Maidford River	RI007035R-02A	Middletown	41.502000	-71.268111

4 *	BB05A	BKE02	Buckeye Brook	RI0007024R-01	Warwick	41.714281	-71.398298
5	GNB07	GNB17	Hardig Brook	RI0007025R-01	Warwick	41.700467	-71.461399
6*	HNT02	USGS 01116850	Hunt River	RI0007028R-03A	North Kingstown	41.623790	-71.481460
7 *	HNT03		Frenchtown Brook & Tribs	RI0007028R-01	North Kingstown	41.625730	-71.484257
8 *	HNT05a		Fry Brook & Tribs	RI0007028R-02	East Greenwich	41.632118	-71.486591
9 *	HNT07		Scrabbletown Brook	RI0007028R-06	North Kingstown	41.594613	-71.498956
10*	HNT08		Mawney Brook	RI0007028R-04	East Greenwich	41.631830	-71.514030
11 *	HNT11		Sandhill Brook	RI0007028R-05	North Kingstown	41.629500	-71.446860
12	ESS45	TLC05	Adamsville Brook	RI0009041R-01	Little Compton	41.558851	-71.129445
13	TLC08		Tribs East of Cold Brook	RI0010048R-03	Little Compton	41.516747	-71.129165
14*	TLC09		Dundery Brook	RI0010048R-02	Little Compton	41.488350	-71.171430
15*	WON01		Woonasquatucket River & Tribs –	RI0002007R-10A	Smithfield	41.920850	-71.552650
16*	WPA07	ESS19_BL14_RWU23	Jamestown Brook	RI0007036R-01	Jamestown	41.526220	-71.374766
17*	TLC04		Quacket Creek	RI0020031R-04	Tiverton	41.57156	-71.18472

*Not sampled due to not meeting the criteria for low gradient method sampling.

Table 5: Biomonitoring stations sampled by RIDEM in 2022.

	Station Name	Alternative Station Names	Official State River Name	Rhode Island Waterbody ID Number	Town	Latitude	Longitude
1	PAW29		Beaver River	RI0008039R-03	Richmond	41.49241	-71.62802
2	PAW47	ESS31, WD-REF, WRB15	Wood River	RI0008040R-16B	Hopkinton, Richmond	41.53988	-71.69683
3	WRB23		Breakheart Brook	RI0008040R-02	Exeter	41.58794	-71.70930
4	WRB18	ESS28, BL19	Parris Brook	RI0008040R-13	Exeter	41.56492	-71.72577

5	QN06		Locke Brook	RI0008039R-10	Exeter	41.53731	-71.58749
6	SAU04		Indian Run	RI0010045R-02	South Kingstown	41.44983	-71.49554
7	QN09		Queen River	RI0008039R-21A	Exeter	41.56257	-71.54798
8	QN03		Glen Rock Brook	RI0008039R-09	South Kingstown	41.52218	-71.61235
9	QN08		Sodom Brook	RI0008039R-21C	Exeter	41.56436	-71.56434
10	WRB36		Brushy Brook	RI0008040R-03A	Hopkinton	41.52872	-71.73631
11	WRB11		Moscow Brook	RI0008040R-12	Hopkinton	41.52348	-71.75095
12	ESS37	PAW45	White Brook	RI0008039R-26	Richmond	41.46275	-71.66950
13	PAW17		Perry Healy Brook	RI0008039R-19	Charlestown	41.37477	-71.71616
14	PAW04	ESS30, BL24	Tomaquag Brook & Tribs	RI0008039R-24	Hopkinton	41.243928	-71.454943
15	PAW13		Parmenter Brook	RI0008039R-37	Hopkinton	41.44754	-71.79024
16	SAU05		Rocky Brook	RI0010045R-04	South Kingstown	41.45158	-71.50143
17	WRB28		Acid Factory Brook	RI0008040R-01	West Greenwich	41.63389	-71.72195
18	WRB40		Roaring Brook	RI0008040R-15	Exeter	41.57747	-71.68141
19	WRB22	BL12	Falls River	RI0008040R-07	Exeter	41.58008	-71.72105
20	WRB22A		Flat River	RI0008040R-08	Exeter	41.57938	-71.71881

Appendix A: Field and Laboratory Forms

1. RIDEM DFW Scientific Collector's Permit Application
2. Field Training Documentation Form
3. RIDEM Macroinvertebrate Biomonitoring Program Sampling Event Documentation
4. Physical Characterization/Water Quality Field Data Sheet
5. USGS Form 9-275F Discharge Measurement and Gage Inspection Notes
6. Outside of Jar Labels for Benthic Macroinvertebrate Samples
7. Inside of Jar Labels for Benthic Macroinvertebrate Samples
8. Benthic Macroinvertebrate Log-in Sheet
9. Habitat Assessment Field Data Sheet (High Gradient Streams)
10. Benthic Macroinvertebrate Laboratory Bench Sheet
11. Microsoft Excel Template to Import Habitat Data into BioQual
12. Microsoft Excel Template to Import Benthic Data into BioQual (with instructions)

Rhode Island
Department of Environmental Management

DIVISION OF FISH AND WILDLIFE

APPLICATION FOR SCIENTIFIC COLLECTOR'S PERMIT

INSTRUCTIONS:

1. Please type or print all information. Attach additional sheets for explanation, if necessary.
2. Refer to the *Rules and Regulations Governing Collector's Permits* for specific prohibitions, exemptions, and other requirements.
3. This application must be filled out COMPLETELY and all applicable information provided or application may not be processed.
4. A fee of $25.00 is required to process this application and can be paid by Check or Money Order ONLY. Checks may be made out to RIDEM/Div. of Fish and Wildlife.

If collecting **terrestrial or freshwater species**, send to:
RIDEM Division of Fish and Wildlife
Great Swamp Field Headquarters
277 Great Neck Road
West Kingston, RI 02892
Or email to: DEM.DFW@dem.ri.gov
Phone: 401-789-0281 Fax: 401-783-7490

If collecting **marine species**, send to:
RIDEM Division of Fish and Wildlife
Marine Fisheries
3 Ft. Wetherill Road
Jamestown, RI 02835
Or email to: DEM.MarineFisheries@dem.ri.gov
Phone: 1-401-423-1923 Fax: 1-401-423-1925

■ New Applicant
□ Type 1(Research & Education)
■ Type 2 (Governmental)
□ Type 3 (Consulting)
□ Type 4 (Municipal Deer Management Permit)

□ Renewal, permit #:_____

APPLICANT INFORMATION

Name: Katie DeGoosh-DiMarzio Occupation: Biologist

Education* (Degree, Institution): MS UMaine Orono D.O.B.: 12-8-1979

Home Address: 235 Promenade Street Room 200

City: Providence State: RI Zip Code: 02908

Phone #: 401-575-7484 Email: katie.degoosh@dem.ri.gov

Business Name: RIDEM Office of Water Resources

Principal Officer/Title: Freshwater Biologist

Business Address: 325 Promenade Street Room 200

City: Providence State: RI Zip Code: 02908

Bus. Phone #: 222-4700 x 7211 Bus. Email: katie.deoosh@dem.ri.gov

**If education does not meet minimum criteria, attach a description of related professional experience, certifications by professional societies, or recommendations by acknowledged authorities.*

➡ **If applying for a Type I, II or III Scientific Collector's Permit, complete Section A.**

➡ **If applying for a Type IV Scientific Collector's Permit, continue to Section B and provide all of the required information.**

PURPOSE OF COLLECTION

Section A: *Type I, II or III Scientific Collector's Permit*

1. Purpose of collection (be specific, attach additional sheet if necessary): part of RIDEM OWR's annual Wadeable Steam Biomonitoring Sampling to assess water quality in rivers and streams under the Clean Water Act (previous permit #2012-37)

2. Terrestrial and/or freshwater species (common and scientific names) to be collected (Fill out attached checklist for marine species): freshwater benthic macroinvertebrates - all macroinvertebrate taxa collected during 3 minute kick sampling will be kept and preserved, any other species collected in the net (young of year fish, salamanders or crayfish) will be documented and returned to the stream)

3. Will you collect sub-legal sized individuals? □ YES or ■ NO

If yes, list species: _____

4. Number required to be collected for each species: all macroinvertebrates collected within 3 minute sampling period will be retained, euthanized and preserved for enumeration and identification in the laboratory.

5. Specific collecting location(s): see attached table, approximately 40 locations visited per year, same sites visited every 3 or 4 years

6. Collecting technique(s) (describe any modified gear): D-frame kick net (500 micron mesh net)

7. Will specimens be retained for study/research? ■ YES or □ NO

If yes, where will the collection be housed? RIDEM OWR or contract laboratory for ID

Period required: kept for five years from date of sampling

8. Final disposition of collected organisms (e.g., released, euthanized): euthanized
9. Federal permit # (if applicable): N/A
10. Vessel information (if applicable): N/A
11. Attach a list of all sub-permittees, including name, position, address, phone number, and affiliation, to be covered by the permit (if applicable).
12. If animals are for experimental purposes, attach a statement or outline of research protocol and/or IACUC protocol and approval information.
13. If collecting marine species, please indicate which species you intend to collect on the marine species checklist (attached). Include additional list of species intended for collection that are not supplied on checklist.

Section B: *Type IV Scientific Collector's Permit (Municipal Deer Management Permit)*

Submit a Deer Management Plan and provide all required supporting information per the specifications outlined in Rule 6.4(d) Rhode Island Rules and Regulations Governing Collector's Permits.

The signature attests to the possession of knowledge, understanding, and willingness to abide by all applicable laws, regulations and requirements, and releases the Rhode Island Department of Environmental Management and the State of Rhode Island and all of their employees and agents from all liability for any injury, damage, or the like, resulting from the activity authorized under the subject collector's permit if issued. Further, the signatory agrees to hold the Department and the State harmless for any damages flowing from activities conducted related to this Permit.

Signature of Applicant: _____ Date:_____

DEM Use Only

Received Date:_____ Check No.:_____

Approved/Disapproved By: _____ **Date:**_____

Christine Dudley, Deputy Chief of Freshwater Fisheries

Approved/Disapproved By: _____ **Date:**_____

Jason Osenkowski, Deputy Chief of Wildlife

Approved/Disapproved By: _____ **Date:**_____

Jason McNamee, Chief of Marine Resource Management

PERMIT #:_____ **Issue Date**: _____ **Expiration Date**:_____

REGULATIONS

RIDEM regulations, including the following, can be found at the RI DEM website:

RHODE ISLAND RULES AND REGULATIONS GOVERNING COLLECTOR'S PERMITS
http://www.dem.ri.gov/pubs/regs/regs/fishwild/fwcollectors16.pdf

RHODE ISLAND RULES AND REGULATIONS GOVERNING IMPORTATION AND POSSESSION OF WILD ANIMALS
http://sos.ri.gov/documents/archives/regdocs/released/pdf/DEM/8229.pdf

RULES & REGULATIONS GOVERNING THE PREVENTION, CONTROL AND SUPPRESSION OF RABIES WITHIN THE STATE OF RHODE ISLAND
http://www.dem.ri.gov/pubs/regs/regs/agric/rabies16.pdf

RHODE ISLAND HUNTING REGULATIONS
http://www.dem.ri.gov/pubs/regs/#FandW

RHODE ISLAND FRESHWATER AND ANADROMOUS FISHING REGULATIONS
http://www.dem.ri.gov/pubs/regs/regs/fishwild/fish1617.pdf

RHODE ISLAND MARINE FISHERIES REGULATIONS
http://www.dem.ri.gov/pubs/regs/regs/fishwild/rimftoc.htm

PARK AND MANAGEMENT AREA RULES AND REGULATIONS
http://www.dem.ri.gov/pubs/regs/regs/fishwild/parkmgmt.pdf

RHODE ISLAND GENERAL LAWS

State of Rhode Island General Laws/ Title 20- Fish and Wildlife
http://webserver.rilin.state.ri.us/Statutes/title20/index.htm
State of Rhode Island General Laws/ Title 11/Chapter 47- Weapons
http://webserver.rilin.state.ri.us/Statutes/title11/index.htm

Please Check All Marine Species You Intend To Collect*

Finfish
- □ American eel
- □ American plaice (Dab)
- □ American sand lance
- □ American shad
- □ Anchovy (spp)
- □ Atlantic cod
- □ Atlantic menhaden
- □ Atlantic moonfish
- □ Atlantic silverside
- □ Atlantic tomcod
- □ Atlantic sturgeon**
- □ Black sea bass
- □ Bluefish
- □ Blue runner
- □ Bonito
- □ Butterfish
- □ Conger eel
- □ Cunner
- □ Drum (spp)
- □ False albacore
- □ Filefish (spp)
- □ Fourspot flounder
- □ Goby (spp)
- □ Gulfstream flounder
- □ Grubby sculpin
- □ Haddock
- □ Hake (spp)
- □ Herring (spp)
- □ Hickory shad
- □ Hogchoker
- □ Jack (spp)
- □ Killifish (spp)
- □ Monkfish (Goosefish)
- □ Mullet (spp)
- □ Needlefish/ halfbeaks
- □ Northern kingfish
- □ Northern pipefish
- □ Northern puffer
- □ Ocean pout
- □ Oyster toadfish
- □ Perch (spp)
- □ Pollock
- □ Rainbow smelt
- □ River herring
- □ Scad (spp)
- □ Sculpin (spp)
- □ Scup
- □ Seahorse
- □ Sea raven
- □ Sea robins (spp)
- □ Sheepshead minnow
- □ Smallmouth flounder
- □ Snapper (spp)
- □ Spotted hake
- □ Sticklebacks (spp)
- □ Striped bass
- □ Summer flounder (fluke)
- □ Tautog (blackfish)
- □ Triggerfish (spp)
- □ Tropical spp.
- □ Weakfish
- □ Windowpane
- □ Winter flounder
- □ Yellowfin tuna
- □ Yellowtail flounder

Elasmobranchs

Sharks:
- □ Atlantic sharpnose
- □ Blacknose
- □ Blacktip
- □ Blue
- □ Bonnethead
- □ Bull
- □ Common thresher
- □ Finetooth
- □ Great hammerhead
- □ Lemon
- □ Nurse
- □ Oceanic whitetip
- □ Porbeagle
- □ Scalloped hammerhead
- □ Shortfin mako
- □ Silky
- □ Smooth dogfish
- □ Smooth hammerhead
- □ Spinner
- □ Spiny dogfish
- □ Tiger

Skates:
- □ Barndoor
- □ Big
- □ Clearnose
- □ Little
- □ Rosette
- □ Thorny
- □ Winter

Rays:
- □ Atlantic torpedo
- □ Bluntnose
- □ Cownose

Prohibited Shark Species
- □ Atlantic angel
- □ Basking
- □ Bigeye sandtiger
- □ Bigeve sixgill
- □ Bigeye thresher
- □ Bignose
- □ Bluntnose sixgill
- □ Caribbean sharpnose
- □ Dusky
- □ Galapagos
- □ Longfin mako
- □ Narrowtooth
- □ Night
- □ Reef
- □ Sand tiger
- □ Sharpnose sevengill
- □ Smalltail
- □ Whale shark
- □ White shark

Research Shark Species**
- □ Sandbar

Crustaceans
- □ American lobster
- □ Amphipods
- □ Asian shore crab
- □ Bay shrimp
- □ Blue crab
- □ Copepods
- □ Fiddler crab
- □ Green crab
- □ Hermit crab
- □ Horseshoe crab
- □ Jonah crab
- □ Lady crab
- □ Mantis shrimp
- □ Mud crab
- □ Rock crab
- □ Shrimp (spp)
- □ Spider crab

Shellfish
- □ Bay quahaug
- □ Bay scallop
- □ Deep sea scallop
- □ Mussels (spp)
- □ Ocean quahaug
- □ Oyster
- □ Periwinkle
- □ Razor clam
- □ Slippersnails
- □ Soft-shell clam
- □ Squid
- □ Surf clam
- □ Whelk (chonch)

Other
- □ Algae
- □ Eelgrass
- □ Jellyfish
- □ Sponges
- □ Tunicates
- □ Polychaetes
- □ Sea cucumber
- □ Sea St

* Collection of species in federal waters requires appropriate permit
** Endangered species, must have appropriate permission to collect
◊ Note reporting requirements for Prohibited and Research Shark Species as stated in RI Marine Fisheries Regulations Section 3.24.2

Rhode Island
Department of Environmental Management

DIVISION OF FISH AND WILDLIFE

401 789-0281
FAX 401 783-7490

SCIENTIFIC COLLECTOR'S PERMIT REPORT

Permit holders must file a report with the Division of Fish and Wildlife within thirty (30) days of the expiration date of the permit or as otherwise specified on the permit.

If collecting **terrestrial or freshwater species**, send to:
RIDEM Division of Fish and Wildlife
Great Swamp Field Headquarters
277 Great Neck Road
West Kingston, RI 02892
Or email to: DEM.DFW@dem.ri.gov
Phone: 401-789-0281 Fax: 401-783-7490

If collecting **marine species**, send to:
RIDEM Division of Fish and Wildlife
Marine Fisheries
3 Ft. Wetherill Road
Jamestown, RI 02835
Or email to: DEM.MarineFisheries@dem.ri.gov
Phone: 1-401-423-1923 Fax: 1-401-423-1925

1. Scientific Collector's Permit #:_____
2. Name:_____
3. Date:_____
4. Organization:_____
5. Federal Permit #, if applicable:_____
6. Provide any changes to your contact information:_____
7. The purpose and objective of the study:_____
   _____
8. Attach a list of any sub-permittees.
9. Attach a list of species collected and include the following:
   a. Species identification
   b. Number of individuals collected;
   c. Lengths, age, and sex, if known;
   d. Location(s) where specimens were collected;
   e. Date received or collected;
   f. Final disposition of the specimens; and
   g. Location where specimens are held, if applicable

**Remember that for any prohibited or research shark species collected for display, annual reports indicating updated length and weight measurements are due by Dec. 31 of each year for the lifespan of the individuals (See R.I. Marine Fisheries Regulations Section 3.24.2)

TRAINING DOCUMENTATION FORM

Signatures below indicate _____ has received a copy of the *RIDEM Quality Assurance Project Plan (QAPP) for RI Wadeable Stream Biomonitoring & Habitat Assessment Program* from the RIDEM/OWR Project Manager. The aforementioned staff has read and understands the document, and has been given the opportunity to ask any questions pertaining to policies and procedures described herein. The undersigned has received appropriate training in these QAPP procedures and has also read the associated Standard Operating Procedures. This original training documentation form will be kept on file with the QA Manager and personnel may be provided with a copy if requested. Subsequent field assessments will be recorded below to document that the Project Manager periodically evaluates said personnel in the field to insure conformance with this QAPP.

_____	_____	_____
Printed Name	Signature	Date
_____	_____	_____
Project Manager	Signature	Date

Personnel Field Training for Biomonitoring Data Collection

To ensure field operations are in compliance with the project data quality objectives indicated in this QAPP, the Project Manager will train personnel to ensure conformance with the QAPP and associated SOPs.

Results of training will be documented below to indicate conformance or non-conformance (or if not evaluated, indicate N/A). Should the undersigned fail to comply with procedures outlined herein the RIDEM/OWR Project Manager will consult with the RIDEM/OWR Quality Assurance Manager and take corrective action to retrain personnel in proper procedures.

FOR TRAINING PURPOSES

Name of Trained Field Personnel: Project Manager Initials:

Training Date:	**Task Evaluated**	**Performance Assessment Result: -Conforms to QAPP -Non-conformance -Not evaluated (N/A)**	**Corrective Actions Taken or other comments**
	Calibration Procedures and Documentation		
	YSI measurements and Data Recording		
	Benthic Sampling Methodology		
	Sample handling, storage and labeling		
	Chain of Custody Procedures and Documentation		

RIDEM Macroinvertebrate Biomonitoring Program Sampling Event Documentation

1 Sampling Event Information

☐ **DATE** _____ **Time of Departure (a.m.):**

☐ General Area Planned to Visit: _____ **Time of Arrival at Foundry (p.m.):**

☐ Posted Field Plan at Mark's cube (note: Who / Where / Which vehicle)

2 Weather

Current Conditions *TIME* *Barometric Pressure (online):*

Circle one: rain Overcast Clear Scattered Clouds

TEMP		**High Temp Forcast**		**Humidity**	**Chanc Rain**	**rain last 24-h?**
F	@ TFG Airport/Warwick (NOAA):	F	pm	%	%	inches
F	@ Smithfield (NOAA):	F	pm	%	%	inches
F	@ Westerly (NOAA):	F	pm	%	%	inches
F	@ Weather.com zipcode:	F	pm	%	%	inches

3 Required Sample Bottles and Labels

15 = Total Number of bottles (with label tape)

15 = Labels for outside of Bottles (on stickly labels)

15 = Labels for inside of bottles (on Write in the Rain Paper)

1 roll of eacl = Clear Packing Tape to put over label once its written AND electrical tape

2 ea. min. = Sharpie and Pencil to write labels

4 Field Gear Inventory (check box when packed and note if we need to order more or resolve any problems)

☐ Coolers with ice pack for bottles/ethanol	☐ YSI meter # _____	☐ Orange Vests / hats
☐ Sample Bottles	☐ Extra YSI batteries	☐ latex/blue gloves
☐ Kick Net	☐ Camera w/ charged battery	☐ First Aid Kit
☐ Waders or Hip boots	☐ decon sprayer for waders	☐ Car keys
☐ White discecting tray	☐ 95% ethanol (2 bottles)	☐ Hand sanitizer/wipes
☐ Timer/Stopwatch	☐ funnel and small forceps	☐ Safety Cones
☐ No. 35 Sieve and bucket	☐ Flow meter/staff	☐ measuring tape/stick
☐ 2 wash bottles, 2 bottles tap water	☐ batteries for Flowmate C	☐ GPS unit w/ batteries

5 Paperwork to bring (in metal clipboard)

☐ List of station order for day	☐ Habitat /PC sheets	☐ flow data collection sheets
☐ Labels for Sample Bottles	☐ station descriptions	☐ ICE emergency sheets
☐ List of carwashes/gas stations	☐ Pens/Pencil/sharpies	☐ Map/atlas

6 Helpful things to bring (but not required)

☐ Sunscreen	☐ Lunch	☐ cell phone/charger
☐ Bugspray	☐ Sunglasses/hat	☐ Towel/dry clothes
☐ Technu	☐ Garbage bag/sample bags	☐ Clippers

END OF THE DAY REMINDERS (please initial who will do this and check off when completed, cross out if NA)

___ Re-fuel Vehicle	___ Return Car Keys	___ Enter habitat data
___ Download Pictures from Camera	___ Charge Camera Battery	___
___ Enter YSI Data	___ Enter Flow Data	___

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
❑	storm (heavy rain)	❑
❑	rain (steady rain)	❑
❑	showers (intermittent)	❑
____%❑	%cloud cover	❑____%
❑	clear/sunny	❑

Has there been a heavy rain in the last 7 days? ❑ Yes ❑ No

Air Temperature_____^{0} C

Other_____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

STREAM CHARACTERIZATION

Stream Subsystem
❑ Perennial ❑ Intermittent ❑ Tidal

Stream Type
❑ Coldwater ❑ Warmwater

Stream Origin
❑ Glacial
❑ Non-glacial montane
❑ Swamp and bog
❑ Spring-fed
❑ Mixture of origins
❑ Other_____

Catchment Area_____km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
❑ Forest ❑ Commercial
❑ Field/Pasture ❑ Industrial
❑ Agricultural ❑ Other _____
❑ Residential

Local Watershed NPS Pollution
❑ No evidence ❑ Some potential sources
❑ Obvious sources

Local Watershed Erosion
❑ None ❑ Moderate ❑ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
❑ Trees ❑ Shrubs ❑ Grasses ❑ Herbaceous

dominant species present _____

INSTREAM FEATURES

Estimated Reach Length _____m

Estimated Stream Width _____m

Sampling Reach Area _____m^2

Area in km^2 (m^2x1000) _____km^2

Estimated Stream Depth _____m

Surface Velocity (at thalweg) _____m/sec

Canopy Cover
❑ Partly open ❑ Partly shaded ❑ Shaded

High Water Mark _____m

Proportion of Reach Represented by Stream Morphology Types
❑ Riffle_____% ❑ Run_____%
❑ Pool_____%

Channelized ❑ Yes ❑ No

Dam Present ❑ Yes ❑ No

LARGE WOODY DEBRIS

LWD _____m^2

Density of LWD _____m^2/km^2 **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating
❑ Floating Algae ❑ Attached Algae

dominant species present _____

Portion of the reach with aquatic vegetation _____%

WATER QUALITY

Temperature_____^{0} C

Specific Conductance_____

Dissolved Oxygen _____

pH _____

Turbidity _____

WQ Instrument Used _____

Water Odors
❑ Normal/None ❑ Sewage
❑ Petroleum ❑ Chemical
❑ Fishy ❑ Other_____

Water Surface Oils
❑ Slick ❑ Sheen ❑ Globs ❑ Flecks
❑ None ❑ Other_____

Turbidity (if not measured)
❑ Clear ❑ Slightly turbid ❑ Turbid
❑ Opaque ❑ Stained ❑ Other_____

SEDIMENT/ SUBSTRATE

Odors
❑ Normal ❑ Sewage ❑ Petroleum
❑ Chemical ❑ Anaerobic ❑ None
❑ Other_____

Oils
❑ Absent ❑ Slight ❑ Moderate ❑ Profuse

Deposits
❑ Sludge ❑ Sawdust ❑ Paper fiber ❑ Sand
❑ Relict shells ❑ Other_____

Looking at stones which are not deeply embedded, are the undersides black in color?
❑ Yes ❑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			**ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)**		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

Form 9-275F
(Apr. 2001)

U.S. DEPARTMENT OF THE INTERIOR
U.S. Geological Survey
WATER RESOURCES DIVISION
DISCHARGE MEASUREMENT AND GAGE INSPECTION NOTES

Meas. No. _____
Comp. by _____
Checked by _____

Sta. No. _____
Sta. Name _____
Date _____, 20____ Party _____
Width _____ Area _____ Vel. _____ G.H. _____ Disch. _____
Method _____ No. secs. _____ G.H. change _____ in _____ hrs.
Method coef. _____ Horiz. angle coef. _____ Susp. _____ Tags checked _____
Meter Type _____ Meter No. _____ Meter _____ ft. above bottom of wt.
Rating used _____ Spin test before meas. _____ ; after _____
Meas. plots _____ % diff. from rating no. _____ Indicated shift _____

GAGE READINGS						
Time					Inside	Outside
	Start					
	Finish					
Weighted MGH						
GH correction						
Correct MGH						

Samples collected: water quality, sediment, biological, other _____

Measurements documented on separate sheets: water quality, aux./base gage, other _____

Rain gage serviced/calibrated ____

Weather: _____
Air Temp. _____°C at _____
Water Temp. _____°C at _____
Check bar/chain found _____
Changed to _____ at _____
Correct _____

Wading, cable, ice, boat, upstr., downstr., side bridge, _____ ft., mi. upstr., downstr. of gage.
Measurement rated excellent (2%), good (5%), fair (8%), poor (> 8%); based on following conditions: Flow: _____
Cross section: _____

Gage operating: _____ Record Removed _____
Battery voltage: _____ Intake/Orifice cleaned/purged: _____
Bubble-gage pressure, psi: Tank _____, Line _____ ; Bubble-rate _____ /min.
Extreme-GH indicators: max _____, min _____
CSG checked: _____ HWM height on stick _____ Ref. elev. _____ HWM elev. _____
HWM inside/outside: _____
Control: _____

Remarks: _____

GH of zero flow = GH _____ - depth at control _____ = _____ ft., rated _____

Sheet No. _____ of _____ sheets

River at -

.0	.10	.20	.30	.40	.50	.60	.70	.75	
ANGLE COEFFICIENT	DIST. FROM INITIAL POINT	WIDTH	DEPTH	OBSERVATION DEPTH	REVOLUTIONS	TIME IN SECONDS	VELOCITY: AT POINT	VELOCITY: MEAN IN VERTICAL	ADJUSTED FOR HOR. ANGLE OR	AREA	DISCHARGE	.80
												.85
												.90
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												.80
.0	.10	.20	.30	.40	.50	.60	.70	.75				

RIDEM Macroinvertebrate Sample
STATION
DATE
STREAM
COLLECTOR
JAR # _______ of _______

RIDEM Macroinvertebrate Sample
STATION
DATE
STREAM
COLLECTOR
JAR # _______ of _______

RIDEM Macroinvertebrate Sample
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COLLECTOR
JAR # of

RIDEM Macroinvertebrate Sample
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BENTHIC MACROINVERTEBRATE SAMPLE LOG-IN SHEET

Date Collected	Collected By	Number of Containers	Preservation	Station #	Stream Name and Location	Date Received by Lab	Lot Number	Date of Completion		
								sorting	mounting	identification

Serial Code Example: B0754001(1)
B = Benthos (F = Fish; P = Periphyton)**#** 0754 = project number **#** 001 = sample number **#** (1) = lot number (e.g., winter 1996 =1; summer 1996 = 2)

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated broader than sampling reach	**6. Channel Alteration**	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
	SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
	9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
	SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
	10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
	SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score _____

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (FRONT)

page _____ of _____

STREAM NAME	LOCATION
STATION #_____ RIVERMILE_____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
COLLECTED BY DATE_____	LOT #
TAXONOMIST DATE_____	SUBSAMPLE TARGET ❑ 100 ❑ 200 ❑ 300 ❑ Other ____

Enter Family and/or Genus and Species name on blank line.

Organisms		No.	LS	TI	TCR	Organisms		No.	LS	TI	TCR
Oligochaeta						Megaloptera					
Hirudinea						Coleoptera					
Isopoda											
Amphipoda						Diptera					
Decapoda											
Ephemeroptera											
						Gastropoda					
						Pelecypoda					
Plecoptera											
						Other					
Trichoptera											
Hemiptera											

Taxonomic certainty rating (TCR) 1-5:1=most certain, 5=least certain. If rating is 3-5, give reason (e.g., missing gills). LS= life stage: I = immature; P = pupa; A = adult TI = Taxonomists initials

Total No. Organisms _____ **Total No. Taxa _____**

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (BACK)

SUBSAMPLING/SORTING INFORMATION

Sorter _____

Date _____

Number of grids picked: _____

Time expenditure _____ No. of organisms _____

Indicate the presence of large or obviously abundant organisms:

QC: ❑ YES ❑ NO **QC Checker** _____

$$\frac{\text{\# organisms originally sorted}}{\square} \div \left(\frac{\text{\# organisms recovered by checker}}{\square} + \frac{\text{\# organisms originally sorted}}{\square} \right) = \text{\% sorting efficiency } \square$$

≥90%, sample passes _____

<90%, sample fails, action taken _____

_____

TAXONOMY

ID _____

Date _____

Explain TCR ratings of 3-5:

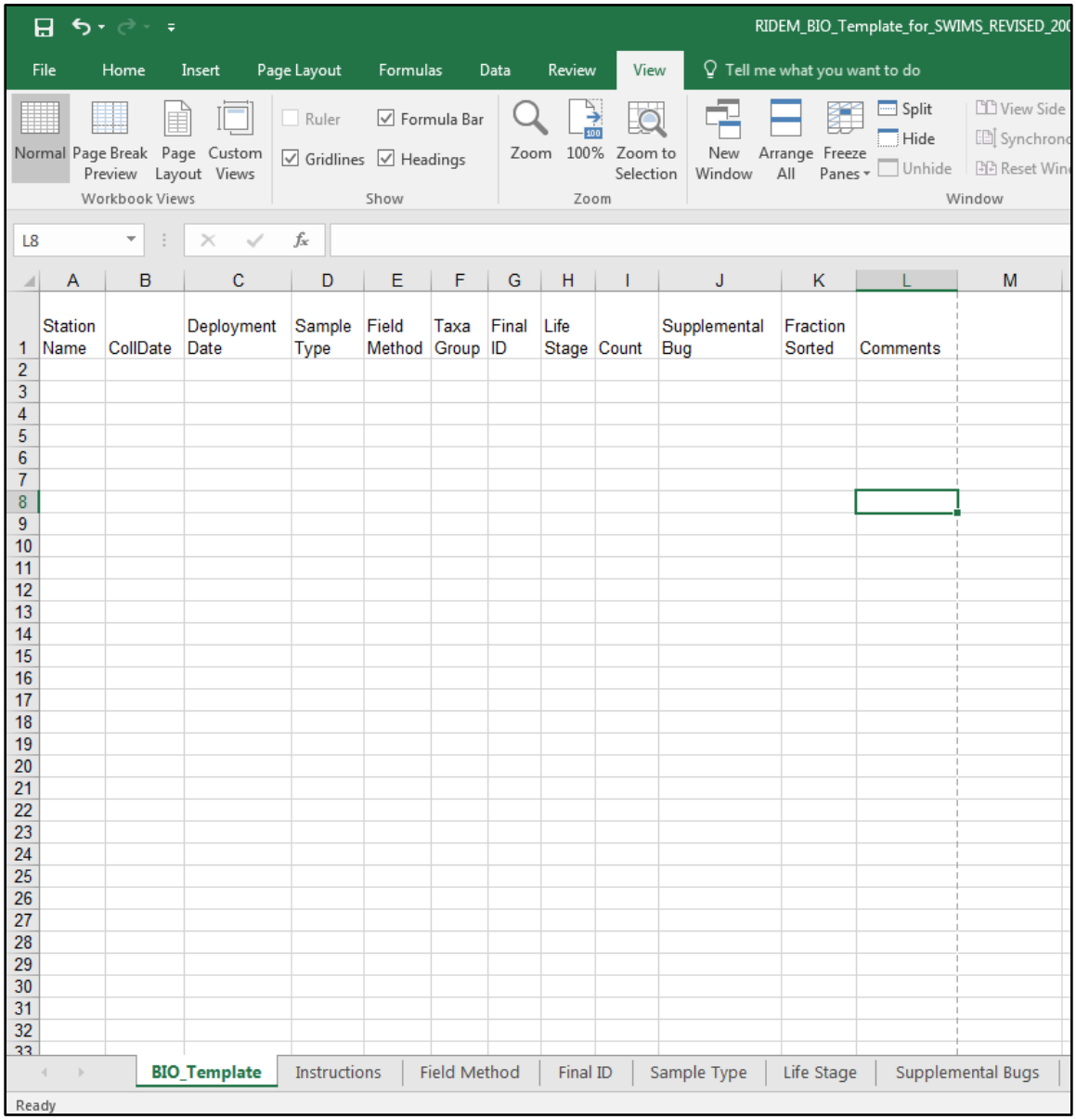
Other Comments (e.g. condition of specimens):

QC: ❑ YES ❑ NO **QC Checker** _____

Organism recognition ❑ pass ❑ fail

Verification complete ❑ YES ❑ NO

Microsoft Excel Template to Import Benthic Data into BioQual (instructions are on 2nd tab)



filepath J:\COMMON\KatieD\Biomonitoring\database\TT_Import_Benthic_YEAR revise 2009.xls

Microsoft Excel Template to Import Habitat Data in Bioqual (with instructions in box)

ID	Site	CollDate	ProjID	HabitatMethod	ActivityType	HabValue	HabParam	comment
			20	RBP-2-2	Field Msr/Obs			

instructions for filling out columns	
ID	autofill starting with 1
Site	- should be UniqueStation from "site" tab
CollDate	MM-DD-YEAR
ProjID	always 20
HabitatMethod	always "RBP-2-2"
ActivityType	Always "Field Msr/Obs"
HabValue	number (usually 0-20 except for flow)
HabParam	use terms from "HabParamName" tab
comment	add any comments needed

Path J:\COMMON\KatieD\Biomonitoring\database file: TT_Import_Hab_Template.xls