



Redefining Clean Water Regulations Reduces Protections for Wetlands and Jurisdictional Uncertainty

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The 2015 Clean Water Rule is being enforced in 26 states, with a legal stay resulting in the prior rules being enforced in the remaining 24 states, and a proposed re-definition open for public comment. These rules define which streams and wetlands are protected by the Clean Water Act and which require a permit for development, fill, or discharge of water and pollutants. In the Wabash River Basin, as much as 39% of wetlands in the basin would lose their current federal protections. The 2015 Clean Water Rule did not expand jurisdictional scope, but the proposed rule would significantly contract protections in our study basin. The proposed re-definition shifts uncertainty from the “significant nexus” test to definitions of stream intermittency and typical hydrologic conditions.

Keywords: waters of the US, WOTUS, policy, clean water act, stream, wetland

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INTRODUCTION

Political and legal debates about the jurisdictional reach of the Clean Water Act (CWA), and thus which streams, lakes, and wetlands are protected as “waters of the United States” (WOTUS), have intensified during the past two decades. The definition of a waterbody as WOTUS is important because WOTUS require permits under the Clean Water Act for modification such as dredging, filling, or discharge of pollutants. At the time of writing, there are two different legal definitions of WOTUS being used, with a third re-definition currently open for public comment. At present, the 2015 Clean Water Rule (CWR) (USDOD and USEPA, 2015) is in effect in 26 states. Due to legal challenges, the remaining states have reverted to prior guidance issued by the U.S. Environmental Protection Agency (EPA) and U.S. Army Corps of Engineers (USACE) in a 2007 response to the 2006 U.S. Supreme Court decision in *Rapanos v. United States* (hereafter “pre-CWR”) (*Rapanos v. United States*, 2006). Further complicating the matter is a 2018 EPA-proposed rule that would revoke the 2015 CWR and re-define WOTUS (hereafter “2018 redefinition”) (USDOD and USEPA, 2018).

The key issue at stake in these legal battles is the CWA’s jurisdictional scope. In broad strokes, opposing political interests debate whether the CWA restricts private property rights unreasonably or protects wetlands, ephemeral streams, and intermittent streams effectively. The legal battles focus on the extent to which the agencies have discretion within the ambiguous meaning of Congress’ intent for the CWA to regulate discharge to “waters of the United States” [33 U.S.C. 1362(7)]. But how do definitional changes in WOTUS actually impact realized resource protection on the ground? To answer that question, we compare the three regulatory possibilities to assess changes in the jurisdictional scope of the CWA and the clarity each rule provides to regulators and landowners about the protections afforded to their waters. Neither existing nor proposed regulations include quantitative, bright-line tests in defining absolute terms that classify the jurisdictional status of every river, stream, lake, pond, or wetland as jurisdictional. As a result, there exists uncertainty around which waters are jurisdictional given the lack

of specificity across heterogeneous environments (hereafter “uncertainty”). Here, we test the critical role that (re)defining WOTUS plays in protecting headwater streams and wetlands.

We studied the Wabash River Basin to demonstrate the practical implications of the evolving definitions of WOTUS in a large river basin. We selected the Wabash River Basin for our case study because it sources the highest nutrient loads in the Mississippi River Basin, contributing disproportionately to the annual “dead zone” in the Gulf of Mexico (Alexander et al., 2007). Since the CWA exempts discharges from agricultural activity from regulation, the high nutrient removal rates in headwater streams and wetlands are critical to preservation of downstream water quality, and ultimately reducing nutrient pollution in the Mississippi River Basin, a nationally recognized environmental priority since the 1990’s.

HOW IS THE JURISDICTIONAL SCOPE OF THE CLEAN WATER ACT DEFINED?

Which Streams Are WOTUS?

Since Congress enacted the CWA in 1972, courts and agencies have attempted to clarify the vague statutory definition of “waters of the United States.” Critically, the definition expanded CWA jurisdiction beyond traditionally navigable waters to include their tributaries and connected wetlands. Since 1986, the EPA and USACE have used the presence of a bed, banks, and evidence of flow as the standard for defining jurisdictional status of streams (USDOD, 1986), which persisted in the CWR. Importantly, this definition requires evidence but not necessarily direct observation of surface flow. The 2018 proposed rule changes this standard, explicitly defining ephemeral streams (i.e., those flowing only in response to storm events) as non-jurisdictional whereas intermittent (i.e., those flowing in absence of storm events) and perennial streams are defined as jurisdictional. This is a significant change from previous guidelines and would exclude many waterways that are currently receiving protection in both pre-CWR and CWR states. For example, current rules include many temporary waterways in arid climates (e.g., desert arroyos) while the proposed 2018 redefinition would exclude those waters. Moreover, the 2018 redefinition is in conflict with the EPA’s own synthesis of the science that concluded the health of traditionally navigable waters is inseparably linked to their tributaries and wetlands, including ephemeral streams (USEPA, 2015).

Which Wetlands Are WOTUS?

Having determined which streams are jurisdictional, regulators next consider the role of wetlands in sustaining the physical, chemical, and biological integrity of waters as a basis for jurisdiction (Rapanos v. United States, 2006; USEPA and USDOD, 2008). Under modern enforcement related to the CWA, wetlands receive protection on the basis of their proximity and connectivity to navigable waters. The USACE districts established working norms that consider wetlands within a specified distance of a navigable water to be jurisdictional even if not directly adjacent, depending upon floodplain location, and using a host of different criteria (USGAO, 2004). The CWR defined wetlands as jurisdictional if they were located: (1) within 100-ft of

a jurisdictional water; (2) within 1,500 feet of a jurisdictional water and within the 100-year floodplain; or (3) within 1,500 feet of a traditionally navigable water. Wetlands in the range of 1,500 to 4,000-ft were suggested to require a “significant nexus” test, requiring expert opinion and study to determine if the water in question, alone or in combination with similar waters, impacted the integrity of a jurisdictional water (Rapanos v. United States, 2006). Wetlands beyond 4,000-ft were considered non-jurisdictional by rule, creating a new class of waters that did not require a significant nexus test. We note also that several special cases were defined in which a significant nexus test was considered to be requisite even though the distance-based criteria may not met (e.g., prairie potholes). Most recently, the 2018 redefinition would establish protection only for wetlands that abut the jurisdictional stream network and which have a perennial or intermittent surface connection with jurisdictional streams. The proposed rule would eliminate jurisdictional status for non-adjacent wetlands, and eliminate the need for any significant nexus test.

ANALYSIS OF THE WABASH RIVER BASIN

To quantify the impact of the various regulations on stream and wetland protection, we applied the guidance and definitions to the Wabash River Basin in the Midwestern U.S. Briefly, we derived stream networks based on topographic data and selected a range of regulatory networks based on a minimum drainage area. Using these stream networks, we next assessed the acreage of wetlands meeting various definitions including abutting or immediately adjacent to the stream, and considering buffers related to the various distances that are specified in previous guidance (USDOD, 1986; USDOD and USEPA, 2015, 2018). Data sources and methods of analysis are detailed in the **Supplementary Materials**. The result of our analyses is that we can assess the wetland acreage that is considered to be jurisdictional, conditionally jurisdictional (i.e., requires a determination or significant nexus test), or non-jurisdictional as a function of which regulation would be considered and which stream network would be jurisdictional. Importantly, our calculations are based on the Wabash River Basin, and may not be representative of the full diversity of landscapes in the U.S. We encourage extension of these concepts to other regions to understand the full impact of the regulatory changes that are currently being litigated and proposed.

THE JURISDICTIONAL SCOPE OF THE CLEAN WATER ACT WAS NOT NECESSARILY EXPANDED BY THE CLEAN WATER RULE

None of the three cases considered provides an explicit definition of which streams should be considered WOTUS, instead leaving uncertainty in the regulatory stream network. In the Wabash River Basin, we contend that the uncertainty lies primarily in headwater reaches draining 0.01–1 mi², which

TABLE 1 | Summary of jurisdictional determinations for streams and wetlands in the Wabash River Basin under the pre-Clean Water Rule, 2015 Clean Water Rule, and 2018 proposed guidance.

	Which streams are WOTUS?	Which wetlands are WOTUS?		
		Protected, by rule	Significant Nexus test required	Not protected, by rule
2007–2015 Pre-Clean Water Rule (pre-CWR)	Bed, banks, evidence of flow	Varies by USACE district; commonly: (1) within 500-ft buffer or less; or (2) within 100-yr floodplain	All wetlands not protected by rule	None
	37–272 × 10 ³ mi	75.3–99.8%	0.20–24.7%	0%
2015 Clean Water Rule (CWR)	Bed, banks, evidence of flow	One of: (1) within 100-ft of a jurisdictional water; (2) within 1,500-ft of jurisdictional water and within 100-yr floodplain; (3) within 1,500-ft of a traditionally navigable water	Does not meet one of 3 articulated conditions, but within 4,000-ft of a jurisdictional water	More than 4,000-ft from a jurisdictional water
	37–272 × 10 ³ mi	76.6–97.3%	2.7–20.3%	0–3.1%
Proposed 2018 rule (2018 Redefinition)	Perennial or intermittent flow in a typical year*	Immediately adjacent wetlands with surface connection in a typical year	None	All non-adjacent wetlands
	37–272 × 10 ³ mi	61.2–92.6%	0%	7.4–38.8%

*language likely biased toward shorter network lengths, but no quantitative definition is provided.

For each wetland definition, the ranges provided reflect the percent of all wetlands in each category, with ranges defined by the uncertainty in jurisdictional networks defined by streams draining at least 0.01–1 mi². For the ranges protected, smaller values are always associated with more contracted networks, reflecting more conservative definitions of what qualifies as a stream.

encompass the range of ephemeral to intermittent streams in the basin (Fritz et al., 2008; Villines et al., 2015). We expect larger streams are predominantly perennial and agreed upon as jurisdictional, while smaller streams are gullies and erosional features. Using the range of 0.01–1 mi², the jurisdictional network spans between 37,000 and 272,000 mi of rivers and streams (**Supplementary Figures 1, 2**). The identical definition between the pre-CWR and CWR suggest no net expansion nor contraction of jurisdictional stream length would be expected.

Compounding the uncertainty in the stream network, the three WOTUS definitions also include uncertainty in which wetlands are jurisdictional. Depending upon the stream network considered jurisdictional, the 2018 redefinition protects a minimum of 61.2–92.6% of wetlands in the basin, while the pre-CWR and CWR guarantee protections to 75.3–99.8% and 76.6–97.3% of all wetlands, respectively. If the significant nexus tests were applied at their most generous (i.e., extending protections to all possible wetlands), the pre-CWR would protect up to 100% of wetlands in the basin, while the CWR would protect 96.9–100%. The ranges are defined by the difference between considering the most contracted stream network (defined by draining more than 1 mi²) and the most expansive stream network (defined by draining more than 0.01 mi²). Overall, we conclude the CWR does not definitively expand nor contract the CWA's jurisdiction. However, the requirement for direct abutment of wetlands to jurisdictional streams in the 2018 redefinition results in a potential decrease of at least 4.7% and as much as 38.8% of wetlands in the basin.

THE CLEAN WATER RULE DECREASED THE REGULATORY BURDEN REQUIRED FOR JURISDICTIONAL DETERMINATIONS

The changes in definitions of wetland jurisdiction are subtle as written, but important when considered across river basins. We consider three types of wetlands: (1) those that are jurisdictional by rule (unequivocally protected); (2) those for which an agency determination or significant nexus test would be required; and (3) those which are not jurisdictional by rule (**Table 1**). For stream networks defined by drainage of at least 0.4 mi², the CWR reduced the area of wetlands that are jurisdictional by rule. For more extensive stream networks (e.g., those defined by draining 0.01 to 0.4 mi²) jurisdictional wetland area increases compared to the pre-CWR (**Supplementary Figure 2**).

Within the range of networks considered (0.01–1.0 mi²), the wetland area subject to determinations or significant nexus tests was not necessarily reduced (**Figure 1**). The area of wetlands requiring a significant nexus test is larger for the CWR than pre-CWR for more expanded networks (draining <0.4 mi²), while the area requiring a significant nexus test is decreased for more contracted networks. This conflicts with one stated goal of the CWR, to reduce uncertainty and the need for regulatory determinations to be made on a case-by-case basis. By comparison, the 2018 redefinition includes no uncertainty, as only wetlands that directly abut the river network are considered jurisdictional. Finally, the CWR created a class of wetlands that are not jurisdictional by rule and require no significant nexus

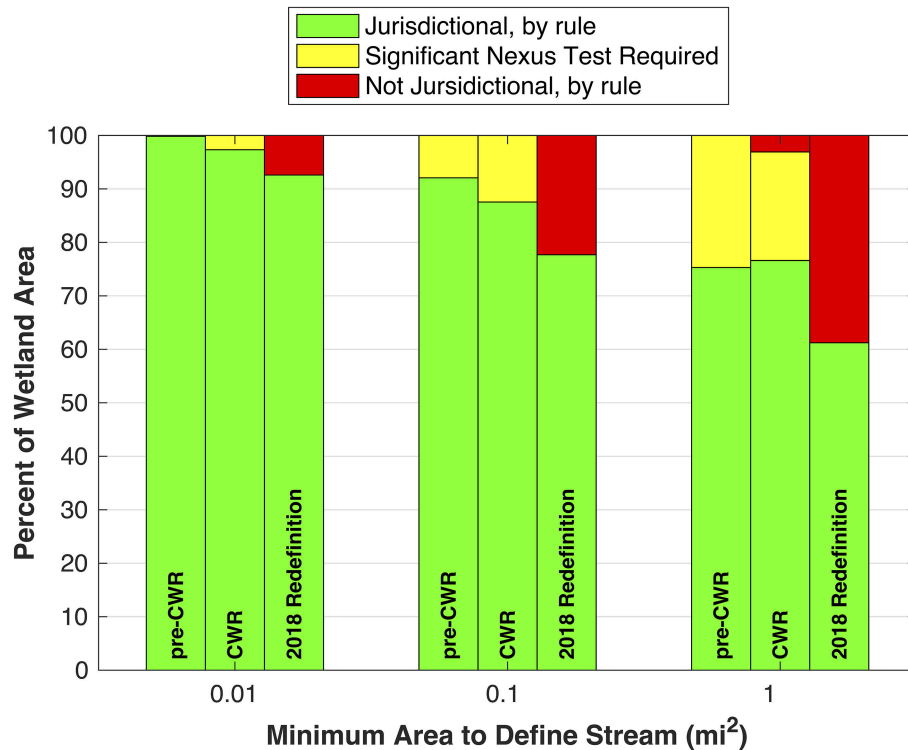


FIGURE 1 | Percentage of wetland area in the Wabash River basin that is unquestionably jurisdictional (i.e., guaranteed protection), requires a significant nexus test to determine jurisdictional status, or is excluded from jurisdiction by rule (i.e., no protection possible). The definition of a stream includes uncertainty in all three rules; however, the more contracted network definitions (i.e., only considering larger streams as jurisdictional; right-most column) result in reduced protection of wetlands.

test. For the CWA, this definition becomes important at the point where jurisdictional streams are defined by more contracted networks (draining more than about 0.4 mi²).

THE 2018 REDEFINITION REDUCES PROTECTIONS FOR WATER RESOURCES

One significant change in the 2018 redefinition is eliminating the longstanding definition of stream networks based on bed, banks, and evidence of flow and replacing it with one requiring intermittent or perennial flow. The emphasis on perennial and intermittent flow, and explicit exclusion of ephemeral flow, would likely result in a bias toward more contracted network definitions. As a consequence, the more contracted network has less wetlands either directly abutting or within specified buffers. Across any buffer considered, such as the pre-CWR 500-ft buffer or upper limit of 4,000-ft in the CWR, the total area of wetlands that are jurisdictional by rule or by significant nexus test decreases due to the more contracted stream network (**Figure 1**).

The 2018 redefinition significantly increases the wetlands that are not jurisdictional by rule, permanently removing protections for 7–39% of wetlands in the Wabash River Basin. In contrast, the pre-CWR and CWR at least allowed the possibility of protections based on a significant nexus test. In this way, the 2018 redefinition does yield an overall reduction in uncertainty and regulatory

burden, but does so at the expense of wetland protections and in opposition to longstanding regulatory guidance and practice.

REQUIRED SCIENTIFIC ADVANCES TO INFORM THE FUTURE OF THE CLEAN WATER ACT

Since 1972, CWA jurisdiction expanded as our scientific understanding of the connection between water resources and their landscapes evolved. However, Congress has never updated its definition of jurisdiction, leaving courts, and agencies to work out practicalities of enforcement. To inform evolving policy guidance, agency rules, and corrective legislation, we identify two key areas of scientific inquiry that should be advanced.

First, the 2018 redefinition does not solve the question of jurisdictional uncertainty for the CWA. Instead, it moves the debate from defining a significant nexus to defining streams and their flow characteristics (e.g., what is a typical year?). Although the 2018 redefinition opposes decades of regulatory norms (USGAO, 2004), guidance (USDOD, 1986; USEPA and USDOD, 2008), and scientific consensus (USEPA, 2015), it does provide a clear definition to regulators with respect to which wetlands are considered jurisdictional. However, the 2018 redefinition defines streams based on intermittent or perennial flow in a typical year. Notably lacking are definitions, or even

guidance, as to what constitutes sufficient frequency of flow to establish jurisdictional status, nor how a typical year is defined in comparison to a flood or drought year. Moreover, the idea of a 30-year moving window implies stationarity in the system (i.e., past observations as indicative of present and future conditions). In contrast, hydrologists broadly recognize that changing climate has removed stationarity from the system (Milly et al., 2008), which sets up a time-variable definition of jurisdictional status for intermittent streams. The static, proximity-based jurisdictional basis is an oversimplification of how healthy ecosystems function and are connected within the landscape. Scientists should pursue a robust and transferable methodology to make decisions that acknowledge the physical, chemical, and biological connectivity between waters to resolve uncertainty in enforcement. Such an advance could standardize the significant nexus test and yield a spatial data set, possibly even with varied degrees of certainty as are present on FEMA's maps of regulatory floodplains.

The definitions necessary for the Clean Water Act draw an artificial separation of surface- and groundwaters, despite widespread recognition that they interact rapidly across many spatial and temporal scales (e.g., Winter et al., 1998). The evolving WOTUS definitions to date slowly advanced upstream from traditionally navigable waters into perennial tributaries, intermittent and ephemeral streams, adjacent wetlands, and non-adjacent wetlands. This is perhaps unsurprising given that the hydrologic cycle depicts all waters as occurring in a continuum, where downstream waters are integrations of upstream waters in both the surface and subsurface. Similarly, aquatic ecosystems reflect an integration of their tributary watersheds, including terrestrial components. The challenge to regulators is, then, to craft guidelines that acknowledge the connectivity of waters and ecosystems without extending jurisdiction to encompass all waters and landscapes.

The Clean Water Rule and its associated scientific synthesis report specifically address subsurface connectivity as a valid basis for establishing a significant nexus under the Clean Water Act (USEPA, 2015). This is in contrast to the general absence of groundwater protections within the Clean Water Act itself, whereas most groundwater protections are either

administered at the state level or via the Safe Drinking Water Act [42 U.S.C. §300f et seq.]. Most recently, two pending petitions ask the U.S. Supreme Court to resolve a split among federal courts about a different connection between downstream waters and point-source discharges (*County of Maui, Hawaii v. Hawaii Wildlife Fund*, 2019; *Kinder Morgan Energy Partners, L.P. v. Upstate Forever*, 2019). They involve the question of how connected discharges to groundwaters must be to establish jurisdiction under the CWA's WOTUS jurisdiction. This emphasizes the importance of science-based information to define the magnitudes and timescales within which waters should be considered connected for regulatory purposes, and beyond that which waters should be considered disconnected. Better understanding of impacts can help answer the most controversial legal questions at stake in agencies and courts.

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RW and AW collaboratively conceived of this project and prepared the manuscript. RW conducted spatial data analyses.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/frwa.2019.00001/full#supplementary-material>

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