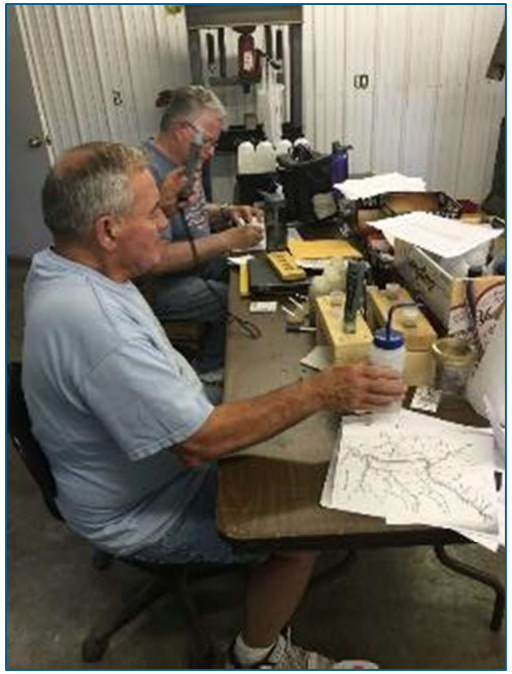
Volunteer Monitoring: Building Credibility



Linda Green & Jinnie Monismith

National Water Quality Monitoring Council

URI WATERSHED WATCH

THE UNIVERSITY OF RHODE ISLAND COOPERATIVE EXTENSION

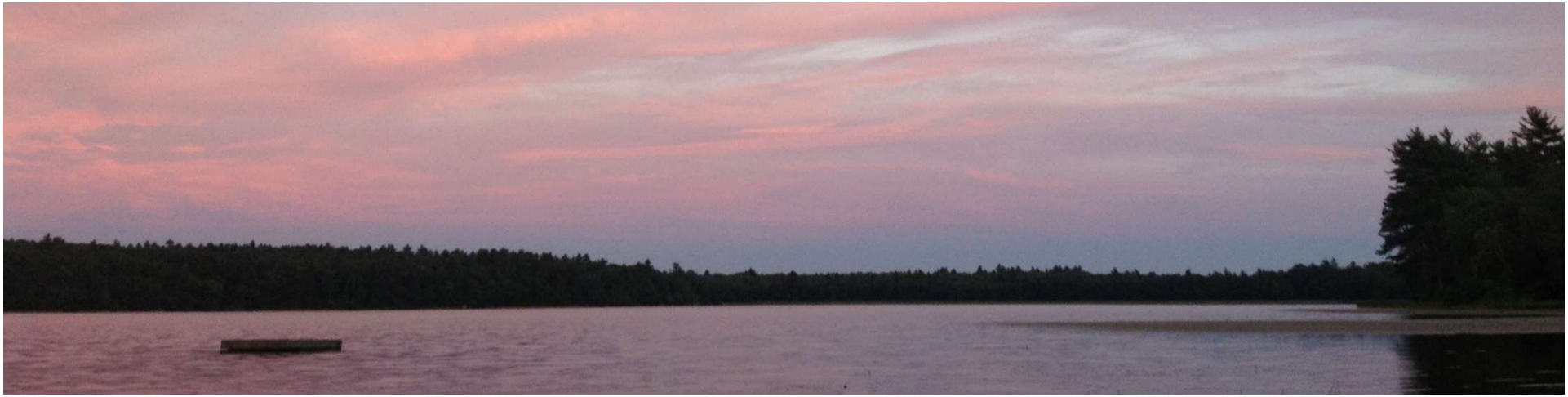
Dickinson

Alliance for Aquatic Resource Monitoring ALLARM est. 1986

Agenda:

- Introductions
- Linda Green, URI – building credibility framework
- Jinnie Monismith, ALLARM – building credibility principles and community examples
- Q&A

Enhancing Credibility in Volunteer Monitoring Programs



Linda Green
University of Rhode Island Watershed Watch

Elizabeth Herron
URI Watershed Watch

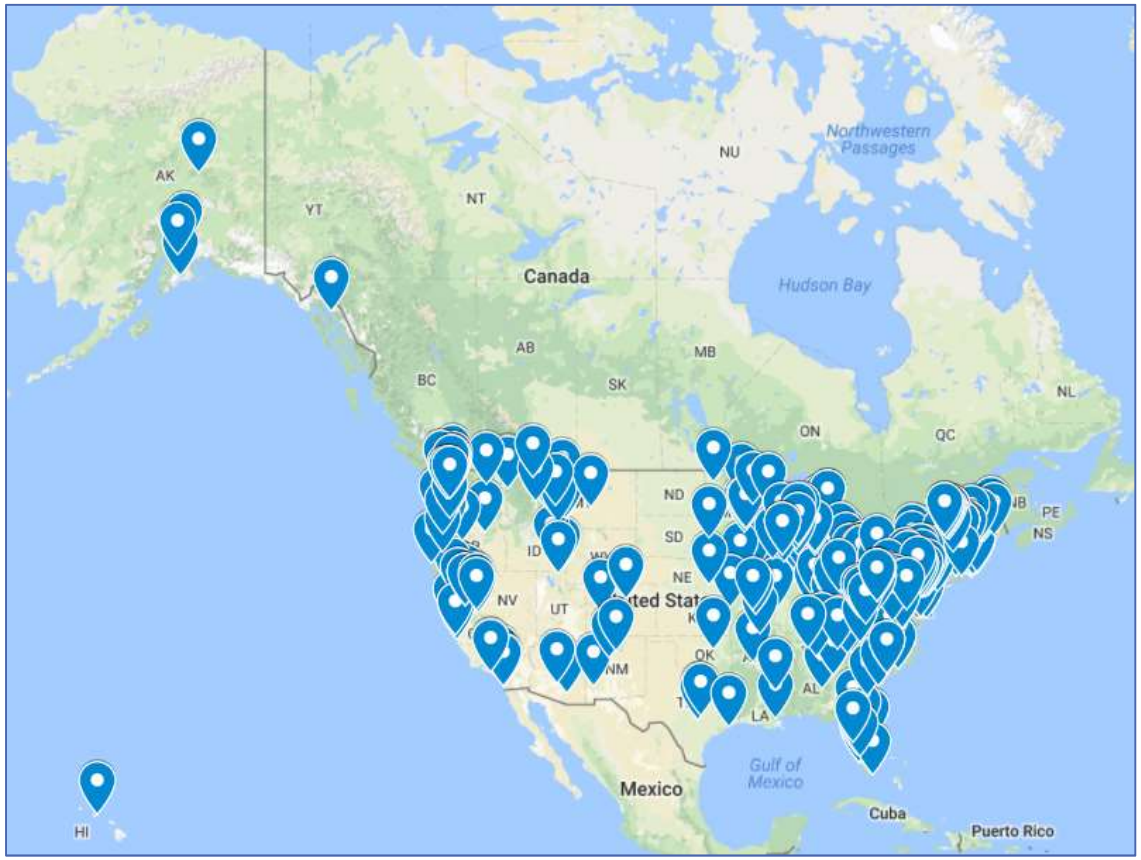
Kris Stepenuck
UVM Sea Grant & Extension

THE UNIVERSITY OF RHODE ISLAND COOPERATIVE EXTENSION

NWQMC Webinar
January 17, 2018

UNIVERSITY OF VERMONT EXTENSION

U.S. Volunteer Monitoring



300-350 stand-alone or parent programs
1675 affiliated/sub-programs
>103,000 volunteers/year, >31,000 sites/year

Thank you Dr. Kristine Stepenuck! www.volunteermonitoring.org

Factsheets

USA Volunteer Water Monitoring Network

www.volunteermonitoring.org

(in *Guide for Growing Programs* section)

- Getting Started (2008)
- Why Volunteer Monitoring Makes Sense (2016)
- **Designing Your Monitoring Strategy (2016)**
- Monitoring Matrix
- Effective Training (2016)
- Monitoring Equipment Suppliers
- **Building Credibility: Quality Assurance and Quality Control for Volunteer Monitoring Programs (2016)**
- Volunteer Management (2016)
- Planning Your Data Management Systems (2016)
- Tips and Tools for Better Presentations (2012)
- Outreach Tools (2012)
- Locating Support and Funding (2012)
- Introduction to Bacteria Monitoring (2015)
- Bacteria Monitoring Methods in Surface Waters (2015)
- Presenting Bacteria Data Effectively (2015)
- Evaluating Your VM Program (2012)

Applying knowledge to improve water quality

Volunteer Water Quality Monitoring

National Water Resource Project

A Partnership of USDA NIFA & Land Grant Colleges and Universities

Successful Programs Have a Sound Scientific Basis

CSREES Volunteer Water Quality Monitoring National Facilitation Project

June 2003
Factsheet IV

Designing Your Monitoring Strategy: Basic Questions and Resources to Help Guide You

University of Rhode Island University of Wisconsin

Elizabeth Herron, Kris Stepanuck, Linda Green and Kelly Addy

Getting Started in Volunteer Water Quality Monitoring?

This factsheet focuses on helping new program coordinators get their programs up and running. Our goal is to provide you with questions to consider, steps to follow, examples of what's worked and direct you to some of the many resources available to assist you in your monitoring efforts.

There are numerous potential monitoring program goals and monitoring activities available to meet those goals. It is essential to accurately identify what you want your volunteer monitoring to accomplish and how you want your data to be used before you consider specifically what and how you want to monitor. In fact, the first step in determining *WHAT* to monitor is deciding *WHY* you want to monitor.

Why Extension Volunteer Water Quality Monitoring Programs Got Started

Volunteer water quality monitoring encompasses a wide range of activities, meeting a diversity of needs. Replies to a recent inquiry of Extension-based volunteer monitoring programs provided a variety of reasons for starting a program. They included:

- To create a long term, credible, data set (address need for data), often due to a lack of watershed monitoring by state or other agencies;
- To educate the public about water quality issues;
- To develop and educate youth (school-based and other youth programs);
- To create consistency in methods, data management, and coordinated use of data between basins, volunteer groups, and agencies;
- To address public interest about why and how monitoring is done and what the results mean;
- To foster community involvement with water resources;
- To respond to a crisis in the shellfish industry caused by poor water quality conditions;
- To address concerns about drinking water quality in private wells.

The program design process discussed in this module includes several basic components:

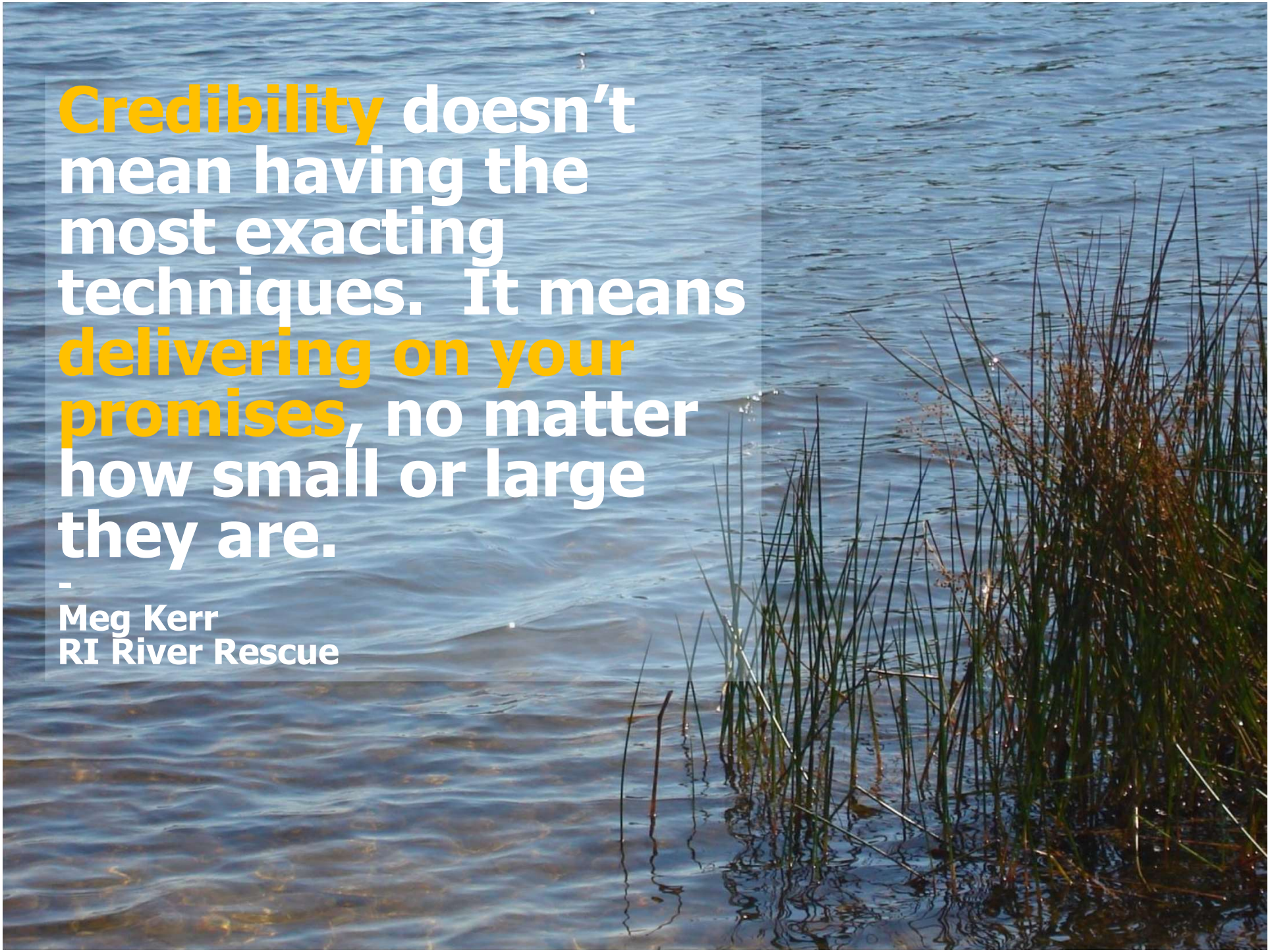
1. defining the question(s) to answer (e.g. is the water safe for swimming?),
2. characterizing how the data will be used (e.g., education or regulatory compliance), and
3. identifying the resources available for accomplishing your goals.

This is the fourth 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.uswaterquality.org/volunteer/ for more information.

- Clear monitoring goals and questions
- Written study design
- Clear documentation of instructions for all monitoring activities
- Monitoring scope and complexity is appropriate to their capabilities
- QA appropriate for data use

www.volunteermonitoring.org
Guide for Growing Programs
Designing Your Monitoring Strategy factsheet

Applying knowledge to improve water quality
Volunteer Water Quality Monitoring
National Water Resource Project
A Partnership of USDA NIFA & Land Grant Colleges and Universities



Credibility doesn't mean having the most exacting techniques. It means delivering on your promises, no matter how small or large they are.

-

Meg Kerr
RI River Rescue

Start With the End in Mind

Why are you starting a citizen science or volunteer monitoring project?

Volunteer Monitoring: Starting Strong webinar
April 2017
https://acwi.gov/monitoring/webinars/index.html

The Continuum of Monitoring Data Use

Education/ Awareness → Baseline, Problem ID, Assess Impairment, Local Decisions → Legal & Regulatory

Increasing Time - Rigor - QA - Expense $$

Nat'l Dir. of Envir. Mon. Progs. - 5th Ed.
Geoff Dates, River Network

The AWW Approach

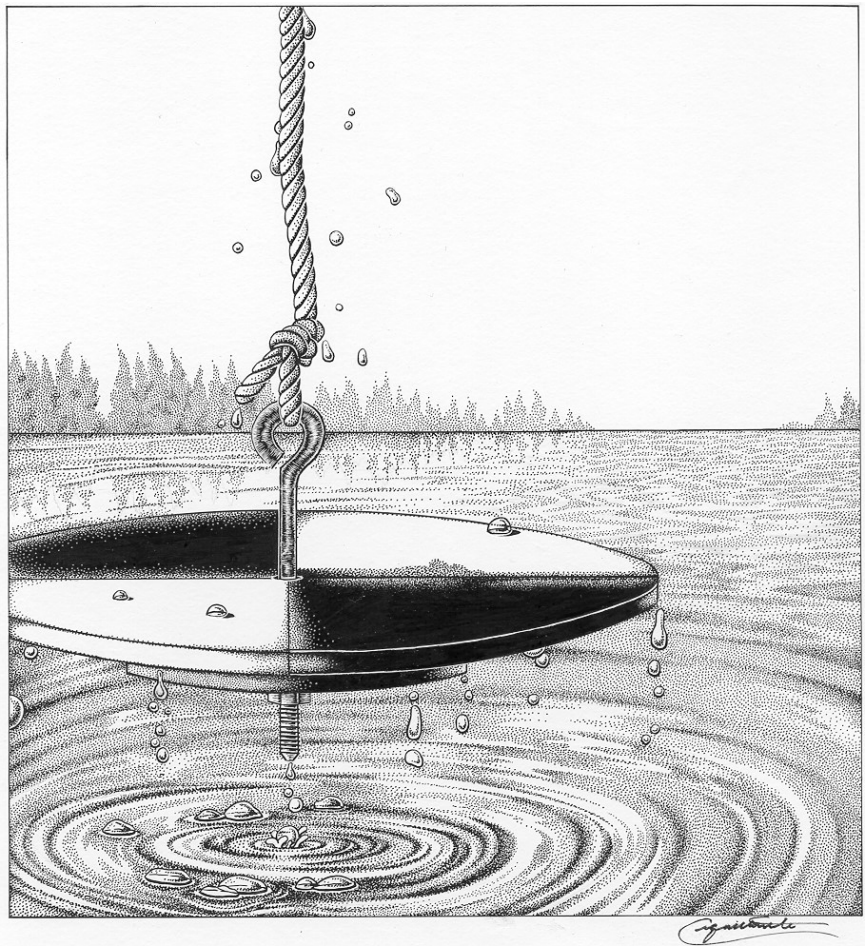
NOT MEANINGFUL

DO-ABLE & MEANINGFUL

NOT DO-ABLE

Alabama Water Watch

Most Widely Used Monitoring Tools?



Assessing What is Possible

Consider

- Skills and knowledge
- Financial resources
- Potential data uses and users
- Level of commitment

Matrix of Monitoring Activities

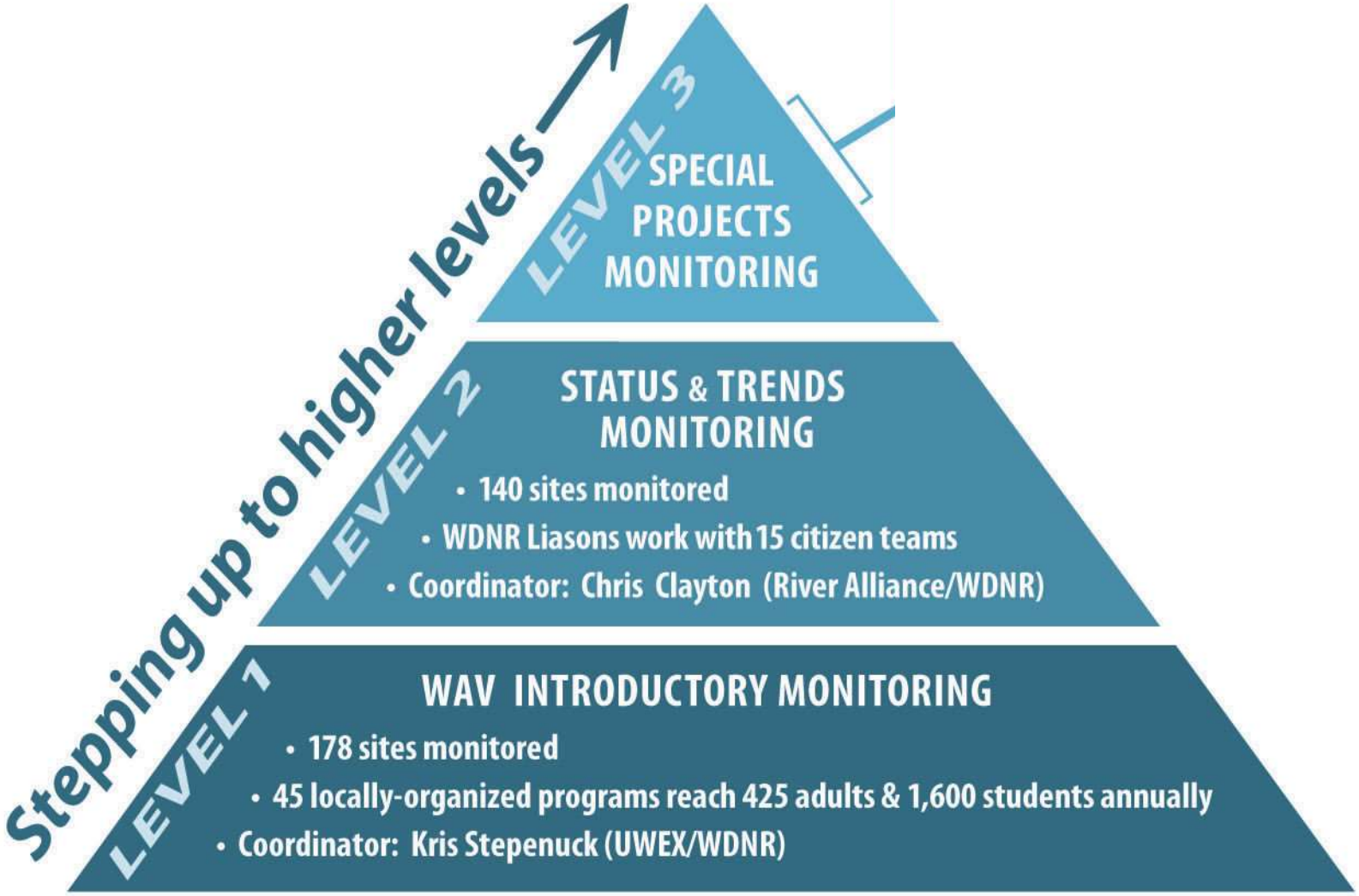
The following table describes in broad terms some of the monitoring activities typically performed by volunteers. This matrix is intended to help direct the selection of monitoring activities according to data objectives and available resources. The table is arranged with the monitoring activities that generally require less effort and resources at the top, increasing in complexity toward the bottom. Within each monitoring activity, there is also often a range of data objectives and resources needed, with more intense data objectives requiring more resources.

			Resources Needed			
Monitoring Activities	Data Objectives	Examples of Activities	Equipment & Supplies	Education & Training	Frequency of monitoring	QA/QC Level & Standards
Shoreline Survey	Educational; General awareness; Gross problem identification or screening; Baseline data; Targeting sites for additional study	Field observations; shoreline land use assessment; I.D. potential sources of pollutants	Map of waterbody, field data sheets Optional: Camera, GPS unit	Understanding of maps and features of concern. Can be self taught or training on how to complete maps and data sheets	Annually	No formal QA/QC plan required. Field Observations on standard forms.
Watershed Assessment	Educational; General awareness; Gross problem identification or screening; Baseline data; Targeting sites for additional study	Field observations, watershed wide land use assessment, I.D. potential sources of pollutants	Map of watershed, field data sheets Optional: camera; permission to access private property, GPS unit	Understanding of maps and features of concern. Can be self taught or training on how to complete maps and data sheets	Annually or less often	No formal QA/QC plan required. Field Observations on standard forms.
Habitat Assessment	Educational; General awareness; Gross problem identification or screening; Baseline data; Targeting sites for additional study/restoration	Visual assessment of critical habitat features; may include measurements of some features. Intensive surveys measure channel depths, sinuosity, etc.	Map of waterbody, field data sheets, measuring tape, measuring stick Optional: camera; permission to access private property, GPS unit	Understanding of maps and features of concern. Training in evaluating habitat features and in how to complete maps and data sheets recommended	Several times a year during different seasons or less is typical, many programs assess habitat annually	Basic written plan – assessment purpose, methods, sites, and schedule.

Page 1
U.S.D.A. National Facilitation of C.S.R.E.E.S. Volunteer Monitoring Efforts Website http://www.usawaterquality.org/volunteer/

National Facilitation Project matrix;
EPA Stream Monitoring Methods, p. 42

Applying knowledge to improve water quality
Volunteer Water Quality Monitoring
National Water Resource Project
A Partnership of USDA NIFA & Land Grant Colleges and Universities



For more information, visit:

http://watermonitoring.uwex.edu

Water Action Volunteers

Data Quality System

- **Before: Plan your Quality Assurance**
  "the broad plan for maintaining overall quality"
  (study design, QAPP, training materials)

- **During: Implement your Quality Control**
  "mechanisms to control errors & increase accuracy"
  (training, follow procedures,proficiency testing)

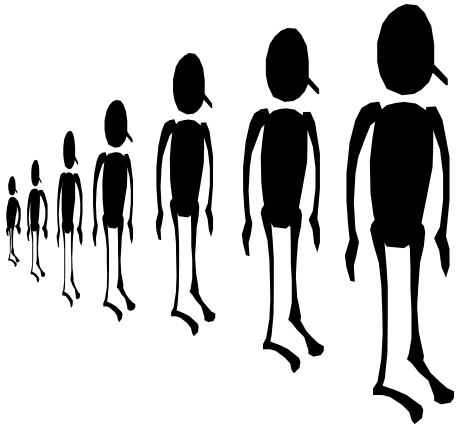
- **After: Conduct your Quality Assessment**
  "review , evaluate, correct, reconcile"

Managing Variability

National Facilitation Project factsheet: *Building Credibility: QA/QC for Volunteer Monitoring Programs*

Quality Is Assured Through:

- Written monitoring procedures
- Adhering to established procedures
- Training and more training
- Routine sampling
- Repetition (replicate and duplicate sampling)
- Monitoring multiple indicators
- QA/QC field and laboratory testing
- Addressing your volunteers' questions

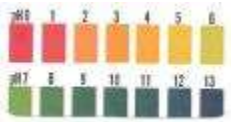


URI WATERSHED WATCH

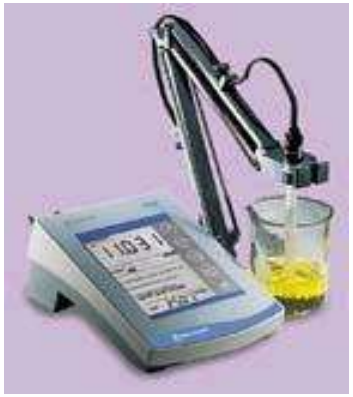
QA/QC: Data Quality Objectives (DQO)

- What level of quality do your data need to be?
  - ✓ Sensitivity
  - ✓ Detection Limits
  - ✓ Precision
  - ✓ Accuracy (bias)
  - ✓ Representativeness
  - ✓ Comparability
  - ✓ Completeness

Sensitivity



- Ability to differentiate between different measurement levels, also referred to as **resolution**
- Example: pH
  - Litmus paper (acid or base)
  - Test strips (single units to 0.2 units)
  - Color comparators (wide range-units, narrow 0.1unit)
  - Pocket pH testers (0.1 unit)
  - Laboratory instruments (0.02 units, may read to 0.001 units)



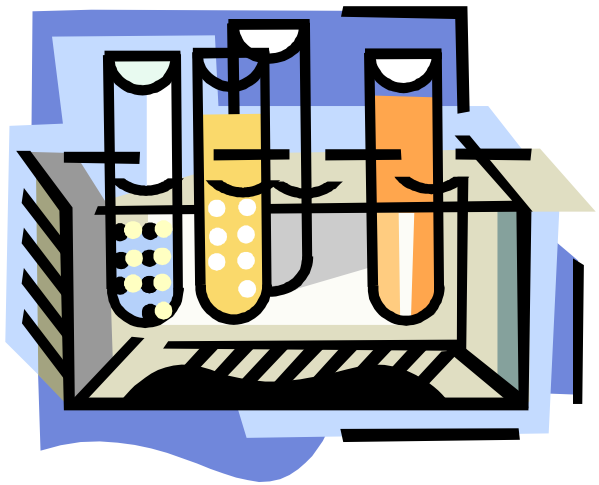
Detection Limit

- The lowest concentration of a given constituent that can be detected and reported as > 0.
- Example: measuring dissolved phosphorus
  - "TesTabs" 0, 1, 2, 3, 4 ppm –whole numbers
  - Color comparator 0, 0.2, 0.4, 0.6 ppm
  - Spectrophotometer – > 0.003 ppm (3 ppb)

P in NE lakes is <0.003 – 0.1 ppm, High P is > 0.025 ppm P

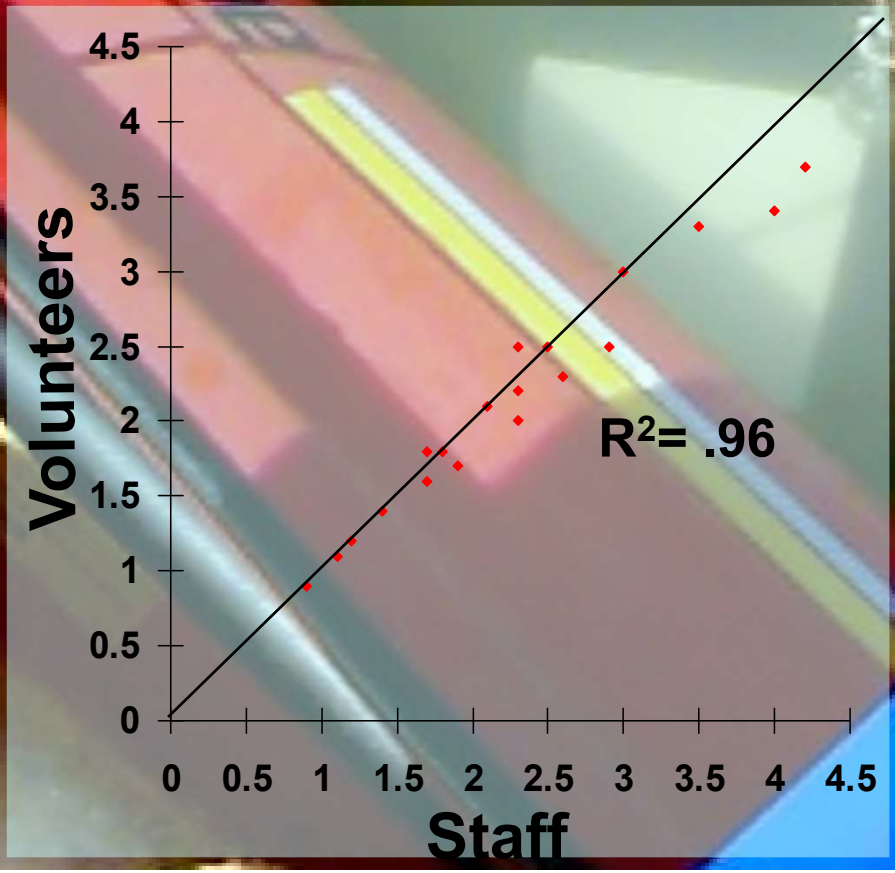
QA/QC: Minimizing Bias (aka improving accuracy, precision)

- Analyze blanks (field and lab)
- Analyze samples of known concentrations (standards)
- Participate in performance audits (from outside source)
- Collect & analyze duplicates
- Replicate 10-20% of samples
- New analysis >= 7 times
- Check against other methods



Extent of Comparability

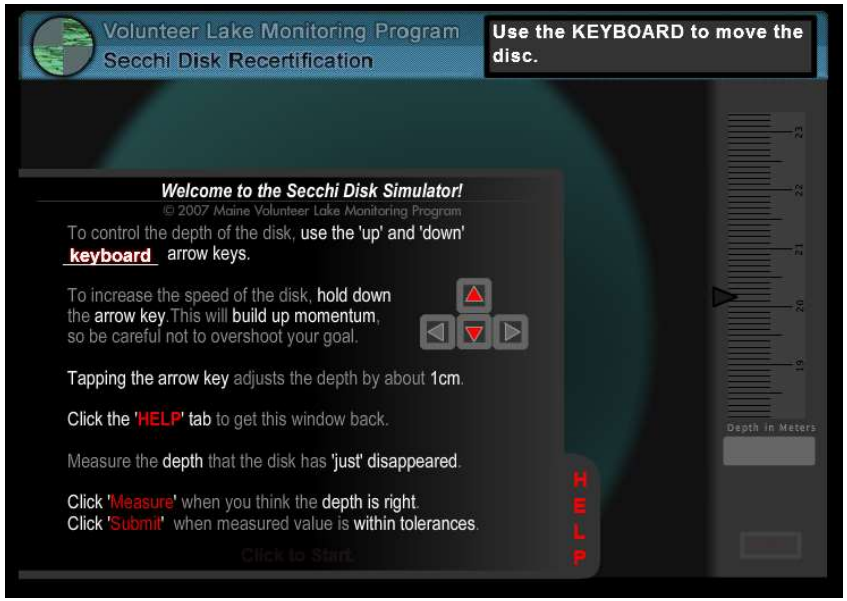
- methods, results, past studies, professionals

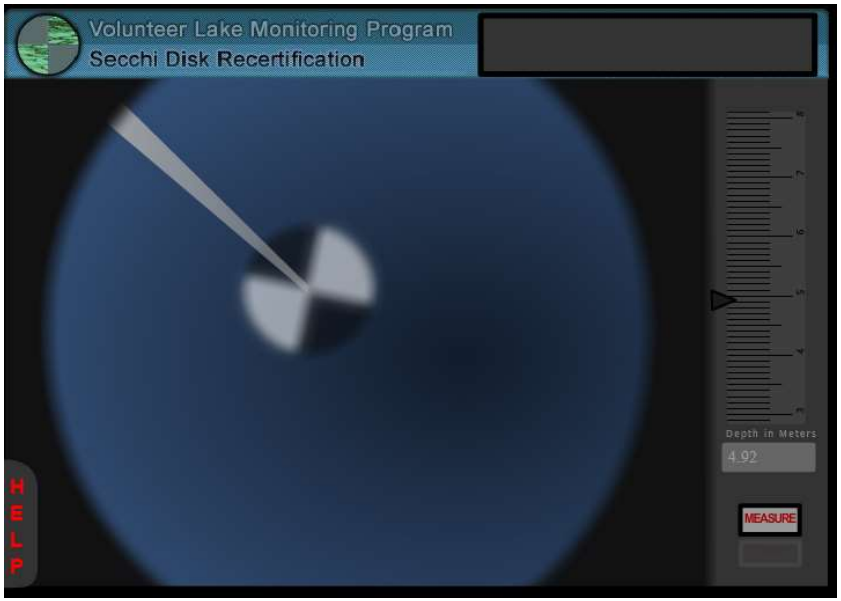


Are your methods comparable to others?

Secchi Simlulator

VLMP
Maine Volunteer Lake Monitoring Program
Keeping a watchful eye on the health of Maine lakes since 1971

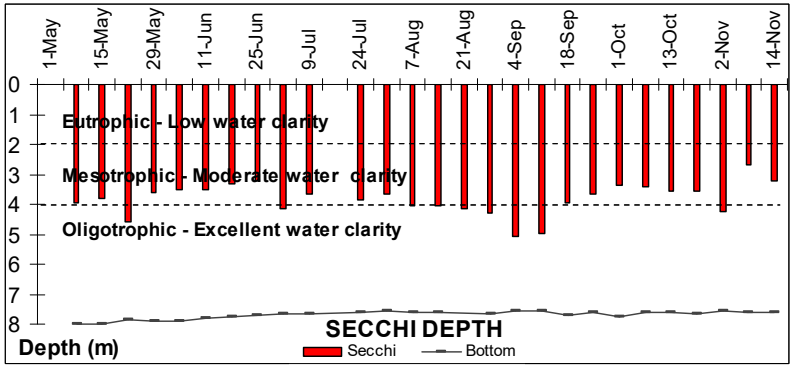


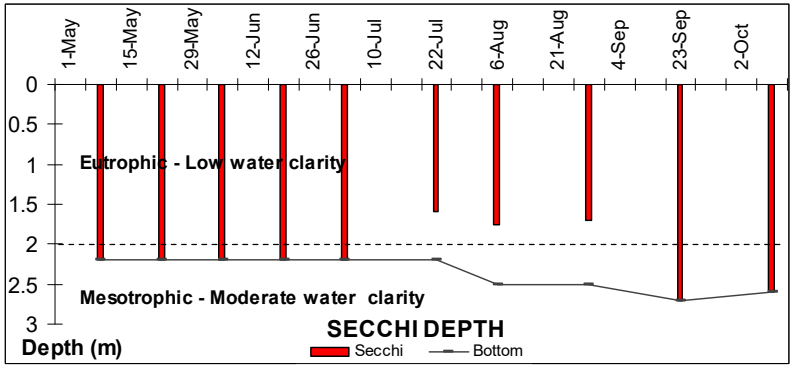


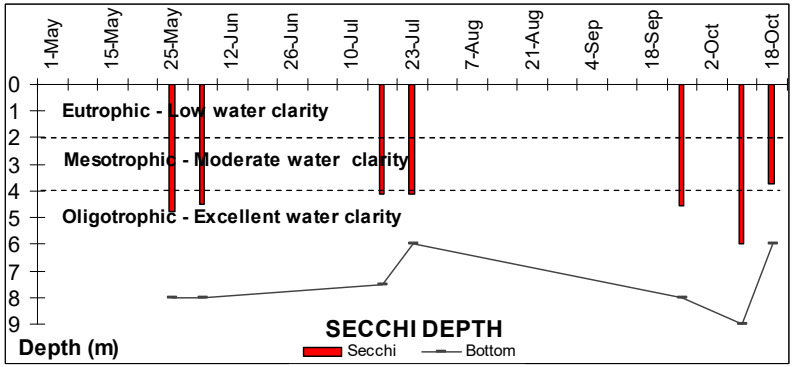
http://www.mainevlmp.org/secchi-simulator/

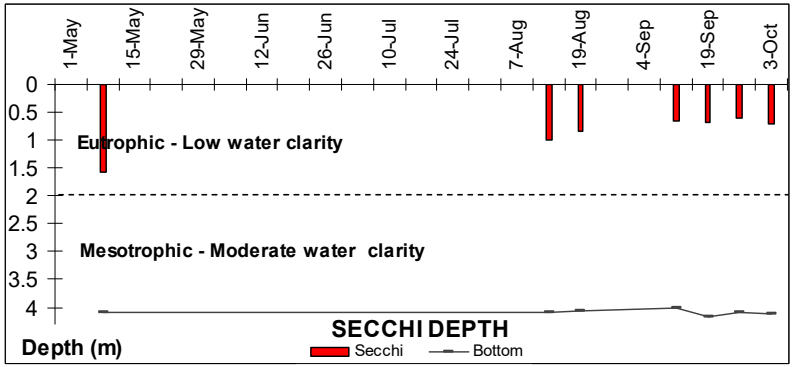
Completeness

comparison between the amount of data you planned to collect versus how much usable data you collected



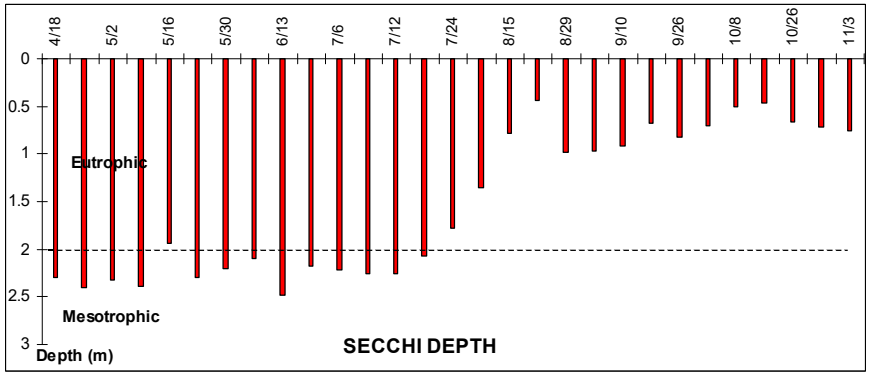


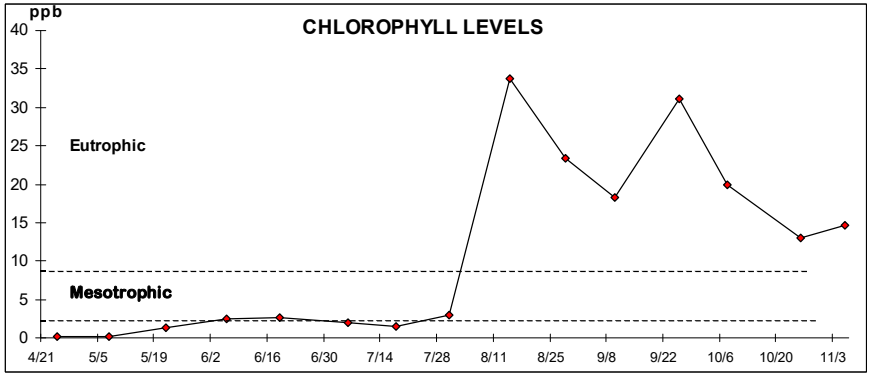




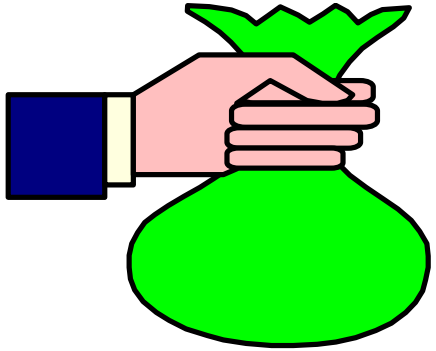
Representativeness

- The extent to which measurements actually depict the true environmental condition or population being evaluated
  - data collected at a site just downstream of an outfall may not be representative of an entire stream, but it may be representative of sites just below outfalls





The most important factor determining the level of quality is the cost of being wrong.

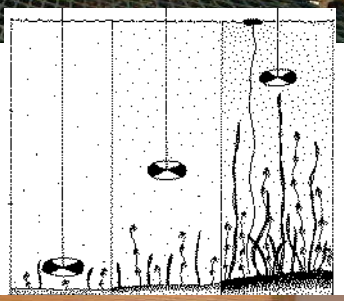


Or the benefits of being correct!

URI Watershed Watch*

- Owns all equipment – annual recalibration
  - Secchi & samplers rope length, thermometers, salinity refractometers
- All new D.O. reagents – every year
  - Empty, wash, re-label
- DO QC testing each summer
- Thorough labware washing
  - Labelling each step

* state-certified for non-potable water



Combination of Field & Lab

Volunteer Field Monitoring:

- Water clarity
- Temperature
- Chlorophyll
- Diss. Oxygen
- Salinity
- Recent weather

WW staff Lab Analyses:

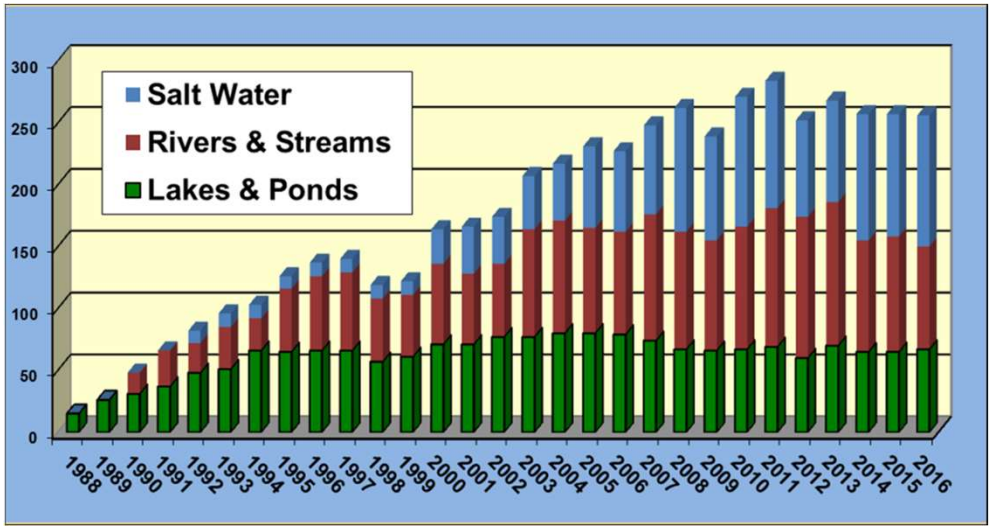
- pH & alkalinity
- Bacteria
  - Enterococci
  - Fecal coliform
- Nutrients
- Chlorophyll

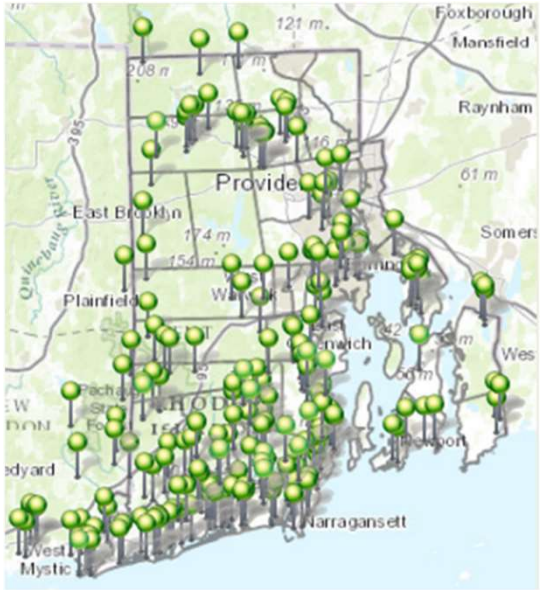
URI Watershed Watch

THE UNIVERSITY OF RHODE ISLAND COOPERATIVE EXTENSION

Monitoring local waters for three decades

- Began in 1988 with 14 lakes
- ~400 volunteer monitors, 250+ sites on 180+ waterbodies





www.uri.edu/watershedwatch/

Hawkins Pond, RI, L. Murphy

THANKS!

Building Credibility in Volunteer Monitoring Programs

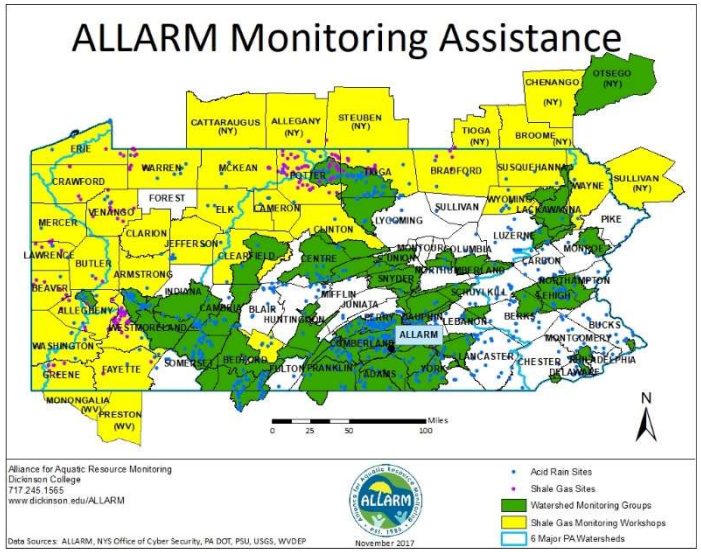
Jinnie Monismith

ALLARM Assistant Director

Dickinson

ALLARM Background

ALLARM educates communities how to use science as a tool to investigate the health of their streams and to use the data they generate for aquatic protection and restoration efforts.



Alliance for Aquatic Resource Monitoring
ALLARM
est. 1986

Dickinson

Components of a successful program

1. Study design
2. Quality Assurance Project Plan (QAPP)
3. Monitoring methods manual (Standard Operating Procedures, SOPs); If program does not have a QAPP, includes:
   a. Quality assurance/quality control (QA/QC) procedures
   b. Data management, review, validation, and verification procedures
4. Volunteer engagement – recruit, train, certify, and retain
5. Evaluation and assessment

Blue = minimum requirements
Black = recommended

Study Design

What is it?

Document that outlines the monitoring program, including how it fits within your organization's objectives and goals

Why is it important?

- Documents the details of the monitoring program for volunteers and data users → eliminates questions of how data were collected
- Consistency between monitors, especially for long-term programs where volunteers and/or monitoring coordinators change over time

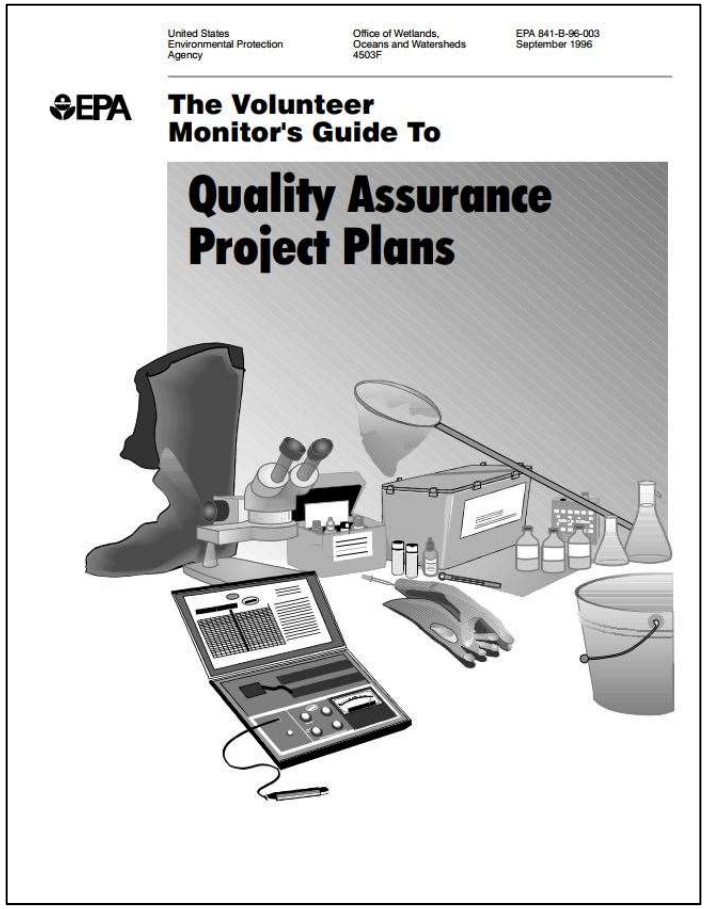
For more information, see:
ALLARM's *Study Design Manual.* January 2010.
http://www.dickinson.edu/download/downloads/id/7016/study_design_manual_2017pdf

What is the question and how will it be investigated?	
Why	• Importance of question • How data will be used, by whom, and for what purpose
What	Characteristics and features of the study area/watershed
Where	Sampling locations
When	• Sampling frequency • Length of program
Who	• Program roles – monitoring coordinator, monitor, etc. • Partnering organizations, agencies, labs, etc.
How	• Parameters/conditions measured • Methods and equipment
QA/QC	• Data quality objectives – accuracy, precision, completeness, representativeness, and comparability • Internal and external methods used
Data	• Data management • Data analysis and interpretation • Results and information sharing

Quality Assurance Project Plans

What is it?

Document that outlines the procedures and measures used to ensure the quality of the data when collecting and analyzing the samples and managing the data


United States Environmental Protection Agency

Office of Wetlands, Oceans and Watersheds 4503F

EPA 841-B-96-003 September 1996

EPA

The Volunteer Monitor's Guide To

Quality Assurance Project Plans

Why is it important?

- Documents the details of the monitoring program for data users → eliminates questions of how data were collected, so they can be used with confidence
- Consistency between monitors, especially for long-term programs where volunteers and/or monitoring coordinators change over time

For more information, see:
The Volunteer Monitor's Guide to Quality Assurance Project Plans.
EPA 841-B-96-003. September 1996.
https://www.epa.gov/sites/production/files/2015-06/documents/vol_qapp.pdf

Monitoring Methods Manuals

What is it?

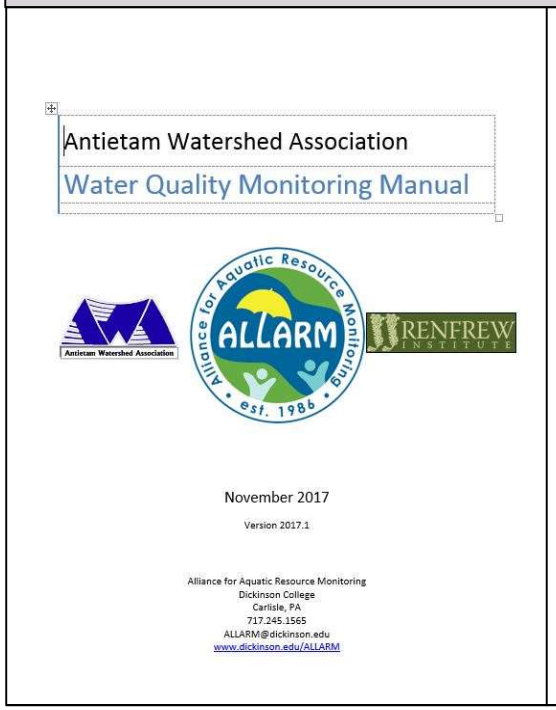
Document that contains the specific, step-by-step procedures used to collect and analyze the samples

Why is it important?

- Minimizes measurement error
- Consistency between monitors

Instructions on how to:

- Collect a sample
- Analyze a sample
- Fill out a data sheet
- Inspect, clean, and maintain equipment
- Manage data
- Ensure data quality (QA/QC)



Antietam Watershed Association

Water Quality Monitoring Manual

November 2017

Version 2017.1

Alliance for Aquatic Resource Monitoring
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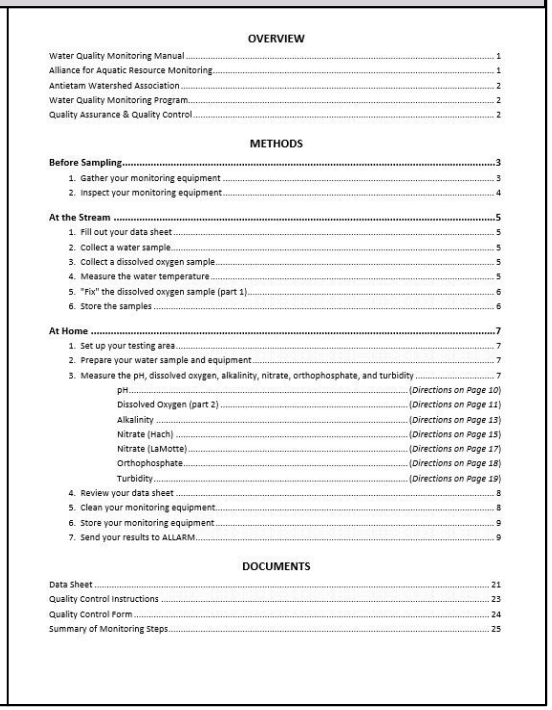
www.dickinson.edu/ALLARM



OVERVIEW

Water Quality Monitoring Manual 1
Alliance for Aquatic Resource Monitoring 1
Antietam Watershed Association 2
Water Quality Monitoring Program 2
Quality Assurance & Quality Control 2

METHODS

Before Sampling 3
1. Gather your monitoring equipment 3
2. Inspect your monitoring equipment 4

At the Stream 5
1. Fill out your data sheet 5
2. Collect a water sample 5
3. Collect a dissolved oxygen sample 5
4. Measure the water temperature 5
5. "Fix" the dissolved oxygen sample (part 1) 6
6. Store the samples 6

At Home 7
1. Set up your testing area 7
2. Prepare your water sample and equipment 7
3. Measure the pH, dissolved oxygen, alkalinity, nitrate, orthophosphate, and turbidity 7
   - pH ..... *(Directions on Page 10)*
   - Dissolved Oxygen (part 2) ..... *(Directions on Page 11)*
   - Alkalinity ..... *(Directions on Page 13)*
   - Nitrate (Hach) ..... *(Directions on Page 15)*
   - Nitrate (LaMotte) ..... *(Directions on Page 17)*
   - Orthophosphate ..... *(Directions on Page 18)*
   - Turbidity ..... *(Directions on Page 19)*
4. Review your data sheet 8
5. Clean your monitoring equipment 8
6. Store your monitoring equipment 9
7. Send your results to ALLARM 9

DOCUMENTS

Data Sheet 21
Quality Control Instructions 23
Quality Control Form 24
Summary of Monitoring Steps 25

For more information, see:
Volunteer Stream Monitoring: A Methods Manual.
EPA 841-B-97-003. November 1997.
https://www.epa.gov/sites/production/files/2015-06/documents/stream.pdf

Volunteer Engagement

What is it?

A process of recruiting, training, certifying, and retaining volunteers.

Why is it important?

An engaged volunteer is confident and motivated to collect high-quality data.

Photos by ALLARM

For more information, see:
Volunteer Stream Monitoring: A Methods Manual.
EPA 841-B-97-003. November 1997.
https://www.epa.gov/sites/production/files/2015-06/documents/stream.pdf

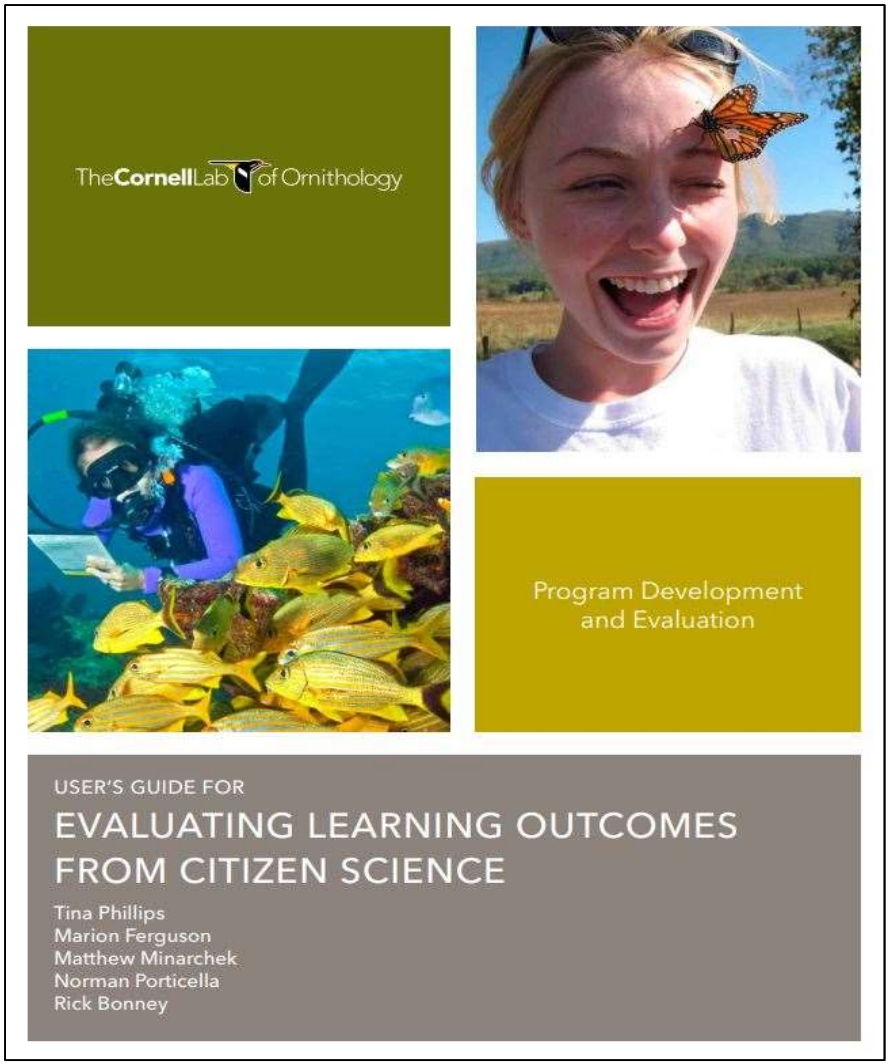
Evaluation & Assessment

What is it?

Process used to document and understand the program's success and effectiveness

Why is it important?

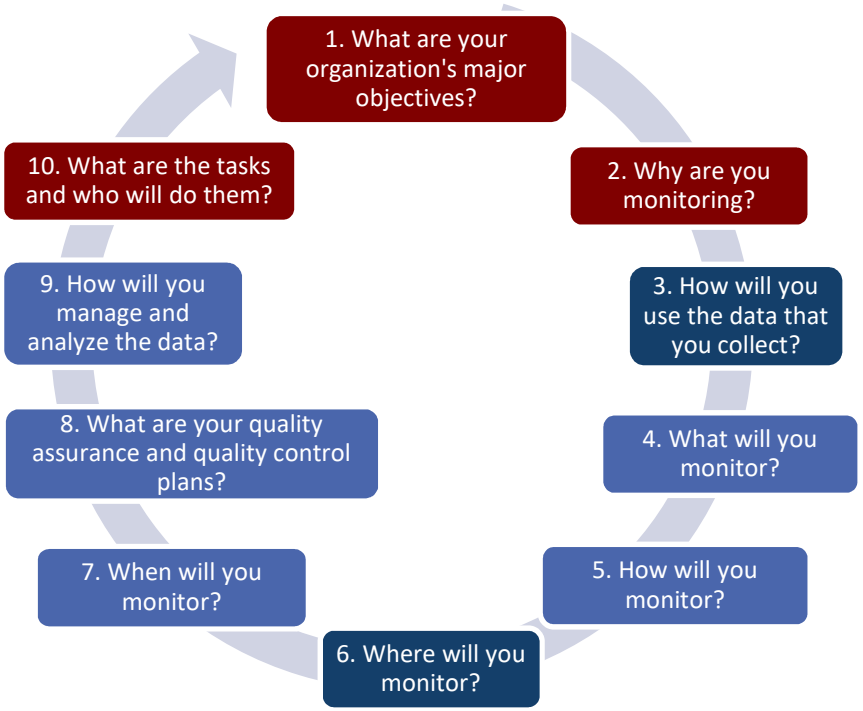
Opportunity to make changes to improve the monitoring program

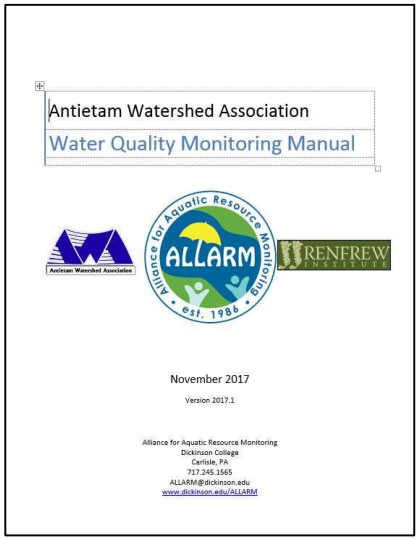


http://www.birds.cornell.edu/citscitoolkit/evaluation

Service Provider – Community Relationship

Planning and developing the monitoring program		
	Service Provider (ALLARM)	**Community** (AWA)
Study Design	●	●
Quality Assurance Project Plan	●	
Monitoring Methods Manual	●	

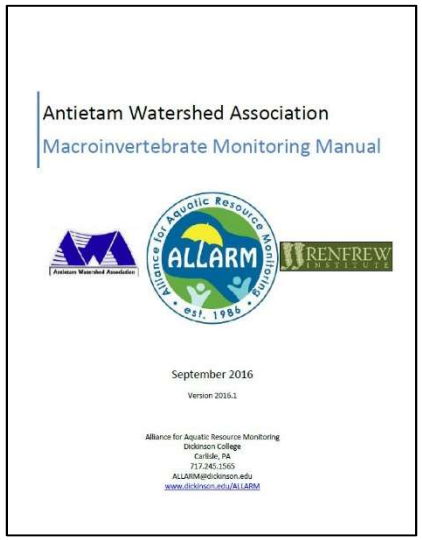



Antietam Watershed Association
Water Quality Monitoring Manual

November 2017

Version 2017.1

Alliance for Aquatic Resource Monitoring
Dickinson College
Carlisle, PA
717.245.1565
ALLARM@dickinson.edu
www.dickinson.edu/ALLARM


Antietam Watershed Association
Macroinvertebrate Monitoring Manual

September 2016

Version 2016.1

Alliance for Aquatic Resource Monitoring
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ALLARM@dickinson.edu
www.dickinson.edu/ALLARM

Service providers may include coordinators from:

- State agencies
- State-funded partnerships
- Extension offices
- Non-governmental organizations

Service Provider – Community Relationship

Engaging volunteers in monitoring		
	Service Provider (ALLARM)	**Community** (AWA)
Recruit volunteers		●
Train (and retrain) volunteers	●	
Certify volunteers (QC support)	●	
Review, validate, and verify data	●	●
Analyze and interpret data	●	●
Share results and outcomes	●	●

Photos by ALLARM

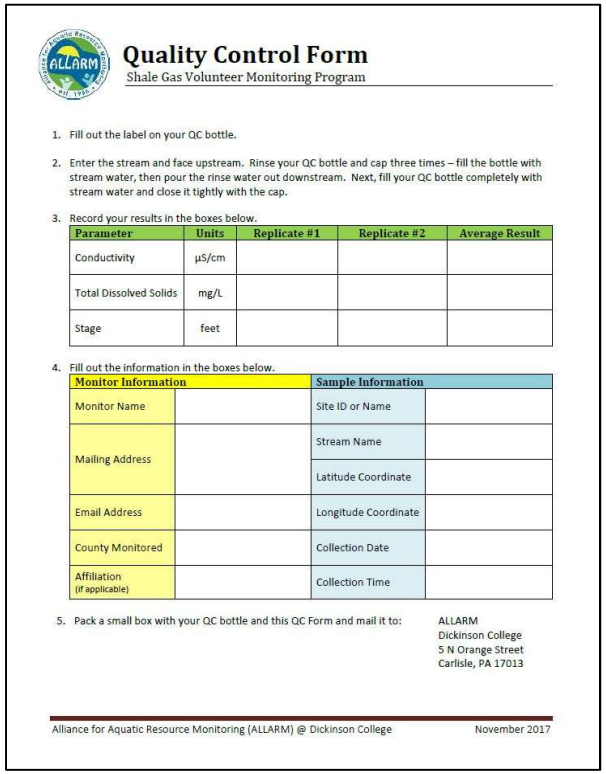
QC support offered by ALLARM:

1. Duplicate sample analysis
2. Side-by-side monitoring/field audit
3. Knowns

ALLARM Community Aquatic Research Laboratory

1. Provide external quality control support to volunteers
2. Evaluate volunteer monitoring equipment
3. Develop and test volunteer monitoring methods

QC Support: Duplicate Sample Analysis



Quality Control Form
Shale Gas Volunteer Monitoring Program

1. Fill out the label on your QC bottle.
2. Enter the stream and face upstream. Rinse your QC bottle and cap three times – fill the bottle with stream water, then pour the rinse water out downstream. Next, fill your QC bottle completely with stream water and close it tightly with the cap.
3. Record your results in the boxes below.

Parameter	Units	Replicate #1	Replicate #2	Average Result
Conductivity	µS/cm			
Total Dissolved Solids	mg/L			
Stage	feet			

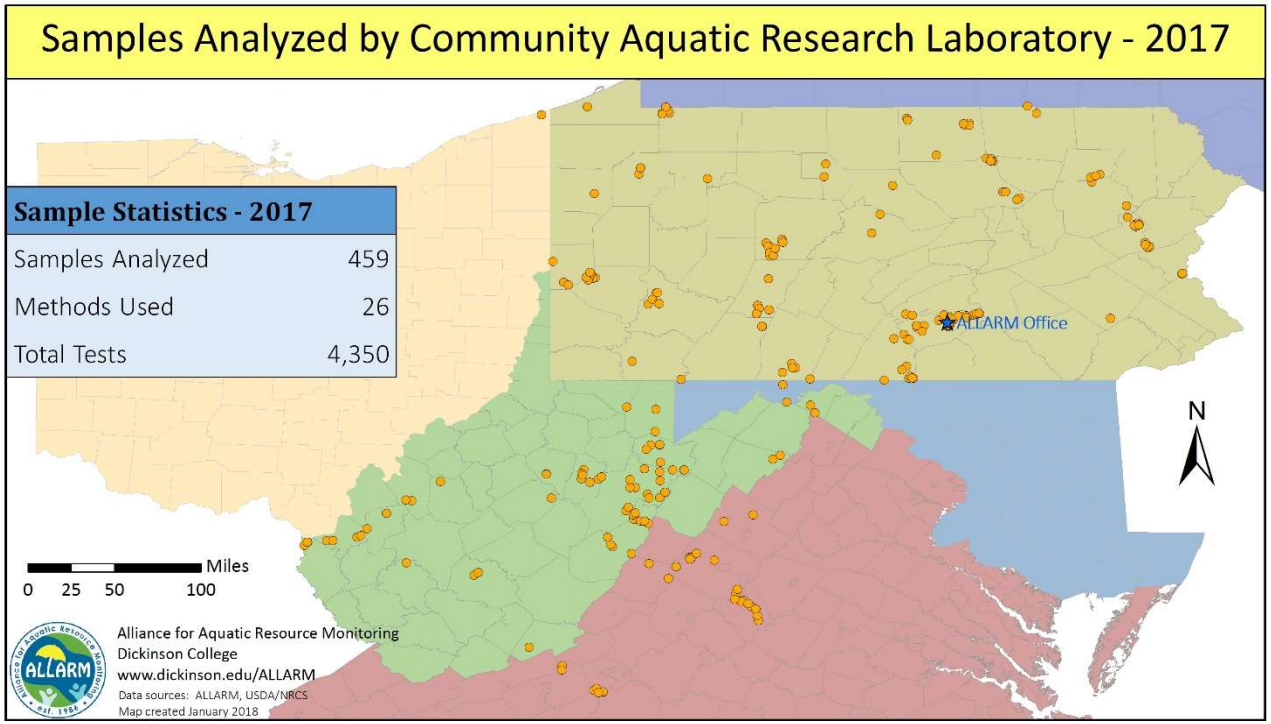
4. Fill out the information in the boxes below.

Monitor Information		Sample Information	
Monitor Name		Site ID or Name	
Mailing Address		Stream Name	
		Latitude Coordinate	
Email Address		Longitude Coordinate	
County Monitored		Collection Date	
Affiliation (if applicable)		Collection Time	

5. Pack a small box with your QC bottle and this QC Form and mail it to:

ALLARM
Dickinson College
5 N Orange Street
Carlisle, PA 17013

Alliance for Aquatic Resource Monitoring (ALLARM) @ Dickinson College November 2017



ALLARM's Quality Control Program is funded by:

1. Chesapeake Monitoring Cooperative – EPA Chesapeake Bay Program
2. Consortium for Scientific Assistance to Watersheds – PA DEP Growing Greener
3. Dickinson College

Evaluate Volunteer Monitoring Equipment

Evaluate monitoring equipment to:

- Become more familiar and learn the advantages and disadvantages
- Create expanded, detailed SOPs
- Improve suggestions for caring, cleaning, and troubleshooting
- Make recommendations

Primary Considerations	Secondary Considerations
Program goals	Are volunteers comfortable handling toxic or hazardous reagents?
Intended data use	Will volunteers share the equipment?
Budget	Number of volunteers and sites to be monitored?
Maintenance requirements and resources available to maintain equipment	How long does the group plan to monitor for?

Dickinson students, faculty, and staff helped ALLARM test conductivity/total dissolved solids meters to help determine which meter is most accurate, precise, and easy to use.

Monitoring & Field Testing

ALLARM monitors and researches local stream, the Letort Spring Run to:

- Develop and test field methods and equipment
- Fine-tune SOPs through first-hand experience
- Validate data management systems with genuine dataset

Thank you! Questions?

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http://web.uri.edu/watershedwatch/
www.volunteermonitoring.org/

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Resources

- **National Water Quality Monitoring Council**
  - https://acwi.gov/monitoring/vm/resources.html
- **USA Volunteer Water Monitoring Network**
  - http://volunteermonitoring.org/
- **Listserves:**
  - The EPA volunteer monitoring listserve: To subscribe, send a blank email message to volmonitor-subscribe@lists.epa.gov
  - The extension listserve: https://list.uvm.edu/cgi-bin/wa?SUBED1=EXTVOLMONNETWORK&A=1
  - Citizen Science Association: http://citizenscience.org/elist/