



# CITIZEN SCIENCE



## Quality Assurance & Documentation

*"One way to open your eyes is to ask yourself,  
'What if I had never seen this before?  
What if I knew I would never see it again?'"*

–Rachel Carson



EPA 206-B-18-001

<https://go.usa.gov/xEw43>

# EXAMPLES

# **Examples** for Citizen Science

## Quality Assurance and Documentation

March 2019

**Disclaimer:** EPA is distributing this information solely as a public service. The inclusion of companies and their products in this document does not constitute or imply endorsement or recommendation by the EPA. EPA retains the sole discretion as to what extent it will use data or information produced or resulting from use of this document.

This document does not define, or otherwise limit, the purpose to which citizen scientists may seek to apply their data or information.

## Introduction

This **Compendium of Examples** includes text (narrative statements) and tables adapted from several Citizen Science Quality Assurance Project Plans or planning documents. Many are from volunteer water quality monitoring programs, but we also included examples (or “samples”) from air quality and biological monitoring projects. We have tried to use examples that follow the recommended tables and narratives found in the Templates document. In some cases, we have provided more than one example for each template, to capture the range of information that can be provided in the QAPP. We have removed names of individuals and replaced them with standard titles such as project manager, or quality assurance manager. And, we have changed the formats of the original QAPPs to better align the information to the Templates, and to illustrate specific principles highlighted in the Handbook and Templates. Finally, we have populated the tables with typical, or suggested, quality control performance goals or acceptance criteria. These goals, however, are not meant to be prescriptive, as projects should evaluate goals based on project purpose, funding, number of volunteers, and other factors.

## **Examples for Templates 1 – 19**

**EXAMPLE TEMPLATE #1: Title and Preparer Page**

Title: Environmental Monitoring Program QAPP

Revision Number: 2

Date: Month x, 20XX

Page x of xx

Project Name: Citizen Science Environmental Monitoring Program

Effective Date of Plan: Month x, 20XX

Name(s) who prepared the plan:

Printed Name and Title: Environmental Monitoring Program Citizen Science Coordinator

Signature and Date: \_\_\_\_\_

Printed Name and Title: Environmental Monitoring Program Quality Assurance Manager

Signature and Date: \_\_\_\_\_

Printed Name and Title: State Department of Environmental Protection Section Leader

Signature and Date: \_\_\_\_\_

Printed Name and Title: Environmental Monitoring Laboratory Director

Signature and Date: \_\_\_\_\_

**EXAMPLE TEMPLATE #2: Example Table of Contents**

Title and Preparer Page .....X

Table of Contents .....X

Problem Definition, Background and Project Description .....X

*A. Problem Definition* .....X

*B. Background* .....X

*C. Project Description* .....X

Data Quality Objectives and Data Quality Indicators .....X

*A. Data Quality Objectives* .....X

*B. Data Quality Indicators*.....X

Project Schedule .....X

Training and Specialized Experience .....X

*A. Training* .....X

*B. Specialized Experience* .....X

Documents and Records .....X

Existing Data and Data from Other Sources .....X

Sampling Design and Data Collection Methods .....X

*A. Sampling Design* .....X

*B. Data Collection Methods* .....X

Sample Handling and Custody .....X

Equipment List, Instrument Maintenance, Testing, Inspection and Calibration .....X

Analytical Methods.....X

Field and Analytical Laboratory Quality Control Summary .....X

Data Management .....X

Reporting, Oversight and Assessments .....X

Data Review and Usability .....X

Project Organization Chart .....X

Project Organization .....X

Project Distribution List .....X

## **EXAMPLE TEMPLATE #3: Problem Definition, Background, and Project Description**

### **Problem Definition:**

Invasive species are a global problem, with potentially high economic costs, and the potential to change ecosystem functioning and diversity. This project monitors a subset of invasive species selected for their relative ease in identification, as well as their potential for negative impacts to our coastal communities and habitats.

### **Background:**

This is a volunteer invasive species monitoring program operated by the State Office of Coastal Zone Management. The program was conceived as a citizen-based complement to the intensive surveys of the Marine Invasive Species Rapid Assessment, which are conducted by a group of state, federal, non-profit and academic partners every three years.

The main goal of the program is to provide early detection of newly arrived non-native species soon after introduction and before populations become established, as well as track the abundance and distribution of invaders already established such as the Green Crab. Because marine systems are open (as compared to lakes and ponds for example), management and eradication of marine invasives once they have been found in the environment is extremely difficult. The majority of marine invasives are spread internationally through aquaculture or shipping, necessitating national or international regulatory changes rather than individual actions.

This project train citizens to monitor invasive species at three islands. Results from the first two years of monitoring show that island sites show higher abundances for several invasive tunicates, than the mainland sites.

### **Project Description:**

The program monitors in three distinct coastal "habitats" which are docks and marinas, tide pools, and cobble shores, in coastal waters, using protocols developed by the program. Volunteers are given 23 Species Identification Cards for sixteen known invaders (like the star tunicate), and seven potential invaders (like the Chinese mitten crabs) selected because of their status as invaders and are relatively easy to identify without the use of microscopy or dissection.

#### **Project Objectives:**

The main goal of the program is to provide early detection of newly arrived non-native species soon after introduction and before populations become established, as well as track the abundance and distribution of invaders already established such as the Green Crab.

**Project Sites:**

Site Name	Island	Descriptions
Tidepool 1	Island 1	Tidepool on backshore of Island
Tidepool 2	Island 2	Tidepool on southern end of Island
Dock 1	Island 1	Main ferry dock on Island 1
Dock 2	Island 2	Main ferry dock on Island 2
Pier 1	Island 3	Main ferry dock on north end of Island

**Time Period:**

The volunteer team visits the same site(s) monthly for six consecutive months, from May through October.

**Data Users:**

The program educates the public (e.g. boaters, fishermen, aquaculturists, teachers) on preventing the spread of marine invasives, especially the Chinese Mitten Crab which attaches to fishing gear, or tunicates that cling to lobster traps, which could be spread by power washing directly into the water.



## EXAMPLE TEMPLATE #4: Data Quality Objectives and Data Quality Indicators

### Data Quality Objectives

*For a water quality project:*

Sufficient and accurate water quality and macroinvertebrate data are collected to document the locations of high quality and impaired stream segments in our state.

*For a continuous air monitoring project:*

Continuous measurements of ozone are collected on an hourly basis so that variability and uncertainty are minimized; the likelihood of decision errors is reduced when comparing results statistically to the national 8-hour standard; and data can be used for screening purposes.

*For a biodiversity research study using volunteers:*

Plant species in the study area's impacted wetlands are accurately identified by the volunteers.

### Data Quality Indicators

**Typical Data Quality Indicator (DQI) activities and performance goals for *in situ* measurements (temperature using a sonde), discrete bottle samples analyzed in a laboratory (for chlorophyll *a*, a measure of algal biomass, using a standard EPA method)**

Data Quality Indicator	Quality control activities and checks	Performance Goal
<b>PRECISION</b>		
Field data	Duplicate temperature profiles will be taken at three sampling stations during each sampling event. Field duplicate bottle samples will be collected at 25% of stations.	Relative percent difference (RPD) of temperature readings <0.2 °C. RPD for field duplicate algae (chlorophyll <i>a</i> ) samples <25%.
Laboratory data	Laboratory duplicates (i.e. splits) for 10% of samples.	RPD for laboratory duplicate algae (chlorophyll <i>a</i> ) samples <25%.
<b>BIAS</b>		
Field data	Check calibration records for sonde temperature sensor.	Return to vendor for annual calibration.
Laboratory data	Blank filters and calibration standards from 0.05µg/L- 200µg/L will be used.	RPD for chlorophyll <i>a</i> calibration standard <10% of known concentration. Blank filters show no contamination.

<b>REPRESENTATIVENESS</b>		
<b>Field data</b>	Evaluate sample design in terms of spatial (e.g. upstream and downstream, mid-point and edge of river) and temporal (or seasonal) variability for both baseline (unimpacted) and impacted conditions.	We are sampling within a 1 km section of the river, upstream, at the discharge and downstream to capture temperature and algae (chlorophyll <i>a</i> ). We are only assessing during summer, so data are meant to be representative of summer months only. Upstream samples should represent unimpacted conditions. All our sampling locations are in the middle of the river. We will collect one out of 10 samples simultaneously at both mid-point and edge of river to capture variation in temperature and chlorophyll <i>a</i> , to determine whether mid-point samples are sufficiently representative of the river segment.
<b>Laboratory data</b>	N/A	N/A
<b>COMPARABILITY</b>		
<b>Field data</b>	Compare methods to previous or existing studies.	The selected sonde model is a commonly used instrument and similar in specifications (e.g. sensitivity, range) to sondes from other studies, including the continuous monitoring sonde on the University buoy located in the river segment. Data from this sonde will be evaluated for usable data during the same time periods.
<b>Laboratory data</b>	Compare methods to previous or existing studies.	Standard EPA Method 445.0 is comparable to data collected using similar methodology.

<b>COMPLETENESS</b>		
<b>Field data</b>	Evaluate percent of samples collected.	Temperature profiles will be conducted at 100% of the stations. We expect to collect 42 chlorophyll <i>a</i> samples, including 14 duplicates. If weather or other issues impede a sampling event, the event will be rescheduled.
<b>Laboratory data</b>	Evaluate percent of samples collected.	100% of all collected samples will be analyzed.
<b>SENSITIVITY OR DETECTION (REPORTING) LIMITS</b>		
<b>Field data</b>	Evaluate specifications for sonde.	The sonde has a sensitivity of 0.1 °C for a temperature range of -5 °C to 95 °C. Depth measurements will be made in cm.
<b>Laboratory data</b>	Evaluate detection limit of laboratory methods.	EPA Method 445.0 has a method detection limit of 0.05µg chlorophyll <i>a</i> /L.

## Data Quality Indicators and Performance Goals for Screening Stormwater Quality in New England

Parameter	Method	Reporting Limits or Measurement Range	Water Quality Criteria or Guidelines (MA or EPA)	Precision or Resolution	Accuracy	Completeness
<b>Field measurements</b>						
pH	Sonde	4 to 10 pH units	6.5 - 8.3	0.02 units	± 0.3 units	90%
Temperature	Sonde	0 to +40°C	28.3°C	0.1 °C	± 0.15°C	90%
Specific Conductivity	Sonde	0 to 100 mS/cm	N/A	5 uS/cm	±10% cal std (µS/cm)	90%
Dissolved Oxygen (DO)	Sonde	0.5mg/L to Sat	≥5 mg/L , ≥60% saturation	0.02mg/L	± 0.5 mg/L	90%
Surfactants	Chemetrics Field Kit	0.25 mg/L <sup>1</sup>	0.25 mg/L	Field dup 30% RPD	See SOP	90%
Ammonia	Test Strip	0.25 mg/L <sup>1</sup>	1.0 mg/L	Field dup 30% RPD	See SOP	90%
Chlorine	Hach Field Kit	0.02 mg/L	N/A	Field dup 30% RPD	See SOP	90%
<b>Laboratory measurements</b>						
Total Phosphorus		5.0 ug/l	N/A	Field dup 30% RPD	MS 70-130%	90%
Total Suspended Solids (TSS)		5 mg/L	N/A	Field dup 30% RPD	See SOP	90%
Biochemical Oxygen Demand (BOD)		2 mg/L	N/A	Field dup 30% RPD	See SOP	90%
Total Petroleum Hydrocarbons (TPH)		Variable	N/A	Field dup 30% RPD	See SOP	
<i>E. coli</i>		4 colonies per 100 ml	≤126 col./100 ml* ≤ 235 col./100 ml	±100 col/100ml or 30% RPD	N/A	90%
<i>Enterococcus</i>		1 colony per 100ml	≤33 col./100 ml* ≤ 61 col./100 ml	±100 col/100ml or 30% RPD	See SOP	90%

<sup>1</sup> Needs field verification to confirm; \* = geometric mean criterion; N/A = not applicable

## Examples of Suggested Data Quality Indicators and Performance Goals for Air Sensors for 4 Types of Citizen Science Applications

Purpose of Monitoring	Pollutants	Precision and Bias Goals	Data Completeness Goals	Rationale
Education and Information	All	<50%	≥ 50%	Measurement error is not as important as simply demonstrating that the pollutant exists in some wide range of concentration.
Hotspot Identification and Characterization	All	<30%	≥ 75%	Higher data quality is needed here to ensure that not only does the pollutant of interest exist in the local atmosphere, but also at a concentration that is close to its true value.
Supplemental Monitoring	Criteria pollutants, Air Toxics (incl. VOCs)	<20%	≥ 80%	Supplemental monitoring might have value in potentially providing additional air quality data to complement existing monitors. To be useful in providing such complementary data, it must be of sufficient quality to ensure that the additional information is helping to "fill in" monitoring gaps rather than making the situation less understood.
Personal Exposure	All	<30%	≥ 80%	Many factors can influence personal exposures to air pollutants. Precision and bias errors suggested here are representative of those reported in the scientific literature under a variety of circumstances. Error rates higher than these make it difficult to understand how, when, and why personal exposures have occurred.

## Additional Data Quality Indicator Activities and Performance Goals for Discrete, Integrated (e.g. composites over 24-hour periods) or Continuous Air Measurements

Data Quality Indicator	Activity	Performance Goal
Precision	Duplicate or collocated instruments are run concurrently (or side by side).	See previous table for goals based on purpose of study.
Bias	Instrument verification for continuous measures in the field include weekly side-by-side comparisons of similar field instruments and daily comparisons of sensors' response to known standards or reference devices (i.e. calibration).	See previous table for goals based on purpose of study.
Representativeness	Evaluate significant events that may impact results.	Information about significant events near the site that may affect the representativeness of the sample will be noted so unusual sample concentration data can be identified.
Representativeness	Evaluate seasonal representativeness.	To be temporally representative of the annual concentration at a given site, the sample dates must be as evenly distributed as possible to capture concentrations that fluctuate seasonally or according to weather patterns.
Comparability	Compare data collected using an air sensor to a co-located federal reference method (FRM) so that the data produced by the sensor are comparable to approved methods.	Similar Relative Percent Difference (RPD) as for co-located measures. Note that this applies to this study only; does not imply that this method is comparable to FRM in all cases.
Completeness	Evaluate the percentage of field measurements (discrete or continuous) made within the time range of interest. If a sample result is missing or has been invalidated because of validation checks, it may not be counted toward completeness.	See previous table for goals based on purpose of study.
Sensitivity	Compare manufacturer specifications or instrument detection limits to appropriate action levels.	The sensitivity of the instrument in use is the minimum detection limit of the instrument. This can be based upon manufacturer specifications or studies to determine the minimum detection (or reporting) limit of the instrument.

## Data Quality Indicators for Biological Sampling

Parameter	Units	Accuracy	Precision	Measurement Range
Macroinvertebrates (rivers, lakes, wetlands)	Individual organism	95% voucher specimens accurately identified to family or order level, verified by experts.	N/A	N/A
Aquatic plant characterization	Individual organism for ID, % area for distribution	All specimens identified to genus or species with positive taxonomic confirmation of voucher specimens by experts for 100% of samples for first crew survey (% for successive surveys dependent on initial QC)	N/A	N/A
Macroinvertebrates	N/A	All preserved specimens accurately identified to family or order level; taxonomic confirmation of voucher specimens by experts.	Standard laboratory procedures; 90% Accuracy of identification when Invertebrate Scientific Advisor examines a minimum of 10% of the original samples	
Nekton	N/A	100% Accuracy of identification evaluated by the Scientific Advisor(s)	N/A	N/A
Birds	N/A	100% Accuracy of identification evaluated by the Scientific Advisor(s)	N/A	N/A
Presence/absence of various species of vegetation (grasses, sedges, eelgrass, macroalgae, etc.)	Present or absent	100% Accuracy of identification evaluated by the Scientific Advisor(s); taxonomic confirmation of voucher specimens by experts	N/A	0 = Absent 1 = Present
Vegetation Abundance	Percent cover (%) / quadrat (0.25 m <sup>2</sup> )	N/A	N/A	0-100 m <sup>2</sup>
Canopy Height	cm	100% Accuracy of identification evaluated by the Scientific Advisor(s)	1 cm	1-150 cm
Vegetation Density	Shoots per quadrat (0.25 m <sup>2</sup> )	N/A	N/A	0-500 m <sup>2</sup>
Location and depth of deep water and shallow water edge (of eelgrass bed)	Meters from shore and meters below surface (water depth)	N/A	0.1 m	from shore: 0-1000 m; water depth: 0-15 m

N/A = not applicable

**EXAMPLE TEMPLATE #5: Project Schedule****Project Activities and Schedule**

Activity	Person responsible	Dates For Annual Activities	
		Anticipated Date(s) of Initiation	Anticipated Date(s) of Completion
Plan Volunteer Program	Program manager and coordinator	January 1	April 30
Revise QAPP and SOPs, as necessary	Program coordinator	February 1	April 15
Inventory supplies and equipment	Coordinator	February 1	March 31
Test water quality equipment	Coordinator	February 1	March 31
Conduct training sessions for volunteer monitors and distribute water quality sampling equipment	Coordinator	April 1	June 30
Receive and review water quality data	Quality Assurance Manager	April 1	December 31
Input data to water quality database	Coordinator	June 1	December 31
Conduct field Audits	Coordinator	June 1	September 30
Synthesize data and create water quality reports	Coordinator	September 30	February 15 after sampling year
Perform annual audit	QA Manager	January 1 after sampling year	February 15 after sampling year



**EXAMPLE TEMPLATE #6: Training and Specialized Experience****A. Training****Training Requirements for Interns and Volunteer Monitors**

<b>Project Function</b>	<b>Description of Training</b>	<b>Training Provided by</b>	<b>Training Provided to</b>	<b>Frequency</b>
Water Sample Collection	Handheld instrument, datalogger, and laboratory sample and data collection procedures, provided in the field	Program Manager/Coordinator	Interns	Annually
Water Sample Analysis	Analysis of water samples in the laboratory	Program Manager/Coordinator	Interns	Annually
Data Management	Logging in samples into database	Database Manager	Interns	Annually
Water Sampling	Water sample collection procedures (annual training sessions)	Program Manager and/or Program Coordinator	Volunteer Monitors	
Water Sampling	Water sample collection procedures in the field during an annual field audit for volunteer groups	Program staff	Volunteer Monitors	
Water Sampling	When samples are dropped off at the laboratory by volunteers the chain of custody form is used to determine if any corrective actions are needed in sample documentation.	Laboratory Managers and Interns	Volunteer Monitors	

### **Volunteer Training Narrative Statement**

All program volunteers (i.e. new, returning and youth) are required to attend annual training prior to participating in the current year's monitoring activities. Training is directed by the state coordinator or a currently Certified Local Trainer. Training is based upon the methodology outlined in the most current version of the program training manual (and associated training materials) and the most current program QAPP.

New and youth volunteers must complete both classroom and field-based training activities. During classroom training volunteers are provided with program background and overview information, including a review of the program objectives, field safety, and monitoring protocols via standardized Microsoft PowerPoint presentations. During the field-based training, volunteers travel to a nearby monitoring station to complete the protocol under the supervision of the trainer. Successful completion of annual training for new and youth volunteers is measured as 100% classroom attendance and demonstration in the field of the ability to implement the protocol (i.e. sample collection, sorting, identification, voucher preparation, and documentation.)

All experienced volunteers must complete, at a minimum, annual field-based training under the supervision of a Certified Local Trainer. Experienced volunteers may be allowed, at the discretion of the Local Trainer, to review classroom presentation materials remotely (e.g. online/electronically) in lieu of classroom training. Successful completion of annual training for Experienced Volunteers is measured as either 100% classroom attendance or remote review of classroom materials with electronic confirmation, along with field demonstration of the ability to implement the protocol (i.e. sample collection, sorting, identification, voucher preparation, and documentation.)

## **B. Specialized Experience**

### **Specialized Experience Narrative Statement**

Volunteers with the marine invasives program get significant support from the state coordinators and scientific community who act as "identification experts". The program manager has 10 years of experience running the program, has a degree in marine biology and has assisted with the marine invasive rapid assessment program.

Volunteers are also encouraged to send photographs of anything unusual back to marine biological specialists at the state office of coastal zone management. Academic experts are sometimes consulted to identify species. Starting in 2016, volunteers are also encouraged to upload any photographs of observed species onto the program page on *iNaturalist* which provides an additional way to verify identifications made.

## EXAMPLE TEMPLATE #7: Documents and Records

### Documents and Records Narrative Statement

This section briefly describes the documents, forms and records utilized by the program and procedures for handling and storing program records. All program data and documents are subjected to QA/QC review before being disseminated to end users. Procedures for reviewing, validating and where necessary qualifying or excluding the information contained in program records are discussed below.

**Data Sheets:** Field data sheets include information about the site location (program ID number), which specific equipment was used to make measurements (thermometer number), the sampling method used (direct fill, pole, or "Bridge Buddy") and equipment calibration results. The field data sheets are also used to record temperature, velocity, depth, color, odor, and turbidity information (see appendix). A separate field data sheet is used by dissolved oxygen monitors (see appendix). Both data sheets will be completed and relinquished to the site coordinator at the drop-off site. Field data sheets are archived by sampling season in a permanent file. Field data are also entered into an event spreadsheet and retained by the organization in hard and digital form.

Lab data sheets for specific conductance and pH are kept by the data manager and entered into an Excel spreadsheet that is saved and printed for review and permanent archiving (see appendix). Outside lab data sheets are sent in electronic format from the outside labs to the Data Manager. Sheets are saved on the organization's hard drive, entered into an excel spreadsheet that contains all other site information, and printed for review and permanent archiving. See the appendix for copies of the various data sheets used in the program.

**Chain of Custody Forms:** Chain of custody forms (see Template #10) are completed for each sample. Forms are provided by the lab supplying analytical services. Copies of these forms will be archived in the organization's office. The original chain of custody forms will be retained and archived by the appropriate laboratory. See the appendices for sample chains of custody.

**Sample Labeling:** All samples are labeled with site ID#, lab site ID # (if different), monitor's initials, date, time of collection, and parameters to be analyzed. See the appendix for full labeling procedure.

**Equipment Custody Form:** Equipment custody forms will be completed by volunteers upon receipt of the sampling kit. This checklist lists all the equipment that was given to the volunteer and inventory numbers of the individual instruments. This allows the organization to keep a constant record of equipment possession. Equipment custody forms are stored indefinitely. New forms will be completed following each annual equipment inspection.

**Training and Evaluation Form:** Volunteer monitors are evaluated at the time of initial training, upon annual renewal training, and again if questions arise about performance. Volunteer training and evaluation forms are archived with other project documents. See the appendix for the various training and evaluation forms.

## Water Sampling Field Data Sheet

### Lake Monitoring Project Observation/Assessment Data Sheet

Observation ID#\*: \_\_\_\_\_ AssessmentID#\*: \_\_\_\_\_  
 Lake / Pond Name: \_\_\_\_\_  
 Town / Count: \_\_\_\_\_

Invasive Observation Description						
Observation <sup>1</sup>	GPS coordinates <sup>2</sup>	Invasive Species Name	Size of plant bed <sup>3</sup>	Invasive Distribution <sup>4</sup>	Substrate <sup>5</sup>	Depth (feet)

1. The number of invasive species locations you find beginning with 1.
2. If known, please enter the Datum of your GPS unit. Example: NAD83 or WGS84 are most common.
3. Estimate bed size in feet as length x width. Example: 45x30 feet
4. Single plant or clump, scattered plants/clumps, dense plants/clumps, linearly scattered, or monoculture
5. Mud, Sand, Gravel, Rock, Wetland, or Mixture

\*These ID #s are given to you after you enter Observation and Assessment information online using iMapInvasives; if you are not entering your data online, leave blank.

**Citizen Science Air Monitoring Collaboration Community Field Data Sheet**

Citizen Science Air Monitoring Collaboration Field Data Sheet					
Name:					
Address:					
Describe location (nearby industries, childcare centers, restaurant, etc.):					
Date	Time	Battery Status (Changed)	Calibration number	Flow Rate	General Observations of the day/location (Bad smell, lots of trucks, etc.)
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					

**EXAMPLE TEMPLATE #8: Existing Data and Data from Other Sources**

**Limitations on Use of Existing Data**

Existing Data	Data Source	How Data Will Be Used	Acceptance Criteria	Limitations on Data Use
Water temperature data	University buoy located upstream from the power generation plant	To determine baseline temperatures of the river for the past 2 years	<ol style="list-style-type: none"> <li>1. Temperature data must be collected from a properly calibrated and functional buoy</li> <li>2. Temperature data were collected from within ½ km of power generation plant</li> <li>3. Sensitivity of the temperature data from the buoy is less than 0.1 °C</li> </ol>	<ol style="list-style-type: none"> <li>1. Temperature data collected from a buoy located downstream</li> <li>2. Temperature data exceed sensitivity acceptance criteria</li> </ol>

## EXAMPLE TEMPLATE #9: Sampling Design and Data Collection Methods

### A: Sampling Design

#### *Sample Design for a Marine Invasives Monitoring Project*

**Sample Design:** The volunteers implement the program monitoring protocols, searching on piers and adjacent rocky shores for twenty-three non-native species of concern. The protocol is described in a guidance document, prepared by the program. Generally, volunteers are trained early in the late spring or early summer. On each visit, the volunteer team (usually two to three people) records the presence and abundance of target species. A typical site is a piling or underside of a dock float at a pier, which can be viewed by leaning over and peering into the water. Site selection and monitoring protocols for each habitat are described in the overarching program guidance document.

**Methods:** Handfuls of fouling organisms are gathered and sorted in trays looking for target species. Volunteers use small nets to search for epibenthic fauna such as shrimps, crabs, or isopods. Large laminated information cards with photos are used to identify species. Volunteers are also encouraged to record any other species, including native species, they observe and there is room on the data sheet to add in additional species that are not on the monitoring list. Abundance is measured qualitatively using the following guidelines:

- Abundant: present almost everywhere you look
- Common: present at most of the monitoring site (present in most locations or over half of the area looked)
- Few: present, but at low abundance (found less than half of places looked)
- Rare: one to two specimens present at site
- Absent: not observed at the site

At each visit, water temperature and salinity are recorded using hand-held thermometers and refractometers, and notes are made on weather conditions and tidal stage. Results are recorded on datasheets and sent to the project manager.

**Locations:** See project description, and map in the Appendix.

**Schedule of the Project (frequency of sampling):** The volunteer team visits the same site(s) monthly for six consecutive months, from May through October. It is anticipated that this project will be funded for the foreseeable future.

**Quality Assurance and Quality Control:** The thermometers and refractometers are calibrated by the project manager at the beginning of the year and checked by volunteers before each monitoring event. Refractometers are checked using deionized water. There is no chain of custody for the datasheets, but each datasheet requires identification of the volunteer collecting the information. The project manager will periodically call volunteers to check on any data that seem unusual or any identification that are in question. Volunteers are instructed to collect a sample and/or photographs if they are not confident in the identification. Factors used by the project manager to identify a potential misidentification are the history of

that species at the site (historical abundance/presence), and if the species in question has close resemblance to native species, etc.

#### *Sample Design for a Water Quality Stream Monitoring Project*

**Sample Design:** Routine sampling activities consist of collecting in-stream samples. As discussed above, routine sampling sites are divided among “indicator” sites and “subwatershed sites” to meet the dual objectives of the program. Indicator sites are selected to be representative of overall water quality and are relatively unchanging over time to allow comparison to past and future investigations. Sites have generally been selected at the downstream ends or key segmentation points of major subwatersheds and at or near locations where there is a longstanding data record.

**Methods:** Sample types include grab samples and direct measurement. Water quality characteristics that are measured and/or observed directly include: temperature, color, odor, turbidity, velocity, depth, specific conductance, and dissolved oxygen. Laboratory-measured indicators may include fecal coliform, *E. coli* and/or *Enterococcus*, along with total nitrogen, ammonia, nitrate/nitrite, total phosphorus, ortho-phosphate, pH, salinity, specific conductance, surfactants and total suspended solids. Bacteria samples analyzed using the Colilert method may also include results for total coliform. This total coliform data is used only as a QC control in the Colilert analysis process and is not used for the direct assessment of water quality. Additional indicators may be evaluated during follow-up and special study sampling as needed.

**Location:** See map in appendix.

**Schedule:** Routine sampling operations are generally scheduled every four weeks, starting in May, and are typically held early on a Wednesday or Thursday morning. The reason for this sampling schedule is to meet new Surface Water Quality Standards for bacteria which stipulate that at least five samples be taken within a six-month period to make a use determination.

**Quality Control:** Field duplicates, field splits, field and lab blanks are collected routinely. See sections below for more information.

#### *Sample Design for a Community-based Air Monitoring Project*

**Important Considerations for Air Monitor Placement:** Appropriate placement of air monitoring devices is critical for collecting useful data. Air pollution concentrations can vary considerably due to factors such as proximity of the pollutant sources, buildings and other obstructions, and atmospheric conditions. For these reasons, you must plan monitoring locations carefully to make sure the collected data are representative of the community you are monitoring and that meet your study objectives. EPA and the community group will work together to identify the locations for this study. The following are some important considerations for choosing representative sampling sites:

- Local atmospheric conditions. Factors such as rain, wind, sunlight, clouds, temperature, and humidity can affect your data.



- ✓ Make sure the unit is protected from the effects of weather using the individual EPA-developed aluminum shields that accompany your monitoring unit.
  - ✓ Temperature and humidity can particularly affect the performance of the monitoring unit. The recommended operating ranges for temperature and Relative Humidity (RH) are 0–40 °C (32–104 °F) and 0–90% RH (with no formation of water droplets), respectively.
  - ✓ Wind speed and direction can also affect measurements. For example, stagnant air can lead to pollutant concentrations that gradually increase, whereas strong winds can decrease concentrations by spreading pollutants over a larger area. Higher winds can also lead to higher concentrations of other pollutants such as dust. Wind direction can affect your results by increasing or decreasing concentrations depending on whether your air monitor is located upwind or downwind of the prevailing wind at the time of data collection. Understanding the effects of wind can aid in choosing a monitoring site and in recognizing when your results might have been affected by wind.
- 
- Primary or secondary source. Some pollutants are emitted directly by a source (primary pollutants), while others are formed as the products of chemical reactions in the air (secondary pollutants). Primary pollutants are often more localized (i.e., near the source) and can have a greater variability over distances than secondary pollutants. It is important to consider whether a pollutant of interest is primary or secondary when deciding where and how to collect monitoring data. More information can be found at: <http://www.epa.gov/air/criteria.html>.
  - Location of pollutant sources relative to the pollutant of interest. NO<sub>2</sub> and PM, for instance, might have much higher concentrations closer to a roadway as both come from automobile emissions. If you want to find out how a roadway influences NO<sub>2</sub> and PM concentrations, you could locate one monitoring unit close to the road and one some distance downwind of the roadway to determine the changes in concentrations.
  - Location of the air monitor relative to the exposed population. If the aim of your study, for example, is to measure the impact of industrial emissions of NO<sub>2</sub> and PM on a neighborhood, the monitoring units could be placed within the neighborhood at varying distances from the facility rather.
  - Air flow. Make sure air flows freely to your monitoring unit by placing it far enough away from the ground (at least 1 meter above the surface) and away from building surfaces, trees, or any other obstructions to flow (ideally at least 1 meter away).
  - Reactions and interferences. Sensors can experience interference from other chemicals in the atmosphere, as well as heat and cold, which can lead to erroneous concentration estimates. Avoid placing the monitoring unit near sources of heat or cold and gases that can react with the pollutant of interest. Possible interferences for the NO<sub>2</sub> component include high concentrations of chlorine (a commonly used disinfectant for swimming pools) and ozone (often formed during warm, dry, and cloudless days with low wind speeds).

*EPA's Air Sensor Guidebook* provides additional details and considerations for choosing sites for air monitoring studies.

**B. Data Collection Methods****Surface Water Field Sample Summary for a River Water Quality Monitoring Project**

Analytes	Sample Type	Number of Sampling Stations	Sampling Frequency	Number of Field Replicates	Total Number of Samples to Lab
<ul style="list-style-type: none"> <li>• Alkalinity</li> <li>• Chlorides</li> <li>• Chlorophyll</li> <li>• Dissolved Oxygen</li> <li>• Metals</li> <li>• Nutrients</li> <li>• Solids</li> </ul>	Surface Grab, see SOP in appendix	Variable year to year depending on number of volunteers but typically 5 to 25	Typically, a minimum of monthly from May through October	>10% of samples	Variable, based on sampling frequency but ranges from 50 to 200 per year
<ul style="list-style-type: none"> <li>• Dissolved Oxygen</li> <li>• pH</li> <li>• Specific Conductance</li> <li>• Turbidity</li> <li>• Water Level</li> <li>• Water Temperature</li> </ul>	<i>In-situ</i> measurements See SOP in appendix	Variable year to year depending on number of volunteers but typically 5 to 25	Typically, every 15 minutes for a minimum 5-day deployment	>10% of profiles are repeated	N/A

*N/A = not applicable*

## Sampling Summary for the Three Components of the Cyanobacteria Monitoring Collaborative Program

	Potential Program Use	Purpose	Sample Location	Sample Frequency	Sample Type	Parameters
<b><i>BloomWatch</i></b>	All State & Federal water programs, general public at large, Citizen Scientists, beach monitors, educational institutions, lay monitoring programs	Determine high probability that a cyanobacteria bloom is occurring (i.e. Vs pollen), utilize an educational tool, document frequency of occurrence, possible hotspots, report occurrence to state	Wherever a bloom appears to be occurring. This could be in open water and widespread, or a distinct scum line located at the shoreline. Any surface water body, anywhere	Whenever a suspected bloom occurs; anywhere, anyplace, anytime	Smartphone image & data submittal via the <i>BloomWatch</i> App (see Cyanos.org)	Waterbody name, weather conditions, water surface conditions, public access, smartphone images, local Lat/Lon
<b>CyanoScope</b>	All State & Federal water programs, local and state boards of health, public surface drinking water suppliers, concerned citizens, Citizen Scientists, academia & educators	To track and document the locations and occurrence of potentially toxic cyanobacteria genera	Any surface water bodies	Anytime, anywhere, any frequency	Concentrated 53-micron plankton net sample	Location data (waterbody name, town, Lat/Lon), digital microscope image submittal
<b>Cyanomonitoring</b>	All State and Federal water monitoring programs, public drinking water supplies, lake & river associations, various stakeholders, researchers	Track spatial and temporal distribution of cyanobacteria pigments, frequency of occurrence, long term trends, concentration levels, and potential toxicity	Minimum of one site per waterbody from the deep hole area or specific shoreside location	Minimum baseline of one sample collected every other week from June 1 through September 30. Additional samples may be collected from other waterbodies, other sites, other depths, and other frequencies, if minimum baseline is completed. Long term monitoring	Integrated tube sample from the surface to a depth of 3 meters, or a one-meter integrated tube sample if collected from the shoreline	Chlorophyll <i>a</i> concentration, Phycocyanin concentration, possible toxin analysis

**Field Sample Summary for a Coastal Wetland Biological Monitoring Project**

<b>Indicators</b>	<b>Number of sample locations</b>	<b>Site location rationale</b>	<b>Frequency, duration, special conditions</b>	<b>Field survey QC</b>
Macroinvertebrates - presence	3 creek bank sites near 0-150-300 feet	Representative of marsh condition at study & reference	Once/year, late summer or fall	Any combination of qualified supervisor, multiple samplers, voucher specimens, photo documentation
Nekton (fish, shrimp, crabs)- presence, relative abundance	3 equally spaced along evaluation area gradient	Representative of marsh condition at study & reference	Three times June - September	Any combination of qualified supervisor, multiple samplers, voucher specimens, photo documentation
Birds - point counts of all species seen or heard	Single vantage point overlooking evaluation area	Representative of marsh condition at study & reference	Five times June - September	Any combination of qualified supervisor, multiple samplers
Vegetation - community composition, percent abundance per species	6 transects, randomly stratified	Representative of marsh condition at study & reference	Once August or September	Any combination of qualified supervisor, multiple samplers, voucher specimens, photo documentation
Tidal hydrology - difference in tidal range	Two fixed locations: one upstream and one downstream of tidal restriction	Representative of tidal flow between study & reference	Once, every 15 minutes for 6 hours from low to high spring tide	Any combination of qualified supervisor, multiple samplers
Land Use	Map and orthophoto analysis using three concentric buffers	Representative of land use effects on marsh conditions	Once, unless alterations in land use	Any combination: Two or more personnel conduct separate mappings of same area, compare results, discuss to resolve differences

## **EXAMPLE TEMPLATE #10: Sample Handling and Custody**

### **Sample Handling and Record Keeping Narrative Statement**

Record keeping serves numerous purposes vital to produce reliable data. In general, all procedures, observations, subjective decision-making, and unusual circumstances are recorded in at least one of the records described below.

**Sample Labeling:** Baseline samples analyzed by the outside lab are labeled with the site name, date, and time of collection. Since the glass bottles used to collect baseline DO samples are reused, the DO bottle needs to have only the site name written on it. All other samples (e.g. for Hot Spot or NPS Assessment) should, at a minimum, be labeled with the date, time of collection, site name, and sample number. Volunteer monitors are instructed to use pens or permanent marker that will not smear if the bottles come in contact with water.

**Field Notebook:** The field notebook is a blank notebook in which all notes and observations are recorded and serves as a duplicate of all information on the data sheet. All entries are initiated by writing the date and initials of the volunteer making the entry. Periodically field notebooks are returned to the Project Manager for review and permanent storage.

**Data Sheets:** Data sheets are preprinted forms on which calibration checks, field measurements and observations are documented. When used in the field, data sheets are completed and relinquished to the Sample Coordinator at the drop-off site. Data sheets are archived by month in a permanent file. Hardcopy and electronic copies of these data are maintained permanently by the program office.

**Chain of Custody Forms:** Chain of custody (COC) forms are completed for each sample shipped to a fixed laboratory for analysis. Copies of these forms are archived permanently in the program office. The original chain of custody forms is retained and archived by the appropriate laboratory.

**Example of a Chain of Custody Form for a Water Quality Monitoring Project**

**Organization** Coast Watch

**Project Name** Bacteria Sampling

**Laboratory** North Shore Bacteria Laboratories

**Sampler's Signature** \_\_\_\_\_

Sample ID	Site name/number	Date	Time	Type or Volume	# of Samples	Analysis	Comments
1	CW-1	8/4/2018	0730	100 mL	1	Enterococci	
2	CW-2	8/4/2018	0812	100 mL	1	Enterococci	High turbidity
3	CW-3	8/4/2018	0915	100 mL	1	Enterococci	
<i>Relinquished by: Signature</i>		<i>Received by: Signature</i>			<i>Condition when received:</i>		<i>Date/Time</i>
<i>Relinquished by: Signature</i>		<i>Received by: Signature</i>			<i>Condition when received:</i>		<i>Date/Time</i>
<i>Relinquished by: Signature</i>		<i>Received by: Signature</i>			<i>Condition when received:</i>		<i>Date/Time</i>

*Additional Comments:*

Page \_\_\_\_\_ of \_\_\_\_\_

## EXAMPLE TEMPLATE #11: Equipment List, Instrument Maintenance, Testing, Inspection and Calibration

### Equipment Inspection, Calibration, and Maintenance for Water Quality Project

Equipment Type, Make and Model	Inspection Frequency	Type of Inspection	Calibration Frequency	Post Check Criteria	Available Parts	Maintenance	Record Keeping
Thermometer, Enviro-Safe "Easy Read" Armor Case Thermometers	Each monitoring event	Visually check for separations in column	Annually against triple point of water Annually against traceable thermometer	n/a	Spare thermometer	Annually or as needed	Logbook notation
pH meter, Oakton Waterproof pHTestr 2	Each monitoring event	Battery life, electrolyte, probe integrity	3-point calibration at beginning of each sampling day, reconfirm after every 25 samples and at end	pH standard 7 solution reads 7.0 +/- 0.2 SU	Spare batteries, electrolyte, and electrodes	Annually or as needed	Logbook notation
Specific Conductance meter, YSI 85	Each monitoring event	Battery life	At beginning of each sampling day, reconfirm after every 25 samples and at end	Standard 1000 uS/cm solution reads 1000 +/- 1%	Spare batteries	Annually or as needed	Logbook notation
Dissolved oxygen meter, YSI 550 or YSI 85	Each monitoring event	Battery life, electrical connections, membrane condition	Saturated air and zero- DO (< 0.5 mg/L) checks at beginning of day, reconfirm after every 25 samples and at end	± 0.5 mg/L of sat. value, < 0.5 mg/L for zero std	Spare membranes, batteries	Annually or as needed	Logbook notation
Depth Gauge (plumb bob)	Each Monitoring Event	Visual for knot and tangle problems	None	None	Sting, replacement bob	Annually or as needed	None

## Air Sensor Field Monitoring Record

### Sensor Monitoring Record

Sensor Unit # \_\_\_\_\_ Date: \_\_\_\_\_ Data recorded by: \_\_\_\_\_

Test Location (description) \_\_\_\_\_ Fresh Batteries installed?  
Yes  Date \_\_\_\_\_  
No

Data logging interval \_\_\_\_\_ min. Operation mode:  
AC power   
Battery

Start date: \_\_\_\_\_ End date: \_\_\_\_\_  
Start time: \_\_\_\_\_ End time: \_\_\_\_\_ Total run time: \_\_\_\_\_ hours

#### Pre-test Instrument Setup

PM<sub>2.5</sub> zero check Performed by: \_\_\_\_\_ Date: \_\_\_\_\_  
PM<sub>2.5</sub> flow rate check Performed by: \_\_\_\_\_ Date: \_\_\_\_\_  
NO<sub>2</sub> zero and span check Performed by: \_\_\_\_\_ Date: \_\_\_\_\_

#### Post-test Instrument Operations

Data downloaded Yes No  File  name: \_\_\_\_\_

Performed by: \_\_\_\_\_ Date: \_\_\_\_\_

#### Comments

---

---

---



**EXAMPLE TEMPLATE #12: Analytical Methods****Water Quality Monitoring Parameters Analyzed at Outside Laboratories**

Matrix	Parameter	Reporting Limit	Analytical & Preparation Method/ SOP Reference	Sample Volume	Containers (number, size, type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)
Seawater	Chlorophyll <i>a</i>	0.1 ug/l	EPA Method 445.0 Acetone extraction	1 liter	500 to 800 polyethylene acid washed	24 hours on ice in dark/collect on filter, frozen or extracted	120 days once filtered
Seawater	Total Dissolved Nitrogen	1 uM (14 ug/l)	Standard method 4500-P Persulfate digestion	1 liter	500 to 800 polyethylene acid-washed	Field filter, store dark at -20 °C	28 days
Seawater and Fresh-water	Total Phosphorus	1 um (31 ug/l)	Persulfate digestion	60 mL	50 to 100 polyethylene acid-washed	Acidify, store dark at -20 °C	28 days
Seawater	Enterococci	1 per 100 mL	Standard Method 1600 Membrane filtration	100 mL	100 to 300 sterilized polyethylene	Store on ice	6 hours

**Water Quality Parameters Analyzed *In Situ***

Matrix	Parameter	Reporting Limit (Resolution)	Analytical & Preparation Method/ SOP Reference
Freshwater	pH	0.1 units	Hydrolab sonde
Freshwater	Dissolved oxygen	0.01 mg/L	Hydrolab sonde
Freshwater	Temperature	0.01 °C	Hydrolab sonde

**EXAMPLE TEMPLATE #13: Field and Analytical Laboratory Quality Control (QC) Summary****Quality Control (QC) Summary for *In Situ* Water Monitoring**

Water Quality Parameter	QC Sample type	Frequency	QC Acceptance Criteria or Performance Goals	Corrective Action	Person Responsible for Corrective Action
Dissolved Oxygen	Measurement replicate	10% or each sampling event	RPD $\leq$ 10% or ABS (absolute difference) $\leq$ 0.4 mg/L or $\leq$ 4%	Recalibrate instrument, repeat measurement	Volunteers; Program Staff
	Initial Calibration Value	Pre and post sampling event	$\pm$ 5.0% of calibration saturation	Recalibrate instrument, repeat measurement	Volunteers; Program Staff
Temperature	Measurement replicate	Precision	RPD $\leq$ 10 %	Repeat measurement	Volunteers; Program Staff
pH	Measurement replicate	10% or each sampling event	ABS $\leq$ 0.3 standard (std) units	Recalibrate instrument, repeat measurement	Volunteers; Program Staff
	Known buffer Initial Calibration Value (e.g., pH = 6.0)	Pre and post sampling event	$\pm$ 0.3 std units	Recalibrate instrument repeat measurement	Volunteers; Program Staff
Specific Conductance	Measurement replicate	10% or each sampling event	RPD $\leq$ 10% or ABS $\leq$ 25 $\mu$ S/cm	Recalibrate instrument, repeat measurement	Volunteers; Program Staff
	ICV (e.g., 100 $\mu$ S/cm)	Pre and post sampling event	$\pm$ 25.0 $\mu$ S/cm	Recalibrate instrument, repeat measurement	Volunteers; Program Staff
Turbidity	Measurement replicate	10% or each sampling event	ABS $\leq$ 1.0 NTU	Recalibrate instrument, repeat measurement	Volunteers; Program Staff
	Field blank	Pre and post sampling event	$\pm$ 0.1 NTU	Recalibrate instrument, repeat measurement	Volunteers; Program Staff

### Typical Quality Control Measures for Biological Sampling

Sample Type	Instrument/Parameter	Accuracy Checks	Precision Checks	% Field QC Samples (blanks and field duplicates)
Physical/visual	Habitat assessments	NA	Different personnel conduct side-by-side assessments, compare	10%
Physical/visual	Aquatic plants	2 personnel conduct separate mappings of same area, compare results, discuss to resolve differences.  2 personnel ID plants separately. Discrepancies/unknowns taken to expert for ID confirmation.	Different personnel conduct side-by-side assessments, compare	10%
Physical/visual	Benthic macroinvertebrates	IDs verified by external expert. 90% Accuracy of identification when Invertebrate Scientific Advisor examines a minimum of 10% of the original samples	Different personnel conduct side-by-side assessments, compare	10%
Physical/visual	Nekton	100% Accuracy of identification evaluated by the Scientific Advisor(s)	N/A	N/A
Physical/visual	Birds	100% Accuracy of identification evaluated by the Scientific Advisor(s)	N/A	N/A
Physical/visual	Vegetation	100% Accuracy of identification evaluated by the Scientific Advisor(s)	N/A	N/A
Inventory, quadrat and line transects	Algae, Eelgrass, Invertebrates	100% Accuracy to genus or species; taxonomic verification of voucher specimens by Scientific Advisor(s).	Different personnel conduct side-by-side assessments, compare	10%

*N/A = not applicable*

## EXAMPLE TEMPLATE #14: Data Management

### Data Management Narrative Statement

Below is a summary of data management procedures, including handling and statistical analyses.

**Data management process and procedures:** Data from field observations is recorded on standardized data sheets on-site at the time the measurements are taken. The volunteers are asked to check that all data is accurate and legible before making a copy and mailing it in on a bi-weekly basis. Volunteers may submit data in a word document copy of the standardized field data sheet via email to the Water Quality Monitoring Coordinator on a weekly basis, however all original field data sheets will also be submitted at the completion of the sampling season. As the data are received by the WQM Coordinator and WQM Assistant, they are reviewed, and the volunteers are contacted to clarify any numbers, issues or if any information is missing. The WQM Coordinator maintains the weekly basic parameter field dissolved oxygen and nutrient data sheets at the BBC office as hard copies of data as well as computer back-up of entered data. Copies of field data sheets are provided to associated laboratories performing the analysis.

The nutrient sampling field observations are recorded on the data sheet/chain of custody form on-site at the time the samples are collected. The volunteers are asked to check that all data is accurate and legible before signing and relinquishing the data sheets with the sample coolers to the WQM Coordinator and the lab. The nutrient analysis data are provided back to the WQM Coordinator in a predefined spreadsheet format. Data entry is checked by laboratory personnel and the QA/QC checks by the Project QA Officer. This nutrient spreadsheet is checked by the WQM Coordinator and if any unusual findings are noted, laboratory personnel will be contacted to discuss data. The nutrient spreadsheet is finally directly imported into the Water Quality Database and the whole of the data rechecked and merged into the Index spreadsheet.

All field data will be reviewed by the WQM Coordinator before being entered by the WQM Coordinator or WQM Assistant into a computer spreadsheet. Upon being entered, the data sheets will be checked against the spreadsheet on a regular basis and against a final print out. As the Water Quality Monitoring Program has been underway, a linked spreadsheet program has been developed to facilitate the data synthesis and display aspects of the project. The program includes automatic calculations of percent oxygen saturation for each entry which allow an additional mechanism for identifying unusual dissolved oxygen or temperature readings or potential data entry errors. If an unusual or unbelievable recording is noted, the volunteer will be contacted to discuss the data. Unusual data will be flagged for further discussion with the Project QA officer. Volunteers are also instructed to take replicate samples if an unusual reading is recorded in the field and record comments on data sheets.

Upon completion of data entry and data checks, the following will be calculated for each parameter: averages, minimum value, maximum value, standard deviation, and any other required calculation. The averages for percent oxygen saturation (using only lowest 20% of readings for any station), Secchi disk, chlorophyll, organic and inorganic nitrogen will be scored and combined to form the Health Index by which embayments will be compared. The linked spreadsheet program is used to produce the annually updated time series graphics and calculations of Bay Health Index. Statistical methods will be used to determine significant trends.

## EXAMPLE TEMPLATE #15: Reporting, Oversight and Assessments

### Reports

*For an Early Stage, Small Monitoring Program*

#### **Reports to Management Narrative Statement**

The Project Manager will submit quarterly progress reports and a final project report to the Project Officer for approval. This final report will include a complete discussion regarding the appropriate use and limitations of the data in terms of quality, as well as all datasets developed within the scope of this project. Additional reports or other information related to project status, concerns, completed deliverables, or any other project needs will be provided when requested.

*For an Experienced Long-Term Monitoring Program with State Funding*

#### **Reports to Management Narrative Statement**

An annual QA memorandum is written at the end of the data collection period. This memorandum summarizes the QA activities conducted during that year, including:

- Summary of QA/QC objectives;
- Description of training activities;
- Conformance to QAPP requirements/procedures, and descriptions of deviations, if any, from the approved QAPP and approved amendments, if any, to the QAPP;
- Limitations of data;
- Documentation of usable data versus amount of data actually collected;
- List of reasons why data are not usable. This includes a review of any of the following
  - Precision
  - Accuracy
  - Representativeness
  - Completeness
  - Comparability
  - Sensitivity
- Summary of conflicts, and subsequent resolution of conflicts, associated with sampling; and
- Use and effectiveness of corrective actions, if corrective actions were taken.

Copies of the memorandum are retained in the program files for reference when preparing the 303(d) list and 305(b) reports. Copies are also transmitted to the state Quality Assurance Manager. Program data are consistently reviewed during the sampling period to determine sampling efficiency.

Quality Assurance System Program Self-Audits are conducted annually for the general operation of program, pursuant to Chapter 9 and Chapter 10 of the state Quality Management Plan (QMP). These assessments document the deviations, if any, between the operation of program during any year, and the consistency with the approved QAPP. The results of the self-audits are transmitted to the state QA Manager.

Though frequent QA management reports will not be generated, frequent review of program data will be conducted to determine sample efficiency. In addition, information is provided to each program group in their annual report documenting any QA issues and flagging data that has been deemed invalid for water quality assessments.

**Assessment**

**Assessment of Data input and Volunteer Field Sampling**

Assessment Type	Frequency of Assessment	What is Being Assessed	Who Will Conduct the Assessment	How Issues or Deviations will be Addressed
Data Checks and Assessments	1/month	Field data entries into spreadsheet and database	Quality Assurance Manager	Verify with sampling team
On-Site Field Inspection	2 weeks into sampling season and mid-season	Field sampling procedures by volunteers compared to the QAPP and SOPs	Quality Assurance Manager	Re-train if necessary

## EXAMPLE TEMPLATE #16: Data Review and Usability

### Data Review and Usability Narrative Statement

**Data Review:** As part of the data review and validation, all field and lab data will be reviewed and discussed by the Program Coordinator to determine if the data meet the objectives as outlined in the QAPP. Decisions will be made to accept or reject the data before presenting the information in any presentations or reports. Errors in data entry will be corrected and any outliers will be flagged for further review. Any data deemed to be not acceptable will be noted in the comments fields of the Program database and will be removed from any statistical calculations.

**Data Verification and Validation:** All data reported for the program will be subject to checks by the Program Coordinator for errors in transcription, calculation, or computer input. Additionally, all data forms will be reviewed to ensure that they are complete and signed by the volunteers. All data forms must be signed and dated on the back of the original data form by the reviewer. Any changes made to the data form must be initialed and dated, and any action taken because of the data review must be recorded on the data form below the reviewer's signature. Only data that meets the following conditions will be accepted and entered into the Monitoring Project Data File:

- Monitors have appropriate levels of training for the tests being conducted.
- Monitors have successfully participated in required training or QA reviews.
- Equipment has been checked and approved prior to or during an annual QA review.
- Data forms are signed by monitors, and date, time, station number, and station description are recorded.
- All required equipment calibrations have been completed and recorded.
- Data entries are legible.

All data that is manually entered into monitoring project database will be verified by a second person. Errors will be immediately corrected.

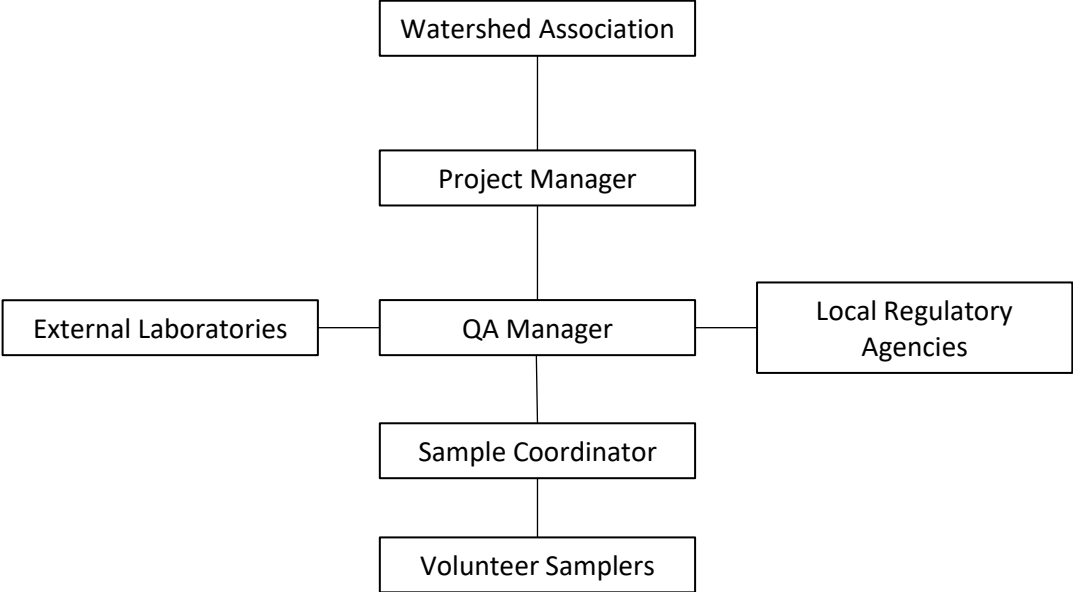
**Data Usability:** Data quality objectives and validation procedures for this program have been designed to ensure that volunteers and/or the Program Coordinator will be able to identify and correct problems in data collection and reporting. Should the results of data validation measures or quality assurance reviews indicate that the integrity of data is questionable and data quality objectives are not being met, the data set (or that portion which is deficient) must be flagged as unacceptable for inclusion in the Program Data File.

The responsibility for deciding to take any corrective action rests with the Program Coordinator. The Program Coordinator is responsible for ensuring that all corrective measures recommended from QA reviews are implemented by monitors. The Program Coordinator has the authority to question data, call for re-training, and recommend replacement of monitors when necessary.

**Data Presentation:** Graphic representation of the data will be provided in the final report.



**EXAMPLE TEMPLATE #17: Project Organization Chart**



**EXAMPLE TEMPLATE #18: Project Organization****Project Organization Table**

Name	Title	Organizational Affiliation	Responsibilities
	Project Manager	Watershed Association	The Project Manager is responsible for the management of the monitoring program. At a minimum, the Project Manager is responsible for obtaining adequate equipment and supplies, training personnel, managing the volunteer sampling process, scheduling, reporting, and taking constructive corrective actions when required.
	QA Manager	Watershed Association	The QA Manager is an individual with adequate expertise in analytical chemistry and field operations to review the procedures and data generated by this project. When necessary, the QA Officer will consult outside experts, including appropriate State Department of Environmental Protection and Environmental Protection Agency (EPA) staff, on relevant technical issues. The QA Officer will ensure that every provision of the QAPP is conducted to the maximum extent practicable. The QA Manager will report any problems to the monitoring program Project Manager after sampling events, and work with the Project Manager to document and correct any deviations, consulting outside experts and advisers as necessary. As appropriate, significant deviations will be reviewed for approval by signatories.
	Sample Coordinator	Watershed Association	For a given sampling event, the Sample Coordinator is responsible for orchestrating the collection of samples and organizing them for pickup by the QA officer for delivery to labs and for other testing. The Sample Coordinator receives samples from volunteer samplers at the watershed association office or other location. The Sample Coordinator is responsible for maintaining proper preservation of samples prior to transport to the lab and supervises volunteer monitors filling out chain of custody forms. The Sample Coordinator will have access to a

			<p>telephone during the monthly sampling event for last minute problems or scheduling. In addition, the Sample Coordinators will replenish supplies for the Volunteer Samplers for the next sampling round.</p> <p>For a given event, the role of Sample Coordinator may be executed by the QA officer, Project Manager, or other trained watershed association staff member, or by a suitably trained volunteer.</p>
	Instructor	Watershed Association	<p>Instructors train and evaluate Volunteer Samplers. They must be familiar with the monitoring program QAPP and the Water Quality Manual. It is recommended that instructors who are not trained staff members of watershed association conduct at least one year of independent sampling and field analysis for the monitoring program or any other institution before assuming the role of Instructor. At the training, topics discussed include: proper sampling techniques and locations, safety, and handling of samples.</p>
	Volunteer Samplers	Watershed Association	<p>Volunteer Samplers perform all field measurements, complete all records, and coordinate the actual collection of samples during a sampling event. The Volunteer Samplers are required to read, understand, and perform all procedures in the Mystic Monitoring Network Water Quality Manual. In addition, they are required to participate in the monitoring program Training Program.</p>

**EXAMPLE TEMPLATE #19: Project Distribution List****Project Contact Information**

Name/Title	Contact Information
Project Manager	Phone Number (xxx) xxx-xxxx Email: <a href="mailto:ProjectLead@email.com">ProjectLead@email.com</a>
Project QA Manager	Phone Number (xxx) xxx-xxxx Email: <a href="mailto:PrjoectQA@email.com">PrjoectQA@email.com</a>
Field Sample Coordinator	Phone Number (xxx) xxx-xxxx Email: <a href="mailto:SampleCoord@email.com">SampleCoord@email.com</a>
Laboratory Contact	Phone Number (xxx) xxx-xxxx Email: <a href="mailto:Samples@TestLab.com">Samples@TestLab.com</a>