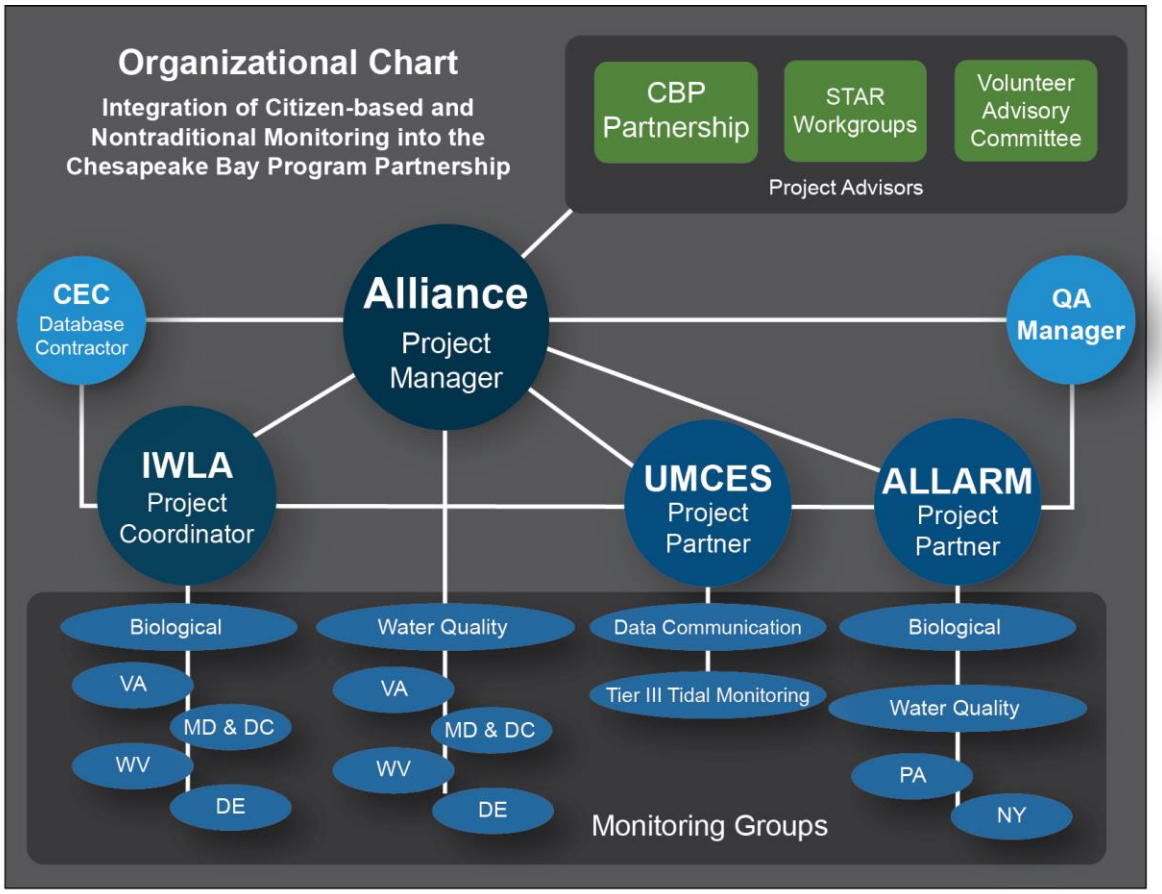
INTEGRATION OF CITIZEN-BASED AND NONTRADITIONAL MONITORING INTO THE CHESAPEAKE BAY PROGRAM PARTNERSHIP STRATEGY: WATER QUALITY AND MACROINVERTEBRATES

INTRODUCTION

There are many sources of data – including data collected by volunteers, local governments, conservations districts, and nongovernmental groups such as academia and watershed organizations that are not currently being used by the Chesapeake Bay Program to track Bay health and determine success of restoration efforts. The Alliance for the Chesapeake Bay (ACB), Izaak Walton League of America (IWLA), Dickinson College's Alliance for Aquatic Resource Monitoring (ALLARM), and the University of Maryland Center for Environmental Science Integration and Application Network (IAN), referred to as the Project Team, are partnered to provide technical, logistical, and outreach support for the integration of citizen-based and non-traditional water quality and macroinvertebrate monitoring data into the Chesapeake Bay Program (CBP) partnership. This is the first effort to integrate citizen science data, to inform policy management and water quality assessments, into a federal program. The integration of these data into the CBP monitoring network will provide additional cost-effective information that supports shared decision-making and adaptive management, as well as demonstrates a framework for the integration of non-traditional data sources which could later be applied to other data gaps in measuring progress towards the 2014 Chesapeake Bay Watershed Agreement.

This six-year project will focus on the identification and integration of citizen-based and non-traditional water quality and benthic macroinvertebrate monitoring data into a new database for the CBP. These data can subsequently be used by the CBP and a wide-range of stakeholders for purposes such as regulatory assessments of water quality criteria, environmental health report cards, environmental health screening, targeting of management actions, and education. The Project Team, using their expertise and knowledge of the citizen-based and non-traditional monitoring community, is working with the CBP Scientific, Technical Assessment and Reporting (STAR) Team and workgroups to:

- Inventory, prioritize and recruit monitoring groups
- Establish institutional structures and procedures for integrating new data
- Facilitate development of monitoring and training protocols, data gathering tools, quality assurance mechanisms, data analysis, and data communication tools
- Provide technical assistance to citizen science and non-traditional monitoring entities

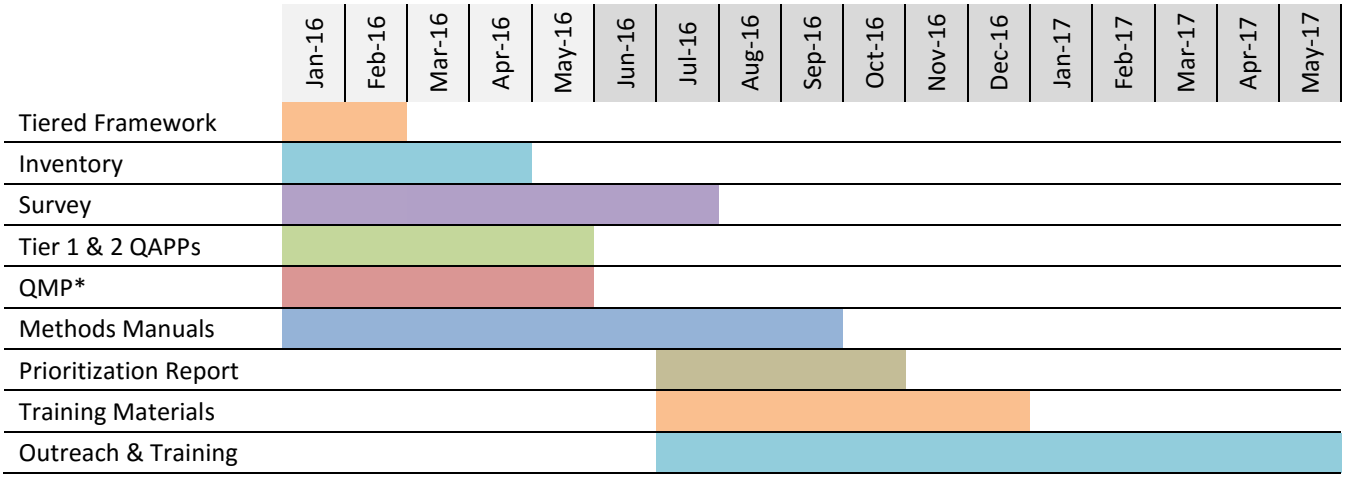


MILESTONES – YEARS 1 & 2

The objectives for Years 1 and 2 (May 2015 – May 2017) of the project include:

- The creation of a tiered framework to inform data integration criteria and strategies.
- An inventory of citizen-based and non-traditional monitoring groups and associated data collected in the Chesapeake Bay watershed.
- Three CBP-approved quality assurance project plans (QAPPs) using the EPA guidance for volunteer monitoring QAPP development, for benthic macroinvertebrates, non-tidal, and tidal water quality monitoring.
- Three CBP-reviewed methods manuals for benthic macroinvertebrates, non-tidal, and tidal water quality monitoring.
- An Increase of spatial and temporal coverage from the CBP partnership's existing watershed and tidal water quality monitoring networks, with a focus on addressing current CBP information gaps and data needs identified through the development of a Prioritization Report.
- Integration of data which are most compatible with the CBP monitoring network in order to build engagement and showcase early success.

- Outreach to citizen-based and non-traditional monitoring groups targeted at identified priority areas.



**Quality Management Plan (QMP)*

Figure 1. This is the estimated timeline for the completion of project milestones and deliverables. The Chesapeake Bay Program can expect presentations from the Project Team on the project milestones and deliverables throughout the development process and upon completion.

TIERED FRAMEWORK

There are various motivations for monitoring and diverse projects where non-traditional data are collected. In the aquatic citizen science field/volunteer monitoring, most organizations developing monitoring programs answer the question "how do they intend to use their data" prior to identifying parameters, appropriate techniques, and corresponding quality assurance measures. This process is done with the goal to match the data quality with the intended use. For the integration of citizen-based and non-traditional data into the CBP, the Project Team examined thirteen states' volunteer monitoring programs, and identified five states to best inform the development of this tiered framework. If data do not meet the data requirements of the different tiers, those data will not be included in this project. Additional documentation on the tiered framework is available.

Table I. The Basics of the Tiered Framework

TIERS	Intended Data Use	Data Requirements
TIER 3	Regulatory Assessments of Water Quality Standards Attainment	United States Environmental Protection Agency (EPA) or CBP approved QAPP and field/lab standard operating procedures.
TIER 2	Environmental Health Report Cards, Environmental Health Screening, Targeting of Management Actions	Has an approved volunteer monitoring Quality Assurance Project Plan (QAPP). Data collected, uses approved field or laboratory standard operating procedures with defined levels of precision and accuracy for the measurements, or program can be participating in an umbrella monitoring initiative that has an approved QAPP or field/lab standard operating procedures.
TIER 1	Education, Environmental Health Screening	Clearly documented monitoring methodology, site locations, and written study designs

The approach needed to integrate monitoring data varies depending on the data quality and intended data use. Therefore a three-tiered strategy will be used in conjunction with this tiered framework.

SURVEY

The Project Team is taking inventory of the citizen-based and non-traditional monitoring groups in the Chesapeake Bay watershed. Currently, there are over 560 monitoring groups identified in the inventory, and this number is growing. These groups will be encouraged to participate in a survey to identify the scope of their monitoring efforts and their quality assurance protocols. A focus group will be assembled for a beta-test of the survey. The expected release date of the survey is April 15, 2016. Follow-up phone calls, emails, and site visits are anticipated. Based on the results of the survey, the monitoring groups will be classified based on the established tiered framework.

TIER 3 STRATEGY

This strategy outlines the approach for integrating monitoring data that has been classified as Tier 3 for the intended use in CBP regulatory assessments of water quality standards attainment. Due to its compatibility with the current CBP monitoring networks, Tier 3 data will be expected to showcase early success and increase engagement. These are the general steps for the Tier 3 strategy:

1) The Project Team will gather the EPA-approved QAPPs or other documentation that demonstrates a monitoring group meets the sampling and analytical requirements defined by the CBP, from monitoring groups presumably collecting Tier 3 tidal or nontidal water quality monitoring data.
2) The Project Team will complete an initial screening of the QAPPs and other documentation (i.e. standing operating procedures and quality assurance protocols), document the findings, and submit documentation to the CBP Data Integrity Workgroup.
3) The Data Integrity Workgroup will then provide expertise for field and laboratory audits. Any deficiencies identified in the document review and on-site audits must be resolved by the monitoring group prior to being accepted into Tier 3.
4) Additionally, the Project Team will determine the monitoring group's incentives for participating in this project, and work towards a mutually beneficial relationship between the CBP community and the Tier 3 monitoring groups.
5) Using training sessions and a guidance document (made available online), the Tier 3 monitoring groups will learn how to submit data into the new citizen-based and non-traditional monitoring database.
6) Monitoring groups collecting Tier 3 data may elect to participate in DIWG quality assurance/quality control assessments, such as: the USGS reference samples, split samples, and blind audit assessments.

TIER 1 & 2 STRATEGY

Data that are classified as Tier 2 and 1 will have many uses, including environmental health report cards, environmental health screening, and targeting of management actions. Three watershed-wide Tier 1 & 2 QAPPs will be developed by the Project Team with clearly defined criteria for Tier 1 & 2 data classification: 1) tidal water quality monitoring, 2) nontidal water quality monitoring and 3) benthic macroinvertebrates. Tier 1 & 2 data will be integrated into the new citizen monitoring and non-traditional monitoring database in order of priority, due to the anticipated magnitude of Tier 1 & 2 data being collected in the Chesapeake Bay watershed. Data uses will be able to make informed decisions about how to use Tier 1 & 2 data based on the available metadata provided by the monitoring groups. These are the general steps for the Tier 1 & 2 strategy:

1) There are very diverse monitoring techniques throughout the watershed for tidal, non-tidal, and benthic macroinvertebrate assessments. The EPA Volunteer Monitoring QAPP Guidelines require a number of metrics including: quality assurance techniques, monitoring methodology, training, and follow up measures conducted by the Project Team. Since monitoring practices vary from state to state, the Project Team will evaluate the most commonly used monitoring techniques and preform comparability studies to produce method manuals and help inform requirements for acceptance into Tiers 1 & 2.
2) Simultaneously, as the Tier 1 & 2 QAPPs are being developed, The Project Team will collaborate with the CBP Integrated Monitoring Networks Workgroup and potential data users to clearly define information gaps to prioritize data needs for the CBP Partnership. This will assist the Project Team in preparation of the *Prioritization Report* to catalogue and prioritize over 100 citizen-based and non-traditional monitoring groups, as well as identify opportunities to showcase early success with data integration.

   Already identified, are CBP water quality monitoring priorities such as:
   - Achieve a higher resolution of data to inform tidal water quality standards attainment assessments for the Clean Water Act
   - Identify nitrogen, phosphorus, and sediment inputs from contributing waters in the watershed to verify effectiveness and progress of management actions
   - Identify nutrient and sediment “hot spots” for better targeted restoration
   - Assess the health of the waters at prominent input sites (i.e. headwaters, major tributary input and small watersheds)
   - Be prepared to address emerging issues such as toxic contaminants and climate change

3) Once the Tier 1 & 2 QAPPs are approved by the CBP designated person(s), the Project Team will target their engagement towards monitoring groups based on the recommendations in the Prioritization Report. The project Team will use the methods manuals, training sessions, guidance documentation, and insights from the Tier 3 integration process, to build relationships with monitoring groups and facilitate data submission into the new citizen-based and non-traditional monitoring database.

4) The Project Team will work with citizen and non-traditional monitoring groups to identify clear incentives for near- and long-term participation. The project Team will help facilitate these incentives with the CBP Partnership.

Approval Process

Products developed by the Project Team as part of this EPA-grant awarded project will go through the following approval process in order to successfully meet the milestones outlined in the CBP-approved workplan. The different products fall into two categories – iterative project tools (i.e. the tiered framework and the inventory of monitoring groups) and comprehensive project products (i.e. the *Prioritization Report*). The CBP Partnership will help to distinguish what level of approval is required for each product.

1) **INWG or DIWG Review.** Present findings to the Integrated Monitoring Networks (INWG) or Data Integrity Workgroup (DIWG) for feedback and guidance.
2) **STAR-approved.** Present product at a STAR Team meeting for feedback and comments. After a 2-week period for comments and edits, the Project Team will recirculate the revised product. If no fatal flaws are found by the STAR Team after recirculation, the product will be deemed STAR-approved.
3) **WQGIT-approved.** The product will be presented at a WQGIT Meeting and the Project Team will seek approval at that meeting (product will be sent out two weeks prior to the meeting). If the WQGIT requests edits be made to the product, the Project Team will make revisions and request approval at the following WQGIT Meeting. Once approval is awarded, the product will be deemed WQGIT-approved.
4) **Management Board-approved.** The product will be presented at a Management Board Meeting and the Project Team will seek approval at that meeting (product will be sent out two weeks prior to the meeting). If the Management Board requests edits be made to the product, the Project Team will make revisions and request approval at the following Management Board Meeting. Once approval is awarded, the product will be deemed Management Board-approved.

Future Considerations: Advancing up the Tier System

Once monitoring groups are submitting data to the CBP Partnership, it will be easier to identify the potential for groups to move from Tier 1 to Tier 2, or Tier 2 to Tier 3.