Message

From: Harris, Stewart [Stewart_Harris@americanchemistry.com]
Sent: 2/2/2018 2:17:44 PM
To: GarberJG@state.gov
CC: Nishida, Jane [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=65e465e683c54e1b825f1bad32dcb099-Nishida, Jane]; Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]; benjamin.friedman@noaa.gov
Subject: ACC Letter Regarding UNEA-3
Attachments: ACC UNEA-3 letter to Judith Garber.pdf

Assistant Secretary Garber,

Please find the attached letter to you from Cal Dooley regarding the significant efforts of the U.S. government at UNEA-3. Let me know if you have any questions.

Thanks,
Stew

Stewart Harris | American Chemistry Council
Director, Marine and Environmental Stewardship, Plastics Division
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American Chemistry Council

CAL DOOLEY
PRESIDENT AND CEO

February 1, 2018

Judith Garber
Acting Assistant Secretary
Bureau of Oceans and International Environmental and Scientific Affairs
U.S. Department of State

Dear Mme Assistant Secretary:

I am writing to thank the U.S. government for its significant efforts to engage with and support its many stakeholders, including the U.S. chemical industry, at the third session of the United Nations Environment Assembly (UNEA-3). The U.S. delegation played a critical role in promoting our country's interests and all three pillars of sustainable development: environment, health, and economic development.

Strong engagement by the U.S. government in UNEA and its related meetings is critical to ensuring the development of sound policy recommendations. While UNEA recommendations are non-binding, the global nature of this body has a profound impact on U.S. businesses operating at home and abroad.

This year's negotiations were complex and covered a broad range of issues, requiring knowledgeable and experienced negotiators. The U.S. delegation included seasoned negotiators and experts from the State Department, NOAA, and EPA, who effectively managed differing member state and stakeholder positions. They also advocated for science- and risk-based approaches to complex global issues such as marine litter and microplastics, as well as the sound management of chemicals and waste.

The outcomes of UNEA-3 demonstrate the importance of robust U.S. government engagement in international environmental forums, and the participation of seasoned negotiators and experts. In an era of limited resources—and given the challenges posed by governments with different agendas broadly affecting U.S. interests—ACC greatly appreciates the U.S. government's focus on and investment in UNEA.

Through the leadership of the International Council of Chemical Associations and World Plastics Council, the American Chemistry Council continues to collaborate with and support the UN Environment Program and the United Nations more broadly to achieve the Sustainable Development Goals and sound management of chemicals worldwide. We look forward to continued, productive engagement with the U.S. government, UN Environment Program, and other stakeholders to achieve these important goals.

Sincerely,

Cal Dooley

Cal Dooley

Cc: Principal EPA Administrator for International, Jane Nishida
Senior Advisor to EPA Administrator Pruitt, Sarah Greenwalt
Deputy Under Secretary of Commerce for Oceans and Atmosphere, Benjamin Friedman

Message

From: Hupp, Millan [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=92CAC7B684B64F90953B753A01BEE0D5-HUPP, MILLA]
Sent: 1/11/2018 3:41:50 PM
To: andy.abboud Redacted
CC: Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]
Subject: Call tomorrow?

Andy,

It was a pleasure to talk with you yesterday. Sarah and I would like to schedule a call with you at 4PM ET, 1PM PT tomorrow (Friday, January 12). We would welcome your thoughts on the current draft agenda as well as on the issues listed below...

Israeli innovation and technology
Atmospheric water generation, irrigation, and purification
The Global Methane Initiative
Site remediation

The dates that we currently have held are February 18 – 23, 2017.

Thank you,

Millan Hupp
Director of Scheduling and Advance
Office of the Administrator
Personal Matters / Ex. Email: hupp.millan@epa.gov

Message

From: Aspatore, Amanda [AAspatore@nma.org]
Sent: 11/29/2017 5:24:22 PM
To: Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]
Subject: NMA WOTUS Step Two Pre-Proposal Comments
Attachments: National Mining Association WOTUS Pre-Proposal Recommendations.pdf

Hi Sarah –
I wanted to make sure you had a copy of NMA's comments on the Agencies' WOTUS "Step Two" pre-proposal request for input. These were submitted to the public docket via regulations.gov yesterday. Thanks so much – I hope that you had a nice Thanksgiving!
Amanda

Amanda E. Aspatore
Vice President, Water Law & Policy
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November 28, 2017

U.S. Environmental Protection Agency
EPA Docket Center
Water Docket
Mail Code 28221T
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Submitted electronically via www.regulations.gov

In Re: National Mining Association Definition of "Waters of the United States" – Pre-Proposal Recommendations; Docket ID No. EPA-HQ-OW-2017-0480

To Whom It May Concern:

The National Mining Association (NMA) submits the following recommendations for the U.S. Environmental Protection Agency (EPA) and Army Corps of Engineers (Corps) to consider as they develop a revised definition of "waters of the United States" (WOTUS) under the Clean Water Act (CWA). NMA appreciates the opportunity to comment on this key initiative, and welcomes the Agencies' encouragement of stakeholder engagement.

NMA and Its Members

NMA is a national trade association representing producers of most of America's metals, coal, and industrial and agricultural minerals; the manufacturers of mining and mineral processing machinery, equipment, and supplies; and the engineering and consulting firms, financial institutions, and other firms serving the mining industry.

NMA's members produce energy, metals, and minerals that are essential to social and economic prosperity, environmental improvement, and a better quality of life. NMA's members have pledged to conduct their activities in a manner that recognizes the needs of society and the need for environmental responsibility, national security, and economic growth. Accordingly, NMA is committed to integrating social, environmental, and economic principles into mining operations from exploration through development, operation, reclamation, closure, and post-closure activities.

The U.S. mining industry is heavily regulated under various state and federal environmental statutory regimes. In advance of any land disturbances, mining operators must obtain multiple environmental licenses and permits, which frequently include CWA

Section 404 and 402 permits, and Section 401 state certifications. Mining operators are likewise subject to other state and federal water quality and management requirements, including state groundwater regulations and, in the case of coal mining, Surface Mining Control and Reclamation Act (SMCRA) provisions. Mining companies expend significant resources on engineering, treatment, and mitigation measures designed to ensure that modern mining does not negatively impact water quality.

NMA has therefore engaged extensively with the Agencies regarding the proper scope of federal CWA jurisdiction for decades. With respect to the 2015 WOTUS Rule, NMA filed comprehensive substantive,[1] technical,[2] and coalition[3] comments on the proposed rule. NMA also met with agency staff on multiple occasions to further discuss the aspects of the rule most important to the mining industry. Due to the extensive state and federal environmental regulations applicable to the mining industry, as well as the fact that mining operations require significant capital investment (for, among other things, environmental engineering, treatment, and mitigation measures), NMA stressed the need for regulatory clarity and the application of appropriate limits on the reach of federal CWA jurisdiction.

Although aspects of the final 2015 WOTUS Rule did seek to address certain concerns raised by NMA and others, ultimately the rule included multiple overly expansive, unclear, and unlawful provisions. Thus, NMA joined with dozens of other industry and agricultural organizations – as well as 31 states – in challenging the rule in court. NMA remains committed to working with the Agencies to help ensure that a revised WOTUS definition is protective of water quality, administrable, lawful, and clear.

Summary of Recommendations

As noted above, due to the overlapping environmental regimes the mining industry operates pursuant to, NMA's members have a substantial interest in ensuring that any final rule defining the extent of federal CWA jurisdiction (1) provides clarity to the regulated community and agency field staff alike; (2) unambiguously excludes on-site water management features from jurisdiction; and (3) places reasonable, defined limits on federal jurisdiction to ensure appropriate environmental protections while avoiding undue permitting delays and allowing federal and state regulators to focus their resources on environmental mandates rather than protracted jurisdictional determinations.

NMA also encourages the Agencies in drafting a future WOTUS definition to take into consideration (1) the text of the CWA; (2) all applicable Supreme Court precedent; (3)

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[1] Nov. 14, 2014 Comments of the National Mining Association on the Proposed Definition of "Waters of the United States" Under the Clean Water Act, 79 Fed. Reg. 22,188 (Apr. 21, 2014).
[2] Nov. 14, 2014 Comments Prepared by GEI Consultants for the National Mining Association on the Proposed Waters of the U.S. Rule With Respect to Definitions of Excluded Erosional Features.
[3] Nov. 13, 2014 Waters Advocacy Coalition Comments on the EPA's and Corps' Proposed Rule to Define "Waters of the United States" Under the Clean Water Act.

Constitutional limitations on federal authority and due process requirements; and (4) policy considerations, such as administrability and regulatory certainty.

With those aims in mind, NMA suggests that the Agencies incorporate the following concepts in any future proposed WOTUS revision:

The Agencies should consider defining the following as "waters of the United States" –

(1) The territorial seas;
(2) Waters subject to the ebb and flow of the tide;
(3) Waters which have been used, are presently used, or are susceptible to use in their natural condition or by reasonable improvement as a means to transport interstate or foreign commerce;
(4) Tributaries to waters identified in categories (1)-(3);
(5) Wetlands adjacent to waters identified in categories (1)-(4);

Where –

The term "waters" means relatively permanent, standing or continuously flowing bodies of water forming geographic features such as streams, oceans, rivers, and lakes.

The term "relatively permanent" means the continuous natural presence of water for at least three continuous months of the year during years of typical precipitation.

The term "tributary" means a water that flows to a (1)-(3) water for at least 90 continuous days at a specified flow magnitude (such as, for example, x cubic feet per second or x percentage of flow contribution to downstream navigable waters).

The term "adjacent" means directly abutting.

The Agencies should also expressly exclude the following from the definition of "waters of the United States," even where they otherwise meet the terms of the preceding paragraphs –

(1) Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of the CWA;
(2) Groundwater;
(3) Water-filled depressions or excavations incidental to mining or construction activity, including mine scars and pits excavated for obtaining minerals, fill, sand, or gravel that fill with water;
(4) Ditches;
(5) Existing long-standing agricultural exclusions, including those for prior converted cropland;

Where –

The Agencies clarify in the preamble of the rule that waste treatment systems include manmade waters and wetlands, systems created in "waters of the United States" or with impounded "waters of the United States," and systems created in or with impounded non-jurisdictional waters and wetlands. For purposes of the application of the waste treatment system exclusion, the term "treatment" includes any active or passive method to retain, concentrate, settle, or reduce or remove pollutants from wastewater and/or stormwater. The term "system" encompasses all components of a waste treatment system, including but not limited to ponds and impoundments, and any features necessary to convey water to and from such ponds and impoundments.

Legal Background

The objective of the CWA is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[4] While Congress envisioned that the federal government would play an important role in working toward that objective, it explicitly announced its policy in the CWA to "recognize, preserve, and protect the primary responsibilities and rights of States to prevent, reduce, and eliminate pollution, to plan the development and use . . . of land and water resources, and to consult with the Administrator in the exercise of his authority under this chapter."[5]

With limited exceptions, the CWA prohibits "discharg[ing]...any pollutant"[6] without a Section 402 permit for discharges covered by the National Pollutant Discharge Elimination System (NPDES) program or a Section 404 permit for discharges of dredged or fill material. The CWA defines the term "discharge of a pollutant" as the "addition of any pollutant to navigable waters from any point source."[7] "Navigable waters," in turn, are defined to mean "the waters of the United States, including the territorial seas."[8] Thus, the extent of federal CWA jurisdiction depends on the scope of the term "waters of the United States."

The Supreme Court first addressed the Agencies' interpretation of "waters of the United States" within the meaning of 33 U.S.C. §1362(7) in *United States v. Riverside Bayview Homes, Inc.*,[9] which involved a wetland adjacent to a navigable water where "the area characterized by saturated soil conditions and wetland vegetation extended beyond the boundary of respondent's property" to "a navigable waterway."[10] Noting that "the Corps must necessarily choose some point at which water ends and land begins,"[11] the Court upheld the Corps' interpretation of "waters of the United States" to include a wetland that is directly connected to, and thus "actually abuts on a navigable waterway."[12]

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[4] 33 U.S.C. §1251(a).
[5] 33 U.S.C. §1251(b).
[6] 33 U.S.C. §1311(a).
[7] 33 U.S.C. §1362(12)(A).
[8] 33 U.S.C. §1362(7).
[9] 474 U.S. 121 (1985).
[10] *Id.* at 131.
[11] *Id.* at 132.
[12] *Id.* at 135.

The Supreme Court next addressed the proper scope of federal CWA jurisdiction in *Solid Waste Agency of Northern Cook County v. United States Army Corps of Engineers (SWANCC).*[13] There, the Court struck down the so called "Migratory Bird Rule," which purported to extend the Agencies' jurisdiction to include any intrastate waters "which are or would be used as habitat" by migratory birds.[14] Specifically, noting that "it was the significant nexus between the wetlands and 'navigable waters' that informed [the Court's] reading of the CWA in *Riverside Bayview,*" the Court held that "nonnavigable, isolated, intrastate waters" which did not "actually abut a navigable waterway" were not "waters of the United States."[15]

Finally, in *Rapanos v. United States,*[16] the Supreme Court "consider[ed] whether four Michigan wetlands, which lie near ditches or man-made drains that eventually empty into traditional navigable waters, constitute 'waters of the United States' within the meaning of the [CWA]."[17] Prior to *Rapanos,* "the Corps [had] interpreted its own regulations to include 'ephemeral streams' and 'drainage ditches' as 'tributaries' that are part of the 'waters of the United States.'"[18] "This interpretation extended the 'waters of the United States' to virtually any land feature over which rainwater or drainage passes and leaves a visible mark."[19] A four-Justice plurality outright rejected that interpretation, holding that "[waters of the United States] do not include channels through which water flows intermittently or ephemerally, or channels that periodically provide drainage for rainfall."[20] Justice Kennedy, concurring in the judgment, agreed that jurisdiction may have been lacking in *Rapanos* because there may not have been a requisite "significant nexus" between the waterbodies at issue and any navigable waters.[21]

As evidenced by the cases above, the Supreme Court has recognized important limits on the scope of CWA jurisdiction. In enacting the CWA, Congress intended "to regulate at least some waters that would not be deemed 'navigable' under the classical understanding of that term."[22] But Congress's use of the term "navigable" reflects a fundamental limit on federal CWA authority, and that term must be given some effect.[23] As Chief Justice Rehnquist noted in the Supreme Court's *SWANCC* opinion, "the term 'navigable' has at least the import of showing us what Congress had in mind as its authority for enacting the CWA: its traditional jurisdiction over waters that were or had been navigable in fact or which could reasonably be so made."[24] Indeed, Congress was exercising its "commerce power over navigation."[25] States challenging the 2015 WOTUS Rule likewise noted that "in order to preserve the federal-state regulatory

[13] 531 U.S. 159 (2001).
[14] *Id.* at 163-164.
[15] *Id.* at 167, 171.
[16] 547 U.S. 715 (2006).
[17] *Id.* at 729.
[18] *Id.* at 725 (citing 33 C.F.R. §328.3(a)(5)).
[19] *Ibid.*
[20] *Id.* at 739.
[21] *Id.* at 759-87.
[22] *Riverside Bayview,* 474 U.S. at 133; *SWANCC,* 531 U.S. at 171-72.
[23] *SWANCC,* 531 U.S. at 172; *Rapanos*, 547 U.S. at 779 (J. Kennedy, concurring).
[24] *SWANCC,* 531 U.S. at 172.
[25] *Id.* at 168 n.3.

balance, the statutory term 'waters of the United States' must be given a meaning that is consistent with the primary purpose of the CWA – to protect navigable-in-fact waters."[26]

Detailed Recommendations

Approach to Defining WOTUS

The statutory definition of the term "navigable waters" contained in the CWA – "the waters of the United States" – is ambiguous, and the Agencies will therefore receive deference from the courts during their "step two" rulemaking under *Chevron USA Inc. v. Natural Res. Def. Council, Inc.*[27] if the rule articulates reasonable definitions of those terms based on the Agencies' statutory interpretation and policy decisions. Importantly, however, courts generally do not afford similar deference to agency interpretations of ambiguous Supreme Court decisions because courts, not agencies, are the experts with regards to analyzing judicial decisions.[28] Indeed, NMA's opening brief in the litigation challenging the 2015 WOTUS Rule presented that very argument: that the 2015 rule did not deserve *Chevron* deference because it was based on an interpretation of Justice Kennedy's *Rapanos* "significant nexus" discussion. NMA therefore encourages the Agencies to avoid basing their "step two" rulemaking on an interpretation of a single judicial opinion, and to instead consider the CWA's text, all applicable Supreme Court decisions, key policy goals, and relevant scientific information as it moves forward with a revised WOTUS definition.

On-Site Waters and Water Management Features

As NMA has pointed out to the Agencies throughout their various WOTUS actions, mine sites typically contain features used and constructed to manage stormwater and process waters that must be expressly excluded from any WOTUS definition. For example, diversion and conveyance ditches and channels, closed loop systems, on-site containment, sedimentation and treatment ponds and impoundments, and other components of water treatment facilities are integral to mining operations. Importantly, these features are used to manage, contain, convey, and treat on-site waters in order to facilitate reuse and recycling, protect water quality, and comply with existing environmental standards pursuant to the CWA and numerous other federal and state mining laws and regulations. It is vital to the mining industry that the Agencies clarify in their "step two" rulemaking that such features are "waste treatment systems" excluded from the definition of WOTUS. Furthermore, additional clarity concerning the scope of the waste treatment exclusion is needed to ensure that water management features at

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[26] State Petitioners' Brief, *Murray Energy Corp. et al. v. U.S. EPA,* No. 15-3751 (6th Cir.) at 3.
[27] 467 U.S. 837 (1984).
[28] *See, e.g., Atkins v. FEC,* 101 F.3d 731 (D.C. Cir. 1996)(en banc)(There is "no reason for courts – the supposed experts in analyzing judicial decisions – to defer to agency interpretations of the [Supreme] Court's opinions").

mine sites can be utilized to properly manage and store water and wastes associated with mining operations and protect downstream water quality.

Water Management at Mine Sites

Mining operations encompass vast stretches of land—typically several square miles – and generally include complex process water systems. Mining operations are also dynamic, with different phases of activities such as construction, extraction and removal, and reclamation occurring concurrently or at varying times and in different areas throughout the mine site. Mining companies depend on a variety of water management features within their mine sites to manage stormwater runoff from disturbed areas, recycle water for reuse, or convey water to ponds or basins where solids are settled out prior to reuse or discharge. Some water management features are created on dry lands, while others are created by impounding or modifying existing "waters of the United States" pursuant to Section 404 permits.[29]

For example, mine operators rely on a broad range of ponds and impoundments (*e.g.*, sediment ponds, heap leach ponds, tailings impoundments, slurry impoundments, mine pits intercepting ground water, etc.) to support mining operations. Mine operators depend on these features, as well as ditches and other conveyances, to manage, store, treat, and beneficially reuse water within the mine site. According to EPA, these ponds and impoundments are considered to be a treatment method because they physically remove suspended solids and metals. By way of example, one of the main functions of on-site ponds and impoundments is to promote the settling of solids. After solid particles settle to the bottom of the water column, those solids are often removed for disposal or further treatment,[30] and the water can be evaporated, reused in mining processes, or discharged from the mine site to navigable waters pursuant to an NPDES permit.

Importantly, on-site water management features are highly regulated during and after the life of the mining operation. Among other things, these systems are designed to ensure that any surface discharge from a mine site into navigable waters is covered by an NPDES permit and as such will not cause or contribute to violations of water quality standards. Moreover, such features are often required to be permitted in accordance with state groundwater protection laws. In fact, many water management features within mine sites are designed to be zero discharge systems. At those sites, water that is collected and managed is either reused in mining processes or it evaporates; it is not discharged to navigable or other state waters.

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[29] As noted in the preamble to the 2015 WOTUS Rule, CWA Section 404 permits are needed to construct waste treatment systems in "waters of the United States," and CWA Section 402 permits may be required for downstream discharges from waste treatment systems to "waters of the United States." *See* 80 Fed. Reg. 37,054 at 37,097.

[30] In some mining operations, solids are designed to stay in impoundments and, at the end of the operating life of the mine, the impoundment is reclaimed.

History and Scope of the Waste Treatment System Exclusion

On-site water management features like those listed above historically have not been deemed "waters of the United States." EPA has in fact determined that these on-site waters are "treatment systems" that represent the best practicable control technology and best available technology economically achievable for purposes of managing process wastewater consistent with the requirements of the CWA, or in other cases, that these features are part of required non-process and stormwater management systems.[31] Likewise, under SMCRA, these features are considered components of required water management systems or, in the case of coal slurry impoundments, are considered part of a coal preparation plant's water circuit.[32]

As such, most on-site waters that could potentially be deemed jurisdictional under current regulations, including ditches and conveyances, fall within the scope of the long-standing waste treatment system exclusion, as the Agencies have recognized in prior guidance documents and practice.[33] The waste treatment system exclusion has been codified in EPA's and the Corps' regulations since 1979 and applied to hundreds of mining permits. However, the application and scope of the exclusion have not always been consistently applied in the courts, and have been misconstrued by mining opponents. Consequently, mining permittees have had to undergo costly jurisdictional determinations and defend against citizen lawsuits.

For example, in *Ohio Valley Envtl. Coalition v. Aracoma Coal Co.*, citizen groups challenged the scope of the waste treatment exclusion by alleging that coal mine operators had to obtain a CWA Section 402 permit for discharges from stream segments used to convey on-site, non-process runoff water to sediment ponds. Contrary to the citizen groups' claims, however, the U.S. Court of Appeals for the Fourth

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[31] *See* effluent limitation guidelines development for the coal, hard rock, and phosphate mining sectors, determining the use of ponds, impoundments, and basins to be the best practicable control technology for controlling discharges of process generated waste water. 42 Fed. Reg. 21,380 (Oct. 17, 1975); 44 Fed. Reg. 2,586 (Jan. 12, 1979); 46 Fed. Reg. 28,873 (May 29, 1981); 47 Fed. Reg. 45,382 (Oct. 13, 1982); 50 Fed. Reg. 41,296 (Oct. 9, 1985); 67 Fed. Reg. 3,370 (Jan. 23, 2002); 42 Fed. Reg. 35,843 (Jul. 12, 1977); 43 Fed. Reg. 9,808 (Mar. 10, 1978); 43 Fed. Reg. 29,711 (Jul. 11, 1978); 47 Fed. Reg. 54,598 (Dec. 3, 1982); 53 Fed. Reg. 18,764 (May 24, 1988).

[32] 30 C.F.R. Part 816; 50 Fed. Reg. 41,296 at 41,303 (Oct. 9, 1985).

[33] *See*, Wilcher, LaJuana S., Memorandum to EPA Director Region X EPA CWA Regulation of Mine Tailings Disposal (Oct. 2, 1992)(clarifying that the discharge of mine tailings for disposal/treatment into impounded waters for the purpose of containing and treating those materials does not require a permit under the CWA, but that any downstream discharge from the waste treatment system requires a CWA Section 402 permit); Regas, Diane, et. al., to EPA Director Region X CWA Regulation of Mine Tailings (May 17, 2002)(affirming revised definitions of fill and discharge of fill material did not alter EPA's interpretation of the exclusion of waste treatment systems from CWA regulation); Grumbles, Benjamin H., Memorandum to Hon. John Paul Woodley, Assistant Secretary of the Army (Civil Works) (Mar. 1, 2006) (recognizing that at times in mining operations some segment of a stream must be used to convey water from a fill to a sediment pond and that such stream segment is an unavoidable and necessary component of the treatment system because it is required to convey water and because it also provides initial treatment by settling some fraction of suspended sediments in the flow, and clarifying that the entire system contributes to ensuring that the discharge from the sediment pond meets the requirements of the CWA and is exempt from CWA regulation).

Circuit upheld the Corps' application of the waste treatment system exclusion to in-stream sediment ponds and stream segments flowing into those ponds within a coal mining site.[34] In so holding, the Court drew upon discussions from agency guidance documents explaining that stream segments are a necessary component of treatment systems because they are required to convey water and provide initial treatment by settling suspended sediment, and because the entire system contributes to ensuring that the discharge from the sediment ponds meets the requirements of the CWA. Importantly, the court emphasized the Agencies' "consistent administrative practice."[35]

CWA technology-based regulations also clearly contemplate that the scope of the waste treatment system includes all structures, channels, ponds[36] and other water treatment components.[37] Furthermore, in developing effluent limitations for the mining sectors, EPA incorporated the use of settling ponds and tailings impoundments for pre-treatment prior to recycle/reuse or discharge, as well as the use of stormwater diversion ditches for keeping non-contaminated water from comingling with process wastewater, as the best practicable control technology currently available.[38] Similarly, environmental standards pursuant to SMCRA also require the use of ditches and sediment ponds as the best technology currently available for preventing additional contributions of suspended solids to stream flow or runoff outside the permit area, as well as for compliance with state and federal water quality standards.[39]

Economic analyses associated with these effluent guideline development efforts were based on the assumption that such "treatment facilities" and "treatment systems" would be used to meet water quality requirements.[40] The guidelines expressly define the term "treatment system" to include "all structures which contain, convey, and as necessary, chemically or physically treat coal mine drainage, coal preparation plant process wastewater, or drainage from coal preparation plant associated areas, which remove pollutants…from such waters. This includes all pipes, channels, ponds, basins, tanks and all other equipment serving such structures."[41] It is therefore clear that waste treatment systems include all those components that together ensure that any discharges from the system to "waters of the United States" meet the requirements of the CWA.

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[34] 556 F.3d 177, 212-216 (4th Cir. 2009).
[35] *Id.* It should also be noted that, in the context of surface coal mining, features such as on-site ponds and conveyances are regulated under SMCRA.
[36] On-site ponds that should be excluded from jurisdiction can also include mine pits that intercept ground water, emergency cooling water ponds, emergency firewater ponds, ponds used for dust suppression water, evaporation ponds, and water recycle ponds.
[37] See 40 C.F.R. Part 434 (o).
[38] *See* Part 436 Mineral Mining and Processing Point Source Category, Final Rule, 42 Fed. Reg. 35,843 (Jul. 12, 1977); Part 436 Mineral Mining and Processing Point Source Category Standard of Performance for New Sources, Phosphate Rock Mining, Final Rule, 43 Fed. Reg. 9,808 (Mar. 10, 1978); Coal Mining Point Source Category; Effluent Limitations Guidelines and New Source Performance Standards, Final Rule, 50 Fed. Reg. 41,296 (Oct. 9, 1985); Part 440 Ore Mining and Dressing Point Source Category; Part 434 Subpart H Western Alkaline Coal Mining.
[39] 30 U.S.C. Section 1265(b) (10).
[40] 50 Fed. Reg. 41,296, 41306 (Oct. 9, 1985); 42 Fed. Reg. 35,843, 35,846 (Jul. 12, 1977).
[41] *Id.*

"Step Two" Waste Treatment System Clarifications

NMA urges the Agencies to retain the current text of the waste treatment exclusion,[42] and to provide additional clarity in the preamble of the "step two" rulemaking regarding its application and scope. Specifically, the Agencies should clarify that on-site water management features, including all structures – natural and man-made – that contain, convey, and, as necessary, chemically or physically treat on-site water associated with mining operations are waste treatment systems and excluded from the definition of "waters of the United States." A lack of clarity concerning this key exclusion would have severe consequences for the mining industry, as on-site water management features would potentially not be able to serve their intended purpose, which would lead to substantial increases in both water usage and treatment costs for mining operations, conflict with the requirements of the CWA, and harm downstream water quality.

As such, the Agencies should explicitly recognize, as they have in prior practice,[43] that the term "system" includes all channels, diversions, ditches, feeder streams, wetlands, and other on-site natural or man-made features carrying flow to and from ponds and impoundments used to treat wastewater and stormwater, as these features are part and parcel of waste treatment systems at mine sites. Such features are necessary to convey and manage wastewater and stormwater within the mine site, and they help sediment and other pollutants settle out before any water is released to downstream "waters of the United States." Water that is conveyed from the mine site to downstream jurisdictional waters requires an NPDES permit and, not surprisingly, NPDES permitting authorities have typically agreed that it would be senseless to require additional permits above the point of discharge to downstream jurisdictional waters. Nevertheless, to avoid any potential confusion in the field concerning the scope of the waste treatment system exclusion, the Agencies should make it clear that the exclusion encompasses all components of the treatment system, including but not limited to ponds/impoundments *and* the related flowing waters within a mining project site that are necessary to convey waters to and from those ponds and impoundments.

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[42] However, NMA does request that the Agencies change the waste treatment system text currently found at 40 C.F.R. § 122.2, which, unlike all other regulatory waste treatment system references, inappropriately includes a sentence proclaiming that "[t]his exclusion applies only to manmade bodies of water which neither were originally created in waters of the United States (such as disposal area in wetlands) nor resulted from the impoundment of waters of the United States," along with a confusing accompanying footnote explaining that EPA suspended the sentence in question since July 21, 1980. The now-suspended sentence would have limited the scope of the waste treatment system exclusion substantially, as many waste treatment systems within the mining industry, as well as in other industries, incorporate "waters of the United States." Even though EPA suspended the sentence attempting to limit the waste treatment system exclusion back in July 1980, the limitation has been erroneously applied since that time, even by some federal courts. *See, e.g.*, *United States v. TGR Corp.*, 171 F.3d 762, 765 (2d Cir. 1999); *Ohio Valley Envtl. Coal. v. U.S. Army Corps of Eng'rs*, 2007 WL 2200686 (S.D. W.Va. June 13, 2007), *rev'd by* 556 F.3d 177 (4th Cir. 2009). To avoid future erroneous attempts to revive the suspended language and to ensure uniformity across all regulatory programs under the CWA, the Agencies should delete the suspended sentence and accompanying footnote 1 from 40 C.F.R. § 122.2. This would also help further clarify that waste treatment systems resulting from the impoundment of jurisdictional waters are excluded from the definition of "waters of the United States."

[43] *Supra* note 31.

The Agencies should also clarify that the term "treatment" for purposes of the waste treatment system exclusion includes, but is not limited to, methods such as wastewater and stormwater retention, concentration (evaporation), settling, or active and passive treatments (in-situ or in-process) to remove or reduce pollutants. Mining companies uniformly rely on these forms of treatment to support their operations and ensure that, if there are any downstream discharges, they meet all applicable NPDES permitting requirements. Waste treatment does not necessarily require the addition of chemicals or the use of complex technologies like ion exchange or reverse osmosis. Natural processes such as detention over time, evaporation, or pollutant uptake by aquatic vegetation can effectively help solids settle out and even remove pollutants as in the case of neutralization and/or geochemical transformations in pipeline mixing. Collecting and retaining wastewater and stormwater runoff in on-site water management features is also a widely used form of waste treatment in many industries, including mining, and as discussed above is widely recognized by EPA and SMCRA authorities.

Without such clarity, mining operations could continue to be subject to onerous administrative and judicial proceedings in which mining companies bear the burden of disproving jurisdiction over water features that the Agencies did not intend to include within the scope of "waters of the United States." Mining companies would also be faced with substantial implementation challenges not anticipated or intended by the Agencies, and the Agencies themselves would likely be forced to waste resources by having to clarify their intent through *amicus* briefs during protracted litigation.

To avoid these unintended consequences, therefore, NMA strongly urges the Agencies to (1) retain the longstanding regulatory exclusion for waste treatment systems; (2) include in the preamble of the "step two" rulemaking language that clarifies that the exclusion includes systems containing manmade waters and wetlands, systems created in "waters of the United States" or with impounded "waters of the United States," and systems created in or with impounded non-jurisdictional waters and wetlands; (3) clarify that the term "treatment" includes any active or passive method to retain, concentrate, settle, or reduce or remove pollutants from wastewater and/or stormwater, and the term "system" encompasses all components of a waste treatment system, including but not limited to ponds and impoundments, and any natural and man-made features necessary to convey water to and from such ponds and impoundments; and (4) remove the suspended language and accompanying footnote from 40 C.F.R. § 122.2, and instead include the same waste treatment language as is found in all other regulatory sections.

Traditional Navigable Waters and Tributaries

As noted above, the text of the CWA "shows that the Act's term 'navigable waters' includes something more than traditional navigable waters,"[44] but the word "navigable" must still be given some effect.[45] In other words, "the term 'navigable' has at least the

[44] *Rapanos,* 547 U.S. at 731.
[45] *SWANCC,* 531 U.S. at 172.

import of showing us what Congress had in mind as its authority for enacting the CWA: its traditional jurisdiction over waters that were or had been navigable in fact or which could reasonably be so made."[46] Indeed, Congress was exercising its "commerce power over navigation."[47] NMA's suggested definition therefore includes waters that have been used, are presently used, or are susceptible to use in their natural condition or by reasonable improvement as a means to transport interstate or foreign commerce.

Likewise, WOTUS should include tributaries to such waters. However, to give effect to both the statutory term "navigable" and adhere to the Section 101(b) policy objective of recognizing and preserving the role of the States, NMA suggests that the Agencies limit the definition of "tributary" to those waters that flow to such navigable waters for at least 90 continuous days at a specified flow magnitude, such as, for example, x cubic feet per second or x percentage of flow contribution to downstream navigable waters. Such a definition is consistent with the plurality opinion in *Rapanos,* and would clearly exclude non-navigable ephemeral streams and drainages. This definition is also consistent with the Agencies' 2008 *Rapanos* guidance, which states that the Agencies should categorically assert jurisdiction over "non-navigable tributaries of traditionally navigable waters that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally."

NMA's proposed definition of "tributary" also takes into account flow duration, magnitude, and frequency, and as such provides regulatory certainty for the public. If historic baseline flow information is unavailable, the Agencies could implement such a standard by modeling it to watershed size so that watershed mapping techniques can be easily used to determine whether a particular waterbody is jurisdictional without the need for flow meters etc. (though site-specific measurements could be taken by landowners that wanted to do so). Converting the flow metric to a watershed area would also necessarily take into account regional differences, as modeled watershed sizes of tributaries that flow 90 continuous days at a specified rate would differ in different regions of the country.

Notably, federal agencies including the Federal Emergency Management Agency (FEMA), U.S. Geological Survey (USGS), Office of Surface Mining Reclamation and Enforcement (OSMRE), National Oceanic and Atmospheric Administration (NOAA), and the Corps, have successfully used watershed modeling to approximate similar flow statistics and watershed areas. This approach would also be consistent with the Corps' previous practice of using a flow metric (such as mean annual flow) as a jurisdictional threshold and equating it to a watershed area. The Agencies are therefore capable of utilizing such an approach with respect to WOTUS, and it would provide much needed regulatory certainty while being easily administrated.

However, NMA cautions that under such an approach, the jurisdictional extent of streams will be dependent on the particular flow frequency, magnitude, and duration metrics used and, where site-specific measurements are not utilized, on modeling

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[46] *SWANCC,* 531 U.S. at 172.
[47] *Id.* at 168 n.3.

accuracy. NMA therefore requests that, should the Agencies utilize this approach, the regional watershed areas resulting from the metrics chosen be provided in the proposed rule so that the Agencies and regulated community can fully assess the potential impacts of the proposal.

Wetlands

In light of the policy objective of preserving the role of the States outlined in CWA Section 101(b), as well as the need for an administrable rule that provides certainty for the regulated public, wetlands should only be subject to CWA jurisdiction when they are adjacent to a navigable water or tributary. Adjacency should in turn be defined to mean "directly abutting," meaning that the wetlands share a common boundary with – and therefore either begin or end in - a WOTUS.

This definition would be consistent with the Supreme Court's holding in *Riverside Bayview,* where the Court upheld federal jurisdiction over wetlands "inseparably bound up with the 'waters of the United States,'"[48] as well as the plurality opinion in *Rapanos,* which held that "*only* those wetlands with a continuous surface connection to bodies that are 'waters of the United States' in their own right, so that there is no clear demarcation between 'waters' and wetlands, are 'adjacent to' such waters and covered by the Act."[49] The definition would also appropriately limit the scope of federal jurisdiction and allow for States to regulate wetlands isolated from WOTUS, thereby helping to further the Congressional policy outlined in CWA Section 101(b). Importantly for NMA's members as well, such a definition would help minimize the current uncertainty and complex factual disputes that have arisen with previous interpretations of adjacency.

Any revised WOTUS definition should also specify that, to be jurisdictional, a wetland must meet all three of the Corps' longstanding criteria for wetlands. Specifically, the Corps' regulations define wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."[50] As such, the Agencies should require in a "step two" rulemaking that wetlands must have a prevalence of hydrophytic vegetation, hydric soils, and permanently or periodically inundated soils saturated to the surface at some time during the growing season to be subject to CWA jurisdiction.

Additional Exclusions

Ditches: While, as noted above, many ditches should be excluded from the definition of WOTUS due to their function as part of a waste treatment system, ditches that serve

[48] *Riverside Bayview,* 474 U.S. at 134-135.
[49] *Rapanos,* 547 U.S. at 742.
[50] 33 C.F.R. 328.3(c)(4).

functions other than as part of a waste treatment system and/or that existed on the landscape prior to mining should likewise not be jurisdictional "waters of the United States."

Ditches are commonly found on mine sites nationwide, and due to the dynamic nature of mining, mining companies constantly have to maintain, modify, move, and reclaim them. A clear exclusion for ditches – both mining-related and other – should be included in any revised definition of WOTUS. Notably, ditches have generally been excluded from CWA jurisdiction. In 1977, the Corps stated that the agency "adopted the suggestion of many commenters that [it] incorporate into [the regulatory] definition…the statement that nontidal drainage and irrigation ditches that feed into navigable waters will not be considered 'waters of the United States'…To the extent that these activities cause water quality problems, they will be handled under other programs of the [CWA]."[51] While since 1986 the Corps has regulated certain ditches on a case-by-case basis, the Agencies' historic practice has been to generally exclude ditches from CWA jurisdiction. Likewise, the plurality opinion in *Rapanos* explained that it would make little sense to treat statutory point sources, such as ditches, as WOTUS, as "the separate classification of 'ditch[es], channel[s], and conduit[s] – which are terms ordinarily used to describe watercourses through which *intermittent* waters typically flow – shows that these are, by and large, *not* waters of the United States."[52] The Agencies should therefore include a clear exclusion for ditches in their "step two" rulemaking.

<u>Groundwater:</u> As recognized in the 2015 WOTUS Rule, groundwater is not a "navigable water" for purposes of the CWA, and any "step two" rulemaking should clearly state that groundwater is not a "water of the United States."

<u>Water-Filled Depressions:</u> Water-filled depressions incidental to mining or construction activity, including mine scars and pits excavated for obtaining minerals, fill, sand or gravel that fill with water, should be excluded from the definition of WOTUS. Such features could come in under the above definition of "tributary," as some contribute flow to downstream WOTUS for 90 consecutive days, but as in the 2015 WOTUS rule, they should be excluded from CWA jurisdiction as they are not part of the natural tributary system and exclusion encourages environmentally beneficial land reclamation activities.

Conclusion

NMA appreciates this opportunity to provide early input on a potential revised WOTUS definition, and supports the Agencies' goal of developing a rulemaking that supports the CWA's stated policy of recognizing, preserving, and protecting the primary responsibility of the States in addressing water pollution and planning the development and use of land and water resources. A definition of WOTUS that furthers this key Congressional objective, provides regulatory certainty, and articulates appropriate limits on federal jurisdiction is vital to the mining industry, and NMA and its members look forward to

[51] 42 Fed. Reg. 37,121 at 37,127 (July 19, 1977).
[52] *Rapanos,* 574 U.S. at 735-36.

working with the Agencies as they move forward with their "step two" rulemaking. Please contact me at aaspatore@nma.org or (202) 463-2646 if you have any questions concerning these comments, or need any additional information.

Sincerely,

Amanda E. Aspatore

Amanda E. Aspatore
Vice President, Water Law & Policy
National Mining Association

Message

From: Hupp, Millan [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=92CAC7B684B64F90953B753A01BEE0D5-HUPP, MILLA]
Sent: 11/17/2017 1:17:45 PM
To: isam taib Ex. 6
CC: Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]; Smotkin, Richard (Contractor) Ex. 6]
Subject: Draft Itinerary - Morocco
Attachments: Pruitt Morocco Trip Notional Schedule_Version 11.14.17 (003).pdf

Isam,

Good morning to you. We wanted to share our notional agenda with you and to kindly request your assistance in confirming the proposed meetings. Presently, we do not have any of them confirmed.

We would be glad to discuss at your convenience and look forward to working with you.

Also, please understand that while this is a draft document, we do ask that it not be distributed.

Thank you so much,

Millan Hupp
Director of Scheduling and Advance
Office of the Administrator
Cell: Ex. 6 Email: hupp.millan@epa.gov

Message

From: Hupp, Millan [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=92CAC7B684B64F90953B753A01BEE0D5-HUPP, MILLA]
Sent: 11/10/2017 7:57:59 PM
To: Smotkin, Richard (Contractor) [Personal Matters / Ex. 6]
CC: Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]
Subject: Re: Follow Up

Yes please.

Sent from my iPhone

On Nov 10, 2017, at 2:53 PM, Smotkin, Richard (Contractor) [Personal Matters / Ex. 6]> wrote:

> Isam. Do you need an intro
>
> Sent from my iPhone
>
> On Nov 10, 2017, at 2:48 PM, Hupp, Millan <hupp.millan@epa.gov> wrote:
>
>> Rick,
>>
>> Sarah and I would like to follow up on some of the items discussed during the Administrator's meeting with Her Highness Princess Lalla Joumala. We want to ensure we are mindful of any suggestions or invitations extended. Please advise on who might be the best person with whom to follow up. If possible, we would like to arrange a call on Monday.
>>
>> Thank you very much,
>>
>> Millan Hupp
>> Director of Scheduling and Advance
>> Office of the Administrator
>> Cel[Personal Matters] Email: hupp.millan@epa.gov

Message

From: Aspatore, Amanda [AAspatore@nma.org]
Sent: 10/12/2017 6:18:37 PM
To: Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]
Subject: RE: Selenium and Groundwater Information
Attachments: DeForest et al 2017 - Selenium Water Column ETC.pdf

Hi Sarah –

I wanted to pass along one additional selenium paper that recommends water column screening values of 6.5 and 3.0 ug/L for lotic and lentic environments, which differs from the current EPA recommended water column concentrations of 3.1 and 1.5 ug/L. Thank you so much!

Sincerely,
Amanda

NMA THE AMERICAN RESOURCE

Amanda E. Aspatore
Vice President, Water Law & Policy
National Mining Association
101 Constitution Ave. NW, Suite 500 East
Washington, D.C. 20001
Phone: (202) 463-2600
Direct Personal Matters /
aaspatore@nma.org

From: Aspatore, Amanda
Sent: Tuesday, September 5, 2017 5:44 PM
To: 'Greenwalt.sarah@Epa.gov' <Greenwalt.sarah@Epa.gov>
Subject: Selenium and Groundwater Information

Sarah –

Attached please find the National Mining Association's (NMA) technical comments on EPA's now final selenium water quality criterion, which include, among other things, suggestions for minor changes to the fish tissue calculations, concerns regarding the national water column calculations, and suggested edits to Footnote 3 of the criterion regarding when use of the fish tissue numbers (as opposed to the water column numbers) is permissible. NMA's comments on the current proposed draft implementation guidance documents are also attached, which outline several issues concerning the limits to state flexibility posed by the current proposed guidance language.

Additionally, attached are several amicus briefs filed to the U.S. Court of Appeals for the 9th Circuit in the case of *Hawaii Wildlife Fund v. County of Maui*, which relates to whether discharges that reach navigable waters through groundwater (among other means) require a CWA NPDES permit. The briefs include: (1) AAR, AFBA, AISI, API, NAM, NMA, TFI, and UWAG's brief asking the 9th Circuit to overturn the lower court's decision; (2) ACWA, CASA, CSAC, IMLA, the League, NACWA, NACo, NLC, and NWRA's brief asking the 9th Circuit to overturn the lower court's decision; and (3) the Obama Administration's brief asking the 9th Circuit to uphold the lower court's decision. The 9th Circuit has scheduled oral argument in the case for Oct. 12, 2017.

Please do not hesitate to contact me with any questions, or if you would like any additional information. Thank you so much – I hope that you are having a good evening!

Sincerely,
Amanda

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LENTIC, LOTIC, AND SULFATE-DEPENDENT WATERBORNE SELENIUM SCREENING GUIDELINES FOR FRESHWATER SYSTEMS

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(Submitted 4 November 2016; Returned for Revision 9 December 2016; Accepted 9 March 2017)

Abstract: There is consensus that fish are the most sensitive aquatic organisms to selenium (Se) and that Se concentrations in fish tissue are the most reliable indicators of potential toxicity. Differences in Se speciation, biological productivity, Se concentration, and parameters that affect Se bioavailability (e.g., sulfate) may influence the relationship between Se concentrations in water and fish tissue. It is desirable to identify environmentally protective waterborne Se guidelines that, if not exceeded, reduce the need to directly measure Se concentrations in fish tissue. Three factors that should currently be considered in developing waterborne Se screening guidelines are 1) differences between lotic and lentic sites, 2) the influence of exposure concentration on Se partitioning among compartments, and 3) the influence of sulfate on selenate bioavailability. Colocated data sets of Se concentrations in 1) water and particulates, 2) particulates and invertebrates, and 3) invertebrates and fish tissue were compiled; and a quantile regression approach was used to derive waterborne Se screening guidelines. Use of a regression-based approach for describing relationships in Se concentrations between compartments reduces uncertainty associated with selection of partitioning factors that are generally not constant over ranges of exposure concentrations. Waterborne Se screening guidelines of 6.5 and 3.0 μg/L for lotic and lentic water bodies were derived, and a sulfate-based waterborne Se guideline equation for selenate-dominated lotic waters was also developed. *Environ Toxicol Chem* 2017;36:2503–2513. © 2017 SETAC

Keywords: Selenium Water quality guideline Tissue-based guideline Trophic transfer Sulfate

INTRODUCTION

Selenium (Se) toxicity to fish is primarily manifested via exposure of adult females to dietary organic Se and subsequent maternal transfer to the eggs, which, at sufficiently high concentrations, can result in edema, larval deformities, and mortality in their offspring [1]. The bioaccumulation potential of Se from water into aquatic food webs is highly dependent on site-specific biogeochemistry and food web characteristics; therefore, a wide range of waterborne Se concentrations across different sites can yield a given Se concentration in fish tissue [2–4]. As such, there is general consensus that Se concentrations in fish tissue, especially in eggs or ovaries, are the most appropriate measures of risk to fish from Se [5–9].

Nevertheless, it is still valuable and cost-effective to identify environmentally protective waterborne Se screening guidelines that, if not exceeded, reduce the need to directly measure Se concentrations in fish tissue. The US Environmental Protection Agency (USEPA), for example, recently finalized Se criteria that consist of water column elements and fish tissue elements, with the fish tissue criterion elements overriding the water column criterion elements [9]. In concept, complying with the water column criterion elements would preclude the need for measuring Se concentrations in fish tissue. The USEPA's water column criteria are 3.1 and 1.5 μg/L in lotic (flowing) and lentic (standing) waters, respectively. The British Columbia Ministry of Environment (BCMOE) also provides Se guidelines for both the water column and fish tissue, as well as for sediment and the dietary pathway (invertebrate tissue); but no hierarchy by which one guideline overrides the other is recommended [7]. The BCMOE water column guideline is 2 μg/L (an "alert concentration" of 1 μg/L is also provided). Australia, New Zealand, and South Africa have a chronic water column Se guideline of 5 μg/L; but they do not currently have fish tissue–based guidelines [10,11].

The first objective of the present study was to develop water Se screening guidelines for lotic and lentic waters. These water Se screening guidelines are conceptually similar to the water column criterion elements recently finalized by the USEPA [9]. Both our approach and the USEPA approach used a multistep Se partitioning model to link an Se criterion or guideline for fish eggs to water column concentrations in lotic and lentic water bodies, but different methodologies for compiling and evaluating the model input data were applied. It should be emphasized that the water Se screening guidelines that we derived, as well as the water column criteria and guidelines recommended by the USEPA and the BCMOE, are not site-specific and are intended to be protective of reasonable worst-case site conditions and food-web types (i.e., high Se bioavailability and trophic transfer

This article includes online-only Supplemental Data.
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Published online 14 March 2017 in Wiley Online Library (wileyonlinelibrary.com).
DOI: 10.1002/etc.3793

Sierra Club v. EPA 18cv3472 NDCA Tier 2 ED_002061_00106547-00001

potential). Development of screening guidelines differs from more rigorous methods for translating between fish and water Se concentrations that are based on site-specific information, such as the Bayesian Monte Carlo approach described in Brix et al. [2] and the ecosystem-scale Se model approach described in Presser and Luoma [12].

The second objective was to develop a methodology for deriving sulfate-dependent waterborne Se screening guidelines for selenate-dominated streams. Increasing sulfate concentrations in water reduce selenate bioavailability at the base of the food web [13,14] and hence to higher–trophic level organisms, including fish. A sulfate-dependent waterborne Se screening guideline for selenate-dominated streams would provide a more meaningful trigger for determining the need to monitor Se concentrations in fish tissue in such waters. A sulfate-dependent guideline for Se would be analogous to hardness-dependent water quality guidelines or criteria for divalent metals [15,16].

METHODS

Terminology

In the remainder of the present study, the term "guideline" is used in a generic context that is not intended to reflect any specific regulatory definition. In addition, for simplicity, the term "fish eggs" is used to refer to both fish eggs and fish ovaries, unless noted otherwise. Lastly, the term "particulate" refers to the base of the food chain and may include both primary producers, such as algae and macrophytes, and detritus.

Se partitioning model

The relationship between Se concentrations in fish tissue or bird eggs and waterborne Se has been studied extensively over the last 25+ yr, leading to development of Se bioaccumulation models. Most of these Se bioaccumulation models are partitioning models relating waterborne Se to fish tissue or bird egg Se concentrations via either multiple food chain steps [12,17–19] or a single step [2,20,21]. Multistep models account for partitioning of Se from water to 1 or more food chain components (e.g., algae, benthic macroinvertebrates) and then into fish tissue or bird eggs, while single-step models directly relate waterborne Se concentrations to colocated fish tissue or bird egg Se concentrations (the latter is typically termed a "bioaccumulation factor" [BAF]).

The key step in these models is the partitioning of Se from water into particulates at the base of the food web (e.g., detritus, algae), termed the "enrichment factor" (EF) [3]. The enrichment factor is an explicit term of a multistep model and an implicit component of the BAF in a one-step model. In multistep partitioning models, trophic transfer factors (TTFs) represent successive steps in the food chain, such as Se transfer from particulates into invertebrates and from invertebrates into fish. Following Presser and Luoma [12], the multistep Se partitioning model is expressed as

$$C_{fish} = C_{water} \times EF_{part} \times TTF_{invert} \times TTF_{fish} \tag{1}$$

where C_{fish} is the fish Se concentration, C_{water} is the waterborne Se concentration, EF_{part} is the enrichment factor (the dissociation constant, K_d, is also used), while TTF_{invert} and TTF_{fish} are invertebrate and fish trophic transfer factors, respectively.

If C_{fish} is set equal to a fish tissue guideline and enrichment factors and trophic transfer factors are defined, then the C_{water} predicted to result in C_{fish} can be calculated by rearranging Equation 1

$$C_{water} = \frac{C_{fish}}{EF_{part} \times TTF_{invert} \times TTF_{fish}} \tag{2}$$

A potential limitation of this equation is that the Se enrichment factors and trophic transfer factors selected to represent a given exposure and food-web scenario are treated as constants across all water and fish Se concentrations. However, the use of constants is not supported by empirical relationships or our understanding of Se biodynamics. Stewart et al. [3], for example, note that enrichment factors and trophic transfer factors are dependent on concentration in a nonlinear manner. The basis for this nonlinearity can be explored further by considering the factors that ultimately influence the magnitudes of Se enrichment factors and trophic transfer factors. In particulates (e.g., phytoplankton), steady-state Se accumulation is determined by a combination of the uptake rate constant ($k_{u,water}$), elimination rate constant ($k_{e,\ water}$), and growth rate constant (g; Equation 3); and in consumers, the steady-state accumulation of Se via the diet is a function of assimilation efficiency (AE), ingestion rate (IR), elimination rate constant ($k_{e,\ diet}$), and g (Equation 4) [22–24].

$$C_{Se,part} = \frac{k_{u,water} \times C_{Se,water}}{k_e + g} \tag{3}$$

$$C_{Se,consumer} = \frac{AE \times IR \times C_{Se,diet}}{k_e + g} \tag{4}$$

Although the influence of Se concentration on some of these key terms that influence Se biodynamics has not been evaluated, there are data supporting the empirical enrichment factor and trophic transfer factor observations. For example, short-term (i.e., 3 h) Se uptake data for *Chlamydomonas reinhardtii* suggest that $k_{u,water}$ decreases with increasing waterborne Se concentration [25]. In diet-borne Se exposures, Guan and Wang [26] observed a concentration-dependent decrease in assimilation efficiency when the Se concentration in algal diets increased.

Consequently, it is clear that enrichment factors, trophic transfer factors, and the factors that influence them are inversely related to the exposure concentration [3,27], as has been observed for divalent metals [28]. In the present study, a multistep Se partitioning model was used in which quantile regression methods were applied to establish relationships for each step in the model to back-calculate waterborne Se screening guidelines from a fish tissue Se guideline. The multistep model is illustrated conceptually in Supplemental Data, Figure S1.

Compilation of Se partitioning data

To develop robust water Se screening guidelines, Se enrichment factors were compiled from a wide range of locations and exposure conditions and trophic transfer factors for invertebrates and fish over a wide range of diet types and exposure concentrations. This data set was assumed to be representative of Se enrichment factors and trophic transfer factors over a broad range of exposure concentrations and, hence, served as the lower and upper bounds of Se enrichment and trophic transfer potential.

Particulates. Selenium enrichment factors and BAFs tend to be greater in lentic than in lotic systems [2,4,12,29], although there is substantial overlap. Nevertheless, the field enrichment factor data compiled were categorized as either lotic or lentic because some degree of distinction between these 2 categories was apparent when considering relationships between water and particulate Se concentrations. Lotic water bodies included creeks, rivers, and, conservatively, sloughs. The latter may possess more lentic characteristics. In addition, laboratory data in which particulates were exposed to selenate or selenite were compiled separately, allowing for the derivation of waterborne Se screening guidelines for lotic and lentic waters and selenate-dominated and selenite-dominated waters.

Sources of colocated field data compiled in Presser and Luoma [12] were initially consulted and then augmented with field-based data from additional studies. Selenium concentration data for bulk sediment were not included because they were considered to have limited relevance to Se trophic transfer; however, Se concentration data based on fine sediments (e.g., silt) were included, where available. When Se data for multiple particulate types were available for a given site, the geometric mean Se concentration was used. Likewise, if Se data were available for multiple water samples from a site, the geometric mean Se concentration was used. Temporally colocated samples were generally collected within 1 mo of each other or within the same season of the same year.

Invertebrates. Paired Se concentrations in aquatic invertebrates and particulates (i.e., their diets) were compiled from the published and gray literature (primarily government agency reports). Data were compiled from laboratory trophic transfer studies and field studies with colocated measurements of Se in invertebrates and their putative diets. Invertebrate Se concentration data were compiled from a range of invertebrate taxa, including amphipods, cladocerans, crayfish, and insects (e.g., caddis flies, chironomids, crane flies, damselflies, mayflies, stone flies, water boatmen).

Fish. Paired Se concentrations in fish tissues (i.e., eggs and whole body) and their diets were compiled from the published and gray literature. The egg-based data were of greater interest because the fish tissue–based guideline being considered in this evaluation is an egg-based guideline; however, whole-body Se trophic transfer factors were also compiled because more data are available for whole-body fish tissue. Given the generally higher mobility of fish species, the fish Se data were compiled from laboratory studies so that dietary Se concentrations were accurately measured.

Se toxicity guideline for fish tissues

We applied an Se guideline of 20 μg/g dry weight for fish eggs [30]. This guideline is based on the 5th percentile of a species sensitivity distribution (SSD) of predominantly fish egg Se 10% effect concentrations (EC10s) for reproductive effects. For comparison purposes (see *Discussion* section), the USEPA's fish egg Se criterion of 15.1 μg/g dry weight was also applied [9].

Water Se screening guideline development

Quantile regression was used to back-calculate waterborne Se screening guidelines from the fish egg Se guideline of 20 μg/g dry weight and the USEPA criterion of 15.1 μg/g dry weight. To minimize the influence of laboratory control and field reference site data, quantile regressions were applied only to Se "exposure" data, which were defined as waterborne Se concentrations >1 μg/L and dietary Se concentrations >2 μg/g dry weight, consistent with definitions in Seiler et al. [31] (control and reference site data reduced the slopes of quantile regressions because they tended to fall below inflection points in the relationships between Se concentrations in food chain model steps). Quantile regression analyses were conducted using the quantile regression package ("quantreg") in the software program *R* [32,33]. We used ln-transformed data because log–log relationships were more linear, had more homogeneously distributed relationships, and fit the data better at lower concentrations. Quantile regression was used to estimate median (50th) and upper (75th, 90th) quantiles of the response variables (i.e., Se concentration in particulates, invertebrates, or fish eggs/ovaries) as conditional linear functions of the independent variables. Ultimately, the 75th quantile was used in the multistep models because the 90th quantile compounded conservatism at each step in the food chain such that back-calculated waterborne Se concentrations (i.e., 0.3–0.5 μg/L) overlapped with or were less than background concentration ranges [31,34] and the 50th quantile was not deemed adequately protective for screening guideline development.

Quantile regression relationships were derived to link fish egg Se to invertebrate (dietary) Se and then invertebrate Se to particulate (dietary) Se (quadrants 1 and 2, respectively; Supplemental Data, Figure S1). Particulate Se was then linked to waterborne Se using quantile regression relationships for 4 different data sets (quadrant 3; Supplemental Data, Figure S1), as follows: 1) lotic field, 2) lentic field, 3) laboratory selenite, and 4) laboratory selenite.

Sulfate-dependent screening guideline for selenate-dominated waters

Data were compiled from laboratory studies in which waterborne selenate and sulfate, along with particulate Se concentrations, were measured. Laboratory data were augmented with field data for Se concentrations in periphyton and colocated waterborne Se and sulfate concentrations; we assumed that waterborne Se was predominantly selenate for field data from oxic mountain streams. Particulate Se concentrations were then used to predict Se concentrations in invertebrates and fish eggs using the quantile regression models described in the section *Water Se screening guideline development.* This generated a data set of predicted fish egg Se concentrations that varied as a function of waterborne selenate and sulfate concentrations. Examples of particulate Se concentrations and predicted Se concentrations in invertebrates and fish eggs, varying as a function of waterborne selenate and sulfate concentrations, are provided in Supplemental Data, Figure S2.

A multiple quantile regression analysis was conducted using predicted fish egg Se concentrations as the dependent variable and waterborne selenate and sulfate concentrations as the independent variables. The 75th quantile of the multiple quantile regression model was used to solve for an environmentally protective, sulfate-dependent guideline for selenate-dominated waters. The 75th quantile was used for consistency with the Se screening methodology described above and because it resulted in ≤5% "false negatives" based on validation with a field data set (see *Results* section).

Validation of waterborne Se guidelines using field data sets

The lotic, lentic, and sulfate-dependent waterborne Se screening guidelines were validated relative to a field-based

Se bioaccumulation database [35] augmented with additional unpublished data (S. Covington, Formation Environmental, Austin, TX, USA, personal communication; Supplemental Data, Tables S7–S9). This database included colocated fish tissue (i.e., whole-body, muscle, egg), waterborne Se data, and, where also available, waterborne sulfate data. To augment the egg Se data, egg Se concentrations were estimated from the more prevalent whole-body and muscle Se concentrations using species-specific relationships. These relationships were developed by deBruyn et al. [36] along with relationships developed for additional fish species (Supplemental Data, Section S1).

For each colocated fish egg and waterborne Se concentration, 2 ratios were calculated: 1) the ratio of waterborne Se concentration to the waterborne Se screening guideline, and 2) the ratio of the fish egg/ovary Se concentration to the tissue guideline of 20 μg/g dry weight. The waterborne Se screening guideline was corroborated by the fish egg Se data when both ratios were <1 or >1; false negatives had a water ratio <1 and a fish ratio >1, while false positives had a water ratio >1 and a fish ratio <1.

RESULTS

Se partitioning data

The Se partitioning data compiled are summarized below, in part, based on enrichment factors and trophic transfer factors because these terms are useful for general comparisons among different levels of the food chain, different site types (lotic vs lentic), and Se species (selenate vs selenite).

Particulates. Overall, 75 and 42 pairs of colocated particulate and water Se data were identified for lotic and lentic sites, respectively (Supplemental Data, Tables S1 and S2). Selenium enrichment factors span almost 3 orders of magnitude and more than an order of magnitude within both lotic and lentic sites (Supplemental Data, Figure S3). In general, lentic enrichment factors are approximately 2 times greater than lotic enrichment factors (e.g., the median lentic and lotic enrichment factors are 1387 and 633 L/kg dry wt, respectively). The field-based Se enrichment factors were also plotted against the corresponding water Se concentrations, and significant inverse relationships ($p < 0.001$) were observed (Supplemental Data, Figure S4). Thus, the highest enrichment factors tend to be associated with relatively low water Se concentrations, and the lowest enrichment factors tend to be associated with relatively high water Se concentrations. Almost all Se enrichment factors above the 90th percentile of the data distribution in both lotic and lentic systems are associated with water Se concentrations <1 μg/L. This highlights the uncertainty and need for caution in selecting point estimate enrichment factors in food chain modeling of Se. The regression-based approach used in the present analysis helps to more appropriately address the concentration-dependent Se enrichment at the base of the food chain.

Paired particulate Se concentrations and waterborne selenate and selenite concentrations from laboratory studies, as well as corresponding waterborne selenate and sulfate concentrations used for the sulfate-dependent waterborne Se screening guideline development, are provided in Supplemental Data, Table S3. As for the field-based enrichment factors, significant inverse relationships between laboratory enrichment factors and corresponding water Se concentrations were observed for selenate ($p < 0.001$) and selenite ($p = 0.03$; Supplemental Data, Figure S5).

Invertebrates. Whereas Se enrichment factors ranged over 2 to 3 orders of magnitude, Se trophic transfer factors for invertebrates generally varied between 0.5 and 3.3, although lower and higher trophic transfer factors were observed in a few cases (Supplemental Data, Table S4 and Figure S6). There were clearly differences among taxa and variables within taxa that influenced the magnitudes of Se trophic transfer factors, but the range in magnitude of invertebrate Se trophic transfer factors was much less than that observed for enrichment factors. There were no clear patterns in how trophic transfer factors vary among taxa because insect taxa, for example, were distributed fairly evenly throughout the data set (Supplemental Data, Figure S6). Given the inverse relationship between the invertebrate trophic transfer factor and dietary exposure concentration observed in several studies, all of the laboratory and field data were pooled and trophic transfer factors were plotted against dietary Se (Supplemental Data, Figure S7). A significant ($p < 0.001$) inverse relationship between Se trophic transfer factors and corresponding diet-borne Se concentrations was observed. The highest trophic transfer factors, such as those greater than the 90th percentile, were generally associated with a dietary Se concentration <1.5 μg/g dry weight, and the lowest trophic transfer factors are generally associated with dietary Se concentrations >10 μg/g dry weight. In comparison, Se concentrations in invertebrates collected at control/reference sites ranged from 0.1 to 5.3 μg/g dry weight, with a geometric mean of 1.1 μg/g dry weight. As for Se enrichment factors, this highlights the uncertainty and need for caution in selecting point estimate trophic transfer factors in food chain modeling of Se and supports the regression-based approach used in the present analysis.

Fish. As for invertebrates, Se trophic transfer factors for fish were much lower in magnitude and much less variable than Se enrichment factors, generally varying between 0.7 and 4.1 for eggs and between 0.3 and 1.5 for the whole body (Supplemental Data, Table S5 and Figure S8). As also observed for Se enrichment factors and invertebrate trophic transfer factors, significant ($p < 0.001$) inverse relationships were observed for both fish egg/ovary and whole-body Se trophic transfer factors versus dietary Se (Supplemental Data, Figure S9).

Se screening guidelines

To develop Se screening guidelines, we first related a fish egg Se guideline of 20 μg/g dry weight to a concentration in the fish diet. Using the 75th quantile of the regression relationship between fish egg and dietary Se, a dietary Se concentration of 10 μg/g dry weight was predicted to result in an egg Se concentration of 20 μg/g dry weight (Figure 1A). This is consistent with dietary Se toxicity data for fish because effect levels of $>10\%$ are typically observed at dietary Se concentrations >10 μg/g dry weight (Figure 1B).

Next, we linked the Se concentration of 10 μg/g dry weight for fish diets (represented by invertebrates) to a particulate Se concentration. Using the 75th quantile regression relationship between invertebrate and particulate Se, a particulate Se concentration of 4.7 μg/g dry weight resulted in an invertebrate Se concentration of 10 μg/g dry weight (Figure 2).

Finally, we linked a particulate Se concentration of 4.7 μg/g dry weight to waterborne Se concentrations using field data for lotic and lentic systems and laboratory data for selenate and selenite. Using the 75th quantile regression relationships between particulate and waterborne Se, waterborne Se concentrations of 6.5 μg/L in lotic systems and 3.0 μg/L in lentic systems resulted in a particulate Se concentration of 4.7 μg/g

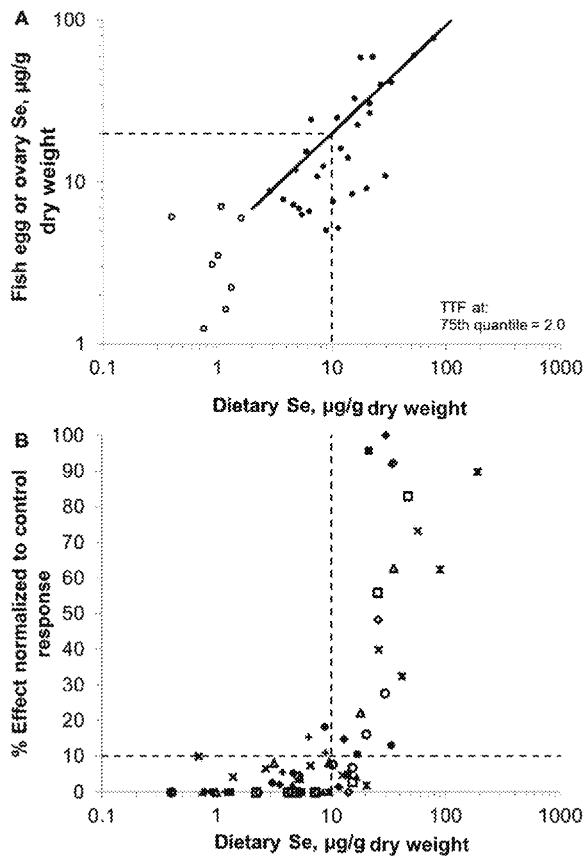

Figure 1. (**A**) Relationship between fish egg or ovary selenium (Se) and dietary Se and (**B**) dietary concentration–response data for fish exposed to organic Se. (**A**) Shown are the 75th quantile (solid line), reference data (○), and exposure data (●). (**B**) Shown are date for bluegill [46] (◆), [47] (■), [48] (▲), [49] (●), and [50] (4–5 °C ◇, 9 °C □); Chinook salmon [51] (Δ); fathead minnow [52] (○); Sacramento splittail [53] (×); white sturgeon [54] (*); and Yellowstone cutthroat trout [55] (+). TTF = trophic transfer factor.

dry weight (Figure 3 and Table 1). Similarly, a selenate concentration of 5.1 µg/L and a selenite concentration of 1.5 µg/L resulted in a particulate Se concentration of 4.7 µg/g dry weight using laboratory data (Figure 4 and Table 1).

For comparison, application of the USEPA's fish egg Se criterion of 15.1 µg/g dry weight to the analysis resulted in back-calculated Se concentrations of 6.5 µg/g dry weight for fish diets and 2.9 µg/g dry weight for invertebrate diets. The particulate Se concentration of 2.9 µg/g dry weight, in turn, translated to waterborne Se concentrations of 2.8 and 1.7 µg/L for lotic and lentic waters, respectively, and to 3.0 and 0.85 µg/L for selenate and selenite, respectively.

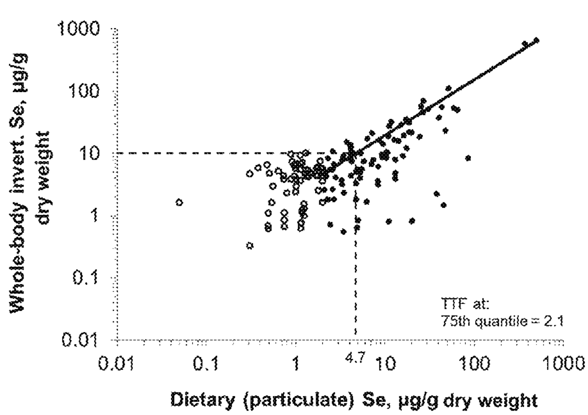

Figure 2. Relationship between whole-body invertebrate selenium (Se) and dietary (particulate) Se. Shown are the 75th quantile (solid line), reference data (○), and exposure data (●). invert. = invertebrate; TTF = trophic transfer factor.

In the field validation for lotic sites, fish Se ratios corroborated waterborne Se ratios 76% of the time, with fish and waterborne Se ratios being both >1 in 18% of the cases and <1 in 58% of the cases (Figure 5). In 18% of the cases, the waterborne Se ratio was >1 but the fish Se ratio was <1 (false positives), whereas in 6% of the cases the waterborne Se ratio was <1 but the fish Se ratio was >1 (false negatives; Figure 5). Overall, therefore, the waterborne Se ratio based on the lotic Se screening guideline was protective in 94% of the samples. For lentic sites, the fish Se ratios corroborated waterborne Se ratios 96% of the time, with 2% of the cases resulting in false positives and 2% of the cases in false negatives (Figure 5).

Sulfate-dependent screening guideline for selenate-dominated waters

Using the multiple quantile regression analysis of fish egg Se concentrations predicted as a function of waterborne selenate and sulfate concentrations to which particulates were exposed (Supplemental Data, Table S6), the following 75th quantile regression equation was derived

$$\text{Mean 75th quantile fish egg Se} = \exp[4.364 - 0.5680(\ln SO_4) + 0.4089(\ln \text{selenate})] \quad (5)$$

The fish egg Se concentrations predicted from waterborne selenate and sulfate concentrations versus fish egg Se concentrations predicted from empirical particulate Se concentrations using Equation 5 are illustrated in Figure 6.

Equation 5 can be rearranged to solve for the waterborne Se concentration which predicts a given fish egg Se concentration at a given waterborne sulfate concentration

$$\text{Waterborne Se screening guideline} = \exp\left[\frac{\ln(\text{fish egg Se guideline}) - 4.364 + 0.5680(\ln SO_4)}{0.4089}\right] \quad (6)$$

where the fish egg Se guideline is 20 µg/g dry weight and SO_4 is the waterborne sulfate concentration (milligrams per liter) of interest.

Equation 6 can be rearranged as follows

$$\text{Waterborne Se screening guideline} = \exp[2.446 \times \ln(\text{fish egg Se guideline}) - 10.67 + 1.389(\ln SO_4)] \quad (7)$$

Examples of waterborne Se screening guidelines as a function of various sulfate concentrations are provided in Table 1.

In the field validation, those data sets containing colocated waterborne sulfate concentrations were used and only data for lotic waters were included, which were primarily mountain streams where selenate is likely to be the predominant form of Se [3]. The fish Se ratios corroborated the waterborne Se ratios 88% of the time, with 7% of the cases resulting in false positives and 5% of the cases resulting in false negatives (Figure 7). Therefore, the waterborne Se ratio based on the sulfate-dependent guideline was protective in 95% of the samples. Results using the 50th and 90th quantiles of the multiple

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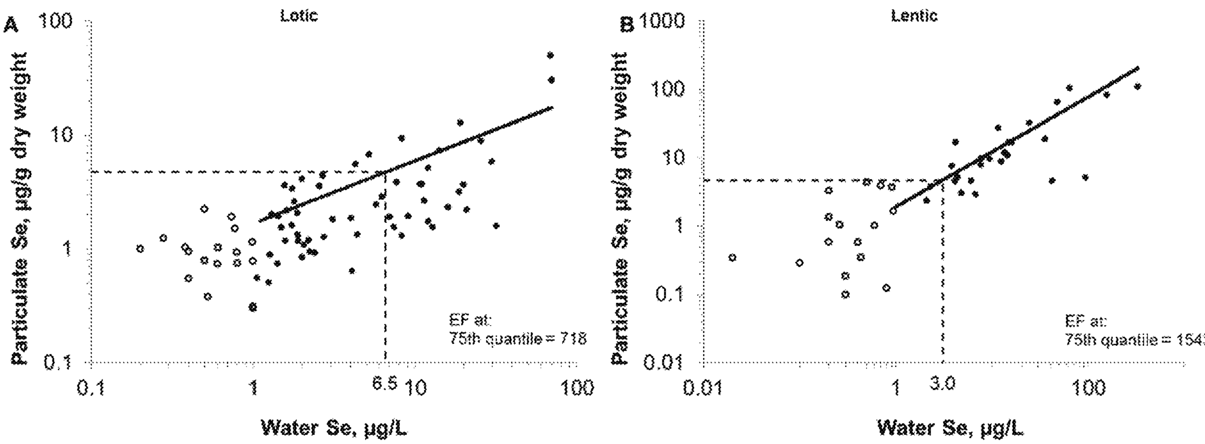

Figure 3. Relationships between particulate and waterborne selenium for (**A**) lotic sites and (**B**) lentic sites. Shown are 75th quantile (solid line), reference data (○), and exposure data (●). EF = enrichment factor; Se = selenium.

quantile regression model for deriving sulfate-dependent waterborne Se screening guidelines are discussed in Supplemental Data, Section S2, for comparison.

The lower bound of the sulfate-dependent model was capped at a sulfate concentration of 43 mg/L, which is the sulfate concentration that results in a guideline of 6.5 µg/L (equivalent to the lotic guideline; Table 1). The lotic Se screening guideline of 6.5 µg/L is based, in part, on the relationship between waterborne and particulate Se in a variety of lotic water bodies. Sulfate concentrations were not always reported in the data sets used to derive the lotic guideline, but reported ranges encompassed low sulfate conditions where available, for example, ranging from <5 mg/L to approximately 100 mg/L [37,38] and from <5 mg/L to approximately 50 mg/L [39]. As such, we expect that the lotic Se screening guideline of 6.5 µg/L would be protective at low sulfate concentrations. The sulfate-dependent guideline appears to have sufficient conservatism such that sulfate concentrations <43 mg/L result in unnecessarily low guidelines. This is supported by the field data used to validate the sulfate-dependent guideline. When the Se guideline is not capped at 43 mg/L, the percentage of sites with observed false negatives decreases only marginally (Figure 7, upper left quadrant), while the number of false positives increases substantially (Figure 7, lower right quadrant). Consequently, capping the guideline based on a sulfate-dependent model does not substantially reduce the level of protection provided but does reduce the number of sites that would be overprotected if the lower bound was not capped.

Table 1. Summary of waterborne selenium (Se) screening guidelines based on 1) field data for lotic and lentic sites, 2) laboratory data for selenate and selenite, and 3) waterborne sulfate concentrations for selenate

Description of approach	Waterborne Se (µg/L)
Field-based water-to-particulate Se data	
Lotic	6.5
Lentic	3.0
Laboratory-based water-to-particulate Se data	
Selenate	5.1
Selenite	1.5
Sulfate-dependent selenate guidelines	
43 mg SO_4/L (lower limit)[a]	6.5
75 mg SO_4/L	14
100 mg SO_4/L	21
150 mg SO_4/L	37
200 mg SO_4/L	55
300 mg SO_4/L	97

[a]The sulfate-dependent model is capped at a lower sulfate concentration of 43 mg/L, which results in the lotic guideline of 6.5 µg/L (see text).

DISCUSSION

Comparisons to other waterborne Se guidelines or criteria

The derived waterborne Se screening guidelines of 6.5 µg/L for lotic systems and 3.0 µg/L for lentic systems are differentiated based on relationships between particulate and waterborne Se concentrations from field data sets. Back-calculated waterborne Se concentrations of 5.1 µg/L for selenate and 1.5 µg/L for selenite were derived from laboratory data. It is unclear why these back-calculated waterborne Se concentrations based on laboratory-based selenate and selenite data are generally less than those derived from field-based lotic and lentic data, but it could be for 1 or more of the following reasons: 1) greater Se bioavailability in laboratory waters; 2) testing of single species in the laboratory that may have a higher Se bioconcentration potential than particulates in the field data sets, where multiple species occur; and/or 3) other conditions associated with laboratory exposures, such as high light intensity and addition of nutrients, that might enhance Se bioaccumulation relative to field sites. The following discussion compares these lotic and lentic guidelines of 6.5 and 3.0 µg/L to other waterborne guidelines and criteria.

The USEPA's recently finalized ambient water quality criteria for Se include a fish egg Se criterion of 15.1 µg/g dry weight as well as water Se criteria of 3.1 µg/L for lotic systems and 1.5 µg/L for lentic systems [9]. In deriving these water column criteria, the USEPA first compiled empirical Se enrichment factors for field sites (26 lentic and 39 lotic sites). The USEPA then modeled Se in the food web using trophic transfer factors based on 1) the fish species reported to be present at each of the sites for which the enrichment factors were compiled, and 2) the diet of each species, which was usually assumed based on typical diets and/or feeding behavior. The fish and invertebrate (dietary) trophic transfer factors were compiled from the literature and government reports. The fish trophic transfer factors were based on whole-body Se concentrations, so a whole-body to egg conversion factor was also applied. The USEPA treated the enrichment factors and trophic transfer factors as constants regardless of the Se concentrations at the site. This produced predictions of

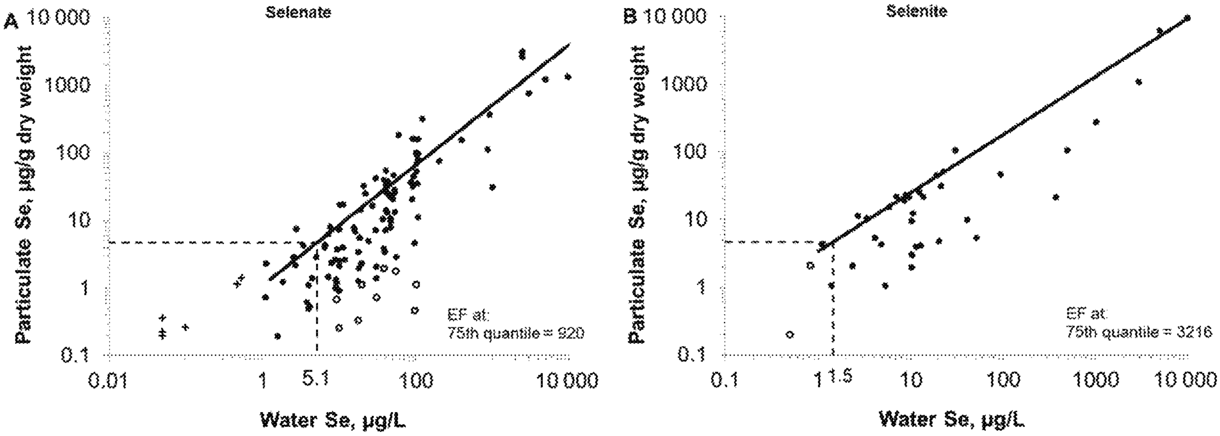

Figure 4. Relationships between particulate and waterborne selenium from laboratory studies with (**A**) selenate and (**B**) selenite. (**A**) Shown are data for 75th quantile (solid line), sulfate ≤267 mg/L (●), sulfate >267 mg/L (○), and controls (+). (**B**) Shown are data for 75th quantile (solid line), controls (○), and exposure data (●). EF = enrichment factor; Se = selenium.

water column Se concentrations that could result in the fish egg Se criterion of 15.1 μg/g dry weight for 39 lotic sites and 26 lentic sites. The water column criteria were then set equal to the 20th percentiles of these distributions for lotic and lentic sites, which were 3.1 and 1.5 μg/L, respectively.

One uncertainty in the approach used by the USEPA [9] is that it can provide counterintuitive results, which is largely a result of the inverse relationship between enrichment factors and water column concentrations. For example, the 2 lentic sites with the lowest back-translated water Se concentrations are reference lakes (Badin Lake and High Rock Lake, NC, USA [40]). The reported water Se concentrations in these lakes were 0.32 and 0.67 μg/L, respectively, and fish Se concentrations were well below criteria (based on measured muscle Se concentrations, the USEPA predicted egg Se concentrations that ranged 3.2–5.8 μg/g dry wt in Badin Lake and 3.1–6.1 μg/g dry wt in High Rock Lake). However, the USEPA's model predicted that water Se concentrations of 0.27 and 0.68 μg/L would be required to achieve the fish egg Se criterion of 15.1 μg/g dry weight. As such, the model is predicting that water column Se concentrations need to be essentially unchanged, in fact lower in Badin Lake, for the fish egg Se criterion of 15.1 μg/g dry weight to be achieved in these 2 reference water bodies. The reason is that the empirical enrichment factors for Badin Lake and High Rock Lake were 12 480 and 4990 L/kg, respectively, and it was assumed that the enrichment factors would be of the same magnitude if the lakes had a fish egg Se concentration of 15.1 μg/g dry weight.

If the USEPA's fish egg Se criterion of 15.1 μg/g dry weight is entered into the quantile regression model described herein, the resulting lotic and lentic water column concentrations are 2.8 and 1.7 μg/L, respectively, which are similar to the USEPA's lotic and lentic criteria of 3.1 and 1.5 μg/L. However, they are mainly similar because, as noted, the USEPA's criteria are based on the relatively nonconservative 20th percentiles of the lotic and lentic sites they evaluated (i.e., by their definition, 20% of sites would not be protected by their water column criteria). If the 5th percentile of their distributions had been used, for example, the lotic and lentic criteria would have been approximately 1.3 and 0.8 μg/L for lotic and lentic water bodies, respectively. To put those concentrations into perspective, of all the field-based water column Se concentrations of 1.5 μg/L and lower ($n = 131$) that were compiled in Appendix I of USEPA [9], just 4 (3%) had an egg Se concentration >15.1 μg/g dry weight. Or, to look at it another way, the mean predicted egg Se concentrations in the same data set averaged 6.6 μg/g dry weight for water bodies with Se concentrations ≤1.5 μg/L (which averaged 0.87 μg/L). The USEPA selected the 20th percentile for deriving water column Se criteria so that the criteria were not within or approaching reference water body ranges.

In addition to differences in the model used herein versus that used by the USEPA, the USEPA's waterborne Se criteria are derived from a fish egg Se criterion of 15.1 μg/g dry weight, whereas a fish egg Se guideline of 20 μg/g dry weight was used in the present evaluation [30]. The key difference between these values is the inclusion of a white sturgeon (*Acipenser transmontanus*) EC10 based on an incomplete concentration–response relationship; this species has the lowest EC10 (15.6 μg/g dry wt) in the database used in the USEPA's SSD, while the second lowest species mean EC10 is 20.6 μg/g dry weight [9]. As noted, inserting the USEPA's fish egg Se criterion of 15.1 μg/g dry weight into our model results in back-calculated lotic and lentic waterborne Se concentrations of 2.8 and 1.7 μg/L, respectively, which are in the same range as those proposed by the USEPA. At first glance, this may seem to suggest that the USEPA's lotic and lentic Se criteria are not inconsistent with what would be derived from our model if the

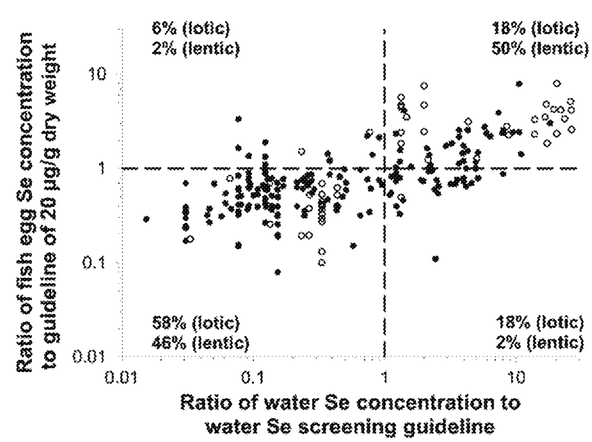

Figure 5. Relationship between mean fish egg selenium (Se) and waterborne Se ratios based on lotic (●) and lentic (○) screening guidelines. Dashed lines indicate waterborne Se ratios (vertical) and egg Se ratios (horizontal). Quadrants show agreement (upper right and lower left) or disagreement (lower right and upper left) between water and egg Se guideline comparisons, with percentage of observations in each quadrant indicated. Upper left quadrant is the false-negative quadrant.

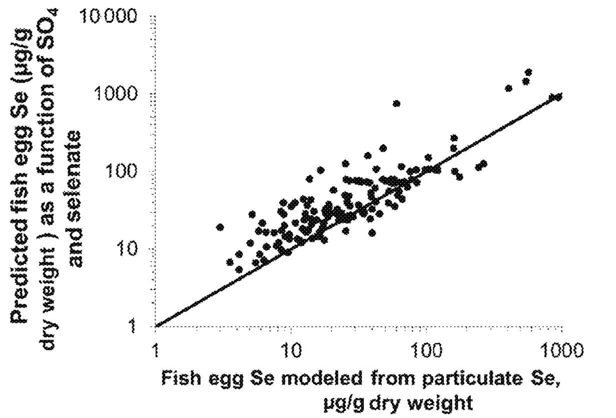

Figure 6. Comparison of 75th quantile fish egg selenium (Se) concentrations predicted from waterborne sulfate (SO_4) and selenate concentrations (*y* axis) versus fish egg Se concentrations predicted from empirical particulate Se concentrations (*x* axis). Solid line represents 1:1 agreement.

egg Se criterion of 15.1 µg/g dry weight is used. As discussed further, however, selection of an appropriate quantile to use in the model may not be independent of the fish egg Se criterion that is used.

We selected the 75th quantile in our model because use of a higher quantile, such as the 90th, resulted in waterborne Se concentrations found in reference areas. We attribute this to compounding quantiles at each step of the model. The 75th quantile was deemed to be a reasonably protective quantile that also provided Se concentrations in the food chain that were toxicologically sensible. For example, the 75th quantile resulted in a back-calculated invertebrate Se concentration of 10 µg/g dry weight, which is consistent with the lower threshold for diet-borne Se toxicity to sensitive fish including the white sturgeon (Figure 1B). These observations were based on an egg Se guideline of 20 µg/g dry weight, but that does not mean the same quantile should be considered for an alternative egg Se

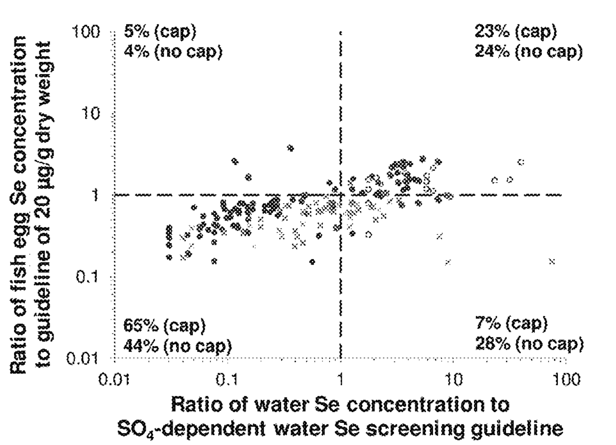

Figure 7. Relationship between mean fish egg selenium (Se) and waterborne Se ratios based on the sulfate-dependent screening guideline. Ratios based on the sulfate (SO_4)–dependent guideline capped at 43 mg SO_4/L are filled symbols (●); ratios based on sulfate-dependent guideline not capped at 43 mg SO_4/L are expressed as open symbols (○) where water Se was >6.5 µg/L and sulfate was >43 mg/L and as crossed symbols (×) where water Se was <6.5 µg/L and sulfate was <43 mg/L. Dashed lines indicate waterborne Se ratios (vertical) and egg Se ratios (horizontal). Quadrants show agreement (upper right and lower left) or disagreement (lower right and upper left) between water and egg Se guideline comparisons, with percentages of observations in each quadrant indicated.

concentration of interest, such as the USEPA's criterion of 15.1 µg/g dry weight. If the USEPA's criterion of 15.1 µg/g dry weight is used, the associated Se concentrations in invertebrates and particulates using the 75th quantile models would be 6.5 and 2.9 µg/g dry weight, respectively. These are below the dietary Se toxicity threshold for fish and near or within the range of reference area invertebrate and particulate Se concentrations in at least some geographic regions [19,29,41,42]. As such, a lower quantile would be justified when considering a lower fish egg Se criterion.

In addition, we note that the diet-to-fish egg trophic transfer factors vary depending on the fish egg Se toxicity threshold used. Based on the 75th quantile of the regression model, a fish egg Se threshold of 20 µg/g dry weight is associated with a trophic transfer factor of 2.0, while a threshold of 15.1 µg/g dry weight is associated with a trophic transfer factor of 2.3. Although we earlier noted the added uncertainty in the white sturgeon EC10 because of the partial concentration–response relationship, it does appear to be among the more sensitive species tested to date. Based on the paired sturgeon egg and diet-borne Se concentrations reported in Linville [43], diet-to-sturgeon egg trophic transfer factors ranged from 0.22 to 0.82. Fish species with relatively low egg Se EC10s may partition a lower proportion of their body burden to eggs than fish species with relatively high egg Se EC10s. For example, the egg Se EC10 for mountain whitefish (*Prosopium williamsoni*) is >33 µg/g dry weight [44], among the highest for fish species tested. Also, egg Se concentrations for this species are often >20 µg/g dry weight in reference waters and typically approximately 8-fold greater than muscle Se concentrations [36,44]. In contrast, the species with the lowest EC10s in the SSD [30] also have the lowest ratios of egg Se concentrations to either whole-body or muscle Se concentrations (Supplemental Data, Figure S12). It is possible that species with higher ratios of egg/ovary to whole-body/muscle Se concentrations have a greater tolerance to Se; however, to our knowledge, this has not yet been demonstrated.

Lastly, the BCMOE's ambient aquatic life guidelines for Se include an alert concentration of 1 µg/L and a guideline of 2 µg/L [7]. These values are based on multiple lines of evidence, including food-web modeling and relationships between aquatic life impacts and corresponding water Se concentrations. The BCMOE did not derive waterborne Se guidelines that varied by site type but noted that the guideline was intended to protect the fish-inhabiting lentic environments, with a greater Se bio-accumulation potential. If the BCMOE's fish egg Se guideline of 11 µg/g dry weight was considered, which includes a safety factor of 2 in its derivation (British Columbia does not use the SSD for guideline derivation), the lotic and lentic back-calculated waterborne Se concentrations using our model are 1.1 and 0.9 µg/L, respectively. As previously discussed (see *Water Se screening guideline development* section), waterborne Se concentrations of this magnitude can be considered reference water body concentrations and are thus not useful as screening-level guidelines.

Important factors in deriving waterborne Se screening guidelines

Although many factors influence Se speciation, bioavailability, and bioaccumulation in aquatic systems, 3 that should currently be considered in development of waterborne Se screening thresholds are as follows: 1) differences between lotic and lentic sites, 2) the influence of exposure concentration on Se partitioning among compartments, and 3) the influence of sulfate on selenate bioavailability. Each of these factors was incorporated into the waterborne Se screening guidelines recommended in the present study.

Regarding differences between lotic and lentic sites, use of colocated waterborne and particulate Se data from lotic and lentic sites still appears to be the most practical approach in accounting for this difference. There is clearly a continuum of Se bioconcentration potential between these 2 site types, but separating particulate Se data by site type facilitates development of waterborne Se screening guidelines that differ appropriately for lotic and lentic sites. However, more research is needed to refine these categories or even eliminate them as expanding research on Se speciation, fate, and biological interactions increases our ability to mechanistically predict Se bioconcentration potential across differing site conditions.

The influence of exposure concentration on Se partitioning among compartments is best addressed by considering relationships between Se concentration at each step in the food chain versus its corresponding exposure concentration, rather than simplifying these relationships to single ratios. Because Se enrichment factors and trophic transfer factors are inversely related to exposure concentration, selection of a single enrichment factor or trophic transfer factor for use in the multistep Se partitioning models is inappropriate. For example, selecting a high percentile enrichment factor or trophic transfer factor may be applicable only to background or reference site Se conditions, whereas selection of a low to even moderate percentile may underestimate Se exposure potential. Use of the regression-based approach quantitatively reduces that uncertainty.

Although both the BCMOE and the USEPA recognize the importance of sulfate on selenate bioavailability, neither derived nor recommended sulfate-dependent Se guidelines/criteria. We demonstrate that the influence of sulfate on the bioconcentration of selenate can be modeled quantitatively, as is done for hardness-dependent guidelines or other toxicity-modifying factors. A waterborne Se screening guideline, such as that derived in the present evaluation, would be applicable only to waters where Se enters a well-oxygenated, lotic receiving water as selenate and in which selenate is the dominant Se species at the interface between waterborne Se and particulate Se. Because of methodological challenges and high costs, it is difficult to evaluate the influence of sulfate on selenate bioconcentration and transfer up the food chain. However, because increasing sulfate concentrations reduce selenate bioconcentration in particulates at the base of food chains, it was possible to model selenate bioconcentration in particulates as a function of waterborne selenate and sulfate concentrations. As additional data on the influence of sulfate on selenate bioconcentration become available, this model can be further refined.

One observation with the recommended sulfate-dependent water Se screening guideline is that it increases at a proportionally greater rate than the waterborne sulfate concentration. For example, while holding the fish egg Se concentration constant, a 2-fold increase in the waterborne sulfate concentration results in a 2.6-fold increase in the sulfate-dependent water Se screening guideline. Alternatively, if the waterborne selenate concentration is held constant, a 2-fold increase in the waterborne sulfate concentration results in a predicted fish egg Se concentration that decreases by a factor of 0.33 (i.e., it decreases at a proportionately lesser rate). Thus, the sulfate-dependent water Se guideline responds more than proportionately to the waterborne sulfate concentration because the predicted fish egg Se concentration responds less than proportionately to the waterborne sulfate concentration. This observation of the model can be compared to empirical data that comprise one component of the model. For example, the slope of the relationship between the natural logarithms of the predicted fish egg Se concentrations and waterborne sulfate concentrations is –0.568 when the waterborne selenate concentration is held constant. This slope from the model falls within the range of empirical slopes (–0.836 to –0.424) when the natural logarithms of algae and macrophyte Se are regressed versus waterborne sulfate concentrations and waterborne selenate is held constant (Supplemental Data, Figure S13). This is perhaps not surprising because the algae and macrophyte data provide the foundation for the sulfate-dependent model, but this supports the idea that the relationship between the sulfate-dependent water Se screening guideline and waterborne sulfate concentrations is consistent with the empirical data.

Outlook and ongoing research needs

Methods for linking waterborne Se concentrations to fish tissue Se concentration range from conservative screening models to site-specific models. Screening models, such as those described in the present study, are intended to determine whether site-specific studies and models are necessary, while site-specific models currently require measurement of Se concentrations in at least one component of the aquatic food web at the site of interest. The ecosystem-scale Se model of Presser and Luoma [12], for example, requires site-specific measurement of Se in particulates at the base of the food web, whereas the Bayesian Monte Carlo model described in Brix et al. [2] requires site-specific measurement of Se in fish tissue.

Currently, models for predicting Se bioaccumulation potential in aquatic food webs as a function of site-specific biogeochemical characteristics are unavailable. The development of models for predicting Se enrichment at the base of aquatic food webs as a function of site-specific chemistry data, including Se speciation and factors that modify Se bioavailability, is the next step for advancing our ability to evaluate site-specific Se bioaccumulation potential. Such modeling at the base of the food web, coupled with an understanding of Se trophic transfer in different food webs (as described in Presser and Luoma [12]), would provide a more flexible and cost-effective tool for Se evaluations over a broad range of biogeochemical conditions.

Such models can be enhanced by considering the biokinetics of Se uptake and elimination at the base of the aquatic food web and through successive trophic levels. Selenium concentrations in surface waters are often temporally variable; thus, it is important to understand how Se concentrations in different food-web components respond to that variability and, ultimately, how those Se concentrations relate to the critical exposure period for fish species of interest at a given site. DeForest et al. [45], for example, conducted an evaluation of existing biokinetic data for Se and found that periphyton-based food webs respond differently to changes in waterborne Se concentrations compared with phytoplankton-based food webs, which is predominantly because of differences in Se uptake rates. More biokinetic Se studies are necessary for a broader range of primary producers and over a broader range of water chemistry conditions. These studies could also help in the development of predictive models of Se enrichment at the base of the food web under varying physicochemical conditions.

Supplemental Data—The Supplemental Data are available on the Wiley Online Library at DOI: 10.1002/etc.3793.

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Data availability—Data are available as Supplemental Data.

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Message

From: Bozek, Richard [RBozek@eei.org]
Sent: 9/15/2017 1:40:04 PM
To: Dominguez, Alexander [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=5ced433b4ef54171864ed98a36cb7a5f-Dominguez,]
CC: Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]
Subject: Monday/Tuesday Meeting

Alex:

Sarah asked that I work with you to schedule a meeting with her either Monday or Tuesday. I will likely have 2-3 people in tow. If you can offer a few time options, I will coordinate with my folks and lock something down. Thanks you so much.

Rich

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Message

From: Bozek, Richard [RBozek@eei.org]
Sent: 9/15/2017 1:26:35 PM
To: dominguez.alex@epa.gov
CC: Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]
Subject: Monday/Tuesday Meeting

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Message

From: Aspatore, Amanda [AAspatore@nma.org]
Sent: 9/5/2017 9:43:48 PM
To: Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]
Subject: Selenium and Groundwater Information
Attachments: Oct 2015 NMA Comments on EPA Proposed Selenium Water Quality Criterion.pdf; NMA 2017 Selenium Implementation Comments.pdf; Industry Coalition County of Maui Amicus Brief.pdf; Municipal Amicus Brief 9th Circuit County of Maui.pdf; EPA Amicus Brief 9th Circuit County of Maui.pdf

Sarah –

Attached please find the National Mining Association's (NMA) technical comments on EPA's now final selenium water quality criterion, which include, among other things, suggestions for minor changes to the fish tissue calculations, concerns regarding the national water column calculations, and suggested edits to Footnote 3 of the criterion regarding when use of the fish tissue numbers (as opposed to the water column numbers) is permissible. NMA's comments on the current proposed draft implementation guidance documents are also attached, which outline several issues concerning the limits to state flexibility posed by the current proposed guidance language.

Additionally, attached are several amicus briefs filed to the U.S. Court of Appeals for the 9th Circuit in the case of *Hawaii Wildlife Fund v. County of Maui*, which relates to whether discharges that reach navigable waters through groundwater (among other means) require a CWA NPDES permit. The briefs include: (1) AAR, AFBA, AISI, API, NAM, NMA, TFI, and UWAG's brief asking the 9th Circuit to overturn the lower court's decision; (2) ACWA, CASA, CSAC, IMLA, the League, NACWA, NACo, NLC, and NWRA's brief asking the 9th Circuit to overturn the lower court's decision; and (3) the Obama Administration's brief asking the 9th Circuit to uphold the lower court's decision. The 9th Circuit has scheduled oral argument in the case for Oct. 12, 2017.

Please do not hesitate to contact me with any questions, or if you would like any additional information. Thank you so much – I hope that you are having a good evening!

Sincerely,
Amanda

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No. 15-17447

IN THE UNITED STATES COURT OF APPEALS
FOR THE NINTH CIRCUIT

HAWAII WILDLIFE FUND; SIERRA CLUB-MAUI GROUP; SURFRIDER FOUNDATION; WEST MAUI PRESERVATION ASSOCIATION,

Plaintiffs-Appellees,

v.

COUNTY OF MAUI,

Defendant-Appellant.

On Appeal from the U.S. District Court, Dist. of Hawaii
No. 12-cv-198, Hon. Susan Oki Mollway, District Judge

BRIEF FOR THE UNITED STATES AS AMICUS CURIAE IN SUPPORT OF PLAINTIFFS-APPELLEES

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The United States respectfully submits this brief as amicus curiae pursuant to Federal Rule of Appellate Procedure 29(a).

INTEREST OF THE UNITED STATES

The United States Environmental Protection Agency (EPA) implements the Clean Water Act (CWA), 33 U.S.C. §§ 1251-1387, together with the states. That includes promulgating regulations regarding the CWA's National Pollutant Discharge Elimination System (NPDES). *Id.* § 1342. The United States participates as amicus curiae because it has an interest in the proper interpretation of the NPDES-permit provisions and the framework for analyzing whether discharges of pollutants to jurisdictional surface waters through groundwater are subject to those provisions.[1] The United States also has an interest because it enforces the CWA and because it is a potential defendant in actions alleging the discharge of pollutants from federal facilities through groundwater.

The United States agrees with the result the district court reached in this case and urges affirmance. In the United States' view, a NPDES

[1] We use the term "jurisdictional surface waters" throughout this brief to mean "waters of the United States."

permit is required here because the discharges from the Defendant-Appellant County of Maui's wastewater treatment facility are from a point source (*i.e.*, the injection wells) to waters of the United States (*i.e.*, the Pacific Ocean[2]). To be clear, the United States does not contend that groundwater is a point source, nor does the United States contend that groundwater is a water of the United States regulated by the Clean Water Act. Moreover, the United States does not agree with the district court's application of the "significant nexus" standard from *Rapanos v. United States*, 547 U.S. 715 (2006).

ISSUES PRESENTED

This amicus brief addresses the following issues:

1. Whether a discharge of pollutants from a point source to jurisdictional surface waters through groundwater with a direct hydrological connection to jurisdictional surface waters is regulated under the CWA.

2. Whether the site-specific facts here give rise to a "discharge of a pollutant" under the CWA.

---

[2] More specifically, into the Pacific Ocean that is part of the United States' territorial seas under the CWA. 33 U.S.C. § 1362(7), (8).

3. Whether the County had fair notice that it was subject to civil penalties for its discharges to jurisdictional surface waters without a NPDES permit.

STATEMENT OF THE CASE

I. Statutory Background

Congress enacted the Clean Water Act to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." 33 U.S.C. § 1251(a). Congress therefore prohibited any non-excepted "discharge of any pollutant" to "navigable waters" unless it is authorized by a permit. *Id.* §§ 1311, 1342, 1344, 1362. The CWA defines "discharge of a pollutant" as "any addition of any pollutant *to* navigable waters from any point source." *Id.* § 1362(12)(A) (emphasis added). Pollutant means "dredged spoil, solid waste, incinerator, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water." *Id.* § 1362(6). The CWA defines "navigable waters" as "the waters of the United States, including the territorial seas"; and a point source is "any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged." *Id.* § 1362(7), (14).

The CWA authorizes EPA to issue NPDES permits under Section 402(a), but EPA may authorize a state to administer its own NPDES program if EPA determines that it meets the statutory criteria. *Id.* § 1342(a), (b). When a state receives such authorization, EPA retains oversight and enforcement authorities. *Id.* §§ 1319, 1342(d). Hawaii obtained such permitting authority in 1974. *See* 39 Fed. Reg. 43,759 (Dec. 18, 1974).

The CWA is a strict-liability regime that prohibits non-excepted discharges unless they are authorized by a CWA permit. *Id.* §§ 1311, 1342, 1344. An unpermitted discharge constitutes a violation of the CWA regardless of fault and is subject to enforcement by the state or federal government or a private citizen. *Id.* §§ 1319, 1365. To establish liability for a violation of the permit requirement, a plaintiff must show there was (1) a discharge (2) of a pollutant (3) to navigable waters (4) from a point source. *Headwaters, Inc. v. Talent Irrigation Dist.*, 243 F.3d 526, 532 (9th Cir. 2001).

The CWA includes a civil-penalty provision for those who violate the Act. 33 U.S.C. § 1319(d). When determining a civil-penalty amount, courts must consider "the seriousness of the violation or violations, the economic benefit (if any) resulting from the violation, any history of such violations, any good-faith efforts to comply with the applicable requirements, the economic impact of the penalty on the violator, and such other matters as justice may require." *Id.*

EPA's longstanding position is that a discharge from a point source to jurisdictional surface waters that moves through groundwater with a direct hydrological connection comes under the purview of the CWA's permitting requirements. *E.g.,* Amendments to the Water Quality Standards Regulations that Pertain to Standards on Indian Reservations, 56 Fed. Reg. 64,876, 64,982 (Dec. 12, 1991) ("[T]he affected ground waters are not considered 'waters of the United States' but discharges to them are regulated because such discharges are effectively discharges to the directly connected surface waters.").

II. FACTUAL BACKGROUND

The County operates the Lahaina Wastewater Reclamation Facility. *Haw. Wildlife Fund v. Cty. of Maui*, 24 F. Supp. 3d 980, 983 (D. Haw. 2014) [*Hawaii I*]. The facility receives approximately four million gallons of sewage each day. *Id.* After treating the sewage, the facility releases three to five million gallons of effluent into four on-site injection wells. *Id.* at 983-84. The effluent travels into a shallow groundwater aquifer and then flows into the Pacific Ocean through the seafloor at points known as "submarine springs." *Id.* at 984; *see also Haw. Wildlife Fund v. Cty. of Maui*, No. 12-198, 2015 WL 328227, at *1 (D. Haw. Jan. 23, 2015) [*Hawaii II*].

EPA, the Hawaii Department of Health (DOH), and others conducted a tracer-dye study that confirmed this conclusion for injection wells 3 and 4. *Hawaii I*, 24 F. Supp. 3d at 984. According to the study, it took the leading edge of the dye 84 days to go from wells 3 and 4 to the ocean and about 64% of the dye injected into these wells was discharged from the submarine springs to the Pacific Ocean. *Id.* The dye's appearance in the ocean "conclusively demonstrated that a hydrogeologic connection exists." *Id.* at 985-86.

Although tracer dye was not placed into well 1 and dye from well 2 was not detected in the study, the County "acknowledge[d] that there is a hydrogeologic connection between wells 1 and 2 and the ocean." *Hawaii II*, 2015 WL 328227, at *1-2. The tracer-dye study models indicated that, in some circumstances, treated effluent from well 2 would move along flowpaths similar to those traveled by the dye injected into wells 3 and 4 and emerge at the same springs. Supplemental Excerpts of Record (SER) 237, 240, 243. There is no dispute that given the proximity of wells 1 and 2, the modeling for well 2 predicts the flowpaths for discharges from well 1. Excerpts of Record (ER) 443; SER 189.

III. Procedural Background

In April 2012, Plaintiffs-Appellees Hawaii Wildlife Fund, Sierra Club-Maui Group, Surfrider Foundation, and West Maui Preservation Association filed suit seeking to require the County to obtain and comply with a NPDES permit and to pay civil penalties. *Hawaii I,* 24 F. Supp. 3d at 986. The district court issued three partial summary-judgment opinions in favor of Plaintiffs. The parties then entered into a settlement agreement, in which the County stipulated to terms contingent on a final judgment that the County violated the CWA and that the County was "not immune from" civil penalties. *Haw. Wildlife Fund v. Cty. of Maui*, No. 12-198, ECF No. 259. The court entered final judgment in accordance with its opinions and the settlement agreement.

The district court's first opinion held the County liable under the CWA for unpermitted discharges from wells 3 and 4. *Hawaii I*, 24 F. Supp. 3d at 1000. The court started its analysis with the language and purpose of the CWA, and also relied on EPA's interpretation and case law. *Id.* at 995-96. The court explained that Plaintiffs "must show that pollutants can be *directly traced* from the injection wells to the ocean such that the discharge at the LWRF is a *de facto* discharge into the ocean." *Id.* at 998 (emphasis in original). The court found that Plaintiffs had met this burden. *Id.* at 998-1000. The district court also found CWA liability under the "significant nexus" standard from Justice Kennedy's concurring opinion in *Rapanos*, 547 U.S. at 755-56, and the Ninth Circuit's application of that standard in *Northern California River Watch v. City of Healdsburg*, 496 F.3d 993, 999-1000 (9th Cir. 2007).

The district court's second opinion held the County liable for unpermitted discharges from wells 1 and 2. *Hawaii II*, 2015 WL 328227, at *6. The County "expressly conced[ed] that pollutants introduced by the County into wells 1 and 2 were making their way to the ocean," and the court rejected the County's argument that liability does not arise unless a pollutant passes through "a series of sequential point sources." *Id.* at *2-4.

The district court's third opinion rejected the County's argument that it was not subject to civil penalties for its unpermitted discharges because it lacked fair notice. *Haw. Wildlife Fund v. Cty. of Maui*, No. 12-198, 2015 WL 3903918, at *6 (D. Haw. June 25, 2015) [*Hawaii III*]. The court determined that the County had notice because the discharges "clearly implicate[d] each statutory element." *Id.* at *4. The court further held that its adjudication of the first motion for partial summary-judgment provided notice to the County. *Id.* at *6.

The parties then entered into a settlement agreement, in which the County stipulated that it would make good faith efforts to obtain and comply with a NPDES permit and that it would pay $100,000 in civil penalties and $2.5 million for a supplemental environmental project, all contingent on a final judgment and ruling that the County violated the CWA and that the County was "not immune from" civil penalties. *Haw. Wildlife Fund v. Cty. of Maui*, No. 12-198, ECF No. 259. The district court then entered a final judgment.

SUMMARY OF ARGUMENT

The judgment should be affirmed because it is consistent with the language and purpose of the Clean Water Act and EPA's longstanding interpretation and practice of issuing NPDES permits for discharges of pollutants similar to the ones here. As Justice Scalia said in *Rapanos*, the statute's language prohibiting "any addition of any pollutant to navigable waters from any point source" does not limit liability only to discharges of pollutants *directly* to navigable waters. *See Rapanos*, 547 U.S. at 743 (plurality op.) (emphasis in original). Courts have interpreted the CWA as covering not only discharges of pollutants directly to navigable waters, but also discharges of pollutants that travel from a point source to navigable waters over the surface of the ground or through underground means. *E.g.*, *Sierra Club v. Abston Constr. Co.*, 620 F.2d 41, 44-45 (5th Cir. 1980). The discharges in this case fall squarely within the statutory language.

In the United States' view, a NPDES permit is required here because the discharges at issue are from a point source (*i.e.*, the injection wells) to waters of the United States (*i.e.*, the Pacific Ocean's coastal waters). To be clear, the United States views groundwater as *neither* a point source *nor* a water of the United States regulated by the CWA. The United States therefore agrees with the district court's conclusion that a NPDES permit was required here, but only to the extent that the court's analysis is consistent with the above-stated principles regarding groundwater.

The district court's conclusions accord with the CWA's purpose. Congress enacted the CWA "to restore and maintain . . . the country's waters"; and to achieve this goal, Congress created a strict-liability regime prohibiting discharges unless they are authorized under the CWA. Recognizing Congress's goals in the CWA, courts have concluded that in certain circumstances discharges of pollutants that reach navigable waters through groundwater fall squarely within the statute's terms. *E.g.*, *Idaho Rural Council v. Bosma*, 143 F. Supp. 2d 1169, 1179-80 (D. Idaho 2001).

Even if Congress's intent on this issue had been ambiguous, EPA has clearly stated for decades that pollutants that move through groundwater can constitute discharges subject to the CWA, and that interpretation is entitled to *Chevron* deference. *Chevron, U.S.A., Inc. v. Nat. Res. Def. Council, Inc.*, 467 U.S. 837, 842-43 (1984). It has been EPA's longstanding position that discharges moving through groundwater to a jurisdictional surface water are subject to CWA permitting requirements if there is a "direct hydrological connection" between the groundwater and the surface water. *See* NPDES Permit Regulation and Effluent Limitations Guidelines and Standards for Concentrated Animal Feeding Operations, 66 Fed. Reg. 2960, 3017 (Jan. 12, 2001). This formulation recognizes that some hydrological connections are too circuitous and attenuated to come under the CWA. *Id.*

The County argues that the district court dispensed with the requirements that a discharge be "from a point source" and "to navigable water" because the effluent was discharged from a nonpoint source and because the effluent was discharged into groundwater, which is not covered by the CWA. Opening Brief (Op. Br.) at 21, 27, 30.

This attempt to bifurcate the movement of the pollutants into two separate events is inconsistent with the statute's language and purpose. It also ignores the undisputed fact that the pollutants moved *through* that groundwater to the ocean.

The County's argument that no civil penalty should have been imposed because the County lacked fair notice lacks merit. The County was on notice both as a general matter—through the CWA's language and EPA's statements in rulemakings—and specifically—through communications from EPA to the County. In any event, the question of fair notice goes to the amount of the civil penalty, an amount the County stipulated to, and is only one of many factors informing a civil-penalty amount.

ARGUMENT

I. THE DISTRICT COURT'S DECISIONS ARE CONSISTENT WITH THE LANGUAGE AND PURPOSE OF THE CWA.

The district court's judgment holding the County liable under the CWA is consistent with the text and purpose of the statute. It is also consistent with EPA's long-held position governing when the CWA requires permits for discharges of pollutants that move to jurisdictional surface waters through groundwater with a direct hydrological connection. The County cannot recast the nature of the discharges to avoid that result.

A. Discharges of Pollutants to Jurisdictional Surface Waters Through Groundwater with a Direct Hydrological Connection Properly Require CWA Permits.

When Congress prohibited the unpermitted "discharge of any pollutant," it defined this term broadly as "any addition of any pollutant to navigable waters from any point source." 33 U.S.C. §§ 1311, 1362(12)(A). As the County concedes, "a point source does not need to discharge directly into navigable waters to trigger NPDES permitting." Op. Br. at 27. Because Congress did not limit the term "discharges of pollutants" to only direct discharges to navigable waters, discharges through groundwater may fall within the purview of the CWA.

This reading of "discharge of a pollutant" has been applied in other similar contexts where discharges of pollutants have moved from a point source to navigable waters over the surface of the ground or by some other means. In *Sierra Club v. Abston Construction*, which addressed discharges from mining operations that traveled to navigable waters in part through surface runoff, the Fifth Circuit stated that "[g]ravity flow, resulting in a discharge into navigable body of water, may be part of a point source discharge if the [discharger] at least initially collected and channeled the water and other materials."[3] 620 F.2d at 44-45; *see also Friends of Sakonnet v. Dutra*, 738 F. Supp. 623, 628, 630 (D.R.I. 1990) (defendant liable for discharge of "raw sewage [that] was running directly from the leaching field, on the surface of the ground for approximately 250 feet, into the [surface water]"); *O'Leary v. Moyer's Landfill, Inc.*, 523 F. Supp. 642, 647 (E.D. Pa. 1981) ("[T]here is no requirement that the point source need be directly adjacent to the waters it pollutes.").

That Congress gave the term "discharge of a pollutant" a broad meaning finds support in cases where CWA liability attached for discharges from point sources that traveled through other means before reaching surface waters. *See Rapanos*, 547 U.S. at 743 (noting that courts have found violations of Section 301 "even if the pollutants discharged from a point source do not emit 'directly into' covered

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[3] The County misconstrues the United States' position as amicus curiae in *Abston Construction*. *See* Op. Br. at 30-31. The United States took the position that discharges of pollutants that traveled indirectly from a point source to jurisdictional surface waters through surface runoff or the gravity flow of rainwater come within the scope of the CWA. Brief for the United States as *Amicus Curiae*, at 35-36, *Sierra Club v. Abston Constr. Co.*, No. 77-2530 (5th Cir. 1980).

waters, but pass 'through conveyances' in between") (citing *Sierra Club v. El Paso Gold Mines, Inc.*, 421 F.3d 1133, 1137 (10th Cir. 2005) (defendant could be liable for discharges conveyed from its point-source mine shaft to jurisdictional surface water through a tunnel that defendant did not own); *United States v. Velsicol Chem. Corp.*, 438 F. Supp. 945, 946-47 (W.D. Tenn. 1976) (holding that CWA covered pollutants discharged from defendant's point source to jurisdictional surface waters conveyed through a sewer system that the defendant did not own)).

Because courts have interpreted the term "discharge of a pollutant" to cover discharges over the ground and through other means, exempting discharges through groundwater could lead to absurd results. As one court noted, "it would hardly make sense for the CWA to encompass a polluter who discharges pollutants via a pipe running from the factory directly to the riverbank, but not a polluter who dumps the same pollutants into a man-made settling basin some distance short of the river and then allows the pollutants to seep into the river via the groundwater." *N. Cal. River Watch v. Mercer Fraser Co.*, No. 04-4620, 2005 WL 2122052, at *2 (N.D. Cal. Sept. 1, 2005).

The County concedes that discharges need not be direct and that a discharge through a conveyance requires a permit. Op. Br. at 27. The County argues, however, that the conveyance itself must be a point source and that because groundwater is not a point source, the district court "impermissibly 'transform[s] a nonpoint source into a point source.'" *Id.* at 27-28, 33. The County's interpretation is flawed. Contrary to the County's argument, the district court did not eliminate the requirement that a discharge be "from a point source." All it said was that pollutants from a point source need not be emitted *directly* into covered waters. The case law does not require the means by which the pollutant discharged from a point source reaches a water of the United States to be a point source.

While the County's statement that the statutory definition of "navigable waters" does not include groundwater is accurate, Op. Br. at 21, it is beside the point. There is no dispute that groundwater itself is not a "navigable water," 80 Fed. Reg. 37,054, 37,055 (June 29, 2015), but the district court's decisions hinge on the movement of pollutants to jurisdictional surface waters through groundwater with a direct hydrological connection. Such an addition of pollutants to navigable waters falls squarely within the CWA's scope.

The County relies on the treatment of groundwater in legislative history, Op. Br. at 21-23, but this "only supports the unremarkable proposition with which all courts agree—that the CWA does not regulate 'isolated/nontributary groundwater' which has no [effect] on surface water." *Bosma*, 143 F. Supp. 2d at 1180. It does not undermine the conclusion that discharges of pollutants through groundwater to jurisdictional surface waters are subject to the NPDES program.

The County contends that case law does not support the district court's interpretation, Op. Br. at 35-37, but this argument largely ignores the majority of the courts that have addressed this issue and concluded that discharges that move from a point source to jurisdictional surface waters via groundwater with a hydrological connection are subject to regulation under the CWA. *See, e.g.*, *Sierra Club v. Va. Elec. & Power Co.*, No. 15-112, 2015 WL 6830301 (E.D. Va. Nov. 6, 2015); *Yadkin Riverkeeper v. Duke Energy Carolinas, LLC*, No. 14-753, 2015 WL 6157706 (M.D.N.C. Oct. 20, 2015); *S.F. Herring Ass'n v. Pac. Gas & Elec. Co.*, 81 F. Supp. 3d 847 (N.D. Cal. 2015); *Hernandez* *v. Esso Std. Oil Co.*, 599 F. Supp. 2d 175 (D.P.R. 2009); *Nw. Envtl. Def. Ctr. v. Grabhorn*, No. 08-548, 2009 WL 3672895 (D. Or. Oct. 30, 2009); *Mercer Fraser*, 2005 WL 2122052; *Bosma*, 143 F. Supp. 2d 1169.

The County's reliance on other case law (Op. Br. at 35-36) is unavailing for three reasons. *First*, none of the cases are controlling precedent. *Second*, most of these decisions are inapposite because they do not address the issue of discharges of pollutants that move through groundwater to jurisdictional surface waters. In *Village of Oconomowoc Lake v. Dayton Hudson, Corp.*, the court examined whether groundwater itself was a navigable water, *i.e.*, a water within the meaning of the CWA. 24 F.3d 962, 965 (7th Cir. 1994). That is distinct from whether a CWA permit is required when pollutants travel to jurisdictional surface waters through groundwater with a direct hydrological connection.

Third, these cases do not foreclose application of the CWA where a direct hydrological connection to jurisdictional surface waters can be found. In *Rice v. Harken Exploration Co.*, the court concluded that a discharge of oil that might reach navigable waters by gradual, natural seepage was not the equivalent of a discharge to navigable waters. 250

F.3d 264, 271 (5th Cir. 2001). The court suggested, however, that it would be open to finding a discharge had occurred through groundwater when it underscored the plaintiffs' failure to provide any "evidence of a close, direct and proximate link between [the defendant's] discharges of oil and any resulting actual, identifiable oil contamination of a particular body of natural surface water." *Id.* at 272.

B. The District Court's Decisions Give Full Effect to Congress's Intent to Restore and Maintain the Nation's Waters.

Congress's purpose in enacting the CWA—to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters"—embraced a "broad, systemic view . . . of water quality." *United States v. Riverside Bayview Homes, Inc.*, 474 U.S. 121, 132 (1985). The County attempts to minimalize that goal. Adopting the County's theory would allow dischargers to avoid responsibility simply by discharging pollutants from a point source into jurisdictional surface waters through any means that was not direct.

Courts have viewed the CWA's broad purpose of protecting the quality of navigable waters as a clear congressional signal that "any pollutant which enters such waters, whether directly or through groundwater, is subject to regulation by NPDES permit." *Wash. Wilderness Coal. v. Hecla Mining Co.*, 870 F. Supp. 983, 990 (E.D. Wash. 1994). "Stated even more simply, whether pollution is introduced by a visible, above-ground conduit or enters the surface water through the aquifer matters little to the fish, waterfowl, and recreational users which are affected by the degradation to our nation's rivers and streams." *Bosma*, 143 F. Supp. 2d at 1179-80.

The state's authority to protect groundwater is in no way impaired by subjecting point sources to NPDES-permit requirements to protect surface waters. Thus, the County's argument that it should not be liable here because "preservation of states' authority over the regulation of groundwater" is a "co-equal" goal of the CWA misses the mark. Op. Br. at 34-35. This emphatically is not a case about the regulation of groundwater. Instead it is about the regulation of discharges of pollutants to waters of the United States. To the extent the County's argument relies on the regulatory scheme governing disposal into wells, Op. Br. at 24-27, that is flawed because the regulation of wells under the Safe Drinking Water Act's (SDWA) Underground Injection Control (UIC) program does not preclude or displace regulation under the

CWA's NPDES program.[4] *See Hudson R. Fishermen's Ass'n v. City of New York*, 751 F. Supp. 1088, 1100 (S.D.N.Y. 1990), *aff'd*, 940 F.2d 649 (2d Cir. 1991) (objectives of the CWA and the SDWA are not "mutually exclusive"); *see also Bath Petrol. Storage, Inc. v. Sovas*, 309 F. Supp. 2d 357, 369 (N.D.N.Y. 2004).

C. The District Court's Finding of Liability Is Consistent with EPA's Longstanding Position.

EPA's longstanding position has been that point-source discharges of pollutants moving through groundwater to a jurisdictional surface water are subject to CWA permitting requirements if there is a "direct hydrological connection" between the groundwater and the surface water. EPA has repeatedly articulated this view in multiple rulemaking preambles. In 1990, EPA stated that "this rulemaking only addresses discharges to water of the United States, consequently discharges to ground waters are not covered by this rulemaking (unless there is a

[4] The County misconstrues EPA's position in *Inland Steel v. EPA*, 901 F.2d 1419 (7th Cir. 1990). EPA argued that not all disposals into injection wells are discharges of pollutants under the CWA, and that the connection between the wells and navigable waters in that case was too attenuated to bring the discharges under the purview of the CWA. *Id.* at 1422-23. That position (embraced by the Seventh Circuit) does not mean that "injection into wells is not a discharge of pollutants requiring a NPDES permit." Op. Br. at 27.

hydrological connection between the ground water and a nearby surface water body)." NPDES Permit Application Regulations for Storm Water Discharges, 55 Fed. Reg. 47,990, 47,997 (Dec. 2, 1990).

And in the preamble to its final rule addressing water quality standards on Indian lands, EPA stated:

> [T]he Act requires NPDES permits for discharges to groundwater where there is a direct hydrological connection between groundwaters and surface waters. In these situations, the affected groundwaters are not considered "waters of the United States" but discharges to them are regulated because such discharges are effectively discharges to the directly connected surface waters.

56 Fed. Reg. at 64,982.

In 2001, EPA reiterated its position: "As a legal and factual matter, EPA has made a determination that, in general, collected or channeled pollutants conveyed to surface waters via ground water can constitute a discharge subject to the Clean Water Act." 66 Fed. Reg. at 3017. EPA recognized that the determination was "a factual inquiry, like all point source determinations," adding:

> The time and distance by which a point source discharge is connected to surface waters via hydrologically connected surface waters will be affected by many site specific factors, such as geology, flow, and slope. Therefore, EPA is not proposing to establish any specific criteria beyond confining

> the scope of the regulation to discharges to surface water via a "direct" hydrological connection.

Id. A general hydrological connection between all groundwater and surface waters is insufficient; there must be evidence showing a direct hydrological connection between specific groundwater and specific surface waters. *Id.*

To the extent there is statutory ambiguity about whether the CWA applies to discharges to jurisdictional surface waters through groundwater, EPA's interpretation is entitled to *Chevron* deference. *Chevron,* 467 U.S. at 842-43.

The County's contention that the direct-hydrological-connection standard is at odds with EPA's recently-stated position on whether groundwater is a jurisdictional water misinterprets EPA's statements. Op. Br. at 38-39. The Clean Water Rule, which was promulgated in June 2015 (and stayed by the Sixth Circuit pending further order of the court, *see In re EPA & Dep't of Def. Final Rule*, 803 F.3d 804, 809 (6th Cir. 2015)), expressly excludes groundwater from the definition of "waters of the United States." 80 Fed. Reg. 37,054. But, as EPA clarified, the fact that groundwater itself is not jurisdictional under the CWA does not mean that pollutants that reach waters of the United

States through groundwater do not require CWA permits. "EPA agrees that the agency has a longstanding and consistent interpretation that the Clean Water Act may cover discharges of pollutants from point sources to surface water that occur via ground water that has a direct hydrologic connection to the surface water. Nothing in this rule changes or affects that longstanding interpretation, including the exclusion of groundwater from the definition of 'waters of the United States.'" *See* EPA, *Response to Comments – Topic 10 Legal Analysis* (June 30, 2015); available at http://www.epa.gov/cleanwaterrule/response-comments-clean-water-rule-definition-waters-united-states. The County erroneously attempts to conflate the jurisdictional exclusion of groundwater with the role that groundwater can play as the pathway through which pollutants from a point source reach jurisdictional surface waters.[5]

[5] The district court stated that if the proposed Clean Water Rule was finalized, it "would likely mean that the groundwater under the [facility] could not itself be considered 'waters of the United States'" and that this would affect whether Plaintiffs could also prevail under *Healdsburg*. *Hawaii I*, 24 F. Supp. 3d at 1001. But the court erred in attempting to apply *Healdsburg* because the jurisdictional status of groundwater itself is irrelevant to whether discharges that move through groundwater to jurisdictional waters require NPDES permits.

II. THE COUNTY IS LIABLE FOR UNPERMITTED DISCHARGES DUE TO THE "DIRECT HYDROLOGICAL CONNECTION" BETWEEN THE GROUNDWATER AND THE OCEAN.

Discharges of pollutants from a point source that move through groundwater are subject to CWA permitting requirements if there is a direct hydrological connection between the groundwater and a jurisdictional surface water.[6] Ascertaining whether there is a direct hydrological connection is a fact-specific determination. 66 Fed. Reg. at 3017. To qualify as "direct," a pollutant must be able to proceed from the point of injection to the surface water without significant interruption. Relevant evidence includes the time it takes for a pollutant to move to surface waters, the distance it travels, and its traceability to the point source. These factors will be affected by the type of pollutant, geology, direction of groundwater flow, and evidence that the pollutant can or does reach jurisdictional surface waters. *Id.*

Here, the district court correctly held that the County discharged pollutants to the ocean through groundwater. In *Hawaii I*, the court

[6] Some courts refer to a "hydrological connection." The more accurate formulation, however, is a "direct hydrological connection," which recognizes that some connections are too circuitous and attenuated to be under the CWA's purview.

determined that a direct hydrological connection exists between the groundwater and the ocean. The tracer-dye study clearly established that the discharges moved from wells 3 and 4 to the ocean in relatively short order.[7] *Hawaii I*, 24 F. Supp. 3d at 984. The study concluded that after 84 days, the dye began to appear along the North Kaanapali Beach, half a mile from the facility. *Id.* The tracer-dye study also estimated that 64% of the treated effluent from wells 3 and 4 followed this route to the ocean. *Id.*

Although the court's ultimate conclusion was correct, the court's alternative explanation for the County's liability under the "significant nexus" standard from *Rapanos* and *Healdsburg* was erroneous. *Hawaii I*, 24 F. Supp. 3d at 1004. *Rapanos* and *Healdsburg* applied the "significant nexus" standard in determining whether the receiving waters were "waters of the United States." In contrast, here, there is no dispute that the Pacific Ocean (the receiving water in this case), as a "territorial sea," is a "navigable water" under the CWA. This Court

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[7] Although this tracer-dye study simplified the analysis, such studies are not the only means of demonstrating a direct hydrological connection. It also is not necessary to trace the exact pathway that the pollutants take to establish that a direct hydrological connection exists.

should clarify that the "significant nexus" standard has no relevance here.

In *Hawaii II*, the district court correctly held the County discharged pollutants from wells 1 and 2 to the ocean through groundwater. But the court's opinion did not go into great detail about the movement through groundwater because the County "expressly conced[ed] that pollutants introduced by the County into wells 1 and 2 were making their way to the ocean" and "acknowledge[d] that there is a hydrogeologic connection between wells 1 and 2 and the ocean." *Hawaii II*, 2015 WL 328227, at *2.

There was additional evidence that a direct hydrological connection existed between wells 1 and 2 and the Pacific Ocean. *First*, the tracer-dye study models indicated that in some circumstances treated effluent from well 2 would move along flowpaths that were similar to those traveled by the dye injected into wells 3 and 4 and would emerge at the same submarine springs. SER 237, 240, 243. Because wells 3 and 4 are located between the springs and well 2, the flowpath for these discharges would be affected by the amount of effluent injected into each well. SER 237. When most of the effluent was injected into wells 3 and 4, the effluent from well 2 would travel northwesterly from the wells and not toward the springs; however, when well 2 received all of the effluent, the study indicated that the discharges would emerge at the springs. SER 240, 243. There was no dispute that given the proximity of wells 1 and 2, the modeling for well 2 predicts the pathways for discharges from well 1. ER 443, SER 189.

Second, Plaintiffs' expert stated that the effluent discharged from wells 1 and 2 "will be conveyed . . . relatively quickly (*i.e.*, with first arrival at the ocean in a matter of months)" and concluded that "[s]ince the aquifer material and hydraulic gradient in the area of all four . . . wells are similar, the groundwater flow will also be similar." SER 183. Although the County's expert argued that the point of entry for pollutants into the ocean from wells 1 and 2 could not be identified, the County did not dispute that the study showed effluent emerging at the same springs where the effluent from wells 3 and 4 emerged. *Haw. Wildlife Fund v. Cty. of Maui*, No. 12-198, ECF No. 136, at 16.

Any fears about the implications of point-source discharges to jurisdictional surface waters through groundwater with a direct hydrological connection being subject to NPDES-permit requirements are unwarranted. Op. Br. at 43-44. EPA and states have been issuing permits for this type of discharge from a number of industries, including chemical plants, concentrated animal feeding operations, mines, and oil and gas waste-treatment facilities. *See, e.g.*, NPDES Permit No. NM0022306, available at https://www.env.nm.gov/swqb/Permits/; NPDES Permit No. WA0023434, available at https://yosemite.epa.gov/r10/water.nsf/NPDES+Permits/CurrentOR&WA821.

Further, only those discharges that move through groundwater with a direct hydrological connection to surface waters are affected. That not all discharges through groundwater are subject to NPDES-permit requirements is shown by cases where the hydrological connections were too attenuated. In *McClellan Ecological Seepage Situation (MESS) v. Weinberger*, the court agreed with the plaintiff that discharges through groundwater may be subject to the CWA and allowed the parties to submit evidence on the issue. 707 F. Supp. 1182, 1196 (E.D. Cal. 1988). Based on evidence indicating that it would take "literally dozens, and perhaps hundreds, of years for any pollutants in the groundwater to reach surface waters," the court found that there were no regulated discharges. *MESS v. Cheney*, 763 F. Supp. 431, 437 (E.D. Cal. 1989). And even after allowing the plaintiff an opportunity to provide more testimony at trial, the court ruled that the plaintiff had failed to meet its burden. *MESS v. Cheney*, No. 86-475, 20 Envtl. L. Rep. 20,877 (E.D. Cal. Apr. 30, 1990), *vacated on other grounds*, 47 F.3d 325, 331 (9th Cir. 1995).

Likewise, in *Greater Yellowstone Coalition v. Larson*, evidence indicated that the connection to surface waters was too attenuated. 641 F. Supp. 2d 1120 (D. Idaho 2009), *aff'd* 628 F.3d 1143, 1153 (9th Cir. 2010). In that case, federal agencies determined that a CWA Section 401 certification was not required for a mining operation. Under Section 401, "[a]ny applicant for a Federal license or permit to conduct any activity . . . which may result in any discharge into the navigable waters, shall provide the licensing or permitting agency a certification from the State . . . that any such discharge will comply with the applicable provisions." 33 U.S.C. § 1341(a)(1). The agencies based their determination on evidence that before reaching surface waters, the pollutants would pass through hundreds of feet of overburden and bedrock, and then travel underground through soil and rock for one to four miles. *Greater Yellowstone*, 641 F. Supp. 2d at 1139. Modeling predicted that the movement of peak concentrations would take between 60 and 420 years. *Id.* The court weighed competing evidence from the plaintiff and ultimately deferred to the agencies' determination that the hydrological connection was too attenuated. *Id.* at 1141.

Unlike *MESS* and *Greater Yellowstone*, in which the connection was too attenuated, the discharges here resulted from a direct hydrological connection, and thus require a permit.

III. THE DISTRICT COURT CORRECTLY HELD THAT THE COUNTY HAD FAIR NOTICE FOR PURPOSES OF CIVIL PENALTIES.

In the Argument section of its brief, the County maintains that this Court should direct the district court to set aside any civil penalties "imposed on the County regardless of the outcome of the challenge to the district court's liability rulings" because it lacked fair notice. Op. Br. at 47. As an initial matter, the County would seemingly be precluded from appealing the fair-notice issue as to civil penalties because it stipulated to their amount in the settlement agreement. To the extent that the County has reserved its right to appeal the issue, however, the County's argument lacks merit.

This Court has held that a party may not be deprived of property through civil penalties without fair notice. *See United States v. Approximately 64,695 Pounds of Shark Fins*, 520 F.3d 976, 980 (9th Cir. 2008). To provide notice, "a statute or regulation must 'give the person of ordinary intelligence a reasonable opportunity to know what is prohibited so that he may act accordingly.'" *Id.*

This Court looks first to the language of the statute when determining whether a party had fair notice. *Id.* As discussed above, Congress used broad language in the CWA in defining the discharge of pollutants, and that expansiveness provides a reasonable opportunity for a person to know what the statute prohibits. The breadth of that language is only bolstered by the intent of the CWA.

Moreover, EPA has made multiple public statements in rulemaking preambles that consistently described its interpretation that discharges of pollutants to jurisdictional surface waters through groundwater with a direct hydrological connection are subject to NPDES permitting under the CWA. Further, with respect to specific communications with the County, EPA sent two letters to the County in early 2010. In January 2010, EPA stated that it was "investigating the possible discharge of pollutants to the coastal waters of the Pacific Ocean along the Kaanapali coast of Maui." SER 5. This investigation was spurred in part by a 2007 study concluding that much of the nitrogen in Kaanapali coastal waters came from the County's facility and a 2009 study that found the same nitrogen signature and other "wastewater presence" in the ocean. *Hawaii I*, 24 F. Supp. 3d at 984. The letter continued: "In order to assess the impact of the [facility's] effluent on the coastal waters and determine compliance with the Act, EPA is requiring the County to sample the injected effluent, sample the coastal seeps, conduct an introduced tracer study, and submit reports on findings to EPA." SER 5. EPA required this sampling, monitoring, and reporting pursuant to CWA Section 308, under which "the [EPA] Administrator shall require the owner or operator of any point source" to provide the information. 33 U.S.C. § 1318(a)(A). The letter provided notice that there was evidence suggesting a hydrological connection.

In March 2010, EPA responded to the County's request for a UIC permit renewal under the SDWA "by informing the County that recent studies 'strongly suggest that effluent from the facility's injection wells is discharging into the near shore coastal zone of the Pacific Ocean."

Hawaii I, 24 F. Supp. 3d at 984 (quoting ER 122). As a result, EPA required the County to apply for a CWA Section 401 water-quality certification for its injection facilities as a prerequisite to EPA's issuance of a new UIC permit. ER 121-22; *see* 33 U.S.C. § 1341(a). The County's assertion that this letter did not put it on notice of potential CWA liability because the certification was related to its UIC permit rather than any obligations under the NPDES program is unavailing. Op. Br. at 56-57. A UIC permit does not preclude the need for a NPDES permit where required, and the March 2010 communication reiterated EPA's position that the discharges might be covered by the CWA, depending on the results of the ordered sampling, monitoring, and reporting.

The County was on fair notice. In any event, fair notice is only one of many factors informing a civil-penalty amount, *see* 33 U.S.C. § 1319(d), and thus the County's argument that the penalty should be set aside for lack of fair notice *alone* is flawed.

CONCLUSION

For the foregoing reasons, the district court's judgment should be affirmed.

Respectfully submitted,

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CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME LIMITATION, TYPEFACE REQUIREMENTS, AND TYPE-STYLE REQUIREMENTS

This brief complies with the type-volume limitation of Fed. R. App. P. 32(a)(7)(B) (for amicus briefs as provided by Fed. R. App. P. 29(d)) because it contains 6,904 words, excluding the parts of the brief exempted by Fed. R. App. P. 32(a)(7)(B)(iii). This brief complies with the typeface requirements of Fed. R. App. P. 32(a)(5) and the type-style requirements of Fed. R. App. P. 32(a)(6) because it has been prepared in a proportionally spaced typeface using Microsoft Word 14-point Century Schoolbook.

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CERTIFICATE OF SERVICE

I hereby certify that on May 31, 2016, I electronically filed the foregoing brief with the Clerk of the Court for the United States Court of Appeals for the Ninth Circuit using the appellate CM/ECF system, which will serve the brief on the other participants in this case.

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No. 15-17447

IN THE

United States Court of Appeals

FOR THE NINTH CIRCUIT

HAWAII WILDLIFE FUND; SIERRA CLUB – MAUI GROUP; SURFRIDER FOUNDATION; and WEST MAUI PRESERVATION ASSOCIATION,
Plaintiffs-Appellees,

v.

COUNTY OF MAUI,
Defendant-Appellant,

On Appeal from the United States District Court for the District of Hawai'i

BRIEF *AMICUS CURIAE* OF THE ASSOCIATION OF AMERICAN RAILROADS; AMERICAN FARM BUREAU FEDERATION; AMERICAN IRON AND STEEL INSTITUTE; AMERICAN PETROLEUM INSTITUTE; NATIONAL ASSOCIATION OF MANUFACTURERS; NATIONAL MINING ASSOCIATION; THE FERTILIZER INSTITUTE; AND UTILITY WATER ACT GROUP IN SUPPORT OF DEFENDANT-APPELLANT

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RULE 26.1 DISCLOSURE STATEMENT

Pursuant to Federal Rule of Appellate Procedure 29(c), *amici* hereby certify that none of them issues stock and none is owned, either in whole or in part, by any publicly held corporation.

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INTEREST OF THE *AMICI CURIAE*

Amici curiae are a coalition of trade associations whose members represent a broad spectrum of the Nation's agricultural, commercial, industrial, and transportation operations. They are the Association of American Railroads; American Farm Bureau Federation; American Iron and Steel Institute; American Petroleum Institute; National Association of Manufacturers; National Mining Association; The Fertilizer Institute; and Utility Water Act Group.[1]

If the district court's novel and overreaching "conduit theory" of Clean Water Act ("CWA") liability stands, *amici*'s members could suddenly be required to obtain CWA Section 402 permits, known as National Pollutant Discharge Elimination System ("NPDES") permits, for activities that have never before been subject to such permitting. Under that theory, an NPDES permit could be mandated any time pollutants are released from any structure that falls within the CWA's definition of "point source" (*e.g.*, pipes, containers, wells, channels, rolling

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[1] This brief is submitted with an accompanying motion for leave under Federal Rule of Appellate Procedure 29(b). No party's counsel authored this brief in whole or in part. No party, party's counsel, or other person, other than *amici curiae*, their members, or their counsel, contributed money that was intended to fund preparing or submitting this brief.

stock, etc.) and eventually reach a navigable water, irrespective of mode or duration of migration. Such an interpretation flies in the face of the CWA. As written, amended, implemented, and enforced in the decades since its inception, the CWA imposes liability only when point sources are the means by which pollutants reach navigable waters. Pollutants that reach navigable waters as the result of diffuse migration are left for states to address under nonpoint source control programs.

The "conduit theory" exposes *amici*'s members to a new threat of federal CWA liability and could unjustifiably impose significant new permitting burdens. Without warning, *amici*'s members may be both civilly and criminally liable for any pollutants released from the innumerable "point sources" under their control that might eventually find their way to navigable waters, whether by groundwater, air, surface runoff, or other means. Because even detailed technical studies may not provide a definitive answer as to whether a pollutant ultimately reaches a navigable water, *amici*'s members might apply for unnecessary NPDES permits simply to avoid potential, severe CWA penalties, thereby incurring significant expense, delay, and operational restrictions. By threatening to impose unprecedented liability to a wide swath of previously unpermitted sources, the "conduit theory" could also cause the NPDES permitting program to balloon to an impracticable scale.

The district court's ruling pointedly ignored the fact that the manner in which pollutants reach navigable waters is critical to—and is indeed the crux of—the fundamental distinction Congress drew between point and nonpoint sources throughout the CWA. As such, *amici* seek its reversal as contrary to the Act's text, structure, and history.

INTRODUCTION AND SUMMARY OF ARGUMENT

Under the district court's "conduit theory," the CWA's NPDES requirements apply whenever two conditions are satisfied: (1) pollutants are released from some "point source," and (2) those pollutants eventually make their way to navigable waters, "regardless of *how* they get there." *Hawai'i Wildlife Fund v. County of Maui* ("*COM I*"), 24 F. Supp. 3d 980, 1000 (D. Haw. 2014); *see also Hawai'i Wildlife Fund v. County of Maui* ("*COM II*"), 2015 WL 328227, at *4-6 (D. Haw. Jan. 23, 2015). Ignoring the language of the statute, the district court determined that the conduit—groundwater—between the point sources (the County's injection wells) and the navigable waters (the Pacific Ocean) "need not [] be 'confined and discrete.'" *COM I*, 24 F. Supp. 3d at 999; *COM II*, 2015 WL 328227, at *4-5. It also found that the distance the pollutants had to migrate through groundwater, as well as the "location and expanse of the pollutant's entry into the ocean," were irrelevant. *COM II*, 2015 WL 328227, at *6. The "conduit theory" marks an unprecedented expansion of the NPDES program, which has until now been understood to apply only to discharges for which the *point source itself* is the direct means by which a pollutant is added to navigable waters.[2]

The "conduit theory" cannot be reconciled with the text, structure, or history of the CWA. Throughout the Act, Congress purposefully distinguished between point sources and nonpoint sources of pollutants. Point sources are "discernible, confined, and discrete conveyance[s]" such as pipes that discharge channeled or collected fluids to navigable waters. 33 U.S.C. § 1362(14). Nonpoint sources, by contrast, release pollutants in a diffuse way (*e.g.*, wind dispersion, groundwater migration, or overland runoff) to a regulated water body.

[2] The "conduit theory" is separate from a narrower question that courts nationwide are split over: whether the CWA regulates discharges to groundwater that has a direct and immediate hydrological connection to navigable waters. *See* Appellant Br. at 35-37. Liability under the "conduit theory" would extend well beyond point source discharges to such groundwater. Moreover, the "conduit theory," as formulated by the district court, could encompass not just pollutants migrating through groundwater, but also windblown pollutants and pollutants in surface runoff.

NPDES requirements apply only to discharges of pollutants from point sources. *See id.* §§ 1311(a), 1342(a). The Act defines "discharge of a pollutant" as the "*addition* of any pollutant *to* navigable waters *from* any *point source*." *Id.* § 1362(12) (emphasis added). Those provisions are central to this case because, when read together, they make clear that NPDES requirements apply only where a "point source" is the means by which pollutants are added to navigable waters. When pollutants eventually reach navigable waters (as here) by means other than a discernible, confined, and discrete conveyance, there is no "discharge of a pollutant." Instead, there is only nonpoint source pollution.

Numerous cases from this Court and other circuits confirm that what differentiates point sources from nonpoint sources is the way in which pollutants reach navigable waters. *See, e.g.*, *Greater Yellowstone Coal. v. Lewis*, 628 F.3d 1143, 1153 (9th Cir. 2010). Both types of pollution ultimately reach navigable waters, so "*how* they get there" does matter. *See COM I*, 24 F. Supp. 3d at 1000. By ignoring this key distinction, the district court's "conduit theory" eviscerates the "clear and precise distinction" that Congress made between point sources that are subject to NPDES regulation and nonpoint sources that are subject to state and local nonpoint source management programs. S. Rep. No. 95-370, at 8 (1977).

Other provisions of the CWA likewise confirm that the "conduit theory" improperly expands the scope of the NPDES program to cover what Congress considered to be nonpoint sources of pollutants. Sections 304(f)(2) and 208(b)(2) refer specifically to the disposal of pollutants in wells and subsurface excavations as one of several specified nonpoint sources. *See* 33 U.S.C. §§ 1314(f)(2), 1288(b)(2). The legislative history for Section 304(f)(2), in particular, reflects that Congress was well aware of the potential for leaching and groundwater contamination from such wells and excavations. But rather than require NPDES permits for such disposals, the CWA vested authority in states and local governments to control any eventual pollution of navigable waters from such sources through nonpoint source management programs.

The district court could not "point to controlling appellate law or statutory text expressly allowing this theory in the present context." *COM I*, 24 F. Supp. 3d at 996. And no wonder—the CWA unambiguously forbids it. But even if this Court finds the Act ambiguous, it must, under the rule of lenity, construe that ambiguity in the County's favor. *See United States v. Granderson*, 511 U.S. 39, 54 (1994).

Beyond the legal infirmities, the practical consequences of the "conduit theory" are especially troubling. Under the "conduit theory," the NPDES program could grow to unworkable proportions, with no meaningful limit on the number of sources it covers. Although this case involves diffuse migration of pollutants through groundwater, the "conduit theory" potentially implicates other means of diffuse migration, such as sheet runoff over land following rainfall or snowmelt, or windblown pollutants. Almost all pollutants that reach navigable waters through one of these diffuse methods can be traced back to some identifiable "point source," such as raw materials piles at an industrial facility, smokestacks, septic tanks, or stormwater infiltration and retention infrastructure. All are quintessential examples of nonpoint source pollution, long recognized by both the courts and EPA. But under the "conduit theory," they could require NPDES permits.

As further evidence of the preposterous nature of the "conduit theory," it is unlikely that NPDES requirements could even be applied to the types of "discharges" that may now become subject to permitting. Even assuming one were able to identify the various discharge points from which migrating pollutants reach navigable waters, access to conduct treatment, sampling, or monitoring would likely be impossible. The NPDES program's purpose was to address "end of pipe" discharges into navigable waters—it simply was not designed to regulate the type of seepage and diffuse migration implicated by the "conduit theory."

For all these reasons and those outlined below, this Court should reject the district court's invented and untenable "conduit theory."

ARGUMENT

I. The District Court's "Conduit Theory" Impermissibly Extends NPDES Requirements to Nonpoint Sources of Pollutants.

To determine the scope of the NPDES program, this Court applies the "traditional tools of statutory construction . . . begin[ning] with the text and the history of the statute." *Blandino-Medina v. Holder*, 712 F.3d 1338, 1343 (9th Cir. 2013). As explained below, Congress intended to subject only direct point source discharges to federal regulation and oversight under the NPDES program—that is, pollutants added to navigable waters from a discernible, confined, and discrete conveyance. In contrast, Congress specifically gave states the authority to address under their own programs nonpoint source abatement, including the control of pollutants that migrate through groundwater and other diffuse means.

Under the district court's novel "conduit theory," an NPDES permit could be required any time pollutants released from a point source migrate through groundwater or other media, and eventually "find their way to" navigable waters. *COM I*, 24 F. Supp. 3d at 996. NPDES requirements could apply no matter how far those pollutants must migrate, no matter how diffuse that migration is, and no matter how many days, weeks, months, or even years that migration takes. Such a broad theory of liability impermissibly expands the scope of the NPDES program to nonpoint sources.

A. Congress Plainly Distinguished Between Point Source Discharges Subject to the NPDES Program and Nonpoint Sources of Pollutants that are Addressed Under Other Programs.

CWA Section 301 states that the "discharge of any pollutant [to a navigable water] by any person shall be unlawful." 33 U.S.C. § 1311(a). Section 402 provides an important exception to this broad prohibition: EPA or a delegated state may "issue a permit for the discharge of any pollutant" from a point source "notwithstanding section 1311(a) of this title." *Id.* §§ 1342(a)(1), 1362(12) (defining "discharge of any pollutant" to mean "any addition of any pollutant to navigable waters from any point source"). A "point source" is "any discernible, confined and discrete conveyance . . . from which pollutants are or may be discharged." 33 U.S.C. § 1362(14). Sections 301 and 402, read along with the pertinent statutory definitions,[3] demonstrate that NPDES permits are required only

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[3] Although Congress did not define "nonpoint source," that term generally refers to "pollution that does not result from the 'discharge' or 'addition' of pollutants from a point source." *See Or. Natural Res. Council v. U.S. Forest Serv.*, 834 F.2d 842, 849 n.9 (9th Cir. 1987).

for point source discharges. Nonpoint source pollution is not regulated under the CWA, but is instead addressed by other environmental programs.

The CWA thus draws a "clear and precise distinction between point sources, which [are] subject to direct Federal regulation, and nonpoint sources, control of which was specifically reserved to State and local governments through the section 208 process," S. Rep. No. 95-370, at 8 (1977), and section 319 nonpoint source management programs. *See* 33 U.S.C. §§ 1288, 1329; *see also Or. Natural Desert Ass'n v. U.S. Forest Serv.*, 550 F.3d 778, 785 (9th Cir. 2008) (explaining that nonpoint sources are "generally excluded from CWA regulations, except to the extent that states are encouraged to promote their own methods of tracking and targeting nonpoint source pollution."). The statute does not provide a "direct mechanism to control nonpoint source pollution but rather uses the 'threat and promise' of federal grants to the states to accomplish this task." *Or. Natural Desert Ass'n v. Dombeck*, 172 F.3d 1092, 1097 (9th Cir. 1998). The statute further directs EPA to provide information to the states to aid in the control of nonpoint source pollution. *See* 33 U.S.C. § 1314(f).

Congress' "disparate treatment" of point source discharges and nonpoint source pollution is an "organizational paradigm of the Act." *Or. Natural Desert*

Ass'n v. U.S. Forest Serv., 550 F.3d at 780. The reasons for Congress' distinction are straightforward:

First, national uniformity in nonpoint source pollution control is "virtually impossible" given variations in climate and geography. *Id.* at 785.

Second, because nonpoint source pollution abatement typically involves land use controls, Congress believed it best to leave such control "to the level of government closest to the sources of the problem," rather than authorizing federal regulatory authority. S. Rep. No. 95-370, at 9.

Third, and related to the previous point, Congress recognized that "many nonpoint sources of pollution are beyond present technology of control." S. Rep. No. 92-414, at 39 (1972); *see also* 117 Cong. Rec. 38,722, 38,825 (Nov. 2, 1971) (statement of Sen. Muskie) ("There is no effective way as yet, other than land use control, by which you can intercept [nonpoint] runoff and control it in the way that you do a point source. We have not yet developed technology to deal with that kind of a problem").[4]

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[4] Senator Muskie further observed that nonpoint source pollution, as distinguished from point source discharges, is "runoff into water that occurs perhaps miles away from the land that adjoins it." 117 Cong. Rec. at 38,825.

Congress knew that both point source discharges and nonpoint source pollution could impact water quality, but it nevertheless decided to address those different sources differently, requiring NPDES permits only for point source discharges to navigable waters.

B. The CWA Only Requires an NPDES Permit When Pollutants Reach Navigable Waters by Means of a Discernible, Confined, and Discrete Conveyance.

The "conduit theory" cannot be reconciled with the CWA's text, which subjects to NPDES regulation only a "discharge of a pollutant" that is itself the "*addition* of any pollutant *to* navigable waters *from* any *point source*." 33 U.S.C. § 1362(12) (emphasis added). Diffuse migration of a pollutant to a navigable water—whether through groundwater or air, or over land—does not constitute an addition of a pollutant to a navigable water *from a point source*. The mere fact that a pollutant was released from a "point source" sometime in the past and eventually finds its way to a navigable water is insufficient to constitute a covered discharge, because the term "discharge of a pollutant" requires that the "point source" itself be the actual or direct conveyance from which the pollutant is added to navigable waters. Any other reading of the CWA's text would eliminate all meaningful differentiation between the terms "point source" and "nonpoint source," as nearly all nonpoint source pollution can be traced back to some conveyance, structure, or area meeting the definition of "point source." The method of addition to a navigable water is the key distinction between the two.

Numerous circuits have recognized that the diffuse migration of pollutants does not constitute a "discharge of a pollutant" subject to NPDES permitting, even when some of the pollutants could be traced back to an identifiable structure or facility that fits the definition of "point source." Thus, for instance, this Court previously held that when precipitation "seeps . . . into [mining] pits containing waste rock" and "eventually enter[s] [a] surface water," it is nonpoint source pollution. *See Greater Yellowstone*, 628 F.3d at 1153. There, the seepage had to "filter[] through 200 feet of overburden and 250 to 750 feet of undisturbed material beneath the overburden [before] eventually entering the surface water." *Id.* Because that seepage made its way to surface waters in a natural and unimpeded manner, the Court held that it was not a point source discharge. *See id.*

Likewise, in *Sierra Club v. Abston Const. Co., Inc.*, 620 F.2d 41, 44 (5th Cir. 1980), the Fifth Circuit rejected a theory of CWA liability that is nearly indistinguishable from the district court's "conduit theory." There, the plaintiff's theory would merely have required "a showing of the original sources of the pollution to find a statutory point source, *regardless of how the pollutant found its way from that original source to the waterway*." *Id.* (emphasis added). Concerned that such a theory could expand the scope of the NPDES program to encompass "the broad drainage of rainwater carrying oily pollutants from a road paralleling the waterway, or animal pollutants from a grazing field contiguous to the waterway," the Fifth Circuit rejected it, holding that "[t]he focus of this Act is on the 'discernible, confined and discrete' conveyance of the pollutant, which would exclude natural rainfall drainage over a broad area." *Id.*

Several other circuits have also recognized that a "discharge of a pollutant" only occurs when a point source directly adds a pollutant to navigable waters. The Second Circuit clarified that the term "'point source' [] does not necessarily refer to the place where the pollutant was created but rather refers only to the proximate source from which the pollutant is directly introduced to the destination water body." *Catskill Mountains v. City of New York*, 273 F.3d 481, 493 (2d Cir. 2001). The District of Columbia and Sixth Circuits similarly held that NPDES requirements apply only when a point source is the site at which a pollutant is first introduced into navigable waters. *See Nat'l Wildlife Fed'n v. Consumers Power Co.*, 862 F.2d 580, 584 (6th Cir. 1988); *Nat'l Wildlife Fed'n v. Gorsuch*, 693 F.2d 156, 165, 175 (D.C. Cir. 1982). Thus, whether pollution is point or nonpoint source is determined at the point "when the pollutant first enters navigable water." *See Gorsuch*, 693 F.2d at 175. The D.C. Circuit further observed that Congress could easily have chosen language that would have imposed NPDES requirements more broadly on "all pollution released through a point source." *See Gorsuch*, 693 F.2d at 176. Instead, Congress directed that "the NPDES system was limited to 'addition' of 'pollutants' 'from' a point source." *Id.* It is not enough to merely trace pollutants back to some release from a point source.

Together these cases expose the incurable flaw in the district court's "conduit theory." NPDES requirements do not apply merely because pollutants that ultimately reach navigable waters were at some point released from something that fits the definition of "point source"—a term that courts have interpreted expansively. *See United States v. Plaza Health Labs, Inc.*, 3 F.3d 643, 651 (2d Cir. 1993) (Oakes, J., dissenting) (listing examples illustrating how "courts have deemed a broad range of means of depositing pollutants in the country's navigable waters to be point sources"). Nearly all pollution that eventually reaches navigable waters likely could be traced back to something that might fairly be characterized as a "point source." But that cannot mean that all such pollution meets the statutory definition of "discharge of a pollutant." 33 U.S.C. § 1362(12). For there to be such a discharge, the "point source" must be the actual and direct means by which the pollutant is added to a navigable water. Otherwise, Congress' "clear and precise" distinction between point source discharges and nonpoint source pollution would be rendered meaningless. *See* S. Rep. No. 95-370, at 8. Contrary to the district court's belief, under the CWA it *does* matter how pollutants arrive at navigable waters. *See COM I*, 24 F. Supp. 3d at 1000.

By ignoring the means by which a pollutant enters a navigable water, the "conduit theory" could result in the imposition of NPDES requirements not only on diffuse migration of pollutants through groundwater, but also on "paradigmatic examples of nonpoint source pollution" such as "runoff or windblown pollutants from any identifiable source, whether channeled or not." *Cordiano v. Metacon Gun Club*, 575 F.3d 199, 224 (2d Cir. 2009). This Court, however, has clarified that "point sources and nonpoint sources are not distinguished by the kind of pollution they create or by the activity causing the pollution, but rather by whether the pollution reaches the water through a confined, discrete conveyance." *Trs. for Alaska v. EPA*, 749 F.2d 549, 558 (9th Cir. 1984). In other words, an interpretation of the Act that turns solely on whether the release of pollutants from a point source eventually reaches a navigable water "would eviscerate the point source requirement and undo Congress' choice" to exclude things like diffuse runoff and atmospheric deposition from the NPDES program. *Cordiano*, 575 F.3d at 224; *see also Alaska Cmty. Action on Toxics v. Aurora Energy Servs.*, 940 F. Supp. 2d 1005, 1026 (D. Alaska 2013) ("a plaintiff seeking to establish a point source discharge, even in the context of airborne pollution, must prove more than that the pollutant originated from an identifiable source"; it must also "prove that the pollutant reached the water through a confined, discrete conveyance"), *rev'd on other grounds*, 765 F.3d 1169 (9th Cir. 2014).

In both *Cordiano* and *Aurora Energy*, windblown pollutants that ended up in jurisdictional waters could be traced back to nearby structures that might in some cases meet the definition of "point source,"[5] but the courts properly held that "wind is the polar opposite of a 'discernible, confined and discrete conveyance.'" *Aurora Energy*, 940 F. Supp. 2d at 1026-27. Under the "conduit theory," however, NPDES permits could conceivably be required for windblown pollutants because wind (like groundwater) serves as a conduit, and according to the district court, conduits "need not also be 'confined and discrete.'" *COM I*, 24 F. Supp. 3d at 999.

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[5] *Cordiano* involved an engineered earthen berm at the back of a shooting range used for bullet containment, located "in close proximity" to wetlands. *See* 575 F.3d at 202, 223-24. *Aurora Energy* involved a coal loading facility's coal piles, railcar unloader, and a stacker-reclaimer used to stack coal onto stockpiles and reclaim coal from those piles to place it on a conveyer belt that carried the coal over open water (Resurrection Bay in Seward, Alaska) to a ship loader. *See* 940 F. Supp. 2d at 1024-25.

Such an expansive interpretation of the Act is contrary to Congress' intent and the text of the CWA.

EPA's prior interpretations of the statutory distinction between point and nonpoint sources provide additional evidence that diffuse migration of pollutants is not subject to the NPDES program. *See* U.S. EPA, "What is Nonpoint Source?"[6] ("Nonpoint source pollution generally results from land runoff, precipitation, *atmospheric deposition*, drainage, *seepage* or hydrologic modification.") (emphasis added); *accord Cordiano*, 575 F.3d at 220-21 (quoting comparable descriptions of nonpoint source pollution from 1987, 1994, and 2003 EPA guidance documents and emphasizing EPA's view that such pollution can be "caused by rainfall or snowmelt moving over *and through the ground* and carrying natural and human-made pollutants," eventually depositing them in navigable waters) (emphasis added). These passages reflect EPA's recognition that *how* pollutants reach navigable waters is the critical distinction between point source discharges and nonpoint source pollutants.

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[6] *Available at* http://www.epa.gov/polluted-runoff-nonpoint-source-pollution/what-nonpoint-source.

The district court here even acknowledged the absence of "controlling appellate law or statutory text expressly allowing" its novel "conduit theory." *COM I*, 24 F. Supp. 3d at 996. Rather, as shown, the statutory text and controlling appellate law demonstrate the "conduit theory" rests on a flawed interpretation of the CWA. The district court nevertheless adopted it because, in its view, it "makes sense to regulate groundwater." *Id.* The district court cannot override Congress' choice in this manner, no matter how reasonable the alternative may seem to it, and this Court must reverse. "However sensible (or not) the [lower court's] position, a reviewing court's task is to apply the text of the statute, not to improve upon it." *EPA v. EME Homer City Generation, L.P.*, 134 S. Ct. 1584, 1600 (2014); *see also FDA v. Brown & Williamson*, 529 U.S. 120, 161 (2000) ("In our anxiety to effectuate the congressional purpose of protecting the public, we must take care not to extend the scope of the statute beyond the point where Congress indicated it would stop.").

C. Other Provisions of the CWA Confirm the NPDES Program Does Not Cover Diffuse Migration of Pollutants through Groundwater.

The statutory text shows Congress believed the types of pollution at issue here—pollutants that migrate to navigable waters following disposal in wells or subsurface excavations—are most appropriately addressed under the CWA's nonpoint source programs. *See* 33 U.S.C. §§ 1288, 1314. CWA Section 304(f), which "concerns nonpoint sources of pollution," *see S. Fla. Water Mgmt. Dist. v. Miccosukee Tribe*, 541 U.S. 95, 106 (2004), requires EPA to provide technical information for states to use in their nonpoint source control programs, including "processes, procedures, and methods to control pollution resulting from . . . the disposal of pollutants in wells or in subsurface excavations." 33 U.S.C. § 1314(f)(2)(D).

The information EPA must provide under Section 304(f) "may range from provisions for evaluating geological characteristics of disposal sites to the costs and benefits of alternative methods of disposal." S. Rep. 92-414, at 53. Congress was well aware of the potential for "groundwater contamination" at "shallower disposal sites," which is why it called upon EPA to outline provisions "to control leaching of materials from such sites, which include land-fill sites as well as abandoned mines." *Id.*

Congress characterized "section [304(f)] and the information on such nonpoint sources [as] among the most important in the 1972 Amendments." H.R. Rep. No. 92-911, at 109 (1972). The various nonpoint sources identified in Section 304(f), including the disposal of pollutants in wells and subsurface excavations, also appear in Section 208(b)(2). *Compare* 33 U.S.C. § 1314(f) *with id.* § 1288(b)(2). Section 208, and later Section 319, "were designated by

Congress as methods to keep states accountable for identifying and tracking nonpoint sources of pollution, as well as identifying 'the best management practices and measures' to reduce such pollution." *Or. Natural Desert Ass'n*, 550 F.3d at 785.

When Congress left nonpoint source pollution control to the states, it acknowledged that "Section 208, the 1972 act's laboratory for new institutional control mechanisms for vexing nonpoint source problems . . . may not be adequate." S. Rep. No. 95-370, at 10. Congress understood that states might resist developing protective control measures, speculating that it "may be that sometime in the future a Federal presence can be justified and afforded." *Id.* Congress nevertheless concluded that "it is both necessary and appropriate to make a distinction as to the kinds of activities that are to be regulated by the Federal Government and the kinds of activities which are to be subject to some measure of local control" under Section 208. *Id.*

That important distinction has remained in place for more than four decades. And states, including Hawai'i, are indeed addressing various nonpoint sources of pollutants under nonpoint source management plans.[7] By vesting authority in the states to address nonpoint source pollution that eventually results from the disposal of pollutants into wells and subsurface excavations, Sections 304(f) and 208(b)(2) confirm that NPDES requirements were never intended to address such disposals. The district court erred by overriding the distinction that Congress intentionally drew between point and nonpoint source pollution and the disparate approaches Congress designated for addressing those types of pollution.

II. The CWA's Penalty Scheme Requires Rejection of the "Conduit Theory"

The CWA clearly forecloses the district court's "conduit theory." But even if this Court finds ambiguity in the statute, it must construe that ambiguity in accordance with the rule of lenity and reject the "conduit theory."

The CWA imposes substantial criminal and civil penalties for violations. "Knowing" criminal violations are punishable by up to $100,000 per violation per day and six years' imprisonment, while negligent criminal violations carry fines of up to $50,000 per violation per day and two years' imprisonment. 33 U.S.C. §

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[7] *See* Hawai'i's Nonpoint Source Management Plan, 2015 to 2020, *available at* http://health.hawaii.gov/cwb/files/2013/05/2015-Hawaii-NPS-Management-Plan.pdf.

1319(c). Even first time criminal violations are punishable by fines of up to $50,000 per violation per day and three years' imprisonment (for knowing violations) or up to $25,000 per violation per day and one year in prison (for negligent violations). *See id.* The CWA also provides for civil penalties in enforcement actions by EPA or private citizens, which can be up to $37,500 per violation. *See* 33 U.S.C. §§ 1319(d), 1365(a).

Criminal statutes like the CWA are subject to the rule of lenity and must be narrowly construed. *See McNally v. United States*, 482 U.S. 350, 359-60 (1987) ("[W]hen there are two rational readings of a criminal statute, one harsher than the other, we are to choose the harsher only when Congress has spoken in clear and definite language."); *see also United States v. Bass*, 404 U.S. 336, 348 (1971) (noting that "legislatures and not courts should define criminal activity"); *Plaza Health Labs*, 3 F.3d at 649 (construing the term "point source" in accordance with the rule of lenity and dismissing criminal prosecutions).

The rule of lenity serves three fundamental purposes: "to promote fair notice to those subject to the criminal laws, to minimize the risk of selective or arbitrary enforcement, and to maintain the proper balance between Congress, prosecutors, and courts." *United States v. Kozminski*, 487 U.S. 931, 952 (1988). This venerable rule of statutory construction also applies in civil cases where a statutory provision, such as CWA Section 402, has both criminal and civil applications. *See Kasten v. Saint-Gobain Performance Plastics Corp.*, 131 S. Ct. 1325, 1336 (2011) ("[T]he rule of lenity can apply when a statute with criminal sanctions is applied in a noncriminal context.").

Here, the district court's "conduit theory" leaves citizens uncertain about whether their operations and activities are punishable by harsh criminal and civil penalties because some amounts of pollutants may eventually reach navigable waters. There is no way every landowner, business owner, operator, or independent contractor can ascertain whether its conduct might result in pollutants being carried from point sources under its control eventually to navigable waters via groundwater migration, wind dispersion, rainwater runoff, or other diffuse means outside of its control. Such migration could occur over long periods of time and across vast geographic areas, and even detailed technical studies may not disclose whether their conduct might be considered a criminal discharge into a navigable water. The rule of lenity exists to protect landowners against this very sort of uncertainty.

The district court's "conduit theory" exposes *amici*'s members and many other landowners and operators to potentially severe penalties based on an interpretation of the CWA that, by the court's admission, lacks any support in controlling appellate law or the statute's text. If there is any ambiguity as to whether the Act's text, structure, or history establishes that the "conduit theory" rests on an "unambiguously correct" statutory interpretation, the rule of lenity requires its rejection. *See Granderson*, 511 U.S. at 54.

III. The Practical Implications of the District Court's "Conduit Theory" Could Be Staggering.

This Court should also reject the district court's "conduit theory" because it may lead to impracticable results that Congress could not have intended when it structured the CWA to make a clear distinction between point and nonpoint sources of pollution. *See Ariz. State Bd. for Charter Schools v. U.S. Dep't of Educ.*, 464 F.3d 1003, 1008 (9th Cir. 2006) ("[W]ell-accepted rules of statutory construction caution us that statutory interpretations which would produce absurd results are to be avoided."); *United States v. Fejes*, 232 F.3d 696, 701 (9th Cir. 2000) (same).

A. Under the "Conduit Theory," the NPDES Program Could Grow to an Unworkable Scale.

The "conduit theory" rests on an interpretation that effectively eliminates Congress' distinction between point and nonpoint sources of pollution (*see supra* Part I). Application of that theory risks triggering exactly the sort of administrative permitting nightmare that Congress has averted by amending the CWA in the past, even with respect to otherwise covered point source discharges. For instance, when Congress amended the Act in 1977 to expressly exempt from the NPDES program return flows from irrigated agriculture, it recognized that "[t]he problems of permitting every discrete source or conduit returning water to the streams from irrigated lands is simply too burdensome to place on the resources of EPA." *See* 123 Cong. Rec. 38,924, 38,956 (Dec. 15, 1977).

Likewise, when Congress amended the Act in 1987 to fundamentally change how stormwater discharges are regulated, it emphasized that permitting authorities must not be overwhelmed by having to permit every conceivable discharge of stormwater from a point source. *See, e.g.*, 131 Cong. Rec. 15,616, 15,657 (June 13, 1985) (declaring it "absurd" to "require everyone who has a device to divert, gather, or collect stormwater runoff and snowmelt to get a permit from EPA as a point source" and warning that such a permitting program "would be an administrative nightmare" and "would also be prohibitively expensive to administer"); 133 Cong. Rec. Daily H168, H170 (daily ed. Jan. 8, 1987) (explaining how the 1987 CWA amendments would "properly reduce the universe of permits required for storm water from millions to thousands" and how "local, State, and Federal officials would be inundated with an enormous permitting workload" without the amendments).

Both amendments were reactive. Congress felt compelled to intervene when it saw how broadly courts and regulators were interpreting the NPDES provisions of the CWA. Yet the administrative burdens Congress sought to avoid when it enacted those amendments pale in comparison to the burdens that could result from adoption of the district court's "conduit theory." Much of what EPA and the courts have long considered to be nonpoint source pollution may suddenly be included in the NPDES program. Indeed, there appears to be no meaningful limit to the number of sources that could require permits under the district court's impermissibly broad interpretation of the statute.

In particular, many treatment and pollution control measures (*e.g.*, green infrastructure) that landowners currently implement without NPDES permits could require such permits under the "conduit theory." Runoff infiltration structures such as sumps, lagoons, and ponds that "are designed to capture a treatment volume of runoff and percolate it through surface soils into the ground water system" may require NPDES permits under the "conduit theory" if the pollutants ultimately migrate to navigable waters, which it should be noted, most groundwater does. *See* U.S. EPA, *National Management Measures to Control*

Nonpoint Source Pollution from Urban Areas, at 5-9 (2005).[8] Imposing NPDES requirements on such facilities makes no sense given that EPA promotes their use specifically to control *nonpoint* source pollution. *See id.* at 5-9 to 5-10 (noting that infiltration reduces runoff volumes and hence, peak flows in storm sewers and downstream waters; filters out pollutants; and facilitates aquifer recharge, which is vital to maintaining stream and wetland hydrology and ensuring survival of biota in wetlands and streams).

Other structures and facilities that treat pollutants via soil percolation—such as septic systems, which are ubiquitous in this country,[9] and spray irrigation (*i.e.*, the disposal of treated municipal wastewater by application to fields, which allows it to percolate through soil and recharge ground water)—might likewise become subject to NPDES permitting under the "conduit theory."

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[8] *Available at* https://www.epa.gov/polluted-runoff-nonpoint-source-pollution/urban-runoff-national-management-measures.

[9] There are over 21,000 septic tanks and 88,000 cesspools used for onsite disposal in Hawai'i alone, all of which have been considered nonpoint source pollution. *See* Hawai'i's Nonpoint Source Management Plan, 2015 to 2020, at 11-12, *available at* http://health.hawaii.gov/cwb/files/2013/05/2015-Hawaii-NPS-Management-Plan.pdf.

A broad range of storage structures and facilities are also at risk of being added to the NPDES program under the "conduit theory" to the extent any pollutants from those structures and facilities eventually migrate to navigable waters. For instance, aquifer recharge and aquifer storage and recovery projects involve the underground injection or infiltration of water via surface spreading, infiltration pits and basins, and injection wells. This can help prevent salt water intrusion into freshwater aquifers[10] and allow water to be stored and later recovered for uses such as drinking water supply, irrigation, or ecosystem restoration projects. Some of these projects are subject to Safe Drinking Water Act requirements for Class V wells, but not to NPDES requirements. Yet the "conduit theory" threatens to add duplicative or even inconsistent requirements.

State regulations with respect to pumping and recharging in the arid West often focus on preserving groundwater balances. As such, water originating below the surface is intentionally reinjected or reinfiltrated. By way of example, rapid

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[10] In coastal areas underlain by freshwater aquifers used for drinking water supply, freshwater is injected into the subsurface to create a barrier between saltwater and freshwater. The injected water creates a mixing zone of lower water quality which impedes the flow of saltwater into portions of the aquifer where freshwater well fields exist.

infiltration basins involve pumping water into a surface excavation and infiltrating it back into the groundwater, if necessary after pre-treatment to ensure compliance with drinking water and other water quality standards. These structures, designed to maintain balanced groundwater resources, should not be subject to new and potentially conflicting regulatory requirements under the NPDES program.

Unlined impoundments are also used in numerous industries. Examples include stormwater ponds, farm ponds, surface impoundments, cooling ponds, and water supply reservoirs. Many of these structures do not currently require NPDES permits. For those that do, the NPDES permits only address discharges of pollutants *directly* to surface waters, not the diffuse migration of pollutants from the unlined bottoms of those structures to navigable waters via soil and groundwater. Owners and operators of those impoundments may need to seek new or modified permits and identify additional NPDES discharge points following the district court's opinion. Likewise, pooling at the bottom of pits, such as gravel pits for highway repairs and road construction and mine pits, may newly face NPDES permitting requirements under the "conduit theory."

Because all that is required under the district court's "conduit theory" to trigger NPDES liability is the release of a pollutant from a "point source" and the eventual migration of that pollutant to a navigable water, hundreds of thousands (or possibly millions) of additional NPDES permits could potentially be required nationwide. Congress could not have intended such an absurd result when it drew sharp and meaningful distinctions between point and nonpoint source pollution control throughout the CWA and preserved primary authority over land use for state and local governments.

B. NPDES Requirements Cannot Be Applied to the Sorts of Features that Would Require Permits Under the "Conduit Theory."

It is far from clear whether NPDES permitting requirements can even be applied intelligibly to the litany of pollutant sources that the "conduit theory" might bring into the NPDES program. NPDES requirements were not designed with diffuse pollutant migration in mind, much less methods to remove pollutants through infiltration and percolation. Rather, NPDES requirements were aimed at "end-of-pipe" discharges directly into surface waters. *See* U.S. EPA, *Overview of the National Pollutant Discharge Elimination System (NPDES) Program*, at 16, 17, 23;[11] *see also* 40 C.F.R. § 122.45(a) (requiring that effluent limitations,

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[11] *Available at* http://www.epa.gov/sites/ production/files/2014-12/documents/ module-npdes.pdf.

standards and prohibitions be established "for each outfall or discharge point of the permitted facility").

For pollutants that migrate diffusely from a particular structure, facility, or land area via groundwater, it may not be possible to determine where the groundwater ultimately connects to a navigable water. Thus, there are no readily identifiable, defined outfalls or discharge points that can be used for purposes of calculating effluent limitations and conducting the required sampling and monitoring. *See* 40 C.F.R. Part 122 Subpart C. Nor would it make sense to simply declare that some aspect of a particular structure or facility (*e.g.*, the bottom of an unlined impoundment) is the discharge point. EPA's permitting guidance directs permit writers to require monitoring to determine compliance with applicable effluent limitations "after all treatment processes." U.S. EPA, *NPDES Permit Writer's Manual* § 8.1.2.3 (Sept. 2010).[12] Again, many infiltration structures and facilities are designed so that pollutant removal occurs during the movement through soil *after* the pollutants are released from the so-called discharge point.

[12] *Available at* https://www.epa.gov/npdes/npdes-permit-writers-manual.

Even assuming NPDES permit writers could somehow identify outfalls or discharge points, it may not be possible for the owner or operator of the "point source" to conduct the required sampling and monitoring because those locations may be miles away and beyond the owner or operator's control. To add to the uncertainty, at the point where groundwater containing pollutants that were released from a "point source" ultimately connects with a navigable water, that groundwater will likely contain pollutants from a host of other sources as well. Variable aspects of groundwater seepage such as flow rates and chemistry could further make applying NPDES regulations impracticable. For instance, unlike traditional "end of pipe" discharges, at various times of year flows can change and surface water can instead flow back into groundwater—a contingency that NPDES regulations do not account for.

In short, it would be impracticable, if not impossible, to apply NPDES requirements to the types of pollution that the "conduit theory" may reach. The permitting process would become even more burdensome and expensive for permit writers and applicants than it already is.

CONCLUSION

The district court's "conduit theory" finds no support in the statute or law, and its application could make the NPDES permitting program unworkable. Accordingly, the district court's decisions should be reversed.

DATED this 28th day of March, 2016.

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CERTIFICATE OF COMPLIANCE

I certify pursuant to Fed. R. App. P. 32(a)(7)(C) that this brief contains 6,912 words and has been prepared in 14-point Times New Roman proportionally spaced typeface.

/s/ David Y. Chung
David Y. Chung

CERTIFICATE OF SERVICE

I certify that on March 28, 2016, I electronically filed a copy of the foregoing brief with the Clerk of Court for the U.S. Court of Appeals for the Ninth Circuit via the appellate CM/ECF system, which will send electronic notification of to all registered CM/ECF users in this case.

/s/ David Y .Chung
David Y. Chung

Appeal No. 15-17447

IN THE UNITED STATES COURT OF APPEALS

FOR THE NINTH CIRCUIT

COUNTY OF MAUI,

Appellant,

vs.

HAWAII WILDLIFE FUND; SIERRA CLUB - MAUI GROUP; SURFRIDER FOUNDATION; WEST MAUI PRESERVATION ASSOCIATION,

Appellees.

On Appeal From the United States District Court for the District of Hawai'i
Honorable Susan Oki Mollway, Chief Judge
Case No. 12-00198 SOM/BMK

MOTION FOR LEAVE TO FILE *AMICI CURIAE* BRIEF OF THE ASSOCIATION OF CALIFORNIA WATER AGENCIES, CALIFORNIA ASSOCIATION OF SANITATION AGENCIES, CALIFORNIA STATE ASSOCIATION OF COUNTIES, INTERNATIONAL MUNICIPAL LAWYERS ASSOCIATION, LEAGUE OF CALIFORNIA CITIES, NATIONAL ASSOCIATION OF CLEAN WATER AGENCIES, NATIONAL ASSOCIATION OF COUNTIES, NATIONAL LEAGUE OF CITIES, NATIONAL WATER RESOURCES ASSOCIATION IN SUPPORT OF DEFENDANT AND APPELLANT COUNTY OF MAUI AND IN SUPPORT OF REVERSAL OF THE DISTRICT COURT'S DECISION

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CORPORATE DISCLOSURE STATEMENT

Amici represent that no parent corporation(s) or publicly held corporation(s) own 10% or more of the stock in any *amici*.

STATEMENT OF COMPLIANCE WITH RULE 29(c)(5)

No party's counsel authored the proposed *amici* brief in whole or in part. No party or party's counsel contributed money intended to fund preparing or submitting the proposed brief. No person, other than *amici curiae*, its members, or its counsel, contributed money that was intended to fund preparing or submitting the proposed brief.

CONSENT OF THE PARTIES

Defendant and appellant, County of Maui, has consented to the filing of the proposed *amici* brief. Counsel for Plaintiffs Earthjustice Legal Defense Fund, has not granted consent to the filing of the proposed brief.

INTEREST OF THE *AMICI CURIAE*

The Association of California Water Agencies ("ACWA") is the largest coalition of public water agencies in the nation, representing 440 public water agencies, which provide water supplies for urban and agricultural use.

The California Association of Sanitation Agencies ("CASA") is a non-profit mutual benefit corporation comprised of more than 100 local public agencies, including cities, sanitation districts, sanitary districts, community services districts, sewer districts, county water districts, California water districts, and municipal utility districts. CASA's member agencies provide wastewater collection, treatment, water recycling, renewable energy and biosolids management services to millions of California residents, businesses, industries, and institutions.

The California State Association of Counties ("CSAC") is a non-profit corporation whose membership consists of the 58 California counties. CSAC's Litigation Overview Committee monitors litigation of concern to counties statewide and has determined that this case is a matter affecting all counties.

The International Municipal Lawyers Association ("IMLA") is a non-profit, nonpartisan professional organization comprised of local government entities, including cities, counties, and subdivisions thereof, as represented by their chief legal officers, state leagues, and individual attorneys. Established in 1935 and consisting of more than 2,500 members, IMLA is the oldest and largest association of attorneys representing United States municipalities, counties, and special districts.

The League of California Cities ("League") is an association of 474 California cities dedicated to protecting and restoring local control to provide for the public health, safety, and welfare of their residents, and to enhance the quality of life for all Californians. The League's Legal Advocacy Committee has identified this case as having statewide or national significance.

The National Association of Clean Water Agencies ("NACWA") is a non-profit trade association representing the interests of publicly owned wastewater and stormwater utilities across the United States. NACWA's members include nearly 300 municipal clean water agencies that own, operate, and manage publicly owned treatment works, wastewater sewer systems, stormwater sewer systems, water reclamation districts, and all aspects of wastewater collection, treatment, and discharge.

The National Association of Counties ("NACo") is the only national association that represents county governments in the United States. NACo's members provide water, wastewater and flood control services to residents of the nation's 3,069 counties.

The National League of Cities ("NLC") is the country's largest and oldest organization serving municipal governments and represents more than 19,000 United States cities and towns. Many of NLC's members provide water and wastewater services.

The National Water Resources Association ("NWRA") is a non-profit, voluntary organization of state water associations, whose members include cities, towns, water conservation and conservancy districts, irrigation and reservoir companies, ditch companies, farmers, ranchers, and others with an interest in water issues in the western states.

Amici's members are responsible for important water supply, water conservation, water treatment and stormwater management services that all discharge to groundwater in some way. The issues presented in this case will define the circumstances under which a Clean Water Act National Pollutant Discharge Elimination System ("NPDES") permit is required for the continued operation and innovative development of *amici*'s members' services to its public constituents.

ARGUMENT

I. THE DISTRICT COURT'S DECISION HAS NO BASIS IN THE TEXT OF THE CLEAN WATER ACT, ITS LEGISLATIVE HISTORY, REGULATIONS OR CONTROLLING CASE LAW

The district court issued a series of summary judgment rulings that collectively apply the Clean Water Act's NPDES permit program to the migration of pollutants from four underground injection control wells at the Lahaina Waste Reclamation Facility through groundwater to the Pacific Ocean.[1] The district court reached this conclusion by applying a novel "conduit" theory that requires an NPDES permit whenever pollutants leave an original point

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[1] Relevant here are the first two decisions, where the district court determined that discharges from well numbers 3 and 4 require an NPDES permit, Hawai'i Wildlife Fund v. County of Maui, 24 F.Supp.3d 980 (D. Haw. May 30, 2014) ("Maui I"); and relied on the same reasoning to require an NPDES permit for discharges from well numbers 1 and 2, Hawai'i Wildlife Fund v. County of Maui, No. 12-00198, 2015 U.S. Dist. LEXIS 82395 *18 (D. Haw. June 25, 2015) ("Maui II")

source and ultimately reach navigable waters "regardless of *how* they get there . . . ." Maui I, 24 F.Supp.3d at 1000 (emphasis in original). *How* pollutants get to navigable waters, however, is the threshold trigger for the NPDES program. Or. Natural Desert Ass'n v. U.S. Forest Svc., 550 F.3d 778, 780 (9th Cir. 2008).

Despite acknowledging the lack of controlling appellate or statutory authority to support its approach, the district court disregarded the NPDES program's threshold "point source" requirement and erroneously imposed liability based on the migration of pollutants through a diffuse, non-point source. If upheld by this Court, the decision will effectively rewrite the NPDES program by eliminating the distinction between point source discharges, which require an NPDES permit, and non-point source discharges, which do not require an NPDES permit.

A. The District Court's Analysis Ignores the Point Source Requirement of the NPDES Program

The NPDES program is triggered by the "discharge of a pollutant" or "pollutants," which the Clean Water Act defines jointly as "any addition of any pollutant to navigable waters from any point source . . . ." See 33 U.S.C. §§ 1311(a), 1342(a); 1362(12); 40 C.F.R. § 122.2; see also Headwaters, Inc. v. Talent Irrigation Dist., 243 F.3d 526, 532 (9th Cir. 2001). A "point source" is "any discernible, confined, and discrete conveyance," which may include a discernible, confined and discrete "conduit[.]" 33 U.S.C. § 1362(14); 40 C.F.R.

§ 122.2. The district court's holding, however, is based on the erroneous theory that for the NPDES program to apply, a point source need not actually deposit the pollutant into the navigable water, because a "conduit" "need not also be 'confined and discrete.'" Maui I, 24 F.Supp.3d at 999.[2]

By definition, the NPDES program only applies to additions of pollutants to navigable waters from point sources, not to additions from non-point sources. When pollutants are added to navigable waters from a non-point source, states regulate the addition. 33 U.S.C. § 1342(a); Oregon Natural Resources Council v. U.S. Forest Service, 834 F.2d 842, 849 (9th Cir. 1987) ("Nonpoint sources, because of their very nature, are not regulated under the NPDES. Instead, Congress addressed non-point sources of pollution in a separate portion of the Act which encourages states to develop areawide waste treatment management plans."). This disparate treatment of discharges from point sources and non-point sources is "an organizational paradigm of the Act." Or. Natural Desert Ass'n, 550 F.3d at 780. Thus, contrary to the district court's analysis, "how" pollutants "get" to navigable water is the threshold question to consider when assessing whether the NPDES program applies.

Congress considered the "vexing nonpoint source problem[]" when it

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[2] In its liability determination, the district court disregarded the requirement that a "point source" be "confined and discrete" to conclude that "not … all conduits must be 'confined and discrete conveyances.'" Maui I, 24 F.Supp.3d at 999.

amended the Clean Water Act in 1972 and decided not to apply the NPDES program to non-point sources. S. Rep. 95-370, at 10.[3] In its considerations, Congress recognized that many non-point sources of pollution are "beyond present technology of control," and those that are controllable are generally regulated by states through their land use controls. Id. at 9; S. Rep. No. 92-414, at 39 (1972); *see also* 117 Cong. Rec. 38,722, 38,825 (Nov. 2, 1971) (statement of Sen. Muskie) (explaining that "[t]here is no effective way as yet, other than land use control, by which you can intercept [non-point] runoff and control it in the way that you do a point source"). In the face of these concerns, Congress also recognized that "it is both necessary and appropriate to make a distinction as to the kinds of activities that are to be regulated by the Federal Government and the kinds of activities which are to be subject to some measure of local control." S. Rep. 95-370 at 10. Congress' "clear and precise" distinction between point sources, which are subject to the NPDES program, and non-point sources, which are subject to other regulatory programs, was intentional.

This Court, as well as other courts, have honored Congress' clear intent, and repeatedly recognize that the NPDES program and other Clean Water Act

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[3] *Amici* believe the statutory text is unambiguous, however, to the extent there is any ambiguity, the legislative history illustrates that Congress made a precise distinction between point and non-point sources. See Caminetti v. United States (1917) 242 U.S. 470, 490 (referring to legislative intent is appropriate to resolve ambiguity).

requirements apply only to the addition of pollutants to navigable waters from point sources, not from non-point sources. See Ecological Rights Found. v. Pac. Gas & Elec. Co., 713 F.3d 502, 505 (9th Cir. 2013); Greater Yellowstone Coalition v. Lewis, 628 F.3d 1143, 1153 (9th Cir. 2010); United States v. Plaza Health Lab., 3 F.3d 643, 646 (2d Cir. 1993); Sierra Club v. Abston Constr. Co., 620 F.2d 41, 45 (5th Cir. 1980).

In Greater Yellowstone Coalition, for example, this Court determined that a discharge to surface water from a pit through the ground did not require a Section 401 certification, because "[t]he § 401 certification requirement applies only to discharges from point sources." Greater Yellowstone Coalition, 628 F.3d at 1153.[4] The ground is not a "point source" because water traveling through the ground to a surface water is "not collected or channeled" even though the discharge may have originated from a point source. Ibid.[5]

Consistent with the Ninth Circuit's recognition that the NPDES program

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4 Mining pits have been found to be point sources in certain circumstances; however, when water travels through the ground and into surface water, the ultimate discharge from the ground to surface water does not qualify as a point source discharge. Greater Yellowstone Coalition, 628 F.3d at 1153; see also Abston Constr. Co., 620 F.2d at 45 (water discharging from the top of a pit dug by miners into a creek constitutes a point source discharge).

5 Similarly, discharges of pollutants to surface water from utility poles, animals, and humans are non-point sources. Ecological Rights Found. v. Pac. Gas & Elec. Co., 713 F.3d 502, 505 (9th Cir. 2013) (utility poles); Oregon Natural Desert Ass'n v. Dombeck, 172 F.3d 1092, 1097-1099 (9th Cir. 1998) (cows); United States v. Plaza Health Lab., 3 F.3d 643, 646 (2d Cir. 1993) (humans).

applies only to discharges from point sources to navigable waters, the Fifth Circuit also rejected the argument that liability arises under the Clean Water Act whenever pollutants enter a waterway "regardless of how the pollutant found its way from that original source to the waterway." Abston Constr., 620 F.2d at 44. In rejecting this argument, the Fifth Circuit correctly recognized that "[t]he focus of this Act is on the 'discernible, confined and discrete' conveyance of the pollutant[.]" Ibid. Absent a "discharge[] from [a] 'discernible, confined, and discrete conveyance(s)' … into a navigable body of water[,]" there is no liability under the Clean Water Act's NPDES program. Id. at 45.

Using a novel theory it refers to as the "conduit theory," the district court ignored the NPDES program's point source requirement and determined instead that liability is triggered when pollutants reach navigable water, "regardless of *how* they get there." Maui I, 24 F.Supp.3d at 1000. However, *how* pollutants enter navigable waters is the threshold question for the NPDES program. See Trustees for Alaska v. EPA, 749 F.2d 549, 558 (9th Cir. 1984); Abston Constr. Co., 620 F.2d at 44; Greater Yellowstone Coalition, 628 F.3d at 1153.

Although the district court assumed that the County's injection wells are point sources, Maui I, 24 F.Supp.3d at 989,[6] and recognized that the wells do

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[6] Several provisions in the Clean Water Act raise questions about whether wells are covered by the NPDES program. Sections 208 and 304 of the Clean Water Act treat disposal of pollutants in wells and subsurface excavations as

not add pollutants directly to a navigable water, it concluded nonetheless that the NPDES program applies because pollutants actually enter navigable waters. Id. at 996 ("It is the migration of the pollutant into navigable-in-fact water that brings groundwater under the Clean Water Act."). In reaching this conclusion, the district court acknowledged that no controlling appellate law or statutory text supports the application of the NPDES program through the so-called conduit theory. Ibid.

There is no support for the conduit theory because there is no basis in the Act, its legislative history or caselaw for such an approach. As explained above, the NPDES program only applies when there is an addition of a pollutant to navigable water from a point source. 33 U.S.C. §§ 1311(a), 1342(12); 1362; 40 C.F.R. § 122.2. The district court imposed liability based on the indirect migration of pollutants to the ocean from diffuse groundwater, without identifying a discharge to navigable water directly from a "confined and discrete" point source. Maui I, 24 F.Supp.3d at 997-98; see ER 410 (diffuse flow has no identifiable discharge point); ER 534, 537, 544, 593 (¶ 24), 599-601

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non-point sources subject to state regulatory programs. 33 U.S.C. §§ 1288(b)(2)(K) (treating disposal of pollutants on land or in subsurface excavations as part of state areawide waste treatment management plan), 1314(f)(D)(2) (describing disposal of pollutants in wells or in subsurface excavations as "nonpoint sources of pollution"). The NPDES program also distinguishes "the disposal of pollutants into wells" which is subject to state regulation, 33 U.S.C. § 1342(b)(1)(D), from the general discharge of pollutants to navigable waters, which is subject to an NPDES permit, 33 U.S.C. § 1342(a).

(¶ 37) (seeps are ephemeral). There is no factual or legal basis for applying the NPDES program to non-point source discharges to navigable waters. For this reason, the district court's decision must be reversed.

B. The Conduit Theory Confuses Point Source Analysis with the Significant Nexus Test and Waters of the United States Jurisprudence

Despite the lack of legal support for its approach, Maui I, 24 F.Supp.3d at 996, the district court relied on cases it believed applied the NPDES program to indirect discharges. See id. at 994-1000.[7] The district court's fundamental error, however, was to apply the "significant nexus" test for assessing whether a water qualifies as a "waters of the United States" to the question of whether the County was adding pollutants to navigable waters from a point source. Id. at 1001 ("the indirect discharge theory does not treat groundwater as itself 'water of the United States,' but as a conduit to such water").[8]

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7 Citing to Rapanos v. United States, 547 U.S. 71 (2006); Solid Waste Agency of N. Cook Cnty v. U.S. Army Corps of Engineers, 531 U.S. 159 (2001), in N. Cal. River Watch v. City of Healdsburg, 496 F.3d 993, 1000 (9th Cir. 2007), Williams Pipe Line Co. v. Bayer Corp., 964 F.Supp. 1300 (S.D. Iowa 1997), Wash. Wilderness Coal. v. Hecla Min. Co., 870 F.Supp. 983 (E.D. Wash. 1994), United States v. Earth Sciences, Inc., 599 F.2d 368 (10th Cir. 1979).

8 As the Supreme Court noted in Lingle v. Chevron U.S.A., it is inappropriate to transmute a test applicable in one context into a different context with its own applicable test. Lingle v. Chevron U.S.A., 544 U.S. 528 (2005). Lingle overturned the transmutation of the "substantially advances" test, applicable in due process challenges, into the context of a regulatory takings challenge. Id. at 544. The Supreme Court noted that using a due

The "significant nexus" test was developed in the "waters of the United States" context and is used to determine when discharges to wetlands that are not traditionally navigable waters are still discharges to waters of the United States. Rapanos v. United States, 547 U.S. 715, 767 (2006) (Kennedy, J., concurring). When a point source discharges to a wetland, it may become necessary to determine whether a "significant nexus" between the non-navigable wetland and traditional navigable waters brings the wetland within the Clean Water Act's definition of "water of the United States." Ibid. If so, point source discharges into that wetland may be subject to the NPDES program because there is a discharge from a point source to a water of the United States. Ibid.

The "significant nexus" test does not determine whether there has been a discharge from a point source or bring a wetland, or any other waterbody, within the Act's definition of "point source." The district court's decision, however, misapplies the "significant nexus" test (which considers indirect impacts) to the question of whether there has been a discharge from a point

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process test in this manner is "not only doctrinally untenable as a takings test -- its application as such would also present serious practical difficulties." Ibid. Here, the district court misappropriated the "significant nexus" test for "waters of the United States" in the wholly separate "point source" context, a mixing of analytical approaches discouraged by the Supreme Court. As in Lingle, such a misapplication of different Clean Water Act approaches is doctrinally untenable and creates immense practical challenges.

source (which focuses on direct, not indirect, non-point source discharges).[9]

As noted above, the line between point and non-point sources delineates the scope of the NPDES program. Dombeck, 172 F.3d at 1096-97. The danger in the district court's reliance on cases applying the "significant nexus" test is that application of the test in the point source context eliminates the line between point and non-point sources and applies the NPDES program to any migration of pollutants to navigable waters, regardless of *how* the pollutants get to navigable waters.

C. The Groundwater at Issue is Neither a Water of the United States nor a Point Source

There appears to be no dispute that the groundwater at issue in this case is not "waters of the United States;" and the district court did not hold otherwise.[10] Maui I, 24 F.Supp.3d at 996 ("An unpermitted discharge into the groundwater,

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[9] For the same reason, the district court's reliance on Healdsburg, 496 F.3d 993 is misplaced. Maui I, 24 F.Supp.3d at 1000-1005. Healdsburg applied the significant nexus test to the question of whether discharges to Basalt Pond were discharges to a navigable water. Healdsburg, 496 F.3d at 995. This Court determined that the hydrologic connection between Basalt Pond and the Russian River qualified Basalt Pond as a navigable water. Healdsburg did not address the point source question.

[10] The Act's language, structure and legislative history supports the exclusion of groundwater from regulation under the NPDES program. 40 C.F.R. § 122.2 (explicitly excluding groundwater from the definition of water of the United States). As noted in the extensive discussion on the Act's legislative history in Umatilla Waterquality Protective Ass'n v. Smith Frozen Foods, Inc., both the House and the Senate considered and declined to extend the Act to groundwater, in part, because "the jurisdiction regarding groundwaters is so complex." 962 F. Supp. 1312, 1316-1319 (D. Or. 1997).

without more, does not constitute a violation of the Clean Water Act"). Circuit Court cases considering whether groundwater is a water of the United States correctly conclude it is not.[11] The district court's determination that the groundwater at issue is not a water of the United States is thus correct.

The groundwater here is also not a point source. 33 U.S.C. 1362(14); 40 C.F.R. § 122.2. Despite the district court's reliance on the groundwater at issue functioning as a "conduit," the court declined to rule that the groundwater is a "point source." Maui II, 2015 U.S. Dist. LEXIS 82395 at *18 ("[t]his court did not rely on the proposition that the groundwater in this case served as a point source.") The district court properly concluded that the groundwater here is not a point source.

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[11] See Rice v. Harken Exploration Co., 250 F.3d 264, 272 (5th Cir. 2001) ("We must construe the [Act] in such a way as to respect Congress's decision to leave the regulation of groundwater to the States"); Vill. Of Oconomowoc Lake v. Dayton Hudson Corp., 24 F.3d 962, 966 (7th Cir. 1994) ("As the statute and regulations stand, however, the federal government has not asserted a claim of authority over artificial ponds that drain into ground waters"); Exxon Corp. v. Train, 554 F.2d 1310, 1322 (5th Cir. 1977) ("the legislative history … belies an intention to impose direct federal control over any phase of pollution of subsurface waters. Instead, the congressional plan was to leave control over subsurface pollution to the states"). Although some district court cases reach the opposite conclusion, they do so by ignoring the Act's language, structure, and legislative history to focus on the Act's broader goals – often to achieve the outcome-oriented result of avoiding dismissal or to deny summary judgment. See, e.g., Coldani v. Hamm, No. 07-660, 2007 WL 2345016; 2007 U.S. Dist. LEXIS 62644 (E.D. Cal. 2007) (denying motion to dismiss); Idaho Rural Council v. Bosma, 143 F.Supp.2d 1169 (D. Idaho 2001) (denying summary judgment); Williams Pipe Line Co., 964 F.Supp. at 1319 (finding Hecla persuasive); Hecla, 870 F.Supp. at 991 (denying motion to dismiss).

Because the groundwater at issue is not a navigable water, Maui I, 24 F.Supp.3d at 996, or a point source, Maui II, 2015 U.S. Dist. LEXIS 82395 at *18, and because the "conduit theory" has no textual, legislative or case law support, there is no tenable legal or factual basis for applying the NPDES program to migrations from the County's wells. See 33 U.S.C. §§1311(a), 1342; 1362; 40 C.F.R. § 122.2. Accordingly, the district court's ruling should be reversed.

II. EXPANDING THE NPDES PROGRAM TO THE MIGRATION OF POLLUTANTS THROUGH GROUNDWATER REWRITES THE EXISTING REGULATORY SCHEME, RESULTS IN AN INFEASIBLE PROGRAM AND UNDERMINES INNOVATIVE APPROACHES TO WATER MANAGEMENT

If upheld, the district court's decision will intrude on the extensive field of existing groundwater regulation, result in an overlapping and unnecessary regulatory regime, create regulatory uncertainty, and threaten *amici*'s members' operation of important water, wastewater, stormwater, flood control, and water conservation projects. It should, therefore, be reversed.

A. Expansion of the Act Overburdens Existing Groundwater Regulatory Structures

The area of groundwater regulation is already occupied by multiple federal and state laws. See, e.g., 42 U.S.C. § 300f, et seq.; 40 C.F.R. 144.1 et seq.; 42 U.S.C. 6901, et seq.; 42 U.S.C. 9601, et seq.; 7 U.S.C. 136, et seq.;40 C.F.R. Parts 9, 141, and 142; Haw. Admin. Rules 13-168-1 et seq.; Cal. Water

Code § 10750 et seq.; Or. Rev. Stat. § 468B.150 et seq.; Wash. Admin. Code § 173-200 et seq.; Mo. Rev. Stat. § 644.061.1 et seq. The district court's decision will superimpose a regulatory scheme not designed to regulate groundwater on top of these laws and regulations, and in many cases, interfere with these laws and regulations.

1. The District Court's Decision Interferes with Existing Federal Groundwater Regulations

By requiring NPDES permits for indirect discharges through groundwater, the district court adds unneeded duplication to the already extensive federal and state-administered regulatory schemes. Comprehensive federal laws, such as the Safe Drinking Water Act and its Underground Injection Control ("UIC") Program, 42 U.S.C. § 300f, et seq., 40 C.F.R. 144.1 et seq., the Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901, et seq., the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9601, et seq., the Federal Insecticide, Fungicide and Rodenticide Act, 7 U.S.C. 136, et seq., and EPA's Groundwater Rule, 40 C.F.R. Parts 9, 141, and 142, establish nationwide standards applicable to the discharge of pollutants to groundwater, injection wells, underground storage tanks, and groundwater quality. Together, these laws are specifically designed to prohibit the contamination of groundwater, regulate underground storage and injection of pollutants, limit the use of pollutants that may migrate into groundwater, and impose significant liability for polluting groundwater.

For example, the wells at issue in this case have EPA- and State-issued UIC permits. The Safe Drinking Water Act's UIC program addresses pollution of groundwater, by imposing construction, operation, monitoring and reporting requirements on discharges from the wells. 40 C.F.R. §§ 146.1-146.14, 144.25. The direct disposal of waste into the wells is therefore fully regulated to prohibit migration of pollutants into underground sources of drinking water. 40 C.F.R. § 144.12. If subject to the NPDES program, these same wells would be regulated by overlapping and even contradictory discharge, operation, monitoring, reporting and permitting requirements. Cf., e.g., 40 C.F.R. § 122.41-122.50 (NPDES requirements) with 40 C.F.R. §§ 146.1-146.14 (UIC program regulations). As described below, application of the NPDES program to these wells and other discharges to groundwater is impractical. Congress did not intend this application.

2. The District Court's Decision Interferes with State Law and State Authority Over Water Resources

States also have extensive regulatory authority over groundwater and water supply through laws adopted pursuant to state land use, waste disposal, water quality, well drilling, and other reserved authority. In accordance with the Supremacy Clause, such state programs must be consistent with federal programs, but are otherwise independent regulatory schemes. Virginia v.

Browner, 80 F.3d 869, 882-883 (4th Cir. 1996). Within this context, state laws regulate the spacing, drilling, construction, operation, and abandonment of wells, as well as pumping of groundwater. They establish standards for water supply, wastewater management and quality, and discharges of storm flows from property into groundwater. See, e.g., Haw. Rev. Stat. § 340E-2 et seq. (drinking water regulations); Cal. Water Code § 13000 et seq. (water quality control); Or. Admin. Rules § 340-041-001 et seq. (water quality standards: beneficial uses, policies and criteria).

Congress preserved the states' central role in water management when it adopted the Clean Water Act.[12] The U.S. Supreme Court, this Court, and the EPA recognize that the states' role should not be compromised.[13] Protection of

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12 33 U.S.C. §§1251(b), (g) ("the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this chapter," and "nothing in this chapter shall be construed to supersede or abrogate rights to quantities of water which have been established by any State."); 1370 (the Act "shall [not] be construed as impairing or in any manner affecting any right or jurisdiction of the States with respect to the waters . . . of such States."); United States v. Appalachian Elec. Power Co., 311 U.S. 377, 406 (1940) (describing federal power to regulate navigable waters); The Daniel Ball, 77 U.S. 557, 563 (1870) (same); California v. United States, 438 U.S. 645, 662 (1978) (describing states' traditional authority to regulate water); California Oregon Power Co. v. Beaver Portland Cement Co., 295 U.S. 142, 158, 163-164 (1935) (same).

13 S. Fla. Water Mgmt. Dist. v. Miccosukee Tribe of Indians, 541 U.S. 95, 107 (2004) ("the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by the Act") (internal citations omitted); Great Basin Mine Watch v. Hankins, 456 F.3d 955, 963(9th Cir. 2006) (same).

state authority under the Clean Water Act is especially important for projects undertaken by *amici*'s members, which develop and protect reliable water supplies in a complex regulatory structure and in an increasingly water-scarce environment.

Extending the NPDES program to apply to groundwater through the conduit theory adds another layer of regulation to a comprehensively regulated field, increases the burden on regulatory agencies to administer yet another permitting program, and creates inevitable conflicts between the expanded NPDES program and state regulation of water supply. For this reason, the Court should reverse the district court's decision.

B. Implementation of the NPDES Program in the Groundwater Context Would be Infeasible

Implementing the NPDES program whenever a pollutant migrates into navigable waters through groundwater is infeasible and leads to the absurd result that every discharge to land, air, non-navigable surface water and groundwater may require an NPDES permit. See Ariz. State Bd. for Charter Schools v. U.S. Dep't of Educ., 464 F.3d 1003, 1008 (9th Cir. 2006) ("statutory interpretations which would produce absurd results are to be avoided."); see also 131 Cong. Rec. 15,616, 15,657 (June 13, 1985) (declaring it "absurd" to "require everyone who has a device to divert, gather, or collect stormwater runoff and snowmelt to get a permit from EPA as a point source" and warning that such a permitting program "would be an administrative nightmare [and] … prohibitively expensive to administer.").

1. Diffuse Points of Discharge are Difficult or Impossible to Locate

Groundwater often has diffuse, unascertainable or ephemeral points of discharge, making it nearly impossible to know in advance whether, when or where a discharge from groundwater to navigable waters will occur. See, e.g., ER 410; (diffuse flows have no identifiable entry point); 534, 537, 544, 593 (¶ 24), 599-601 (¶ 37) (seeps are small and ephemeral). The uncertainty surrounding whether a particular pollutant will ever discharge from groundwater to a navigable water creates a situation where *amici*'s members and their permitting agencies will not know if an NPDES permit is required until after a discharge commences. The uncertainty also makes it infeasible to determine when, where, and how compliance is measured when there is "no confined and discrete" point of discharge from groundwater to a navigable water.

Courts recognize that it may be impossible to predict, regulate or control the discharge of a pollutant from groundwater to a navigable water. See Greater Yellowstone Coal, 641 F.Supp.2d at 1141 ("The Court can also envision future monitoring and enforcement issues. How do you accurately decide if the contamination originated from this source, or perhaps another source."). Applying the NPDES program in a context where a discharge point is unascertainable or ephemeral is infeasible. In light of the civil and criminal penalties applicable to violations of the NPDES program, the rule of lenity compels a narrow construction of "point source" and rejection of the expansive and unsupported "conduit theory." See Plaza Health Labs, 3 F.3d at 649; Kasten v. Saint-Gobain Performance Plastics Corp., 131 S. Ct. 1325, 1336 (2011).

2. Physical Differences between Surface and Groundwater Make Permit Requirements Impossible to Formulate and Implement

Differences between hydrologic conditions in groundwater and surface water limit regulators' and dischargers' ability to implement the NPDES program in the groundwater context. Important features unique to groundwater include subsurface geology; multiple and diffuse points of discharge; other sources of pollution such as pollutant plumes; chemical reactions related to the groundwater geology that may alter the nature of a pollutant once it enters a groundwater formation; saltwater intrusion; and "naturally occurring" elements that qualify as "pollutants" under the Clean Water Act (e.g., selenium or arsenic).[14]

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[14] See, e.g., 80 Fed. Reg. 63552 (2015) (Reopening of Request for Scientific Views on the Draft Aquatic Life Ambient Water Quality Criterion for Selenium--Freshwater 2015); Pac. Coast Fedn. of Fishermen's Ass'ns v. Glaser, 2013 U.S. Dist. LEXIS 132240 at *21 (E.D. Cal. Sept. 16, 2013) ("discharges [containing naturally-occurring selenium] would otherwise … require an

Water quality based effluent limits ("WQBELs") provide one example of how the differences between groundwater and surface water make it infeasible to implement the NPDES program's requirements to groundwater. Section 122.44 of 40 C.F.R. requires NPDES permits to include WQBELs if there is a reasonable potential that a discharge will interfere with water quality standards. 40 C.F.R. 122.44(a). Development of effluent limitations requires, in part, characterization of the effluent flow, flow variability, pollutant concentration, and stormwater influence within the navigable waters that receive the discharge. See 33 U.S.C. § 1311(e); 40 C.F.R.§ 122.44; U.S. EPA, NPDES Permit Writer's Manual 2010: 6-12 – 6-22.

Characterizing the flow of groundwater or the influence of stormwater on groundwater discharges to navigable waters poses significant challenges, especially where groundwater has ephemeral seeps or diffuse discharges. This is the case here, where 90% of the submarine groundwater migrates to the ocean through diffuse flow and 10% migrates through ephemeral seeps. ER 493 (¶ 48), 534, 537, 544, 593 (¶ 24), 599-601 (¶ 37). In addition, as the groundwater at issue flows toward the ocean, it encounters sedimentary capstone formations, leaches nutrients along the flow path, and mixes with saltwater. State of Hawai'i Department of Health, U.S. EPA, and U.S. Army

NPDES permit").

Engineer Research and Development Center, Lahaina Groundwater Tracer Study, 60-61 (Nov. 2012).[15] These types of interactions often result in the groundwater accumulating naturally occurring "pollutants," making effluent limitations impractical: WQBELS do not reduce naturally occurring pollutants.

Similarly, implementing other NPDES permit requirements, such as outfall monitoring (as illustrated here, groundwater generally does not generally have a discernible outfall), 40 C.F.R. § 122.21(j)(4)(i), reporting of noncompliant discharges (no "person" discharges naturally occurring arsenic or selenium, for example) 40 C.F.R. § 122.41(l), and enforcement of discharge violations would likewise be infeasible.

The complexity surrounding subsurface waters was one of the driving factors for Congress' intentional exclusion of groundwater from the Clean Water Act's NPDES program.[16] Additional complexity resulting from the conduit theory will overburden regulatory agencies and the regulated community. Uncertainty and complexity justified exclusion of groundwater from the Act since at least the congressional hearings in 1971, and justifies this Court's reversal of the district court's decision here.

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15 Available at https://www3.epa.gov/region9/water/groundwater/uic-pdfs/lahaina02/lahaina-gw-tracer-study-final-report-june-2013.pdf. Per Hawai'i District Court Local Rule 10.2(d), portions of this Study were filed in the district court at DE 79-10, 79-20, 89-4, 127-2, 129-3, 137-4, 139-10, 141-7, 155-5, 173-34, 217-5.

16 See footnote 10, above.

C. The District Court's Decision Improperly Exposes *Amici*'s Members to Liability for Lawful Operations Critical to Public Health and Safety

Long-term, the district court's decision will delay or prevent *amici*'s members' water supply, conservation, treatment and management projects, which directly benefit the public, by requiring compliance with impractical permits and exposing members to enforcement actions and citizen suits.

1. Groundwater Recharge

The western United States has experienced drought conditions since at least 2013. Water purveyors throughout the region are developing new water sources and new storage facilities to preserve and augment supplies. A major part of that effort is using subsurface aquifers to store water and highly treated recycled wastewater for potential use in water supply systems, consistent with water quality standards. To protect raw water in aquifers from saltwater intrusion, some members of *amici* also inject recycled and potable water into groundwater basins to create a barrier between saltwater and freshwater. Groundwater storage allows water supply agencies to increase water storage and reduce losses from evaporation. Under the district court's reasoning, if water, which an agency puts into the ground as part of a groundwater recharge project, migrates to "waters of the United States," it will require an NPDES permit in addition to other permits already applicable to the projects.

Requiring an NPDES permit will put existing and future recharge projects at risk. As described above, hydrologic conditions unique to the groundwater setting make implementing the NPDES program infeasible for groundwater recharge projects. If the Court upholds the district court's rationale, regulatory authorities across the Ninth Circuit will be forced to issue NPDES permits for groundwater recharge projects without the ability to develop appropriate or attainable permit requirements. *Amici*'s members will be at risk of either having an unachievable permit imposed on their operations, or being sued for operating without a permit. Such open-ended liability will be a major disincentive for investment in new groundwater recharge projects.

2. Other Recycled Water

Other uses of recycled water will also be put at risk by the district court's decision. Land application (for irrigation purposes) and impoundment of recycled water (for other supply purposes) where it can seep into the ground, then to navigable waters, may trigger NPDES requirements under the district court's decision. See, e.g., Cal. Code Regs., tit. 22, div. 4; Or. Admin. Rules, 340-055 et seq.; Wash. Admin. Code, Ch. 173-219; Tx. Admin. Code, tit. 30, Pt. 1, Ch. 210. Requiring *amici*'s members, individual property owners and other recycled water users to obtain an NPDES permit, in addition to all other permits for recycled water use, will significantly slow and complicate the regulatory process, reducing the use of recycled water. States and the EPA are encouraging new recycled water projects as part of protecting our nation's waters. Imposing NPDES requirements by upholding the district court's decision will disincentive recycled water projects and run contrary to state and federal policy.

3. Other Water Supply Infrastructure

Water supply *amici* also own and operate surface water impoundments, such as terminal reservoirs, and subsurface water pipelines that often percolate and leak water into the surrounding groundwater.[17] Determining the point of discharge from reservoirs and underground pipelines, as well as which NPDES permit requirements should apply to infrastructure with thousands of points of discharge is not feasible or within the scope of the Act. The conduit theory thus compromises the continued operation of water supply storage facilities and pipelines.

4. Low Impact Development and Green Infrastructure

Many of *amici*'s members operate municipal separate storm sewer

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[17] Potable water is often considered a pollutant. See, e.g., W.R. Grace & Co. v. United States EPA, 261 F.3d 330, 333 (3d Cir. 2001) (describing disinfection process creating chloramines to inactivate bacteria); see also, California State Water Resources Control Board Order No. WQ 2014-0194-DWQ, Statewide National Pollutant Discharge Elimination System Permit for Drinking Water System Discharges to Waters of the United States (Nov. 18, 2014).

systems ("MS4"), and are subject to NPDES permits specific to MS4s. 33 U.S.C. 1342(p)(3)(B); 40 C.F.R. 122.26. These permits require agencies across the country to use LID infrastructure to retain, percolate and infiltrate stormwater.[18] The district court's decision would expose these agencies to liability for infiltrating stormwater as required by their MS4 permits and the EPA. It would also apply to individual property owners who install similar LID infrastructure as part of new development or redevelopment.

In addition, communities nationwide are undertaking massive upgrades to their sewer systems to reduce combined sewer overflows ("CSOs"). An estimated 10 trillion gallons of stormwater rushes off rooftops, roadways, parking lots, and other impervious surfaces.[19] In areas with combined sewers, stormwater combines with sanitary flows, often overwhelming the sewer system, and causing overflows of untreated water and wastewater into

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[18] See, e.g., U.S. EPA, Memorandum: Protecting Water Quality with Green Infrastructure in EPA Permitting and Enforcement Programs, Apr. 20, 2011; see also, Los Angeles Regional Water Quality Control Board Order No. R4-2012-0175, NPDES Permit No. CAS004001, Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges Within the Coastal Watersheds of Los Angeles County, Except Those Discharges Originating From the City of Long Beach MS4, (Nov. 8, 2012) Provision VI.D.7.c.i (requiring new development and redevelopment projects to retain on-site stormwater runoff from the 0.75-inch , 24-hour rain event or the 85th percentile, 24-hour rain event).

[19] See Natural Resources Defense Council, Rooftops to Rivers II: Green Strategies for Controlling Stormwater and Combined Sewer Overflows, http://www.nrdc.org/water/pollution/rooftopsII/default.asp (October 2013).

waterways. Wastewater utilities have begun using green infrastructure projects to slow the flow of stormwater, to prevent stormwater from entering the sewer system, and to reduce the occurrence of CSOs.

State and federal regulators and the regulated community rely on LID and green infrastructure to treat stormwater pollution and prevent untreated wastewater from entering the nation's waters. The district court's decision would deal a major blow to these efforts.

5. Regulatory Enforcement and Third Party Lawsuits

Not only is it often unclear whether and where discharges from groundwater enter a navigable water, in the case of exfiltration from underground pipes, it is nearly impossible to determine whether and where discharges from pipes enter groundwater. In the event a regulatory agency determines an NPDES permit is not required for a water or wastewater system, reservoir, or other project, but later evidence demonstrates a discharge from groundwater to a water of the United States, dischargers may face crippling liability. See 33 U.S.C. § 1365. Even if all of *amici's* members sought NPDES permits for their potential discharges to groundwater, developing specific permit standards is infeasible (see Section II.B, above); poorly written requirements could put dischargers immediately out of compliance, expose them to citizen suit liability and enforcement actions, and provide no possibility of attaining compliance.

The district court's decision would therefore create a new, burdensome and impractical regulatory program, expose *amici's* members' to significant liability for their lawful operations, and compromise water supply and management across the country.

CONCLUSION

For the reasons set forth above, the district court's decision should be reversed.

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Dated: March 28, 2016

Respectfully submitted,

By: */s/ Shawn Hagerty*

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CERTIFICATE OF COMPLIANCE

In accordance with the Federal Rules of Appellate Procedure, rule 32(a)(7) and Ninth Circuit Rule 32-1, I, Shawn Hagerty, hereby certify that the foregoing was produced on a computer, is proportionately spaced, has a typeface 14 points or more and, according to the word count function on the word processing program used, this brief contains 6,726 words.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct and that this certificate is dated March 28, 2016.

/s/ Shawn Hagerty
SHAWN HAGERTY

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CERTIFICATE OF SERVICE

I hereby certify that I electronically filed:

AMICI CURIAE BRIEF OF THE ASSOCIATION OF CALIFORNIA WATER AGENCIES, CALIFORNIA ASSOCIATION OF SANITATION AGENCIES, CALIFORNIA STATE ASSOCIATION OF COUNTIES, INTERNATIONAL MUNICIPAL LAWYERS ASSOCIATION, LEAGUE OF CALIFORNIA CITIES, NATIONAL ASSOCIATION OF CLEAN WATER AGENCIES, NATIONAL ASSOCIATION OF COUNTIES, NATIONAL LEAGUE OF CITIES, NATIONAL WATER RESOURCES ASSOCIATION IN SUPPORT OF DEFENDANT AND APPELLANT COUNTY OF MAUI AND IN SUPPORT OF REVERSAL OF THE DISTRICT COURT'S DECISION with the Clerk of the Court for the United States Court of Appeal for the Ninth Circuit by using the appellate CM/ECF System on March 28, 2016.

I certify that all participants in the case are registered CM/ECF users and that service will be accomplished by the appellate CM/ECF system.

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GEI Consultants

Consulting Engineers and Scientists

Review of EPA 2016 Draft Selenium Criteria Implementation Guidance Documents

EPA-F-820-16-007
EPA-F-820-16-008
EPA-F-820-16-009
EPA-F-820-16-010

PREPARED ON BEHALF OF THE NATIONAL MINING ASSOCIATION

Submitted to Docket ID No.: EPA-HQ-OW-2016-0551

February 2017

Review of EPA 2016 Draft Selenium Criteria Implementation Guidance Documents

GEI Consultants

Consulting Engineers and Scientists

PREPARED ON BEHALF OF THE NATIONAL MINING ASSOCIATION

Submitted to Docket ID No.: EPA-HQ-OW-2016-0551

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Table of Contents

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1. Introduction

GEI Consultants, Inc. (GEI) toxicologists, water quality specialists, and regulatory strategists are recognized experts in water quality effects on aquatic life. In fact, our significant experience related to selenium (Se) spans over 20 years of study at sites throughout the U.S. and Canada. We frequently provide expert testimony and support for regulatory water quality hearings, environmental assessments, and ambient water quality standards development. Our personnel have served as invited experts for Se risk evaluation in aquatic environments for the Society of Environmental Toxicology and Chemistry, provided peer review for Se effects issues near coal mining sites in British Columbia (on behalf of the BC Ministry of the Environment), and provided technical review of Se issues for the North American Metals Council – Selenium Working Group, as well as other water quality issues for the National Mining Association. We have been involved with Se-related issues in waters throughout the U.S., including the collection of considerable water quality and biological data from a wide variety of waterbodies, evaluation of Se bioaccumulation trends, detailed Se source and fate identification, and development of site-specific Se standards. As such, we believe we can provide a unique perspective on these draft guidance documents and respectfully submit the following comments.

We appreciate the opportunity to review and comment on these documents and hope that the EPA will take our comments under consideration when finalizing the guidance documents.

2. Comments on EPA-F-820-16-0010: *Technical Support for Adopting and Implementing EPA's 2016 Selenium Criterion in Water Quality Standards*

2.1 Comments on Options for Implementing EPA's Selenium Criterion

2.1.1 Site-specific Fish Tissue Criterion Elements Using the Species Recalculation Procedure

We agree with the EPA's allowance for the development of site-specific criteria using the recalculation procedure (EPA 2016e). However, since the toxicity database for selenium is relatively small and does not strictly follow the 1985 guidelines minimum data requirements in its complete form, it would be beneficial for the EPA to provide recommendations on minimum requirements for use of the recalculation procedure for selenium.

One recommendation that should be included for a recalculation procedure approach for selenium would be to first delete any species not present or expected to be present, or not acting as a surrogate for other resident species in waters of interest. The next step would be to recalculate the final chronic value (FCV) using the remaining most sensitive species and revised "N". If the recalculated FCV is greater than genus mean chronic value (GMCV) for the most sensitive species in the revised database, defaulting to the lowest GMCV for species present or expected to be present would be appropriate. Alternatively, if following deletion of non-resident species results in a database distinctly not meeting the minimum data requirements (i.e., the 8-family rule), again, the recommended FCV equals the lowest GMCV for species present following EPA (1994).

We would also recommend allowing for development of a site-specific tissue criterion element based on elevated ambient conditions. In states such as Colorado, site-specific criteria for selenium concentrations in the water column have been developed and approved by the EPA for regions of the state where naturally elevated selenium concentrations in water and fish tissues have been linked to the underlying geology. In locations where it has been established that the water column concentrations are naturally elevated, it can be assumed that any elevated fish tissue concentrations are also occurring because of the natural conditions. The EPA should allow for development of site-specific "ambient" tissue criteria based on existing fish tissue concentrations at these locations.

Additionally, in locations where water column concentrations are a result of both ambient conditions and regulated discharges, the fish tissue concentrations are a result of a combination of ambient and anthropogenic inputs. Ambient tissue criteria for these streams would need to address the degree of influences from the different sources.

2.1.2 Variances

The EPA suggests that states and tribes should consider using water quality standard variances for selenium before revising the designated use for a waterbody for which attainment of the new selenium criteria is not feasible. While we agree with this as one potential option, it should not be the first option considered. We are aware of some states (e.g., Colorado) which require evaluation of all other factors prior to considering a variance, such as whether or not the standards are appropriate due to natural or anthropogenic conditions, evaluation of the correct aquatic life use classification, or modified flow conditions that affect attainability. A reasonable approach to setting standards for a waterbody is to first determine the correct designated uses of the waterbody. Once the designated use is set, a determination can be made as to what standards are necessary and appropriate for protection of that use. Only after these initial evaluations should a variance be considered and pursued to avoid unjustified costs to regulated dischargers. We recommend that the EPA include a discussion of variances as an option; however, the guidance should also clarify that a variance does not need to precede revision of uses or development of appropriate site-specific standards and, in some cases, variances may be used in conjunction with other revisions.

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3. Comments on EPA-F-820-16-007: *Technical Support for Fish Tissue Monitoring for Implementation of EPA's 2016 Selenium Criterion*

We appreciate the guidance provided on fish tissue monitoring to support implementation of the selenium standard. We are in agreement that the fish tissue elements should supersede water column elements when both types of data are available and the system is stable with no new inputs of selenium. We have some comments on more specific portions of the implementation guidance, as follows.

3.1 Comments on Monitoring Strategy-Tissue Type

3.1.1 Tissue Type

We appreciate that this section includes an in-depth discussion of the factors that should be considered when determining what type of fish tissue to collect for monitoring plans focused on evaluation of selenium concentrations. Based on the mechanism through which selenium toxicity manifests itself, we agree that collection of egg-ovary tissue is preferable to the collection of whole-body or muscle tissues samples. But, as discussed in the document (EPA 2016b), we have also experienced difficulties in past selenium monitoring studies when the timing of the studies, regulatory restrictions, size of the target fish, and necessary size of the sample mass for analysis have made collection of egg-ovary tissues impractical or impossible. In these cases, we concur that whole-body or muscle tissues should be collected instead.

The implementation guidance could also include some direction as to what documentation, if any, will be required in study plans as to the factors that are considered in making this decision on an individual study plan basis. For example, it may be known that the collection of egg-ovary tissues is impractical, while in other cases, this decision may be need to be made in the field. The guidance should encourage flexibility in the study plan development to state which types of tissue may be available, and then state the factors that were considered (or will be considered during the sampling event) if the choice is to collect whole-body or muscle tissues instead of egg-ovary tissues based on practical concerns. For example, there could be a single or limited number of individuals collected in the field that could provide egg-ovary tissues for analysis, while there could be a larger number of individuals of the same species that could be collected as whole-body fish. In this case, the higher number of whole-body fish would provide more valuable information on variability in selenium concentrations at a site than a single egg-ovary sample.

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The EPA provides a detailed description of the necessity for timing the collection of egg/ovary tissues to coincide with the pre-spawn window. The discussion presented also states that a substantial amount of variation in selenium concentrations could be expected to occur based on exact timing of collection during the egg maturation process and differences among species reproductive cycles. In our experience, the timing of spawning can still vary even with species with well-known life-cycles and in streams that we have sampled annually for multiple years. Estimating this window exactly in order to time the sampling to specifically capture this period can be difficult from a practical standpoint. The spawning windows presented in Appendix B are useful, but they indicate that multiple species in each watershed have windows that span five months or more.

Also, collection of egg/ovary tissues from migrating fish species will be contentious in cases where selenium sources are not well documented, as egg/ovary tissues will be collected from one waterbody but will have accumulated the selenium load from a differing waterbody. While this issue is alluded to, there is no clear guidance provided for how to handle this from an impairment listing perspective (EPA 2016b). We would suggest that when there is potential for questions to arise about the origin of the selenium load, the implementation guidance be flexible enough to allow additional data to be assessed or collected if needed to clarify this situation. In some cases, this could be discussions with regional biologists to determine life histories of the migrating fish species specific to the waterbody in question, while in other cases it could be necessary for additional tissue samples to be collected from the waterbody. If additional tissue samples are desired, such sampling could include: 1) egg-ovary tissues from a second fish species that is considered a resident fish could be collected during the same sampling event; 2) whole-body tissue samples could be collected in the same sampling event of the same fish species but in a size range that indicates these are juvenile fish that would not be expected to be migrating, or 3) whole-body fish tissues of the same species collected during a second sampling event that is timed specifically to avoid the collection of migrating fish. In each of these cases, the guidance should be flexible enough to ensure all data would then be considered when making a decision as to impairment of a waterbody and the origin of the selenium source.

Similar to our comment on the timing of the collection of egg-ovary tissues, recommendations should be provided as to determining the appropriate timing when collecting whole-body or muscle samples. The support document appears to indicate in this and future sections that summer or fall may be the appropriate time period, but it then states that seasonal considerations are less stringent for whole-body and muscle tissue (EPA 2016b). Providing flexibility for this type of sampling in order for it to correspond with monitoring strategies that are already in place for other contaminants is an important factor, as noted in the document. Many of the ongoing fish tissue sampling programs that are in place are based on human-health concerns and target the collection of edible-sized fish of certain species that are commonly fished for and consumed. As selenium tissue sampling is instead focusing on the protection of aquatic life, with the emphasis on fish reproductive

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success, the guidance should state that the appropriate time period for collection of whole-body or muscle tissues should be based on knowledge of both the waterbody itself and knowledge of the life histories of the fish species to be targeted to ensure that the fish collected for analysis are resident fish that appropriately represent selenium concentrations in the waterbody.

We have also observed considerable variation in whole-body selenium concentrations among fish of the same species and approximate size collected at the same location in different seasons, and we have occasionally observed substantial variation even within the same sampling event. For example, at one site in Colorado, we observed Brook Stickleback whole-body tissue concentrations ranging from 24 mg/kg dw Se to 66 mg/kg dw Se during one spring sampling event, and from 20 mg/kg dw Se to 23 mg/kg dw Se during another sampling event. At another Colorado site with lower whole-body tissue concentrations in Creek Chub, we observed concentrations ranging from 6 to 11 mg/kg dw Se in the spring, while data from the summer and fall ranged from and 3 to 5 mg/kg dw. Using data from only the spring event could have indicated impairment, while data from the summer and fall events were well below the standard. Without a recommended time frame preferred for sampling, the ability to compare among sites and geographic regions is compromised. It may be that despite the desire for egg/ovary tissue data, sampling difficulties would preclude such sampling on a regional or geographic scale. This suggests that the guidance may want to allow the flexibility to simply focus on whole body sampling in general.

Finally, the guidance appears to be recommending against the collection of muscle plugs in lieu of egg/ovary, whole-body, or muscle fillet samples based on the variability in selenium concentrations based on sample collection location, detrimental effects to individual fish from this type of sample collection, and the potential to collect too little sample mass for analysis needs. The intent of this discussion on the potential issues with using muscle plugs should be clarified. The current text should more clearly state that the collection of muscle plugs should be avoided unless there is a specific need to collect information on a species of special concern that can be safely sampled in this manner without a risk of mortality. Also, the guidance should note that data from this type of sample collection may be considered acceptable if data on selenium concentrations in endangered or threatened species are necessary, as this may be the only way to collect such data from species at risk.

3.1.2 Sample Type

We agree that compositing fish tissue samples is necessary in some cases to provide sufficient amount of tissue for analysis in small-bodied fish species. However, while compositing fish of sufficient size may save on analytical costs, EPA also seems to be recommending replicate sampling to allow evaluation of the variability of selenium within a population. In addition, replicates are needed for statistical testing of data between locations or over time (noted elsewhere in the EPA guidance), which would be difficult, at best, if only composites were taken. As noted above, variable selenium concentrations can be found even when sampling time, sampling location, species collected, and size of fish collected have been accounted for. While this issue is acknowledged, the guidance needs to allow flexibility for states to develop their own guidance to help resolve this issue locally. Analyzing fish tissue samples individually and then utilizing the mean or geometric mean of these values (similar to the EPA's calculation of GMCVs) to determine compliance would ensure that the appropriate measure is used for attainment decisions, while still ensuring information on this variability was not lost. As there is no recommendation included for multiple sites, locations, or years to be sampled for a waterbody, this may be particularly important to identify when selenium concentrations in a single fish sample are exerting a large influence in either direction on the average or composite.

A recommendation should be included in this portion of the discussion for the first (or first few) such sampling event in a water body to involve analysis of individual fish samples rather than composite fish samples when sufficient mass is available to provide some information on what to expect in variability at a site. If little variability is documented, then compositing of fish could be recommended on that basis. We realize some of these concerns are briefly addressed in the "Individual Sample" section; however, their vague specifications do not provide clear direction on how flexible states can be when making the decision of when to collect individual versus composite samples.

If compositing of fish continues to be recommended but the number of composite replicates is to be determined on a case-by-case basis, the discussion in this section should include further details on how to justify that decision. Based on how the guidance currently discusses sample type and number, one composite sample of five or fewer fish would be considered a sufficient amount of data upon which to determine impairment or non-impairment. As discussed further in a later section of this document, we have observed considerable variation in selenium concentrations among individuals from the same site and species, and this variation will not be accounted for adequately when determining impairment if a single composite sample is all the information this decision is based on. The EPA should clarify that the number of samples required for an impairment decision may differ between sites based on site-specific variability of fish tissue concentrations and population size of fish species present, but at a minimum decisions should not be based on a single sample, whether from an individual fish or composite.

This document should also present more clarification as to the length and description of stream reach utilized for the composite sample. If tissue samples are collected throughout a stream reach that includes portions both upstream and downstream of a selenium source, then collection of fish tissues throughout this reach may not provide valuable information when composited.

3.1.3 Target Species

As noted in the criteria document and this support document, toxicity data on fish species indicates that sensitivity to and bioaccumulation of selenium varies considerably in different fish species (EPA 2016a and 2016b). A list of fish species to target is included in this section for use by monitoring agencies to determine if their monitoring programs are including the appropriate fish species, which is stated to be those that are selenium sensitive and potentially accumulate high concentrations of selenium. We would first like to ask that a discussion of how these species included in Table 3 were selected, as selenium toxicity data are not available for most of these species. We assume that the list may reflect common species in genera for which there are fish tissue thresholds, but that is not clear.

Clarification should also be given as to the difference between a species being sensitive to selenium versus having the potential to accumulate high concentrations of selenium. The beginning of this section indicates that states and tribes should target species with higher selenium sensitivity, but then subsequently notes that the appropriate species are those that potentially accumulate high concentrations of selenium. In our experience, many waterbodies do not have a resident fish species that exhibits both attributes. For example, collection of a sensitive fish species from the genus *Oncorhynchus* versus a more tolerant species that also has a higher bioaccumulation potential such as those from the genus *Rhinichthys* could result in a different decision as to whether the waterbody was considered impaired or not. In addition, there may be low numbers of the sensitive species to the point that the sample number would be limited or that a higher risk exists of population-level effects from tissue collection, while higher numbers of the tolerant species were present. Further, specific recommendations as to how to select the species for sampling from those on the target list should be provided to maintain consistency in state sampling plans when these types of decisions arise. For example, if multiple species from the target list are present in a waterbody but the intent is to collect only a single species, then the species to be collected should be the most sensitive fish species that is present in sufficient numbers to allow for tissue collection without impacting the population. For example, in Idaho, collecting permits address the concern of impacts to populations by specifying that the number of fish of each species collected for tissues can be no more than 30 percent of the total number of fish of that species collected within the specified reach, and Colorado Parks and Wildlife specifies that the number of fish sampled for tissues shall be restricted to 10 percent of the total take of that species per sampling location.

The support document should also provide guidance on whether and when the collection of multiple species would be appropriate, and then discuss how data from multiple species would be utilized in the determination of impairment or non-impairment. For example, if Northern Pike (*Esox lucius*) were found to have whole-body tissue concentrations of 12.0 mg/kg dw, and White Sturgeon (*Acipenser transmontanus*) at the same sample site was found to have whole-body tissue concentrations of 7.5 mg/kg dw, one species is exceeding the criterion while the other is not. Since Northern Pike are one of the less sensitive species in the selenium toxicity database (with a whole-body chronic value of 14.2 mg/kg dw), and White Sturgeon are more sensitive, it would be more appropriate to use the White Sturgeon data for comparison to the criterion when a large discrepancy exists between tissue concentrations in different species with known differing sensitivities.

This section also states that part of the reasoning behind providing the target species list is to encourage states to sample the same species since it is difficult to compare contaminant monitoring results within a state or among states otherwise because of the various factors that cause variability in selenium sensitivity and bioaccumulation rates. Despite acknowledging this and presenting a list of target species that appears to include those with a wide range of both sensitivities and bioaccumulation rates, it is an inherent part of the criteria document that all data are compared to the same tissue criterion. However, when data from multiple species are available, and sensitivities are known, the most scientifically valid approach is to compare the most sensitive species to the criterion value.

3.2 Comments on Leveraging Existing Fish Tissue Monitoring Programs and Sample Design

Many of the comments discussed in Section 3.1.1 are also applicable to the subsections *Consistency with Existing Programs* and *Temporal Considerations*.

The support document should discuss more fully how to deal with the issue that arises when migrating fish are collected for tissue analysis in one section of a waterbody that may have spent previous months in another section of the waterbody. While this migration period may be the optimal time frame for the collection of egg/ovary tissue samples, attributing these data to the correct stream reach or waterbody accountable for the selenium bioaccumulation versus the actual reach the fish were collected in will be difficult in some cases. In waterbodies with well documented selenium inputs and fish species with well-known life migratory patterns, perhaps inferences can be made as to how to appropriately react to any exceedances or lack of exceedances that occur. However, further sampling (such as whole-body tissue collection during seasons when fish would not be migrating) or research on the origin of selenium inputs should be recommended when the outcome is not clear and migratory species are involved. Otherwise, we foresee that lack of specific guidance for these situations as resulting in issues with interpretation of the data when determining compliance or non-compliance. For example, the current fish tissue sampling protocol in Idaho recommends that young of year salmonids (defined as fish less than 100 millimeters in length) be preferentially collected where possible in the months of August or September to ensure that the fish that are collected have spent most of their life history in the stream (Idaho Fish Sampling Protocol Technical Team 2016).

Regular yearly sampling and more intensive sampling in targeted basins is suggested in this section, but no guidance is provided as to how to interpret variation between years or sites.

We also presume that even in some basins that are not targeted, there would be a benefit to sampling multiple sites within the basin.

3.3 Comments on Existing Resources and Information

We agree that all available existing data should be considered and utilized as necessary. However, because existing data may have been collected in conjunction with fish advisory programs to protect human health, it was likely collected with different end points in mind. The EPA should expand this discussion to provide guidance on how fish tissue collected for human health studies will be incorporated into monitoring and listing strategies by the states for selenium. Recommendations or discussion of how to incorporate these differing types of historical data that may not necessarily be collected consistent with the recommendations in this guidance document would also be useful. We recommend that the guidance provide enough flexibility for the states to allow data collected for different study types be qualified, and used only for preliminary assessments, and that final decisions are not made until additional data are collected. In addition, while historical data may be informative and could be utilized to indicate areas in which more targeted monitoring may be necessary, it would be helpful to have some guidance on what period of time would be considered when evaluating compliance or additional monitoring needs based on historical data, such as a recommendation to use data no more than five years old.

3.4 Comments on Sample Assessment: Analytical Chemistry

Although we agree that a list of test procedures and method detection limits (MDLs) provided in tables 5 and 6 is useful, this section would be even more informative if the EPA provided specific MDL targets for laboratories to meet. We would recommend a minimum of the 0.2 mg/kg limit achieved by EPA Method 6020A for tissues. We also would like to point out that the MDL for EPA Method 6010C of 5 mg/kg listed in the table may not be significantly lower than the tissue criterion of 8.5 mg/kg; the difference between these two values could potentially be within the realm of analytical error, this method should not be included in this table. Similarly, the MDL listed in Table 6 for EPA Method 200.8 Rev 5.4 (7.9 µg/L) is higher than the water column criteria for lotic and lentic waters of 3.1 and 1.5 µg/L, respectively; therefore, this method or detection limit should be excluded from this table. We are aware of labs using Method 200.8 that are able to attain much lower detection limits using this method than 7.9 µg/L. An appropriate detection level for comparison to the water column criteria values would be the 0.6 µg/L listed for EPA Method 200.9. Additionally, method 6020A listed in Table 5 for tissues, is also applicable to water, with a detection limit of approximately 0.7 µg/L, this method would also be appropriate.

3.5 Comments on Sample Assessment: Statistical Analysis

The support document cites EPA (2000) in recommending that the t-test be used to statistically compare the mean of all fish tissue data for a single species to the criterion to

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determine if the mean exceeds the water quality standard. This section should be expanded to provide more specific guidance as to what this means and to support whether use of a t-test for comparison is appropriate when comparing site values to a single criterion value. Limited amounts of tissue data or highly variable tissue data may not be appropriate for comparison using the t-test statistic. The ANOVA approach or use of a nonparametric statistical test may be more appropriate under some scenarios.

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4. Comments on EPA-F-820-16-009: *FAQs: Implementing WQS that Include Elements Similar or Identical to EPA's 2016 Selenium Criterion in Clean Water Act Section 402 NPDES Programs*

4.1 Comments on Q1-2 - Which elements of a four-part criterion for selenium should be used when implementing WQS through the NPDES permits program?

We agree that states or tribes should be able to use any of the elements of the four-part criterion for reasonable potential (RP) analysis. However, this concept is somewhat contradicted in the flowchart in Attachment 2, and in the responses to Q2-1 and Q2-4. For clarity, we recommend this question be deleted from Section 1 of this document and be covered only in Section 2, the discussion of RP determinations.

4.2 Comments on Q1-4 - May permit writers use mixing zones, initial zones of dilution, or dilution factors in NPDES permitting for selenium?

Q1-4 addresses the use of mixing zones or dilution factors for National Pollutant Discharge Elimination System (NPDES) permitting for selenium. The EPA's response is that because selenium is a bioaccumulative pollutant mixing zones should be handled as described in Chapter 5 in the Water Quality Standards Handbook (EPA 2014). However, the Water Quality Standards Handbook is referring to bioaccumulative pollutants for which human health risks are a concern, not protection of aquatic life. Mixing zones and dilution factors should be allowed for selenium where appropriate, as selenium does not cause a human health risk at levels near those which cause aquatic life impairment, and therefore should not be classified with other bioaccumulative pollutants.

4.3 Comments on Q2-1 - Which elements of a four-part criterion for selenium should be used for conducting RP analyses?

In response to Q2-1 the EPA states that "any of the elements of the criterion can be used by the permitting authority to determine whether the discharge causes, has the RP to cause, or contributes to an in-stream excursion above the state or authorized tribe's EPA approved WQC". The EPA then goes on to state that fish tissue concentrations not exceeding the fish tissue element does not mean there is no RP, and that the RP evaluation should then include

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an evaluation of the water column element of the standard. We do not agree with this approach.

As stated in the 2016 selenium criteria document the egg-ovary element supersedes all other elements, and muscle/whole-body supersedes the water column element. This is an appropriate approach because the tissue based elements are based directly on measured tissue concentrations and toxic effects in fish, while the water column element is based on modeling and includes multiple levels of uncertainty. Since the EPA intends for tissue based elements to supersede water column elements per the criteria document, this determination should apply in all situations, including RP analysis. If a receiving stream below an existing discharger is not exceeding the tissue-based element, which is the criterion value, then there is strong evidence that the existing discharger can continue historical selenium discharge amounts without RP to cause or contribute to an exceedance of the criteria in the future.. More specifically, even if the discharger is exceeding the water column element, if fish tissues in the receiving waters are in attainment this just indicates that the food web and bioaccumulation pathways (uptake and trophic transfer functions) in this particular system differ from those used in the back-calculation of the default water-column element and do not result in elevated fish-tissue concentrations. While there is acknowledgment of this uncertainty in converting tissue elements to water column concentrations in the criteria document, the document also says that uncertainty can be reduced by using site-specific data. Measured fish tissue concentrations from the receiving waters downstream of a discharger are, in fact, such site-specific data and are more appropriate for determining RP than the back-calculated water column criterion element.

Use of fish tissue concentrations to determine RP is also in alignment with the decision making process for assessment protocol. According to the EPA's FAQ's on implementing the criteria for 303(d) and 303(b), when fish tissues are below the criteria, the stream segment is considered attaining, regardless of whether the water column criteria is exceeded.

4.4 Comments on Q2-4 - If a state or authorized tribe has sufficient and representative fish tissue data available to demonstrate that selenium levels in fish tissue do not indicate an excursion of the fish tissue elements of the four-part selenium criterion, can that information be used to determine that there is no RP and, thus, no need for a WQBEL?

The response to Q2-4 somewhat contradicts the response to Q2-1, by noting that while the EPA considers the water column element to be the most appropriate predictor for whether the discharge has RP, there may be specific situations for which there may be a determination that there is no RP based on fish tissue concentrations. One of these situations is if the population of fish have already been exposed to existing levels of selenium and the system is determined to be in steady-state. However, there is no explanation in this document as to what data would be required to demonstrate "steady-state" (EPA 2016d). The EPA states in the selenium criterion document that it estimates that concentrations of selenium in fish tissue will not reach steady-state for several months in lotic systems and longer time periods in lentic systems (EPA 2016a). We recommend the EPA provide more specific guidance on what length of time constitutes steady-state. For example, we would recommend that if an existing discharger has been discharging into lotic waters for at least year, and there have been no other changes to selenium concentrations in the system, it should be presumed that this system is at steady state. This same approach can be used in situations where new discharges are constructed on streams that already receive selenium inputs and the new discharge does not appreciably change the selenium concentration in the receiving stream. The EPA should also provide guidance as to what specific information would be required to demonstrate that a new discharger is at steady-state, such as monthly effluent data initially to show either consistency with selenium concentrations or at least no increase in selenium concentrations over time.

The response to this question also states that fish tissue levels must be "significantly below the criterion's fish tissue element." There is no indication in the criteria document that attainment with the standard requires tissue to be "significantly" below the criterion. If tissues are below the criterion they are not exceeding the criterion. Safety factors that are inherent in the criteria derivation provide enough conservatism to allow a direct comparison of the fish tissue concentration to the criterion. Alternatively, application of a confidence interval could be considered when comparing multiple samples to the criterion, and would be useful in accounting for some of the variability in fish tissue results. The mercury implementation guidance states that RP may be found if tissues are below but "close" to the criterion and recommends applying a confidence interval such as the 95 percent upper confidence limit on the mean for use in comparing tissue values to the tissue based criterion.

As such, we recommend the EPA combine the responses to questions regarding RP to develop a more coherent and cohesive response. There is a discrepancy between the responses given to the questions, with one stating that you must revert to WQ data even if fish tissues are meeting the criteria and the other stating there are exceptions and fish tissue may be used to determine RP. Regardless, fish tissue data should and can be used to determine RP.

4.5 Comments on Q2-5 - In cases in which a discharge occurs at a lotic location and downstream waters are lentic waterbody types (e.g., lakes, impoundments), which selenium criterion water column element should be used in RP analysis?

The response to Q2-5 states that water quality and hydrological modeling may be needed to ensure protection of downstream waters. However, if a system is in "steady-state" modeling would not be necessary and a simpler option would be to determine if fish tissues in the downstream lentic waters are attaining the tissue criteria. If a discharge is ongoing and is not expected to change, and if fish tissues are in attainment in downstream lentic waters this would indicate the upstream discharge is not impacting the lentic system, and would not be expected to impact the system in the future. There are many factors affecting the uptake in different types of waterbodies that would be difficult to account for using hydrological modeling. The use of actual data is much more straightforward and eliminates uncertainty and assumptions.

GEI has conducted studies in regions where they have observed naturally elevated water column and tissue concentrations in the lotic waters, but attaining values in the downstream lentic waters. For example, in a study conducted in the Cottonwood Creek watershed in the Denver metro area in Colorado, selenium in the water column was found to be elevated in the creeks due to the natural geology in the region. Fish tissue concentrations in one of these creeks were also elevated and ranged from 12.6 to 17.5 mg/kg dw. However, tissues collected from the reservoir located approximately 1 mile downstream ranged from 3.3 mg/kg dw whole-body to 4.4 mg/kg dw in egg/ovary tissue, values which are both well below the criterion. This demonstrates that lotic and lentic systems are very different, and concentrations in one cannot necessarily be used to predict the other.

4.6 Comments on Q3-1 - Can an NPDES permitting authority using a state- or authorized tribal-adopted standard based on or similar to EPA's recommended four-part selenium criterion derive selenium NPDES permit WQBELs for a noncontinuous or intermittent effluent discharge containing selenium? How?

The response to Q3-1 states that the intermittent element can be used for determination of NPDES permit limits for non-continuous or intermittent discharges. We do not recommend use of the intermittent element to develop permit limits. The intermittent element equation is based on the number of days that the discharge occurs, and it is unclear how this could be incorporated in an NPDES permit, since for many intermittent discharges the discharge is dependent on volume, storm events, or other factors and the number of days that the discharge would occur is unknown and would not be able to be incorporated into the permit prior to occurring. One option would be to include the equation itself as a permit limit, this would allow the intermittent limit to be calculated and reported on the discharge monitoring report once the factors above are known. It is possible that there could be instances where an intermittent discharger has regular discharge intervals and the last five years of data could be used to estimate a discharge frequency. However, this would only apply to limited situations.

Alternatively, an acute standard may be appropriate for these situations if discharges occur at a frequency and duration that is less than a chronic exposure. While the EPA has not provided a true acute criterion, other studies have shown that such a value can be derived using biokinetic modeling to ensure that short term pulses do not exceed exposures that could result in non-attainment of the fish tissue criterion (e.g., DeForest et al. 2016).

4.7 Comments on Q3-2 – Can an NPDES permitting authority develop permit limits (WQBELs) for a four-part selenium criterion using the fish tissue element(s) of a four-part criterion (i.e., egg-ovary or whole body and/or muscle) rather than the water column element?

The response to Q3-2 states that the water column element should be used to develop water quality based effluent limits (WQBELs) in NPDES permits and that the EPA has not developed guidance for calculating a WQBEL directly from a fish-tissue criterion element. Use of fish tissue should be an option and we recommend the EPA provide general guidance on developing permit limits from the tissue criterion element rather than leaving it open to broad interpretation. While a tissue based permit limit may not be desirable in all situations, such as when there are multiple dischargers or selenium sources in a waterbody, there may be instances in which it would be beneficial. For example, if a permittee has demonstrated that fish tissue concentrations are attaining the criterion, but the permit writer has other reasons for including a selenium limit even though there should technically be no RP, it may be beneficial for a permittee to request a tissue-based permit limit.

We understand that any option being considered for implementation of tissue-based limits must address all aspects of permitting including monitoring and reporting requirements, potential use of mixing zones, antidegradation considerations, and total maximum daily loads (TMDL) for the site. While challenges exist for each of these permitting components, options do exist for implementing a tissue-based permit limit.

Monitoring requirements for a tissue-based permit limit could include an annual or semi-annual sampling requirement, with the requirement to meet the EPA's fish tissue criteria values unless site-specific standards have been established. While there may be concern with infrequent monitoring, this would be similar to whole effluent toxicity (WET) testing, in which samples are often collected quarterly, and in some cases only semi-annually or annually.

Another option would be to implement a permit "trigger" water column concentration similar to what Kentucky has included in their selenium criteria implementation. This water column trigger could be based on the assumption that if fish tissue are meeting the EPA criterion values in the receiving water, the current selenium concentrations being discharged from the facility result in attainment, therefore the trigger could be set to match the discharge concentration.

As discussed in Section 4.2, the concerns with mixing zones for bioaccumulative pollutants was based on human health risks, not protection of aquatic life. Mixing zones and dilution factors should be allowed for selenium, as selenium does not cause a human health risk at levels near those which cause aquatic life impairment, and therefore should not be classified with other bioaccumulative pollutants. The selenium fish tissue concentration is unlikely to change dramatically based on exposure to mixing zones unless the full life cycle of the fish exists within the mixing zone.

According to the EPA's Water Quality Standards Handbook, "The antidegradation review requirements of this provision of the antidegradation policy are triggered by any action that would result in the lowering of water quality in a high-quality water." Should fish tissue limits be implemented, the concentration in the tissue would be a reflection of the water quality. It is likely states would need to make revisions to their antidegradation and antibacksliding policies to be able to compare tissue limits to previous water column limits. The most straightforward way would be to assume that if water column concentrations were in attainment in the receiving water during the previous permit cycle, any fish tissue collected during that same permit cycle represents attaining conditions. Therefore, if the permit limit for the next permit cycle is set to be in line with the fish tissue concentrations measured in the receiving water during the previous permit cycle, these attaining conditions are maintained and there would be no degradation of the water quality.

Discharge to an impacted stream segment would require the evaluation of a TMDL. The new EPA tissue based criteria allows for 303(d) assessments to be based solely on tissue samples collected in the stream segment; however, the EPA expects the TMDL to be implemented through a water column criteria, which may be site-specific if necessary. If a TMDL is established based on tissue limits, the tissue-based permit limit could easily be evaluated in the context of the TMDL. For example, if a TMDL for the entire stream segment is set at 12.0 mg/kg dw (egg/ovary) of a certain species, representative fish collected for the segment would have to remain below that amount. Unlike typical TMDLs which allocates a small portion of the pollutant to each discharger, a single tissue based TMDL would be included for each discharger. This approach facilitates communication amongst dischargers along a stream segment encouraging them to coordinate the collection of data and in turn, collectively work to reduce the tissue based TMDL.

4.8 Comments on Q3-3 - EPA's 2016 selenium criterion does not include an acute expression. Must permits contain both short- and long-term limit expressions?

Question 3-3 discusses the need for permits to include both short- and long-term limits even though the EPA has only provided a monthly average criterion element and an intermittent exposure element. The response states that both maximum daily and average monthly limitations (or average weekly and average monthly for publicly owned treatment works) are required "unless impracticable." Because selenium toxicity is based on long term dietary uptake of selenium and maternal transfer it does seem impracticable (and unnecessary) to determine acute and chronic limits for all dischargers. In most cases, with a continuous discharge, monthly limits are appropriate, and there is no need to develop acute limits since use of the intermittent equation to calculate an acute limit would result in a value equivalent to the monthly average value anyway. There may be certain situations where an acute limit may be necessary, depending on discharge frequency and potential for instream dilution, but these situations are likely very limited.

There are other parameters for which acute and chronic limits are not implemented in NPDES permits. The WET limits are an example in which, in many cases, either acute or chronic limits are present in permits, not both. WET is not a standard toxicant, and is designed to evaluate the potential combined toxicity of pollutants in effluent. In the permits issued under the Colorado Discharge Permit System, the determination to use acute or chronic WET limits is based on the instream waste concentration (IWC = [Facility Flow / (Stream Chronic Low Flow + Facility Flow)] x 100%). If the IWC is greater than 9.1% the permit will have chronic WET limits and if the IWC is less than or equal to 9.1%, or the stream does not have an aquatic life use, acute limits apply. Because selenium is not a standard toxicant either, in that its toxicity is a result of longer term dietary uptake, a similar approach should be taken for selenium limits in permits.

4.9 Comments on Q3-4 - NPDES regulations require that permit limits for metals be expressed as total recoverable; however, selenium is a nonmetal or metalloid. Should selenium be expressed as total recoverable in WQBELs and, if so, how should an NPDES permitting authority translate the dissolved selenium water column element of EPA's 2016 selenium criterion to a total recoverable selenium NPDES permit limit?

The response to Q3-4 suggests that a total recoverable-to-dissolved selenium ratio of 1.00 be used to calculate total recoverable permit limits from the dissolved selenium water column. While we agree that it is often necessary to use a default ratio, it should be clarified that there are options for calculation site-specific translators if data are available. There is a history of use of a selenium translator that differs from 1.00. The EPA previously reported that 92.2 percent of the selenium in Belews Lake was dissolved, resulting in a total recoverable-to-dissolved selenium ratio of 1.085. This ratio has been used by several states (Colorado and Utah) to convert the EPA's former total recoverable chronic criterion of 5 µg/L selenium to a dissolved chronic criterion of 4.6 µg/L dissolved selenium. If applied to the EPA's current dissolved criterion values of 3.1 µg/L lotic and 1.5 µg/L lentic this ratio would convert the criterion values to total recoverable values of 3.4 µg/L and 1.6 µg/L. Although these changes seem minor, when applied to permit limits, use of a total recoverable-to-dissolved selenium ratio other than 1.00 could result in larger differences. Alternatively, the EPA could use the updated selenium database to calculate a new translator ratio based on concentrations reported in the studies that were used for criteria derivation if the appropriate data are available.

4.10 Comments on Q4-1 - What EPA analytical test methods are recommended for use in analyzing water and fish tissue samples for selenium under EPA's NPDES program?

Comments regarding this question/answer are found in Section 3.4.

4.11 Comments on Q5-1 - Would a compliance schedule be allowed in an NPDES renewal permit in which a WQBEL is being replaced with a more stringent permit limit based on EPA's 2016 selenium criterion?

The response to this question states that a compliance schedule would "possibly" be allowed. This contradicts the Draft *Technical Support for Adopting and Implementing EPA's 2016 Selenium Criterion in Water Quality Standards* is which compliance schedules are specifically listed as an option for implementing the selenium criterion. Compliance schedules should be allowed in all cases as the new the EPA water column criterion element is significantly lower than the previous criterion and will likely require dischargers to make operational changes in order to meet them.

5. Comments on EPA-F-820-16-008: *FAQs: Implementing the 2016 Selenium Criterion in Clean Water Act Section 303(d) and 305(b) Assessment, Listing, and Total Maximum Daily Load (TMDL) Programs*

5.1 Comments on Q1 – How should states, authorized tribes, and territories implement EPA's 2016 selenium criterion in their assessment and section 303(d) listing programs?

As discussed in Section 4.4, further discussion and a clear definition of steady-state should be included in the technical support documents and FAQs since the decision matrix is based on a determination of whether a waterbody is at steady-state.

While we agree with the decision matrix for situations in which fish tissue and water column data are available, we do not agree with scenario 8 if fish tissue are not available due to the waterbody being a fishless water (EPA 2016c). Viable fish populations cannot become established in stream reaches with limited or unsuitable habitat, as is often characteristic of ephemeral, intermittent, and headwater streams. Attainment of the water column criteria in these streams will not result in fish inhabiting the waterbody when their absence is due to physical habitat limitations. In addition, water in many of these streams is only flowing in certain reaches and may rarely (if ever) reach downstream waters. In these cases, the lack of connection downstream naturally inhibits the migration of any fish into these waters. We would argue that an alternative to assessment of fishless waters could be the requirement to collect fish tissue data at the nearest downstream exposure point and compare those values to the fish tissue element of the criterion. If downstream waters that support fish are in attainment with the fish tissue criterion, it is not necessary to implement unreasonable water quality standards to protect non-existent fish in upstream waters.

A second alternative for waters with insufficient habitat and/or flow to support a fish population on a continuing basis could be evaluation based on invertebrate tissue concentrations instead of water column concentrations. Evaluation of invertebrate tissue concentrations is more in line with protection of the existing aquatic life, and toxicity data presented in the selenium criterion document for invertebrate species (EPA 2016a). In fact, the research cited in the technical support document for fish tissue monitoring states that selenium bioaccumulation in insects provided a more accurate measurement of accumulation risk in the food chain than selenium concentrations in the water column (EPA 2016b). This is a further indication that it would be more appropriate to evaluate fishless waters on the basis of selenium concentrations in macroinvertebrate tissues relative to macroinvertebrate toxicity data than the current recommendation to use water column concentrations. The discussion on mussels and clams further supports this, as it points to the differences in potential selenium bioaccumulation based on differences in macroinvertebrate communities.

Overall, use of a water column criterion element that is back-calculated from a fish tissue-based criterion is not appropriate in waters that do not support fish populations because of habitat or flow restrictions – particularly because macroinvertebrates are known to be less sensitive than fish, as documented by toxicity values listed in EPA's criterion document and EPA's reference to field studies that demonstrate they are less sensitive than fish.

5.2 Comments on Q5 - Should states and authorized tribes complete assessments and section 303(d) listings for waterbodies that have only selenium water column data?

When water column data are the only data available and they indicate an exceedance of the criterion, the EPA should recommend states and tribes not place the waterbody on a 303(d) list, but rather move such waterbodies to a type of monitoring or provisional list and require the collection of fish tissue data to confirm whether listing of a waterbody is necessary. For example, Colorado currently uses this approach such that if a water is not determined to be "impaired" but further evaluation is needed they place these waterbodies on a "monitoring and evaluation" (M&E) list. Because most 303(d) listing cycles are two-year cycles, this would allow sufficient time for collection of fish tissue data prior to the next listing cycle. This would reduce the need for states to put extensive effort into developing TMDLs for situations where they may not be needed.

5.3 Comments on Q6 - How should states and authorized tribes complete assessments and section 303(d) listings for fishless waters?

The comments for Q1 that were associated with assessment of fishless waters are also applicable to this comment.

5.4 Comments on Q7 - How should states and authorized tribes complete assessments and section 303(d) listings using fish data?

The EPA's answer to this question indicates that states and tribes should assess the waterbody using the water column elements of the criterion if target species are not captured or present. We do not agree with this, the waterbody should be assessed using fish tissue data from any species present. We have conducted studies on many streams that supported healthy fish populations but did not include any of the species listed in the table. As such, fish tissue data from any available species provides more valuable information to evaluate against the fish tissue element of the criterion rather than evaluation of the water column element.

However, the guidance should allow additional flexibility for states to evaluate the potential that such available fish species may not be as sensitive as those that drive the criterion and comparisons may not necessarily lead to impairment decisions simply because of that.

5.5 Comments on Q8 - How should states and authorized tribes complete assessments and section 303(d) listings when there are data for multiple fish species?

The EPA should give more consideration to the use of data from multiple fish species in which average selenium concentrations are less than the fish tissue criterion for most species but higher than this criterion for other species. If the species in exceedance had toxicity data available that indicated that the tissue concentration is less than the EC_{10} for the species, the waterbody should be given further consideration before listing it as impaired. See also our response in Section 3.1.3, in which we discuss concerns with target species.

5.6 Comments on Q9 – How should states and authorized tribes complete assessments and section 303(d) listings when there are multiple samples for a single fish species?

While we agree with the flexibility provided in the EPA's answer to Q9, recommendations as to how to interpret varying results when there are multiple samples for a single fish species would be helpful. This would include some specification as to the temporal and spatial variability that would be considered acceptable when averaging fish tissue values or compositing fish tissue samples. Further guidance would result in a greater ability to compare data within or across states.

5.7 Comment on Q10 - How should states and authorized tribes complete assessments and section 303(d) listings when there are anadromous or potamodromous fish species in the waterbody?

We agree with not using adult anadromous fish for completing water quality assessments. While we agree that life histories of potamodromous fish should be considered, and the migration period may be the optimal time frame for the collection of egg/ovary tissue samples, attributing these data to the correct stream reach or waterbody accountable for the selenium bioaccumulation versus the actual reach the fish were collected in will be difficult in some cases. This was addressed in more detail in Section 3.2.

5.8 Comment on Q11 - How should states and authorized tribes complete assessments and section 303(d) listings when there are new inputs of selenium?

Our comments on defining “steady-state” in Section 4.4 are also applicable to the answer to this question.

6. Conclusion

Overall, if the changes outlined above are made, we believe this guidance will be useful for stakeholders in the implementation of EPA's tissue-based selenium criterion. We are not sure splitting them into four separate documents is necessary, however, and some consolidation and reduction in redundancy by combining into a single guidance document may benefit the reader.

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Review of EPA 2015 Draft Se Criteria Document

EPA 822-P-15-001

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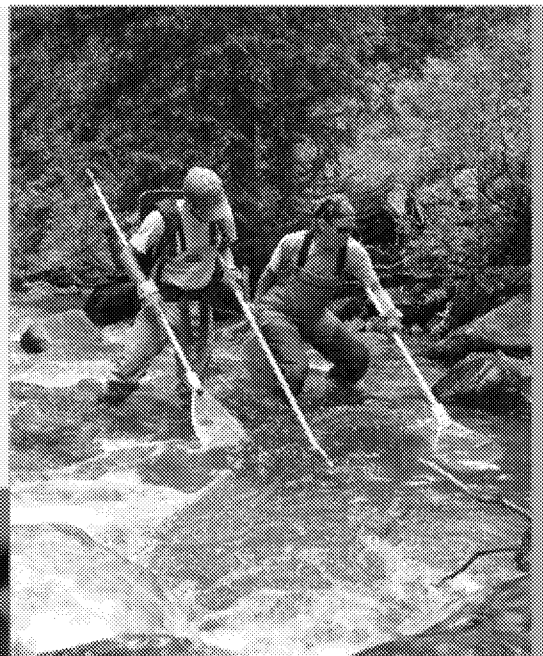
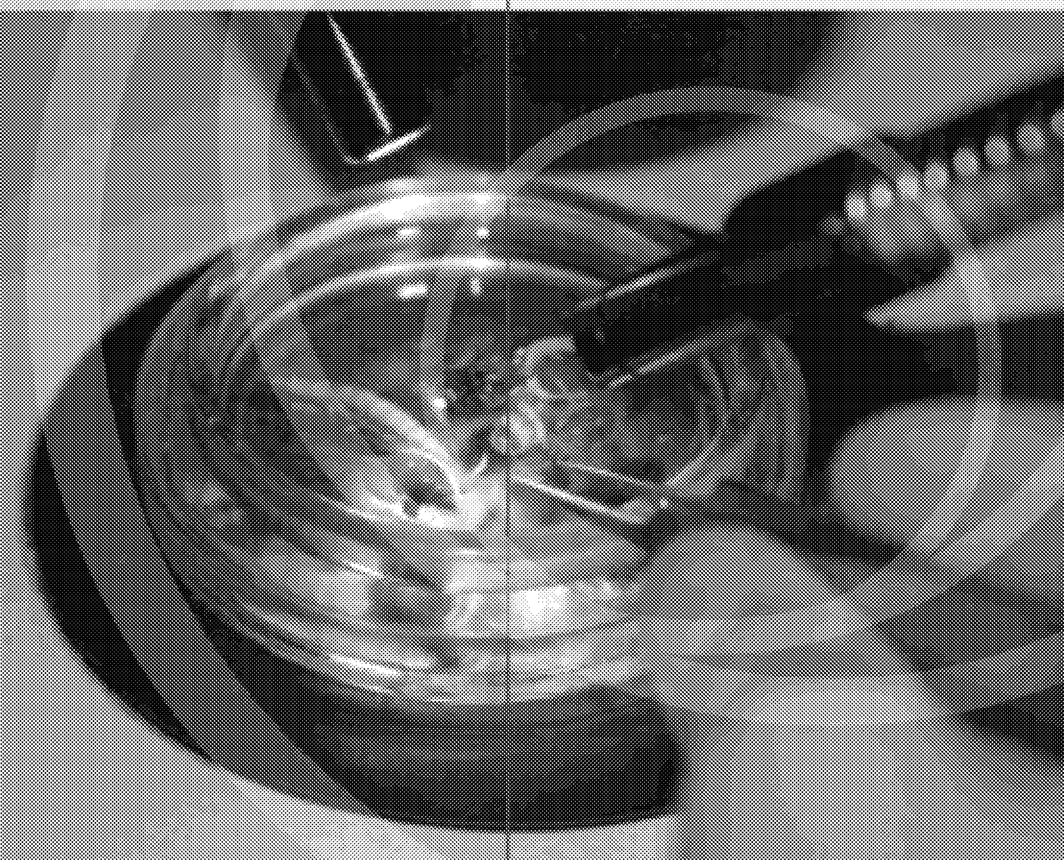
October 2015





Review of EPA 2015 Draft Se Criteria Document

EPA 822-P-15-001

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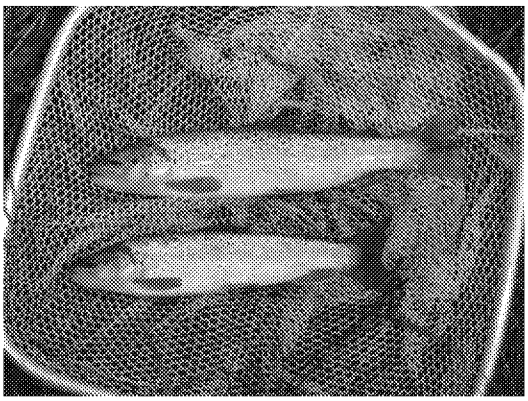

Submitted to:
Docket ID No. EPA-HQ-OW-2004-0019

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Executive Summary

GEI Consultants, Inc. (GEI) toxicologists, water quality specialists, and regulatory strategists are recognized experts in water quality effects on aquatic life. In fact, our significant experience related to selenium (Se) spans over 20 years of study at sites throughout the U.S. and Canada. We frequently provide expert testimony and support for regulatory water quality hearings, environmental assessments, and ambient water quality standards development. Our personnel have served as invited experts for Se risk evaluation in aquatic environments for the Society of Environmental Toxicology and Chemistry, provided peer review for Se effects issues near coal mining sites in British Columbia (on behalf of the BC Ministry of the Environment), and provided technical review of Se issues for the North American Metals Council – Selenium Working Group, as well as other water quality issues for the National Mining Association (NMA). We have been involved with Se-related issues in waters throughout the U.S., including the collection of considerable water quality and biological data from a wide variety of waterbodies, evaluation of Se bioaccumulation trends, detailed Se source and fate identification, and development of site-specific Se standards. As such, we believe we can provide a unique perspective on this draft criterion and respectfully submit the following comments.

As stated in our prior review of the 2014 draft document, we commend EPA's effort in developing Se criteria that are generally consistent with the latest science regarding Se toxicity. We support the use of a fish-tissue based chronic criterion as the overriding criterion, as this is the most ecologically relevant measure of toxicity for Se. We also agree with the use of EC_{10}s rather than some other endpoint, as this is the more conservative approach. We also support EPA's conclusions regarding the timing of tissue data collection that samples collected within one year of each other are reasonable for acceptability.

We do have some concerns with several of the data decisions made by EPA in calculating the chronic tissue criterion concentrations. We have provided recommendations on revisions to the White Sturgeon, Bluegill and Brown Trout genus mean chronic values (GMCVs) or species mean chronic values (SMCVs). Should our recommendations be accepted, the result would be small, but significant, changes, with an egg/ovary criterion to 17.9 mg/kg, the whole-body criterion to 9.5 mg/kg, and the muscle criterion to 12.0 mg/kg. These revisions are based on our reanalysis of the studies, recalculation of conversion factors, or both.

We do not agree with the approach used to develop national water-column criteria. Our review provides discussion on why single nationwide standards are not appropriate and why site-specific water-column standards, calculated using EPA's Equation 18 from the criteria document, are a more scientifically justifiable approach. In addition, we provide an example of how limited the data set is, and how inclusion of additional data can make a substantial difference in the calculated water column criteria. Lastly, we would strongly recommend

EPA consider changing the paradigm for National Pollution Discharge Elimination System (NPDES) permitting such that direct use of tissue criteria would be possible. To our understanding, there is nothing in the Clean Water Act that would preclude this. By writing permits to the most defensible endpoint of tissues, EPA would eliminate the need for backing into water concentrations by methods that invariably add significant error and uncertainty.

There are several other components of the criteria that should be reevaluated by the EPA. The use of "never to be exceeded" frequency for the tissue criteria is inappropriate and not in line with standard criteria attainment requirements. We recommend clarification of tissue sampling requirements and use of an alternative approach such as the geometric mean of samples collected, with an allowable exceedance frequency of no more than once every three years on average – consistent with other criteria. Another issue that requires reevaluation is how to establish criteria for streams with no existing fish populations. The default by EPA is to use water-column criteria; however, we provide discussion of an alternative involving use of the chronic invertebrate data provided in the EPA document.

Another topic that needs further consideration is providing discussion for how to use natural background Se concentrations to develop ambient based site-specific criteria (either tissue or water-based) where elevated concentrations are present unrelated to human-induced sources. EPA's discussion of site-specific standard development includes nothing on this issue (despite our raising this point last year) and needs further clarification.

We have some concern with the EC_{10} calculations used in the document such as the use of TRAP for all statistical analyses and we recommend EPA consider other options as well. We have also provided additional information regarding calculation of egg/ovary to whole-body conversion factors (CFs), which we used to revise the GMCVs and SMCVs discussed previously.

Overall, this document is a substantial improvement over pre-2014 Se criteria documents, and we look forward to the final draft document, with the hope our recommendations are taken into consideration.

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1. Introduction

The EPA approach in the 2015 draft Se criteria document is more in line with standard water quality criteria development methodology (Stephan et al. 1985) than previous attempts at revising and updating the Se criteria, and includes a critical evaluation of 16 studies on various fish species and results in Se tissue thresholds for twelve fish species in ten genera. Criteria calculations follow recommendations by Stephan et al. (1985) and use the 5th percentile calculation accounting for the relative sensitivities of all species in the data set. This approach results in more scientifically defensible criteria than the previous draft tissue criterion based on a single study.

We would like to acknowledge the extensive effort that EPA and others put into development of these updated chronic Se criteria and realize that considerable attempts were made to create a scientifically sound criteria document. However, it seems that even though a substantial number of interested parties provided written comments to the first draft of this criteria document in 2014, the majority of these comments do not appear to be addressed in the criteria, with no responses provided as to the reason why particular comments were not considered in the revision beyond responding to those provided by the peer reviewers. Having ecologically relevant water quality criteria based on current science is of great importance to the scientific and regulated community and we appreciate this opportunity to again provide our comments and recommendations on the 2015 draft Se criteria document.

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2. Positives

As we stated in our review of the 2014 draft document, this document and the tissue-based criteria approach is a significant improvement over the 2004 draft criteria document (EPA 2004). We strongly support EPA's decision to develop Se criteria that are toxicologically and ecologically relevant.

The document is clearly laid out, follows standard protocols for water quality criteria development, and includes thorough descriptions of the steps used in development of the criteria. We are in support of the following core components of the 2015 draft criteria document (see Sections 2.1 through 2.4 below):

- Tissue-based standards,
- Use of EC_{10}s, and
- Timing of tissue data collection
- Exclusion of juvenile survival data

In addition, in Sections 3 and 4 of this review, we have provided several recommended revisions and considerations that we believe will make the 2015 draft criteria document even more scientifically sound.

2.1 Tissue-based Standards

As stated in our previous review, we strongly support the approach of a fish tissue-based Se chronic criterion approach (egg/ovary and whole-body) in the final document as the primary criterion. Fish tissue-based Se criteria are consistent with the latest scientific information regarding the toxicology of Se to aquatic life. Tissue-based criteria are the most ecologically relevant for Se, as they are based on the chronic toxicity pathway which includes bioaccumulation of Se through dietary exposure and incorporates such variables as chemical reaction rates and exchange rates between sediment, water, and organism (Brix and DeForest 2008, Chapman et al. 2009). In addition, we strongly urge EPA to consider how such tissue-based criteria can be directly incorporated into NPDES permitting, as discussed further later in this review.

2.2 Use of EC_{10}s

We agree with the use of EC_{10} values to develop the tissue-based Se criteria, as data allow. Use of EC_{10}s is more conservative and consistent with other recent approaches (e.g., DeForest and Adams 2011). In addition, for many of the studies, other endpoints (e.g., EC_{20}) may not be able to be determined based on the response curves observed in the data.

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We also understand that not all available studies provide sufficient data to reliably calculate EC_{10} values. In general, we support the data decisions used by EPA for those studies, with the exception of the suggested modifications for specific studies and their data noted later in our review (Section 3.1).

2.3 Timing of Tissue Data Collection

We support EPA's conclusions that selenium measurements from samples collected at the same site within 1 year can serve as matched pairs of measurements, and feel the timing of tissue data collection will be an important component of implementing tissue-based criteria into NPDES permits and general 303(d) assessments. Allowance of appropriate sampling windows provides time for analysis of effluent data and potential follow-up tissue sampling. In addition, this large sampling window could be very important in ephemeral and intermittent aquatic systems where water may only be present during certain times of the year, resulting in limited time periods to conduct fish sampling.

2.4 Reliance on Maternal Transfer Rather Than Juvenile Survival Data

We would like to point out one additional point which we strongly agree with. We support EPA's decision to not rely on juvenile survival data, including overwinter survival, in developing the Se criteria. Although winter-stress may be a valid hypothesis, there are no data supporting its occurrence in the field (Janz 2008). Additionally, if other commenters have concerns with the exclusion of winter-stress data, we would recommend directing them to the Bluegill studies by Hermanutz et al. (1992, 1996), which included Bluegill exposed to year-round seasonal conditions in an outdoor test system, and thus include "winter stress" under natural conditions.

3. Key Issues and Recommendations

While the 2015 draft Se criteria are an improvement over previous criteria, there are some key areas of the criteria that we feel still need closer examination and revision. We presented many of these recommendations and revisions to these key issues in our review of the 2014 draft, but most appear not to have been addressed. We provide additional comments on these areas below, and a further discussion of new concerns on the 2015 draft.

3.1 Review of Toxicity Studies Used for Criteria Development

The 2015 draft Se criteria document includes reproductive toxicity study data for nine fish genera (Table 3.1, page 40). As noted previously, overall, we concur with most of the data usage decisions made by EPA. However, we would like to reiterate some of our comments and suggestions on the data that were used to develop the egg/ovary chronic criterion (and subsequently, the whole-body and muscle criteria), as well as provide new comments and suggestions. We believe incorporation of these suggested changes would result in an egg/ovary chronic criterion that is even more scientifically defensible and have greater consistency with EPA's other data-usage decisions used elsewhere in their document.

3.1.1 General

As with the 2014 review, we examined each of the data points deemed acceptable by EPA for use in the egg/ovary criterion calculation (Table 3.1, page 40) to determine if we saw any potential issues with EPA's use of the data.

We continue to have some concerns with the use of TRAP for all data analysis (described in Section 4.2), although we do understand the value in standardizing the calculation of chronic values from each study by using one statistical approach. However, many of the values calculated by TRAP differ considerably from those calculated by the study authors. We would recommend EPA consider comparing effects calculations using other standard toxicological statistical programs to better understand the variability among programs and any implications of their choice to use TRAP for the resulting criteria.

3.1.2 White Sturgeon

In the 2015 draft criteria document EPA included data from the Linville (2006) White Sturgeon study. These data were not included in the 2014 draft, but White Sturgeon is now the most sensitive species in the database. This study was a dietary exposure in which adult female sturgeon were fed a Se spiked diet, and effects on larvae were measured. Larval effects were observed for edema and deformities.

EPA calculated an EC_{10} for total deformities (edema + skeletal) of 16.3 mg/kg using TRAP. This value was calculated based on a partial dose response. When data from this study are analyzed, TRAP warns that data should only be used for "exploratory purposes." Due to the partial response in the data, the calculation is highly dependent on the initial guess used for the slope in TRAP. In fact, in Appendix C (EPA 2015), EPA shows how choice of initial slope can affect these calculations, with EC_{10} values ranging from 16.3 mg/kg to 19.1 mg/kg when using different slopes. EPA selected the most conservative value for use in criteria development, even while acknowledging there was no scientific reason one value was more valid than another (and, in fact, all calculated values were statistically identical).

Generally, use of an EC_{10} based on a partial response is not appropriate for national criteria development, especially when it results in a value becoming the "most sensitive" and thereby driving the final criterion. In fact, on page 33 of the 2015 draft criteria document EPA states that "an EC10 based on only one partial response would not ordinarily be included in the data set." A similar partial response was observed in the Fathead Minnow data from the GEI 2008 study; EPA excluded these Fathead Minnow data from the chronic dataset because of an "insufficient response." EPA's reasoning for using the White Sturgeon data that had only a partial response is that there are data that suggest that the federally-listed Green Sturgeon is also sensitive to selenium. The Green Sturgeon study consisted of effects on survival and percent body weight in juvenile sturgeon and is not comparable to the reproductive endpoints in all other studies used for criteria development. However, we realize that EPA is concerned with protecting any threatened or endangered species, and the criteria document states that the White Sturgeon serves as a surrogate for other sturgeon as well.

Although the White Sturgeon data are somewhat questionable, they are important data due to the threatened or endangered listings of other species of sturgeon. However, we do recommend revisions to the EC_{10} value used for criteria calculations. As stated previously, the EC_{10} is based on only a partial response, therefore when the threshold sigmoid nonlinear regression model in TRAP is used, several curves may be fit by varying the slope used in the calculation. In Appendix C of the 2015 EPA criteria document, four EC_{10} values have been calculated, all with the same goodness of fit. While EPA chose the most conservative value for use in criteria calculations, we recommend use of the geometric mean of the four EC_{10}s, as they are all equally valid. This results in an egg/ovary EC_{10} of 17.8 mg/kg dw for White Sturgeon (Table 2).

3.1.3 Bluegill

In the 2015 draft Se criteria document, EPA utilized three Bluegill studies in the derivation of the tissue-based criteria: Doroshov et al. (1992), Coyle et al. (1993), and Hermanutz et al. (1992, 1996). While we agree with the use of the Doroshov et al. (1992) and Coyle et al. (1993) studies, we have several concerns regarding the use of the Hermanutz et al. (1992, 1996) data.

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EPA reported an egg/ovary EC_{10} of 12.68 mg/kg for the Hermanutz et al. (1992, 1996) studies. This value was derived through a reanalysis of the data using TRAP and combining results from Studies I and II (Hermanutz et al. 1992, 1996) – in other words, they actually combined data from studies conducted over two different years, a data usage practice rarely used in criteria development. EPA elected to exclude Study III and several streams from Study II because they were considered to be "recovering" streams and were no longer receiving aqueous Se dosing. However, fish in these streams were obviously exposed to dietary Se throughout the study, which is the same exposure route that was used in other studies considered acceptable by EPA, such as the Linville (2006) White Sturgeon study, the Doroshev et al. (1992) Bluegill study, and the CP&L (1997) Largemouth Bass study. It is unclear why these dietary studies were included in the criteria development and the "recovering" streams from Studies II and III, which showed no effects, were not.

In addition, we previously expressed several concerns about the results of Studies I and II and the resulting analysis:

- The studies were conducted 1 year apart, which resulted in significant variation in all of the measured water quality parameters between the two studies.
- There were differences in how EPA analyzed and used the data from the two studies in Appendix C (see pages C-107 and C-108 of the 2014 draft Se criteria document).
- There were differences in egg and larvae survival between Studies I and II (see pages C-107 and C-108 of the 2014 draft Se criteria document).
- The ovary Se concentrations resulting from the same water exposures were quite different. These variations raise concerns that differences in Se uptake, bioaccumulation, exposure, or other factors could have been occurring between Studies I and II.
- In Study I, geometric mean ovary Se concentrations were higher in the 10 µg/L exposure (17.71 mg/kg) than the 30 µg/L exposure (15.46 mg/kg). Related to the concerns discussed above, this unexpected result indicates there may have been an issue with study conditions that caused inconsistencies with Se uptake, bioaccumulation, or exposure.

Based on these concerns, as well as the omission of any data from Study III, we recommend the Hermanutz et al. (1992, 1996) data could be completely removed from the database used for criteria derivation altogether. If only the other two chronic values for Bluegill (20.75 mg/kg [Doroshov et al. 1992] and 24.55 mg/kg [Coyle et al. 1993]) are used, a Bluegill egg/ovary GMCV of 22.57 mg/kg would be appropriate, and show that the value EPA derived from the Hermanutz et al. studies would be an outlier.

3.1.3.1 Use of Only Egg Data from Bluegill Studies with Egg and Ovary Data Available

Both Doroshov et al. (1992) and Coyle et al. (1993) present tissue data for both ovaries and eggs. It is unclear why EPA only used egg data from these studies and did not include both egg and ovary tissues as an average value. On page 78 of the 2014 draft Se criteria document, EPA suggests that it is appropriate to use the average of egg and ovary concentrations when both tissues are reported when deriving CFs. We recommend EPA include data for both ovaries and eggs, or at the very least provide details about its preference for egg versus ovary tissues, as this information will be important to make sure future toxicity testing and criteria implementation include measurement of Se in appropriate tissues.

3.1.4 Brown Trout

In the 2015 draft Se criteria document, EPA utilized Brown Trout data from Formation Environmental (2011). During this study, a tank overflow accident occurred which resulted in the loss of several study fish. In the 2014 draft, EPA presented two approaches for dealing with this loss of these study organisms: 1) assume that all fry lost were dead or deformed ("worst case" assumption) and 2) assume that fry lost had the same rates of mortality and deformities as those not lost ("optimistic" assumption). In the 2014 draft, EPA chose to assume the "worst case" scenario and derived an egg/ovary EC_{10} of 15.91 mg/kg using the results from that scenario and the deformity alone endpoint. In the 2015 draft EPA acknowledged the uncertainty with how to best address the loss of fish, and decided to calculate an EC_{10} for survival only during the first portion of the test, prior to the accident. This resulted in calculation of an EC_{10} of 18.09 mg/kg egg dw for larval survival.

We still believe that all appropriate data from this study should be used and that the "optimistic" scenario should be considered, as it reflects what was observed in the remaining population (i.e., the fish not lost to overflow). EPA did not provide any reasons for why use of all data with the "optimistic" assumption is not a valid approach. As stated previously, throughout GEI's 25 years of conducting toxicity tests in our laboratory, we have observed that dead fish actually collect at the bottom of the aquarium not at the top, where fish would be more likely to be lost in an overflow event. Therefore, based on what has been observed in standard toxicity tests EPA should use their "optimistic" (i.e., what we consider to be realistic) assumption, and continue to use the entire data set that provides both survival and deformity information, rather than just using survival data from one portion of the test.

We also believe there is no valid reason to use the deformities endpoint alone when the combined survival and deformities endpoint is available. In fact, this is more in line with the EPA's previous approach in the 1999 ammonia criteria document where they used the combined survival and growth endpoint, termed "biomass." Additionally, there were no difficulties in using TRAP to fit the combined data, and these data and resulting graphs are provided in Appendix C, Figure 1 of the EPA 2015 draft Se criteria document. When these

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combined data are used, the EC_{10} for the "optimistic" assumption is 21.16 mg/kg for egg/ovary, which we recommend as an appropriate and protective Brown Trout chronic value.

3.2 Additional Fish Species

Another fish family used in development of the EPA criterion was Poeciliidae, which includes *Gambusia holbrooki* and *Gambusia affinis*. These fish are livebearers and were not included in development of the egg/ovary value, but were used as one of the values in the dataset, increasing the N used in calculations.

There are three additional fish species that could also be included to increase the number of values in the dataset. Although no valid reproductive studies have been conducted on these species, similar to the EPA decisions on invertebrates, field studies have demonstrated that these species are not sensitive to elevated selenium concentrations so they could be used to increase the N. Central Stonerollers (*Campostoma anomalum*), Red Shiner (*Cyprinella lutrensis*), and Sand Shiners (*Notropis stramineus*) were able to maintain successful reproducing populations (similar to their populations at low Se locations) with whole body tissue concentrations over 40 mg/kg dw in a study conducted near Pueblo, Colorado (GEI 2007). These data are also provided in Appendix E of the EPA 2015 draft criteria document (Table E-18). Because these species are insensitive to elevated selenium, they would not be in the top four most sensitive; however, they can be included in the total number of species. Inclusion of these fish species increases N from 15 to 18.

3.3 Derivation of Tissue Criterion Elements

3.3.1 Updates to Egg/Ovary Criterion

Implementing the data usage modifications discussed above (Section 3.1.1) results in changes to the criteria calculations. The following is a summary of our recommended modifications:

- Update the White Sturgeon SMCV to 17.8 mg/kg
  - Result of calculating the geometric mean of the four EC_{10}s calculated by EPA
- Update the Bluegill GMCV to 22.57 mg/kg
  - Result of excluding the Hermanutz et al. (1992, 1996) studies
- Update the Brown Trout SMCV to 21.16 mg/kg
  - Result of using all data (survival and deformity) with the "optimistic"/realistic assumption for addressing the issue of the fry lost during the study
- Include three additional fish species to increase N based on observed insensitivity to Se

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The order and chronic values for the top four most sensitive species change as a result of the modifications to the White Sturgeon, Bluegill and Brown Trout GMCVs (Table 1). In addition, the sample size increases from N=15 to N=18. Using the data presented in Table 3, an updated egg/ovary criterion of 17.9 mg/kg can be derived using EPA criteria calculation methodology (Stephan et al. 1985; Table 2). We recommend EPA considers this recalculated criterion, as it is based on sound data for relevant species.

Table 1: Modified version of Table 3.2 of the 2015 draft Se criteria document following adjustments to chronic values for White Sturgeon, Bluegill, and Brown Trout based on review and analysis of study data. N=18. Asterisks indicate values that differ from those reported in the 2015 draft Se criteria document.

Rank	GMCV (mg Se/kg dw EO)	Species	SMCV (mg Se/kg dw EO)
9	56.22	Dolly Varden, *Salvelinus malma*	56.22
8	<34	Northern Pike, *Esox lucius*	<34
7	27	Desert Pupfish, *Cyprinodon macularius*	27
6	<23.85	Fathead Minnow, *Pimephales promelas*	<23.85
5	22.71	Cutthroat Trout, *Oncorhynchus clarki*	24.45
		Rainbow Trout, *Oncorhynchus mykiss*	21.1
4	22.57*	Bluegill Sunfish, *Lepomis macrochirus*	22.57*
3	21.16*	Brown Trout, *Salmo trutta*	21.16*
2	20.35	Largemouth Bass, *Micropterus salmoides*	20.35
1	17.8*	White Sturgeon, *Acipenser transmontanus*	17.8*

Table 2: Updated calculation of egg/ovary fish tissue-based Se criterion based on modifications in Table 2 (N = 14 genera, R = sensitivity rank in database).

Rank	Genus	GMCV	ln GMCV	(ln GMCV)^2	P = R/(N+1)	√P
1	*Acipenser*	17.80	2.8792	8.2898	0.0526	0.2294
2	*Micropterus*	20.35	3.0131	9.0787	0.1053	0.3244
3	*Salmo*	21.16	3.0521	9.3154	0.1579	0.3974
4	*Lepomis*	22.57	3.1166	9.7133	0.2105	0.4588
		Sum	12.0610	36.3972	0.5263	1.4101

Calculations:
Chronic Egg/Ovary Criterion

$$S^2 = \frac{\sum(\ln GMCV)^2 - (\sum \ln GMCV)^2/4}{\sum P - (\sum\sqrt{P})^2/4} = \frac{36.3972 - (12.0610)^2/4}{0.5263 - (1.4101)^2/4} = 1.0306 \qquad S = 1.0152$$

$L = [\sum \ln GMCV - S(\sum\sqrt{P})]/4 = [12.0610 - 1.0152(1.4101]/4 = 2.6574$

$A = S(\sqrt{0.05}) + L = (1.0152)(0.2236) + 2.6574 = 2.8844$

Final Chronic Value = FCV = e^A = **17.8927**

3.3.2 Updates to Whole-body Criterion

In Section 3.1.5.2 of the 2015 draft Se criteria document, EPA presents its approach for deriving a whole-body-based criterion. To develop whole-body chronic values, EPA translated the egg/ovary chronic values used to develop the egg/ovary criterion using egg/ovary to whole-body CFs (Table 3.5 of the 2015 draft Se criteria document). These converted values were then used to calculate a whole-body criterion of 8.0 mg/kg. EPA again used a sample size of 15, which included the three invertebrate-based values, the two assumed crustaceans, and *Gambusia*.

As we previously commented, in the past EPA has used regression-based CFs (e.g., Bluegill CF from EPA's 2004 draft Se criteria document). However, in the 2015 draft Se criteria document, EPA developed CFs based on the median of available matched egg/ovary and whole-body Se data. We believe a more appropriate method would be to use regression-based egg/ovary to whole-body translators when appropriate (i.e., when the regression relationship had an R^2 value >0.70). We translated the egg/ovary database to whole-body and derived an updated whole-body criterion (Table 3 and Table 4). For *Oncorhynchus*, individual CFs were used to translate each species individually (*O. mykiss* and *O. clarkii*), but an overall regression using data for both species was used to convert the *Oncorhynchus* egg/ovary GMCV to a whole-body GMCV of 14.99 mg/kg (Table 6). In addition, as discussed in Section 4.3.1, we corrected and updated the median-based CFs based on our review of EPA's data and addition of our data; these updates were incorporated here. Many of these recommendations, which are based on data EPA had in 2014 or were provided in our earlier review in 2014, were not used, with no reasons provided.

The whole-body criterion should also be adjusted as a result of our updates to the White Sturgeon, Bluegill, and Brown Trout egg/ovary chronic values.

Incorporating our modifications to the egg/ovary to whole-body translators, updated toxicity values for White Sturgeon, Bluegill, and Brown Trout, and increasing the sample size from 15 to 18 results in an updated whole-body criterion of 9.55 mg/kg which can be derived using EPA criteria calculation methodology (Stephan et al. 1985; Table 7). We recommend EPA considers this recalculated criterion with regression-based CFs in place of median-based conversion factors when possible, as it is based on sound data for relevant species.

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Table 3: Modified version of Table 3.5 of the 2015 draft Se criteria document following adjustments to conversion factors and chronic values for White Sturgeon, Bluegill, and Brown Trout recommended by GEI Consultants, Inc. Asterisks indicate egg/ovary values that differ from those reported in the 2015 draft Se criteria document.

Rank	Taxon	EO Chronic Value	EO/WB Regression[a] or Median-based CF	Calculated WB Repro Chronic Value	Basis for EO/WB Ratio (from Appendix B)
8	*Salvelinus*	56.22	y=0.9617x+5.5021	59.57	Regression-based Dolly Varden (includes M/WB conversion)
7	*Esox*	34	y=0.9426x-1.4953	30.55	Regression-based Northern Pike (includes M/WB conversion)
6	*Cyprinodon*	27	1.21	22.31	Median Desert Pupfish EO/WB from EPA 2014
5	*Pimephales*	23.85*	1.40	17.04	Median Fathead Minnow EO/WB (from GEI Consultants, Inc. 2008)
4	*O. mykiss*	21.1	y=0.6582x-0.0949	13.79	Regression-based Rainbow Trout (includes M/WB conversion)
	O. clarkii	24.45	2.32	10.54	Modified median Cutthroat Trout (includes M/WB conversion)
	Oncorhynchus	22.71	y=0.5731x+1.9711	14.99	Regression-based Rainbow Trout and Cutthroat Trout (includes M/WB conversion)
3	*Salmo*	21.16*	1.45	14.59	Median Brown Trout EO/WB
2	*Micropterus*	20.35	y=0.4384x+2.161	11.08	Regression-based Centrarchidae (Bluegill, smallmouth bass, green sunfish) EO/WB
1	*Lepomis*	22.57*	y=0.4239x+1.2392	10.81	Regression-based Bluegill EO/WB
	Acipenser	17.8	1.694	10.51	Median White Sturgeon EO/M (1.330) x median fish M/WB (1.274)

Table 4: Updated calculation of whole-body fish tissue-based Se criterion based on modifications recommended by GEI Consultants, Inc., including use of EO/WB regressions (N = 18 genera, R = sensitivity rank in database).

Rank	Genus	GMCV	ln GMCV	$(\ln GMCV)^2$	P = R/(N+1)	$\sqrt{P}$
1	*Acipenser*	10.51	2.3523	5.3334	0.0526	0.2294
2	*Lepomis*	10.81	2.3805	5.6666	0.1053	0.3244
3	*Micropterus*	11.08	2.4051	5.7847	0.1579	0.3974
4	*Salmo*	14.59	2.6803	7.1842	0.2105	0.4588
		Sum	9.8183	24.1690	0.5263	1.4101

Calculations:
Chronic Whole-body Criterion

$$S^2 = \frac{\sum(\ln GMCV)^2 - (\sum \ln GMCV)^2/4}{\sum P - (\sum\sqrt{P})^2/4} = \frac{24.1690 - (9.8183)^2/4}{0.5263 - (1.4101)^2/4} = 2.3707 \qquad S = 1.5397$$

$L = [\sum \ln GMCV - S(\sum\sqrt{P})]/4 = [9.8183 - 1.5397(1.4101]/4 = 1.9118$

$A = S(\sqrt{0.05}) + L = (1.5397)(0.2236) + 1.9118 = 2.2561$

Final Chronic Value = FCV = e^A = **9.5457**

3.3.3 Updates to Muscle Criterion

In Section 3.1.5.3 of the 2015 draft Se criteria document, after presenting its approach for developing the egg/ovary criterion, EPA presents its approach for deriving a muscle-based criterion. To develop muscle chronic values, EPA translated the egg/ovary chronic values used to develop the egg/ovary criterion using egg/ovary to muscle CFs (Table 3.7 of the 2015 draft Se criteria document). These converted values were then used to calculate a muscle-based criterion of 11.3 mg/kg. EPA again used a sample size of 15, which included the three invertebrate-based values, the two crustaceans and *Gambusia*.

As a result of our recommended updates to the White Sturgeon, Bluegill, and Brown Trout egg/ovary chronic values, the muscle criterion will also need to be adjusted.

Incorporating our suggested modifications results in several changes in the top four most sensitive species of the muscle-based toxicity database (Table 5). In addition, the sample size increases from N=15 to N=18 as a result of the additional fish species discussed previously. Using the data presented in Table 6 an updated muscle criterion of 11.96 mg/kg can be derived using EPA criteria calculation methodology (Stephan et al. 1985). We recommend EPA considers this recalculated criterion, as it is based on sound data for relevant species.

Table 5: Modified version of Table 3.7 of the 2015 draft Se criteria document following adjustments to chronic values for White Sturgeon, Fathead Minnow, Bluegill, and Brown Trout based on review and analysis of study data. Asterisks indicate values that differ from those reported in the 2015 draft Se criteria document.

Rank	Taxon	EO Chronic Value	EO/M Ratio	Calculated Muscle Repro Chronic Value	Basis for EO/M Ratio (from Appendix B)
	Salvelinus	56.22	1.264	**44.478**	Median Dolly Varden EO/M
8	*Cyprinodon*	27	0.95	**28.421**	Median Desert Pupfish EO/WB divided by median fish M/WB
7	*Salmo*	21.16*	1.135	**18.643***	Median Brown Trout EO/
6	*Esox*	34	1.875	**18.133**	Median Northern Pike EO/M
5	*Micropterus*	20.35	1.187	**17.144**	Median Micropterus EO/M
4	*Lepomis*	22.57*	1.375	**16.415***	Median Bluegill EO/M
3	*Pimephales*	23.85	1.59	**15.0**	Median Cyprinidae EO/M
2	*Acipenser*	17.8	1.33	**13.383**	Median White Sturgeon EO/M
1	*O. mykiss*	21.1	1.916	11.013	Median Rainbow Trout EO/M
	O. clarkii	24.45	1.805	13. 546	Median Cutthroat Trout EO/M
	Oncorhynchus	22.71	1.86	**12.214**	Using geomean of species ratios yields geomean of SMCVs

Table 6: Updated calculation of muscle fish tissue-based Se criterion based on modifications to Table 8 (N = 18 genera, R = sensitivity rank in database).

Rank	Genus	GMCV	ln GMCV	(ln GMCV)^2	P = R/(N+1)	$\sqrt{P}$
1	*Oncorhynchus*	12.214	2.5026	6.2629	0.0526	0.2294
2	*Acipenser*	13.383	2.5940	6.7288	0.1053	0.3244
3	*Pimephales*	15.0	2.7081	7.3335	0.1579	0.3974
4	*Lepomis*	16.415	2.7982	7.8299	0.2105	0.4588
	Sum		10.6028	28.1551	0.5263	1.4100

Calculations:
Chronic Muscle Criterion

$$S^2 = \frac{\sum(\ln GMCV)^2 - (\sum \ln GMCV)^2/4}{\sum P - (\sum\sqrt{P})^2/4} = \frac{28.1551 - (10.6028)^2/4}{0.5263 - (1.4100)^2/4} = 1.7159 \qquad S = 1.3099$$

$L = [\sum \ln GMCV - S(\sum\sqrt{P})]/4 = [10.6028 - 1.3099(1.4100]/4 = 2.1889$

$A = S(\sqrt{0.05}) + L = (1.3099)(0.2236) + 2.1889 = 2.4818$

Final Chronic Value = FCV = e^A = **11.9634**

3.4 Derivation of Protective Water Column Concentrations

3.4.1 Use of Probability Distribution of Water Column Concentrations

As stated previously, we do not agree with the general approach used to derive the two default water column concentrations meant to be protective of fish-tissues. Table 3.13 on page 82 of the 2015 draft Se criteria document presents site-specific data for 20 lentic and 33 lotic species-site combinations and includes site-specific enrichment factors (EF), species-specific whole-body to egg/ovary conversion factors (CF), and composite trophic transfer function ($TTF^{composite}$) values based on expected trophic levels at the site.

The final water quality criteria selected for lotic and lentic systems were based on Figure 3.96, page 84 of the 2015 draft Se criteria document. This figure is a probability distribution of the water column concentrations for lentic and lotic sites after being translated from the final egg/ovary tissue criterion (data from EPA Table 3.13). As we stated in our previous review, it appears this figure and the choice of a 20th percentile were used as if these represented sensitivity distribution curves, in which protectiveness can be predicted based on selecting a certain percentile value from the curve. However, these are not sensitivity distribution curves – in fact, as we pointed out last year, each value on these curves is a translated water concentration value that was specifically calculated to be protective of the egg/ovary tissue criterion. ***Therefore, each and every point on this graph (and those values in the far-right column of Table 12) is protective of the egg/ovary criterion based on the site-specific parameters at that site (given site-specific EF, CF, TTF)***.

Thus, the analysis by EPA actually demonstrates that water concentrations that are protective of the tissue criterion can range from 0.23 µg/L to 50.4 µg/L for lentic sites, and 1.2 µg/L to 40.6 µg/L for lotic sites, depending on the site-specific factors used in Equation 18. By selecting a 20th percentile value to use as the water column criteria, as EPA did, 80% of the sites in Table 3.13 would be overprotected, and 20% of the sites would be underprotected, resulting in a water column criterion that is wrong virtually 100% of the time – with the exception being the particular sites that fell right on the 20th percentile lines.

We believe there are a number of valid approaches to translate an egg/ovary criterion to a water column value, such as Equation 18 or a bioaccumulation factor (as discussed later), but only if the proper data are used in the equations. The key is to properly characterize the base of the food chain, which for lotic systems includes incorporating sediment and/or periphyton data, rather than relying on suspended particulate Se data. Other modeling approaches that also capture the various aspects of the system could also be used to translate a water column criterion.

In addition, the dataset used to derive EPA's water column values is very limited, especially when considering this is supposed to be the basis for a national criterion. Using additional data from several GEI projects (and other GEI updates previously discussed in this

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document), we recalculated the lotic water column value using EPA's method and derived a value of 4.2 µg/L. Paired data from GEI projects were available for 47 additional sites, which more than doubles the database used by EPA. Protective values for these lotic sites range from 1.18 µg/L to 81.03 µg/L. While we still believe this method for calculating a nationwide water column value is over-conservative, this recalculation demonstrates how additional data can substantially affect the final value. If EPA intends to use this method to calculate a nationwide water column value, there should be more effort put into collecting site-specific data to include in the database, and not just relying on a few published literature values, most of which were data collected more than 20 years ago.

In addition, we also concur with comments provided by (API 2015) regarding the counterintuitive results calculated when using constant EFs and TTFs. We would agree that the alternative approaches they provide for these calculations would result in more appropriate protective water column criteria.

3.4.2 Intermittent-exposure Element

The intermittent exposure component of the water column-based criterion attempts to address pulses of elevated Se concentrations that could contribute to chronic effects. The equation to calculate the intermittent exposure criterion seems to be an oversimplification as it is essentially just a rearrangement of the equation to calculate a 30-day average concentration. A more appropriate way to determine limits for short-term elevated pulsed Se exposures would be to use a scientifically-based biokinetic model as discussed in Appendix G of the 2014 draft Se criteria document, and described in more depth in DeForest et al. (in press). We have also provided further recommendations on calculation of this element in our previous review (GEI 2014a).

3.5 Recommendations for "Never to be Exceeded" Frequency

Although it is inherent in the way this document was written that the burden to determine how a tissue-based standard will be implemented will be left to the States, we would like to comment on the "instantaneous" and "never to be exceeded" language that is presented in relation to the proposed tissue standard.

Generally, the term "never to be exceeded" requires substantive clarification to make clear what is expected – an issue that cannot wait for some future undetermined "implementation guidance" document. The way the language is written currently suggests that a single fish tissue sample with a concentration above the criteria (egg/ovary, whole-body, or muscle) would result in non-attainment – a result that is in direct contradiction to the data used to develop the criterion, which are based on EC_{10}s calculated from means of treatments. However, other alternatives could be employed (as discussed in our previous review) to ensure that a single fish would not be used to determine attainment. We also support the very detailed analysis of this issue contained in last year's comments by NAMC-SWG (2014).

3.6 Concerns with Primacy of Water Column Values

We also have serious concerns with Footnote 3 of the proposed criterion. Footnote 3 outlines two scenarios in which water column values have primacy over fish tissue values – "fishless waters" and waters with "new or increased inputs of selenium until equilibrium is reached." Specifically, Footnote 3 states:

> Water column values are based on dissolved total selenium (includes all oxidation states, i.e., selenite, selenate, organic selenium and any other forms) in water. Water column values have primacy over fish tissue values under two circumstances: (1) "Fishless waters" (waters where fish have been extirpated, or where physical habitat and/or flow regime cannot sustain fish); and (2) New or increased inputs of selenium until equilibrium is reached.

While we understand the concerns EPA is seeking to address with respect to these two scenarios, we think that the proposed language, when taken in conjunction with the anti-backsliding provisions of the CWA, the requirements of the National Pollutant Discharge Elimination System (NPDES) permitting process for establishing water quality-based effluent limits (WQBELs), and state antidegradation regulations could in some instances effectively nullify the fish tissue approach all together. While EPA considers this an "implementation" issue, it is in fact the language of the criterion itself that will cause the issue and it cannot be rectified with implementation guidance. However, we think that there are ways to address EPA's intent in the criterion document that will allow state programs to maintain the primacy of the fish tissue values in permits without compromising the quality of downstream waters or waters with new or expanded selenium discharges.

The CWA's anti-backsliding provision provides that "a permit may not be renewed, reissued, or modified…to contain effluent limitations which are less stringent than the comparable effluent limitations in the previous permit." CWA Sec. 402(o). While there are listed exceptions to the anti-backsliding requirements, many state agencies and their NPDES permit writers construe these exceptions narrowly and generally interpret anti-backsliding to mean that permits cannot be modified or renewed with less stringent WQBELs than those contained in the previous version. Additionally, certain anti-backsliding exceptions for WQBELs are tied to both attainment and antidegradation regulations, which may cause additional issues with their application in some state programs.

As written, with respect to new or expanded discharges, the criterion would require a permit writer to put WQBELs based on the proposed water column criteria into NPDES permits during the months or even years that it takes for the receiving water to reach "equilibrium."[1]

[1] Importantly, Footnote 1 explains that the egg/ovary criterion element "overrides any whole-body, muscle, or water column element when egg/ovary concentrations are measured, except in [the situations outlined in Footnote 3]," and Footnote 2 states that the fish whole body or muscle criterion element "overrides any water column element when both fish tissue and water concentrations are measured, except in [the situations outlined

Due to the conservative estimates used to derive the water column concentrations, it is possible that in many instances a post-equilibrium discharge limit derived from a fish tissue concentration-based effluent limit will be higher than one based on the water column value. However, because a discharger's permit will already contain the more stringent limitation, even after equilibrium is reached a discharger may only be allowed to have a limitation based on a fish tissue concentration put into their permit if that limitation would be more stringent than the one based on the water column value. In other words, there will likely be instances in which a fish tissue-based effluent limitation will not be permissible if states adopt the criterion as proposed despite the fact that such a limitation would represent the best available science and reflect the EPA's intent as we understand it. This same analysis applies to existing discharges where states may choose to first apply a WQBEL based on the proposed water column criterion where data regarding fish tissue and fish egg ovary selenium concentrations may be scarce, not collected during permit renewal, or otherwise unavailable at the time of permit renewal.

While for some states programs this may not pose an issue (and we support such states' interpretation of anti-backsliding), and for others implementation guidance *may* be able to address this issue by fitting the criterion into one of the anti-backsliding exceptions, it is unclear if that will be legally possible, and regardless it would not matter because as a practical matter dischargers would have already had to install control technologies to treat to the more stringent water column-based limit despite the fact that such controls are not necessary to protect aquatic life. In more extreme cases, dischargers may not be able to get a permit at all based on Footnote 3 due to elevated natural background levels of selenium, despite the fact that certain levels of selenium could be discharged safely as demonstrated by the fish tissue concentrations, because permit writers would be inappropriately basing their calculations on the water column number. Because of this, we make two recommendations. The first is deleting Footnote 3 as written, and instead including a provision for new or expanded discharges whereby limitations are derived from fish tissue concentrations but compliance cannot be tested until the appropriate amount of time has elapsed for the receiving water to reach equilibrium (i.e., a bioaccumulation study special condition requirement). The second is renaming the water column "criteria" as water column "thresholds," as was done in Kentucky's recently approved selenium water quality criteria revision. This would clarify EPA's intent to allow fish tissue concentrations to have primacy over the water column values.

With respect to "fishless waters," Footnote 3 will likewise lead to situations in which dischargers must install expensive control technologies or not be able to discharge selenium at all despite the fact that such requirements are not necessary to protect aquatic life. We

in Footnote 3]." Therefore, when read together, Footnotes 1-3 make clear that, with respect to "fishless waters" and waters with new or increased selenium inputs until equilibrium is reached, the water column element must be used as the applicable water quality criterion. Permit writers must therefore, based on this language, use the water column values to derive applicable water quality-based effluent limitations.

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understand that EPA is required under the CWA to protect downstream waters when deriving water quality criteria. However, a scientifically defensible approach to "fishless waters" that EPA should provide to states as an option in the criterion is the derivation of a site-specific criterion that takes into account the sensitivity of the macrobenthos in the receiving water to protect the receiving water's attainable uses (i.e., to protect the receiving water's macrobenthic communities), while protecting downstream waters through determination of the flow rate of the receiving water into the nearest fish-containing water and ensuring that the fish tissue standard is being met in the downstream fish populations. Such a criterion would ensure that both in-stream and downstream aquatic life are protected without arbitrarily assigning overly-protective water column-based limitations to permittees. We therefore again recommend deleting Footnote 3 as written, and instead including a provision for "fishless waters" that allows for the development of site-specific criteria that protect the attainable use of in-stream macrobenthos as well as downstream fish populations through application of the tissue-based criterion (see additional discussion in Section 3.6.1).

Concerning a related issue, we also note that EPA guidance limits the terms of compliance schedules to five years, as do many state permitting programs based on EPA's guidance. Because in some situations where selenium levels are being decreased based on the new criterion it may take longer than 5 years for corresponding fish tissue concentrations to decrease, NMA recommends including a provision in the criterion stating that longer compliance schedules may be needed with respect to bioaccumulants. Although again this could be considered an "implementation" issue, because it is a facet of the criterion that could directly conflict with existing state water quality programs – thereby limiting states' ability to adopt it – it is necessary to adopt language in the criterion itself that addresses this concern.

3.6.1 Recommendation for Invertebrate Tissue Criterion

In cases where fish populations are not present due to flow limitations the aquatic life to be protected are the macrobenthos. In EPA's analysis of invertebrate data, the most sensitive species had a GMCV of 24.2 mg Se/kg dw wb. All other effect concentrations for invertebrates for which chronic data were available were substantially higher than 24.2 mg/kg. Therefore, based on these data, an invertebrate Se tissue concentration of 24.2 mg/kg dw would be protective of these invertebrates and an appropriate tissue-based criterion for fishless waters.

4. Other Issues and Considerations

The previous sections highlighted specific recommendations for revisions to the document and criteria. In this section we present other issues which we believe need reconsideration. While we may not have specific recommendations on these issues, we feel they do need to be reexamined to ensure the science supporting the decisions made to develop the Se criteria are solid.

4.1 Background Selenium Sources and Occurrences

EPA provides some discussion of Se sources in Section 3.1 of the 2014 draft selenium criteria document. EPA discusses natural Se deposits and highlights areas where Se deposits have been brought to the surface through mining activities and where irrigation in the western United States may cause leaching from high Se soils. However, in addition to human-induced/ irreversible activities that may contribute to elevated Se in surface waters, there are also natural processes that may leach Se into groundwater, and consequently into surface waters, that were not discussed in the draft criteria document. We provided more in depth information on this topic in our previous review (GEI 2014a).

4.1.1 Incorporation of Background Conditions into Site-specific Criteria

Appendix K of the 2015 draft Se criteria document, which describes methods for deriving site-specific criteria, does not discuss inclusion/consideration of data from reference or background sites. This is especially critical at sites with background levels of Se that would be considered elevated, comparatively speaking. In Appendix A, Examples 1-6 include calculation of site-specific criteria that includes background Se concentrations of 5.0 µg/L. Working through the calculation results in a site-specific water column criteria that are always lower than the original background concentration. It is unclear how these calculations could be applied to sites with naturally elevated background Se and result in a Se criterion that would be appropriate for that site.

As discussed in Section 4.1 of this review, ambient site-specific criteria may be appropriate in many parts of the country containing underlying geology with elevated Se levels. This naturally elevated Se may lead not only to elevated water concentrations, but also to naturally elevated fish tissue concentrations, resulting in the need for not only site-specific water column criteria but also a need for an approach that acknowledges there could be site-specific tissue criteria. In our previous review a more in depth discussion of this issue was provided along with specific examples (GEI 2014a).

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4.2 Use of TRAP versus Other Statistical Methods

As mentioned previously, we continue to have some concern with the exclusive use of TRAP for determination of all EC_{10} values used in criteria development. TRAP may work well with certain data sets, but may pose problems for analysis of others. We provided additional discussion of the potential issues in our previous review (GEI 2014a).

In many of the studies provided in the 2015 draft Se criteria document, the EC_{10} values calculated by EPA differed from the original values determined by the study authors and those calculated by DeForest and Adams (2011). EPA should provide a list of all parameters and "Initial Guesses" on slopes used for analyses.

4.3 Additional Discussion of Tissue Criterion Elements

4.3.1 Conversion Factors

As part of our previous review, we conducted an evaluation of the conversion factors (CFs) developed by EPA in the 2014 draft Se criteria document wherein we reviewed all of the data used and corrected values where mistakes were found. A detailed evaluation of this issue is also presented by NAMC-SWG (2014).

In addition to reviewing EPA's data and calculations, we also compiled matched tissue data from studies conducted by GEI to supplement the CF database (GEI Appendix A, 2014). We also used the matched egg/ovary, whole-body, and muscle Se data provided in the 2014 draft Se criteria document, which was further updated by GEI as described above, and developed regression-based CFs (Table 9; GEI Appendix A). When the regression has a relatively high goodness of fit (i.e., when R^2 is at least 0.70), we recommend using the regression equation in place of the median (or geometric mean) ratios, as the regression better predicts tissue concentrations, particularly at the high and low ends of the spectrum. Where the strength of the regression is not as high (e.g., creek chub, Fathead Minnow, mountain whitefish), it may be more appropriate to use the median or geometric mean CF to represent the central tendency of the relationship. As shown in Section 3.3.2, we used the regression-based CFs where appropriate to translate the updated egg/ovary criterion database for these species to whole-body for the purposes of deriving the updated whole-body criterion. For the remaining species, we used the updated and new median ratio-based CFs.

4.4 Derivation of Water Column-based Criterion Elements

In Section 3.2 of the 2015 draft Se criteria document, EPA derives an equation to be used to translate the egg/ovary tissue criterion into a water column criterion. The result is Equation 18 on page 63:

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$$C_{water} = \frac{C_{egg-ovary}}{TTF^{composite} \times EF \times CF}$$

Where:

C_{water} = Concentration of selenium dissolved in water (µg/L)
$C_{egg/ovary}$ = Selenium concentration in the eggs or ovaries of fish (µg/g)
$TTF^{composite}$ = Product of all trophic transfer functions
EF = Enrichment function (L/g)
CF = Whole-body to egg/ovary conversion factor (dimensionless ratio)

There are several components of this equation that require further analysis and consideration.

4.4.1 Discussion of Trophic Transfer Functions (TTF)

4.4.1.1 Importance of Site-specific TTFs

Ranges of TTFs can vary widely due to site-specific factors. To demonstrate this in our previous review (GEI 2014a), we reviewed data in Appendix B of the 2014 draft Se criteria document and compiled information on the ranges of TTFs for each species with data derived from field studies. We also verified the median TTF values and found several errors in Tables 9 and 10 on pages 76 and 77 of the 2014 draft, these errors still remain in the 2015 draft and should be fixed. Additionally, we recalculated TTF's including additional data that were submitted for addition to the TTF database in our previous review, but were not incorporated in the 2015 draft. These values are included in Table 7 (below) and the corrections are shown in bold with the incorrect values shown as strikeouts.

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Table 7: TTF median ratios from Table 3.10 and 3.11 in the 2015 draft Se criteria document and calculated ranges and geomean ratios. Italicized values are lab-based TTF values; other TTFs are from field data. Strikeouts indicate EPA calculation errors. Revised values and species added to the database are shown in bold. Invertebrate and fish groups are indicated with orange and blue shading, respectively.

Common Name	Scientific Name	TTF Median Ratio
Crustaceans		
Amphipod	*Hyalella azteca*	~~1.22~~ **1.06**
Copepod	Copepods	*1.41*
Crayfish	Astacidae	1.46
Waterflea	*Daphnia magna*	*0.74*
Insects		
Dragonfly	Anisoptera	~~1.97~~ **0.89**
Damselfly	Coenagrionidae	~~2.88~~ **1.30**
Mayfly	*Centroptilum triangulifer*	2.38
Midge	Chironomidae	1.90
Water boatman	Corixidae	1.48
Mollusks		
Asian clam	*Corbicula fluminea*	*4.58*
Zebra mussel	*Dreissena polymorpha*	*4.00*
Annelids		
Blackworm	*Lumbriculus variegatus*	*1.29*
Other		
Zooplankton	Zooplankton	2.01
Bluehead sucker	*Catostomus discobolus*	1.04
Cypriniformes		
Common Carp	*Cyprinus carpio*	**1.29**
Creek Chub	*Semotilus atromaculatus*	**1.02**
Red Shiner	*Cyprinella lutrensis*	**1.34**
Redside Shiner	*Richardsonius balteatus*	**0.77**
Fathead Minnow	*Pimephales promelas*	**1.26**
Flannelmouth Sucker	*Catostomus latipinnis*	1.06
Longnose Sucker	*Catostomus catostomus*	0.90
Sand Shiner	*Notropis stramineus*	**1.60**
Blacknose Dace	*Rhinichthys atratulus*	**0.71**
White Sucker	*Catostomus commersonii*	**1.04**
Cyprinodontiformes		
Mosquitofish	*Gambusia* sp.	**0.97**
Northern Plains Killifish	*Fundulus kansae*	1.27
Western Mosquitofish	*Gambusia affinis*	1.25
Esociformes		
Northern Pike	*Esox lucius*	2.04
Gasterosteiformes		
Brook Stickleback	*Culaea inconstans*	**1.79**

4.4.1.2 Use of Composite TTFs

The composite TTF is the product of the TTFs that represent dietary pathways of Se exposure for a given species within an aquatic system. As we commented in our previous review, the $TTF^{composite}$ approach would require prey item-specific consumption rate/frequency data (ideally site-specific) to best characterize exposure. Species-and site-specific dietary preference data are likely not available for many combinations of organisms. In those scenarios, assumptions will need to be made for each prey item, introducing additional and potentially unrealistic uncertainty to derive a TTF composite value.

For more accurate analysis of a specific aquatic system, the best approach is to collect and analyze tissue and water samples to measure actual Se concentrations rather than making assumptions and using highly uncertain composite TTFs.

4.4.2 Enrichment Factors (EF)

Pages 74 of the 2015 draft Se criteria document state that "The single most influential step in selenium bioaccumulation occurs at the base of the aquatic food webs (Chapman et al. 2010)" and "The availability of selenium measurements from particulate material was limited." Given these statements and how critical it is to generate valid Enrichment Factors (EF), EPA should consider inclusion of an uncertainty discussion related to the particulate material Se data and how representative the calculated EF values may (or may not) be to all sites. Additional data to add to the EF database from GEI studies are were included in Appendix A of our previous review. These additional data were not incorporated into the 2015 draft; therefore, calculated EF values for GEI studies are shown in Appendix A.

4.4.3 Classification of Aquatic Systems – Lotic vs. Lentic

It is known that bioaccumulation of Se is significantly different in lentic and lotic systems (Adams et al. 2000). EPA differentiates between system types using EFs and residence time. As discussed in our previous review, this makes sense in theory, however, the resulting data have substantial overlap, indicating the differences are not that clear. It would be more appropriate to develop site-specific criteria rather than create artificial groupings of waterbody types that mask the site-specific differences so important to ensuring attainment of the tissue criterion.

4.5 Site-specific Criteria

4.5.1 Deriving Site-specific Water Concentration Values from the Egg/Ovary Criterion

Appendix K of the 2015 draft Se criteria document describes a methodology to derive site-specific criteria using a mechanistic modeling approach. However, Appendix K seems to simply be a more detailed presentation of information presented in the main text. It does not describe the process or data requirements that a state or tribe would need to follow/generate in order to have their site-specific criteria considered by EPA. In our previous review we discussed several questions and concerns that should be addressed to enable states and tribes to appropriately develop site-specific criteria (GEI 2014a).

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5. Conclusions

Overall, the 2015 draft Se criteria document, including the tissue-based criteria approach, is a significant improvement over the 2004 draft criteria document. We strongly support EPA's decision to develop tissue-based Se criteria that are toxicologically and ecologically relevant. While we support the overall approach and core of the 2015 draft Se criteria document, we have several recommended revisions and considerations that, if considered by EPA, could significantly improve the scientific validity of the document and resulting Se criteria.

5.1 Reevaluation of Acceptable Studies

We reviewed all of the reproductive toxicity study data deemed acceptable by EPA in the 2015 draft Se criteria document. Data were presented for ten fish genera. Overall, we concur with most of the data usage decisions made by EPA, but have comments and suggestions on some of the data that were used to develop the egg/ovary chronic criterion (and subsequently, the whole-body and muscle criteria).

Specifically, we had comments on usage of specific White Sturgeon, Bluegill and Brown Trout data in the criteria calculations.

- White Sturgeon – We recommend using the geometric mean of all the EC10s calculated by EPA, as the goodness-of-fit is equal for all curves, therefore all EC10s are equally appropriate. The recommended egg/ovary EC_{10} value, which is equivalent to the SMCV, is 17.8 mg/kg.
- Bluegill – We have concerns about the data used from the Hermanutz et al. (1992, 1996) studies. We recommend rejecting data from all Hermanutz studies. Using only data from the other two studies, the updated Bluegill egg/ovary GMCV is 22.57 mg/kg, with an accompanying whole-body value of 10.58 mg/kg using regression-based CF.
- Brown Trout – We recommend using the Brown Trout EC_{10} calculated under the "optimistic"/realistic assumption for dealing with the lab accident that resulted in loss of study organisms in the Formation Environmental (2011) study. The recommended EC_{10} value, which is equivalent to the SMCV, is 21.16 mg/kg, with an accompanying whole-body value of 14.59 mg/kg based on updated CFs.
- We developed regression-based CFs for translating between egg/ovary and whole-body. When the regression relationship is strong, we recommend using regression-based CFs instead of median ratio-based CFs.

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Incorporation of these suggested changes results in updated egg/ovary, whole-body, and muscle chronic criteria that are even more scientifically defensible and consistent with EPA's other data-usage decisions (Table 13).

5.2 Other Considerations

As stated in our review of the 2014 criteria document (GEI 2014b), we agree that any fish tissue collected is representative of accumulation over time and could be considered an "instantaneous" measurement of the current conditions. However, we believe the use of the term "instantaneous" leads to some confusion regarding the tissue sampling requirements. We support the thorough discussion of this topic in the NAMC-SWG 2014 review and agree that there will be natural variability in the tissue samples collected, and a single sample may be over- or under-representative of site conditions. The best way to represent environmental conditions is to average the tissue samples in some manner. We recommend replacing "instantaneous" with "seasonal average" in the tissue criterion requirements.

Another issue that requires reevaluation and clarification is how to establish criteria for streams with no existing fish populations. The default approach is to use water-column criteria; however, an alternative states could be provided is the use of the chronic invertebrate data provided by EPA to develop invertebrate tissue-based site-specific criterion and associated protective water-column criteria.

Another topic that needs further consideration is the use of natural background Se concentrations to develop ambient based site-specific criteria. We have provided discussion of how this has been successfully done in Colorado in our previous review (GEI 2014a), and how it should be considered on a case-by-case basis nationwide. EPA's discussion of site-specific standard development is lacking and needs further clarification.

Finally, we have also provided additional field data for CFs, trophic transfer functions, and enrichment factors for EPA to incorporate and improve their database (GEI 2014a, Appendix A).

5.3 Discussion of Final Criterion

As stated above, we strongly support EPA's decision to develop tissue-based Se criteria that are toxicologically and ecologically relevant. The tissue-based criteria, including our recommended modifications and updates, reflect the best science and are protective of fish.

EPA also derived nationwide lentic and lotic water column-based criteria to supplement the tissue-based criteria. However, as discussed in Section 3.3 it is not possible or appropriate to derive a single nationwide standard for water column-based criteria for only two water body types (lentic or lotic), and such an effort is not supported by EPA's own analysis. While we agree that use of Equation 18 or other approaches could be used to translate a water column criterion from the egg/ovary criterion, this type of modeling should only be done with the appropriate site-specific data and not rely on default generalized model parameters. In addition, as noted earlier, we strongly urge EPA to evaluate direct use of tissue-based criteria in NPDES permitting, which would obviate the need for the back-calculation to a water value, thus eliminating the potential errors and uncertainty that arise in such calculations.

Regarding implementation of the tissue-based criteria, the use of "never to be exceeded" frequency is inappropriate and not in line with standard criteria attainment requirements. We recommend clarification of tissue sampling requirements and use of an alternative approach such as the geometric mean of samples collected, with an allowable exceedance frequency of no more than once every 3 years on average.

Based on the results of our analysis, we recommend updating the proposed egg/ovary, whole-body, and muscle chronic criteria to include our suggested changes (Table 8). In addition, because nationwide water column-based criteria cannot not be derived reliably, we advise EPA to only recommend water column-based criteria be developed on a site/state/region-specific basis (Table 8).

Table 8: Revision of Table 4.1 from the 2015 draft Se criteria document, including our revisions and recommendations.

Media Type	Fish Tissue		Water Column[3]	
Criterion Element	**Egg/Ovary[1]**	**Fish Whole-Body or Muscle[2]**	**Monthly Average Exposure**	**Intermittent Exposure**
Magnitude[4]	17.9 mg/kg	9.5 mg/kg whole-body or 12.0 mg/kg muscle (skinless, boneless filet)	n/a	Site-specific
Duration	Seasonal average	Seasonal average	30 days	Site-specific
Frequency	Not more than once in 3 years on average	Not more than once in 3 years on average	Not more than once in 3 years on average	Site-specific

1. Overrides any whole-body, muscle, or water column elements when fish egg/ovary concentrations are measured.
2. Overrides any water column element when both fish tissue and water concentrations are measured.
3. Water column values are based on dissolved selenium in water.
4. Magnitude is the geometric mean of tissue samples collected.

6. References

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Appendix A Supplemental Data

Revised EPA Table 3.11 with updated TTFs from Table B-7 using additional data provided by GEI

Common Name	Scientific Name	AE	IR	ke	TTF
Cypriniformes					
Bluehead Sucker	*Catostomus discobolus*	-	-	-	1.04
Longnose Sucker	*Catostomus catostomus*	-	-	-	0.9
White Sucker	*Catostomus commersonii*	-	-	-	~~1.18~~ 1.04
Flannelmouth Sucker	*Catostomus latipinnis*	-	-	-	1.06
Common Carp	*Cyprinus carpio*	-	-	-	~~1.34~~ 1.29
Red Shiner*	*Cyprinella lutrensis*	-	-	-	1.34
Redside Shiner*	*Richardsonius balteatus*	-	-	-	0.77
Creek Chub	*Semotilus atromaculatus*	-	-	-	~~1.12~~ 1.02
Fathead Minnow	*Pimephales promelas*	-	-	-	~~1.57~~ 1.26
Sand Shiner	*Notropis stramineus*	-	-	-	~~1.83~~ 1.6
Blacknose Dace*	*Rhinichthys atratulus*	-	-	-	0.71
Cyprinodontiformes					
Mosquitofish	*Gambusia sp.*	-	-	-	~~0.86~~ 0.97
Western Mosquitofish	*Gambusia affinis*	-	-	-	1.25
Northern Plains Killifish	*Fundulus kansae*	-	-	-	1.27
Esociformes					
Northern Pike	*Esox lucius*	-	-	-	2.04
Gasterosteiformes					
Brook Stickleback	*Culaea inconstans*	-	-	-	~~1.69~~ 1.79
Perciformes					
Black Crappie	*Pomoxis nigromaculatus*	-	-	-	2.67
Bluegill	*Lepomis macrochirus*	-	-	-	1.48
Green Sunfish	*Lepomis cyanellus*	-	-	-	~~1.27~~ 1.12
Largemouth Bass	*Micropterus salmoides*	-	-	-	~~1.27~~ 1.41
Smallmouth Bass*	*Micropterus dolomieu*	-	-	-	0.83
Striped Bass	*Morone saxatilis*	0.375	0.335	0.085	1.48
Walleye	*Sander vitreus*	-	-	-	1.82
Yellow Perch	*Perca flavescens*	-	-	-	1.42

Common Name	Scientific Name	AE	IR	ke	TTF
Salmoniformes					
Brook Trout	*Salvelinus fontinalis*	-	-	-	~~0.88~~ 0.97
Brown Trout	*Salmo trutta*	-	-	-	1.44
Mountain Whitefish	*Prosopium williamsoni*	-	-	-	1.38
Cutthroat Trout	*Oncorhynchus clarkii*	-	-	-	1.07
Rainbow Trout	*Oncorhynchus mykiss*	-	-	-	1.19
Westslope Cutthroat Trout	*Oncorhynchus clarkii lewisi*	-	-	-	1.2
Scorpaeniformes					
Mottled Sculpin	*Cottus bairdi*	-	-	-	1.38
Sculpin	*Cottus sp.*	-	-	-	1.29
Siluriformes					
Black Bullhead	*Ameiurus melas*	-	-	-	~~0.91~~ 0.87
Channel Catfish	*Ictalurus punctatus*	-	-	-	0.73

Notes:
* Additional species added to the database

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Revised EPA Table 3.12 with updated conversion factors for use in back calculating water column vaues using additional data provided by GEI

Common Name	Scientific Name	E/O to WB CF Median Ratio
Acipenseriformes		
White Sturgeon	Acipenser transmontanus	1.69
Cypriniformes		
Bluehead Sucker	*Catostomus discobolus*	1.82
Flannelmouth Sucker	*Catostomus latipinnis*	1.41
White Sucker	*Catostomus commersonii*	~~1.41~~ 1.38
Common Carp	*Cyprinus carpio*	1.92
Razorback Sucker	*Xyrauchen texanus*	~~1.42~~ 1.45
Roundtail Chub	*Gila robusta*	2.07
Fathead Minnow*	*Pimephales promelas*	1.4
Creek Chub*	*Semotilus atromaculatus*	1.99
Esociformes		
Northern Pike	*Esox lucius*	~~2.39~~ 2.41
Perciformes		
Bluegill	*Lepomis macrochirus*	2.13
Green Sunfish	*Lepomis cyanellus*	1.45
Smallmouth Bass	*Micropterus dolomieu*	1.42
Salmoniformes		
Brook Trout	*Salvelinus fontinalis*	~~1.38~~ 1.4
Dolly Varden	*Salvelinus malma*	1.61
Brown Trout	*Salmo trutta*	1.45
Rainbow Trout	*Oncorhynchus mykiss*	~~2.44~~ 2.46
Cutthroat Trout	*Oncorhynchus clarkii*	~~2.30~~ 2.32
Mountain Whitefish	*Prosopium williamsoni*	~~7.39~~ 7.42

Notes:
* Additional species added to the database.

Revised EPA Table 3.13 (lotic data only) with CFs, TTFs and revised back calculated water column values using updated values from Tables 3.11 and 3.12, and including additional GEI data

Reference	Site	Species	Site Type	EF[a]	CF[b]	TTF[composite-c]	Cwater[d]
Butler et al. 1991	Uncompahgre River at Colona	Rainbow Trout	Lotic	0.63	~~2.44~~ 2.46	2.44	~~4.21~~ 4.73
Butler et al. 1993	Spring Cr. at La Boca	Speckled Dace	Lotic	0.18	~~2.00~~ 1.96	~~2.78~~ 2.41	~~15.89~~ 21.05
Butler et al. 1995	Hartman Draw near mouth, at Cortez	Fathead Minnow	Lotic	0.15	~~2.00~~ 1.40	~~2.77~~ 2.69	~~19.13~~ 31.69
Butler et al. 1995	McElmo Cr. at Hwy. 160, near Cortez	Speckled Dace	Lotic	0.90	~~2.00~~ 1.96	~~2.78~~ 2.41	~~3.16~~ 4.21
Butler et al. 1995	McElmo Cr. downstream from Alkali Cyn.	Speckled Dace	Lotic	0.37	~~2.00~~ 1.96	~~2.78~~ 2.41	~~7.73~~ 10.24
Butler et al. 1995	McElmo Cr. downstream from Yellow Jacket Cyn.	Fathead Minnow	Lotic	0.12	~~2.00~~ 1.40	~~2.77~~ 2.69	~~23.79~~ 39.61
Butler et al. 1995	McElmo Cr.upstream from Yellow Jacket Cyn.	Speckled Dace	Lotic	0.10	~~2.00~~ 1.96	~~2.78~~ 2.41	~~29.77~~ 37.89
Butler et al. 1995	Navajo Wash near Towaoc	Speckled Dace	Lotic	0.20	~~2.00~~ 1.96	~~2.78~~ 2.41	~~14.52~~ 18.95
Butler et al. 1995	San Juan River at Four Comers	Speckled Dace	Lotic	0.26	~~2.00~~ 1.96	~~2.78~~ 2.41	~~10.85~~ 14.57
Butler et al. 1995	San Juan River at Mexican Hat Utah	Common Carp	Lotic	0.29	1.92	~~1.70~~ 1.64	~~16.72~~ 19.60
Butler et al. 1995	Woods Cyn. Near Yellow Jacket	Fathead Minnow	Lotic	0.40	~~2.00~~ 1.40	~~2.77~~ 2.69	~~7.05~~ 11.88
Butler et al. 1997	Cahone Canyon at Highway 666	Green Sunfish	Lotic	0.20	1.45	~~2.44~~ 2.16	~~22.81~~ 28.58
Butler et al. 1997	Mud Creek at Highway 32, near Cortez	Fathead Minnow	Lotic	0.07	~~2.00~~ 1.40	~~2.77~~ 2.69	~~40.60~~ 67.90
Casey 2005	Deerlick Creek	Rainbow Trout	Lotic	2.24	~~2.44~~ 2.46	2.44	~~1.19~~ 1.33
Casey 2005	Luscar Creek	Rainbow Trout	Lotic	0.33	~~2.44~~ 2.46	2.44	~~8.15~~ 9.04
GEI 2013*	GC-1	Red Shiner	Lotic	0.88	1.96	2.33	4.44
GEI 2013*	SC-1	Fathead Minnow	Lotic	0.96	1.4	2.69	4.98
GEI 2013*	SC-2	Red Shiner	Lotic	0.50	1.96	2.33	7.83
GEI 2013*	SC-3	Red Shiner	Lotic	0.52	1.96	2.33	7.535
GEI 2013*	SC-4	Sand Shiner	Lotic	0.67	1.96	2.48	5.46
GEI 2013*	SC-6	Red Shiner	Lotic	0.06	1.96	2.33	67.67
GEI 2013*	SC-8	Fathead Minnow	Lotic	0.21	1.4	2.69	22.32
GEI 2013*	SC-9	Red Shiner	Lotic	0.33	1.96	2.33	11.83
Formation 2012	Crow Creek - 1A	Sculpin	Lotic	0.80	~~1.63~~ 1.69	2.80	~~4.33~~ 4.73
Formation 2012	Crow Creek - 3A	Sculpin	Lotic	0.81	~~1.63~~ 1.69	2.82	~~4.24~~ 4.64
Formation 2012	Crow Creek - CC150	Sculpin	Lotic	1.04	~~1.63~~ 1.69	2.69	~~3.46~~ 3.79
Formation 2012	Crow Creek - CC350	Sculpin	Lotic	1.16	~~1.63~~ 1.69	2.75	~~3.02~~ 3.32
Formation 2012	Crow Creek - CC75	Sculpin	Lotic	1.19	~~1.63~~ 1.69	2.63	~~3.09~~ 3.38
Formation 2012	Deer Creek	Sculpin	Lotic	1.55	~~1.63~~ 1.69	2.68	~~2.32~~ 2.55

Reference	Site	Species	Site Type	EF[a]	CF[b]	TTF[composite-c]	Cwater[d]
Formation 2012	Hoopes Spring - HS	Sculpin	Lotic	0.24	~~1.63~~ 1.69	3.51	~~11.25~~ 12.57
Formation 2012	Hoopes Spring - HS3	Sculpin	Lotic	0.54	~~1.63~~ 1.69	2.39	~~7.54~~ 8.21
Formation 2012	Sage Creek - LSV2C	Sculpin	Lotic	0.45	~~1.63~~ 1.69	2.83	~~7.63~~ 8.32
Formation 2012	Sage Creek - LSV4	Sculpin	Lotic	0.69	~~1.63~~ 1.69	2.67	~~5.21~~ 5.75
Formation 2012	South Fork Tincup Cr.	Sculpin	Lotic	1.32	~~1.63~~ 1.69	2.85	~~2.56~~ 2.82
Hamilton and Buhl 2004	lower East Mill Creek	Sculpin	Lotic	1.32	1.96	2.02	~~3.03~~ 3.43
GEI Unpublished*	C-BCR2	Green Sunfish	Lotic	0.76	1.45	2.16	7.5
GEI Unpublished*	C-CC1	Green Sunfish	Lotic	0.64	1.45	2.16	8.9
GEI Unpublished*	C-CC2	Green Sunfish	Lotic	0.54	1.45	2.16	10.5
GEI Unpublished*	C-CF1	Green Sunfish	Lotic	1.48	1.45	2.16	3.87
GEI Unpublished*	C-CLF1	Green Sunfish	Lotic	0.65	1.45	2.16	8.86
GEI Unpublished*	C-CLF2	Green Sunfish	Lotic	0.80	1.45	2.16	7.18
GEI Unpublished*	C-HC1	Creek Chub	Lotic	0.78	1.99	1.4	8.19
GEI Unpublished*	C-LF1	Creek Chub	Lotic	0.07	1.99	1.4	91.8
GEI Unpublished*	C-LFWOC1	Longnose Dace	Lotic	0.06	1.96	2.41	60.1
GEI Unpublished*	C-LMF1	Creek Chub	Lotic	0.53	1.99	1.4	12.19
GEI Unpublished*	C-SC1	Smallmouth Bass	Lotic	0.50	1.42	2.36	10.66
GEI Unpublished*	C-TF1	Green Sunfish	Lotic	0.30	1.45	2.16	18.83
GEI Unpublished*	C-WOC1	Green Sunfish	Lotic	0.09	1.45	2.16	67.02
GEI Unpublished*	H-BHC1	Green Sunfish	Lotic	0.28	1.45	2.16	20.17
GEI Unpublished*	H-BHC2	Green Sunfish	Lotic	0.29	1.45	2.16	19.87
GEI Unpublished*	H-BHC3	Green Sunfish	Lotic	0.24	1.45	2.16	24.26
GEI Unpublished*	H-BLB1	Green Sunfish	Lotic	0.37	1.45	2.16	15.62
GEI Unpublished*	H-BLB2	Creek Chub	Lotic	0.36	1.99	1.4	17.67
GEI Unpublished*	H-CC1	Green Sunfish	Lotic	0.42	1.45	2.16	13.56
GEI Unpublished*	H-HC1	Creek Chub	Lotic	0.89	1.99	1.4	7.18
GEI Unpublished*	H-JSB1	Green Sunfish	Lotic	3.97	1.45	2.16	1.44
GEI Unpublished*	H-LCR2	Bluegill	Lotic	0.62	2.13	2.85	4.78
GEI Unpublished*	H-LF1	Green Sunfish	Lotic	0.49	1.45	2.16	11.74
GEI Unpublished*	H-LKC1	Creek Chub	Lotic	0.33	1.99	1.4	19.59
GEI Unpublished*	H-MR1	Green Sunfish	Lotic	0.13	1.45	2.16	43.33

Reference	Site	Species	Site Type	EF[a]	CF[b]	TTF[composite-c]	Cwater[d]
GEI Unpublished*	H-MR2	Green Sunfish	Lotic	0.15	1.45	2.16	38.99
GEI Unpublished*	H-MR3	Green Sunfish	Lotic	0.23	1.45	2.16	24.88
GEI Unpublished*	H-MR4	Green Sunfish	Lotic	0.77	1.45	2.16	7.43
GEI Unpublished*	H-SB1	Green Sunfish	Lotic	0.60	1.45	2.16	9.6
GEI Unpublished*	H-SF1	Green Sunfish	Lotic	0.32	1.45	2.16	17.69
GEI Unpublished*	H-SF2	Green Sunfish	Lotic	0.40	1.45	2.16	14.4
Saiki and Lowe 1987	San Luis Drain	Western Mosquitofish	Lotic	0.36	~~1.63~~ 1.69	2.46	~~10.94~~ 11.96
Saiki and Lowe 1987	Volta Wasteway	Western Mosquitofish	Lotic	1.03	~~1.63~~ 1.69	2.46	~~3.82~~ 4.18
Saiki et al. 1993	Mud Slough at Gun Club Road	Bluegill	Lotic	1.37	2.13	2.12	~~2.55~~ 2.89
Saiki et al. 1993	Salt Slough at the San Luis National Wildlife Refuge	Bluegill	Lotic	0.43	2.13	2.12	~~8.18~~ 9.22
Saiki et al. 1993	San Joaquin R. above Hills Ferry Road	Bluegill	Lotic	0.36	2.13	2.12	~~9.78~~ 11.01
Saiki et al. 1993	San Joaquin R. at Durham Ferry State Recreation Area	Bluegill	Lotic	0.75	2.13	2.12	~~4.68~~ 5.29
GEI 2014c*	BC-3	Redside Shiner	Lotic	0.53	1.96	1.73	10
GEI 2014c*	CC-2	Creek Chub	Lotic	0.98	1.99	1.4	6.56
GEI 2014c*	DC-1	Creek Chub	Lotic	1.52	1.99	1.4	4.22
GEI 2014c*	DC-2	Brook Stickleback	Lotic	0.74	1.69	2.38	6.05
GEI 2014c*	DC-3	Brook Stickleback	Lotic	0.68	1.69	2.38	6.52
GEI 2014c*	GC-2	Creek Chub	Lotic	0.85	1.99	1.4	7.53
GEI 2014c*	GC-3	Creek Chub	Lotic	0.55	1.99	1.4	11.73
GEI 2014c*	HG-2	Creek Chub	Lotic	0.75	1.99	1.4	8.58

Notes:
* Additional studies added to the database.
[a] Geometric mean of the median enrichments functions (EF) for all available food types (algae, detritus, and sediment). EF (L/g) = Cfood/Cwater.
[b] Taxa-specific conversion whole-body to egg ovary conversion factor (CF; dimensionless ratio).
[c] Composite trophic transfer factor (TTFcomposite). Product of TTF values for all trophic levels.
[d] Translated water concentration corresponding to a revised egg-ovary criterion element of 17.90 mg Se/kg dw (original criterion = 15.8 mg Se/kg dw).

Revised EPA Table B-7 updated with additional GEI data

Common name	Scientific name	Order	Family	Genus	TTF	TTF source data
Alligator Gar	*Atractosteus spatula*	Lepistosteiformes	Lepisosteidae	Atractosteus	~~1.27~~ 1.26	All fish
Black Bullhead	*Ameiurus melas*	Siluriformes	Ictaluridae	Ameiurus	~~0.91~~ 0.87	Exact match
Black Crappie	*Pomoxis nigromaculatus*	Perciformes	Centrarchidae	Pomoxis	2.67	Exact match
Black Redhorse	*Moxostoma duquesnei*	Cypriniformes	Catostomidae	Moxostoma	~~1.05~~ 1.04	Family Catostomidae
Blacknose Dace	*Rhinichthys atratulus*	Cypriniformes	Cyprinidae	Rhinichthys	~~1.46~~ 0.71	~~Family Cyprinidae~~ Exact Match
Blue Catfish	*Ictalurus furcatus*	Siluriformes	Ictaluridae	Ictalurus	0.73	Genus Ictalurus
Bluegill	*Lepomis macrochirus*	Perciformes	Centrarchidae	Lepomis	1.48	Exact match
Bluehead Sucker	*Catostomus discobolus*	Cypriniformes	Catostomidae	Catostomus	1.04	Exact match
Brassy Minnow	*Hybognathus hankinsoni*	Cypriniformes	Cyprinidae	Hybognathus	~~1.46~~ 1.26	Family Cyprinidae
Brook Stickleback	*Culaea inconstans*	Gasterosteiformes	Gasterosteidae	Culaea	~~1.69~~ 1.79	Exact match
Brook Trout	*Salvelinus fontinalis*	Salmoniformes	Salmonidae	Salvelinus	~~0.88~~ 0.97	Exact match
Brown Bullhead	*Ameiurus nebulosus*	Siluriformes	Ictaluridae	Ameiurus	~~0.91~~ 0.87	Genus Ameiurus
Brown Trout	*Salmo trutta*	Salmoniformes	Salmonidae	Salmo	1.44	Exact match
Bullhead		Siluriformes	Ictaluridae		~~0.82~~ 0.80	Family Ictaluridae
Chain Pickerel	*Esox niger*	Esociformes	Esocidae	Esox	2.04	Genus Esox
Channel Catfish	*Ictalurus punctatus*	Siluriformes	Ictaluridae	Ictalurus	0.73	Exact match
Common Carp	*Cyprinus carpio*	Cypriniformes	Cyprinidae	Cyprinus	~~1.34~~ 1.29	Exact match
Common Snook	*Centropomus undecimalis*	Perciformes	Centropomidae	Centropomus	~~1.48~~ 1.45	Order Perciformes
Crappie	*Pomoxis sp.*	Perciformes	Centrarchidae	Pomoxis	2.67	Genus Pomoxis
Creek Chub	*Semotilus atromaculatus*	Cypriniformes	Cyprinidae	Semotilus	~~1.12~~ 1.02	Exact match
Cutthroat Trout	*Oncorhynchus clarkii*	Salmoniformes	Salmonidae	Oncorhynchus	1.07	Exact match
Dolly Varden	*Salvelinus malma*	Salmoniformes	Salmonidae	Salvelinus	~~0.88~~ 0.97	Genus Salvelinus
Fathead Minnow	*Pimephales promelas*	Cypriniformes	Cyprinidae	Pimephales	~~1.57~~ 1.52	Exact match

Common name	Scientific name	Order	Family	Genus	TTF	TTF source data
Flannelmouth Sucker	*Catostomus latipinnis*	Cypriniformes	Catostomidae	Catostomus	1.06	Exact match
Flathead Catfish	*Pylodictis olivaris*	Siluriformes	Ictaluridae	Pylodictus	~~0.82~~ 0.80	Family Ictaluridae
Flathead Chub	*Platygobio gracilis*	Cypriniformes	Cyprinidae	Platygobio	~~1.46~~ 1.26	Family Cyprinidae
Freshwater Drum	*Aplodinotus grunniens*	Perciformes	Sciaenidae	Aplodinotus	~~1.48~~ 1.45	Order Perciformes
Gizzard Shad	*Dorosoma cepedianum*	Clupeiformes	Clupeidae	Dorosoma	~~1.27~~ 1.26	All fish
Goldeye	*Hiodon alosoides*	Hiodontiformes	Hiodontidae	Hiodon	~~1.27~~ 1.26	All fish
Green Sunfish	*Lepomis cyanellus*	Perciformes	Centrarchidae	Lepomis	~~1.27~~ 1.12	Exact match
Iowa Darter	*Etheostoma exile*	Perciformes	Percidae	Etheostoma	1.62	Family Percidae
Kokanee Salmon	*Oncorhynchus nerka*	Salmoniformes	Salmonidae	Oncorhynchus	1.19	Genus Oncorhynchus
Largemouth Bass	*Micropterus salmoides*	Perciformes	Centrarchidae	Micropterus	~~1.27~~ 1.41	Exact match
Largescale Sucker	*Catostomus macrocheilus*	Cypriniformes	Catostomidae	Catostomus	~~1.05~~ 1.04	Genus Catostomus
Longnose Dace	*Rhinichthys cataractae*	Cypriniformes	Cyprinidae	Rhinichthys	~~1.46~~ 1.26	Family Cyprinidae
Longnose Sucker	*Catostomus catostomus*	Cypriniformes	Catostomidae	Catostomus	0.90	Exact match
Mixed					0.87	Exact match
Mosquitofish	*Gambusia sp.*	Cyprinodontiformes	Poeciliidae	Gambusia	~~0.86~~ 0.97	Exact match
Mottled Sculpin	*Cottus bairdi*	Scorpaeniformes	Cottidae	Cottus	1.38	Exact match
Mountain Whitefish	*Prosopium williamsoni*	Salmoniformes	Salmonidae	Prosopium	1.38	Exact match
Northern Pike	*Esox lucius*	Esociformes	Esocidae	Esox	2.04	Exact match
Northern Pikeminnow	*Ptychocheilus oregonensis*	Cypriniformes	Cyprinidae	Ptychocheilus	~~1.46~~ 1.26	Family Cyprinidae
Northern Plains Killifish	*Fundulus kansae*	Cyprinodontiformes	Fundulidae	Fundulus	1.27	Exact match
Northern Redbelly Dace	*Chrosomus eos*	Cypriniformes	Cyprinidae	Chrosomus	~~1.46~~ 1.26	Family Cyprinidae
Northern Squawfish	*Ptychocheilus oregonensis*	Cypriniformes	Cyprinidae	Ptychocheilus	~~1.46~~ 1.26	Family Cyprinidae
Quillback	*Carpiodes cyprinus*	Cypriniformes	Catostomidae	Carpiodes	~~1.05~~ 1.04	Family Catostomidae
Rainbow Trout	*Oncorhynchus mykiss*	Salmoniformes	Salmonidae	Oncorhynchus	1.19	Exact match

Common name	Scientific name	Order	Family	Genus	TTF	TTF source data
Razorback Sucker	*Xyrauchen texanus*	Cypriniformes	Catostomidae	Xyrauchen	~~1.05~~ 1.04	Family Catostomidae
Red Shiner	*Cyprinella lutrensis*	Cypriniformes	Cyprinidae	Cyprinella	~~1.46~~ 1.34	~~Family Cyprinidae~~ Exact Match
Redbreast Sunfish	*Lepomis auritus*	Perciformes	Centrarchidae	Lepomis	~~1.37~~ 1.30	Genus Lepomis
Redear Sunfish	*Lepomis microlophus*	Perciformes	Centrarchidae	Lepomis	~~1.37~~ 1.30	Genus Lepomis
Redside Shiner	*Richardsonius balteatus*	Cypriniformes	Cyprinidae	Richardsonius	~~1.46~~ 0.77	~~Family Cyprinidae~~ Exact Match
River Carpsucker	*Carpiodes carpio*	Cypriniformes	Catostomidae	Carpiodes	~~1.05~~ 1.04	Family Catostomidae
River Redhorse	*Moxostoma carinatum*	Cypriniformes	Catostomidae	Moxostoma	~~1.05~~ 1.04	Family Catostomidae
Rock Bass	*Ambloplites rupestris*	Perciformes	Centrarchidae	Ambloplites	~~1.48~~ 1.41	Family Centrarchidae
Roundtail Chub	*Gila robusta*	Cypriniformes	Cyprinidae	Gila	~~1.46~~ 1.26	Family Cyprinidae
Sacramento Perch	*Archoplites interruptus*	Perciformes	Centrarchidae	Archoplites	~~1.48~~ 1.41	Family Centrarchidae
Sacramento Pikeminnow	*Ptychocheilus grandis*	Cypriniformes	Cyprinidae	Ptychocheilus	~~1.46~~ 1.26	Family Cyprinidae
Sailfin Molly	*Poecilia latipinna*	Cyprinodontiformes	Poeciliidae	Poecilia	~~1.06~~ 1.11	Family Poeciliidae
Sand Shiner	*Notropis stramineus*	Cypriniformes	Cyprinidae	Notropis	~~1.83~~ 1.60	Exact match
Sauger	*Sander canadensis*	Perciformes	Percidae	Sander	1.82	Genus Sander
Sculpin	*Cottus sp.*	Scorpaeniformes	Cottidae	Cottus	1.29	Exact match
Shadow Bass	*Ambloplites ariommus*	Perciformes	Centrarchidae	Ambloplites	~~1.48~~ 1.41	Family Centrarchidae
Shorthead Redhorse	*Moxostoma macrolepidotum*	Cypriniformes	Catostomidae	Moxostoma	~~1.05~~ 1.04	Family Catostomidae
Silver Carp	*Hypophthalmichthys molitrix*	Cypriniformes	Cyprinidae	Hypophthalmichthys	~~1.46~~ 1.26	Family Cyprinidae
Smallmouth Bass	*Micropterus dolomieu*	Perciformes	Centrarchidae	Micropterus	~~1.27~~ 0.83	~~Genus Micropterus~~ Exact Match
Smallmouth Buffalo	*Ictiobus bubalus*	Cypriniformes	Catostomidae	Ictiobus	~~1.05~~ 1.04	Family Catostomidae
Speckled Dace	*Rhinichthys osculus*	Cypriniformes	Cyprinidae	Rhinichthys	~~1.46~~ 1.26	Family Cyprinidae

Common name	Scientific name	Order	Family	Genus	TTF	TTF source data
Spotted Bass	*Micropterus punctulatus*	Perciformes	Centrarchidae	Micropterus	~~1.27~~ 1.12	Genus Micropterus
Spotted Gar	*Lepisosteus oculatus*	Lepistosteiformes	Lepisosteidae	Lepisosteus	~~1.27~~ 1.26	All fish
Stonecat	*Noturus flavus*	Siluriformes	Ictaluridae	Noturus	~~0.82~~ 0.80	Family Ictaluridae
Striped Bass	*Morone saxatilis*	Perciformes	Moronidae	Morone	~~1.48~~ 1.45	Order Perciformes
Striped Mullet	*Mugil cephalus*	Mugiliformes	Mugilidae	Mugil	~~1.27~~ 1.26	All fish
Sucker		Cypriniformes	Catostomidae		~~1.05~~ 1.04	Family Catostomidae
Sunfish Species		Perciformes	Centrarchidae		2.00	Exact match
Tilapia		Perciformes	Cichlidae		~~1.48~~ 1.45	Order Perciformes
Trout Species	*Oncorhynchus sp.*	Salmoniformes	Salmonidae	Oncorhynchus	1.19	Genus Oncorhynchus
Tui Chub	*Gila bicolor*	Cypriniformes	Cyprinidae	Gila	~~1.46~~ 1.26	Family Cyprinidae
Utah Sucker	*Catostomus ardens*	Cypriniformes	Catostomidae	Catostomus	~~1.05~~ 1.04	Genus Catostomus
Walleye	*Sander vitreus*	Perciformes	Percidae	Sander	1.82	Exact match
Western Mosquitofish	*Gambusia affinis*	Cyprinodontiformes	Poeciliidae	Gambusia	1.25	Exact match
Westslope Cutthroat Trout	*Oncorhynchus clarkii lewisi*	Salmoniformes	Salmonidae	Oncorhynchus	1.20	Exact match
White Bass	*Morone chrysops*	Perciformes	Moronidae	Morone	~~1.48~~ 1.45	Order Perciformes
White Crappie	*Pomoxis annularis*	Perciformes	Centrarchidae	Pomoxis	2.67	Genus Pomoxis
White Sturgeon	*Acipenser transmontanus*	Acipenseriformes	Acipenseridae	Acipenser	~~1.27~~ 1.26	All fish
White Sucker	*Catostomus commersonii*	Cypriniformes	Catostomidae	Catostomus	~~1.18~~ 1.04	Exact match
Wiper	*Morone chrysops x Moron saxatilis*	Perciformes	Moronidae	Morone	~~1.48~~ 1.45	Order Perciformes
Yellow Perch	*Perca flavescens*	Perciformes	Percidae	Perca	1.42	Exact match

Specific Columns from EPA Table B-8 with revised TTF values using additional GEI data

Reference	Site Description	Site ID	Target Fish Species Common Name	Effective TTF	Target Fish TFF	TFF Composite
Default			Black Bullhead	2.03	~~0.91~~ 0.87	~~1.85~~ 1.77
Default			Black Crappie	1.93	2.67	5.14
Default			Blacknose Dace	1.78	~~1.46~~ 0.71	~~2.59~~ 1.26
Default			Blue Catfish	2.11	0.73	1.53
Default			Bluegill	1.93	1.48	2.85
Default			Bluehead Sucker	1.16	1.04	1.21
Default			Brassy Minnow	1.28	~~1.46~~ 1.26	~~1.86~~ 1.61
Default			Brook Stickleb Ack	1.33	~~1.69~~ 1.79	~~2.25~~ 2.38
Default			Brook Trout	2.09	~~0.88~~ 0.97	~~1.85~~ 2.03
Default			Brown Bullhead	2.05	~~0.91~~ 0.87	~~1.87~~ 1.78
Default			Brown Trout	1.73	1.44	2.49
Default			Bullhead	2.05	~~0.82~~ 0.8	~~1.68~~ 1.64
Default			Channel Catfish	1.86	0.73	1.35
Default			Common Carp	1.27	~~1.34~~ 1.29	~~1.70~~ 1.64
Default			Crappie	1.93	2.67	5.14
Default			Creek Chub	1.37	~~1.12~~ 1.02	~~1.53~~ 1.40
Default			Cutthroat Trout	1.89	1.07	~~2.02~~ 2.02
Default			Fathead Minnow	1.77	~~1.57~~ 1.52	~~2.77~~ 2.69
Default			Flannel Mouth Sucker	1.55	1.06	1.64
Default			Flathead Chub	1.91	~~1.46~~ 1.26	~~2.79~~ 2.41
Default			Freshwater Drum	1.86	~~1.48~~ 1.45	~~2.76~~ 2.70
Default			Gizzard Shad	1.00	~~1.27~~ 1.26	~~1.27~~ 1.26
Default			Goldeye	1.74	~~1.27~~ 1.26	~~2.20~~ 2.19
Default			Green Sunfish	1.93	~~1.27~~ 1.12	~~2.44~~ 2.16
Default			Iowa Darter	1.90	1.62	3.08
Default			Kokanee Salmon	1.56	1.19	1.85
Default			Largemouth Bass	1.79	~~1.27~~ 1.41	~~2.27~~ 2.52
Default			Longnose Dace	1.91	~~1.46~~ 1.26	~~2.79~~ 2.41
Default			Longnose Sucker	1.41	0.90	1.27
Default			Mixed	1.41	0.87	1.23
Default			Mosquitofish	1.96	~~0.86~~ 0.97	~~1.69~~ 1.90
Default			Mottled Sculpin	1.92	1.38	2.65
Default			Mountain Whitefis H	2.11	1.38	2.9
Default			Northern Pike	1.79	2.04	3.66
Default			Northern Plains Killifish	1.91	1.27	2.44
Default			Northern Redbelly Dace	1.28	~~1.46~~ 1.26	~~1.87~~ 1.61
Default			Northern Squawfish	1.87	~~1.46~~ 1.26	~~2.73~~ 2.36
Default			Rainbow Trout	2.05	1.19	2.44
Default			Red Shiner	1.74	~~1.46~~ 1.34	~~2.53~~ 2.33
Default			Redside Shiner	2.25	~~1.46~~ 0.77	~~3.28~~ 1.73
Default			River Carpsucker	1.10	~~1.05~~ 1.04	~~1.16~~ 1.14

Reference	Site Description	Site ID	Target Fish Species Common Name	Effective TTF	Target Fish TFF	TFF Composite
Default			Roundtail Chub	2.30	~~1.46~~ 1.26	~~3.35~~ 2.90
Default			Sacramento Perch	1.29	~~1.48~~ 1.41	~~1.90~~ 1.82
Default			Sailfin Molly	1.29	~~1.06~~ 1.11	~~1.36~~ 1.43
Default			Sand Shiner	1.55	~~1.83~~ 1.60	~~2.84~~ 2.48
Default			Sauger	1.73	1.82	3.16
Default			Sculpin	1.99	1.29	2.57
Default			Shorthead Redhorse	1.41	~~1.05~~ 1.04	~~1.48~~ 1.47
Default			Smallmouth Bass	1.86	1.27	2.35
Default			Speckled Dace	1.91	~~1.46~~ 1.26	~~2.78~~ 2.41
Default			Stonecat	1.60	0.82	1.31
Default			Sucker	1.20	~~1.05~~ 1.04	~~1.27~~ 1.25
Default			Sunfish Species	1.92	2.00	3.84
Default			Tilapia	1.20	~~1.48~~ 1.45	~~1.78~~ 1.74
Default			Trout Species	1.97	1.19	2.34
Default			Tui Chub	1.45	~~1.46~~ 1.26	~~2.12~~ 1.83
Default			Utah Sucker	1.20	~~1.05~~ 1.04	~~1.27~~ 1.25
Default			Walleye	1.76	1.82	3.21
Default			Western Mosquitofish	1.96	1.25	2.46
Default			Westslope Cutthroat Trout	1.91	1.20	2.29
Default			White Bass	1.86	~~1.48~~ 1.45	~~2.76~~ 2.70
Default			White Crappie	1.93	2.67	5.14
Default			White Sturgeon	2.00	~~1.27~~ 1.26	~~2.53~~ 2.52
Default			White Sucker	1.43	~~1.18~~ 1.04	~~1.68~~ 1.49
Default			Wiper	1.72	~~1.48~~ 1.45	~~2.55~~ 2.49
Default			Yellow Perch	1.65	1.42	2.35
Saiki et al. 1993			Bluegill	1.43	1.48	2.12
Saiki et al. 1993			Largemouth Bass	1.21	1.27	1.54
Saiki et al. 1993			Western Mosquitofish	1.74	1.25	2.18
Formation 2012	Crow Creek - CC150	CC- 150	Brown Trout	2.08	1.44	3.00
Formation 2012	Crow Creek - CC150	CC- 150	Sculpin	2.08	1.29	2.69
Formation 2012	Crow Creek - 1A	CC- 1A	Brown Trout	2.16	1.44	3.12
Formation 2012	Crow Creek - 1A	CC- 1A	Sculpin	2.16	1.29	2.80
Formation 2012	Crow Creek - CC350	CC- 350	Brown Trout	2.13	1.44	3.07
Formation 2012	Crow Creek - CC350	CC- 350	Sculpin	2.13	1.29	2.75
Formation 2012	Crow Creek - 3A	CC- 3A	Brown Trout	2.19	1.44	3.15
Formation 2012	Crow Creek - 3A	CC- 3A	Sculpin	2.19	1.29	2.82
Formation 2012	Crow Creek - CC75	CC- 75	Brown Trout	2.04	1.44	2.94
Formation 2012	Crow Creek - CC75	CC- 75	Sculpin	2.04	1.29	2.63
Formation 2012	Deer Creek	DC- 600	Brown Trout	2.08	1.44	2.99
Formation 2012	Deer Creek	DC- 600	Sculpin	2.08	1.29	2.68
Formation 2012	Hoopes Spring - HS	HS	Brown Trout	2.72	1.44	3.92
Formation 2012	Hoopes Spring - HS	HS	Sculpin	2.72	1.29	3.51

Reference	Site Description	Site ID	Target Fish Species Common Name	Effective TTF	Target Fish TFF	TFF Composite
Formation 2012	Hoopes Spring - HS3	HS-3	Brown Trout	1.85	1.44	2.67
Formation 2012	Hoopes Spring - HS3	HS-3	Sculpin	1.85	1.29	2.39
Formation 2012	Sage Creek - LSV2C	LSV- 2C	Brown Trout	2.19	1.44	3.16
Formation 2012	Sage Creek - LSV2C	LSV- 2C	Sculpin	2.19	1.29	2.83
Formation 2012	Sage Creek - LSV4	LSV- 4	Brown Trout	2.07	1.44	2.98
Formation 2012	Sage Creek - LSV4	LSV- 4	Sculpin	2.07	1.29	2.67
Formation 2012	South Fork Tincup Cr.	SFTC-1	Brown Trout	2.21	1.44	3.18
Formation 2012	South Fork Tincup Cr.	SFTC-1	Sculpin	2.21	1.29	2.85

Message

From: Aspatore, Amanda [AAspatore@nma.org]
Sent: 9/5/2017 8:17:49 PM
To: Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]
Subject: Conductivity Information
Attachments: 2008 Pond Passmore Study_opt.pdf; 2009 Pond Passmore Study_opt.pdf; National Mining Association Cover Letter - Conductivity Comments_opt.pdf; National Mining Association Conductivity Comments_opt.pdf; Gina McCarthy Conductivity TMDL Brief.pdf; Lower Court Conductivity TMDL Decision_opt.pdf; NACWA, NCBA, NMA 4th Cir TMDL Amicus Brief.pdf; WVA Coal Association 4th Circuit Conductivity TMDL Amicus.pdf; OVEC v Fola District Court Decision.pdf; State of WV Brief 4th Circuit OVEC v. Fola.pdf; OVEC v. Fola 4th Circuit Decision.pdf

Hi Sarah –

Attached please find some information on conductivity that I thought might be helpful. Included are the following:

Technical Conductivity Documents:

1) 2008 Pond Passmore Study - The original study by Gregory Pond, Margaret Passmore etc. from which EPA's Appalachian conductivity "benchmark" was derived, and which serves as the basis for all of EPA's current conductivity initiatives, including the proposed draft conductivity field-based methodology.
2) 2009 Pond Passmore Study - A later study by Pond and Passmore that reached very different conclusions from those in the original study, including that sites with conductivity > 500 µS/cm were not impaired, that ion makeups vary, and that stressors other than conductivity cause additional degradation (highlighted in the document, starting pg. 13).
3) NMA's comments (with cover letter) on the proposed draft conductivity methodology.

Conductivity Litigation Documents:

1) *OVEC v. McCarthy* – Federal district court utilizing conductivity "benchmark" (which serves as the basis for the current draft conductivity methodology) over objection of both EPA and State in the context of TMDL development:
    a. Obama Administration brief supporting West Virginia's decision to delay development of conductivity TMDLs due to complexity of the science.
    b. Adverse district court holding that EPA had to approve or deny State's "constructive submission" of no conductivity TMDLs, in part based on the "extensive" existing scientific record on conductivity (i.e., EPA's Appalachian "benchmark").
    c. Industry amicus briefs in EPA's appeal to 4th Circuit addressing conductivity (4th Circuit decision pending).
2) *OVEC v. Fola* – Federal district court utilizing EPA's "benchmark" to impose post-hoc numeric conductivity limit directly onto permittee over objection of State:
    a. District court decision setting post-hoc NPDES permit limit based on benchmark.
    b. **State brief** to 4th Circuit explaining that State expressly rejected standards applied by district court and asking 4th Circuit to overturn (NMA and others also amici in case).
    c. 4th Circuit decision upholding lower court decision despite State's brief.

Thank you so much – I know how busy you all are, and I really appreciate your taking the time to look at this issue! I will also be passing along some information on selenium and groundwater permitting shortly. Please do not hesitate to contact me if you have any questions or would like any additional information.

Sincerely,
Amanda

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Downstream effects of mountaintop coal mining: comparing biological conditions using family- and genus-level macroinvertebrate bioassessment tools

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Abstract. Surface coal mining with valley fills has impaired the aquatic life in numerous streams in the Central Appalachian Mountains. We characterized macroinvertebrate communities from riffles in 37 small West Virginia streams (10 unmined and 27 mined sites with valley fills) sampled in the spring index period (March–May) and compared the assessment results using family- and genus-level taxonomic data. Specific conductance was used to categorize levels of mining disturbance in mined watersheds as low ($<$500 μS/cm), medium (500–1000 μS/cm), or high ($>$1000 μS/cm). Four lines of evidence indicate that mining activities impair biological condition of streams: shift in species assemblages, loss of Ephemeroptera taxa, changes in individual metrics and indices, and differences in water chemistry. Results were consistent whether family- or genus-level data were used. In both family- and genus-level nonmetric multidimensional scaling (NMS) ordinations, mined sites were significantly separated from unmined sites, indicating that shifts in community structure were caused by mining. Several Ephemeroptera genera (e.g., *Ephemerella*, *Epeorus*, *Drunella*) and their families (Ephemerellidae, Heptageniidae) were correlated most strongly with the primary NMS axis ($r > 0.59$ for these genera; $r > 0.78$ for these families). These same Ephemeroptera were absent and, thus, eliminated from most of the mined sites. Total Ephemeroptera richness and relative abundance both declined with increasing mining disturbance. Several other metrics, such as richness, composition, tolerance, and diversity, clearly discriminated unmined vs mined sites. Most family-level metrics performed well and approximated the strength of genus-based metrics. A genus-based multimetric index (MMI) rated more mined sites as impaired than did the family-based MMI. Water-quality variables related to mining were more strongly correlated to NMS axis-1 scores, metrics, and MMIs than were sedimentation and riparian habitat scores. Generally, the correlations between the genus-level MMI and water-quality variables were stronger than the correlations between the family-level MMI and those variables. Our results show that mining activity has had subtle to severe impacts on benthic macroinvertebrate communities and that the biological condition most strongly correlates with a gradient of ionic strength.

Key words: bioassessment, coal mining, macroinvertebrates, specific conductance, Ephemeroptera, multimetric index, taxonomic resolution.

Many studies have shown that coal mining activities negatively affect stream biota in nearly all parts of the globe (e.g., Lewis 1973a, b, Scullion and Edwards 1980, Winterbourn and McDiffett 1996, Garcia-Criado et al. 1999, Kennedy et al. 2003). Acidic coal mine drainage (pH $<$ 6) and associated water-quality degradation have been studied the most extensively of all effects (e.g., Herlihy et al. 1990, Maltby and Booth 1991, Winterbourn and McDiffett 1996, Verb and Vis 2000, Cherry et al. 2001, DeNicola and Stapleton 2002, Freund and Petty 2007). In the northern Appalachians and Allegheny Plateau, certain coal strata have higher S content than other strata and tend to cause acidic mine drainage. Some coal mining activities routinely produce acidic mine drainage, but mountaintop mining (MTM) in the steep terrain of the Central Appalachian coalfields of Kentucky, Virginia, and West Virginia generally results in alkaline mine drainage

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Sierra Club v. EPA 18cv3472 NDCA Tier 2 ED_002061_00106917-00001

(pH > 7). Calcareous strata and lower concentrations of S in the coal help to explain this alkaline mine drainage. Coal is made up primarily of organic elements (e.g., C, H) and inorganic elements (e.g., Al, Fe, Ca, Mg, Na, K, and S), and it contains trace elements (including As, Be, Cd, Co, Cr, Hg, Mn, Ni, Pb, Sb, and Se).

During MTM, several overburden layers of sedimentary rock are removed to access coal layers. Some of the mined rock is returned to the mountaintop and graded, but excess spoil typically is placed in valleys adjacent to the surface mine, resulting in valley fills (VFs) or hollow fills (detailed in Slonecker and Benger 2002). VFs permanently bury the ephemeral, intermittent, and perennial streams located adjacent to the mining operations. Land reclamation involves regrading and revegetation using grasses and other herbaceous plants that might be exotic (e.g., *Lespedeza cuneata*). Unlike clear-cut logging, colonization by native plants and trees is normally very slow because of heavy removal of topsoil and compaction of remaining soils on mine sites (Handel 2003). Biogeochemical properties of reclaimed mine soils can be radically different from forest soils, especially in terms of C and nutrient availability (Simmons et al. 2008). Across the MTM region as a whole, Wickham et al. (2007) found that interior forest loss from MTM was 1.75 to 5× greater than overall forest loss attributable to MTM and indicated that fragmentation of forests and introduction of edge forest can change the condition and ecological function of the remaining forest.

The direct impacts of MTM and associated fills on buried streams are undisputed (USEPA 2005). The streams buried by the overburden are permanently eliminated, and MTM and associated VFs have several indirect effects on downstream waters. Precipitation and groundwater in the mined watersheds percolate through the unconsolidated overburden on the mined sites and in the VFs and dissolve minerals until they discharge from the toe of the fills as surface water. The water quality downstream of the VFs can have elevated levels of SO_4, Ca, Mg, hardness, Fe, Mn, Se, alkalinity, K, acidity, and NO_3/NO_2 (Bryant et al. 2002). Sediment runoff is controlled through a series of sediment-control structures and ponds, but excess fine sediment might be increased in streams downstream of VFs (Wiley and Brogan 2003). Moreover, decreased evapotranspiration on the mined site and storage in the VFs can increase instream baseflows 6 to 7× downstream of VFs compared to unmined streams (Wiley et al. 2001), and peak flows might be higher (Wiley and Brogan 2003). These water-quality, hydrological, and physical habitat changes have the potential to negatively affect the instream aquatic life downstream of alkaline MTM and the associated VFs.

Contemporary MTM effects on downstream benthic macroinvertebrates have been reported in West Virginia and Kentucky (Green et al. 2000, Chambers and Messinger 2001, Howard et al. 2001, Pond 2004, Hartman et al. 2005, Merricks et al. 2007). Green et al. (2000) used family-level data because the state monitoring and assessments were done at the family level, and data comparability with state regulatory decisions was an important consideration. Green et al. (2000) also recognized that the family-level assessments might be conservative in that they might underestimate impairment caused by mining. Howard et al. (2001) and Pond (2004) identified consistent impairment of VF streams using genus-level data in Kentucky.

The West Virginia Department of Environmental Protection (WVDEP), the state agency charged with protecting the state's waters under the Clean Water Act (CWA), currently uses the family-level Stream Condition Index (WVSCI; Gerritsen et al. 2000) to conduct bioassessments and interpret the effect as biological impairment of aquatic life use. The state has listed many of the streams located downstream of mined areas and associated VFs as impaired on their CWA section 303(d) list of waters needing Total Maximum Daily Loads (TMDLs) (WVDEP 2007b). In many instances, the mining activity and associated VFs are the only sources of pollutants in the watershed.

Despite these studies, there have been different interpretations by regulators, the regulated community, and researchers about the severity and potential cumulative effects of MTM on resident aquatic life (USEPA 2005). Disagreement between regulators and the regulated community concerning the severity of impairment from mining and VFs might stem from differences in level of taxonomic identification, the different analyses and metrics used by various entities (e.g., regulators, regulated community, and researchers), and the ways in which these metrics are used by state agencies to interpret compliance with water-quality standards. In the Central Appalachians, both West Virginia and Virginia state agencies use family-level assessments to assess stream conditions and all related stressors. However, US Environmental Protection Agency (EPA) Region 3 and WVDEP have recently developed a genus-level mulitmetric index (MMI) called the Genus-Level Index of Most Probable Stream Status (GLIMPSS; Appendix 1), and WVDEP is using this MMI to do assessments. Recent studies on the benefits of finer taxonomic resolution indicate more accurate assessments when genus- or species-level data are used rather than family-level data (Guerold 2000, Hawkins et al. 2000, Lenat and Resh 2001, Arscott et al. 2006), but family-level assessments are also useful (Bowman and Bailey 1998, Bailey et al. 2001, Pond and McMurray 2002, Chessman et al. 2007), and the choice of which to use depends on the objectives of the assessments. Here, we compare family- and genus-level data using regulatory tools, such as WVSCI and GLIMPSS, and selected metrics that are commonly used by states and the regulated community to determine attainment of aquatic life uses for CWA programs. We examine the severity of impairment in waters downstream of VFs using genus-level data and offer further analyses of correlated stressors.

Methods

Site selection and study area

We sampled a total of 27 mined sites with VFs (mined) and 10 unmined sites in the region of MTM in the Central Appalachians (ecoregion 69; Woods et al. 1996) of West Virginia (Appendix 2). We selected sites to provide a range of mining intensity and water quality typical of MTM in this ecoregion. Locations of sample reaches in mined sites ranged from 0.15 km to 2.2 km downstream of the nearest mainstem or tributary VF (mean = 0.8 km). These data spanned collections taken in 1999/2000 ($n = 19$ sites) and 2006/2007 ($n = 18$ additional sites). We evaluated 6 sites (3 reclaimed mined and 3 unmined) for temporal changes over a 6- to 7-y recovery period (1999/2000–2006/2007). We did not combine data from the 2006/2007 revisit samples from these 6 sites with data from other sites in any statistical tests, but we did include the data in exploratory analyses.

The ecoregion is characterized by highly dissected terrain with similar forest types, geology, and climate. Bedrock geology is sedimentary and consists of interbedded sandstones, siltstones, shale, and coal. The dominant vegetation is mixed mesophytic forest (Braun 1950). Most unmined sites had minor anthropogenic influences (e.g., roads, gas wells, past channelization, timbering). Therefore, we considered them to be least disturbed (Stoddard et al. 2006) rather than pristine or minimally disturbed. Mined sites were located downstream of VFs in perennial reaches. Whereas some mined sites had limited mining disturbance prior to the MTM (e.g., contour mining with no VFs), many sites were relatively undisturbed prior to mining. Site watershed areas were relatively small and ranged from 0.5 to 15 km^2. Small streams in this ecoregion typically flow through constrained valleys with relatively high gradients and have boulder–cobble substrates (Woods et al. 1996). Reach slopes in this study ranged from 2 to 7% with an average of 3% (USEPA, unpublished data). Precipitation patterns are generally uniform throughout the study region; however, in summer 1999, this coalfield region reached extreme drought status. Rainfall was considered to be normal in our study area during 2006/2007 sampling (US Drought Monitor Archives 2008; http://drought.unl.edu/dm/archive).

Macroinvertebrate data

We collected macroinvertebrates from riffles using a 0.5-m-wide kicknet (595-μm mesh) in the spring index period (March–May 1999/2000 and 2006/2007). Briefly, we composited 4 targeted 0.25-m^2 kick samples to obtain a 1-m^2 sample from a 100-m reach at each site. In the laboratory, we randomly subsampled organisms in gridded pans to obtain 200 ± 20% individuals. We identified individuals to the genus level for most groups, except Turbellaria, Nematoda, Hydracarina, and Oligochaeta. In cases where the number of sorted organisms was far greater than the target, we subsampled all samples to 200 organisms using a Fortran® program (http://129.123.10.240/WMCPortal/modelSection.aspx?section=125&title=build&tabindex=-1; Western Center for Monitoring and Assessment of Freshwater Ecosystems, Utah State University, Logan, Utah). We sorted entire samples for some sites with low densities. For family-level analyses, we collapsed genera and summed them to family names in the database.

Environmental data

Bryant et al. (2002) reported monthly water samples at our mined and unmined sites collected in 1999/2000 ($n = 19$ sites), but we sampled only 1 of the 18 remaining sites for water chemistry in 2007. We used mean ($n = 13$ mo) chemical concentrations for the sites sampled in 1999/2000, whereas the sample collected in 2007 consisted of a representative grab sample taken at the time of macroinvertebrate sampling. Chemical variables included total metals, dissolved Fe and Mn, nutrients (NO_3, total P), total suspended solids, alkalinity, hardness, anions and cations, pH, and specific conductance. We recorded in situ physicochemical variables (pH, specific conductance, and temperature) at the time of benthic sampling at all 37 sites with a portable multiparameter sonde (Hydrolab Quanta; Hydrolab Corp., Austin, Texas). Sample collection, analytical methods, and results for water chemistry (1999/2000 data set) were reported in Bryant et al. (2002).

Percent mining in the catchment might serve as an appropriate indicator of mining disturbance, but we thought that our mining land-cover estimates were not sufficiently accurate for quantification (e.g., outdated imagery and inaccurate satellite interpretation). We offer these estimates in Appendix 2 for information purposes only. SO_4 concentration has been recommended as a way to estimate mining disturbance in some studies (Herlihy et al. 1990, Rikard and Kunkle 1990), but we lacked SO_4 data for nearly ½ of the sites. Therefore, we assigned sites to 4 categories of mining disturbance (unmined, low, medium, high) using specific conductance as the indicator based on the strong relationship between monthly SO_4 and specific conductance in the Bryant et al. (2002) data set ($R^2 = 0.94$, $p < 0.001$, $n = 511$). Many studies have shown that specific conductance is also a strong indicator of land disturbance, such as urbanization or agriculture (Herlihy et al. 1998, Dow and Zampella 2000, Paul and Meyer 2001, Black et al. 2004), but our sites included only upstream mining disturbances. We derived mining disturbance categories by splitting the range of mined-site conductivities into 3 categories (low: <500 μS/cm [$n = 7$], medium: 500-1000 μS/cm [$n = 8$], high: >1000 μS/cm [$n = 12$]). These categories were used primarily for graphical interpretations and to interpret taxonomic composition along a categorical gradient.

We scored physical habitat (0–20 points/metric; 0–200 points for total score) at all sites using the US EPA Rapid Bioassessment Protocol (RBP) (Barbour et al. 1999). We considered only the following RBP habitat metrics, embeddedness, sediment deposition, channel alteration, riparian zone width, and the total score, based on our knowledge of these metrics in relation to mined watersheds and their overall responsiveness in these small Central Appalachian streams.

Data analyses

We ordinated family- and genus-level community composition data across all sites with nonmetric multidimensional scaling (NMS; PC-ORD, version 4.25; MjM Software, Gleneden Beach, Oregon) using the Bray–Curtis similarity coefficient (Bray and Curtis 1957, McCune and Grace 2002) based on $\log_{10}(x + 1)$ abundances. We computed the data with 400 maximum iterations, 40 real runs, and 50 randomized runs. We grouped sites as unmined or mined with low, medium, or high disturbance. Taxa found at <5% (~2 sites) of all sites were removed prior to running NMS (as recommended by McCune and Grace 2002). The final matrices included 88 genera (of 162 total) and 44 families (of 48 total). We also tested for congruence in genus- and family-level community composition with Mantel's test using matrices calculated from Bray–Curtis similarity matrices (McCune and Grace 2002). The Mantel test compared the 37-site Bray–Curtis matrices between the family- and genus-level data sets by testing the significance of the correlation between matrices using 1000 Monte Carlo permutations (McCune and Grace 2002). We used the nonparametric multiresponse permutation procedure (MRPP) to determine if genus and family composition differed between disturbance categories (PC-ORD). Ranked Sorenson distances from the 37 sites were used to test the hypothesis of no difference between categories. MRPP produced an *A*-statistic, which compared observed vs expected within-site homogeneity based on the distance matrices (positive *A*-values indicate higher within-site homogeneity than expected by chance, i.e., differences in invertebrate composition between sites), and a *p*-value indicating statistical significance.

We compared several commonly used macroinvertebrate metric values between unmined and all mined sites and analyzed the influence of family- and genus-level determinations on these comparisons. Metrics included genus- and family-level total taxon richness, Ephemeroptera–Plecoptera–Trichoptera (EPT) richness, Ephemeroptera richness, Plecoptera richness, biotic index (BI), and Shannon diversity (H′). Some of these metrics are component metrics of the WVSCI and GLIMPSS and some of them are used commonly by other entities (e.g., researchers and the regulated community). The BI indicates the abundance-weighted tolerance value of the subsample and relies on tolerance values used by WVDEP that correspond to values reported in Hilsenhoff (1988), Lenat (1993), and Barbour et al. (1999). We used *t*-tests (after confirming that metric skew was <±1) to detect differences between unmined and all mined sites with genus- and family-level metrics.

We calculated family-level (WVSCI; Gerritsen et al. 2000) and genus-level (GLIMPSS; Appendix 1) MMIs. These MMIs are used by WVDEP to assess condition and aquatic life-use attainment throughout the state. A comparison of the component metrics is shown in Appendix 1. Briefly, GLIMPSS is calibrated by region and season, whereas WVSCI is applied statewide within a broad single index period. Both MMIs were developed using similar methods, the same reference-site selection criteria, and 100-point best standard value (BSV) scoring procedures (Barbour et al. 1999). WVDEP has established an impairment threshold at the 5th percentile of WVDEP's reference distribution. Sites that score at or above this threshold are considered not impaired, whereas sites that score below the threshold are considered impaired. We used GLIMPSS scoring criteria for WVDEP's spring index period (March–May). For the GLIMPSS and WVSCI, scores <62 and <68, respectively, were rated impaired.

We also related ordination results (i.e., NMS axis-1 scores), biological metrics, and MMIs to chemical and habitat data using Spearman correlation coefficients. We correlated water-quality concentrations to individual metrics and MMIs in a separate analysis because the (nearly) full suite of chemical variables was available for only 20 of the 37 sites. Distance (km) downstream of VFs and the total count of fills upstream of the sampling reach were correlated to biological indicators, but only within the mined-site data set.

Results

Assemblage comparisons

NMS produced 2-dimensional ordinations with relatively high resemblance between family- and genus-level determinations (Fig. 1A, B). A 2-dimensional solution was found with satisfactory stress values of 15.7% for the genus ordination and 18.1% for the family ordination. NMS axis 1 represented the most variance in both taxonomic treatments (45% for genus, 67% for family). Both axes accounted for significantly more variance than would be expected by chance (Monte Carlo permutation test, $p = 0.02$, 50 permutations). In both genus- and family-level runs, mined sites were separated considerably from unmined sites in ordination space, which indicates that shifts in community structure were caused by mining intensity.

In general, low, medium, and high disturbance sites were similarly aligned along the primary axis in the 2 ordinations, but in a few instances, the mined-site cluster overlapped the unmined-site cluster (Fig. 1A, B). MRPP showed similar significant differences in genus- and family-level composition between all 4 disturbance categories (genus: $A = 0.38$, $p < 0.00001$; family: $A = 0.36$, $p < 0.00001$). McCune and Grace (2002) suggested that an A-value >0.3 indicates very high within-group homogeneity. For genus- and family-level taxonomy, within-group variability (distance) was lowest in unmined and low-disturbance sites and greatest in high-disturbance sites. Within the 3 mined categories, MRPP still showed significant differences in assemblage composition (genus: $A = 0.15$, $p = 0.0006$; family: $A = 0.21$, $p = 0.00003$) across disturbance categories. The Mantel test showed a strong positive correlation between family- and genus-level Bray–Curtis dissimilarity matrices and, thus, high overall similarity between family- and genus-level composition with respect to the sites (standardized Mantel statistic, $r = 0.82$, $p = 0.001$). Revisited sites

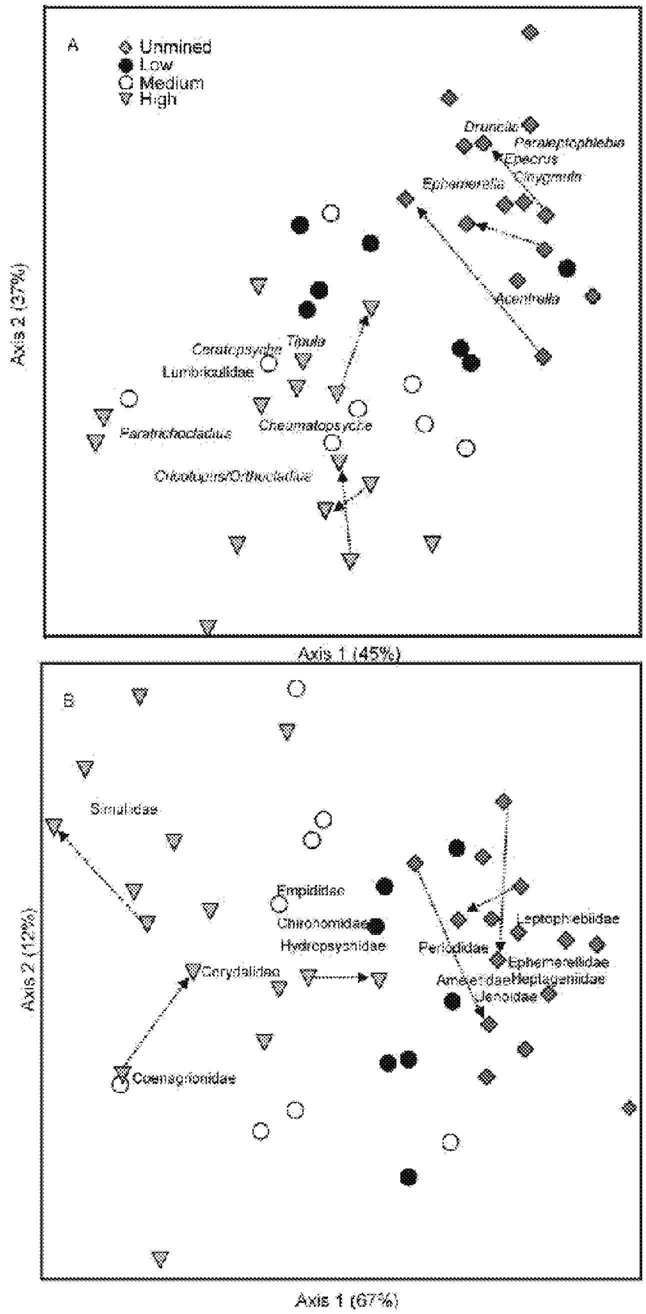

FIG. 1. Nonmetric multidimensional scaling ordination for genus (A) and family (B) determinations at sites categorized by mining disturbance (unmined, low, medium, high). Percent variance explained by each axis is in parentheses. Vectors represent temporal shift of community at 6 revisited sites from 1999/2000 samples to 2006/2007 samples. For clarity, only the 6 most strongly positively and negatively correlated taxa for axis 1 are shown.

(6–7-y period) shifted in ordination space (i.e., as indicated by vectors; Fig. 1A, B), but these pairs of sites generally plotted within their respective category domains.

Table 1. Mean metric values among unmined and mined sites. Statistical comparisons were based on Student's t-tests. EPT = Ephemeroptera, Plecoptera, Trichoptera.

Metric	Unmined	Mined	t	p
Total generic richness	31.9	21.7	–4.6	<0.001
Total family richness	19.9	11.7	–6.1	<0.001
EPT generic richness	17.9	8.9	–7.1	<0.001
EPT family richness	12.8	6.3	–5.9	<0.001
No. Ephemeroptera genera	8.2	2.1	–11.4	<0.001
No. Ephemeroptera families	4.7	1.6	–8.3	<0.001
No. Plecoptera genera	6.0	2.7	–5.3	<0.001
No. Plecoptera families	4.0	2.0	–4.2	<0.001
Genus Biotic Index	2.4	4.5	5.8	<0.001
Family Biotic Index	3.4	4.3	3.6	0.002
Genus Shannon H'	2.7	2.1	–3.7	0.002
Family Shannon H'	2.1	1.5	–3.9	0.001
% Orthocladiinae	5.1	22.1	4.8	<0.001
% Chironomidae	13.5	27.1	2.0	0.056
% Ephemeroptera	45.6	7.4	–6.4	<0.001
% Plecoptera	23.8	27.3	0.5	0.63
% EPT	77.9	51.1	–3.2	0.003

Simultaneous ordination of taxa and sites showed key genera and families typical of unmined and mined streams (Fig. 1A, B). In general, Ephemeroptera taxa were consistently weighted toward positive NMS axis-1 scores and unmined sites, whereas hydropsychid caddisflies, several Diptera, and oligochaetes were aligned with mined sites. Genera with the 5 highest correlations to NMS axis-1 scores included the caddisfly *Cheumatopsyche* ($r = -0.72$) and *Ceratopsyche* ($r = -0.62$), and the mayfly *Epeorus* ($r = 0.70$), *Ephemerella* ($r = 0.67$), and *Drunella* ($r = 0.59$). In the family ordination, families with the highest correlation to NMS axis-1 scores included the mayflies Ephemerellidae ($r = 0.89$), Heptageniidae ($r = 0.78$), Leptophlebiidae ($r = 0.67$), the caddisfly Uenoidae ($r = 0.68$), and the dipteran family Chironomidae ($r = -0.61$). The relative frequencies of EPT taxa among disturbance categories are reported in Appendix 3.

Metric comparisons

Nearly all metrics were able to detect mining influence, and t-statistics were generally stronger for genus-level metrics, but some family-level metrics performed as well as or better than genus-level metrics (e.g., total family richness, family Shannon H'; Table 1). Metric values for unmined sites were significantly different from metric values at mined sites ($p < 0.001$), except % Plecoptera ($p = 0.63$) and % Chironomidae ($p = 0.056$). Both genus and family Plecoptera richness metrics performed well (Table 1). Performance of the % Chironomidae metric ($t = 2.0$) was improved by identifying midges to the subfamily level (% Orthocladiinae, $t = 4.8$). Total and EPT richness declined similarly and consistently as disturbance category increased (Fig. 2A, B).

The greatest difference between family- and genus-level metrics occurred with the BI, an abundance-weighted pollution-tolerance metric. Low family BI values (i.e., representing the abundance of more sensitive taxa at unmined sites) were compressed within a narrow range and changed little between low-disturbance and unmined sites, whereas the more responsive genus BI decreased from >3 at low-disturbance sites to 0 at unmined sites to reflect the greater abundance of more sensitive genera present in the unmined sites (Fig. 3). A more consistent relationship between the genus- and family-level values of metrics was apparent at higher values of BI (>~3.5).

Family- and genus-level MMI comparisons

The GLIMPSS and WVSCI were strongly correlated ($r = 0.90$, $p < 0.0001$), and both MMIs generally agreed by assessing unmined sites as unimpaired and highly disturbed sites as impaired (Fig. 4). However, WVSCI appeared to underestimate impairment for some low- and medium-disturbance sites (Table 2).

Water chemistry, physical habitat, and biological relationships

Most of the chemical and physical variables differed significantly between unmined and mined sites (Mann–Whitney test, $p < 0.05$; Table 3). Mean elevation and watershed area did not differ significantly between mined and unmined sites. Mean water temperature did not differ significantly between mined and unmined sites ($p = 0.97$), even though many of the

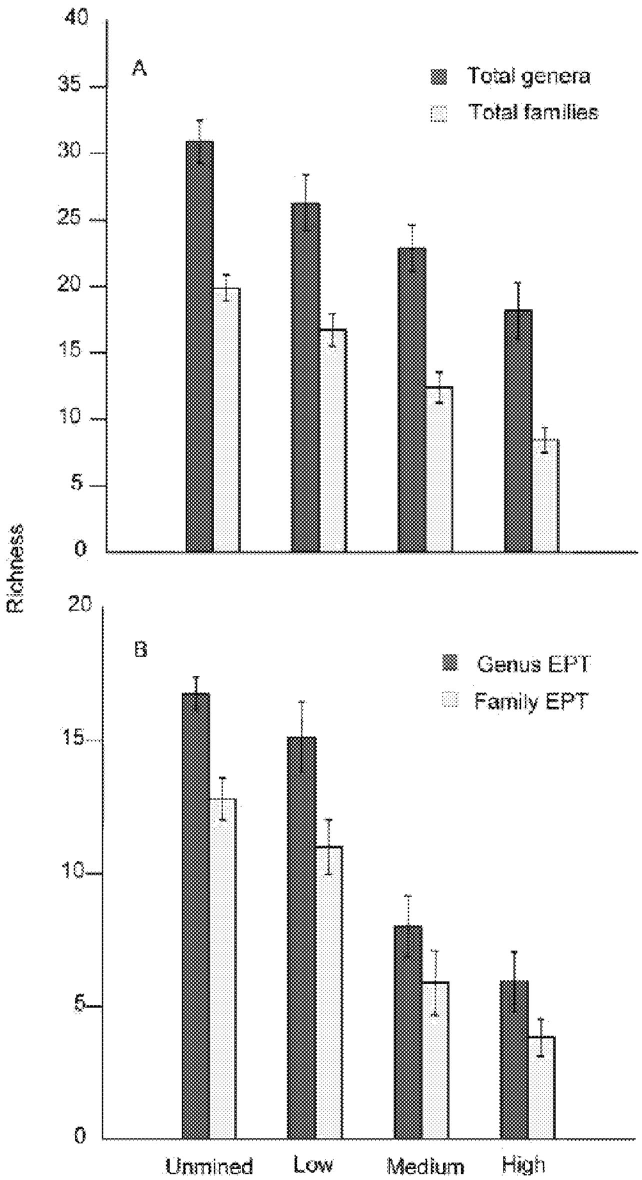

FIG. 2. Mean (±1 SE) total (A) and Ephemeroptera, Plecoptera, Trichoptera (EPT) (B) richness of genus- and family-level determinations across sites grouped by mining disturbance categories.

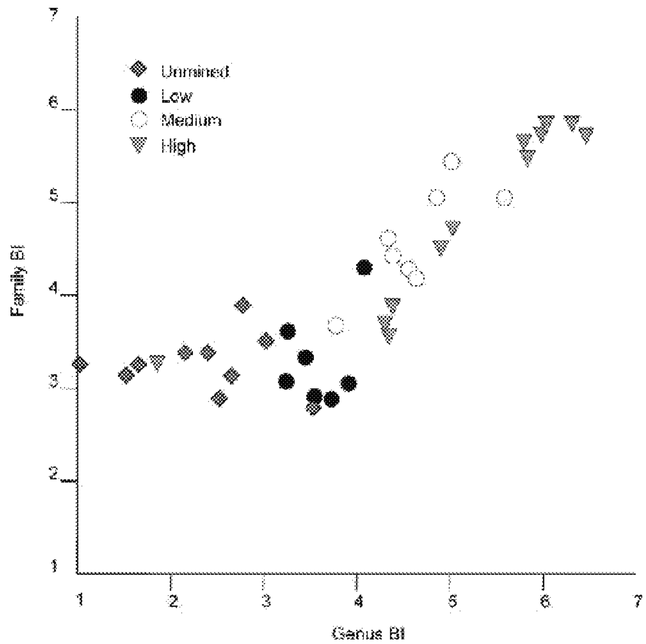

FIG. 3. Scatterplot for the relationship between genus and family biotic index (BI) values at sites categorized by mining disturbance.

mined sites were downstream of sediment-control ponds, which can become warm from insolation. Measures of ionic strength, including individual ions, were more affected by mining than were individual metals or habitat metrics. We did not encounter classic acidic mine drainage because all of our mined sites had relatively high HCO_3 alkalinity and circumneutral pH.

For the 20-site subset, water-quality variables and the total RBP habitat scores were relatively strongly correlated with many biological metrics and the MMIs (Table 4). Most biological metrics and the MMIs had substantially stronger correlations with specific conductance and individual ions than with the mining-related metals or individual habitat variables. NO_3-N was strongly correlated with many biological metrics, but total P was not detected at any site. The strongest relationships between biological variables and any metals were those between EPT and Ephemeroptera generic richness and Se ($r = -0.88$), and between % Chironomidae and dissolved Fe ($r = 0.61$).

For the complete 37-site data set and a smaller subset of environmental variables, the relationships between specific conductance and MMIs and NMS axis 1 were stronger than the relationships between pH, temperature, any of the individual habitat metrics, or the total RBP habitat score and MMIs or NMS axis-1 scores (Table 5). Percent Ephemeroptera showed a sharp nonlinear threshold response to specific conductance, whereby nearly all Ephemeroptera were eliminated from most medium- and high-disturbance sites (Fig. 5A, B). Percent Ephemeroptera was less strongly correlated with habitat-quality metrics than with specific conductance (see Table 4).

Temporal trends in condition

Minor shifts (i.e., vectors) in NMS ordination space (Fig. 1A, B) were observed for the 6 sites that were sampled in 1999/2000 and revisited in 2006/2007. After this 6- to 7-y period, both MMIs indicated that

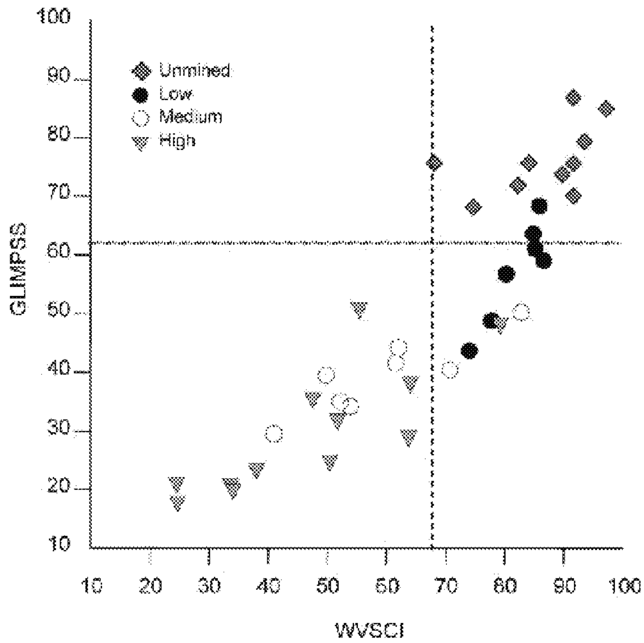

FIG. 4. Scatterplot for the relationship between Genus-Level Index of Most Probable Stream Status (GLIMPSS) and West Virginia Stream Condition Index (WVSCI) categorized by mining disturbance. Vertical and horizontal dashed lines represent impairment thresholds (68 for WVSCI; 62 for GLIMPSS) based on the 5th percentiles of West Virginia Department of Environmental Protection reference distributions.

the 3 mined sites remained impaired, and the sites showed variable signs of further degradation or slight improvement (Table 6). At Stanley Fork, MMIs, total taxon richness, EPT richness, and total RBP habitat score improved over time, but specific conductance increased substantially. MMIs at unmined sites were relatively stable or increased over time and indicated that unmined sites remained unimpaired. These sites were less variable than mined sites and had more consistent total taxon richness, EPT richness, and Ephemeroptera richness over time.

Discussion

The CWA directs states and tribes to designate beneficial uses for streams. Most waters in the US are designated for "aquatic life uses," which means the water must support fish, shellfish, insects, and other wildlife that inhabit the water. Water-quality standards, including numeric parameter-specific criteria and narrative criteria, are meant to protect those designated uses and specific aquatic life. Numeric water-quality criteria (e.g., Se, Fe, Al, pH, total suspended solids [TSS]) are sometimes exceeded in mined streams, but biological assessments (including

TABLE 2. Frequencies of assessment ratings of impaired and unimpaired based on genus- and family-level metrics for sites in 4 mining disturbance categories. GLIMPSS = Genus-Level Index of Most Probable Stream Status, WVSCI = West Virginia Stream Condition Index.

	GLIMPSS (genus level)		WVSCI (family level)	
Category	Impaired	Unimpaired	Impaired	Unimpaired
High	12	0	11	1
Medium	8	0	6	2
Low	5	2	0	7
Unmined	0	10	0	10

MMIs) more commonly indicate impairment. For example, Ephemeroptera are a major component of the macroinvertebrate assemblage and often account for 25 to 50% of total macroinvertebrate abundance in least-disturbed Central Appalachian streams sampled in the spring. Therefore, Ephemeroptera richness and composition metrics are appropriate indicators for bioassessments in this region. Our finding that entire orders of benthic organisms (e.g., Ephemeroptera) were nearly eliminated in MTM streams is a cause for concern and is evidence that the aquatic life use is being impaired.

Our results indicate that MTM is strongly related to downstream biological impairment, whether raw taxonomic data, individual metrics that represent important components of the macroinvertebrate assemblage, or MMIs are considered. The severity of the impairment rises to the level of violation of water-quality standards (WQS) when states use biological data to interpret narrative standards. For example, in West Virginia, the narrative WQS reads, "... no significant adverse impact to the chemical, physical, hydrologic, or biological components of aquatic ecosystems shall be allowed" (WVDEP 2007a). Pertinent to ionic stress effects, Kentucky's narrative WQS states, "Total dissolved solids or specific conductance shall not be changed to the extent that the indigenous aquatic community is adversely affected" (KYDEP 2007). Both WVDEP and Kentucky Department of Environmental Protection (KYDEP) have used biological data to interpret its narrative WQS and then listed mining-impaired streams on their 303(d) lists. More research is necessary to determine whether MTM-impaired streams can be restored to full-attainment status through water-quality improvements (e.g., permits or TMDL implementation) and physical restoration. Family-level assessments might detect high and moderate mining impacts and potential recovery endpoints, but we think that genus-level assessments will be required for thorough stressor

TABLE 3. Chemical and habitat variables at mined and unmined sites. Chemical values are in mg/L unless otherwise specified; p values are associated with comparisons between mined and unmined sites done with Kruskal–Wallis 1-way analysis of variance using the Mann–Whitney U-statistic. Total P was not detected in any samples (0.05 mg/L detection limit). RBP = Rapid Bioassessment Protocol.

	Mined		Unmined		
Variable	n	Mean (range)	n	Mean (range)	p
Watershed area (km^2)	27	4.9 (0.5–15.9)	10	3.0 (0.8–7.0)	0.516
Elevation (m)	27	313.2 (230–500)	10	307 (259–421)	0.973
Temperature (°C)	27	11.7 (7.8–18.2)	10	12 (7.3–16.5)	0.682
pH (SU)	27	7.9 (6.3–8.9)	10	7.1 (6.1–8.3)	0.005
Specific conductance (µS/cm)	27	1023 (159–2540)	10	62 (34–133)	0.000
Embeddedness score	27	13.6 (3–18)	10	16.4 (12–19)	0.004
Sediment deposition score	27	13.4 (6–18)	10	14.8 (10–19)	0.229
Channel alteration score	27	14.7 (7–19)	10	16.8 (15–18)	0.011
Riparian zone width score	27	14.5 (7–20)	10	16.4 (9–20)	0.143
Total RBP habitat score	27	147.8 (126–171)	10	158.5 (141–168)	0.006
HCO_3	13	183 (10.7–501.8)	7	20.9 (6.1–35)	0.002
Al (µg/L)	13	96 (<50–272)	7	92.5 (<50–183)	0.380
Ba (µg/L)	13	41.1 (22–68)	7	39.6 (15–72)	0.692
Ca	13	137.5 (38–269)	7	7.5 (2.7–12)	0.000
Cl	13	4.6 (<2.5–11)	7	2.8 (<2.5–4)	0.022
Cu (µg/L)	13	2.6 (<2.5–3.4)	7	2.9 (<2.5–5)	0.496
Hardness	13	801.4 (225–1620)	7	42 (17–72)	0.000
Dissolved Fe (µg/L)	13	91.8 (<50–281)	7	74.3 (<50–185)	0.362
Total Fe (µg/L)	13	275.6 (66–650)	7	176 (65–471)	0.322
Pb (µg/L)	13	1.2 (<1–4)	7	1.2 (<1–2.1)	0.496
Mg	13	122.4 (28–248)	7	4.3 (2.3–7)	0.000
Dissolved Mn (µg/L)	13	113.4 (6.5–853)	7	20.9 (<5–55)	0.165
Total Mn (µg/L)	13	141.4 (9–904)	7	34.1 (<5–83)	0.143
Ni (µg/L)	13	14.2 (<10–59)	7	<10	0.287
NO_3-N	13	3.4 (0.8–16.5)	7	0.4 (0.1–0.9)	0.001
K	13	9.9 (3–19)	7	1.6 (1.3–2)	0.000
Se (µg/L)	13	10.6 (<1.5–36.8)	7	<1.5	0.001
Na	13	12.6 (2.6–39)	7	2.4 (0.7–5.5)	0.001
SO_4	13	695.5 (155–1520)	7	16 (11–21.6)	0.000
Zn (µg/L)	13	9.1 (<2.5–27)	7	10.2 (3.3–23.4)	0.322

identifications and to detect subtle improvements from stressor abatement activities.

Our results confirm that MTM impact to aquatic life is strongly correlated with ionic strength in the Central Appalachians, but habitat quality did explain some variance in MMIs and other metrics. All mined sites with specific conductance >500 µS/cm were rated as impaired with the genus MMI (GLIMPSS). Undisturbed streams in the Central Appalachians are naturally very dilute, with background conductivities generally <75 µS/cm. Downstream of MTM sites, specific conductance and component ions can be elevated 20 to 30× over the background levels observed at unmined sites (e.g., SO_4: 38×, Mg: 32×, HCO_3: 15×) (Bryant et al. 2002). Mount et al. (1997) recognized the toxicity of major ions and developed predictive models to assess the acute toxicity attributable to major ions using *Ceriodaphnia dubia*, *Daphnia magna*, and *Pimephales promelas*. They reported that the relative ion toxicity was K > HCO_3 ≈ Mg > Cl > SO_4; this order was confirmed by Tietge et al. (1997), who used the models to quantify and predict the toxicity from major ions but also identified toxicity from other toxic compounds in some high-salinity waters. Our data showed that the toxic ions reported by Mount et al. (1997) had strong correlations with benthic macroinvertebrate metrics and MMIs (Table 4) but at concentration ranges much lower than those reported in Mount et al. (1997).

Merricks et al. (2007) reported sporadic acute toxicity to *C. dubia* and *D. magna* at sites draining VFs in West Virginia but did not conclude whether ions or metals were responsible. Soucek and Kennedy (2005) observed SO_4 toxicity to *Hyallela azteca* but at higher concentrations (>2000 mg/L in hard water) than were found in our study. Our mined sites averaged nearly 700 mg/L SO_4, whereas unmined sites averaged only 16 mg/L. A water-quality guideline of <100 mg/L SO_4 was recommended to protect freshwater organisms in British Columbia (Singleton

Table 4. Spearman correlation coefficients ($n = 20$) between genus and family metrics and multimetric indices (MMIs) in relation to environmental variables from the 20-site data subset. All chemical variables are total concentrations unless specified as dissolved. Units are as in Table 3. Biological metrics are abbreviated to order or family name. GLIMPSS = Genus-Level Index of Most Probable Stream Status, WVSCI = West Virginia Stream Condition Index, RBP = Rapid Bioassessment Protocol. Temperature, total P, Ba, Cu, total Fe, Ni, Pb, and Zn were not significantly correlated with metrics ($p > 0.05$). Coefficients in bold are statistically significant ($p < 0.05$).

Variable	GLIMPSS	WVSCI	Total generic richness	Total family richness	EPT generic richness	EPT family richness	No. Ephemeroptera genera	No. Ephemeroptera families	No. Plecoptera genera	No. Plecoptera families
pH	–0.30	–0.29	–0.12	–0.36	–0.23	–0.30	–0.35	–0.37	–0.01	0.02
Specific conductance	**–0.90**	**–0.80**	**–0.74**	**–0.89**	**–0.88**	**–0.88**	**–0.90**	**–0.90**	**–0.75**	**–0.73**
Embeddedness score	**0.61**	**0.57**	**0.67**	**0.64**	**0.69**	**0.72**	**0.52**	**0.50**	**0.61**	**0.60**
Sediment deposition score	**0.52**	**0.62**	0.40	**0.50**	**0.56**	**0.66**	0.44	**0.52**	**0.47**	**0.45**
Channel alteration score	**0.51**	**0.46**	**0.58**	**0.50**	**0.52**	**0.53**	0.34	0.34	**0.58**	**0.58**
Riparian width score	0.21	0.04	0.37	0.21	0.24	0.22	0.13	0.08	0.26	0.23
Total RBP habitat score	**0.76**	**0.74**	**0.76**	**0.75**	**0.78**	**0.83**	**0.64**	**0.66**	**0.76**	**0.72**
HCO_3	**–0.78**	**–0.72**	**–0.67**	**–0.77**	**–0.76**	**–0.75**	**–0.75**	**–0.77**	**–0.65**	**–0.62**
Al	0.28	0.38	0.24	0.43	0.35	**0.45**	0.29	0.24	0.11	0.12
Ca	**–0.89**	**–0.79**	**–0.75**	**–0.86**	**–0.88**	**–0.87**	**–0.88**	**–0.89**	**–0.81**	**–0.75**
Cl	**–0.54**	–0.40	**–0.52**	**–0.57**	**–0.53**	**–0.52**	**–0.53**	**–0.48**	**–0.52**	**–0.50**
Hardness	**–0.89**	**–0.79**	**–0.74**	**–0.85**	**–0.89**	**–0.87**	**–0.87**	**–0.88**	**–0.81**	**–0.78**
Dissolved Fe	–0.29	–0.41	–0.04	–0.28	–0.30	–0.39	–0.33	–0.42	–0.22	–0.23
Mg	**–0.88**	**–0.83**	**–0.71**	**–0.85**	**–0.89**	**–0.90**	**–0.87**	**–0.89**	**–0.81**	**–0.79**
Dissolved Mn	**–0.46**	**–0.45**	–0.17	–0.34	–0.39	–0.43	**–0.46**	**–0.53**	–0.32	–0.30
Total Mn	–0.36	–0.35	–0.04	–0.25	–0.28	–0.35	–0.37	**–0.47**	–0.21	–0.20
$NO_2 + NO_3$	**–0.86**	**–0.82**	**–0.68**	**–0.83**	**–0.83**	**–0.79**	**–0.89**	**–0.87**	**–0.79**	**–0.75**
K	**–0.92**	**–0.88**	**–0.75**	**–0.89**	**–0.88**	**–0.90**	**–0.88**	**–0.89**	**–0.77**	**–0.72**
Se	**–0.85**	**–0.78**	**–0.76**	**–0.82**	**–0.88**	**–0.84**	**–0.88**	**–0.87**	**–0.83**	**–0.80**
Na	**–0.67**	**–0.57**	**–0.57**	**–0.68**	**–0.57**	**–0.59**	**–0.60**	**–0.59**	**–0.48**	**–0.42**
SO_4	**–0.89**	**–0.79**	**–0.75**	**–0.88**	**–0.89**	**–0.88**	**–0.89**	**–0.87**	**–0.79**	**–0.69**

2000). We think that surrogate test organisms (e.g., daphnids, amphipods) are more tolerant of pollutants than are resident Appalachian biota and that toxicity results might not translate into protective criteria.

Elevated conductivity can be toxic through effects on osmoregulation (Wichard et al. 1973, McCulloch et al. 1993, Ziegler et al. 2007). Aquatic insects, such as Ephemeroptera, have relatively high cuticular permeability and regulate ion uptake and efflux using specialized external chloride cells on their gills and integument and internally via Malpighian tubules (Komnick 1977, Gaino and Rebora 2000). Large increases in certain ions can disrupt water balance and ion exchange processes and cause organism stress or death. Tests for conductivity toxicity for mayflies have produced varying results (Goetsch and Palmer 1997, Chadwick et al. 2002, Kennedy et al. 2003, Hassell et al. 2006), but we think that these studies used taxa that are more tolerant (i.e., *Hexagenia*, *Centroptilum*, *Cloeon*, *Isonychia*) than Central Appalachian mayflies (e.g., ephemerellids, heptageniids). Other unknown effects might include ionic stress on reproductive success.

Even at relatively low concentrations, increased conductivity can cause significantly higher drift rates in benthos (Wood and Dykes 2002), but some taxa are not affected (Blasius and Merritt 2002). It is plausible that sensitive taxa are absent from mined streams because of this drift, but increased drift does not explain how recolonization is hindered. Alternatively, elevated specific conductance might simply be an indicator of mining disturbance, and other mining-related variables (e.g., metal concentrations) might be causing or contributing to the impairment. Our bioassessment indicators were not strongly correlated with dissolved or total metals concentrations in the water column, but these results do not rule out possible exposure to metals via dietary uptake (Gerhardt 1992, Buchwalter and Luoma 2005, Cain et al. 2006, Buchwalter et al. 2007) or microhabitat smothering by metal hydroxide precipitate (Wellnitz et al. 1994, USEPA 2005).

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TABLE 4. Extended.

Variable	Genus Biotic Index	Family Biotic Index	Shannon H' (genus)	Shannon H' (family)	% Ortho-cladiinae	% Chiro-nomidae	% Ephemer-optera	% Plecoptera	% EPT
pH	0.34	0.36	–0.12	–0.26	**0.53**	0.31	–0.35	–0.13	–0.32
Specific conductance	**0.83**	**0.68**	**–0.83**	**–0.83**	**0.48**	0.26	**–0.88**	–0.19	**–0.68**
Embeddedness score	**–0.53**	**–0.45**	**0.62**	**0.56**	–0.02	0.21	0.44	**0.45**	**0.47**
Sediment deposition score	**–0.60**	**–0.57**	**0.48**	**0.56**	–0.34	–0.23	**0.48**	**0.49**	**0.63**
Channel alteration score	**–0.46**	–0.32	**0.48**	0.36	–0.05	0.24	0.28	0.42	0.35
Riparian width score	–0.08	0.00	0.27	0.12	0.25	**0.55**	–0.05	0.10	–0.05
Total RBP habitat score	**–0.70**	**–0.57**	**0.72**	**0.71**	–0.21	–0.02	**0.58**	0.38	**0.60**
HCO_3	**0.81**	**0.70**	**–0.62**	**–0.73**	**0.54**	0.37	**–0.75**	–0.26	**–0.74**
Al	–0.24	–0.02	0.41	0.37	–0.24	–0.15	0.24	–0.08	0.17
Ca	**0.85**	**0.73**	**–0.78**	**–0.81**	**0.47**	0.26	**–0.88**	–0.28	**–0.74**
Cl	0.41	0.33	**–0.58**	–0.40	0.00	–0.16	**–0.46**	–0.10	–0.22
Hardness	**0.85**	**0.72**	**–0.77**	**–0.80**	**0.47**	0.26	**–0.90**	–0.26	**–0.73**
Dissolved Fe	0.41	0.34	–0.22	–0.43	**0.45**	**0.61**	**–0.51**	0.14	–0.40
Mg	**0.87**	**0.76**	**–0.74**	**–0.81**	**0.52**	0.32	**–0.92**	–0.32	**–0.77**
Dissolved Mn	**0.46**	0.44	–0.40	**–0.49**	0.42	0.35	**–0.52**	–0.07	–0.41
Total Mn	0.41	0.41	–0.30	–0.35	0.40	0.31	**–0.49**	–0.09	–0.36
$NO_2 + NO_3$	**0.85**	**0.82**	**–0.63**	**–0.73**	**0.60**	0.39	**–0.90**	–0.44	**–0.79**
K	**0.91**	**0.74**	**–0.78**	**–0.87**	**0.58**	0.40	**–0.90**	–0.27	**–0.80**
Se	**0.79**	**0.70**	**–0.68**	**–0.73**	0.44	0.32	**–0.86**	–0.28	**–0.72**
Na	**0.71**	**0.57**	–0.44	**–0.56**	**0.60**	0.32	**–0.58**	–0.20	**–0.60**
SO_4	**0.83**	**0.69**	**–0.79**	**–0.80**	**0.48**	0.26	**–0.88**	–0.25	**–0.71**

MMIs were correlated with Se, but Se is considered relatively nontoxic to invertebrates, and this element is a greater concern for bioaccumulation in vertebrates than it is for toxicity in invertebrates (Lemly 1999, Hamilton 2004). Ingersoll et al. (1990) reported chronic Se toxicity to *D. magna* at concentrations >10 to 100× higher than those found in our study, but Halter et al. (1980) reported chronic toxicity (14 d) in *H. azteca* at levels ~2× as high as our maximum concentration. A review by deBruyn and Chapman (2007) suggested that Se could cause sublethal effects to invertebrates at concentrations considered safe for fish and birds.

In cases where MTM activities resulted in smaller increases in ionic strength, we observed less-severe biological impairment. Within the mined site data set, we found no evidence that MMIs were significantly correlated with the number of VFs upstream or distance from the fill ($p > 0.05$), but these indicators appeared to be related to our inexact estimates of the amount of mining in the watershed. Aerial photos of these particular operations revealed that VFs were relatively small in size and intervening unmined tributaries probably offered some degree of dilution to our downstream sampling sites. For example, Dingess Camp had 1 small VF in its headwaters and 2 intervening unmined tributaries upstream of our sample reach. This site was rated unimpaired and had corresponding specific conductance of 423 μS/cm and total RBP habitat score of 160. However, medium- and high-specific-conductance sites contained either 1 large VF or multiple small VFs with no intervening unmined tributaries to provide dilution. This observation suggests that maintaining some unmined watersheds to provide adequate dilution immediately downstream of future MTM projects might be an effective way to protect downstream resources. These unmined watersheds also could act as refugia for maintenance of regional diversity and sources of recolonization for some species for reclaimed or restored reaches below VFs (e.g., Lowe et al. 2006). Future research should focus on the impairment mechanism and should include investigations of chronic effects on osmoreg-

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TABLE 5. Spearman correlation coefficients of Genus-Level Index of Most Probable Stream Status (GLIMPSS) and West Virginia Stream Condition Index (WVSCI) and genus- and family-level nonmetric multidimensional scaling (NMS) axis scores vs a truncated list of environmental variables available for the entire 37-site data set. Values in bold are statistically significant ($p < 0.05$). RBP = Rapid Bioassessment Protocol.

			Genus		Family	
	GLIMPSS	WVSCI	NMS 1	NMS 2	NMS 1	NMS 2
Temperature (°C)	0.09	0.02	–0.14	**0.33**	–0.02	**0.41**
pH (SU)	**–0.44**	**–0.47**	**–0.47**	**–0.39**	**–0.47**	0.01
Specific conductance (µS/cm)	**–0.91**	**–0.80**	**–0.84**	**–0.72**	**–0.90**	0.16
Embeddedness score	0.23	0.22	0.22	0.04	0.15	0.04
Sediment deposition score	0.20	0.28	0.30	–0.07	0.20	**–0.33**
Channel alteration score	0.29	0.20	0.28	0.15	**0.33**	0.00
Riparian score	0.11	0.02	0.15	0.04	0.14	0.19
Total RBP habitat score	**0.38**	**0.43**	**0.45**	0.12	**0.38**	–0.16
Watershed area (km^2)	–0.19	–0.19	–0.22	–0.26	–0.25	**–0.37**
Elevation (m)	0.16	0.24	0.07	0.30	0.15	0.29

ulation from elevated specific conductance, catastrophic drift with no recolonization, chronic metal exposure via dietary uptake, and further study of the most vulnerable life stages. It is necessary to identify the specific parameters causing impairment to develop appropriate water-quality standards and control solutions.

Influence of MTM and taxonomic resolution on community composition

Unmined streams had assemblages (genus and family level) that differed markedly from assemblages in mined streams; ordinations showed strong shifts in taxonomic composition as indicated by the spread of sites categorized by mining disturbance. In general, Ephemeroptera genera and families were most indicative of unmined streams and contributed the most to separation of sites in ordination space. Mined sites also revealed signature communities dominated by facultative and tolerant taxa such as orthoclads, hydropsychids, oligochaetes, and other Diptera. In both mined and unmined streams, Plecoptera abundance often was dominated by the nemourid *Amphinemura*, a moderately facultative genus that is ubiquitous in small streams throughout the ecoregion.

Use of genus or family taxonomic determinations did not affect our multivariate ordination interpretations. Lenat and Resh (2001) indicated that family-level data approximate finer taxonomic data with multivariate statistics (Furse et al. 1984, Bowman and Bailey 1998); however, Hawkins et al. (2000) found that genus-level multivariate predictive models performed better than family-level models in California streams. Arscott et al. (2006) also showed that genus- and species-level ordinations distinguished urban and agricultural impacts to streams better than did family-level ordinations in the Hudson River Valley. We reason that genus- and family-level ordinations were relatively similar in our data set because many families collected had few genera at each site and because of spatial proximity and physical similarity of small study streams within the ecoregion and strong chemical stressor effects on mined communities.

Metric comparisons

Condition assessment of aquatic resources should rely on proven indicator metrics that are responsive to increasing stress (Karr and Chu 1999). In our analyses, genus-level metrics most accurately detected mining impacts based on *t*-tests, but family- and order-level metrics also were highly successful. The fact that most family- and order-level metrics could easily discriminate mining influences confirms that VF sites were considerably impacted and would certainly represent nonattainment of CWA designated use for aquatic life. The commonly used % EPT metric was less sensitive than other metrics because this metric was driven primarily by the presence of tolerant hydropsychid caddisflies or *Amphinemura* at mined sites. Total and EPT richness was greatly reduced below VFs (by 30–50% of values at unmined sites). In contrast, Merricks et al. (2007) did not find a significant decline in taxon richness below VFs. However, the single reference site used by Merricks et al. (2007) had values of specific conductance that were 4× higher than the average value at our unmined sites, indicating some disturbance at their reference site. Furthermore, the taxon richness value at their reference site was only ½ of the taxon richness we commonly observed.

Genus-level data offer better responsiveness than family- or order-level data because of the larger number of taxa identified and the more accurate tolerance values assigned to genera (Lenat and Resh 2001, Chessman et al. 2007). Differences in total taxon richness might be minimized because generic richness within individual invertebrate families (i.e., low genus:family ratios) seems to be lower in small Central Appalachian streams than in larger warm-water systems. Therefore, family-level taxon richness offers a close approximation to genus-level taxon richness in these small Appalachian systems. Exceptions to this are, for example, the families Chironomidae, Baetidae, Ephemerellidae, Heptageniidae, Hydropsychidae, Elmidae, and Perlodidae. Some of these same genus-rich families contain genera with a wide range of pollution-tolerance values (Blocksom and Winters 2006). This fact was evident in the comparison of genus- and family-level BI values. The family-level BI will be less sensitive than the genus-level BI if genera within a family have a broad range of tolerance values. Genus and family BIs were better correlated in the mid- and upper range of the BI scale than in the low range, a result that might reflect the narrower range of tolerance values in the more pollution-tolerant families normally found in mined streams. Ephemeroptera metrics performed similarly across taxonomic levels (i.e., genus, family, and order levels); populations were nearly eliminated below VFs in our study and others (Howard et al. 2001, Pond 2004, Hartman et al. 2005, Merricks et al. 2007). The only mayflies observed frequently at our low- to medium-disturbance sites were *Baetis* and *Plauditus*, 2 relatively facultative genera (Appendix 3).

MMI comparisons and impairment ratings

Nearly all of the mined sites were assessed as impaired based on GLIMPSS, whereas none of the unmined sites was assessed as impaired. Assessment ratings based on genus- and family-level MMIs were in agreement 81% of the time for sites in our data set. Genus-level GLIMPSS assessment ratings also agreed with family-level WVSCI assessment ratings ~80% of the time during development of GLIMPSS, which included all forms of impacts (not just mining; WVDEP, unpublished data; $n = 421$ for spring index period, ecoregions 67–69; Woods et al. 1996). However, 18% of the time, the WVSCI missed moderate impairment as rated by the GLIMPSS (73 of 421 sites). We think that this discrepancy represents a significant loss in assessment accuracy and supports the use of genus-level assessments in all state regulatory assessments of stream condition and related stressors. Several authors have acknowledged that family-level assessments (MMIs, multivariate predictive models, pollution-tolerance indices, or ordinations) can detect obvious impairment in relation to reference conditions (Bailey et al. 2001, Lenat and Resh 2001, Arscott et al.

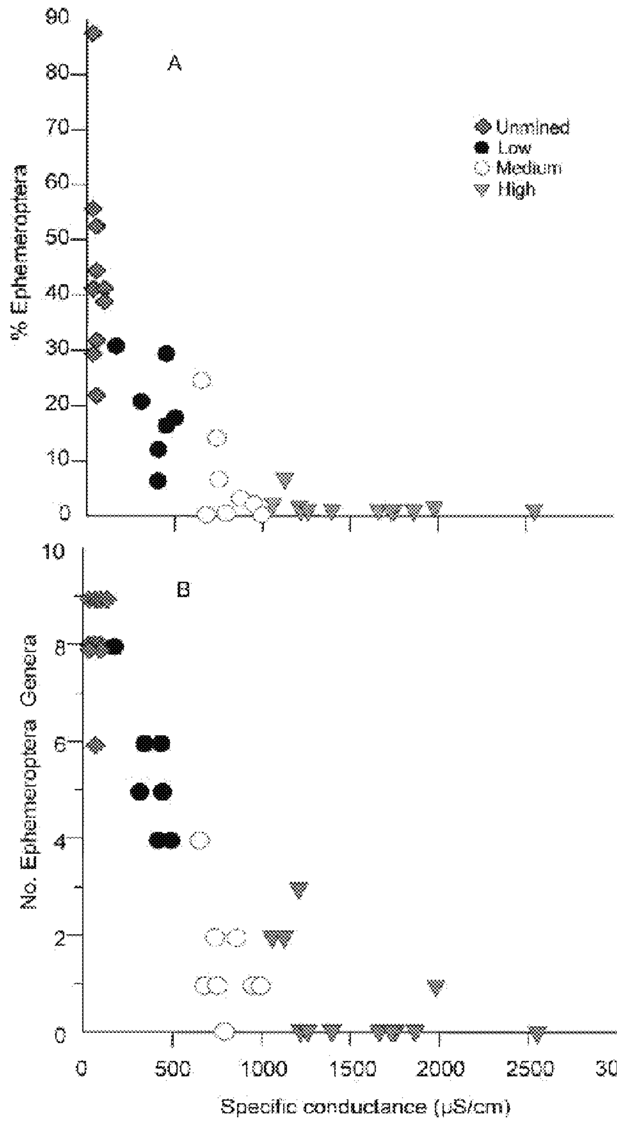

FIG. 5. Scatterplots for the relationship between % Ephemeroptera (A) and number of Ephemeroptera genera (B) and specific conductance at sites categorized by mining disturbance.

2006, Chessman et al. 2007). WVSCI detected severe impacts but missed some low- to moderate-disturbance impacts that were detected by the GLIMPSS. The limitations of the WVSCI are that it does not use Ephemeroptera metrics, which were part of the GLIMPSS, and it does not account for spatial and temporal differences in benthic communities, whereas GLIMPSS is specifically calibrated to reference sites that have been seasonally and regionally partitioned. We did not attempt to modify the WVSCI to account for these issues because seasonal or regional adjustments were considered unnecessary in the development of WVSCI (Gerritsen et al. 2000).

TABLE 6. Multimetric indices (MMIs), selected metric values, specific conductance, and total Rapid Bioassessment Protocol (RBP) habitat scores for 6 sites (3 reclaimed mined sites, 3 unmined sites) visited in 1999/2000 and revisited in 2006/2007. GLIMPSS = Genus-Level Index of Most Probable Stream Status, WVSCI = West Virginia Stream Condition Index, EPT = Ephemeroptera, Plecoptera, Trichoptera.

	Ballard (mined)		Stanley Fork (mined)		Sugartree (mined)		Rushpatch (unmined)		Spring (unmined)		White Oak (unmined)	
Stream	1999	2006	2000	2006	1999	2006	1999	2006	1999	2006	2000	2007
GLIMPSS	51	38	21	34	32	29	75	75	74	79	75	85
WVSCI	55	52	25	38	52	36	68	90	90	95	91	88
Total generic richness	33	20	14	28	22	20	42	40	33	37	32	30
EPT generic richness	12	9	2	6	4	4	17	19	17	21	17	20
Ephemeroptera generic richness	3	3	0	0	0	0	9	7	8	8	9	8
Specific conductance (μS/cm)	1201	1195	1387	2010	1854	1910	60	70	51	66	64	88
Total RBP habitat score	148	149	145	155	141	154	147	144	156	149	161	163

Water-chemistry, physical habitat, and biological relationships

Water quality structured benthic communities more than habitat quality. Our study and others (Chambers and Messinger 2001, Howard et al. 2001, Fulk et al. 2003, Pond 2004, Hartman et al. 2005, Merricks et al. 2007) suggest that specific conductance is the best predictor of the gradient of conditions found downstream of alkaline mine drainage and VF sites in the Central Appalachians. In previous studies, MMIs and Ephemeroptera metrics were strongly negatively correlated with instream specific conductance in West Virginia (Green et al. 2000, Chambers and Messinger 2001) and Kentucky (Howard et al. 2001, Pond 2004). Yuan and Norton (2003) found that Ephemeroptera richness was particularly sensitive to increasing specific conductance in the Mid-Atlantic Highlands. Black et al. (2004) reported that Ephemerellidae and Heptageniidae (the 2 primary mayfly families eradicated from our high-specific-conductance sites) had low specific-conductance optima in Pacific Northwest streams. In an analysis of West Virginia data, Fulk et al. (2003) confirmed that WVSCI scores were negatively correlated with individual and combined ion concentrations, but also with the concentrations of Be, Se, and Zn. Hartman et al. (2005) reported significantly lower densities of Ephemeroptera, Coleoptera, Odonata, noninsects, scrapers, and shredders ($p < 0.03$) in West Virginia VF streams compared to reference streams, but they also found that total abundance of all organisms was not substantially reduced in VF streams. Hartman et al. (2005) also reported that Ephemeroptera family richness was negatively related to specific conductance and that many of the richness metrics were negatively related to particular metals. Ephemeroptera are known to be sensitive to trace metals, especially in soft waters (Clements 2004), but we found that metal concentrations in the water column were not strongly correlated to Ephemeroptera (except Se) in our hard-water mined streams. Last, NO_3-N was significantly related to benthic metrics, but we did not visually observe excessive algal growth during the surveys. However, we cannot assume that diatom communities were not affected at these sites. Total P was probably limiting (it was below the 0.05 mg/L detection limit). Thus, most N probably was exported from the watershed and was autocorrelated with ionic strength.

Individual physical habitat variables and total RBP habitat score were more correlated with MMIs or individual metrics in the 20-site subset (Table 4) than in the full data set (Table 5). The discrepancy between habitat correlations in the 20-site subset vs the 37-site data sets probably arose because more mined sites had better habitat quality in the 37-site data set than in the 20-site subset. Howard et al. (2001) and Pond (2004) reported that habitat indicators (chiefly sedimentation and embeddedness) were strongly correlated with MMIs and particular metrics in Kentucky headwater streams. Surface mining can deliver excess sediment to watersheds (Starnes and Gasper 1995, Waters 1995, Chambers and Messinger 2001). We did not observe excessive sedimentation in our sampled reaches downstream of VF sediment-control ponds, but sediments might be transported and deposited farther downstream. Hartman et al. (2005) did not find significant differences in sedimentation below VFs after 5 to 20 y and speculated that after the initial pulse of sediments from mining operations, fine sediments might be sufficiently flushed from headwater reaches.

Observations on recovery

Our 3 revisits to sites downstream of reclaimed MTM and VFs revealed little sign of biological recovery (with MMIs or selected metrics) after 6 to 7 y, whereas communities within the 3 unmined catchments remained relatively stable. Habitat improvement was subtle at the downstream reaches of mined streams, but specific conductance remained very high, indicating that water chemistry is limiting recovery of these communities. Impacts to ecosystem structure and function (i.e., soil and water biogeochemistry, leaf decomposition, macroinvertebrates) remained after 15 y of recovery of a coal-mined watershed in Maryland (Simmons et al. 2008), and the oldest VF site in the data set given in Merricks et al. (2007) still had downstream specific conductance values >1200 μS/cm and no mayflies after 15 y. Further studies are needed to determine long-term recovery patterns of aquatic communities downstream of MTM and VFs.

Concluding Comments

We explored a causal link between MTM and biological degradation, and our data support the type of logical argument summarized by Beyers (1998) for establishing causal connections. Fore (2003) modified Beyers' 10 criteria and demonstrated causal links between human disturbance and biological condition in mid-Atlantic streams. The 10 criteria are: 1) strength, 2) consistency, 3) specificity, 4) temporality, 5) dose response, 6) plausibility, 7) experimental evidence, 8) analogy, 9) coherence, and 10) exposure. Eight of the 10 criteria were relevant for constructing a causal inference argument with our bioassessment data. We excluded specificity (because the bioassessment tools respond to many sources of degradation) and exposure (because we did not evaluate exposure indicators in affected organisms). Our data met 6 of the remaining 8 relevant criteria:

1. Ninety-three percent of the mined streams and none of the unmined streams were impaired using the preferred genus-level GLIMPSS, indicating the strength of the association.
2. The relationship between MTM and biological impairment has been confirmed by other investigators working in the Central Appalachians of West Virginia and Kentucky, indicating consistency.
3. Because our unmined sites were not impaired and were selected to be typical of least disturbed reference sites, these sites are representative of premining conditions in the watershed. We think it is reasonable to conclude that mining disturbance preceded the observed biological change (temporality).
4. Biological condition degraded in response to increasing mining disturbance, as measured by mining-related water-quality parameters, indicating dose response.
5. The premise that MTM causes downstream biological degradation is plausible given the wholesale landscape changes, hydrological alterations, and potential toxicants that are discharged. For example, elevated ionic strength can impair osmoregulation, which offers a plausible mechanism of impairment to macroinvertebrates.
6. Similar stressors cause similar effects to those found here (analogy). For example, diverse human activities (urbanization, oil- and gas-well drilling, road salting) that produce elevated ionic strength or landscape disturbance also are correlated with downstream impairment in empirical studies, and experimental toxicity testing has confirmed the toxicity of mining-related component ions.

We are currently conducting chronic toxicity testing experiments using surrogate organisms to provide experimental evidence that quantifies the toxicity of these mining effluents on downstream waters. These experiments will test the ambient downstream waters and synthesized waters that will mimic the ionic components of waters downstream of mines but will not contain any other potential toxicants (e.g., metals). The results of these experiments will help to provide more coherence between empirical and experimental evidence on the downstream chemical effects of MTM to aquatic life.

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APPENDIX 1. Additional information on development and application of the Genus-Level Index of Most Probable Stream Status (GLIMPSS).

The GLIMPSS was developed using best standard practices based on US Environmental Protection Agency (EPA) guidelines (Barbour et al. 1999) and Karr and Chu (1999) using >3000 statewide probabilistic and targeted sites (265 reference, 775 stressed) collected between 1998 and 2006. US EPA Region 3 and West Virginia Department of Environmental Protection (WVDEP) used widely recommended index calibration and validation techniques that included testing 36 different metrics for discrimination efficiency, redundancy, response to stressors, variability, and precision. Data were partitioned by bioregional (Allegheny Plateau, Central Appalachian–Ridge and Valley) and seasonal (winter, spring, summer) factors after examining nonmetric multidimensional scoring (NMS) ordinations and metric distributions. GLIMPSS metrics and scoring criteria were developed for 7 strata. For our study sites, we used metrics and final scoring criteria developed for the Mountain Spring stratum (i.e., spring index period/combined ecoregions 67 and 69). Table A1 compares the metrics used in the GLIMPSS to the family-level West Virginia Stream Condition Index (WVSCI).

TABLE A1. List of metrics used in the Genus-Level Index of Most Probable Stream Status (GLIMPSS) and the West Virginia Stream Condition Index (WVSCI). Metric scoring formulae indicate metric value (x) divided by the best standard value (BSV) that corresponds to the 5^{th} or 95^{th} percentile (depending on metric response direction) of West Virginia Department of Environmental Protection (WVDEP) data distribution for all sites in the spring index period, ecoregions 67/69 (for GLIMPSS), or within a broader March to October index period applied statewide (for WVSCI). The final GLIMPSS and WVSCI scores are calculated as the average metric score. Final GLIMPSS scores <62 were rated impaired; final WVSCI scores <68 were rated impaired. Intolerant richness is based on count of taxa with tolerance values <4. EPT = Ephemeroptera, Plecoptera, Trichoptera.

Metric	Scoring formula (value/BSV)100
GLIMPSS	
Total generic richness	$(x/41.5)100$
Intolerant richness	$(x/22.5)100$
Ephemeroptera generic richness	$(x/11)100$
Plecoptera generic richness	$(x/9)100$
Clinger generic richness	$(x/21.5)100$
Genus biotic index	$(10 - x)/(10 - 1.7)100$
% Ephemeroptera	$(x/53.5)100$
% Orthocladiinae	$(100 - x)/(100 - 0.7)100$
% 5 dominant genera	$(100 - x)/(100 - 47.2)100$
WVSCI	
Total family richness	$(x/22)100$
EPT family richness	$(x/13)100$
Family biotic index	$(10 - x)/(10 - 2.6)100$
% EPT	$(x/89.3)100$
% Chironomidae	$(100 - x)/(100 - 1.7)100$
% 2 dominant families	$(100 - x)/(100 - 37.3)100$

APPENDIX 2. General site information by mining disturbance category. Estimated percentage of the watershed mined, number of fills, and distance of site from nearest fill were determined using 1993 Landsat multiresolution land-cover data (for the 1999–2000 data set) and by digitized aerial photography with a 2006 mining permit boundary layer (2006–2007 data set). Distance to nearest fill (distance) is indicated as a mainstem (M) or tributary (T) fill. Mining activity was recorded as of the time of sampling. LF = left fork, UT = unnamed tributary, – = not applicable.

Site	Year	Watershed	Disturbance category	Watershed area (km^2)	Elevation (m)	% mining	No. of fills	Distance (km)	Mining activity
Rockhouse	1999	Coal	Medium	4.0	292.8	47	1	0.37 (M)	Inactive
Beech	1999	Coal	Medium	11.6	289.8	19	5	0.67 (T)	Inactive
LF Beech	2000	Coal	High	6.8	280.6	45	1	0.55 (T)	Active
Buffalo	1999	Coal	Medium	3.1	500.2	1	5	0.35 (T)	Inactive
Sandlick	2007	Coal	Low	11.4	245.4	9	2	0.96 (T)	Active
Laurel	2007	Coal	High	15.9	244.7	20	7	0.75 (T)	Active
Hughes	2000	Gauley	Medium	9.9	283.7	32	8	0.44 (T)	Inactive
Neff	1999	Gauley	Low	3.0	424.0	12	3	1.65 (T)	Inactive
Robinson	2007	Gauley	High	12.4	341.3	76	7	1.1 (T)	Active
Sugarcamp	2007	Gauley	Medium	5.2	328.2	31	2	2.2 (T)	Active
UT Twentymile1	2007	Gauley	High	0.8	331.1	85	1	0.51 (M)	Active
Boardtree	2007	Gauley	High	2.9	316.9	80	1	0.15 (M)	Active
Hardway	2007	Gauley	High	1.4	349.9	14	1	0.62 (M)	Active
Sugartree	1999	Guyandotte	High	1.9	256.2	50	2	0.08 (T)	Inactive
Stanley	2000	Guyandotte	High	4.5	250.1	65	6	0.32 (T)	Inactive
Ballard	1999	Guyandotte	High	6.2	260.8	17	8	0.93 (T)	Inactive
Cow	2000	Guyandotte	Low	1.3	439.2	1	1	1.02 (M)	Inactive
LF Cow	1999	Guyandotte	Low	3.2	353.8	13	2	0.61 (T)	Inactive
Hall	1999	Guyandotte	Medium	0.5	439.2	65	1	0.37 (M)	Inactive
Whitman	2007	Guyandotte	Low	2.8	324.9	41	1	1.2 (T)	Active
Ellis Camp	2007	Guyandotte	Low	1.0	274.3	49	1	0.99 (M)	Inactive
Winding Shoals	2007	Guyandotte	High	1.2	243.2	75	1	0.64 (M)	Inactive
Camp	2007	Guyandotte	Medium	1.5	335.8	35	2	0.85 (M)	Active
Righthand	2007	Guyandotte	Medium	12.4	230.1	17	6	0.89 (T)	Active
Slab	2007	Guyandotte	High	9.3	255.9	52	4	0.99 (T)	Active
Jims	2007	Tug Fork	High	1.3	250.2	57	1	0.60 (M)	Inactive
Dingess Camp	2007	Tug Fork	Low	2.1	280.4	16	1	1.8 (M)	Inactive
Oldhouse	1999	Coal	Unmined	1.8	317.2	–	–	–	Unmined
White Oak	2000	Coal	Unmined	2.7	350.8	–	–	–	Unmined
Trace	2007	Coal	Unmined	1.8	259.1	–	–	–	Unmined
Neil	1999	Gauley	Unmined	3.9	289.8	–	–	–	Unmined
Rader	2000	Gauley	Unmined	5.3	420.9	–	–	–	Unmined
Ash	2007	Gauley	Unmined	7.0	286.5	–	–	–	Unmined
UT Twentymile2	2007	Gauley	Unmined	0.8	279.8	–	–	–	Unmined
Spring	1999	Guyandotte	Unmined	1.4	274.5	–	–	–	Unmined
Rushpatch	1999	Guyandotte	Unmined	2.1	286.7	–	–	–	Unmined
Cabin	1999	Guyandotte	Unmined	4.7	265.4	–	–	–	Unmined

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APPENDIX 3. Relative frequency (%) of Ephemeroptera, Plecoptera, and Trichoptera occurrences among mining disturbance categories. Note the strong dose response of many taxa along the mining disturbance gradient.

Order	Family	Genus	Unmined ($n = 10$)	Low ($n = 7$)	Medium ($n = 8$)	High ($n = 12$)
Ephemeroptera	Ameletidae	*Ameletus*	90	71	25	0
Ephemeroptera	Baetidae	*Acentrella*	60	43	25	8
Ephemeroptera	Baetidae	*Baetis*	70	71	63	17
Ephemeroptera	Baetidae	*Diphetor*	10	0	0	0
Ephemeroptera	Baetidae	*Plauditus*	10	43	13	25
Ephemeroptera	Ephemerellidae	*Drunella*	90	57	0	0
Ephemeroptera	Ephemerellidae	*Ephemerella*	100	86	25	8
Ephemeroptera	Ephemerellidae	*Eurylophella*	20	0	0	0
Ephemeroptera	Ephemeridae	*Ephemera*	20	0	0	0
Ephemeroptera	Heptageniidae	*Cinygmula*	80	43	0	0
Ephemeroptera	Heptageniidae	*Epeorus*	100	43	0	0
Ephemeroptera	Heptageniidae	*Stenacron*	30	0	0	0
Ephemeroptera	Heptageniidae	*Stenonema*	30	14	0	0
Ephemeroptera	Isonychiidae	*Isonychia*	0	14	0	0
Ephemeroptera	Leptophlebiidae	*Paraleptophlebia*	90	43	0	0
Plecoptera	Capniidae	Capniidae	10	0	0	0
Plecoptera	Chloroperlidae	*Alloperla*	0	14	0	0
Plecoptera	Chloroperlidae	*Haploperla*	30	14	25	0
Plecoptera	Chloroperlidae	*Sweltsa*	20	14	0	0
Plecoptera	Leuctridae	*Leuctra*	90	29	25	17
Plecoptera	Nemouridae	*Amphinemura*	100	100	88	75
Plecoptera	Nemouridae	*Ostrocerca*	10	0	0	0
Plecoptera	Nemouridae	*Prostoia*	10	43	13	0
Plecoptera	Peltoperlidae	*Peltoperla*	0	29	13	8
Plecoptera	Perlidae	*Acroneuria*	30	29	13	8
Plecoptera	Perlidae	*Eccoptura*	0	0	0	8
Plecoptera	Perlidae	*Hansonoperla*	10	0	0	0
Plecoptera	Perlodidae	*Clioperla*	0	0	0	8
Plecoptera	Perlodidae	*Diploperla*	0	14	13	8
Plecoptera	Perlodidae	*Isoperla*	20	29	25	25
Plecoptera	Perlodidae	*Malirekus*	10	0	0	0
Plecoptera	Perlodidae	*Remenus*	30	29	0	8
Plecoptera	Perlodidae	*Yugus*	60	14	0	0
Plecoptera	Pteronarcyidae	*Pteronarcys*	60	43	13	0
Plecoptera	Taeniopterygidae	*Taenionema*	0	14	0	0
Plecoptera	Taeniopterygidae	*Taeniopteryx*	10	0	13	0
Trichoptera	Glossosomatidae	*Agapetus*	10	0	0	0
Trichoptera	Glossosomatidae	*Glossosoma*	0	14	0	8
Trichoptera	Hydropsychidae	*Ceratopsyche*	10	43	38	50
Trichoptera	Hydropsychidae	*Cheumatopsyche*	0	86	88	92
Trichoptera	Hydropsychidae	*Diplectrona*	80	71	75	42
Trichoptera	Hydropsychidae	*Hydropsyche*	10	57	88	67
Trichoptera	Hydroptilidae	*Hydroptila*	10	0	0	8
Trichoptera	Hydroptilidae	*Ochrotrichia*	0	0	0	8
Trichoptera	Hydroptilidae	*Stactobiella*	0	0	13	0
Trichoptera	Lepidostomatidae	*Lepidostoma*	10	0	0	0
Trichoptera	Limnephilidae	*Pycnopsyche*	20	0	0	0
Trichoptera	Philopotamidae	*Chimarra*	0	29	13	33
Trichoptera	Philopotamidae	*Dolophilodes*	20	43	13	8
Trichoptera	Philopotamidae	*Wormaldia*	20	0	0	0
Trichoptera	Polycentropodidae	*Polycentropus*	30	29	13	8
Trichoptera	Psychomyiidae	*Lype*	10	0	0	0
Trichoptera	Rhyacophilidae	*Rhyacophila*	70	57	50	17
Trichoptera	Uenoidae	*Neophylax*	70	71	13	8

Evaluating Appropriate Existing and Designated Uses of Straight Creek (Lee County, VA) Using Current Macroinvertebrate, Habitat and Water Quality Data

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Background

The Powell River watershed (USGS Hydrologic Unit Code #06010206) includes portions of Virginia's Wise and Lee Counties. The Powell River flows through Virginia and Tennessee and joins the Clinch River at the Norris Reservoir. Straight Creek (located in Lee County) is a tributary to the North Fork of the Powell River (Figure 1, MapTech 2006).

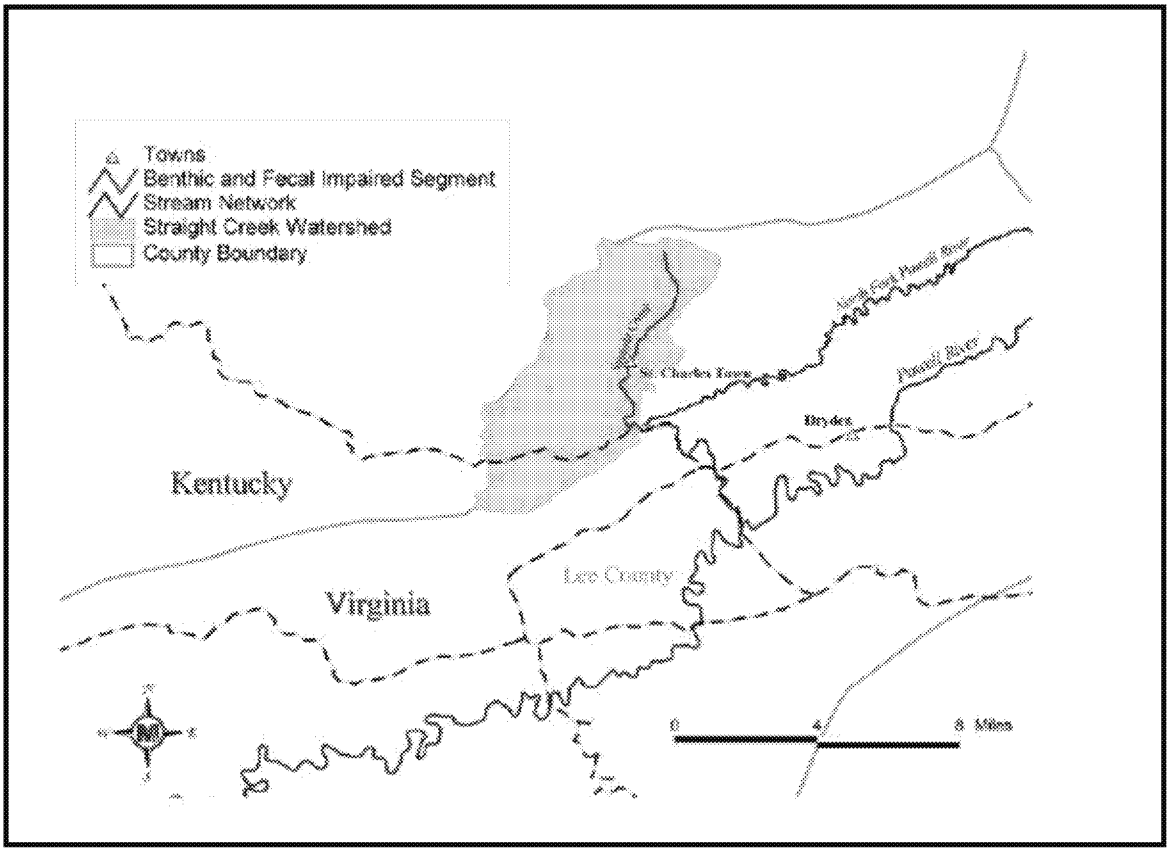

Figure 1. Location of the Straight Creek Watershed (MapTech 2006)

The Straight Creek watershed contains approximately 27.7 square miles (17,728 acres). Major tributaries include Stone Creek, Puckett Creek, Baileys Trace, Gin Creek and Big Branch. The land use is estimated to be primarily forested (80%) with significant amounts of abandoned (11.3%) and active mine lands (7.4%) (MapTech 2006). Active permitted mining operations occur in the headwaters of Gin Creek (Powell Mountain), Baileys Trace (Powell Mountain) and Straight Creek (Lone Mountain). The areas shown as permitted mining land use on Baileys Trace and at the headwaters of Straight Creek are primarily associated with coal preparation plants and ancillary support areas (VMIG 2008). The majority of the abandoned mine lands in the watershed are highwalls and their associated benches. Residential areas are scattered throughout the watershed along the valley bottoms, and are estimated to be less than 1% of the land use, with St. Charles being the largest town in the watershed (population in July 2007 was 153) (www.city-data.com) (Figure 2 and Table 1, MapTech 2006).

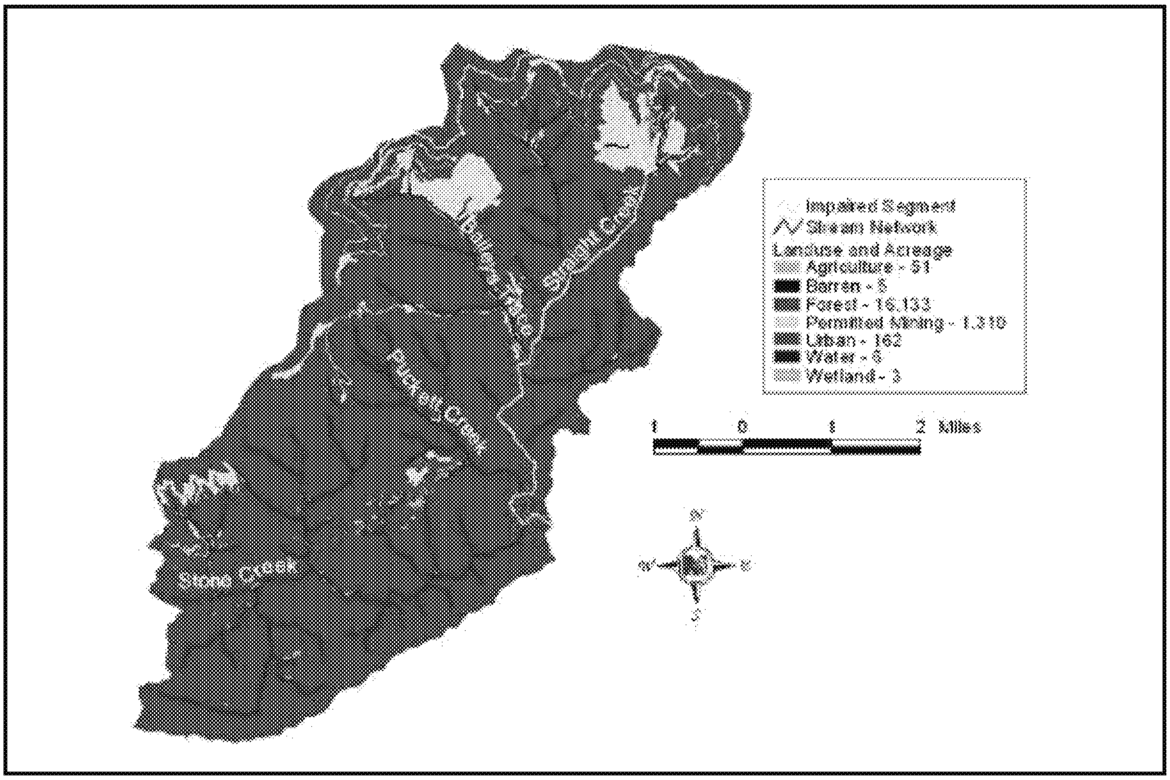

Figure 2. Land Use in Straight Creek (MapTech 2006)

Table 1. Land Uses in Straight Creek Watershed (MapTech 2006)

Land Use	Acres	% of total
AML	1991	11.3
Barren	5	0.0
Commercial	17	0.1
Forest	14142	80.0
Pasture/Hay	42	0.2
Permitted Mining	1310	7.4
Residential	145	0.8
Row Crops	9	0.1
Water	6	0.0
Wetlands	3	0.0
Total Acres	**17670**	**100**

The mainstem of Straight Creek was initially listed on the *Virginia 1994 TMDL Report* for violations of the bacteria standard and then on the *Virginia 1996 Section 303(d) TMDL Priority List* for violations of the narrative General Standard (based on family-level macroinvertebrate surveys). Elevated levels of fecal coliform bacteria recorded at Virginia Department of Environmental Quality (VDEQ) ambient water quality monitoring stations showed that this stream segment does not support the primary contact recreation use (*e.g.*, swimming, wading and fishing). VDEQ analyzed macroinvertebrate samples using a modified Rapid Bioassessment Protocol (RBP) II method (comparison of test sites to single reference sites which do support the aquatic life use) to assess the aquatic life use in Straight Creek as moderately impaired. VDEQ also listed several tributaries of Straight Creek for impaired aquatic life use on the 1996 303(d) list including Stone Creek, Ely Creek, Puckett Creek, Lick Branch of Puckett Creek, Gin Creek and Baileys Trace.

The United States Environmental Protection Agency (EPA) has consistently stated that states should use biological assessments to determine impairments of aquatic life designated uses when the states develop their Section 303(d) lists. EPA has also repeatedly stated that biological assessments are an extremely useful way to determine water quality impairments because biological assessments directly measure whether the aquatic life use is being supported. Furthermore, the biological data integrate and reflect the effect of both physical and chemical stressors. This has been EPA's position since at least 1994 (see ww.epa.gov/owow/tmdl/1994guid.html) and was reiterated in the most recent comprehensive guidance on 303(d) listings in 2005 (See Sections IV.H & IV.K of the 2006 Integrated Report Guidance at www.epa.gov/owow/tmdl/2006IRG/report/2006irg-sec4.pdf).

VDEQ used the process outlined in EPA's Stressor Identification Guidance Document (USEPA 2000) to identify the most probable stressors in Straight Creek. Chemical and physical monitoring data from VDEQ and Virginia Department of Mines, Minerals and Energy (DMME) monitoring sites provided evidence to support or eliminate potential stressors. VDEQ considered several potential stressors including sediment, total dissolved solids, toxics, low dissolved oxygen, nutrients, pH, metals, conductivity, temperature and organic matter. Following the analysis, VDEQ classified potential stressors into three categories:

- Non-Stressor: Those stressors with data indicating normal conditions, without water quality standard violations or without the observable impacts usually associated with a specific stressor.
- Possible Stressor: Those stressors with data indicating possible links, but inconclusive data.
- Most Probable Stressor: The stressor(s) with the most consistent information linking it with the degraded benthic and habitat metrics.

For Straight Creek, VDEQ concluded that sediment and total dissolved solids (TDS) are the most probable stressors causing impairment of the aquatic life use. VDEQ used these stressors to develop the TMDL to address benthic impairment (MapTech, Inc. 2006). We reviewed the stressor identification analysis for Straight Creek and concurred with the findings. However, it is important to note that additional stressors associated with residential land use (straight pipes and failing septic systems) may also be contributing nutrients, organics, household chemicals and other toxicants. However, these types of intermittent and diffuse discharges are often difficult to characterize with the available monitoring data.

Biological Monitoring, Inc. (BMI) was contracted by the Virginia Mining Issues Group (VMIG is an industry stakeholder group) to provide technical expertise regarding TMDL issues in Straight Creek. Industry TMDL issues focus primarily on Straight Creek's aquatic life use impairment, the most probable stressors impairing the use, and potential remediation goals. VMIG questioned whether complete aquatic life use attainment is possible based on required effluent limits and cost effective and reasonable best management practices. Therefore, VMIG proposed to conduct an aquatic life Use Attainability Analysis (UAA) to determine appropriate and achievable goals for Straight Creek. In October 2007, VMIG submitted a UAA study plan to characterize the existing and designated uses of Straight Creek to VDEQ (Biological Monitoring Inc. 2007). VMIG also developed an Implementation Plan for the Straight Creek and Tributaries Total Maximum Daily Load Study (VMIG 2008).

Use of Biological Data to Determine Existing and Designated Aquatic Life Uses

Section 101(a)(2) of the Clean Water Act states that "…it is the national interim goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983." Clean Water Act Section 303(c)(2)(A) requires water quality standards to "protect the public health and welfare, enhance the quality of water, and serve the purposes of this Chapter." EPA's regulations at 40 C.F.R. Part 131 interpret and implement these provisions through a requirement that water quality standards protect section 101(a)(2) uses unless those uses have been shown to be unattainable, effectively creating a rebuttable presumption of attainability. Unless the state rebuts this presumption, a default designation of the section 101(a)(2) uses applies. This approach was upheld in Idaho Mining Association v. Browner, 90 F.Supp. 2d 1078, 1092 (D. Id. 2000). Where a state believes that a use specified in section 101(a)(2) is not attainable and wishes to remove or subcategorize this use, a state or tribe must show that the use change will not result in removing an existing use and complete a UAA (see Appendix 2 for relevant regulatory text from the Federal Water Quality Standards regulation at 40 C.F.R. § 131.10).

EPA's regulations define existing uses as "...those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards." Existing uses are relevant to two provisions in the Federal regulation – 40 C.F.R. § 131.10(g), designated uses, and 40 C.F.R. § 131.12(a)(1), antidegradation. Overall, these provisions: 1) prohibit removal of a designated use that would also remove an existing use and 2) require the maintenance and protection of existing instream water uses and the level of water quality necessary to protect existing uses when implementing a state's or tribe's antidegradation policy.

A waterbody will have achieved some degree of use related to aquatic life on or after November 28, 1975. In some cases, the use and water quality actually achieved may be more degraded than the designated use assigned to the waterbody. For example, while the water quality since November 28, 1975 may never have been sufficient to support the diverse aquatic community associated with the waterbody's designated use, it is likely that the water quality in the waterbody supports or has supported some less diverse community of organisms. When such uses have been achieved on or after November 28, 1975, EPA considers the use reflecting the highest degree of aquatic life achieved to be "existing" uses. Where a state is designating its uses or revising its designated uses, the state must ensure that the resulting water quality will not jeopardize the less diverse aquatic community (and thus the existing use).

Furthermore, states are not bound by their designated use classification categories when describing existing uses. When evaluating the uses actually achieved along a continuum of biological condition, the existing uses of a waterbody are the "highest degree of uses" and water quality necessary to support those uses, that have been achieved since November 28, 1975, independent of the designated use. "Highest degree of uses" generally means the degree of use closest to those supported by minimally impacted conditions, which usually is associated with the highest level of water quality and biological condition. In other words, even if a biological condition comparable to the designated use has never been achieved since November 28, 1975, the highest biological condition achieved since November 28, 1975 must be protected as the existing use. States can describe the biological condition using a variety of bioassessment tools such as taxa lists, indicator taxa, individual metrics (e.g. composition, tolerance) or multimetric indices that combine several individual metrics, taxa lists and indicator taxa.

EPA's existing use regulations ensure that the waterbody's highest degree of uses and the necessary levels of water quality actually achieved on or after November 28, 1975 will be maintained and protected consistent with the overall objective of the Clean Water Act (CWA) to restore and maintain the physical, chemical, and biological integrity of the nation's waters. Thus, 40 C.F.R. §§ 131.10(g) and 131.12(a)(1) define the absolute "floor" or minimum use and necessary level of water quality achieved that must be maintained and protected in a waterbody. In other words, even if a state finds that the existing use is less than the designated use, and a new use is appropriate, the state must assign a use that is at least equivalent to the biological condition of the existing aquatic life use. A state can not assign a new use that does not protect the highest existing use achieved in the waterbody.

A state should determine existing uses on a site-specific basis to ensure it has identified the highest degree of uses and water quality necessary to support the uses that have been achieved since November 28, 1975. When describing existing uses, states should articulate not only the use(s) that has been achieved, but also the water quality supporting the specific use(s) that has been achieved. For aquatic life, states should consider the available biological data as an indicator of both water quality and the actual aquatic life use, in conjunction with any available chemical water quality data. Both historical (since

November 28, 1975) and current data should be used to make sure the highest degree of uses and water quality are described.

In May 2008, the Wheeling Freshwater Biology Team (FBT) collected macroinvertebrate, water chemistry and habitat data to provide USEPA and VDEQ with an additional independent dataset on the current biological condition of Straight Creek and selected major tributaries. VDEQ's final analysis of existing uses and appropriate designated uses should consider all available water quality, habitat and biological data (including additional assemblages such as fish) to ensure that the highest use is characterized accurately. Most of the existing data we have reviewed was collected on the mainstem of Straight Creek. We collected more data on some of the major tributaries of Straight Creek. We offer our data as additional information on the existing and appropriate designated uses of Straight Creek and some major tributaries and to make recommendations on the appropriate extent and timing of the UAA study plan.

Methods

We sampled field chemistry and physical parameters (specific conductivity, temperature, dissolved oxygen, % saturation of dissolved oxygen and pH) at 23 sites in the Straight Creek watershed and at 1 site in a nearby reference watershed (Clear Creek) from May 6-8, 2008. We collected macroinvertebrate samples and RBP visual habitat information at 8 of the sites in the Straight Creek watershed and at the reference site on Clear Creek, a direct tributary to the North Fork of the Powell River. These 8 sites were located on the mainstem of Straight Creek (2 sites), Gin Creek (2 sites), Baileys Trace (2 sites), Fawn Branch (1 site) and Big Branch (1 site). We also collected additional water quality samples (total metals, hardness, alkalinity, major anions and cations, and nutrients) at 5 sites, including the mainstem of Straight Creek (2 sites), Gin Creek (2 sites) and Baileys Trace (1 site). We selected sites to bracket mining and residential influences on the main stem of Straight Creek and its major tributaries. The complete list of 23 sites is shown in Table 2. The subset of 8 sites where we collected macroinvertebrates in the Straight Creek watershed is shown in Figure 3.

We collected macroinvertebrates from riffles using a 0.3-m-wide d-frame net (595-µm mesh) in the spring index period (May 2008) using the VDEQ method. We composited 6 d-frames (each 1/3 m^2) collected from a 100-m reach at each site for a total of approximately 2 square meters. In the laboratory, we randomly subsampled organisms in gridded pans to obtain 200 ± 20% individuals. We identified individuals to the genus level for most groups, except Turbellaria, Nematoda, Hydracarina, and Oligochaeta. For calculation of the multimetric Virginia Stream Condition Index (VSCI) we subsampled all samples to 110 organisms using a Fortrant program (http://129.123.10.240/WMCPortal/modelSection.aspx?section¼125&title¼ build&tabindex¼-1; Western Center for Monitoring and Assessment of Freshwater Ecosystems, Utah State University, Logan, Utah). For family-level analyses, we collapsed genera and summed them to family names in the database.

The VSCI uses eight core metrics that are scored individually and then combined into a single index value (Tetra Tech 2003). The eight metrics include EPT taxa, Total taxa, % Ephemeroptera, % Plecoptera plus Trichoptera less Hydropsychidae (a predominantly pollution tolerant caddisfly family), % Chironomidae, % Top 2 Dominant Taxa, HBI (a modified Family biotic index), and % Scrapers. Standard values and standardization equations for the VSCI metrics are shown in Table 3. For a detailed explanation of the multimetric index development please review the document 'A Stream Condition Index for Virginia Non-Coastal Streams' at http://www.deq.virginia.gov/watermonitoring/pdf/vastrmcon.pdf.

Figure 3. Sampling sites where macroinvertebrates were collected (May 2008)

Table 2. Sampling Sites on Straight Creek and Selected Tributaries (May 5-6, 2008)

Site #	Location	temp	cond	pH	DO (%sat)	Macroinverts: VSCI Score	water quality sample
1	Gin Creek at Darbyville Church	13.8	742	8.6	10.83 (--)	23.5	X
2	Gin Creek ds of Powell Mountain Coal	15.2	804	8.5	10.3 (103)	61.3	X
3	UNT to Gin Creek	12.3	1040	8.4	10.1 (95)		
4	Gin Creek us of UNT	15.3	760	8.4	10.1 (101)		
5	UNT to Straight Creek receives Lone Mountain refuse fill	18.6	1323	8.3	9.1 (98)		
6	Straight Creek us of Lone Mountain UNT	15.9	519	8.2	9.6 (98)		
7	Straight Creek ds of Lone Mountain UNT	16.8	782	8.2	9.6 (98)	56.2	X
8	Straight Creek ds of residences, us of St. Charles	18.0	577	9.0	12.5 (132)	16.3	X
9	Baileys Trace ds of Thermal Coal Sign	18.2	717	8.7	9.6 (103)	37.9	X
10	UNT to Bailey Trace at substation	13.3	93	7.4	9.3 (89)		
11	Deep mine seep? near #10	15.2	1362	2.8	9.9 (99)		
12	Bailey Trace ds Powell Mountain Coal gate	15.6	923	8.4	9.7 (98)	72.5	X
13	Potts Branch ds residences	16.9	206	7.4	7.2 (74)		
14	Fawn Branch ds residences	17.2	224	8.4	9.8 (102)	35.4	
15	Big Branch ds of Dearth Hollow	11.7	170	7.9	10.1 (93)	73.2	
16	Big Branch ds of Murphys Hollow	12.5	217	7.7	10.1 (95)		
17	UNT to Straight Creek in St. Charles	11.9	320	3.3	10.3 (96)		
18	Thermal Coal discharge	16.8	1585	8.5	8.7 (90)		
19	Puckett Creek at mouth	17.8	503	9.0	10.5 (111)		
20	Puckett Creek us of Baker Hollow Rd and AMD project	16.5	289	8.7	10.0 (103)		
21	Puckett Hollow most us site	14.5	314	8.1	9.2 (90)		
22	Puckett Creek	18.0	309	8.8	10.8 (114)		
23	Straight Creek near mouth at Hawkthorn Rd	19.1	687	8.8	11.1 (120)		
27	Clear Creek	12.2	20	6.8	9.8 (91)	79.7 75.7	

Table 3. VSCI Metrics: Standard Best Values and Scoring Equations.

Metrics that decrease with stress	Standard (best value) X_{95}	X_{min}	Standardization equation (Section 3.6, Equation 1; X=metric value)
Total taxa	22	0	score = 100 × (X/22)
EPT taxa	11	0	score = 100 × (X/11)
% Ephemeroptera	58.9	0	score = 100 × (X/58.9)
% Plec+Tric less Hydropsych.	34.8	0	score = 100 × (X/34.8)
% Scrapers	49.1	0	score = 100 × (X/49.1)
Metrics that increase with stress	**Standard (best value) X_5**	**X_{max}**	**Standardization equation (Section 3.6, Equation 2; X=metric value)**
% Chironomidae	0	100	score = 100 × [(100-X)/(100-0)]
% Top 2 Dominant	29.5	100	score = 100 × [(100-X)/(100-29.5)]
HBI (family)	3.2	10	score = 100 × [(10-X)/(10-3.2)]
Final index score for a site is determined by averaging the site's 8 unitless standardized metric scores, using a maximum metric score of 100 for any metric whose individual score at a site exceeded 100.			

The VSCI was originally developed using Virginia's historical biomonitoring database, which contained a significant number of upstream control sites that VDEQ used for point source assessments using the Rapid Bioassessment Protocols (RBP) (Barbour et al. 1999). Reference sites in the central Appalachian ecoregion, piedmont ecoregions and headwater streams were limited in that dataset. This dataset also included pseudoreplication of some sites.

In 2006, VDEQ used their independent probabilistic database (sample n=350) with data collected from 2001-2004, to validate the VSCI (VDEQ 2006) (http://www.deq.virginia.gov/export/sites/default/watermonitoring/pdf/scival.pdf). The probabilistic dataset was free of the pseudoreplication issues inherent in the historical dataset. VDEQ used this data set to fill data gaps, test the proposed VSCI against several classification variables including season, stream size, ecoregion, bioregion, river basin, regional office, and sampling technique, and to review the recommended best standard values for the eight core metrics. VDEQ confirmed that the VSCI works well to discriminate between sites with acceptable water quality and habitat versus sites with degraded water quality and habitat. VDEQ found potential seasonal, ecoregion, bioregion, basin size, and sampling method patterns in the ordinations. However, VDEQ decided the patterns were not strong enough to support recalibrating the VSCI by season, sampling method, bioregion, or basin size. VDEQ also concluded that it was not necessary to revise the metric best standard values used for scoring individual metrics and calculating the VSCI.

VDEQ suggested slight adjustments to the interpretation of the VSCI scores for assessing aquatic life uses. The 10th percentile from their probabilistic data set was 58.5 while the 10th percentile from Tetra Tech's original analysis of targeted data was 61.3. The average 10th percentile cutoff from both data sets was 59.9. VDEQ rounded the assessment threshold to 60. For the VDEQ 2008 305(b)/303(d) Integrated Water Quality Report, VDEQ assessed streams with VSCI scores ≥ 60 as "fully supporting the aquatic life use" and streams with VSCI scores < 60 as"impaired" (VDEQ 2007). We used this threshold to determine aquatic life use impairment.

We collected chemical variables at the subset of 5 sites, including alkalinity, hardness, sulfate, chloride, sodium, potassium, total phosphorous, nitrite + nitrate, total Al, total As, total Cr, total Pb, total Ni, total Ca, total Cu, total Fe, total Mg, total Mn, total Se and total Zn. We also recorded in situ physicochemical variables (pH, specific conductance, dissolved oxygen, % saturation of dissolved oxygen and temperature) at the time of benthic sampling at all 23 sites with a portable multiparameter sonde (Hydrolab Quanta; Hydrolab Corp., Austin, Texas).

We collected field chemistry measurements and water chemistry measurements mid-stream and followed EPA Region III sampling submission guidelines for proper containers, preservatives, holding time and shipping requirements. The water quality samples were analyzed for major cations and ions, nutrients, and metals by the EPA Region 3 Environmental Science Center Laboratory in Fort Meade, MD.

We scored the physical habitat (0–20 points/metric; 0–200 points for total score) at all sites using the RBP (Barbour et al. 1999). We considered a subset of the RBP habitat metrics (epifaunal substrate, embeddedness, sediment deposition, channel alteration, bank stability, riparian zone width and the total score) for this assessment, based on our knowledge of these metrics in relation to watersheds with mining and residential land uses, and their overall responsiveness in these small Central Appalachian streams.

Results

Macroinvertebrates

At several sites in the Straight Creek watershed, the VSCI scores (Table 4 and Figure 4) indicated current attainment of the aquatic life use (Sites 2 on Gin Creek, 12 on Baileys Trace, and 15 on Big Branch) or close to attainment (Site 7 on Straight Creek). Other sites are clearly impaired (Sites 1 on Gin Creek, 8 on Straight Creek, 9 on Baileys Trace and 14 on Fawn Branch). The sites closest to the mining operations were in better condition than those downstream, where the additional effects of residential land use and other stressors were reflected in the lower VSCI scores. Our results confirm this pattern on Gin Creek, Baileys Trace and Straight Creek, which was evident in earlier VDEQ macroinvertebrate data (Maptech 2006), USFWS data (USFWS 2007) and industry data (VMIG 2008) collected on the mainstem of Straight Creek. VSCI scores, individual metric values and taxonomic lists for each site are provided in Tables 4, 5 and 6 (Table 6 appears in Appendix 1).

Table 4. VSCI Scores (May 2008)

Station ID	Stream Name	Location	Latitude DD	Longitude DD	VSCI
Straight 1	Gin Creek	at Darbyville Church	36.82716	83.05145	23.5
Straight 2	Gin Creek	DS of Powell Mountain	36.83558	83.05439	61.3
Straight 7	Straight Creek	DS of Lone Mountain	36.83341	83.03385	56.2
Straight 8	Straight Creek	DS of residences, US of St. Charles	36.82072	83.04351	16.3
Straight 9	Baileys Trace	DS of Thermal Coal sign	36.80597	83.05875	37.9
Straight 12	Baileys Trace	DS Powell Mountain Coal Co.	36.82265	83.07014	72.5
Straight 14	Fawn Branch	US of trash collection area	36.81155	83.06407	35.4
Straight 15	Big Branch	US of residences	36.80301	83.04108	73.2
Ref 27	Clear Creek	DS of Fawn Hollow Road REF	36.9336	82.5836	79.7
Ref 27	Clear Creek (dup)	DS of Fawn Hollow Road REF	36.9336	82.5836	75.7

Actual 200± 20% pick was computer subsampled to 110 individuals for VSCI calculations.

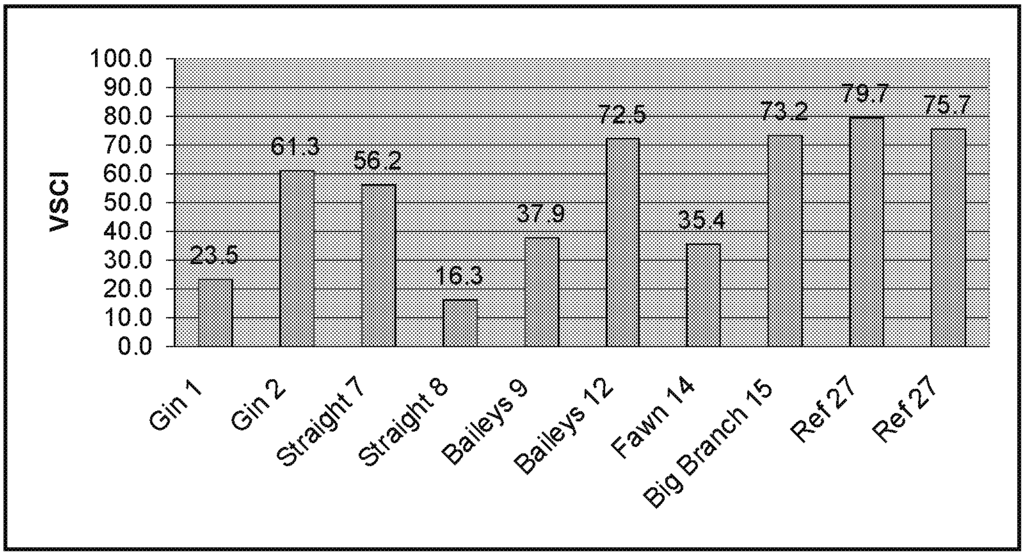

Figure 4. VSCI Scores (May 2008)

Table 5. Individual Metric Values (May 2008)

Station ID	Straight 1	Straight 2	Straight 7	Straight 8	Straight 9	Straight 12	Straight 14	Straight 15	Ref 27	Ref 27
Stream Name	Gin Creek	Gin Creek	Straight Creek	Straight Creek	Baileys Trace	Baileys Trace	Fawn Branch	Big Branch	Clear Creek	Clear Creek (dup)
Location	at Darbyville Church	DS of Powell Mountain	DS of Lone Mountain	DS of residences, US of St. Charles	DS of Thermal Coal sign	DS Powell Mountain Coal Co.	US of trash collection area	US of residences	DS of Fawn Hollow Road REF	DS of Fawn Hollow Road REF
Latitude DD	36.82716	36.83558	36.83341	36.82072	36.80597	36.82265	36.81155	36.80301	36.9336	36.9336
Longitude DD	83.05145	83.05439	83.03385	83.04351	83.05875	83.07014	83.06407	83.04108	82.5836	82.5836
VSCI	23.5	61.3	56.2	16.3	37.9	72.5	35.4	73.2	79.7	75.7
# Individuals	110	110	110	110	110	110	110	110	110	110
# Total Taxa (Family)	9	13	16	9	13	17	10	17	26	22
# EPT Taxa (Family)	4	8	8	1	6	10	5	13	15	15
% Ephemeroptera	11.0	12.4	3.6	0.0	23.2	19.4	17.2	23.6	23.9	19.4
% Plec+Trich-Hydropsychid	1.0	60.4	38.5	1.2	3.9	47.5	8.0	72.4	41.8	52.7
% Scrapers	0.0	5.6	1.2	2.0	4.3	9.2	4.2	3.7	13.4	15.8
% Chironomidae	82.78	17.20	42.51	94.05	62.20	11.98	66.81	2.03	13.93	16.67
% 2 Dominant Taxa (Family)	93.30	69.60	65.18	95.24	84.25	49.31	81.93	68.29	41.29	59.46
HBI (Family)	5.76	2.12	3.95	5.92	5.24	2.74	5.07	1.67	2.72	2.27

Site 27 was located on Clear Creek, and served as a local reference. We collected replicate samples on Clear Creek (our Standard Operating Procedures require at least 10% replication). The VSCI scores for these two samples were 79.7 and 75.7, indicating full support of the aquatic life use. The two subsamples from this site contained numerous Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) taxa (collectively called EPT taxa) including *Ameletus, Acentrella, Baetis, Plauditus, Drunella, Ephemerella, Eurylophella, Cinygmula, Epeorus, Stenonema, Leptophlebiidae (prob. Paraleptophlebia), Sweltsa, Leuctra, Amphinemura, Peltoperla, Acroneuria, Pteronarcys, Taeniopteryx, Ceratopsyche, Cheumatopsyche, Diplectrona, Lepidostoma, Dolophilodes, Polycentropus* and *Rhyacophila.*

Photo 1. Site 27. Clear Creek looking downstream


Photo 2. Site 27. Clear Creek looking upstream

Site 7 was located on the mainstem of Straight Creek, downstream of the Lone Mountain processing discharge point. The VSCI score at this site was 56.2, indicating slight impairment of the aquatic life use. Although 43% of the subsample was composed of Chironomidae, many of the other taxa collected are common to headwater streams. The subsample collected from this site contained several EPT taxa including *Ameletus, Acentrella, Baetis, Plauditus, Ephemerella, Leuctra, Amphinemura, Isoperla, Cheumatopsyche and Hydroptila*. The relative abundances of these taxa in the subsample were low, except for *Leuctra* and *Amphinemura*.


Photo 3. Site 7. Straight Creek looking downstream

Site 8 was located further downstream on the mainstem of Straight Creek, downstream of the first clutch of residences, but still upstream of St. Charles. The VSCI score at this site declined to 16.3, which was the lowest VSCI score encountered in this survey. Chironomidae made up 94% of the individuals in the subsample. The taxa list at this site was quite diminished compared to upstream. For example, the only EPT taxa found at this site was the stonefly *Leuctra*, and the subsample only contained 3 individuals.

Photo 4. Site 8. Straight Creek looking downstream

Site 2 was located on Gin Creek, downstream of the Powell Mountain discharge. The VSCI score at this site was 61.3, indicating attainment of the aquatic life use. Chironomidae made up only 17.2% of the subsample. The subsample from this site contained several EPT including *Acentrella, Baetis, Plauditus, Ephemerella, Epeorus, Leuctra, Amphinemura, Perlesta, Cheumatopsyche, Diplectrona, Hydropsyche* and *Dolophilodes*. *Leuctra* was the most abundant taxon in the subsample.

Photo 5. Site 2. Gin Creek looking downstream

Site 1 was located further downstream on Gin Creek, downstream of the Darbyville Church. The VSCI score at this site declined to 23.5. Chironomidae made up 82.8% of the subsample. The subsample from this site contained fewer EPT taxa and they were all present at low relative abundances: *Acentrella, Baetis, Plauditus, Eurylophella, Leuctra,* and *Cheumatopsyche*.

Photo 6. Site 1. Gin Creek looking upstream

Photo 7. Site 1. Gin Creek looking downstream

Site 12 was located on Baileys Trace, downstream of the Powell Mountain Coal operation. The VSCI score for this site was 72.5 indicating the aquatic life use is fully supported in this reach. Chironomidae made up only 12% of the subsample. The subsample from this site contained many EPT taxa including *Acentrella, Baetis, Plauditus, Ephemerella, Epeorus, Leuctra, Amphinemura, Perlesta, Taeniopteryx, Cheumatopsyche, Chimarra* and *Rhyacophila*. The stonefly *Leuctra* was the dominant taxon in the subsample.

Photo 8. Site 12. Baileys Trace looking downstream

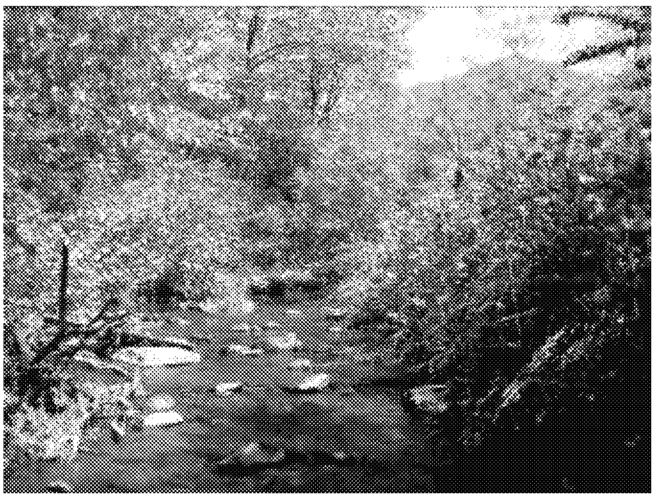

Photo 9. Site 12. Baileys Trace looking upstream

Site 9 was located further downstream on Baileys Trace, downstream of the Thermal Coal sign and a defunct bridge over Bailey Trace. The VSCI score for this site was 37.9. Chironomidae made up 62.2% of the subsample. The subsample from this site contained several EPT taxa including *Acentrella, Baetis, Plauditus, Epeorus, Leptophlebiidae* (prob. *Paraleptophlebia*), *Leuctra, Amphinemura, Ceratopsyche* and *Cheumatopsyche*.

Photo 10. Site 9. Baileys Trace looking downstream

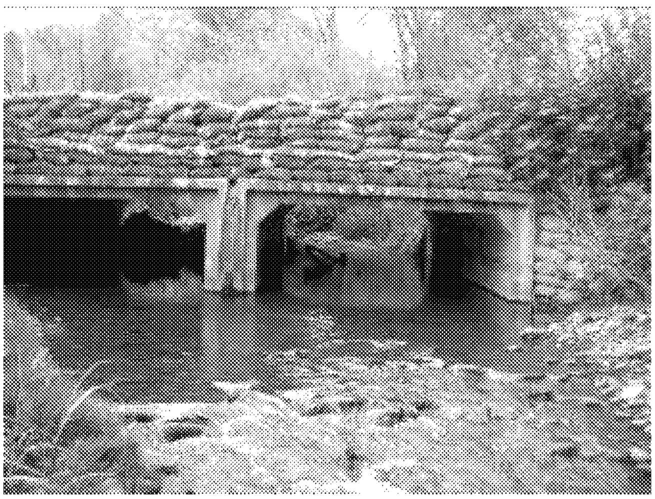

Photo 11. Site 9. Baileys Trace looking upstream

Site 14 was located on Fawn Branch, upstream of the trash collection center. The VSCI score for this site was 35.4. Chironomidae made up 66.8% of the subsample. The subsample from this site contained several EPT taxa including *Acentrella, Baetis, Plauditus, Ephemerella, Eurylophella, Epeorus, Leuctra, Cheumatopsyche* and *Hydropsyche*.

Photo 12. Site 14. Fawn Branch looking downstream

Photo 13. Site 14. Fawn Branch looking upstream

Site 15 was located on Big Branch, upstream of any residences. The VSCI score for this site was 73.2, indicating full support of the aquatic life use. Chironomidae made up only 2% of the subsample. The subsample from this site contained several EPT taxa including *Acentrella, Baetis, Ephemerella, Epeorus, Stenacron, Paraleptophlebia, Leuctra Amphinemura, Isoperla, Agapetus, Diplectrona, Wormaldia, Polycentropus* and *Neophylax*. *Leuctra* and *Amphinemura* dominated the subsample.

Photo 14. Site 15. Big Branch looking downstream

Photo 15. Site 15. Big Branch looking upstream

Habitat

The RBP visual habitat assessment scores are provided in Table 7. Note that individual parameters are scored on a scale of 0 to 20. Scores from 16-20 are considered "optimal". Scores from 11 to 15 are considered "suboptimal" but the habitat is generally still capable of supporting macroinvertebrate and fish assemblages that would support aquatic life uses. Scores from 6 to 10 are considered "marginal" and scores from 0 to 5 are considered "poor". We consider epifaunal substrate, embeddedness, sediment deposition, channel alteration, bank stability, riparian zone width, and the total scores to be most relevant to the objectives of this study. The channel flow status and velocity/depth measures vary with season and the water year and tend to be more a function of natural conditions unless otherwise noted in the field (e.g. channel alteration causing dewatering or over wide channels).

Table 7. Individual and Total RBP Habitat Scores (May 2008)

Station ID	Stream Name	Epi Sub	Emb	VelDep	Sed Dep	Flow Status	Chan Alt	Rif Freq	LB Stab	RB Stab	LB Veg	RB Veg	LB Rip	RB Rip	Total RBP
Straight 1	Gin Creek	15	14	10	11	15	15	18	9	5	8	3	9	1	133
Straight 2	Gin Creek	16	14	10	12	15	15	18	7	7	6	4	5	3	132
Straight 7	Straight Creek	12	12	10	8	14	15	14	7	7	5	5	7	2	117
Straight 8	Straight Creek	13	12	10	11	15	15	17	8	8	6	6	5	4	130
Straight 9	Baileys Trace	17	17	10	14	16	13	15	9	8	9	4	9	2	143
Straight 12	Baileys Trace	17	12	10	10	16	15	17	8	9	3	8	2	8	135
Straight 14	Fawn Branch	16	14	10	11	15	13	18	9	7	8	3	8	1	133
Straight 15	Big Branch	18	15	10	12	14	18	17	7	8	8	8	7	9	151
Straight 27	Clear Creek	19	19	18	19	15	18	18	10	10	10	10	9	10	185

Scores for epifaunal substrate, embeddedness, channel alteration and bank stability were generally in the optimal to suboptimal range. The substrates were dominated by boulder, cobble or large gravel substrates and provided adequate habitat for aquatic life. At a few sites (7 and 12), the sediment deposition scores were in the high marginal range. At a few sites (2 and 7), the bank vegetation scores were in the marginal range. At several sites (1, 2, 7, 8, 12 and 14) the riparian vegetative zone scores were in the marginal range. Riparian zones were commonly disturbed by roads, lawns, houses and other buildings. Disturbance of the riparian zone can alter shading and increase stream temperatures, decrease the delivery of coarse organic matter to the stream, decrease certain types of fish and macroinvertebrate habitat, and decrease stream bank stability.

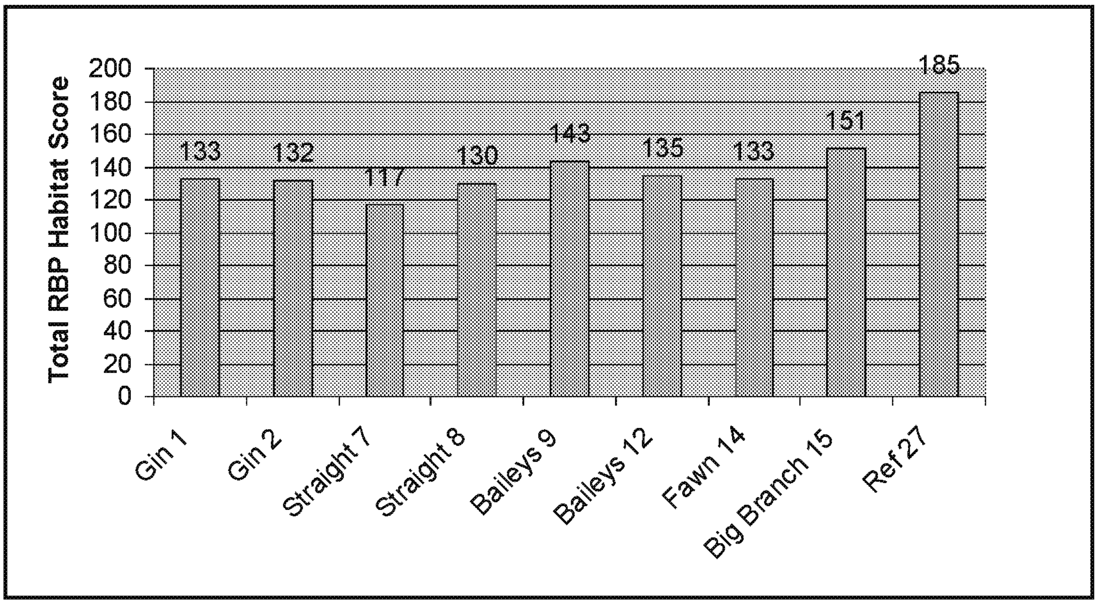

Figure 5. Total RBP Habitat Scores (May 2008)

Water Quality

In Situ Measurements

We observed several tributaries with low conductivity, indicating generally good water quality with a potential to support the aquatic life use (Table 2): Baileys Trace tributaries including Potts Branch (site 13, sp. Cond = 206 µS/cm), Fawn Branch (site 14, sp. Cond = 224 µS/cm), and an unnamed tributary (UNT) (site 10, sp. Cond. = 93 µS/cm); Big Branch (site 15, sp. Cond. = 170 µS/cm and site 16, sp. Cond. = 217 µS/cm); and Puckett Creek upstream of the US Army Corps of Engineers (USACE) Acid Mine Drainage (AMD) treatment site (site 20, sp. Cond. = 289 µS/cm, site 21, sp. Cond = 314 µS/cm, and site 22, sp. Cond. = 309 µS/cm). Many of these sites have no active mining but have a few residences.

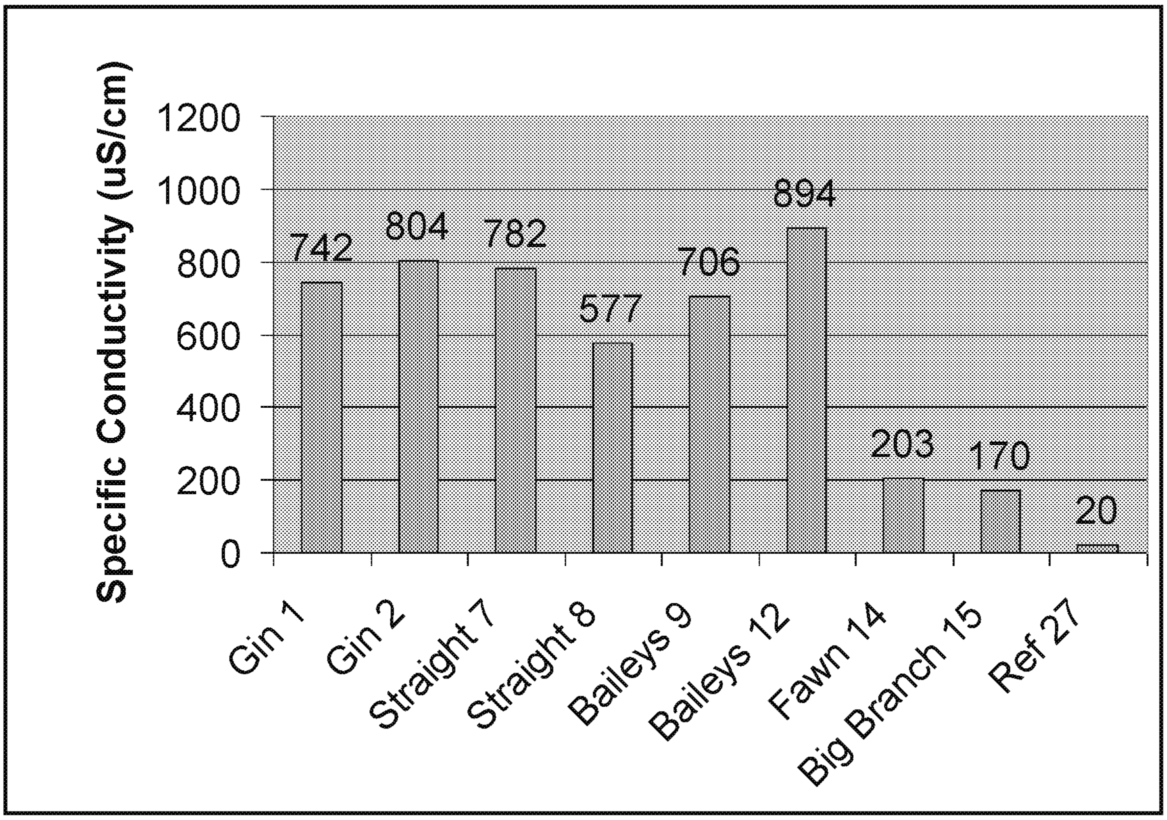

Figure 6. Specific Conductivity (May 2008)

Generally, we observed the highest conductivity levels nearest coal mining operations (both active and inactive) and upstream of residences (Figure 6). We found a few sites with acidic mine drainage (site 11, a ground water seep on Baileys Trace, with a pH of 2.8 and site 17, a UNT on Straight Creek, with a pH of 3.3). We also observed a white precipitate on the substrate of Straight Creek, just upstream and downstream of site 17. The precipitate seemed to originate from a groundwater discharge point just upstream of site 17. This precipitate could be aluminum. Both of these acidic discharges were small and not discharging much flow at the time of this visit.

The conductivity levels in Straight Creek and its tributaries are elevated compared to background levels in the unmined portions of the watershed and at the reference site. Conductivity on the main stem of Straight Creek ranged from 519 µS/cm upstream of the UNT which receives the Lone Pine Coal refuse fill to 782 µS/cm directly downstream of the Lone Mountain refuse fill to 577 µS/cm in the mid reaches to 687 µS/cm at the mouth. The conductivity levels in Gin Branch ranged from 804 µS/cm downstream of Powell Mountain Coal to 742 µS/cm in Darbyville, and in Baileys Trace they ranged from 923 µS/cm downstream of Powell Mountain Coal to 717 µS/cm near the mouth. Puckett Creek ranged from 314 µS/cm at the most upstream site to 503 µS/cm at the mouth.

Laboratory Water Quality Samples

The laboratory water chemistry results in the headwaters of Gin Creek, Straight Creek and Baileys Trace reflect the water quality changes due solely to mining (sites are located upstream of any residential stressors). Conductivity is elevated in the headwaters of Gin Creek, Straight Creek and Baileys Trace compared to Fawn Branch and Big Branch. The additional water quality data available in Gin Creek and Straight Creek show typical increases in hardness, alkalinity and sulfate normally associated with alkaline mine drainage (Table 8). Note that the dominant anions and cations are bicarbonate, sulfate and sodium. This differs from alkaline mine drainage in southern WV where calcium and magnesium are normally the dominant cations.

Trace metals were often not detected in the water column (Al, As, Cr, Pb and Se) or detected at levels less than the available water quality criteria (Ni, Cu, Fe, Mn and Zn). However, in our opinion, this does not completely rule out metals as a possible stressor. In watersheds with potential sources of metals (e.g. mining) there is potential for sediment contamination and metal uptake via dietary exposure. Water quality criteria do not account for this exposure route and do not protect aquatic life from metal contamination of instream sediments. We did not collect any data on metal concentrations of stream sediments.

Some of the sites located downstream of residences have some evidence of nutrient enrichment causing increased algal productivity, since the dissolved oxygen (DO) concentrations represented supersaturated conditions (e.g. site 8 on Straight Creek had a DO % saturation of 132%, and site 23 on Straight Creek had a DO % saturation of 120%). The nitrate+nitrite concentrations were not high (all < 1 mg/l). Unfortunately, the detection limit for total phosphorous in these analyses was too high (0.05 mg/l) to detect any differences between the sites.

Table 8. Water Quality Parameters (May 2008)

Station ID	Straight 1	Straight 2	Straight 7	Straight 8	Straight 9
Stream Name	Gin Creek	Gin Creek	Straight Creek	Straight Creek	Baileys Trace
Temp (oC)	13.80	15.20	16.80	18.00	16.55
pH	8.60	8.50	8.20	9.00	8.65
DO (mg/L)	10.83	10.30	9.60	12.50	9.85
Sp Cond (umhos/cm)	742	804	782	577	706
Alkalinity (mg/L)	219	249	332	158	228
Hardness	133	140	173	139	87
Sulfate (mg/L)	143	152	172	208	130
Chloride (mg/L)	14.2	15.9	9.22	6.23	7.46
Sodium (mg/L)	127	141	190	124	147
Potassium (mg/L)	4.08	4.7	5.07	4.2	4.08
Total Phosphorous (mg/L)	0.05	0.05	0.05	0.05	0.05
NO2-NO3-N (mg/L)	0.053	0.098	0.623	0.102	0.195
Total Al (mg/L)	<0.2	<0.2	<0.2	<0.2	<0.2
Total As (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001
Total Cr (mg/L)	<0.002	<0.002	<0.002	<0.002	<0.002
Total Pb (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001
Total Ni (mg/L)	0.0024	0.0019	0.0031	0.0021	0.0015
Total Ca (mg/L)	32	33.8	44.4	34.6	19.3
Total Cu (mg/L)	0.0033	0.0024	0.0036	0.0022	0.003
Total Fe (mg/L)	0.396	<0.1	0.272	<0.1	<0.1
Total Mg (mg/L)	12.8	13.6	15.1	12.8	9.49
Total Mn (mg/L)	0.0238	0.0064	0.0423	0.0123	0.0049
Total Se (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005
Total Zn (mg/L)	0.0051	0.002	0.0035	0.0022	0.0023

Associations Between Biological Condition, Water Quality and Habitat

Our previous research in the southern coal fields of West Virginia (Pond et al. 2008) found that total dissolved solids (TDS) are a plausible cause of aquatic life use impairment downstream of alkaline coal mine drainage. In that study, we found that all mined sites with specific conductance > 500 µS/cm were rated as impaired using a genus-level multimetric index. In this study, we found that some sites with conductivity > 500 µS/cm were rated as not impaired using the family-level VSCI (sites 2 and 12, see Figure 7). There could be two reasons for this. First, our work with other EPA R III states indicates that family level indices and genus level indices agree on attainment decisions around 80% of the time. Family-level indices appear to underreport impairment compared to genus level indices. It is likely that a genus-level multi-metric index would assess more sites in this study as impaired. VDEQ currently uses the family-level VSCI for the purposes of determining existing uses, appropriate designated uses, and impairment of aquatic life uses.

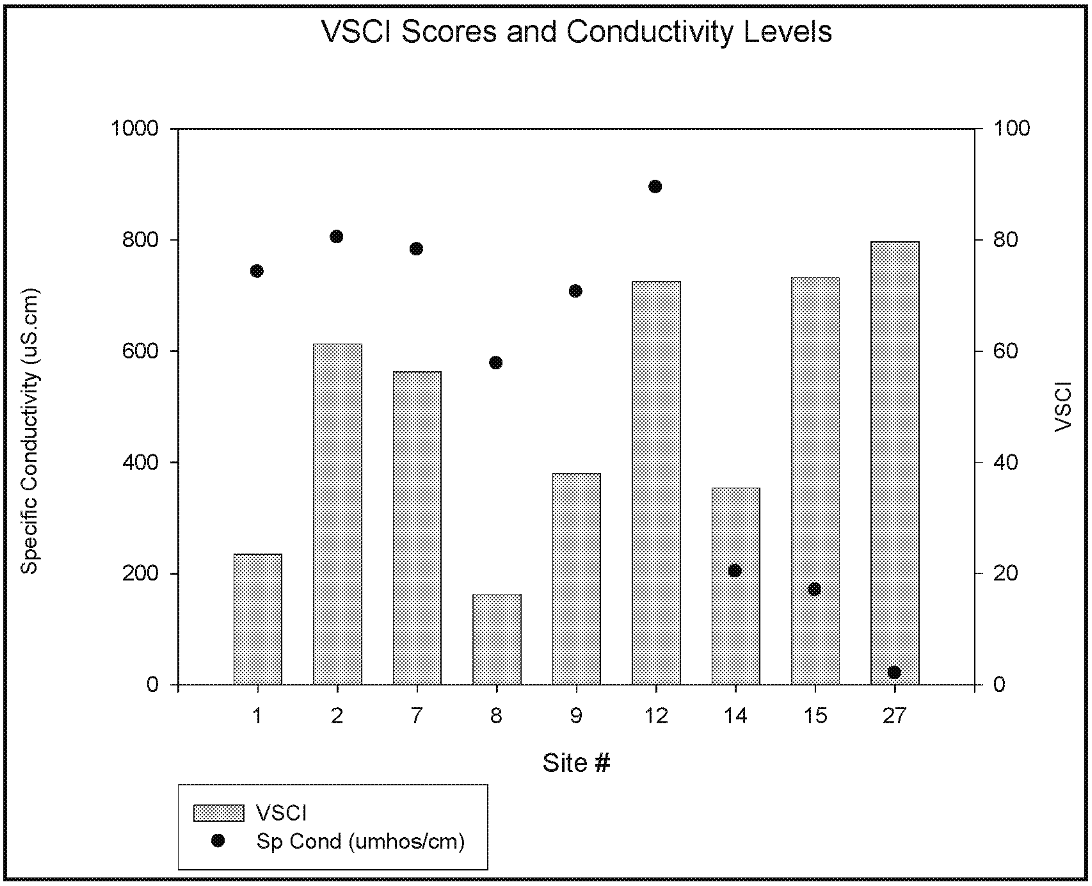

Figure 7. USEPA VSCI Scores and Conductivity (May 2008)

Secondly, the ion matrix and concentrations of the TDS in Straight Creek is different from the alkaline mine drainage we studied in the coal fields of southern West Virginia. The dominant ions in the coal mining discharge in our previous work were bicarbonate, sulfate, magnesium and calcium (Bryant et al. 2002). In the southern coal fields, the ions were elevated above background as follows: K^+, 5x; $HCO3^-$, 15x; Mg^{2+}, 32x; Cl^-, 2x; SO_4^{2-}, 38x; Ca^{2+}, 18x; and Na^+, 5x. The dominant ions in the Straight Creek TDS appear to be bicarbonate, sulfate and sodium and the ion concentrations are not as elevated as in the southern WV coal fields. In Straight Creek, the ion matrix downstream of the mines was elevated above the same background levels as follows: K^+, 3x; $HCO3^-$, 12x; Mg^{2+}, 3x; Cl^-, 4x; SO_4^{2-}, 10x; Ca^{2+}, 4x; and Na^+, 61x . Both the ion matrix and the total concentrations of ions are different in the Straight Creek mine drainage.

Many of these ions can be toxic to aquatic life. Mount et al. (1997) recognized the toxicity of major ions and developed predictive models to assess the acute toxicity attributable to major ions using the surrogates *Ceriodaphnia dubia*, *Daphnia magna* and *Pimephales promelas*. They reported that the relative ion toxicity was $K > HCO3 \approx Mg > Cl > SO4$; this order was confirmed by Tietge et al. (1997), who used the models to quantify and predict the toxicity from major ions but also identified toxicity from other toxic compounds in some high-salinity waters. Sodium and calcium were not found to be toxic to these organisms, and in fact calcium had an ameliorating effect on the toxicity of the other ions. The dominant cation in Straight Creek, Na^+, was not a toxicant to the surrogate organisms tested by Mount et al. (1997).

Regardless of the ion matrix, we recommend that VDEQ continue to monitor specific conductivity instream and in point source effluents as an accurate and cost effective means to indicate TDS levels, general water quality status and water quality trends in the watershed. This is particularly important since active and inactive coal mining is a major land use in the watershed and is one source of elevated TDS and conductivity.

As stated earlier, in all three streams, we found further degradation of the aquatic life use downstream where the additional effects of residential land use and other stressors are reflected in the lower VSCI scores. In our study, the increased impairment (indicated by lower VSCI scores and more tolerant taxa), did not correspond with increased conductivity measures, indicating that stressors other than conductivity or TDS are probably causing the additional degradation in the macroinvertebrate community (see Figure 7). However, the increased impairment downstream also did not correlate to decreased total RBP habitat scores (see Figure 8). We do not believe differences in physical habitat explain the differences in the VSCI scores from upstream to downstream that we observed in our study.

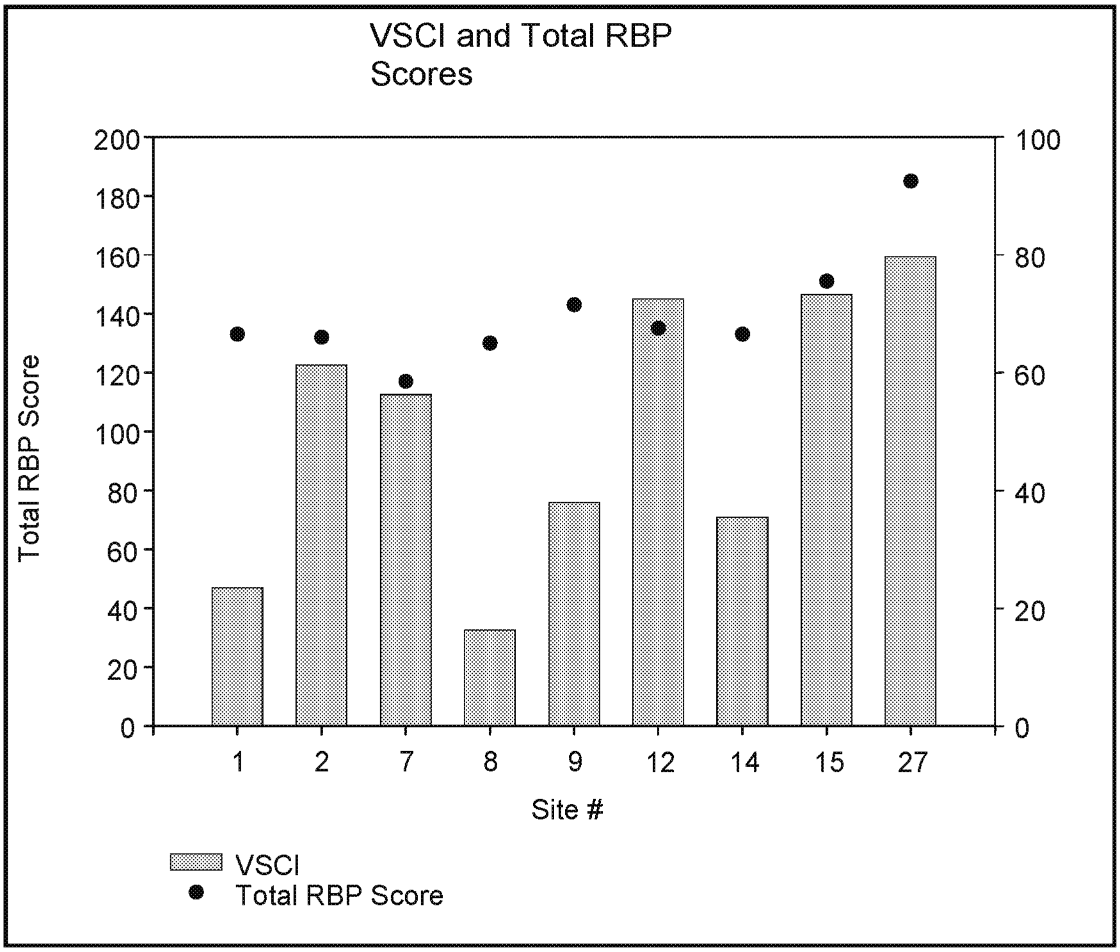

Figure 8. VSCI Scores and Total RBP Scores (May 2008)

It is possible that the increased degradation we observed downstream of residential areas is caused by unmeasured pollutants, household chemicals and toxicants that are intermittently discharged from straight pipes or failing septic systems. It is also possible that these residential reaches experience more scouring during rainfall events due to the increased impervious surfaces, channelization and incision present in the residential areas. Frequent scouring can create unstable habitats for aquatic life.

Discussion

In this study, we found evidence that portions of Straight Creek and its tributaries are already supporting the designated aquatic life use as defined by VDEQ (i.e., family-level VSCI scores indicate current attainment). In these segments, the designated use is an existing use, as defined in EPA's regulations at 131.3(e), and therefore may not be removed. For example, we found the aquatic life use to be currently attained in the headwaters of Gin Creek (VSCI score 61.3), Baileys Trace (VSCI score 72.5) and Big Branch (VSCI score 73.2).

In our study, we found the aquatic life use was slightly impaired (VSCI score 56.2) in the headwaters of Straight Creek (Figure 4). Two recent independent studies reported that the VSCI scores recently indicated attainment of the aquatic life use nearer the headwaters of Straight Creek (USFWS 2007 and VMIG 2008, Figure 9). After reviewing these other available data sources, we conclude that the designated use in the headwaters of Straight Creek is an existing use and can not be removed.

In addition, Soucek (2001) sampled three sites on Puckett Creek, upstream of any acid mine drainage inputs, and found diverse assemblages of macroinvertebrates including many mayflies (e.g. *Epeorus, Stenonema, Ameletus, Ephemerella, Eurylophella*), caddisflies (e.g. *Lepidostoma, Diplectrona*) and stoneflies (e.g. *Leuctra, Amphinemura, Yugus*). These available data suggest that the designated uses in these reaches of Puckett Creek may have been existing uses, and therefore the designated uses should not be removed from these reaches.

We sampled physical and chemical parameters at several sites in the Straight Creek watershed (Table 2) where we did not sample macroinvertebrates or collect additional water chemistry samples. Specific conductivity can be a very good general indicator of water quality. For example, although we did not collect macroinvertebrates in Puckett Creek, the conductivity at three sites in the watershed were all < 500 µS/cm, indicating fairly good water quality. This indicates that some reaches of Puckett Creek probably have the potential to support the designated aquatic life use, and Soucek (2001) confirms that the upper reaches of Puckett Creek have contained diverse assemblages of macroinvertebrates.

VDEQ's final analysis of existing uses should consider all available water quality, habitat and other biological data (including additional assemblages such as fish) to ensure that the highest use (the existing use) is characterized accurately. For example, USGS

(Hufshmidt et al. 1981) published hydrology and water quality data for the Straight Creek watershed following the Surface mining Control and Reclamation Act of 1977. The USGS had synoptic monitoring sites on Bailey Trace, Puckett Creek, and on the mainstem of Straight Creek. The 1981 report indicates that total dissolved solids at these sites was in the range of 50-150 mg/L in that time period, indicating fairly good water quality. These TDS levels correspond to specific conductivity levels of 71-214 µS/cm. This report also indicates that pH, acidity, alkalinity and dissolved iron were not serious problems in Baileys Trace and were not significantly different from unmined streams but that dissolved manganese was somewhat elevated (> 200 µg/L) in Baileys Trace, Puckett Creek and the mainstem of Straight Creek. The water quality data collected in this study indicated total Mn levels were all far less than 200µg/l.

Other sites in our study have impaired aquatic life uses (Sites 1 on Gin Creek, 8 on Straight Creek, 9 on Baileys Trace, and 14 on Fawn Branch). However, these sites still support some aquatic life, as evidenced by the taxa lists. The existing use in these reaches clearly includes an aquatic life use, but the historical data should be carefully reviewed to determine the highest use attained (the existing use).

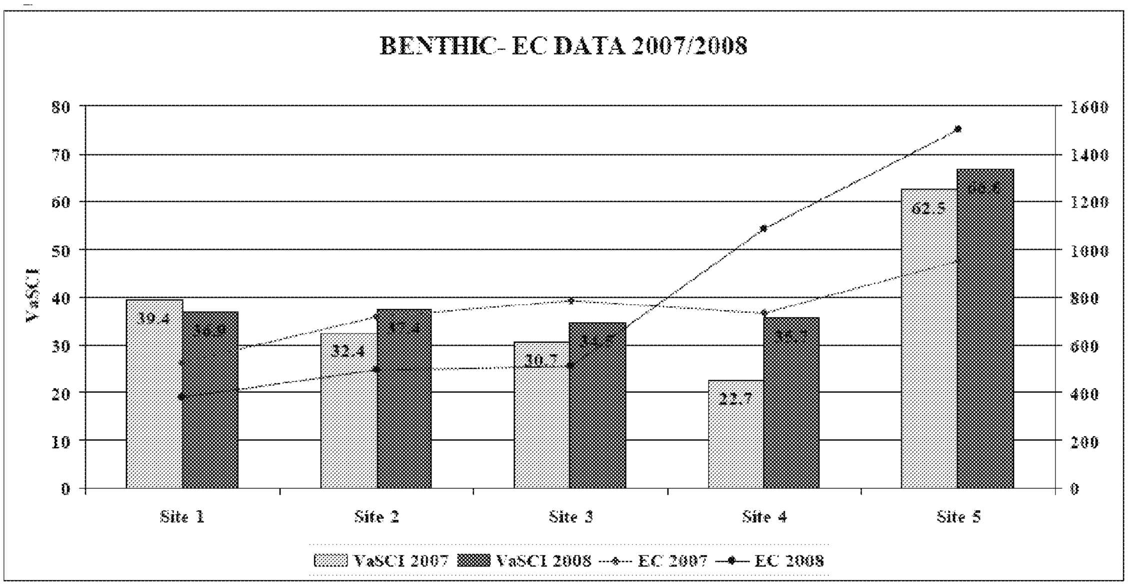

Figure 9. USFWS and VMIG Benthic and Electrical Conductivity (EC) Data (VMIG 2008)

We observed increased stress and subsequent impairment of the aquatic life use further downstream in Baileys Trace, Gin Creek and Straight Creek where residential land use and additional stressors increased. Our findings agree with the earlier studies conducted on the mainstem of Straight Creek (MapTech 2006, USFWS 2007, VMIG 2008, Figure 9, VSCI scores and electrical conductivity (EC)). We have observed similar increased impairment with additional stressors in studies of watersheds with mining and residential land uses in southern WV (Green et al. 2000) and KY (Pond 2004).

The TMDL states there are 140 failing septic systems and 216 straight pipes contributing to the bacteria load. This TMDL Implementation plan calls for the elimination of all straight pipes and failing septic systems. For example, the North St. Charles Sewer Project is underway and when completed will eliminate approximately 110 failing septic systems or straight pipes in Straight Creek. In addition, the coal industry proposed a decentralized sewage system for the Fawn Branch/Dominion community. We understand that a grant was obtained for this project, and designs are in development. The system will be operated by the St. Charles Water and Sewer Authority, who will oversee the hookups to the mainline. This action would not only reduce the bacterial loads and hopefully restore the recreational use, but should also prevent nutrients, organics, household chemicals and toxicants from entering streams, which should also positively impact the aquatic life use.

The Implementation Plan also calls for the restoration and reclamation of high priority abandoned mine lands (AML), reclamation/revegetation of disturbed forest lands, restoration/stabilization of eroding stream segments, greater enforcement for nonpoint source (NPS) contributors, and mandatory implementation of Best Management Practices (BMPs).

We support addressing residential sources as an obvious first step. VDEQ should also continue to evaluate existing and proposed mining activities to make sure that the biological condition and aquatic life uses do not degrade due to mining activity. This is especially important given that currently the aquatic life uses are attained or close to being attained nearest the mining activity. Additional mining activity has the potential to further impair the aquatic life uses in those locations.

The coal industry has also reported that they have implemented BMPs to provide rapid reclamation and revegetation of disturbed areas, accelerate road sump/pond clean-out schedules and a process change at the Lone Mountain coal preparation plant which reduced chemical oxygen demand by approximately 65% (presentation by Keith Mohn, Lone Mountain Processing, 2008).

The Implementation Plan addresses TDS loadings in the same manner as sediment loadings, through stream bank stabilization, restoration of riparian buffers, and restoration of AML lands. This report does not offer many actions to be taken at mining point sources to reduce TDS loadings. Our data indicate that TDS concentrations were highest nearest the mining point sources. Stream bank stabilization projects aimed at reducing sediment loads will not likely reduce TDS loadings. Furthermore, streambank stabilization and channel reconfiguration projects offer many benefits, but they do not always fully restore aquatic habitats and in some cases have even been shown to favor aquatic life typical of disturbed environments (Tullos et al. 2009), at least initially.

Recommendations

A state or tribe should determine existing uses on a reach-specific basis to ensure that they identify the highest degree of uses and water quality necessary to support the uses that have been achieved in a waterbody since November 28, 1975. When describing existing uses, states and tribes should articulate not only the highest aquatic life use that has been achieved (using the biological measures), but also, if possible, the water quality supporting that specific aquatic life use. For aquatic life, states and tribes should consider the available biological data as an integrating indicator of water quality, habitat quality and the actual use, in conjunction with any available chemical water quality and habitat data. In other words, the biological data will integrate and reflect the effect of all water quality and habitat quality stressors on the aquatic life use, whether or not there are data available for all water quality and habitat quality stressors. Furthermore, states can use biological data to directly describe existing aquatic life uses in a very specific way (e.g. highest VSCI scores range from 50 to 60 in a particular reach over a three year period), outside of the definitions of the state's designated use structure. This is to ensure that at a minimum, the highest degree of existing use and biological condition for a specific waterbody is protected. Once the existing uses have been defined, the state should also make an evaluation of the potential condition of each stream, in order to assign the appropriate designated use.

Biological data are the best direct measure of the existing and appropriate aquatic life uses in the watershed. To support TMDL implementation, and the UAA, we recommend that VDEQ review all available sources of biological data and, if deemed necessary, collect additional macroinvertebrate samples throughout the watershed (including all major tributaries) to confirm the attainment status of all tributaries. Where the existing use is attaining or has attained the designated use, the use can not be removed. We recommend that any tributaries or reaches that are close to attaining the use (and therefore reasonably have the potential to attain the use) should retain the designated aquatic life use.

Other reaches or tributaries that are currently impaired should be carefully evaluated to characterize the existing use, and the potential for improvement following point and nonpoint source controls, before considering the refinement of the aquatic life use.

States and tribes should also carefully consider how refinement of aquatic life uses might impact downstream reaches. For example, a state may decide to refine an aquatic life use in an urbanized reach, and have lower biocriteria thresholds for that urbanized reach, but may not change the numeric water quality criteria for that reach because of concerns regarding protection of downstream aquatic life uses.

We recommend that VDEQ continue to carefully manage permitted activities in the watershed so that water quality does not degrade further due to coal mining or other land use activities in the Straight Creek watershed. Water quality should be maintained at the current levels to protect the existing uses in the Straight Creek watershed and in downstream waters.

We recommend that the UAA study should be delayed until the TMDL is implemented in Straight Creek. The coal industry developed a TMDL Implementation Plan (VMIG 2008) that proposes several activities that should improve water quality and biological condition. We believe that the TMDL implementation should have a positive effect on the biological communities and associated aquatic life uses in the mainstem of Straight

Creek. It remains to be seen whether these projects will result in full attainment of the aquatic life use in those reaches that are currently impaired.

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Appendix 1. Tables

Table 6. Taxonomic Lists (from 200±20% organism subsample)

Table 6. Taxonomic Lists (from 200±20% organism subsample)

Order	Family	Genus	Gin Creek 1	Gin Creek 2	Straight Creek 7	Straight Creek 8	Baileys Trace 9	Baileys Trace 12	Fawn Branch 14	Big Branch 15	Clear Creek 27
		Nematoda									1
Coleoptera	Elmidae	Optioservus			2	3	6	14			
Coleoptera	Elmidae	Oulimnius		3							8
Coleoptera	Psephenidae	Ectopria		1							2
Coleoptera	Psephenidae	Psephenus		7		2	3	5	9	1	
Decapoda	Cambaridae	Cambarus							1	1	2
Diptera	Blephariceridae	Blepharicera									3
Diptera	Ceratopogonidae	Bezzia/Palpomyia									2
Diptera	Ceratopogonidae	Probezzia									1
Diptera	Chironomidae	Chironomus					1				
Diptera	Chironomidae	Corynoneura							2		1
Diptera	Chironomidae	Cricotopus	20								
Diptera	Chironomidae	Cricotopus/Orthocladius	40	12	25	120	50	16	36		2
Diptera	Chironomidae	Diamesa	23	3	5	7	4	1	13		
Diptera	Chironomidae	Eukiefferiella	10		20		2	2	4		6
Diptera	Chironomidae	Micropsectra			10		5				1
Diptera	Chironomidae	Microtendipes	10								4
Diptera	Chironomidae	Nilotanypus								1	1
Diptera	Chironomidae	Parametriocnemus	30	8	10	30	55		48		
Diptera	Chironomidae	Paratrichocladius		14		30			20		
Diptera	Chironomidae	Polypedilum	10		10			2			3
Diptera	Chironomidae	Rheocricotopus									1
Diptera	Chironomidae	Stempellinella									4
Diptera	Chironomidae	Tanytarsus						1			14
Diptera	Chironomidae	Thienemanniella							1	1	
Diptera	Chironomidae	Thienemannimyia	10	10	10	50	25	2	8	2	8
Diptera	Chironomidae	Tvetenia	20		15		16	2	27	1	

Table 6. Taxonomic Lists (from 200±20% organism subsample)

Order	Family	Genus	Gin Creek 1	Gin Creek 2	Straight Creek 7	Straight Creek 8	Baileys Trace 9	Baileys Trace 12	Fawn Branch 14	Big Branch 15	Clear Creek 27
Diptera	Empididae	Chelifera			1						
Diptera	Empididae	Empididae		1		1		2			
Diptera	Empididae	Hemerodromia	3	1	6			1	2		
Diptera	Sciaridae	Corynoptera									2
Diptera	Simuliidae	Prosimulium									1
Diptera	Simuliidae	Simulium	1		16	1	6	1	4		6
Diptera	Tipulidae	Antocha			1		1	2			
Diptera	Tipulidae	Hexatoma									2
Diptera	Tipulidae	Limnophila									1
Diptera	Tipulidae	Molophilus									1
Diptera	Tipulidae	Pseudolimnophila									1
Diptera	Tipulidae	Tipula		1							
Ephemeroptera	Ameletidae	Ameletus			1						7
Ephemeroptera	Baetidae	Acentrella	9	7	2		8	9	8	11	6
Ephemeroptera	Baetidae	Baetidae			1		1				
Ephemeroptera	Baetidae	Baetis	12	4	3		39	30	6	26	3
Ephemeroptera	Baetidae	Plauditus	1	3	1		8	1	22		16
Ephemeroptera	Ephemerellidae	Drunella									8
Ephemeroptera	Ephemerellidae	Ephemerella		14	1			1	2	12	2
Ephemeroptera	Ephemerellidae	Eurylophella	1						2		1
Ephemeroptera	Heptageniidae	Cinygmula									4
Ephemeroptera	Heptageniidae	Epeorus		3			2	1	1	4	4
Ephemeroptera	Heptageniidae	Heptageniidae									5
Ephemeroptera	Heptageniidae	Stenacron								4	
Ephemeroptera	Heptageniidae	Stenonema									1
Ephemeroptera	Leptophlebiidae	Leptophlebiidae					1				6
Ephemeroptera	Leptophlebiidae	Paraleptophlebia								1	
Haplotaxida	Naididae	Naididae	1		2	1					
Lumbriculida	Lumbriculidae	Lumbriculidae	4		2	3	5				
Megaloptera	Corydalidae	Corydalus				1					
Megaloptera	Corydalidae	Nigronia					1				

Table 6. Taxonomic Lists (from 200±20% organism subsample)

Order	Family	Genus	Gin Creek 1	Gin Creek 2	Straight Creek 7	Straight Creek 8	Baileys Trace 9	Baileys Trace 12	Fawn Branch 14	Big Branch 15	Clear Creek 27
Odonata	Gomphidae	Gomphidae			1			2		2	1
Plecoptera	Chloroperlidae	Chloroperlidae								1	
Plecoptera	Chloroperlidae	Sweltsa									1
Plecoptera	Leuctridae	Leuctra	2	131	56	3	8	67	19	107	95
Plecoptera	Nemouridae	Amphinemura		9	27		2	20		61	7
Plecoptera	Peltoperlidae	Peltoperla									1
Plecoptera	Perlidae	Acroneuria									4
Plecoptera	Perlidae	Perlesta		1				9			
Plecoptera	Perlodidae	Isoperla			2					3	
Plecoptera	Perlodidae	Perlodidae			1						1
Plecoptera	Pteronarcyidae	Pteronarcys									11
Plecoptera	Taeniopterygidae	Taeniopteryx						2			1
Trichoptera	Glossosomatidae	Agapetus								3	
Trichoptera	Hydropsychidae	Ceratopsyche					1				2
Trichoptera	Hydropsychidae	Cheumatopsyche	2	5	3		4	19	2		1
Trichoptera	Hydropsychidae	Diplectrona		5						1	9
Trichoptera	Hydropsychidae	Hydropsyche		1					1		
Trichoptera	Hydropsychidae	Hydropsychidae			4						
Trichoptera	Hydroptilidae	Hydroptila			9						
Trichoptera	Lepidostomatidae	Lepidostoma									3
Trichoptera	Philopotamidae	Chimarra						4			
Trichoptera	Philopotamidae	Dolophilodes		10							3
Trichoptera	Philopotamidae	Wormaldia								1	
Trichoptera	Polycentropodidae	Polycentropus								1	2
Trichoptera	Rhyacophilidae	Rhyacophila						1			4
Trichoptera	Uenoidae	Neophylax								1	

Appendix 2.

Relevant Regulatory Text from the Federal Water Quality Standards regulation (WQS Regulation) at 40 C.F.R. § 131.10

(a) Each State must specify appropriate water uses to be achieved and protected. The classification of the waters of the State must take into consideration the use and value of water for public water supplies, protection and propagation of fish, shellfish, and wildlife, recreation in and on the water, agricultural, industrial, and other purposes including navigation. In no case shall a State adopt waste transport or waste assimilation as a designated use for any waters of the United States.
(b) In designating uses of a water body and the appropriate criteria for those uses, the State shall take into consideration the water quality standards of downstream waters and shall ensure that its water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters.
(c) States may adopt sub-categories of a use and set the appropriate criteria to reflect varying needs of such sub-categories of uses, for instance, to differentiate between cold water and warm water fisheries.
(d) At a minimum, uses are deemed attainable if they can be achieved by the imposition of effluent limitations required under sections 301(b) and 306 of the Act and cost-effective and reasonable best management practices for nonpoint source control.
(e) Prior to adding or removing any use, or establishing sub-categories of a use, the state shall provide notice and an opportunity for a public hearing under § 131.20(b) of this regulation.
(f) States may adopt seasonal uses as an alternative to reclassifying a water body or segment thereof to uses requiring less stringent water quality criteria. If seasonal uses are adopted, water quality criteria should be adjusted to reflect the seasonal uses, however, such criteria shall not preclude the attainment and maintenance of a more protective use in another season.
(g) States may remove a designated use which is not an existing use, as defined in § 131.3, or establish subcategories of a use if the State can demonstrate that attaining the designated use is not feasible because:

(1) Naturally occurring pollutant concentrations prevent the attainment of the use; or

(2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or

(3) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or

(4) Dams, diversions, or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or

(5) Physical conditions related to natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or

(6) Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

(h) States may not remove designated uses if:

(1) They are existing uses, as defined in § 131.3, unless a use requiring more stringent criteria is added; or

(2) Such uses will be attained by implementing effluent limits required under sections 301(b) and 306 of the Act and by implementing cost-effective and reasonable best management practices for nonpoint source control.

(i) Where existing water quality standards specify designated uses less than those which are presently being attained, the State shall revise its standards to reflect the uses actually being attained.

(j) A State must conduct a use attainability analysis as described in § 131.3(g) whenever:

(1) The State designates or has designated uses that do not include the uses specified in section 101(a)(2) of the Act; or

(2) The State wishes to remove a designated use that is specified in section 101(a)(2) of the Act or to adopt subcategories of uses specified in section 101(a)(2) of the Act which require less stringent criteria.

(k) A State is not required to conduct a use attainability analysis under this regulation whenever designating uses which include those specified in section 101(a)(2) of the Act.

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA

OHIO VALLEY ENVIRONMENTAL COALITION, INC.; SIERRA CLUB; WEST VIRGINIA HIGHLANDS CONSERVANCY, INC.; & WEST VIRGINIA RIVERS COALITION;	)	
Plaintiffs,	)	
v.	)	**CIVIL ACTION NO. 3:15-cv-00271**
GINA MCCARTHY, Administrator, United States Environmental Protection Agency, & SHAWN M. GARVIN, Regional Administrator, United States Environmental Protection Agency, Region III,	)	**EPA'S MEMORANDUM OPPOSING PLAINTIFFS' MOTION FOR SUMMARY JUDGMENT AND SUPPORTING EPA'S CROSS-MOTION FOR SUMMARY JUDGMENT**
Defendants.	)	

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INTRODUCTION AND SUMMARY

Defendants United States Environmental Protection Agency, et al., (collectively "EPA"), oppose Plaintiffs' motion for summary judgment and cross-move for summary judgment on all claims for relief in this case. Because review is limited to the administrative record, resolution of this case is appropriate through summary judgment.

The West Virginia Department of Environmental Protection ("DEP") has a robust program for establishing total maximum daily loads ("TMDLs") throughout West Virginia under the Clean Water Act ("CWA"). A TMDL sets the maximum amounts of a pollutant that sources can discharge into a waterbody and still meet applicable water quality standards. Over the past eleven years, DEP has established more than 4,000 TMDLs, and it is continuing to develop others for impaired waterbody segments. In the course of developing TMDLs, the need for additional information or revised methodologies may arise, requiring that those TMDLs be deferred or assigned a lower priority until a later time when needed information will be available and the State can develop the TMDLs consistent with its efforts to develop other TMDLs within its borders.

This is the situation here. DEP transmitted to EPA six separate reports between 2009 and 2014 that submitted 1,546 distinct TMDLs for almost 1,000 separate waterbodies in six different watersheds within West Virginia: Upper Ohio South, Dunkard Creek, Lower Kanawha River, Elk River, Monongahela River, and West Fork River watersheds. EPA reviewed and approved those 1,546 TMDLs.

In the course of working on these TMDLs, DEP identified certain waters as biologically impaired due to ionic toxicity. Ionic toxicity results from the presence of excessive amounts of dissolved solids (e.g., mineral salts) in a waterbody and can cause biologic impairment by adversely impacting aquatic life. While DEP explained that it had sufficient information regarding instream ionic toxicity levels and their effects on benthic macroinvertebrates to identify the waters as impaired, it lacked sufficient information about which particular dissolved solids (*e.g.*, chlorides, sulfates, potassium, magnesium, etc.) caused the ionic stress, and their associated impairment thresholds and their sources, to establish a defensible TMDL. Accordingly, DEP explained that it was deferring submission of these TMDLs pending development of the necessary information and that the waters would remain on the list of impaired waters required by the CWA, known as the Section 303(d) list. DEP "agree[d] that TMDLs must be developed for all 303(d) listed impairments" (A.R. WF River Doc. 33 at 89) and that it would develop a plan for completing the deferred TMDLs. DEP also explained that it would have to develop a new assessment methodology for developing these ionic toxicity TMDLs, in accordance with a new West Virginia law (Senate Bill 562 (SB 562)). Thereafter, in response to comments from EPA and environmental groups, DEP established a schedule, ranging between 2020 and 2025 depending upon the particular watershed, when it would establish these deferred TMDLs. Supp. A.R.WV 303(d) Lists Doc. 52 & 53.

Plaintiffs contend that under either an "actual submission" or "constructive submission" theory (Claims 1 and 2 of Plaintiffs' Amended Complaint), DEP's deferral of the TMDLs for ionic toxicity constitutes a submission of "no" such TMDLs (i.e., a State determination that none will ever be developed), and, therefore, that EPA has a mandatory duty under the CWA to disapprove that "actual submission" or "constructive submission" and establish these deferred TMDLs itself. Section I of this brief explains that Plaintiffs have not established standing regarding their claims for many of the TMDLs for which they request relief. Section II explains that the State's deferral, and subsequent rescheduling, neither actually nor constructively renounced its obligation to submit those TMDLs in the future. Moreover, the legal theories Plaintiffs rely upon cannot be used to usurp the State's ability to set TMDL priorities and timing.

In their third through eighth claims for relief, Plaintiffs inappropriately attempt to bootstrap their challenges to EPA's acknowledgment of the State's deferral onto EPA's approvals of the 1,546 TMDLs for other pollutants that DEP submitted for the waterbodies within the six watersheds. Although each of EPA's approvals of the 1,546 TMDLs constitutes a final agency action as the individual approved TMDL reviewable under the Administrative Procedure Act ("APA"), Plaintiffs do not challenge any of the approved TMDLs. Instead, they challenge EPA's acknowledgment of the State's deferral. Section III below demonstrates that EPA does not approve State TMDL priority rankings or schedules, and EPA's acknowledgment of the States' deferral constitutes neither an "approval" under the CWA nor final agency action within the meaning of the APA. Accordingly, claims three through eight must be dismissed. But even if EPA's acknowledgment of the State's deferral were judicially reviewable, EPA's action should be upheld. Section IV demonstrates that the CWA does not, as Plaintiffs' contend, require that State's submit all TMDLs for a particular waterbody or watershed simultaneously. Moreover, the reasons the State deferred issuing the TMDLs for ionic toxicity – the need for additional information and the development of a new assessment methodology – were reasonable. Accordingly, summary judgment should be entered for EPA.

BACKGROUND

I. STATUTORY AND REGULATORY BACKGROUND

The Clean Water Act establishes a comprehensive program "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters" through the reduction and eventual elimination of the discharge of pollutants into those waters. 33 U.S.C. § 1251(a). States are primarily responsible for achieving these goals. *Id.* § 1251(b).

A. The NPDES Permit Program

The CWA's central regulatory features are established by the National Pollutant

Discharge Elimination System ("NPDES") permit program. 33 U.S.C. § 1342(a)(1); 40 C.F.R. §122.44(a), (d)(1). Pollutant discharges from point sources into waters of the United States are prohibited unless in compliance with CWA requirements, such as compliance with an NPDES permit. 33 U.S.C. § 1311(a). If the conditions of a permit are violated, they may be enforced by the United States, or any interested person, including a State. *Id.* § 1319. Since 1982, West Virginia has been authorized to administer the NPDES permitting program. 47 Fed. Reg. 22363 (May 24, 1982); *see* 33 U.S.C. § 1342(b).

NPDES permits control water pollution from point sources by means of two different overarching strategies. The first, the "technology-based" approach, reduces pollution by requiring dischargers to achieve specified restrictions on the quantities, rates, and concentrations (known as "effluent limitations") based on specific process-based controls. 33 U.S.C. §§ 1311, 1314, 1316-17, 1362(11). The CWA requires EPA to develop and promulgate national technology-based regulations establishing minimum levels of wastewater treatment for categories of industrial sources. During the 1970s and 1980s, EPA gave priority to developing the new technology-based regulations, which EPA and the states implemented through the new NPDES permit program. *See Environmental Defense Fund, Inc. v. Costle,* 636 F.2d 1229 (D.C. Cir. 1980). EPA has thus issued technology-based regulations for more than 50 major categories of industrial dischargers, including the coal mining point source category. 40 C.F.R. Pts. 405-471.

B. TMDLs

While the initial emphasis was on technology-based effluent limitations, the CWA also directs that NPDES permits include limits sufficiently stringent to implement applicable water quality standards. 33 U.S.C. § 1311(b)(1)(C); 40 C.F.R. § 122.44(d)(1)(vii)(A). States, with federal approval and oversight, adopt water quality standards ("WQS") for each particular waterbody or waterbody segment within their boundaries. 33 U.S.C. § 1313(a), (b) & (c)(1). A

WQS identifies (1) the "designated uses" for a particular waterbody (e.g., public water supply, support of aquatic life, and/or recreational uses) and (2) a "water quality criterion" expressed as a level (e.g., a pollutant-specific concentration and/or a narrative condition) that must not be exceeded so that the waterbody can support those uses (e.g.iron concentrations necessary for aquatic life). *Id.* § 1313(c)(2); 40 C.F.R. § 131.3(i). Several water quality standards may apply to the same waterbody segment. EPA either approves a State's proposed water quality standards or, if it disapproves, promulgates standards for the State. *Id.* § 1313(c)(3).

After adoption and approval of water quality standards, CWA Section 303(d) directs the States to identify, and prioritize water-quality-limited segments ("WQLSs"), i.e., the individual water segments that do not or are not expected to meet applicable water quality standards even after implementation of technology-based effluent limitations. *Id.* § 1313(d)(1)(A) & (B); 40 C.F.R. §§ 130.2(j) & 130.7(b)(1). EPA's regulations specify that the States submit their WQLSs in lists (known as "Section 303(d)" lists) to EPA for approval or disapproval on a biennial basis. 40 C.F.R. § 130.7(d)(7). If EPA disapproves, it must identify the WQLSs to be added within 30 days from the date of disapproval. 33 U.S.C. § 1313(d)(2).

States are to develop a TMDL for each impaired waterbody and the particular pollutant for which that waterbody is impaired. 33 U.S.C. § 1313(d). TMDL development requires States to identify the maximum amount of pollutant "loading", *i.e.*, quantity of a particular pollutant, that the impaired waterbody can receive from all sources and still meet the relevant water quality standard. *Id.* § 1313(d)(1)(C); 40 C.F.R. § 130.2(e). Each TMDL must, among other things: (1) be designed to meet the applicable water quality standard for which it is established; (2) include, as appropriate, both wasteload allocations from point sources and load allocations from non-point sources; (3) consider the impacts of background pollutant contributions; (4) consider seasonal variations; (5) include a margin of safety; and (6) be subject to public participation. *Id.*

§§ 130.7, 130.7(c)(1), 130.2(g)-(i). Developing a TMDL typically requires a significant amount of technical analysis, and may take years to complete once initiated depending, among other things, upon the information and studies required. Once a State submits a TMDL to EPA, the CWA directs EPA to approve or disapprove that TMDL within 30 days of submittal. If EPA disapproves a particular TMDL, EPA must establish a federal TMDL for the WQLS within 30 days of the Agency's disapproval. 33 U.S.C. § 1313(d)(2).

TMDLs function primarily as planning devices and are not self-executing. *Pronsolino v. Nastri*, 291 F.3d 1123, 1129 (9th Cir. 2002). Instead, each TMDL represents a goal that may be implemented by adjusting pollutant discharge requirements in individual NPDES permits and/or by establishing nonpoint source controls. *Sierra Club v. Meiburg*, 296 F.3d 1021, 1025 (11th Cir. 2002). Thus, TMDLs form a basis for further State actions with respect to particular pollutant discharges. Regardless of whether a TMDL has been established, State-issued NPDES permits must include effluent limits as stringent as necessary to meet water quality standards. 33 U.S.C. § 1311(b)(1)(C); 40 C.F.R. § 122.44(d)(1)(vii)(A). Under the CWA, the absence of TMDLs does not prevent NPDES permitting authorities from otherwise assuring that point source discharges do not cause or contribute to exceedances of water quality standards.

C. State Schedules and Approaches to Developing TMDLs

States are required to establish a priority ranking for WQLSs that are typically submitted together with their Section 303(d) lists, 33 U.S.C. § 1313(d)(1)(A). The ranking is used to prioritize TMDLs for development. *Id.* § 1313(d)(1)(C). In establishing a priority ranking, States must consider the severity of the pollution and the uses of the listed waterbody. *Id.* § 1313(d)(1)(A). Beyond these two statutory factors, States retain considerable discretion and may consider other factors when prioritizing and scheduling TMDLs, including: vulnerability of particular waters; recreational, economic, and aesthetic importance of particular waters;

restoration potential; degree of public interest and support; State or national policies and priorities; technical considerations, such as the complexity of the impairment; availability of adequate data and models; and implementation of watershed-based permitting programs or basin planning cycles. *See, e.g.*, 57 Fed. Reg. 33040, 33,044-45 (July 24, 1992); A.R. EPA TMDL Guid. Doc. 6 at 3. The State's schedule is to identify those WQLSs targeted for TMDL development in the next two years. 40 C.F.R § 130.7(b)(4) & (d)(1).

Although States typically submit their priority rankings of WQLSs together in the same document that transmits their Section 303(d) lists, EPA does not approve or disapprove the substance of these rankings. *See* 33 U.S.C. §§ 1313(d)(1)(A) & (d)(2). Moreover, if a WQLS on a 303(d) list subsequently achieves the water quality standard for which it is impaired, it may be removed from the next Section 303(d) list and thus a TMDL is no longer required. 40 C.F.R. §§ 131.7(b)(1) & 130.2(j).

The CWA does not require States to develop and submit TMDLs to EPA on any particular timeframe, stating instead that after the first submittal, States should submit TMDLs to EPA "from time to time," i*d.* § 1313(d)(2), "in accordance with the priority ranking." *Id.* § 1313(d)(1)(C). In 1997 Guidance, EPA recommended that States normally plan to establish TMDLs for all WQLSs on their 1998 Section 303(d) lists and subsequent lists within eight to thirteen years of the initial listing, but recognized that shorter or longer times may be needed depending on specific factors and circumstances. A.R. EPA TMDL Guid. Doc. 6 at 3.

The Act provides States with broad latitude to determine how to best organize an approach that efficiently and effectively considers the applicable factors and establishes priorities for developing and completion of TMDLs. In this regard, States have discretion to employ a rotating basin or other watershed schema, or a pollutant-by-pollutant focus, when prioritizing and developing TMDLs. *Id.* at 2. Thus, for example, a State may strive to develop and establish all TMDLs for different pollutants for the same waterbody at the same time, or they may elect to establish together several different TMDLs for the same pollutant for different waterbodies.

II. FACTUAL BACKGROUND

A. West Virginia's Section 303(d) Program

DEP's 1996 Section 303(d) list included 51 "priority" WQLS and 469 mine drainage impacted WQLS. A.R. WV 303(d) Doc.1. DEP subsequently submitted, and EPA approved and/or disapproved, as appropriate, 303(d) lists in 1998, 2002, 2004, 2008, 2010 and 2012. A.R. WV 303(d) Docs. 3, 5, 9, 11, 13, 15, 17 and 20. As DEP has continued to assess the numerous waterbody segments throughout West Virginia, it has added additional WQLS to its 303(d) lists. On April 13, 2015, DEP submitted to EPA its 2014 Section 303(d) list, which identifies 1,157 WQLSs for TMDL development. Supp. A.R.WV 303(d) Lists Docs. 52-# 61.

In 1995, the lead plaintiff in this current case and others sued EPA alleging, among other things, that a constructive submission of no TMDLs had occurred for West Virginia, thereby triggering EPA duties to disapprove that submission and to establish all the TMDLs then required based on West Virginia's 1996 Section 303(d) list. *Ohio Valley Environmental Coalition v. Browner*, Nos. 2:95-0529 & 2:96-0091 (S.D. W.Va.). The case was resolved by a consent decree, whereby either DEP would undertake an aggressive TMDL development program or EPA would do it if DEP did not. *Id. (*entered on July 9, 1997). Since entry of that consent decree, DEP has devoted significant resources to TMDL development, and has established a robust program for developing and submitting TMDLs to EPA. Since 2004, EPA has approved over 4,000 TMDLs submitted by DEP. Supp. A.R.WV 303(d) Lists Doc. 55. DEP anticipates developing and submitting over 400 TMDLs between now and 2019 for a variety of waterbodies and pollutants. Supp. A.R.WV 303(d) Lists Doc. 53. The Administrative Record in this case amply documents DEP's robust TMDL output and its continued commitment to develop TMDLs.

B. DEP's Watershed Cycle for TMDL Development and EPA's Approval of TMDLs Submitted for Waters in the Six Watersheds

Although not required to do so, DEP generally utilizes a watershed approach as an organizational tool to efficiently develop and submit TMDLs to EPA:

> The DEP's TMDLs are developed according to the Watershed Management Framework cycle. The framework divides the state into 32 major watersheds and operates on a five year, five-step process. The watersheds are divided into five hydrologic groups (A - E). Each group of watersheds is assessed once every five years. . . . The TMDL process begins in the first year of the cycle with pre-TMDL sampling and public meetings in the affected watersheds. The data is compiled and TMDL development begins in year two of the cycle. In the third year, TMDL development continues and the TMDL is drafted. The TMDL is finalized in the fourth year. In the fifth year of the cycle, TMDL implementation is initiated through the NPDES permitting process and efforts toward limiting nonpoint source loading.

A.R. WV 303(d) Doc. 20 at 32. Thus, each year DEP typically conducts some phase of TMDL development work in each of West Virginia's 32 major watersheds, and it typically establishes TMDLs in each of these watersheds every five years.

Although it is not always possible based upon the circumstances, "WVDEP's TMDL development program has historically attempted to comprehensively address all streams and all impairments in a particular watershed simultaneously." This typically includes a 48-month TMDL development process involving "an extensive data generating and gathering effort . . . intended to produce scientifically valid TMDLs." A.R. Dunkard Doc. 39 at 77; A.R. Upper Ohio Doc. 39 at 72.

DEP's TMDL development work in the six watersheds at issue in this lawsuit does not all operate on the same cycle. In six separate reports sent by DEP to EPA from 2009 to 2014, DEP submitted 1,546 TMDLs for almost 1,000 different waterbodies or waterbody segments in six different watersheds: the Upper Ohio South, the Dunkard Creek, the Lower Kanawha River, the Elk River, the Monongahela River, and the West River watersheds. Specifically, included within the six referenced reports DEP submitted to EPA are: 6 TMDLs for selenium; 911 TMDLs for iron; 50 TMDLs for aluminum; 18 TMDLs for chloride; 56 TMDLs for pH; 2 TMDLs for manganese; 503 TMDLs for fecal coliform bacteria. A.R. Upper Ohio Doc. 39; A.R. Dunkard Doc. 39; A.R. Elk River Doc. 26; A.R. Lower Kanawha Doc. 25; A.R. Monongahela River Doc. 32; A.R. WF River Doc. 33.

EPA reviewed these TMDL submissions, as required by 33 U.S.C. § 1313(d)(2), and approved the submitted TMDLs on September 24, 2009, September 30, 2009, May 17, 2012, April 23, 2012, April 2, 2014, and July 29, 2014. A.R. Upper Ohio Doc. 37 & 38; A.R. Dunkard Doc. 37 & 38; A.R. Elk River Docs 24 & 25; A.R. Lower Kanawha Doc. 23 &24; A.R. Monongahela River Doc. 29 & 30; A.R. WF River Docs 30 & 31.

C. DEP's Deferral of TMDLs for Ionic Toxicity for Waterbodies in the Six Watersheds.

1. Identification of Ionic Stress as a Biologic Impairment Stressor

West Virginia has established numerous water quality criteria to support designated uses of West Virginia waters. Most of West Virginia's criteria are numeric expressions of concentration of particular pollutants. *See* W.Va. Code R § 47-2, Appendix E, Table 1. In addition, West Virginia has a narrative water quality criterion that, as applied to aquatic life, in pertinent part prohibits:

> [m]aterials in concentrations which are harmful, hazardous or toxic to man, animal or aquatic life; ... [and] . . . [a]ny other condition ... which adversely alters the integrity of the waters of the State . . . ; no significant adverse impact to the chemical, physical, hydrologic, or biological components of aquatic ecosystems shall be allowed.

Id. §§ 47–2–3.2, –3.2.e, –3.2.i.

Since 2002, DEP has utilized the West Virginia Stream Condition Index ("WVSCI") to identify biologically impaired waters based upon a direct measurement of a waterbody's biological condition. *See, e.g.,* A.R. WV 303(d) Doc. 17 at 14-15. Thus, when DEP identifies waters on its Section 303(d) list as biologically impaired, it does not necessarily know the impairing pollutant or pollutants. Accordingly, prior to developing TMDLs, DEP performs extensive monitoring and conducts a "stressor identification" to identify the impairing pollutants. *See, e.g.,* A.R. WV 303(d) Doc. 17 at 14-15.

In accordance with this process, DEP conducted a pre-TMDL stressor identification analysis for biologically impaired waters in the Dunkard Creek and Upper Ohio South watersheds. That analysis identified organic enrichment, ionic toxicity, sedimentation, metals toxicity, pH, or metals flocculation as the impairing stressors in biologically impaired streams in those watersheds. A.R. Dunkard Doc. 39 at 14; A.R. Upper Ohio Doc 39 at 16. DEP found that many of the biological impairments caused by these forms of pollution could be properly addressed by the use of a surrogate TMDL for a different pollutant. A.R. Upper Ohio Doc. 39 at 16-17; A.R. Dunkard Doc. 39 at 15.

For those waters where the identified impairing stressor was ionic toxicity, DEP did not identify a surrogate pollutant for which it could develop a TMDL. Ionic toxicity is not the result of a single substance, but rather the cumulative effect of a number of dissolved solids (salts) or component ions. Some of the waters impaired by ionic toxicity were also impaired by chlorides, which are component ions that contribute to ionic toxicity. Chlorides are governed by a separate numeric water quality criterion in West Virginia. Accordingly, DEP established TMDLs for these waters based upon the numeric criterion for chlorides. While DEP noted that this approach would likely reduce the ionic toxicity biological impairment, AR Dunkard Creek Doc. 39 at 15 & 77, DEP did not use these chloride TMDLs as surrogates for ionic toxicity TMDLs, because

DEP could not make a technical conclusion that the chlorides TMDLs would fully resolve the ionic toxicity biological impairment. DEP also noted the strong presence of sulfates (another component ion) in some waters likely played a role in the ionic toxicity. A.R. Upper Ohio Doc. 39 at xi & 17; A.R. Dunkard Doc. 39 at x, 15 & 77-78)).

DEP conducted a similar process and analysis for the waterbodies in the other watersheds at issue in this case. A.R. Elk River Watershed, Doc. 26 at 19-25; A.R. Lower Kanawha, Doc. 25 at 19-26; A.R. Monongahela River Watershed, Doc. 32 at 17-24; A.R. West Fork River Watershed, Doc. 33 at 18-24.

2. DEP's Decision to Defer Issuing TMDLs for Ionic toxicity

DEP did not submit ionic toxicity TMDLs to EPA at the time it submitted TMDLs for other pollutants for the waters in the Dunkard Creek and Upper Ohio South watersheds, explaining that, due to the current lack of necessary information, development of those TMDLs would be deferred. DEP concluded that "[t]here is insufficient information available regarding the causative pollutants and their associated impairment thresholds for biological TMDL development for ionic toxicity *at this time*." *Id.* (emphasis added). DEP therefore explained that it was "deferring" development of ionic toxicity TMDLs for those waters. A.R. Upper Ohio Doc. 39 at 17; A.R. Dunkard Doc. 39 at 15. In response to comments, DEP explained these data gaps and uncertainties, in detail, which include concerns that:

> WVDEP lacks the water quality and source data necessary to use total dissolved solids in a reference reach approach … [; that] pre-TMDL monitoring efforts are being expanded to address this shortfall . . . . [; that] the ionic strength and constituent make-up of the background and the various point and nonpoint sources existing in the watershed may have dissimilar toxic impacts to the benthic community . . . [; that t]he normalization . . . associated with TMDLs based upon total dissolved solids or specific conductance may incorrectly target pollutant reductions from non-problematic sources . . . [; and that specific, described efforts are ongoing that] may provide more concrete TMDL endpoints for ionic stress biological impairment than currently available . . . .

A.R. Upper Ohio Doc. 39 at 72-73; A.R. Dunkard Doc. 39 at 77-78. It thus explained that it would be "prudent to delay TMDL development (as afforded by USEPA guidance) to allow their consideration." *Id.* At the same time, DEP "recognize[d] that the deferral of TMDLs cannot be indefinite," A.R. Upper Ohio Doc. 39 at 73; A.R. Dunkard Doc. 39 at 78, and explained that it would "cooperate" with EPA to develop a plan "that will be pursued to ensure the timely development of the deferred TMDLs." *Id.* Accordingly, DEP retained those impaired waters on the Section 303(d) list to ensure their completion in the future.

DEP also concluded that additional information was needed to develop TMDLs for ionic toxicity for the waters in the Elk River and Lower Kanawha watersheds. A.R. Elk River Doc. 26 at 23; A.R. Lower Kanawha, Doc. 25 at 22-23.

To address DEP's need to develop more information before establishing TMDLs for ionic toxicity, EPA and DEP jointly began work to develop pilot TMDLs for ionic toxicity for the Monongahela and Upper Kanawha watersheds. This included, beginning in 2010, work by EPA's contractor, Tetra Tech, Inc. A.R. 1st & 2nd Claims Docs. 3, 4 and 5, and an expenditure of over $400,000 of EPA contract funds. DEP and EPA devoted significant resources, over a prolonged period of time, considering numerous technical issues for developing these pilot TMDLs. Notwithstanding these efforts, additional technical information was still needed before the TMDLs could be established.

D. Enactment of SB 562 for a New Assessment Methodology

In 2012, West Virginia enacted a new law designated Senate Bill ("SB") 562. A.R. WV 303(d) Doc. 45 (text of statute). This law requires that DEP, among other things, establish through rules a new methodology replacing WVSCI for assessing biological impairments for West Virginia's narrative water quality standards. This involves consideration of how aquatic biological communities are evaluated. For example, comments by a Plaintiff in this case and

EPA urged DEP to replace WVSCI and use the Genus Level Index of Most Probable Stream Status ("GLIMPSS") instead to measure the aquatic biological community. *E.g.,* A.R. Upper Ohio Doc. 39 at 71; Supp. A.R.WV 303(d) Doc. 51-01 at 2-3. GLIMPSS utilizes genus-level data and accounts for seasons and geography, and is understood to have a finer (and more accurate) resolution. Supp. A.R.WV 303(d) Doc.5 at 2-3. Because the analysis to develop a TMDL target, called the endpoint, and to generate allocations to achieve that endpoint, necessarily depend upon how the aquatic biological community is measured, a change in the methodology measuring the aquatic biological community likely would alter TMDL endpoints and allocations. A.R. 1st & 2nd Claims Doc. 38 at 1. A TMDL using a superseded methodology would be of limited use for purposes of implementation.

In response to a comment received in connection with the TMDLs in the West Fork River watershed, DEP explained the impact of S.B. 562 on ionic toxidity TMDLs, as follows in pertinent part:

> DEP agrees that TMDLs must be developed for all 303(d) listed impairments but disagrees that the presented TMDLs [for waterbodies in the West Fork River watershed] are made invalid by the omission of TMDLs for the subject biological impairments. Additionally, DEP does not interpret 40 CFR 130.7(c)(1)(ii) as mandating concurrent TMDL development for all impairments.
>
> Prior to the passage of SB 562, DEP and EPA were implementing the TMDL development plan for "ionic stress" biological impairments referenced in the comments. * * * TMDL development has been paused with the passage of SB 562 because it potentially changes the basis for determining impairment and requires a new assessment methodology to be presented to the West Virginia Legislature prior to its implementation.
>
> The Clean Water Act and its implementing regulations do not prescribe an exact time frame between initial 303(d) listing and TMDL development. Biological impairments for which TMDLs have not been developed, including, but not limited to those in the West Fork River watershed, will remain on the 303(d) list. DEP recognizes the long time periods of 303(d) listing for some of the impairments and will develop TMDLs as soon as practicable after the accomplishing SB 562 requirements.

A.R. WF River Doc. 33 at 89-90. Consistent with SB 562, DEP has been working to develop a new assessment methodology that effectively assesses biological impairment across a broad range of stressors.

E. DEP's 2014 303(d) List Prioritizing the Deferred TMDLs for Ionic Stress

In its 2012 Section 301(d) list, DEP did not set a date for completing ionic toxicity TMDLs for the waters within the six watersheds at issue in this case. Rather, in view of the uncertainty S.B. 562 introduced into further TMDL development, DEP cited the dates for completing these TMDLs as "TBD - To be determined. TMDLs will be developed as soon as practicable after the effective date of rules enacted pursuant to Senate Bill 562." *See* A.R. WV 303(d) Doc. 20 at List pages 4, 8, 9, 10, 11, 44, 50.

After reviewing DEP's draft 2014 303(d) list, EPA and Plaintiffs submitted comments recommending that DEP establish dates by which it planned to complete the deferred TMDLs. Supp. A.R.WV 303(d) Lists Doc. 51-01 at 4 & Doc. 52 at 31. In response, and consistent with its rotating watershed approach for developing TMDLs, DEP included in its final 2014 Section 303(d) list submitted to EPA projected dates for completing TMDL development for the deferred TMDLs ranging from 2020 to 2025, depending upon the watershed. Supp. A.R.WV 303(d) Lists Doc. 52 at 31 & Doc. 53 at 15, 16, 39, 40, 41, 43, 49-54.

STANDARD OF REVIEW

I. EPA FINAL AGENCY ACTION MUST BE UPHELD UNLESS PLAINTIFFS ESTABLISH IT IS ARBITRARY AND CAPRICIOUS

The CWA citizen suit provision allows suits to be brought in district court against the "the Administrator [of EPA] where there is alleged a failure of the Administrator to perform any act or duty under this chapter which is not discretionary with the Administrator." 33 U.S.C. § 1365(a)(2). Such claims are available only where Congress has imposed by statute a clear-cut, mandatory duty for EPA to act in the statute. S*ee Monongahela Power Co. v. Reilly,* 980 F.2d 272, 276 & n.3 (4th Cir. 1992). With certain exceptions not relevant here, review of "final agency actions" by EPA under the Clean Water Act is available, if at all, under the Administrative Procedure Act ("APA") and its deferential standard of review.

Under the APA, agency action must be upheld unlesst is "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law." 5 U.S.C. § 706(2)(A). The scope of review under this standard is narrow, and a court may not substitute its judgment for that of the agency. *See Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto Ins. Co.*, 463 U.S. 29, 43 (1983); *Citizens to Preserve Overton Park v. Volpe*, 401 U.S. 402, 416 (1971). Under this standard an agency's factual determinations are entitled to substantial deference. *Arkansas v. Oklahoma*, 503 U.S. 91, 112 (1992). "[S]o long as the agency 'provide[s] an explanation of its decision that includes a rational connection between the facts found and the choice made,' its decision should be sustained." *American Whitewater v.* Tidwell, 770 F.3d 1108 (4th Cir. 2014) (citation omitted). Even an agency decision "of less than ideal clarity" may be upheld by the court "if the agency's path may reasonably be discerned." *Motor Vehicle Mfrs. Ass'n v. State Farm Mutual Ins.*, 463 U.S. 29, 43 (1983)). Further, when examining agency scientific findings made within an area of an agency's technical expertise, a reviewing court must be at its most deferential. *Marsh v. Oregon Natural Resources Council*, 490 U.S. 360, 376-77 (1989).

II. JUDICIAL REVIEW IS LIMITED TO THE ADMINISTRATIVE RECORD AND RESOLVED THROUGH SUMMARY JUDGMENT.

In a case such as this, judicial review is limited to the administrative record prepared by the agency for its decision. *Overton Park,* 401 U.S. at 419-20; *Vermont Yankee Nuclear Power Corp. v. NRDC*, 435 U.S. 519, 549 (1978). The Parties have stipulated that review in this case will be based on the administrative record. Dkt. No. 25. Because review is limited to the administrative record, resolution through summary judgment is proper. *Adams v. United States*, 318 F.2d 861, 865 (9th Cir. 1963). The district court "is not required to resolve any facts in a review of an administrative proceeding. . . . [T]he function of the district court is to determine whether or not as a matter of law the evidence in the administrative record permitted the agency to make the decision it did." *Occidental Eng'g Co. v. INS*, 753 F.2d 766, 769 (9th Cir. 1985).

ARGUMENT

I. PLAINTIFFS HAVE NOT ESTABLISHED ORGANIZATIONAL STANDING FOR ALL WATERBODY SEGMENTS WITHIN THE SIX WATERSHEDS FOR WHICH DEP HAS DEFERRED ISSUING TMDLS FOR IONIC TOXICITY

To establish standing Plaintiffs must show (1) an injury in fact that is "concrete and particularized" and "actual or imminent"; (2) that the injury is fairly traceable to the defendant's challenged conduct; and (3) that the injury is likely to be redressed by a favorable decision. *Lujan v. Defenders of Wildlife*, 504 U.S. 555, 560-61 (1992) (internal quotation marks omitted). To achieve representational standing, and organization must, among other things, demonstrate that at least one of its members would have standing to sue in his or her own right. *American Canoe Ass'n v. Murphy Farms, Inc.*, 326 F.3d 505, 517 (4th Cir. 2003). To establish injury-in-fact, "a plaintiff need only show that he used the affected area, and that he is an individual for whom the aesthetic and recreational values of the area [are] lessened" by the defendant's activity. *Piney Run Preservation Ass'n v. County Com'rs of Carroll County, MD*, 268 F.3d 255, 263 (4th Cir. 2002) (internal quotation marks omitted; modification in original).

Beyond assertions in their Amended Complaint, Plaintiffs have not submitted a declaration with their Motion for Summary Judgment that asserts an injury-in-fact in any waterbody within the Monongahela River watershed at issue in this case. Further, while Plaintiffs' Amended Complaint purports to seek relief as to 179 streams in Appendix A and 396 streams in Appendix B, their declarations allege that certain individuals satisfy the injury-in-fact requirement only as to approximately 50 individual waterbodies. Of these 50 waterbodies, Plaintiffs have submitted declarations alleging certain members satisfy the injury-in-fact requirement as to only a very small number (less than a dozen) of streams in five of the six watersheds that form the basis of their Amended Complaint and Motion for Summary Judgment. Accordingly, Plaintiffs lack standing to bring any of their claims for relief regarding any waterbodies except as to those waterbodies in the referenced footnote. For those seven waterbodies, EPA does not contest Plaintiffs' standing. To the extent Plaintiffs assert an injury in fact in their declarations regarding waterbodies outside the six referenced watersheds, as discussed below, the Amended Complaint does not include claims for relief for such waters.

II. DEP HAS NOT MADE AN ACTUAL OR CONSTRUCTIVE SUBMISSION RENOUNCING ITS OBLIGATION TO SUBMIT TMDLS ADDRESSING IONIC TOXICITY FOR WATERS IN THE SIX WATERSHEDS.

A. Regardless of How the Actual and Constructive Submissions Theories are Construed, Neither Actual Nor Constructive Submissions of No TMDLs Have Occurred.

Plaintiffs invoke the nondiscretionary duty prong of the CWA citizen suit provision, 33 U.S.C. § 1365(a)(2), to argue in Section I of their brief that an "actual" – as opposed to a "constructive" – submission of "no TMDLs" by a State triggers CWA nondiscretionary duties for EPA to establish TMDLs in lieu of the State. Br. at 13-17. Plaintiffs next argue in the alternative, in Section II of their brief, that there has been a "constructive submission" of "no TMDLs" because Plaintiffs interpret DEP as having "clearly and unambiguously demonstrated that it has no intention of developing" the deferred TMDLs for ionic toxicity, Pl. Br. at 17-21.

Neither the statute, nor case law, nor commonsense supports Plaintiffs' formulation of the actual and constructive submission theories. *See* Sections II.B.1 & C.1 below. The Court, however, need not decide the validity and precise contours of these theories because here DEP has neither actually nor constructively renounced its obligation to complete ionic toxicity TMDLs for the waterbodies at issue. Quite the opposite. DEP has retained on its Section 303(d) list the waters where TMDLs have been deferred, it has expressly acknowledged "that TMDLs must be developed for all 303(d) listed impairments," A.R. WF River Doc. 33 at 89, and that "the deferral of TMDLs cannot be indefinite." A.R. Upper Ohio Doc. 39 at 73; A.R. Dunkard Doc. 39 at 78. In fact, DEP has established and submitted to EPA its 2014 priority ranking for these deferred TMDLs, setting projected dates for completing the deferred ionic toxicity TMDLs at issue in this case. Supp. A.R.WV 303(d) Doc. 52 at 31 & Doc. 53 at 15, 16, 39, 40, 41, 43, 49-54.

As explained (*supra* at 12-14), the State initially deferred issuing TMDLs for ionic toxicity in the Upper Ohio South, Dunkard Creek, Lower Kanawha River, and Elk River watersheds because "[t]here was insufficient information available regarding the causative pollutants and their associated impairment thresholds for biological TMDL development for ionic toxicity." A.R. Lower Kanawha Doc. 25 at 22-23; A.R. Elk River Doc. 26 at 23. Following enactment of SB 562 by the West Virginia legislature, DEP also determined that TMDL development should be deferred until it can establishe TMDLs based upon the new assessment methodology required by SB 562: "[D]evelopment has been *paused* with the passage of SB 562 because it potentially changes the basis for determining impairment and requires a new assessment methodology to be presented to the West Virginia Legislature prior to its implementation." A.R. WF River Doc. 33, at 90 (emphasis added). As explained *supra* at 13-14, because the analysis to develop a TMDL necessarily depends upon how the aquatic biological community is measured, a change in the methodology measuring the aquatic biological community likely would alter the TMDL developed.

DEP's use of terms such as "pause," "defer," and "suspend" conveys only a temporary delay and reprioritization, not express or implied renunciation of DEP's obligations, and DEP's identification of projected dates for their completion confirms and fully resolves this issue. Indeed, DEP set these dates in response to comments by EPA and Plaintiffs in this case. Supp. A.R.WV 303(d) Doc. 51-01 at 4; Supp. A.R.WV 303(d) Doc. 52 at 31 & 53 at 15, 16, 39, 40, 41, 43, 49-54. In sum, DEP cannot be said to have expressly and unambiguously renounced its obligation to ever submit those TMDLs. While Plaintiffs may not agree with the dates selected by DEP for completing these TMDLs, that disagreement cannot create an actual or constructive submission under any rationale formulation of those legal theories. Thus, regardless of the validity or precise elements of an actual or constructive submission theory, the facts here readily demonstrate that neither has occurred.

B. DEP Has Not Actually Submitted "No" TMDLs for Ionic toxicity

1. There is No Support for Plaintiffs' Formulation of an Actual Submission Theory

Plaintiffs quote out of context isolated portions from footnote 18 in *American Canoe Ass'n v. EPA,* 54 F. Supp. 2d 621, 628 n.18 (E.D. Va. 1999), to manufacture a theory that when a State "'communicate[s] expressly to EPA prior to a scheduled deadline that it would not or could not comply with the schedule,'" Br. at 16 (quoting footnote 18 of *American Canoe),* "it constitutes," Br. at 16 (plaintiffs' words), an actual submission. Plaintiffs then rely upon isolated portions of the record, which they misconstrue, to argue that three statements by DEP constitute the express statement that it would submit no TMDLs. *Id.*

There is no basis in law or logic for Plaintiffs' legal theory. First, *American Canoe* is not an actual submission case, and the language Plaintiffs quote refers to the basis for and interpretation of a consent decree, not the CWA. After the *American Canoe* Court found that

Virginia failure to submit no TMDLs at all (or at most one TMDL) throughout the entire State over a nearly 20-year period constituted a constructive submission, 54 F.Supp. 2d at 624 & n.8, the Parties negotiated, and the court entered, a consent decree that expressly provided that if Virginia failed to establish TMDLs according to a schedule specified in the consent decree, then EPA would be required to do so. *Id.* Upon rejecting arguments by intervenors that the decree should not be entered, the court in footnote 18, *id.* at 628 n.18, merely described the basis for and operation of the consent decree, not a free-standing "actual" submission theory of "no TMDLs" under the CWA.

Unlike the judicially enforceable consent decree schedule in *American Canoe*, the CWA does not create an enforceable schedule for TMDL development. As explained *infra* at 36-38, Section 303(d)(1)(A) of the CWA, 33 U.S.C. § 1313(d)(1)(A), and the relevant case law afford States great discretion in setting their own schedule for the order and timing by which they develop and submit TMDLs to EPA. *See also Hayes v. Whitman,* 264 F.3d 1017, 1024 (10th Cir. 2001) (the "constructive-submission theory is not designed to challenge the timeliness or adequacy of the state's TMDL submissions . . . ."); *Sierra Club v. Browner,* 843 F. Supp. 1304, 1314 (D. Minn. 1993) ("the Act does not set deadlines for the development of a certain number of TMDLs."). Thus, even assuming an actual submission of "no" TMDLs could occur in theory, applying that theory to a particular subset of TMDLs while the State is working to develop other TMDLs is highly problematic. It would, at a minimum, require that the State clearly and unambiguously say, expressly, that it will never submit the particular TMDLs at issue. And even then, given a State's discretion to set its own TMDL schedule, an actual submission of "no" TMDLs may not occur if the State is working to develop other TMDLs to which the State assigns a higher priority.

Plaintiffs contend that a preliminary exchange of emails set a goal of 2013 for TMDL development. Even apart from Plaintiffs' mischaracterization of the documents they rely upon,[1] their argument is inapposite because, unlike the judicially enforceable, consent decree schedule in *American Canoe,* there is no such enforceable schedule applicable to the deferred TMDLs at issue here. Moreover, the fact that a State may have changed its priorities and delayed development of specific TMDLs in light of new information and circumstances does not violate any CWA-mandated schedule. And as discussed above, after having deferred issuing the relevant TMDLs for ionic toxicity, DEP has established a schedule for completing those TMDLs. *Supra* at 15.

Plaintiffs also misplace their reliance on *Sierra Club v. McLerran*, Civ. No. 11-CV-1759-BJR, 2015 WL 1188522 (W.D. Wash. Mar. 16, 2015), *appeals filed,* Nos. 15-35380, 15-35381, 15-35382 (9th Cir.), to support their actual submission theory. That case involved only whether a constructive – not an actual – submission occurred, and the Court found that a constructive submission had not occurred, even though the TMDL at issue had not been completed for nearly 20 years and the State had not yet scheduled a date for its completion. *Id.* at *10. Moreover, Plaintiffs (at 17) quote dicta in that decision stating that "a state that has publicly indicated, as Plaintiffs claim [the Department of] Ecology has, that it will not produce a specific TMDL has violated its statutory obligations with respect to that TMDL, no matter how robust its program otherwise is." *McLerran, supra,* at * 7. The context makes clear, however, that the Court's was not, as Plaintiffs suggest, referring to the situation where particular TMDLs have been deferred

[1] Plaintiffs (Br. at 8 & 16) mischaracterize an attachment to an email from an EPA employee to several other EPA and WVDEP employees that included a "draft list of bulleted action items" for further discussion after an initial meeting. A.R. 1st & 2nd Claims Doc. 14-00 & 14-01. The attached document, after first calling for further discussion, states only in relevant part that: "Schedule dates for ionic strength TMDLs included in draft 2010 IR. Goal will be to have all completed at end of 2013." *Id.* Doc. 14-01. This isolated email does not set a schedule, let alone an enforceable deadline.

and reprioritized to a later date, but rather where a State publically renounces its obligation to produce the TMDL at issue. *Id.* Finally, the constructive submission standard enunciated in *McLerran* fully undermines the theory Plaintiffs' posit for an express, actual "no" submission of DEP's merely deferred and rescheduled TMDLs. *Id.* at * 7. The *McClerran* Court explained that "[a] constructive submission occurs only when a state has clearly and unambiguously abandoned its obligation to produce a TMDL or TMDLs. * * * It does not occur merely because a state has prioritized one TMDL over another."

2. Plaintiffs Have Mischaracterized the Relevant Facts, Which Do Not Constitute an Actual Submission of No TMDLs

None of the three statements Plaintiffs identify from its search of the record reflect an express, or implied, renunciation by DEP of its obligation to establish the deferred TMDLs. Plaintiffs' contention that DEP's plan to "postpone" ionic toxicity TMDLs must be construed in light of words on a slide in a PowerPoint presentation: "Do Nothing!" (A.R. 1st & 2nd Claims Doc. 103-01 at 9; Plaintiffs' Br. at 15 & 20) mischaracterizes that slide. The slide was prepared by EPA's contractor, not DEP, and it is the ninth of forty-two slides in a presentation titled "WV Ion TMDL Endpoint Analysis" that was part of joint efforts by EPA and DEP to establish pilot ionic toxicity TMDLs. The slide is entitled "Environmental Covariates," a statistical concept. A.R. 1st & 2nd Claims Doc. 103-01 at 7. On its face, the slide refers to a decision not about whether to establish TMDLs for ionic toxicity, but rather a decision about how to address possible environmental covariates (i.e., "do nothing" about the covariates) when determining the TMDL endpoint. The remainder of the presentation discuss various specific covariates and confounding factors, and the final slide discusses what further analysis may be needed. A.R. 1st & 2nd Claims Doc. 103-01 at 42.

The second and third statements identified by Plaintiffs likewise fail to establish actual submissions of no TMDLs. These statements consist of DEP's explanation that work on ionic toxicity TMDLs would be "suspended" due to the passage of SB 562. A.R. Monongahela River Doc. 32 at viii; A.R. West Fork River Watershed, Doc. 33 at viii. Even standing alone, the term "suspended" does not mean abandoned, but connotes a temporary stoppage. And DEP's use of that word in context, in the same sentence, makes this unmistakably clear: "WVDEP has also suspended biological impairment TMDL development pending receipt of legislative approval of the new assessment methodology." A.R. Monongahela River Doc. 32 at viii.; A.R. WF River Doc. 33 at viii (emphasis added). Similarly, in response to comments on the ionic toxicity TMDLs in the West Fork River watershed, DEP explained that: "TMDL development has been paused with the passage of SB 562 because it potentially changes the basis for determining impairment and requires a new assessment methodology to be presented to the West Virginia Legislature prior to its implementation." A.R. WF River Doc. 33 at 90 (emphasis added).

Nothing in these statements remotely suggests that DEP has abandoned, expressly or otherwise, these TMDLs for ionic toxicity. Indeed, DEP is proceeding to develop the necessary new assessment methodology that, once approved, would be a basis for identifying TMDL endpoints. Moreover, as already explained, DEP in its 2014 Report has prioritized these TMDLS, setting a schedule for when they will be completed.

Plaintiffs argue that, just as EPA determined it should add impaired waters to DEP's 2012 Section 303(d) list when DEP declined to do so because of SB 562, the Court should find that EPA should establish ionic toxicity TMDLs. Plaintiffs' simplistic comparison is wholly inapt, ignoring fundamental legal and factual differences between the listing of impaired waters and establishment of TMDLs. Determining whether to identify a waterbody as impaired requires an evaluation of whether "existing and readily available" data indicates that waterbody is meeting its applicable water quality standards. *See generally* A.R. West Virginia 303(d) Lists

Doc. # 20 at 13-18 & Doc. # 23; 40 CFR 130.7(b)(5). TMDL development begins *after* impairment has been determined. A glance at the summary of the technical work provided in any of the TMDL reports at issue in this case demonstrates that TMDL development involves a different set of activities, requiring far greater data and information, technical analysis and policy judgment, and resource investment. In the Section 303(d) list context, EPA made a reasonable technical determination that there was sufficient existing information to identify impairments and took action. Moreover, because Section 303(d) lists are developed by the State and submitted to EPA every two years, 40 C.F.R. § 130.7(d)(1), DEP had the opportunity to reassess EPA's impairment determinations upon completing the new methodology pursuant to SB 562. With respect to TMDLs, DEP explained that existing information was simply not adequate to complete ionic toxicity TMDLs for these waters and that development of the new methodology pursuant to SB 562 was likely to impact how TMDLs would be developed, warranting their deferral. In contrast to the every-two-year listing cycle, States are required to submit TMDLs only "from time to time," 33 U.S.C. § 1313(d)(3), "in accordance with the priority ranking," *id.* § 1313(d)(1)(C), and thus States possess significant discretion in prioritizing which and when particular TMDLs are to be developed.

Given these factors, and the flexibility afforded States to make prioritization decisions, DEP's TMDL deferral decision is precisely the type of technical judgement by an expert agency that is entitled to significant deference. Similarly, EPA's approach here – determining that it had a reasonable basis to add waters to the State's 303(d) list, but that the State's deferral decision in the wholly different TMDL development context did not constitute an actual, or constructive, submission requiring EPA approval or disapproval – is rational and warrants deference. In sum, EPA's action to list waters in West Virginia's 2012 Section 303(d) list in no way suggests that there has been an actual, or constructive, submission of "no" TMDLs.[2] If anything, EPA's action on the 2012 303(d) list shows that where EPA in its legal and technical judgment determined it was appropriate to act, it did so without any need for court intervention.

Plaintiffs' actual submission claim, built upon their misreading of *American Canoe Ass'n*, and mischaracterizations of the record, is legally and factual flawed, and should be dismissed.

C. There Has Not Been a Constructive Submission of "No" TMDLs for Ionic toxicity

1. The Act and Case Law Do Not Support Invocation of the Constructive Submission Theory on the Facts Here.

DEP has a robust TMDL program, and it has submitted 1,546 TMDLs for nearly 1,000 separate waterbodies in the six watersheds at issue in this case. In this context Plaintiffs' invocation of the constructive submission theory -- to dictate the priority and timing of when a narrow subset of TMDLs (those addressing ionic toxicity) that have not yet been completed -- depends on a novel, and untenable, reading of the CWA and the applicable caselaw that would expand the constructive submission theory well beyond the limited circumstances in which it applies. The constructive submission theory is inapplicable where, as here, the State has a robust

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[2] The decision in *Sierra Club v. Browner*, 843 F. Supp. 1304, 1314 (D. Minn. 1993), illustrates this disconnect in Plaintiffs' argument:

> The EPA has disapproved Minnesota's most recent WQLS list [i.e., 303(d) list] and has developed its own . . . . Minnesota has identified TMDLs that it believes should receive the highest priority, it has initiated work on developing those TMDLs, and has implemented some TMDLs. Although Minnesota and the EPA may not be implementing TMDLs as quickly as plaintiffs would like, the Act does not set deadlines for the development of a certain number of TMDLs. The Act instead requires the development of TMDLs 'in accordance with the priority ranking' of the WQLS list. 33 U.S.C. § 1313(d)(1)(C). A finding of a constructive submission of no TMDLs would therefore be inappropriate on this record.

TMDL program, has already established thousands, though not all, TMDLs, and has expressly acknowledged its obligation to complete the remaining TMDLs.

The Ninth Circuit explained in *San Francisco Baykeeper v. Whitman*, 297 F.3d 877 (9th Cir. 2002), that the doctrine was created by the courts to address the narrow situation in which a State has submitted no TMDLs at all for a prolonged period of time, *id.* at 881 (i.e.,"a complete failure by a state to submit TMDLs"), and this State inaction is "construed as a constructive submission of no TMDLs, which in turn triggers the EPA's nondiscretionary duty to act." *Id.* The theory is thus necessarily narrow, applicable "only when 'the state fails to submit any TMDLs and has no plans to remedy this situation.'" *Baykeeper*, 297 F.3d at 882 (quoting *Scott v. City of Hammond*, 741 F.2d 992, 998 (7th Cir. 1984)). Accordingly, in *Baykeeper,* the Ninth Circuit concluded that California's actions, having submitted at least eighteen TMDLs and having a plan for the rest "preclude any finding that the state has 'clearly and unambiguously' decided not to submit any TMDLs." *Id.* at 883

The *Scott v. City of Hammond* case concerned TMDLs for all of Lake Michigan, and it arose in a context where two States, Illinois and Indiana, submitted no TMDLs at all over a prolonged period. 741 F.2d at 996-97. In that circumstance the Court decided only that it was possible for a constructive submission to occur. *Id.* The Court explained constructive submission requires a finding "that the states have determined not to submit TMDL proposals," *Id.* at 997 n.11, which would not be the case if there are "reasons . . . which may justify the states' failure to submit TMDL's" or if "the states are, or will soon be, in the process of submitting TMDL proposals or that some factor beyond the scope of the complaint has made TMDL submissions impracticable" *Id.*

In *Hayes v. Whitman*, 264 F.3d 1017 (10th Cir. 2001), the Court concluded that the constructive submission theory "is necessarily a narrow one," *id.* at 1024, and that it may occur "[o]nly upon this determination that the states' inaction was so clear as to constitute a 'constructive submission' of no TMDLs." *Id.* at 1023. The State's decision to renounce its obligation must be "clearly and unambiguously express[ed]" by its actions, *id.* at 1024, but where the State "has submitted a number of TMDLs and is making progress toward completing about 1500 TMDLs over a twelve-year period . . . a constructive-submission claim is not viable." *Id.*

In sum, at least three key elements must adhere before courts will find a constructive submission. First, a State's abandonment of its obligation to submit TMDLs must be widespread and prolonged, and it must be clear and unambiguous. Second, it must be clearly established that the State has no intention or plan of ever remedying that situation. Third, a necessary corollary of these requirements is that the constructive submission theory is not available as a means to alter or challenge a State's priorities by which particular TMDLs should be established. *Hayes*, 264 F.3d at 1024 (the "constructive-submission theory is not designed to challenge the timeliness or adequacy of the state's TMDL submissions . . . ."). *See also Sierra Club v. Browner*, 843 F. Supp. 1304, 1314 (D.Minn.,1993) (claims that some TMDLs will not be established quickly enough does not create a constructive submission because "the Act does not set deadlines for the development of a certain number of TMDLs.").

Plaintiffs contend that the district court in *McLerran*, 2015 WL 1188522, rejected EPA's interpretation that constructive submission is a narrow theory. But as already noted, in that case the court found that a constructive submission had not occurred where a TMDL had not been established for nearly 20 years and the State had not yet set a schedule for its completion. *Id.* at *10. That court's dicta, discussing hypothetical circumstances in which the theory might apply, are simply beside the point. Moreover, in *McLerran*, the court found that a lack of adequate information to develop the relevant TMDL precluded a finding of constructive submission, *id.* at

*10, and that a constructive submission "does not occur merely because a state has prioritized one TMDL over another." *Id.* at *7.

In sum, there is no support for Plaintiffs' attempt to use the constructive submission theory to prioritize a particular subset of TMDLs above all others. To rule otherwise would allow an actual, or constructive, submission theory to dictate a State's schedule for issuing particular TMDLs, thereby usurping State authority, disregarding the CWA's "from time to time" and "priority" setting language, and opening the courts to lawsuits whenever a party is dissatisfied with a State's pace or priority setting for establishing particular TMDLs.

2. A Constructive Submission Has Not Occurred for the Relevant TMDLs.

Even were the Court to apply the constructive submission theory to the TMDLs at issue here, no constructive submission has occurred. DEP has an ongoing, robust program for establishing TMDLs, having submitted over 4,000 TMDLs to EPA since 2004. For the waters within the six watersheds at issue here, DEP has most recently established 1,546 TMDLs and plans to establish more TMDLs in the future for these and other waters. *See* Supp. A.R.WV 303(d) Doc. 53. And for the particular ionic toxicity TMDLs at issue here, DEP fully explained why those TMDLs should be deferred, and has established projected completion dates. Although developing the required rules and new assessment methodology required by SB 562 has taken DEP longer than it initially anticipated, that process is well underway.

These circumstances do not form the basis for finding a constructive submission of no TMDLs. Even where States have submitted far fewer TMDLs, the courts have declined to find a constructive submission. *See Baykeeper*, 297 F.3d at 882-83 (and citing cases). And where the theory has been found to apply, the State has submitted no TMDLs at all, or only a very few, over a prolonged period of time and had no intention of remedying that situation. *E.g., Kingman Park Civic Ass'n v. EPA*, 84 F. Supp. 2d 1, 6 (D.D.C. 1999) ("An eighteen-year failure to calculate and submit any TMDLs constitutes constructive – if not outright – determination that no TMDLs are necessary."); *Alaska Center for the Environment v. Reilly*, 762 F. Supp. 1422, 1426-27 (W.D. Wash. 1991) (failure to submit any TMDL for over ten years was constructive submission).

Plaintiffs rely upon the same mischaracterization of documents to support their constructive submission claim as their actual submission claim, and for the reasons already discussed those assertions lack merit. Plaintiffs further argue that DEP may in the future delist some waters as impaired for ionic stress based upon the new assessment methodology it is preparing, that this is DEP's true intent, and that this possibility constitutes a constructive submission. Because Section 303(d) lists are submitted every two years, the listing status of waterbodies may change based upon new information or analyses. And when they do change, EPA's approval or disapproval of such actions, 33 U.S.C. § 1313(d)(2), is subject to judicial review. Plaintiffs' speculation does not support a finding of constructive submission of no TMDLs. Plaintiffs' constructive submission claim has no basis in law or fact and should be dismissed.[3]

[3] Were the Court to find an actual or constructive submission of "no" TMDLs, Plaintiffs are still not entitled to the remedy they seek. Plaintiffs request that the Court order EPA to develop and establish the deferred TMDLs. The CWA citizen suit provision, however, limits the remedy to "order[ing] the Administrator to perform [the nondiscretionary] act or duty," 33 U.S.C. § 1365(a), here a remand to EPA to approve or disapprove the constructive submission. Only <u>if</u> the Administrator disapproves the constructive submission is the EPA Administrator under a duty to establish a TMDL. *Hayes*, 264 F.3d at 1023; *Scott*, 741 F.2d at 997. Accordingly, imposing a schedule on EPA to establish an ionic stress TMDL is not an appropriate remedy. *See also American Canoe Ass'n v. EPA*, 30 F. Supp. 2d at 922 & n.17 ("the appropriate remedy . . . would appear to be an order directing EPA to approve or disapprove Virginia's constructive submission").

D. Plaintiffs Requested Relief for Their First and Second Claims, Regarding Waters Other than Those Impaired by Ionic Toxicity in the Upper Ohio South, Dunkared Creek, Lower Kanawha, Elk River, West Fork River, and Monongahela River Watersheds, Should be Dismissed.

In addition to not establishing standing, or an actual or constructive submission of "no" ionic toxicity TMDLs, a significant portion of the relief Plaintiffs' request– their request for an order compelling EPA to issue TMDLs for any biologically impaired waters (other than those waters impaired by ionic stress in the six referenced watersheds) – should be dismissed for two additional reasons. First, Plaintiffs' first and second claims for relief in their First Amended Complaint plead claims for relief only with regard to waters within the six referenced watersheds based upon their ionic toxicity. While Plaintiffs request an order compelling EPA to issue TMDLs for an additional 17 waterbodies identified in Appendix A to the Amended Complaint, in the Coal River, Upper Kanawha, and Gauley River watersheds, the Amended Complaint alleges no specific factual allegations or claims for relief regarding those waters. Nor does Plaintiffs' motion for summary judgment assert any claims or argument with respect to DEP's actions constituting an actual or constructive submission for these waters. Thus, even had such claims been pled in the complaint, because Plaintiffs fail to raise such argument in their ,motion for summary judgment, they are now waived and should be dismissed, given that Plaintiffs agreed that this case would be resolved by summary judgment, Joint Report of Rule 26(f) Conference, at 2 (Dkt, No. 25). *See, e.g.,Wild Bainbridge v. Mainlander Services Corp.* 544 F. Supp. 2d 1159, 1167 (W.D. Wash. 2008).

Similarly, the factual allegations in the Amended Complaint and the arguments asserted in Plaintiffs' motion focus exclusively on waters identified as impaired for ionic toxicity. While Plaintiffs request relief as to 396 waters identified in Appendix B of the Amended Complaint, Plaintiffs do not assert either in the Amended Complaint or in their motion for summary judgment that any of the Appendix B waters are biologically impaired due to ionic toxicity. Nor do Plaintiffs make any arguments regarding these waters in their Summary Judgment Motion. This request for relief, therefore, should be dismissed. *Id.* Finally, to the extent Plaintiffs infer that DEP failed to establish TMDLs for biological impairments other than those caused by ionic toxicity, the record in this case demonstrates otherwise. For example, DEP resolved biological impairments caused by organic enrichment, sedimentation, aluminum toxicity, and pH toxicity through TMDLs for surrogate parameters for 64 waters in the West Fork River watershed. A.R. West Fork River Doc. 33 at 22-24.

III. BECAUSE PLAINTIFF'S THIRD THROUGH EIGHTH CLAIMS DO NOT CHALLENGE FINAL AGENCY ACTION, THIS COURT LACKS AUTHORITY TO REVIEW THEM AND SHOULD DISMISS THOSE CLAIMS

Plaintiffs' frame their third through eighth claims for relief as APA challenges to EPA's approval of 1,546 TMDLs completed by the State for such pollutants as selenium, iron, aluminum, manganese, chlorides, pH, and fecal coliform for nearly 1,000 waterbodies within the six watersheds. Plaintiffs, however, take no issue with the TMDLs EPA has approved. Rather, under the guise of challenging these final agency actions under the APA, Plaintiffs re-state their discredited challenge to the State's deferral of ionic toxicity TMDLs until a later time. As set forth above, the State's deferral of those TMDLs does not constitute an actual or constructive submission requiring action by EPA. Similarly, EPA's approval of the submitted TMDLs does not constitute a final agency action by EPA on the deferrals and thus is not judicially reviewable. Petitioners may not obtain judicial review of EPA's mere acknowledgment of the deferral by bootstrapping their challenge to distinct EPA approvals of 1,546 TMDL submissions.

A. Standard for Determining Whether Agency Action Is Final

Judicial review under the APA is limited to "final agency action." 5 U.S.C. § 704 ("Agency action made reviewable by statute and final agency action for which there is no other adequate remedy in a court are subject to judicial review."). If the challenged agency action is not final, as is the case here, the Court lacks authority to review it. *Flue-Cured Tobacco Cooperative Stabilization Corp. v. EPA*, 313 F.3d 852, 857 & 862 (4^{th} Cir. 2002). Finality is a "threshold question[]" that determines whether judicial review is available. *Fund for Animals, Inc. v. U.S. Bureau of Land Mgmt.*, 460 F.3d 13, 18 (D.C. Cir. 2006).

The Supreme Court has explained that, with regard to finality, "[t]he core question is whether the agency has completed its decisionmaking process, and whether the result of that process is one that will directly affect the parties." *Franklin v. Massachusetts*, 505 U.S. 788, 797 (1992). Two conditions must be satisfied for agency action to be "final." *See Bennett v. Spear*, 520 U.S. 154, 177-78 (1997). "First, the action must mark the 'consummation' of the agency's decisionmaking process" and "must not be of a merely tentative or interlocutory nature." Id. (citation omitted). Second, the agency action "must be one by which 'rights or obligations have been determined,' or from which 'legal consequences will flow.'" *Id.* at 178 (citation omitted).

This finality requirement is necessarily assessed on an issue-by-issue basis, because an action may be final as to a particular issue or problem but not another. *E.g. Air Brake Systems, Inc. v. Mineta*, 357 F.3d 632, 638 (6th Cir. 2004) (interpreting the same opinion letter as final for one issue in the case, but not final for another). "A decision by an agency to defer taking action is not a final action reviewable by the court." *American Petroleum Institute v. EPA*, 216 F.3d 50, 68 (D.C. Cir. 2000). There also is no final agency action in an analogous situation where an agency issues some, but not all, regulatory action in an area, because "an agency's failure to regulate more comprehensively [than it has] is not ordinarily a basis for concluding that the regulations already promulgated are invalid." *Hazardous Waste Treatment Council v. EPA*, 861 F.2d 277, 287 (D.C. Cir. 1988). "Likewise, an agency's pronouncement of its intent to defer or to engage in future rulemaking generally does not constitute final agency action reviewable by this court." *In re Bluewater Network*, 234 F.3d 1305, 1313 (D.C. Cir. 2000). It is thus a well-established tenent of administrative law that an agency's decision to defer the completion of a particular regulatory action is not final agency action and thus not subject to judicial review.

B. EPA's Acknowledgment of the State's Deferral of TMDLs Addressing Ionic Stress Neither Concluded the Decisionmaking Process Nor Established Rights or Obligations.

EPA's acknowledgment that the State has deferred the completion of ionic stress TMDLs is but one step taken by EPA, and the DEP, within the broader scope of these agencies' ongoing efforts to ensure that the outstanding TMDLs for the relevant waterbodies are ultimately submitted by the State and reviewed by EPA. Although Plaintiffs disagree with the State's deferral decision, this step does not mark the "consummation" of the State's proceedings to complete those particular TMDLs. And EPA's acknowledgment of the State's deferral neither concludes EPA's oversight of the State's development of these TMDLs nor does it constitute EPA's final action to approve or disapprove those TMDLs once completed by the State. The deferral of the TMDLs and EPA's acknowledgment is at best an interlocutory step in the ongoing TMDL process, and thus not subject to review. See Bennett v. Spear, 520 U.S. at 177-78.

The situation here is similar to that in *Portland Cement Association v. EPA*, 665 F.3d 177 (D.C.Cir.2011) (per curiam), where environmental groups challenged EPA's failure to regulate greenhouse gases from cement facilities as part of a final action that established standards for other pollutants from cement plants. *Id.* at 182. In its explanation of its action, EPA stated that it did "not yet have adequate information about greenhouse gas emissions to set a standard," and that it was "working towards a proposal for greenhouse gas standards," which it would issue after obtaining additional information. *Id.* at 184. The D.C. Circuit held that this deferral was not final agency action and thus was not subject to judicial review,[4] because these "explicitly tentative and conditional statements—which expressed certainty only as to EPA's decision to continue the process of studying greenhouse gases" could not "possibly be considered 'final.' " *Id.* at 193. Here, DEP's decision to defer ionic toxicity TMDL development is likewise a decision to continue the process of obtaining additional information and, thus, does not constitute final agency action. By the same token, EPA's mere acknowledgment of that deferral is non-final.

Moreover, DEP's deferral, and EPA's acknowledgment of that deferral, has not fixed or changed legal obligations. *See Home Builders v. Norton*, 415 F.3d 8, 15 (D.C. Cir. 2005) ("if the practical effect of the agency action is not a certain change in the legal obligations of a party, the action is non-final for the purpose of judicial review."). For this reason, just as "[a] decision to defer has no binding effect on the parties or on EPA's ability to issue a ruling in the future." *Am. Petroleum Inst.*, 216 F.3d at 69, EPA's acknowledgment of that deferral has no binding effect.

Plaintiffs raise a number of reasons why they disagree with the State's deferral of the particular TMDLs at issue and EPA's acknowledgment of that deferral. That Plaintiffs disagree, however, does not make that deferral and EPA's acknowledgment of it a final agency action, and it does not establish a right to judicial review at this time.

C. The Discretion Afforded States to Set Their Priority Ranking for Developing TMDLs Confirms that EPA's Acknowledgment of the State's Deferral Does Not Constitute Final Agency Action

DEP's decision to defer development of certain TMDLs constitutes nothing more than a

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[4] The Clean Air Act provides for judicial review in the courts of appeals of "final agency action," 42 U.S.C. § 7607(b), incorporating the finality requirement of the Administrative Procedure Act. *1000 Friends of Maryland v. Browner*, 265 F.3d 216, 224 (4th Cir. 2001).

modification to its priority ranking, a matter that the CWA has left to the discretion of the States. Although the CWA requires that States establish a priority ranking for completing TMDLs, EPA is not required to approve that prioritization or the State's schedule. The CWA requires that "[e]ach State shall identify those waters within its boundaries . . . * * * [and] establish a priority ranking for such waters," 33 U.S.C. § 1313(d)(1)(A), for purposes of developing TMDLs. *Id.* § 1313(d)(1)(C). The Act, however, requires that each State submit "from time to time" to EPA, for review and approval, only "the waters identified and the loads established" – that is, each of the particular waterbodies listed as impaired and each of the TMDLs that a State completes. *Id.* § 1313(d)(2). Thus, the CWA is specific and clear: EPA must review only the Section `303(d) list (the "waters identified") and the TMDLs (the "loads established"). Conspicuously absent from Section 303(d)(2) is any mention of EPA approval or disapproval of States' priority rankings for establishing TMDLs. "Where Congress includes particular language in one section of a statute but omits it in another section of the same Act, it is generally-presumed that Congress acts intentionally and purposely in the disparate inclusion or exclusion." *Russello v. U.S.*, 464 U.S. 16, 23 (1983).

Accordingly, the courts that have reviewed this question have agreed that EPA is not required to review and approve the particular priority ranking States establish for TMDL development. The court in *Potomac Riverkeeper, Inc. v. EPA*, No. 04-3885, 2006 WL 890755, at *10 (D. Md. 2006), explained that "there is no provision that requires EPA to approve or disapprove a state's priority rankings." *Id.* at 10 (footnote omitted). Although in dicta, the district court in *Sierra Club, Inc. v. Leavitt*, 393 F. Supp. 2d 1263, 1273 (N. D. Fla. 2005), *aff'd and rev'd in part; judgment vacated in relevant part,* 488 F.3d 904 (11th Cir. 2007), also declined to intervene and second-guess a State's projected TMDL schedule, because EPA is not required to approve or second-guess the State's particular priority ranking for completing

TMDLs.[5] *See also* A.R. EPA 303(d) List Guidance Doc. 8 at 63 ("EPA will review the priority ranking but will not take action to approve or disapprove it.") (setting out EPA guidance on priority ranking).

This discretion afforded by the CWA for States to set their own priority for developing TMDLs, coupled with Congress' decision not to require EPA review and approval of those scheduling decisions, reflects an intent to give States the flexibility they need in establishing TMDLs. In the course of TMDL development, facts and circumstances will inevitably change, information may prove unavailable and require additional investigation, and competing demands on limited resources among competing TMDL projects may arise. An opportunity for judicial review simply does not arise whenever these or other relevant factors prompt a State to adopt one TMDL schedule over another, or to modify its schedule by deferring and rescheduling certain TMDLs.

Plaintiffs should not be permitted to accomplish through the backdoor -- alleging EPA's acknowledgment of the State's deferral is a final agency action -- what they cannot do directly through the front door in a challenge to DEP's prioritization decisions.

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[5] Specifically, the district court explained in pertinent part that:

> No requirement is present that EPA approve the [States'] rankings. Importantly, in its Decision Document, while the EPA specifically approves or disapproves [the State's] decision to list, not list, or delist waters, the section discussing prioritization does not "approve" or "disapprove" [the State's] ranking; it merely concludes that Florida did, in fact, rank its waters and set a TMDL schedule accordingly.

Leavitt, 393 F.Supp.2d at 1273. On appeal, the Eleventh Circuit concluded that plaintiffs did not actually challenge the State's priority ranking for completing TMDLs, and thus the court of appeals did not address that issue and vacated district court's summary judgment on that claim. 488 F.3d at 917-18. Nevertheless, the district court fully examined, and properly addressed, this issue.

IV. EVEN IF EPA'S ACKNOWLEDGMENT OF THE STATE'S DEFERRAL CONSTITUTED FINAL AGENCY ACTION, THAT ACTION SHOULD BE UPHELD

A. Plaintiffs' Challenges Regarding DEP's Deferrals of TMDLs for Ionic toxicity for Waters in the Lower Kanawha River, Elk River, and Monongahela River Watersheds are Barred Because Plaintiffs Failed to Raise their Concerns During the Relevant Administrative Proceedings.

It is "inappropriate for courts reviewing appeals of agency decisions to consider arguments not raised before the administrative agency involved." *Pleasant Valley Hosp., Inc. v. Shalala*, 32 F.3d 67, 70 (4th Cir. 1994); *see First Citizens Bank & Trust Co. v. Camp*, 409 F.2d 1086, 1088 89 (4th Cir. 1969). Thus, a plaintiff challenging agency action is barred from raising issues that it could have raised in comments at the appropriate time, but failed to do so. *Pleasant Valley Hosp.*, 32 F.3d at 70.

Plaintiffs had the opportunity to, but did not submit comments to DEP regarding DEP's statements in its draft reports deferring ionic toxicity TMDLs for waters in the Lower Kanawha River, the Elk River, and the Monongahela River watersheds. Plaintiffs, therefore, are barred from challenging EPA's alleged approvals of those deferrals for those three watersheds (Plaintiffs' Fifth, Sixth and Seventh Claims for Relief). That Plaintiffs raised their concerns regarding deferrals in other watersheds, in those separate administrative proceedings, does not cure the bar applicable here. If anything, it underscores that their claims regarding these watersheds are waived.

B. EPA Reasonably Construes the CWA to Preserve State Discretion to Submit Some TMDLs for a Particular Waterbody or Waterbodies First While Deferring The Submittal of Other TMDLs for Those Waters for Another Time

Plaintiffs contend that EPA's alleged final action approving the State's deferrals should be set aside because, "[b]y undertaking the TMDLs for the streams at issue, DEP committed itself to develop TMDLs for the waters as a whole," and that this alleged requirement that all TMDLs for waterbodies be established simultaneously applies "as a matter of law." Pl. Br. at 38. Plaintiffs' interpretation is inconsistent with the terms of the CWA, EPA's regulations, and the caselaw, and adopting it would represent a significant and counterproductive departure from the discretion States and EPA need to efficiently and effectively prioritize TMDL development.

1. The Act, Relevant Regulations and the Case Law Support EPA's Interpretation that States Are Not Required to Submit All TMDLs for a Particular Waterbody Simultaneously

Under the CWA, each TMDL is designed to address the permissible loading for a particular waterbody for only a single pollutant. Because a waterbody may be listed as impaired on a State's 303(d) list for multiple water quality standards, multiple TMDLs addressing different pollutants may be necessary for the same waterbody. But in each circumstance, each TMDL still addresses only a specific pollutant. Nothing in the Act, EPA's regulations, or the caselaw requires that States submit all TMDLs for the same waterbody simultaneously.

EPA resolved this issue when it set out the basic operation of the TMDL program in binding regulations promulgated in 1985, where EPA confirmed that a TMDL consists of loads of a single pollutant, rather than multiple pollutants to a particular waterbody. For example, EPA initially proposed for comment a definition of "TMDL" as follows: "– The total loadings of pollutants and natural background for a receiving water which will meet all applicable water quality standards." 47 Fed. Reg. 46,671/col. 3 (Oct. 19, 1982) (proposed § 130.2 Total maximum daily load (TMDL)). A commenter raised a concern that this proposed language might be construed as requiring a single TMDL to allocate multiple pollutants. EPA accordingly clarified its regulations, as follows:

> One commenter suggested that the definition of TMDL was not clear because referring to "total loadings of pollutants" implies that a TMDL should cover several pollutants. We revised the definition to clarify that a single TMDL covers only one specific pollutant or one property of pollution, for example, acidity, biochemical oxygen demand, radioactivity, or toxicity. Thus, more than one TMDL may be required for a segment where there may be violations of more than one criterion in the applicable [water quality standards].

50 Fed. Reg. 1774, 1776 (Jan. 11, 1985). Thus, in the final definition of TMDL, EPA clarified and resolved this issue by omitting the phrase "total loadings of pollutants" and making other corresponding changes. Id. at 1780. In this manner, EPA established that each TMDL addresses only one pollutant for the applicable water quality standards for a particular waterbody. EPA's interpretation of its own regulation is controlling. *Auer v. Robbins*, 519 U.S. 452, 461 (1997) (the agency's interpretation must be given "'controlling weight unless it is plainly erroneous or inconsistent with the regulation.'")

Because Plaintiffs have not in their complaint challenged EPA's regulations, they cannot challenge them now. And even had they pled a challenge to EPA's regulations, such a challenge is time-barred. 28 U.S.C. § 2401(a).

Moreover, EPA's interpretation is reasonable and supported by the CWA text and caselaw and should thus be upheld. Under *Chevron U.S.A. Inc. v. NRDC*, 467 U.S. 837 (1984), unless Congress "has directly spoken to the precise question at issue," *id* at 842, "the question for the court is whether the agency's answer [to an ambiguous statutory provision] is based on a permissible construction of the statute." *Id.* at 843. If the statute is susceptible to more than one interpretation, the court must accept the interpretation chosen by the agency if it is reasonable. *Id.* at 845.

The courts have long understood that a TMDL is a waterbody-specific and pollutant-specific calculation. *See, e.g., San Francisco Baykeeper v. Browner*, 146 F. Supp. 2d 991, 995

(N.D. Cal. 2001), *aff'd*, 297 F.3d 877 (9th Cir. 2002) ("The TMDL calculation must be made on a waterbody-specific and a pollutant-specific basis wherever a pollution problem has been identified and other regulatory approaches are not resolving the problem"); *see Sierra Club v. Meiburg*, 296 F. 3d 1021, 1025 (11th Cir. 2002) ("Each TMDL serves as the goal for the level of *that* pollutant in *the* waterbody to which *that* TMDL applies") (emphasis added).

EPA's interpretation is reasonable, consistent with the Act and deserves deference under Chevron. Certainly nothing in the Act precludes EPA's interpretation, and Plaintiffs have failed to demonstrate otherwise.

In addition, nothing in the CWA's text or context requires that all TMDLs for a particular waterbody be established simultaneously. As explained, the Act requires only that States establish TMDLs "from time to time," 33 U.S.C. § 1313(d)(2), "in accordance with the priority ranking," *id* § 1313(d)(1)(C), and then requires only that the State's prioritization for TMDL development take into "account the severity of the pollution and the uses to be made of such waters." *Id.* § 1313(d)(1)(A). The reference to pollution and uses of the waters, together with discretion to submit TMDLs "from time to time" affords States the flexibility to consider each pollutant separately within the same water (i.e., the specific waterbody segment) when setting their priorities and establishing TMDLs. Likewise, EPA's longstanding guidance for prioritizing and scheduling TMDL development, discussed *supra* at 6-7, also anticipate that States may consider the different pollutants and TMDLs for the same waterbody, and each of their different circumstances, including the need for information. This further confirms that State's need not establish all TMDLs for a single waterbody at the same time.

Finally, the caselaw fully supports EPA's interpretation. In *Dioxin/Organochlorine Center v. Clarke,* 57 F.3d 1517 (9th Cir. 1995), the plaintiff criticized a TMDL approved by EPA for a particular waterbody because EPA did not at the same time consider other chemical pollutants that may impact that same waterbody. *Id.* at 1526. The Court definitively rejected this argument, explaining that "[n]othing in the Clean Water Act requires TMDLs to be established for all pollutants at once." *Id.* at 1524.

To be sure, States have discretion to establish several or even all TMDLs for the same waterbody simultaneously for different pollutants, just as States may elect to proceed on a pollutant-by-pollutant basis. These matters, however, are left to a State's discretion, allowing the State to decide how it may best utilize its limited resources to address the relevant factors based upon the different circumstances that arise, including a situation like that facing DEP, where additional information is needed and a new assessment methodology is being developed. Thus, the fact that DEP has established several TMDLs addressing different pollutants for the same waterbody does not create a statutory requirement that all TMDLs for that waterbody be established together.

Accepting Plaintiffs' interpretation would also lead to absurd and highly counterproductive results. Under such an interpretation, States would be prohibited from establishing *any* TMDLs for a waterbody until they had sufficient information to establish *all* TMDLs for that waterbody. This would mean that where concerns exist with information gaps, needed updates in assessment approaches, or other relevant factors that require deferring the completion of one TMDL for a waterbody, or a type of TMDL for waterbodies in a watershed, a State could not establish any TMDLs for those waters. Such a result would be counterproductive to the Act's basic purposes and would delay the environmental benefits to be gained from issuing many TMDLs that are otherwise ready for development.

2. Plaintiffs Provide No Support for Their Interpretation

Plaintiffs (at 35-39) form their argument almost entirely by quoting, out of context, isolated snippets of the decision in *Anacostia Riverkeeper, Inc. v. Jackson*, 798 F. Supp. 2d 210, 227

(D.D.C. 2011). Contrary to Plaintiffs' suggestions, the question whether TMDLs must be prepared for all pollutants in a single waterbody simultaneously simply was not presented to the *Anacostia Riverkeeper* court. To the contrary, that court considered only a single TMDL for a single pollutant in a waterbody, the Anacostia River. 798 F. Supp. 2d at 213. (In fact, TMDLs for other pollutants had been prepared at different times for that waterbody.) The issue in *Anacostia Riverkeeper,* however, concerned only whether, for the particular TMDL and particular pollutant at issue, all designated uses for that waterbody in the applicable water quality standards (i.e., the standards for the pollutant at issue), must be considered when setting that TMDL. Based upon the record in that case, the Court concluded that they must be. *Id.* at 228-45; *see also id.* at 234 n.19 (clarifying in a hypothetical the narrow issue resolved, which concerned only a TMDL for a particular pollutant). This case, therefore, provides no support for Plaintiffs' theory that because one or more TMDLs have been establish for certain waterbodies, DEP was required to either establish all TMDLs for those waterbodies at the same time, or delay establishing all TMDLs for those waterbodies.

C. The Step-At-a-time Doctrine Supports the State's Deferral and EPA's Acknowledgment of It

Even were the Court to accept Plaintiffs' "all or nothing" TMDL interpretation, that would not be a basis to disregard the State's deferral of TMDLs for ionic toxicity or overturn EPA's response to it. In order to adapt to the realities of a given situation, agencies are often required to regulate in steps in order to achieve Congressional directives, as the Supreme Court has explained:

> Agencies, like legislatures, do not generally resolve massive problems in one fell regulatory swoop. *See Williamson v. Lee Optical of Okla., Inc.*, 348 U.S. 483, 489 (1955) ("[A] reform may take one step at a time, addressing itself to the phase of the problem which seems most acute to the legislative mind"). They instead whittle away at

> them over time, refining their preferred approach as circumstances change and as they develop a more-nuanced understanding of how best to proceed. *Cf. SEC v. Chenery Corp.* 332 U.S. 194 (1947) ("Some principles must await their own development, while others must be adjusted to meet particular, unforeseeable situations.").

Massachusetts, 549 U.S. at 524.

In particular, when a lack of resources, adequate information or existing technical expertise makes it difficult for an agency to achieve its full regulatory mandate in accordance with statutory time requirements, it may accomplish that task in a stepped process. *Grand Canyon Air Tour Coal. v. FAA*, 154 F.3d 455, 478 (D.C. Cir. 1998); *U.S. Air Tour Ass'n v. FAA*, 298 F.3d 997, 1010 (D.C. Cir. 2002) (allowing the agency to regulate in stages in order to address "unresolved technical issues"); *City of Las Vegas v. Lujan*, 891 F.2d 927, 935 (D.C. Cir. 1989) ("[A]gencies have great discretion to treat a problem partially [and a court] would not strike down [agency action] if it were a first step toward a complete solution."). An incremental regulatory approach is particularly appropriate "against a shifting background in which facts, predictions, and policies are in flux." *Nat'l Ass'n of Broadcasters v. FCC*, 740 F.2d 1190, 1210 (D.C. Cir. 1984).

Given DEP's reasons for the deferral, its unquestionable progress issuing other TMDLS throughout the State, including the waterbodies in the watersheds at issue here, and its schedule for the deferred TMDLs, DEP's approach and EPA's acknowledgment of it is permissible under the step-at-a time doctrine.

D. Even If EPA's Acknowledgment of DEP's Deferral Were Final Agency Action, that Acknowledgment was Reasonable and Should be Upheld.

1. Upper Ohio South River and Dunkard Creek Watersheds

In response to comments expressing dissatisfaction with DEP's decision to defer TMDLs for ionic toxicity for streams in the Upper Ohio South River and Dunkard Creek watersheds, DEP stated in relevant part:

> The biologically impaired streams with ionic stressors pose several TMDL development challenges at this time. * * *
>
> Although WVDEP would prefer to develop TMDLs that are based upon the toxic effect of a causative pollutant, the potential viability of developing TMDLs using a cumulative measure of ionic strength (specific conductance/total dissolved solids) is recognized. The water quality data gaps and scientific uncertainties discussed below are of concern.

A.R. Upper Ohio Doc. 39 at 72-73; A.R. Dunkard Doc. 39 at 77-78. DEP next explained these data gaps and uncertainties, in detail. *Supra* at 12-13 (DEP's explanation). Accordingly, DEP stated that it "believes it prudent to delay TMDL development (as afforded by USEPA guidance) to allow their consideration"; that "WVDEP recognizes that the deferral of TMDLs cannot be indefinite" and that DEP would cooperate with EPA "to ensure the timely development of the deferred TMDLs" and that "WVDEP will consider all viable methodologies to develop the TMDLs, including but not limited to those proposed by the commenter." *Id.*

Plaintiffs ask the Court to substitute their opinion (in the form of an opinion offered during the public comment period by Dr. Bernhardt) for the foregoing technical judgment. Br. at 40-42. Even putting aside the deference owed to expert agencies' technical judgments, Plaintiffs' references to Dr. Bernhard's opinion address only a portion of DEP's concerns, and then do so incompletely. Developing TMDLs is not merely a matter of establishing an instream threshold. EPA's regulations define "total maximum daily load" as the sum of "waste load allocations" and "load allocations." 40 C.F.R. § 130.2(i). Accordingly, TMDL development includes information regarding source contributions. Dr. Bernhard acknowledged this information is needed to develop TMDLs: "'the appropriate course is for WVDEP to identify the specific sources of conductivity for the ionic stress streams and to establish waste load allocations for those sources for total conductivity.'" Pl. Br. at 23 (quoting Plaintiffs' comments). This, however, was precisely the type of information that DEP lacked.

EPA acknowledged DEP's explanation for its deferral, noting that it would "work closely with DEP to develop strategic monitoring plans" needed to develop the deferred TMDLs, and explained that even though a chloride TMDL was established, which "will provide some reductions to address the ionic stress impairment, it is uncertain that the attainment of the chloride water quality criterion alone would resolve the biological impairments." A.R. Upper Ohio Doc. 37 & 38 at 5; A.R. Dunkard Doc. 37 & 38 at 5. EPA was not required to address specifically and resolve the merits of Plaintiffs' comments to DEP when acknowledging the State's decision to defer certain TMDLs to another time. Requiring such a level of scrutiny and explanation by EPA is inconsistent with the CWA, given that EPA does not review and approve State priority ranking decisions. EPA's explanation was reasonable and should be upheld.

2. Lower Kanawha River and Elk River Watersheds

Plaintiffs' (at 42-43) reliance on EPA's March 2011 *A Field-Based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams* (2011 Benchmark), A.R. 1st & 2nd Claims Doc. 189, to challenge EPA's acknowledgment of DEP's TMDL deferral is misplaced. Plaintiffs do not allege they raised these comments on DEP's draft report and deferral statement. As previously explained, Plaintiffs' arguments regarding these watersheds are barred. For the same reason, Plaintiffs' arguments that EPA failed to adequately explain its reasoning must also be rejected.

In any case, the 2011 Benchmark is of only limited relevance to DEP's and EPA's actions in 2012 and 2014. While the 2011 Benchmark presents evidence that there are levels of conductivity associated with ionic toxicity harmful to the benthic macroinvertebrate community, DEP's actions are not inconsistent. Even before the 2011 Benchmark, DEP was identifying waters as impaired by ionic toxicity based on impacts to the benthic macroinvertebrate community. *See, e.g.,* A.R. Dunkard Doc.39 at 12-15; A.R. Upper Ohio Doc. 39 at 14-17.

Furthermore, while the 2011 Benchmark identifies an instream level of conductivity associated with harm to the macroinvertebrate community in certain waters, given the nature of conductivity and the combination of salts that might make up its toxicity, it is appropriate to seek stream-specific and source-specific information on component ionic strength and constituents for TMDL development. Indeed, EPA consulted that document as reference material with its contractor in connection with efforts to develop a pilot ionic strength TMDL, A.R. 1st & 2nd Claims Doc. 189, and significant additional analysis was conducted to identify appropriate ionic toxicity TMDL endpoints. *See* A.R. 1st & 2nd Claims Doc. 38 & 39. In sum, Plaintiffs' claims here are waived, and their reliance on the 2011 Benchmark is a red herring that provides no basis to attack EPA's acknowledgment of DEP's deferral.

3. The Monongahela River and West River Watersheds

In 2012 the West Virginia legislature enacted SB 562, directing DEP to replace its current methodology for assessing the biological health of streams with a new, revised methodology. DEP notified EPA in April 2012 that enactment of SB 562 required that work on biological TMDLs be "postponed" until the new methodology could be developed. A.R. 1st & 2nd Claims Doc. 162. As previously explained, *infra* at 13-14, a different assessment methodology, for example, one that measures the aquatic biological community with a finer resolution, will likely alter the TMDL developed.

In response to DEP's statements in its draft TMDL reports for the Monongahela River watershed, that it was deferring the ionic toxicity TMDLs at issue, EPA commented:

> The draft TMDL states that WV has decided to suspend biological impairment TMDL development pending completion of new regulations as directed by WV SB 562. While SB 562 does not appear expressly to preclude TMDL development, EPA remains hopeful that we can come to agreement on the resumption of the work on these important TMDLs in order to continue progress towards restoration of water quality in the affected impaired streams. To the extent WV is suspending biological impairment TMDL development

> pending adoption of new regulations, presumably including a new assessment methodology, EPA would appreciate WVDEP providing information on the status of regulation development. EPA remains eager to work closely with WVDEP as WVDEP prepares new rules implementing SB 562.

A.R. Monongahela River Doc. 27-01 at 2. In its final TMDL report for the West Fork River watershed, DEP confirmed that "TMDL development has been paused with the passage of SB 562 because it potentially changes the basis for determining impairment and requires a new assessment methodology to be presented to the West Virginia Legislature prior to its implementation." A.R. WF River Doc. 33 at 90. It further explained that the deferred TMDLs for ionic toxicity "will remain on the 303(d) list"; confirmed that TMDLs must be developed for all impairments on the Section 303(d) list; and stated that it "will develop TMDLs as soon as practicable after the accomplishing SB 562 requirements." *Id.* at 89-90.

Plaintiffs contend that the State's enactment of SB 562 is an inadequate basis for deferring TMDL development, that EPA agreed with that position in its comments, and that EPA failed to explain why it added biologically impaired waters to West Virginia's 303(d) list, but allegedly "approved" DEP's deferral of TMDLs. Plaintiffs are incorrect.

As an initial matter, Plaintiffs failed to raise these concerns to DEP regarding the deferred ionic toxicity TMDLs in the Monogohela River watershed, and thus its claims regarding those waters are waived.

In any event, EPA's comments did not, as Plaintiffs contend, object to the State's deferral, or offer a definitive view of the requirements of SB 562. Moreover, as explained *supra* at 24-25, developing a TMDL raises different and more complex issues than merely listing a stream as impaired, and there was no inconsistency in EPA's listing while acknowledging DEP's deferral of TMDLs for ionic toxicity. Nor can EPA be faulted for not providing a fully explanation of the issues Plaintiffs now raise, since Plaintiffs' failed to raise those concerns during the applicable notice and comment period. Even if EPA's acknowledgment of DEP's deferral was of "less than ideal clarity," on these points, it should be upheld because "the agency's path may reasonably be discerned." *Motor Vehicle*, 463 U.S. at 43. Because EPA's path acknowledging the State's deferral may be reasonably discerned, and was reasonable, it should be upheld.

E. The Margin of Safety Requirement Provides No Basis to Challenge EPA's Acknowledgment of West Virginia's Deferral

Plaintiffs dismiss DEP's explanation that additional information was needed for ionic toxicity TMDL development by pointing to the "margin of safety" component of TMDLs, which, according to Plaintiffs, "takes into account any lack of knowledge." Br. at 45 (quoting portion of 33 U.S.C. § 1313(d)(1)(C)). In this way, Plaintiffs, in effect, ask the Court to issue a declaratory judgment regarding the appropriate contents and sufficiency of a hypothetical "margin of safety" in a yet-to-be established TMDL for ionic toxicity. This, of course, would be inappropriate.

Even so, Plaintiffs' reliance on a TMDL's "margin of safety" component to rebut DEP's explanation for deferring the ionic toxicity TMDLs is misplaced and mischaracterizes the record, the CWA, and the case law. Significantly, Plaintiffs' brief quotes only part of the applicable CWA "margin of safety" provision. As fully stated, a TMDL's "margin of safety" takes "into account any lack of knowledge <u>concerning the relationship between effluent limitations and water quality</u>." 33 U.S.C. § 1313(d)(1)(C)(emphasis added). *See NRDC v. Muszynski*, 268 F.3d 91, 101-102 (2d Cir. 2001) (upholding EPA's approval of a 10% margin of safety in the amount of phosphorus for a TMDL to account for uncertainty in the relationship between projected phosphorus levels and actual water quality); *Anacostia Riverkeeper,* 798 F. Supp. 2d at 251-53 (incorporating a margin of safety through the use of conservative modeling assumptions). This provision, therefore, provides no support for Plaintiffs' argument that the "margin of safety" can be stretched to accommodate any lack of information (no matter how much, or how fundamental). *See, e.g., McLerran*, 2015 WL 1188522 at *8 (rejecting a similar "margin of safety" argument because that provision does "not address a lack of knowledge regarding the *source* of the pollutants.") (emphasis in original). Moreover, because the margin of safety concept anticipates providing additional protection (i.e., the margin), it cannot serve as a stand-in for the fundamental lack of information or analyses needed to establish the TMDL in the first place.

Finally, the cases Plaintiffs rely upon are inapposite. In *NRDC v. Fox,* 909 F. Supp. 153 (S.D.N.Y. 1995), the court stated, in dicta, without analyzing the underscored statutory text above, that completing TMDLs with "less than ideal data" may rely upon the "margin of safety" provision. *Id.* at 157. Even then, there is a difference between "less than ideal data" and the absence of fundamental data necessary to establish a TMDL. *Id.* In *Idaho Sportsmen's Coalition v. Browner,* 951 F. Supp. 962 (W.D. Wash. 1996), the court stated generally, again in dicta, that the "margin of safety" provision shows "that a lack of precise information must not be a pretext for delay," *id* at 966. Here, however, DEP did not defer ionic toxicity TMDL development for the waterbodies at issue based on a need for "precise information." Instead, it reasonably deferred those TMDLs until it could develop the methodologies and information about the relevant pollutants and their sources necessary to develop technically sound and defensible TMDLs.

CONCLUSION

For the reasons stated above, the United States respectfully requests that the Court grant EPA's cross-motion for summary judgment and deny Plaintiffs' motions for summary judgment.

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that the foregoing filing was electronically filed with the Clerk of the Court on February 19, 2016, using the Court's electronic filing system, which will send notification of said filing to the attorneys of record that have, as required, registered with the Court's system.

/S/ David Kaplan

IN THE UNITED STATES DISTRICT COURT FOR
THE SOUTHERN DISTRICT OF WEST VIRGINIA

HUNTINGTON DIVISION

OHIO VALLEY ENVIRONMENTAL
COALITION, INC.,
SIERRA CLUB,
WEST VIRGINIA HIGHLANDS
CONSERVANCY, INC. and
VIRGINIA RIVERS COALITION,

Plaintiffs,

v. CIVIL ACTION NO. 3:15-0271

GINA MCCARTHY, Administrator,
United States Environmental Protection Agency and
SHAWN M. GARVIN, Regional Administrator,
United States Environmental Protection Agency,
Region III,

Defendants.

MEMORANDUM OPINION AND ORDER

I. Introduction

Pending in this administrative review action are cross-motions for summary judgment brought by Plaintiffs Ohio Valley Environmental Coalition, Inc., Sierra Club, West Virginia Highlands Conservancy, and Virginia Rivers Coalition (collectively the "Environmental Groups"), ECF No. 30, and by Defendants Gina McCarthy, Administrator of the United States Environmental Protection Agency, and Shawn Garvin, a regional administrator for the same agency (collectively "EPA"), ECF No. 38. In this citizen suit pursuant to the Federal Water Pollution Control Act (Clean Water Act or "CWA"), 33 U.S.C §§ 1251–1388., and under the Administrative Procedure Act ("APA"), 5 U.S.C. §§ 701–706, the Environmental Groups challenge EPA's failure to disapprove actual or constructive submissions by the West Virginia Department of Environmental Protection ("WVDEP") that lacked total maximum daily loads ("TMDLs") for certain West Virginia waterbodies previously identified by WVDEP and EPA as "biologically impaired." The Environmental Groups seek an order declaring EPA's alleged failure in violation of the CWA's process for reviewing state TMDL submissions, 33 U.S.C § 1313, and in violation of the APA's prohibition on agency action that is arbitrary, capricious, abusive of discretion, and otherwise not in accordance with law, 5 U.S.C. § 706(2). 2d Am. Compl. 35–37, ECF No. 78. The Environmental Groups also request an order declaring EPA's decision to approve sets of TMDLs for a particular watershed arbitrary and capricious because not all TMDLs for that watershed were submitted to EPA. *Id.*

The Court, in an Order dated September 9, 2016, determined that the Environmental Groups have standing to bring this case. ECF No. 81. On October 20, 2016, the Court heard oral argument on the remaining issues raised in the cross motions for summary judgment.

The remaining issues raised by the cross motions for summary judgment require the Court to determine: (1) EPA's liability on Claims 1 and 2, which allege EPA violated a nondiscretionary duty under the CWA to, first, disapprove WVDEP's actual or constructive submissions of no biological impairment TMDLs for biologically impaired waterbodies, some of which are impaired specifically by ionic toxicity, and second, to establish those undeveloped TMDLs; and (2) EPA's liability on Claims 3 through 8, which allege EPA violated the APA by arbitrarily or capriciously approving WVDEP's TMDL Lists for certain waterbodies, which included no ionic toxicity TMDLs despite those waterbodies' state of ionic impairment.

Having considered the briefing, the administrative record, and the arguments raised at oral argument, the Court **GRANTS** in part and **DENIES** in part the Environmental Groups' Motion for Summary Judgment, ECF No. 30, and **GRANTS** in part and **DENIES** in part EPA's Cross Motion for Summary Judgment. ECF No. 38.

II. Background

A. *The structure of the Clean Water Act*

In 1972 Congress passed amendments to the Federal Water Pollution Control Act, which are commonly known as the Clean Water Act ("CWA"). The goal of the CWA is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" and to attain "water quality which provides for the protection and propagation of fish, shellfish, and wildlife." 33 U.S.C. § 1251(a). Congress expected the CWA to solve the Nation's water quality crisis by 1985. *Id.* The CWA provides for two primary mechanisms to achieve this ambitious goal: point source pollution controls embodied in the National Pollution Discharge Elimination System ("NPDES") and ambient water quality standards implemented through the Total Maximum Daily Load ("TMDL") program. *See* §§ 1311, 1313.

NPDES permits address point source pollution outfalls through technology-based controls. § 1311. Any discharge from a point source into waters within the jurisdiction of the CWA is unlawful unless the discharge complies with an NPDES permit. *Id.* NPDES permits, however, do not address ambient water quality of the waters into which permitted discharges are emitted.

TMDLs, the subject of this litigation, were designed to address ambient water quality in bodies of water that do not meet water quality standards even after NPDES permits have been issued to point source discharges. *Id.*; *see also San Francisco BayKeeper v. Whitman*, 297 F.3d 877, 880 (9th Cir. 2002). In other words, TMDLs place daily limits on the total load from all sources of a pollutant or pollutants discharged into a body of water. The CWA gave states a key role in developing water quality standards ("WQS"), identifying bodies of water that do not meet those standards, and developing TMDLs to bring those bodies of water into compliance. *See* § 1313; 40 C.F.R. § 130.7. EPA then reviews state action to ensure compliance with the CWA. *Id.*

Before a state can begin development of TMDLs, the CWA requires each state to develop a WQS consistent with the CWA's requirements. §§ 1313(a)(3)(A), (b), (c); *see also* 40 C.F.R. §§ 130.2(d), 131.4(a). A WQS identifies the "designated uses" for a particular waterbody (e.g., public water supply, support of aquatic life, or recreational uses) and a "water quality criteria" expressed as a numeric limit or narrative condition that must be met for the waterbody to support the identified uses (e.g., iron concentrations necessary for aquatic life). § 1313(c)(2); 40 C.F.R. § 131.3(i).

When existing pollution controls in a waterbody are not stringent enough to meet applicable water quality standards and the waterbody therefore cannot support its designated uses, that waterbody must be classified by the state as "impaired." § 1313(d)(1); 40 C.F.R. § 130.7. States must place all impaired waters on a list commonly referred to as a "303(d) List" for review and approval by EPA. *Id.* States, through 303(d) Lists, also "establish a priority ranking of impaired waterbodies, taking into account the severity of the pollution and the uses to be made of such waters." § 1313(d)(1)(A); *see also* 40 C.F.R. § 130.7(b)(4). States then submit 303(d) Lists to EPA, and EPA must either approve or disapprove of the list within thirty days. § 1313(d)(2); 40 C.F.R. § 130.7(d)(2). The CWA does not require EPA to approve a state's priority ranking. *See* § 1313. If EPA disapproves a state's 303(d) List, EPA must establish a list of waterbodies that should have been included in the state's 303(d) List within thirty days of the disapproval. *Id.*

Bodies of water listed on a state's 303(d) List are, as demonstrated by their presence on the list, not meeting the applicable WQS. § 1313(d)(1)(A). Where a body of water is not meeting its WQS, the CWA requires states to develop a TMDL for that body of water in accordance with the waterbody's priority ranking on the state's 303(d) List. § 1313(d)(1)(C); 40 C.F.R. § 130.7(c)(1). "A TMDL establishes the maximum daily discharge of pollutants into a waterway" from all sources. *Hayes v. Whitman*, 264 F.3d 1017, 1021 (10th Cir. 2001) (citing *Scott v. City of Hammond*, 741 F.2d 992, 996 (7th Cir. 1984)). As a state develops a TMDL for a particular body of water in accord with that waterbody's priority ranking, EPA regulations permit a state to produce a TMDL for each individual pollutant affecting a particular body of water or to produce a TMDL via a "biomonitoring" approach. 40 C.F.R. § 130.7(c)(1)(i). As with 303(d) Lists, states must submit their TMDLs to EPA, and EPA must approve or disapprove of the TMDLs within thirty days. § 1313(d)(2). If EPA disapproves of a TMDL, EPA must develop, submit for public comment, and finalize a TMDL within thirty days. *Id.*

B. *West Virginia's statutory structure and history of biologic impairment TMDLs*

West Virginia's water quality standards include two narrative water quality criteria, which are designed to protect uses of West Virginia's streams related to aquatic life. Those criteria provide:

> 3.2. No sewage, industrial wastes or other wastes present in any of the waters of the state shall cause therein or materially contribute to any of the following conditions thereof:
> . . .
> 3.2.e. Materials in concentrations which are harmful, hazardous or toxic to man, animal or aquatic life;
> . . .
> 3.2.i. Any other condition, including radiological exposure, which adversely alters the integrity of the waters of the State including wetlands; no significant adverse impact to the chemical, physical, hydrologic, or biological components of aquatic ecosystems shall be allowed.

W. VA. CODE R. §§ 47-2-3.2.e–3.2.i. From 2002 through 2010, West Virginia used the West Virginia Stream Condition Index ("WVSCI") as its methodology for assessing compliance with the narrative criteria that protect aquatic life. EPA Enclosure 1 Review of W. Va.'s 2012

Section 303(d), J.A. 2597. Beginning in 1998 West Virginia used the health of the macroinvertebrate community to assess compliance with narrative water quality standards. *Id.* By 2002 West Virginia, in conjunction with Tetra Tech, Inc. and EPA, developed the WVSCI. *Id.*; The West Virginia GLIMPSS: Genus Level Index of Most Probable Stream Status, J.A. 2621 [hereinafter GLIMPSS]. "The WVSCI summarizes family [taxonomic] level identifications of benthic macroinvertebrate assemblages to bioassess the condition of wadeable streams." GLIMPSS, J.A. 2621. WVSCI was developed using data collected by EPA and WVDEP from riffle habitats in wadeable streams in West Virginia. EPA Enclosure 1 Review of W. Va.'s 2012 Section 303(d), J.A. 2597.

WVSCI is scaled from 0 (worst) to 100 (best). *Id.* The score is calculated through a combined multimetric index that consists of six benthic community metrics. *Id.* A threshold score of 68.0 was considered by WVDEP to represent a body of water fully supportive of narrative water quality standards. *Id.* WVDEP standardized a score of 68.0 to represent the fifth percentile of reference sites, meaning ninety-five percent of reference streams[1] had a higher score. *Id.* In WVDEP's 2002 303(d) List through its 2010 list WVDEP incorporated a "gray zone" of 60.6 to 68.0. *Id.*; W. Va. 2002 Section 303(d) List, J.A. 1242. Bodies of water that scored in this range were not considered impaired. *Id.* WVDEP claimed that a score in the gray zone did not statistically support impairment; it believed that a score below 60.6 was a sign of statistically significant impairment. *Id.* EPA did not agree, and in comments to WVDEP on its 2008 and 2010 303(d) Lists, EPA explained that WVDEP's gray zone was not statistically supportable. EPA Enclosure 1 Review of W. Va.'s 2012 Section 303(d), J.A. 2597–98 n. 3. Nonetheless, EPA approved 303(d)

[1] "Reference conditions represent the characteristics of stream reaches that are least disturbed by human activities and are used to define benchmarks for chemical, biological, and habitat conditions for a region." GLIMPSS, J.A. 2631.

Lists that employed the grey zone. *Id.* In general, WVSCI was an approved and accepted methodology to determine biological impairment. *See Id.* at. 2597–98 (EPA used WVSCI without the gray zone to list streams on WVDEP's 2012 303(d) List).

Methodologies like WVSCI detect impairment, but "they do not identify the cause or causes of the impairment." TMDL Guidance, Suppl. J.A. 4592. Accordingly, in order to identify causes of impairment—a necessary preliminary step for developing a TMDL—EPA has developed a "stressor identification process." *Id.* at 4593. In the development of TMDLs, West Virginia routinely performs the stressor identification process. *See, e.g.*, Dunkard Creek Watershed TMDL, J.A. 756.

West Virginia considers ionic toxicity one stressor among many that cause biological impairment, and in numerous waterbodies the State has found ionic toxicity a significant stressor, giving rise to biological impairment. *See, e.g.*, *id.* at 757–59. Since 2006, West Virginia has determined that ionic toxicity is the stressor causing biological impairment in at least 179 streams. W. Va. 2008 303(d) List, J.A. 1864, 1886, 1890, & 1897 (identifying ionic toxicity as the cause of biological impairment for four streams in the Upper Kanawha Watershed, seven streams in the Coal River Watershed, and six streams in the Gauley River Watershed); Upper Ohio South TMDL, J.A. 1097 (identifying ionic toxicity as the cause of biological impairment for nine streams in the Upper Ohio South Watershed); Dunkard Creek TMDL, J.A. 759 (identifying ionic toxicity as the cause of biological impairment for four streams in the Dunkard Creek Watershed); Lower Kanawha TMDL, J.A. 559. Plaintiffs also identify 396 other streams on West Virginia's 2012 303(d) List which were listed as biologically impaired but for which a stressor identification has not been performed. Compl. ¶ 65, ECF No. 78.

Although WVDEP has identified ionic toxicity as a cause of biological impairment in many streams throughout the state since at least 2006, WVDEP has not issued any TMDLs for ionic toxicity. *See* 2008 W. Va. Integrated Water Quality Monitoring and Assessment Report, J.A. 1864 (explaining that Stillhouse Branch was determined to be biologically impaired due to ionic stress as early as 2003 and placed on the 303(d) List in 2006 but TMDL development was deferred). WVDEP has issued TMDLs for bodies of water deemed to be biologically impaired from causes other than ionic toxicity, *see, e.g.*, Upper Ohio South TMDL, J.A. 1097, but stopped issuing TMDLs addressing biologic impairment regardless of the cause in 2012—the decision that sparked this litigation, Letter from Randy C. Huffman, Cabinet Sec'y, WVDEP, to Jon M. Capacasa, Dir., Water Prot. Div., EPA Region III (Apr. 6, 2012), J.A. 3298.

In the years leading up to that decision, it was WVDEP's position that it had insufficient information "regarding the causative pollutants and their associated impairment thresholds for biological TMDL development for ionic toxicity stressed streams." Upper Ohio South Watershed: TMDL Report Draft, Mar. 2009, J.A. 1024. Quizzically, it was also WVDEP's position that "[a] strong presence of sulfates and other dissolved solids exists . . . in all streams where ionic toxicity has been determined to be a significant biological stressor. *Id.*; Dunkard Creek Watershed: TMDL Final Report, Sept. 11, 2009, J.A. 759. As early as 2008 WVDEP designated "mining" as the source of biological impairment for streams that had undergone a stressor identification process that identified ionic toxicity as a significant stressor. 2008 W. Va. Integrated Water Quality Monitoring and Assessment Report, J.A. 1864. In the same set of findings WVDEP explained "water quality data indicates elevated conductivity and sulfates contributed by mining discharges," further supporting the correlation between sulfates and ionic toxicity. *Id.*

TMDL completion dates for waters determined to be impaired by "mining" (ionic toxicity) ranged broadly from 2006 in WVDEP's 2006 303(d) List, to 2016 in its 2008 List, to 2013 in its 2010 List, to "TBD" in its 2012 List for the same stream. *See* 2008 W. Va. Integrated Water Quality Monitoring and Assessment Report, J.A. 1864 (determining in 2003 to 2004 that ionic toxicity is a stressor in Stillhouse Branch and first listing it on a 303(d) List in 2006 but delaying TMDL development for ionic toxicity due to a lack of data on the causative pollutants of ionic toxicity); *see, e.g.*, W. Va. 2006 Section 303(d) List, J.A. 1676 (Stillhouse Branch. Listed as "CNA-Biological"); W. Va. 2008 Section 303(d) List, J.A. 1897; W. Va. 2010 303(d) List, J.A. 2135; W. Va. 2012 Section 303(d) List, J.A. 2378.[2] All bodies of water biologically impaired by ionic toxicity were, and still are, retained on WVDEP's 303(d) Lists. Upper Ohio South Watershed: TMDL Report Draft, Mar. 2009, J.A. 1024; Dunkard Creek Watershed: TMDL Final Report, Sept. 11, 2009, J.A. 759.

In the fall of 2010, EPA and WVDEP began a project to develop a pilot TMDL for ionic toxicity in four streams in the Upper Kanawha Watershed. W. Va. Ionic Stress Background Info., Suppl. J.A. 5230–31. The project called for completing pilot ionic toxicity TMDLs for those streams by August 2012. *Id.* In 2011, in the midst of the pilot project, EPA published "A Field-Based Aquatic Life Benchmark of Conductivity in Central Appalachian Streams," ("Benchmark") a peer-reviewed and highly respected study of the causes and effects of ionic toxicity in Appalachian streams. *See Ohio Valley Envtl. Coal., Inc. v. Fola Coal Co., LLC*, 82 F. Supp. 3d 673, 679–80 (S.D. W.Va. 2015), *aff'd*, ___ F.3d ___, No. 16-1024, 2017 WL 35726 (4th Cir. Jan.

[2] Although Stillhouse Branch is listed as impaired by "CNA-Biological" in the earlier 303(d) Lists, WVDEP's statements in its 2008 Integrated Report indicate that ionic toxicity was identified in the stream as early as 2003. *See* W. Va. 2006 Section 303(d) List, J.A. 1676; 2008 W. Va. Integrated Water Quality Monitoring and Assessment Report, J.A. 1864. It is not clear why WVDEP designated Stillhouse Branch using the broader designation for biological impairment, "CNA-Biological," without also identifying the underlying impairment as ionic toxicity.

4, 2017) [hereinafter *OVEC*]; A Field-Based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams (Final Report), EPA/600/R-10/023F (2011), J.A. 3301 [hereinafter The Benchmark].

The Benchmark, among other things, identified the constituent salts (Ca, Mg, SO4, HCO3) that contribute ions resulting in ionic toxicity as well as their source—surface mining, valley fills, slurry impoundments, coal refuse fills, and deep mines. *OVEC*, F. Supp. 3d at 687. The Benchmark also found that the constituent salts and their sources were nearly uniform across "the examined region," which includes Ecoregions 69 and 70 (most of West Virginia, excluding the Eastern Panhandle). *Id.*; WVDEP Aquatic Life Use Assessment Methodology for Wadeable Streams and Rivers, May 2016, J.A. 3971 (depicting a map designating West Virginia's Level III Ecoregions). "It is precisely because water in the examined regions is so consistently and uniformly dominated by a distinct mixture of ionic pollutants that setting a benchmark for the Appalachian Region is possible." *Id.* (citing The Benchmark, 4, J.A. 3320). The Benchmark ultimately concluded that when conductivity in a stream reaches 300 micro Siemens per centimeter (µS/cm), a measure of conductivity that demonstrates a presence of dissolved ions, the stream is biologically impaired. *Id.* (finding WVSCI score of 64 corresponds to 300 µS/cm. A score of 68 is the threshold below which a body of water is considered impaired.).

In February 2012, after EPA published the Benchmark, WVDEP and EPA considered a TMDL endpoint for conductivity of 720 µS/cm, well above the threshold in the Benchmark. W. Va. Ionic Stress TMDL Dev., Suppl. J.A. 5224. Although WVDEP did not see the pilot project through to the end, Tetra Tech, the same company that helped develop WVSCI, prepared a draft report synthesizing what data the pilot project had collected up to that point. *See* WV Ion TMDL Endpoint Analysis, Draft Technical Document, Dec. 2012, J.A. 3079. The report concluded, as did the Benchmark, that total dissolved solids and certain mixes and concentrations of particular ions (Ca, Mg, SO4, HCO3) directly correlate with WVSCI scores—the higher the concentration, the lower the WVSCI score. *Id.* at J.A. 3099. The authors of the report also explained that due to the geologic and macroinvertebrate community similarities of ecoregions 69 and 70, the data collected from each was used to produce general recommendations to reduce ionic toxicity in all streams in those regions. *Id.*, J.A. 3083–87.

In April 2012, WVDEP ended its participation in the pilot program before a pilot TMDL could be fully developed. On April 6, 2012, WVDEP Secretary Randy Huffman sent a letter to EPA Region III terminating West Virginia's participation in the pilot project, claiming passage of Senate Bill 562 ("SB 562") precluded WVDEP from continuing to use WVSCI to determine biologic impairment and therefore WVDEP could not continue to develop a TMDL using WVSCI. Letter from Randy C. Huffman, Cabinet Sec'y, WVDEP, to Jon M. Capacasa, Dir., Water Prot. Div., EPA Region III, J.A. 3298–99.

SB 562 requires WVDEP to develop a new assessment methodology for measuring compliance with West Virginia's narrative water quality standards but the new methodology must be as protective or more protective than WVSCI. SB 562 states:

> (f) The secretary shall propose rules measuring compliance with the biologic component of West Virginia's narrative water quality standard [which] requires evaluation of the holistic health of the aquatic ecosystem and a determination that the stream: (i) Supports a balanced aquatic community that is diverse in species composition; (ii) contains appropriate trophic levels of fish, in streams that have flows sufficient to support fish populations; and (iii) the aquatic community is composed of benthic invertebrate assemblages sufficient to perform the biological functions necessary to support fish communities within the assessed reach, or, if the assessed reach has insufficient flows to support a fish community, in those downstream reaches where fish are present. The secretary shall propose rules for legislative approval in accordance with the provisions of article three, chapter twenty-nine-a of this code that

> implement the provisions of this subsection. Rules promulgated pursuant to this subsection may not establish measurements for biologic components of West Virginia's narrative water quality standards that would establish standards less protective than requirements that exist at the time of enactment of the amendments to this subsection by the Legislature during the 2012 regular session.

2012 W. Va. Acts 562 (codified at W. VA. CODE § 22-11-7b).

WVDEP interprets SB 562 to preclude the use of the WVSCI methodology for finding biological impairment from the date SB 562 was passed. W. Va. Draft 2012 Integrated Water Quality Monitoring and Assessment Report, J.A. 2332. As a result, it is also WVDEP's position that "the effect of [SB 562] necessarily requires WVDEP to postpone the TMDL development process" for all biologically impaired streams until a new methodology is developed and approved by the Legislature. Letter from Randy C. Huffman, Cabinet Sec'y, WVDEP, to Jon M. Capacasa, Dir., Water Prot. Div., EPA Region III, J.A. 3298–99. WVDEP applied its interpretation to both the 179 waterbodies determined to be biologically impaired from ionic toxicity and the 396 waterbodies biologically impaired but for which no stressor identification has been conducted.

In response, EPA requested that WVDEP clarify its interpretation of SB 562 and its effect on West Virginia's WQS and other CWA mandated programs. Letter From Shawn Garvin, Regional Adm'r, EPA Region III, to Randy C. Huffman, Cabinet Sec'y, WVDEP, (Nov. 6, 2012), J.A. 2740–41. The record before the Court does not contain a formal response.

EPA, conversely, does not interpret SB 562 to preclude WVDEP from developing TMDLs for biologically impaired streams. Draft TMDL for Selected Streams in the Monongahela River Watershed, W. Va. EPA Comments—Oct. 24, 2013, J.A. 188. ("SB 562 does not appear to expressly preclude TMDL development."). It was also EPA's stated position as late as 2014 that the Genus Level Index of Most Probable Stream Status ("GLIMPSS")[3] is a valid methodology that could replace WVSCI and comply with SB 562. EPA's Comments on W. Va's 2014 Draft Section 303(d) List, Jul. 11, 2014, J.A. 2752. EPA has urged WVDEP to adopt GLIMPSS since 2010.[4] *Id.* at 2751. To date, WVDEP has not adopted a new methodology to replace WVSCI.

Due to WVDEP's interpretation of SB 562, WVDEP stopped adding waters newly determined to be biologically impaired to its 303(d) List because it believed that it could no longer use WVSCI to determine biological impairment. EPA Enclosure 1, Review of W. Va. 2012 Section 303(d), J.A. 2603. WVDEP also did not set dates for completing TMDLs for any body of water already found to be biologically impaired. Rather, DEP noted that in light of SB 562 those TMDLs would be completed "TBD – To be determined. TMDLs will be developed as soon as practicable after the effective date of rules enacted pursuant to [SB 562]." W. Va. 2012 Draft 303(d) List, J.A. 2364, 2368.

WVDEP submitted its 2012 303(d) List to EPA without adding new biologically impaired waterbodies. EPA Enclosure 2, EPA's List Dev. Process, J.A. 2603. EPA partially disapproved that list because the State failed to "evaluate all existing and readily available water quality-related data and information, specifically, information related to whether certain waters are achieving

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[3] WVDEP and EPA developed GLIMPSS in a joint effort as a next generation index "designed to provide higher resolution than . . . family-level WVSCI." EPA's Comments on W. Va's 2014 Draft Section 303(d) List, Jul. 11, 2014, J.A. 2751. EPA described GLIMPSS as using "41 different biological metrics . . . tested across seasonal and geographic strata, primarily to refine expectation criteria for aquatic life use attainment in WV." *Id.* GLIMPSS provides better diagnostic capabilities than WVSCI and a more accurate index "that more directly measures specific aquatic life attainment in West Virginia streams as it accounts for natural variability driven by geographic location, seasonality, and waterbody size." *Id.* GLIMPSS was developed with nearly 400 reference sites, whereas WVSCI was developed with only 107. *Id.* Finally, EPA believes GLIMPSS "is also better suited than WVSCI to detect biological changes due to climate change." *Id.*

[4] Kentucky, Ohio, Pennsylvania, Maryland, and Tennessee use a form of genus-level assessment to determine biologic impairment. *Id.*

West Virginia's narrative water quality criteria as applied to the aquatic life uses." *Id.* In its letter disapproving the 2012 303(d) List, EPA stated, "[r]ecognizing WVDEP's position that it is unable to carry out the requirement set forth in 40 CFR 130.7(b)(5), EPA has an obligation to take action to ensure that the federal requirement is satisfied." Letter from Shawn M. Garvin, Regional Adm'r, EPA Region III, to Randy C. Huffman, Cabinet Sec'y, WVDEP (Mar. 25, 2013), J.A. 2584. EPA fulfilled its obligations by developing a 303(d) List of waters in West Virginia that are not achieving the narrative standards that protect the aquatic life use, i.e., by adding biologically impaired waterbodies to West Virginia's 2012 303(d) List using WVSCI as the methodology to determine biologic impairment. *Id.*

In response, WVDEP's director of the Division of Water and Waste Management, Scott Mandirola, sent a letter to EPA's Bill Richardson in Region III's Water Protection Division. Mandirola explained:

> DEP is neither unable nor unwilling to carry out its responsibilities under the CWA, but it is both unwilling and unable to violate its obligations under [SB 562] or the West Virginia Administrative Procedures Act. [T]he West Virginia Legislature has made the policy decision that the biologic health of a stream . . . must be measured using more factors than simply a [WVSCI] score taken at one point in a watercourse.

Letter from Scott G. Mandirola, Dir, Div. of Water and Waste Mgmt., WVDEP, to Bill Richardson, Water Prot. Div. EPA Region III (May 8, 2013), J.A. 2707.

Despite WVDEP's interpretation of SB 562, in its draft 2014 303(d) List WVDEP stated: "The DEP is proposing to retain most of the biological impairments identified in the Final West Virginia 2012 Section 303(d) List and to add *new* listings using the *WVSCI*." W. Va. Draft 2014 Section 303(d) List, Suppl. J.A. 4955 (emphasis added). Even though WVDEP resumed use of WVSCI for identifying biologically impaired streams, WVDEP's 2014 Draft 303(d) List again set no dates for completing TMDLs for biologically impaired streams, only noting that the date for TMDL development was "TBD." *Id.* at Suppl. J.A. 4958, 4975. WVDEP also explained that it would not be developing biologic impairment TMDLs because state law precluded it from using WVSCI. *Id.* at 4958. Both EPA and Plaintiffs submitted comments to WVDEP recommending that WVDEP establish a schedule for developing TMDLs for biologically impaired streams. EPA's Comments on W. Va. 2014 Draft Section 303(d) List, July 11, 2014, J.A. 2753, 2785. In its 2014 303(d) List submitted to EPA for final approval on April 13, 2015, WVDEP deferred completion dates for TMDLs for waterbodies that had previously been listed as "TBD" to dates ranging from 2020 to 2025. Letter from Scott Mandirola, Dir. Div. of Water and Waste Mgmt., WVDEP to Evelyn MacKnight, Assoc. Dir., Office of Standards, Assessments and TMDLs, EPA Region III, (Apr. 13, 2015), J.A. 3046; *see also, e.g.*, W. Va. 2014 Section 303(d) List, J.A. 2805–06. Although WVDEP set dates for biological impairment TMDLs, EPA did not take any additional action on WVDEP's schedule. From 2012 to the present the Court is unaware of any completed TMDLs for biologically impaired waterbodies even though EPA has approved numerous TMDLs for other pollutants with numeric limits, such as metals, pH, and chlorides. *See, e.g.*, Letter from Jon M. Capacasa, Dir. Water Prot. Div., EPA Region III, to Scott Mandirola, Dir. Div. of Water and Waste Management, WVDEP, J.A. 38–39.

WVDEP has also been unable to promulgate a new methodology to determine biologic impairment. In the initial aftermath of SB 562, WVDEP expected to develop a new methodology in a year's time. In the WVDEP Director's April 6, 2012 letter to the EPA Region III Administrator, the Director expected that a new methodology would be submitted to the Legislature for approval within a year.[5] Letter from Randy C. Huffman, Cabinet Sec'y, WVDEP,

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[5] By way of background, in order for WVDEP's new methodology to become a final

to Jon M. Capacasa, Dir., Water Prot. Div., EPA Region III, J.A. 3298–99. WVDEP was not able to meet this goal. In 2014, WVDEP predicted that it would be able to submit its new methodology to the 2015 legislature, but then later that year determined that it would submit the methodology to the 2016 legislature. W. Va. Draft 2014 Section 303(d) List, Suppl. J.A. 4954; 2014 W. Va. Integrated Water Quality Monitoring and Assessment Report, J.A. 2767. To date, WVDEP has not finalized a new methodology and now predicts that "it will still be some time before [WVDEP has] sufficient data to compliment [sic] any benthic macroinvertebrate index."[6] EPA's Surreply 4 n. 2, ECF No. 75 (quoting Letter from Scott Mandirola, Dir., Div. of Water and Waste Mgmt., WVDEP, to Bill Richardson, Water Prot. Div, EPA Region III (Jul. 5, 2016), https://www.epa.gov/sites/production/files/2016-07/documents/wvdep_comments_re_epa_overlist_july_5_2016.pdf).

Pursuant to West Virginia law, a new methodology, even if it were now finalized by WVDEP, would not be considered until the 2018 legislative session. *See* W. VA. CODE §§ 29A-3-11, 29A-3-12. At oral argument counsel for the Environmental Groups requested the Court take judicial notice of the list of regulations submitted to the West Virginia Legislature to be considered

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binding regulation, it must first submit the proposed regulation to the Legislative Rule-Making Review Committee. W. VA. CODE § 29A-3-11. The Committee may then make a recommendation to the West Virginia Legislature to approve the regulation with or without changes or amendments, or the Committee may simply reject the rule. *Id.* If the Committee submits the regulation to the Legislature, the Legislature may approve, disapprove, or amend the regulation. W. VA. CODE § 29A-3-12.

[6] The letter from which the quote is taken is not part of the administrative record submitted to the Court. In its Surreply, EPA requests that the Court take judicial notice of the letter, which is publically available on EPA's website. ECF No. 75. "A court may take judicial notice of information publically announced on a party's web site, so long as the web site's authenticity is not in dispute and it is capable of accurate and ready determination." *Jeandron v. Bd. of Regents of Univ. Sys. of Md.*, 510 Fed.Appx. 223, 227 (4th Cir. 2013) (citing Fed. R. Evid. 201(b); *O'Toole v. Northrop Grumman Corp.*, 499 F.3d 1218, 1225 (10th Cir. 2007)). Plaintiffs do not dispute the authenticity of the of the website from which the letter was taken, and as a government record, it is capable of accurate and ready determination. The Court therefore takes judicial notice of the letter.

in the 2017 legislative session. The list is maintained on the Secretary of State's website.[7] Upon inspection of the list, WVDEP has not submitted a proposed methodology to be considered by the legislature for the 2017 session. Pl's. Ex. 1, ECF No. 84-1, http://www.sos.wv.gov/administrative-law/modified/Pages/default.aspx. In order for the Legislative Rule-Making Review Committee and ultimately the West Virginia Legislature to consider a regulation in the 2017 legislative session, the regulation must have been submitted to the Secretary of State and the Committee by July 27, 2016. *Summary of Regular Rule Making Steps*, WEST VIRGINIA SECRETARY OF STATE, http://www.sos.wv.gov/administrative-law/rulemaking/Pages/stepsummary.aspx (last visited Nov. 16, 2016). The Court is unaware of any schedule, self-imposed or otherwise, for the completion of WVDEP's new methodology.

Plaintiffs filed suit pursuant to the citizen suit provision of the CWA, § 1365(a)(2), asserting that EPA had a nondiscretionary duty to promulgate TMDLs for biologically impaired bodies of water when WVDEP stated that it would not issue those TMDLs. Plaintiffs also brought suit pursuant to 5 U.S.C. § 706(2) of the Administrative Procedure Act, claiming that EPA's approval of TMDLs for six watersheds was arbitrary and capricious, an abuse of discretion, or contrary to law because the TMDLs for each watershed did not include TMDLs for streams impaired by ionic toxicity.

III. Legal Standard

To obtain summary judgment, the moving party must show that there is no genuine issue as to any material fact and that the moving party is entitled to judgment as a matter of law. Fed. R. Civ. P. 56(a). In considering a motion for summary judgment, the Court will not "weigh the

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[7] In accord with the standard explained in footnote six, the Court takes judicial notice of the list of proposed regulations maintained on the West Virginia Secretary of State's website. *See id.*

evidence and determine the truth of the matter." *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 249 (1986). Here the parties agreed that the facts consist solely of the administrative record and the parties do not dispute any relevant facts in that record. Summary judgment based on the facts presented in the administrative record is therefore appropriate. *See Occidental Eng'g Co. v. INS*, 753 F.2d 766, 769 (9th Cir. 1985) ("[T]he function of the district court is to determine whether . . . as a matter of law the evidence in the administrative record permitted the agency to make the decision it did.").

IV. Discussion

A. *The CWA claims and background of the Constructive Submission Doctrine*

When Congress passed the CWA, it set a strict deadline for development of 303(d) Lists and the attendant TMDLs. Under the previous water pollution control regime, states declined to follow federal directives to develop and submit water quality standards. *Kingman Park Civic Assoc v. EPA*, 84 F.Supp.2d 1, 7 (D.D.C. 1999). A central motivation for Congress to enact the CWA was to address this problem. *Id.* Congress lamented in 1971 that '[m]ore than 4 years after the deadline for submission of standards, only a little more than half of the states have fully approved standards.'" *Id.* (quoting S. REP. NO. 92-414, at 4 (1971), *as reprinted in* 1972 U.S.C.C.A.N. 3668, 3671.

Consequently, the CWA commanded states to submit all TMDLs not more than one hundred eighty days after EPA published a list of pollutants to be addressed by TMDLs and then "from time to time" thereafter.[8] 33 U.S.C. § 1313(d)(2). Congress gave EPA one year from

[8] Worth mentioning is that before the first round of TMDLs could be implemented states would also have to develop WQS and secure approval from EPA for them. Had Congress' original schedule been followed, both WQS and TMDLs would have been in place eighteen months after Congress passed the CWA. § 1313(a).

October 18, 1972 to publish this list, making states' 303(d) Lists and TMDLs due on April 16, 1974. *See id.* Congress, aware of the herculean task of collecting data on all pollutants affecting all waterbodies on a state's 303(d) List in such a short time, decided in favor of speed of implementation rather than certainty, declaring that TMDLs should use "a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality." § 1313 (d)(1)(c).

Not to be rushed, however, EPA did not identify pollutants for TMDLs until December 28, 1978—more than six years after the CWA deadline. 43 Fed. Reg. 60,662 (Dec. 28, 1978). States were therefore not required to submit their TMDLs until June 26, 1979 and thereafter "from time to time." *See* § 1313(d)(2); *NRDC v. Fox*, 909 F.Supp. 153, 157 (S.D.N.Y. 1995) (citing *Scott*, 741 F.2d at 996 n. 10).

States and EPA largely ignored this deadline until the 1990's and early 2000's. *See, e.g.*, *San Francisco BayKeeper*, 297 F.3d at 883 (California did not submit any TMDLs until 1991); *Friends of the Wild Swan, Inc. v. EPA*, 130 F. Supp. 2d 1184, 1189 (D. Mont. 1999) (from 1979 to 1992 Montana did not submit any 303(d) Lists or TMDLs); *Kingman Park Civic Assoc.*, 84 F. Supp. 2d at 2 (The District of Columbia did not submit TMDLs for eighteen years); *Am. Canoe Assoc., Inc. v. EPA*, 30 F. Supp. 2d 908, 919 (E.D. Va. 1998) (Virginia did not submit any TMDLs for two decades); *Sierra Club v. Hankinson*, 939 F. Supp. 865, 868 (N.D. Ga. 1996) (Georgia did not submit a 303(d) List until 1992 and submitted its first TMDL in 1994); *Idaho Sportsmen's Coal. V. Browner*, 951 F. Supp. 962, 964 (D. Idaho 1996) (Idaho did not submit a 303(d) List until 1989). *Alaska Ctr. for the Env't v. Reilly*, 762 F. Supp. 1422, 1425 (W.D. Wash. 1991) (Alaska had not submitted any TMDLs by 1991). As an example of the scope of the noncompliance at the time the *Alaska Center* Court found "[i]n 1989 EPA Region IV approved 163 TMDLs, Region V approved 74, Region I approved 50, Region VIII approved 16, Region X approved 11. Regions II, III, and VII however, approved no TMDLs." *Alaska Ctr.*, 762 F. Supp. at 1425 (Alaska, Washington, and Idaho had not submitted any TMDLs by 1991).[9]

Congress apparently did not anticipate a total failure of compliance by EPA and the states, and accordingly made no explicit provision in the CWA to address when states fail to submit a TMDL. Congress, perhaps naively, expected the states to comply with the CWA and submit TMDLs to EPA for review. As such, it was not clear from the language of the CWA what recourse EPA had if states declined to submit TMDLs. Read literally, EPA's duty to act was only triggered upon a submission from a state. *See* § 1313 ("Each State shall submit to the Administrator . . . , for his approval the waters identified and the loads established . . . .").

The majority of courts faced with this problem have adopted the "constructive submission" doctrine. *See San Francisco BayKeeper*, 297 F.3d at 882; *Hayes*, 264 F.3d at 1023; *Kingman Park Civic Assoc*, 84 F. Supp. 2d at 5. The doctrine, established by *Scott v. City of Hammond*, concludes that EPA's duty to approve or disapprove a TMDL is triggered "if a state fails over a long period of time to submit proposed TMDLs." 741 F.2d at 996 (finding the doctrine applicable after three years of inaction). The failure of a state to submit TMDLs to EPA is a "constructive submission" to EPA of no TMDLs. *Id.* The Seventh Circuit reasoned that although the CWA does not explicitly compel EPA to act when a state fails to act, it did not "believe that Congress intended that the

[9] To put the number of TMDLs approved by the various regions in 1989 in perspective, Alaska alone has 3,000,000 lakes and thousands of rivers and streams that needed to be tested and incorporated into the state's water quality management program. *Alaska Ctr. for Env't v. Browner*, 20 F.3d 981, 985 (9th Cir. 1994). Out of those streams and lakes, even Alaska's threadbare water quality program identified *several hundred* impaired bodies of water in need of TMDLs. *Alaska Ctr.*, 762 F. Supp. at 1426 (emphasis added). No EPA region approved anywhere near several hundred TMDLs at the time. *Id.* Or, in Oklahoma's case, the state had 1,500 outstanding TMDLs and planned to produce about 100 per year—as many or more TMDLs than the numbers approved by entire EPA Regions in 1989. *See Hayes*, 264 F.3d at 1024.

states by inaction could prevent implementation of TMDLs." *Id.* at 997. The Seventh Circuit noted, however, that the appeal came to it from a motion to dismiss and, with only the complaint before it, it could not determine whether the states (Illinois and Indiana) "are, or will soon be, in the process of submitting TMDL proposals." *Id.* at 997 n. 11. If the states were in the process of submitting the missing TMDLs, then the constructive submission doctrine might not apply. *Id.*

The Seventh Circuit's condition has served as a guidepost for courts in their decisions addressing constructive submissions. Where plaintiffs have brought claims alleging that a state has failed to produce any TMDLs for any waters on its 303(d) List—a challenge to a statewide TMDL program—Courts have declined to find a constructive submission if the state has produced at least some TMDLs and has a credible plan to fulfill its CWA obligations. *See Hayes*, 264 F.3d at 1024. "If a state has submitted or soon plans to submit TMDLs for its impaired waterbodies, the constructive-submission analysis would be factually inapplicable." *Id.* (finding a programmatic challenge to Oklahoma's TMDL process did not rise to a constructive submission because Oklahoma had submitted "a number" of TMDLs and was making progress toward completing 1,500 in twelve years); *see also San Francisco BayKeeper*, 297 F.3d at 883 (finding a programmatic challenge to California's TMDL program did not prove a constructive submission where California had submitted eighteen TMDLs and had a schedule to complete the rest).

On the other hand, where plaintiffs brought a programmatic challenge and a state has not produced any TMDLs and is not in the process of producing them, courts have found a constructive submission. *See Alaska Ctr.*, 762 F. Supp. at 1429 (holding Alaska had not submitted any TMDLs for any body of water in the state and had no plan to comply with the CWA, and therefore a constructive submission had occurred).

The doctrine is equally applicable to a single missing TMDL as it is to a programmatic failure. "Naturally a state that has publically indicated . . . that it will not produce a specific TMDL has violated its statutory obligations with regard to that TMDL, no matter how robust its program otherwise is." *Sierra Club v. McLerran*, No. 11-cv-1759, 2015 WL 1188522, at *7 (W.D. Wash Mar. 16, 2015) *see also Scott*, 741 F.2d at 996–97 (finding a constructive submission doctrine applicable where states did not submit TMDLs for a single body of water—Lake Michigan).

Thus, a constructive submission occurs where a "state's actions clearly and unambiguously express a decision to submit no TMDL for a *particular* impaired waterbody." *Hayes*, 264 F.3d at 1024 (emphasis added).

B. *Application of the Constructive Submission Doctrine to this case*

By its own admission, WVDEP has chosen to pursue a new methodology to calculate biological impairment and has stopped submitting TMDLs for biologic impairment, claiming a state law does not permit it to comply with federal directives. It expressly informed EPA in 2012 that it would not be issuing any TMDLs for biologic impairment until it developed a new methodology to determine biologic impairment and secured legislative approval of that methodology. At the same time WVDEP withdrew from the very pilot program that, seen to completion, would have resulted in a TMDL for ionic toxicity—an impairment that has avoided any regulation thus far. For over four years, WVDEP has made successive promises to deliver the new methodology to the West Virginia Legislature and for four years has failed to even develop a methodology, to say nothing of actually submitting it to the Legislature. WVDEP has not produced a schedule for when the methodology might be finished.

In the meantime, it has stopped complying with the CWA and denied it has the data to fulfill its duties, all the while possessing a significant amount of information and two accepted and valid methodologies (WVSCI and GLIMPSS) to determine biologic impairment. Moreover, in an apparent attempt to avoid EPA rejection of its 303(d) List, WVDEP used WVSCI to determine biologic impairment of new streams while at the same time arbitrarily denying that it has the authority to use WVSCI to determine biologic impairment for the development of TMDLs. All of WVDEP's plodding and EPA's appeasement have resulted in an abjuration of WVDEP's and EPA's duties committed to each by the CWA. WVDEP has publically stated that it will not develop TMDLs for biologic impairment and has continued to move the goalposts for when it will begin developing them once again. Consequently, WVDEP has constructively submitted no TMDLs for biologic impairment to EPA, triggering EPA's duty to approve or disapprove of the submission.

i. *WVDEP's biological impairment TMDL schedule*

EPA attempts to disguise WVDEP's decision by arguing that WVDEP understands it has a duty to submit TMDLs for all waters listed on its 303(d) List, but that here WVDEP has only postponed or reprioritized TMDLs for biologic impairment—not refused to act. Thus, EPA contends, WVDEP will soon submit TMDLs and the constructive submission analysis is factually inapplicable. As evidence, EPA points to the terms "pause," "defer," and "suspend" used in WVDEP statements about its TMDL program. EPA also relies on WVDEP's 2014 303(d) List where, after EPA and plaintiffs prodded, WVDEP added dates by which TMDLs would be issued for biologically impaired streams. The dates range from 2020 to 2025 with no explanation for how WVDEP could achieve them. WVDEP explained that after considering resources and available information the dates were "the next practical opportunity" based on WVDEP's watershed-by-watershed approach to TMDL development. 2014 W. Va. Integrated Water Quality Monitoring and Assessment Report, JA 2785. There is ample evidence to doubt the credibility of these dates.

West Virginia has a five-year schedule for developing TMDLs on a watershed-by-watershed approach. Draft 2012 Integrated Water Quality Monitoring and Assessment Report, J.A. 2349; *see also* EPA Memo. Supp. Cross-Mot. Summ. J. 9, ECF No. 73. "WVDEP's TMDL development program has historically attempted to comprehensively address all streams and all impairments in a particular watershed simultaneously." EPA Memo. Supp. Cross-Mot. Summ. J., at 9 (quoting Dunkard Creek Watershed: TMDL Report, Draft, J.A. 821). In other words, it takes WVDEP five years to develop TMDLs for any given watershed. Draft 2012 Integrated Water Quality Monitoring and Assessment Report, J.A. 2349. If West Virginia's 2020 completion date for biologically impaired bodies of water is to be believed, West Virginia, by its own stated process, would have had to start developing biologic impairment TMDLs by 2015.

Yet, currently, WVDEP believes it does not have an approved methodology to use to determine biologic impairment and it will be sometime before the legislature approves one. Even if WVDEP finalized a methodology today, the earliest that such a methodology could be used is 2018. WVDEP missed the deadline to submit regulations to the 2017 legislature and now must wait to submit any methodology to the 2018 legislature. Even 2018 assumes that the West Virginia Legislature will approve whatever final methodology WVDEP creates in the 2018 legislative session. There is obviously no guarantee that it will.

Moreover, although belied by the scientific data in the record,[10] WVDEP claims that it lacks necessary information to develop a TMDL for ionic toxicity (one of the impairments that

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[10] In section II.B of this Opinion, the Court recounted WVDEP's estimation in 2006 that dissolved solids and sulfates are highly correlated to ionic toxicity. The section also summarizes EPA's peer reviewed Benchmark for ionic toxicity in streams in the Appalachian region and Tetra Tech's data analysis of data collected during WVDEP and EPA's pilot ionic toxicity TMDL project. Although the data on ionic toxicity appears to be extensive, including determinations of levels of ionic toxicity and the causative ions which result in impairment, EPA credits WVDEP's claims that it still lacks certain data necessary to create an ionic toxicity TMDL.

leads to biologic impairment). Assuming the Legislature approves whatever methodology WVDEP ultimately develops, WVDEP will have to then spend time conducting research to address ionic toxicity. And, if EPA and WVDEP are to be believed, creating a TMDL for ionic toxicity is a complex task that cannot be rushed: very likely adding a year or more to the ultimate development of a TMDL for ionic toxicity. Given the statement by WVDEP in its most recent letter, however, that it will still be some time before a methodology is completed, that timeline may be overly optimistic, casting serious doubt on WVDEP's ability to develop TMDLs by 2025—much less 2020.

Naturally, the Court does not believe that WVDEP is obliged to produce a TMDL immediately upon the addition of a body of water to a 303(d) List, but it must at least have a plan to complete it. *See Hayes*, 264 F.3d at 1024. The distinction that has become apparent in TMDL jurisprudence is between states that have neither produced the delinquent TMDLs nor have any plan to do so, and those that at the very least have a concrete plan to comply with their duties. *Compare, e.g.*, *Sierra Club v. Browner*, 843 F. Supp. 1304, 1313 (D. Minn. 1993) (finding a constructive submission of all TMDLs in the state did not occur because Minnesota had completed 18 TMDLs) *with Alaska Ctr.*, 762 F. Supp. at 1429 (finding Alaska had not produced any TMDLs and had no plan to comply with its CWA duties).

Put another way, courts that have found a constructive submission inapplicable have gone to great lengths to emphasize that at least *something* related to the development of the challenged TMDLs was being done. *See Fox*, 93 F. Supp. 2d at 540 (finding constructive submission doctrine inapplicable because New York submitted some of the missing TMDLs and formulated a plan to for finishing the rest of the missing TMDLs); *Idaho Sportsman Coal.*, 951 F. Supp. at 967–68 (finding constructive submission inapplicable because Idaho had submitted three of the missing

TMDLs and proposed a schedule for completing the rest); *Hankinson*, 939 F. Supp. at 871 n. 6 (finding although plaintiffs challenged Georgia's statewide TMDL program, "[t]he Court does not find the constructive submission analysis to be appropriate for this case because Georgia has made *some* TMDL submission, albeit totally inadequate." (emphasis in original)). "Even in *Scott* . . . the Seventh Circuit remanded the case to the district court for a determination whether the state was in the process of submitting any TMDLs . . . ." *San Francisco BayKeeper*, 297 F.3d at 883.

The Ninth Circuit found this distinction dispositive. In *San Francisco BayKeeper*, plaintiffs brought a challenge claiming that California had not submitted any TMDLs statewide and therefore had made a constructive submission of no TMDLs in the state, requiring EPA to act. *San Francisco BayKeeper*, 297 F.3d at 883. The district court found, and the Ninth Circuit agreed, that no constructive submission had occurred because California had actually produced eighteen TMDLs and had established a "concrete" schedule for completing all TMDLs for the entire state. *See, San Francisco BayKeeper, Inc. v. Browner*, 147 F. Supp. 2d 991, 1000 (N.D. Cal 2001), *aff'd sub nom. San Francisco BayKeeper v. Whitman*, 297 F.3d at 883. In fact, California was in the process of conducting 200 TMDL studies. *Id.* Accordingly, the Ninth Circuit affirmed the district court's holding that California had not made a statewide constructive submission of no TMDLs. *San Francisco BayKeeper*, 297 F.3d at 883; *see also Hayes*, 264 F.3d at 1023 ("If a state has submitted or soon plans to submit TMDLs for its impaired waterbodies, the constructive submission analysis would be factually inapplicable.").

Conversely, where Alaska failed to develop TMDLs and had no credible plan to complete them, the same scenario the court is faced with here concerning a subset of TMDLs, the district court found that a constructive submission had occurred. *See Alaska Ctr.*, 762 F.Supp. at 1429.[12]

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[12] The Court is aware that, unlike this case, *Hayes*, *San Francisco BayKeeper*, and *Alaska*

The facts presented to the Court in this case bare a much closer resemblance to those addressed by the *Alaska Center* Court than those presented to the *San Francisco BayKeeper* Court. WVDEP has not produced biological impairment TMDLs since 2012, stated that it cannot produce them, and has not proposed a credible schedule for producing them.

In light of WVDEP's statements that it will not be producing biological impairment TMDLs and its failure to produce a credible plan to comply with its CWA duties, it has made a constructive submission of no biological impairment TMDLs that triggered EPA's duty under the CWA to approve or disapprove of the submission.

ii. *WVDEP's reasons for not developing biological impairment TMDLs and EPA's responses*

Further eroding WVDEP's credibility, and calling into question EPA's acquiescence, is WVDEP's use of WVSCI in its 2014 303(d) List to determine biologic impairment. Since the passage of SB 562, it has been WVDEP's stated position that the legislation barred WVDEP from using WVSCI, and because it could not use WVSCI to determine biologic impairment, it could not develop TMDLs for biologic impairment until a new methodology was developed. Then, without explanation, WVDEP stated in its 2014 303(d) List that it would use *WVSCI* to add *new* biologically impaired streams to that list. In that same list, however, WVDEP concluded that SB 562 precluded it from using WVSCI and therefore it could not develop TMDLs for biologic

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Center were all challenges alleging a complete statewide failure to produce any TMDLs for any body of water. 264 F.3d at 1023; 297 F.3d at 883; 762 F. Supp. at 1429. Nevertheless, the interpretation and application of *Scott* by these cases to require some amount of effort to complete missing TMDLs in order to avoid a constructive submission is not confined to a wholesale statewide failure. It is equally applicable to particular groups of TMDLs or even single missing TMDLs. *See Scott*, 741 F.2d at 992. The Court will take up this issue in more detail in Section IV.B.iii below.

impairment. WVDEP's position on SB 562 defies explanation and critically undermines WVDEP's excuse for not developing the TMDLs at issue and accordingly EPA's inaction.

Moreover, SB 562, a state law, cannot be the justification for WVDEP's failure to comply with the CWA. It is a bedrock principle of American federalism enshrined in Article VI of the Constitution that a state law in itself cannot limit the scope of an otherwise constitutional federal law. "[a]bsent statutory authority in the CWA . . . it cannot possibly be urged that . . . state law in itself can contradict or limit the scope of the CWA, for that would run squarely afoul of our Constitution's Supremacy Clause. *N. Plains Res. Council v. Fidelity Expl. & Dev. Co.*, 325 F.3d 1155, 1165 (9th Cir. 2003) (citing U.S. Const. art. VI, cl. 2; *Nat'l Audubon Soc'y, Inc. v. Davis*, 307 F.3d 835, 851 (9th Cir. 2002)).

Yet, in effect, that is exactly what EPA and WVDEP are claiming when EPA accepts WVDEP's position that state law precludes it from issuing TMDLs required by the CWA. Whatever the effect of SB 562, it cannot "contradict or limit the scope of the CWA." *Id.* When it became clear to EPA that WVDEP would rely on state law to stop complying with federal law, EPA was obliged to act to ensure the CWA is enforced expeditiously. *See* § 1313. At first, EPA reminded WVDEP of the supremacy of federal law when it disapproved WVDEP's 2012 303(d) List and overlisted a number of impaired bodies of water. "Even assuming that SB 562 . . . precludes WVDEP from assessing state waters against . . . narrative water quality criteria . . . , SB 562 is a state law that does not override federal requirements." EPA Enclosure 1: Review of W. Va.'s 2012 Section 303(d), J.A. 2599. Yet, when considering TMDLs, EPA accepts WVDEP's claim that state law precludes it from issuing TMDLs, choosing to construe it as a "pause" in TMDL development.

For support EPA relies on language in the CWA that permits states to submit TMDLs "from time to time" to argue that the CWA imposes no specific schedule on the creation of TMDLs and therefore WVDEP may "pause" its program. Rather, EPA's argument goes, states may produce TMDLs at a pace consistent with priority ranking and available resources, and here the state mandated search for a new methodology has consumed WVDEP's resources. Although the Court seriously doubts that a state could avoid the mandatory duty to develop TMDLs by claiming that the CWA imposes no set schedule to develop them,[13] EPA's argument is inapplicable here. *See Scott*, 741 F.2d at 998 ("We cannot allow the states' refusal to act to defeat the intent of Congress that TMDL's be established *promptly*." (emphasis added)).

[13] The context of the statutory language cited by EPA runs counter to EPA's intended meaning. The "from time to time" language is found in the same subsection where Congress required states to submit all TMDLs six months after EPA published its list of pollutants to be addressed by TMDLs. § 1313(d)(2). Rather that providing cover for states to plod along, the section indicates that Congress conceived the TMDL program as continuous and iterative. Once all TMDLs were promulgated and incorporated into a state's water management plan where they would be used to set NPDES permit limits, states were expected to continuously monitor ambient water quality. § 1313(d)(1)(A); 40 C.F.R. § 130.7(d). Where changes in water quality were detected, old TMDLs would need to be revised or retired and new TMDLs might have to be issued if new pollutants started to appear. *Id.* It is quite obvious that Congress could not predict when and if circumstances for a particular impaired body of water would change and therefore could not command states to produce replacement or new TMDLs on any set schedule. What is clear from the passage of the CWA is that the impetus for amending the Federal Pollution Water Control Act was state intransigence. *Kingman Park Civic Ass'n*, 84 F.Supp.2d at 7. "Although 1965 legislation required the states to develop water-quality standards for interstate waters within their boundaries, Congress lamented in 1971 that '[m]ore than 4 years after the deadline for submission of standards, only a little more than half of the states have fully approved standards.'" *Id.* (quoting S. REP. NO. 92-414, at 4 (1971), *as reprinted in* 1972 U.S.C.C.A.N. 3668, 3671.) And lest EPA forget, the stated policy enacted by the CWA was to eliminate the discharge of pollutants by 1985. § 1295(a). The Court seriously doubts that Congress would have created a mandatory regulatory structure that it believed would cure the nation's water quality ills in a short time only to permit states to develop TMDLs at whatever pace the state deemed fit. "[F]rom time to time" read in context, embodies Congress' intent that once all TMDLs were issued, states would continue to monitor their waters and revise TMDLs as it became necessary—not that states can sit on their hands until they are ready to act.

What EPA ignores about WVDEP's actions since SB 562 is that WVDEP is not developing TMDLs for biologic impairment. It is developing a methodology to determine biologic impairment—the two are not equivalent. The CWA does not permit a state to discontinue developing required TMDLs to work on some other aspect of its water regulation scheme. It is beside the point that EPA believes that the CWA does not impose a set schedule for development of TMDLs. What is undisputed, and determinative, is that states *must* develop TMDLs. WVDEP has stated unequivocally that it is not developing TMDLs for biologically impaired bodies of water. If WVDEP had continued to work on these TMDLs while it developed a new methodology, or produced a credible schedule for developing TMDLs, EPA's argument might be compelling. *See San Francisco BayKeeper*, 297 F.3d at 883; *Hayes*, 264 F.3d at 1023; *Browner*, 843 F. Supp. at 1313 (finding that a statewide challenge to Minnesota's TMDL program failed because Minnesota had concrete plans approved by EPA to produce the missing TMDLs and had produced 43 already). The fact is WVDEP has done neither, and accordingly EPA's argument is inapplicable.[14]

iii. *EPA's arguments concerning TMDL prioritization*

EPA counters that the Court cannot apply the constructive submission doctrine to a subset of TMDLs within a state without invading the discretion of the state committed to it by the CWA to prioritize the development of TMDLs. This same argument was rejected in *McLerran*, 2015 WL 1188522, at *7, and is now rejected here.[15] There is no support in TMDL jurisprudence for EPA's

[14] Also troubling to the Court, but not addressed by either party, is that by refusing to use a methodology to determine biologic impairment, WVDEP has consequently stopped enforcing its narrative water quality standards codified at §§ 47-2-3.2.e–3.2.i of the West Virginia Code. Yet, SB 562 did not change the narrative water quality standards, and importantly, it requires that any enforcement of the narrative water quality standards through a new methodology is at least as protective as the use of WVSCI. W. VA. CODE § 22-11-7b.

[15] The *McLerran* Court addressed many of the same arguments raised by EPA in this case

contention. In fact, the case that established the constructive submission doctrine, *Scott*, 741 F.2d at 992, was a challenge to missing TMDLs for a single body of water, Lake Michigan. Presumably both Illinois and Indiana are required to develop TMDLs for more bodies of water than just Lake Michigan. The *Scott* Court had no trouble finding the doctrine applicable to the plaintiff's challenge to a specific subset of TMDLs. *See id.*

Moreover, later cases such as *San Francisco BayKeeper* and *Hayes*, on which EPA relies, addressed programmatic challenges to a statewide TMDL program. *See* 297 F.3d at 882–83; 264 F.3d at 1024. Thus, as already noted earlier, where plaintiffs had challenged the entire program, a

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and therefore provides persuasive authority for addressing EPA's arguments here. *See* 2015 WL 1188522, at *5–*7. Although EPA has decided to argue this case in a similar manner, raising many of the same arguments, the outcome of *McLerran* rests on facts materially distinct from this case. The *McLerran* Court held that a constructive submission had not occurred where the state of Washington had not finalized a draft TMDL for PCBs in the Spokane River. *Id.* at *8–*9. Rather, Washington created a "task force" that would address PCBs in the Spokane. *Id.* at *5. After Washington formed the task force in lieu of the TMDL, the plaintiffs requested EPA to make a determination whether Washington had made a constructive submission. *Id.* EPA found that Washington's delay of the TMDL was within its discretion if a TMDL was even needed because of gaps in data and the delays associated with preparing a TMDL. *Id.* The plaintiffs brought both CWA and APA claims and the court found that a constructive submission had not occurred because Washington did not know the source of 57% of the PCBs. *Id.* at *8. Thus, compliance with the TMDL would unfairly fall on identified sources. *Id.* The court further held that the plaintiffs' assertion that Washington had all but completed the TMDL and then stepped away was incorrect. *Id.* at *9. The court credited Washington's interpretation of a draft of the TMDL released as incomplete and preliminary and determined that Washington still needed to conduct additional analyses to complete the TMDL. *Id.* "Therefore, [Washington's] failure to submit the PCB TMDL did not clearly and unambiguously indicate its intent to abandon the PCB TMDL." *Id.* The court, however, found that EPA's determination that the task force was a suitable alternative to a TMDL was contrary to law under the APA chiefly because the task force had no goal, no timeline, and did not explain whether it would ever submit a TMDL. *Id.* at *10–*11. In this case, EPA has made no formal determination of WVDEP's decision to stop issuing biological impairment TMDLs, although it has voiced concern. More importantly, and as will be discussed in greater detail, gaps in data have not precluded the development of the missing TMDLs—a state law has. Even still, it appears to the Court that there has been a significant accumulation of high quality data identifying not only the sources but also the constituent ions and ion mixes that produce ionic toxicity. Finally, WVDEP has stopped issuing TMDLs for all biological impairments, not just ionic toxicity, but admittedly has sufficient information to issue those TMDLs as evidenced by WVDEP's production of those TMDLs before SB 562 was passed.

showing that the state was producing some TMDLs made a constructive submission inapplicable. *See id.* The question raised in those cases was whether California and Oklahoma had abandoned their TMDL programs. *Id.* Evidence that proved that both states had developed some TMDLs demonstrated that both states had functioning TMDL programs, however meager. *Id.* Importantly, those cases and others like them did not address the applicability of the doctrine to challenges aimed at some but not all TMDLs in a state. Thus, they do not support EPA's contention. *See id.*; *Fox*, 93 F.Supp.2d at 542. But, as already noted, *Scott* was such a challenge, and the doctrine was found applicable. 741 F.2d at 992. More recently, the *McLerran* Court addressed the issue in more detail and wisely found that a state's duty to develop a TMDL is not diluted by its ability to choose in which order it will develop required TMDLs. 2015 WL 1188522, at *7. Otherwise, the court reasoned, a state could continually use prioritization to avoid developing particular TMDLs—an absurd result in light of the text of the CWA. *Id.*

It is undisputed that the CWA permits states to prioritize waters on its 303(d) List and commands states to develop TMDLs in accord with that prioritization. § 1313(d). Where a state explicitly announces that it is not developing TMDLs, the state has not reprioritized the TMDLs—it has instead determined that no TMDL will be adopted for an extended and indefinite period. Here, WVDEP has declared that it will not develop TMDLs for biologic impairment and has spun its wheels on something else entirely under the guise of a reprioritization. Reprioritization, however, implies that WVDEP is working on the missing TMDLs, just in a different order. But in reality, WVDEP is not working on the missing TMDLs at all. It is working on an assessment tool with no end in sight and no plan to develop the missing TMDLs anytime soon. "[I]t would be absurd for the Court to hold that a state could perpetually avoid this requirement under the guise of prioritization; such an administrative purgatory clearly contravenes the goal and purpose of the CWA." *Id.*

In a related argument, EPA maintains that only a programmatic failure of a state's TMDLs can result in a constructive submission. EPA is flat wrong. To return to the *Scott* case, the Seventh Circuit dealt with a challenge to some, but not all, TMDLs in Illinois and Indiana. 741 F.2d at 992. The plaintiff did not argue that the two states had failed to produce any TMDLs, and the *Scott* Court did not believe it necessary for the plaintiff to prove a complete programmatic failure in order for the court to find that a constructive submission was applicable to the case. *Id.* at 998; *see also McLerran*, 2015 WL 1188522, at *7 ("[A] state's discretion to prioritize TMDLs over other TMDLs does not remove its ultimate obligation to produce a TMDL for each water pollutant of concern in every 303(d) water segment.").

The *Scott* Court's holding is consistent with the text of the CWA. Indeed, the CWA imposes a duty on states to produce TMDLs. *See* § 1313(d)(1)(C). It does not impose a duty on states to simply have a TMDL program. *See id.* Although the former may necessitate the latter, the converse is not true. The presence of a robust TMDL program does not discharge the specific duty imposed by the CWA to produce a TMDL for each body of water on a 303(d) List. *McLerran*, 2015 WL 1188522, at *7. The Court thus rejects the proposition that a TMDL challenge must challenge a statewide failure.

iv. *EPA's argument concerning gaps in WVDEP's data*

EPA's final argument addresses TMDLs for biologic impairment caused by ionic toxicity and insists that although WVDEP's stated policy is that SB 562 precludes the development of the missing TMDLs, WVDEP also lacks crucial information about the constituent pollutants that cause ionic toxicity. WVDEP, EPA argues, should be permitted to postpone TMDL development where it lacks necessary information without triggering EPA's duty to develop TMDLs in their place. There are at least two problems with EPA's argument, in addition to the previously discussed presence of high quality data about ionic toxicity in the record. *See supra* Section II.B. First, WVDEP created its own information gap by withdrawing from the pilot TMDL program with EPA. Had WVDEP continued its work with EPA, EPA might have a credible argument that ionic toxicity is a complex problem that requires years to develop a TMDL. As it stands, however, WVDEP's claimed ignorance about ionic toxicity, and the best way to create a TMDL to address it, is self-imposed. States, and in this case EPA, cannot be permitted to hide behind "technical difficulties" of their own making to avoid federal statutory duties.

EPA's claim that it was justified in not assuming its duties because WVDEP should be permitted to conduct the research needed to develop an ionic toxicity TMDL is a diversion from the relevant issue in this case—WVDEP's decision to stop issuing TMDLs for biologic impairment because of SB 562. The Court has no doubt that in 2010 WVDEP lacked necessary information to develop an ionic toxicity TMDL. A constructive submission suit at that time may have been premature. Nevertheless, in the last four years WVDEP has not completed the first step to fill in the blanks, claiming quite publically that state law barred it from continuing its work on any biologic impairment TMDL, including ionic toxicity TMDLs. It is this policy, and not technical issues, that has stopped WVDEP from developing required TMDLs. Accordingly, EPA's arguments about missing data or the complexity of the problem miss the point that WVDEP stopped producing ionic toxicity TMDLs because of SB 562.

Second, the excuse given for not developing *any* biologic impairment TMDLs (including ionic toxicity TMDLs) is SB 562, not gaps in crucial information. Gaps in information arguably exist, although created by WVDEP, but WVDEP has stopped developing *all* TMDLs that address biologic impairment. EPA and WVDEP only claim to lack information about ionic toxicity, not the other causes of biologic impairment. In fact, while WVDEP has never issued a TMDL for ionic toxicity, before SB 562, WVDEP issued numerous TMDLs to address other causes of biologic impairment. *See, e.g.*, Decision Rationale Total Maximum Daily Loads for Selected Streams in the Upper Ohio South River Watershed W. Va., Sept. 2009, J.A. 1035–37. Surely informational deficiencies are not keeping WVDEP from developing TMDLs for other causes of biologic impairment. Thus, EPA's argument again misses the mark. It was not gaps in data, or any other technical problem, that forced WVDEP to abandon biological impairment TIMDLs, it was SB 562.

Consequently, the Court feels obliged to note that the text of SB 562 does not change the narrative WQS and requires that any new methodology "may not establish measurements . . . that would [be] less protective than [WVSCI]." This requirement sets a floor for whatever methodology is eventually developed, meaning that any new methodology should not generally result in delisting streams on West Virginia's 303(d) List already found to be impaired as determined by WVSCI. Bodies of water that already have been determined to be biologically impaired as a result of their WVSCI score, the bodies of water at issue here, will therefore still be considered impaired when using a new methodology. Were WVDEP to develop TMDLs for these bodies of water using WVSCI, they would quite obviously meet West Virginia's WQS and fulfill its CWA duties. Moreover, had WVDEP adopted GLIMPSS as a way to comply with SB 562, as EPA urged in 2014, and produced TMDLs based on GLIMPSS, these would also quite obviously comply with West Virginia's WQS and the CWA. This is all to say that WVDEP could develop TMDLs with either of the two valid and accepted methodologies and still develop a new methodology with little consequence for TMDLs produced with the established methodologies.

That approach, in practice, may mean that if a TMDL is produced using WVSCI, WVDEP might need to revisit that TMDL in the future, as it will have to do for all the biological impairment TMDLs issued before 2012 because they were developed using WVSCI. Of course, the use of GLIMPSS might prospectively solve that issue. Still, a review should not be a major impediment since it is WVDEP's policy to conduct a TMDL review process in every watershed every few years as part of its TMDL program. WVDEP's refusal to produce TMDLs, using either WVSCI or GLIMPSS, makes little sense when streams that already have been determined to be impaired will not be delisted with a new methodology and will still need a TMDL.

Lastly and most importantly, the fundamental federal structure of our Constitution demands that West Virginia's federal duties must prevail over SB 562. Notwithstanding, with GLIMPSS as a viable alternative that could comply with SB 562, it is not entirely clear what reason WVDEP has for not producing biological impairment TMDLs. What is clear, however, is that EPA must act when WVDEP's actions either clearly run afoul of federal supremacy, if SB 562 is truly the reason for WVDEP's inaction, or have no basis in fact, as when WVDEP laments that it has no methodology that it can use. Neither reason is a proper basis for EPA to accept inaction.

C. *Conclusion*

WVDEP has explicitly stated first that it cannot develop biologic impairment TMDLs due to state law and then proposed dates to develop TMDLs, which the Court finds are unsubstantiated and unrealistic. This is especially true for the subset TMDLs that address ionic toxicity. WVDEP has not even been able to produce a schedule for when it will finalize its new assessment methodology. It is clear and unambiguous that WVDEP has decided not to submit TMDLs for biologically impaired bodies of water. WVDEP's complete abdication of its CWA duties and utter lack of a plan to comply with those duties is a constructive submission of no TMDLs for all biologically impaired bodies of water, triggering EPA's nondiscretionary duty to approve or disapprove of the submission.

D. *The APA claims*

The Environmental Groups also move for summary judgment on their APA claims. EPA brought a cross motion for summary judgment directed at the Environmental Groups' APA claims. The Environmental Groups' APA claims challenge EPA's approval of TMDLs for six watersheds that did not include TMDLs for ionic toxicity as arbitrary, capricious, or otherwise contrary to law. Although the APA claims are directed solely at TMDLs for ionic toxicity, the CWA claims address all biologically impaired bodies of water in West Virginia, of which all waterbodies impaired by ionic toxicity are a part. The APA claims are subsumed by the CWA claims and are duplicative. "Congress did not intend the general grant of review in the APA to duplicate existing procedures for review of agency action." *Bowen v. Massachusetts*, 487 U.S. 879, 903 (1988). Indeed, the APA limits review of agency action to agency actions "for which there is no other adequate remedy in a court." 5 U.S.C. § 704. "Because review of [the Environmental Groups'] claim *is* available under the Clean Water Act, it is not subject to review under the APA." *Hayes*, 264 F.3d, 1025 (emphasis in original); *see also Allegheny Cty. Sanitary Auth. v. EPA*, 732 F.2d 1167, 1177 (3d Cir. 1984) (finding plaintiff could not sustain an APA claim when it had a valid claim pursuant to the CWA); *Am. Canoe Ass'n, Inc. v. EPA*, 30 F.Supp.2d 908, 915 n. 6 (E.D. Va. 1998) (same). Accordingly, the Court grants summary judgment in favor of EPA on the Environmental Groups' APA claims.

E. *Remedy*

The Environmental Groups' CWA claim was brought pursuant to 33 U.S.C. § 1365 which authorizes a citizen to bring suit against the administrator of the EPA "where there is alleged a failure of the Administrator to perform any act or duty under this chapter which is not discretionary." EPA has a nondiscretionary duty to approve or disapprove within thirty days a TMDL submission by West Virginia. WVDEP's decision not to submit biological impairment TMDLs to EPA for approval triggered EPA's duty to either approve or disapprove of the submission that no TMDLs are necessary for biological impairment within thirty days. Accordingly, EPA must, within thirty days of this order, approve or disapprove of WVDEP's submission of no TMDLs for *all* bodies of water identified as biologically impaired but lack a TMDL to address that impairment.

The Environmental Groups urge the Court to require EPA to produce the missing TMDLs within thirty days as if EPA had disapproved WVDEP's constructive submission because they believe that EPA cannot approve a submission of no TMDLs for bodies of water listed on a 303(d) List. There is a certain simplicity and harmony to the Environmental Group's argument. For every body of water listed on West Virginia's 303(d) List it must also produce a TMDL. It stands to reason then that EPA could never approve a submission that no TMDL is needed for a body of water on a 303(d) List.

Nevertheless, the Court does not believe that it can order EPA to produce the TMDLs without EPA first disapproving West Virginia's constructive submission. Section 1365(a)(2) permits suit to compel EPA to perform a nondiscretionary duty. EPA inherits a nondiscretionary duty to act (approve or disapprove) once a submission, or constructive submission, has been made. *Scott*, 741 F.2d at 998; *Fox*, 909 F. Supp. at 158. The CWA commits to EPA's discretion its choice between approval and disapproval. § 1313(d)(2); *see Hayes*, 264 F.3d at 1023; *Scott* 741 F.2d at 995. Where it disapproves a submission, it then inherits a nondiscretionary duty to produce the TMDLs that were disapproved. § 1313(d)(2). If EPA were to approve a constructive submission, essentially deciding in this case that no biological impairment TMDLs are necessary, that decision would then likely be subject to judicial review under the APA. At present, however, the Court can only order the EPA to perform the nondiscretionary duty which it has failed to assume—approve or disapprove WVDEP's constructive submission.

V. Conclusion

For the reasons stated in this Memorandum Opinion and Order, the Court **GRANTS** in part and **DENIES** in part the Environmental Groups' Motion for Summary Judgment, ECF No. 30, and **GRANTS** in part and **DENIES** in part EPA's Cross Motion for Summary Judgment. ECF No. 38. EPA shall approve or disapprove WVDEP's constructive submission of no TMDLs for all biologically impaired bodies of water for which no TMDL has been developed to address that impairment within thirty days of this order. EPA shall inform the Court upon reaching its decision. The Court will retain jurisdiction of the case until EPA submits its decision.

The Court **DIRECTS** the Clerk to send a copy of this Order to counsel of record and any unrepresented parties.

ENTER: February 14, 2017

Robert C. Chambers

ROBERT C. CHAMBERS, CHIEF JUDGE

No. 17-1430

IN THE UNITED STATES COURT OF APPEALS
FOR THE FOURTH CIRCUIT

OHIO VALLEY ENVIRONMENTAL COALITION, INC.; SIERRA CLUB; WEST VIRGINIA HIGHLANDS CONSERVANCY, INC.; WEST VIRGINIA RIVERS COALITION,

Plaintiffs-Appellees,

v.

SCOTT PRUITT, Administrator, United States Environmental Protection Agency; CECIL RODRIGUES, Acting Regional Administrator, United States Environmental Protection Agency, Region III,

Defendants-Appellants.

On Appeal from an Order of the United States District Court
for the Southern District of West Virginia (Hon. Robert C. Chambers)
Civil Action No. 3:15-cv-00271

BRIEF OF NATIONAL ASSOCIATION OF CLEAN WATER AGENCIES, NATIONAL MINING ASSOCIATION, AND NATIONAL CATTLEMEN'S BEEF ASSOCIATION AS *AMICI CURIAE* IN SUPPORT OF DEFENDANTS-APPELLANTS

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July 24, 2017

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INTERESTS OF *AMICI*

The National Association of Clean Water Agencies ("NACWA") is a non-profit trade association representing the interests of publicly owned wastewater and stormwater utilities across the United States. NACWA's members include nearly 300 municipal clean water agencies that own, operate, and manage publicly owned treatment works, wastewater sewer systems, stormwater sewer systems, water reclamation districts, and all aspects of wastewater collection, treatment, and discharge.

The National Mining Association ("NMA") is the national trade association of the mining industry. NMA's members include the producers of most of the nation's coal, metals, industrial and agricultural minerals; the manufacturers of mining and mineral processing machinery, equipment and supplies; and the engineering and consulting firms, financial institutions and other firms serving the mining industry.

The National Cattlemen's Beef Association ("NCBA") is the largest and oldest national trade association representing U.S. cattle producers, representing more than 30,000 direct members and more than 175,000 cattle producers and feeders through its state affiliates.[1]

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[1] No party's counsel authored any part of this brief, and no party or person other than *amicus*, its members, or its counsel made any monetary contribution intended to fund preparation or submission of this brief. *See* Fed. R. App. P. 29(a)(4)(E).

Sierra Club v. EPA 18cv3472 NDCA Tier 2 ED_002061_00106921-00007

SUMMARY OF ARGUMENT

Under the Clean Water Act ("CWA"), states must "from time to time" develop and submit to the U.S. Environmental Protection Agency ("EPA") total maximum daily loads ("TMDLs")—pollution budgets consistent with state water quality standards for waterbodies not currently meeting such standards. EPA must approve or disapprove any TMDLs submitted. Since 2004, the State of West Virginia[2] has submitted to EPA over 4,000 TMDLs, including over 500 since February 2016. Although West Virginia has continued to establish TMDLs for several other pollutants, in 2012 it temporarily paused work on TMDLs specifically focusing on "biological impairment" while it establishes an improved assessment methodology to inform such TMDLs. West Virginia is working on this methodology, is addressing biological impairment through scores of TMDLs for other pollutants, and has set a schedule to complete biological impairment TMDLs between 2017 and 2027.

Despite West Virginia's robust program and its commitment to complete biological impairment TMDLs over the next 10 years, the District Court found that the state had "refused" to develop such TMDLs. The Court held this constituted a "constructive submission" of "no TMDLs" for up to 573 waterbodies and ordered EPA to approve or disapprove this "submission" within 30 days.

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[2] The West Virginia Department of Environmental Protection ("WVDEP") is the state agency in charge of developing and submitting TMDLs.

The decision below is patently incorrect and should be reversed for several reasons. First, the "constructive submission" theory on which the decision is based is contrary to the CWA's text, has no basis in the legislative history, is inconsistent with Congress's allocation of authority to the states in the TMDL program, and is unnecessary in light of other mechanisms to prompt action. This Court should expressly reject this theory and reverse on this ground.

Second, even if the "constructive submission" theory were valid in some narrow circumstances, it does not apply on the facts of this case. Courts have held that a "constructive submission" of a TMDL can be found, if at all, only where a state's failure to develop TMDLs is so pervasive and longstanding that it amounts to a "clear and unambiguous statement" that the state refuses to undertake this duty. Indeed, no Court of Appeals has ever found that a constructive submission actually occurred. The few district court decisions that apply the theory involved extreme circumstances: failures to develop *any* TMDLs over a period of eleven to eighteen years, and no plans to do so. In contrast, several federal courts have found *no* constructive submission where states had far less robust programs than West Virginia. The record demonstrates that West Virginia has an active and extensive TMDL program, has stated its intention to develop biological impairment TMDLs and has adopted and submitted to EPA a schedule to do so. West Virginia's decision to temporarily pause work on one type of TMDL while developing a new methodology and continuing to submit other types of TMDLs is well within the state's discretion. The District Court misread the case law and misapplied it to the facts of this case. If this Court does not reject the constructive submission theory outright, it should reverse on the grounds that the theory, even if valid, would not apply here.

Finally, the District Court erred in failing to give any weight to EPA's expert judgment about West Virginia's management of its TMDL program. TMDL programs are large-scale, technically complex and resource intensive endeavors. Ionic toxicity—one of the key pollutants allegedly causing biological impairments at issue in this case—presents unique challenges because the relevant science is complex, evolving, and unsettled. EPA—the expert agency charged by Congress with oversight of TMDL programs—concluded that West Virginia's management of its program and its actions related to biological impairment did not amount to a "constructive submission" of "no TMDLs." Yet the District Court gave no deference to EPA's judgment, and instead substituted its own views on the science and proper management of the state's program. This error contributed to the District Court's mistaken finding of constructive submission.

Amici's members are frequently subject to TMDLs, and they rely on having a process through which to engage with states and EPA during TMDL development to help ensure that they are based on valid science. A ruling upholding the constructive submission theory, and the District Court's misapplication of the theory to the facts of this case, would undermine that process and hinder states' and EPA's ability to develop TMDLs grounded in appropriately vetted science and effectively manage TMDL programs.

ARGUMENT

I. THE "CONSTRUCTIVE SUBMISSION" THEORY HAS NO STATUTORY BASIS AND THIS COURT SHOULD REJECT IT

The CWA established a cooperative federalism regime for protecting water quality, under which states have the primary role in defining and implementing water quality objectives. At the federal level, EPA is charged with adopting national, technology-based effluent limitations guidelines governing discharges of pollution from certain categories of point sources, such as wastewater treatment plants and power plants. These limitations are implemented through the national pollutant discharge elimination system ("NPDES") permit program, implementation of which has been delegated to the states in all but a few cases. States are also charged with establishing and implementing water quality standards for their waterbodies, which they accomplish in part through the imposition of water quality-based effluent limitations in NPDES permits and application of technology-based and other CWA requirements. EPA oversees these state programs, pursuant to statutory mechanisms that differ from program to program.

One such program is established by CWA Section 303(d), which requires each state to identify waterbodies within its boundaries for which effluent limitations are insufficient to achieve applicable water quality standards (commonly called "impaired" waters). Section 303(d) requires states to "establish a priority ranking of such waters, taking into account the severity of the pollution and the uses to be made of such waters." 33 U.S.C. § 1313(d)(1)(A). "[I]n accordance with [this] priority ranking," the state must set TMDLs for certain pollutants (identified by EPA as appropriate for this purpose) for the impaired waters. *Id.* § 1313(d)(1)(C). TMDLs identify the total amount (load) of pollutants that can be discharged into a waterbody to achieve applicable water quality standards, and include budget-like allocations of this total load among different point and non-point sources.

When Congress enacted the CWA in 1972, it established an initial deadline for state submission of impaired waters and TMDLs to EPA, and directed states to make further submissions "from time to time" thereafter. Specifically, CWA Section 304(a)(2)(D) required EPA to publish by October 1973 information on pollutants "suitable for maximum daily load measurement," *id.* § 1314(a)(2)(D), a task EPA completed in December 1978. Section 303(d) provides that, no more than 180 days later (*i.e.*, by June 1979), each state was required to submit to EPA a list of its impaired waters and any TMDLs established for those waters. After that, Section 303(d) requires that "[e]ach State shall submit to [EPA] *from time to time*" any additional waters identified as impaired and any TMDLs. *Id.* § 1313(d)(2) (emphasis added).

Within thirty days after any state submission, EPA must approve or disapprove the state's identification of impaired waters and any TMDLs. *Id.* If EPA approves, the waters and/or TMDLs must be incorporated into the state's overall water quality plan under Section 303(e). *Id.* If EPA disapproves, EPA itself must—within thirty days after disapproval—identify such impaired waters and establish such TMDLs as the agency "determines necessary" to implement applicable water quality standards. *Id.*

At issue in this case is the "constructive submission" theory, an artifice superimposed on Section 303(d) by the Seventh Circuit over thirty years ago in *Scott v. City of Hammond*, 741 F.2d 992 (7th Cir. 1984), and misapplied by the District Court in the instant case. "We believe," the *Scott* court said, "that, if a state fails over a long time to submit proposed [TMDLs], this prolonged failure may amount to the 'constructive submission' by that state of no [TMDLs]." *Id.* at 996. If such a "'constructive submission'" of "no TMDLs" were found, "then the EPA would be under a duty to either approve or disapprove the 'submission.'" *Id.* at 997. This artifice was not based on the statute's text or legislative history, but rather on the Seventh Circuit's views on how best to achieve the CWA's policy objectives, as it understood them: "We think it unlikely that an important aspect of the federal scheme of water pollution control could be frustrated by the refusal of states to act." *Id.* Notably, however, the Seventh Circuit remanded the case to the district court, leaving the door open for "evidence indicating that the states are, or will soon be, in the process of submitting TMDL proposals." *Id.* at 997 n.11.

This Court should reject the constructive submission theory, as it has no basis in the CWA's text. The statute is clear: After the initial 1979 deadline for submissions was met, states must submit identifications of impaired waters and TMDLs "from time to time." The CWA provides no mandate or direction as to any deadline, pace or frequency for such submissions. Nor does it prescribe any consequence for perceived delay or default in making such submissions. The constructive submission theory, however, attempts to rewrite the CWA to establish a deadline for action and a remedy for breach that Congress chose not to impose.

The Supreme Court has made clear that courts are not at liberty to "revise legislation . . . just because the text as written creates an apparent anomaly as to some subject it does not address." *Michigan v. Bay Mills Indian Cmty.*, 134 S. Ct. 2024, 2033 (2014). The "last redoubt of losing causes," the Court has underscored, is "the proposition that the statute at hand should be liberally construed to achieve its purposes. That principle may be invoked, in case of ambiguity, to find *present rather than absent elements* that are essential to operation of a legislative scheme;

but *it does not add features* that will achieve the statutory 'purposes' more effectively." *Dir., Office of Workers' Compensation Programs v. Newport News Shipbuilding & Dry Dock Co.*, 514 U.S. 122, 135-36 (1995) (emphasis added) (citation omitted). Adding elements to Section 303(d)—based on a one-sided view of Congressional purpose—is exactly what the Seventh Circuit in *Scott* and the District Court in this case have done.

As this Court has emphasized, "where Congress knows how to say something but chooses not to, its silence is controlling." *Discover Bank v. Vaden*, 396 F.3d 366, 370 (4th Cir. 2005) (citation omitted); *see also, e.g., Meghrig v. KFC W., Inc.*, 516 U.S. 479, 485 (1996). Congress has shown throughout the CWA—including in other, simultaneously enacted subsections of Section 303 itself—that it knows very well how to establish firm deadlines for state or other action if it chooses to do so. In Section 303(c)(1), for example, Congress provided that states "shall from time to time (*but at least once each three year period beginning with* the date of enactment of the Federal Water Pollution Control Act Amendments of 1972) hold public hearings [regarding water quality standards]." 33 U.S.C. § 1313(c)(1) (emphasis added). Several other provisions of the CWA similarly demonstrate Congress's ability to set specific deadlines. *See, e.g., id.* § 1254(n)(3) ("The Administrator shall submit to Congress, from time to time, reports . . . but at least one such report during any six-year period."); *id.*

§ 1341(a)(1) (prescribing consequences for refusal to act "within a reasonable period of time (which shall not exceed one year)").

Congress has also demonstrated in at least a dozen other provisions of the CWA that it knows how to prescribe consequences for state inaction or delay if it wishes to do so. By way of example, Section 303(b)(1) provides that if a state "fails to submit water quality standards within the times prescribed in [section 303(a)]," EPA "shall promptly prepare and publish proposed regulations setting forth water quality standards" for the state. *Id.* § 1313(b)(1). Many other provisions of the CWA include similarly specific remedies for inaction or delay. *See, e.g., id.* § 1314(*l*)(3) (EPA to act "[i]f a State fails to submit control strategies in accordance with" requirements and deadlines); *id.* § 1329(d)(3) (EPA to act if state "does not submit the report required . . . within the time period specified"); *id.* § 1268(c)(2)(C) (EPA to promulgate standards if states fail to do so); *id.* § 1313(a)(1)-(3) (EPA to promulgate changes if state does not adopt them within 90 days of notification); *id.* § 1313(c)(3); *id.* § 1313(i)(2)(A); *id.* § 1319(a)(2); *id.* § 1341(a)(1); *id.* § 1344(j). Congress established no such requirements or consequences in Section 303(d).

In the absence of any textual basis, the *Scott* court and the District Court below relied instead on their view that, without the constructive submission theory, the CWA's "objectives" would be frustrated. That would not be a valid ground for rewriting the statute even if true, but in this instance it is also based on a one-sided and mistaken view of Congress's objectives. In enacting the CWA generally and Section 303 in particular, Congress was concerned with preservation of state regulatory authority. The CWA underscores that "[i]t is the policy of the Congress to recognize, preserve, and protect the primary responsibilities of States" to address water pollution. 33 U.S.C. § 1251(b); *see also* Oliver A. Houck, *The Clean Water Act TMDL Program: Law, Policy, and Implementation* 14-24 (2d ed. 2002) (discussing congressional focus on state authority under Section 303). Further, the CWA's drafters did not view Section 303(d) as an important driver of action. Senator Muskie, the lead sponsor of the legislation, stated that "[t]he Administrator should assign secondary priority to [Section 303]" and that states likewise should instead prioritize implementation of effluent limitations. 118 Cong. Rec. 33,696 (Oct. 4, 1972). The legislative history therefore provides no indication that Congress intended to silently limit states' authority in the manner implied by the constructive submission theory.

Importantly, TMDLs are a mechanism to implement *state* water quality standards. They implicate land-use decisions related to non-point sources of pollution that the CWA expressly left within the states' sphere of control and are (as discussed at greater length in Section III, *infra*) complex, unwieldy tools that take years or decades to develop and implement. Especially in the case of complex pollutants and water quality issues, it is critical that states have adequate time and flexibility to develop TMDLs based on appropriately vetted science. It is no surprise, therefore, that Congress left the pace of TMDL development to the states' discretion. By contrast, it is highly unlikely that Congress intended *silently* to enact the deadline and sanctions regime implied by the constructive submission theory, thereby substantially expanding federal authority over states, without any reference in the statute's text or whisper of commentary in the legislative history. *Cf. United States v. Bass*, 404 U.S. 336, 349 (1971) ("[U]nless Congress conveys its purpose clearly, it will not be deemed to have significantly changed the federal-state balance.").

Finally, to the extent courts are concerned that states may refuse altogether to develop TMDLs, there are other mechanisms through which EPA and citizens can encourage or compel action. EPA has several such mechanisms, including support through federal grants to state water quality programs under CWA Section 106, 33 U.S.C. § 1256. Citizens can challenge EPA approvals of state impaired waters or TMDL lists under the Administrative Procedure Act ("APA"), as Plaintiffs-Appellees did in this case and other plaintiffs have done in similar suits. *See, e.g.*, *Potomac Riverkeeper, Inc. v. U.S. EPA*, No. RDB 04-3885, 2006 WL 890755, at *8, *10 (D. Md. Mar. 31, 2006); *Natural Res. Def. Council, Inc. v. Fox*, 93 F. Supp. 2d 531, 534 (S.D.N.Y. 2000), *aff'd sub nom. NRDC, Inc. v. Muszynski*, 268 F.3d 91 (2d Cir. 2001); *Friends of the Wild Swan, Inc. v. U.S. EPA*, 130 F. Supp. 2d 1184, 1192 (D. Mont. 1999); *Am. Littoral Soc'y v. U.S. EPA Region*, 199 F. Supp. 2d 217, 229 (D.N.J. 2002). They can also petition EPA to encourage development of TMDLs and can seek judicial review of the agency's response or unreasonable delay in responding. 5 U.S.C. § 706(1)-(2). They can likewise petition state environmental agencies and may be able to bring unreasonable delay or mandamus actions under state law to compel action. *See, e.g.*, Revised Model State Administrative Procedure Act § 501(d) (2010), http://www.uniformlaws.org/shared/docs/state%20administrative%20procedure/msapa_final_10.pdf (authorizing unreasonable delay claims); *State ex rel. Laurel Mountain/Fellowsville Area Clean Watershed Ass'n, Inc. v. Callaghan*, 418 S.E.2d 580, 585 (W. Va. 1992) (granting mandamus to require WVDEP to address mining site); *Allen v. State of W. Va. Human Rights Comm'n*, 324 S.E.2d 99, 107, 127-28 (W. Va. 1984) (granting mandamus based on agency's "extraordinary delay" in taking required action). It is therefore wrong to suggest that the only means to prompt state action is by rewriting the CWA to create a deadline and remedy that Congress did not enact.

II. EVEN IF THE CONSTRUCTIVE SUBMISSION THEORY WERE A PERMISSIBLE INTERPRETATION, ITS REQUIREMENTS PLAINLY ARE NOT MET HERE

For the reasons set forth above, *Amici* strongly urge this Court to reject the constructive submission theory. But even if the theory were based on a permissible reading of the CWA, it plainly does not apply on the facts of this case. West Virginia has submitted thousands of TMDLs since 2004, including 500 since February 2016, and has a schedule to complete biological impairment TMDLs from 2017 to 2027. Courts have applied the constructive submission theory only in extreme circumstances, and several courts have found there is no constructive submission where the relevant states had substantially less robust programs. There is no basis for concluding that West Virginia has constructively submitted "no TMDLs." This Court accordingly should reverse the decision below.

A. The Constructive Submission Theory is Extremely Narrow, Requiring a Clear and Unambiguous Refusal to Submit TMDLs

No other Court of Appeals, including *Scott*, has actually found a constructive submission, and affirmation of the District Court's decision in this case would be an unprecedented and dramatic expansion of the theory. The Tenth Circuit in *Hayes v. Whitman* concluded that the theory is "necessarily . . . narrow" and that only a state's "clearly and unambiguously" expressed decision to submit no TMDLs could be deemed a constructive submission. 264 F.3d 1017, 1024 (10th Cir. 2001). *Hayes* found no constructive submission where the state had submitted "somewhere between three and twenty-nine" TMDLs (though plaintiffs claimed that none met the CWA's requirements) and had a plan to submit 1,400 more in the next decade. *Id.* at 1022. The Ninth Circuit in *San Francisco Baykeeper v. Whitman* endorsed the Tenth Circuit's approach, finding no constructive submission where the state had submitted "at least eighteen" TMDLs and had a schedule to complete the remaining TMDLs within 12 years. 297 F.3d 877, 880, 883 (9th Cir. 2002). Even *Scott* did not find a constructive submission; the court held only that the case should not be dismissed for failure to state a claim, and remanded with instructions to the district court "to proceed as if the states had submitted proposals of no TMDL's unless [there is] evidence indicating that the states are, or will soon be, in the process of submitting TMDL proposals." 741 F.2d at 997 n.11.

Likewise, in only a few other cases involving "egregious circumstances" have district courts found that alleged facts could amount to a constructive submission. *See Sierra Club v. U.S. EPA*, 162 F. Supp. 2d 406, 418 n.18 (D. Md. 2001) (citing cases and finding them not applicable as state had made "several TMDL submissions"); *see also S.F. Baykeeper*, 297 F.3d at 882-83 & n.2 (contrasting cases). Those cases involved allegations that states failed to make *any* TMDL submissions for eleven to eighteen years, in violation of the CWA's *initial 1979 deadline* (not the requirement to submit TMDLs "from time to time" thereafter), and had *no plans* to complete any TMDLs. *See, e.g.*, *Kingman Park Civic Ass'n v. U.S. EPA*, 84 F. Supp. 2d 1, 3, 5 (D.D.C. 1999) (denying EPA motion to dismiss where, eighteen years after 1979 deadline, state had not submitted a single TMDL); *Alaska Ctr. for the Envt. v. Reilly* ("*ACE*"), 762 F. Supp. 1422, 1425, 1429 (W.D. Wash. 1991) (state had not submitted any TMDLs for over ten years and had no plans to establish any); *see also Am. Canoe Ass'n v. U.S. EPA*, 30 F. Supp. 2d 908, 913, 927 (E.D. Va. 1998) (denying EPA motion to dismiss where state had not submitted any TMDLs in nearly twenty years since 1979 deadline). By contrast, several courts have found no constructive submission based on completion of *some* TMDLs and plans to develop more, even where the existing TMDLs and plans were inadequate. *E.g.*, *Sierra Club v. Hankinson*, 939 F. Supp. 865, 871-72 & n.6 (N.D. Ga. 1996); *see also Hayes*, 264 F.3d at 1022.

Notably, the CWA gives states broad discretion to prioritize among TMDLs. Section 303(d) allows each state to "establish a priority ranking" for its impaired waters and to establish TMDLs "from time to time" in accordance with that ranking. 33 U.S.C. § 1313(d)(1)(A)-(C), (d)(2). Courts accordingly have recognized that it would be inappropriate to usurp a state's authority to prioritize among TMDLs. *See Sierra Club v. Browner*, 843 F. Supp. 1304, 1314 (D. Minn. 1993) (although the state "and the EPA may not be implementing TMDLs as quickly as plaintiffs would like, the Act does not set deadlines for the development of a certain number of TMDLs"); *cf. Sierra Club v. McLerran*, No. 11-CV-1759-BJR, 2015 WL 1188522, at *7 (W.D. Wash. Mar. 16, 2015) (constructive submission "does not occur merely because a state has prioritized one TMDL over another").

And no court has ever found a constructive submission, as the District Court did here, based on failure to develop a particular TMDL or a category of TMDLs. The decisions cited above involved complete, statewide programmatic failures. Even where plaintiffs challenged a failure to submit particular TMDLs, courts reviewed the TMDL program as a whole to understand whether the state exercised its discretion under the CWA to prioritize. *See Hayes*, 264 F.3d at 1024 (discussing TMDLs in terms of "particular impaired waterbodies" but reviewing entire TMDL program); *cf. McLerran*, 2015 WL 1188522, at *7-8 (discussing state program as whole and rationale for reprioritizing and delaying TMDLs at issue).

B. West Virginia Has a Robust TMDL Program and Has Committed to Establishing TMDLs for Biologically Impaired Waterbodies, Including Ionic Toxicity TMDLs

West Virginia plainly has not made a "clear and unambiguous statement" that it is abandoning or refusing to complete TMDLs either generally or for particular waterbodies or pollutants—quite the contrary. The state has completed over 4,000 TMDLs since 2004, including 500 since February 2016, and has addressed biological impairment through hundreds of TMDLs addressing specific

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pollutants. It has established a schedule to complete biological impairment TMDLs between 2017 and 2027. JA2791-2844 (2014 303(d) list); *see also* JA2852-3001 (listing developed TMDLs addressing biological impairment).[3] This case bears no resemblance to *Kingman Park, ACE*, or *Scott*, where states submitted no TMDLs and had no plans to do so. And West Virginia's program far exceeds those reviewed in *Hankinson*, *Hayes*, and *S.F. Baykeeper*, where states had only submitted a few TMDLs and schedules that plaintiffs alleged were inadequate, yet the courts still found no constructive submission. The decision below is founded on a patent misreading of precedent and misapplication to the facts.

The District Court's analysis reveals several fundamental errors. First, the Court found that West Virginia "has declared that it will not develop TMDLs for biologic impairment." Memorandum Opinion and Order at 32, Dist. Ct. ECF No. 87 ("Dist. Ct. Order"). That is incorrect. While West Virginia stated that it was "pausing" work on biological impairment TMDLs while it develops a supporting assessment methodology, it declared its intent to develop such TMDLs as soon as practicable, set dates for completion of such TMDLs, and continued development of hundreds of other TMDLs—including many that address biological impairment through specific pollutants.

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[3] References to the Joint Appendix ("JA") are references to the Joint Appendix for summary judgment. Dist. Ct. ECF Nos. 65, 69.

The TMDLs at issue in this case are intended to remedy biological impairment, which refers to water quality that harms aquatic organisms to a defined extent, as related to "ionic toxicity," which refers to elevated level of ions (or "salt") in the water that allegedly can cause such impairment in some circumstances. As explained in Section III, *infra*, biological impairment and ionic toxicity present complex technical issues on which the science is evolving and unsettled.

In April 2012, West Virginia informed EPA that—in light of the recent enactment of a state law, SB 562, which required establishment of a new methodology to assess biological impairment—it would "postpone" biological impairment TMDLs (including for ionic toxicity) while developing this methodology. JA3298-99 (2012 WVDEP Letter to EPA). West Virginia communicated to EPA its plans to develop TMDLs "as soon as practicable after the effective date of rules enacted pursuant to [SB 562]." JA2368 (2012 Draft 303(d) List). In 2013, the state restated that it was *not* "unable or unwilling" to carry out its CWA responsibilities. JA2707 (2013 WVDEP Letter to EPA). And in 2015, in response to comments, the state set specific dates for biological impairment TMDL completion such that all biological impairment TMDLs would be completed between 2017 and 2027. JA3046 (2015 Letter from WVDEP to EPA), JA22791-844 (W. Va. 2014 303(d) list); JA3060.

West Virginia stated in 2015 that it was working on its new biological impairment assessment methodology, JA3047, and in 2016 it notified EPA that it continued collecting data to continue that work. Dist. Ct. Order at 16.[4] In 2015 and 2016, West Virginia continued to communicate with EPA regarding its methodology. JA4146-52 (Feb. 2016 emails discussing meeting on draft biological assessment rule); JA4137-43 (Nov.-Dec. 2015 emails discussing EPA comments on draft methods); JA4123-32 (Sept. 2015 emails scheduling EPA-WVDEP call). Meanwhile, West Virginia has submitted scores of TMDLs since 2014 that address biological impairment caused by other pollutants. JA87-92 (West Fork River watershed), JA259-65 (Monongahela River watershed), JA3684-89 (Tygart River).

Yet the District Court dismissed all this evidence without justification. The Court also erroneously concluded that EPA and West Virginia claimed the state was not required to develop biological impairment TMDLs because state law (SB 562) trumps the CWA. Dist. Ct. Order at 28. Neither EPA nor West Virginia has made any such claim. To be sure, SB 562's enactment caused WVDEP to temporarily pause work on biological impairment TMDLs to develop a new assessment methodology. But neither the state nor EPA has ever claimed that this

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[4] Citing July 5, 2016 WVDEP Letter to EPA at https://www.epa.gov/sites/production/files/2016-07/documents/wvdep_comments_re_epa_overlist_july_5_2016.pdf

obviates the state's obligations under the CWA. On the contrary, the state has declared its intention to develop the relevant TMDLs and submitted a schedule to do so.

Finally, the District Court mistakenly viewed the constructive submission theory as precluding West Virginia from deferring work on one type of TMDLs while developing others, effectively eliminating the state's clear statutory grant of authority to prioritize. The Court held that the constructive submission theory applies to failures to address a particular waterbody or category of pollutants, primarily citing *Scott* and *Sierra Club v. McLerran*. Dist. Ct. Order at 22, 27 n.12, 31-32. The few district court decisions that found that alleged facts could amount to a constructive submission, however, involved statewide programmatic failures. Although *Scott* involved allegations that states failed to develop TMDLs for Lake Michigan, the Seventh Circuit held only that the case should not be dismissed for failure to state a claim, and the district court on remand could find no constructive submission based on "evidence indicating that the states are, or will soon be, in the process of submitting TMDL proposals." 741 F.2d at 997 n.11. *McLerran* found no constructive submission, underscoring that constructive submission "does not occur merely because a state has prioritized one TMDL over another." *McLerran*, 2015 WL 1188522, at *7.

Regardless, even if constructive submission could be further stretched to cover state decisions about categories of TMDLs, West Virginia has not refused to complete biological impairment TMDLs. It has stated its intention to do so, has a schedule, and is entitled to decide how best to sequence TMDLs in light of available science, methods and resources. The state may not be developing biological impairment TMDLs "as quickly as plaintiffs [or the District Court] would like," *Browner*, 843 F. Supp. at 1314, or in the order they might prefer. But that is not a valid basis for usurping the state's authority to prioritize its program.

The record in this case provides no basis on which to conclude that West Virginia has effectively submitted to EPA a decision that no TMDLs are required. The District Court's decision therefore should be reversed.

III. THE DISTRICT COURT ERRED IN FAILING TO ACCORD ANY DEFERENCE TO EPA, AND IN SUBSTITUTING ITS OWN JUDGMENT AS TO APPROPRIATE MANAGEMENT OF A HIGHLY COMPLEX, TECHNICAL REGULATORY PROGRAM

The District Court compounded its error by failing to give any deference to EPA's judgment that West Virginia had made no constructive submission. TMDL programs are complex, massive enterprises that require allocation of scarce resources to address challenging technical issues. EPA, which is charged by Congress with overseeing these programs, works closely with the states in this endeavor and is uniquely qualified to evaluate their performance. If courts are to entertain constructive submission claims, they should defer to EPA's expertise.

A. EPA's Expert Judgment With Regard to West Virginia's TMDL Program is Entitled to Deference as a Matter of Law

As this Court has explained, "'[c]ourts are expert at statutory construction, while agencies are expert at statutory implementation.' . . . It is crucial therefore that courts in [a] highly technical arena respect the strengths of the agency processes on which Congress has placed its imprimatur." *North Carolina ex rel. Cooper v. Tenn. Valley Auth.*, 615 F.3d 291, 305-06 (4th Cir. 2010) (quoting *Negusie v. Holder*, 555 U.S. 511, 530 (2009)). It is a bedrock principle of administrative law that "[e]specially in matters involving not just simple findings of fact but complex predictions based on special expertise, 'a reviewing court must generally be at its most deferential.'" *Ohio Valley Envt'l Coal. v. Aracoma Coal Co.*, 556 F.3d 177, 192 (4th Cir. 2009) (quoting *Balt. Gas & Elec. Co. v. Natural Res. Def. Council, Inc.*, 462 U.S. 87, 103 (1983)); *see also Nat'l Ass'n of Clean Water Agencies v. EPA*, 734 F.3d 1115, 1145 (D.C. Cir. 2013). Those principles govern here, where Congress has made states the primary actors under the complex regulatory regime established by Section 303(d) and has given EPA limited oversight authority. Yet the District Court failed to adhere to them.

Alongside their "constructive submission" claim, Plaintiffs-Appellees brought an APA challenge to EPA's approval of West Virginia's Section 303(d) list. The District Court rejected the APA claim as "duplicative," but had the court addressed the merits of the APA claim, it would have reviewed EPA's action under the highly deferential "arbitrary and capricious" standard. It makes little sense that EPA's views on the state's program were given no deference at all, merely because Plaintiffs-Appellees also framed their claims in terms of the constructive submission theory. The gravamen of the constructive submission and APA claims is the same and the same standard of review should apply. Here, the District Court erred in giving no deference to EPA's judgment at all, reviewing the highly technical issues presented *de novo*. *See, e.g.*, Dist. Ct. Order at 9-10, 24 & n.10, 33-36.

B. State TMDL Programs Are Large, Technically Complex and Resource-Intensive and States and EPA Need Discretion to Prioritize

The scale and complexity of state TMDL programs is enormous. West Virginia, for example, must evaluate 18 pollutants that may be present in 32 major watersheds that contain thousands of individual waterbodies. *See* JA2758 (WVDEP, 2014 West Virginia Integrated Water Quality Monitoring and Assessment Report); JA2790-844 (2014 Section 303(d) list) (listing over 1,000 impaired entries).

For each separate segment of a waterbody, the state must collect and analyze large amounts of water quality data. *See* JA909-25 (EPA Guidance for 2006

Assessment (July 29, 2005)) (describing methodology, data collection, and data evaluation); JA4541-47 (EPA Guidance on the TMDL Process (1991)) (illustrating steps for TMDL development). States use this data to identify the pollutants in the water, their sources, and their impacts. *Id.*; *see also* Declaration of Helene Drago ¶ 4, Dist. Ct. ECF No. 91-1 ("Drago Decl.") (listing TMDL development steps). To measure biological impairment, for example, a state performs biological assessments and, if the data shows impairment, the state then must collect further data and perform additional analysis to identify the stressor causing the impairment. *See* JA4592 (EPA Stressor Identification Guidance Document (2000)). Such data collection is resource-intensive and time-consuming, and the right data is not always immediately available. *See* Valentina Cabrera-Stagno, EPA, *Developing Effective TMDLs: An Evaluation of the TMDL Process* 2 (2007), https://www.epa.gov/sites/production/files/2015-10/documents/2009_09_09_tmdl_results_29cabrera_wef07_paper7.pdf.

In the present case, West Virginia has a comprehensive strategy to monitor and sample surface waters across the state at various intervals and intensities, collecting data on a rotating watershed basis. It uses this data to perform water quality assessments. JA2760-70 (2014 Integrated Water Quality Report). Before developing TMDLs, the state revisits every listed stream to collect additional data. JA4955 (W. Va. Draft 2014 Section 303(d) List).

TMDLs therefore require substantial time and resources. EPA has long recognized TMDL development can take 8 to 13 years, and court-imposed schedules have allowed up to 20 years. Claudia Copeland, Cong. Research Serv., R42752, *Clean Water Act and Pollutant Total Maximum Daily Loads (TMDLs)* 4-5 (2012), https://fas.org/sgp/crs/misc/R42752.pdf. Resources for TMDL development, moreover, are scarce. It is impossible to collect and evaluate data, develop TMDLs, and implement them for every waterbody and every pollutant at once, and this puts a premium on states' discretion to prioritize among TMDLs. Drago Decl. ¶ 5 (development of TMDL can cost millions of dollars); *see also* Copeland, *supra*, at 17; Cabrera-Stagno, *supra*, at 3.

All of these factors highlight the need for courts to afford deference to EPA's and states' judgment regarding the administration of TMDL programs, including with respect to the timing and sequencing of TMDLs for individual waterbodies as well as categories of TMDLs.

C. The Science of Ionic Toxicity Is Complex, Evolving and Unsettled

In addition to these general issues of TMDL program administration, "ionic toxicity"—on which the Complaint and much of the District Court's decision in this case focus—presents especially complex, novel issues. Ionic toxicity refers to adverse effects on aquatic organisms as a result of elevated concentrations of ions such as sodium or chloride. As explained below, it is emblematic of the scientific and technical challenges presented by TMDLs for complex pollutants and further underscores the rationale for deference to EPA's judgment in this case.

Focusing on a single EPA study from 2011, the District Court mistakenly treated the science of ionic toxicity as well settled and conclusive, and impugned West Virginia's rationale for delaying development of biological impairment TMDLs. *See* Dist. Ct. Order at 9-10 (citing JA3301 (Benchmark Study)); *id.* at 24 n.10. In reality, however, the science in this area continues to evolve and remains unsettled. In 2011, EPA developed a "benchmark" study addressing dissolved salts that evaluated field data to determine whether increased ion mixtures impacted macrovertebrate species composition in Appalachian streams. But this study includes many important caveats, was never intended to be a conclusive endpoint, and was criticized by scientific commenters. Indeed, EPA subsequently worked for years to develop a novel *draft* field-based methodology intended to help states develop water quality criteria related to ionic toxicity, and it was only made available for public comment in December 2016. 81 Fed. Reg. 94,370 (Dec. 23, 2016).

EPA received over 900 comments on this draft methodology, *see* Docket EPA-HQ-OW-2016-0353, and many underscore the complexity and uncertainty surrounding both the draft methodology, specifically, and the relationship between ionic toxicity and biological impairment, generally. Many commenters highlighted shortcomings in EPA's assumptions and methods. *See, e.g.*, Comment Letter from Water Env't Fed'n to EPA at 1-3 (Apr. 24, 2017) ("WEF Comments"); Comment Letter from Nat'l Council for Air & Stream Improvement to EPA 2-3, 6-13 (Apr. 24, 2017). For example, commenters pointed out that the use of field observation and statistical modeling does not lend itself to traditional toxicological analysis used in developing aquatic life criteria and TMDLs. Comment Letter from Nat'l Ass'n of Clean Water Agencies 1 (Apr. 24, 2017) ("NACWA Comments"). Additionally, using field data introduces serious confounding factors that must be accounted for before biological effects can be ascribed to conductivity, or conductivity to any particular source. *Id.* at 2; *see also* GEI Consulting Review of EPA's Draft Field-Based Methods for Developing Aquatic Life Criteria for Specific Conductivity, submitted on Behalf of Nat'l Mining Ass'n 2-1 to 2-6 (Apr. 2017). More traditional, robust scientific studies are needed to understand the role ions play in biology and which ions have which effect. NACWA Comments at 3; *see also* WEF Comments at 2-3.

EPA has not announced whether or when it will finalize its draft methodology. Regardless, it is clear that the science of ionic toxicity is far from settled and that West Virginia's decision to pause development of biological impairment TMDLs while developing a new assessment methodology was a reasonable exercise of its discretion. Further, given EPA's deep substantive expertise and close collaboration with the state on these issues, the agency was far better positioned than the District Court to evaluate the reasonableness of that decision. The District Court erred in failing to give any weight to EPA's expert views and in finding a constructive submission.

CONCLUSION

For the reasons set forth above, the decision below should be reversed.

Dated: July 24, 2017

Respectfully submitted,

s/ Joel C. Beauvais

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CERTIFICATE OF COMPLIANCE

I certify that the foregoing Brief of National Association of Clean Water Agencies, National Mining Association, and National Cattlemen's Beef Association as Amici Curiae in Support of Defendants-Appellants complies with type-volume limits because, excluding the parts of the document exempted by Federal Rule of Appellate Procedure 32(f), the brief contains 6,496 words, and is proportionately spaced using a roman style typeface of 14-point.

s/ Joel C. Beauvais
Joel C. Beauvais
Attorney for Amici Curiae *National Association of Clean Water Agencies, National Mining Association and National Cattlemen's Beef Association*

Dated: July 24, 2017

CERTIFICATE OF SERVICE

I, Joel C. Beauvais, hereby certify that on July 24, 2017, I electronically filed the foregoing Brief of National Association of Clean Water Agencies, National Mining Association and National Cattlemen's Beef Association as *Amici Curiae* in Support of Defendants-Appellants with the Clerk of the Court for the United States Court of Appeals for the Fourth Circuit by using the appellate CM/ECF system, which will send notice of such filing to all registered CM/ECF users.

s/ Joel C. Beauvais
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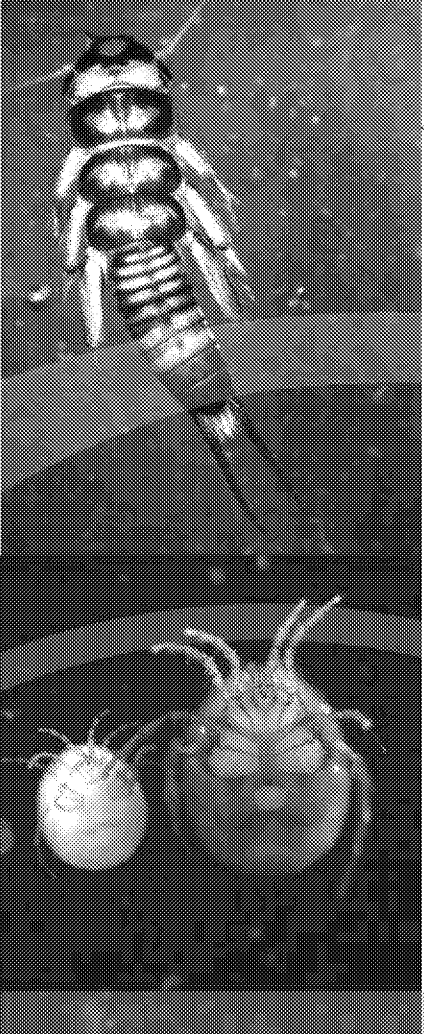
GEI Consultants

Consulting Engineers and Scientists



Review of EPA's Draft Field-Based Methods for Developing Aquatic Life Criteria for Specific Conductivity

EPA-822-R-07-010

PREPARED ON BEHALF OF THE NATIONAL MINING ASSOCIATION

Submitted to Docket ID No.: EPA-HQ-OW-2016-0353

April 2017

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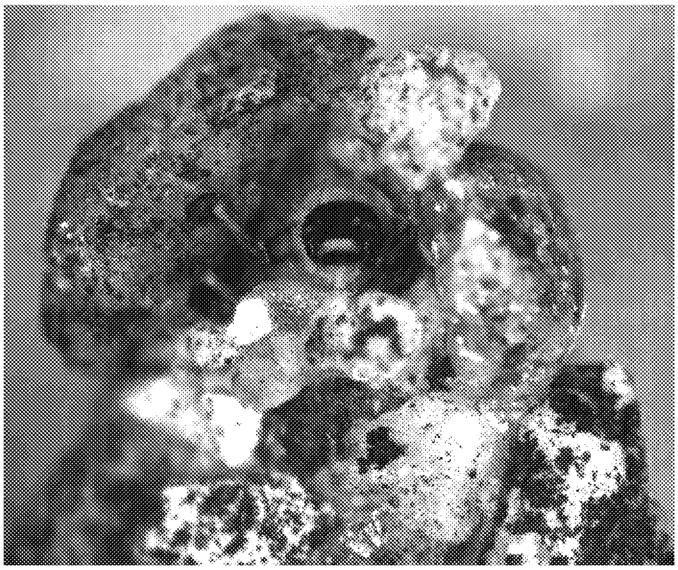

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List of Abbreviations and Acronyms

CCC	criterion continuous concentration
CDF	cumulative distribution function
CMC	criterion maximum concentration
CMEC	criterion maximum exposure concentration
ECDF	empirical cumulative distribution function
EC_{20}	20% effect concentration
EPA	U.S. Environmental Protection Agency
FFG	functional feeding group
GEI	GEI Consultants, Inc.
HC_{05}	hazard concentration 5th percentile
LC_{50}	median lethal concentrations
NMA	National Mining Association
PaFBC	Pennsylvania Fish and Boat Commission
SC	specific conductivity
SSD	species sensitivity distribution
WABbase	water analysis database
WVDEP	West Virginia Department of Environmental Protection
WVSCI	West Virginia Stream Condition Index
XC_{95}	extirpation coefficient 95th percentile
XCD	extirpation coefficient distribution
XC	extirpation coefficient

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Executive Summary

On behalf of the National Mining Association (NMA), GEI Consultants, Inc. (GEI) has previously conducted detailed technical reviews of the draft and final EPA Benchmark Reports. Overall, as noted in those prior reviews, the methodology recommended for development of field-based conductivity criteria is inherently flawed and does not provide a reliable means of truly ensuring protection for 95% of the aquatic community as set forth in U.S. Environmental Protection Agency (EPA) guidance for development of aquatic life criteria.

EPA uses a risk assessment framework to develop the draft conductivity criteria. While we support this approach in general, there are substantial flaws in the Problem Formulation that cannot be adequately addressed in the Analysis Plan to achieve appropriate goals and endpoints. In particular, the XCD method does not develop criteria that would be protective of 95% of aquatic species, but instead effectively sets conductivity criteria concentrations very close to natural background concentrations, which is not consistent with the broad ecological integrity goals of the Clean Water Act. EPA appears to only be concerned with protecting against presumed extirpation at the genus level, but gives no consideration to diversity or abundance or other straightforward methods of evaluating overall health of aquatic communities, even though diversity is a well-established means of evaluating benthic invertebrate community health and structure.

While the EPA states that this Draft Conductivity Criteria methodology is modeled after the 1985 Guidelines, the method described in the EPA Draft Conductivity Criteria differs significantly in that the points in the species sensitivity distribution (SSDs) consist of extirpation coefficients (XCs) rather than median lethal concentrations (LC_{50}s) or chronic response values (e.g., EC_{20}s) from exposure to a single chemical in controlled laboratory studies. The resulting criterion continuous concentration (CCC) derived using this method does not represent a specific conductivity (SC) concentration that would protect 95% of the species with respect to SC. Rather, the CCC identifies the lowest possible SC concentration higher than undisturbed "background" SC that is associated with subtle changes in the presence/absence of select macroinvertebrate genera. This is a fundamentally inappropriate interpretation of the 1985 Guidelines and its goal to derive aquatic life protection criteria that are protective of all but 5% of the most sensitive species to a pollutant or stressor.

One of the major conceptual issues with the XCD-based CCC derivation method is the assumption that the absence of any benthic invertebrate genera is solely due to a conductivity level that exceeds the physiological limits of that genus, thereby leading to extirpation. However, their own data show substantial differences in XC_{95} values within a genus across ecoregions, thereby highlighting our concern that genera characterized as being sensitive to conductivity in one ecoregion may in fact not be sensitive to conductivity in another

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ecoregion. Such large variability in the purported physiological limits of "sensitive" genera raises considerable uncertainty regarding the applicability of conductivity as a determinant of the frequency of occurrence (or absence/extirpation) of a given taxa. This is an extremely important issue that puts into question the entire approach used in EPA's Benchmark Report and needs to be fully investigated by EPA before any conductivity criterion is adopted on a more national basis.

Traditionally, EPA methods for derivation of protective aquatic life criteria are based on the existence of consistent (i.e., unimodally decreasing, or negative) stressor-response relationships. In the case of the SC criteria, if conductivity were indeed the primary response driver, a consistent stressor-response should be apparent, where each of the taxa would respond negatively (e.g., decreased probability of occurrence) to increased conductivity. However, when evaluating taxa response profiles from Ecoregions 69 and 70, only about 40% of taxa show this negative response. In contrast, 20% actually show a positive response to increased SC, 20% show a negative response at both low and high SC, and 15% show little to no response. There is simply no way to reconcile these widely conflicting stressor-responses into a single SC criteria concentration that would actually be protective of 95% of all macroinvertebrate taxa expected to be present at a site.

Conductivity tolerance (or perhaps it's actually "preference"), as a surrogate summary metric for total ionic content of water, is evidently more akin to temperature tolerance/preference than to that of traditional toxic chemicals such as metals or pesticides. Just as there are taxa (*e.g.*, specific species of fishes) that prefer warm waters and those that prefer cold waters, there are invertebrate taxa that appear to prefer low conductivity and those that appear to prefer higher conductivity. We do not agree that conductivity is necessarily the direct causative agent for the presence and absence of taxa in any particular location in the datasets used by EPA. Ionic tolerance may play one role in establishing which species inhabit a site, but other chemical, physical, and biological factors discussed in our review likely have equally important roles.

EPA believes the various genera do not need to exhibit the same responses to conductivity for the calculation of the HC_{05}, and this is evident when looking at the top ten "most sensitive" taxa (i.e., those with the lowest XC_{95} values) across selected ecoregions. Using data from seven ecoregions selected from the list of 24 ecoregions used in the EPA's development of the Background to Criteria Regression approach, the top ten most sensitive taxa from each ecoregion were identified and capture probability/response-curves developed. There was little overlap in the "stressor response profiles" for these ten genera across ecoregions, which further highlights contradictions between assumed physiological sensitivities to conductivity across ecoregions. The resulting differences in the genus' extirpation coefficients (XC95) across multiple ecoregions provide further evidence that conductivity is likely not the causative factor in the presence/absence of these genera.

For the EPA Draft Conductivity Criteria, EPA correctly points out that the data do not generally exist to directly evaluate what SC level might protect aquatic life from acutely toxic (i.e., short-term) exposures. Instead, EPA suggests derivation of a Criterion Maximum Exposure Concentration (CMEC) which is the 90th percentile of SC observations at site with water chemistry conditions such that they meet the CCC. While this 90th percentile-based CMEC may indeed represent a less stringent SC criterion than the CCC, this is a largely arbitrary percentile selection that has little direct relationship to a SC concentration that would protect from acute exposures to nine taxa at relevant times of year. Therefore, we suggest that until such data can be made available, EPA should not propose a method for derivation of CMECs for SC.

We agree with EPA that an evaluation of causality is critically important in any scientific endeavor, particularly when proposing the use of a field-based method using macroinvertebrate community structure data that is subject to a potentially high degree of confounding. For the EPA Draft Conductivity Criteria, however, no new causality analysis has been conducted. Rather, EPA only choses to suggest that "it is good practice" to further evaluate the performance of the XCD model. We agree, but are very concerned that EPA has not chosen to conduct such an analysis here.

We also reviewed Appendix G, which discusses the extent to which EPA feels the ecoregional criteria for benthic macroinvertebrates are protective of fish. While EPA notes that the observed, and presumed, tolerance to conductivity may be due to the probability of capturing and enumerating fish, additional analysis is needed. This describes one of the main issues with using this method on fish. The problem formulation section earlier in the EPA Draft Conductivity Criteria suggests that indirect effects to fish, such as prey (benthic invertebrate) abundance, are possible. Yet, Appendix G does not provide any further examination on this issue, making this a critical but untested statement by EPA.

In summary, there are a number of significant weaknesses in the approach used by EPA to develop conductivity criteria on a national scale that preclude its adoption. Setting criteria with this approach would not be protective of the overall aquatic invertebrate community.

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1. Introduction

GEI Consultants, Inc. (GEI) toxicologists, water quality specialists, and regulatory strategists are recognized experts in water quality effects on aquatic life. We frequently provide expert testimony and support for regulatory water quality hearings, environmental assessments, use-attainability analyses, and ambient water quality standards development. Our personnel have served as invited experts for tiered aquatic life use evaluations, provided peer review and independent development of multiple aquatic life criteria using U.S. Environmental Protection Agency (EPA) methods, and provided technical review of mountaintop mining and other land use issues—including the original EPA Conductivity Benchmark for the National Mining Association, and participated in development of a structured framework for stressor analyses for the Water Environment Research Foundation. We have been involved with water quality and aquatic life issues in waters throughout the U.S., including the collection of considerable water quality and biological data from a wide variety of waterbodies and development of site-specific standards for many metals and metalloids. As such, we can provide a unique perspective on EPA's draft criteria document and respectfully submit the following comments.

This report summarizes GEI's technical review of EPA's public review draft of Field-Based Methods for Developing Aquatic Life Criteria for Specific Conductivity (EPA 2016; hereafter referred to as "EPA Draft Conductivity Criteria"). This review is being conducted on behalf of the National Mining Association (NMA) in support of their comments being submitted as part of Docket EPA-HQ-OW-2016-0353.

The EPA Draft Conductivity Criteria document describes field-based methods for derivation of aquatic life protection criteria in flowing waters for dissolved inorganic ions, measured collectively as specific conductivity (SC). This method relies heavily on documents such as the EPA's Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses (Stephan et al. 1985, hereafter referred to as the "1985 Guidelines") and A Field-Based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams (EPA 2011, hereafter referred to as the "EPA Benchmark Report"). EPA's Benchmark Report used field data from stream benthic macroinvertebrate surveys to derive an aquatic life benchmark for SC that, according to the EPA, may be applied to waters in the central Appalachian Region that are dominated by salts of calcium (Ca^{2+}), magnesium (Mg^{2+}), sulfate (SO_4^{2-}) and bicarbonate (HCO_3^-) at circumneutral to mildly alkaline pH. While the EPA states that this conductivity benchmark was derived using a method modeled after the 1985 Guidelines, the use of field benthic macroinvertebrate community data as opposed to individual species laboratory toxicity data represents a significant technical departure from this guidance.

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The EPA Draft Conductivity Criteria builds upon methods described in the EPA Benchmark Report to estimate a protective maximum exposure concentration, duration, and frequency for SC on a more national basis. As such, the field-based approach includes methods for assessing the application of field-based criteria developed in one geographic region to another. Such methods are being proposed to develop SC criteria on the scale of Level III ecoregions (Omernik 1987 and 1995); however, EPA suggests that in some cases it may be appropriate to develop criteria on a different scale due to significant variation in background SC levels across an ecoregion. The method is intended to protect 95% of resident macroinvertebrate genera present based on field data from within the ecoregion.

On behalf of NMA, GEI previously conducted detailed technical reviews of both the draft and final EPA Benchmark Reports (GEI 2010 and 2012). It is important to reinforce the issues and concerns raised in our prior reviews, as they are directly relevant to the scientific basis for this draft conductivity criteria document. Based on our reviews of both the draft and final aquatic life benchmark for conductivity, the data and assumptions used by the EPA to develop the benchmark and the subsequently proposed methods for deriving a field-based aquatic life criteria are inherently flawed. Simply put, EPAs proposed derivation of field-based SC criteria does not represent a plausible and reliable means of truly ensuring protection for 95% of the full aquatic community.

This report presents GEI's technical evaluation of the EPA Draft Conductivity Criteria we provide comments beginning with the problem formulation (Section 2), including a discussion of the nature of and measures of effects proposed by EPA. We then discuss in Section 3 EPAs analysis plan which represents the core quantitative elements of EPAs proposed SC criteria. In this section, we include a discussion of how these criteria compare to EPA's 1985 Guidelines for development of ambient aquatic life criteria, a discussion of our concerns with the extirpation coefficient distribution (XCD) methodology used to derive the Criterion Continuous Concentration (CCC), concerns with development of EPA's background-criteria estimation model, and the lack of discussion of causality. We also provide a brief review of Appendix G which proposes fish as an alternative assessment endpoint.

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2. Comments on Problem Formulation

As is becoming standard practice for new or revised aquatic life criteria documents, the EPA Draft Conductivity Criteria is built upon a risk assessment-based framework (EPA 1992), the core elements of which are a Problem Formulation and Analysis Plan. Perhaps the most critical phase of a properly conducted ecological risk assessment is the Problem Formulation which sets the stage for what problem is being addressed by the assessment, identification of the stressor in question, and how to measure the adverse effects in an ecologically meaningful way. From there, the Analysis Plan describes the numeric methods needed to achieve the goals and endpoints set forth in the Problem Formulation. This is a solid foundation upon which to build aquatic life criteria with which we support.

The Problem Formulation phase of any ecological risk evaluation is the critical first planning step that "establishes the goals, breadth, and focus of the assessment" (EPA 1992). As a result, no matter how thorough or rigorous the Analysis Plan may appear to be, any flaws in the Problem Formulation can significantly call into question the entire assessment. In the case of EPA's Draft Conductivity Criteria, it is our opinion that the assessment and measurement endpoints in the XCD method contain fundamental flaws in reasoning that do not support use of the species sensitivity distribution-based (SSD-based) analytical framework set forth in the 1985 Guidelines, as discussed in Section 3.1 (Stephan et al. 1985). Specifically, the hazard concentration 5th percentile (HC_{05}) values for SC derived from distributions of extirpation coefficient 95th percentile (XC_{95}) values do not represent protection of all but 5% of even macroinvertebrate genera from extirpation. Instead, the XCD method calculates a lower percentile of genera (ranked by their XC_{95} distributions) that is closest to the background SC of minimally affected or undeveloped macroinvertebrate assemblages.

A central theme for our concerns with EPAs XCD method is that we are not convinced that the XC_{95} values represent the true sensitivities of macroinvertebrate genera to SC. In large part, this is because of the disparate kinds of SC "response" curves observed between genera (GEI 2010 and 2012); and indeed wildly different XC_{95} values even within a genus (see Section 3.2.2.2 below). Even if we were to accept that the XC_{95} for each genus represents a reliable representation of the physiological sensitivity of organisms within that genus to SC, many genera with higher XC_{95} values represent likely preferences for higher SC values, not simply tolerance. As such, these organisms would naturally not be expected to be observed at lower SC values near the criterion concentration (Section 3.2.2.3). As discussed later in this review, the variable response curves should be interpreted as representing the variable "preferences" of organisms for different ranges of conductivity – not differential sensitivity or physiological "tolerance" assumed by EPA. In broader terms, these different "response" curves may not at all represent physiological tolerance to SC as a discrete

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stressor, but rather the culmination of the many ecological factors shaping which taxa will or will not be observed in a particular sample.

Therefore, it is essentially impossible for the XCD method to develop criteria concentrations that are protective of 95% of species as is the overall protection goal stated in the 1985 Guidelines (Stephan et al. 1985). Given that this represents a significant departure from how the 1985 Guidelines are constructed (see Section 3.1), the EPA Draft Conductivity Criteria does not adequately defend how EPA's 95% protection goals can be achieved. This represents a fundamental flaw in the Problem Formulation portion of the proposed SC criteria methods presented therein.

Other comments regarding elements of the Problem Formulation are presented in the following subsections.

2.1 Nature of the Effect

In this section, EPA develops the argument that "the background SC of an ecoregion is strongly associated with a predictable extirpation of 5% of species or genera." While EPA correctly points out that it is inappropriate to set SC criteria below the natural background of an ecoregion, the XCD method effectively sets criteria concentrations very close to (i.e., just above) that natural SC background of the ecoregion. EPA correctly points out that "species do not occur where the SC is lower or higher than their SC tolerance" (pg. 2-14), and goes on in this section to use ecological niche theory to explain how physiological tolerances to SC can help determine where an organism is expected (or most likely) to be observed. However, EPA appears to only be interested in organisms with realized niches in which their presumed "optimum" condition is near/equal to its lower tolerance limit (e.g., as exhibited by the mayfly genus *Ephemerella*). Little to no explanation is given to what this means for organisms for which SC concentrations near EPA's proposed criteria would be significantly lower than their SC "optimum."

This, in effect, means that the nature of the ecological effect to be addressed by these SC criteria is the smallest detectable difference in presence/absence patterns of genera with XC_{95} values close to the HC_{05}. Again, this does not represent a SC concentration that would be associated with protection of 95% of the macroinvertebrate (or even all animal) genera; indeed, no such single SC concentration can do so (Section 3.2.2.3). Setting an ecological effect to be so similar to natural background is not, in our opinion, consistent with the broad ecological integrity protection goals of the Clean Water Act (EPA 1991). At the very least, EPA must better explain how the nature of the effect is consistent EPA's well-established protection goals for the entire aquatic community.

2.2 Assessment Endpoints and Measures of Effect

The EPA Draft Conductivity Criteria are based on an assessment endpoint that is largely based on macroinvertebrate assemblages (the "entity" to be protected) that provide multiple ecosystem services. EPA discussed the importance of this entity at some length, but does not provide much, if any, discussion regarding the "attribute" to be protected by the SC criteria. If one assumes the attribute EPA wishes to protect is extirpation at the genus level, they do not justify why this attribute is superior over other possible attributes such as macroinvertebrate diversity and abundance (which are cited as examples of ecosystem services on pg. 2-21 of the EPA Draft Conductivity Criteria). Indeed, macroinvertebrate community diversity is an extremely well-established means of evaluating community structure that has been widely used in the development of numeric multimetric indices for environmental protection purposes (Barbour et al. 1999; Bukantis 1998; Jessup 2010; Jessup and Gerritsen 2002; Royer and Mebane 2002).

Therefore, EPA should at a minimum explain why such a common metric was not selected in lieu of what was selected for the EPA Draft Conductivity Criteria. We are concerned over this obvious omission because, as illustrated in Section 2.2.1 below, relationships between SC and macroinvertebrate diversity can be extremely different than the distribution of XC_{95} values might suggest. Another equally plausible ecological "attribute" EPA could have considered would the functional feeding groups represented by different macroinvertebrate genera; this is explored in Section 2.2.2 below.

2.2.1 *Macroinvertebrate Diversity*

The West Virginia Department of Environmental Protection (WVDEP) uses a multi-metric diversity index called the West Virginia Stream Condition Index (WVSCI; EPA 2000) which was developed specifically for use in interpreting compliance with their state narrative water quality standards which include "No significant adverse impact to the chemical, physical, hydrologic, or biological components of aquatic ecosystems shall be allowed" (WVDEP 2010; Appendix B). The threshold WVSCI score for inclusion of a stream on the 303(d) impairment list is 60.6, and a WVSCII score of 68 represents acceptable ecological integrity based on the 5th percentile of available reference site scores.

The protection goals inherent to this narrative standard would appear to be equally plausible as assessment endpoints that could be used to support these SC criteria. However, WVDEP's guidance for interpretation of this narrative water quality standard clearly shows that the relationship of WVSCI score vs. conductivity is highly variable at conductivity values near the CCCs derived for ecoregions 69 and 70 of 310 µS/cm and 340 µS/cm SC, respectively. As illustrated in the figure (Figure 2-1) below, a very high proportion of streams with less than a WVSCI score of 60.6 or 68 would occur at SC concentrations at or below the CCCs EPA would propose for these regions.

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This points another fundamental flaw in EPA's method. The data being used across the ecoregions were from sampling efforts designed to evaluate overall macroinvertebrate community health. As such, they are generally comprised of single samples across multiple sites in ecoregions, with laboratory processing protocols to minimize effort (i.e., often fixed-count subsampling), and development of metrics to discriminate differences in community structure between background and perturbed sites (including multiple stressors, like water quality, habitat loss, flow modifications, etc.). The sampling was not designed, nor ever intended, to capture ALL invertebrate taxa at a location. As such, it is not appropriate to use such data to attempt to prove "presence" or "absence" at any particular site – meaning any estimation of "extirpation" is meaningless.

When the data are used correctly, in the context of overall invertebrate community health, it's clear that the relationship to conductivity is less clear than the EPA approach would indicate. This is discussed further in other sections below.

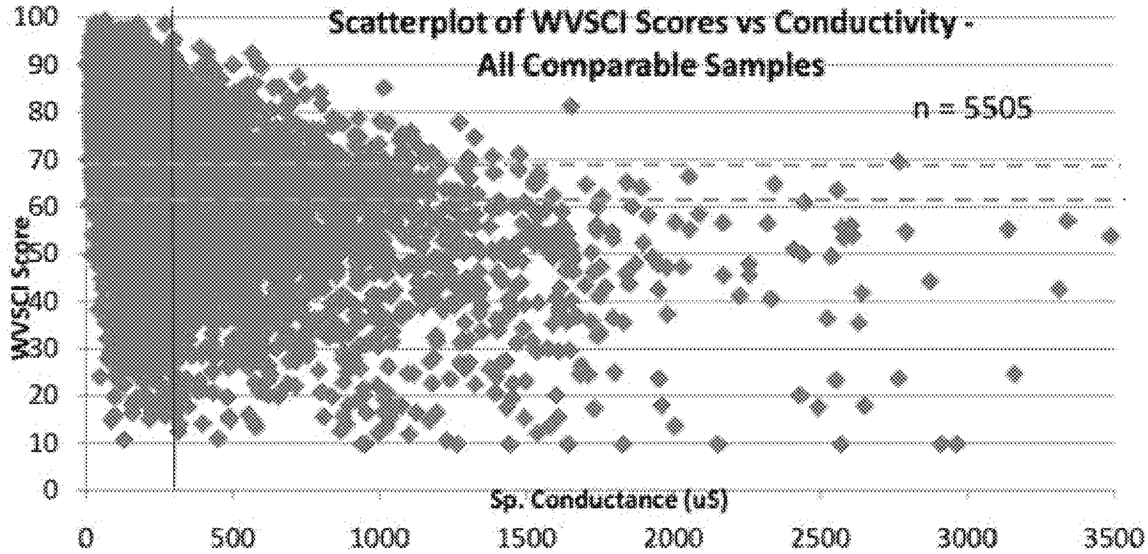

Figure 2-1: Plot of West Virginia Stream Condition Index (WVSCI) scores as a function of conductivity (from WVDEP 2010). Red line indicates approximate CCCs for Ecoregions 69 and 70. Orange line indicates 303(d) listing threshold, and green line indicates acceptable ecological integrity value.

2.2.2 Functional Feeding Groups

Although the benthic macroinvertebrate community may differ across ranges of conductivity, as discussed in Section 3.2.2.3, the ecological functionality of these different communities are retained throughout the relevant range. A biological community can be considered ecologically functional if all key functional feeding groups (FFGs) (*e.g.*, carnivores, omnivores, grazers, etc.) are present (Cummins et al., 2005). GEI conducted an analysis (GEI 2010) to evaluate whether changes in FFG balance occurs across the range of conductivity. For a sequence of conductivity values ranging from 100 to 10,000 µS/cm, we determined the FFG composition for taxa that would be present above each value using the 163 genera that were used in the EPA Benchmark Document. For example, for the conductivity value of 400 µS/cm, all taxa with an XC_{95} value less than 400 µS/cm were removed from the data set (as though extirpated). We then determined the relative proportion of each functional feeding group in the remaining taxa. We concluded that the proportional abundance of FFGs within the regional pool of taxa was nearly constant through approximately 2,500 µS/cm. Omnivores, which represent less than 2% of taxa in most locations, became effectively absent above 5,000 µS/cm. (Figure 2-2). The first major FFG to become absent with increasing conductivity, was the filter-collectors, but this occurred only when conductivity values exceeded 10,000 µS/cm.

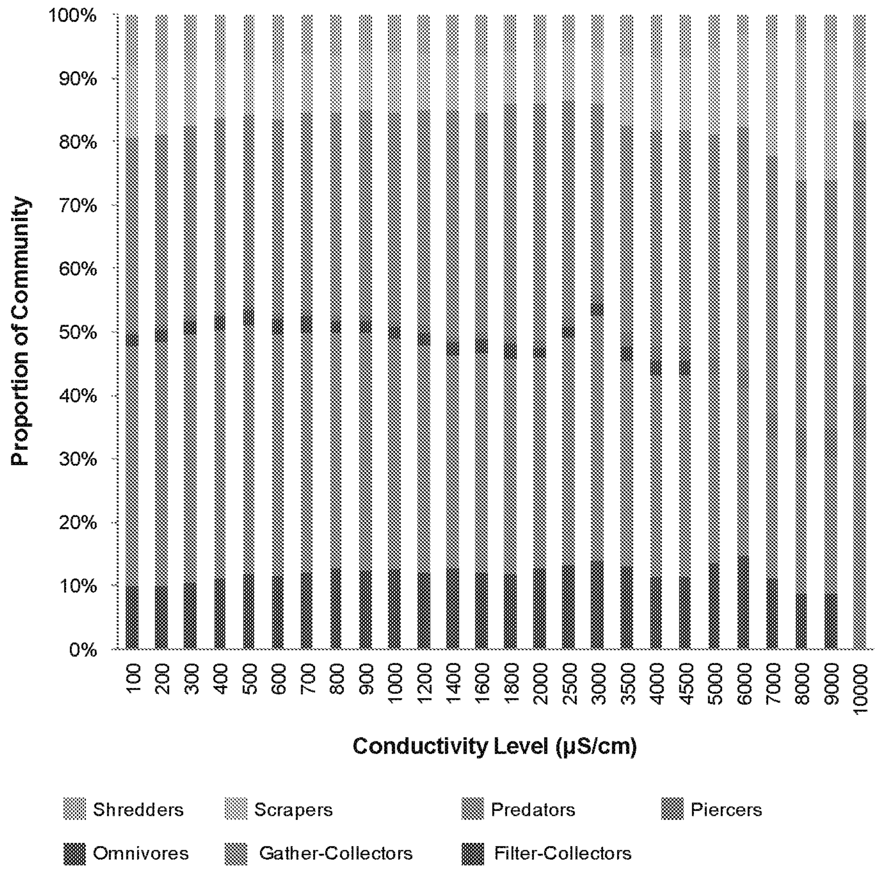

Figure 2-2: Proportion of generic richness by functional feeding group within the regional taxa pool at varying conductivity levels. All genera with an XC_{95} less than the conductivity level are considered to be unavailable. Note that the x-axis is not evenly divided.

2.2.3 Measures of Effect

The measures of effect in Section 2.6.2 of the EPA Draft Conductivity Criteria are based on the 5th percentile (HC_{05}) of the distribution of XC_{95} values. EPA recognizes that not all species within a macroinvertebrate genus will necessarily exhibit the same physiological sensitivity to SC (footnote 2, page 2-22), and even that specific genera and/or their resulting XC_{95} values may only serve as indirect "surrogates" of actual sensitivity in field populations (much like SSDs for more traditional criteria). However, as we show in Section 3.2.3.1, differences in XC_{95} values for the *same* taxa in different ecoregion show substantial variability which stretches the credibility of these assumptions. At the very least, this variability represents an untested assumption upon which their proposed SC criteria are based.

2.3 Selection of a Field-Based Method

Given our concerns noted above, it is premature for EPA to use a field-based method for derivation of SC criteria using the methods described in the EPA Draft Conductivity Criteria. With respect to the Problem Formulation section of these draft criteria, we note significant concerns with how the 95% protection goals of aquatic life protection criteria can possibly supported by the XCD method, and that the assessment endpoints and measures of effect would benefit from an analysis of other alternatives that may achieve the same goals. Finally, as we have noted in previous review of the conductivity benchmark (GEI 2010, and 2012), we also do not agree with all aspects of EPA's causality analysis suggesting that the many confounding factors which control the presence vs. absence of macroinvertebrate genera have been addressed. And as noted in Section 3.2.3.1 below, EPA fails to heed their own advice to conduct new causality analyses for ecoregions outside of 69 and 70 for which their original analysis was done. Therefore, we consider the issue of causality to be as yet unresolved.

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3. Comments on Analysis Plan

The Analysis Plan section of the EPA Draft Conductivity Criteria describes the numeric methods for derivation of the Criterion Continuous Concentration (CCC, often referred to as "chronic criteria") and Criterion Maximum Exposure Concentration (CMEC, which presumably is equivalent to what is often referred to as "acute criteria) for SC. These methods are to be used in ecoregions in which sufficient macroinvertebrate and SC data are available. In regions for which sufficient paired data are not available, methods are presented to estimate SC criteria for "new" areas using either background matching or the background-to-criteria regression method. In the sections below, we summarize our primary technical concerns and comments regarding these numeric methods for derivation of SC criteria.

3.1 General Comparison to 1985 Guidelines

While the EPA states that this Draft Conductivity Criteria methodology is modeled after the 1985 Guidelines, the use of field benthic macroinvertebrate community data as opposed to individual species laboratory toxicity data represents a significant technical departure from this guidance. As detailed in Stephan et al. (1985), the 1985 Guidelines provide a very structured approach for developing water quality criteria for the protection of aquatic life. The 1985 Guidelines method relies on data collected by conducting laboratory toxicity tests, because as stated "…it is not feasible to determine national criteria by conducting such field tests…" (Stephan et al. 1985).

Following the 1985 guidelines, a literature review is conducted and the available acute and chronic data are evaluated, as well as all test conditions under strictly controlled conditions. There are specific test acceptability criteria which must be considered before a toxicity study is considered valid and acceptable for criteria development. Some of these requirements include: use of appropriate control and dilution water, acceptable control survival, technical grade test material, whether or not species were fed during the test, test renewal type and frequency, age of organisms at test initiation, and test duration. If the specific criteria for each study is not met, the data should not be used for criteria development. Field-based criteria differ significantly from the recommendations in the 1985 Guidelines as none of these test acceptability conditions can be determined or controlled.

One example of how these acceptability conditions could affect the field based criteria is when you evaluate the use of rare taxa in the EPA Criteria Document. As we noted in our review of the EPA Benchmark Document (GEI 2010 and 2012), EPA could have controlled for the effects of rare taxa by including in their SSD only those genera that had a high capture probability in the reference sites. In discussing criteria development, the 1985 Guidelines (Stephan et al. 1985) stated that "data should usually be rejected if they are from… tests in which too many organisms in the control treatment died or showed signs of stress of

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disease...." EPA (2011) considered a 1% collection probability in reference sites to be acceptable, but a 1% survival rate in a laboratory test would clearly not be acceptable. Use of taxa with low capture probability should be excluded if the 1985 Guidelines were more closely followed.

The method recommended in the EPA Draft Criteria document, which was also used in EPA (2011) has the appearance of being based on the 1985 Guidelines primarily because it used the 5th percentile of an SSD as the basis for mathematical derivation of the criteria value. As we have noted in our previous reviews of the EPA Benchmark Report (GEI 2010 and 2012), an SSD represents the response of individual taxa to a toxicant as a distribution with respect to exposure and is a widely used statistical approach for derivation of regulatory aquatic life criteria worldwide (Posthuma et al. 2002, Stephan et al. 1985). It is implicitly assumed that if the exposure level of a stressor or pollutant is kept below the 5th percentile of the SSD, at least 95% of tested aquatic species (or their surrogates) composing the distribution will be protected. In this respect, EPA's conductivity data analysis nominally follows the standard methodology in aggregating species responses to SC to genera and using interpolation to estimate the chosen percentile.

However, the method described in the draft document and in EPA (2011) differs significantly from the 1985 Guidelines in that the points in the SSDs consist of extirpation coefficients (XCs) rather than median lethal concentrations (LC_{50}s) or chronic response values (e.g., EC_{20}s) from exposure to a single chemical in controlled laboratory studies. The XC is defined by EPA as the level of exposure above which a genus is "effectively absent" from waterbodies in a region—i.e., the 95th percentile of the distribution of a calculated "probability of occurrence" of a genus with respect to conductivity, or XC_{95} (EPA 2003 and 2011). The EPA Draft Conductivity Criteria goes on to derive the CCC on the basis of the 5th percentile (i.e., the hazard concentration 5th percentile; HC_{05}) of all of the available XC_{95} data for a particular ecoregion.

Our primary concern is that this is a fundamentally incorrect application of an SSD approach. In particular, and as we discussed in Section 2 of this report, the resulting CCC derived using this method *does not* represent a SC concentration that would protect 95% of the species with respect to SC. Rather, the CCC identifies the lowest possible SC concentration higher than undisturbed "background" SC that is associated with subtle changes in the presence/absence of select macroinvertebrate genera. This is a fundamentally inappropriate interpretation of the 1985 Guidelines and its goal to derive aquatic life protection criteria that are protective of <u>all</u> but 5% of the most sensitive species to a pollutant or stressor.

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3.2 Concerns Regarding Derivation of the CCC

3.2.1 Establishing the Data Set

One significant problem specific to this field-based approach is that the data that will be used to calculate SC criteria are likely not going to have been collected using an experimental design appropriate for EPA's usage of the data.

Although as we noted above in our discussion of the West Virginia multimetric index, the methods used to collect and enumerate macroinvertebrates are appropriate for general comparisons of overall community health using standard metrics (e.g., taxonomic diversity or abundance, e.g., EPA 2000), they are not appropriate for making inferences about the presence or absence of any specific taxa, particularly rare taxa. The use of data collected with a study design inappropriate for the end use of the data leads to uncertainty and inaccurate results.

For example, GEI conducted an analysis of subsampling that is a required step in the field sampling method and model assumptions used in EPA 2011 to determine how much these factors affected the field-based conductivity benchmark (Roark et al. 2013; Figure 3-1). The conclusions reached in that evaluation apply to the draft EPA SC document as well, since the recommended methods are similar: 1) subsampling does affect the HC_{05} calculation – larger subsamples would result in higher HC_{05} values; 2) the number of bins used and weighting of the cumulative distribution function for conductivity also affects the HC_{05}; 3) the modeling decision to only use genera that occurred in ≥ 25 samples and at least one reference location reduced the number of taxa included in the derivation of the benchmark from about 500 taxa to only 163, which has a significant effect on the HC_{05}.

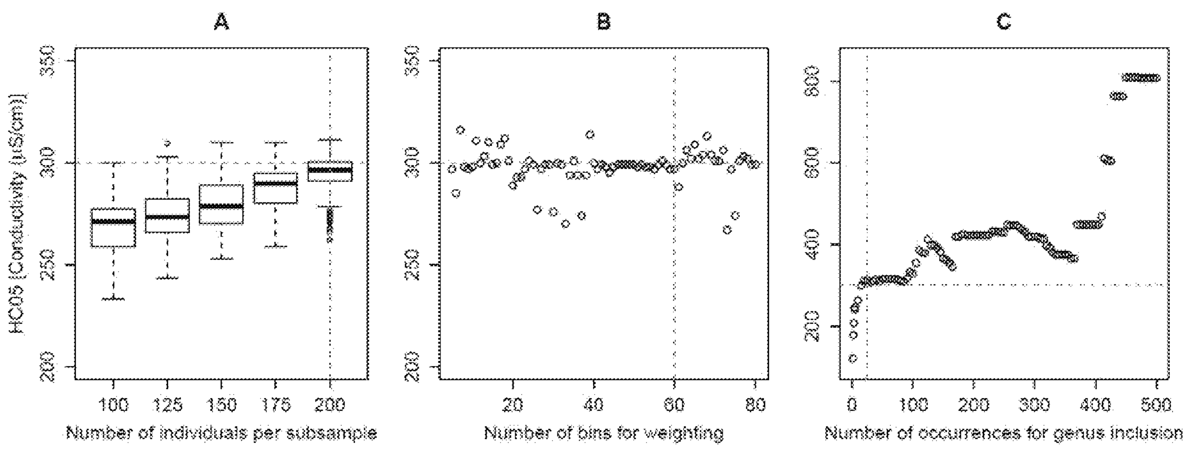

Figure 3-1: Effect of subsampling (A), binning and weighting (B), and number of stations required for inclusion of genera (C) on the final conductivity benchmark value. Vertical and horizontal dashed lines in each panel mark the x-axis value elected, and the conductivity benchmark proposed, respectively, as per Cormier et al. (2013) and USEPA (2011). In panel A, n=250 per group; dark bars represent median; boxes bound 1st and 3rd quartiles; whiskers extend to the most distant point with 1.5x the height of the box. (From Roark et al. 2013)

There is another concern with developing extirpation coefficient and species sensitivity distributions using field based count data. Specifically, the relative abundance of any one genus is not factored into the presence/absence benchmark approach. Thus, single individuals are afforded the same weighting as multiple individuals in the same sample. This is tenuous when extirpation of a genus is largely pinned on the presence or absence of a single individual. As noted above, the benthic invertebrate processing approach that utilizes subsampling of the entire sample can greatly affect the outcome of distributions. In the case of data from Ecoregion 50 in northeastern Minnesota, for the 20 most sensitive genera, single individuals represented from 7% to 63% of their respective occurrences with an average of *40% of the data being used to develop extirpation coefficients and species sensitivity distributions based on genera represented by a single organism in a sample* (Cormier 2016). And as noted below, those presumptively "sensitive" genera exhibited little relation to conductivity. With such a significant portion of the data comprised of single individuals, sampling and laboratory processing bias is likely significantly influencing the outcome of the use of presence/absence data.

3.2.2 Use of XCD Method

As has been noted in our previous reviews of the EPA Benchmark Report (GEI 2010 and 2012) it is important to recognize that the XC_{95} is not the same as an effect concentration that would typically be derived from a laboratory toxicity test (e.g., LC $_{50}$ for acute or EC_{20} for chronic or equivalent). The mathematical construct behind the XC_{95} is quite different from that of the EC_{20}. The XC_{95} is not equivalent to a concentration at which 95% of the individuals of a genus would demonstrate an adverse effect in a controlled laboratory toxicity test with a single toxicant, nor is it equivalent to a concentration at which there is a 95% probability of absence from a field location. EPA (2011) used an empirical cumulative distribution function (ECDF) to determine the XC_{95} for each of the 163 selected genera in the EPA Benchmark Report. Simply described, the conductivity values for each sample in which a genus is present are ranked from low to high, and the XC_{95} is determined as, "the conductivity value below which 95% of the observations [in fixed-count subsamples] of the genus occur and above which only 5% occur" (EPA 2011). While this is an accurate description of the value represented by the 95^{th} percentile of the ECDF, neither the EPA Draft Conductivity Criteria nor the EPA Benchmark Report (EPA 2011) present convincing evidence that this is an appropriate metric to quantify extirpation or to use in an SSD.

The actual relationship of the XC_{95} to the likelihood of presence or absence is unclear. For example, for any taxon, additional samples with low conductivity values well below any proposed conductivity effect concentration (e.g., 100 µs/cm) would not alter the calculated XC_{95}, because only samples with the taxon present are used in the ECDF (except for the calculation of the weights), yet the existence of additional sites where the taxon was absent should be reflected as a difference in the probability of detection or of the inference of extirpation. Yet, due to the ECDF-based estimate, additional absence data do not change the XC_{95}. In contrast, within the data set used to estimate extirpation for each taxon, each

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instance that a genus is incorrectly inferred to be absent based on a fixed-count subsample, the XC_{95} is incrementally reduced, which also reduces the HC_{05}. The net effect of all incorrect inferences of absence across all genera may significantly bias the HC_{05} value downward, whereas there is no error (i.e., false presence) that affects a move of the HC_{05} in the positive direction.

3.2.2.1 XC_{95} Inconsistencies

One of the major conceptual issues with the XCD-based CCC derivation method is the assumption that the absence of any benthic invertebrate genera is solely due to a conductivity level that exceeds the *physiological limits* of that genus. However, as we have noted in our prior comments to the underlying EPA Benchmark Report (GEI 2010 and 2012; Roark et al. 2013) and in Section 3.2.3.1 of this document, there are many factors that contribute to the absence of benthic invertebrates from a stream sample, such as interspecific competition, habitat suitability, other stressors (i.e., metals and sedimentation), or simply sampling and sample processing bias, which were not addressed in the document.

However, if the premise is true that absence is due to conductivity's effects on a genus' physiological limits, then any particular genus' XC_{95} should be relatively consistent across ecoregions. As a demonstration of how the XC_{95} can vary across ecoregions, GEI recently reviewed EPA's white paper and corresponding data regarding the development of a conductivity benchmark for Ecoregion 50 (Northern Lakes and Forest) in Minnesota (Cormier 2016; also Appendix D of the EPA Draft Conductivity Criteria). The XC_{95}s derived from the data set from Ecoregions 69 & 70 in West Virginia (EPA 2011), which was originally used to develop the EPA conductivity benchmark and XC_{95} methodology described in the EPA Conductivity Criteria document, were compared to the XC_{95}s for Ecoregion 50 (Minnesota) to provide some insight to the presumed physiological limits and/or conflicting limits previously identified for some taxa.

When considering the entire taxa list, most genera rankings greatly changed between ecoregions, putting the concept of conductivity (hence "physiological limits") as the prime reason for presence/absence into significant doubt. In fact, when considering the 20 most sensitive taxa based on their XC_{95} ranking for each ecoregion (i.e., 50 vs. 69 &70), there are only two genera – *Leptophlebia* and *Epeorus* – that are common to both lists, strongly indicating there is not a universally expressed relationship between presence of genera and conductivity.

There were also noticeable differences in extirpation coefficients (Figure 3-2) for genera that were common to both datasets, suggesting that any conclusion of the cause for presence/absence is not actually tied to physiological limits or any purported relationship to "conductivity." Rather, it is simply an artifact of the EPA Conductivity Criteria methodology, or the many other ecological factors other than SC that affect the frequency of occurrence (or absence) of invertebrates.

As case in point, the most sensitive genus found in Ecoregions 69 & 70 was the genus *Lepidostoma* (XC_{95} = 121 µS/cm). However, in Ecoregion 50, the genus *Lepidostoma* was actually one of the least sensitive genera (XC_{95} = 1,527 µS/cm). The difference between these two extirpation coefficients represents a positive *1,162% difference* (Figure 3-2, left panel Rank 1, right panel Rank 121). Even if the SC sensitivity of individual species within the genus may be expected to differ (e.g., Footnote 2; EPA 2016), it is difficult to imagine that species within the same genus would exhibit such a large magnitude of XC_{95}s values across two different ecoregions if conductivity is the primary cause of presence/absence of the genus.

Similarly, the third most sensitive genus in Ecoregion 50 – *Rhyacophila* (XC_{95} = 254 µS/cm) – was actually fairly tolerant of conductivity (XC_{95} >1,890 µS/cm) in Ecoregions 69 and 70; a negative 87% difference (Figure 3-2, right panel Rank 3).

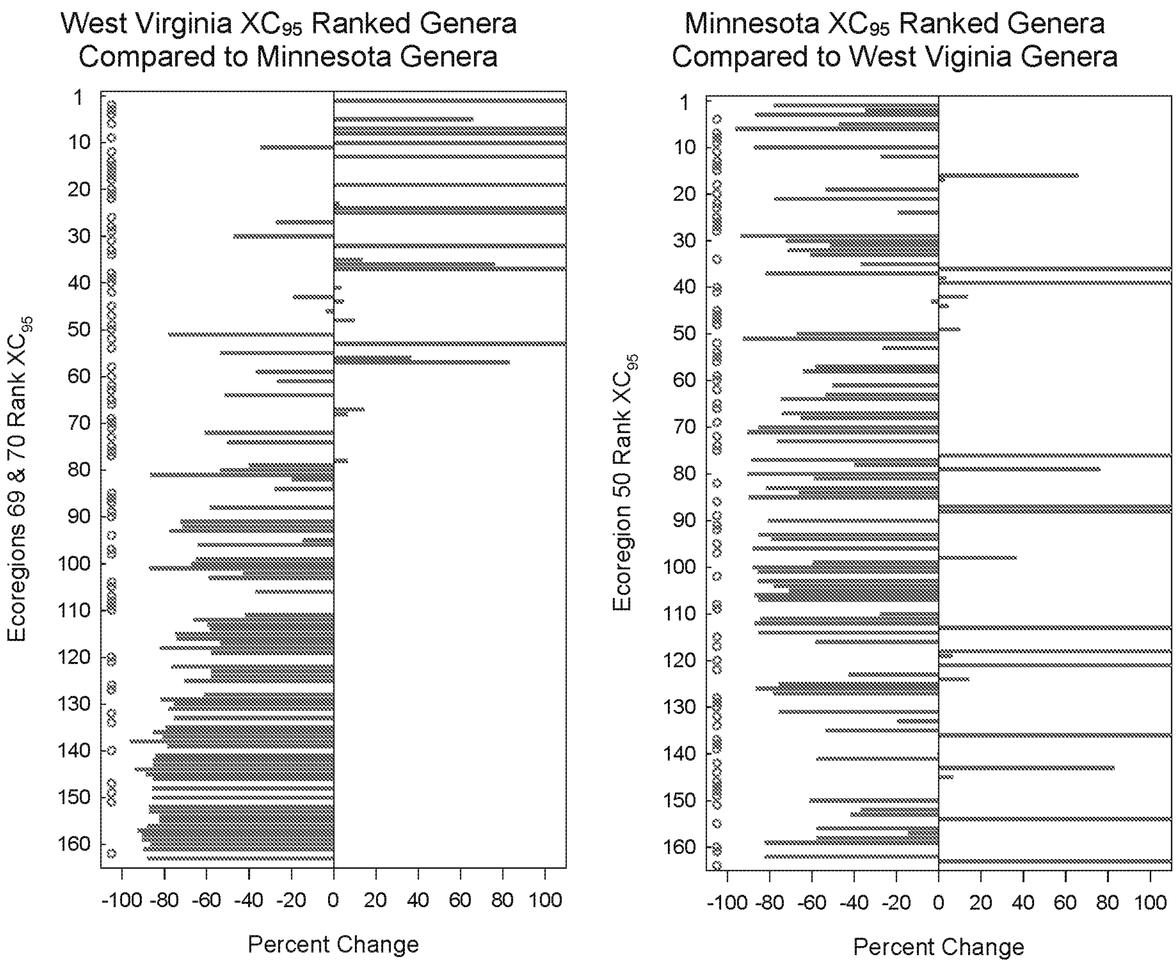

Figure 3-2: The percent change in extirpation coefficients for common genera from Ecoregions 69 & 70 compared to Ecoregion 50. Rank 1 is the smallest XC_{95} value for each ecoregion. Open circles denote unique genera to each ecoregion. Positive percent change values are truncated at 110%, because the maximum percent change was 1,162%. Percent Change = [(MN XC_{95} - WV XC_{95}) / WV XC_{95}] × 100.

These substantial differences in XC_{95} values within a genus across ecoregions highlight our concern that genera characterized as being sensitive to conductivity in one ecoregion may in fact not be sensitive to conductivity in another ecoregion. Such large variability in the purported physiological limits of "sensitive" genera raises considerable uncertainty regarding the applicability of conductivity as a determinant of the frequency of occurrence (or absence/extirpation) of a given taxa. This is an extremely important issue that puts into question the entire approach used in EPA's Benchmark Report and needs to be fully investigated by EPA before any conductivity "criterion" is adopted on a more national basis.

While arguments have been presented that differing extirpation coefficients for the same genus would be expected because the physiological limits of individual species within a genus may be different (EPA 2016; Footnote 2), that is an untested hypothesis and should be a concern with how a national level criterion approach is applied to site-specific water quality conditions.

However, we do have data from species within the genus *Boyeria* which exemplify this issue from the Ecoregion 50 and 69 & 70 data sets. All three ecoregions are represented by two common species *Boyeria grafiana* and *Boyeria vinosa* as well as an unidentified species. Given the commonality of the taxa at the species level it would be expected that extirpation coefficients would be similar for species within the genus – yet there was a difference of over 7,000 µS/cm in their XC_{95} values, again significantly challenging the premise that conductivity is the primary factor that affects the distribution of this genus.

3.2.2.2 Taxonomic Responses to Conductivity – Preference or Tolerance

As we've noted in prior reviews of the EPA Benchmark Document (GEI 2010 and 2012), and worth repeating here, one of the primary underlying principles governing the use of an SSD to derive biological thresholds is that all of the organisms represented in the distribution exhibit a negative response to an increase in the stressor in question (Posthuma et al. 2002, Stephan et al. 1985). As we pointed out in our original reviews (GEI 2010 and 2012), three types of stressor-responses are recognized by EPA (2011):

- decreasing probability of observation with increasing conductivity,
- increasing probability of observation with increasing conductivity, and
- optimal or "bell-curve" probability of observation with increasing conductivity.

In addition to these three stressor-response profiles, a fourth type not recognized by EPA—but frequently observed in their dataset— is characterized by basically no response or a bimodal, "inverse optimal" response to conductivity (Figure 3-3).

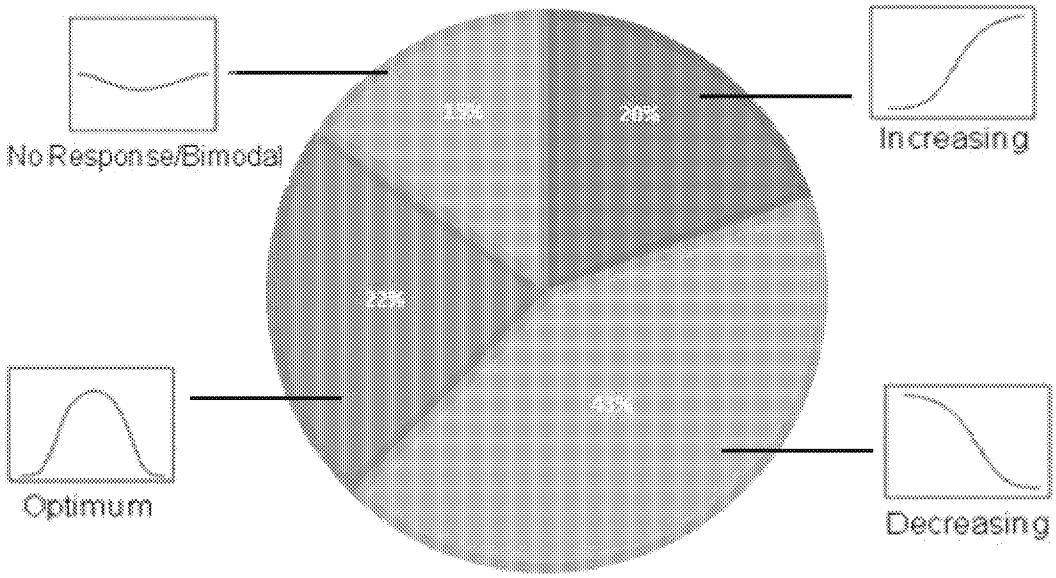

Figure 3-3: Percentage of genera with different types of stressor-response profiles with respect to conductivity and probability of capture (based on data from EPA 2016).

If EPA wishes to use stressor-response data for criteria development, a consistent "dose-response" should be apparent, where each of the taxa would respond negatively (e.g., decreased "probability of occurrence") to increased conductivity. A graphical representation of this type of response (i.e., the stressor-response profile) would resemble the "decreasing" conductivity responses for *Ephemerella* in Figure 3-4 (EPA 2016; Appendices A and B), where the y-axis shows the response (i.e., probability of observing) and the x-axis shows the concentration of the stressor that is presumably inducing that response (i.e., conductivity). In this case, to be protective, it appears that conductivity should always be *below* roughly 300-400 µS/cm. Note that roughly 43% of the taxa in EPA's original analysis of data from Ecoregions 69 and 70 follow this pattern (Figure 3-3).

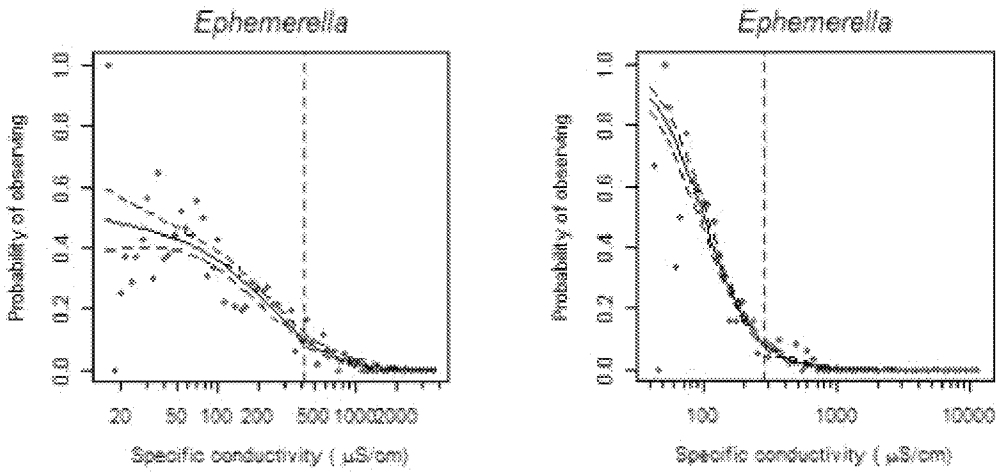

Figure 3-4: *Ephemerella* probability of observing versus conductivity (Appendices A and B from EPA 2016). Ecoregion 69 - left panel, ecoregion 70 – right panel.

Again, the approach to building an SSD used by EPA would *only be valid* if all of the organisms incorporated into the SSD respond similar to *Ephemerella*, since it assumes a protective level set at the lower end of the distribution (i.e., where organisms are more sensitive) will also protect all of the species at the upper end of the distribution (i.e., where organisms are less sensitive). *This is simply not the case with the field-based data used in the EPA Draft Conductivity Criteria.*

In fact, approximately 20% of the genera in the original EPA analysis from Ecoregions 69 and 70 exhibit "positive" stressor-response profiles (Figure 3-3), as exhibited by *Hemerodromia* in Figure 3-5 (EPA 2016; Appendices A and B) – a direct contradiction to the "decreasing" stressor-response profile required to be used in an SSD. And if conductivity is the reason for this response profile and we wish to protect this organism from extirpation, under this circumstance, conductivity would always need to be *above* roughly 200 µS/cm.

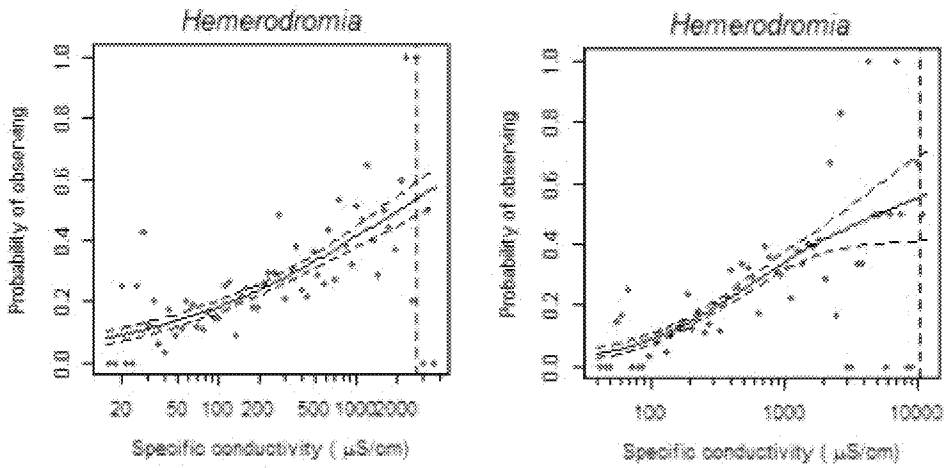

Figure 3-5: *Hemerodromia* probability of observing versus conductivity (Appendices A and B from EPA 2016). Ecoregion 69 - left panel, ecoregion 70 – right panel.

Roughly 22% of the taxa exhibit a *negative response* at both the low and high end of the range of conductivity levels, but a positive response in the middle of that same range (Figure 3-3). This "optimum" bellcurve-type of stressor-response profile would resemble that shown in the *Caenis* panels in Figure 3-6 (EPA 2016; Appendices A and B). Here, in order to accurately calculate a "protective value", it would theoretically be necessary to calculate two XC_{95} values, with one being >100 µS/cm <u>and</u> the other being <1200 µS/cm for Ecoregion 69 and one <2,500 µS/cm for Ecoregion 70; i.e., one threshold at the low and one at the high end of the x-axis where the positive and negative responses are observed.

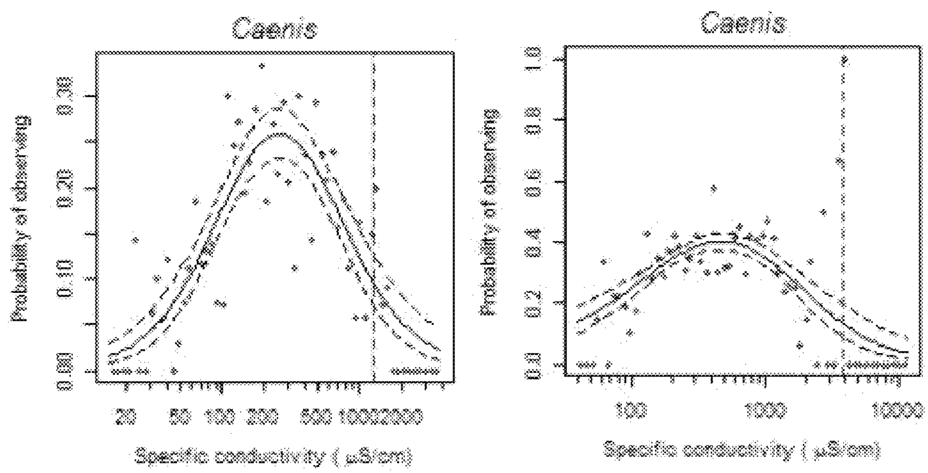

Figure 3-6: *Caenis* probability of observing versus conductivity (Appendices A and B from EPA 2016). Ecoregion 69 - left panel, ecoregion 70 – right panel.

A few of the taxa exhibit the inverse of that curve, responding *positively* at both the low and high end of the range of conductivity levels, but poorly in the middle of that same range (Figure 3-3). This type of "bimodal" stressor-response profile would resemble that shown in the *Dolophilodes* panel in Figure 3-7 (EPA 2016; Appendix B). Here, it would theoretically be necessary to again calculate two XC_{95} values with one *less than* roughly 100 µS/cm and the other *greater than* roughly 7,000 µS/cm; i.e., two thresholds bracketing the middle of the x-axis to capture the range where negative responses are observed. Of course, this "stressor response profile" may be an artifact that results from the use of non-independent stressor analysis curves generated using data collected using field-based methods, rather than an actual response to conductivity (GEI 2010 and 2012).

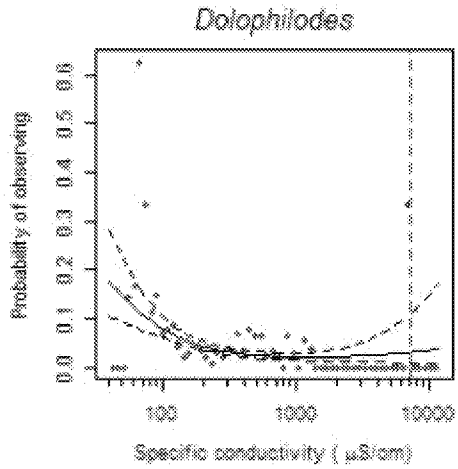

Figure 3-7: *Dolophilodes* probability of observing versus conductivity (Appendix B from EPA 2016).

A number of the taxa (roughly 15%) in the Ecoregions 69 and 70 datasets actually show very little response to conductivity at all, as shown in the "No-response" *Tvetenia* stressor-response profile in Figure 3-8 (EPA 2016; Appendices A and B), making it difficult to identify any kind of effect concentration. In fact, as noted in our analysis of the Ecoregion 50 dataset earlier, many of the "most sensitive" genera showed this non-response profile.

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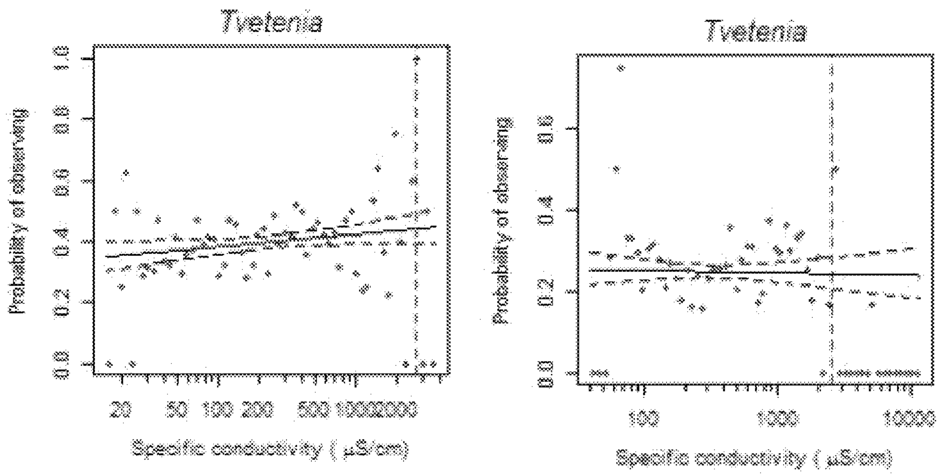

Figure 3-8: *Tvetenia* capture probability versus conductivity (Appendices A and B from EPA 2016). There does not appear to be an Optimal Conductivity Range for this genus. Ecoregion 69 - left panel, ecoregion 70 – right panel.

Thus, if we accept the premise that physiological limits with respect to conductivity are responsible for the presence/absence of benthic invertebrate taxa (i.e., extirpation), thresholds more appropriately based on the full range of capture probability/stressor-response profiles would be as follows:

Response Profile	Possible Threshold
▪ Negative response (*Ephemerella*):	< 300-400 µs/cm
▪ Positive response (*Hemerodromia*):	> 200 µs/cm
▪ Bell-curve response (*Caenis*):	> 100 and < 1,200-2,500 µs/cm
▪ Bimodal response (*Dolophilodes*):	< 100 and > 7,000 µs/cm
▪ No response (*Tvetenia*):	no threshold necessary

As noted in our original reviews (GEI 2010 and 2012), there is simply no way to reconcile these widely conflicting stressor-responses into a single SC criteria concentration that would actually be "protective" of 95% of the taxa. More importantly, if one accepts that the capture probability data in Appendices A and B (EPA 2016) represent actual stressor-response relationships, the criteria values in case studies I and II of approximately 300 µS/cm could actually be interpreted as *not protective*, for a large percentage of the organisms. This is examined further in the next section.

3.2.2.3 Protectiveness of Criteria/Benchmark Calculated Using the XCD Method

To further evaluate the protectiveness of using the XCD and accompanying SSD method for development of field-based SC criteria, we reexamined the data used in the original EPA Benchmark Document in the context of data screening tools used by EPA and how those tools affect the premise of protection of 95% of the taxa given the conflicting response

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profiles noted above and the potential need to create multiple HC_{05} values if we truly want to protect 95% of the taxa.

If we accept, for the sake of discussion, the oversimplification that conductivity is the causative agent behind the presence and absence (i.e., "capture probability") of taxa, it becomes apparent that most taxa have not only an upper limit to conductivity (i.e., an extirpation concentration, per EPA) but a lower limit as well. Using the same approach described in the EPA Draft Conductivity Criteria, we can develop a minimum conductivity that would afford protection to the 95% of taxa that would be extirpated by low conductivity. Specifically, we estimated the 95th percentile of the weighted cumulative distribution function (CDF) of XC05 (instead of 5th percentile of weighted CDF of XC_{95}) using the same 163 taxa that were used to develop the EPA Conductivity Benchmark to address both ends of the "sensitivity distribution" if all the various response curves are taken into account. The resulting lower bound on conductivity is 130 µS/cm, suggesting that as long as conductivity is above 130 µS/cm not more than 5% of species will be extirpated by the effect of low conductivity.

Figure 3-9 displays the outcome of this analysis. The values for each taxon are represented on a horizontal gray line, with the median conductivity (i.e., the XC50) for each taxon depicted by red circles, the minimum conductivity of each taxon depicted by blue circles, and the maximum conductivity of each taxon depicted by green circles. The 5th and 95th percentiles of these conductivity ranges are indicated by the 'x' and '+' symbols located to the left and right of the median, respectively. Note that the 95th percentile (+) is equivalent to the EPA's XC_{95}. As shown in Figure 3-9, a range of conductivity from 130 to 300 µS/cm, highlighted in yellow, would be acceptable to 90% of taxa evaluated – equivalent to protecting the 95th percentile from both ends of the distribution. Again, if conductivity is the causative agent for the distribution of these genera, then to meet the goal of 95% protection, we have to protect the full range of responses…including those genera sensitive to higher conductivity as well as those that are sensitive to lower conductivity.

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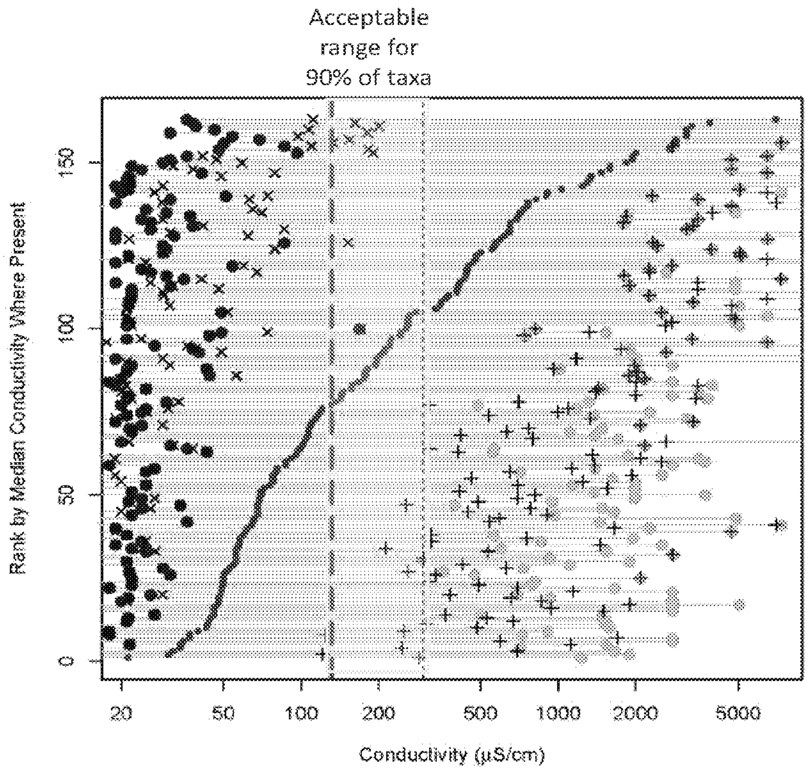

Figure 3-9: Preferred conductivity range for 163 of the taxa included in the 2011 EPA benchmark for Ecoregions 69 and 70. The x-axis is on a logarithmic scale.

Recognizing that the 163 taxa included in EPA's Benchmark analysis represent only a third of the taxa in Ecoregions 69 and 70 in the WVDEP water analysis database (WABbase) database, we ran a similar analysis to that described above using all of the approximately 500 taxa in Ecoregions 69 and 70 in the WABbase when the benchmark was developed. Using all taxa available, we noted that there are many taxa that are never found in locations with conductivity as low as 300 µS/cm.

Regardless, the analysis with the full list of genera indicates that conductivity would need to be *greater than* 1130 µS/cm to protect 95% of the taxa from the effects of low conductivity. Conversely, conductivity would also have to be *less than* 120 µS/cm to protect 95% of taxa from the effects of high conductivity (Figure 3-10 [Note that the symbols and colors presented in Figure 3-10 adhere to the descriptions of those presented previously in Figure 3-9]). This effectively results in the "Impossible Zone," identified in Figure 3, which contrasts with the "Acceptable Range" identified in Figure 2. We called this the "Impossible Zone" because with all 500 taxa included, the minimum conductivity required to protect 95% of taxa from low conductivity is greater than the maximum conductivity required to protect 95% of taxa from high conductivity. Again accepting the oversimplification that conductivity is the determinant of species presence/absence, it becomes readily apparent that conductivity preference varies widely among taxa, and that, when we include all 500 taxa, there is no

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single conductivity value or range that will protect 95% of taxa – the apparent goal of the EPA draft criterion.

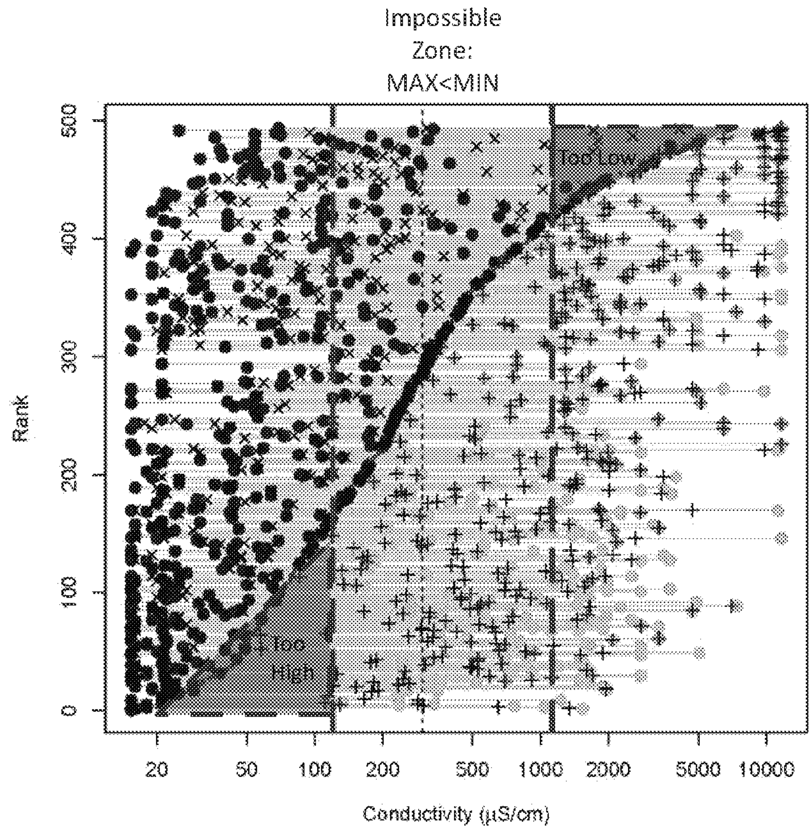

Figure 3-10: Preferred conductivity range for the nearly 500 taxa included in the WABbase used for the EPA benchmark for Ecoregions 69 and 70. The x-axis is on a logarithmic scale.

Conductivity tolerance/preference, as a surrogate summary metric for total ionic content of water, is evidently more akin to temperature tolerance/preference than to that of traditional contaminants such as metals or pesticides. Just as there are taxa (*e.g.*, specific species of fishes) that prefer warm waters and those that prefer cool waters, there are taxa that appear to prefer low conductivity and those that appear to prefer higher conductivity. Of course, like temperature, there is little doubt that extreme conductivity, low or high, has the potential to exceed the physiological limits of all taxa.

Finally, despite the capture probability graphs suggesting an upper and lower bound on the range of conductivity preference for many taxa, we do not agree that conductivity is necessarily the direct causative agent for the presence and absence of taxa in any particular location. Ionic tolerance may play one role in establishing which species inhabit a site, but other chemical, physical, and biological factors discussed in the preceding section likely have equally important roles.

3.2.3 Use of the Background-to-Criterion Regression Method

Section 3.7 and Appendix D in the EPA Draft Conductivity Criterion document discuss the development of the Background-to-Criterion Regression Model (B-C Model) that is intended to be applied to areas where there is insufficient water chemistry and biological data to calculate ecoregion-specific taxa level extirpation coefficients and hazardous concentrations. However, as is clear from our analyses above, the premise that salt-intolerant genera only occur within habitats where the lowest background conductivity occur and that genera are extirpated in habitats with higher conductivity is not well supported by the variable XC_{95} values observed for genera common among ecoregions. As such, development of the regression analysis using such variable XC_{95} values is fundamentally flawed or is, at best, an untested hypothesis.

3.2.3.1 Discussion of top 10 most sensitive taxa

The EPA Draft Conductivity Criteria further highlights the key issue of variable stressor-response profiles when expanding the approach to multiple ecoregions. As discussed herein there are multiple profiles that characterize the probability of capturing a single individual representative of a taxonomic element based on the range of SC observed within an ecoregion. The methodology imposes the extirpation coefficient regardless of the taxonomic element's (genus level) preference/response to the environmental condition. Furthermore, EPA assumes that the taxonomic list does not need to exhibit the same responses to conductivity for the calculation of the HC_{05}, and this is evident in the top ten list of taxa for selected ecoregions.

Seven ecoregions were selected from the list of 24 ecoregions used in the EPA's development of the Background to Criteria Regression model, and included Arizona/ New Mexico – Ecoregion 23, Idaho – Ecoregion 17, Illinois – Ecoregions 54 & 72, Minnesota – Ecoregion 50, Mississippi – Ecoregion 65, and West Virginia – Ecoregion 69 (note that the values for genera from Ecoregion 69 in the EPA Draft Conductivity Criteria differ from those in the original benchmark document as additional data were added; EPA 2011). Ecoregions were selected to represent different ecotypes from the West, Midwest, and Eastern portion of the U.S. Benthic invertebrate data were paired with measurements of conductivity for the respective sample location and the taxonomic list was filtered for taxa that were not present in at least 25 samples for an ecoregion per EPA's approach. For each ecoregion, the XC_{95} values were calculated using the methodology described in Section 3.1.2 of EPA 2016 while capture probabilities were based on the observed range of conductivity with 60 bins created for each ecoregion. The derivation of the HC_{05} resulted in a value for each ecoregion that was contained in the range of XC_{95}s for top ten list of taxa (Table 3-1) and corroborated results presented in Table 2-D of the EPA Draft Conductivity Criteria.

Using these data, the top ten "most sensitive" taxa (i.e., genera with the lowest resulting XC_{95} values) from each ecoregion were identified and capture probability/response-curves developed. Each top ten list of the most sensitive taxa for each ecoregion contains a mix of decreasing or no response/bimodal profiles with varying degrees of occurrence as well as a mixture of the other profiles identified earlier (Appendix A – Figure A-1). For example, in Idaho Ecoregion 17, *Stempellina* exhibits the smallest XC_{95} value of 175 µS/cm yet exhibits no apparent response to conductivity. In Arizona Ecoregion 23, taxa such as *Amphinemura*, *Lepidostoma*, and *Zaitzevia* all exhibit decreasing responses to the range of conductivity values, but these taxa also present conflicting information in their respective stressor-response profiles. All three taxa reveal patterns in capture probabilities that are either zero (0.00) or one (1.00) on the lower range of conductivity, which stems from the left skewed distribution for conductivity (Appendix A– Figure A-1). The left skewed distribution results in a number of conductivity bins that contain a small number of sites, thus presence of merely one individual is sufficient to indicate a 100% chance of finding the taxon given the imposed distribution on the range of conductivity values observed in an ecoregion. The relatively high number of zero probability findings could be an artifact of a skewed distribution or simply the taxon was not collected even though it may have been present.

Other patterns in the response-profiles indicate that taxa can be relatively rare across the range of environmental conditions. For example, in Minnesota Ecoregion 50, *Larsia*, *Paraponyx*, and *Campeloma* all exhibit poor capture probabilities, generally less than 20%, through the conductivity range of approximately 50 to 300 µS/cm and do not show a clear response to conductivity (Appendix A– Figure A-1). Furthermore, these taxa were observed in a small number of samples just above the ≧ 25 sample cut-off ranging from 25 to 47 samples out of the 734 samples comprising the Ecoregion 50 dataset. The absence of a well-defined response to conductivity raises concern regarding the appropriateness of calculating "extirpation coefficients" when the rarity of a taxon is not fully vetted with respect to habitat preferences, substrate conditions, or flow characteristics, much less a lack of significant response to conductivity. Similarly poor capture probabilities were observed for Illinois Ecoregion 54 where the vast majority of taxa exhibited no definitive response to conductivity.

Next, the same "top ten" taxa from these ecoregions were summarized alphabetically by genus with their sensitivity rank and XC_{95} value (Table 3-1). Note that since there was little overlap in "top ten" genera across ecoregions, we also included the corresponding sensitivity rank for the genus in the other ecoregions where it was found. This top ten list further highlights the contradictory nature of assumed physiological sensitivities to conductivity across ecoregions – contradictory, of course, only if we accept the premise that the responses to conductivity is a measure of physiological tolerance. While the species within a genus may differ across ecoregions; the premise behind a genus level response to a toxicant is that all individuals should exhibit similar sensitivity level (Stephan et al. 1985). And, indeed, there are similarities for certain genera across ecoregions. For example, the XC_{95}s for *Epeorus*

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range from only 200 to 499 µS/cm for four of the seven selected ecoregions (Table 3-1). Yet, for the majority of taxa, there are vastly different XC_{95}s across ecoregions. For example, the XC_{95}s for *Isonychia* ranged from 149 to 1,830 µS/cm, while *Rhyacophilia* ranges 10-fold across ecoregions, from 201 to 2,054 µS/cm. These differences in the genus' extirpation coefficients across multiple ecoregions provide further evidence, in addition to the earlier examples, that puts into doubt that conductivity is the causative factor in the presence/absence of these genera.

Table 3-1: Listing of the top ten genera for seven selected ecoregions along with the corresponding rank for the same taxon when found in the other ecoregions (see text for explanation). Taxa rank and XC_{95} value are provided (Rank / XC_{95}).

Genera	AZ, 23	ID, 17	IL, 54	IL, 72	MN, 50	MS, 65	WV, 69
Agapetus	3 / 200	18 / 424					
Agnetina					9 / 317		
Alloperla							5 / 261
Ameletus	11 / 297	83 / 962					7 / 295
Amphinemura	5 / 252					98 / 563	36 / 722
Anthopotamus			4 / 808				
Baetisca					174 / 1,998	10 / 149	41 / 918
Basiaeschna				7 / ,1160	114 / 1,412		
Bezzia					134 / 1,527		6 / 294
Campeloma					10 / 318		
Caudatella		3 / 233					
Centroptilum			10 / 849	4 / 1,070	171 / 1,998		50 / 1,163
Cinygmula	4 / 207	79 / 907					16 / 366
Conchapelopia			64 / 1,600	1 / 918	100 / 1,353	74 / 442	9 / 323
Dolophilodes		9 / 333			1 / 198		103 / 2,768
Doroneuria		4 / 233					
Dromogomphus			2 / 755	51 / 1,830		43 / 325	
Drunella	1 / 168	63 / 780					19 / 423
Endochironomus			65 / 1,600	3 / 1,040	55 / 867		
Epeorus	18 / 350	25 / 499			2 / 200		8 / 302
Ephemera			1 / 723		46 / 719		15 / 360
Ephemerella	23 / 420	41 / 687			45 / 719	3 / 111	17 / 388
Ephoron			6 / 814				
Erpobdella			88 / 1,960	2 / 943			
Eurylophella					14 / 397	9 / 149	29 / 574
Glossosoma	9 / 259	30 / 600			39 / 650		61 / 1,725
Glutops		5 / 254					
Heptagenia			28 / 1,071	14 / 1,260	53 / 867		10 / 343
Hesperophylax	8 / 259						
Hexatoma	66 / 820	42 / 687			26 / 533	2 / 92	105 / 2,768
Isonychia	54 / 800		13 / 908	49 / 1,830	54 / 867	8 / 149	54 / 1,270
Larsia					7 / 317		
Lepidostoma	6 / 258	98 / 1,345			96 / 1,353		11 / 357
Leptophlebia					16 / 422		1 / 191

Genera	AZ, 23	ID, 17	IL, 54	IL, 72	MN, 50	MS, 65	WV, 69
Macromia			3 / 770	90 / 2,551	67 / 882	13 / 156	
Megarcys		7 / 280					
Menetus			46 / 1,283	8 / 1,190			
Mooreobdella			87 / 1,960	5 / 1,110			
Musculium				6 / 1,110			
Narpus	2 / 191	48 / 725					
Neophylax		8 / 283			78 / 1,134		18 / 388
Oxyethira					119 / 1,447	1 / 79	
Paracloeodes			5 / 810	59 / 2,020			
Paralauterborniella			43 / 1,264	114 / 2,620		6 / 135	
Paraleptophlebia	17 / 340	38 / 653			154 / 1,998		4 / 256
Paraperla		6 / 265					
Paraponyx					8 / 317		
Procloeon			9 / 832	61 / 2,020	31 / 568		28 / 556
Progomphus			8 / 822	68 / 2,160		25 / 221	
Prosimulium		67 / 907				7 / 135	31 / 606
Pseudocloeon			21 / 935	10 / 1,205	170 / 1,998		
Pseudolimnophila						4 / 114	33 / 660
Pycnopsyche					120 / 1,447	5 / 123	3 / 232
Remenus							2 / 223
Rhithrogena		10 / 367					
Rhyacophila		62 / 780			3 / 201	108 / 607	76 / 2,054
Serratella	36 / 606	23 / 482			4 / 251		26 / 500
Somatochlora				9 / 1,194	141 / 1,594		
Stempellina		1 / 174			81 / 1,134		27 / 529
Sweltsa	10 / 273	33 / 635					64 / 1,756
Triaenodes			7 / 821		22 / 502		
Trissopelopia					6 / 295		
Visoka		2 / 203					
Xenochironomus					5 / 293		
Zaitzevia	7 / 259	95 / 1,345					

The B-C Model characterizes the relationships between HC_{05} values and the "Background" conductivity conditions for each ecoregion as based on the 25th percentile of measured concentrations. While the least squares regression model does not require predictor variables to meet the assumptions of normality, the use of skewed data in the calculation of XC_{95} values and characterizing genera conductivity response profiles is a concern. Benthic invertebrate and water quality data often are collected in a clumped and uneven way, thus it is common to have data with high number of observations aggregated at a particular part of a gradient, while another part of the gradient is relatively under-represented. This results in skewed distributions which is apparent in the conductivity data (Appendix A – Figure A-2). The weighted cumulative distribution function is used to account for this discrepancy but the skewed data may have unintended consequences on the calculation of the XC_{95}. Genera observed to occur in the tails of the distribution, whether left or right skewed typically express greater capture probabilities due to the small number of sites (i.e., <5) observed. Thus, the response profiles provide the allure that a genus may always be present at low conductivity or extirpated at higher conductivities when it is possible that other factors are affecting the presence/absence of a genus.

3.3 Issues with Deriving the CMEC

Most aquatic life criteria consist of two criterion magnitudes, or concentrations: the Criterion Maximum Concentration (CMC, or "acute criterion") and the Criterion Continuous Concentration (CCC, or "chronic criterion"). For the EPA Draft Conductivity Criteria, EPA correctly points out that the data do not generally exist to directly evaluate what SC level might protect aquatic life from acutely toxic (i.e., short-term) exposures. Instead, EPA suggests derivation of a Criterion Maximum Exposure Concentration (CMEC) which is the 90th percentile of SC observations at site with water chemistry conditions such that they meet the CCC. The CCC used to determine whether or not SC criteria are met at a site are defined as the annual geometric mean SC values from sampling stations that meet the CCC for that region.

While this 90th percentile-based CMEC may indeed represent a less stringent SC criterion than the CCC, this is a largely arbitrary percentile selection that has little basis on a SC concentration that would protect from acute exposures to sensitive taxa at relevant times of year. Nor does it account for the variable stressor-response profiles, so would not be protective of the overall invertebrate community. While EPA does evaluate the limited data that do exist to evaluate maximum SC concentrations that precede observations of salt-intolerant taxa, they admit that even for relatively large data sets (e.g., ecoregions 69 and 70), only modest amounts of such data exist. Therefore, we suggest that until such data can be made available, EPA should not propose derivation of CMECs for SC.

3.4 Discussion of Causation

We agree with EPA that an evaluation of causality is critically important in any scientific endeavor, particularly when proposing the use of a field-based method using macroinvertebrate community structure data that is subject to a potentially high degree of confounding. Any chemical or biological variables that are correlated with either conductivity or the biotic response may confound the presumed relationship between conductivity and biological impairment. In its original Conductivity Benchmark EPA acknowledges that plausible confounding factors likely exist, and recommends use of the method described in the EPA Benchmark Report to analyze confounding factors. However, in the EPA Benchmark Report they concluded that the influence of confounding factors is not *strong enough* to prevent use of the conductivity benchmark (EPA 2011). As we have previously commented (GEI 2010 and 2012), we do not agree with this conclusion; the confounding factors require a more in-depth analysis to evaluate whether or not conductivity *alone* is a strong enough indicator of adverse changes to allow for its use in derivation of a regulatory criteria.

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For the EPA Draft Conductivity Criteria, however, no new causality analysis has been conducted. Rather, EPA only choses to suggest that "it is good practice" to further evaluate the performance of the XCD model. We agree, but are very concerned that EPA has not chosen to conduct this analysis. Given the observations we present in Section 3.2.3.1 of this report, the high amount of variability in XC_{95} values for the same taxa between different ecoregions suggest that alternate explanations for the presence vs. absence of several taxa critically need to be evaluated. This concern also extends to use of the background-correction method because it still relies on XCD-based CCC values from ecoregions from which a causal analysis has not yet been conducted.

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4. Discussion of Using Fish as an Alternative Assessment Endpoint

The previous sections highlighted recommendations for revisions to the document and criteria. In this section we present a discussion of Appendix G: Using an Alternative Assessment Endpoint (Species of Fish) and areas which need reconsideration. While we may not have specific recommendations on how to address the issues with this section, it should be reexamined to ensure the science supporting the decisions made to develop the conductivity criteria are solid.

Appendix G discusses the extent to which EPA feels the ecoregional criteria for benthic macroinvertebrates are protective of fish. EPA utilized a combined (composite) data set for stream fish from Ecoregions 67-70 in their assessment. A composite data set had to be used due to lesser amounts of fish data in comparison to invertebrates.

GEI notes that the fish data were aggregated across multiple sampling programs, states, and ecoregions. While EPA made clear their rationale for this, the approach is inherently problematic due to variability in fish survey/sampling techniques, likely wide variability in stream size, and assessment approaches utilized by different states and regulatory programs. Additional concerns related to EPA's Appendix G approach are summarized below.

Fish community sampling conducted by state and federal agencies is typically not done to characterize *every* single species in a population. Rather, the goal of most fish sampling efforts, particularly "rapid bioassessment" type protocols that were utilized for most of the fish community data EPA relied on in its assessment, is to obtain fish samples that provide a snapshot of the overall fish community (Barbour et al. 1999). This hopefully captures the majority of the species present at the time of sample. In other words, these methods are not developed for assessing which species might specifically be considered "present" or "absent" (i.e., extirpated) in a given water body. For example, Pennsylvania Department of Environmental Protection's 2013 protocol states that "The objective is to acquire a *representative* (emphasis added) sample of the fish population in a wadeable stream or river by sampling all physical stream habitats in relative proportion to their availability. The collected sample will contain most of the species in the stream at the time of sampling in numbers proportional to their actual abundances." (Botts 2013). This approach will bias against fish species with low abundance or attributes that make them more difficult to capture through standard fish sampling techniques (e.g., cryptic coloration, small size, highly-specific habitat requirements, etc.). In addition, electrofishing is regarded as standard equipment for fish community surveys in most wadeable and headwater streams. However, standard fish community survey approaches are not designed to ensure capture of 100% of species in a surveyed area. Cryptic species and smaller fish are more likely to not be detected via electrofishing (Zale et al. 2013).

While Appendix G notes that the observed, and presumed, tolerance to conductivity may be due to the probability of capturing and enumerating fish, additional analysis is needed. This describes one of the main issues with using this method on fish. Fish are highly mobile, with some species exhibiting long-range (e.g., dozens to hundreds of miles) movement patterns that driven by many factors including, but not limited to reproductive cycles, food availability, thermal and flow regimes, etc. The fish survey data are generally "snapshots" of a fish community on a given day not an in depth assessment of the kinds of data that can reliably determine "extirpation," particularly on the basis of presumed physiological tolerance to SC.

EPA's evaluation/characterization of reference data for fish was not consistent with the approach taken for benthic macroinvertebrates. Specifically, the fish data set "contained an uncertain number of reference sites; but there are at least 134 sites with >90% forest cover which are more likely to be representative of good to high quality stream systems than those with less forest cover." Such a "qualitative characterization" of reference sites seems inadequate, particularly when it is inconsistent with the approach utilized for benthic macroinvertebrates.

The problem formulation section earlier in the EPA Conductivity Criteria suggests that indirect effects to fish, such as prey (benthic invertebrate) abundance, are possible. Yet, Appendix G does not provide any further examination on this issue, making this a critical but untested statement by EPA. This is particularly of concern because the XCD method inherent to the SC criteria does not take organism abundance into account.

Appendix G also states that "*the purpose of this assessment is to determine the sensitivity of fish relative to macroinvertebrates…*" (page G-5). It concludes to have demonstrated that fish are either directly or indirectly affected by increased SC based on results that show "*XC_{95} values for fish fall within the range of XC_{95} values calculated for benthic macroinvertebrates.*" (page G-33). This statement is provided without any of the accompanying effort to address correlation or causation or confounding or any level of uncertainty in the analysis of this broad fish analysis. Without undertaking any such effort, there is no way to determine whether XC_{95} similarities are functionally significant, as EPA surmises, or instead whether this is purely a coincidence.

GEI's also evaluated EPA's Appendix G fish data file (from the docket) titled "Combined Less". Through this review GEI observed multiple data-related issues that are worrisome:

- Most fish community survey sites were sampled only once. This is of concern given that fish are highly mobile, with distributions that can vary seasonally and with their reproductive cycles, and as such, extirpation may not be conclusively determined from only one survey.

- Table G-1 in the "Combined Less" data file points out that the majority of water quality parameters had sample sizes substantially less than the 3,277 values for SC. In other words, matched water quality and fish community parameters were available for far less than 3,277 sites for which SC values were available. Specific examples include:
  - Habitat – 801 values (24%)
  - Alkalinity – 995 values (30%)
  - Bicarbonate, sulfate, calcium – 1,014 values (30%)
  - Hardness – 1,488 values (45%)

- Pennsylvania Fish and Boat Commissions's (PaFBC's) data set provided a significant amount of the fish community and water quality data in Appendix G with 2,101 sites being surveyed, as compared to all other data sets. Of the 42,336 records in EPA's fish data file, 17,100 (40%) were from PaFBC. Appendix G does not appear to have evaluated the extent to which the PaFBC data may be driving the Appendix G SC evaluation for fish.

- PaFBC's data set also seems to lack presumably important data. Specifically, the PaFBC data set lacks:
  - Fish abundance numbers
  - Habitat data (i.e., there are no qualitative habitat assessment scores in the PaFBC data set)
  - Fish size data is also missing, which presumably could be used to evaluate for overall health and status, i.e., multiple year classes present, etc.

- 1,326 PaFBC records show hatchery fish (brook, brown, rainbow trout) from hundreds of sites. The presence of hatchery trout can alter fish community dynamics. As an example, Vincent (1987) reported 49% decrease in wild brown trout number and biomass in a Montana stream following three years of rainbow trout stocking. Fish stocking with legal (or near legal) sized fish also increases the abundance of larger-sized predatory fish in a system, which could reduce abundance (and presence) of prey species. Thus, abundance of fish species that are already in low abundance for any factor could be decreased further, or result in extirpation, following stocking.

- A brief evaluation of PaFBC sites sampled multiple times showed potentially significant variability in the fish assemblage despite relatively consistent conductivity numbers. For example:

- PaFBC Site ID PaFBC0043 (Monogahela River watershed) was visited twice (May and September) in 2004. Location verified via GPS coordinates.
  - May visit: SC = 125 μS/cm, total fish taxa = 8
  - Sept visit: SC = 111 μS/cm, total fish taxa = 24
- PaFBC Site ID PaFBC1339 (Allegheny River watershed) was visited twice: July 1991 and July 2008. Location verified via GPS coordinates.
  - July 1991 visit: SC = 780 μS/cm, total fish taxa = 9
  - July 2008 visit: SC = 1,033 μS/cm, total fish taxa = 15 (despite higher conductivity).

To summarize, the examples above clearly display significant variability in the fish community despite relatively consistent or even increasing SC values. This underscores the importance of multiple fish community site visits, which are not available for the majority of fish community data that are included in the "Combined Less" Appendix G fish community data file.

Additionally, EPA conducted no ground-truthing of the data set. This could have been done by simply identifying sites where there are paired fish, invertebrate, and SC data and comparing the taxa assemblages against the XC_{95}s to generate "predicted taxa assemblage" vs. "observed taxa assemblage". This evaluation could likely have been done using the GPA coordinates in the data files.

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5. Conclusions

Our key concerns and comments with respect to the EPA Draft Conductivity Criteria are summarized below:

- The CCC derived using the methods described in the EPA Draft Conductivity Criteria does not represent a SC concentration that would protect 95% of the species with respect to SC. This is a fundamentally inappropriate interpretation of the 1985 Guidelines and its goal to derive aquatic life protection criteria that are protective of all but 5% of the most sensitive species to a pollutant or stressor.

- We are concerned that the XCD method effectively sets conductivity criteria concentrations very close to natural background concentrations, which is not consistent with the broad ecological integrity goals of the Clean Water Act. No consideration to diversity or abundance or other straightforward methods of evaluating aquatic community structure, even though diversity is a well-established means of evaluating benthic invertebrate community health and structure.

- There are substantial differences in XC_{95} values within a genus across ecoregions; with genera characterized as being sensitive to conductivity in one ecoregion not sensitive to conductivity in another ecoregion. Such large variability in the purported physiological limits of "sensitive" genera raises considerable uncertainty regarding the applicability of conductivity as a determinant of the frequency of occurrence (or absence/extirpation) of a given taxa.

- If EPA wishes to use stressor-response data to build an SSD for criteria development, a consistent stressor-response is required, where all genera respond negatively (e.g., decreased "probability of occurrence") to increased SC. Yet, there are widely conflicting stressor-responses across genera used by EPA and there is simply no way to reconcile these into a single SC criteria concentration that would be protective of 95% of the invertebrate community.

- We do not agree that conductivity is necessarily the direct causative agent for the presence and absence of taxa in any particular location. Just as there are taxa (e.g., specific species of fishes) that prefer warm waters and those that prefer cool waters, there are taxa that appear to prefer low conductivity and those that appear to prefer higher conductivity.

- When the capture probability/response-curves for the top ten "most sensitive" taxa from each ecoregion are compared, there is little overlap in "top ten" genera across

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ecoregions. Additionally, individual general often exhibit significantly different XC_{95} values across ecoregions. These differences in the genus' extirpation coefficients across multiple ecoregions provide further evidence that conductivity is not the causative factor in the presence/absence of these genera.

- EPA suggests derivation of a Criterion Maximum Exposure Concentration (CMEC) set at the 90th percentile of SC observations at sites with water chemistry conditions such that they meet the CCC. While this 90th percentile-based CMEC may indeed represent a less stringent SC criterion than the CCC, this is an arbitrary percentile selection that has little direct relationship to a SC concentration that would protect from acute exposures to sensitive taxa at relevant times of year. In addition, as with the CCC, it does not take into consideration the variable stressor-response profiles, so would not be protective of 95% of the invertebrate community. Therefore, EPA should not propose a method for derivation of CMECs for SC.

- EPA states that an evaluation of causality is critically important in any scientific endeavor, particularly when proposing the use of a field-based method using macroinvertebrate community structure data that is subject to a potentially high degree of confounding. We are very concerned that EPA has not chosen to conduct such an analysis here.

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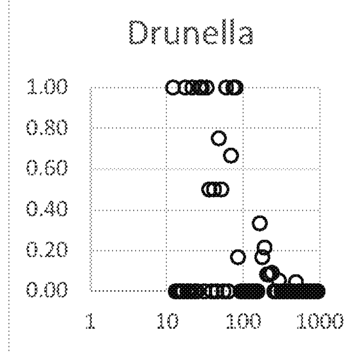
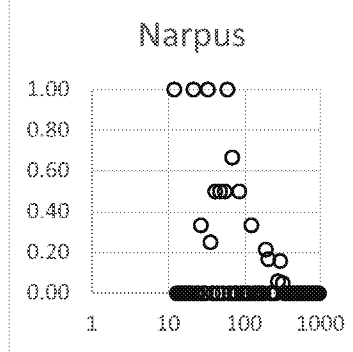
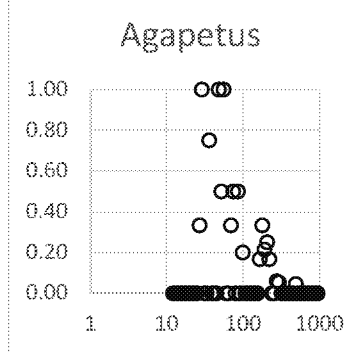
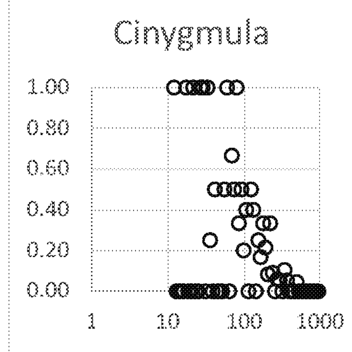
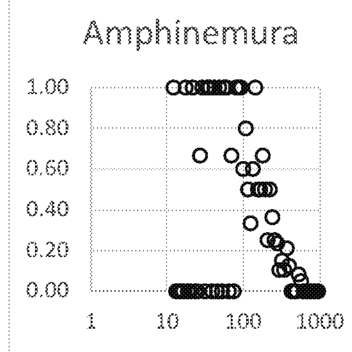
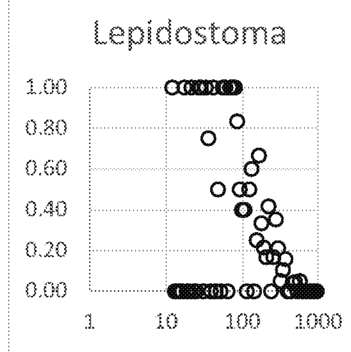
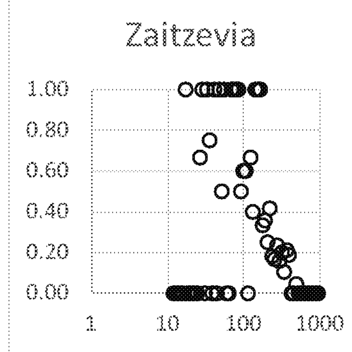
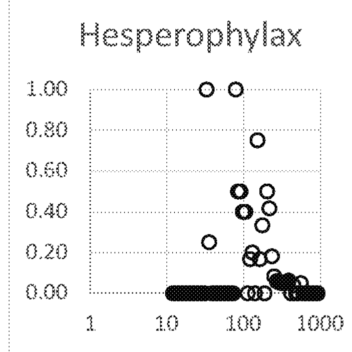
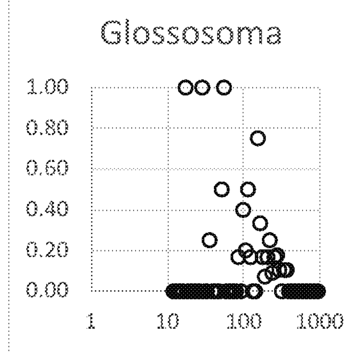
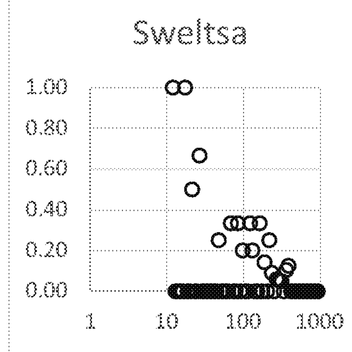
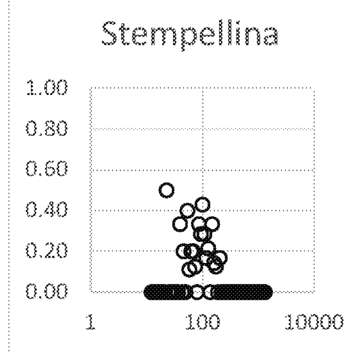
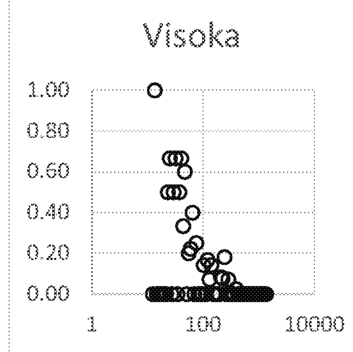
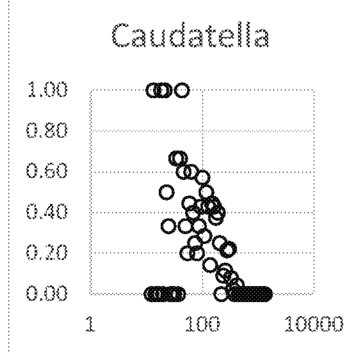
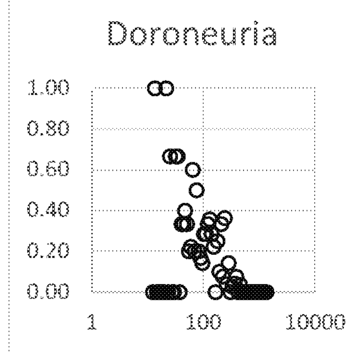
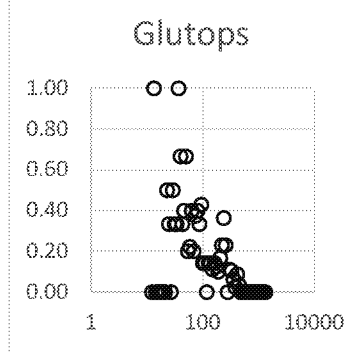
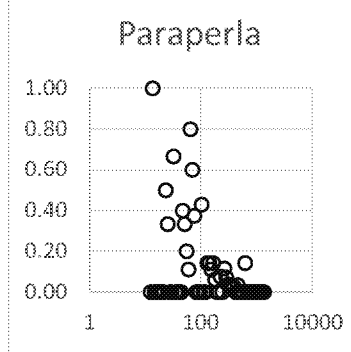
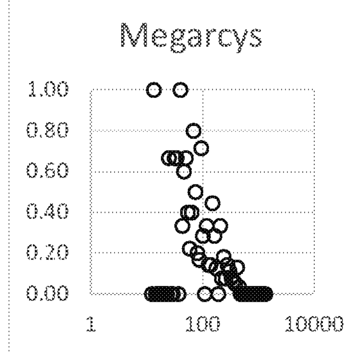
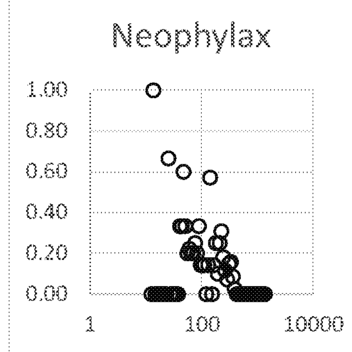
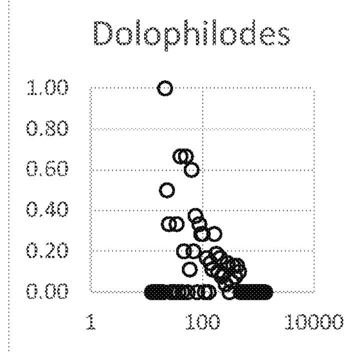
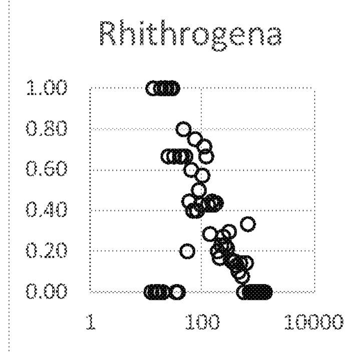
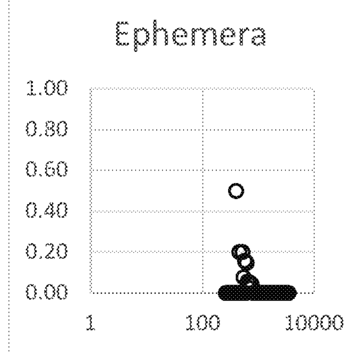
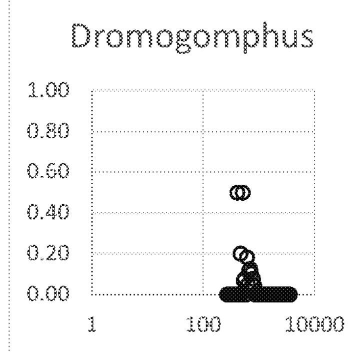
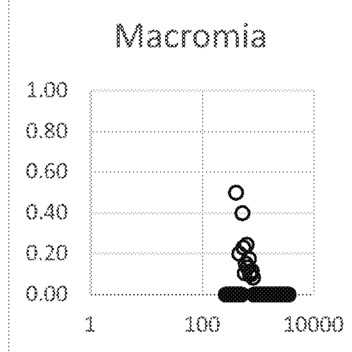
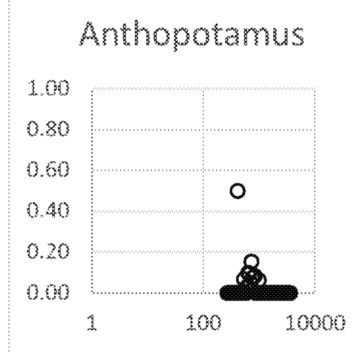
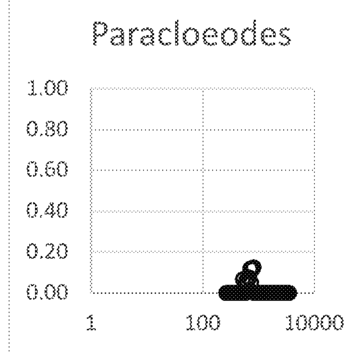
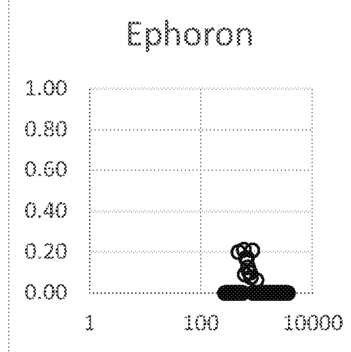
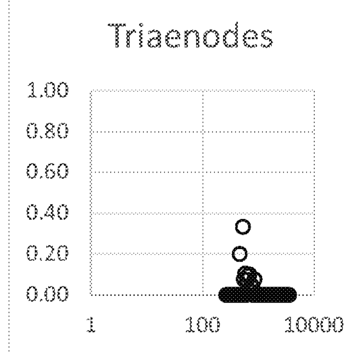
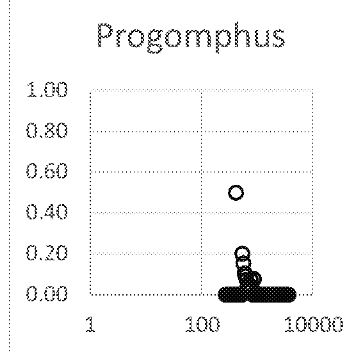
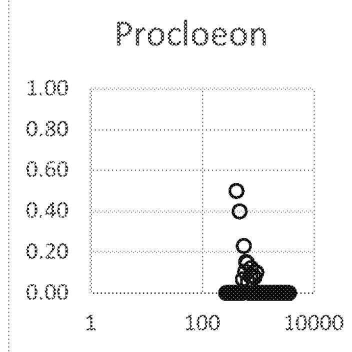
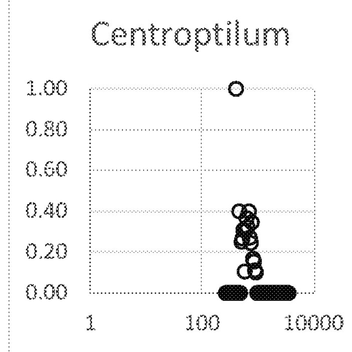
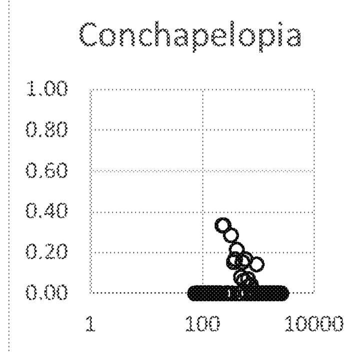
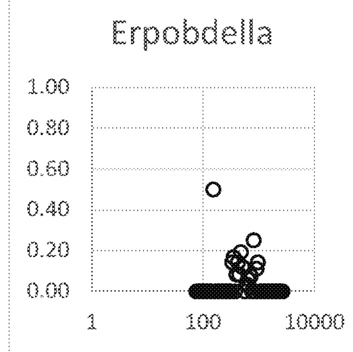
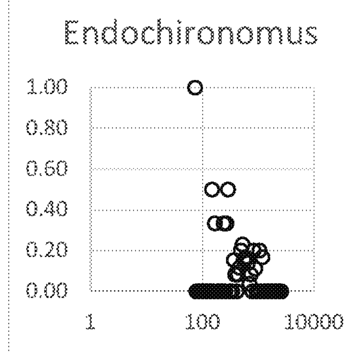
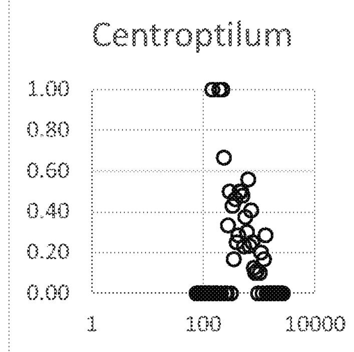
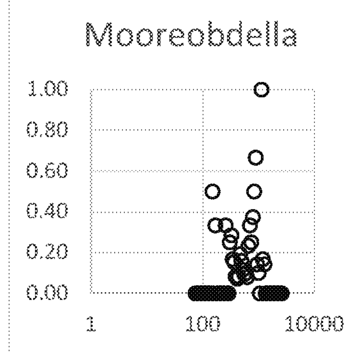
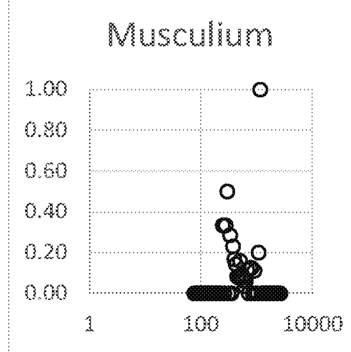
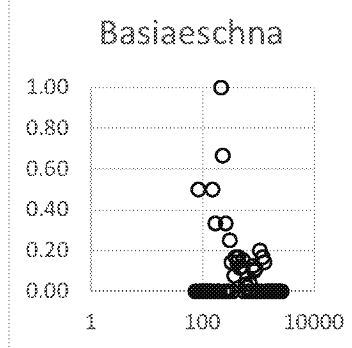
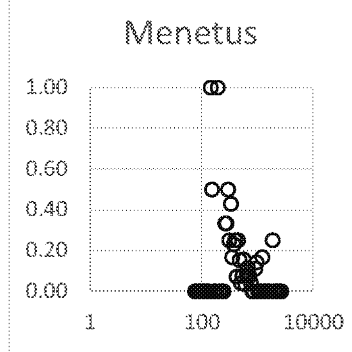
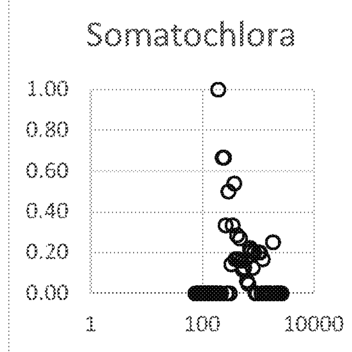
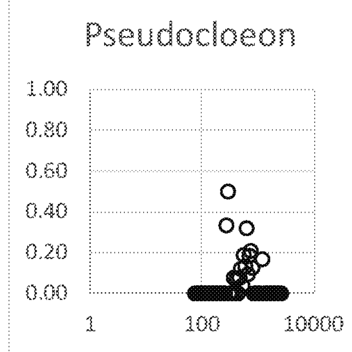
Appendix A Additional Figures

Figure A-11:Capture probability profiles for the top ten list of genera for the selected ecoregions. Genera are ranked from 1 to 10 with number 1 exhibiting the lowest XC_{95} value for the respective ecoregion. X-axis is specific conductivity in µS/cm, and y-axis is capture probability.

State / Ecoregion	1	2	3	4	5	6	7	8	9	10
AZ 23 n = 97 HC_{05} 252 µS/cm										
ID 17 N = 110 HC_{05} 265 µS/cm										
IL 54 n = 124 HC_{05} 821 µS/cm										
IL 72 n = 116 HC_{05} 1,110 µS/cm										

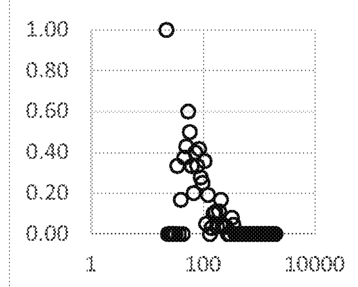
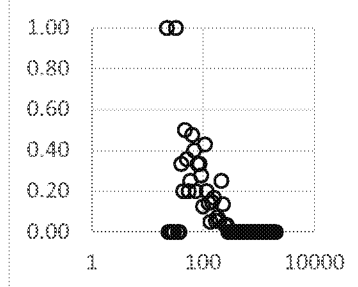
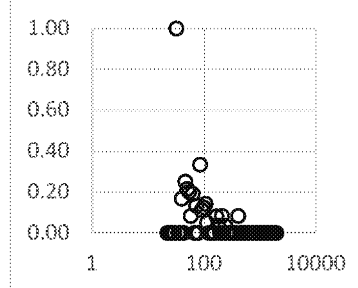
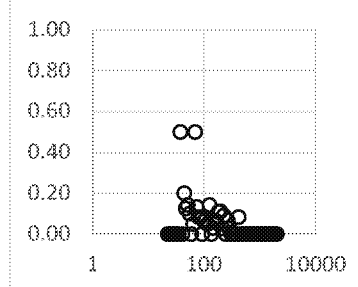
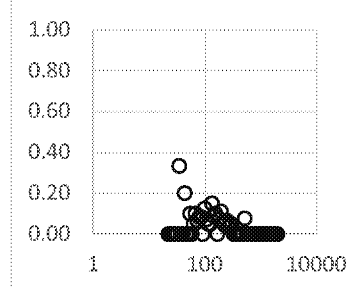
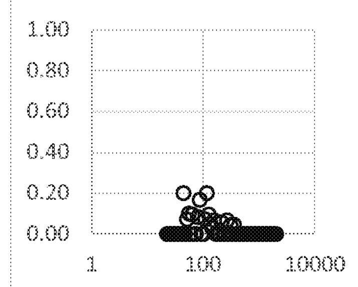
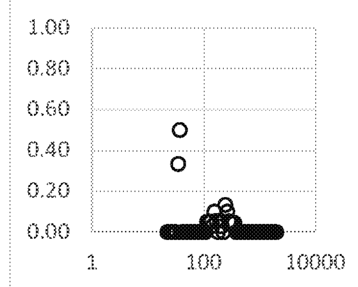
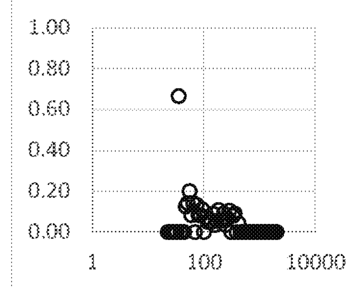
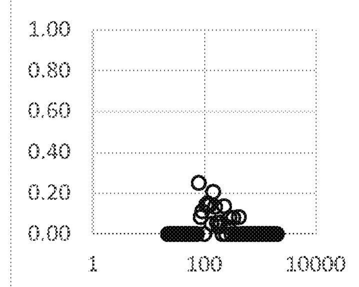
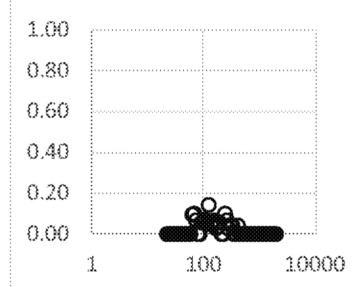
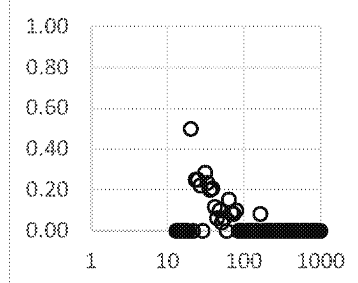
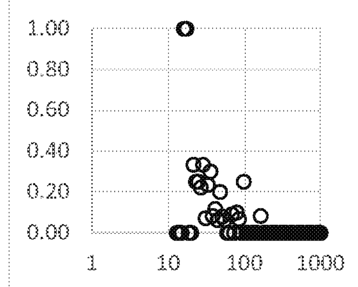
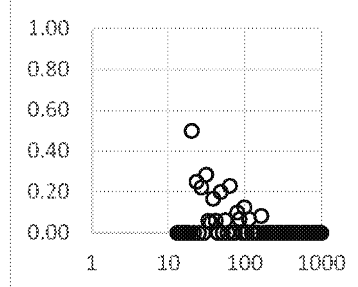
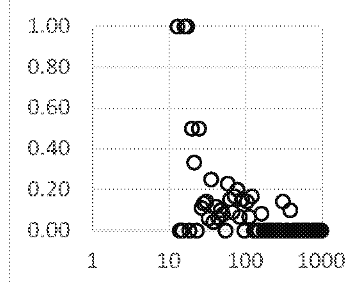
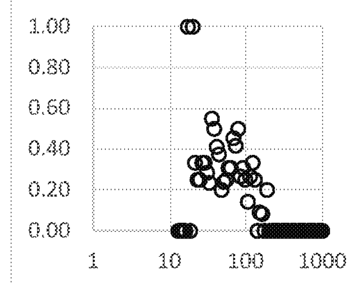
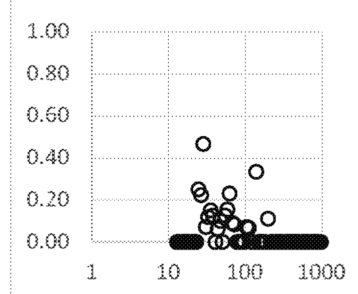
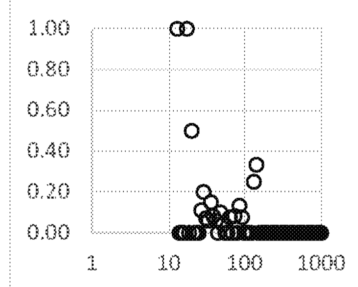
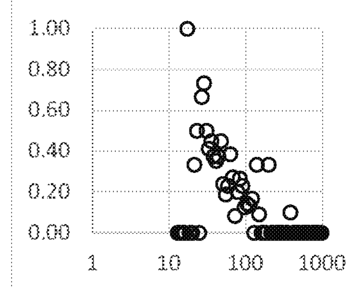
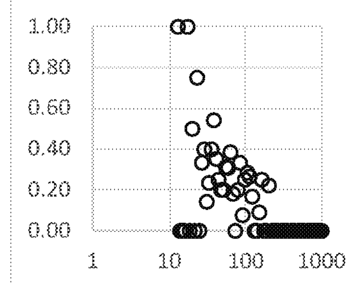
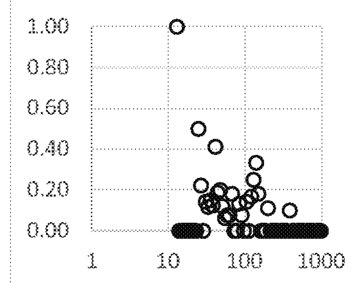
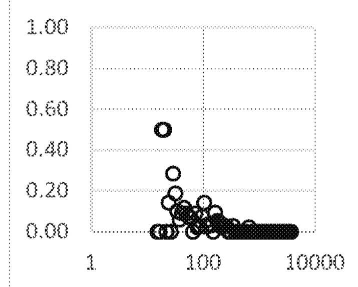
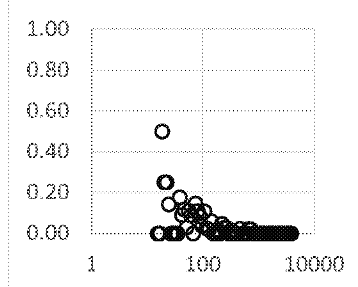
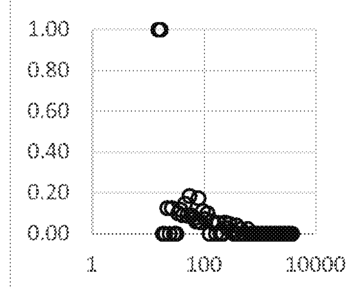
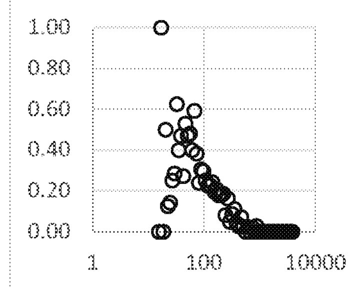
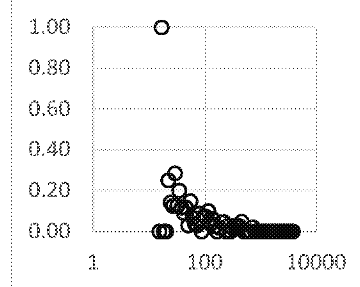
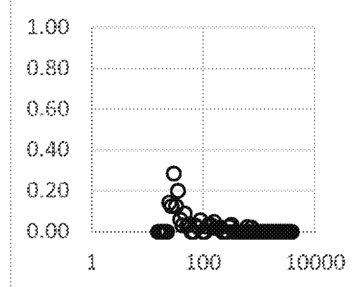
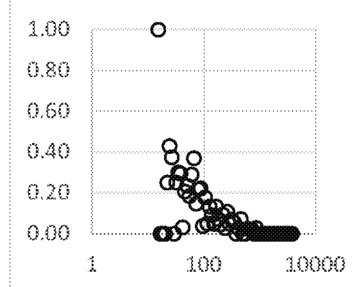
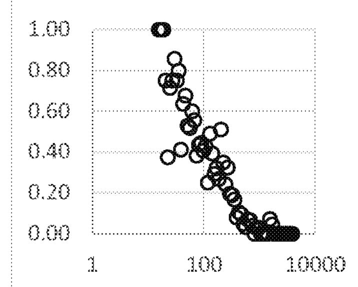
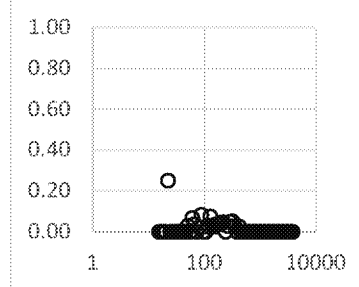
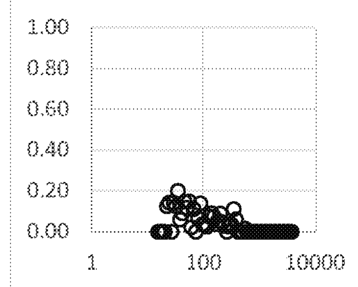
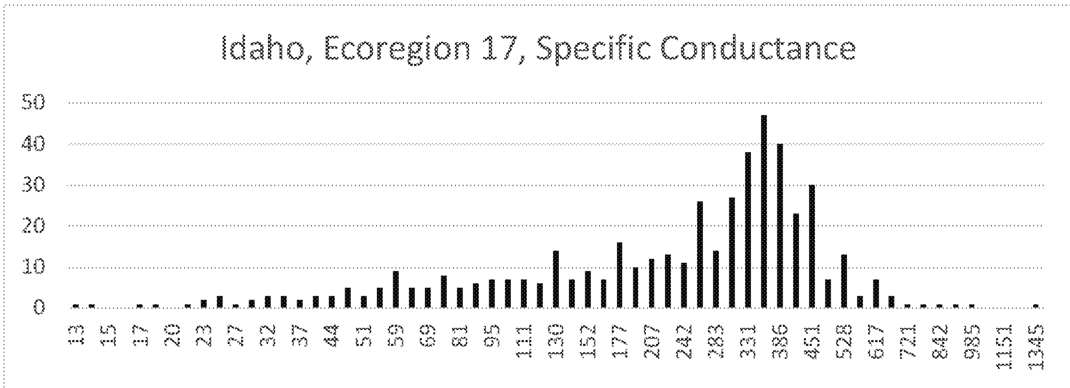
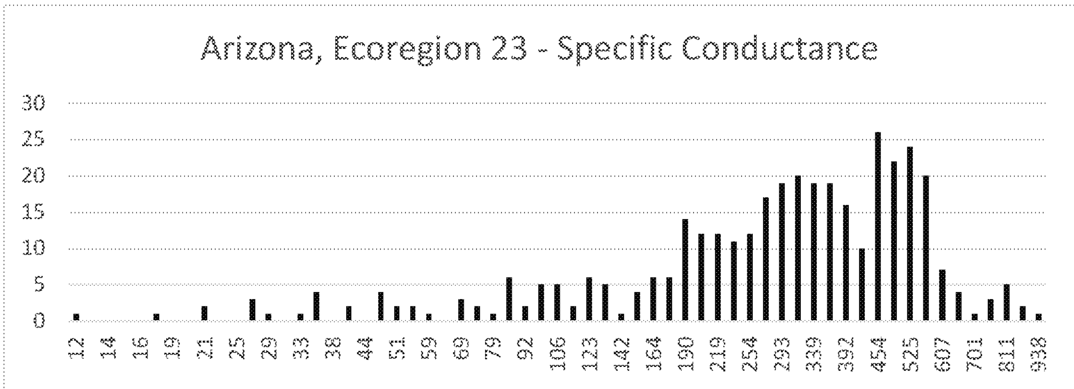
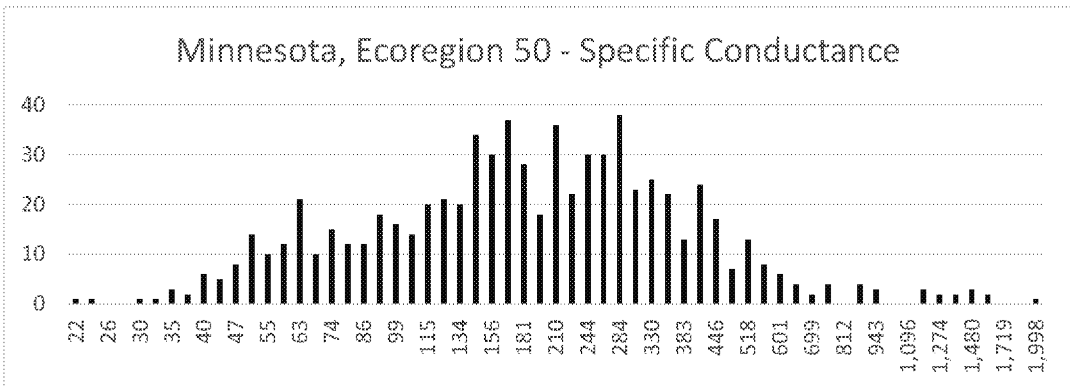
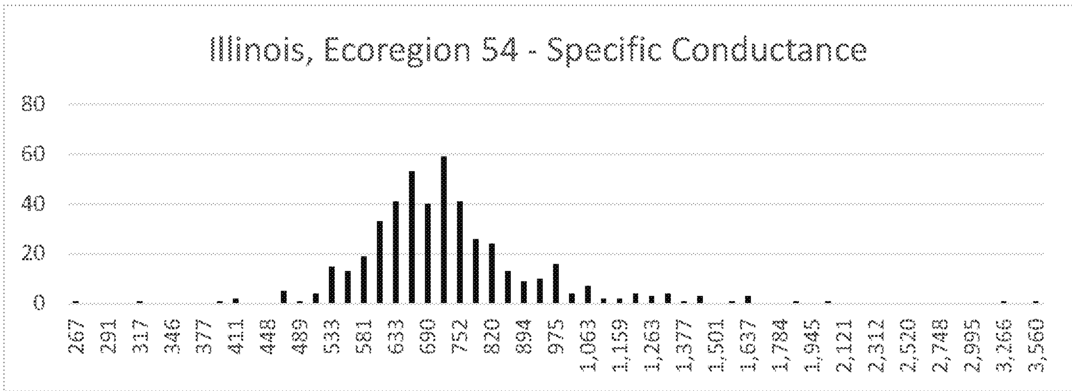
State / Ecoregion	1	2	3	4	5	6	7	8	9	10
MN 50 n = 176 HC_{05} 317 µS/cm	Dolophilodes 	Epeorus 	Rhyacophila 	Serratella 	Xenochironomus 	Trissopelopia 	Larsia 	Paraponyx 	Agnetina 	Campeloma 
MS 65 n = 115 HC_{05} 135 µS/cm	Oxyethira 	Hexatoma 	Ephemerella 	Pseudolimnophila 	Pycnopsyche 	Paralauterborniella 	Prosimulium 	Isonychia 	Eurylophella 	Baetisca 
WV69 n = 142 HC_{05} 302 µS/cm	Leptophlebia 	Remenus 	Pycnopsyche 	Paraleptophlebia 	Alloperla 	Bezzia 	Ameletus 	Epeorus 	Conchapelopia 	Heptagenia 

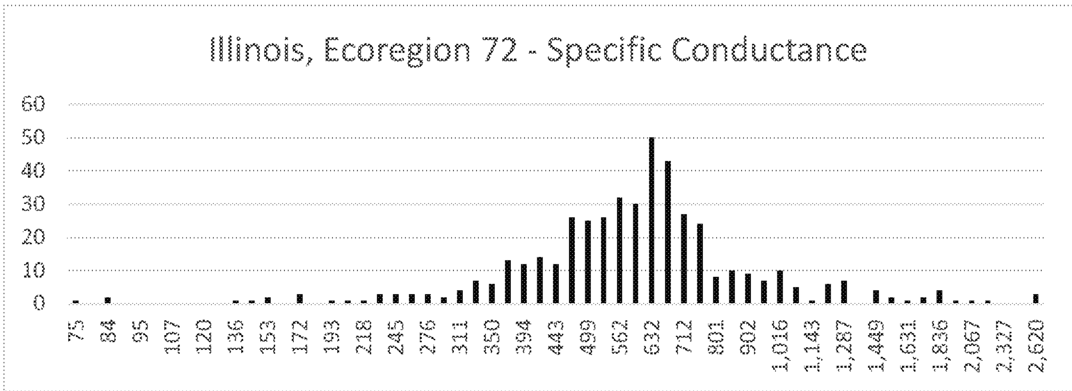
Figure A-2: Histograms of conductivity for selected ecoregions. X-axis is specific conductivity in µS/cm, and y-axis is number of observations per bin.








Illinois, Ecoregion 54 - Specific Conductance
80
60
40
20
0
267
291
317
346
377
411
448
489
533
581
633
690
752
820
894
975
1,063
1,159
1,263
1,377
1,501
1,637
1,784
1,945
2,121
2,312
2,520
2,748
2,995
3,266
3,560


Illinois, Ecoregion 72 - Specific Conductance
60
50
40
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10
0
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84
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107
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193
218
245
276
311
350
394
443
499
562
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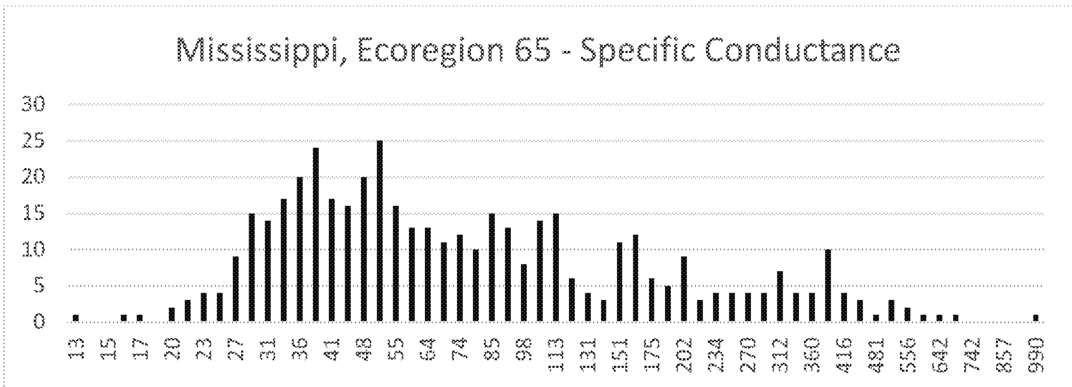
2,620


Mississippi, Ecoregion 65 - Specific Conductance
30
25
20
15
10
5
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13
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17
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23
27
31
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41
48
55
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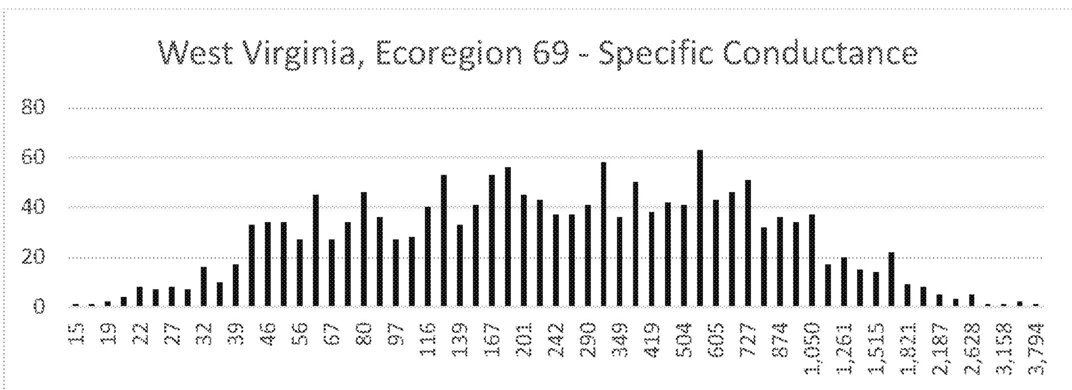
West Virginia, Ecoregion 69 - Specific Conductance
80
60
40
20
0
15
19
22
27
32
39
46
56
67
80
97
116
139
167
201
242
290
349
419
504
605
727
874
1,050
1,261
1,515
1,821
2,187
2,628
3,158
3,794

Appendix B WVDEP 2010

Sierra Club v. EPA 18cv3472 NDCA Tier 2 ED_002061_00106922-00052

west virginia department of environmental protection

Justification and Background for Permitting Guidance for Surface Coal Mining Operations to Protect West Virginia's Narrative Water Quality Standards, 47 C.S.R. 2 §§ 3.2.e and 3.2.i

PURPOSE

The West Virginia Department of Environmental Protection ("DEP") adopts this Justification and Background for its "Permitting Guidance for Surface Coal Mining Operations to Protect West Virginia's Narrative Water Quality Standards" (the "Guidance"). The Guidance is intended to facilitate compliance with applicable statutory and regulatory requirements and to provide reasonable means of effectuating the intent of the narrative criteria, as well as to enforce the mandate of the Clean Water Act ("CWA") that every permit contain effluent limitations that reflect the practicable pollution reduction a state can achieve.[1]

The Guidance was developed in accordance with the West Virginia Water Pollution Control Act ("WVWPCA"), which states that "the public policy of the State of West Virginia to maintain reasonable standards of purity and quality of the water of the State consistent with (1) public health and public enjoyment thereof; (2) the propagation and protection of animal, bird, fish, aquatic and plant life; and (3) the expansion of employment opportunities, maintenance and expansion of agriculture and the provision of a permanent foundation for healthy industrial development."[2]

As it must, the Guidance also recognizes the intent of the West Virginia Legislature, which has formally resolved as follows:

- That any interpretation and implementation of West Virginia's narrative water quality standards is the responsibility of the West Virginia Department of Environmental Protection;
- That the requirements of the narrative criteria are met when a stream (a) supports a balanced aquatic community that is diverse in species composition; and (b) contains appropriate trophic levels of fish (in streams with sufficient flows to support fish populations); and (c) the aquatic community is not composed only of pollution tolerant species or

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[1] *American Paper Institute, Inc. v. United States Environmental Protection Agency*, 996 F.2d 346, 349 (D.C. Cir., 1993)

[2] W. Va. Code § 22-11-2(a).

the aquatic community is composed of benthic invertebrate assemblages sufficient to perform the biological functions necessary to support fish communities within the assessed reach (or, if the assessed reach has insufficient flows to support a fish community, in those downstream reaches where fish are present); and

- That interpretation of West Virginia's narrative water quality standards must faithfully balance the protection of the environment with the need to maintain and expand opportunities for employment, agriculture, and industry as set forth in the Legislature's statement of public policy as contained in the West Virginia Water Pollution Control Act.[3]

BACKGROUND

West Virginia has had primacy of the NPDES program since 1982 and has narrative water quality standards that predate its NPDES primacy. These criteria are found in West Virginia's *Code of State Rules*, which states, in pertinent part, "No significant adverse impact to the chemical, physical, hydrologic, or biological components of aquatic ecosystems shall be allowed."[4]

In light of its goals to advance, wherever attainable, water quality that provides for recreation and the protection and propagation of fish, shellfish, and wildlife,[5] and to assure that surface mining operations are conducted so as to protect the environment,[6] DEP reviewed its NPDES permitting and compliance assessment protocols vis-à-vis West Virginia's narrative water quality standards and solicited public comment regarding these issues. As a result, DEP adopts the Guidance, which describes the procedures DEP will implement in the development of NPDES permits for the coal mining industry. These new procedures shall take effect immediately. In light of the changing nature of the policy concerns addressed herein, this document is intended to be dynamic and will likely be modified in the future as technology and best management practices develop and improve.

While DEP appreciates EPA's recent effort to assist the states in interpreting their various narrative water quality standards, DEP finds that the Guidance is the more appropriate approach for West Virginia for several reasons. First, it involves subject matter uniquely within DEP's expertise and special knowledge. Further, while this document specifically addresses concerns related to the mining industry, it is designed to be adapted in the future to address all discharges to water bodies that will cause, or that have the reasonable potential to cause or contribute to, excursions from water quality standards. Finally, it does not use an overbroad, generic criterion (i.e. conductivity) to set unattainable limits, but instead identifies specific pollutants that can be managed through the inclusion of appropriate whole effluent toxicity ("WET") monitoring and/or limits and best management practices ("BMPs") in NPDES permits, where there is reasonable potential to cause or contribute to excursions from water quality criteria. If the

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[3] H.C.R. 111 (2010 Regular Session).
[4] 47 C.S.R. 2 § 3.2.i
[5] *See* 33 U.S.C. § 1251(a)(2)
[6] *See* 30 U.S.C. § 1202(d)

applicant cannot demonstrate, by means of its chemical and biological monitoring and the control measures outlined in the plans it will submit with its application, that it does not have reasonable potential ("RP") to cause or contribute to an excursion above the narrative criteria, the permit writer should treat new or expanded discharges as if they have RP and include WET limits in the permit, in accordance with 40 C.F.R. § 122.44(d)(1)(v). Alternatively, if the operator identifies toxic pollutants that can be regulated through the use of numeric limits, DEP will put a regulatory control number for those pollutants in the operator's permit.

PROTECTION OF THE AQUATIC ECOSYSTEM

As stated above, the narrative water quality criteria set out in 47 C.S.R. 2 § 3.2.i prohibits the introduction of wastes that cause significant adverse impact to the chemical, physical, hydrologic or biological components of aquatic ecosystems. These criteria are valid components of West Virginia water quality standards that have been properly promulgated by the West Virginia Legislature and approved by the EPA. The phrase "significant adverse impact" is not defined in the CWA or the WVWPCA, the regulations promulgated thereunder or in any literature or guidance published by the EPA. DEP has determined that "significant adverse impact" is more than a change in the numbers or makeup of the benthic macroinvertebrate community in a segment of a water body downstream from a point source discharge. It is, instead, a material decline in the overall health of an aquatic ecosystem.[7] A goal of the CWA and the WVWPCA is to protect the aquatic ecosystem as a whole; it is a holistic standard that requires a holistic approach to ecosystem assessment. In contrast to numeric water quality criteria, which can be applied by analysis of samples of water taken at any discharge or monitoring point in a stream, compliance with a standard that protects the aquatic ecosystem must be assessed in the broader area comprising the ecosystem. An ecosystem does not exist at a single point and, accordingly, its health cannot be assessed at a single point.

The Pond-Passmore Study, upon which EPA relied in the development of its guidance on this subject, concludes that West Virginia's narrative standard is violated by surface coal mining operations based on the Study's application of two biologic assessment tools, the West Virginia Stream Condition Index ("WVSCI") and the draft Genus Level Index of Most Probable Stream Status ("GLIMPSS"), to samples of benthic macroinvertibrate life taken from these streams. This conclusion is flawed for two reasons. First, West Virginia does not use the draft GLIMPSS in its assessment of the biologic health of State streams. Second, these tools are just that – tools. They are not stand-alone determinants of compliance with the narrative standard. Any application of these assessment tools in determining compliance with the narrative standard must faithfully apply the language of the standard itself, which prohibits significant adverse impacts on the chemical, physical, hydrologic or biological components of the aquatic ecosystem. Thus, DEP's Guidance follows long-standing EPA guidance, which indicates that biosurveys cannot fully characterize an entire aquatic community and its many attributes, and accordingly suggests that "State standards should contain biological criteria that consider various components (e.g.

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[7] An aquatic ecosystem is a dynamic complex of plant, animal, and microorganism communities and their non-living environment interacting as a functional unit within water. *See*, Coweeta Long Term Ecological Research "Glossary of Terms."

algae, invertebrates, fish) and attributes (measures of structure and/or function) of the larger aquatic community."[8]

Through implementation of the Guidance, DEP continues its existing practice of using WVSCI in addition to consideration of other factors affecting the aquatic ecosystem to enforce its narrative water quality standards. By way of background, WVSCI was developed for EPA by national experts to assess biological integrity in West Virginia's waterways through "careful measurement of the natural aquatic ecosystem and its constituent biological communities,"[9] including the evaluation of benthic macroinvertebrate communities. It was specifically designed for assessment of the biological component of the 47 C.S.R. 2 § 3.2.i narrative criteria and has been used as a tool in developing the Impaired Streams List ("303(d) List") and the TMDLs resulting therefrom for almost a decade.[10] WVSCI acknowledges that "[i]t is the responsibility of West Virginia's [Department] of Environmental Protection to maintain and protect the ecosystem health of the state's waters[,]" and "[i]n keeping with the Clean Water Act and technical guidance from USEPA, DEP developed water quality standards for the protection of ecosystem health."[11]

DEP's Guidance is the appropriate methodology for implementing West Virginia's narrative water quality standards, because it is consistent with the Federal Regulations regarding establishing limitations, standards, and other permit conditions for NPDES programs, and it incorporates a holistic approach to ecosystem assessment and protection. The CWA's implementing regulations require WET testing and limits when the State finds that a discharge has RP to cause or contribute to excursions from water quality standards.

> [W]hen the permitting authority determines . . . that a discharge causes, has the reasonable potential to cause, or contributes to an in-stream excursion above a narrative criterion within an applicable State water quality standard, the permit must contain effluent limits for whole effluent toxicity. Limits on whole effluent toxicity are not necessary where the permitting authority demonstrates in the fact sheet or statement of basis of the NPDES permit . . . that chemical-specific limits for the effluent are sufficient to attain and maintain applicable numeric and narrative State water quality standards.[12]

WET testing allows flexibility where appropriate (e.g. allowing time to collect additional data for RP determination to supplement limited data sets) and is consistent with DEP's policy that

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[8] EPA's *Policy on the Use of Biological Assessments and Criteria in the Water Quality Program* (May 1991) ("1991 Policy")

[9] A Stream Condition Index for West Virginia Wadeable Streams, March 28, 2000 (Rev. July 21, 2000) ("Stream Condition Index").

[10] However, a stand-alone WVSCI score has never been the sole determinant of compliance or non-compliance with the narrative standard. This is because WVSCI scores are influenced by many factors (e.g. habitat, geology, and pH).

[11] Stream Condition Index

[12] 40 C.F.R. § 122.44(d)(1)(v)

permittees develop robust monitoring plans with the intention of identifying any causative pollutants and adjusting their methods of operation so that those problems may be remedied before the aquatic community suffers a significant breakdown.

WVSCI considers various components (e.g. algae, invertebrates, fish) and attributes (measures of structure and/or function) of the larger aquatic community. "Because biological integrity is a strong indicator of overall ecological integrity, it can serve as both a meaningful goal and a useful measure of environmental status. . . ."[13] Based on the 5th percentile of reference values, the current WVSCI score that indicates the integrity of a benthic macroinvertebrate community in West Virginia's wadeable streams is 68.0. The threshold for inclusion on the 303(d) List has historically been 60.6. That value subtracts a precision estimate from the 5th percentile of reference values, and its historical use was intended to take into account sampling error and to aid DEP in allocating its resources so as to avoid misclassifying non-impaired waters as impaired. WVSCI and its application in the 303(d) listing process are consistent with methodologies implemented to assess protection of aquatic ecosystems by all of West Virginia's neighboring states.

CAUSATIVE POLLUTANTS / PROTECTIVE THRESHOLDS

EPA has recently set a numeric limit on conductivity at 500 µS/cm, finding that conductivity levels below 300 µS/cm generally will not cause a water quality standard violation and that in-stream conductivity levels above 500 µS/cm are likely to be associated with adverse impacts that may rise to the level of exceedances of narrative state water quality standards.[14] However, DEP's data shows that more than a simple conductivity measurement is necessary to determine the health of a stream. As proof that a number for specific conductance is an inappropriate gauge, FIGURE 1 below illustrates that a stream can have a low level of specific conductance and a WVSCI score firmly within the range for impairment; conversely, a stream can have a high level of specific conductance and a WVSCI score that indicates the stream is above the threshold for impairment. WVSCI scores are affected by many factors: habitat, other uses of the stream and the surrounding land, other pollutants unrelated to conductivity (e.g. fecal coliform), *inter alia*. Certain stream reaches simply cannot attain a "good" WVSCI score because of those factors.

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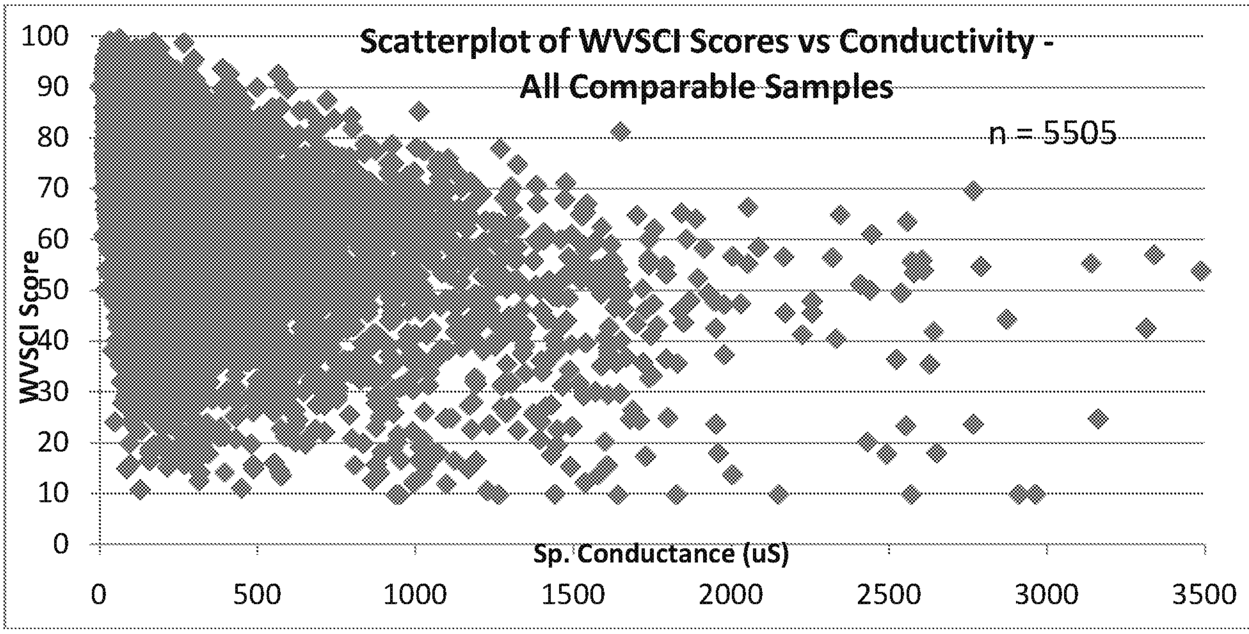
[13] 1991 Policy

[14] EPA's *Detailed Guidance: Improving EPA's Review of Appalachian Surface Coal Mining Operations under the Clean Water Act, National Environmental Policy Act, and the Environmental Justice Executive Order* (April 1, 2010) ("April 1 Memo")



The Pond-Passmore Study found a shift in the benthic macroinvertibrate community downstream from mining activity, but did not otherwise correlate this finding with any significant or adverse impairment of the ecosystem. Where the only impacts to this component of the ecosystem are diminished numbers of certain genera of mayflies, without evidence that this has had any adverse impact of any significance on the rest of the ecosystem, the State cannot say that there has been a violation of its narrative standard. Various scientific studies and evaluations performed by DEP indicate that lowered biological condition is associated with increased ionic strength, but scientists remain less than certain about the specific causative pollutant(s) and the concentration(s) responsible for impairment. Additional uncertainty is present in correlative studies, because the effects of increased ionic strength cannot be completely distinguished from the effects of other stressors that often co-occur (e.g. organic enrichment, sedimentation). In fact, most available information attempts to relate biological condition to a surrogate parameter, such as specific conductance.

Because conductivity represents the combined concentrations of all different dissolved ions, each with potential varying toxic effects, regulation solely via an indicator such as specific conductance is not the best way to protect against excursions from narrative standards. For example, the elevated dissolved pollutants most commonly associated with mining discharges are sulfate and bicarbonate alkalinity. EPA has not published national recommended aquatic life protection criteria for those pollutants. Similarly, chloride, for which West Virginia has adopted EPA's recommended numeric aquatic life protection water quality criteria, may also be present in some cases. But because chloride seldom exists in the absence of sulfates or alkalinity, singular control of chloride cannot be expected to resolve all ionic stress.

DEP has performed a correlative evaluation of benthic condition and specific conductance. This evaluation suggests that native aquatic life is protected at various values and ranges of specific conductance. This finding supports the basic scientific principle that correlation is not cause and effect. Even though the DEP evaluation applied various filters to the evaluated dataset to address complicating factors listed above, the biological condition of a stream may be different from the condition predicted by specific conductance. In situations such as these, where DEP has determined that it is infeasible to calculate a numeric effluent limit to implement a narrative water quality standard, DEP will include in the permit appropriate WET limits and BMPs to control or abate the discharge of pollutants, in accordance with 40 C.F.R. § 122.44(k)(3).

DEP routinely identifies biological stressors when developing TMDLs for biologically impaired waters. Stressor identification employs a strength-of-evidence approach that considers multiple information sources. Researchers evaluate water quality monitoring data, physical habitat data, field notes, and the composition of the biological assemblage concurrently to identify significant stressors. DEP's most recent stressor identification protocols, as used in the EPA-approved TMDL process, include the guidelines shown in FIGURE 2 below for evaluating water chemistry to determine if ionic strength is a significant stressor:

Candidate Cause	Parameter	Elimination (Rule out stressors at these thresholds) Elimination Threshold	Strength of Evidence (Evidence for each Candidate Cause as stressor) Candidate Stressor Thresholds	
4. Ionic strength	Conductivity	< 326.9 umhos	Consider as independent stressor in non-acidic, non-AMD streams, when conductivity values met threshold ranges and sulfates and chloride violate conditions listed as follows.	
			>1533	Definite Stressor
			1075-1532.9	Likely stressor
			767-1074.9	Possible stressor
			517-766.9	Weak stressor
			327-516.9	Equivocal or No Trend
	Sulfates	< 56.9 mg/l	>417	Definite Stressor
			290-416.9	Likely stressor
			202-289.9	Possible stressor
			120-201.9	Weak stressor
			57-119.9	Equivocal or No Trend
	Chloride	< 60 mg/l	>230.0	Definite Stressor
			160.1-229.9	Likely stressor
			125.1-160	Possible stressor
			80.1-125.0	Weak stressor
			60.1-80.0	Equivocal or No Trend

Based on FIGURE 2, it is clear the EPA limits of 300 – 500 µS/cm established in the April 1 Memo are far more stringent than what it has long approved for West Virginia's TMDL process. As shown above, conductivity in the 300 – 500µS/cm range is "Equivocal or No Trend" as a stressor. Conductivity does not even become a "Likely Stressor" of a stream under this EPA-approved approach until it reaches three to five times these limits: 1075-1532.9 µS/cm. This is additional support for the State's conclusion that reliance on the single surrogate of specific conductance to implement and/or enforce the State's narrative water quality standards is improper. It also demonstrates that EPA's proposed limits are too narrowly focused on a single parameter and single aquatic species to determine the health of the impacted watershed.

Only the West Virginia Legislature can adopt a numeric water quality standard for conductivity (or any other pollutant); DEP has no authority to immediately or unilaterally implement numeric standards. Through adoption of H.C.R. 111, the West Virginia Legislature has given DEP direction as to how it should implement its narrative water quality standards. Even if the Legislature does adopt a numeric standard for conductivity, DEP cannot implement it until after it is approved by the EPA. Based on the loose and questionable causal relationship between conductivity and stream impairment, it remains unclear whether EPA would approve such a numeric limit. EPA's duly promulgated regulation endorses establishment of WET limits where, as here, a state is unable to use a limit for a surrogate parameter. DEP can implement new permitting controls based on the agency's best professional judgment of actions necessary to protect the State's waters using its narrative criteria, with follow-up monitoring and contingencies for unsatisfactory outcomes. Thus, DEP is protecting against excursions from its narrative water quality standards by establishing WET limits and verifying impacts to a stream (or lack thereof) by requiring an extensive, comprehensive monitoring plan for the entire watershed.

April 24, 2017

Colleen Flaherty
Health and Ecological Criteria Division
Mail Code 4304T
U.S. Environmental Protection Agency
1200 Pennsylvania Ave., N.W.
Washington, D.C. 20460
ATTN: Docket ID No. EPA-HQ-OW-2016-0353

Submitted electronically via regulations.gov and to flaherty.colleen@epa.gov

In Re: Comments of the National Mining Association on the U.S. Environmental Protection Agency's *Draft Field-Based Methods for Developing Aquatic Life Criteria for Specific Conductivity*

Dear Ms. Flaherty,

Attached please find the comments of the National Mining Association (NMA) on the U.S. Environmental Protection Agency's draft document, *Field-Based Methods for Developing Aquatic Life Criteria for Specific Conductivity.* 81 Fed. Reg. 94379 (Dec. 23, 2016). NMA is a national trade association that includes: the producers of most of the nation's coal, metals, industrial and agricultural minerals; the manufacturers of mining and mineral processing machinery, equipment and supplies; and the engineering and consulting firms, financial institutions and other firms serving the mining industry. NMA appreciates this opportunity to comment on EPA's draft conductivity methodology.

NMA's comments identify several significant flaws with EPA's draft methodology that render it inappropriate for use in the derivation of numeric aquatic life criteria. Most notably, the comments explain how the proposed methodology does not produce criteria protective of 95% of aquatic species, fundamentally misinterprets EPA's 1985 *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses*, and fails to account for data that provides substantial evidence for the fact that conductivity is not likely the causative factor for the presence or absence of genera. NMA's comments also note concerns regarding the fact that EPA failed to conduct a new causality analysis, despite the fact that such an analysis is critically important where a field-based method using data subject to a potentially high degree of confounding is proposed.

These weaknesses in EPA's proposed approach preclude its adoption. As such, NMA requests that EPA withdraw the proposed methodology in its entirety. Please contact me at aaspatore@nma.org or (202) 463-2646 with any questions.

Sincerely,

Amanda E. Aspatore

Amanda E. Aspatore
Vice President, Water Law & Policy
National Mining Association

Enclosure

IN THE UNITED STATES DISTRICT COURT FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA

CHARLESTON DIVISION

OHIO VALLEY ENVIRONMENTAL COALITION, WEST VIRGINIA HIGHLANDS CONSERVANCY and SIERRA CLUB,

Plaintiffs,

v.

CIVIL ACTION NO. 2:13-21588
(Consolidated with 2:13-16044)

FOLA COAL COMPANY, LLC,

Defendant.

MEMORANDUM OPINION AND ORDER

This suit concerns allegations that Defendant Fola Coal Company, LLC, has violated the narrative water quality standards of three separate permits for discharges from three mines into tributaries of Leatherwood Creek. On June 1–4, 2015, the Court held a bench trial regarding jurisdiction and liability, and the parties timely conducted post-trial briefing.

As explained below, the Court **FINDS** that Plaintiffs have established, by a preponderance of the evidence, that Defendant has committed at least one violation of its permits governing Fola Mine No. 2 and Fola Mine No. 6 by discharging into Road Fork and Cogar Hollow high levels of ionic pollution, which have caused or materially contributed to a significant adverse impact to the chemical and biological components of the applicable streams' aquatic ecosystem, in violation of the narrative water quality standards that are incorporated into those permits. However, the Court further **FINDS** that Plaintiffs have not met their burden in establishing liability for alleged violations with respect to discharges from Fola Mine No. 4A into Right Fork, under NPDES Permit No. WV1013815.

I. BACKGROUND

Plaintiffs Ohio Valley Environmental Coalition ("OVEC"), West Virginia Highlands Conservancy, and Sierra Club filed this case pursuant to the citizen suit provisions of the Federal Water Pollution Control Act ("Clean Water Act" or "CWA"), 33 U.S.C. § 1251 et seq., and the Surface Mining Control and Reclamation Act ("SMCRA"), 30 U.S.C. § 1201 et seq. Compl., ECF No. 1. Before proceeding to the parties' evidence and arguments, the Court will first discuss the relevant regulatory framework and the factual background of this case.

A. Regulatory Framework

The primary goal of the CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." 33 U.S.C. § 1251(a). To further this goal, the Act prohibits the "discharge of any pollutant by any person" unless a statutory exception applies; the primary exception is the procurement of a National Pollutant Discharge Elimination System ("NPDES") permit. 33 U.S.C. §§ 1311(a), 1342. Under the NPDES, the U.S. Environmental Protection Agency ("EPA") or an authorized state agency can issue a permit for the discharge of any pollutant, provided that the discharge complies with the conditions of the CWA. 33 U.S.C. § 1342. A state may receive approval to administer a state-run NPDES program under the authority of 33 U.S.C. § 1342(b). West Virginia received such approval, and its NPDES program is administered through the West Virginia Department of Environmental Protection ("WVDEP"). 47 Fed. Reg. 22363-01 (May 24, 1982). All West Virginia NPDES permits incorporate by reference West Virginia Code of State Rules § 47-30-5.1.f, which states that "discharges covered by a WV/NPDES permit are to be of such quality so as not to cause violation of applicable water quality standards promulgated by [West Virginia Code of State Rules § 47-2]."[1] This is an enforceable permit condition.[2] *See, e.g.*, *OVEC v. Elk Run Coal Co., Inc.*, No. 3:12-cv-0785, 2014 WL 29562, at *3, *6 (S.D. W. Va. Jan. 3, 2014); *OVEC v. Elk Run Coal Co., Inc.*, No. 3:12-cv-0785, 24 F.Supp.3d 532 (S.D. W. Va. June 4, 2014); *OVEC v. Fola (Stillhouse)*, No. 2:13-5006, 2015 WL 362643 (Jan. 27, 2015).

Coal mines are also subject to regulation under the SMCRA, which prohibits any person from engaging in or carrying out surface coal mining operations without first obtaining a permit from the Office of Surface Mining Reclamation and Enforcement ("OSMRE") or an authorized state agency. 30 U.S.C. §§ 1211, 1256, 1257. A state may receive approval to administer a state-run surface mining permit program under the authority of 30 U.S.C. § 1253. In 1981, West Virginia received conditional approval of its state-run program, which is administered through the WVDEP pursuant to the West Virginia Surface Coal Mining and Reclamation Act ("WVSCMRA"). W. Va. Code §§ 22-3-1 to -33; 46 Fed. Reg. 5915-01 (Jan. 21, 1981). Regulations passed pursuant to the WVSCMRA require permittees to comply with the terms and conditions of their permits and all applicable performance standards. W. Va. Code R. § 38-2-3.33.c. One of these performance standards requires that mining discharges "shall not violate effluent limitations or cause a violation of applicable water quality standards." *Id.* § 38-2-14.5.b. Another performance standard mandates that "[a]dequate facilities shall be installed, operated and

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[1] At the time of filing, the mining operations at issue here were each regulated under WV/NPDES permits reissued in 2008. At that time, W.Va. Code R. § 47-30-5.1.f read as quoted here. *See* Mem. Op. & Order 12–21, May 29, 2015, ECF No. 94.

[2] The Court pauses here to reject Defendant's recurring and spurious mischaracterizations of prior holdings. It is the express language of Defendant's federally approved WV/NPDES permits as issued by the WVDEP that requires compliance with state narrative water quality standards as an enforceable permit condition. It is the WVDEP as the issuing agency—not Congress and not this Court—that incorporated narrative water quality standards as enforceable WV/NPDES permit conditions.

maintained using the best technology currently available . . . to treat any water discharged from the permit area so that it complies with the requirements of subdivision 14.5.b of this subsection." *Id.* § 38-2-14.5.c.

B. Factual Background

This controversy concerns discharges from three surface mines along the southern portion of the Leatherwood Creek watershed: (1) Fola Surface Mine No. 2 in Clay and Nicholas Counties, West Virginia; (2) Fola Surface Mine No. 4A in Clay County, West Virginia; and (3) Fola Surface Mine No. 6 in Nicholas County, West Virginia. Stipulation ¶6, ECF No. 53.

Defendant's mining activities at Surface Mine No. 2 are regulated under WV/NDPES Permit WV1013840 and West Virginia Surface Mining Permit S201293, both originally issued in 1994. *Id.* at ¶¶6–7. WVDEP reissued WV/NPDES Permit No. WV1013840 in 2001, 2004, 2008, and 2014. At the time this complaint was filed, the 2008 reissuance was in effect. Outfall 001 of Surface Mine No. 2 discharges into Road Fork and Leatherwood Creek. *Id.*

Defendant's mining activities at Surface Mine No. 4A are regulated under WV/NPDES Permit WV1013815 and West Virginia Surface Mining Permit S200502. *Id.* at ¶¶21, 23. WV/NPDES Permit WV1013815 was originally issued in 1993, and was reissued in 1999, 2006, 2008, and 2014. At the time this complaint was filed, the 2008 reissuance was in effect. Outfalls 22, 23, and 027 of Surface Mine No. 4A discharge into Right Fork of Leatherwood Creek and Cannal Coal Hollow.[3] *Id.*

[3] Plaintiffs' Amended Complaint also complains of discharges from Outlet 025 at Surface Mine No. 4A. ECF No. 39. However, Plaintiffs did not present any testimony regarding Outlet 025 during trial. Upon Defendant's oral motion for a directed verdict regarding Outlet 025, Plaintiffs' counsel advised the Court and Defendant that they had intended to drop any claims related to Outlet 025. Tr. 3 at 204, ECF No. 106. Accordingly, any claims relating to Outlet 025 were dismissed.

Finally, Defendant's mining activities at Surface Mine No. 6 are regulated under WV/NPDES Permit WV1018001 and West Virginia Surface Mining Permit S2011999, both originally issued in 2000. *Id.* at ¶¶42–44. WVDEP reissued WV/NPDES Permit WV1018001 in 2008. *Id.* at ¶43. At the time this complaint was filed, the 2008 reissuance was in effect. Outlets 013, 015, and 017 of Surface Mine No. 6 discharge into Cogar Hollow, a small tributary of Leatherwood Creek. *Id.* at ¶43.

In recent years, water quality measurements from the above listed discharges have routinely shown discharges of high conductivity. Stipulation ¶14, ECF No. 53 (showing discharges from Outlet 001 at Mine No. 2 with conductivity measurements consistently around 3000 µS/cm); *id.* at ¶32 (showing discharges from Outlets 22, 23, 27 at Mine No. 4A consistently ranging from approximately 1500 µS/cm to above 3000 µS/cm); *id.* at ¶47 (showing discharges from Outlets 013, 015, 017 with conductivity measurements consistently ranging from approximately 2500 µS/cm to 4000 µS/cm). Water quality measurements have also revealed elevated conductivity in Leatherwood Creek and its tributaries. *Id.* at ¶13 (showing conductivity levels ranging from 3000 µS/cm to 4000 µS/cm in Road Fork); *id.* at ¶33 (showing conductivity levels consistently above 1000 µS/cm below Mine No. 4A); *id.* at ¶46 (showing conductivity levels ranging from 3000 µS/cm to 5000 µS/cm in Cogar hollow).

On June 1–4, 2015, the Court conducted a bench trial on liability issues. At the close of the evidence, the Court entered an oral finding on general causation, but reserved judgment on issues of specific causation. Tr. 4 at 259–60, June 4, 2015, ECF No. 107. Since that time, the parties have provided timely post-trial briefing. In Section II, the Court will review the evidence and arguments concerning general causation and elaborate on its general causation finding. In

Section III, the Court will move on to review the evidence and arguments concerning specific causation for each of the three mine permits at issue.[4]

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[4] Defendant expresses concern regarding potential bias related to one member of the Court's staff in an early and lengthy footnote in its post-trial briefing. ECF No. 116 at 3 n.3. Specifically, Defendant provides a survey of publically available electronic media detailing the employment and advocacy history of one of the Court's term law clerks, Ms. McCrae. *Id.* Defendant refers to a denied recusal motion in a 2008 case, but does not expressly request anything from the Court on this occasion. Absent some motion, Defendant's concerns are not properly before the Court. The Court nevertheless offers the following comments.

"There is always some risk of bias; to constitute grounds for disqualification, the probability that a judge will decide a case on a basis other than the merits must be more than 'trivial.'" *United States v. DeTemple*, 162 F.3d 279, 287 (4th Cir. 1998) (citing *In the Matter of Mason*, 916 F.2d 384, 386 (7th Cir. 1990)). "A judge should not allow family, social, political, financial, or other relationships to influence judicial conduct or judgment." Canon 2, Code of Conduct of United States Judges.

In 1948, Congress authorized district courts to employ law clerks, though it did so without elaborating on the specific duties of law clerks. 28 U.S.C. § 752. Law clerks are considered part of a judge's personal staff. Code of Conduct for Judicial Employees § 310.30(a). "The proper role of the judicial adjunct, who in the federal setting may be defined as anyone who helps with the work of Article III courts but whose conditions of employment are not as prescribed in Article III, is to advise and assist the real judge. It is not to be the real judge, only called something else." *Geras v. Lafayette Display Fixtures, Inc.*, 742 F.2d 1037, 1047 (7th Cir. 1984) (Posner, J., dissenting). "No American judge today believes that a law clerk becomes a judge by preparing an opinion draft." *Id.* Judges decide cases; law clerks perform tasks as directed.

Here, Defendant appears to offer no complaint of bias on behalf of the Court, instead questioning potential biases of a subordinate staff-member, a term law clerk. Such concerns are trivial at best. At the risk of stating the obvious, a term law clerk is not a judge. A term law clerk performs tasks as delegated to him or her by a supervising judge. A term law clerk does not enjoy the exercise of discretion. That responsibility is reserved for the judge and the judge alone. A term law clerk merely acts in service of a supervising judge's discretion.

Even ignoring that obvious point, the Court further notes that whatever the specific content of individual statements, the surveyed conduct occurred over four years ago. *See DeTemple*, 162 F.3d at 287 (holding that judge in a bankruptcy fraud proceeding was not required to recuse himself, in part because the judge "last represented [defendant's creditor] almost two years before DeTemple filed for personal bankruptcy and five years prior to his indictment."). In the four years or more that has elapsed since any of the surveyed conduct, Ms. McCrae graduated with honors from a distinguished law school and completed the majority of her service to this Court. The passage of considerable time—in addition to the simple fact that a law clerk is not a federal judge—suggests that there is not a need for recusal here, a point presumably recognized by Defendant as no such motion was made.

Moreover, this Court has decided cases similar to the case at bar for nearly a decade. The decision here is consistent with existing case law. That consistent, existing case law predates not only Ms. McCrae's service as a term clerk with this Court, but also predates much of the conduct

II. General Causation

Generally speaking, Plaintiffs are faced with the dual burden of establishing both general and specific causation.[5] At the close of trial, the Court announced its finding that Plaintiffs met their burden with respect to general causation. Tr. 4 at 259–60, ECF No. 107. Specifically, Plaintiffs proved by a preponderance of the evidence that conductivity, as a measure of a consistent mix of ions typical of alkaline mine drainage in the Appalachian region, may cause or materially contribute to biological impairment to aquatic life as measured by the West Virginia Stream Condition Index ("WVSCI"), thereby constituting a violation of the narrative water quality standards incorporated into Defendant's permits.[6] *Id.*; *accord OVEC v. Elk Run Mining Co.*, 24 F.Supp. 3d 532 (S.D. W.Va. 2014); *OVEC v. Fola Coal Co. (Stillhouse)*, 2015 WL 362643 (S.D.

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causing Defendant's concern. All told, given the nature of term clerk employment, the remoteness of the conduct complained of, and the existence of earlier, consistent precedents, it is difficult to characterize Defendant's concerns as anything more than a trivial and tangential waste of judicial resources.

[5] *See Dittrich-Bigley v. Gen-Probe, Inc.*, No. 11-1762, 2013 WL 3974107, at *7 (D. Minn. July 31, 2013) ("Generally, causation is divided into two components: general and specific. General causation is whether X *can* cause Y. Specific causation is whether X *did* cause Y.") (emphasis in original); *Heller v. Shaw Indus., Inc.*, No. 9507657, 1997 WL 535163, at *6 (E.D. Pa. Aug. 18, 1997) ("General causation addresses whether products of the same nature as [the] defendant's product are capable of causing the type of injuries alleged . . . [, while] specific causation addresses whether [the] defendant's product more likely than not caused injuries in this particular case."). *But cf. Ranes v. Adams Labs. Inc.*, 778 N.W.2d 677, 688 (Iowa 2010) (explaining that while it is analytically helpful to think in terms of general and specific causation in toxic torts cases, both are aspects of factual causation and are not necessarily separately required elements).

[6] The West Virginia Stream Condition Index, or WVSCI, is a multimetric index used to conduct biological assessments of stream conditions. The WVDEP relied on WVSCI as a means to determine whether a violation of the biological standard in subsection 3.2.i was occurring, such that a stream needed to be listed as "impaired" under a Section 303(d) of the Clean Water Act. "[T]he EPA—the final authority regarding whether a state's narrative water quality are being violated for the purposes of Section 303(d) listing—recently made the *specific finding* that WVSCI scores below 68 'indicate that [the] waters [at and in which such scores were assessed] do not achieve the West Virginia narrative criteria as applied to the aquatic life uses'—defined by the EPA to mean the biological standards embodied in § 47–2–3.23 and –3.21." *Elk Run*, 24 F.Supp.3d at 550 (quoting March 25, 2013, Letter from EPA to WVDEP).

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W.Va. Jan. 27, 2015) The bases for the Court's finding on general causation are explained in further detail below, with the majority of discussion focused on Defendant's critiques of EPA's Benchmark, followed by a brief review of other scholarly publications on the question.

A. Introducing the EPA's Benchmark

Yet again, the Court begins its analysis of general causation with arguments concerning the import and reliability of the EPA's Benchmark. *See Elk Run*, 24 F.Supp.3d at 558–59; *Fola (Stillhouse)*, 2015 WL 362643. In March 2011, the EPA released "A Field-Based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams" ("EPA's Benchmark" or "Benchmark"). Joint Ex. 17. The EPA's Benchmark is the studied result of qualified authors and reviewers. *Id.* at ix–xiii (listing authors, contributors, and reviewers, including Defendant's expert, Dr. Charles Menzie).

In the nearly three hundred page Benchmark, the EPA reached the conclusion that "salts, as measured by conductivity, are a common cause of impairment of aquatic macroinvertebrates" in central Appalachian streams only after considering and then ruling out the potential confounding effects of habitat, organic enrichment, nutrients, deposited sediments, pH, selenium, temperature, lack of headwaters, catchment areas, settling ponds, dissolved oxygen, and metals. EPA's Benchmark at A–1, B–1; *see also id.* at A–40 ("This causal assessment presents clear evidence that the deleterious effects to benthic invertebrates are *caused by, not just associated with,* the ionic strength [, i.e., conductivity,] of the water.... When [other potential] causes are absent or removed, a relationship between conductivity and ephemeropteran [, i.e. mayfly,] richness is still evident." (emphasis added)); *id.* at A–37 ("As conductivity increases, the occurrence and capture probability decreases for many genera in West Virginia ... at the conductivity levels predicted to cause effects. The loss of these genera is a severe and clear effect."). The Benchmark also found that "of the

[nine] land uses ... analyzed, only mining especially associated with valley fills[, i.e., mountaintop mining with valley fills,] is a substantial source of the salts that are measured as conductivity." *Id.* at A–18.

The EPA ultimately concluded that the "chronic aquatic life benchmark value for conductivity" in West Virginia streams is 300 µS/cm. *Id.* at xv. To derive this recommended high-end threshold value, the EPA used the 5th percentile of a species sensitivity distribution, based on the standard methodology for deriving water-quality criteria, meaning that this 300 µS/cm benchmark value for conductivity is "expected to avoid the local extirpation [due to the salts measured as conductivity] of 95% of native species." *Id.* at xiv.

In support of both the specific 300 µS/cm benchmark value and the general causal linkage between conductivity and impairment to aquatic macroinvertebrates, the Benchmark contains a graph which charts, for 163 genera, the level of ionic exposure above which a genus is effectively absent from water bodies in a region, with conductivity readings on the x axis and proportion of genera extirpated on the y axis. *Id.* at xiv, 18 fig. 8. A fairly consistent line is formed as conductivity and extirpation both increase, illustrating the causal connection between conductivity and significant biological impairment which Plaintiffs seek to prove. *See id.* at 18 fig. 8. Relatedly, the EPA reported its finding that "the probability of impairment at 500 µS/cm is 0.72 and at 300 µS/cm, is 0.59." Tr. 2 at 111, June 2, 2015, ECF No. 100; Joint Ex. 17 at A-36. Stated differently, when conductivity reaches 300 µS/cm, it is more likely than not that the streams will suffer impairment. Moreover, the likelihood of impairment continues to increase as conductivity further exceeds that threshold. Joint Ex. 17 at A-36; Tr. 2 at 110–12, ECF No. 100.

Upon reviewing the EPA's findings, the Scientific Advisory Board ("SAB") made the follow comments:

> Mountaintop mining and valley fills are important sources of stress to aquatic systems in the Central Appalachian region, both from the perspective of localized and cumulative regional impacts. In a companion report, the Panel provides a review of EPA's assessment of the impacts associated with mountaintop mining and valley fills. There is clear evidence that valley fills are associated with increased levels of dissolved ions (measured as conductivity) in downstream waters, and that these increased levels of conductivity are associated with changes in the composition of stream biological communities.

Pls.' Ex. 128 at PE1418, Tr. 2 at 112–13, ECF No. 100. The SAB further concluded that the EPA had presented a "convincing case" for establishing the causal relationship between conductivity and loss of genera. Pls.' Ex. 128 at PE1431, Tr. 2 at 115, ECF No. 100.

Plaintiffs rely on EPA's Benchmark here as they have elsewhere: as a scientific study which, among others, supports Plaintiffs' general causation theory that high conductivity levels in streams impacted by alkaline mine drainage causes or contributes to biological impairment. Defendant's many critiques of the EPA Benchmark will be considered below. Before doing so, however, it is necessary to briefly revisit general principles regarding the degree of deference owed EPA's Benchmark in the analysis to follow.

"Particularly with environmental statutes such as the Clean Water Act, the regulatory framework ... requires sophisticated evaluation of complicated data.... [A court] therefore do[es] not sit as a scientific body in such cases, meticulously reviewing all data under a laboratory microscope." *Crutchfield v. Cnty. of Hanover, Virginia,* 325 F.3d 211, 218 (4th Cir.2003) (citation omitted) (internal quotation marks omitted). Instead, "[a] reviewing court must generally be at its most deferential when reviewing factual determinations within an agency's area of special expertise.... It is not the role of a reviewing court to second-guess the scientific judgments of the EPA." *Sw. Pennsylvania Growth Alliance v. Browner,* 121 F.3d 106, 117 (3d Cir.1997) (citation omitted) (internal quotation marks omitted); *see also Baltimore Gas & Elec. Co. v. Natural Res. Def. Council, Inc.,* 462 U.S. 87, 103, 103 S.Ct. 2246, 76 L.Ed.2d 437 (1983) ("[A] reviewing court must remember that the [agency] is making predictions, within its area of special expertise, at the frontiers of science. When examining this kind of scientific determination, as opposed to simple findings of fact, a reviewing court must generally be at its most deferential."); *Envtl. Def. Ctr.*, 344 F.3d at 869 ("We treat EPA's decision with great deference because we are reviewing the agency's technical analysis and judgments, based on an evaluation of complex scientific data within the agency's technical expertise."); *Chem. Mfrs. Ass'n v. U.S. E.P.A.*, 919 F.2d 158, 167 (D.C.Cir.1990) ("[W]e give considerable latitude to the EPA in drawing conclusions from scientific and technological research, even where it is imperfect or preliminary." (internal quotation marks omitted)).

"[T]echnological and scientific issues ... are by their very nature difficult to resolve by traditional principles of judicial decisionmaking. For this reason, we must look at the decision not as the chemist, biologist or statistician that we are qualified neither by training nor experience to be, but as a reviewing court exercising our narrowly defined duty of holding agencies to certain minimal standards of rationality." *Reynolds Metals Co. v. U.S. E.P.A.*, 760 F.2d 549, 558–59 (4th Cir. 1985) (internal quotation marks omitted). "[A]n agency's data selection and choice of statistical methods are entitled to great deference, ... and its conclusions with respect to data and analysis need only fall within a zone of reasonableness." *Id.* at 559 (citations omitted) (internal quotation marks omitted). In the context of agency action, "if the agency fully and ably explains its course of inquiry, its analysis, and its reasoning sufficiently enough for us to discern a rational connection between its decision-making process and its ultimate decision, [a court] will let its decision stand." *Crutchfield*, 325 F.3d at 218 (brackets omitted) (internal quotation marks omitted).

In light of these precedents, and as previously analyzed by this Court, EPA's Benchmark must be afforded deference. *See Elk Run*, 24 F.Supp.3d at 558–59, *Fola (Stillhouse)*, 2015 WL 362643 at *4–6. The EPA's Benchmark methodically defines its inquiry, explains its reasonable analysis, and thoroughly supports its ultimate, rational conclusions. Additionally, the Benchmark underwent extensive scientific review, and it is respected as good—or even excellent—science within the relevant scientific community.[7] Dr. Palmer, Tr. 2 at 96, ECF No. 100.

B. Critiques of the EPA Benchmark

Turning to consider newly presented evidence and argument, two recurring questions underlie the Court's instant analysis of general causation as related to EPA's Benchmark: (1) whether specific expertise in epidemiology is required for the development or review of EPA's Benchmark; and, in a similar vein, (2) whether specific expertise in ecology is required for the development or review of EPA's Benchmark.[8] We are faced with these fundamental questions

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[7] The Court further notes that sub-parts of the Benchmark were later published in an esteemed peer-reviewed scientific journal. *See* Susan M. Cormier, Glenn W. Suter II & Lei Zheng, *Derivation of a Benchmark for Freshwater Ionic Strength,* 32 Envtl. Toxicology & Chemistry 263 (2013), Joint Ex. 3; Susan M. Cormier & Glenn W. Suter II, *A Method for Assessing Causation of Field Exposure–Response Relationships,* 32 Envtl. Toxicology & Chemistry 272 (2013), Pls.' Ex. 140; Susan M. Cormier et al., *Assessing Causation of the Extirpation of Stream Macroinvertebrates by a Mixture of Ions,* 32 Envtl. Toxicology & Chemistry 277 (2013), Joint Ex. 4; Susan M. Cormier et al., *Relationship of Land Use and Elevated Ionic Strength in Appalachia Watersheds*, 32 Envtl. Toxicology & Chemistry 296 (2013), Joint Ex. 6; Susan M. Cormier & Glenn W. Suter II, *A Method for Deriving Water-Quality Benchmarks Using Field Data*, 32 Envtl. Toxicology & Chemistry 255 (2013), Pls.' Ex. 139; Glenn W. Suter II & Susan M. Cormier, *A Method for Assessing the Potential for Confounding Applied to Ionic Strength in Central Appalachian Streams,* 32 Envtl. Toxicology & Chemistry 288 (2013), Joint Ex. 5.

[8] *Compare* Dr. Garabrant, Tr. 1 at 49, ECF No. 105 (explaining his qualifications as a reviewer of the EPA Benchmark despite having no formal ecological training or experience as follows: "Well, I understand epidemiology, and I understand how to analyze data. I've spent my career doing that. I've spent my career doing divisional research, analyzing complex datasets, publishing papers in the peer-reviewed literature, and I know how to analyze data. And I do understand the principles of epidemiology. The EPA said they used epidemiology. They didn't use it properly. They did not do what scientists agree they have to do to analyze data properly. So while

because of the apparent (and unsurprising) difficultly in finding an expert in both epidemiology *and* ecology. Instead, the Court heard testimony of expert epidemiologists with no formal ecological training and expert ecologists with no formal epidemiological training.[9] From this mix of incomplete expertise, we are left with the task of sorting competing expert opinions.

As argued by Defendant, because the EPA incorporated principles of epidemiology into its causal analysis, assessing the reliability of the EPA's findings requires review by an epidemiologist.[10] Defendant's expert epidemiologist, Dr. David Garabrant, reviewed the EPA's findings and found several areas where he believed the EPA misapplied epidemiological principles. Tr. 1 at 11, June 1, 2015, ECF No. 105 (asked whether the EPA correctly applied principles of epidemiology, Dr. Garabrant responded, "In some ways, yes; and in some ways, no."). Dr. Garabrant thusly criticized perceived failures on the part of EPA (1) to consider effect modification, (2) to define reliable and valid criteria for assessing confounding, (3) to adequately respond to the quality of the available data, and (4) to transparently and non-manipulatively

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I am not an ecologist, I do understand complex data, I do understand biostatistics, and I do understand epidemiology. The EPA is not entitled to their own version of science.") *and* Dr. Wing, Tr. 2 at 13, ECF No. 100 (explaining that "it's important to have substantive knowledge in the area in which one conducts analyses and draws opinions. . . . Because science involves more than data analysis. There's an important distinction between a data analyst and a scientist because variables in data don't speak for themselves. They require interpretation and understanding of mechanisms, theories in the field, and so on.").

[9] Meaning that whatever their qualifications, no testifying expert held a graduate-level degree in both the natural sciences *and* epidemiology, nor did any testifying expert claim expertise in both fields. That said, testifying ecological experts, e.g., Dr. Menzie, Dr. Palmer, and Dr. Baker, each have considerable expertise in statistical analysis of datasets within their respective disciplines. In contrast, Dr. Garabrant has no formal training related to aquatic ecology and testified to only reviewing literature on aquatic ecology and freshwater macroinvertebrates for purposes of this litigation. Tr. 1 at 53–55, ECF No. 105.

[10] However, also note that "epidemiological studies are not necessarily required to prove causation, as long as the methodology employed by the expert in reaching his or her conclusion is sound." *Benedi v. McNeil-P.P.C., Inc.*, 66 F.3d 1378, 1384 (4th Cir. 1995); *see also United States v. W.R. Grace*, 504 F.3d 745, 765 (9th Cir. 2007) ("the fact that a study is associational—rather than an epidemiological study intended to show causation—does not bar it from being used to inform an expert's opinion").

disclose *all* data. Each of Dr. Garabrant's critiques will be reviewed in turn below, but first the Court observes that Plaintiffs' responses to these critiques can be boiled down to the suggestion that Dr. Garabrant's critiques are fundamentally flawed insofar as Dr. Garabrant did not adequately understand the underlying subject matter, i.e., freshwater ecology.[11]

Taking a particularly illustrative example, Dr. Garabrant's critique of Table B-7 of the EPA Benchmark suggests an inability to correctly apply common statistical tools presumably well within his epidemiological expertise and, in doing so, to adequately interpret available ecological data. Table B-7 offers a relatively straightforward presentation of data purporting to represent two regression lines. Joint Ex. 17 at JE0773. Dr. Garabrant demonstrated the perceived failings of the table by attempting to recreate the graph. *See* Tr. 1 at 22–24, ECF No. 105. Using the data in the table, Dr. Garabrant's recreated graph offered only the nonsensical result of predicting a total absence of mayflies at background conductivity levels. *Id.* Basic knowledge of ecology and observed conditions tell us that, as graphed by Dr. Garabrant, the numbers in Table B-7 cannot be correct. Thus, Dr. Garabrant offered his expert opinion that the table was nonsense. Tr. 1 at 22 ("Something's seriously wrong. It is not a valid result."); *id.* at 24 ("We know that the maximum number of ephemeropteran genera is 14. Of course, the minimum has to be zero. All this [table] generates is negative numbers. It's nonsense.").

Contrary to Dr. Garabrant's opinion, Plaintiffs' expert found the same Table B-7 to be perfectly sensible with the addition of a single interpretive move. Though explained elsewhere in the Benchmark (see, e.g., Figures 13a, 13b, 13c, 13d, and 13e), the authors made no explanation of

[11] For instance, Plaintiffs' expert, Dr. Wing opined that, in his assessment, "[Dr. Garabrant's] statistical analysis and his opinions about the Benchmark are uninformed for the most part by a nuanced and thorough understanding of the topic of stream ecology, which would be necessary for a proper evaluation of that topic." Tr. 2 at 41, ECF No. 100.

whether a logarithmic scale should be used to interpret the data shown at Table B-7.[12] Though not specifying that the data in the table would need to be logarithmically transformed, according to Dr. Baker, the appropriateness of using a log scale would be obvious to an ecologist. Tr. 4 at 229–30, ECF No. 107. With that background expertise in ecological data analysis, Dr. Baker produced two graphs, each using different scales, and each showing results consistent with the data analyzed. Pls.' Exs. 176 and 177.

Thus, what appeared to one epidemiological expert to be an incorrect and nonsensical table, was in fact a perfectly sensible table that the authors merely neglected to adequately label for non-expert reviewers. While there is likely no across-the-board answer to what respective degrees of epidemiological and ecological expertise are necessary to evaluate the EPA's Benchmark, this example serves as a ready reminder in the analysis to follow that something beyond wholly non-contextual data analysis may be needed.[13]

1. Assessment of Effect Modification

[12] Dr. Baker recalled a general explanation specifying use of a logarithmic scale offered elsewhere in the Benchmark, but he was not able to quickly find such a reference while on the stand. Even with the benefit of greater time and digital copy, the Court was similarly unable to find such a general reference.

[13] As explained by Dr. Garabrant, "[i]ssues such as confounding and effect modification are universal issues in complex, multivariate datasets. Epidemiology has worked out approaches to correctly recognize and, when possible, adjust for and deal with those issues. . . . [T]hose issues are not unique to ecologic datasets. They run through ecology, psychology, economics, human health studies. Those are just characteristics of large multivariable datasets." Tr. 1 at 50, ECF No. 105. While these principles and concepts may be universally applicable, Dr. Garabrant nevertheless managed to handily demonstrate how readily and unabashedly an analyst can misstep when applying them if he is unfamiliar with the subject matter under analysis.

Dr. Garabrant's misstep gives pause precisely because it was the result of a simple mathematical exercise; one that required mastery of little more than most are taught in high-school. Presumably, it is not Dr. Garabrant's competency at graphing that failed him, but his ability to sensibly interpret and analyze *ecological* data. As cautioned by Dr. Wing, "the further one goes from one's substantive knowledge, the more difficultly one would have even if the methods used, for example, in statistics were the same." Tr. 2 at 21, ECF No. 100.

Turning to Dr. Garabrant's broader critiques of the EPA Benchmark, we begin with the suggestion that the Benchmark is fundamentally flawed insofar as the EPA failed to account for effect modification. As explained by Dr. Garabrant, "[e]ffect modification occurs when the association between two factors is different depending on the presence or absence of a third factor. If, for example, the association between an exposure and an outcome is different for men than for women, sex modifies the relationship between the exposure and the outcome." ECF No. 90-1 at 3; *see also* Dictionary of Epidemiology (Miquel Porta ed., 6th ed. 2014) (defining "effect modification" as a "[v]ariation in the selected effect measure for the factor under study across levels of another factor"); *id.* (defining "effect modifier" as "[a] pre-exposure factor across whose levels the value of the effect measure of interest varies; [a] factor that biologically, clinically, socially, or otherwise alters the effects of another factor under study"). When effect modification is present, "[c]ombining the two groups to create a summary measure of association is meaningless: it is not true for men and it is not true for women." ECF No. 90-1 at 3. Thus, before a causal analysis moves on to continue potential confounders, it is essential to first assess whether effect modification is present. Dr. Garabrant, Tr. 1 at 14–15, ECF No. 105.

Returning to Dr. Garabrant's critique, indeed, the words "effect modification" cannot be found in the text of the Benchmark, suggesting to Dr. Garabrant that the EPA did no analysis of effect modification. In an effort to assess the presence or absence of effect modification, Dr. Garabrant turned to the underlying data and produced a series of figures purportedly showing the presence of effect modification. *See* Def.'s Exs. 31–36. In each table, the percent of sites with ephemeroptera present is represented along the y-axis, conductivity is represented along the x-axis, and blue, red, and green lines run across the graph as representations of low-, mid-, and upper-range values for a given potential effect modifier, respectively. Taking the example of pH as a potential effect modifier (Def.'s Ex. 31), Dr. Garabrant explained that the effect of pH can be gleaned from looking at "the vertical distance between the green line and the blue line holding conductivity constant," with greater vertical distance suggesting greater likelihood of effect modification. Tr. 1 at 36–37, ECF No. 105.

Using these tables to thusly visualize the data, Dr. Garabrant reached the conclusion that effect modification was present with respect to pH (Tr.1 at 37, ECF No. 105 (discussing Def.'s Ex. 31: "[i]f pH is neutral to high, there is no relationship between conductivity and Ephermera. If pH is low, the insects are adversely affected. That's what effect modification looks like")), stream size (Tr. 1 at 39, ECF No. 105 (discussing Def.'s Ex. 32: "I think you have evidence here of effect modification . . . You are getting a different answer according to stream size. That's effect modification")), dissolved oxygen (Tr. 1 at 41, ECF No. 105 (discussing Def.'s Ex. 33)), iron (Tr. 1 at 43, ECF No. 105 (discussing Def.'s Ex. 34)), and manganese (Tr. 1 at 44–45, ECF No. 105 (discussing Def.'s Ex. 36)). Thus, the Court has one trained epidemiologist, with no formal background or experience in ecology, claiming that the EPA neglected to consider effect modification, and in so doing, missed the presence of several effect modifiers, thereby undermining the entirety of its causal analysis.

A second trained epidemiologist offered testimony on the same issue, but reached starkly different conclusions. Responding to Dr. Garabrant's analysis of effect modification and EPA's Benchmark, Plaintiffs' expert, Dr. Wing, cautioned that, "in order to make a decision about interaction or effect modification, it's first necessary to have some idea about the topic one is investigating because without that, one can make egregious mistakes about an analysis which can be done by someone who doesn't know anything about the topic but could result in essentially meaningless conclusions or actually conclusions that are misleading." Tr. 2 at 20, ECF No. 100.

He further stated the belief "that the issue of effect modification or interaction is one that should be made based on subjective knowledge in the area, and it's not one that's simply a statistical requirement or rule." Tr. 2 at 20, ECF No. 100.

Consistent with that fundamental reservation and despite his considerable epidemiological expertise, Dr. Wing was unable to agree with Dr. Garabrant's conclusion that effect modification is present in the dataset and yet left unaddressed by EPA. Looking, for example, at Dr. Garabrant's figure assessing dissolved oxygen as a potential effect modifier (Def.'s Ex. 33), Dr. Wing observed similar trends across low-, mid-, and upper-range dissolved oxygen levels. Tr. 2 at 45, ECF No. 100. According to Dr. Wing, the similarity of the trend, or slope, suggests an *absence* of effect modification. *Id.* Moreover, solely based on the graph relied upon by Dr. Garabrant, Dr. Wing explained that it was impossible to definitively assess effect modification because Dr. Garabrant neglected to include any information on sample size or precision (e.g., no slope estimates or standard error estimates are provided). Tr. 2 at 46, ECF No. 100. And so the opinion of a second epidemiologist without ecological training reaches not only a contrary conclusion about effect modification, but further identifies an analytical barrier to reliably interpreting the graphs relied upon by the first.

To that uncertain mix, Dr. Baker contributes his opinion on effect modification as an ecologist without formal epidemiological training. Like Dr. Wing, Dr. Baker similarly critiqued the absence of information on sample size or precision.[14] Dr. Baker further called attention to the

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[14] On cross-examination, Dr. Baker was asked why he did not recreate plots, just as Dr. Garabrant had done, and calculate measures of significance necessary to interpret the plots created by Dr. Garabrant. Tr. 4 at 236–38, ECF No. 107. Like Dr. Garabrant, Dr. Baker did have access to the dataset and the expertise necessary to repeat the analysis. Since he could have repeated Dr. Garabrant's analysis to reveal error bars and since we find ourselves in an adversarial context, it is not unreasonable to ask why Dr. Baker did not do so.

That said, even in an adversarial context, it is arguably reasonable to expect that experts fact that values were binned across the conductivity gradient by Dr. Garabrant in a manner that failed to control for sample size within each bin.[15] Most surprising, however, was Dr. Baker's testimony that the EPA *did* assess effect modification. According to Dr. Baker, the term "effect modification" is not commonly used in ecology. Tr. 4 at 239, ECF No. 107. Instead, ecologists commonly refer to "covariation" as a "catchall term" used for both confounding and effect

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will proffer opinions in such a way that enables others to evaluate the significance and reliability of their work. As reminded by the current and past presidents of the International Epidemiological Association in the Forward to the Sixth Edition of the Dictionary of Epidemiology, "[t]he nature of science is not to reach consensus but to advance our knowledge by bringing conflicting ideas to critical examinations." Consistent with this interest in enabling critical examinations, in the context of science conducted purely for sake of advancing knowledge, experts are expected to provide sufficient information to enable peer review. This expectation of transparency ensures integrity and allows for meaningful discussions of what is known or unknown, and to what degree. It is not unreasonable for a court to have similar minimum expectations in the service of reaching reliable final judgments.

Thus, the better question might have been why did Dr. Garabrant *not* include indicators of significance in the analysis he conducted and presented to this Court. One can only imagine what dimensions of bias may be introduced to expert findings when moved from the theoretically unbiased universe of Science to the purposefully adversarial universe of courts. Without making judgments as to motive, reasonable possible inferences could be as troubling as thinking that Dr. Garabrant did not do so because he did not understand the interpretive significance of such indicators—calling the competency of his analysis more generally into question—or that he did not do so precisely because he did understand the interpretive significance—calling the credibility of his analysis more generally into question. Such musings could and should be rendered unnecessary merely by experts taking care to present findings to the Court with a degree of transparency that enables critical examination of conflicting ideas.

[15] Whatever conclusion is to be reached in light of the alleged obstacles to interpreting the significance of the plots, Dr. Baker added that conclusions regarding pH would be immaterial because EPA controlled for any effect modification occurring at pH<6 by truncating the data accordingly.

Though criticized, truncating data and sample selection appear to be accepted methodological approaches to control for confounding. *See e.g.* Virginia Tech, Pls.' Ex. 173 at PE 1692 ("This was accomplished by seeking study streams with attributes such as habitat quality that were as similar as possible to minimally-disturbed reference streams of the region. The design was intended to ensure that TDS, including its component ions, was the primary factor associated with biotic stress in these streams"); Dr. Wing, Tr. 2 at 32–33, ECF No. 100 (explaining the methodological validity of truncating data as a means of controlling for potential confounding effects).

modification. Tr. 4 at 191, ECF No. 107. Though never using the term, Dr. Baker remains assured that the EPA considered effect modification through alternate means. *Id.* at 191, 239.

Even standing independently, the rebuttal arguments offered by Dr. Wing and Dr. Baker arguably do enough to dispose of Dr. Garabrant's critique of the EPA Benchmark related to analysis of effect modification. Dr. Wing's testimony effectively draws the adequacy of Dr. Garabrant's expertise into question, and Dr. Baker's testimony demonstrates the importance of ecological expertise in reading and evaluating the EPA's work. Furthermore, Plaintiffs' expert testimony does not stand alone; it is accompanied by and consistent with the expertise and analysis of the EPA—an expert federal agency acting in its area of expertise.[16]

2. Analysis of Confounding

Dr. Garabrant further argued that the EPA performed an unreliable analysis of confounding, thereby rendering EPA's causal conclusions invalid. The Dictionary of Epidemiology defines "confounding" as

> [T]he distortion of a measure of the effect of an exposure on an outcome due to the association of the exposure with other factors that influence the occurrence of the outcome. Confounding occurs when all or part of the apparent association between the exposure and the outcome is in fact accounted for by other variables that affect the outcome and are not themselves affected by exposure."[17]

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[16] As previously noted by the Court, in developing the Benchmark, the EPA's findings were subjected to review and comment by the Science Advisory Board. *Fola (Stillhouse)*, 2015 WL 362643, at *6. As noted by Dr. Garabrant, not only are there epidemiologists on the Science Advisory Board, "there are some very fine [epidemiologists]" serving in that capacity. Tr. 1 at 71, ECF No. 105. While offering constructive criticisms for further analysis, these epidemiologists evidently accepted the EPA's Benchmark as adequate, to say the least.

[17] In addition to this textbook definition, we might also keep in mind that, "confounding, like many concepts in science, is a basic concept, but it's not a settled concept, meaning that there are disagreements between epidemiologists, even in textbooks, about exactly how to define 'confounding.'" Dr. Wing, Tr. 2 at 25, ECF No. 100; *see also* Sharon Schwartz et al., Toward a Clarification of the Taxonomy of "Bias" in Epidemiology Textbooks, *Epidemiology* 26:2 (March 2015), Pls.' Ex. 170 ("We identified and reviewed 28 textbooks that met the inclusion criteria. Our review verified the norm of categorizing bias into confounding, selection bias, and information bias. All textbooks that included an organizing scheme (24/28) used these categories. However,

As argued by Dr. Garabrant, the EPA failed to adequately and reliably assess confounding, instead relying on an unverified and subjective methodology. Tr. 1 at 16–18, ECF No. 105.

Asked to comment on the validity of EPA's approach to analyzing confounding, Dr. Garabrant hestitated to say whether the approach was valid or not. Tr. 1 at 16, ECF No. 105 ("It's hard to say whether it is valid. I have never seen it used. I haven't seen any validation of it. I have never seen any test of this method to show that it works. So I would say it's not known whether it's reliable or not. EPA created it."). Beginning broadly, Dr. Garabrant called attention to the following paragraph from the Benchmark explaining the EPA's approach to confounding in its causal analysis:

> Weighing evidence for confounding factors differs from weighing evidence for causation. The causal assessment in Appendix A determines whether dissolved salts are an important cause of biological impairment in the region. This assessment of confounding accepts the result of the causal assessment and attempts to determine whether any of the known potential confounders interfere with estimating effects of conductivity to a significant degree.

EPA Benchmark at B-3. As explained by Dr. Garabrant, this paragraph reflects an analytical error on the part of the EPA akin to "putting the cart before the horse." Tr. 1 at 17, ECF No. 105 ("[T]he idea that you accept the result of causal assessment and then look at confounding is simply putting the cart before the horse. It's backwards."). In addition to this analytical error, Dr. Garabrant suggested that EPA's approach was relatively arbitrary and subjective. Tr. 1 at 16, ECF No. 105.

Dr. Garabrant then went on to explain that epidemiologists commonly rely on a relatively straightforward way to identify the presence of confounding effects: compare the results of a crude

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only one textbook articulated the 2 elements of a consistent taxonomy—a feature that unites confounding, selection bias, and information bias and a feature that differentiates them. There was variation across textbooks as to how close they came to a clear description of the structure of their schema.").

analysis testing the association between conductivity and extirpation against the results of an adjusted analysis that introduces a potential confounding factor.[18] Tr. 1 at 18–19, ECF No. 105. Using the same dataset relied upon by the EPA, Dr. Garabrant performed precisely that analysis. *See* Def.'s Ex. 40. The results of that analysis are reproduced in the following table:

Variable	**Adjusted parameter estimate of conductivity**	**Percent change in parameter estimate after adjustment**
Dissolved Manganese	-2.13	81.94%
Sulfate	-3.16	22.85%
Total Magnesium	-4.77	18.67%
Total Orthophosphates	-4.69	17.17%
Hardness	-4.45	12.81%
Alkalinity	-4.42	12.23%
Watershed Square Kilometers	-4.41	12.04%
Dissolved Calcium	-3.47	11.87%
Total Selenium	-4.40	11.82%
Dissolved Orthophosphates	-4.40	11.72%
Total Manganese	-3.50	10.90%

Table 1: Confounders present in the EPA dataset. Adjusted conductivity parameter estimate and percent of change effected by each confounder. Crude conductivity (logarithm transformed) parameter estimate is -3.88. Def.'s Ex. 40.

Referring to this table, Dr. Garabrant offered testimony that any change in parameter estimate after adjusting for a given variable greater than 10% signals the presence of confounding. Tr. at 71–72. On cross-examination, however, Dr. Garabrant readily acknowledged that while "there is widespread agreement that more than fifty percent change is important," in the range of ten to twenty percent, judgments about confounding would depend on the analyst's background

[18] In contrast, Dr. Wing offered testimony that "there is not a set of rules for saying whether or not there's confounding." Tr. 2 at 27, ECF No. 100. Moreover, "different epidemiologists have somewhat different definitions of 'confounding'" such that "even if there were rules, they would have different rules." Dr. Wing, Tr. 2 at 27–28, ECF No. 100. Ultimately, according to Dr. Wing, "[you have to understand the substance of the topic" when conducting a causal analysis precisely because "[t]here's no generic analytic method which produces reliable science." Tr. 2 at 28, ECF No. 100. Here, it is perfectly reasonable to expect that the EPA possesses such expertise.

knowledge in the subject matter at issue. Tr. 1 at 72, ECF No. 105. As already mentioned, Dr. Garabrant is without precisely that background knowledge. Accordingly, the Court is left to conclude that Dr. Garabrant's ten percent threshold is itself arbitrary and unreliable.

Beyond analytical differences of opinion, the Court is further unmoved by Dr. Garabrant's analysis of confounding given the quality of underlying data and the nature of certain variables. First, as will be discussed at length in the next section, some of the variables analyzed by Dr. Garabrant for confounding are known to ecologists to have little to no relevance in the context of West Virginia streams impacted by alkaline mine drainage. (e.g., orthophosphates, *see infra* Section II.B.3.a). Second, and also discussed below, the database lacks a significant number of data points for some of these variables *unless* total and dissolved values are considered together. (e.g., magnesium, calcium, selenium, and manganese, *see infra* Section II.B.3.a).

Like Dr. Garabrant, this Court would be unable to set anything but an arbitrary threshold for recognizing potential confounding variables. Instead, the Court continues to rely on the expertise of ecologists and testimony assuring the Court that the EPA engaged a reasonable and verified analysis of confounding.[19]

3. Adequacy of the underlying data

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[19] Furthermore, the Court notes that EPA's findings are corroborated by considerable peer-reviewed scientific literature. *See infra* Section II.C. Such studies, which will be reviewed below, reach corroborating conclusions regarding the causal relationship between ionic pollution and loss of freshwater macroinvertebrates despite reliance on unique methodologies and distinct datasets. Dr. Baker estimated that, across the published literature, roughly six to ten different statistical techniques have been relied upon to test that causal relationship. Tr. 3 at 123, ECF No. 106. Whatever technique is used, experts have consistently identified conductivity as the most likely cause of biological impairment. Similarly, Dr. Baker estimated that at least five different methods had been used across the published literature to analyze potential confounding factors. *Id.* at 124. Again, whatever the method used, experts have consistently ruled out potential confounders and identified conductivity as the most likely cause of biological impairment.

Dr. Garabrant offered two critiques of the data relied upon by EPA in developing the Benchmark. First, Dr. Garabrant highlighted missing data points (e.g., limited number of data points for dissolved calcium). Second, Dr. Garabrant criticized EPA's presentation of data and its analysis thereof as misleading.

a. "Missing" Data

With respect to allegations of fatally missing data, Dr. Garabrant prepared a table reporting the number and percent of missing data points for each variable missing greater than 50% of the possible data points. Def. Ex. 38 (reproduced below).

Variable	Number Missing (out of 2,210 total observations)	Percent Missing (out of 2,210 total observations)
Dissolved magnesium	2209	99.95%
Dissolved calcium	2201	99.59%
Dissolved manganese	2190	99.10%
Dissolved orthophosphates	2171	98.24%
Total orthophosphates	2170	98.19%
Dissolved selenium	1897	85.84%
Total selenium	1714	77.56%
Percent brush	1493	67.56%
Percent barren	1493	67.56%
Percent wetland	1493	67.56%
Percent agricultural	1493	67.56%
Percent urban	1493	67.56%
Percent woodland	1493	67.56%

Table 2: Number and percent of missing for each variable (Missing > 50% only). Def.'s Ex. 38.

According to the table, greater than 98% of the data points are missing for dissolved magnesium, dissolved calcium, dissolved manganese, dissolved orthophosphates, and total orthophosphates. Def.'s Ex. 38. Additionally, between 67% and 78% of the data was missing for various land cover variables, 85% of the data was missing for dissolved selenium and 77% missing for total selenium. According to Dr. Garabrant, these deficiencies in the dataset prevented the EPA from meaningfully analyzing potential effects of these variables.[20] Tr. 1 at 24–25, ECF No. 105.

However, as an ecologist, Dr. Baker was not similarly troubled by the missing data. First, he explained that deficiencies found in dissolved magnesium, were well compensated for by data on total magnesium.[21] Tr. 4 at 199–201, ECF No. 107. As is the case with magnesium, greater than 50% of the sites in the WVDEP database had available data points for total calcium and total manganese. *Id.* Similarly, when the data points for both dissolved and total selenium are combined, greater than 50% of the sites had data on selenium levels.[22] *Id.*

With respect to alleged missing data on land cover categories, Dr. Baker was similarly untroubled. Dr. Baker testified that, as an ecologist, one would not be likely to consider any of these variables as potential confounding variables and would therefore likely ignore these categories as immaterial. *Id.* Finally, with respect to orthophosphates, Dr. Baker explained again that the lack of data would not trouble an ecologist in this context, because orthophosphates in high concentrations are associated with agricultural landscapes, which are generally not found near—much less coextensive with—mining areas in West Virginia. *Id.* at 201. Stated differently, the absence of land cover data or orthophosphate measurements would only trouble a reviewer to the extent that he did not have the necessary background familiarity with ecology and land use

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[20] Surprisingly, Dr. Garabrant did not similarly conclude that these perceived data deficiencies prevent meaningful analysis of potential effect modification. Nearly half of Dr. Garabrant's likely effect modifiers also appear in his table listing variables with insufficient datapoints. *Compare* Def.'s Ex. 38 *and* Def.'s Ex. 40. For example, we see that there is only one data entry for dissolved magnesium among a total 2,210 observations, yet Dr. Garabrant concluded that dissolved magnesium is a likely effect modifier. Similarly, Dr. Garabrant identified dissolved manganese as the most likely effect modifier, despite there being only twenty data points for dissolved manganese among a total 2,210 observations.

[21] Dr. Baker represented that the dataset includes over 1,000 data points for Total Magnesium, Total Calcium, and Total Manganese. No testimony was offered to suggest different effects based on whether substances are present in ionized or non-ionized forms.

[22] Notwithstanding observations about the amount of selenium data available, all experts agreed that the EPA Benchmark recognized that given the limited available data, occurrence and effects of selenium should be investigated further.

patterns to independently recognize the insignificance of the variables.

b. "Hidden" Data

In addition to purportedly fatally missing data, Dr. Garabrant also criticized the EPA Benchmark for "hiding data." As explained by Dr. Garabrant, a series of tables provided in Appendix B (Tables B-8 (habitat), B-13 (Embeddedness), B-15 (pH), B-23 (stream size), B-25 (dissolved oxygen), B-28 (iron), B-29 (Aluminum), B-30 (Manganese)) all share a common flaw: failure to include significant chunks of data for conductivity levels between 200 µS/cm and 1500 µS/cm, instead, only showing data at extreme conductivity conditions (i.e., < 200 µS/cm and > 1,500 µS/cm). In some instances, these tables fail to include significant mid-range data for not only conductivity, but also for the variable of interest (e.g., mid-range iron data was not included in Table B-28). Dr. Garabrant recognized and critiqued the absence of mid-range data, and was unable to provide any methodological or analytical justification for its absence.

Making good use of database access, Dr. Garabrant recreated the suspect tables to include mid-range data (*see* Def.'s Exs. 39, 43–49) and then continued to plot the data represented in each table (*see* Def.'s Exs. 30–36). Based on this information, Dr. Garabrant reached two conclusions: (1) effect modification is present with respect to each co-variate represented; and (2) there is a consistent absence of conductivity effects regardless of co-variate levels until conductivity reaches 1200 µS/cm to 1500 µS/cm. These conclusions suggested to Dr. Garabrant that there are serious flaws in the EPA's analysis. Tr. 1 at 33–46, ECF No. 105. In turn, Dr. Garabrant's only explanation for how the Benchmark reached publication despite hidden data became the suggestion that the SAB and peer reviewers would not have had access to the dataset and the ability to perform the analysis he did. Tr. 1 at 48–49, ECF No. 105.

Through the testimony of Dr. Baker and Dr. Wing, Plaintiffs supplied convincing rebuttals to each criticism related to "hidden data" raised by Dr. Garabrant. Not only are these rebuttal arguments convincing, but to some extent, they also highlight the drawbacks of data analysis performed with relatively limited understanding of the subject matter being analyzed. First, Dr. Baker explained a methodological reason EPA did not include mid-range data in the tables: given the nature of the data, mid-range values were irrelevant to answering the question asked. Tr. 4 at 203–04, 207–11, ECF No. 107. The EPA dataset was qualitatively limited (or coarse) in that the data captured presence or absence of mayflies, but not information on abundance or variety. The category "mayflies" includes a variety of discrete species, each with particular sensitivity to conductivity. Some mayflies are uniquely sensitive, while others are uniquely tolerant to conductivity. As established in the then published literature, *all* mayflies—sensitive and tolerant alike—can be expected to have a negative response to conductivity levels in excess of 1,500 μS/cm. Stated differently, until conductivity exceeds 1,500 μS/cm, the available data would likely show *some* mayfly present.[23] If *some* mayfly is present, however, that does not necessarily tell us anything about abundance (i.e., only one bug could be present) or variety (i.e., only one species of mayfly could be present). Accordingly, if the question is whether or not mayflies may be present regardless of co-variate influences, the data only allow us to answer that question if we look to the extreme conductivity ranges (i.e., lowest conductivities where we would expect even the most sensitive mayflies to be present and the highest conductivities where we would expect even the most tolerant mayflies to be absent).

Given Dr. Baker's more nuanced explanation of the import of the data shown and the data

[23] As explained directly by Dr. Baker, "[t]he criteria the EPA was using here was to find any site with a mayfly. Now because the mayfly is an order, there are many families with different characteristics and also genera within those families, and we know that at least a few of them can tolerate exceptionally high conductivities. Therefore, it would not be surprising at all to find mayflies, a mayfly, at nearly all of the sites between 200 and 1,500 μS/cm." Tr. 4 at 203–04, ECF No. 107.

not shown, Dr. Garabrant's criticism of hidden data does little to impugn the work of EPA scientists, instead illustrating Dr. Wing's point that data analysis is not the same as the interpretation of data. While an epidemiologist may be qualified to run data analyses on any dataset, it should not be assumed that an epidemiologist is necessarily otherwise qualified to interpret the results of that analysis.

Second, Dr. Baker tailored his interpretation of the data presented according to the function of the tables in the overall analysis. Importantly, these tables were not relied upon by the EPA to identify threshold effects; these tables were introduced to explain EPA's confounding analysis. Presence or absence of some mayfly genera without any data on abundance or variety explains very little that would help to identify a conductivity threshold at which the most sensitive macroinvertebrates suffer extirpation.

4. Inter-state differences in species sensitivity

Dr. Garabrant's observations about the differences between XC95 values in West Virginia and in Kentucky are among his most immediately compelling observations. The Benchmark's XC95 values report genera-specific response thresholds at which you can expect 95% of freshwater macroinveterates to tolerate conductivity levels. While it is not surprising to expect different genera to have different response thresholds, Dr. Garabrant made the troubling observation that there are variances in the response thresholds *within* genera based on whether the data was sourced from West Virginia or Kentucky. For example, cross comparison of tables reveals the following differences between response thresholds for genera in West Virginia and Kentucky, among others:

Genera	West Virginia	Kentucky
Diphetor	632	190
Oulimnius	>2,791	320
Pycnopsyche	295	>775
Wormaldia	>1,553	235
Dolophilodes	>863	270
Oulimnius	>2,791	320
Ablabesmyia	>11,646	>1,410
Lepidostoma	~121	149

Table 3: XC95 thresholds identified in EPA's Benchmark for selected genera under the West Virginia and Kentucky datasets.

It is easy to share Dr. Garabrant's shock upon noticing that different genera apparently have different response thresholds depending on whether they are observed in one state or another.[24] Surely biological responses should not vary according to political boundaries; indeed, as aptly stated by Dr. Garabrant, "bugs don't know where they live." Tr. 1 at 29, ECF No. 105.

Though Dr. Garabrant could only imagine such discrepancies suggested fatal methodological and analytical flaws, Dr. Baker readily offered sound explanations rooted in the nature of data analysis and data collection. Tr. 4 at 211–14, ECF No. 107. First, whatever the differences in XC95 values of a few genera, across the entire datasets, the XC95 are very well correlated.[25] *Id.* at 211–12. Second, the West Virginia dataset includes several thousand samples; the Kentucky dataset includes roughly two hundred. *Id.* at 213–14. All else being equal, based on sample size alone, the Kentucky data would have a larger possibility of error and the West Virginia database would be more reliable. *Id.* In addition to differences in the quantity of data, the quality of the data for each state is unique. *Id.* at 214–15. In Kentucky, sampling protocol

[24] It is worth noting that Plaintiffs are not complaining of conductivity levels that mildly exceed EPA's Benchmark of 300 μS/cm. With few exceptions, the conditions at issue here exceed nearly all the XC95 threshold values from either state.

[25] Dr. Baker further noted that the particular taxa discussed by Dr. Garabrant "represent the most extreme outliers, so they are an example of just taking the [worst] cases to make a comparison." Tr. 4 at 212, ECF No. 107.

directs that *all* bugs collected in the sample be counted. *Id.* In West Virginia, the sampling protocol directs that only a subset of the total sample be counted. *Id.*

Given these differences in collection methods and database size, one would expect that the EPA would identify two different and loosely associated benchmarks. Yet the methodology used by the EPA identified remarkably similar benchmark values notwithstanding species-specific differences.[26] Dr. Garabrant correctly concludes that the datasets are imperfect—individually and relatively. So far as this Court understands ecological study, datasets are invariably imperfect. Notwithstanding perennial deficiencies in information, it remains the task of the scientist to distill reliable (and in the regulatory context, actionable) results. Based on Dr. Baker's explanation of the distorting effect of the quality and quantity of data in West Virginia as opposed to Kentucky, the Court remains confident that the EPA Benchmark presents reliable findings based on the information available. This is particularly the case with respect to the EPA's analysis and conclusions based on the WVDEP database. Tr. 4 at 216, ECF No. 107 ("Overall, I would expect the West Virginia dataset to be a little bit more precise given the nature of the data size.").

C. Scholarly Publications and Expert Opinions

In addition to EPA's Benchmark, Plaintiffs further relied on a seemingly ever-growing collection of published, peer-reviewed journal articles addressing the connection between conductivity and impairment in Appalachian streams. Through the testimony of experts, the Court was introduced to myriad peer-reviewed articles. In revisiting that collection of articles below, note the complete absence of peer-reviewed scientific articles to the contrary.[27] Tr. 2 at 95,

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[26] Dr. Baker offered testimony explaining that the XC95 values in both states were closely correlated even in the aggregate and in an analog scale. Tr. 4 at 227, ECF No. 107.

[27] In collaboration with colleagues, Dr. Menzie developed a paper titled "A Cautionary

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ECF No. 100. Instead, the scientific community repeatedly reaches and reports the same conclusion despite the use of multiple methodologies relying on a variety of datasets and conducted by a range of expert scientists.[28] Given that growing and consistent body of scientific study, it is not surprising that Dr. Palmer is of the opinion that "there is a strong relationship and evidence of causation between high conductivity and impairment" in central Appalachian streams impacted by alkaline mine drainage. Tr. 2 at 94, ECF No. 100 ("I have at this point absolutely no doubt. There are so many studies that have been done, using very different methods and very different places that have all reached the same conclusion."); *see also* Tr. 3 at 125–26 (Dr. Baker explains that the relationship between elevated conductivity and biological impairment is very strongly supported, to the point that he would sooner consider it a fact of science than a theory).

The scientific literature concerning the relationship between conductivity and impairment likely began in earnest in 2003 with publication of an Environmental Impact Study (EIS) of mountaintop mining valley fills. Tr. 2 at 99, ECF No. 100. Authors of the EIS examined changes in water chemistry and biological assemblages, finding increased concentrations of sulfates and dissolved solids, increased specific conductance, and a coincident decrease in sensitive taxa in impacted streams. Tr. 2 at 99–100, ECF No. 100. Other early publications included a paper by

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Note About Deriving Causal Relationships in Water Quality Benchmarks from Field Observations Data: A Case Study in West Virginia Headwaters." That paper includes some of the same material, tables, and conclusions offered as testimony before this Court, on this and previous occasions. Tr. 4 at 89, ECF No. 107. Development for publication was supported and funded by Fola, Alpha, and Rio Tinto. *Id.* at 90–91. Dr. Menzie submitted the paper for publication to *Environmental Science and Technology*, a journal which has previously published Dr. Menzie's work and the journal that published a series of articles by Cormier and Suter ostensibly comprising the EPA's Benchmark. *Id.* at 89–90. "A Cautionary Note" was not accepted for publication.

[28] As relayed by Dr. Palmer, "[o]ne of the things we're taught very early on as a scientist, that the strongest form of inference you can make is if you have multiple ways to reach the same conclusion; if you use multiple methods, different kinds of experiments, observations, and particularly if different people do this work so you can eliminate potential methodological differences that individuals might impart." Tr. 2 at 96, ECF No. 100.

Kennedy et al. the following year, relaying the finding that exposure to elevated conductivity levels resulted in loss of organisms (Joint Ex. 9; Tr. 2 at 100, ECF No. 100), and a 2005 publication by Hartman examining the relationship between conductivity and mayfly richness. Tr. 2 at 100, ECF No. 100.

In 2008, Gregory Pond et al. published a paper in the Journal of North American Benthological Society, titled "Downstream effects of mountaintop coal mining: comparing biological conditions using family- and genus-level macroinvertebrate bioassessment tools."[29] Joint Ex. 13. In the underlying study, the authors conducted field sampling in order to analyze differences in water chemistry and macroinvertebrate assemblages at mined and unmined sites. Tr. 2 at 104. Pond et al., concluded that there was strong evidence of a causal relationship between conductivity and biological impairment. *Id.* at 104 ("Our results indicate that [mountaintop removal mining] is strongly related to downstream biological impairment, whether raw taxonomic data, individual metrics that represent important components of the macroinvertebrate assemblage, or [multimetric indexes] are considered. The severity of the impairment rises to the level of violation of water-quality standards (WQS) when states use biological data to interpret narrative standards."). Moreover, the authors particularly noted that mayflies were especially sensitive to changes in water chemistry. *Id.* at 104.

Furthermore, Pond et al. calculated correlation coefficients of "[GLIMPSS] and [WVSCI] and genus- and family-level nonmetric multidimensional scaling (NMS) axis scores [verses] a truncated list of environmental variables," including conductivity, embeddedness scores, sediment deposition scores, and total rapid biological protocol ("RBP") habitat scores.[30] *See* Table 5, Pls.'

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[29] Authors include Gregory J. Pond, Margaret E. Passmore, Frank A. Borsuk, Lou Reynolds, and Carole J. Rose.

[30] The EPA's rapid bioassessment protocol is a multimetric tool for scoring habitat quality

Ex. 173 at JE0196. The authors found statistically significant correlations between the metrics and the total RBP habitat score (GLIMPSS 0.38; WVSCI 0.43), but not the embeddedness scores (GLIMPSS 0.23; WVSCI 0.22) or the sediment deposition scores (GLIMPSS 0.20; WVSCI 0.28). *Id.* The correlation coefficient for conductivity was almost two-fold the other values (GLIMPSS –0.91; WVSCI –0.80). *Id.* These findings support the conclusion that '[w]ater quality structured benthic communities more than habitat quality." Pls.' Ex. 173 at JE0198.

Though relatively insignificant, Pond 2008 did find some positive correlation between habitat quality and aquatic life; however, subsequent studies have made further efforts to parse the difference between habitat influenced effects and the effects of water chemistry. *See e.g.* Pls.' Ex. 173 at PE 1537 ("This suggests that degradation of water quality and the resultant increases in specific conductivity, component ions, and trace metals limit aquatic life regardless of habitat quality."); Virginia Tech, Pls.' Ex. 173 at PE 1703 ("Nonetheless, the extensive effort undertaken to locate test sites with abiotic conditions comparable to those of reference sites was successful in minimizing biotic influence from non-TDS [total dissolved solids] stressors, including poor habitat quality. This was an important step toward defining TDS sensitivity . . .")[31]; Pond 2014 ("Habitat can be a limiting factor, but by design, we removed significant habitat degradation factors by selecting sample reaches with relatively good habitat and intact riparian vegetation at reference and VF sites . . ."); *id.* ("Overall, biological variation was strongly correlated with water chemistry and less by reach-scale habitat and landscape conditions. Since ion concentrations explained the greatest amount of biological impacts and were the most altered (compared to reference), this suggests that recovery is potentially hindered by ions, even in forested reaches long

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based on the aggregation of scores assigned to ten different variables. Total RBP scores are grouped into four different categories, or levels: optimal, suboptimal, marginal, and poor.

[31] "TDS stressors" would include the sort of ionic pollution alleged in this case. Similarly, an assessment of "TDS sensitivity" would include analysis of ionic pollution sensitivities.

after reclamation."); Hitt et al, Joint Ex. 8, Pls.' Ex. 173 at JE0129 (regarding impacts to fish assemblages, the authors noted that "[o]bserved effects of [mountaintop removal mining] could not be explained by changes in physical habitat conditions").

The following year, Pond published a second article, "Patterns of Ephemeroptera taxa loss in Appalachian headwater streams," in *Hydrobiologia*. Pls.' Ex. 131. As was the case with his earlier work, Pond again relied on experimental fieldwork, but he conducted unique fieldwork in a different area. *Id.* In this second article, Pond compared mayfly assemblages at some ninety-two sites in Kentucky, focusing on taxa richness (i.e., "the number of different groups of mayflies," Tr. 2 at 105, ECF No. 100) and relative abundance. In so doing, Pond discovered that both mayfly richness and relative abundance were significantly higher at reference sites and both were significantly lower at mined sites. Tr. 2 at 105–06, ECF No. 100. Furthermore, consistent with earlier analyses, Pond reported that "[r]elative mayfly abundance was most strongly correlated to specific conductance (r = 0.72) compared to total habitat score (r = 0.59)." Pls.' Ex. 173 at PE1526; *id.* at PE1536 ("Analyses from WV mining areas (Hartman et al., 2005; Merricks et al., 2007; Pond et al. 2008) indicated that the decline in mayflies from mountaintop mining correlates most strongly to specific conductance.").

In the same year that Pond 2010 was published, *Science Policy Forum* published an article co-authored by Dr. Palmer and titled "Mountaintop Mining Consequences."[32] Pls.' Ex. 133. Here, rather than experimental fieldwork, the authors relied on data from a variety of sources, including data from the WVDEP database. Tr. 2 at 106, ECF No. 100. Through that data, the authors again examined the relationship between water chemistry and mining activities. *Id.* at 106.

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[32] Additional authors include E.S. Bernhardt, W.H. Schlesinger, K.N. Eshleman, E. Foufoula-Georgiou, M.S. Hendryx, A.D. Lemly, G.E. Likens, O.L. Loucks, M.E. Power, and P.R. Wilcock.

In so doing, the authors again observed that mining contributed to poor water chemistry, particularly marked by elevated conductivity levels, and that significant declines in macroinvertebrate taxa resulted. *Id.*

The following year, the *Journal of the North American Benthological Society* published a paper by Eric Merriam et al., titled "Additive effects of mining and residential development on stream conditions in a central Appalachian watershed." Joint Ex. 11. As explained by Dr. Palmer, Merriam et al., examined the combined effects of streams impacted by mining as compared to streams otherwise impacted by development, finding that mining impacts do contribute to changes in macroinvertebrate community structure. Tr. 2 at 108–09, ECF No. 100. These changes in community structure would appear to have been more closely related to changes in water chemistry as compared to changes in habitat. Pls.' Ex. 173 at JE0173–74 ("We found significant effects of mining on in-stream conditions. Increased levels of mining resulting in poorer water quality, primarily through increases in specific conductance and associated dissolved chemical constituents. . . . Mining had no measurable effect on habitat complexity or quality."). Thus, relying on unique data and methodology the authors were able to conclude as follows:

> Our results are similar to those of recent studies that have identified changes in water quality to be the dominant stressor in mined systems (Fulk et al. 2003, Freund and Petty 2007, Pond et al. 2008, Petty et al. 2010, Pond 2010). Increased specific conductance is consistently the dominant stressor in streams affected by mountaintop removal mining in southern West Virginia (Hartman et al. 2005, Merricks et al. 2007, Pond et al. 2008). . . . Furthermore, increased specific conductance is a consistnely important predictor of ecological condition in these systems . . . Our results corroborate those of numerous studies in which Ephemeroptera was identified as one of the most sensitive taxa to increases in ionic strength associated with large-scale surface mining in the Central Appalachian region.

Pls.' Ex. 173 at JE0174.

This brings us to publication of EPA's Benchmark. As evident by the foregoing discussion, by the time the EPA published the Benchmark, scientific literature on the subject was already well developed, and according to Dr. Palmer, had already established a likely relationship between conductivity and impairment in Appalachian streams impacted by alkaline mine drainage. Tr. 2 at 110, ECF No. 100. Nevertheless, studies examining the probable relationship between mining, high conductivity, and impairment continued to reach publication in peer-reviewed scientific journals.

In 2011, Dr. Bernhardt and Palmer published an article titled "The environmental costs of mountaintop mining valley fill operations for aquatic ecosystems of the Central Appalachians" in the *Annals of the New York Academy of Sciences*. Joint Ex. 1; Tr. 2 at 117, ECF No. 100. There, the authors concluded that there was a significant relationship between mining activities and changes in the chemical composition of streams below mining. Tr. 2 at 117, ECF No. 100. Such changes were strongly associated with biological impairment of those streams. *Id.* at 117. Particularly, the authors explained that "[a]ll available data show that it becomes increasingly unlikely to find an unimpaired aquatic benthic community as conductivity increases." Pls.' Ex. 173 at JE0010. Elaborating on the same point, the article goes on to say that:

> Whether or not individual component ions within mining-derived runoff reach streamwater concentrations that are individually lethal or toxic to aquatic life, the cumulative effect of elevated concentrations of multiple contaminants is clearly associated with a substantial reduction in water quality and biological integrity in streams and rivers below mine sites. ***All research to date indicates that conductivity is a robust measure of the cumulative or additive impacts of the elevated concentrations of multiple chemical stressors from mine sites that lead to biological impairment of streams.***

Pls.' Ex. 173 at JE0014 (emphasis added).

Dr. Lindberg next joined Dr. Bernhardt on a paper published in the *Proceedings of the National Academy of Sciences* titled "Cumulative impacts of mountaintop mining on an

Appalachian watershed."[33] Pls.' Ex. 136. In this study, the authors "document the cumulative impact of more than 100 mining discharge outlets and approximately 28 km^2 of active and reclaimed surface coal mines on the Upper Mud River of West Virginia." Pls.' Ex. 173 at PE1759. In so doing, they observed that "[a]ll tributaries draining mountaintop-mining-impacted catchments were characterized by high conductivity and increased sulfate concentration." *Id.* More broadly, the unique approach taken in this paper established the cumulative impacts of mining in a watershed, with conductivity, sulfates, and selenium all significantly increasing with increased mining. Tr. 2 at 118–19, ECF No. 100; Pls.' Ex. 173 at PE1763 ("Our synoptic survey approach conclusively demonstrates that the observed increases in conductivity and [selenium] concentration can be attributed directly to the areal extent of surface coal mining occurring in the watershed.").

Still in 2011, another study authored by Dr. Pond reached publication in *Hydrobiologia*: "Biodiversity loss in Appalachian headwater streams (Kentucky, USA): Plecoptera and Trichoptera communities." Pls.' Ex. 137. Here, Dr. Pond again documented the effects of mining and residential land use disturbances on macroinvertebrates, particularly stonefly (Plecoptera) and caddisfly (Trichoptera) assemblages. Tr. 2 at 119, ECF No. 100. Dr. Pond found not only extirpation of these genera associated with mining disturbances, but further remarked that habitat factors could not explain the observed impacts. Tr. 2 at 119–20, ECF No. 100; Pls.' Ex. 173 at PE1775–76 ("no habitat factors were significantly correlated with relative abundance metrics").

In 2013, Pond published yet another co-authored paper on the subject; this time in *Environmental Monitoring and Assessment* and titled "Calibration and validation of a regionally and seasonally stratified macroinvertebrate index for West Virginia wadeable streams." Pls.' Ex.

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[33] The *Proceedings of the National Academy of Science* is regarded as a rigorously peer-reviewed scientific journal. Tr. 2 at 119.

138. The article describes "the development, validation, and application of a geographically- and seasonally partitioned genus-level index of most probable stream status (GLIMPSS) for West Virginia wadeable streams." Pls.' Ex. 173 at PE1786. Importantly, the genus-level index developed therein proved to be a more reliable predictor of stream quality than its family-level counterpart, WVSCI. Tr. 2 at 121, ECF No. 100 ("pointing out that a genus-level index is much more appropriate to use because the family-level index is not adequately sensitive [] because it lumps genera that have very different tolerance levels."). These findings would suggest that WVDEP reporting of streams impaired according to WVSCI score is under-inclusive. Pls.' Ex. 173 at PE1803 ("Overall, GLIMPSS rate more than twice the number of sites as 'severely degraded' compared with WVSCI across all strata.").

Adding to the variety of methods used to address the question, Bernhardt et al., later published "How Many Mountains" in *Environmental Science and Technology*. Joint Ex. 2. In an attempt to further assess the extent of pollution resulting from mining, the authors "mapped surface mining from 1976 to 2005 for a 19,581 km^2 area of southern West Virginia and linked these maps with water quality and biological data for 223 streams." Pls.' Ex. 173 at JE0020. In so doing, they observed that the amount of mining in an area was highly correlated to increased conductivity in area streams. Pls.' Ex. 173 at JE0020 ("The extent of surface mining within catchments is highly correlated with the ionic strength and sulfate concentrations of receiving streams."). Then, relying on generalized additive models, the authors identified the following thresholds at which amount of watershed mining, stream ionic strength, or sulfate concentrations render impairment likely: "We find this threshold is reached once surface coal mine occupy >5.4% of their contributing watershed area, ionic strength exceeds 308 $\mu S/cm^{-1}$, or sulfate concentrations exceed 50 mg/L^{-1}." *Id.* Though the authors relied on different data and a unique methodology, they nonetheless arrived at a conductivity threshold remarkably similar to the threshold identified by the EPA. Further consistent with the Benchmark, the authors did so only after controlling for the potential effects of habitat. Pls.' Ex. 173 at JE0022 ("Finally, [general additive models] allowed us to model the stressor-response relationship after controlling the effect of instream habitat quality, a variable that influences community metrics independently of catchment mining and stream chemistry.").

In 2013, Dr. James Kunz introduced yet another novel methodological approach and reached consistent results. Kunz et al., *Use of Reconstituted Waters to Evaluate Effects of Elevated Major Ions Associated with Mountaintop Coal Mining on Freshwater Invertebrates*, 32 Envtl. Toxicology & Chemistry 2826 (2013), Joint Ex. 10. The authors of this paper exposed selected freshwater organisms to mixtures with different ionic strengths in a laboratory in order to perform toxicity testing. Particularly of note, the ionic composition of some the reconstituted mixtures was representative of the ionic composition of central Appalachian waters impacted by alkaline mine drainage from mountaintop removal and valley fills:

> Two of the reconstituted waters had ionic compositions representative of alkaline mine drainage associated with mountaintop removal and valley fill-impacted streams (Winding Shoals and Boardtree, with elevated Mg, Ca, K, SO^4, HCO^3), and a third reconstituted water had an ionic composition repreentative of neutralized mine drainage (Upper Dempsey, with elevated Na, K, SO^4, and HCO^3). The waters with similar conductivites but, with different ionic compositions had different effects on the test organisms. The Winding Shoals and Boardtree reconstituted waters were consistently toxic to the mussel, the amphipod, and the mayfly.

Pls.' Ex. 173 at JE0152; Tr. 2 at 137, ECF No. 100. Furthermore, through laboratory analysis, Kunz et al., identified toxic impacts to *Centroptilum*, a mayfly, between 800 and 1,300 μS/cm; remarkably consistent with the Benchmark value of 1,092 μS/cm derived from statistical analysis of the WVDEP database. Joint Ex. 17 at D-3.

Next, the scientific literature returns to the authors of EPA's Benchmark, Drs. Susan Cormier and Glenn Suter, and the subsequent publication of several component sections of the Benchmark in the peer-reviewed scientific journal *Environmental Toxicology and Chemistry*.[34] In one of these component articles, Cormier and Suter analyzed six characteristics of causation: co-occurrence, preceding causation, interaction, alteration, sufficiency, and time order, finding all but one strongly supported the causal relationship, with no evidence available for the outstanding characteristic.[35] Susan M. Cormier et al., *Assessing Causation of the Extirpation of Stream Macroinvertebrates by a Mixture of Ions,* 32 Envtl. Toxicology & Chemistry 277 (2013), Joint Ex. 4. Cormier and Suter further found that "[t]he conductivity at mined sites is 10 to 50 times greater than at unmined sties. The source of increased conductivity is independently corroborated and consistent." Pls.' Ex. 173 at JE0083. Relying on multiple lines of evidence, including not only their own findings in developing the Benchmark, but also based on the collection of research available in the published literature, Cormier and Suter conducted a formal causal analysis linking high conductivity and extirpation of sensitive macroinvertebrates in central Appalachian streams:

Through this assessment, the authors found that a mixture containing the ions

[34] *See* Cormier et al., *Derivation of a Benchmark for Freshwater Ionic Strength, supra* note 5; Cormier et al., *A Method for Assessing Causation, supra* note 5; Cormier et al., *Assessing Causation of the Extirpation of Stream Macroinvertebrates by a Mixture of Ions, supra* note 5; Cormier et al., *Relationship of Land Use and Elevated Ionic Strength in Appalachia Watersheds, supra* note 5; Cormier et al., *A Method for Deriving Water-Quality Benchmarks Using Field Data, supra* note 5; Suter et al., *A Method for Assessing the Potential for Confounding Applied to Ionic Strength in Central Appalachian Streams, supra* note 5.

[35] Of note, time order was the only factor that did not strongly support the causal relationship. Instead, Cormier and Suter found that they lacked the necessary evidence to assess whether time order supported the causal relationship, and therefore scored time order as providing "no evidence" either way. Pls. Ex. 173 (explaining that the authors "could not obtain conductivity and biological survey data collected before and after construction of a valley fill or release of ion-rich effluents from other sources. Hence, this characteristic of causation is scored as no evidence."). Though Cormier and Suter were unable to obtain the necessary information to assess the significance of time order in assessing the causal relationship, the record here is replete with such information and evidence.

> [calcium, magnesium, bicarbonate, and sulfate], as measured by conductivity, is a common cause of extirpation of aquatic macroinvertebrates in Appalachia where surface coal mining is prevalent. The mixture of ions is implicated as the cause rather than any individual constituent of the mixture. The authors also expect that ionic concentrations sufficient to cause extirpations would occur with a similar salt mixture containing predominantly [bicarbonate, sulfate, calcium, and magnesium] in other regions with naturally low conductivity.

Pls.' Ex. 173 at JE0080.

Cormier and Suter independently published their confounding factor analysis as well. Cormier & Suter, *A Method for Assessing the Potential for Confounding Applied to Ionic Strength in Central Appalachian Streams*, 32(2) Envtl. Toxicology and Chemistry 288 (2013), Pls.' Ex. 139. Using a weight-of-evidence approach, that analysis considers twelve potential confounders: habitat, organic enrichment, nutrients, deposited sediments, pH, selenium, temperature, lack of headwaters, catchment area, settling ponds, dissolved oxygen, and metals. Pls.' Ex. 173 at JE0091. By adapting principles of epidemiology to the applied study of multivariate ecological field data, Cormier and Suter examine and methodically eliminate each potential confounder. Particularly of note, Cormier and Suter considered and rejected the idea that embeddedness or the presence of upstream ponds confounds the relationship between conductivity and impairment. Pls.' Ex. 173 at JE0094 ("No evidence supported embeddedness as a factor"); *Id.* at JE0096 ("The weight of evidence for confounding from ponds is uniformly negative, so we conclude that the presence of ponds has little or no effect on invertebrate response to conductivity.").

More recently, in 2014, Drs. Pond, Margaret Passmore, Kelly Krock, and Jennifer Fulton—all with the EPA—along with Nancy Pointon, John Felbinger, Craig Walker, and Whitney Nash—colleagues from the OSMRE—published a peer-reviewed scientific article in *Environmental Management* finding, among other conclusions, that the vast majority of streams adjacent to reclaimed mine sites with valley fills were still impaired eleven to thirty-three years after reclamation. Pond et al., *Long-Term Impacts on Macroinvertebrates Downstream of Reclaimed Mountaintop Mining Valley Fills in Central Appalachia*, 54(4) Envtl. Mgmt. 919 (October 2014), Pls.' Ex. 141, Tr. 2 at 129–33 ("Although these [valley fills] were constructed pursuant to permits and regulatory programs that have as their stated goals that (1) mined land be reclaimed and restored to its original use or a use of higher value, and (2) mining does not cause or contribute to violations of water quality standards, we found sustained ecological damage in headwater streams draining [valley fills] long after reclamation was completed"). The article explains that researchers "found that known sensitive taxa such as the mayflies *Ephemerella* and *Epeorus* and the caddisfly *Neophylax* were found at 100% of the reference sites but were absent from 12 of 15 (~80%) of the [valley fill] sites." Pls.' Ex. 173 at PE1832. As explained by Dr. Palmer, this most recent article by Dr. Pond and colleagues, based on a natural experiment, showed that the likely explanation for finding unexpected organisms in high conductivity waters is that the organisms are drifting into these areas. Tr. 2 at 130, ECF No. 100.

Furthermore, it is also of note that in selecting reference streams for this most recent study, Dr. Pond and his collaborators selected sites with comparable temperature and habitat regimes to the mined sites. Pls.' Ex. 173 at PE1827 ("Local reference streams were sighted in close proximity (range .75 to 10.5 km) to paired [valley fills] . . . and had similar catchment areas, forest types, and base geology"). That methodological approach had the effect of eliminating temperature and habitat scores as potential confounding factors. Pls.' Ex. 173 at PE1836 ("Habitat can be a limiting factor, but by design, we removed significant habitat degradation factors by selecting sample reaches with relatively good habitat and intact riparian vegetation at reference and [valley fill] sites"). The experiment also relied on reference sites that "were not pristine, as their catchments frequently had poorly maintained roads and culverts, utility right-of-ways, gas wells, or underground mining that did not discharge to the watershed," thereby further eliminating potentially confounding factors. Pls.' Ex. 173 at PE1827.

On the basis of this outstanding collection of peer-reviewed studies, the Court finds that the link between surface mining and biological impairment of downstream waters has been sufficiently—if not definitively—established in the scientific literature. "There's field data. There's lab data. There's observational data. There's field experimental data. There's toxicity testing." Tr. 2 at 141, ECF No. 100. Through myriad lines of evidence, researchers have reached the same general causation conclusion, without a single peer-reviewed publication reporting contrary findings. In Dr. Palmer's expert opinion, there is no remaining doubt on the question of general causation, leaving only surprise that researchers are continuing to study the question. *Id.* at 141 ("I would say there's no doubt. What surprised me is that the studies continue to go on. . . . because it's been so well-established.").

III. Specific Causation

Having met the burden of establishing the general principle that high conductivity levels in streams, caused by alkaline mine drainage, lead to biological impairment, Plaintiffs' must next establish by a preponderance of the evidence that high conductivity levels, caused by Defendant's mine discharges, are causing or materially contributing to biological impairment in this particular instance.[36]

A. Stream Conditions

[36] *See* Sanne H. Knudsen, *The Long-Term Tort: In Search of a New Causation Framework for Natural Resource Damages*, 109 Nw. U. L. Rev. 475, 532 (Winter 2004) ("In the oil spill context, proving general causation would require showing that exposure to oil is capable of causing the alleged injury—e.g., disrupting the reproductive capacity of sea otters. Proving specific causation would require showing that sea otters were exposed to oil in doses capable of causing injury and that the oil came from the defendant's release.")

As introduced above, this case concerns discharges from three surface mines operated by Defendant: (1) Fola Surface Mine No. 2, discharging into Road Fork; (2) Fola Surface Mine No. 4A, discharging into Right Fork; and (3) Fola Surface Mine No. 6, discharging into Cogar Hollow. Largely through the testimony of Drs. Palmer, Swan, and Menzie, the Court heard detailed information on the each of the associated streams, spanning from before Defendant's mining operations began through to current conditions. Factual findings relating to pre-mining and current conditions for each surface mine are provided below. As demonstrated by that evidence, these streams have endured a pattern of increasing conductivity levels, increasing sulfates, and declining WVSCI scores.

1. Fola Surface Mine No. 2 – Road Fork

Fola Surface Mine No. 2 is regulated under WV/NPDES Permit No. WV1013840 and West Virginia Surface Mining Permit S201293. Stipulation ¶¶6–7, ECF No. 53. Three valley fills at Mine No. 2 drain into Outlet 001, which discharges into Road Fork. *Id.* at ¶¶3–5, 10.

Prior to Defendant's mining activities, Road Fork was without notable water quality issues. Collected in 1992 and 1993, pre-mining samples taken downstream from Outlet 001 and upstream from the confluence of Road Fork and Leatherwood Creek, showed conductivity levels ranging from 40 μS/cm to 73 μS/cm and sulfates ranging from 0.01 mg/l to 30 mg/l. Stipulation, ECF No. 53, Pls.' Ex. 73. In its 1994 Cumulative Hydrologic Impact Assessment (CHIA), WVDEP observed that "Road Fork does not appear heavily impacted by extensive past mining which has occurred in this area. This is indicated by low metals and sulfates that are less than 30 milligrams per liter." Pls.' Ex. 118 at PE1209–10.

Since Defendant's mining activities began, Road Fork water quality has notably suffered. Monitoring in 2010 through 2012 at that same discharge point revealed conductivity levels ranging from 1,803 μS/cm to 5,700 μS/cm and sulfates ranging from 886 mg/L to 3,304 mg/L. In May 2014, the conductivity level of water discharged from Outlet 001 was 2,920 μS/cm and the sulfate level was 1,900 mg/L. Pls.' Exs. 2, 3. The following table provided by Dr. Palmer compiles the data collected at Fola Mine No. 4A discharges, including Broadtree Branch measurements as a comparison point for water chemistry characteristic of alkaline mine drainage. *See* Pls.' Ex. 38.

Location	pH	Conductivity	Ca	Mg	Na	K	CL	SO_4
Road Fork Outlet 001 (11/2006)	8.28	3290	358	310	12	n/a	2	419
Road Fork BASD-RFI (5/21/2011)	7.8	3200	385	382	11.9	10.7	18.5	1860
Road Fork BASD-RFI (5/21/2012)	7.98	2700	370	356	11.8	22.2	n/a	1860
Road Fork BASD-RFI (5/20/2013)	8.1	2530	330	320	12.7	19.1	n/a	1970
Road Fork Outlet 001 (Hansen 9/9/2014)	7.18	3370	290	300	10	17	ND	2100
Road Fork BASD-RFI (Hansen 5/19/2014)	7.18	3370	320	292	10.6	17.7	n/a	1620
Boardtree Branch	8	2367	241	260	12	21	11	1580

Table 4: Water quality data for Mine No. 2 discharges into Road Fork, including data from Boardtree Branch as a reference point.

Consistent with the observed decline in water quality, the aquatic community at Road Fork is biologically impaired. Between 2011 and 2014, Defendant reported WVSCI scores between 46 and 56 in Road Fork downstream of Outlet 001. Stipulation ¶17. These scores are well below the accepted EPA threshold marking impairment at WVSCI scores under 68. *See Elk Run*, 24 F.Supp.3d at 554–56 (discussing reliance on WVSCI scores lower than 68 as an agency-derived and federally approved marker of biological impairment); *see also*, *supra* note 6. On May 9, 2014, Dr. Christopher Swan conducted field sampling immediately downstream of Outlet 001. Based on that sampling effort, Dr. Swan identified a WVSCI score of 39.66 and a GLIMPSS score of 20.22. Pls.' Ex. 25. Both numbers clearly indicate impairment. *See* Pls.' Ex. 173 at JE0024; Tr. 2 at 89–90, 161, ECF No. 100; Tr. 3 at 36–37, June 3, 2015, ECF No. 106. Given these numbers, it is not at all surprising that WVDEP lists Road Fork and Leatherwood Creek as biologically impaired due to mining on its 2012 CWA 303(d) List. Joint Ex. 20; Tr. 2 at 149, ECF No. 100. Furthermore, WVDEP observed in its Elk River Watershed TMDL that ionic toxicity is a definite stressor at Road Fork. Joint Ex. 16 at 24; Tr. 2 at 149–50, ECF No. 100 ("In [Road Fork/Leatherwood Creek] . . ., the [stressor identification] process determined ionic toxicity to be a significant stressor. A strong presence of sulfates and other dissolved solids exists in those waters and in all other streams where ionic toxicity has been determined to be a significant biological stressor.").

In addition to conducting water sampling, multiple experts also provided assessments of habitat at Road Fork. Dr. Swan reported a 163 RBP habitat score in Road Fork. Pls.' Ex. 31. In contrast to Dr. Swan's optimal-range RBP score, Dr. Menzie also conducted or oversaw RBP assessments. The average RBP score taken by two Exponent staff members in October 2014 was 137.5, or suboptimal.[37] Def.'s Ex. 138. Drs. Swan and Menzie both reported the presence of metal hydroxides in some stretches of stream. Tr. 3 at 58, 67–69, ECF No. 106; Tr. 4 at 23, ECF No. 107.

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[37] Whatever critiques one may have of RBP habitat assessment protocol, presumably all can agree that the experience and qualifications of the person performing the habitat assessment are extremely relevant to determining the reliability of that assessment. Though he deliberately deviated from the WVDEP protocol for conducting an RBP habitat assessment, the Court has no doubt that Dr. Menzie possesses the necessary experience and qualifications to render his assessment reliable. However, the Court heard nothing on the identity, experience, or qualifications of Exponent staff members that performed RBP habitat assessments at Dr. Menzie's request. Accordingly, the Court hesitates to rely on such assessments.

2. Fola Surface Mine No. 4A – Right Fork

Fola Surface Mine No. 4A is regulated under WV/NPDES Permit No. WV1013815 and West Virginia Surface Mining Permit S200502. Stipulation ¶¶23–24, 26, ECF No. 53. Plaintiffs specified three outlets in their complaint—Outlets 22, 23, and 27—each of which discharges into tributaries of Leatherwood Creek. *Id.* at ¶¶21–22.

Though there was some pre-Fola mining in the area, Right Fork was unimpaired and in fair shape prior to Defendant's mining operations. In its 2003 CHIA, the WVDEP observed that though some sub-watersheds of Right Fork had elevated Manganese and sulfates related to pre-Fola mining, the upper reaches of the watershed maintained low sulfates. Pls.' Ex. 89 at PE0574–75. Indicating high water quality, the report further noted that "all [monitoring] stations provide adequate habitat and contain populations of benthic macroinvertebrates. All the stations have high EPT indices." Pls.' Ex. 89 at PE 0577–78. The majority of pre-Fola water samples showed conductivity levels below the EPA threshold of 300 μS/cm, with some samples deviating upward as high as 1500 μS/cm. Pls.' Ex. 44.

Not surprisingly, the relatively good water quality at Right Fork contributed to unimpaired conditions. In 1997, WVDEP reported an excellent WVSCI score of 84 for Right Fork. Joint Ex. 23 at 68, Tr. 2 at 173, ECF No. 100. In 2000 and 2001, Fola's consultant collected a number of biological surveys from seventeen different sampling locations. Among thirty-three samples from those seventeen sites, only six returned WVSCI scores below 68. Stipulation ¶¶22, 29–31, Tr. 2 at 177, ECF No. 100.

Since Defendant's mining activities began, Right Fork water quality has notably suffered. Though jumps in conductivity had previously been rare, since 2001, conductivity levels in Right Fork have been almost entirely above 1,500 μS/cm, now with jumps up to and exceeding 2,500 μS/cm. Stipulation ¶33. Similarly, since 2001, sulfate levels are consistently above 600 mg/l; and sometimes as high as 1,200 mg/l. Stipulation ¶33.

Consistent with conditions in Right Fork itself, in 2011 and 2012, discharges from Outlets 022, 023, and 027 consistently ranged from 1,500 μS/cm to more than 3,000 μS/cm. Stipulation ¶32. In May and September 2014, conductivity from the three discharges ranged from 1820 to 2,958 μS/cm, with sulfate levels between 920 and 1,800 mg/l. Pls.' Ex. 2–5. The following table provided by Dr. Palmer compiles the data collected at Fola Mine No. 4A discharges, including Broadtree Branch measurements as a comparison point for water chemistry characteristic of alkaline mine drainage. *See* Pls.' Ex. 49.

	Location	pH	Conductivity	Ca	Mg	Na	K	CL	SO_4
Pre-Fola Mining	**FOLA – 6 (2001)**	7.15	461	34	25	8	3	3	120
	FOLA – 7 (2001)	7.35	367	34	75	2	3	1	110
Post-Fola Mining	**BASD3RLW (2012)**	8.38	1689	265	211	30	16	n/a	1150
	BASD1RLW (2012)	8.17	1538	202	156	31	14	n/a	942
	Outlet 022 (Hansen 2014)	7.9	1820	140	120	62	12	32	920
	Outlet 023 (Hansen 2014)	8.1	2720	280	260	100	16	ND	1800
	Outlet 027 (Hansen 2014)	7.12	2390	220	130	140	14	ND	1300
Reference	**Boardtree Branch**	8	2367	241	260	12	21	11	1580

Table 5: Water quality data for Mine No. 4A discharges into Right Fork, including data from Boardtree Branch as a reference point.

The noted decline in water quality has been accompanied by a decline in WVSCI scores. On May 9, 2014, Dr. Christopher Swan conducted field sampling downstream of Outlets 022, 023, and 027.[38] Based on that sampling effort, Dr. Swan identified a WVSCI score of 38.21 and a GLIMPSS score of 25.79. Pls.' Ex. 25; Tr. 2 at 184, ECF No. 100. Both numbers clearly indicate impairment and are a far cry from the pre-Fola mining scores. Given these numbers, it is not at all surprising that WVDEP lists Right Fork and Leatherwood Creek as biologically impaired due to mining on its 2012 CWA 303(d) List. Joint Ex. 20; Tr. 2 at 149, ECF No. 100. Furthermore, WVDEP observed in its Elk River Watershed TMDL that ionic toxicity levels in Right Fork are a definite stressor. Joint Ex. 16 at 24; Tr. 2 at 149–50, ECF No. 100 ("In [Right Fork/Leatherwood Creek] . . ., the [stressor identification] process determined ionic toxicity to be a significant stressor. A strong presence of sulfates and other dissolved solids exists in those waters and in all other streams where ionic toxicity has been determined to be a significant biological stressor.").

With respect to habitat, Dr. Swan calculated an RBP score of 172 at Right Fork, which is in the optimal range. Pls.' Ex. 32; Tr. 2 at 185, ECF No. 100. The average RBP score taken by two Exponent staff members in October 2014 was 128, or suboptimal. Def.'s Ex. 138.

3. Fola Surface Mine No. 6 – Cogar Hollow

Fola Surface Mine No. 6 is regulated under WV/NPDES Permit No. WV1018001 and West Virginia Surface Mining Permit S2011999. Stipulation ¶¶42–44, ECF No. 53. Three valley fills at Mine No. 6 drain into Outlets 013, 015, and 017, to be discharged to Cogar Hollow, a tributary of Leatherwood Creek. Stipulation ¶¶40–41; Tr. 2 at 187–88, ECF No. 100.

Before Defendant's mining activities began, Cogar Hollow enjoyed healthy water quality.

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[38] As will be discussed in greater detail below, Dr. Swan's sampling area was not immediately downstream of Outlets 022, 023, and 027 and did not isolate the impacts of these three discharge outlets. Instead, Dr. Swan's sampling area accounted for as many as twelve additional outlets.

Measured at monitoring point S3-1A, conductivity levels were usually well below 300 µS/cm. Stipulation ¶45. Sulfate levels were similarly low. *Id.* As it did with other Leatherwood Tributaries, here WVDEP again noted that "all [monitoring] stations provide adequate habitat and contain populations of benthic macroinvertebrates. All the stations have high EPT indices." Pls.' Ex. 89 at PE 0577–78.

Since Defendant's mining activities began, Cogar Hollow water quality has diminished considerably, including extremely elevated conductivity and sulfate levels. Measurements taken since July 2012 consistently reveal conductivity levels ranging from 3,000 µS/cm to 5,000 µS/cm. Stipulation ¶47; Tr. 2 at 191–92, ECF No. 100. In May 2014, conductivity from the three discharges ranged from 2,910 µS/cm to 3,202 µS/cm and the sulfate level was 1,900 mg/l to 2,400 mg/l. Pls.' Ex. 2–3, 5. The following table provided by Dr. Palmer compiles the data collected at Fola Mine No. 4A discharges, including Broadtree Branch measurements as a comparison point for water chemistry characteristic of alkaline mine drainage. Pls.' Ex. 57.

Location	pH	Conductivity	Ca	Mg	Na	K	CL	SO_4
Mine No. 6 Outlets (July 2007)	6.03	3420	486	254	9	n/a	1	1912
Mine No. 6 Outlet 013 (June 5, 2012)	7.52	n/a	n/a	448	n/a	n/a	8.93	2786
Mine No. 6 Outlet 015 (June 5, 2012)	7.09	n/a	n/a	n/a	n/a	n/a	7.98	2018
Mine No. 6 Outlet 017 (May 23, 2012)	6.53	n/a	n/a	284	n/a	n/a	10.24	2133
Mine No. 6 Outlet 013 (Hansen 2014)	7.73	4200	360	400	63	20	ND	2700
Boardtree Branch	8	2367	241	260	12	21	11	1580

Table 6: Water quality data for Mine No. 6 discharges into Cogar Hollow, including data from Boardtree Branch as a reference point.

On May 9, 2014, Dr. Christopher Swan conducted field sampling immediately downstream of Outlets 013, 015 and 017. Based on that sampling effort, Dr. Swan identified a

WVSCI score of 41.81 and a GLIMPSS score of 20.03. Pls.' Ex. 25; Tr. 2 at 194, ECF No. 100. Both numbers clearly indicate impairment. Dr. Swan further conducted a RBP habitat assessment, scoring the stream at 145, or suboptimal. Pls.' Ex. 30; Tr. 3 at 44, ECF No. 106. Similarly, the average RBP score taken by two Exponent staff members in October 2014 was 138.5, again, suboptimal. Def.'s Ex. 138.

On the basis of the foregoing site-specific evidence, the Court **FINDS** by a preponderance of the evidence that Road Fork, Right Fork, and Cogar Hollow are biologically impaired.

B. Legal Standard

The Court must find a violation here if Defendant's discharges cause or materially contribute to a significant adverse impact to the chemical or biological components of aquatic ecosystems. W. Va. Code R. § 47-2-3.2.i. Through requiring that a discharge "cause or materially contribute" to biological impairment, West Virginia law imposes something less stringent than traditional but-for causation. Unfortunately, available state law does not elaborate on what precisely that standard means as applied.

This Court has previously ruled that "[i]t is readily conceivable that multiple pollutants or stream characteristics might simultaneously materially contribute to impairment; and [a plaintiff] need only provide evidence showing it is more probable than not that ionic pollution as measured by conductivity is among some collection of material contributors." *Fola (Stillhouse)*, 2015 WL 362643, at *8. This approach to "material contribution" is consistent with the Ninth Circuit's explanation that "material contribution" suggests that "more than one factor can be a substantial cause, and no single factor need be the sole causative element." *Frito-Lay, Inc. v. Local Union No. 137*, 623 F.2d 1354, 1363 (9th Cir. 1980); *accord Feather v. United Mine Works of America*, 903 F.2d 961, 967 (3rd Cir. 1990).

This Court's interpretation of the material contribution standard flows from the observation that, "as a matter of plain meaning and common sense, it is possible to identify a factor that is materially contributing to a given condition without conclusively eliminating contributions by additional factors in a dynamic system." *Fola (Stillhouse)*, 2015 WL 362643, at *9. Similarly, in the context of environmental litigation, it is reasonable to expect that biological communities may be simultaneously impaired by varied and multiple pollutants. Liability cannot be skirted by the mere presence of multiple stressors, lest we enable the simple nature of ecological systems to invariably frustrate the Clean Water Act.

While something less than traditional but-for causation is required, Defendant argues that, if the word "material" is to have any import, "material contribution" must amount to something more than a contributing factor test. Def.'s Post-Trial Brief, ECF No. 116 at 27 (citing *Artz v. Chicago, R.I. & P.R. Co.*, 38 Iowa 293, 296–97 (Iowa 1874)). *But see Coeur D'Alene Tribe v. Asarco Inc.*, No. CV91–0342NEJL, 2001 WL 34139603, at *4 (D. Idaho March 30, 2001) (considering liability for comingled pollutants under a contributing factor rest, the court observed that "[plaintiffs] have the burden of proving a release that results in commingled hazardous substances is a 'contributing factor' [more than a de minimum amount—to an extent that at least some of the injury would have occurred if only the Defendant's amount of release had occurred]."); *cf.* Sanne H. Knudsen, *The Long-Term Tort: In Search of a New Causation Framework for Natural Resource Damages*, 109 Nw. U. L. Rev. 475, 532 (Winter 2004) (explaining that the "[contributing factor] doctrine appears suited to handle problems of synergistic harms"). As argued by Defendant, "even if the conductivity [here] were fully treated, it is unclear what the resulting stream score would be given the other factors at issue." *Id.* at 28. This framing reflects a fundamental misunderstanding. Obtaining a WV/NPDES permit to discharge into a given waterway does not transmute a permitee into a guarantor that the receiving stream has or will maintain a passing WVSCI score. More modestly, issuance of the permit requires that a permitee not cause or materially contribute to impairment; it does not require or guarantee nonimpairment generally.

Thus, the Court continues to require that Plaintiffs demonstrate that it is more probable than not that ionic pollution, measured as conductivity, is among some collection of material contributors to biological impairment. Conductivity levels in the streams at issue need not be the sole cause of observed biological impairment, but must be a substantial contributor. This standard does not require scientific certainty, but rather legal probability. *Fola (Stillhouse)*, 2015 WL 362643, at *17, *quoting Ferebee v. Co.*, 736 F.2d 1529, 1536 (D.C. Cir. 1984); *Bunting v. Secretary of Health & Human Services*, 931 F.2d 867, 873 (Fed. Cir. 1991).

C. Specific Causation Analysis

1. Defendant's Motion for a Directed Verdict regarding Fola Surface Mine No. 4A

At the close of Plaintiffs' case in chief, Defendant moved for a directed verdict as to claims involving Fola Surface Mine No. 4A, covered by WV/NPDES Permit No. WV1013815. Tr. 3 at 202, ECF No. 106. Defendant argues that it is entitled to a directed verdict regarding Fola Surface Mine No. 4A because Plaintiffs' compliance evidence does not isolate the effects of the discharges from Outlets 022, 023, and 027. *Id.* Outlets 022 and 023 at Mine No. 4A discharge into Right Fork, a tributary of Leatherwood Creek. Outlet 027 at Mine No. 4A discharges into Cannel Coal Hollow, a small tributary of Leatherwood Creek. Plaintiffs' consultant conducted biological sampling to determine a WVSCI score for Right Fork at a stream reach below the confluence of Cannel Coal Hollow. In addition to Outlets 022, 023, and 027, some twelve additional outlets discharge into Right Fork or Cannel Coal Hollow upstream of Plaintiffs' compliance sampling location. As a result, Plaintiffs' sampling does not isolate the effect of discharges only from Outlets 022, 023, and 027. Tr. 2 at 199, ECF No. 100 (testimony of Dr. Palmer, agreeing that sampling did not isolate the effects of discharges only from Outlets 022, 023, and 027).

In answer to Defendant's oral motion, Plaintiffs maintained that, under a material contribution standard, they presented sufficient evidence to show that high conductivity discharges from the three outlets are materially contributing to the impairment observed downstream in Right Fork. Tr. 3 at 203, ECF No. 106. Plaintiffs report that the combined flow from Outlets 022, 023, and 027 is approximately 400 to 420 gallons per minute, or roughly 576,000 to 604,800 gallons per day. In April 2012, WVDEP reported that the total flow at the mouth of Right Fork is approximately 7.49 cubic feet per second, or roughly 4.5 million gallons per day. Def.'s Ex. 198 at FOLA#4A000986. Relying on those flow estimates, Plaintiffs calculate that Outlets 022, 023, and 027 contribute one-eighth or more of the total Right Fork flow. As reasoned by Plaintiffs, though their compliance sampling did not isolate the effects of Outlets 022, 023, and 027, a one-eighth contribution to the total flow is sufficient to meet the material contribution standard.

The Court disagrees. While "material contribution" does not require evidence that a single stressor independently causes impairment, it must require something more than what Plaintiffs have demonstrated here. First, the flow evidence offered by Plaintiffs is thin at best. It does not account for seasonal variations or for the variability of inputs from rainfall. Moreover, the Court heard no expert testimony to suggest that the some 600,000 gallons per day coming from the three outlets at issue materially contributes to impairment observed downstream after the introduction of nearly four million additional gallons from sources unknown, but including at least twelve other discharge outlets—each of which is a potential source of ionic pollution. Without supporting scientific testimony, the Court cannot connect the discharges at issue to the area where

Plaintiffs performed compliance sampling. Doing so would be little more than non-scientific speculation. Thus, the Court cannot conclude that Plaintiffs have demonstrated that Outlets 022, 023, and 027 are materially contributing to downstream impairment.

Accordingly, the Court **FINDS** that Plaintiffs have not met their burden of proving that discharges from Outlets 022, 023, and 027 cause or materially contribute to biological impairment of Right Fork, and Defendant is therefore entitled to judgment as a matter of law regarding alleged violations of WV/NPDES Permit No. WV1013815, governing Fola Surface Mine No. 4A.

2. Liability with respect to Fola Surface Mine No. 2 and No. 6.

Having found that both Road Fork and Cogar Hollow are biologically impaired, the Court finally turns to the question of whether Plaintiffs' have met their burden in establishing that high conductivity discharges from Defendant's Mine No. 2 and Mine No. 6 cause or materially contribute to impairment.

Plaintiffs have sufficiently demonstrated that the discharges in question share the characteristic ionic composition identified and analyzed by the EPA in its Benchmark. Dr. Palmer testified that the ionic composition of the discharges matches the characteristic ionic composition associated with alkaline mine drainage in the region (e.g., sulfates, bicarbonates, calcium, and magnesium). Stipulation ¶¶18, 36, 38, 48; Pls.' Exs. 38, 49, 57; Tr. 2 at 93, 156–57, 181–84, and 192–93, ECF No. 100. To demonstrate the similarity, Dr. Palmer compared water quality measurements at each discharge outlet to the composition of reconstituted water from Boardtree Branch—recognized as representing the particular ionic composition of regional alkaline mine drainage. *See supra* Tables 4, 5, and 6; Kunz et al., *Use of Reconstituted Waters to Evaluate Effect of Elevated Major Ions Associated with Mountaintop Coal Mining on Freshwater Invertebrates*, 32 Envtl. Toxicology & Chemistry 2826 (2013), Joint Ex. 10. Testing the characteristically composed water, Kunz et al., reported adverse effects to the mayfly *Isonychia* at conductivity levels of 1090 µS/cm—well below the conductivity levels at issue here.

Additionally, Plaintiffs have unequivocally demonstrated that the conductivity levels at issue here are sufficiently high to cause the observed impairment. Discharges from Fola Surface Mine No. 2 and No. 6 consistently and grossly exceed the threshold identified by EPA at which it becomes more likely than not that a stream will suffer biological impairment. *See Mancuso v. Consolidated Edison Co. of New York, Inc.*, 56 F.Supp. 391, 403 (S.D.N.Y. 1999) ("A fundamental tenet of toxicology is that the 'dose makes the poison' and that all chemical agents, including water, are harmful if consumed in large quantities, while even the most toxic substances are harmless in minute quantities.") aff'd in part, vacated in part, 216 F.3d 1072 (2nd Cir. 2000). Here, Defendant's discharges are consistently in the range of 2,000 µS/cm to 3,000 µS/cm, and are sometimes as high as 4,000 µS/cm to 5,000 µS/cm. Pls.' Ex. 37, 45, 55; Tr. 2 at 155–56, 178, 191, ECF No. 100. Those conductivity levels are several times the threshold identified by an expert federal agency as well as thresholds independently researched and reported in peer-reviewed scientific journals.[39]

Sampling at Road Fork and Cogar Hollow revealed changes in the macroinvertebrate community that are consistent with impairment caused by high conductivity levels. Multiple peer-reviewed scientific articles report finding that high conductivity associated with alkaline mine drainage leads to the extirpation of mayflies. Pls.' Ex. 173 at PE1536, JE0010, PE1832; Tr. 2 at 105–07, 137, ECF No. 100. Here, consistent with those reported findings, sampling revealed the complete extirpation of mayflies. Tr. 3 at 162–64, ECF No. 106 (noting that the complete

[39] Though not required for a finding of violation, the Court notes that the evidence presented is arguably sufficient to establish that though conductivity may not be the sole driver of impairment here, conductivity levels such as these are likely capable of causing impairment even standing alone.

extirpation of mayflies—organisms known to be particularly sensitive to conductivity—is strong evidence that conductivity is driving impairment); Joint Ex. 1 ("The clear patterns linking high conductivity to a loss of mayfly taxa has ecosystem-scale importance since mayflies often account for 25-50 percent of total macroinvertebrate abundance in the least-disturbed Central Appalachian streams.").

On the basis of the evidence presented, the Court **FINDS** that Plaintiffs have demonstrated the following by a preponderance of the evidence: (1) Road Fork and Cogar Hollow are biologically impaired, as measured by WVSCI scores below the federally approved threshold score of 68; (2) the discharges complained of share the same characteristic composition presently known in the scientific community to cause or materially contribute to impairment in central Appalachian streams; (3) the conductivity levels observed at Defendant's discharges are far in excess of the thresholds identified by the EPA and the available scientific literature known to cause stress to aquatic communities; (4) Defendant's mining operations are the only land use that could have caused impairment; and (5) changes in the biological community particularly show the loss of conductivity-intolerant organisms. Thus, the Court **FINDS** that high conductivity discharges from Fola Surface Mine No. 2 and No. 6 are causing or materially contributing to the biological impairment of Road Fork and Cogar Hollow in violation of Defendant's current WV/NPDES permits.

These findings are consistent with WVDEP's determination that ionic toxicity is a "significant stressor" in both Road Fork and Right Fork. Joint Ex. 16 at JE0578 ("A strong presence of sulfates and other dissolved solids exists in those waters and in all other streams where ionic toxicity has been determined to be a significant biological stressor."

Moreover, these findings are consistent with the testimony of Dr. Menzie, Defendant's only expert testifying on specific causation. Dr. Menzie offered consistent and repeated testimony that conductivity is one among a small collection of substantial causes of impairment. Tr. 3 at 240, ECF No. 106 ("[Conductivity is] going to play some role."); Tr. 4 at 104, ECF No. 107 ("I include conductivity as a stressor along with that"); Tr. 4 at 76, ECF No. 107 (listing precipitates, temperature, and conductivity as the drivers of impairment at the Leatherwood tributaries); Tr. 4 at 98-100, ECF No. 107 (explaining that conductivity is one of the factors causing impairment, but adding that he did not think it possible to allocate contribution more precisely). Though inconsistent with all other scientific evidence addressing thresholds, Dr. Menzie further maintained the opinion that conductivity levels in the range of 1,000 μS/cm to 3,000 μS/cm are capable of independently influencing WVSCI scores. Tr. 4 at 100, ECF No. 107. Even assuming Dr. Menzie's idiomatic threshold is correct despite all evidence to the contrary, this case concerns discharges with conductivity levels in that range and well above. Thus, WVDEP and all testifying experts in this case share the opinion that conductivity levels are causing or materially contributing to biological impairment.

3. Defendant's Rebuttal Arguments

Defendant advances a variety of arguments designed to defeat Plaintiffs' theory of specific causation. These arguments question the reliability and credibility of Plaintiffs' experts, the adequacy of Plaintiff's causation evidence, and the possibility of alternative drivers of impairment. Notwithstanding the fact that experts for both parties agree that conductivity levels are materially contributing to the observed biological impairment of Road Fork and Cogar Hollow, counsel continues to piecemeal attack Plaintiffs' evidence on specific causation.

As stated by Defendant, with regard to specific causation, "[d]etermining which factors are material is the stuff of scientific investigation, not assumption." ECF No. 116 at 8. Here, Plaintiffs' experts, Defendant's expert, and the WVDEP all agree: high conductivity is materially contributing to biological impairment at Road Fork and Cogar Hollow. The Court will not displace these expert opinions based on independent scientific investigation in favor of lay assumptions. Accordingly, the Court declines to delve further into counsel's evidence-based arguments; leaving only Defendant's legal argument regarding the adequacy of notice of potential liability.

Contrary to Defendant's assertion, in 2008, when Defendant's permits were last renewed, Defendant had notice of potential liability should it cause or contribute to biological impairment. Defendant's permits incorporate § 47-30-5.1.f., an unambiguous permit condition imposing liability should a permitee violate West Virginia's narrative water quality standards. *See OVEC v. Elk Run*, 2014 WL 29562, at *10. At the earliest, permittees have had notice of such potential liability since the predecessor to § 47-30-5.1.f. first became effective in 1985, or at the latest, upon original issuance or renewal of a particular permit. *Id.*

Not only did Defendant therefore have notice of potential liability provided in the plain language of its permits and each subsequent reissuance, but at the time of reissuance, Defendant further had the benefit of scientific literature demonstrating the harmful effects of high conductivity. As reviewed above, in a 2003 Programmatic Environmental Impact Statement on Mountaintop Mining/Valley Fills in Appalachia, the EPA reported a known association between increases in conductivity and coincident downstream biological impairment.[40] The EPA's

[40] Commenters on the draft EIS included several representatives for the West Virginia Coal Association, as well as representatives on behalf of the Kentucky Coal Association and Ohio Coal Association. EPA, Public Comment Compendium: Mountaintop Mining/Valley Fills in Appalachia Final Programmatic Environmental Impact Statement, Vol. 1 (Oct. 2005) (available at: http://www.epa.gov/region3/mtntop/documents.htm#cd).

Environmental Impact Statement was followed by additional publications in the peer-reviewed scientific literature well before Defendant's 2008 permit reissuance. *See supra* Section II.C. Accordingly, the Court concludes that Defendant had the benefit of adequate notice.

IV. CONCLUSION

In sum, the Court **FINDS** that Plaintiffs have established, by a preponderance of the evidence, that the Defendant has committed at least one violation of its permits for Mine No. 2 and Mine No. 6 by discharging into Road Fork and Cogar Hollow high levels of ionic pollution, which have caused or materially contributed to a significant adverse impact to the chemical and biological components of the applicable streams' aquatic ecosystem, in violation of the narrative water quality standards that are incorporated into those permits.

The Court **DIRECTS** the Clerk to send a copy of this written Opinion and Order to counsel of record and any unrepresented parties.

ENTER: August 12, 2015

ROBERT C. CHAMBERS, CHIEF JUDGE

Given the prevalence of such commenters, it is difficult to imagine that Fola could have remained uninformed of the EPA's draft EIS. To the contrary, it more likely suggests regional, industry-wide awareness.

PUBLISHED

UNITED STATES COURT OF APPEALS
FOR THE FOURTH CIRCUIT

No. 16-1024

OHIO VALLEY ENVIRONMENTAL COALITION; WEST VIRGINIA HIGHLANDS CONSERVANCY; and SIERRA CLUB,

Plaintiffs - Appellees,

v.

FOLA COAL COMPANY, LLC,

Defendant - Appellant.

AMERICAN FOREST AND PAPER ASSOCIATION; AMERICAN PETROLEUM INSTITUTE; NATIONAL ASSOCIATION OF CLEAN WATER AGENCIES; NATIONAL ASSOCIATION OF HOME BUILDERS; NATIONAL ASSOCIATION OF MANUFACTURERS; NATIONAL MINING ASSOCIATION; UTILITY WATER ACT GROUP,

Amici Supporting Appellant.

Appeal from the United States District Court for the Southern District of West Virginia, at Charleston. Robert C. Chambers, Chief District Judge. (2:13-cv-05006)

Argued: October 27, 2016 Decided: January 4, 2017

Before MOTZ and DIAZ, Circuit Judges, and Gerald Bruce LEE, United States District Judge for the Eastern District of Virginia, sitting by designation.

Affirmed by published opinion. Judge Motz wrote the opinion, in which Judge Diaz and Judge Lee joined.

ARGUED: Michael Shane Harvey, JACKSON KELLY PLLC, Charleston, West Virginia, for Appellant. Joseph Mark Lovett, APPALACHIAN MOUNTAIN ADVOCATES, Lewisburg, West Virginia, for Appellees. Thomas M. Johnson, Jr., OFFICE OF THE ATTORNEY GENERAL OF WEST VIRGINIA, Charleston, West Virginia, for Amici The State of West Virginia and West Virginia Department of Environmental Protection. **ON BRIEF:** Robert G. McLusky, Jennifer L. Hughes, JACKSON KELLY PLLC, Charleston, West Virginia, for Appellant. J. Michael Becher, APPALACHIAN MOUNTAIN ADVOCATES, Lewisburg, West Virginia; James M. Hecker, PUBLIC JUSTICE, Washington, D.C., for Appellees. Karen C. Bennett, Samuel L. Brown, Brian R. Levey, Kristy Bulleit, HUNTON & WILLIAMS LLP, Washington, D.C.; Jan A. Poling, AMERICAN FOREST & PAPER ASSOCIATION, Washington, D.C.; Amanda Waters, Erica Spitzig, NATIONAL ASSOCIATION OF CLEAN WATER AGENCIES, Washington, D.C.; Linda E. Kelly, Quentin Riegel, NATIONAL ASSOCIATION OF MANUFACTURERS, Washington, D.C.; Peter Tolsdorf, AMERICAN PETROLEUM INSTITUTE, Washington, D.C.; Tom Ward, NATIONAL ASSOCIATION OF HOME BUILDERS, Washington, D.C., for Amici American Forest & Paper Association, American Petroleum Institute, National Association of Clean Water Agencies, National Association of Home Builders, National Association of Manufacturers, National Mining Association and Utility Water Act Group. John C. Cruden, Assistant Attorney General, David S. Gualtieri, Jennifer Neumann, Environment and Natural Resources Division, UNITED STATES DEPARTMENT OF JUSTICE, Washington, D.C., for Amicus United States Environmental Protection Agency. Patrick Morrisey, Attorney General, Elbert Lin, Solicitor General, Erica N. Peterson, Assistant Attorney General, OFFICE OF THE ATTORNEY GENERAL OF WEST VIRGINIA, Charleston, West Virginia; Kristin Boggs, General Counsel, Thomas L. Clarke, Senior Policy Advisor and Counsel, WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION, Charleston, West Virginia, for Amici The State of West Virginia and West Virginia Department of Environmental Protection.

DIANA GRIBBON MOTZ, Circuit Judge:

Several environmental groups brought this action against a coal company, alleging that the company had violated the Clean Water Act and seeking appropriate injunctive relief. After a bench trial, the district court found that the company had indeed violated the Act and ordered it to take corrective measures. The company appeals, principally asserting that its National Pollution Discharge Elimination System ("NPDES") permit shields it from liability. Because the company did not comply with the conditions of its permit, the permit does not shield it from liability under the Clean Water Act, and the district court properly ordered appropriate remedial measures. Accordingly, we affirm the judgment of the district court.

I.

A.

The Clean Water Act forbids all discharges of pollutants into waters of the United States, unless the discharger holds a permit. 33 U.S.C. §§ 1311(a), 1342, 1362 (2012). The Act shields NPDES permit holders from liability if their discharges comply with their permits. 33 U.S.C. § 1342(k). A typical NPDES permit lists numerical limitations on specific types of effluents and includes other conditions required for compliance with state and federal law. The Act requires that effluent limits reflect applicable water quality standards. See 33 U.S.C. § 1312(a). These water quality standards may be numerical or narrative, 40 C.F.R. § 131.3(b) (2016), and may, but need not be, contained in a permit.

Under the Act, if a state receives approval from the Environmental Protection Agency ("EPA"), it can administer its own NPDES permitting program. See 33 U.S.C. § 1342(b). EPA reviews and must approve any substantive changes to a state's permit program. See id. In 1981, West Virginia received EPA approval to administer its own permit program and has done so ever since.

West Virginia has promulgated a number of regulations necessary to comply with the national NPDES program. All West Virginia NPDES permits incorporate (either expressly or by reference) numerous provisions of the West Virginia Code of State Rules. These include a series of regulations governing NPDES permits in general, as well as a separate series of regulations governing NPDES permits for coal mining. Compare W. Va. Code R. § 47-10 (2016) (general NPDES regulations), with W. Va. Code R. § 47-30 (coal mine NPDES regulations).

In 1996, Fola Coal Company, LLC obtained a West Virginia NPDES coal mine permit to discharge into Stillhouse Branch, a tributary of Twentymile Creek and a waterway adjacent to Fola's surface mining facility in central West Virginia. Fola applied for and received a renewed NPDES permit in 2009. The provisions of that permit lie at the heart of this case.

B.

On March 13, 2013, three environmental groups -- Ohio Valley Environmental Coalition, West Virginia Highlands Conservancy, and Sierra Club (collectively "the Coalition") -- filed this action under the Clean Water Act's citizen suit provision, 33 U.S.C. § 1365. The Coalition alleged that Fola violated 5.1.f, a West Virginia regulation incorporated in Fola's permit. At the time Fola's renewal permit was issued in 2009, 5.1.f provided:

> The discharge or discharges covered by a WV/NPDES permit are to be of such quality so as not to cause violation of applicable water quality standards adopted by the Department of Environmental Protection, Title 47, Series 2.

W. Va. Code R. § 47-30-5.1.f (2009). The Coalition alleged that Fola violated 5.1.f by discharging ions and sulfates in sufficient quantities to cause increased conductivity in Stillhouse Branch, which resulted in a violation of water quality standards. Specifically, the Coalition asserted that Fola's discharges violated two narrative water quality standards contained in Fola's permit. See id. §§ 47-2-3.2.e, -3.2.i (2016); see infra n.8.

In response to the Coalition's allegations, Fola pointed out that it disclosed the nature of its discharges when it applied for the 2009 renewal permit. At that time, Fola had stated that its discharges would include ions and therefore be highly conductive. Despite this disclosure, the West Virginia Department of Environmental Protection ("WVDEP") set no specific limitations on conductivity in Fola's permit. By declining to do so, Fola asserted, WVDEP made an affirmative choice not to impose any limit on conductivity. According to Fola, it followed that 5.1.f did not obligate Fola to limit the conductivity of its discharges even if that conductivity resulted in a violation of water quality standards. Fola reasoned that, because it complied with the effluent limits expressly set out in its permit, the permit shielded it from all liability under the Act.

To gain support for its view that 5.1.f imposed no obligation on it, in 2013 Fola sought clarification from WVDEP regarding a new West Virginia law enacted a year earlier, involving the permit shield. The new law provided that "Notwithstanding any rule or permit condition to the contrary, . . . compliance with a permit issued pursuant to this article shall be deemed compliance for purposes of" the Clean Water Act's permit shield. 2012 W. Va. SB 615 (formerly codified at W. Va. Code § 22-11-6(2) (2013)). WVDEP responded that, in its view, this legislation did not substantively change existing law but simply clarified West Virginia's consistent interpretation of the permit shield. Under this assertedly consistent view, a permit holder need only disclose its discharges of effluents to WVDEP and comply with the effluent limits in the permit. If the permit holder did this, according to WVDEP, the permit would shield the permit holder from all liability under the Clean Water Act.

In 2015, WVDEP attempted to remove from 5.1.f the language at issue in this case, which requires permit holders to comply with water quality standards. In doing so, WVDEP admitted that when the agency had issued Fola a renewal permit in 2009, 5.1.f "require[d] coal NPDES permittees to meet water quality standards, whether or not such standards are delineated in the permit or contained in the administrative record of the permitting process." WVDEP, Response to Comments, 47 CSR 30, WV/NPDES Rule for Coal Mining Facilities, at 1 (2014), http://apps.sos.wv.gov/adlaw/csr/readfile.aspx?DocId=26342&Format=PDF. Nonetheless, WVDEP opined that its removal of the relevant language from 5.1.f "does nothing more than make [state law] consistent with" the Clean Water Act, which, according to WVDEP, did not require compliance with water quality standards. Id.

Notwithstanding WVDEP's views, EPA did not approve WVDEP's attempted changes to 5.1.f. Instead, in a series of letters to WVDEP, EPA explained its concerns that the elimination of the water quality standards language in 5.1.f could cause state law to conflict with federal law and weaken the state's NPDES program. WVDEP's explanations did not assuage EPA's concerns, and EPA did not approve any changes to 5.1.f or to any other language incorporated in Fola's permit. In 2015, the West Virginia Legislature enacted another provision similar to SB 615 that explicitly prohibited enforcing water quality standard violations against permit holders. But again, EPA did not approve the removal of the relevant portion of 5.1.f or any similar changes to the state's NPDES permit program that might affect Fola's permit.

Nevertheless, armed with WVDEP's interpretation of SB 615 and the legislative actions outlined above, Fola urged the district court to hold that permit provision 5.1.f did not prohibit Fola from violating West Virginia water quality standards. Fola further contended that it could not be held accountable for increased conductivity and resulting water quality violations because the effluents it discharged fell within the numerical levels allowed in its permit or were disclosed during the permitting process.

C.

After a bench trial, at which the district court considered mountains of expert testimony, reports, and charts, the court issued a thorough written opinion. The court found that 5.1.f constituted an enforceable permit provision that required Fola to refrain from violating West Virginia's water quality standards, including the narrative water quality standards contained in §§ 47-2-3.2.e and -3.2.i.

The court found that mine drainage like that which Fola discharged into Stillhouse Branch deposited significant amounts of ions into the receiving water.[1] Ohio Valley Envtl. Coalition, Inc. v. Fola Coal Co., 82 F. Supp. 3d 673, 686–87 (S.D. W. Va. 2015). These ions are measured by conductivity, id. at 687, and the conductivity of Stillhouse Branch had markedly increased since Fola began discharging mine drainage into the water, id. at 696–98.

As conductivity in Stillhouse Branch increased, the experts explained and the court found, sensitive insect species, which could not adapt to the sudden and dramatic change, died. Id. at 687. The decrease in aquatic diversity caused a decrease in the stream's score on the West Virginia Stream Condition Index ("the

[1] In order to extract coal, Fola blasted rock and dumped it into Stillhouse Branch. See Gregory J. Pond et al., Downstream Effects of Mountaintop Coal Mining: Comparing Biological Conditions Using Family- and Genus-Level Macroinvertebrate Bioassessment Tools, 27 J. N. Am. Benthological Soc'y 717, 718 (2008) (explaining surface coal mining). The minerals in the rock reacted with the flowing water to release calcium, bicarbonate, and sulfate ions. See Emily S. Bernhardt et al., How Many Mountains Can We Mine? Assessing the Regional Degradation of Central Appalachian Rivers by Surface Coal Mining, 46 Envtl. Sci. & Tech. 8115, 8115 (2012).

Index"),[2] which WVDEP and EPA had long used to measure the health of streams. The court noted that EPA considered Index scores below 68 to indicate impairment and that, in 2009 when WVDEP issued Fola's renewal permit, WVDEP had generally shared that view. See id. at 677, 679 & n.4. The trial evidence established that since 2003 Stillhouse Branch had consistently scored well below 68, ranging from 31.6 to 58.17. Id. at 696.

The district court concluded that "when conductivity reaches 300 [µS/cm], it is more likely than not that" the Index score will drop below 68 and "the subject stream will be biologically impaired." Id. at 687 (citing EPA, A Field-Based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams (Final Report), EPA/600/R-10/023F, at A-36 (2011)). Samples from Stillhouse Branch reported conductivity that was ten times higher than this 300 µS/cm threshold. Id. at 696–98. The court found that Fola's mining increased conductivity in Stillhouse Branch and that "high conductivity in downstream Stillhouse Branch is causing -- or, at the very least materially contributing to -- a significant adverse impact to the chemical and biological components of the stream's aquatic ecosystems" in

[2] See A Stream Condition Index for West Virginia Wadeable Streams 1-2 (2000), http://www.dep.wv.gov/WWE/watershed/bio_fish /Documents/WVSCI.pdf.

violation of the West Virginia narrative water quality standards incorporated into Fola's permit. Id. at 698.

With respect to remedy, the district court, at Fola's urging, rejected the Coalition's proposed remedy as too burdensome. Instead, the court appointed a Special Master of Engineering to monitor Fola's implementation of less burdensome methods Fola proposed. Fola timely noted this appeal.

D.

A court must interpret an NPDES permit as it would a contract. Piney Run Pres. Ass'n v. Cty. Comm'rs, 268 F.3d 255, 269 (4th Cir. 2001). Thus, to the extent that the judgment of the district court rests on interpretation of Fola's NPDES permit, that interpretation constitutes a legal question, which we review de novo. Id. But to the extent that judgment rests on factual findings made after a bench trial, we can reverse only if those findings are clearly erroneous. Id.

II.

Fola principally contends that the district court misinterpreted its permit.

In doing so, Fola presents a narrow argument. The company expressly acknowledges that its permit "incorporates" 5.1.f. Reply Br. at 3. Fola admits that "permit holders are not shielded from violations of permit conditions." Id. at 1. And the company forgoes any claim that 5.1.f does not impose water quality standards, including those found in 3.2.e and 3.2.i. Fola's sole argument is that 5.1.f controls the conduct of WVDEP, the state regulator, and imposes no requirements on Fola, the regulated entity.

Fola offers three points assertedly supporting this argument. First, the company maintains that 5.1.f is ambiguous but is best interpreted as a regulation of the permitting authority, not the permit holder. Second, Fola contends that the district court failed to examine "extrinsic evidence," which it argues eliminates any ambiguity and demonstrates that, in the "contemplation of the parties," 5.1.f clearly imposed no obligation on the permit holder. Finally, Fola claims that our holding and analysis in Piney Run requires a court to conclude that 5.1.f imposes obligations only on the permitting authority. We consider each of these arguments in turn.

A.

We initially examine the language of Fola's permit to determine if it is indeed ambiguous. As we recognized in Piney Run, "if 'the language [of a permit] is plain and capable of legal construction, the language alone must determine' the permit's meaning." Piney Run, 268 F.3d at 270 (quoting FDIC v. Prince George Corp., 58 F.3d 1041, 1046 (4th Cir. 1995)).

Contrary to Fola's assertions, the text of 5.1.f of the permit seems straightforward and unambiguous. The provision prohibits "discharges covered by" the permit from violating water quality standards. Of course, it is the permit holder that generates "discharges covered by" the permit. Thus, the provision controls the activities of the permit holder -- here Fola. The state agency simply drafts the permit. That agency, WVDEP, has no control over the permit holder's discharges.

Further, there is no mention in 5.1.f of "regulating," "drafting a permit," or "determining effluent limits," all core activities of the state regulator. Rather, the language of 5.1.f focuses on the discharges themselves. One would have to rewrite 5.1.f substantially to read it as imposing obligations on WVDEP.[3] As written, the plain language of 5.1.f indicates it applies to Fola, the permit holder, not WVDEP, the agency granting the permit.

Review of the provisions surrounding 5.1.f further supports this conclusion. 5.1.f is contained in a section of the permit

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[3] For example, if 5.1.f imposed requirements on the state regulator rather than the permit holder, it would more naturally read: "The discharge or discharges covered by a WV/NPDES permit are to be ~~of such quality~~ regulated by the Department of Environmental Protection so as not to cause violation of applicable water quality standards adopted by ~~the Department of Environmental Protection~~ that agency, Title 47, Series 2." Notably, these changes would require both insertions and deletions.

entitled "Conditions Applicable to All Permits," and in a subsection entitled "Duty to Comply; Penalties." The first mandate of the subsection states, "The permittee must comply with all conditions of a WV/NPDES permit." See W. Va. Code R. § 47-30-5.1.a (2009) (emphasis added).

This subsection then lists several ways a permit holder can violate the permit separate and apart from violations of the permit's effluent limits. For example, under this subsection, a permit holder violates the permit when it "falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under a WV/NPDES permit." Id. § 47-30-5.1.d. And a permit holder violates a permit when it "knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit." Id. § 47-30-5.1.e.

It seems unlikely that immediately following these clear restrictions on permit holders, in a subsection specifically addressed to permit holders, the drafters inserted in 5.1.f a directive not to permit holders, but only to the regulating agency. Indeed, it makes little sense for 5.1.f to be incorporated into all coal mining permits, see id. § 47-30-5, if 5.1.f does not obligate the permit holder in any way.

Accordingly, the district court's conclusion that 5.1.f unambiguously regulates permit holders seems entirely warranted.[4]

B.

Furthermore, rather than supporting Fola's interpretation, all relevant extrinsic evidence points to the conclusion that 5.1.f imposes obligations on the permit holder, not the state permitting agency.

Fola's argument to the contrary relies almost entirely on statements from WVDEP and the West Virginia Legislature. Fola contends that these statements prove that neither body intended 5.1.f to create an obligation on permit holders to meet water quality standards beyond the numerical effluent limits in the permit. The Legislature's 2013 and 2015 amendments and WVDEP's statements certainly evince West Virginia's <u>present</u> desire to cease enforcement of water quality standards against permit holders. But neither WVDEP's current interpretation nor the Legislature's actions in amending state law in 2013 and 2015 constitute extrinsic evidence supporting Fola's interpretation of its <u>2009</u> permit.

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[4] Fola contends that the district court's holding renders the effluent limits in the permit superfluous. But by Fola's own admission, the effluent limits do not delineate <u>all</u> the discharges disclosed to the regulating agency. 5.1.f captures those discharges, not explicitly regulated by effluent limits, which nonetheless decrease water quality and harm the aquatic ecosystem.

And Fola is simply wrong in contending that "[t]here is no evidence that West Virginia ever intended" to hold permit holders liable for violations of water quality standards. Br. of Appellant at 34 (emphasis added). In fact, Fola has provided no evidence that the Legislature or WVDEP lacked this intent when Fola's renewal permit was issued in 2009. Rather, the record evidence indicates this was precisely what was intended.

In 2011, two years after the issuance of Fola's current permit, WVDEP pursued an enforcement action against Fola's parent company based on violations of the exact water quality standards at issue here as incorporated into the NPDES permit through 5.1.f. See Complaint in Intervention at 12, United States v. Consol Energy, Inc., No. 1:11-cv-0028 (N.D. W. Va. Mar. 14, 2011), ECF No. 6-1. And Fola's parent company agreed to injunctive relief to remedy these violations. Consent Decree, Consol Energy, No. 1:11-cv-0028 (N.D. W. Va. Jun. 15, 2011), ECF No. 3-1. Moreover, as late as 2015, WVDEP interpreted 5.1.f to require coal companies holding NPDES permits to meet water quality standards. See WVDEP, Response to Comments, at 1. This was the very reason why WVDEP attempted to amend 5.1.f. See id.

Fola nonetheless insists that 5.1.f cannot subject it to any substantive obligations because, during the formal rulemaking in which 5.1.f was added to West Virginia's NPDES program, EPA stated that the new rules would not alter any "substantive rights or obligations." Revision of West Virginia's NPDES Program Transferring Authority over Coal Mines and Coal Preparation Plants from the West Virginia Department of Natural Resources; Division of Water Resources to Its Division of Reclamation, 50 Fed. Reg. 2996, 2997 (Jan. 23, 1985). That argument both misreads the history of 5.1.f and ignores important record evidence.

5.1.f's prohibition against violating water quality standards originated in pre-1984 West Virginia surface coal mining regulations. See West Virginia Surface Mining Reclamation Regulations, ch. 20-6, ser. VII, § 6B.04 (1983) ("Effluent Limitations - Discharge from the permit area shall not violate effluent limitations or cause a violation of water quality standards."). At that time, the surface coal mining regulations clearly recognized that permit holders were subject to enforcement actions for violating both effluent limitations and water quality standards. Id. In 1984, West Virginia consolidated its surface coal mining regulations with its water pollution regulations. See Preamble to Proposed Regulations Consolidating the Article 5A and Article 6 Program (filed Nov. 9, 1984). As a result of this consolidation, the regulations governing NPDES permits for coal mines thereafter included provisions like 5.1.f that were previously found in the surface mining regulations. See WVDEP, Response to Comments, at 1.

The origin of 5.1.f renders untenable Fola's reliance on EPA's determination that the consolidated new regulations did not alter "substantive rights or obligations." EPA was correct. The new regulations did not alter any obligations under a permit; they simply brought existing obligations on surface coal mines into a single regulatory scheme. Surface coal mining facilities were already subject to substantively identical obligations prior to the consolidation of the regulations. Thus, EPA had no reason to conclude that the consolidated regulations altered any "substantive rights or obligations."

Moreover, although ignored by Fola, EPA's view as to the reach of 5.1.f has been consistent, as has the acceptance by courts of EPA's view when interpreting similar water quality provisions. In contrast to WVDEP's recent change of heart, EPA has remained clear through the years that 5.1.f imposes obligations on permit holders. Before us, EPA has filed an authoritative amicus brief pointing this out and reiterating its position. As EPA notes in its brief, some of the NPDES permits that EPA itself has issued impose narrative water quality standards like those in Fola's permit.[5] That water quality standards have been enforced against NPDES permit holders demonstrates the error in Fola's contention that 5.1.f cannot reasonably be interpreted to impose obligations on permit holders like Fola.

In sum, both the plain language of the provision and the extraneous evidence support the district court's holding that 5.1.f constitutes, as it has for decades, a regulation enforceable against NPDES permit holders, not the state permitting agency.

C.

Finally, Fola argues that our holding in Piney Run somehow prohibits this conclusion. According to Fola, Piney Run held that permit holders "who disclose their pollutants to the permitting agency and thereafter comply with the effluent limits

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[5] See, e.g., EPA NPDES Permit No. NH0100099 for the Town of Hanover, New Hampshire, pt. I.A.2, .3 and .6, https://www3.epa.gov/region1/npdes/permits/2015/finalnh0100099permit.pdf; EPA 2015 Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity, pt. 2.2.1, https://www.epa.gov/sites/production/files/2015-10/documents/msgp2015_finalpermit.pdf. Moreover, courts have enforced water quality standards provisions when, as here, the NPDES permit incorporates these standards. See, e.g., Nat. Res. Def. Council, Inc. v. Cty. of Los Angeles, 725 F.3d 1194, 1199, 1205 (9th Cir. 2013); Nw. Envtl. Advocates v. City of Portland, 56 F.3d 979, 985-90 (9th Cir. 1995); Nat. Res. Def. Council v. Metro. Water Reclamation Dist. of Greater Chicago, 175 F. Supp. 3d 1041, 1049-54 (N.D. Ill. 2016). In support of its contrary view, Fola relies on inapposite, unpublished, and overruled cases.

in their NPDES permits are shielded from liability" under the Clean Water Act. Br. of Appellant at 43. Therefore, Fola contends, since it "disclosed the presence of conductivity in its discharges and has complied with the effluent limits established by . . . WVDEP," it too is shielded from liability under the Act, even if it violated provision 5.1.f of its permit. Id. There are multiple problems with this contention.

First, and most fundamentally, Fola misstates our holding in Piney Run. We expressly held that a permit shields "its holder from liability . . . as long as . . . the permit holder complies with the express terms of the permit and with the Clean Water Act's disclosure requirements." Piney Run, 268 F.3d at 259 (emphasis added).[6] Fola ignores the emphasized language and wishes away its violation of one of "express terms of the permit" -- provision 5.1.f. Piney Run offers no support for this approach.

Fola attempts to bolster its misunderstanding of Piney Run by misinterpreting the careful examination of the history of the Clean Water Act we set forth in that case. See id. at 264-66. We recognized that requirements that permit holders meet water

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[6] Of course, to obtain the benefits of the permit shield a permit holder must also not discharge a pollutant in excess of the effluent limitations for that pollutant as listed in the permit. Piney Run, 268 F.3d at 259. That requirement is not at issue here.

quality standards had been the "primary means of federal regulation" prior to the 1972 enactment of the Clean Water Act. Id. at 264. The Act provided regulators with another tool -- "direct limitations on the discharge of pollutants" in the form of numerical caps on those discharges -- and a means to regulate -- NPDES permits. Id. at 265 (quoting Friends of the Earth, Inc. v. Gaston Copper Recycling Corp., 204 F.3d 149, 151 (4th Cir. 2000)(en banc)).

In Piney Run, we explained that adherence to its permit shielded a permit holder from liability under the Act. Id. But contrary to Fola's apparent belief, we did not hold that numerical limitations on specific pollutant discharges constituted the only proper subject of regulation under the Clean Water Act. Rather, we noted that, despite the Clean Water Act's "shift in focus of environmental regulation towards the discharge of pollutants, water quality standards still have an important role in the [Clean Water Act's] regulatory scheme." Id. (emphasis added).

Compounding its error, Fola refuses to recognize that Piney Run involved very different issues than those presented here. In Piney Run, we did not consider the enforceability of a permit's requirement that the permit holder adhere to water quality standards, let alone the enforceability of the specific narrative water quality standards required by West Virginia's

NPDES permit. Piney Run involved the enforcement of numerical limitations on the discharge of pollutants under a very different Maryland NPDES permit.[7] In that context, we concluded that the holder of a Maryland NPDES permit who "discharges pollutants that are not listed in its permit" was nonetheless shielded from liability under the Clean Water Act if it "adequately disclosed" those discharges "to the permitting authority." Id. at 268.

But this conclusion in Piney Run does not allow an NPDES permit holder in West Virginia to ignore 5.1.f's requirement "not to cause violation of applicable water quality standards." Indeed, although Piney Run involved a permit that regulated only numerical effluent limitations, rather than also directing adherence to water quality standards like the permit at issue here, we iterated and reiterated that only "follow[ing] the terms of their NPDES permits" allows permit holders to avoid liability. Id. at 265; see also id. at 259 (explaining that to be shielded from liability under the Clean Water Act, a permit holder must comply "with the express terms of [its] permit"). Piney Run provides Fola no way to avoid liability if Fola has

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[7] Maryland's NPDES permits do not contain a provision similar to 5.1.f. Rather, unlike in West Virginia, the Maryland permitting agency simply will not issue a permit unless it "finds that the discharge meets . . . applicable State and federal water quality standards." Md. Code Ann., Envir. § 9-324(a)(1) (West 2016).

not complied "with the express terms of its permit," including provision 5.1.f.

Nothing in Piney Run forbids a state from incorporating water quality standards into the terms of its NPDES permits. Rather, Piney Run held, as we do today, that a permit holder must comply with all the terms of its permit to be shielded from liability. The terms of Fola's permit required it to comply with water quality standards. If Fola did not do so, it may not invoke the permit shield.

III.

Having rejected Fola's principal contention that 5.1.f imposes no obligations on it, we turn to Fola's remaining argument -- that the district court erred in finding that Fola violated 5.1.f.

A.

Through 5.1.f., Fola's permit incorporates narrative water quality standards prohibiting discharges into Stillhouse Branch that are "harmful" or have a "significant adverse impact" on aquatic ecosystems.[8] In a long, remarkably thorough opinion, the

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[8] These standards provide in relevant part:

> 3.2 No sewage, industrial wastes or other wastes present in any of the waters of the state shall cause therein or materially contribute to any of the following conditions . . .

(Continued)

district court explained its reasons for concluding that Fola's discharges into Stillhouse Branch violated these narrative water quality standards in Fola's permit. The court relied on the testimony, reports, charts, studies, and exhibits from experienced scientists who had published extensively in peer-reviewed journals. All of the experts supported the Coalition's contention that Fola violated the permit's narrative water quality standards.[9]

In doing so, the experts used the West Virginia Stream Condition Index to determine whether Fola's discharges biologically compromised Stillhouse Branch. Both EPA and WVDEP have long used the Index to measure water quality. When a

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> . . .
> 3.2.e. Materials in concentrations which are harmful, hazardous or toxic to man, animal or aquatic life;
> . . .
> 3.2.i. Any other condition, including radiological exposure, which adversely alters the integrity of the waters of the State including wetlands; no significant adverse impact to the chemical, physical, hydrologic, or biological components of aquatic ecosystems shall be allowed.

W. Va. Code R. § 47-2-3 (2016).

[9] Fola offered a witness whom the district court found "h[eld] no training in the study of ecology" and, prior to being retained by Fola as an expert in this litigation, "had never analyzed the type of ecological data" at issue here. Fola, 82 F. Supp. 3d at 681. On appeal, Fola does not suggest that the district court should have credited this witness's testimony.

stream's Index score falls below 68, EPA considers the stream impaired under 33 U.S.C. § 1313(d). See infra n.11. The experts explained that the release of ions from Fola's discharges caused the conductivity in Stillhouse Branch to increase and sensitive insect species to die, thereby causing the stream's Index score to fall well below 68. Fola, 82 F. Supp. 3d at 696. On the basis of the expert evidence, the district court found that Fola's discharges caused or materially contributed to the impairment of Stillhouse Branch by increasing the conductivity of the stream.

On appeal, Fola makes no contention that the district court erred in finding that Fola's discharges in fact caused or materially contributed to the biological impairment in Stillhouse Branch. And Fola does not argue that narrative water quality standards cannot be enforced; it could not do so given that the Supreme Court has held to the contrary. See PUD No. 1 of Jefferson Cty. v. Wash. Dep't of Ecology, 511 U.S. 700, 716 (1994) (explaining that the Clean Water Act "permits enforcement of broad, narrative criteria" and "only one class of criteria, those governing 'toxic pollutants listed pursuant to section 1317(a)(1),' need be rendered in numerical form").

Instead, Fola offers brief and largely derivative "process" arguments. A substantial portion of those arguments involve Fola's mischaracterization of the district court's careful and detailed fact-finding. Fola attempts to treat that fact-finding, which of course can only be reversed if clearly erroneous, as "rulemaking" subject to de novo review.

B.

First, Fola maintains that it was deprived of "fair notice" that water quality standards were enforceable provisions of its permit. This assertion rests on Fola's own misinterpretation of the language in its 2009 permit and a studied refusal to acknowledge that language's history, all of which we detail above. Suffice it to say again that, when the Coalition filed this lawsuit in March 2013, Fola had been bound by the 2009 permit at issue here for four years. Moreover, in 2011, two years prior to the commencement of this action, WVDEP brought suit to enforce the water quality standards at issue here against Fola's parent company. And, prior to initiation of this case, Fola's parent company had in fact agreed to take measures to remedy its violations of those water quality standards. Fola thus had ample, personalized notice that the water quality standards in a West Virginia NPDES permit were enforceable, and would be enforced, against a permit holder.

Fola next contends that it relied on guidance from WVDEP that the State would not pursue any enforcement action based on conductivity or water quality standards. But again as explained above, Fola offers no evidence that WVDEP made any such assurance in 2009 when WVDEP last renewed Fola's permit. Moreover, such contemporaneous assurances seem unlikely given WVDEP's decision in 2011 to bring an enforcement action based on these very water quality standards. Further, even if Fola had offered evidence that WVDEP made such assurances when it issued Fola's renewal permit in 2009, that would not foreclose the Coalition from bringing this lawsuit. For Congress enacted the citizen suit provision of the Clean Water Act to address situations, like the one at hand, in which the traditional enforcement agency declines to act. See Gwaltney of Smithfield, Ltd. v. Chesapeake Bay Found., Inc., 484 U.S. 49, 53, 60 (1987). An agency's informal assurance that it will not pursue enforcement cannot preclude a citizen's suit to do so. See 33 U.S.C. § 1365(b)(1)(B).

Finally, Fola argues that the district court engaged in unlawful rulemaking. That argument is similarly unsound. Hornbook law defines "a rule" as "a generally applicable principle or standard developed by some authority including administrative authorities." 1 Admin. L. & Prac. § 1:20 (3d ed. 2016). The district court did not create any "generally applicable principle or standard." The court made factual findings based on the evidence presented in this particular case. The only rules for which the court found Fola liable are contained in its permit, specifically §§ 47-30.5.1.f and 47-2-

3.2.e and -3.2.i. These rules have long been incorporated into Fola's permit, and EPA has never approved their removal. They remain unchanged and controlling.

We must reject Fola's attempts to transform the district court's detailed fact-finding into rulemaking. After carefully assessing the record before it, the district court found as a fact that that a failing Index score indicated an impaired stream and that Fola's mining caused the increased conductivity that resulted in that impairment. These findings are well supported by the record evidence. None are clearly erroneous.

Some even rest on undisputed facts. For example, EPA has identified, and Fola does not dispute, "mining" as the source of the impairment of Stillhouse Branch. See WVDEP, 2012 Final West Virginia Integrated Water Quality Monitoring and Assessment Report List Page 14 (reviewing the 2012 Clean Water Act Section 303(d) Impaired Waters List). Moreover, Fola stipulated that its mine is the only mine that discharges into Stillhouse Branch. And WVDEP itself has explained, and Fola does not disagree, that the Index "was specifically designed for assessment of the biological component of the 47 C.S.R. 2 § 3.2.i narrative criteria" as applicable to waters such as Stillhouse Branch. WVDEP, Justification and Background for Permitting Guidance for Surface Coal Mining Operations to Protect West Virginia's Narrative Water Quality Standards, 47

C.S.R. 2 §§ 3.2.e and 3.2.i, at 4 (2010), http://www.dep.wv.gov/pio/Documents/Narrative/Narrative Standards Guidance Justification.pdf.

Despite this historic consensus, Fola argues that WVDEP has recently rejected the Index as a sole determinant of water quality, and that the court has therefore "usurped" the agency's role in its use of the Index. This argument rests on a mischaracterization of the district court's use of the Index. The court did not enshrine the Index as the sole acceptable method of establishing violations of water quality standards. Rather, the court explained that it only relied on the Index "[i]n the absence of [WVDEP] advancing a meaningful methodological alternative." Fola, 82 F. Supp. 3d at 679. On appeal, neither Fola nor WVDEP points to any "methodological alternative" to the Index. In the absence of any alternative, the district court simply applied the methodology both WVDEP and EPA have applied for years.

The district court found that, until 2012, EPA and WVDEP had generally agreed to use an Index score of 68 to determine whether water quality standards were being met. If a stream scored below 68, the stream was to be listed as impaired. Id.

at 677.[10] The record offers abundant support for this finding. See, e.g., Letter from Shawn M. Garvin, EPA Regional Administrator, to Randy C. Huffman, Secretary, WVDEP [hereinafter Garvin Letter], Enclosure 1, at 16 (Mar. 25, 2013) ("When determining whether to add waters to West Virginia's Section 303(d) list, EPA used West Virginia's narrative water quality criteria (W. Va. CSR §§ 47-2-3.2(e) & (i)) as applied to the aquatic life uses, and WVDEP's bioassessment listing methodology for its 2010 Section 303(d) list (i.e., [the Index]) . . . ."); see also WVDEP, 2010 West Virginia Integrated Water Quality Monitoring and Assessment Report 14 (2010) (explaining the direct relationship between § 47-2-3.2.i, Index scores, and impaired water listing).

Indeed, Fola concedes that EPA and WVDEP have long used the Index. Neither agency -- nor anyone else before this case -- suggested that this use required promulgation of a formal rule. Rather, the Index has been used, as the district court used it, as a method for assessing compliance with narrative water

[10] Prior to 2012 when it ceased using the Index to determine impairment, WVDEP had attempted to include a "gray-zone" listing between 60.6 and 68.0. EPA rejected this approach as "unsupportable," and continues to use 68 as the threshold. See Garvin Letter, Enclosure 1, at 12 n.3. For our purposes, this dispute is immaterial because the district court found that Stillhouse Branch had an Index score ranging from 31.60 to 58.17. Fola, 82 F. Supp. 3d at 696. Fola does not challenge these findings.

quality standards. Far from creating a rule for determining violations of water quality standards, the court simply made a factual determination using the Index as a well-established methodology. Employing this methodology, the district court came to the same conclusion as EPA had -- Stillhouse Branch was impaired.[11]

Similarly, contrary to Fola's assertions, the district court's determinations as to conductivity also constituted findings of fact, not rulemaking. The court heard extensive expert testimony on the causal relationship between increased conductivity in Appalachian streams and impairment as evidenced by declining Index scores. Fola, 82 F. Supp. 3d at 679-86. The court credited the testimony of accepted experts and an authoritative EPA publication. All concluded that mining activities cause increases in conductivity, which in turn cause impairment. Id. at 686–96.

The court noted that peer-reviewed scientific articles first recognized the relationship of mining, conductivity, and

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[11] While Fola focuses on notice as it relates to procedure, it is worth mention that Fola also had notice of the court's factual determination that Stillhouse Branch was impaired. WVDEP (with EPA approval) has listed Stillhouse Branch on its impaired waters list based on biological impairment since 2006. See WVDEP, 2006 Integrated Water Quality Monitoring and Assessment Report List Page 15 (2006); id. at 20 (explaining that WVDEP assessed biological impairment using the Index).

decreased Index scores in 2008, a year before issuance of Fola's renewal permit. See id. at 690 (citing Pond et al., supra n.1). Other articles strengthened these findings. Id. (citing, among others, M.A. Palmer et al., Mountaintop Mining Consequences, 327 Sci. 148 (2010) (finding that as conductivity increased, Index scores decreased)). In rebuttal, Fola offered an expert whom the district court found unqualified -- an assessment Fola does not challenge on appeal.

Finally, the relief the district court ordered belies any suggestion that it engaged in rulemaking. The court had the "discretion to determine" appropriate relief. See Friends of the Earth, Inc. v. Laidlaw Envtl. Servs. (TOC), Inc., 528 U.S. 167, 192 (2000). In exercising that discretion, the district court refused to order Fola to implement the solution the Coalition proposed, a reverse osmosis system. The court deemed this solution "too expensive and too uncertain." Order Specifying Relief at 5, Fola, No. 2:13-cv-5006 (S.D. W. Va. Dec. 8, 2015), ECF No. 183. Instead, the court appointed a special master to oversee implementation of Fola's proposed solution, which focused on water management practices that respond to the unique characteristics of Stillhouse Branch. Id. at 6–7. The court did not require Fola to achieve any particular Index score or conductivity level, but simply ordered Fola to take appropriate measures either to reduce the conductivity in its discharges or to increase the Index score of Stillhouse Branch. Id. at 1. The relief ordered by the district court reflects its careful fact-based findings, not unprincipled rulemaking.

In sum, Fola's arguments as to why the district court erred in finding that Fola violated its permit, like Fola's arguments as to the permit's reach, uniformly fail.

IV.

Accordingly, for the reasons set forth above, the judgment of the district court is

AFFIRMED.

No. 16-1024

IN THE UNITED STATES COURT OF APPEALS
FOR THE FOURTH CIRCUIT

OHIO VALLEY ENVIRONMENTAL COALITION, WEST VIRGINIA HIGHLANDS CONSERVANCY, and SIERRA CLUB,
Plaintiffs-Appellees/Cross-Appellants,

v.

FOLA COAL COMPANY, LLC,
Defendant-Appellant/Cross-Appellee

On Appeal from the United States District Court for the Southern District of West Virginia at Huntington
Case No. 2:13-cv-5006, Honorable Robert C. Chambers

BRIEF OF AMICI CURIAE STATE OF WEST VIRGINIA AND WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION

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INTRODUCTION

Amici State of West Virginia and its Department of Environmental Protection ("WVDEP") respectfully submit this brief to address the questions raised in this Court's September 6, 2016 Order.[1]

The Clean Water Act ("CWA") empowers state agencies like WVDEP to administer a permit system to regulate the discharge of effluents into state waters. Through this system, WVDEP ensures compliance with state ambient water quality standards developed for particular streams. Specifically, WVDEP imposes specific effluent limits on permittees, monitors their compliance with these limits, and retains the right to amend the permits if the limits prove insufficient to maintain ambient water quality. Federal and state law require that WVDEP provide a shield to permittees who comply with the specific discharge limits in their permits for any effluent that was disclosed during the permitting process. *Piney Run Pres. Ass'n v. Cnty. Comm'rs of Carrol Cnty., Md.*, 268 F.3d 255, 258 (4th Cir. 2001).

This system is a classic exercise in cooperative federalism, in which the federal government relies on experts at the state level to make the principal determinations about how best to ensure local water quality. In this case, the district court impermissibly circumvented WVDEP's permit process by imposing

[1] Specifically, this Court asked *amici* to address (1) whether Fola's permit contains water quality requirements, and if so, the methodology to gauge compliance, (2) the relationship between water quality requirements and effluent limits, and (3) how conductivity relates to water quality requirements.

an obligation on a permittee to comply with a conductivity limit that does not appear in its permit. If this decision were permitted to stand, courts would be enabled to make policy determinations reserved to the States, introducing confusion into the scope of WVDEP's permits and the permit shield.

To illustrate, the district court here purported to bind a permittee to maintain a certain West Virginia Stream Condition Index ("WVSCI") score to reduce conductivity levels in certain waters. But WVDEP does not impose a conductivity limit on permittees and even the Environmental Protection Agency ("EPA") has no recommended limit on conductivity. In fact, WVDEP has concluded that conductivity at the level imposed by the district court correlates poorly with WVSCI scores, which can be affected by a variety of environmental factors.

In short, WVDEP has made a reasoned decision not to impose a conductivity effluent limit on permittees. The district court should not be permitted to upend WVDEP's permit process and undermine the federal and state permit shields.

ARGUMENT

I. Permittees Cannot Be Held Liable for Discharge of Effluents that Were Disclosed to WVDEP But Not Specifically Limited in the Permit.

The CWA authorizes States to administer an NPDES permit program, subject to EPA oversight, whereby state agencies develop water quality standards and can enforce them by placing specific effluent limits in individual permits. *See Westvaco Corp. v. EPA*, 899 F.2d 1383, 1384 (4th Cir. 1990); 33 U.S.C. § 1342.

Under the CWA, WVDEP calculates effluent limits for specific discharges, which are designed to cumulatively ensure a stream meets its ambient water quality standard. *See* 33 U.S.C. § 1312; 1342(b). These standards can be expressed either as numeric or narrative standards. Numeric standards express the pollution limit for the entire stream. WVDEP then calculates the amount of pollutant that can be discharged from a particular outlet, while protecting the overall water quality of the stream, accounting for the various factors affecting the quality of the stream. WVSCR § 47-30-6.2.c. These effluent limits are included in specific NPDES permits. WVDEP may also develop specific effluent limits in permits to protect narrative water quality standards, such as the requirement that discharges not have a "significant adverse impact" on "biological components of aquatic ecosystems." WVSCR § 47-2-3.2.i; 40 C.F.R. §§ 122.44(d)(1)(v) – (vii).

EPA's NPDES permitting regulations set out a detailed and thorough process by which the State can develop these effluent limits, taking into account technical and scientific considerations. 40 C.F.R. § 122.44. This process provides the public with an opportunity to comment on permit limitations, and EPA with an opportunity to review, before they become final. 33 U.S.C. §§ 1342(b)(3)-(4). If WVDEP later concludes that the effluent limits are not sufficient to ensure water quality, it can initiate procedures to modify the limits. WVCSR § 47-30-8.2.c.2.

Indeed, WVDEP *must* reevaluate permits every five years to ensure water quality standards are being met. 33 U.S.C. § 1342(b)(1)(B); W. Va. Code § 22-11-11(c).

Both state and federal law shield permit holders from liability for purported water quality impairment so long as the permittee makes adequate disclosures to the permitting authority and complies with the terms in its permit. 33 U.S.C. § 1342(k); W. Va. Code § 22-11-6. This process ensures that expert state agencies like WVDEP, not courts, make decisions about how best to convert state water quality standards into specific effluent limits from an individual source. Thus, as this Court has held, "as long as a permit holder complies with the CWA's reporting and disclosure requirements, it may discharge pollutants not expressly mentioned in the permit" that were "reasonably anticipated by, or within the reasonable contemplation of, the permitting authority." *Piney Run*, 268 F.3d at 268.

A. The district court concluded that Fola's permit imposes not only specific effluent limits, but also a freestanding obligation to comply with the general narrative water quality standard contained in West Virginia Rule 5.1.f, which at the relevant time stated that "discharges covered by a WV/NPDES permit are to be of such quality so as not to cause violation of applicable water quality standards . . . ." WVCSR § 47-30.5.1.f (2010). The court based its decision on Section C of Fola's permit, which incorporates by reference the permitting procedures of the West Virginia Rules, listing 19 headings in a table of contents format.

This Court must interpret such language "in the context of the entire NPDES permit and the permitting process," *Piney Run*, 268 F.3d at 269, and this holistic approach refutes the district court's strained reading. Section A of the permit contains specific discharge limits and monitoring requirements that WVDEP uses to ensure compliance. JA 1244-1255. Consistent with federal law, these monitoring requirements apply only to the specific effluent limits listed in Section A of the permit, and the absence of monitoring requirements for conductivity indicates it was not intended as a limitation in the permit. *See* 40 CFR 122.44(i)(1). Section D, in turn, provides that WVDEP may modify the effluent limits in Section A whenever necessary to ensure compliance with water quality standards. JA 1258. In light of the specific discharge limitations, corresponding monitoring requirements, and mechanism for amendment, it would not make sense that WVDEP would hide a sweeping requirement to comply with narrative water quality standards in a cross-reference to a rule heading. Rather, in context, this provision is plainly an instruction *to WVDEP* to develop specific effluent limits in permits in light of the narrative water quality standards.

B. The text of Rule 5.1 confirms this commonsense reading of the permit. That Rule shows that WVDEP knew how to impose a requirement on a "permittee," such as the mandate that the "permittee shall comply" with certain limits on pollutants prescribed by federal law. WVCSR § 47-30.5.1.b. By contrast, Rule 5.1.f, identified by the district court, states in the passive voice that "discharges covered by a WV/NPDES permit are to be of such quality so as not to cause violation of applicable water quality standards. . . ." WVCSR § 47-30.5.1.f (2010). This provision, on its face, distinguishes between the "discharges covered by a WV/NPDES permit"—i.e., the specific effluent limits—and the "applicable water quality standards" enforced by WVDEP through the permit process.

C. Moreover, if the permit were interpreted to incorporate a freestanding obligation to comply with the narrative requirement, it would undermine the entire structure of the CWA. It would supplant WVDEP's role under the CWA in implementing ambient water quality standards by setting specific effluent limits in permits. For example, the iron effluent limits in Fola's permit for outlets 031-034 were 1.99 mg/l for the monthly average and 3.45 mg/l for the daily maximum. JA 1272-1275. These limits, as well as limits on any other outlets, are designed to ensure the overall stream meets the 1.5 mg/l numeric water quality standard, WVCSR § 47-02, Appendix E, Table 1. Under the district court's view, it would be uncertain whether WVDEP should enforce the 1.5 mg/l water quality standard against a permittee or the effluent limits in the permit.

For these reasons, this Court rejected a literal reading of the permit at issue in *Piney Run*, which stated that "the discharge of pollutants not shown shall be illegal." 268 F.3d at 270. A blanket prohibition on the discharge of all unlisted pollutants, the Court reasoned, would expose the permittee to liability in a host of unanticipated circumstances and undermine the permit process as a whole. *See id.* at 270-71. Because his Court rejected *explicit* permit language in *Piney Run* to preserve the structure of the federal and state permit shields, it should likewise do so here, where the district court made an unwarranted inference from a table in the permit that makes reference to 19 different sections of state rules.

D. Finally, WVDEP in a series of letters confirms the reading of Fola's permit described above.

In March 2012, WVDEP rejected a request by OVEC to take enforcement action against Fola for elevated levels of selenium for specific outlets, even though no such requirements were contained in Fola's permit. JA 88-89. WVDEP responded to that request by explaining that the West Virginia permit shield provision "precludes [WVDEP] from issuing a notice of violation for exceedances of selenium water quality standards . . . where a permittee is in compliance with their WV/NPDES permit." JA 89. The letter further explained that the permit shield under West Virginia law is consistent with the federal permit shield, as interpreted by this Court in *Piney Run*. *See id.*

Then, in a series of letters between WVDEP and EPA in 2012 and 2013, WVDEP repeatedly confirmed that the purpose of the new law was to "clarify[] that compliance with the effluent limits contained in a [NPDES] permit is deemed compliant with [state law]." JA 72 (Aug. 9, 2012 letter). WVDEP explained that this reading was in agreement with EPA's revised policy statement on the federal permit shield, which likewise provided that permittees are shielded as to pollutants expressly limited in the permit (as long as the limits are met) and other pollutants specifically made part of the record during the permitting process. JA 83-84 (Jun. 5, 2013). In another letter, again echoing *Piney Run*, WVDEP explained that permittees are "shielded from liability for the discharge of pollutants not expressly mentioned in the permit" provided those pollutants were within WVDEP's "reasonable anticipation," that is, disclosed in the permit application. JA 70.

Any fair reading of these letters shows that WVDEP has interpreted the permit shield as "co-extensive" with the federal permit shield, which provides that a permittee cannot be held liable for discharging an effluent that had been disclosed during the permit process but not limited in the permit, *Piney Run*, 268 F.3d at 268. Under state law, WVDEP's interpretation of its own rules is entitled to "much weight." *Crockett v. Andrews*, 172 S.E.2d 384, 387 (W. Va. 1970). And the attempt by the district court to detect ambiguity in these letters by misconstruing isolated phrases must fail.

II. WVDEP Does Not Have A Conductivity Standard For Water Quality Nor Does It Impose A Conductivity Effluent Limit On Permittees.

WVDEP does not impose a conductivity limit on permittees and EPA has not provided a recommended conductivity limit. Moreover, WVDEP has concluded that, particularly at the level imposed by the district court, both WVSCI and conductivity are poor measures of stream health.

WVDEP has rejected use of the standards the district court adopted, WVSCI and conductivity, for determining water quality. In 2010, West Virginia adopted "Permitting Guidance for Surface Coal Mining Operations to Protect West Virginia's Narrative Water Quality Standards."[2] This Guidance explained that WVSCI is "a tool to be used as a[] . . . indicator of stream health, but not the sole criteria," and that WVDEP must instead assess the health of the aquatic ecosystem as a whole.[3] The West Virginia Legislature agreed with this approach, instructing WVDEP to approach narrative water quality standards based on an "evaluation of the holistic health of the aquatic ecosystem." W.Va. S.B. 562 (2012).

WVDEP's decision not to rely on the WVSCI score or conductivity for water quality is scientifically sound and reasonable. As WVDEP explained, WVSCI is a poor measure of the health of the aquatic ecosystem because it is a measurement taken at a single point in a stream and assesses only the impact on

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[2] WVDEP, Permitting Guidance for Surface Coal Mining Operations to Protect West Virginia's Narrative Water Quality Standards, 47 C.S.R. 2 §§ 3.2.e and 3.2.i (Aug. 12, 2010; revised May 11, 2012), http://www.dep.wv.gov/pio/Documents/2011-05-11%20%20Narrative%20Standards%20Permitting%20Guidance%20(Rev%20%202).pdf (hereinafter Guidance).

[3] WVDEP, Justification and Background for Permitting Guidance for Surface Coal Mining Operations to Protect West Virginia's Narrative Water Quality Standards, 47 C.S.R. 2 §§ 3.2.e and 3.2.i, at 4 (Aug. 12, 2010), http://www.dep.wv.gov/pio/Documents/2011-05-11%20%20Narrative%20Standards%20Permitting%20Guidance%20(Rev%20%202).pdf ("Justification").

insects rather than the broader health of the stream. Guidance at 4. Moreover, WVDEP concluded that conductivity itself is perhaps an even less effective measure of stream health. Justification at 5. And even if conductivity were an appropriate standard, WVDEP's scientific studies show that conductivity is poorly correlated with WVSCI scores, which can be affected by a variety of environmental factors. Justification at 5.[4]

It is inconsistent with the structure of the CWA for a district court to set a conductivity standard that WVDEP itself declined to adopt. The CWA charges States with the task of enforcing the State's water quality standards. And the district court's decision would effectively impose on permit holders a numeric water quality standard that WVDEP reasonably declined to adopt and bypass the experts charged under federal and state law with administering permits. The CWA does not allow courts to circumvent the States in this manner.

CONCLUSION

The decision of the district court should be reversed.

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[4] WVDEP has also been actively exploring, with EPA's approval, addressing conductivity in state streams through the CWA's Total Maximum Daily Loads ("TMDL") process by 2020 to 2025. EPA MSJ Opp., Dkt. No. 39, *Ohio Valley Envtl. Coal. v. McCarthy*, 3:15-cv-271, at 2-3 (S.D. W. Va. Feb. 19, 2016). WVDEP has not yet established these TMDLs because, as explained above, it has not determined the best measure by which to measure and address conductivity. As EPA recently explained to a federal district court, "the reasons [why] the State deferred issuing the TMDLs for [conductivity] . . . were reasonable." *Id.* at 3.

Respectfully submitted,

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October 6, 2016

CERTIFICATE OF COMPLIANCE

1. This brief complies with the type-volume limitation of Fed. R. App. P. 29 & 32(a)(7)(B). This brief contains 10 pages as ordered by this Court, excluding the parts of the brief exempted by Fed. R. App. P. 32(a)(7)(B)(iii).

2. This brief complies with the typeface requirements of Fed. R. App. P. 32(a)(5) and the type style requirements of Fed. R. App. P. 32(a)(6) because it has been prepared in a proportionally spaced typeface using Microsoft Word in 14-point Times New Roman font.

Date: October 6, 2016

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CERTIFICATE OF SERVICE

I certify that on October 6, 2016, the foregoing document was served on the counsel of record for all parties through the CM/ECF system.

/s/ Thomas M. Johnson, Jr.	October 6, 2016
Thomas M. Johnson, Jr.	Date

RECORD NO. 17-1430

IN THE

United States Court of Appeals
FOR THE FOURTH CIRCUIT

OHIO VALLEY ENVIRONMENTAL COALITION INC.; SIERRA CLUB; WEST VIRGINIA HIGHLANDS CONSERVANCY; and WEST VIRGINIA RIVERS COALITION,

Plaintiffs-Appellees,

v.

SCOTT PRUITT, Administrator, United States Environmental Protection Agency, and CECIL RODRIGUES, Acting Regional Administrator, United States Environmental Protection Agency, Region III.

Defendants-Appellants.

ON APPEAL FROM THE UNITED STATES DISTRICT COURT FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA AT CHARLESTON

BRIEF OF *AMICUS CURIAE* WEST VIRGINIA COAL ASSOCIATION SUPPORTING FEDERAL DEFENDANTS-APPELLANTS

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UNITED STATES COURT OF APPEALS FOR THE FOURTH CIRCUIT
DISCLOSURE OF CORPORATE AFFILIATIONS AND OTHER INTERESTS

Disclosures must be filed on behalf of all parties to a civil, agency, bankruptcy or mandamus case, except that a disclosure statement is **not** required from the United States, from an indigent party, or from a state or local government in a pro se case. In mandamus cases arising from a civil or bankruptcy action, all parties to the action in the district court are considered parties to the mandamus case.

Corporate defendants in a criminal or post-conviction case and corporate amici curiae are required to file disclosure statements.

If counsel is not a registered ECF filer and does not intend to file documents other than the required disclosure statement, counsel may file the disclosure statement in paper rather than electronic form. Counsel has a continuing duty to update this information.

No. 17-1430 Caption: Ohio Valley Environmental Coalition v. Environmental Protection Agency

Pursuant to FRAP 26.1 and Local Rule 26.1,

West Virginia Coal Ass'n
(name of party/amicus)

who is amicus, makes the following disclosure:
(appellant/appellee/petitioner/respondent/amicus/intervenor)

1. Is party/amicus a publicly held corporation or other publicly held entity? ☐ YES ☐ NO

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If yes, identify all parent corporations, including all generations of parent corporations:

3. Is 10% or more of the stock of a party/amicus owned by a publicly held corporation or other publicly held entity? ☐ YES ☐ NO
If yes, identify all such owners:

Sierra Club v. EPA 18cv3472 NDCA Tier 2 ED_002061_00106927-00002

4. Is there any other publicly held corporation or other publicly held entity that has a direct financial interest in the outcome of the litigation (Local Rule 26.1(a)(2)(B))? ☐ YES ☐ NO
If yes, identify entity and nature of interest:

5. Is party a trade association? (amici curiae do not complete this question) ☐ YES ☐ NO
If yes, identify any publicly held member whose stock or equity value could be affected substantially by the outcome of the proceeding or whose claims the trade association is pursuing in a representative capacity, or state that there is no such member:
See attached page

6. Does this case arise out of a bankruptcy proceeding? ☐ YES ☐ NO
If yes, identify any trustee and the members of any creditors' committee:

Signature: s/ Douglas J. Crouse Date: July 24, 2017

Counsel for: ______________________

CERTIFICATE OF SERVICE

****

I certify that on July 24, 2017 the foregoing document was served on all parties or their counsel of record through the CM/ECF system if they are registered users or, if they are not, by serving a true and correct copy at the addresses listed below:

s/ Douglas J. Crouse
(signature)

July 24, 2017
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Response to Question No. 5

All member companies of the trade association party that are publically traded, or whose parent companies are publically traded, whose stock or equity value may be affected substantially by the outcome of the proceeding, are identified below.

West Virginia Coal Association

Member	Parent
Alliance Coal, LLC	Alliance Resource Partners
Alpha Natural Resources, LLC	None
ArcelorMittal	None
Arch Coal, Inc.	None
CONSOL Energy, Inc.	None
Natural Resource Partners, LP	None
United Coal Company, LLC	None

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INTEREST OF *AMICUS CURIAE*

West Virginia is the nation's second leading coal producer.[1] The industry provides thousands of high-paying jobs and represents a significant portion of the tax base in West Virginia. Coal accounts for the production of over 30 percent of the nation's electricity,[2] and West Virginia also produces a significant amount of the nation's metallurgical coal (coal used to produce "coke" used in the production of steel and metal alloys). The West Virginia Coal Association ("WVCA") is a trade association representing approximately ninety-eight percent of West Virginia's underground and surface coal mine production.[3] Its members include coal producers, mineral and land owners and ancillary businesses. Most or all of its coal-producing members must apply for and hold National Pollutant Discharge Elimination System ("NPDES") permits for discharges of stormwater from

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[1] U.S. Energy Information Administration, Frequently Asked Questions (2017) (2015 data), available at https://www.eia.gov/tools/faqs/faq.php?id=69&t=2; "Coal Data Browser" (aggregate coal mine average employees 2015) (last accessed July 23, 2017).

[2] U.S. Energy Information Administration, Frequently Asked Questions (2017) (2016 data); *id.* available at; https://www.eia.gov/tools/faqs/faq.php?id=69&t=2; "Coal Data Browser" (aggregate coal mine average employees 2015) (last accessed July 23, 2017) West Virginia State Treasury, Coal Severance Tax Archive, available at http://www.wvtreasury.com/Banking-Services/Revenue-Distributions/Coal-Severance-Tax/Coal-Severance-Tax-Archive (last accessed July 23, 2017).

[3] *See* West Virginia Coal Association, Who we Are, available at http://www.wvcoal.com/who-we-are (last accessed July 23, 2017).

sediment control ponds designed to capture all of the surface runoff at surface mines into waters of the United States.

Both mine operators and land owners at reclaimed mine sites have been targeted by OVEC and the Sierra Club in CWA citizen suits. Those suits have sought to impose "conductivity" limits in NPDES permits held by mine operators and to require landowners to obtain NPDES permits at reclaimed mine sites where the operator has previously been released of NPDES permit obligations.[4]

The issue raised in this case – whether the West Virginia Department of Environmental Protection ("WVDEP") or the EPA has an immediate obligation under the CWA to develop TMDLs for ionic toxicity – has significant implications for the coal mining industry. TMDLs are implemented by allocating allowable pollutant "loads" to both "point" and "non-point" sources of pollutants. Memorandum Opinion and Order, Docket No. 87 at 3-5 (Feb. 14, 2017) ("Op.") (App-___-___).

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[4] *See, e.g., Ohio Valley Envtl. Coal., Inc., et al. v. Elk Run Coal Co., Inc.*, 24 F.Supp.3d 532 (S.D. W. Va. 2014); *Ohio Valley Envtl. Coal., Inc., et al. v. Fola Coal Co., LLC*, 120 F.Supp.3d 509 (S.D. W. Va. 2015); *Ohio Valley Envtl. Coal., Inc., et al. v. Fola Coal Co., LLC*, Nos. 2:13-cv-21588; 2:13-cv-16044, 2016 WL 3190255 (S.D. W. Va. June 7, 2016) (conductivity cases); *West Virginia Highlands Conservancy, et al. v. Pocahontas Land Corp.*, No. 2:13-cv-12500 (S.D. W. Va.); *Ohio Valley Envtl. Coal., Inc., et al. v. Pocahontas Land Corp.*, No. 2:15-cv-15515 (S.D. W. Va.); *Ohio Valley Envtl. Coal., Inc., et al. v.Hernshaw Partners, LLC*, 984 F.Supp.2d 589 (S.D. W. Va. 2013) (landowner cases).

The goal of OVEC and the Sierra Club is to effect the imposition of ionic toxicity "loads" by imposing effluent limits in NPDES permits on "conductivity." They have argued that the imposition of such limits requires the WVCA's members to construct and operate "reverse osmosis" treatment facilities, technology that is not only unproven for this purpose but which is unsustainably expensive.[5] This unprecedented relief would jeopardize the ability of the WVCA's members to maintain their businesses – which is precisely OVEC and the Sierra Club's goal. This lawsuit is just the latest in a long series of legal challenges OVEC and the Sierra Club have brought in state and federal courts in which they have sought to have their opinions substituted for the technical judgments of WVDEP and EPA, all in an attempt to achieve their goal of moving states "beyond

[5] In CWA citizen's suits, OVEC and the Sierra Club has urged the court to require a West Virginia mine operator to install reverse osmosis treatment systems capable of treating many hundreds of gallons per minute of runoff. *See* Order Specifying Relief, *Ohio Valley Envtl. Coal., Inc., et al. v. Fola Coal Co., LLC*, No. 2:13-cv-5006 (S.D. W. Va. Dec. 8, 2015), Docket No. 183. In a recent case the same district court found that the present value cost to construct and operate t a reverse osmosis system to treat discharges from just one surface mine outlet would cost more than $136 million. *Id.* at 5.

coal" – *i.e.*, ending coal mining.[6] For these reasons, the questions presented here squarely implicate the interests of the WVCA and its members.[7]

The WVCA joins, but does not repeat, the arguments of EPA and other amici that the district court lacked authority to create a mechanism of judicial review where none exists. Rather, it seeks to explain why even if the court had such authority, it erred in ordering EPA to immediately commence TMDL development for the 179[8] streams that WVDEP has identified as not meeting water quality standards for the protection of aquatic life due to "ionic toxicity."[9]

BACKGROUND AND SUMMARY OF ARGUMENT

Surface mines remove rock or "overburden" to access coal seams. Mine operations use the broken rock to backfill the mine site and to place "excess" rock in "valley fills." *See Ohio Valley Envt'l Coal. v. Aracoma Coal Co.*, 556 F.3d 177, 186 (4th Cir. 2009). When rain and ground water contact the broken rock it can

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[6] *See* Sierra Club, About the [Beyond Coal] Campaign, available at http://content.sierraclub.org/coal/about-the-campaign (last accessed July 23, 2017).

[7] Neither EPA nor its counsel authored this brief in whole or in part, nor did EPA or any other party contribute money to fund this brief.

[8] Op. at 7.

[9] The district court denied WVCA's motion to intervene below, finding its claim of harm too remote notwithstanding the Sierra Club's efforts to impose conductivity effluent limits on mine operators through citizen suits. Memorandum Opinion and Order denying Motion by West Virginia Coal Association to Intervene as a Defendant, Docket No. 32 (Dec. 14, 2015).

dissolve the salts, minerals and metals from the rock. This water is collected in sediment control ponds and is discharged in compliance with "effluent limits" imposed in water discharge (NPDES) permits designed to ensure that water quality standards are met in the receiving streams. *Id.* at 189-91 (describing CWA and other permitting programs at mine sites).

To evaluate whether waters were maintaining the aquatic life uses recognized by its water quality standards, as required by CWA § 303(d)(1)(A), WVDEP used the "West Virginia Stream Condition Index" ("WVSCI") from 2002 to 2010. Op. at 5. The WVSCI relies exclusively on measures of aquatic insects to determine if aquatic life uses are being attained. But, as the district court noted, the WVSCI provides no information on the cause(s) of impairment. *See* Op. at 5-7.

The identification of the cause of impairment can be relatively straightforward where data shows that in-stream concentrations of specific pollutants exceed the allowable concentrations established by rulemaking in "water quality criteria" adopted under CWA § 303(c) (33 U.S.C. § 1313(c)) to protect aquatic life uses. Thus, for many of the substances in storm water discharges from surface mines, such as iron and aluminum, WVDEP has established specific water quality criteria expressed as an allowable in-stream concentration. *See* W. Va.

Code St. R. § 47-2-8, App. E, Table 1. [10] But, for other salts and minerals frequently discharged by surface mines and other earth disturbing activities, neither WVDEP nor EPA have adopted or recommended specific water quality criteria because they have not been identified as causing or contributing to significant adverse effects.

Solutions containing these salts and minerals can include electrically charged atoms and molecules known as "ions." These ions affect the ability of the water to carry minute electrical charges, and this effect can be measured as "conductivity" or "specific conductance." Higher levels of dissolved salts, minerals and metals are more conductive and produce higher levels of "conductivity."[11]

Exercising its obligations to identify so-called "impaired" waters under CWA § 303(d)(1), WVDEP used the WVSCI to identify 179 streams as impaired due to "ionic toxicity," or "conductivity." But, as discussed below, those labels do not suggest that conductivity itself is the "cause" of impairment nor do they seek to identify the particular substances contributing to impairment any more than identifying a water as impaired by "metals" or "pollutants" indicates which metals or pollutants are present and contributing to impairment. And, WVDEP has not

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[10] For example, to protect most aquatic life chronic iron concentrations may not exceed 1.5 milligrams per liter (mg/l). *Id.* § 8.15.

[11] Conductivity is measured in "microsiemens per centimeter" (μS/cm).

established a water quality criterion for conductivity because it has determined that WVSCI scores and conductivity are poorly correlated. *See* Justification and Background for Permitting Guidance for Surface Coal Mining Operations to Protect West Virginia's Narrative Water Quality Standards, 47 CSR 2 §§ 3.2.e & 47 CSR 2 §§ 3.2.i, 5-7 (Aug. 12, 2010) (infeasible to calculate a numeric conductivity limit to implement narrative water quality standard because conductivity levels are poor predictors of WVSCI scores), available at http://www.dep.wv.gov/pio/Pages/Commentsonnarrativewaterqualitystandards.aspx (last accessed July 23, 2017). Accordingly, WVDEP proposed in 2012 to delay TMDL development for the 179 streams identified as impaired for ionic toxicity until the particular substance(s) causing impairment are identified. *See generally* JA 3079-3102 (App-___-___).

WVDEP also proposed to delay TMDL development because it has been directed by the West Virginia Legislature to use measures of attainment with aquatic life uses that do not rely exclusively on insects, but which rely primarily on the preservation of fish communities. JA 2332 (App-___). WVDEP has a massive TMDL program underway. It has prepared some 500 TMDLs since 2016 and is in the process of preparing at least 180 TMDLs unrelated to the 179 streams at issue by 2020.[12] In light of that on-going effort, WVDEP reasonably chose to expend its

[12] JA 2789-844 (App-___-___).

resources on other TMDL efforts and to delay TMDL development for streams listed as impaired based on a methodology (WVSCI) that WVDEP has been directed to change. *See id.* ("In response to the legislation, DEP is not adding new biological impairments to the 2012 Section 303(d) list. Previously listed impairments are being retained. When new rules become effective, delisting without TMDL development may occur if the application of the assessment methodology demonstrates a non-impaired condition.").[13] Accordingly, EPA approved WVDEP's delay in the development of TMDLs for waters with elevated conductivity. *See* EPA's Memorandum Opposing Plaintiffs' Motion for Summary Judgment and Supporting EPA's Cross-Motion for Summary Judgment, Docket No. 39 at 12-15 (Feb. 19, 2016).

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[13] The district court erroneously found that Senate Bill 562 requires that any new assessment methodology must be at least as protective as the WVSCI and that any new methodology should therefore not result in the delisting of streams that have already been placed on the 303(d) list as biologically impaired. Op. at 11-12, 35. The statutory language cited by the district court merely states that any new methodology may not "establish standards less protective than requirements that exist at the time of enactment of the amendments to this subsection…." 2012 W. Va. Acts 562 (codified at W. Va. Code § 22-11-7b). The WVSCI is merely guidance. It has never been subjected to rulemaking or adopted as a water quality standard, and thereby cannot be a "requirement." Further, the West Virginia Legislature has recently clarified that any new methodology may not "establish standards less protective than *legislatively-approved rules* that existed at the time of enactment…." 2017 W. Va. Acts 687 (codified at W. Va. Code § 22-11-7b). Accordingly, the district court incorrectly interpreted SB 562 as setting WVSCI "as a floor for whatever methodology is eventually developed." Op. at 35.

The district court, however, swept all that away. It created an extra-statutory right of review. And, as it has done before, the court conducted that review without extending appropriate deference to the agencies charged with administering the complex program for developing water quality standards and for implementing CWA § 303(d). *See Aracoma Coal Co.,* 556 F.3d at 201 (reversing same court for failure to accord deference to Corps of Engineers in application of CWA § 404). Instead, it declared that EPA has already "concluded that when conductivity in a stream reaches 300 µS/cm … the stream is biologically impaired." Op. at 10. Relying on this characterization of EPA's Conductivity "Benchmark," it rejected all suggestions that there was any reason to delay development of TMDLs. And, by doing so, it thereby implicitly ruled those TMDLs must achieve conductivity levels of 300 µS/cm.[14]

The district court thereby declared that all streams with conductivity levels of 300 uS/cm are impaired, and effectively crafted a new water quality standard for conductivity, and ordered EPA to use it as a basis for developing TMDLs that the State will convert into NPDES permits. *See* Op. at 3-5 (describing TMDL process and permitting and environmental programs for surface mining). That was error and as this Court should, as it has done at least four times previously, reverse the district court below for its failure to defer to the agencies charged with the

[14] *See* footnote 5, *supra.*

complex legal scientific judgments required by the statutes regulating the effect of mining.[15] *See Aracoma,* 556 F.3d 177 (4th Cir. 2009) (reversing decision invalidating four "fill" permits where district court substituted own judgment for agency's); *OVEC v. Bulen,* 492 F.3d 493 (4th Cir. 2005) (reversing order invalidating "nationwide" CWA "fill" permit for mining for failure to defer to reasonable agency construction); *Kentuckians for the Commonwealth, Inc. v. Rivenburgh,* 317 F.3d 425 (4th Cir. 2003) (reversing ruling that coal mine valley fills were not "fill material" under CWA after district court failed to defer to agency) & *Bragg v. West Virginia Coal Ass'n,* 248 F.3d 275 (4th Cir. 2001), *cert. denied,* 534 U.S. 1113 (2002) (reversing on 11th Amendment grounds ruling that SMCRA rule prohibited valley fills).

DISCUSSION

Even if the judicial artifice used by the district court to review decisions to delay TMDL development survives scrutiny, its application of that artifice cannot. The delays proposed by WVDEP and accepted by EPA were not only entirely reasonable and appropriate, but arguably even required. Accordingly, the district court's order that EPA prepare TMDLs for all biologically impaired streams should be vacated and reversed.

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[15] If OVEC and the Sierra Club have its way, the district court's order will lead to the imposition of NPDES permit limits on conductivity at mined properties – limits that the district court has already determined cannot practicably be met using affordable treatment technologies.

CWA § 303(d)(1)(A) requires states to identify waters for which existing discharge limits "are not stringent enough to implement any [applicable] water quality standards." 33 U.S.C. § 1313(d)(1)(A). Then, for those identified waters states shall establish TMDLs "for those *pollutants* which the [EPA] identifies under [33 U.S.C. §] 1314(a)(2) … as suitable for such calculations." Here, there were complexities with both the process for identifying streams and then with determining whether and how a pollutant could be identified and controlled to achieve water quality standards—complexities the district court was quick, and wrong, to discount.

A. The District Court Erroneously Determined that EPA's Conductivity Benchmark has Established a Conductivity Threshold for Ionic Toxicity.

The district court embraced EPA's 2011 "Conductivity Benchmark"[16] as conclusively proving that conductivities of 300 µS/cm in typical mine waters will necessarily yield a flunking WVSCI score. Op. at 10. Accordingly, it concluded,

[16] *See A Field-Based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams*, EPA/600/R-10/1023F (March 2011), available at https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=233809. EPA described the report as using "field data to derive an aquatic life benchmark for conductivity that can be applied in the Appalachian Region that are dominated by [certain] salts." *Id.* at xiv. There, EPA observed that its Benchmark "is provided as scientific *advice….*" *Id.* at 41. More recently, EPA has acknowledged that its "Benchmark" methodology is "*not a regulation* and do[es] not propose legally binding requirements." *See Fact Sheet: Draft Field-Based Methods for Developing Aquatic Life Criteria for Specific Conductivity*, EPA 822-F-07-005 (Dec. 2016).

WVDEP had no reason to delay the development of TMDLs for conductivity. *Id.* at 34. But that conclusion ignored both important legal constraints and depended on a highly parsed review of technical documents without proper deference to contrary constructions by the implementing agencies. For several reasons, it was entirely lawful and reasonable of WVDEP to delay TMDL development of conductivity TMDLs pending identification of the specific pollutants that are contributing to biological impairment.

First, CWA § 303(d)(1)(C) requires states to establish TMDLs only for "those *pollutants* which [EPA] identifies under [33 U.S.C. §] 1314(a)(2) as suitable for such calculation." 33 U.S.C. § 1313(d)(1)(C). Thus, while the identification of a causative pollutant is not a prerequisite for placing a stream on the § 303(d) list, it is a prerequisite for developing a TMDL. *Compare* 33 U.S.C. § 1313(d)(1)(A)(establishing listing criteria as identification of water not implementing water quality standards) with 33 U.S.C. § 1313(d)(1)(C)(imposing TMDL requirement only on "pollutants."). The same district court has also previously ruled that conductivity is a metric or condition – *not* a "pollutant." *See Ohio Valley Envt'l Coal., Inc. v. Fola Coal Co., LLC*, No 2:13-cv-5006, 2014 WL 4925492 at *4 (S.D. W.Va. Sept 30, 2014) ("The Court further recognizes that conductivity is itself not a pollutant, but rather is a measure of ionic pollution….").

The district court, unconcerned by this statutory limitation, forged ahead. It reasoned that identifying particular pollutants is unnecessary because the ionic mixture in waters discharged from the mines that EPA's Benchmark examined is relatively consistent. *See* Op. at 10. But the declaration that the ionic complexion of mine waters is relatively consistent does not address the statutory requirement that TMDLs be imposed on specific "pollutants" rather than on some non-pollutant metric. *See Va. Dept. of Transp. v. EPA*, No. 1:12-cv-775, 2013 WL 53741 at *5 (E.D. Va. 2013) (EPA prohibited from regulating stormwater, a non-pollutant, as a surrogate for sediment where CWA restricts regulation to "pollutants").[17]

Second, it was error to *require* that WVDEP or EPA regulate conductivity because conductivity itself is not the cause of impairment and because WVDEP has reasonably concluded that it is poorly correlated with the WVSCI metric it historically used to measure impairment. The decision by WVDEP not to use conductivity for immediate TMDL development, and EPA's approval of that decision were entitled to deference. *See Aracoma Coal Co.*, 556 F.3d at 192 (courts

[17] Before imposing an effluent limit on a surrogate parameter, the permitting authority must demonstrate that the proxy or surrogate parameter is a proper indicator for the pollutant(s) that actually cause the violation of the applicable water quality standard. 40 C.F.R. § 122.44(d)(vi) (requiring identification of a "specific chemical pollutant" for which the indicator is being used and the level at which the specific chemical pollutant causes an excursion of the water quality standard).

should be at their most deferential when reviewing complex matters involving special agency expertise).

Like WVDEP, EPA has also conceded that conductivity itself is neither a pollutant nor the "cause" of biological impairment. In 2011, EPA's Science Advisory Board ("SAB") reviewed a draft of EPA's Conductivity Benchmark by which EPA correlated the presence or absence of aquatic insects with conductivity in an effort to infer a causal relationship between conductivity and the presence or absence of specific insects. There, the SAB observed that "[c]onductivity itself *is not a pollutant*, but is a surrogate for the major constituent ions in the mixture." *Review of Field-Based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams* at 20 (March 25, 2011), available at https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=233809. It noted further that "the scientific credibility of the benchmark would be strengthened by analysis relating the constituent ions to observed biological community changes." *Id.* at 2.

EPA issued the Final Benchmark the following month without identifying the role of individual ions or "pollutants". There EPA conceded that "[c]onductivity per se is not the cause of toxic effects…." U.S. EPA. *A Field-Based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams (Final Report)*, EPA/600/R-10/023F, 2011 at 26, ¶ 1, available at https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=233809 ("Benchmark").

Further, EPA acknowledged in the "causal assessment" portion of its Final Benchmark that "[t]his causal assessment does not attempt to identify the constituents of the mixture that account for the effect." *Id.* at A-40, ¶ A.3.[18]

Later, EPA employees authored a series of peer reviewed articles designed to justify the use of the Benchmark to establish a causal link between conductivity and impacts to aquatic insects used to measure aquatic health. The authors again observed that "conductivity per se is not the cause of toxic effects," and noted that "waters with different mixtures of ions but the same conductivity may have different toxicities." *See* Susan M. Cormier, et al, *Derivation of a Benchmark for Freshwater Ionic Strength*, 32 Envt'l Toxicology & Chemistry 263, 269 (2012). Likewise, they conceded that their "causal assessment does not attempt to identify

[18] The district court stated that "[t]he Benchmark … identified the constituent salts … that contribute ions resulting in ionic toxicity…." Op. at 10. To the extent that the district court intended this to mean that the Benchmark determined that the four ions typically found in surface mine discharges (calcium, magnesium, sulfate and bicarbonate) are also the pollutants causing impairment, it was flatly wrong. The Benchmark made no such finding – rather, it used the four ions to simply "fingerprint" mine waters so that it could more precisely correlate conductivity from mine sites to field data on aquatic insect effects. That is, it used the "fingerprint" to exclude sites that exhibit elevated conductivity from ions such as chlorides, which are typically produced by gas wells or deep underground mines but not by surface mines. *See, e.g.,* Benchmark at 9 (noting that sites with elevated conductivity marked by high chloride and low sulfate were removed from EPA's analysis to ensure that the drainage was mine-related and not related to gas development brines); *see also Review of Field-Based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams*, at 2 (March 25, 2011), available at https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=233809 (noting that Benchmark did not identify ions actually causing impairment).

constituents of the mixture that account for the effects." Susan M. Cormier, et al, *Assessing Causation of the Extirpation of Stream Macroinvertebrates by a Mixture of Ions*, 32 Envt'l Toxicology & Chemistry 277, 285 (2012).

Compounding these limitations on the Benchmark is EPA's concession that the statistical tools it used to infer a causal relationship *do not prove that any particular waterbody is impaired as a result of conductivity*. Instead, EPA scientists acknowledged that its work focused on the question of "general causation" ("Is agent C capable of causing effect E in the region?") rather than a specific causation ("Did C cause E?"). Susan M. Cormier, et al., *A Method for Assessing Causation of Field Exposure-Response Relationships*, 32 Envt'l Tox. & Chem. 272 (2012). There, EPA scientists acknowledged "[t]he method described here determines whether an agent has caused a biological effect in a region, not that it causes all instances of the effect, ... *nor that it causes the effect at any particular site*." *Id.*at 272. The district court improperly conflated these concepts to interpret the Benchmark as proving that conductivity is the specific cause of impairment for all of the particular streams on WVDEP's § 303(d) list, and then used this conclusion to dismiss WVDEP's delays in TMDL development as pretense.

WVDEP has previously and reasonably rejected the use of conductivity as a predictor of impairment. In addition to the fact that conductivity is neither a pollutant nor a condition that "causes" impairment, WVDEP has determined that it is poorly correlated with WVSCI scores. *See* Justification and Background for Permitting Guidance for Surface Coal Mining Operations to Protect West Virginia's Narrative Water Quality Standards, 47 CSR 2 §§ 3.2.e & 47 CSR 2 §§ 3.2.i, 5-7 (Aug. 12, 2010) (infeasible to calculate a numeric conductivity limit to implement narrative water quality standard because conductivity not good predictor of WVSCI scores. West Virginia Department of Environmental Protection, Narrative Water Quality Permitting Guidance, available at http://www.dep.wv.gov/pio/Pages/Commentsonnarrativewaterqualitystandards.aspx. (last accessed July 23, 2017).

Beyond that, The Benchmark cannot be used to determine whether a stream is biologically impaired in West Virginia. EPA did not design the Benchmark to link conductivity levels to WVSCI scores. Instead, it correlated conductivity to the presence or absence of some 163 specific insects. *See* "Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses." EPA, PB-227-049 (Stephen, et al.) (discussed *infra*). Only as an afterthought, and only after receiving comments on the draft benchmark, did EPA attempt to link conductivity to WVSCI. It included a single "regression" line purporting to show a correlation between conductivity and WVSCI scores. *See* Benchmark at A-36. But at least one expert hired by the Sierra

Club and OVEC has conceded that neither the Benchmark nor the regression line can be used to predict a WVSCI score at a particular conductivity level. *See* Trial Transcript at 325-26, *OVEC, et al. v. Fola Coal Company, LLC*, No. 2:15-cv-1371 (S.D.W.Va. Mar. 15, 2017), ECF No. 76 (Dr. Matthew Baker testifying that conductivity is not a great predictor of a specific WVSCI score).

The district court ignored all this in favor of its own construct of the Benchmark as establishing an enforceable water quality standard. As this Court has noted, "[e]specially in matters involving not just simple findings of fact but complex predictions based on special expertise, 'a reviewing court must generally be at its most deferential.'" *Aracoma Coal Co.*, 556 F.3d at 192 (quoting *Baltimore Gas & Elec. Co. v. Natural Res. Def. Council*, 462 U.S. 87, 103, 103 S.Ct. 2246 (1983)). The district court should have granted deference to WVDEP's reasonable decision to defer development of TMDLs for ionic toxicity until the scientific and regulatory community can better understand the causative factors of (and attendant management options for) such impairment. *See id.* at 201 ("'Agencies are entitled to select their own methodology as long as that methodology is reasonable,' and we must defer to such agency choices." (quoting *Hughes River Watershed Conservancy v. Johnson*, 165 F.3d 283, 289 (4th Cir. 1999))).

B. EPA's Conductivity Benchmark does not Form a Basis for Requiring EPA and/or WVDEP to Prepare Ionic Toxicity TMDLs.

A review of the history surrounding development of EPA's Benchmark reveals the complexity and unsettled nature of the science regarding the effects of conductivity on water quality. In 1985, EPA published "Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses." ("Guidelines"). The Guidelines were intended to be used by EPA to issue recommended national water quality criteria pursuant to CWA § 304(a). 33 U.S.C. § 1314(a) (providing that EPA will develop and publish information on effects of pollutants for use by states in developing water quality standards). Those Guidelines are used to identify both continuous and maximum thresholds for particular pollutants above which aquatic impacts are considered unacceptable. Guidelines at 4. They rely on laboratory toxicity texts (*id.* at 2), and require test results for the effects of particular "toxicants" on cold and warm water fish, amphibians, planktonic crustaceans, insects and mollusks. *Id.* at 8–9, 12–13. EPA's Benchmark is completely different. It relied exclusively on field data collected by the WVDEP. It evaluated the correlations between water chemistry and some measure of stream habitat only on aquatic insects, but included no data or analysis on effects to fish, amphibians, mollusks or other families of animals. Benchmark at 34.

The Benchmark relies on the presence or absence of insects at varying conductivity levels in the WVDEP database. That database included over 500 genera[19] of aquatic insects, but EPA relied only on those genera that appeared in over 25 samples and at least one "reference" (undisturbed) stream. There were 163 such genera. For each, EPA plotted its presence or absence against conductivity levels.

The "extirpation threshold" for each genus was calculated as the conductivity level below which 95 percent of the observed incidents of that insect appeared in the database. Put another way, only 5 percent of a genus appeared in the database at a higher conductivity. EPA effectively assumed that the absence of more than 5% of an individual genus above that conductivity threshold was due to physiological limitations caused by the conductivity. EPA then determined that the conductivity at which 5 percent of the 163 genera (8 genera) of insects reached their extirpation threshold would mark the conductivity Benchmark for the state. That level was ~300 µS/cm.

In other words, in WVDEP's database, 8 of the 163 genera reached their extirpation threshold at ~300 µS/cm. However, those 8 most sensitive genera used to define the Benchmark are not evenly distributed throughout the state—in fact,

[19] "Genera" is defined as "a category of biological classification ranking between the family and the species, comprising structurally or phylogenetically related species or an isolated species exhibiting unusual differentiation…." Merriam-Webster (11th ed. 2016).

most are relatively rare. Thus, their absence from a sample was used to determine the point at which impacts are significant at a disturbed site even though those insects may never have inhabited the same site in its undisturbed state.

EPA's early efforts to use the Benchmark as a water quality criterion were quickly challenged. A successful challenge was reversed only when EPA conceded that the Benchmark could not be used as an enforceable standard. *National Mining Assoc. v. Jackson*, 816 F.Supp.2d 37 (D.D.C. 2011), *rev'd*, 758 F.3d 243, 252 (D.C. Cir. 2014) ("As EPA acknowledged at oral argument, 'The Guidance has no legal impact.'"). In late December 2016, drawing off of its 2011 Benchmark, EPA finally subjected its work to public comment when it published its draft "Field-Based Methods for Developing Aquatic Life Criteria for Specific Conductivity." 81 Fed. Reg. 94,370 (Dec. 23, 2016).

The draft "Field-Based Methods" document has proven to be controversial. Many comments have been submitted challenging both the basic assumptions used by EPA as well as the weight of the science.[20] For example, the Florida Department of Environmental Protection commented that the draft document fails to explain how the absence of 5% of the chosen insects relates to the "fishable, swimmable" goals of the CWA. Comments by the Fla. Dept. of Envt'l. Protection, ¶¶ 5 & 6, at 5. The National Council of Air & Stream Improvement, Inc.

[20] Comments may be accessed at https://www.regulations.gov/docket?D=EPA-HQ-OW-2016-0353 (last accessed July 23, 2017).

("NCASI") has noted that while all but four states use multi-metric indices of biological life to evaluate attainment with aquatic life "uses" under the CWA, EPA's draft has done little to relate those indices to its field-based criterion. Comments by the NCASI at 6. The NCASI also commented that the field data used is not as precise in discerning clear impacts as are laboratory data, and EPA's draft significantly undervalues the importance of factors other than conductivity, such as organic loading and habitat quality. *Id.*

Comments were also submitted concerning the draft's stated "extirpation" threshold. Specifically, the comments noted that if genera are more or less tolerant to conductivity, then their relative sensitivity should be consistent across data sets. However, there are great and unexplained differences in the apparent extirpation threshold for the same genera in different databases and ecoregions. For example, the extirpation threshold for one particular insect is 193 μS/cm in West Virginia Ecoregion 69, but is 805 μS/cm in adjacent West Virginia Ecoregion 70. In Minnesota Ecoregion 47 the same genus exists at conductivities of 885 to 998 μS/cm. These variances are greatest in the genera that occur in less than 100 samples, but decrease with increasing occurrence of a genus. This suggests that the thresholds are affected by sampling error, especially among the relatively rare insects found in lower conductivity waters. American Iron and Steel Institute Comments, Part 1 at 1-2, 5-17; Comments by Civil & Environmental Consultants, Inc., Table 1 (comparing lists of salt-intolerant insects from West Virginia Ecoregions 69 & 70).

The National Mining Association noted that the 163 genera of insects used by EPA represent only about one-third of the taxa in Ecoregions 69 and 70 in West Virginia. There are many other insects never found in locations with conductivity below 300 µS/cm. If the full list of insects is used to derive extirpation thresholds, then conductivity needs to *exceed* 1130 µS/cm to protect 95% of the insects from the apparent effects of *low* conductivity. This results in an "impossible" zone for conductance between ~ 120 to 1130 µS/cm because the minimum conductivity required to protect 95% of the insects from low conductivity is higher than the maximum conductivity required to protect 95% from high conductivity. Comments by National Mining Assn., Figures 3-9 & 3-10.

Given the complexity of the science, the fact that the science is still in a state of flux, and the controversy surrounding EPA's assumptions, the district court overstepped its bounds by relying on the Benchmark to create an enforceable duty to create TMDLs for ionic toxicity. *See Aracoma Coal Co.*, 556 F.3d at 192, 201 (courts should be at their most deferential when reviewing complex matters involving special agency expertise).

C. WVDEP Reasonably Delayed TMDL Development for Streams Listed as Impaired Based on the WVSCI while it Develops an Assessment Tool for Biological Impairment in Favor of an Improved, More Holistic Methodology.

Between 2002 and 2010, WVDEP used the WVSCI to identify impaired streams. JA 2597 (App-___). WVSCI is an assessment tool; on a scale of 0 to 100 it measures the types, numbers, and proportions of certain aquatic insects in a stream and compares the measurements to those found in undisturbed "reference" streams. *Id.* A score of 100 represents the biological condition of reference streams. *Id.* Decreased WVSCI scores indicate impacts on aquatic life but provide no further information about the pollutant(s) responsible for those impacts (sometimes impacts are not caused by a pollutant at all). *See* Justification and Background for Permitting Guidance for Surface Coal Mining Operations to Protect West Virginia's Narrative Water Quality Standards, 47 CSR 2 §§ 3.2.e & 47 CSR 2 §§ 3.2.i, 5-7 at 4 (Aug. 12, 2010).

Consistent with WVDEP's determination that the WVSCI provides no measure of impacts to fish or higher order animals, both WVDEP and the West Virginia Legislature have rejected its continued use to measure compliance with the narrative water quality standards for aquatic life. *The Impacts of Mountaintop Removal Coal Mining on Water Quality in Appalachia: Hearing Before the Subcomm. on Water & Wildlife of the Subcomm. on Envt. & Public Works*, 111th Cong. 95 (2009) (statement of Randy Huffman, Cabinet Sec'y, WVDEP), at 95

("Without any evidence of any significant impact on the rest of the ecosystem beyond the diminished numbers of certain genus of mayflies, the State cannot say there has been a violation of its narrative standard.").[21]

In 2010, the West Virginia Legislature declared that the narrative standards are met when there are sufficient aquatic insects to support fish, and that WVDEP is the entity responsible for interpreting and applying the narrative standards. H. Con. Res. 111, 79th Reg. Sess. (W.Va. 2010). And again, in 2012, the Legislature directed WVDEP to propose rules for measuring compliance with the narrative standards, stating that compliance must be tied to a determination that the aquatic community is "composed of benthic invertebrate assemblages sufficient to … support fish communities" and is not to be determined by reference to insect indices alone. S.B. 562, 80th Leg., 2d Re. Sess. (W.Va. 2012) (now codified at W. Va. Code § 22-11-7b(f)). WVDEP has not yet completed that task.

It is entirely reasonable for WVDEP to defer TMDLs for ionic toxicity until an improved methodology is developed. TMDL development is an inherently complex process, and the lack of a sound assessment tool for determining biological impairment adds an extra layer of complexity. Here, WVDEP and the

[21] WVDEP has also stated that "a stand-alone WVSCI score has never been the sole determinant of compliance or non-compliance with the narrative standard." Justification and Background for Permitting Guidance for Surface Coal Mining Operations to Protect West Virginia's Narrative Water Quality Standards, 47 CSR 2 §§ 3.2.e & 47 CSR 2 §§ 3.2.i, 5-7 at 4, n.10.

State Legislature have rejected the WVSCI due to its limitations as an assessment tool. The district court should have granted deference to WVDEP's decision to delay TMDL development for streams where the characterization of impairment can reasonably be expected to change as a result of a new assessment methodology. *Aracoma Coal Co.*, 556 F.3d at 201 (courts should defer to agencies' preferred methodology so long as the methodology is reasonable).

CONCLUSION

For the foregoing reasons, as well as those articulated by EPA and other amici, the Court should reverse the district court's decision below.

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Sent: 7/25/2017 9:20:54 PM
To: Matthew Freedman [mfreedman@globalimpact-inc.com]
CC: Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]; Richard L. Smotkin [Rick_Smotkin@Comcast.com]
Subject: Re: US EPA Administrator Visit to Australia

Call went very well. We let them know that we are sending our meeting request through ethics so we will include Chevron on that list.

Would love to update you sometime in the next couple of days.

Sent from my iPhone

On Jul 25, 2017, at 5:00 PM, Matthew Freedman <mfreedman@globalimpact-inc.com> wrote:

> How did you call go?
>
> I was thinking that we might want to do a small roundtable with the US Chamber with American companies. We could also do a few one on one corporate meetings, too. Chevron, for example, is checking to see about their needs - they may want a group or a one on one depending on the level of participation they can get. The Chevron team is on the West Coast and they need to figure out schedules. Chevron has a $80 B LNG investment, the largest US company in the country and largest infrastructure investment.
>
> The MOU sounds great; well put together and a great deliverable.
>
> Matthew
>
>> On Jul 25, 2017, at 7:28 AM, Matthew Freedman <mfreedman@globalimpact-inc.com> wrote:
>>
>> He MAY be a citizen of Italy but no one is sure ... so Matt is stepping down as Resource Minister, but not as a Senator, until things are clarified. (His mom told him last month that she applied for citizenship for him but he was unaware). Interesting twist.
>>
>> Matthew
>>
>>> On Jul 25, 2017, at 7:22 AM, Greenwalt, Sarah <greenwalt.sarah@epa.gov> wrote:
>>>
>>> Appreciate the update Matthew.
>>>
>>> **Sarah A. Greenwalt**
>>> Senior Advisor to the Administrator
>>> for Water and Cross-Cutting Issues

U.S. Environmental Protection Agency
Work: 202-564-1722 | Cell Personal Matters / Ex.
Greenwalt.Sarah@epa.gov

From: Hupp, Millan
Sent: Tuesday, July 25, 2017 7:19 AM
To: Matthew Freedman <mfreedman@globalimpact-inc.com>
Cc: Greenwalt, Sarah <greenwalt.sarah@epa.gov>; Richard L. Smotkin <Rick_Smotkin@Comcast.com>
Subject: Re: US EPA Administrator Visit to Australia

Good to know. Will do.

Sent from my iPhone

On Jul 25, 2017, at 7:10 AM, Matthew Freedman <mfreedman@globalimpact-inc.com> wrote:

> Also FYI Matt Canavan resigned this morning from the Australian Cabinet. So scratch him off the list of meetings. You should ask the Embassy for the list of those actually being lined up for a meeting. We should align what we suggested with what they are doing.
> Matthew
>
> > On Jul 25, 2017, at 7:07 AM, Hupp, Millan <hupp.millan@epa.gov> wrote:
> >
> > Thank you, Matthew.
> >
> > Sent from my iPhone
> >
> > On Jul 24, 2017, at 8:56 PM, Matthew Freedman <mfreedman@globalimpact-inc.com> wrote:
> >
> > > M: Here are some more details for the IPA activity. Very strong group for the Administrator. I would support a 2 hour event given the level of the folks, and the substance to be covered.

Can either do Sydney or Melbourne whichever is best on the schedule. Wanted you to have this before your call tomor.

Matthew

Begin forwarded message:

From: John Roskam <jroskam@ipa.org.au>
Subject: RE: US EPA Administrator Visit to Australia
Date: July 24, 2017 at 8:06:46 PM EDT
To: Matthew Freedman <mfreedman@globalimpact-

inc.co m>

Hi Matthew
I've been talking with the team here and I what I'd like to suggest is that the IPA hold a two-hour roundtable/meeting/seminar with Scott in either Sydney or Melbourne - whichever is more convenient.

The participants would be as follows:

Professor Peter Ridd from James Cook University. He is professor at the university's College of Science and Engineering and he's written extensively about the scientific method and public policy. You might care to pass on this article to Scott's team as an example of Peter's arguments - http://www.onlineopinion.com.au/view.asp?article=11455

Dr Jennifer Marohasy who is a Senior Fellow at the Institute of Public Affairs and the editor of a new book 'Climate Change: The Facts 2017'.

Jennifer is Australi a's authorit y of temper ature and climate variabili ty.

Dr John Abbot from the Univers ity of Tasma nia who is researc hing the use of technol ogy in science policy develop ment

Profess or Suri Ratnapl a from the Univers ity of Queens land. H e is a profess or of law and an authorit y on environ mental rule-making and federal/ state relation s.

Profess or Aynsley Kellow -

Professor of Politics and Policy at the University of Tasmania - author of many works on science and public policy.

All of these people are excellent and I know Scott and his team would learn a great deal from a discussion with them.

Other people who I'd suggest Scott should consider meeting would include Maurice Newman, the former chair of the prime minister's business advisory council, Dr Gary Branks formerly of the Productivity Commission, and Henry Ergas the writer and consultant if Henry happened to be in Australia at the time. I can get you all of these people's details. I've spoken to Brendan Pearson at the Minerals Council and he mentioned that he's working with the Embassy.

I'm very happy to help in any way possible.
kind regards
John

Matthew Freedman
CEO/Global Impact, Inc.

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Washington, DC
20005

mfreedman@globalimpact-inc.com

Personal Matters / Ex. 6

www.globalimpact-inc.com

Skype: matthewfreedman1

Australian Cell:
Personal Matters / Ex. 6
(16 hour time difference)

<PastedGraphic-3.pdf>

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Sent: 7/25/2017 11:07:05 AM
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CC: Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]; Richard L. Smotkin [Personal Matters / Ex. 6]
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> >
> > Dr Jennifer Marohasy who is a Senior Fellow at the Institute of Public Affairs and the editor of a new book 'Climate Change: The Facts 2017'. Jennifer is Australia's authority of temperature and climate variability.
> >
> > Dr John Abbot from the University of Tasmania who is researching the use of technology in science policy development
> >
> > Professor Suri Ratnapla from the University of Queensland. He is a professor of law and an authority on environmental rule-making and federal/state relations.

Professor Aynsley Kellow - Professor of Politics and Policy at the University of Tasmania - author of many works on science and public policy.

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Sent: 7/10/2017 10:09:16 AM
To: Matthew Freedman [mfreedman@globalimpact-inc.com]
CC: Chmielewski, Kevin [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a8c269da515e475d9705f091dd2713f6-Chmielewski]; McMurray, Forrest [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=344246fb2cb643bfab4f92fe016566e2-McMurray, F]; Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]; Rick Smotkin
Personal Matters / Ex. 6
Subject: Re: Australia meeting

Thank you, Matthew. Will review these items with our team this morning and report back. Very much appreciate your efforts and look forward to catching up on next steps.

Millan

Sent from my iPhone

On Jul 10, 2017, at 5:36 AM, Matthew Freedman <mfreedman@globalimpact-inc.com> wrote:

> Millan:
>
> Wanted to followup my previous communication.
>
> 1. Having thought thru various ideas I like the idea of going to Melbourne and meeting with the Labor Government of the Victorian Government. It allows the Administrator to say that he met both sides, and discussed issues. And they are doing very creative things and the Vic government is 'open for business' so many US companies in the high tech arena are making Melbourne their new corporate HQ home. Maybe we can identify a few of them to connect with the EPA Administrator.
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> While climate change will not be on the agenda expect it come up and we need to be able to say that we 'agree to disagree' as good friends. I suggested to the Embassy that the Victorian Minister for Innovation and Trade (Philip Dalidakis) be included on their side since having him at the table would be good.
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> 2. Had a long conversation with James Shea, the Embassy lead. He, Cosi (Minister Frydenberg office) and your Advance lead in the International Affairs office will be speaking Tuesday morning to coordinate. The Embassy was not aware of some of the potential requests for meetings so this next call (which is weekly between the parties) should clarify that you, indeed, want to move forward with a formal request to see the Foreign Minister, Minister of Trade and Investment (Steven Chiobo), Prime Minister, and others.
>
> 3. The trip might have a theme related to environmental cooperation focused on the topic of innovation - one that both sides can rally around - since both countries are focused on innovation at a national level. And doing more with less requires being smarter and more strategic. Hence, it is useful for the EPA Adm and the Aus counterparts to learn about how each country thinks about protecting the environment in the context of smaller staffs and budgets. The

US press has made it sound like less money equals less commitment so changing the dynamic would be useful. Using innovation is a bridge in this regard, and having several EPA activities in this area to put on the table would be useful. Some of the past EPA/NASA activities might qualify but my information is a little dated.

4. Great Barrier Reef and Tasmania I would agree at this point is a bridge too far for this visit.

Rick and I will attend and will be present but will not be listed as members of the delegation. Also, I will make all arrangements for us; we do not want to utilize any USG assets for our involvement. Friday/Sat/Sun when we arrive will be easy, but we will not likely participate in the official meetings.

Matthew

On Jul 6, 2017, at 9:49 AM, Matthew Freedman wrote:

> Millan:
>
> Greetings from Marrakech. Sorry for the delay in followup. I am still collecting inputs from friends but wanted to give you some additional thoughts on scheduling.
>
> I think it is important to play both offense and defense. Offense to move forward the Agenda from the Administrator and defense in terms of a 'risk mitigation' strategy to address in a proactive manner critics from whatever perspective. That is why I urge consideration of some type of deliverable - a Comminique, Statement of Principles, Memorandum of Understanding - something that codifies the goals and objectives of the trip but also the larger issues. This will blunt any criticism in the future and allows the Administrator for focus on the positive outcomes.
>
> The trip will undoubtedly turn to issues where the Administration differs from the current Aus government - climate change is but one issue, but there is no reason not to have an informed and thoughtful discussion. It allows both parties to address critics, and to move on. With a document that can be readied - several paragraphs only - it would frame the meetings and the agenda that is being put together. That would, by definition, make some meetings more important and others less. For example, State of Victoria meetings might be more important if part of a Communique talked about future discussions on Federal vs State environment issues/deregulation etc. and the Administrator wanted to have a parallel dialogue between EPA and the States in the US.
>
> You also asked about the initial days. Here is an update
>
> Arrival Friday.
>
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available. The Embassy will handle but just wanted you to be aware. Walking around Sydney Harbor, the Rocks (where the early boats came in with British prisoners arrived) is fascinating. You will need some down time, too. In the afternoon you might consider taking the ferry from Circular Quay to either the Zoo (15 min). There is a great Chinese/Asian rest, WOO about 7 min walk from the hotel. In fact, Circular Quay, Rocks etc are all within 3 blocks of the hotel so easy logistics. The best single book to understand the foundation and history of Aus is The Fatal Shores which gives the context of how and why the British would round up undesireables and send them to Aus for being petty criminals etc (and no London police force then)

-- Saturday : A morning water taxi ride from Circular Quay to The Boathouse for breakfast would be great. It is owned by the (former) Minister of Trade Andrew Robb, a good friend, and the breakfast food is special. With good weather you can sit outside at picnic tables with umbrellas and enjoy Saturday morning with locals. Also, you can take a15 minute ride to Bondi Beach from Circular Quay and walk as long as you want on a long and winding paved walking trail along the sea at a high level with runners, surfers etc and watch the surfers. I can send some photos if useful to visualize. Definitely a memorable experience. Dinner? Could be at a traditional German place in The Rock, if the Administrator likes German but I'll come up with other options. There are several along on the pier at Woogamalloo - steak, Indian, Chinese - first rate which is about a 7 min drive from the hotel.

-- Sunday: It would be nice to see if part of the schedule tied to Sydney Harbor clean up that is being proposed for Monday might be shifted even though it may be inconvenient for some. Otherwise, we might think of one or two individual meetings, and then a small CEO roundtable in the hotel in the afternoon. Maybe a visit from the US Consul General to give an overview. I am getting specific suggestions on invitees etc.

I think it may be useful to meet someone in the Labor Party opposition, but will get informal guidance from Josh's office. Again, so the Administrator can say that he heard all sides on environmental issues.

I've received an updated/more detailed draft schedule from the Embassy but reminded them that I'm simply providing input to you and that all the normal decision-making processes and communications need to remain in place, and that my only role is to provide informal input and suggestions to decision-makers.

Would be pleased

<image001-3.jpg>

Matthew C. Freedman
President/CEO
Global Impact Inc.
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mfreedman@globalimpact-inc.com
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Personal Matters / Ex. 6 c
o

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<image001-3.jpg>

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<Mail Attachment.ics>

Message

From: Hupp, Millan [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=92CAC7B684B64F90953B753A01BEE0D5-HUPP, MILLA]
Sent: 7/16/2017 1:25:07 PM
To: Matthew Freedman [mfreedman@globalimpact-inc.com]
CC: Chmielewski, Kevin [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a8c269da515e475d9705f091dd2713f6-Chmielewski]; McMurray, Forrest [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=344246fb2cb643bfab4f92fe016566e2-McMurray, F]; Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]; Rick Smotkin
Personal Matters / Ex. 6
Subject: Re: [SPAM] Re: Australia meeting

Sounds good. We will plan for Monday morning.

Sent from my iPhone

On Jul 15, 2017, at 5:39 PM, Matthew Freedman <mfreedman@globalimpact-inc.com> wrote:

> M: Change of plans. We were deplaned from Lisbon and now on the flight tomor, Sunday, getting in late in the evening. Thanks to United Airlines.
>
> Let's aim to connect on Monday. Can be available at your convenience. FYI the Outback place has a town called Alice Springs, that is associated with Uluru. I can try to come up with another Outback experience that is closer, but this is the iconic one.
>
> Matthew
>
> On Jul 15, 2017, at 5:24 PM, Hupp, Millan wrote:
>
>> Matthew,
>>
>> Very helpful call yesterday, thank you. Thank you, also, for the points below. Safe travels today. We will plan on giving you a call tomorrow afternoon.
>>
>> Millan
>>
>> Sent from my iPhone
>>
>> On Jul 15, 2017, at 6:05 AM, Matthew Freedman <mfreedman@globalimpact-inc.com> wrote:
>>
>>> Millan:
>>>
>>> Great call yesterday. I'm wheels up now but anytime this weekend at 5pm Saturday would be good to followup.
>>>
>>> A few items we discussed.

1. A trip to the Outback. The classic is Ayers Rock, locally called Uluru. It will require 24 hours - maybe the weekend eg Sunday works but that would conflict with the visit to the LNG plant. You can google it - www.uluru-australia.com and see. Flights from Sydney are easiest. Usually in the morning, and then stay over one night and take the next morning flight back. Sunset and sunrise are just amazing. In a 100,000 acre national park. Quite an experience. It might change Monday a bit but that would also work out since it seems that the Monday events can be truncated if required and wouldn't impact Canberra or the rest of the schedule.

2. Meetings in Canberra:
Foreign Minister Julie Bishop
Trade and Investment Minister Steven Chiobo
Minister of Resources Matt Canavan
Prime Minister Malcomb Turnbull
Senator and Minister for Agriculture and Water Barnaby Joyce
Senator and Minister for Innovation Industry and Science Arthur Sinodinos

3. Would like to get a formal invitation from the American Australian Council, the dominant US-based NGO to cohost with other NGOs in Aus - like Institute for Public Affairs to discuss deregulation. Can get from Embassy the contact point for IPA if you don't have one with the organization. But would be good to get a US organization extending invitations along with other NGOs, in addition to the formal Aus government invitation.

4. Messaging:

I believe that having a thematic approach would be most beneficial in the future. Innovation Deregulation and Federal/State relations would be the talking points in each meeting, and in any pre- or post-press that is sought. I would identify something EPA is currently doing or will likely be doing to address the issue of innovation as it impacts smaller staffing, budgets etc. This doesn't lessen the commitment to protecting the environment just an implicit notion that the USG has, in the past, been taking more and more authority and through innovation (agility, speed new public/private partnerships using technology) EPA can meet and further it's core mission.

Innovation can also be related to private sector business (to highlight what they are doing.) Deregulation would be focused on the how foreign governments and partners are untying regulations in order to foster economic growth and job creation. Federal/State relations would be to better understand how others approach the appropriate balance between federal responsibilities and those left to the States. In the end it could be a statement issued by EPA alone, or, ideally, with Minister Frydenberg. We can discuss this idea now and get some closure on a joint statement that can be pre-

cooked. If the Adm meets with the PM it will certainly need to be done so both sides have something that they can reference is building a stronger Aus-US partners (see AUSMIN comminque that outlines our overall relationship with US).
dfat.gov.au/geo/united-states-of-america/ausmin
https://www.state.gov/r/pa/prs/ps/2017/06/271560.htm

1.

Each of these three areas allow for a positive dialogue, and followup on a quarterly basis. It may require identifying some things EPA is currently doing now in each of these areas that could contribute to a dialogue, not just in Aus but other countries as well.

You should also seek a State/DOD brief on the destruction of coral reefs by the Chinese, more destruction in the past two years than in the history of man- which is also a good talking point when the Great Barrier Reef protection comes up Aus officials.

Matthew

On Jul 10, 2017, at 11:09 AM, Hupp, Millan wrote:

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Washington, DC 20007

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www.globalimpact-inc.com

Personal Matters / Ex. 6

Australian Cell:
Personal Matters / Ex. 6
(16 hour time difference)

skype: matthewfreedman1

<image001-3.jpg>

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From: Hupp, Millan [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=92CAC7B684B64F90953B753A01BEE0D5-HUPP, MILLA]
Sent: 7/15/2017 4:24:27 PM
To: Matthew Freedman [mfreedman@globalimpact-inc.com]
CC: Chmielewski, Kevin [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a8c269da515e475d9705f091dd2713f6-Chmielewski]; McMurray, Forrest [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=344246fb2cb643bfab4f92fe016566e2-McMurray, F]; Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]; Rick Smotkin
Personal Matters / Ex. 6
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dfat.gov.au/geo/united-states-of-america/ausmin
https://www.state.gov/r/pa/prs/ps/2017/06/271560.htm

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Rick and I will attend and will be present but will not be listed as members of the delegation. Also, I will make all arrangements for us; we do not want to utilize any USG assets for our involvement. Friday/Sat/Sun when we arrive will be easy, but we will not likely participate in the official meetings.

Matthew

On Jul 6, 2017, at 9:49 AM, Matthew Freedman wrote:

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Greetings from Marrakech. Sorry for the delay in followup. I am still collecting inputs from friends but wanted to give you some additional thoughts on scheduling.

I think it is important to play both offense and defense. Offense to move forward the Agenda from the Administrator and defense in terms of a 'risk mitigation' strategy to address in a proactive manner critics from whatever perspective. That is why I urge consideration of some type of deliverable - a Comminique, Statement of Principles, Memorandum of Understanding - something that codifies the goals and objectives of the trip but also the larger issues. This will blunt any criticism in the future and allows the Administrator for focus on the positive outcomes.

The trip will undoubtedly turn to issues where the Administration differs from the current Aus government - climate change is but one issue, but there is no reason not to have an informed and thoughtful discussion. It allows both parties to address critics, and to move on. With a document that can be readied - several paragraphs only - it would frame the meetings and the agenda that is being put together. That would, by definition, make some meetings more important and others less. For example, State of Victoria meetings might be more important if part of a Communique talked about future discussions on Federal vs State environment issues/deregulation etc. and the Administrator wanted to have a parallel dialogue between EPA and the States in the US.

You also asked about the initial days. Here is an update

Arrival Friday.

-- Since you will arrive around 6:30 am you will either need to get an early check in or have the booked the rooms the previous evening so that they are available. The Embassy will handle but just wanted you to be aware. Walking around Sydney Harbor, the Rocks (where the early boats came in with British prisoners arrived) is fascinating. You will need some down time, too. In the afternoon you might consider taking the ferry from Circular Quay to either the Zoo (15 min). There is a great Chinese/Asian rest, WOO about 7 min walk from the hotel. In fact, Circular Quay, Rocks etc are all within 3 blocks of the hotel so easy logistics. The best single book to understand the foundation and history of Aus is The Fatal Shores which gives the context of how and why the British would round up undesireables and send them to Aus for being petty criminals etc (and no London police force then)

-- Saturday : A morning water taxi ride from Circular Quay to The Boathouse for breakfast would be great. It is owned by the (former) Minister of Trade Andrew Robb, a good friend, and the breakfast food is special. With good weather you can sit outside at picnic tables with umbrellas and enjoy Saturday morning with locals. Also, you can take a15 minute ride to Bondi Beach from Circular Quay and walk as long as you want on a long and winding paved walking trail along the sea at a high level with runners, surfers etc and watch the surfers. I can send some photos if useful to visualize. Definitely a memorable experience. Dinner? Could be at a traditional German place in The Rock, if the Administrator likes German but I'll come up with other options. There are several along on the pier at Woogamalloo - steak, Indian, Chinese - first rate which is about a 7 min drive from the hotel.

-- Sunday: It would be nice to see if part of the schedule tied to Sydney Harbor clean up that is being proposed for Monday might be shifted even though it may be inconvenient for some. Otherwise, we might think of one or two individual meetings, and then a small CEO roundtable in the hotel in the afternoon. Maybe a visit from the US Consul General to give an overview. I am getting specific suggestions on invitees etc.

I think it may be useful to meet someone in the Labor Party opposition, but will get informal guidance from Josh's office. Again, so the Administrator can say that he heard all sides on environmental issues.

I've received an updated/more detailed draft schedule from the Embassy but reminded them that I'm simply providing input to you and that all the normal decision-making processes and communications need to remain in place, and that my only role is to provide informal input and suggestions to decision-makers.

Would be pleased

<image001-3.jpg>

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Message

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Sent: 7/19/2017 2:12:32 AM
To: Matthew Freedman [mfreedman@globalimpact-inc.com]
CC: Chmielewski, Kevin [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a8c269da515e475d9705f091dd2713f6-Chmielewski]; McMurray, Forrest [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=344246fb2cb643bfab4f92fe016566e2-McMurray, F]; Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]; Richard L. Smotkin Personal Matters / Ex. 6
Subject: Re: Australia meeting

Matthew,

Thank you. Always appreciate your thoughts. We had a productive call this morning and are waiting on an updated agenda. We are traveling the next couple days but would like to catch up on Friday whenever you are available.

Millan

Sent from my iPhone

On Jul 18, 2017, at 9:01 PM, Matthew Freedman <mfreedman@globalimpact-inc.com> wrote:

> Millan:
>
> A few additional thoughts.
>
> I think that the trip will be more hostile than what the Administrator may be expecting. While we have discussed the differences in policies between the Turnbull Administration and the Trump Administration the outright hostility may come to the surface more frequently than you might expect. He needs to be prepared for a more confused and angry group of Aussies.
>
> I also think that having one single meeting with the Victorian Government may be useful politically, but the outcome may be no different than if the Administrator met with Bernie Sanders. That is, the Victorian Government will be hostile to any Trump appointee and when you mix in climate change issues and the Paris Accord - I think the Administrator will not find the local government meeting particularly useful or insightful for him. So if a Vic meeting is important (not to me, tho) I would limit it to one single meeting, check the box, and move on.
>
> I have been in contact with the ExDir of the Institute for Public Affairs, the conservative/dereg think tank, and I believe that they can provide very useful discussions related to the topics of the science of climate change (something that the Aussies are also looking into) and other issues given the work they have done. They are aligned with the Trump vision on various issues, including coal, the challenge to businesses given the environmental approvals required, the unprecedented gov???t control related to gas exploration/development, gas/fracking challenges. These are the inputs/meetings that he should be focused on.

In the next few days I???ll have developed a list of some additional events or people that he should meet, through the IPA vehicle. They also can do an event in Sydney, Canberra and/or Melb - so we are not limited to the Melb.

There are also a few right-leaning Labor Party leaders that it might be worth the Administrator to meet, and I???ll pass along those names as well. I???m also thinking about having him meet privately with the Labor Party Leader, who is likely to become the next Prime Minister, Bill Shorten, who is also a good friend.

Would be interested in the latest outcomes from your call with the Embassy.

Matthew

> On Jul 16, 2017, at 9:25 AM, Hupp, Millan <hupp.millan@epa.gov> wrote:
>
> Sounds good. We will plan for Monday morning.
>
> Sent from my iPhone
>
> On Jul 15, 2017, at 5:39 PM, Matthew Freedman <mfreedman@globalimpact-inc.com> wrote:
>
>> M: Change of plans. We were deplaned from Lisbon and now on the flight tomor, Sunday, getting in late in the evening. Thanks to United Airlines.
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>> Let's aim to connect on Monday. Can be available at your convenience. FYI the Outback place has a town called Alice Springs, that is associated with Uluru. I can try to come up with another Outback experience that is closer, but this is the iconic one.
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--Sunday:Itwouldbenicetos

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e inconvenient for some. Otherwise, we might think of one or tw o individual meetings, and then a small CEO roundtable in the h otelintheafternoon.MaybeavisitfromtheUSConsulGeneral to give an overview. I am getting specific suggestions on invi teesetc.

IthinkitmaybeusefultomeetsomeoneintheLaborP arty opposition, but will get informal guidance from Josh's o ffice. Again, so the Administrator can say that he heard all si des on environmental issues. I've received an updated/more detaileddraftschedulefromtheEmbassybutremindedthemth

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ision-making processes and communications need to remain in place, and that my only role is to provide informal input and su ggestions to decision-makers. Would be pleased

<image001-3.jpg>

Mat

thewC.FreedmanPresident/CEOGlobalImpactInc.110130thSt reet, NW Suite 500 Washington, DC 20007

mfreedman@globalimp

act-inc.com
www.globalimpact-inc.com

Personal Matters / Ex. 6

Personal Matters / Ex. 6

Australian Cell: +Personal Matters / Ex. 6 (16 hour time difference)

skype: matthewfreedman1

<image001-3.jpg>

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Message

From: Hupp, Millan [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=92CAC7B684B64F90953B753A01BEE0D5-HUPP, MILLA]
Sent: 6/22/2017 7:22:55 PM
To: Matthew Freedman [mfreedman@globalimpact-inc.com]; Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]
CC: Smotkin, Rick [Personal Matters / Ex. 6]; Chmielewski, Kevin [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a8c269da515e475d9705f091dd2713f6-Chmielewski]
Subject: RE: Connecting

Matthew – looping in Sarah here as she will be our lead on building out the Administrator's schedule for this trip. She was also on the call and will assist us in working with our international team to begin working on these initial steps.

Thank you,
Millan

From: Matthew Freedman [mailto:mfreedman@globalimpact-inc.com]
Sent: Thursday, June 22, 2017 1:41 PM
To: Hupp, Millan <hupp.millan@epa.gov>
Cc: Smotkin, Rick Personal Matters / Ex. 6 >
Subject: Re: Connecting

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Matthew

Matthew C. Freedman
CEO
Global Impact Inc.
Personal Matters / Ex. 6
Sent from my iPhone

On Jun 22, 2017, at 1:20 PM, Hupp, Millan <hupp.millan@epa.gov> wrote:

> Thank you so much, Rick.
>
> ---
>
> **From:** Smotkin, Rick [m Personal Matters / Ex. 6]
> **Sent:** Thursday, June 22, 2017 12:27 PM
> **To:** Hupp, Millan <hupp.millan@epa.gov>; Matthew Freedman <mfreedman@globalimpact-inc.com>
> **Subject:** Connecting
>
> Millan
>
> Connecting you with Matt so you have his email.

ThAnka!

Sent from my iPhone

Message

From: Slone, Deck [DSlone@archcoal.com]
Sent: 4/6/2018 3:52:12 PM
To: Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]
Subject: RE: Following up

10:30 on Tuesday sounds good, Sarah. Shall I come to the EPA offices at that time? Thanks so much for fitting this into your schedule. Looking forward to it.

DS

From: Greenwalt, Sarah <greenwalt.sarah@epa.gov>
Sent: Friday, April 06, 2018 8:30 AM
To: Slone, Deck <DSlone@archcoal.com>
Subject: RE: Following up

I have some time at 10:30 next Tuesday, if that would work with your schedule.

Sarah A. Greenwalt

U.S. Environmental Protection Agency
Work: 202-564-1722 Personal Matters / Ex. 6
Greenwalt.Sarah@epa.gov

From: Slone, Deck [mailto:DSlone@archcoal.com]
Sent: Thursday, April 5, 2018 5:50 PM
To: Greenwalt, Sarah <greenwalt.sarah@epa.gov>
Subject: RE: Following up

I do, Sarah, thanks – and also expect to be in DC with some time on Tuesday of next week if you'd like to connect in person. Tomorrow I'm free any time other than 10:30 ET.

Looking forward to connecting.

DS

Sent: Thursday, April 05, 2018 4:06 PM
To: Slone, Deck <DSlone@archcoal.com>
Subject: RE: Following up

Hi Deck,

Thank you for reaching out. Do you have some time to chat tomorrow?

Sarah A. Greenwalt

U.S. Environmental Protection Agency
Work: 202-564-1722 | Personal Matters / Ex. 6
Greenwalt.Sarah@epa.gov

From: Slone, Deck [mailto:DSlone@archcoal.com]
Sent: Thursday, April 5, 2018 10:54 AM
To: Greenwalt, Sarah <greenwalt.sarah@epa.gov>
Subject: Following up

Hey Sarah –

Just following up on my voice mail earlier this week. Any chance you might have a few minutes to chat today, as a follow-up to the Administrator's interest in the export story? I'm open for much of the day, so just let me know if there is a time that might work for you. Thanks again for the good discussion, and I look forward to connecting soon.

Best,

Deck

Deck S. Slone
Senior Vice President,
Strategy and Public Policy
Arch Coal, Inc.
One CityPlace Drive
Saint Louis, MO 63141
314.994.2717
dslone@archcoal.com

***Email Disclaimer: The information contained in this e-mail, and in any accompanying documents, may constitute confidential and/or legally privileged information. The information is intended only for use by the designated recipient. If you are not the intended recipient (or responsible for delivery of the message to the intended recipient), you are hereby notified that any dissemination, distribution, copying, or other use of, or taking of any action in reliance on this e-mail is strictly prohibited. If you have received this e-mail communication in error, please notify the sender immediately and delete the message from your system.

From: Gunasekara, Mandy [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=53D1A3CAA8BB4EBAB8A2D28CA59B6F45-GUNASEKARA,]
Sent: 5/8/2017 2:55:19 PM
To: Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]
CC: Birsic, Michael J. (MPC) [mjbirsic@marathonpetroleum.com]
Subject: Connection

Hi Sarah,
I'm cc'ing Mike Birsic is a good friend who represents Marathon Petroleum Co. He'd like to see about coordinating a meeting with you and Tim Peterkoski, MPC's lead on environmental issues who will be in town on Thursday. Tim would like to touch base on ELGs.
I hope you two can find a time to connect.
Best,
Mandy

Message

From: Hupp, Millan [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=92CAC7B684B64F90953B753A01BEE0D5-HUPP, MILLA]
Sent: 6/26/2017 3:21:51 PM
To: Matthew Freedman [mfreedman@globalimpact-inc.com]
CC: Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]; Richard L. Smotkin Personal Matters / Ex. 6; Chmielewski, Kevin [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a8c269da515e475d9705f091dd2713f6-Chmielewski]
Subject: RE: Connecting

Absolutely.

From: Matthew Freedman [mailto:mfreedman@globalimpact-inc.com]
Sent: Monday, June 26, 2017 10:02 AM
To: Hupp, Millan <hupp.millan@epa.gov>
Cc: Greenwalt, Sarah <greenwalt.sarah@epa.gov>; Richard L. Smotkin <Personal Matters / Ex. 6>; Chmielewski, Kevin <chmielewski.kevin@epa.gov>
Subject: Re: Connecting

Any chance I could move it back to 11? I have a noon Confcall I can't change.
Matthew

Matthew C. Freedman
CEO Global Impact Inc
Personal Matters /
Mfreedman@globalimpact-inc.com
Skype: matthewfreedman1

Australian cell Personal Matters / Ex. 6 (16 time difference)

Sent from my iPad

On Jun 26, 2017, at 9:00 AM, Matthew Freedman <mfreedman@globalimpact-inc.com> wrote:

> Great. Look forward to seeing you tomorrow
> Matthew
>
> Matthew C. Freedman
> CEO Global Impact Inc
> Personal Matters / Ex. 6
> Mfreedman@globalimpact-inc.com
> Skype: matthewfreedman1
>
> Australian cell: Personal Matters / Ex. (16 time difference)
>
> Sent from my iPad
>
> On Jun 26, 2017, at 7:51 AM, Hupp, Millan <hupp.millan@epa.gov> wrote:
>
>> I apologize, I meant Tuesday. 11:30AM Tuesday, June 27th works well on our end.

Please give me a call when arrive at the north entrance and we will come down to get you.

My cell is Personal Matters / Ex. 6 I'm not often near my desk phone.

From: Matthew Freedman [mailto:mfreedman@globalimpact-inc.com]
Sent: Monday, June 26, 2017 7:30 AM
To: Hupp, Millan <hupp.millan@epa.gov>
Cc: Matthew Freedman <mfreedman@globalimpact-inc.com>; Greenwalt, Sarah <greenwalt.sarah@epa.gov>; Richard L. Smotkin Personal Matters / Ex. 6 Chmielewski, Kevin <chmielewski.kevin@epa.gov>
Subject: Re: Connecting

10:30 am on Wedn, June 28 works if good for you. Can come your way. I have a CAC and USG id. I guess they will call you from security. Correct?
What's your cell and office number?

If you mean Tuesday I need to be at the WH at 10 so I would need to push the meeting to 11:30.

Matthew

> On Jun 26, 2017, at 7:01 AM, Hupp, Millan <hupp.millan@epa.gov> wrote:
>
> Matthew --
>
> A face to face would be great before you begin your travels. There are a few areas that we can discuss from a logistics and relationships perspective though not quite as much from a policy and mission perspective without Sarah. Regardless, sitting down to get the ball rolling on this would be beneficial.
>
> Would 10:30AM happen to work for you?
>
> ---
>
> **From:** Matthew Freedman [mailto:mfreedman@globalimpact-inc.com]
> **Sent:** Friday, June 23, 2017 9:49 AM
> **To:** Greenwalt, Sarah <greenwalt.sarah@epa.gov>
> **Cc:** Matthew Freedman <mfreedman@globalimpact-inc.com>; Hupp, Millan <hupp.millan@epa.gov>; Richard L. Smotkin Personal Matters / Ex. 6 Chmielewski, Kevin <chmielewski.kevin@epa.gov>
> **Subject:** Re: Connecting
>
> I'm back July 14, and we will need to have an ongoing dialogue with the team to move the ball forward. Probably a call once or twice a week if you guys think appropriate.
>
> I've been in direct contact with the Minister in Aus, and will be speaking with his senior staffer (Cosi) who is the lead from their side on Monday night. Also, Jim Carouso, the Charge at the US Emb in Canberra is a close personal friend and would likely have good inputs, but I want to wait a bit before I contact him. But by next week you should have all the inputs and can decide how best to proceed.

Also, I believe that there will be a large CODEL in the country at the same time. Will try to get some more granularity - R and D from the Senate, across committee jurisdictions.

Just let me know if a sitdown would be useful. Or another call.

Matthew

> On Jun 23, 2017, at 9:43 AM, Greenwalt, Sarah <greenwalt.sarah@epa.gov> wrote:
>
> Thanks Matthew, this is extremely helpful!
>
> It would be great to sit down with you to discuss. I will be in Canada for the CEC Council meeting from Tuesday-Thursday morning. When do you return from Morocco?
>
> Alternatively, if Milan is available I can try to call in.
>
> Sent from my iPhone
>
> On Jun 23, 2017, at 8:20 AM, Matthew Freedman <mfreedman@globalimpact-inc.com> wrote:
>
>> Millan:
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>>
>> Matthew
>> PS Delta does fly into Sydney from LA
>>
>>> On Jun 22, 2017, at 3:22 PM, Hupp, Millan <hupp.millan@epa.gov> wrote:
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>>> Matthew – looping in Sarah here as she will be our lead on building

out the Administrator's schedule for this trip. She was also on the call and will assist us in working with our international team to begin working on these initial steps.

Thank you,
Millan

From: Matthew Freedman [mailto:mfreedman@globalimpact-inc.com]
Sent: Thursday, June 22, 2017 1:41 PM
To: Hupp, Millan <hupp.millan@epa.gov>
Cc: Smotkin, Rick
Personal Matters / Ex. 6
Subject: Re: Connecting

Thanks Rick for putting the call together. Look forward to continuing the dialogue.

One initial step would be to get a better sense of the current US Australian environmental agreements that are currently in place and whether they should be changed or updated or canceled and replaced with others. It would also be relatively easy to put together a joint advisory task force on environmental issues thus creating a new mechanism for ongoing discussions.

I spoke with my friends at US Pacific Fleet Command and they have numerous environmental and maritime issues they would be interested in furthering.

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CEO
Global Impact Inc.
Personal Matters /
Sent from my iPhone

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> Thank you so much, Rick.
>
> **From:** Smotkin, Rick [mailto:Rick_Smotkin@Comcast.com]
> **Sent:** Thursday, June 22, 2017 12:27 PM
> **To:** Hupp, Millan <hupp.millan@epa.gov>; Matthe

w Freedman <mfreedman@globalimpact-inc.com>
Subject: Connecting

Millan

Connecting you with Matt so you have his email.

ThAnka!

Sent from my iPhone

Matthew Freedman
CEO/Global Impact, Inc.

1101 30th St, NW Suite 500
Washington, DC 20005

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Sent: 6/26/2017 11:01:39 AM
To: Matthew Freedman [mfreedman@globalimpact-inc.com]; Greenwalt, Sarah [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6c13775b8f424e90802669b87b135024-Greenwalt,]
CC: Richard L. Smotkin Personal Matters / Ex. 6 Chmielewski, Kevin [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a8c269da515e475d9705f091dd2713f6-Chmielewski]
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Matthew C. Freedman
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Sent from my iPhone

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mfreedman@globalimpact-inc.com

Personal Matters / Ex. 6

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Skype: matthewfreedman1

Australian Cell: Personal Matters / Ex. 6 (16 hour time difference)

Message

From: Greenwalt, Sarah [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=6C13775B8F424E90802669B87B135024-GREENWALT,]
Sent: 11/29/2017 5:49:10 PM
To: Aspatore, Amanda [AAspatore@nma.org]
Subject: RE: NMA WOTUS Step Two Pre-Proposal Comments

Thank you Amanda. I'll review these this weekend.

Sarah A. Greenwalt
Senior Advisor to the Administrator
for Water and Cross-Cutting Issues

U.S. Environmental Protection Agency
Work: 202-564-1722 | Cell: Personal Matters /
Greenwalt.Sarah@epa.gov

From: Aspatore, Amanda [mailto:AAspatore@nma.org]
Sent: Wednesday, November 29, 2017 12:24 PM
To: Greenwalt, Sarah <greenwalt.sarah@epa.gov>
Subject: NMA WOTUS Step Two Pre-Proposal Comments

Hi Sarah –
I wanted to make sure you had a copy of NMA's comments on the Agencies' WOTUS "Step Two" pre-proposal request for input. These were submitted to the public docket via regulations.gov yesterday. Thanks so much – I hope that you had a nice Thanksgiving!
Amanda

Amanda E. Aspatore
Vice President, Water Law & Policy
National Mining Association
101 Constitution Ave. NW, Suite 500 East
Washington, D.C. 20001
Phone: (202) 463-2600
Dire Personal Matters /
aaspatore@nma.org

Message

From: Greenwalt, Sarah [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=6C13775B8F424E90802669B87B135024-GREENWALT,]
Sent: 11/16/2017 1:25:47 AM
To: justin.wormmeester@bnsf.com
CC: Ferguson, Lincoln [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=08cd7f82606244de96b61b96681c46de-Ferguson, L]
Subject: Contact

Justin,

The Administrator has asked me to reach out to discuss an issue that was raised in the meeting you had earlier this afternoon. I would be happy to set aside some time for a phone call on Friday if you're available.

Best,

Sarah A. Greenwalt
Senior Advisor to the Administrator
for Water and Cross-Cutting Issues

U.S. Environmental Protection Agency
Work: 202-564-1722 | Cell: Personal Matters / Ex. 6
Greenwalt.Sarah@epa.gov

Message

From: Greenwalt, Sarah [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=6C13775B8F424E90802669B87B135024-GREENWALT,]
Sent: 9/20/2017 12:35:48 AM
To: Shea, Quin [QShea@eei.org]
CC: Bolen, Brittany [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=31e872a691114372b5a6a88482a66e48-Bolen, Brit]
Subject: RE: Thank You

Thank you, Quin. It was wonderful to meet you as well.

Sarah A. Greenwalt
Senior Advisor to the Administrator
for Water and Cross-Cutting Issues

U.S. Environmental Protection Agency
Work: 202-564-1722 Personal Matters / Ex. 8
Greenwalt.Sarah@epa.gov

From: Shea, Quin [mailto:QShea@eei.org]
Sent: Tuesday, September 19, 2017 8:58 AM
To: Greenwalt, Sarah <greenwalt.sarah@epa.gov>
Cc: Bolen, Brittany <bolen.brittany@epa.gov>
Subject: Thank You

Sarah: I want to express my appreciation to you, Brittany and the DOJ team for taking time out of your busy schedules to meet with us yesterday. We found the conversation to be very constructive and intend to follow up shortly with additional input. It was a pleasure meeting you and thanks again for your courtesy. Best, Quin

Quinlan J. Shea, III (Quin)
Vice President, Environment
Edison Electric Institute
701 Pennsylvania Avenue, NW
Washington, DC 20004
Personal Matters /
qshea@eei.org

Message

From: Greenwalt, Sarah [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=6C13775B8F424E90802669B87B135024-GREENWALT,]
Sent: 7/21/2017 11:20:09 PM
To: rbozek@eei.org
Subject: Quick call

Hi Richard,

Wondering if you have a few minutes for a phone call over the next few days. My cell number is listed below.

Thanks!

Sarah A. Greenwalt
Senior Advisor to the Administrator
for Water and Cross-Cutting Issues

U.S. Environmental Protection Agency
Work: 202-564-1722 | Cell Personal Matters /
Greenwalt.Sarah@epa.gov

Message

From: Greenwalt, Sarah [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=6C13775B8F424E90802669B87B135024-GREENWALT,]
Sent: 5/20/2017 2:38:55 AM
To: Beeman, Guy M. (MPC) [gmbeeman@marathonpetroleum.com]
CC: Peterkoski, Timothy J. (MPC) [tjpeterkoski@marathonpetroleum.com]
Subject: Re: Thank You/Marathon Petroleum/ELGs

Thank you for coming in! Pleasure to meet with you guys. I will let you know if I have any follow up questions.

Best,
Sarah

Sent from my iPad

On May 15, 2017, at 10:23 AM, Beeman, Guy M. (MPC) <gmbeeman@marathonpetroleum.com> wrote:

> Good morning Sarah,
>
> Thank you for taking your time last Thursday to discuss Marathon's view on refinery ELG's. As you review our information, please do not hesitate to reach out if you have any questions or would like additional information. We look forward to working with you.
>
> Best regards,
>
> Guy
>
> --
> **Guy Beeman, Jr.**
> *Representative, Federal Government Affairs*
> Marathon Petroleum Corporation
> Personal Matters / Ex. 6 direct
> cell
> gmbeeman@marathonpetroleum.com
> 1201 F. Street NW #625
> Washington, DC 20004

Message

From: Greenwalt, Sarah [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=6C13775B8F424E90802669B87B135024-GREENWALT,]
Sent: 5/11/2017 5:50:37 PM
To: Beeman, Guy M. (MPC) [gmbeeman@marathonpetroleum.com]
Subject: Re: [EXTERNAL] Connection

Great, Valerie will be down to get you.

Sent from my iPhone

On May 11, 2017, at 1:46 PM, Beeman, Guy M. (MPC) <gmbeeman@marathonpetroleum.com> wrote:

> Hi Sarah,
> We are all checked in for our 2 pm meeting and are downstairs at the security desk.
>
> Thanks,
>
> Guy
>
> Sent from my iPhone
>
> On May 8, 2017, at 12:56 PM, Greenwalt, Sarah <greenwalt.sarah@epa.gov> wrote:
>
>> Looking forward to it!
>>
>> **Sarah A. Greenwalt**
>> Senior Advisor to the Administrator
>> for Water and Cross-Cutting Issues
>>
>> U.S. Environmental Protection Agency
>> Work: 202-564-1722 | Cell: Personal Matters
>> Greenwalt.Sarah@epa.gov
>>
>> **From:** Birsic, Michael J. (MPC) [mailto:mjbirsic@marathonpetroleum.com]
>> **Sent:** Monday, May 8, 2017 12:08 PM
>> **To:** Greenwalt, Sarah <greenwalt.sarah@epa.gov>; Gunasekara, Mandy <Gunasekara.Mandy@epa.gov>
>> **Cc:** Peterkoski, Timothy J. (MPC) <tjpeterkoski@marathonpetroleum.com>; Menefee, Jake E. (MPC) <jakeemenefee@marathonpetroleum.com>; Beeman, Guy M. (MPC) <gmbeeman@marathonpetroleum.com>
>> **Subject:** RE: [EXTERNAL] Connection
>>
>> Sarah,
>>
>> 2pm on Thursday works great. Thank you for the quick response and making time on your calendar to speak with us. Unfortunately, I am going to be unavailable on Thursday afternoon, so I am CC'ing my colleagues Jake Menefee and Guy Beeman who will be accompanying Tim on Thursday.
>>
>> Please let any of us know if you have any questions or need anything prior to our meeting on Thursday. Thank you again and see you soon.

Mike

From: Greenwalt, Sarah [mailto:greenwalt.sarah@epa.gov]
Sent: Monday, May 08, 2017 11:40 AM
To: Birsic, Michael J. (MPC); Gunasekara, Mandy
Subject: RE: [EXTERNAL] Connection

Thanks, Mandy!

Mike, I can do this Thursday at 2pm if that works for you guys.

Sarah A. Greenwalt
Senior Advisor to the Administrator
for Water and Cross-Cutting Issues

U.S. Environmental Protection Agency
Work: 202-564-1722 | Cell: Personal Matters / Ex. 6
Greenwalt.Sarah@epa.gov

From: Birsic, Michael J. (MPC) [mailto:mjbirsic@marathonpetroleum.com]
Sent: Monday, May 8, 2017 11:01 AM
To: Gunasekara, Mandy <Gunasekara.Mandy@epa.gov>; Greenwalt, Sarah <greenwalt.sarah@epa.gov>
Subject: RE: [EXTERNAL] Connection

Mandy, thanks for the connection. Sarah, nice to meet you (electronically anyway). Tim was planning to be in town on the 11th and wanted to chat ELGs if you are available. I know how busy you all are, so if 11th is too short of notice, happy to work with you on another date in the near future.

Thanks again Mandy and Sarah we are looking forward to working with you.

Mike

From: Gunasekara, Mandy [mailto:Gunasekara.Mandy@epa.gov]
Sent: Monday, May 08, 2017 10:55 AM
To: Greenwalt, Sarah
Cc: Birsic, Michael J. (MPC)
Subject: [EXTERNAL] Connection

Hi Sarah,
I'm cc'ing Mike Birsic is a good friend who represents Marathon Petroleum Co. He'd like to see about coordinating a meeting with you and Tim Peterkoski, MPC's lead on environmental issues who will be in town on Thursday. Tim would like to touch base on ELGs.
I hope you two can find a time to connect.
Best,
Mandy

Message

From: Greenwalt, Sarah [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=6C13775B8F424E90802669B87B135024-GREENWALT,]
Sent: 4/5/2018 9:05:41 PM
To: Slone, Deck [DSlone@archcoal.com]
Subject: RE: Following up

Hi Deck,

Thank you for reaching out. Do you have some time to chat tomorrow?

Sarah A. Greenwalt

U.S. Environmental Protection Agency
Work: 202-564-1722 | Cell Personal Matters /
Greenwalt.Sarah@epa.gov

From: Slone, Deck [mailto:DSlone@archcoal.com]
Sent: Thursday, April 5, 2018 10:54 AM
To: Greenwalt, Sarah <greenwalt.sarah@epa.gov>
Subject: Following up

Hey Sarah –

Just following up on my voice mail earlier this week. Any chance you might have a few minutes to chat today, as a follow-up to the Administrator's interest in the export story? I'm open for much of the day, so just let me know if there is a time that might work for you. Thanks again for the good discussion, and I look forward to connecting soon.

Best,

Deck

Deck S. Slone
Senior Vice President,
Strategy and Public Policy
Arch Coal, Inc.
One CityPlace Drive
Saint Louis, MO 63141
Personal Matters /
dslone@archcoal.com

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Message

From: Greenwalt, Sarah [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=6C13775B8F424E90802669B87B135024-GREENWALT,]
Sent: 4/10/2018 2:06:04 PM
To: Slone, Deck [DSlone@archcoal.com]
Subject: RE: Following up

My cell number is listed below.

Sarah A. Greenwalt

U.S. Environmental Protection Agency
Work: 202-564-1722 | Cell: Personal Matters / Ex. 6
Greenwalt.Sarah@epa.gov

From: Slone, Deck [mailto:DSlone@archcoal.com]
Sent: Monday, April 9, 2018 2:59 PM
To: Greenwalt, Sarah <greenwalt.sarah@epa.gov>
Subject: Re: Following up

Sarah —

I will not be in DC tomorrow after all, but still hoping we can connect via phone. Does 10:30 ET tomorrow (Tuesday) still work for you? Thanks again for trying to accommodate. Talk soon.

Best,

Deck

Sent from my iPhone

On Apr 6, 2018, at 9:30 AM, Greenwalt, Sarah <greenwalt.sarah@epa.gov> wrote:

> I have some time at 10:30 next Tuesday, if that would work with your schedule.
>
> **Sarah A. Greenwalt**
>
> U.S. Environmental Protection Agency
> Work: 202-564-1722 | Cell: Personal Matters /
> Greenwalt.Sarah@epa.gov
>
> **From:** Slone, Deck [mailto:DSlone@archcoal.com]
> **Sent:** Thursday, April 5, 2018 5:50 PM
> **To:** Greenwalt, Sarah <greenwalt.sarah@epa.gov>
> **Subject:** RE: Following up
>
> I do, Sarah, thanks – and also expect to be in DC with some time on Tuesday of next week if you'd like to connect in person. Tomorrow I'm free any time other than 10:30 ET.
>
> Looking forward to connecting.

DS

Sent: Thursday, April 05, 2018 4:06 PM
To: Slone, Deck <DSlone@archcoal.com>
Subject: RE: Following up

Hi Deck,

Thank you for reaching out. Do you have some time to chat tomorrow?

Sarah A. Greenwalt

U.S. Environmental Protection Agency
Work: 202-564-1722 | Cell: Personal Matters / Ex. 6
Greenwalt.Sarah@epa.gov

From: Slone, Deck [mailto:DSlone@archcoal.com]
Sent: Thursday, April 5, 2018 10:54 AM
To: Greenwalt, Sarah <greenwalt.sarah@epa.gov>
Subject: Following up

Hey Sarah –

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Best,

Deck

Deck S. Slone
Senior Vice President,
Strategy and Public Policy
Arch Coal, Inc.
One CityPlace Drive
Saint Louis, MO 63141
Personal Matters / Ex.
dslone@archcoal.com

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From: Greenwalt, Sarah [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=6C13775B8F424E90802669B87B135024-GREENWALT,]
Sent: 4/10/2018 2:05:52 PM
To: Slone, Deck [DSlone@archcoal.com]
Subject: RE: Following up

Yes, that works. Speak to you soon.

Sarah A. Greenwalt

U.S. Environmental Protection Agency
Work: 202-564-1722 | Cell: Personal Matters /
Greenwalt.Sarah@epa.gov

From: Slone, Deck [mailto:DSlone@archcoal.com]
Sent: Monday, April 9, 2018 2:59 PM
To: Greenwalt, Sarah <greenwalt.sarah@epa.gov>
Subject: Re: Following up

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Sent from my iPhone

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> U.S. Environmental Protection Agency
> Work: 202-564-1722 | Cell: Personal Matters
> Greenwalt.Sarah@epa.gov
>
> ---
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> **From:** Slone, Deck [mailto:DSlone@archcoal.com]
> **Sent:** Thursday, April 5, 2018 5:50 PM
> **To:** Greenwalt, Sarah <greenwalt.sarah@epa.gov>
> **Subject:** RE: Following up
>
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To: Slone, Deck <DSlone@archcoal.com>
Subject: RE: Following up

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Sarah A. Greenwalt

U.S. Environmental Protection Agency
Work: 202-564-1722 | Cell: Personal Matters / Ex. 6
Greenwalt.Sarah@epa.gov

From: Slone, Deck [mailto:DSlone@archcoal.com]
Sent: Thursday, April 5, 2018 10:54 AM
To: Greenwalt, Sarah <greenwalt.sarah@epa.gov>
Subject: Following up

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Deck

Deck S. Slone
Senior Vice President,
Strategy and Public Policy
Arch Coal, Inc.
One CityPlace Drive
Saint Louis, MO 63141
Personal Matters / Ex. 6
dslone@archcoal.com

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Message

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Sent: 4/27/2017 8:36:38 PM
To: evan.karanovich@cfacorp.com
CC: Ferguson, Lincoln [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=08cd7f82606244de96b61b96681c46de-Ferguson, L]

Mr. Karanovich,

It was such a pleasure to run into you and Mr. Cathy this afternoon! We appreciate you guys taking the time to chat for a few minutes. As we said, one of the things both Lincoln and I miss about living in Oklahoma is our proximity to a Chick-fil-A. I speak for us both when I say that we greatly admire the culture you guys have cultivated at your company.

Blessings,
Sarah and Lincoln

Sarah A. Greenwalt
Senior Advisor to the Administrator
for Water and Cross-Cutting Issues

U.S. Environmental Protection Agency
Work: 202-564-1722 | Cell: Personal Matters / Ex. 6
Greenwalt.Sarah@epa.gov