QUALITY ASSURANCE PROGRAM PLAN

Surface Water Monitoring & Assessment

Massachusetts Department of Environmental Protection
Division of Watershed Management-Watershed Planning Program
2015-2019

Massachusetts Department of Environmental Protection
Bureau of Water Resources
Division of Watershed Management - Watershed Planning Program

CN # 460.0, rev. 1.1
June, 2015

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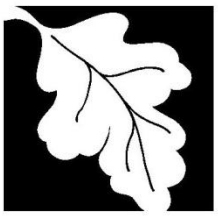

COMMONWEALTH OF MASSACHUSETTS
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QUALITY ASSURANCE PROGRAM PLAN
Surface Water Monitoring & Assessment
2015-2019

DWM Control Number: 460.0, rev. 1.1
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Foreword:

This Quality Assurance Program Plan (QAPP) pertains to surface water data collection by the Massachusetts Department of Environmental Protection (MassDEP), Division of Watershed Management's (DWM) --- Watershed Planning Program (WPP). It addresses all chemical, physical and biological monitoring to be performed by DWM-WPP from 2015 through 2019 (with annual addendum updates). Appendices as part of this QAPP include stand-alone laboratory QA Plans, field and laboratory Standard Operating Procedures (SOPs), project-level QAPPs, Sampling and Analysis Plans (SAPs) and other supporting documentation. These are included on a companion QAPP CD.

For additional information that is not contained in this QAPP, see other applicable and current DEP policies, procedures and plans.

DWM-WPP's programmatic QAPP is generally consistent with the intent of EPA's Quality Policies (http://www.epa.gov/irmpoli8/policies/21060.pdf) and Quality Procedures (http://www.epa.gov/irmpoli8/policies/2106p01.pdf).

EPA guidance and requirement documents used to guide development of this QAPP include:

- EPA Guidance on Systematic Planning using the Data Quality Objectives Process (QA/G-4; EPA/240/B-06/001, February 2006)
- EPA Guidance for Quality Assurance Project Plans (QA/G-5; EPA/240/R-02/009, December 2002)
- EPA Guidance on Choosing a Sampling Design for Environmental Data Collection (QA/G-5S, EPA/240/R-02/005; December, 2002)
- EPA Guidance on Quality Assurance Project Plans for Modeling (QA/G-5M, EPA/240/R-02/007; December, 2002)
- EPA Guidance for Standard Operating Procedures (QA/G-6, EPA/600/B-07/001; April 2007)
- EPA Guidance on Environmental Data Verification and Data Validation (QA/G-8, EPA/240/R-02/004; November, 2002 and reissued January, 2008)
- EPA QAPP Guidance for Projects Using Only Existing (Secondary) Data, Rev. #2, 10/13/09, EPA-Region 1
- Quality Assurance Project Plans (QA/R-5; EPA/240/B-01/003, March 2001 and reissued May, 2006)

Document Availability:

The 2015-2019 QAPP (main report without appendices) is available electronically at DEP's web site: http://www.mass.gov/eea/agencies/massdep/water/watersheds/environmental-monitoring-quality-management-program.html

A CD of the entire QAPP (including appendices) is available upon request to: Richard Chase at PH: 508-767-2859, or @ richard.f.chase@state.ma.us; or by mail at MassDEP-Div. of Watershed Management, 8 New Bond St., Worcester, MA. 01606.

In addition, copies of the QAPP CD have been submitted to the State Library at the State House in Boston.

This information can be made available in alternate formats upon request by contacting the American Disabilities Act (ADA) Coordinator at 617-292-5751.

Acknowledgments:

Many thanks to the following DEP staff persons who contributed information and/or insights toward completion of this multi-year program QAPP and its implementation. DWM-WPP: Kimberly Groff, Arthur Johnson, Christine Duerring, Jane Ryder, Laurie Kennedy, Joan Beskenis, Jeff Smith, Mark Mattson, Bob Nuzzo, Bob Maietta, Pete Mitchell, Dan Davis, James Meek, Matt Reardon, Kari Winfield, Tom Dallaire, Elaine Hartman, Therese Beaudoin, Jenny Sheppard, Gerry Szal and Bill Dunn. WES Lab: Jean Tang, Ron Stoner, Tess Burdin, Nina Duston, Carol Batdorf, Peter Piro, Valerie Casella, Michael Bebirian, Ann Marie Allen and Oscar Pancorbo.

USEPA-Region 1 provided financial support and technical assistance. EPA staff included Mary Jo Feuerbach, Katrina Kipp, John Smaldone, Diane Switzer, Ernest Waterman, Dan Boudreau, Dave McDonald, Michael Dowling, Andrea Traviglia and Tom Faber.

Credits: Cover photo of field reconnaissance at the East Brookfield River, Chicopee watershed, 2013 taken by James Meek. Individual watershed maps were created by Jane Ryder (MassDEP).

Disclaimers:

References to trade names, commercial products and manufacturers in this QAPP does not constitute endorsement. Web links are provided for convenience and may not function if the url address has changed.

TABLE OF CONTENTS

Figures *(Note: The watershed maps shown in this document comprise all the Commonwealth's watersheds and are intended to provide general information on location within Massachusetts, proximity to adjoining states, relative basin size and the cities/towns lying within each watershed (MassGIS))*

Tables

List of Acronyms:

ACOE.....	US Army Corps of Engineers
AED.....	Automated Electronic Defibrillation
ANSI.....	American National Standards Institute
AVS.....	Acid Volatile Sulfide

BMP.....	Best Management Practice
BOD.....	Biochemical Oxygen Demand
BPJ.....	Best Professional Judgment
BRP.....	Bureau of Resource Protection
BST	Bacteria Source Tracking
CAF.....	Corrective Action Form
CFS.....	Cubic Feet Per Second
COD.....	Chemical Oxygen Demand
CMR.....	Code of Massachusetts Regulations
CN	Control Number (documents)
CPR.....	Cardiopulmonary Resuscitation
CWA.....	Clean Water Act
CWF.....	Cold Water Fishery
DCR.....	Massachusetts Department of Conservation and Recreation
DMF.....	Division of Marine Fisheries
DMR	Discharge Monitoring Report (NPDES)
DO.....	Dissolved Oxygen
DFG.....	Department of Fish and Game
DQO	Data Quality Objective
DWM.....	Division of Watershed Management
DWP.....	Drinking Water Program
EDC.....	Endocrine Disrupting Compounds
EEA.....	Executive Office of Energy and Environmental Affairs
EHSS.....	Evidence of Human Sewage Source
EPA.....	United States Environmental Protection Agency
EPT.....	Ephemeroptera, Plecoptera, Trichoptera
FPS..... .	Feet Per Second
FWA	Fluorescent Whitening Agents
GPS.....	Global Positioning System
ILW.....	Integrated List of Waters
ISO	International Organization for Standardization
MassDEP.....	Massachusetts Dept. of Environmental Protection
MassGIS.....	Massachusetts Geographic Information System
MDFW.....	Massachusetts Division of Fisheries and Wildlife
MDPH.....	Massachusetts Department of Public Health
MDL.....	Method Detection Limit
MPN.....	Most Probable Number
MRL.....	Minimum Reporting Limit
MWWP.....	Massachusetts Waterwatch Partnership
NERL	New England Regional Laboratory (EPA)
NPDES.....	National Pollutant Discharge Elimination System
PAH.....	Polycyclic Aromatic Hydrocarbon
PALIS.....	Pond and Lake Information System
PCB.....	Polychlorinated Biphenyl
PFD	Personal Flotation Device
POTW.....	Publicly Owned Treatment Works
PPCP.....	Pharmaceuticals and Personal Care Products

QAP	Quality Assurance Plan (laboratory)
QAPP.....	Quality Assurance Project Plan
QA/QC.....	Quality Assurance/ Quality Control
QMP	Quality Management Plan
RBP.....	Rapid Bioassessment Protocol
SARIS.....	Stream and River Inventory System
SEM.....	Simultaneously Extracted Metals
SMART.....	Strategic Monitoring and Assessment of River basin Teams
SWQS.....	Surface Water Quality Standards
TALUs	Tiered Aquatic Life Uses
TMDL.....	Total Maximum Daily Loads
TNTC.....	Too Numerous To Count
TOXTD.....	MassDEP DWM Toxicity Testing Database
TRC.....	Total Residual Chlorine
TSS.....	Total Suspended Solids
USGS.....	United States Geological Survey
WAAS.....	Wide Area Augmentation System
WBID.....	Waterbody Identification Code
WBS.....	Waterbody System Database
WES.....	Wall Experiment Station Laboratory
WPP	Watershed Planning Program
WWF.....	Warm Water Fishery
WWTP.....	Waste Water Treatment Plant

List of Units:

cfs.....	cubic feet per second
cfu.....	colony forming unit
mg/Kg	milligram per kilogram
mg/L.....	milligram per liter
mg/m^3	milligram per cubic meter
mi^2	square mile
mL.....	milliliter
µg/kg.....	microgram per kilogram
µg/L.....	microgram per liter
µS/cm.....	Microsiemens per centimeter
ng.....	nanogram
ppb	parts per billion
ppm	parts per million
SU	standard units

A3. DISTRIBUTION LIST

The following groups have been made aware of this QAPP:

- MassDEP, DWM-WPP staff
- MassDEP QA Managers (DEP, BWR)
- MassDEP, Division of Municipal Services
- Wall Experiment Station laboratory (selected staff persons)
- USEPA-New England (relevant staff persons)

Electronic copies of this QAPP have been placed on the DWM-WPP network drive, the DEP enterprise drive and the DEP internet site @: http://www.mass.gov/eea/agencies/massdep/water/watersheds/environmental-monitoring-quality-management-program.html.

A4. PROGRAM DESCRIPTION & ORGANIZATION

DEP's emphasis on a "quality system" approach forms the basis for DWM's generation of usable data of documented quality. This approach is detailed in the EPA-approved DEP Quality Management Plan (QMP) for Federally Funded Programs (DEP 2014). The DEP QMP is consistent with EPA's Quality Policy and related guidance.

The QAPP process is one part of a programmatic focus on data quality. As set forth in the departmental QMP, program-level and project-specific QAPPs, SOPs and other plans and policies, DWM-WPP strives to set and maintain a high standard for all its work.

The Massachusetts Department of Environmental Protection (MassDEP), Bureau of Water Resources (BWR), Division of Watershed Management (DWM), Watershed Planning Program (WPP) is responsible for (or plays a significant role in) a variety of programs aimed at implementing the Clean Water Act (CWA). Among these are:

- Watershed-based Monitoring, Assessment and Implementation
- Development of Total Maximum Daily Load (TMDL) Implementation Plans
- Water Quality Standards
- Wastewater Discharge Permitting
- Stormwater NPDES Program
- Water Withdrawal Permitting Program
- Wetlands Monitoring and Assessment
- Non-Point Source (NPS) Pollution Program, and
- Technical assistance for the Division of Municipal Services Grants and Loans Program

A central component in implementing these programs is water quality monitoring to determine pollutant levels and loads, biotic metrics of ecological integrity, designated use impairments and attainments, and in general, the "state of the waters". Monitoring performed as part of these programs meet the ten basic elements of a State water resource

monitoring program outlined by EPA and the prerequisites of CWA Section 106(e)(1). These ten elements are generally as follows:

1. ***Monitoring Program Strategy:*** A comprehensive long-term monitoring program strategy that serves Massachusetts water quality management needs and addresses all State waters, including streams, rivers, lakes, reservoirs, estuaries, coastal areas, wetlands, and groundwater.

2. ***Monitoring Objectives:*** Monitoring objectives that are effective in generating data that serve management decision needs

3. ***Monitoring Design:*** An approach and rationale for selection of sample sites that best serve the monitoring objectives. The monitoring program ultimately will integrate several monitoring designs (e.g., fixed station, intensive and screening-level monitoring, rotating basin, etc.) to meet the full range of decision needs.

4. ***Core and Supplemental Water Quality Indicators:*** Core indicators are selected to represent each applicable designated use, plus supplemental indicators selected according to site-specific or project-specific decision criteria.

5. ***Quality Assurance:*** Quality management plans and quality assurance program/project plans are developed and implemented (maintained and peer reviewed in accordance with EPA policy) to ensure the scientific validity of monitoring and laboratory activities, and to ensure that State reporting requirements are met.

6. ***Data Management:*** An electronic data system is developed and utilized for water quality, fish tissue, toxicity, sediment chemistry, habitat, biological data, with timely data entry (following appropriate metadata and State/Federal geo-locational standards) and public access.

7. ***Data Analysis/Assessment:*** The State has a methodology for assessing attainment of water quality standards based on analysis of various types of data (chemical, physical, biological, land use) from various sources, for all waterbody types and all State waters. The methodology includes criteria for compiling, analyzing, and integrating all readily available and existing information (e.g., volunteer monitoring data, discharge monitoring reports).

8. ***Reporting:*** The State produces timely and complete water quality reports and lists called for under federal regulatory requirements.

9. ***Programmatic Evaluation:*** The State, in consultation with its EPA Region, conducts periodic reviews of each aspect of its monitoring program to determine how well the program serves its water quality decision needs for all State waters, including all waterbody types.

10. ***General Support and Infrastructure Planning:*** Current and future resource requirements (funding, staff, training, laboratory resources) for fully implementing the monitoring program strategy.

A more detailed description of the key elements of Massachusetts water quality monitoring programs and strategy can be found here: http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/stratgy9.pdf.

Figure 1 provides an overview of specific personnel involved in data collection and use at DWM-WPP. Table 1 provides more detailed descriptions of the roles and responsibilities for these DWM staff and state/ contract laboratory staff (as of February, 2015). Due to statewide monitoring responsibilities, DWM-WPP staff are based in Worcester, MA.

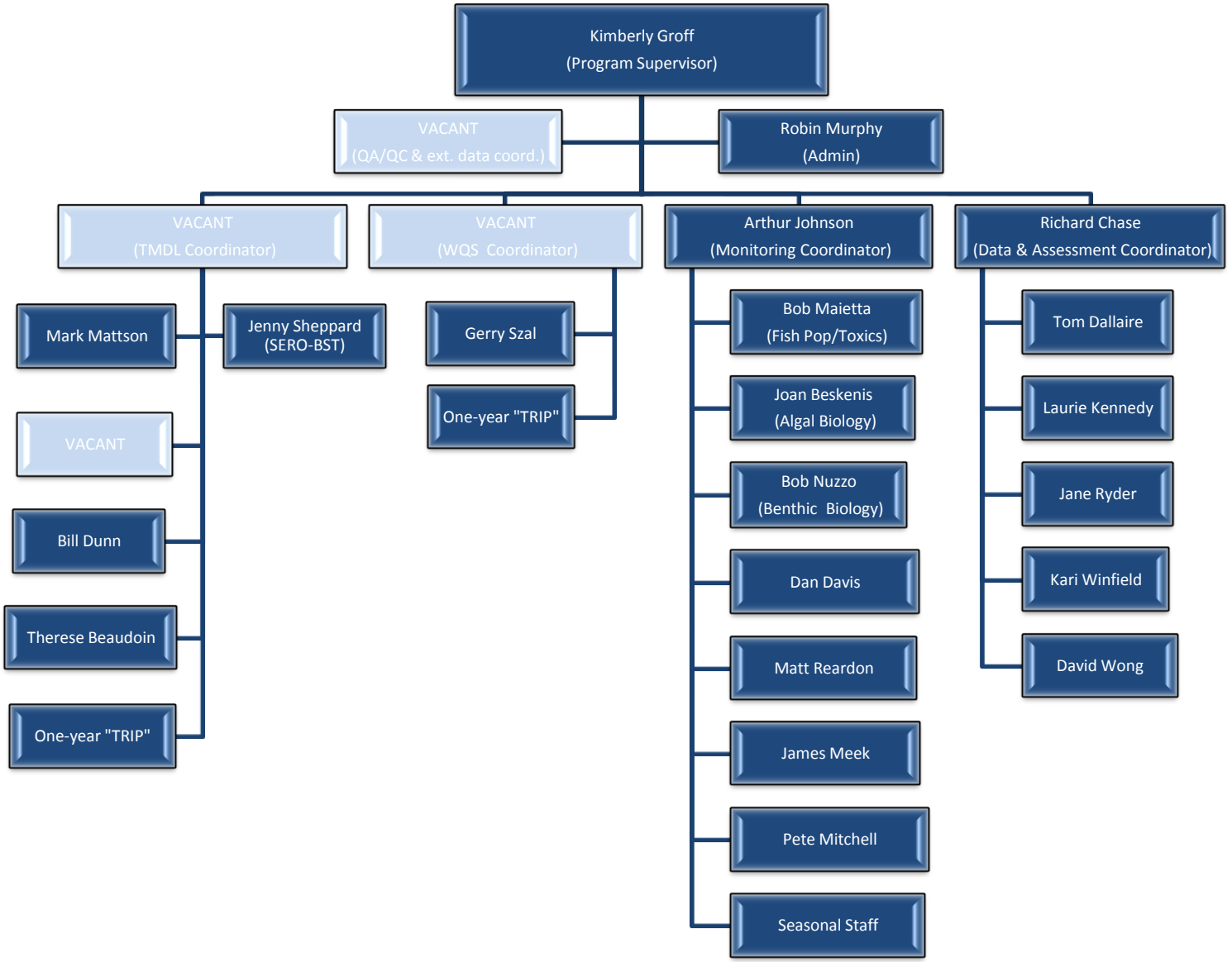
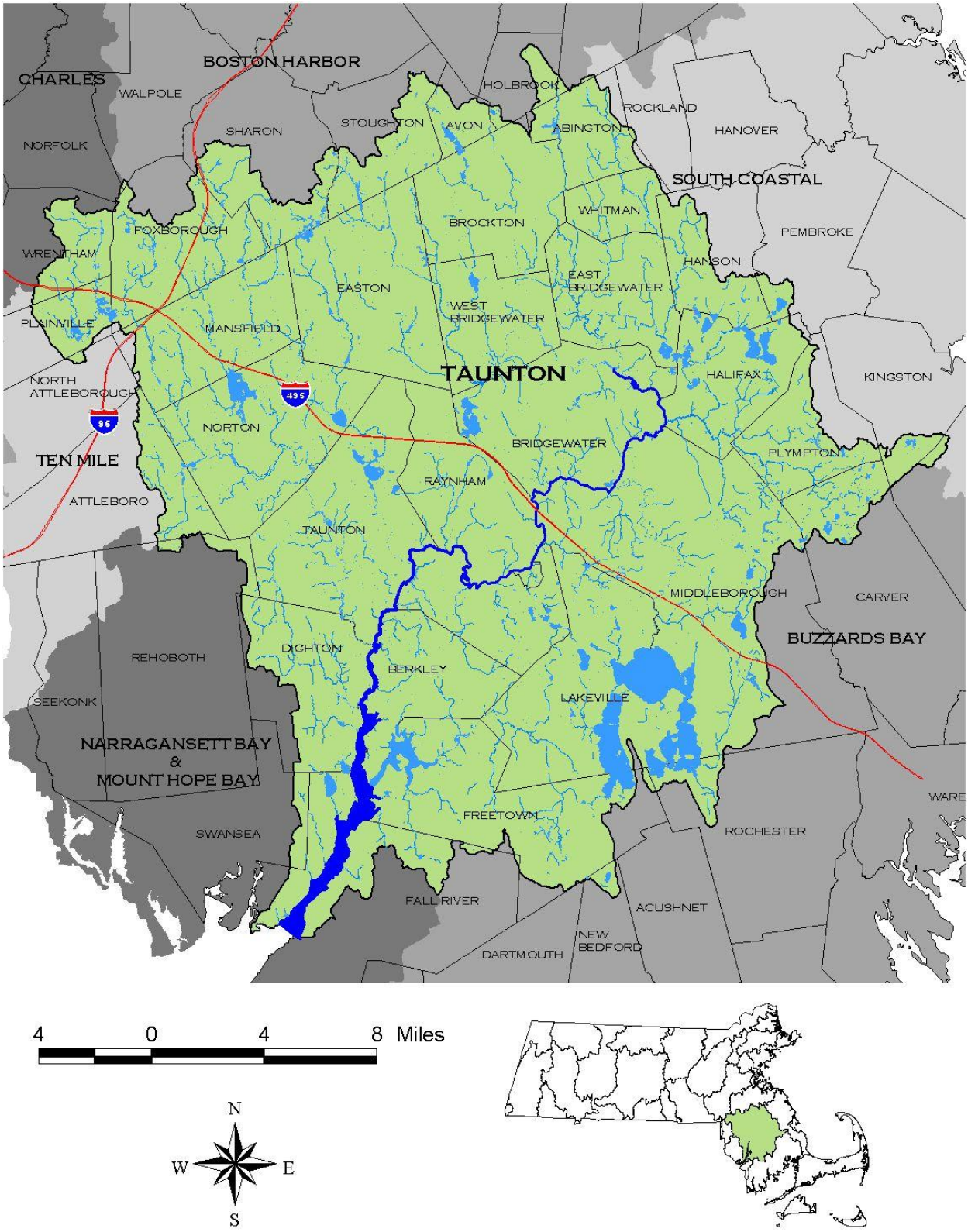


Figure 1: DWM-WPP Org Chart (2015)

Table 1. Program Roles and Responsibilities related to monitoring and data use

PERSONNEL, TITLE AND/OR PRIMARY ROLE	RESPONSIBILITIES
Kimberly Groff, Program Supervisor, Watershed Planning Program (WPP)	Overall management of administrative and technical work by the Watershed Planning group.
Arthur Johnson, Monitoring Coordinator	Planning and coordination of all environmental monitoring by WPP. This includes technical oversight, staff assignments and scheduling.
Richard Chase, Data & Assessment Coordinator	Completion of CWA Section 305(b) data collection and assessments, including technical oversight of data QA/QC and management.
VACANT, TMDL Coordinator	Development and implemention of Total Maximum Daily Loads (TMDLs) for State waters.
VACANT, Water Quality Standards Coordinator (Gerry Szal: active, interim role re: WQS)	Provides technical oversight in the development and evaluation of ambient water quality standards.
VACANT, QA/QC and external data coordinator	Overall quality assurance and quality control for environmental monitoring and data handling at WPP, including SOP development, training,, data review and validation, QAPP development, QC reporting, coordination with labs and EPA, calibration and maintenance of multi-probe instruments and other instrumentation as applicable. Also, coordination of external data submittals, and associated QA/QC review, databases and analysis.
Bob Nuzzo, Benthic Biologist	Sampling, analysis and generation of valid data for benthic macroinvertebrates in rivers and streams, in order to assess aquatic life use and describe site-specific ecology.
James Meek, Matt Reardon, Pete Mitchell and Dan Davis; Monitoring Survey Coordinators	Designing sampling and analysis plans, coordinating surveys, performing waterbody assessment and related tasks
Mark Mattson, Bill Dunn; Therese Beaudoin; TMDL coordinators	Developing sampling plans/designs and QAPPs for the TMDL-related sampling, as well as for any special TMDL surveys, training, modeling, project management, etc.
Bob Maietta, Fish Biologist	Coordination of fish tissue and population surveys, and associated tasks including sample preparation, and validation and management of biological data. DEP representative on interagency fish kill and fish toxics committees
Joan Beskenis, Benthic Biologist	Sampling, analysis and generation of valid data for periphyton and cyanobacteria in rivers, streams and lakes
Laurie Kennedy, David Wong, misc. assessment staff; waterbody assessments	Coordinating waterbody assessments for designated uses (e.g., primary and secondary contact, aesthetics, aquatic life use, and fish consumption)

PERSONNEL, TITLE AND/OR PRIMARY ROLE	RESPONSIBILITIES
Tom Dallaire and Kari Winfield, Database Management	Database management at WPP, including downloading and processing of raw multi-probe data, data entry, database development and database exports.
Jane Ryder, assessment support	Geo-referencing for WPP monitoring stations, fieldsheet quality control, database entry and proofing, ArcMap products, NPDES toxicity database coordinator
Survey crews (WPP staff, seasonal employees and regional office staff as needed)	Under the direction of the survey coordinators and survey crew leaders, water quality, flow and biological survey crews follow relevant WPP SOPs to collect data.
Nina Duston, Michael Bebirian, Jean Tang, Ron Stoner, Peter Piro, Carol Batdorf, Tess Burdin and others; Wall Experiment Station (WES) Lab, Lawrence, Ma.	Responsible for specific lab management (microbiology, inorganic, organic, LIMS, etc.), sample analyses, quality control and data production at WES.
Oscar Pancorbo, Director Wall Experiment Station (WES) Lab, Lawrence, Ma.	Lab direction, management, technical oversight, quality assurance and lab data production related to the performance of water quality analyses according to established EPA/other methods and WES laboratory Standard Operating Procedures (SOPs).
Misc. labs under contract	Overall lab management and technical oversight regarding the performance of water quality analyses and submittal of validated data to WPP in compliance with contractual arrangements.
DWM-regional Bacteria Source Tracking (BST)	Finding potentially pathogenic pollution sources, documenting findings and coordinating solutions. Work includes designing annual sampling and analysis plans, performing surveys, compiling data and preparing reports. Related tasks involve working with respective DEP regional offices on pollution issues.



Taunton Watershed

NOTE FOR SECTION A5:
SEE ALSO ANNUAL SAMPLING & ANALYSIS PLANS (SAPS) FOR ADDITIONAL, PROJECT-SPECIFIC OBJECTIVES. THE STAND-ALONE SAPS ARE DEVELOPED EACH YEAR, BASED ON CURRENT MONITORING NEEDS.

A5 PROGRAM GOALS AND OBJECTIVES

DWM_WPP's surface water monitoring efforts support DEP programmatic goals and functions to preserve, protect, assess and restore water quality. The main *programmatic objectives* related to DWM surface water quality monitoring are as follows:

- Collect chemical, physical and biological data to assess the degree to which designated uses (such as primary and secondary contact recreation, fish consumption, aquatic life use and aesthetics) are being met in waters of the Commonwealth (CWA 305(b) purposes), and to support the analysis and development of TMDL implementation plans to reduce pollutant loads that contribute to water quality violations and impairments (CWA 303(d) purposes)

- Screen fish in selected waterbodies for fish tissue contaminants (metals, PCBs and organochlorine pesticides) to provide for public health risk assessment

- Locate pollution sources and work to promote and facilitate timely correction

- Over the long term and to the extent feasible, collect water quality data to enable the determination of water quality trends in parameter concentrations and/or loads.

- Develop new or revised water quality standards, which may require short-term research monitoring directed towards the establishment or revision of water quality policies, guidelines or standards.

- Measure the effectiveness of water quality management projects or programs (such as the effectiveness of implementing a TMDL Best Management Practices (BMP) for the control of nonpoint pollution at a particular site, or of a comprehensive assessment of a state-wide policy or permitting program).

A5.1 Evolution of a Statewide Water Quality Network for Massachusetts

Historical DEP publications (USGS 2001; DWM 2004) recommended monitoring approaches for Massachusetts that meet multiple needs of local, state, and federal agencies, and that provide an effective framework for meeting the programmatic objectives of waterbody assessment, protection and restoration. The DEP/USGS report focused on a network involving five tiers as follows:

- ***Tier I monitoring*** involves a basin-based assessment of existing surface water quality conditions to reflect mandates of Section 305 (b) of the Clean Water Act (CWA). Tier I is statewide in scale, comprehensive, repeated at regular intervals, and can be probabilistic or deterministic in design. The goal of Tier I monitoring is to increase the number of stream miles and lake acres that are assessed and to reduce the historical bias towards problem areas.

- ***Tier II monitoring*** involves determining contaminant loads carried by major rivers at strategic locations (e.g. mouths of major rivers, state borders).

- ***Tier III monitoring*** is targeted monitoring to identify impaired waterbodies as required by Section 303(d) of the CWA, to determine causes and sources of impairments, to identify pollution sources or "hot spots" and to allow other site-specific evaluations.

- ***Tier IV monitoring*** is to develop Total Maximum Daily Loads (TMDLs) for specific waterbodies.

- ***Tier V monitoring*** is compliance-based monitoring to meet regulatory and permit limits.

Because resources are far too limited to currently implement such a network in its entirety, WPP monitoring consists of collecting data under Tiers I, III and IV of the statewide water quality network.

The 2004 DWM monitoring strategy report (DEP 2004) expanded on the network concept by proposing specific improvements and prioritized actions as part of a long-term strategy. This strategy places the highest priority on monitoring elements aimed at knowing the condition of Massachusetts' waters, finding pollution sources and developing strategies for restoring impaired waters.

As of April, 2015, DWM-WPP is updating the statewide, comprehensive monitoring strategy for Massachusetts.

A5.2 WPP's Current Monitoring Network

WPP's assessment of waterbody conditions in Massachusetts has historically been carried out using a 5-year cycle, in which targeted surface waters in each watershed were strategically sampled over a five-year period. The types of monitoring objectives that can be addressed using targeted monitoring include source identification, stressor identification, trend analysis, TMDL development, water quality criteria/biocriteria development and 303(d) list development. In selecting sample types, locations, parameters and survey frequencies, each targeted monitoring decision was based on a collective, working knowledge of the basin, review of relevant historical data and a prioritization of monitoring needs. Emphasis was placed on assessing water quality with respect to Massachusetts' water quality standards and criteria, and on the development of implementation plans to

reduce point and non-point pollutant loads. Figure 2 shows WPP's historical water quality, fish toxics and benthic sampling stations from 1994 through 2013.

An important component of WPPs targeted monitoring approach is sampling reference sites, with a specific focus on the biological communities and associated water quality at "least disturbed" sites. Monitoring from 2010-2015 has provided multiple years of data for each site, which will be used by WPP to study the "reference" conditions and intra and inter-year variations of physiochemical parameters and biological communities. These data help to assess aquatic life use at probabilistic monitoring sites.

WPP's primary focus from 2010-2015 was to develop a statewide assessment for a specific target population --- non-tidal perennial wadeable streams --- using probabilistic monitoring within each basin cohort. See Figure 3 for 2010-2015 basin cohorts. Probability-based data collection enables greater areal coverage and enhanced assessment of stream miles, since the results are inferred to be representative of unassessed waterbodies sharing similar characteristics. Site selection was random, based on standardized procedures outlined in WPP SOP CN 306.0. More detail on probabilistic sampling designs can be found here: http://www.epa.gov/nheerl/arm.

While it is a long-term goal, WPP does not currently have a statewide, fixed-station monitoring network, due to resource limitations.

Starting in 2016, WPP plans to conduct a multi-year, statewide probabilistic assessment of lakes and ponds, based on randomized sampling of a defined target population. As more information is developed for this approach, this QAPP will be amended to include monitoring rationale, sampling plans, and SOPs.

For more information on WPP's current monitoring rationale, see Section B1.

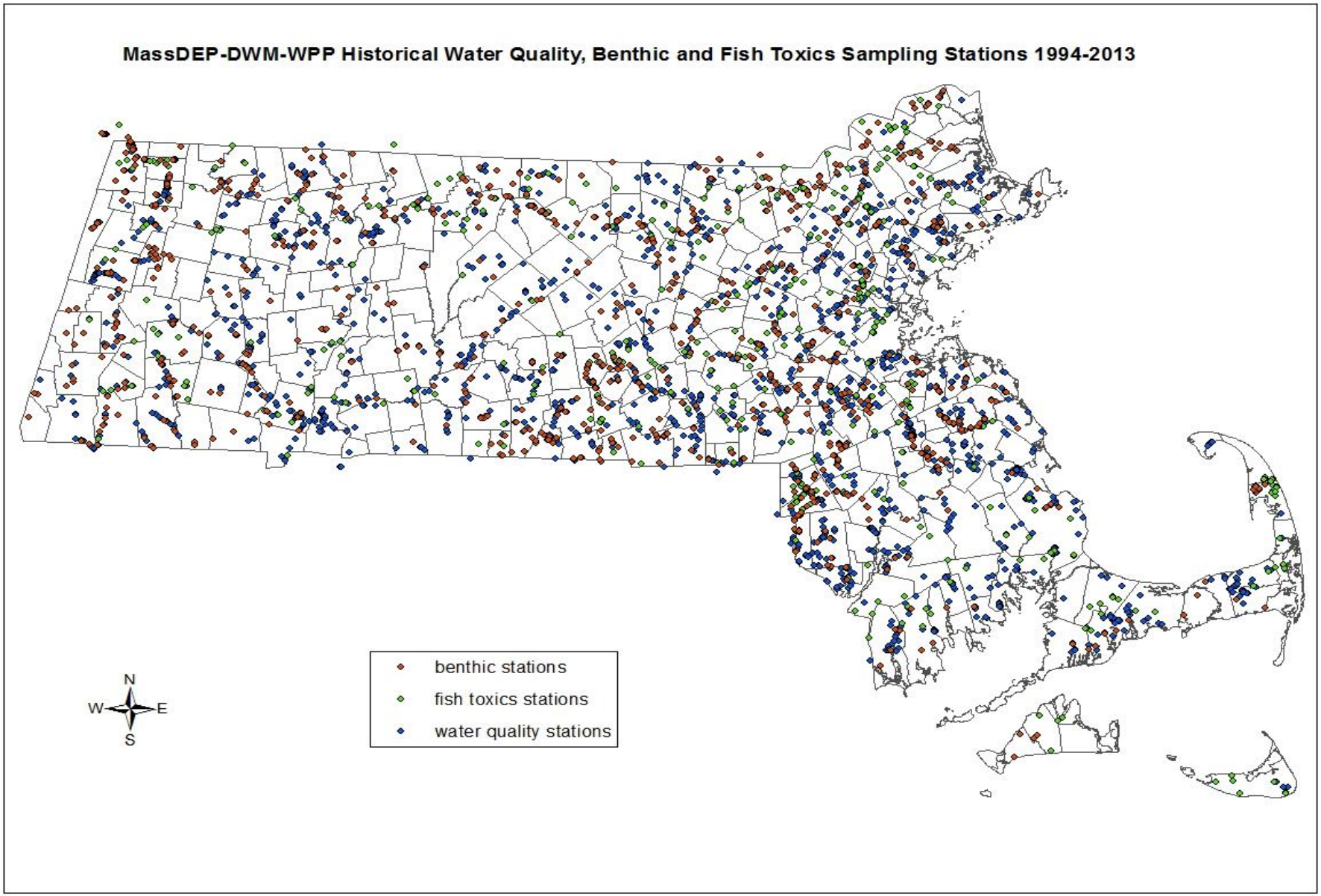


Figure 2: MassDEP-DWM-WPP Historical Water Quality, Benthic and Fish Toxics Sampling Stations (1994-2013)

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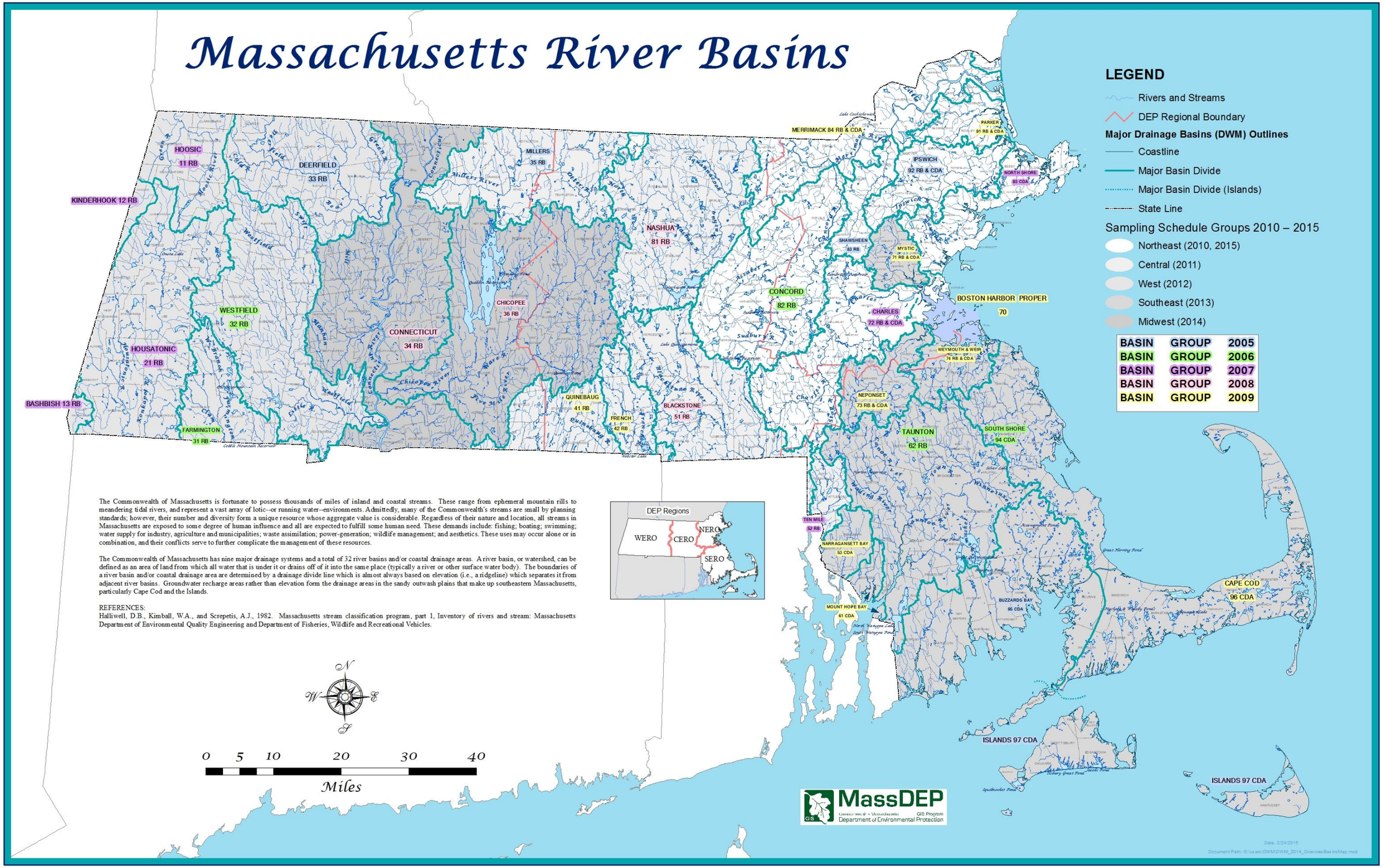
Massachusetts River Basins

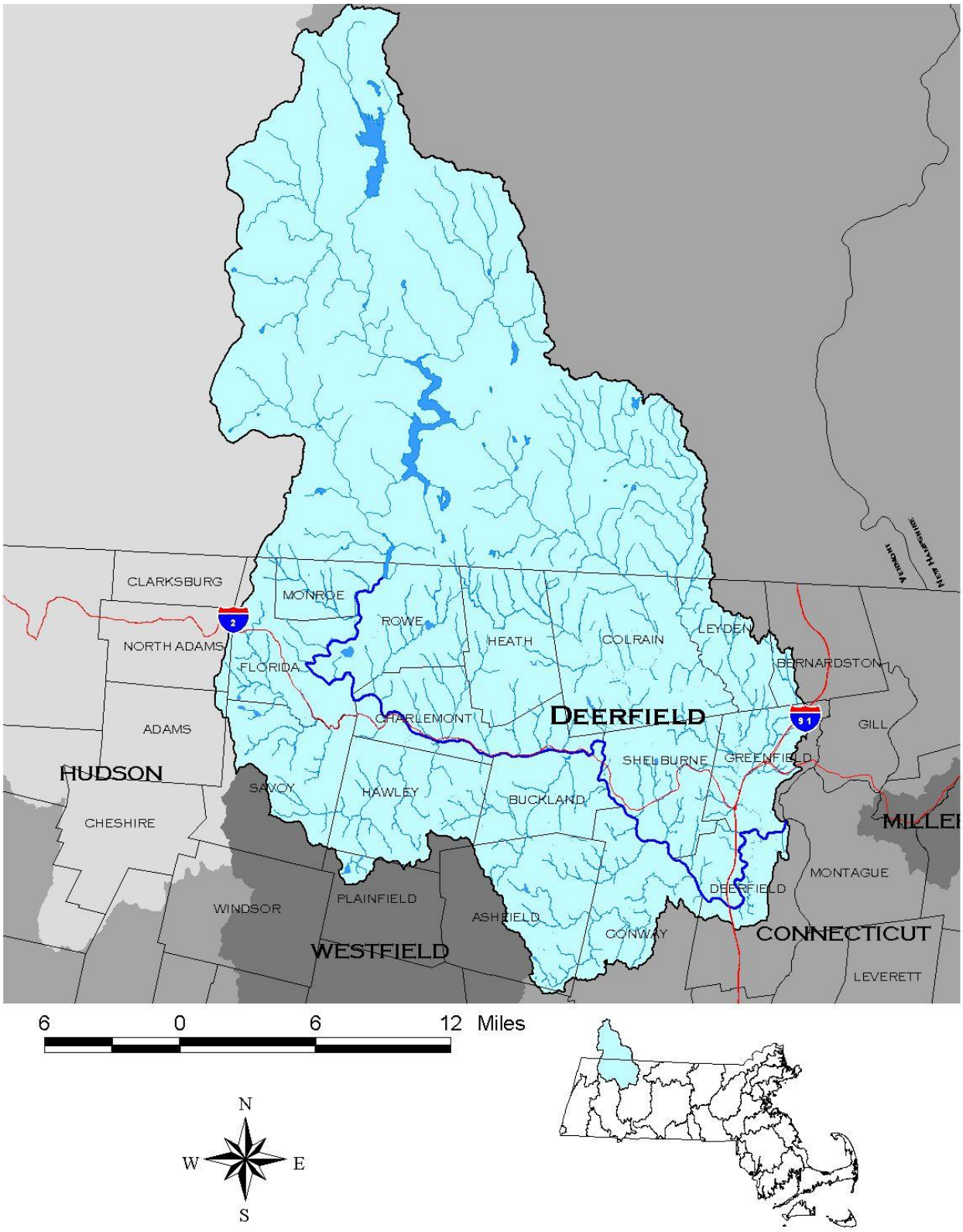


The Commonwealth of Massachusetts is fortunate to possess thousands of miles of inland and coastal streams. These range from ephemeral mountain rills to meandering tidal rivers, and represent a vast array of lotic--or running water--environments. Admittedly, many of the Commonwealth's streams are small by planning standards; however, their number and diversity form a unique resource whose aggregate value is considerable. Regardless of their nature and location, all streams in Massachusetts are exposed to some degree of human influence and all are expected to fulfill some human need. These demands include: fishing; boating; swimming; water supply for industry, agriculture and municipalities; waste assimilation; power-generation; wildlife management; and aesthetics. These uses may occur alone or in combination, and their conflicts serve to further complicate the management of these resources.

The Commonwealth of Massachusetts has nine major drainage systems and a total of 32 river basins and/or coastal drainage areas. A river basin, or watershed, can be defined as an area of land from which all water that is under it or drains off of it into the same place (typically a river or other surface water body). The boundaries of a river basin and/or coastal drainage area are determined by a drainage divide line which is almost always based on elevation (i.e., a ridgeline) which separates it from adjacent river basins. Groundwater recharge areas rather than elevation form the drainage areas in the sandy outwash plains that make up southeastern Massachusetts, particularly Cape Cod and the Islands.

REFERENCES:
Halliwell, D.B., Kimball, W.A., and Screpetis, A.J., 1982. Massachusetts stream classification program, part 1, Inventory of rivers and stream: Massachusetts Department of Environmental Quality Engineering and Department of Fisheries, Wildlife and Recreational Vehicles.

Figure 3: Massachusetts River Basins



Deerfield Watershed

A6 PROJECT SCHEDULING & COORDINATION

The schedule and logistics for WPP's annual monitoring seasons (typ. April though October) are dependent on several factors, including:

- available staff
- available resources (equipment, funds, laboratories, etc.)
- anticipated data needs (internal)
- requests for data (by external parties)
- availability of "external" data (gathered by external groups)
- related efforts by others (e.g., planned/on-going projects, monitoring, etc.)

In general, the typical schedule for planning and conducting WPP surveys and using data to generate reports and to make decisions is outlined in Figure 4.

Coordination between WPP staff helps to formulate sampling plans. Information from other groups, such as USEPA, USGS, Mass. DCR, Mass. DFG, other Mass DEP programs, consultants and contractors and volunteer monitoring associations, also assists in allocating monitoring resources. Each year, WPP typically requests and receives in-kind assistance from EPA-NE. This assistance can be for sampling, sample analysis, ambient toxicity testing, discharge compliance monitoring, or other EPA-NE capability.

WPP Survey Coordinators play the lead role in planning and conducting field surveys for water quality, benthic macroinvertebrates, fish populations, fish tissue toxic contaminants, benthic algae, flow (as needed), and other project-specific survey needs. Survey planning usually includes the following tasks:

- Development of project-specific Sampling & Analysis Plans
- Field-reconnaissance of watersheds to be sampled
- Discussions with project partners and interested parties
- Designing economical and efficient field survey routes to be taken by survey crews
- Documenting required survey routing, station information and logistics in crew-specific Survey Books
- Pre-logging samples into the WES State Laboratory Information Management System (LIMS)
- Setting up fieldsheets with preliminary information
- Scheduling field crew members and vehicles (with WPP's Monitoring Manager)
- Preparing crew-specific, pre-labeled sample containers, and
- Scheduling and assembling required field gear for field crews

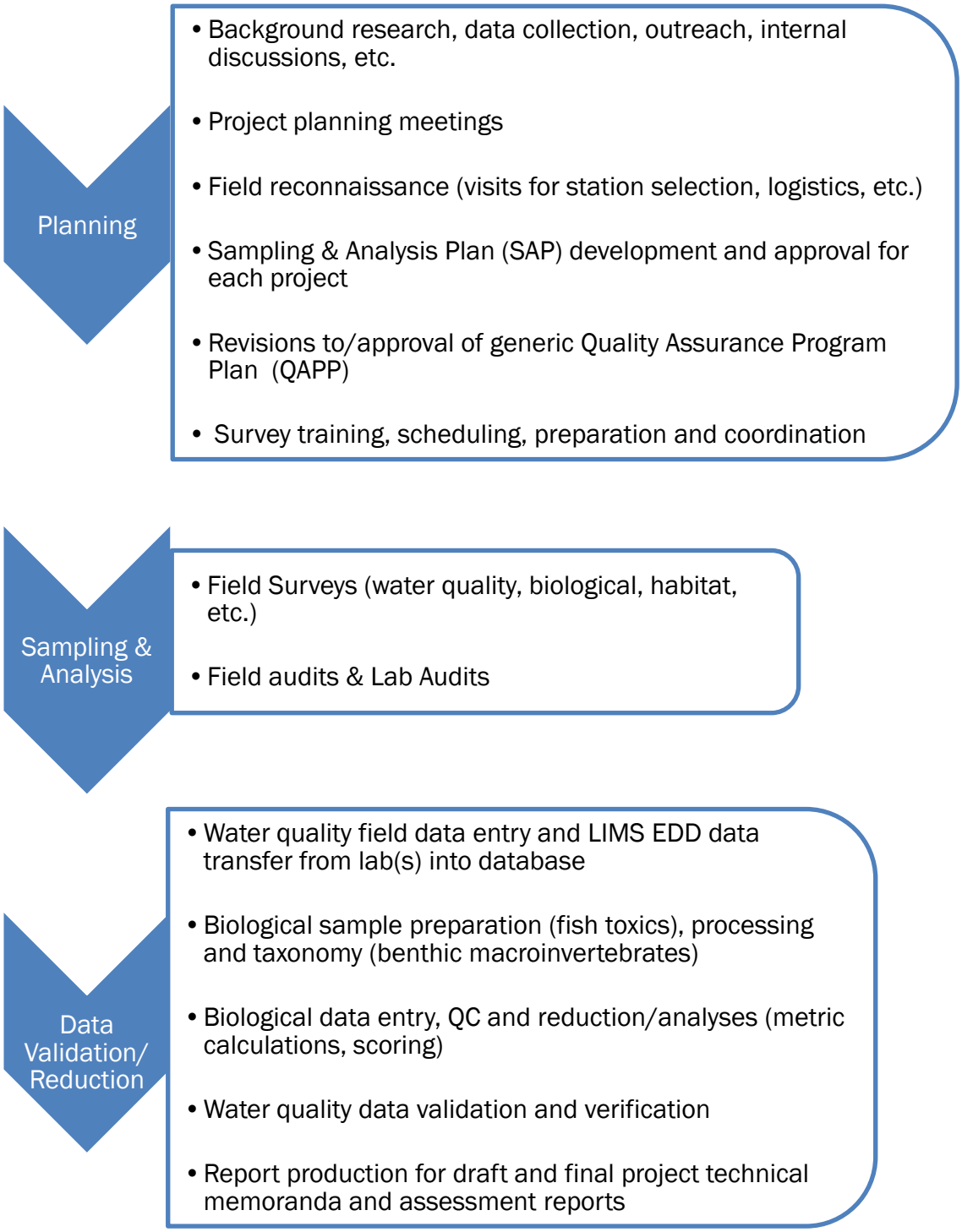
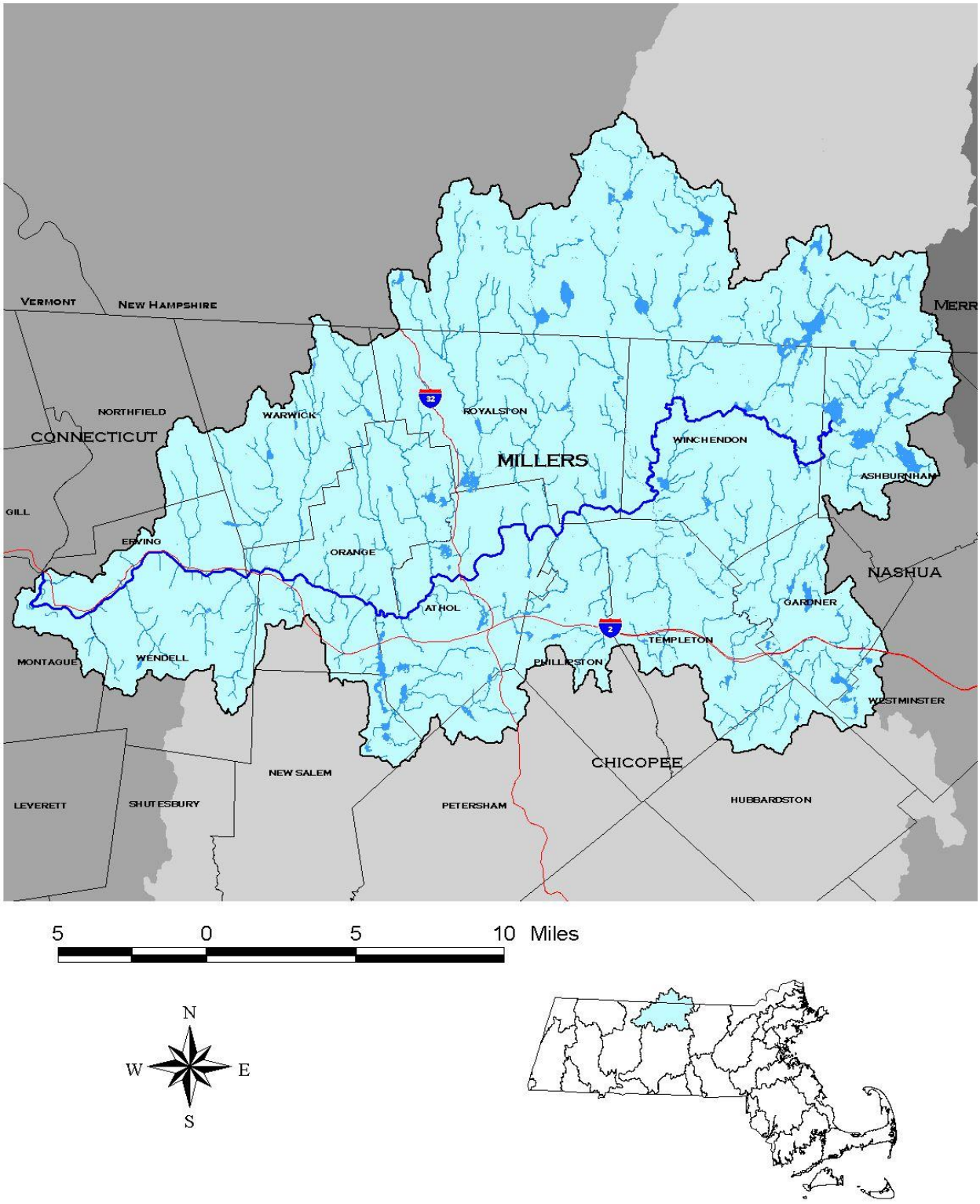


Figure 4: Major Planning Tasks for WPP Watershed Monitoring Projects



Millers Watershed

A7 DATA QUALITY OBJECTIVES AND CRITERIA

Quality assurance activities, as detailed in this and other WPP QAPPs, result in data of known and documented quality. Parameter-specific data quality objectives (DQOs) are outlined in Table 2.

Failure to meet these planned DQOs may subject project data to qualification or censoring during post-monitoring quality control review, but decisions to censor or qualify data are not based solely on meeting DQOs. As outlined in Section D of this QAPP, WPP uses all available information and best professional judgement in its evaluation of data quality.

Method detection and reporting limit information in Table 2 is based on the latest determinations by DEP's Division of Environmental Analysis, Wall Experiment Station (WES) in Lawrence, MA., EPA-NE's lab in No. Chelmsford, MA., misc. private contract labs and WPP's internal labs in Worcester, MA. In all cases, suitable method detection limits (MDLs) and reporting limits (RLs) are required for all analyses (e.g., RLs < applicable criteria).

Where applicable, "action levels" related to individual parameters in Table 2 can be found in Mass. most current surface water quality standards (314 CMR 4.00): http://www.mass.gov/dep/water/laws/regulati.htm#wqual.

The data quality concepts of precision, accuracy, representativeness, completeness and comparability (PARCC) are discussed below, along with other data quality issues, such as holding time, sensitivity and detection limits. While more commonly associated with quantitative chemical data, these concepts can also be applied to qualitative/quantitative physical and biological data, as applicable.

For data quality issues related to WPP's use of secondary data (generated by others), see Section B9 of this QAPP.

A7.1 Accuracy

Accuracy is determined by how close a reported result is to a true or expected value and the degree to which bias is avoided or minimized.

Laboratory accuracy will be determined by following the policy and procedures provided in the laboratory's Quality Assurance Plan and analyte-specific WPP SOPs. These generally employ estimates of percent recoveries for known internal standards, matrix spikes and performance evaluation samples, and evaluation of blank contamination.

Depending on the analyte, specific accuracy objectives can be concentration-based (e.g. +/- 0.010 mg/l @ < .05 mg/l and + /- 20% @ > .05 mg/l), or can be defined in terms of percent recovery percentages (e.g. 80-120 % recovery of matrix spike/PE sample).

Accuracy for multi-probe measurements is tested prior-to-use using standards that bracket the measurement range and after use checked against standards to determine if probes remained in calibration at the end of the measurement period. A NIST-certified thermometer is used to periodically check thermometer accuracy. Lower limit accuracy for

dissolved oxygen (DO) is checked using a zero DO standard (when and where low DOs are expected). The post-sampling checks of each unit ensure that the readings taken during the survey(s) were within QC acceptance limits for each multi-probe analyte.

Accuracy assessment for biological identifications usually entails confirmation of voucher specimens and/or random samples by expert peer(s).

A7.2 Precision

Precision is a measure of the degree of agreement among repeated measurements and is estimated through sampling and analysis of replicate (e.g., duplicate, triplicate) samples.

Laboratory precision of lab duplicates will be determined by following the policy and procedures provided in the laboratory's Quality Assurance Plan and individual WPP SOPs. This varies depending on the lab and analyte, but typically involves analysis of same-sample lab duplicates and matrix spike duplicates.

Overall precision objectives using relative percent difference (RPD) of field duplicate samples vary depending on the parameter and typically range from 10-25% RPD. WPP recognizes that precision estimates based on small numbers can result in relatively high RPDs (due to small number effect).

Precision of the multi-probe measurements can be determined by taking duplicate (via a second placement of the unit) readings at the same station location. This is sometimes performed for lake surveys. Multi-probe precision objectives generally range from 5-10 % RPD depending on the parameter.

In general, assessment of precision for biological samples typically involves comparison of identifications, counts and other measures by the same analyst and/or by separate analysts using same and duplicate samples. The type of QC sampling depends on the type of biological sample being collected.

A7.3 Representativeness

Representativeness refers to the extent to which measurements characterize the true environmental condition. Sampling locations and survey times are selected to ensure that the samples taken represent typical field conditions at the time and location of sampling, and not anomalies due to uncommon effects. In some cases, stations are chosen to evaluate site-specific impacts (i.e. "hot spots") which dictate the representativeness of distinct conditions. Other factors, such as seasonality and weather conditions, must be considerd by data users when evaluating what the resulting data are representative of (e.g., wet weather water quality).

A7.4 Completeness

Completeness refers to the amount of valid data collected using a measurement system. It is expressed as a percentage of the number of valid measurements that should have been

collected. For WPP monitoring, the completeness criterion is typically 80-100%. This assumes that, at most, one event out of five might be cancelled for some reason that could cause an incomplete data set with up to 20 % of the planned-on data not obtained.

A7.5 Comparability

Comparability refers to the extent to which the data from a study is comparable to other studies conducted in the past or from other areas. For WPP monitoring, the use of standardized sampling and analytical methods, units of reporting, and site selection procedures help to ensure comparability of data. Review of existing data and methods used to collect historical data have been reviewed and taken into account in the sampling design. Efforts to enhance data comparability are made where possible and appropriate.

A7.6 Detection Limits

In general, detection limits define the smallest amount of analyte that can be detected above signal noise and within certain confidence levels. Typically, Method Detection Limits (MDL) are calculated in the laboratory by analyzing a minimum of seven low-level standard solutions using a specific method. (Detection limits in the traditional sense do not apply to some measurements such as pH and temperature that have essentially continuous scales.) Multiplication factors are typically applied to MDL values by labs to express Reporting Limits (RL) which define a level above which there is greater confidence in reported values. Where low-level results are needed, WPP sometimes requests that labs, if possible, report results down to the MDL value with qualification as appropriate (rather than "<RDL").

A7.7 Holding Times

Most analytes have standard holding times (maximum allowed time from collection to analysis) that have been established to ensure analytical accuracy. Where established holding times are exceeded, violations are taken into account during the data validation process.

A7.8 Sensitivity

Sensitivity characterizes the ability of the method or instrument to discriminate between measurement responses. The specifications for sensitivity are unique to each analytical instrument and are typically defined in laboratory Quality Assurance Plans (QAP) and SOPs.

A7.9 Standard Protocols

The use of approved field and laboratory SOPs by WPP and its agents provides a high level of assurance that programmatic data quality objectives shall be met consistently. As noted above, use of standard methodologies also helps data comparability and accuracy.

A7.10 Performance Auditing

Subject to adequate time and resources, scheduled and unscheduled *field audits* are planned and executed by WPP's QA Analyst to evaluate implementation of field methods, consistency with this QAPP and compliance with WPP sampling SOPs. Ideally, field audits are planned for each WPP survey type (e.g., water quality, benthic macroinvertebrate, fish, etc.) and each survey crew member every monitoring season, but this does not happen in practice. Due to limited resources and multiple staff involved, WPP's QA Analyst annually prioritizes which field audits to do.

Proficiency testing of laboratory analytical accuracy and precision is usually performed for several analyte groups (e.g., nutrients, metals, chlorophyll a, bacteria). These are single- and/or double-blind *lab QC checks* using WPP-prepared solutions and purchased QC check samples. All audit results are compared to "true" values/results, evaluated against acceptance limit criteria and used to help validate the data. Results are also provided to lab analysts, survey coordinators and data users.

A7.11 Modeling Projects

The data quality objectives for any modeling data generated by WPP or its agents are addressed in WPP's most current version of its TMDL modeling QAPP (Appendix C). This QAPP will be updated in 2015/16.

Table 2. Data Quality Objectives for WPP Monitoring (primarily based on MassDEP- WES lab analyses, unless otherwise noted; *ITALICS= INACTIVE*)

ANALYTE	ANALYTICAL METHOD(S)	UNITS	EXPECTED RANGE (APPROX.)	METHOD DETECTION LIMIT, MDL	MINIMUM REPORTING LIMIT (MRL)	ACCURACY (+/-)	OVERALL PRECISION (RPD OR OTHER)	RESOLUTION
WPP Multi-Probe Instruments (Hydrolab® Series 4a and 5; YSI 600XLM and 6920V2; Onset DO/T, Onset conductivity loggers, PME Mini-DOT loggers)								
Temperature	SM 2550	°C	0-30	NA	NA	0.15	+/- 0.1	0.01 °C
Depth	---	meters	0-10	NA	0.1	0.1 m	10%	0.01 m
pH	SM 4500-H^+	standard units	4-9	NA	NA	0.2	+/- 0.1	0.01
Dissolved Oxygen (Clark cell membrane)	SM 4500-O G	mg/L	0-14	NA	0.2	0.2	+/- 0.2	0.01 mg/L
Dissolved Oxygen (optic)	HACH 10360 ASTM D888-05	mg/L	0-14	NA	0.2	0.2	+/- 0.2	0.01 mg/L
% Oxygen Saturation	---	%	0.2-110	NA	NA	2 %	5% RPD	0.1 %
Specific Conductance	SM 2510	µS/cm	75-700 (fresh)	NA	NA	1% of range	5%	4 digits
Total Dissolved Solids (TDS) - calculated value	---	mg/l	50-5000 (fresh-brackish)	---	---	---	10%	0.1
Salinity	SM 2520B	PSU	0-35	NA	NA	0.2	+/- 0.1	0.01
Turbidity	▪ *ISO 7027* ▪ *USGS TWRI Book 9 Section 6.7*	*NTU*	*0.1-100*	*NA*	*NA*	*2 NTU*	*10%*	*0.1 NTU*
Chlorophyll fluorescence (in-vivo screening)	▪ Turner SCUFA fluorometry ▪ YSI fluorometry probes (IVF)	ug/l (RFU)	0-100	0.2	1.0	---	30%	0.1 ug/l (0.1% RFU)
Phycocyanin (in-vivo screening)	YSI fluorometry (IVF, BGA-PC) Turner Cyclops 7	cells/ml (RFU) ug/l	0-200,000 0-500	220 (est.) 1 (est.)	500 2	---	30%	1 cell/ml (0.1% RFU) 0.1

ANALYTE	ANALYTICAL METHOD(S)	UNITS	EXPECTED RANGE (APPROX.)	METHOD DETECTION LIMIT, MDL	MINIMUM REPORTING LIMIT (MRL)	ACCURACY (+/-)	OVERALL PRECISION (RPD OR OTHER)	RESOLUTION
Continuous D.O., temperature (and time) using Onset ProV2 and DO/T loggers	MassDEP protocol	mg/l °C	0-15 0-30	NA	NA	+/- 0.5° +/- 0.5° ± 1 minute per month (vs. NIST clock)	< 0.5 difference when compared to side-by-side field readings using just-calibrated (D.O.) and NIST-traceable probes (T)	0.1°
Temperature (long-term) using fiber-optic distributed temperature sensing (FO-DTS)	*USGS and UNH (general guidance)*	*°C*	*Reserved*					
Physico-chemical								
Flow (Q)	USGS TWRI Book 3	cfs	variable	NA	NA	15% (estimated)	15% (same crew)	NA
Water velocity (V)	▪ USGS TWRI Book 3, Book 8 Chapter B2 ▪ Indiv. meter protocols	fps	0-5	NA	NA	2% (estimated)	+/- 0.2 fps	0.001
Staff gage readings	USGS TWRI Book 3	feet	---	NA	NA	0.01	+/- 0.02	0.02
Time-of-Travel	*USGS TWRI Book 3*	*Reserved* *(ug/l (dye); hrs since injection; miles travelled; flow)*						
Total Phosphorus (TP) *Total Dissolved P (TDP)* Dissolved Reactive P (DRP) Total Reactive P (TRP)	SM 4500 P-E	mg/L	0-0.15	---	0.002	80-120% recovery of QC standard and lab-fortified matrix <50 ppb, 5 ppb >50 ppb, 10%	<50 ppb, 5 ppb >50 ppb, 10% RPD	NA

ANALYTE	ANALYTICAL METHOD(S)	UNITS	EXPECTED RANGE (APPROX.)	METHOD DETECTION LIMIT, MDL	MINIMUM REPORTING LIMIT (MRL)	ACCURACY (+/-)	OVERALL PRECISION (RPD OR OTHER)	RESOLUTION
Total Phosphorus (TP), Total Dissolved P (TDP)	USGS I-4650-03	mg/L	0-0.15	---	0.002	80-120% recovery of QC standard and lab-fortified matrix <50 ppb, 5 ppb >50 ppb, 10%	<50 ppb, 5 ppb >50 ppb, 10% RPD	NA
Total Nitrogen (TN) Total Dissolved N (TDN)	USGS I-4650-03	mg/l	0-1	---	0.050	80-120 % recovery for QC std. and lab fortified matrix	0.02 or 25% RPD	NA
Ammonia Nitrogen (NH3-N)	EPA 350.1	mg/L	0-0.5	---	0.02	80-120% recovery for QC standard and lab fortified matrix	0.01 or 20% RPD	NA
Nitrate-Nitrite-N (NO3-NO2-N)	EPA 353.1	mg/l	0-1	---	0.02	80-120 % recovery for QC std. and lab fortified matrix	0.02 or 25% RPD	NA
Total Kjeldahl Nitrogen (TKN)	*EPA 351.2*	*mg/l*	*0-1*	---	*0.10*	*80-120 % recovery for QC std. and lab fortified matrix*	*0.02 or 25% RPD*	*NA*
Total Suspended Solids (TSS)	SM 2540D	mg/l	0-100	---	1.0	80-120 % recovery for QC std. and/or lab fortified blank	1.5 or 40% RPD	NA
Turbidity	SM 2130B	NTU	1-100	---	0.3	1% of full scale (0-10) 5% full scale (0-100)	20%	0.01 NTU
Turbidity (DWM lab)	SM 2130B	NTU	1-100	0.2 (est.)	0.5 (est.)	1% of full scale (0-10) 5% full scale (0-100)	20%	0.01 NTU
Transparency tube	---	*cm*	*Reserved*					
Salinity	*Refractometer*	*PSU*	*Reserved*					
Alkalinity	SM 2320B	mg/l as CaCO3	Neg.-200	---	2.0	80-120 % recovery for QC std. and lab fortified matrix <20, 2 mg/l >20, 10 %	2.0 or 20% RPD	NA

ANALYTE	ANALYTICAL METHOD(S)	UNITS	EXPECTED RANGE (APPROX.)	METHOD DETECTION LIMIT, MDL	MINIMUM REPORTING LIMIT (MRL)	ACCURACY (+/-)	OVERALL PRECISION (RPD OR OTHER)	RESOLUTION
Hardness	SM 2340B (and EPA 200.7)	mg/l as CaCO3	0-100	---	2.0	80-120 % recovery for QC std. and lab fortified matrix for Ca and Mg (200.7 / 200.8 methods)	20 %	NA
Hardness (WPP lab)	*Chemetrics K-4520 (SM 2340C)*	*mg/l as CaCO3*	*20-200*	*20*	*20*	*80-120 % recovery for QC std. and lab fortified matrix*	*5 or 20% RPD*	*1 (<30)* *5 (30-100)* *10 (100-200)*
Chloride	SM-4500-Cl-E	mg/l	0-100	---	1.0	90-110 % recovery for QC std. and lab fortified matrix	20 %	NA
Biochemical Oxygen Demand (BOD-5 and 21 day "ultimate" BOD)	*SM 5210B*	*mg/l*	*Reserved*					
Chemical Oxygen Demand (COD)	*EPA 5220B*	*mg/l*	*Reserved*					
Total Oxygen Demand (TOD)	*ASTM D6238-98*	*mg/l*	*Reserved*					
Total Organic Carbon (TOC) and Dissolved Organic Carbon (DOC) (via contract)	*SM 5310B*	*mg/l*	*0-10*	*1.0*	*1.0*	*80-120 % recovery for QC std., lab fortified blank and matrix*	*20% RPD*	*NA*
Sulfate	*EPA 300.0*	*mg/l*	*0-10*	*0.07*	*0.15 est.*	*80-120 % recovery for QC std., lab fortified blank and matrix*	*20% RPD*	*NA*
UVA254	*SM 5910B*	*cm^{-1}*	*0-0.5*	*0.1 (est.)*	*0.1 (est.)*	*Compare to expected absorbances of KHP QC stds. To verify RSD<20%*	*20% RPD*	*NA*
Sodium, Potassium, Silica	*EPA 200.7*	*mg/l*	*0-10*	*0.20 (Na)* *0.73 (K)* *0.03 (Si)*	*.50 (Na) est.* *2.0 (K) est.* *0.1 (Si) est.*	*Same as above*	*20% RPD*	*NA*

ANALYTE	ANALYTICAL METHOD(S)	UNITS	EXPECTED RANGE (APPROX.)	METHOD DETECTION LIMIT, MDL	MINIMUM REPORTING LIMIT (MRL)	ACCURACY (+/-)	OVERALL PRECISION (RPD OR OTHER)	RESOLUTION
Perchlorate	*EPA 314.0, 314.1, 314.2, 331.0*	*ug/l*	*0-5*	*0.2 (est.)*	*1.0 (est.)*	*80-120 % recovery for QC std. and lab fortified matrix*	*5 or 20% RPD*	*NA*
Color (true) (WPP Lab)	SM 2120C SM 2120B (visual)	CU	0-500	5	10	80-120% of color standard <5 CU for blanks	<50, 10 CU >50, 20% RPD	1 CU
Chlorophyll *a* (WPP lab)	EPA 445.0 modified	ug/l	0-100	0.1	0.1	75-125 % for QC std.	2.0 or 20% RPD	0.1
Microcystin-LR	Abraxis ELISA	ug/l	0-20	0.15	0.15	0.20 (est.)	20%	0.10
Microcystins (total) (WPP lab)	QualiTube kit (Envirologix; ELISA)	ug/l	0->3.0 (UQL for kit)	0.3	0.5	NA	NA	NA
Fluorescent Whitening Agents (FWA) [4] • OB1 • OB2 • FWA1 • FWA2 • FWA4	SPE-HPLC-FL (WES)	ug/l	---	0.071 0.037 0.0027 0.025 0.051	0.21 0.11 0.0081 0.075 0.15	40-140% recovery for LFM and LFB	30% RSD	baseline separation of indiv. analytes
Optical Brighteners (WPP)	DWM CN 58.0	P/A	---	---	---	N.A.	N.A.	P/A test
Detergents (WPP) (CHEMets kit K-9400)	EPA 425.1	mg/l linear ABS (eq. wgt. 325)	---	0.125	0.25	0.5 (est.)	30%	0.25 (0-3 mg/l range)
Ammonia-N test strips (screening)	HACH Aquacheck (DL65059)	mg/l	0-5	0.125 (est.)	0.25	0.5 (est.)	30%	0.25 (0-6 mg/l range)
Secchi disc (lakes)	MassDEP protocol	meters	0-5 m	NA	NA	NA	10 %	0.1 m
Lake Bathymetry	MassDEP protocol	meters	0-100 m	NA	NA	+/- 0.5 meter for indiv. datum	+/- 0.5 meter for indiv. datum	0.1 m
GPS	MassDEP protocol	meters	---	NA	NA	+/- 2 meters (WAAS-corrected)	+/- 2 meters	---

ANALYTE	ANALYTICAL METHOD(S)	UNITS	EXPECTED RANGE (APPROX.)	METHOD DETECTION LIMIT, MDL	MINIMUM REPORTING LIMIT (MRL)	ACCURACY (+/-)	OVERALL PRECISION (RPD OR OTHER)	RESOLUTION
Metals (dissolved in water):								
Aluminum	EPA 200.8	ug/l	0-100	---	40 (5.0)[7]	85-115 % recovery for QC std. and lab fortified blank 70-130% for LFM	20% RPD	NA
Antimony	EPA 200.8	ug/l	0-20	---	0.50 (0.50)	Same as above	20% RPD	NA
Arsenic	EPA 200.8	ug/l	0-20	---	1.5 (0.50)	Same as above	20% RPD	NA
Barium	EPA 200.8	ug/l	0-10	---	0.50 (0.20)	Same as above	20% RPD	NA
Beryllium	EPA 200.8	ug/l	0-5	---	0.60 (0.20)	Same as above	20% RPD	NA
Cadmium	EPA 200.8	ug/l	0-10	---	0.50 (0.10)	Same as above	20% RPD	NA
Chromium	EPA 200.8	ug/l	0-10	---	0.80 (0.50)	Same as above	20% RPD	NA
Cobalt	EPA 200.8	ug/l	0-10	---	0.50 (0.20)	Same as above	20% RPD	NA
Copper	EPA 200.8	ug/l	0-20	---	0.90 (0.20)	Same as above	20% RPD	NA
Iron	EPA 200.8	ug/l	0-10	---	0.50 (50)	Same as above	20% RPD	NA
Lead	EPA 200.8	ug/l	0-10	---	0.50 (0.20)	Same as above	20% RPD	NA
Manganese	EPA 200.8	ug/l	0-10	---	0.50 (0.20)	Same as above	20% RPD	NA
Mercury	EPA 245.1 EPA 7470A	ug/l	0-5	---	0.50	Same as above	20% RPD	NA
Molybdenum	EPA 200.8	ug/l	0-10	---	0.50 (0.50)	Same as above	20% RPD	NA
Nickel	EPA 200.8	ug/l	0-10	---	0.50 (0.20)	Same as above	20% RPD	NA
Selenium	EPA 200.8	ug/l	0-20	---	8.0 (1.0)	Same as above	20% RPD	NA
Silver	EPA 200.8	ug/l	0-10	---	0.50 (0.20)	Same as above	20% RPD	NA

ANALYTE	ANALYTICAL METHOD(S)	UNITS	EXPECTED RANGE (APPROX.)	METHOD DETECTION LIMIT, MDL	MINIMUM REPORTING LIMIT (MRL)	ACCURACY (+/-)	OVERALL PRECISION (RPD OR OTHER)	RESOLUTION
Thallium	EPA 200.8	ug/l	0-5	---	0.50 (0.50)	Same as above	20% RPD	NA
Vanadium	EPA 200.8	ug/l	0-5	---	0.50 (0.20)	Same as above	20% RPD	NA
Zinc	EPA 200.8	ug/l	0-50	---	0.60 (5.0)	Same as above	20% RPD	NA
Calcium	EPA 200.7	mg/l	0-50	---	0.60 (0.10)	Same as above	20% RPD	NA
Magnesium	EPA 200.7	mg/l	0-10	---	0.030 (0.10)	Same as above	20% RPD	NA
Organics								
Extractable petroleum Hydrocarbons (EPH)	*MA EPH*	*ug/l*	*Reserved (aliphatic:C9 - C18; C19 -C36) (aromatic: C11 - C22)*					
Pesticides (various)	*EPA 507 EPA 508 EPA 608 EPA 8081A & 3510*	*ug/l*	*Reserved*					
Polychlorinated Biphenyls (PCBs)	*EPA 608 EPA 8082 & 3510*	*ug/l*	*Reserved*					
Semi-volatile organics	*EPA 8270D/625*	*ug/l*	*Reserved*					
Volatile organics	*EPA 8260B/624*	*ug/l*	*Reserved*					
Emerging Contaminants (PPCPs, EDCs)	*EPA 525.2 (modified) EPA 1694 EPA 1698 USGS O-2080-08*	*ng/l*	*Reserved*					
Caffeine[4]	Modified EPA 525.2	ug/l	---	0.016	0.10	70-130% recovery for LFM and LFB	30% RSD	---
Microbiological								

ANALYTE	ANALYTICAL METHOD(S)	UNITS	EXPECTED RANGE (APPROX.)	METHOD DETECTION LIMIT, MDL	MINIMUM REPORTING LIMIT (MRL)	ACCURACY (+/-)	OVERALL PRECISION (RPD OR OTHER)	RESOLUTION
E. coli , Enterococci bacteria (Colilert®, Enterolert®) @WES/DWM	SM 9223B	MPN/100 ml	0-2420 (max. with quanti-tray for un-diluted samples	1 MPN/100 ml	MPN of 1 /100 ml	Presence and/or >2420 MPN on positive control and absence and/or 0 (<RDL) for negative control	Within 50 MPN/ 100mls, OR <30%RPD (<50 MPN for any value) <20% (50-500 MPN) <10 %RPD (500-5000 MPN) < 5% (>5000 MPN) (%RPDs for log_{10} transformed field duplicate data)	NA
E. coli bacteria (modified MTEC MF)	EPA 1603	cfu/100 ml	0-5000	5 cfu/100 ml	5 cfu/100 ml (WES lab)	"TNTC" on positive control and 0 or less than reporting limit for negative control	Within 50 CFUs, OR For Log_{10} duplicate data: <30%RPD (<50) <20% (50-500) <10% (500-5000) < 5% (>5000 CFUs)	NA
Fecal coliform bacteria (MF)	*SM 9222D*	*cfu/100 ml*	*0-5000*	*5 cfu/100 ml*	*5 cfu/100 ml (WES lab)*	*"TNTC" on positive control and 0 or less than reporting limit for negative control*	*Same as above*	*NA*
Enterococci bacteria (MF)	EPA 1600	cfu/100 ml	0-5000	5 cfu/100 ml	5 cfu/100 ml (WES lab)	Same as above	Same as above	NA
Bacteroidetes human marker[4] (HF134 @ 68C)	WES nested PCR	P/A	---	---	---	Confirmation of results using PCR positive & negative controls and method blanks	Confirmation of results using lab method duplicate	P/A test
Bacteroidetes human marker[4] (HF183 @ 68C)	WES nested PCR	P/A	---	---	---	Same as above	Same as above	P/A test

ANALYTE	ANALYTICAL METHOD(S)	UNITS	EXPECTED RANGE (APPROX.)	METHOD DETECTION LIMIT, MDL	MINIMUM REPORTING LIMIT (MRL)	ACCURACY (+/-)	OVERALL PRECISION (RPD OR OTHER)	RESOLUTION
Bacteroidetes Group Marker [4] (GB32 @55 C)	PCR (2000 AEM 66:1587-1594)	P/A	---	---	---	Same as above	Same as above	P/A test
Enterococcus faecium human marker[4] (esp gene)	PCR (2005 ES&T 39:283-287)	P/A	---	---	---	Same as above	Same as above	P/A test
Biological								
Macrophyte Percent Cover (lakes)	MassDEP protocol	0-100%	NA	NA	NA	NA (if true % cover were known, results would be expected to be +/- 20%)	NA	NA
Macrophyte Identification	MassDEP protocol	NA	NA	NA	NA	Qualitative assessment by aquatic plant experts in DWM via spot checking/testing the accuracy of identification using the same plants.	Qualitative assessment based on same-plant identifications by other survey crewmembers	NA
Habitat Assessment	USEPA RBP III	NA	NA	NA	NA	NA	Qualitative evaluation based on duplicate assessment by other survey crewmembers	NA
Benthic Macroinvertebrates (taxonomy)	USEPA RBP III	NA	NA	NA	NA	Qualitative assessment based on spot checks for taxonomic accuracy using the same samples, by separate DWM macroinvertebrate experts.	Qualitative assessment based on same-sample identification by other taxonomists in the group	NA
Benthic Macroinvertebrates (sample sorting efficiency)	USEPA RBP III	NA	NA	NA	NA	>90% efficiency	NA	NA

ANALYTE	ANALYTICAL METHOD(S)	UNITS	EXPECTED RANGE (APPROX.)	METHOD DETECTION LIMIT, MDL	MINIMUM REPORTING LIMIT (MRL)	ACCURACY (+/-)	OVERALL PRECISION (RPD OR OTHER)	RESOLUTION
Fish Population	USEPA RBP III	NA	NA	NA	NA	Qualitative assessment, based on in-field or lab specimen verification by other trained/expert DWM fish taxonomists (for fish type/species).	Qualitative and/or quantitative assessment based on replicate analysis of an adjacent reach by the same DWM taxonomists	NA
Ambient freshwater toxicity (acute, chronic)	*EPA 2021.0 EPA 2002.0*	*Reserved*						
Sediment Quality								
Total Organic Carbon	*EPA 9060 (Lloyd Kahn)*	*g/kg dry*	---	---	*0.1*	---	*< 20% RPD for field duplicates*	---
Acute freshwater sediment toxicity (% survival and growth)	*EPA/600/R-99/064*	*%*	---	*NA*	*NA*	*Evaluate statistical significance of survival and growth vs. test control*	---	---
% Solids/ % water	*ASTM E203; SM 2540G*	*%*	---	*NA*	*NA*	---	*+/- 10 % for field duplicates*	---
Grain size	*ASTM D422*	*% of various sizes*	---	*NA*	*NA*	---	*+/- 15 % for field duplicates*	*NA*
Total Phosphorus (TP)	*EPA 3050B USGS I-6600-88 SM 4500-P-E*	*mg/kg dry*	*Reserved*					
Total Nitrogen (TN)	*TBD*	*mg/kg dry*	*Reserved*					
Acid Volatile Sulfide (AVS)-Simultaneously Extracted Metals (SEM)	*EPA, 1991*	*umol/g dry wt. (AVS)* *mg/kg dry wt. (SEM)*	---	---	*AVS= 0.05 umol/g (2 ug/g)* *(see also metals RLs)*	*75-125 % recovery for aqueous lab QC stds. and lab fortified matrix*	*< 30% RPD for field duplicates*	*NA*
Metals and Organics (in sediment):								
Silver (Ag)	*EPA 200.7 EPA 6010B*	*mg/kg dry*	---	---	*(3)*	*70-130 % recovery for aqueous lab QC stds. and lab fortified matrix*	*< 30% RPD for field duplicates*	*NA*
Aluminum (Al)	*Same as above*	*mg/kg dry*	---	---	*(20)*	*70-130 % recovery*	*< 30% RPD*	*NA*

ANALYTE	ANALYTICAL METHOD(S)	UNITS	EXPECTED RANGE (APPROX.)	METHOD DETECTION LIMIT, MDL	MINIMUM REPORTING LIMIT (MRL)	ACCURACY (+/-)	OVERALL PRECISION (RPD OR OTHER)	RESOLUTION
Arsenic (As)	*Same as above*	*mg/kg dry*	*---*	*---*	*(10)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Barium (Ba)	*Same as above*	*mg/kg dry*	*---*	*---*	*(3)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Beryllium (Be)	*Same as above*	*mg/kg dry*	*---*	*---*	*(1)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Calcium (Ca)	*Same as above*	*mg/kg dry*	*---*	*---*	*(20)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Cadmium (Cd)	*Same as above*	*mg/kg dry*	*---*	*---*	*(3)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Cobalt (Co)	*Same as above*	*mg/kg dry*	*---*	*---*	*(3)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Chromium (Cr)	*Same as above*	*mg/kg dry*	*---*	*---*	*(3)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Copper (Cu)	*Same as above*	*mg/kg dry*	*---*	*---*	*(3)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Iron (Fe)	*Same as above*	*mg/kg dry*	*---*	*---*	*(10)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Potassium (K)	*Same as above*	*mg/kg dry*	*---*	*---*	*(500)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Magnesium (Mg)	*Same as above*	*mg/kg dry*	*---*	*---*	*(20)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Manganese (Mn)	*Same as above*	*mg/kg dry*	*---*	*---*	*(2)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Sodium (Na)	*Same as above*	*mg/kg dry*	*---*	*---*	*(500)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Nickel (Ni)	*Same as above*	*mg/kg dry*	*---*	*---*	*(6)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Lead (Pb)	*Same as above*	*mg/kg dry*	*---*	*---*	*(10)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Antimony (Sb)	*Same as above*	*mg/kg dry*	*---*	*---*	*(10)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Selenium (Se)	*Same as above*	*mg/kg dry*	*---*	*---*	*(10)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Thallium (Tl)	*Same as above*	*mg/kg dry*	*---*	*---*	*(20)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Vanadium (V)	*Same as above*	*mg/kg dry*	*---*	*---*	*(3)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Zinc (Zn)	*Same as above*	*mg/kg dry*	*---*	*---*	*(3)*	*70-130 % recovery*	*< 30% RPD*	*NA*
Mercury (Hg), total	*Same as above*	*mg/kg dry*	*---*	*---*	*---*	*70-130 % recovery*	*< 30% RPD*	*NA*
PCB Arochlor 1232	*EPA 8082/3541*	*µg/g dry*	*---*	*0.026*	*0.078*	*65-135 % recovery for lab QC stds. and lab fortified matrix*	*< 30% RPD for field duplicates*	*NA*
PCB Arochlor 1242	*EPA 8082/3541*	*µg/g dry*	*---*	*0.0052*	*0.0156*	*65-135 % recovery*	*< 30% RPD*	*NA*
PCB Arochlor 1248	*EPA 8082/3541*	*µg/g dry*	*---*	*0.012*	*0.036*	*65-135 % recovery*	*< 30% RPD*	*NA*
PCB Arochlor 1254	*EPA 8082/3541*	*µg/g dry*	*---*	*0.011*	*0.033*	*65-135 % recovery*	*< 30% RPD*	*NA*
PCB Arochlor 1260	*EPA 8082/3541*	*µg/g dry*	*---*	*0.040*	*0.120*	*65-135 % recovery*	*< 30% RPD*	*NA*

ANALYTE	ANALYTICAL METHOD(S)	UNITS	EXPECTED RANGE (APPROX.)	METHOD DETECTION LIMIT, MDL	MINIMUM REPORTING LIMIT (MRL)	ACCURACY (+/-)	OVERALL PRECISION (RPD OR OTHER)	RESOLUTION
HCCP	*EPA 8081A/ 3541*	*µg/g dry*	*---*	*0.075*	*0.225*	*60-140 % recovery for lab QC stds. and lab fortified matrix*	*< 30% RPD*	*NA*
Trifluralin	*EPA 8081A/ 3541*	*µg/g dry*	*---*	*0.079*	*0.237*	*60-140 % recovery*	*< 30% RPD*	*NA*
HCB	*EPA 8081A/ 3541*	*µg/g dry*	*---*	*0.035*	*0.105*	*60-140 % recovery*	*< 30% RPD*	*NA*
α-BHC	*EPA 8081A/ 3541*	*µg/g dry*	*---*	*0.0024*	*0.0072*	*60-140 % recovery*	*< 30% RPD*	*NA*
β-BHC	*EPA 8081A/ 3541*	*µg/g dry*	*---*	*0.0083*	*0.0249*	*60-140 % recovery*	*< 30% RPD*	*NA*
Lindane	*EPA 8081A/ 3541*	*µg/g dry*	*---*	*0.0037*	*0.0111*	*60-140 % recovery*	*< 30% RPD*	*NA*
δ-BHC	*EPA 8081A/ 3541*	*µg/g dry*	*---*	*0.0054*	*0.0162*	*60-140 % recovery*	*< 30% RPD*	*NA*
Heptachlor	*EPA 8081A/ 3541*	*µg/g dry*	*---*	*0.0030*	*0.0090*	*60-140 % recovery*	*< 30% RPD*	*NA*
Aldrin	*EPA 8081A/ 3541*	*µg/g dry*	*---*	*0.0026*	*0.0078*	*60-140 % recovery*	*< 30% RPD*	*NA*
Heptachlor Epoxide	*EPA 8081A/ 3541*	*µg/g dry*	*---*	*0.0023*	*0.0069*	*60-140 % recovery*	*< 30% RPD*	*NA*
DDE	*EPA 8081A/ 3541*	*µg/g dry*	*---*	*0.0024*	*0.0072*	*60-140 % recovery*	*< 30% RPD*	*NA*
DDD	*EPA 8081A/ 3541*	*µg/g dry*	*---*	*0.0024*	*0.0072*	*60-140 % recovery*	*< 30% RPD*	*NA*
DDT	*EPA 8081A/ 3541*	*µg/g dry*	*---*	*0.0044*	*0.0132*	*60-140 % recovery*	*< 30% RPD*	*NA*
Methoxychlor	*EPA 8081A/ 3541*	*µg/g dry*	*---*	*0.0051*	*0.0153*	*60-140 % recovery*	*< 30% RPD*	*NA*
Chlordane	*EPA 8081A/ 3541*	*µg/g dry*	*---*	*0.063*	*0.189*	*60-140 % recovery*	*< 30% RPD*	*NA*
Toxaphene	*EPA 8081A/ 3541*	*µg/g dry*	*---*	*0.074*	*0.222*	*60-140 % recovery*	*< 30% RPD*	*NA*
Phenol	*EPA 8270C*	*µg/g dry*	*---*	*0.26*	*0.78*	*60-140 % recovery for lab QC stds. and lab fortified matrix*	*< 30% RPD*	*NA*
2-Chlorophenol	*EPA 8270C*	*µg/g dry*	*---*	*0.32*	*0.96*	*60-140 % recovery*	*< 30% RPD*	*NA*
2-Nitrophenol	*EPA 8270C*	*µg/g dry*	*---*	*0.17*	*0.51*	*60-140 % recovery*	*< 30% RPD*	*NA*
Dichlorophenol	*EPA 8270C*	*µg/g dry*	*---*	*0.33*	*0.99*	*60-140 % recovery*	*< 30% RPD*	*NA*
Naphthalene	*EPA 8270C*	*µg/g dry*	*---*	*0.17*	*0.51*	*60-140 % recovery*	*< 30% RPD*	*NA*
4-Chloro-3-methylphenol	*EPA 8270C*	*µg/g dry*	*---*	*0.32*	*0.96*	*60-140 % recovery*	*< 30% RPD*	*NA*
Trichlorophenol	*EPA 8270C*	*µg/g dry*	*---*	*0.37*	*1.11*	*60-140 % recovery*	*< 30% RPD*	*NA*
Dimethyl phthalate	*EPA 8270C*	*µg/g dry*	*---*	*0.32*	*0.96*	*60-140 % recovery*	*< 30% RPD*	*NA*
Acenaphthylene	*EPA 8270C*	*µg/g dry*	*---*	*0.36*	*1.08*	*60-140 % recovery*	*< 30% RPD*	*NA*
Acenaphthene	*EPA 8270C*	*µg/g dry*	*---*	*0.35*	*1.05*	*60-140 % recovery*	*< 30% RPD*	*NA*

ANALYTE	ANALYTICAL METHOD(S)	UNITS	EXPECTED RANGE (APPROX.)	METHOD DETECTION LIMIT, MDL	MINIMUM REPORTING LIMIT (MRL)	ACCURACY (+/-)	OVERALL PRECISION (RPD OR OTHER)	RESOLUTION
Fluorene	*EPA 8270C*	*µg/g dry*	*---*	*0.32*	*0.96*	*60-140 % recovery*	*< 30% RPD*	*NA*
Diethyl phthalate	*EPA 8270C*	*µg/g dry*	*---*	*0.13*	*0.39*	*60-140 % recovery*	*< 30% RPD*	*NA*
Pentachlorophenol	*EPA 8270C*	*µg/g dry*	*---*	*0.17*	*0.51*	*60-140 % recovery*	*< 30% RPD*	*NA*
Phenanthrene	*EPA 8270C*	*µg/g dry*	*---*	*0.13*	*0.39*	*60-140 % recovery*	*< 30% RPD*	*NA*
Anthracene	*EPA 8270C*	*µg/g dry*	*---*	*0.27*	*0.81*	*60-140 % recovery*	*< 30% RPD*	*NA*
Fluoranthene	*EPA 8270C*	*µg/g dry*	*---*	*0.13*	*0.39*	*60-140 % recovery*	*< 30% RPD*	*NA*
Pyrene	*EPA 8270C*	*µg/g dry*	*---*	*0.08*	*0.24*	*60-140 % recovery*	*< 30% RPD*	*NA*
Butyl-benzo-phthalate	*EPA 8270C*	*µg/g dry*	*---*	*0.11*	*0.33*	*60-140 % recovery*	*< 30% RPD*	*NA*
Bis(2-ethylhexyl)adipate	*EPA 8270C*	*µg/g dry*	*---*	*0.10*	*0.3*	*60-140 % recovery*	*< 30% RPD*	*NA*
Benzo(a)anthracene	*EPA 8270C*	*µg/g dry*	*---*	*0.08*	*0.24*	*60-140 % recovery*	*< 30% RPD*	*NA*
Chrysene	*EPA 8270C*	*µg/g dry*	*---*	*0.23*	*0.69*	*60-140 % recovery*	*< 30% RPD*	*NA*
Benzo(b)fluoranthene	*EPA 8270C*	*µg/g dry*	*---*	*0.10*	*0.3*	*60-140 % recovery*	*< 30% RPD*	*NA*
Benzo(k)fluoranthene	*EPA 8270C*	*µg/g dry*	*---*	*0.08*	*0.24*	*60-140 % recovery*	*< 30% RPD*	*NA*
Benzo(a)pyrene	*EPA 8270C*	*µg/g dry*	*---*	*0.26*	*0.78*	*60-140 % recovery*	*< 30% RPD*	*NA*
Indeno(,2,3-cd)pyrene	*EPA 8270C*	*µg/g dry*	*---*	*0.27*	*0.81*	*60-140 % recovery*	*< 30% RPD*	*NA*
Dibenzo-a,h-Anthracene	*EPA 8270C*	*µg/g dry*	*---*	*0.19*	*0.57*	*60-140 % recovery*	*< 30% RPD*	*NA*
Benzo-ghi-perylene	*EPA 8270C*	*µg/g dry*	*---*	*0.17*	*0.51*	*60-140 % recovery*	*< 30% RPD*	*NA*
Total PAHs	*—*	*µg/g dry*	*---*	*—*	*—*	*—*	*—*	*NA*
Pesticides (various)	*Reserved*							
Polychlorinated Biphenyls (PCBs)	*Reserved*							
Extractable Petroleum Hydrocarbons (EPH)	*Reserved*							
VOCs	*EPA 5035A EPA 8260B (SW-846)*	*Reserved*						
Fish Tissue Toxics								
-Length	Fish Processing SOP	mm	150-800	N/A	N/A	0.1	0.1	NA
-Weight (wet)	Fish Processing SOP	Grams wet	80-4000	N/A	N/A	20	20	NA

ANALYTE	ANALYTICAL METHOD(S)	UNITS	EXPECTED RANGE (APPROX.)	METHOD DETECTION LIMIT, MDL	MINIMUM REPORTING LIMIT (MRL)	ACCURACY (+/-)	OVERALL PRECISION (RPD OR OTHER)	RESOLUTION
-Age	Fish Processing SOP	years	1-10	N/A	N/A	+/- 1	+/-1	NA
Lipids	Mod. AOAC 983.21	%	2-40	N/A	N/A	25%	30%	NA
Arsenic	*EPA 200.9*	*ug/g wet*	*0-1*	*0.080*	*0.080*	*25%*	*30%*	*NA*
Cadmium	*EPA 200.9*	*ug/g wet*	*0-1*	*0.20*	*0.60*	*25%*	*30%*	*NA*
Lead	*EPA 200.9*	*ug/g wet*	*0-1*	*0.20*	*0.60*	*25%*	*30%*	*NA*
Mercury	EPA 7473	ug/g wet	0-5	0.002	0.006	25%	30%	NA
Selenium	*EPA 200.9*	*ug/g wet*	*0-1*	*0.20*	*0.60*	*25%*	*30%*	*NA*
PCB Arochlor 1232	Mod. AOAC 983.21	ug/g wet	0-5	0.019	0.057	25%	30%	NA
PCB Arochlor 1242	Mod. AOAC 983.21	ug/g wet	0-5	0.043	0.13	25%	30%	NA
PCB Arochlor 1248	Mod. AOAC 983.21	ug/g wet	0-5	0.038	0.11	25%	30%	NA
PCB Arochlor 1254	Mod. AOAC 983.21	ug/g wet	0-5	0.038	0.11	25%	30%	NA
PCB Arochlor 1260	Mod. AOAC 983.21	ug/g wet	0-5	0.022	0.066	25%	30%	NA
Chlordane	Mod. AOAC 983.21	ug/g wet	0-5	0.11	0.33	25%	30%	NA
Toxaphene	Mod. AOAC 983.21	ug/g wet	0-5	0.25	0.75	25%	30%	NA
a-BHC	Mod. AOAC 983.21	ug/g wet	0-5	0.0060	0.018	25%	30%	NA
b-BHC	Mod. AOAC 983.21	ug/g wet	0-5	0.010	0.030	25%	30%	NA
Lindane	Mod. AOAC 983.21	ug/g wet	0-5	0.0060	0.018	25%	30%	NA
d-BHC	Mod. AOAC 983.21	ug/g wet	0-5	0.028	0.084	25%	30%	NA
Hexachlorocyclopentadiene	Mod. AOAC 983.21	ug/g wet	0-5	0.010	0.030	25%	30%	NA
Hexachlorobenzene	Mod. AOAC 983.21	ug/g wet	0-5	0.084	0.25	25%	30%	NA
Endosulfan I	Mod. AOAC 983.21	ug/g wet	0-5	0.0031	0.0093	25%	30%	NA
Trifluralin	Mod. AOAC 983.21	ug/g wet	0-5	0.047	0.14	25%	30%	NA
Heptachlor	Mod. AOAC 983.21	ug/g wet	0-5	0.0060	0.018	25%	30%	NA
Heptachlor Epoxide	Mod. AOAC 983.21	ug/g wet	0-5	0.014	0.043	25%	30%	NA
Methoxychlor	Mod. AOAC 983.21	ug/g wet	0-5	0.026	0.078	25%	30%	NA
DDD	Mod. AOAC 983.21	ug/g wet	0-5	0.007	0.021	25%	30%	NA
DDE	Mod. AOAC 983.21	ug/g wet	0-5	0.010	0.030	25%	30%	NA
DDT	Mod. AOAC 983.21	ug/g wet	0-5	0.011	0.033	25%	30%	NA

ANALYTE	ANALYTICAL METHOD(S)	UNITS	EXPECTED RANGE (APPROX.)	METHOD DETECTION LIMIT, MDL	MINIMUM REPORTING LIMIT (MRL)	ACCURACY (+/-)	OVERALL PRECISION (RPD OR OTHER)	RESOLUTION
Endosulfan I	Mod. AOAC 983.21	ug/g wet	0-5	0.021	0.063	25%	30%	NA
Aldrin	Mod. AOAC 983.21	ug/g wet	0-5	0.0080	0.024	25%	30%	NA
Endrin	Mod. AOAC 983.21	ug/g wet	0-5	0.0036	0.011	25%	30%	NA
PCNB	Mod. AOAC 983.21	%	50-150	NA	NA	40%	NA	NA
PCB Congener BZ # 8	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0024	0.0072	25%	30%	NA
PCB Congener BZ # 18	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0006	0.0018	25%	30%	NA
PCB Congener BZ # 28	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0072	0.022	25%	30%	NA
PCB Congener BZ # 44	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0074	0.022	25%	30%	NA
PCB Congener BZ # 52	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0063	0.019	25%	30%	NA
PCB Congener BZ# 66	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0074	0.022	25%	30%	NA
PCB Congener BZ# 77	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0080	0.024	25%	30%	NA
PCB Congener BZ# 81	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0036	0.011	25%	30%	NA
PCB Congener BZ # 101	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0098	0.029	25%	30%	NA
PCB Congener BZ# 105	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0069	0.021	25%	30%	NA
PCB Congener BZ# 114	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0092	0.028	25%	30%	NA
PCB Congener BZ# 118	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0093	0.028	25%	30%	NA
PCB Congener BZ# 123	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0088	0.023	25%	30%	NA
PCB Congener BZ# 126	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0008	0.0024	25%	30%	NA
PCB Congener BZ # 128	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0011	0.0033	25%	30%	NA
PCB Congener BZ # 138	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0012	0.0036	25%	30%	NA
PCB Congener BZ # 153	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0077	0.023	25%	30%	NA
PCB Congener BZ# 156	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0012	0.0036	25%	30%	NA
PCB Congener BZ# 157	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0011	0.0033	25%	30%	NA
PCB Congener BZ# 167	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0052	0.016	25%	30%	NA
PCB Congener BZ# 169	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0012	0.0036	25%	30%	NA
PCB Congener BZ# 170	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0011	0.0033	25%	30%	NA
PCB Congener BZ# 180	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0017	0.0051	25%	30%	NA
PCB Congener BZ # 187	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0065	0.020	25%	30%	NA

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PCB Congener BZ# 189	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0009	0.0027	25%	30%	NA
PCB Congener BZ # 195	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0012	0.0036	25%	30%	NA
PCB Congener BZ # 206	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0013	0.0031	25%	30%	NA
PCB Congener BZ # 209	Mod. AOAC 983.21	ug/g wet	0-0.02	0.0012	0.0036	25%	30%	NA

Notes:

1) Detection and reporting limit information in Table 2 is based primarily on the WES lab, unless otherwise noted for WPP and other labs.

2) Accuracy and precision goals are based on potential error introduced via both field and lab activity. The analytical method limits are published in the analytical method and/or provided by the lab, as are the achievable laboratory limits. Multi-Probe information for accuracy, precision and resolution is based on manufacturer's specifications. RPD precision objectives relate to field duplicates.

3) Fish tissue PCB/pesticide MDL/MRL values are based on most recent analyses by WES, and as all DL values, subject to change. PAH analysis for fish tissue samples is not normally performed for DWM samples, and so DQO's for these are not presented here.

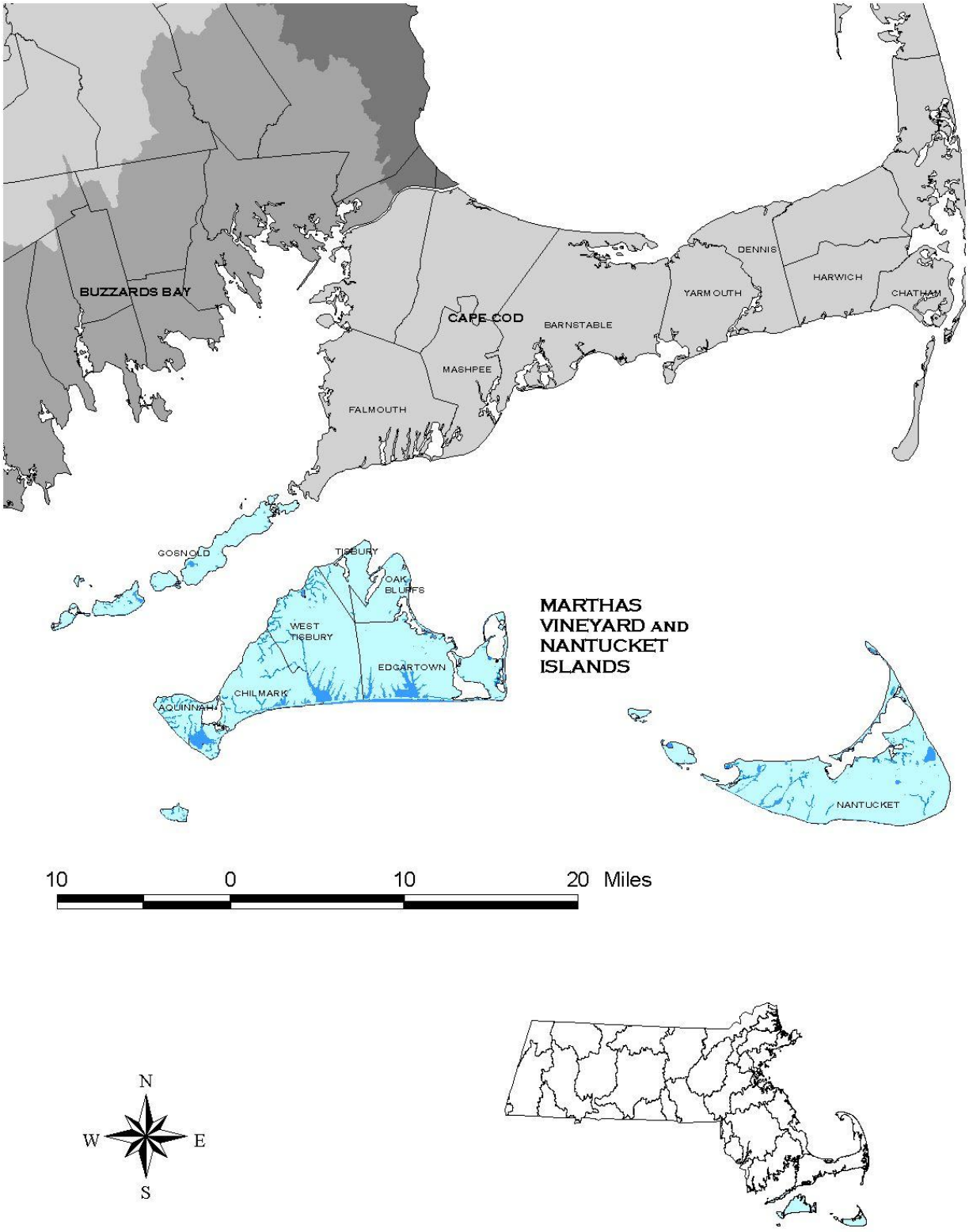
4) These analytes comprise the Evidence of Human-Sewage Source (EHSS) suite of tests performed at WES as part of bacteria source tracking studies to assist in locating and fixing microbial pollution sources.

5) Information provided in *ITALICS* indicates currently *INACTIVE* parameters (not routinely or currently being analyzed for)

7) RL information in parentheses ( ) indicates those attainable by the EPA backup lab in No. Chelmsford, MA.

8) "NA"= Not Applicable

9) "---"= no data



Islands Watershed

A8 TRAINING

Annual and/or as needed training in field and laboratory methods and procedures is provided to WPP staff (full time and seasonals) to ensure consistent adherence to SOPs and data quality. The main focus of this training is to review both the fundamentals and finer details of sample collection, associated documentation, lab requirements and protocols and safety issues. Types of available WPP training is summarized in Table 3.

Training is dependent on the specific type of monitoring planned (e.g., if flow surveys are not currently planned, then flow training is not provided. If, however, the need arises to gather flow data, then flow training is scheduled prior to actual surveys) and the level of staff experience. Most of the training done annually focuses on seasonal staff.

Table 3: Types of WPP Training

TRAINING	DESCRIPTION	TRAINER(S)
CPR-AED and First Aid *	Practice of Cardiopulmonary Resuscitation (CPR), Automated Electronic Defibrillation (AED) and first aid techniques to rescue and aid victims	American Red Cross and/or ARC-certified MassDEP instructors
Health & Safety	Discussion of safety precautions both in the field and in the lab	Richard Chase, Bob Nuzzo
Multi-probe Use	Discussion and practicum on how to use Hydrolab and YSI multi-probe units in the field to collect water quality data (single-use and deployment)	Richard Chase, Matt Reardon, Bob Nuzzo
Water quality surveys (general)	Discussion of survey preparation, field procedures and special considerations (e.g., clean metals sampling) for stream and pond surveys	James Meek, Dan Davis, Matt Reardon, Pete Mitchell,Richard Chase, subject matter-expert staff
Lake Monitoring	Review of SOPs for lake/pond surveys, including safety, boat use, sampling gear, aquatic plant identification, etc.	Mark Mattson, Richard Chase, misc. staff
Benthic Macroinvertebrate and Periphyton surveys	Field and lab instruction on survey preparation, sample collection, field data collection, sample sorting, etc.	Bob Nuzzo, Joan Beskenis (respectively)
Electrofishing surveys	How to assist in performing electrofishing surveys safely and with minimal field error (fish toxics and populations)	Bob Maietta, Dan Davis, Pete Mitchell
E. coli by Colilert® (also Enterolert®)	Review of SOP for sample analysis at WPP lab, including safety and waste management issues	Chris Duerring, Joan Beskenis, Richard Chase
Flow	Discussion and practicum on proper preparation and performance of flow surveys, including use of velocity meters and data processing	Richard Chase
Chlorophyll a	How to perform analysis for chlorophyll a content in water samples	Joan Beskenis
Color, turbidity and hardness analyses	How to perform lab analyses for true color, total hardness and turbidity (WPP lab)	Richard Chase, selected staff

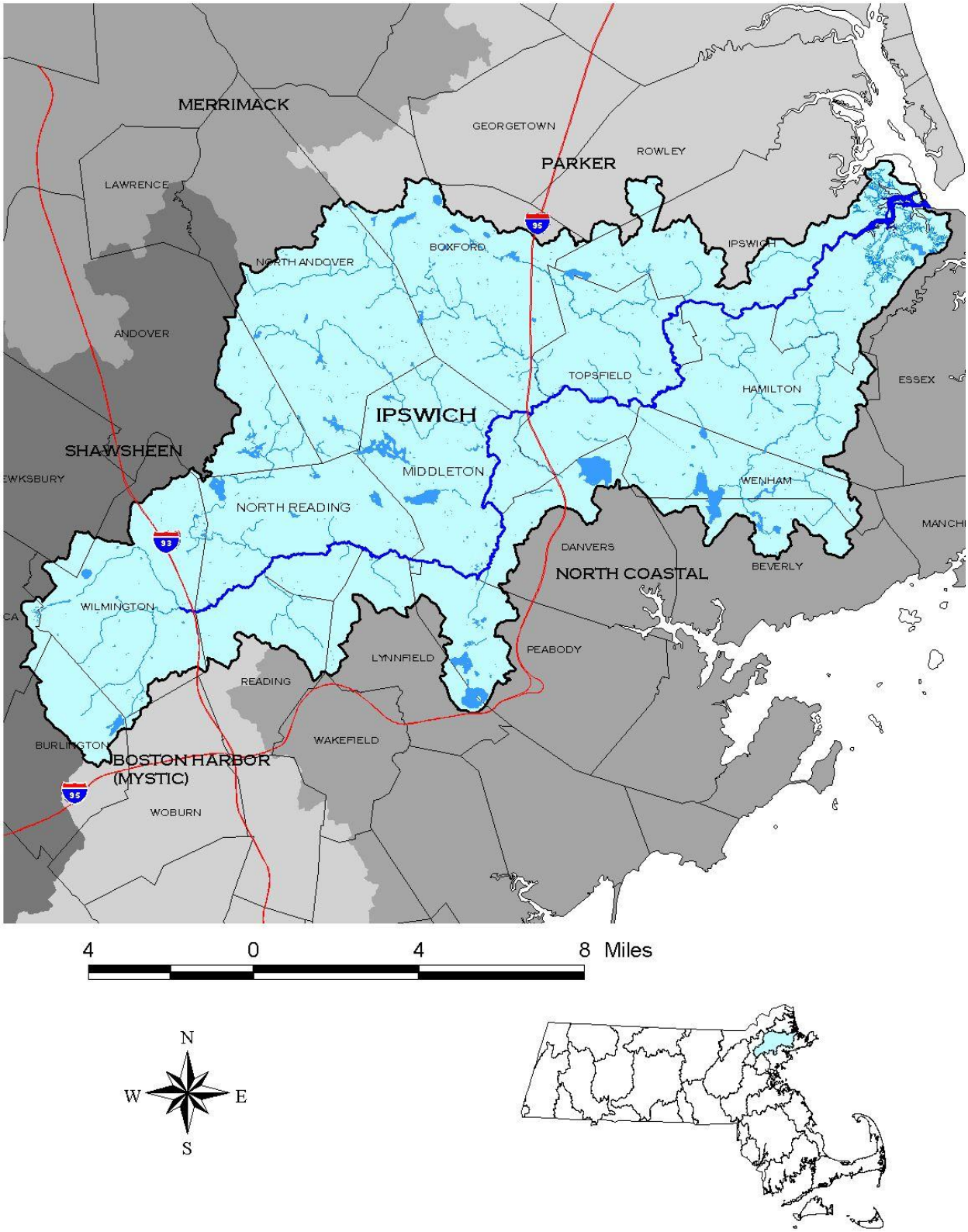
TRAINING	DESCRIPTION	TRAINER(S)
Decontamination for invasives control	Overview of decontamination issues and requirements for DWM surveys to prevent the spread of invasive organisms	James Meek
Bacteria (and pollutant) source tracking	Review of BST "toolbox" for both field and lab activities, including successes/failures based on working knowledge base	Chris Duerring, Jenny Sheppard
Field metadata and lab data reporting and management	Review of procedures for lab recordkeeping and data entry into WPP databases for both field and lab data	Tom Dallaire, Jane Ryder, Kari Winfield, Richard Chase, selected staff

** Highly recommended for field and lab staff, but not required.*

Person serving as monitoring survey crew leaders should have the following qualifications:

- Familiarity with this QAPP (and the project QAPP as applicable) and all applicable SOPs
- Completion of applicable training (e.g., water quality/multiprobe sampling)
- Prior field experience with survey equipment and with similar monitoring surveys
- Recent training in CPR-AED/first aid by the American Red Cross (at least one certified person per survey crew is recommended)
- Be physically able to access the stations, carry equipment and samples, and perform the sampling.

All field survey crew personnel and WES/WPP lab personnel are trained in the proper application of standard operating procedures (SOPs). Training can take place in the office, field or laboratory, and can take place prior to data collection and/or "on the job". WPP training activity is documented using standard training signature sheets. All training records are stored at WPP's QA office in Worcester, MA.



Ipswich Watershed

A9 DOCUMENTATION AND RECORDS

A9.1 Field Records

Observations made and measurements taken in the field are recorded on standardized DWM-WPP Field Sheets (paper). Fieldsheets are the main tools for recording field data (not field notebooks, which can also be used as a secondary source of survey metadata). For most surveys, an individual field sheet is used for each station per sampling event. Fieldsheet types include:

- "Rivers & Streams"
- "Lakes & Ponds"
- "Pipes and Conduits"
- "Bacteria Source Tracking"
- "Multi-Probe Deployment"
- "Habitat Assessment Field Scoring"
- "Biomonitoring Field Data" (benthic surveys)
- "Fish Collection Data & Inventory" (fish tissue toxics)
- "Macrophyte Distibution Map" (lake-specific outline maps)
- "Fish Field Data" (fish population)
- "Stream Walk" (pollution source tracking)
- "Probabilistic Site Evaluation"

Waterproof (e.g., Rite-in-the-Rain) paper is used exclusively. These forms are reviewed annually and updated as needed. Samples of selected completed DWM-WPP Field Sheets can be found in Appendix K. While each fieldsheet type is unique, common information recorded on field sheet forms includes, but is not limited to:

- Site name and watershed location
- Station Description (including GPS coordinates)
- Station Access Information
- Sample Name and ID #
- Personnel on-site performing the sampling
- Dates and times of sample collection
- Pertinent observations regarding uses (aquatic life, recreation, etc.)
- Summary of weather conditions
- Site observations and any aberrant sample handling comments
- Sample collection information (sample collection methods and devices, sample collection depth /heights, sample preservation information, matrix sampled, etc.).

Certain information that will not change can be pre-filled out prior to the survey to save time in the field. Other information that is time-, location- and/or condition-specific is filled out at the station ONLY. Each sheet should be filled out completely using (blue) ink pens. Upon completion of the survey, each completed field sheet is submitted to the QA Analyst for hard copy filing.

As noted above, paper notebooks are optional for DWM-WPP field surveys. These can be used based on individual staff preference to record detailed, additional information that is not contained on the standard, primary and required fieldsheets. Copies of field notebook pages become part of the hard copy file for the project.

Survey guidebooks are provided to each crew lead by the Survey Coordinator. These books contain detailed driving directions and maps to each sequential sampling station, along with photos, helpful hints, contact information and survey-specific emergency hospital locations.

A9.2 Digital Field Records

Electronic field records include multiprobe logger data files and calibration files, GPS unit waypoint files and digital photographs. Procedures for uploading data files from water quality probes and GPS units are described in the instrument SOPs.

Use of digital cameras (and video as appropriate) for photo documentation and GPS for geo-referencing is highly encouraged to augment metadata information. Although a digital camera is standard equipment for every WPP sampling team, the need to collect digital photos is project-specific, and at the discretion of the field crew. When collected, digital pictures and videos are uploaded to WPP's secure network drive using a dedicated photodocumentation folder, in project-specific sub-folders, and renamed as applicable.

Note: DWM-WPP plans to switch from paper fieldsheets to electronic notepads in the near future. As of 2015, however, DWM-WPP does not yet employ field computers (e.g., netbooks, notepads, tablets, etc.) in standard practice to record fieldsheet or other information while in the field. To prevent against loss, completed paper fieldsheets are scanned to create electronic backup records.

A9.3 Laboratory Records

A9.3.1 WES laboratory (Lawrence, MA)

A standard chain-of-custody (COC) form is used to transfer sample custody for all samples from DWM-WPP staff to the WES laboratory. Electronic copies of completed COC forms are stored on a shared network drive by WES. See Appendix K for sample WES COC form.

The WES laboratory tracks samples via an electronic Laboratory Information Management System (LIMS), which was planned for a major upgrade in 2015. The LIMS system provides for efficient and accurate data transfers to DWM-WPP's database system (i.e., LIMS extracts). The WES LIMS system is supported by periodic network backups per DEP IT protocols.

In general, most hard copy data including logbooks, data analysis books, control charts, chain of custody forms, log-in sheets and data reports are archived for storage within a secure building according to DEP recordkeeping requirements. See the WES QA Plan for more information on recordkeeping.

A9.3.2 DWM-WPP Laboratory (Worcester, MA)

For samples to be analyzed at DWM-WPP's laboratory, the WES chain-of-custody (COC) form is used to transfer sample custody for all samples from WPP staff to the WPP laboratory. Paper copies of completed COC forms are filed in WPP project folders.

WPP laboratories track sample information in various ways, depending on the type of analysis performed. Lab records are both in paper and digital formats. Hard copy lab records include: logbooks, data analysis books, control charts and data reports, and are stored according to DEP recordkeeping requirements. Electronic lab notebooks are also used for several analyses. These result in batch-specific electronic lab data files, which are used to produce analyte-specific electronic data deliverables (EDDs) for upload to DWM-WPP's database system.

A9.3.3 Contract laboratories

Contract documents for laboratory services are kept in the DWM-WPP's QA office (paper and electronic). Contract lab COC forms are used when available and when deemed sufficient to meet WPP's information needs. In some cases, WPP may use the WES lab COC form for non-WES lab samples if a contract lab COC form is found to be insufficient. When contract labs are used, copies of completed COC forms are included in the data report packages, which are filed in WPP project folders. WPP's contract labs are required to submit formal EDDs using WPP's standard format so that contract lab data can be uploaded to WPP's database system with minimal transcription error.

A9.4 Data Records (paper)

Formal WPP project folders containing field metadata, lab data, data reports and relevant additional information (e.g., survey weather and streamflow conditions) are kept at WPP's offices in Worcester, MA. These records are maintained complete and orderly by all users via "folder rules" (including "sign-out" protocols), and are considered "backup" to digital data records.

A9.5 Data-Related Records (electronic)

The majority of program data records are in electronic format. Electronic office records pertinent to WPP's data operations and available to staff include, but are not limited to, the following types of information on the shared network drives:

- Automated probe QC and calibration records
- Draft and Final data (QC levels 1through 5; see Section D1)
- Digital photo-documentation (site reconnaissance, surveys, etc.)
- Survey guidebooks
- Fieldsheet data and metadata (following data entry)
- Working files and data analyses
- Standard Operating Procedures (field, office, lab) and policies

- Standard forms
- QC records
- NPDES permit information
- Secondary data (from sources external to WPP)
- Internal databases
- Draft and final reports and plans (e.g., TMDL, water quality assessments, Sampling & Analysis Plans, etc.)

A9.6 Document Tracking: "Control Numbers"

The WPP QC Analyst assigns document control numbers (CN) to all Quality Assurance Project Plans, SOPs, Assessment Reports and other important documents. Assigning a control number provides a formal reference number for citation purposes and helps to ensure differentiation of multiple versions of a document when they exist. All CN documents can be electronically accessed internally by WPP staff using WPP's Document Control Number Database (MS Access), or directly via the formal network repository for WPP documents: W/DWM/SOP.

A9.7 Sampling Station Registration

Prior to visiting sampling stations for data collection, WPP's electronic station definition files are updated to create new (proposed) stations where needed. Each unique location (or station) sampled is given a "Unique ID" number and description associated with it.

A9.8 Documentation Protocols

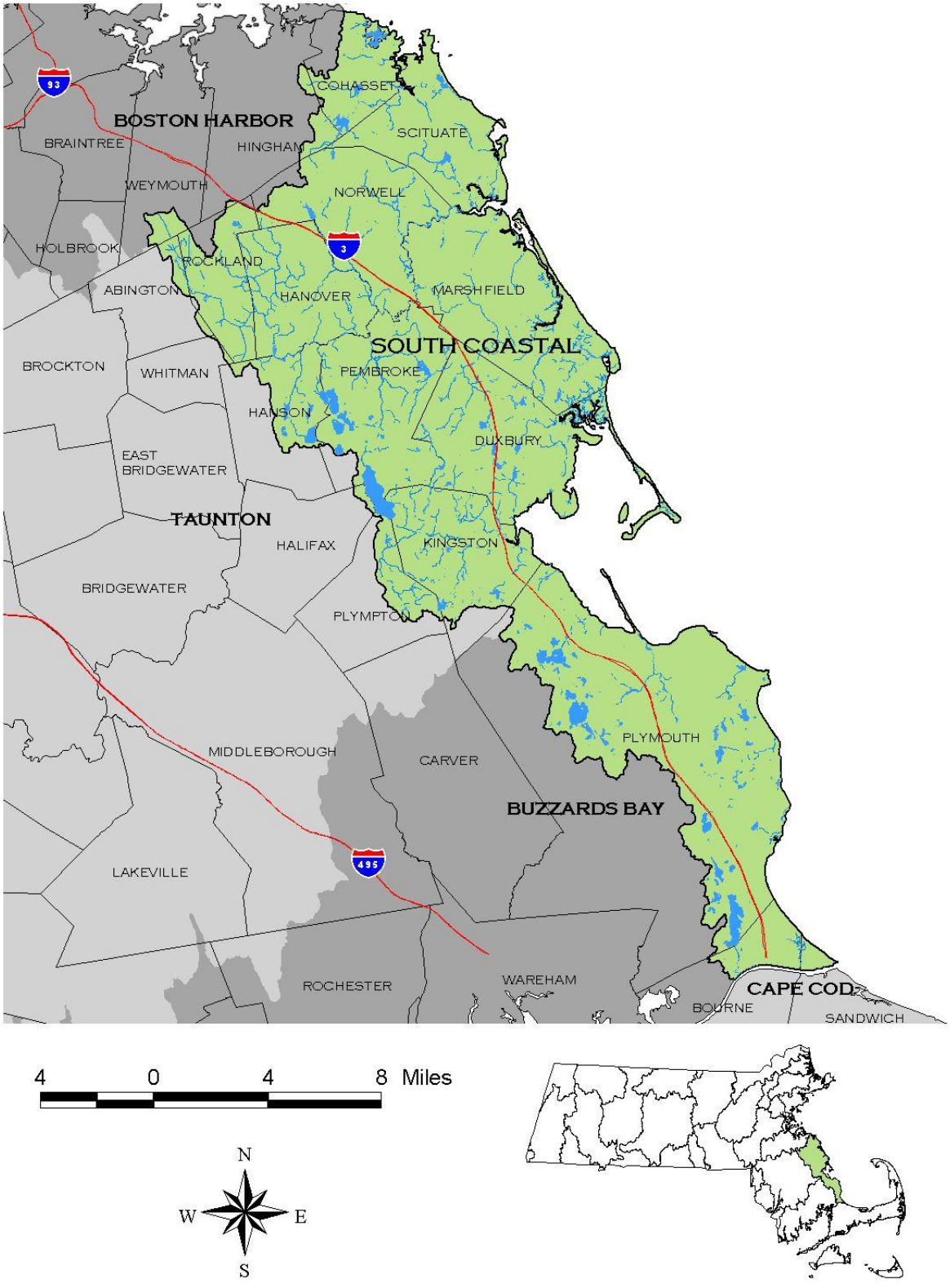
All DWM-WPP paper and digital records related to data collection are considered formal records subject to WPP and DEP-wide (i.e., State Record Retention requirements) documentation protocols.

Example documentation procedures include, but are not limited to:

- Use of indelible ink (not pencil) for paper records
- No omissions in the data (completeness)
- 100% QC checks on hand-entered data
- No use of erasing, "white-outs", removal of pages, and multiple crossovers to correct errors. When errors do occur, they should be corrected according to the following procedures:
    - Draw a single line through the incorrect entry, insert the correct entry into the closest space available and initial and date the correction;
    - Groups of related errors on a single page should have one line through the entries and should be initialed and dated with a short comment supplied for the reason of data deletion.

Table 4. WPP Project Documentation and Data Records

SAMPLE COLLECTION RECORDS	HEALTH & SAFETY RECORDS	FIXED LABORATORY RECORDS	DATA AND QA/QC ASSESSMENT RECORDS
Field Sheets	MSDS/SDS	Chain of Custody (COC) Forms	Data Validation Report for specific data sets
Chain of Custody Forms	Hazardous Waste Generation Forms and Waste Receipt Forms	Laboratory Raw Data Reports and Notebooks	QA/QC section in published reports (e.g. Tech Memos)
Digital photos	Training forms	Electronic Laboratory Data (LIMS, EDD)	MS Excel data validation sheets
Survey-related Correspondence (e.g., e-mail)	Annual Operational Safety Reports	Analytical Instrument Logbooks	Technical Correspondence (e.g., e-mail)
GPS waypoints	Field/lab audit reports	Laboratory QC Results	Raw, preliminary and final data files (QC1-QC4)
Probe/logger Raw Data (Hard Copy & digital)	Corrective Action Forms	Level 1 and Level 2 Data QC reviews (WES)	Station definition files
Training forms		Reagent Water Logbook	
Field Notebook (optional)		Performance Evaluation Test Results	
Corrective Action Forms		MDL Studies	
		Probe Instrument Calibration Logbook, User Reports, and Maintenance Logbook	
		Automated logger QC data	
		Incubator Temperature Log and other calibration logs	
		Training forms	



South Coastal Watershed

NOTE FOR SECTION B1:

SEE ALSO ANNUAL PROJECT-SPECIFIC SAMPLING & ANALYSIS PLANS (SAPs)

B1 SAMPLING PROCESS DESIGN

B1.1 Long-Term Design Strategy

DWM-WPP's ambient surface water monitoring program is a vital component of a comprehensive statewide monitoring approach to protect and restore the waters of the Commonwealth. The long-term approach for watershed-scale monitoring is to effectively utilize a combination of targeted, probabilistic, fixed-site and project-specific sampling networks, in order to address multiple objectives.

Requirements to support two of the objectives---waterbody assessments and TMDL development--- are that the monitoring strategy be:

- statewide in scale
- comprehensive (all water bodies in the Commonwealth are assessed)
- repeated at regular intervals
- increase the number of stream miles and lake acres assessed, and
- reduce the historical bias toward problem areas

WPP monitoring from 2010 through 2015 largely focused on a probabilistic statewide assessment of wadeable streams, with limited targeted sampling. In 2016-2018, WPP is planning to conduct a statewide lakes assessment using a probabilistic design. Planning documents for the lakes assessment are in preparation.

WPP continues to evaluate the technical value as well as the practical feasibility within WPP's resource constraints for a continuous, fixed-site monitoring stationnetwork for major river systems within Massachusetts. As of 2015, there are no plans in place.

Undoubtedly, another important ingredient in an effective, long-term statewide monitoring program is partnering with monitoring groups outside WPP. Consistent with recent by WPP efforts to improve the process for requesting, receiving and reviewing quality-controlled data from outside groups, WPP is committed to fostering long-term data partnerships with other agencies and groups collecting data. These data can be important, supplemental information for decision makers.

For more information on the WPP's long-term strategy:
http://www.mass.gov/eea/agencies/massdep/water/watersheds/water-quality-monitoring-program.html

B1.2 Short-Term Sampling Plans

The decision making process regarding where, when, how, why and what to sample is complex and challenging. The overall scope of the monitoring effort is limited by available human resources, equipment, funds, competing needs and priorities. Each year, WPP staff develop Sampling and Analysis Plans (SAPs) which guide data gathering activities. For details regarding project-specific sampling locations, frequencies, analytes, methods, etc., see the separate and individual Sampling & Analysis Plans (SAPs). These annual SAPs are supplements to this programmatic QAPP, and their contents mirror selected QA-R5 Guidance elements (i.e., A4-A6, B1, and B9) as they pertain to those projects.

B1.3 Core Indicators

Although highly projectdependent on specific SAPaWPP typically monitors specific core and supplemental indicators to assess the aquatic life uses, water contact recreational uses, and other human health-related water uses as defined in the Massachusetts Water Quality Standards (WQS), as indicated below. Core and Supplemental indicators used by DWM-WPP are shown below (Table 5).

Table 5: Core and Supplemental Indicators

INDICATOR TYPE	AQUATIC LIFE	RECREATION	FINFISH/SHELLFISH CONSUMPTION
Core	Macroinvertebrate community Fish community Periphyton/Phytoplankton Macrophyton Habitat quality * Flow Dissolved oxygen pH Temperature Turbidity Suspended solids Lake trophic status	Pathogens (e.g., *E. coli*) Transparency Algal blooms, (chlorophyll) Macrophyte density Land-use/% impervious cover	Mercury PCBs Pesticides Shellfish bed closures (non-management)

INDICATOR TYPE	AQUATIC LIFE	RECREATION	FINFISH/SHELLFISH CONSUMPTION
Supplemental	Toxic pollutants (e.g., metals) Toxicity tests (water, sediment) Tissue chemical assays Nutrients Chlorophyll Sediment chemistry Organism condition factor Non-native species Land-use/% impervious cover Fish kills Pollutant loadings Chloride Specific conductance	Aesthetics Objectionable deposits (scums, sheens, etc.) Flow/water level, Sediment quality Color/Turbidity pH	Other contaminants of concern Pathogens

* Water quantity (discharge), geomorphology (slope, bank stability, channel morphology), substrate (sediment type, embededness) and riparian zone (shoreline vegetation, canopy)

B1.4 Probabilistic Sampling Design: Rivers & Streams (2011-2015)

The goal of the Massachusetts Probabilistic Monitoring and Assessment Program (MAP2) is to provide a comprehensive assessment of the condition of river and stream "waters" in Massachusetts through the implementation of probabilistic sampling designs. As of 2011, wadeable rivers and streams are the only water resource in Massachusetts that has an implemented probabilistic sampling design. The survey design for MAP2 is a stratified five-year basin rotation design with a different group of basins getting sampled each year from 2011 to 2015 to provide state-wide coverage.

Objectives: The objectives, or design requirements, for the MAP2 project are to produce:

1. An unbiased assessment (Support/Impaired) of aquatic life, recreational and aesthetic uses in wadeable non-tidal perennial streams of Massachusetts.
2. An analysis of long term trends in aquatic life, recreational and aesthetic use assessments in wadeable non-tidal perennial streams of Massachusetts.

Survey Design: The survey design is facilitated via Generalized Random Tessellation Stratified Design (GRTS), made available by EPA, Corvalis, OR. The design characteristics (as taken from the EPA-ORD-NHEERL-WED-Aquatic Resource Monitoring webpage) include:

1. Spatially balances sample across the resource (improved precision)
2. Enables design-based estimators including variances
    a. Precise control over inclusion probabilities

b. Element & region variable probability assignment
c. Joint inclusion probability can be determined

3. Controls sample and subsample spatial balance
4. Nested subsamples easily selected
5. Unified theory for point, network, and areal resources such as lakes, streams, and coastal waters

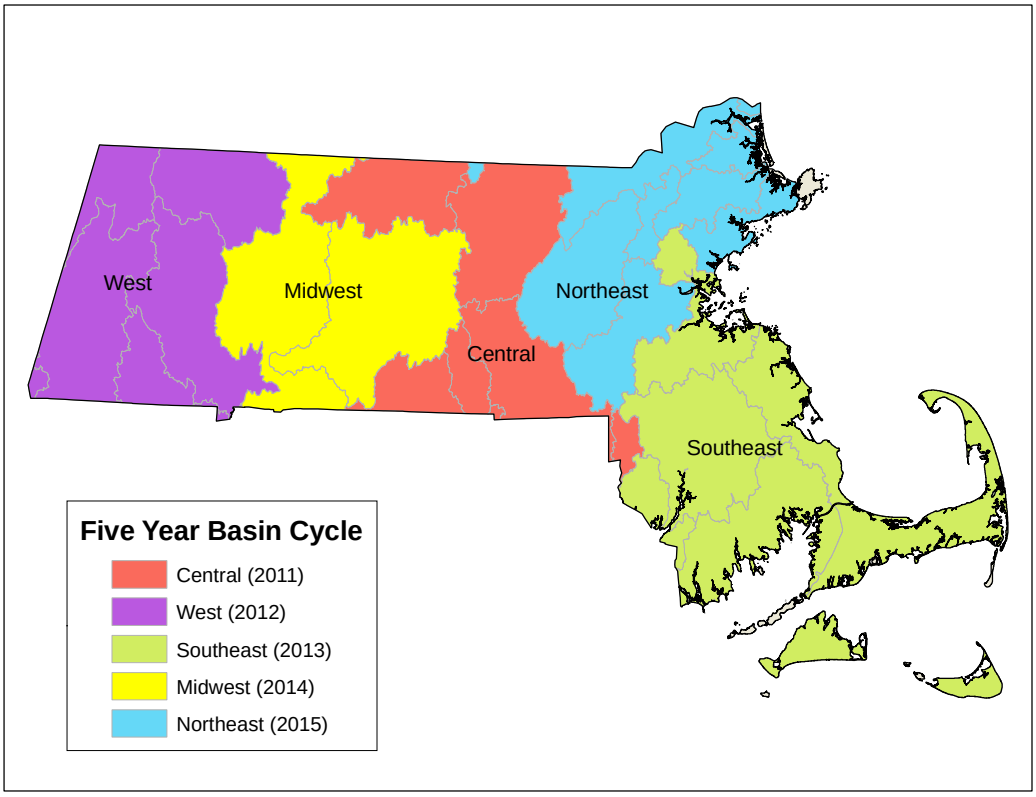


Figure 5. The basin cohorts that represent the stratification boundaries in the Probabilistic survey design for rivers/streams (2011-2015).

Target Population: The target population is all wadeable 1st – 4th Strahler Order non-tidal perennial rivers and streams within the Commonwealth of Massachusetts. A stream/river is defined as a flow of water confined in a defined channel (bed and banks) under normal flow conditions. Artificial manmade channels such as canals and pipelines are not included in this definition unless the origins of the manmade feature was a natural stream feature and recognized as such in previous classifications. Stream orders from 1st to 4th (Strahler Order) encompass approximately 95% of the non-tidal perennial (continuous flow in part of the stream bed all year around during normal rainfall years without chemical/physical effects from tidal cycles) river miles in Massachusetts. Streams shall be shallow enough that a representative sample of the indicator can be collected during the index period under normal hydrological condition.

Sample Frame: The target population is stratified into five separate groups or strata. The spatial boundaries for the five strata are defined by grouping the 27 basins identified in the existing Massachusetts 5-Year Basin Cycle into five basin cohorts (Figure 5). The goal of the groupings is to provide operational efficiency and balance the number of river miles and sampling effort in each cohort. A 5-year rotating basin design is used for the sampling allocation with one basin cohort or design stratum sampled each year. This design will provide statewide coverage after 5 years, with the completion of the 2015 sampling year.

The sample frame was derived from the National Hydrography Dataset (NHD), in particular NHD (1:24,000). The University of Massachusetts Amherst, under contract to MassDEP, enhanced the NHD, creating feature type (FCODE) subcategories and calculating Strahler stream order for each reach. The feature types were the main instrument used to identify which segments in NHD were included in the sample frame. More information, including a description of each FCODE and whether it was included or excluded from the sample frame, can be found in the 2015 SAP (Appendix G).

Stratification: The sites were stratified by basin group (central, west, midwest, southeast, northeast)

Multi-density Categories: Unequal selection probabilities were used to create multi-density categories and allocate sites equally among Strahler Orders 1st, 2nd, 3rd, and 4th.

Panels: Single Panel

Sample Size: The expected sample size is 32 sites with an oversample of 128 sites.

Site Use: Assume the base design has 32 sites. Sites are listed in siteID order and must be used in that order within each stratum. All sites that occur prior to the last site used must have been evaluated for use and then either sampled or reason documented why that site was not used. As an example, if 32 sites are to be sampled and it required that 61 sites be evaluated in order to locate 32 stream sites able to be sampled, then the first 61 sites in siteID order would be used. It is also permissible to replace sites within each stratum.

The primary objective at each site will be to collect sufficient data to assess, using WPP assessment methodology, the status (support/impaired) of aquatic life, recreational and aesthetic uses.

Table 6. Indicators sampled at probabilistic river and stream sites

INDICATORS	SAMPLE FREQUENCY (MINIMUM)
Bacteria (E. coli)	5
Nutrients (TN,TP, Ammonia)	5
Chloride	5
Color	5
Turbidity	5

INDICATORS	SAMPLE FREQUENCY (MINIMUM)
Total Suspended Solids	5
Dissolved Oxygen Probe Deploys (48-120 hours)	3
Temperature Probe Deploys (July-September)	1
Habitat Assessment	1
Fish Community	1
Macroinvertebrate Community	1

Evaluation Process: The survey design weights that are given in the design file assume that the survey is implemented as designed. Typically, users prefer to replace sites that cannot be sampled with other sites to achieve the sample size planned. The site replacement process is described above. When sites are replaced, the survey design weights are no longer correct and must be adjusted. The weight adjustment requires knowing what happened to each site in the base design and the over sample sites. EvalStatus is initially set to "NotEval" to indicate that the site has yet to be evaluated for sampling. When a site is evaluated for sampling, then the EvalStatus for the site must be changed. See the site evaluation SOP (CN 306.0)

Statistical Analysis: Any statistical analysis of data must incorporate information about the monitoring survey design. In particular, when estimates of characteristics for the entire target population are computed, the statistical analysis must account for any stratification or unequal probability selection in the design. Procedures for doing this are available from the Aquatic Resource Monitoring web site (http://www.epa.gov/nheerl/arm). A statistical analysis library of functions is available from the web page to do common population estimates in the statistical software environment R.

The statistical analysis of the data will be conducted with *spsurvey*, a software package developed by EPA EMAP Design Team. The spsurvey library is used with the R statistical program and is capable of selecting sites based on GRTS for probabilistic surveys and calculating population estimates using data collected during the survey. The primary product of the statistical analysis is estimate on the portion of the target population in each assessment category (Support, Impaired, and Not Assessed). As the data collection in each design stratum is completed, the data will be analyzed for the individual stratum and then added to the data from any other stratum within the 5-year cycle and analyzed together. The design enables the calculation of population estimates on an annual and regional basis with moderate precision (+/- 3 to 15 percent with 90% confidence) and on a statewide basis after 5 years with a higher precision (+/- 1%-7% with 90% confidence).

B1.5 Probabilistic Sampling Design: Lakes & Ponds (2016-2018 PROPOSED)

Probabilistic-based sampling of lakes and ponds by DWM-WPP is currently planned for 2016-2018. See addendums to this QAPP for more information on this project.

B1.6 Targeted Sampling Designs: (2015-2019)

The Massachusetts Targeted Monitoring Program (TMP) is a component of the state water monitoring strategy that uses targeted monitoring sites to achieve monitoring objectives. The types of monitoring objectives that can be addressed within TMP includes source identification, stressor identification, trend analysis, TMDL development, water quality criteria/biocriteria development and 303(d) list development. The TMP is typically implemented on a full five year cycle in conjunction with the other components of the monitoring strategy, but can also be done on a project basis outside the five-year cycle. The major basins in the state are regionally assigned to five groups with each group containing an approximately equal quantity of river miles. During each year of the five year cycle, one basin group will be monitored by Massachusetts Department of Environmental Protection (MassDEP), Division of Watershed Management (DWM), Watershed Planning Program (WPP) personnel thus covering the entire state in five years (Figure 1).

River and stream surveys are typically performed during low-flow, dry-weather conditions, which more closely approximate the worst-case scenario with respect to the potential for impairments. Planned surveys are conducted in both dry and wet weather, and surveys are cancelled only when wet weather conditions result in unsafe sampling conditions (e.g., extremely high streamflows). Due in part to the difficulties planning and implementing wet weather surveys, any wet weather data collected is usually unplanned.

River & stream water quality surveys generally consist of five or six monthly sampling events from April 1 to October 15 (primary contact recreation period) on rivers and streams. Typical analytes include pH, dissolved oxygen, temperature, conductivity, turbidity, total suspended solids, true color, chloride, nutrients (TP, TN, NH3-N), dissolved metals and indicator bacteria (*E. coli* for freshwater and Enterococci for coastal areas). Sampling locations for rivers and streams are intended to represent lotic conditions, although some locations in and near wetlands may also represent wetland water quality conditions. River surveys are sometimes supplemented by wastewater discharge sampling, which serves to document pollutant loading from point sources to the river at the time of the survey and to assess compliance with NPDES discharge permit limits. Stream discharge measurements may be made at selected stations to supplement data from the United States Geological Survey (USGS) stream gages. Discharge measurements provide data for the calculation of pollutant mass loadings, as well as for assessing the impacts on stream biota of low-flow conditions resulting from drought and/or water withdrawals. Additional site-specific data may also be collected for the development of water quality models. These data may include sediment oxygen demand, nutrient flux and nutrient partitioning, and metal toxicity determinations.

The biological monitoring component in rivers typically consists of habitat assessments and surveys to collect macroinvertebrates, fish, aquatic plants and periphyton. These assessments help determine aquatic life use-support status.

The Rapid Bioassessment Protocols (RBPs), based on those developed by the EPA, are used to monitor the health of benthic macroinvertebrate communities in wadeable streams. These methods were developed to minimize laboratory time requirements for taxonomic identification and enumeration of benthos. Kick-net samples are collected at sites for

upstream/downstream comparisons, for comparisons against a regional or surrogate reference, or for long-term trend monitoring. Two different levels of analysis are employed, RBP II or RBP III, depending on the objectives to be served. Based on scoring of several metrics, three categories of impairment are discerned by the RBP II (nonimpaired, moderately impaired, and severely impaired), while the RBP III distinguishes between four (nonimpaired, slightly impaired, moderately impaired, severely impaired). Benthic macroinvertebrate RBPs are conducted at up to 50 sampling sites per year.

The analysis of the structure and function of the finfish community as a measure of biological integrity is also a component of the water quality monitoring program. Fish community data quality and comparability are assured through the use of qualified fisheries professionals and the application of consistent methods. The Department utilizes a standardized method based on the EPA Rapid Bioassessment Protocol V (RBP V) to improve data comparability among wadeable sampling sites throughout the state. The fish collection procedures employ a multi-habitat approach that allows for sampling of habitats in relative proportion to their local availability. Electrofishing has generally proven to be the most comprehensive and effective *single* method for collecting stream fishes, and is, therefore, the preferred method for obtaining a representative sample of the fish community at each sampling site. Fish (except young-of-the-year) collected within the study reach are identified to species (or subspecies), counted, and examined for external anomalies (i.e., deformities, eroded fins, lesions, and tumors). Aquatic life use-support status is derived from knowledge of the environmental requirements (i.e., water temperature and clarity, dissolved oxygen content, etc.) and relative tolerance to water pollution of the fish species collected.

Algae represent a third community that is typically assessed as part of the biomonitoring efforts. The analysis of the attached algae or periphyton community in shallow streams or the phytoplankton in deeper rivers and lakes employs an indicator species approach whereby inferences on water quality conditions are drawn from an understanding of the environmental preferences and tolerances of the species present. Algal indicators of the presence of elevated metals concentrations, nutrient enrichment, or other pollutants are noted. Because the algal community typically exhibits dramatic temporal shifts in species composition throughout a single growing season, results from a single sampling event are generally not indicative of historical conditions. For this reason the information gained from the algal community assessment is more useful as a supplement to the assessments of other communities that serve to integrate conditions over a longer time period. In some instances, where information pertaining to primary production is required, algal biomass analysis or chlorophyll determinations may be performed. Results of these analyses are used to evaluate the trophic status of lakes, ponds, and impoundments. Similar information from riverine and coastal waters is used to identify those waterbodies subjected to excessive nutrient enrichment. Results at public drinking water reservoirs can indicate whether land uses need to be addressed as sources of nutrients and can help water suppliers adjust treatment processes if necessary.

Assays for the presence of toxic contaminants in fish tissue is another important WPP monitoring element. These data help assess the risk to human consumers associated with the consumption of freshwater finfish. In the past fish collection efforts were generally

restricted to waterbodies where wastewater discharge data or previous water quality studies indicated potential toxic contamination problems. More recently concerns about mercury contamination from both local and far-field sources have led to a broader survey of waterbodies throughout Massachusetts. In both cases, the analyses have been restricted to edible fish fillets. This "Toxics-in-Fish" monitoring program is a cooperative effort of the Department of Environmental Protection, the Department of Fish and Game (DFG), and the Department of Public Health (DPH). Uniform protocols, designed to assure accuracy and prevent cross-contamination of samples, are followed for fish collection, processing and shipping. Fish are typically obtained with electrofishing gear or gill nets. Lengths and weights are measured and fish are visually examined for tumors, lesions, or other indications of disease. Data are provided to the DPH, which is the agency responsible for performing the risk assessments and issuing public health advisories. (Other tissue assays to trace the fate and transport of toxic contaminants in the aquatic environment are performed on a limited basis, primarily to support waste site clean-up activities)

Lake sampling consists of biological surveys of the macrophyton (i.e., aquatic vascular plants) community, "in-situ" measurements using metered probes, and limited water quality sampling to provide data for the calculation of TMDLs or the derivation of nutrient criteria. Lake surveys typically include sampling and measurements for chlorophyll a, Secchi depth, nutrients and dissolved oxygen/temperature profiles. Lake surveys are generally conducted on multiple days for TMDL development and consist of bathymetric mapping; physical, chemical and biological sampling of the open water areas, tributary stream(s), and outlet; and a quantitative and qualitative mapping of the aquatic macrophyton community. The lake is sampled during the summer months when productivity is high. Some limited use assessments may be accomplished through the lake monitoring described above depending upon the scope of the individual lake surveys. Cover estimates and species distribution of macrophytes, and measurements of water column transparency support a limited assessment of the recreational uses. Finally, macrophyte surveys are used to document the spread of several non-native and potentially nuisance aquatic plant species that are known to be present in Massachusetts.

Because bacterial contamination is one of the leading causes of impairment in Massachusetts waters, special consideration has recently been given to locating sources of bacterial contamination of waterways, and then working with regional and local parties on potential corrective actions. In order to efficiently and correctly track down the likely source(s), DWM has formulated and tested field and lab protocols for use by DWM-regional staff. Conceptually, the "toolbox" approach is used to:

- Identify and prioritize contaminated subwatershed(s) for locating sources;
- Characterize the priority subwatershed(s);
- Design and carry out screening-level sampling; and
- Evaluate screening level data and design and perform source location monitoring.

This targeted and adaptive monitoring design includes the use of GIS land-use coverages, other overlays, and color ortho photos to identify potential sources, and the use of both dry weather and wet weather sampling (to determine the contribution of stormwater runoff). The

monitoring design employs an iterative sampling process that involves the adjustment of sampling site locations in response to a timely review of previous results in an effort to narrow down the exact location of the bacteria sources. The sampling includes the bracketing of suspected point sources (e.g., pipes, ditches, culverts) and non-point sources (e.g., specific land-use types, small tributaries, neighborhoods). Sampling stations also include base stations established during screening level sampling to document and track reference conditions. A key element of this project is the capacity to analyze a large number of samples while maintaining rapid turn-around time between the collection of those samples and the availability of the analytical results. This is essential for the determination of how to proceed with subsequent sampling. To this end, the Department utilizes the IDEXX, Inc. Colilert® and Enterolert® testing system at each regional office (located in laboratory facilities at the western, central, southeast and northeast DEP regional offices), subject to available resources. Use of this EPA-approved technology lessens the burden placed on the Department's Wall Experiment Station for bacterial analyses and decrease sample delivery time. Sampling results, associated subwatershed information, and local input are used to identify sources of bacteria contamination to the extent of the Department jurisdictional authority, at a minimum. Appropriate authorities are then notified of the suspected source(s) and recommendations for further source tracking work (e.g., for likely illicit discharges to storm sewer), clean-up, or enforcement action may be made.

Targeted monitoring can also be employed to demonstrate non-point source (NPS) program effectiveness by identifying, through monitoring, waterbodies where improvement can be measured as a result of NPS Program activities. Due to resource limitations, such targeted sampling is not designed to demonstrate BMP or project effectiveness, but program effectiveness. Because the NPS program is a partnership program, data from other sources outside DEP can also be used to meet program goals.

Special project monitoring is also sometimes performed by WPP due to priority issues of concern, subject to staff availability and other resources. These surveys are usually planned on a "fast track" but with the same attention to quality work in the field and in the lab.

B1.7 Targeted Sampling Design: Reference Site Network (2011-2015)

The Reference Site Network (RSN) is a project focusing on the biological communities (macroinvertebrates, fish, and periphyton) and associated water quality at "reference" or "least disturbed" sites in the northeastern highlands (58) and northeastern coastal plains (59) ecoregions (Figure 6). Sites selected for the network will be monitored each year by Massachusetts Department of Environmental Protection (MassDEP), Division of Watershed Management (WPP) personnel thus providing multiple years of data for each site. The finalized monitoring data will be used by WPP to study the "reference" conditions and intra and inter-year variations of physiochemical parameters and biological communities. This will provide an initial dataset to assist with the development of water quality criteria, biocriteria and tiered aquatic life use (TALU), and the assessment of aquatic life use at MAP2 monitoring sites.

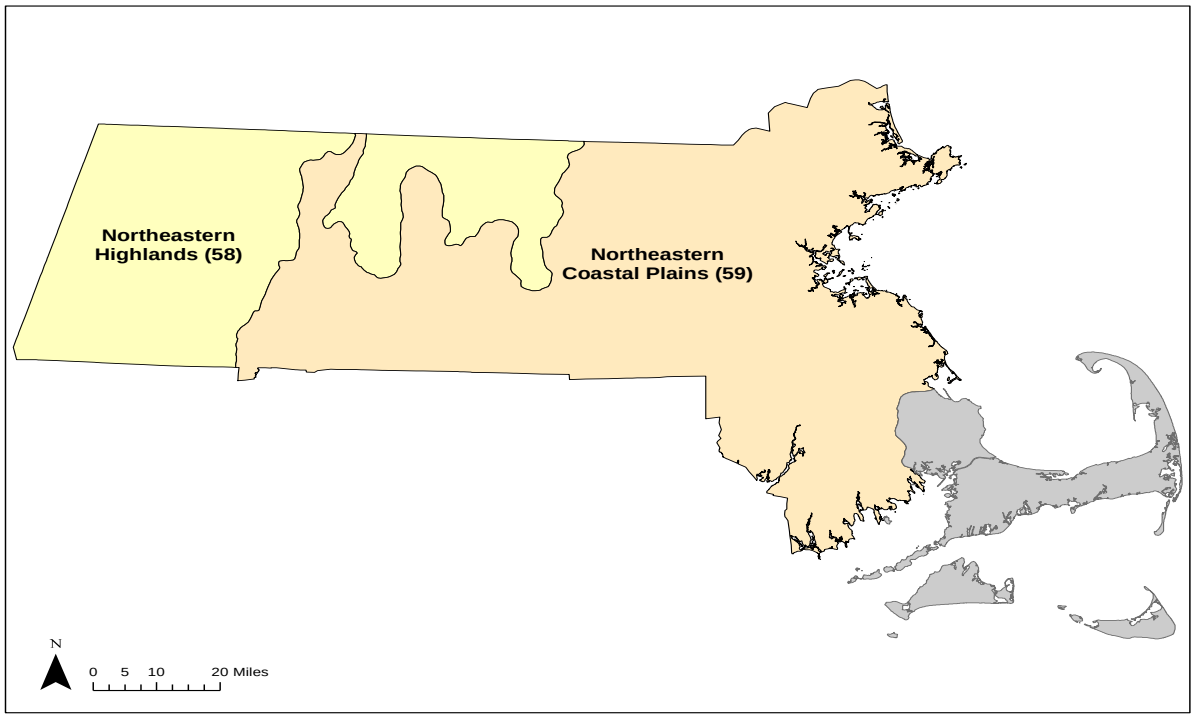


Figure 6. Northeastern highlands (58) and northeastern coastal plains (59) ecoregions

WPP is currently developing biocriteria and exploring the development of tiered aquatic life uses. The implementation of biocriteria and tiered aquatic life uses increases the accuracy and precision of aquatic life use assessments and improves water quality goal-setting processes. Understanding the "reference" condition and inter-year variation within indices of biotic integrity used for assessment is critical for the development and implementation of biocriteria and tiered aquatic life use. Without an understanding of the "reference" condition and variation within the indices, it is conceivable policy decisions could be made (e.g. 303(d) listing, antidegradation) based on a low index score that is due to natural or sampling variation versus an actual impairment or degradation of the resource. The data collected for the RSN will be an initial step in understanding this variation.

The goal of the RSN monitoring surveys is to collect sufficient data at "reference/least disturbed" sites to assess the quality of aquatic life in multiple assemblages. The types of data that are typically collected at each of the sites to reach this goal are:

- Benthic macroinvertebrate community
- Habitat assessments
- Fish community
- Periphyton community
- Nutrients (total phosphorus, total nitrogen, nitrate-nitrite, and ammonia)
- Other Water Quality (chloride, true color, and turbidity)
- Temperature (instantaneous)
- Continuous temperature (year around)

- Dissolved oxygen (instantaneous)
- Continuous dissolved oxygen (4-5 month duration)
- Aesthetics observations

The Reference Site Network utilizes a human disturbance index (HDI) to identify watersheds with the least human disturbance or "reference" watersheds. Candidate "reference" watersheds are selected using the HDI. In the selection process, an attempt is made to select watersheds of varying sizes and geographic locations. Candidate "reference" watersheds are evaluated with field and desktop reconnaissance in late March or early April. Preference is given to watersheds with legacy macroinvertebrate sites that are representative of the watershed. Once the "reference" watersheds are selected, monitoring sites are established in each watershed if a legacy site is not available. For more information on the RSN, see the 2015 SAP.

Following completion of the 2015 monitoring season, WPP will have sampled approximately 28 reference sites statewide.

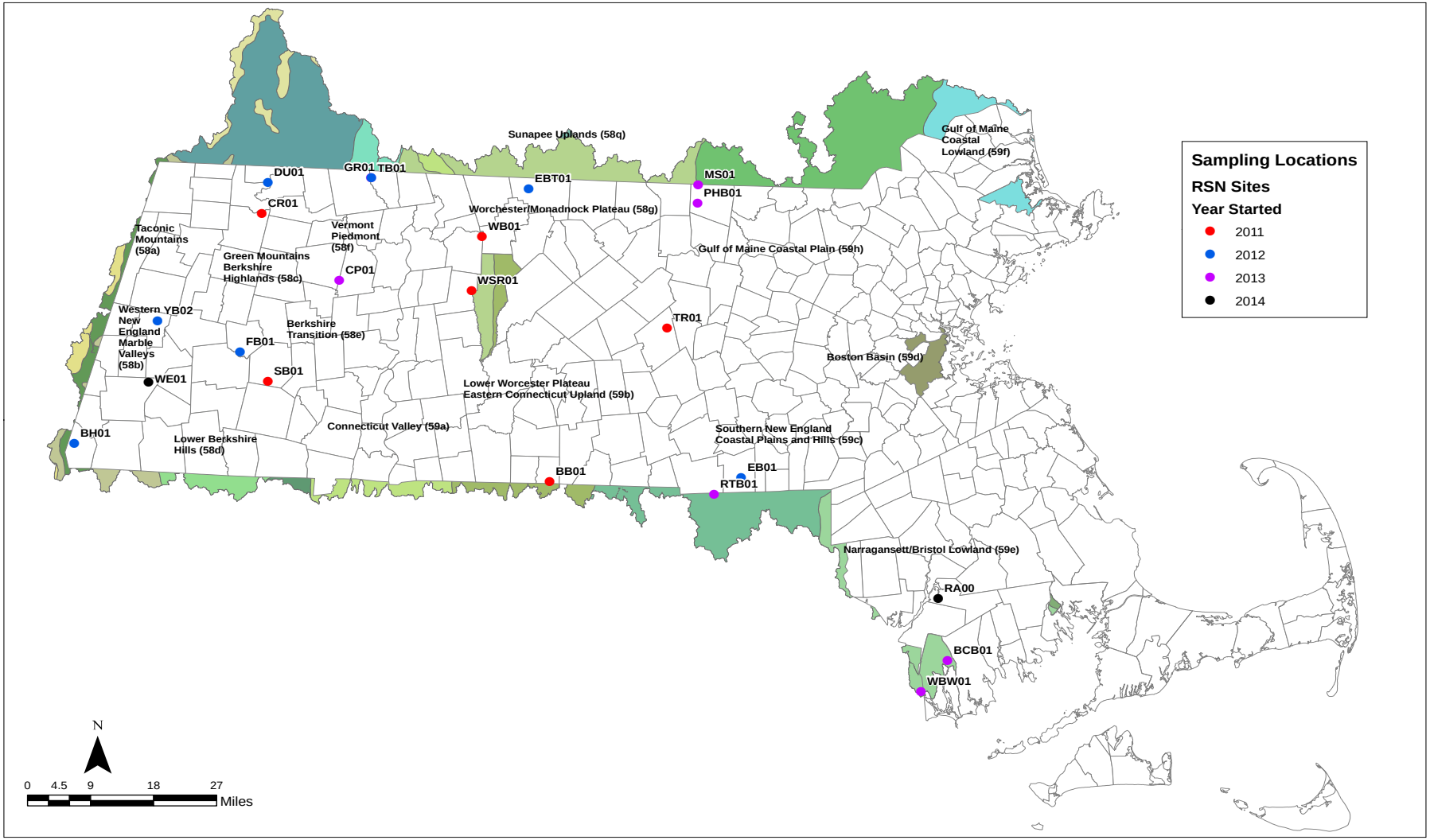


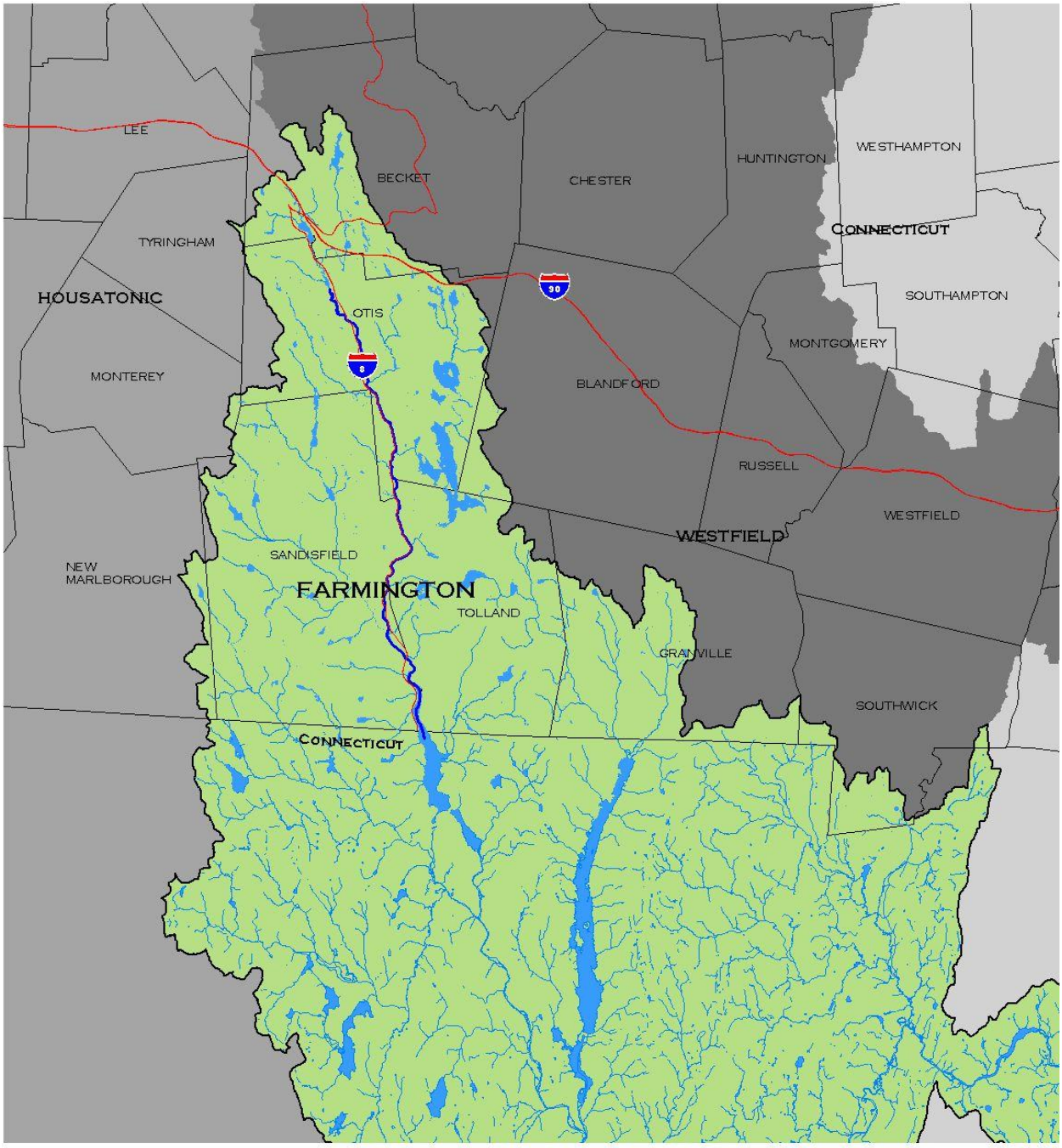
Figure 7. Reference Site Network watersheds, inc. the location of selected monitoring sites (thru 2014) and ecoregions (Level IV)

B1.8 How Data Are Used

In addition to direct uses, such as comparison to State ambient water quality standards or EPA criteria, specific ways in which DWM-WPP's final data are used include but are not limited to:

- Assessment decision-making as directed in the latest Consolidated Assessment and Listing Methodology (CALM)
- Model input (e.g., hydrologic, water quality models)
- Mass balance calculations (e.g., pollutant loading)
- Criteria development (e.g., nutrients)
- Inferential statistics (e.g., probability-based sampling data)
- NPDES permit-writing
- TMDL-related data analyses and determinations
- Coldwater fishery designations
- Freshwater fish consumption advisories (in coordination with MDPH)
- Trend analysis (e.g., fish tissue Hg concentrations, in coordination with MassDEP-ORS)
- Descriptive statistics (e.g., geomeans for bacteria data, minima/maxima for dissolved oxygen and temperature, ANOVA) with or without uncertainty statements
- Future sampling plan development
- Non-DEP studies and data requests (WPP data provided to other groups for their use)
- Evaluation of the effectiveness of water quality programs (such as the NPS Program), based on improvements in water quality or waterbody health.

DWM-WPP's current CALM guidance is available in Appendix E of this QAPP (and in future addendums to this QAPP as the CALM is revised). Because the CALM guidance changes in time based on new or revised assessment procedures, the CALM relevant to 2015-2019 data is not known at this time. Versions of the CALM are specific to bi-annual Integrated List Reports, and document the rationale behind the listing decisions. Regardless of version, the CALM is always generally consistent with the EPA's CALM template (http://www.epa.gov/owow/monitoring/calm.html).



Farmington Watershed

B2 SAMPLING METHODS

B2.1 Sampling-Related SOPs

All WPP field sampling follows the most current and approved DWM Standard Operating Procedures (SOPs), as listed in Table 7, along with applicable standard reference documents used to help formulate them.

Table 7: WPP Field Method SOPs

CONTROL NUMBER(S)	SOP SUBJECT MATTER	APPLICABLE "STANDARD" METHOD REFERENCE(S)
CN 0.2	Field safety	---
CN 1.21	Sample collection (general)	- USGS TWRI Book 9 USGS. National Field Manual for the Collection of Water-Quality Data (1998) - Standard Methods for the Examination of Water and Wastewater (21st edition, 2005)
CN 1.25	GPS data collection	---
CN 1.27/28	Property Access	---
CN 1.3	Use of sample collection pole	---
CN 1.4	Use of bottle basket sampler	---
CN 1.9	LIMS pre-login (WES lab only)	---
CN 3.5	Chlorophyll a sampling	---
CN 4.24	Multiprobe use	- Hydrolab, YSI, Onset manuals
CN 4.28	Hydrolab Quickguide	
CN 4.31	YSI Quickguide	
CN 4.41	Multiprobe deployment	- Hydrolab, YSI, Onset manuals
CN 4.61	Oakton pH-Conductivity Meter	- Oakton meter manual
CN 4.70	Mini-DOT Quickguide	- Mini-DOT meter manual
CN 4.61	Onset DO/T logger Quickguide	- Onset DO/T meter manual
CN 39.2	Benthic macroinvertebrate/Habitat	- Modified RBP (EPA) - USGS TWRI Book 5 (1987)
CN 40.1	Fish collection/preparation for fish tissue analysis	- EPA guidance for fish sampling and analysis for fish advisories (1995) - USGS TWRI Book 5 (1987)
CN 55.0	Secchi transparency	- EPA Volunteer Lake Monitoring methods manual (1991)
CN 58.0	Optical brighteners	---
CN 58.5	Fluorometer use to detect optical brighteners	---
CN 59.5	Decontamination to prevent the spread of invasives	---

CONTROL NUMBER(S)	SOP SUBJECT MATTER	APPLICABLE "STANDARD" METHOD REFERENCE(S)
CN 60.0	Periphyton (benthic algae)	- Modified RBP (EPA) - USGS TWRI Book 5 (1987)
CN 67.2	Macrophyte survey mapping	- USGS TWRI Book 5 (1987) - EPA Volunteer Lake Monitoring methods manual (1991)
CN 68.0-68.6	Flow monitoring SOP and quickguides	- USGS TWRI Book 3 - Sontek, Swoffer, Gurley, Global Water meter manuals
CN 71.0	Sediment sampling	- USGS TWRI Book 9 Chapter A8 (1998)
CN 75.1	Fish Population	- Modified RBP (EPA) - USGS TWRI Book 5 (1987)
CN 82.1	Bathymetric mapping	- Lowrance LMS-240 manual
CN 101.2	Metals sampling (clean technique)	- USGS TWRI Book 9 (1998) - EPA Method 1669 Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels (1996)
CN 103.1	Continuous temperature monitoring	- Onset Stowaway® and ProV2 manuals
CN 103.5	Onset HOBO Shuttle Quickguide	- Onset manual
CN 200.0	Digital camera use	- Kodak and Olympus camera manuals
CN 210.1	Mobile phone use	- Verizon cell phone manual, contract
CN 230.0	Sampling for algal toxins	---

* Information provided in *ITALICS* indicates currently *INACTIVE or PENDING* field methods (not routinely or currently being used)

B2.2 Field Safety

WPP's survey coordinators and crewmembers are trained in field safety issues, use best professional judgment (BPJ) to safeguard crew members, and at no time allow personal health & safety to be compromised. The "SAFETY FIRST" principle applies at all times.

WPP's "standard-issue" Field Kits are brought on each field survey. These kits include miscellaneous items often needed in the field, including safety equipment such as plastic gloves, safety glasses, sunscreen, insect repellant, ivy wash, etc.

First Aid Kits containing basic first aid materials are included in every crew's field gear as standard. In situations where sampling stations are far from the vehicle, crews have been instructed to take the first aid kit to the station.

Training in cardiopulmonary resuscitation/automatic electronic defibrillation (CPR/AED) and basic first aid procedures for WPP survey personnel is strongly encouraged. An Adult

CPR/AED review training course is held annually at DWM-Worcester (CERO) and other regional offices.

Each crewmember is expected to dress appropriately for the season, weather and field conditions, and wear personal protective equipment (PPE) as needed. Each crewmember has also been advised to wear orange, reflective safety vests, especially when sampling in high vehicular traffic areas. These vests are available to staff along with other PPE items. To assist crews in survey preparation, survey trip checklists and field kit checklists are used.

WPP cellular phones are also required "standard" issue for each field survey. These are in addition to any personal cell phones owned by crew members, and ensure availability for emergency use as well as field coordination as necessary.

A WPP "safety officer" has been designated and helps to coordinate procurement of safety equipment, safety training, annual safety reporting and assistance as needed. As of 2015, WPP's interim safety officer is Richard Chase.

B2.3 Field Equipment

A partial list of primary field equipment used by WPP is provided in Table 8.

Table 8: WPP Field Equipment

EQUIPMENT OR SERVICE	CN # REFERENCE	NOTES
Field kits	CN 0.2	Each includes first aid kit
PFDs	CN 0.2	---
Cleats for boots	CN 0.2	For added traction when wading
Cell phones	CN 210.1	---
Digital cameras	CN 200.0	Station photo records, reconnaissance, etc.
GPS units	CN 1.25	Lat/long with WAAS enabling
Hip chains	---	---
Densiometers	---	*Canopy cover measurement. (not regularly-used by DWM).*
Rangefinders	---	---
Multi-probe loggers for unattended deployment	CN 4.4	DO/T primarily. Also pH and conductivity feasible for deployment
4+ parameter multi-probes (attended)	CN 4.24	DO/T/pH/conductivity/etc.
Probe deployment tubes	CN 4.4	Multiple sizes depending on logger type deployed
Single probes	CN 4.24 CN 4.61	e.g., temperature, conductivity, etc.
Van Dorn bottle samplers	CN 1.21	---
Chlorophyll a sampling tubes	CN 3.5	Rigid tube/fixed depth and flex tube/variable depth
Sonar depth sounder	CN 82.1	---

EQUIPMENT OR SERVICE	CN # REFERENCE	NOTES
Bottle baskets	CN 1.4	For bridge drops
Sample collection poles	CN 1.3	Extension poles to sample hard to reach areas
Continuous temperature probes	CN 103.1	24 hour continuous recording at 30 min intervals for 3-6 month durations per site (typ.)
Flow meters	CN 68.0	Propeller and acoustic Doppler technology
Staff gages	CN 68.0	Each 3 feet long
Dye testing	CN 68.0	For time-of-travel, mixing zone studies, etc.
Portable peristaltic pump	CN 1.21	For use in hard-to-sample areas, for field-filtration, etc.
NIST-traceable thermometers	CN 103.1	Field/lab QC for temperature
Sediment samplers	CN 71.0	---
ISCO auto-samplers	---	---
Backpack electroshockers	CN 75.1	---
Electroshocking boat	CN 75.1 CN 40.1	---
Large sampling boats	---	e.g., Boston Whaler
Small sampling boats	---	Canoes and rowboats
Outboard boat motors	---	Including one electric motor
True color analysis (field/lab)	CN 2.3	Mainly for in-lab use (2 color wheels and one HACH spectrophotometer)
Portable turbidimeter (field/lab)	CN 95.1	Mainly for in-lab use
Colilert® / Enterolert® analysis (field/lab)	CN 198.0	Mainly for in-lab use (2 incubators)
Fluorometer (bacteria source tracking)	CN 58.5	Primarily for in-lab use only
Phycocyanin probe	CN 409.0	Pigment concentrations correlated to cyanobacteria levels (and associated potential for cyanotoxins)
misc. test kits (e.g., detergents, microcystins)	Varies	Mainly for in-lab use . Follow manufacturer's instructions.
QC/PT audit samples	---	Quantitative QC/Proficiency Test (PT) samples for nutrients (TP, TN, NH3, etc.), chlorophyll a, bacteria (e.g., *E. coli*), metals, etc.
Contract labs for sample analyses	---	Use of selected labs under a State-vendor Master Services Agreement for Laboratory Services (or individual RFR)
* Information provided in *ITALICS* indicates currently *INACTIVE or PENDING* field equipment (not routinely or currently being used)		

B2.4 Bottle Groups, Types and Preservatives for Typical Analytes

Bottle group designations, associated parameters, and bottle type and preservative requirements for water, sediment and tissue sample analytes are shown in Table 9.

B2.5 Field Sample "OWMID #" Allocations

Sample identification numbers are systematically allocated by WPP's Database Manager when needed. Printed OWMID # labels are provided to each project Principle Investigator for use on the fieldsheet forms. This process helps to avoid using ID#s more than once, misinterpretation of written ID#s, and other sample ID-related problems.

For Rivers and other non-lake surveys, six digit ID# (e.g., 36-2105) labels are affixed on the fieldsheets for each separate sample, using designated, 2-digit project prefixes.

For Lake surveys, one five-digit ID# (e.g., LB-268_) label is physically affixed on the fieldsheet in the top corner of pg.2. This ID# controls up to 10 samples IDs, where the last digit is filled in by the survey lead (e.g., LB -2681) for each separate sample (with "0" always being the multi-probe ID).

B2.6 Field Quality Control (see B5)

B2.7 Field Documentation (see A9)

Table 9: Bottle Group Codes, Container Types and Field Preservation Methods for WPP Samples [1]

ANALYTE GROUP & BOTTLE CODE		PARAMETERS	BOTTLE TYPE(S) [2]	SPECIAL PRESERVATIVE [3]
WATER & BIOLOGICAL				
Chemistry	C	Alkalinity, hardness, turbidity, color	HDPE (500 mls)	None, except for hardness by SM 2340B where HNO3 is used to pH < 2
Chemistry (WPP)	R	Turbidity, color , hardness (kit), etc.	HDPE (120-250 mls)	None
Nutrients +	N	Total phosphorus, total nitrogen, ammonia nitrogen, nitrate-nitrite nitrogen (and chloride)	HDPE (250-500 mls)	H2SO4 (9N, 1 ml.) to pH < 2
Phosphate fractions	P1 P2	Total Reactive P Dissolved Reactive P	HDPE (250-500 mls)	None
Solids (in water)	S	Total suspended solids, total solids, total dissolved solids	HDPE (1000 mls)	None
Bacteria	B	*E. coli* and Enterococci (typically)	Sterile, sealed plastic (120-250 mls)	Sodium thiosulfate ($Na_2S_2O_3$) for dechlorination as needed
Human Markers of Sewage Source	HMSS	*E. coli,* fecal coliform, Enterococci, Bacteroidetes and Enterococci human markers, caffeine and FWAs	Amber glass 1000 mls; 2 liters per site (1L for micro/FWAs and 1L for caffeine); extra 2 liters at one site for caffeine lab QC	None (sterile bottle for micro); WES lab prepared
Chlorophyll	I	Chlorophyll a	HDPE (500-1000 mls)	None
Algae (in water)	A	Phytoplankton ID and enumeration	HDPE (120-250 mls)	Lugol's solution
Cyanotoxins	CYANO	Microcystins (total), MC-LR	Amber glass (120 mls)	None
Misc. Ions	*C2*	*Sulfate, etc. (by 300.0)*	*HDPE, 500-1000 mls.(C)*	None
FWA	FWA	Fluorescent Whitening Agents	Amber glass (500 mls)	None
Toxicity	*TOX*	*various toxicity end points, including whole effluent toxicity and ambient toxicity*	*PE (sufficient volume to meet lab analytical reqts.)*	*None*
UV-Absorbing	*UVA*	*UVA254*	*HDPE, 500-1000 mls.(C)*	None

ANALYTE GROUP & BOTTLE CODE		PARAMETERS	BOTTLE TYPE(S) [2]	SPECIAL PRESERVATIVE [3]
Metals (dissolved)	M	Al, Sb, As, Be, Cd, Cr, Cu, Pb, Ni, Se, Ag, Mn, Co, Mo, Ba, Fe, V, Tl, Zn, Ca, Mg and hardness calculation (typical ambient water quality suite); also Na, K, Si by 200.7	Certified, trace-clean HDPE (500 mls)	1:1 HNO3 to pH < 2 [4]
Metals (total recoverable)	M2	Same as above (unfiltered)	Certified, trace-clean HDPE (500 mls)	1:1 HNO3 to pH < 2 [4]
Organic Carbon	*OC*	*Total/Dissolved Organic Carbon*	*Amber glass, 250 mls. (D)*	*Field-filtered; HCl to pH<2 (in bottle);*
Oxygen Demand	*OD*	*BOD, COD, TOD*	*Glass "BOD" bottles (300 ml with glass stopper)*	*None for BOD* *1:1 H2SO4 to pH < 2 for COD*
Volatile Organics	*VOC*	*Various*	*Glass with Teflon-lined septum caps (40 mls)*	*1:1 HCL (no headspace)*
Hydrocarbons	*HC*	*Oil and grease, total petroleum hydrocarbons, various poly-aromatic hydrocarbons*	*Amber glass (1000 mls)*	*1:1 H2SO4 to pH < 2*
PCBs and Pesticides (in water)	*PCB*	*Various*	*NA*	*None*
Extractable Organics	*EOC*	*Various*	*Amber glass (1000 mls)*	*None*
Perchlorate	*PER*	*Perchlorate*	*HDPE (120 mls)*	*None*
Chlorophyll (in benthic algae)	I	Chlorophyll a	jars (containing acetone; at lab after scraping subtrate)	90% acetone in a buffered aqueous solution (at lab)
Benthic algae	A	ID and enumeration	Glass vials (2-4 dram with screw type caps) in a 1 liter jar half filled with in-stream water to keep the vials from heating.	M3 or Lugol's (as needed) Refrigerated/iced at lab until analysis
Benthic Macroinvertebrates	---	ID and enumeration	2 liter wide-mouth leak-proof Nalgene bottle. Specimen vials (in 1l Nalgene PMP jars)	Denatured 100% reagent alcohol (5% methanol, 5% isopropanol, 90% ethanol) . Refrigerated/iced (if not preserved)
FISH TISSUE				
Metals	M	Mercury, *Lead, Selenium, Arsenic, Cadmium*	HPDE cup (at lab after processing)	Ice/refrigeration @ < 6C in dark, followed by freezing

ANALYTE GROUP & BOTTLE CODE		PARAMETERS	BOTTLE TYPE(S) (2)	SPECIAL PRESERVATIVE (3)
PCBs and Organochlorine Pesticides (fish)	PCB	Various (including PCB *congenors* and arochlors)	Aluminum foil (at lab after processing)	Ice/refrigeration @ < 6C in dark, followed by freezing
SEDIMENTS				
Sediment toxicity (e.g., Hyalella azteca, Chironomus tentans)	*TOX*	---	*HDPE plastic or glass; 3 liters if two species test; or 2 liters of one specie test*	*Ice/refrigeration @ < 6C in dark*
AVS/SEM (acid-volatile sulfide/ simultaneously-extracted metals)	---	---	*4 oz. WM amber glass w/ Teflon-lined cap (120 ml)*	*Ice/refrigeration @ < 6C in dark*
Polycyclic aromatic hydrocarbons (PAHs)	*PAH*	*Various*	*4 oz. WM amber glass w/ Teflon-lined cap (120 ml; > 200 grams)*	*Ice/refrigeration @ < 6C in dark*
PCB arochlors	*PCB*	*Various*	*4 oz. WM amber glass (120 ml; > 200 grams)*	*Ice/refrigeration @ < 6C in dark*
Chlorinated Pesticides	*PEST*	*Various*	*4 oz. WM amber glass (120 ml; > 200 grams)*	*Ice/refrigeration @ < 6C in dark*
TOC/DOC	*SOC*	---	*4 oz. WM amber glass*	*Ice/refrigeration @ < 6C in dark*
Metals (total concentrations for each element)	*M*	*Various*	*plastic or glass 4 oz./120 ml.*	*Ice/refrigeration @ < 6C in dark*
% solids/ % water	---	---	*4 oz. WM amber glass*	*Ice/refrigeration @ < 6C in dark*
Grain size distribution	---	---	*1 liter*	*N.A.*
Nutrients (TP, TN)	*N*	*TP, TN*	*HDPE plastic or glass*	*Ice/refrigeration @ < 6C in dark*

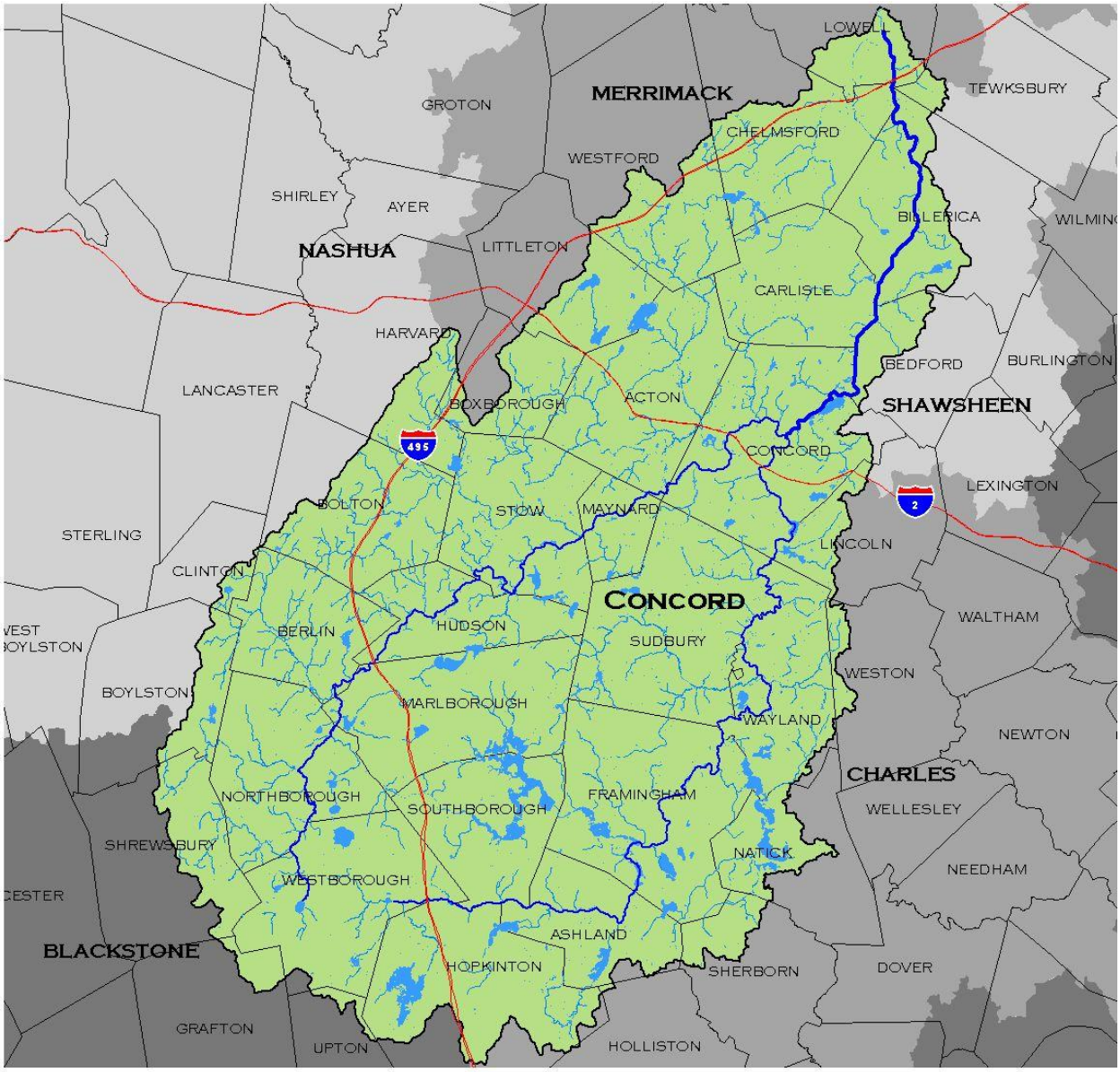
(1) For any given analyte, bottle type and preservative recipe are generally independent of analytical method. Differences in required preservative within a bottle group are addressed on a case-by-case basis.

(2) In all cases, new, pre-cleaned bottles are used.

(3) Wet ice to < 6 deg. C in dark cooler is standard short-term storage for all water samples

(4) Typically occurs at the lab within 24 hours

(5) Information provided in *ITALICS* indicates currently *INACTIVE* parameters (not routinely or currently being analyzed for)



Concord Watershed

B3 SAMPLE HANDLING AND TRACKING

B3.1 Assignment of LOCATION ID#s (Station ID and Unique ID)

Prior to each survey, the Survey Coordinator must verify that each station to be visited has been given the following two location-specific IDs: 1) Station ID# (e.g., BB01) and more importantly, 2) Unique ID# (e.g., W0657). These ID#s are based on the Water Body System (WBS) database of monitoring stations. Both ID #s are used on the station-specific DWM fieldsheets. If unplanned station visits occur for which the Station ID and/or the Unique ID were not provided, the Survey Coordinator shall get both immediately following the survey, and insert the IDs onto the appropriate fieldsheet.

B3.2 Assignment of SAMPLE ID#s ("OWMID")

See B2.5. The Database Manager provides each Survey Coordinator with a season's worth of sample ID# or "OWMID"s (on pre-printed labels—one ID per label). The Survey Coordinators are responsible for avoiding the use of duplicate OWMIDs by using these labels on the fieldsheets (one label per sample). Multi-probe data at each station also get separate Sample IDs. If the ID label sheets are lost, new sheets containing new numbers are generated. Typically, each survey crew lead is provided with an extra ID label sheet for use as needed (e.g., in the survey guidebooks, so that they are returned). If a labeling mistakeis made, a new label is affixed over the old one.

B3.3 LIMS Pre-login

For samples planned to be delivered to the WES lab, samples are pre-logged into the WES LIMS database using local access to the LIMS Sample Master Pro software. The specific procedures for pre-logging samples in this way are provided in CN 1.9. Based on their unique SAPs, survey coordinators plan their use of OWMID #s using a MS Excel spreadsheet that is used to mail-merge to the LIMS login process (LIMS-link). This is required for all DWM surveys (except DWM-regional monitoring). If changes occur during or after the survey, the survey coordinators coordinate with WES to ensure that the COC paper record and the final LIMS entries (by WES) are accurate and identical.

B3.4 Sample Bottle Labeling

Bottle labels are printed during the WES LIMS pre-login process (both for samples going to WES, as well as for samples going to other labs). For non-WES lab samples, the LIMS pre-login process is used to generate labels only (samples are not actually pre-logged into LIMS). Use of the LIMS-Link procedure generates printed sample bottle labels for the bottle and for the caps with the sample-specific OWMID# and Lab Sample # on the labels. As part of survey preparation, these pre-printed bottle labels are affixed to bottles prior to the bottles getting wet. An example of the required container label displaying the OWMIDs is shown in Appendix K. To minimize sample bottle mixups, labeled bottles are placed in individual bottle bags--- each bag containing all the bottles for each specific station.

B3.5 Sample Preparation (following Collection)

Depending on the analyte, samples may need to be prepared for later analysis (e.g., filleting fish for tissue samples, filtering for true color, chlorophyll a, soluble nutrients). For water samples, this usually involves filtration to remove suspended solids or generate a non-filterable residue (e.g., via 0.45u filter). In certain instances involving dissolved analyte fractions (e.g., total dissolved phosphorus), every attempt is made to filter samples immediately after collection in the field. Where this cannot be accomplished, samples are filtered as soon as possible. In any case, the timing of filtration is noted on the fieldsheet and COC form.

B3.6 Sample Preservation and Transport

Most samples are typically delivered to the State laboratory, Wall Experiment Station (WES) in Lawrence, Massachusetts. Samples can also be delivered to one or more contract labs for analysis. Samples for color, turbidity, chlorophyll a, aquatic plants, benthic macroinvertebrates and *E.coli* and/or Enterococci by Colilert® / Enterolert® are delivered to the DWM lab in Worcester, MA. If samples are delivered by a person(s) that was not involved in taking the sample, the COC form will be filled out and signed off during the transfer.

All samples taken are preserved in coolers containing wet ice to <6 deg. C. until delivered to the lab.

Bacteria samples transported in coolers are kept in plastic bags immersed in ice to keep them dry. All bacteria samples are delivered to the appropriate lab(s) for analysis ASAP and within 6 hours of collection. Typically, bacteria sample bottles contain sodium thiosulfate for dechlorination, in case of residual chlorine. (The presence of residual chlorine is site-specific; lack of sodium thiosulfate in sample bottles is only allowed when there is no possibility of residual chlorine being present at each location.)

Nutrient (e.g., TP, TN, NH3-N, NO3-NO2-N) samples are preserved with sulfuric acid (9N) immediately after collection. Metals samples are preserved with HNO3 to pH<2 at the WES lab within 24 hours. For all preservation requirements for DWM samples, see Table 10.

B3.7 Sample Delivery (and Use of Chain-of-Custody (COC) Forms)

When field samples arrive at the lab, the DWM staff relinquishes custody of samples to the laboratory staff. The sample containers are removed from the shipping or transportation cooler and visually inspected for damage such as leakage, breakage, or contamination. The samples received are then compared with accompanying custody and analysis specification forms to make sure that the paperwork agrees with the labels on each sample container. Standard chain-of-custody (COC) forms are used to transfer sample custody from DWM staff to the WES, DWM or other labs as appropriate. All individuals who handle samples are

required to sign and date the COC forms. After samples have been officially transferred and assigned laboratory identification numbers, they are stored, distributed and analyzed according to the lab's QA Plan and SOPs.

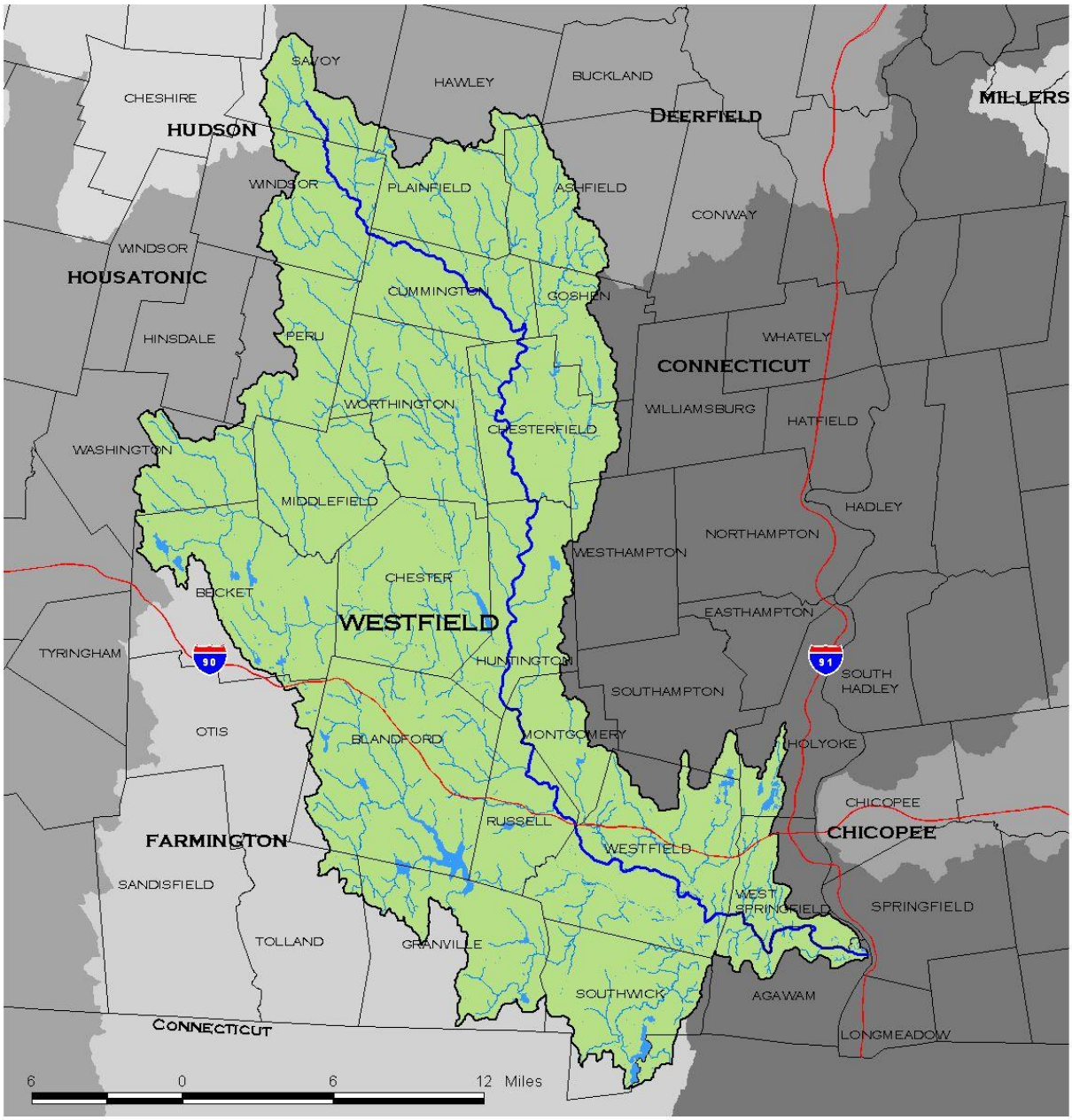
The proper procedure for filling out a COC form and transferring sample custody is documented in the respective laboratory Quality Assurance Plans, and in this QAPP. A copy of the WES SOP for filling out the COC form is posted in the DWM-Worcester lab. In practice, the survey coordinators prepare the COC forms automatically using the WES LIMS pre-login procedures (for WES samples) and/or via PC/manual (for all other labs). Once prepared, survey paperwork is checked for errors prior to use.

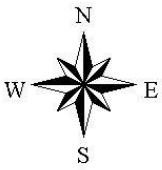
COC users are advised to:

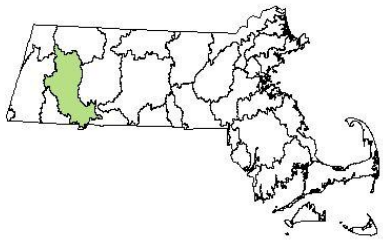
- Sign into and out of the storage fridge when samples are kept temporarily in cold storage (<6 deg. C) at the DWM lab prior to delivery to the lab
- Fill out the Sample Field ID (OWMID#), Site Name (e.g., PB01) and sample-specific dates/times for all samples
- Leave the Field Locator column BLANK
- List the MassDEP Division always, specifically and consistently as "DWM-WP"
- List the Project Name consistently
- Be specific in the Analysis Requested column; including analyte (and specific method if appropriate)
- Always use sample preservation codes
- Have copies of the completed COC forms sent to DWM electronically
- Hide the identity of field QC samples from the lab

B3.8 Lab Sample Tracking

The Wall Experiment Station (WES) tracks samples via a Laboratory Information Management System (LIMS). The DWM labs use lab notebooks (paper and electronic) and standardized lab data reports to keep track of samples. DWM ensures that similar internal mechanisms are in place for any contract labs it employs.







Westfield Watershed

B4 ANALYTICAL METHODS

All WPP samples are analyzed using standard protocols contained in accepted WES Lab, WPP Lab or other laboratory-specific SOPs. Analyses are consistent with each lab's laboratory Quality Assurance Plan and Lab Safety Plan.

B4.1 WPP Lab SOPs

All WPP lab work follows the most current and approved Standard Operating Procedures (SOPs), as listed in Table 10 and provided in Appendix E.

Table 10: WPP Lab Method SOPs

CONTROL NUMBER	SOP
CN 0.35	DWM lab safety
CN 0.4	DWM lab data reporting
CN 0.42	EDD template
CN 2.3	Color analysis
CN 3.4	Chlorophyll *a* analysis
CN 4.24, 4.31, 4.61, 4.70, 4.80	Probe calibrations, various units (lab)
CN 39.2	Benthic macroinvertebrate analysis
CN 60.0	Benthic algae analysis
CN 95.7	Turbidity analysis
CN 143.0	Detergents analysis (kit)
CN 146.0	Hardness analysis (kit)
CN 150.0, 150.5	Cyanobacteria counts
CN 151.9	Alkalinity by Gran Titration (low-level ALK)
CN 198.0	Colilert® (and Enterolert®) bacteria analysis
CN 229.0	Ammonia kit (screening-level)
CN 230.0	Algal toxins

B4.2 WES and Contract Lab SOPs

Upon request and as applicable, the WES lab, EPA-NERL lab and contract labs employ the following laboratory procedures for WPP samples (Table 11). See also Appendices D and F.

When contracting with external contract labs, state-certification for method-specific project analytes (via the MassDEP Laboratory Certification Office) is preferred, but not essential. Certification status is reviewed along with lab QAPs, SOPs and other QA documentation when selecting labs and evaluating data.

Table 11: WES, EPA and Contract Lab Method SOPs for WPP Samples

LAB	DOCUMENT TITLE
WES	Laboratory Quality Assurance Plan
WES	Processing Fish Samples Intended for Contaminant Analysis
WES	Level 1 + Level 2 QA Reviews of DEA/WES Analytical Data
WES	Procedure for Completing the WES Sample Tracking & Chain-of-Custody Record
WES	SM9223 – MPN Enzyme Substrate Coliform Test Most Probable Number Procedure for Analysis of Potable and Non-Potable Water Samples
WES	Reagent Water System - Reverse Osmosis/De-ionization System for the DEA/WES Microbiology Laboratory
WES	Determination of *Bacteroidetes* Group Marker By PCR Assay Based on AEM 66:1587
WES	Determination of *Bacteroidetes* Human-Specific Marker - Modified Method of AEM 66:1587
WES	USEPA Method 1600 – Standard Enterococci Membrane Filtration Procedure
WES	U.S. EPA Method 1603 – *E. coli* Membrane Filtration Procedure
WES	SM 9222D – Standard Fecal Coliform Membrane Filtration Procedure
WES	Determination of Enterococcal *esp* Gene (Sewage Marker) Based on ES&T 39:283
WES	USEPA Method 200.2 – Sample Preparation Procedure for Spectrochemical Determination of Total Recoverable Elements
WES	USEPA Method 200.7 – Determination of Metals & Trace Elements & Hardness in Water & Wastes by ICP-AES
WES	USEPA Method 200.8 – Determination of Metals and Trace Elements in Water and Wastes by Inductively Coupled Plasma-Atomic Mass Spectrometry
WES	*USEPA Method 200.9 – Determination of Trace Elements By Stabilized Temperature Graphite Furnace Atomic Absorption Spectrometry*
WES	USEPA Method 245.1 – Determination of Mercury in Water by Cold Vapor Atomic Absorption Spectrometry
WES	SM2130B - Determination of Turbidity, Nephelometric Method
WES	SM2320B - Determination of Alkalinity by the Titration Method
WES	Reagent Water System, Reverse Osmosis/De-Ionization System – Chemistry Laboratories
WES	*USEPA Method 245.6 – Determination of Mercury In Tissues By Cold Vapor Atomic Absorption Spectrometry (CVAAS)*
WES	USEPA Method 350.1 – Determination of Ammonia, Colorimetric Automated Phenate

LAB	DOCUMENT TITLE
WES	*USEPA Method 351.2 – Determination of Kjeldahl Nitrogen, Colorimetric Semi-automated Block Digester, Auto Analyzer*
WES	USEPA Method 353.1 – Determination of Nitrate Nitrite Nitrogen, Colorimetric-Automated, Hydrazine Reduction
WES	USEPA 3015 – Sample Preparation Procedure for Microwave-Assisted Acid Digestion of Aqueous Samples and Extracts
WES	USEPA Method 3050B – Acid Digestion of Sediments, Sludges, and Soils
WES	USEPA 3051 – Sample Preparation Procedure For Microwave-Assisted Acid Digestion of Sediments, Sludges, Soils, and Oils.
WES	Modified USEPA Method 3052 – Multiwave Microwave Digestion of Fish/Biota Tissue
WES	SM2540D – Determination of Total Suspended Solids Dried at 103-105°C
WES	SM 4500 Cl^-E – Determination of Chloride
WES	Evaluation of Alkaline Persulfate Digestion as an Alternative to Kjeldahl Digestion for Determination of Total and Dissolved Nitrogen and Phosphorus in Water, WRIR 03-4174
WES	*SM4500 PE – Determination of Total Phosphorus, Ascorbic Acid Method*
WES	*SM5210 – Determination of Biochemical Oxygen Demand (BOD)*
WES	*SM5220B – Determination of Chemical Oxygen Demand, Open Reflux Method*
WES	SM5540C – Determination of Anionic Surfactants as MBAS
WES	Multiwave Microwave Digestion for Fish Tissue
WES	*USEPA Method 507 – Determination of Nitrogen & Phosphorus Containing Pesticides in Water by GC & ECD*
WES	*USEPA Method 508 – Determination of Chlorinated Pesticides in Water by GC with an ECD*
WES	*USEPA Method 8081A & 3510 (water) & 3541 (soils) – Determination of Chlorinated Pesticides in Soils & Water*
WES	*USEPA Method 8082 & 3541 (soils) & 3510 (waters) – Determination of PCBs in Soil & Waters*
WES	Modified AOAC Method 983.21 Determination of Organochlorine Pesticides, PCB Aroclors, and PCB Congeners in Fish and Biological Tissue
WES	The Determination of Fluorescent Whitening Agents in Water and Wastewater using 100 mL
WES	*MA EPH Method – Determination of Extractable Petroleum Hydrocarbons*
WES	*Determination of PCB Toxic Congeners in Water and Wastewater*
WES	*Determination of PCB Toxic Congeners in Soils and Sediments*
WES	*USEPA Method 524.2 – Measurement of Purgeable Organic Compounds in Water by Capillary Column GC/MS*
WES	*USEPA Method 8260B – Determination of Volatile Organic Compounds By Gas Chromatography/Mass Spectrometry (GC/MS)*

LAB	DOCUMENT TITLE
WES	*USEPA Method 8270C – Determination of Semi-Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)*
WES	Caffeine In Water by Solid-Phase Extraction and Capillary Column Gas Chromatography/Mass Spectrometry
WES	*USEPA Method 5035A – Sampling Volatile Organic Compounds In Soils and Sediments*
EPA	USEPA Method 200.8 – Determination of Metals and Trace Elements in Water and Wastes by Inductively Coupled Plasma-Atomic Mass Spectrometry
EPA	*Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms*
EPA	*Methods for Measuring the Acute Toxicity of Effluents and Receiving Water to Freshwater and Marine Organisms*
EPA	*Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates*
Contract Labs (various)	Contract lab SOPs vary from year to year, depending on WPP's needs. See Appendix F and subsequent QAPP addendums for specific SOP references.

* Information provided in *ITALICS* indicates presently *INACTIVE* methods for WPP samples (not routinely or currently being analyzed for)

B4.3 Analytical Methods, Reporting Units and Holding Times

The methods and associated holding times for common WPP parameters are provided in Table 12 primarily for methods used by the WES and WPP labs, but also for those that may be employed by contract labs to be used from 2015-2019 (based on WPP's past experience). In many cases, WPP's contract labs use the same or similar standard methods (and associated holding times). WPP ensures that identical (or similar) established methods are employed by all contract labs in order to be able to compare data from different labs. Detection limits (MDLs, MRLs, RLs) using these methods can vary within labs (temporally) and among different labs. For detection limit information, see Table 2 (Element A7). Typically, none of WPP's aqueous samples are frozen prior to analysis, except in cases of anticipated and unavoidable holding time exceedances. Decisions to freeze samples, such as nutrients, are made on a case-by-case basis by WPP and the analytical lab, and the data are automatically qualified (or censored as appropriate) during WPP's data validation process.

Table 12: Analytical Methods and Holding Times for typical WPP surface water samples

PARAMETER	UNITS	METHOD(S)	HOLDING TIME (DAYS)
WATER			
Chloride	mg/L	SM 4500-CL-(E)	28
Alkalinity	mg/L	SM 2320-B	14
Color (true)	CU	SM 2120-B visual	2
Color (true)	CU	SM 2120-C	2

PARAMETER	UNITS	METHOD(S)	HOLDING TIME (DAYS)
Hardness	mg/L as CaCO3	SM 2340-B (EPA 200.7)	180
	mg/L as CaCO3	SM 2340-C	2
Turbidity	NTU	EPA 180.1	2
	NTU	SM 2130-B	2
Total Suspended Solids	mg/L	SM 2540-D	7
	mg/L	EPA 160.2	7
E. coli - Modified m-TEC	CFU/100mL	EPA 1603	6 hours (collection to lab receipt) and analysis within 2 hours of receipt.
E. coli - MTEC	CFU/100mL	SM 9213-D	Same as above
E. coli - MF	CFU/100mL	EPA 1103.1	Same as above
E. coli – "Colilert" ®	MPN/100mL	SM 9223-B	Same as above
Enterococci	CFU/100mL	EPA 1600	Same as above
	MPN/100mL	"Enterolert"®	Same as above
	MPN/100mL	ASTM D6503-99	Same as above
Enterococcus HM gene (EHSS suite)	P/A	WES PCR methods	Same as above
Bacteroidetes Human Markers (EHSS suite)	P/A	WES PCR methods	Same as above
Total Nitrogen	mg/L	USGS I-4650-03	28
Kjeldahl-N	*mg/L*	*EPA 351.2*	*28*
Nitrate/Nitrite-N	mg/L	EPA 353.1	28
Ammonia-N	mg/L	EPA 350.1 (rev. 2.0)	28
	mg/L	LACHAT 10-107-06-1-B	28
	mg/L	ASTM D6919-03	28
	mg/L	SM 4500-NH3-B,C	28
Ammonia-N (screening)	mg/L	HACH Aquachek test strips (DL65059)	ASAP (8 hours)
Dissolved Reactive Phosphorus (DRP)	mg/L	SM 4500-P-A,B1,E	2
Total Dissolved Phosphorus (TDP)	mg/L	SM 4500-P-E	2
Total Reactive Phosphorus (TRP)	mg/L	SM 4500-P-E	2
Total Phosphorus	mg/L	USGS I-4650-03	28
	mg/L	SM 4500-P-E	28
Microcystins (MC-LR)	ug/l	ELISA (Abraxis) WES Lab	2
Microcystins (screening)	ug/l	ELISA (Envirologix Quali-Tube ™) WPP Lab	2
Chlorophyll a	ug/l mg/m3	EPA 445.0 (modified, Welschmeyer)	1 (sample filtration) 21 (analysis, frozen filter)
Metals (trace, in water)	ug/L	EPA 200.7, 200.8, 200.9 and 245.1 (Hg)	28 (Hg) 180 (others)
Caffeine (EHSS suite)	ug/l	EPA 525.2 (modified)	14

PARAMETER	UNITS	METHOD(S)	HOLDING TIME (DAYS)
OB-1, OB-2, FWA-4, FWA-1 & FWA-2	ug/L	"FWA" (WES)	7
Sulfate	*mg/l*	*EPA 300.0*	*28*
UVA254	*cm $^{-1}$*	*SM 5910B*	*14*
Si, Na,K, etc.	*mg/l*	*EPA 200.7*	*180 days*
TOC/DOC	*mg/l*	*SM 5310-B*	*28 days*
BOD	*mg/l*	*SM 5210 B*	*1*
COD	*mg/l*	*SM 5220*	*1*
Volatile organics	*ug/L*	*EPA 624*	*14*
Extractable Organics	*ug/L*	*SM 5520*	*7 (extraction)* *40 (analysis)*
Oil and grease, total petroleum hydrocarbons, numerous poly-aromatic hydrocarbons	*ug/l*	*SM 5520D, (O&G)* *EPA 625*	*28 (O&G)*
Perchlorate	*ug/l*	*EPA 314.0*	*28*
Emerging Contaminants (PPCPs, EDCs, etc.)	*ug/l*	*EPA 1694* *EPA 1698*	*2-7 days (analyze extracts within 40 days)*
SEDIMENT			
Acute freshwater toxicity (sediment)	*(% survival and growth)*	*EPA/600/R-99/064*	*14*
Total Organic Carbon (sediment)	*g/kg dry*	*EPA 9060 (Lloyd Kahn)*	*14*
% Solids/ % water (sediment)	*%*	*ASTM E203;* *SM 2540G*	*14*
Grain size (sediment)	*% of various sizes*	*ASTM D422*	*14*
AVS-SEM (sediment)	*umol/g dry wt. (AVS)* *mg/kg dry wt. (SEM)*	*EPA, 1991*	*21*
PCBs (sediment)	*µg/g dry*	*EPA 8082/3541*	*14*
Organochlorine Pesticides (sediment)	*µg/g dry*	*EPA 8081A/ 3541*	*14*
PAHs (sediment)	*µg/g dry*	*EPA 8270C*	*14*
Metals (sediment)	*mg/kg dry*	*EPA 200.7* *EPA 6010B*	*180*
Hg (sediment)	*mg/kg dry*	*EPA 245.1* *EPA 7473* *EPA 1631*	*28*
FISH TISSUE			
Hg	ug/g (wet)	EPA 7473	28
PCBs and Organochlorine Pesticides	ug/g (wet)	Modified AOAC 983.21	180 (frozen)
Metals (Cd, As, Pb, Se)	*ug/g (wet)*	*EPA 200.9*	*180 (frozen)*

* Information provided in *ITALICS* indicates presently *INACTIVE* parameters (not routinely or currently being analyzed for)
** Changes to analytes and/or methods shall be noted in annual addendums

B4.5 EPA-NERL Assistance

Upon request, the EPA-New England Regional Laboratory in No. Chelmsford, MA. can provide assistance in a number of monitoring areas, including lab analyses. Where appropriate, WPP requests that its standard template for Electronic Data Deliverables (EDD) be used for EPA data reporting.

B4.6 Laboratory Data Reporting Formats

WES Lab, WPP Lab, EPA-NERL and contract lab quality-controlled data are provided to WPP's Data Management Team in digital format (e.g., periodic WES LIMS extracts, .snp/pdf e-files, Electronic Data Deliverables or EDDs). Hard copy data reports, when provided, are placed in project folders.

The WES Lab provides monthly data transmittals via their LIMS. These represent final laboratory data for WPP review and subsequent data validation. For the LIMS data transfers, each successive data transfer overwrites the last. Following preliminary WPP QC review for completeness and typographic-type errors, lab data can be released to the monitoring survey coordinators and other data users as "raw" data (QC status 1).

B4.7 WES Lab Data Qualifiers

The WES Lab makes every effort to avoid the use of data qualifiers through sound lab practices, including efficient sample tracking, diligent reagent preparation and quality control, multi-level data reviews, and re-testing as needed. In some instances, however, qualification of data is necessary and, in all cases, helpful when needed. WES laboratory staff may use the following standard data qualifiers/text results for WPP results, as reported via the LIMS:

WES LIMS Qualifiers:

- "**ND**" = Analyte not detected above Minimum Reporting Limit (MRL)
- "**B**" = Analyte found in reagant blank (and in sample)
- "**H**" = Analytical holding time exceeded
- "**J**" = misc. QC criteria not met
- "**R**" = Sample results rejected; re-analysis warranted
- **"N"** = GC/MS non-target tentatively identified compound

B4.8 EPA-NERL Qualifiers

When EPA provides water quality lab services to DEP (e.g., for ambient metals analysis), the following standard data symbols are used. During data validation, these are applied to WPP final results "as-is" or using the equivalent standard WPP qualifier.

- RL = Reporting limit
- ND = Not Detected above Reporting limit
- NA = Not Applicable due to high sample dilutions or sample interferences
- NC = Not calculated since analyte concentration is ND.
- J = Estimated value
- J1 = Estimated value due to MS recovery outside accceptance criteria
- J2 = Estimated value due to LFB result outside acceptance criteria
- J3 = Estimated value due to RPD result outside acceptance criteria
- J4 = Estimated value due to LCS result outside acceptance criteria
- E = Estimated value exceeds the calibration range
- L = Estimated value is below the calibration range
- B = Analyte is associated with the lab blank or trip blank contamination. Values are qualified when the observed concentration of the contamination in the sample extract is less than 10 times the concentration in the blank
- R = No recovery was calculated since the analyte concentration is greater than four times the spike level.

B4.9 WPP Use of Contract Labs

Based on the specific analytical needs of WPP projects, laboratory services are sometimes contracted via Request for Responses (RFR) or a Master Services Agreement (MSA). As of April 2015, the following labs are pre-approved under an existing MSA (BRP#2014-02):

PhycoTech, Inc
620 Broad St., Ste. 100
St. Joseph, MI 49085

AXYS ANALYTICAL SERVICES LTD.
2045 Mills Road West
Sidney, BC
CANADA V8L 5X2

New England Testing Laboratory, Inc.
1254 Douglas Ave.
North Providence, RI 02904

ChemServe Environmental Analysts
317 Elm St. St.
Milford, NH 03055

TestAmerica, Inc.

53 Southampton Rd.
Westfield, MA. 01085

Cole Ecological, Inc.
15 Bank Row
Greenfield, Ma.

WPP requires that its standard template for Electronic Data Deliverables (EDD) be used for data reporting.

B4.10 Contract Lab Qualifiers

When WPP employs a private laboratory for analytical services, the qualifiers used varies from lab to lab, and are specified in each lab's QAP. Any lab-specific data qualifiers applied to WPP data are taken into account during WPP's data validation process by applying the qualifiers directly to WPP final results "as-is" or by using the equivalent standard WPP qualifier.

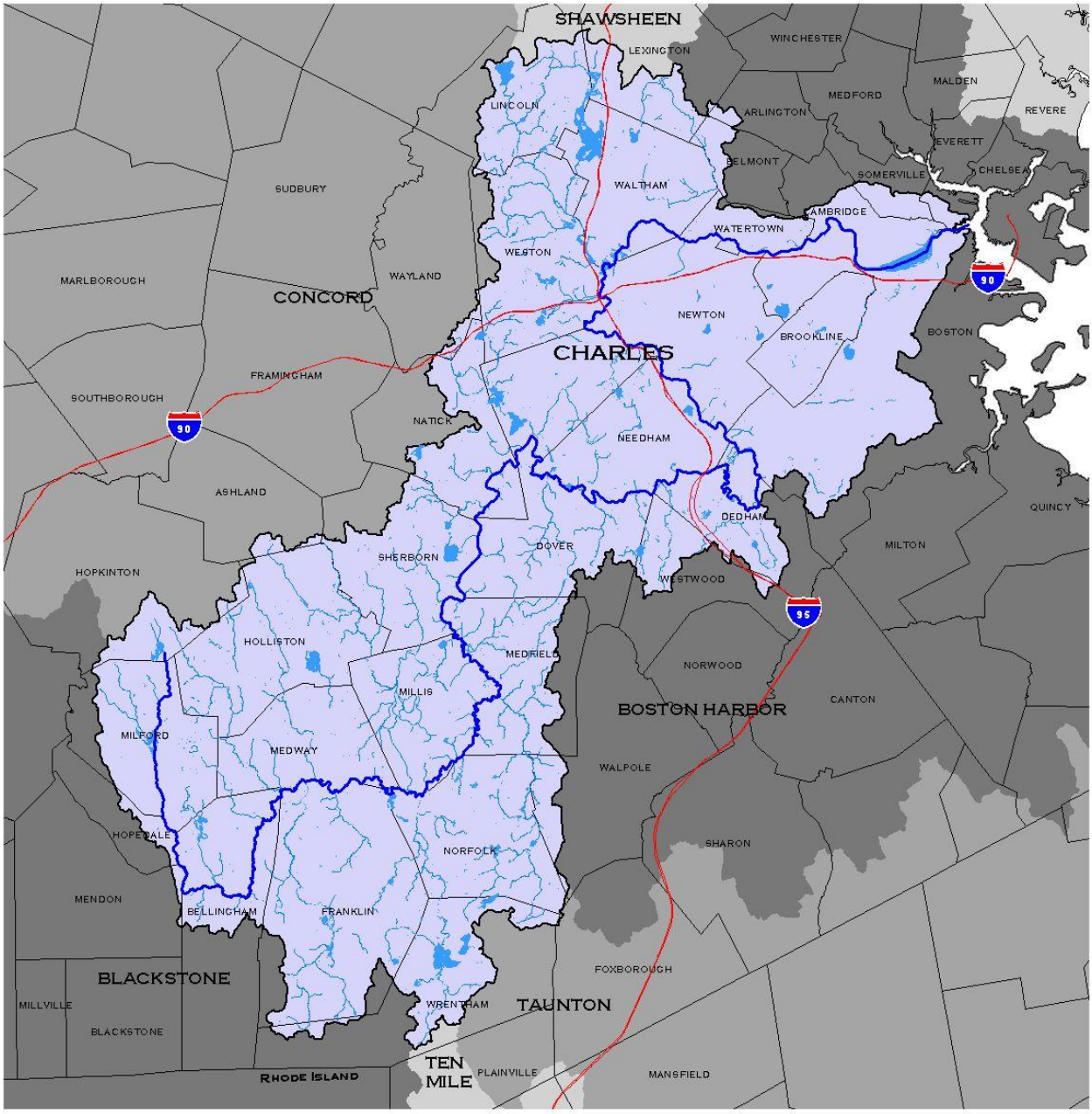
B4.11 WPP Lab Qualifiers

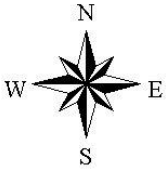
WPP lab staff use the following standard lab qualifiers for in-house analyses (e.g., true color, chlorophyll a, turbidity, *E. coli*, etc.) when needed:

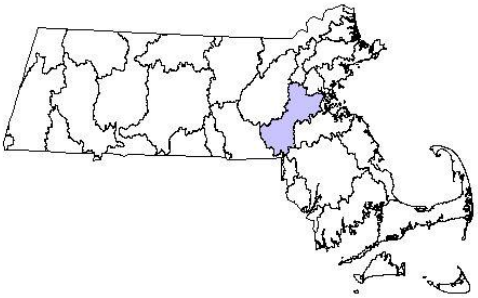
DWM Lab Qualifiers:

- "**B**" = Analyte found in reagant blank
- "**H**" = Analytical holding time exceeded.
- "**J**" = misc. QC criteria not met
- "**<X**" = sample concentration < MDL and "X" is numeric method detection limit value
- "**<Y**" = sample concentration < RDL and "Y" is numeric reporting limit value
- "**>Z**" = sample concentration > UQL and "Z" is the upper quantitation limit value
- ****** = missing result
- **##** = censored data

All lab qualifiers are reviewed during the data validation process. See Element D1.2 for a complete description of final WPP data qualifiers that are used when reporting data, which may differ from the lab qualifiers used for preliminary data.







Charles Watershed

B5 QUALITY CONTROL

By providing important information necessary to assess data quality, WPP's quality control program serves to minimize cumulative uncertainty for measured variables.

B5.1 Field Quality Control

WPP surveys are planned well in advance to ensure proper coordination takes place among all parties, to allow adequate preparation time for crews and to ensure proper procedures are followed. Well-planned and executed surveys help to minimize field error.

Water Quality Surveys:
To estimate the overall precision or repeatability of results, a subset of WPP field samples are replicated by taking co-located, simultaneous, duplicate grab samples. Approx. 10% of the total number of samples and a minimum of one per survey per analyte group is typically collected. Where co-located, simultaneous, duplicate grab samples cannot be taken for any reason, it is noted on the fieldsheet what alternate type of field duplicate (e.g., sequential duplicate) was actually taken. On a project-specific basis, samples may be replicated at a higher percentage and/or in triplicate.

In addition, ambient field blanks are taken at 10% of total samples to evaluate if any sample contamination may have occurred due to improper sample collection, atmospheric fallout or other causes.

Performance Evaluation (PE) samples may also be delivered to a lab to evaluate lab analytical accuracy and precision. Typically, WPP evaluates a sub-set of analyses each year by providing labs with QC samples for which WPP knows the "true" concentrations (e.g., E. coli count, nutrient/metal concentrations, etc.). These QC samples may be single-blind (sample type known by the lab, but not concentration) or double-blind (concentration unknown AND sample disguised as a real sample). These are prepared by WPP, by its agents, or are purchased through a Proficiency Test (PT) provider.

Training sessions for WPP field monitoring staff are held each Spring, prior to any field surveys, to ensure that field measurements and samples will be taken consistent with accepted, approved WPP SOPs. For experienced staff, these can be a basic review session, but for seasonal staff, a more thorough approach is taken to cover all aspects of field work.

In addition, field audits can be performed by WPP's QA Analyst to ensure consistent application of field protocols among different field crews.

See Tables 14-17 for quality control requirements for water quality analytes, multiprobe parameters (including continuous deployment) and for continuous temperature sensors, respectively.

Biological Surveys:
See biological programs QAPPs and SOPs (Appendices A, B and E).

B5.2 Lab Quality Control

WPP requires sufficient laboratory quality control for all its data generation activities. Laboratory quality control processes are described in the WES Lab and WPP Lab QAPs and SOPs, as well as in the QA documentation for contract labs. Required lab quality control procedures include but are not limited to detailed recordkeeping, SOPs that are current/updated, participation in proficiency testing studies, use of appropriate QC samples (e.g., lab blank, reagent blanks, sample duplicate and matrix spike analyses), and keeping internal control and calibration charts.

For detailed descriptions of calibration and maintenance procedures for WES and other labs, see the applicable lab QAPs and SOPs, adopted herein by reference.

For all labs used, WPP requests that laboratory quality control data be included with submitted data packages. Analysis of these lab QC data helps inform WPP's data validation process.

Table 13. Operating Specifications for WPP Reagent Water System

Manufacturer/Brand	Thermo Scientific E-pure®
Series	1090
Water quality output	Type 1 RGW per ASTM D1193; 18.2 M-ohm-cm
Max. flow rate	2.5 LPM (pressure-feed @ 60 HZ)
Feedwater reqts.	HQ tap water or better
Resistivity measurement	0.01-18.2M-ohm-cm (temperature-compensated at 25 deg. C); +/-3%
Treatment methods (cartridges)	Cellulose/resin filtration (pretreatment), ion-exchange (deionization), activated carbon organics filtration, 0.2u final filtration
# cartridges	4

Table 14. Field Sampling Quality Control Requirements for **Water Quality Analytes** (e.g. TP, E. coli bacteria, Chlorophyll a, etc.)

QC SAMPLE TYPE	FREQUENCY	CORRECTIVE ACTION	PERSONS RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR	MEASUREMENT PERFORMANCE CRITERIA
Ambient Field Blanks	Minimum 10% of samples collected, and a minimum of 1 per survey	Qualify or censor data as necessary	Survey Coordinator and QA Analyst	Accuracy (contamination)	No target analytes exceeding MDL
Field Duplicates	Minimum 10% of samples collected, and a minimum of 1 per survey	Evaluate and compare lab dups and field dups (overall precision). Censor or qualify data as necessary	Survey Coordinator and QA Analyst	Overall Precision	See Table 2 for precision DQOs
Performance Evaluation Samples (PES)	1-2 occasions per season, per lab and per analyte group	Discuss with lab; rerun test samples. Censor or qualify data as necessary	QA Analyst and lab QC officer	Accuracy	Same as QC/PT sample acceptance criteria (provided by PT lab)
Cooler Temperature Blank	Each cooler	Add more ice; drain cooler water	Survey crew leader	Accuracy (preservation)	0-6 deg. C

Table 15. General Field & Laboratory Quality Control Requirements for **Biological Samples** (e.g. periphyton, macroinvertebrates, fish)

QC SAMPLE TYPE	FREQUENCY	CORRECTIVE ACTION	PERSONS RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR	MEASUREMENT PERFORMANCE CRITERIA
Field Duplicates	Minimum 10% of samples collected, and a minimum of 1 per survey	Evaluate and compare duplicate data; censor or qualify data as necessary	Biological Survey Coordinator	Overall Precision	See Table 2 for precision DQOs
Duplicate habitat assessment	Every station; every survey	Disagreement in habitat parameter scoring will be discussed and resolved before the Habitat Assessment can be considered complete.	Survey Coordinator and field crew	Precision	See Table 2 for DQO

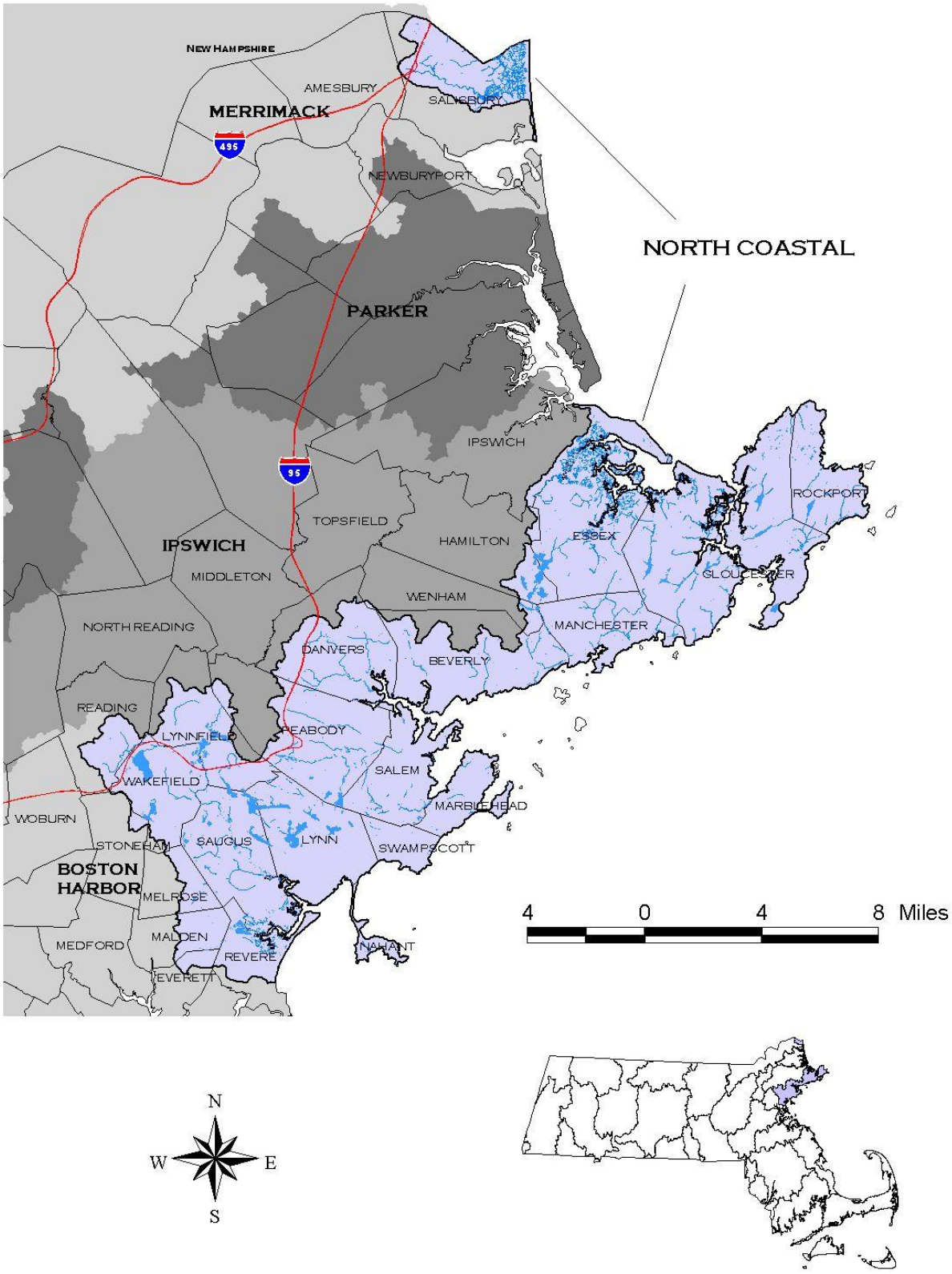
QC SAMPLE TYPE	FREQUENCY	CORRECTIVE ACTION	PERSONS RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR	MEASUREMENT PERFORMANCE CRITERIA
"Expert" verification of taxonomic IDs & enumerations	As needed and spot checks	Work with taxonomist to determine correct identity when there is disagreement. Seek assistance from authority on the taxonomic group if identity cannot be resolved.	Bio-Survey Coordinator	Accuracy	See Table 2 for DQO
QC checks on sorting efficiency (inverts)	10% of samples	Repicking of the subsample with the addition of the "discovered" specimens.	Bio-Survey Coordinator	Completeness	>90% sorting efficiency

Table 16. Field and Laboratory Quality Control Requirements for **ATTENDED Multi-Probe Instruments** (e.g., pH, Conductivity, etc.)

QC SAMPLE TYPE	FREQUENCY/ NUMBER	METHOD/SOP QC ACCEPTANCE LIMITS	CORRECTIVE ACTION (CA)	PERSONS RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR	MEASUREMENT PERFORMANCE CRITERIA
Pre-Calibration (or pre-deployment)	Each day used	See SOP (CN 4.24) and multi-probe instrument manuals	Re-calibrate to within allowable specs.	Multi-Probe Coordinator & QA Analyst	Accuracy/bias Contamination	Must meet or exceed instrument accuracy specs
Field Duplicate reading (Lakes only)	Approximately 10% of sites, minimum of one per trip	RPD < 10%	Re-deploy and start reading sequence again	Field survey crew leader	General precision	RPD < 10%
Instrument Blank	After pre & post calibrations	No target compounds> lowest calibration standard	Retest and/or qualify data	Multi-Probe Coordinator & QA Analyst	Accuracy/bias Contamination	No target compounds> lowest calibration level
Post-Survey (or post-deployment) Check and User Report	End of each day or after deployment	See SOP (CN 4.24) and multi-probe instrument manuals	If outside acceptance limits, discard or qualify data	Multi-Probe Coordinator & QA Analyst	Accuracy/bias Contamination	Must meet or exceed instrument accuracy specs

Table 17. Field and Laboratory Quality Control Requirements for UNATTENDED **Continuous Loggers** (e.g., D.O., temperature, etc.)

QC SAMPLE TYPE	FREQUENCY/ NUMBER	QC ACCEPTANCE LIMITS	CORRECTIVE ACTION (CA)	PERSONS RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR	MEASUREMENT PERFORMANCE CRITERIA
Pre-Deployment QC Check	Before every use for each sensor	D.O.: +/- 0.3 mg/l Temperature: +/- 0.3 deg. C (vs. NIST-certified lab thermometer) Time: +/- 1 minute	Replace with more accurate sensor	Project Coordinator & QA Analyst	Accuracies for D.O., temperature and time compared against 100% saturation concentration, NIST-traceable thermometer and PC network clock, respectively	See SOP (CN 103.1) and sensor specifications
During-Deployment QC checks (Field Duplicate readings)	Each sensor; min. 1X/month (or more freq. for shorter duration deployments)	D.O.: +/- 0.5 mg/l Temperature: +/- 0.5 deg. C (vs. NIST-certified lab thermometer) Time: +/- 1 minute	Replace with more accurate sensor; re-deploy	Project Coordinator & QA Analyst	Accuracy as above	See SOP (CN 103.1) and sensor specifications
Post-Deployment Checks	After every use for each sensor	D.O.: +/- 0.5 mg/l Temperature: +/- 0.5 deg. C (vs. NIST-certified lab thermometer) Time: +/- 1 minute	If data outside acceptance limits, discard or qualify data	Project Coordinator & QA Analyst	Accuracy as above	See SOP (CN 103.1) and sensor specifications



North Coastal Watershed

B6 FIELD EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

All field equipment used by WPP to collect environmental data is inspected, maintained, calibrated (as applicable) and tested prior to use.

In addition to rigorous pre-survey calibrations, water quality instruments are also checked following use to ensure they were operating properly during field data collection. A summary of inspection and maintenance procedures for each instrument type is contained in Table 18.

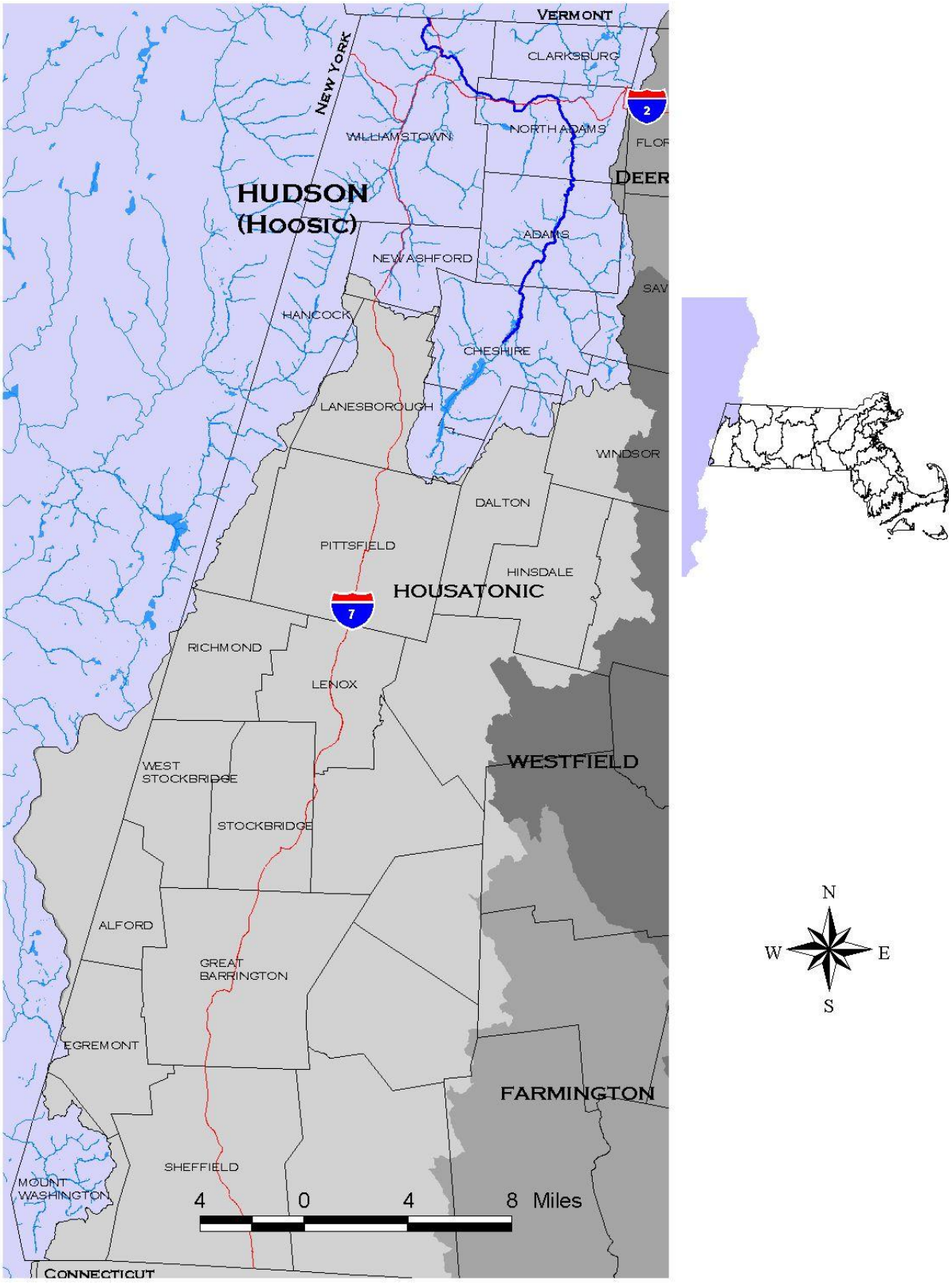
Table 18. WPP Field Equipment Calibration, Inspection and Maintenance

INSTRUMENT	PERSON(S) RESPONSIBLE	FREQUENCY OF CALIBRATION	INSPECTION ACTIVITY AND FREQUENCY	MAINTENANCE ACTIVITY AND FREQUENCY	TESTING ACTIVITY AND FREQUENCY	CORRECTIVE ACTION (CA)	SOP REFERENCE
Multiprobes: * • Hydrolab® Series 4/5 • YSI 600XLM/ 6920V2 • Onset DO/T • Other	Richard Chase Bob Nuzzo Matt Reardon Therese Beaudoin	Pre-cal/re-cal prior to and within 24 hours of use Post-use QC checks	Visual & Electronic; Monthly and/or before each use	Hardware & Software Repair and maintenance as needed.	Pre-survey calibration & post-survey QC checks	Re-calibrate as necessary during pre-calibration; censoring or qualifying data if post-survey check indicates excessive drift or inaccuracies in comparison to pre-calibrated readings and standard solutions	CN 4.24
Velocity Meters (for flow measurement) 1) Price AA 2) Teledyne-Gurley 3) Swoffer 4) Sontek ADV FlowTracker	Richard Chase Users	Before each use	Visual & Electronic; Before and after each use	Inspect post-use for damage; lubricate parts as needed per SOP. Also, repair and maintenance as needed.	Prior to each use in the lab; field testing in Spring prior to seasonal use.	Re-calibrate as necessary. If repair and/or re-calibration ineffective, replace with alternate device.	CN 68.0
Lowrance depthfinders (lakes)	Mark Mattson Matt Reardon	See SOP 82.1	See SOP 82.1	See SOP 82.1	See SOP 82.1	See SOP 82.1	CN 82.1
Phycocyanin Probe (Turner Cyclops/ Databank)	Joan Beskenis	Annually (Spring) using standard. Before and after each use using solid secondary standard	Visual, before and after each use	Cleaning as needed; before and after each use	See SOP 409.0	Re-calibrate as needed during pre-calibration; censoring or qualifying data if post-survey check indicates excessive drift or inaccuracies	CN 409.0

INSTRUMENT	PERSON(S) RESPONSIBLE	FREQUENCY OF CALIBRATION	INSPECTION ACTIVITY AND FREQUENCY	MAINTENANCE ACTIVITY AND FREQUENCY	TESTING ACTIVITY AND FREQUENCY	CORRECTIVE ACTION (CA)	SOP REFERENCE
NIST-traceable thermometer (field)	Richard Chase	Annually, and as needed based on QC checks.	Visual & Electronic; Before and after each use	As needed	Annual (Spring) comparison to WPP's NIST-traceable thermometer	Replace unit as needed	CN 4.24 CN 103.1
Temperature-only Loggers * (Onset PROV2)	Richard Chase James Meek Matt Reardon	Annually, and as needed based on QC checks.	Visual & Electronic; Before, during and after each use; if possible, review data while deployed to ensure working order and accuracy	NA	Annual (Spring) QC check against WPP NIST-traceable thermometer and PC network clock, per SOP.	Replace with working sensor.	CN 103.1
GPS	James Meek Matt Reardon Dan Davis	---	Settings (annually)	As needed per manual	Annually	---	CN 1.25
WPP cell phones	All users	NA	Battery charge (prior to each use)	Battery charging and replacement (as needed)	Operation (when in use)	Charge battery Replace battery Replace phone (as needed)	CN 210.1
Stormwater samplers (ISCO)	*TBD*	*NA*	*Before each use and during site visits*	*Cleaning as needed; re-deploying with new tubes, bottles, etc.*	*Before each use*	*TBD (case-by-case)*	*Instrument Manuals*
Master-Flex peristaltic pump (field filtration)	*Richard Chase*	*NA*	*Before each use (in the lab)*	*As needed.*	*Before each use (in the lab).*	*Repair as needed.*	*CN 1.21*

Note: Information provided in *ITALICS* indicates currently *INACTIVE* equipment (not routinely or currently being used)

* WPP checks temperature loggers and probes annually against a NIST-traceable thermometer at near 0.0 ° C and room temperature (approx. 20-22 ° C).



Hudson Watershed

B7 LAB INSTRUMENT CALIBRATION, INSPECTION AND MAINTENANCE

All laboratory instruments involved in analyses of WPP samples are inspected, maintained, calibrated (as applicable) and tested prior to use. Details on the calibration of each WPP lab analytical instrument are contained in Table 19.

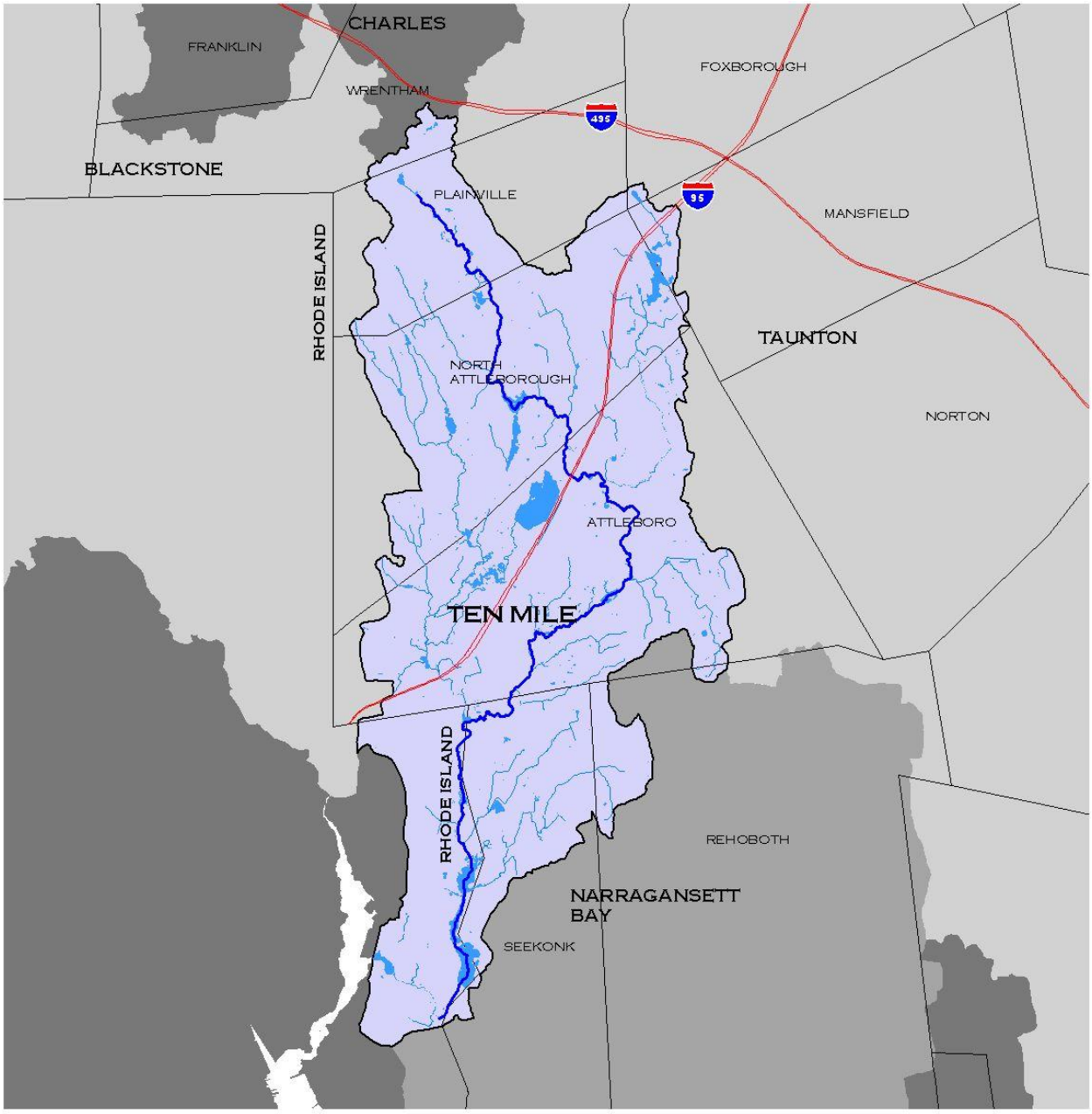
For detailed descriptions of calibration procedures for WES and other lab instrumentation, see the applicable lab QAPs and SOPs, adopted herein by reference.

Table 19: WPP Analytical Instruments Calibration and Maintenance

INSTRUMENT	PERSON(S) RESPONSIBLE	FREQUENCY OF CALIBRATION	INSPECTION ACTIVITY AND FREQUENCY	MAINTENANCE ACTIVITY AND FREQUENCY	TESTING ACTIVITY AND FREQUENCY	CORRECTIVE ACTION (CA)	SOP REFERENCE
NIST-traceable thermometer (lab) *	Richard Chase	Annually, and as needed based on QC checks.	Visual & Electronic; Before and after each use	As needed	Annual re-calibration by manufacturer vs. NIST-certified	Send to manufacturer for re-calibration per SOP	CN 4.24 CN 103.1
IDEXX Colilert System (sealer, incubators, incubator thermometers, etc.)	Richard Chase Joan Beskenis	Sealer and incubators: Prior to each use. Incubator thermometers: annually to NIST-traceable	Visual checks prior to each use, including incubator temperature checks	Per equipment manual (IDEXX, Inc.)	NA	Apply temperature correction factors to incubator temps as needed	CN 198.0
Turner TD-700 Fluorometer (Chl a analysis)	Joan Beskenis	Prior to and following the sampling season	Calibration uses pure or re-hydrated Chlorophyll a preparations, or a solid standard	As needed per SOP	Periodic QC checks using dehydrated Chl a during seasonal use	Re-calibrate as necessary per SOP	CN 3.4
Hach color wheel (apparent and true color analyses)	Mark Mattson Richard Chase	NA	Visual; prior to each use	Wipe clean prior to each use	Periodic QC checks during use per SOP	Stop; check procedures; re-test; notify QC Analyst if problem persists	CN 2.2
Turbidimeter	Richard Chase Users (checks)	Calibration using a range of standards: every 3 months. Low standard check: prior to each use	Visual; daily when in active use.	As needed per SOP	Periodic QC checks during use per SOP	Censor or qualify data if QC check data indicate excessive drift or inaccuracies in comparison to standard calibration solutions	CN 95.7

INSTRUMENT	PERSON(S) RESPONSIBLE	FREQUENCY OF CALIBRATION	INSPECTION ACTIVITY AND FREQUENCY	MAINTENANCE ACTIVITY AND FREQUENCY	TESTING ACTIVITY AND FREQUENCY	CORRECTIVE ACTION (CA)	SOP REFERENCE
Spectrophoto-meter (HACH 2800) misc. analyses, inc. true color)	Richard Chase	Prior to the sampling season	Prior to every use (water damage, electronic anomalies, etc.)	As needed per SOP	QC checks every batch	Re-calibrate as necessary per SOP	CN 2.3 (color)
Microscopes	Joan Beskenis Bob Nuzzo	As needed per manual	Prior to every use (general operation)	As needed per manual	NA	NA	CN 60.0 CN 39.2
Barnstead E-PURE® reagent water system	Richard Chase Bob Nuzzo	NA	Weekly and prior to every use (general operation)	Annually and as needed (Change DI/AC cartridges, 0.2 final filter; disinfect) O-ring replacement	Prior to every use	Yes. Varies. - If < 18.2 meg.Ω-cm - If leaking - If low flow/clog - Pump problem	Cn 4.99

* The NIST-traceable thermometer is calibrated annually at four temperatures (from 0-100 ° C) and issued a traceable certificate. The calibration is consistent with ISO 17025 and ANSI/NCSL Z540-1.



Ten Mile Watershed

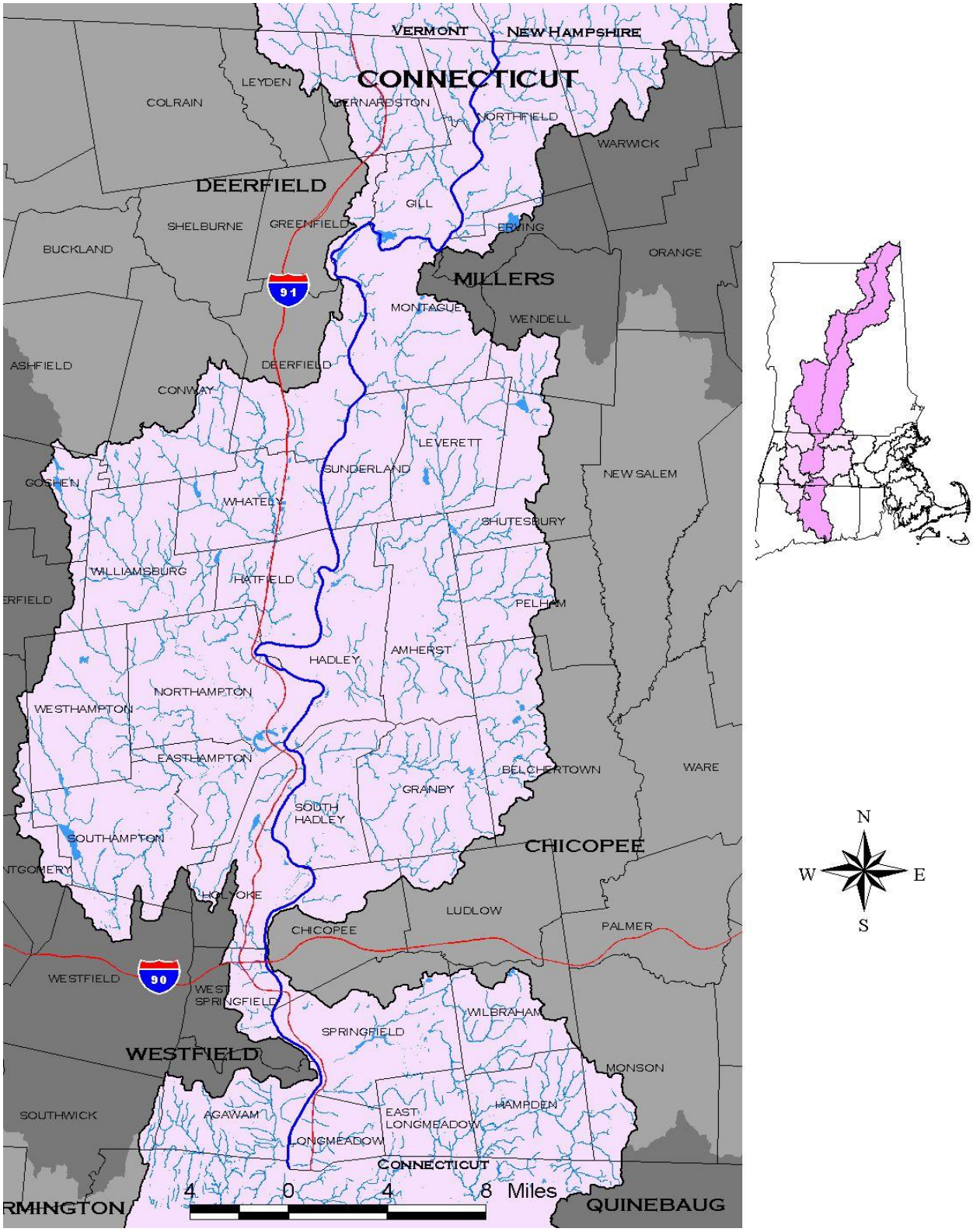
B8 INSPECTION OF SUPPLIES

Based on their individual responsibilities, designated WPP staff are responsible for ensuring the adequacy of supplies and equipment necessary to perform monitoring surveys. Equipment and supplies are ordered annually and as needed to meet specific monitoring and analytical needs. Wherever feasible, WPP strives to avoid or minimize the use of hazardous materials, to minimize the environmental impacts of its purchasing decisions, and to make cost-effective purchasing decisions. Table 20 provides some examples of types of supplies used by WPP (not exhaustive).

Following use, efforts are made to recycle used supplies wherever possible at the 8 New Bond St. location. Disposal of liquid and solid wastes is done in the most environmentally-sensitive ways possible, and in compliance with applicable MA. regulations.

Table 20: WPP Supplies

WPP STAFF	PROGRAM AREA(S)	TYPES OF SUPPLIES
Richard Chase	Monitoring Quality Control Safety	Sampling devices, multi-probe units, analytical kits, Colilert® / Enterolert® reagents and supplies, sample bottles, QC samples and services, lab analytical services, safety equipment and supplies, phones, cameras, GPS units, etc.
Richard Chase Bob Nuzzo	Instrumentation	DIW system maintenance supplies, probes and sonde parts, calibration reagents, water system cartridges, etc.
Bob Maietta Dan Davis	Fish Monitoring	Electroshocking equipment, nets, knives, boating supplies, etc. related to fish toxics and fish population sampling
Bob Nuzzo	Benthic Macroinvertebrates Microscopy	Nets, reagents, bottles, etc. related to benthic macroinvertebrate sampling & analysis, microscopy parts and equipment
Mark Mattson	Lake and TMDL Monitoring	Depthfinders, boating supplies, misc. test equipment
Joan Beskenis	Benthic algae Microscopy	Supplies and reagents for chlorophyll a analysis, benthic algae sampling and analysis
Bill Dunn	Vehicles	Maintenance items for vehicles
James Meek Matt Reardon Dan Davis Pete Mitchell	Monitoring	Project-specific supplies and equipment as needed
Edie Blackney	Purchasing	Purchasing and accounting; also office supplies



Connecticut Watershed

NOTE FOR SECTION B9:

SEE ALSO ANNUAL PROJECT-SPECIFIC SAMPLING & ANALYSIS PLANS (SAPs) IN APPENDIX G AND IN THE ANNUAL QAPP ADDENDUMS.

B9 NON-DIRECT MEASUREMENTS & USE OF SECONDARY DATA

Given the inherent limitations of any monitoring program, use of reliable, quality-controlled data from external sources has become an integral part of WPP's decision-making. Both in planning its own data collection work and evaluating other's available data, WPP assembles data and information from a wide variety of sources. In cases where there are no recent WPP data available, decisions regarding waterbody health can be based solely on external (non-WPP), non-direct or secondary data submitted to MassDEP (by regulation, request or voluntarily), as well as gathered by MassDEP (e.g., data mining) with permission to use as appropriate.

Because WPP has limited control over the QA planning and implementation for outside monitoring activities, the degree to which QAPPs, SOPs and other QA/QC measures are in place varies from project to project. This makes it especially critical that data quality is assessed prior to use of external data. Based on current WPP procedures in place to request, receive and review submitted data, WPP strives to verify the accuracy and evaluate the quality of all external data submitted and found.

Although WPP's use of secondary data is combined with its own primary data, the uses are generally consistent with EPA-New England guidance for projects using only secondary data (USEPAe; http://www.epa.gov/region1/lab/qa/pdfs/EPANESecondaryDataGuidance.pdf).

B9.1 Sources of Information

Potential sources of secondary data that meet WPP's needs include, but are not limited to, monitoring data reports from federal, state and municipal programs, various non-governmental organizations (NGO), grant-funded (Sections 314, 319, 104, or 604(b) of the CWA) projects and volunteer monitoring organizations. The following partial list provides some of the possible sources of information for DWM's watershed assessment, TMDL and other work. See also Table 21.

Federal Agencies

- U.S. Environmental Protection Agency (EPA)
- National Estuaries Program (NEP)
- U.S. Fish and Wildlife Service (USFWS)
- U.S. Army Corps of Engineers (ACOE)
- National Oceanographic and Atmospheric Administration (NOAA)
- U.S. Geological Survey (USGS)

- Natural Resources Conservation Service (NRCS)
- National Ecological Obsevatory Network (NEON)

State Agencies

- Department of Environmental Protection - Drinking Water Program
- Department of Environmental Protection - Wetlands and Waterways Program
- Department of Environmental Protection - Watershed Permitting Program
- Massachusetts Office of Coastal Zone Management (CZM)
- Massachusetts Department of Conservation and Recreation (DCR)
- Massachusetts Department of Fish and Game (DFG)
    - Massachusetts Division of Marine Fisheries (DMF)
    - Massachusetts Division of Ecological Restoration (DER)
- Massachusetts Department of Public Health (DPH)
- Massachusetts Water Resources Authority (MWRA)
- Massachusetts Office of Geographic and Environmental Information (MassGIS)

Municipalities

- Municipal Conservation Commissions (non-point source assessment)
- Municipal and Industrial NPDES Permit Monitoring Requirements (including service contracts for toxicity testing)
- Public drinking water system testing

Private Consulting Firms

- Misc. project data

Academic and Research

- Colleges, universities and other academic/research institutions
- Scientific/engineering literature, including conference and symposium papers

Volunteer Monitoring Organizations

- Watershed associations
- Lake & Pond associations
- Citizen monitoring groups

B9.2 Types of Non-Direct Data

The types of secondary data gathered by WPP for potential use vary widely depending on the source (chemical, biological, ecological, regulatory, etc.). These may include:

- measured surface water quality/quantity data
- hydrologic and water quality model output
- measured pollutant loads
- literature values and data

- historical environmental data
- permit records (e.g., DMRs)
- geographic information system data
- beach and shellfish bed closure records
- measured fish tissue contaminants
- sediment quality data, and
- weather records.

The form these data take can be electronic (e.g., internet, database reports, spreadsheets, etc.) or paper (e.g., in published reports, scientific literature, etc.).

B9.3 Data Quality Evaluation for Secondary Data

WPP's current process for requesting, receiving and reviewing external data is outlined here: http://www.mass.gov/eea/agencies/massdep/water/watersheds/external-data-submittals-for-the-wpp.html.

WPP categorizes external data into 3 general levels, which are related to the monitoring objectives (i.e., why the data was collected):

1. Educational/Stewardship-level
2. Screening level, and
3. Regulatory/Assessment level.

While extremely important, data collected primarily for educational and/or stewardship purposes (level 1) generally does not meet the rigor (i.e., accuracy, precision, frequency, comparability, overall confidence, etc) required for use in making water quality assessment decisions or in developing TMDLs. Although this type of data can be submitted, it is unlikely the data will be used for 305(b) or 303(d)-related decision making.

Screening-level data (level 2) are also very important and welcome, but generally fail to meet one or more WPP criteria required for direct use in water quality assessments or TMDLs. Level 2 data may meet the data quality objectives in the submitter's Quality Assurance Project Plan (QAPP), but not those in the WPP's monitoring program QAPP approved by USEPA. Level 2 data may be used to direct future WPP sampling efforts and as supporting evidence.

Level 3 assessment-level data have been deemed by MassDEP, based on the WPP's external data review procedures, to be directly usable for 305(b) and 303(d) decision-making. These data are considered scientifically sound and legally defensible, and are typically the result of extensive planning, attention to detail, relatively stringent data quality objectives, training, standard field and lab procedures, metadata collection, project organization, and data verification. Contingent upon WPP staff review and approval, these data can help determine if a waterbody is meeting water quality standards or is impaired.

All external data submitted electronically are reviewed using a consistent procedure. Use of WPP's data submittal template is the preferred format for external data submittals. Once data are received by WPP, a standard data review spreadsheet is used to facilitate and document the review.

NOTE: QAPP approval, submittal of the data integrity statement and/or data submittal does not guarantee that the associated data will be used by the WPP.

In order for data to be used by WPP, certain quality criteria must be met. A preliminary review of the data involves an evaluation based on the following three main criteria.

1) Monitoring is performed consistent with an acceptable Quality Assurance Project Plan including acceptable standard operating procedures;
2) Data resulted from use of an acceptable, preferably state-certified lab (certified for the applicable analyses) that has a documented, acceptable laboratory Quality Assurance Plan (QAP) and Standard Operating Procedures (SOPs); and
3) Results include documented QA/QC data

Failure to meet any of these basic criteria (i.e., no QAPP, questionable analytics or poor QC documentation) seriously undermines WPP's confidence in the secondary data. Lack of attention to QA/QC may result in non-use of the data by WPP, without any further review. If one or more of the basic criteria are not met, the decision to do additional review is made on a case-by-case basis.

Preferred characteristics of external data submittals, based on additional review, include:

- Clarity, organization, detail, completeness and accuracy of the raw and/or analyzed data (including fieldsheets, notebook pages, QC analyses, spreadsheet data, etc.)
- Estimates of overall precision of field duplicates/replicates compared to project DQOs contained in the QAPP for the secondary data.
- Estimates of accuracy of lab analyses, using field blank data, raw bench sheets, Quality Control/Performance Evaluation (QC/PE) samples, spiked sample matrices, and positive/negative controls (for bacteria samples), as compared to project DQOs
- Clear signs of QAPP implementation (i.e., documentation of actual QC measures to ensure data quality, such as the frequency of instrument calibration and maintenance, problem identification and response, and personnel training)
- Evaluation of field audit information (if available)
- Assessment of holding time violations
- Assessment of the frequency of field QC sampling (vs. QAPP)
- Availability of side-by-side and/or inter-laboratory QC audit information, if available, to assess inter-group and/or inter-lab precision (if available)
- Opportunities for personal communication with project lead(s) and/or QC officer(s), if needed, to address questions (such as, were sample data representative of a waterbody at a specific location?).

- Appropriate and accurate data analyses.
- Method consistency among project participants and over time throughout the duration of the project.
- Availability of completed Chain-of-Custody (COC) forms

Data usability determinations can be analyte-specific (e.g., phosphorus data is OK, but do not use chlorophyll a data), time-specific (e.g., do not use data prior to their SOP being in place or training taking place) or location-specific (e.g., do not use data from Station X due to non-representativeness).

A standard external data review form is used for all WPP reviews. One or more WPP staff conducts these reviews. The data usability assessment begins with assembling all available information from the submittal, which may include data reports, data files, QC information, email, etc. For information deemed missing, the contact for the external data group is contacted to see if the information is available and can be sent. The initial preliminary review determines if the recommended pre-requisites, as identified above, were met. Submitted data are stored in the appropriate DEP-network location.

The subsequent detailed review involves reviewing the data in more detail, specifically looking at the following, when and if available, and as appropriate:

- Analytical holding time violations
- Frequency of QC samples (blank and duplicates) taken for each survey, and compare to QAPP
- Field blank sample results to verify lack of contamination
- Field duplicate sample results to verify acceptable precision
- Laboratory records (lab notebooks, lab bench sheets, if available) for potential effects on data quality, including multi-probe calibration books for potential effects on data quality
- Quality control results contained in laboratory data reports for potential implications to data quality (based on lab accuracy and precision data), and lab analytical performance during survey period based on results of any QC/PE testing
- Miscellaneous documentation (training records, e-mails, phone records, pers. comms., etc.) to highlight any potential problems affecting data quality
- Overall quality of other data, as available (e.g., benthic macroinvertebrates, fish toxics, other “biological” data)
- Raw data fieldsheets (and field notebook(s) data, if available) for accuracy and consistency with other survey data, especially with regard to station location
- Raw data Chain-of-Custodies (COCs) for accuracy and potential problems

Communication with data providers regarding data completeness, missing information and other questions takes place as necessary. In many cases, additional information is requested by DWM from the data provider to help finalize the review. It may also be necessary for DWM to postpone decisions regarding the usability of certain external data,

pending submittal of additional information, lack of staff resources to adequately review the data, or for other reason(s).

Based on the review (and any follow-up), conclusions regarding the usability of the data, as a whole and/or by components, are documented on the data review form, and become the basis for WPP's use or non-use of the submitted data. Data are categorized as Level 1, 2 or 3. Some or all of the data deemed to be Level 3 (potentially suitable for use in waterbody assessments) by WPP can be accepted, accepted with caveat/qualification and/or not used, depending on the circumstances.
Submitted data may be accepted, accepted with caveat/qualification or rejected.

While DWM may use acceptable secondary data in decision-making, WPP does not formally manage any secondary data in its primary data repository or databases. Therefore, it is not possible for WPP to export quality-controlled, secondary data to WQX/STORET. When appropriate, however, WPP recommends the use of the WQX/STORET to external monitoring groups, as a mechanism to upload their quality-controlled, final data to EPA."

Table 21: Potential Secondary Data Providers to WPP [2015] (subject to availability, as agency monitoring programs and group projects can vary from year to year)

DATA SOURCE	SURFACE WATERBODY TYPES	SAMPLE DATA PARAMETERS*	SAMPLING DESIGN	GEOGRAPHIC AREA OF ACTIVITY	WEB DATA LINKS**, 2015 (*SUBJECT TO AVAILABILITY AND CHANGE*)
Massachusetts Department of Public Health (MA. DPH)	Marine beaches	Indicator bacteria	Fixed	Coastal areas	http://mass.digitalhealthdepartment.com/public_21/index.cfm "Beaches Bill" database
MA. DPH (in coordination with MassDEP)	Freshwater beaches	Cyanobacterial toxins	Targeted	Statewide	---
MA. DPH (in coordination with MassDEP-DWM, DFG, DMF and ORS) - Freshwater and marine fish advisories - Selected project data	Lakes & ponds Rivers	Metals, toxins (in fish tissue) Sediment quality Water quality	Targeted	Statewide	http://webapps.ehs.state.ma.us/dph_fishadvisory/default.aspx program-specific databases (ORS)
Massachusetts Department of Conservation and Recreation (DCR) - cooperatively with USGS	Weather Streamflow (general)	Precipitation Drought status (varies by program)	Fixed and variable	Varies by program	http://www.mass.gov/eea/agencies/dcr/water-res-protection/water-data-tracking/rainfall-program.html http://www.mass.gov/eea/agencies/dcr/water-res-protection/water-data-tracking/rainfall-program-links-generic.html
MA. DCR	Lakes and ponds	Secchi depth Nutrients Chlorophyll a Bacteria Non-native plants	Targeted	Statewide	---
MA. DCR - cooperatively with Massachusetts Water Resources Authority	Drinking-water protection	Nutrients alkalinity, hardness bacteria/pathogens macroinvertebrates	Fixed site	Quabbin Reservoir, Ware River, and Wachusett Reservoir watersheds	http://www.mass.gov/eea/agencies/dcr/water-res-protection/water-quality-monitoring/
MA. DCR	Public beaches	Bacteria	Fixed site	Statewide	http://www.mwra.state.ma.us/harbor/html/beachdata.htm "Beaches Bill" database

DATA SOURCE	SURFACE WATERBODY TYPES	SAMPLE DATA PARAMETERS*	SAMPLING DESIGN	GEOGRAPHIC AREA OF ACTIVITY	WEB DATA LINKS**, 2015 (*SUBJECT TO AVAILABILITY AND CHANGE*)
MA. DCR - Areas of Critical Environmental Concern (ACEC)	All	---	---	Statewide	http://www.mass.gov/eea/agencies/dcr/conservation/ecology-acec/areas-of-critical-environmental-concern-acec.html
MassDEP (in coordination with UMass-Dartmouth SMAST (Mass. Estuaries Project)	Estuaries Coastal tributaries	Nitrogen Salinity Bacteria DO/T Phosphorus Eelgrass	Fixed site	Mass. estuaries	http://www.oceanscience.net/estuaries/index.htm Related Technical Memoranda from SMAST to DEP
MassDEP - Coastal ecology	Estuaries	Eelgrass coverage	Fixed site	Mass. estuaries	http://www.mass.gov/eea/agencies/massdep/water/watersheds/eelgrass-mapping-project.html
MassDEP - Lake management	Lakes & ponds	Herbicide applications	---	Statewide	Program-specific database
MassDEP - Wetland Monitoring	Wetlands	Various	Project-specific	Statewide	http://www.mass.gov/eea/agencies/massdep/water/watersheds/wetlands-protection.html#2
MassDEP - Waste site cleanup	Any potentially affected waters	Varies by project	Varies by project	Site-specific	http://www.mass.gov/eea/agencies/massdep/cleanup/reports/
MassDEP - Sustainable Water Management Initiative (SWMI-related information, including DFG and USGS data)	Rivers & Streams	In-stream flow Fisheries (inc. CWF) GIS Water usage ecological	Historical data and modeling	Statewide	http://www.mass.gov/eea/agencies/massdep/water/watersheds/sustainable-water-management-initiative-swmi.html
MassDEP-Division of Municipal Services	All	Indicative summaries for grant projects Pre- and post-project data (when available)	Varies by project	Statewide	http://www.mass.gov/eea/agencies/massdep/water/grants/watersheds-water-quality.html#3

DATA SOURCE	SURFACE WATERBODY TYPES	SAMPLE DATA PARAMETERS*	SAMPLING DESIGN	GEOGRAPHIC AREA OF ACTIVITY	WEB DATA LINKS**, 2015 (*SUBJECT TO AVAILABILITY AND CHANGE*)
Department of Fish and Game (DFG) - Fisheries and Wildlife	Lakes & ponds Rivers & streams	Fish populations Target fish community Bathymetry Trout-stocked waters Coldwater fisheries	Targeted	Statewide	http://www.mass.gov/eea/agencies/dfg/dfw/publications/fisheries-publications-dwf.html Freshwater sampling database (data sharing)
MA. DFG - Marine Fisheries	Marine shellfishing areas, rivers & streams	Saxitoxin (in tissue) Fish passage Dissolved oxygen temperature bacteria Fish counts and restoration data	Fixed site	Coastal areas	http://www.mass.gov/eea/agencies/dfg/dmf/ http://www.mass.gov/eea/agencies/dfg/dmf/publications/technical.html http://www.mass.gov/eea/agencies/dfg/dmf/programs-and-projects/diadromous-fisheries.html Shellfish classification areas and fish passage barriers (data sharing)
MA. DFG - Division of Ecological Restoration	Rivers & streams Wetlands Salt marshes Lakes & ponds	Streamflow Temperature Habitat Macroinvertebrates Aesthetics Dam removal	Targeted	Varies by project	http://www.mass.gov/eea/agencies/dfg/der/publications/ http://www.rifls.org/
Massachusetts Office of Coastal Zone Management (MA. CZM) - Coastal Water Quality - grant projects	Coastal streams and wetlands	Dissolved oxygen pH nutrients salinity macroinvertebrates invasive species	Fixed site	Coastal areas	http://www.mass.gov/eea/agencies/czm/program-areas/coastal-water-quality/ http://www.mass.gov/eea/agencies/czm/program-areas/aquatic-invasive-species/ http://www.mass.gov/eea/agencies/czm/program-areas/coastal-habitat/
Massachusetts Office of Geographic and Environmental Information (MassGIS)	All	Multiple layers	---	Statewide	http://www.mass.gov/mgis/laylist.htm
Boston Water & Sewer Commision	Piped flows	Combined Sewer Overflows	fixed	Greater Boston	http://www.bwsc.org/about_bwsc/systems/outfall_maps/outfall_maps.asp

DATA SOURCE	SURFACE WATERBODY TYPES	SAMPLE DATA PARAMETERS*	SAMPLING DESIGN	GEOGRAPHIC AREA OF ACTIVITY	WEB DATA LINKS**, 2015 (*SUBJECT TO AVAILABILITY AND CHANGE*)
Massachusetts Dept. of Transportation- Highway Division ▪ Environmental	Highway runoff	Road-salt related data	Fixed site	Statewide	http://www.massdot.state.ma.us/highway/Departments/EnvironmentalServices.aspx
Massachusetts Water Resources Authority	Boston Harbor and tributaries Water supply reservoirs	Nutrients Bacteria Physical/clarity DW parameters CSO discharges	Fixed site	Central to eastern MA.	http://www.mwra.state.ma.us/harbor/html/bhrecov.htm http://www.mwra.state.ma.us/04water/html/wat.htm http://www.mwra.com/03sewer/html/sewcso.htm
Massachusetts Bays National Estuary Program Buzzards Bay National Estuary Program Narragansett Bay Estuary Program	Bays & estuaries Salt marshes Rivers & streams	Dissolved oxygen Temperature Nutrients Chlorophyll a Fish community Invasive organisms Habitat SAV Sediment quality	Varies by project	Coastal & Marine	http://www.mass.gov/eea/agencies/mass-bays-program/publications/ http://www.buzzardsbay.org/technical-data.htm http://nbep.org/publications.html
Volunteer Lake Associations (various)	Lakes, Ponds	Secchi depth Nutrients Chlorophyll a	Fixed site	Lake-specific	various
Volunteer Watershed Associations (various)	Rivers, Streams	Dissolved oxygen pH temperature bacteria nutrients	Fixed site	Basin-specific	various
Cape Cod Commission, Water Resources Office	Rivers & streams Lakes & Ponds Groundwater Stormwater	Vary by project	Varies by project	Cape Cod	http://www.capecodcommission.org/index.php?id=49&maincatid=23
US Army Corps of Engineers, NE District	Reservoirs	Varies by project	Varies by project	Project-based	http://www.nae.usace.army.mil/ http://www.nae.usace.army.mil/Missions/ProjectsTopics.aspx

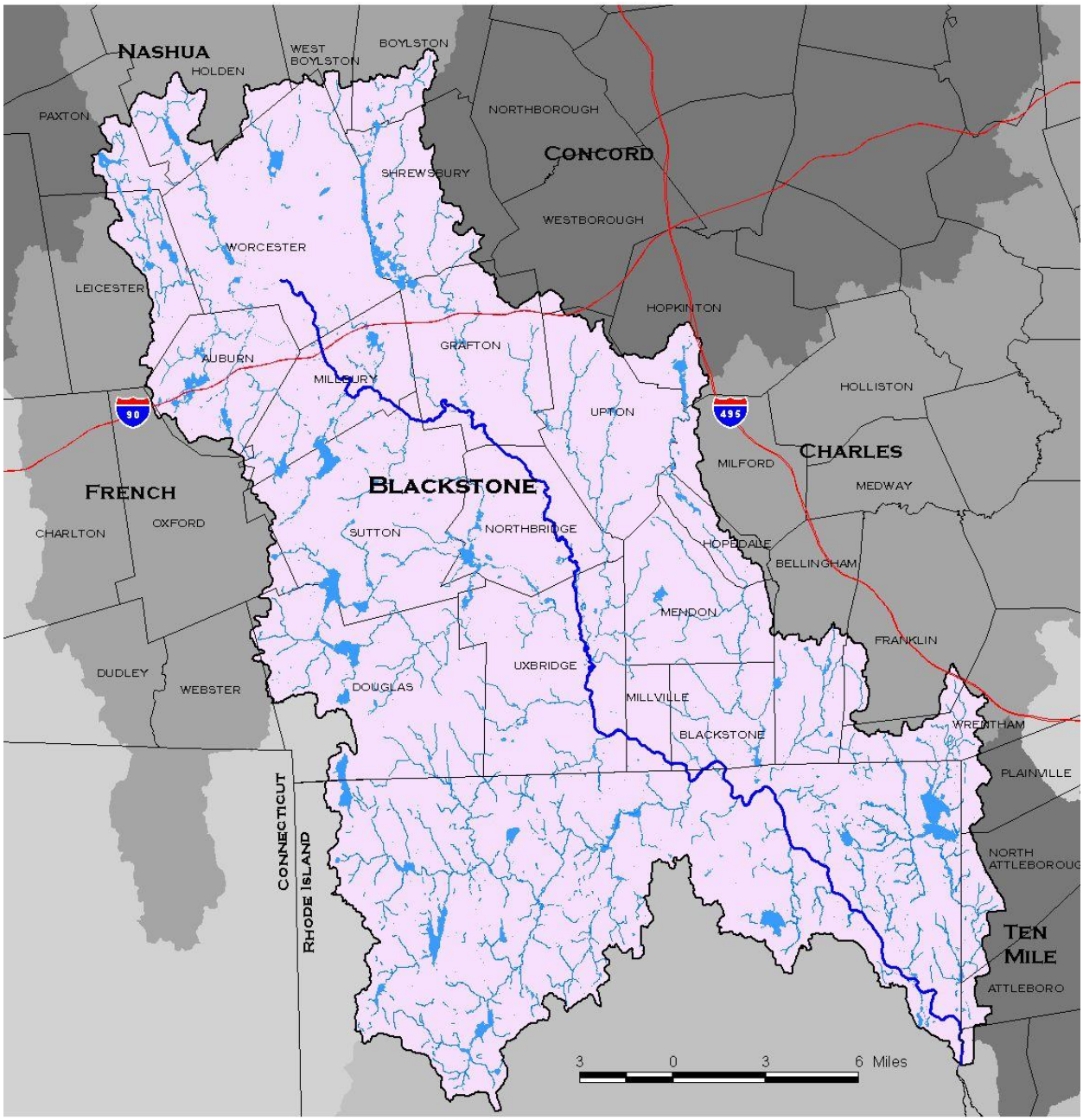
DATA SOURCE	SURFACE WATERBODY TYPES	SAMPLE DATA PARAMETERS*	SAMPLING DESIGN	GEOGRAPHIC AREA OF ACTIVITY	WEB DATA LINKS**, 2015 (*SUBJECT TO AVAILABILITY AND CHANGE*)
National Oceanographic and Atmospheric Administration (NOAA) - National Climatic Data Center (NCDC) - National Weather Service	---	Weather parameters Precipitation	Fixed	Statewide	http://cdo.ncdc.noaa.gov/ulcd/ULCD http://www.erh.noaa.gov/box/dailystns.shtml http://www7.ncdc.noaa.gov/CDO/cdo http://www.weather.gov/climate/index.php?wfo=box.
United States Geological Survey (USGS)	Rivers & streams Reservoirs Impoundments Lakes & Ponds	Streamflow Precipitation Water quality Historical data	Fixed site and variable	Varies by project	http://ma.water.usgs.gov/ http://ma.water.usgs.gov/water/kml_sitemap/kml_sw_MARI.html http://waterdata.usgs.gov/ma/nwis/current/?type=flow http://water.usgs.gov/osw/streamstats/ http://nwis.waterdata.usgs.gov/usa/nwis/qwdata http://ma.water.usgs.gov/publications/ http://ma.water.usgs.gov/projects/ http://water.usgs.gov/nawqa/
USEPA National Pollutant Discharge Elimination System (NPDES) (Mass is non-delegated as of 2015)	Lakes & ponds Rivers & streams Bays and estuaries (associated with discharges)	Required parameters for permitted discharges Also, Discharge Monitoring Report (DMR) data (ambient chemistry and whole effluent toxicity) NPDES-regulated communities (e.g., MS4) Combined Sewer Overflow discharges	Fixed	Permittee-based locations and regional (MS4)	https://icis.epa.gov/icis/jsp/common/LoginBody.jsp;jsessionid=2DbTKyvQ2ZPI3X1m3KIpJShDh2zKhkQJvy1JrQQ11BNQGqsRwQIg!-1628596325 (password required) http://www.epa-otis.gov/otis/icis_npdes_query.html http://www.epa.gov/region01/npdes/stormwater/ma.html

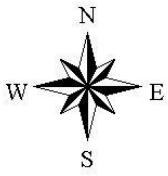
DATA SOURCE	SURFACE WATERBODY TYPES	SAMPLE DATA PARAMETERS*	SAMPLING DESIGN	GEOGRAPHIC AREA OF ACTIVITY	WEB DATA LINKS**, 2015 (*SUBJECT TO AVAILABILITY AND CHANGE*)
USEPA - WQX database	Lakes & ponds Rivers & streams	various	---	Statewide and neighboring states	http://www.epa.gov/storet/dw_home.html http://www.waterqualitydata.us/
USEPA - Superfund sites	Varies by project	Varies by project	Varies by project	On-site, Off-site	http://www.epa.gov/ne/superfund/findsite/fndindex.htm http://www.epa.gov/superfund/sites/cursites/index.htm http://yosemite.epa.gov...
USEPA - Region 1 projects - Wadeable streams - National Lakes & Ponds	Varies by project	Varies by project	Varies by project	Project-based	http://www.epa.gov/NE/lab/reportsdocuments/wadeable/index.html http://www.epa.gov/NE/lab/nelp.html http://www.epa.gov/NE/charles/sciencereports.html
US Fish & Wildlife Service - NE region	Varies by project	Fish counts Fish community Habitat Invasive species	Varies by project	Location-based (regional offices)	http://www.fws.gov/r5crc/Stuff/stuff.html http://www.fws.gov/northeast/EcologicalServices/index.html
Federal Energy Regulatory Commission (FERC)	Rivers	Licensed facilities	---	Statewide	http://www.ferc.gov/industries/hydropower/gen-info/licensing.asp
Bordering states with cross-border segment data (NY, VT, NH, CT and RI)	Rivers Lakes	Varies by State	Varies by project	State-shared watersheds	http://www.dem.ri.gov/pubs/data.htm http://www.vtwaterquality.org/wqd_mgtplan/waterq_data.htm http://des.nh.gov/organization/divisions/water/wmb/swqa/ http://www.ct.gov/deep/cwp/view.asp?a=2719&q=325616&deepNav_GID=1654 http://www.dec.ny.gov/chemical/8459.html
New England Interstate Water Pollution Control Commision (NEIWPCC)	Varies by project	Varies by project	Varies by project	Project-based	http://www.neiwpcc.org/wqmonitoring.asp

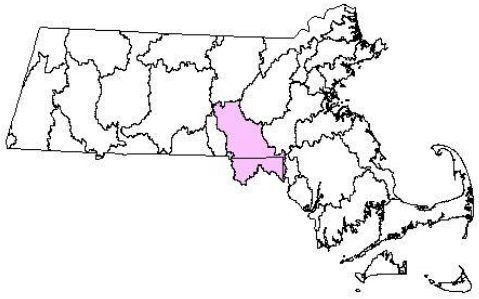
DATA SOURCE	SURFACE WATERBODY TYPES	SAMPLE DATA PARAMETERS*	SAMPLING DESIGN	GEOGRAPHIC AREA OF ACTIVITY	WEB DATA LINKS**, 2015 (*SUBJECT TO AVAILABILITY AND CHANGE*)
Misc. Projects (academic, contractor services, other)	Varies by project	Varies by project:	Varies by project	Project-based	---

* Actual parameters sampled for can vary from year-to-year and from project-to-project for many groups. "Nutrients" can include total phosphorus, dissolved reactive P, total reactive P, total dissolved P, total nitrogen, ammonia-nitrogen, nitrate+nitrite-nitrogen, dissolved organic N, etc.

** These are general links, some of which contain data. DWM-WPP typically contacts individual staff to receive data files electronically (non-web-based; e.g., e-mail attachments, CD, etc.).







Blackstone Watershed

B10 DATA MANAGEMENT

In coordination with project-level staff, WPP's data management team facilitates the storage of raw field data, lab data and associated metadata in both hard copy and electronic formats, performs validation and verification procedures to finalize all data, and provides mechanisms for staff and outside groups to access these data.

Only WPP-collected data are formally managed in WPP databases. This includes sample data collected by WPP and analyzed by external lab contractors. Regional bacteria source tracking (BST) data, however, are managed differently due to the unique nature of this type of monitoring activity. Unless otherwise specified, only BST data based on multiple station visits ("base stations") are entered into the WPP database (single site visit data are not entered).

Data not collected by WPP staff (including DEP project data) are considered "secondary data" and are reviewed for usability as described in Section B9.

As detailed in Section D2, the actual results that have been censored are not reported, although the metadata for these censored samples is included in WPP's database. Censoring denotation is used in place of the actual results. Usable but qualified data are flagged with standardized qualifier symbols.

B10.1 Data Management Protocols

Table 22: WPP Data Management SOPs

CONTROL NUMBER	SOP
CN 0.40	WPP lab data reporting
CN 0.41	EDD definitions
CN 0.42	EDD template
CN 0.44	Lab data elements
CN 0.6	Station definition
CN 0.8	Data Use
CN 0.9	Data Management (DRAFT until new WPP database is developed---projected for 2016).
CN 56.4, 56.5, 56.6, 56.9	Data Validation

B10.2 WPP Databases

Environmental "databases" currently in use (or pending) by WPP include:

- Commercial Off-The-Shelf data management system (COTS) *WPP data (pending)*

- Data warehouse (1994-2004) *WPP data*
- Data warehouse (2004-present) *WPP data*
- Benthic macroinvertebrate database *WPP data*
- WPP Station Georeferences *WPP data*
- Assessment Reporting (ADB; via EPA application) *WPP data*
- Toxicity Testing Data (ToxTD)*---non-WPP data*
- Herbicide Applications (HERB) *---non-WPP data*

As of April, 2015, WPP is actively engaged in procuring a commercial, off-the-shelf (COTS) database system under a cloud-hosted solution. This system will serve data management needs for discrete water quality, biological and continuous data. It will also facilitate data flows to EPA's WQX database. This system is expected to be procured, installed, developed for WPP data, and in use by WPP staff sometime in 2016.

For internal staff use, two separate data warehouses exist for WPP water quality data. These include historical as well as more recently validated data. These warehouses will be used to import or migrate water quality data into the new WPP data management system. Biological data from a separate database for benthic macroinvertebrate data will also be migrated into the new COTS solution, which is also planned to manage fish community data collected by WPP.

WPP's georeferencing system for all historical and current sampling stations (water quality and biological) include station descriptions, unique IDs, lat-long coordinates and GIS reference tables and shape files. Waterbody and segment information for riverine systems is included in the Stream and River Inventory System (SARIS). The Pond and Lake Inventory System (PALIS) provides a numbering and inventory system for lentic systems. Both SARIS and PALIS are revised and updated as needed as new/different information is produced. The station, segment and waterbody-related information is critical to data management.

WPP uses EPA's Assessment Database (ADB) to track water quality assessment data, including use attainment, and causes and sources of impairment. WPP tracks this information for surface waters statewide. The ADB (http://www.epa.gov/waters/adb/) is designed to support three principal functions:

- Improve the quality and consistency of water quality reporting
- Reduce the burden of preparing reports under Sections 305(b), 303(d), 314, and 319 of the Clean Water Act (CWA)
- Improve water quality data analysis

WPP's toxicity database (ToxTD) is currently a dBase III database containing acute and chronic whole effluent toxicity testing and associated chemistry data submitted by permittees as required by their National Pollutant Discharge Elimination System (NPDES) permits. The facilities are required to submit reports to DEP monthly, quarterly, biannually, or annually based on the permit requirements. WPP staff review the reports, fill the relevant data into coding sheets, and enter these data into the ToxTD database. These external, secondary data assist in making waterbody assessment decisions. As of April, 2015, WPP is investigating options to modernize this system. There are no plans to migrate these

secondary ToxTD data to WPP's main database system or WQX, because these data sets are not collected or "owned" by WPP.

WPP's HERB dBase III database is used to track aquatic herbicide license applications, to generate licenses and to manage lake-specific data associated with herbicide treatments. Currently, the WPP receives a request for a license to apply chemicals detailing information such as location, chemical and type of aquatic weeds targeted. Designated WPP staff review the applications and can issue licenses detailing special and general conditions. Most of the herbicide license application information is entered into the HERB database. By December 31st of each year, the companies who receive licenses to apply chemicals are required to submit annual reports detailing the location, treatment date, application rate and actual weight/volume for each chemical used. WPP staff review and enter the data into the HERB database to reflect actual amounts of chemicals used. There are no plans to migrate these secondary HERB data to WPP's main database system or WQX, because these data sets are not collected or "owned" by WPP.

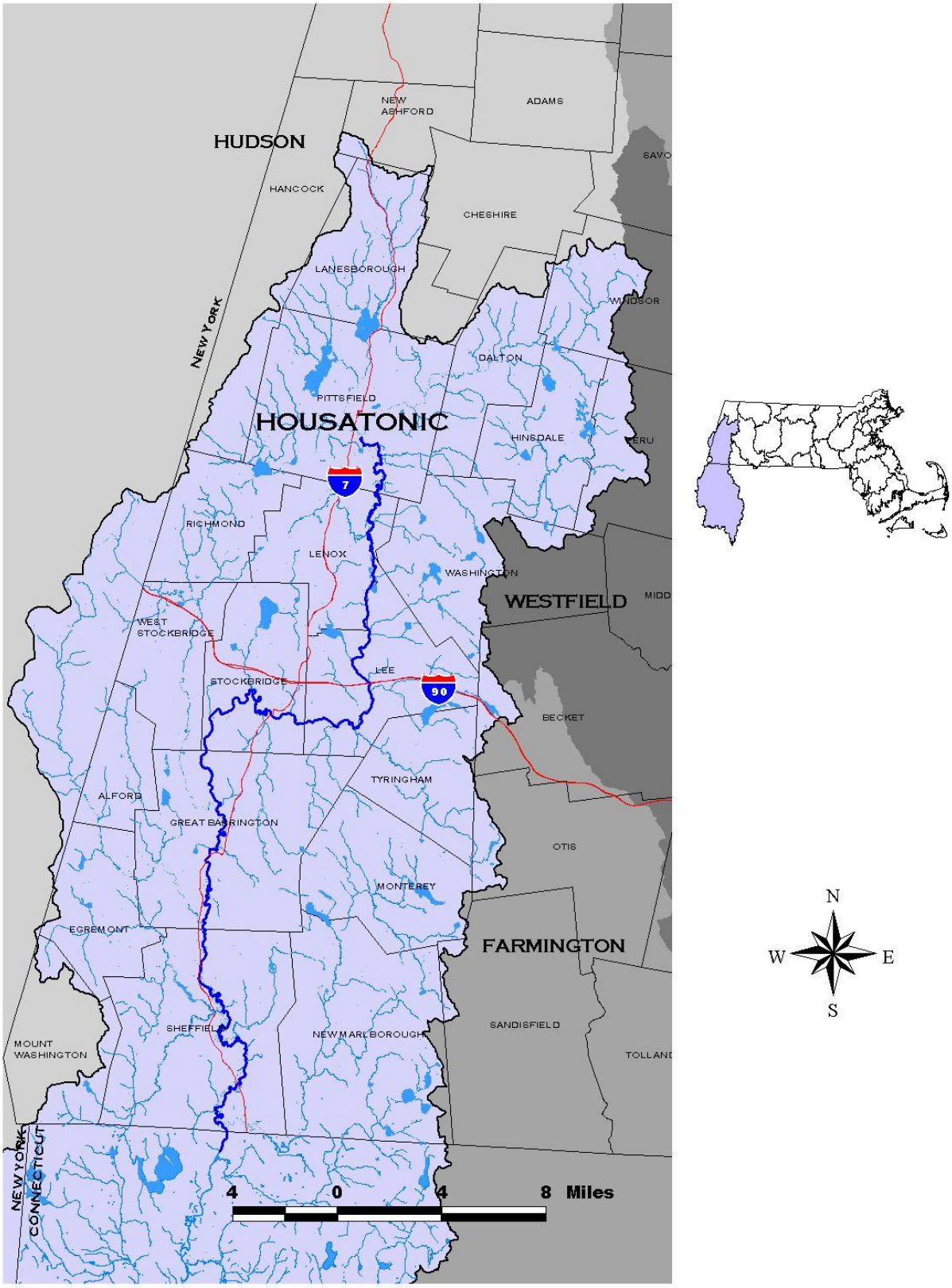
B10.3 Data Entry Processes

All completed WPP field sheets, notebook pages and COC forms are filed with the QC Analyst for preliminary review and hard copy filing. Any field notebook page(s) are photocopied and added to the final hard copy file. All files are stored at the Worcester office. As of April 2015, WPP plans to explore options for collecting all field data electronically, sometime in 2016/17 after the new COTS database system is in place.

The data management group has primary responsibility for fieldsheet data entry and electronic data file transmission. While the Principle Investigators (PIs) are responsible for ensuring the completeness and quality of field data prior to data entry, the data entry staff work closely with the PIs on any discrepancies found on the fieldsheets. Incomplete and/or erroneous field-recorded data and information will be brought to the attention of the appropriate field crew, coordinator and/or person(s). Most of the data contained on the fieldsheets is entered into the WPP database. Data entry is followed by data entry QC, where all entered data are checked against the original data and metadata by a 2nd WPP staff person.

Laboratory quality-controlled data from WES are sent via the WES Laboratory Information Management System (LIMS) to WPP electronically on an approximate monthly basis. Each successive file overwrites the previous one. Lab data from contract labs and WPP's labs are also provided to the QC Analyst and Database Manager using standard Electronic Data Deliverable (EDD) templates.

Entered field and lab data/metadata are processed using WPP's data validation procedures, and are eventually finalized following completion of the validation steps. See Section D1 for more specific information on WPP's data validation methodology.



Housatonic Watershed

C1 CORRECTIVE ACTIONS

Recognizing DEP's commitment to continual improvement and the common QA theme of "Plan-Do-Check-Act", WPP takes corrective actions when necessary based on a graded approach. Problems encountered that have a direct and meaningful effect on data quality are dealt with using formal corrective action forms and communications. Less important issues are resolved on a case-by-case basis using more informal methods (e.g., email clarification).

C1.1 Field-Related Evaluation and Correction

Review of field activities related to data integrity and safety is the joint responsibility of the Survey Coordinator for each project, the Monitoring Coordinator and the QA Analyst.

Although infrequently done due to staffing limitations, WPP's field audit process calls for the QA Analyst to accompany survey crews to evaluate adherance to the applicable SOPs and the program QAPP by crews and individual crew members. These field audits attempt to evaluate at least one survey per watershed and, ideally, each survey crew member a minimum of one time. WPP sampling staff in need of performance improvements may be directed to re-read the relevant standard operating procedure and/or may be re-trained. If errors in sampling techniques are consistently identified, mandatory re-training will be scheduled.

C1.2 Lab-Related Evaluation and Correction

WPP's QA Analyst has the primary responsibility to ensure that data from laboratories are consistently of known, documented and usable quality. This is done mainly by reviewing lab reports for errors, inconsistencies and poor QC results, but also via frequent communication with lab staff. Ideally, the need for corrective action can be communicated in a timely fashion to avoid future problems and/or data censoring.

For all labs used, the WPP QA Analyst works with each lab to avoid misunderstandings early on. This includes visits to contract labs to discuss method and logistical specifics. In addition, external, single- and double-blind laboratory audits using quantitative QC check samples are typically initiated by WPP for nutrients (TP, NH3-N, TN, NO3-NO2), bacteria and metals. WPP also performs self-audits for Colilert® bacteria analysis using semi-quantitative PE samples (*E. coli* within a defined range).

Assessment of laboratory performance is mainly the responsibility of individual labs used (e.g., WES) prior to data transmittal. During QC review at the lab, it is likely that errors requiring corrective action may be found.

C1.3 Database-Related Evaluation and Correction

WPP's Database Manager is responsible to ensure that housed data are secure, organized, accessible and free from systematic error. The need for corrective actions concerning the

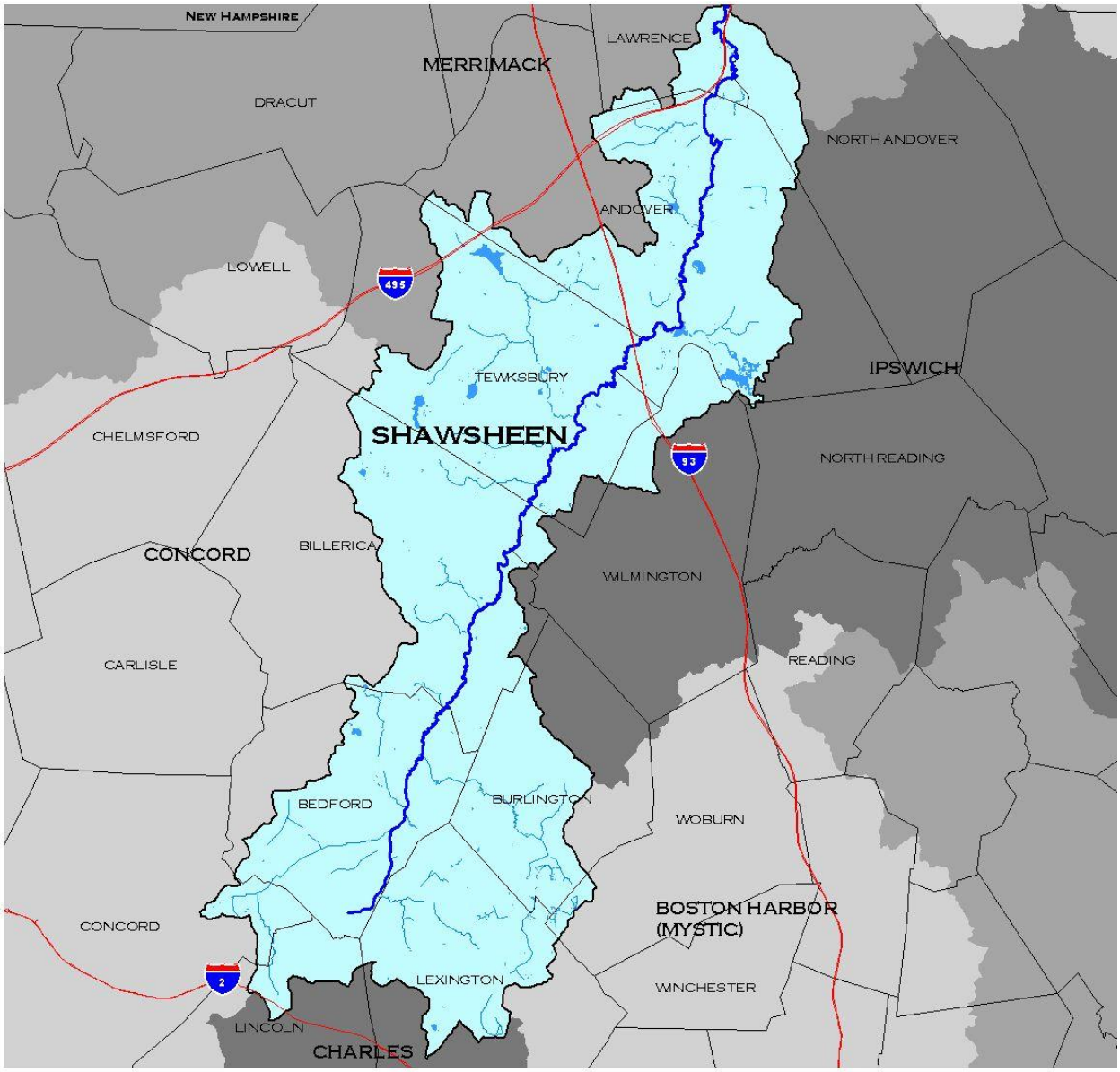
database system is attenuated somewhat by the "built-in" QA inherent in database development and maintenance (e.g., locked computer code, redundancy checks, etc.). Nevertheless, issues can arise that require resolution. Database-related issues and problems can be brought to the attention of the Database Manager by any staff, but the corrective actions needed to resolve problems are handled by the WPP data management group. Corrective actions take place as soon as possible and can include:

- Changes to database to correct for transcription errors, based on data entry QC
- Changes to VB code
- Changes to import files based on new or updated information, such as LIMS data corrections and updates

C1.4 Corrective Action Form

A Corrective Action Form (CAF) can be used for issues that have a direct and meaningful effect on data quality. These forms can also used for all field and laboratory deviations and deficiencies that cannot be handled immediately. The CAF is not only the first step toward resolution, but also provides for documentation of the problem. Refer to DWM's Corrective Action Procedures SOP (CN 5.0) for more information.

In practice, however, the CAF is rarely used and corrective actions are documented via email.



Shawsheen Watershed

C2 REPORTING

C2.1 Program-Level Quality Assurance

Annual quality assurance self-assessments are generated by BRP and DWM-WPP (and other DEP Bureaus) to evaluate compliance with DEP's current Quality Management Plan (QMP). The self-assessments are provided to EPA Region 1.

C2.2 Data Validation

DWM-WPP's Quality Assurance Analyst is responsible for ensuring that all aspects of data gathering (planning, sample collection, lab analysis, data management, etc.) result in quality-controlled, usable data. To document steps taken and decisions made, an annual Data Validation Report (DVR) is produced summarizing QC activities for annual water quality datasets and detailing all censoring and qualification decisions. Supporting documention affecting data decisions may include QC test results, Proficiency Test (PT) conclusions, e-mail communications, corrective actions and field/lab audit results. The DVR essentially completes the data validation process, resulting in final data.

C2.3 Internal and On-Line Data Reporting

As data are finalized, final data are made available to staff using MS Excel spreadsheets and MS Access by project. The internal data warehouse includes standard statistical calculations.

As of April, 2015, WPP is working to develop a preferred alternative for posting data files (water quality and biological data) to the DEP web site.

C2.4 WPP Technical Memoranda

Using final data, WPP staff develop project-specific Technical Memoranda summarizing findings. These reports are made available internally, as well posted to DEP's web site.

C2.5 EPA Database Reporting

Once data are finalized, data are exported to EPA's STORET Water Quality Exchange (WQX) network (http://www.epa.gov/storet/wqx/index.html). WPP's goal for assembling, validating and finalizing laboratory, instrument and biological data is within 6-9 months of data collection. The frequency of water quality data transmittals to STORET may vary from once per year to several times per year, depending on the availability of final data.

DWM-WPP also employs the Assessment Database Version 2.3 to track water quality assessment decisions, including causes and sources of impairment (http://www.epa.gov/waters/adb/).

C2.6 Integrated List

On a biennial basis, DEP generates an *Integrated List of Waters (ILW)* that combines reporting elements of sections 305(b) and 303(d) of the Clean Water Act. The integrated listing format allows states to provide the status of all their assessed waters in a single, multi-part list. The ILW report presents the individual categories of Massachusetts' waters for the current CWA listing cycle. Each waterbody or segment is listed in one of the following five categories:

1) Unimpaired and not threatened for all designated uses
2) Attaining some uses and not assessed for others
3) No uses assessed (Insufficient information to make assessments for any uses)
4a) TMDL is completed
4b) Impairment controlled by alternative pollution control requirements
4c) Impairment not caused by a Pollutant --- TMDL not required
5) Impaired or threatened for one or more uses and requiring a TMDL

The latest version of the Integrated List can be found on the DEP web page: http://www.mass.gov/dep/water/resources/tmdls.htm

C2.7 Water Quality Assessments

Results of monitoring efforts, combined with all other reliable information, constitute the basis for making water quality assessments. The Consolidated Assessment and Listing Methodology (CALM) guidance document contains MassDEP's reasoning and justification for site-specific designated use decisions. The 2012 version of the CALM is here: http://www.mass.gov/eea/docs/dep/water/resources/07v5/2012calm.pdf.

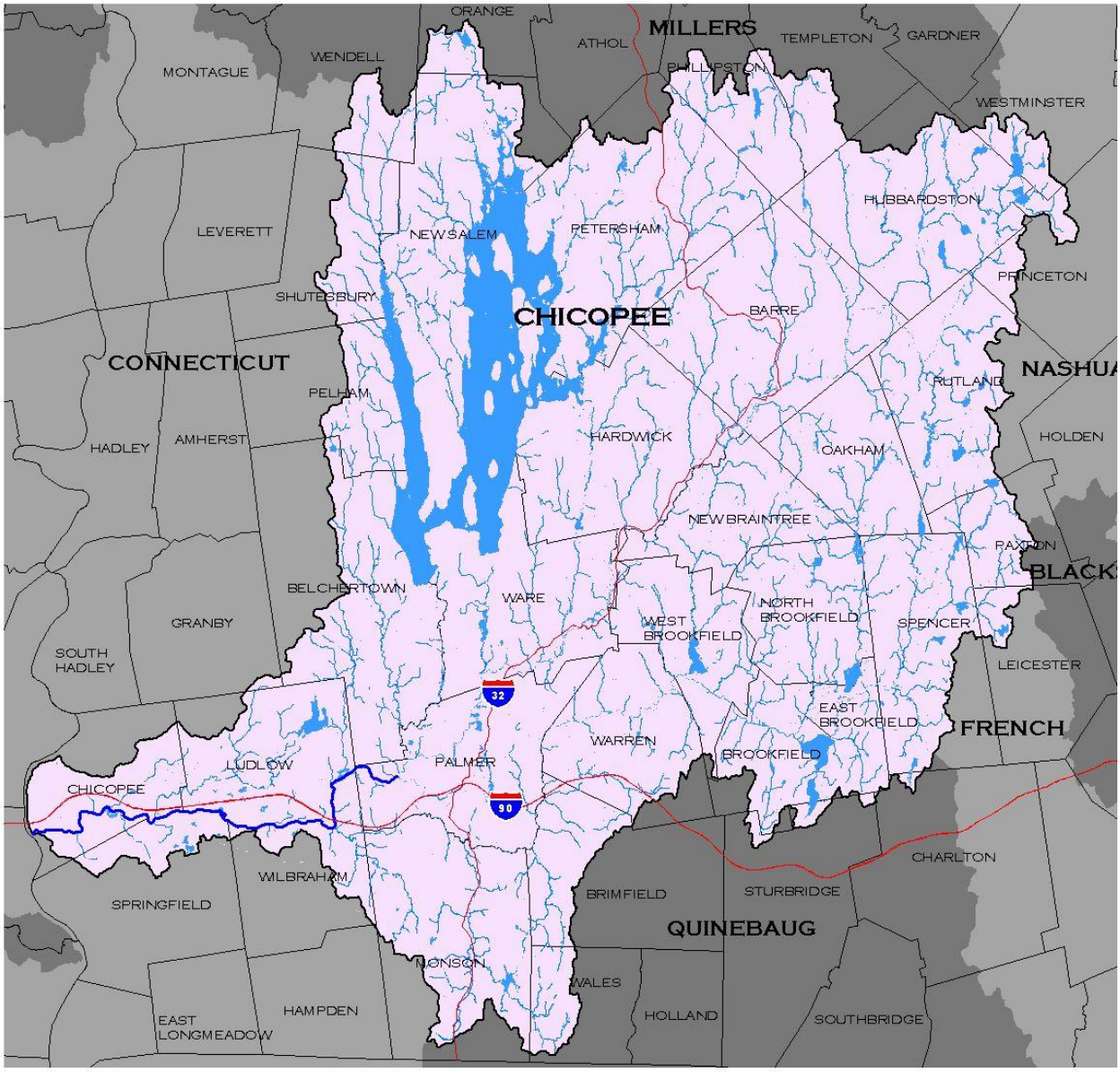
Use-attainment determinations are made for each waterbody segment for which adequate data and information are available. (Many waters remain not assessed for one or more uses in any given assessment cycle and many small and/or unnamed streams and ponds have never been monitored and assessed). Results of DEP water quality assessments are available at: http://www.mass.gov/eea/agencies/massdep/water/watersheds/water-quality-assessments.html.

C2.8 TMDLs

Section 303(d) of the Clean Water Act and the EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for waterbodies that are not meeting designated uses under technology-based controls. The TMDL process establishes the maximum allowable loading of pollutants that a waterbody can receive and still meet the SWQS established for protecting public health and maintaining the designated beneficial uses of those waters. TMDL analyses are based on available data and information and documented in TMDL reports. Final reports are posted on DEP's web site: http://www.mass.gov/dep/water/resources/tmdls.htm.

C2.9 TMDL Modeling Reports

As described in WPP's TMDL Modeling QAPP, selection and use of models will be thoroughly documented in Modeling Reports. See Appendix C for more information.



Chicopee Watershed

D1 DATA REVIEW AND VALIDATION

DWM-WPP uses standardized procedures for managing, reviewing and validating primary water quality data. These procedures are contained in the following SOPs (Appendix E):

- CN 56.4 Data Validation_Attended data
- CN 56.5 Data Validation_Unattended data
- CN 56.6 Data Validation_Laboratory data
- CN 56.9 Data Validation_Summary

NOTE: The review and validation of WPP biological data (e.g., aquatic macroinvertebrates, fish toxics, fish populations) are done in accordance with the stand-alone QAPPs and SOPs for those programs (available on 2015-2019 QAPP CD).

Review of secondary data sources (gathered by others) for usability is described in Section B9.3.

D1.1 "QC Status" Levels for WPP Data

The following categories of "data readiness" are used at DWM-WPP, as it relates to the use and transmission of draft and final data. All WPP data are categorized into five levels, depending on and reflecting the status of review and validation (finalization). The preferred QC Status levels for use and/or release of WPP data are QC Status 4 (final) and QC Status 5 (final, published). Although not recommended, all levels (QC1-5) can be shared with others if requested (e.g. for Freedom of Information Act purposes) with the appropriate disclaimers based on the QC status of the data.

QC Status 1:
Raw data. Generally not suitable for use or transmission, but can be transmitted to other parties upon request provided data are sent as "DRAFT" with standard disclaimers.

QC Status 2:
Draft data that has been entered into the appropriate WPP electronic system or database and for which data entry QC has taken place. This stage is for technical QC review.

QC Status 3:
Draft data for which technical QA/QC review (e.g. QC sample results, outlier identification, comparison to project QAPP DQOs, etc.) has taken place. This stage is for project-level review.

QC Status 4:
Final Data. This level of data reflects project-level review by appropriate staff for reasonableness, completeness and acceptability. These data can be freely used and cited in documents without caution or caveat (reviewed and approved by all appropriate WPP staff).

The following guidelines pertain to receipt and use of QC Status 4 data:

a) When using, analyzing, presenting or transmitting QC4 data, do not make any changes affecting CONTENT, including symbols and qualifiers used, censoring decisions, etc.
b) When presenting data, provide KEY to symbols and qualifiers used.
c) See final data file "READ ME" sheets for additional information.

QC Status 5:

Final data in a published, citable report. The QC Status 4 guidelines stated above apply to the data contained in a report. As for QC4-level, these data have been reviewed and approved by all appropriate DWM staff.

D1.2 WPP Final Data Qualifiers

Standard data symbols are used to denote specific problems or issues for final datum. These are applied to both qualified and censored data to provide data users with additional information.

General Symbols (applicable to all data types):

- " **##** " = Censored data (i.e., data that has been discarded for some reason; check qualifier symbol for cause(s)).
- " ****** " = Missing data (i.e., data that should have been reported, but were not for any reason other than no water).
- " **–** " = No data (i.e., data not collected nor intended)
- " **^^** " = No water (i.e., a special case of missing data due to dry/no water conditions)
- " **<MRL**" = Less than method reporting limit (MRL). Denotes a sample result that went undetected using a specific analytical method, or was detected but the result is less than the allowable reporting limit. The actual, numeric MRL is specified (eg. <0.2).

Multi-probe-specific Qualifiers:

" **i** " = inaccurate readings from Multi-probe likely; may be due to significant pre-survey calibration problems, post-survey checks outside typical acceptance ranges for the low ionic and deionized water checks, lack of calibration of the depth sensor prior to use, or to checks against laboratory analyses. Where documentation on unit pre-calibration is lacking, but SOPs at the time of sampling dictated pre-calibration prior to use, then data are considered potentially inaccurate.

Qualification Criteria for Depth (i):

- Clearly erroneous readings due to faulty depth sensor: Censor (i)
- Negative depth readings: Censor (i)
- 0.0 m depth readings: Qualify (i)
- Positive depth readings: Accept without qualification

" m " = method not followed; one or more protocols contained in the DWM Multi-probe SOP not followed, ie. operator error (eg. less than 3 readings per station (rivers) or per depth (lakes), or instrument failure not allowing method to be implemented.

" s " = field sheet recorded data were used to accept data (i.e., not data electronically recorded in a data logger or in cases where data logging is not possible (e.g., single-probes)).

" u " = unstable readings, due to lack of sufficient equilibration time prior to final readings, non-representative location, highly-variable water quality conditions, etc. See Section 4.1 for acceptance criteria.

" c " = unit not calibrated for a particular parameter and/or greater than calibration standard used for pre-calibration, or outside the acceptable range about the calibration standard. Typically used for conductivity (>718, 1,413, 2,760, 6,668 or 12,900 uS/cm) or turbidity (>10, 20 or 40 NTU). It can also be used for TDS and Salinity calculations based on qualified ("c") conductivity data, or that the calculation was not possible due to censored conductivity data (TDS and Salinity are calculated values and entirely based on conductivity reading).

" r " = data may not be representative due to circumstances and/or conditions at the time of sampling.

" t " = tidal influence likely (not indicative of freshwater flow)

Sample-Specific Qualifiers:

" a " = accuracy as estimated at WES Lab via matrix spikes, PT sample recoveries, internal check standards and lab-fortified blanks did not meet project data quality objectives identified for program or in QAPP.

" b " = blank Contamination in lab reagant blanks and/or field blank samples (indicating possible bias high and false positives).

" d " = precision of field duplicates (as RPD) did not meet project data quality objectives identified for program or in QAPP. Batched samples may also be affected.

" **e** " = not theoretically possible. Specifically, used for bacteria data where colonies per unit volume for e-coli bacteria > fecal coliform bacteria, for lake Secchi and station depth data where a specific Secchi depth is greater than the reported station depth, and for other incongruous or conflicting results.

" **f** " = frequency of quality control duplicates did not meet data quality objectives identified for program or in QAPP.

" **h** " = holding time violation (usually indicating possible bias low)

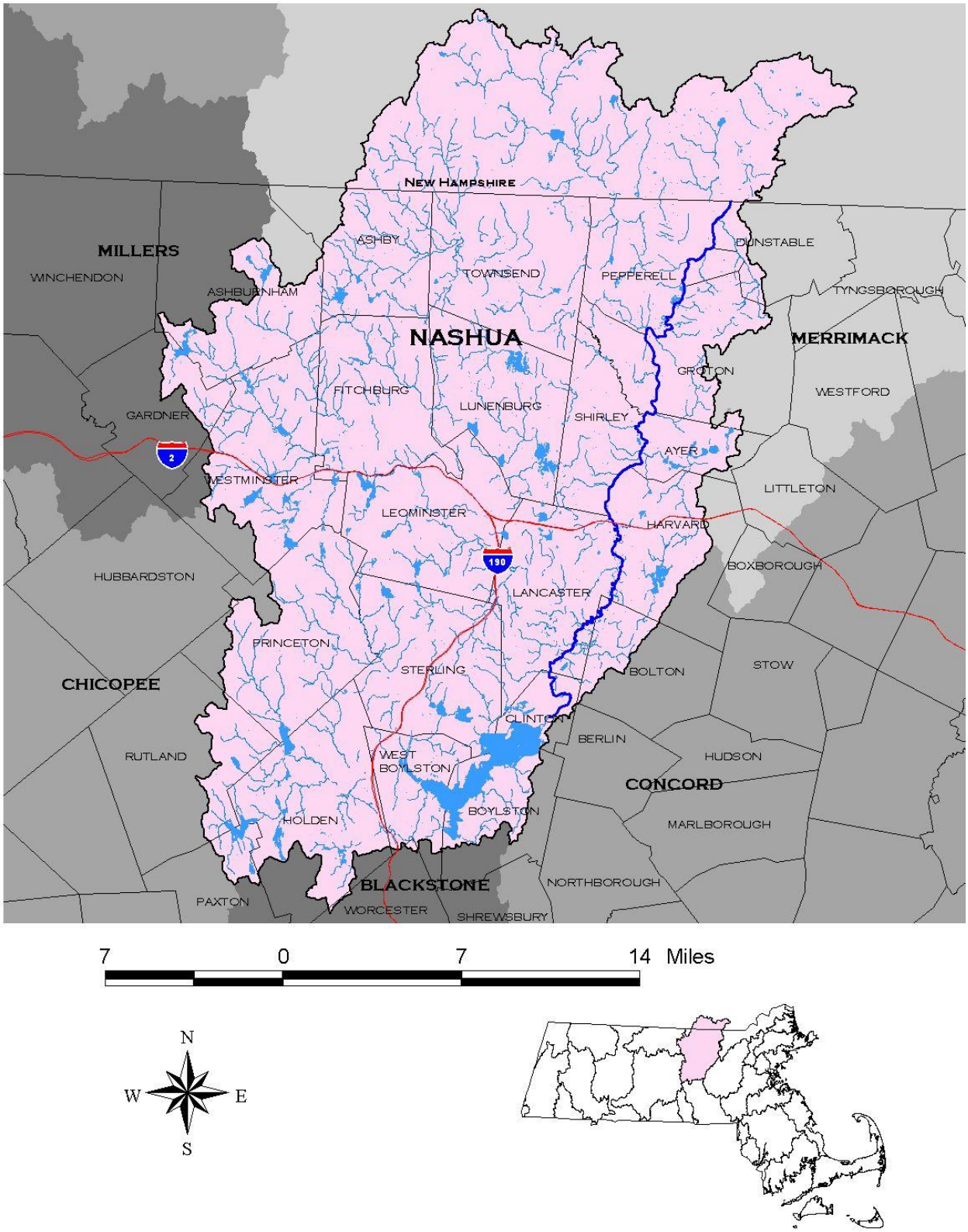
" **j** " = 'estimated' value; can be used for lab-related issues where certain lab QC criteria are not met and re-testing is not possible (as identified by the WES lab only). Also used to report sample data where the sample concentration is less than the 'reporting' limit or RDL and greater than the method detection limit or MDL (mdl< x <rdl). Also used to note where values have been reported at levels less than the mdl. Also used for estimated ranges based on known metadata.

" **m** " = method SOP not followed, only partially implemented or not implemented at all, due to complications with sample matrix (eg. sediment in sample, floc formation), lab error (eg. cross-contamination between samples), additional steps taken by the lab to deal with matrix complications, lost/unanalyzed samples, use of expired reagents and missing data.

" **p** " = samples not preserved per SOP or analytical method requirements.

" **r** " = data may not be representative due to circumstances and/or conditions at the time of sampling, including the possibility of "outlier" data.

" **t** " = tidal influence likely (not indicative of freshwater flow)



Nashua Watershed

D2 DATA VALIDATION METHODOLOGY

D2.1 Data Quality Control Procedures

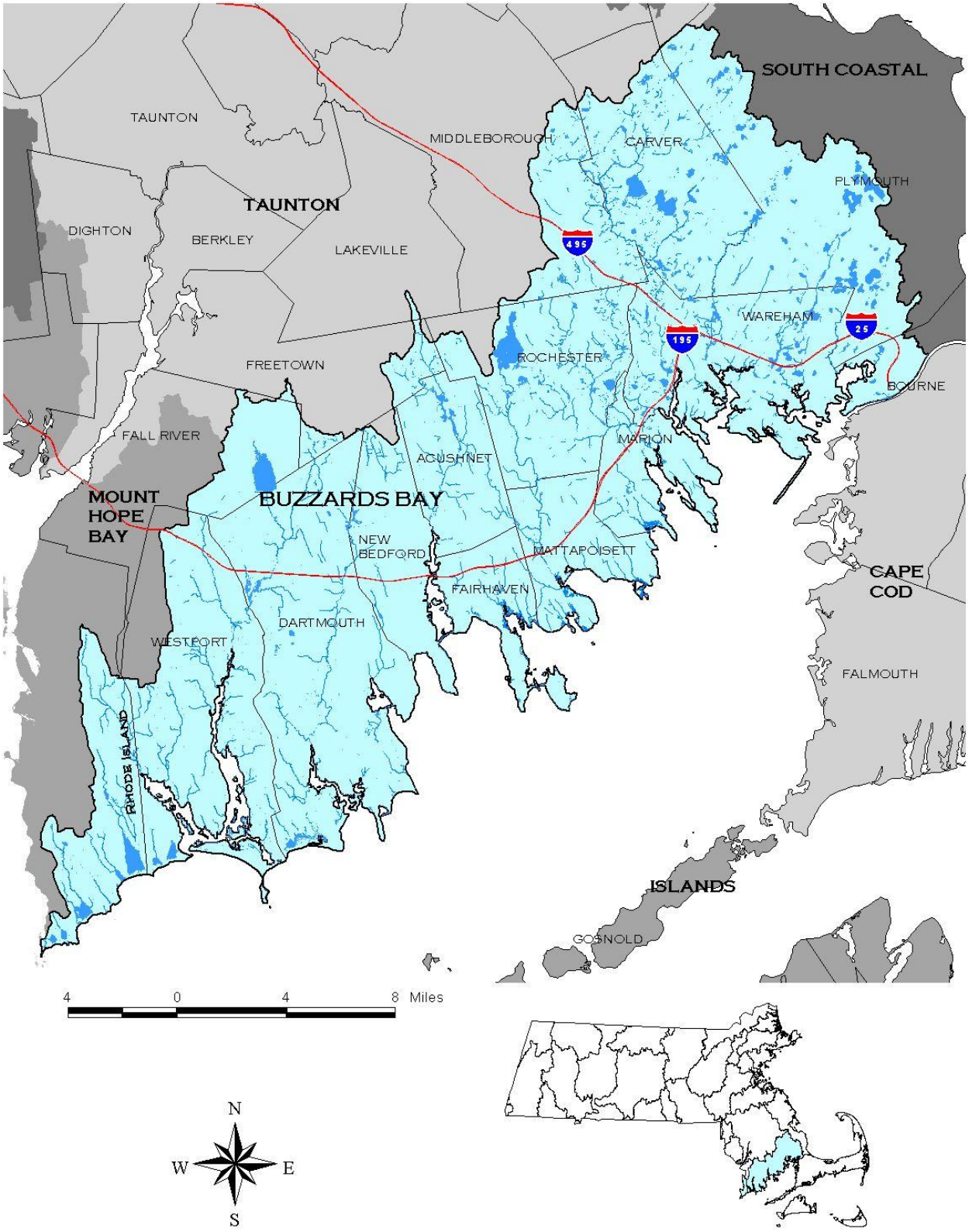
Data validation steps applied to raw and draft monitoring data include the following. See WPP's Data Validation SOPs (CN 56.4, CN 56.5, CN 56.6 and CN 56.9) for more detailed information.

- Review raw data fieldsheets (and field notebook data if available) for accuracy and potential problems; flag all "issues" for later follow-up.
- Review raw data COCs for accuracy and potential problems; flag all "issues".
- Perform data entry into the WPP database entry module for all applicable field- and lab data.
- Check accuracy of all data entered into the database ("data entry QC").
- Evaluate field crew performance on specific surveys (and in general, as appropriate) based on the results of field audits; flag "issues".
- Review hard copy WPP laboratory records (lab notebooks, lab bench sheets) for potential effects on data quality (e.g., suggested qualification by lab analysts, metadata denoting sample issues, etc.)
- Review WPP multi-probe calibration books and electronic summary for potential effects on data quality.
- Review quality control results contained in the WES and contract laboratory data reports for potential implications to data quality and to determine if any data was or should have been qualified by WES (based on lab accuracy and precision data).
- Review WES and contract laboratory data reports for potential problems, such as missing data, typos, missing pages, correct MDLs/RDLs, etc.
- Evaluate WES (and other labs as appropriate) analytical performance during survey period based on results of QC/PE testing.
- Review miscellaneous documentation (e.g., e-mails, phone records, pers. comms.) to highlight any potential problems affecting data quality.
- Review analytical holding time violations for potential exceedences.
- Review frequency of QC samples taken for each survey, and compare to QAPP DQOs for blank and duplicate frequencies.

- Review field QC results for ambient field blanks for potential contamination issues.
- Review field QC results for field duplicates for potential problems related to repeatability of results.
- Apply significant figure and other reporting rules to draft and final data.
- Review available technical memoranda (TMs) for river/stream, lakes, benthic macroinvertebrates, fish toxics, and other "biological" data for potential issues affecting data quality; flag in annual DVR and follow-up as needed.

D2.2 Data Validation Decision-Making

WPP's semi-automated validation procedures result in draft decisions to qualify, censor or accept each datum. These decisions are based on acceptance criteria defined by WPP, as well as project and program DQOs. The preliminary decisions are then reviewed using best professional judgment and pertinent information by WPP's data, QA and project staff.



Buzzards Bay Watershed

D3 DATA USABILITY

Data of known and documented quality (i.e. "QC Status 4" and "5") can be used without caveat for analysis, decision making and reporting (as described in Section C2). The extent to which data are determined to be useful is an on-going in-house evaluation based on cumulative confidence (and uncertainty) in the data, data conclusiveness and results of QC and data analyses. If certain data do not meet the program Data Quality Objectives (DQO's), data may be censored, qualified or left as draft subject to further review. Any limitations on data use will be detailed in both interim and final reports.

Final monitoring data are used in project-specific technical memoranda, which include summary quality control evaluations. These memoranda support determinations made as part of the watershed assessment and TMDL development processes.

The successfulness of DWM monitoring is evaluated on a continuous basis. Data for each project are evaluated with regard to both programmatic and project-specific objectives. Final data are used to answer important questions related to the current health of surface waters in the Commonwealth and to the potential for improvements in environmental quality.

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GLOSSARY:

A common understanding of terminology is critical to an effective QA program. All project personnel should have the same working knowledge of these terms. The following terms are commonly-used in describing project QA/QC, from QAPP development to lab analysis and reporting. In most cases, these suggested definitions are entirely consistent with EPA guidance.

PARCC Concepts:

Precision: A data quality indicator, precision measures the level of agreement or variability among a set of repeated measurements, obtained under similar conditions. Precision is usually expressed as a standard deviation in absolute or relative terms.

Accuracy: A data quality indicator, accuracy is the extent of agreement between an observed value (sampling result) and the accepted, or true, value of the parameter being measured. High accuracy can be defined as a combination of high precision and low bias.

Representativeness: A data quality indicator, representativeness is the degree to which data accurately and precisely portray the actual or true environmental condition measured.

Comparability: A data quality indicator, comparability is the degree to which different methods, data sets, and/or decisions agree or are similar.

Completeness: A data quality indicator that is generally expressed as a percentage, completeness is the amount of valid data obtained compared to the amount of data planned.

General QA/QC:

Analyte: Within a medium, such as water, an analyte is a property or substance to be measured. Examples of analytes would include pH, dissolved oxygen, bacteria, and heavy metals.

Bias: Often used as a data quality indicator, bias is the degree of systematic error or inaccuracy present in the assessment or analysis process. When bias is present, the sampling result value will differ from the accepted, or true, value of the parameter being assessed in one direction. Bias should not be used interchangeably with accuracy.

Censored data: Data that has been found to be unacceptable as a result of the data validation process, including review for conformance to the approved QAPP and data quality objectives for the project (ex. required holding times for analysis, required frequency of field blanks and duplicates/splits, acceptability of precision estimates (standard deviation, SD or relative percent difference, RPD).

Chain-of-Custody: Used for routine sample control for regulatory and non-regulatory monitoring. The chain-of-custody form contains the following information: sample IDs, collection date/time/samplers, sample matrix, preservation reqts., delivery persons/ date/time, etc… Used also as a general term to include sample labels, field logging, field sheets, lab receipt and assignment, disposal and all other aspects of sample handling from collection to ultimate analysis.

Data users: The group(s) that will be applying the data results for some purpose. Data users can include the principle investigators, as well as government agencies, schools, universities, watershed organizations, and business and community groups.

Data quality objectives (DQOs): Data quality objectives are quantitative and qualitative statements describing the degree of the data's acceptability or utility to the data user(s). They include indicators such as accuracy, precision, representativeness, comparability, and completeness (PARCC). DQOs specify the quality of the data needed in order to meet monitoring project goals.

Matrix: A matrix is a specific type of medium, such as surface water or sediment, in which the analyte of interest may be contained.

Measurement Range: The measurement range is the extent of reliable readings of an instrument or measuring device, as specified by the manufacturer.

Method Validation: Testing procedure for existing, new and modified methods, in which several evaluation steps are typically employed: determinations of MDL, method precision, method accuracy, and sensitivity to variation in method steps ("method ruggedness", SM, 1998).

Minimum Reporting Limit (MRL): Also known as the Reporting Limit (RL), the lower limit that the lab feels comfortable reporting with a high level of certainty. This limit is typically a multiplier of the MDL (2-5X).

Performance Audit: Unscheduled evaluation of field sampling QC or laboratory QC procedures by a third party not directly involved in the taking, transport and analysis of the samples; used to detect deviations from accepted SOPs. Audits can take many forms. Submittal of identical check samples to two different labs is an example of an external, blind performance audit. Inter-lab comparison samples can also be used to test the lab's proficiency in relation to other labs. Results of audits are documented and any necessary corrections recommended.

Practical Quantitation Limit (PQL): The lowest concentration of an analyte that can be reliably measured within specified limits of precision and accuracy during routine laboratory operating conditions. (50 FR 46906, November 13, 1985) PQLs can range from 3-10 times the MDL.

Protocols: Protocols are detailed, written, standardized procedures for field and/or laboratory operations.

Quality assurance (QA): QA is an integrated management system designed to ensure that a product or service meets defined standards of quality with a stated level of confidence. QA activities involve planning quality control, quality assessment, reporting, and quality improvement. These activities can be internal (within the main group) or external (involving outside parties).

Quality assurance project plan (QAPP): A QAPP is a formal written document describing the detailed quality control procedures that will be used to achieve a specific project's data quality requirements. A QAPP is a planning tool to ensure that project goals are achieved. Typically, QAPPs are finalized prior to monitoring activities and any deviations from the final QAPP made during the actual monitoring are noted in a subsequent task, such as the data reporting phase of the project. QAPPs can be of two main types:

- A "project-specific QAPP" provides a QA blueprint specific to one project or task and is considered the sampling and analysis plan/workplan for the project.

- A "generic program QAPP" is an overview-type plan that describes program data quality objectives, and documents the comprehensive set of sampling, analysis, QA/QC, data validation and assessment SOPs specific to the program. An example is a macroinvertebrate monitoring program performed throughout many watersheds within a State.

Quality control (QC): QC is the overall system of technical activities designed to measure quality and limit error in a product or service. A QC program manages quality so that data meets the needs of the user as expressed in a quality assurance project plan. Specific quality control samples include blanks, check samples, matrix spikes and replicates.

Random Sample: A sample chosen such that the choice of each event in the sample is left entirely to chance; an unbiased sample generally representative of the population. Randomness is a property of a sample that must exist for almost any statistical test, but may not be appropriate for all sampling designs (ex. Non-random site selection based on targeting specific conditions or based on practical considerations).

Relative standard deviation (RSD): A measure of precision calculated by dividing the std. deviation by the mean, expressed as a percentage. Used when sample number exceeds two.

Relative percent difference (RPD): A measure of precision used for duplicate sample results. It is calculated by dividing the difference between the two results by the mean of the two results, expressed as a percentage. Used when sample number equals two.

Sensitivity: Similar to resolution, sensitivity refers to the capability of a method or instrument to discriminate between measurement responses.

Standard deviation(s): Used in the determination of precision, standard deviation is the most common calculation used to measure the range of variation among repeated measurements. The standard deviation of a set of measurements is expressed by the positive square root of the variance of the measurements.

Standard operating procedures (SOPs): An SOP is a written, official document detailing the prescribed and established methods used for performing project operations, analyses, or actions. Each DWM SOP is reviewed and approved for accuracy and applicability by DWM managers.

Trend: Systematic tendency over time in a specific direction in time series data, ideally collected at uniform intervals, collected and analyzed using the same (or comparable) methods and containing no gaps in periodic data.

True value: In the determination of accuracy, observed measurement values are often compared to true, or standard, values. A true value is one that has been sufficiently well established to be used for the calibration of instruments, evaluation of assessment methods or the assignment of values to materials.

Variance: A statistical term used in the calculation of standard deviation, variance is the sum of the squares of the difference between the individual values of a set and the arithmetic mean of the set, divided by one less than the numbers in the set.

<u>Field Quality Control</u>:

Duplicate sample: Used for quality control purposes, field/lab duplicate samples are two samples taken generally at the same time from, and representative of, the same site/sample that are carried through all assessment and analytical procedures in an identical manner. Field duplicate samples are used to measure natural variability as well as the precision of field sampling and lab analytical methods. Lab duplicates are used as a measure of method precision. More than two duplicate samples are referred to as replicate samples.

DWM field blank water: Deionized water made available by properly-maintained and -functioning water filtration system located in DWM laboratory.

Environmental sample: An environmental sample is a specimen of any material collected from an environmental source, such as water or macroinvertebrates collected from a stream, lake, or estuary.

Field blank: A field blank is created by filling a clean sample bottle with deionized or distilled water in the field during sampling activities. The sample is treated the same as other samples taken from the field. Field blanks are submitted to the lab along with all other samples and are used to detect any contaminants that may be introduced during sample collection, fixing, storage, analysis, and transport.

Field composite sample: A sample taken by mixing equal volumes of a pre-determined number of grab samples from the same location at different times, ie. a time-composite. Used to assess average conditions present between the first and last grab samples that are composited. Use time-composite sampling only for those parameters that can be shown to remain unchanged under the specific conditions of composite sample collection. Flow-weighted composite sampling is a variation to time-composite sampling, in which sample volume adjustments are made to each grab based on variations in flow, such as occurs during stormwater monitoring loading studies.

Field integrated sample: A sample taken by simultaneously combining a matrix across vertical or horizontal strata as an evaluation of average composition within the boundaries of the integration (ex. Photic zone sampling for chlorophyll a). Sampling tubes can sample continuous, integrated media.

Field Split: A second sample generated from the same sampling location and at the same time by splitting a large volume sample from one sampler deployment into two equal volume samples. Used to measure precision, except that associated with actual sample collection, and excludes natural variability. Also referred to as duplicate subsample.

Field Duplicate (sequential): A second sample generated from the same sampling location as the initial sample, but from a second sampler deployment immediately after the first. Used to measure overall field sampling precision and includes an unknown amount of natural variability (spatial and temporal), if present.

Field Duplicate (simultaneous): A second sample generated from the same sampling location and at the same exact time as the other sample by simultaneous deployment of two identical sampling devices or by the simultaneous filling of two separate sample bottles. Used to measure overall field sampling precision and includes an unknown amount of natural variability (spatial), if present. Also referred to as a co-located duplicate.

Grab Sample: A manually collected sample at a specific location and time. Given practical constraints and budget limitations, assumptions are usually made that the natural variation is small enough over space/time to consider the grab to be representative of conditions over a greater expanse and/or longer period. In some cases, these assumptions may not always be valid.

Laboratory Quality Control:

Blind sample: A blind sample is a sample submitted to an analyst without their knowledge of its identity or composition. Blind samples are used to test the analyst's or laboratory's expertise in performing the sample analysis.

Calibration Blank: Reagent-grade, purified water (deionized/distilled) used as a zero standard; used to "zero" lab instruments, evaluate instrument drift and check for sample contamination of field blanks.

Calibration Check Standard: A standard used to check the calibration of an instrument between periodic recalibrations.

Detection limits: Applied to both methods and equipment, detection limits are descriptions of the lowest concentration of a target analyte that a given method or piece of equipment can reliably ascertain as greater than zero. Specific detection limits include: Instrument detection limit, level of quantitation, lower level of detection, method detection limit, practical quantitation limit and reporting (detection) limit.

Instrument detection limit (IDL): The concentration that produces a signal greater than five times the signal/noise ratio of the instrument.

Level of Quantitation (LOQ): The concentration that produces a signal sufficiently greater than the blank that it can be detected; typ. The concentration that produces a signal 10*s above the blank signal. Typically, ten times the IDL (SM, 1998).

Lower level of detection (LLD): Measurement level reproducible with 99% certainty; typically twice the IDL.

Method detection limit (MDL): The MDL is the concentration that produces a signal with a 99% probability that it is different from the blank, after going through the entire method. The smallest amount that can be detected above the noise in a procedure and within a stated confidence level. Typically, four times the IDL.

Practical Quantitation Limit (PQL): The lowest concentration level that several labs can report using the same method and samples; typically, ten times the IDL, and 3-5 times the MDL.

Reporting Limit (RL): Also known as the Reporting Detection Limit (RDL), the lower limit that the lab feels comfortable reporting with a high level of certainty. For practical purposes, the RDL is often equivalent to the MDL when data with values down to the lowest possible limits are needed.

Equipment or rinsate blank: Used for quality control purposes, equipment or rinsate blanks are types of field blanks used to check specifically for carryover contamination from reuse of the same sampling equipment (see field blank).

Lab Split: A sample that has been divided into two or more subsamples. Splits are submitted to different analysts or laboratories and are used to measure the precision of the analytical methods. Lab splits are an external QC protocol.

Lab duplicate: A sample that has been divided into two or more subsamples. It is processed concurrently and identically with the initial sample by the same laboratory. It is used to measure the precision of the analytical methods. Lab duplicates are also referred to as lab splits.

Method Blank: An aliquot of clean reference matrix carried through the analytical process to assess the degree of laboratory contamination and indicate accuracy.

Matrix Spike: A sample to which a known concentration of target analyte has been added. When analyzed, the difference in analyte concentration between a spiked sample and the non-spiked sample should be equivalent to the amount added to the spiked sample. Lab QC sample used to assess sample matrix effects on recovery of target analyte and evaluate accuracy. Also known as Lab-fortified matrix. Duplication of this sample is referred to as matrix spike duplicate or lab-fortified matrix duplicate.

Performance evaluation (PE) samples: A sample of known concentration submitted "blind" (without lab's knowledge) to the analyst. PE samples are provided to evaluate the ability of the analyst or laboratory to produce analytical results within specified limits, and as an indicator of method accuracy. Also called a laboratory control sample.

Spike Blank: Known concentration of target analyte(s) introduced to clean reference matrix and processed through the entire analytical procedure; used as an indicator of method performance and accuracy. Also known as Lab-fortified blank.

Standard reference materials (SRM): An SRM is a certified material or substance with an established, known and accepted value for the analyte or property of interest. Employed in the determination of bias, SRMs are used as a gauge to correctly calibrate instruments or assess measurement methods. SRMs are produced by the U. S. National Institute of Standards and Technology (NIST) and characterized for absolute content independent of any analytical method.

Qualifier: Used to indicate additional information about the data, and generally denoted as capital letters in data reports. Qualifier acronyms or terms are unique to each laboratory.

Quality Assurance Plan (QAP): A comprehensive laboratory document detailing lab quality control procedures (eg. WES QAP).

APPENDICES

Appendix A: WPP Biological Assessment Monitoring Program QAPP *(by reference; on QAPP CD)*

Appendix B: WPP Fish Toxics Programmatic QAPP *(by reference; on QAPP CD)*

Appendix C: WPP QAPP for TMDL Modeling *(by reference; DRAFT COPY on QAPP CD)*

Appendix D: WES Laboratory QA Plan and SOPs *(by reference; on QAPP CD)*

Appendix E: WPP monitoring, analytical and data management SOPs *(by reference; on QAPP CD)*

Appendix F: Contract Lab SOPs *(by reference; on QAPP CD and annual addendums as necessary)*

Appendix G: WPP annual Sampling & Analysis Plans (SAPs) *(by reference; on QAPP CD) Example SAP provided.*

Appendix H: Probabilistic Survey Design

Appendix I: WPP Documentation Forms *(examples)*

APPENDICES A-G

NOTE: The following large documents are included herein by reference. They can be viewed using the DWM QAPP CD (2015-2019)

Appendix A: DWM Biological Assessment Monitoring Program QAPP

Appendix B: DWM Fish Toxics Programmatic QAPP

Appendix C: DWM QAPP for TMDL Modeling

Appendix D: WES Laboratory QA Plan and SOPs

Appendix E: DWM monitoring, analytical and data management SOPs

Appendix F: Contract Lab SOPs

Appendix G: DWM annual Sampling & Analysis Plans (SAPs) *(double-click next page to open entire example document)*

Appendix G

WPP annual, project-specific Sampling & Analysis Plans (SAPs)

2015 example provided (double-click below to open entire SAP document)

SAMPLING & ANALYSIS PLAN
2010 PROBABILISTIC MONITORING
NORTHEAST REGION

CN#: 366.0

Massachusetts Department of Environmental Protection
Division of Watershed Management
627 Main Street, Second Floor
Worcester, MA

NOTE: This draft sampling plan provides detail re: sampling locations, frequencies, analytes, methods, etc. and is intended to augment DWM's multi-year programmatic QAPP approved by EPA. The contents mirror selected elements of DWM's programmatic QAPP (i.e.,QA-R5 EPA Guidance)

Appendix H:

MAP2 Project Probabilistic Survey Design

Massachusetts Probabilistic Monitoring and Assessment Program (MAP2) Wadeable Rivers and Streams Survey Design 2011-2015

Contact:
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Division of Watershed Management
Massachusetts Department of Environmental Protection (MassDEP)
627 Main Street, 2nd Floor
Worcester, MA 01604
508-767-2863

Description of Sample Design

The goal of the Massachusetts Probabilistic Monitoring and Assessment Program (MAP2) is to provide a comprehensive assessment of the condition of "waters" in Massachusetts through the implementation of probabilistic sampling designs. As of 2011, wadeable rivers and streams are the only water resource in Massachusetts that has an implemented probabilistic sampling design. It is planned that additional probabilistic sampling designs will be completed and implemented for lakes and estuaries when sufficient resources are available. The survey design for MAP2 is a stratified five-year basin rotation design with a different group of basins getting sampled each year from 2011 to 2015 to provide state-wide coverage (Figure 1).

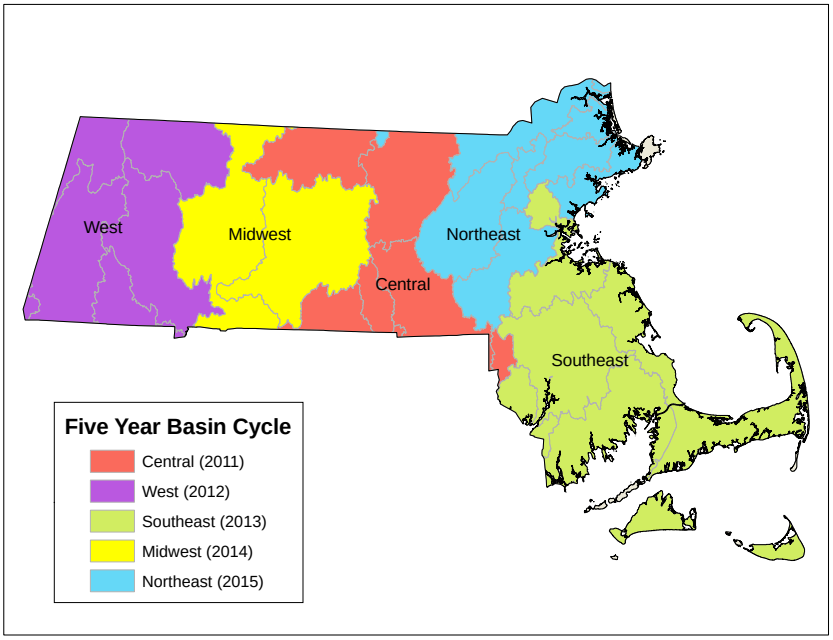


Figure 1 The five-year basin cycle that will be implemented from 2011-2015.

Objectives: The objectives, or design requirements, for the MAP2 project are to produce:

3. An unbiased assessment (Support/Impaired) of aquatic life, recreational and aesthetic uses in wadeable non-tidal perennial streams of Massachusetts.
4. An analysis of long term trends in aquatic life, recreational and aesthetic use assessments in wadeable non-tidal perennial streams of Massachusetts.

Target Population: The target population is all wadeable 1^{st} – 4^{th} Strahler Order non-tidal perennial rivers and streams within the Commonwealth of Massachusetts.

Sample Frame: The sample frame was derived from the National Hydrography Dataset (NHD), in particular NHD (1:24,000). The University of Massachusetts Amherst, under contract to MassDEP, enhanced the NHD, creating feature type (FCODE) subcategories and calculating Strahler stream order for each reach (Attachment 1). The feature types were the main instrument used to identify which segments in NHD were included in the sample frame. Table 2 contains a description of each FCODE and indicates whether it was included or excluded from the sample frame.

Stratification: The sites were stratified by basin group (central, west, midwest, southeast, northeast)

Multi-density Categories: Unequal selection probabilities were used to create multi-density categories and allocate sites equally among Strahler Orders 1st, 2nd, 3rd, and 4th.

Panels: Single Panel

Sample Size: The expected sample size is 32 sites with an oversample of 128 sites.

Site Use: Assume the base design has 32 sites. Sites are listed in siteID order and must be used in that order within each stratum. All sites that occur prior to the last site used must have been evaluated for use and then either sampled or reason documented why that site was not used. As an example, if 32 sites are to be sampled and it required that 61 sites be evaluated in order to locate 32 stream sites able to be sampled, then the first 61 sites in siteID order would be used. It is also permissible to replace sites within each stratum.

Table 2 Feature types included and excluded from the sample frame.

Feature Type	FCCODE	New FCODE	New Feature Type	Sample Frame
Connector	33400	33400	Connector	Include
Canal/Ditch	33600	33600-A	Natural Ditch	Include
		33600-B	Tidal Ditch	Exclude
		33600-C	Artificial Ditch	Exclude
		33600-AS	Artificial Swamp Ditch	Exclude
Surface Aqueduct	42801	42801-A	Natural Surface Aqueduct	Include
		42801-B	Artificial Surface Aqueduct	Exclude
Elevated Aqueduct	42802	42802-A	Natural Elevated Aqueduct	Include
		42802-B	Artificial Elevated Aqueduct	Exclude
Underground Aqueduct	42803	42803-A	Natural Underground Aqueduct	Include
		42803-B	Artificial Underground Aqueduct	Exclude
Underground Pipeline	42807	42807-A	Natural Underground Pipeline	Include
		42807-B	Artificial Underground Pipeline	Exclude
River	46000	46000-A	Freshwater river	Include
		46000-B	Tidal River	Exclude
Intermittent River	46003	46003	Intermittent river	Exclude
Perennial River	46006	46006-A	Freshwater Perennial River	Include
		46006-B	Tidal Perennial River	Exclude
Artificial Paths (AP)	55800	55800-A	Wetland/River Artificial Pathway	Include
		55800-AO	Coastline Artificial Pathway	Exclude
		55800-AS	Terminus Wetland Artificial Pathway	Exclude
		55800-B	Lake/Pond/Reservoir Artificial Pathway	Exclude
		55800-Canal	Canal Artificial Pathway	Exclude
		55800-D	Tidal Artificial Pathway	Exclude
		55800-E	Tributary to Mainstem Centerline AP	Exclude
		55800-F	Man-Made Artificial Pathway	Exclude
Coastline	56600	56600	Coastline	Exclude

Description of Sample Design Output: **The output is provided as a shapefile for the sites. Note that the ".dbf" file may be read in Excel. The attributes are as follows:**

Variable Name	Description
SiteID	Unique site identification (character)
x	x-coordinate from map projection (see below)
y	y-coordinate from map projection (see below)
mdcaty	Multi-density categories used for unequal probability selection
weight	Weight (in km), inverse of inclusion probability, to be used in statistical analyses
stratum	Strata used in the survey design
panel	Identifies base sample by panel name and Oversample by OverSamp
EvalStatus	Site evaluation decision for site: TS: target and sampled, LD: landowner denied access, etc (see below)
EvalReason	Site evaluation text comment
auxiliary variables	Remaining columns are from the sample frame provided

B. **Evaluation Process:** The survey design weights that are given in the design file assume that the survey is implemented as designed. Typically, users prefer to replace sites that cannot be sampled with other sites to achieve the sample size planned. The site replacement process is described above. When sites are replaced, the survey design weights are no longer correct and must be adjusted. The weight adjustment requires knowing what happened to each site in the base design and the over sample sites. EvalStatus is initially set to "NotEval" to indicate that the site has yet to be evaluated for sampling. When a site is evaluated for sampling, then the EvalStatus for the site must be changed. See the site evaluation SOP (CN 306.0)

C. **Statistical Analysis:** Any statistical analysis of data must incorporate information about the monitoring survey design. In particular, when estimates of characteristics for the entire target population are computed, the statistical analysis must account for any stratification or unequal probability selection in the design. Procedures for doing this are available from the Aquatic Resource Monitoring web site (http://www.epa.gov/nheerl/arm). A statistical analysis library of functions is available from the web page to do common population estimates in the statistical software environment R.

ATTACHMENT

(Date)

Dear Landowner:

The Massachusetts Department of Environmental Protection (MassDEP) is conducting an environmental assessment of rivers and streams across Massachusetts. A total of 150 river and stream monitoring sites were randomly selected throughout the state by a computer to provide a statistically unbiased assessment. According to parcel maps and aerial photos, we would need to access your property to reach one of the selected monitoring sites. The purpose of this letter is to request access permission to conduct the stream monitoring. We realize that accessing your property is a privilege and we will respect your rights and wishes at all times. We have enclosed a copy of an aerial photo map identifying the monitoring site location we wish to access.

The goal of the monitoring is to collect sufficient data to assess if the state's rivers and streams are meeting their intended uses in accordance with the Clean Water Act (i.e., is it suitable for fish and other aquatic life, are bacteria levels safe for people to come in contact with the water, etc.). Water chemistry, aquatic life, and habitat will be monitored at each of the selected sites to reach this goal. The monitoring involves approximately a dozen site visits between April and October 2011, with most visits lasting approximately 15 minutes to collect water samples. On two of the site visits, we will spend up to 2 hours at the site collecting biological samples (aquatic insects and fish that live in the river). All sampling will occur on weekdays during regular business hours.

Please contact me at (Phone) or (Email) to grant or deny MassDEP permission to access your property. Thank you for assistance.

Sincerely,

(Name)
(Title)

Appendix H Attachment – Site Evaluation Results for the First 78 Sites (2015)

Rejection Reason Key (WE=Wetland, NW=Not wadeable, CB=Cranberry bog ditch, APD=Access Permission Denied, FE=Sample frame error, FE-I=Sample frame error-intermittent, FE-M=Sample frame error-Impounded (man-made), FE-A=Sample frame error-artificial channel, FE-T=Sample frame error-Tidal, NRL=No response from landowner, O=Other) Refer to Appendix A for a more detailed description.

Site ID	Evaluation Status	Rejection Reason	Waterbody	Town	Basin	Strahler Order	Latitude	Longitude
MAP2-641	Reject	FE-I	Unnamed Tributary	Salisbury	North Coastal	1st	42.86472	-70.88261
MAP2-642	Accept		Ipswich River	Middleton	Ipswich	4th	42.61693	-70.99641
MAP2-643	Reject	FE-I	Unnamed Tributary	Tewksbury	Shawsheen	2nd	42.60500	-71.24697
MAP2-644	Reject	FE-A	Unnamed Tributary	Northborough	SuAsCo	1st	42.31606	-71.60954
MAP2-645	Reject	WE	East Meadow River	Haverhill	Merrimack	3rd	42.81592	-71.03739
MAP2-646	Accept		River Meadow Brook	Chelmsford	SuAsCo	4th	42.59436	-71.34067
MAP2-647	Reject	FE-I	Unnamed Tributary	Lincoln	Charles	1st	42.41912	-71.29294
MAP2-648	Reject	FE-I	Unnamed Tributary	Berlin	SuAsCo	1st	42.38137	-71.66004
MAP2-649	Reject	NW	Ipswich River	North Reading	Ipswich	4th	42.57540	-71.07246
MAP2-650	Reject	FE	Unnamed Tributary	Wilmington	Shawsheen	1st	42.59184	-71.17449
MAP2-651	Accept		Cold Spring Brook	Hopkinton	SuAsCo	3rd	42.22478	-71.47767
MAP2-652	Accept		Charles River	Bellingham	Charles	3rd	42.10498	-71.45840
MAP2-653	Reject	NRL	Muddy Brook	Rowley	Parker	2nd	42.70787	-70.95369
MAP2-654	Accept		Beaver Brook	Dracut	Merrimack	4th	42.67184	-71.34445
MAP2-655	Accept		Elizabeth Brook	Stow	SuAsCo	4th	42.42764	-71.48545
MAP2-656	Reject	APD	Charles River	Medway	Charles	4th	42.13911	-71.38732
MAP2-657	Accept		Powwow River	Amesbury	Merrimack	4th	42.86593	-70.96159
MAP2-658	Reject	FE-T	Bass River	Beverly	North Coastal	2nd	42.55633	-70.88867
MAP2-659	Reject	FE-I	Pinnacle Brook	Andover	Shawsheen	1st	42.62973	-71.18938
MAP2-660	Accept		Whitehall Brook	Hopkinton	SuAsCo	3rd	42.25321	-71.56727
MAP2-661	Reject	WE	Unnamed Tributary	Haverhill	Merrimack	2nd	42.74141	-71.07000
MAP2-662	Reject	FE-I	Unnamed Tributary	Westford	SuAsCo	1st	42.58622	-71.40365
MAP2-663	Accept		Hurd Brook	Needham	Charles	2nd	42.30494	-71.23383
MAP2-664	Reject	NRL	North Brook	Berlin	SuAsCo	4th	42.35568	-71.62830
MAP2-665	Accept		Ipswich River	Middleton	Ipswich	4th	42.57903	-70.99154
MAP2-666	Reject	FE-A	Heath Brook	Tewksbury	Shawsheen	1st	42.59137	-71.23321
MAP2-667	Accept		Unnamed Tributary	Framingham	SuAsCo	1st	42.32485	-71.43529
MAP2-668	Reject	WE	Unnamed Tributary	Millis	Charles	1st	42.16831	-71.38710
MAP2-669	Reject	NW	Shawsheen River	Andover	Shawsheen	4th	42.62585	-71.15911

Rejection Reason Key (WE=Wetland, NW=Not wadeable, CB=Cranberry bog ditch, APD=Access Permission Denied, FE=Sample frame error, FE-I=Sample frame error-intermittent, FE-M=Sample frame error-Impounded (man-made), FE-A=Sample frame error-artificial channel, FE-T=Sample frame error-Tidal, NRL=No response from landowner, O=Other) Refer to Appendix A for a more detailed description.

Site ID	Evaluation Status	Rejection Reason	Waterbody	Town	Basin	Strahler Order	Latitude	Longitude
MAP2-670	Accept		Stony Brook	Chelmsford	Merrimack	4th	42.62539	-71.38909
MAP2-671	Reject	APD	Dudley Brook	Sudbury	SuAsCo	1st	42.37102	-71.44132
MAP2-672	Reject	FE-I	Unnamed Tributary	Medway	Charles	1st	42.15353	-71.45849
MAP2-673	Accept		Jackman Brook	Georgetown	Parker	1st	42.73504	-70.94273
MAP2-674	Reject	NRL	Unnamed Tributary	Ashby	Merrimack	1st	42.70503	-71.87688
MAP2-675	Accept		Beaver Brook	Waltham	Charles	3rd	42.39010	-71.19672
MAP2-676	Reject	WE	Elizabeth Brook	Harvard	SuAsCo	3rd	42.46594	-71.54676
MAP2-677	Accept		Saugus River	Wakefield	North Coastal	3rd	42.49581	-71.03874
MAP2-678	Reject	WE	Unnamed Tributary	Groton	Merrimack	2nd	42.58139	-71.49994
MAP2-679	Reject	WE	Unnamed Tributary	Natick	Charles	3rd	42.25481	-71.33276
MAP2-680	Accept		Broad Meadow Brook	Marlborough	SuAsCo	2nd	42.34770	-71.51794
MAP2-681	Accept		Fish Brook	Boxford	Ipswich	3rd	42.63392	-70.97474
MAP2-682	Accept		Vine Brook	Bedford	Shawsheen	2nd	42.50179	-71.24072
MAP2-683	Reject	NRL	Hazel Brook	Wayland	SuAsCo	1st	42.39352	-71.33891
MAP2-684	Reject	WE	Unnamed Tributary	Millis	Charles	2nd	42.16401	-71.37344
MAP2-685	Accept		Shawsheen River	North Andover	Shawsheen	4th	42.69712	-71.14400
MAP2-686	Reject	NRL	Unnamed Tributary	Dunstable	Merrimack	1st	42.67682	-71.47239
MAP2-687	Reject	WE	Unnamed Tributary	Lincoln	SuAsCo	1st	42.42168	-71.33825
MAP2-688	Reject	FE-I	Unnamed Tributary	Medfield	Charles	1st	42.19590	-71.32535
MAP2-689	Reject	FE-I	Unnamed Tributary	Newbury	Parker	1st	42.76763	-70.93949
MAP2-690	Accept		Unnamed Tributary	Harvard	SuAsCo	2nd	42.47683	-71.56542
MAP2-691	Reject	FE-I	Unnamed Tributary	Weston	Charles	1st	42.35522	-71.28711
MAP2-692	Accept		Unnamed Tributary	Bolton	SuAsCo	3rd	42.43570	-71.57041
MAP2-693	Accept		Ipswich River	North Reading	Ipswich	4th	42.57183	-71.09625
MAP2-694	Accept		Nashoba Brook	Acton	SuAsCo	3rd	42.52678	-71.41342
MAP2-695	Reject	FE-M	Rock Meadow Brook	Westwood	Charles	2nd	42.25041	-71.22236
MAP2-696	Accept		Unnamed Tributary	Shrewsbury	SuAsCo	3rd	42.29107	-71.68853
MAP2-697	Reject	WE	Black Brook	Hamilton	Ipswich	2nd	42.62803	-70.86781
MAP2-698	Accept		Cow Pond Brook	Groton	Merrimack	3rd	42.62973	-71.50616

Rejection Reason Key (WE=Wetland, NW=Not wadeable, CB=Cranberry bog ditch, APD=Access Permission Denied, FE=Sample frame error, FE-I=Sample frame error-intermittent, FE-M=Sample frame error-Impounded (man-made), FE-A=Sample frame error-artificial channel, FE-T=Sample frame error-Tidal, NRL=No response from landowner, O=Other) Refer to Appendix A for a more detailed description.

Site ID	Evaluation Status	Rejection Reason	Waterbody	Town	Basin	Strahler Order	Latitude	Longitude
MAP2-699	Reject	WE	Unnamed Tributary	Sudbury	SuAsCo	1st	42.37229	-71.38893
MAP2-700	Accept		Mill River	Norfolk	Charles	3rd	42.12177	-71.36544
MAP2-701	Reject	NW	Parker River	Georgetown	Parker	2nd	42.72554	-71.02079
MAP2-702	Reject	WE	Unnamed Tributary	Tewksbury	Merrimack	1st	42.63803	-71.26758
MAP2-703	Accept		Hop Brook	Northborough	SuAsCo	3rd	42.28713	-71.65129
MAP2-704	Reject	NW	Charles River	Medfield	Charles	4th	42.16381	-71.33272
MAP2-705	Accept		Cobbler Brook	Merrimac	Merrimack	2nd	42.82611	-70.98401
MAP2-706	Reject	O	Proctor Brook	Peabody	North Coastal	1st	42.53425	-70.94372
MAP2-707	Accept		Beaver Brook	Dracut	Merrimack	4th	42.66818	-71.32634
MAP2-708	Reject	PI	Sudbury River	Westborough	SuAsCo	4th	42.26655	-71.57717
MAP2-709	Reject	FE-I	Unnamed Tributary	Essex	North Coastal	1st	42.61016	-70.77760
MAP2-710	Accept		Stony Brook	Westford	Merrimack	4th	42.59759	-71.44757
MAP2-711	Reject	FE-I	Unnamed Tributary	Wellesley	Charles	1st	42.28926	-71.27745
MAP2-712	Reject	WE	Unnamed Tributary	Hudson	SuAsCo	2nd	42.40402	-71.55194
MAP2-713	Reject	FE-I	Unnamed Tributary	Ipswich	Parker	1st	42.70533	-70.85661
MAP2-714	Accept		Spring Brook	Bedford	Shawsheen	2nd	42.49406	-71.25598
MAP2-715	Accept		Cochituate Brook	Framingham	SuAsCo	4th	42.31932	-71.39558
MAP2-716	Accept		Bogastow Brook	Millis	Charles	4th	42.18702	-71.37582
MAP2-717	Accept		Shawsheen River	Andover	Shawsheen	4th	42.65219	-71.15097
MAP2-718	Accept		Stony Brook	Westford	Merrimack	4th	42.60918	-71.41168

Appendix I:

WPP Documentation Forms

Examples of completed fieldsheets, chain-of-custody forms, lab reports, training records and other forms

1. **Training Form**
2. **Fieldsheets**
   a) *Rivers & Streams*
   b) *Multiprobe Deployment*
   c) *Lakes & Ponds*
   d) *Bacteria Source Tracking*
   e) *Pipes & Conduits*
   f) *Streamwalk Observations*
   g) *Biomonitoring*
   h) *Fish Populations*
   i) *Fish Collections for Tissue Toxins*
   j) *Habitat Evaluation*
3. **COC form**
4. **Aquatic Macroinvertebrate Sample Processing Record**
5. **Aquatic Macroinvertebrate Sample Sorting QC Check**
6. **Aquatic Macroinvertebrate Lab Data Sheet**
7. **Laboratory Data Report** *(double-click to view entire document)*
8. **Electronic Data Deliverable (EDD)**
9. **Multiprobe User Report**
10. **Hazardous Waste Generation Record**
11. **External Data Review (example)**
12. **Field Survey Checklists**
13. **Sample Labels**
14. **Fish Kill Reporting guidance (MA. DFG, 2015)**

MassDEP-DWM Field & Lab Training Verification Form

NAME: Amanda Meisner

	Content [1, 2]	Trainee Signature	Training Date(s)		Trainer Signature
☒	Multi-probe Use (Hydrolab)	Amanda Meisner	5/18/09	RC	R. [illegible]
☒	Multi-probe Use (YSI)	Amanda Meisner	5/18/09	RC	R. [illegible]
☐	Multi-probe Use (Eureka)				
☐	Multi-probe calibration				
☒	Annual Monitoring Survey Guide [3]	Amanda Meisner	5/18/09	RC	R. [illegible]
☒	General Field Sampling (Rivers)	Amanda Meisner	5/18/09	RC	R. [illegible]
☐	General Sampling and Boat Use (Lakes)				
☒	Field Safety	Amanda Meisner	5/18/09	RC	R. [illegible]
☒	Clean Sampling Technique for Metals	Amanda Meisner	6/4/09	JM	James Mutt
☐	Special Field Decontamination Procedures				
☐	LIMS Pre-login				
☐	Flow Monitoring				
☐	Aquatic Macrophyte ID				
☐	Benthic Macroinvertibrate Sampling				
☐	Fish Sampling (Populations)				
☐	Fish Sampling (Toxics)				
☒	Turbidity Analysis (DWM Lab)	Amanda Meisner	5/27/09	KD	[illegible]
☒	Color Analysis (DWM Lab)	Amanda Meisner	5/27/09	KD	[illegible]
☐	Hardness Analysis (DWM Lab)				
☒	Chlorophyll a Analysis (DWM Lab)	Amanda Meisner	6/8/09	JB	Jean Besheres
☐	Colilert (E. coli) Analysis (DWM Lab)				
☐	Detergents (DWM Lab)				
☒	Periphyton Field Sheets-Water Quality	Amanda Meisner	6/18/09	JB	Jean Besheres
☒	Periphyton Sampling	Amanda Meisner	6/16/09	JB	Jean Besheres

NOTES:

1) Training is provided on an individual basis and is based on survey and analytical needs for the current year's activities
2) Personal health and safety issues are addressed in all training modules as applicable. CPR and AED training is not included in this list, but is provided and recommended by DEP; the decision to sign-up for CPR-AED is up to each individual.
3) The Annual Monitoring Survey Guide developed by DWM's QA Analyst is used for review training purposes and provides information and guidance on various monitoring program topics, such as field and lab safety, sampling and logistical considerations, contact information and new procedures (with linked references to SOPs, as applicable).

Massachusetts Depa nt of Environmental Protection/Division of Wa ed Management

iver and Stream Survey Fieldsheet

Rivers and Streams

2009

Project Lead (initial) _____.

Station Sheet 3 of 16.

General Information *(fill out prior to departure)*

Project	Boston Harbor-Neponset (2009)	**Weather conditions last 3 days:** *see attached* (http://www.erh.noaa.gov/box/dailystns.shtml)	
River	Neponset River	**Sampling Survey Crew:** *(use full names; last name is OK for year-round DWM employees)*	
Town	Walpole	**Crew Lead(s):** Jamie Carr (Crew 2)	
Site Name	NE11	**Others:** - MMccaren	

Station Information *(fill out at station for observable station area within 10 meters up/down)* ***DETERMINE LEFT/RIGHT BANK BY LOOKING DOWNSTREAM***

Date: 7/7/2009 **Time** *(24 hr):* 9:16 AM X PM ___ X **Flowing** ☐ No Water ☐ Stagnant ☐ Ice-covered ☐ No Access

Station Description *(use DWM station file descriptions; if pre-typed, confirm no changes to description by checking this box* X*, OR edit text based on changes)*

[Access through parking area off RT 27, south of Robbins Road intersection, Walpole.]

Station Access *(how to get to station and how sampled)* wade center stream, u/s of bridge

"Field" Lat/Long *(GPS unit/lat-long in decimal degrees/accuracy):* ___ / ___

Riparian Area *(provide brief description)* parking lot, mowed upstream

% Open Sky ☐ densiometer ☐ clinometer X visual estimate; *(0-100%: e.g., totally open=100%; total canopy shade=0%)* = 90 %

Photos *(# and subject)*

Weather *(check one only)*	**Air Temperature** *(°F)*	**Wind Conditions**	**Water Odor**	**Water Clarity** *(check most applicable, based on visual, in-stream appearance; same for color)*	**Water Color**
☐ Clear	☐ <20	X Calm (0-1 mph)	☐ None	☐ Unobservable (_____)	☐ Unobservable (_____)
X Mostly sunny	☐ 21-30	☐ Slight breeze (1-5 mph)	☐ Sulfide (rotten egg)	X Clear	☐ Clear
☐ Mostly cloudy	☐ 31-40	☐ Moderate winds (5-15 mph)	☐ Fishy	☐ Slightly turbid	☐ Greyish
☐ Overcast	☐ 41-50	☐ Strong gusts (15-25 mph)	☐ Effluent (treated)	☐ Moderately turbid	☐ Brownish
☐ Foggy	☐ 51-60	☐ Storm winds (> 25 mph)	☐ Raw sewage	☐ Highly turbid/ murky	☐ Blackish
☐ Drizzly	☐ 61-70	**Average Water Velocity**	☐ Chlorine		X Reddish
☐ Rain	X 71-80	☐ ~ 0 fps ☐ 3-5 fps	☐ Petroleum		☐ Light yellow
☐ Sleet	☐ 81-90	☐ < 1 fps ☐ > 5 fps	X Musty (basement)		☐ Dark tan
☐ Snow	☐ 91-100	X 1-3 fps	☐ Rotting vegetables		☐ Rusty (orangish)
	☐ >100		☐ Other _____		☐ Greenish _____
					☐ Other

River Water Level *(vs. mean AHWL)*

(AHWL – annual high water line)

☐ Low (estimate minus _____ feet)

- Exposed substrates? ☐ NO ☐ YES

☐ Normal

X High (estimate plus _____ feet)

Staff gage reading *(feet):* _____

(gage= _____ *)*

Fixed-point vertical distance to H20 surface *(feet):* _____

(fixed-point= _____ *)*

Aquatic Plants *(check one ONLY for overall density; circle type)*

Sparse=~1-25% (S) Moderate=25-50% (M) Dense=50-75% cover (D) Very Dense=75-100% cover (VD)

Overall Density

☐ Unobservable (why: _____)

☐ None

X Sparse

☐ Moderate

☐ Dense

☐ Very Dense

Dominant Plants and Type

E=emergent S=submerged F=floating

bullrush E / S / F

unknown pondweed E / S / F

_____ E / S / F

_____ E / S / F

_____ E / S / F

_____ E / S / F

Phytoplankton Presence *(check one)*

X Unobservable ☐ Suspended in water column

☐ None ☐ Floating clumps/mats

Periphyton *(check ALL that apply; density=area covered)*

☐ **Unobservable** *(why:* _____*)*

X **None**

☐ **Filamentous** S / M / D / VD ☐ On plants ☐ On rocks ☐ On bottom ☐ On woody debris ☐ Riffle ☐ Run ☐ Pool Color: _____

☐ **Film** S / M / D / VD ☐ On Plants ☐ On Rocks ☐ On bottom ☐ On woody debris ☐ Riffle ☐ Run ☐ Pool Color:

☐ **Loose Floc** S / M / D / VD ☐ On Plants ☐ On Rocks ☐ On bottom ☐ On woody debris ☐ Riffle ☐ Run ☐ Pool Color: _____

☐ **Moss** S / M / D / VD

Bottom Substrate *(check all that apply; estimate, % cover & add to 100%):* ☐ Bedrock (____%) ☐ Boulder (____%) X Cobble (25%) X Coarse gravel (35%) X Sand (40%) ☐ Silt (____%) ☐ Mud (____%) ☐ Clay (____%) = 100% OR ☐ **Unobservable**

Sampling Location Information *(for the observable station area within 10 meters up/down; If unobservable, note why in the descriptions)*

Floating Scum(s)? ☐ unobservable ☐ NO X YES *If yes:* ☐ oily sheens ☐ pollen/dust blankets ☐ algal mat X foam ☐ other

Describe Scum(s) *(esp. if sheen and/or foams are natural, petroleum-based or man-made)*:

Uses Observed? ☐ unobservable X NO ☐ YES *If yes:* ☐ swimming ☐ boating ☐ water intake ☐ fishing ☐ other

Description of Observed Use(s) or Indicators of Use(s) *(include numbers as applicable)*:

Objectionable Deposits? ☐ unobservable X NO ☐ YES *If yes:* ☐ trash ☐ orange floc ☐ other

Description of Objectionable Deposits *(type, extent and area affected...)*:

Shoreline Erosion? ☐ unobservable X NO ☐ YES *(note locations and extent of undercut banks, existing and potential slope failures, landslides, etc.)*

Description of Erosion:

Wildlife Sightings? ☐ unobservable ☐ NO X YES *If yes:* ☐ fish ☐ mammals X birds ☐ reptiles ☐ waterfowl ☐ amphibians ☐ other

Description of Wildlife Sightings and/or Indications *(e.g. geese droppings, nests, etc.; include numbers as applicable)*:

Potential Pollution Sources? ☐ none ☐ outfall pipes *(storm, wwtp, etc.)* ☐ garbage dumping ☐ land clearing ☐ lawns ☐ septic X road runoff ☐ other

Description of Potential Pollution Sources:

parking lot, Train Station

For office use only Field Sheet Login # **09-B008-03** Unique ID # **W1943** Revision Date 1/10/2008

MMM 7/15/09

SAMPLE DATA	General Notes:
Bottle Sample(s) collected? ☒ yes ☐ no	
Samples taken from *(check all that apply)*	
☐ from shore ☒ wade in ☐ boat ☐ other *(explain)*	
☐ left bank ☐ right bank ☒ center stream	**Sample-Specific Notes:**
(looking DOWNSTREAM to determine left/right bank)	Samples were physically collected by: J Carr
☐ Off Bridge?: If so… ☐ upstream side ☐ downstream side	
(If Van Dorn used, Serial # =)	
☐ Upstream of a discharge ☐ Downstream of a discharge	Discharge Description:
☐ Tidal Information: ☐ Not Applicable, or… Samples taken during… ☐ Ebb (outgoing tide) ☐ Flow (incoming tide) ☐ Slack tide ☐ Indeterminable	

OWMID #	Sample Time	Analyte/Bottle Group										Sample Type							QA/QC			Total # of Bottles
												Grab			Composite							
➢ "X" all applicable boxes ➢ Provide sample times for all samples ➢ Provide separate OWMID#s for each matrix and sample type, and for QA/QC samples. ➢ Affix ID labels in boxes below	*(24 hr)*	Chemistry (C)	Nutrients [1] (N)	Solids [2] (S)	Bacteria (B)	BOD/COD (D)	TOX [2] (T)	Chl a [2] (I)	Metals (M)	Color /Turbidity (R)	Other [2]	Manual Grab	Basket	Sampling Pole	Width/Depth Integrated	Flow Composite	Time Composite	Ambient Field Blank [2]	Field Blank	Duplicate [3]	Other [2]	
73-0395	9:17		X		X					X		X								X		3
73-0396	9:17		X		X					X		X								X		3
73-0397	9:22		X		X					X								X	X			3

[1] ***preservatives used*** *(for water matrix nutrients) (check one)* ☒ 9N H_2SO_4 ☐ 1:1 HCl ☐ To Be Frozen ☐ HNO3 *(metals)*
[2] *describe more specifically in notes if needed.*
[3] ***for duplicate samples:*** *use different ID# for each sample, check 'Duplicate' column for each ID*

Multi-Probe DATA *Record last STABLE readings per Multi-probe SOP. For TDS/Salinity in table, circle one as applicable.*
Make sure to use a different ID# for Multi-probe (or single probe) data.

OWMID#: *Affix OWMID # Label here*	Sonde #:	Logger #:
Depth calibrated at ***(24 hr):***	**Multi-probe (sample-specific) Notes:**	
Manual (watch) Time ***(24 hr):***		
Single Probe used? ☐ Yes ☐ No	**Single Probe Model and Serial #:**	

Time	Temp. (°C)	DO (mg/l)	Depth (meters)	Scond (µS/cm)	pH	% Sat	TDS/Salinity (g/l)/(ppt)	Chlorophyll (ug/l)	Phycocyanin (cells/ml)

Cooler Temperature (post sampling at Lab): _____ **Project Lead** (initial) _____

Massachusetts Departm[ ]of Environmental Protection/Division o[ ]'atershed Management

Deploy Crew-Order: 3-2 Pickup Crew-Order: 4

Project Lead (initial) JSW

Probe Deployment (2009)

Station Sheet 17 of 17.

Site and Survey Information			
Project	Boston Harbor-Neponset (2009)	Weather for last 3 days: *see attached (http://www.erh.noaa.gov/box/dailystns.shtml)*	
River	Unnamed Tributary	Current weather: 85° Sunny	
Town	Walpole	Crew Lead: J. Carr	
Site Name	UT01 (W1952)	Other(s): K. Davies	
OWMID #:	**73-0443**	Sonde ID#: 42969	Tube #: 7

DEPLOYMENT *(Determine left or right bank by looking downstream.)*

Start Date: 8/10/2009 **Immersion Time (24 hr):** 12:26 AM ____ PM X

Probe Type: ☐ DO/T ☐ TEMP ☒ DO/T/pH/Cond ☐ Other: ____

Apparatus *(check all that apply)* ☒ ABS tube ☐ anchor block ☒ cable & locks security ☒ storage cup removed?

Deployment station maximum depth *(in meters)*: 0.7 **Deployment probe depth** *(in meters)*: 0.1

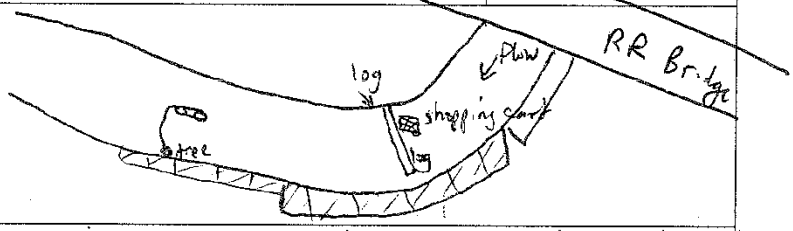
Deployment site--- *general description of site & access, including info re: up/down of structures, construction, etc:*

Probe is cabled to a tree on left bank. It is ≈ 20Ft downstream of the most visible gabion rock baskets.

Photos *(# and subject)*

"Field" Lat/Long *(GPS unit/lat-long in decimal degrees/accuracy)*: /

Sketch of Install:



General comments: QC probe is at least 3 inches deep but is reading 0.0.

Flow condition: ☒ Flowing ☐ No Water ☐ Stagnant ☐ Ice-covered ☐ No Access

Est. water velocity: ☐ ~0 fps ☐ < 1 fps ☒ 1 - 3 fps ☐ 3 - 5 fps ☐ >5 fps

Water Odor: ☐ None ☐ Sulfide ☐ Chlorine ☐ Petroleum ☒ Musty ☐ Sewage/Septic ☐ Unobservable ☐ Other:

Water Clarity: ☒ Clear ☐ Slightly turbid ☐ Moderately turbid ☐ Highly turbid ☐ Unobservable

Water Color: ☐ Clear ☐ Greyish ☐ Brownish ☐ Blackish ☒ Yellow/Tan ☐ Rusty/Reddish ☐ Unobservable ☐ Other:

NON-DEPLOYED MULTIPROBE DATA (for QC duplicate using separate OWMID#, at deployment)

OWMID#: **73-0463**	Sonde #: 45830	Logger #: 1455
Depth calibrated at *(24 hr)*: 12:24	Non-deployed multi-probe notes:	
Manual (watch) Time *(24 hr)*: 12:24		

Time	Temp. (°C)	DO (mg/l)	Depth (meters)	Scond (µS/cm)	pH	% Sat	Chl a (ug/l)	TDS/Salinity (g/l)/(ppt)
12:37:04	24.25	7.93	0.0	541.4	7.23	96.5		.3465

12:27

For office use only: Field Sheet Login # 09-B506-02 **Unique ID: W1952** Revision Date 1/10/2008

9/14/09

RETRIEVAL *(Determine left or right bank by looking downstream.)*

Crew Lead: P. Mitchell | **Other(s):** L. DAVIES

End Date: 8/12/2009 | **Taken-out-of-water Time (24 hr):** | **AM** X **PM** ____

Evidence of sonde movement during deployment? ☐ yes ☑ no | **Sonde submersed in water?** ☑ yes ☐ no

Sonde ID #: 42969 | **Tube ID #:** 7

Observations (sample-specific comments)---- *description of retrieval*

GOOD DEPLOY.

Photos *(# and subject)*

NO

General comments: DARK GREEN MAT ALGAE ON ROCKS + WOOD, SPARSE.

Est. water velocity: ☐ ~0 fps ☐ < 1 fps ☑ 1 - 3 fps ☐ 3 - 5 fps ☐ >5 fps

Water Odor: ☒ None ☐ Sulfide ☐ Chlorine ☐ Petroleum ☐ Musty ☐ Sewage/Septic ☐ Unobservable ☐ Other:

Water Clarity: ☒ Clear ☐ Slightly turbid ☐ Moderately turbid ☐ Highly turbid ☐ Unobservable

Water Color: ☐ Clear ☐ Greyish ☐ Brownish ☐ Blackish ☒ Yellow/Tan ☐ Rusty/Reddish ☐ Unobservable ☐ Other:

0926

NON-DEPLOYED MULTI-PROBE DATA (for QC duplicate using separate OWMID#, at retrieval)

OWMID#: **73-0483**

Sonde #: pm ~~42969~~ 45830

Logger #: 1455

Depth calibrated at *(24 hr)*: 0926

Manual (watch) Time *(24 hr)*: 0926

Non-deployed multi-probe notes:

1455

Time	Temp. (°C)	DO (mg/l)	Depth (meters)	Scond (µS/cm)	pH	% Sat	Chl a (ug/l)	TDS/Salinity (g/l)/(ppt)
932 33	24.49	5.56	0.0	540.2	7.00	67.8	---	0.3458

Project Lead (initial) _____.

Massachusetts Department of Environmental Protection/Division of Watershed Management

Lake and Pond Survey Field Sheet

B 997

Project Lead (initial) . 2009 Station Sheet ___ of ___.

General Information *(fill out prior to departure)*

PROJECT Bassin 1/1/09	**Weather conditions last 3 days:** *(see attached; http://www.erh.noaa.gov/box/dailystns.shtml)*
Lake East Monponsett Pond	**Sampling Survey Crew:** *(use full names; last name is OK for year-round DWM employees)*
Town Halifax	Crew Lead(s): M MATTSON
PALIS #	Others: M. McCarey
Site Name B deep hole mm 12/15/09	**Van Dorn ID#:**

Station Information *(fill out at station)*

Date 8/25/09 **Time** *(24 hr.)* 1305 am ____ pm ✓ ☐ No Water ☐ Stagnant ☐ Ice-covered ☐ No Access

Station Description and Access *(describe precisely where samples are taken using shore markers, GPS, etc. Also, note any posted restrictions on access)*

under road with prom

"Field" Lat/Long *(GPS unit/lat-long in decimal degrees/accuracy):* / /

Samples or Measurements Taken? ☒ yes ☐ no If not, why?:

"Deep Hole" sampled? ☒ yes ☐ no **Aquatic Plant Survey conducted?** ☐ yes ☒ no

Lake Level Measurement *(if available, note source/type)*: ☐ **Low** (estimate minus ____ feet) ☒ **Normal** ☐ **High** (estimate plus ____ feet)

Current Weather *(check one only)*	**Air Temp**	**Wind Conditions**	**Water Odor** *(surface)*	**Water Clarity** *(check one only; If unobservable, note why)*	**Water Color** *(color at ½ Secchi depth as appears on white Secchi parts)*
☐ Clear	☐ <20 °F	☒ Calm (0-1 mph)	☒ None	☐ Unobservable	☐ Unobservable (____)
☒ Mostly sunny	☐ 21-30	☐ Slight breeze (1-5 mph)	☐ Sulfide (rotten egg)	☐ Clear	☐ Clear ☐ Light yellow
☐ Mostly cloudy	☐ 31-40	☐ Moderate winds (5-15 mph)	☐ Fishy ☐ Raw sewage	☐ Slightly turbid	☐ Greyish ☐ Dark tan
☐ Overcast	☐ 41-50	☐ Gusty (15-25 mph)	☐ Effluent ("treated")	☒ Moderate turbid	☐ Brownish ☐ Rusty (orangish)
☐ Foggy	☐ 51-60	☐ Strong winds (> 25 mph)	☐ Chlorine	☐ Highly turbid/ suspended solids/ murky	☐ Blackish ☒ Greenish
☐ Drizzly	☐ 61-70		☐ Petroleum		☐ Reddish ☐ Blue
☐ Rain	☐ 71-80		☐ Musty (basement)		☐ Other
☐ Sleet ☐ Snow	☒ 81-90		☐ Rotten vegetation		
	☐ 91-100		☐ Other		

Wind Direction *(blowing from the .)*	**Wave Height**	**Algae @ Station** *(0-1 m. deep; check ONE only)*	**Aquatic Plants @ Station** *(check ONE for each and list exotics)*			
			Sparse *(~1-25%)* Moderate *(25-50%)* Dense *(50-75%)* Very Dense *(75-100%)*			
☒ Calm	☒ Calm (0 in)	☐ None ☒ Dense *(50-75%)*	**Floating (F)**	**Emergent (E)**	**Submerged (S)**	**Overall density**
☐ North ☐ East	☐ 0-2 in	☐ Sparse *(~1-25%)* ☐ Very Dense *(75-100%)*	☒ None	☒ None	☒ None	☒ None
☐ Northeast	☐ 2-5 in	☐ Moderate *(25-50%)* ☐ Floating scum	☐ Sparse	☐ Sparse	☐ Sparse	☐ Sparse
☐ Northwest	☐ 5-10 in	**Algae Description** *(describe shapes if possible: spherical, filaments, etc.; genus/sp. if known)*:	☐ Moderate	☐ Moderate	☐ Moderate	☐ Moderate
☐ South ☐ West	☐ 10-15 in	dense pvr floc in	☐ Dense	☐ Dense	☐ Dense	☐ Dense
☐ Southeast	☐ 15-20 in	water	☐ Very Dense	☐ Very Dense	☐ Very Dense	☐ Very Dense
☐ Southwest	☐ >20 in		% Duckweed: ____ % **Exotics:**			

Whole Lake Information *(fill out for the lake as a whole, check multiple boxes if applicable and note locations of observations; if unobservable, note why)*

Aquatic Plant Cover (WHOLE LAKE) ☐ Unobservable ☐ None ☒ Sparse *(~1-25%)* ☐ Moderate *(25-50%)* ☐ Dense *(50-75%)* ☐ Very Dense *(75-100%)*

- Describe dominant plants *(in order of dominance; circle type (E, S, F); also list any EXOTICS)*: 1) pickerel weed (E / S / F)
- Is Duckweed present on the lake? ☐ no ☒ yes (0.01 %) 2) juncus (E / S / F)
- If wind-driven, average width of Duckweed band at shore: 0.01 meters 3) ____ (E / S / F)
- **Exotics:** ☐ Trapa ☒ Cabomba ☐ P. crispus ☐ Egeria ☐ Nymphoides pelt. (yellow) ☒ Lythrum 4) ____ (E / S / F)
  ☐ Najas minor ☒ Phragmites ☐ Milfoil (☐ spicatum ☐ heterophyllum ☐ aquaticum ☐ Other) 5) ____ (E / S / F)

Floating Scum(s) ☐ unobservable ☒ no ☐ yes *If yes:* ☐ oily sheens ☐ pollen/dust blankets ☐ algal mat ☐ foam ☐ other
Describe Scum(s) *(esp. if sheen and/or foams are natural, petroleum-based or man-made)*:
- If wind-driven, average width of algal mat band at shore: ____ meters

Uses Observed ☐ unobservable ☐ no ☐ yes *If yes:* ☒ swimming ☒ boating ☐ water intake ☐ fishing ☐ other
Description of Observed Use(s) or Indicators of Use(s) *(include numbers as applicable)*:

Objectionable Deposits ☐ unobservable ☒ no ☐ yes *If yes:* ☐ trash ☐ flocculent mass ☐ other
Description of Objectionable Deposits *(type, extent and area affected...)*:

Shoreline Erosion ☐ unobservable ☒ no ☐ yes *(note locations for undercut banks, existing and potential slope failures, landslides, etc.)*
Description of Erosion:

Wildlife Sightings ☐ unobservable ☐ no ☒ yes *If yes:* ☐ fish ☐ mammals ☒ birds ☐ reptiles ☐ waterfowl ☐ amphibians ☐ other
Description of Wildlife Sightings and/or Indications *(e.g. geese droppings, nests, etc.; include numbers as applicable)*: 1 seagull

Potential Pollution Sources ☐ none ☐ outfall pipes *(storm, wwtp, etc.)* ☐ garbage dumping ☐ land clearing ☐ lawns ☐ septic ☐ road runoff ☒ other
Description of Potential Pollution Sources: small cranberry bog

For office use only Field Sheet Login #: 09-G006-05 **Unique ID #** WØ93Ø Revision Date 1/10/2008

9/18/09

LB-439_

SAMPLE DATA

Bottle Sample(s) collected?	☒ Yes ☐ No	VAN DORN Serial # :	5052A (if > one used, clarify in notes)
Secchi Time (24 hr.)	1315 am ___ pm ___		
Secchi depth (m)	0.8 Dup. 0.7 M	General Notes:	
Secchi viewfinder used?	☒ Yes ☐ No		
Secchi on bottom?	☐ Yes ☒ No		Bloom
Secchi in weeds?	☐ Yes ☒ No	Sample-Specific Notes:	collected for Algal ID
Secchi taken in sunlight?	☒ Yes ☐ No		
Station Maximum Depth (m)	3.6 m		
Maximum Depth Method	☒ Secchi disk line ☐ Lead line ☐ Sonar ☐ Survey rod ☐ Other:		

- "X" all applicable boxes - Provide sample times for all samples - Provide separate OWMID#s for each matrix and sample type, and for QA/QC samples. - Use sequential last digits in OWMIDs (1,2,3...)		Sample Depth (m)		Matrix		Analyte/Bottle Group									Sample Type (1 per sample)						QA/QC			
															Grab			Composite						
OWMID #	Sample Time (manual; 24 hr.)	Relative Depth (S, M, NB) [4]	Measured depth (except for S) Integrated depth	Sediment (Z)	Water	Chemistry (C)	Nutrients [1] (N) [2]	Solids (S)	Bacteria (B)	Chlorophyll a (I)	Algae (A)	Zoops (G)	Color / Turbidity (R)	Other [2]	Manual Grab	Van Dorn Bottle [2]	Petite Ponar	Depth Integrated / tube	Grab Composite	Ambient Field Blank/ Other [2]	Field Blank	Duplicate [3]	Other [2]	Total # of Bottles
LB-439 1	1310	S	0.2				X				X		X		X									
LB-439 2	1315	NB	3.0				X									X								
LB-439 3	1320	-	0-2.5							X								X						
___-___																								
___-___																								
___-___																								
___-___																								
___-___																								

[1] preservatives used (for water matrix nutrients) (check all that apply) ☐ 9N H_2SO_4 ☐ 1:1 HCl ☐ To Be Frozen
[2] describe specifically in notes
[3] for duplicate samples: use different ID# for each sample and check 'Duplicate' column for each ID [4] S=surface M=mid-depth NB=near bottom

Multi-Probe DATA

Record last (stable)readings at each depth. Use another field sheet form if more rows needed. For TDS or Salinity, circle one. Make sure to use a separate, unique ID# for Multi-probe data. If single probe units used, specify in notes.

OWMID#:	LB-439 0	Sonde #: 44853	Logger #: 1454
Duplicate readings taken? ☐ Yes ☐ No		Multiprobe (sample-specific) Notes:	
Duplicate OWMID#:			
Depth calibrated at (24 hr): 1300			
Manual (watch) Sample Time (24 hr):			
Single Probe used? ☐ Yes ☐ No		Single Probe Model and Serial #:	

Time	Temp. (°C)	DO (mg/l)	Depth (meters)	Scond (µS/cm)	pH	% Sat	TDS/Salinity (g/l)/(ppt)	Chlorophyll (ug/l)	Phycocyanin (cells/ml)
1316	27.24	5.5	0.6	150.9	8.45	121.1	.0966	—	—
1325	26.76	7.88	1.0	150.6	6.79	99.5	.0964		
1334	26.52	7.89	2.0	151.1	6.73	99.3	.0967		
1342	24.57	0.1	3.0	157.5	6.13	1.2	.1008		

Cooler Temperature (post sampling at Lab): _____ deg. C

Project Lead (initial)_____

Massachusetts Department of Environmental Protection/Division of Watershed Management

Bacteria Source Tracking (Rivers)

Project Lead (initial) _____. 2009 Station Sheet ___ of ___.

General Information *(fill out prior to departure)*	
Project SCRO BST	**General weather attached for last 3 days at:**
River Meadow Brook	**Current survey weather:** Overcast
Town Bridgewater	**Crew Lead:** Beasley, Sheppard
Station ID MB02	**Other Crew:**

Station Information *(within 10 meters up/down. Determine left or right bank by looking downstream)*

Date: 8/12/09 **Time (24 hr):** 12:25 AM ___ PM X **Photos** *(# and subject)*

Station Description and Access: Harvard Street, East Bridgewater

"Field" Lat/Long *(GPS unit/lat-long in decimal degrees/accuracy):* / /

Observations and potential pollution sources *(continue on back)*:

Flow condition: X Flowing ☐ No Water ☐ Stagnant ☐ Ice-covered ☐ No Access

Average Water Velocity: ☐ ~0 fps ☐ < 1 fps X 1 - 3 fps ☐ 3 - 5 fps ☐ >5 fps

River Water Level: ☐ Low X Normal ☐ High

Fixed-point vertical distance to water surface (ft.): **Staff gage reading:**

Conductivity readings taken: Yes ___ No X **If yes, meter used and serial #:**

Water Odor: X None ☐ Sulfide ☐ Chlorine ☐ Petroleum ☐ Musty ☐ Sewage/Septic ☐ Other:

Water Clarity: ☐ Clear X Slightly turbid ☐ Moderately turbid ☐ Highly turbid

Water Color: ☐ Clear ☐ Greyish ☐ Brownish ☐ Blackish X Yellow/Tan ☐ Rusty/Reddish ☐ Other

Aquatic plant density: ☐ None X Sparse (0-25%) ☐ Moderate (25-50%) ☐ Dense (50-75%) ☐ Very Dense (75-100%)

Film Periphyton: ☐ None ☐ Sparse X Moderate ☐ Dense ☐ Very Dense

Filamentous Periphyton: X None ☐ Sparse ☐ Moderate ☐ Dense ☐ Very Dense

Phytoplankton presence: X None ☐ Suspended in water column ☐ Floating clumps/mats

Optical Brightener Samplers deployed? Yes ___ No X **If yes, deploy/pickup dates:** /

Sample Collection information (for in-stream only; for pipe discharges, use "Pipes" fieldsheet)

Type: ☐ wade in X from shore ☐ bridge ☐ other:

Location: X center stream ☐ left bank ☐ right bank ☐ other:

Tidal Information (if applicable): ☐ Ebb (outgoing) ☐ Flow (incoming) ☐ Slack tide ☐ indeterminable

Preservative: X $Na_2S_2O_3$ ☐ other:

OWM ID (affix sample ID label in boxes below)	Sample Time (24 hr)	Analyte				Sample Type			QA/QC			Total # of bottles	Sample Notes **
		Bacteria (B)	FWA	Fluorometry	Other*	Manual Grab	Sampling Pole	Other **	Blank	Duplicate	Other		
RS-1592	12:25	X					X			X		1	
RS-1593	12:26	X					X			X		1	
RS-1594	12:30	X				X			X			1	

* Write in code: A = Algae, C = Chemistry, D = BOD/COD, DNA = Bacteroides/other, M = Metals N = Nutrients, R = Color, S = Solids

** if > 1 sampling method used for different samples, note differences

Massachusetts Departme[illegible] Environmental Protection/Division o[illegible] itershed Management

Project Lead (initial) _____.

Pipes and Closed Conduits (2009)

Station Sheet ___ of ___.

General Information	
Project Cape Cod Lakes	**Weather for last 3 days:** *see attached (http://www.erh.noaa.gov/box/dailystns.shtml)*
Pipe discharges to: Billington Sea	**Current survey weather:** overcast
Town Plymouth	**Crew Lead:** T. Beasley
Site Name Billington Street Bog (E2)	**Other Crew:** J. Sheppard

Site Information (Determine left or right bank by looking downstream.)

Date: 10/13/09 **Time (24 hr):** 15:36 AM ___ PM X

Photos *(# and subject)*

Sampling Location *(describe where and how sampled, including how accessed; include sketch on reverse):*

Billington Street Bog – pipe discharge

"Field" Lat/Long *(GPS unit/lat-long in decimal degrees/accuracy):* / /

Source Water: ☐ stormwater ☐ WWTP outfall ☐ sewer (illicit) ☐ CSO ☐ unknown ☒ other: C. Bog

Type: ☒ plastic ☐ concrete ☐ metal ☐ clay/brick ☐ other:

Pipe Size (ID): ☐ 4" ☐ 6" ☐ 12" ☐ 18" ☐ 24" ☐ 30" ☒ 36" ☐ 42" ☐ 48" ☐ other:

Est. pipe slope (in feet per 100'): ☐ .5' ☐ 1' ☐ 3' ☐ 5' ☐ 10' ☐ 20' ☐ 30' ☐ other:

Pipe flow condition: ☒ Flowing ☐ No Water ☐ Stagnant (Pooled) ☐ Ice-covered ☐ No Access

Est. water velocity in pipe: ☐ ~0 fps ☐ < 1 fps ☐ 1 - 3 fps ☒ 3 - 5 fps ☐ >5 fps

Est. water height in pipe (in feet):

Water Odor: ☒ None ☐ Sulfide ☐ Chlorine ☐ Petroleum ☐ Musty ☐ Sewage ☐ Septic ☐ Other:

[redacted]

Water Color: ☒ Clear ☐ Greyish ☐ Brownish ☐ Blackish ☐ Rusty/Reddish ☒ Yellow/Tan ☐ Other:

Water Clarity: ☐ Clear ☒ Slightly turbid ☐ Moderately turbid ☐ Highly turbid

Field Probe(s) used? Yes _____ No X ; *(If so, describe unit and ID#, and manually record results on back of fieldsheet)*

Observations *(continue on back, with sketch as needed):* Discharge – 26" deep, 36" width
Speed 1ft per second

Sample Collection

Sample Notes: Preserved with H_2SO_4

OWM ID (affix sample ID label in boxes below)	Sample Time (24 hr)	Bottle Group: Chemistry (C)	Nutrients (N)	Solids (S)	Bacteria (B)	BOD/COD (D)	TOX (T)	Metals (M)	Other *	Sample Type: Manual Grab	Sampling Pole	Time Composite	Other	QA/QC: Blank	Duplicate	Other	Total # of bottles
96-0166	15:36		X								X						1
Affix OWMID # Label here																	
Affix OWMID # Label here																	

** Write in code: A = Algae, DNA = human marker methods, FWA = Fluorescent Whiting Agent samples, OB = Optical Brightener device, R = Color, OG = Oil & Grease/TPH, PCB = polychlorinated biphenyls and pesticides*

09-G013-02 (JP 16Dec09)

For office use only: Field Sheet Login # ~~09-A030-02~~ **Unique ID:** W2093 **Revision Date 1/10/2008**

E: JP 14Oct09

...setts Department of Environmental Protection/Division of Watershed Management

Rivers and Streams

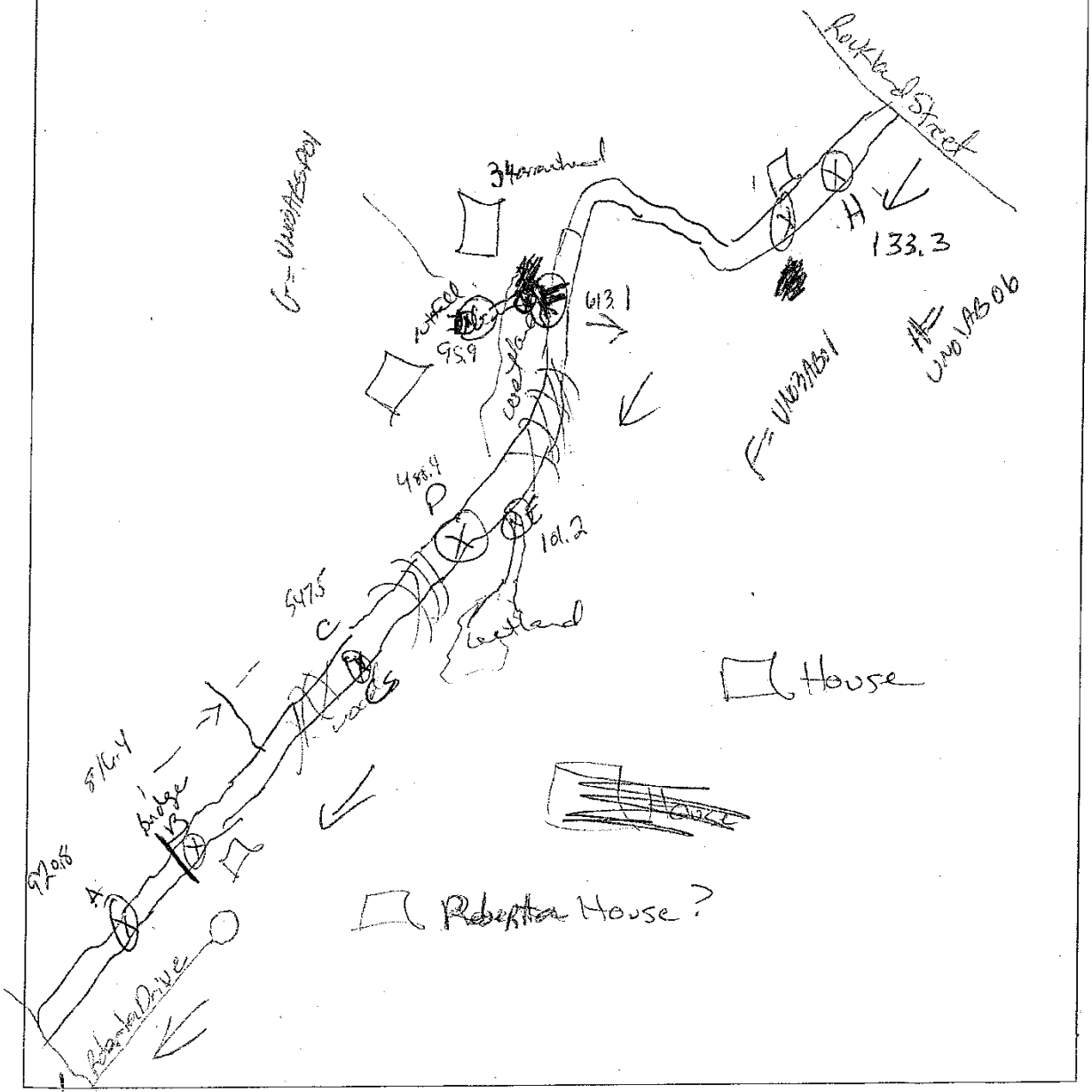
...ject Lead (initial)_____

Stream Walk Observation Form

Stream Walk Sheet ___ of ___.

General Information	
Project: SERO BST	Current Survey Weather: hot, sunny
Sub-watershed: APonagansett	Crew: Beasley, T
Water Body:	Date: 8/5/09 Walk Begin Time:
Town(s): Dartmouth	Walk Photos #s:
Landmark for upstream extent of study reach (GPS lat/long): Lucy Drive	Landmark for downstream extent of study reach (GPS lat/long): Rockland St

Sketch of Reach *(Include letter-coded (A, B, C, etc.) sample stations at their approximate locations):*



For office use only: Field Sheet Login # Unique ID: Revision Date 2/11/2009

Fill out separate Side 2s for each station on the stream walk (even if outfall dry). *Fill out Side 1 Once Only*

Station ID *(to match with sketch on front sheet):* A

Date:	Location Description:	Lat/Long (GPS):	Station Photos (#s):
8/5/09	Approx 140Ft NNW from UNOIAB02 - Ind of Roberta Dr, dsd		

Sample Collection *(looking downstream)* Stone bridge, Centreville, RI

☑ Mid-stream ☐ Right Bank ☐ Left Bank ☐ Outfall ☐ Pool Below Outfall

RS-1548	RS-1549	RS-1550	*Affix OWMID # Label here*
Sample Time (*24 hr*)/Type/QC: 13:35 /Bac	Sample Time (*24 hr*)/Type/QC: 13:35 /Bac/Dup	Sample Time (*24* hr)/Type/QC: 13:30 /Bac/Blank	Sample Time (*24* hr)/Type/QC:

Probe ID#: / Probe Sample Time (*24 hr*):	Temperature:	pH:	Conductivity:	Other Parameters:

Notes:

Outfall Description & Indicators *(for outfall station only)* X

Presence of flow	☑ Yes	☐ No	☐ Stagnant		Outfall Flow Rate (Q=V/T, where V=volume in time T, or Q in cfs=$8.69D^{2.60}H^{1.86}$):
Flow Description:	☐ Drip	☑ Low (<5GPM)	☐ Moderate	☐ High	
Est. velocity (fps):	Water depth (H) (ft):		Pipe Diameter (D) (ft):		
Submerged in water?	☐ No	☐ Partially	☐ Complete		
Submerged in Sediment?	☐ No	☐ Partially	☐ Complete		
Pipe Outfall Material/Type:	☐ Plastic	☐ Concrete	☐ Metal	☐ Clay/Brick	☐ Other:
Outfall Pipe Shape:	☐ Box	☐ Circular	☐ Elliptical	☐ Other:	
Tide Gate: ___ Yes	☑ No		Debris blocking outlet:: ___ Yes	___ No	
Water Odor *(in bottle)*:	___None	___Sewage/Septic	___Sulfide	___Petroleum	___Chlorine ___Musty
Water Color *(in clear bottle)*:	___Clear	___Brownish	___Grayish	___Yellow/Tan	___Reddish ___Blackish ___Other:
Water Clarity:	☐ Clear	☐ Slightly Turbid	☐ Moderately Turbid	☐ Highly Turbid	
Floatables:	☐ None	☐ Sewage	☐ Foam/suds	☐ Oily sheen	☐ Other:
Outfall Condition:	☐ Corrosion	☐ Cracks/chips	☐ Peeling paint	☐ Other:	
Deposits/Stains:	☐ Oil	☐ Flow Line	☐ Paint	☐ Other:	
Abnormal Vegetation:	☐ Yes	☐ No	☐ Describe:		
Pipe Benthic Growth:	☐ Brown	☐ Orange	☐ Green	☐ Other:	
Outfall Pool Quality:	☐ Odors	☐ Colors	☐ Floatables	☐ Petroleum	☐ Suds ☐ Sewage fungus ☐ Other:

Notes:

Riparian Condition *(at station)*

Land Use in areas adjacent to and immediately upstream of sampling site:

☐ Farm/ crops ☐ Pasture/ grazing ☐ Construction ☐ Forest ☐ Park ☐ Stores/ mall ☑ Suburban Res. ☐ Urban Res. ☐ Parking lot

Proximate lawn/grassy area present:	☑ Yes	☐ No	Approx/Avg. distance from Water: ____ ft
Stormwater drainage channels present:	☐ Yes	☑ No	Notes:

Notes:

In-stream Indicators *(at station)*

Water Odor *(in bottle)*:	☑ None	___Sewage/Septic	___Sulfide	___Petroleum	___Chlorine ___Musty
Water Color *(in clear bottle)*:	☑ Clear	___Brownish	___Grayish	___Yellow/Tan	___Reddish ___Blackish ___Other:
Water Clarity:	☑ Clear	☐ Slightly Turbid	☐ Moderately Turbid	☐ Highly Turbid	
Floatables:	☑ None	☐ Sewage	☐ Foam/suds	☐ Oily sheen	☐ Other:
Abnormal Vegetation:	☑ Yes	☐ No	☐ Describe:		

Notes:

Massachusetts DEP/DWM — Biomonitoring Field Data Sheet (Page 1 of 2) — Revision Date: June 2007

River Basin Weymouth Weir — Stream Name Accord Brook — Unique ID _____

Investigator(s) Matt R., AJ, JB, AM, DC — Start Time: 10:15 — End Time: 11.30

Describe site Location: Prospect St. (upst.) Hingham

RECONNAISSANCE | (HABITAT) | (INVERTEBRATE) | FISH | ALGAE | WATER QUALITY | FLOW

GEOMORPHOLOGY CHARACTERIZATION

• **Channel Type**

- ☐ Riffle-pool
- ☐ Dune-ripple
- ☐ Step-pool
- ☐ Cascade
- ☐ Bedrock
- ☐ Plane bed
- ☐ Braided
- ☐ Alluvial fans

RIPARIAN ZONE INSTREAM FEATURES

•**Surrounding Land Use**

- _____% Forest
- _____% Field/Pasture
- _____% Agriculture
- 100 % Residential
- _____% Commercial
- _____% Industrial
- _____% Other

•**Canopy Cover** 80 %

•**Densiometer** (EPA 0-17) ___; OR

•**Local Water Erosion**

- ☑ None
- ☐ Slight
- ☐ Moderate
- ☐ Heavy

•High Water Mark 0.2 m

•Dam present ☐ Yes ☑ No

•Channelized ☑ Yes ☐ No

Densiometer full scale_____ (full scale x 1.04 = %)

•**Est. avg. Stream Width** 2.5 m; range:

•**Est. avg. Stream Depth**

- ♦Riffle 0.2 m; range:
- ♦Run 0.2 m; range:
- ♦Pool 0.2 m, range:

•**Velocity**

- _____m/s @ deployment
- _____m/s @ recovery

• **Est. Fish Reach Length**_____m

Local Watershed NPS Pollution

- ☑ No evidence
- ☐ some potential sources: _____
- ☐ Obvious sources: _____

SEDIMENT/SUBSTRATE

• **Odors**

- ☐ None/normal
- ☑ Anaerobic
- ☐ Chemical
- ☐ Petroleum
- ☐ Sewage
- ☐ Other

• **Deposits**

- ☑ None
- ☐ Paper fiber
- ☐ Sand
- ☐ Sawdust
- ☐ Sludge
- ☐ Other

• **Oils**

- ☑ None
- ☐ Slight
- ☐ Moderate
- ☐ Profuse
- ☐ Relict Shells
- ☐ Other

INORGANIC SUBSTRATE COMPONENTS		% Composition in Sampling:	
Substrate	*Size (Minshall 1984)*	*Area*	*Reach*
Bedrock		___ %	___ %
Boulder	> 256 mm (10 in)	25 %	25 %
Cobble	64-256 mm (2.5-10 in)	55 %	55 %
Pebble	16-64 mm (0.6-2.5 in)	___ %	___ %
Gravel	2-16 mm (0.1-0.6 in)	15 %	15 %
Sand	0.06-2 mm (gritty)	5 %	5 %
Silt	0.004-0.06 mm	___ %	___ %
Clay	< 0.004 mm (slick)	___ %	___ %

Marl or travertine? ☐ present

WATER CHARACTER

• **Water Odors**

- ☑ Normal/None
- ☐ Chemical
- ☐ Fish
- ☐ Petroleum
- ☐ Sewage
- ☐ Other

• **Water Surface Oils**

- ☑ None
- ☐ Flecks
- ☐ Globs
- ☐ Slick/Sheen

• **Water Color** reddish-brown

• **Turbidity** (if not measured)

- ☑ Clear
- ☐ Slight
- ☐ Moderate
- ☐ Severe (opaque)

ORGANIC SUBSTRATE COMPONENTS		
Substrate	Characteristic	% Comp. in sample reach
Detritus	Sticks, wood, coarse plant materiall (CPOM)	100 %
Muck-Mud	Black, very fine organics (FPOM)	___ %

HabSamp ID#: 2009025

BenSamp ID#(s): 2009028

Date 17 July 2009

Station ACC003

• Weather Conditions:
♦ Now ☐ Rain/sleet/snow ☐ cloud cover high haze %
♦ Antecedent Period Ppt. Amount (data from http://www.erh.noaa.gov/box/dailystns.shtml)
24 h—
7 d—

How were samples collected?
☒ wading
☐ from bank
☐ from boat

• Riparian vegetation (18 m buffer)
Record dominant species present and % area covered
40 % trees- red maple, red oak, ash,
50 % shrubs& vines grn. brier, Clethora, Bl. rad., Va. creeper, bittersweet
50 % herbaceous jwd, grasses, Peltandra,

• Aquatic vegetation (coverage within reach: 90 %)
Record dominant spp. and % composition (should = 100%)
% rooted emergent
% rooted submergent
2 % rooted floating Calla trifolia
% free floating
98 % mosses

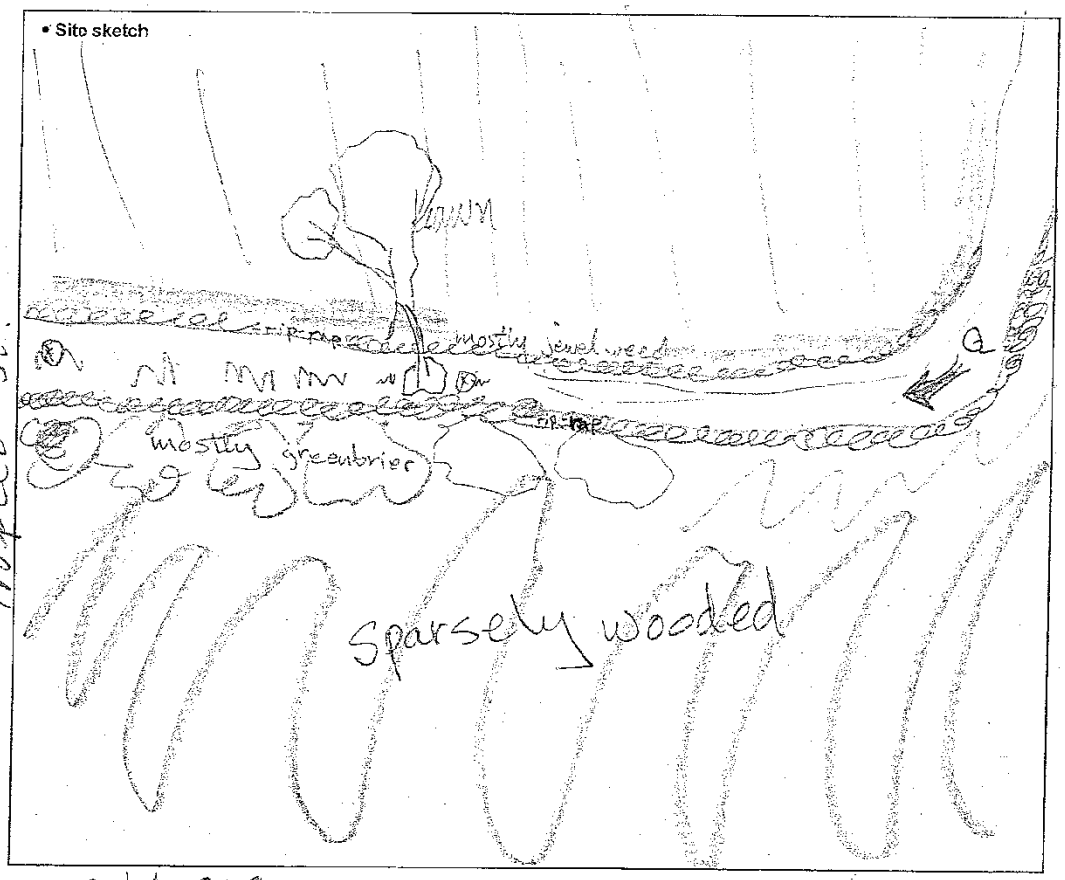
• Algae (coverage within reach: 0 %)

Forms	Color			Substrate				Microhabitat		
	Green	Brown	Other	Rock	Wood	Plant	Other	Pool	Riffle	Other
☐ filamentous	☐	☐		☐	☐	☐		%	%	
☐ flock	☐	☐		☐	☐	☐		%	%	
☐ thin film	☐	☐		☐	☐	☐		%	%	
☐ other	☐	☐		☐	☐	☐		%	%	

• Number of algae samples taken:

	Riffles	Snags	Stream Banks	Submerged Macrophytes	Other
• Number of jabs/kicks in ea. habitat type:	10				
• habitat types by % of sample reach	30 %	20 %	%	50 %	%

• Site sketch



Date 17 July 2009 Station ACCB03

HF

Massachusetts DEP/DWM Biomonitoring Field Data Sheet (Page 1 of 2) Revision Date: October 2003

River Basin NASHUA Stream Name PHILLIPS BROOK Sarls #

Investigator(s) MAVETTA Start Time: 0945 End Time: 1030

Describe site Location: ~40m Below TO ~40 m ABOVE Bridge ON Fred Smith ROAD

RECONNAISSANCE | HABITAT | INVERTEBRATE | FISH | ALGAE | WATER QUALITY | FLOW

STREAM CHARACTERIZATION

- Subsystem Classification
  - ☐ Tidal
  - ☐ Lower Perennial
  - ☒ Upper Perennial
  - ☐ Intermittent
- Stream Type
  - ☒ Coldwater
  - ☐ Warmwater

RIPARIAN ZONE INSTREAM FEATURES

- Surrounding Land Use
  - 30 % Forest
  - 10 % Field/Pasture
  - 30 % Agriculture
  - 20 % Residential
  - ____ % Commercial
  - ____ % Industrial
  - 10 % Other ROADS
- Canopy Cover ~~40%~~ 50% TO
- Local Water Erosion
  - ☐ None
  - ☒ Slight MUD
  - ☐ Moderate
  - ☐ Heavy
- High Water Mark 1½ FT
- Dam present ☐ Yes ☒ No
- Channelized ☐ Yes ☒ No
- Est. Stream Width 5 m
- Est. Stream Depth
  - Riffle 0.1 m
  - Run 0.3 m
  - Pool 0.6 m
- Velocity
  - ____ m/s @ deployment
  - ____ m/s @ recovery
- Est. Fish Reach Length 80 m

Local Watershed NPS Pollution

- ☐ No evidence
- ☒ some potential sources: FARM, ROADS, RESIDENCES
- ☐ Obvious sources:

SEDIMENT/SUBSTRATE

- Odors
  - ☒ None/normal
  - ☐ Anaerobic
  - ☐ Chemical
  - ☐ Petroleum
  - ☐ Sewage
  - ☐ Other
- Deposits
  - ☐ None
  - ☐ Paper fiber
  - ☒ Sand
  - ☐ Sawdust
  - ☐ Sludge
  - ☐ Other
- Oils
  - ☒ None
  - ☐ Slight
  - ☐ Moderate
  - ☐ Profuse
  - ☐ Relict Shells
  - ☐ Other
- Are undersides of rocks (not deeply embedded) black?
  - ☒ Yes
  - ☐ No RSM ?

INORGANIC SUBSTRATE COMPONENTS		% Composition in Sampling:	
Substrate	*Size (Minshall 1984)*	*Area*	*Reach*
Bedrock		____ %	____ %
Boulder	> 256 mm (10 in)	20 %	____ %
Cobble	64-256 mm (2.5-10 in)	~~40~~ 30 %	____ %
Pebble	16-64 mm (0.6-2.5 in)	20 %	____ %
Gravel	2-16 mm (0.1-0.6 in)	10 %	____ %
Sand	0.06-2 mm (gritty)	20 %	____ %
Silt	0.004-0.06 mm	____ %	____ %
Clay	< 0.004 mm (slick)	____ %	____ %

WATER CHARACTER

- Water Odors
  - ☒ Normal/None
  - ☐ Chemical
  - ☐ Fish
  - ☐ Petroleum
  - ☐ Sewage
  - ☐ Other
- Water Surface Oils
  - ☒ None
  - ☐ Flecks
  - ☐ Globs
  - ☐ Slick/Sheen
- Water Color Slight Yellow
- Turbidity (if not measured)
  - ☒ Clear
  - ☐ Slight
  - ☐ Moderate
  - ☐ Severe (opaque)

Marl or travertine? ☐ present

ORGANIC SUBSTRATE COMPONENTS		
Substrate	Characteristic	% Comp. in sample reach
Detritus	Sticks, wood, coarse plant material (CPOM)	____ %
Muck-Mud	Black, very fine organics (FPOM)	____ %

HabSamp ID#:

BenSamp ID#(s):

Date 9/4/03 Station Phillips Brk

River Basin_____ Stream Name_____ Saris #_____

Investigator(s)_____ Start Time:_____ End Time:_____

Describe site Location: SAME

_____

• Weather Conditions:	How were samples collected?
• Now ☐ Rain/sleet/snow ☐ cloud cover 0 %	☒ wading
• Antecedent Period Ppt. Amount (data from http://www.erh.noaa.gov/box/dailystns.shtml)	☐ from bank
24 h—	☐ from boat
7 d—	

• Riparian vegetation (18 m buffer)
Record dominant species present and % area covered
30 % trees
40 % shrubs& vines
30 % herbaceous

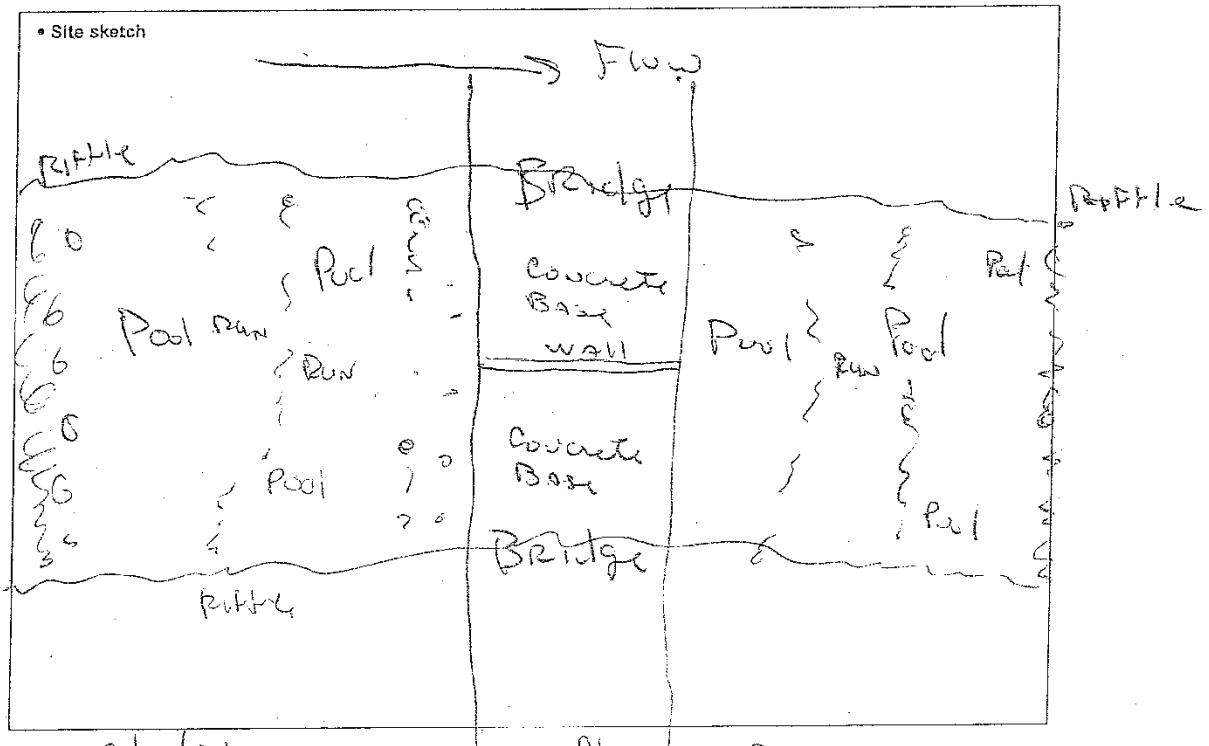
• Aquatic vegetation (coverage within reach: _____%)
Record dominant spp. and % composition (should = 100%)
_____% rooted emergent
100 % rooted submergent
_____% rooted floating
_____% free floating
_____% mosses

• Algae (coverage within reach: 60 %) • Number of algae samples taken: NIRE

Forms	Color			Substrate				Microhabitat		
	Green	Brown	Other	Rock	Wood	Plant	Other	Pool	Riffle	Other
☒ filamentous	☒	☐		☒	☐	☐		%	%	
☐ flock	☐	☐		☐	☐	☐		%	%	
☒ thin film	☐	☒		☒	☒	☒		%	%	
☐ other	☐	☐		☐	☐	☐		%	%	

	Riffles	Snags	Stream Banks	Submerged Macrophytes	Other
• Number of jabs/kicks in ea. habitat type:					
• habitat types by % of sample reach	%	%	%	%	%

• Site sketch



Date 9/4/03 Station Phillips Brk.

FISH FIELD DATA SHEET (FRONT SHEET)

Site/Project# Phillips Brook, Noshua Watershed Sample ID Code
Location Waterbody Name Phillips Brook
Type of Sample (Gear) Backpack Shocker Date Sampled 9/4/08
Fish Identified by R Mietta Page 1 of 1

SPECIES	TOTAL (COUNT)	LENGTH (mm) /WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES* D	E	F	L	M	S	T	Z
BND		60/2.1	75/4.0	68/3.2	59/1.9	47/1.0								
		59/1.8	60/2.6	49/1.6	61/2.2	69/1.9								
~~THH~~ 11 6,10,30,27 14,6,5,10,10,15,15 4,2,5		75/3.8	74/1.6	64/2.6	76/-	65/1.9								
		50/0.1	60/1.4	43/-	50/1.0	44/0.7								
		70/3.4	26	60/1.8	32/0.2	70/-								
CS		100/9.8	120/18.0	114/16.8	111/17.2	100/9.2								
		100/10.5	115/-	105/11.2	80/3.8	75/4.1								
~~THH~~ 1		95/7.7	115/11.8	114/13.9	63/1.8	93/8.0								
		115/16.6	95/9.3	69/2.7	70/2.5	71/3.4								
		70/2.8	65/2.6	115/15.5	65/3.5	82/6.0								
FF		75/3.3	85/5.5	96/6.8	104/8.0	100/7.6								
		83/5.1	73/3.0	94/8.9	103/11.0	84/4.0								
		70/1.7	~~265.1~~	~~UNR 182.7~~	108/11.4	100/8.5								
		81/5.6	90/7.3	85/5.1	87/4.5	95/6.6								
		85/5.3	100/-											
EBT		135/-	171/51.9	150/30.1										

Native → Bad fin condition → Stocked

Native Brown Trout 160/38.8 240/145.6 E

Anomaly Codes; D = deformities; E= erodes fins; F = fungus; L = lesions; M = multiple DELT anomalies; S= Emaciated; T = tumors; Z= other

BND = TNTC (~~2~~-300)

FISH COLLECTION DATA & INVENTORY

WATERBODY and PROJECT CODE:	STATION:	DATE:
Windsor Pond Public Request	Windsor Pond	7/3/2008

WATER TEMPERATURE:	WEATHER:	METHOD of COLLECTION:	COLLECTORS:
	high 80's partly cloudy	Electrofishing	Bob Wiedta, Rachel Ackerman, Tim Prior

Sample Code	Species	Length ~~cm~~ mm	Weight g	Ageing Structure	Age	Sample Type	Lab / Analysis	Samples Sent	Results Received
001A	~~B~~ LMB	440	1200	Scales		C	WES Hg only		
001B	~~B~~ LMB	427	1020						
001C	~~B~~ LMB	364	700						
002A	YP	151	20			C			
002B	YP	149	20						
002C	YP	170	50						
003A	WS	363	430			C			
003B	WS	340	370						
003C	WS	330	340						
004A	P	168	120			C			
004B	P	170	100						
004C	P	162	90						

COMMENTS: Golden Shiner, BC, Brown Trout, Unid'd minnow,

Massachusetts DEP/DWM Habitat Assessment Field Scoring Sheet (page 1 of 2) Revision Date: October 2003

Investigator(s): MAIETA River Basin: NASHUA

Stream Name: Phillips Brook Sarisf#:

Describe site location: ~40 m Below — ~40 m Above Bridge ON Fred Smith Road

Scoring for wadable riffle/run dominated streams (moderate to high gradient) with velocities approx. 30 cm/s or greater.

Habitat parameter	Category: Optimal	Suboptimal	Marginal	Poor
1. Instream cover (fish)	A mix of submerged logs, undercut banks, rubble, or other stable habitat in > 50% of the sample area.	30-50% of area with a mix of stable habitat; adequate habitat for maintenance of populations.	10-30% of area with a mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	< 10% of area with a mix of stable habitat; lack of habitat is obvious; substrate unstable of lacking.
SCORE	20 19 18 **17** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Epifaunal Substrate (in sampled area only)	Well-developed riffle and run; riffle is as wide as stream and length extends two times the width of stream; abundance of cobble (Boulders prevalent in headwater streams).	Riffle is as wide as stream but length is < 2X width; abundance of cobble; boulders and gravel common.	Run area may be lacking; riffle not as wide as stream and its length < 2X the stream width; gravel or bedrock prevalent; some cobble present.	Riffles or runs virtually nonexistent; bedrock prevalent; cobble lacking.
SCORE	20 19 18 17 16	15 **14** 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Embeddedness (riffles/runs)	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment.	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 > 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
4. 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 or dredging may be present but not recent (> 20 y). Bridge is stretch	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted.
SCORE	20 19 18 17 16	**15** 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Sediment Deposition	Little or no enlargement of islands or point bars and < 5% of the bottom affected by sediment deposition. Appears some sand from road	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 in pools prevalent.	Heavy deposits of fine material, increased bar development; > 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

Date 9/4/08 Station Phillips Brook

Habitat Parameter	Category: Optimal	Suboptimal	Marginal	Poor
6. Velocity-Depth Combinations 1. slow deep 2. fast deep 3. slow shallow 4. fast shallow	All 4 velocity/depth patterns present. Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream < 7:1 (generally 5-7); variety of habitat is key. In streams where riffles are continuous, location of boulders or other large, natural obstructions is important.	Only 3 of 4 velocity/depth patterns present. Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Only 2 velocity/depth patterns present; usually lacking deep areas. Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Dominated by one velocity/depth pattern. 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
7. Channel Flow Status	Water reaches the base of both 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
8. Bank Vegetative Protection (score each bank) *Note: Determine left or right side by facing downstream*	More than 90% of the streambank surfaces covered by naturally occuring 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 naturally occuring 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 I very high; vegetation has been removed to 5 cm or less in average stubble height.
SCORE 9 Left bank	10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 Right bank	10 (9)	8 7 6	5 4 3	2 1 0
9. Bank Stability (score each bank)	Banks stable; evidence of erosion of 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 9 Left bank	10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 Right bank	10 (9)	8 7 6	5 4 3	2 1 0
10.Riparian Vegetative Zone Width (score each side)	Width of riparian zone >18 m; human activities (e.g., parking lots, roadbeds, clear-cuts, lawns, crops, etc.) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 m; human activities have impacted zone a great deal.	Width of riparian zone < 6 m; little or no riparian vegetation due to human activities.
SCORE 7 Left zone	10 (9)	8 (7) 6	5 4 3	2 1 0
SCORE 7 Right zone	10 (9)	8 (7) 6	5 4 3	2 1 0

TOTAL SCORE 78 + 30 = 15?

Comments: Lot of Pilmentus green Algae - very productive Moderate

Date 9/4/08 Station Phillips Brk

Crew 1

Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
Department of Environmental Protection
Senator William X. Wall Experiment Station

Sample Tracking Chain-of-Custody Record

Client: BRP DIV WATERSHED MGMNT - WATERSHED P
Project: Cape Cod (2009)
Coordinator: Daniel Davis
Contact: Richard Chase

ENTERED 6/24/09

Cooler Temperature at Receipt: 1 C

WES Sample Log-In Batch # 2009278

Chain of Custody: (Required, including signatures, for all samples submitted to WES Laboratories)

Relinquished by:					Received by:				
Printed Name	Signature	Org.	Date	Time	Printed Name	Signature	Org.	Date	Time
MAGGIE MURPHY		DWM	6/23/09	17:05	DWM FRIDGE		DEP-DWM	6/23/09	17:05
DwmFridge		Dwm	6/24/09	0820	Tim Prior		Dwm	6/24/09	0820
Tim Prior		Dwm	6/24/09	1100	Isabel Silvestre		DEP-DWM	6/24/09	11:00

Sample Lab ID	Sample Field ID	Site Name	Field Locator (within Site)	Matrix	Collector	Collection Date/Time	Preserv. Code	Grab/ Comp.	Chlorine Residual (yes/no)
2009278-001	96-0064N	W1917		SRW	J Meek	6/23/2009	1,2	G	
Analysis Requested:	Ammonia-N by EPA 350.1	Total Nitrogen by USGS I-4650-03		Total Phosophorus by USGS I-4650-03		10:09			
2009278-002	96-0065N	W1916		SRW	J Meek	6/23/2009	1,2	G	
Analysis Requested:	Ammonia-N by EPA 350.1	Total Nitrogen by USGS I-4650-03		Total Phosophorus by USGS I-4650-03		10:28			
2009278-003	96-0066N	W1916		SRW	J Meek	6/23/2009	1,2	G	
Analysis Requested:	Ammonia-N by EPA 350.1	Total Nitrogen by USGS I-4650-03		Total Phosophorus by USGS I-4650-03		10:28			
2009278-004	96-0067N	W1916		SRW	J Meek	6/23/2009	1,2	G	
Analysis Requested:	Ammonia-N by EPA 350.1	Total Nitrogen by USGS I-4650-03		Total Phosophorus by USGS I-4650-03		10:38			
2009278-005	96-0068N	W1915		SRW	J Meek	6/23/2009	1,2	G	
Analysis Requested:	Ammonia-N by EPA 350.1	Total Nitrogen by USGS I-4650-03		Total Phosophorus by USGS I-4650-03		10:49			
2009278-006	96-0070N	W1918		SRW	J Meek	6/23/2009	1,2	G	
Analysis Requested:	Ammonia-N by EPA 350.1	Total Nitrogen by USGS I-4650-03		Total Phosophorus by USGS I-4650-03		11:54			
2009278-007	96-0071N	W1919		SRW	J Meek	6/23/2009	1,2	G	
Analysis Requested:	Ammonia-N by EPA 350.1	Total Nitrogen by USGS I-4650-03		Total Phosophorus by USGS I-4650-03		12:20			

Sample Lab ID	Sample Field ID	Site Name	Field Locator (within Site)	Matrix	Collector	Collection Date/Time	Preserv. Code	Grab/ Comp.	Chlorine Residual (yes/no)
2009278-008	96-0072N	W1920		SRW	J Meek	6/23/2009 12:34	1,2	G	
Analysis Requested:	Ammonia-N by EPA 350.1	Total Nitrogen by USGS I-4650-03		Total Phosophorus by USGS I-4650-03					
2009278-009	96-0076N	W1921		SRW	J Meek	6/23/2009 13:46	1,2	G	
Analysis Requested:	Ammonia-N by EPA 350.1	Total Nitrogen by USGS I-4650-03		Total Phosophorus by USGS I-4650-03					
2009278-010	96-0077N	W1926		SRW	J Meek	6/23/2009 13:58	1,2	G	
Analysis Requested:	Ammonia-N by EPA 350.1	Total Nitrogen by USGS I-4650-03		Total Phosophorus by USGS I-4650-03					

Preservative Codes:					
1= Cool <= 4C	3=pH < 2 with HNO3	6=Ascorbic Acid	9=Mercuric choloride (HgCl2)	12=Ethylenediamine	15=Reagent Water (Type I)
2= pH < 2 with H2SO4	4= pH < 2 with HCl	7=Filtered (0.45-um pore size)	10=Sodium sulfite (Na2S)	13=EDTA	
	5=pH > 12 with NaOH	8=Sodium Thiosulfate (Na2S2O3)	11=Ammonium choloride (NH4Cl)	14=Methanol	

Remarks:

SAMPLE CONDITIONS REVIEW FORM

Massachusetts Department of Environmental Protection
Senator William X. Wall Experiment Station
37 Shattuck St., Lawrence, MA

LOGIN BATCH #	200927 8				DATE:	6/24/09
		YES	NO	NA	Initials	Notes
Q1	Was the cooler temperature between 2 and 6 degrees Celsius?	☑	☐	☐	CAB	
Q2	Was the cooler temperature recorded on the *Sample Tracking & COC Record*?	☑	☐	☐	CAB	
	INORGANIC CHEMISTRY LABORATORY					
Q3	Were all sample containers intact and were they tightly capped when received?	☑	☐	☐	IS	
Q4	Is there any visual indication or other evidence that the samples were not collected according to U.S. EPA or other standard protocol?	☐	☑	☐	IS	
Q5	Are the number, matrices, and field ID labels of the samples the same as stated on the *Sample Tracking & COC Record*?	☑	☐	☐	IS	
	Sample storage location(s)	Refrig #4				
	MICROBIOLOGY LABORATORY					
Q3	Were all sample containers intact and were they tightly capped when received?	☐	☐	☐		
Q4	Is there any visual indication or other evidence that the samples were not collected according to U.S. EPA or other standard protocol?	☐	☐	☐		
Q5	Are the number, matrices, and field ID labels of the samples the same as stated on the *Sample Tracking & COC Record*?	☐	☐	☐		
	Sample storage location(s)					
	ORGANIC CHEMISTRY GC & LC LABORATORY					
Q3	Were all sample containers intact and were they tightly capped when received?	☐	☐	☐		
Q4	Is there any visual indication or other evidence that the samples were not collected according to U.S. EPA or other standard protocol?	☐	☐	☐		
Q5	Are the number, matrices, and field ID labels of the samples the same as stated on the *Sample Tracking & COC Record*?	☐	☐	☐		
	Sample storage location(s)					
	ORGANIC CHEMISTRY GC/ MS LABORATORY					
Q3	Were all sample containers intact and were they tightly capped when received?	☐	☐	☐		
Q4	Is there any visual indication or other evidence that the samples were not collected according to U.S. EPA or other standard protocol?	☐	☐	☐		
Q5	Are the number, matrices, and field ID labels of the samples the same as stated on the *Sample Tracking & COC Record*?	☐	☐	☐		
	Sample storage location(s)					
Q6	Were the data from the *Sample Tracking & COC Record* transcribed into the LIMS and have all questions been answered in the LIMS?	☑	☐	☐	LDD	

MASSDEP/DIVISION OF WATERSHED MANAGEMENT

Mossy Sample

Macroinvertebrate Sample Processing Record

BenSampID: 2009035
Field ID: CRB03
Watershed (Project): Weymouth Weir 2009 @rte 37
Stream/reach: Cranberry Brook, Braintree
Processing Date: 23 Sept 2009
Random Grid Sequence: 7, 4, 14, 13
Number of grids used:
# of grids used in supplemental subsample:
Pickate saved? (Y) or N

Collection Date: 23 July 2009
Unique ID: B0___
Sample Type: RSP Kick
Processed by: David Caron
Rough ct. in 1° subsample: 101
Rough ct. in supplemental subsample: 293

1° Subsample VIALS (list taxa included and counts)

A. Chironomidae 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸
Oligochaeta 𝍸

B. Hydropsychidae 𝍸 𝍸 𝍸 𝍸

C. Elmidae 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 larvae
𝍸 adults

D. Simuliidae 𝍸 𝍸

E. Pelycopoda 𝍸
Amphipoda 𝍸
Hirudinea 𝍸

F. Supplemental - 293

G. L/R

H.

I.

J.

Large/rare specimens vial (list, and keep vouchers, of all not found in 1° subsample, counts not needed)

Tipulidae
Odonata

QC CHECK ON MACROINVERTEBRATE SAMPLE SORTING

QC date: 23 October 2009 QC reviewer: Nuzzo .

Sample # 2009035 Collection Date: 23 July 2009 .
Watershed/station: Wey-Wei/CRB02, Cranberry Brook
Sorted by: D. Canon

Sample Type (circle one): RBP Multiplates Other:_____

Sample Unit (circle one): Whole 100-count Other subsample (describe):_____

Rough count: 220 PSE: (220/229) x 100 = 96% MQO: 90%
Corrective Action: add specimens to 2° subsample specimens

Total additional animals found in "pickate" (listed below): 9

- Trichoptera, Hydropsychidae—1
- Coleoptera, Elmidae—2
- Diptera
    - Simuliidae—1
    - Chironomidae—5

Additional subsample units (describe): one grid; M. Reardon Rough count: 174 .
PSE: (174/176) x 100 = 99% MQO: 90%
Corrective Action: these specimens combined with specimens listed above.
Total additional animals found in "pickate" from remaining subsample units (listed below): 2

- Diptera, Chironomidae—1
- Coleoptera, Elmidae—1

MOUNTED 1/4/2010

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATERSHED MANAGEMENT
Aquatic Macroinvertebrate Data Sheet

Watershed: Ipswich Waterbody name: Fish Brook Station Code: F866 Date collected: 12 Aug 2005

Location description: upst. fr. Middletown Rd, Boxford, MA

Collector: JF Sorted by: JF Taxonomist: JF
Sample Type: RBP III
BenSamp ID#: 20050772

Form revision date: November 2005

MOLLUSCA
Gastropoda

Pelecypoda

ANNELIDA
Oligochaeta
Lumbriculidae — 1

Hirudinea

CRUSTACEA
Isopoda

Amphipoda
Gammaridae - 2 - Gammarus sp - 2

Decapoda

Hydrachnidia

INSECTA
Ephemeroptera

Odonata
Coloptericidae - 8 - (these are immature and cannot be reliably separated from Coenagrionidae)

Plecoptera
same vial
Perlidae - 7 - Acroneuria sp - 7 (includes 2 immature exuvia)
Leuctridae - Leuctra sp - 4

Megaloptera
Corydalidae - 2 - Nigronia serricornis - 2

Trichoptera
Hydropsychidae ~~28~~ 30 - Hydropsyche betteni - ~~28~~ 9
(includes several early instar Hydropsyche sp.) — 21
[prob. Hydropsyche sp.]

Philopotamidae - 2 - Chimarra aterrima ~~obscura~~

Coleoptera
same vial
Psephenidae - 1 (A) - Psephenus herricki - 1
Elmidae - 5 + 1 (A) - 6
Stenelmis sp - 1
Promoresia sp - 1
Optioservus sp - 3
Oulimnius latiusculus (A) - 1

Diptera (Chironomidae spp. on back)
same vial
Tipulidae - 4 - Dicranota sp - 4
Empididae - 1 - Hemerodromia sp - 1
Simuliidae - 2 - Simulium sp - 2
[Chironomidae - 33 - (32 mounted)]

Other Insecta Aeshnidae

Other Invertebrata

59
32
91

Life stage is larva or nymph unless indicated as: "(P)" [= pupa] or "(A)" [= adult]
Total No. of Organisms: 102
Family QC check completed by:
Date:

Total No. of Kinds:
Genus/species QC check completed by:
Date: 8 Feb. 2010

56 - 79

		count	Comments
Chironominae			
Chironomini			
	Microtendipes rydalensis gr.	9	
	Polypedilum aviceps	2	
	P. illinoense	1	
Tanytarsini			
	Micropsectra sp.	1	
	Rheotanytarsus pellucidus	2	
	Stempellinella sp.	1	("sp. A")
	Tanytarsus sp.	2	
Diamesinae			
Orthocladiinae			
	Paramerionemus sp.	4	
	Tvetenia paucunca	3	
Tanypodinae			
	Conchapelopia sp.	7	
Total chironomid count:		32	

DOUBLE-CLICK ON PAGE 1 OF REPORT BELOW TO OPEN ENTIRE DOCUMENT (example lab report)

Report Print Date: 11/4/2009

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF ENVIRONMENTAL ANALYSIS
WILLIAM X. WALL EXPERIMENT STATION
EPA #: MA00019

Analysis Report for Login Batch: 2009284

Prepared For: BRP DIV WATERSHED MGMNT - WATERSHED PLANNING
Contact: Richard Chase
Project Name: Cape Cod (2009)
Project Coordinator: Daniel Davis

Sample Lab ID#:	2009284-001	Site:	W1917			Matrix:	SRW	Collect Date:	10/6/2009 10:52 AM
Sample Field ID#:	96-0523N	Locator:				Collector:	Mitchell, P	Receive Date:	10/7/2009 11:15 AM

Analyte/Compound	Result	Units	MDL	MRL	Method	Analysis Date	Status
Ammonia-N	0.06	mg/L	0.02	0.06	EPA 350.1	10/08/2009 10:22 AM	Approved
Total Nitrogen	1.3	mg/L	0.040	0.12	USGS I-4650-03	10/23/2009 11:26 AM	Approved
Total Phosphorus	0.17	mg/L	0.005	0.015	USGS I-4650-03	10/23/2009 11:26 AM	Approved

Sample Lab ID#:	2009284-002	Site:	W1916			Matrix:	SRW	Collect Date:	10/6/2009 10:59 AM
Sample Field ID#:	96-0524N	Locator:				Collector:	Carr, J.	Receive Date:	10/7/2009 11:15 AM

Analyte/Compound	Result	Units	MDL	MRL	Method	Analysis Date	Status
Ammonia-N	0.07	mg/L	0.02	0.06	EPA 350.1	10/08/2009 10:22 AM	Approved
Total Nitrogen	0.73	mg/L	0.040	0.12	USGS I-4650-03	10/23/2009 11:26 AM	Approved
Total Phosphorus	0.12	mg/L	0.005	0.015	USGS I-4650-03	10/23/2009 11:26 AM	Approved

Sample Lab ID#:	2009284-003	Site:	W1916			Matrix:	SRW	Collect Date:	10/6/2009 10:59 AM
Sample Field ID#:	96-0525N	Locator:				Collector:	Carr, J.	Receive Date:	10/7/2009 11:15 AM

Analyte/Compound	Result	Units	MDL	MRL	Method	Analysis Date	Status
Ammonia-N	0.07	mg/L	0.02	0.06	EPA 350.1	10/08/2009 10:22 AM	Approved
Total Nitrogen	0.73	mg/L	0.040	0.12	USGS I-4650-03	10/23/2009 11:26 AM	Approved
Total Phosphorus	0.12	mg/L	0.005	0.015	USGS I-4650-03	10/23/2009 11:26 AM	Approved

Sample Lab ID#:	2009284-004	Site:	W1916			Matrix:	SRW	Collect Date:	10/6/2009 11:03 AM
Sample Field ID#:	96-0526N	Locator:				Collector:	Mitchell, P	Receive Date:	10/7/2009 11:15 AM

Analyte/Compound	Result	Units	MDL	MRL	Method	Analysis Date	Status
Ammonia-N	ND	mg/L	0.02	0.06	EPA 350.1	10/08/2009 10:22 AM	Approved
Total Nitrogen	ND	mg/L	0.040	0.12	USGS I-4650-03	10/23/2009 11:26 AM	Approved
Total Phosphorus	ND	mg/L	0.005	0.015	USGS I-4650-03	10/23/2009 11:26 AM	Approved

ND = Analyzed for, but not detected above MDL (equiv. U)
Estimated Value:
M = Analyte concentration > MDL but < MRL
H = USEPA holding time exceeded
J = Other QC criteria not met (see comments)
NA = Not applicable

B = Analyte detected in sample, and in LB, LRB, and/or trip blank or no trip blank was collected
N = GC/MS non-target tentatively identified compound (TIC) - no standard available for quantitation
R = Data rejected due to severe QC, quantitation and/or qualitative ID deficiencies
MDL = Method Detection Limit
MRL = Minimum Reporting Limit

LRB = Laboratory Reagent Blank
LB = Laboratory Blank (equiv. Method Blank)
LFB = Laboratory Fortified Blank (equiv. LCS)
LFM = Laboratory Fortified Sample Matrix (equiv. MS)
QCS = Quality Control Sample (external to lab) - acceptance limits as per method or interlaboratory proficiency study

LabID	LabSNum	FieldSampNum	Analyte/Characteristic	Sample Fraction	Result	LabQual	ResComm	Units	MDL	RDL	UQL	Analytical Method	AnalDate	AnalTime	SiteLocator	CollectDate	CollectTime
G&L Labs	50301-01	73-0632 B	E. coli - modified MTEC	Total	80			CFU/100mL	10	**		EPA 1603	09/15/09	3:05:00 PM		9/15/09	9:33 AM
G&L Labs	50301-02	73-0633 B	E. coli - modified MTEC	Total	150			CFU/100mL	10	**		EPA 1603	09/15/09	3:05:00 PM		9/15/09	9:46 AM
G&L Labs	50301-03	73-0634 B	E. coli - modified MTEC	Total	160			CFU/100mL	10	**		EPA 1603	09/15/09	3:05:00 PM		9/15/09	10:08 AM
G&L Labs	50301-04	73-0635 B	E. coli - modified MTEC	Total	160			CFU/100mL	10	**		EPA 1603	09/15/09	3:05:00 PM		9/15/09	10:25 AM
G&L Labs	50301-05	73-0636 B	E. coli - modified MTEC	Total	100			CFU/100mL	10	**		EPA 1603	09/15/09	3:05:00 PM		9/15/09	10:38 AM
G&L Labs	50301-06	73-0637 B	E. coli - modified MTEC	Total	30			CFU/100mL	10	**		EPA 1603	09/15/09	3:05:00 PM		9/15/09	10:55 AM
G&L Labs	50301-07	73-0638 B	E. coli - modified MTEC	Total	2500			CFU/100mL	10	**		EPA 1603	09/15/09	3:05:00 PM		9/15/09	11:24 AM
G&L Labs	50301-08	73-0639 B	E. coli - modified MTEC	Total	230			CFU/100mL	10	**		EPA 1603	09/15/09	3:05:00 PM		9/15/09	11:32 AM
G&L Labs	50301-09	73-0640 B	E. coli - modified MTEC	Total	180			CFU/100mL	10	**		EPA 1603	09/15/09	3:05:00 PM		9/15/09	11:52 AM
G&L Labs	50301-10	73-0641 B	E. coli - modified MTEC	Total	110			CFU/100mL	10	**		EPA 1603	09/15/09	3:05:00 PM		9/15/09	12:18 PM
G&L Labs	50301-11	73-0642 B	E. coli - modified MTEC	Total	150			CFU/100mL	10	**		EPA 1603	09/15/09	3:05:00 PM		9/15/09	12:33 PM
G&L Labs	50301-12	73-0643 B	E. coli - modified MTEC	Total	400			CFU/100mL	10	**		EPA 1603	09/15/09	3:05:00 PM		9/15/09	12:46 PM
G&L Labs	50301-13	73-0644 B	E. coli - modified MTEC	Total	>8000			CFU/100mL	10	**		EPA 1603	09/15/09	3:05:00 PM		9/15/09	1:30 PM
G&L Labs	50301-14	73-0645 B	E. coli - modified MTEC	Total	>8000			CFU/100mL	10	**		EPA 1603	09/15/09	3:05:00 PM		9/15/09	1:32 PM
G&L Labs	50301-15	73-0646 B	E. coli - modified MTEC	Total	<10			CFU/100mL	10	**		EPA 1603	09/15/09	3:05:00 PM		9/15/09	1:35 PM
G&L Labs	50301-16	73-0647 B	E. coli - modified MTEC	Total	210			CFU/100mL	10	**		EPA 1603	09/15/09	3:05:00 PM		9/15/09	1:42 PM
G&L Labs	50300-01	73-0649 B	E. coli - modified MTEC	Total	60			CFU/100mL	10	**		EPA 1603	09/15/09	2:05:00 PM		9/15/09	9:34 AM
G&L Labs	50300-02	73-0650 B	E. coli - modified MTEC	Total	160			CFU/100mL	10	**		EPA 1603	09/15/09	2:05:00 PM		9/15/09	10:00 AM
G&L Labs	50300-03	73-0651 B	E. coli - modified MTEC	Total	<10			CFU/100ml	10	**		EPA 1603	09/15/09	2:05:00 PM		9/15/09	10:10 AM
G&L Labs	50300-04	73-0652 B	E. coli - modified MTEC	Total	50			CFU/100mL	10	**		EPA 1603	09/15/09	2:05:00 PM		9/15/09	10:30 AM
G&L Labs	50300-05	73-0653 B	E. coli - modified MTEC	Total	1500			CFU/100mL	10	**		EPA 1603	09/15/09	2:05:00 PM		9/15/09	10:40 AM
G&L Labs	50300-06	73-0654 B	E. coli - modified MTEC	Total	210			CFU/100mL	10	**		EPA 1603	09/15/09	2:05:00 PM		9/15/09	10:54 AM
G&L Labs	50300-07	73-0655 B	E. coli - modified MTEC	Total	350			CFU/100mL	10	**		EPA 1603	09/15/09	2:05:00 PM		9/15/09	11:00 AM
G&L Labs	50300-08	73-0656 B	E. coli - modified MTEC	Total	470			CFU/100mL	10	**		EPA 1603	09/15/09	2:05:00 PM		9/15/09	11:11 AM
G&L Labs	50300-09	73-0657 B	E. coli - modified MTEC	Total	100			CFU/100mL	10	**		EPA 1603	09/15/09	2:05:00 PM		9/15/09	11:27 AM
G&L Labs	50300-10	73-0658 B	E. coli - modified MTEC	Total	760			CFU/100mL	10	**		EPA 1603	09/15/09	2:05:00 PM		9/15/09	11:40 AM
G&L Labs	50300-11	73-0659 B	E. coli - modified MTEC	Total	450			CFU/100mL	10	**		EPA 1603	09/15/09	2:05:00 PM		9/15/09	11:57 AM
G&L Labs	50300-12	73-0660 B	E. coli - modified MTEC	Total	1300			CFU/100ml	10	**		EPA 1603	09/15/09	2:05:00 PM		9/15/09	12:11 PM
G&L Labs	50300-13	73-0661 B	E. coli - modified MTEC	Total	60			CFU/100mL	10	**		EPA 1603	09/15/09	2:05:00 PM		9/15/09	12:38 PM
G&L Labs	50300-14	73-0662 B	E. coli - modified MTEC	Total	900			CFU/100mL	10	**		EPA 1603	09/15/09	2:05:00 PM		9/15/09	12:49 PM
G&L Labs	50300-15	73-0663 B	E. coli - modified MTEC	Total	360			CFU/100mL	10	**		EPA 1603	09/15/09	2:05:00 PM		9/15/09	1:08 PM
G&L Labs	50300-16	73-0664 B	E. coli - modified MTEC	Total	340			CFU/100mL	10	**		EPA 1603	09/15/09	2:05:00 PM		9/15/09	1:08 PM
G&L Labs	50300-17	73-0665 B	E. coli - modified MTEC	Total	<10			CFU/100mL	10	**		EPA 1603	09/15/09	2:05:00 PM		9/15/09	1:15 PM
G&L Labs	50300-18	73-0666 B	E. coli - modified MTEC	Total	120			CFU/100mL	10	**		EPA 1603	09/15/09	2:05:00 PM		9/15/09	9:21 AM

		Required
LabID	Laboratory Name	Yes
LabSNum	Laboratory Sample Number	Yes
FieldSampNum	Field/Client Sample Number	Yes
Analyte/Characteristic	Analyte	Yes
Sample Fraction	Fraction associated with analyte	Yes
Result	Result value	Yes*
LabQual	Laboratory Qualifier	Conditional
ResComm	Result Comments	Conditional
Units	Analyte/Characteristic Units	Yes
MDL	Minimum detection level	Yes*
RDL	Reporting detection limit	Yes*
UQL	Upper Quantification Limit	Conditional*
Analytical Method	Analytical Method	Yes
AnalDate	Analysis Date	Yes
AnalTime	Analysis Time	Yes
SiteLocator	Site or Station locator information	optional
CollectDate	Sample Collection Date	optional
CollectTime	Sample Collection Time	optional

Example EDD lab data submittal

MULTI-PROBE PRE-CAL CHECKLIST & USER REPORT

(Please review Checklist prior to survey departure and complete/return User Report when returning Multi-probe to DWM.)

MULTI-PROBE PRE-CAL CHECKLIST

Project/Basin SuAsCo **Monitoring Coordinator** Therese
CREW # 1

Sent Items:

- ☑ SONDE # 767AB
- ☑ LOGGER # 1139AJ
- ☑ CABLE 25 (ft/m)
- ☑ WEIGHTED GUARD
- ☑ LINKS
- ☑ AUX. WEIGHT
- ☑ AUX. BATT
- ☑ DI H2O
- ☑ FIELD STO. CUP
- ☑ RAG
- ☑ CASE
- ☑ EDITED SITE LIST
- ☑ FIELD GUIDE
- ☑ FIELD SHEETS

Date/Time 2-18-10 0543 **Multi-probe Calibrator (initials)** JS

USER REPORT

Monitoring Coordinator Therese **User Name** TMB

Returned Items:

- ☑ SONDE #_____
- ☑ LOGGER #_____
- ☑ CABLE _____ft/m
- ☑ WEIGHTED GUARD
- ☑ LINKS
- ☑ AUX. WEIGHT
- ☑ AUX. BATT
- ☑ DI H2O
- ☑ FIELD STO. CUP
- ☑ RAG
- ☑ CASE
- ☑ EDITED SITE LIST
- ☑ FIELD GUIDE
- ☑ FIELD SHEETS

User Observations:

- ☐ Sonde/sensor(s) malfunctioned _____
  damaged _____
- ☐ Bubbles observed under DO membrane
- ☐ Stirrer spinning inconsistent (Hydrolab)
- ☐ Case damaged
- ☐ Logger battery failure ____
  malfunction
- ☐ Readings would not stabilize for pH____ DO____ %Sat.____ Sp.Cond./Sal.____ Temp.____
  Depth_____ Turbidity_____
- ☐ Cable damaged ____
  malfunctioned _____
- ☒ No Problems

Comments:_____

Date/Time 2/18/10 **User (initials)** TMB

HAZARDOUS WASTE GENERATION RECORD

Lab # 229 Year 2009 Page 1 of 1

For months with no waste generated enter the month in the "Date" column, "None generated" in the "Description" column and "0" in the "Volume or weight" column

Date	Initials	Description	Volume or weight
6/22	JD	acetone	~400 mls
6/23	JD	"	~300 mls
6/25	A.M	acetone	~150 mls
6/26	A.M	acetone	~150 mls
7/1	A.M	acetone	~200 mls
7/7	A.M	acetone	~250 mls
7/23	A.M.	acetone	~500 mls
7/30	A.M.	acetone	~500 mls
8/1	A.M	acetone	~200 mls
8/4	A.M	acetone	~250 mls
8/5	A.M.	acetone	~200 mls
8/13	A.M.	acetone	~100 mls
8/26	A.M.	acetone	~150 mls
8/27	A.M.	acetone	~100 mls
9/2	A.M.	acetone	~300 mls
9/3	AM	acetone	~150 m/s
9/9	A.M.	acetone	~200 mls
9/24	A.M	acetone	~200 mls
9/25	A.M.	acetone	~600 mls
			~5 l.
			~1.5 gal.

VSQG Hazardous Waste Generation Monthly Limit = 100 ℓ = 100 kg = 27 gal.
total for all labs!

WPP External Data Review *(example)*

See Appendix E (QAPP CD).

WATER QUALITY SURVEY CHECKLIST

- ❑ **Multi-probes** (reserved one week prior to survey) and **tarp** (if raining)
- ❑ Pre-filled **fieldsheets** for each crew with fieldsheet sample labels attached
- ❑ Pre-filled **COC** forms for each crew
- ❑ **Notification and coordination with all applicable labs** re: sample delivery, including DWM labs
- ❑ **Pre-logged sample data into WES LIMS**, including pre-filled and printed sample bottle labels (for WES samples only)
- ❑ Labeled **sample bottles** (for each crew and from each lab), including QC samples and an "extra" bottle bag/crew
- ❑ Acid **preservative** (9N H2SO4 in plastic bag with lots of disposable pipettes; for NUTS samples only)
- ❑ **Coolers w/ ice** (including cooler thermometer)
- ❑ **Survey books,** including USGS/other road/trail maps (for each crew)
- ❑ **Vehicle books** (inc. gas/maintenance card and garage card)
- ❑ **Clipboard, ink field pens and extra fine point Sharpies** (field notebook optional)
- ❑ **DWM cell phone** (signed out) and phone number list
- ❑ **Digital camera** (signed out)
- ❑ **Field kit, including separate first aid kit**
- ❑ **Personal protective equipment** (e.g., waterproof boots, raingear, PFDs, sunglasses, hat, warm clothing, traffic safety vest, and other items as needed that are not already in field kit)
- ❑ **Personal tools and materials** (e.g., Swiss army knife, Leatherman, bug net hat, field notebook, etc...)
- ❑ **Bottle basket sampler** (bridge drops)
- ❑ **Van Dorn sampler, Secchi disk, weighted hose sampler** (lakes)
- ❑ **Anchor bucket** (w/ rope attached)
- ❑ **Traffic safety cone** (min. one in each vehicle)
- ❑ **Basement and outdoor storage building items** (as needed)
- ❑ **Survey-specific items** (e.g. measuring tape, max. depth device, machete, etc. as needed)

LAKES SURVEY CHECKLIST

	Vehicles, boats and sampling gear		Field Apparel, personal gear
	State vehicle, clipboard		Rain gear (if needed)
	Roof rack or trailer (or truck)		Sunglasses
	Boat, oars, oarlocks		Insect repellant, sun screen
	Motor, gas, oil or electric motor and charged battery		Food and water
	Tool kit with spare parts, shear pins, knife, pliers etc.		Miscellaneous items
	2 anchors, rope		Field notebook
	Life jackets (one for each crew member)		7.5 minute USGS map of area
	DI rinse jug one gallon for rinsing Van Dorn		Arcview printed map of lake
	Secchi disk with line calibrated to 0.1 m intervals		Field data sheets, COC forms
	(2) Weighted hoses (Tygon tube 1 cm ID) for integrated Chl a samples, and/or rigid white PVC integrated depth sampler		Waterproof pens and Sharpies
	Funnel for tube chl a blank		SOPs, this SAP
	Multiprobe (precalibrated with appropriate length cable)		Probe clamp for boat
	View scope		Field kit, w/First aid kit
	Van Dorn bottle(s), line and messenger		Cell phone (w/ contacts)
	Depth sounder		Clipboard
	Cooler and ice		Duct tape, tools
	H2SO4 (9.4N) preservative and disposable droppers		List of OWMIDs
	Sample bottles (and extra bag of bottles) & labels		Compass
	Clamping device		Fire extinguisher (if required)
	1 liter blank filled with deionized water for TP, color and chl a		Whistle (or horn if required)
			GPS unit (DWM)

MULTI-PROBE DEPLOYMENT SURVEY CHECKLIST

- ❑ **Probe request form** (as sent one week prior to survey and the completed form containing pre-set sonde ID, OWMID and tube# alignments)
- ❑ **Multi-probe deployment sondes** (reserved one week prior to survey) and placed in the correct numbered tubes at the lab
- ❑ **Deployment tubes** (individually numbered, containing sondes and placed in green PVC carry bags)
- ❑ **Multi-probe QC sonde** (reserved one week prior to survey) with clips as needed for bridge drop anchor assembly
- ❑ Pre-filled **fieldsheets** for each crew with fieldsheet sample labels attached
- ❑ **Deployment survey books,** including USGS/other road/trail maps (for each crew)
- ❑ **Vehicle books** (inc. gas/maintenance card and garage card; for each crew)
- ❑ **Clipboard, ink field pens and extra fine point Sharpies** (field notebook optional)
- ❑ **DWM cell phone** (signed out) and phone number list
- ❑ **Digital camera** (signed out, optional)
- ❑ **Field kit, including separate first aid kit**
- ❑ **Personal protective equipment** (e.g., waterproof boots, raingear, PFDs, sunglasses, hat, light clothing, traffic safety vests, and other items as needed that are not already in field kit)
- ❑ **Personal tools and supplies** (e.g., food, water, Swiss army knife, Leatherman, misc. personal items, etc...)
- ❑ **Anchor bucket** for sonde bridge drops (w/ rope attached)
- ❑ **Traffic safety cones** (min. one in each vehicle)
- ❑ **Anchor blocks** for bridge drop deployments and as resting blocks for wade-in deployments (in basement ; as needed)
- ❑ **Deployment tool bag** (contains measuring tape, machete, loppers, crimping device, cable cutters, bungee cords, extra key set, rags, WD-40, etc...)
- ❑ **Container of cables** (contains specific-size cables in separate bags)
- ❑ **Lock, L-bracket and key bucket** (contains numbered keys and locks and L-brackets)

BIOMONITORING SURVEY CHECKLIST

- ❑ Two nets
- ❑ Blue bucket
    - o Vials- 2 dram/4 dram
    - o Forceps-long w/curved tips
    - o Compass
    - o Densitometer
    - o Pencils, china markers, rubber bands, etc.
    - o Zip-lock bags
    - o Soap/detergent
- ❑ Hip boots/chest waders
- ❑ Wading stick
- ❑ Sorting trays/ice cube trays
- ❑ 2-liter bottles (2 per site sampled); 1-liter bottles
- ❑ Wash water carboy
- ❑ 100% reagent alcohol (1-liter/sample bottle)
- ❑ Insect repellent
- ❑ Rain gear
- ❑ Clipboard and field sheets (high gradient and low gradient as approp.)
- ❑ Site list
- ❑ Digital camera
- ❑ Field kit, including separate first aid kit
- ❑ Aquascope
- ❑ Misc. personal protective equipment (e.g., waterproof boots, raingear, PFDs, sunglasses, hat, light clothing, traffic safety vests, and other items as needed that are not already in field kit)
- ❑ Personal tools and supplies (e.g., food, water, Swiss army knife, Leatherman, misc. personal items, etc...)
- ❑ Cell phone
- ❑ Cooler w/ ice
- ❑ Boot Dryer (when overnight stay involved)
- ❑ Decontamination sprayers (with approp. Solution)

SURVEY FIELD KIT ITEMS

Field Kit Items:	√
Standard:	
FIRST AID KIT (STAND ALONE)	
EXTRA MARKERS (SHARPIE, PEN, PENCIL)	√
Rubber bands	√
Assorted gloves	√
Plastic sampling gloves (several pairs)	√
Compass	√
Glow stick	
Colored flagging	
Flashlight	√
Sunscreen	√
Insect repellent	√
Bacteriocide lotion	√
Poison ivy/oak wash lotion	√
Foot ruler	√
CPR face mask	√
Safety glasses (1 pair)	√
Safety vests	√
Can liner bags	√
Plastic tie wraps	√
Screwdriver	√
Disposable 2 ml. pipettes	
Optional: (not included as standard)	
Electrical tape	
Moist towelettes/paper towels	
State map	
Polarized sunglasses	
Poison Ivy pre-exposure lotion	
Tape measure	

PROJECT SAMPLE LABELS (Examples)

12-KC01 11 August 1997
Kinderhook Creek dnst. fr. Brodie Mountain Road, Hancock, MA

coll. R. Nuzzo

Example of label to be placed in containers with <u>benthos samples</u>.

12-KC01 11 August 1997

Philopotamidae

Example of label to be placed in <u>benthos</u> specimen vials after sorting.

12-KC01 11 August 1997
Kinderhook Creek dnst. fr. Brodie Mountain Road, Hancock, MA

<u>Chimarra</u> sp.
det. R. Nuzzo

Example side label for <u>benthos</u> (orient the head with its ventral surface facing up).

Massachusetts DEP
Wall Experiment Station
Sample Field No._____
Sample Lab No._____

Example of label to be placed on <u>WQ bottles</u>.

Commonwealth of Massachusetts

Division of Fisheries & Wildlife

MassWildlife

Wayne F. MacCallum, *Director*

Procedure for Contacting the Division When a Fish Kill Has Been Reported

When you receive a call about dead fish, **regardless of the circumstances**, follow these procedures for contacting the Division of Fisheries & Wildlife, the lead agency for coordinating fish kill response:

- Get the name and phone number of an actual witness to the fish kill
- Call the Fish Kill Coordinator, Richard Hartley at: office (508) 389-6330 or cell (508) 479-4092. If the Fish Kill Coordinator is unavailable, leave a message including the name and number of the witness and the location of the fish kill.
- From April 1st through October 1st, **Concurrent with contacting the Fish Kill Coordinator**, call the Fish Kill cell phone at (508) 450-5869.
- If you do not hear back from the Fish Kill Coordinator or the Fisheries Biologist on call within ½ hour, call the Department of Environmental Law Enforcement Radio Room which is staffed 24/7 at 1-800-632-8075.
- Outside of the standby time period (October 2nd through March 31st), if a fish kill report is received outside of normal working hours, 8:00-4:30 or on a weekend or holiday, leave a message on the Fish Kill Coordinator's work phone and cell phone. If you do not hear back from the Fish Kill Coordinator within ½ hour, call the Environmental Law Enforcement Radio Room at 1-800-632-8075.
- **All media inquiries must be forwarded to Amy Mahler at:**

  (617) 626-1129 Work
  (617) 910-7014 Cell