QAPPs, Data Quality and Information Sharing for MA. Water Resources

MassDEP

Bureau of Water Resources, Division of Watershed Management, Watershed Planning Program

Quality Assurance Project Plans

* Standard QAPP elements
* Graded approach
* Implementation!
* Agency QAPP review & approval
* EPA, DEP, etc. guidance on-line
  * DEP web page
  * EPA web page
  * WPP program QAPP

Our goals can only be reached through a vehicle of a plan, in which we must fervently believe, and upon which we must vigorously act. There is no other route to success.

-Pablo Picasso

Group A: Project Management and Objectives

* A1 Title and Approval Sheet
* A2 Table of Contents
* A3 Distribution List
* A4 Project/Task Organization (org chart)
* A5 Problem Definition/Background
* **A6 Project Objectives/Task Description**
* A7 Data Quality Objectives and Criteria
* A8 **Training**
* A9 **Documentation and Records**

Monitoring Objectives

* For "assessment" and TMDL-support objectives, design for consistency with MA. Consolidated Assessment and Listing Methodology (CALM)
  * http://www.mass.gov/eea/docs/dep/water/resources/07v5/2016calm.pdf
* Other objectives:
  * Pollutant source ID
  * Establish baseline conditions
  * Long-term trends
  * Post-restoration

Benefits of Training

* "Calibrate" data collectors (e.g., visual estimates)
* Consistency in SOP implementation (e.g., completing field forms, sampling techniques, etc.)
* Opportunities for Q&A, fine tuning procedures
* Emphasize and practice safety procedures
* "QA Officer"

Project documentation supports data validation and sharing

- field notebooks/fieldsheets
- training records
- equipment programming records
- instrument calibration records
- photos
- coc forms
- audit reports
- value-added metadata (e.g., notes re: deviations from sops)

Group B: Data Generation and Acquisition (Sampling and Analysis)

* B1 Sampling Process Design (Experimental Design)
* **B2 Sampling Methods***
* B3 Sample Handling and Custody*
* **B4 Analytical Methods***
* **B5 Quality Control**
* B6 Instrument/Equipment Testing, Inspection, and Maintenance*
* B7 Instrument/Equipment Calibration and Frequency*
* B8 Inspection/Acceptance of Supplies and Consumables
* B9 Non-direct Measurements
* B10 Data Management

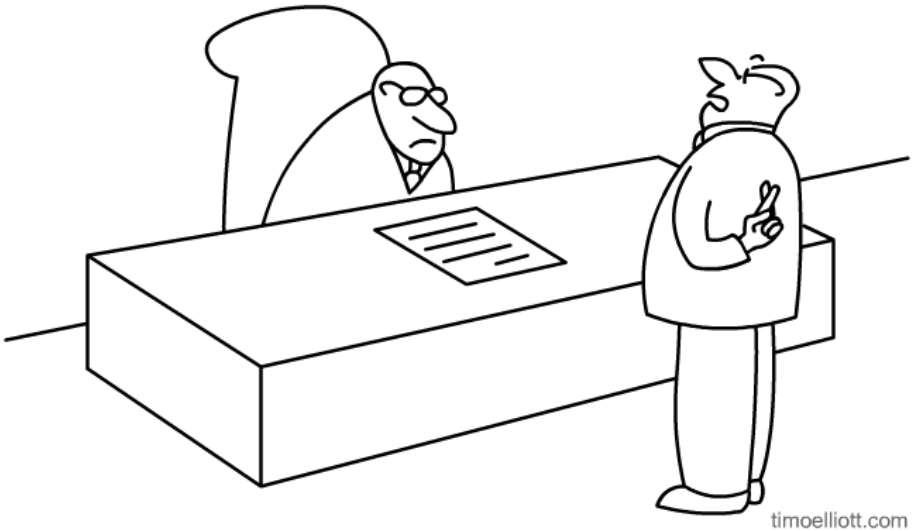
**Details in the attached field and laboratory SOPs, lab Quality Assurance Plans, etc.*

Sampling Methods

* Example Problems:
  * Equipment blank detections
  * Quality of sampling containers
  * Deployed probes coming “out-of-water”, fouling
  * Poor sampling efficiency (electrofishing, benthic inverts)
  *

Analytical Methods & QC

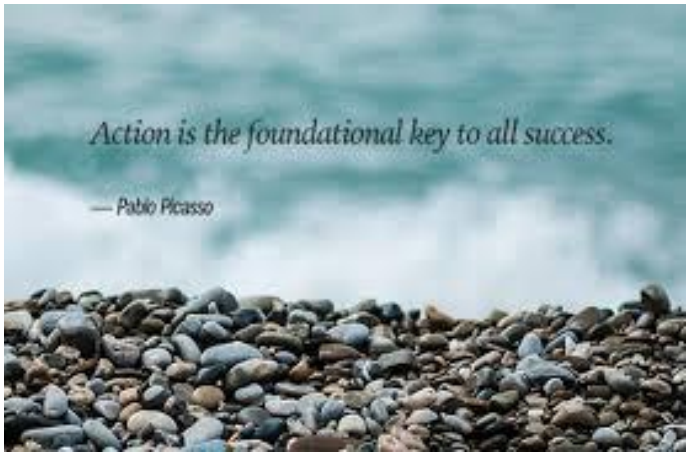
* Example Problems:
  * Failed QC audit (double-blind)
  * Poor lab SOP/practice non-representative analysis sample
  * Freezing as a “default” sample preservation technique
  * Fraud



"Yes sir, you can absolutely trust those numbers"

Quality Control actions

* Audits (lab, field) Test assumptions *[**trust, but verify**]*
* Prove repeatability and accuracy of results
* Corrective actions
* Use QC data to help validate results



Group C: Assessment and Oversight
Group D: Data Validation and Usability

* C1 Assessments and Response Actions
* C2 Reports to Management

* **D1 Data Review, Verification and Validation**
* D2 Verification and Validation Methods
* D3 Reconciliation with User Requirements

Potential/Example Issues Affecting Data Quality

* Reporting errors
* Non-representative sampling
* Inappropriate lab/field practices (e.g., calibrations that don't bracket expected range; holding times exceeded)
* Miscommunications
* Failure to check/audit lab and field crews for accuracy, procedures, etc.
* Poor field technique
* Insufficient training (resulting in inconsistent application of SOPs)
* Lack of pre-calibration and/or post-survey checks for probes
* Lack of or incomplete metadata
* Lack of field QC samples
* Use of unclean sample containers
* Insufficient expert verifications
* Lab fraud
* Assuming data are fine without checking
* Not adhering to good modeling practice (inc., garbage IN, garbage OUT)

Benefits Of Quality Assurance

* Generate data of known and documented quality
* Standardization of procedures (SOPS), field and lab
* QC data and documentation promotes usability of data
* Promotes a culture of Quality
* Help projects to meet both project AND data quality objectives
* Training ensures consistency and QAPP execution
* No guarantees, but excellence more likely

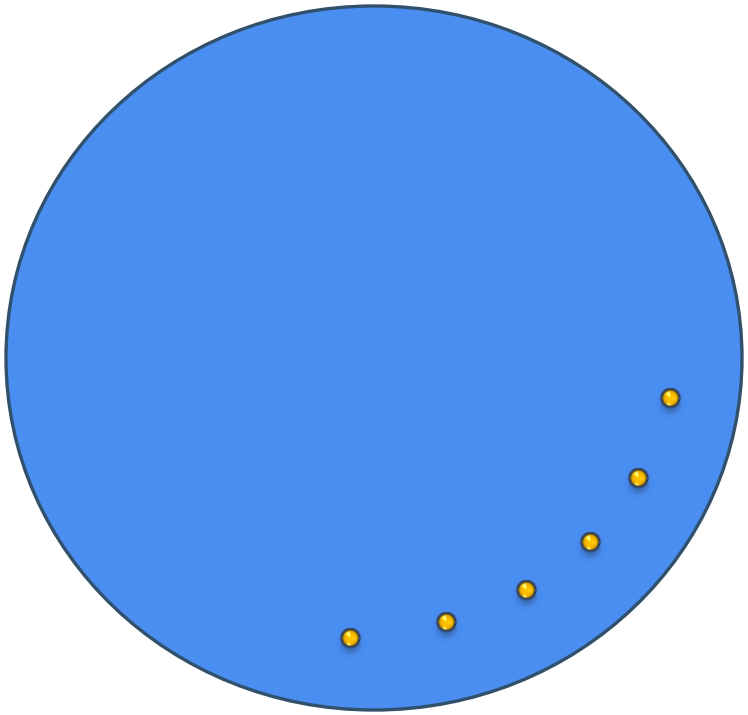
Indicators Used in Assessing Designated Uses

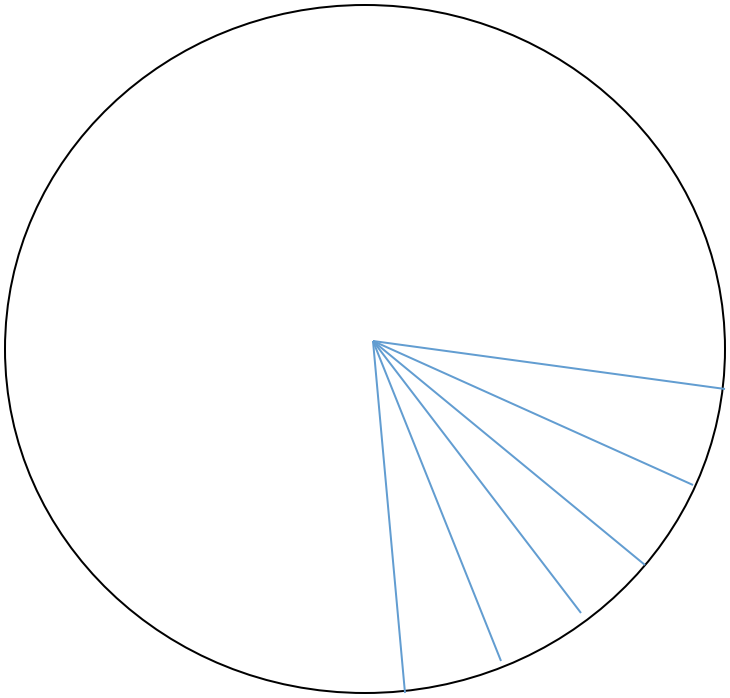
INDICATOR CATEGORY	AQUATIC LIFE	RECREATION	FINFISH/SHELLFISH CONSUMPTION	DRINKING WATER
Core	Macroinvertebrate community Fish community Periphyton/Phytoplankton Macrophyton Eelgrass Habitat quality Flow **Dissolved oxygen (continuous)** pH **Temperature (continuous)** Turbidity Suspended solids **Specific conductance/Chloride** **Lake trophic status (inc. Secchi)**	**Pathogens (e.g., *E. coli*)** **Transparency (Secchi)** Algal blooms, chlorophyll **Cyanotoxins** Macrophyte density Land-use/% impervious cover Bathing beach closures	Mercury PCBs Pesticides Shellfish bed closures (non-management)	Primary drinking water standards (legally enforceable under the SDWA)
Supplemental	Toxic pollutants (e.g., metals) Toxicity tests (water, sediment) Tissue chemical assays Nutrients Chlorophyll Emerging contaminants Sediment chemistry Organism condition factor **Invasive species** Land-use/% impervious cover Fish kills Pollutant loadings	Fluorescent whitening agents **Objectionable scums, sheens, debris, deposits** Flow/water level Sediment quality Color/Turbidity pH	Other contaminants of concern Pathogens	Secondary drinking water standards or other health-based advisories (unenforceable guidelines)

MassDEP Data "Needs" for surface waters (examples)

* *E. coli*/Enterococci bacteria
* Long-term temperature and optic DO/temp deployments
* Fall-Winter-Spring chloride data
* Spatial-temporal visual records for aesthetics, blooms, stressors, fish kills, spills, no-low flows, etc.
* Sources of pollutants (e.g., bacteria source tracking)
* Nutrient levels (TP, TN), chl a (lakes), cyanobacteria (counts, toxins)
* Benthic Macroinvertebrate data, habitat scores, metrics
* Project-specific baseline conditions and/or "Success story" data documenting improvements (or other) in WQ
* Long-term fixed site data throughout the state

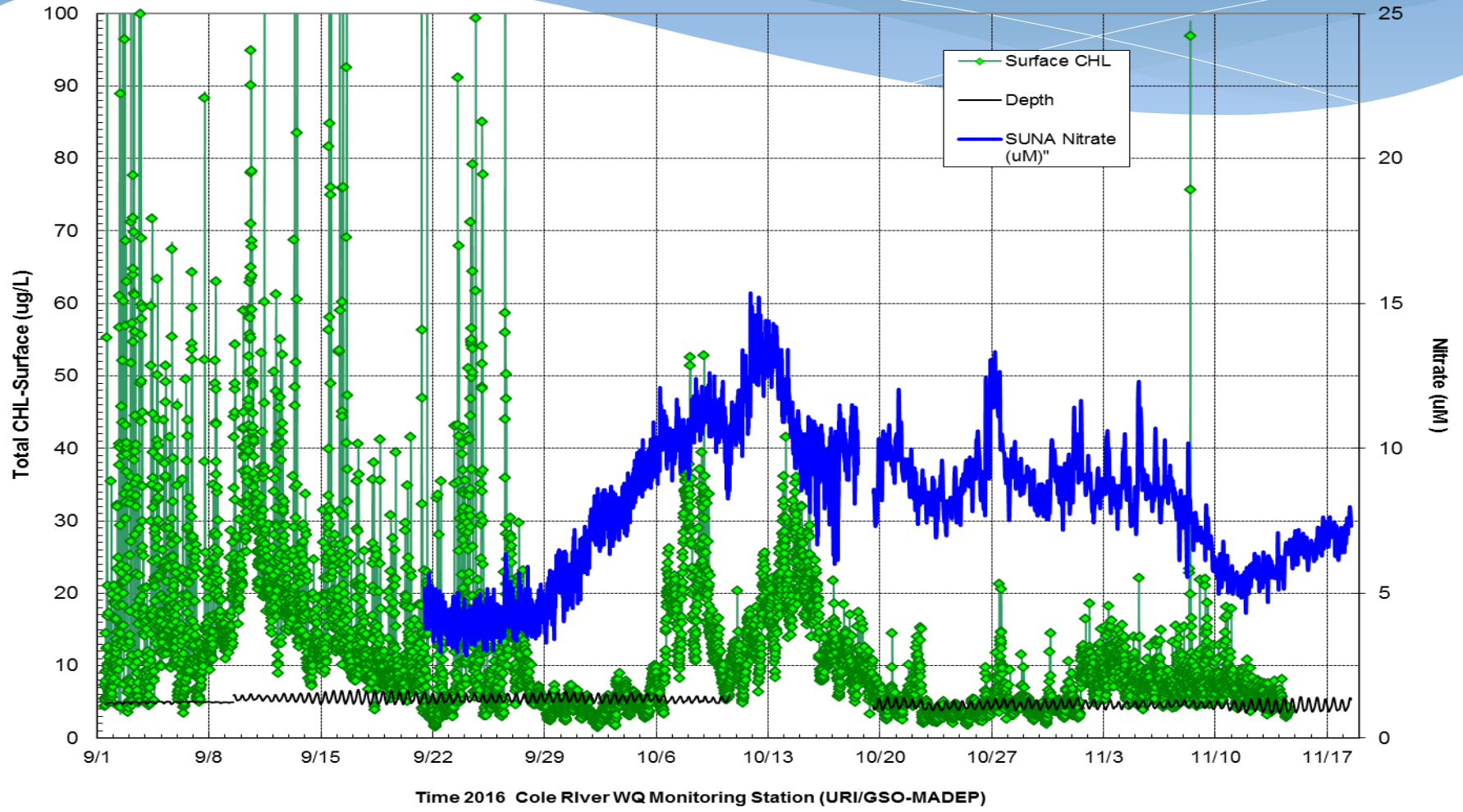
Temporal Limitations of Grab Sampling



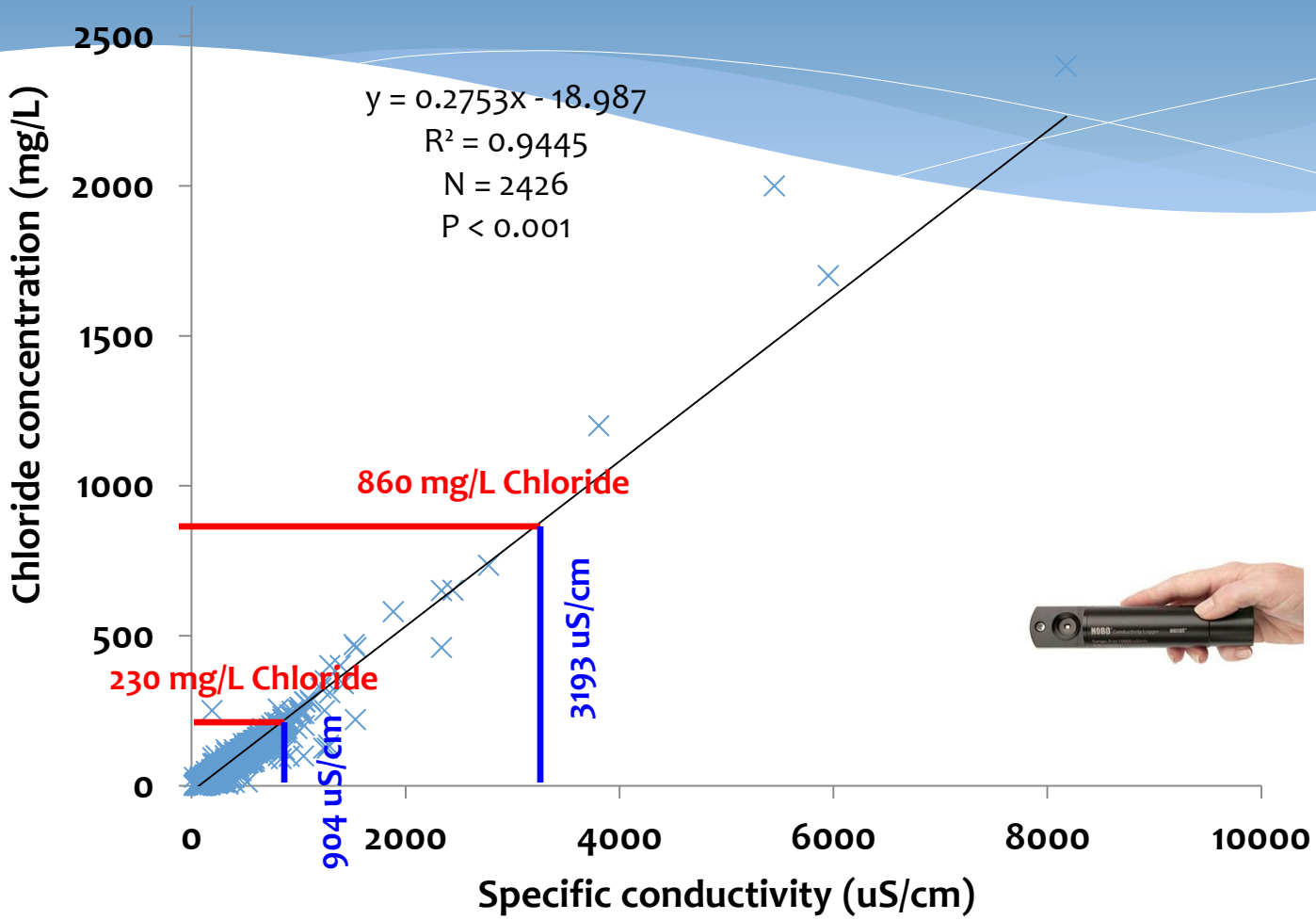


Usefulness of Continuous Data

(preliminary data)



MA. Freshwater Model for SC vs. Cl



Submittal of Data to MassDEP

- Web page
  - *external-data-submittals*
- Updated guidance sheets (example)
  - *CN 000.72b - Guidance_External Data Submittal & Review.doc*
- Data Submittal Checklist: All information should be sent electronically via e-mail (or other)
  - Cover Letter/e-mail (address: WQData.Submit@state.ma.us)
  - Data file(s) using WPP data submittal template
  - Statement of Data Integrity (WPP-Form_Data Integrity)
  - Copy of approved QAPP

Data Requirements for Use in CWA 305(b) Assessments

* QAPP
* Use of a state-certified or otherwise acceptable laboratory
* Demonstrated attention to QA/QC
* Data submittal using WPP's "EDD" template, including QC data *
  * Other formats accepted, but may complicate review/use
* Narrative report containing data *
* High usability score based on WPP's data review

* *recommended*

MassDEP-DWM-WPP's standardized review process to determine usability of external data

* SOP, training and calibration of reviewers
* External data warehouse
* Tiered scoring system
  * screening-level vs. assessment-level
* Integration of non-DEP data into CWA 305(b) decision-making

Minimizing Uncertainty in Designated Use Assessments

* In order to minimize the chances of making either of the following two errors:
  * Concluding the segment is impaired, when in fact it is not, and
  * Deciding not to declare a segment impaired, when it is in fact impaired.
* **Use only scientifically-defensible data and analysis methods**
* **Work on more numeric criteria in SWQS (e.g., biocriteria), including M/F/D and appropriate reference conditions**
* **Statistical approaches to decision-making**
* **More DATA that is more current, in more places, and for more pollutants**

Attention to Emerging and Persistent Issues

* Micro-plastics
* Climate change
* Trash
* PPCPs
* Chloride
* Invasive species
* Cyanotoxins
* Community-level water quality impacts
* Dams
* Healthy watersheds & watershed BMPs
* Hardness/DOC
* Engagement when voices are needed…
* New discoveries?

Environmental data quality – A critical driver for knowledge, protection and restoration

* What are the true environmental conditions?
* Data as a precious (dwindling?) resource
* Limited data quantity magnifies importance of data quality
* Good quality data help to better understand and manage resources
* Greater spatial/temporal coverage via a network of credible data collectors

Data Sharing

- **DEP reports, data & assessments on-line**
  - Interactive, geospatial data viewer (pending)
  - Expanded use of MA volunteer data
- **Improved databases**
  - EPA WQX/STORET/WQPortal (https://www.waterqualitydata.us/)
  - EPA continuous data strategy
  - More regional databases? (https://www.waterqualitydata.us/other_portal_links/)
  - Unifying data model (inc. QC)?
- **Opportunities:**
  - More resources/$ needed for monitoring and data sharing
  - Reducing analytical costs
  - More inter-method comparison testing
  - Better citizen–science tools for data collection and sharing

QAPP and Data Submittals

(meeting attendees only)

Monitoring Group (in attendance)	QAPP status	QAPP Update Approval (2017)	Data Submittal(s) to DEP
Charles River Watershed Association	DEP-Approved	pending	yes
OARS (Assabet, Sudbury and Concord Rivers)	DEP-Approved	---	yes
Town of Charlton	---	---	yes
Neponset River Watershed Association	DEP-Approved	---	yes
Nashua River Watershed Association	DEP-Approved	---	yes
Upper Blackstone WPAD	DEP-Approved	pending	yes
Connecticut River Watershed Council	DEP-Approved *	---	---
Deerfield River Watershed Association	DEP-Approved	---	---
Ipswich River Watershed Association	DEP-Approved	pending	yes
Housatonic Valley Association	DEP-Approved	pending	yes
City of Lowell	Initial draft received; expecting draft#2	---	---

** project-specific (vs. program)*

Visioning for Improved Assessments

- Increase use of external data via NEW WPP data submittal portal
- Improve data accessibility
  - EQuIS dataflow to EPA Water Quality Exchange (WQX),
  - Water Quality Exchange Grants (e.g., NHD baselayer for GIS products; interactive data viewer)
- Where possible, continued automation/streamlining of data flows and tool development to support assessment decision-making
- Implementation of EPA's new ATTAINS database for 2018 and beyond.
- Improved ability to evaluate/understand effectiveness measures (permits, grants, etc.)
- Continue to enhance dataflows to improve the geographic coverage and water quality reporting (e.g., emerging contaminants, aquatic invasive species, chloride, pathogens, continuous data etc.) including communicating with extern groups on DEP's data needs.

Massachusetts Water Quality Standards

Water Quality Standards

- Provides inventory of waters
- Classifies water use goals
- Ascribes uses
- Prescribes minimum criteria (numeric and narrative) to protect uses
- Provides regulations

WQS CLASSIFICATION OF SURFACE WATERS

Designated Uses described in the classes:

INLAND WATER CLASSES (Rivers and Lakes)

***CLASS A** - public water supply and their tributaries, excellent habitat for fish, other aquatic life and wildlife, primary and secondary contact recreation, even if not allowed, excellent aesthetic value, protected as Outstanding Resource Waters.*

***CLASS B** - habitat for fish, other aquatic life, and wildlife (Cold and Warm), primary and secondary contact recreation. treated water supply, irrigation and other agricultural uses, industrial cooling and process, good aesthetic value.*

***CLASS C** - habitat for fish, other aquatic life and wildlife, secondary contact recreation, irrigation of crops used for consumption after cooking, industrial cooling and process, good aesthetic value.*

COASTAL AND MARINE CLASSES (Estuaries)

***CLASS SA** - excellent habitat for fish, other aquatic life and wildlife, primary and secondary contact recreation, sea grass, shellfish harvesting without depuration (Approved and Conditionally Approved Shellfish Areas), excellent aesthetic value.*

***CLASS SB** - habitat for fish, other aquatic life and wildlife, primary and secondary contact recreation, seagrass, shellfish harvesting with depuration (Restricted and Conditionally Restricted Shellfish Areas), good aesthetic value.*

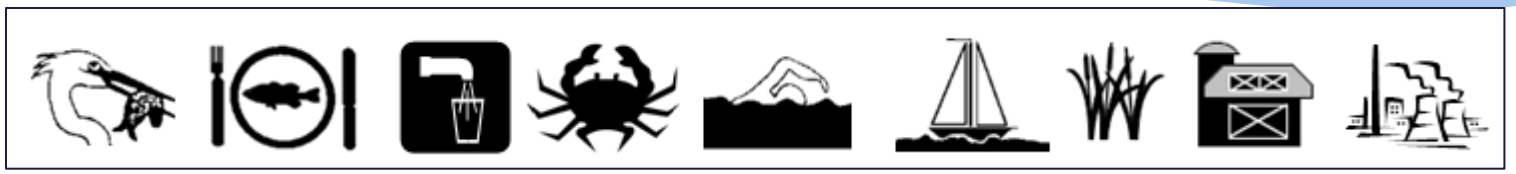
***CLASS SC** - habitat for fish, other aquatic life and wildlife, secondary contact recreation. certain industrial cooling and process, good aesthetic value.*

MA WQS – Classify waters, designate uses and define criteria

- **Aquatic Life**
- **Fish Consumption**
- **Public Water Supply (acknowledged as use but not assessed) refer to Drinking Water Program/public water suppliers for info)**
- **Shellfish Harvesting**
- **Primary Contact Recreational (e.g., swimming)**
- **Secondary Contact Recreational (e.g., boating)**
- **Aesthetics**
- **Agricultural (presumed support)**
- **Industrial (presumed support)**

We report on these uses as three waterbody types – rivers, lakes, estuaries

How Data are used by WPP to make Designated Use impairment decisions



http://www.mass.gov/eea/agencies/massdep/water/watersheds/water-quality-assessments.html

http://www.mass.gov/eea/agencies/massdep/water/watersheds/total-maximum-daily-loads-tmdls.html

How Data are used by WPP to make Designated Use impairment decisions:

Fish Consumption

* Rivers, Streams, Lakes, Ponds and Estuaries:
  * Site-specific DPH fish consumption advisory

How Data are used by WPP to make Designated Use impairment decisions:

Shellfish Harvesting

* DMF Shellfishing Area Classifications:
  * SA Waters:
    * Conditionally-approved
    * Restricted
    * Conditionally-Restricted
    * Prohibited (except in cases where new closures are management-based)
  * SB waters:
    * Conditionally-Restricted
    * Prohibited (except in cases where new closures are management-based)

How Data are used by WPP to make Designated Use impairment decisions:

Aesthetics

* Rivers & Streams:
  * >40% filamentous cover and/or excess algal/plant growth
  * High level of visual and/or olfactory nuisance

* Lakes:
  * Secchi < 1.2 m
  * Dense macrophyte cover
  * Excess algal growth

Note: Aesthetic impairments result in impaired 1°/2° contact recreation

How Data are used by WPP to make Designated Use impairment decisions:

Contact Recreation (1°/2°)

* 1° Contact Recreation for Rivers, Streams, Lakes and Ponds:
  * Geo mean bacteria > criterion
  * Secchi < 1.2 m
  * DCR beach closures >10% season
  * Aesthetic use impairment
  * Estuaries: similar to above, but also CSO w/o approved variance

* 2° Contact Recreation: All waterbodies
  * Geo mean bacteria > criterion
  * Presence of a CSO w/o an approved variance
  * Aesthetic use impairment

How Data are used by WPP to make Designated Use impairment decisions:

Aquatic Life Use

* Lakes:
  * Cyanobacteria advisories
  * Fish community showing abnormalities
  * Chlorophyll a>16 ug/l
  * Macrophyte /algal density > 25% lake area
  * Habitat stress
  * Presence of non-native species
  * >10% toxicity tests showing <75% survival
  * Frequent exceedance of DO, pH, temperature criteria
  * TP levels > EPA criteria (Gold book), in combination with other indicators of enrichment, inc. Secchi < 1.2 m
  * Toxic chems > acute criteria (N > 1)
  * Other exceedances of guidelines/criteria (e.g., sediment quality, tissue residues)

How Data are used by WPP to make Designated Use impairment decisions:

Aquatic Life Use

* Estuaries:
  * Chlorophyll a >10 ug/l
  * > 10% loss eelgrass cover (1990's vs. 2010-2013)
  * Poor macroinvertebrate metrics and habitat stress
  * Macroalgae accumulations
  * Nutrient levels elevated (> MEP threshold criteria; e.g., >0.5 mg/l TN or estuary-specific criteria)
  * Fish community showing abnormalities
  * >10% toxicity tests showing <75% survival
  * Frequent exceedance of DO, pH, temperature criteria
  * Toxic chems > acute criteria (N > 1)
  * Other exceedances of guidelines/criteria (e.g., sediment quality, tissue residues)

How Data are used by WPP to make Designated Use impairment decisions:

Aquatic Life Use

Rivers & Streams:

- Cyanobacteria advisories
- Impaired benthic or fish community
- Chlorophyll a>200 mg/m2 (benthic); >16 ug/l (water)
- Filamentous algae>40%
- Habitat stress
- Presence of non-native species
- >10% toxicity tests showing <75% survival
- Frequent (>10%) and/or prolonged exceedance of DO, pH, temperature criteria (inc. WWF/CWF criteria)
- TP levels > EPA criteria (Gold book), in combination with other indicators of enrichment
- Toxic chems > acute criteria (N > 1)
- Other exceedances of guidelines/criteria (e.g., sediment quality, tissue residues)

Selected Links to Quality Assurance in Environmental Monitoring

MassDEP:

* QAPP guide: http://www.mass.gov/eea/agencies/massdep/water/watersheds/environmental-monitoring-quality-management-program.html
* QAPP guide (inland waters): http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/inlandq.doc
* QAPP guide (coastal waters): http://www.mass.gov/eea/docs/czm/cwq/general-qapp.doc
* General guidance for volunteers: http://www.mass.gov/eea/agencies/massdep/water/watersheds/environmental-monitoring-for-volunteers.html
* Search for certified labs: http://public.dep.state.ma.us/Labcert/Labcert.aspx

USEPA:

* QA guidance: http://www.epa.gov/QUALITY/qapps.html

Other:

* NHDES: http://des.nh.gov/organization/divisions/water/wmb/vrap/categories/publications.htm

QA/QC "Top 10"

1. Safety 1st!
2. QAPP (esp. defining monitoring objectives, and implementation)
3. Good Laboratory Practices
4. Instrument calibration, inspection & maintenance
5. QC-sampling (field and lab)
6. Avoiding systematic bias(es)
7. Documentation
8. Being free to censor/qualify data as needed
9. Consistency & standardization
10. Taking CARE to get the details right (esp. on what matters the most)

CSREES Volunteer Water Quality Monitoring National Facilitation Project

December 2004
Factsheet VI

Building Credibility:
Quality Assurance and Quality Control for Volunteer Monitoring Programs

University of Rhode Island **University of Wisconsin**

Elizabeth Herron, Linda Green, Kris Stepenuck and Kelly Addy

The ultimate goal of most volunteer monitoring programs is to ensure that well-trained volunteers collect high quality data and that the data are used. Despite decades of demonstrating that volunteers can and do collect representative data, government agencies, scientists and often the general public are sometimes reluctant to use data not collected by "experts". Therefore volunteer water quality monitoring programs must work especially hard to build and maintain credibility – some have even said, "twice as hard for half the recognition." This factsheet provides an overview of quality assurance and quality control issues and provides examples of methods used by Cooperative Extension and other volunteer monitoring programs to substantial the credibility of their data.

Water quality monitoring data are typically gathered to support decision-making, whether it is for encouraging waterfront residents to convert lawns into vegetated buffers, for enacting local ordinances to strengthen wetlands protection or storm water management, or for regulatory action. In order to be useful, monitoring data must provide relevant information - if the concern is potential bacterial contamination, measuring turbidity or dissolved oxygen won't help much. And the data must be credible, which usually means that it is documented and defensible. Data of unknown quality are essentially useless, and useless data can potentially corrupt the decision-making process. Therefore incorporating a Quality System into your monitoring program is necessary for generating useful data.

Quality System Components: Assurance, Control and Assessment

Generating reliable data requires adherence to an overall quality policy or system, but what exactly makes up that system? The **Quality System** can most easily be thought of in terms of what you need to do *Before*, *During* and *After* your monitoring effort (Table 1). Three elements combine to form the Quality System: Quality assurance, control and assessment[1]. Developing your Quality System should be an iterative process and focused on how you intend for the data to be used. This system should be incorporated into every aspect of your monitoring program - the bedrock upon which your program is based.

Table 1. Data Quality System

Before - Plan	During - Implement	After - Assess
Quality Assurance	Quality Control	Quality Assessment
Study design Quality Assurance Project Plan Develop training program and materials	Training Follow the written monitoring manual Follow standard operating procedures (SOPs) Document changes Proficiency testing	Data proofing/review Outside performance evaluation Reconcile data with objectives Revise SOPs as needed

This is the sixth in a series of factsheet modules which comprise the Guide for Growing CSREES Volunteer Monitoring Programs, part of the *National Facilitation of Cooperative State Research Education Extension Service (CSREES) Volunteer Monitoring Efforts* project. Funded through the USDA CSREES, the purpose of this four-year project is to build a comprehensive support system for Extension volunteer water quality monitoring efforts nationally. The goal is to expand and strengthen the capacity of existing Extension volunteer monitoring programs and support development of new groups. Please see http://www.usawaterquality.org/volunteer/ for more information.

DATA QC REQUIREMENTS	DATA LEVEL		
	Level 1	*Level 2*	*Level 3*
	Educational/Stewardship	**Screening**	**Regulatory/Assessment**
Agency-approved QAPP	No	Yes	Yes
State-certified (or otherwise acceptable) laboratory analysis (parameter-specific)	No	Yes	Yes
Documented QA/QC activities and data quality assessment	No	**Yes/No**	**Yes**
Number of valid results (vs. required sample "N" for decision)	No	**Yes/No**	**Yes**
Representative, documented, and accurately-described sampling locations	No	Yes	Yes
Training	No	**Yes/No**	**Yes**
Data Validation and verification	No	**Yes/No**	**Yes**
Internal field and/or lab audit(s)	No	Yes/No	Yes/No
Project organization	No	**Yes/No**	**Yes**
Data Quality Objectives (relatively stringent and comparable to DWM-WPP's)	No	**Yes/No**	**Yes**
Use of lab(s) and/or calibrated instruments (vs. kit use)	No	**Yes/No**	**Yes**
Documented QC (e.g., instrument calibration) and methods	No	**Yes/No**	**Yes**
External field and/or lab audit(s) by agency/other	No	**No**	**Yes/No**
Calibration of instruments prior to use	No	**Yes/No**	**Yes**
Inspection/maintenance activities (as needed)	No	**Yes/No**	**Yes**
Sufficient metadata documentation (e.g., fieldsheets)	No	**Yes/No**	**Yes**
Voucher sample verification (biological)	No	**Yes/No**	**Yes**

**** "Yes" = required*** ***"Yes/No" = not necessary, but recommended*** ***"No"= not required***

Recommended Minimum Sample Number, Frequency and Timing for Example Parameters

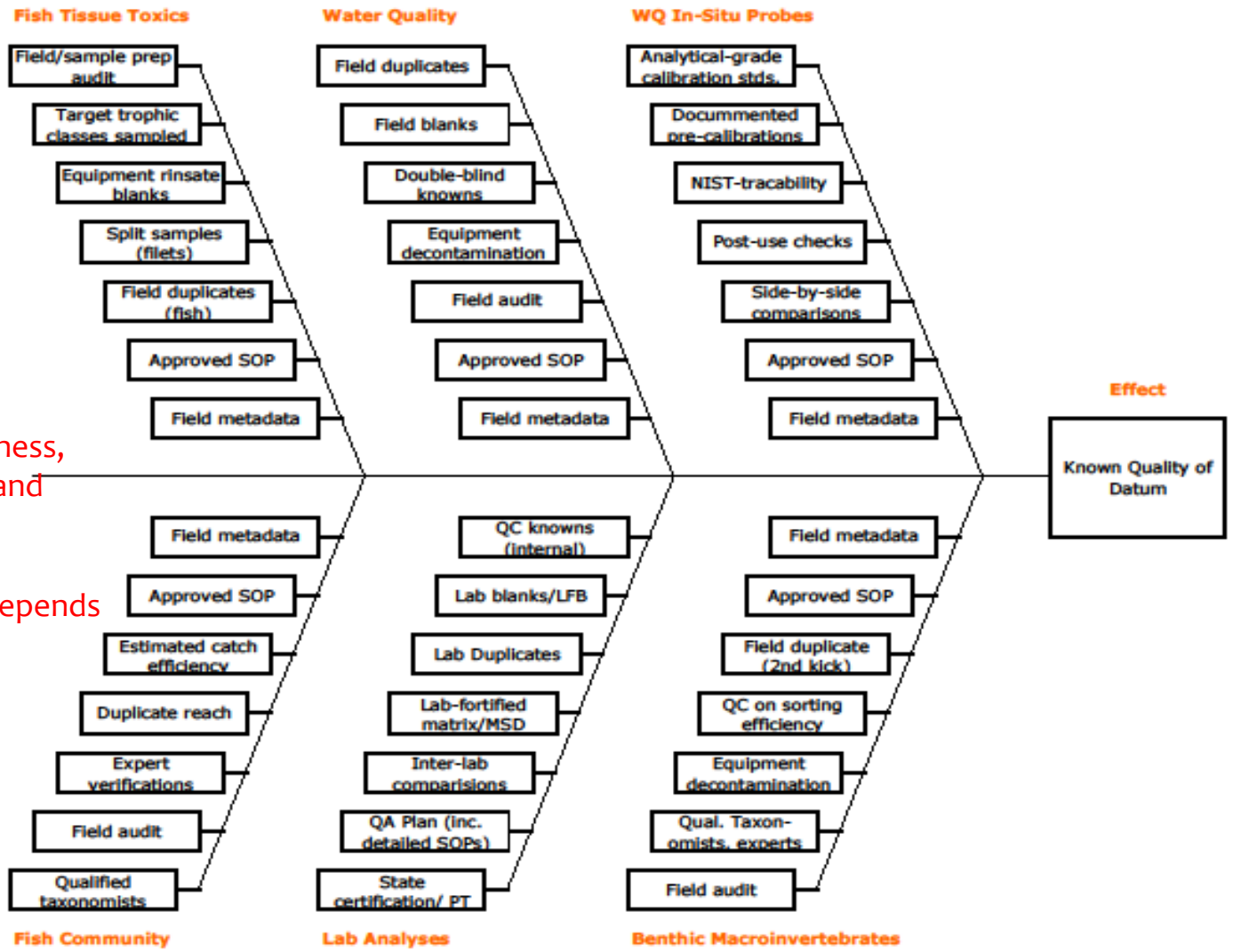
Parameter	Streams		Lakes	
	Min. Sample Number and Frequency	Sampling Period **	Min. Sample Number and Frequency	Sampling Period **
D.O. (discrete)	5 results, pre-dawn	June - September	3 results (epilimnetic)	June - September
D.O. (continuous)	30 days	June - September	30 days	June - September
pH	5 results	June - September	3 results (epilimnetic)	June - September
Temperature (discrete)	5 results, afternoon	June - September	3 results (epilimnetic)	June - September
Temperature (continuous)	30 days	June - September	30 days	June - September
Bacteria (e.g., *E. coli*)	3-5 results (in 30-90 days)*	April 1-October 15	3-5 results (in 30-90 days)*	April 1-October 15
Nutrients (inc. chl a for lakes)	5 results	June- September	3 results	June - September
Secchi depth	---	---	3 results	June - September
Chloride	3 results	4 day period (yr-round)	---	---
"Clean" metals	3 results	4 day period (summer)	---	---
Misc. toxics/ emerging contam.	3 results	30 day period (summer)	3 results (epilimnetic)	30 day period (summer)
Fish community	1 survey	April 1-October 15	1 survey	April 1-October 15
Fish tissue contaminants (e.g., Hg, PCBs, pesticides)	1 survey	Any	1 survey	Any
Benthic invertebrates (RBP3)	1 survey	July – October	---	---
Weed surveys	1 survey	June- September	1 survey	June- September
Aesthetics	1 survey	April 1-October 15	1 survey	April 1-October 15

* 30 days (bathing); 90 days (non-bathing) ** "worst-case" typ. July-Aug

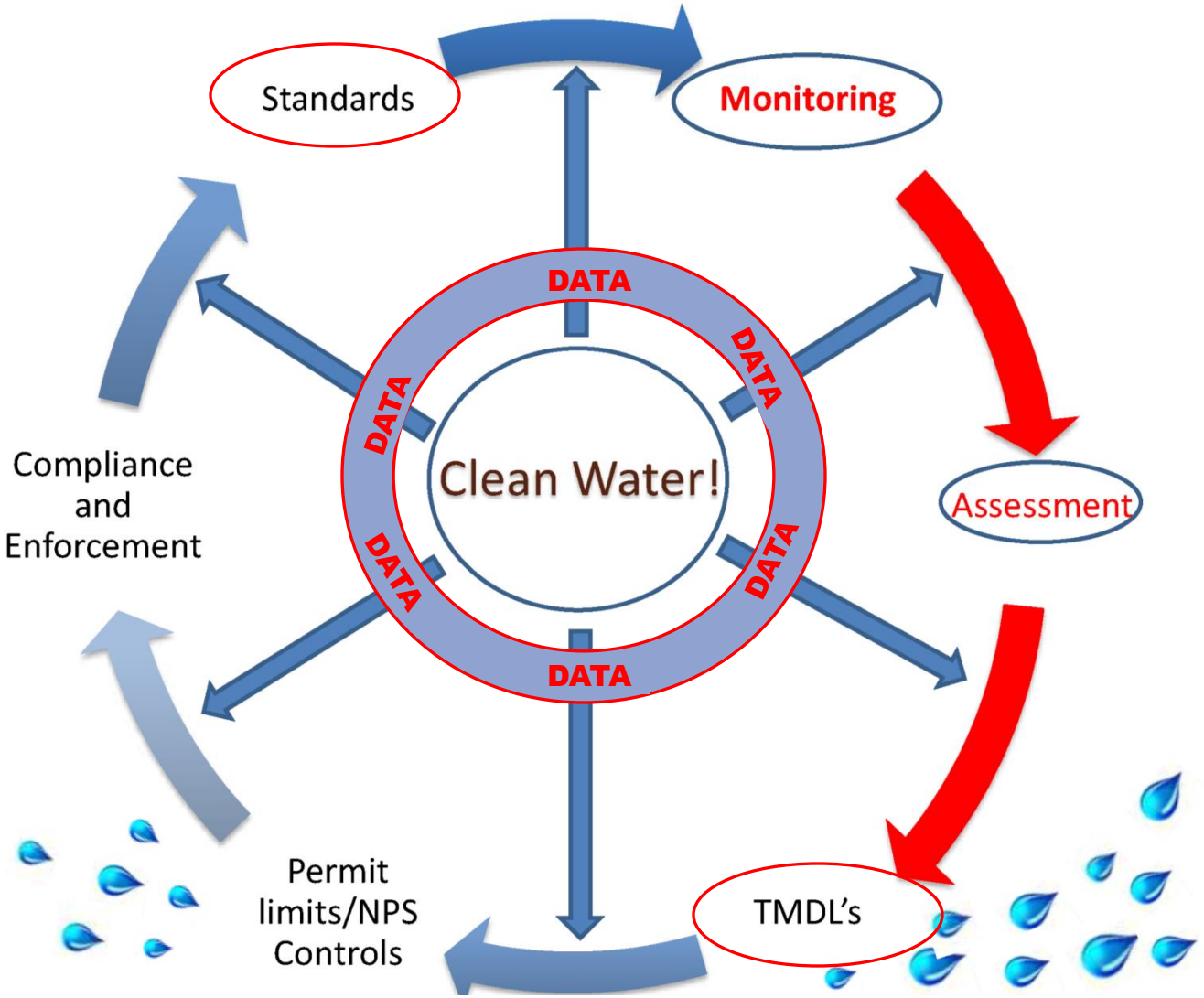
p.a.r.c.c.

precision,
accuracy,
representativeness,
completeness and
comparability

[QC activities depends on the project]

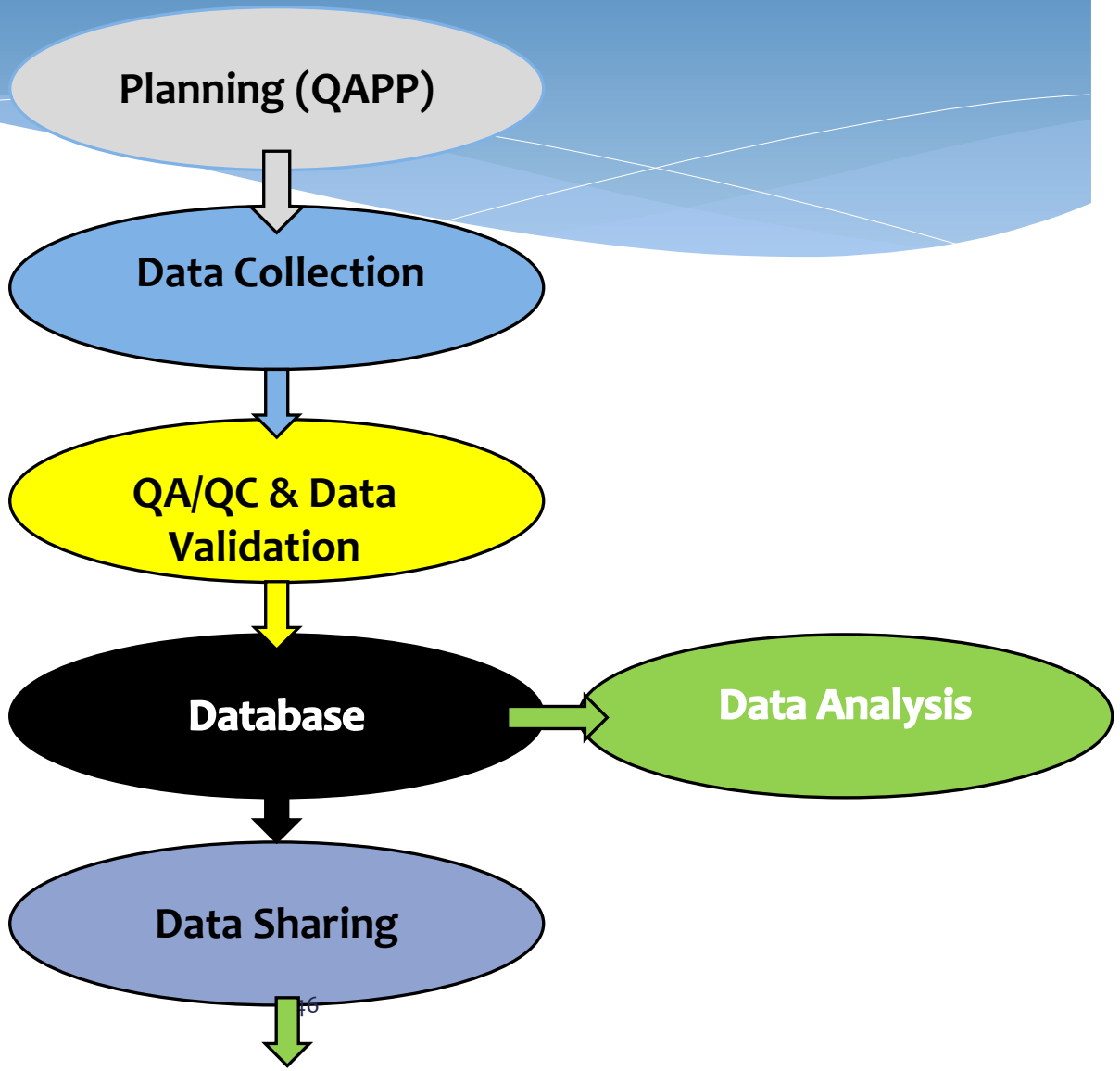


MassDEP Watershed Planning Program Scope



Data Management Model

Data Can not be validated without a QAPP



Data Review & Validation

Data Validation Decision-Making

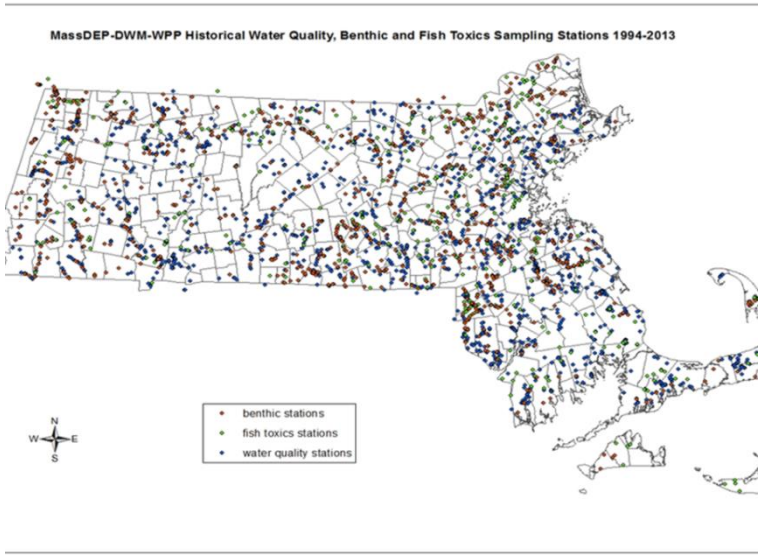
* Qualify
* Censor, or
* Accept without caveat ~~each datum~~

Water Resource Management Trends:

* Solving Water quality problems expensive
* Requires science-driven solutions
* Technology allows for data sharing
* Increasing number of data collectors (federal, state, NGO, regulated community, private)
* Increasing need to leverage partnerships in data collection
* Collection data is expensive, get it right to optimize usability

Why QAPP? Environmental Monitoring is Complex

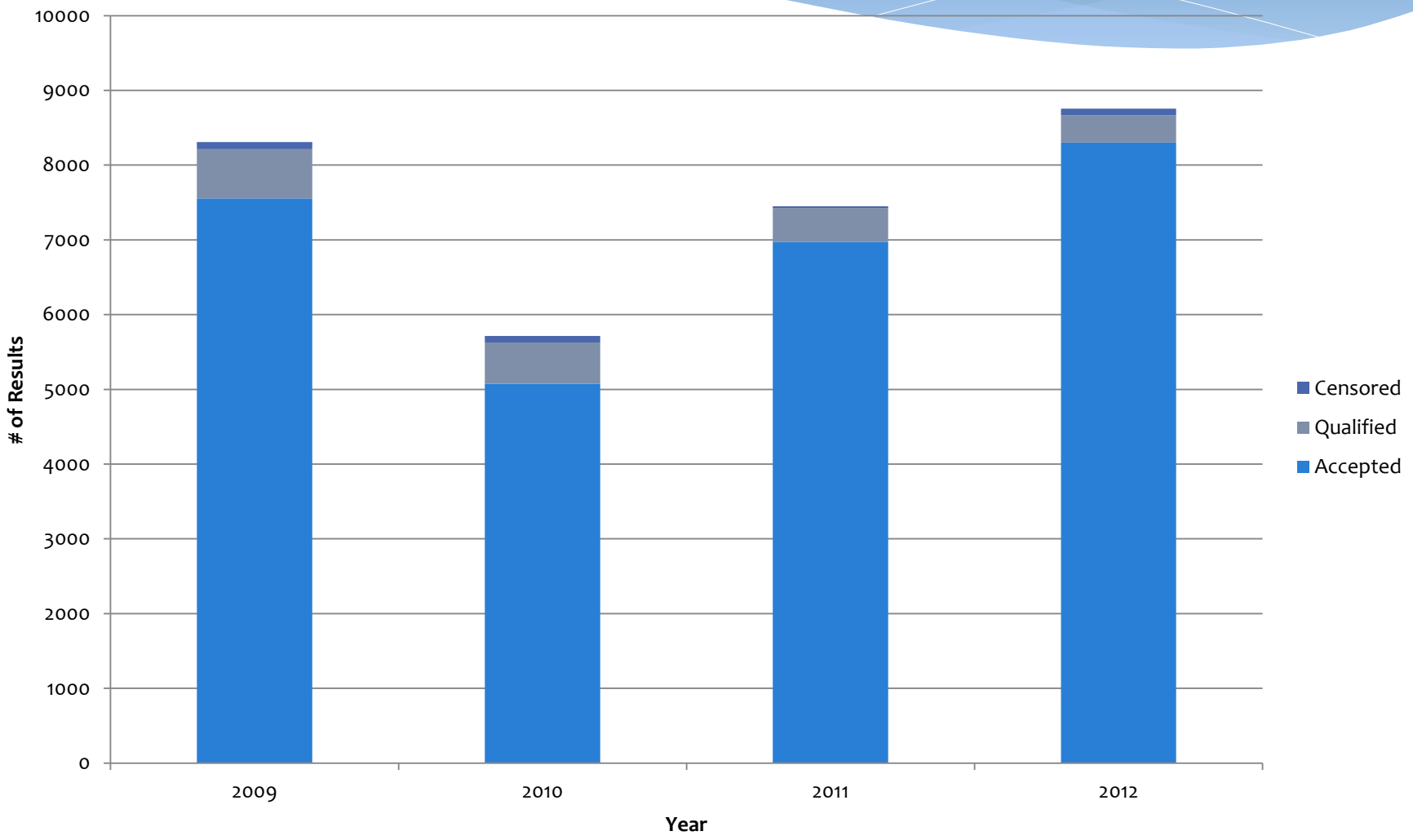
* Data collection methods (grab, continuous)
* Lab analysis (instruments and methods), detections in the ppt
* Data Types (Biological and Chemical)



Outreach Goals

* Promote long-term data partnerships with outside entities (including sister agencies, academia, consultants, volunteer groups, etc.)
* Establish and maintain effective communication with Potential External Data Sources (P.E.D.S.)
* Continue to provide QA/QC guidance (inc. reviews and approvals, as needed)
* Maximize the use of quality-controlled, non-DEP data to the extent practicable and appropriate

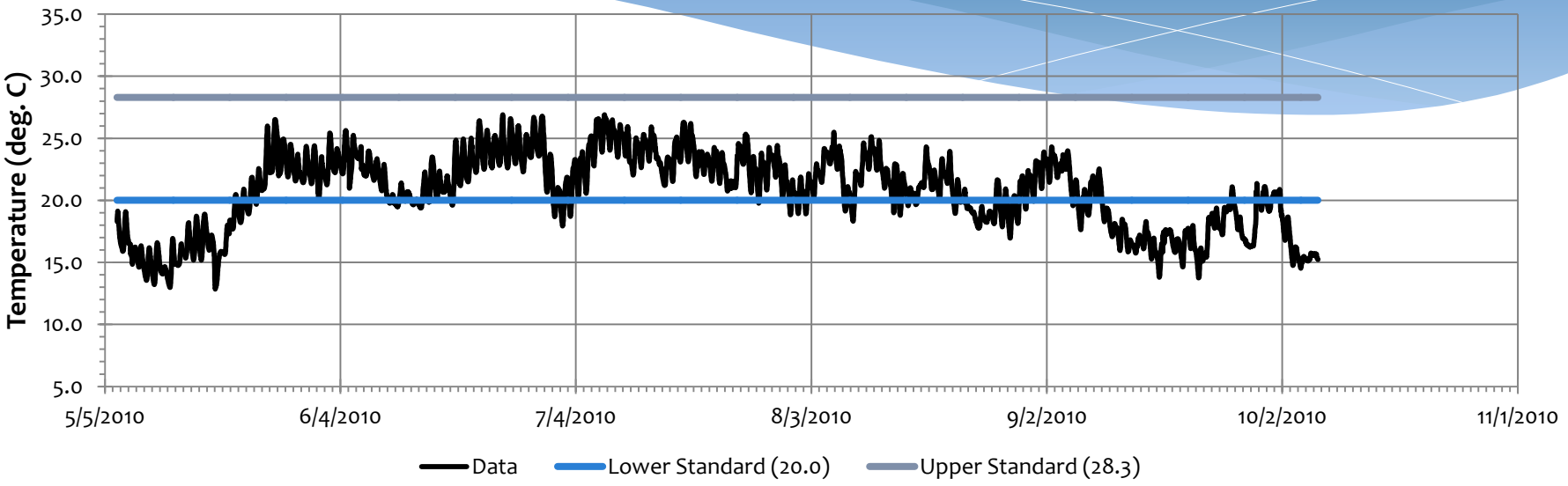
DWM Water Quality Result Decisions, 2009-2012

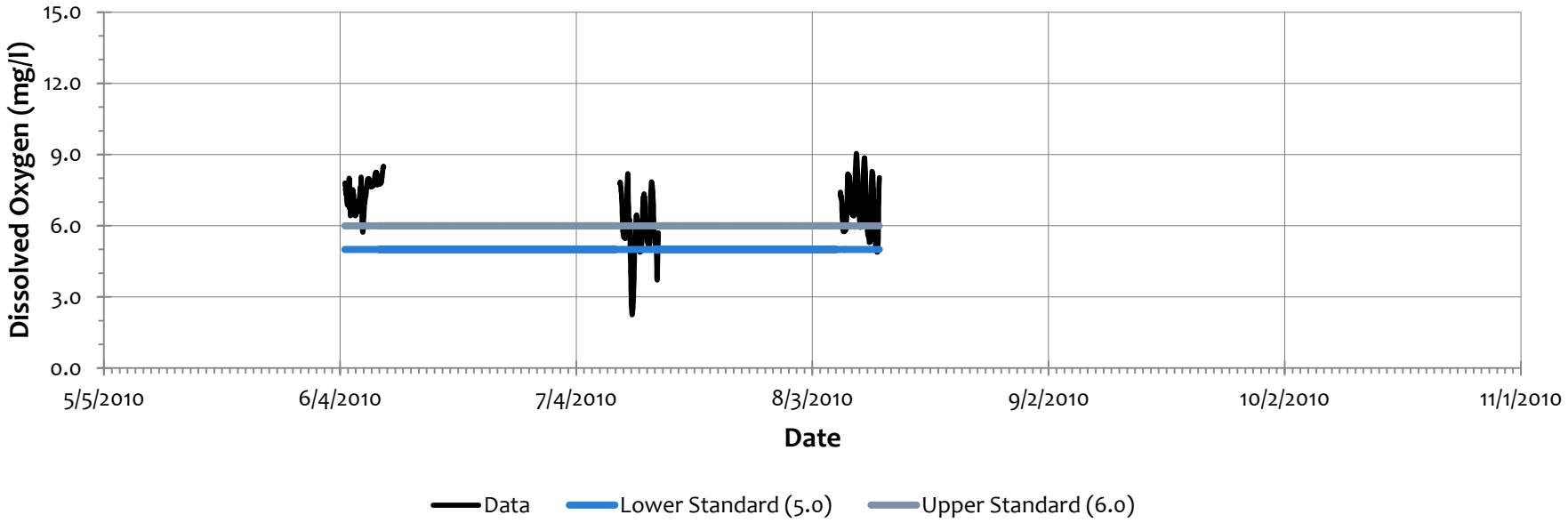


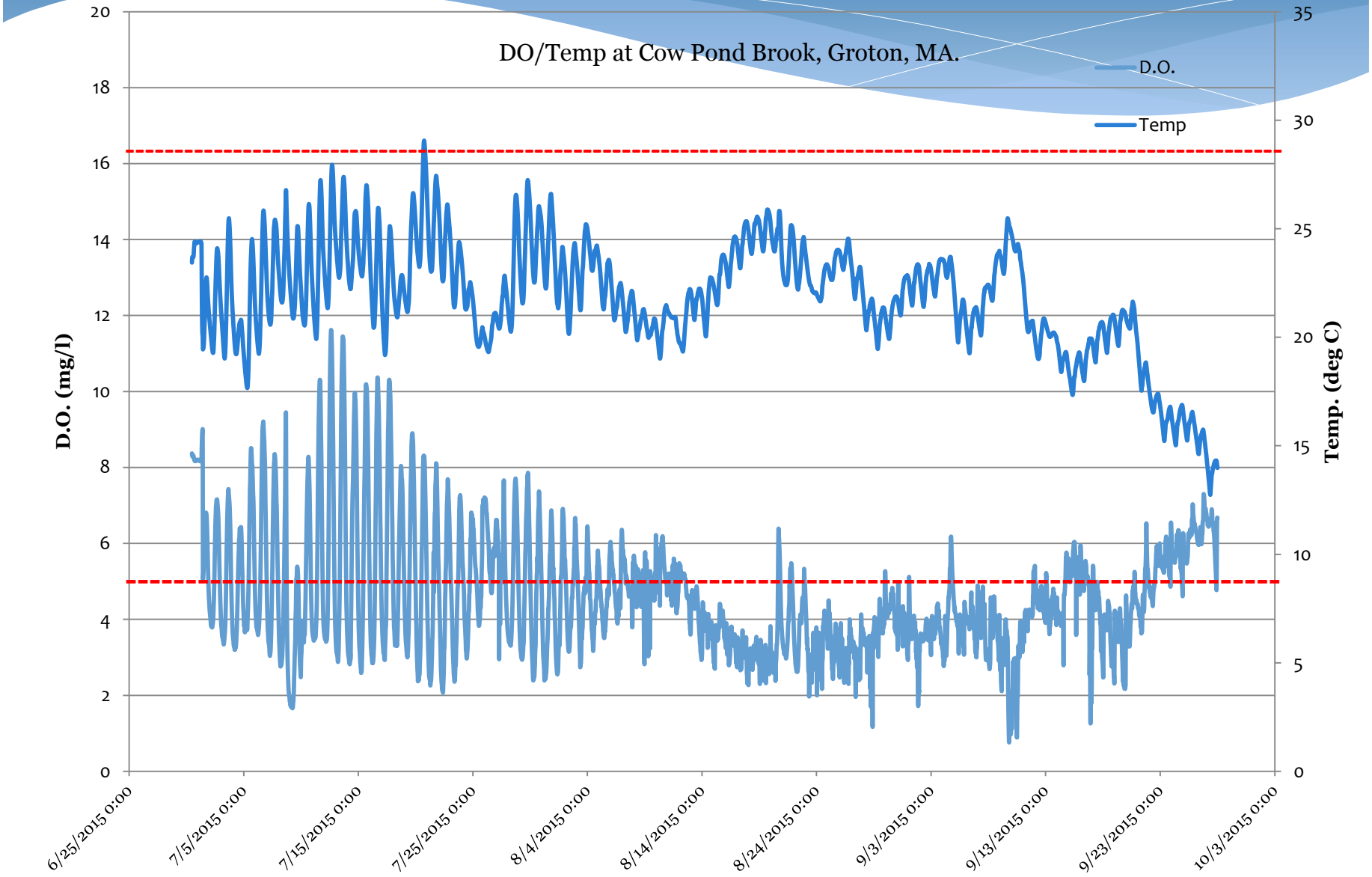
Monitoring Considerations…

* No monitoring data are immune from error!
* Use a graded approach to QA/QC
* Submit QC'd data to EPA's WQX/STORET DB (WQX Web)
* Biological data often provide a more robust indication of ALU impairment
* Continuous data have high return on investment (lots of data points!; e.g., temp, D.O., COND)

unnamed tributary to Sudbury River locally known as Cochituate Brook, Framingham, MA.






DO/Temp at Cow Pond Brook, Groton, MA.
D.O.
Temp
D.O. (mg/l)
Temp. (deg C)
0
2
4
6
8
10
12
14
16
18
20
0
5
10
15
20
25
30
35
6/25/2015 0:00
7/5/2015 0:00
7/15/2015 0:00
7/25/2015 0:00
8/4/2015 0:00
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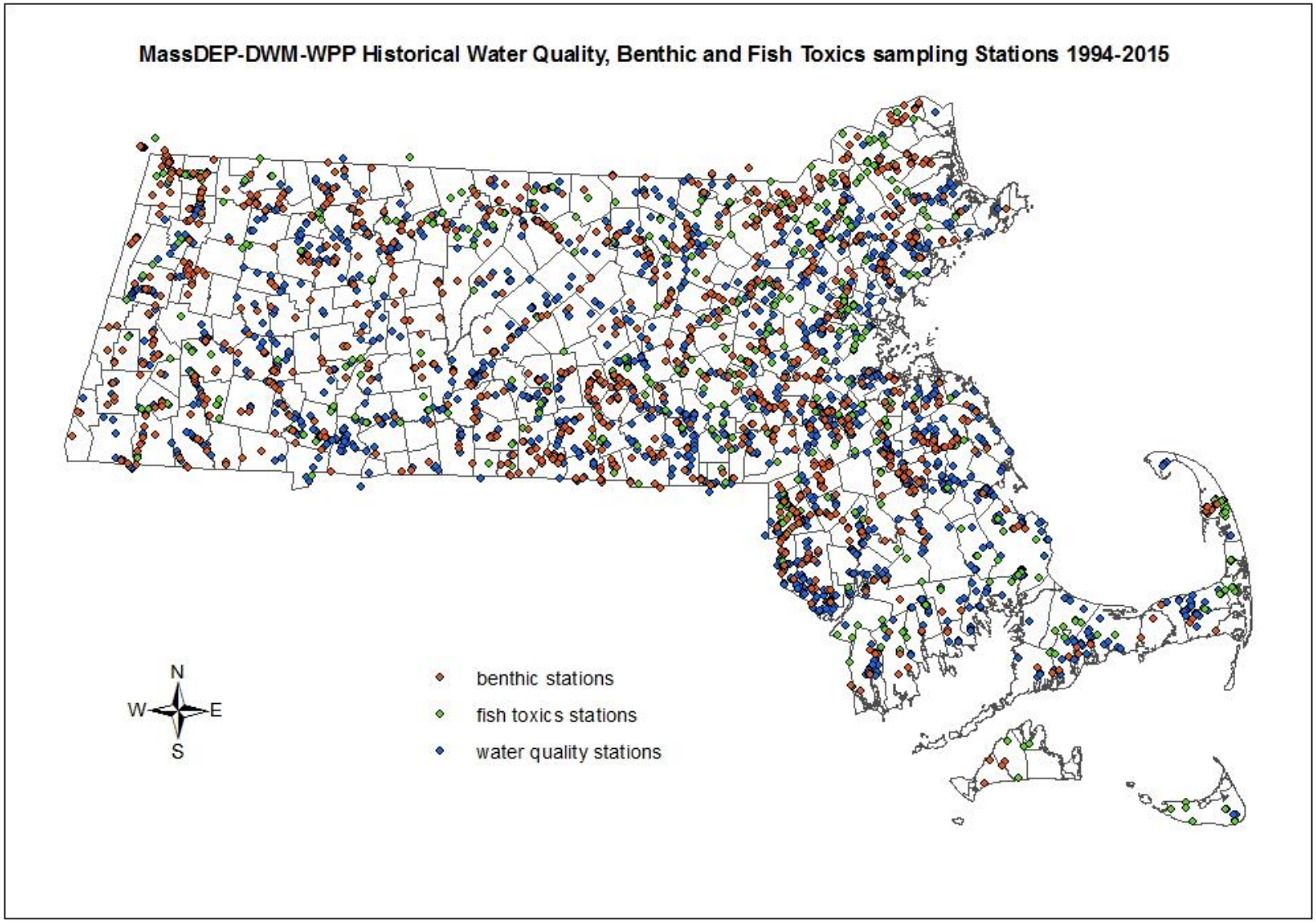
10/3/2015 0:00


MassDEP-DWM-WPP Historical Water Quality, Benthic and Fish Toxics sampling Stations 1994-2015
N
W
E
S
benthic stations
fish toxics stations
water quality stations

Potential Improvements in Data Exchange

- On-line data viewer for MassDEP-WPP data & decisions
- Improved template for data submittal to WPP
- Accessory DEP database for external data
- Streamlined tools for using acceptable external data for 305(b) assessments
- Dedicated DEP staffing for external data coordination ?
- Citizen data collection in every watershed ?
  - More widespread QAPP approvals
  - Greater citizen recruitment
- Cooperative projects with DEP ?
- Enhanced Grant funding for volunteer monitoring ?

Spatial Documentation:
Integrated Report GIS datalayers and dataviewer

MassGIS Data - MassDEP 2014 Integrated List of Waters (305(b)/303(d))

May 2016

Download this layer:

- Shapefiles and DBF tables (9 MB)
- ArcGIS 10 File Geodatabase (6 MB)

Each download includes an ArcMap 10 layer (LYR) file and Excel spreadsheets.

View the data online at http://www.mass.gov/eea/agencies/massdep/water/watersheds/integrated-list-of-waters.html

Overview

The MassDEP Division of Watershed Management (DWM), Watershed Planning Program (WPP) 2014 Integrated List of Waters (305(b)/303(d)) data layer represents the combined reporting elements for the 2014 cycle of both sections 305(b) and 303(d) of the Federal Clean Water Act (CWA). The objective of this statute is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. As one step toward meeting this goal each state must administer a program to monitor and assess the quality of its surface waters and provide periodic status reports to the U.S. Environmental Protection Agency (EPA), the U.S. Congress, and the public.

Section 305(b) of the CWA codifies the process whereby waters are evaluated with respect to their capacity to support designated uses as defined in the Massachusetts Surface Water Quality Standards. These uses include aquatic life, fish consumption, drinking water, shellfish harvesting, primary (e.g., swimming) and secondary (e.g., boating) contact-recreation, and aesthetics. The 305(b) process entails assessing each of these uses, where applicable, for rivers, lakes and coastal waters. Where possible, causes and sources of use impairment are also identified. Once a water body is identified as impaired by a pollutant, MassDEP is required under Section 303(d) of the CWA, and the implementing regulations at 40 CFR 130.7, to develop a pollutant budget designed to restore the health of the impaired water body. The process of developing this pollutant budget, generally referred to as a Total Maximum Daily Load (TMDL), includes identifying the cause (type of pollutant) and source (where the pollutant comes from), determining how much of the pollutant is from direct discharges (point sources) or indirect discharges (non-point sources), determining the maximum amount of the pollutant that can be discharged to a specific water body to meet water quality standards, and developing a plan to meet that goal. In short a TMDL is a clean-up plan that is required under the CWA to restore water quality and enable waters to attain designated uses.

Click to see the full size image.

In November 2001 EPA released guidance to the states for the preparation of an optional report that would combine reporting elements of both sections 305(b) and 303(d) of the CWA. This combined report format, the Integrated List of Waters report, allows states to provide the status of all their assessed waters in a single, multi-part list. States list each waterbody or segment thereof in one of the following five categories:

Category 1) Unimpaired and not threatened for all designated uses;

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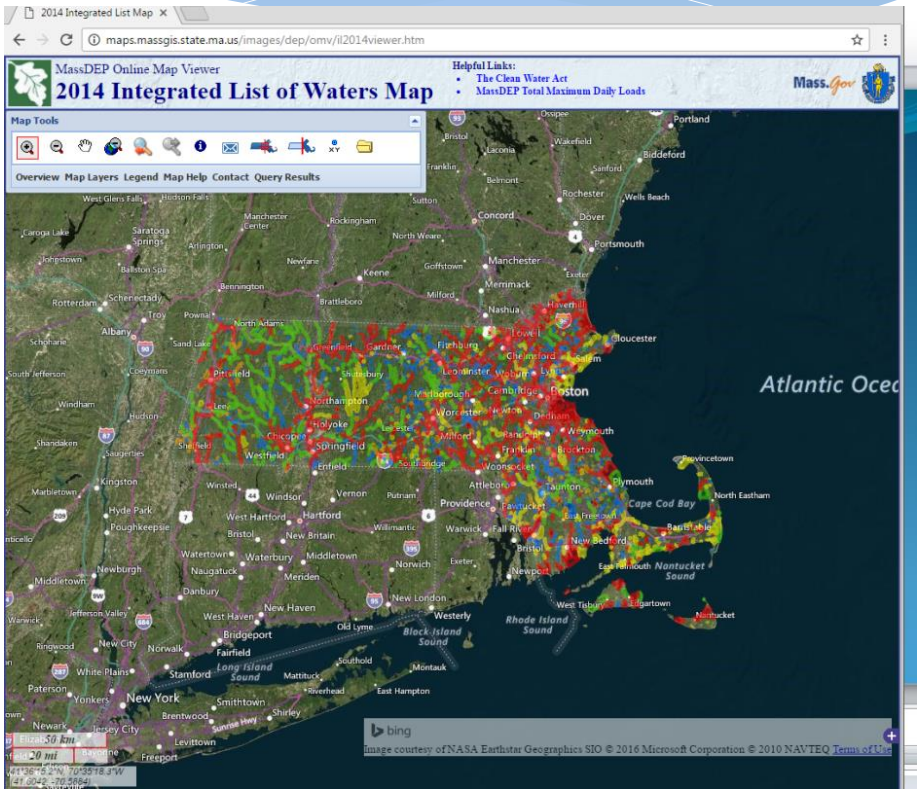


Quick Dataviewer Demo

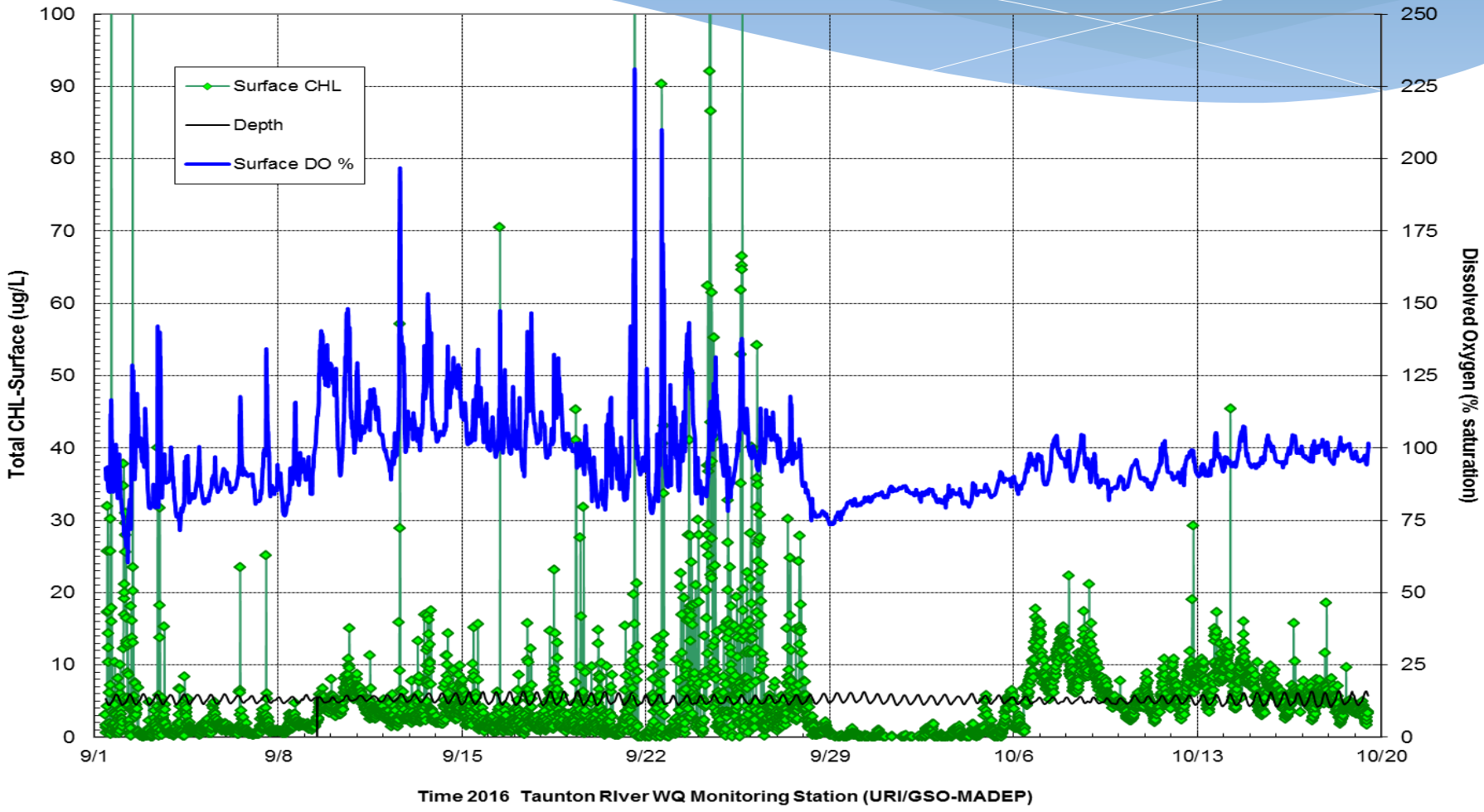
http://maps.massgis.state.ma.us/images/dep/omv/il2014viewer.htm

REFERENCES and LINKS

1. Mass Water Quality Standards: http://www.mass.gov/eea/agencies/massdep/water/regulations/314-cmr-4-00-mass-surface-water-quality-standards.html
2. External Data Submittal Portal: http://www.mass.gov/eea/agencies/massdep/water/watersheds/external-data-submittals-for-the-wpp.html
3. CALM Guidance Manuals: http://www.mass.gov/eea/agencies/massdep/water/watersheds/water-quality-assessments.html#3
4. Integrated List of Waters: http://www.mass.gov/eea/agencies/massdep/water/watersheds/total-maximum-daily-loads-tmdls.html#2
5. Integrated List of Waters GIS datalayers: http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/wbs2014.html
6. Integrated List of Waters dataviewer: http://www.mass.gov/eea/agencies/massdep/water/watersheds/integrated-list-of-waters.html
7. Older Water Quality Assessment Reports: http://www.mass.gov/eea/agencies/massdep/water/watersheds/water-quality-assessments.html#3

Usefulness of Continuous Data

(preliminary data)



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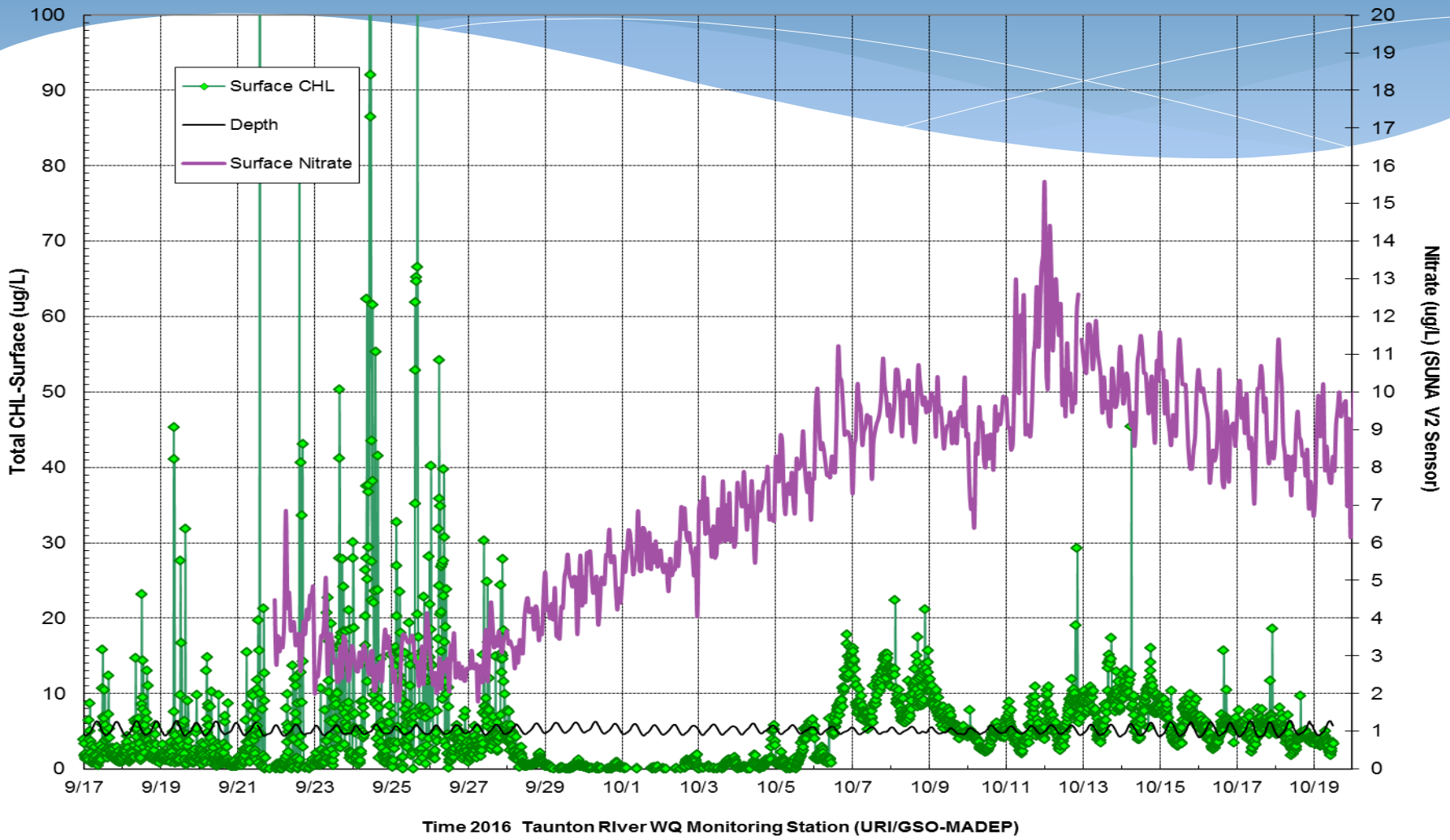
(preliminary data)



The Importance of QAPPs for Data Reliability

* Approved QAPPs are step 1 in MassDEP's review and usability determination for surface water quality data collected from non-DEP sources *(External Data)*

DESIGNATED USES OF MASSACHUSETTS SURFACE WATERS

* ***AESTHETICS*** - Free from objectionable deposits; floating debris, scums, objectionable odors/colors, excessive turbidity, nuisance species…
* ***PRIMARY CONTACT RECREATION*** - Suitable for prolonged contact with the water where there is a significant risk of ingestion of water.
* ***SECONDARY CONTACT RECREATION*** - Suitable for incidental contact with water is either incidental or accidental.
* ***AQUATIC LIFE*** - Suitable habitat for sustaining a native, naturally diverse, community of aquatic flora and fauna. Two subclasses of aquatic life in freshwater: *Cold Water Fishery and Warm Water Fishery.*
* ***FISH CONSUMPTION*** - acceptable concentrations of pollutants in edible portions of fish (and other aquatic life) for human consumption.
* ***SHELLFISH HARVESTING*** (in SA and SB segments) – Class SA waters where designated shall be suitable for shellfish harvesting without depuration (Approved and Conditionally Approved Shellfish Areas); Class SB waters where designated shall be suitable for shellfish harvesting with depuration (Restricted and Conditionally Restricted Shellfish Areas).
* ***PUBLIC WATER SUPPLY*** - used to denote those waters used as a source of public drinking water. These waters are designated for protection as Outstanding Resource Waters under 314 CMR 4.04(3).
* ***AGRICULTURAL*** - suitable for irrigation or other agricultural uses.
* ***INDUSTRIAL*** – suitable for compatible industrial cooling and process uses.


PLAN
What are we going to do?
-Identify needs and opportunities;
-Set your expectations;
-Define your basic plan to meet your needs and opportunities; and
-Determine financial and personnel requirements, and the schedule.
DO
Let's do what we said!
- Identify who is responsible and affected;
- Develop procedures and tools to fulfill objectives and meet the plan;
- Develop and provide training relevant to the plan and the people involved; and
- Follow the procedures, processes, and tools.
CHECK
Have we met our expectations?
- Assess our performance;
- Determine if we met objectives and targets;
- Did things work as planned and expected;
- Identify any "root causes"; and
- Determine corrective actions.
ACT
Do we need any changes,
where do we go from here?
- Determine what, if anything, needs to be changed;
- Identify specific adjustments; and
- Determine if we stay with our current plan, or if we want to take on anything else.

Data Validation: Some potential issues affecting data quality

* Reporting errors (*e.g., wrong units, miscalculated results*)
* Non-representative sampling (*e.g., lateral variability, mixing zones*)
* Inappropriate lab procedures (*e.g., MRLs > MCLs*)
* Failure to train field crews (*inconsistent technique*)
* Poor calibration procedures (e.g., lack of post-survey checks, expected range not bracketed (*inaccurate measurements*)
* Lack of field QC samples (*inability to assess accuracy and precision and perform QA*)
* Use of unclean sample containers (*contaminants in samples*)
* Insufficient expert verifications (*accuracy of IDs unknown*)
* Holding times exceeded (*results suspect*)