IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF NORTH DAKOTA
SOUTHEASTERN DIVISION

STATE OF NORTH DAKOTA et al.,	)	
	)	
Plaintiffs,	)	
	)	
v.	)	Case No. 3:15-cv-59-DLH-ARS
	)	
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY et al.,	)	
	)	
	)	
Defendants.	)	
	)	

Brief of the Society of Wetland Scientists as Amicus Curiae
in Opposition to Plaintiff States' Motion for Summary Judgment
and in Support of Upholding the Clean Water Rule

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Interests of the Amicus Curiae[1]

The Society of Wetland Scientists (SWS) is a leading professional association of wetland and aquatic scientists around the world, including the United States. Established in 1980, SWS advances scientific and educational objectives related to wetland science and encourages professional standards in all activities related to wetland science. SWS has over 3,000 members and publishes a peer-reviewed quarterly journal, *Wetlands*, concerned with all aspects of wetland biology, ecology, hydrology, water chemistry, soil, and sediment characteristics. SWS supports the use of the best available scientific information in making decisions on the use and management of wetland and aquatic resources.

As a scientific society, SWS weighs in on the definition of "waters of the United States" under the Clean Water Act (CWA), 33 U.S.C. §1251 et seq. (2012), relying on scientific research and experience with tributaries and geographically proximate adjacent waters. This brief elaborates on the scientific basis behind efforts to address human activities that alter the integrity of aquatic ecosystems. Damage to these systems can affect society in a number of ways, including: harming human welfare and property via flooding, impairing human health via water pollution, loss of recreational opportunities, and threatening species, including commercial species harvested in fisheries, via water pollution and a loss of connectivity. Millennium Ecosystem Assessment, *Ecosystems and Human Well-Being: Wetlands and Water* 1–3 (José

[1] This brief was not authored in whole or in part by any party's counsel, no party or party's counsel contributed money that was intended to fund preparing or submitting the brief, and no person—other than the amicus curiae or its counsel—contributed money that was intended to fund preparing or submitting this brief.

Sarukhán et al. eds., 2005); *see also* David Moreno-Mateos & Margaret A. Palmer, *Watershed Processes as Drivers for Aquatic Ecosystem Restoration*, in *Foundations of Restoration Ecology* (Margaret A. Palmer et al. eds., 2d ed. 2016). SWS believes that the Clean Water Rule's definition of "waters of the United States," 80 Fed. Reg. 37,054 (June 29, 2015), is a scientifically justified approach to address these impacts.

I. The Clean Water Rule is scientifically sound.

In drafting the Clean Water Rule, the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (Corps) utilized many methodologies employed by wetland and water scientists. The agencies studied key chemical, physical, and biological features of water systems and relied upon studies that used rigorous and respected methodologies in researching aquatic ecosystems.

A. Key chemical, physical, and biological features are used to study water systems.

All water systems, including wetlands, are composed of three structural components: water, substrate (physical and chemical features), and biota (animal, plant, and microorganism life). Nat'l Research Council, *Wetlands: Characteristics and Boundaries* 3–4 (1995); *see also* Figure 1. Each component interacts with the others to shape the functions (services) of water systems, such as trapping and filtering of sediment and pollutants, retaining and attenuating floodwaters (dissipating stream energy), storing runoff and other water, contributing flow, and providing aquatic habitat (to name a few functions represented in Figure 1). In the Connectivity Report, the study underlying the Clean Water Rule, the EPA and the Corps examined connections among the three components to provide an integrated, scientific perspective on water systems. EPA Office of Research & Dev., *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence* 1-2 to 1-19 (Jan. 2015) [hereinafter *Connectivity Report*].

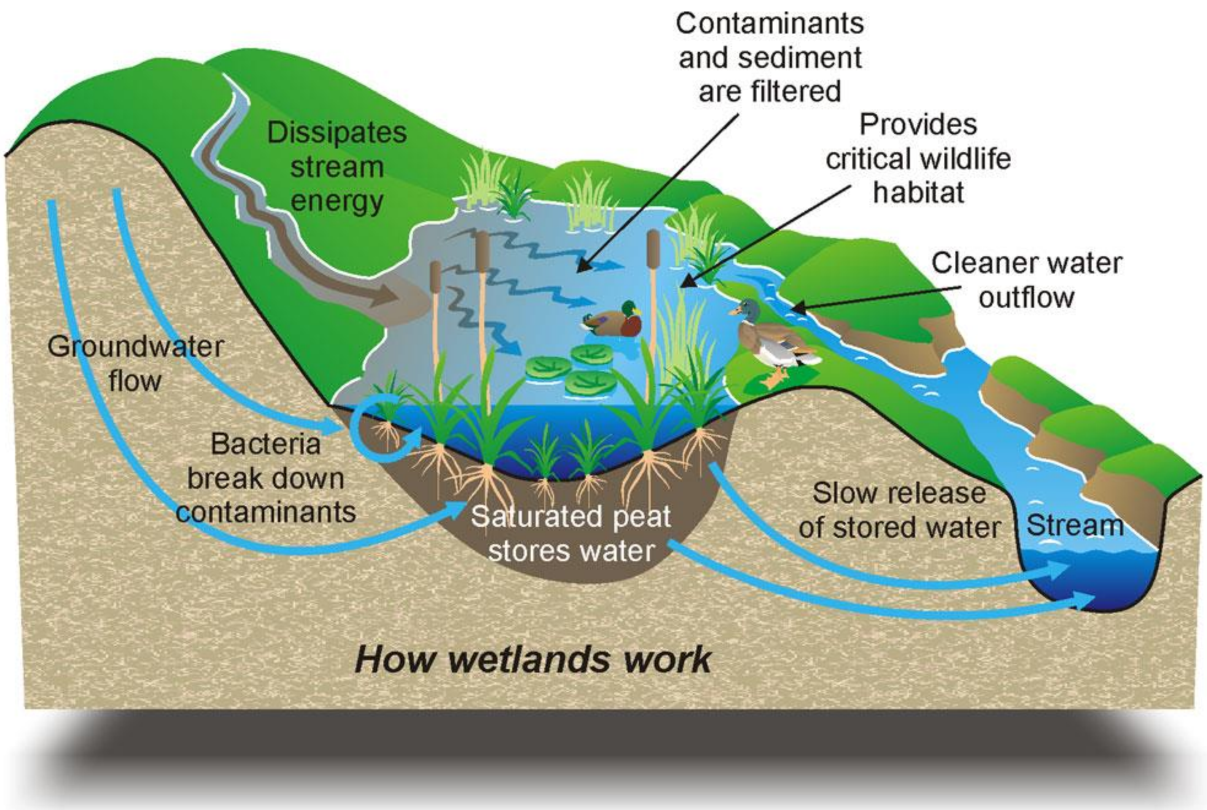

Figure 1. How Wetlands Work. Source: Delaware Wetland Monitoring and Assessment Program.

B. Rigorous research methods are used to study these attributes, and to study aquatic ecosystems as a whole.

The study of water systems integrates several scientific disciplines. In the context of understanding wetlands, hydrology, geology, and chemistry are used to examine how wetlands regulate stream flow, filter pollutants and sediment, incorporate excess nutrients, act to control flooding, and connect to groundwater. *See, e.g.*, Carol A. Johnston, *Sediment and Nutrient Retention by Freshwater Wetlands: Effects on Surface Water Quality*, 21 Critical Rev. Envtl.

Control 491–565 (1991); Donald L. Hey & Nancy S. Philippi, *Flood Reduction Through Wetland Restoration: The Upper Mississippi River Basin as a Case History*, 3 Restoration Ecology 4–17 (2006); Peter J. Hancock et al., *Preface: Hydrogeoecology, the Interdisciplinary Study of Groundwater Dependent Ecosystems*, 17 Hydrogeology J. 1–3 (2009). Ecological research can be used to examine the role of wetlands as habitats for fish and wildlife, and their support of food webs within and among interconnected water systems. *See, e.g.*, Matthew J. Gray et al., *Management of Wetlands for Wildlife*, in 3 *Wetland Techniques: Applications and Management* 121–80 (James T. Anderson & Craig A. Davis eds., 2013); Michael E. Sierszen et al., *Watershed and Lake Influences on the Energetic Base of Coastal Wetland Food Webs Across the Great Lakes Basin*, 38 J. Great Lakes Res. 418–28 (2012). Underlying this cross-disciplinary approach is a focus on the various methodologies noted above. Scientists and researchers do not apply these methods independently of each other, but rather actively compare them to ensure that results are robust and reproducible. *Cf.* David Goodstein, *How Science Works*, in Fed. Judicial Ctr., *Reference Manual on Scientific Evidence* 37, 44 (3d ed. 2011).

To study water systems, scientists use a wide range of sampling and analytical methods to make on-site observations and measurements. *See Methods in Biogeochemistry of Wetlands* (R.D. DeLaune et al. eds., 2013). These methods include examining the chemical and physical characteristics of the waters, characterizing soil and sediment samples, sampling plant communities, and quantifying the direction and movement of water and materials (dissolved and particulate) in stream networks and to/from wetlands. *See generally id.*; *see also Tools in Fluvial Geomorphology* (G. Mathias Kondolf & Hervé Piégay eds., 2d ed. 2016). These sampling and analytical methods are well-established, rigorous, and refined over time; they are used to enhance scientific understanding of the relationships between the various components of water systems.

Watershed or hydrologic studies may make use of "natural experiments" (a form of observational study), which focus on comparing a natural event or feature with areas (or times) with and without the event or feature. *Reference Manual on Scientific Evidence*, *supra*, at 290; *see also* Judith A. Layzer, *Natural Experiments: Ecosystem-Based Management and the Environment* (2008). In studying developed and undeveloped watersheds, for example, the assignment of subjects (e.g., watersheds) to groups (e.g., developed or not) is akin to randomization. Such natural experiments are often necessary because ethical considerations (i.e., concerns of deliberately damaging those systems), size, and cost create barriers for actual experiments on existing systems. *See* Susan Haack, *Defending Science—Within Reason: Between Scientism and Cynicism* (2003). Rather than disrupting existing systems, scientists focus on variability to extrapolate the effects of differences on the overall water system. Scientists also use naturally occurring and injected tracers in freshwater ecosystems that do not cause any harm to the system but move with the water and identify the direction and magnitude of water fluxes as well as the rates of many ecological processes. Patrick J. Mulholland et al., *Measurement of Phosphorus Uptake Length in Streams: Comparison of Radiotracer and Stable PO4 Releases*, 47 Canadian J. Fisheries & Aquatic Sci. 2351–57 (1990); G. Bertrand et al., *Environmental Tracers and Indicators Bringing Together Groundwater, Surface Water and Groundwater-Dependent Ecosystems: Importance of Scale in Choosing Relevant Tools*, 72 Envtl. Earth Sci. 813–27 (2014); N. Martínez-Carreras et al., *Hydrological Connectivity as Indicated by Transport of Diatoms Through the Riparian–Stream System*, 12 Hydrology & Earth Sys. Sci. Discussions 2391–434 (2015). This has been increasingly important in documenting flow paths and connectivity and the role of systems in global biogeochemical cycles. Benjamin W. Abbott et al., *Using Multi-Tracer Inference to Move Beyond Single-Catchment Ecohydrology*, 160 Earth-Sci. Reviews 19–42 (2016); *see also* Scott G. Leibowitz et al., *Connectivity of Streams and Wetlands to Downstream Waters: An Integrated Systems Framework*, 54 J. Am. Water Resources Ass'n 298–322 (2018) (providing an extensive review of hydrologic connectivity and describing methods specifically suited to detect stream and wetland connectivity to downstream waters).

Modeling methods also enhance scientific understanding of the water-system relationships. *See* Nat'l Judicial Coll., *Hydrologic Modeling Benchbook* 31 (2010) (describing computer-based models as "essential" for understanding water systems). Models serve multiple purposes. First, they enable scientists to test their understanding of interrelationships between different components of a water system. *Id.* Second, they enable scientists to predict the outcomes of potential human activities that may cause damage—without modifying those systems. *Id.* Models also make it possible to study processes at scales of watersheds to continents that are too extensive to be investigated by observations alone, and to simulate scenarios of hydrologic and other wetland/watershed processes drawn from the historical record. *E.g.*, Kangsheng Wu & Carol A. Johnston, *Hydrologic Comparison Between a Forested and a Wetland/Lake Dominated Watershed Using SWAT*, 22 Hydrological Processes 1431–42 (2008).

C. The EPA's Connectivity Report, which informed the development of the Clean Water Rule, represents the state of the science on how streams and wetlands contribute to the chemical, physical, and biological integrity of downstream waters.

The Connectivity Report is the key document that provides scientific support for the Clean Water Rule by establishing how streams and wetlands connect to downstream waters. The Connectivity Report reached its conclusions using studies that applied all of the well-established methodologies discussed above. Indeed, the EPA, in the Connectivity Report, compiled these studies to ensure the use of high-quality, relevant research. *Connectivity Report*, *supra*, at 1-16 to 1-17; *see also* U.S. Envtl. Prot. Agency & U.S. Dep't of Army, *Technical Support Document for the Clean Water Rule: Definition of Waters of the United States* 158–63 (May 27, 2015) [hereinafter *Technical Support Document*] (describing the extensive process of peer review of the Connectivity Report itself, including the use of a panel of 27 technical experts from an array of relevant fields, as well as other public processes). The Connectivity Report reviewed and synthesized more than 1,200 peer-reviewed scientific publications and was developed over the course of several years. *Connectivity Report*, *supra*, at ES-2. It included only studies that were peer reviewed or otherwise verified for quality assurance. *Id.* The focus on high standards and verification through peer review means that the Connectivity Report used the best available science to develop the Clean Water Rule. *See* Clean Water Rule, 80 Fed. Reg. at 37,055; *see also, e.g.*, P.J. Sullivan et al., *Report: Best Science Committee*, *Defining and Implementing Best Available Science for Fisheries and Environmental Science, Policy, and Management*, 31 Fisheries 460, 462 (2006) (describing assurance of data quality and use of rigorous peer review as aspects of best available science).

The Connectivity Report meticulously explains the central role that streams and wetlands play "in maintaining the structure and function of downstream waters." *Connectivity Report*, *supra*, at ES-6. Streams and wetlands "influence the timing, quantity, and quality of resources available to downstream waters" by serving as sources, sinks, and refuges of materials and by providing functions related to the transformation and lag of materials. *Id.* at ES-6, ES-9.

The functions provided by, and the effects of, an individual stream or wetland on downstream waters are cumulative and should be considered over time and in the context of other streams and wetlands in the watershed. *Id.* at ES-5, 6-7. For example, an individual ephemeral stream may contribute only a small amount of water, organisms, and/or materials to downstream waters in a given year, but the aggregate contribution from that stream over time or from all of the ephemeral streams in that watershed can be substantial. *Id.* at ES-5, ES-14, 6-11. Similarly, one stream may provide many functions, such as water transport, nutrient removal and transformation, flood mitigation, and habitat, and these functions should be considered cumulatively when evaluating the overall effect of that stream on downstream waters. *Id.* at ES-5, 1-10, 1-11.

Wetlands and their functions also should be considered in the aggregate, as the cumulative influence of many wetlands in a watershed can strongly alter "the spatial scale, magnitude, frequency, and duration of hydrologic, biological and chemical fluxes or transfers of water and materials to downstream waters." *Id.* at ES-11, 4-44. For example, multiple wetlands may reduce flooding due to their cumulative storage of larger amounts of water. *Id.* at ES-14. Negative effects also can be cumulative—a single discharge of a pollutant may have a negligible effect, but multiple discharges could have a cumulative negative impact, degrading downstream waters. *Id.* at 6-12. Human activities can affect the functions provided by streams and wetlands, which, in some instances, can harm downstream waters.[2]

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[2] For example, culverts, channelization, and water withdrawals can negatively affect the connectivity between headwater streams and downstream waters, as well as the functions provided by streams and wetlands. *Connectivity Report*, *supra*, at ES-9, ES-13, 1-11, 2-44, 6-10. Dams may impair wetland functions and block migrating fish and organisms from moving upstream, and levees and urban stormwater drainage may eliminate or impair the habitats provided by streams and wetlands. *Id.* at 1-11, 2-45. Wetland drainage for agricultural and other activities leads to lost connectivity and functions, such as decreased water storage and increased pollutant delivery to downstream waters. *Id.* at 2-45 to 2-47.

These potential negative impacts demonstrate that we must protect hydrologically connected streams and wetlands to minimize adverse effects from human activities. The Clean Water Rule was designed to do this by identifying as jurisdictional those waters—including streams and wetlands—that support the objective of 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) (2012). The Connectivity Report describes the myriad ways in which streams and wetlands are connected to, and influence the chemical, physical, and biological integrity of, downstream waters, including primary waters, and the EPA and the Corps appropriately relied on the Connectivity Report to inform the definition of "waters of the United States" in the Clean Water Rule.

II. "Waters of the United States" is a legal determination informed by science.

Jurisdiction under the CWA has both legal and scientific components. The CWA defines the term "navigable waters" as "waters of the United States," which has been further refined by case law, regulation, and agency guidance. Traditional navigable waters, interstate waters, and the territorial seas (hereinafter collectively referred to as "primary waters") are indisputably "waters of the United States."[3] But for other waters, such as tributaries and waters adjacent to those tributaries, scientific research plays a critical role in determining their qualifications for

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[3] The States (Pl. States' Mem. in Supp. of Mot. for Summ. J. 25–26, ECF No. 212) and the American Farm Bureau Federation Amici (Br. Amicus Curiae of the American Farm Bureau Federation et al. 19–20, ECF No. 218) argue that the Rule should not categorically apply to all interstate waters, but they ignore the fact that CWA regulations have historically applied to interstate waters. *See* 33 C.F.R. § 328.3(a) (1987).

CWA protection by assessing how these waters affect the chemical, physical, and biological integrity of primary waters.

A. The law establishes that CWA jurisdiction requires a "significant nexus" to a primary water.

While "waters of the United States" include more than primary waters, the CWA's jurisdictional scope has limits. In *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers*, the U.S. Supreme Court noted that the term "navigable" has some import in CWA jurisdictional determinations. 531 U.S. 159, 172 (2001). Accordingly, agencies and courts have employed the "significant nexus" analysis, endorsed by Justice Kennedy in *Rapanos v. United States*. 547 U.S. 715, 759 (2006) (Kennedy, J., concurring in the judgment); *Technical Support Document*, *supra*, at 379 (noting that the agencies have made significant nexus determinations in every state in the country). This approach recognizes that upstream waters must be protected to ensure the integrity of primary waters. *Rapanos*, 547 U.S. at 774–75.

B. Scientific research grounds the Clean Water Rule's approach to "significant nexus."

The Clean Water Rule relies on the best available science to establish criteria for the requisite "significant nexus" between primary waters and other waters. Primary waters do not exist in isolation. Nat'l Research Council, *Compensating for Wetland Losses Under the Clean Water Act* 46–59 (2001). Rather, they are heavily influenced by their interactions with streams, wetlands, and open waters within their watersheds. As the Connectivity Report correctly emphasizes:

> The structure and function of downstream waters ***highly depend*** on materials—broadly defined as any physical, chemical, or biological entity—that originate outside of the downstream waters. Most of the constituent materials in rivers, for example, originate from aquatic ecosystems located upstream in the drainage network or elsewhere in the drainage basin, and are transported to the river through flowpaths[.]

Connectivity Report, *supra*, at ES-15 (emphasis added). The Clean Water Rule appropriately defines "significant nexus" using scientifically supported functions to demonstrate strong chemical, physical, and biological connections between upstream waters and primary waters. *See* 80 Fed. Reg. at 37,067 (describing the nine functions).[4]

Scientific literature strongly supports the nine functions listed in the Clean Water Rule's "significant nexus" definition, each of which relates to the chemical, physical, and/or biological integrity of primary waters. For example, wetlands enhance the chemical integrity of downstream waters through trapping, transforming, and filtering pollutants. *See* Carol A. Johnston et al., *The Cumulative Effect of Wetlands on Stream Water Quality and Quantity: A Landscape Approach*, 10 Biogeochemistry 105–41 (1990). Wetlands also recycle nutrients and export organic material important for downstream food webs. *See* Michael E. McClain et al., *Biogeochemical Hot Spots and Hot Moments at the Interface of Terrestrial and Aquatic Ecosystems*, 6 Ecosystems 301–12 (2003); Nathan J. Smucker & Naomi E. Detenbeck, *Meta-Analysis of Lost Ecosystem Attributes in Urban Streams and the Effectiveness of Out-of-Channel Management Practices*, 22 Restoration Ecology 741–48 (2014).

[4] Since the Rule was developed, a number of reviews have been published that provide overviews and updates on these connections and their importance. *E.g.*, Matthew J. Cohen et al., *Do Geographically Isolated Wetlands Influence Landscape Functions?*, 113 Proc. Nat'l Acad. Sci. U.S.A. 1978–86 (2016); Ken M. Fritz et al., *Physical and Chemical Connectivity of Streams and Riparian Wetlands to Downstream Waters: A Synthesis*, 54 J. Am. Water Resources Ass'n 323–45 (2018); Charles R. Lane et al., *Hydrological, Physical, and Chemical Functions and Connectivity of Non-Floodplain Wetlands to Downstream Waters: A Review*, 54 J. Am. Water Resources Ass'n 346–71 (2018). Although these recent studies were not part of the scientific record that formed the basis of the Clean Water Rule, these studies demonstrate that scientific research continues to provide support for the Clean Water Rule.

Similarly, the functions of streams, wetlands, and open waters affect the physical integrity of downstream waters. *See, e.g.*, Tim D. Fletcher et al., *Protection of Stream Ecosystems from Urban Stormwater Runoff: The Multiple Benefits of an Ecohydrological Approach*, 38 Progress in Physical Geography 543–55 (2014). These waters contribute flow to primary waters. *See, e.g.*, Carol A. Johnston & Boris A. Shmagin, *Regionalization, Seasonality, and Trends of Streamflow in the U.S. Great Lakes Basin*, 362 J. Hydrology 69–88 (2008). Research has shown that many wetlands without a year-round surface connection to primary waters flow into perennial streams a significant amount of the time, thereby contributing water and other materials downstream. *See, e.g.*, Owen T. McDonough et al., *Surface Hydrologic Connectivity Between Delmarva Bay Wetlands and Nearby Streams Along a Gradient of Agricultural Alteration*, 35 Wetlands 41–53 (2015); Heather E. Golden et al., *Hydrologic Connectivity Between Geographically Isolated Wetlands and Surface Water Systems: A Review of Select Modeling Methods*, 53 Envtl. Modelling & Software 190–206 (2014); *see also* Jacob D. Hosen et al., *Dissolved Organic Matter Variations in Coastal Plain Wetland Watersheds: The Integrated Role of Hydrological Connectivity, Land Use, and Seasonality*, 32 Hydrological Processes 1664–81 (2018).[5]

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[5] Recent advances in remote sensing have allowed scientists to detect and quantify physical connections that allow temporally variable surface water flows between streams and wetlands that were previously considered isolated. Melanie K. Vanderhoof et al., *Temporal and Spatial Patterns of Wetland Extent Influence Variability of Surface Water Connectivity in the Prairie Pothole Region, United States*, 31 Landscape Ecology 805–24 (2016); Melanie K. Vanderhoof et al., *Patterns and Drivers for Wetland Connections in the Prairie Pothole Region, United States*, 25 Wetlands Ecology & Mgmt. 275–97 (2017). These studies spanned five ecoregions in the larger Prairie Pothole Region in north-central North America and the Delmarva Peninsula in eastern Maryland.

Wetlands also retain and attenuate floodwaters, as well as store runoff. *See* Hisashi Ogawa & James W. Male, *Simulating the Flood Mitigation Role of Wetlands*, 112 J. Water Resources Plan. & Mgmt. 114–28 (1986); Carol A. Johnston, *Material Fluxes Across Wetland Ecotones in Northern Landscapes*, 3 Ecological Applications 424–40 (1993).[6] In addition, wetlands trap sediment and nutrients, thereby preventing the degradation of downstream water quality. *See* Carol A. Johnston et al., *Nutrient Trapping by Sediment Deposition in a Seasonally Flooded Lakeside Wetland*, 13 J. Envtl. Quality 283–90 (1984). Extensive evidence demonstrates that wetlands act to remove nutrients, thereby regulating the movement of excess nitrogen and phosphorus to downstream waters. *E.g.*, Stephen J. Jordan et al., *Wetlands as Sinks for Reactive Nitrogen at Continental and Global Scales: A Meta-Analysis*, 14 Ecosystems 144–55 (2011); McClain et al., *supra*.

Furthermore, research has confirmed that like small streams in some regions, small wetlands play a disproportionately large role in landscape-scale nutrient processes. *See* Bruce J. Peterson et al., *Control of Nitrogen Export from Watersheds by Headwater Streams*, 292 Sci. 86–90 (2001); Richard B. Alexander et al., *Effect of Stream Channel Size on the Delivery of Nitrogen to the Gulf of Mexico*, 403 Nature 758–61 (2000); *see also* Frederick Y. Cheng & Nandita B. Basu, *Biogeochemical Hotspots: Role of Small Water Bodies in Landscape Nutrient Processing*, 53 Water Resources Res. 5038–56 (2017). These are exactly the wetlands that are

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[6] Hydrological modeling recently showed that depressional wetlands in the Prairie Pothole Region attenuate peak flows, thus decreasing the probability of downstream flooding. Grey R. Evenson et al., *Depressional Wetlands Affect Watershed Hydrological, Biogeochemical, and Ecological Functions*, 28 Ecological Applications 953–66 (2018).

likely to be filled and thus are at greater risk without protection. Kimberly J. Van Meter & Nandita B. Basu, *Signatures of Human Impact: Size Distributions and Spatial Organization of Wetlands in the Prairie Pothole Landscape*, 25 Ecological Applications 451–65 (2015).

The Clean Water Rule's definition of "significant nexus" also recognizes how streams, wetlands, and open waters affect the biological integrity of downstream waters. Such waters provide important foraging, nesting, breeding, spawning, and nursery habitat for species that occur in primary waters. *See* Marcus Sheaves, *Consequences of Ecological Connectivity: The Coastal Ecosystem Mosaic*, 391 Marine Ecology Progress Series 107–15 (2009); Raymond D. Semlitsch & J. Russell Bodie, *Are Small, Isolated Wetlands Expendable?*, 12 Conservation Biology 1129–33 (1998); Shannon E. Pittman et al., *Movement Ecology of Amphibians: A Missing Component to Understanding Amphibian Declines*, 169 Biological Conservation 44–53 (2014).

Although the States assert that there is a disconnect between the science in the record and the agencies' portrayal of the science underlying the Clean Water Rule (Pl. States' Mem. 47, ECF No. 212), the Connectivity Report and the research described herein make clear that the categories of upstream waters covered by the Rule have significant connections to, and perform significant functions for, downstream waters. *See, e.g.*, *Connectivity Report*, *supra*, at ES-2 to ES-3. The Connectivity Report explains that the "scientific literature unequivocally demonstrates that streams, individually or cumulatively, exert a strong influence on the integrity of downstream waters" and that "the literature clearly shows that wetlands and open waters in riparian areas and floodplains are physically, chemically, and biologically integrated with rivers via functions that improve downstream water quality[.]" *Id.* Science overwhelmingly shows a "significant nexus" between covered waters and traditional navigable waters. Moreover, the preamble to the Clean Water Rule repeatedly states that it was informed by the Connectivity Report and took into account science when determining the scope of the Rule and which waters had a significant nexus to downstream waters. *See, e.g.*, Clean Water Rule, 80 Fed. Reg. at 37,057 (stating "[a]lthough these conclusions [in the Science Advisory Board review and the Connectivity Report] play a critical role in informing the agencies' interpretation of the CWA's scope, the agencies' interpretive task in this rule—determining which waters have a 'significant nexus'—requires scientific and policy judgment, as well as legal interpretation").

Also contrary to the States' arguments, the definition of "connectivity"[7] in the Connectivity Report and the definition of "significant nexus" in the Clean Water Rule are both supported by science. Whether the functions of a particular stream, wetland, or open water (or a group of "similarly situated" waters) satisfy the legal threshold of "significant nexus" depends on the extent of its connectivity with primary waters. Furthermore, the States' observation (Pl. States' Mem. 48, ECF No. 212) that the Connectivity Report does not use the words or phrases "significant nexus," "nexus," and "navigable waters" is actually consistent with the scientific nature of the report. The absence of these words and phrases is expected—as the Connectivity Report explains, scientists and policymakers use different language, with policymakers using terms that "lack scientific definitions." *Connectivity Report*, *supra*, at 1-1 to 1-2.; *cf.* Goodstein, *supra*, at 51 ("Science and the law differ both in the language they use and the objectives they seek to accomplish."). Also, as the agencies noted,

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[7] Connectivity refers to "the degree to which components of a watershed are joined and interact by transport mechanisms that function across multiple spatial and temporal scales." *Connectivity Report*, *supra*, at ES-6.

> [t]he scientific literature does not use the term "significant" as it is defined in a legal context, but it does provide information on the strength of the effects on the chemical, physical, and biological functioning of the downstream water bodies from the connections among tributaries, adjacent waters, and case-specific waters and those downstream waters.

U.S. Envtl. Prot. Agency & U.S. Dep't of Army, *Clean Water Rule Response to Comments – Topic 9: Comments on Scientific Evidence Supporting Rule* 23. In sum, the Clean Water Rule is appropriately informed by science, including the Connectivity Report.

III. Best available science supports the Clean Water Rule's categorical treatment of tributaries.

The U.S. Supreme Court has held that federal agencies may craft a categorical rule to assert CWA jurisdiction over certain waters so long as "it is reasonable . . . to conclude that, in the majority of cases," the category of waters has "significant effects on water quality and the aquatic ecosystem[.]" *United States v. Riverside Bayview Homes, Inc.*, 474 U.S. 121, 135 n.9 (1985). The agencies found that tributaries, as a category, significantly affect the chemical, physical, and biological integrity of primary waters and concluded that tributaries are "waters of the United States" and warrant categorical treatment under the Rule. *Technical Support Document*, *supra*, at 53–55, 272.

While the States and the American Farm Bureau Federation Amici object to the categorical treatment of tributaries on various grounds, there "is strong scientific evidence to support the EPA's proposal to include all tributaries within the jurisdiction of the Clean Water Act." *See* Clean Water Rule, 80 Fed. Reg. at 37,064 (quoting Science Advisory Board Review Report). Scientific research demonstrates extensive connections between tributaries and their downstream primary waters sufficient to warrant categorical inclusion under the Clean Water Rule. *See* R. Eugene Turner & Nancy N. Rabalais, *Linking Landscape and Water Quality in the Mississippi River Basin for 200 Years*, 53 BioScience 563–72 (2003).

A. The Clean Water Rule's definition of tributary is scientifically sound.

The Clean Water Rule defines "tributary" in a manner consistent with scientific understanding. Under the Clean Water Rule, a "tributary . . . contributes flow, either directly or through another water" to primary waters and is "characterized by the presence of the physical indicators of a bed and banks and an ordinary high water mark." 80 Fed. Reg. at 37,105. The Clean Water Rule notes that tributaries may be natural or human-made and include "rivers, streams, [and] canals," as well as ditches that are not otherwise excluded by the Rule. *Id.* From a scientific perspective, whether a tributary is natural or human-made is immaterial; what matters is whether the water contributes flow to another waterbody.

At its most basic level, a tributary is simply a waterbody that flows into a larger waterbody. From a scientific perspective, "a tributary is the smaller of two intersecting channels, and the larger is the main stem." Lee Benda et al., *The Network Dynamics Hypothesis: How Channel Networks Structure Riverine Habitats*, 54 BioScience 413, 415 (2004). A standard stream ordering system classifies the smallest streams as first-order streams; when two streams meet, they form a second-order stream, and so on. *See* Arthur N. Strahler, *Quantitative Analysis of Watershed Geomorphology*, 38 Transactions Am. Geophysical Union 913–20 (1957). The smaller waters are intrinsically linked to primary waters both structurally and functionally. *See* Dennis F. Whigham et al., *Impacts of Freshwater Wetlands on Water Quality: A Landscape Perspective*, 12 Envtl. Mgmt. 663–71 (1988). Indeed, "[t]he great majority of the total length of river systems is comprised of lower-order or headwater systems." J. David Allan & María M. Castillo, *Stream Ecology: Structure and Function of Running Waters* 2 (2d ed. 2007); *see also* Ken M. Fritz et al., *Comparing the Extent and Permanence of Headwater Streams from Two Field Surveys to Values from Hydrographic Databases and Maps*, 49 J. Am. Water Resources Ass'n 867–82 (2013).

Under the Clean Water Rule, a water meets the definition of a tributary even if it contributes flow to a primary water through a non-jurisdictional water, an approach about which the States and American Farm Bureau Federation Amici complain (Pl. States' Mem. 12-13, ECF No. 212; Br. Amicus Curiae of the American Farm Bureau Federation et al. 20–21, ECF No. 218). Including such waters is sound because the scientific definition of tributary focuses on the hydrologic connection between waters. In fact, the Clean Water Rule's definition of "tributary" is actually conservative and includes fewer waters than the Science Advisory Board, for example, would have included. The Clean Water Rule requires tributaries to have both a bed and banks (channels) and an ordinary high water mark (OHWM). In comments to the EPA, however, the Science Advisory Board noted that not all tributaries have OHWMs. Ltr. from EPA Sci. Advisory Bd., to Gina McCarthy, EPA Administrator, *Science Advisory Board (SAB) Consideration of the Adequacy of the Scientific and Technical Basis of the EPA's Proposed Rule Titled "Definition of Waters of the United States Under the Clean Water Act"* (Sept. 30, 2014) (on file with epa.gov).

B. Compelling scientific evidence demonstrates that tributaries significantly affect the chemical, physical, and biological integrity of primary waters.

The National Academy of Sciences has extensively documented the connections between tributaries and downstream waters. *See, e.g.*, Nat'l Research Council, *Missouri River Planning: Recognizing and Incorporating Sediment Management* (2011); Nat'l Research Council, *Achieving Nutrient and Sediment Reduction Goals in the Chesapeake Bay: An Evaluation of Program Strategies and Implementation* (2011). Scientific studies demonstrate how tributaries significantly affect the functions and integrity of downstream waters through chemical, physical, and biological interrelationships, especially regarding how physical aspects (e.g., flow) can influence chemical processes (e.g., pesticide contamination), which in turn can affect the biological features (e.g., species) of a water.

Scientific research demonstrates the strong chemical connections between tributaries and downstream primary waters in the movement of contaminants and pathogens. Sediment-laden waters typically transport some contaminants (such as mercury) from tributaries to downstream waters. *See* Willem Salomons & Ulrike Förtsner, *Metals in the Hydrocycle* (1984). Waterborne pathogens (such as bacteria and viruses) that originate from agricultural and municipal wastes are also transported to downstream waters through tributaries. *See* Pramod K. Pandey et al., *Contamination of Water Resources by Pathogenic Bacteria*, 4 AMB Express (2014); Cassandra C. Jokinen et al., *Spatial and Temporal Drivers of Zoonotic Pathogen Contamination of an Agricultural Watershed*, 41 J. Envtl. Quality 242–52 (2012); Isabelle Jalliffier-Verne et al., *Cumulative Effects of Fecal Contamination from Combined Sewer Overflows: Management for Source Water Protection*, 174 J. Envtl. Mgmt. 62–70 (2016). Pathogens may pose a risk to human health, highlighting the importance of regulating and protecting tributaries to ensure the integrity of primary waters.

Tributaries also have important physical connections with downstream primary waters. The water flow from tributaries helps to create and maintain river networks. Indeed, most of the water in most rivers comes from tributaries. *See, e.g.*, Richard B. Alexander et al., *The Role of Headwater Streams in Downstream Water Quality*, 43 J. Am. Water Resources Ass'n 41–59 (2007). This is true even if a tributary does not flow seasonally or perennially. For example, the Technical Support Document cites a 2006 study by Vivoni et al. that showed that 76% of the flow in the Rio Grande after a storm came from ephemeral tributaries. *Technical Support Document*, *supra*, at 246.

Furthermore, tributaries support the metabolism of river ecosystems. Among other things, they export organic matter (dissolved and particulate) that is incorporated into the food webs of downstream waters, and the resulting turbid water shades and protects fish and amphibians from damage by ultraviolet radiation. *E.g.*, Paul C. Frost et al., *Environmental Controls of UV-B Radiation in Forested Streams of Northern Michigan*, 82 Photochemistry & Photobiology 781–86 (2006). Other biological connections relate to the passive and active transport of living organisms. *See* Judy L. Meyer et al., *The Contribution of Headwater Streams to Biodiversity in River Networks*, 43 J. Am. Water Resources Ass'n 86 (2007) (discussing how organisms rely on streams); Moreno-Mateos & Palmer, *supra*; Carol A. Johnston, *Beaver Wetlands*, in *Wetland Habitats of North America: Ecology and Conservation Concerns* 161–72 (Darold P. Batzer & Andrew H. Baldwin eds., 2012).

Accordingly, the Clean Water Rule's categorical treatment of tributaries reflects scientific reality.

IV. Best available science supports the Clean Water Rule's categorical treatment of adjacent waters based on geographic proximity.

Scientific research demonstrates that adjacent waters warrant regulation under the Clean Water Rule because of their chemical, physical, and biological connections to downstream primary waters. 80 Fed. Reg. 37,057–58.

A. Compelling scientific evidence demonstrates that waters within 100 feet of an OHWM significantly affect the chemical, physical, and biological integrity of primary waters.

Waters, including wetlands, ponds, oxbows, and impoundments, within 100 feet of an OHWM are "hotspots" of ecological function/processes and species diversity affecting the flux of materials (water, sediment, energy, organic matter, pollutants, and organisms) to primary waters. *See* Peter M. Groffman et al., *Down by the Riverside: Urban Riparian*

Ecology, 1 Frontiers Ecology & Env't 315–21 (2003). These adjacent waters affect the movement of pollutants from uplands into streams and rivers; regulate stream temperatures, light, and flow regimes; reduce downstream flooding; and provide nursery areas and critical habitat for aquatic biota, including threatened and endangered species. *See* J. V. Ward et al., *Riverine Landscape Diversity*, 47 Freshwater Biology 517–39 (2002). Riparian wetlands act as buffers, effectively reducing concentrations of nutrients and other pollutants. For example, riparian wetlands may remove up to 100% of the nitrate-nitrogen that enters them. *See* M. S. Fennessy & J. Cronk, *The Effectiveness and Restoration Potential of Riparian Ecotones for the Management of Nonpoint Source Pollution, Particularly Nitrate*, 27 Critical Revs. Envtl. Sci. & Tech. 285–317 (1997). Nitrate is a serious water pollutant and a major contributor to coastal algal blooms, as in the Gulf of Mexico's hypoxic "dead zone," as well as nuisance algal blooms in many other surface waters. *See* William J. Mitsch et al., *Nitrate-Nitrogen Retention in the Mississippi River Basin*, 24 Ecological Engineering 267–78 (2005).

These adjacent waters can act as sources, sinks, or transformers of materials from upland habitats. As sources, adjacent waters contribute organic materials, such as leaf litter, that provide food (energy) for many in-stream species. *See* Robin L. Vannote et al., *The River Continuum Concept*, 37 Canadian J. Fisheries & Aquatic Sci. 130–37 (1980). They also carry woody debris, which increases habitat complexity and biodiversity. *See* J. David Allan, *Stream Ecology: Structure and Function of Running Waters* (1st ed. 1995); J. V. Ward et al., *supra*.

Adjacent waters are also major sinks for materials. By capturing and storing sediment eroded from nearby uplands, they reduce downstream sediment transport and its negative effects on fish feeding and spawning, macroinvertebrate communities, and overall habitat quality. *See*

C. P. Newcombe & D. D. MacDonald, *Effects of Suspended Sediments on Aquatic Ecosystems*, 11 N. Am. J. Fisheries Mgmt. 72–82 (1991). These adjacent waters convert materials from one form to another; plants and algae can consume nutrients and bind them in their tissues, reducing the risk of downstream eutrophication. Wetlands in particular mitigate nonpoint source pollution, such as insecticides and fertilizers, thus protecting stream water quality and drinking water supplies. *E.g.*, Robert Everich et al., *Efficacy of a Vegetative Buffer for Reducing the Potential Runoff of the Insect Growth Regulator Novaluron*, in *Pesticide Mitigation Strategies for Surface Water Quality* 175–88 (2011); Mitsch et al., *supra*. Adjacent waters also slow the movement of materials and biota, by providing temporary storage of excess water during times of high precipitation to dissipate the energy of flows (reducing erosion and soil loss) and attenuate flood peaks. *See* William J. Mitsch & J. Gosselink, *Wetlands* (5th ed. 2015).

Hydrologic connections do not need to be continuous to have a substantial effect on downstream primary waters. Hydrologic connectivity involves longitudinal, lateral, and vertical exchange, and adjacent waters are intimately linked to streams and rivers both in space (i.e., proximity to the OHWM) and time (e.g., by means of high water and flood events). Seasonal high water levels increase connectivity, promoting the lateral movement of animals between lakes, wetlands, stream channels, and their adjacent waters. This facilitates use of critical spawning and nursery habitats by fish and supports the biological integrity of the system. Many fish are sustained by varied habitats dispersed throughout the watershed for spawning, nurseries, growth, and maturation. *See* Kurt D. Fausch et al., *Landscapes to Riverscapes: Bridging the Gap Between Research and Conservation of Stream Fishes*, 52 BioScience 483–98 (2002).

Overall, the benefits of protecting waters within 100 feet of an OHWM accrue both locally (at that point on the river system) and cumulatively (at the watershed scale). Although the

States take issue with the 100-foot threshold (Pl. States' Mem. 23, ECF No. 212), the States appear to ignore scientific studies specifically described in the preamble to the Clean Water Rule itself. The preamble notes that "[m]any studies indicate that the primary water quality and habitat benefits will generally occur within a several hundred foot zone of a water." 80 Fed. Reg. at 37,085. The Clean Water Rule's categorical inclusion of these adjacent waters thus reflects scientific reality.

B. Compelling scientific evidence demonstrates that waters within 100-year floodplains significantly affect the chemical, physical, and biological integrity of primary waters.

The Clean Water Rule's coverage of waters within 100-year floodplains is based on scientific understanding of watershed dynamics. These dynamics include not only surface expressions of connectivity (floods), but also underlying hydrologic conditions.

Every primary water has a watershed, which can be described as the land area that drains into that primary water and its tributaries. *See* Paul R. Bierman & David R. Montgomery, *Key Concepts in Geomorphology* (2014). During any flood event, primary waters and their tributaries may overflow their banks. *Id.* The proportion of land that becomes obviously flooded (the "floodplain") depends upon rate and total amount of rainfall. The geographic extent of the floodplain also depends upon the watershed's topography, soil saturation, and geological characteristics. *See* W. R. Osterkamp & J. M. Friedman, *The Disparity Between Extreme Rainfall Events and Rare Floods—With Emphasis on the Semi-Arid American West*, 14 Hydrological Processes 2817–29 (2000). A landscape with more topographic relief (steeper) will have a smaller floodplain than a flatter landscape where floodwaters more readily spread outward. *See* A.D. Howard, *Modelling Channel Evolution and Floodplain Morphology*, in *Floodplain Processes* 15–62 (Malcolm G. Anderson et al. eds., 1996).

Although every flood is unique in extent and duration, scientists describe floodplains statistically to characterize other hydrologic (non-flooding) features. *See* G.R. Pandy & V.-T.-V. Nguyen, *A Comparative Study of Regression Based Methods in Regional Flood Frequency Analysis*, 225 J. Hydrology 92–101 (1999). For example, the “100-year floodplain” represents the land area that has a 1% chance of being inundated by flood waters in any given year (1/100 likelihood). This definition is entirely statistical; such floods can occur more often in a 100-year floodplain, even two years or more in a row. It is incorrect to conclude, as the States do (Pl. States’ Mem. 22, ECF No. 212), that waters on a 100-year floodplain have a connection with a primary water only once in a century.

Moreover, floodwaters are only the surface expressions of a flood. Focusing exclusively on the surface connection of the water, as the American Farm Bureau Federation Amici do (Br. Amicus Curiae of the American Farm Bureau Federation et al. 27–28, ECF No. 218), ignores how waters within the 100-year flood zone affect the chemical, physical, and biological integrity of primary waters. Rainfall permeates into the soil and often moves underground toward open waterbodies, such as primary waters. *See* William M. Alley et al., *Flow and Storage in Groundwater Systems*, 296 Sci. 1985–90 (2002); Florian Malard et al., *A Landscape Perspective of Surface-Subsurface Hydrological Exchanges in River Corridors*, 47 Freshwater Biology 621–40 (2002). Groundwater movement also contributes to baseflow in the absence of a 100-year flood. This understanding results from tracer techniques that show large proportions of streamflow are derived from groundwater. *E.g.*, Alley et al., *supra*.

The water science community understands that factors other than surface flooding determine the actual extent of hydrologic connections between waters in a floodplain. The direction of movement and the rate at which the water moves depend upon topography, geology, and rainfall. *See* Jack A. Stanford & J.V. Ward, *An Ecosystem Perspective of Alluvial Rivers: Connectivity and the Hyporheic Corridor*, 12 J. N. Am. Benthological Soc'y 48–60 (1993); Alley et al., *supra*. Impermeable subsurface layers, like clay layers under sand and/or limestone in Florida, can reduce the downward movement of water and force it to move laterally. *See* Peter W. Bush & Richard H. Johnston, *Ground-Water Hydraulics, Regional Flow, and Ground-Water Development of the Floridan Aquifer System in Florida and in Parts of Georgia, South Carolina, and Alabama: Regional Aquifer-System Analysis* (U.S. Geological Survey, Professional Paper 1403-C, 1988). Often subsurface impermeable (or semi-permeable) layers are not level; they may slope toward waterbodies, and this subsurface lateral flow may re-emerge in a surface waterbody, such as a primary water. However, subsurface lateral flow can occur even without sloping impermeable layers; when more water pools in a particular subsurface location, lateral flow will occur from areas of higher pressure to areas of lower pressure, which may be river channels, wetlands, or lakes. *See* Jacob Bear, *Hydraulics of Groundwater* (2012).

Furthermore, changes in land use can affect flood dynamics. Increasing the proportion of the landscape that is covered with impermeable surfaces (such as streets and roofs) may increase flood intensity and duration. *See* E. S. Bedan & J.C. Clausen, *Stormwater Runoff Quality and Quantity from Traditional and Low Impact Development Watersheds*, 4 J. Am. Water Resources Ass'n 998–1008 (2009).

Many different types of waterbodies can occur in 100-year floodplains. Tributaries and other waters can be connected to a primary river in more than one way. *See* C. Amoros & G. Bornette, *Connectivity and Biocomplexity in Waterbodies of Riverine Floodplains*, 47 Freshwater Biology 761–76 (2002). Headwaters and tributaries may flow directly into primary waters, adding organic matter and constituents that create unique water chemistry in the primary water.

See Takashi Gomi et al., *Understanding Processes and Downstream Linkages of Headwater Systems: Headwaters Differ from Downstream Reaches by Their Close Coupling to Hillslope Processes, More Temporal and Spatial Variation, and Their Need for Different Means of Protection from Land Use*, 52 BioScience 905–16 (2002). Wetlands may border primary waters, buffering the input of floodwaters, altering the water chemistry of floodwaters and the primary water itself, and providing habitat and resources for local biota. *See* Joy B. Zedler, *Wetlands at Your Service: Reducing Impacts of Agriculture at the Watershed Scale*, 1 Frontiers Ecology & Env't 65–72 (2003).[8]

Even other waterbodies with no obvious surface connections to primary waters may still be hydrologically connected to them. Lakes, ponds, wetlands, and streams that flow into these apparently isolated waterbodies may have no surface connections to the primary water but, in addition to storing water as previously described, can have subsurface connections through groundwater. Bear, *supra*. These subsurface connections can carry water to primary waters; for example, water seeping down out of an apparently isolated waterbody may hit an impermeable layer and move laterally until it emerges in the primary waterbody. *See* Geoffrey C. Poole, *Fluvial Landscape Ecology: Addressing Uniqueness Within the River Discontinuum*, 41

[8] Wetlands in agricultural areas "also provide habitat for pollinators and natural enemies of crop pests." Shan Ma & Scott M. Swinton, *Valuation of Ecosystem Services from Rural Landscapes Using Agricultural Land Prices*, 70 Ecological Econ. 1649, 1652 (2011). The role of wetlands in supporting pollinators and food production was recently noted in an assessment by the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES). *See* IPBES, *The Assessment Report on Pollinators, Pollination and Food Production* (2017).

Freshwater Biology 641–60 (2002). Therefore, loss of a superficially isolated waterbody can reduce water volume and alter flow characteristics of a primary water.

Evidence for these connections can be observed in the physical and chemical properties of primary waters. *See* Malard et al., *supra*. Temperature, alkalinity, salinity, nitrate, other chemicals and pollutants, and dyes have been used as tracers to show the impact of groundwater connections to surface waters. *See* C. Soulsby et al., *Inferring Groundwater Influences on Surface Water in Montane Catchments from Hydrochemical Surveys of Springs and Streamwaters*, 333 J. Hydrology 199–213 (2007). Furthermore, additions of pollutants into apparently isolated waterbodies or disparate areas of the watershed can affect primary waters. *See* David N. Lerner & Bob Harris, *The Relationship Between Land Use and Groundwater Resources and Quality*, 26 Land Use Pol'y S265–S273 (2009). Tracer and stable isotope studies have established the path and rate of water movements in Florida, substantiating that a distant source can pollute primary waters. *See* M. Badruzzaman et al., *Sources of Nutrients Impacting Surface Waters in Florida: A Review*, 109 J. Envtl. Mgmt. 80–92 (2012). These studies highlight the chemical, physical, and biological connections between a primary water and other waterbodies that are located within its 100-year floodplain, thus justifying the inclusion of these adjacent waters in the Clean Water Rule.

C. Compelling scientific evidence demonstrates that waters within 1500 feet of high tide lines of tidally influenced primary waters or OHWMs of the Great Lakes significantly affect the integrity of these primary waters.

Scientific evidence strongly supports protecting waters located within 1500 feet of such primary waters. These waters have the same types of connections and functions as the tributaries and other adjacent waters discussed *supra*. Adjacent waters within 1500 feet of primary waters have important chemical connections to those waters. Adjacent waters that were thought to be isolated have become more saline (which can degrade the agricultural productivity of surrounding lands), providing empirical data regarding the groundwater connection between adjacent waters and primary waters. *See, e.g.*, Cameron Wood & Glenn A. Harrington, *Influence of Seasonal Variations in Sea Level on the Salinity Regime of a Coastal Groundwater-Fed Wetland*, 53 Groundwater 90–98 (2014). In addition, adjacent waters in the 1500-foot zone may release freshwater into coastal waters, thereby reducing the salinity of these waters. *See, e.g.*, Fred H. Sklar & Joan A. Browder, *Coastal Environmental Impacts Brought About by Alterations to Freshwater Flow in the Gulf of Mexico*, 22 Envtl. Mgmt. 547–62 (1998).

The inputs of groundwater into coastal waters are quite large, and groundwater can contain high levels of dissolved solids and nutrients. *See, e.g.*, Willard S. Moore, *Large Groundwater Inputs to Coastal Waters Revealed by 226-Ra Enrichments*, 380 Nature 612–14 (1996); Matthew A. Charette et al., *Utility of Radium Isotopes for Evaluating the Input and Transport of Groundwater-Derived Nitrogen to a Cape Cod Estuary*, 46 Limnology & Oceanography 465–70 (2001); J. M. Krest et al., *Marsh Nutrient Export Supplied by Groundwater Discharge: Evidence from Radium Measurements*, 14 Global Biogeochemical Cycles 167–76 (2000). As in inland systems, coastal wetlands remove nutrients, such as nitrate, thereby reducing down-gradient eutrophication in primary waters. *See* Marcelo Ardón et al., *Drought-Induced Saltwater Incursion Leads to Increased Wetland Nitrogen Export*, 19 Global Change Biology 2976–85 (2013). Thus, adjacent waters protect and improve the quality of primary waters by removing harmful contaminants or transforming and transporting nutrients to primary waters. *See* Clifford N. Dahm, *Nutrient Dynamics of the Delta: Effects on Primary Producers*, 14 S.F. Estuary & Watershed Sci. Art. 4 (2016).

Adjacent waters also physically influence primary waters through surface and subsurface connections. *See* Figure 2. Adjacent waters contribute flow to nearby primary waters and retain floodwaters and sediments. *See, e.g.*, Paul M. Barlow, *Ground Water in Freshwater-Saltwater Environments of the Atlantic Coast* (U.S. Geological Survey, Circular 1262, 2003). Further, adjacent waters significantly affect the biological integrity of primary waters. Wetlands near tidally influenced primary waters can serve as a critical source of freshwater for some species

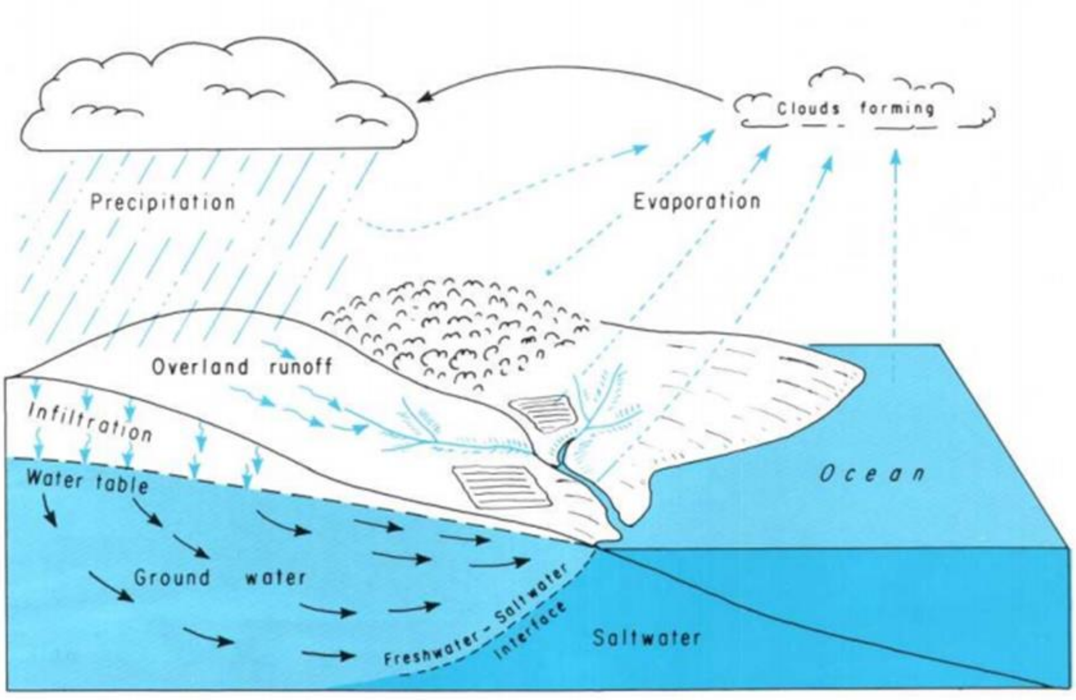

Figure 2. Freshwater-Saltwater Interface. Source: Ralph C. Heath, *Basic Ground-Water Hydrology* (U.S. Geological Survey, Water-Supply Paper 2220, 2004).

that use wetlands and coastal waters. *See Technical Support Document*, *supra*, at 292–93. Adjacent wetlands, lakes, ponds, and other waters also provide important foraging and breeding habitat for coastal species. *See, e.g.*, David J. Jude & Janice Pappas, *Fish Utilization of Great Lakes Coastal Wetlands*, 18 J. Great Lakes Res. 651–72 (1992); Michael E. Sierszen et al., *A Review of Selected Ecosystem Services Provided by Coastal Wetlands of the Laurentian Great Lakes*, 15 Aquatic Ecosystem Health & Mgmt. 92–106 (2012).

Distance is but one factor that affects the connectivity between waters, and as with the other geographical distance limitations discussed *supra*, the agencies' selection of 1500 feet as the distance limitation is conservative from a scientific perspective. Waters located beyond this threshold can be chemically, physically, and biologically connected to tidally influenced primary waters or the Great Lakes. While the categorical jurisdictional line could have been drawn farther from high tide lines, science strongly supports connecting the majority of lakes, wetlands, ponds, and other waters located within this 1500-foot area to primary waters.

Once again, the Clean Water Rule's categorical inclusion of these adjacent waters reflects scientific reality.

V. Agency consideration of science is necessary to achieve the goals of the Clean Water Act.

As a scientific society, SWS would like to emphasize that "science is the driving force" behind environmental laws. Fred P. Bosselman & A. Dan Tarlock, *The Influence of Ecological Science on American Law*, 69 Chi.-Kent L. Rev. 847, 847 (1994). And as the EPA itself stated recently, "[t]he best available science must serve as the foundation of EPA's regulatory actions." Strengthening Transparency in Regulatory Science, 83 Fed. Reg. 18,768, 18,769 (proposed Apr. 30, 2018) (emphasis added) (internal citation omitted); *see also* EPA, *Scientific Integrity Policy* 1 (2012), https://www.epa.gov/sites/production/files/2014-02/documents/scientific_integrity_policy_2012.pdf (stating that "[s]cience is the backbone of the EPA's decision-making"). The CWA requires the EPA, which has the primary authority to define "waters of the United States,"[9] to consider science when promulgating rules under the Act.

[9] Administrative Authority to Construe § 404 of the Federal Water Pollution Control Act, 49 Op. Att'y Gen. 197 (1979) (explaining that the EPA Administrator, rather than the Secretary of the Army, has the ultimate authority to interpret CWA jurisdictional terms).

The CWA's stated objective is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." 33 U.S.C. § 1251(a). The *only* way to make sound determinations regarding the restoration and maintenance of waters' "chemical, physical, and biological integrity" is through science because otherwise, no empirical determinations can be made about the chemical, physical, and biological integrity of our waters. The U.S. Supreme Court noted that the CWA's "objective incorporated a broad, systemic view of the goal of maintaining and improving water quality: as the House Report on the legislation put it, 'the word "integrity" . . . refers to a condition in which the natural structure and function of ecosystems [are] maintained.'" *Riverside Bayview Homes, Inc*., 474 U.S. at 132 (citing H.R. Rep. No. 92–911, at 76 (1972)). The *only* way to assess "water quality" or the "natural structure" or "function" of "ecosystems" is through science, again, because otherwise, there is no way of empirically assessing water quality or the function of ecosystems.

Every aspect of the CWA's implementation requires the use of science. For example, the Corps, the agency vested with responsibility to issue CWA section 404 permits, relies on scientific manuals in making those CWA site determinations. *See, e.g.*, *Tin Cup LLC v. U.S. Army Corps of Eng'rs*, No. 4:16-cv-00016-TMB, 2017 WL 6550635, at *8 (D. Alaska Sept. 26, 2017) (discussing the scientific basis of CWA jurisdictional determinations and noting that the Corps' supplemental manual for Alaska "reflect[s] the benefit of nearly two decades [of] advancement in wetlands research and science"). The Corps' CWA determinations themselves have been labeled as "scientific decision[s]." *Avoyelles Sportsmen's League, Inc. v. Marsh*, 715 F.2d 897, 906 (5th Cir. 1983). Indeed, the U.S. Supreme Court recently underscored, in a reference to the Clean Water Rule, the agencies' reliance on science. *U.S. Army Corps of Eng'rs v. Hawkes Co., Inc*., 136 S. Ct. 1807, 1812 n.1 (2016) ("In 2015, the Corps adopted a new rule modifying the definition of the scope of waters covered by the Clean Water Act in light of scientific research and decisions of this Court interpreting the Act.").

The traditional deference that courts afford to EPA and Corps decisions often is based on the agencies' rigorous use of science, as was the case with the Clean Water Rule. *See Marsh v. Or. Natural Res. Council*, 490 U.S. 360, 377 (1989). Not surprisingly, the Corps' CWA determinations are routinely upheld when based upon rigorous scientific literature or studies. *See, e.g.*, *Sierra Club v. U.S. Army Corps of Eng'rs*, 464 F. Supp. 2d 1171, 1225 (M.D. Fla. 2006) (court upheld Corps' CWA mitigation plan where "scientifically supported"), *aff'd*, 508 F.3d 1332, 1337 (11th Cir. 2007); *Precon Dev. Corp. v. U.S. Army Corps of Eng'rs*, 984 F. Supp. 2d 538, 545, 560, 561–62 (E.D. Va. 2013) (Corps' CWA findings upheld as "sufficient evidence" where they included scientific literature showing that the wetlands "support[ed] the water integrity of the [river] by removing nitrates and phosphorous, storing water, and slowing flow" and had an important "biological and ecological impact" on the river); *Nw. Envtl. Def. Ctr. v. Wood*, 947 F. Supp. 1371, 1384 (D. Or. 1996) (Corps' decision must be upheld so long as it was "carefully considered [and] based on evidence from scientific studies" (citation omitted)).

Science permeates all aspects of the CWA and must do so for the EPA and the Corps to fulfill their mandates. The agencies relied on the best available science, including the Connectivity Report, when promulgating the Clean Water Rule, and as such, the Clean Water Rule should be upheld.

VI. Conclusion

The U.S. Supreme Court has held that federal agencies may protect waters on a categorical basis if most waters in that category have a significant effect on primary waters. The best available science overwhelmingly demonstrates that the waters treated categorically in the Clean Water Rule have significant chemical, physical, and biological connections to primary waters. Accordingly, the Society of Wetland Scientists writes in support of upholding the Clean Water Rule and respectfully requests this Court to deny Plaintiff States' Motion for Summary Judgment.

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Respectfully submitted,

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