Citizen Science Q&A: Quality Assurance Project Plans or QAPPs
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Through the Citizen Science Association Law & Policy Working Group, the Emmett Environmental Law & Policy Clinic at Harvard Law School has volunteered to make its students available to answer questions about relevant laws and policies raised by citizen science projects. The questions below were submitted through the working group's question submission form.

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Question 1: Are there court cases brought by environmental or community groups where the court talks about Quality Assurance Project Plans (QAPPs), either because the plaintiffs used one or because the court thinks they should have used one?

There are very few judicial decisions involving the use of QAPPs by environmental or community groups. In particular, we have not identified any decisions where such groups alleged violations of the environmental laws, supported those claims by citizen-generated data, and the court ruled on the adequacy of those data with reference to the citizens' use or failure to use a QAPP. One case we found involved the plaintiffs' request that the court require the defendant to implement a monitoring program as a remedy in a Clean Water Act case, and the defendant's argument that the proposed monitoring should be rejected because it did not include a QAPP. Another case involved a state's decision not to place certain water bodies on its Section 303(d) impaired waters list after community groups submitted data gathered without a QAPP that suggested the waters were impaired. A third case involved a challenge to a Forest Service cattle grazing program.

A. Center for Environmental Law & Policy v. United States Fish & Wildlife Service

In this case, the Center for Environmental Law & Policy (CELP) filed a motion for a permanent injunction against the U.S. Fish and Wildlife Service (FWS) for discharging pollutants into a creek without a National Pollutant Discharge Elimination System (NPDES) permit.[1] Among other remedies, CELP wanted FWS to implement a monitoring program at the creek to facilitate its eventual compliance with the Clean Water Act (CWA).[2] The FWS argued that this monitoring requirement would be "inconsistent with what is ultimately required by the NPDES permit, thus creating unnecessary expense, and would not yield scientifically valid or useful data because CELP [had] not proposed a Standard Operating Procedure and Quality Assurance Project Plan."[3] Accordingly, the FWS argued in part that CELP's request that the FWS create a monitoring program should be denied because CELP had not proposed a QAPP.

The court granted the injunction in part, but postponed the organization's requested monitoring requirement.[4] With regard to the monitoring program, the court agreed with FWS that "requiring monitoring now could be problematic if an NPDES permit is issued in a few months and includes different monitoring requirements."[5] However, the court, also acknowledging that the FWS had been illegally discharging pollutants for over thirty-seven years,[6] held that if an NPDES permit were not in effect by January 1, 2018, then the court *would* impose a temporary monitoring requirement on FWS and require it to disclose the results of this monitoring on its website.[7] Thus, the court disagreed with the FWS's argument that CELP's immediate failure to propose a QAPP would make a monitoring requirement useless.[8] Rather, to ensure that the monitoring data was "scientifically valid and useful," the court ordered the parties to confer and propose a monitoring plan to the court on or before September 1, 2017.[9]

B. Potomac Riverkeeper, Inc. v. Wheeler

In this case, Potomac Riverkeeper and other community groups who use the Shenandoah River challenged the U.S. Environmental Protection Agency's (EPA) approval of Virginia's 2016 Section 303(d) "impaired waters" list in part because Virginia's Department of Environmental Quality (VDEQ) refused to rely on the Shenandoah Riverkeeper's submitted data.[10] In explaining its refusal to base its impairment decision on the citizen-group data, VDEQ noted that the data was not collected under a QAPP.[11]

Procedurally, the plaintiffs claimed that VDEQ had failed to follow two EPA regulations: (1) 40 C.F.R. § 130.7(b)(5), which requires states to "assemble and evaluate all existing and readily available water quality-related data and information to develop the [state's impaired waters] list[;]" and (2) 40 C.F.R. § 130.7(b)(6)(iii), which requires states to provide a "rationale for any decision to not use any existing and readily available data and information . . . as described in § 130.7(b)(5)."[12]

VDEQ claimed that it considered the data provided by Shenandoah Riverkeeper in compliance with EPA's regulations, but refused to rely on such data because its policy required that the agency *base* its impairment decisions *solely* on "data collected with an agency-approved quality assurance plan."[13] EPA eventually approved VDEQ's impairment list, but clarified that "'the lack of a formalized methodology' for handling particular kinds of data 'is not a basis for a state to avoid evaluating data or information when developing its 303(d) list.'"[14] VDEQ could not categorically exclude citizen-group data because it was not collected under a state-approved QAPP.[15]

The court found that, under EPA's regulations, VDEQ must "take the preliminary step of 'assembl[ing] and evaluat[ing] data' before deciding whether to 'use' or 'to not use' the data to make an impairment determination."[16] However, VDEQ's decision *to not use* data requires only a logical rationale which EPA has discretion to either accept or reject.[17] Thus, the court concluded that because VDEQ considered the citizen group's data, did not reject the data entirely, and explained that citizen-collected data must undergo the same scrutiny as VDEQ-collected data, VDEQ "met its obligation to 'assemble and evaluate'" the data.[18] Finally, the court found that EPA reasonably accepted VDEQ's decision not to use citizen-collected data to make its impairment decision.[19]

Accordingly, while a state cannot categorically reject citizen-science data without reason because of 40 C.F.R. § 130.7(b)(5), this case suggests that state agencies and EPA have significant leeway in determining how much weight to give to data that was not collected under a QAPP.

C. Central Sierra Environmental Resource Center v. Stanislaus National Forest

In this case, the Central Sierra Environmental Resource Center (CSERC) prepared a QAPP in 2009 "to establish methodologies to sample, gather, and report on water quality in streams in Stanislaus National Forest" for Section 303(d) listing purposes.[20] CSERC, continuing to use the "same testing that [it] conducted in 2009-2010," argued that subsequent data showed that "the Forest Service [was] authorizing grazing on its land that result[ed] in violations of the REC-1 standard in the Basin Plan," and that doing so was arbitrary and capricious under the Administrative Procedure Act (APA).[21] However, despite CSERC's evidence, the court held that due to the "Forest Service's efforts to reduce potential water quality violations, issuing the challenged grazing permits and [Areas of Interest or AOIs] was not arbitrary, capricious, or contrary to law."[22]

Although CSERC lost this CWA claim, the court explained that the 2009 data CSERC collected under its QAPP was incorporated into State Water Board and EPA processes that ultimately resulted in the inclusion of six creeks recommended by CSERC in the Central Valley Regional Board's 303(d) list of "impaired waters."[23] According to the State Water Board, "data collected under a QAPP 'pursuant to the requirements of 40 CFR 31.45[24] are acceptable for use in developing the [CWA] section 303(d) list.'"[25] Thus, even though CSERC lost its CWA claim, it seems that having a QAPP allowed CSERC to influence what streams where included on the Section 303(d) list.

Question 2: Are there states that require that citizen groups follow a QAPP before the state agency will use the data? Does it depend on the purposes for which they are using the data? Are there states that provide assistance to community groups in preparing QAPPs?

In almost all states, the state environmental agency has a QAPP in place for its own water quality monitoring program. Some states, such as Maine, require citizens participating in a volunteer water quality monitoring program to follow this existing QAPP, although some changes can be made to the sampling requirements to meet the specific project goals. Some states (such as Massachusetts) require a QAPP for all data used by the agency, while others (such as Illinois and North Carolina) require a QAPP only when data is being used for agency decision-making, but not for educational purposes.

Most states appear to follow EPA's guidelines for developing a QAPP, both for agency data collection and citizen science projects. As a general rule, citizen science data collection projects should have some form of a QAPP in place if the volunteers hope to have the data used as part of a rulemaking or enforcement action process.

Alabama: Alabama Water Watch is a statewide, volunteer water quality monitoring group that has an EPA- and Alabama Department of Environmental Management-approved QAPP.[26]

Arizona: For the Arizona Department of Environmental Quality (ADEQ), data are credible and relevant to an impaired water identification or Total Maximum Daily Load (TMDL) decision

only when the monitoring entity provides the Department: (1) a Quality Assurance Plan (QAP) that contains minimum information requirements; and (2) a Sampling and Analysis Plan (SAP) that contains certain minimum information requirements.[27] ADEQ may accept a QAP or SAP with less than the required elements if "an element is not relevant to the sampling activity and [] its omission will not impact the quality of the results based upon the type of pollutants to be sample[d], the type of surface water, and the purpose of the sampling."[28] Moreover, ADEQ may determine that other types of data are credible, including:

a. Data collected before July 12, 2002 that ADEQ determines yield results of comparable reliability to the data collected under the QAP and SAP requirements;

b. Data collected before July 12, 2002 as part of an ongoing monitoring effort by a governmental agency and that ADEQ determines yield results of comparable reliability to the data collected under the QAP and SAP requirements; or

c. Instream water quality data collected under the terms of a NPDES or AZPDES permit or a compliance order issued by ADEQ or EPA, a consent decree signed by ADEQ or EPA, or a sampling program approved by ADEQ or EPA under WQARF or CERCLA, and ADEQ determines that the data yield results of comparable reliability to data collected under the QAP and SAP requirements.[29]

Overall, a monitoring entity must collect, preserve, and analyze data using methods of sample collection, preservation, and analysis established under Ariz. Admin. Code R9-14-610.[30]

For more information on water quality monitoring, see ADEQ's citizen science webpage[31] and the Arizona Water Watch Citizen Science Handbook.[32]

Alaska: The Alaska Department of Environmental Conservation (ADEC) requires individuals to submit a QAPP before collecting and submitting water quality data.[33] The agency provides a Water Programs Quality Management Plan, a template QAPP, and contact information for further assistance.[34]

Arkansas: Although Arkansas does not explicitly require a QAPP for citizen science data, the agency has a QAPP for its own data collection and analysis, Arkansas' Water Quality and Compliance Monitoring Quality Assurance Project Plan.[35]

California: The California State Water Resources Control Board requires a QAPP for citizen science monitoring projects (*e.g.*, Yuba Watershed Monitoring Project) and provides guidance documents, a checklist, examples, and contact information for further assistance with putting together a QAPP.[36]

The California Air Resources Board (CARB) provides the Quality Management Plan (QMP): Volume I of the Quality Assurance Manual, the Quality Assurance Project Plan for Gaseous Pollutant Air Monitoring Program (Gas QAPP), and a QMP Checklist.[37]

Colorado: The Colorado Water Quality Monitoring Council requires a SAP or QAPP for water quality sampling projects.[38] The Colorado Department of Public Health and Environment provides a SAP template here.[39]

Connecticut: Although the Connecticut Department of Energy and Environmental Protection (DEEP) does not explicitly require that citizen scientists obtain a QAPP to submit data to the agency, DEEP provides its own 2014-2018 Quality Management Plan (QMP) on its webpage.[40] An updated version of the QMP is expected to be available sometime in 2020.

District of Columbia: No person may "perform monitoring for the regulatory and decisionmaking purposes of the [District of Columbia Water Pollution Control Act of 1984] without a quality assurance project plan approved by" the Director of the Department of Consumer and Regulatory Affairs or his or her representative.[41] The QAPP must contain the following information: (a) Purpose of the monitoring; (b) Location of the monitoring; (c) Frequency of the monitoring; (d) Type and number of samples to be collected; (e) Parameters to be analyzed; (f) Laboratory facilities to be used; (g) Start and end dates for the monitoring; and (h) Quality assurance manual.[42] An example of an environmental group's QAPP is available here.[43]

Florida: The submission of environmental data or reports to the Florida Department of Environmental Protection (FDEP) must follow the quality assurance procedures provided in Title 62, Chapter 62-160 of the Florida Administrative Code, entitled "Quality Assurance." Procedures listed in this regulation include, but are not limited to:

> field activities (sample collection, sample preservation, field measurements, and site evaluation); sample handling, storage and/or transport (except common carriers); laboratory activities (e.g., sample receipt, analysis, data review and data validation); additional data review, summaries or data presentation activities; and all activities that impact data quality such as providing sample containers, instrument calibration services, or reagents and standards (except commercial vendors).[44]

Georgia: "Sampling methods for water quality samples collected and reported by any person(s), (including volunteer groups), to the [Georgia Department of Natural Resources, Environmental Protection Division] for its use in listing or delisting impaired waters pursuant to the State's responsibilities under Sections 303(d) and 305(b) of the Federal Act [must] conform to the guidance in the Water Protection Branch Quality Assurance Manual (June, 1999), or most current version[45]…. Analytical standards for these samples must comply with the requirements of Title 40, Code of Federal Regulations, Part 136. Sample analyses shall be performed by an analyst certified in compliance with the Georgia State Board of Examiners for Certification of Water and Wastewater Treatment Plant Operators and Laboratory Analysts Act, as amended, or by a laboratory facility accredited in compliance with the Georgia Rules for Commercial Environmental Laboratory Accreditation (O.C.G.A. 12-2-9). *A site-specific sampling and quality assurance plan is required if the data is to be considered and Division concurrence must be obtained prior to monitoring*. Laboratories operated by Federal and State government agencies and laboratories at academic institutions with active or current contracts with the Division are exempt from these provisions. *The Division may use water quality data for screening purposes if it was collected by any person(s), (including volunteer groups), without an approved sampling and quality assurance plan.*"[46]

Hawaii: The Hawaii State Department of Health (DOH) requires the development of a QAPP, Quality Assurance/Quality Control (QA/QC) and Standard Operating Procedures (SOP) for those interested in submitting data to the DOH.[47]

Idaho: Under the Idaho Department of Environmental Quality's (IDEQ) Outside Data Policy, information collected by unknown or untrained individuals who have not followed standard or reported protocols is categorized as Tier III data.[48] Tier III data "may be considered as general background information, but it is not of sufficient rigor and relevance for listing decisions or regulatory actions."[49]

Tier II information, where "data collectors will have followed documented field, laboratory, and data-handling protocols," is used in Section 305(b) reports, subbasin assessments, and TMDL development.[50] IDEQ usually considers citizen volunteer monitoring data as Tier II data.[51]

Tier I data connotes the highest degree of scientific rigor, and is characterized as typically including "monitoring data collected by professional scientists or professionally trained technicians."[52] Tier I data are collected under a QAPP.[53]

Illinois: To be considered in the state's process for revising its list of impaired waters under Section 303(d) of the CWA, the Illinois Environmental Protection Agency (Illinois EPA) requires that all submitted data be collected pursuant to a QAPP approved by a project manager and quality-assurance officer.[54] The plan must be prepared in accordance with the U.S. Environmental Protection Agency's guidance document EPA QA/R-5, *EPA Requirements for Quality Assurance Project Plans*, March 2001.[55]

Illinois also has a three-tier voluntary lake monitoring program.[56] Only Tier 3 volunteers, who are subject to more stringent requirements and are chosen by the Illinois EPA, can collect data for agency decision-making.[57] It is not clear that a QAPP is needed for Tier 3 volunteers under this program.

Indiana: The Indiana Department of Environmental Management (IDEM) uses a tiered approach to external data. The three tiers, level of scientific rigor, and potential uses are listed in the table below.[58]

Data Tier	Scientific Rigor Requirements	Potential Uses for Which the Office of Water Quality (OWQ) Considers the Data Reliable
3	Data must possess a high level of scientific rigor and are reliable for OWQ regulatory decision-making	• CWA Section 305(b) assessments of beneficial use support and Section 303(d) listing decisions • Determining lake trophic level and lake trends for CWA Section 314 assessments • TMDL modeling • Determining representative background conditions for the purpose of developing NPDES permits • Determining or changing the anti-degradation classification of a waterbody

		• One of more Tier 2 uses
2	Data must possess a moderate level of scientific rigor and are reliable for non-regulatory decision-making by OWQ and the other uses shown	• Supplementary information for use in planning and prioritization of OWQ monitoring efforts for baseline and other projects • Supplementary information for use in planning and prioritizing watersheds for TMDL monitoring and development • Demonstrating the effectiveness of implementation of measures recommended in a watershed management plan or an approved TMDL (incremental improvements that meet EPA performance measures) • Establishing need for low interest loans to assist with formation of regional sewer and water districts (RSWDs) • Supplementary information for use in evaluating loan applications for drinking water and wastewater infrastructure improvements through the Indiana State Revolving Loan Fund (SRF) • Supplementary information for use in evaluating CWA Section 401 permit applications and identifying potential wetland mitigation sites[59] • Watershed management planning • Determining water quality trends over time • Increasing public awareness, support and involvement in water quality improvements by demonstrating the effectiveness of measures implemented as recommended in watershed management plans, approved TMDLs, long-term combined sewer overflow (CSO) control plans and municipal separate storm sewer system (MS4) permits • Screening for potential recreational use issues including human health use (lakes and streams) and aesthetics (lakes) • All Tier 1 uses
1	Data are not reliable for decision-making either because data quality is unknown or is based on sound science but characterized by a low level of scientific rigor	• Education and raising awareness • Supplementary information for total maximum daily load development • Supplementary information for OWQ's Integrated Report

To validate external data for agency use, IDEM will further look for the following types of data quality documentation:

a. A QAPP;

b. Any project-specific planning documents that describe the study design, identify the analytical equipment and methods used, and document the quality assurance and quality control procedures, etc.;

c. Standard Operating Procedures (SOPs) that describe field, laboratory, or other relevant processes;

d. Published, approved sampling or analytical methods and documents that describe any non-standard analytical methods used; or

e. Results from quality control samples and other procedures designed to ensure data quality.[60]

Nonetheless, IDEM only *requires* QAPPs for EPA-funded projects.[61] For more guidance and templates, see IDEM's QAPP Guidance and External Data Framework (EDF) webpages.[62]

Iowa: In order to submit water quality data, volunteer monitoring groups must first submit a "volunteer water quality monitoring plan" for the Iowa Department of Natural Resources' (IDNR) approval.[63] The plan must include a "statement of intent[,]" the names of all participants, the duration of the monitoring effort, the "[l]ocation and frequency of sample collection[,]" the "[m]ethods of data collection and analysis[,]" and "[r]ecord keeping and data reporting procedures."[64]

In addition to this, citizen-submitted data must be approved before it is considered credible.[65] To be approved, data must be submitted by a "qualified volunteer" who must request that it be deemed credible at the time of submission.[66] "[Q]ualified volunteers must have the training and experience to ensure quality assurance and quality control for the data being produced, or be under direct supervision of a person having such qualifications."[67]

IDNR thus requires a QAPP for its volunteer water quality monitoring program, and provides EPA's guide for creating a QAPP.[68]

Kansas: The Kansas Department of Health and the Environment requires the development of a QAPP for stream teams and volunteer monitoring projects.[69]

Kentucky: The Kentucky Energy and Environmental Cabinet's Division of Water (DOW) requires a QAPP whenever "DOW funds a project or issues a certification."[70] A project must also "develop or follow existing [Standard Operating Procedures or SOPs] that have been reviewed and approved by DOW and [Cabinet] quality assurance staff."[71] Templates are available here.[72]

Louisiana: The Louisiana Department of Environmental Quality has an approved QAPP for its Ambient Water Quality Monitoring Data Network.[73] It is unclear how citizen scientists would participate in the network and whether they would need to obtain an additional QAPP.[74]

Maine: All samples of benthic macroinvertebrates that are collected for the purpose of classifying attainment of waters and streams, whether collected by the Maine Department of

Environmental Protection (Maine DEP) or by any person submitting data to Maine DEP, must include a QAPP approved by the Department.[75]

Maine DEP also has a project-wide QAPP and SOPs in place for its Volunteer River Monitoring Program.[76] Volunteers and groups taking part in this water quality monitoring program must follow this QAPP, although they may alter the sampling and analysis plans (SAPs) to more closely meet the goals of their specific project.[77]

Maryland: The Maryland Department of the Environment (MDE) uses a tiered approach to using external data for water quality monitoring.[78]

Data Tier	Scientific Rigor Requirements	Potential Uses for Which MDE Considers the Data Reliable
Level 3 data are regulatory, decision-making, legally defensible data.	• These data must be accompanied by a QAPP consistent with EPA data guidance specified in *Guidance for Quality Assurance Project Plans*. • Documentation of field sampling and/or lab testing protocols or SOPs required. • This information must be consistent with Maryland's Assessment Methodologies.	• List or delist waters (Category 2 or Category 5) on the Integrated Report (IR) • Assess waters for IR • Attainment purposes • Use with state data for TMDL development • All uses listed in Levels 1 and 2
Level 2 data are data with a defined methodology but do not meet Level 3 data requirements and are not used to make regulatory assessment decisions (Category 2 or Category 5 of the IR). However, waters with this level of data may be placed in Category 3 of the IR, denoting that there are insufficient data to make an assessment but that follow up monitoring is necessary.	• These data should be accompanied by QAPP consistent with EPA data guidance specified in *Guidance for Quality Assurance Project Plans* or other equivalent documentation. • Field sampling and/or lab testing protocols or SOPs. • This information may use a monitoring method similar to MDE protocols but not fully approved by MDE due to differences in sampling or testing methodology.	• Track performance of TMDL implementation • Category 3 designations for the IR • Help target stream segments for water quality standards attainment assessments • Be used as initial screening for listing or delisting waters (Category 2 or Category 5) on the IR • Identify waters for MDE follow up monitoring • All uses listed in Level 1
Level 1 data include programs whose data do not meet the requirements of Level 2 and Level 3 but are of known quality and as a result still contribute to understanding of the health of the Bay watershed.	• No QAPP or SOP required by MDE. • Uniform methodology recommended. • QAPP, SOPs and/or lab methods do not meet MDE quality assurance/quality control requirements.	• Educational or outreach purposes • Location information on where monitoring is taking place • Baseline data • Notification of possible pollution events

	• May include land use data, visual observations of water quality condition, or data not consistent with Maryland's Assessment Methodologies.	• Assess the general condition of surface waters in Maryland • Identify waters for MDE follow up monitoring • Highlight local, community projects that are implemented to improve the health of the Bay watershed

MDE provides a link to EPA's QAPP documentation, and contact information for further technical assistance.[79]

Massachusetts: For the Massachusetts Department of Environmental Protection (MassDEP) to use external data:

a. Monitoring must be conducted under a MassDEP-approved QAPP, which includes program specifics, the SOPs for field sampling and laboratory analyses, and other details;

b. Samples must be analyzed by a qualified laboratory that has proven capabilities for the selected analyses, well-documented SOPs, and a quality assurance plan; and

c. Information must be documented in a citable report, which includes in addition to data and data analysis, a discussion of quality assurance and quality control (QA/QC) results, as well as data management.[80]

While MassDEP does not provide direct technical assistance in preparing QAPPs, the agency offers guidance documents and examples on its website: (1) Massachusetts Inland Volunteer Monitoring General Quality Assurance Project Plan (QAPP); (2) Massachusetts Volunteer Coastal Monitoring General Quality Assurance Project Plan (QAPP).[81]

Michigan: The Michigan Department of Environment, Great Lakes, and Energy's (EGLE) Cooperative Lakes Monitoring Program and Michigan Clean Water Corps both offer volunteer water quality monitoring opportunities.[82] While EGLE does not explicitly state that citizen science will only be considered by the agency by following a QAPP, the Cooperative Lakes Monitoring Program follows a quality assurance/quality control process.[83]

Minnesota: If a citizen scientist is interested in having their data used by the Minnesota Pollution Control Agency (MPCA) for assessment purposes, *i.e.*, CWA Section 303(d) impairment listing or CWA Section 305(b) use-support status, the citizen scientist must complete a monitoring plan that contains all the applicable elements of a QAPP prior to beginning the sampling.[84]

For further information on standard operating procedures for water quality monitoring visit here.[85]

Mississippi: While it is unclear whether the Mississippi Department of Environmental Quality (MDEQ) uses citizen scientist data, all sampling for water quality used by the agency "must be

conducted in accordance with the MDEQ-approved Quality Management Plan (QMP), Quality Assurance Project Plan (QAPP), or its equivalent."[86]

MDEQ provides a library of EPA quality assurance guidelines here.[87]

Missouri: For the development of an impairment list under Section 303(d) of the CWA, the Missouri Department of Natural Resources (MDNR) "will receive and review all data submitted, and will use scientifically defensible data."[88] Scientifically defensible data must meet one of the following criteria:

a. All environmental data generated directly by MDNR or through contracts funded by the department or EPA are governed by a QAPP as required by the Total Quality Management Plan completed by MDNR and EPA. The organization responsible for collection or collection and analysis of the environmental sampling must write and adhere to a QAPP approved by MDNR's quality assurance manager; or

b. All environmental data collected by any other agencies, organizations, or individuals that are governed by an internal quality assurance program that has been reviewed and approved by MDNR.[89]

Montana: The Montana Department of Environmental Quality (MDEQ) has a voluntary water quality monitoring program. A sampling and analysis plan (SAP) or QAPP is required for volunteers to submit data.[90]

Nevada: While the Nevada Division of Environmental Protection does not explicitly require citizen scientists to obtain a QAPP to submit data to the agency, the "Nevada Quality Assurance Program Plan [] for Surface Water Sampling establishes specific quality requirements for the collection and management of surface water quality data."[91]

New Hampshire: The New Hampshire Department of Environmental Services (NHDES) administers Watershed Assistance Grants to support local projects that help monitor and control nonpoint source pollution.[92] The funding for these grants comes from EPA under Section 319 of the CWA.[93] Any project funded by these grants, which involves the collection, analysis, or manipulation of environmental data, requires the preparation of a quality assurance document, *i.e.*, a QAPP or a site specific project plan (SSPP).[94] The document must be approved by NHDES and EPA prior to monitoring and collection.[95]

NHDES provides guidance and template QAPPs and SSPPs for citizen scientists here.[96]

New Jersey: Data that has met specific quality requirements in accordance with a QAPP and is submitted electronically through EPA's Water Quality Exchange (WQX) web portal can be used by the New Jersey Department of Environmental Protection (NJDEP) to assess water quality for the New Jersey Integrated Water Quality Assessment Report.[97] The agency provides documentation on how to prepare a QAPP and examples of QAPPs here.[98]

New Mexico: The New Mexico Environment Department (NMED) requires organizations that are funded by EPA grants, and collect environmental data used in decision-making, to obtain an approved QAPP.[99] Organizations may also have to provide NMED a Field Sampling Plan (FSP)

for the project.[100] However, a FSP is not needed if a project specific QAPP has sufficient details regarding the sampling plan.[101]

EPA- and NMED-approved QAPPs are available here.[102]

New York: The New York Department of Environmental Conservation (NYDEC) requires a QAPP for all data used by the agency, whether it is generated by DEC or by an outside party: "All environmental projects are to be conducted according to approved Quality Assurance Project Plans (QAPPs), Standard Operating Procedures (SOPs), equipment manufacturers specifications and 40 CFR Part 136, as appropriate."[103] NYDEC follows EPA's QAPP requirements.[104]

North Carolina: The North Carolina Department of Environmental Quality (NCDEQ) requires a QAPP for citizen science water quality data for most agency uses of that data.[105]

Data Tier	Scientific Rigor Requirements	Potential Uses for Which NCDEQ Considers the Data Reliable
Submitting Data for Regulatory Use	• From representative location • Sufficient number of samples • Analyzed by certified lab • Applicable NC standard • QA/QC documentation, including QAPP and SOPs	• CWA Section 303(d) listing • Use support • Standards attainment • Water quality modeling
Submitting Data for Non-Regulatory Use	• Photos • Stories • Water quality data not from a certified lab • Water quality data for which NC has no standard	• Information • Screening • Support for water quality data • Further investigation

North Dakota: While the North Dakota Department of Environmental Quality (NDDEQ) does not explicitly state whether the agency requires citizen scientists to follow a QAPP, NDDEQ provides its own data collection methodology, SOPs, and chain of custody log forms here.[106]

Ohio: The Ohio Environmental Protection Agency (Ohio EPA) requires quality assurance documentation for all data submitted to the agency. Specifically,

> [s]tudy plans are required for all water quality monitoring projects undertaken pursuant to the credible data rules.[107] The person submitting the project study plan must be a Qualified Data Collector (QDC) [3745-4-03]. Ohio EPA will review project study plans (depending upon available personnel) within 60 days of receipt. Ohio EPA will notify the person submitting the project study plan when

deficiencies are found, and provide an opportunity to re-submit the plan. If not disapproved within 60 days, the project study plan is considered approved. The administrative rules for the program provide guidelines for the study plan content. Under the regulations the QDC is obligated to adhere to the study plan throughout the sampling effort.[108]

Data Tier	Scientific Rigor Requirements	Potential Uses for Which Ohio EPA Considers the Data Reliable
Level 3 Ohio Admin. Code 3745-4-06	• Level 3 QDC is required for selecting the appropriate field and laboratory methods, including quality assurance/quality control steps, that fit the objectives and purpose of the data collection project. • The QDC must prepare and follow an approved study plan using the guidelines found in Appendix A of rule 3745-4-06. Appendix B gives laboratory quality assurance plan guidelines.	• Any regulatory purpose
Level 2 Ohio Admin. Code 3745-4-05	• Level 2 or Level 3 QDC required. • The QDC must prepare and follow an approved study plan using the guidelines found in Appendix A of rule 3745-4-05. Appendix B gives laboratory quality assurance plan guidelines	• Initial screening of water quality • Evaluating the effectiveness of pollution control efforts
Level 1 Ohio Admin. Code 3745-4-04	• Level 1, Level 2, or Level 3 QDC is required. • The QDC must prepare and follow an approved study plan based upon guidance materials available from the sources listed below or other similar resources. o Healthy Water Healthy People: http://epa.ohio.gov/oeef/ProjectWET.aspx o U.S. EPA Volunteer Monitoring: https://www.epa.gov/nps/nonpoint-source-volunteer-monitoring	• Public awareness • Educational purposes

Level 2 and Level 3 study plans cover many of the same elements that EPA requires in QAPPs for EPA-funded water monitoring.[109] A citizen scientist receiving funding from the EPA should be able use the information in the QAPP to fulfill most Level 2 and Level 3 study planning guidelines.[110]

Oklahoma: The Oklahoma Conservation Commission has a volunteer monitoring program called Blue Thumb.[111] While it is unclear whether a QAPP is required, volunteers do have to follow peer- and EPA-approved SOPs issued by the Oklahoma Conservation Commission.[112]

The Oklahoma Department of Environmental Quality (ODEQ) also provides sample instructions for the general public on its website.[113]

Oregon: The Oregon Department of Environmental Quality (ODEQ) has an approved QAPP for its collection and use of water quality monitoring data.[114] Citizen scientists must "review this

QAPP to make sure they understand and agree to the general procedures that pertain to volunteer groups."[115] Citizen scientists must then "complete their own Sampling and Analysis Plan [SAP] which describes aspects of the monitoring that are specific to their project."[116] ODEQ provides a SAP template and protocols on the agency's website.[117]

Pennsylvania: For the Pennsylvania Department of Environmental Protection (PennDEP) to use outside data in CWA Section 305(b)/303(d) assessments, the data must have quality assurance documentation.[118] PennDEP will screen all outside sources of data for the following minimal requirements:

a. Written documentation of the protocols used in sampling and analysis describing quality assurance and quality control measures in the form of a Monitoring Study Design or QAPP; and

b. The location and extent of the waterbody.[119]

Citizen scientists who would like to begin monitoring with the goal of having their data utilized by PennDEP are encouraged to reference the published handbook for volunteer monitors: Designing Your Monitoring Program – A Technical Handbook for Community-Based Monitoring in Pennsylvania.[120]

Rhode Island: For the Rhode Island Department of Environmental Management (RIDEM), surface water samples must be "collected, preserved, and analyzed in accordance with 40 C.F.R. § 136."[121] Bioassays must also be performed in compliance with the protocols listed in 40 C.F.R. § 136.[122] Accordingly, citizen scientists most likely need to develop a QAPP and follow RIDEM protocols.[123]

South Carolina: The South Carolina Department of Health and Environmental Control (SCDHEC) "requires that all environmental special projects involving the generation, acquisition, and use of environmental data be planned and documented and have an Agency-approved QAPP prior to the start of data collection."[124]

For a QAPP template and further information on quality assurance documentation, please visit here.[125]

South Dakota: The South Dakota Department of Environment and Natural Resources' (DENR) Quality Management Plan applies to "[d]ata acquired from sources outside of DENR (databases, publications, contractual projects)."[126] Accordingly, for a citizen science project receiving Section 319 grant funds to collect environmental data, the project sponsor must have a project-specific sampling and analysis plan (SAP) that addresses the 16 elements required of a QAPP, and is approved by DENR and EPA.[127]

Texas: The Texas Commission on Environmental Quality (TCEQ) requires that all "environmental data generated and collected by or for TCEQ" for decision-making "is of known quality."[128] Environmental data operations subject to QAPP requirements include, but are not limited to:

a. sampling and analysis;

b. compilation or use of data collected from existing sources (acquired or secondary data);

c. development and/or use of models of environmental processes; and

d. collection or calculation of geospatial data.[129]

Any outside party preparing a QAPP must do so in accordance with the requirements contained in EPA's QAPP guidelines (EPA QA/R-5).[130]

A TCEQ QAPP template for surface water monitoring is available here.[131]

Utah: All water quality monitoring projects by the Utah Department of Environmental Quality (UDEQ) *and its cooperators* are required to meet the agency's blanket QAPP and standard operating procedures (SOPs).[132] Accordingly, citizen scientists wishing to influence UDEQ's decision-making should be prepared to write a Sample Analysis Plan (SAP) and follow UDEQ's SOPs.[133]

Vermont: "Sample collection, preservation, handling and analysis [must] conform as closely as practicable to methods established in the most current edition" of the QAPP prepared by the [Vermont Department of Environmental Conservation (DEC)] and EPA.[134] DEC thus requires a QAPP for water quality monitoring projects through its LaRosa Volunteer Water Quality Monitoring Analytical Services Partnership,[135] and provides umbrella QAPPs that volunteers must follow for its Lay Monitoring Program[136] and Lake Champlain Long-Term Water Quality and Biological Monitoring Project.[137]

Virginia: The Virginia Department of Environmental Quality (VDEQ) requires a QAPP for citizen science water quality data for most agency uses of that data (*see* table below).[138] VDEQ provides a QAPP template, citizen science manual, and contacts for questions.[139]

Data Tier	Scientific Rigor Requirements	Potential Uses for Which Ohio DEQ Considers the Data Reliable
Level III	• VDEQ-approved QAPP and field or lab SOPs. • Field and/or laboratory audit required. • Group provides calibration and quality control associated information to VDEQ when submitting data. • This information must meet the specific criteria stated in the QAPP.	• List or delist waters on the 303(d) Impaired waters list • Assesses waters for 305(b) Report • Use with VDEQ data for TMDL development • All uses listed in Levels I and II
Level II	• VDEQ-approved QAPP and approved field or lab SOPs • At this level, there may be deviation from an approved method if it can be demonstrated that the method collects data of similar quality to an approved method.	• Identify waters for VDEQ follow up monitoring • Track performance of TMDL implementation • All uses listed in Level I

Level I	• No QAPP or SOP required by VDEQ. • Uniform methodology recommended. • QAPP, SOPs and/or lab methods do not meet VDEQ quality assurance/quality control requirements. • There is no Virginia Water Quality Standard for parameter the method measures.	• Educational purposes • Baseline determination • Notification of possible pollution events • Local land use decisions • Special studies

Washington: In collecting and analyzing water quality data for (i) determining whether any water of the state is to be placed on or removed from the CWA Section 303(d) impairment list, (ii) establishing a TMDL, or (iii) determining a surface water's designated use, data is considered credible data if:

a. Appropriate quality assurance and quality control procedures were followed and documented in collecting and analyzing water quality samples;

b. The samples or measurements are representative of water quality conditions at the time the data was collected;

c. The data consists of an adequate number of samples based on the objectives of the sampling, the nature of the water in question, and the parameters being analyzed; and

d. Sampling and laboratory analysis conform to methods and protocols generally acceptable in the scientific community as appropriate for use in assessing the condition of the water.[140]

Most groups that have received a grant to complete water quality monitoring must therefore submit a QAPP before completing such monitoring.[141] The Washington Department of Ecology (DOE) provides a template , a checklist, and guidelines for completing the QAPP.[142]

West Virginia: The West Virginia Department of Environmental Protection (WVDEP) requires that project teams and volunteer monitoring projects funded by CWA Section 319 prepare QAPPs.[143] However, not all QAPPs will contain the same elements; "[s]ome projects require a more or less extensive QAPP, depending on project objectives. For example: a project that is intended to gather biological monitoring data for public information and education would probably not require the same QAPP elements as a project that is gathering stream chemistry data for decision making or planning purposes."[144]

Wisconsin: "Any grant provided for funding of a planning project that includes acquisition of physical or chemical data may be conditioned upon the sponsor being required to implement a quality control and quality assurance plan approved by" the Wisconsin Department of Natural Resources (WDNR).[145]

WDNR also provides umbrella quality assurance documentation for its citizen science volunteer projects.[146] For example, the Water Action Volunteers Stream Monitoring Program (WAV) "incorporates three levels of participation for citizen scientists who are interested in monitoring local streams: Introductory (Level 1), Status and Trends (Level 2), and Special Projects

Monitoring (Level 3)."[147] All volunteer levels must follow an EPA-approved QAPP[148] and/or WDNR's quality assurance/quality control methodologies, which are provided in project-specific manuals.[149]

Additional resources for project methodologies and protocols may be found here.

Wyoming: "Development of scientifically valid chemical, physical and biological monitoring data [must]:

(i) Consist of data collection using accepted referenced laboratory and field methods employed by a person who has received specialized training and has field experience in developing a monitoring plan, a quality assurance plan, and employing the methods outlined in such plans or works under the supervision of a person who has these qualifications. Specialized training includes a thorough knowledge of written sampling protocols and field methods such that the data collection and interpretation are reproducible, scientifically defensible and free from preconceived bias; and

(ii) Include[] documented quality assurance consisting of a plan that details how environmental data operations are planned, implemented and assessed with respect to quality during the duration of the project."[150]

Accordingly, all "local interest groups, volunteer monitors, individuals and land management organizations that want their water quality monitoring data accepted and used by the Water Quality Division (WQD) Watershed Protection Program (WPP) for designated use support determination must collect that data under an approved" Sampling and Analysis Plan (SAP).[151] Wyoming's water quality QAPP and standard operating procedures manual are available here.[152]

Topics for Additional Research

We were unable to find information regarding quality assurance procedures for Delaware, Nebraska, and Tennessee. Further research into the quality assurance guidelines for these states is recommended.

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[1] *Ctr. for Envtl. Law & Policy v. United States Fish & Wildlife Serv.*, No. 2:15-CV-0264-SMJ, 2017 WL 1731706, at *4-5 (E.D. Wash. May 3, 2017).

[2] *Id.* at *6.

[3] *Id.*

[4] *Id.* at *5-7.

[5] *Id.* at *7.

[6] *Id.* at *6.

[7] *Id.* at *6-7.

[8] *Id.* at *7 ("CELP is correct… that monitoring is a key part of ensuring compliance with limitations imposed by the CWA.").

[9] *Id.*

[10] *Potomac Riverkeeper, Inc. v. Wheeler*, 381 F. Supp. 3d 1, 15 (D.D.C. 2019).

[11] *See id.* at 9.

[12] *Id.* at 1.

[13] *Id.*

[14] *Id.* at 9–10.

[15] *Id.* at 10.

[16] *Id.* at 15.

[17] *Id.*

[18] *Id.* at 16.

[19] *Id.*

[20] *Cent. Sierra Envtl. Res. Ctr. v. Stanislaus Nat'l Forest*, No. 117CV00441LJOSAB, 2019 WL 3564155, at *9 (E.D. Cal. Aug. 6, 2019).

[21] *Id.* at *12.

[22] *Id.* at *17.

[23] *Id.* at *10-11.

[24] This regulation was removed in 2014. *See Federal Awarding Agency Regulatory Implementation of Office of Management and Budget's Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards*, 79 Fed. Reg. 75,735, 76,054 (Dec. 19, 2014).

[25] *Cent. Sierra Envtl. Res. Ctr.*, 2019 WL 3564155, at *9.

[26] Mobile Bay National Estuary Program, *Volunteer Water Quality Monitoring: A How-to Guide for Coastal Alabama* 7 (May 2017), http://www.mobilebaynep.com/images/uploads/library/Volunteer_WQM_Guide_narrative_final2017_08.pdf; *see also* Alabama Department of Environmental Management, *State of Alabama Water Quality Monitoring Strategy* 30-34, http://www.adem.state.al.us/programs/water/wqsurvey/WQMonitoringStrategy.pdf.

[27] Ariz. Admin. Code R18-11-602.A.

[28] *Id.* R18-11-602.A.1. & R18-11-602.A.2.b.

[29] *Id.* R18-11-602.A.4.

[30] *Id.* R18-11-602.A.5.

[31] *Citizen Science Water Monitoring | AZWW*, ARIZ. DEP'T OF ENVTL. QUALITY, https://azdeq.gov/node/4497.

[32] Arizona Department of Environmental Quality, *Arizona Water Watch Citizen Science Handbook* (Apr. 2017), https://static.azdeq.gov/wqd/azww/azww_handbook.pdf.

[33] *Alaska Ambient Water Quality Data Information*, ALASKA DEP'T OF ENVTL. CONSERVATION, https://dec.alaska.gov/water/water-quality/ambient-water-quality-data (last visited Jan. 28, 2020).

[34] *Quality Assurance*, ALASKA DEP'T OF ENVTL. CONSERVATION, https://dec.alaska.gov/water/water-quality/quality-assurance/ (last visited Jan. 28, 2020).

[35] Arkansas Department of Environmental Quality, *Arkansas' Water Quality and Compliance Monitoring Quality Assurance Project Plan* (2016), https://www.adeq.state.ar.us/water/planning/surface/pdfs/2016-qapp.pdf.

[36] *Quality Assurance/Quality Control – QAPP*, CAL. WATER BOARDS, https://www.waterboards.ca.gov/water_issues/programs/quality_assurance/qapp.html (last visited Jan. 28, 2020).

[37] *Quality Management Plan*, CAL. AIR RES. BOARD, https://ww2.arb.ca.gov/quality-management-plan (last visited Jan. 28, 2020).

[38] *Data Gathering & Validation, Monitoring Best Practices*, COLORADO WATER QUALITY MONITORING COUNCIL (CWQMC), http://www.coloradowaterdata.org/aboutcwqmc.html (last visited Jan. 28, 2020).

[39] *Colorado Environmental Records*, COLORADO DEP'T OF PUB. HEALTH & ENV'T, https://environmentalrecords.colorado.gov/HPRMWebDrawer/Record?q=recNotes%3A2.Monitor-Plan%2BAnd%2B%28recOwner%3D9%2BOr%2BrecOwner%3D1723%2BOr%2BrecOwner%3D1322%2BOr%2BrecOwner%3D1028%2BOr%2BrecOwner%3D1321%29&sortBy= (last visited Jan. 28, 2020).

[40] *Quality Assurance*, CONN. DEP'T OF ENERGY & ENVTL. PROTECTION, https://www.ct.gov/deep/cwp/view.asp?a=2701&q=323452&deepNav_GID=1651 (last visited Jan. 28, 2020).

[41] D.C. Mun. Regs. Tit. 21, §§ 1901.1, 1999.1.

[42] *Id.* § 1901.3

[43] Friends of Rock Creek's Environment (FORCE) [now Rock Creek Conservancy], *Draft Quality Assurance Project Plan* (May 2010), https://doee.dc.gov/sites/default/files/dc/sites/ddoe/page_content/attachments/APP%205%20RSW%20Pre-Imp%20Monitoring%20QAPP.pdf.

[44] Fla. Admin. Code Ann. r. 62-160.110(2).

[45] Georgia Department of Natural Resources Environmental Protection Division, *Water Protection Branch Quality Assurance Manual* (June 1999; Last Updated Jan. 2005), https://epd.georgia.gov/document/publication/waterprotectionbranchqualityassurancemanualrevision2005pdf/download.

[46] Ga. Comp. R. & Regs. 391-3-6-.03(13) (emphasis added); *see also* Georgia Department of Natural Resources Environmental Protection Division, *Guidance On Submitting Water Quality Data For Use By The Georgia Environmental Protection Division In 305(b)/303(d) Listing Assessments* (Oct. 2002), https://epd.georgia.gov/document/publication/sqap-gwf1pdf/download.

[47] Jill Komoto, Malama Kai Foundation, on behalf of the State of Hawai'i Tourism Authority's Natural Resources Program, *Taking Care of Hawai'i's Waters: A Guide for Getting Started in Volunteer Water Monitoring* 27-32 (n.d.), https://kohalacenter.org/archive/himoes/pdf/WaterQualityManual_Final_10_2.pdf.

[48] *Outside Data Policy*, IDAHO DEP'T OF ENVTL. QAULITY, http://www.deq.idaho.gov/water-quality/surface-water/monitoring-assessment/outside-data-policy/ (last visited Jan. 29, 2020).

[49] *Id.*

[50] *Id.*

[51] *Id.*

[52] *Id.*

[53] *Id.*

[54] *Guidance for Consideration in Preparing the 2020 Integrated Report on Illinois Water Quality, including the List of Clean Water Act Section 303(d) Impaired Waters*, ILL. ENVTL. PROTECTION AGENCY, https://www2.illinois.gov/epa/topics/water-quality/watershed-management/resource-assessments/Pages/guidance.aspx (last visited Jan. 29, 2020).

[55] *Id.*

[56] *See Tiered Approach*, ILL. ENVTL. PROTECTION AGENCY, https://www2.illinois.gov/epa/topics/water-quality/monitoring/vlmp/Pages/tiered-approach.aspx (last visited Jan. 29, 2020).

[57] *See id.*; *see also Training*, ILL. ENVTL. PROTECTION AGENCY, https://www2.illinois.gov/epa/topics/water-quality/monitoring/vlmp/Pages/training.aspx (last visited Jan. 29, 2020).

[58] This table is reproduced from IDEM's *General Guidance for the Office of Water Quality External Data Framework*. Jody Arthur, Indiana Department of Environmental Management, *General Guidance for the Office of Water Quality External Data Framework* 5 (2015), https://www.in.gov/idem/cleanwater/files/edf_guidance_general.pdf.

[59] "The [External Data Framework] does not currently accept wetland water quality data. This use pertains specifically to data collected on flowing waters. Secondary data may be used by OWQ to help substantiate any claims made in the process of reviewing a Clean Water Act Section 401 permit regarding the condition of a potentially affected waterbody and/or identify potential mitigation sites where such activities might improve water quality." *Id*. at 5 n.3.

[60] *Id.* at 7.

[61] *Quality Assurance Project Plan (QAPP) Guidance*, INDIANA DEP'T OF ENVTL. MGMT., https://www.in.gov/idem/nps/3383.htm (last visited Jan. 29, 2020).

[62] *Id.*; *External Data Framework*, INDIANA DEP'T OF ENVTL. MGMT., https://www.in.gov/idem/cleanwater/2485.htm (last visited Jan. 29, 2020).

[63] Iowa Admin. Code 567-61.11(455B).

[64] *Id.*

[65] *Id.* 567-61.12(455B).

[66] *Id.*

[67] *Id.* 567-60.2(455B).

[68] *Volunteer Water Monitoring*, IOWA DEP'T OF NAT. RES., https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Monitoring/Volunteer-Water-Monitoring (last visited Jan. 29, 2020) (under the Technical Resources Tab).

[69] Kansas Department of Health and Environment, Bureau of Water, Nonpoint Source Section, *Preparing Quality Assurance Project Plans (QAPPs)* (2000), http://www.kdheks.gov/nps/QAPPGuidance.pdf.

[70] *Quality Assurance & Standard Operating Procedures*, KENTUCKY ENERGY AND ENVIRONMENT CABINET, https://eec.ky.gov/Environmental-Protection/Water/QA/Pages/default.aspx (last visited Jan. 29, 2020).

[71] *Id.*

[72] *Id.*

[73] Louisiana Department of Environmental Quality, *Quality Assurance Project Plan for the Ambient Water Quality Monitoring Network* (2019), https://edms.deq.louisiana.gov/app/doc/view.aspx?doc=11925523&ob=yes&child=yes.

[74] *See Ambient Water Quality Monitoring Data*, LOUISIANA DEP'T OF ENVTL. QUALITY, https://deq.louisiana.gov/page/ambient-water-quality-monitoring-data (last visited Jan. 29, 2020).

[75] Code Me. R. tit. 06-096 Ch. 579, § 3.A.

[76] *VRMP Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOPs)*, ME. DEP'T OF ENVTL. PROTECTION, https://www.maine.gov/dep/water/monitoring/rivers_and_streams/vrmp/qapp/index.htm (last visited Jan. 29, 2020).

[77] *Volunteer River Monitoring Program (VRMP)*, ME. DEP'T OF ENVTL. PROTECTION, https://www.maine.gov/dep/water/monitoring/rivers_and_streams/vrmp/index.html (last visited Jan. 29, 2020).

[78] *Information about Submitting Water Quality Data for Maryland's Integrated Report*, MARYLAND DEP'T OF THE ENV'T, https://mde.maryland.gov/programs/Water/TMDL/Integrated303dReports/Pages/Data-Solicitation.aspx (last visited Jan. 29, 2020).

[79] *Id.*

[80] *Water Quality Monitoring for Volunteers*, MASS. DEP'T OF ENVTL. PROTECTION, https://www.mass.gov/guides/water-quality-monitoring-for-volunteers (last visited Jan. 29, 2020).

[81] *See id.*

[82] *See Cooperative Lakes Monitoring Program*, MICH. DEP'T OF ENV'T, GREAT LAKES, & ENERGY, https://www.michigan.gov/egle/0,9429,7-135-3313_3681_3686_3731-195536--,00.html (last visited Jan. 30, 2020); MICH. CLEAN WATER CORPS, https://micorps.net/ (last visited Jan. 30, 2020).

[83]Ralph Bednarz et al., Michigan Dep't of Env't, Great Lakes, & Energy Report No. MI/DEQ/WRD-15/004, *Cooperative Lakes Monitoring Program Manual* 41 (2015; revised 2019), https://micorps.net/wp-content/uploads/sites/63/2019/06/CLMP-Manual-2019update.pdf; *see also* Michigan Dep't of Envtl. Quality, *Quality Assurance Project Plan for Michigan's Inland Lake Water Quality Assessment Monitoring Program* (2001, revised 2008), https://www.michigan.gov/documents/deq/wrd-swas-LWQA-0110qapp_454495_7.pdf.

[84] Minn. Pollution Control Agency, *Volunteer Surface Water Monitoring Guide*, at Appendix D, pg. 113 of 173, (2003), https://www.pca.state.mn.us/sites/default/files/wq-s1-15.pdf.

[85] *Water monitoring: Standard operating procedures*, MINN. POLLUTION CONTROL AGENCY, https://www.pca.state.mn.us/water/water-monitoring-standard-operating-procedures (last visited Jan. 30, 2020).

[86] 11 Code Miss. R. Pt. 6, R. 2.1.B.

[87] *Quality Assurance*, MISS. DEP'T OF ENVTL. QUALITY, https://www.mdeq.ms.gov/water/groundwater-assessment-and-remediation/library/general/quality-assurance/ (last visited Jan. 30, 2020).

[88] Mo. Code Regs. Ann. tit. 10, § 20-7.050(2)(A).

[89] *Id.*

[90] *Monitoring Water Quality*, MONTANA DEP'T OF ENVTL. QUALITY, http://deq.mt.gov/Water/SurfaceWater/monitoring (last visited Jan. 30, 2020).

[91] *Water Quality Monitoring*, NEV. DIVISION OF ENVTL. PROTECTION, https://ndep.nv.gov/water/rivers-streams-lakes/water-quality-monitoring (last visited Jan. 30, 2020); *see also* Nevada Division of Environmental Protection, *Nevada Quality Assurance Program Plan for Surface Water Sampling* (2014), https://ndep.nv.gov/uploads/documents/QAPrP_Final_Jan2014_1.pdf.

[92] *Quality Assurance for Section 319 Watershed Assistance Grants*, N.H. DEP'T OF ENVTL. SERV., https://www.des.nh.gov/organization/divisions/water/wmb/was/qapp/index.htm (last visited Jan. 30, 2020).

[93] *See id.*

[94] *See id.*

[95] *See id.*

[96] *See id.*

[97] *How is Data Used?*, *Community Water Monitoring*, N.J. DEP'T OF ENVTL. PROTECTION, https://www.state.nj.us/dep/wms/bears/comm_water_monitoring.htm (last visited Jan. 30, 2020).

[98] *Study Designs and Quality Assurance Project Plans (QAPPs)*, N.J. DEP'T OF ENVTL. PROTECTION, https://www.state.nj.us/dep/wms/bears/cwm_qapps.htm (last visited Jan. 30, 2020).

[99] *Quality Assurance and Quality Control*, N.M. DEP'T OF ENV'T, https://www.env.nm.gov/surface-water-quality/qaqc/ (last visited Jan. 30, 2020).

[100] *See id.*

[101] *See id.*

[102] *EPA Approved Quality Assurance Project Plans*, N.M. DEP'T OF ENV'T, https://www.env.nm.gov/surface-water-quality/qapps/ (last visited Jan. 30, 2020).

[103] *Analytical Services and QA/QC Program*, N.Y. DEP'T OF ENVTL. CONSERVATION, https://www.dec.ny.gov/chemical/23850.html (last visited Jan. 30, 2020).

[104] *See id.*

[105] *Who collects the data?*, *Water Quality Data Assessment*, N.C. DEP'T OF ENVTL. QUALITY, https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-quality-data-assessment (last visited Jan. 30, 2020).

[106] *Water Quality Monitoring & Assessment*, N.D. DEP'T OF ENVTL. QUALITY, https://deq.nd.gov/WQ/3_Watershed_Mgmt/5_WQMonit/WQMonit.aspx#WQMonit_Facts (last visited Jan. 30, 2020).

[107] Ohio Admin. Code 3745-4-01–3745-4-06.

[108] *Credible Data – References*, OHIO ENVTL. PROTECTION AGENCY, https://epa.ohio.gov/dsw/credibledata/study_plans (last visited Jan. 30, 2020).

[109] *See id.*

[110] *See id.*

[111] *Blue Thumb, Water Quality Division*, OKLAHOMA CONSERVATION COMM'N, https://www.ok.gov/conservation/Agency_Divisions/Water_Quality_Division/WQ_Blue_Thumb/index.html (last visited Jan. 30, 2020).

[112] *See Water Quality* Monitoring, OKLA. CONSERVATION COMM'N, https://www.ok.gov/conservation/Agency_Divisions/Water_Quality_Division/WQ_Monitoring/index.html (last visited Jan. 30, 2020); *Field Forms*, BLUE THUMB, http://www.bluethumbok.com/field-forms.html (last visited Jan. 30, 2020).

[113] *Sample Collection Assistance*, OKLA. DEP'T OF ENVTL. QUALITY, https://www.deq.ok.gov/state-environmental-laboratory-services/sample-collection-assistance/ (last visited Jan. 30, 2020).

[114] *Quality assurance project and sampling and analysis plans, Volunteer Monitoring Resources*, OR. DEP'T OF ENVTL. QUALITY, https://www.oregon.gov/deq/wq/Pages/WQ-Monitoring-Resources.aspx (last visited Jan. 30, 2020).

[115] *Id.*

[116] *Id.*

[117] *Id.*

[118] Pennsylvania Department of Environmental Protection, *Bureau of Clean Water: Outside Agency Data and Quality Assurance Requirements* 1 (July 2013), http://files.dep.state.pa.us/Water/Drinking%20Water%20and%20Facility%20Regulation/WaterQualityPortalFiles/Methodology/2015%20Methodology/Outside%20Agency%20Data.pdf.

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[120] *Id.*; *see also* River Network & Pennsylvania Department of Environmental Protection, *Designing Your Monitoring Program: A Technical Handbook for Community-Based Monitoring In Pennsylvania* (2001), http://files.dep.state.pa.us/water/BWEW/Watershed%20Management/lib/watershedmgmt/stormwater_management/ms4_resource_cd/involvement/volunmonchapter1.pdf.

[121] 250 R.I. Code R. 150-05-1.24.A.

[122] *Id.* 150-05-1.24.B.

[123] *See* Rhode Island Department of Environmental Management, *Quality Management Plan* 20 (2017), http://www.dem.ri.gov/programs/benviron/assist/pdf/quality-management-plan.pdf ("Office Chiefs, and in some cases Section Supervisors within Offices, oversee the work of that outside entity and have primary responsibility for ensuring the quality of the data delivered under those agreements and contracts. The outside entities may include a consultant, contractor, citizen group or non-governmental organization. The degree and formality of oversight of those entities will be examined as this QMP is implemented but it is expected that the assessments and reviews defined later in this Plan will apply to these situations.").

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For Preparing Quality Assurance Project Plans (QAPPs) For Environmental Monitoring Projects/Studies 7 (2018), https://www.scdhec.gov/sites/default/files/media/document/QAPP%20Guide%20June%202018.pdf.

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[126] South Dakota Department of Environment and Natural Resources, *Quality Management Plan* 4 (2016), https://denr.sd.gov/des/sw/documents/QMP2016RevV.pdf.

[127] South Dakota Department of Environment and Natural Resources, *319 Program Guidelines and Internal Controls* 10 (2016), https://denr.sd.gov/dfta/wp/documents/319GuidelinesInternalControls2016Final_000.pdf.

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[129] Texas Commission on Environmental Quality, *Quality Management Plan*, at 65, Appendix G (2020), https://www.tceq.texas.gov/assets/public/compliance/compliance_support/qa/qmp.pdf.

[130] *See id.*; *see also Quality Assurance Project Plan*, TEXAS COMM'N ON ENVTL. QUALITY, https://www.tceq.texas.gov/agency/qa/qapp (last visited Jan. 31, 2020).

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[132] *Quality Assurance and Quality Control Program: Water Quality Monitoring*, UTAH DEP'T OF ENVTL. QUALITY, https://deq.utah.gov/water-quality/quality-assurance-and-quality-control-program-monitoring-water-quality (last visited Jan. 31, 2020).

[133] *See Tier 2*, UTAH WATER WATCH, https://extension.usu.edu/utahwaterwatch/monitoring/Tier2/index (last visited Jan. 31, 2020); *see also* Utah Water Watch & Utah Division of Water Quality, *Tier 2 Manual Supplement to the UWW Program Manual*, at 6-7 (Apr. 2018), https://extension.usu.edu/utahwaterwatch/ou-files/Tier2manual_draft_4.9.2018.pdf ("A Sample Analysis Plan (SAP) is required for all monitoring activity overseen by the DWQ.").

[134] 16-5 Vt. Code R. § 100(e).

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