Report on the Repeal of the Clean Water Rule and its Replacement with the Navigable Waters Protection Rule to Define Waters of the United States (WOTUS)

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EXECUTIVE SUMMARY

In June 2015, the U.S. Environmental Protection Agency (EPA) and the Army Corps of Engineers (Army Corps) published the final Clean Water Rule: Definition of Waters of the United States (Clean Water Rule). Unlike many major environmental regulations, the Clean Water Rule did not propose new environmental standards or policy instruments to achieve those standards. Instead, it sought to standardize the characteristics of water bodies that are subject to a variety of regulations under the Clean Water Act (CWA) – those that are considered “Waters of the United States” (WOTUS) – with a particular focus on those waters in the legal “gray areas” that have prompted litigation over the past several decades. These include small headwaters, “isolated” wetlands, and ephemeral and intermittent streams. WOTUS jurisdictional definitions determine which waterbodies are subject to CWA regulations, affecting agricultural operations, construction and land development projects, and other activities that involve things like filling of wetlands or increasing runoff of water pollutants into the bodies of water in contention. By the end of the Obama Administration, the fate of the WOTUS definition in the Clean Water Rule was in limbo, having been challenged in the courts and stayed in many states.

In Executive Order 13778 in February 2017, the Trump Administration announced a planned repeal of the 2015 Clean Water Rule, and in July 2017, the EPA and the Army Corps announced a two-step process in which the Rule would be first repealed, and then replaced. In this report, we review the final economic analyses (EAs) for the Clean Water Rule repeal (EPA-Army 2019) and its replacement with the Navigable Waters Protection Rule (EPA-Army 2020a), which became effective in June 2020 and is now the subject of several legal challenges, itself.¹ In comparison to its repealed predecessor, the Navigable Waters Protection Rule narrows the scope of federal jurisdiction under the CWA – it removes from federal jurisdiction many waters that had been considered WOTUS under the 2015 Clean Water Rule, especially isolated wetlands and ephemeral streams. It is not clear exactly what share of U.S. waters are affected by the repeal and replacement, but a 2017 EPA and Army Corps staff analysis suggested that the affected waters would include about 18 percent of U.S. streams (including 35 percent of streams in the arid West) and just over one-half of U.S. wetlands.²

In January 2020, the External Environmental Economics Advisory Committee³ approved our proposal to evaluate a series of economic questions raised by the EPA/Army Corps repeal and replacement rules codifying a narrower definition of WOTUS. After a brief introduction to the history of WOTUS definitions and litigation, we address four major topics: the agencies’ application of economic theory, especially the concept of federalism in environmental regulation; the quality and impact of the agencies’ assumptions in their benefit-cost analyses about likely state reactions to narrowing CWA jurisdiction (i.e., the “federalism scenarios”); the methods used to estimate the forgone benefits from reducing CWA jurisdiction; and the avoided cost estimates in the EAs.⁴ Here in the executive summary, we summarize five key findings.

² Media reports have noted that this analysis was not included in the repeal and replacement EAs. See: https://www.eenews.net/stories/1060109323, and https://www.eenews.net/assets/2018/12/11/document_gw_05.pdf.
³ The External Environmental Economics Advisory Committee (E-EEAC) is an independent organization dedicated to providing up-to-date, non-partisan advice on the state of economic science as it relates to the U.S. EPA’s programs. See https://www.e-eeac.org for more information.
⁴ We include as Appendix 1 the original charge questions for our committee’s work.
The agencies’ assertion in the EAs that water quality is a “local public good” is inconsistent with the best available science on hydrologic connectivity and ignores transboundary pollution.

The EAs for the Clean Water Rule repeal and its replacement, the Navigable Waters Protection Rule, both assert that “…states may be in a better position than the federal government to regulate local environmental public goods (e.g., water quality),” but the best available research in science and economics contradicts this statement. With respect to water quality science, the jurisdictional WOTUS guidelines in the Clean Water Rule were supported by an extensive analysis of scientific publications, peer-reviewed by an expert panel appointed by the EPA Science Advisory Board. This work showed that the waters affected by the repeal and replacement (e.g., non-floodplain wetlands, intermittent and ephemeral streams) are connected biologically, chemically and physically to downstream waters. Additional peer-reviewed research published since 2015 supports these findings, and neither the repeal nor the replacement EA provides any new evidence to suggest that the science supporting the original rule was faulty.

The science suggests that the affected waters are connected to downstream waters, and many state borders are arbitrary with respect to hydrological features such as watershed boundaries (for example, the three case-study watersheds analyzed in the EAs all cross multiple state lines). Under these conditions, the narrowing of CWA jurisdiction will likely result in transboundary pollution. The basic theory of efficient regulatory decentralization assumes that there is no transboundary pollution, and the empirical literature in economics suggests that in the presence of such externalities, water quality is likely to decrease. Even if water science did not contradict the arguments in the repeal and replacement analyses, conclusions from the literatures on interest group politics and competition in regulatory stringency would be additional reasons to worry about decentralization. Thus, in our view, the theoretical justification for decentralization in this case is weak. We recommend that in future rulemakings, EPA and the Army Corps assess the potential importance of inter-state spillovers from reducing the CWA’s scope, and if they are significant, correct the assertion that water quality in this context is a “local public good.”

The agencies’ prediction that many states will regulate waters newly removed from the CWA’s reach has a strong impact on the benefit-cost analysis, and it is inconsistent with states’ prior behavior, our own interpretation of state laws and regulations, and EPA’s Guidelines for Economic Analysis.

In the repeal and replacement EAs, the agencies argue that if some states decide to regulate the waters from which federal protection is removed, then these states will not experience changes in water quality and their associated benefits and costs, so they are dropped from the benefit-cost analysis. The agencies’ approach is very unusual; we cannot find another example in contemporary regulatory impact analysis. The agencies construct a counterfactual to federal regulation that is speculative to a degree that appears to violate EPA’s Guidelines for Economic Analysis, categorizing each U.S. state according to its likelihood of assuming (in whole or in part) the federal role for the waters being removed from federal jurisdiction. In the ensuing analysis, they exclude 23 states considered most likely to protect these waters from the benefit and cost calculations, and they exclude an additional 8 states in their most optimistic scenarios. Not surprisingly, excluding dozens of states from the benefit-cost calculations has a large impact on national net benefit estimates.
The prediction that dozens of states will assume jurisdiction over the waters newly removed from federal CWA jurisdiction is inconsistent with states’ prior behavior, as well as EPA’s Guidelines. For example, in 2001, a Supreme Court decision removed federal protection from a large share of U.S. wetlands when it overturned the Migratory Bird Rule; in response, only a few states moved to expand their own jurisdiction over some of the affected waters over the following two decades.

The agencies’ predictions are also inconsistent with our interpretation of state laws. They apply three criteria to make these predictions – whether states: (1) currently regulate surface waters more broadly than the CWA requires; (2) have “broad legal limitations” on regulating beyond federal jurisdiction; and (3) currently have a “dredge-and-fill” program for wetland regulation. Based on a state-by-state review, we show that the agencies were more optimistic than the data would justify in their application of all three criteria. Given the flaws in the agencies’ predictions about the likelihood of state action, and the large effect of this subjective approach on the benefit and cost estimates, we recommend that the agencies avoid this subjective approach to predicting the likely reactions of state regulators in future rulemakings, and that stakeholders avoid interpreting any of the numbers in the “federalism scenarios” within the EAs.

(3) The agencies’ approach to environmental federalism in the repeal and replacement rules has important implications for other federal regulations, which underscores the need for guidelines for objective practice, as well as retrospective analysis.

The fact that an environmental problem (such as surface water pollution) has some local effects does not mean that economic analysis would always or even usually imply that local rather than federal regulation produces better environmental and economic outcomes. The potential reach of the agencies’ theoretical and empirical arguments for decentralization in the Clean Water Rule repeal and replacement is broad. Many of the major U.S. environmental statutes assert federal jurisdiction over matters that could alternatively be decentralized to states. Congress debated this kind of decentralization during the 1970s when the major statutes (including the CWA) were passed and revisited it again in the 1990s, when the 1990 Clean Air Act Amendments and 1996 Safe Drinking Water Act Amendments arguably further expanded the federal role. As we highlight in detail in our report, there are arguments on both sides of this debate, but the theoretical and empirical approach in this particular case for decentralization is not convincing. However if this federalism analysis is going to be applied in other regulatory settings, we recommend that the agencies seek guidance from the Office of Management and Budget, the EPA Science Advisory Board, or other institutions that provide best practices for regulatory impact analysis, to ensure that the process is carried out objectively and carefully. Retrospective analysis, in which the Agencies examine ex post the accuracy of their state behavior predictions, seems particularly important.

(4) The meta-analysis used to estimate the forgone benefits of removing wetlands from CWA protection is generally well done, but its subsequent use for predicting wetland damages was less so, and the approach would benefit from additional transparency and sensitivity analysis.

In their original analysis for the Clean Water Rule repeal, the agencies eliminated prior estimates of forgone benefits from reducing federal wetlands protection, an approach economists criticized (Boyle et al. 2017).
In the final repeal and replacement EAs, the agencies instead implement a meta-analysis to estimate the forgone wetland benefits from narrowing CWA jurisdiction, leveraging existing local studies that provide estimates of wetland benefits in specific locations, and combining them in a statistical framework that allows geographic and socioeconomic factors to influence the transfer of benefit values. The statistical model is then used to predict wetland values in areas where no original studies exist. This approach is far preferable to eliminating the wetland benefit estimates altogether, and our review concludes that the agencies’ meta-analysis meets the standards for best practice.

Like any statistical model, however, many researcher choices – which existing wetland benefit estimates to include or exclude, how to specify the regression equations, and which parameters and choices to select for sensitivity analysis – influenced the overall estimates produced by the model. We conclude that the meta-regression itself was well executed but its subsequent use for predicting losses was less so, and many of the decisions appear to bias downward the estimates of losses. We highlight several changes to the approach included in the final EAs that, in our view, would have provided additional transparency and potentially better estimates of forgone wetland benefits. In particular, we recommend that in future rulemakings the agencies avoid assuming that the damages from wetland losses stop at state borders, that they include a wider range of revealed and stated preference studies in their models valuing wetland losses, and that they provide more transparency on the sensitivity of benefit predictions to changes in key prediction parameters.

(5) The selection of sites for the agencies’ case studies does not serve the stated objectives for this portion of the EAs in terms of representativeness, scope of impacts assessed and monetized, or integration with the national benefit-cost analysis.

In addition to estimating the national benefits and costs of the replacement rule, the agencies implemented case studies in three different watersheds comprising parts of the Ohio River Basin, the Lower Missouri River Basin, and the Rio Grande River Basin. This approach had the potential to provide more detailed benefit and cost estimates in specific locations and illustrate the full range of potential outcomes from narrowing WOTUS jurisdictional definitions. Unfortunately, the case studies did not fulfill this role, for several reasons.

First, like the national benefit-cost analysis, the case studies only monetize estimates of the impacts on the wetlands regulatory program, and not the other parts of the CWA affected by the Clean Water Rule repeal and replacement; the more detailed data and water-quality modeling available in these watersheds should have allowed monetization of additional impacts. Second, the three chosen watersheds are all in states that are strongly skewed to the bottom of the list of state net benefits in the national analysis, so that the fact that net benefit numbers in the case studies are even more strongly favorable to the rule than the national estimates is not very illuminating. Choosing case studies from both the low and the high end of the spectrum of anticipated impacts (benefits and costs) would have been more informative. Finally, consistent with the EAs as a whole, the case studies ignore inter-connectedness between the affected waters and those downstream, contrary to the best available science. This is ironic, given that all three case-study watershed boundaries include multiple states (KY, IN, OH and WV in the Ohio case study; CO, KS, NE and MO in the Missouri case study; and TX and NM in the Rio Grande case study). This highlights the potential importance of inter-state water quality spillovers under the CWA and provides additional grounds to critique the federalism arguments made in the EAs.

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Given our findings, we recommend that future case-study approaches to evaluating the benefits and costs of WOTUS rulemakings select watersheds more likely to demonstrate the geographic heterogeneity of potential impacts, rather than choosing those likely to see low impacts. We also suggest that the agencies use the case studies to quantify and monetize a fuller range of potential benefits and costs.

The Obama Administration’s 2015 Clean Water Rule had estimated national economic impacts ranging from a net cost of $134 million per year to a net benefit of $439 million per year (EPA-Army 2015).7 The Trump Administration’s 2020 Navigable Waters Protection Rule has estimated national economic impacts ranging from a net cost of $310 million per year to a net benefit of $484 million per year.8 Both the old and the new rule have a wide range of net impacts, crossing zero in each case. Our report identifies several ways in which the Agencies may have underestimated the forgone benefits of repeal and replacement (for example, by only focusing on impacts to wetlands acreage, and through their process of benefit transfer). However, were the EPA and Army Corps to make all of our suggested changes to their EAs for the repeal and replacement, we cannot say whether the resulting benefit and cost estimates would look very different. On this basis, compared to other controversial rulemakings, such as the recent changes to the federal Mercury and Air Toxics Rule (Aldy et al. 2019), the stakes in the case of WOTUS may seem smaller.

However, as a precedent for future EAs, the agencies’ theoretical arguments about the efficiency of decentralized environmental regulation and the empirical application of these arguments within the two recent WOTUS EAs are worthy of attention and further discussion by economists, lawyers and policymakers. Our report does not view the EAs’ theoretical arguments for decentralization of CWA regulation as strong, but they could be appropriate in other cases. In contrast, the empirical approach of dropping states from benefit-cost calculations based on speculation about their future actions is not sound in the case of the recent WOTUS EAs, and it is unlikely to be sound in other regulatory contexts. We hope that by highlighting these important challenges, our report will lead to a rigorous discussion of whether and how agencies should deal with these issues in future environmental regulation.

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6 States in the case studies are: KY, IN, OH and WV in the Ohio case study; CO, KS, NE and MO in the Missouri case study; and TX and NM in the Rio Grande case study.

7 We convert estimates in EPA-Army (2015) from $2014 to $2018, for consistency with the estimates from the repeal and replacement rules reviewed in this report.

8 We use data from Tables ES-7 and ES-8 in EPA-Army (2020a) to make these calculations, described further in Section 3 of the report.
INTRODUCTION

U.S. federal agencies must complete a rigorous benefit-cost analysis, also known as a regulatory impact analysis or economic analysis (EA), for all major rules – those with expected annual costs of $100 million or more. This threshold, unadjusted for inflation, was established by executive order during the Reagan Administration, and it covers both new rules and proposals to repeal existing rules. The requirement is not a strict benefit-cost test; agencies may still promulgate and implement rules for which the monetized costs exceed monetized benefits. Nonetheless, these EAs of major rules are important inputs to the U.S. environmental policy process.9

In this report, we assess several different aspects of the EAs that accompanied a multi-step rulemaking, repeal and replacement process under the Clean Water Act (CWA), from the Obama Administration’s 2015 Clean Water Rule to the repeal of that rule by the Trump Administration and its replacement with the Navigable Waters Protection Rule in 2020. The CWA governs the discharge of pollution into “navigable waters,” defining those as “the waters of the United States, including territorial seas.”10 The CWA does not itself define “waters of the United States” (WOTUS) further, leaving jurisdictional determinations to the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (Army Corps).

The rules regarding the definition of WOTUS do not propose new environmental standards or policy instruments to achieve those standards. Instead, they seek to standardize the characteristics of water bodies that are subject to a variety of CWA regulations, with a particular focus on those waters in the legal “gray areas” that have prompted litigation, including small headwaters, “isolated” wetlands, and ephemeral and intermittent streams. These jurisdictional definitions matter on the ground for agricultural operations, construction and land development projects, and other activities that involve things like filling of wetlands, or increasing runoff of water pollutants into the bodies of water in contention.

Section 1 of our report provides background information on the regulatory context and the history of WOTUS litigation. Section 2 assesses the use of economic theory (particularly the theory of environmental federalism) to justify the Trump Administration’s repeal and replacement process that narrows the scope of CWA jurisdiction. Section 3 gauges the impact of a key aspect of the recent WOTUS EAs – the integration of predicted state reactions into the estimation of benefits and costs. Section 4 evaluates the methods used to estimate and monetize the forgone benefits from narrowing CWA jurisdiction, in terms of lost wetlands acreage. Section 5 considers the quality of the case studies in the Agencies’ EAs, and Section 6 considers the quality of the included cost estimates.

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9 The treatment of benefit-cost analysis within the individual environmental statutes ranges from a requirement for all new drinking water standards under the Safe Drinking Water Act, to the Clean Air Act’s prohibition on the consideration of costs in setting the National Ambient Air Quality Standards (Morgenstern 2000). Even where benefit-cost considerations are excluded from the statutes, however, presidential executive orders from all administrations, of both political parties, since Richard Nixon have sustained and modified the EA requirement over time (Hahn et al. 2003).

10 CWA, 33 U.S.C. Sec. 1362(7)
What is the regulatory context in which the Clean Water Rule was promulgated, then repealed, and then replaced with the Navigable Waters Protection Act to define “Waters of the United States” (WOTUS)?

The CWA is the primary federal law that governs water quality in the United States. The waterbodies to which the CWA applies have been at the center of several recent Supreme Court Cases and have received much attention during the Obama and Trump administrations. As noted above, the definition of WOTUS has been left to regulation by the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (Army Corps), the two agencies with jurisdiction over parts of the CWA, which have frequently made these decisions on a case-by-case basis.

Efforts to define WOTUS have a long history. Agency regulations were issued in 1977, 1980, 1982, 1986, and 1988 (Figure 1). In 1981, EPA proposed a rule defining WOTUS that was also put out for rulemaking by the Corps in 1982. By 1983 EPA and the Corps had adopted what became known as the joint definition of WOTUS:

“(a) All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of tide;

(b) All interstate waters, including interstate “wetlands”;

(c) All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, “wetlands,” playa lakes, or natural ponds the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters: (1) Which are or could be used by interstate or foreign travelers for recreational or other purposes; (2) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or (3) Which are used or could be used for industrial purposes by industries in interstate commerce;

(d) All impoundments of waters otherwise defined as waters of the United States under this definition;

(e) Tributaries of waters identified in paragraphs (1)-(4) of this definition;

(f) The territorial seas; and

(g) “Wetlands” adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a)-(f) of this definition.”

11 Also known as the Federal Water Pollution Control Act, 33 U.S.C. 1251 et seq.
The scope of the statutory and regulatory definitions was challenged in several high-profile wetlands cases that reached the U.S. Supreme Court. The first of these was *United States v. Riverside Bayview Homes, Inc., et al.* in 1985. Riverside Bayview Homes, Inc. owned land near the shores of Lake St. Clair, Michigan. After the company began filling wetlands on its property, the Army Corps brought the case to Federal District Court. The Army Corps argued that a landowner was required to obtain a permit before filling wetlands adjacent to navigable waters. When the case reached the Supreme Court, the court sided in a unanimous ruling with the Army Corps, arguing that the requirement of a permit was reasonable and that wetlands adjacent to navigable waters fell within the scope of the CWA.

**FIGURE 1. WOTUS Timeline**
In 2001, arguments over WOTUS again reached the Supreme Court in *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Eng’rs (SWANCC)*. The SWANCC case featured a consortium of suburban municipalities near Chicago, IL. The municipalities wanted to use an abandoned sand and gravel mine for a landfill. However, in the several decades since it had been abandoned, some of the excavation trenches in the mine had become permanent and seasonal ponds that provided habitat for migrating birds. The Army Corps denied the consortium a permit to fill these ponds. The Army Corps argued that it had jurisdiction over these isolated waters since they were connected to navigable waters through what was known as the Migratory Bird Rule, which had been adopted by EPA and the Army Corps in 1986, and asserted that even isolated waters fell within CWA jurisdiction if they were habitat for migratory bird species that cross state lines. However, in a 5-4 majority opinion, the Supreme Court sided with SWANCC and argued that the Migratory Bird Rule was not supported by the CWA. The decision led to numerous challenges as to whether certain isolated waters fell under the CWA’s regulatory scope.

In 2006, the Supreme Court again took up the issue of whether the CWA regulates isolated waters. In *Rapanos v. United States*15, two developers, John Rapanos and June Carabell argued that properties that they owned, isolated from traditional navigable waters, did not fall under CWA jurisdiction. No majority of justices supported any of Rapanos’ three opinions. The plurality opinion16 from Rapanos limited WOTUS to:

“only those relatively permanent, standing, or continuously flowing bodies of water ‘forming geographic features’ that are described in ordinary parlance as ‘streams[,] . . . oceans, rivers, and lakes.’” 17

In his concurring opinion, Justice Kennedy rejected the plurality test and instead focused on whether or not a water has a “significant nexus” with a navigable water.18 In response to Rapanos, EPA and the Army Corps issued guidance explaining that the “significant nexus” standard applied to the prior EPA and Corps joint definition was the “controlling” standard to make jurisdictional determinations.19 This guidance is often referred to as the 2008 Rapanos Guidance and left the door open for many case-by-case determinations of a “significant nexus.”

In June 2015, EPA and the Army Corps published the final Clean Water Rule: Definition of Waters of the United States (Clean Water Rule).20 The rulemaking relied upon the “significant nexus” standard and sought to standardize the characteristics of water bodies that would be subject to a variety of CWA regulations.21 In making this rule, the Agencies sought to significantly reduce the number of case-by-case WOTUS determinations.

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16 A plurality opinion occurs when a majority of the judges agree on the result of a case, but not the reasoning.
17 *Rapanos*, at 739.
18 *Id.* at 779.
21 Id. at 37,057.
The Clean Water Rule was challenged immediately in the courts, with disagreement over which federal court level had jurisdiction. The issue was resolved in favor of the district courts. Those district courts stayed the rule in many states, which had the effect in those states of reverting to the pre-2015 guidance from the EPA and the Army Corps that had been used to make jurisdictional determinations on a case-by-case basis (Figure 2). Thus, by the end of the Obama Administration, the fate of the WOTUS definition in the Clean Water Rule was in limbo.

**FIGURE 2. Applicability of the 2015 Clean Water Rule by U.S. State in July 2019**

In Executive Order 13778 in February 2017, the Trump Administration announced a planned repeal of the stayed 2015 Clean Water Rule. In response, EPA and the Department of Defense published an “Intention to Review and Rescind or Revise the Clean Water Rule.” Implementing a two-step process to that end, EPA and the Army Corps issued an advance notice of proposed rulemaking in July 2017 seeking comment on repeal of the 2015 rule.

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25 In addition to the two-step repeal and replace plan, the Trump Administration engaged in a third rulemaking process designed to suspend the Clean Water Rule until February 2020. While the Clean Water Rule stated that it was effective as of August 28, 2015, EPA and the Corps published a separate final rule (Applicability Date Rule), which added a new “applicability date” of February 6, 2020, to the Clean Water Rule. See 83 Fed. Reg. 5,200, (Feb. 6, 2018). This delay was also litigated, and federal courts determined that the EPA and the Corps had violated the Administrative Procedures Act in the delay proposal.
In July 2018, EPA and the Army Corps issued a supplemental notice seeking additional comment on the repeal of the 2015 Clean Water Rule.\textsuperscript{26} The agencies then issued a proposed rulemaking for a replacement WOTUS jurisdictional determination in February 2019.\textsuperscript{27} This rule, known as the Navigable Waters Protection Rule, was finalized in April 2020, with an effective date of June 20, 2020, and it is now the subject of several legal challenges.\textsuperscript{28} In comparison to its repealed predecessor, the Navigable Waters Protection Rule promulgated under President Trump narrows the scope of federal jurisdiction under the CWA – it removes from federal jurisdiction many waters that had been considered WOTUS under the 2015 Clean Water Rule, especially isolated wetlands and ephemeral streams. It is not clear exactly what share of U.S. waters are affected by the repeal and replacement, but 2017 EPA and Army Corps staff analysis suggested that the affected waters would include about 18 percent of U.S. streams (including 35 percent of streams in the arid West) and just over one-half of U.S. wetlands.\textsuperscript{29}

Given its convoluted history, five EAs are associated with the recent WOTUS processes – one each for the 2015 Clean Water Rule, a 2017 repeal proposal, the 2019 repeal final rule, the 2019 draft of the replacement rule, and the final 2020 Navigable Waters Protection Rule.\textsuperscript{30} Estimated benefits and costs of these rules vary widely, especially on the benefits side. Our analysis in Sections 2 through 6 focuses on the final EAs for the 2019 repeal of the Clean Water Rule (originally promulgated in 2015) and its final replacement, the 2020 Navigable Waters Protection Rule.

\begin{itemize}
  \item \textsuperscript{26} 83 Fed. Reg. 32,227 (July 12, 2018).
  \item \textsuperscript{27} 84 Fed. Reg. 4,154 (Feb. 14, 2019).
  \item \textsuperscript{29} Media reports have noted that this analysis was not included in the repeal and replacement EAs. See: \url{https://www.eenews.net/stories/1060109323}, and \url{https://www.eenews.net/assets/2018/12/11/document_gw_05.pdf}.
  \item \textsuperscript{30} The 2017 repeal proposal was never finalized via publication in the \textit{Federal Register}.
\end{itemize}
Did EPA and the Army Corps correctly apply economic theory when they argued in their economic analyses that reducing the scope of federal jurisdiction over water quality could improve efficiency?

When the Agencies prepared the EAs supporting the repeal and replacement of the Clean Water Rule, they implemented a set of scenarios that make different assumptions about how individual states will react to the narrowing of CWA jurisdiction. We refer to this as the agencies’ “federalism analysis,” and it is a not an approach used (to our knowledge) in any prior federal rulemaking. In their federalism analysis, the agencies predict that some states may react to the narrowing of federal jurisdiction by enacting their own new rules that bring the affected waters under state control. If this occurs, the agencies argue, then the narrowing of federal jurisdiction will not actually create benefits or costs in these states (though it may shift the distribution of costs from federal to state entities). Thus, the states presumed to take this approach are simply removed from the agencies’ estimation of national economic impacts in the federalism scenarios.

We discuss the actual classification of states with respect to their likely responses to changes in CWA jurisdiction, and the impact of this approach on the benefit and cost estimates, in Section 3. In this section, we assess the quality of the theoretical discussion in the EAs that underpins this novel approach. The repeal and replacement EAs both include discussions of the theory of federalism as it applies to environmental regulation. This discussion provides theoretical support for the agencies’ approach to incorporating anticipated state regulator responses to reducing the jurisdiction of the CWA.31

Both EAs contain the following statement in their Executive Summaries, referring to an environmental federalism literature review (Fredriksson 2018) and associated peer review reports (MDB, Inc. 2019), commissioned by the Agencies:

“The federalism literature illustrates that states may be in a better position than the federal government to regulate local environmental public goods (e.g., water quality). When given more flexibility over which waters to regulate, states may be able to direct resources toward their high priority waters and limit expenditures on their low priority waters, thereby maximizing the net benefits derived from their waters” (EPA-Army 2020a, p. xii; EPA-Army 2019, p. ix).

This argument raises three important issues related to the theory of federalism in the context of environmental regulation, which we discuss in more detail below. First, the statement hinges critically on the extent to which “water quality” in the context of these rules is, in fact, a “local public good”; our interpretation of the literature suggests that in many cases it may not be. Second, the discussions give little weight to the literatures on the political economy of interest groups and the risk of a “race to the bottom,” both important considerations relevant to the CWA. Third, the question of economies of scale in permitting and other regulatory activity is important and germane, but is not fully explored in the analyses.

31 The language on the theory of federalism in both EAs (EPA-Army 2020a, EPA-Army 2019) is very similar, thus we address this issue for the two studies taken together, rather than discussing each individually.
Finally, both EAs use concepts from the economic theory of pollution control to suggest – explicitly or implicitly – that regulating water quality in “smaller” waters is likely to have lower marginal benefits than similar regulation in larger waters. Given our reading of water quality science, we cast doubt on this idea.

2.A. “Water quality” may not be a “local public good” in the context of the Clean Water Rule repeal and replacement.

If water quality in the waters on the jurisdictional margin between the Clean Water Rule and the Navigable Waters Protection Rule is a local public good, then local and national benefits are identical (since all benefits are local). In this case, states acting to maximize “the net benefits derived from their waters” will maximize national net benefits (with several caveats, discussed below). If, however, the quality of the waters on the jurisdictional margin is not a local public good – that is, if actions within one state’s marginal waters affect others – then states maximizing their individual net benefits will create external costs and benefits, a common economic justification for federal regulation. The EAs supporting the Clean Water Rule repeal and the Navigable Waters Protection Rule take the first view. The scientific literature indicates that the second view applies to many of the relevant waters, and the economic literature suggests that states export water quality damages to their downstream neighbors in many settings fitting these conditions.

The scientific literature indicates that non-floodplain wetlands, intermittent and ephemeral streams, and other waters pulled from one side of the jurisdiction determination to the other by the Clean Water Rule repeal and replacement are connected biologically, chemically and physically to downstream waters. Many state borders are arbitrary with respect to hydrological features on the landscape, such as watershed boundaries. Thus, the statement in both economic analyses that water quality in the affected water bodies is a “local public good” contradicts much scientific evidence. Information on the extent of inter-state spillovers from these regulatory changes would seem to be essential to determining whether the federalism argument is justified. No such information is presented in the EAs.

The 2015 Clean Water Rule’s jurisdictional guidelines are supported by an extensive analysis of scientific publications (U.S. EPA 2015b), peer-reviewed by an expert panel appointed by EPA’s Science Advisory Board (U.S. EPA 2015c). This report, a more recent *amicus curiae* brief filed by the Society of Wetland Scientists (Society of Wetland Scientists 2018), and peer-reviewed papers published since the original report (e.g., Brooks et al. 2018, Cohen et al. 2016, Colvin et al. 2019, Evenson et al. 2018, Gardner et al. 2019, Golden et al. 2019, Lane et al. 2018), suggest that the Agencies’ jurisdictional guidelines in the original Clean Water Rule were supported by the best available science. Indeed, the primary basis for multiple lawsuits filed by environmental groups regarding the Navigable Waters Protection Rule when it was finalized in April 2020, and subsequent filings by 17 states and 2 cities in May 2020, is that the replacement rule’s jurisdictional guidelines are arbitrary and contrary to the best available science, in violation of the Administrative Procedures Act. Given the litigious history of the definition of WOTUS under the CWA, it is perhaps not surprising that several lawsuits have already been filed regarding this latest development. However, we note that neither the repeal nor the replacement rule provides any new scientific analysis, nor any evidence that the peer-reviewed scientific analysis of the connectivity question for the original rule was faulty.  

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32 The commissioned review of the economic literature, Fredriksson (2018) lists “Isolated wetlands, intermittent or ephemeral streams, and other geographically restricted waters without unique species...” (p. 2) as examples of “local public goods.” We would simply note that this contrasts strongly with the scientific literature cited above, and that Fredriksson (2018) includes no citations to the literature justify this statement.
Citing the Agencies’ commissioned environmental federalism review (Fredriksson 2018), both EAs discuss the fact that the basic theory of efficient regulatory decentralization assumes no transboundary pollution (Oates and Schwab 1988), and that with transboundary pollution, decentralization can result in inefficiently weak regulation (Dijkstra and Fredriksson 2010). However, neither EA mentions the weight of scientific evidence regarding connectivity of the waters on the jurisdictional margin in the repeal and replacement, and implications for water quality impacts that cross state lines. This is a critical omission, given that agencies’ argument that decentralization will be efficient hinges on this point.

States have a theoretical incentive to export the damages from water pollution to their downstream neighbors when regulation is decentralized. Do they do so in practice? The Agencies’ commissioned review (Fredriksson 2018) addresses this empirical issue, though this portion of the literature is not discussed in either EA. Perhaps the most directly relevant study with respect to this context is by Sigman (2005), who shows that water pollution downstream of states authorized to permit facilities and to monitor and enforce standards within the National Pollution Discharge Elimination System (NPDES), a key portion of the CWA, is elevated relative to that downstream of states for which the federal government plays this role. This is precisely the kind of free-riding that federalism theory would predict in the presence of inter-state pollution under the CWA, though the estimated cost of this behavior appears to be modest (Sigman 2005). Helland and Whitford (2003) find a similar pattern with respect to both air and water pollutants regulated under the Toxics Release Inventory. Gray and Shadbegian (2004) observe free-riding in air emissions, but not water pollution, from pulp and paper mills near state borders. Empirical studies have also confirmed that states and countries export water pollution to downstream neighbors outside of the United States (Sigman 2002, Lipscomb and Mobarak 2017). Of these studies of free-riding and transboundary water pollution, four find evidence consistent with free-riding, and one finds no evidence for free-riding in water pollution (only for air pollution). On balance, this would appear to be a concern in the context of the Clean Water Rule repeal and its replacement with the Navigable Waters Protection Act. The lack of discussion of this evidence in either EA is a second critical omission in the federalism arguments put forward therein.

2.B. Even if water quality is a “local public good” in this context, decentralization of regulation may not be efficient.

Above, we suggest that if water quality in the context of the repealed Clean Water Rule and new Navigable Water Protection Rule were, indeed, a local public good, then economic theory would suggest that states maximizing their own net benefits from water resource management would maximize national net benefits, with some important caveats. Here we address two such caveats, both discussed in the EAs: the political economy of interest groups, and the “race to the bottom.”

33 This discussion appears in Section II.A.2 of both analyses, on p. 32 of EPA-Army (2019), and pp. 34-35 of EPA-Army (2020).

34 Empirical papers have also demonstrated free-riding among states with respect to other transboundary environmental concerns, such as air pollution (Monogan et al. 2017, Banzhaf and Chupp 2012) and endangered species preservation (List et al. 2002).
2.B.1. Political economy of interest groups

Arguments about the political economy of regulation provide an important counterbalance to federalism arguments in the economic literature on environmental regulation. Both EAs briefly discuss this aspect of the economic theory of regulation, which is covered more thoroughly in the Agencies’ commissioned literature review.35

Theory suggests that it is unlikely that decentralized environmental authorities will behave efficiently. Many bureaucracies undertake actions to minimize conflict or avoid attention (Hilton 1972, Joskow 1974, Leav-er 2009). Other oversight agencies may operate to maximize budgets (Niskanen 1971), or minimize costs subject to an arbitrarily chosen performance standard (Garvie and Keeler 1994). Many states may lack the administrative capacity to oversee major environmental programs (Lester 1995).

One especially notable concern, dating to an influential theory of regulation literature (Stigler 1971, Peltzman 1976) and more recently trade policy (Grossman and Helpman 1994), is that politicians and regulators maximize a combination of anticipated political support (as campaign contributions from individuals or firms, for example), and their citizens’ welfare. Observed policy outcomes, thus, reflect both factors.

Research has not clearly determined the extent to which interest groups carry greater weight for local versus national regulation (Dal Bó 2006). However, to the extent that state standards allow more decisions for interest groups to tailor to their benefits than a single set of national standards do, local decisions may allow a greater role for interest groups. If the weight of interest-group preferences is disproportionate relative to those of citizens more generally at the local level, federal standard-setting may be justified, even where pollution does not cross state boundaries.

The empirical literature with respect to interest group influence and pollution regulation, specifically, is thin. In addition, these papers focus on relative changes in interest group influence and other aspects of political economy when CWA permitting, monitoring and enforcement are delegated to the states (and EPA retains the authority to review state decisions) – not when the choice to regulate or not is delegated to the states, as is done for the waters on the jurisdictional margin in the replacement of the Clean Water Rule with the Navigable Waters Protection Rule. One analysis of NPDES inspections of pulp and paper mills suggests that the stringency of enforcement efforts by state agencies in authorized states responds to both local and national interest groups (Helland 1998). Grooms (2015), also focusing on the NPDES program, finds that state authorization does not affect violation rates, except in states with a long-run prevalence of corruption, where reported violations drop significantly post-authorization.36 Grant and Grooms (2017) find that non-profit environmental groups reduce both inspections and violation rates under the CWA; their results suggest that such groups (in lobbying for better water quality) do not influence local regulators’ decisions (in which case one would expect to see an increase in inspections) but likely influence the behavior of regulated facilities directly. Clean Water and Clean Air Act inspection probabilities are associated with congressional representatives’ voting scores and committee memberships, consistent with bureaucratic interest and the influence of local interest groups (Helland 1998, Innes and Mitra 2015). Taken together, the literature suggests that local and national interest groups can influence regulatory and water quality outcomes under the CWA in authorized states.37

35 The relevant discussion is on pp. 32-33 of EPA-Army (2019) and p. 35 of EPA-Army (2020a).
36 Corruption is measured as the number of federal, state and local public officials in each state-year convicted in federal court of a corruption-related crime, a measure commonly used in the economic literature, though not without its critics (Grooms 2015, Fredriksson 2018).
37 Existing cross-state heterogeneity under decentralized pollution oversight is pronounced. Appendix 2, derived from Shim-
All of these studies cited above differ from the current context, in which the Navigable Waters Protection Rule delegates to the states the determination of which waters originally covered by the Clean Water Rule should be protected, abdicating the federal role for these waters. In this context, given economic theory and empirical evidence, one would expect the stringency of water quality protection for the affected waters to decrease, at least in some states. Authorized states have always been able to implement and enforce standards that are more stringent than the federal standards under the CWA, so it is not clear why any states would do so now, in response to the reduced CWA jurisdiction associated with the Navigable Waters Protection Rule. Given this asymmetry, the effect of local interest group influence may be to reduce water quality in the context of the new Rule. This point is not discussed in either EA, and it is an important limitation of the federalism arguments in these documents.

2.B.2 Race to the bottom

Both EAs include identical one-paragraph discussions of the possibility that states will engage in a “race to the bottom” under decentralized regulation, competing in the reduction of regulatory stringency to attract polluting industries. In this discussion, the analyses suggest that the empirical literature mostly fails to confirm the presence of this kind of inter-state competition, consistent with the same claim in the commissioned literature review (Fredriksson 2018, p. 7).

Our view of the likelihood that reducing the scope of federal water quality jurisdiction would result in a race to the bottom is less definitive than that expressed in the two EAs. The assumptions that must be met in order for regulatory competition to be efficient are sufficiently stringent that real-world regulatory competition among states is likely inefficient (Levinson 2003). Race-to-the-bottom behavior among state and local governments is confirmed by credible and well-designed studies in the empirical literature on firm-oriented tax breaks and other business development incentives (Mast 2020, Ossa 2017, Felix and Hines 2013). The literature also provides evidence that environmental regulation imposes local costs, while a large share of benefits may spill over jurisdictional boundaries (Walker 2013), and that some firm location decisions may be influenced by state regulatory stringency (Kahn and Mansur 2013, Greenstone 2002), teeing up the right conditions for states to compete in this way.

However, empirical evidence of states’ strategic interaction with respect to water pollution regulation is mixed. States may respond to the stringency of their neighbors’ regimes, for example, but they appear to respond to both weaker and stronger regulation (Konisky 2007). Another study suggests that states

shack (2014) and author calculations, documents, for example, that in 2011 Pennsylvania led inspections at more than 90 percent of its CWA major facilities, while New York led inspections at less than 15 percent of its CWA majors. In 2011, Texas issued enforcement actions at more than 50 percent of its CWA majors, while Pennsylvania issued actions at less than 10 percent of such facilities. Even if one focuses on states within a single EPA region, heterogeneity is pronounced. Less than 40 percent of CWA majors in Florida were inspected in 2017, for example, while 100 percent of CWA majors in Alabama were inspected in the same year. Although the examples depicted here are ad hoc, general patterns are consistent across states and years. Though cross-state differences in oversight intensity may be attributable to industrial composition, facility characteristics, and other factors, such extreme heterogeneity may be consistent with interest group pressures or other sources of inefficient decentralized regulation (Shimshack 2014, Innes and Mitra 2015).

The relevant text is on p. 35 of EPA-Army (2020a), and p. 32 of EPA-Army (2019). Note that a “race to the top,” in which states compete to increase regulatory stringency, is also theoretically possible, particularly as states compete to attract individuals who value environmental quality. However, given that states have always been able to implement and enforce standards that are more stringent than the minimum standards in the federal CWA, the option to race to the top has always been available, and we would not expect any change in the incentive to do this due to the reductions in CWA jurisdiction under the Navigable Waters Protection Rule.

A similar “race to the bottom” may also occur for other areas of environmental oversight, including surface mining, Clean Air Act, and toxic substances regulation (Woods 2006, Konisky 2007).
respond only to neighbors with stronger regulations (Fredriksson and Millimet 2002). States may also compete in many dimensions at once, making it difficult to determine whether a race to the bottom is occurring without simultaneously considering tax policy and public goods provision, along with regulation (Fredriksson et al. 2004).

On balance, it is hard to conclude from this literature, as the EAs do, that a race to the bottom is unlikely when the federal government’s jurisdiction over water quality is curtailed. The possibility of a race to the bottom is another important counterpoint to the argument that federalism is efficient (even for local public goods). More information about the relative mobility, size and influence of industries (such as agriculture, construction and real-estate development) likely to be affected by the regulatory changes might provide some indication whether dismissing the race to the bottom concern is warranted. We would note that these industries may behave very differently from the relatively immobile, capital intensive industries typically studied in the prior literature.

2.C. The analyses may understated the importance of economies of scale when regulation is decentralized.

Both EAs acknowledge that, if some states take over the role previously played by the federal government in protecting the affected waters, the costs of the necessary regulatory activity will shift from the federal to state governments. “Economies of scale” occur within activities that become more efficient or effective as the scale increases (for example, activities associated with large fixed costs). Federal regulation (permitting, monitoring, and enforcement) in this setting may enjoy greater economies of scale than state regulation (so that average costs may increase when these duties are abdicated to states), though this specific point is only briefly mentioned in the EAs.40

Much of the scientific and legal dispute over the rules involves the question of which exact waters qualify for protection. Answering this question for a particular water or development project is not trivial and may require expertise in hydrology, law, and engineering. For example, Section 404 of the CWA regulates dredging or fill material. Since the Supreme Court’s Rapanos decision, the Army Corps has been required to judge whether tens of thousands of development projects qualify for CWA protection (“are jurisdictional”). These decisions are the subject of analysis in these EAs and in external analyses (Sunding 2014). As a federal agency, the Army Corps has invested in hiring and training staff and developing standardized procedures for jurisdictional decisions. Similarly, EPA hires and trains large numbers of specialized staff with expertise in designing and implementing regulation. The data collection necessary to assess hydrological conditions for defining and classifying waterways is also currently concentrated at the federal level.

There are potential fixed costs and returns to scale to developing a system that relies on technical hydrology, engineering, and legal questions to apply a uniform standard (whether within or across states) for interpreting CWA regulations. The Army Corps and EPA have local staff, though it is likely that state agencies rather than local staff of federal agencies would implement newly-decentralized water quality protection that now falls outside the scope of the CWA. The existence of such fixed costs provides one rationale for centralization.

40 “On the other hand, environmental protections may involve economies of scale, which favors a centralized system (Adler 2005)” (EPA-Army 2019, p. 32).
2.D. Concepts from the theory of pollution control are misapplied in the two economic analyses.

A final critique of the use of economic theory in the two economic analyses has to do with a misapplication of the theory of pollution control. To repeat one section of the federalism quote at the start of this section, both EAs suggest that via a decentralized approach, “...states may be able to direct resources toward their high priority waters and limit expenditures on their low priority waters, thereby maximizing the net benefits derived from their waters.” In a related point, in Section III.B. of the repeal (EPA-Army 2019, p. 50), the text states: “If the marginal benefits of regulating water decline as smaller waterbodies are regulated (which would be a common assumption of diminishing marginal benefits) then the benefits of the 2015 Rule and 2017 proposal may have been overstated.”

Both of these quotes imply that protecting the smaller, more isolated waters that switch jurisdiction between the 2015 Clean Water Rule and the 2020 Navigable Waters Protection Rule generates smaller incremental benefits than does protecting larger waters downstream. The “common assumption of diminishing marginal benefits” comes from the economics of pollution control, in which the marginal benefit function for pollution abatement is typically (though not always) downward-sloping, and incremental control generates increasingly smaller incremental benefit, all else equal.

We question this analogy. As the scientific literature points out, small streams and wetlands (particularly headwaters) frequently have a disproportionately large impact on the biological integrity of downstream waters, providing habitat (e.g., foraging, nesting, breeding, spawning) for important species that inhabit primary waters (Gardner et al. 2019). Lower-order streams comprise the “great majority of the total length of river systems” (Allan and Castillo 2007), and some major water pollution problems that cause significant economic damages, such as nutrient over-enrichment that creates coastal “dead zones,” originate far upstream (Rabotyagov et al. 2014). From an economic perspective, water pollution in upstream areas also has the potential to travel longer distances instream, causing greater economic damages (depending on pollutants’ residence time instream) to exposed people, firms, and ecosystems along its route than equivalent pollution in downstream waters.41 For these reasons, regulating polluting activities in smaller waters would not necessarily have lower marginal benefit than regulating further downstream.

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41 In addition, many waterbodies impacted by the repeal and replacement are wetlands, which have experienced a well-documented, long-run decline in the United States, suggesting that the value of preservation on the margin may be growing over time. For example, total wetland area in the lower 48 states declined by approximately 53 percent from the 1780s to the 1980s (Johnson 1994).
SECTION 3

Does the Agencies’ categorization of states in their federalism analysis reflect the most likely state responses to the changes in the jurisdictional definition of WOTUS from the Clean Water Rule repeal and its replacement with the Navigable Waters Protection Act? What are the broader implications of the Agencies’ federalism analysis for environmental regulation?

A key aspect of the quantitative analysis of benefits and costs of both the repeal of the Clean Water Rule and its replacement, the Navigable Waters Protection Rule, is the Agencies’ categorization of U.S. states in terms of their likely reaction to the federal changes in WOTUS jurisdiction. Both EAs describe the significant uncertainty in categorizing states in this way. They argue, however, that if some states decide to regulate the waters over which the federal government abdicates jurisdiction via the repeal and replacement, then estimation of the benefits and costs of rescinding federal protection of these waters should take these state reactions into account.

This is similar to concerns economists have raised about other federal policies – subsidies for retrofitting appliances or trading in fuel-inefficient vehicles, for example – that should not be credited for actions that would have been taken by firms or consumers even in the absence of the policy incentive (Bennear et al. 2013, Li et al. 2013). In economic terms, this concern is referred to as “additionality,” and it has to do with defining the appropriate counterfactual to a policy action. EPA’s Guidelines for Economic Analysis state that, because actions by state and local governments can affect the benefits and costs of federal rules, related state rules that are legally required but not yet implemented may be included when estimating benefits and costs (EPA 2010b, p. 5-13). However, the EAs go well beyond this, speculating about the future actions of states that are not legally required to act, which contravenes the Guidelines:

“It is important, however, that the analyst not simply speculate that another rule will be implemented. Any other rule included in the baseline, other than those already promulgated, should be imminent or reasonably anticipated with a high degree of certainty” (EPA 2010b, p. 5-13).

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42 In this case, the Guidelines suggest that the analyst should “use professional judgment to determine what would happen in the absence of EPA action. If the state would implement the regulation in the absence of EPA action, then a reasonable case can be made that this state regulation should be included in the baseline” (EPA 2010b, p. 5-13).

43 Kling (2019) highlights this issue in her expert review of these analyses on behalf of the Office of the New York State Attorney General.
To implement the federalism scenarios in the EAs, the agencies first predict state responses to the narrowing of federal water quality jurisdiction to identify states that are “likely” to assume (in whole or in part) the federal role for the affected waters.\textsuperscript{44} They then selectively remove groups of states deemed “likely to act” from their benefit-cost calculations.\textsuperscript{45}

The agencies use three indicators to decide how states will respond to the narrowing of federal CWA jurisdiction under Section 404: (1) whether a state currently regulates any intrastate waters beyond federal waters, (2) whether state law restricts regulation of waters outside of federally-designated WOTUS, and (3) whether a state currently has a dredge-and-fill program (EPA-Army 2020a, p. 38-39).\textsuperscript{46} Relying on information such as state legislation and regulations, websites of state agencies, and prior analyses by other institutions, the agencies created “snapshots” of state regulatory authority to classify states according to each of the three indicators (EPA-Army 2020a, p. 36; EPA-Army 2020b).\textsuperscript{47} Table 1 shows how they use this information to characterize states’ likely potential response to narrowing CWA jurisdiction (EPA-Army 2020a, p. 39).

\begin{table}[h]
\centering
\caption{Creation of three categories of potential state responses to narrowing CWA jurisdiction in the Navigable Waters Protection Rule (Table II-1 in EPA-Army 2020a)}
\begin{tabular}{|c|c|c|}
\hline
Category & State regulatory indicators & Potential Response \\
\hline
1 & State has broad legal limitations on regulating aquatic resources OR does not have a state-level dredged and fill program and relies on CWA section 401 certification to address dredged and fill activities. & Unlikely to increase state regulatory practices to address changes in federal jurisdiction. \\
\hline
2 & Has a state-level dredged and fill program that does not regulate waters of the state more broadly than CWA AND does not have broad legal limitations on regulating aquatic resources & Likely to continue the state’s current permitting practices and may choose to change state programs to provide some regulatory coverage of waters that would no longer be “waters of the United States.” \\
\hline
3 & Has a state-level dredged and fill program AND regulates “waters of the state” more broadly than CWA & Likely to continue the state’s current dredged/fill permitting practices, which already regulate beyond some areas of 2019 Rule. \\
\hline
\end{tabular}
\end{table}

\textsuperscript{44} The benefit and cost estimates in the EAs include only those for changes likely to occur due to the narrowed scope of section 404 dredge-and-fill permitting under the wetlands regulatory program. For this reason, the agencies’ categorization of states according to their likely actions with respect to the wetlands regulatory program is the only piece of this analysis we discuss here. Three different documents must be read together to determine how the EA for the Navigable Waters Protection Rule characterizes state legal authority under the CWA: the EA, itself (EPA-Army 2020a, pp. 28-47), the Resource and Programmatic Assessment for the Navigable Waters Protection Rule (EPA-Army 2020b, pp. 42-50), and Appendix A to the Resource and Programmatic Assessment (EPA-Army 2020c, pp. 1-88). Unfortunately, the three sources share few common definitions, which makes understanding the agencies’ process a challenge. The EA and the Resource and Programmatic Assessment refer to numbers of states that are in certain overlapping categories of jurisdiction without naming the specific states, and the state-by-state review of laws and regulations in Appendix A does not define how those laws and regulations might be related to these categories, undermining the use of the categorical “state numbers” in the other two documents. The EA creates a state graphic using categories about current regulation and regulatory authority, some of which can be compared to the specific laws and regulations in Appendix A (EPA-Army 2020c).

\textsuperscript{45} We briefly summarize the five sections of the CWA relevant to the Clean Water Rule repeal and replacement and examine the quality of the agencies’ categorization of states for the additional CWA sections (beyond the wetlands regulatory program) in Appendix 3.

\textsuperscript{46} Many additional considerations for making this determination were suggested in the Agencies’ commissioned review of the federalism literature (Fredriksson 2018), but were not used in the EA. The EA notes that “effective [replacement] regulation . . . requires the political capital and fiscal resources to do so,” and asserts that how the states have exercised authority in the past is the “best indication of how states will exercise their authority” with respect to the proposed jurisdictional changes (EPA-Army 2020a, p. 35).

\textsuperscript{47} Some of the supporting information includes surveys of possible future actions (EPA-Army 2020a, footnote 41; EPA-Army 2020b, p. 43).
In the federalism analysis, scenario 0 includes benefit and cost estimates for all 49 affected states (Hawaii is excluded from all of the scenarios). Scenarios 1 and 2 drop 23 states that the agencies place into category 3 of Table 1 – states that are assumed to assert state jurisdiction to maintain an equivalent regulatory control of former WOTUS, fully subsuming the federal role – on the basis that there will be no benefits or costs to reducing federal jurisdiction over wetlands in these states. Scenario 3, the most optimistic, drops benefits and costs for eight additional states that the agencies place into category 2.

These federalism scenarios are responsible for a significant share of the variation in benefit and cost estimates in the EAs. In Table 2, we report the net benefits of the Navigable Waters Protection Rule, which we calculate from the benefit and cost estimates in the Rule’s EA (EPA-Army 2020a). While the Agencies implement the “federalism scenarios” in both EAs, we focus here on the EA for the Navigable Waters Protection Rule (EPA-Army 2020a), because it is this replacement rule – should it hold up in court – that will determine net benefits going forward.

### TABLE 2. Annual net benefit calculations for the Navigable Waters Protection Rule, by “federalism” scenario (2018 $millions)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Low</th>
<th>Mean with low cost savings</th>
<th>Mean with high cost savings</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 0</td>
<td>-310.44</td>
<td>71.3</td>
<td>339.5</td>
<td>484.08</td>
</tr>
<tr>
<td>Scenario 1</td>
<td>-76.1</td>
<td>68.11</td>
<td>201.21</td>
<td>255.48</td>
</tr>
<tr>
<td>Scenario 2</td>
<td>-76.1</td>
<td>68.11</td>
<td>201.21</td>
<td>255.48</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>-83.11</td>
<td>54.05</td>
<td>159.35</td>
<td>208.46</td>
</tr>
</tbody>
</table>

Notes: The “low” net benefit estimates in column 1 subtract the highest estimate of forgone benefits (in Table ES-8 in EPA-Army 2020a) from the lowest estimate of avoided costs (in Table ES-7 in EPA-Army 2020a). The “high” net benefit estimates in column 4 subtract the lowest estimate of forgone benefits (in Table ES-8) from the highest estimate of avoided costs (in Table ES-7). The two mean estimates in the middle of the table subtract the “mean” estimate of forgone benefits (in Table ES-8) from the low (column 2) and high (column 3) estimates of avoided costs (in Table ES-7). There are no mean cost estimates reported in Table ES-7. The federalism scenarios in each row are as follows: scenario 0 includes avoided costs and forgone benefits for all states except Hawaii; scenarios 1 and 2 drop 23 states (CA, CT, FL, IL, IN, MA, MD, ME, MI, MN, NH, NJ, NY, OH, OR, PA, RI, TN, VA, VT, WA, WV, and WY) presumed to take over regulation of the newly non-jurisdictional waters; and scenario 3 drops the 23 states dropped in scenarios 1 and 2 along with 8 additional states (DE, GA, IA, KS, MT, NC, UT, and WI) also presumed to take over regulation of the waters newly removed from federal jurisdiction.

Table 2 demonstrates that the process through which the agencies predicted how states would react to the reduction of federal CWA jurisdiction is not only novel, but it has a meaningful impact on the benefit and cost estimates. Net benefits in the agencies’ scenario 0 – in which benefits and costs are estimated according to standard practice, including waters in all of the affected U.S. states – range from a $310 million annual net loss to a $484 million annual net gain. At the other end of the spectrum in scenario 3, once forgone benefits and avoided costs of reducing the scope of federal CWA jurisdiction are excluded for all 31 states for which the agencies’ analysis determined that there was some likelihood that states would take over the former federal role, the range of economic impacts is much tighter, from an $83 million annual net loss, to a $208 million annual net gain.

An additional illustration of the impact on the “bottom line” numbers of the federalism analysis comes from the state-by-state analysis in Appendix E of the EA. In Table 3, we calculate net benefits of the Navigable Waters Protection Rule by state, and also indicate the category chosen by the agencies for each state for the

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48 Here we use total costs and benefits for low, mean, and high scenarios reported in the EAs. However, we find that the national forgone benefits reported for the low and high scenarios in the EAs do not match with the sum of forgone state benefits. If we use our own sum of state benefits, rather than those reported in the EAs, net benefits change to a range of -$507M to $508M (Scenario 0), -$142M to $262M (Scenarios 1, 2), and -$131M to $213M (Scenario 3).
federalism analysis. Using these data, the mean forgone benefits from narrowing the jurisdictional scope of the wetlands regulatory program in the State of Florida, alone, amount to more than 47 percent of forgone

TABLE 3. Annual net benefits of the Navigable Waters Protection Rule by state, ranked least to largest (2018 $million)

<table>
<thead>
<tr>
<th>State</th>
<th>Net benefits (midpoint cost savings - mean forgone benefits)</th>
<th>Likely response category in federalism analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>FL</td>
<td>($45.27)</td>
<td>3</td>
</tr>
<tr>
<td>NC</td>
<td>($0.37)</td>
<td>2</td>
</tr>
<tr>
<td>MI</td>
<td>$0.00</td>
<td>3</td>
</tr>
<tr>
<td>NJ</td>
<td>$0.00</td>
<td>3</td>
</tr>
<tr>
<td>NH</td>
<td>$0.03</td>
<td>3</td>
</tr>
<tr>
<td>NY</td>
<td>$0.06</td>
<td>3</td>
</tr>
<tr>
<td>VT</td>
<td>$0.09</td>
<td>3</td>
</tr>
<tr>
<td>ID</td>
<td>$0.13</td>
<td>1</td>
</tr>
<tr>
<td>WY</td>
<td>$0.17</td>
<td>3</td>
</tr>
<tr>
<td>MT</td>
<td>$0.24</td>
<td>2</td>
</tr>
<tr>
<td>SC</td>
<td>$0.27</td>
<td>1</td>
</tr>
<tr>
<td>DE</td>
<td>$0.32</td>
<td>2</td>
</tr>
<tr>
<td>RI</td>
<td>$0.32</td>
<td>3</td>
</tr>
<tr>
<td>ND</td>
<td>$0.35</td>
<td>1</td>
</tr>
<tr>
<td>NE</td>
<td>$0.37</td>
<td>1</td>
</tr>
<tr>
<td>MA</td>
<td>$0.40</td>
<td>3</td>
</tr>
<tr>
<td>IA</td>
<td>$0.55</td>
<td>2</td>
</tr>
<tr>
<td>CO</td>
<td>$0.62</td>
<td>1</td>
</tr>
<tr>
<td>SD</td>
<td>$0.75</td>
<td>1</td>
</tr>
<tr>
<td>NM</td>
<td>$0.77</td>
<td>1</td>
</tr>
<tr>
<td>MD</td>
<td>$0.83</td>
<td>3</td>
</tr>
<tr>
<td>ME</td>
<td>$0.90</td>
<td>3</td>
</tr>
<tr>
<td>NV</td>
<td>$0.93</td>
<td>1</td>
</tr>
<tr>
<td>TN</td>
<td>$1.05</td>
<td>3</td>
</tr>
<tr>
<td>LA</td>
<td>$1.11</td>
<td>1</td>
</tr>
<tr>
<td>AK</td>
<td>$1.17</td>
<td>1</td>
</tr>
<tr>
<td>CT</td>
<td>$1.21</td>
<td>3</td>
</tr>
<tr>
<td>MN</td>
<td>$1.23</td>
<td>3</td>
</tr>
<tr>
<td>OK</td>
<td>$1.39</td>
<td>1</td>
</tr>
<tr>
<td>UT</td>
<td>$1.52</td>
<td>2</td>
</tr>
<tr>
<td>MS</td>
<td>$1.63</td>
<td>1</td>
</tr>
<tr>
<td>AZ</td>
<td>$1.69</td>
<td>1</td>
</tr>
<tr>
<td>VA</td>
<td>$1.82</td>
<td>3</td>
</tr>
<tr>
<td>WI</td>
<td>$2.06</td>
<td>2</td>
</tr>
<tr>
<td>MO</td>
<td>$3.56</td>
<td>1</td>
</tr>
<tr>
<td>PA</td>
<td>$3.66</td>
<td>3</td>
</tr>
<tr>
<td>IL</td>
<td>$4.47</td>
<td>3</td>
</tr>
<tr>
<td>GA</td>
<td>$5.34</td>
<td>2</td>
</tr>
<tr>
<td>WA</td>
<td>$5.77</td>
<td>3</td>
</tr>
</tbody>
</table>
benefits for the entire United States. Florida’s share of the Rule’s estimated U.S. cost savings, in contrast, is only about 10 percent, using either the high- or the low-cost, state-specific estimate in the EA. Note that Florida is one of only two states for which the estimated net benefit of the Navigable Waters Protection Rule is negative (a loss of more than $45 million annually), even when calculated at the mean forgone benefit and the midpoint of the high and low avoided cost estimates. The agencies place Florida in category “3” in the federalism analysis – those states likely to completely subsume the missing federal role in wetlands protection – so it is retained in federalism scenario 0, but dropped from the benefit and cost calculations in scenarios 1-3. Because it has high forgone benefits from wetlands protection under the old jurisdictional standard, and low avoided costs, dropping this single state is highly favorable to the national “bottom line” of the Rule.

Continuing along these lines, among the ten states in a list of those that, if dropped, would provide a result most favorable to the Rule – those ranked at the top of Table 3 – seven are placed in category 3. Among the ten states that, if dropped, would provide a result least favorable to the Rule – those ranked at the bottom of Table 3 – five are placed in category 3. Despite the single very influential example of Florida, then, we cannot conclude that the agencies’ classification of states in the federalism analysis was strategic. However, the placement of states into the federalism categories strongly influences the economic impact estimates. If the practice of speculating about likely state responses and adjusting benefit and cost estimates based on those predictions is going to be used in economic analysis of federal regulations going forward, the practice would benefit from guidelines and oversight from the Office of Management and Budget (OMB), similar to the way in which other influential processes and parameters (e.g., discount rates, treatment of uncertainty) are discussed in documents such as OMB’s Circular A-4 and the EPA Guidelines for Preparing Economic Analysis.49

We discuss two potential problems with this approach as taken by the agencies in the sub-sections that follow. First, the approach requires the agencies to make an educated guess about how states are likely to

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react to the reduction in federal CWA jurisdiction. The agencies chose not to use what might be the best evidence of states’ future behavior – their prior record in protecting wetlands. Second, even if we assume that the process used to categorize states by their likely future behavior was appropriate, we identify several shortcomings of the agencies’ placement of states into categories for the federalism analysis in the Navigable Waters Protection Rule. We end the section by highlighting the EAs’ silence on the broader implications of their arguments around environmental federalism and discussing what the EAs’ arguments at face value might imply for other environmental regulation.

3.A. The prediction that dozens of states will assume jurisdiction over the waters newly removed from federal CWA jurisdiction is inconsistent with states’ prior behavior.

As noted in Section 2, states not prohibited from doing so have always been able to enact water quality protection rules that are more stringent than those in the CWA, and it is not clear why such states would do so now, in response to the repeal and replacement of the Clean Water Rule, when they have not done so already. The situation that most closely replicates the current process of reducing federal jurisdiction over wetlands under the CWA occurred after the 2001 SWANCC decision. Recall that the 2001 SWANCC decision overturned the Migratory Bird Rule, effectively removing the basis for CWA jurisdiction over some wetlands. In response, only a few states moved to expand state jurisdiction over some of the affected waters, though almost 20 years have passed since the SWANCC decision. The EAs do not discuss this past experience with jurisdictional changes, which would seem to be an important signal of states’ likely future behavior.

Consider, also, that although the wetlands regulatory program under the CWA has existed for decades, only two states (Michigan and New Jersey) have proactively obtained the authority to implement this program. In contrast, all but a few states have requested and received authorization to implement the NPDES program, so states’ decisions regarding wetlands jurisdiction cannot be attributed simply to inertia. Two additional states (Arizona and Florida) initiated the Section 404 authorization process in 2018. This could provide some support for the agencies’ contention that additional states will expand their wetland protection efforts due to the repeal and replacement of the Clean Water Rule. The agencies’ treatment of these two states is not consistent with this conclusion, however, as Florida is assumed to take over the federal role in the Navigable Waters Protection Rule’s EA scenarios 1, 2 and 3, but Arizona is not.

Both Michigan and New Jersey – the two states that are authorized to implement the wetlands regulatory program – are included in the group of states dropped from the benefit-cost analysis in federalism scenari-

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50 See Congressional Research Service (2016), pp. 18-19. States that adopted limited legislation to expand jurisdiction when federal jurisdiction narrowed due to SWANCC include Wisconsin, Indiana and Ohio. A handful of additional states extended existing water quality programs to include some of the affected wetlands (Kusler and Christie 2006, Pyle 2002).

51 It is too early to empirically analyze the impact of the reduced CWA jurisdiction under the Navigable Waters Protection Rule, which took effect in June 2020. Nonetheless, early anecdotal evidence suggests that both requests for dredge-and-fill permits and approval of those permits have increased in number and speed (see: https://news.bloomberglaw.com/environment-and-energy/companies-eager-to-lock-in-trump-era-water-rule-exemptions).

os 1-3, on the assumption that they will regulate the affected waters when federal jurisdiction is removed. However, the agencies assume that 21 additional states will take over the federal role for these waters in their scenarios 1 and 2 in the EA for the Navigable Waters Protection Rule, and that 28 additional states will do so in scenario 3. In our view, Scenarios 1-3, in which dozens of states expand their own jurisdiction over the marginal wetlands to fully assume the prior federal role, seem highly unlikely, given states’ past behavior.53

Other aspects of CWA oversight also raise questions about the likelihood that states would choose to implement new water quality protection rules in the foreseeable future. Decades after CWA delegation of oversight responsibilities to states began, dozens of states had failed to assume full CWA primacy within the NPDES program, particularly with regard to pretreatment, general permit, and sludge oversight programs (Grooms 2015). This occurred despite substantial resources from the federal EPA to authorized states under Section 106 of the CWA to support NPDES oversight activities. In sharp contrast to the Clean Water Rule, NPDES authorization also preserved federal and regional “backstop” authority to ensure compliance with national environmental quality targets and priorities.

3.B. Even if taken at face value, the Agencies’ categorization of states for the federalism scenarios may be flawed.

Below, we provide our own assessment of the agencies’ classification of states for the federalism analysis in the EA for the Navigable Waters Protection Rule. Recall from Table 2 that the agencies placed states into categories 1-3 depending on: (1) whether they currently regulate any intrastate waters beyond federal waters, (2) whether state law restricts regulation of waters outside of federally-designated WOTUS, and (3) whether the state currently has a dredge-and-fill program. The sub-sections that follow assess the application of each of these three criteria in turn.

3.B.1. The agencies may have included too many states among those which “currently regulate” surface waters more broadly than the CWA requires.

While the language in the EA (see Table 2) puts states into categories based on whether they currently regulate “waters of the state” more broadly than the CWA’s federal jurisdiction, in Appendix A (EPA-Army 2020c) the agencies seem to have used a state’s potential to regulate more broadly, rather than its actual behavior, to apply this first criterion. The EA and supporting public documents do not provide sufficient data to determine whether a state currently regulates waters beyond federal waters.54 This leap from the potential to regulate to the likelihood of doing so may be based on the idea that states that do not have laws restricting their regulatory capacity to the level of federal regulation would continue regulating waters that are already regulated, and might even increase to compensate for the narrowing of federal jurisdiction. But this would also depend on what waters a state regulates beyond federal jurisdiction, and how much. Moreover, the argument that inertia would leave current sites regulated would not necessarily apply to

53 In the EA for the repeal of the Clean Water Rule, the agencies state that they “do not take a position on which of these three federalism scenarios is most likely” (EPA-Army 2019, p. xiv). However, the EA for the replacement – the Navigable Waters Protection Rule – states: “In the agencies’ best professional judgment, based on the environmental federalism literature (Fredriksson 2018), Scenario 0 is among the least likely scenarios to take place” (EPA-Army 2020, p. xiv).

54 “[S]tate-level baseline regulations may be broader than the federal requirements. In this case . . . states may simply maintain their broader, baseline regulations (EPA-Army 2020a, p. 44).”
future determinations.

Additionally, in determining whether states regulate beyond federal law, the Resource and Programmatic Assessment notes that many states regulate groundwater (EPA-Army 2020b, pp. 44-45), which is generally not subject to jurisdiction under the CWA except in limited circumstances. If states’ groundwater regulations were used to determine whether they were currently “regulating beyond the federal jurisdiction,” we take issue with this choice, as groundwater regulation may be irrelevant to a state’s likelihood of expanding the scope of surface water quality regulation in response to the Clean Water Rule repeal and replacement.

The EA seems to rely heavily on some categorizations of states within an Environmental Law Institute (ELI) study analyzing state water regulation after federal jurisdiction was limited by the SWANCC and Rapanos decisions. The ELI report states that it is:

“vexing to try to determine with precision which states presently [as of 2013] protect waters that are no longer subject to federal regulation (or whose regulation under the federal Clean Water Act has become uncertain), and what those categories of waters are. . . [C]oming up with a definitive, water-by-water answer has proven elusive for various reasons (Environmental Law Institute 2013, p. 34).”

Apparently relying on the same report, with respect to section 404 dredge-and-fill permits, the EA identifies 24 states as “regulating waters more broadly than the CWA requires,” even though the ELI report notes that most of these states also are subject to restrictions which would keep them from regulating beyond federal jurisdiction (EPA-Army 2020a, pp. 40-41). According to the ELI report, as of 2013, only eight states (California, Connecticut, Illinois, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont) regulate more than the federal CWA (post Rapanos) and do not have other restrictions that would prevent them from doing so (Environmental Law Institute 2013, p. 34). Note that this list of eight states does not include Florida, or any of the other additional 15 states that the agencies placed into category 3 in their federalism analysis.

3.B.2. The agencies may have included too many states among those that do not have “broad legal limitations” on regulating waters beyond federal jurisdiction.

The second criterion the agencies used to place states into categories for the federalism analysis assesses


56 In addition to laws, regulations and executive orders that could deter states’ taking on greater regulatory jurisdiction, the ELI study also notes that many states have property restrictions that go beyond federal law, in which a state might have to compensate private property owners affected by regulation, even beyond any U.S. constitutional requirement. While this of course does not prohibit a state from expanding regulatory jurisdiction, it would be an important deterrent (Environmental Law Institute 2013).

57 Even within these states, the ELI report does not indicate the extent of possible “greater” regulation or through what regulatory mechanism it occurs. While the ELI report is clearly among the most important sources used to categorize states for the federalism analysis, the EA acknowledges that the report has some known “shortcomings and inaccuracies” that may limit its usefulness (EPA-Army 2020a, p. 37).
the presence of “broad legal limitations on regulating aquatic resources” (see Table 2). Although the definition of legal limitation might seem clear, the term “broad legal limitation” used in the categorization of the states is not. In the EA, a legal limitation is defined as a “state prohibiting by law or requiring additional justification” for imposing regulatory requirements beyond federal jurisdiction (EPA-Army 2020a, pp. 39, 42).

Given the way that states are classified under this criterion in the EA, it appears that the term “broad legal limitation” is defined as only including those states with a general legislative or statutory prohibition on exceeding federal jurisdiction, and does not include less broad applications or states wherein additional justification for exceeding federal jurisdiction is required. If that is the case, the agencies’ approach will tend to over-predict states’ future actions to expand their water quality jurisdiction.

In Appendix 4, we describe several potential discrepancies between selected states categorized in the EA (EPA-Army 2020a, pp. 40-41) as not having “broad legal limitations,” and the actual laws and regulations of those states. We identified these discrepancies in our own state-by-state review of relevant laws and regulations. In total, the agencies classify 40 states as not having “broad legal limitations.” Appendix 4 identifies 16 states for which we view this classification as a poor (or at the very least, noisy) indicator of the likelihood of taking legal action to assume the prior federal role in the waters removed from federal protection under the Navigable Waters Protection Rule.

3.B.3. The existence of a dredge-and-fill program may not be a good indicator of a state’s likelihood of assuming protection of the waters removed from federal jurisdiction.

The third criterion used to place states into categories for the federalism analysis – whether a state has its own dredge-and-fill program – is much more straightforward than the other two. However, we would note that, while Connecticut, Hawaii, Idaho, Iowa, Kansas, Massachusetts, New York, Pennsylvania, Tennessee, and Wyoming all have state dredge-and-fill programs as indicated in the EA (EPA-Army 2020a, p. 40), none have a “no net loss of wetlands” policy meaning that even if certain wetlands meet state jurisdiction but are not WOTUS, they would not necessarily be protected. This could lead to potential loss of benefits that could be even higher than in a state which does not have the authority to regulate beyond WOTUS. Thus, even this simplest of the three “federalism” criteria may not be a good predictor of future state behavior and the resulting benefits and costs of narrowing federal jurisdiction.

3.C. Broader implications for environmental policy

As noted, the federalism analysis in the EAs is novel. Though the potential reach of their theoretical arguments is quite broad, the agencies do not discuss the implications of their arguments or their empirical approach in the benefit-cost analysis for other environmental statutes. Many other landmark U.S. environmental laws have federal regulation at the heart of their approach. Clean Air Act designation of nonattainment areas, Safe Drinking Water Act setting of Maximum Contaminant Levels, Superfund prioritization of

the National Priorities List, and other policies all involve federal jurisdiction over environmental decisions that could alternatively be decentralized to states.

Many arguments in the EAs apply to these other environmental domains also. Taking the EAs’ theoretical and empirical arguments about environmental federalism at face value might also argue for substantially weakening federal regulations in other domains, and instead allowing state and local jurisdiction over these issues. For example, one might argue that drinking water is a local public good, since drinking water systems are largely municipal (Dinan et al. 1999). Similarly, some toxic air pollution includes heavy metals that travel short distances (criteria pollutants like particulates may travel further). Localized contamination due to Superfund sites might also be seen as a local public good.

One could debate whether each of these domains should be subject to federal or state regulation. States had primarily managed these environmental problems before the 1970s, generally with weak regulation. Congress carefully debated the merits of federal versus state regulation in the 1970s and found an important role for federal regulation, which is how these laws were first passed. Congress revisited these issues again in the 1990s, and through the 1990 Clean Air Act Amendments and 1996 Safe Drinking Water Act Amendments, decided to construct an even larger role for federal policy.

As the EAs highlight, there are arguments on both sides of these debates. The EAs largely portray economic research as arguing for local and state regulation of these environmental problems, but our interpretation, discussed in Section 2, is that economic research equally well provides other and perhaps stronger reasons to support federal regulation under the CWA. Analyzing these decentralization arguments for other domains like air pollution and drinking water is beyond the scope of our report, but we sense that the argument from economic research is not unequivocal for those environmental issues, either. This also makes the questionable categorization of states by their likely reactions to decentralization critically important – not just to the EAs related to shifting views on WOTUS, but to any future application of the approach in federal rulemaking.

We emphasize, again, that if the federalism analysis remains an approach to prospective regulatory impact analysis, guidance from OMB, the EPA Science Advisory Board, or other institutions would help to ensure that the process is carried out objectively. Retrospective analysis, to determine how well agencies predict future state actions, would also appear to be a critical requirement.

SECTION 4
Do the Agencies’ estimates of the “national-level” benefits of protecting wetlands in the repeal and replacement economic analyses reflect the best available methods and data from the literature in environmental and resource economics?

This section of our review addresses the national-level wetland benefit estimates that support the Clean Water Rule repeal and replacement EAs (EPA-Army 2019, EPA-Army 2020a). The EAs use a meta-analysis approach to estimate the national forgone wetland benefits from the narrowing of federal CWA jurisdiction over these waters. The use of a meta-equation to compute estimates of the benefits and costs of a regulation is common, and it is one form of what is known as “benefit transfer” (see USEPA 2010b, p. 7-48). Existing studies that provide estimates of wetland benefits in specific U.S. locations are combined in a statistical framework that allows one to understand how geographical and socioeconomic factors influence the values of wetlands. This produces a benefit function that is used to predict wetland values in areas where no original studies exist. The agencies can then develop an estimate of the national forgone benefits from removing federal protection from the marginal wetlands in the repeal and replacement rules; as we note in Section 3, the EAs do this by state for 49 out of the 50 states (all but Hawaii), and then sum across states to obtain the national estimates.

Our review examines four main aspects of the meta-analysis and its use for benefit transfer (EPA-Army 2020a, Appendix D). First, we review the selection of studies in the development of the data to support estimation of the meta-equation. We review whether the list of studies included is appropriate and the extent to which these studies adequately capture wetlands’ economic benefits. Second, we examine the assumptions that support the benefit calculations. These include both theoretical and statistical assumptions that underlie the computation of changes in economic benefits from changes in wetlands. Third, we examine how the EAs predict changes in wetlands due to changes in jurisdictional scope. Fourth, we address how benefits were scaled to state and national levels in the EAs. This includes reviewing how aspects such as the impacted population influenced benefit estimates.

4.A. Choosing the supporting studies for the meta-analysis is a key component of benefit estimates. We review these underlying studies.

A key first step in the meta-analysis process is to determine which prior original studies should form the foundation for the statistical analysis. Intuitively, the predicted wetland benefits will rely to a large extent on the reported values in these underlying studies.

The repeal and replacement EAs draw from the same set of studies. To begin, 17 stated preference studies with 38 accompanying observations were assembled. Among these, 11 studies and 21 observations focus on freshwater wetlands and form the basis for the meta-analysis in the EAs. The EAs describe some aspects of the process used to determine which studies to include. The reports state that “the agencies carefully vetted wetland valuation studies included in the meta-analysis to support wetland valuation.” (EPA-Army 2019, pp. 59). The 2019 and 2020 EAs highlight a consulting report from ICF International that describes reasons for including and excluding specific wetland valuation studies from the meta-analysis (ICF 2018).
The EAs also cite a working paper by Moeltner et al. (2018) that is now published (Moeltner et al. 2019). We comment on four specific points regarding this process.

4.A.1. Total value of wetlands

In both the repeal and the replacement EAs, the agencies use only stated preference studies for valuing wetlands; this was true as well for the EA that accompanied the original 2015 Clean Water Rule (EPA-Army 2015). The 2015 EA explains that stated preference studies were used because these studies avoid the difficulty in adding up the values of individual services that wetlands provide. Instead, they rely on, “stated preference studies to estimate total values for all services collectively…” (EPA-Army 2015, p. 44). The 2019 and 2020 EAs do not provide a rationale for their exclusive use of stated preference surveys, so we assume it was similar in spirit.

The logic behind the use of stated preference studies to measure total value is sound if the underlying stated preference surveys are designed to measure the total value individuals place on the resource. The ICF report describes some variation across studies in the services valued (ICF 2018). These services range from “recreational resource for resident hunters” to “wetlands as a habitat for migratory birds.” Some studies include a wider range of services including “flood control, water quality improvement, wildlife production and habitat, and bird watching/hiking.” We performed our own review of the studies included across the various EAs (Appendix 5, Table A5.1). We similarly find that some studies invoked specific services of wetlands, while others were more broadly defined.

In conducting the meta-analysis, the 2019 and 2020 EAs control for variation in the range of services valued in the individual studies. Specifically, the studies are coded as having measured four broad categories of services: (a) provisioning (e.g., fishing and hunting); (b) regulating (e.g., flood control and water filtration); (c) cultural (e.g., non-extractive recreation); and (d) supporting (e.g., habitat). Dummy variables identifying which services were valued in each study are included in the regression specification. However, controlling for these differences does not imply that the predicted benefit estimates reflect the full portfolio of services. This depends on how the estimation results are used for prediction, and our reading of the EAs implies that only supporting services are represented in the actual benefit estimates reported.

We return to this point below when discussing technical implementation aspects. Here we note that by leaving out other important determinants of value beyond supporting services, the approach undermines the rationale for limiting the analysis to stated preference studies, since the final predictions do not represent total economic value. This suggests that the predicted values from the meta-analysis may be lower than their full, true values.

A further consideration that the 2019 and 2020 EAs did not address is the extent to which the stated preference surveys address all affected wetland benefits. This goes beyond what is controlled in the meta-equation to a question of whether the existing studies collectively address all wetland values. For example, some important benefits of wetlands (e.g., the connectivity they provide for aquatic ecosystems) may not be easily conveyed and estimated in a stated preference study. As a team familiar with the implementation of such studies we know that it is typically not tractable to account for all wetland benefits in stated preference studies. What is estimated are total values for the services described in the survey. Thus, it is likely that the existing studies, even collectively, do not capture all wetland benefits.
We conclude that the approach used in the 2019 and 2020 EAs inherently undervalues the total benefits of wetlands. This does not necessarily limit its use to measure benefits. However, we believe that this aspect of the underlying analysis should be made more explicit. The potential underestimation should also be considered in conclusions regarding the total cost and benefits of the Clean Water Rule repeal and its replacement with the Navigable Waters Protection Rule.

4.A.2. Rural versus urban values of wetlands

The benefits of environmental amenities vary across the landscape and depend on many factors including the quality and quantity of services they provide and the socio-economic characteristics of the population they impact. We examined the underlying studies in the meta-analysis and found that the large majority of these studies elicited values for wetlands in rural areas (Appendix 5, Table A5.1). Since the meta-analysis does not differentiate urban versus rural values, the implied weights in the regression data suggest the estimated benefits primarily reflect rural areas. However, wetland values may differ between rural and urban areas for a number of reasons such as scarcity, condition, and proximity to population centers. Indeed, in their meta-analysis using a broader collection of studies, Brander et al. (2006) find significantly higher values for urban wetlands than for rural wetlands. Like the emphasis on valuing only supporting services, the failure to differentiate urban wetlands may result in an underestimate of forgone benefits from removing wetlands from federal protection. This feature of the benefit estimation approach should be noted.


The 2019 EA suggests that two studies from the 2015 Clean Water Rule EA (Azevedo et al. 2000, Dillman et al. 1993) were excluded, in part, for not being peer-reviewed. For example, for Azevedo et al. (2000), the EA notes, “No summary statistics, standard errors, or confidence intervals are reported, and it is unclear if the report was peer reviewed.” (EPA-Army 2019, p. 55). For Dillman et al. (1993), the EA states, “Finally, the study does not appear to be peer reviewed.” (EPA-Army 2019, p. 56) These were not the only reasons given for exclusion of these studies by the EA. However, the 2019 and 2020 EAs do include several non-peer-reviewed studies (Appendix 5, Table A5.1). This inconsistency raises some questions about the selection mechanisms that were used to choose studies for the meta-analysis. It is important to understand that in a meta-analysis it is the collective knowledge gained from the existing studies that makes the approach useful for predicting economic values – i.e. the component studies collectively provide more information than can be gleaned from any single study. Excluding studies comes at the cost of reducing the available information set and so should be based on carefully defined criteria. If peer review was a critical criterion it could have been fully explained, controlled for in the estimation of the meta-equation and then applied in computing wetland values.
4.B. The next significant component of the meta-analysis involves a statistical analysis to predict benefits.

The technical steps used to carry out the meta-regression for the 2019 and 2020 EAs are generally consistent with best contemporary practice. Rather than normalizing values as dollars per wetland acre the regression explains scenario values recovered from the original studies as a function of the number of acres protected and the baseline acres against which the change is compared. For all but one study the number of protected acres is explicitly stated in the scenario. In most of the studies the baseline acres are likewise given, though in a few cases the baseline is imputed or inferred for the meta-analysis.

The specification exhibits other features considered best practice, such as controlling for moderator and context variables, accommodating theoretical adding up conditions, and flexibly allowing scenario values to depend on baseline acres. The parameters of the equation are recovered using a sophisticated Bayesian algorithm that makes efficient use of all the information in the sample. These are all positive elements of the analysis. The fact that Moeltner et al. (2019) was published in a peer-reviewed academic journal supports our generally positive assessment. However, there are two specific aspects of the implementation steps that we believe need additional explanation, due to their likely large impact on the estimates.

4.B.1. Results

While the technical elements of the meta-analysis generally meet best practice standards, there are some points of concern regarding the actual results. As noted above, following Moeltner et al. (2019) the EAs categorize the studies included in the regression as measuring values for the four broad categories of services provided by wetlands: (a) provisioning (e.g., fishing and hunting); (b) regulating (e.g., flood control and water filtration); (c) cultural (e.g., non-extractive recreation); and (d) supporting (e.g., habitat). The meta-regression includes dummy variables for the first three of these. Nearly all of the studies used in the analysis reflect values for supporting services and so there is no dummy variable in the regression for this service. This specification implies that coefficient estimates for the dummy variables provisioning, regulating, and cultural reflect economic value relative to the baseline supporting service. Intuitively these parameters should be positive — additional services (beyond supporting) provided by wetlands should increase their economic value. However, Moeltner et al. (2019) find that wetlands with provisioning and cultural services diminish value — the former substantially — while only regulating services augment value beyond the supporting baseline. In Moeltner et al. (2019), the authors state that the strong negative effects of provisioning services seem odd and may point to issues with the model — especially regarding the relatively small sample size (p. 8). As an alternative explanation, the authors also mention it could reflect society’s willingness to pay to prevent extractive services in wetlands.

It seems likely to us that the counterintuitive signs reflect something unobserved in the regression that is exacerbated by the small sample. Referring back to our discussion in Section 4.A.1, the existing studies may not measure all wetland benefits and the dummy variables are likely capturing other study features, in addition to differences in services valued. More importantly, the existing studies do not provide a convincing research design for causally identifying differences in value estimates across services. That is, if the four services included in the analysis were fully inclusive and clearly defined, and we were convinced there were no missing relevant variables describing differences across study locations and implementation procedures,
then the meta-equation could provide a plausible test of whether the coefficients on provisioning, regulating, and cultural service are positive and significant. This is not the case – the dummy variables on these services are simply indicators that likely to reflect multiple drivers of value. Thus, the negative coefficients on provisioning and cultural services should not be interpreted as causal.

This is important for two reasons. First, if unobserved study characteristics are responsible for the negative coefficients (rather than true negative values for these services), then the counterintuitive signs provide suggestive statistical evidence that not all wetland services have been valued by the existing studies and, therefore, wetland benefits are underestimated. Second, the counterintuitive signs present challenges in how to best use the meta-regression results for benefit transfer. We discuss this in the next subsection.

4.B.2. Computation of Value Estimates

Using meta-analysis for benefit transfer requires decisions on estimating the meta-regression and decisions on how the estimation results are used for prediction. Our general impression is that the estimation step was executed with more care and transparency than the prediction step. Specifically, the EAs use the parameter estimates from the meta-regression to construct a benefit function for predicting the economic value of lost wetlands. For this, decisions are needed on how the explanatory variables in the meta-equations should be coded to compute the value estimates. Four categories of decisions are especially impactful.

First, decisions are needed on what wetland services to include in the predictions. Taking the specification literally, coding all of the service dummy variables to zero means the estimates only reflect values for the supporting service. In the 2019 EA there is not an explicit statement on which of the services are included (i.e. which dummy variables are turned on) in the predictions. We infer from the 2019 document that the service dummy variables are all coded to zero since the description emphasizes the use of income, region of the country, and the proportion of forested wetland acres as the state-level predictors (p. 65). As noted above, if this is the case then the EA underestimates the value of wetland losses since it only reflects supporting services.

The 2020 document is somewhat clearer on the service coding. The description indicates that the regulating and provisioning services are set to zero and the cultural service is set to one. This is an arbitrary choice that was likely taken to allow the positive and negative coefficients on regulating and provisioning to offset, thereby producing estimates that are again based largely on supporting services (since the coefficient on cultural services is close to zero).

Given that the odd signs on the service dummy variables are likely the result of correlated unobserved study attributes, we believe it would have been better to not control for these variables in the meta-analysis. Leaving them out of the specification would allow the benefit function to simply predict average values for wetland acre changes based on the mix of services represented in the original studies. More importantly, it would avoid needing to interpret and turn on/off dummy variables that have no causal relationship to the wetland services assigned to them.

Second, an important conditioning variable in the meta-regression is the dummy variable local. This is coded to one when the sample from the original study is not statewide. Importantly, the coefficient on local is positive and large – implying that studies with sub-state samples on average generate larger economic values. This is almost certainly due to the larger values generated by more localized resources. It seems this
variable is coded to zero for prediction – a decision that pushes the predictions for losses down in a way that is likely substantial. This arbitrary decision implies that there is no premium on local wetlands near population centers, which serves to bias wetland values downward.

Third, another important conditioning variable in the meta-regression is the dummy variable *lump sum*. This variable is used because the meta data include studies that solicited one-time (lump sum) payments from households and studies that solicited annual values. The former reflects the discounted present value of the perpetual stream of services the household receives from the scenario. The latter reflects the current period flow value. The two types of values are linked by the discount rate. It is common and accepted practice in meta-analysis to combine both types of studies and to control for the different interpretations as the EAs have done.

Our concern is how this variable is used for prediction. Coding it to zero implies the predicted benefit estimates are annual flows and coding it to one implies they are present values. The EAs seek one-time estimates of losses (present values) and so the *lump sum* variable is coded to one for prediction. While this is an acceptable decision, it should be pointed out that this imbeds an implicit assumption about the discount rate used in the analysis. In the meta data 12 of the 21 observations report annual values and 9 of 21 report one-time payments. The coefficient on *lump sum* – and hence the implicit discount rate linking annual and one-time payments – is based on comparisons between these two subsamples. The non-linearities in the model make it difficult to intuit how consequential this implicitly determined discount rate is for the final predictions.

An alternative is to code the *lump sum* dummy variable to zero, use the equation to predict annual flow values, and then convert the annual flow values to their present value equivalents using an explicit discount rate assumption (e.g. \( r=0.07 \)). Comparing the two approaches would provide transparency on how important this decision was for the predictions and it would constitute a useful robustness check.

Finally, we note that the benefit function is convex in baseline acres. This means that the economic value of incrementally adding acres is higher when baseline acres is higher. A convex benefit function in baseline acres is plausible if ecological conditions imply that the flow of services increases at an increasing rate with wetland acres. Alternatively, it may be that the convexity is based on unobserved features of the underlying studies that are correlated with scenarios’ baseline acre definition. Either way, the convexity of the benefit function is important because it implies that the choice of baseline acres matters for predicting the value of wetland acres lost in a state. The EAs use 10,000 acres as the uniform baseline for all states, since this is the average size of baseline acres in the meta-data. There is no discussion in the EAs on how sensitive the final predictions are to this choice.

This is relevant because the choice of 10,000 acres is arbitrary – it is based on features of the meta-sample, rather than conditions that may exist in places where wetland losses could occur. Specifically, baseline acres in the meta-regression refer to the size of the overall wetland system that is affected by an increase or decrease in acres *in that system*. Ideally, predicted values for wetland losses in a state would be conditional on the size of wetland systems in the state that are affected by the change of jurisdiction. Since wetland systems likely range from relatively small for urban area to quite large for rural systems – and will vary substantially within and across states – it is not clear how effectively the 10,000 baseline acres assumption proxies for conditions at places the policy may affect. The absence of information on sensitivity and the arbitrariness of the 10,000-acre assumption together generate substantial uncertainty in how consequential these decisions are for estimates of economic losses.
4.B.4. Robustness Analysis

The EAs perform a robustness check on the sensitivity of including the 21 individual observations from the 11 studies. This is the leave-one-out analysis described in Appendix C of EPA-Army (2019). The intuition behind this analysis is to leave one observation out of the meta-analysis, perform the meta-analysis, and then see how well it predicts the value of wetlands for the observation that was left out. One can then quantify the prediction error using the same approach for all observations that support the study. In their analysis, the agencies view the results of the leave-one-out analysis as supportive of the studies and methods used in the meta-analysis. They view their prediction error as reasonable, especially given the small number of studies used in the meta-analysis.

While we appreciate the inclusion of this sensitivity analysis and agree it is competently executed, we do not think the robustness analysis focuses on the key elements. First, we believe that the leave one out analysis would be more informative if individual studies, rather than individual observations, were scrutinized. Second, and more generally, there are several other dimensions of robustness analysis that would have been more informative. We suggest that the following additions would have helped readers understand the role of implementation assumptions in predicting losses from wetlands:

• Including a wider range of studies, including hedonic property value and recreation demand, in the meta data.

• Examining specifications that do not include the service dummy variables and the benefit predictions therefrom. This would allow estimates to reflect the average value of wetlands represented in the sample, without the need to arbitrarily zero some in and out for prediction.

• For the specification with service dummy variables included, examining predictions with different combinations of service dummy variables turned on and off. For example, it would be useful to see predictions that keep the regulating dummy variable on while zeroing out the cultural and provisioning dummy variables, due to their counter-intuitive signs.

• Examining predictions with the original specification that keep the local dummy variable on, due to its sizeable positive impact on per household benefits.

• Examining the role of the discount rate implied by the mixing of annual and one-time payment studies. How do the estimates change if the lump sum variable is turned on versus off (with an assumed discount rate) to predict benefits?

• Examining predictions using different assumptions for baseline acres, varying the uniform assumption used for all states and/or tailoring the assumption to conditions in individual states.
4.C. Predicted Change in Wetland Area

The benefit function provides predictions for the per household value of a wetland acre change, conditional on the baseline acres, percent of forested wetlands, region of the country, and average household income. Using the benefit function to predict aggregate economic losses from changes in protected wetlands requires two additional pieces of information: (a) a prediction on the number and place of wetlands lost due to the change in jurisdiction; and (b) the number and place of households affected by the loss. In this section we comment on (a) and turn to (b) in the following section.

The 2015 EA reviews CWA Section 404 permit applications to estimate the fraction of wetland acres that were previously non-jurisdictional and would become jurisdictional under the new rule. The description is fairly transparent for how the number of additional acres generating costs under the new rule is determined. However, the description on how the 2015 EA arrives at a lower estimate of 1,154 newly protected acres and a higher estimate of 1,890 newly protected acres references a figure that does not exist in the document and so it is not clear how the agencies arrive at these figures (p. 43). The 2019 EA uses the lower number from the 2015 document as an initial estimate of the aggregate acres that would be lost upon the removal of the prior definition. The 2019 EA does not provide an explanation for why it only considered the lower number, when the 2015 report provided a lower and a higher estimate. Thus, the confusion from the 2015 document is brought forward and amplified in the 2019 document’s selective use of its predictions.

The 2019 report initially reports aggregate losses from the new WOTUS definition that combine predictions from the benefit function and an apportionment of the 1,154 acres across individual states (Table III-7). The scale of lost acres is subsequently reduced, however, based on the federalism analysis that is an emphasis of the 2019 and 2020 EAs. As we discuss in Sections 2 and 3, this approach to reducing the scale of losses from a reduction in federal protections is inconsistent with best practice for economic analyses at the agencies.

The 2020 EA appears to replicate elements of the 2015 process to predict changes in jurisdictional wetland acres when moving from the 2019 to the final rule. It also discusses different scenarios for how state-level responses might mitigate losses of wetland acres. However, there is no obvious reference to a total number of predicted wetland acres that should be used as the basis for estimating aggregate economics losses. The closest to this is in Appendix D, Table D-4, where state level changes in wetland acres are listed out as inputs for the benefit transfer exercise. However, it is not clear how to relate these figures to the process described on pp. 68-72.

Our overall conclusion is that the description of this critical aspect of predicting economic losses is unclear and incomplete in the 2015, 2019, and 2020 EAs, and that the 2019 and 2020 EAs are inconsistent in their use of the 2015 information. They also implement assumptions on federalism that reduce the scale of wetland losses, but do not conform to agency precedence of best practice for conducting economic analyses.
4.D. Scaling of Benefits

With a prediction for the number of acres lost in each state, the next step in the analysis is to determine the number and location of households that are affected. This is the extent of the market assumption. A key concern we have with the 2019 and 2020 EAs is how they define and justify the extent of the market. In the primary analysis, economic losses from reduced wetland acres are only counted for households residing in the state where the reduction occurs. That is, the willingness to pay for wetlands declines to zero at a state border. This assumption cannot be rationalized with generic economic theory. In addition, it is inconsistent with the spatial nature of watersheds and wetlands. Surface waters, groundwater, and wetlands are ecologically connected across space in systems that do not necessarily conform to state boundaries. Likewise, some wetland services – such as nutrient filtration – generate benefits in locations far from the location of an actual wetland.

Limiting the affected populations to state boundaries is also inconsistent with the total values estimated by existing studies. These total values likely contain a substantial nonuse component that is reflective of wetland connectivity. Thus, even though values may be estimated at a local of state level in the exiting studies the total values can, and likely do, include consideration for the upstream and downstream connectivity of wetlands that may expands beyond the boundary for those sampled in the existing studies. No discussion or assessment is presented about how this connectivity was handled in selecting and coding the existing studies.

The decision to limit losses to state residents is also inconsistent with the spirit of many of the assumptions used to calibrate the benefit function. Cutting off benefits at the state boundary implies a comparatively high focus on more local benefits – using a model that is not well setup to represent important elements of this. Similarly, the decision to zero out the local dummy variable when generating household-level predictions deemphasizes the role of local resources that the aggregation strategy favors. These inconsistencies likely lead to per household values that are biased down when the objective is to represent state rather than regional losses.
Are the Agencies’ “qualitative case studies” sufficiently comprehensive in estimating benefits and damages, and what are the implications for benefit-cost analysis of the hydrological connectivity issues raised in the WOTUS debate?

The EA for the Navigable Waters Protection Rule (EPA-Army 2020a) contains three case studies of the benefits and costs of the rule as applied to the Ohio River Basin, the Lower Missouri River Basin, and the Rio Grande River Basin (Figure 3). According to the Agencies, the case studies were intended to highlight potential impacts of the rule on permits, hydrographic features, facilities regulated under various CWA sections, and on the environment. The case studies are meant to illustrate the range of potential outcomes from the revised WOTUS definition, rather than to develop conclusive quantitative estimates of the economic and environmental outcomes of the final replace rule (EPA-Army 2020a).

**FIGURE 3. Case Study Locations in the Navigable Waters Protection Rule EA**

The agencies state that the smaller geographic scales of the case studies allow for a more detailed analysis than the national-scale benefit-cost analysis discussed in Sections 3 and 4, with “better than average data availability” and the ability to “maintain the transparency and rigor of approaches that are feasible” (EPA-Army 2020a, p. xi). The agencies also go on to state that, “the major factors in selecting specific case study locations included: completed coverage of the National Hydrography Dataset (NHD), availability of other data (e.g., studies needed for monetizing forgone benefits), and projected state responses to a change in CWA jurisdiction” (EPA-Army 2020a, p. xviii).
In section 5.A, we focus on the economic analysis of forgone benefits described in the case studies. We begin with a brief summary of the economic analyses and key assumptions made by the agencies to determine forgone benefits resulting from a changed WOTUS definition. In section 5.B, we describe three key findings of our review of the economic analysis related to the selection of case studies, missing benefits, and issues of interconnectedness and how they affect valuation estimates. We conclude in section 5.C by summarizing implications of these limitations for the interpretation of the Navigable Waters Protection Rule.

5.A. Case study methods

In each of the three case studies, the EA used a similar approach to estimate potential forgone benefits. Figure 4, adapted from the EA (EPA-Army 2020a, Figure II-1, p. 26), describes the logic used by the agencies in determining if a change in the definition of WOTUS would lead to changes in environmental outcomes (forgone benefits). The agencies first determine if a regulated entity will affect waters where classification as WOTUS changed from the baseline regulatory regime. Where waters are determined to lose WOTUS classification, the agencies apply the alternative “federalism scenarios” discussed in Section 3.

Under scenarios in which states are assumed to provide less stringent protections under the revised WOTUS definitions, the agencies then make assumptions about the response of regulated entities – will they continue existing compliance practices or reduce their compliance to the new, less stringent requirements? Where regulated entities are assumed to reduce their compliance with a CWA section, the agencies estimate the cost savings resulting from reduced compliance, as well as the forgone benefits of more stringent water quality protection. The forgone benefits are then due to a decrease in the spatial footprint of affected area, the application of fewer mitigation measures, the issuance of fewer discharge permits, and/or greater net loss in wetlands or stream acres.

Forgone benefits considered in the EA include impacts on, “stream flows, water quality, drinking water treatment, endangered and threatened species habitats, and other ecosystem services” (EPA-Army 2020a). Figure 5 provides a conceptual diagram showing the links between reduced CWA jurisdiction and the potential economic impacts of changes in ecosystem extent, flood risk, drinking water treatment costs, and other ecosystem services. Although this diagram displays the conceptual framework for estimating a broad range of benefits, the case studies focus almost exclusively on Section 404. This is consistent with the agencies’ approach to the national benefit-cost analysis, but as we note later, it is a missed opportunity to use the case studies to perform more comprehensive analysis.

To estimate values of lost mitigation area under the Section 404 wetlands regulatory program, the agencies transferred benefits from a stated preference study on resident WTP for wetland preservation in rural Kentucky (Blomquist and Whitehead 1998). Respondents in this study were asked for their WTP to purchase and maintain 500 acres of wetlands that would otherwise be destroyed by mining. This yielded low and high estimates for per household WTP for a change in wetland acres. The agencies applied these estimates to their estimates of changes in wetland acres in each case study watershed, and then aggregated benefits to all households in the state containing the majority of each watershed area plus all counties bordering the affected watershed. Benefits were annualized over a 20-year time horizon (2020-2039) using discount rates of 3 and 7 percent.
FIGURE 4. Potential impact of changes in federal CWA jurisdiction under the Navigable Waters Protection Rule

Source: EPA-Army (2020a, Figure II-1, p. 26).

FIGURE 5. Potential environmental impacts to select CWA program changes under the Navigable Waters Protection Rule

Source: EPA-Army (2020a, Figure III-9, p. 105).
5.B. Key findings relevant to the case studies

We note three key findings based on our review of the estimation of forgone benefits as it applies to the case studies. First, the EA provides weak and often conflicting justifications for the selection of case study locations, resulting in examples that likely underestimate forgone benefits. Second, the EA underestimates benefits by only considering changes under CWA Section 404 and ecosystem service impacts associated with non-mitigated wetlands. Third, the EA does not sufficiently address issues of interconnectedness of waterways and the spatial distribution of beneficiaries impacted by changes in water quality or aquatic habitats.

5.B.1. Case study site selection does not appear to serve the stated objectives of the agencies’ case-study approach.

The agencies provide weak and sometime conflicting justifications for the selection of the three case study watersheds. According to the EA, the case study selection “prioritized locations for which primary wetland studies were available and states were less likely to continue to regulate newly non-jurisdictional waters” (EPA-Army 2020a, p. 164). The agencies also note that cases were selected in order to highlight impacts of the rule across various sections of the CWA.

In practice, however, the case studies only monetize forgone benefits from changes in section 404 permits affecting the amount of non-mitigated wetland acres. For other CWA programs, the agencies cite data limitations that prevent them from monetizing economic impacts. If one goal was to highlight potential impacts across the full scope of CWA programs, then the selected cases did not provide the appropriate context or data to meet this objective.

In Section 3, we identify problems with the agencies’ categorization of states by their likely reaction to the narrowing of federal CWA jurisdiction. In the case study selection, the agencies state that they focus on states less likely to expand protections in response to these changes. In our reading of the case study analysis, ten states are included in the three cases, as follows: Kentucky, Indiana, Ohio and West Virginia in the Ohio River Basin case study; Colorado, Kansas, Nebraska and Missouri in the Lower Missouri case study; and New Mexico and Texas in the Rio Grande case study. Two of the case studies (Lower Missouri and Rio Grande) appear to meet this criterion, as all of the affected states are placed in category 1 in the federalism analysis (“unlikely to increase state regulatory practices”), except Kansas, which is in the middle category 2 (Table 1, Table 3). In the Ohio River Basin case study, in contrast, only one (Kentucky) out of the four states in the basin is in category 1, while the other three are in category 3.59 Thus, as in the nationwide benefit-cost analysis discussed in Sections 3 and 4, the agencies drop the benefit and cost estimates from the case studies for these states in federalism scenarios 1-3. This practice, as noted in Section 3, has a large impact on the benefit and cost estimates in the case studies, as well. The same concerns about the speculative nature of this exercise, and the degree to which it influences the estimates, are valid here.

59 In the qualitative discussions of non-Section 404 impacts in the case studies, the selected basins also may not fulfill this criterion. For example, in the Lower Missouri River Basin, the agencies assume that the 402 permits that are impacted by the NWPR are issued in states (Colorado and Kansas) that they consider “likely to provide partial regulatory coverage” of the affected waters. Further, as it pertains to Section 402, the EA mentions that several current point sources in the case study areas are subject to Technology Based Effluent Standards and are therefore assumed not to change their behavior. For Section 311, the EA describes a number of spills that occurred in the watersheds and the resulting clean-up response. They argue that, “the response may be the same as existing practice given the potential for spills to travel to jurisdictional waters through non-jurisdictional conveyances.”
The EA contains conflicting statements about the selection of case studies based on their extent of potentially impacted stream and wetland acres. The report states that cases were prioritized “where non-permanent streams represent a relatively large fraction of waters located within the states” (EPA-Army 2020a, p. 94). However, the EA later notes “case study locations do not include watersheds predicted to see the largest changes in wetland areas or ephemeral streams and may therefore not be representative of potential impacts of the final rule across the United States” (EPA-Army 2020a, p. 164). This is an important point that we believe warrants further discussion.

From Table 3, we can see that the states included in the case study river basins are strongly skewed to the bottom of the list of state net benefits from the narrowing of federal CWA jurisdiction in the Navigable Waters Protection Rule. Six of the ten states at the very bottom of Table 3 (WV, OH, KS, IN, KY, and TX – ranked 41st, 44th, 45th, 46th, 48th, and 49th, respectively, out of the 49 states in the analysis) make up the majority of states in three case-study river basins. The remaining case-study states (NE, CO, NM, and MO) rank 15th, 18th, 20th, and 35th, respectively. None of the states among those with the lowest (or even negative) net benefits from the narrowing of federal CWA jurisdiction over wetlands in the Navigable Waters Protection Rule are included in the case studies. Thus, it is not surprising that the net benefit numbers in the case studies are even more favorable to the rule than the national estimates discussed in Sections 3 and 4. The case study analysis might have been more illuminating if the agencies had chosen at least one case study watershed at the low end of the spectrum of estimated net benefits – for example, in a state such as Florida or North Carolina.

Another way to think about this has to do with the size of the populations affected by the changes in the wetlands regulatory program that are monetized in the case studies, which also has a strong effect on the net benefit estimates (because household WTP from the benefit transfer study is multiplied by the number of households in the affected region). Figure 3 showing the location of the three case studies illustrates that they exclude coastal areas with large population centers.

Each case study does include part of a metropolitan area. The Ohio River Basin case study includes Cincinnati, Ohio. The Lower Missouri case study includes parts of Kansas City. The Rio Grande River Basin case study includes areas near Santa Fe. In this regard, these watersheds may reflect benefits that are higher than areas with no major metropolitan areas. However, when compared to the larger United States, these benefits may still be on the low end in terms of the affected population. For example, Keiser and Shapiro (2019) estimate the benefits from improved water quality due to the CWA’s large municipal grants program. Figure 6 displays one figure from this study, which shows the ratio of benefits to costs of this program nationwide. Although the benefit to cost ratio for the grants program is less than one across the U.S., benefits are generally much higher on the east and west coasts. The three case study areas are in areas of the United States in which the benefits of water quality are generally smaller. Although the case studies are not directly comparable to Keiser and Shapiro’s (2019) findings, this suggests that the case studies may not be very informative of cost-benefit ratios in other parts of the United States.
FIGURE 6. Example of variation in the net benefits of water quality improvements

Note: This figure displays the ratio of improved housing values (benefits) to costs of Clean Water Act grants to municipal wastewater treatment plants. Source: Appendix Figure VIII, Keiser and Shapiro (2019).

5.B.2 The monetary benefit and cost estimates in the case studies focus narrowly on Section 404 impacts, ignoring water quality impacts through other parts of the CWA.

Changes to the definition of WOTUS have the potential to affect all sections of the CWA including Section 303 (Total Maximum Daily Loads) and Section 401 (State certification of water quality). However, the case studies only analyze Sections 311 (pertaining to Oil Spill Prevention, Preparedness, Reporting and Response), 402 (pertaining to NPDES permits), and 404 (pertaining to wetlands), and ultimately only value forgone benefits related to wetland loss under section 404. Note that the agencies did estimate changes in water quality resulting from fewer 404 permits under the revised rule using a biophysical model (the Soil Water Assessment Tool). However, the associated impacts of changes in water quality on dredging costs and drinking water treatment costs were not monetized and are therefore treated as zero in the final benefit cost comparisons associated with each case study. This choice clearly reduces net benefits relative to a comprehensive approach, since the avoided costs from fewer 404 permits are fully accounted for, but forgone benefits aside from WTP for avoided loss of wetland acreage are excluded.

Previous EPA economic analyses of the clean water rule (EPA-Army 2015, 2017, 2019) monetized impacts under both section 402 and section 404. However, the agencies dropped the analysis of section 402 impacts in the EA for the Navigable Waters Protection Rule (EPA-Army 2020a). Failure to estimate benefits associated with the full scope of the CWA means that the agencies have underestimated both forgone benefits and avoided costs. Monetizing only section 404 impacts in the case studies is at odds with EPA’s own justification for inclusion of cases designed to represent the full range of potential impacts from the rule.

60 Sections 303 and Section 401 were discussed in the EA but were not actually analyzed in the case studies.
Dozens of analyses performed by EPA over the last several decades have analyzed various sections of the CWA and have produced a number of benefit estimates of rules and regulations (Keiser, Kling, and Shapiro 2020). This includes numerous analyses of effluent limitation guidelines, economic analysis of the CWA Hazardous Substances Spill Prevention (USEPA 2018), and a retrospective analysis of the CWA (USEPA 2000). Table 4 summarizes the valuation methods applied by EPA in these and other previous EAs. These prior studies by EPA have direct applications to CWA Sections 402, 311, and 303. The EA’s justification that insufficient data prevented the valuation of impacts under other CWA sections is not consistent with past academic or regulatory studies that demonstrate that these benefits can be estimated using existing models and data.

**TABLE 4. Regulatory impact analyses that monetize impacts of water quality changes excluded from the EA for the Navigable Waters Protection Rule**

<table>
<thead>
<tr>
<th>Regulatory Impact Analyses</th>
<th>CWA Section</th>
<th>Monetized values</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>• Recreational benefits from improved fishing opportunities (stated preferences)</td>
</tr>
<tr>
<td>Economic Analysis of the Final Phase II Stormwater Rule – 1999 (EPA 1999b)</td>
<td>402</td>
<td>• Health benefits from avoided contaminated stormwater effluent</td>
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<td></td>
<td></td>
<td>• Water quality improvement (stated preferences)</td>
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<td>• Erosion and sediment control benefits</td>
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<tr>
<td>Environmental Impact and Benefits Assessment for Final Effluent Guidelines and Standards for the Construction and Development Category – 2009 (EPA 2009)</td>
<td>402</td>
<td>• Surface water quality improvements (stated preferences)</td>
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<td></td>
<td></td>
<td>• Avoided costs for reservoir dredging, drinking water treatment, and maintenance of navigational waterways</td>
</tr>
<tr>
<td>Environmental and Economic Benefits Analysis for Proposed Section 316(b) Existing Facilities Rule – 2011 (EPA 2011)</td>
<td>316(b)</td>
<td>• Threatened and Endangered species (stated preferences)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Forgone catch value of commercial and recreational fishing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Watershed improvements and other non-use values (stated preferences)</td>
</tr>
<tr>
<td>Economic Analysis of Final Water Quality Standards for Nutrients for Lakes and Flowing Waters in Florida - (EPA 2010a)</td>
<td>303</td>
<td>• Water quality improvements (stated preferences)</td>
</tr>
<tr>
<td>Economic and Environmental Benefits Analysis of the Final Meat and Poultry Products Rule – 2004 (EPA 2004)</td>
<td>304(a), 305(b), 303(d)</td>
<td>• Avoided costs drinking water treatment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Water quality improvements (stated preferences)</td>
</tr>
<tr>
<td>Benefit and Cost Analysis for the Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category – 2015 (EPA 2015a)</td>
<td>304(a)</td>
<td>• Avoided costs of negative health impacts including cardiovascular diseases, cancer, IQ losses, and other non-cancer health effects</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Water quality improvements and threatened and endangered species protection (stated preferences)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Avoided costs of sediment deposits, impoundment failures, and groundwater withdrawal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Air related health benefits</td>
</tr>
</tbody>
</table>
In addition to missing forgone benefits across CWA programs, the EA focuses on a very narrow set of potential forgone benefits, even with respect to Section 404. Changes in the extent of wetlands, streams, and other aquatic habitats, as well as direct and indirect effects on water quality through changes in sediment, nutrients, or other contaminants, can affect a variety of water-related services, from recreation to human health (Keeler et al. 2012; Olmstead 2010; Brauman et al. 2007). Instead of using the cases to explore a variety of scenarios for how the NWPR would affect the provision and value of multiple ecosystem services, the agencies based their estimates on only a single contingent valuation survey for wetland loss conducted in the late 1990s in one rural Kentucky watershed (Blomquist and Whitehead 1998). The limited methodological scope adopted by the agencies ignores decades of research in environmental economics that has produced well-established methods relating changes in water quality to impacts on human wellbeing and associated ecosystem services, including travel cost models, choice experiments, avoided cost approaches, and hedonic models (Carlsson et al. 2003; Dumas et al. 2005; Olmstead 2010; Van Houtven et al. 2014; Keeler et al. 2016).

Of particular concern is the EA’s lack of consideration for forgone recreational benefits. Water-based recreational use often comprises the largest share of benefits of water quality improvements in the United States (Freeman 1982; Olmstead 2010; Keiser 2019). The fact that the EA does not mention recreational damages and does not attempt to measure forgone benefits of water-based recreational use is a serious shortcoming of the analysis.61 The EA also appears to place recreational industries and households on the same footing. For example, the agencies write:

“Changes in water quality can also impact recreational activities and by extension those businesses and localities that support these activities (e.g., NAICS Code: 423910-Sporting and Recreational Goods and Supplies Merchant Wholesalers) (EPA-Army 2020a, p. 187).”

Economists have demonstrated that households, not recreational industries, likely represent the largest share of benefits of recreational impacts of these rules (Olmstead 2010; Freeman, Herriges and Kling 2014; Phaneuf and Requate, 2017). Several decades of work, dozens of textbooks, and hundreds of papers have been written on consumer welfare in the context of recreational demand models. A focus on industries seems misplaced given this literature.

5.B.3 Consistent with the rest of the EA, the case studies ignore interconnectedness between the waters newly removed from CWA jurisdiction, and those that remain.

As noted in Section 2, the benefits of water quality improvements are connected through hydrologic relationships that govern flow between areas such as intermittent streams and traditional navigable waters and how those waters transport nutrients, sediments, and other contaminants from upstream areas to downstream areas. Connectivity also concerns how the potential benefits and burdens of changes in water quality and the extent of wetland and other riparian habitats are distributed. Actions that impact water quality

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61 Recreational use is subsumed in the benefit estimates for Section 404, but is not addressed or measured for Section 402 or other sections (303, 311, etc.).
in one location may translate into important economic impacts that occur in a different location, affecting different groups of beneficiaries. The assumption that water quality in the context of the Clean Water Rule repeal and replacement is a “local public good” represents a departure from scientific consensus on the interconnectedness of streams, rivers, wetlands and other parts of waterways (Leibowitz et al. 2008; Sullivan et al. 2020; Mihelcic and Rains 2020).

In addition to the connections between wetlands and stream and local waterbodies, water quality impacts may extend to the basin scale – affecting nutrient loading, flow regimes, and habitat alteration in coastal areas. Advancements in hydrologic modeling from the catchment to basin-scale mean that well-parameterized models already exist in many U.S. river basins that could simulate changes in the extent of wetland area or changes in discharge of pollutants to local waters (Morgan and Owens, 2001; David et al., 2010; Ribaudo et al., 2014; Kling et al. 2017). Not only does the EA not take advantage of these models or select case studies where the modeling and data already exist to evaluate alternative scenarios, but the agencies ignore all forgone benefits that occur outside the state and adjacent counties to the case study watersheds. We find it ironic that the Agencies’ contention that removing federal jurisdiction from the affected waters is efficient hinges on inter-state impacts being small or non-existent, yet all three case studies are performed in watersheds that cross multiple state lines.

Physical, chemical, and biological connectivity also extends to economic benefits. Upstream actions that affect water quality will result in changes to economic benefits not only in these areas, but to the connected waterways as well. This includes forgone benefits to downstream recreational users, impacts on amenity values (such as the impacts of how waters look and smell on home prices), increased drinking water treatment costs, dredging, and impacts on other valued ecosystem services. As we note above, EPA ignores most of these benefits in the individual case studies. We argue that these missing benefits are likely even larger considering that EPA does not address issues of hydrologic connectivity in their analysis.

Connectivity is also important in the estimation of affected populations and methods used to aggregate benefits from specific sites to broader populations and beneficiaries. The case studies assume benefits are constant in the state with the majority of the area of the watershed of interest and the counties in other states adjacent to the watershed boundary. In reality, benefits in the form of WTP for wetland protection likely scale with distance, where local residents are willing to pay more for local benefits and these values decline with distance (Bateman 2006; Hanley 2003; Schaafsma 2012). Economists can adjust for the spatial heterogeneity of benefits by using distance decay models to adjust value estimates as a function of distance (Johnston 2014; Johnston 2015; He et al. 2015). As an alternative, intercept surveys can be used to collect information on the home location, distance traveled, and user community that visits a wetland or other natural amenity in order to better understand the user profile of potentially affected beneficiaries (Ditton and Hunt 2001; Flint et al. 2016).

There are also ecosystem services where potential beneficiaries of changes in water-related ecosystem services are located far from the affected ecosystem. For example, waterfowl hunters travel long distances to hunt wetland complexes, often crossing state and watershed boundaries. In fact, Mullen (2019) notes that some of the states expected to lose the greatest extent of protected wetland acres under the NWPR are important locations for wetland bird hunting and attract recreationists from across the United States. The EA ignores forgone benefits that accrue to any residents beyond those in the state and adjacent counties to the watershed of interest, which will further reduce estimates of benefits.
Last, the case studies miss an opportunity to address potential environmental justice implications related to the distribution of benefits across affected populations. The discharge of contaminants, oil spills, sewer and stormwater overflows, and extractive development can directly and indirectly affect public health, property values, and access to high quality freshwater ecosystems. These impacts may be most pronounced in low-income communities and those already overburdened by environmental hazards or disinvestments in infrastructure that have made them more vulnerable to changes in flooding and degraded water quality. Data from EPA’s own environmental justice atlas could be used to identify the intersection of potential changes in permitting under the NWPR and communities most vulnerable to water quality changes. Doing so would more directly address EPA’s own commitment to the “fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.”

5.C. Summary of the case-study approach

Estimating the full suite of benefits from a change in water quality or habitat across space and time is challenging. Even with advances in integrated assessment models and spatially-explicit benefits estimates, data limitations often prevent economists from assessing all potential impacts of environmental changes as they apply to all potential beneficiaries. However, the case studies presented in the EA are far from taking advantage of the frontiers in economic or hydrologic science. The EA applies benefit estimates from a single stated preference study of Kentucky residents from 20 years ago and assumes these benefits are a reasonable proxy for residents in different states out to the year 2040. The EA monetized benefits from only one section of the CWA, considered only wetlands acreage in their analysis of affected habitats, and based benefits estimates on a single study, instead of applying a meta-analysis or benefits transfer function as recommended by contemporary guidance for stated preference valuation (Johnston et al. 2017). If the EPA preferred to use a local study for the case studies, it would seem natural to use the opportunity to analyze how well the meta-analysis predicts benefits. In this manner, the case studies could be informative of the accuracy of the national wetland analysis. The agencies selection of case studies was poorly justified and may have further reduced estimates of forgone benefits. Last, the assumptions about connectivity severely limited the scope of the analysis – ignoring downstream impacts and distant beneficiaries. Taken together, these limitations in scope and scale of the assessment mean the cases studies offer little value in understanding the potential impacts and associated economic costs and benefits of the NWPR.
Do the Agencies’ regulatory cost estimates in the repeal and replacement economic analyses reflect the best available methods and data from the literature in environmental and resource economics?

This section discusses the quality of the avoided cost estimates in the two EAs and channels they may not capture. Both EAs use estimates of the avoided cost of permits and administration for several sections of the CWA, with a primary focus on the wetlands regulatory program in Section 404. These avoided costs are equivalent to the “benefits” of repealing the Clean Water Rule and replacing it with the Navigable Waters Protection Rule, because with fewer waters remaining under federal jurisdiction, fewer costs will be incurred to protect them.

To calculate costs of a dredge-and-fill permit from the Army Corps of Engineers, two sets of estimates are available. The EAs use estimates from the Army Corps, which reports permit costs for the types of projects likely to be affected by the Rule changes. The EAs also cite an older survey from Sunding and Zilberman (2002), which finds somewhat larger costs.

Economists have long recognized that the approach taken to cost estimation in the EAs – adding up statutory, accounting, or engineering costs – can either understate or overstate the true economic costs of a policy. In this case, specifically, a few costs not considered in the EAs may be important. First, we discuss the costs of time and delay. Second, we outline avoidance or preventative costs, through which project managers change the scope or location of their project to avoid potential regulatory challenges. Third, production costs can create interactions with preexisting taxes. Finally, market power in industries paying regulatory costs can mean that consumers of goods produced on project sites pay part of the economic cost of regulatory compliance (e.g., permitting).

Before proceeding, a few clarifications may be useful. Sunding and Zilberman (2002), referenced in the EAs, mention some of these additional costs, but that mention does not receive careful discussion in the agencies’ analyses. It is worth highlighting that the costs discussed in this section may be more difficult to quantify and subject to more uncertainty than the direct compliance costs that are quantified, though they may have moderate or large magnitude. Finally, these costs are not unique to one section of the CWA, or even to surface water quality regulation; many environmental policies can create the costs highlighted in this section, including other kinds of water quality policies (Keiser et al. 2019).

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62 They also include some additional costs for Section 311, which regulates discharge of oil and other hazardous substances; Section 401, which requires a state water certification; and Section 402, which requires every source discharging directly into US waters to hold a permit (i.e., the NPDES) (EPA-Army 2019, Table III-8, p. 73). However, because only the Section 404 avoided costs and forgone benefits are included in the national benefit-cost analysis, we do not discuss these other cost calculations in our review.
6.A Time and delay costs

Water quality permits, including dredge-and-fill permits (CWA Section 404) and NPDES permits (CWA Section 402), can take substantial amounts of time for approval; typical durations for Section 404 permits are one to two years (Sunding and Zilberman 2002). This time has economic value for permit applicants. To the extent that a development project itself creates economic value (e.g., a dam, building, agricultural site, or site used for other kinds of production), that economic value decreases as the development project is completed later, due to the time value of money. Delays can also require additional out-of-pocket spending on staff, equipment, and materials. Some projects can only be completed in specific seasons, so the total project delay can exceed the duration of waiting for a permit. While we are not aware of quantification of the value of such delays for CWA permits specifically, research has highlighted delays in constructing nuclear power plants as one important reason why their costs often greatly exceed \textit{ex ante} predictions (Davis 2012).

6.B Avoidance or preventative costs

The EAs count the costs of actually complying with CWA statutory and permit issuance requirements. An important cost this overlooks is the set of actions that project developers undertake to avoid compliance costs. A classic literature in economics emphasizes that people affected by environmental externalities undertake “defensive,” “avoidance,” “averting,” or “preventative” investments to protect themselves from the externality, and that these avoidance investments represent economic costs (Courant and Porter 1981; Bartik 1988). A recent empirical literature finds that defensive or preventative investments are an important part of the social cost of air pollution, drinking water pollution, and other environmental externalities (Graff Zivin and Neidell 2009, Neidell 2009, Graff Zivin et al. 2011, Barreca et al. 2016, Ito and Zhang 2020, Deschênes et al. 2018). The same idea applies to costs of environmental regulation.

Project managers could make a wide variety of choices in response to expected permit costs. Managers can scrap a project entirely; relocate the project to a site with lower expected permit costs; change the project design, technology, or materials; or make other choices that are hard to observe and measure. Indeed, economic theory would predict that on the margin, managers should make project decisions that equate the additional permitting cost with the defensive cost to avoid additional permit costs and delays.

Direct evidence on the importance of this channel for wetlands regulatory program permitting is limited, though Sunding and Zilberman (2002) note it is relevant. Land use regulation in general can discourage construction, increase construction costs, and increase building prices (Mayer and Somerville 2000, Quigley and Raphael 2005, Sunding 2005).

6.C Interactions with the tax system

A general cost of environmental regulation, of which CWA regulatory costs are an example, is that it increases the cost of producing goods and services. This tends to increase the cost of a typical basket of goods for a typical consumer (the “price index”). Because a household’s purchasing power equals the household’s income divided by the price index, environmental regulation decreases a household’s purchasing power. In the absence of other tax policies, the measures of the costs of regulation in the EAs would capture this channel.
The EA measures are incomplete, however, because the federal government and most states impose taxes on income, payroll, and sales. On the margin, these taxes create a gap between the wage a worker receives and the salary a firm pays. By decreasing real wages, regulations act like an additional tax on labor supply that can increase the deadweight loss from existing taxes (Fullerton and Metcalf 1997, Parry 1997, Goulder et al. 1999, Goulder 2013). This cost may occur due to a range of environmental policies, including other components of the CWA and the SDWA, and is not unique to this setting Keiser, Kling, and Shapiro (2019).

The magnitude of these general equilibrium costs due to CWA policies is unknown. In completely different settings, such as climate change and energy policies, some analyses find that these tax interactions are one-fourth to one-third as large as the direct costs of regulating pollution (Bovenberg and Goulder 1996; Murray et al. 2005).

### 6.D Market power

A fourth type of potential cost not counted in the two EAs comes from market power. Many industries that generate substantial environmental externalities, including electricity generation, oil refining, and steel may involve substantial market power. In concentrated industries, production is below its socially optimal level and consumers pay costs that exceed competitive rates. Market power in these industries creates deadweight loss that is a real social cost. Regulation can increase production costs in such industries, which can further increase prices above their optimal competitive level. In such settings, regulation increases the deadweight loss due to market power, since production is already below its socially optimal level.

The potential of environmental regulation to interact with market power has been known in general for decades (Buchanan 1969, Barnett 1980). Empirical analysis of these interactions is limited; some research has focused on climate change and air pollution policy in the cement industry (Ryan 2012, Fowlie et al. 2016), while other research investigates electricity generation.

While we are not aware of empirical applications of these concepts to surface water quality regulation, the theoretical ideas are similar to other environmental settings. An important question is the degree to which market power characterizes industries affected by the Clean Water Rule repeal and its replacement with the Navigable Waters Protection Rule. Some affected projects are in agriculture or mining, which are somewhat competitive industries with many large and medium firms, limited market power, and where these concerns may be limited. Land development and construction are also affected industries, and recent research suggests that imperfect competition in the U.S. construction industry gives firms significant wage- and price-setting power (Kroft et al. 2020). To the extent that firms affected by the Clean Water Rule repeal and replacement are in industries where market power is greater, these costs may be relatively more important.

In summary, while the agencies do use the best available estimates of avoided regulatory compliance costs in the two EAs, they exclude potentially important partial and general equilibrium costs related to time and delay, regulatory avoidance, tax interactions, and market power. We are not able to bound the magnitude of the additional avoided costs that might be attributed to each of these omitted cost categories. However, we can say that excluding potential avoided costs would tend to lower the net benefits (avoided costs, less forgone benefits) of the repeal and replacement rules.


Brief of the Society of Wetland Scientists as Amicus Curiae in Support of Plaintiffs’ Motion for Summary Judgment, States of New York, California, Connecticut, Maryland, New Jersey, Oregon, Rhode Island, Vermont, and Washington; Commonwealth of Massachusetts; and the District of Columbia v. E. Scott Pruitt, as Administrator of the United States Environmental Protection Agency; R.D. James, as Assistant Secretary of the Army for Civil Works; and United States Army Corps of Engineers.


Ossa, R. 2019. A quantitative analysis of subsidy competition in the U.S. Working paper University of Zurich and CPER. URL: https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnxwc-m9mb3NzYXV6aHxneDo3Nzg5Yjk1NTkzMGE2Njll.


Review Topics in the Approved E-EEAC Proposal

1. **Provide background on the 2015-2019 WOTUS process and the 2015 and 2017 EAs.** This section of the report will expand on the WOTUS history described above. We will discuss the scope and methods for estimating the benefits and costs of the 2015 rule in the first EA. The report will also note that EPA and the Corps eliminated the 2015 wetland benefit estimates in the 2017 repeal proposal and examine the reasons given for this choice. Much of our reasoning here may be similar to that in Boyle et al. (2017). We will also assess the 2017 EAs’ claim that repeal of the 2015 rule decreased uncertainty by improving the consistency and stability of CWA jurisdictional decisions, generating unquantifiable benefits. The report will also assess the qualitative distributional analysis in the 2017 repeal EA. Assumptions and components of the 2015-2017 EAs that carried over to the 2019 final EA will be identified and reviewed.

2. **Assess applications of economic theory in the 2019 EAs.** We will identify and clarify misconceptions in the theoretical discussions on the economics of pollution control, environmental federalism, and the practice of benefit transfer in the 2019 final repeal and 2019 final replacement rules.

3. **Review the federalism analysis in the 2019 EAs.** We will review the EAs’ determination of the likelihood that each state would regulate waters that would have been considered WOTUS under the 2015 rule, but will not under the 2019 repeal and 2019 replacement final rules. This determination is used throughout the 2019 repeal EA and the 2019 replacement EA to support sensitivity analysis of the benefit and cost estimates. For example, if some states will continue to regulate the relevant water bodies under the repealed 2015 rule, to the extent that state law allows them to do this, even if the 2019 rule replaces it, then this could reduce the estimated benefits and costs of the 2019 replacement. This aspect of the analysis is responsible for a significant share of the variation in the estimated benefits and costs, so we will determine whether the approach is reasonable. The approach is also an example of current EPA’s emphasis on environmental federalism and could be used in other regulatory settings, thus our analysis here could have general implications outside of the WOTUS process.

4. **Assess the comprehensiveness of the water quality benefits (or foregone benefits) estimated in the 2019 EAs.** Both EAs include a fairly narrow set of studies of benefits. We will consider whether a broader focus could have been warranted. For example, do the cited stated preference studies include benefits from flood control, recreation or property value impacts? We will also discuss the implications for benefit-cost analysis of the hydrological connectivity issues raised in the EAs, with reference to the three “qualitative case studies” used in the 2019 final EA.

5. **Review the new “national-level” wetland benefit estimates in the 2019 final EAs.** The 2019 EAs use a new benefit transfer function approach, rather than the simpler benefit transfer approach in the 2015 EA (and rather than eliminating wetland benefit estimates as in the 2017 draft replacement). Our review will closely examine:
   a. The choice of WTP estimates to include and exclude. For example, several WTP estimates that were included in the original 2015 EA are excluded from the 2019 EAs. Some WTP estimates brought to light in the public comment process, but that had been excluded from the original 2015 EA, are excluded in the meta-analysis used in both the 2019 final repeal and 2019 final replacement EAs. The 2019 EAs also reject the “blended” WTP estimates in favor of new “state level” WTP estimates.
b. The meta-analysis approach in the 2019 EAs includes only stated preference estimates. Would it have been advisable to incorporate revealed preference estimates of wetland benefits, and if so, how could that be accomplished?

c. Conditional on the choice of studies to include, we will also examine the implementation of the benefit transfer function approach using meta-analysis.

6. **Assess the quality of the regulatory cost estimates in the 2019 repeal and replacement EAs.** Because these estimates have been less controversial than the benefit estimates and have been reviewed and revised by economists in prior work (Sunding and Zilberman 2002), the report’s review of the EAs’ cost estimates may be fairly brief.
Evidence of state heterogeneity in regulatory stringency under decentralized pollution oversight

FIGURE A2.1. CWA and CAA inspection and enforcement metrics for the ten largest U.S. states (2011)

Source: Shimshack (2014).

FIGURE A2.2. CWA inspections per major facility in 2017 for states in EPA Region 4.

Source: Data represent author calculations derived from EPA Enforcement and Compliance History Online (ECHO) state water dashboards: https://echo.epa.gov/trends/comparative-maps-dashboards/state-water-dashboard.
FIGURE A2.3. Percent of major facilities with state-led CWA enforcement actions in 2017, for states in EPA Region 4

Source: Data represent author calculations derived from EPA Enforcement and Compliance History Online (ECHO) state water dashboards: https://echo.epa.gov/trends/comparative-maps-dashboards/state-water-dashboard. Data are not conditioned on detected violations.
Brief review of the CWA sections affected by the Clean Water Rule repeal and its replacement with the Navigable Waters Protection Rule

The process of putting states into categories for the agencies’ federalism analysis is complicated by the fact that state rules regarding the jurisdiction of water quality regulation may vary across the waterbodies and activities governed by different sections of the CWA. States can assert regulatory jurisdiction under five different CWA sections: Section 401 (33 U.S.C. Sec. 1341 - Water quality certification); Section 402 (33 U.S.C. Sec. 1342 – National Pollutant Discharge Elimination System (“NPDES”)); Section 404 (33 U.S.C. Sec. 1344 – Dredge and Fill Permit Program); Section 303 (c and d) (33 U.S.C. Sec. 1313 – Water Quality Standards and Total Maximum Daily Load); and Section 311 (33 U.S.C. Sec. 1321 – oil and hazardous substance liability). State jurisdictional definitions under each of these areas mediate the benefits of federal protection (and thus the forgone benefits of removing federal protection), with the largest changes and impacts likely under the permitting systems in Sections 402, 404, 311, and the water-quality-related permitting decisions under Section 303.

Section 401 allows states to enforce water quality standards under federal permits. The EA notes that with fewer waters under federal jurisdiction, states will have less opportunity to enforce federal water quality standards (EPA-Army 2020a, p. 29). The NPDES program in Section 402 requires technology and water quality standards for pollution sources that discharge into WOTUS. The NPDES requirements, in turn, are determined by the designation of “impaired” jurisdictional water bodies under Section 303. As long as they maintain minimum standards, states and tribes are allowed to take over the administration of this program (a process described in Section 2 of this report as “authorization”), though its application is still to federal waters. Section 404, often referred to as the wetlands regulatory program, is administered jointly by EPA and the Army Corps, and it regulates the discharge of dredge and fill material into WOTUS. Finally, the oil and hazardous substance liability under Section 311 does not allow state or tribal delegation, but shrinking the WOTUS jurisdiction would mean that oil or hazardous spill regulation and cleanup funding would not apply to newly created “state jurisdictional” waterways.
Discrepancies between Agencies’ characterization of likely state reactions to narrowing CWA jurisdiction, and relevant state laws and regulations

**Colorado** law (EPA-Army 2020c) notes that the state cannot regulate return agricultural flow more extensively than under federal law, and the state’s water quality control commission can only adopt rules more stringent than enforceable federal requirements after a public hearing, finding, and demonstration.63

**Florida** law requires that no standards can be set above federal standards unless additional requirements and findings occur, along with a high-level executive branch review.64 This is mistakenly characterized in EPA-Army (2020c) as “allowing regulations to exceed federal regulations if they are in counterpoise.” This comes from a 1978 case, examining what kinds of regulatory comparisons can even be sent to the high-level executive committee by review.65 The language taken from the case is meant to imply that a comparison of whether or not a Florida regulation exceeds a federal one is only possible when the federal and state regulations are comparable. In this case, counterpoise refers to situations in which the federal and state laws are subject to exact comparison.66

In **Indiana**, since the passage of HB 1082 into law in 2016, all environmental rules more stringent than federal rules are subject to legislative veto; meaning they cannot go into effect until the legislature has had a chance to overrule them.67 Additionally, Indiana Code 13-14-9-8 (h) specifies that if:

> “a proposed rule is adopted by a board under subsection (e)(1) based on a determination by the commissioner under subsection (a)(1)(A) and the federal law, rule, or regulation on which the adopted rule is based is later repealed or otherwise nullified by legislative or administrative action, then that part of the adopted rule that corresponds to the repealed or nullified federal law, rule, or regulation is void as of the effective date of the legislative or administrative action repealing or otherwise nullifying the federal law, rule, or regulation.”68

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66 Id.
[VBF NOTE – I could not find the codification of this law in the Indiana Code Annotated – the electronic search functions for the Indiana code have specific problems and an inability to search – doc. May 20, 2020.]
68 I.G.C. 13-14-9-8-(h)
**Iowa** laws prevent more stringent state water quality effluent standards\(^{69}\) and require special administrative procedures for increased stringency over any implementation of federal rules or environmental standards.\(^ {70}\)

**Maine, Michigan, North Dakota, Oklahoma, Utah, Virginia, and West Virginia** have laws, and **Maryland** operates under a 24-year-old executive order, that require additional administrative justification and/or findings if a state agency chooses to impose a rule more stringent that federal requirements.\(^ {71}\) **Nevada** has a requirement for additional procedures if a state regulation will be more stringent than the federal regulation.\(^ {72}\)

A 1994 **New Jersey** executive order requires additional procedures and the substantive justification of a cost-benefit analysis in order for a state agency to regulate beyond federal standards, and a 2010 executive order prohibits the state from regulating beyond federal law except in limited circumstances.\(^ {73}\)

**Oregon** has blanket administrative procedures rules that instruct that Oregon regulations be equivalent to federal ones unless certain exceptions apply.\(^ {74}\)

**Tennessee** requires special procedures and justifications if state rules would increase costs to local government.\(^ {75}\)

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\(^{69}\) Iowa Code 455B.171

\(^{70}\) Iowa Code 455B.105(3).


\(^{72}\) Appendix A, at 50.


\(^{74}\) Or. Rev. Stat. section 183.332.

\(^{75}\) Tenn. Code Ann. Section 4-5-226(k).
# APPENDIX 5

## Review of Wetland Studies for National Meta-analysis

### TABLE A5.1 Wetland Studies for National Meta-analysis

<table>
<thead>
<tr>
<th>WTP Study</th>
<th>Types of Benefits Estimated</th>
<th>Wetland Site</th>
<th>Rural vs Urban</th>
<th>Annual vs. One Time Payment</th>
<th>Peer-reviewed (yes/no)?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awondo et al. (2011)</td>
<td>Primarily downstream water quality (associated with recreational swimming) benefits at lake.</td>
<td>Ohio</td>
<td>Rural, but specific area that is highly visited by public</td>
<td>annual</td>
<td>Y</td>
</tr>
<tr>
<td>Beran (1995)</td>
<td>Protecting forested wetlands.</td>
<td>South Carolina</td>
<td>Rural (&quot;three commonly recognized wetlands to be added to Francis Beidler Forest in South Carolina.&quot;)</td>
<td>lump sum</td>
<td>N (dissertation)</td>
</tr>
<tr>
<td>Blomquist and Whitehead (1998)</td>
<td>Respondents told wetlands had various benefits such as flood protection, water quality improvements, and wildlife/recreation.</td>
<td>Kentucky</td>
<td>Rural (Western Kentucky)</td>
<td>annual</td>
<td>Y</td>
</tr>
<tr>
<td>de Zoysa (1995)</td>
<td>Water safety and quality (specifically from nitrogen pollution) and wildlife environment</td>
<td>Ohio</td>
<td>Rural, large river basin in Ohio</td>
<td>lump sum</td>
<td>N (dissertation)</td>
</tr>
<tr>
<td>Loomis et al. (1991)</td>
<td>Non-Specific, but respondents given information specifically about fish and wildlife benefits of Wetlands</td>
<td>California</td>
<td>Large area, but predominately rural, specifically the San Joaquin Valley</td>
<td>annual</td>
<td>N (edited volume)</td>
</tr>
<tr>
<td>WTP Study</td>
<td>Types of Benefits Estimated</td>
<td>Wetland Site</td>
<td>Rural vs Urban</td>
<td>Annual vs. One Time Payment</td>
<td>Peer-reviewed (yes/no)?</td>
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<tr>
<td>McDonald et al. (1998)</td>
<td>Respondents told wetlands benefits included water quality improvement (as tied to recreation and swimming) and wildlife habitat</td>
<td>Georgia</td>
<td>Rural, but near urban</td>
<td>annual</td>
<td>Y</td>
</tr>
<tr>
<td>Mullarky and Bishop (1999)</td>
<td>Protecting threatened wetlands</td>
<td>Wisconsin</td>
<td>Non-specific, but wetlands were going to be destroyed by highway expansion</td>
<td>lump sum</td>
<td>N (conference paper)</td>
</tr>
<tr>
<td>Newell and Swallow (2013)</td>
<td>Respondents told wetland benefits included water quality, wildlife, recreation, and conservation</td>
<td>Rhode Island</td>
<td>Unspecified, but rural</td>
<td>lump sum</td>
<td>Y</td>
</tr>
<tr>
<td>Poor (1999)</td>
<td>Increasing wetland protection</td>
<td>Nebraska</td>
<td>Non-specific, but survey highlights wetlands as waterfowl habitat</td>
<td>annual</td>
<td>Y</td>
</tr>
<tr>
<td>Whitehead and Blomquist (1991)</td>
<td>Respondents told wetlands had various benefits such as flood protection, water quality improvements, and wildlife/recreation</td>
<td>Kentucky</td>
<td>Rural</td>
<td>annual</td>
<td>Y</td>
</tr>
<tr>
<td>Whitehead et al. (2009)</td>
<td>Not specific, but respondents told that area had specific wetland benefits</td>
<td>Michigan</td>
<td>Rural, but for specific, named, wetland area</td>
<td>lump sum</td>
<td>Y</td>
</tr>
</tbody>
</table>