MassDEP’s Surface Water Monitoring Program

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Outline

* Background CWA
* Monitoring Networks
* Probabilistic Monitoring
* Water Resource Management Trends
Background

- CWA goal to restore and maintain integrity of Nation’s waters
- MassDEP administers a multi-faceted water quality management program
- Program relies on credible water monitoring data to inform decision-making
- States allowed flexibility to design and carry out water monitoring programs
MassDEP Watershed Planning Program Scope
Assess the status or condition of Massachusetts’ waters: *Water is the current condition relative to management goals?*

Develop, implement and evaluate pollution control strategies: *Watershed plans, total maximum daily loads (TMDL), wastewater permit effluent limits*

Review standards: *cold water fisheries, EPA Guidance toxics (cadmium (2016); EPA Recreation Criteria (2012)*

Measure the effectiveness of water quality management programs – *Are we meeting water Quality Standards?*
Monitoring Networks

- **Deterministic** (“Targeted”) Site- or Issue-specific Networks implemented on rotating watershed or priority-driven schedules
- **Fixed-site Networks** of strategic sites sampled long-term at regular intervals to assess loadings and trends
- **Statistically-valid** (“Probabilistic”) Networks employ randomly selected sites to provide unbiased assessments to be applied at larger scales (state-wide)
Monitoring Networks

  - 5-year rotating basin
  - Location specific assessment
  - Condition of surface water
  - Many locations Co-located with WWTP discharges
Water Quality Assessment

MassDEP Integrated List of Waters

- Primary Contact
- Secondary Contact
- Aesthetics
- Fish Edibility
- Shellfishing
- Aquatic Life
Pollution Control Nutrient TMDLs

What is Probabilistic Monitoring?

Uses a randomly selected subset of a defined target population to provide an unbiased estimate on the condition of the target population along with a statement on the uncertainty of the estimate.

- Randomly selected subset – ensures “representativeness” or unbiased estimate
- Target populations – Lakes, wetlands, wadeable streams, cold water fisheries, large rivers, marine and coastal etc.
- Uncertainty statement – ex. 53% +/- 3% of lakes support aquatic life
EPA Rationale for Probabilistic Monitoring

- Clean Water Act (CWA) Section 305(b) – condition of all waters
- Cost-effectiveness – Census vs. Probability surveys
- Provides a more complete and less biased assessment of water quality condition in the state (sample clean and dirty)
- Potential to improve resource allocation among competing monitoring objectives
- Potential to streamline CWA Section 305(b) reporting
- Encouragement from EPA to include statistical surveys in the state monitoring strategy = Funding
- National Assessment of Water Quality
Massachusetts Probabilistic Monitoring and Assessment Program (streams)

- Objectives
  - Provide an unbiased assessment (Support/Impaired)
  - Provide an unbiased estimation of the major causes & sources of impairments
  - Potential to provide an analysis of trends (repeat sampling of random sites)
  - Continue to explore opportunities for other data analysis that will provide insight into the water quality condition of the target population (e.g. biological criteria development)
Wadeable Streams (2011-2015)

* Design
  * **Target Population:** All wadeable 1\textsuperscript{st} – 4\textsuperscript{th} Strahler Order non-tidal perennial rivers and streams within MA
  * **Sample Frame:** National Hydrography Dataset (NHD) (1:24,000)
  * **Stratification:** Sites stratified by 5 basin groups
  * **Sites Selected:**
    * 35 base and 128 oversample per basin group
    * 182 base sites statewide
Wadeable Stream Sites Sampled (2011-2015)

≈ 35 sites/region, 182/state
MA Wadeable Streams (2011-2015)

**Sampling Plan**

- Water Quality: monthly (May - September)
  - E. coli, total phosphorus, total nitrogen, ammonia, chloride, color, turbidity
- Dissolved metals: monthly (June - August)
- Deployed multi-probes: variable (May - Sept)
  - Continuous dissolved oxygen and temperature
- Macroinvertebrate community: once (July - August)
- Fish community: once (August – September)
Extent of Aquatic Life Use
stressors violating water quality criteria or guidance values in the target population. Error bars represent the 95% confidence interval.
Percentage of river miles in the target population supporting *Primary Contact Recreational Use* and *Secondary Contact Recreational Use*. Error bars represent the 95% confidence intervals.
Lakes (2016-2018)

Design

- **Target Population:**
  - All permanent freshwater lakes, reservoirs, & ponds in MA
  - > 2 hectares in surface area and > 2 meters at max depth

- **Sample Frame:** National Hydrography Dataset (NHD) (1:24,000)

- **Stratification:** Sites stratified by 3 basin groups

- **Sites Selected:**
  - 25 base and 100 oversample per basin group
  - 75 base sites statewide
Lakes Three Year Basin Stratification

Three Year Basin Stratification
Basin Group (Year)
- West (2016)
- Northeast (2017)
- Southeast (2018)
Sampling Plan
Index Site (max lake depth)

- Frequency - every 6 weeks (June - September)
- Secchi disk
- Depth profiles - dissolved oxygen, temperature, pH, and specific conductivity
- Epilimnion – total phosphorus, total nitrogen, chloride, alkalinity, hardness, dissolved organic carbon, dissolved silica, color and turbidity
- Hypolimnion – total phosphorus and total nitrogen
- Photic zone composite – chlorophyll a, phytoplankton community
• Sampling Plan (Continued)
  • Shoreline Site - site of probable public recreation (e.g. beach, boat ramp)
    • E. coli: monthly (May - September)
    • Algal toxins (microcystin and anatoxin a): monthly (July – September)
    • Phytoplankton community: monthly (July – September)
  • Whole Lake
    • Fish tissue – mercury, organochlorine pesticides, and metals
    • Littoral macroinvertebrate community
    • Macrophyte – biovolume, percent cover and non-natives
    • Bathymetry
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, private)
* Increasing need to leverage partnerships in data collection
* Data collection is expensive, get it right to optimize usability
Water Quality Data Sources

**Massachusetts State Agencies**
- Department of Environmental Protection - Drinking Water Program, Wetlands and Waterways Program, Watershed Planning, Wastewater Management Program and Permitting
- Department of Environmental Protection/UMass Dartmouth - Massachusetts Estuaries Project (MEP)
- Office of Coastal Zone Management (CZM)
- Department of Conservation and Recreation (DCR)
- Department of Fish and Game - Division of Marine Fisheries
- Department of Fish and Game - Division of Fisheries and Wildlife
- Department of Public Health (DPH)
- Massachusetts Water Resources Authority (MWRA)
- MassGIS data layers pertaining to land use, percent impervious cover, pollution sources, etc.

**Federal Agencies**
- U.S. Geological Survey
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Army Corps of Engineers
- National Oceanographic and Atmospheric Administration

**Other Sources**
- Massachusetts Water Resources Research Center
- Colleges, Universities and associated academic institutions
- Watershed and lake associations
- Citizen monitoring programs
- Municipal Conservation Commissions (nonpoint source assessment)
- WWTPs - NPDES Permit Monitoring Requirements
- Municipal Facilities Plans
- Environmental consultants
Questions?

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Data Submission Guidelines


WPP-Guidance_external data guidance sheets\CN000.72a - Guidance_External Data Submittal & Review_1-29-14.doc