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Quality Control: Potomac Riverkeeper v. Wheeler & Standards for Qualitative Citizen Water Quality Data in Virginia

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QUALITY CONTROL: *POTOMAC RIVERKEEPER V. WHEELER* & STANDARDS FOR QUALITATIVE CITIZEN WATER QUALITY DATA IN VIRGINIA

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INTRODUCTION

The purpose of the Clean Water Act ("CWA") "is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[1] One way the CWA seeks to achieve this purpose is by requiring states to establish water quality standards.[2] "A water quality standard defines the water quality goals of a water body . . . by designating the . . . uses" of that waterbody and setting pollution limits to protect such uses.[3] Recreation, including swimming, fishing, boating, and enjoyment of aesthetic values, is one example of a designated use.[4] In order to ensure compliance with these state water quality standards, the CWA also requires each state to regularly assess and determine the quality of its waters, identify waters that fail to meet state water quality standards, designate these waters as "impaired," and list them accordingly.[5] Importantly, in developing this list, the CWA mandates that "[e]ach State shall assemble and evaluate all existing and readily available water quality-related data and information . . . ."[6] This includes water quality-related data and information provided by citizens.[7]

Citizen science plays an important role in CWA regulation and enforcement.[8] For example, water quality monitoring by individuals and

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[1] 33 U.S.C. § 1251 (2020).

[2] *Id.* § 1313.

[3] 40 C.F.R. § 131.2 (2020).

[4] *See, e.g.*, 9 VA. ADMIN. CODE § 25-260-10 (2021).

[5] 40 C.F.R. § 130.7(b). *See also* 33 U.S.C. § 1313(c), (d).

[6] 40 C.F.R. § 130.7(b)(5).

[7] *Id.*

[8] *See, e.g.*, George Wyeth, *Citizen Science & Environmental Agency Programs in the United States*, ENV'T L. REP. BLOG (Mar. 9, 2020), https://www.eli.org/vibrant-environment-blog/citizen-science-environmental-agency-programs-united-states [https://perma.cc/M2TF-VD4Y] (explaining that "[m]easuring water quality is a fundamental part of the Clean

citizen groups is one way the public contributes to the CWA's goals.[9] Water quality-related data and information (the term "data" encompasses this phrase for the purpose of this Article) provided by citizens take many forms. Water quality monitoring results often take the form of quantitative data.[10] Importantly, scientists routinely combine these quantitative measures with qualitative observations of water quality.[11] Public comments, photographs, videos, and reports by experts on waterbody uses constitute qualitative data.[12] Notably, citizen water quality-related data and information must meet data quality standards in order for state environmental agencies to use this data for regulatory decision-making. These agencies must provide a "rationale for any decision to not use any existing and readily available data and information."[13]

Data quality is a common rationale for why state environmental agencies choose not to rely on citizen water quality-related data and information for impairment listing decisions.[14] Yet, agency guidance for

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Water Act scheme, but is resource-intensive to implement. Since the process of taking samples is relatively simple . . . ordinary citizens are capable of doing the job.").

[9] *See, e.g.*, *Citizen Monitoring*, VA. DEP'T ENV'T QUAL., https://www.deq.virginia.gov/water/water-quality/monitoring/citizen-monitoring [https://perma.cc/4898-4AHQ] (last visited Mar. 11, 2022).

[10] EPA, HANDBOOK FOR CITIZEN SCIENCE QUALITY ASSURANCE AND DOCUMENTATION 8 (2019) [hereinafter HANDBOOK] (describing quantitative data as a "statistic, such as the mean or median, and a measure of variability, estimated from the collected data, which can be visually displayed on a graph or map.").

[11] *See, e.g.*, VA. DEP'T ENV'T QUAL., FISH KILL INVESTIGATION GUIDANCE MANUAL 8-6 (2002), *available at* https://townhall.virginia.gov/l/GetFile.cfm?File=C:\TownHall\docroot\GuidanceDocs\440\GDoc_DEQ_1457_v1.pdf [https://perma.cc/42PK-EU33] (explaining that "[n]otations on [water quality] conditions at a kill site and the affected species may often be as helpful to the diagnostician as samples sent to the lab."). *See also* JACK EDWARD MCKEE & HAROLD W. WOLF, WATER QUALITY CRITERIA 65 (2d ed. 1963) (discussing case where qualitative "circumstantial evidence of the growth of weeds, the foul odor [emanating] from a pool, and the preferences of cattle and horses for other bodies of water were sufficient [evidence] to conclude that the water was in fact polluted.").

[12] HANDBOOK, *supra* note 10, at 7 (describing qualitative data as "descriptive outcomes").

[13] 40 C.F.R. § 130.7(b)(6)(iii).

[14] NAT'L ADVISORY COUNCIL FOR ENV'T POL'Y & TECH., INFORMATION TO ACTION 19–20 (2018) [hereinafter NACEPT 2018], https://www.epa.gov/citizen-science/information-action-strengthening-epa-citizen-science-partnerships-environmental [https://perma.cc/YT5Y-CGX7] (listing data quality concerns as number one barrier to agency using citizen data). *See also* VT. DEP'T ENV'T CONSERVATION, VT. SURFACE WATER ASSESSMENT AND LISTING METHODOLOGY 12 (Mar. 2014), https://dec.vermont.gov/content/vermont-surface-water-assessment-and-listing-methodology-march-2014 [https://perma.cc/WAS9-F2YX] (noting that "[d]ata can be rejected from consideration in the event that it does not meet data quality objectives established by individual [quality assurance plans].").

citizens on how to prepare and submit quality data varies not only by state, but also by data type. For example, in Virginia, the state environmental agency, the Department of Environmental Quality ("DEQ"), provides detailed quality assurance protocols for how citizens should submit quantitative data, such as water quality monitoring results, yet offers no specific guidance for how citizens should submit qualitative data for agency use in regulatory decision-making. This approach not only devalues qualitative data, but also inhibits DEQ from seeing the whole water quality picture because it ignores critical information provided by citizens concerning water pollution impacts on recreational designated uses.

This Article explores the issue of quality of citizen data through the lens of *Potomac Riverkeeper v. Wheeler*, a recent impaired waters listing case concerning the Shenandoah River in Virginia. Part I of this Article provides a brief overview of citizen science data in regulation and policymaking under the CWA. Part II discusses *Potomac Riverkeeper v. Wheeler*, examining Virginia's water quality-related data standards and DEQ's use (and non-use) of citizen water quality-related data and information in that case. Finally, Part III argues that Virginia should establish clear, reasonable, and specific data quality standards for qualitative citizen data so as to not only ensure DEQ's valid use of such water quality-related data and information in supporting impaired waters determinations, but also enhance agency transparency in regulatory decision-making.

I. CITIZEN SCIENCE DATA

A. What Is Citizen Science?

"Citizen science is the [voluntary] involvement of the public in scientific research."[15] Generally, citizen environmental science involves "open collaboration" between individuals and organizations,[16] drawing upon "the collective strength of communities and the public to identify research questions, collect and analyze data, interpret results, make new discoveries, and develop technologies and applications [in order] to understand and solve environmental problems."[17] Importantly, "[c]itizen

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[15] George Wyeth et al., *The Impact of Citizen Environmental Science in the United States*, 49 ENV'T L. REP. 10237, 10238 (2019).
[16] 15 U.S.C. § 3724(c)(1).
[17] *What Is Citizen Science?*, EPA, https://www.epa.gov/citizen-science/basic-information-about-citizen-science-0 [https://perma.cc/AUN8-QG73] (last visited Mar. 11, 2022).

science is an approach to environmental information that *actively and genuinely* encourages and solicits public input in the scientific process and incorporates data and information generated outside of traditional institutional boundaries."[18] Yet, citizen science is more than volunteers collecting data and participating in research.[19] "It is a model for the democratization of research and policy making."[20] For this reason, citizen science not only contributes practical scientific value to federal, state, and local governments, but also helps promote governmental transparency in agency decision-making.

The practice of citizen science is not new. The public has been involved in the scientific process for centuries.[21] National governments, including the United States, have even outsourced scientific research to citizens.[22] The professionalism of science in the twentieth century led to a decline in public involvement as universities, expert research initiatives, and government agencies became centers of scientific research.[23] However, in environmental science, this trend began to reverse with the advent of the modern environmental movement in the 1970s.[24] The proliferation of citizen water quality monitoring programs following the enactment of the CWA is one example of the growth of modern citizen science.[25]

Today, "[c]itizen science is flourishing as a tool for scientific advancement and as a movement engaging the public."[26] There are a few reasons for this. First, technological advances "for measuring pollution

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[18] NAT'L ADVISORY COUNCIL FOR ENV'T POL'Y & TECH., ENV'T PROTECTION BELONGS TO THE PUBLIC 1 (Dec. 2016) [hereinafter NACEPT 2016], https://www.epa.gov/citizen-science/nacept-2016-report-environmental-protection-belongs-public-vision-citizen-science [https://perma.cc/MJ4F-3HSY] (emphasis added).

[19] *Id.*

[20] *Id.*

[21] Annie E. Brett, *Putting the Public on Trial: Can Citizen Science Data be Used in Litigation and Regulation?*, 28 VILL. ENV'T L.J. 163, 168 (2017) (noting "gentlemen naturalists," like Charles Darwin, and amateur birdwatchers as historical examples).

[22] *See, e.g.*, Letter, Transcript: Jefferson's Instructions to Meriwether Lewis (June 20, 1803), https://www.loc.gov/exhibits/lewisandclark/transcript57.html [https://perma.cc/F3UC-4F3U] (last visited Mar. 11, 2022) (instructing Lewis and members of federally funded Corps of Discovery to conduct scientific observations of environment and collect samples of observed flora and fauna).

[23] Brett, *supra* note 21, at 169.

[24] *Id.*

[25] *Id.*; *see also* NACEPT 2016, *supra* note 18, at 5 (highlighting nearly 50 years of volunteer water quality monitoring programs, noting that "[t]he foundation of citizen science at EPA begins with volunteer water quality monitoring programs formalized in the early 1970s," and explaining how EPA currently supports such programs).

[26] Wyeth et al., *supra* note 15, at 10238.

levels and other environmental conditions have provided vast new opportunities and increased the potential for citizen science generally, as well as for increasing the impact of citizen science on government decisions and actions."[27] Tools for data collection, data analysis, and data sharing "are more widely available and less expensive" than in the past.[28] Every citizen with a smartphone has the potential capability to do citizen science. "The use of smartphones for citizen science allows [citizens to collect data] in photographs and videos, and through built-in and add-on [remote] sensors . . . easily tracked through global positioning systems that are automatically included in most smartphones."[29] As such, "citizens are more and more engaged in collecting environmental data, and many environmental agencies are using these data."[30] Additionally, citizens possess a greater "understanding of and comfort with technology."[31] For example, "[l]ocal environmental organizations across the country have developed significant technical capacity that they did not have a decade ago."[32]

There is also an increased public awareness of environmental issues—particularly environmental justice—that has resulted in more people and citizen organizations getting involved in citizen science as a means to influence environmental policy and enhance government accountability.[33] "Many citizen science efforts are driven by underserved communities concerned about the impacts of pollution from multiple sources."[34] Notably:

> At the same time that the capacity [and environmental awareness] of citizens scientists is growing, several of the agencies that have traditionally provided most environmental data are under tight resource constraints. This is not a new problem. Government science has always faced limits on the ability to generate the data needed to understand environmental issues. Necessary initiatives and data sets are often nonexistent, incomplete, or inadequate. . . . In

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[27] *Id.* at 10241.
[28] *Id.*
[29] *Id.*
[30] HANDBOOK, *supra* note 10, at 1.
[31] Wyeth et al., *supra* note 15, at 10242.
[32] *Id.* (discussing sensors-based carbon dioxide monitoring network in Oakland, California "that allows [local] communit[y] to identify hot spots cand facilitate reductions in CO_2 emissions.").
[33] *Id.* at 10243.
[34] *Id.*

> recent years, agency resources for data gathering have not kept pace with needs, and in some cases are declining. Declining budgets have also led to more widespread concern about the adequacy of governmental environmental monitoring and the ability of governments to maintain the appropriate expertise.[35]

The existence of gaps in environmental data increases the challenge of achieving environmental policy goals, including those of the CWA. "Citizen science can fill data gaps and provide information useful for effective decision-making, as well as provide data over spatial and temporal scales that would otherwise not be possible."[36] Recognizing the potential of citizen science, federal, state, and local governments have enacted legislation, policies, and programs to encourage the practice of citizen science and the use of citizen data in agency decision-making.[37] For example, in 2016, Congress enacted the bipartisan-supported Crowdsourcing and Citizen Science Act, which encourages federal agencies to use citizen science.[38] EPA is one such federal agency that has sought to encourage and incorporate citizen science into environmental regulation and policy-making.[39] Notably, one of EPA's primary uses of citizen science data for regulation is the CWA.[40] "Similarly, numerous states now maintain programs to facilitate citizen science and improve the utility of volunteer data."[41] Even Virginia offers grant funding to Commonwealth citizens for the purpose of state water quality monitoring.[42]

B. The Clean Water Act & Citizen Science Data

Under the CWA, water quality protection programs offer "[t]he clearest opportunity for the use of citizen-generated data."[43] The CWA

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[35] *Id.* at 10242.
[36] *Id.*
[37] *See, e.g.*, *Examples of Citizen Science Projects Supported by EPA*, EPA, https://www.epa.gov/citizen-science/examples-citizen-science-projects-supported-epa [https://perma.cc/VU8Q-DX2J] (last visited Mar. 11, 2022).
[38] 15 U.S.C. § 3724.
[39] HANDBOOK, *supra* note 10, at 1.
[40] Wyeth et al., *supra* note 15, at 10243.
[41] *Id.* at 10239 (citing examples of water quality monitoring programs, as well as state agency guidance for citizen science).
[42] *Citizen Monitoring*, VA. DEP'T ENV'T QUALITY, https://www.deq.virginia.gov/water/water-quality/monitoring/citizen-monitoring [https://perma.cc/VZT7-6W92] (last visited Mar. 11, 2022).
[43] Wyeth et al., *supra* note 15, at 10243.

requires each state to develop water quality standards for state water bodies[44] in order to achieve the CWA's objective of restoring and maintaining the chemical, physical, and biological integrity of the country's water.[45] "A water quality standard consists of two parts: a list of designated uses—such as drinking or swimming—and the water quality criteria necessary to support those uses."[46] Criteria can be numeric (i.e., expressed quantitatively using amounts) or narrative (i.e., expressed descriptively using words).[47] To ensure compliance with state water quality standards, states must regularly assess and determine the quality of its waters, identify waters that fail to meet state water quality standards, designate these waters as "impaired," and list them accordingly.[48] Importantly, in Virginia, the presence of waste substances that directly or indirectly interferes with a designated use constitutes a failure to satisfy narrative water quality criteria, meaning the waterbody is impaired.[49]

For each waterbody listed on the state's "impaired waters list" or "303(d) list," the state must establish a "total maximum daily load" ("TMDL") that "limit[s] the amount of particular pollutants the water can receive and still meet all applicable water quality standards."[50] Importantly, "EPA regulations outline the process a state must follow in preparing its impaired waters list."[51] EPA regulations specifically require states to consider citizen-submitted information during this process, mandating that "[e]ach State shall assemble and evaluate *all* existing and readily available water quality-related data and information . . . ."[52] Moreover, EPA regulations explain that this includes water quality-related data and information about "water quality problems [that] have been reported by . . . members of the public."[53] Further, these regulations "also require states to provide a written rationale for any decision not to use relevant and readily available data," including citizen data.[54] Each state must submit this documentation biennially in the form of an "integrated

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[44] 33 U.S.C. § 1313(a)–(c).
[45] *See id.* § 1251(a).
[46] Potomac Riverkeeper v. Wheeler, 381 F. Supp. 3d 1, 5 (D.D.C. 2019) (citing 33 U.S.C. § 1313(c)(2)(A)) (internal quotations omitted).
[47] 40 C.F.R. § 131.11(b).
[48] 33 U.S.C. § 1313(c), (d); 40 C.F.R. § 130.7(b)(3), (d).
[49] 9 VA. ADMIN. CODE § 25-260-10, 20.A.
[50] *Potomac Riverkeeper*, 381 F. Supp. 3d at 5 (citing 33 U.S.C. § 1313(d)(1)(C); 40 C.F.R. § 130.7(c)(1)).
[51] *Id.*
[52] 40 C.F.R. § 130.7(b)(5) (emphasis added).
[53] *Id.*
[54] *Id.* § 130.7.

report."[55] Notably, "EPA's integrated reporting guidance recommends further steps that facilitate the use of citizen-generated data, including transparency regarding state assessment methodology and the quality assurance and quality control criteria used to evaluate data submitted by third parties."[56] EPA's integrated reporting guidance "explicitly identifies 'conservation/environmental organizations' and 'citizen monitoring groups' as entities that the state should encourage to develop quality assurance [protocols]."[57] Accordingly, clear standards and clear expectations for data quality are necessary to encourage citizen science and ensure the use of citizen water quality-related data and information in impaired waters lists.

II. QUALITY CONTROL CONCERNS & QUALITY ASSURANCE PROCEDURES

While the CWA provides opportunities for state environmental agencies to use citizen data to inform agency decision-making, the data must satisfy data quality standards in order for the agency to use this data as evidence for listing a waterbody as impaired. The issue of data quality significantly impacts the acceptance and use of citizen data in regulatory decision-making.[58] Citizen data face skepticism from scientists and policymakers alike[59] despite recent efforts by local, state, and federal governments to encourage citizen science and assist in providing data quality guidance.[60] There is some basis for this skepticism because citizen data can vary.[61] Scientific reviews of citizen science projects show that "[t]he variability in [data collected by citizens] suggests that the accuracy of citizen science projects [and the data collected] may be highly dependent on methodology, training, and even motivation of the volunteers."[62]

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[55] *Id.* § 130.7(d)(1).
[56] Wyeth et al., *supra* note 15, at 10243 (citing EPA, GUIDANCE FOR 2006 ASSESSMENT, LISTING, AND REPORTING REQUIREMENTS PURSUANT TO SECTIONS 303(D), 305(B), AND 314 OF THE CLEAN WATER ACT (July 2005), https://www.epa.gov/sites/production/files/2015-10/documents/2006irg-report.pdf [https://perma.cc/X9G2-V3WF]).
[57] *Id.*
[58] *See, e.g.*, KASANTHA MOODLEY & GEORGE C. WYETH, *Enabling Citizen Science Programs at Environmental Agencies: Recommendations to the U.S. Environmental Protection Agency*, ENV'T L. INST. (Oct. 2020), https://www.epa.gov/sites/default/files/2020-11/documents/enabling_citizen_science_programs_at_environmental_agencies.pdf [https://perma.cc/D2U8-T649].
[59] Brett, *supra* note 21, at 173 (discussing "lack of widespread scientific acceptance").
[60] *See* EPA, *supra* note 37.
[61] Brett, *supra* note 21, at 163 (noting uncertainty of data quality).
[62] *Id.* at 174.

Nonetheless, the possibility—as well as the perception—of data quality issues underscores the need for states to create and articulate clear, reasonable, and specific standards for data quality that citizens can follow to ensure their data meets standards for use in regulatory decision-making.

In 2019, EPA released a "Handbook for Citizen Science Quality Assurance and Documentation" to assist the public in developing methodologies to assure data quality.[63] The purpose of the Handbook is to "convey common expectations for quality assurance process and documentation, and best management practices for organizations that train and use volunteers in the collection of environmental data."[64] The Handbook expressly acknowledged agency skepticism about data quality as a "major challenge" to citizen science.[65] The Handbook also highlighted data quality control in the form of a Quality Assurance Project Plan ("QAPP") as "[o]ne of the keys to breaking down this barrier."[66] EPA defines a QAPP as "a document that explains how organizations [and individuals] ensure, using quality assurance and quality control activities, that the data they collect can be used for its intended purpose."[67] Moreover, "[b]y writing and applying a QAPP, an organization [or individual] builds data quality procedures into the project from the beginning and will be more confident that the data will meet the specific needs of the project."[68] This is important because "the individuals interested in the project, or the agencies that make decisions based on the data and information from the project, will have a better understanding of the quality of the underlying data."[69] As such, state environmental agencies may be more likely to accept and use the data.

The level of data quality assurance required varies depending on the intended purpose for data use. "Data collected for legal and policy action would require more extensive quality assurance and documentation than data collected for increasing public understanding."[70] As such, data collected for the intended purpose of providing evidence to support an impairment listing requires extensive quality assurance and documentation.[71] "For example, an effort to engage local communities in measuring water

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[63] HANDBOOK, *supra* note 10, at 4.
[64] *Id.* at 12.
[65] *Id.* at 5.
[66] *Id.*
[67] *Id.*
[68] *Id.*
[69] HANDBOOK, *supra* note 10, at 5.
[70] *Id.* at 7.
[71] *Id.*

quality may produce information indicating a need to curb pollution from specific sources."[72] EPA recommends "[i]n these situations, [that citizens develop] more stringent quality assurance and documentation . . . [and] pursu[e] the highest level of quality assurance that will meet a project's intended purpose."[73] Also, EPA notes "that data used in regulatory and policy decision making often must be collected using approved methods, which may include acceptance testing to demonstrate equivalence to these methods."[74] This level of quality assurance is a reasonable requirement—albeit time and resource-intensive for citizens—given that agency decisions are subject to judicial review under the Administrative Procedure Act.[75] Courts evaluate agency decisions using the arbitrary and capricious standard of review, which requires an agency to show a logical connection between the facts and the decision made.[76] Therefore, an agency must be able to legally defend its decision and the data on which the agency based its decision. For this reason, EPA "STRONGLY recommend[s]" citizen scientists use the nineteen QAPP templates the Handbook provides for addressing a project's management, data collection, data assessment, and data review as citizens undertake scientific research with the intent of informing legal or policy action.[77] These templates cover everything from Table of Contents and Project Schedule documents to documentation of Sample Handling and Custody.[78] Practically, for citizen scientists seeking to collect data for legal and policy action, a QAPP or equivalent document is essential.

EPA acknowledges the high standard that citizen water quality-related data and information must meet to inform a state's impaired waters list.[79] As such, EPA encourages each state and its environmental agency to actively engage with its citizens during the listing process.[80] Specifically, EPA encourages state environmental agencies to support citizen efforts to collect quality data. "Data quality criteria should be

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[72] *Id.* at 8.
[73] *Id.*
[74] *Id.* at 13.
[75] 5 U.S.C. § 706 (2021).
[76] Motor Vehicles Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co., 463 U.S. 29, 29 (1983).
[77] HANDBOOK, *supra* note 10, at 11–12.
[78] *Id.*
[79] *See generally* EPA, GUIDANCE FOR 2006 ASSESSMENT, LISTING, AND REPORTING REQUIREMENTS PURSUANT TO SECTIONS 303(D), 305(B), AND 314 OF THE CLEAN WATER ACT (July 2005) [hereinafter EPA GUIDANCE 2006], https://www.epa.gov/sites/production/files/2015-10/documents/2006irg-report.pdf [https://perma.cc/AUS8-W9FN].
[80] 40 C.F.R. § 130.7 (2021).

published along with any solicitations of data and information. Ideally, [quality assurance and/or quality control] protocols should be made available to the public well in advance of any such solicitation for any given reporting cycle."[81] Additionally:

> EPA recommends that states work with data-generating [citizen] organizations not only during the period of time just before the Integrated Report, but on a more continual basis, to help ensure their data are collected and stored in such a way that the data will be of high quality.[82]

EPA recognizes that citizens need practical assistance and clarity of expectations in order to succeed in their mission to affect environmental decision-making.[83] Attorneys, scientists, and expert citizen organizations can offer guidance, however, state environmental agencies have a role and a responsibility to engage with citizens during the decision-making process. As such, EPA regulations authorize states "to review and comment on proposed QAPPs [or equivalent documents]" and "even issue formal approvals creating a presumption in favor of the quality of data collected in conformity with such plans."[84] This presumption is a significant acknowledgment of the value citizen science can bring to CWA enforcement. While failure to secure state approval of a QAPP or equivalent document does not mean the state automatically rejects the relevant citizen-generated data,[85] a formal approval helps assuage concern about the data's quality. Critically, state environmental agencies must communicate agency expectations for data quality in order for citizens to take advantage of this opportunity.

Regarding data quality, the Handbook does not distinguish between quantitative data and qualitative data in its discussion.[86] It suggests that both quantitative data and qualitative data can provide useful—and

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[81] HANDBOOK, *supra* note 10, at 11–12.
[82] *Id.*
[83] Marc B. Mihaly, *Citizen Participation in the Making of Environmental Decisions: Evolving Obstacles and Potential Solutions Through Partnership with Experts and Agents*, 27 PACE ENV'T L. REV. 151, 169 (2009) (discussing importance of experts partnering with citizens in order for public participation to have "true effects on [environmental decision-making] process and outcome").
[84] Wyeth et al., *supra* note 15, at 10243.
[85] Potomac Riverkeeper v. Wheeler, 381 F. Supp. 3d 1, 16 (D.D.C. 2019).
[86] *See* HANDBOOK, *supra* note 10, at 15–17.

even sufficient—information for impairment listings.[87] Although the Handbook acknowledges that citizen water quality-related data and information intended for use in legal or policy action generally requires more quantitative data than qualitative data as evidence to support such decisions, qualitative data can also provide sufficient information for making an impairment determination in certain situations.[88] As such, EPA encourages states to develop methodologies for assessing the quality of citizen qualitative data, as well as guidance for how citizens should gather and submit such data so as to ensure it is of high quality.[89] Only when state environmental agencies make their data quality expectations clear can citizens hope to satisfy data quality standards. Yet, EPA appears to assume not only a willingness on the part of the state environmental agency to encourage the gathering of high-quality citizen data by developing data quality guidance and quality assurance protocols, but also that such guidance exists for all data that citizens may seek to submit.[90] Virginia is one example of a state where the state environmental agency has de facto limited the data citizens can submit with the intended purpose of informing an impairment decision due to the agency's failure to develop clear, reasonable, and specific data quality standards for qualitative data.[91]

III. VIRGINIA'S CURRENT APPROACH TO CITIZEN WATER QUALITY DATA

Virginia, like many states, prioritizes quantitative water quality-related data and information for water quality assessment.[92] In fact, it is DEQ's long-standing policy to rely on quantitative data for impairment decisions, using qualitative data—specifically, "visual assessment"—solely for informing agency monitoring.[93] Yet, DEQ's refusal to consider qualitative data as a potential indicator of water quality impairment—particularly for recreational designated uses—ignores the big picture.

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[87] *See id.*
[88] *See, e.g.*, *id.* at 8 (explaining that regulatory decision-making "typically" requires quantitative data, meaning qualitative data can suffice in certain circumstances). *See also* VT. DEP'T ENV'T CONSERVATION, *supra* note 14, at 23 (including record of public complaints concerning algal conditions as sufficient qualitative data source for impaired waters listing).
[89] *See, e.g.*, EPA GUIDANCE 2006, *supra* note 79, at 29 (developing assessment methodologies).
[90] *Id.* at 30–32.
[91] *See infra* notes 92–108 and accompanying text.
[92] *See* VA. DEP'T ENV'T QUALITY, WATER QUALITY ASSESSMENT GUIDANCE MANUAL FOR 2022, at 44, 63–67 (2021).
[93] Potomac Riverkeeper, Inc. v. Wheeler, 381 F. Supp. 3d 1, 15 (D.D.C. 2019).

A. Quantitative Citizen Data: Water Quality Monitoring Data

Virginia has developed data quality guidance and quality assurance protocols for quantitative citizen water quality-related data and information.[94] Specifically, water quality monitoring data.[95] Under Virginia law, it is one of DEQ's goals "to encourage citizen water quality monitoring."[96] Virginia has established "a citizen water quality monitoring program to provide technical assistance and may provide grants to support citizen water quality monitoring groups" to achieve this goal.[97] Citizen scientists monitor waterways throughout Virginia. "The work they do saves the [Commonwealth] many thousands of dollars each year and provides vital information for protecting [Virginia's] waters."[98] Notably, such monitoring must be "conducted in a manner consistent with the Virginia Citizens Monitoring Methods Manual [("the Manual")]."[99] This Manual explains how DEQ treats citizen data—quantitative *and* qualitative.[100] Importantly, the Manual separates citizen data into three tiers of uses.[101] The lowest tier of data quality is Level I data:

> "Level I" data includes data for which there is no Quality Assurance Project Plan (QAPP) or Standard Operational Procedures (SOP) on file. Such data is not approved by DEQ for assessment but is still used (1) to identify sites that may require DEQ to perform follow-up monitoring, (2) for educational or out-reach purposes, and (3) to notify DEQ of significant pollution events for rapid agency response.[102]

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[94] *Citizen Monitoring: Develop a Quality Assurance Plan*, VA. DEP'T ENV'T QUALITY, https://www.deq.virginia.gov/water/water-quality/monitoring/citizen-monitoring [https://perma.cc/5C4X-NY8G] (last visited Mar. 11, 2022).
[95] *Id.*
[96] VA. CODE. ANN. § 62.1-44.19:11 (2020).
[97] *Id.*
[98] VA. DEP'T ENV'T QUALITY, *supra* note 42.
[99] VA. CODE. § 62.1-44.19:11.
[100] Potomac Riverkeeper, Inc. v. Wheeler, 381 F. Supp. 3d 1, 7 (2019) (citing VA. DEP'T ENV'T QUALITY, VIRGINIA CITIZEN WATER QUALITY MONITORING PROGRAM METHODS MANUAL A9-1 (2007)).
[101] VA. DEP'T ENV'T QUALITY, VIRGINIA CITIZEN WATER QUALITY MONITORING PROGRAM METHODS MANUAL A9-1, at A9-1 to A9-3 (2007) [hereinafter MANUAL] (Appendix 9 outlines quality assurance and quality control protocols, as well as data quality tiers).
[102] *Potomac Riverkeeper*, 381 F. Supp. 3d at 7 (internal citations and quotation marks omitted).

The middle tier of data quality is Level II data:

> "Level II" data is generated using a monitoring method similar—but not identical—to DEQ protocols. Such data is only partially approved by DEQ and is used for the same purposes as Level I data, as well as to identify possible waters with observed effects or waters that appear to be healthy but will need DEQ monitoring data to confirm. Of relevance here, DEQ uses Level II data to classify water segments as Category 3 (prioritized for follow-up monitoring).[103]

Finally, the top tier for data quality is Level III data:

> "Level III" data must be prepared using DEQ testing and quality assurance protocols. A group responsible for preparing such data must have in place a DEQ approved [Quality Assurance Project Plan] and [Standard Operating Procedures]. Level III data is treated as if DEQ had collected and analyzed the data for itself, and—unlike Level I and Level II data—*Level III data is used to determine whether waters should be added to or removed from Virginia's impaired waters list*.[104]

The purpose of Virginia's data-use hierarchy is to ensure DEQ uses citizen *water quality monitoring* data appropriately in its decisions; it is a quality assurance measure.[105] This desire to support agency decisions with defensible, quality data is reasonable given the possible variability of quality in citizen data.[106] Yet, it is unreasonable to expect qualitative citizen water quality-related data and information to satisfy data quality standards for data when DEQ has not provided specific data quality guidance for such data. The Manual addresses only quantitative, water quality monitoring data; not qualitative data.[107] Yet, DEQ has made the Manual and its tiers the arbiter of quality for all data rather than develop guidance and assessment methods specifically for qualitative data.[108]

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[103] *Id.* (internal citations and quotation marks omitted).
[104] *Id.* (emphasis added) (internal citations and quotation marks omitted).
[105] MANUAL, *supra* note 101, at viii–ix.
[106] *Potomac Riverkeeper*, 381 F. Supp. 3d at 15.
[107] MANUAL, *supra* note 101, at iii, 1-5 to 1-6.
[108] *Potomac Riverkeeper*, 381 F. Supp. 3d at 7 (noting that "[t]he manual separates citizen data into three tiers" without distinguishing between quantitative and qualitative data).

It is unreasonable for DEQ to establish Level III data as the gold standard for both quantitative data and qualitative data without also providing clear expectations for how qualitative data can meet this standard.

B. Qualitative Water Quality-Related Data and Information

Virginia lacks specific data quality guidance for evaluating qualitative citizen data.[109] In fact, EPA has repeatedly highlighted Virginia's failure to develop a "formalized methodology for handling particular kinds of [qualitative] data."[110] For example, EPA's comments to Virginia's 2010 and 2012 Integrated Reports noted that DEQ had not developed "formal quality assurance/quality control protocols for evaluating photographs and testimonials submitted by the public."[111] Additionally, EPA emphasized 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 and that a citizen-group's failure to maintain a state-approved quality assurance plan [as a result] is not a sufficient basis for categorically excluding that group's data.[112]

Yet, the absence of clear agency expectations for qualitative data means it is difficult for the public to ensure that data submitted in the form of photographs, videos, public comments, expert reports, and more will actually satisfy Virginia's data quality standards, thereby allowing DEQ to use it in listing decisions. This frustrates the public's involvement in the water quality assessment process, as seen in the recent impaired waters listing case, *Potomac Riverkeeper v. Wheeler*, because it consequently limits the use of citizen water quality-related data and information in agency decision-making.

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[109] *See Water Quality Assessments*, VA. DEP'T ENV'T QUALITY, https://www.deq.virginia.gov/water/water-quality/assessments [https://perma.cc/4KK9-82X9] (last visited Mar. 11, 2022) (lacking any mention of non-water quality monitoring types of data: "During the Water Quality Assessment process, monitoring results are analyzed to determine if the water quality meets set standards and is clean enough for swimming, fishing and other uses."). *See also* VA. DEP'T ENV'T QUALITY, *supra* note 92, at 58–67 (Non-Agency Data lacking reference to non-monitoring types of data).

[110] *Potomac Riverkeeper*, 381 F. Supp. 3d at 8–10 (internal citations omitted) (noting that lack of such a methodology "is not a basis for a state to avoid evaluating data or information when developing its 303(d) list.").

[111] *Id.*

[112] *Id.* at 9–10 (internal quotations omitted).

C. Potomac Riverkeeper v. Wheeler

In *Potomac Riverkeeper v. Wheeler*, recreational and conservation citizen organizations ("citizen groups") challenged EPA's approval of Virginia's 2016 impaired waters list for failing to identify any segments of the Shenandoah River as impaired "despite numerous complaints from the public of excessive algal growth" interfering with their recreational use.[113] These citizen groups argued that EPA's approval was arbitrary and capricious for two reasons.[114] First, because DEQ had failed to "assemble and evaluate" all relevant water quality-related data and information when it refused to rely on qualitative citizen data to make an impairment decision regarding recreational use.[115] Second, because DEQ had failed to apply Virginia's narrative water quality criteria to determine the Shenandoah River's attainment status.[116] The court concluded that EPA's approval of the list was not arbitrary and capricious, finding EPA's approval "reasonable" and giving "significant deference" to the agency's scientific judgment.[117] Specifically, the court found that it was reasonable for EPA to approve Virginia's impaired waters list because DEQ had fulfilled its nondiscretionary duty to evaluate all relevant water quality-related data and information by "collecting, responding to, analyzing, discussing, and acting on the [citizens'] data."[118] The fact that DEQ did not *use* any qualitative citizen data to make an impairment determination for the Shenandoah River did not matter.[119] The court also found EPA acted reasonably in approving Virginia's impaired waters list because it was reasonable for EPA to defer to Virginia's judgment that DEQ needed to collect additional data before making an impairment determination under Virginia's narrative criteria "[g]iven the mixed and potentially unreliable picture of algal growth."[120] Ultimately, DEQ's concerns about data quality won the day.

Yet, DEQ created the very situation that allowed the agency to easily dismiss the citizen groups' qualitative data by failing to develop specific data quality guidance for qualitative data despite the fact that

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[113] *Id.* at 5.
[114] *Id.* at 12–13.
[115] *Id.* at 12.
[116] *Potomac Riverkeeper*, 381 F. Supp. 3d at 12.
[117] *Id.* at 20–22 (internal citations omitted).
[118] *Id.* at 15.
[119] *Id.*
[120] *Id.* at 19–21.

the agency received significant quantities of qualitative data from the citizen groups for over the better part of a decade. From 2010 to 2016, the citizen groups submitted multiple types of citizen-generated water quality-related data and information in their efforts to inform DEQ's impairment determination for the Shenandoah River.[121] At no point did DEQ reach out to these groups, offering data quality guidance or making known the agency's expectations.[122] Qualitative data submitted in the citizen groups' public complaints included such water quality-related data and information as: public comments of citizen water quality observations; "126 testimonials by recreational users"; expert reports, including a report "documenting excessive algal growths and their negative impacts on recreational use throughout at least the period from 2007 to 2014"; "15 videos of algal blooms (along with a table reporting their date and location)"; and over 1,000 photographs.[123] Notably,

> The expert report [also] included a systematic study of algae coverage in many areas during the months of June and July of 2012, an evaluation of the scope and extent of algal growth in the Shenandoah River, and citations to scientific literature supporting the methodologies used to measure algal growth and its impact on recreational use and aquatic life.[124]

Even so, DEQ repeatedly concluded that the qualitative citizen data provided "insufficient data to justify listing any stretches of the Shenandoah River as impaired" despite citizen qualitative data evidencing interference with recreational use.[125] DEQ classified such citizen data as "largely anecdotal,"[126] thereby questioning the data quality. DEQ also used the term "anecdotal" to describe the reports of algal growth included in the expert report, noting that such citizen observations contained in the report "had to be confirmed through objective monitoring data to ensure that impairment decisions remained unbiased and defensible."[127] DEQ did not consider citizens' personal, accumulated experiences with the

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[121] *Id.* at 8–11 (discussing citizen groups' long-running dispute with DEQ and specific types of qualitative data citizen groups submitted for use in integrated reports).
[122] *Potomac Riverkeeper*, 381 F. Supp. 3d at 8–11.
[123] *Id.* (internal quotation marks and citations omitted).
[124] *Id.* at 8–9 (internal quotation marks and citations omitted).
[125] *Id.* at 9 (internal quotation marks omitted).
[126] *Id.*
[127] *Id.* at 15.

Shenandoah River to be "objective" evidence.[128] Moreover, DEQ highlighted "its long-standing policy of basing impairment decisions solely on Level III data collected with an agency-approved quality assurance plan."[129] The lack of QAPPs or equivalent documents for the various types of qualitative citizen data automatically meant that DEQ would not consider the data up to the standard required for Level III data.[130]

DEQ failed to clearly articulate to the public the data quality standards it requires for qualitative water quality-related data and information in order to use such data for impairment decisions. DEQ claimed it "values the information gathered by its citizen monitors,"[131] but it chose not to develop data quality guidance for qualitative data that citizen groups repeatedly submitted despite nearly a decade of public complaints and an eventual legal challenge.[132] Additionally, DEQ neglected to develop quality assurance protocols for particular types of data while simultaneously establishing a state approved QAPP as necessary criteria for achieving Level III data quality for all data.[133] Further, DEQ devalued the qualitative data submitted by citizens, referring to it as "anecdotal" and assuming such data could not be reliable evidence of waterbody impairment of recreational uses.

Potomac Riverkeeper v. Wheeler illustrates the difficulty citizens can experience in meeting data quality standards when submitting qualitative water quality-related data and information for use in regulatory decision-making. This difficulty is increased when the agency's expectations for data quality are unclear. If Virginia truly is to encourage the use of citizen science in protecting water quality, then it must develop clear, reasonable, and specific data quality standards for qualitative data.

IV. VIRGINIA SHOULD DEVELOP DATA QUALITY STANDARDS FOR QUALITATIVE WATER QUALITY-RELATED DATA AND INFORMATION

A. Data Quality Standards for Qualitative Water Quality-Related Data and Information Would Acknowledge the Scientific Value that Qualitative Data Can Bring to Water Quality Assessments

Qualitative data—not just quantitative water quality monitoring data—can provide sufficient information for a state environmental agency

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[128] *Potomac Riverkeeper*, 381 F. Supp. 3d at 15.
[129] *Id.*
[130] *Id.* at 7 (defining requirements for Level III data).
[131] *Id.* at 15.
[132] *See id.*
[133] *See id.*

to assess whether a waterbody is impaired or not.[134] Virginia prefers to rely on quantitative data for impairment listings.[135] However, in certain situations, qualitative data can provide credible, useful, and sufficient information about water quality.[136] This data is particularly relevant in situations where pollutants interfere with citizens' recreational use of a waterbody as in *Potomac Riverkeeper*. Other states have recognized the scientific value of using qualitative data in water quality assessments, including impairment listings, by developing data quality standards for qualitative data and clearly articulating agency expectations. For example, in Vermont, a waterbody is listed as impaired for nutrient pollution if "[a]n on-going record of public complaint concerning the algal conditions in the water has been established."[137] It is reasonable to rely on such qualitative data because algal blooms provide visual, as well as sensory (e.g., smell, touch, and even taste if one is so unfortunate), evidence of water quality impairment that is not only noticeable to the public, but also interferes with the public's recreational use of the relevant waterbody.[138] Additionally, in California, the state water control board expressly accepts qualitative citizen water quality-related data and information for use in impairment decisions.[139] The agency also explains the minimum data quality requirements for such data with clarity and detail on its public website:

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[134] DENISE KEEHNER, EPA, INFORMATION CONCERNING 2014 CLEAN WATER ACT SECTIONS 303(D), 305(B), AND 314 INTEGRATED REPORTING AND LISTING DECISIONS (Sept. 2013) [hereinafter EPA MEMO], https://www.epa.gov/tmdl [https://perma.cc/FK65-Z89N] (explaining that "[a] number of States have listed waterbodies [as impaired] for nutrients and nutrient-related impacts based on a range of [assessment] methods [including] simple visual assessments . . . ." and discussing examples of visual assessment methods from Oregon, Vermont, Montana, Delaware, Iowa, and New Mexico); 9 VA. ADMIN. CODE § 25-260-20 (plain language of narrative criteria states "interference" with recreational use constitutes impairment).

[135] *See, e.g.*, MANUAL, *supra* note 101.

[136] *See* EPA MEMO, *supra* note 134, at 7–11; State Water Control Bd. v. Captain's Cove Utility Co., Aug. 5, 2008 Va. App. LEXIS 375, *9–12 (2008).

[137] *See* EPA MEMO, *supra* note 134, at 10.

[138] *Id.*

[139] *Water Quality Assessment: Data Submittal Requirements,* CA. WATER BDS., [hereinafter *Water Quality Assessment: Data Submittal Requirements*], https://www.waterboards.ca.gov/water_issues/programs/water_quality_assessment/data_requirements.html#instructions_no%20n_ceden_submissions [https://perma.cc/53D4-2FVC] (last visited Mar. 11, 2022); *Water Quality Assessment: Data Solicitation*, CA. WATER BDS., https://www.waterboards.ca.gov/water_issues/programs/water_quality_assessment/data_solicitation.html [https://perma.cc/QNY2-FYC4] (last visited Mar. 11, 2022) (noting, however, that state environmental agency uses qualitative evidence in impairment listings decisions as "ancillary evidence").

Qualitative information, such as narratives, must:

- Describe events or conditions that indicate impacts on water quality
- Provide linkage between the measurement endpoint (e.g., a study that may have been performed for some other purpose) and the water quality standard of interest
- Be scientifically defensible
- Provide analyst's credentials and training
- Be verifiable by the State Water Board or Regional Water Board staff

Photographic documentation must include description of:

- Date and time photograph(s) taken
- The spatial representation of the photographs, (e.g., reach, location)
- The temporal representation, (e.g., time of year)
- The linkage between photograph-represented condition and condition that indicates impacts on water quality
- The photographer's rationale for area photographed and camera settings used
- Any additional pertinent information about the photograph(s) to support assessment[140]

Notably, the agency also explains that "data cannot be assessed if these minimum requirements are not met," thereby making its data quality expectations clear and saving citizens resources they might have otherwise spent.[141]

Citizens can collect, prepare, record, and submit qualitative data in a way that satisfies data quality standards for use in impaired waters listings[142] provided data quality expectations are clear. This is why EPA recommends that states "include in their assessment methods their data quality, quantity, and representativeness expectations and protocols for making water quality attainment determinations. *Such expectations are*

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[140] *Water Quality Assessment: Data Submittal Requirements*, *supra* note 139.
[141] *Id.*
[142] *See* HANDBOOK, *supra* note 10, at 17.

particularly important when information from stakeholders can be used to assess whether applicable water quality standards are being met."[143] This is particularly relevant for water quality assessment of a waterbody's designated recreational uses because qualitative data can illuminate whether or not citizens will swim, fish, boat, or enjoy the aesthetics of the waterbody.[144] Citizens' personal risk tolerances or aesthetic preferences for using a waterbody for recreation may differ from the numeric pollutant values at which DEQ considers the waterbody to be impaired.[145] Yet, if the qualitative citizen data, whether in the form of photos, videos, or public comments, shows that citizens will not recreate in a waterbody due to the condition of the water, whether actual or perceived, then this data provides a valuable indicator of poor water quality and possibly even impairment.[146] Virginia's water quality standards recognize this reality. The Commonwealth's narrative water quality criteria considers a waterbody to be impaired if the water quality situation directly or indirectly interferes with recreational use.[147] For this reason, qualitative water quality-related data and information submitted by citizens brings critical scientific value to the water quality assessment and impairment listing process because it completes the picture of Virginia's water quality that DEQ cannot see relying on quantitative data alone.

B. Data Quality Standards for Qualitative Water Quality-Related Data and Information Should Be Clear, Reasonable, and Specific to Inform Citizens of Agency Expectations

Presently, Commonwealth citizens seeking to submit qualitative data for use in regulatory decision-making have no guidance from DEQ concerning the agency's expectations for qualitative data.[148] They can infer, based on the outcome of *Potomac Riverkeeper*, that qualitative data is unwelcomed and unworthy from DEQ's perspective to support an impairment

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[143] EPA MEMO, *supra* note 134, at 12–13 (emphasis added).
[144] State Water Control Bd. v. Captain's Cove Utility Co., Aug. 5, 2008 Va. App. LEXIS 375, at *9–12 (2008) (relying on qualitative evidence, including visual yellow condemnation signage at beach, as evidence that public would likely not recreate in waterbody regardless of whether water quality standards attained).
[145] *Id.*
[146] *Id.* at *25–26 (explaining that Virginia water quality regulation "clearly contemplates that some substances may not violate water quality standards, while still interfering with designated uses of state waters") (citing 9 VA. ADMIN. CODE § 25-260-20).
[147] 9 VA. ADMIN. CODE § 25-260-20.
[148] *See supra* notes 92–108 and accompanying text.

decision.[149] Nonetheless, EPA recognizes the value of such data,[150] encouraging Virginia to develop data quality standards for qualitative citizen data to inform citizens of DEQ's expectations.[151] Virginia's data quality standards for qualitative citizen water quality-related data and information should be clear, reasonable, and specific to achieve this aim.

1. Clear

Clear data quality standards for qualitative water quality-related data and information clearly and explicitly articulate agency expectations for data quality.[152] Additionally, they should expressly state for what intended purposes DEQ will or will not use qualitative data.[153] DEQ should also address whether it will consider qualifying qualitative data sufficient to support an impairment decision as primary or ancillary evidence of impairment. Moreover, DEQ should use non-specialized language where possible to ensure understanding for lay persons, as well as defining technical terms. DEQ should prominently display data quality standards information on its public website so it is easily accessible to citizens. Further, DEQ should advise citizens who submit information related to potential water quality standards violations about any deficiencies that DEQ identifies in this information meeting data quality standards, so the citizens can conform their methods and ensure the usefulness of their information.

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[149] Potomac Riverkeeper v. Wheeler, 381 F. Supp. 3d 1, 9, 15 (D.D.C. 2019).

[150] *See, e.g.*, *Basic Information About Citizen Science*, EPA, https://www.epa.gov/citizen-science/basic-information-about-citizen-science-0 [https://perma.cc/P8BU-DEUK] (last visited Mar. 11, 2022) (explaining how citizen science helps EPA by filling data gaps, leveraging resources, and helping EPA build meaningful relationships with communities). *See also* NACEPT 2018, *supra* note 14, at 16–19 (examples of successful EPA-community collaborations for environmental citizen science); HANDBOOK, *supra* note 10, at 5 (noting that Handbook's purpose is to "convey common expectations for quality assurance and documentation" in order to "level the playing field for organizations that train and use volunteers in the collection of environmental data").

[151] *Potomac Riverkeeper*, 381 F. Supp. 3d at 8.

[152] *See, e.g.*, NACEPT 2016, *supra* note 18, at x (explaining that environmental agencies "increase [citizen] data utility by investing in data standard setting and providing clear guidelines for producing data fit for purpose and communicating the data quality needed for a range of data uses").

[153] *See, e.g.*, HANDBOOK, *supra* note 10, at 7–8 (discussing categories of use and types of data and level of detail required for each), 11–12 (explaining recommended quality assurance elements for each use category to ensure data quality).

2. Reasonable

Reasonable data quality standards have a rational connection between the type of data submitted and the requirements for use. Regarding data use for regulatory decision-making, reasonable data quality standards should include clear and specific processes for authenticating data and determining the credibility of experts.[154] DEQ should assess individual expertise not solely in terms of education, training, and professional experience, but should also consider demonstrated, accumulated personal experience of a waterbody or section of a waterbody.[155] Importantly, given that the goal of water quality standards is to prevent interference with designated uses, actual waterbody users' information must carry substantial weight, as long as the data submitted meets basic evidentiary requirements for data quality. Although deciding whether conditions interfere with the public's use of a waterbody is, to some degree, a subjective exercise, agency officials must not presume to replace users' judgements with their own.[156] Rather, DEQ must assess and evaluate such citizen reports, and appropriately act upon them if they provide credible bases to determine use-attainability.

3. Specific

Specific data quality standards explain in detail what data-specific information citizens must include with the data they submit. The requested information should be specific, as well as tailored, to the data type. For example, such information could include: data and time of collection; location; time of year; who collected the data and how; connection between represented condition and conditions that indicates impacts on water quality; rationale for area photographed or recorded (if relevant) as well as camera settings used; and expert's credentials and training.[157] Regarding expertise, DEQ should also request and must consider additional factors that lend value and credibility to public reports of water quality

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[154] *See, e.g.*, *Water Quality Assessment: Data Submittal Requirements*, *supra* note 139 (requesting documentation of expert's training and credentials); *see also* FED. R. EVID. 702 (defining expert witness as person who qualifies as expert by "knowledge, skill, experience, training, or education").
[155] *See, e.g.*, FED. R. EVID. 702.
[156] State Water Control Bd. v. Captain's Cove Utility Co., Aug. 5, 2008 Va. App. LEXIS 375, at *8 (2008).
[157] *See* Potomac Riverkeeper v. Wheeler, 381 F. Supp. 3d 1, 12, 15 (D.D.C. 2019).

conditions, including: a person's familiarity with normal or historical conditions in the waterbody and other similar waterbodies, and the length of time a person has used and been familiar with the waterbodies.

C. Data Quality Standards for Qualitative Water Quality-Related Data and Information Would Encourage Citizen Science in the Commonwealth, Increasing Public Participation and Government Transparency

Virginia's approach to citizen water quality-related data and information devalues qualitative data for use in regulatory decision-making. This, in turn, reduces or eliminates the value of the state's narrative criteria, particularly as they are intended to protect recreational uses. The lack of clear data quality expectations for qualitative citizen data means citizens cannot confidently submit data on interference with recreational use that will satisfy DEQ's Level III data quality standard. As such, DEQ will not use this data to make an impairment determination.[158] This reality discourages citizen science by obstructing citizen participation in the impaired waters listing process because citizens are unable to achieve their intended purpose of supporting impairment decisions with "sufficient" evidence since no one knows what "sufficient" means for qualitative data.[159] Accordingly, Virginia should develop clear, reasonable, and specific data quality standards for qualitative citizen data in order to encourage public participation in protecting water quality as well as to increase governmental transparency in the impaired waters listing process.

1. Public Participation

Clear, reasonable, and specific data quality standards for qualitative data would encourage public participation because such standards would inform citizens of Virginia's expectations for data quality for photographs, videos, public comments, and other types of qualitative water quality-related data and information that citizens can easily collect representing interference with their recreational use.[160] The lack of data quality guidance for qualitative data makes it impossible for citizens to

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[158] MANUAL, *supra* note 101, at A9-1.
[159] *See* Mihaly, *supra* note 83, at 165–66 (explaining that ineffective citizen participation has deleterious effect on civic society by discouraging the public, "leading [them] to deep cynicism about the political system").
[160] *See id.* at 153.

know where the data they provide falls within DEQ's data standards hierarchy and whether DEQ will use such data for the citizens' intended purpose.[161] Clear data quality standards "help ensure that citizen scientists understand what they need to do for their work to be used by [Virginia], and to help them establish appropriate goals for their efforts."[162] Notably, "[t]his gives citizen groups a clear target to shoot for and reduces the risk that they will go to a great deal of work collecting data but not have [DEQ accept it]."[163] While Virginia's current data quality approach is an obstacle to public participation, the Commonwealth can encourage public participation in the impaired waters listing process by developing and articulating agency expectations for qualitative citizen water quality-related data and information.

2. Government Transparency

Additionally, data quality standards for qualitative data would encourage citizen science by encouraging citizens to play a larger role in agency decision-making, thereby increasing government transparency. The CWA regulations requiring water quality protection programs are unique in "explicitly calling on states to consider data from outside sources."[164] This requirement "gives such data legitimacy" that other environmental protection programs may lack due to their reliance on agency data.[165] Virginia can enhance the legitimacy of the data on which it bases its impaired waters listing by developing clear, reasonable, and specific data quality standards for qualitative water quality-related data and information. This action would likely expand DEQ's pool of quality data and, potentially, the quantity of non-agency data that DEQ incorporates into the integrated reports. More importantly, expanding the pool of quality citizen water quality-related data and information "forces information on [agency] staff and decision-makers who would not have faced it otherwise, because they were simply unaware, because they were pressured not to see, or because the information contravened their own ideologies."[166] This

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[161] *See, e.g.*, ENV'T L. INST., CITIZEN SCIENCE PROGRAMS AT ENVIRONMENTAL AGENCIES: CASE STUDIES 37 (2020) (stating that "[c]lear data quality guidelines are an important tool, providing an open and transparent road map for citizen groups wishing to influence government action").
[162] *Id.*
[163] *Id.*
[164] *Id.*
[165] *Id.*
[166] Mihaly, *supra* note 83, at 161.

is important because "[w]hen entrenched existing stakeholders dominate government processes, the status quo prevails, and substantial change becomes problematic."[167] As such, Virginia's inclusion of citizen water-quality-related data and information matters is critical not only for transparent state governance, but also for achieving the Commonwealth's water quality goals.

Virginia's lack of data quality standards for qualitative water quality-related data and information obscures the impaired waters listing process because it allows Virginia to use the lack of an agency-approved quality assurance plan for such citizen data as an excuse for not using this data for an impairment decision despite the fact that the absence of a QAPP does not mean the data is of low quality.[168] This is an obstacle to government accountability that the Commonwealth itself has created. Virginia bears responsibility for both developing data quality standards and evaluating the quality of submitted citizen data.[169] Virginia's failure to develop data quality guidance and assessment methods for qualitative water quality-related data and information increases the opacity of its data review because it de facto excludes certain citizen data from impairment decisions, thereby limiting transparency in the impaired waters listing process. Yet, clear, reasonable, and specific data quality standards for qualitative citizen data would enhance government transparency because it would allow citizens a greater opportunity to contribute to Virginia's impaired waters listing process by helping them submit quality data that DEQ could use in its impairment determinations. The greater the quantity of *quality* citizen data—whether quantitative or qualitative—that DEQ receives showing signs of waterbody impairment, the greater the likelihood that DEQ would find sufficient information exists to list a waterbody as impaired. As such, citizens could help hold the state accountable to its CWA goals simply by gathering and submitting quality data.

D. Data Quality Standards for Qualitative Water Quality-Related Data and Information Would Benefit Virginia Economically and Environmentally

Unless EPA mandates Virginia to finally develop data quality standards and assessment methodologies for qualitative water quality-related

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[167] *Id.* at 163.
[168] *See, e.g.*, Potomac Riverkeeper v. Wheeler, 381 F. Supp. 3d 1, 9 (D.D.C. 2019).
[169] EPA GUIDANCE 2006, *supra* note 79, at 42–44; 40 C.F.R. § 130.7(b)(5).

data and information as required by CWA regulations,[170] it seems unlikely that the Commonwealth will develop such standards on its own initiative.[171] However, Virginia stands to receive economic as well as environmental benefits by developing clear, reasonable, and specific data quality standards for qualitative citizen water quality-related data and information.

1. Economic Benefits

"Citizen scientists can provide information that would not otherwise be available due to time, geographic, or resource constraints."[172] Importantly, citizen water quality-related data and information can save Virginia money. It already has. For example, DEQ previously has invested funds in volunteer water quality monitoring, "receiv[ing] over $750,000 worth of data collected for its $200,000 investment in citizen science (i.e., through state grants and staff support), for an over 275 percent return on investment of agency resources."[173] More data meeting DEQ's Level III data quality standard means DEQ would have more quality data to use to assess Virginia's waters. This would not only provide a more holistic picture of the water quality situation throughout the Commonwealth, but also save DEQ staff time and money on the data gathering end, allowing them to focus precious agency resources on water quality assessment. Additionally, quality qualitative water quality-related data and information would allow DEQ to use such data as primary evidence or ancillary evidence to support an impairment decision, rather than simply as a reason for DEQ to gather additional quantitative data at the agency's expense.[174]

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[170] 40 C.F.R. § 130.7(b)(6) (mandatory duty to develop assessment methodologies for evaluating water quality-related data and information and include description of methodologies used to develop TMDL list in integrated report).

[171] *See, e.g.*, *Potomac Riverkeeper*, 381 F. Supp. 3d at 8 (internal citations omitted) (repeatedly highlighting Virginia's failure to develop assessment methodologies despite years of feedback from EPA).

[172] *Citizen Science for Environmental Protection*, EPA, https://19january2017snapshot.epa.gov/citizen-science_.html [https://perma.cc/L93V-MTMN] (last updated Dec. 14, 2020).

[173] EPA, EPA NEEDS A COMPREHENSIVE VISION AND STRATEGY FOR CITIZEN SCIENCE THAT ALIGNS WITH ITS STRATEGIC OBJECTIVES ON PUBLIC PARTICIPATION 10 (2018).

[174] *See, e.g.*, *Potomac Riverkeeper*, 381 F. Supp. 3d at 9 (noting DEQ used qualitative data submitted by citizen groups to classify river segments for additional water quality monitoring).

2. Environmental Benefits

Virginia's development of clear, reasonable, and specific data quality standards for qualitative water quality-related citizen data and information would benefit the Commonwealth because expanding the pool of quality data helps provide a more accurate picture of the environmental status of Virginia's waters. This would likely not only improve the efficiency and thoroughness of the impaired waters listing process by increasing the quantity of quality water quality-related data and information available for assessment, but also help Virginia achieve its water quality goals. Quantitative and qualitative citizen data together would provide a holistic overview of Virginia's waters because the latter illuminates the former. Qualitative water quality-related data and information, such as photographs, videos, and public comments, often expressly address whether citizens would fish or swim in a particular waterbody.[175] If the photographs, videos, or public comments show or tell that the water quality condition is of such that it directly or indirectly impacts citizens' willingness or ability to recreate in or on a waterbody, then that water is impaired under Virginia's narrative criteria.[176] Qualitative data, therefore, should be a critical component of DEQ's assessment concerning whether a waterbody meets water quality standards for its designated uses. For this reason, clear, reasonable, and specific data quality standards for qualitative citizen data would help Virginia achieve its CWA goals by providing a comprehensive overview of the Commonwealth's water quality situation.

CONCLUSION

In the Commonwealth, citizen science has the potential to contribute valuable scientific insight on Virginia's water quality situation in the form of qualitative water quality-related data and information. Such data is especially relevant as evidence of waterbody impairment due to direct or indirect interference with designated recreational uses, such as swimming, fishing, boating, or enjoyment of aesthetics. However, Virginia's current approach to qualitative citizen data undermines the public's ability to submit quality qualitative data for use in regulatory decision-making—specifically, impairment decisions—due to the lack of clear, reasonable,

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[175] *See, e.g.*, *id.* at 9–10 (noting qualitative data submitted by citizen groups whose members' use of Shenandoah River was impaired by water quality situation).
[176] 9 VA. ADMIN. CODE § 25-260-20.

and specific data quality standards for such data. This muddies the water not only of DEQ's data quality expectations, but also of the impaired waters listing process. Therefore, Virginia should establish clear, reasonable, and specific data quality standards for qualitative water quality-related data and information to ensure DEQ's valid use of such data in impaired waters listings, enhancing agency transparency, and improving the Commonwealth's capacity to achieve its water quality goals under the CWA.